

PinPoint™ III

ENVELOP

Spray Application

Operator Manual



Thank you for your business!

At CapstanAG, our goal is to redefine the way people do their chemical application. Our PWM control systems have been setting the bar for maximum productivity for more than 20 years. Our focus on performance, support, and education have dramatically changed the landscape of agricultural chemical application.

CapstanAG specializes in creating proprietary systems for the agricultural industry, primarily focusing on chemical and fertilizer applications. Our inventive process involves research, engineering, design, and lab and field testing.

Service Contact Information

If a problem occurs with your system that cannot be corrected with the information in this manual, please contact your dealer for service and technical assistance. If further assistance is needed, contact CapstanAG.

System Purchased: _____
Dealer: _____
Contact: _____
Phone: _____
Address: _____
City,State/Province, Zip: _____

Factory Service/Repairs

CapstanAG

4225 S.W. Kirklawn Ave. | Topeka, KS 66609

Hours: 8:00 a.m. to 4:30 p.m. CST

Toll-free number: (855) 628-7722 | Fax: (785) 232-7799

CapstanAG.com | CapstanAG.ca

prodsupport@capstanag.com

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Chapter 1: Safety

Topics:

- Signal Words
- Safety Signs
- Pressurized Fluid Lines
- Personal Protective Equipment
- Battery Safety
- Chemical Safety
- Emergency Safety

Signal Words



DANGER: Indicates an imminent hazard which, if not avoided, will result in death or serious injury. This signal word is limited to the most extreme situations, typically for aircraft components that, for functional purposes, cannot be guarded.



WARNING: Indicates a potential hazard which, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.



CAUTION: Indicates a potential hazard which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

IMPORTANT: This is used to draw attention to specific information that is necessary for the operation, setup, or service of the system.

Note: This is used for additional information that can help understand or operate the system.

Safety Signs

Ammonia, Anhydrous

UN No. 1867-5
CAS No. 76-15-5

DANGER

Flammable gas, toxic if inhaled, causes severe skin burns and eye damage. Very toxic to aquatic life.

Store locked up in a well ventilated place. Keep away from heat/sparks/open flames/hot surfaces – No smoking. Wear protective gloves/protective clothing/eye protection/face protection. Avoid release to the environment.

IF EXPOSED: Immediately call a POISON CENTER or doctor/physician. IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. IF IN EYES: rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing. IF INHALED remove victim to fresh air and keep at rest in a position comfortable for breathing.

| | |
|----------------------------|----------------------|
| Fill Weight: 19.25 lbs. | Lot Number: 186AE21 |
| Gross Weight: 21 lbs. | Fill Date: 3/31/2014 |
| Expiration Date: 5/10/2020 | |

chemLABS • 600 Astro-Med Way • West Warwick, RI 02893 USA • 877-757-7978



Figure 1: Safety Sign Example

The HCS aligned its provisions with the United Nations' Globally Harmonized System (GHS) Classification and Labeling of Chemicals in 2012. This is a GHS safety label example for a chemical hazard.

These labels and safety messages warn all personnel about hazardous chemicals or potentially unsafe chemical conditions that may exist while working around agricultural application equipment.

CapstanAG add-on application systems for OEM and retrofit agricultural application equipment (booms and toolbars) may contain HCS pictographs and GHS safety labels and safety signal word messages.

Pressurized Fluid Lines

Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can accidentally burst when too much heat is present.

Personal Protective Equipment

Wear close-fitting clothing and the correct personal protective equipment (PPE) for the job. Refer to the specific chemical manufacturer documentation or other information for correct PPE.

Battery Safety

Use the procedure in the appropriate agricultural equipment manual for connecting, disconnecting, and jump-starting the machine's battery.

Keep sparks and flames away from the battery. Battery gas can explode and cause serious injury. Do not smoke in the battery charging area.

Remove jewelry, which might make electrical contact and create sparks.

Chemical Safety

Chemicals used in agricultural applications can be harmful to your health and/or the environment if not used correctly. Always follow all label directions for effective, safe, and legal use of agricultural chemicals.

Emergency Safety

Fire extinguishing systems must meet the applicable OSHA requirements, and all users of portable/ fixed fire suppression equipment must know the types, limitations, and proper uses of this equipment; including hazards involved with incipient stage firefighting.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.

Know the location of fire extinguishers and first aid kits and how to use them.

Examine the fire extinguisher and service the fire extinguisher regularly.

Follow the recommendations on the instructions plate.

Very small fires can be put out (extinguished) with a fire extinguisher. Use an appropriate method to extinguish a fire (water for paper fires, and chemical extinguishers for electrical or chemical fires).

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Chapter 2: Warranty

Topics:

- [Limited Warranty](#)

Limited Warranty

What does the Limited Warranty cover?

The ultimate purchaser/user (“you”), by acceptance of seller Capstan Ag Systems, Inc.’s, (“our,” “we,” or “us”) product, assume all risk and liability of the consequences of any use or misuse by you, your employees, or others.

All replacement components furnished under this warranty, but shipped before the failed component is returned for evaluation, will be invoiced in the usual manner and warranty adjustments will be made after the component claimed to be defective has been returned to and inspected and deemed defective by us at our factory.

Upon determining that a component has failed under warranty, the repaired component or replacement component, furnished under this warranty, will be shipped at our expense, to your location. We will credit you an amount equal to the incoming freight you paid. We shall not be responsible for installation costs. (You shall be responsible for all customs and brokerage fees for all international transactions.)

If the component does not prove to be defective, you shall be liable for all freight, inspection, and handling costs. In no event will any claim for labor or incidental or consequential damages be allowed for removing or replacing a defective product. Warranty will be denied on any component which has been subject to misuse, abuse, accidents, or alterations, or to improper or negligent use, maintenance, storage, transportation, and handling.

Our liability under this warranty, or for any loss or damage to the components whether the claim is based on contract or negligence, shall not, in any case, exceed the purchase price of the components and upon the expiration of the warranty period all such liability shall terminate. The foregoing shall constitute your exclusive remedy and our exclusive liability.

The terms of this warranty do not in any way extend to any product which was not manufactured by us or one of our affiliates.

While necessary maintenance or repairs on your CapstanAG product can be performed by any company, we recommend that you use only authorized CapstanAG dealers. Improper or incorrectly performed maintenance or repair voids this warranty.

The foregoing warranty is exclusive and is in lieu of all other warranties expressed or implied. We shall not be liable for any incidental or consequential damages resulting from any breach of warranty.

Your exclusive remedy for breach of warranty shall be repair or replacement of defective component(s): Provided, if the component(s) are incapable of being repaired or replaced, your exclusive remedy shall be credit issued, but such credit shall not exceed the purchase price of the components.

On any claim of any kind, including negligence, our liability for any loss or damage arising out of, or from the design, manufacture, sale, delivery, resale, installation, technical direction of installation, inspection, repair, operation of use of any products shall in no case exceed the purchase price allocable to the components.

In no event, whether as a result of breach of contract or warranty or alleged negligence, shall we be liable for incidental or consequential damages, including, but not limited to: personal injury, loss of profits or revenue, loss of use of equipment or any associated equipment, cost of capital, cost of substitute equipment, facilities or services, downtime costs, environmental damage, crop losses, or claims of customers of you for such damages.

What is the period of coverage?

We warrant to you that our products are free from defects in material and workmanship in normal use and service for a period of one year from date of purchase.

How do you get service?

Our obligation under this warranty shall be limited to the repairing or replacing at our option, the component which our inspection discloses to be defective, free of charge, return freight paid by us, provided you: (i) Notify us of defect within thirty (30) days of failure; (ii) Return the defective component to us, freight prepaid; (iii) Complete the Owner Registration Form and returned it to us; and (iv) Establish that the product has been properly installed, maintained and operated in accordance with our instructions or instructions contained in our operations or maintenance manuals and within the limits of normal usage.

Any claim for breach of our warranty must be in writing addressed to us and must set forth the alleged defect in sufficient detail to permit its easy identification by us. All breach of warranty claims must be made within thirty (30) days after expiration of the warranty period, which is applicable to the defective product. Any breach of warranty claim not timely made will not be honored by us and will be of no force and effect. Any component that needs to be repaired or evaluated for warranty has to be authorized before return. Contact the factory (785-232-4477) to get a Return Materials Authorization (RMA #). This helps to track the part coming into the factory for repair or replacement.

Before returning any component to the factory, clean the component as well as possible to remove any dirt or chemical residue. Components received at the factory that are not clean will be returned and warranty denied.

After receiving your RMA #, package the part, making sure to include the RMA #, customer's name, your address and phone number and description of problems or failure. If the component(s) are not returned to the shipping address below within the thirty (30) day period, no credit will be issued for the part. Ship to:

Capstan Ag Systems, Inc.

Attn: Warranty/Repair

4225 SW Kirklawn Ave.

Topeka, KS 66609

Phone: (785) 232-4477 | Fax: (785) 232-7799

Hours: 8 am to 4:30 pm CST

Once the package is received by us, we have thirty (30) days to process the warranty claim. If the warranty claim is still open after thirty (30) days, the warranty will be accepted, and credit issued to.

How does state law relate to this Limited Warranty?

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.¹

¹ Rev. Date 11/02/2021

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Chapter 3: Introduction

Topics:

- [This Manual](#)
- [System Identification](#)
- [Virtual Terminal Display](#)
- [Using the CapstanAG App with PinPoint III](#)

This Manual

This manual includes operation, maintenance, and installation information for the system you purchased.

Make sure that all personnel have read this manual and that they thoroughly understand the safe and correct operation and maintenance procedures. Failure to do so could result in personal injury or equipment damage.

This manual should be considered a permanent part of your system and should remain with the system at all times and when you sell it.

Right and left sides of the system are determined by facing the direction of forward travel of the machine on which the system is installed.

The information, screenshots, and other illustrations were correct at the time of publication. Changes can occur without notice.

This manual contains important information on how to safely and correctly install, operate, and maintain CapstanAG products. These instructions will help keep personnel safe, reduce downtime, and increase the reliability and life of the equipment, its components, and related systems.

Review the safety information in the manual(s) from the Original Equipment Manufacturer (OEM).

Follow the instructions (in this manual) and in the OEM manual(s) for each step, to make sure that work conditions in and around the OEM equipment are safe.

It is important for all individuals working with chemicals to understand the potential risks, necessary safety precautions, and proper response in the event of accidental contact.

Review the OEM manual(s) for chemical safety information.

Read, understand, and review the procedures in this manual and OEM manual(s). Use the Safety Data Sheets (SDS) and the required Personal Protective Equipment (PPE) for hazardous chemicals.

Please keep this manual and all enclosed documentation in an accessible location known to all operators, installation, and maintenance personnel.

If you do not understand the CapstanAG equipment after reading this manual, please obtain the proper training before working with equipment, to make sure that your own safety, as well as your coworkers' safety, is maintained.

Do not attempt to operate any equipment or system until you completely understand why, when, and how it operates. If you are uncertain after studying this manual, please contact CapstanAG.

System Identification

Write the system name, serial number, and other information down in the Service Contact Information on the inside cover of this manual. Your dealer will use these numbers when you order parts. File a copy of the identification numbers in a secure place off the machine.

If you are not the original owner of this machine, it is in your interest to contact your local CapstanAG dealer to inform them of this unit's serial number. Providing this information will help CapstanAG notify you of any issues or product improvements.

Virtual Terminal Display

This system can be used with most touch-screen Virtual Terminal (VT) displays. The VT display interacts with the GPS and electronic control devices centralizing the ability to communicate, record, store, and show data.

Note: Each VT display is different, and the system screens may be different from what is shown in this manual.

How to Find the Software Version Information

The system must be installed and connected to the virtual terminal in the cab before you can find the CapstanAG icon on the display.

1. Select the CapstanAG icon on your virtual terminal (VT) display.

Note: Each VT display is different, and the system screens may be different from what is shown in this manual. Each VT display is different, and the system screens may be different from what is shown in this



2. Navigate:
3. The software version is displayed in the middle of the screen.
4. Make sure to write down the current information in the Service Contact Information on the inside cover of this manual.

Using the CapstanAG App with PinPoint III

The CapstanAG mobile app is available for iOS¹ or Android powered Smartphones and can be downloaded from Google Play Store or Apple App Store. Note that screen representations are shown for an Android powered device. The iOS interface appears slightly different, but functionality is unchanged.

The CapstanAG app can be used with the PinPoint III system for:

- Individual/sectional nozzle control (key fob mode only)
- Pressure control (key fob mode only)
- PinPoint III system firmware updates
- System diagnostics

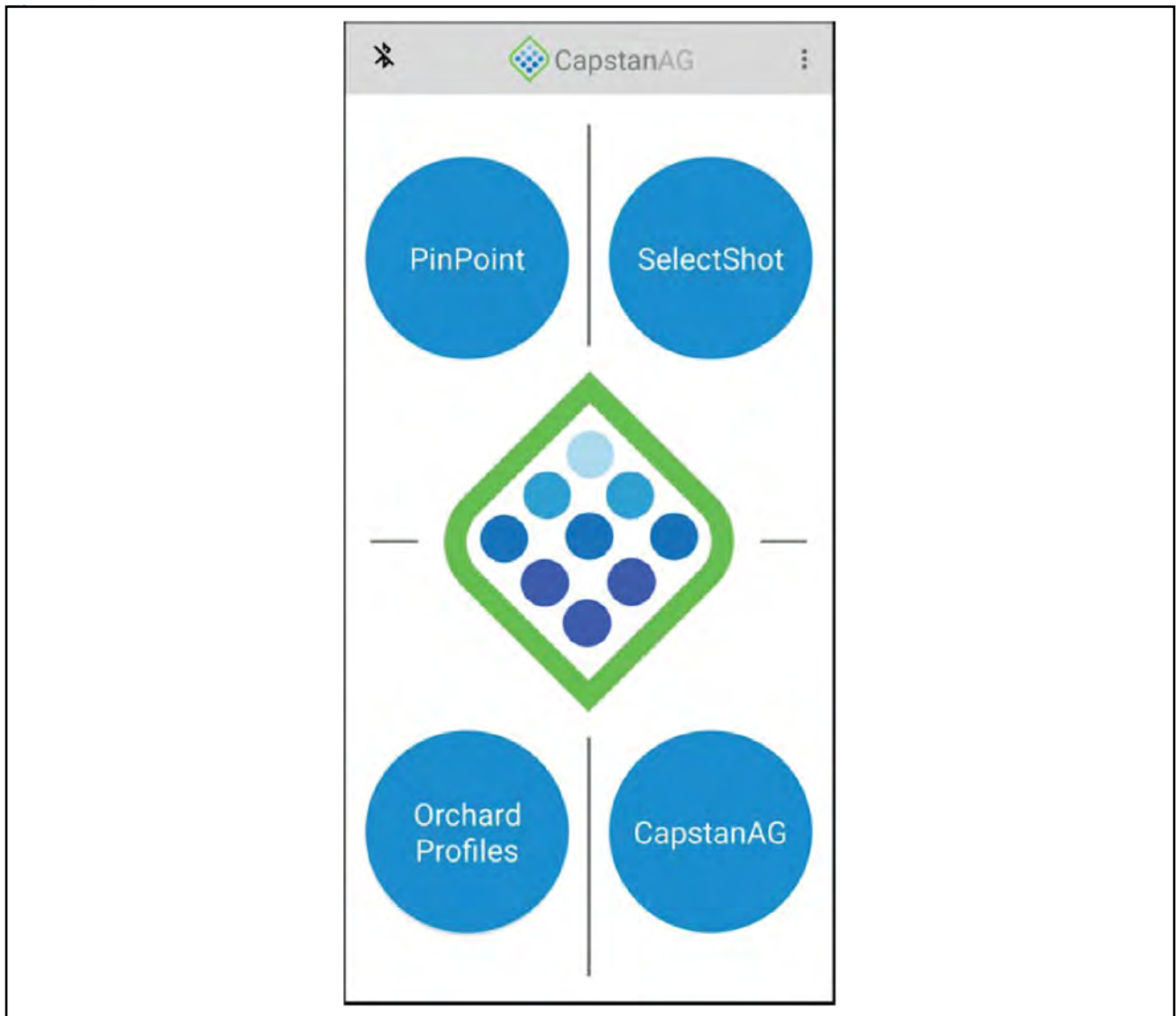


Figure 2: CapstanAG App

From the CapstanAG app home screen, tap the PinPoint Icon to access PinPoint III features.

¹ iOS is Trademarked by Cisco Systems and Apple licenses iOS.

Establishing Bluetooth Connection

Verify Bluetooth on your phone is turned on. Connect the CapstanAG app to the PinPoint III system.

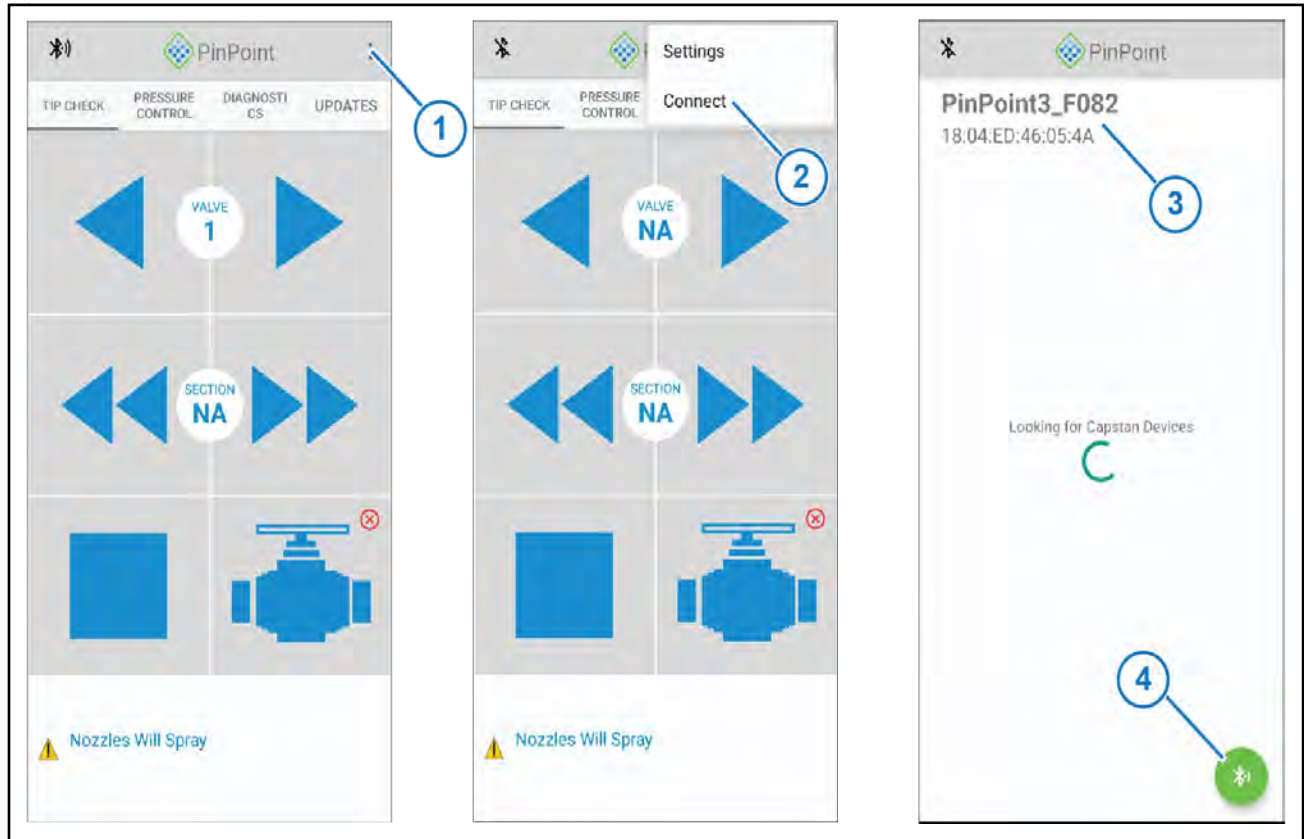


Figure 3: CapstanAG App Bluetooth Connection

1. Tap the menu icon (Figure 3, Item 1) at the upper right corner of the screen.
2. Tap Connect (Figure 3, Item 2).
3. Select the PinPoint III (Figure 3, Item 3) from the Capstan Devices list.

Note: Ensure no other Bluetooth devices are connected to your smart phone prior to establishing connection.

Note: If no Capstan device is found initially tap the Bluetooth icon (Figure 3, Item 4) to restart device search.

Tip Check

Once connected to the PinPoint III and the system is in key fob mode, tip checks can be performed. Refer to [Key Fob Boom Shutoff Dry Test](#), under Initial System Setup for more information on how to put the system in Key Fob Mode.

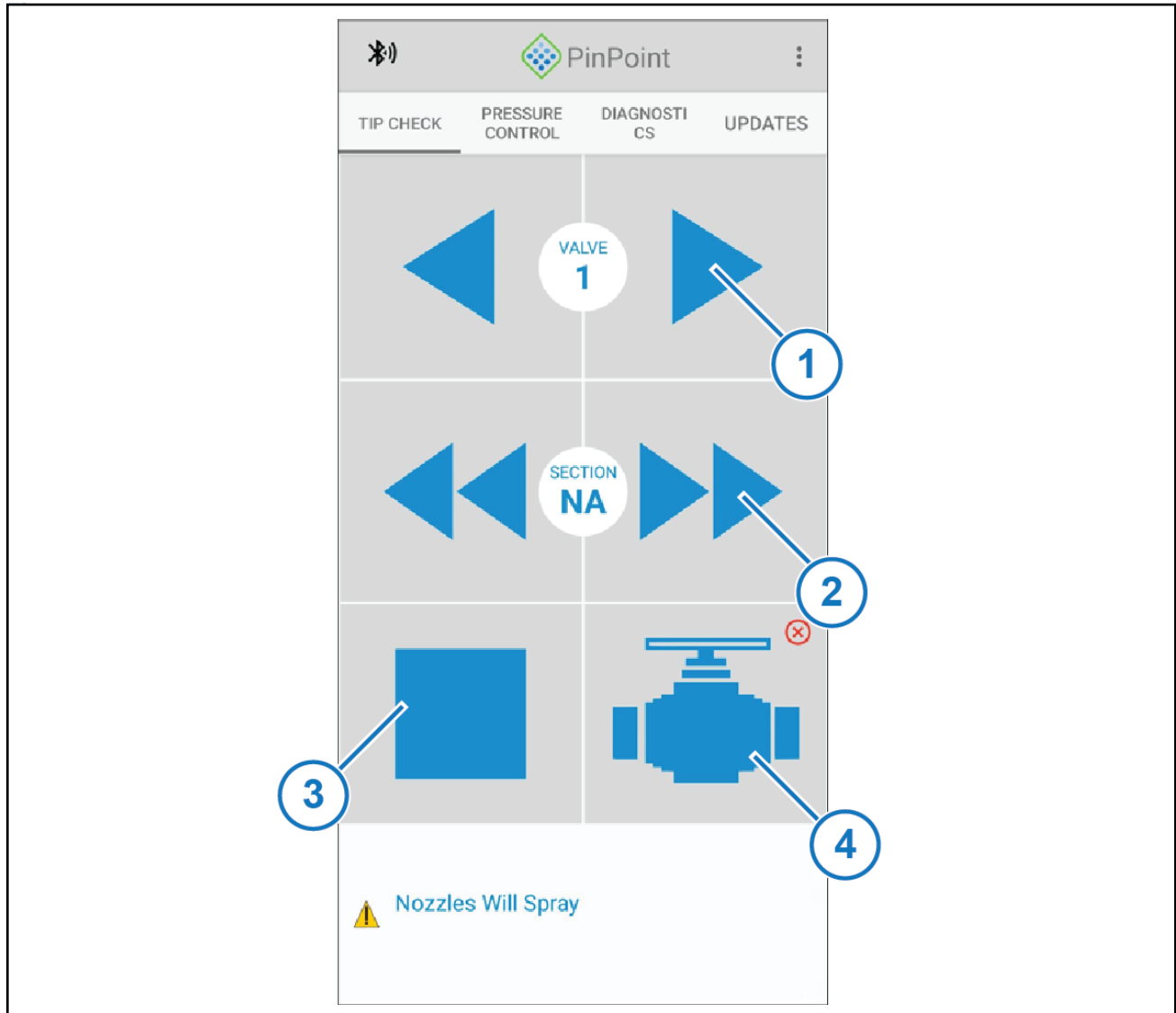


Figure 4: Tip Check

1. Tap the Tip Check icon in the menu ribbon.
2. Tap the single arrow icons (Figure 4, Item 1) to cycle each nozzle valve individually in sequence.
3. Tap the double arrow icons (Figure 4, Item 2) to cycle all nozzles in a section in sequence.
4. Tap the stop icon (Figure 4, Item 3) to stop the nozzles cycling.
5. The valve icon (Figure 4, Item 4) is used to control section valves.

Pressure Control

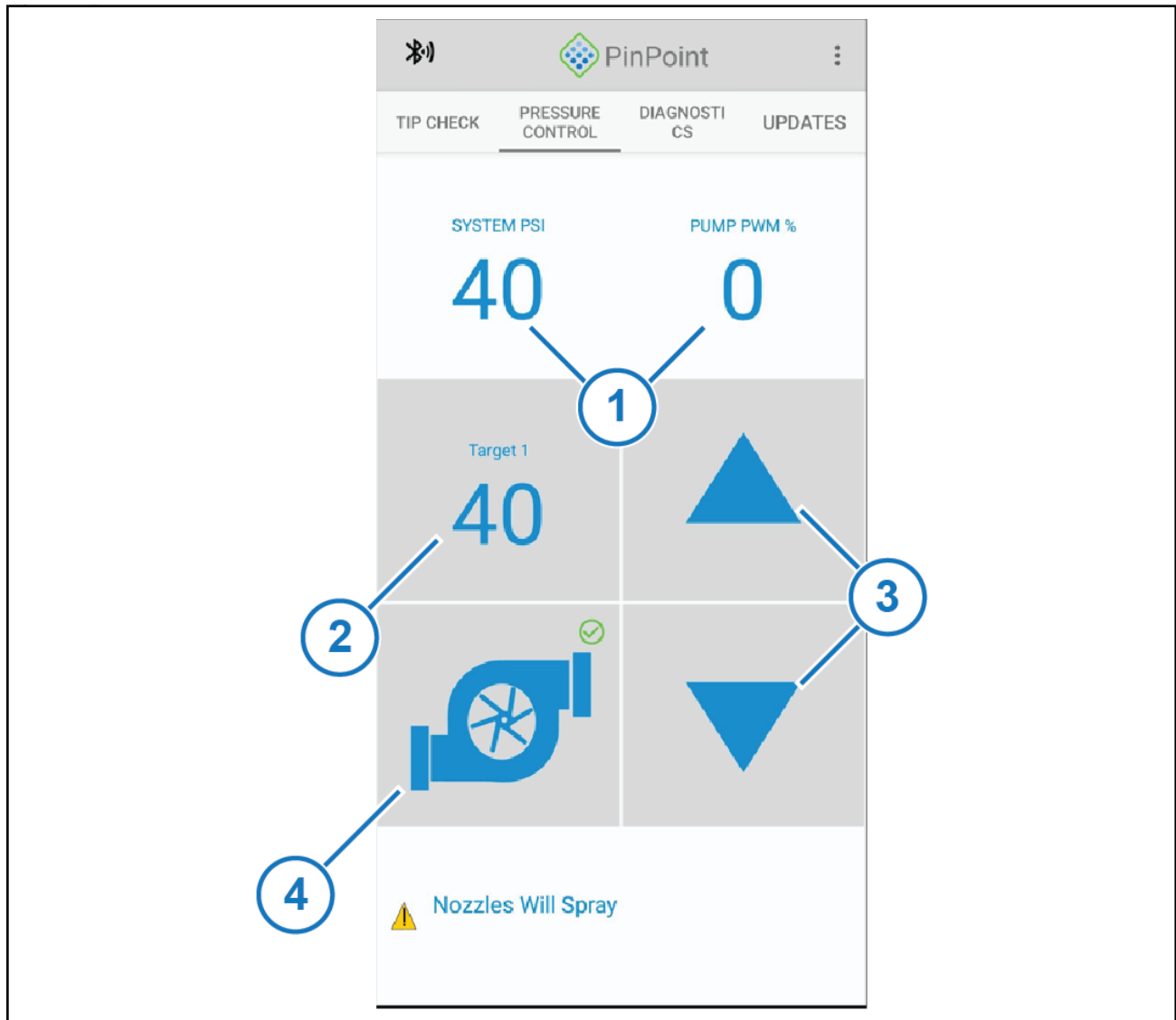


Figure 5: Pressure Control

1. Tap the Pressure Control icon in the menu ribbon.
2. The System PSI and Pump PWM (Figure 5, Item 1) display current system values.
3. The Target icon (Figure 5, Item 2) is used to toggle between set pressure points.
4. The Up and Down arrows (Figure 5, Item 3) are used to increase and decrease target pressure.
5. The Pump icon (Figure 5, Item 4) is used to toggle the pump on and off.

Software Update

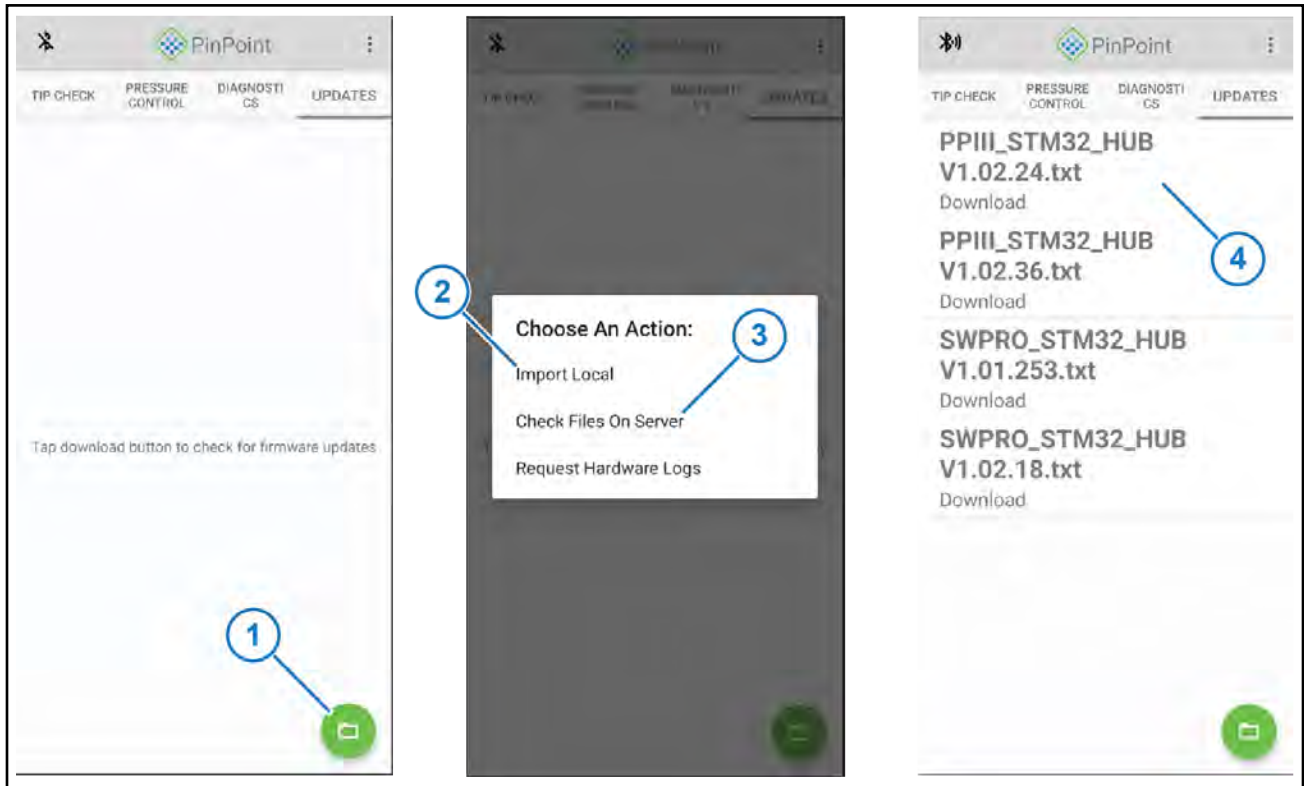


Figure 6: Software Update

1. Tap the Updates icon in the menu ribbon.
2. Tap the folder icon (Figure 6, Item 1).
3. If the software update file has been saved to your device tap the Import Local icon (Figure 6, Item 2).
4. If the update file is not on your device, tap the Check Files on Server icon (Figure 6, Item 3) to browse for files on the Capstan server.
5. Tap the desired software revision (Figure 6, Item 4) from the displayed list.
6. The selected software revision will now begin transferring to the PinPoint III Hub. The upload status is indicated by the blue status bar that appears on the app screen.

Note: If using an Apple device to perform a software update, do not allow the screen of your device to go to sleep or the file transfer could fail.

Chapter 4: Installation

Topics:

- [Prepare for Installation and Setup](#)
- [Tip Selection and Capacities](#)
- [Nozzle Types and Component Identification](#)
- [Assemble the Nozzle Valves](#)
- [Install the Gateway Hub](#)
- [Install the VCMs](#)
- [Install the Pressure Sensor](#)
- [Install the Battery Harness](#)
- [Install the Circuit Breaker](#)

Prepare for Installation and Setup



CAUTION: Before installation, operation, or service to the system, read and understand the machine’s operator manual and the system operator manual. Chemical residue may be present on/in the OEM equipment. Use the correct personal protective equipment.

IMPORTANT: Before installation, make sure that all parts are included in the shipping boxes, using the list of parts included in the order.

IMPORTANT: Do not attach the harnesses with cable ties until the dry test of the system is complete.

Check the general system layout at the back of this manual.

The VCMs are tagged and marked for the appropriate boom sections (1 to 10, etc.). Make sure that the VCMs are installed on the appropriate boom sections. Boom section 1 is the leftmost boom when at the back of the machine facing the front of the machine.

Although the installation is usually straightforward, the following are common installation oversights:

- Always follow the spray nozzle manufacturer guidelines.
- When routing nozzle harnesses and other wiring through the boom fold and swing joints, allow for boom joints to operate without damaging harnesses.
- Use the correct tip choices.

Tip Selection and Capacities

| Orifice Size | Flow US GPM | PSI | | Speed Range | | | | | |
|--------------|-------------|-------|-----|-------------|-------------|-------------|-------------|-------------|------------|
| | | Gauge | Tip | 3 GPA | 5 GPA | 8 GPA | 10 GPA | 15 GPA | 20 GPA |
| 05 | 0.336 | 20 | 18 | | 5.0 to 20.0 | 3.1 to 12.5 | 2.0 to 10.0 | 1.3 to 6.7 | 1.0 to 5.0 |
| | 0.412 | 30 | 27 | | 6.1 to 24.5 | 3.8 to 15.3 | 2.4 to 12.2 | 1.6 to 8.2 | 1.2 to 6.1 |
| | 0.476 | 40 | 36 | | 7.1 to 28.3 | 4.4 to 17.7 | 2.8 to 14.1 | 1.9 to 9.4 | 1.4 to 7.1 |
| | 0.532 | 50 | 45 | | | 4.9 to 19.8 | 3.2 to 15.8 | 2.1 to 10.5 | 1.6 to 7.9 |
| | 0.583 | 60 | 54 | | | 5.4 to 21.6 | 3.5 to 17.3 | 2.3 to 11.5 | 1.7 to 8.7 |

Figure 7: Tip Selection Chart

When selecting the correct tips:

- Always use 110° spray angle tips and maintain the boom height of at least 24 in (61 cm). If 80° spray angle tips are used, maintain the boom height of at least 36 in (91 cm).
- The tip selection charts, in the operation section of this manual, describes the speed ranges that can be expected when operating with a rate controller at various rates and pressures.
- To use the chart, select the application rate (Figure 7, Item 1).
- Move down the column to the desired speed range (Figure 7, Item 2).
- Select a tip (Figure 7, Item 3) that provides the boom pressure you wish to spray (Figure 7, Item 4).

