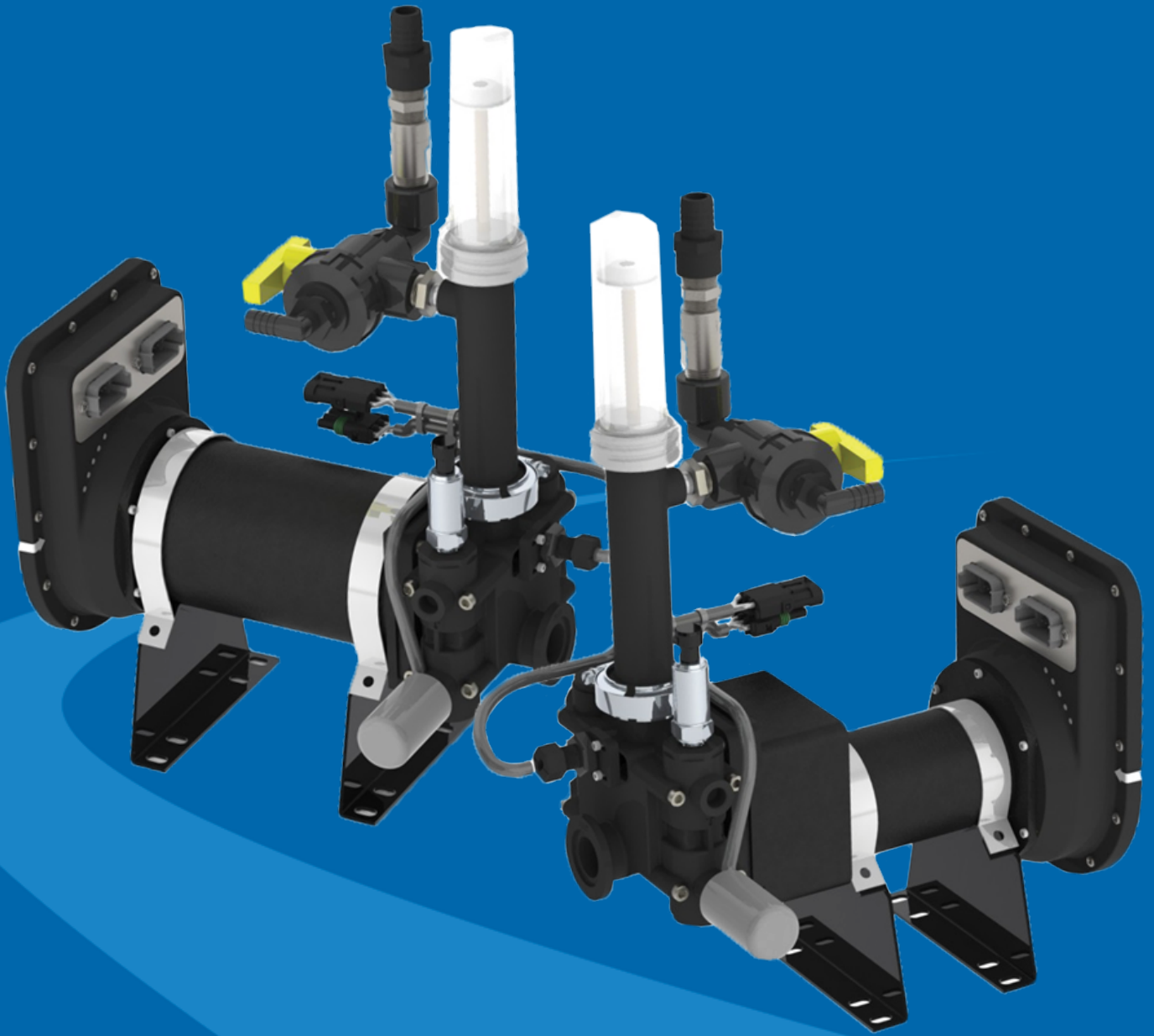


RAVEN

Installation & Operation Manual



Sidekick Pro™

*1 to 40 oz./min. and 5 to 200 oz./min.
[0.3 to 11.8 dL/min. and 1.5 to 59 dL/min.]*

Disclaimer

While every effort has been made to ensure the accuracy of this document, Raven Industries assumes no responsibility for omissions and errors. Nor is any liability assumed for damages resulting from the use of information contained herein.

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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.

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 or Envizio Pro II
- Viper Pro

Sidekick Pro Features

Closed Calibration System

Calibrating chemical injection pumps is necessary for accurate chemical injection applications. The Sidekick Pro closed calibration system allows the operator to perform calibration or system tests without catching or handling dangerous chemicals.

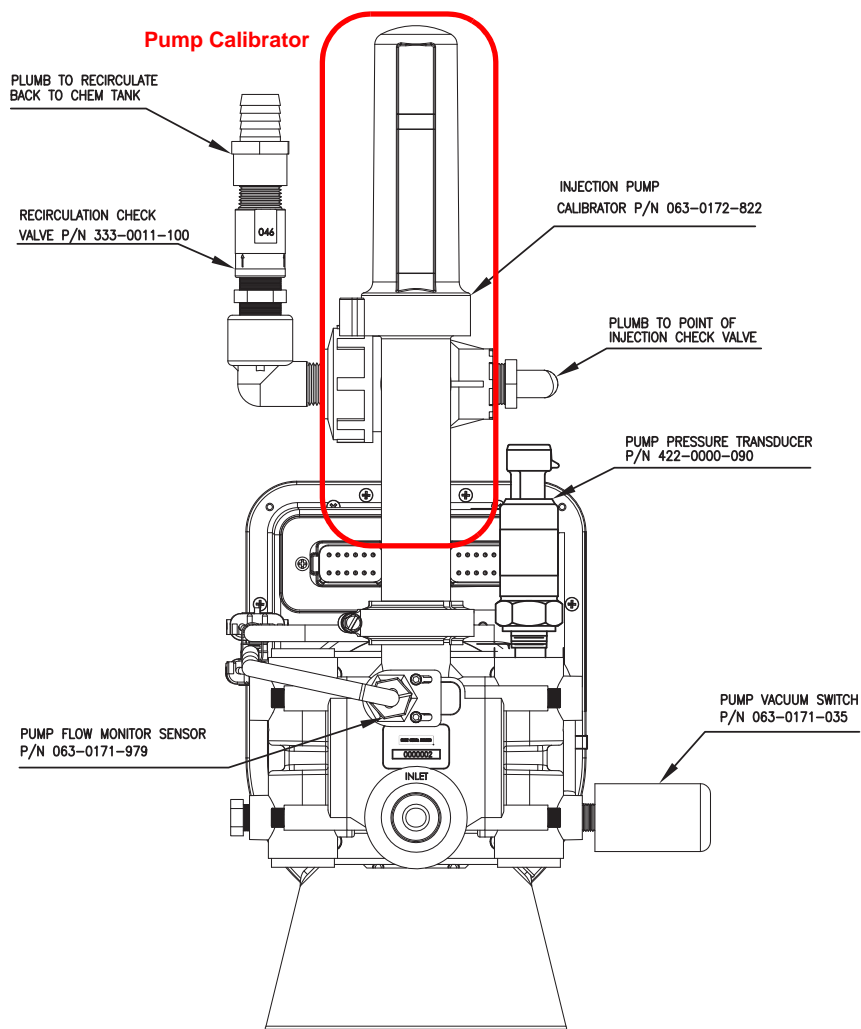
Priming

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.

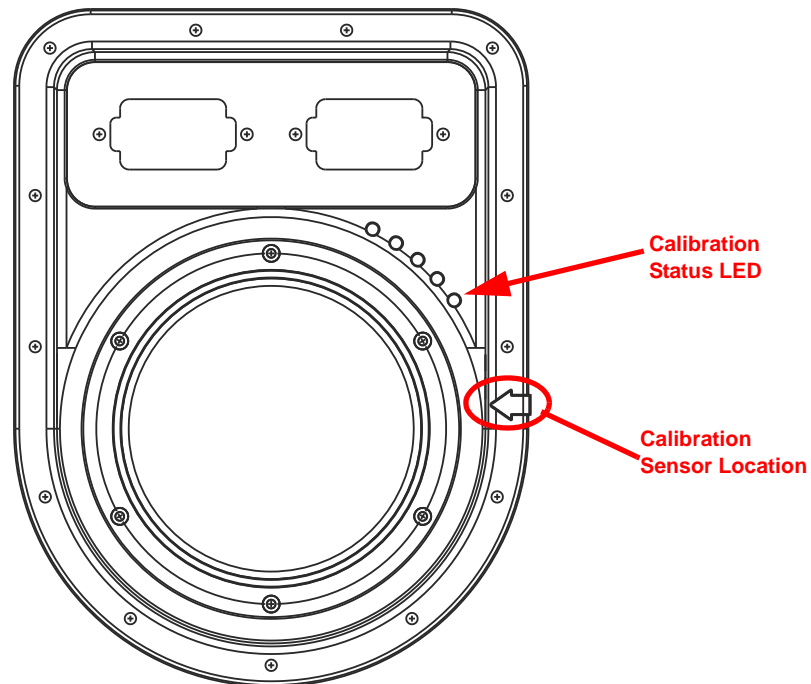
Integrated Calibration Switch

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 39 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



Fast Rate Response

The Sidekick Pro direct injection system is capable of making accurate adjustments to chemical injection rates more quickly than previous Raven injection systems to help ensure accurate and proper chemical applications in the field.

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

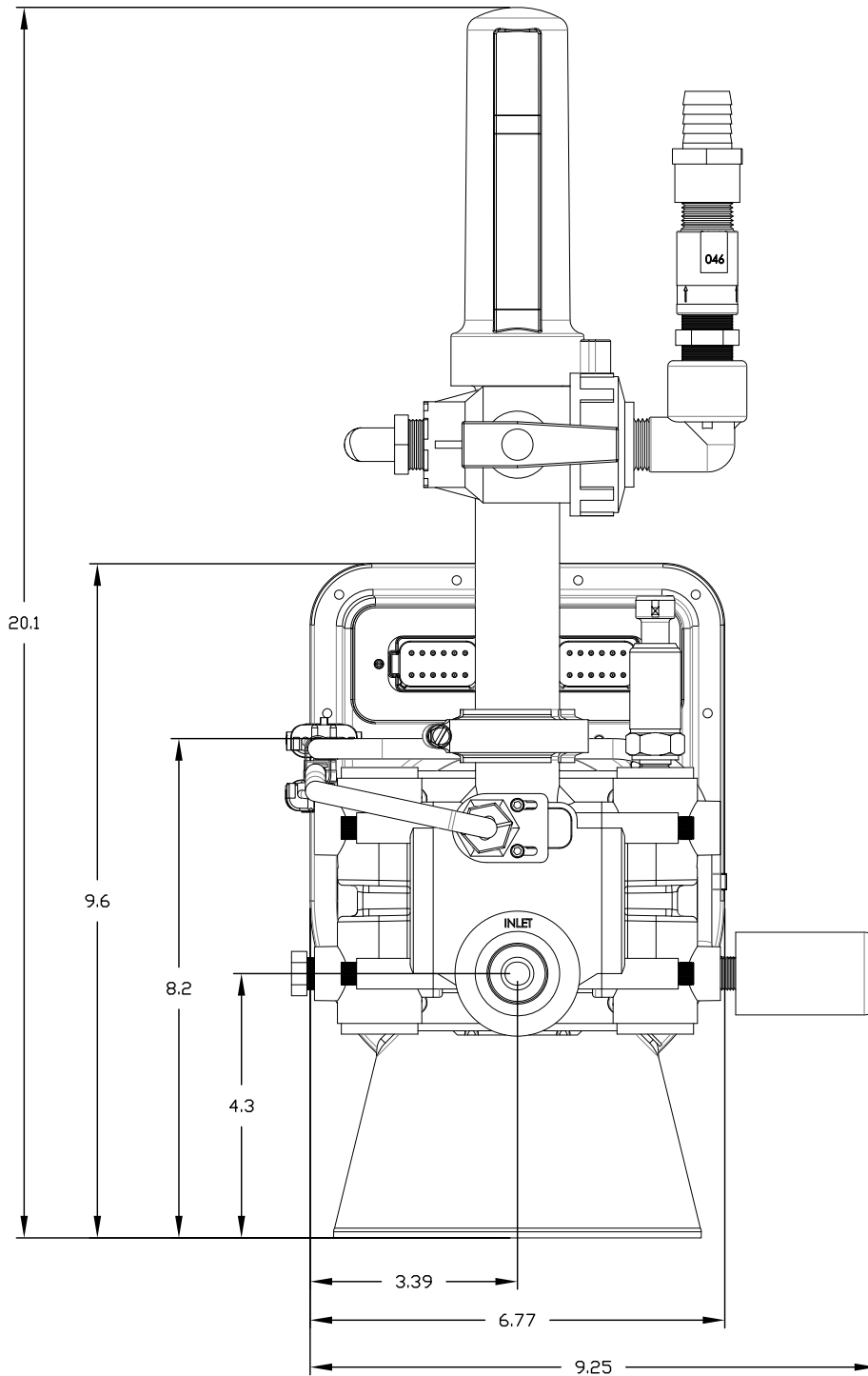
The CAN integrated Sidekick Pro offers enhanced monitoring of pump operation during chemical injection applications to alert the operator to conditions such as an empty chemical supply tank, low injection pressure, incorrect meter calibration, or issues with the injection pump valves.

Sidekick Pro Pump Specifications

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

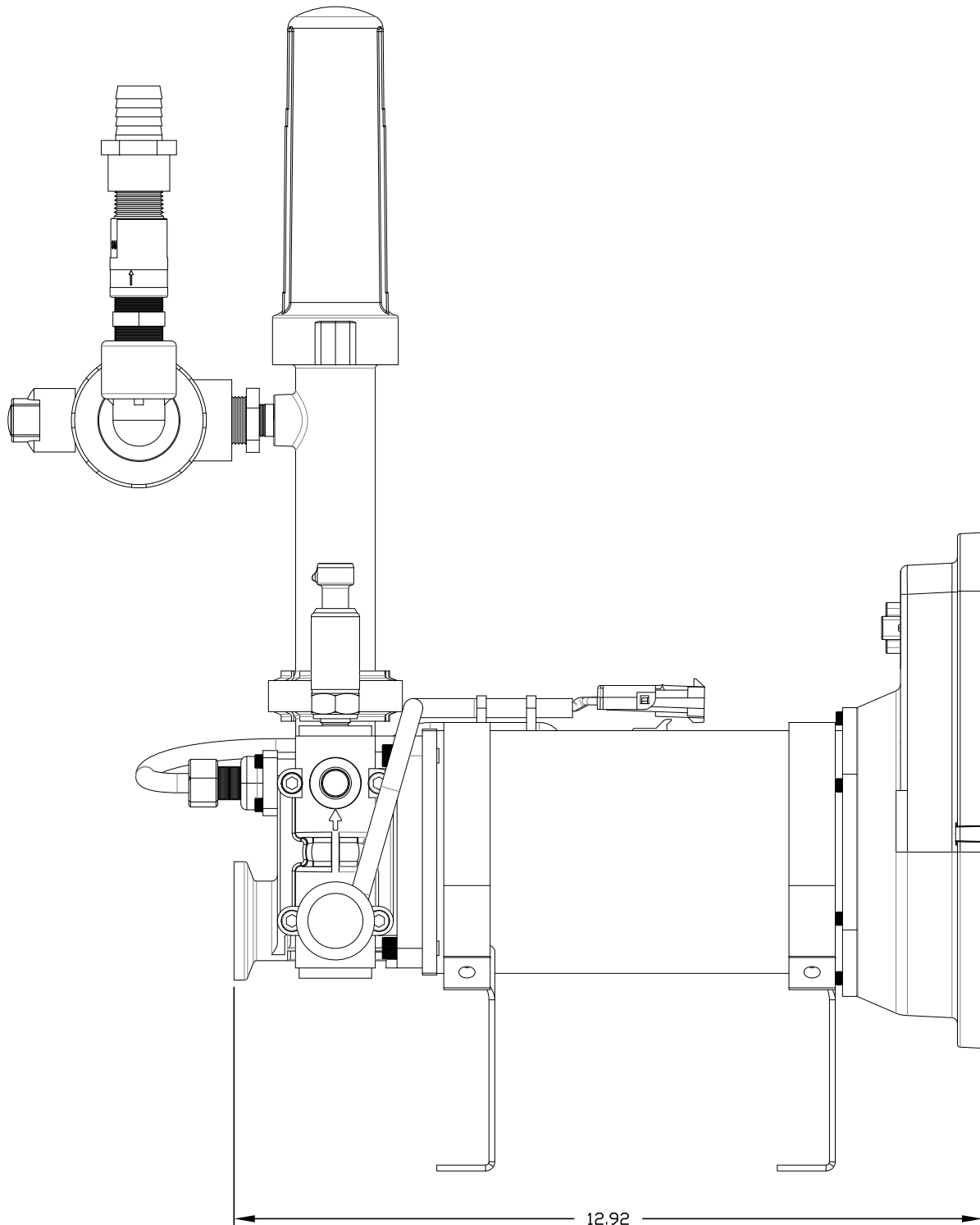
Dimensions	Pump (See Figure 3 on page 7 or Figure 4 on page 8)	
	Injection Module Width - 28.5" [71.12 cm] Depth - 12" [30 cm] (17" [43 cm] with plumbing) Height - 42" [106.75]	
Pistons	1 @ 0.750" Dia.	
Maximum Stroke Length	0.390"	
Flow Output Range	P/N 063-0173-081 5-200 oz./min. [1.5-59 dL/min.]	P/N 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 (in inches)



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].

Updates

Updates for Raven manuals as well as several system components are available at the Applied Technology Division web site:

www.ravenhelp.com

Sign up for e-mail alerts to receive notice when updates for your Raven products are available on the Raven web site.

At Raven Industries, we strive to make your experience with our products as rewarding as possible. One way to improve this experience is to provide us with feedback on this manual.

Your feedback will help shape the future of our product documentation and the overall service we provide. We appreciate the opportunity to see ourselves as our customers see us and are eager to gather ideas on how we have been helping or how we can do better.

To serve you best, please send an email with the following information to

techwriting@ravenind.com

- Sidekick Pro™ Installation & Operation Manual*
- Manual No. 016-0171-391 Rev. B*
- Any comments or feedback (include chapter or page numbers if applicable).*
- Let us know how long have you been using this or other Raven products.*

We will not share your email or any information you provide with anyone else. Your feedback is valued and extremely important to us.

Thank you for your time.

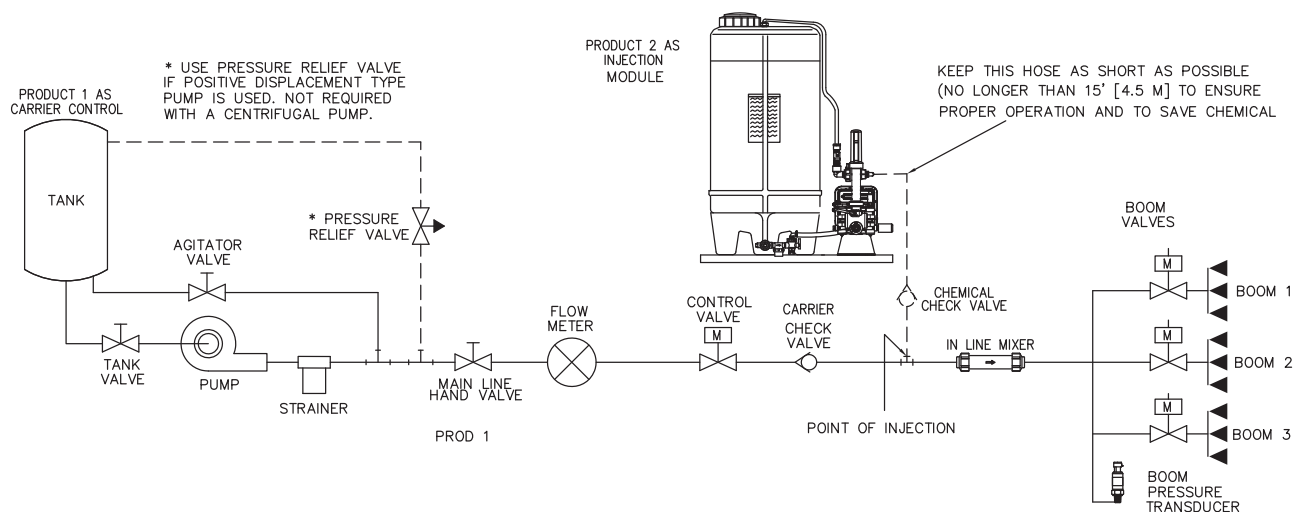
Overview

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

1. Select and plumb the point of injection. See page 12.
 - a. Install carrier and chemical injection check valves.
 - b. Install in-line mixer.
2. Mount the Sidekick Pro injection module or tank. See page 15.
3. Mount the Sidekick Pro injection pump. See page 16.
4. Plumb the Sidekick Pro pump and injection lines into the main carrier line at point of injection. See page 18.
5. Install the closed calibration system. See page 19.
6. Plumb the recommended rinse system. See page 20.
7. Connect the Sidekick Pro injection pump to CANbus. See page 22.
8. Connect the Sidekick Pro pump to source of electrical power. See page 22.

