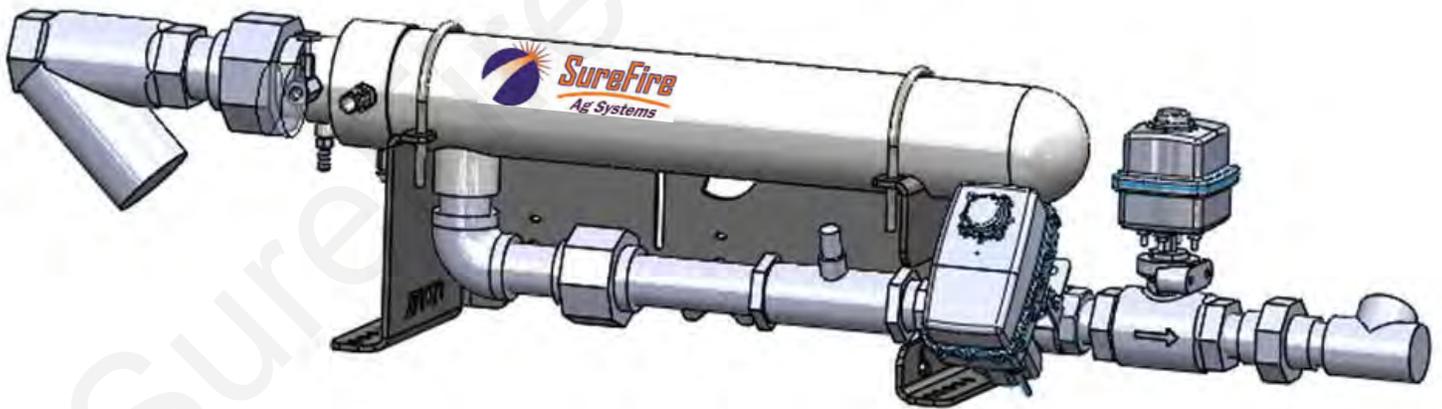


**396-2850Y1**



**NH<sub>3</sub>**  
**Precision Anhydrous Ammonia**  
**Application for**  
**John Deere**  
**GreenStar Rate Controller (GRC)**



**SureFire**  
**Ag Systems**

**NOTICE**

*Operator should read this manual before operating the system.*



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For additional parts drawings or product manuals, go to [continentalnh3.com/product-manuals.html](http://continentalnh3.com/product-manuals.html).

*The components of your system may vary from the components shown in this manual due to different configurations and locations of valves, splitters, manifolds, and other components. Various configurations are shown in this manual, but not every situation can be covered here.*

*It is the responsibility of the owner/operator to assure that all necessary components are installed correctly and continue to remain in a safe operating condition.*

*All personnel operating or working around an anhydrous ammonia system must be thoroughly trained in safe anhydrous ammonia procedures.*

*Operators of anhydrous ammonia systems should always carry on their person an emergency squeeze bottle of fresh water. There should always be five gallons of clean water available on the nurse tank for immediate flushing in the event of an accidental exposure.*

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# Safety

A

**TAKE NOTE! THIS SAFETY ALERT SYMBOL FOUND THROUGHOUT THIS MANUAL IS USED TO CALL YOUR ATTENTION TO INSTRUCTIONS INVOLVING YOUR PERSONAL SAFETY AND THE SAFETY OF OTHERS. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN INJURY OR DEATH.**



**THIS SYMBOL MEANS  
ATTENTION!  
BECOME ALERT!  
YOUR SAFETY IS INVOLVED!**

Note the use of the signal words DANGER, WARNING and CAUTION with the safety messages. The appropriate signal word for each has been selected using the following guidelines:



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



**WARNING:** Indicates a potentially hazardous situation that, 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.



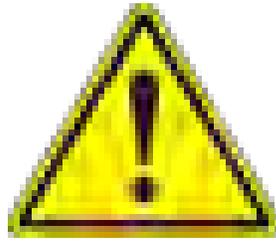
**CAUTION:** Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

**NOTICE** is used to address safety practices not related to personal safety.





**ATTENTION:** Please follow all of the instructions in this manual carefully and read the entire manual completely. Failure to do so may cause the product to function improperly or fail causing serious injury or death.



**DANGER**

**DANGER**

**ANHYDROUS AMMONIA IS AN INHALATION HAZARD AND WILL CAUSE SERIOUS INJURY OR DEATH. PLEASE USE EXTREME CAUTION WHEN HANDLING IT OR PERFORMING ANY MAINTENANCE ON EQUIPMENT USED FOR ANHYDROUS AMMONIA.**

**ATTENTION:** Before performing any installation, repair or maintenance please follow the instructions below.

1. You must be trained and certified to work with anhydrous ammonia. If you are not, please seek out the appropriate agricultural department to attend a class to obtain the proper training and certification.
2. Wear appropriate safety goggles, gloves and breathing apparatuses.
3. Always know which way the wind is blowing.
4. Drain all tanks, hoses and piping of anhydrous ammonia COMPLETELY before removing, installing, performing maintenance or repairing any equipment.
5. Always remove device from service before performing any maintenance or repair.
6. Have sufficient water nearby.
7. Obey all local, state and federal laws regarding the handling of anhydrous ammonia.



## Anhydrous Ammonia Safety

Anhydrous ammonia is an important source of nitrogen fertilizer for crops. The improper handling of anhydrous ammonia can have catastrophic results on both plants and farm workers. Common injuries are severe burns to eyes, skin and the respiratory tract.

- Personal protective equipment (PPE) should always be worn. Standard PPE should be non-vented goggles, rubber gloves with thermal lining, face shield or an approved respirator. Wear a lightweight rubber suit, or (at the very least) a long sleeve shirt and coveralls.
- Make sure anhydrous ammonia tanks are not filled beyond the recommended capacity.
- Use care when handling the hose end valve so that it does not open accidentally. Do not move the hose by handling valve handle.
- Be sure to bleed the hose coupling before disconnecting. Use care when cleaning plugged knives as anhydrous ammonia could be built up behind the plug.
- Use emergency water supply for at least 15 minutes if exposed to anhydrous ammonia and then seek emergency medical attention.
- Always have a small squeeze bottle of fresh water at all times.
- Never assume NH<sub>3</sub> lines are empty, including the lines connected to the Torpedo.
- Make sure the system is completely drained of NH<sub>3</sub>. It can hide in low areas of the system. Look for frost on the hose or equipment. That usually means there is NH<sub>3</sub> there.
- Always use high pressure hose when ammonia can be trapped in that segment, such as between the tank and the Torpedo.
- Any place that has a high pressure hose should also have a hydrostatic relief valve and a bleed valve.
- Always handle valves by the body and by the wheel or latch.
- Always make sure you are upwind of potential NH<sub>3</sub> release points.
- When you park, position NH<sub>3</sub> equipment downwind from dwellings, people, and livestock.
- Close the valve on the tank when you stop.
- The first treatment for anhydrous ammonia exposure is WATER.

