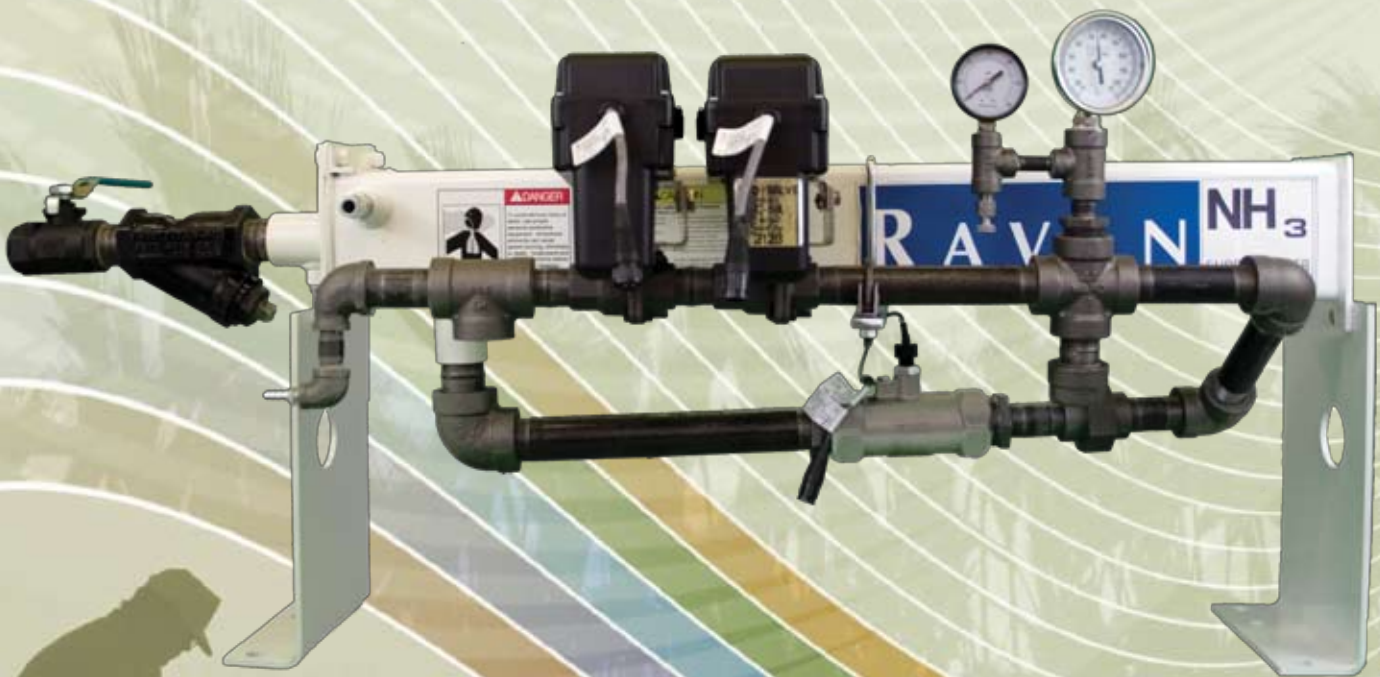


RAVEN

*Simply improving your position.<sup>SM</sup>*

# Installation & Operation Manual



AccuFlow™

## ***Disclaimer***

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## CHAPTER

# 1

# *Important Safety Information*

## NOTICE

- Read this manual carefully before installing the AccuFlow system.
- Review procedures for safe handling and use of anhydrous ammonia (NH<sub>3</sub>) with your NH<sub>3</sub> supplier.  
If you are not trained to handle anhydrous ammonia, contact your NH<sub>3</sub> supplier or the appropriate agricultural department for information on training
- Please review the operation and safety instructions included with your implement and/or controller.
- Follow safety information presented within this manual and review operation of the AccuFlow system with your anhydrous ammonia (NH<sub>3</sub>) supplier.
- Follow all safety labels affixed to the AccuFlow system components. Be sure to keep safety labels in good condition and replace any missing or damaged labels. To obtain replacements for missing or damaged safety labels, contact your local Raven dealer.
- Do not attempt to modify or lengthen any of the system control cables. Extension cables are available from your local Raven dealer.
- If you require assistance with any portion of the installation or service of your Raven equipment, contact your local Raven dealer for support.

## DANGER

### Anhydrous Ammonia (NH<sub>3</sub>) Under Pressure

Anhydrous ammonia can cause severe burning, blindness, or death. Carefully read and follow all safety instructions and warnings before operating or servicing equipment.


1. Review safety requirements associated with NH<sub>3</sub> and the AccuFlow manual with your NH<sub>3</sub> supplier.
  - a. Always wear proper personal protective equipment when working with the AccuFlow system and anhydrous ammonia. Appropriate protective clothing includes, but is not limited to:
    - Goggles or Face Shield
    - Protective Suit and Gloves
    - Respirator
  - b. **DO NOT** allow any one to operate the AccuFlow system without proper instruction and training.

2. Use caution when handling anhydrous ammonia (NH<sub>3</sub>) products.
  - a. Stand 'up wind' when working around anhydrous ammonia (NH<sub>3</sub>) and related equipment. Always keep anhydrous ammonia equipment away from buildings, livestock, and other people.
  - b. Anhydrous ammonia may cause sickness or death. Never work on NH<sub>3</sub> equipment in confined spaces. Seek immediate medical attention if symptoms of illness occur during, or shortly after, use of anhydrous ammonia products.
  - c. Keep a source of clean water (at least five gallons) readily available while working with anhydrous ammonia. In case of exposure, flush exposed skin or eyes immediately with large quantities of water and seek immediate medical attention.
  - d. NH<sub>3</sub> can be harmful to the environment if not used properly. Follow all local, state, and federal regulations regarding proper handling of anhydrous ammonia.
3. Thoroughly bleed all system lines and disconnect nurse tank hose before beginning service or maintenance. **Allow a minimum of one (1) hour to fully discharge the system.** Verify gauge pressure is at zero before opening the system.
  - a. Always remove the AccuFlow system from service before performing maintenance.
4. Use extreme caution when opening a previously pressurized system.


Before performing service or maintenance on the AccuFlow™ system, read and follow the instructions provided in the *Discharging the AccuFlow System* section on page 29 to properly discharge

## Discharging the AccuFlow System

The AccuFlow system must be discharged of all anhydrous ammonia and the system must be completely shut down before the implement can be transported.

	<p><b>! DANGER</b></p> <p>DO NOT transport the AccuFlow system while it is charged with anhydrous ammonia. The AccuFlow Super Cooler and product lines must be completely discharged before transporting the implement.</p>
---	---

The following procedure outlines the proper method for discharging NH<sub>3</sub> from the AccuFlow system and preparing the system for transport, service, or maintenance.

	<p><b>! DANGER</b></p> <p>Use extreme caution when opening a previously pressurized system. Exposure to anhydrous ammonia can cause severe burning, blindness, or death. To avoid injury or death, always wear proper personal protective equipment.</p>
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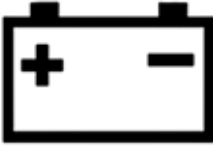

**Note:** Personal protective equipment such as a respirator, protective suit and gloves are required when working with anhydrous ammonia products.

Before transporting the AccuFlow system or beginning service or maintenance:

1. Toggle the console or vehicle Master Switch to the off position.
2. Completely close the main shut-off valve on the supply or nurse tank.
3. Resume field application until the pressure gauge reads no remaining pressure is in the AccuFlow system.
4. Verify that the console and/or vehicle Master switch, and all section switches, are in the off position.
5. Completely close the Emergency Shut-off valve on the AccuFlow Super Cooler.
6. Bleed and disconnect the nurse tank supply hose from the AccuFlow system.
7. Toggle the console Master and all section switches to the on position.
8. While standing upwind from the implement, slowly open bleed valve(s) until fully open. Refer to Figure 1 on page 10 for assistance locating AccuFlow bleed valve(s).
9. **Allow a minimum of one (1) hour to fully discharge the system.** Verify that the pressure gauge on the AccuFlow Manifold reads zero and the Super Cooler is not cold to the touch before opening the system. This ensures that all liquid NH<sub>3</sub> has evaporated and pressure has been discharged.

## Additional Safety Information

### Electrical Safety

	<div style="background-color: yellow; text-align: center; padding: 5px;">  <b>CAUTION</b> </div> <p>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 cable is the last cable to be connected.</p>
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**Notes:**



## CHAPTER

# 2

## *Introduction*

The AccuFlow system is designed to provide continuous and automatic control of anhydrous ammonia applications via a Raven Serial (i.e. SCS 440 or 660) or CAN (i.e. SCS 4000/5000, Viper Pro, or Envizio Pro) Console. The application rate is monitored by a flow meter connected to the Super Cooler and controlled by the Raven Console via the control valve(s). Simply set the target application rate on your Raven console and let the system adjust for the vehicle speed.

**Note:** *To properly measure and control application, anhydrous ammonia must be in a liquid state when it passes through the flow meter. To remain liquid, anhydrous ammonia must be stored at a temperature of -28° F (-33° C) or kept under pressure at higher temperatures.*

*To help ensure that the ammonia is in a liquid state as it passes through the flow meter, and thus accurately measured, the AccuFlow Super Cooler uses a small amount of anhydrous ammonia from the nurse tank to reduce the temperature of the ammonia being applied.*

## *Kit Contents*

Please review the following tables for components, parts, and fittings you should have received with your Raven AccuFlow system. It may be necessary to order some components of the AccuFlow system separately. Before beginning assembly and installation, verify that all required components have been purchased.

AccuFlow Systems and Kits		Single Cooler Kits		Dual Cooler Systems	
		Two Valve Kit	Fast Valve Kit	Two Valve Kit	Fast Valve Kit
Components	P/N	117-0171-161	117-0171-162	117-0171-281	117-0171-280
AccuFlow Super Cooler	063-0172-877	1	1	2	2
Fittings for Assembly	063-0172-495	1	1	1	1
Fittings for Assembly, Dual Cooler	063-0172-987			1	1
Flow Meter, RFM 60S	063-0171-666	1	1	1	1
Valve, Standard, 1" Carbon Steel	063-0172-977	1		1	
Valve, On/Off	063-0172-978	1		1	
Valve, Fast, 1" Carbon Steel	063-0172-979		1		1

**Note:** *AccuFlow systems will require appropriate Flow Cabling to connect to your Raven Control Console. Contact your local Raven dealer for assistance and information.*

To provide the most responsive control of anhydrous ammonia applications when using a multi-section tool bar, a Check Valve Assembly (P/N 063-0173-030, ordered separately) should be installed if the section on/off valves are mounted next to the distributor manifolds. Refer to the following system diagrams for installation location. Contact your local Raven dealer for more information.

See Chapter 7, System Diagrams, for detailed diagrams and system connections.

## Parts for Fittings and Assemblies (P/N 063-0171-495, Boxed)

The following plumbing components and fittings are included with each Raven AccuFlow system:

Qty.	Components	P/N	Qty.	Components	P/N
1	• Valve, Ball, Steel, 1-1/4"	019-0159-245	1	• Fitting, Elbow, Reducing, 1/2" x 1/4"	333-0005-009
3	• U-Bolt w/ Hardware	107-0159-447	1	• Fitting, Elbow, Reducing, 1" x 1/2"	333-0005-010
2	• Bracket, Mounting, Cooler	107-0171-063	1	• Fitting, Union, 1"	333-0006-004
1	• Bracket, "Z", NH <sub>3</sub>	107-0171-068	1	• Pipe, Nipple, 1/4" x 2"	333-0008-002
1	• Tubing, EVA, 3/8" (7 ft.)	214-0001-035	1	• Pipe, Nipple, 1/2" x 1-1/2"	333-0008-015
1	• Tubing, EVA, 3/4" (28 ft.)	214-0001-036	1	• Pipe, Nipple, 1/2" x 2"	333-0008-016
2	• Tube, Vapor	214-0002-002	2	• Pipe, Nipple, 1" x 2"	333-0008-029
1	• Gasket, Teflon, 1" Pipe Union	219-0000-076	1	• Pipe, Nipple, 1" x 3"	333-0008-031
2	• Bolt, 3/8" x 1-1/4"	311-0054-106	1	• Pipe, Nipple, 1" x 5"	333-0008-033
4	• Nut, Hex, 3/8"	312-1001-037	3	• Pipe, Nipple, 1" x 8"	333-0008-034
4	• Washer, Lock, 3/8"	313-1000-022	3	• Pipe, Nipple, 1-1/4" x 2"	333-0008-038
1	• Chain Link, Quick, 3/16"	319-1000-010	1	• Pipe, Nipple, 1-1/4" x 12"	333-0008-044
2	• Fitting, Hose, Barb, 1/4" x 3/8"	333-0002-004	1	• Fitting, Cap, 1"	333-0009-090
2	• Fitting, Hose, Barb, 1/2" x 3/4"	333-0002-011	1	• Strainer, Y-Type, 1-1/4"	333-9000-025
1	• Fitting, Bushing, 1-1/2" x 1-1/4"	333-0003-019	1	• Valve, Bleed, 1/4"	334-0001-012
1	• Fitting, Bushing, 1-1/2" x 1"	333-0003-020	1	• Gauge, Pressure, 0 - 150 PSI	417-0001-008
1	• Fitting, Bushing, Reducing, 1" x 1/2"	333-0003-094	1	• Gauge, Temperature	417-0001-009
1	• Fitting, Tee, 1/4"	333-0004-001	2	• Magnet, Ceramic (w/i Strainer Assembly)	418-0000-001
1	• Fitting, Tee, 1"	333-0004-005	5	• Cable Tie, Black	435-1000-003
1	• Fitting, Tee, 1/2" x 1/2" x 1/4"	333-0004-009	6	• Clamp, Hose	435-3003-003
1	• Fitting, Cross, 1"	333-0004-029	1	• Clamp, Muffler	435-3003-030
1	• Fitting, Elbow, 90° 1-1/4"	333-0005-006			

**Note:** Refer to Figure 2 on page 11 or Figure 3 on page 12 for a diagram of these fittings and parts.

## Parts for Dual Cooler System Fittings and Assemblies (P/N 063-0172-987)

Dual Cooler Systems (P/N 117-0171-280 and 117-0171-281), as well as the Single to Dual Cooler Kit (P/N 117-0171-151), include the following additional fittings and components:

Qty.	Components	P/N
1	• Valve, Ball, Steel, 1-1/4"	019-0159-245
2	• U-Bolt w/ Hardware	107-0159-447
2	• Bracket, Mounting, Cooler	107-0171-063
1	• Tubing, EVA, 3/8" (7 ft.)	214-0001-035
1	• Tubing, EVA, 3/4" (28 ft.)	214-0001-036
2	• Tube, Vapor	214-0002-002
1	• Gasket, Teflon, 1" Pipe Union Washer	219-0000-027
2	• Bolt, 3/8" x 1-1/4"	311-0054-106
2	• Nut, Hex, 3/8"	312-1001-037
2	• Washer, Lock, 3/8"	313-1000-022
1	• Chain Link, Quick, 3/16"	319-1000-010
2	• Fitting, Hose, Barb, 1/4" x 3/8"	333-0002-004
2	• Fitting, Hose, Barb, 1/2" x 3/4"	333-0002-011

Qty.	Components	P/N
2	• Fitting, Bushing, 1/2" x 1/4"	333-0003-005
1	• Fitting, Tee, 1/2"	333-0004-003
1	• Fitting, Tee, 1-1/4"	333-0004-006
1	• Fitting, Elbow, 90° 1-1/4"	333-0005-006
1	• Fitting, Union, 1-1/4"	333-0006-005
5	• Pipe, Nipple, 1-1/4" x 2"	333-0008-038
1	• Pipe, Nipple, 1-1/4" x 6"	333-0008-042
1	• Strainer, Y-Type, 1-1/4"	333-9000-025
2	• Magnet, Ceramic (w/i Strainer Assembly)	418-0000-001
3	• Cable Tie, Black	435-1000-003
4	• Clamp, Hose	435-3003-002
2	• Clamp, Hose	435-3003-003

**Note:** The Single to Dual Cooler Kit (P/N 117-0171-151) also includes an additional AccuFlow Super Cooler (P/N 063-0172-877).



## *Contacting Raven Industries*

Updates for Raven manuals as well as software updates for Raven consoles are available at the Raven Flow Controls Division web site:

<http://www.ravenprecision.com>

Sign up for e-mail Alerts and we will notify you when updates for your Raven Flow Controls products are available on the Raven web site.

For additional support, contact your local Raven dealer or the Raven Customer Support Center by any one of the following methods:


- **Via phone:** 1-800-243-5435
- **Via mail:**  
Raven Industries  
Flow Controls Division  
205 E 6th Street  
Sioux Falls, SD 57104
- **Via e-mail:** [atdinfo@ravenind.com](mailto:atdinfo@ravenind.com)

## CHAPTER

# 3

## *Installation*

The following sections are included to illustrate the proper procedure for mounting and plumbing the AccuFlow system.

	<p><b>! DANGER</b></p> <p>Anhydrous ammonia can cause severe burning, blindness, or death. Refer to the <i>Discharging the AccuFlow System</i> section on page 29 and follow the procedure for bleeding the AccuFlow system before beginning maintenance.</p>
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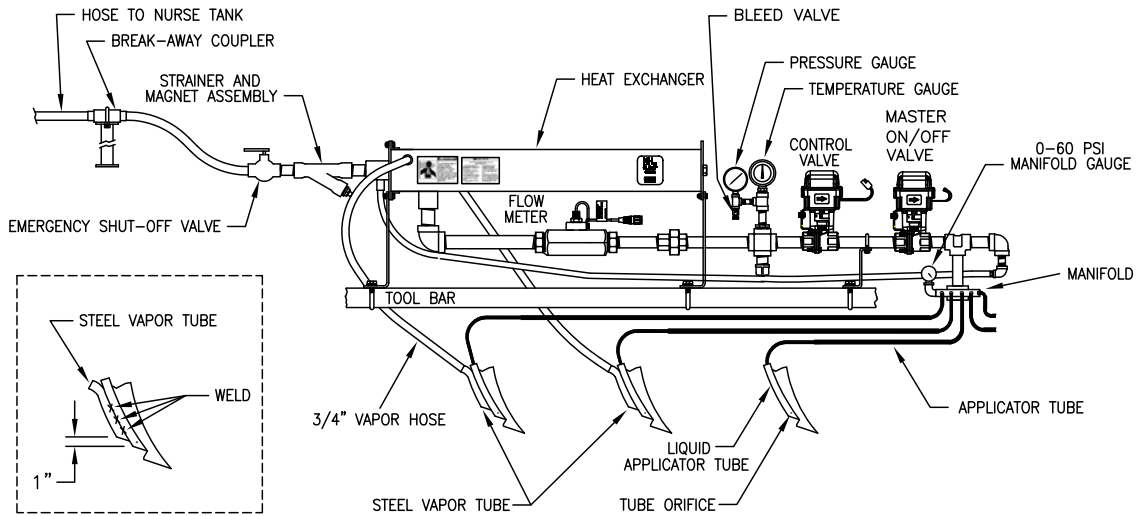
This manual assumes you have already read and followed instructions for installation of the Raven control console which will be controlling the application of anhydrous ammonia through the AccuFlow system.