Nozzle Valve Types and Component Identification (Spitfire Valve)

7-Watt—15 Series Coil Assembly Components

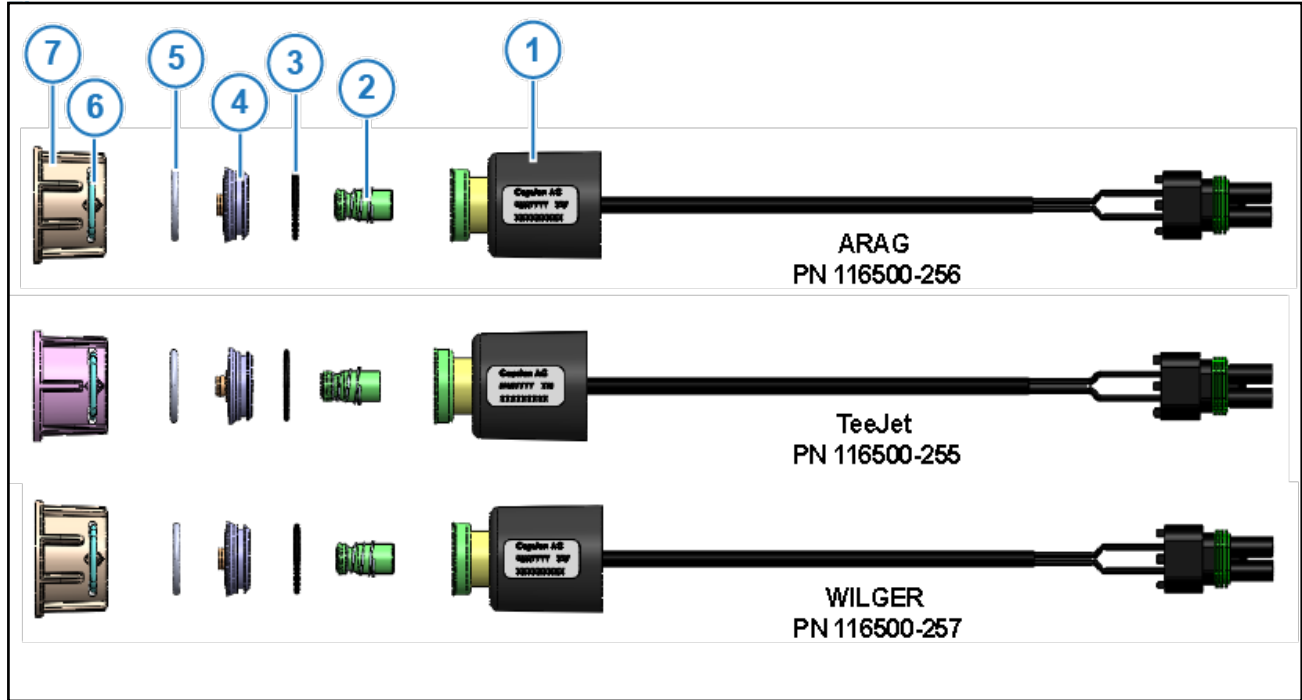


Figure 8: 7-Watt Coil Components

Refer to [Figure 8](#)

| Item | Description | Arag Part Number | TeeJet Part Number | Wilger Part Number |
|------|---------------------------------------|---|---|---|
| 1 | Coil | 116500-201 | 116500-201 | 116500-201 |
| 2 | Plunger | 716009-120 | 716009-120 | 716009-120 |
| 3 | O-ring (Inner) | 116500-221 | 116500-221 | 116500-221 |
| 4 | Orifice Assembly (Identifiers) | 116500-243 Mound: Black Tail: Black Shoulder on Tail: No | 116500-244 Mound: Black Tail: SS Shoulder on Tail: Yes | 116500-244 Mound: Black Tail: SS Shoulder on Tail: Yes |
| 5 | O-ring (Spoked) | 116500-225 | 116500-225 | 116500-225 |
| 6 | U-clip | 116500-222 | 116500-222 | 116500-222 |
| 7 | Fly Nut | 116500-271 | 116500-272 | 116500-273 |
| | Plug (not pictured) | 116500-278 | 116500-277 | 116500-279 |

12-Watt Coil Components

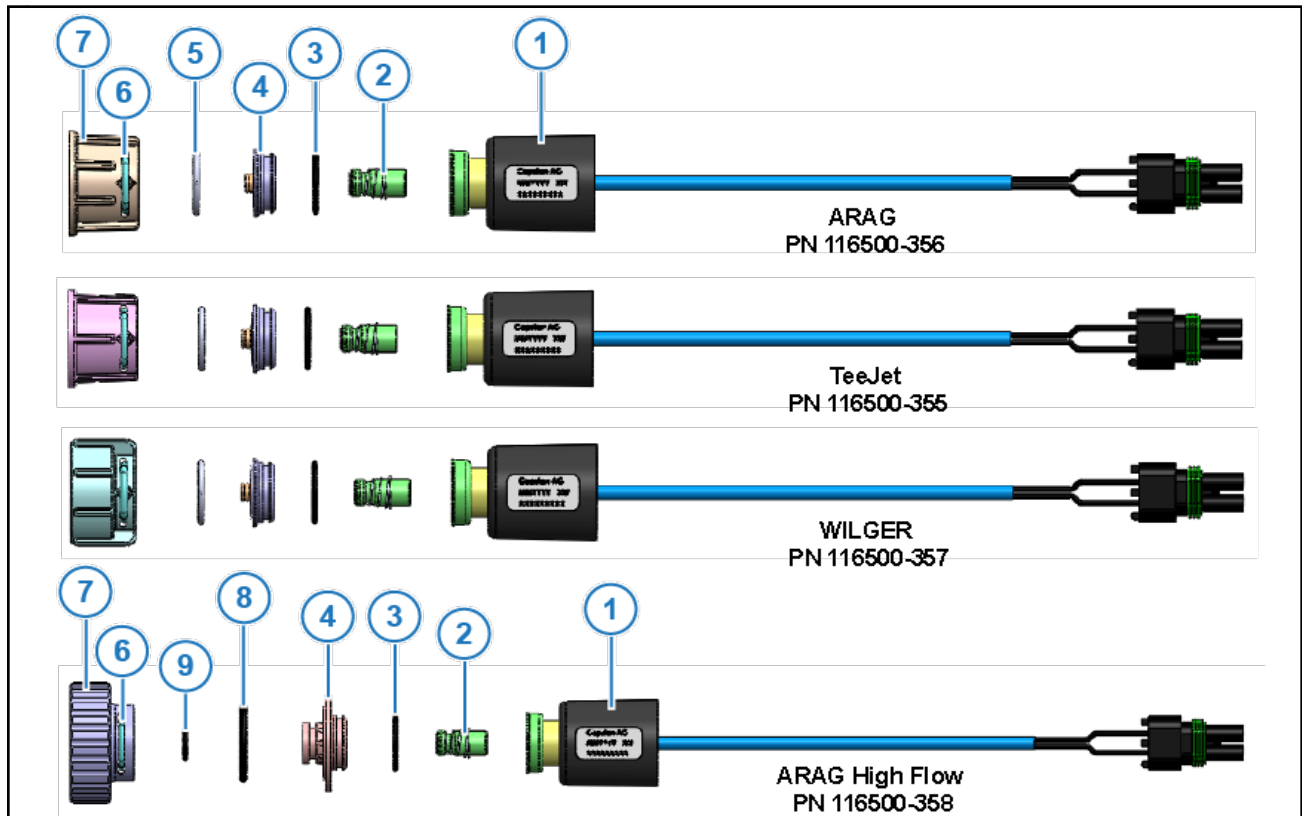


Figure 9: 12-Watt Coil Components

Refer to [Figure 9](#)

| Item | Description | Arag Part Number | TeeJet Part Number | Wilger Part Number | Arag High Flow Part Number |
|------|---------------------------------------|---|---|---|--|
| 1 | Coil | 116500-301 | 116500-301 | 116500-301 | 116500-301 |
| 2 | Plunger | 716009-120 | 716009-120 | 716009-120 | 716009-120 |
| 3 | O-ring (Inner) | 116500-221 | 116500-221 | 116500-221 | 116500-221 |
| 4 | Orifice Assembly (Identifiers) | 116500-245 Mound: SS Tail: Black Shoulder No on Tail: | 116500-246 Mound: SS Tail: SS Shoulder Yes on Tail: | 116500-246 Mound: SS Tail: SS Shoulder Yes on Tail: | 116500-234 Mound: SS Tail: SS Shoulder NA on Tail: |
| 5 | O-ring (Spoked) | 116500-225 | 116500-225 | 116500-225 | NA |
| 6 | U-clip | 116500-222 | 116500-222 | 116500-222 | 116500-222 |
| 7 | Fly Nut | 116500-271 | 116500-271 | 116500-271 | 116500-191 |
| 8 | O-ring (outer) | NA | NA | NA | 715022-215 |
| 9 | O-ring (stem) | NA | NA | NA | 715022-211 |
| | Plug (not pictured) | 116500-278 | 116500-277 | 116500-279 | 116500-276 |

Nozzle Valve Types and Component Identification (Legacy Valve)

7-Watt—15 Series Coil Assembly Components

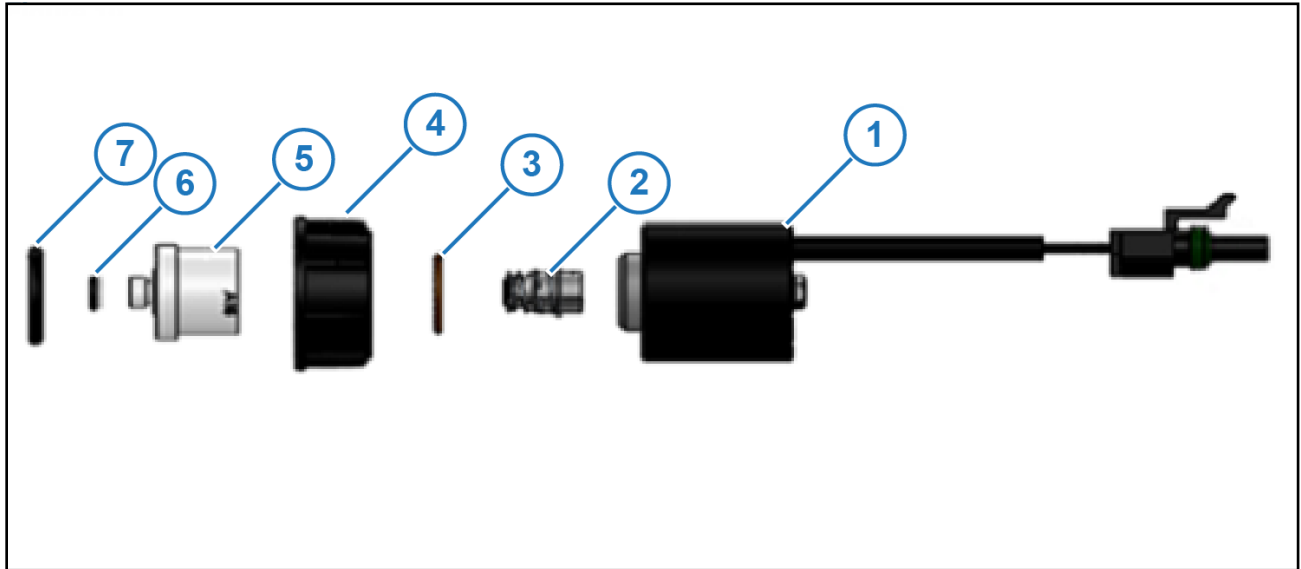


Figure 10: 7-Watt Valve Assembly

Table 1: 15 Series Coil Assembly Components

Refer to [Figure 10](#)

| Item | Description | Arag High Flow (116290-211) | Arag (116290-111) | Tee Jet (116190-111) | Wilger (116390-111) |
|------|-------------------------------|--------------------------------|----------------------|-------------------------|------------------------|
| 1 | 7-Watt Coil Assembly | 116189-111 | 116189-111 | 116189-111 | 116189-111 |
| 2 | Plunger Assembly | 716009-111 | 716009-111 | 716009-111 | 716009-111 |
| 3 | Inner Valve O-Ring | 715022-204 | 715022-204 | 715022-204 | 715022-204 |
| 4 | Fly Nut | 717101-306 | 717101-006 | 717101-105 | 717101-007 |
| 5 | Valve Body | 116182-211 | 116182-111 | 116186-111 | 116188-111 |
| 6 | Valve Body Stem O-ring | 715022-211 | 715022-201 | 715022-200 | 715022-201 |
| 7 | Nozzle Body Fly Nut O-ring | 715022-215 | 715022-205 | 715022-202 | 715022-206 |

12-Watt—24 Series Coil Assembly Components

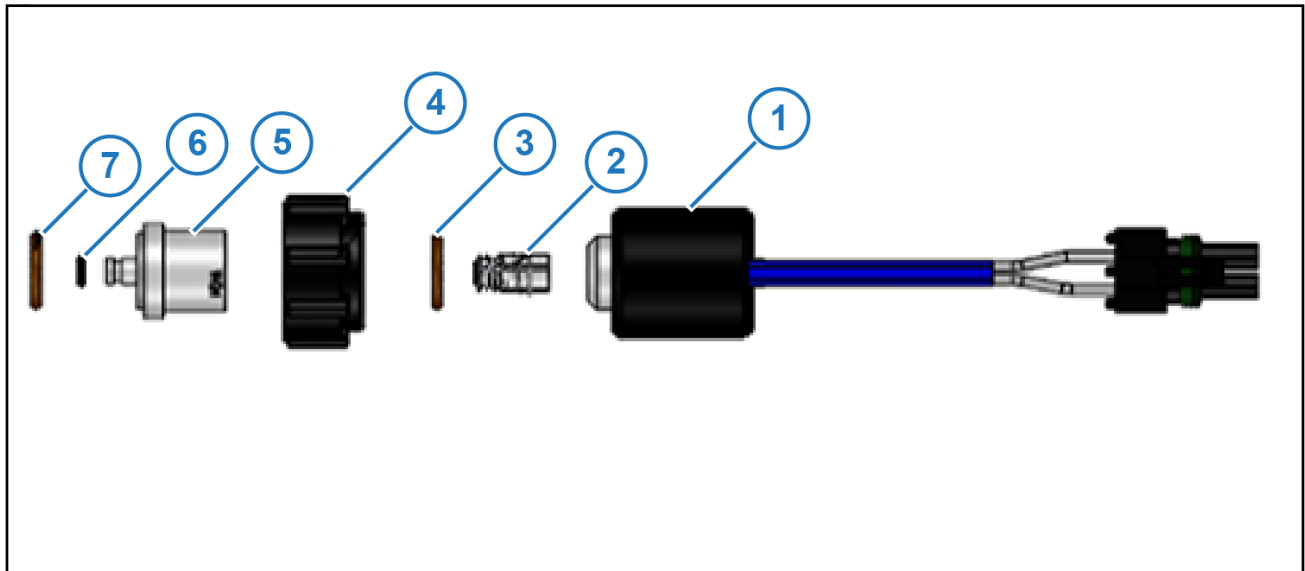


Figure 11: 12-Watt Valve Assembly

Table 2: 24 Series Coil Assembly Components

Refer to [Figure 11](#)

| Item | Description | Arag High Flow (116290-211) | Arag (116290-111) | Tee Jet (116190-111) | Wilger (116390-111) |
|------|-------------------------------|--------------------------------|----------------------|-------------------------|------------------------|
| 1 | 12-Watt Coil Assembly | 625147-011 | 625147-011 | 625147-011 | 625147-011 |
| 2 | Plunger Assembly | 716009-111 | 716009-111 | 716009-111 | 716009-111 |
| 3 | Inner Valve O-Ring | 715022-204 | 715022-204 | 715022-204 | 715022-204 |
| 4 | Fly Nut | 717101-306 | 717101-006 | 717101-105 | 717101-007 |
| 5 | Valve Body | 116182-215 | 116182-150 | 116186-112 | 116188-112 |
| 6 | Valve Body Stem O-ring | 715022-211 | 715022-201 | 715022-200 | 715022-201 |
| 7 | Nozzle Body Fly Nut O-ring | 15022-215 | 715022-205 | 715022-202 | 715022-206 |

Assemble the Nozzle Valves

1. If necessary, remove the drip check valve and diaphragm cap from each nozzle body.

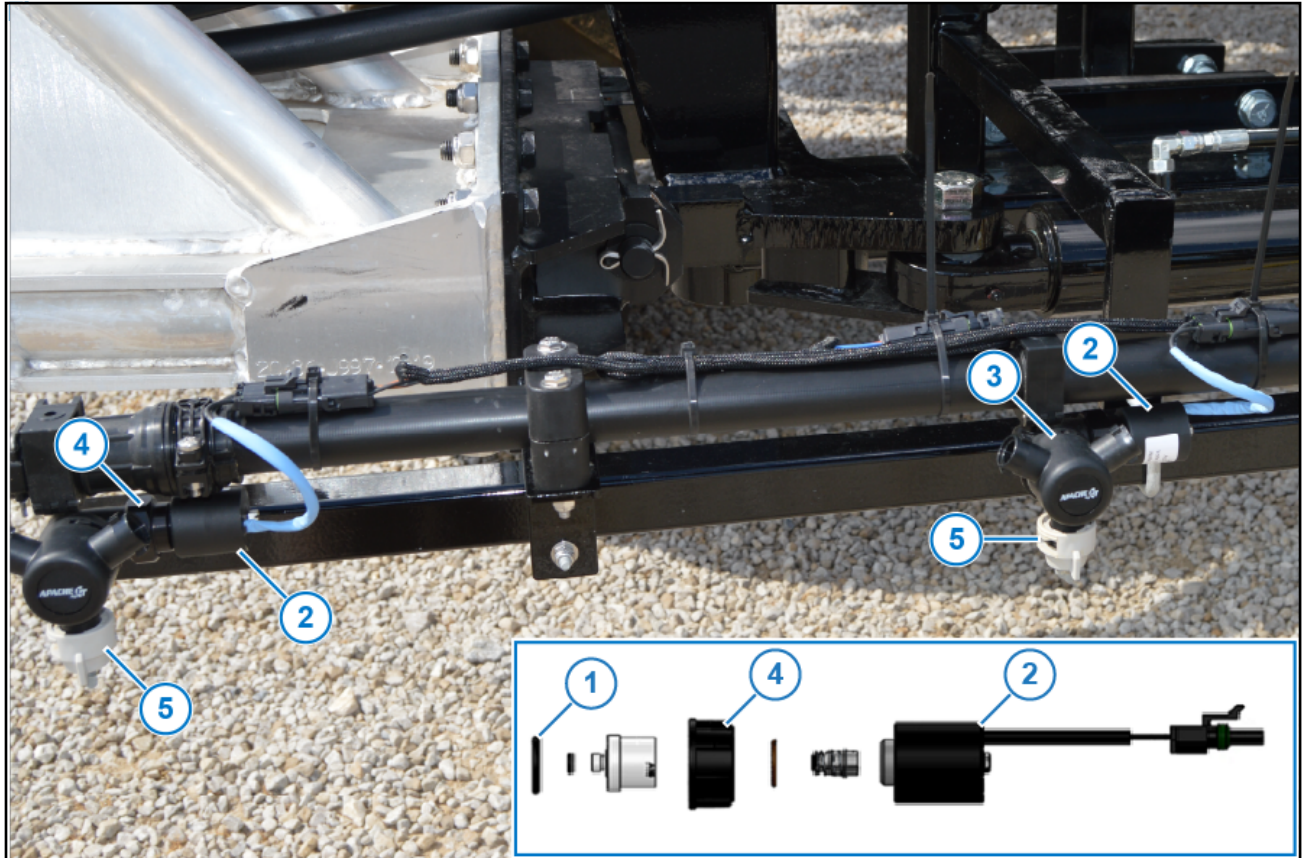


Figure 12: Nozzle Valve Assembly

2. Install the O-ring (Figure 12, Item 1) onto the nozzle valve assembly (Figure 12, Item 2).
3. Install the nozzle valve assembly onto the nozzle body (Figure 12, Item 3).
4. Tighten the fly nut (Figure 12, Item 4).

IMPORTANT: For Spitfire valves, the coil housing **MUST NOT** spin. Hold the coil stationary while tightening the flynut. If the coil is rotated while tightening the flynut, damage to the spoke O-ring will occur and cause the valve to leak.

For Legacy valves, it is normal for the coil housing to spin as the flynut is tightened.

The nozzle valves only need to be snug to prevent leakage.

5. Install and tighten the spray tip (Figure 12, Item 5).
6. Repeat Steps 1—5 for all nozzle valve assemblies.

Move the Spray Tube Mount (Nozzle Valve Interference)

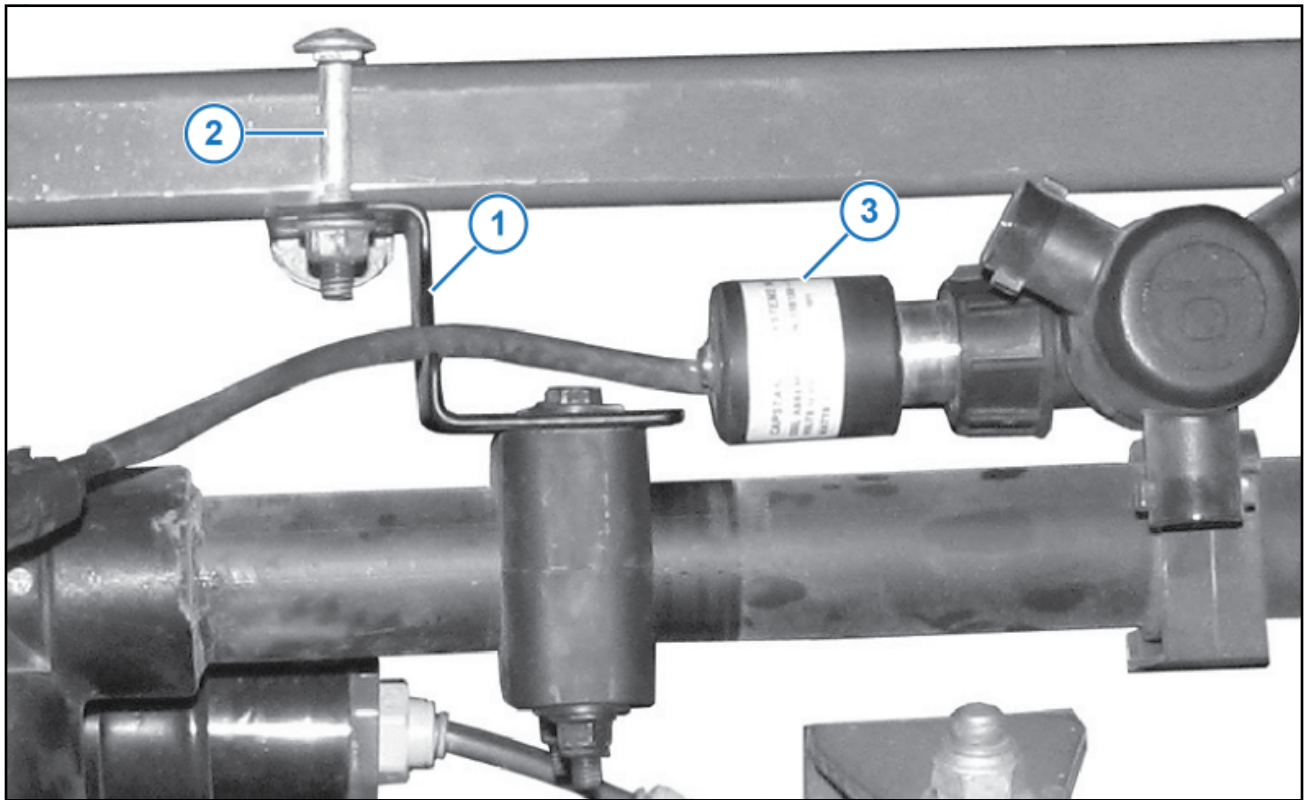


Figure 13: Spray Tube Mount/Nozzle Valve Interference

If a spray tube mount (Figure 13, Item 1) prevents nozzle valve installation:

1. Loosen the spray tube mount bolts (Figure 13, Item 2).
2. Slide the spray tube mount away from the nozzle valve assembly (Figure 13, Item 3) until the nozzle valve assembly can be properly installed.
3. Tighten the spray tube mount bolts.

Install the Gateway Hub

1. Locate an accessible location near the center of the boom mast.
2. Install the hub onto the boom mast with the supplied mounting bracket.

Gateway Hub Identification

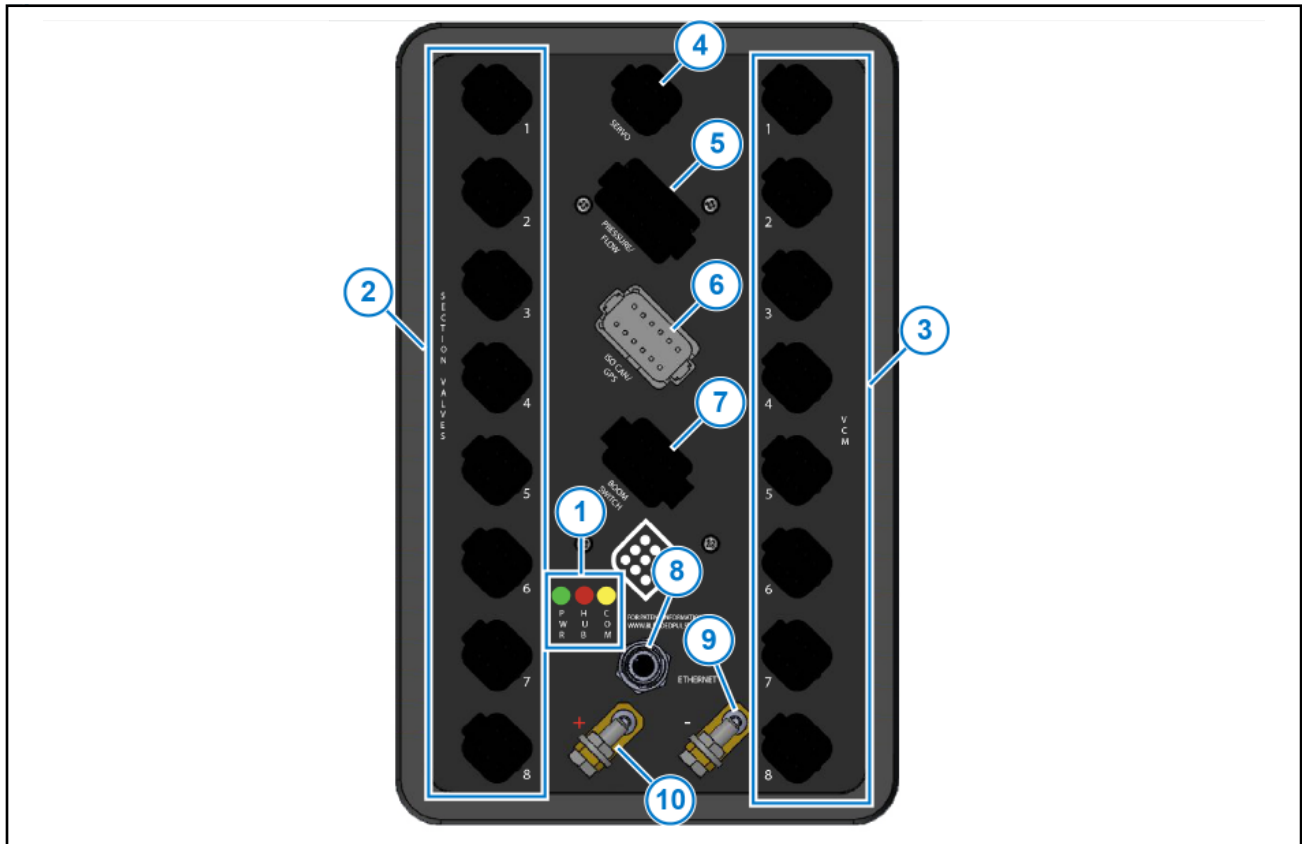


Figure 14: Gateway Hub Identification

Table 3: Gateway Hub Connections

Refer to [Figure 14](#)

| Item | Name | Description |
|------|----------------|---|
| 1 | LEDs | Green—PWR: Power—On when there is key-switch power to the hub |
| | | Red—HUB: Blinks when the main hub processor is running |
| | | Yellow—COM: Blinks when the hub is communicating over CAN or Ethernet |
| 2 | SECTION VALVES | The Section Valve ports |
| 3 | VCM | The VCM ports |
| 4 | SERVO | The Servo port |
| 5 | PRESSURE/FLOW | The Pressure/Flow port |
| 6 | ISO CAN/GPS | The ISO CAN/GPS port |
| 7 | BOOM SWITCH | The Boom Switch port |
| 8 | ETHERNET | The Ethernet port is used to connect the hub to the CapMod |
| 9 | Ground Lug | Connect the ground wire to this lug |
| 10 | Power Lug | Connect the power wire to this lug |

Install the VCMs

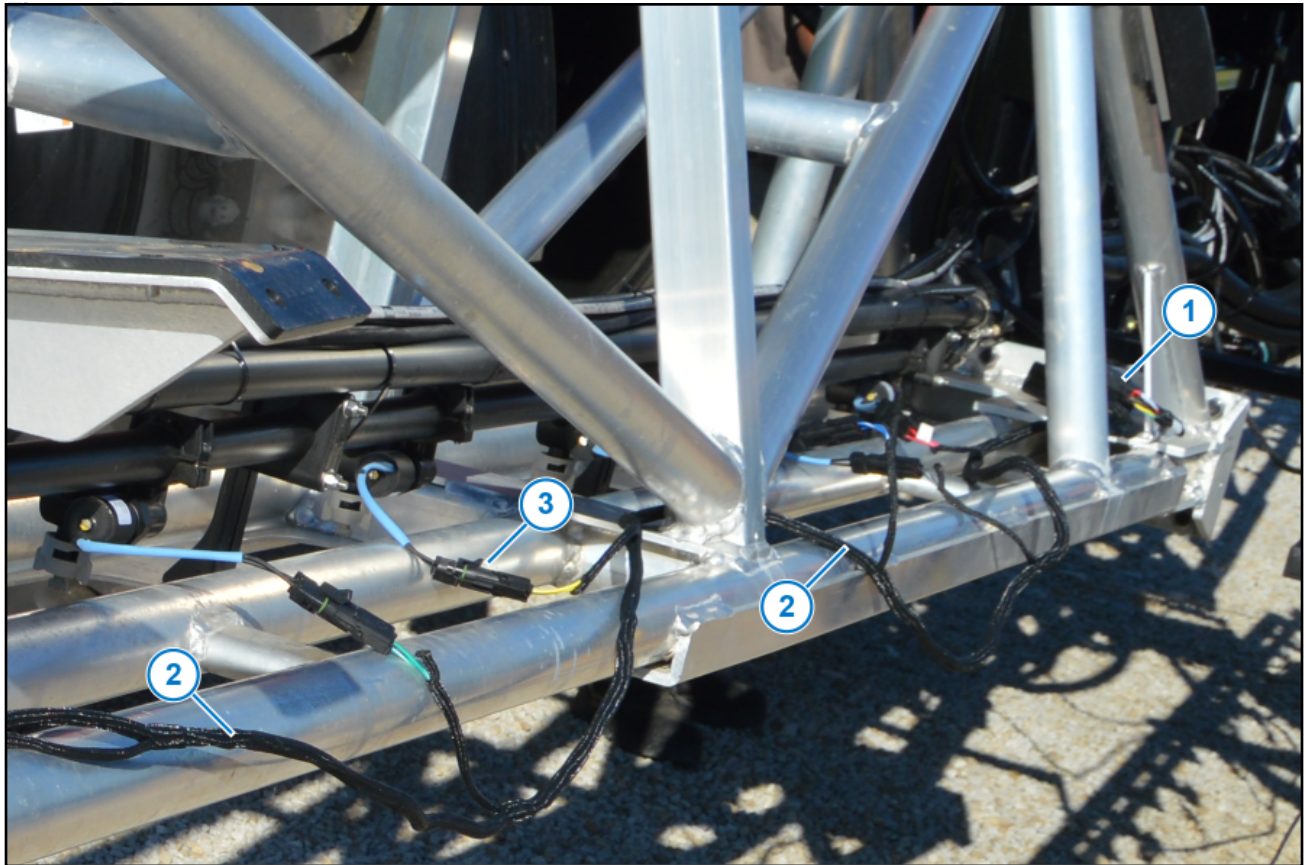


Figure 15: VCM Installation

1. Place each VCM (Figure 15, Item 1) adjacent to the first nozzle on the associated boom section. The VCMs are tagged and marked for the appropriate boom sections.
2. Make sure that each tagged VCM is installed on the correct boom section.
3. Route the harness (Figure 15, Item 2) along the booms.
4. Connect the harness connectors (Figure 15, Item 3) at the VCMs and the nozzle valves.
5. Install dust caps on any unused connectors.

Install the VCM Extension Harnesses

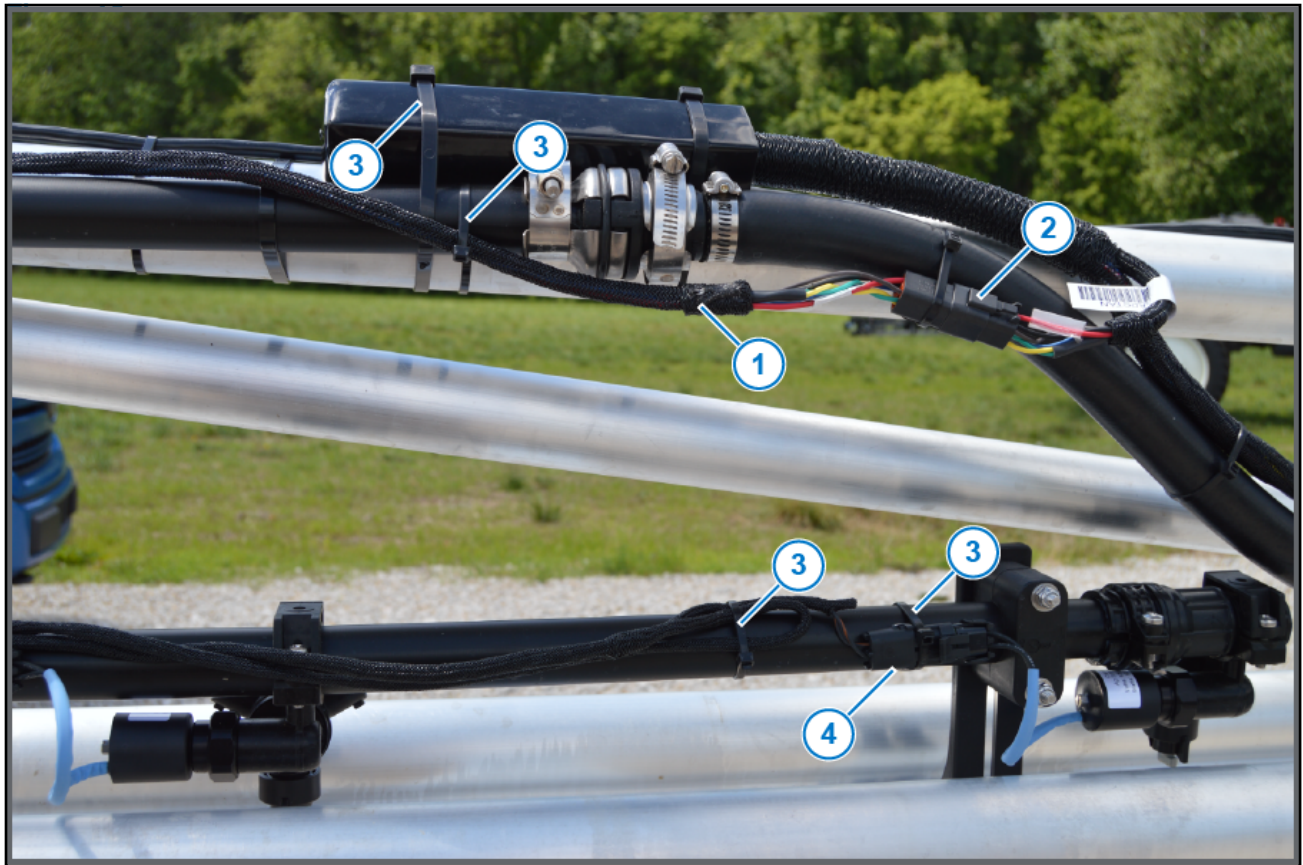


Figure 16: VCM Extension Harness

1. Connect each extension harness (Figure 16, Item 1) to the VCM 6-pin connector (Figure 16, Item 2).
2. Route the extension harnesses along the boom to the Gateway hub at the center of the machine.
Make sure that there is enough slack in the extension harnesses to raise and lower the booms and to avoid pinch points at the boom fold and pivot points.
3. Connect each extension harness to the correct connector on the Gateway hub (VCM Section 1, 2, etc.)
4. Use cable ties (Figure 16, Item 3) to attach the VCMs, harnesses, and nozzle connectors (Figure 16, Item 4) to the boom.

Install the Pressure Sensor (Optional)



Figure 17: Pressure Sensor

1. Remove the existing machine pressure sensor from the boom manifold.
2. Install the tee fitting and other hardware with Teflon tape.
3. Install the new pressure sensor with Teflon tape.
IMPORTANT: Do not over-tighten the pressure sensor when installing into plastic tee fittings.
4. Install the existing machine pressure sensor with Teflon tape.

Install the Pressure Sensor Adapter Harness

1. Route the pressure sensor adapter harness to the Gateway hub.
2. Connect the pressure sensor adapter harness to the harness that connects to the PRESSURE/FLOW port on the hub.

Install the Battery Harness

1. Route the battery harness connectors to the Gateway hub.
2. Connect the positive (+) red cable to the power (+) lug on the Gateway hub using the 1/4" hardware.
3. Connect the negative (-) black cable to the ground (-) lug on the Gateway hub using the 1/4" hardware.
4. Tighten the nuts on the power cables.
5. Install the rubber boots onto the terminals.
6. Route the battery harness from the hub over the boom mast and under the sprayer to the batteries.

IMPORTANT: Make sure that there is enough slack in the harness to raise and lower the boom mast.

Install the Circuit Breaker

1. Disconnect the battery power cables.
2. Cut a short length of wire from the battery harness positive (+) red cable. The length of the wire must reach from the circuit breaker mounting location to the battery positive (+) terminal.
3. Strip the insulation from each cut end of the wire.
4. Crimp the provided ring terminals to the end of each cable.

IMPORTANT: If the machine is so equipped, the system must be wired to the main power disconnect.

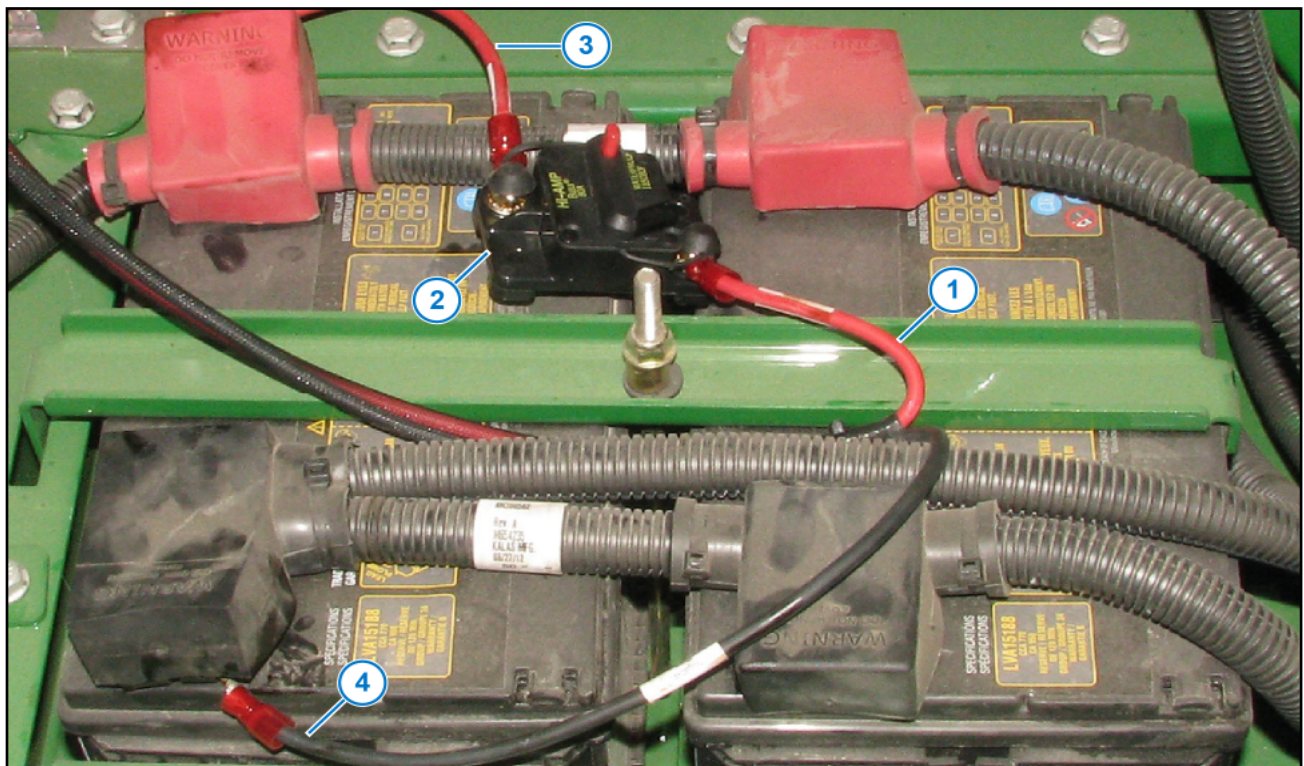


Figure 18: Circuit Breaker

5. Connect the positive (+) harness cable (Figure 18, Item 1) to the stud labeled **AUX** on the circuit breaker (Figure 18, Item 2).

Using the short length of cable from Step 2 (Figure 18, Item 3), connect one end to the stud labeled **BAT** on the circuit breaker. Connect the other end of the cable to the positive (+) battery terminal.

6. Connect the negative (-) black cable on the battery harness ([Figure 18](#), Item 4) to the battery ground terminal.

Chapter 5: Initial System Setup

Topics:

- [Factory Reset Procedure](#)
- [Initial Setup of the Configuration Settings](#)
- [VCM \(Geometry\) Setup Procedure](#)
- [Initial Setup of System Settings](#)
- [Initial VT System Setup Procedure](#)
- [System Dry Tests](#)
- [System Wet Tests](#)
- [Change the Units of Measure](#)

The first time your system is set up, these processes must be completed:


1. Initial Setup of the Boom Settings
2. VCM Setup Procedure
3. Initial Setup of the System Settings
4. Initial VT System Setup Procedure
5. System Dry Tests
6. System Wet Tests

Factory Reset Procedure

Important: Always save your profile settings and/or record all settings and location setup information before performing a factory reset.

Navigate:  > **Initial Setup** > **Configuration** > **Factory Reset** > **Yes**

Initial Setup of the Configuration Settings

1. Navigate:  > **Initial Setup** > **Configuration**
2. Go through each menu item to make sure that each setting is correct for your machine and operating conditions.

For machine specific settings, refer to the PinPoint™ III Envelop website at www.capstanag.com/pinpoint-iii-envelop.

For setting definitions, refer to [Initial Setup Settings Descriptions](#).

VCM (Geometry) Setup Procedure

1. Navigate:  > **Initial Setup** > **VCM Setup**

The hub detects which VCM port each VCM connector is installed into.

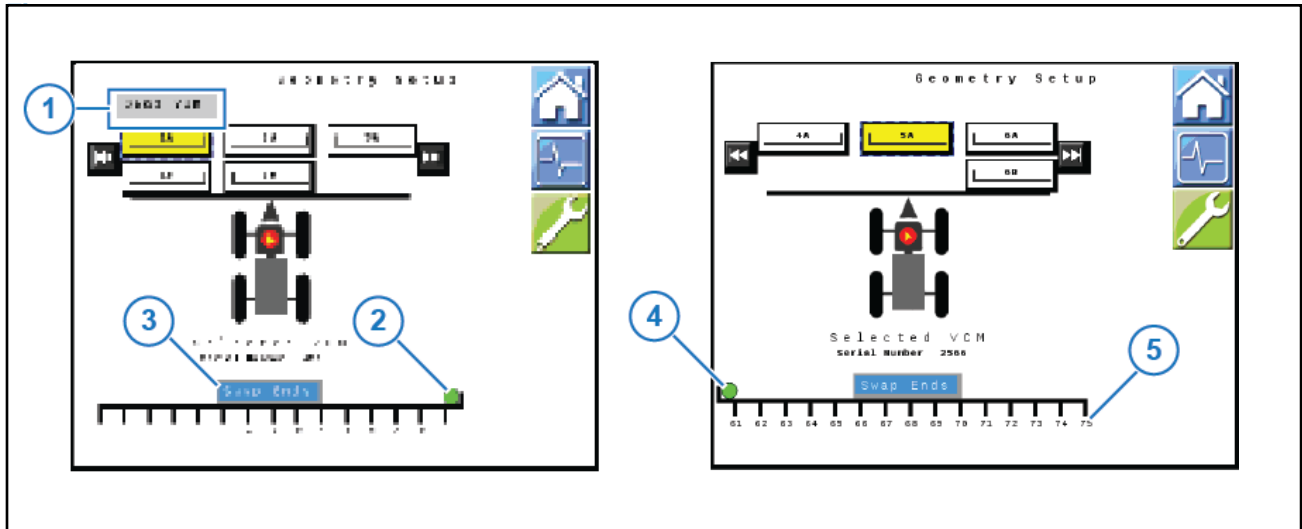





Figure 19: Geometry Setup

2. If there are two VCMs on one section, you can change their positions. A Swap VCMs icon will show at the top of the screen (Figure 19, Item 1).
3. If the orientation on a VCM (Figure 19, Item 2) is incorrect, select Swap Ends (Figure 19, Item 3) to change which end the VCM (Figure 19, Item 4) is on.
4. Select  to go to the next VCMs in sequence.
5. Make sure that the number of nozzles controlled by each VCM (5) matches your machine.
6. Perform the [Key Fob Boom Shutoff Dry Test](#).

Initial Setup of System Settings

Change the Boom and Nozzle Settings

1. Navigate:  > Boom/Nozzle > Nozzle Bounds
2. Change any of the values as needed.
For machine specific settings, refer to PinPoint™ III Envelop website at www.capstanag.com/pinpoint-iii-envelop.
For setting definitions, refer to [Boom/Nozzle Settings Menu Descriptions](#).