***NH<sub>3</sub> is a very dangerous product. It can kill you or blind you or worse. If you have not taken an approved NH<sub>3</sub> Safety class, do not work around NH<sub>3</sub>. If you have had the course, follow ALL safety precautions ALL the time.***

# BE CAREFUL !

# NOTICE

Before you start applying NH<sub>3</sub>—

- Know the wind direction.
- Are the hoses in good condition?
- Has the expiration date been passed on any hose or other dated component?
- Are all fittings clean and free from rust?
- Do low-pressure tubes have any leaks?
- Are any knives plugged?
- Is the tank secure with a locking hitch pin?
- Is the pressure relief valve operating correctly?
- Does the tank have five gallons of fresh water?
- Is PPE available and being worn (goggles, gloves, long-sleeve shirt) ?

Before performing maintenance on the toolbar or equipment—

- Put on gloves and goggles
- Make sure you have emergency water
- Check wind direction and stay upwind
- Park away from buildings, livestock, and people
- Before servicing, close the valve on the NH<sub>3</sub> tank and continue application to bleed the system.
- Be sure the tank valve is closed. Turn the Master valve on and leave it on during bleeding.
- Disconnect the nurse tank supply hoses.
- Open all bleeder valves on cooler and rest of system.
- Check any hoses that have a low loop in them
- Even after bleeding, slowly and cautiously loosen any fittings to be sure there is no ammonia trapped inside.

## Regular Maintenance—

- Check unit regularly for leaks and wear
- Clean the unit and, if possible, store inside out of the weather
- If the unit is leaking from a weld seam, remove from service and send in for repair
- If leaking from a threaded connection, try tightening the connection with a wrench
- If leaking from the dump knives when not applying, install a repair kit on the Torpedo to replace the internal O-rings. Also, may need to install a repair kit on the Master shutoff valve (O-rings and seals).

## Torpedo Maintenance

- Close the valve on the nurse tank
- Open all valves to drain the system of ammonia
- Open all bleeder valves and drain flush valve on the Torpedo



# Things to Know About Anhydrous Ammonia (NH<sub>3</sub>)

Anhydrous ammonia is a colorless non-flammable liquefied gas. Its vapor is lighter than air and has the same pungent odor as household ammonia. Although ammonia vapor is lighter than air, the vapors from a leak may hug the ground appearing as a white cloud. Chemically, ammonia is 82% nitrogen (N) and 18% hydrogen (H) and has the chemical formula NH<sub>3</sub>. Ammonia by weight is 14 parts nitrogen to 3 parts hydrogen, or approximately *82% nitrogen and 18% hydrogen*.

The definition of *anhydrous* is *without water*. Whereas household ammonia is 95% water, anhydrous ammonia has no water. Ammonia is so hygroscopic (water loving) that one cubic foot of water will dissolve 1300 cubic feet of ammonia vapor making water the primary weapon for first responders.

Ammonia weighs 5.15 pounds per gallon in contrast to water which weighs 8.33 pounds per gallon. Since ammonia is so soluble in water there will be no layering effect when liquid ammonia is spilled into a surface water body. Booms, pads, sweeps and pillows that are usually used to contain and recover petroleum are ineffective on spills of ammonia into surface water.

Ammonia is a non-flammable gas but will ignite at a temperature of 1204°F within vapor concentration limits between 15% and 28%. (Paper ignites at 450°F, coal at 750°F.) Outside conditions that would support these vapor concentrations are very rare.

Ammonia will corrode galvanized metals, cast iron, copper, brass, or copper alloys. All ammonia piping, valves, tanks and fittings are constructed of steel.

Liquid ammonia boils at any temperature greater than -28°F and will expand to 850 times its liquid volume. One gallon of liquid will expand to 850 gallons or 113 cubic feet of gas.

## Ammonia Fast Facts

### NH<sub>3</sub> Vapor

Ammonia appears in nature as a natural substance that results from decomposition.

Ammonia vapor is a colorless gas with a pungent odor.

Ammonia exists as a vapor at atmospheric conditions.

Ammonia vapor is lighter than air and tends to rise when released to atmosphere.

### NH<sub>3</sub> Liquid

Liquid ammonia released to atmosphere forms a white smoke by freezing the moisture in the air.

Liquid ammonia has a very high coefficient of expansion with temperature.

One gallon of liquid ammonia weighs approximately 5.15 lbs.; however the weight varies with temperature.

When liquid ammonia reaches a temperature between its melting and critical points, it exerts a vapor pressure that increases with temperature.

A closed container of liquid ammonia is in equilibrium with ammonia vapor and the container pressure bears a definite relationship to the temperature.

### Physical Data

Boiling point is -28°F.

Ignition point is 1,204°F.



## Storage and Handling

Ammonia is stored and transported as a liquid under pressure.

The pressure on the tank is the vapor pressure and remains the same whether the tank is 10% full or 80% full. This pressure is dependent on the temperature of the NH<sub>3</sub>.

The maximum filling level of an anhydrous ammonia tank is 85%.

## Flammability

Anhydrous ammonia is classified by the DOT as a non-flammable gas.

Ammonia vapor is flammable over a narrow range of 15% to 28% by volume in air and a strong ignition source must be present.

## Anhydrous Ammonia Application

Precision application of anhydrous ammonia starts with a proper metering system. It is crucial to be sure the metering and control system is applying what is required.

Accurate metering of anhydrous ammonia is difficult to achieve with a conventional variable orifice meter. Anhydrous ammonia is stored and transported as a liquid. To maintain NH<sub>3</sub> as a liquid it must be kept below -28°F or maintained under pressure. If the temperature of the NH<sub>3</sub> increases above -28°F some of the liquid changes to a gas as the NH<sub>3</sub> begins to boil. Application equipment typically uses tank pressure to deliver NH<sub>3</sub> to the soil. An increase in tank pressure would tend to force more NH<sub>3</sub> through the distribution lines. The actual pounds of NH<sub>3</sub> being applied decreases or increases as tank pressure fluctuates unless continuous adjustments are made to the meter.

If NH<sub>3</sub> is released into the atmosphere it will expand rapidly to occupy a volume 850 times greater than the original liquid. NH<sub>3</sub> readily changes from liquid to gas in the nurse tank and distribution system. Consequently the ratio of NH<sub>3</sub> gas to liquid continually changes as it passes through the distribution lines. About 1% of the liquid will vaporize during the ammonia flow from the tank dip tube to the metering point. 1% liquid when expanded to vapor at 100 lb tank pressure will occupy approximately 25% to 30% of the delivery chamber. At 50 lb tank pressure this increases to over 60% of the delivery chamber occupied by vapor. This makes metering and distributing NH<sub>3</sub> very difficult to do consistently and accurately.

Automatic NH<sub>3</sub> controls utilizing the **SureFire Torpedo™ NH<sub>3</sub> System** eliminate the problems found in conventional systems. The first step to accuracy is **eliminating errors caused by vapor** in the system. The second step is **compensating for ground speed and tank pressure fluctuations**. The SureFire Torpedo™ system uses a **heat exchanger to convert the NH<sub>3</sub> to 100% liquid for precise metering**. *With the heat exchanger delivering 100% liquid to the flowmeter, the precise amount needed is metered and delivered.* The controller and control valve will **adjust for ground speed changes** to eliminate misapplications that are common in conventional meter systems. This eliminates guessing and manually adjusting for different tank pressures or rates.

For high volume application, wide implements, fast speeds and cold temperatures the *delivery component pieces are critical for delivering the flow needed*. A flow that can be delivered at 90° may not be achievable when the temperature drops to 40° if the system components are not designed and sized correctly. These pieces include: **Tank withdrawal valve, NH<sub>3</sub> delivery hose and breakaway coupler, and heat exchanger with adequate capacity**. The components of a SureFire system are designed to deliver the flow you need.