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

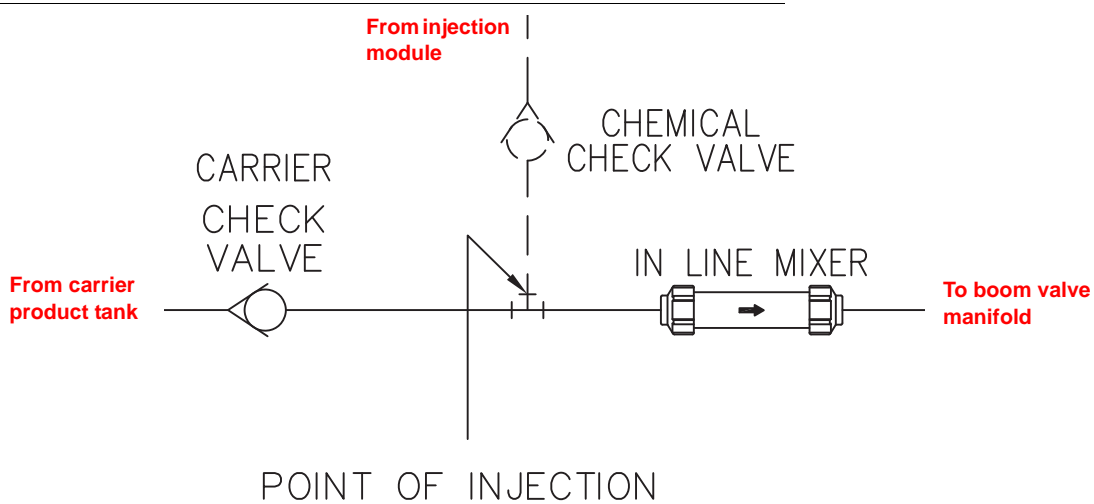


Initial Plumbing and Point of Injection

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

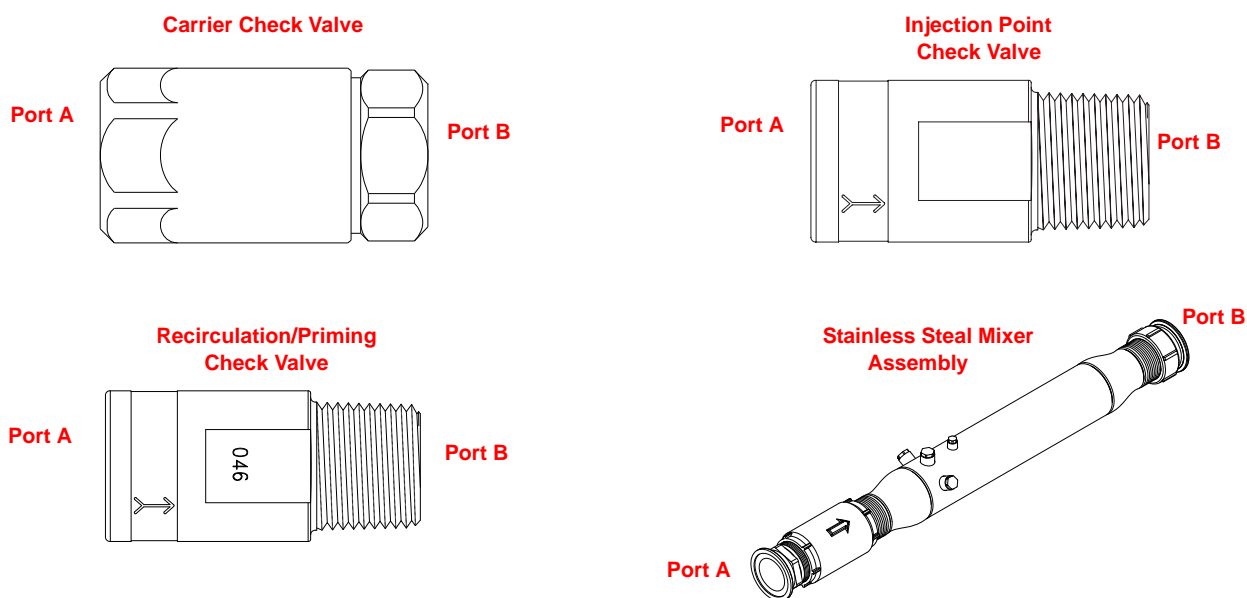


Check valves are used in both the carrier and injection lines to prevent back flow and contamination of carrier and chemical reservoirs. An in-line mixer should be installed after the point of injection to ensure even mixing of the injected product.

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 13 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 14 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 13 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]	333-0011-102	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"

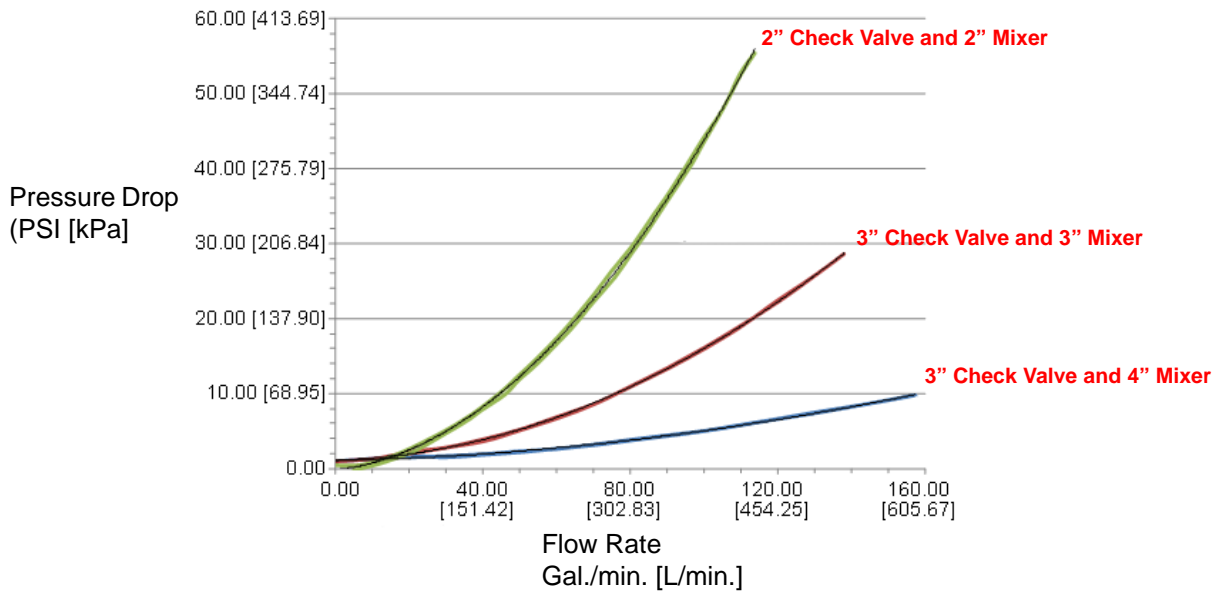
a. Has 0.046" Bleed Hole.

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



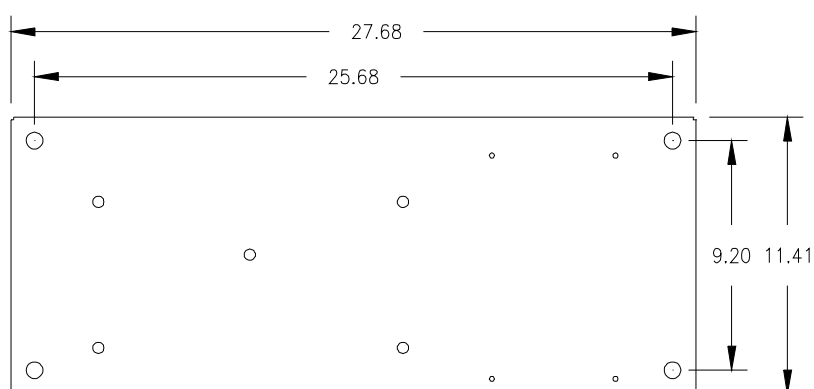
Mount the Sidekick Pro Pump and Chemical Tank

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.

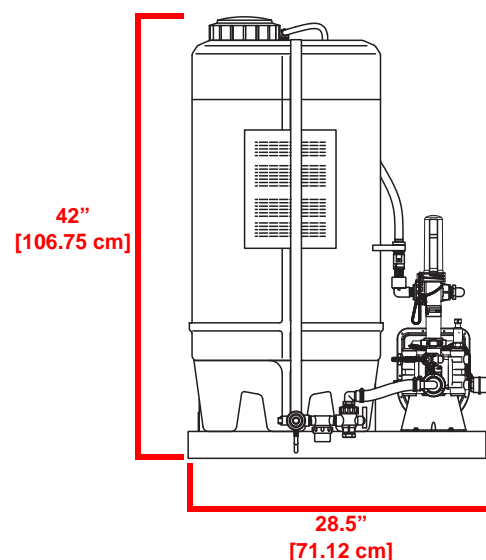
FIGURE 5. Injection Module Platform Dimensions



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.

The assembled injection module will measure approximately as follows:
 Width - 28.5" [71.12 cm]
 Depth - 12" [30 cm] (17" [43 cm] with plumbing)
 Height - 42" [106.75 cm]

- 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 waste during rinsing.*

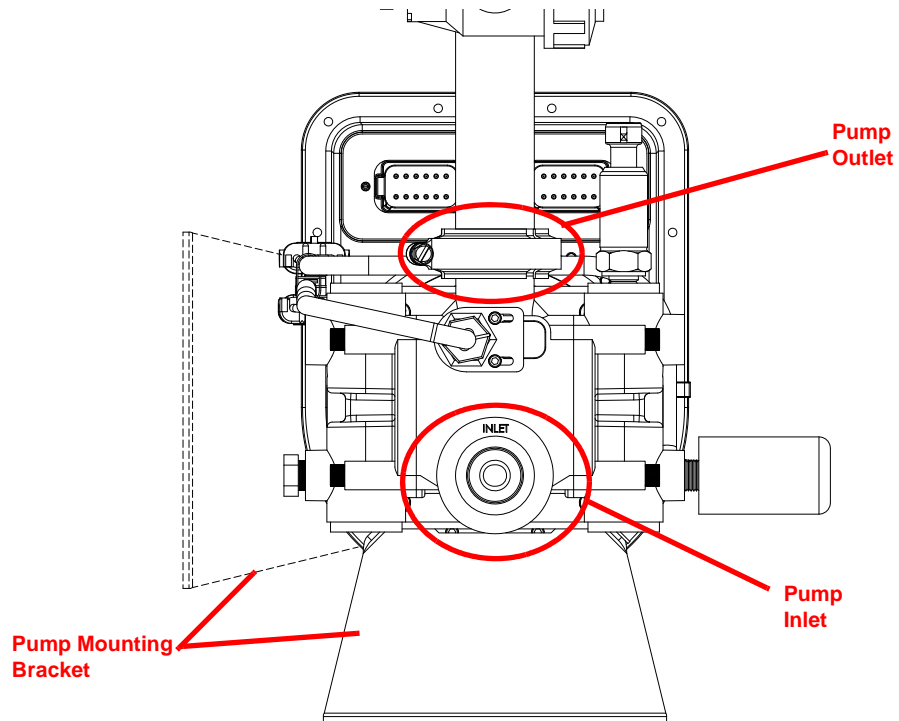
If vacuum errors are encountered during pump operation, one or both of the following corrective measures may be necessary to reduce inlet pressure:

- 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 21.

Mount the Sidekick Pro Pump

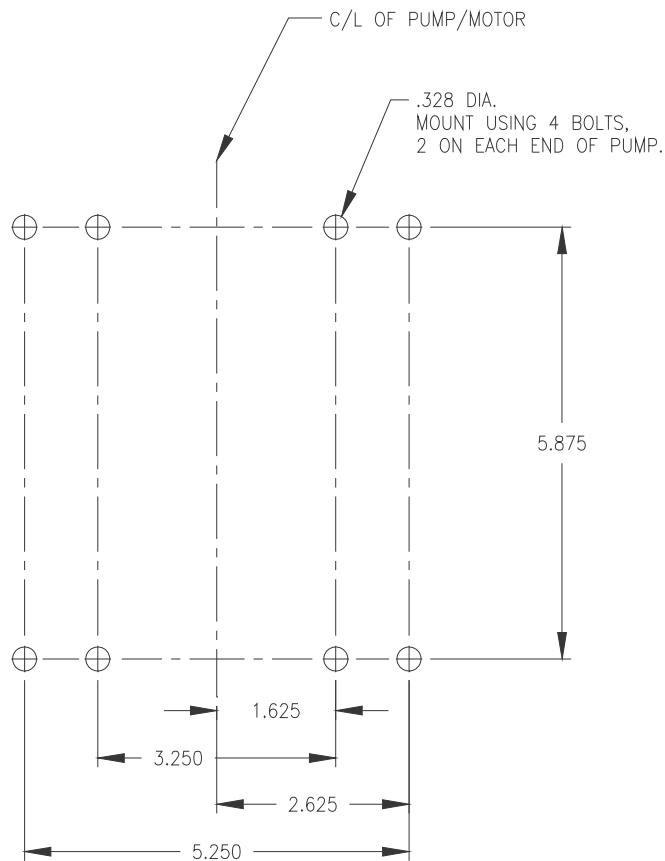
- Mount the Sidekick Pro pump as close as possible to the selected point of injection.
- Mount the Sidekick Pro pump so that the outlet port is pointing up. The pump will not meter product application correctly if the pump is mounted in any other orientation.
- The Sidekick Pro should be mounted in a 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.

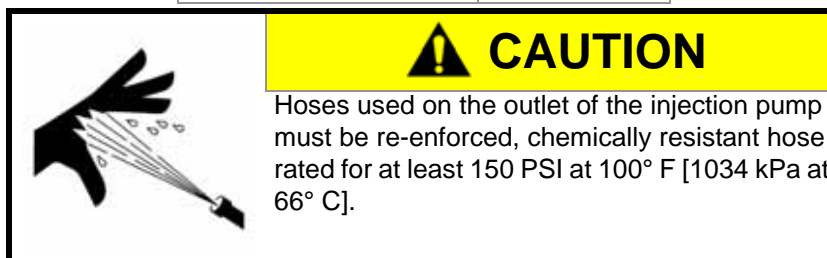
Strainer

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"



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 43 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 19 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 11.

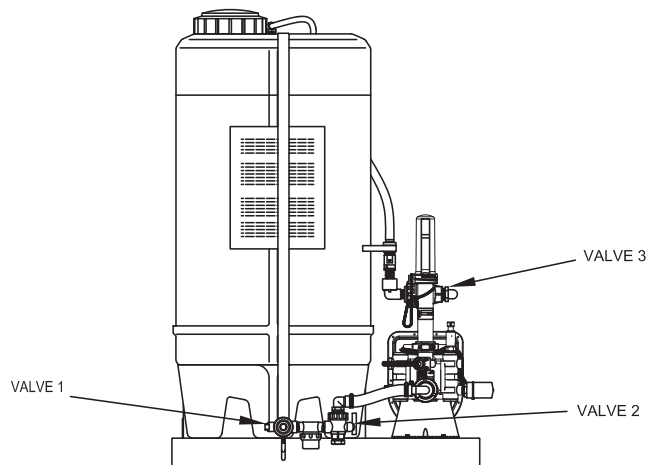
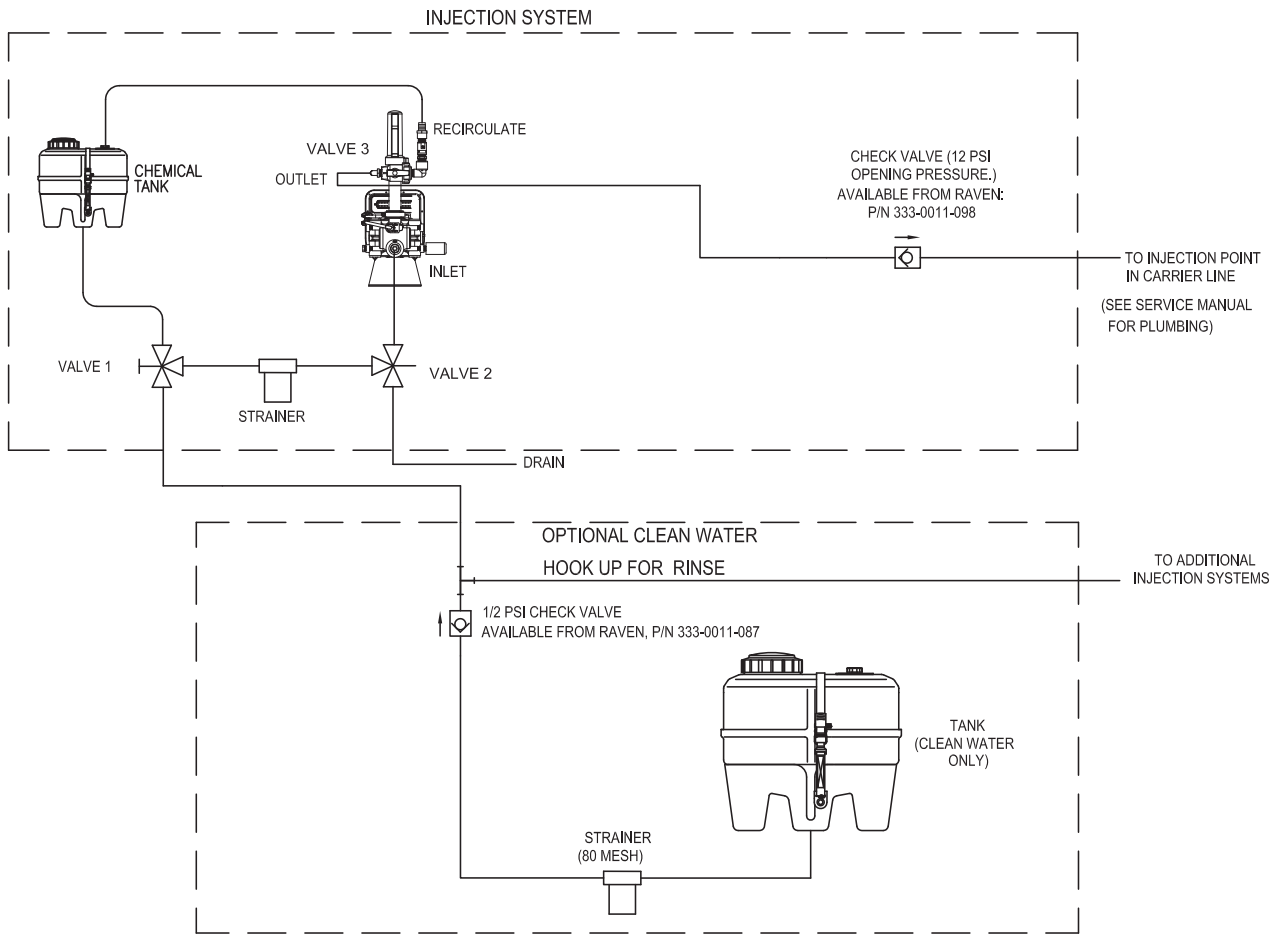
Plumb the Recommended Pump Rinse System

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 21.*

- 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.

Generation 1 Cabling Platform

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 23.
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 23.

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. Generation 1 CAN Node Power Wiring Diagram

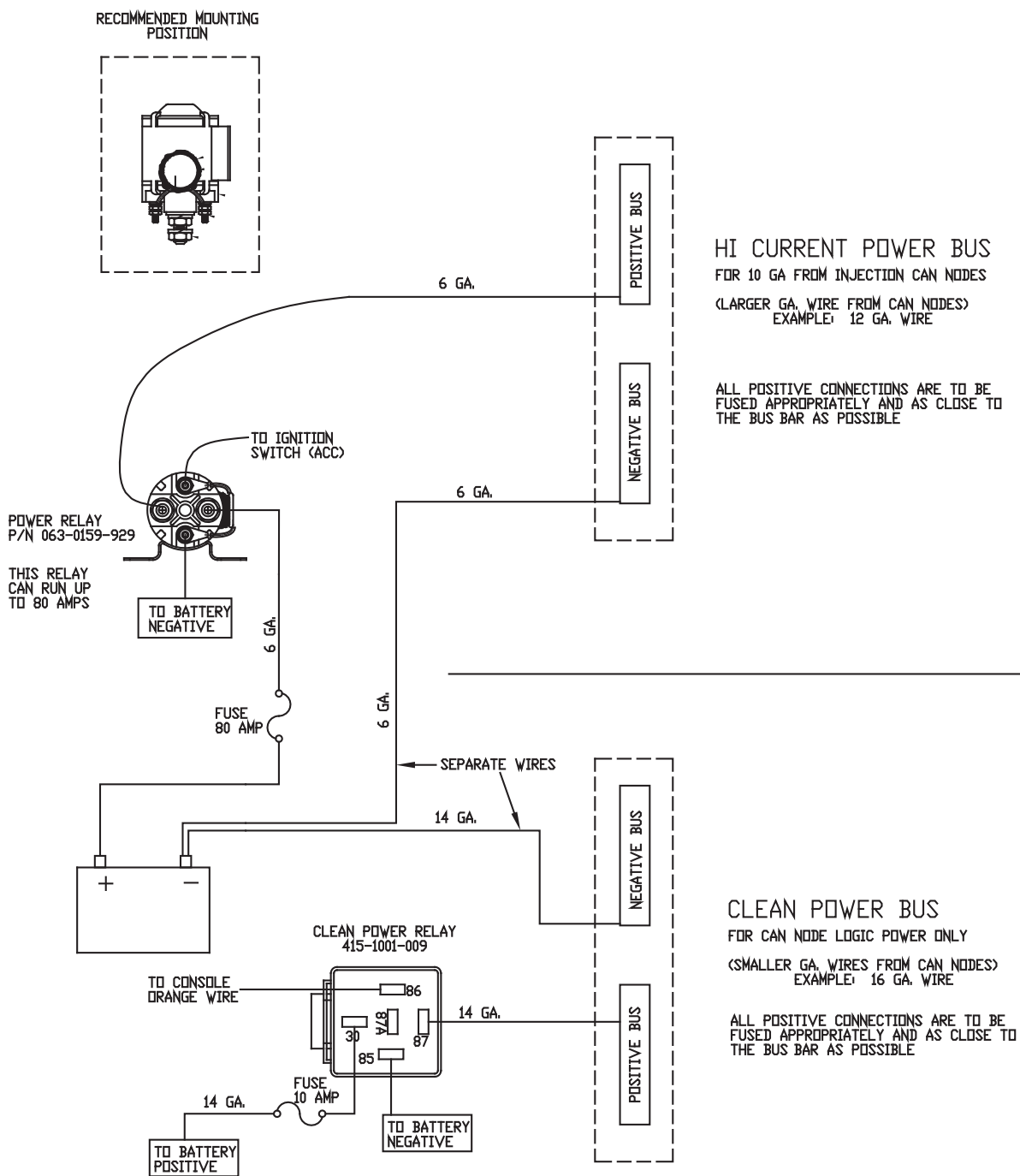


FIGURE 10. Generation 1 35' CAN Motor Control Cable with Agitator Connection (P/N 115-0171-943)