3. Navigate:  > Boom/Nozzle > Nozzle Setup

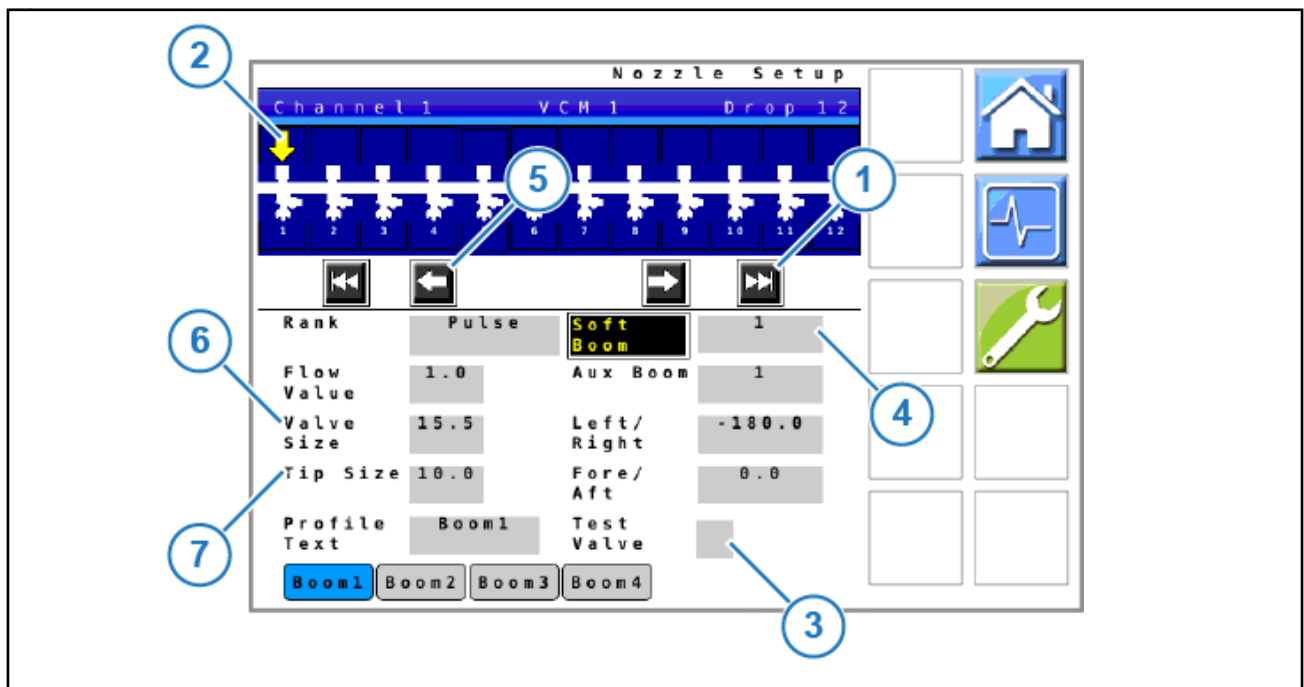




Figure 20: Nozzle Setup Screen

4. On the Nozzle Setup screen, select  (Figure 20, Item 1) to go to the next set of 12 nozzles in sequence.
5. Make sure that the yellow arrow (Figure 20, Item 2) is highlighting the correct nozzle.
6. To make sure that the correct valve is highlighted, select the box next to (Figure 20, Item 3) Test Valve. With an X in the box, the valve will pulse. Remove the X to stop the valve.
7. Select the box (Figure 20, Item 4) next to **Soft Boom** to change the boom layout as desired. Refer to your machine's Integration instructions for exact soft boom configurations.
8. Select  to go the previous set of 12 nozzles in sequence.
9. If necessary, change the valve size (Figure 20, Item 6) or tip size (Figure 20, Item 7).


10. Select the box next to the text and enter the desired value.

If the value will be the same for all valves or tips, select **Yes** on the dialog that appears to change all nozzles.

From this screen, you can also change the profile names.

For more information, refer to [Change a Profile Name](#).

Change a Profile Name

1. Navigate:  > Boom/Nozzle > Nozzle Setup

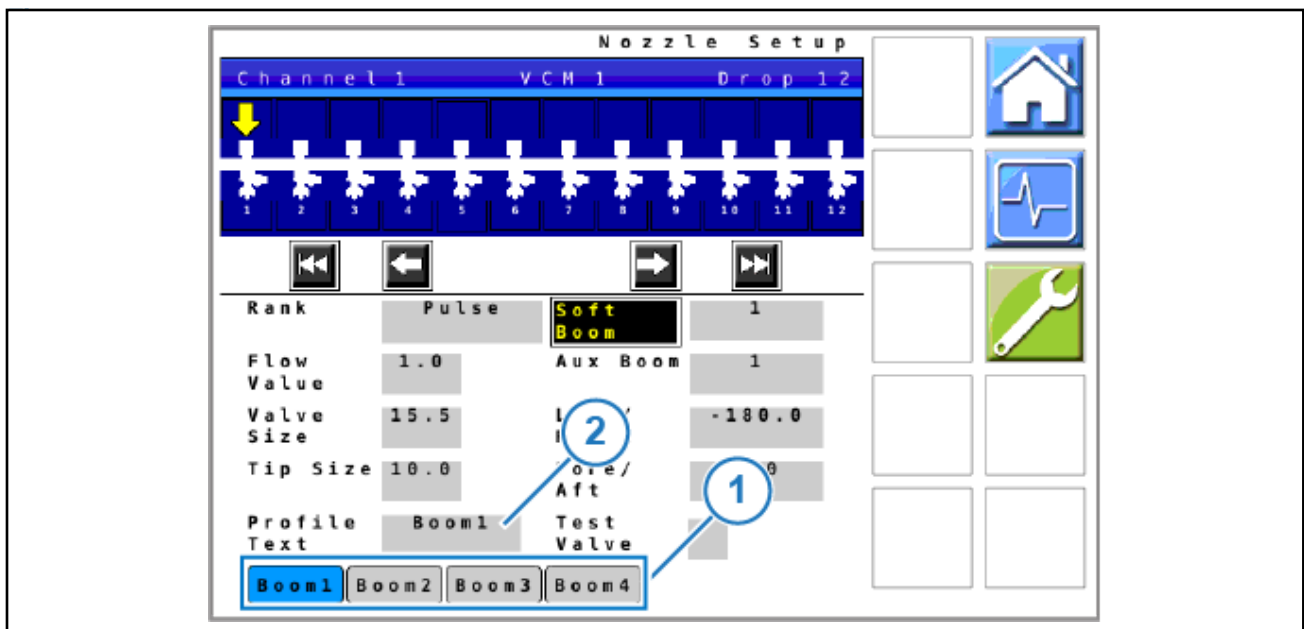



Figure 21: Profile Names on Nozzle Setup Screen

2. At the bottom of the screen, select the desired Profile name (Figure 21, Item 1).
3. Select the box (Figure 21, Item 2) next to **Profile Text**.
4. Enter the desired profile name.
The profile name is limited to six characters.
5. The updated profile name will show on the name screen.

Note: To use modified profiles, **Custom** must be selected on the home screen.

Change the Pressure Settings

1. Navigate:  > Pressure
2. Select each menu item and go through each screen with additional menu items to make sure that each setting is correct for your machine and operating conditions.

For machine specific settings, refer to the integration instruction that came with the system or the

PinPoint™ III Envelop website at www.capstanag.com/pinpoint-iii-envelop.

For setting definitions, refer to [Pressure Settings Menu Descriptions](#).

Change the Flow Settings

1. Record flowmeter pulses/10 gal or pulses/10 Liters information from the flowmeter tag. The information will be used during the initial system setup.


2. Navigate:  > Flow

3. Enter flowmeter cal number in the Meter 1 Calibration field.

Note: If the machine is equipped with a remote fill station, record flowmeter calibration number from corresponding flowmeter and enter into Meter 2 Calibration field.

For setting definitions, refer to [Flow Settings Menu Descriptions](#).

Change the Navigation Settings

1. Navigate:  > Navigation > Vehicle

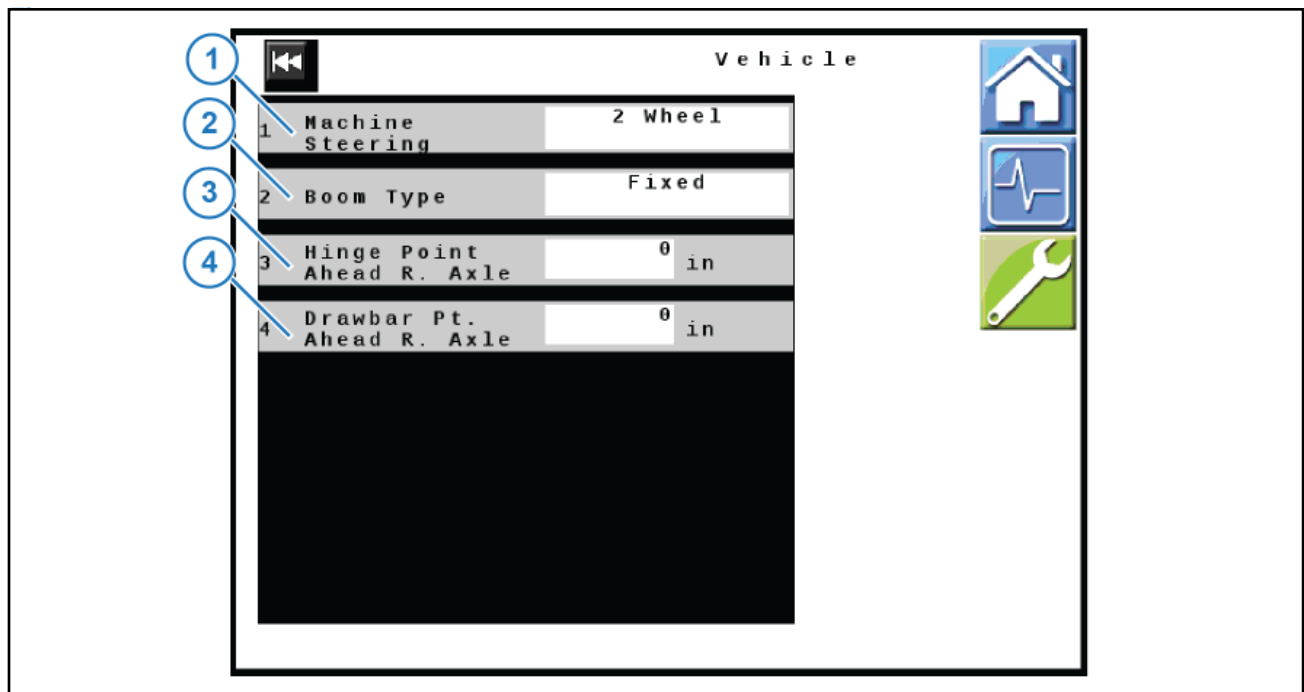


Figure 22: Vehicle Settings

2. Select the correct **Machine Steering** (Figure 22, Item 1) option for your machine:
 - 2 Wheel
 - 4 Wheel
 - Articulated

3. Select correct **Boom Type** (Figure 22, Item 2) option for your machine:

- Fixed
- Pull

Note: If using a fixed boom sprayer, the **Hinge Point Ahead Rear Axle** and the **Drawbar Point Ahead Rear Axle** values will be left at zero. If using a Pull Type sprayer, refer to Figure 23 for measurement instructions. For setting definitions navigate: **Navigation Settings > Menu Descriptions**.

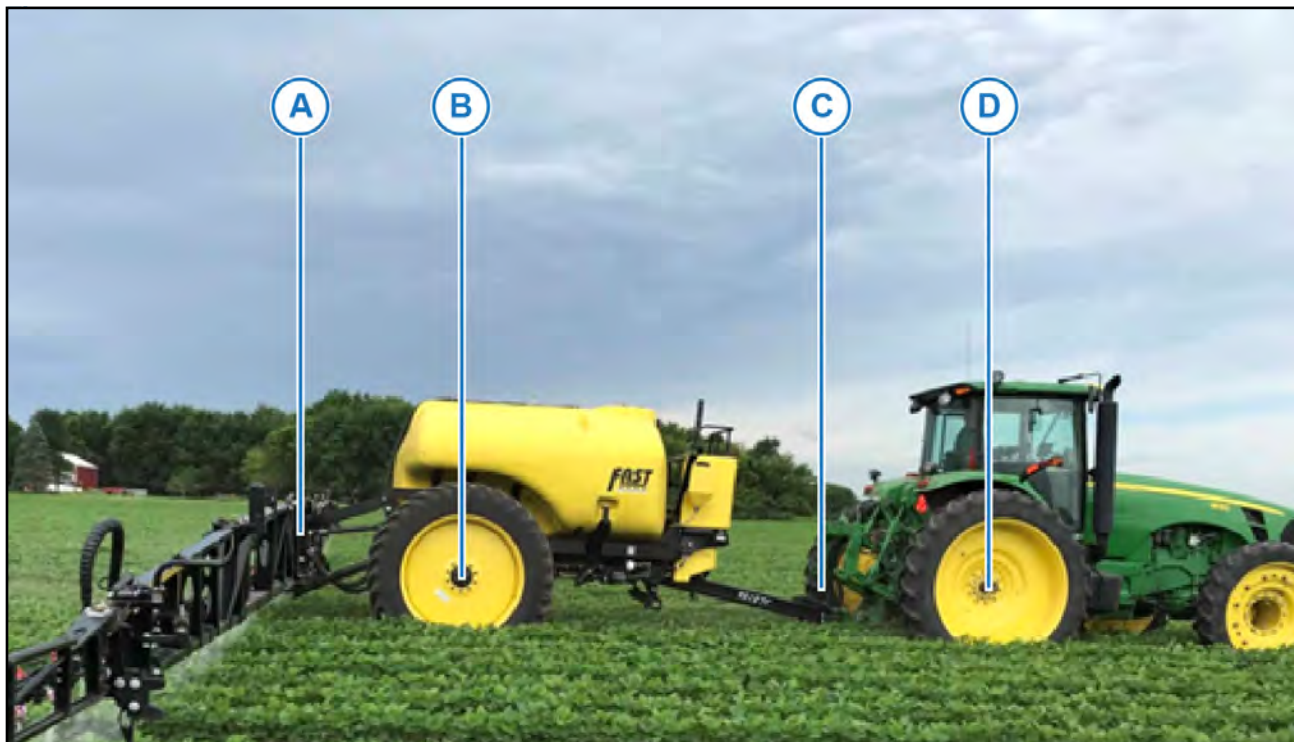


Figure 23: Navigation Setting Measurements


4. For Pull Type sprayers only, use a tape measure to take and record the following measurements:

- Drawbar Pt. Ahead R. Axle (D–C)
- Boom Ahead Rear Axle (D–A)
- Trail Axle Ahead R. Axle (D–B)

5. Enter the correct **Drawbar Pt. Ahead R. Axle** measurement (Figure 22, Item 4) on the **Vehicle** screen as a (-) negative value. The remaining values will be entered on the **Implement** screen.

6. For all machines, use a tape measure to take and record the following measurements:

- Boom Ahead Rear Axle (if not already recorded)
- GPS Ahead of Rear Axle
- GPS Right of Center
- GPS Height from Ground

7. Navigate:  > **Navigation** > **Implement**

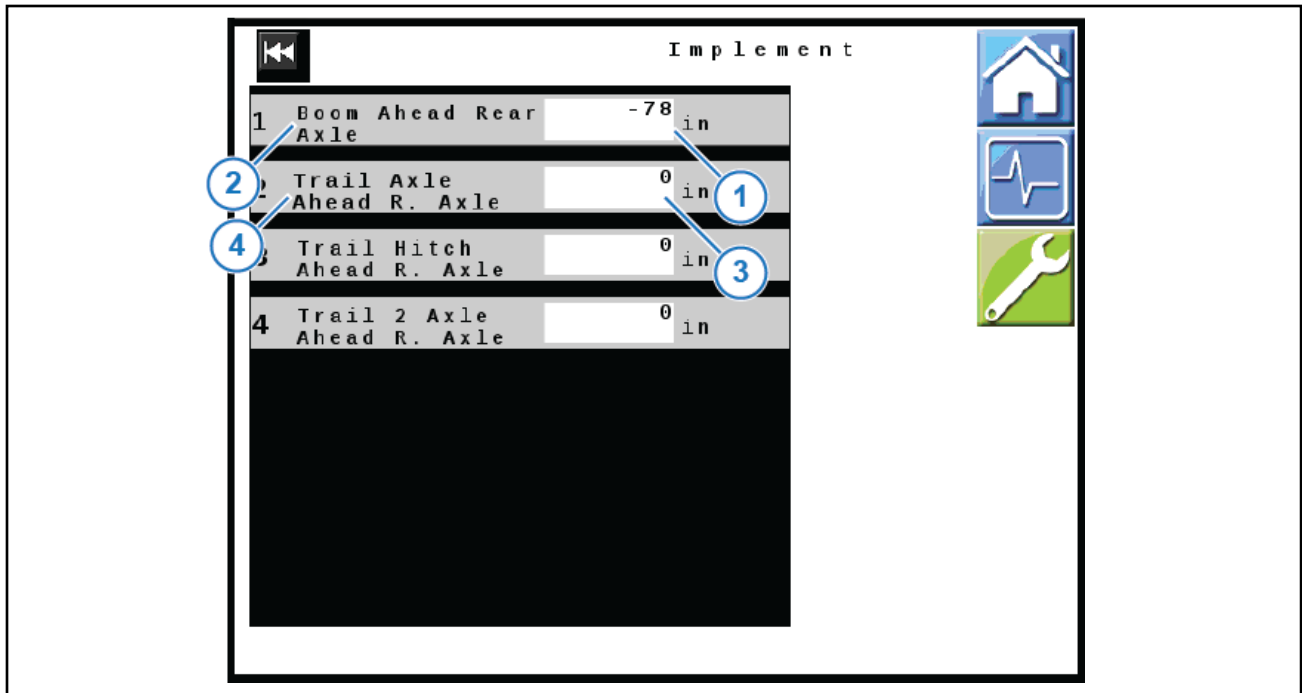


Figure 24: Implement Screen

8. Select the box (Figure 24, Item 1) next to Boom Ahead Rear Axle (Figure 24, Item 2).

9. Enter the correct value.

If the boom is behind the rear axle, the value will be (-) negative.

10. Select the box (Figure 24, Item 3) next to Trail Ahead Rear Axle (Figure 24, Item 4).

11. Enter the correct value

For Pull Type sprayers, this value will be (-) negative, for all other machines, this value will be left at zero.

12. Navigate:  > 

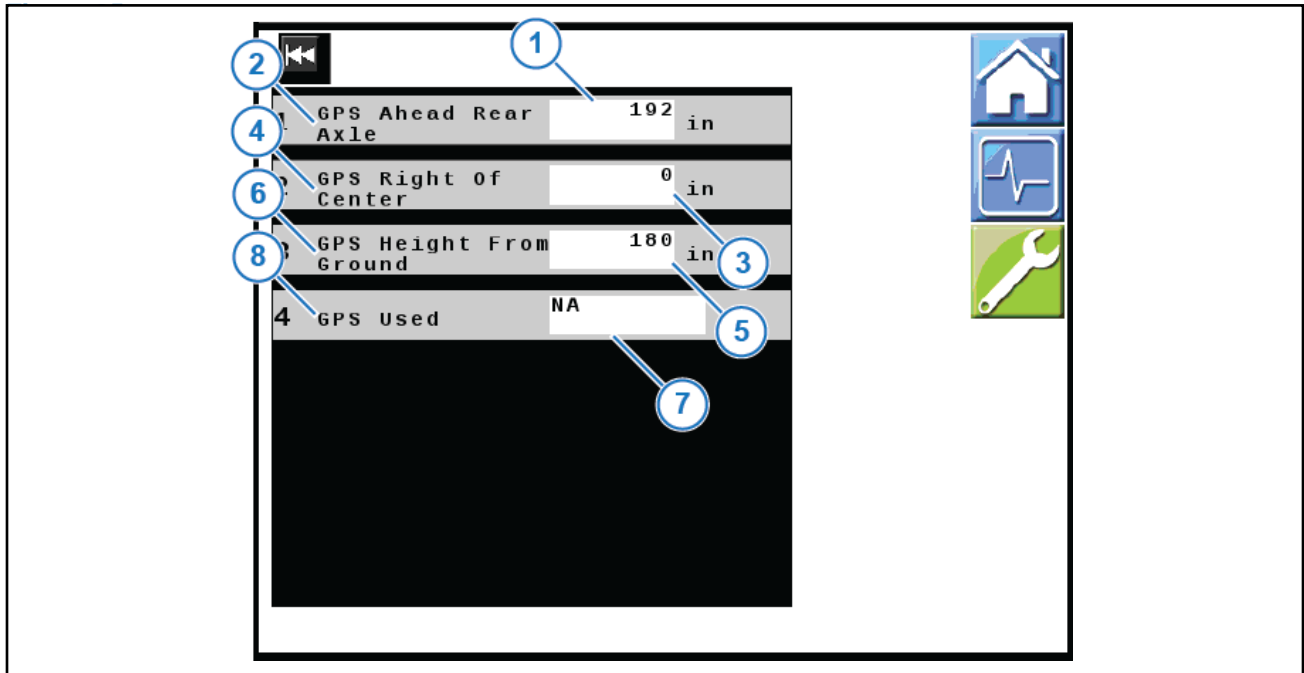


Figure 25: Implement Screen 2

13. Select the box (Figure 25, Item 1) next to GPS Ahead Rear Axle (Figure 25, Item 2).
14. Enter the correct value.
15. Select the box (Figure 25, Item 3) next to GPS Right of Center (Figure 25, Item 4).
16. Enter the correct value.
17. Select the box (Figure 25, Item 5) next to GPS Height From Ground (Figure 25, Item 6).
18. Enter the correct value.
19. Select the box (Figure 25, Item 7) next to GPS Used (Figure 25, Item 8).
20. Select the type of GPS from the list of available options.


Not all of the options may show on your system. Only the types available for your system will show on your list.

If you have serial GPS, select NMEA0183

If you have CAN GPS, available types include—in preference order:

- a. J1939
- b. ISO 11783
- c. NMEA2000

Compass Calibration Procedure

1. Navigate:  > **Navigation** > **Compass**

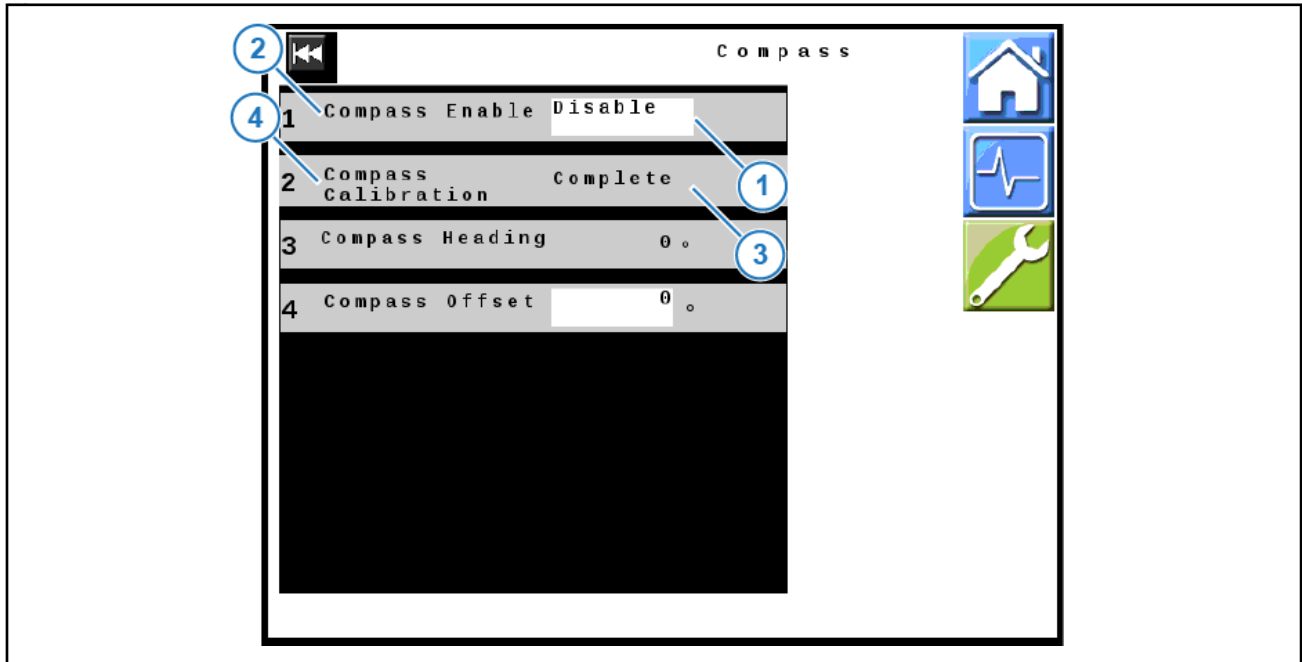


Figure 26: Compass Screen

2. Select the box (Figure 26, Item 1) next to Compass Enable (Figure 26, Item 2).
3. Select Enable.
4. Select the box (Figure 26, Item 3) next to Compass Calibration (Figure 26, Item 4).
5. Follow the prompts on the VT screen to complete the compass calibration.
6. Set compass to **Disable** after calibration is complete.

Initial VT System Setup Procedure

1. Refer to your specific VT manual(s) for system display setup information.
2. Visit www.capstanag.com/pinpoint-iii-envelop for machine specific CapstanAG setup information.

System Dry Tests

Follow these procedures to make sure that the soft boom and nozzle valves are operating correctly.

Boom Shutoff Dry Test

1. Make sure that the engine is off and the key is on.

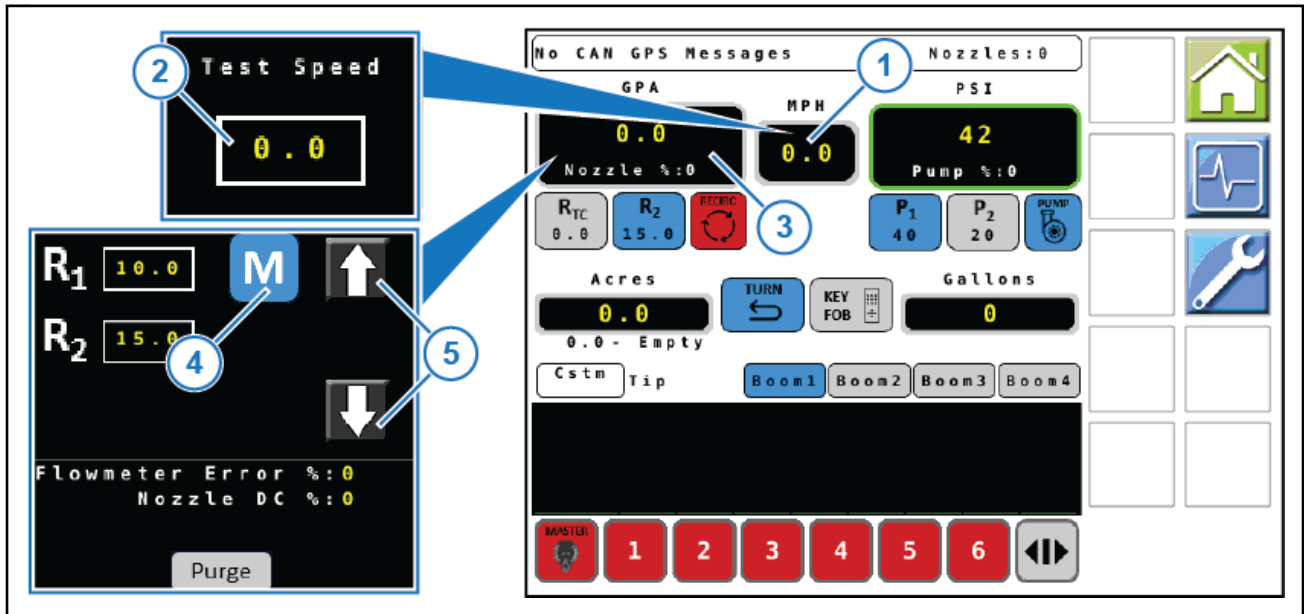


Figure 27: Boom Shutoff Dry Test

2. Select the speed box (Figure 27, Item 1).
3. Set a test speed (Figure 27, Item 2).
4. Select the rate box (Figure 27, Item 3).
5. Select M (Figure 27, Item 4) and then use the arrow icons (Figure 27, Item 5) to change the rate.
6. Turn on all boom switches.
7. Turn on the master switch.
All nozzles valves should start clicking.
8. Turn off all of the boom sections.
9. Turn on boom section 1.
10. Make sure the nozzle valves for the correct boom section are clicking.
11. Turn off boom section 1.
12. Repeat steps 9—11 for each boom section.
13. Turn off the master switch.

Key Fob Boom Shutoff Dry Test

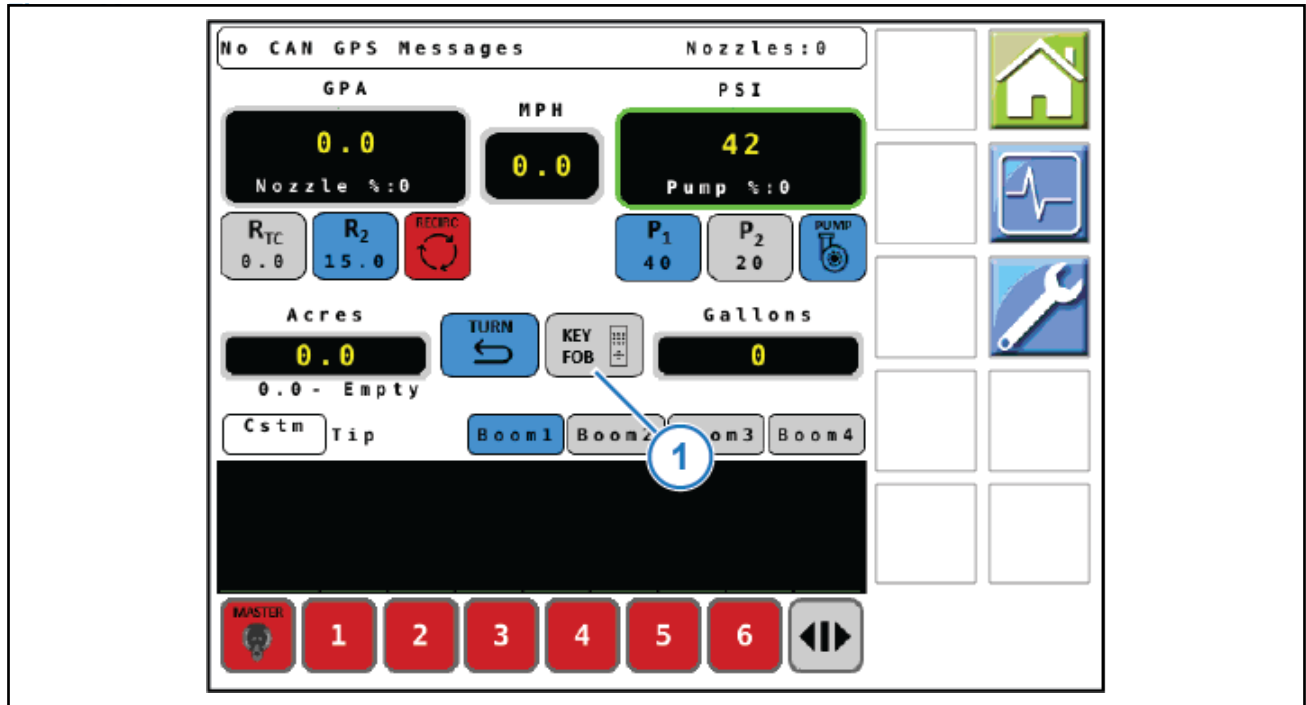


Figure 28: Run Screen

1. To initiate the key fob boom shutoff dry test, select the **KEY FOB** icon (Figure 28, Item 1).

Note: The CapstanAG Mobile App can be used with the system in key fob mode for this test procedure.

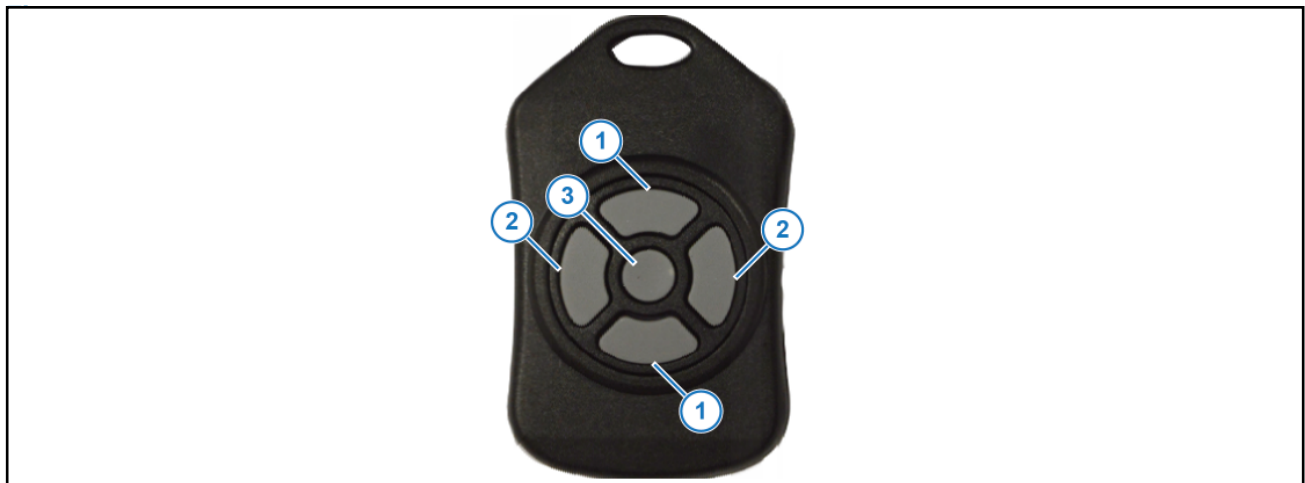


Figure 29: Key Fob

2. Press the top/bottom buttons (Figure 29, Item 1) on the key fob to turn on/off each boom section. Make sure that each boom section is operating (clicking) in the correct order.
3. Press the right/left buttons (Figure 29, Item 2) on the key fob to turn on/off each individual nozzle valve. Make sure that each nozzle valve is operating (clicking) in the correct order.
4. Press the center button (Figure 29, Item 3) on the key fob to turn off the whole boom.
5. On the VT screen, select the box (Figure 29, Item 3) next to Key Fob (Figure 29, Item 4) until OFF shows.

System Wet Tests

Follow these procedures to make sure that the soft boom and nozzle valves are operating correctly.

Boom Shutoff Wet Test

1. Fill the sprayer with approximately 400 gallons of water.
2. Make sure that the VT display and rate controller are off.
3. Start the machine engine and set to idle speed.
4. Turn on the VT display and rate controller.

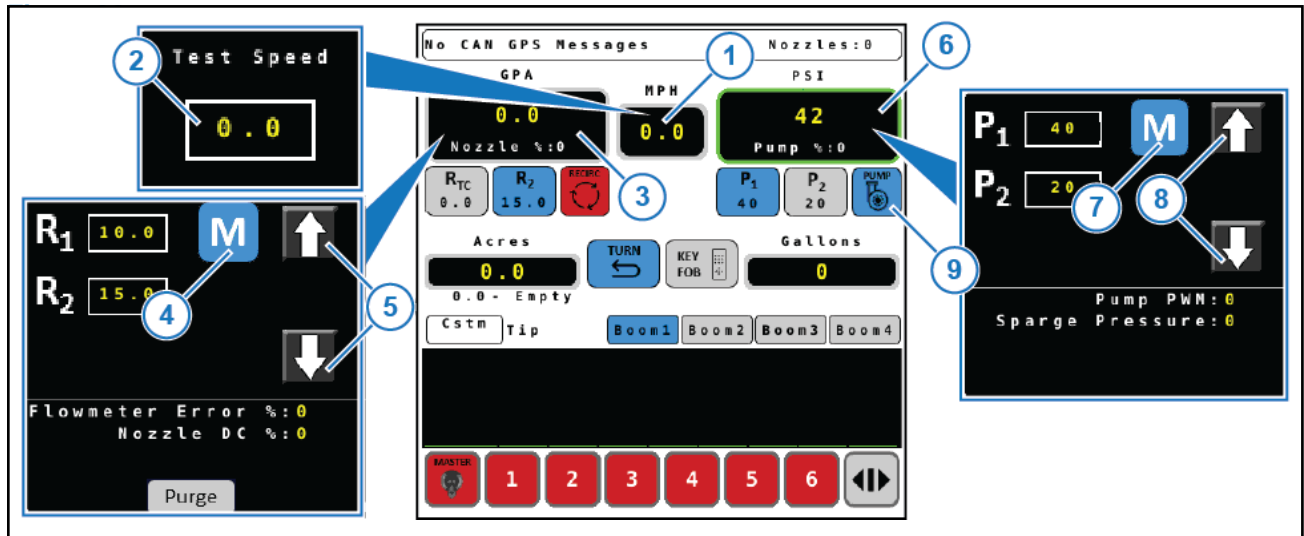


Figure 30: Boom Shutoff Wet Test

5. Select the speed box (Figure 30, Item 1).
6. Set a test speed (Figure 30, Item 2).
7. Select the rate box (Figure 30, Item 3).
8. Select M (Figure 30, Item 4) and then use the arrow icons (Figure 30, Item 5) to change the rate.
9. Select the pressure icon (Figure 30, Item 6).
10. Select M (Figure 30, Item 7) and then use the arrow icons (Figure 30, Item 8) to change the pressure.
11. Select the Pump icon (Figure 30, Item 9) to turn on pump.
12. Make sure that the system is controlling the pressure.
13. Turn on all of the boom switches.
14. All of the nozzle valves on the boom should start to spray.
15. Turn off all of the boom sections.
16. Turn on boom section 1.

The nozzle valves on boom section 1 should start to spray.
17. Repeat Step 16 for each boom section and make sure that each boom section operates in the correct order.

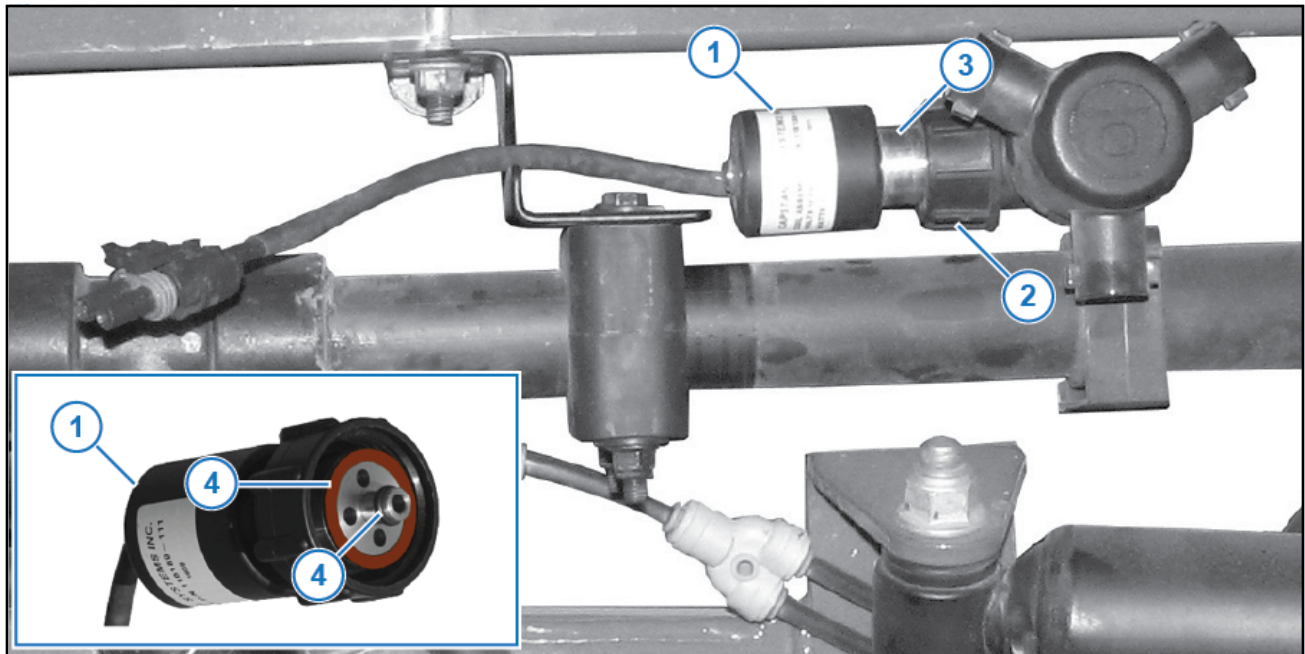


Figure 31: Nozzle Valve Leaks

If a leaking valve body is found, check the following:

18. If the coil housing (Figure 31, Item 1) spins, tighten the fly nut (Figure 31, Item 2) until the coil housing does not spin.
19. If the coil housing does not spin, remove the nozzle valve (Figure 31, Item 3).
20. Inspect the O-rings (Figure 31, Item 4). If an O-ring is damaged, replace the O-ring.
If the O-rings appear to be okay, install the existing nozzle valve.

Key Fob Boom Shutoff Wet Test

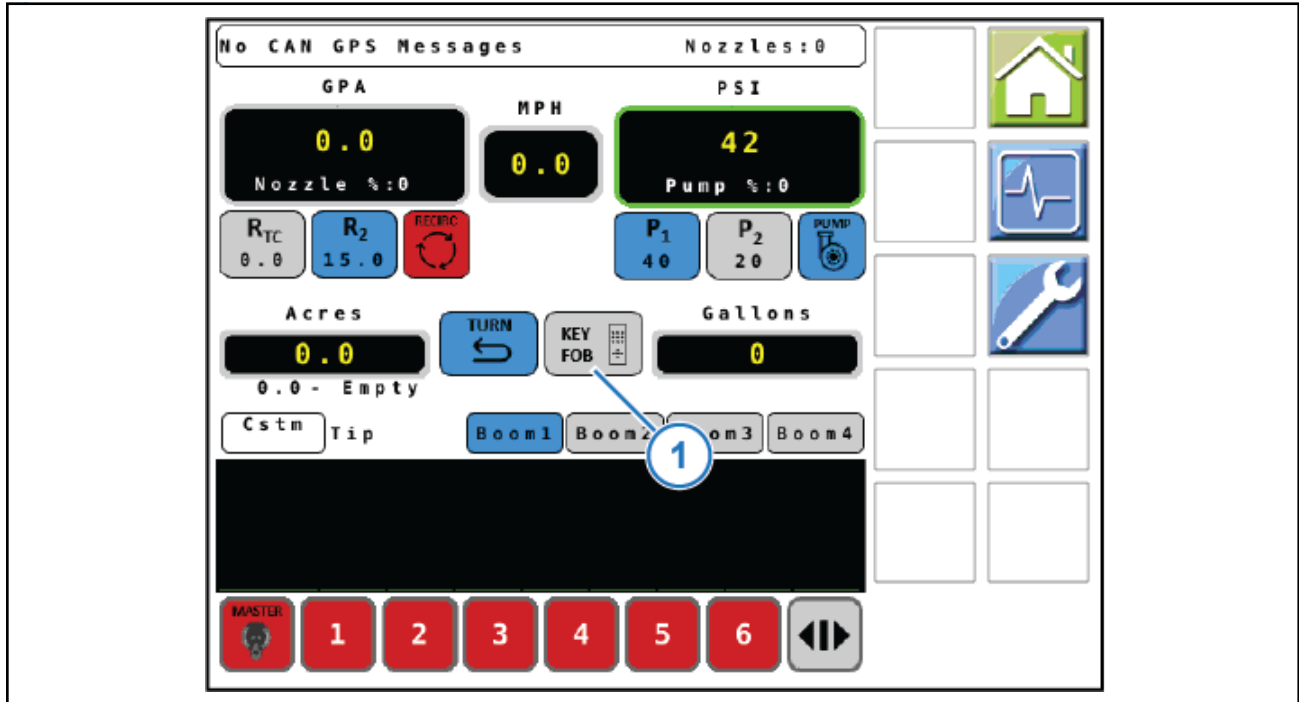


Figure 32: Key Fob Mode

1. After performing the boom shutoff wet test, initiate the key fob boom shutoff wet test, by selecting the **KEY FOB** icon (Figure 32, Item 1)
2. Turn on all of the boom section switches and the master switch.

