QuikChek Troubleshooting —SureFire Torpedo NH3 System

Safety First

Anhydrous ammonia can be very dangerous. It can blind you or cause serious, painful injuries, or even kill you. All personnel who will work with anhydrous ammonia should take a complete anhydrous ammonia safety course.

1. Always carry a small bottle of water with you for immediate eye flushing.
2. Always have 5 gallons of clean water available for immediate flushing.
3. Know where a large supply of water is nearby. Immediate first aid for contact with skin or eyes is flush, flush, flush.
4. Position the implement and yourself so that the wind will help in the event of an unexpected release.
5. This is not a complete list of safety instructions. **Take the safety course and follow all precautions every time**.

Troubleshooting

This sheet contains troubleshooting procedures for the various components of your system as well as general information about the operation of your system and the components in it. It is important that the operator understand the basic operation of the system and how each component works. This basic understanding will help guide the operator in troubleshooting when something is not working.

1. You need a voltmeter that has a continuity tester. This is an essential item to troubleshoot harnessing and electrical issues.
2. If the system has been working and now isn't working, start with the question, "What has changed, what is different, when was it last working?" That will often give you a place to start looking.
3. Always verify the controller setup. Entries can be changed accidentally or setup items can change if the controller loses power or is not shut down properly.
4. A good question is "What happens when you slow down?" Does it work better at a slower speed?
5. After checking the controller setup, go to the section that has the troubleshooting information about the component that is not working. Sometimes, a problem is not just caused by one thing, but may be a combination of things.

System Basics

As the anhydrous ammonia comes through the hose from the nurse tank to the implement, it is a mixture of liquid and vapor. The purpose of the cooler (heat exchanger) is to cool this mixture so it becomes all liquid. The flowmeter can accurately measure liquid. It cannot measure a mix of liquid and vapor. The flowmeter measures the liquid anhydrous ammonia. The controller adjusts the control valve to allow the needed amount through depending on the current rate, speed, and width.

The cooler works by directing a small portion of the liquid (2-3%) through the central cooling chamber. This liquid changes to a vapor (vaporizes) in the central cooling chamber, and then goes out to the ground through the vapor tubes. As this liquid vaporizes in the central cooling chamber, it absorbs a large amount of heat (everything else gets real cold), and the anhydrous ammonia going through the cooler to the flowmeter is completely in the liquid state.

Harness Troubleshooting Basics-"If a component isn't working, is it an electrical problem?"

1. Check for voltage (or do other test) at the end of the harness that connects to the component in question.
2. If there is a problem there, do the same test at the end of the next harness working your way back towards the controller. You may need to consult a wiring harness pinout to determine which pins to test.
3. To isolate the problem, do a **continuity test** on the suspected wires.

Verify Controller Setup

1. Using the screenshots in the manual that came with your system, **verify that the controller has been set up correctly**. Do not skip this step.

Valves —"One or more electric valves won't open".

1 Are all manual valves open on the nurse tank?

2 Can you open and close the Master ON/OFF valve using the controller?

3 Can you open and close the electric section valves using the controller?

Electric ON/OFF Valve Basics

Three-wire valve pinout: A-12V Power B-Ground C-Signal (12V=ON; 0V=OFF)

1. Check for **constant 12 V power to** valve. (Need power and ground wire– A & B)
2. Check for **12 V signal to valve** when valve should be open. (Need signal and ground wire—B & C– 12 V when valve should be open)
3. When troubleshooting a valve problem, switch the harness connection from a working valve to the valve that is not working, or plug the connector from the non-working valve into a known working valve to help identify the problem.
4. Is the controller set up correctly for valve type and section configuration?
5. When a valve is not working, you need to find out: Is it a **bad valve**, a **bad harness**, a **controller setup problem,** or a **controller problem**?

If a valve won't turn on, but everything checks out as OK, check to see if the controller thinks the system is in an area that has already been applied or that is outside a boundary.