**Note:** *In addition to the Raven Control Console and associated cabling, a speed sensor and Flow Cabling must also be installed with the Raven AccuFlow system. Refer to Chapter 7, System Diagrams, for examples of AccuFlow systems and cable connections. Contact your local Raven dealer for more information and assistance.*

## *Assembling the AccuFlow System*

Refer to the following figures when assembling the AccuFlow system (P/N 063-0172-991 or 063-0171-157). All nuts and bolts required for assembly are included.

FIGURE 1. Typical AccuFlow System (Single Section, Two Valves)



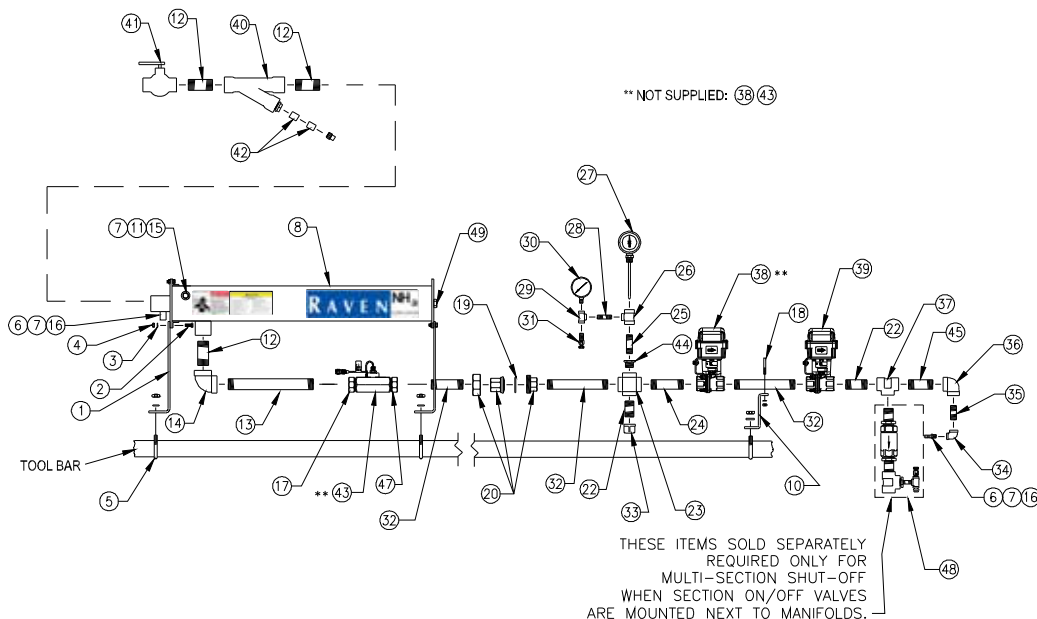
**Note:** AccuFlow systems with a Fast Control Valve (P/N 063-0172-979) will only have a single control valve in place of the Control Valve and Master On/Off Valve as shown in the diagram above.

A Space Saver Kit (P/N 117-0159-723) is also available. Contact your local Raven dealer for more information.

# AccuFlow System Diagrams

FIGURE 2. AccuFlow Two Valve System (30 GPM)

## 30 GPM ACCU-FLOW 2 VALVE SYSTEM ON/OFF CONTROL VALVE REPLACEMENT PARTS



**\*\* High Pressure NH<sub>3</sub> Plumbing Should Be Done With Schedule 80 Pipe And Fittings \*\***

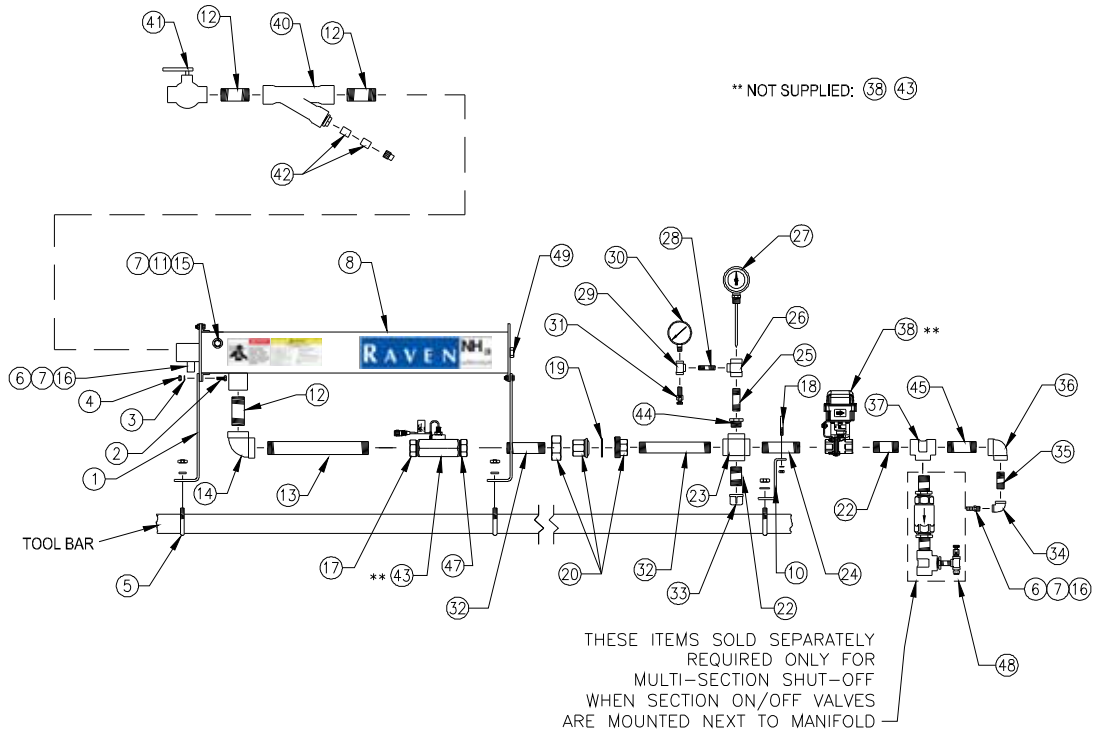
ITEM	DESCRIPTION	RAVEN PART #	ITEM	DESCRIPTION	RAVEN PART #
1	Cooler Bracket	107-0171-063	26	1/2" x 1/2" x 1/4" Pipe Tee	333-0004-009
2	3/8"-16 x 1 1/4" Bolt	311-0054-106	27	Temperature Gauge	417-0001-009
3	3/8" Lock Washer	313-1000-022	28	1/4" x 2" Pipe Nipple	333-0008-002
4	3/8"-16 Hex Nut	312-1001-037	29	1/4" Pipe Tee	333-0004-001
5	U-Bolt Assembly	107-0159-447	30	0-150 PSI Gauge	417-0001-008
6	3/8" EVA Hose	214-0001-035	31	1/4" Bleed Valve	334-0001-012
7	Hose Clamp	435-3003-003	32	1" x 8" Pipe Nipple	333-0008-034
8	Super Cooler (30 GPM)	063-0159-877	33	1" Pipe Cap	333-0009-090
10	Z-Bracket	107-0171-068	34	1/2" x 1/4" Pipe Elbow	333-0005-009
11	1/2" x 3/4" Hose Barb	333-0002-011	35	1/2" x 2" Pipe Nipple	333-0008-016
12	1 1/4" x 2" Pipe Nipple	333-0008-038	36	1" x 1/2" Pipe Elbow	333-0005-010
13	1 1/4" x 12" Pipe Nipple	333-0008-044	37	1" Pipe Tee	333-0004-005
14	1 1/4" Elbow	333-0005-006	38	Control Valve	063-0172-977
15	3/4" EVA Hose	214-0001-036	39	On/Off Valve	063-0172-978
16	1/4" x 3/8" Hose Barb	333-0002-004	40	1 1/4" Y-Strainer	333-9000-025
17	1 1/2" X 1 1/4" Bushing	333-0003-019	41	1 1/4" Steel Ball Valve	019-0159-245
18	1 1/2" Muffler Clamp	435-3003-030	42	Ceramic Magnets	418-0000-001
19	1" Pipe Union Gasket	219-0000-076	43	Flow Meter, 60S	063-0171-666
20	1" Pipe Union	333-0006-004	44	1" x 1/2" Reducing Bushing	333-0003-094
22	1" x 2" Pipe Nipple	333-0008-029	45	1" x 3" Pipe Nipple	333-0008-031
23	1" Pipe Cross	333-0004-029	46	Vapor Tubes (Not Shown)	214-0002-002
24	1" x 5" Pipe Nipple	333-0008-033	47	1 1/2" x 1" Bushing	333-0003-020
25	1/2" x 1 1/2" Pipe Nipple	333-0008-015	48	Check Valve Assy Multi-Section	063-0173-030
			49	Relief Valve	334-0002-005

054-0159-117  
03/09 REV. E  
SHEET 1 OF 1

**Note:** Install the provided teflon gasket (P/N 219-0000-076, Item # 19) to eliminate leaks from the 1" Union.

FIGURE 3. AccuFlow Fast Valve System (30 GPM)

### 30 GPM ACCU-FLOW SYSTEM FAST VALVE REPLACEMENT PARTS



**\*\* High Pressure NH<sub>3</sub> Plumbing Should Be Done With Schedule 80 Pipe And Fittings \*\***

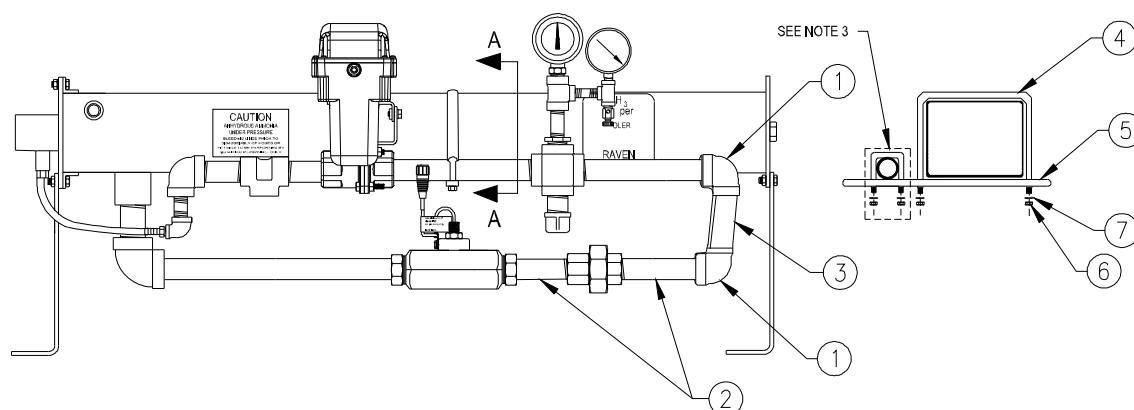
ITEM	DESCRIPTION	RAVEN PART #	ITEM	DESCRIPTION	RAVEN PART #
1	Cooler Bracket	107-0171-063	26	1/2" x 1/2" x 1/4" Pipe Tee	333-0004-009
2	3/8"-16 x 1 1/4" Bolt	311-0054-106	27	Temperature Gauge	417-0001-009
3	3/8" Lock Washer	313-1000-022	28	1/4" x 2" Pipe Nipple	333-0008-002
4	3/8"-16 Hex Nut	312-1001-037	29	1/4" Pipe Tee	333-0004-001
5	U-Bolt Assembly	107-0159-447	30	0-150 PSI Gauge	417-0001-008
6	3/8" EVA Hose	214-0001-035	31	1/4" Bleed Valve	334-0001-012
7	Hose Clamp	435-3003-003	32	1" x 8" Pipe Nipple	333-0008-034
8	Super Cooler (30 GPM)	063-0159-877	33	1" Pipe Cap	333-0009-090
10	Z-Bracket	107-0171-068	34	1/2" x 1/4" Pipe Elbow	333-0005-009
11	1/2" x 3/4" Hose Barb	333-0002-011	35	1/2" x 2" Pipe Nipple	333-0008-016
12	1 1/4" x 2" Pipe Nipple	333-0008-038	36	1" x 1/2" Pipe Elbow	333-0005-010
13	1 1/4" x 12" Pipe Nipple	333-0008-044	37	1" Pipe Tee	333-0004-005
14	1 1/4" Elbow	333-0005-006	38	Fast Valve	063-0172-979
15	3/4" EVA Hose	214-0001-036	39	1 1/4" Y-Strainer	333-9000-025
16	1/4" x 3/8" Hose Barb	333-0002-004	41	1 1/4" Steel Ball Valve	019-0159-245
17	1 1/2" x 1 1/4" Bushing	333-0003-019	42	Ceramic Magnets	418-0000-001
18	1 1/2" Muffler Clamp	435-3003-030	43	Flow Meter, 60S	063-0171-666
19	1" Pipe Union Gasket	219-0000-076	44	1" x 1/2" Reducing Bushing	333-0003-094
20	1" Pipe Union	333-0006-004	45	1" x 3" Pipe Nipple	333-0008-031
22	1" x 2" Pipe Nipple	333-0008-029	46	Vapor Tubes (Not Shown)	214-0002-002
23	1" Pipe Cross	333-0004-029	47	1 1/2" x 1" Bushing	333-0003-020
24	1" x 5" Pipe Nipple	333-0008-033	48	Check Valve Assy Multi-Section	063-0173-030
25	1/2" x 1 1/2" Pipe Nipple	333-0008-015	49	Relief Valve	334-0002-005

054-0159-118  
03/09 REV. E  
SHEET 1 OF 1

**Note:** Install the provided teflon gasket (P/N 219-0000-076, Item # 19) to eliminate leaks from the 1" Union.



FIGURE 4. Optional AccuFlow Space Saver Kit (P/N 117-0159-723)



ITEM	DESCRIPTION	RAVEN PART #
1	Fitting, Pipe Elbow 90 Degree, Malleable Iron	333-0005-005
2	Fitting, Pipe Nipple Blk. Iron Sch. 80, 1" NPT x 3"	333-0008-031
3	Fitting, Pipe Nipple Blk. Iron Sch. 80, 1" NPT x 6"	333-0008-471
4	U-Bolt, Space Saver, Anhydrous System	107-0171-276
5	Bracket, Space Saver, Anhydrous System	107-0171-275
6	Nut, Plain Hexagon, 3/8"-16 UNC-2B	312-1001-037
7	Split Lock Washer, 3/8"	313-1000-022

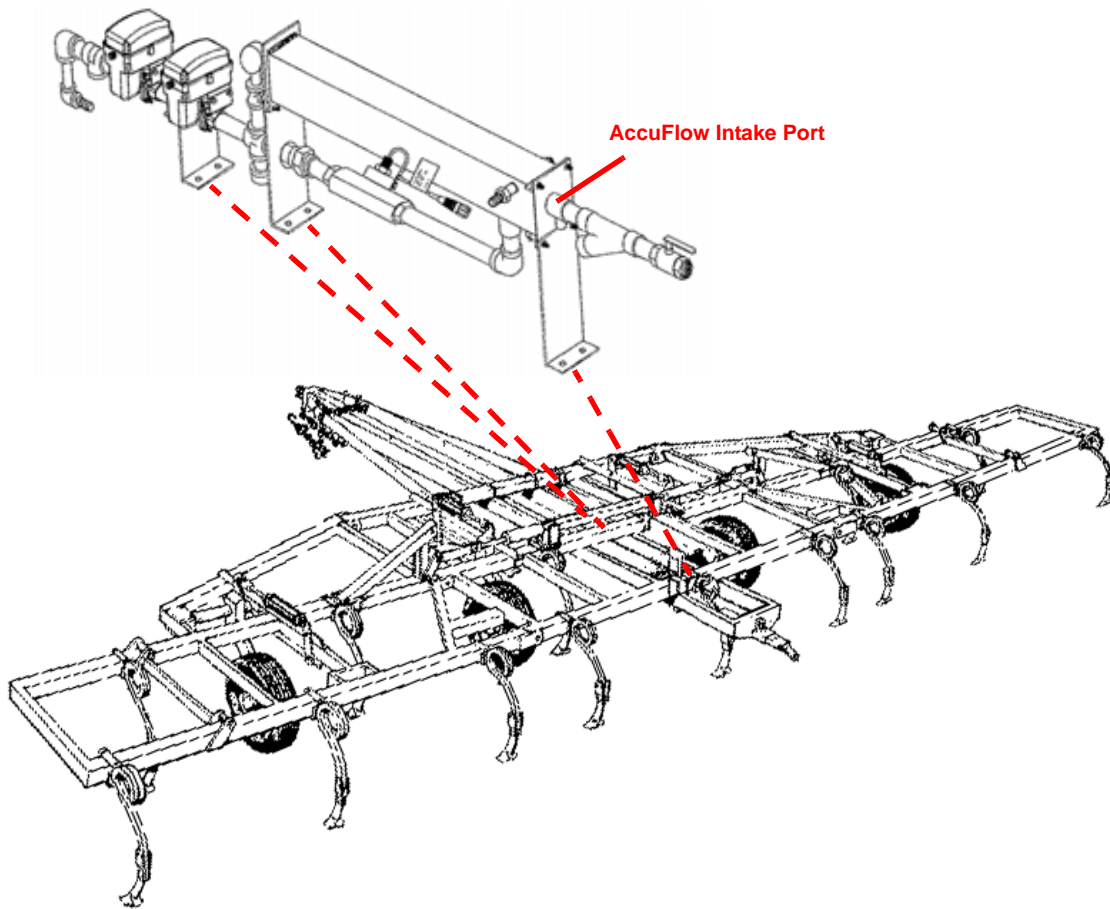
**NOTES:**

- 1) Use Rectorseal #5 on all pipe joints.
- 2) Assemble fittings according to the diagram above. Item 3 should angle upward at approximately 45 degrees.
- 3) The hardware to mount the 1" pipe nipple to the bracket (item 5) is supplied with Accu-Flow System.