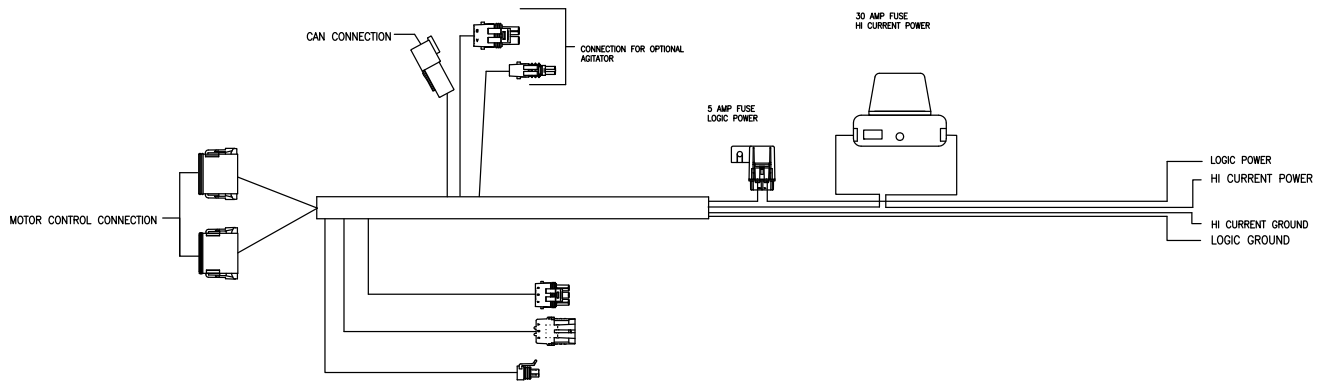


FIGURE 11. Generation 1 CAN Motor Control Cable (P/N 115-0171-944)

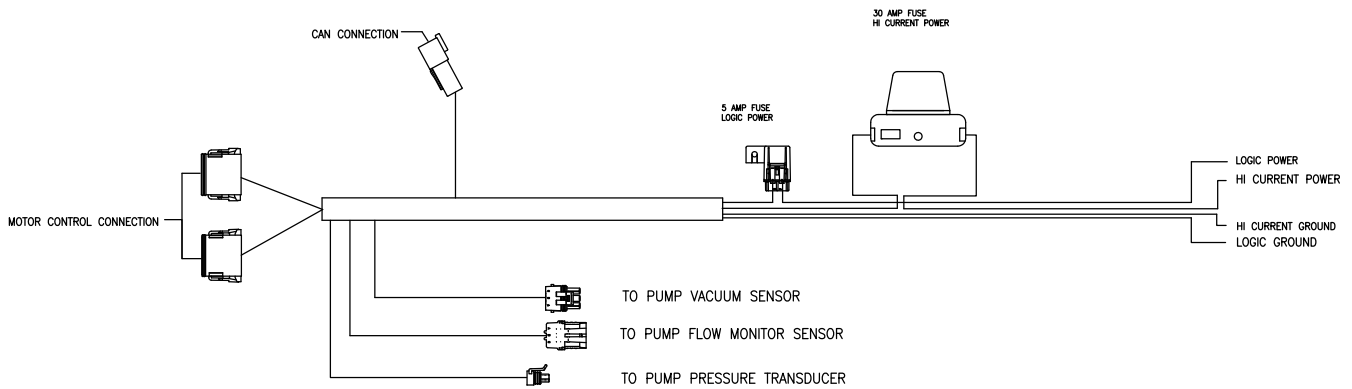
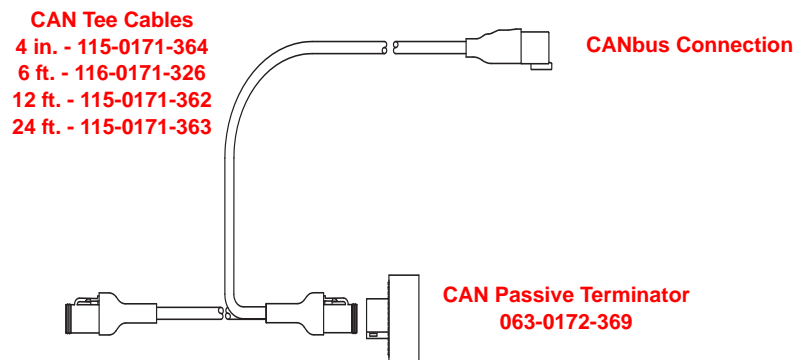


FIGURE 12. Generation 1 CAN Extension Cables with Tee and Passive Terminator



Generation 2 Cabling Platform

The logic and high current power connections for the first Sidekick Pro injection pump are provided within the chassis cable installed on the vehicle. If additional Sidekick Pro injection pumps will be added, a separate cable will be required to provide power for each additional pump. Refer to Figure 14 on page 26.

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 23.
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 23.

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 13. Generation 2 CAN Motor Control Cable (P/N 115-0171-952)

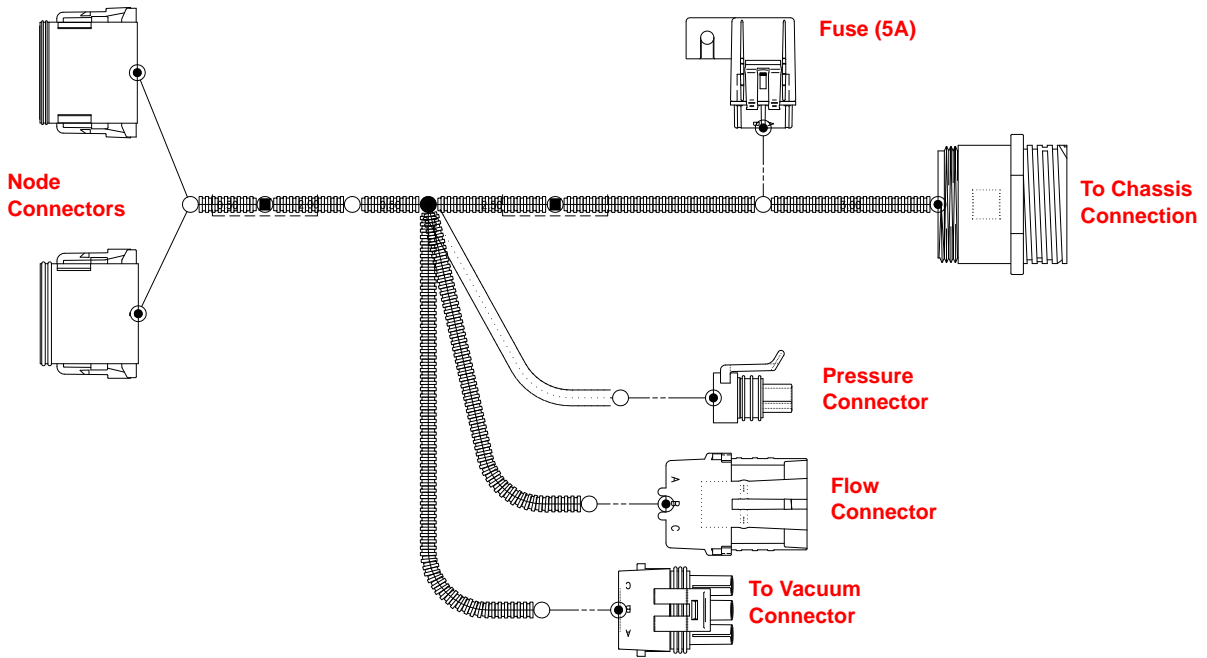
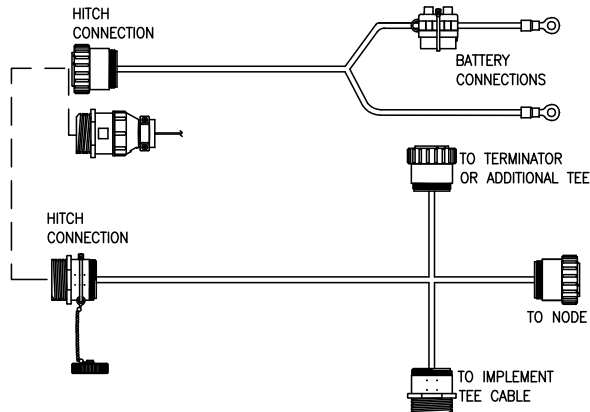


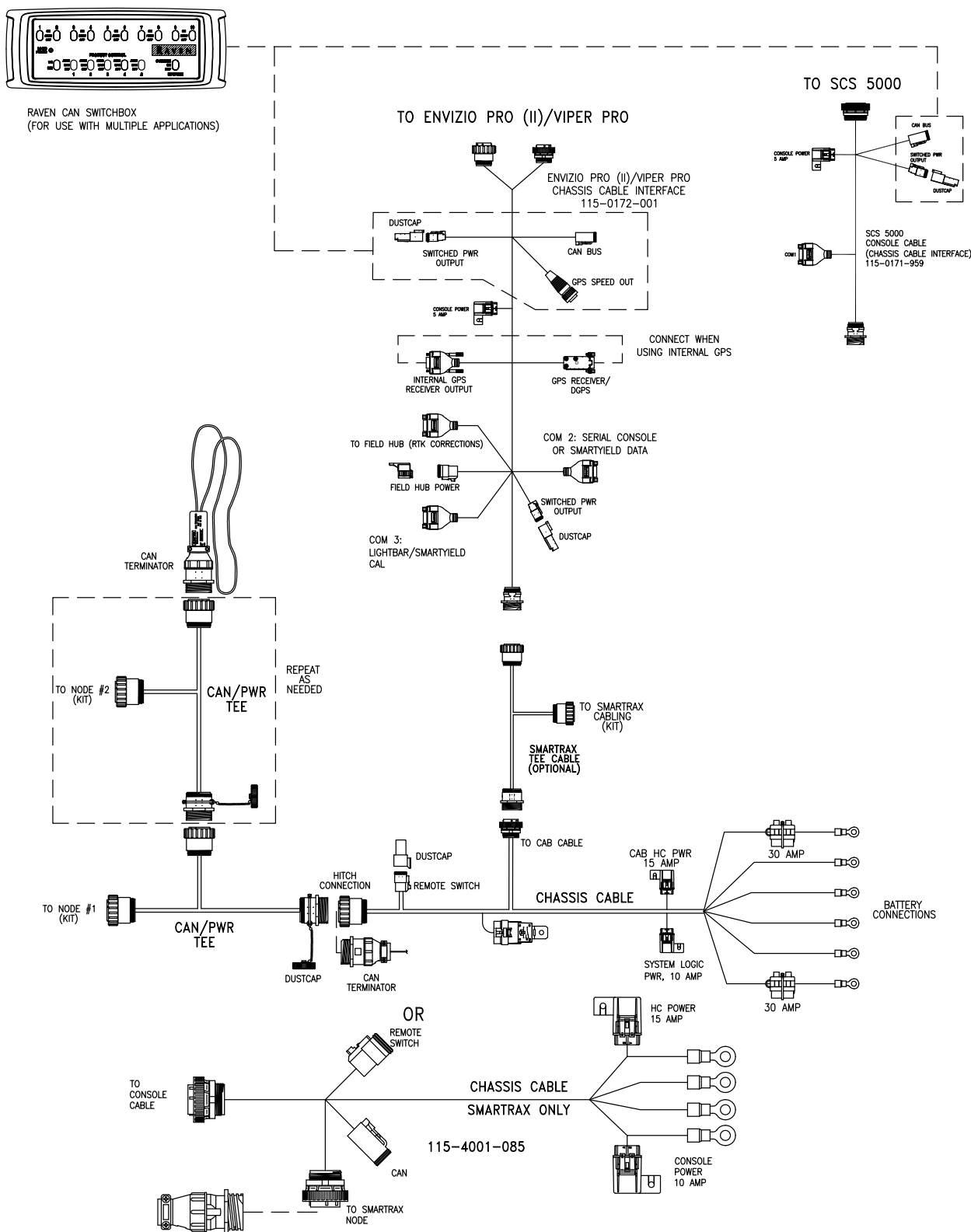
FIGURE 14. Generation 2 Cabling for Additional Injection Pumps (D/N 054-5000-001)



Note: For applicators operating more than two high volume injection pumps at the same time, select one power cable and one injection node add on cable for each additional pump:

- Power cable, injection pump add on chassis (P/N 115-0171-953)
- Node Cable, 6' injection pump add on (P/N 115-0171-954)
- Node Cable, 12' injection pump add on (P/N 115-0171-955)
- Node Cable, 24' injection pump add on (P/N 115-0171-956)
- Node Cable, 36' injection pump add on (P/N 115-0171-957)

FIGURE 15. Generation 2 CAN System Wiring Diagram (D/N 054-5000-001)

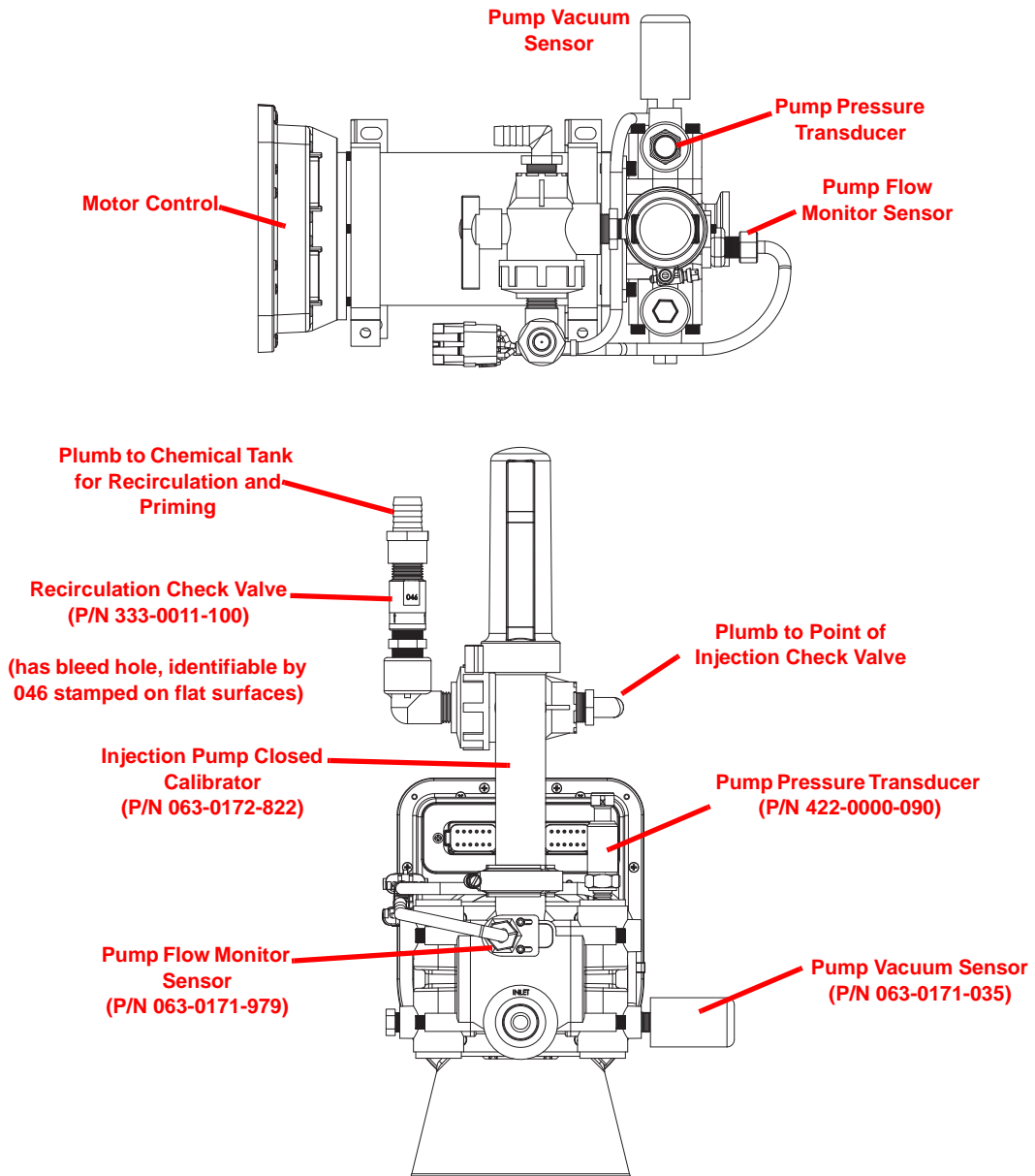


Sidekick Pro CANbus Connection

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 16. CAN Motor Control and Pump Connection (D/N 054-6400-006)



Detecting and Addressing the Motor Control Node

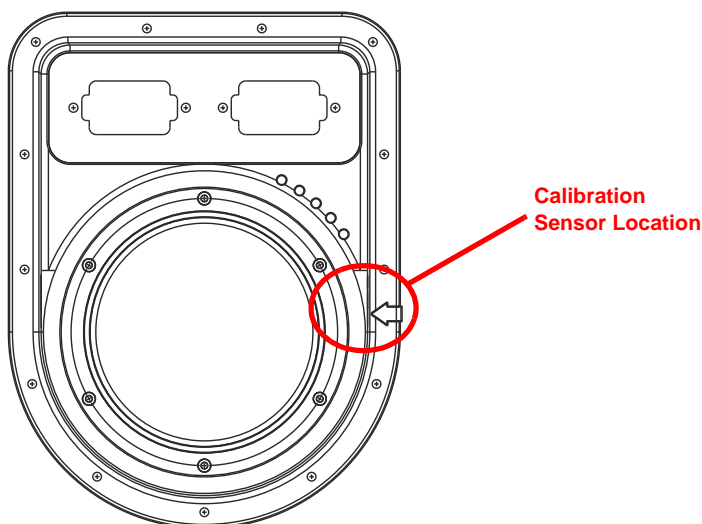
Review the CAN setup section of the Raven control console manual for detailed CANbus system information.

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 17. 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 36 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.

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:

- Pump Type
- Meter Cal
- Valve Type and Valve Cal
- Rate Cal
- Flow Cal 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.*

Pump Type

The type of pump used for chemical injection must be selected during the initial product calibration for each injection pump connected to the control system. Select either “High, 5-200 oz./min.” [1.5-59 dl/min.] or “Low, 1-40 oz./min.” [0.3-11.8 dl/min.] for each product control channel.

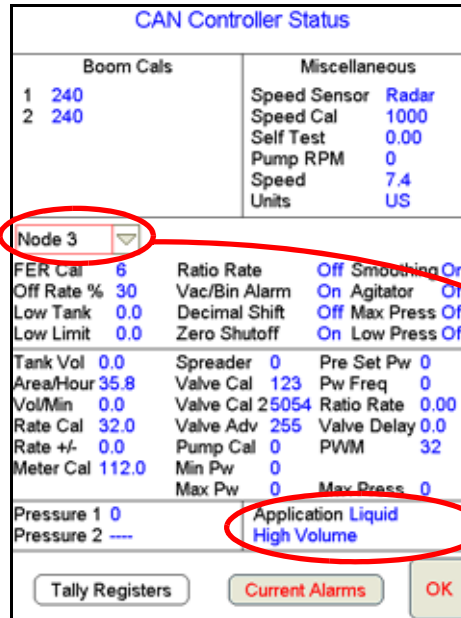
Note: *Firmware version 1.20 or higher is recommended for the Sidekick Pro injection node. Refer to the specific Raven control console operation manual for information on checking and updating node firmware versions for each node on the CANbus.*

Viper Pro

Note: Software version 3.6 or higher will be required to select the pump type on the Viper Pro field computer.

To set the pump type on the Viper Pro field computer:

1. Touch the Product Control area at the bottom of the main screen.
2. On the CAN Controller Status screen, select the control channel to which the injection pump is assigned.



3. Touch the Application area at the bottom of the screen and select the High or Low Volume options as appropriate for the pump connected to the selected control channel.
4. Repeat this process for any additional injection pumps connected to other control channels.

Envizio Pro

Note: Software version 3.4 or higher will be required to select the pump type on the Envizio Pro or Envizio Pro II field computers.

To set the pump type from the field computer Home screen:

1. Touch the Tools Menu icon and select the Product Control icon from the System menu.
2. On the Product Control Configuration screen, toggle the control channel icon in the upper, right corner of the screen to select the appropriate control channel for the injection pump.
3. Touch the Pump Type button.
4. Select the High or Low Volume options as appropriate.
5. Repeat this process for any additional injection pumps connected to other control channels.

SCS 4000/5000 Series Consoles

Note: Software version 3.4 or higher will be required to select the pump type on the SCS 4000/5000 Series consoles.

The pump type setting is available in the initial calibration sequence. The SCS console will automatically start the initial calibration sequence when a Sidekick Pro motor control node is detected on the CANbus for the first time.

Use the CE key to toggle the HIGH VOLUME PUMP or LOW VOLUME PUMP setting for the pump connected to the highlighted control channel.

If the console has already been programmed, use the following process to access and change the pump type setting.

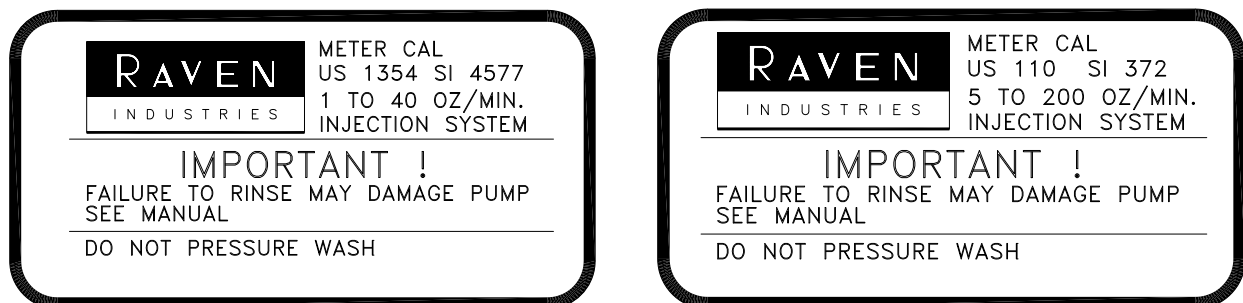
1. Press and hold the SELF TEST key.
2. The display will flash the current settings. After 12 seconds, the display will stop on US ACRES.
3. Press CE to change the working units.
4. Press ENTER to accept the new setting and proceed to the next screen.
5. Repeat step 3 and step 4 as necessary for the system settings.
6. When the console displays HIGH VOLUME PUMP, press the CE key to toggle between the HIGH VOLUME PUMP and LOW VOLUME PUMP options.
7. Press the ENTER key when the appropriate pump type is selected to save the setting and proceed with the initial calibration sequence.

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 39 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.):

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

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):

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

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.

Flow Cal (Envizio Pro only)

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

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

FER Cal (SCS 4000/5000 Series and Viper Pro 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.