To open valves and begin applying, the system must have a rate, speed, and width. If the system sees any of these as 0, it will not turn on. Determine if the controller is seeing any of these as 0. The controller could see rate and width as 0 if it thinks the system is out of bounds or is in an already-applied area.

Troubleshooting QuikChek—SureFire Torpedo NH3 System

Flowmeter

Flowmeter pinout: A- Signal B- 12V Power C- Ground

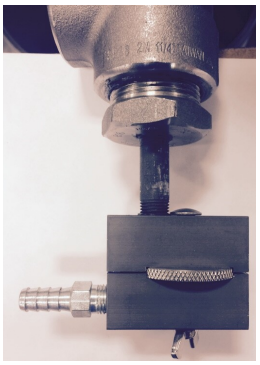
1. **Check for constant 12 V power to flowmeter.** (Need power and ground wire— **B & C**—Constant 12 V-check with voltmeter)
2. Must get pulse signal from flowmeter back to controller. **Do a Tap Test**. Hold one end of a wire on Pin A. Tap other end of wire repeatedly on Pin C. Does a flow register on the display? **(To register flow on the display, you must have: Flowmeter turbine and sensor must produce the flow signal. The turbine must spin freely and the sensor must create the pulse. Signal and ground wire must get signal to controller.)**
3. If the display shows a constantly changing flow that won't settle down, it may be caused by vapor going through the flowmeter. This means that the cooler is not cooling adequately to change everything to liquid. Try slowing down during application to see if flow display settles down. To increase cooling capacity, change to a larger orifice on the variable dump orifice that returns liquid to the cooler for the cooling chamber. Verify that vapor tubes are not plugged. A plugged vapor tube can cause erratic flow readings.
4. Compare NH3 tank weights to amount shown by display and adjust flow cal number if necessary.

Control Valve Basics (Two-wire servo)—"System won't lock on to rate or takes too long to get to rate"

1. The control valve will get signal from controller to increase flow (open further) or to reduce flow (close down some). Positive voltage will increase flow, negative voltage will decrease flow. If valve moves in the wrong direction, the polarity is reversed. Check voltage between the two pins on this harness as controller tells valve to open or close to verify the signal is being sent.
2. Control Valve Calibration or Gain Settings control how quickly the control valve moves. **If the system has trouble locking on to rate, (goes back and forth above and below rate)**, slow the valve down and/or increase the allowable error. **If the system is too slow responding to rate or speed changes**, speed up the valve calibration (Gain) settings.
3. Set the display so the Control Valve will remain in the same position when the system turns off. It won't have to adjust as much when application resumes.

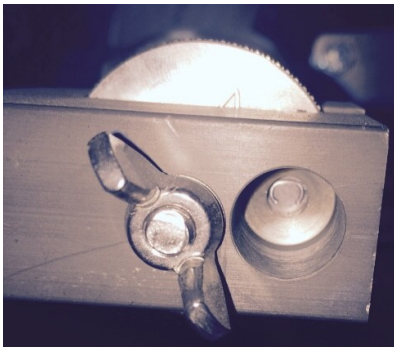
Vapor Tubes

Your system will have two or four vapor tubes that distribute the vapor that is used in the cooling process. All of these tubes must be kept open. A plugged vapor tube can result in inadequate cooling which may leave vapor in the anhydrous stream going through the flowmeter. The display will indicate an erratic rate when this happens. Be careful when clearing plugged lines, as a sudden anhydrous ammonia release may occur.



Variable Dump Orifice

This controls how much liquid is returned to the central cooling chamber. If too much liquid is returned, there will be too much vapor going out through the vapor tubes. This may cause streaking as the crop grows where this extra N is. If not enough liquid is returned, the flow through the flowmeter may contain some vapor. This will cause the flowmeter to read erratically. In normal operation, there will be frost on the first 12" or so of vapor tube coming out of the cooler. This will vary depending on the temperature and humidity. If there is not much frost, you may need to use a larger orifice. If there is frost for a longer piece of the vapor tube, you may be able to use a smaller orifice. See the chart in the manual for orifice recommendation based on the amount of anhydrous you are using.