## Mounting the AccuFlow System

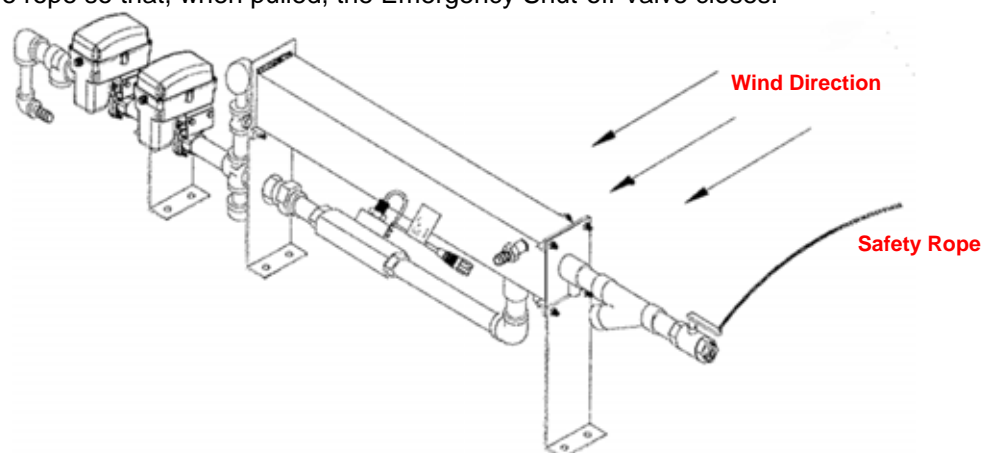
Use the provided U-Bolts and hardware (P/N 107-0159-447) to mount the AccuFlow system directly to the frame of the tool bar or implement. The intake port of the AccuFlow Super Cooler should be pointing toward the rear of implement and nurse tank.

FIGURE 5. AccuFlow Mounting Example



## Emergency Shut-off Rope Installation

Using the provided Quick Link (P/N 319-1000-010), securely tie a length of rope to the Emergency Shut-off Valve. Route the rope so that, when pulled, the Emergency Shut-off Valve closes.



	<p style="text-align: center;"><b>⚠ WARNING</b></p> <p>Anhydrous ammonia can cause severe burning, blindness, or death. Always work upwind of an implement with the AccuFlow system. If the Emergency Shut-Off Rope cannot be routed to the vehicle's cab, make sure to orient the vehicle to allow the rope to be pulled from a location upwind of the implement.</p>
--	--

## Plumbing the AccuFlow System

The following steps will guide you through the final system connections for the AccuFlow Super Cooler and NH<sub>3</sub> plumbing.

**Note:** Schedule 80 pipe and fittings should be used to plumb high pressure NH<sub>3</sub> systems.

Control valves used with liquid systems **cannot** be used with the NH<sub>3</sub>. Specially designed Control Valve(s) must be used with the AccuFlow system to control application of NH<sub>3</sub>. This special NH<sub>3</sub> Control Valve can be used with all other chemicals; i.e. herbicides, insecticides, and liquid fertilizer.

To complete installation of the AccuFlow system:

1. Install Flow Meter (RFM 60S) and Control Valve.

**Note:** The ON/OFF Valve will not be used if a Fast Control Valve is installed.

2. Weld the provided Steel Vapor Tubes (P/N 214-0002-002) to the center applicator knives as shown in Figure 1 on page 10.
3. From the roll of 3/4" EVA Tubing (P/N 214-0001-036), cut two hoses which will be used to connect the Steel Vapor Tubes (installed in step 2) to the hose barbs located on the sides of the AccuFlow Super Cooler.

4. Connect the 3/8" EVA Tubing (P/N 214-0001-035) to the AccuFlow outlet (hose barb after valve(s)). Route the tubing from the AccuFlow outlet to the inlet at the bottom of the Super Cooler Intake port.
5. Verify that all of the applicator hoses are of equal length from each manifold hose barb to each liquid applicator tube.
6. Verify that all of the orifice openings in the liquid applicator tubes are unplugged and have the same diameter.
7. For high flow systems (20 GPM or greater):
  - a. Use 1-1/4" hose between the nurse tank and AccuFlow Emergency Shut-off Valve (P/N 019-0159-245). This hose should be as short as possible and must be no longer than 15 feet.
  - b. Install a 1-1/4" break-away coupler to connect the nurse tank and the AccuFlow Intake Port. A high flow tank valve is also recommended.
  - c. Do not use street elbows to avoid excessive pressure drop.

**Note:** Consult your local  $\text{NH}_3$  supplier for appropriate hoses, break-away fittings, manifolds, and orifices for use with the AccuFlow system.

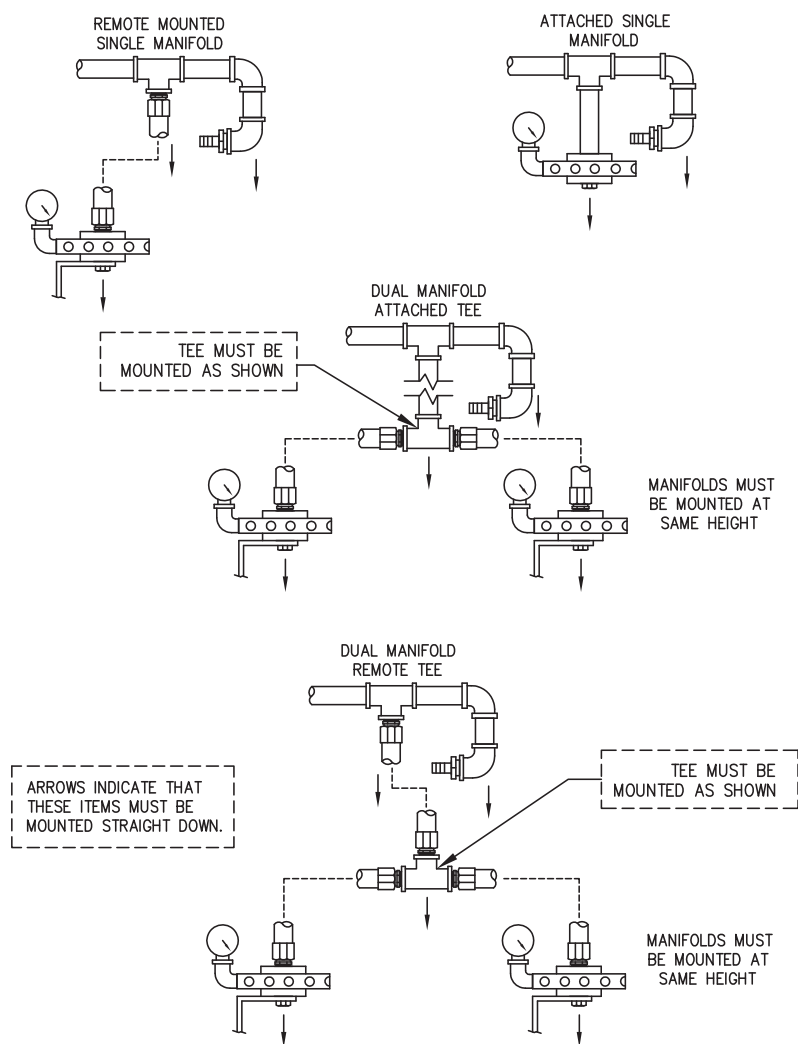
8. Verify installation by referring to Figure 1 on page 10.

## Mounting the Manifold

The following figure illustrates the various methods of connecting your existing  $\text{NH}_3$  manifold(s) (manifold not included with AccuFlow system). When installing your manifold, Raven recommends the following:

- Attach a 0-60 PSI gauge in one outlet of each  $\text{NH}_3$  manifold connected to the AccuFlow system.
- Verify that all manifold(s) hose barbs are the same orifice diameter.
- Verify all hoses from the flow divider are the same length.
- Verify all hoses to the manifolds are the same length.

FIGURE 6. Manifold Mounting Examples (Single Section Tool Bar)



**Note:** If more than two manifolds will be used with the AccuFlow system, a flow divider manifold will be required.

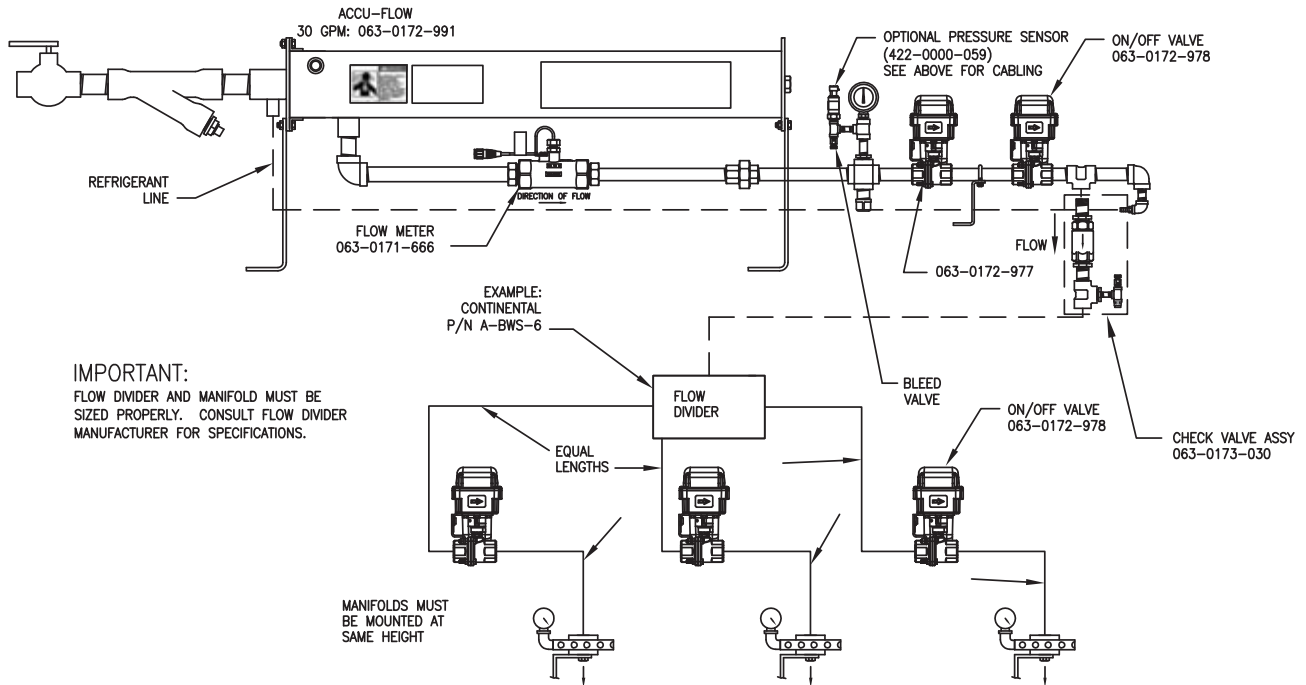
## AccuFlow Multi-Section Control

**Note:** Adding a flow divider will decrease the pressure of anhydrous ammonia for application. Size the flow divider for minimal pressure drop to avoid reducing system capacity. Consult the manufacturer or dealer for specifications and sizing information.

The following diagrams illustrate the required plumbing for a multi-section control system.



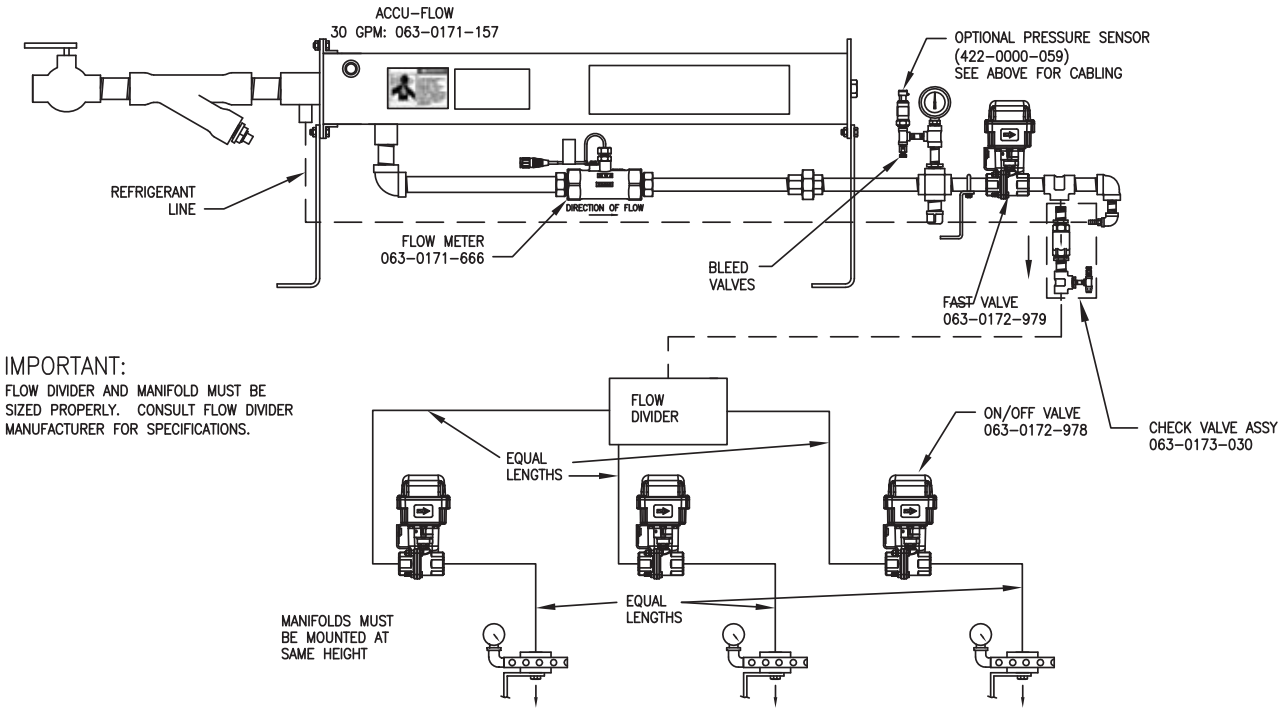
FIGURE 7. Multi-Section Tool Bar with Two Valve System



**Note:** Contact your local NH<sub>3</sub> dealer for proper orifice diameter, flow dividers, and manifold selections for your specific application.

**Note:** Adding a flow divider will decrease the pressure of anhydrous ammonia for application. Size the flow divider for minimal pressure drop to avoid reducing system capacity. Consult the manufacturer or dealer for specifications and sizing information.

FIGURE 8. Multi-Section Tool Bar with Fast Valve System



**Note:** Contact your local NH<sub>3</sub> dealer for proper orifice diameter, flow dividers, and manifold selections for your specific application.

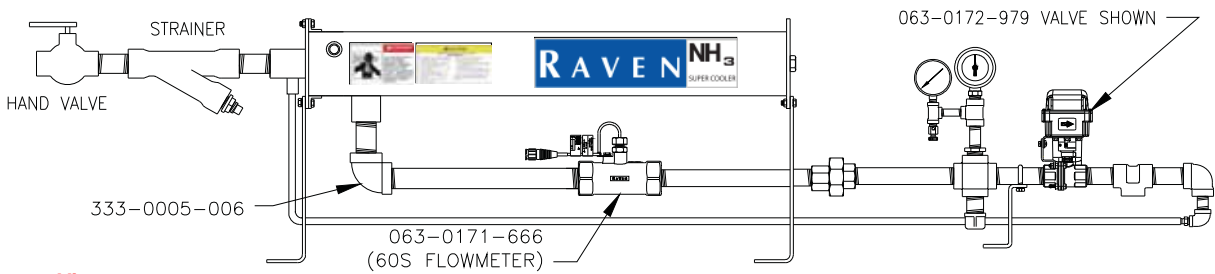
### Dual Cooler Installation

The following diagrams are provided to assist with mounting and connecting an AccuFlow Dual Cooler System.