Note: The CapstanAG Mobile App is available for iOS¹ and Android and is in both stores. You can use the app as a key fob for this test procedure.

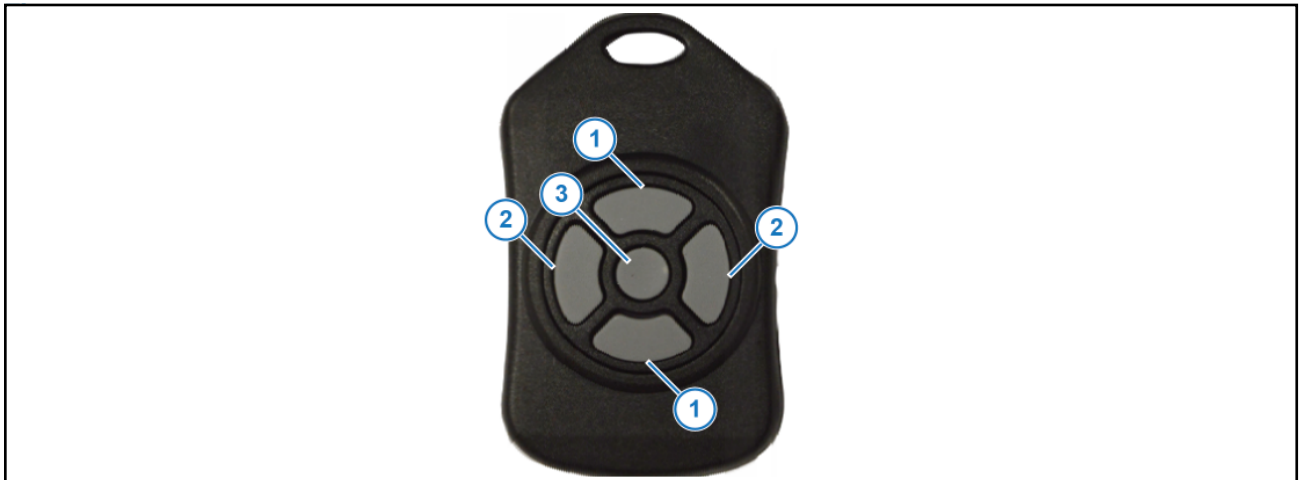


Figure 33: Key Fob

3. Press the top/bottom buttons (Figure 33, Item 1) on the key fob to turn on/off each boom section. Make sure that each boom section is spraying in the correct order.

¹ iOS is Trademarked by Cisco Systems and Apple licenses iOS.

4. Press the right/left buttons (Figure 33, Item 2) on the key fob to turn on/off each individual nozzle valve. Make sure that each nozzle valve is spraying in the correct order.
5. Press the center button (Figure 33, Item 3) on the key fob to turn off the whole boom.
6. Deselect the **KEY FOB** icon (Figure 32, Item 1).

Change the Units of Measure

Note: This setting is set by the virtual terminal. Refer to the VT manual for more information.

Chapter 6: Operation

Topics:

- [Main System Screen](#)
- [Operate the System](#)
- [Settings Menu Information](#)
- [Machine Specific Information](#)
- [Nozzle Speed Ranges](#)

Main System Screen

The main system screen is the main user interface for the control of the system.

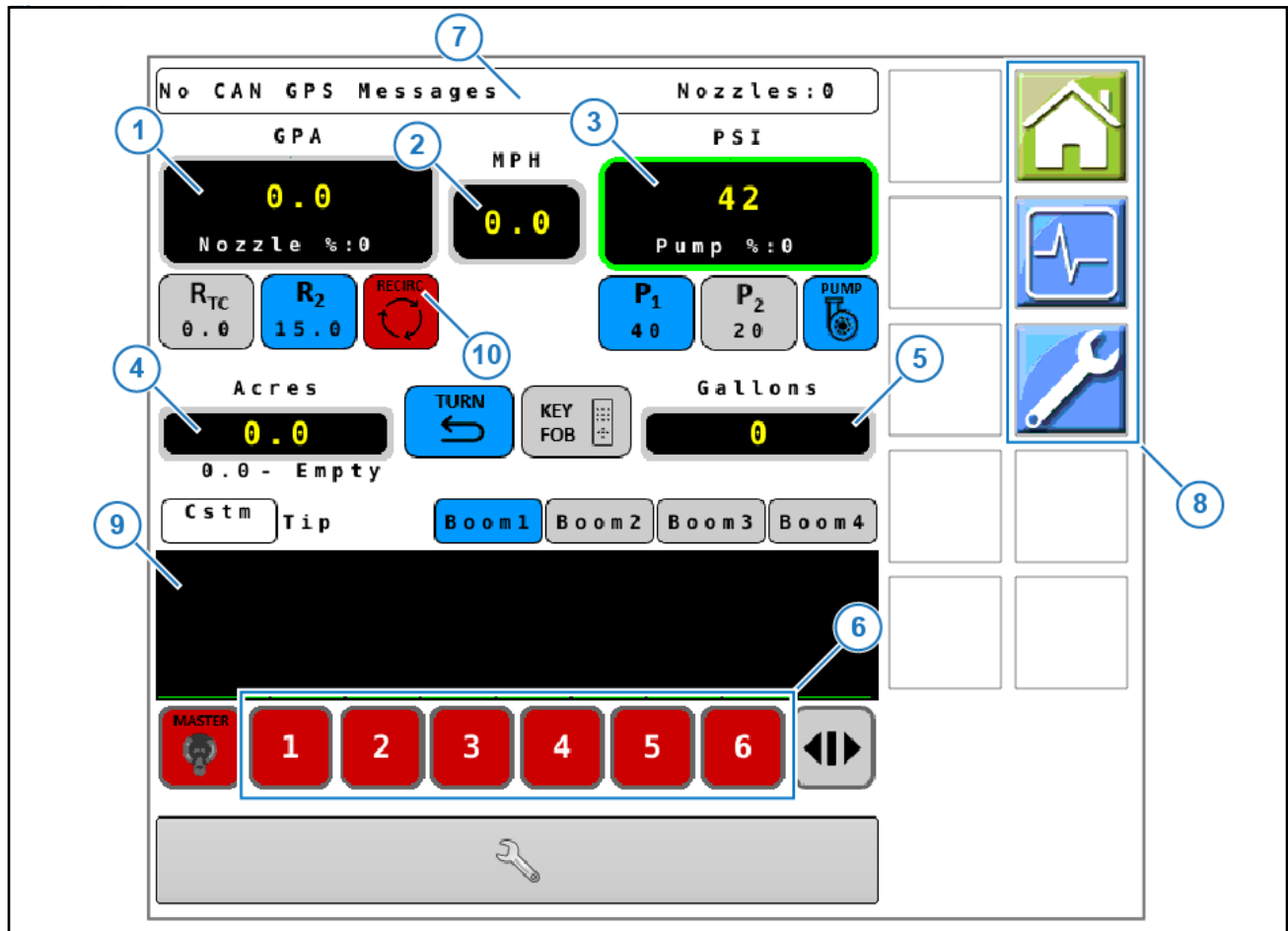


Figure 34: Main System Screen







Table 4: Main System Screen Identification

Refer to [Figure 34](#)

| Item | Name | Description | Action |
|------|--------------|---|--|
| 1 | Rate | Actual application rate is displayed | Select for additional rate information |
| 2 | Speed | Actual speed is displayed | Select to change to test speed |
| 3 | Pressure | Actual pressure is displayed | Select for additional pressure information |
| 4 | Area | Counter for area covered | Select to see additional area counters |
| 5 | Volume | Counter for volume of fluid sprayed | Select to see additional volume counters |
| 6 | Profiles | Individual profile Soft Keys | Select one of the customizable profiles |
| 7 | Message Area | Displays system status, fault codes, and number of nozzles currently on | Shows any system fault messages in this area. For more information refer to Troubleshooting Charts . |

| Item | Name | Description | Action |
|------|--------------------|--|--|
| 8 | Softkeys | Alternate menu soft keys | Select to navigate to other screens. For more information, refer to Softkey Descriptions . |
| 9 | Section Duty Cycle | Shows average duty cycle of nozzles on in each section | Rises and falls with each section's respective duty cycle. Sections will change color depending on condition: Green - Normal Condition; Yellow - Required rate exceeds capabilities; Red - Fault Condition |
| 10 | Boom Recirculation | Boom Recirculation Soft Key | Controls/displays status of boom recirculation |

Softkey Descriptions

| Icon | | Description |
|--|--|--|
|  |  | Select this softkey icon to open the Settings screen. The background of the icon is green when you are on the Settings screen. |
|  |  | Select this softkey icon to navigate to the main Home screen The background of the icon is green when you are on the Home screen. |
|  |  | Select this softkey icon to navigate to the Diagnostics screen. The background of the icon is green when you are on the Diagnostics screen. |

Operate the System

1. Set up the VT display to operate.
Refer to the VT manual for more information.
2. Once the VT display is set up and the CapstanAG system is shown on the display, select the desired profile from the bottom of the screen.
3. Start operation.

Settings Menu Information

Boom/Nozzle Settings Menu Descriptions

Table 5: Nozzle Bounds

| Line | Line Title | |
|------|---|--------------|
| | Description | |
| 1 | PWM Minimum % | |
| | This is the minimum pulse duty cycle for the nozzle valves. This value must not be lower than the Nozzle Pulse Frequency. | |
| 2 | PWM Maximum % | |
| | This is the limit of the maximum nozzle duty cycle. | |
| 3 | Nozzle Pulse Frequency | |
| | CapstanAG systems run at 10 pulses per second pulse frequency. CapstanAG does not recommend pulse frequencies slower than 10Hz in sprayer applications. | |
| 4 | Low Press Shutoff | |
| | When enabled, this setting causes the solenoid valves to shut off, like diaphragm drip checks at this value. When the low pressure shutoff value is 8 PSI, a message will show when the pressure goes below 8 PSI. At this point, nozzle valves will close. Nozzle valves will open, and the message will clear when the pressure increases to at least 12 PSI. | |
| 5 | Valve Type | |
| | Solenoid valve type that the system uses for flow detection. | |
| | 7W | 7-watt Coil |
| | 12W | 12-watt Coil |
| 6 | 12WH | |
| | 15-series valve with 12-watt coil and a heavy spring plunger | |
| 6 | Valve Diagnostics | |
| | If the system is not using nozzles that use the CapstanAG nozzle diagnostics properly, the nozzle diagnostics can be disabled here. CapstanAG uses this feature on demonstration units and development units where lights are substituted for valves or reset to Coil Only. Coil Only disables the plunger movement detection without disabling short or open data. | |
| 7 | Zero Speed Spray | |
| | This feature allows the system to apply product when the machine is not moving. Select On to allow the system to spray when the machine is not moving. Select Off to make sure that the system will not spray when the machine is stopped. | |

Table 6: Nozzle Setup

| Nozzle Setup |
|---|
| This screen is used to change nozzle information and to set the profile icons. For more information, refer to Change the Boom and Nozzle Settings . |

Table 7: Recirculation

| Line | Line Title | |
|------|---|--|
| | Description | |
| 1 | Recirculation | |
| | If the system has a recirculation system select the desired operation mode and an icon will show on the run screen. Disable this feature if there is not a recirculation system on the machine. | |
| | Manual | In Manual mode, select the recirculation icon to turn the system on and off. |
| | Auto | In Auto mode, select the recirculation icon to start the system the first time. After the initial start, the machine will operate the recirculation system when all of the nozzles are off. |
| | Auto Delay 30s | In Auto Delay 30s, select the recirculation icon to start the system the first time. After the initial start, the machine will operate the recirculation system as needed and will wait 30 seconds after you stopped spraying to turn the system back on. This is the recommended operation mode if your machine has a recirculation system. |
| | Conventional Standby | In Conventional Standby, the default standby boom pressure set point is set when the boom is turned off. |
| 2 | Recirculation Valve | |
| | Select the default state of the recirculation valve | |
| 3 | Cycle Boom Valves | |
| | Enable this feature if the system has boom section valves and a recirculation system. For all other systems, this feature is set to Disable. | |

Pressure Settings Menu Descriptions

Table 8: Pump Setup

| Line | Line Title | |
|------|--|--|
| | Description | |
| 1 | Servo Type | |
| | Select the correct servo type for your machine. | |
| 2 | Servo Minimum | |
| | The servo minimum value is the minimum duty cycle that the pump will be driven. It is important that this value corresponds with the minimum duty cycle used by the rate controller. | |
| 3 | Servo Maximum | |
| | The servo maximum value is the maximum duty cycle that the pump will be driven. It is important that this value corresponds with the maximum duty cycle used by the rate controller. | |
| 4 | Servo Man Speed | |
| | The servo manual speed controls how fast the pressure changes in manual mode. If the valve operates too slowly in manual mode, increase this value. If the valve operates too quickly in manual mode, decrease this value. | |
| 5 | Pump Seal Shutdown | |
| | When the sensor falls below the pump seal shutdown value, the pump shuts off to prevent the pump from operating dry and causing pump seal failure. | |

| Line | Line Title | |
|------|---|--|
| | Description | |
| 6 | Pump Pulses/Rev | |
| | On sprayers that are equipped with a pump speed sensor, use this feature to limit the maximum pump speed to the selected pump pulses per revolution (RPM). | |
| 7 | Pump Max. Speed | |
| | The pump maximum speed is used on sprayers that are equipped with a pump speed sensor. When the pump speed limit is enabled, it will limit the maximum pump speed to the selected RPM. | |
| 8 | Rx Method | |
| | Minimum | The target pressure corresponds to the minimum prescription pressure for the boom. |
| | Maximum | The target pressure corresponds to the maximum prescription pressure for the boom. |
| | Average | This is the default setting. The target pressure corresponds to the average prescription pressure of the boom. |
| 9 | Min Pressure | |
| | If a minimum pressure is set, the system will not go below this value. | |
| 10 | Max Pressure | |
| | If a maximum pressure is set, the system will not exceed this value. | |
| 11 | Max Flow | |
| | If a maximum flow is set, the system will not exceed this flow. | |
| 12 | Pump Start-up Status | |
| | Set to Off: pump will always be off when the machine is started and must be started from the VT display. Set to Last: pump will begin in the same mode as it was when the machine was turned off. | |
| 13 | Fill Station PWM | |
| | Sets fill station pump PWM percentage when pump control is taken at the remote fill station | |

Table 9: Sensor Setup

| Line | Line Title | |
|------|---|--|
| | Description | |
| 1 | Sensor 1 Minimum | |
| | The minimum voltage for sensor 1 | |
| 2 | Sensor 1 Maximum | |
| | The maximum voltage for sensor 1 | |
| 3 | Sensor 1 Minimum | |
| | The minimum pressure for sensor 1 | |
| 4 | Sensor 1 Maximum | |
| | The maximum pressure for sensor 1 | |
| 5 | Sensor 1 Offset | |
| | It is common to have 1 to 5 VDC sensors and 0.5 to 5 VDC sensors. The sensor offset is used when the sensor does not match a gauge. Entering an offset value will scale the sensor up or down. The sensor offset allowable range is $\pm 1-9$. | |

| Line | Line Title |
|------|---|
| | Description |
| 6 | Sensor 2 Minimum |
| | The minimum voltage for sensor 2 |
| 7 | Sensor 2 Maximum |
| | The maximum voltage for sensor 2 |
| 8 | Sensor 2 Minimum |
| | The minimum pressure for sensor 2 |
| 9 | Sensor 2 Maximum |
| | The maximum pressure for sensor 2 |
| 10 | Sensor 2 Offset |
| | It is common to have 1 to 5 VDC sensors and 0.5 to 5 VDC sensors. The sensor offset is used when the sensor does not match a gauge. Entering an offset value will scale the sensor up or down. The sensor offset allowable range is ±1-9. |

Table 10: Control Tuning (Pressure)

| Line | Line Title |
|------|--|
| | Description |
| 1 | System Gain |
| | The system gain or Gain K scales all of the pressure gain values together. Most of the gain adjustments should be made to system gain. The higher the number, the more sensitive the control system. |
| 2 | Gain P |
| | The Gain P or proportional gain causes the control system to respond faster when the errors are greater. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish, system use a higher number. |
| 3 | Gain I |
| | The Gain I or integral gain causes the control system to accelerate faster when the errors are greater. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number. Integral gain is generally set at 1/10th of the proportional gain. |
| 4 | Gain D |
| | The Gain D or differential gain causes the control system to accumulate errors faster when errors are small. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number. Differential gain is rarely used and is generally set at 1/10th of the integral gain or zero. |
| 5 | Deadband |
| | The deadband pressure is used to tune out instability by providing a pressure zone that is considered satisfactory, thus requiring no action by the control system. The higher the number, the less sensitive the control system. To stabilize an oscillating system, use a higher number. To speed up a sluggish system, use a lower number. Range 0 to 100. |

| Line | Line Title |
|------|---|
| | Description |
| 6 | Run/Hold Delay |
| | Run/Hold Delay stops control when there is no flow. It will restart control once nozzles are on and the set delay time has elapsed. |
| 7 | Rate Sync |
| | Rate Sync changes the nozzle duty cycle based on the vehicle speed obtained from the GPS receiver. |

Flow Settings Menu Descriptions

Table 11: Flowmeter

| Line | Line Title |
|------|---|
| | Description |
| 1 | Flowmeter Setup |
| | Flowmeter Setup menu |
| 2 | Control Tuning |
| | Control Tuning menu |
| 3 | Display Duty Cycle or Rate |
| | Select which option you would like to be displayed on the home screen during application. |
| 4 | Rate Alarm Set point |
| | Enter a value to enable an audiovisual alarm to be triggered if the actual rate deviates from the specified rate by the set percentage. |

Table 12: Flowmeter Setup

| Line | Line Title | |
|------|---|--|
| | Description | |
| 1 | Meter 1 Type | |
| | Type of flowmeter used on your machine. | |
| | Transparent | The flow signal from the flowmeter will be used without any adjustment at flows above the “set flowmeter” minimum. |
| | Correction | At flows above the minimum, the signal from the flowmeter is used, but adjusted with calculations for turn compensation and individual nozzle shutoff. At flows below the “set flowmeter” minimum, the value is calculated. |
| | Calculation | All flow is calculated, the flowmeter is not used. |
| 2 | Meter 1 Minimum | |
| | The flowmeter minimum value is the minimum flow at which the flowmeter is accurate. | |
| 3 | Meter 1 Calibration | |
| | The calibration value must match the tag on the flowmeter or a catch test. | |

| Line | Line Title | |
|------|--|---|
| | Description | |
| 4 | Meter 1 Error Limit | |
| | The flowmeter error limit ranges from Disabled to 50%. Flow % higher than the chosen % will cause a fault message and an alarm. | |
| 5 | Specific Gravity 1 | |
| | Specific gravity refers to the density or weight per gallon as compared to water (Water = 8.35 lb./gal.). For water-based products, use 1.00. For liquid fertilizer, use 1.2 for 10 lb/gal product, etc. Specific gravity is used to calculate flow. | |
| 6 | Meter 2 Type | |
| | Type of fill or second flowmeter used on your machine. | |
| | Transparent | The flow signal from the flowmeter will be used without any adjustment at flows above the “set flowmeter” minimum. |
| | Correction | At flows above the minimum, the signal from the flowmeter is used, but adjusted with calculations for turn compensation and individual nozzle shutoff. At flows below the “set flowmeter” minimum, the value is calculated. |
| | Calculation | All flow is calculated, the flowmeter is not used. |
| | Flow Signal Out | Flow signal out is used to send a signal to an external rate controller. |
| 7 | Meter 2 Minimum | |
| | The flowmeter minimum value is the minimum flow at which the flowmeter is accurate. | |
| 8 | Meter 2 Calibration | |
| | The calibration value must match the tag on the flowmeter or a catch test. | |
| 9 | Meter 2 Error Limit | |
| | The flowmeter error limit ranges from Disabled to 50%. Flow % higher than the chosen % will cause a fault message and an alarm. | |
| 10 | Specific Gravity 2 | |
| | Specific gravity refers to the density or weight per gallon as compared to water (Water = 8.35 lb./gal.). For water-based products, use 1.00. For liquid fertilizer, use 1.2 for 10 lb/gal product, etc. Specific gravity is used to calculate flow. | |
| 11 | JD-R Low Flow Mode | |
| | Only applicable to John Deere R Series sprayers in SharpShooter™ mode. Flow and pressure control are modified due to the low flow control. | |
| 12 | Preset Rate Average | |
| | Absolute | The target rate will be adjusted up or down to adjust for increased or decreased flows at individual nozzles. |
| | Average | The target rate will remain the same regardless of increased or decreased flows at individual nozzles. Flow added to nozzles will be taken from the rest of the boom. |
| 13 | Flowmeter Sense Resistor | |
| | In most cases, set to Pull Up; however, some flowmeter manufacturers require this setting to be Pull Down. | |

| Line | Line Title |
|------|--|
| | Description |
| 14 | Tank Sensor Calibration |
| | Only used by specific European sprayers. |

Table 13: Control Tuning (Flow)

| Line | Line Title |
|------|--|
| | Description |
| 1 | System Gain |
| | The system gain or Gain K scales all of the pressure gain values together. Most of the gain adjustments should be made to system gain. The higher the number, the more sensitive the control system. |
| 2 | Gain P |
| | The Gain P or proportional gain causes the control system to respond faster when the errors are greater. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish, system use a higher number. |
| 3 | Gain I |
| | The Gain I or integral gain causes the control system to accelerate faster when the errors are greater. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number. Integral gain is generally set at 1/10th of the proportional gain. |
| 4 | Gain D |
| | The Gain D or differential gain causes the control system to accumulate errors faster when errors are small. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number. Differential gain is rarely used and is generally set at 1/10th of the integral gain or zero. |
| 5 | Deadband |
| | The deadband flow is used to tune out instability by providing a flow zone that is considered satisfactory, thus requiring no action by the control system. The higher the number, the less sensitive the control system. To stabilize an oscillating system, use a higher number. To speed up a sluggish system, use a lower number. Range 0 to 100. |
| 6 | Nozzle PWM Cycle Time |
| | The nozzle PWM cycle time value only affects in-line or bypass valve servo types. The nozzle PWM cycle time (4.0 seconds) is the time it takes for the pulsing nozzles to modulate from minimum to maximum duty cycle. To speed up a sluggish system reaction time, enter a lower number. To slow down the reaction time of an oscillating system, enter a higher number. |

Maps Settings Menu Descriptions

The Maps Settings Menu is not used at this time.

Navigation Settings Menu Descriptions

Table 14: Vehicle

| Line | Line Title |
|------|--|
| | Description |
| 1 | Machine Steering |
| | The type of steering of your machine |
| 2 | Boom Type |
| | Type of boom on your machine |
| 3 | Hinge Point Ahead of R. Axle |
| | Measure and record the distance from the hinge point to the rear axle. A positive number indicates that the boom is ahead of the rear axle. A negative number indicates the hinge point is behind the rear axle. Only used for articulated machines. |
| 4 | Drawbar Pt. Ahead of R. Axle |
| | Measure and record the distance from the hitch pin on the drawbar to the rear axle. A positive number indicates that the boom is ahead of the rear axle. A negative number indicates the drawbar is behind the rear axle. Only used for trailers. |

Table 15: Implement

| Line | Line Title |
|------|---|
| | Description |
| 1 | Boom Ahead Rear Axle |
| | Measure and record the distance the boom is from the rear axle. A positive number indicates that the boom is ahead of the rear axle. A negative number indicates that the boom is behind the rear axle. |
| 2 | Trail Axle Ahead R. Axle |
| | Measure and record the distance the trailer axle is from the trailer rear axle. A negative number indicates that the trail axle is behind the rear axle. Only used for trailers. |
| 3 | Trail Hitch Ahead R. Axle |
| | Measure and record the distance of the trailer hitch on the rear of the first trailer from the rear axle of the trailer. A negative number indicates that the trail hitch is behind the rear axle. Only used for double trailers. |
| 4 | Trail 2 Axle Ahead R. Axle |
| | Measure and record the distance the trail 2 axle is from the rear axle of the tractor. A negative number indicates that the trail 2 axle is behind the rear axle. Only used for double trailers. |

Table 16: ISO Look Ahead

| Line | Line Title |
|------|---|
| | Description |
| 1 | ON Look Ahead Time |
| | The time prior to entering a not applied area that a nozzle will turn on. |

| Line | Line Title |
|------|---|
| | Description |
| 2 | OFF Look Ahead Time |
| | The time prior to entering an applied area that a nozzle will turn off. |

Table 17: CapMod Overlap

| Line | Line Title |
|------|---|
| | Description |
| 1 | Overlap Distance R/L |
| | The right/left overlap is the extra distance that will be sprayed perpendicular to the boom. |
| 2 | Overlap Distance Fwd |
| | Extra distance that will be sprayed in the forward direction. |
| 3 | Overlap Distance Bwd |
| | Extra distance that will be sprayed in the rearward direction. |
| 4 | Boundary Dist. R/L |
| | The right/left overlap is the extra distance that will be sprayed perpendicular to the boom at boundaries. |
| 5 | Boundary Dist. Fwd |
| | Extra distance that will be sprayed in the forward direction at boundaries. |
| 6 | Boundary Dist. Bwd |
| | Extra distance that will be sprayed in the rearward direction at boundaries. |
| 7 | Overlap Rate |
| | The % rate that will be applied in the extra distance that is overlapped. |
| 8 | Look Ahead Time |
| | This is used to account for system delays. It affects the on/off performance. If extra overlap is desired adjust the overlap distances. |

Table 18: GPS

| Line | Line Title |
|------|--|
| | Description |
| 1 | GPS Ahead Read Axle |
| | Measure and record the distance from the GPS to the rear axle. |
| 2 | GPS Right of Center |
| | Measure and record the distance from the GPS to the center of the machine. |
| 3 | GPS Height from Ground |
| | Measure and record the distance from GPS to the ground. |
| 4 | GPS Used |
| | The type of GPS the machine and system are using. |

Table 19: Compass

| Line | Line Title |
|------|---|
| | Description |
| 1 | Compass Enable |
| | Must have GPS signal to calibrate the compass. |
| 2 | Compass Calibration |
| | Follow the on screen instructions for calibration. |
| 3 | Compass Heading |
| | The compass heading should approximately line up with the direction that the machine is facing |
| 4 | Compass Offset |
| | This value is used after calibrating the 3-dimensional compass to correlate the chassis with the hub. |

Table 20: Gyro

| Line | Line Title |
|------|--|
| | Description |
| 1 | Gyro |
| | The gyro is used to aid turn compensation. It can be disabled if it is malfunctioning. |
| 2 | Contour |
| | Turn compensation has a deadband to prevent slight turns from affecting application. Enable contour if you are spraying contours and would like to disable the deadband. |

Initial Setup Settings Descriptions

Table 21: Configuration

| Line | Line Title | |
|------|--|---|
| | Description | |
| 1 | Task Controller Mode | |
| | Select the rate control mode for your system: | |
| | External Rate | Rate and sections are controlled by an external rate controller. |
| | Internal Rate | The PinPoint III™ system controls rate, sections are externally controlled. |
| | ISO | The task controller supplies the target rate and section control up to individual nozzle control. The PinPoint III system controls the rate. |
| 2 | Fluid Control Mode | |
| | Select the fluid control mode for your system: | |
| | Synchro | External Rate mode: the rate controller controls the nozzles and the PinPoint III™ system controls the pump to a target pressure. Internal Rate or ISO mode: the PinPoint III system controls the nozzles and the pump. |
| | No Pulse Mode | The PinPoint III valves are used for on/off functions. Rate is controlled by pressure. |
| | Conventional | Used with no VCMs or pulsing valves. PinPoint III serves as the rate controller. |

| Line | Line Title | |
|------|--|--|
| | Description | |
| 3 | Product Mode | |
| | Single | One product is applied. |
| | Boost | One product is applied with two valves at each location. |
| | Dual | Two products are applied. |
| 4 | Master Switch Source | |
| | None | There is no master switch connected to the CapstanAG system. |
| | External | The master switch is wired to the hub. |
| | On-Screen | The master switch is shown on the VT display. |
| 5 | Boom Switch Source | |
| | None | There is no boom switch connected to the system. Use this setting for CAN boom switches. |
| | External | The boom switches are wired to the Gateway hub. |
| 6 | Master Switch Input | |
| | This setting allows for different polarity switches. | |
| 7 | VT Update Rate | |
| | VT Update rate can be lowered for a virtual terminal (VT) that cannot handle enough data. | |
| 8 | Display Smoothing | |
| | Actual rate and pressure are shown as on target if within 10%. | |
| 9 | Nozzle Spacing | |
| | The default nozzle spacing is provided by the VCMs. This setting overrides any default set elsewhere. | |
| 10 | Total Number of Nozzles | |
| | Displays the current number of nozzles detected by the PinPoint III. | |
| 11 | Factory Reset | |
| | Resets the entire system to factory defaults | |
| 12 | Maximum TC Sections | |
| | This settings limits the maximum number of Task Controller (TC) sections. The actual number of sections is automatically configured by the task controller and the system. | |
| 13 | Selected VT | |
| | If multiple virtual terminals (VT) are present, select the desired VT. | |
| 14 | Selected TC | |
| | If multiple task controllers (TC) are present, select the desired TC. | |
| 15 | Aux Boom Configuration | |
| | Some machines have pre-configured auxiliary booms. If a configuration matches your machine, select it here. | |
| 16 | Software Restart | |
| | Restarts the PinPoint™ system. | |

| Line | Line Title |
|------|---|
| | Description |
| 17 | Machine Configuration |
| | Configurations can be saved and retrieved. |
| 18 | Fill Station |
| | Only used on Case machine pump control. |
| 19 | Language |
| | Sets language of the PinPoint III VT. English is currently the only supported language. |
| 20 | Units (Pressure) |
| | Toggles the default pressure units in the PinPoint III VT |

Table 22: VCM Setup

| VCM Setup |
|--|
| Use this screen to edit VCM information. For more information, refer to VCM (Geometry) Setup Procedure |

US Measurement Nozzle Speed Ranges
Nozzle Spacing—15 in

| Tip Size | Gauge (PSI) | 3 GPA | | | | 5 GPA | | | | 8 GPA | | | | 10 GPA | | | | 12 GPA | | | | 15 GPA | | | | 20 GPA | | | |
|---------------|-------------|-------|-----|-----|------|-------|-----|-----|------|-------|-----|-----|------|--------|-----|-----|------|--------|-----|-----|------|--------|-----|-----|------|--------|-----|-----|------|
| | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | |
| | | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% |
| 0.1 GPM #1 | 20 | 2 | 5 | 7 | 9 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 3 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 2 | 0 | 1 | 1 | 2 | 0 | 1 | 1 | 1 |
| | 30 | 3 | 6 | 9 | 11 | 2 | 3 | 5 | 7 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 3 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 2 | 0 | 1 | 1 | 2 |
| | 40 | 3 | 7 | 10 | 13 | 2 | 4 | 6 | 8 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 | 1 | 1 | 2 | 3 | 0 | 1 | 1 | 2 |
| | 50 | 4 | 7 | 11 | 15 | 2 | 4 | 7 | 9 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 2 |
| | 60 | 4 | 8 | 12 | 16 | 2 | 5 | 7 | 10 | 2 | 3 | 5 | 6 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 | 1 | 1 | 2 | 2 |
| 70 | 4 | 9 | 13 | 17 | 3 | 5 | 8 | 10 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 3 | 1 | 1 | 2 | 3 | |
| 0.15 GPM #1.5 | 20 | 3 | 7 | 10 | 14 | 2 | 4 | 6 | 8 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 3 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 2 |
| | 30 | 4 | 9 | 13 | 17 | 3 | 5 | 8 | 10 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 3 | 1 | 1 | 2 | 3 |
| | 40 | 5 | 10 | 15 | 20 | 3 | 6 | 9 | 12 | 2 | 4 | 6 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 1 | 2 | 3 |
| | 50 | 6 | 11 | 17 | 22 | 3 | 7 | 10 | 13 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 |
| | 60 | 6 | 12 | 18 | 24 | 4 | 7 | 11 | 14 | 2 | 5 | 7 | 9 | 2 | 4 | 5 | 7 | 2 | 3 | 5 | 6 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 |
| 70 | 7 | 13 | 20 | 26 | 4 | 8 | 12 | 16 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | |
| 0.2 GPM #2 | 20 | 5 | 9 | 14 | 19 | 3 | 6 | 8 | 11 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 4 | 1 | 1 | 2 | 3 |
| | 30 | 6 | 11 | 17 | 23 | 3 | 7 | 10 | 14 | 2 | 4 | 6 | 9 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 3 |
| | 40 | 7 | 13 | 20 | 26 | 4 | 8 | 12 | 16 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| | 50 | 7 | 15 | 22 | 29 | 4 | 9 | 13 | 18 | 3 | 5 | 8 | 11 | 2 | 4 | 7 | 9 | 2 | 4 | 5 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 4 |
| | 60 | | | | | 5 | 10 | 14 | 19 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 6 | 1 | 2 | 4 | 5 |
| 70 | | | | | 5 | 10 | 16 | 21 | 3 | 6 | 10 | 13 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 9 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 5 | |
| 0.25 GPM #2.5 | 20 | 6 | 12 | 17 | 23 | 3 | 7 | 10 | 14 | 2 | 4 | 6 | 9 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 3 |
| | 30 | 7 | 14 | 21 | 28 | 4 | 8 | 13 | 17 | 3 | 5 | 8 | 11 | 2 | 4 | 6 | 8 | 2 | 4 | 5 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 4 |
| | 40 | | | | | 5 | 10 | 15 | 20 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 2 | 4 | 5 |
| | 50 | | | | | 5 | 11 | 16 | 22 | 3 | 7 | 10 | 14 | 3 | 5 | 8 | 11 | 2 | 5 | 7 | 9 | 2 | 4 | 5 | 7 | 1 | 3 | 4 | 5 |
| | 60 | | | | | 6 | 12 | 18 | 24 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 1 | 3 | 4 | 6 |
| 70 | | | | | 6 | 13 | 19 | 26 | 4 | 8 | 12 | 16 | 3 | 6 | 10 | 13 | 3 | 5 | 8 | 11 | 2 | 4 | 6 | 9 | 2 | 3 | 5 | 6 | |
| 0.3 GPM #3 | 20 | 7 | 14 | 21 | 27 | 4 | 8 | 12 | 16 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| | 30 | | | | | 5 | 10 | 15 | 20 | 3 | 6 | 9 | 13 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 5 |
| | 40 | | | | | 6 | 12 | 17 | 23 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 1 | 3 | 4 | 6 |
| | 50 | | | | | 7 | 13 | 20 | 26 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 13 | 3 | 5 | 8 | 11 | 2 | 4 | 7 | 9 | 2 | 3 | 5 | 7 |
| | 60 | | | | | 7 | 14 | 21 | 29 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 14 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 5 | 7 |
| 70 | | | | | 5 | 10 | 14 | 19 | 4 | 8 | 12 | 15 | 4 | 8 | 12 | 15 | 3 | 6 | 10 | 13 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 | |
| 0.4 GPM #4 | 20 | | | | | 5 | 11 | 16 | 22 | 3 | 7 | 10 | 14 | 3 | 5 | 8 | 11 | 2 | 5 | 7 | 9 | 2 | 4 | 5 | 7 | 1 | 3 | 4 | 5 |
| | 30 | | | | | 7 | 13 | 20 | 27 | 4 | 8 | 12 | 17 | 3 | 7 | 10 | 13 | 3 | 6 | 8 | 11 | 2 | 4 | 7 | 9 | 2 | 3 | 5 | 7 |
| | 40 | | | | | | | | | 5 | 10 | 14 | 19 | 4 | 8 | 12 | 15 | 3 | 6 | 10 | 13 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 |
| | 50 | | | | | | | | | 5 | 11 | 16 | 21 | 4 | 9 | 13 | 17 | 4 | 7 | 11 | 14 | 3 | 6 | 9 | 11 | 2 | 4 | 6 | 9 |
| | 60 | | | | | | | | | 6 | 12 | 18 | 23 | 5 | 9 | 14 | 19 | 4 | 8 | 12 | 16 | 3 | 6 | 9 | 13 | 2 | 5 | 7 | 9 |
| 70 | | | | | | | | | 6 | 13 | 19 | 25 | 5 | 10 | 15 | 20 | 4 | 8 | 13 | 17 | 3 | 7 | 10 | 14 | 3 | 5 | 8 | 10 | |
| 0.5 GPM #5 | 20 | | | | | 7 | 13 | 20 | 27 | 4 | 8 | 12 | 17 | 3 | 7 | 10 | 13 | 3 | 6 | 8 | 11 | 2 | 4 | 7 | 9 | 2 | 3 | 5 | 7 |
| | 30 | | | | | | | | | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 14 | 3 | 5 | 8 | 11 | 2 | 4 | 6 | 8 |
| | 40 | | | | | | | | | 6 | 12 | 18 | 24 | 5 | 9 | 14 | 19 | 4 | 8 | 12 | 16 | 3 | 6 | 9 | 13 | 2 | 5 | 7 | 9 |
| | 50 | | | | | | | | | 7 | 13 | 20 | 26 | 5 | 11 | 16 | 21 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 14 | 3 | 5 | 8 | 11 |
| | 60 | | | | | | | | | 7 | 14 | 22 | 29 | 6 | 12 | 17 | 23 | 5 | 10 | 14 | 19 | 4 | 8 | 12 | 15 | 3 | 6 | 9 | 12 |
| 70 | | | | | | | | | 6 | 12 | 19 | 25 | 6 | 12 | 19 | 25 | 5 | 10 | 16 | 21 | 4 | 8 | 12 | 17 | 3 | 6 | 9 | 12 | |

Figure 35: Speed Range (MPH) - 15" Nozzle Spacing

| Tip Size | Gauge (PSI) | 3 GPA | | | | 5 GPA | | | | 8 GPA | | | | 10 GPA | | | | 12 GPA | | | | 15 GPA | | | | 20 GPA | | | |
|----------------|-------------|-------|-----|-----|------|-------|-----|-----|------|-------|-----|-----|------|--------|-----|-----|------|--------|-----|-----|------|--------|-----|-----|------|--------|-----|-----|------|
| | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | |
| | | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% |
| 0.6 GPM #6 | 20 | | | | | | | | | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 13 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 |
| | 30 | | | | | | | | | 6 | 12 | 18 | 24 | 5 | 10 | 14 | 19 | 4 | 8 | 12 | 16 | 3 | 6 | 10 | 13 | 2 | 5 | 7 | 10 |
| | 40 | | | | | | | | | 7 | 14 | 21 | 28 | 6 | 11 | 17 | 22 | 5 | 9 | 14 | 18 | 4 | 7 | 11 | 15 | 3 | 6 | 8 | 11 |
| | 50 | | | | | | | | | | | | | 6 | 12 | 19 | 25 | 5 | 10 | 15 | 21 | 4 | 8 | 12 | 17 | 3 | 6 | 9 | 12 |
| | 60 | | | | | | | | | | | | | 7 | 14 | 20 | 27 | 6 | 11 | 17 | 23 | 5 | 9 | 14 | 18 | 3 | 7 | 10 | 14 |
| 70 | | | | | | | | | | | | | 7 | 15 | 22 | 29 | 6 | 12 | 18 | 24 | 5 | 10 | 15 | 20 | 4 | 7 | 11 | 15 | |
| 0.8 GPM #8 | 20 | | | | | | | | | 6 | 12 | 19 | 25 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 17 | 3 | 7 | 10 | 13 | 2 | 5 | 7 | 10 |
| | 30 | | | | | | | | | 8 | 15 | 23 | 30 | 6 | 12 | 18 | 24 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 16 | 3 | 6 | 9 | 12 |
| | 40 | | | | | | | | | | | | | 7 | 14 | 21 | 28 | 6 | 12 | 18 | 23 | 5 | 9 | 14 | 19 | 4 | 7 | 11 | 14 |
| | 50 | | | | | | | | | | | | | | | | | 7 | 13 | 20 | 26 | 5 | 10 | 16 | 21 | 4 | 8 | 12 | 16 |
| | 60 | | | | | | | | | | | | | | | | | 7 | 14 | 22 | 29 | 6 | 11 | 17 | 23 | 4 | 9 | 13 | 17 |
| 70 | | | | | | | | | | | | | | | | | 6 | 12 | 19 | 25 | 5 | 9 | 14 | 19 | | | | | |
| 1.0 GPM #10 | 20 | | | | | | | | | 7 | 15 | 22 | 29 | 6 | 12 | 18 | 24 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 16 | 3 | 6 | 9 | 12 |
| | 30 | | | | | | | | | | | | | 7 | 14 | 22 | 29 | 6 | 12 | 18 | 24 | 5 | 10 | 14 | 19 | 4 | 7 | 11 | 14 |
| | 40 | | | | | | | | | | | | | | | | | 7 | 14 | 21 | 28 | 6 | 11 | 17 | 22 | 4 | 8 | 12 | 17 |
| | 50 | | | | | | | | | | | | | | | | | | | | | 6 | 12 | 19 | 25 | 5 | 9 | 14 | 19 |
| | 60 | | | | | | | | | | | | | | | | | | | | | 7 | 14 | 20 | 27 | 5 | 10 | 15 | 20 |
| 70 | | | | | | | | | | | | | | | | | | | | | 7 | 15 | 22 | 29 | 6 | 11 | 17 | 22 | |
| 1.2 GPM #12 | 20 | | | | | | | | | | | | | | | | | 6 | 11 | 17 | 22 | 4 | 9 | 13 | 18 | 3 | 7 | 10 | 13 |
| | 30 | | | | | | | | | | | | | | | | | 7 | 14 | 20 | 27 | 5 | 11 | 16 | 22 | 4 | 8 | 12 | 16 |
| | 40 | | | | | | | | | | | | | | | | | | | | | 6 | 13 | 19 | 25 | 5 | 9 | 14 | 19 |
| | 50 | | | | | | | | | | | | | | | | | | | | | 7 | 14 | 21 | 28 | 5 | 11 | 16 | 21 |
| | 60 | | | | | | | | | | | | | | | | | | | | | | | | | 6 | 12 | 17 | 23 |
| 70 | | | | | | | | | | | | | | | | | | | | | | | | | 6 | 12 | 19 | 25 | |
| 1.25 GPM #12.5 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 GPM #15 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Figure 36: Speed Range (MPH) - 15" Nozzle Spacing (cont'd)