After this precise metering the *challenge of row distribution* still awaits. The proper **manifold system** is important for row to row accuracy. The manifold can also be a cause of flow restrictions in high flow applications. The SureFire Torpedo system uses the best in class Continental 360 series manifolds or the Continental Vertical Dam Manifold series.

## Setting Up Your System

The following pages show some of the calculations needed to determine the specific components of your SureFire Torpedo™ NH<sub>3</sub> system.

First, the **width, rate, and speed** will be used to determine the amount of NH<sub>3</sub> your system will need to deliver. With this information, the **tank withdrawal valves, NH<sub>3</sub> hose(s), and Torpedo™ heat exchanger** can be selected.

Next, the distribution system will be set up. This takes into account the **row spacing, number of rows, amount of NH<sub>3</sub> per row, and how many sections** there will be. With this information, the **splitter, manifolds, section valves, and hoses** can be selected.

## The Smaller Pieces

There are other smaller pieces that are, nonetheless, very important. One of these components is the **hydrostat relief valve**. These are located in segments of the system that may experience a build-up of pressure from NH<sub>3</sub> left in the line.



153-A-400-B 1/4" Hydrostat Relief Valve—250 PSI —  
(Keep the dust cap on)  
Used in various segments of the system  
as a safety relief valve.



End view

*The Hydrostat relief valve has a Manufactured Date (mfg). Replace 5 years after manufacture.*

**Bleeder valves** are located throughout the system. The operator should be familiar with all the locations and make certain that all parts of a segment are bled off before working on the system.

*Some components of your system may have separate Instruction Sheets, Installation Information, or Safety Information. Read all such product literature before installing or operating the system and retain the information for future reference.*

Your SureFire Torpedo™ NH<sub>3</sub> system is designed to provide safe, reliable, dependable, and accurate distribution of NH<sub>3</sub>. It requires the operator to exercise due diligence in setting up, operating, and maintaining all system components to continue operating safely.

Remember:

# BE CAREFUL WITH THIS STUFF!

## Sizing System components

The SureFire Torpedo system is available in three models. All models use the same Continental cooler (the "Torpedo"). The main difference in the models is larger inlet plumbing from the tank to the cooler for higher-rate applications. The following table shows the flow and application rates that are attainable with each SureFire Torpedo™ model.

### SureFire Torpedo™ Model # 100, 200 or 300 Kit

Model #	34 degrees F (50 PSI)		Max App Rate Lbs N / acre		60 degrees F (93 PSI)		Max App Rate Lbs N / acre	
	GPM	Lbs NH <sub>3</sub> per hour	40' at 8 MPH	60' at 8 MPH	GPM	Lbs NH <sub>3</sub> per hour	40' at 8 MPH	60' at 8 MPH
100	23	7100	150	100	28	8650	185	120
200	35	10800	230	150	43	13500	285	190
300	50	15450	330	220	64	20000	427	285

### Calculating NH<sub>3</sub> Flow

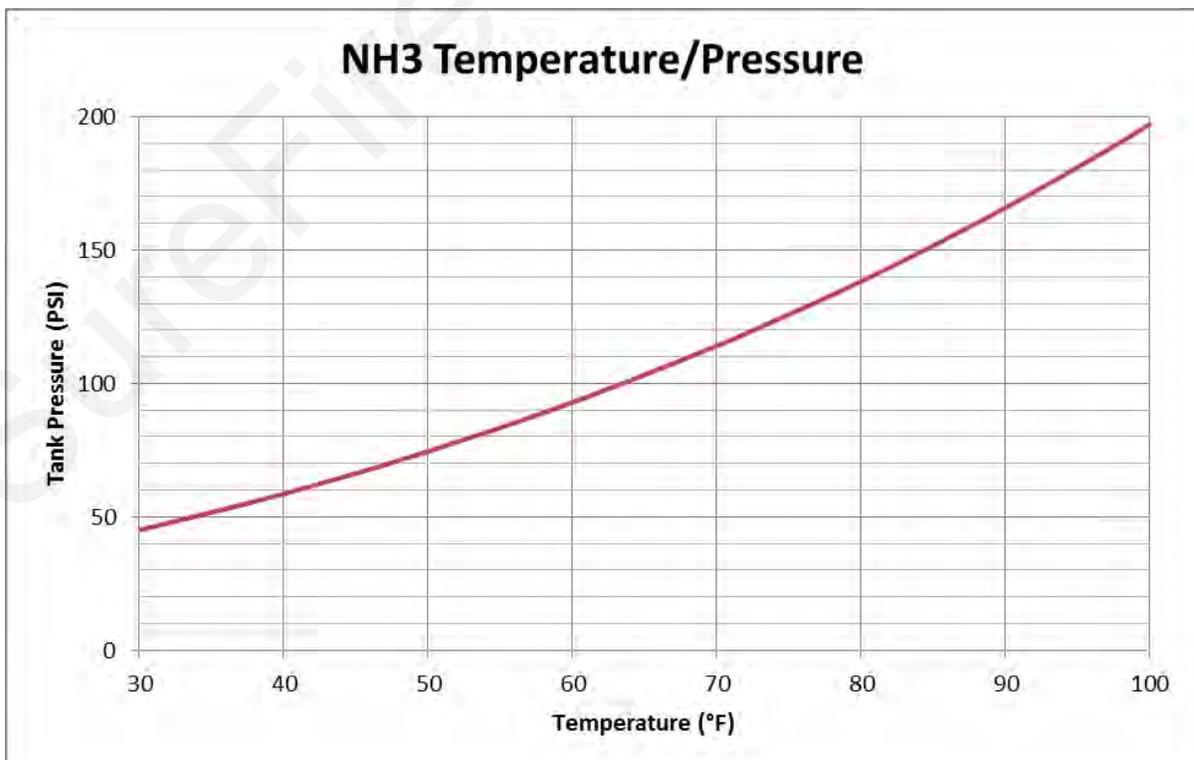
Do the following calculation to determine the proper Torpedo Model for your application:

$$\text{Rate (lbs of N) per acre} \times \text{Speed} \times \text{Width (feet)} \times 0.1212 / 0.82 = \text{NH}_3 \text{ Lbs / hr}$$

$$\text{NH}_3 \text{ lbs/hr} / 60 \text{ min/hr} / 5.15 \text{ lbs/gal} = \text{GPM (NH}_3\text{)}$$