FIGURE 9. Dual Cooler with Fast Valve System

Side View



Bottom View

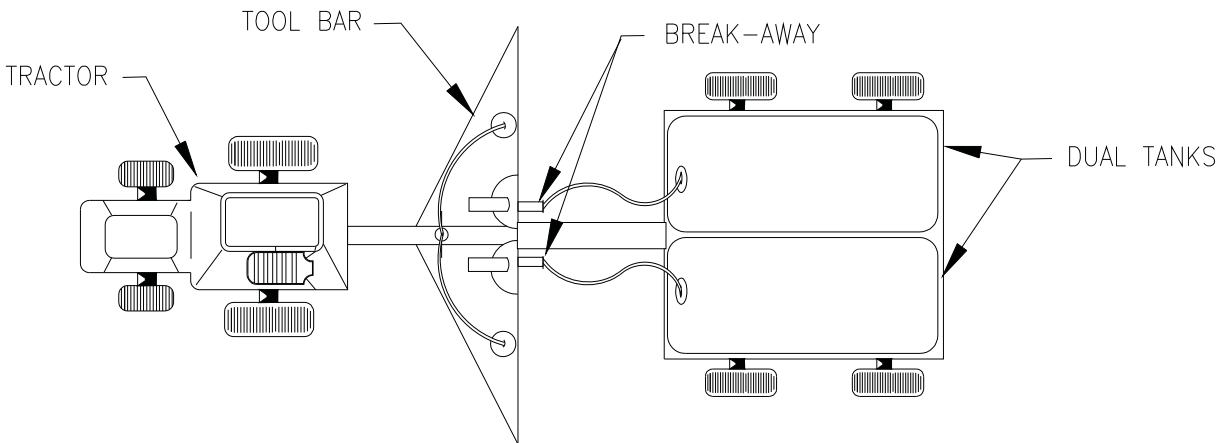
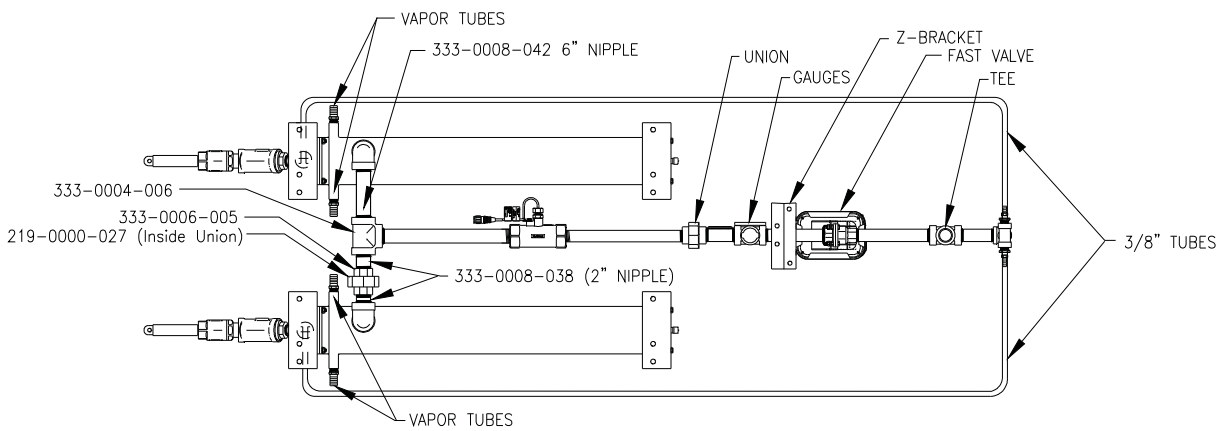
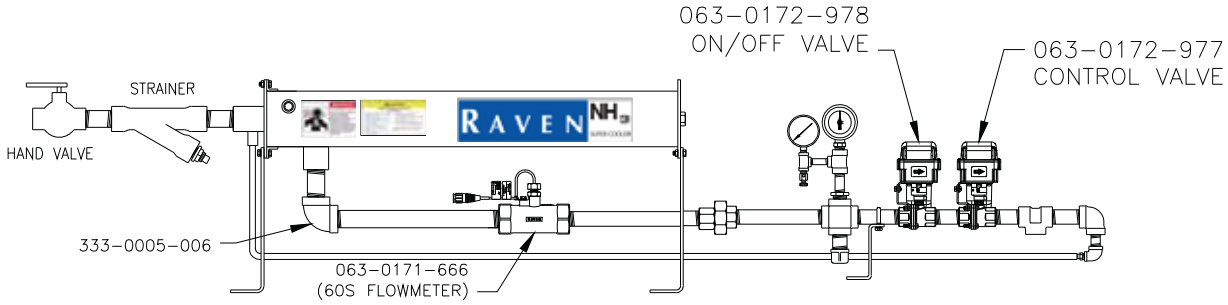


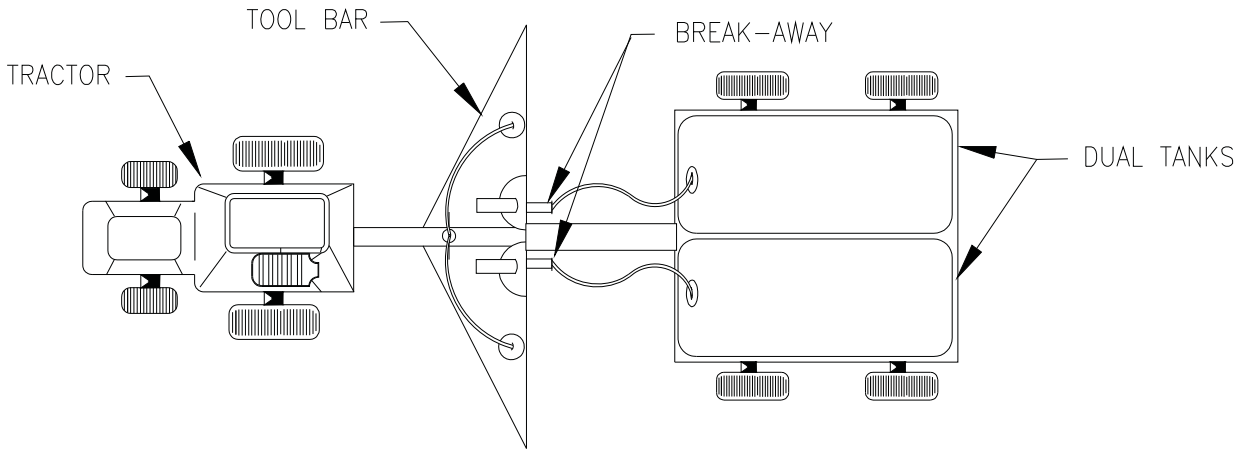
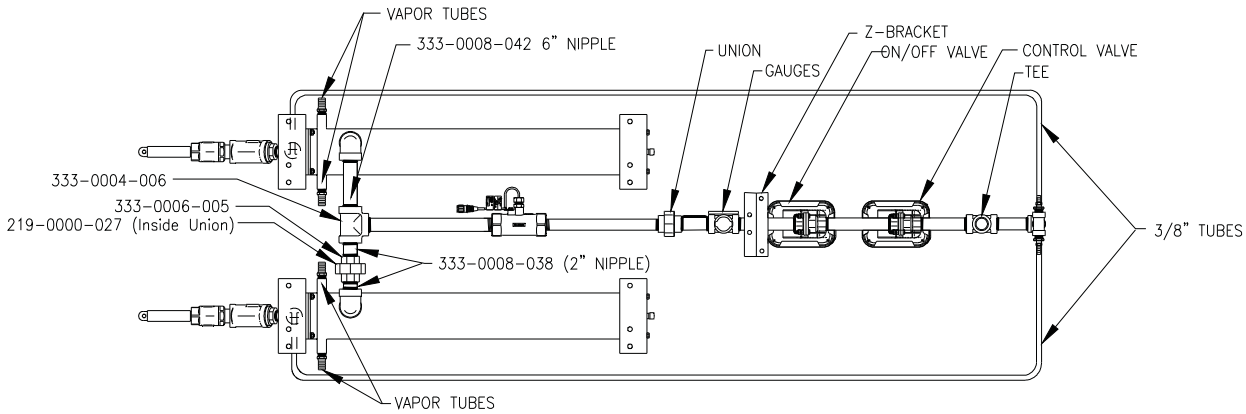


FIGURE 10. Dual Cooler with 2 Valve System

Side View



Bottom View



## *Checking for System Leaks*

Once the AccuFlow™ has been installed on your implement, check the system for leaks by charging the system with compressed air and applying soapy water to all plumbing joints and hoses. Thoroughly examine plumbing connections for bubbles indicating any kind of leak. Fix any leaks before charging the AccuFlow™ system with anhydrous ammonia.

## CHAPTER

# 4

## *Calibration & Operation*

This chapter contains information on calculating or adjusting calibration values for the AccuFlow system. These values must be programmed on the console providing product control. Refer to your console's *Installation & Operation* manual for detailed programming instructions.

**Note:** *Before the AccuFlow system and connected console may be used to control anhydrous ammonia application, the following calibration values must be programmed on your Raven Product Control Console:*

- Boom Cal
- Speed Cal
- Meter Cal
- Valve Cal
- Rate Cal

---

### *Adjusting the Boom Cal*

The Boom Cal for the AccuFlow system can be calculated with the following formula:

$$\text{Number of Applicator Knives} \times \text{Spacing in inches [centimeters]} = \text{Implement Width} \quad (\text{EQ 1})$$

#### **For Example:**

If your implement has 16 knives spaced 30 inches apart, the calculated implement width is equal to 480 inches. Enter 480 as the Boom Cal on your console.

---

### *Adjusting the Speed Cal*

Calculate the Speed Cal according to your console's *Installation & Operation* manual. No adjustments to the Speed Cal are required for the AccuFlow system.

## Adjusting the Meter Cal

Locate the Meter Cal value printed on the tag attached to the AccuFlow Flow Meter. This value will be referred to as the “original Meter Cal.” The original Meter Cal can be adjusted to display application rates in either pounds of actual nitrogen per acre (lbs(N)/acre), or kilograms of actual nitrogen per hectare (kg(N)/ha).

**Note:** *All volumes will be displayed in pounds [kilograms] of actual nitrogen. To properly control the application of anhydrous ammonia, enter the target application rates as pounds [kilograms] of actual nitrogen per acre [hectare] or lbs(N)/acre [kg(N)/ha].*

Use the following formulas to adjust the original Meter Cal for the desired display preferences:

$$(\text{lbs(N)/acre}) \text{ Original Meter Cal} / 4.22 = \text{Adjusted Meter Cal} \quad (\text{EQ 2})$$

$$(\text{kg(N)/ha}) \text{ Original Meter Cal} / [0.506] = \text{Adjusted Meter Cal} \quad (\text{EQ 3})$$

Round the calculated value to the nearest 3 digit whole number and enter the value as the Meter Cal on your Raven console.

### For Example:

Given an original Meter Cal of 720 [190].

$$(\text{lbs(N)/acre}) 720 / 4.22 = 170.62 \quad (\text{EQ 4})$$

$$(\text{kg(N)/ha}) 190 / [0.506] = 375.494 \quad (\text{EQ 5})$$

From the calculated values, round the adjusted Meter Cal value to 171 [375] and enter this value on your Raven console.

## Calculating the Required Capacity

To ensure that the desired application rate (in pounds [kilograms] of actual nitrogen per minute) does not exceed the AccuFlow system capacity, the required capacity of the application must be verified.

Using the following formula to calculate the required capacity:

$$\frac{\text{Target Application Rate} \times \text{Target Application Speed} \times \text{Implement Width}}{5940[60,000]} = \text{lbs[kg](N)/min} \quad (\text{EQ 6})$$

**Note:** *Be sure to enter the Target Application Rate in pounds [kilograms] of nitrogen per acre [hectare] and the Implement Width as calculated in the “Adjusting the Boom Cal” section on page 23.*

### For Example:

(English Units) Given a target application rate of 150 lbs(N)/acre at an average of 5.5 mph and a calculated implement width of 480 inches, the required capacity is:

$$\frac{150 \times 5.5 \times 480}{5940} = 66.6 \text{ lbs(N)/min} \quad (\text{EQ 7})$$

(SI Units) Given a target application rate of 68 kg(N)/ha at an average of 10 km/hr and a calculated implement width of 1220 centimeters, the required capacity is:

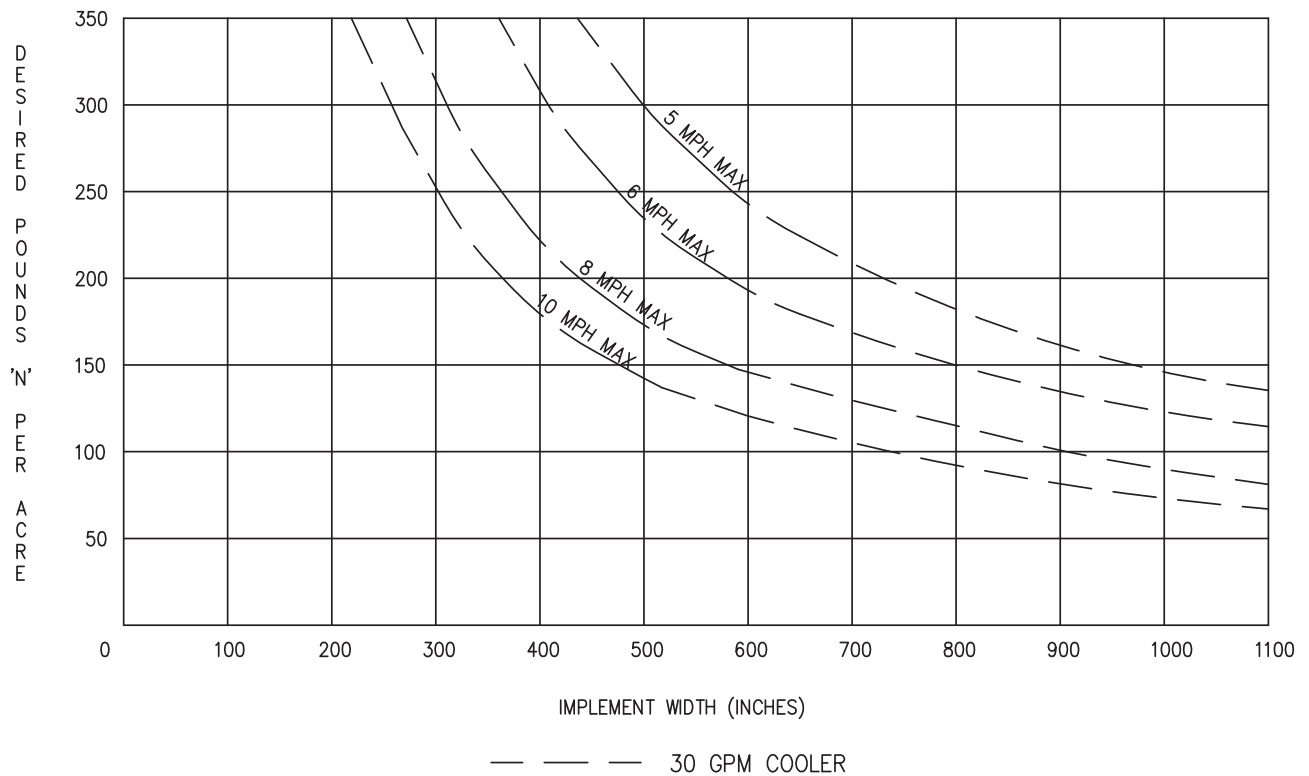
$$\frac{68 \times 10 \times 1220}{60,000} = 13.8 \text{ kg(N)/min} \tag{EQ 8}$$

The maximum capacity of the 30 GPM AccuFlow system is 126 lbs(N)/min [57 kg(N)/min]. Contact your local Raven dealer if the maximum rate is exceeded.

## System Capacity Chart

The following System Capacity Chart illustrates the capacity of the AccuFlow system in various configurations. Refer to this chart as part of the calculation for required capacity and when troubleshooting the AccuFlow system.

FIGURE 1. System Capacity Chart




## Adjusting the Valve Cal

Refer to your Raven Console's *Installation & Operation Manual* for your Raven Console for instructions on calculating or adjusting the Valve Cal.


**Note:** The Valve Cal may need to be adjusted to obtain desired results, particularly in applications using low flow rates.

## Charging the AccuFlow System

The following procedure will guide you through the proper method for connecting and charging the AccuFlow system.

	<b>NOTICE</b>
	Carefully read all directions in this section before beginning this procedure and make sure that all steps are completed before proceeding.  Review the safety requirements associated with the handling and application of anhydrous ammonia with your local NH <sub>3</sub> supplier.

1. Verify that all hoses, fittings, and mounting bolts are securely fastened or tightened.
2. Verify that the AccuFlow Flow Meter is connected to the Flow Meter connector on the Flow Meter cabling.
3. Verify that the AccuFlow Control Valve is connected to the Flow or Product cable connector.
4. Verify the on/off valve(s) are connected to the on/off connectors on the Flow Meter cabling.
5. Toggle the Master switch to the off position.
6. Verify that the motorized Control Valves are in the Off position.
7. Close bleed valve and all bleed ports.
8. Turn the AccuFlow Emergency Shut-off Valve to the full open position.
9. Connect and secure the hose from the nurse tank to the AccuFlow implement.
10. Turn the nurse tank shut-off valve just enough to allow NH<sub>3</sub> to pressurize the system.
11. Inspect the system for leaks.
  - a. If leaks are detected, proceed to step 12.
  - b. If no leaks are detected, skip to step 13.
12. If leaks are present:
  - a. Close the nurse tank shut-off valve.
  - b. Open the bleed valve(s) located on the AccuFlow system Figure 1, “Typical AccuFlow System (Single Section, Two Valves),” on page 10 and allow at least 60 minutes for all NH<sub>3</sub> in the lines to evaporate and discharge from the system. When the system is fully discharged, the AccuFlow Super Cooler should not feel cold and the pressure gauge reading on the AccuFlow system should be at zero.
  - c. After the system is completely discharged, disconnect the nurse tank hose.

	<b>! DANGER</b>
	Use extreme caution when opening a previously pressurized anhydrous ammonia system. Exposure to anhydrous ammonia can cause severe burning, blindness, or death. Always wear proper personal protective equipment when working with anhydrous ammonia products.

- d. Correct leaks and repeat step 9 through step 11.
13. Verify that pressure gauge readings on the AccuFlow system and the nurse tank are matching. If the pressure readings do not match, one of the gauges may be defective and should be replaced.
14. Turn the nurse tank shut-off valve to fully open. The AccuFlow system is now charged and ready for operation.

---

## Verifying AccuFlow Operation

Once the AccuFlow system is charged, the system is ready for the application of anhydrous ammonia to your field(s). The following items should be checked periodically to ensure proper operation of the AccuFlow system and application of anhydrous ammonia:

1. Verify that the Implement/Boom Widths, Speed Cal, Meter Cal, Valve Cal, and Rate Cals have been programmed correctly on your console (refer to your console's Operation manual for details).
2. Toggle the console to Manual Control Mode.
3. Toggle the Master switch to the off position.
4. Toggle the switch for section 1 (Boom 1) on. If a multi-manifold system is in use, toggle all sections on. Toggle any section switches not in use to their off positions.
5. With the Master switch in the off position, drive at the target application speed to verify the Speed readout on your console.
6. With applicator knives in the ground, toggle the Master switch to the on position.
7. While driving at the target application speed, manually adjust the flow with the INC/DEC switch until the Target Rate is achieved.

**Note:** *The manifold pressure must be greater than 10 PSI to ensure proper operation.*

8. Toggle your console to Automatic Mode. In Automatic Mode, the console will adjust the control valve automatically to maintain the Target Rate regardless of vehicle speed. If the console is not capable of maintaining the Target Rate, refer to Issue 12 in the Troubleshooting section later in this manual.
9. After two minutes of continuous operation, record the AccuFlow temperature and pressure from the two gauges mounted near the AccuFlow Super Cooler.