Nozzle Spacing - 20 in

| Tip Size | Gauge (PSI) | 3 GPA | | | | 5 GPA | | | | 8 GPA | | | | 10 GPA | | | | 12 GPA | | | | 15 GPA | | | | 20 GPA | | | | | | | |
|---------------|-------------|-------|-----|-----|------|-------|-----|-----|------|-------|-----|-----|------|--------|-----|-----|------|--------|-----|-----|------|--------|-----|-----|------|--------|-----|-----|------|---|---|---|---|
| | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | | | | |
| | | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | | | | |
| 0.1 GPM #1 | 20 | 2 | 3 | 5 | 7 | 1 | 2 | 3 | 4 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 2 | 0 | 1 | 1 | 2 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| | 30 | 2 | 4 | 6 | 9 | 1 | 3 | 4 | 5 | 1 | 2 | 2 | 3 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 2 | 0 | 1 | 1 | 2 | 0 | 1 | 1 | 1 | | | | |
| | 40 | 2 | 5 | 7 | 10 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 4 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 2 | 0 | 1 | 1 | 2 | 0 | 1 | 1 | 1 | | | | |
| | 50 | 3 | 6 | 8 | 11 | 2 | 3 | 5 | 7 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 2 | 0 | 1 | 1 | 2 | | | | |
| | 60 | 3 | 6 | 9 | 12 | 2 | 4 | 5 | 7 | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 | 1 | 1 | 2 | 2 | 0 | 1 | 1 | 2 | | | | |
| 70 | 3 | 7 | 10 | 13 | 2 | 4 | 6 | 8 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 | 1 | 1 | 2 | 3 | 0 | 1 | 1 | 2 | | | | | |
| 0.15 GPM #1.5 | 20 | 3 | 5 | 8 | 10 | 2 | 3 | 5 | 6 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 2 | 0 | 1 | 1 | 2 | | | | |
| | 30 | 3 | 6 | 10 | 13 | 2 | 4 | 6 | 8 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 | 1 | 1 | 2 | 3 | 0 | 1 | 1 | 2 | | | | |
| | 40 | 4 | 7 | 11 | 15 | 2 | 4 | 7 | 9 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 2 | | | | |
| | 50 | 4 | 8 | 12 | 17 | 2 | 5 | 7 | 10 | 2 | 3 | 5 | 6 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 | 1 | 1 | 2 | 2 | | | | |
| | 60 | 5 | 9 | 14 | 18 | 3 | 5 | 8 | 11 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 4 | 1 | 1 | 2 | 3 | | | | |
| 70 | 5 | 10 | 15 | 20 | 3 | 6 | 9 | 12 | 2 | 4 | 5 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 1 | 2 | 3 | | | | | |
| 0.2 GPM #2 | 20 | 3 | 7 | 10 | 14 | 2 | 4 | 6 | 8 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 3 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 2 | | | | |
| | 30 | 4 | 9 | 13 | 17 | 3 | 5 | 8 | 10 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 3 | 1 | 1 | 2 | 3 | | | | |
| | 40 | 5 | 10 | 15 | 20 | 3 | 6 | 9 | 12 | 2 | 4 | 6 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 1 | 2 | 3 | | | | |
| | 50 | 5 | 11 | 16 | 22 | 3 | 7 | 10 | 13 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 | | | | |
| | 60 | 6 | 12 | 18 | 24 | 4 | 7 | 11 | 14 | 2 | 5 | 7 | 9 | 2 | 4 | 5 | 7 | 2 | 3 | 5 | 6 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 | | | | |
| 70 | 6 | 13 | 19 | 26 | 4 | 8 | 12 | 16 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | | | | | |
| 0.25 GPM #2.5 | 20 | 4 | 9 | 13 | 17 | 3 | 5 | 8 | 10 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 3 | 1 | 1 | 2 | 3 | | | | |
| | 30 | 5 | 11 | 16 | 21 | 3 | 6 | 10 | 13 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 | | | | |
| | 40 | 6 | 12 | 18 | 24 | 4 | 7 | 11 | 15 | 2 | 5 | 7 | 9 | 2 | 4 | 5 | 7 | 2 | 3 | 5 | 6 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 | | | | |
| | 50 | 7 | 14 | 20 | 27 | 4 | 8 | 12 | 16 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | | | | |
| | 60 | 7 | 15 | 22 | 30 | 4 | 9 | 13 | 18 | 3 | 6 | 8 | 11 | 2 | 4 | 7 | 9 | 2 | 4 | 6 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 4 | | | | |
| 70 | | 5 | 10 | 15 | 19 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 6 | 2 | 3 | 5 | 6 | 1 | 2 | 4 | 5 | | | | |
| 0.3 GPM #3 | 20 | 5 | 10 | 15 | 21 | 3 | 6 | 9 | 12 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 | | | | |
| | 30 | 6 | 13 | 19 | 25 | 4 | 8 | 11 | 15 | 2 | 5 | 7 | 9 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | | | | |
| | 40 | 7 | 15 | 22 | 29 | 4 | 9 | 13 | 17 | 3 | 5 | 8 | 11 | 2 | 4 | 7 | 9 | 2 | 4 | 5 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 4 | | | | |
| | 50 | | 5 | 10 | 15 | 20 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 2 | 4 | 5 | 1 | 2 | 4 | 5 | | | |
| | 60 | | 5 | 11 | 16 | 21 | 3 | 7 | 10 | 13 | 3 | 5 | 8 | 11 | 2 | 4 | 7 | 9 | 2 | 4 | 5 | 7 | 2 | 4 | 5 | 7 | 1 | 3 | 4 | 5 | | | |
| 70 | | 6 | 12 | 17 | 23 | 4 | 7 | 11 | 14 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 4 | 6 | 8 | 1 | 3 | 4 | 6 | | | | |
| 0.4 GPM #4 | 20 | 7 | 14 | 20 | 27 | 4 | 8 | 12 | 16 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | | | | |
| | 30 | | 5 | 10 | 15 | 20 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 2 | 3 | 5 | 7 | 1 | 2 | 4 | 5 | | | |
| | 40 | | 6 | 12 | 17 | 23 | 4 | 7 | 11 | 14 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 4 | 6 | 8 | 1 | 3 | 4 | 6 | | | |
| | 50 | | 6 | 13 | 19 | 26 | 4 | 8 | 12 | 16 | 3 | 6 | 10 | 13 | 3 | 5 | 8 | 11 | 2 | 4 | 6 | 9 | 2 | 4 | 6 | 9 | 2 | 3 | 5 | 6 | | | |
| | 60 | | 7 | 14 | 21 | 28 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 14 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 9 | 2 | 5 | 7 | 9 | 2 | 4 | 5 | 7 | | | |
| 70 | | 8 | 15 | 23 | 30 | 5 | 10 | 14 | 19 | 4 | 8 | 11 | 15 | 4 | 7 | 11 | 14 | 3 | 6 | 10 | 13 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 | | | | |
| 0.5 GPM #5 | 20 | | 5 | 10 | 15 | 20 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 2 | 4 | 5 | 1 | 2 | 4 | 5 | | | |
| | 30 | | 6 | 12 | 18 | 24 | 4 | 8 | 11 | 15 | 3 | 6 | 9 | 12 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 6 | | | |
| | 40 | | 7 | 14 | 21 | 28 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 14 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 9 | 2 | 5 | 7 | 9 | 2 | 4 | 5 | 7 | | | |
| | 50 | | 5 | 10 | 15 | 20 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 2 | 4 | 5 | 2 | 4 | 6 | 8 | | | |
| | 60 | | 5 | 11 | 16 | 22 | 3 | 7 | 10 | 13 | 3 | 6 | 9 | 12 | 2 | 4 | 7 | 9 | 2 | 4 | 5 | 7 | 2 | 4 | 5 | 7 | 2 | 4 | 6 | 9 | | | |
| 70 | | 6 | 12 | 18 | 23 | 4 | 8 | 11 | 14 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 4 | 6 | 8 | 2 | 5 | 7 | 9 | | | | |

Figure 37: Speed Range (MPH) - 20" Nozzle Spacing

| Tip Size | Gauge (PSI) | 3 GPA | | | | 5 GPA | | | | 8 GPA | | | | 10 GPA | | | | 12 GPA | | | | 15 GPA | | | | 20 GPA | | | |
|----------------|-------------|-------|-----|-----|------|-------|-----|-----|------|-------|-----|-----|------|--------|-----|-----|------|--------|-----|-----|------|--------|-----|-----|------|--------|-----|-----|------|
| | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | |
| | | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% |
| 0.6 GPM #6 | 20 | | | | | 6 | 12 | 18 | 24 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 1 | 3 | 4 | 6 |
| | 30 | | | | | 7 | 14 | 22 | 29 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 14 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 5 | 7 |
| | 40 | | | | | | | | | 5 | 10 | 16 | 21 | 4 | 8 | 12 | 17 | 3 | 7 | 10 | 14 | 3 | 6 | 8 | 11 | 2 | 4 | 6 | 8 |
| | 50 | | | | | | | | | 6 | 12 | 17 | 23 | 5 | 9 | 14 | 19 | 4 | 8 | 12 | 15 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 9 |
| | 60 | | | | | | | | | 6 | 13 | 19 | 25 | 5 | 10 | 15 | 20 | 4 | 8 | 13 | 17 | 3 | 7 | 10 | 14 | 3 | 5 | 8 | 10 |
| 70 | | | | | | | | | 7 | 14 | 21 | 27 | 5 | 11 | 16 | 22 | 5 | 9 | 14 | 18 | 4 | 7 | 11 | 15 | 3 | 5 | 8 | 11 | |
| 0.8 GPM #8 | 20 | | | | | 7 | 15 | 22 | 30 | 5 | 9 | 14 | 19 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 7 |
| | 30 | | | | | | | | | 6 | 11 | 17 | 23 | 5 | 9 | 14 | 18 | 4 | 8 | 11 | 15 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 9 |
| | 40 | | | | | | | | | 7 | 13 | 20 | 26 | 5 | 11 | 16 | 21 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 14 | 3 | 5 | 8 | 11 |
| | 50 | | | | | | | | | 7 | 15 | 22 | 30 | 6 | 12 | 18 | 24 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 16 | 3 | 6 | 9 | 12 |
| | 60 | | | | | | | | | | | | | 6 | 13 | 19 | 26 | 5 | 11 | 16 | 22 | 4 | 9 | 13 | 17 | 3 | 6 | 10 | 13 |
| 70 | | | | | | | | | 7 | 14 | 21 | 28 | 6 | 12 | 17 | 23 | 5 | 9 | 14 | 19 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 14 | |
| 1.0 GPM #10 | 20 | | | | | | | | | 6 | 11 | 17 | 22 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 | 2 | 4 | 7 | 9 |
| | 30 | | | | | | | | | 7 | 14 | 20 | 27 | 5 | 11 | 16 | 22 | 5 | 9 | 14 | 18 | 4 | 7 | 11 | 14 | 3 | 5 | 8 | 11 |
| | 40 | | | | | | | | | | | | | 6 | 12 | 19 | 25 | 5 | 10 | 16 | 21 | 4 | 8 | 12 | 17 | 3 | 6 | 9 | 12 |
| | 50 | | | | | | | | | | | | | 7 | 14 | 21 | 28 | 6 | 12 | 17 | 23 | 5 | 9 | 14 | 19 | 3 | 7 | 10 | 14 |
| | 60 | | | | | | | | | | | | | 6 | 13 | 19 | 25 | 6 | 13 | 19 | 25 | 5 | 10 | 15 | 20 | 4 | 8 | 11 | 15 |
| 70 | | | | | | | | | | | | | 7 | 14 | 21 | 28 | 7 | 14 | 21 | 28 | 6 | 11 | 17 | 22 | 4 | 8 | 12 | 17 | |
| 1.2 GPM #12 | 20 | | | | | | | | | 6 | 12 | 19 | 25 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 17 | 3 | 7 | 10 | 13 | 2 | 5 | 7 | 10 |
| | 30 | | | | | | | | | | | | | 6 | 12 | 18 | 24 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 16 | 3 | 6 | 9 | 12 |
| | 40 | | | | | | | | | | | | | 7 | 14 | 21 | 28 | 6 | 12 | 18 | 23 | 5 | 9 | 14 | 19 | 4 | 7 | 11 | 14 |
| | 50 | | | | | | | | | | | | | | | | | 7 | 13 | 20 | 26 | 5 | 11 | 16 | 21 | 4 | 8 | 12 | 16 |
| | 60 | | | | | | | | | | | | | | | | | 7 | 14 | 22 | 29 | 6 | 12 | 17 | 23 | 4 | 9 | 13 | 17 |
| 70 | | | | | | | | | | | | | | | | | 6 | 12 | 19 | 25 | 6 | 12 | 19 | 25 | 5 | 9 | 14 | 19 | |
| 1.25 GPM #12.5 | 20 | | | | | | | | | 8 | 16 | 23 | 31 | 6 | 13 | 19 | 25 | 5 | 10 | 16 | 21 | 4 | 8 | 13 | 17 | 3 | 6 | 9 | 13 |
| | 30 | | | | | | | | | | | | | 7 | 14 | 22 | 29 | 6 | 12 | 18 | 24 | 5 | 10 | 14 | 19 | 4 | 7 | 11 | 14 |
| | 40 | | | | | | | | | | | | | | | | | 7 | 13 | 20 | 27 | 5 | 11 | 16 | 22 | 4 | 8 | 12 | 16 |
| | 50 | | | | | | | | | | | | | | | | | 7 | 15 | 22 | 29 | 6 | 12 | 18 | 24 | 4 | 9 | 13 | 18 |
| | 60 | | | | | | | | | | | | | | | | | | | | | 6 | 12 | 18 | 24 | 4 | 9 | 13 | 18 |
| 70 | | | | | | | | | | | | | | | | | | | | | 6 | 13 | 19 | 25 | 5 | 10 | 14 | 19 | |
| 1.5 GPM #15 | 20 | | | | | | | | | | | | | 7 | 14 | 21 | 28 | 6 | 12 | 17 | 23 | 5 | 9 | 14 | 18 | 3 | 7 | 10 | 14 |
| | 30 | | | | | | | | | | | | | | | | | 7 | 13 | 20 | 27 | 5 | 11 | 16 | 21 | 4 | 8 | 12 | 16 |
| | 40 | | | | | | | | | | | | | | | | | 7 | 15 | 22 | 30 | 6 | 12 | 18 | 24 | 4 | 9 | 13 | 18 |
| | 50 | | | | | | | | | | | | | | | | | | | | | 7 | 13 | 20 | 26 | 5 | 10 | 15 | 20 |
| | 60 | | | | | | | | | | | | | | | | | | | | | 7 | 13 | 20 | 26 | 5 | 10 | 15 | 20 |
| 70 | | | | | | | | | | | | | | | | | | | | | 7 | 14 | 21 | 28 | 5 | 11 | 16 | 21 | |

Figure 38: Speed Range (MPH) - 20" Nozzle Spacing (cont'd)

Blended Pulse™ Droplet Classification Table—US Measurements

| | | Extremely Fine (EF) | Very Fine (VF) | Fine (F) | Medium (M) | Coarse (C) | Very Coarse (VC) | Extremely Coarse (EC) | Ultra Coarse (UC) | | | | | | | | | | | | |
|--|-----------|---------------------|----------------|-----------|------------|------------|------------------|-----------------------|-------------------|-----------|-----------|----------|--------------|-----------|------------|-----------|-------------|---------------|-----------|-----------|----|
| | | <50 | 50 - 136 | 137-177 | 178-218 | 219-349 | 350-428 | 429-622 | >622 | | | | | | | | | | | | |
| ** Blanks cells represent nozzles either not available or below the manufacturers operating specifications | | | | | | | | | | | | | | | | | | | | | |
| ** Hypro and TeeJet droplet classifications below may not match manufacturers spec sheets. The chart below adjusts the droplet classification to be representative of the Actual Nozzle Pressure | | | | | | | | | | | | | | | | | | | | | |
| Tip Size | Gauge PSI | Nozzle PSI | Wilger | | | | Hypro | | | | | | TeeJet | | | | | | | | |
| | | | ER (110°) | SR (110°) | MR (110°) | DR (110°) | HF (140°) | GRD (120°) | LD (110°) | VP (110°) | TR (110°) | F (110°) | TTJ60 (110°) | XR (110°) | XRC (110°) | DG (110°) | TJ60 (110°) | DGTJ60 (110°) | TT (110°) | TP (110°) | |
| 0.1 GPM #1 | 20 | 20 | F | | | | | | | | | | | F | | | | | | C | |
| | 30 | 30 | F | | | | | | | | | | | F | F | | | | | M | F |
| | 40 | 40 | VF | | | | | | | | | | | F | F | | | | | M | F |
| | 50 | 50 | VF | | | | | | | | | | | F | F | | | | | M | F |
| | 60 | 60 | VF | | | | | | | | | | | VF | VF | | | | | F | VF |
| | 70 | 70 | VF | | | | | | | | | | | | | | | | | F | |
| 0.15 GPM #1.5 | 20 | 20 | F | | | | | | | | | | | F | | | | | | C | |
| | 30 | 30 | F | M | C | VC | | | | | | | | F | F | M | | F | M | F | |
| | 40 | 40 | F | M | C | C | | | | | | | | F | F | F | | F | M | F | |
| | 50 | 50 | VF | M | C | C | | | | | | | | F | F | F | | F | M | F | |
| | 60 | 59 | VF | M | C | C | | | | | | | | F | F | F | | F | F | F | |
| 0.2 GPM #2 | 20 | 20 | F | | | | | M | M | F | M | | | C | M | F | | | | VC | |
| | 30 | 30 | F | C | C | XC | | M | M | F | F | | | C | F | F | M | F | M | C | F |
| | 40 | 39 | F | M | C | VC | | M | M | F | F | | | M | F | F | M | VF | M | M | F |
| | 50 | 49 | F | M | C | VC | | M | M | F | F | | | M | F | F | M | VF | F | M | F |
| | 60 | 59 | F | M | C | C | | M | M | F | F | | | M | F | F | M | VF | F | M | F |
| | 70 | 69 | VF | M | C | C | | F | M | F | F | | | M | | | | | | F | |
| 0.25 GPM #2.5 | 20 | 19 | M | | | | | M | M | M | | | | VC | M | M | | | | VC | |
| | 30 | 29 | M | C | VC | XC | | M | M | F | | | | C | M | F | | | | C | |
| | 40 | 39 | M | C | C | VC | | M | M | F | | | | C | F | F | | | | M | |
| | 50 | 49 | F | M | C | VC | | M | M | F | | | | M | F | F | | | | M | |
| | 60 | 58 | F | M | C | VC | | M | M | F | | | | M | F | F | | | | M | |
| | 70 | 68 | F | M | C | C | | F | M | F | | | | M | | | | | | F | |
| 0.3 GPM #3 | 20 | 19 | M | | | | | M | C | M | M | | | VC | M | M | | | | VC | |
| | 30 | 29 | M | C | VC | XC | | M | C | F | M | | | C | M | F | C | F | M | C | F |
| | 40 | 39 | F | C | VC | XC | | M | M | F | F | | | C | F | F | M | F | M | C | F |
| | 50 | 48 | F | C | C | VC | | M | M | F | F | | | M | F | F | M | F | M | C | F |
| | 60 | 58 | F | C | C | VC | | M | M | F | F | | | M | F | F | M | F | F | M | F |
| | 70 | 67 | F | C | C | VC | | M | M | F | F | | | M | | | | | | M | |
| 0.4 GPM #4 | 20 | 19 | C | | | | | C | C | M | M | | | VC | M | M | | | | VC | |
| | 30 | 28 | C | C | VC | XC | | C | C | M | M | | | C | M | M | C | F | C | C | M |
| | 40 | 38 | M | C | VC | XC | | C | M | F | F | | | C | M | M | M | F | C | C | M |
| | 50 | 47 | M | C | VC | XC | | M | M | F | F | | | M | F | F | M | F | C | M | F |
| | 60 | 56 | M | C | C | VC | | M | M | F | F | | | M | F | F | M | F | M | M | F |
| | 70 | 66 | M | C | C | VC | | M | M | F | F | | | M | | | | | | M | |
| 0.5 GPM #5 | 20 | 18 | C | | | | | C | C | M | C | | | VC | M | M | | | | VC | |
| | 30 | 27 | C | VC | XC | XC | | C | C | M | M | | | C | M | M | C | M | | VC | M |
| | 40 | 36 | M | C | XC | XC | | C | C | F | F | | | C | M | M | C | M | | C | M |
| | 50 | 45 | M | C | XC | XC | | M | M | F | F | | | C | M | M | M | F | | C | F |
| | 60 | 54 | M | C | VC | XC | | M | M | F | F | | | C | F | F | M | F | | C | F |
| | 70 | 63 | M | C | VC | XC | | M | M | F | F | | | M | | | | | | M | |

Figure 39: Droplet Classification Table ASABE S-5572.1

| | | Extremely Fine (EF) | Very Fine (VF) | Fine (F) | Medium (M) | Coarse (C) | Very Coarse (VC) | Extremely Coarse (EC) | Ultra Coarse (UC) | | | | | | | | | | | |
|--|-----------|---------------------|----------------|-----------|------------|------------|------------------|-----------------------|-------------------|-----------|-----------|----------|--------------|-----------|------------|-----------|-------------|---------------|-----------|-----------|
| | | <50 | 50 - 136 | 137-177 | 178-218 | 219-349 | 350-428 | 429-622 | >622 | | | | | | | | | | | |
| ** Blanks cells represent nozzles either not available or below the manufacturers operating specifications | | | | | | | | | | | | | | | | | | | | |
| ** Hypro and TeeJet droplet classifications below may not match manufacturers spec sheets. The chart below adjusts the droplet classification to be representative of the Actual Nozzle Pressure | | | | | | | | | | | | | | | | | | | | |
| Tip Size | Gauge PSI | Nozzle PSI | Wilger | | | | Hypro | | | | | TeeJet | | | | | | | | |
| | | | ER (110°) | SR (110°) | MR (110°) | DR (110°) | HF (140°) | GRD (120°) | LD (110°) | VP (110°) | TR (110°) | F (110°) | TTJ60 (110°) | XR (110°) | XRC (110°) | DG (110°) | TJ60 (110°) | DGTJ60 (110°) | TT (110°) | TP (110°) |
| 0.6 GPM #6 | 20 | 17 | C | | | | | VC | VC | M | C | | VC | M | C | | | | VC | |
| | 30 | 26 | C | XC | XC | | | C | C | M | C | M | C | M | M | | M | C | VC | M |
| | 40 | 35 | C | VC | XC | XC | | C | C | M | M | M | C | M | M | | M | C | VC | M |
| | 50 | 43 | C | VC | XC | XC | | C | C | M | M | M | C | M | M | | F | C | VC | M |
| | 60 | 52 | C | C | XC | XC | | C | C | F | M | F | C | M | M | | F | C | C | M |
| 70 | 61 | C | C | VC | XC | | C | C | F | M | | M | | | | | | | C | |
| 0.8 GPM #8 | 20 | 16 | C | | | | | VC | VC | C | C | | VC | C | C | | | | VC | |
| | 30 | 24 | C | XC | XC | | VC | VC | VC | C | C | | VC | C | C | | M | C | VC | C |
| | 40 | 32 | C | XC | XC | XC | UC | C | C | M | C | M | VC | M | C | | M | C | VC | C |
| | 50 | 39 | C | VC | XC | XC | UC | C | C | M | M | M | C | M | M | | M | C | C | M |
| | 60 | 47 | C | VC | XC | XC | UC | C | C | M | M | M | C | M | M | | M | C | C | M |
| 70 | 55 | C | VC | XC | XC | UC | C | C | M | M | | C | | | | | | C | | |
| 1.0 GPM #10 | 20 | 14 | VC | | | | | | | | | | | | | | | | | |
| | 30 | 21 | VC | | | | UC | | | C | VC | | XC | C | C | | M | | UC | |
| | 40 | 28 | C | XC | XC | UC | UC | | | C | E | M | XC | C | C | | M | | XC | |
| | 50 | 35 | C | XC | XC | UC | UC | | | M | M | M | VC | C | C | | M | | XC | |
| | 60 | 42 | C | VC | XC | UC | UC | | | M | M | M | VC | M | M | | M | | VC | |
| 70 | 49 | C | VC | XC | XC | UC | | | M | M | | VC | | | | | | VC | | |
| 1.2 GPM #12 | 20 | 12 | | | | | | | | | | | | | | | | | | |
| | 30 | 18 | | | | | | | | | | | | | | | | | UC | |
| | 40 | 24 | | | | | | | | | | | | | | | | | UC | |
| | 50 | 30 | | | | | | | | | | | | | | | | | XC | |
| | 60 | 36 | | | | | | | | | | | | | | | | | VC | |
| 70 | 42 | | | | | | | | | | | | | | | | | VC | | |
| 1.25 GPM #12.5 | 20 | 12 | XC | | | | | | | | | | | | | | | | | |
| | 30 | 18 | XC | | | | | | | | | | | | | | | | | |
| | 40 | 24 | VC | XC | UC | | | | | | | | | | | | | | | |
| | 50 | 30 | VC | XC | UC | UC | | | | | | | | | | | | | | |
| | 60 | 36 | VC | XC | XC | UC | | | | | | | | | | | | | | |
| 70 | 42 | C | VC | XC | XC | | | | | | | | | | | | | | | |
| 1.5 GPM #15 | 20 | 10 | XC | | | | | | | | | | | | | | | | | |
| | 30 | 15 | XC | | | | | | | | | | | | | | | | | |
| | 40 | 21 | XC | | | | | | | | | | | | | | | | | |
| | 50 | 26 | VC | XC | UC | | | | | | | | | | | | | | | |
| | 60 | 31 | VC | XC | XC | UC | UC | | | | | | | | | | | | | |
| 70 | 36 | VC | XC | XC | UC | UC | | | | | | | | | | | | | | |

Figure 40: Droplet Classification Table ASABE S-5572.1 (cont'd)

Nozzle Speed Ranges

Metric Nozzle Speed Ranges

Nozzle Spacing—38 cm

| Tip Size | Gauge (kPa) | 30 l/ha | | | | 50 l/ha | | | | 60 l/ha | | | | 70 l/ha | | | | 80 l/ha | | | | 100 l/ha | | | | 120 l/ha | | | | | | | |
|---------------|-------------|---------|-----|-----|------|---------|-----|-----|------|---------|-----|-----|------|---------|-----|-----|------|---------|-----|-----|------|----------|-----|-----|------|----------|-----|-----|------|---|----|----|----|
| | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | | | | |
| | | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | | | | |
| 0.1 GPM #1 | 138 | 4 | 7 | 11 | 14 | 2 | 4 | 6 | 8 | 2 | 4 | 5 | 7 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| | 207 | 4 | 9 | 13 | 17 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 9 | 2 | 4 | 6 | 7 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| | 276 | 5 | 10 | 15 | 20 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 9 | 2 | 4 | 6 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 4 | 5 | 1 | 3 | 4 | 6 |
| | 345 | 6 | 11 | 17 | 22 | 3 | 7 | 10 | 13 | 3 | 6 | 8 | 11 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 6 | 1 | 3 | 4 | 6 |
| | 414 | 6 | 12 | 18 | 24 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 | 3 | 5 | 8 | 10 | 2 | 5 | 7 | 9 | 2 | 4 | 5 | 7 | 2 | 3 | 5 | 6 | 2 | 3 | 5 | 6 |
| | 483 | 7 | 13 | 20 | 26 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 13 | 3 | 6 | 8 | 11 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 2 | 3 | 5 | 7 |
| 0.15 GPM #1.5 | 138 | 5 | 11 | 16 | 21 | 3 | 6 | 9 | 13 | 3 | 5 | 8 | 11 | 2 | 5 | 7 | 9 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 | 1 | 3 | 4 | 5 |
| | 207 | 6 | 13 | 19 | 26 | 4 | 8 | 12 | 15 | 3 | 6 | 10 | 13 | 3 | 6 | 8 | 11 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 6 | 2 | 3 | 5 | 6 |
| | 276 | 7 | 15 | 22 | 30 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 15 | 3 | 6 | 10 | 13 | 3 | 6 | 8 | 11 | 2 | 4 | 7 | 9 | 2 | 4 | 6 | 7 | 2 | 4 | 6 | 7 |
| | 345 | 8 | 17 | 25 | 33 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 17 | 4 | 7 | 11 | 14 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 4 | 6 | 8 |
| | 414 | 9 | 18 | 27 | 36 | 5 | 11 | 16 | 22 | 5 | 9 | 14 | 18 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 14 | 3 | 5 | 8 | 11 | 2 | 5 | 7 | 9 | 2 | 5 | 7 | 9 |
| | 483 | 10 | 20 | 30 | 39 | 6 | 12 | 18 | 24 | 5 | 10 | 15 | 20 | 4 | 8 | 13 | 17 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 5 | 7 | 10 |
| 0.2 GPM #2 | 138 | 7 | 14 | 21 | 28 | 4 | 8 | 13 | 17 | 3 | 7 | 10 | 14 | 3 | 6 | 9 | 12 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 2 | 3 | 5 | 7 |
| | 207 | 9 | 17 | 26 | 34 | 5 | 10 | 15 | 21 | 4 | 9 | 13 | 17 | 4 | 7 | 11 | 15 | 3 | 6 | 10 | 13 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 9 | 2 | 4 | 6 | 9 |
| | 276 | 10 | 20 | 30 | 40 | 6 | 12 | 18 | 24 | 5 | 10 | 15 | 20 | 4 | 8 | 13 | 17 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 5 | 7 | 10 |
| | 345 | 11 | 22 | 33 | 44 | 7 | 13 | 20 | 27 | 6 | 11 | 17 | 22 | 5 | 9 | 14 | 19 | 4 | 8 | 12 | 17 | 3 | 7 | 10 | 13 | 3 | 6 | 8 | 11 | 3 | 6 | 8 | 11 |
| | 414 | 12 | 24 | 36 | 48 | 7 | 15 | 22 | 29 | 6 | 12 | 18 | 24 | 5 | 10 | 16 | 21 | 5 | 9 | 14 | 18 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| | 483 | | | | | 8 | 16 | 24 | 31 | 7 | 13 | 20 | 26 | 6 | 11 | 17 | 22 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 13 | 3 | 7 | 10 | 13 |
| 0.25 GPM #2.5 | 138 | 9 | 17 | 26 | 35 | 5 | 10 | 16 | 21 | 4 | 9 | 13 | 17 | 4 | 7 | 11 | 15 | 3 | 7 | 10 | 13 | 3 | 5 | 8 | 10 | 2 | 4 | 7 | 9 | 2 | 4 | 7 | 9 |
| | 207 | 11 | 21 | 32 | 43 | 6 | 13 | 19 | 26 | 5 | 11 | 16 | 21 | 5 | 9 | 14 | 18 | 4 | 8 | 12 | 16 | 3 | 6 | 10 | 13 | 3 | 5 | 8 | 11 | 3 | 5 | 8 | 11 |
| | 276 | | | | | 7 | 15 | 22 | 30 | 6 | 12 | 18 | 25 | 5 | 11 | 16 | 21 | 5 | 9 | 14 | 18 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| | 345 | | | | | 8 | 16 | 25 | 33 | 7 | 14 | 21 | 27 | 6 | 12 | 18 | 24 | 5 | 10 | 15 | 21 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 14 | 3 | 7 | 10 | 14 |
| | 414 | | | | | 9 | 18 | 27 | 36 | 8 | 15 | 23 | 30 | 6 | 13 | 19 | 26 | 6 | 11 | 17 | 23 | 5 | 9 | 14 | 18 | 4 | 8 | 11 | 15 | 4 | 8 | 11 | 15 |
| | 483 | | | | | 10 | 20 | 29 | 39 | 8 | 16 | 24 | 33 | 7 | 14 | 21 | 28 | 6 | 12 | 18 | 24 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 16 | 4 | 8 | 12 | 16 |
| 0.3 GPM #3 | 138 | 10 | 21 | 31 | 41 | 6 | 12 | 19 | 25 | 5 | 10 | 16 | 21 | 4 | 9 | 13 | 18 | 4 | 8 | 12 | 16 | 3 | 6 | 9 | 12 | 3 | 5 | 8 | 10 | 3 | 5 | 8 | 10 |
| | 207 | | | | | 8 | 15 | 23 | 30 | 6 | 13 | 19 | 25 | 5 | 11 | 16 | 22 | 5 | 10 | 14 | 19 | 4 | 8 | 11 | 15 | 3 | 6 | 10 | 13 | 3 | 6 | 10 | 13 |
| | 276 | | | | | 9 | 18 | 26 | 35 | 7 | 15 | 22 | 29 | 6 | 13 | 19 | 25 | 6 | 11 | 17 | 22 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 15 | 4 | 7 | 11 | 15 |
| | 345 | | | | | 10 | 20 | 30 | 39 | 8 | 16 | 25 | 33 | 7 | 14 | 21 | 28 | 6 | 12 | 18 | 25 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 16 | 4 | 8 | 12 | 16 |
| | 414 | | | | | 11 | 22 | 32 | 43 | 9 | 18 | 27 | 36 | 8 | 15 | 23 | 31 | 7 | 13 | 20 | 27 | 5 | 11 | 16 | 22 | 4 | 9 | 13 | 18 | 4 | 9 | 13 | 18 |
| | 483 | | | | | 12 | 23 | 35 | 47 | 10 | 19 | 29 | 39 | 8 | 17 | 25 | 33 | 7 | 15 | 22 | 29 | 6 | 12 | 17 | 23 | 5 | 10 | 15 | 19 | 5 | 10 | 15 | 19 |
| 0.4 GPM #4 | 138 | | | | | 8 | 16 | 25 | 33 | 7 | 14 | 20 | 27 | 6 | 12 | 18 | 23 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 14 | 3 | 7 | 10 | 14 |
| | 207 | | | | | 10 | 20 | 30 | 40 | 8 | 17 | 25 | 33 | 7 | 14 | 21 | 29 | 6 | 13 | 19 | 25 | 5 | 10 | 15 | 20 | 4 | 8 | 13 | 17 | 4 | 8 | 13 | 17 |
| | 276 | | | | | 12 | 23 | 35 | 46 | 10 | 19 | 29 | 39 | 8 | 17 | 25 | 33 | 7 | 14 | 22 | 29 | 6 | 12 | 17 | 23 | 5 | 10 | 14 | 19 | 5 | 10 | 14 | 19 |
| | 345 | | | | | | | | | 11 | 22 | 32 | 43 | 9 | 18 | 28 | 37 | 8 | 16 | 24 | 32 | 6 | 13 | 19 | 26 | 5 | 11 | 16 | 22 | 5 | 11 | 16 | 22 |
| | 414 | | | | | | | | | 12 | 24 | 35 | 47 | 10 | 20 | 30 | 41 | 9 | 18 | 27 | 35 | 7 | 14 | 21 | 28 | 6 | 12 | 18 | 24 | 6 | 12 | 18 | 24 |
| | 483 | | | | | | | | | | | | | 11 | 22 | 33 | 44 | 10 | 19 | 29 | 38 | 8 | 15 | 23 | 31 | 6 | 13 | 19 | 26 | 6 | 13 | 19 | 26 |
| 0.5 GPM #5 | 138 | | | | | 10 | 20 | 30 | 40 | 8 | 17 | 25 | 34 | 7 | 14 | 22 | 29 | 6 | 13 | 19 | 25 | 5 | 10 | 15 | 20 | 4 | 8 | 13 | 17 | 4 | 8 | 13 | 17 |
| | 207 | | | | | | | | | 10 | 21 | 31 | 41 | 9 | 18 | 26 | 35 | 8 | 15 | 23 | 31 | 6 | 12 | 18 | 25 | 5 | 10 | 15 | 21 | 5 | 10 | 15 | 21 |
| | 276 | | | | | | | | | 12 | 24 | 36 | 47 | 10 | 20 | 30 | 41 | 9 | 18 | 27 | 36 | 7 | 14 | 21 | 28 | 6 | 12 | 18 | 24 | 6 | 12 | 18 | 24 |
| | 345 | | | | | | | | | | | | | 11 | 23 | 34 | 45 | 10 | 20 | 30 | 40 | 8 | 16 | 24 | 32 | 7 | 13 | 20 | 26 | 7 | 13 | 20 | 26 |
| | 414 | | | | | | | | | | | | | | | | | 11 | 22 | 33 | 44 | 9 | 17 | 26 | 35 | 7 | 15 | 22 | 29 | 7 | 15 | 22 | 29 |
| | 483 | | | | | | | | | | | | | | | | | 12 | 24 | 35 | 47 | 9 | 19 | 28 | 38 | 8 | 16 | 24 | 31 | 8 | 16 | 24 | 31 |

Figure 41: Speed Range (KPH) 38cm Nozzle Spacing

| Tip Size | Gauge (kPa) | 30 l/ha | | | | 50 l/ha | | | | 60 l/ha | | | | 70 l/ha | | | | 80 l/ha | | | | 100 l/ha | | | | 120 l/ha | | | |
|----------------|-------------|---------|-----|-----|------|---------|-----|-----|------|---------|-----|-----|------|---------|-----|-----|------|---------|-----|-----|------|----------|-----|-----|------|----------|-----|-----|------|
| | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | |
| | | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% |
| 0.6 GPM #6 | 138 | | | | | | | | | 10 | 20 | 30 | 39 | 8 | 17 | 25 | 34 | 7 | 15 | 22 | 30 | 6 | 12 | 18 | 24 | 5 | 10 | 15 | 20 |
| | 207 | | | | | | | | | 12 | 24 | 36 | 48 | 10 | 21 | 31 | 41 | 9 | 18 | 27 | 36 | 7 | 14 | 22 | 29 | 6 | 12 | 18 | 24 |
| | 276 | | | | | | | | | | | | | 12 | 24 | 36 | 48 | 10 | 21 | 31 | 42 | 8 | 17 | 25 | 33 | 7 | 14 | 21 | 28 |
| | 345 | | | | | | | | | | | | | | | | | 12 | 23 | 35 | 47 | 9 | 19 | 28 | 37 | 8 | 16 | 23 | 31 |
| | 414 | | | | | | | | | | | | | | | | | 10 | 20 | 31 | 41 | 10 | 20 | 31 | 41 | 9 | 17 | 26 | 34 |
| 483 | | | | | | | | | | | | | | | | | 11 | 22 | 33 | 44 | 11 | 22 | 33 | 44 | 9 | 18 | 28 | 37 | |
| 0.8 GPM #8 | 138 | | | | | | | | | | | | | 11 | 21 | 32 | 43 | 9 | 19 | 28 | 38 | 8 | 15 | 23 | 30 | 6 | 13 | 19 | 25 |
| | 207 | | | | | | | | | | | | | | | | | 11 | 23 | 34 | 46 | 9 | 18 | 28 | 37 | 8 | 15 | 23 | 31 |
| | 276 | | | | | | | | | | | | | | | | | | | | | 11 | 21 | 32 | 42 | 9 | 18 | 27 | 35 |
| | 345 | | | | | | | | | | | | | | | | | 12 | 24 | 36 | 48 | 10 | 20 | 30 | 40 | 10 | 20 | 30 | 40 |
| | 414 | | | | | | | | | | | | | | | | | | | | | 11 | 22 | 33 | 43 | 11 | 22 | 33 | 43 |
| 483 | | | | | | | | | | | | | | | | | | | | | 12 | 23 | 35 | 47 | 12 | 23 | 35 | 47 | |
| 1.0 GPM #10 | 138 | | | | | | | | | | | | | | | | | 11 | 22 | 33 | 44 | 9 | 18 | 27 | 36 | 7 | 15 | 22 | 30 |
| | 207 | | | | | | | | | | | | | | | | | | | | | 11 | 22 | 33 | 43 | 9 | 18 | 27 | 36 |
| | 276 | | | | | | | | | | | | | | | | | | | | | | | | | 10 | 21 | 31 | 42 |
| | 345 | | | | | | | | | | | | | | | | | | | | | | | | | 12 | 23 | 35 | 47 |
| | 414 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 483 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.2 GPM #12 | 138 | | | | | | | | | | | | | | | | | | | | | 10 | 20 | 30 | 40 | 8 | 17 | 25 | 33 |
| | 207 | | | | | | | | | | | | | | | | | | | | | | | | | 10 | 20 | 31 | 41 |
| | 276 | | | | | | | | | | | | | | | | | | | | | | | | | 12 | 24 | 35 | 47 |
| | 345 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 414 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 483 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.25 GPM #12.5 | 138 | | | | | | | | | | | | | | | | | | | | | | | | | 10 | 21 | 31 | 42 |
| | 207 | | | | | | | | | | | | | | | | | | | | | | | | | 12 | 24 | 36 | 48 |
| | 276 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 345 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 414 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 483 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 GPM #15 | 138 | | | | | | | | | | | | | | | | | | | | | | | | | 12 | 23 | 35 | 46 |
| | 207 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 276 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 345 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 414 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 483 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Figure 42: Speed Range (KPH) 38cm Nozzle Spacing (cont'd)