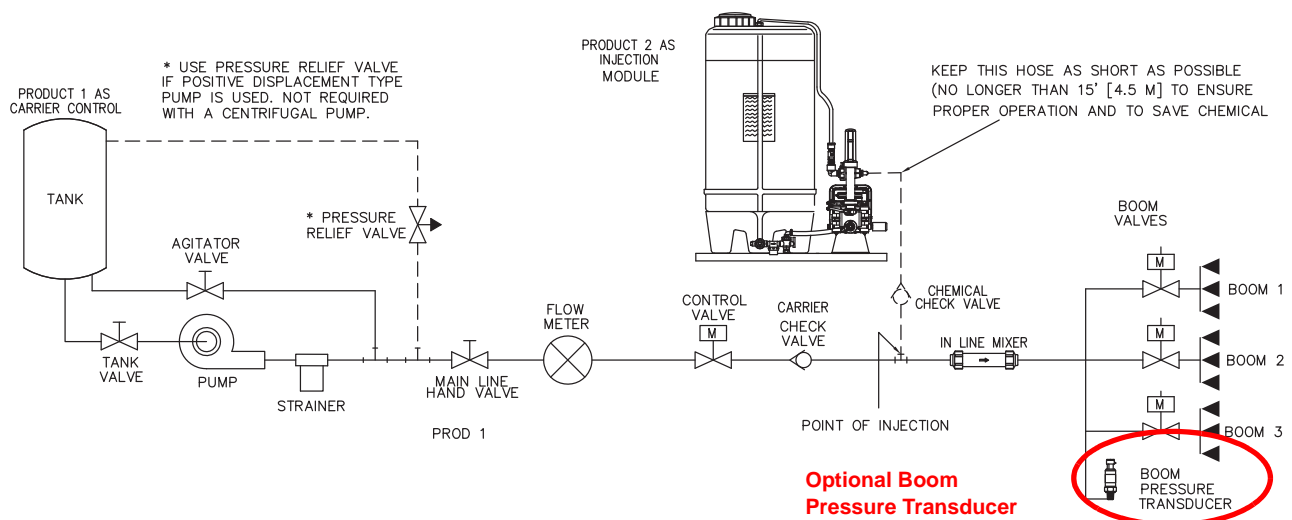
Note: The range for the FER error cal is 0 through 9. The default value for any Sidekick Pro injection pump is 6.

Pressure Transducer Calibration

Before operating the Sidekick Pro system, it is necessary to calibrate the pressure transducers which monitor the injected chemical and carrier product pressure (if available).

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. Before operating the Sidekick Pro system, the pump transducer must be calibrated.

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 there is no pressure at the pump outlet port.
2. Select or display the set up screens for the correct product.
3. Verify no product pressure is in the injection lines.
4. Enter a value of zero for the pressure calibration value.

Note: *The operator has the option of disabling all feedback for the high and low pressure alarms via the control console menus.*

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 on control channel 1 and the ratio rate application mode must be enabled. If a carrier product is not set as "product 1," the low pressure alarm will not function even if the alarm is enabled on the control console.*

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 36 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:

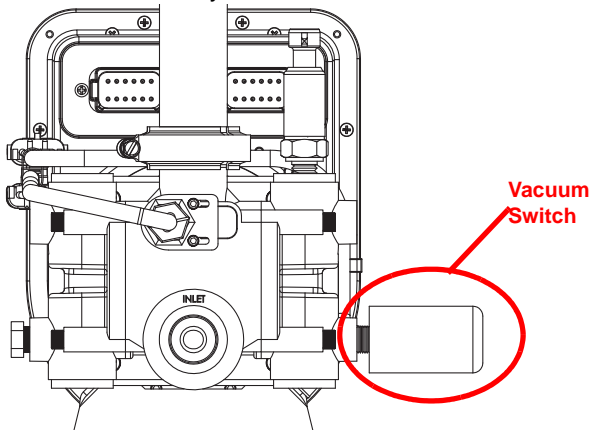
1. Verify control console setup
2. Prime the injection pump
3. Calibrate the injection pump

Verify Control Console Settings

Review the *Control Console Calibration* section on page 31 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. Injection pressure is less than 12 PSI [82.7 kPa]
 - b. Pump is in the off condition
 - c. Vacuum pressure less than 11.5 inches of mercury



Note: The vacuum switch on the pump will engage and a flow alarm will be displayed if product cannot be drawn into the pump (e.g. vacuum pressure at or above 11.5 inches of mercury). Check

screens, hose diameter and any hand valves between the chemical tank and pump inlet. Also, verify that the product is flowing freely. Cold temperatures and low viscosity products may cause high vacuum pressures and cause the pump not to operate properly.

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.

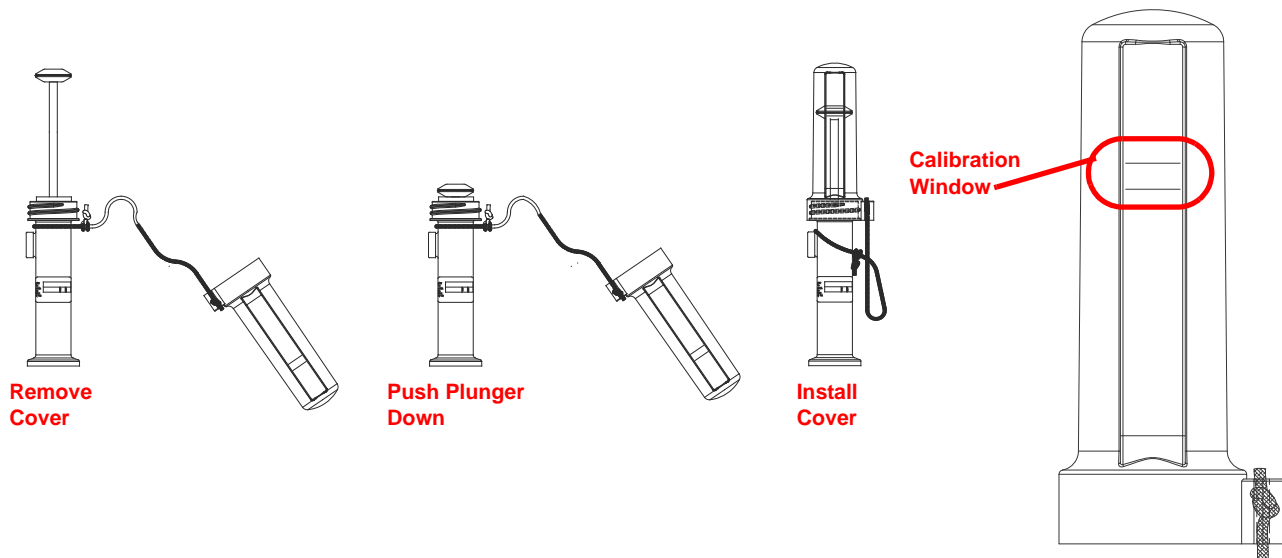
Press the “End Prime” button to stop the priming procedure at any time. If the pump fails to prime successfully after the first attempt, restart the priming procedure. If the pump is still unable to prime successfully, refer to Chapter 7, *Troubleshooting*, for assistance diagnosing issues with the injection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

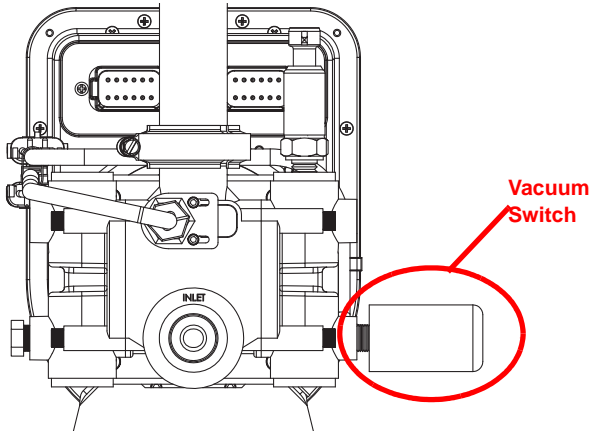
1. Ensure the pump is primed as described in the *Prime the Injection Pump* section on page 38 before proceeding with the calibration process.
2. Remove the cover from the injection pump calibrator.
3. Press the calibrator all the way down and replace the calibrator cover.

FIGURE 3. Sidekick Pro Pump Calibrator



4. Verify the following conditions are present:
 - a. Injection pressure is less than 12 PSI [82.7 kPa]
 - b. Pump is in the off condition

- c. Vacuum pressure less than 11.5 inches of mercury



Note: The vacuum switch on the pump will engage and a flow alarm will be displayed if product cannot be drawn into the pump (e.g. vacuum pressure at or above 11.5 inches of mercury). Check screens, hose diameter and any hand valves between the chemical tank and pump inlet. Also, verify that the product is flowing freely. Cold temperatures and low viscosity products may cause high vacuum pressures and cause the pump not to operate properly.

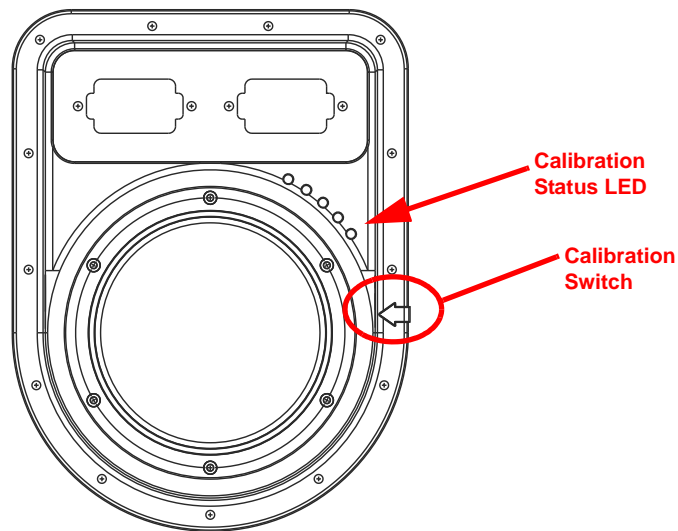
5. On the control console, navigate to the Injection Diagnostics display and begin the pump calibration. Refer to Chapter 5, *Setting Application Mode and Injection Diagnostics* and the console specific section details to locate the Injection Diagnostics display.
6. Begin the calibration process on the 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 (e.g. screw driver or spare bolt) past the integrated calibration sensor twice.

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.

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.

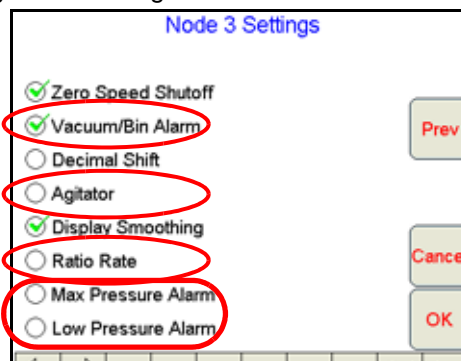
Viper Pro

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:

www.ravenhelp.com

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 the first data display, or Feature Settings area.
3. Touch the Next button to display the following screen.

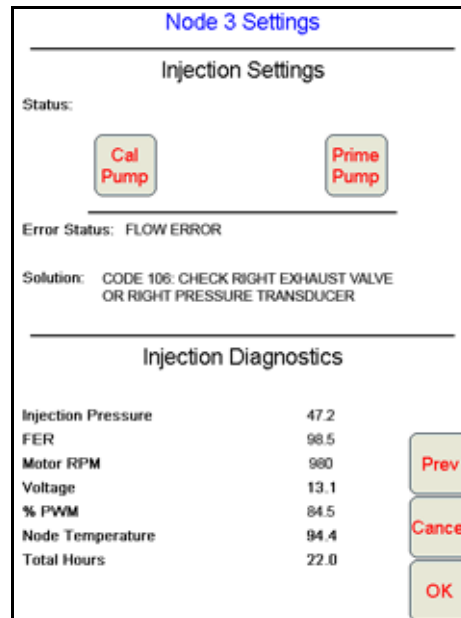


4. The Vacuum/Bin Alarm is enabled by default when a motor control node is detected on the CANbus. Deselect this option to disable the audible alarm for injected products.
5. When enabled, the Agitator option will send power to an agitator motor via the CAN motor control cable. See Figure 10 on page 24.

6. Select the Max Pressure Alarm option to enable alarms for high pressure conditions.
7. Select the Low Pressure Alarm option to enable alarms for low pressure conditions.

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 the second data display, or Product Control Settings area, 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.

FER. The Flow to Encoder Ratio is a tool used in conjunction with the FER 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.

Total Hours. The total run time of the selected injection pump is displayed in this area.



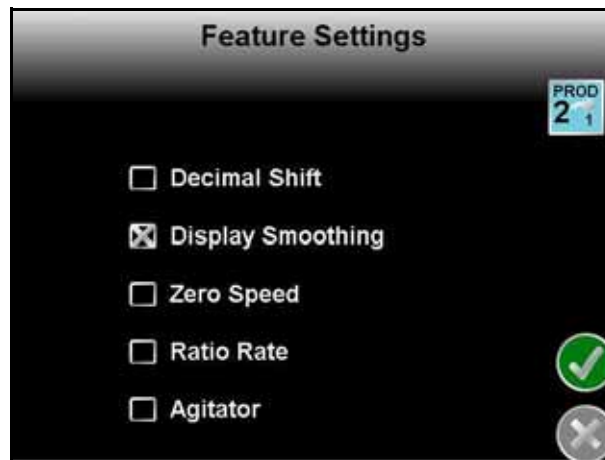
Envizio Pro

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:

www.ravenhelp.com

Application Mode Setup

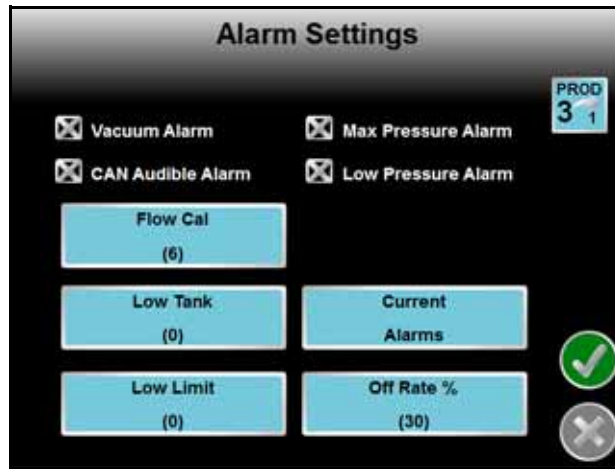
1. Touch the “Tools Menu” icon on the Envizio Pro Home screen.
2. Select the “Product Control” icon within the System menu and touch the “Feature Settings” button to display the following screen.



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 10 on page 24.

Enabling Alarms

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 “Alarm Settings” button to display the following screen.



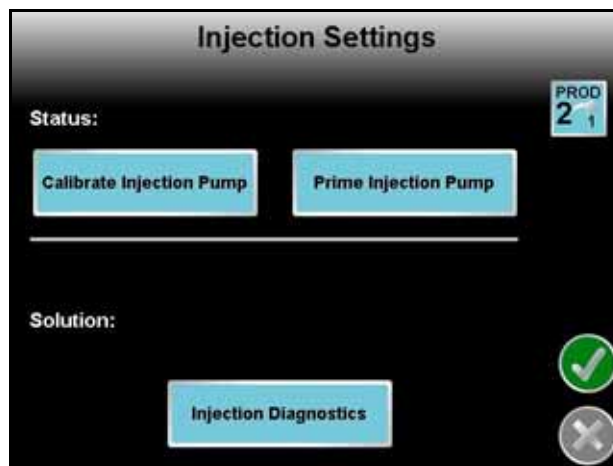
Note: Alarm settings for the Sidekick Pro™ injection system will only be displayed if a control channel corresponding to a detected motor control node is selected. Use the “Select Product” icon in the upper, right corner of the display to cycle through the alarm settings for each available control channel.

3. Select the desired alarm conditions to enable on-screen alerts for specific error conditions. If the CAN Audible Alarm setting is selected, the field computer will also sound an alert tone when an error condition is encountered.

Review the *Flow Cal (Envizio Pro only)* section on page 34 for details on the Flow Cal value. Refer to the *Envizio Pro and Envizio Pro II Installation and Operation Manual* for more information on the low tank, current alarms, low limit and off rate percent settings.

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.



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.

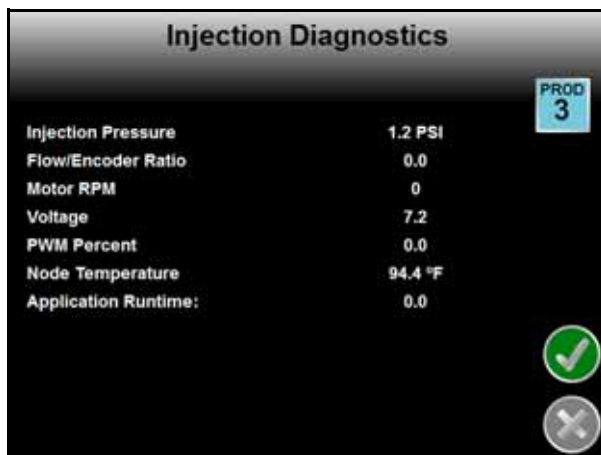
Calibrate Injection Pump

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

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

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.

Flow/Encoder Ratio. The flow to encoder ratio is a tool used in conjunction with the Flow 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 Percent. 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.

Application Runtime. The total run time of the selected injection pump is displayed in this area.

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:

www.ravenhelp.com

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 Product submenu is displayed on the screen.
2. Use the up or down arrows to select the Max PSI Err option and use the CE key to toggle the Maximum pressure alarm on or off.
3. Use the up or down arrows to select the Low PSI Err option and use the CE key to toggle the Low pressure alarm on or off.
4. Use the up or down key to select the Vacuum or Bin Level Alarm to receive an audible alarm if the system detects a vacuum error condition with the injection system.
5. When enabled, the Agitator option will send power to an agitator motor via the CAN motor control cable. See Figure 10 on page 24.
6. 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

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.

	<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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Maintenance and Cleaning

	<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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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.

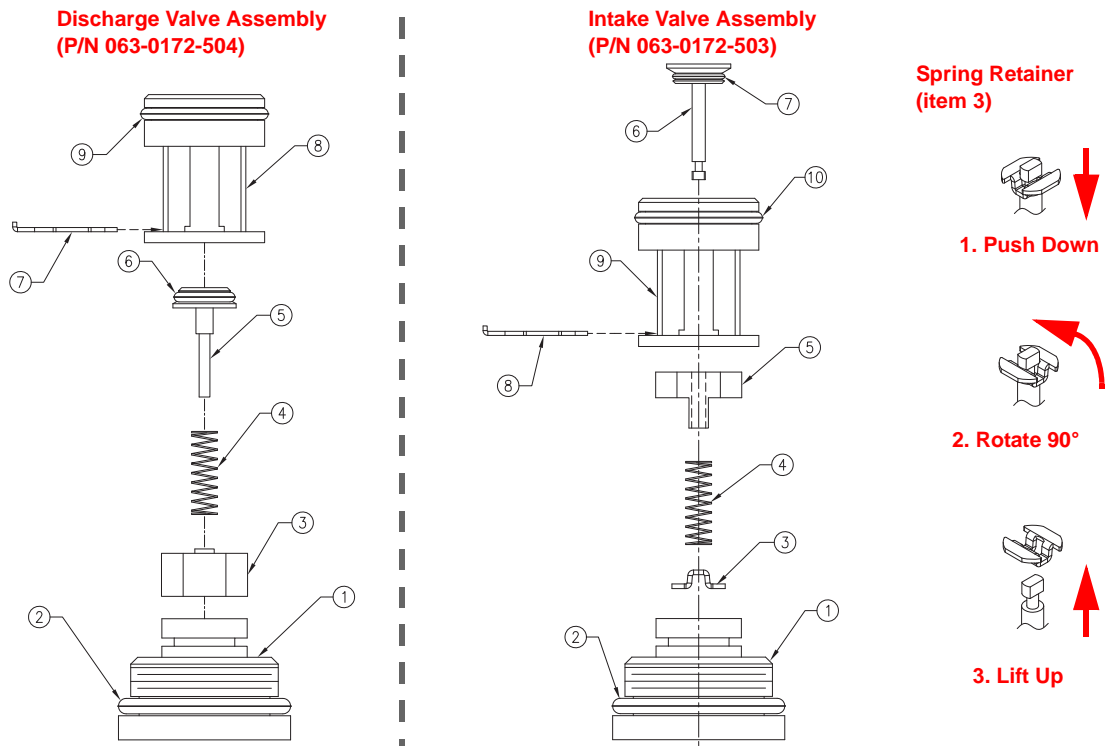
Note: *The intake and discharge valve assemblies contain parts which are not interchangeable. To ensure proper re-assembly, it is recommended that the intake and discharge valve assemblies are cleaned and inspected separately.*

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 53.
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




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)




Pump Cam and Bearing

	<p style="text-align: center;">⚠ CAUTION</p> <p>Chemical residue or build up may be present on internal pump components. Wear gloves when servicing internal pump assemblies.</p>
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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

	<p style="text-align: center;">⚠ CAUTION</p> <p>Chemical residue or build up may be present on internal pump components. Wear gloves when servicing internal pump assemblies.</p>
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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 (D/N 063-0173-081)