System Capacity—"I can't hit the rate I want without slowing down."

The capacity of a system depends on a combination of several factors:

1. **Tank Pressure**: Tank pressure is the force that pushes the anhydrous through the system. Tank pressure is determined by the temperature of the NH3 in the tank. At 40ºF this pressure will be 60 PSI. At 80ºF the pressure will be about 140 PSI. This means the capacity of the system will be less at a lower temperature.
2. **Tank valve and other valves and hoses from nurse tank to the heat exchanger**: To achieve the high flow required by a wide implement putting on a high rate of N at a high speed, all of these components in the path from the nurse tank to the heat exchanger must be adequately sized. This becomes more critical as the temperature (and thus the tank pressure) decreases. Do these items have the capacity for the flow I need?
3. Splitters, manifolds, knives, and all hoses and tubes: The **A-360 splitter** is designed to work with one of two orifices installed on each outlet. Using too small of an orifice can result in a restriction that may limit flow. Using too large of an orifice may result in increased variation between output to each section. The **A-360 manifold** comes in three sizes. The manifolds for a system are selected based on the use that was anticipated at the time the system was ordered. See the manual for determining proper splitter orifice size and manifold selection.

NH3 Application—Common Problems and Possible Solutions

1. **Rate is jumping around.**

   A. Could be vapor in flowmeter. Not everything is being turned to liquid in the cooler.

   What happens when you slow down? If it gets better, you need to switch to a bigger orifice on the variable dump orifice that returns the liquid to the internal cooling chamber. See the chart in the manual for which orifice should be used for your flow rate.

   Check frost on vapor tubes coming out of cooler. Should have 1' to 2' of frost on these tubes (this may vary depending on temperature and humidity). If there is not frost here, you need to switch to a larger orifice on the variable dump orifice that returns the liquid to the internal cooling chamber.

   Are all the vapor tubes open all the way to the ground? A plugged vapor tube can cause insufficient cooling which will leave vapor going through the flowmeter.

2. **System won't lock on to the rate.**

   A. If the system won't lock on to the rate, but goes back and forth above and below the rate as you are going across the field, the Gain or Valve Calibration may be set too high. The controller may be moving the control valve too quickly when a small change is needed. This can cause the system to get in a back and forth cycle where it won't settle down to the rate. Lower the Gain or Valve Calibration to slow it down. If the Gain or Valve Calibration is too slow, the controller will be slow responding to rate or speed changes and it will take a long time to get up or down to the new rate.

   B. This can also be caused by the Allowable Error being too small. Typically, this should be 2-3%. With a 2% allowable error, the controller does not make any adjustment to the control valve if the applied rate is within 2% of the Target Rate. If this is set at 0%, the controller tries to adjust every time the applied rate is off even a small amount. This can start a cycle where the variation actually gets worse as it tries to make repeated corrections.

   Some variation in Applied Rate as you go across the field is normal. Some displays take this out with Rate Smoothing, so that changes in Applied Rate don't show on the screen as long as the rate is within 10% of the Target Rate.

   C. A worn or faulty flowmeter can cause the rate to jump around. If the turbine is not turning smoothly, it will send out uneven pulses which show up as the rate jumping around. Inspect and clean flowmeter turbine.

3. **Can't hit rate.**

   A. Do the calculations to see how much NH3 is needed (GPM). What is the tank pressure? Are the hoses, valves, and other plumbing sufficient to allow the desired flow at this temperature/pressure?

   B. Slow down. What happens when you slow down? If this helps, find out how fast you can go and still hit the rate. Check the items in 3A (above) for system capacity at current temperature/pressure conditions.

   C. Are all knives and vapor tubes open and flowing? Be careful when cleaning plugged tubes or knives as a sudden release of ammonia could occur.

   D. What orifices are installed in the splitter? Are they appropriate for the desired flow?