Nozzle Spacing - 50 cm

| Tip Size | Gauge (kPa) | 30 l/ha | | | | 50 l/ha | | | | 60 l/ha | | | | 70 l/ha | | | | 80 l/ha | | | | 100 l/ha | | | | 120 l/ha | | | |
|---------------|-------------|---------|-----|-----|------|---------|-----|-----|------|---------|-----|-----|------|---------|-----|-----|------|---------|-----|-----|------|----------|-----|-----|------|----------|-----|-----|------|
| | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | |
| | | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% |
| 0.1 GPM #1 | 138 | 3 | 5 | 8 | 11 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 | 1 | 1 | 2 | 3 |
| | 207 | 3 | 7 | 10 | 13 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 | 1 | 2 | 2 | 3 |
| | 276 | 4 | 8 | 11 | 15 | 2 | 5 | 7 | 9 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 4 |
| | 345 | 4 | 8 | 13 | 17 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 | 2 | 4 | 5 | 7 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| | 414 | 5 | 9 | 14 | 19 | 3 | 6 | 8 | 11 | 2 | 5 | 7 | 9 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 3 | 5 |
| | 483 | 5 | 10 | 15 | 20 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 9 | 2 | 4 | 6 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 4 | 5 |
| 0.15 GPM #1.5 | 138 | 4 | 8 | 12 | 16 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 4 | 5 | 1 | 2 | 3 | 4 |
| | 207 | 5 | 10 | 15 | 20 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 4 | 6 | 7 | 1 | 3 | 4 | 6 | 1 | 2 | 4 | 5 |
| | 276 | 6 | 11 | 17 | 23 | 3 | 7 | 10 | 14 | 3 | 6 | 8 | 11 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 | 1 | 3 | 4 | 6 |
| | 345 | 6 | 13 | 19 | 25 | 4 | 8 | 11 | 15 | 3 | 6 | 9 | 13 | 3 | 5 | 8 | 11 | 2 | 5 | 7 | 9 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 6 |
| | 414 | 7 | 14 | 21 | 28 | 4 | 8 | 12 | 17 | 3 | 7 | 10 | 14 | 3 | 6 | 9 | 12 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 |
| | 483 | 7 | 15 | 22 | 30 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 15 | 3 | 6 | 10 | 13 | 3 | 6 | 8 | 11 | 2 | 4 | 7 | 9 | 2 | 4 | 6 | 7 |
| 0.2 GPM #2 | 138 | 5 | 11 | 16 | 21 | 3 | 6 | 10 | 13 | 3 | 5 | 8 | 11 | 2 | 5 | 7 | 9 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 6 | 1 | 3 | 4 | 5 |
| | 207 | 7 | 13 | 20 | 26 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 13 | 3 | 6 | 8 | 11 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 |
| | 276 | 8 | 15 | 23 | 30 | 5 | 9 | 14 | 18 | 4 | 8 | 11 | 15 | 3 | 6 | 10 | 13 | 3 | 6 | 8 | 11 | 2 | 5 | 7 | 9 | 2 | 4 | 6 | 8 |
| | 345 | 8 | 17 | 25 | 34 | 5 | 10 | 15 | 20 | 4 | 8 | 13 | 17 | 4 | 7 | 11 | 14 | 3 | 6 | 9 | 13 | 3 | 5 | 8 | 10 | 2 | 4 | 6 | 8 |
| | 414 | 9 | 18 | 28 | 37 | 6 | 11 | 17 | 22 | 5 | 9 | 14 | 18 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 14 | 3 | 6 | 8 | 11 | 2 | 5 | 7 | 9 |
| | 483 | 10 | 20 | 30 | 40 | 6 | 12 | 18 | 24 | 5 | 10 | 15 | 20 | 4 | 9 | 13 | 17 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 |
| 0.25 GPM #2.5 | 138 | 7 | 13 | 20 | 26 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 13 | 3 | 6 | 8 | 11 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 | 2 | 3 | 5 | 7 |
| | 207 | 8 | 16 | 24 | 32 | 5 | 10 | 15 | 19 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 14 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 | 2 | 4 | 6 | 8 |
| | 276 | 9 | 19 | 28 | 37 | 6 | 11 | 17 | 22 | 5 | 9 | 14 | 19 | 4 | 8 | 12 | 16 | 4 | 7 | 11 | 14 | 3 | 6 | 8 | 11 | 2 | 5 | 7 | 9 |
| | 345 | 10 | 21 | 31 | 42 | 6 | 13 | 19 | 25 | 5 | 10 | 16 | 21 | 4 | 9 | 13 | 18 | 4 | 8 | 12 | 16 | 3 | 6 | 9 | 13 | 3 | 5 | 8 | 10 |
| | 414 | 11 | 23 | 34 | 46 | 7 | 14 | 21 | 27 | 6 | 11 | 17 | 23 | 5 | 10 | 15 | 20 | 4 | 9 | 13 | 17 | 3 | 7 | 10 | 14 | 3 | 6 | 9 | 11 |
| | 483 | | | | | 7 | 15 | 22 | 30 | 6 | 12 | 19 | 25 | 5 | 11 | 16 | 21 | 5 | 9 | 14 | 19 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 |
| 0.3 GPM #3 | 138 | 8 | 16 | 24 | 32 | 5 | 9 | 14 | 19 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 14 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 9 | 2 | 4 | 6 | 8 |
| | 207 | 10 | 19 | 29 | 39 | 6 | 12 | 17 | 23 | 5 | 10 | 14 | 19 | 4 | 8 | 12 | 17 | 4 | 7 | 11 | 14 | 3 | 6 | 9 | 12 | 2 | 5 | 7 | 10 |
| | 276 | 11 | 22 | 33 | 45 | 7 | 13 | 20 | 27 | 6 | 11 | 17 | 22 | 5 | 10 | 14 | 19 | 4 | 8 | 13 | 17 | 3 | 7 | 10 | 13 | 3 | 6 | 8 | 11 |
| | 345 | | | | | 7 | 15 | 22 | 30 | 6 | 12 | 19 | 25 | 5 | 11 | 16 | 21 | 5 | 9 | 14 | 19 | 4 | 7 | 11 | 15 | 3 | 6 | 9 | 12 |
| | 414 | | | | | 8 | 16 | 25 | 33 | 7 | 14 | 20 | 27 | 6 | 12 | 18 | 23 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 16 | 3 | 7 | 10 | 14 |
| | 483 | | | | | 9 | 18 | 27 | 35 | 7 | 15 | 22 | 29 | 6 | 13 | 19 | 25 | 6 | 11 | 17 | 22 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 15 |
| 0.4 GPM #4 | 138 | 10 | 21 | 31 | 41 | 6 | 12 | 19 | 25 | 5 | 10 | 16 | 21 | 4 | 9 | 13 | 18 | 4 | 8 | 12 | 16 | 3 | 6 | 9 | 12 | 3 | 5 | 8 | 10 |
| | 207 | | | | | 8 | 15 | 23 | 30 | 6 | 13 | 19 | 25 | 5 | 11 | 16 | 22 | 5 | 10 | 14 | 19 | 4 | 8 | 11 | 15 | 3 | 6 | 10 | 13 |
| | 276 | | | | | 9 | 18 | 26 | 35 | 7 | 15 | 22 | 29 | 6 | 13 | 19 | 25 | 5 | 11 | 16 | 22 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 15 |
| | 345 | | | | | 10 | 20 | 30 | 39 | 8 | 16 | 25 | 33 | 7 | 14 | 21 | 28 | 6 | 12 | 18 | 25 | 5 | 10 | 15 | 20 | 4 | 8 | 12 | 16 |
| | 414 | | | | | 11 | 22 | 32 | 43 | 9 | 18 | 27 | 36 | 8 | 15 | 23 | 31 | 7 | 13 | 20 | 27 | 5 | 11 | 16 | 22 | 4 | 9 | 13 | 18 |
| | 483 | | | | | 12 | 23 | 35 | 47 | 10 | 19 | 29 | 39 | 8 | 17 | 25 | 33 | 7 | 15 | 22 | 29 | 6 | 12 | 17 | 23 | 5 | 10 | 15 | 19 |
| 0.5 GPM #5 | 138 | | | | | 8 | 15 | 23 | 31 | 6 | 13 | 19 | 25 | 5 | 11 | 16 | 22 | 5 | 10 | 14 | 19 | 4 | 8 | 11 | 15 | 3 | 6 | 10 | 13 |
| | 207 | | | | | 9 | 19 | 28 | 37 | 8 | 16 | 23 | 31 | 7 | 13 | 20 | 27 | 6 | 12 | 18 | 23 | 5 | 9 | 14 | 19 | 4 | 8 | 12 | 16 |
| | 276 | | | | | 11 | 22 | 32 | 43 | 9 | 18 | 27 | 36 | 8 | 15 | 23 | 31 | 7 | 14 | 20 | 27 | 5 | 11 | 16 | 22 | 5 | 9 | 14 | 18 |
| | 345 | | | | | 12 | 24 | 36 | 48 | 10 | 20 | 30 | 40 | 9 | 17 | 26 | 35 | 8 | 15 | 23 | 30 | 6 | 12 | 18 | 24 | 5 | 10 | 15 | 20 |
| | 414 | | | | | | | | | 11 | 22 | 33 | 44 | 9 | 19 | 28 | 38 | 8 | 17 | 25 | 33 | 7 | 13 | 20 | 26 | 6 | 11 | 17 | 22 |
| | 483 | | | | | | | | | 12 | 24 | 36 | 48 | 10 | 20 | 31 | 41 | 9 | 18 | 27 | 36 | 7 | 14 | 21 | 29 | 6 | 12 | 18 | 24 |

Figure 43: Speed Range (KPH) 50cm Nozzle Spacing

| Tip Size | Gauge (kPa) | 30 l/ha | | | | 50 l/ha | | | | 60 l/ha | | | | 70 l/ha | | | | 80 l/ha | | | | 100 l/ha | | | | 120 l/ha | | | |
|----------------|-------------|---------|-----|-----|------|---------|-----|-----|------|---------|-----|-----|------|---------|-----|-----|------|---------|-----|-----|------|----------|-----|-----|------|----------|-----|-----|------|
| | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | | Min | | Max | |
| | | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% | 25% | 50% | 75% | 100% |
| 0.6 GPM #6 | 138 | | | | | 9 | 18 | 27 | 36 | 7 | 15 | 22 | 30 | 6 | 13 | 19 | 26 | 6 | 11 | 17 | 22 | 4 | 9 | 13 | 18 | 4 | 7 | 11 | 15 |
| | 207 | | | | | 11 | 22 | 33 | 44 | 9 | 18 | 28 | 37 | 8 | 16 | 24 | 31 | 7 | 14 | 21 | 28 | 6 | 11 | 17 | 22 | 5 | 9 | 14 | 18 |
| | 276 | | | | | | | | | 11 | 21 | 32 | 42 | 9 | 18 | 27 | 36 | 8 | 16 | 24 | 32 | 6 | 13 | 19 | 25 | 5 | 11 | 16 | 21 |
| | 345 | | | | | | | | | 12 | 24 | 36 | 47 | 10 | 20 | 30 | 41 | 9 | 18 | 27 | 36 | 7 | 14 | 21 | 28 | 6 | 12 | 18 | 24 |
| | 414 | | | | | | | | | | | | | 11 | 22 | 33 | 44 | 10 | 19 | 29 | 39 | 8 | 16 | 23 | 31 | 6 | 13 | 19 | 26 |
| 483 | | | | | | | | | | | | | 12 | 24 | 36 | 48 | 11 | 21 | 32 | 42 | 8 | 17 | 25 | 34 | 7 | 14 | 21 | 28 | |
| 0.8 GPM #8 | 138 | | | | | 11 | 23 | 34 | 46 | 10 | 19 | 29 | 38 | 8 | 16 | 24 | 33 | 7 | 14 | 21 | 29 | 6 | 11 | 17 | 23 | 5 | 10 | 14 | 19 |
| | 207 | | | | | | | | | 12 | 23 | 35 | 47 | 10 | 20 | 30 | 40 | 9 | 17 | 26 | 35 | 7 | 14 | 21 | 28 | 6 | 12 | 17 | 23 |
| | 276 | | | | | | | | | | | | | 12 | 23 | 35 | 46 | 10 | 20 | 30 | 40 | 8 | 16 | 24 | 32 | 7 | 13 | 20 | 27 |
| | 345 | | | | | | | | | | | | | | | | | 11 | 23 | 34 | 45 | 9 | 18 | 27 | 36 | 8 | 15 | 23 | 30 |
| | 414 | | | | | | | | | | | | | | | | | 10 | 20 | 30 | 40 | 10 | 20 | 30 | 40 | 8 | 16 | 25 | 33 |
| 483 | | | | | | | | | | | | | | | | | 11 | 21 | 32 | 43 | 11 | 21 | 32 | 43 | 9 | 18 | 27 | 36 | |
| 1.0 GPM #10 | 138 | | | | | | | | | 11 | 22 | 34 | 45 | 10 | 19 | 29 | 39 | 8 | 17 | 25 | 34 | 7 | 13 | 20 | 27 | 6 | 11 | 17 | 22 |
| | 207 | | | | | | | | | | | | | 12 | 24 | 35 | 47 | 10 | 21 | 31 | 41 | 8 | 17 | 25 | 33 | 7 | 14 | 21 | 28 |
| | 276 | | | | | | | | | | | | | | | | | 12 | 24 | 36 | 48 | 10 | 19 | 29 | 38 | 8 | 16 | 24 | 32 |
| | 345 | | | | | | | | | | | | | | | | | | | | | 11 | 21 | 32 | 43 | 9 | 18 | 27 | 36 |
| | 414 | | | | | | | | | | | | | | | | | | | | | 12 | 23 | 35 | 47 | 10 | 19 | 29 | 39 |
| 483 | | | | | | | | | | | | | | | | | | | | | | | | | 11 | 21 | 32 | 42 | |
| 1.2 GPM #12 | 138 | | | | | | | | | | | | | 11 | 22 | 33 | 44 | 10 | 19 | 29 | 38 | 8 | 15 | 23 | 30 | 6 | 13 | 19 | 25 |
| | 207 | | | | | | | | | | | | | | | | | 12 | 23 | 35 | 47 | 9 | 19 | 28 | 37 | 8 | 16 | 23 | 31 |
| | 276 | | | | | | | | | | | | | | | | | | | | | 11 | 22 | 32 | 43 | 9 | 18 | 27 | 36 |
| | 345 | | | | | | | | | | | | | | | | | | | | | 12 | 24 | 36 | 48 | 10 | 20 | 30 | 40 |
| | 414 | | | | | | | | | | | | | | | | | | | | | | | | | 11 | 22 | 33 | 44 |
| 483 | | | | | | | | | | | | | | | | | | | | | | | | | 12 | 24 | 36 | 48 | |
| 1.25 GPM #12.5 | 138 | | | | | | | | | | | | | | | | | | | | | 10 | 19 | 29 | 38 | 8 | 16 | 24 | 32 |
| | 207 | | | | | | | | | | | | | | | | | | | | | 11 | 22 | 33 | 44 | 9 | 18 | 28 | 37 |
| | 276 | | | | | | | | | | | | | | | | | | | | | | | | | 10 | 21 | 31 | 41 |
| | 345 | | | | | | | | | | | | | | | | | | | | | | | | | 11 | 23 | 34 | 45 |
| | 414 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 483 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 GPM #15 | 138 | | | | | | | | | | | | | | | | | | | | | 11 | 21 | 32 | 42 | 9 | 18 | 26 | 35 |
| | 207 | | | | | | | | | | | | | | | | | | | | | | | | | 10 | 20 | 31 | 41 |
| | 276 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 345 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 414 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 483 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Figure 44: Speed Range (KPH) 50cm Nozzle Spacing (cont'd)

Blended Pulse™ Droplet Classification Table—Metric

| | | Extremely Fine (EF) | Very Fine (VF) | Fine (F) | Medium (M) | Coarse (C) | Very Coarse (VC) | Extremely Coarse (EC) | Ultra Coarse (UC) | | | | | | | | | | | |
|--|-------------|---------------------|----------------|-----------|------------|------------|------------------|-----------------------|-------------------|-----------|-----------|----------|--------------|-----------|------------|-----------|-------------|---------------|-----------|-----------|
| | | <50 | 50 - 136 | 137-177 | 178-218 | 219-349 | 350-428 | 429-622 | >622 | | | | | | | | | | | |
| ** Blanks cells represent nozzles either not available or below the manufacturers operating specifications | | | | | | | | | | | | | | | | | | | | |
| ** Hypro and TeeJet droplet classifications below may not match manufacturers spec sheets. The chart below adjusts the droplet classification to be representative of the Actual Nozzle Pressure | | | | | | | | | | | | | | | | | | | | |
| Tip Size | Gauge (kPa) | Nozzle (kPa) | Wilger | | | | Hypro | | | | | TeeJet | | | | | | | | |
| | | | ER (110°) | SR (110°) | MR (110°) | DR (110°) | HF (140°) | GRD (120°) | LD (110°) | VP (110°) | TR (110°) | F (110°) | TTJ60 (110°) | XR (110°) | XRC (110°) | DG (110°) | TJ60 (110°) | DGTJ60 (110°) | TT (110°) | TP (110°) |
| 0.1 GPM #1 | 138 | 137 | F | | | | | | | | | | F | | | | | | C | |
| | 207 | 206 | F | | | | | | | | | | F | F | | | | | M | F |
| | 276 | 275 | VF | | | | | | | | | | F | F | | | | | M | F |
| | 345 | 343 | VF | | | | | | | | | | F | F | | | | | M | F |
| | 414 | 412 | VF | | | | | | | | | | VF | VF | | | | | F | VF |
| 483 | 481 | VF | | | | | | | | | | | | | | | | | F | |
| 0.15 GPM #1.5 | 138 | 137 | F | | | | | | | | | | F | | | | | | C | |
| | 207 | 205 | F | M | C | VC | | | | | | | F | F | | M | | F | M | F |
| | 276 | 273 | F | M | C | C | | | | | | | F | F | F | | | F | M | F |
| | 345 | 342 | VF | M | C | C | | | | | | | F | F | F | | | F | M | F |
| | 414 | 410 | VF | M | C | C | | | | | | | F | F | F | | | F | F | F |
| 483 | 478 | VF | F | M | C | | | | | | | | | | | | | | F | |
| 0.2 GPM #2 | 138 | 136 | F | | | | M | M | F | M | | | C | M | F | | | | VC | |
| | 207 | 203 | F | C | C | XC | | M | M | F | F | | C | F | F | M | F | M | C | F |
| | 276 | 271 | F | M | C | VC | | M | M | F | F | | M | F | F | M | VF | M | M | F |
| | 345 | 339 | F | M | C | VC | | M | M | F | F | | M | F | F | M | VF | F | M | F |
| | 414 | 407 | F | M | C | C | | M | M | F | F | | M | F | F | M | VF | F | M | F |
| 483 | 475 | VF | M | C | C | | F | M | F | F | | M | | | | | | | F | |
| 0.25 GPM #2.5 | 138 | 134 | M | | | | M | M | M | | | | VC | M | M | | | | VC | |
| | 207 | 202 | M | C | VC | XC | | M | M | F | | | C | M | F | | | | C | |
| | 276 | 269 | M | C | C | VC | | M | M | F | | | C | F | F | | | | M | |
| | 345 | 336 | F | M | C | VC | | M | M | F | | | M | F | F | | | | M | |
| | 414 | 403 | F | M | C | VC | | M | M | F | | | M | F | F | | | | M | |
| 483 | 470 | F | M | C | C | | F | M | F | | | M | | | | | | | F | |
| 0.3 GPM #3 | 138 | 133 | M | | | | M | C | M | M | | | VC | M | M | | | | VC | |
| | 207 | 199 | M | C | VC | XC | | M | C | F | M | | C | M | F | C | F | M | C | F |
| | 276 | 266 | F | C | VC | XC | | M | M | F | F | | C | F | F | M | F | M | C | F |
| | 345 | 332 | F | C | C | VC | | M | M | F | F | | M | F | F | M | F | F | M | F |
| | 414 | 399 | F | C | C | VC | | M | M | F | F | | M | F | F | M | F | F | M | F |
| 483 | 465 | F | C | C | VC | | M | M | F | F | | M | | | | | | | M | |
| 0.4 GPM #4 | 138 | 129 | C | | | | C | C | M | M | | | VC | M | M | | | | VC | |
| | 207 | 194 | C | C | VC | XC | | C | C | M | M | | C | M | M | C | F | C | C | M |
| | 276 | 259 | M | C | VC | XC | | C | M | F | F | | C | M | M | M | F | C | C | M |
| | 345 | 323 | M | C | VC | XC | | M | M | F | F | | M | F | F | M | F | C | M | F |
| | 414 | 388 | M | C | C | VC | | M | M | F | F | | M | F | F | M | F | M | M | F |
| 483 | 452 | M | C | C | VC | | M | M | F | F | | M | | | | | | | M | |
| 0.5 GPM #5 | 138 | 125 | C | | | | C | C | M | C | | | VC | M | M | | | | VC | |
| | 207 | 187 | C | VC | XC | XC | | C | C | M | M | | C | M | M | C | M | | VC | M |
| | 276 | 250 | M | C | XC | XC | | C | C | F | F | | C | M | M | C | M | | C | M |
| | 345 | 312 | M | C | XC | XC | | M | M | F | F | | C | M | M | M | F | | C | F |
| | 414 | 375 | M | C | VC | XC | | M | M | F | F | | C | F | F | M | F | | C | F |
| 483 | 437 | M | C | VC | XC | | M | M | F | F | | M | | | | | | | M | |

Figure 45: Droplet Classification Table ASABE S-5572.1

| | | Extremely Fine (EF) | Very Fine (VF) | Fine (F) | Medium (M) | Coarse (C) | Very Coarse (VC) | Extremely Coarse (EC) | Ultra Coarse (UC) | | | | | | | | | | | |
|--|-------------|---------------------|----------------|-----------|------------|------------|------------------|-----------------------|-------------------|-----------|-----------|----------|--------------|-----------|------------|-----------|-------------|---------------|-----------|-----------|
| | | <50 | 50 - 136 | 137-177 | 178-218 | 219-349 | 350-428 | 429-622 | >622 | | | | | | | | | | | |
| ** Blanks cells represent nozzles either not available or below the manufacturers operating specifications | | | | | | | | | | | | | | | | | | | | |
| ** Hypro and TeeJet droplet classifications below may not match manufacturers spec sheets. The chart below adjusts the droplet classification to be representative of the Actual Nozzle Pressure | | | | | | | | | | | | | | | | | | | | |
| Tip Size | Gauge (kPa) | Nozzle (kPa) | Wilger | | | | Hypro | | | | | TeeJet | | | | | | | | |
| | | | ER (110°) | SR (110°) | MR (110°) | DR (110°) | HF (140°) | GRD (120°) | LD (110°) | VP (110°) | TR (110°) | F (110°) | TTJ60 (110°) | XR (110°) | XRC (110°) | DG (110°) | TJ60 (110°) | DGTJ60 (110°) | TT (110°) | TP (110°) |
| 0.6 GPM #6 | 138 | 120 | C | | | | | VC | VC | M | C | | VC | M | C | | | | VC | |
| | 207 | 180 | C | XC | XC | | | C | C | M | C | M | C | M | M | | M | C | VC | M |
| | 276 | 240 | C | VC | XC | XC | | C | C | M | M | M | C | M | M | | M | C | VC | M |
| | 345 | 300 | C | VC | XC | XC | | C | C | M | M | M | C | M | M | | F | C | VC | M |
| | 414 | 360 | C | C | XC | XC | | C | C | F | M | F | C | M | M | | F | C | C | M |
| | 483 | 420 | C | C | VC | XC | | C | C | F | M | | | M | | | | | | C |
| 0.8 GPM #8 | 138 | 109 | C | | | | | VC | VC | C | C | | VC | C | C | | | | VC | |
| | 207 | 163 | C | XC | XC | | VC | VC | VC | C | C | | VC | C | C | | M | C | VC | C |
| | 276 | 218 | C | XC | XC | XC | UC | C | C | M | C | M | VC | M | C | | M | C | VC | C |
| | 345 | 272 | C | VC | XC | XC | UC | C | C | M | M | M | C | M | M | | M | C | C | M |
| | 414 | 327 | C | VC | XC | XC | UC | C | C | M | M | M | C | M | M | | M | C | C | M |
| | 483 | 381 | C | VC | XC | XC | XC | C | C | M | M | | | C | | | | | | C |
| 1.0 GPM #10 | 138 | 97 | VC | | | | | | | | | | | | | | | | | |
| | 207 | 146 | VC | | | | UC | | | C | VC | | XC | C | C | | M | | UC | |
| | 276 | 195 | C | XC | XC | UC | UC | | | C | C | M | XC | C | C | | M | | XC | |
| | 345 | 243 | C | XC | XC | UC | UC | | | M | M | M | VC | C | C | | M | | XC | |
| | 414 | 292 | C | VC | XC | UC | UC | | | M | M | M | VC | M | M | | M | | VC | |
| | 483 | 341 | C | VC | XC | XC | UC | | | M | M | | VC | | | | | | VC | |
| 1.2 GPM #12 | 138 | 83 | | | | | | | | | | | | | | | | | | |
| | 207 | 124 | | | | | | | | | | | | | | | | | UC | |
| | 276 | 135 | | | | | | | | | | | | | | | | | UC | |
| | 345 | 207 | | | | | | | | | | | | | | | | | XC | |
| | 414 | 248 | | | | | | | | | | | | | | | | | VC | |
| | 483 | 290 | | | | | | | | | | | | | | | | | VC | |
| 1.25 GPM #12.5 | 138 | 84 | XC | | | | | | | | | | | | | | | | | |
| | 207 | 125 | XC | | | | | | | | | | | | | | | | | |
| | 276 | 167 | VC | XC | UC | | | | | | | | | | | | | | | |
| | 345 | 209 | VC | XC | UC | UC | | | | | | | | | | | | | | |
| | 414 | 251 | VC | XC | XC | UC | | | | | | | | | | | | | | |
| | 483 | 292 | C | VC | XC | XC | | | | | | | | | | | | | | |
| 1.5 GPM #15 | 138 | 71 | XC | | | | | | | | | | | | | | | | | |
| | 207 | 107 | XC | | | | UC | | | VC | VC | | | | VC | | | | | |
| | 276 | 142 | XC | | | | UC | | | VC | VC | | | | VC | | | | | |
| | 345 | 178 | VC | XC | UC | | UC | | | VC | VC | C | | | VC | | | | | |
| | 414 | 214 | VC | XC | XC | UC | UC | | | VC | VC | C | | | VC | | | | | |
| | 483 | 249 | VC | XC | XC | UC | UC | | | C | C | | | | | | | | | |

Figure 46: Droplet Classification Table ASABE S-5572.1 (cont'd)

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Chapter 7: Maintenance

Topics:

- [Service the System](#)
- [Inspect the System](#)
- [Clean the System](#)
- [Storage of the System](#)
- [Recommended Guidelines for Maintenance/Service](#)
- [Baseline Evaluation Process](#)
- [Strainers and Screens](#)
- [Nozzle Valves](#)

Service the System



CAUTION: Before operation or service to the system, read and understand the machine's operator manual and the system operator manual. Chemical residue may be present on/in the OEM equipment. Use the correct personal protective equipment.

Before servicing the system or plumbing components, release the pressure and empty any product from the system and liquid delivery lines.

Jump Start, Weld On, or Charge the Machine

If jump starting the machine, make sure that you trip the circuit breaker to prevent damage.

If charging the machine's batteries or welding on the machine, trip the circuit breaker.

Inspect the System

- Inspect the hoses for cuts, nicks, or abrasions before each use. Immediately replace any damaged hoses.
- Make sure that the strainers are clean.
- Make sure that all hoses and wiring are secure.
- Check for loose hoses, mounting hardware, and other components. Tighten if necessary.
- Check for damaged or missing decals. Replace if necessary.

Clean the System

- Thoroughly clean the system after each use.
- Avoid high-pressure spray when cleaning the system components.

Storage of the System

Thoroughly clean the implement and the system before any long storage.

Winterize for Storage

Do not use fertilizer to winterize! The use of fertilizer to winterize will cause internal damage to the nozzle valves.

Note: Improper winterizing will result in damage to the internal components of the nozzle valves.

Thoroughly clean the system before winter storage. Flush the system with clean water.

Winterize the system with RV antifreeze for winter storage. Proper winterizing of the machine with a CapstanAG system installed on it is essential. Make sure that the lines are completely full of antifreeze at 100% strength and that the nozzle valves are purged until 100% antifreeze is seen at all nozzle valves.

Recommended Guidelines for Maintenance/Service

When servicing a system, it is recommended to do these:

- Do the baseline service checks and verify the original setup values in this manual.
- Identify individual performance problems. Evaluate possible causes and corrections for performance issues.
- Troubleshoot individual components and replace, if needed.

IMPORTANT: The primary service tool will be a voltmeter that can measure voltage and resistance (ohms).

Baseline Evaluation Process

1. Make sure that the voltage readings are correct.
2. Visually check of all wire connections, harnesses, and connectors. Make sure that there are no loose, broken, or damaged parts.
3. Make sure that the correct tip size is used for the application.
4. Compare the current settings with those recorded in the manual during setup.
5. Make sure that the liquid product plumbing and the strainer(s) are clean.
6. Perform a like component swap test to see if the failure follows the component.
7. Repair or replace any damaged components.
8. Perform the system tests.
9. Review the system testing information in this manual.

Strainers and Screens

IMPORTANT: Clean the strainers on a regular basis.

Check the mesh size of the strainers and replace the screens if they are too coarse. Use 80-mesh or finer strainer screens. The filter manufacturer is specified only on the strainer housing. Only a color code identifies the strainer mesh size, which is not consistent between filter suppliers. An 80-mesh screen is required to prevent nozzles from plugging. When selecting a strainer, do not rely on the color coding. Check with the strainer manufacturer to be sure and select the 80-mesh strainer.

Plugged strainers will cause a reduction in system operating pressure.

When replacing the mesh screen on a Tee-jet Strainers:

1. Install and set the mesh screen in the strainer head.
2. Install the strainer cap.

IMPORTANT: Failure to do this will likely result in a damaged mesh screen and overall strainer failure.

Nozzle Valves

Plugged nozzle valves can be classified into two categories:

- Plunger blockage
- Plunger stuck

Plunger blockage results when larger debris catches between the orifice and plunger seal. This is the smallest flow passage within the nozzle valve.

Stuck plungers result when smaller debris collects around the barrel of the plunger and binds the plunger in place. Symptoms of a blocked or stuck plunger are:

- Constant application
- Leaking when the nozzle is shut off
- No application

Note: Pinched or split O-rings will also cause nozzles to drip when shutoff.

Note: Operating a plugged nozzle valve for extended periods of time may result in a nozzle valve coil failure. Immediately clean any plugged nozzle valves.


Note: Before removing the nozzle valves, make sure that the pressure has been released from the boom tubes.

If plugged nozzles are a frequent problem in a particular boom section, examine the boom filter screens for plugged or damaged screens.

CapstanAG recommends using an 80-mesh screen to prevent the nozzles from plugging.

Check the mesh size of the strainers and replace strainers if they are too coarse.

Clean the Nozzle Valve(s)

 **WARNING:** Chemical residues may be present in the agricultural equipment. Always use proper personal equipment to avoid personal injury.

1. Release pressure from the system before servicing.
2. Clean the system before installation or service of the fittings, hoses, valves, or nozzles.

Legacy Valve Service Procedure

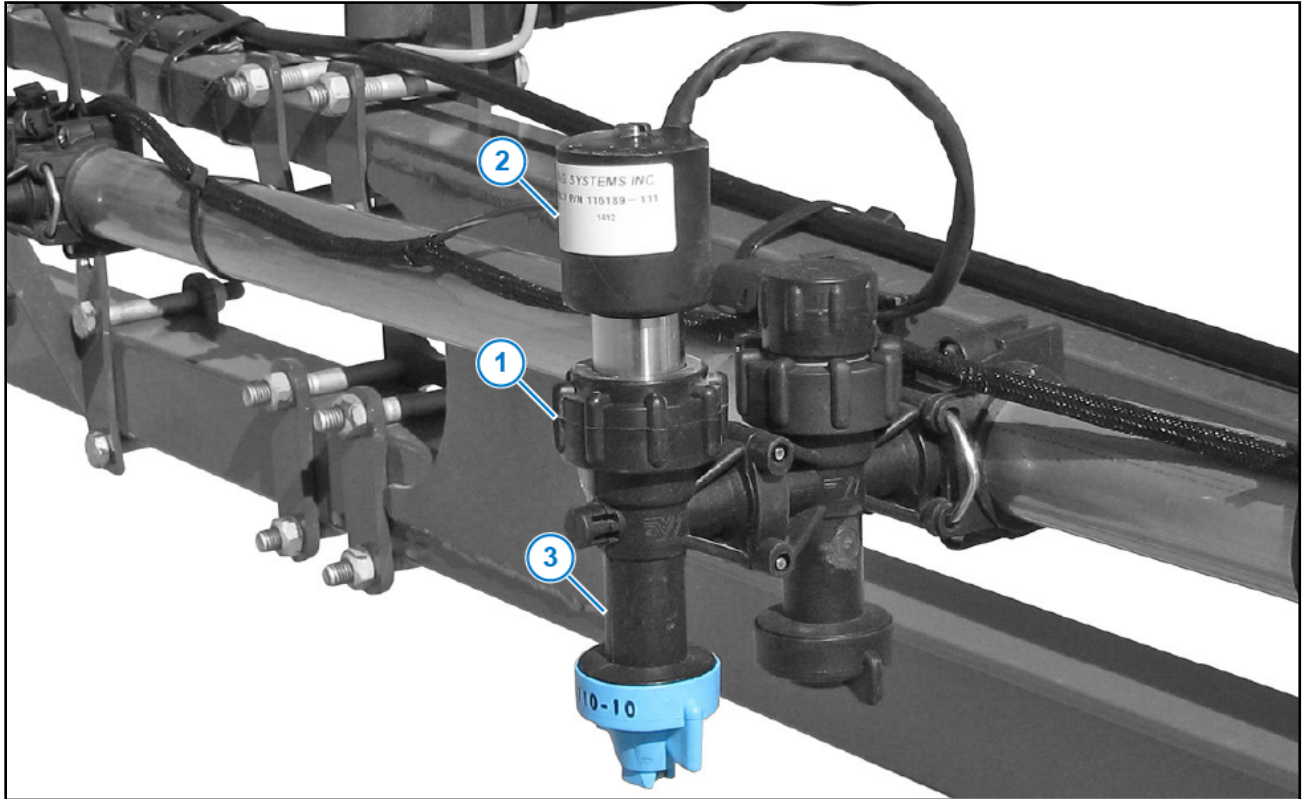


Figure 47: Nozzle Valve Disassembly

1. Unscrew the fly nut (Figure 47, Item 1) counter-clockwise to remove the nozzle valve assembly (Figure 47, Item 2) from the nozzle body (Figure 47, Item 3).

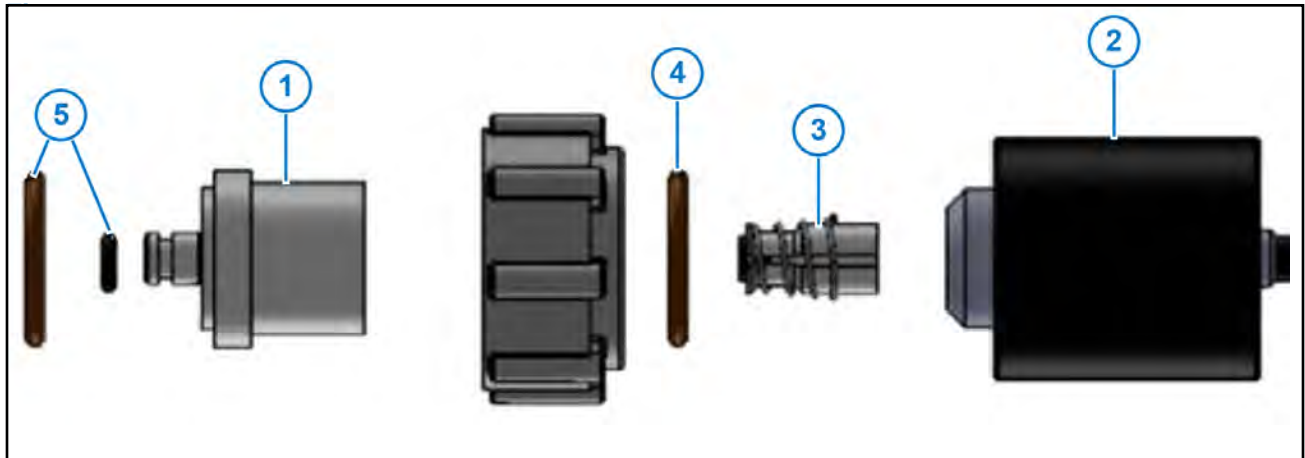


Figure 48: Nozzle Valve

2. Use pliers or other appropriate tool to hold the valve body (Figure 48, Item 1) so that the assembly coil harness faces the ground.
3. Rotate the coil (Figure 48, Item 2) counter-clockwise to remove the coil from the valve body.
4. Remove the plunger (Figure 48, Item 3) from the coil.
5. Inspect the O-ring (Figure 48, Item 4) on the coil.
6. Inspect the O-rings (Figure 48, Item 5) on the valve body.
7. Wash the nozzle valve components to remove any debris.
8. Inspect the plunger for wear or damage.
9. If there is wear or damage to the plunger, replace the plunger.
10. Inspect the valve body.
Make sure that the orifice is not plugged with debris, worn, or damaged.
11. If there is wear or damage to the orifice, replace the valve body.
12. Wash the nozzle body components to remove any debris.

IMPORTANT: Do not use brake cleaner. Brake cleaner can damage the seal.

IMPORTANT: During installation, apply 40 in-lbs (4.52 Nm) of torque to the coil when it threads into the valve body to properly seat the O-ring.

Spitfire Valve Service Procedure

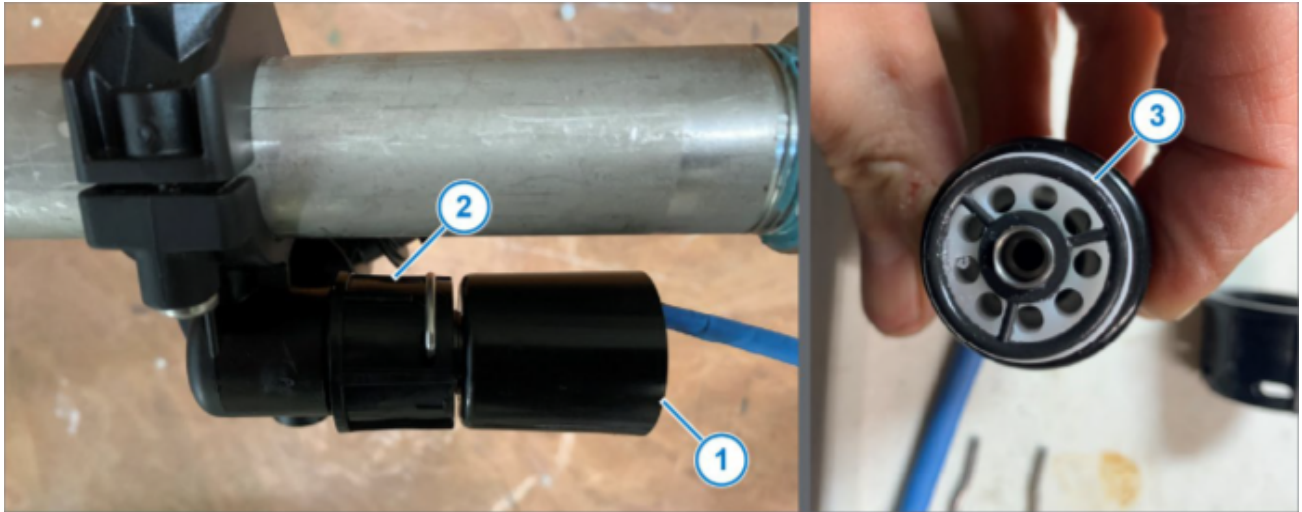


Figure 49: Flynut

Hold the coil (Figure 49, Item 1) stationary while tightening or loosening the flynut (Figure 49, Item 2). If the coil is rotated while tightening or loosening the flynut, damage to the spoke O-ring (Figure 49, Item 3) can occur and cause the valve to leak.

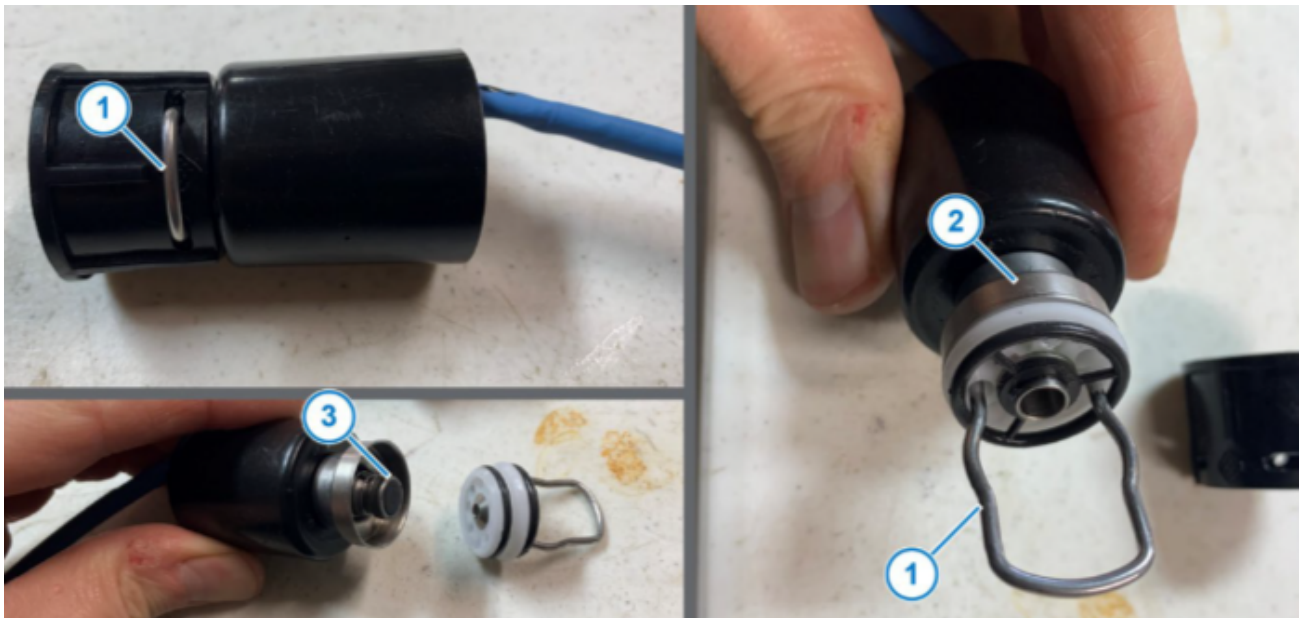


Figure 50: Retaining Clip

To service the valve components, remove the retaining clip (Figure 50, Item 1). Use the retaining clip to remove the orifice insert (Figure 50, Item 2) to service the plunger (Figure 50, Item 3).