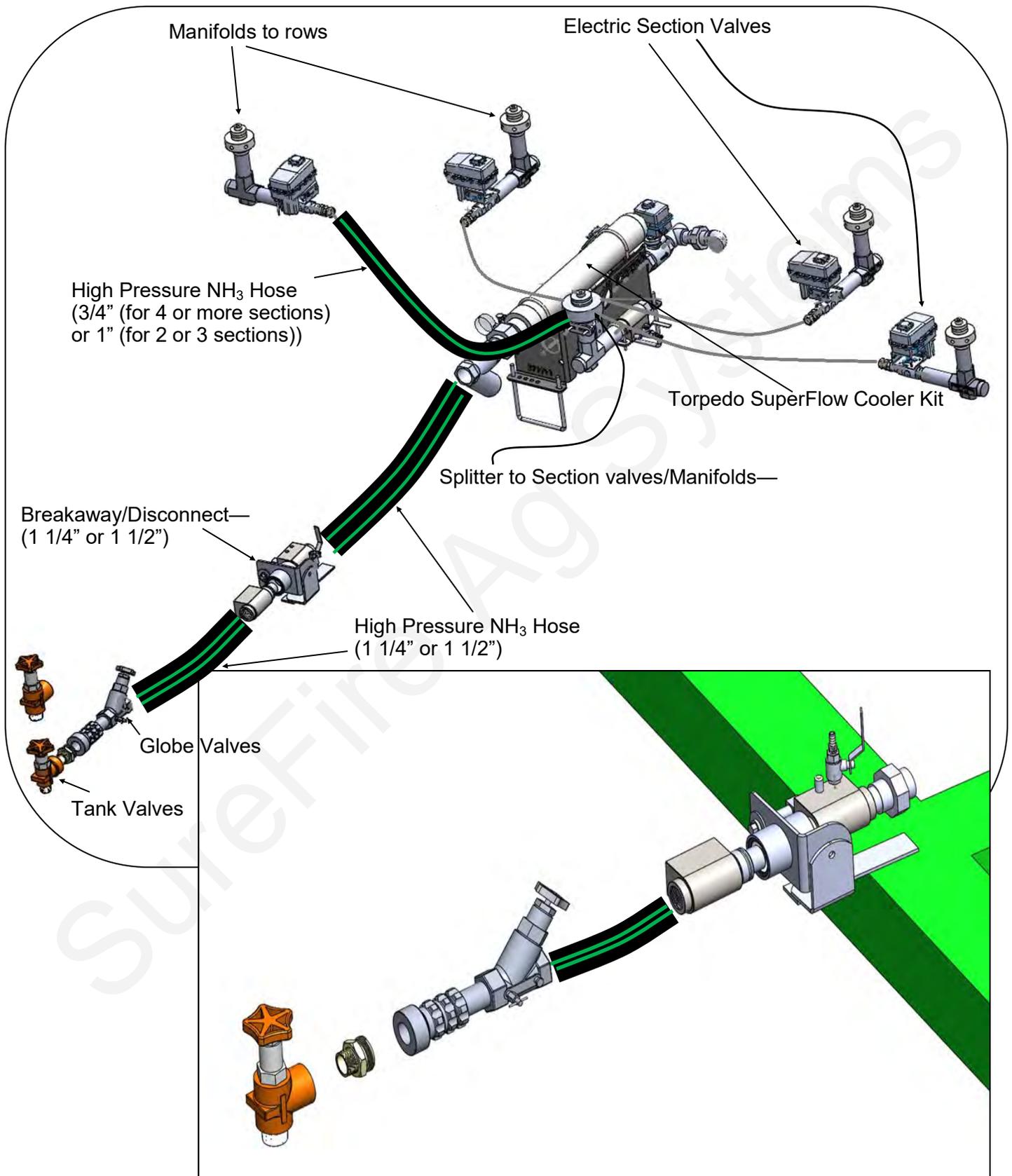
$$\text{Lbs of NH}_3 \times 0.82 = \text{Lbs of N}$$

$$\text{Lbs of NH}_3 = \text{Lbs of N} / 0.82$$



# System Overview with 4 electric Section Valves

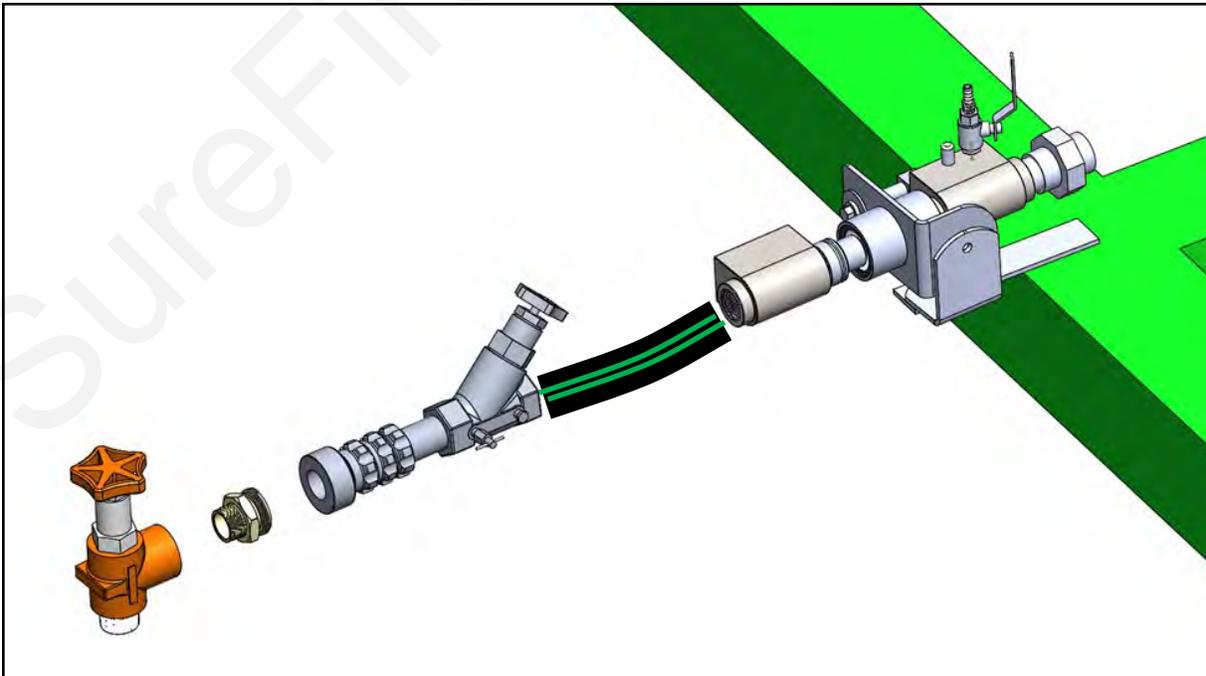
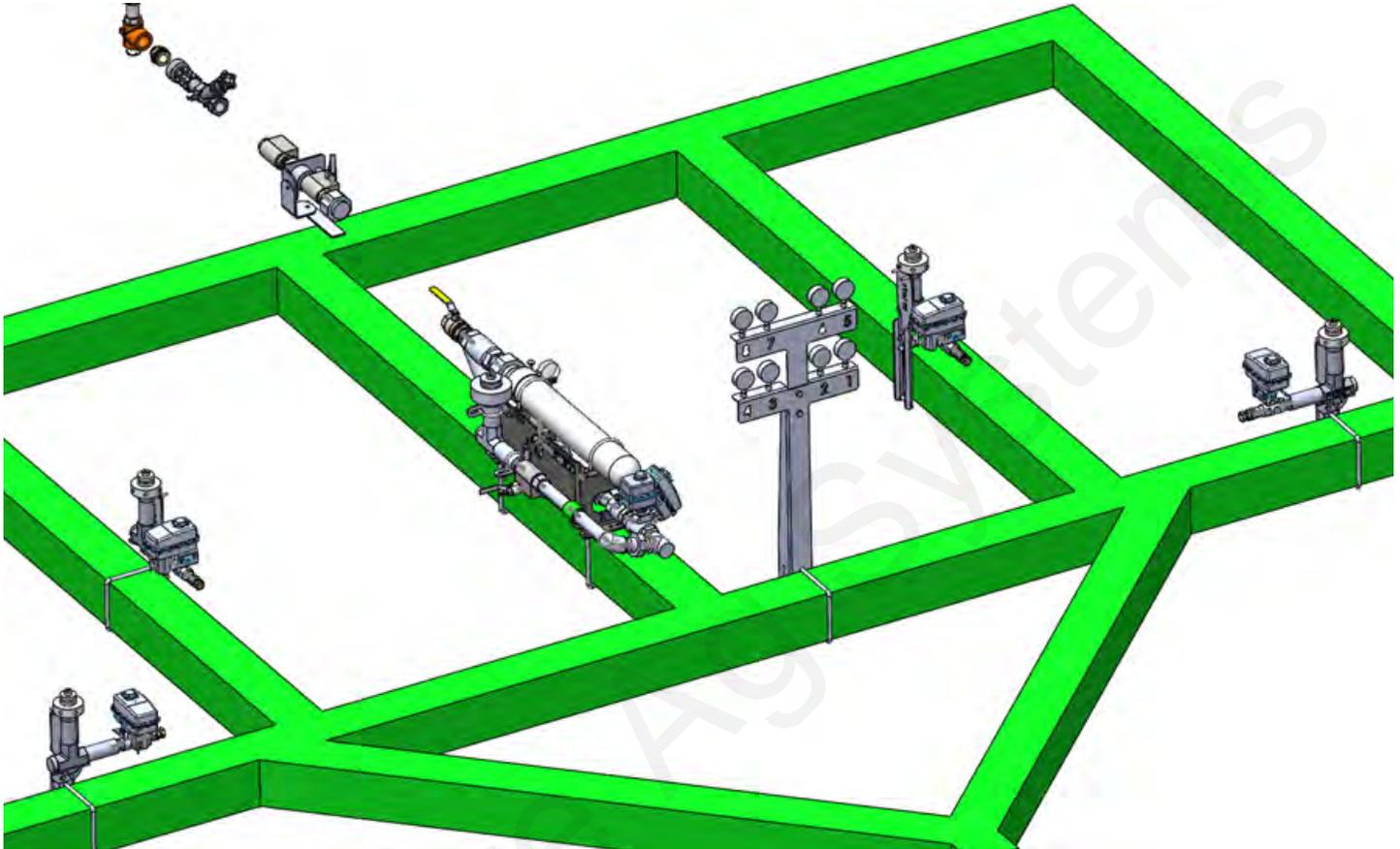
## Torpedo™ Model 100 and Model 200