Discharge Valve Assembly
(P/N 063-0172-504)
See Figure 1 on page 53

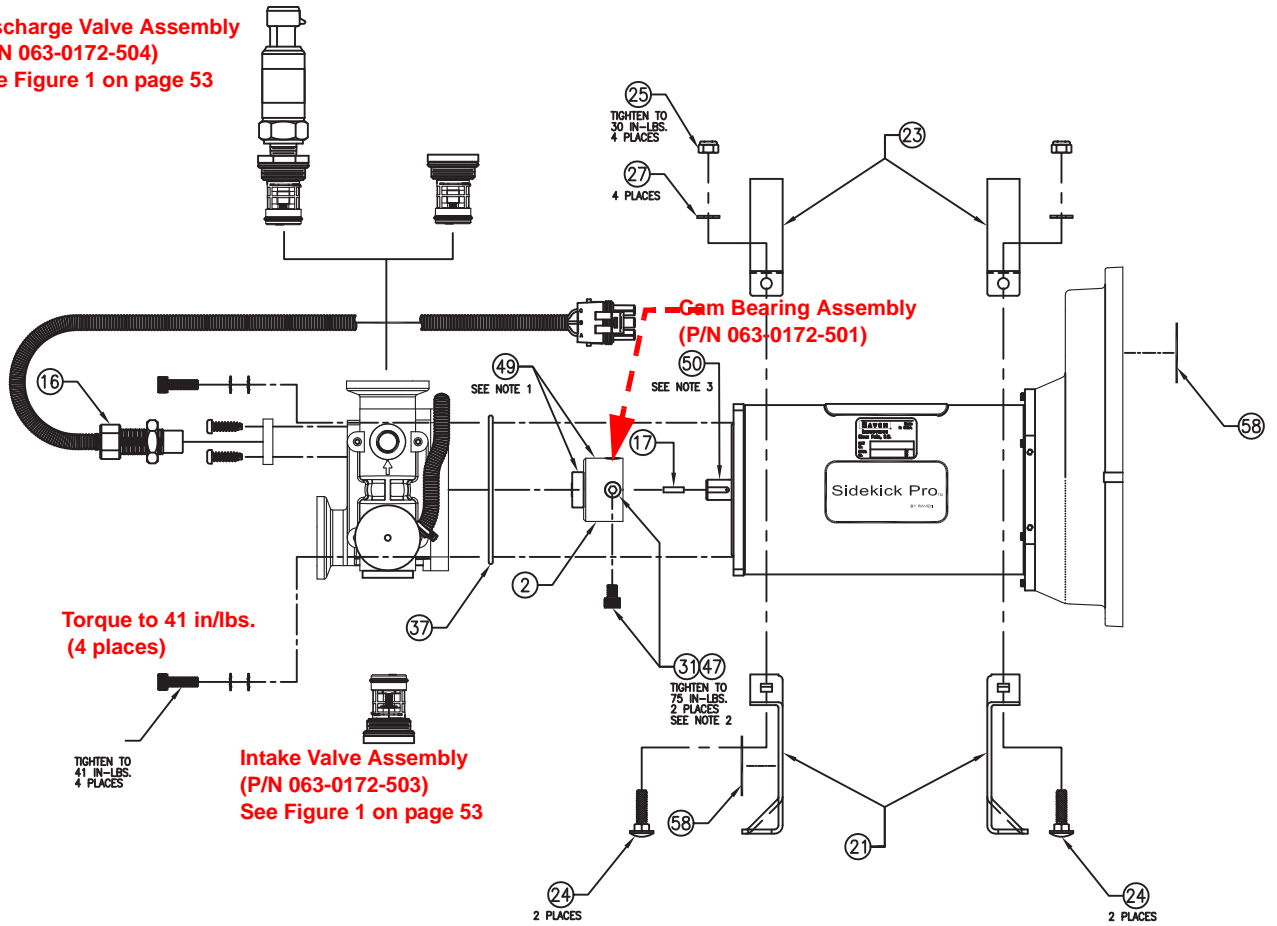
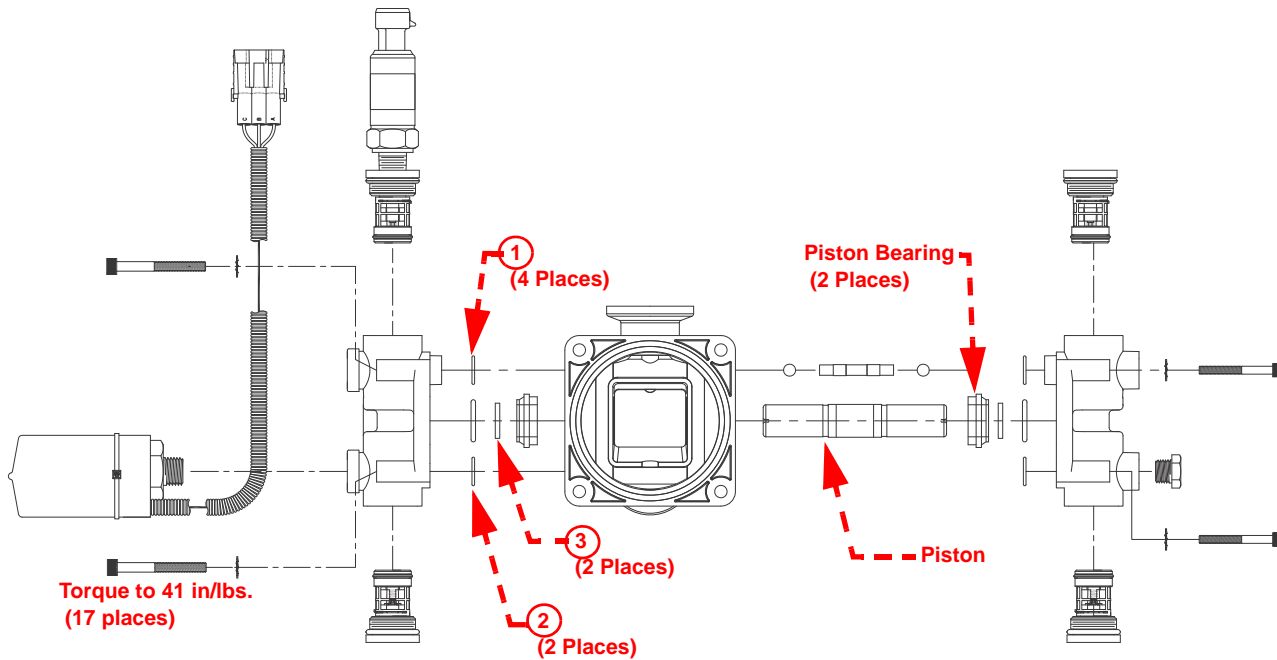


FIGURE 3. Pump Head Parts and Seal Installation (D/N 063-0173-081)



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.
5. Carefully remove the pump heads. While removing the pump heads, take care not to damage the exposed finish on the piston during disassembly.
6. 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.


7. Inspect the piston for scratches. If the finish is scratched or damaged, replace the piston.
8. Inspect the piston bearing for wear and replace if necessary.
9. 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.

- a. Install the slipper seal onto the piston.
- b. Using general purpose grease, lubricate the o-ring and seat over the slipper seal.

- c. 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.
 - d. Install the pump head to the pump assembly.
 - e. Repeat the above steps to install the remaining pump head.
10. Tighten socket head screws to the torque specified in Figure 3 on page 56.


Seasonal Maintenance and Storage

	<p style="text-align: center;">⚠ 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.*

1. Empty product from the chemical supply tank and flush the injection pump with water.
2. Remove hardened chemical residues or build up by flushing the injection system with:
 - a. kerosene or fuel oil if the last product through the pump was petroleum based.
 - b. soap and water if the last product through the pump was water based.
3. Remove the intake and discharge valve assemblies from the pump.

	<p style="text-align: center;">⚠ CAUTION</p> <p>Chemical residue or build up may be present on internal pump components. Wear gloves when servicing internal pump assemblies.</p>
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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 52.

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 54 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.

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

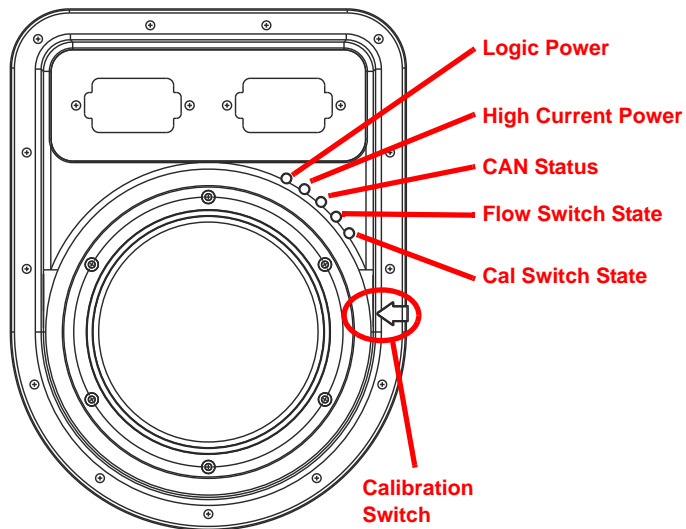


TABLE 1. LED Status Indicators

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.

Alarms

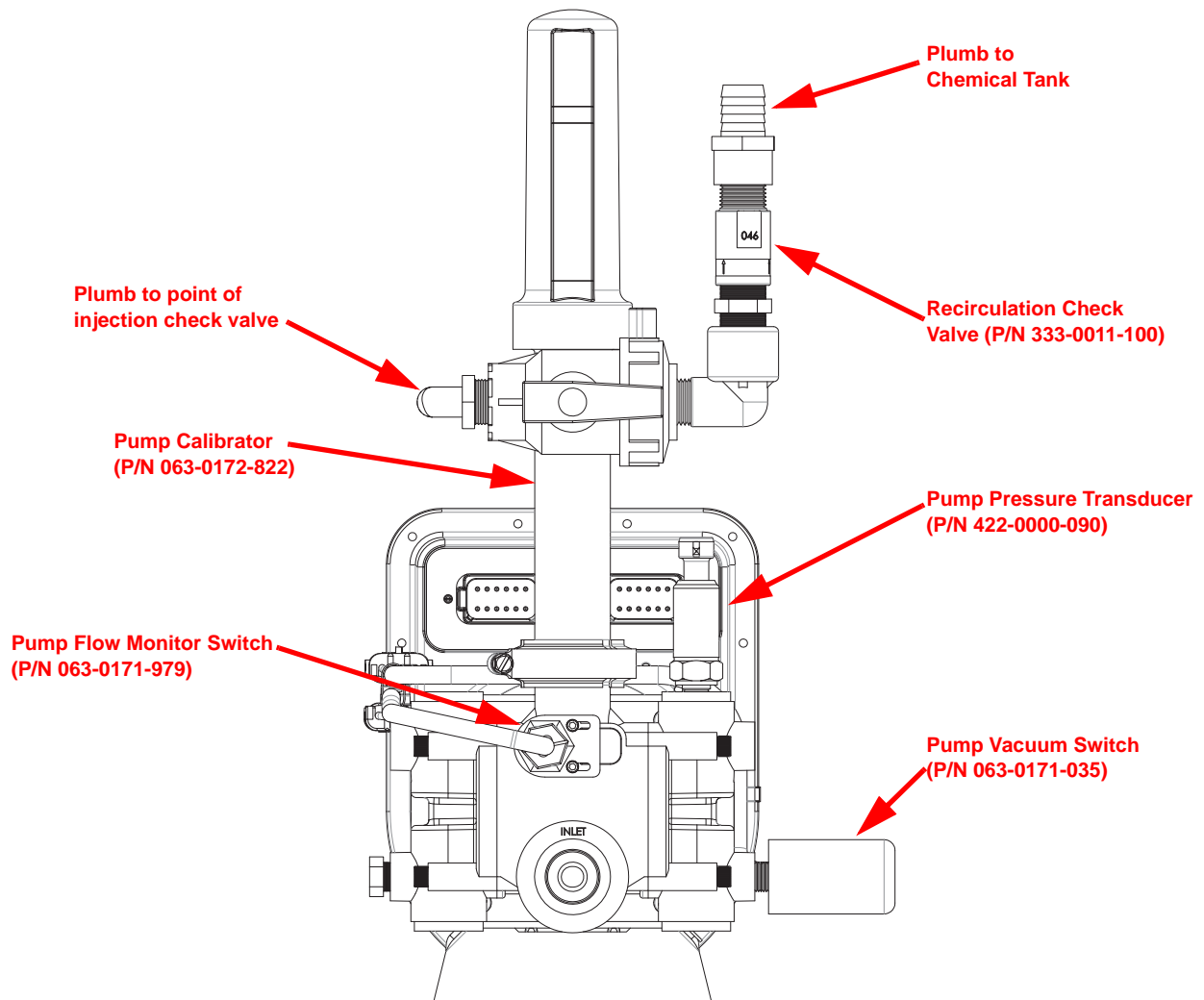
TABLE 2. Sidekick Pro Error Codes for Viper Pro and Envizio Pro

Error Description	Possible Cause	Solution
Off Rate Alarm	<ul style="list-style-type: none"> Difference between actual and target application rates has been greater than 28% for more than 5 seconds 	<ul style="list-style-type: none"> Required flow rate is out of range for the injection pump. Calculate the volume per minute required for the application and verify rate is within range of the injection pump.
Low Tank Alarm	<ul style="list-style-type: none"> Chemical supply tank is below the refill threshold level 	<ul style="list-style-type: none"> Refill injection chemical supply tank and reset tank level in VT display.
Flow Error Alarm	<ul style="list-style-type: none"> Flow obstruction in inlet cartridges Chemical supply tank is out of chemical 	<ul style="list-style-type: none"> Perform a pump calibration test. If the pump does not calibrate properly, remove the intake cartridges and perform pump maintenance to clear obstructions. Refill chemical supply tank and perform the pump priming procedure.
Flow Error Alarm	<ul style="list-style-type: none"> Flow obstruction in discharge cartridges 	<ul style="list-style-type: none"> Perform a pump calibration test. If the pump does not calibrate properly, remove the discharge cartridges and perform pump maintenance to clear obstructions.
Low Pressure Alarm	<ul style="list-style-type: none"> Injection pressure is lower than carrier pressure 	<ul style="list-style-type: none"> Perform a pump calibration test. If the pump does not calibrate properly, clean the injection pump inlet and discharge valves. Calibrate the pump transducer. Check lines between injection pump and in-line mixer. Verify all hand valves are in the correct position. Replace the pump transducer.
Maximum Vacuum Alarm	<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.


Error Description	Possible Cause	Solution
Maximum Pressure Alarm	<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.
Pressure Sensor Alarm	<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.
Motor/Encoder Alarm	<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.
HC Power Alarm	<ul style="list-style-type: none"> • Injection node not connected to high current power 	<ul style="list-style-type: none"> • Verify high current breaker is not tripped. • Verify battery connections.
Zero Speed Alarm	<ul style="list-style-type: none"> • Faulty cabling, connection or speed sensor. 	<ul style="list-style-type: none"> • Verify speed sensor and signal. Refer to the field computer operation manual for information on testing speed and flow cabling and troubleshooting the speed sensor.
Low Limit Alarm	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •

Sidekick Pro Pump Replacement Parts

FIGURE 1. Injection Pump Components




Injection Pump Pressure Transducer

	<p style="text-align: center;">⚠ 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 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.

	<p style="text-align: center;">⚠ 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>
---	--

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 style="text-align: center;">⚠ 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>
---	---

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 style="text-align: center;">⚠ 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>
---	--

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.

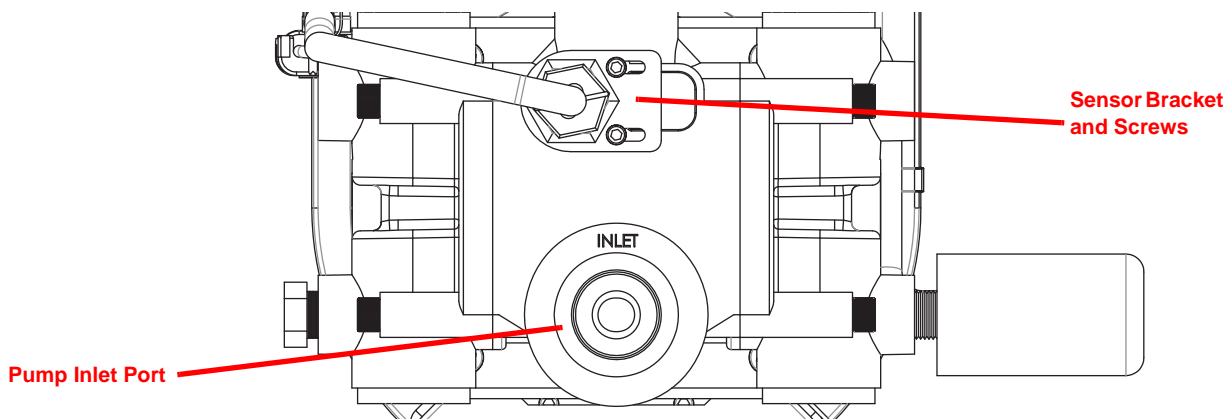
Note: *Do not over tighten the pressure transducer. Overtightening the pressure transducer may damage the pump head.*

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

Injection Pump Flow Monitor Sensor

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

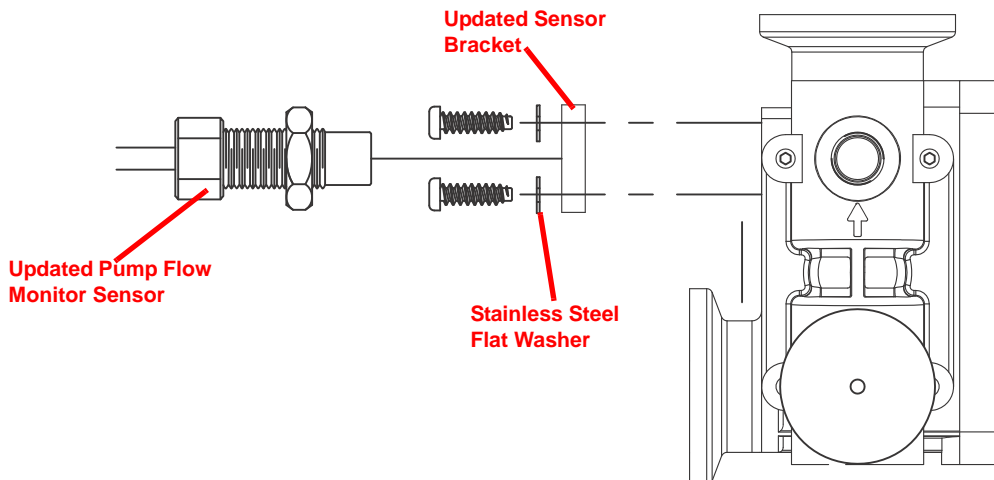
FIGURE 2. Pump Head and Flow Monitor Sensor



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

Note: *It is recommended to replace the sensor bracket if an updated flow monitor sensor is supplied with a new bracket and mounting hardware. The updated flow sensor is designed to improve flow sensitivity while the updated sensor bracket and hardware will help to secure the sensor body properly in the pump head.*

FIGURE 3. Flow Sensor Update Kit (P/N 117-0171-455) with Bracket and Hardware



Remove the existing allen screws and sensor bracket. Loosely mount the supplied bracket to the pump head using the supplied washers and allen screws. The updated flow monitor sensor and bracket should be mounted to the pump head as shown in Figure 3 above.

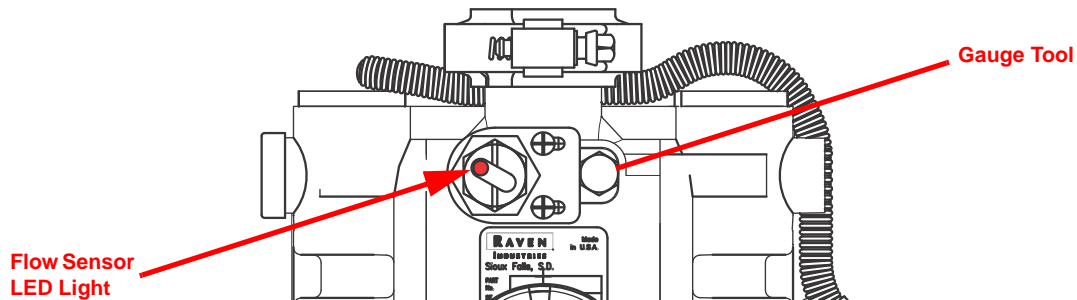
- Thread two 5/16" nuts (not supplied) onto a 5/16" bolt (not supplied) to make a gauge tool.



The gauge tool will be used to help align the sensor bracket and ensure the sensor body is mounted properly on the pump head.

- Insert the gauge tool into the recess in the pump head to the right side of the sensor bracket as shown in Figure 4 below.

FIGURE 4. Gauge Tool and Flow Sensor Bracket Alignment



- Tighten the two allen head screws to secure the sensor bracket.

Note: Leave the gauge tool in place to ensure that the sensor bracket stays properly aligned during the rest of the process. The gauge tool may be removed once the sensor lock nut is tightened.

- Thread the new flow monitor sensor into the pump head until the sensor body contacts the pump head.
- Tighten the sensor assembly a partial turn until the line on the flow monitor sensor is near vertical and the LED is on the left side of the line. **Do not overtighten.**

Flow Monitor Switch Adjustment Procedure

- Set the hand valves for the system to recirculate product to the chemical tank and prime and calibrate the pump.
- 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).

The LED indicator should be flashing while the pump is running. If the indicator light is not flashing, turn the sensor body a few degrees until the LED flashes.

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

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

Injection Pump Encoder

Encoder Removal

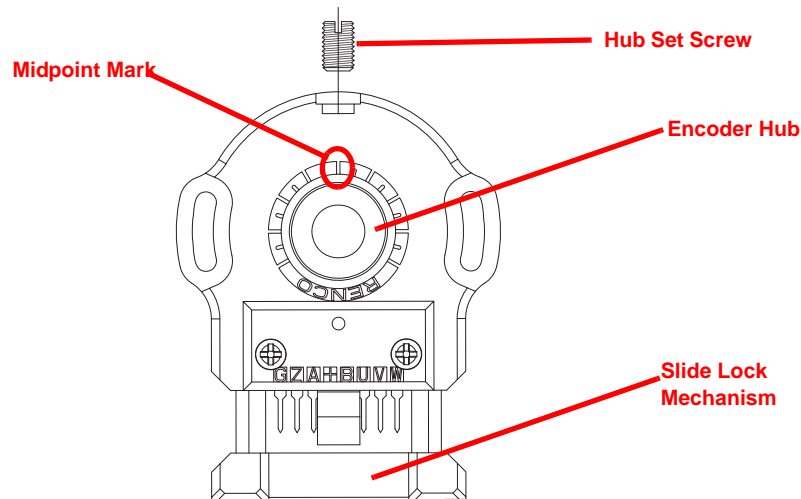
1. Loosen the set screw from the encoder hub.
2. Remove the mounting screws.
3. Carefully slide the encoder assembly off of the shaft.
4. Use a screwdriver to gently lift the locking tab and disconnect the encoder cable connector.

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 5. 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. If the set screw is not snug, the pump may not control correctly or will run erratically.

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.