**Note:** *These gauge readings must be obtained while the AccuFlow system is actually applying NH<sub>3</sub>. Readings will be incorrect if the system is shut off, even momentarily.*

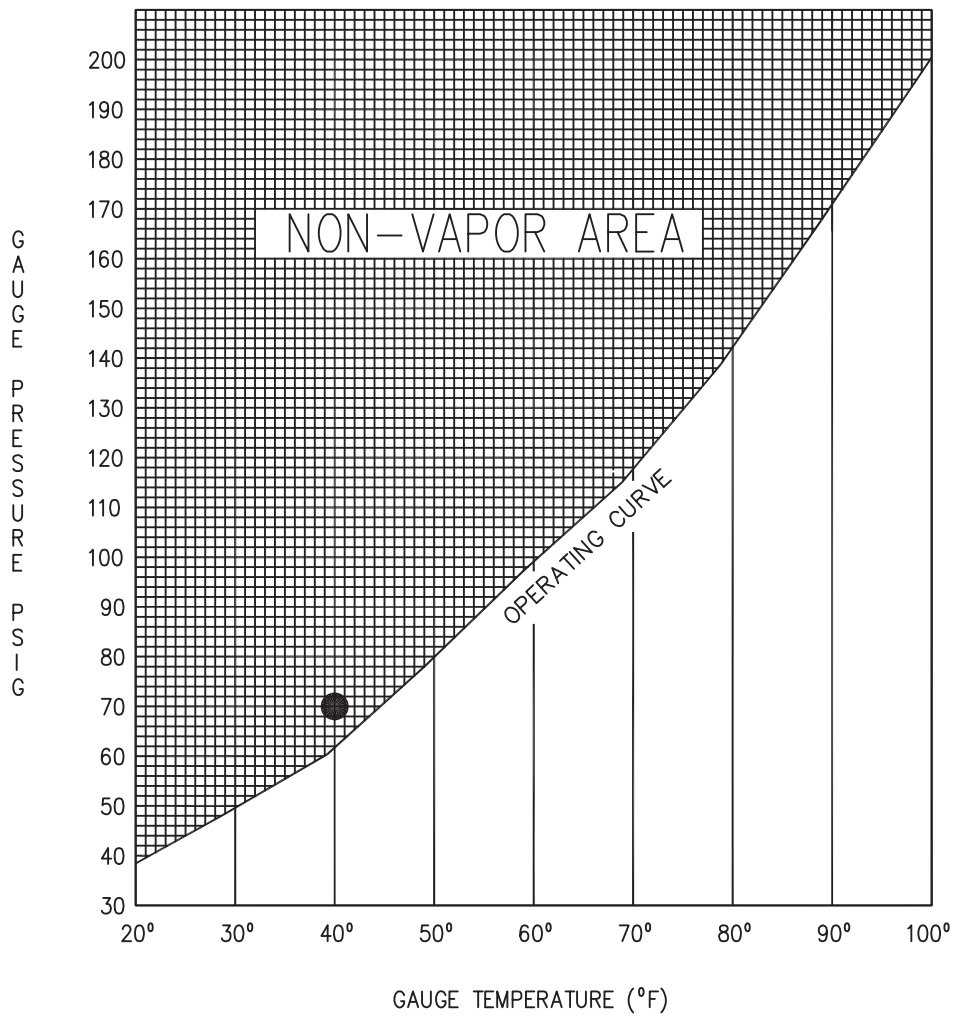
10. Locate the Pressure vs. Temperature chart in Appendix A. Find the intersection point of the recorded gauge readings on the chart. This point must be located in the Non-Vapor area (above the line). If the intersection point is outside of the Non-Vapor area (below the line), refer to Issue 17 in the Troubleshooting section later in this manual.

### For Example:

Given an observed pressure reading 70 PSI and temperature reading 40° F. The point where these two readings intersect is within the Non-Vapor area. See the *Pressure vs. Temperature Chart* on the following page.



FIGURE 2. Pressure vs. Temperature Chart



11. Clean magnets in Strainer and Magnet Assembly after every 4 or 5 tank loads (at minimum) of NH<sub>3</sub>.

**Note:** Perform the Discharging the AccuFlow System procedure found on page 29.

12. If an additive such as N-Serve (Dow Chemical) or ACA (Amoco) is used with the system, periodic cleaning of the AccuFlow Flow Meter may be required. Refer to Appendix F for instructions on disassembling the Flow Meter.




CHAPTER

5


*Service &  
Maintenance*

The following sections are included to illustrate the proper procedure for servicing and maintaining the AccuFlow system. This chapter also includes instructions for disassembling the AccuFlow Super Cooler for cleaning and storage.


	<p><b>! DANGER</b></p> <p>Anhydrous ammonia can cause severe burning, blindness, or death. Refer to the <i>Discharging the AccuFlow System</i> section on page 29 and follow the procedure for bleeding the AccuFlow system before beginning maintenance.</p>
---	---

### *Discharging the AccuFlow System*

The AccuFlow system must be discharged of all anhydrous ammonia and the system must be completely shut down before the implement can be transported.

	<p><b>! DANGER</b></p> <p>DO NOT transport the AccuFlow system while it is charged with anhydrous ammonia. The AccuFlow Super Cooler and product lines must be completely discharged before transporting the implement.</p>
---	---

The following procedure outlines the proper method for discharging NH<sub>3</sub> from the AccuFlow system and preparing the system for transport, service, or maintenance.

	<p><b>! DANGER</b></p> <p>Use extreme caution when opening a previously pressurized system. Exposure to anhydrous ammonia can cause severe burning, blindness, or death. To avoid injury or death, always wear proper personal protective equipment.</p>
---	--


**Note:** *Personal protective equipment such as a respirator, protective suit and gloves are required when working with anhydrous ammonia products.*

Before transporting the AccuFlow system or beginning service or maintenance:

1. Toggle the console or vehicle Master Switch to the off position.
2. Completely close the main shut-off valve on the supply or nurse tank.
3. Resume field application until the pressure gauge reads no remaining pressure is in the AccuFlow system.
4. Verify that the console and/or vehicle Master switch, and all section switches, are in the off position.
5. Completely close the Emergency Shut-off valve on the AccuFlow Super Cooler.
6. Bleed and disconnect the nurse tank supply hose from the AccuFlow system.
7. Toggle the console Master and all section switches to the on position.
8. While standing upwind from the implement, slowly open bleed valve(s) until fully open. Refer to Figure 1 on page 10 for assistance locating AccuFlow bleed valve(s).
9. **Allow a minimum of one (1) hour to fully discharge the system.** Verify that the pressure gauge on the AccuFlow Manifold reads zero and the Super Cooler is not cold to the touch before opening the system. This ensures that all liquid NH<sub>3</sub> has evaporated and pressure has been discharged.

## *Servicing and Storing the AccuFlow System*

When storing the AccuFlow system or when the AccuFlow system will not be used for extended periods, clean the inside of the Super Cooler with kerosene and coat with a 10 weight motor oil. Refer to the following section for instructions on disassembling the AccuFlow Super Cooler to perform service or maintenance.

	<p><b>! DANGER</b></p> <p>Anhydrous ammonia can cause severe burning, blindness, or death. Refer to the <i>Discharging the AccuFlow System</i> section on page 29 and follow the procedure for bleeding the AccuFlow system before beginning maintenance.</p>
---	---

## Opening the Super Cooler



### CAUTION

Anhydrous ammonia residue may be present within the Super Cooler chamber. Wear protective clothing and gloves when working with anhydrous ammonia products or servicing the AccuFlow system.

1. Refer to the *Discharging the AccuFlow System* section on page 29. Ensure that all  $\text{NH}_3$  has evaporated and vapors have been exhausted before proceeding.
2. Disconnect all external plumbing and fittings from the Super Cooler Assembly and remove the Super Cooler from the mounting brackets (4 bolts).
3. Use a vise to clamp the Super Cooler with the relief valve pointed upward.
4. Remove the four bolts on the Super Cooler closest to the Intake.
5. Remove the inner assembly with a twist-pull motion.

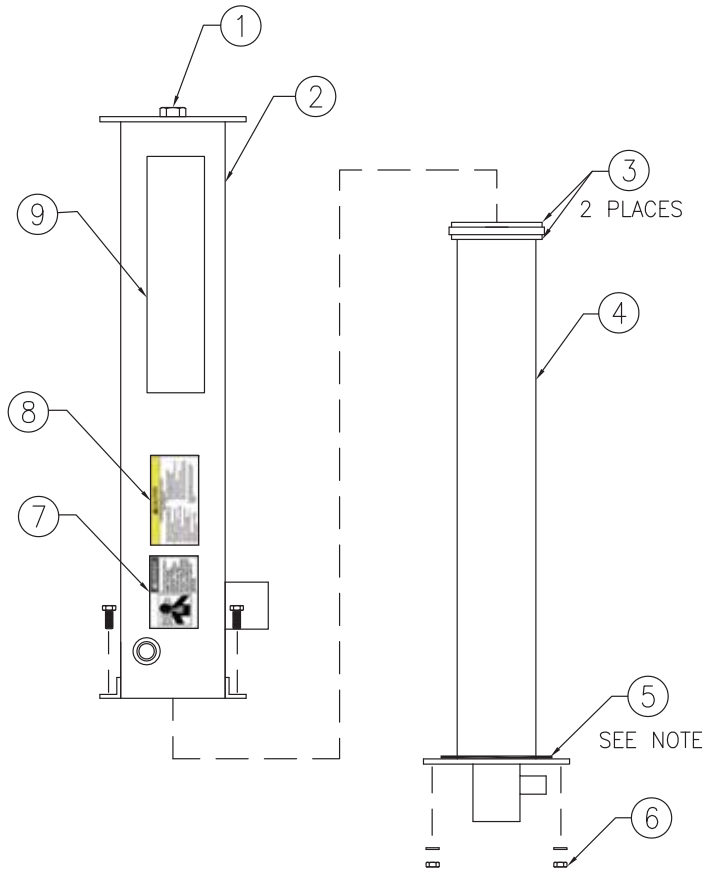


### CAUTION

DO NOT FORCE. The Super Cooler Assembly should separate with moderate and steady pressure.

6. Clean residue from the inner assembly and inspect the Super Cooler assemblies for damage and wear.
7. After cleaning and inspecting the assembly, lubricate the two O-Ring seals with brake fluid and reseal seals on the intake end of the Super Cooler before reassembling.
8. Insert the inner assembly into the casing and replace the four bolts at the intake end of the Super Cooler assembly.
9. Place the Super Cooler on mounting brackets and re-tighten the four mounting bolts.

FIGURE 1. AccuFlow Super Cooler Assemblies (P/N 063-0172-877)



Item #	Description	P/N
1.	Relief Valve	334-0002-005
2.	Outer Assembly	116-0159-683
3.	O-Ring	219-0000-036
4.	Inner Assembly	116-0159-430
5.	Gasket	219-0000-143
6.	3/8" Hex Nut	312-1001-037
7.	Danger Label	039-0159-034
8.	Caution Label	039-0159-035
9.	Raven Label	039-0159-020

**Note:** Accuflow Super Coolers with part numbers 063-0159-837 and 063-0159-546 require a Gasket Retainer Kit (P/N 117-0171-121). To order Replacement Gaskets only, use P/N 219-0000-142C and P/N 219-0000-144.

## Flow Meter Maintenance and Adjustment

Refer to the following procedure when removing the Flow Meter for maintenance or service.

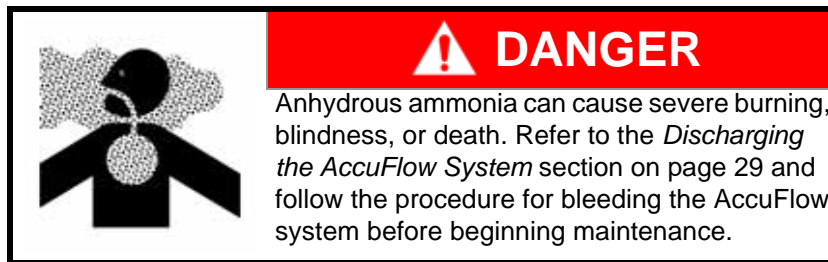
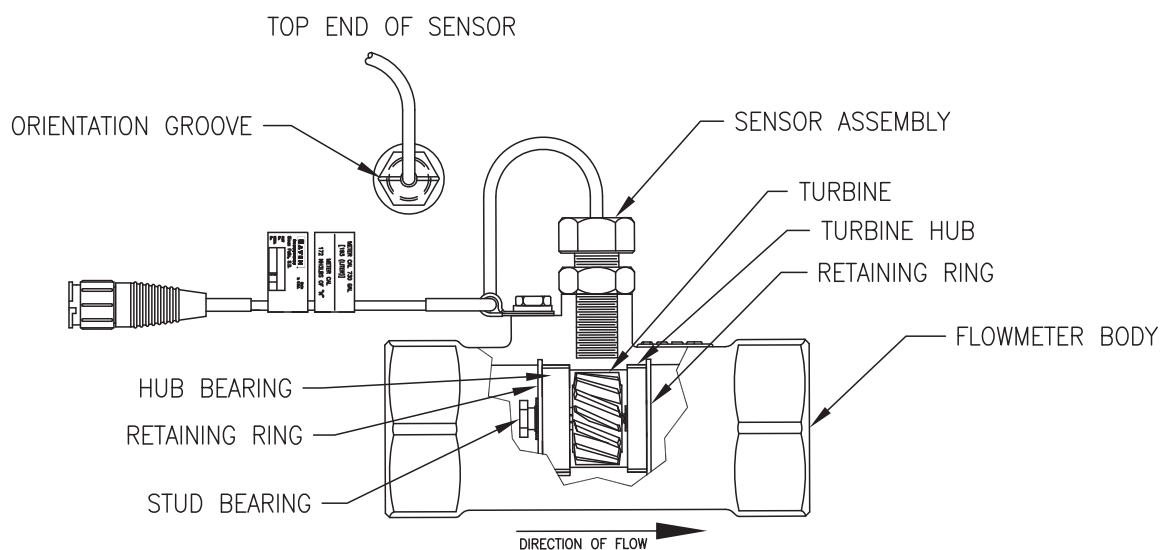


FIGURE 2. Flow Meter Housing and Assembly




1. To avoid introducing foreign material to the AccuFlow system, brush off the outside of the Flow Meter before disassembling and removing the Flow Meter.
2. Carefully remove the retaining rings.
3. Remove the bearing hub, turbine hub, and turbine from inside Flow Meter housing.
4. Carefully clean any metal filings, residues, or foreign material from the turbine and hubs. Use pressurized air to blow metal filings and debris out of both hubs and turbine.
5. To confirm that the turbine and blades are not worn, hold the turbine bearing hub while spinning the turbine. The turbine should spin freely with very little drag.
6. If the bearing hub stud is adjusted or replaced, repeat step 4 to verify turbine fit before reassembling.
7. Replace the turbine hub and retaining ring in the Flow Meter housing.
8. Replace the turbine against turbine hub inside the Flow Meter housing so that the stud keys within the Flow Meter housing line up with the grooves in the hub.
9. Place the retaining ring on to lock bearing hub in place.
  - a. Spin turbine by blowing on it.
  - b. Tighten bearing hub stud until turbine stalls.
  - c. Loosen the stud 1/3 of a turn. The turbine should be able to spin freely.
10. Carefully direct a low pressure jet of air (5 psi [34.5 kPa]) through Flow Meter in the direction of flow and again in the opposite direction to verify that the turbine spins freely.

11. If there is drag, loosen the stud on the bearing hub 1/16 turn until the turbine spins freely.
12. If turbine spins freely and the cables have checked out O.K., but the Flow Meter is not totalizing properly, verify that the sensor is threaded all the way into the flow meter body, and the orientation groove on top of the sensor is parallel with flow meter body. if flow meter still does not totalize, replace Sensor Assembly.

## CHAPTER

# 6

## Troubleshooting



**WARNING**

Anhydrous ammonia may be under pressure. Before disconnecting any fittings or hoses, be sure to purge the system of all liquid NH<sub>3</sub> (see the *Discharging the AccuFlow System* section on page 29).

### Issue 1:

Raven control console reports inaccurate AccuFlow measurements (i.e. console indicates more product applied than actual product removed from tank).

1. Record the operating temperature and pressure as well as static tank pressure from the AccuFlow gauges mounted on Manifold. Refer to Figure 1, “Typical AccuFlow System (Single Section, Two Valves),” on page 10 for assistance locating gauges.
2. Verify that NH<sub>3</sub> is in a liquid state at the flow meter by comparing the observed gauge readings to the Figure 2, “Pressure vs. Temperature Chart,” on page 28.

**Note:** *To properly measure and control application, anhydrous ammonia must be in a liquid state when it passes through the flow meter. To remain liquid, anhydrous ammonia must be stored at a temperature of -28° F (-33° C) or kept under pressure at higher temperatures.*

If the observed gauge readings and Pressure-Temperature chart:

- a. indicate that NH<sub>3</sub> is in a liquid state (Non-Vapor), check and clean the AccuFlow Flow Meter and check cable connections before proceeding to step 3.
  - b. do not indicate liquid NH<sub>3</sub> is passing through the Flow Meter, skip to step 4.
3. Refer to Figure 1, “System Capacity Chart,” on page 25 to verify that the target application speed is below the maximum speed allowed for your implement width and the target rate.
    - a. If the maximum speed is exceeded, reduce the application speed.
    - b. If the application speed is within allowable range, skip to step 5.
  4. Refer to the system diagrams in Chapter 3, *Installation* and verify that the AccuFlow system is plumbed correctly. If the system is plumbed correctly, proceed to step 5.
  5. Verify that the difference between the static and operating pressures (gauge readings obtained in step 1) does not exceed 5 PSI.

If the pressure difference:

- a. is greater than 5 PSI, proceed to step 6.
  - b. exceeds 5 PSI, skip to step 7.
6. The following maintenance and service steps should be
- a. Clean the strainer located next to the Super Cooler. Check hoses for deterioration and replace if necessary.
  - b. Remove all excess hose length between the nurse tank and break-away coupler (typically 12 feet).
  - c. Remove excess hose between break-away coupler and the AccuFlow system (typically 3 feet).
  - d. Verify that break-away coupler is 1-1/4", not 1". If the break-away coupler is the correct size, proceed to step 7.
7. Verify flow through the Super Cooler chamber by:
- a. Removing the vapor hoses from the steel vapor tubes at applicator knives.
  - b. Secure hose ends so each hose end can be viewed from vehicle cab.
  - c. Operate vehicle and AccuFlow system for a short period (at least 30 seconds).
  - d. Verify a heavy stream of anhydrous ammonia vapor is discharged from each hose end. If not, disassemble and clean Super Cooler. Refer to the *Opening the Super Cooler* section on page 31 for detailed instructions on disassembling the Super Cooler.

### Issue 2:

Console does not power-up or no indicators are lit to verify system power-up.

#### Solutions:

1. Check fuses either on the back of the console or on the console's cable. Refer to your console's Operation manual for assistance.
2. Check power and ground connections to the battery. Verify that the power leads from the console cable are connected directly to the battery, not chassis ground or another power source.
3. Check operation of the Master switch.