# System Overview with 4 Electric Section Valves

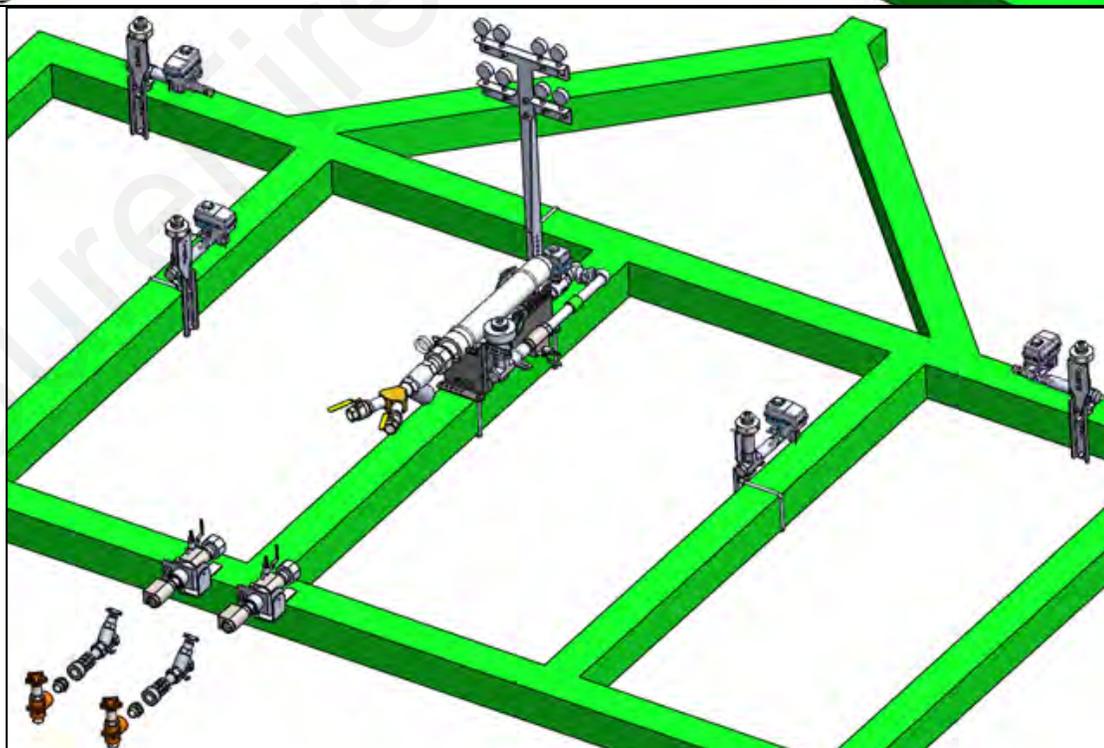
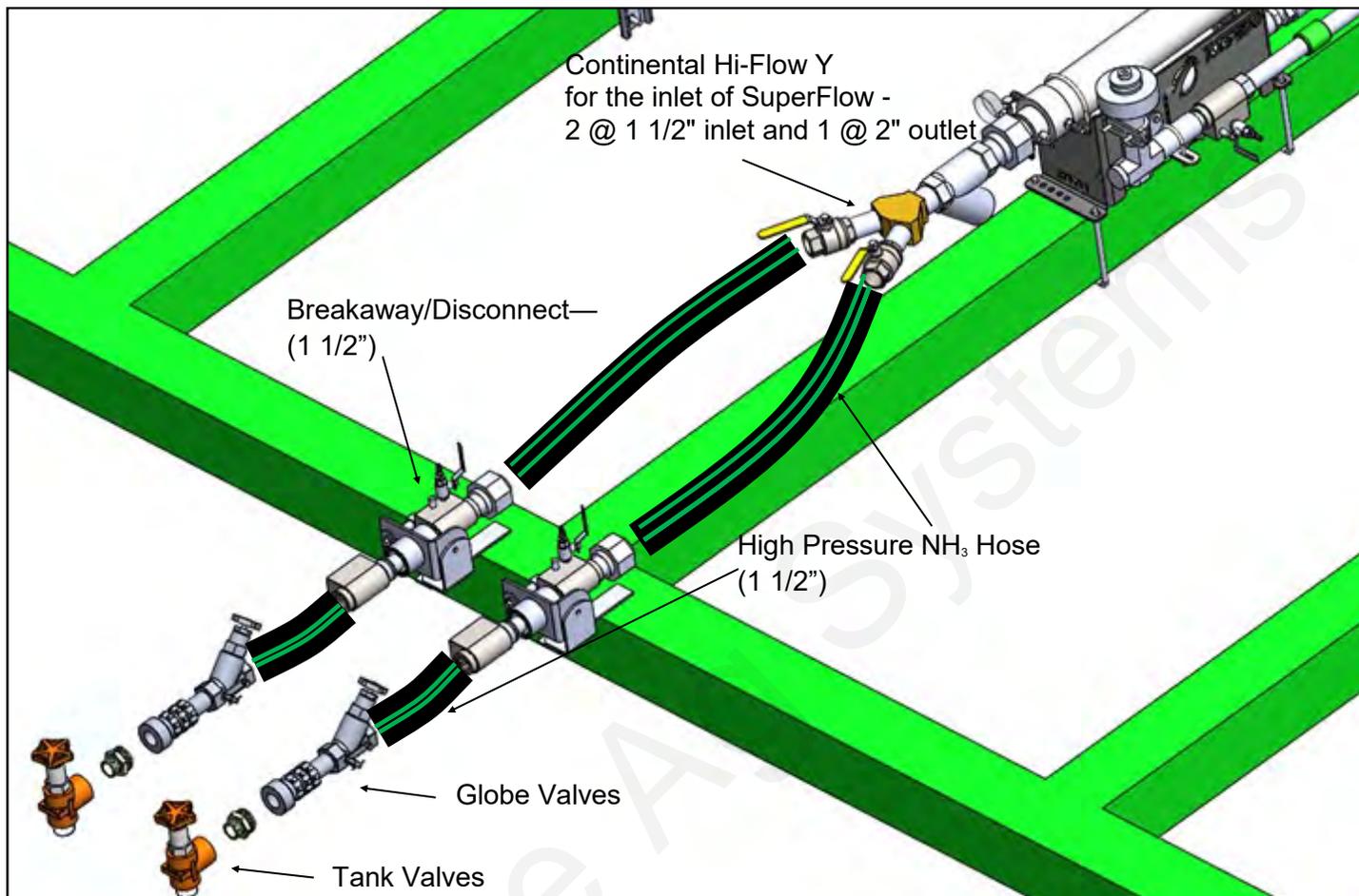
## Torpedo™ Model 100 and Model 200