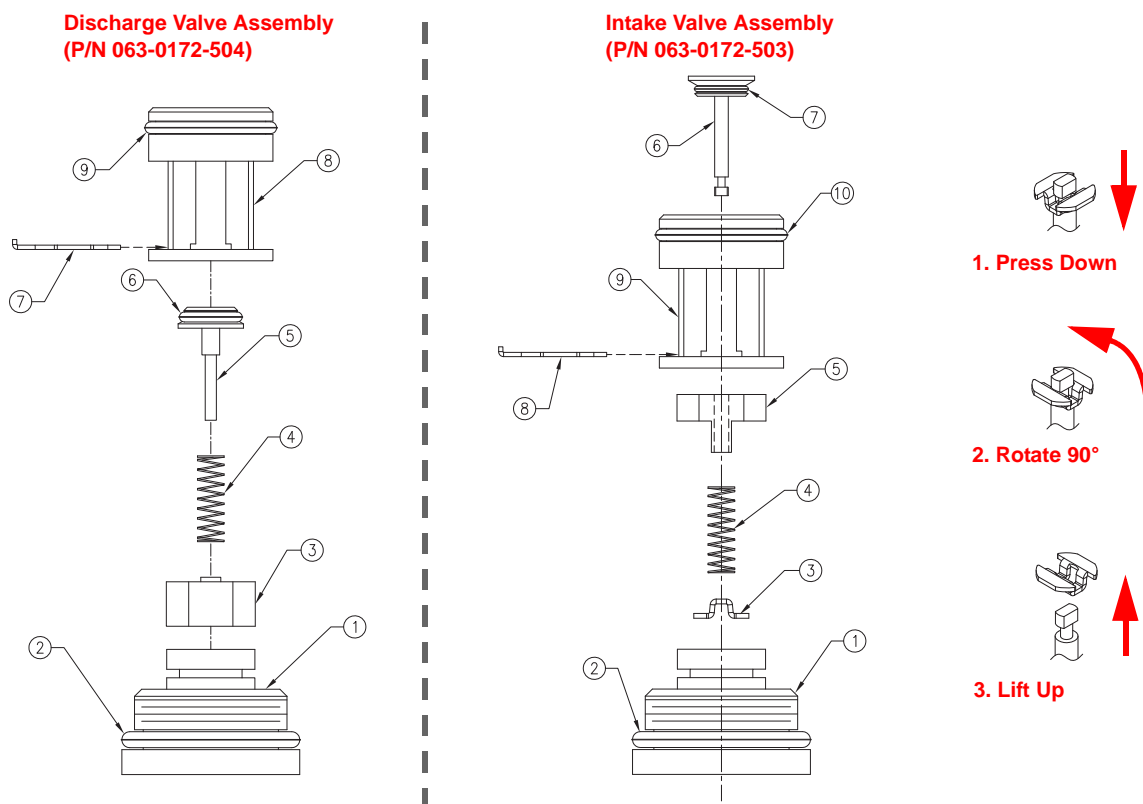
7. Rotate the body of the encoder if necessary to install the mounting screws in the center of each slot on the side of the encoder.
8. Install the mounting screws finger tight and press the slide lock mechanism toward the encoder body.
- Insert the 8-pin connector on the encoder cable to the encoder 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 6. Check Valve Spring Retainer Assemblies



Sidekick Pro™ 1 to 40 oz./min. Pump

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

1	HARNES, ENCODER	115-0171-861			54
4	LABEL, SIDEKICK PRO	041-0159-841			53
					52
2	TIE, CABLE	435-1000-005			51
1	LABEL, 1 TO 40 OZ.-MIN. INJECTION SYSTEM	041-0159-806			50
1	LABEL, SERIAL	041-0159-710			49
AR	SEALANT, RECTORSEAL	222-1001-026			48
AR	COMPOUND, ANTI-SIEZE, NICKEL	222-1001-079		SEE NOTE 3, SHT. 2 OF 3	47
AR	GREASE	222-1001-114			46
AR	GREASE, LUBRICATING	222-0000-002	VERSILUBE	SEE NOTE 4, SHT. 2 OF 3	45
AR	SEALANT, THREAD	222-1001-029	LOCTITE #242		44
2	SEAL, SLIPPER	219-0000-125			43
2	O-RING	219-0007-117	2-117V965-80		42
1	O-RING	219-0003-045			41
4	O-RING	219-0002-015			40
1	O-RING	219-0001-153			39
2	SCREW	311-0004-040			38
8	SCREW	311-0068-191	10-24 x 1 1/2" S.S. SHC	SEE NOTE 5, SHT. 2 OF 3	37
2	SCREW	311-0004-013	#6-32 x 1/2"		36
4	SCREW, SOCKET HEAD, CAP	311-0073-066	1/4"-20 x 3/4"	SEE NOTE 5, SHT. 2 OF 3	35
2	SCREW, CAP, HEX SOCKET HEAD	311-0068-060	1/4" x 20 x 1/4"		34
6	SCREW, SOCKET HEAD CAP	311-0068-007	#4-40 x 1/2"		33
8	WASHER, LOCK, INTERNAL TOOTH	313-3000-017	1/4"	STAINLESS STEEL	32
8	WASHER, LOCK, INTERNAL TOOTH	313-3000-014	#10	STAINLESS STEEL	31
4	WASHER	313-2300-009			30
2	WASHER, LOCK	313-3000-007	#6 INTERNAL TOOTH		29
4	NUT, LOCK, NYLON INSERT	312-4000-057			28
4	BOLT, CARRIAGE	311-0069-004	1/4"-20 x 1" LG.	SEE NOTE 5, SHT. 2 OF 3	27
					26
2	TIE, SCREW MOUNT	435-1000-030	8" LG.	BLACK NYLON	25
2	TIE, CABLE	435-1000-002			24
4"	CONDUIT, CONVOLUTED	434-1001-016	1 @ 4" LG.		23
2	STRAP	107-0171-600			22
1	PLUG, HEX, PIPE	333-0009-061	1/4" NPT		21
2	BRACKET, MOUNTING, PUMP/MOTOR	107-0171-599			20
1	BRACKET, SENSOR	106-0159-539			19
1	SHUTTLE MAGNET/PIN ASSY	063-0173-398			18
2	BALL	321-0000-380			17
1	KEY	107-0171-588	1/8 x 1/8 x 1/2		16
1	SENSOR, FLOWMETER	063-0171-979B			15
1	SWITCH, VACUUM	063-0171-035B	INJECTION SYSTEM		14
1	TRANSDUCER, PRESSURE	422-0000-090	0-250 PSI, S. S.		13
1	CARTIDGE, EXHAUST	063-0172-504B			12
2	CARTRIDGE INTAKE	063-0172-503B			11
1	MOTOR CONTROL CAN, INTEGRATED	063-0173-082B			10
1	ASSEMBLY, BEARING	063-0172-501			9
2	WASHER, FLAT	313-2301-003	.375 OD x .144 ID	STAINLESS STEEL	8
1	ENCODER	422-0000-096			7
1	MOTOR	416-0000-040			6
1	DISCHARGE VALVE,/TRANSDUCER PLUG ASSEMBLY	063-0173-310B			5
2	HEAD, 3/4" PUMP	107-0171-526			4
1	PISTON, 3/4" PUMP	107-0171-531			3
2	BEARING, PISTON	325-0000-018			2
1	HOUSING, 3/4" INJECTION PUMP	107-0171-523			1
QTY. REQ'D.	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	SPECIFICATION	MATERIAL OR NOTE	ITEM NO.

FIGURE 7. CAN Integrated Pump (P/N 063-0173-103) Housing and Encoder

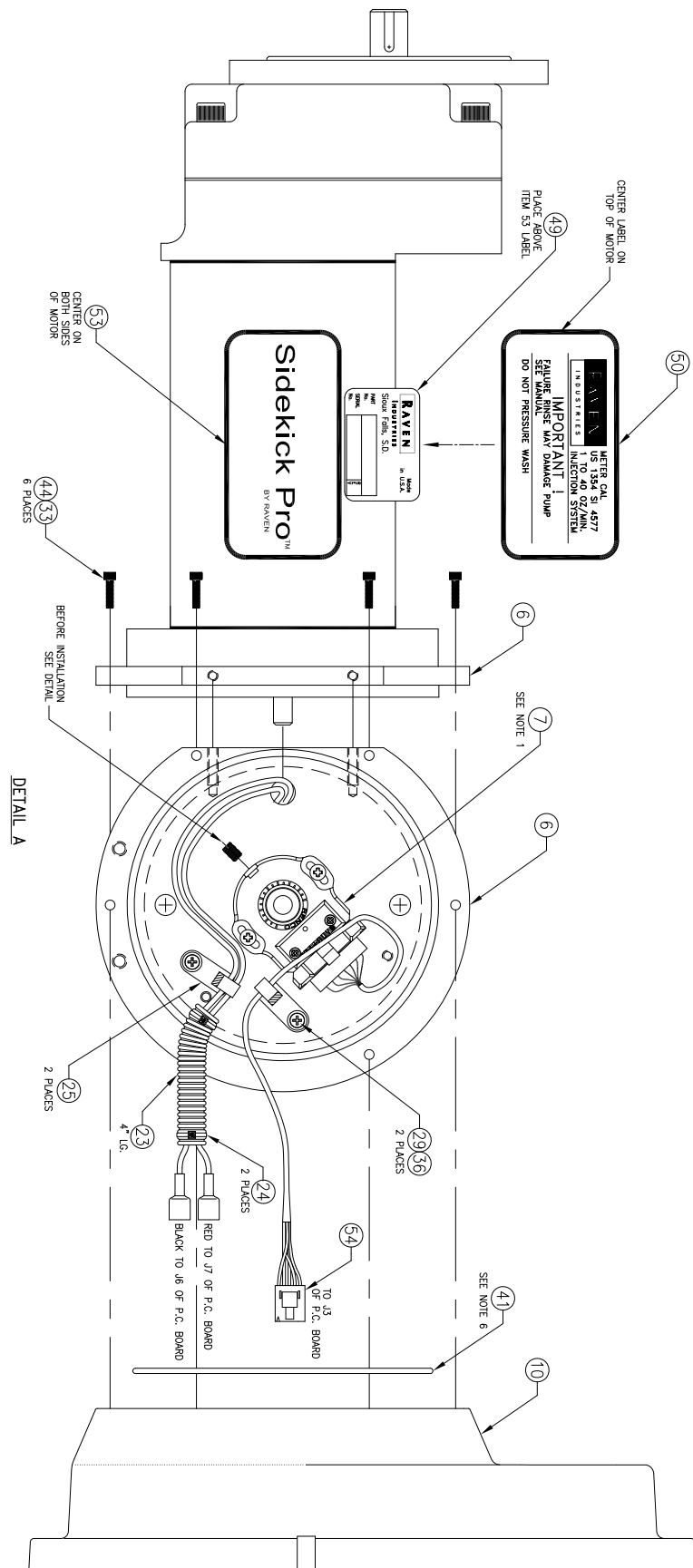
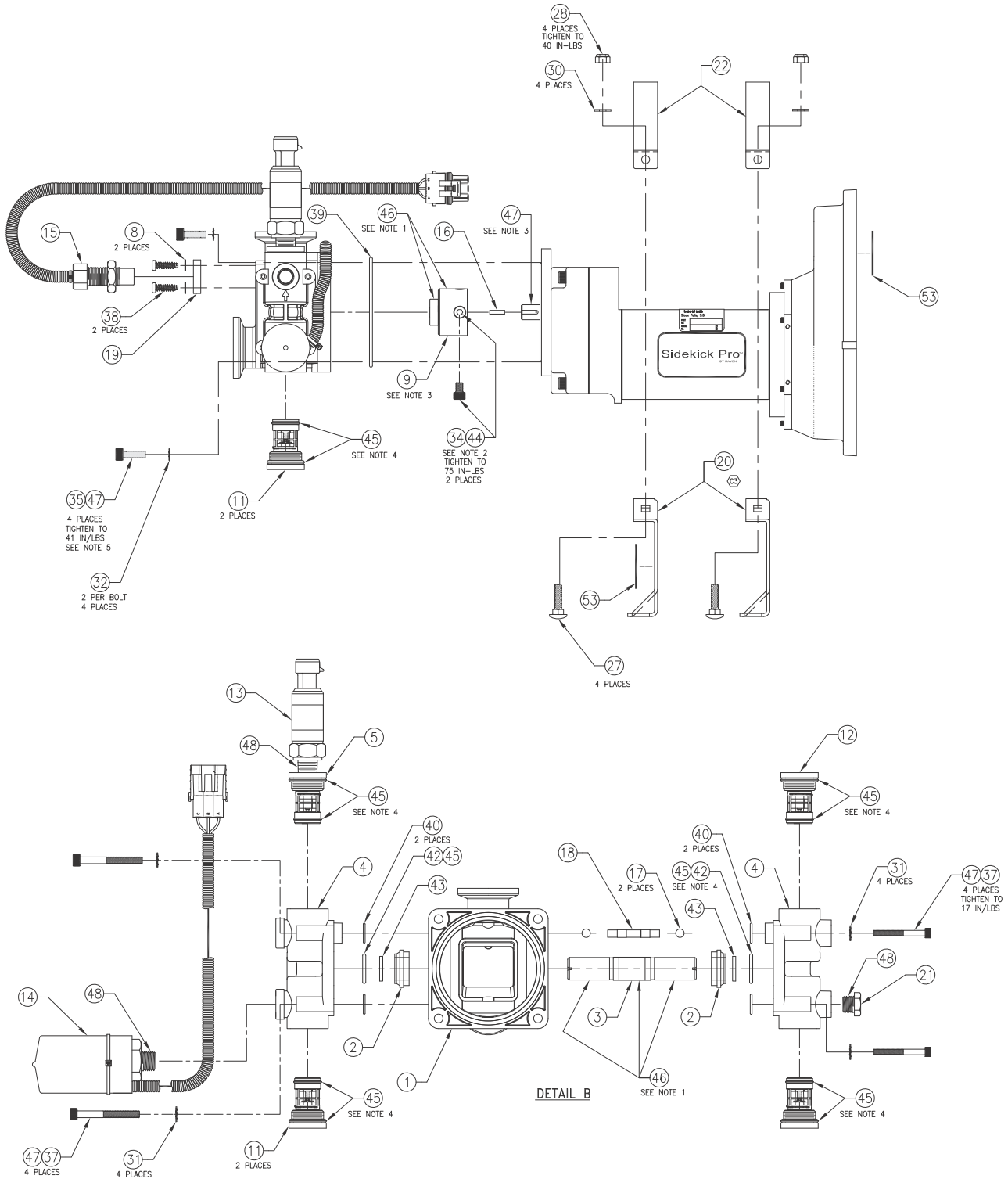


FIGURE 8. CAN Integrated Pump (P/N 063-0173-103) Pump Head and Mounting Bracket



Sidekick Pro™ 5 to 200 oz./min. Pump

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

1	HARNESS, ENCODER	115-0171-861			54
4	LABEL, SIDEKICK PRO	041-0159-841			53
2	TIE, CABLE	435-1000-005			52
2	TIE, CABLE	435-1000-002			51
1	LABEL, 5 TO 200 OZ.-MIN. INJECTION SYSTEM	041-0159-807			50
1	LABEL, SERIAL	041-0159-710			49
AR	SEALANT, RECTORSEAL	222-1001-026			48
AR	COMPOUND, ANTI-SIEZE, NICKEL	222-1001-079		SEE NOTE 3, SHT. 2 OF 3	47
AR	GREASE	222-1001-114			46
AR	GREASE, LUBRICATING	222-0000-002	VERSILUBE	SEE NOTE 4, SHT. 2 OF 3	45
AR	SEALANT, THREAD	222-1001-029	LOCTITE #242		44
2	SEAL, SLIPPER	219-0000-125			43
2	O-RING	219-0007-117	2-117V965-80		42
1	O-RING	219-0003-045			41
4	O-RING	219-0002-015			40
1	O-RING	219-0001-153			39
2	TERMINAL	405-2001-048	10/12 GA. Q.C., F.I., 1/4" F.		38
2	SCREW	311-0004-040			37
8	SCREW	311-0068-191	10-24 x 1 1/2" S.S. SHC	SEE NOTE 5, SHT. 2 OF 3	36
2	SCREW	311-0004-013	#6-32 x 1/2"		35
4	SCREW, SOCKET HEAD, CAP	311-0073-066	1/4"-20 x 3/4"	SEE NOTE 5, SHT. 2 OF 3	34
2	SCREW, CAP, HEX SOCKET HEAD	311-0068-060	1/4" x 20 x 1/4"		33
6	SCREW, SOCKET HEAD CAP	311-0068-007	#4-40 x 1/2"		32
8	WASHER, LOCK, INTERNAL TOOTH	313-3000-017	1/4"	STAINLESS STEEL	31
8	WASHER, LOCK, INTERNAL TOOTH	313-3000-014	#10	STAINLESS STEEL	30
4	WASHER	313-2300-009			29
2	WASHER, LOCK	313-3000-007	#6 INTERNAL TOOTH		28
4	NUT	312-4000-057			27
4	BOLT, CARRIAGE	311-0069-004	1/4"-20 x 1" LG.	SEE NOTE 5, SHT. 2 OF 3	26
					25
2	TIE, SCREW MOUNT	435-1000-030	8" LG.	BLACK NYLON	24
4"	CONDUIT, CONVOLUTED	434-1001-016			23
2	STRAP	107-0171-594			22
1	PLUG, HEX, PIPE	333-0009-061	1/4" NPT		21
2	BRACKET, MOUNTING, PUMP/MOTOR	107-0171-589			20
1	BRACKET, SENSOR	106-0159-539			19
1	SHUTTLE MAGNET/PIN ASSY	063-0173-398			18
2	BALL	321-0000-380			17
1	KEY	107-0171-588	1/8 x 1/8 x 1/2		16
1	SENSOR, FLOWMETER	063-0171-979B			15
1	SWITCH, VACUUM	063-0171-035B	INJECTION SYSTEM		14
1	TRANSDUCER, PRESSURE	422-0000-090	250 PSI., S.S.		13
1	CARTIDGE, EXHAUST	063-0172-504B			12
2	CARTRIDGE INTAKE	063-0172-503B			11
1	MOTOR CONTROL CAN, INTEGRATED	063-0173-082B			10
1	ASSEMBLY, BEARING	063-0172-501			9
2	WASHER, FLAT	313-2301-003	.375 OD x .144 ID	STAINLESS STEEL	8
1	ENCODER	422-0000-096			7
1	MOTOR	416-0000-039			6
1	DISCHARGE VALVE/TRANSDUCER PLUG ASSEMBLY	063-0173-310B			5
2	HEAD, 3/4" PUMP	107-0171-526			4
1	PISTON, 3/4" PUMP	107-0171-531			3
2	BEARING, PISTON	325-0000-018			2
1	HOUSING, 3/4" INJECTION PUMP	107-0171-523			1
QTY. REQ'D.	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	SPECIFICATION	MATERIAL OR NOTE	ITEM NO.

FIGURE 9. CAN Integrated Pump (P/N 063-0173-081) Housing and Encoder

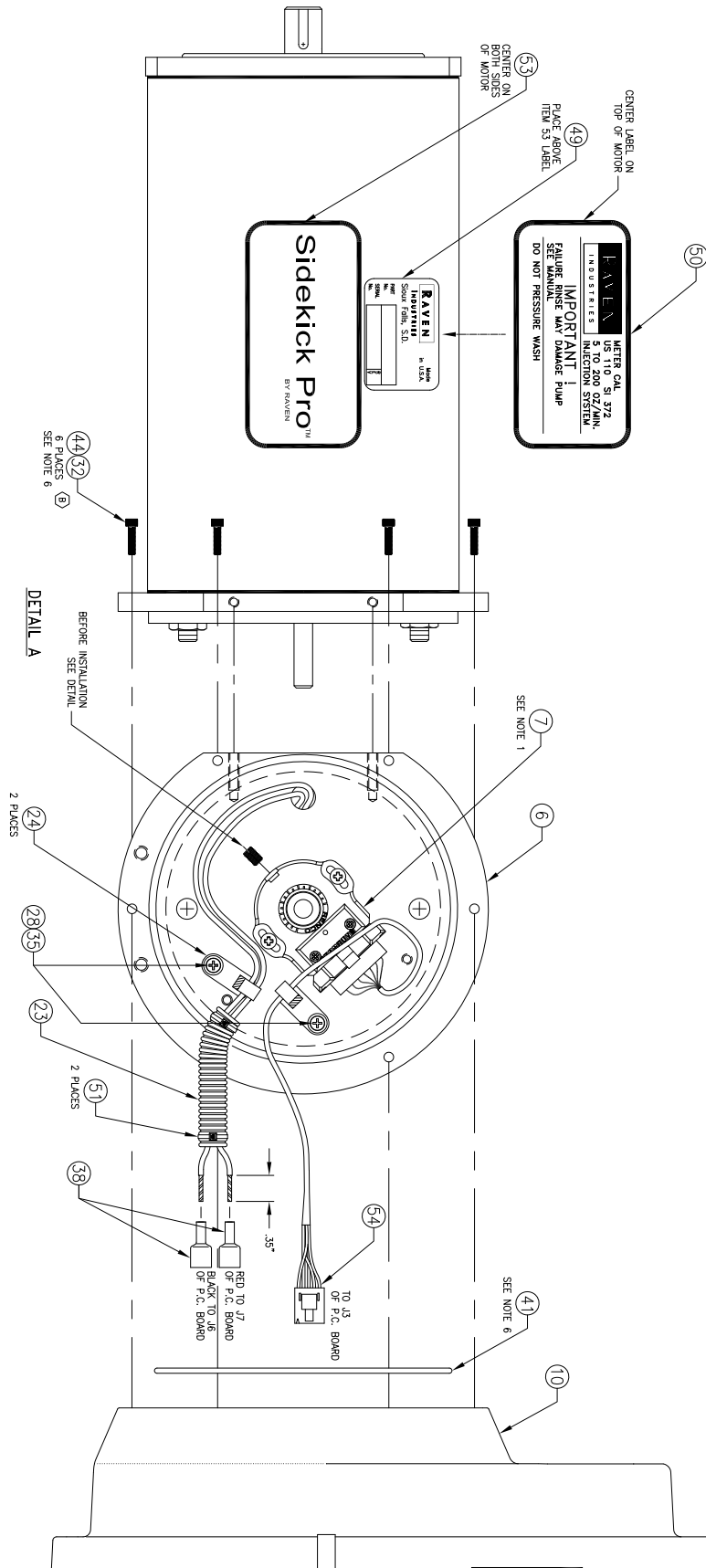
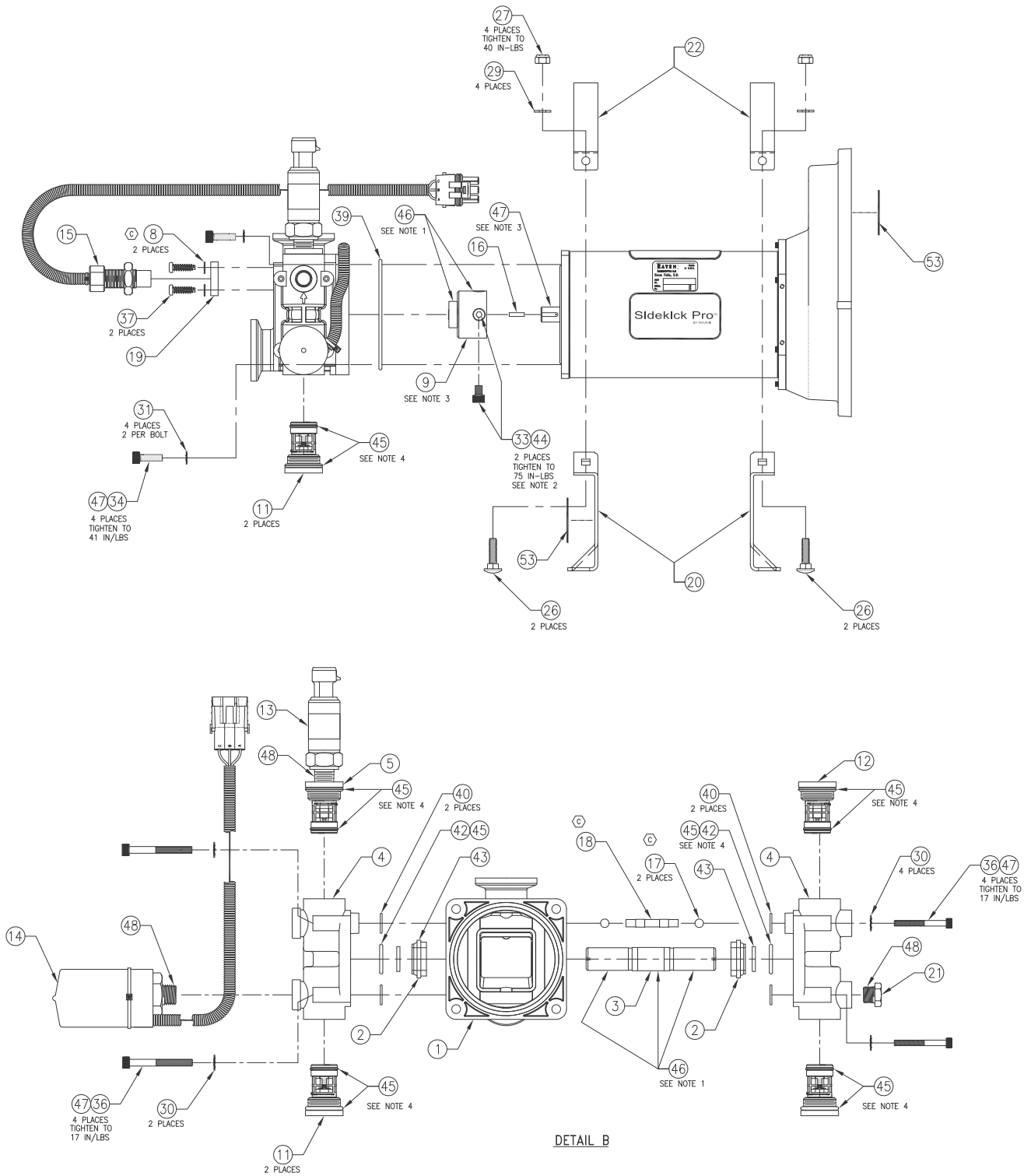