If none of the above steps resolve the issue, your console may require repair. Contact your local Raven dealer for further assistance.

### Issue 3:

(SCS 400 to 700 Series consoles only) All keyboard lights are on at the same time.

#### Solution:

Your console may require repair. Contact your local Raven dealer for further assistance.

### Issue 4:

(SCS 400 to 700 Series consoles only) Keyboard does not work for entries.

#### Solution:

Your console may require repair. Contact your local Raven dealer for further assistance.



**Issue 5:**

Indicator light(s) on specific keys will not illuminate.

**Solution:**

Your console may require repair. Contact your local Raven dealer for further assistance.

**Issue 6:**

Console displays flashing “CAL” whenever vehicle engine is started.

**Solution:**

1. Check battery voltage.
2. Console power may be toggled by the vehicle’s ignition switch or connected to a “dirty” power source. Verify that the power leads from the console cable are connected directly to the battery, not chassis ground or another power source.

**Issue 7:**

Console displays flashing “CAL” whenever the Master switch is toggled on or off.

**Solution:**

1. Check battery voltage.
2. Console power may be connected to a “dirty” power source. Verify that the power leads from the console cable are connected directly to the battery, not chassis ground or another power source.

**Issue 8:**

Console’s TIME feature is inaccurate or drifts.

**Solution:**

Your console may require repair. Contact your local Raven dealer for further assistance.

**Issue 9:**

Display digits are missing segments.

**Solution:**

Your console may require repair. Contact your local Raven dealer for further assistance.

**Issue 10:**

Speed constantly displays a zero value.

**Solutions:**

1. Check Speed Sensor Cable and connectors or the port on the back of your console for loose pins.
2. Clean pins and sockets on Speed Sensor cable connectors.



3. If no Speed Sensor Extension Cable is installed, the Speed Sensor Switch Assembly may require a replacement. Contact your local Raven dealer for further assistance.

### Issue 11:

(Wheel Drive Speed Sensors) Speed display is inaccurate or unstable.

#### Solutions:

1. Check that the issue is encountered on hard surface roads.
  - a. If the Speed display is accurate on hard surfaces, investigate mounting the Speed Sensor on a different wheel.
  - b. If the Speed display is still inaccurate on hard surfaces, proceed to step 2.
2. Verify that all magnets are detected by the speed sensor by:
  - a. Removing one set of magnets (one red and one black) from the wheel.
  - b. Reposition remaining magnets directly across from each other.
  - c. Adjust the Speed Cal by entering a value twice as large as the correct Speed Cal value.
  - d. Recheck speed display on hard surface road.
  - e. Continue checking sets of magnets (replacing previously removed set) these two magnets and replace with other two.
  - f. Run speed check again.

If the Speed display is inaccurate with only one set of magnets, replace the bad set.

If the Speed display is inaccurate with all sets of magnets, replace Speed Sensor Assembly.

**Note:** *Re-enter original Speed Cal after testing is complete.*

### Issue 12:

Rate Reads "0000".

#### Solutions:

1. Verify Speed display is being registered accurately. If the Speed displays a constant zero value, troubleshoot the Speed Sensor according to the procedure addressed in Issue 10.
2. Verify that the console is registering flow by confirming the Total Volume display is correct.  
If the Total Volume display is incorrect, see Troubleshooting Issue 14.


### Issue 13:

Rate display is inaccurate or unstable.

#### Solutions:

1. Verify that all calibration values are entered correctly on your console (see your console's Operation manual for instructions).
2. Verify the Speed display is registering accurately.  
If Speed display is inaccurate, troubleshoot the Speed Sensor according to the procedure addressing Issue 10.
3. In Manual (MAN) Control Mode, verify that Rate display holds a constant value.  
If the Rate display is unstable, see Issue 17 for further troubleshooting tips.

- Hoses connecting the AccuFlow system should not exceed 15' of 1-1/4" hoses and a 1-1/4" breakaway.

	<p style="text-align: center;"><b>! WARNING</b></p> <p>Anhydrous ammonia may be under pressure. Before disconnecting any fittings or hoses, be sure to purge the system of all liquid NH<sub>3</sub> (see the <i>Discharging the AccuFlow System</i> section on page 29).</p>
---	---


- Remove any street elbows and replace with a conventional elbow and nipple.
- Verify that the nurse tank has a high flow valve.

**Issue 14:**

Rate does not change in either Manual or Automatic Control Modes.

**Solutions:**

- Check the Control Valve cabling for wear and breaks.
- Check and clean cable connections as necessary.
- Check the voltage at the Control Valve connector by:
  - powering on your console.
  - set the Master switch to the on position.
  - set all products or the console to Manual (MAN) Control Mode.
- Hold the Increase/Decrease (INC/DEC) switch. With the INC/DEC switch in operation, check for voltage at the Control Valve.
- Verify that valve is turning by watching the coupler shaft. If the valve does not open or close, replace the Control Valve Motor.

	<p style="text-align: center;"><b>! WARNING</b></p> <p>Anhydrous ammonia may be under pressure. Before disconnecting any fittings or hoses, be sure to purge the system of all liquid NH<sub>3</sub> (see the <i>Discharging the AccuFlow System</i> section on page 29).</p>
---	---

**Issue 15:**


Total Volume does not register.

**Solutions:**

- Test the Flow Meter cable and any extension cables for breaks or shorts. Refer to your console's Operation manual for testing procedure.



2. Check and clean internal components of Flow Meter. Refer to your console's Operation manual for Flow Meter cleaning and adjustment procedure.

	<p><b>WARNING</b></p> <p>Anhydrous ammonia may be under pressure. Before disconnecting any fittings or hoses, be sure to purge the system of all liquid NH<sub>3</sub> (see the <i>Discharging the AccuFlow System</i> section on page 29).</p>
---	---

**Issue 16:**

Total Volume registers flow inaccurately.

**Solutions:**

1. Verify product flow corresponds to the direction of the arrow stamped on the Flow Meter.
2. Clean Flow Meter according to Appendix F.
3. See Console Installation Manual.

**Issue 17:**

Motorized Control Valve rotates more than 1/4 turn.

**Solution:**


Replace motorized Control Valve.

**Issue 18:**

Pressure and temperature gauge readings indicate that NH<sub>3</sub> passing through the AccuFlow Flow Meter is not in a liquid state.

**Solutions:**

1. Check that the vapor tubes have been affixed to the applicator knives correctly and that the openings for NH<sub>3</sub> are not plugged or filled with debris.
2. If additives such as N-Serve or ACA have been or are being used with the AccuFlow system, disassemble and clean Super Cooler chamber. See Appendix B for more information about servicing the Super Cooler.

	<p><b>WARNING</b></p> <p>Anhydrous ammonia may be under pressure. Before disconnecting any fittings or hoses, be sure to purge the system of all liquid NH<sub>3</sub> (see the <i>Discharging the AccuFlow System</i> section on page 29).</p>
---	---

3. Determine if the operating pressure drop is within tolerances. See step 5 addressing Issue 1.

---

CHAPTER

7

*System Diagrams*

This chapter contains examples of AccuFlow System Cabling for various Raven Control Consoles.

FIGURE 1. SCS 440 with AccuFlow System (2 Valve, Single Section Tool Bar)

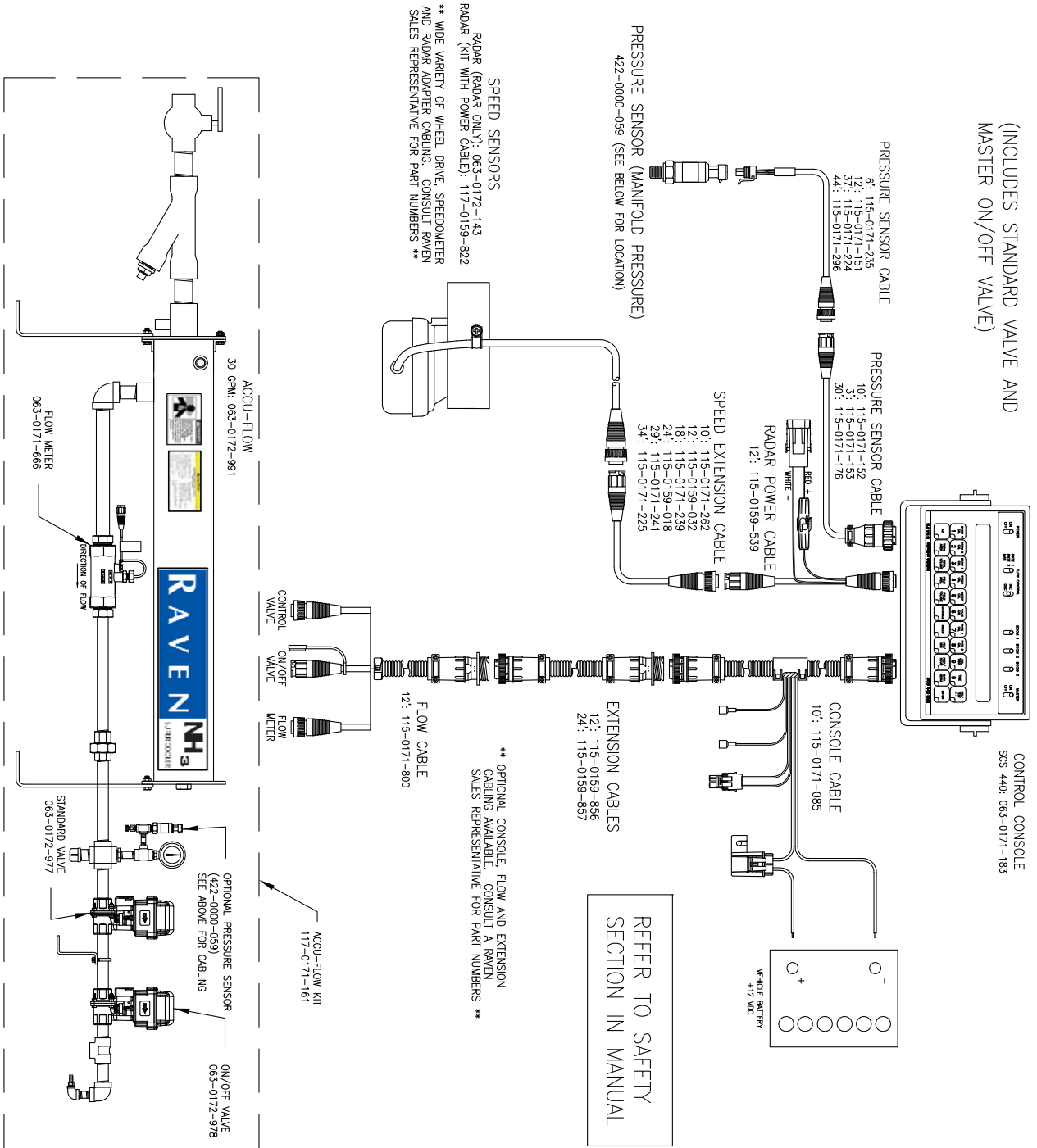


FIGURE 2. SCS 440 with AccuFlow System (Fast Valve, Single Section Tool Bar)

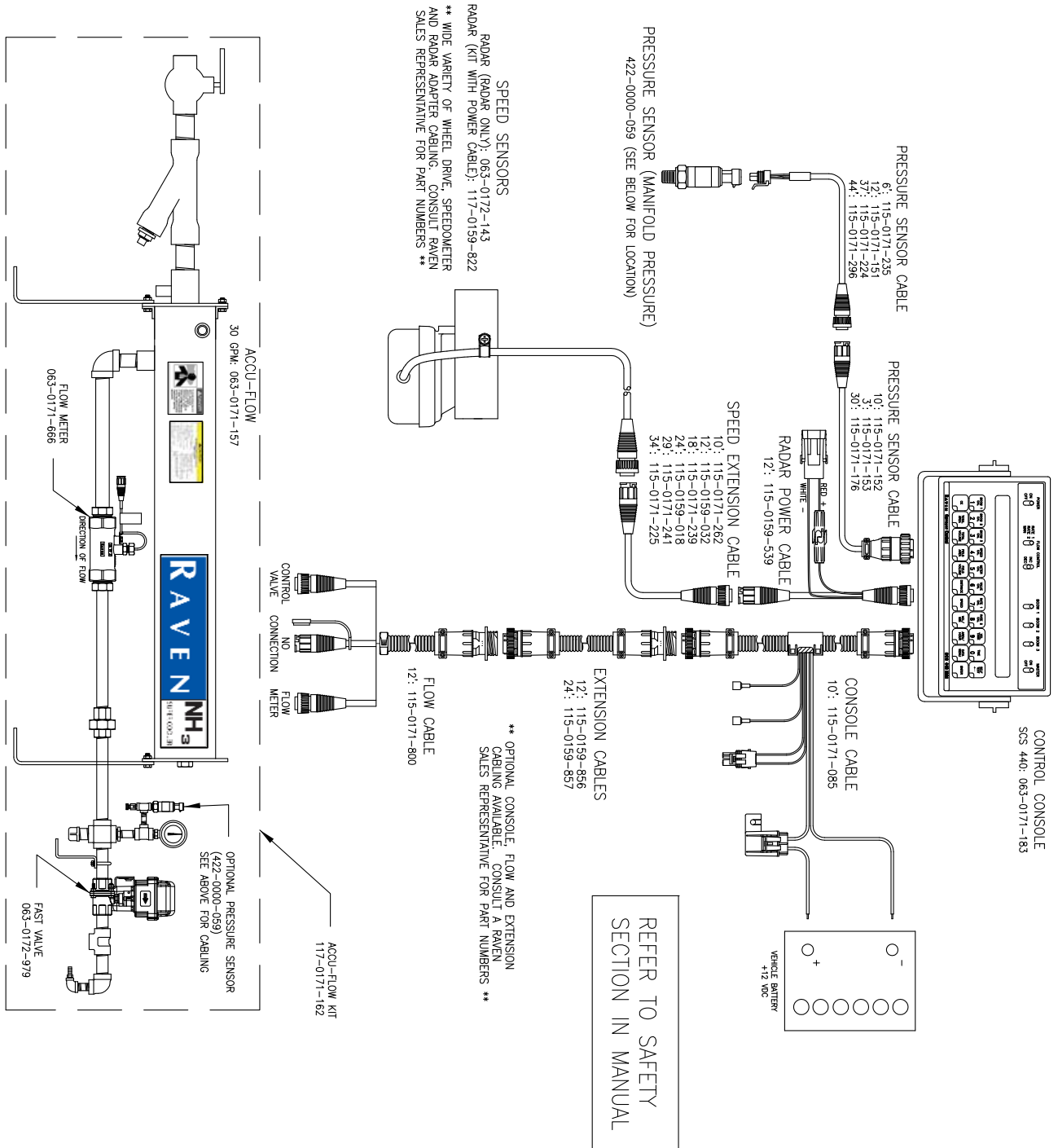
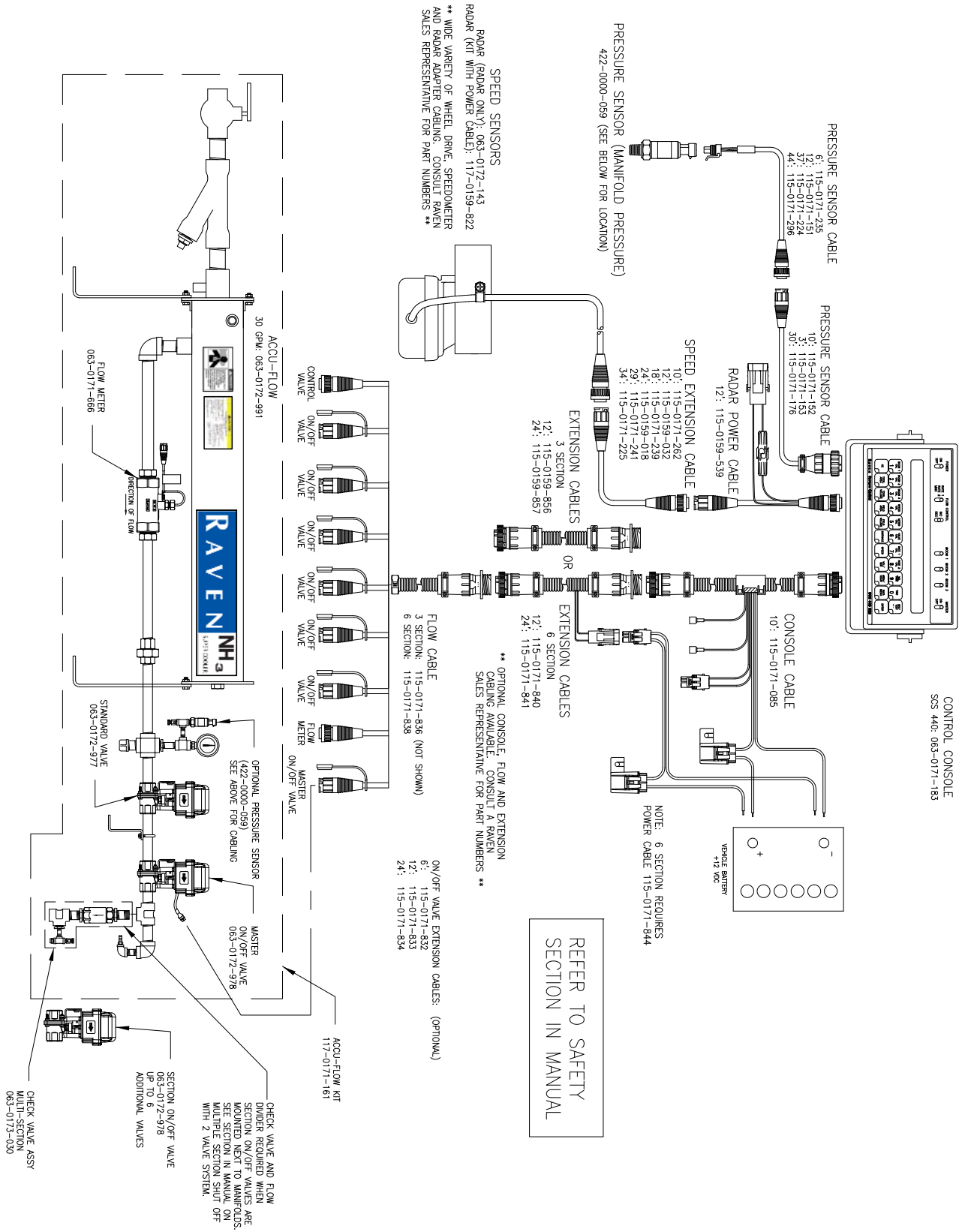