Optional Gauge Tree shown



# System Overview with Torpedo™ Model 300

159-00-200150



Installation and Setup Instruction Tags-See the manual and accompanying literature for more information.

## VARIABLE DUMP ORIFICE

To minimize the amount of ammonia going out the dump lines use the chart to determine the orifice setting use.

GPM	1-10	11-20	21+	N-Serve
Orifice	A	B	C	D

to

$$\text{Tool bar width in feet} \times \text{Speed} \\ \times \text{Actual lbs N per acre} \times 0.1212 \\ / 0.82 / 5.14 / 60 = \text{GPM}$$

PN 398-10-2807Y1

("D" orifice is only for users having problems with N-Serve plugging up the heat exchanger.)

## DUMP OUTLET HOSE BARBS (2)

Connect an appropriate length of 3/4" hose from each dump outlet hose barb to the 2 vapor knives on the applicator. Fasten each end with a worm gear clamp.

PN 398-10-2808Y1

Some applicators already have the vapor knives attached. If not, use the ones in the kit.

PN 398-10-2808Y1

## Installation Instructions A-360SP Splitter

Correct Orifices Must Be Installed  
Before Use.

See orifice chart on back side of this tag.

See the instruction sheet and manual for details.

PN 398-10-2811Y1

## A-360SP Splitter Orifices

Pressure	100 PSI	50 PSI	Orifice
Flow	Up to 7 GPM	Up to 5 GPM	<b>.302</b>
Per Outlet	5 to 12 GPM	4 to 9 GPM	<b>.437</b>

$$\# \text{NH}_3 \text{ per acre} \times \text{speed} \times \text{tool bar width in feet} \times .1212 \\ \div 5.14 \div 60 \div \text{number of manifolds} = \text{GPM per outlet}$$

Or

$$\# \text{N per acre} \times \text{speed} \times \text{tool bar width in feet} \times 0.1212 \div 0.82 \\ \div 5.14 \div 60 \div \text{number of manifolds} = \text{GPM per outlet}$$

## Bleeder Valve Installation Instructions

Connect hose and run hose to a safe location to bleed ammonia vapor.

## Bleeder Valve Safety

### USE INSTRUCTIONS

This may not be the only place you have to bleed. Be certain entire system has been bled before working on system.

Be certain it is **safe** to bleed the system.

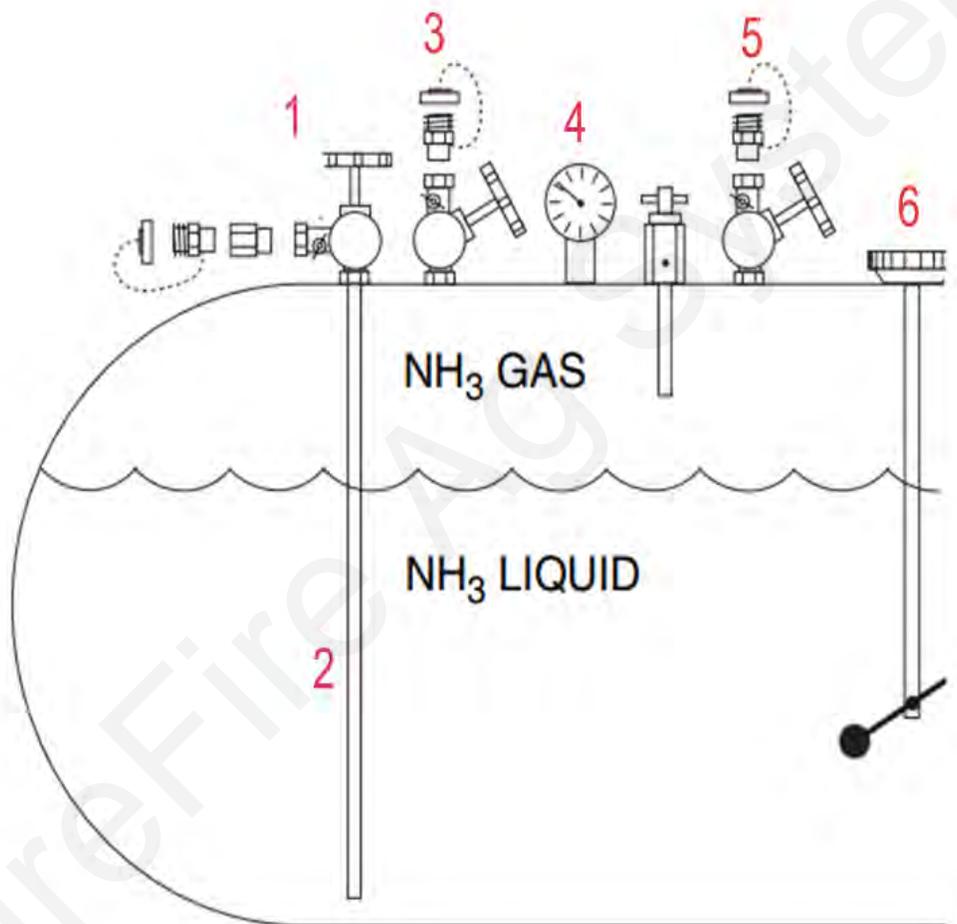
Open valve **SLOWLY** when bleeding system.