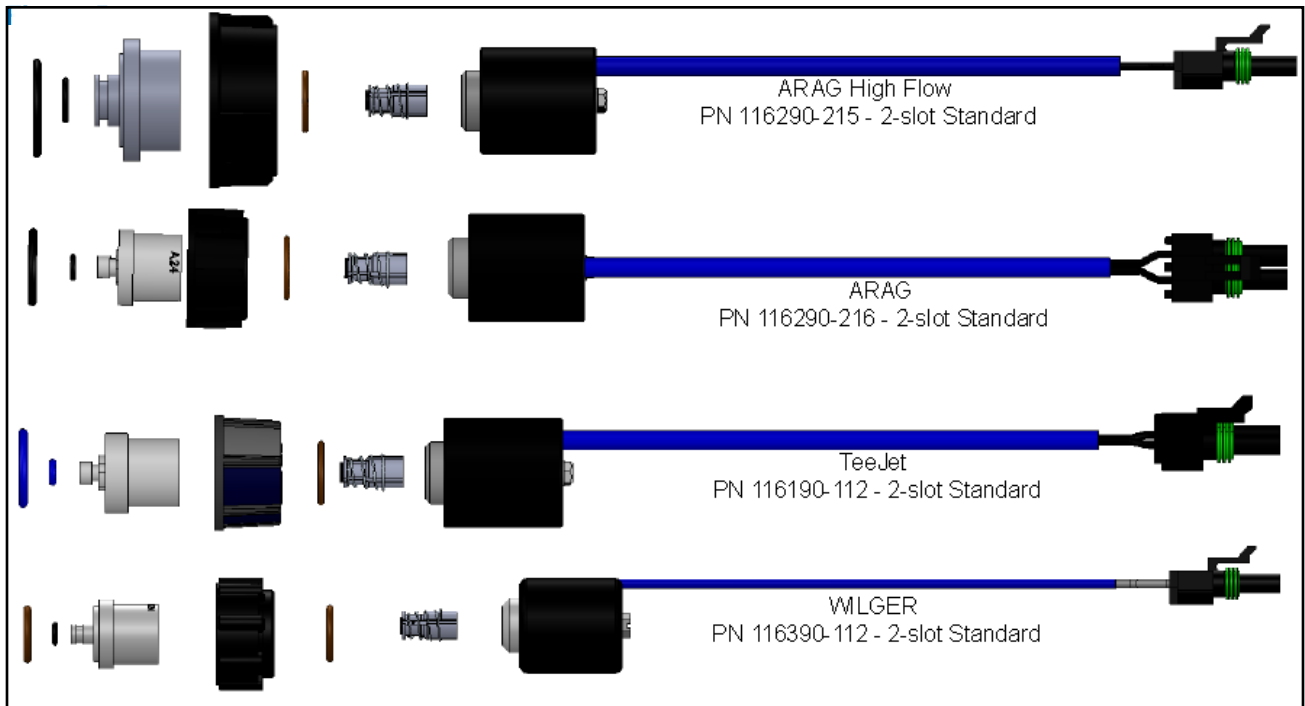


Figure 51: Spitfire Valve

Refer to [Figure 51](#) for disassembly of the Spitfire valve.

Plunger Seal Inspection

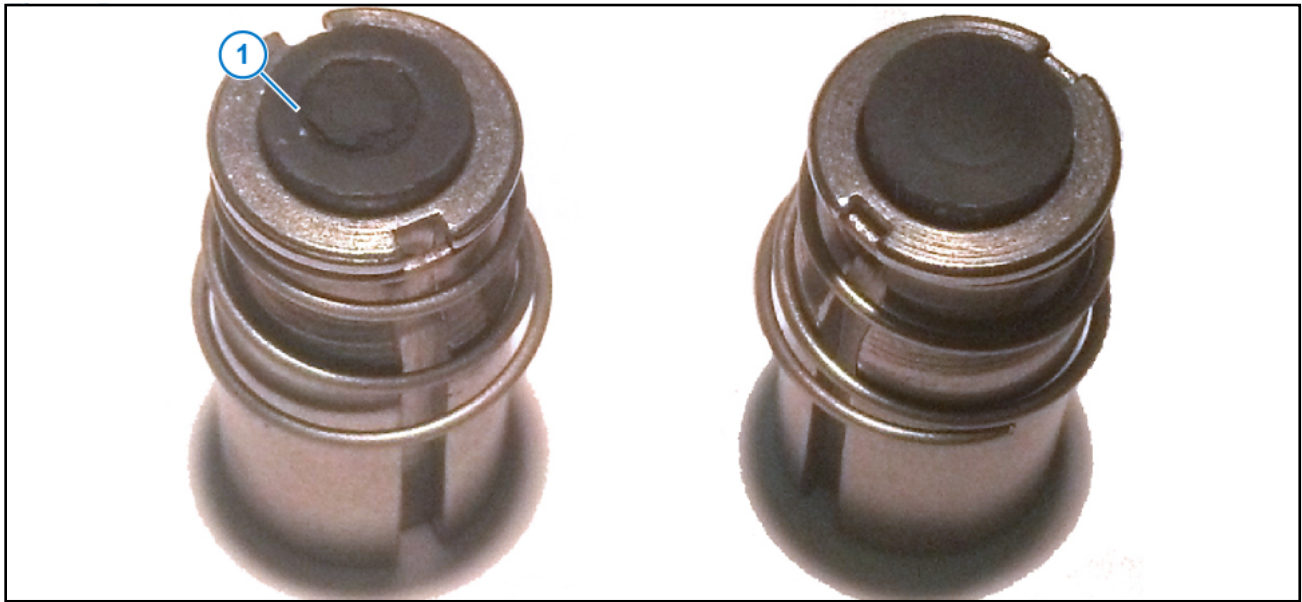


Figure 52: Plunger Assembly

After extended use, the plunger seal will wear a groove (Figure 52, Item 1) where the seal impacts the hard orifice seat. Replace the plunger if worn or damaged.

As the groove deepens, the pressure capacity of the valve will decrease until the pressure capacity interferes with the operating pressure of the system.

The result is erratic pulsing, often described as “flickering.” The system will operate normally at lower pressures until replacement parts can be installed. High operating pressures and abrasive chemicals will accelerate the wear of the plunger seal material.

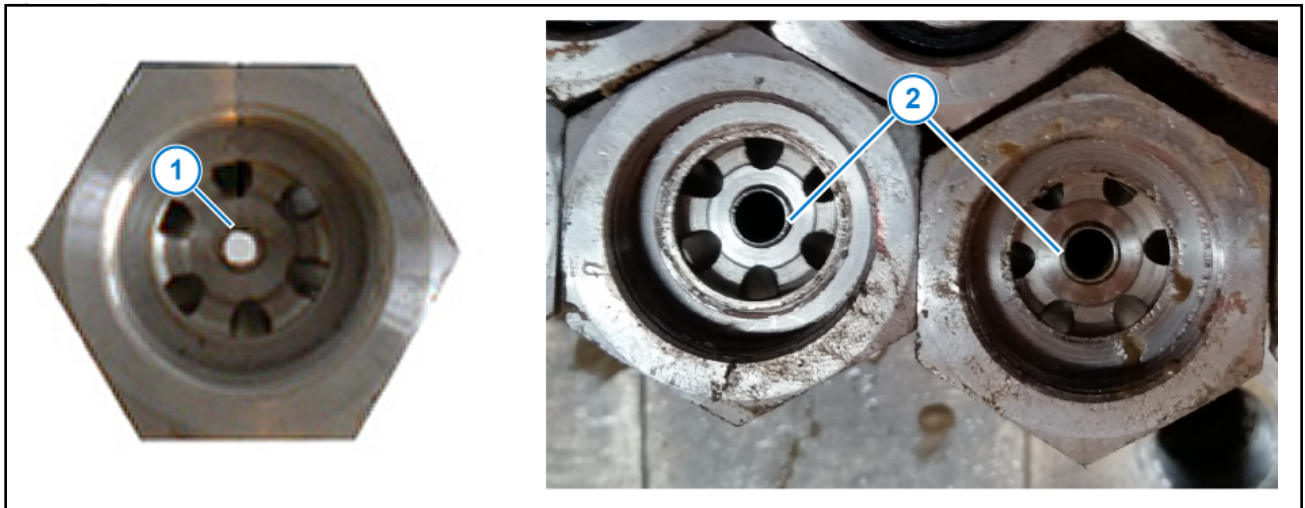


Figure 53: Legacy Valve Body Plunger Seat

Make sure that the plunger seats are still smooth and not pitted.

(Figure 53, Item 1) A plunger seat on a new valve body

(Figure 53, Item 2) Worn plunger seat on a used valve body

Chapter 8: Troubleshooting

Topics:

- [Troubleshooting Charts](#)
- [Interchange Components](#)
- [Coil Assembly Test](#)
- [Circuit Breaker Test](#)
- [System Load Capacity Test](#)
- [VCM Voltage Test](#)
- [Boom Shutoff Signal Test](#)
- [Pressure Sensor Signal Test](#)
- [Power to the Pressure Sensor Input Test](#)
- [Technical Bulletin](#)

Troubleshooting Charts

Table 23: System Fault Codes

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|---------------------------------------|--|--|--|
| Fault 1: Reset | Brown out reset | The system has reset after a low voltage event. | Make sure that the system has at least 12 V. Note: At 10 V to 10.5 V the reset will occur. |
| | | | Check the power connections for reliable supply. |
| Fault 2: Reset | Watchdog reset | The processor got stuck in a task. | Continue operation. If problem persists, do a Factory Reset. |
| Fault 4: Memory Fault | Internal FLASH write Fault | The hub did not write correctly to the FLASH memory | Upload software to hub. |
| | | | Contact CapstanAG to repair or replace the hub. |
| Fault 7: Memory Fault | EEPROM read Fault | The hub did not read correctly from EEPROM memory | If the system does not operate correctly, first perform a Factory Reset. |
| | | | Upload software to hub. |
| | | | Contact CapstanAG to repair or replace the hub. |
| Fault 8: Memory Fault | EEPROM write Fault | The hub did not write correctly to EEPROM memory | If the system does not operate correctly, first perform a Factory Reset. |
| | | | Upload software to hub. |
| | | | Contact CapstanAG to repair or replace the hub. |
| Fault 9: Internal Communication Fault | Processor to processor communication with VCM Port 1 | The main hub processor and VCM 1 port connector on the hub have stopped communicating. | If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub. |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|--|--|--|---|
| Fault 10: Internal Communication Fault | Processor to processor communication with VCM Port 2 | The main hub processor and VCM 2 port connector on the hub have stopped communicating. | If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub. |
| Fault 11: Internal Communication Fault | Processor to processor communication with VCM Port 3 | The main hub processor and VCM 3 port connector on the hub have stopped communicating. | If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub. |
| Fault 12: Internal Communication Fault | Processor to processor communication with VCM Port 4 | The main hub processor and VCM 4 port connector on the hub have stopped communicating. | If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub. |
| Fault 13: Internal Communication Fault | Processor to processor communication with VCM Port 5 | The main hub processor and VCM 5 port connector on the hub have stopped communicating. | If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub. |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|--|--|---|---|
| Fault 14: Internal Communication Fault | Processor to processor communication with VCM Port 6 | The main hub processor and VCM 6 port connector on the hub have stopped communicating. | If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub. |
| Fault 15: Internal Communication Fault | Processor to processor communication with VCM Port 7 | The main hub processor and VCM 7 port connector on the hub have stopped communicating. | If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub. |
| Fault 16: Internal Communication Fault | Processor to processor communication with VCM Port 8 | The main hub processor and VCM 8 port connector on the hub have stopped communicating. | If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub. |
| Fault 25: No CAN Communications | No CAN communications | ISOBUS CAN is disconnected or damaged | Do a check of the connections for the ISOBUS CAN—ISO CAN GPS connector on hub and the harnesses on the machine. |
| | | | Do a check for proper termination on the ISOBUS CAN. |
| Fault 26: No CAN GPS Messages | No CAN GPS Messages | After CAN GPS is selected, the system is not receiving CAN GPS Messages. Note: Options are only visible on the display if the system detects that they are available. | Verify the GPS source and change if necessary. |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|--|--|---|--|
| Fault 27: No CAN Lat/ Lon Message | No CAN Lat/ Lon Message | After CAN GPS is selected the system is not receiving CAN latitude and longitude GPS Messages. Note: Options are only visible on the display if the system detects that they are available. | Verify GPS source is transmitting Lat/Lon. |
| | | | Verify the GPS source and change if necessary. |
| Fault 28: No CAN Course Over Ground/ Speed Over Ground Message | No CAN Course Over Ground/ Speed Over Ground Message | After CAN GPS is selected the system is not receiving CAN bearing and speed GPS Messages. Note: Options are only visible on the display if the system detects that they are available. | Verify GPS source is transmitting bearing and speed. |
| | | | Verify the GPS source and change if necessary. |
| Fault 29: No CAN VT Reception | No CAN Communications With The VT | ISOBUS CAN Fault | Check the connections for the ISOBUS CAN—ISO CAN GPS connector on hub and the harnesses on the machine. Check for proper termination on the ISOBUS CAN. |
| | | No virtual terminal display connected | Connect the virtual terminal display. |
| | | | |
| Fault 30: No CAN TC Reception | No CAN Communications With The TC | ISOBUS CAN Fault | Check the connections for the ISOBUS CAN—ISO CAN GPS connector on hub and the harnesses on the machine. Check for proper termination on the ISOBUS CAN. |
| | | Task Controller is not configured correctly | Machine Task Controller setup required. |
| | | Task Controller is not enabled or not unlocked | Contact your machine dealer. |
| | | | |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|--|------------------------------------|--|---|
| Fault 32: No RS-232 GPS Communications | No RS-232 GPS | No GPS messages are being received | Cycle the GPS power Check the GPS antenna connections and fuses |
| | | GPS messages are being received but are empty | Wait for the GPS antenna to acquire satellites |
| | | Faulty GPS antenna | Replace the GPS antenna |
| | | Faulty GPS receiver | Replace the GPS receiver |
| | | Incorrect GPS settings | Wait 10 seconds while the GPS verifies itself. Change GPS receiver settings to: <ul style="list-style-type: none"> • Baud Rate: 19200 to 115200 • GGA: 10 Hz or more • VTG: 10 Hz or more • ZDA: 1 Hz or more |
| Fault 33: No RS-232 GGA Message | No RS-232 GGA Message | Incorrect GPS settings | Change the GGA message rate to at least 10 Hz on the GPS receiver |
| Fault 34: No RS-232 VTG Message | No RS-232 VTG Message | Incorrect GPS settings | Change the VTG message rate to at least 10 Hz on the GPS receiver |
| Fault 36: No Ethernet Communications | No Ethernet Communications | No Ethernet communication with the CapMod | Check the harnessing between the Ethernet port on the hub and the CapMod Ethernet port. |
| | | | Contact CapstanAG to repair or replace the hub or CapMod. |
| Fault 38: Internal Communication Fault | Accelerometer initialization error | Communication problem with the Inertial Measurement Unit in the hub. | Contact CapstanAG to repair or replace the hub. |
| | | | Disable the compass and gyro on the display. |
| Fault 39: Internal Communication Fault | Accelerometer read error | Communication problem with the Inertial Measurement Unit in the hub. | Contact CapstanAG to repair or replace the hub. |
| | | | Disable the compass and gyro on the display. |
| Fault 40: Internal Communication Fault | Compass initialization error | Communication problem with the Inertial Measurement Unit in the hub. | Contact CapstanAG to repair or replace the hub. |
| | | | Disable the compass and gyro on the display. |
| Fault 41: Internal Communication Fault | Compass read error | Communication problem with the Inertial Measurement Unit in the hub. | Contact CapstanAG to repair or replace the hub. |
| | | | Disable the compass and gyro on the display. |
| Fault 42: Internal Communication Fault | Gyroscope initialization error | Communication problem with the Inertial Measurement Unit in the hub. | Contact CapstanAG to repair or replace the hub. |
| | | | Disable the compass and gyro on the display. |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|---|--|--|--|
| Fault 43: Internal Communication Fault | Gyroscope gyro read error | Communication problem with the Inertial Measurement Unit in the hub. | Contact CapstanAG to repair or replace the hub. |
| | | | Disable the compass and gyro on the display. |
| Fault 44: Drop 1 Power Short | Power shorted to ground on drop 1 | Damaged harness | Inspect the harness, repair or replace as necessary |
| Fault 45: Drop 2 Power Short | Power shorted to ground on drop 2 | Damaged harness | Inspect the harness, repair or replace as necessary |
| Fault 46: Drop 3 Power Short | Power shorted to ground on drop 3 | Damaged harness | Inspect the harness, repair or replace as necessary |
| Fault 47: Drop 4 Power Short | Power shorted to ground on drop 4 | Damaged harness | Inspect the harness, repair or replace as necessary |
| Fault 48: Drop 5 Power Short | Power shorted to ground on drop 5 | Damaged harness | Inspect the harness, repair or replace as necessary |
| Fault 49: Drop 6 Power Short | Power shorted to ground on drop 6 | Damaged harness | Inspect the harness, repair or replace as necessary |
| Fault 50: Drop 7 Power Short | Power shorted to ground on drop 7 | Damaged harness | Inspect the harness, repair or replace as necessary |
| Fault 51: Drop 8 Power Short | Power shorted to ground on drop 8 | Damaged harness | Inspect the harness, repair or replace as necessary |
| Fault 52: VCM drop 1 controller version error | VCM drop 1 controller version does not match the Hub application | The VCM drop version was updated with the latest Hub update and needs to be boot-loaded. | Perform a factory reset or software reset to trigger VCM drop bootload |
| Fault 53: VCM drop 2 controller version error | VCM drop 2 controller version does not match the Hub application | The VCM drop version was updated with the latest Hub update and needs to be boot-loaded. | Perform a factory reset or software reset to trigger VCM drop bootload |
| Fault 54: VCM drop 3 controller version error | VCM drop 3 controller version does not match the Hub application | The VCM drop version was updated with the latest Hub update and needs to be boot-loaded. | Perform a factory reset or software reset to trigger VCM drop bootload |
| Fault 55: VCM drop 4 controller version error | VCM drop 4 controller version does not match the Hub application | The VCM drop version was updated with the latest Hub update and needs to be boot-loaded. | Perform a factory reset or software reset to trigger VCM drop bootload |
| Fault 56: VCM drop 5 controller version error | VCM drop 5 controller version does not match the Hub application | The VCM drop version was updated with the latest Hub update and needs to be boot-loaded. | Perform a factory reset or software reset to trigger VCM drop bootload |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|---|--|--|--|
| Fault 57: VCM drop 6 controller version error | VCM drop 6 controller version does not match the Hub application | The VCM drop version was updated with the latest Hub update and needs to be boot-loaded. | Perform a factory reset or software reset to trigger VCM drop bootloader |
| Fault 58: VCM drop 7 controller version error | VCM drop 7 controller version does not match the Hub application | The VCM drop version was updated with the latest Hub update and needs to be boot-loaded. | Perform a factory reset or software reset to trigger VCM drop bootloader |
| Fault 59: VCM drop 8 controller version error | VCM drop 8 controller version does not match the Hub application | The VCM drop version was updated with the latest Hub update and needs to be boot-loaded. | Perform a factory reset or software reset to trigger VCM drop bootloader |
| Fault 60: Drop 1 CAN Failure | CAN Failure on drop 1 | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| Fault 61: Drop 2 CAN Failure | CAN Failure on drop 2 | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| Fault 62: Drop 3 CAN Failure | CAN Failure on drop 3 | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| Fault 63: Drop 4 CAN Failure | CAN Failure on drop 4 | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| Fault 64: Drop 5 CAN Failure | CAN Failure on drop 5 | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| Fault 65: Drop 6 CAN Failure | CAN Failure on drop 6 | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|--|--|-------------------------|---|
| Fault 66: Drop 7 CAN Failure | CAN Failure on drop 7 | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| Fault 67: Drop 8 CAN Failure | CAN Failure on drop 8 | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| Fault 68: VCM drop 1 Firmware update failure | A firmware update failed on VCM drop 1 | Process failure | Perform a software reset from the System Menu. |
| | | Poor harness connection | Inspect the harness connections on VCM Drop 1. |
| Fault 69: VCM drop 2 Firmware update failure | A firmware update failed on VCM drop 2 | Process failure | Perform a software reset from the System Menu. |
| | | Poor harness connection | Inspect the harness connections on VCM Drop 2. |
| Fault 70: VCM drop 3 Firmware update failure | A firmware update failed on VCM drop 3 | Process failure | Perform a software reset from the System Menu. |
| | | Poor harness connection | Inspect the harness connections on VCM Drop 3. |
| Fault 71: VCM drop 4 Firmware update failure | A firmware update failed on VCM drop 4 | Process failure | Perform a software reset from the System Menu. |
| | | Poor harness connection | Inspect the harness connections on VCM Drop 4. |
| Fault 72: VCM drop 5 Firmware update failure | A firmware update failed on VCM drop 5 | Process failure | Perform a software reset from the System Menu. |
| | | Poor harness connection | Inspect the harness connections on VCM Drop 5. |
| Fault 73: VCM drop 6 Firmware update failure | A firmware update failed on VCM drop 6 | Process failure | Perform a software reset from the System Menu. |
| | | Poor harness connection | Inspect the harness connections on VCM Drop 6. |
| Fault 74: VCM drop 7 Firmware update failure | A firmware update failed on VCM drop 7 | Process failure | Perform a software reset from the System Menu. |
| | | Poor harness connection | Inspect the harness connections on VCM Drop 7. |
| Fault 75: VCM drop 8 Firmware update failure | A firmware update failed on VCM drop 8 | Process failure | Perform a software reset from the System Menu. |
| | | Poor harness connection | Inspect the harness connections on VCM Drop 8. |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|---|-------------------------------|----------------------|---|
| Fault 76: Section 1 Valve Short Circuit | Section 1 Valve Short Circuit | Damaged harness | Check the connections to section 1 valve and section 9 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 1 |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 77: Section 2 Valve Short Circuit | Section 2 Valve Short Circuit | Damaged harness | Check the connections to section 2 valve and section 10 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 2 |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 78: Section 3 Valve Short Circuit | Section 3 Valve Short Circuit | Damaged harness | Check the connections to section 3 valve and section 11 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 3 |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 79: Section 4 Valve Short Circuit | Section 4 Valve Short Circuit | Damaged harness | Check the connections to section 4 valve and section 12 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 4 |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 80: Section 5 Valve Short Circuit | Section 5 Valve Short Circuit | Damaged harness | Check the connections to section 5 valve and section 13 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 5 |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 81: Section 6 Valve Short Circuit | Section 6 Valve Short Circuit | Damaged harness | Check the connections to section 6 valve and section 14 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 6 |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|---|-------------------------------|----------------------|---|
| Fault 82: Section 7 Valve Short Circuit | Section 7 Valve Short Circuit | Damaged harness | Check the connections to section 7 valve and section 15 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 7 |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 83: Section 8 Valve Short Circuit | Section 8 Valve Short Circuit | Damaged harness | Check the connections to section 8 valve and section 16 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 8 |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 84: Section 1 Valve Open Circuit | Section 1 Valve Open Circuit | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 85: Section 2 Valve Open Circuit | Section 2 Valve Open Circuit | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 86: Section 3 Valve Open Circuit | Section 3 Valve Open Circuit | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 87: Section 4 Valve Open Circuit | Section 4 Valve Open Circuit | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 88: Section 5 Valve Open Circuit | Section 5 Valve Open Circuit | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|--|------------------------------|---|--|
| Fault 89: Section 6 Valve Open Circuit | Section 6 Valve Open Circuit | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 90: Section 7 Valve Open Circuit | Section 7 Valve Open Circuit | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 91: Section 8 Valve Open Circuit | Section 8 Valve Open Circuit | Damaged harness | Inspect the harnesses and connections, repair or replace as necessary |
| | | Internal hub problem | Contact CapstanAG to repair or replace the hub. |
| | | Servo valve failure | Repair or replace the servo valve |
| Fault 92: Section 1 Low Pressure | Section 1 Low Pressure | If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 93: Section 2 Low Pressure | Section 2 Low Pressure | If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 94: Section 3 Low Pressure | Section 3 Low Pressure | If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 95: Section 4 Low Pressure | Section 4 Low Pressure | If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 96: Section 5 Low Pressure | Section 5 Low Pressure | If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|------------------------------------|-------------------------|---|--|
| Fault 97: Section 6 Low Pressure | Section 6 Low Pressure | If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 98: Section 7 Low Pressure | Section 7 Low Pressure | If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 99: Section 8 Low Pressure | Section 8 Low Pressure | If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 100: Section 1 High Pressure | Section 1 High Pressure | If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 101: Section 2 High Pressure | Section 2 High Pressure | If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 102: Section 3 High Pressure | Section 3 High Pressure | If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 103: Section 4 High Pressure | Section 4 High Pressure | If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 104: Section 5 High Pressure | Section 5 High Pressure | If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|--------------------------------------|-------------------------|---|--|
| Fault 105: Section 6 High Pressure | Section 6 High Pressure | If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 106: Section 7 High Pressure | Section 7 High Pressure | If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 107: Section 8 High Pressure | Section 8 High Pressure | If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 108: Servo Valve Short Circuit | Servo Short Circuit | Damaged harness | Repair or replace the harness |
| | | Damaged valve | Repair or replace the valve |
| Fault 109: Servo Valve Open Circuit | Servo Open Circuit | Damaged harness | Repair or replace the harness |
| | | Damaged valve | Repair or replace the valve |
| | | Connectors are not connected | Check the connections |
| Fault 110: Flowmeter Short Circuit | Flowmeter Short Circuit | Damaged harness | Repair or replace the harness |
| | | Damaged flowmeter | Repair or replace the flowmeter |
| Fault 111: Flowmeter Open Circuit | Flowmeter Open Circuit | Damaged harness | Repair or replace the harness |
| | | Damaged flowmeter | Repair or replace the flowmeter |
| | | Connectors are not connected | Check the connections |
| Fault 112: System 1 Low Pressure | System 1 Low Pressure | The system is below the minimum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 113: System 1 High Pressure | System 1 High Pressure | The system is above the maximum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 114: System 2 Low Pressure | System 2 Low Pressure | The system is below the minimum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 115: System 2 High Pressure | System 2 High Pressure | The system is above the maximum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 116: VCM Memory | VCM Memory | Settings in the VCM do not match settings in the Hub. | Cycle the power to the system |
| | | | Perform a factory reset |
| | | | Upload software to the hub |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|------------------------------------|--|---|---|
| Fault 117: Boom Profile Mismatch | Nozzle Memory | The boom profile in memory doesn't match the attached hardware. | Cycle the power to the system |
| | | | Perform a factory reset |
| | | | Upload software to the hub |
| Fault 118: Nozzle Count Error | Nozzle Count Error | The number of attached nozzle valves doesn't match the value in memory | Cycle the power to the system |
| | | | Perform a factory reset |
| | | | Verify all valves are functional |
| Fault 119: System Memory | System Memory | The hub did not read the menu settings correctly from memory. | Cycle the power to the system |
| | | | Perform a factory reset |
| | | | Contact CapstanAG to repair or replace the hub. |
| Fault 120: Pump Seal | Pump Seal | System pressure dropped below the minimum for 8 seconds. | Fill the tank and then restart the pump. To restart the pump: Go to the main screen CapstanAG operating screen: Select System>>On/off icon next to Pump is system status window |
| Fault 121: Control Duty Cycle Zero | Control Duty Cycle | Pump control is off because external rate controller is off. (Only used in External Task Control Mode with Synchro fluid control) | Check the rate controller settings and change as necessary. |
| Fault 122: Low Pressure | Low Pressure | The system is below the minimum voltage for the pressure sensor. | Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary. |
| Fault 123: Flow Percentage | Flow percentage exceeds the maximum value set in the system menu | Flowmeter calibration number is incorrect | Check the flowmeter calibration. |
| | | Damaged flowmeter | Repair or replace the flowmeter as necessary. |
| | | Wrong tip size on display | Change the value on the display |
| | | Wrong valve size on display | Change the value on the display |
| | | Boom leak | Inspect the booms and repair any damage |
| | | Section valve not operating | Inspect the section valves and repair/replace as necessary |
| | | Plugged strainers | Clean or replace the strainers |
| | | Lodged plungers | Clean or replace the strainers |
| Fault 125: Low Flow Rate Sync | Low Flow Rate Sync | This is used only for John Deere and is information only. | |
| Fault 126: Pump Speed | Pump Speed | On a system with a pump speed sensor, the system has exceeded the maximum allowable pump speed. | Fill the tank |
| | | | Reduce the pressure or flow |

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|----------------------------|-----------------|---|--------------------------------|
| Fault 127: Plug Strainer | Plug Strainer | Strainer is clogged | Clean or replace the strainers |
| Fault 128: Low Tank Volume | Low Tank Volume | The tank volume is low | Fill the tank |
| Fault 129: Float Switch | Float Switch | The float switch indicated that the tank is empty or there is vapor in the lines. | Fill the tank |
| Fault 130: Float Switch 2 | Float Switch 2 | The float switch indicated that the tank is empty or there is vapor in the lines. | Fill the tank |

Table 24: Valve Fault Codes

| Fault Code: Message | Fault | Cause(s) | Correction(s) |
|--------------------------------|---------------------|--|---|
| Fault 500: Valve Lodged Open | Valve Lodged Open | Debris in the valve | Clean the valve |
| Fault 501: Valve Lodged Closed | Valve Lodged Closed | Debris in the valve | Clean the valve |
| Fault 502: Coil Circuit Open | Coil Circuit Open | Coil wire is pinched, cut, broken, or disconnected | Check the coil connection and resistance: <ul style="list-style-type: none"> • 7-watt coils resistance — 21 ohms to 23.5 ohms • 12-watt coils resistance — 10 ohms to 11.5 ohms |
| Fault 503: Coil Circuit Short | Coil Circuit Short | Internal coil short: Coil wire is pinched, cut, or broken | Check the coil connection and resistance: <ul style="list-style-type: none"> • 7-watt coils resistance — 21 ohms to 23.5 ohms • 12-watt coils resistance — 10 ohms to 11.5 ohms |
| Fault 504: Extra Coil | Extra Coil | A valve has been sensed on a VCM after the system was setup. | If you do have an extra valve, perform a factory reset to correctly set up the system. |
| | | | If you do not have additional valve(s), there is a VCM problem and you must repair or replace the VCM. |

Table 25: System Operation Errors

| Issue | Cause(s) | Correction(s) |
|--|---|---|
| Under application | Tips are too small | Find and install tips that are the correct size |
| | Plugged tips | Clean or replace the tips |
| | Plugged filter(s) | Clean or replace the filter(s) |
| | Filter(s) not correctly installed | Correctly install filter(s) |
| | Plugged, kinked, or collapsed hoses | Check all hoses and replace as needed |
| | Pump is not turned on | Refer to the sprayer manual for instructions to start the pump |
| | Outrunning sprayer liquid system capability | Slow down |
| | | Run at optimum pressure per nozzle speed range charts |
| | Incorrect rate settings | Check and adjust the rate settings |
| | Incorrect calibration settings | Refer to the rate controller and/or system manuals for instructions |
| | Faulty radar | Replace the radar |
| | Poor GPS satellite signal | Make sure that the GPS is working correctly |
| | Faulty rate controller switch(es) | Locate and replace the faulty switch(es) |
| | Servo valve not working correctly | Inspect the Servo valve and replace as necessary |
| Flowmeter calibration value is incorrect | Check the flowmeter calibration | |
| Faulty flowmeter | Repair or replace the flowmeter | |
| Over application | Tips are too large | Install tips of the correct size |
| | Worn tips | Replace the tips |
| | Speed too slow | Increase speed |
| | Incorrect rate settings | Check the rate settings and adjust as necessary |
| | Incorrect calibration settings | Refer to the rate controller and/or system manuals for instructions |
| | Servo valve not working correctly | Inspect the Servo valve and replace as necessary |
| | Flowmeter calibration value is incorrect | Check the flowmeter calibration |
| | Faulty flowmeter | Repair or replace the flowmeter |

| Issue | Cause(s) | Correction(s) |
|---|---|---|
| Rate instability | Low voltage to the rate controller | Test the voltage and repair as needed |
| | Faulty flowmeter | Repair or replace the flowmeter |
| | Faulty speed sensor reading | Inspect the radar and replace as needed |
| | Collapsed suction hose | Replace the suction hose |
| | Inlet plugged | Inspect the inlet and clean as necessary |
| | Incorrect valve calibration settings | Check the valve calibration settings and adjust as necessary. Refer to the rate controller manual |
| | Incorrect system gain | Check of the system gain and adjust as needed |
| | The system run/hold parameter is too short | Incrementally adjust up the system run/hold parameter to decrease the instability |
| | Air in the spray boom | Bleed air from the system |
| | Faulty rate controller | Replace the rate controller |
| Pressure instability | Faulty rate controller | Replace the rate controller |
| | Worn or sticky poppet(s) | Inspect the poppet(s) and replace as necessary |
| | Incorrect system gain setting | Check the system gain setting and adjust as needed |
| | Faulty pressure sensor | Replace the pressure sensor |
| Single nozzle valve drips when shut off | Plunger is lodged with debris | Clean the nozzle valve |
| | Plunger is worn | Replace the plunger |
| | O-ring is pinched or broken | Replace the O-ring |
| Single nozzle valve sprays erratically | Plunger is worn | Replace the plunger |
| Single nozzle valve will not shut off | Plunger is lodged with debris | Clean the nozzle valve |
| | O-ring is pinched or broken | Replace the O-ring |
| Section will not spray | Faulty VCM | Repair or replace the VCM |
| | Damaged VCM extension harness | Repair or replace the VCM extension harness |
| | Rate controller is not activating the section | Make sure that the section signal is getting to the hub. |
| | | Repair or replace the rate controller components. |
| Skips at the edges of a field | Overlap distance is set too low | Increase the overlap distance to at least 40" |
| | Incorrect GPS antenna location | Check the measurements to the GPS antenna location |
| | The display overlap settings are incorrect | Set the look ahead time and overlap distance to prevent skips |
| | Incorrect ball valve settings | Make sure that the ball valves are turning on soon enough or turning off late enough |

Table 26: Rate Controller Errors

| Issue | Cause(s) | Correction(s) |
|--|--|---|
| Under application | Tips are too small | Install tips of the correct size Check the low rates with a Wilger Quick Calibrator (or similar) or with a catch time test at each nozzle: <ul style="list-style-type: none"> • Oz/min per nozzle = GPA x Test Speed (mph) x Nozzle Spacing (inches) / (5940 x 128) • Oz/min per nozzle = G/1000 ft² x Test Speed (mph) x Nozzle Spacing (inches) / (136 x 128) |
| | Plugged filters | Inspect the filters and replace as needed |
| | | Make sure that the filters are installed correctly |
| | Plugged lines | Make sure that the lines are clean and do not have any kinks |
| | Shutoff valve is partially closed | Make sure that each shutoff valve is fully open |
| | Control Valve Type: Use A, B, C, or D as it applies to your Machine | A. Pressure set too low on the flow by-pass lines <ul style="list-style-type: none"> • Make sure that the settings on each pressure controlled by-pass valve are correct B. In-line Servo flow control valve is stuck <ul style="list-style-type: none"> • Make sure that the Servo flow control valve is operating correctly C. Servo signal wire polarity is switched <ul style="list-style-type: none"> • Make sure that the valve opens with a rate increase • Make sure that the valve closes with a rate decrease D. Top PWM valve is set too low <ul style="list-style-type: none"> • Adjust the rate controller PWM valve to the desired setting |
| | Electric Servo Valve pump control is stuck | Make sure that the electric Servo pump control is operating correctly |
| | PWM spool is stuck | Change the rate to observe whether the rate change is slow, limited, or does not change at all. Replace as needed |
| | Worn pump | Speed data error |
| | | Incorrect speed calibration number |
| Poor GPS satellite reception/number of satellites | | |
| Spraying too fast which outruns the liquid system capability | | |

| Issue | Cause(s) | Correction(s) |
|-------------------|--|---|
| Under Application | Worn flowmeter | Remove the rate smoothing feature |
| | | Put the rate controller in manual mode at a test speed Note: Putting the rate controller in manual mode will lock the Servo valve position unless the valve position is changed manually. If the rate becomes stable: <ul style="list-style-type: none"> • Worn Servo Valve • Worn PWM Valve If the rate remains unstable, the issue is usually the flowmeter signal instability. Manually increase the rate. The rate and pressure should increase. If the rate does not increase: <ul style="list-style-type: none"> • Worn Servo Valve • Worn PWM Valve Manually decrease the rate. The rate and pressure should decrease. If the rate does not decrease: <ul style="list-style-type: none"> • Worn Servo Valve • Worn PWM Valve |
| Over Application | Worn tips or tips that are too big | Install tips of the correct size Check the low rates with a Wilger Quick Calibrator (or similar) or with a catch time test at each nozzle: <ul style="list-style-type: none"> • $\text{Oz/min per nozzle} = \text{GPA} \times \text{Test Speed (mph)} \times \text{Nozzle Spacing (inches)} / (5940 \times 128)$ • $\text{Oz/min per nozzle} = \text{G}/1000 \text{ ft}^2 \times \text{Test Speed (mph)} \times \text{Nozzle Spacing (inches)} / (136 \times 128)$ |
| | Incorrect speed calibration value | Adjust the speed calibration setting |
| Rate Instability | Check the rate controller calibration values | Check the valve type and change if necessary Check the valve calibration. Refer to the rate controller information for the cal number for the specific valve type |
| | Worn or sticking Servo valve | Inspect the Servo valve and replace as needed |
| | Worn of sticking PWM valve | Inspect the PWM valve and replace as needed |
| | Flowmeter signal instability | Make sure that the flowmeter signal is correct |
| | Plugged, kinked, or collapsed hoses | Inspect all hoses and replace as needed |

| Issue | Cause(s) | Correction(s) |
|------------------|---------------------------------|--|
| Rate Instability | Controller pressure instability | Isolate the display from the rate controller and then put the system in manual mode at 50% |
| | | Inspect the rate controller pressure sensor and replace as needed |
| | | Make sure that the rate controller calibration values are correct |

Interchange Components

The system includes a number of usages of the same part in multiple locations:

- Nozzle Valves
- Extension Harnesses
- VCMs

When troubleshooting failed components, it can be helpful to replace the failed part with a working part at another location. If the problem follows the failed part to the new location, repair or replace the failed part.

If the problem does not follow the failed part, then the problem is likely elsewhere in the system, and other troubleshooting means may be followed.

Note: Use caution when failed parts are interchanged with a part that is operating correctly; in rare cases, the failed component may cause other components to fail at the new location.

Coil Assembly Test

Use a voltmeter to measure the ohms of resistance across pins A and B on the coil connector.

Note: Correct resistance is:

- 7-watt coils resistance — 21 ohms to 23.5 ohms
- 12-watt coils resistance — 10 ohms to 11.5 ohms

If resistance value is incorrect:

- Clean the connector terminals and retest
- Replace the coil assembly

Coil assembly failures are often the result of two factors:

- Extended valve use with a plugged nozzle
- Extended use in corrosive environments

CapstanAG recommends cleaning any plugged valve assemblies immediately. Additionally, rinse the inside of the booms, and wash the outside of the coil assemblies with clean water as often as practical.

Circuit Breaker Test



Figure 54: Circuit Breaker

The circuit breaker has a manual trip button (Figure 54, Item 1) and a manual reset lever (Figure 54, Item 2). A tripped circuit breaker is an indicator of a short or overload condition.

Do not reset the circuit breaker without looking into the cause of the tripped circuit breaker.

Note: The circuit breaker is usually located near the battery or in the battery compartment. The 60A or 80A circuit breaker is equipped with a manual trip. To reset the breaker, rotate the tripped lever back into the reset position.

IMPORTANT: When disconnecting the battery terminals, remove the negative (-) cable first, then remove the positive (+) cable. When connecting cables, connect the positive (+) cable first, then connect the negative (-) cable.

System Load Capacity Test

1. Start the machine engine.
2. Turn on all the boom sections.
3. Turn on all electrical loads, including the air conditioning, foam marker monitors, etc.
4. Observe the voltage readout on the correct settings screen in the display.

The nozzle valves operate best at 12 VDC or higher. Using less than 12 VDC will result in reduced pressure capacity. This will often result in erratic nozzle pulsing, sometimes described as flickering. Also, inspect the nozzle valves for worn plunger seals.