FIGURE 10. CAN Integrated Pump (P/N 063-0173-081) Pump Head and Mounting Bracket



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)**

1	WARRANTY, EXTENDED	016-0171-536A			53
1	FITTING REDUCER BUSHING	333-0003-071			52
1	ENVELOPE, PLASTIC	053-0159-015			51
1	BOX, SHIPPING	053-0159-151		SEE NOTE 5	50
4	REINFORCEMENT, CORNER	053-0159-157			49
1	REINFORCEMENT, BOX BOTTOM	053-0159-153			48
1	TRAY, BOX, BOTTOM	053-0159-152			47
1	MANUAL	016-0171-391			46
1	LABEL, GENERIC	--- --- ---		SEE NOTE 5	45
AR	SEALANT, THREAD	222-1001-075	TRUE BLUE		44
AR	SEALANT	222-1001-074	RECTORSEAL #21	SEE NOTE 3	43
2	GASKET, M-100	219-0000-129		VITON	42
1	STRAINER, 1/2"	333-9000-008			41
1	FITTING, NIPPLE	333-0008-154	1/2" x 1/2"	POLYPROPYLENE	40
1	FITTING, NIPPLE	107-0159-907	1/2" x 4"		39
1	FITTING, BUSHING	333-0003-069	1/2" NPT. x 1/4" NPT		38
1	FITTING, NIPPLE	333-0008-165	1/4" NPT, CLOSE, S. S.		37
1	FITTING	333-0002-108	1/2" HB x 1/2" FNPT	POLYPROPYLENE	36
1	FITTING, PLUG	333-0009-064	3/4"		35
2	FITTING, PLUG	333-0009-063	1/2"		34
1	FITTING, ELBOW	333-0002-047	1/2 HB X 1/2 NPT		33
1	FITTING, ELBOW, FLANGED	333-0002-200	M-100 x 3/4" H.B. 90°		32
1	FITTING, ELBOW	333-0002-048	3/4" H.B. x 1/2" NPT		31
2	FITTING, STREET ELBOW	333-0007-031	1/2"		30
1	FITTING, ELBOW	333-0002-050	3/4" x 1/2" H B		29
9	WASHER, LOCK	313-1000-017	1/4"		28
4	WASHER	313-2301-810	.625 OD x .281 ID		27
9	WASHER, FENDER	313-2300-124	1.50 OD x .25 ID		26
4	WASHER, FENDER	313-2300-122	.390 x 1.63 x .060		25
6	WASHER	313-2300-012			24
6	NUT, HEX	312-4000-059	5/16-18 NYLON LOCK		23
4	NUT	312-1001-031	1/4-20		22
4	BOLT, CARRIAGE	311-0069-014	1/4-20 x 3.5"		21
4	BOLT	311-0050-202	1/4-20 x 5/8"		20
4	BOLT	311-0052-108	5/16-18 x 1 3/4 ZINC		19
5	BOLT	311-0050-105	1/4-20 x 1"		18
1	BOLT, J-HOOK	321-0000-316			17
2	CLAMP, V-BAND, FC-100	435-3003-044			16
2	CLAMP, HOSE	435-3003-003			15
2	CLAMP, HOSE	435-3003-002			14
29"	HOSE, 1/2" BRAIDED EVA	214-0001-014	1 @ 32" LG.		13
7"	HOSE, 3/4" EVA	214-0001-005			12
1	VALVE, 3-WAY, CONTINUOUS FLOW	334-0001-054			11
2	VALVE, 3-WAY	334-0001-037			10
1	VALVE, CHECK 1/2" WITH BLEED HOLE	333-0011-100	12 PSI	STAINLESS STEEL	9
1	STRAP, TANK MOUNTING STAINLESS	107-0171-375			8
1	TUBE, FORMED UPRIGHT	107-0171-374			7
1	COVER, FILLWELL	118-0159-043			6
1	TANK, 24 GAL.	118-0159-016			5
1	SADDLE, MOLDED	118-0159-007			4
1	PUMP, SIDEKICK PRO	063-0173-103B	1 TO 40 OZ/MIN		3
1	CALIBRATOR, PUMP	063-0172-822			2
1	WELDMENT, PLATFORM	116-0159-484			1
QTY. REQ'D.	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	SPECIFICATION	MATERIAL OR NOTE	ITEM NO.

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

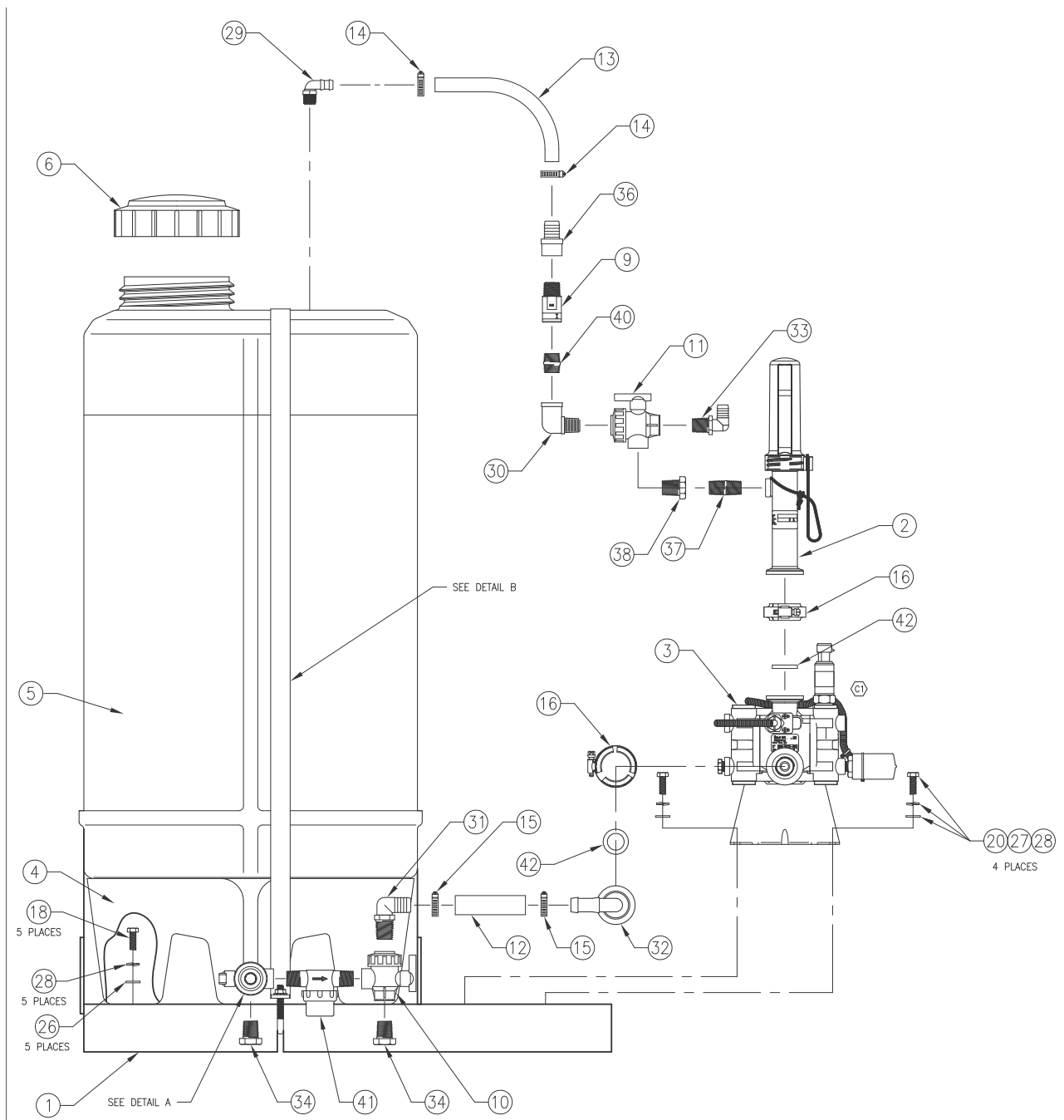


FIGURE 12. Injection Module (P/N 063-0173-212) Final Plumbing and Mounting

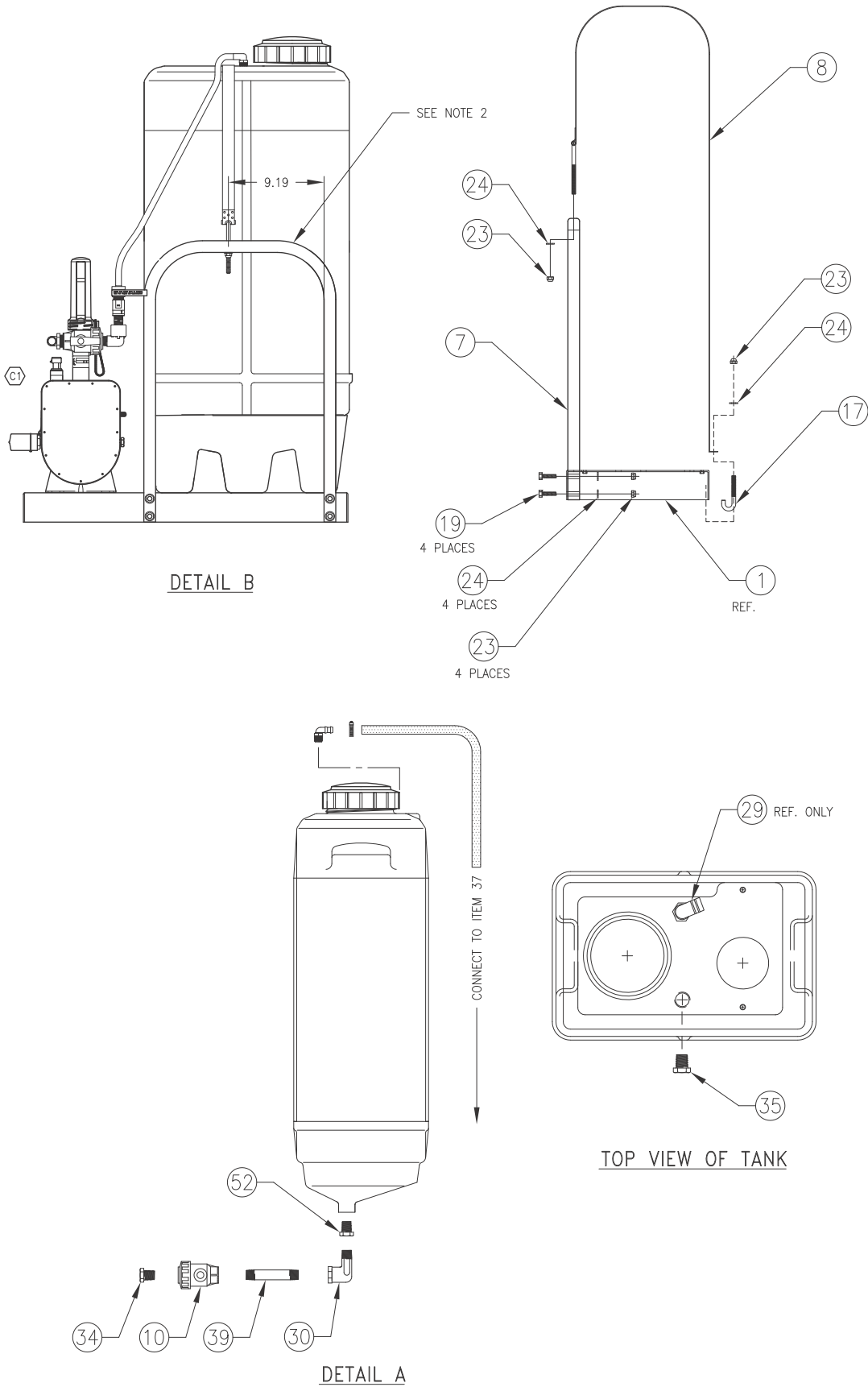
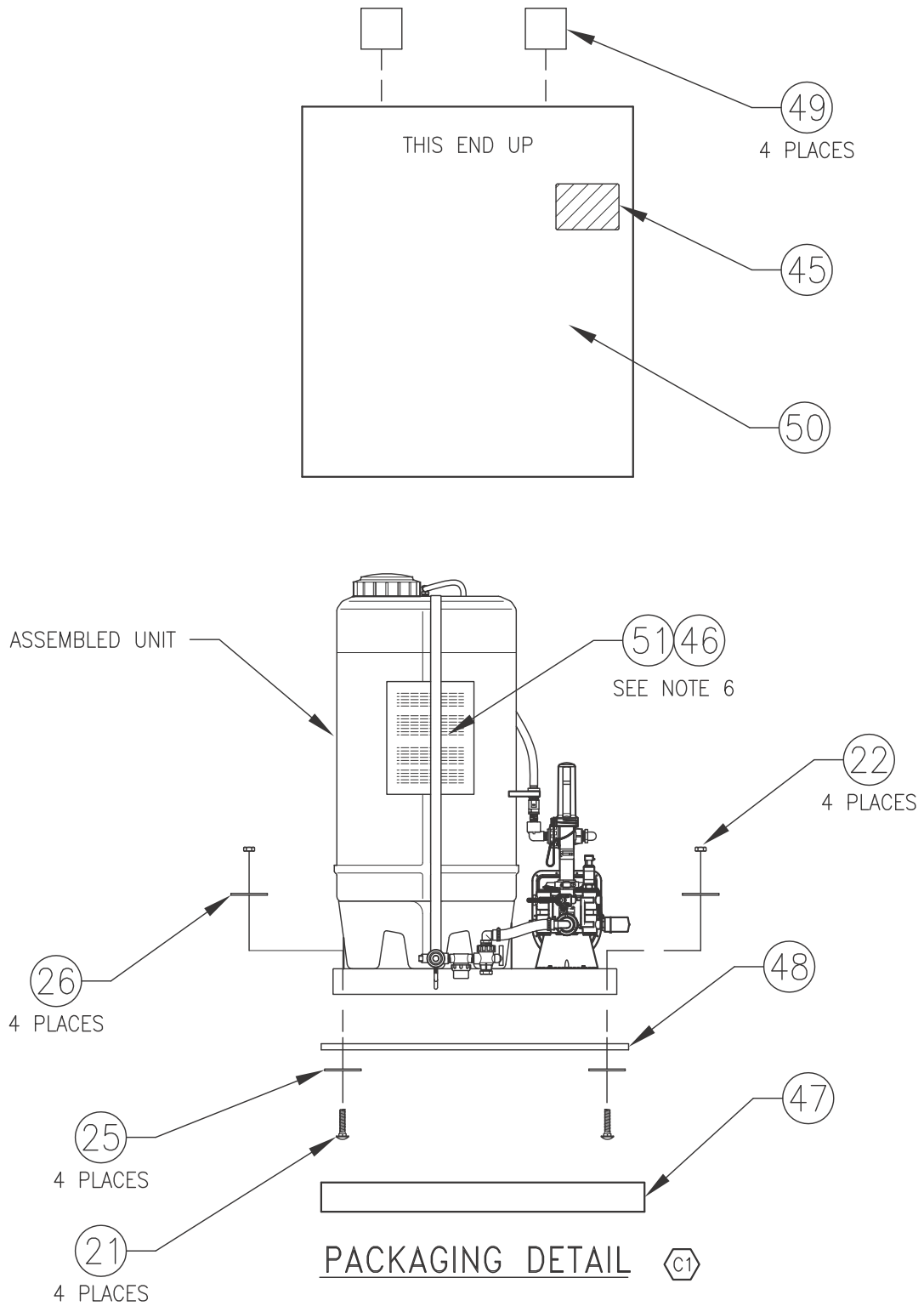


FIGURE 13. Injection Module (P/N 063-0173-212) Module Mounting



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)**

1	WARRANTY, EXTENDED	016-0171-536A			53
1	FITTING REDUCER BUSHING	333-0003-071			52
1	ENVELOPE, PLASTIC	053-0159-015			51
1	BOX, SHIPPING	053-0159-151		SEE NOTE 5	50
4	REINFORCEMENT, CORNER	053-0159-157			49
1	REINFORCEMENT, BOX BOTTOM	053-0159-153			48
1	TRAY, BOX, BOTTOM	053-0159-152			47
1	MANUAL	016-0171-391			46
1	LABEL, GENERIC	--- --- ---		SEE NOTE 5	45
AR	SEALANT, THREAD	222-1001-075	TRUE BLUE		44
AR	SEALANT	222-1001-074	RECTORSEAL #21	SEE NOTE 3	43
2	GASKET, M-100	219-0000-129		VITON	42
1	STRAINER, 1/2"	333-9000-008			41
1	FITTING, NIPPLE	333-0008-154	1/2" x 1/2"	POLYPROPYLENE	40
1	FITTING, NIPPLE	107-0159-907	1/2" x 4"		39
1	FITTING, BUSHING	333-0003-069	1/2" NPT. x 1/4" NPT		38
1	FITTING, NIPPLE	333-0008-165	1/4" NPT, CLOSE, S. S.		37
1	FITTING	333-0002-108	1/4" HB x 1/2" FNPT	POLYPROPYLENE	36
1	FITTING, PLUG	333-0009-064	3/4"		35
2	FITTING, PLUG	333-0009-063	1/2"		34
1	FITTING, ELBOW	333-0002-047	1/2 HB X 1/2 NPT		33
1	FITTING, ELBOW, FLANGED	333-0002-200	M-100 x 3/4" H.B. 90°		32
1	FITTING, ELBOW	333-0002-048	3/4" H.B. x 1/2" NPT		31
2	FITTING, STREET ELBOW	333-0007-031	1/2"		30
1	FITTING, ELBOW	333-0002-050	3/4" x 1/2" H B		29
9	WASHER, LOCK	313-1000-017	1/4"		28
4	WASHER	313-2301-810	.625 OD x .281 ID		27
9	WASHER, FENDER	313-2300-124	1.50 OD x .25 ID		26
4	WASHER, FENDER	313-2300-122	.390 x 1.63 x .060		25
6	WASHER	313-2300-012			24
6	NUT, HEX	312-4000-059	5/16-18 NYLON LOCK		23
4	NUT	312-1001-031	1/4-20		22
4	BOLT, CARRIAGE	311-0069-014	1/4-20 x 3.5"		21
4	BOLT	311-0050-202	1/4-20 x 5/8"		20
4	BOLT	311-0052-108	5/16-18 x 1 3/4 ZINC		19
5	BOLT	311-0050-105	1/4-20 x 1"		18
1	BOLT, J-HOOK	321-0000-316			17
2	CLAMP, V-BAND, FC-100	435-3003-044			16
2	CLAMP, HOSE	435-3003-003			15
2	CLAMP, HOSE	435-3003-002			14
29"	HOSE, 1/2" BRAIDED EVA	214-0001-014	1 @ 32" LG.		13
7"	HOSE, 3/4" EVA	214-0001-005			12
1	VALVE, 3-WAY, CONTINUOUS FLOW	334-0001-054			11
2	VALVE, 3-WAY	334-0001-037			10
1	VALVE, CHECK 1/2" WITH BLEED HOLE	333-0011-100	12 PSI	STAINLESS STEEL	9
1	STRAP, TANK MOUNTING STAINLESS	107-0171-375			8
1	TUBE, FORMED UPRIGHT	107-0171-374			7
1	COVER, FILLWELL	118-0159-043			6
1	TANK, 24 GAL.	118-0159-016			5
1	SADDLE, MOLDED	118-0159-007			4
1	PUMP, SIDEKICK PRO	063-0173-081B	5 TO 200 OZ/MIN		3
1	CALIBRATOR, PUMP	063-0172-822			2
1	WELDMENT, PLATFORM	116-0159-484			1
QTY. REQ'D.	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	SPECIFICATION	MATERIAL OR NOTE	ITEM NO.