FIGURE 3. SCS 440 with AccuFlow System (2 Valve, Multi-Section Tool Bar)



REFER TO SAFETY SECTION IN MANUAL



FIGURE 4. SCS 440 with AccuFlow System (Fast Valve, Multi-Section Tool Bar)

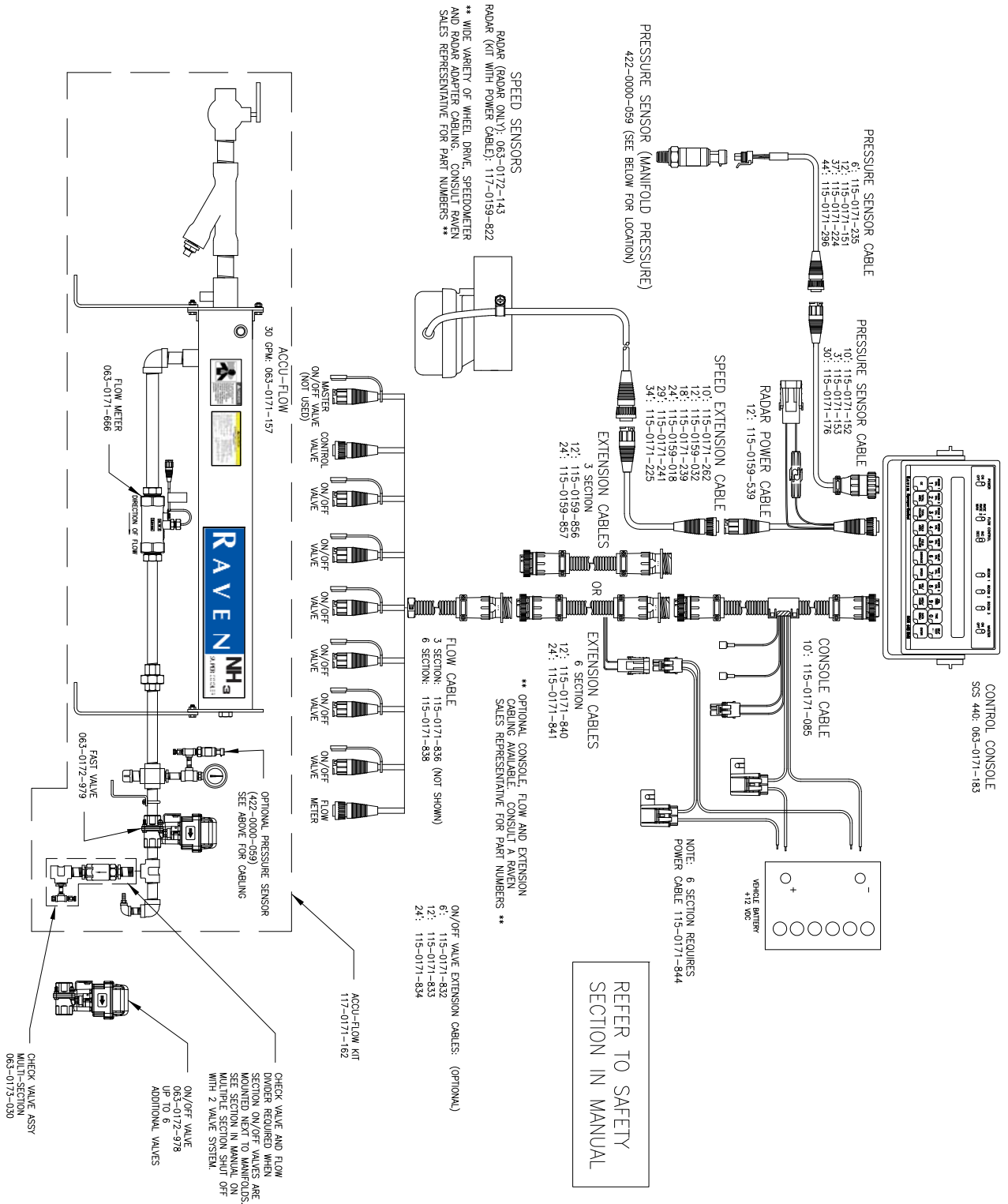


FIGURE 5. SCS 4400 with AccuFlow System (2 Valve, Single Section Tool Bar)

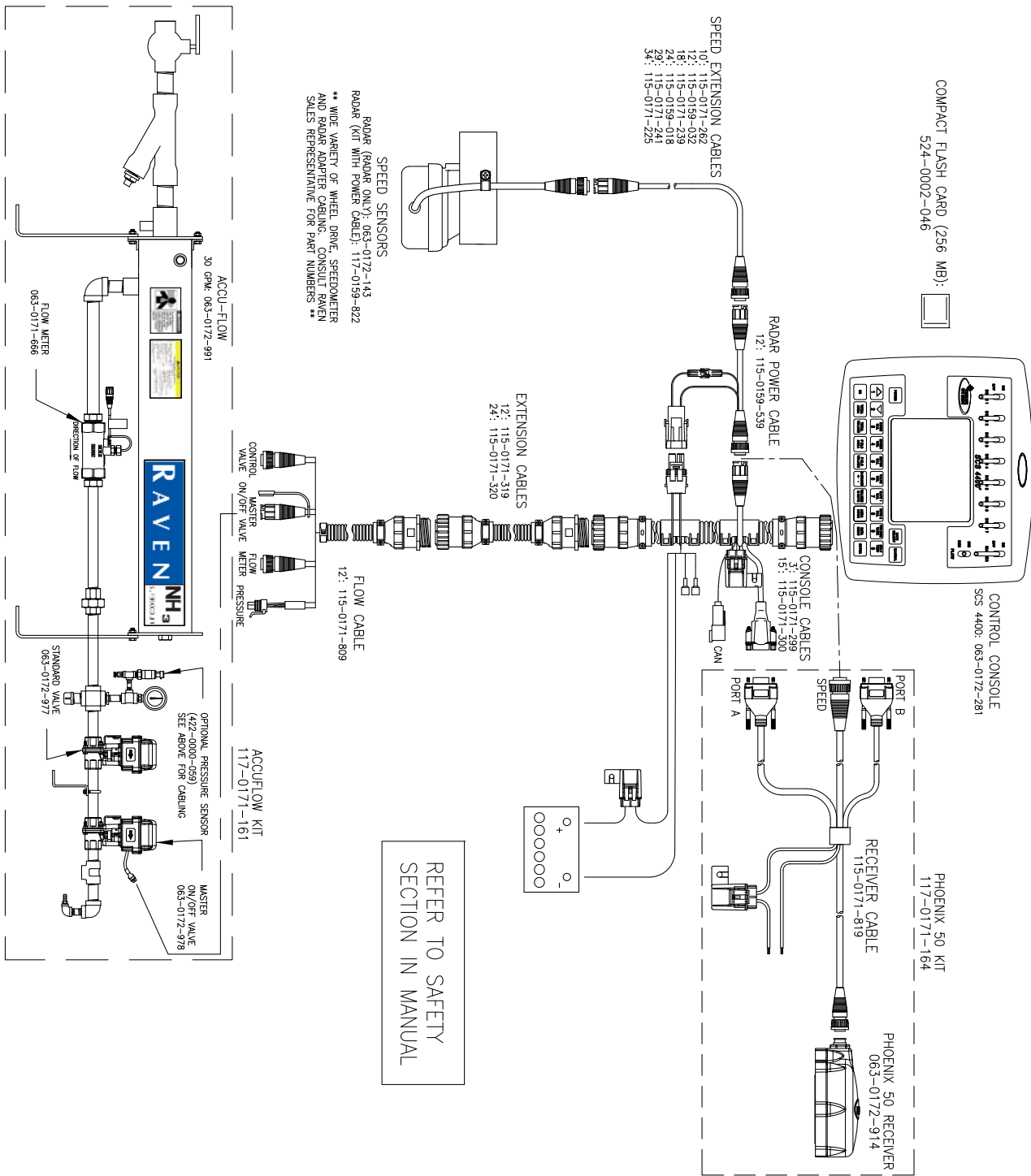


FIGURE 6. SCS 4400 with AccuFlow System (Fast Valve, Single Section Tool Bar)

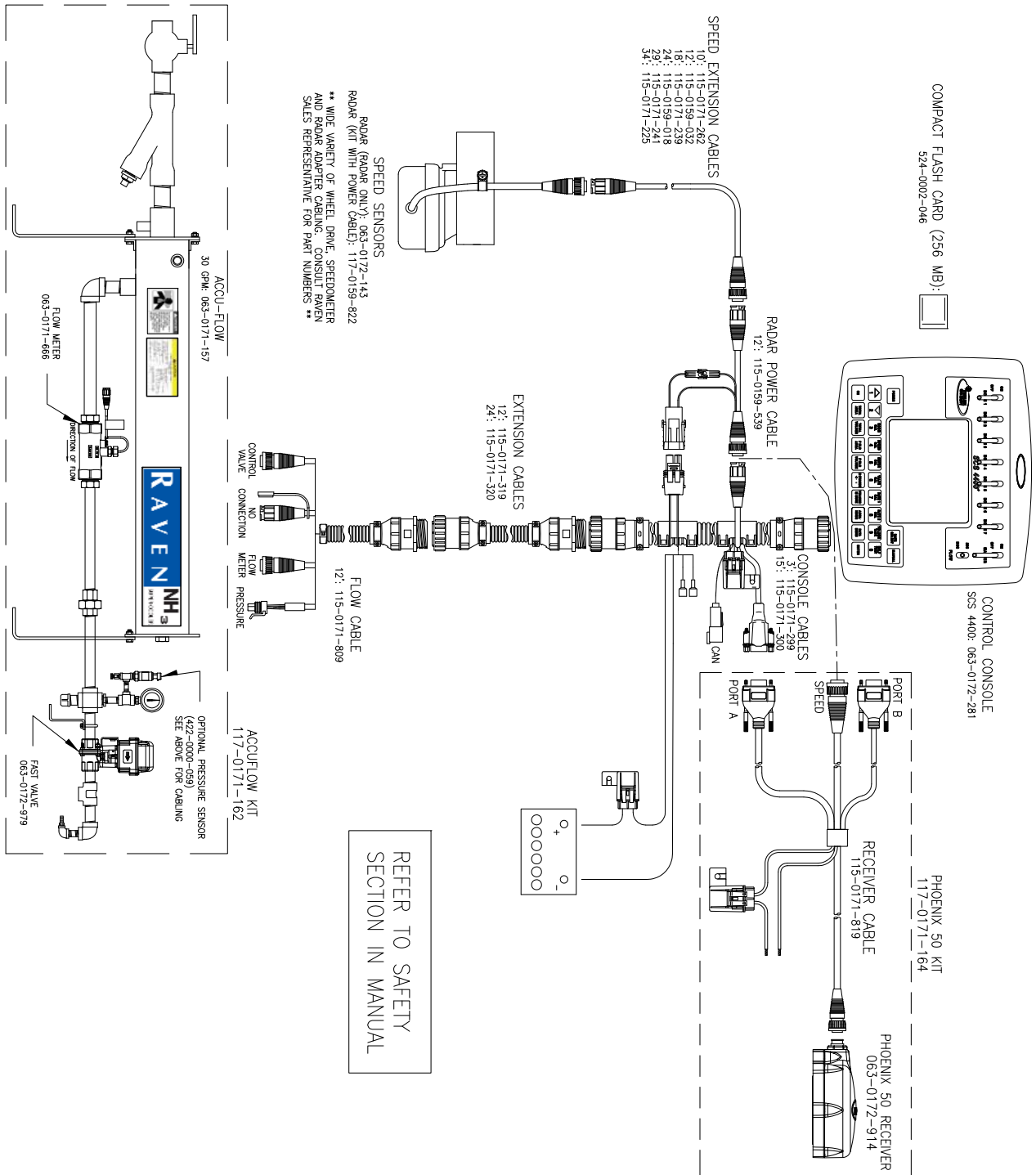
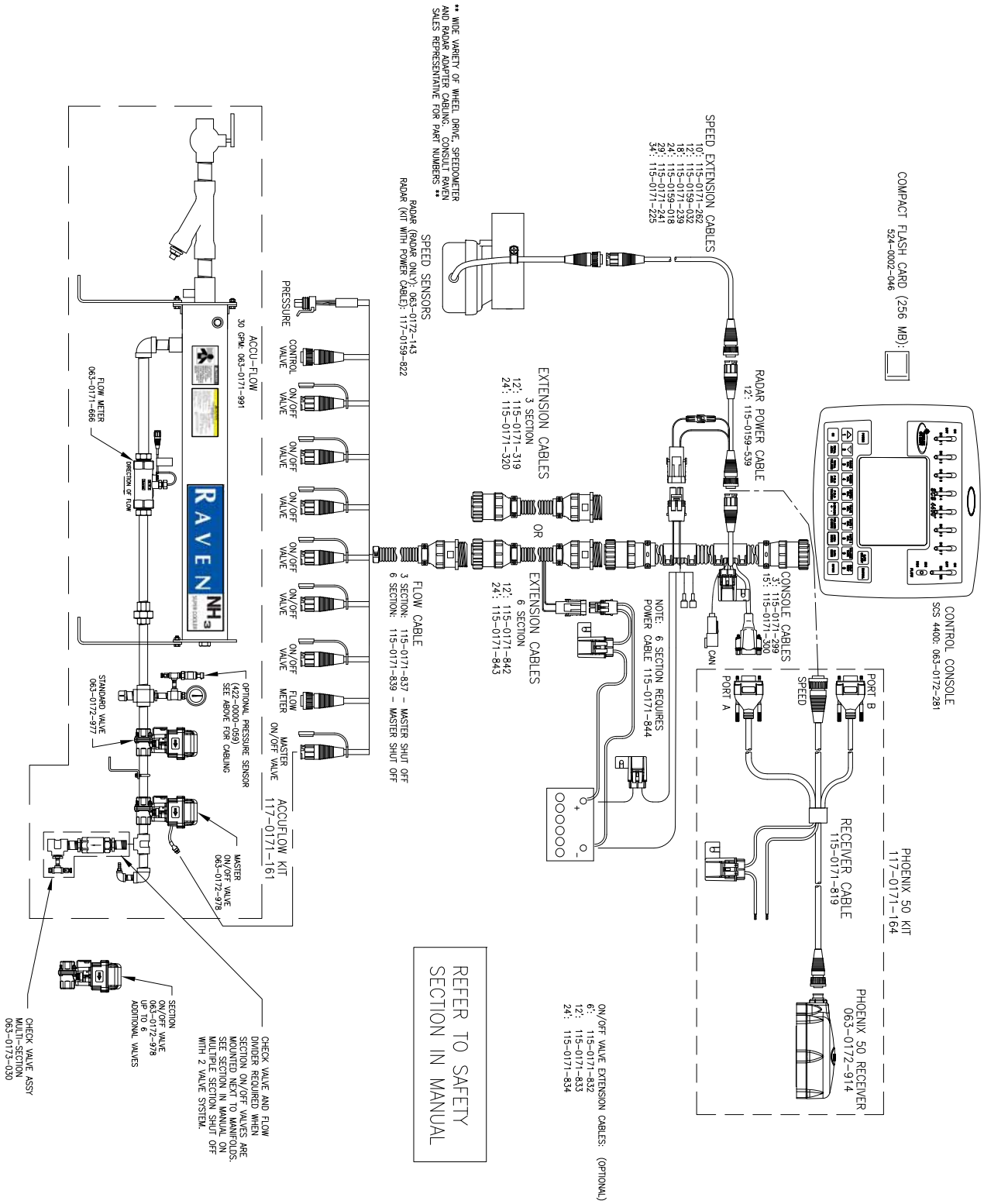
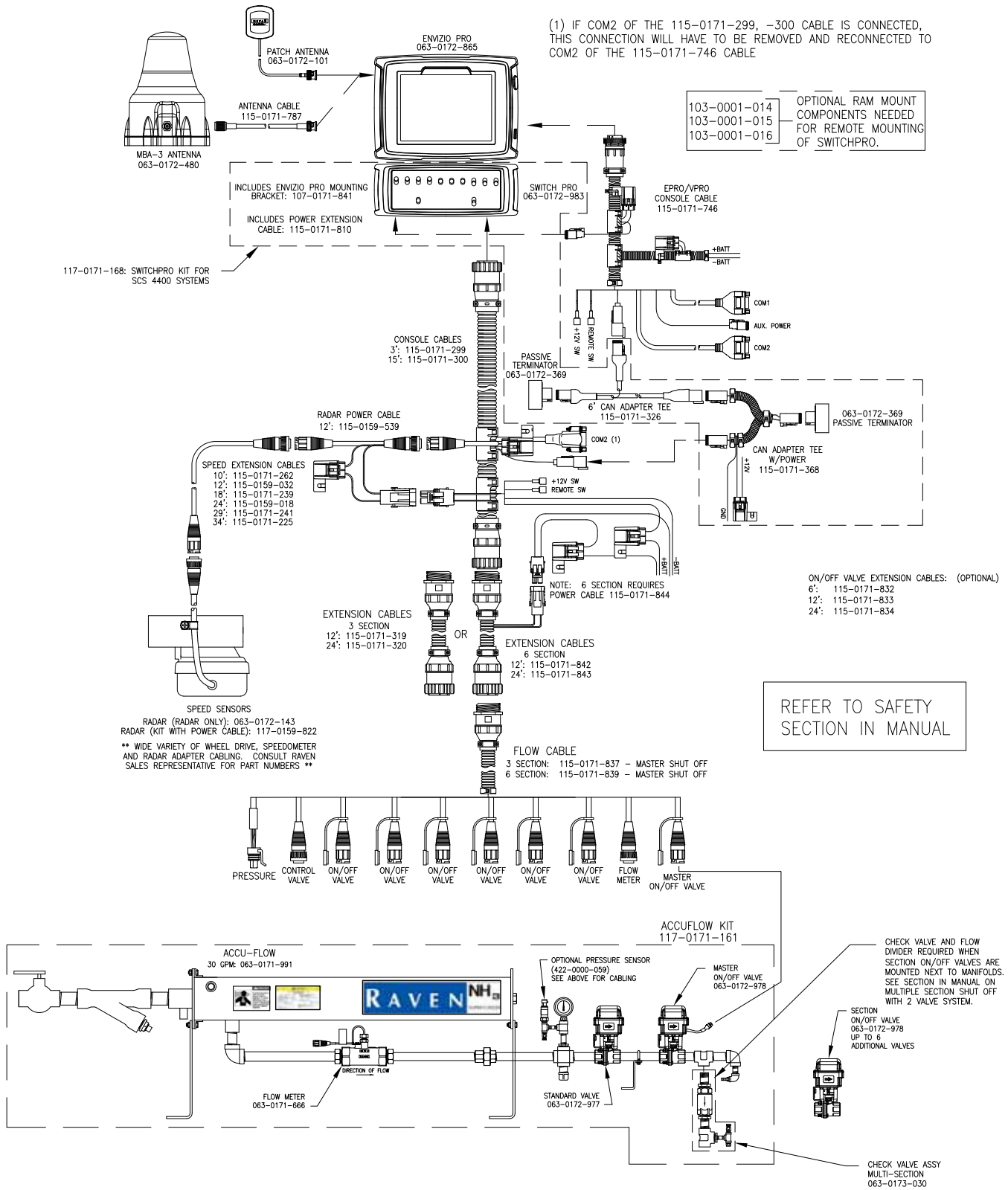