PN 398-10-2810Y1



# NH<sub>3</sub> Tank

1. Withdrawal valve
2. Dip Tube
3. Liquid Fill Valve
4. Pressure Gauge
5. Vapor Valve
6. Liquid Level Float Gauge



## Safety Reminder

*Always bleed all segments of the system before working on or around the system.*

# Continental Tank Valves

## 153-

1406-G High Flow  
1 1/4" MPT Tank Connector x 1 1/2" FPT Outlet  
45 GPM



1809-BFV High Flow  
1 1/2" MPT Tank Connector x 1 1/2" FPT Outlet  
60 GPM



*Depending on the rates, speeds, and tank pressure (temperature), a system may need to be connected to tanks with High Flow tank valves in order to allow enough product flow. The entire plumbing arrangement (valves, hoses, connections) must have high flow capacity in order to maximize flow to reach high rates at high speeds and cold temperatures.*

### **Safety Reminder**

*Always bleed all segments of the system before working on or around the system.*

# NH<sub>3</sub> Inlet Plumbing Kit from Nurse Tank to Breakaway 158-00-

This kit includes: 1 1/4" or 1 1/2" High Pressure hose and one of the following Globe Valve Assemblies

## Globe Valve Assembly 153-

### A-215-L

1 1/4" Globe valve x 1 3/4" Female Acme Fitting  
Long with bleeder valve



### A-216-L

1 1/4" Globe valve x 2 1/4" Female Acme Fitting  
Long with bleeder valve



### A-217-L

1 1/2" Globe valve x 2 1/4" Female Acme Fitting  
Long with bleeder valve



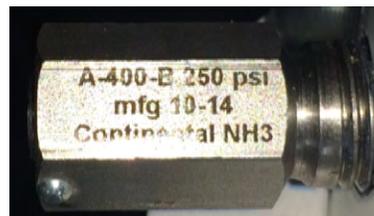
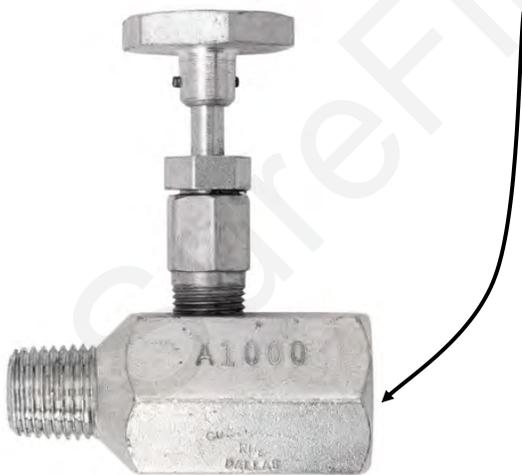
# Torpedo Kit 159-00— Kit includes Breakaway, High Pressure NH<sub>3</sub> Hose and SuperFlow NH<sub>3</sub> Assembly



153-A-SWV-125 (on Torpedo Model 100)  
 1 1/4" Full Port **Disconnect/Breakaway**  
 153-A-SWV-150 (on Models 200 and 300)  
 1 1/2" Full Port **Disconnect/Breakaway**

- Full port 1 1/4" (or 1 1/2") through-holes
- Practically no pressure drop
- Swing valve style checks that swing out of the flow for superior flow characteristics
- All Stainless Steel, except housing, prevents rust and corrosion
- Built-in reconnection and disconnection acme bolt
- Dual 1/4" pipe ports on each side for bleeder valves and hydrostats
- 35% larger than other units
- **Read the complete installation and operating instructions that come with Disconnect/Breakaway**

153-A-1000 1/4" MPT x 1/4" FPT NH<sub>3</sub> Needle Valve--



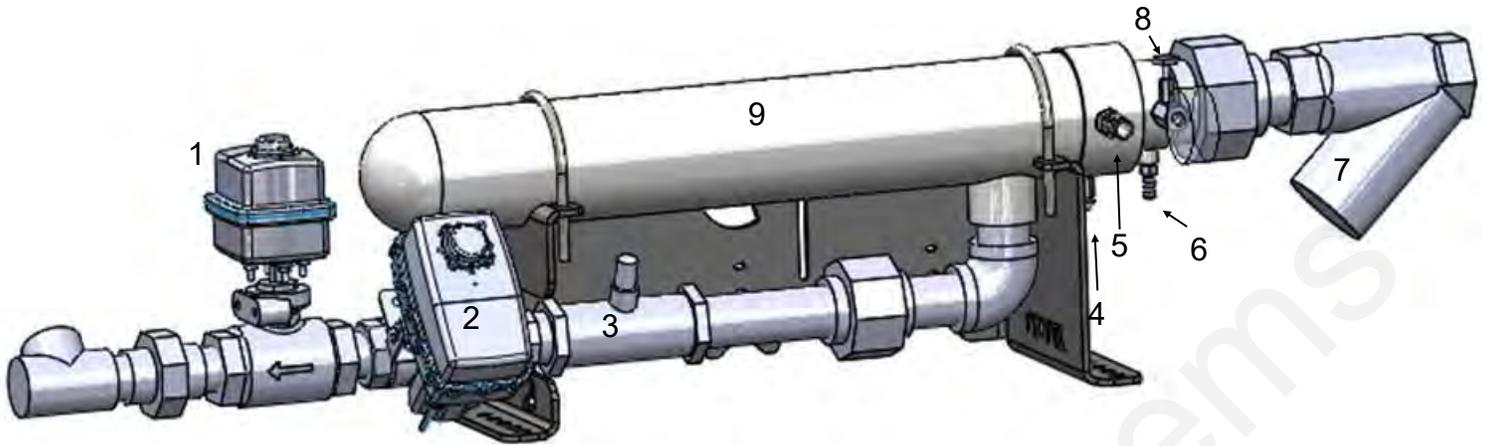
End view

153-A-400-B 1/4" **Hydrostat Relief Valve**—250 PSI—(Keep the black cap on)  
 Used in various segments of the system as a safety relief valve. This component has a **MFG Date** stamped on it. Replace within 5 years.