FIGURE 14. Injection Module (P/N 063-0173-213) Plumbing and Valves

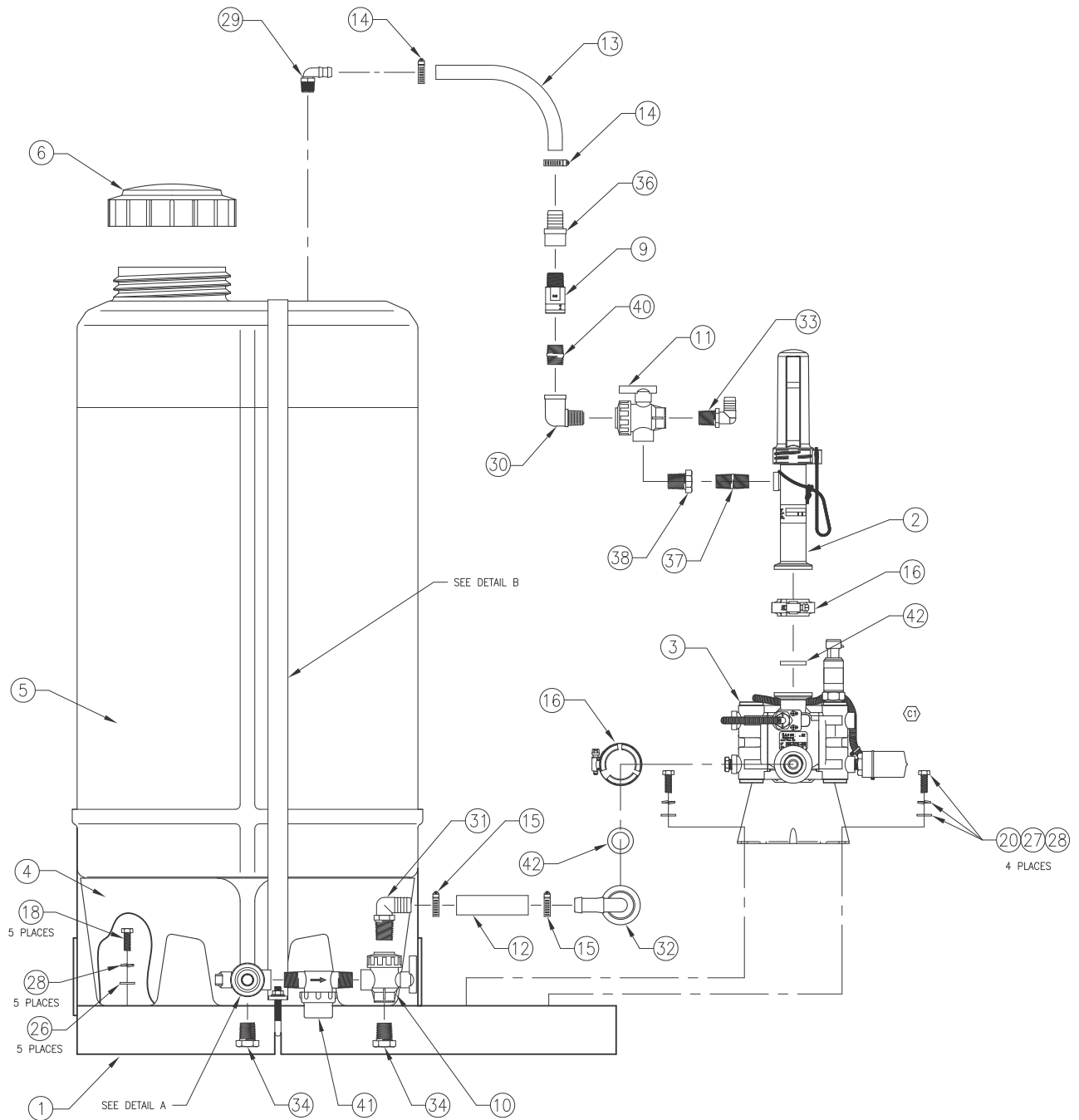


FIGURE 15. Injection Module (P/N 063-0173-213) Final Plumbing and Mounting

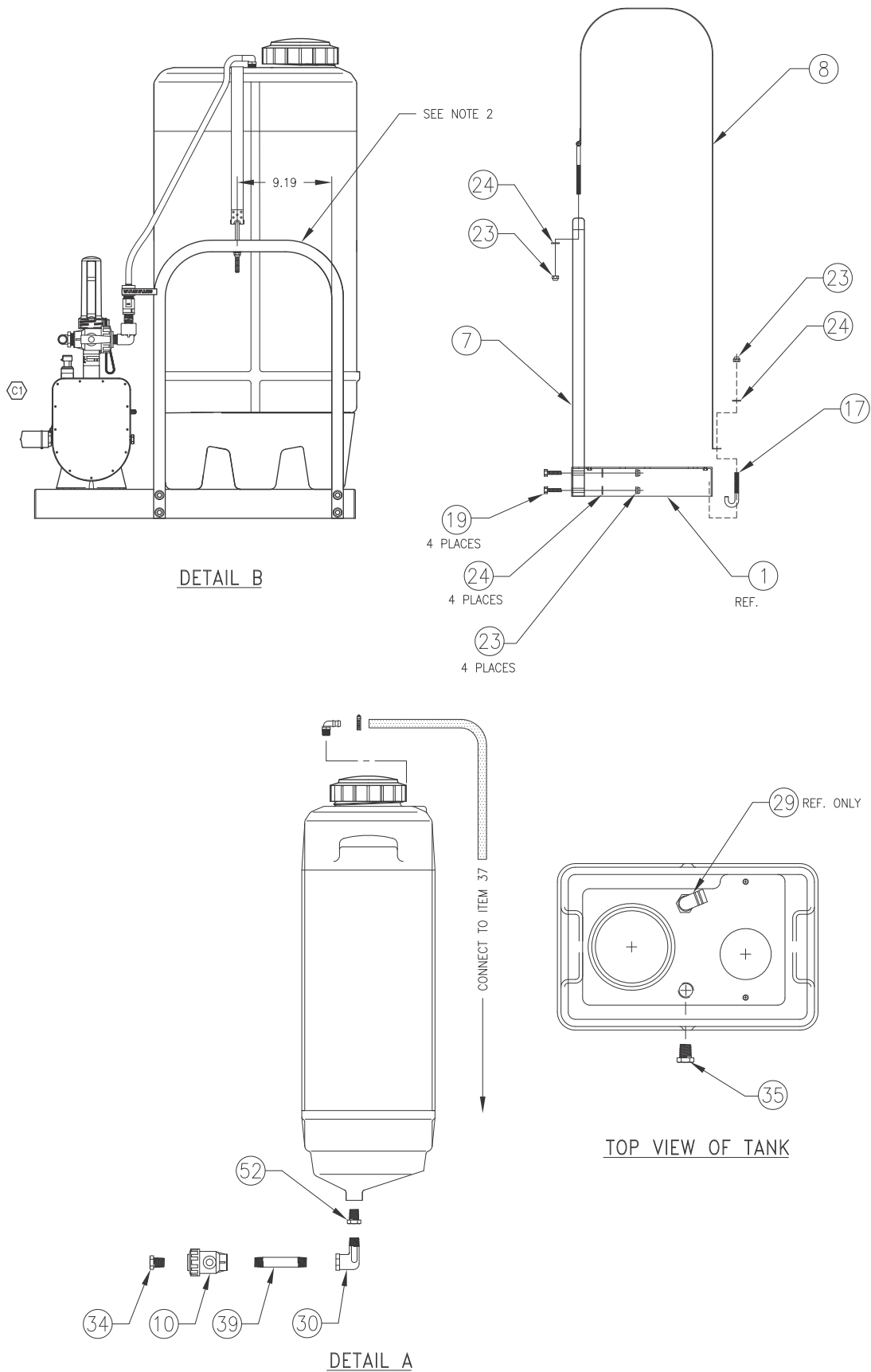
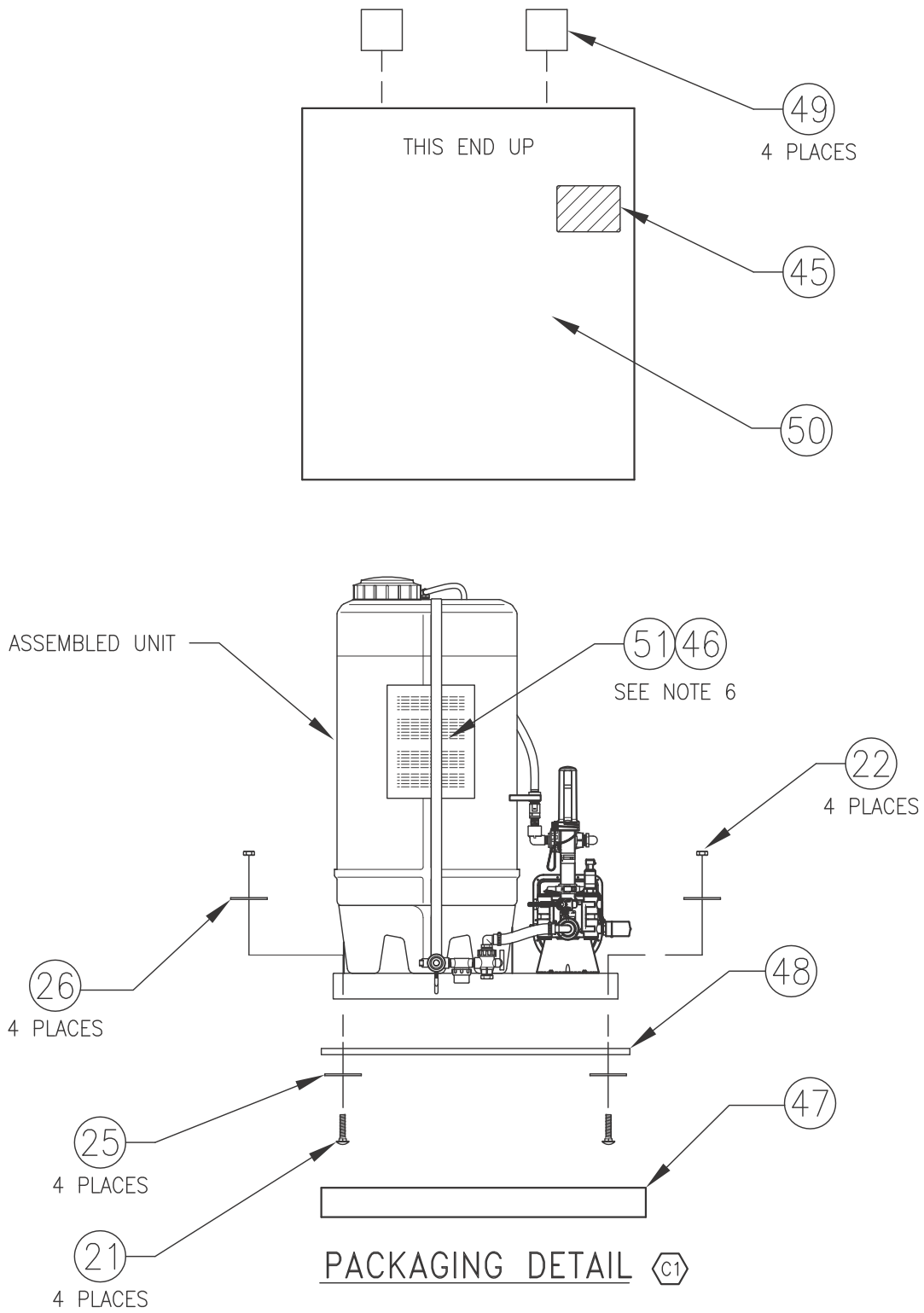


FIGURE 16. Injection Module (P/N 063-0173-213) Module Mounting



CHAPTER

9

System Diagrams

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

FIGURE 2. Sidekick Pro with Viper Pro Liquid Product Control System (D/N 054-2140-007)

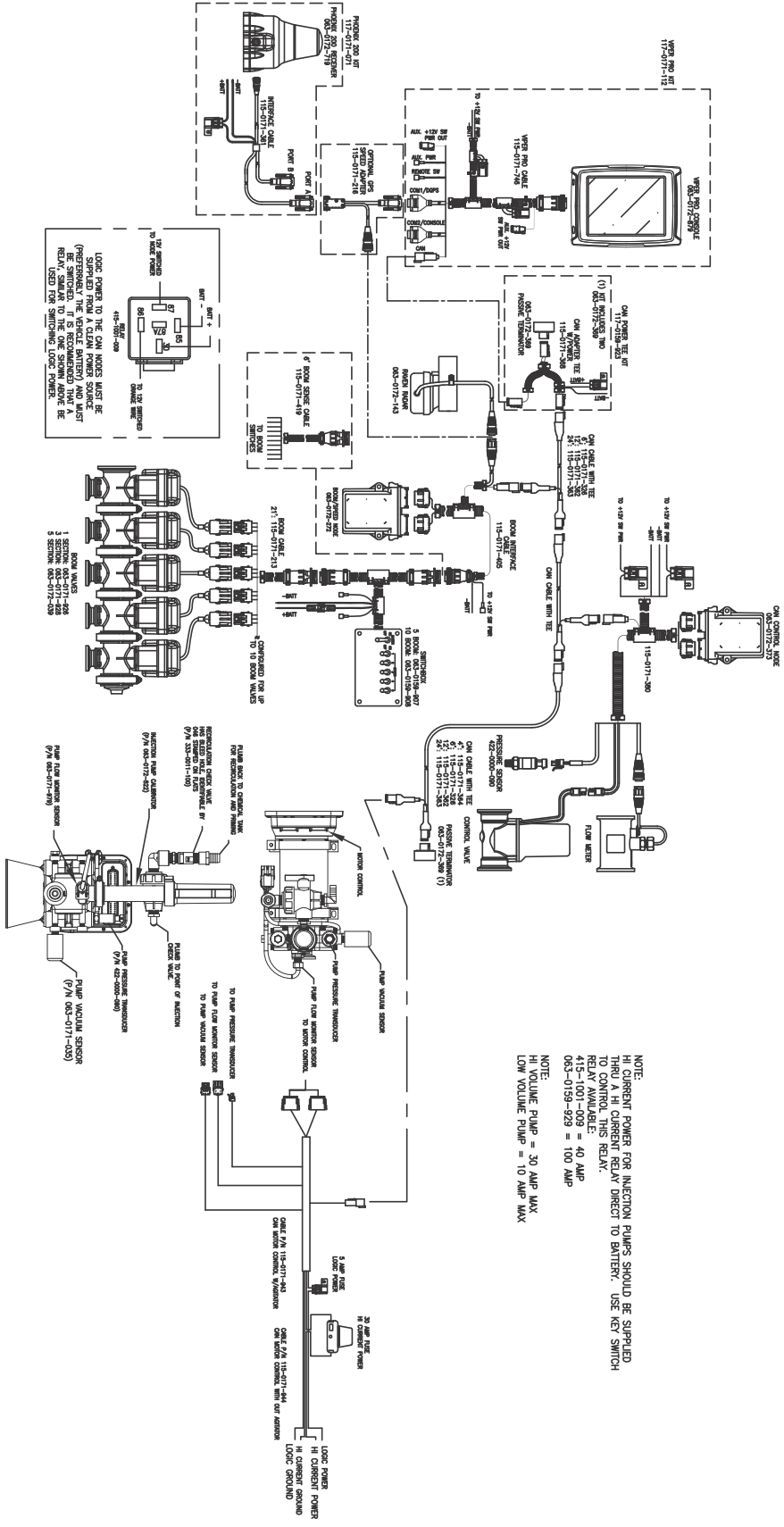
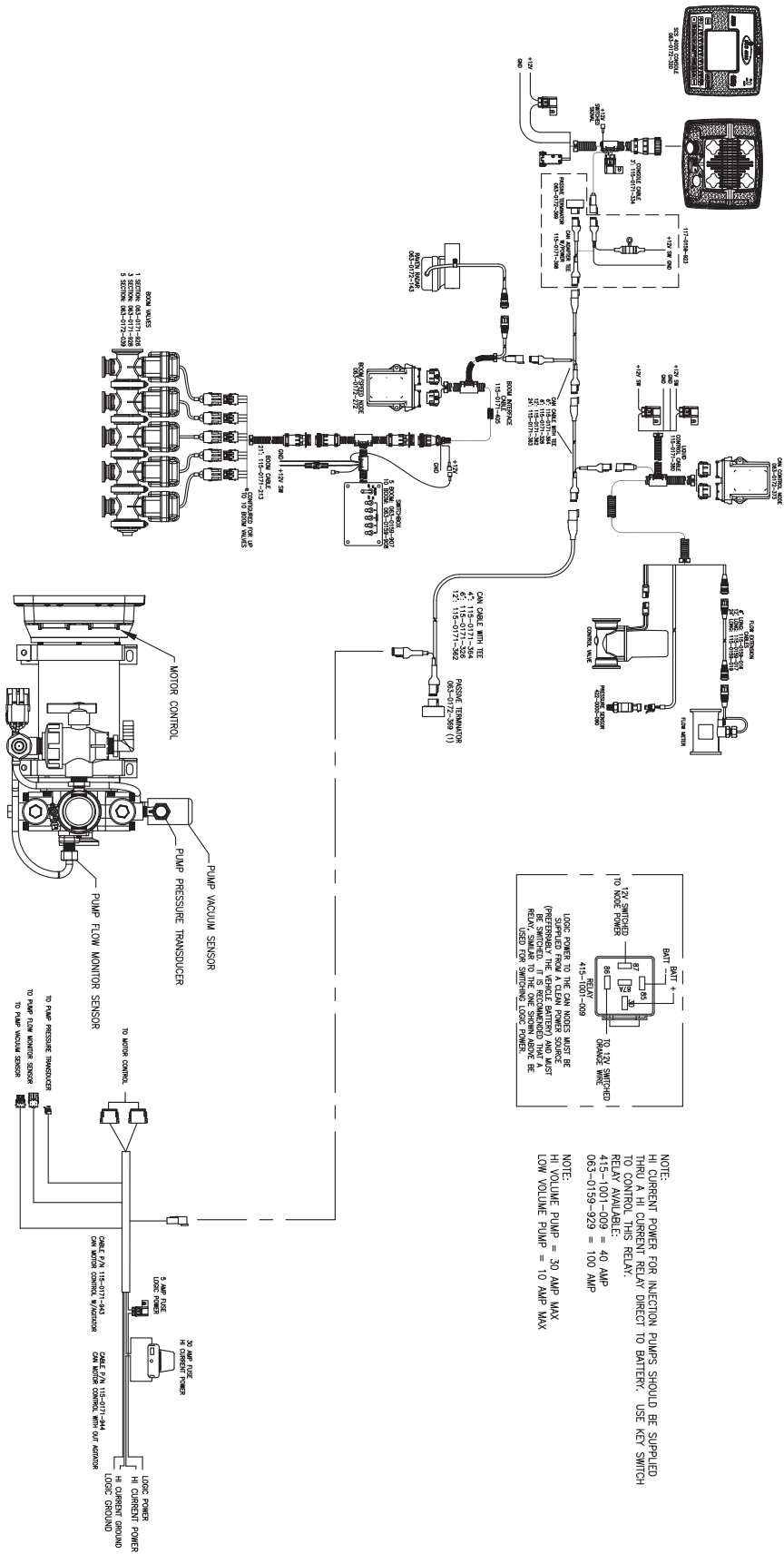


FIGURE 3. Sidekick Pro with SCS 4400 Liquid Product Control System (D/N 054-2840-009)



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RAVEN

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 when used for intended purpose.

How Long is the Coverage Period?

Raven Applied Technology products are covered by this warranty for 12 months from the date of retail sale. In no case will the Limited Warranty period exceed 24 months from the date the product was issued by Raven Industries Applied Technology Division. This warranty coverage applies only to the original owner and is non-transferable.

How Can I Get Service?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including proof of purchase) must be included inside the box to be sent to Raven Industries.

What Will Raven Industries Do?

Upon confirmation of the warranty claim, Raven Industries will (at our discretion) repair or replace the defective product and pay for the standard return freight, regardless of the inbound shipping method. Expedited freight is available at the customer's expense.

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, labor, or other 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.



Extended 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 when used for intended purpose.

Do I Need to Register My Product to Qualify for the Extended Warranty?

Yes. Products/systems must be registered within 30 days of retail sale to receive coverage under the Extended Warranty. If the component does not have a serial tag, the kit it came in must be registered instead.

Where Can I Register My Product for the Extended Warranty?

To register, go online to www.ravenhelp.com and select Product Registration.

How Long is the Extended Warranty Coverage Period?

Raven Applied Technology products that have been registered online are covered for an additional 12 months beyond the Limited Warranty for a total coverage period of 24 months from the date of retail sale. In no case will the Extended Warranty period exceed 36 months from the date the product was issued by Raven Industries Applied Technology Division. This Extended Warranty coverage applies only to the original owner and is non-transferable.

How Can I Get Service?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including proof of purchase) must be included inside the box to be sent to Raven Industries. In addition, the words "Extended Warranty" must appear on the box and all documentation if the failure is between 12 and 24 months from the retail sale.

What Will Raven Industries Do?

Upon confirmation of the product's registration for the Extended Warranty and the claim itself, Raven Industries will (at our discretion) repair or replace the defective product and pay for the standard return freight, regardless of the inbound shipping method. Expedited freight is available at the customer's expense.

What is Not Covered by the Extended 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, labor, or other damages. Cables, hoses, software enhancements, and remanufactured items are not covered by this Extended Warranty. 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.

RAVEN

Sidekick Pro™

1 to 40 oz./min and 5 to 200 oz./min.
[0.3 to 11.8 dL/min. and 1.5 to 59 dL/min.]
Installation & Operation Manual
(P/N 016-0171-391 Rev B 8/12 E19877)



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