If low voltage is observed, inspect:

- Battery terminals, clean as necessary
- Battery condition
- Alternator condition
- Electrical connections

Circuit Breaker Test

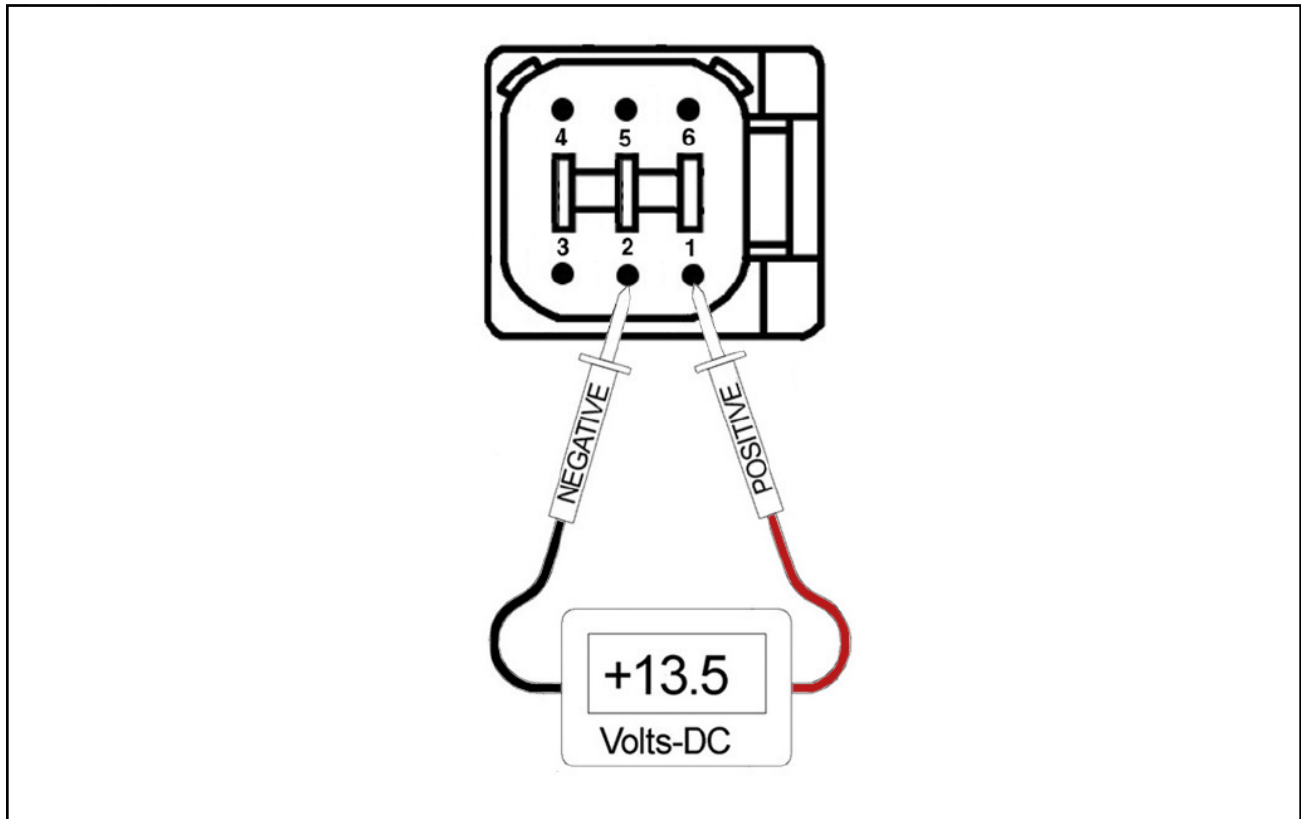


Figure 55: VCM Voltage Test Setup

Disconnect the VCM extension harness (6-pin Deutsch connector) at each boom section VCM.

- With the engine of the machine running, use a voltmeter to observe that there is a 13.5 VDC between pin 1 and pin 2.
- With the engine of the machine running, use a voltmeter to observe that there is a 13.5 VDC between pin 2 and pin 6.

Make sure that the polarity is accurate by looking at the positive voltage when the red (positive) probe is connected to pin 1, and the black (negative) probe is connected to pin 2.

If there is no voltage present between pin 2 and pin 6:

- Turn on the key.
- Make sure there are no short circuit alarms on the VT.
- Check the voltage at the hub.
- Inspect the circuit breaker at the machine battery.
- Inspect the PinPoint™ battery harness connections.

VCMs require constant power on pin 1 and key switched power on pin 6.

Boom Shutoff Signal Test

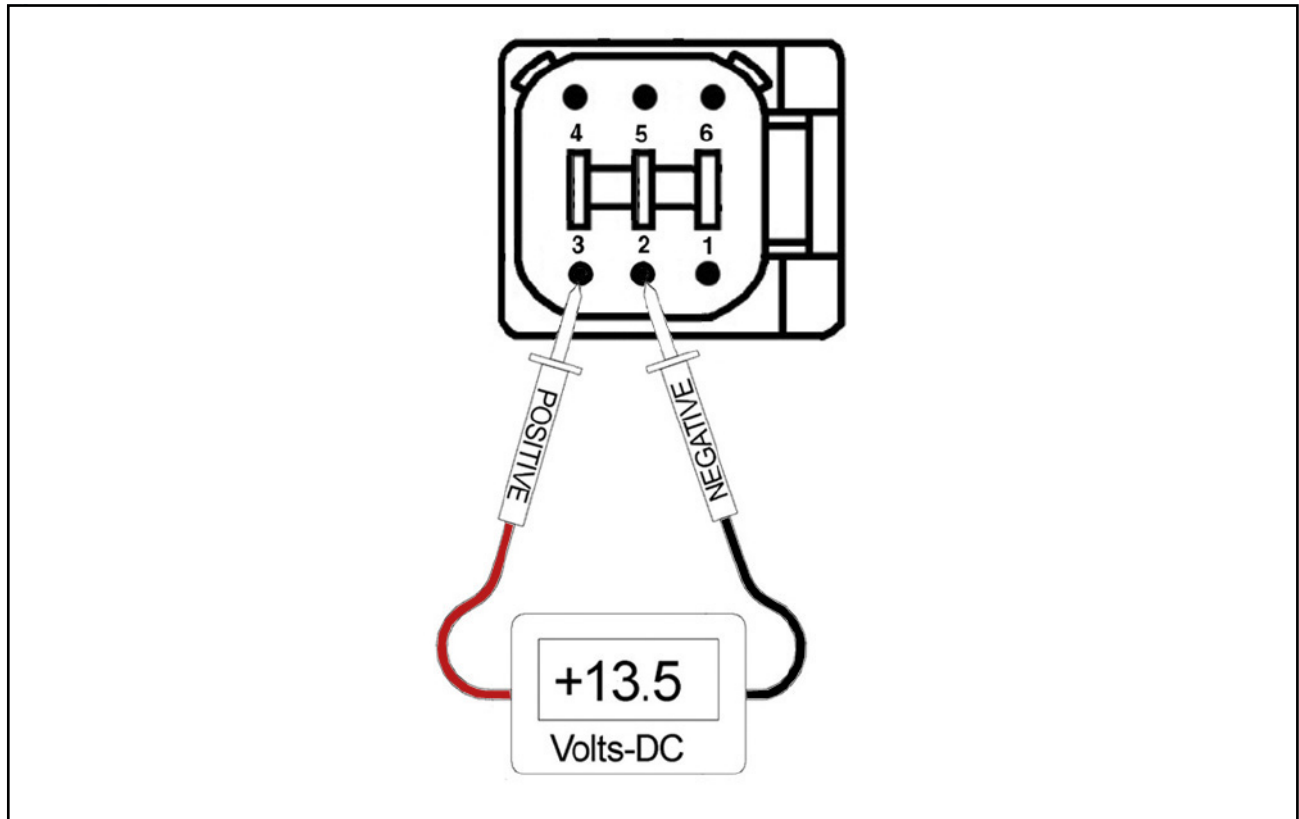


Figure 56: Boom Shutoff Signal Test Setup

Disconnect the VCM extension harness (6-pin Deutsch connector) from the VCM.

Turn on the boom section shutoff switch for the VCM being tested.

- With the engine of the machine running, use a voltmeter to observe that there is a 13.5 VDC between pin 2 and pin 3.
- With the engine of the machine off, there is a 12.0 VDC between pin 2 and pin 3. Make sure that the polarity is accurate by looking at the positive voltage when the red (positive) probe is connected to pin 3, and the black (negative) probe is connected to pin 2.

If there is no voltage present:

- Check the boom shutoff switches
- Check the voltage at the hub
- Inspect the circuit breaker at the machine battery
- Inspect the PinPoint™ battery harness connections

For a VCM to spray, there must be 12V on pin 1 (constant power), pin 3 (boom signal), and pin 6 (key switched power).

Pressure Sensor Signal Test

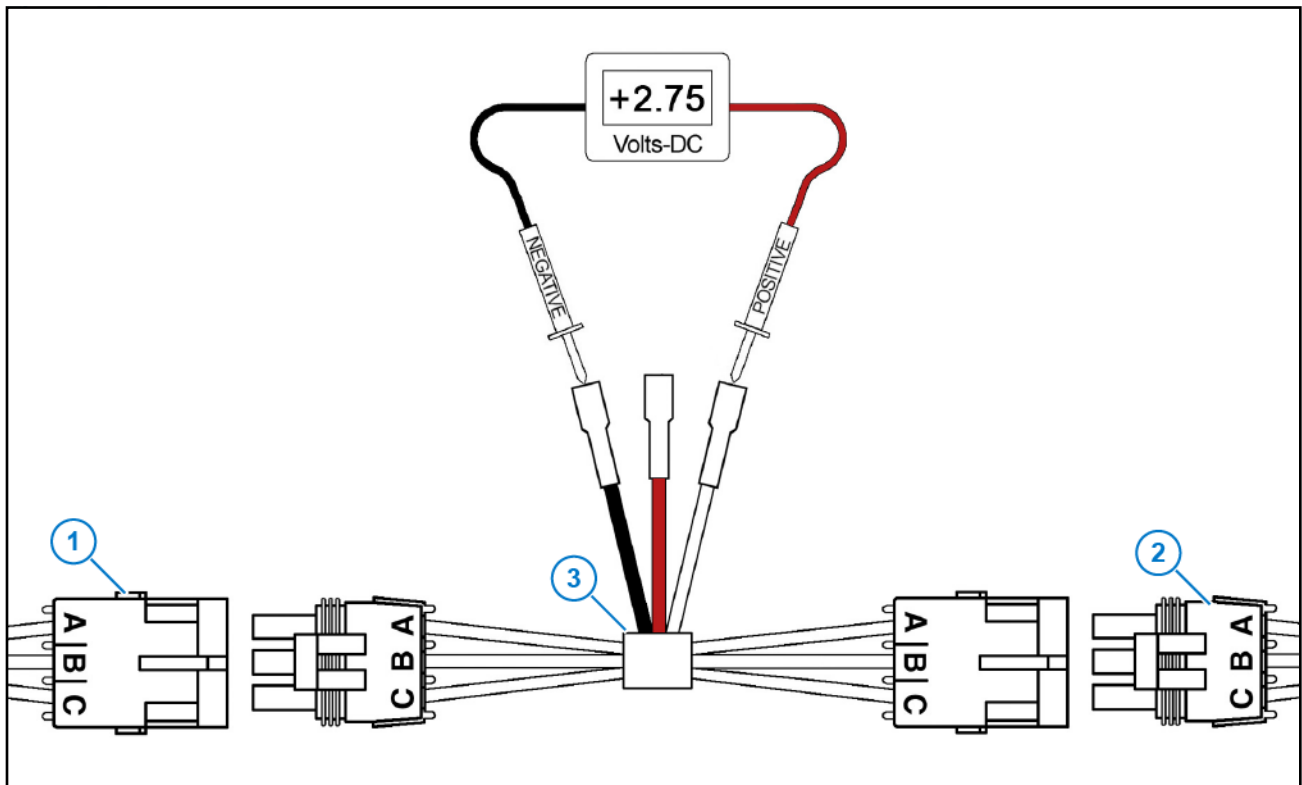


Figure 57: Pressure Sensor Signal Test Setup

Disconnect the pressure sensor (Figure 57, Item 1) from the pressure sensor harness (Figure 57, Item 2). Connect one end of the pressure sensor breakout harness diagnostic tool (Figure 57, Item 3) into the pressure sensor shroud connector. Connect the other end into the pressure sensor harness tower connector.

With the engine running and the system is turned on, use the rate controller to establish 50 psi on the pressure gauge.

Use a voltmeter to observe that there is 2.75 VDC between the black and white wires on the pressure sensor breakout harness.

Using the rate controller, adjust the pressure to 100 psi. The voltmeter should read 5.0 VDC.

If accurate voltage is not present:

- Verify the accuracy of the pressure gauge on the sprayer.
- Check the power to the pressure sensor.
- Use the serial diagnostics to check the pressure sensor calibration.
- Replace the pressure sensor.

Power to Pressure Sensor Input Test

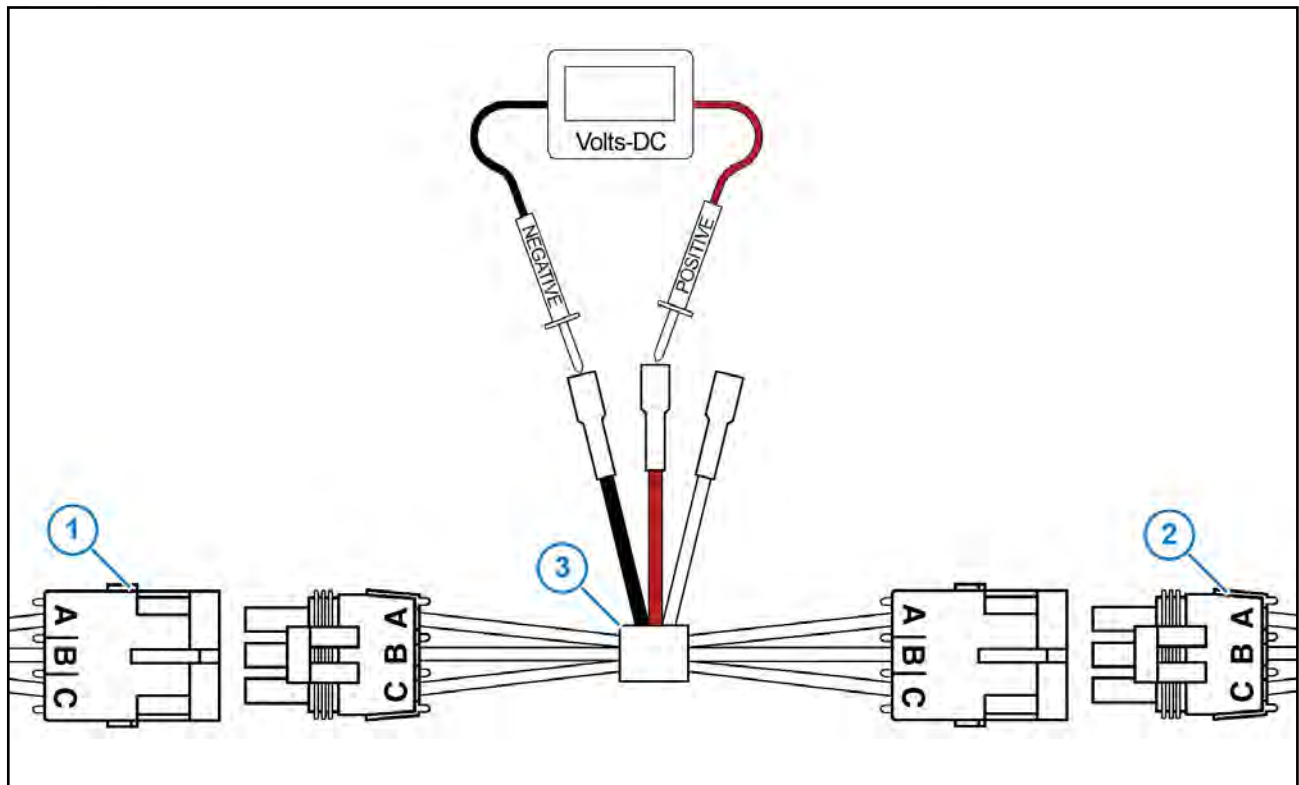


Figure 58: Power to Pressure Sensor Input Test Setup

Disconnect the pressure sensor (Figure 58, Item 1) from the pressure sensor harness (Figure 58, Item 2). Connect one end of the pressure sensor breakout harness diagnostic tool (Figure 58, Item 3) into the pressure sensor shroud connector. Connect the other end into the pressure sensor harness tower connector.

Use a voltmeter to observe that there is 13.5 VDC between the red and black wire on the pressure sensor breakout harness with the engine running or 12.0 VDC without the engine running.

Be sure the polarity is accurate by observing that there is positive voltage when the red (positive) probe is connected to the red pressure sensor breakout harness wire, and the black (negative) probe is connected to the black pressure sensor breakout harness wire.

If no voltage is present:

- Inspect the circuit breaker at the machine battery
- Inspect the PinPoint™ battery harness connections
- Inspect the battery condition
- Inspect the alternator condition

Technical Bulletin

This technical bulletin was originally produced July 11, 2001. The latest revision to this bulletin was made November 1, 2017.

Spray Skips from Poor Pulse Blending

Over the years, CapstanAG field engineers have received many questions about Blended Pulse™ spraying and its potential for causing skips in the field. In rare instances, skipping has been documented in the field. This technical bulletin is intended to explain pulse blending, and the techniques used to provide optimum spray coverage and to prevent skipping.

What is Blended Pulse™ spraying? Each nozzle in a Blended Pulse™ spray system emits 10 spray pulses per second. Adjacent nozzles have alternate timing. The alternating pulses, the overlapping spray patterns, and the natural dispersing of droplets, blend together to provide consistent coverage of the target.

What makes the pulses blend? Below is an illustration of what a blended pulse spray pattern might look like if it were sprayed upon a flat surface. This spray pattern is similar to a #8 size flat fan spray tip (with a 110° fan angle) that is spraying 5 GPA at 15 mph with a 50 psi boom pressure. The nozzles are 20 in apart. Each tip is rotated 12.5° to prevent pattern interference between nozzles. The minimum boom height is 21 in above the spray target.

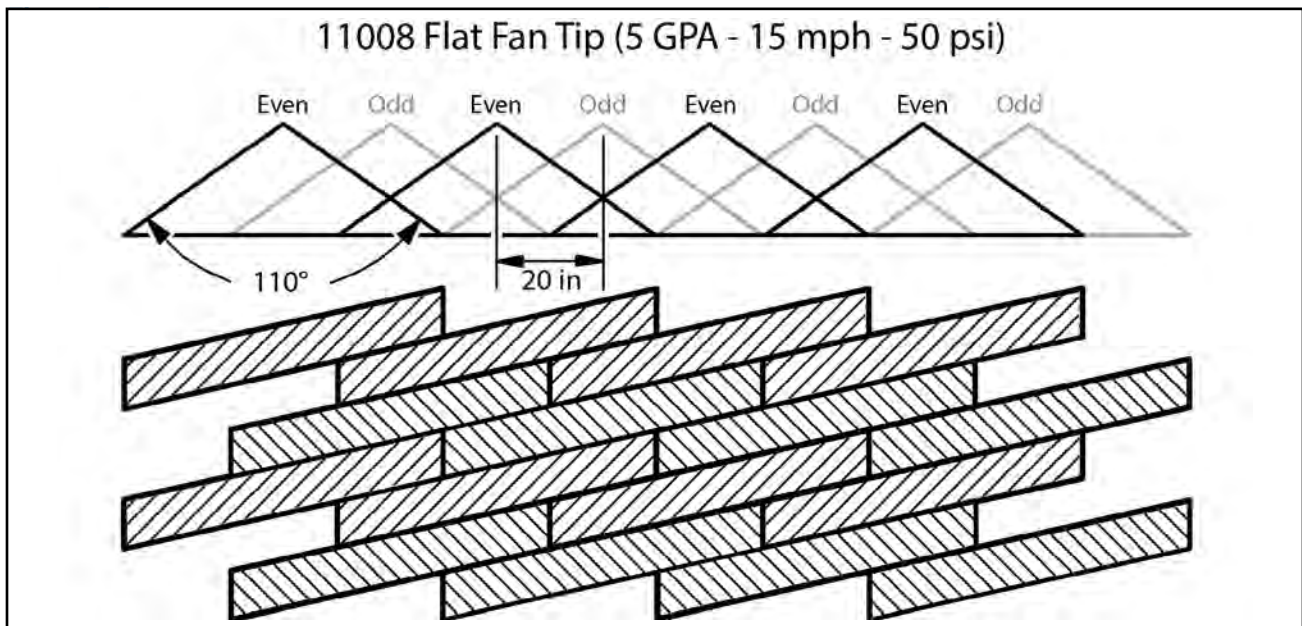


Figure 59: 11008 Flat Fan Tip

In this example, each nozzle sprays 1/3 of the time, but adjacent nozzles alternate and overlap to fill in areas between the nozzles. As the sprayer increases speed, rate, or boom height, the pulses become wider, this provides additional overlap, better pulse blending, and increased spray coverage.

As the sprayer decreases speed or rate, skips may begin to appear. For this example, a smaller tip size would be recommended if slower speeds are desired.

Pattern width and natural droplet dispersion are not shown in the diagram. These factors help to smooth out the pulses and fill in skips. The amount of droplet dispersion depends upon the style of tip being used. For example, low-drift tips typically emit large droplets and provide minimal droplet dispersion.

What causes skipping? Below is the same illustration from the previous page except that 80° fan angle tips are used rather than 110° tips. In this case, the 21 in boom height does not provide

adequate nozzle overlap and skips can be seen. Tips emitting small droplets, with plenty of droplet dispersion, will fill in large skips. Large droplet tips may not fill in the skips, and this may result in poor coverage. The skips appear as diagonal lines in the direction of travel. The angle of the diagonal depends upon the speed of the sprayer.

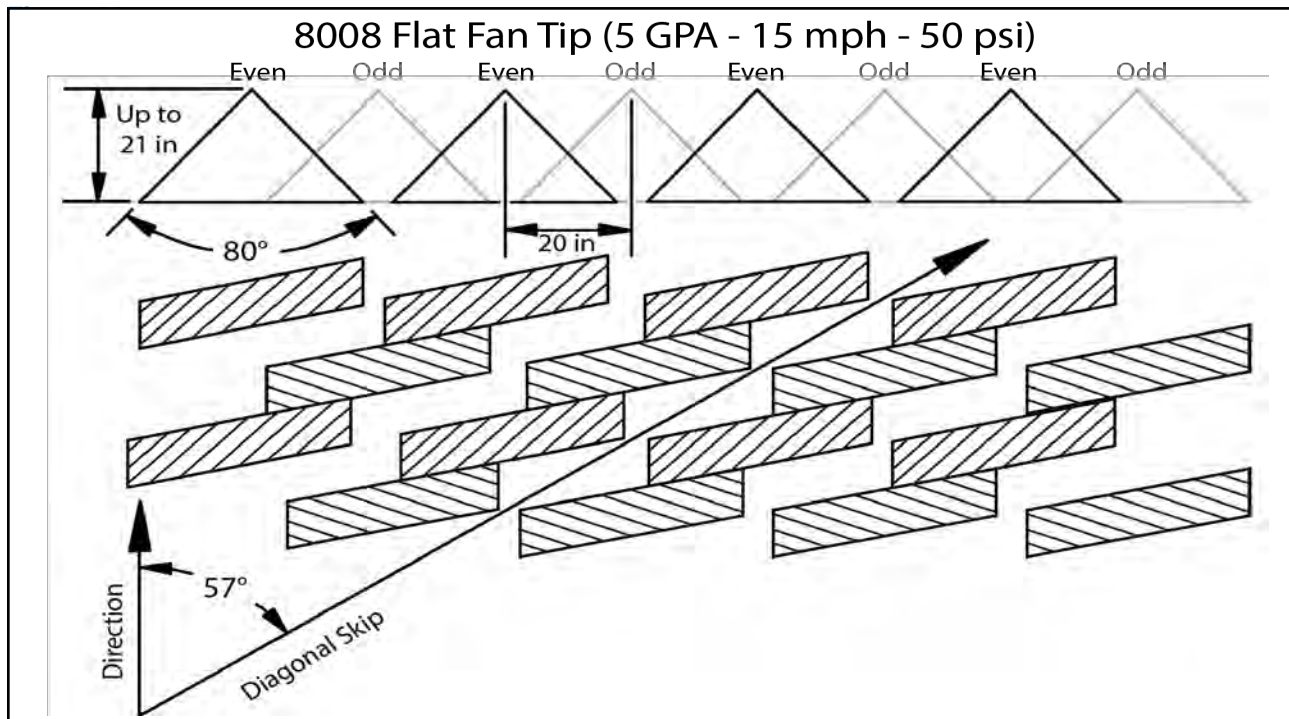


Figure 60: 8008 Flat Fan Tip

To Prevent Skipping

1. Use wide-angle spray tips and appropriate boom heights to provide 150% nozzle overlap.
 - For 80° tips, use 36 in or greater boom height.
 - For 110° tips, use 24 in or greater boom height.
 - Use pressures which fully develop the intended fan angle.
2. Avoid pulse duty cycles below 33%.
 - Use appropriately sized spray tips for the desired speed, rate, and pressure ranges.
 - Avoid speeds in the lower 1/3 of the speed range.
 - Avoid rates in the lower 1/3 of the rate range.
3. Use additional caution when using drift control tips or drift control additives which increase droplet size and reduce droplet dispersion. Follow the boom height, duty cycle, and tip selection recommendations to make sure that there is adequate spray coverage.
4. Always read and follow chemical label instructions. Agronomic and environmental factors significantly affect efficiency of the chemicals, and will magnify the adverse effects of poor coverage. Follow boom height, duty cycle, and tip selection recommendations for hot and dry field conditions, large/mature weed pressures, etc.
5. Always apply Blended Pulse™ broadcast sprays using a 10 Hz or greater pulse frequency. The CapstanAG master module and display allow the pulse frequency to be reduced for non-sprayer applications, when uniform coverage is not required.

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Chapter 9: Schematics

Topics:

- [VCM Connector Pinout](#)
- [Hub Connector Pin Identification](#)
- [System Layout](#)

VCM Connector Pinout

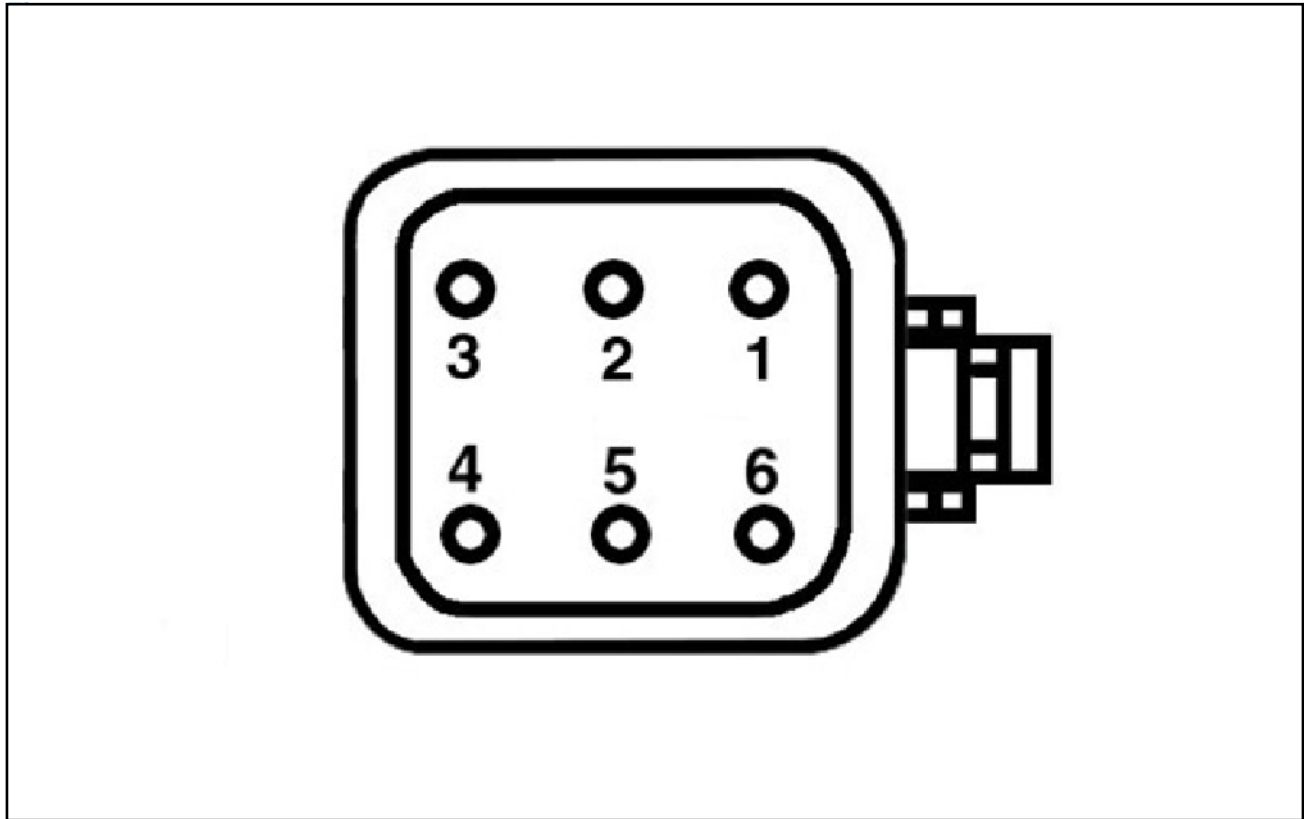


Figure 61: VCM Connector

Table 27: VCM Connector Pinout

| Pin | Description | Wire Color | Pin | Description | Wire Color |
|-----|--------------------|------------|-----|--------------------|------------|
| 1 | Power | Red | 4 | CAN High | Yellow |
| 2 | Ground | Black | 5 | CAN Low | Green |
| 3 | Boom Switch Signal | Blue | 6 | Key Switched Power | Brown |

Hub Connector Pin Identification

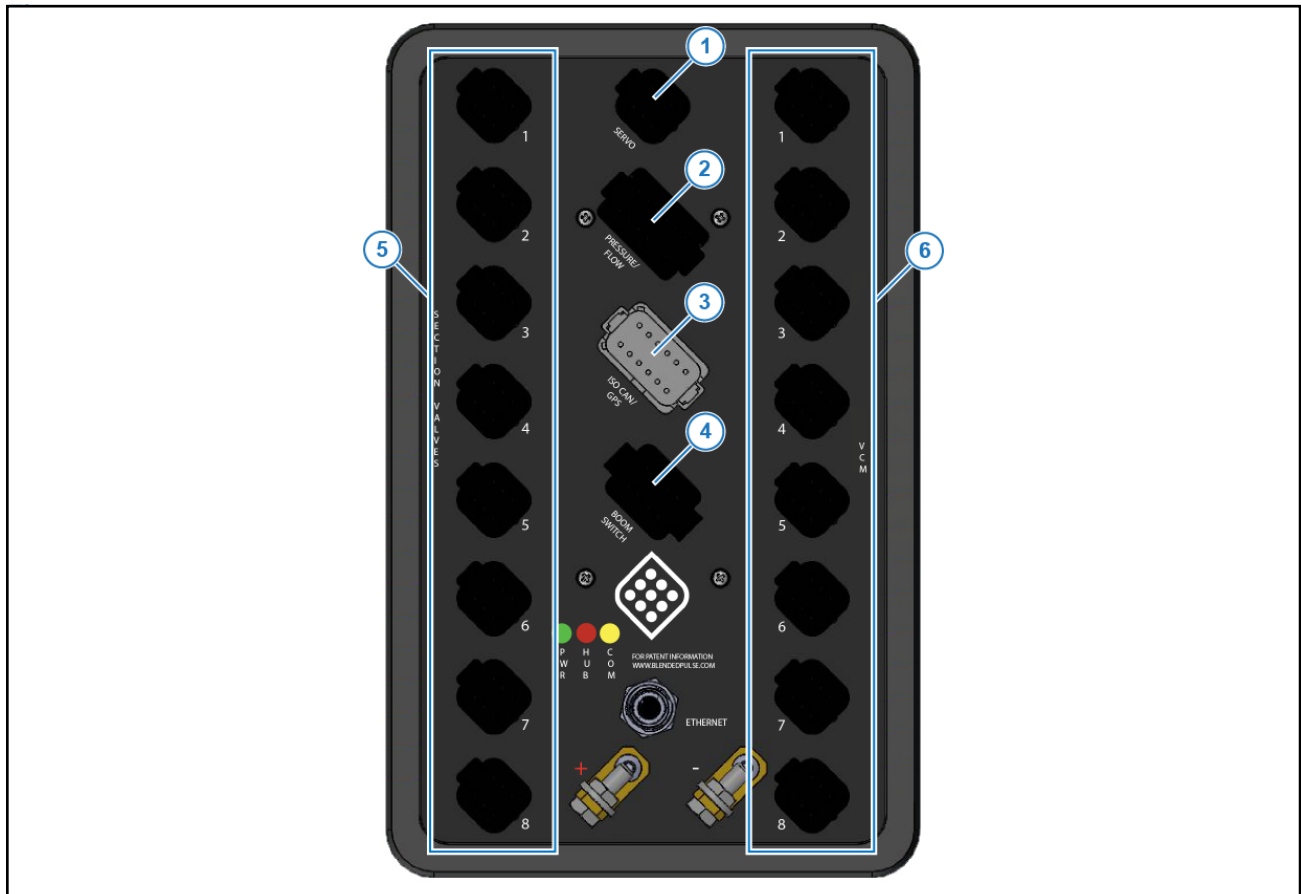


Figure 62: Gateway Hub

Table 28: Servo Port (Figure 62, Item 1) Pinout

| Pin | Description | Pin | Description |
|-----|-----------------------|-----|------------------------|
| 1 | Servo In INC (+) | 4 | Servo 2 Out Ground (-) |
| 2 | Servo Out INC (+) | 5 | Servo Out DEC (-) |
| 3 | Servo 2 Out Power (+) | 6 | Servo In DEC (-) |

Table 29: Pressure/Flow Port (Figure 62, Item 2) Pinout

| Pin | Description | Pin | Description |
|-----|------------------------|-----|------------------------|
| 1 | Flowmeter Power | 7 | Pressure Sensor Ground |
| 2 | Flowmeter Signal | 8 | Sparge Pressure Signal |
| 3 | Flowmeter Ground | 9 | Pressure Sensor Power |
| 4 | Pressure Sensor Power | 10 | Fill Flowmeter Ground |
| 5 | Boom Pressure Signal | 11 | Fill Flowmeter Signal |
| 6 | Pressure Sensor Ground | 12 | Fill Flowmeter Power |

Table 30: ISO CAN/GPS Port (Figure 62, Item 3) Pinout

| Pin | Description | Pin | Description |
|-----|--------------------|-----|-----------------------|
| 1 | ISO CAN High | 7 | Sensor Power |
| 2 | ISO CAN Low | 8 | Analog In |
| 3 | Key Switched Power | 9 | Digital In 2 |
| 4 | RS232 TX | 10 | Digital In 1 |
| 5 | RS232 RX | 11 | Ground |
| 6 | Ground | 12 | Boom Master Switch In |

Table 31: Boom Switch Port (Figure 62, Item 4) Pinout

| Pin | Description | Pin | Description |
|-----|--------------|-----|--------------|
| 1 | Section 1 In | 5 | Section 5 In |
| 2 | Section 2 In | 6 | Section 6 In |
| 3 | Section 3 In | 7 | Section 7 In |
| 4 | Section 4 In | 8 | Section 8 In |

Table 32: Section Valve Ports (Figure 62, Item 5) Pinout

| Section Valve 1 | | | |
|-----------------|------------------|-----|------------------|
| Pin | Description | Pin | Description |
| 1 | Section 1 Signal | 4 | Section Pressure |
| 2 | Ground | 5 | Section Ground |
| 3 | Section Power | 6 | Section 9 Signal |

Table 33: Section Valve Ports (Figure 62, Item 5) Pinout

| Section Valve 2 | | | |
|-----------------|------------------|-----|-------------------|
| Pin | Description | Pin | Description |
| 1 | Section 2 Signal | 4 | Section Pressure |
| 2 | Ground | 5 | Section Ground |
| 3 | Section Power | 6 | Section 10 Signal |

Table 34: Section Valve Ports (Figure 62, Item 5) Pinout

| Section Valve 3 | | | |
|-----------------|------------------|-----|-------------------|
| Pin | Description | Pin | Description |
| 1 | Section 3 Signal | 4 | Section Pressure |
| 2 | Ground | 5 | Section Ground |
| 3 | Section Power | 6 | Section 11 Signal |

Table 35: Section Valve Ports (Figure 62, Item 5) Pinout

| Section Valve 4 | | | | | |
|-----------------|------------------|--|-----|-------------------|--|
| Pin | Description | | Pin | Description | |
| 1 | Section 4 Signal | | 4 | Section Pressure | |
| 2 | Ground | | 5 | Section Ground | |
| 3 | Section Power | | 6 | Section 12 Signal | |

Table 36: Section Valve Ports (Figure 62, Item 5) Pinout

| Section Valve 5 | | | | | |
|-----------------|------------------|--|-----|-------------------|--|
| Pin | Description | | Pin | Description | |
| 1 | Section 5 Signal | | 4 | Section Pressure | |
| 2 | Ground | | 5 | Section Ground | |
| 3 | Section Power | | 6 | Section 13 Signal | |

Table 37: Section Valve Ports (Figure 62, Item 5) Pinout

| Section Valve 6 | | | | | |
|-----------------|------------------|--|-----|-------------------|--|
| Pin | Description | | Pin | Description | |
| 1 | Section 6 Signal | | 4 | Section Pressure | |
| 2 | Ground | | 5 | Section Ground | |
| 3 | Section Power | | 6 | Section 14 Signal | |

Table 38: Section Valve Ports (Figure 62, Item 5) Pinout

| Section Valve 7 | | | | | |
|-----------------|------------------|--|-----|-------------------|--|
| Pin | Description | | Pin | Description | |
| 1 | Section 7 Signal | | 4 | Section Pressure | |
| 2 | Ground | | 5 | Section Ground | |
| 3 | Section Power | | 6 | Section 15 Signal | |

Table 39: Section Valve Ports (Figure 62, Item 5) Pinout

| Section Valve 8 | | | | | |
|-----------------|------------------|--|-----|-------------------|--|
| Pin | Description | | Pin | Description | |
| 1 | Section 8 Signal | | 4 | Section Pressure | |
| 2 | Ground | | 5 | Section Ground | |
| 3 | Section Power | | 6 | Section 16 Signal | |

Table 40: VCM Ports (Figure 62, Item 6) Pinout

| Pin | Description | | Pin | Description |
|-----|--------------------|--|-----|--------------------|
| 1 | Power | | 4 | CAN Hi |
| 2 | Ground | | 5 | CAN Low |
| 3 | Section Signal Out | | 6 | Key Switched Power |

System Layout

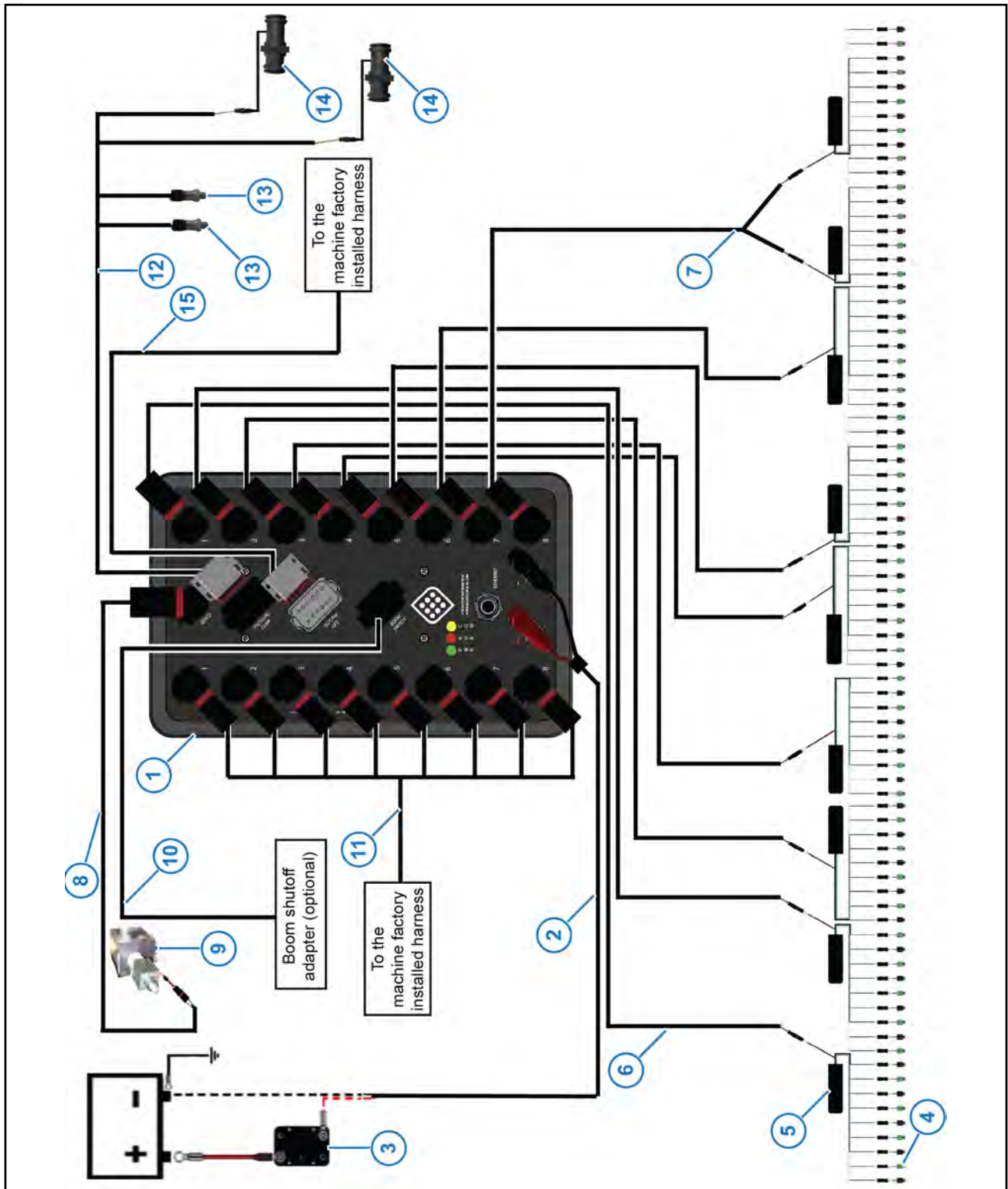


Figure 63: System Layout

Table 41: System Layout Diagram Components

| Item | Description |
|------|--|
| 1 | Gateway Hub |
| 2 | Power Harness |
| 3 | Circuit Breaker Kit (Optional) |
| 4 | Valve Assembly |
| 5 | VCM |
| 6 | Extension Harness |
| 7 | Y-adapter Harness |
| 8 | Harness to Connect to the Servo Port |
| 9 | PWM or Servo Valve |
| 10 | Harness to Connect to the Boom Switch Port |
| 11 | Shutoff Harness |
| 12 | Harness to Connect to the Pressure/Flow Port |
| 13 | Pressure Sensor |
| 14 | Flowmeter |
| 15 | Harness to Connect to the ISO CAN/GPS Port |

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