FIGURE 7. SCS 4400 with AccuFlow System (2 Valve System, Multi-Section Tool Bar)

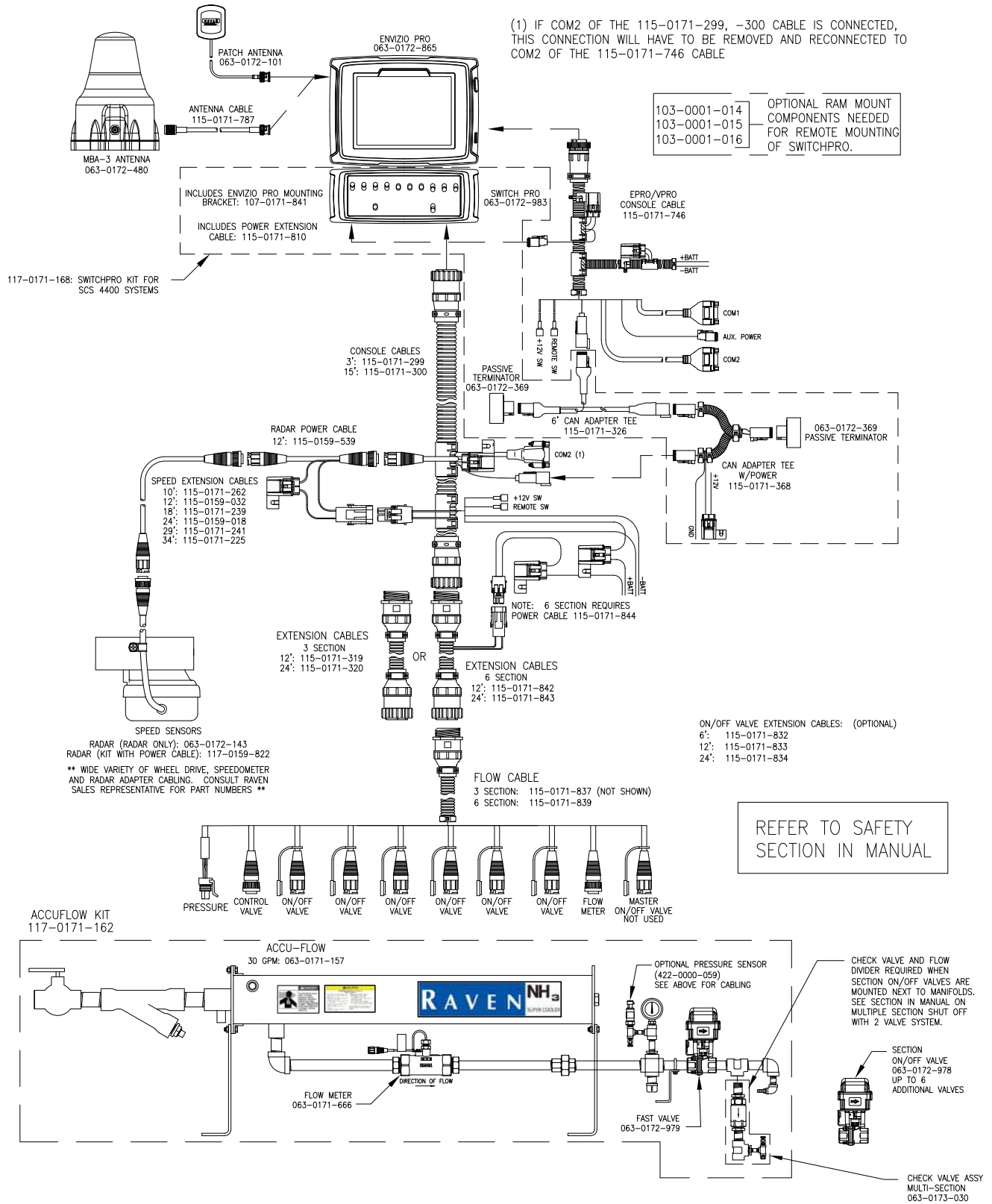




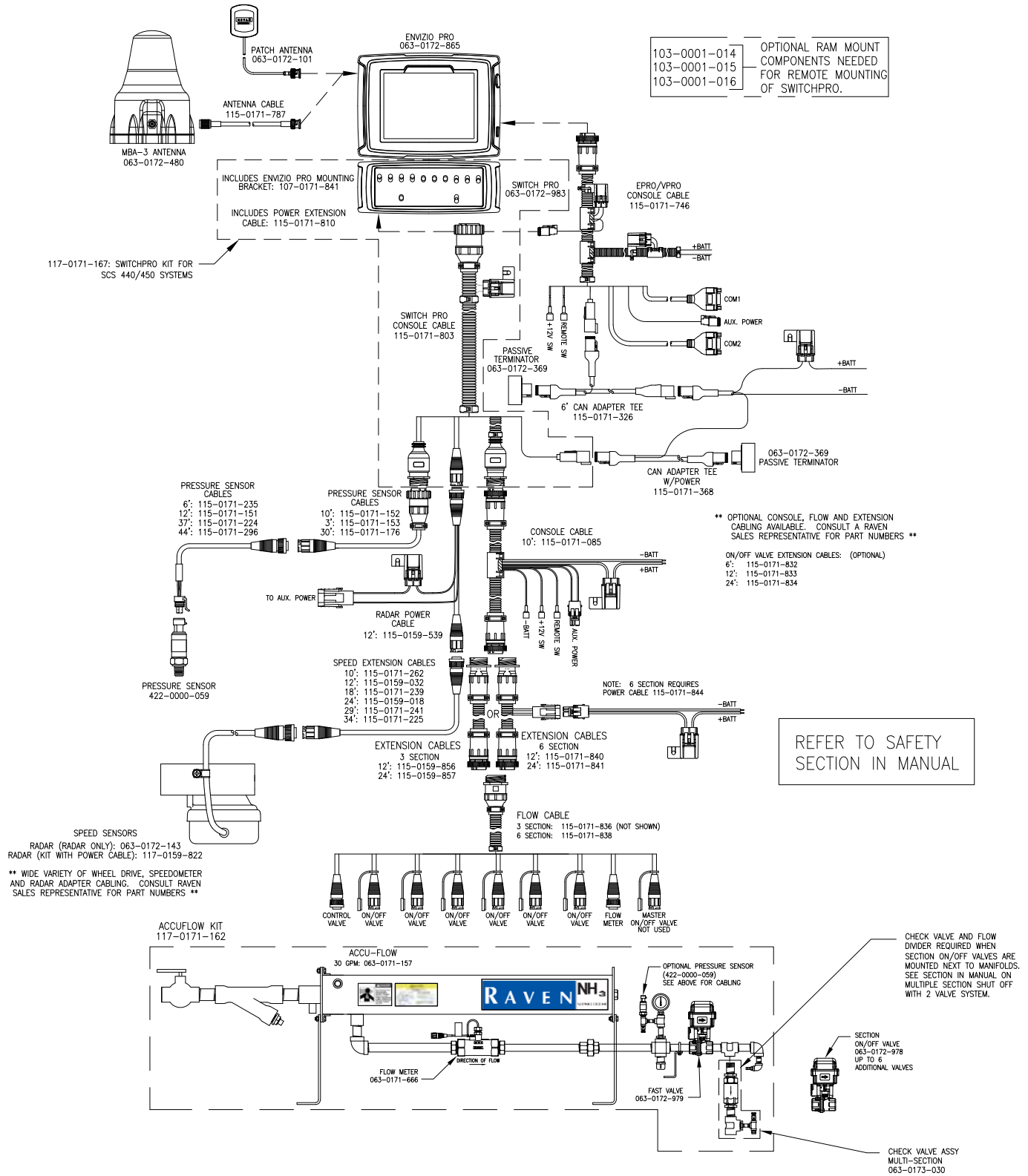
**FIGURE 9. Envizio Pro/Switch Pro (SCS 4400 Cabled Systems) with AccuFlow (2 Valve, Multi-Section Tool Bar)**



**FIGURE 10. Envizio Pro/Switch Pro (SCS 4400 Cabled Systems) with AccuFlow (Fast Valve, Multi-Section Tool Bar)**



**FIGURE 11. Envizio Pro/Switch Pro (SCS 440/450 Cabled Systems) with AccuFlow (Fast Valve, Multi-Section Tool Bar)**



SPEED SENSORS  
 RADAR (RADAR ONLY): 063-0172-143  
 RADAR (KIT WITH POWER CABLE): 117-0159-822  
 \*\* WIDE VARIETY OF WHEEL DRIVE, SPEEDOMETER AND RADAR ADAPTER CABLING. CONSULT RAVEN SALES REPRESENTATIVE FOR PART NUMBERS \*\*

\*\* OPTIONAL CONSOLE, FLOW AND EXTENSION CABLING AVAILABLE. CONSULT A RAVEN SALES REPRESENTATIVE FOR PART NUMBERS \*\*  
 ON/OFF VALVE EXTENSION CABLES: (OPTIONAL)  
 6': 115-0171-832  
 12': 115-0171-833  
 24': 115-0171-834

REFER TO SAFETY SECTION IN MANUAL

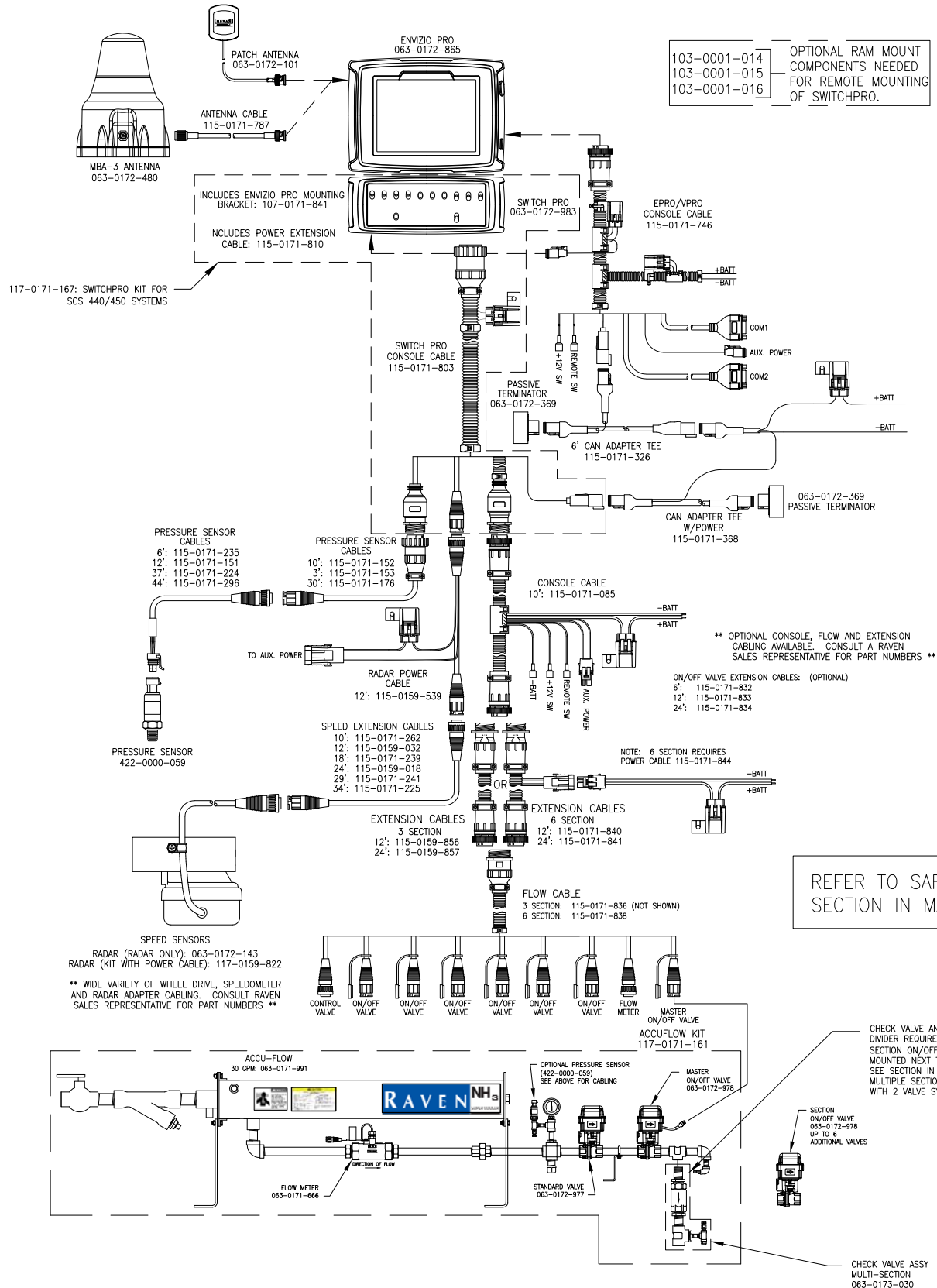
CHECK VALVE AND FLOW DIVIDER REQUIRED WHEN SECTION ON/OFF VALVES ARE MOUNTED NEXT TO MANIFOLDS. SEE SECTION IN MANUAL ON MULTIPLE SECTION SHUT OFF WITH 2 VALVE SYSTEM.

SECTION ON/OFF VALVE 063-0172-978 UP TO 6 ADDITIONAL VALVES

CHECK VALVE ASSY MULTI-SECTION 063-0173-030



**FIGURE 12. Envizio Pro/Switch Pro (SCS 440/450 Cabled Systems) with AccuFlow (2 Valve, Multi-Section Tool Bar)**



**Notes:**

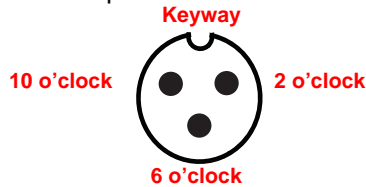
## CHAPTER

# 8

# Testing Speed and Flow Meter Extension Cables

## Speed Sensor Extension Cable

Disconnect the extension cable from the Speed Sensor Assembly cable. Hold the extension cable connector so that the keyway is pointing in the 12 o'clock position as shown below.



## Pin Designations and Voltage Readings

The following tables show the following pin designations and voltage readings.

Pin Location	Designation
2 o'clock	Power
10 o'clock	Ground
6 o'clock	Signal

Pin Connections	Voltage
10 o'clock to 6 o'clock	+5 Volts
10 o'clock to 2 o'clock	+5 Volts <sup>a</sup>

a. +12 Volts may be present if the cable is being used with a radar

## Testing the Speed Sensor Extension Cable

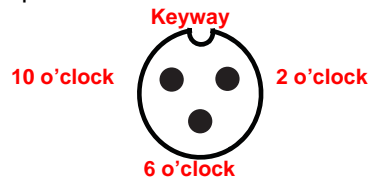
1. Enter a Speed Cal of 9999 by touching the Speed button on the Product Control screen.
2. Zero the odometer by entering a zero value in the Distance button.
3. With a small jumper wire (or paper clip), short between the 10 o'clock and 6 o'clock sockets with a 'short-no-short' motion. Each time contact is made, the Distance total should increase by increments of 1 or more.
4. If the Distance total does not increase, remove the section of cable and repeat the test at the connector that is the next closest to the node. If the distance total now increases with the short-no-short test, replace the defective cable as required.

5. If no pulses are registered, perform the above voltage checks.
6. If all of the cables test 'good', replace the Speed Sensor.

**Note:** After testing is complete, re-enter the correct Speed Cal before starting an application.

## Flow Meter Extension Cable

Before starting this test, disconnect the flow meter cable from the flow meter. Hold the flow meter cable so that the keyway is pointing in the 12 o'clock position as shown below.



## Pin Designations and Voltage Readings

The following tables show the following pin designations and voltage readings.

Pin Location	Designation
2 o'clock	Ground
10 o'clock	Power
6 o'clock	Signal
Pin Connections	Designation
6 o'clock to 2 o'clock	+5 Volts
10 o'clock to 2 o'clock	+5 Volts

## Testing the Flow Meter Cable

1. Enter a Meter Cal of 1 in Liquid or Direct Injection modes, or Density of 1 and Spreader Constant of 0 in Granular mode, on the Calibration Settings screen in the Product Control menu.
2. Touch the Volume/Area Settings button and note the Total Volume for each Product Node connected to the CANbus.
3. Turn the boom and master switch On.
4. With a small jumper wire (or paper clip), short between the 2 o'clock and 6 o'clock sockets with a 'short-no-short' motion. Each time contact is made, the Total Volume number should increase by increments of 1 or more.
5. If the Total Volume value does not increase, remove the section of cable and repeat the test at the connector that is the next closest to the node. Replace the defective cable as required.
6. Verify the pin connection and voltage from the previous chart.
7. If all of the cables test good, replace the Rate Sensor.

**Note:** After testing is complete, re-enter the correct Cal values before starting an application.

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**RAVEN**

# **RAVEN INDUSTRIES**

## **Limited Warranty**

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### ***What Does this Warranty Cover?***

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

### ***How Long is the Coverage Period?***

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

### ***How Can I Get Service?***

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

### ***What Will Raven Industries Do?***

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

### ***What is not Covered by this Warranty?***

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

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

**R A V E N**

AccuFlow™  
Installation & Operation Manual  
(P/N 016-0159-403 Rev W 6/09)

*Simply improving your position.™*



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