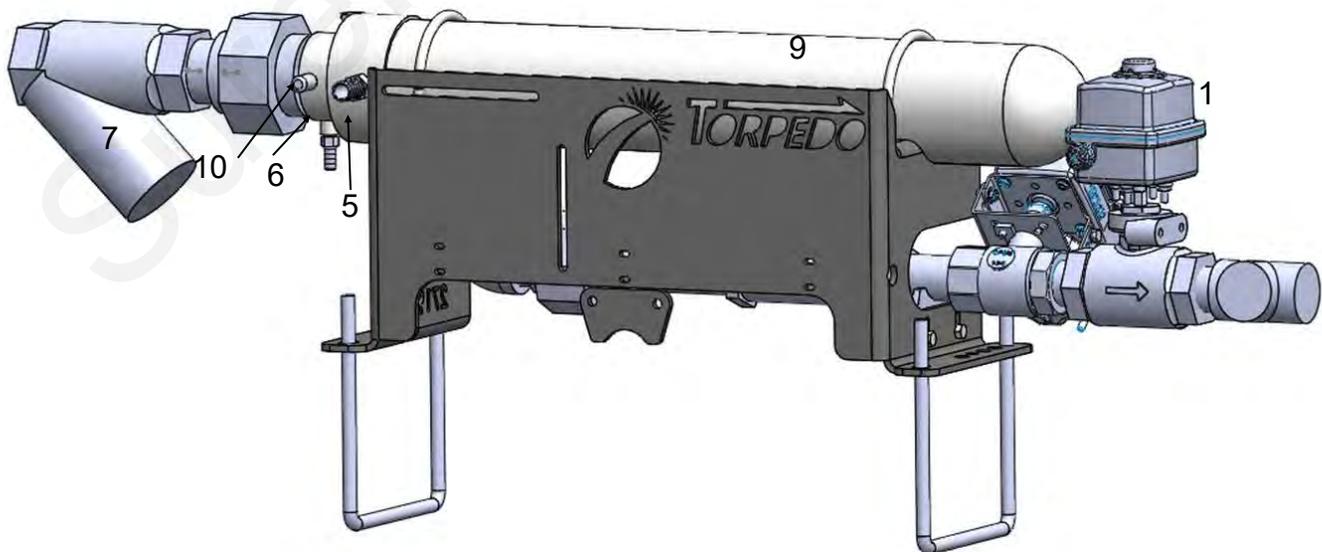
## Safety Reminder

*Wear tight-fitting non-vented goggles when working around anhydrous ammonia.*

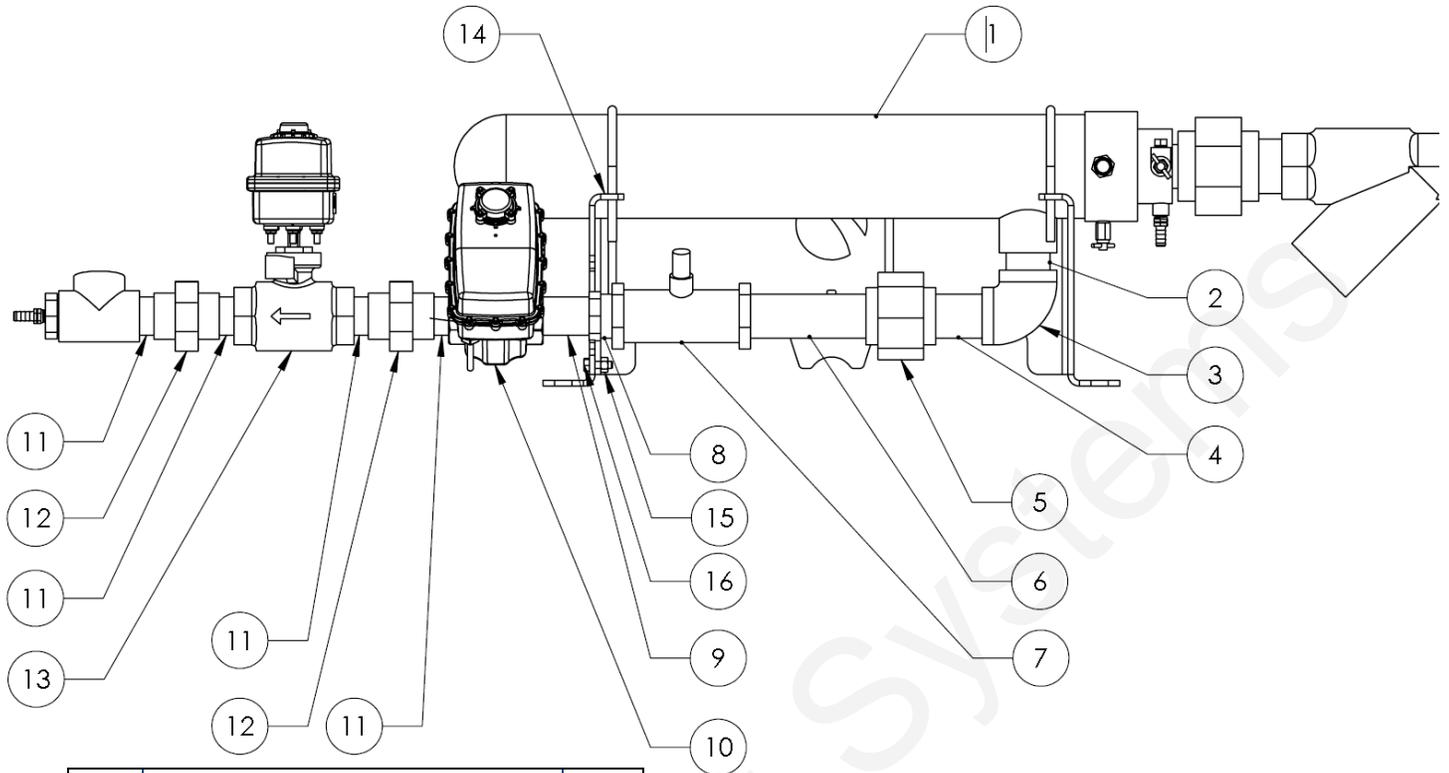
# Torpedo™ SuperFlow NH<sub>3</sub> Assembly 202-2693Y1



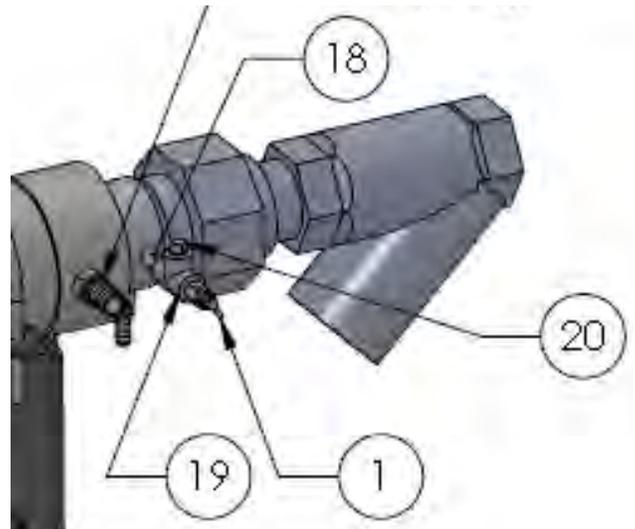
1	202-2691Y1	SureFire 1 1/4" NH <sub>3</sub> <b>Servo Valve</b> —7 sec. 118 degree open/close - 3-pin WP tower (2-wire)
2	202-KZ67GY	1 1/4" SS KZ NH <sub>3</sub> <b>shut-off valve</b> with 3-pin WP shroud
3	204-02-2692Y1	Raven SS RFM 60S <b>Flowmeter</b> 1 to 60 GPM with 3-pin MP 150 shroud
4	153-A-411	1/4" Bleeder valve
5	151-050075	1/2"MPT X 3/4" Hose Barb—Dump Outlet Hose Barb (plumb to Dump Knife)
6	151-025038	1/4"MPT X 3/8" Hose Barb—3/8" product feedback hose attaches here
7	762-A1SC-2	2" Y filter
8	153-A-1000	1/4" MPT x 1/4" FPT NH <sub>3</sub> <b>Needle Valve</b> --can attach pressure gauge or transducer here
9	762-A-SF-3000Y2-S	Continental <b>SuperFlow Exchanger</b> and vapor tubes/ etc.
10	153-A-400-B	1/4" <b>Hydrostat Relief Valve</b> —250 PSI—(Keep the dust cap on)



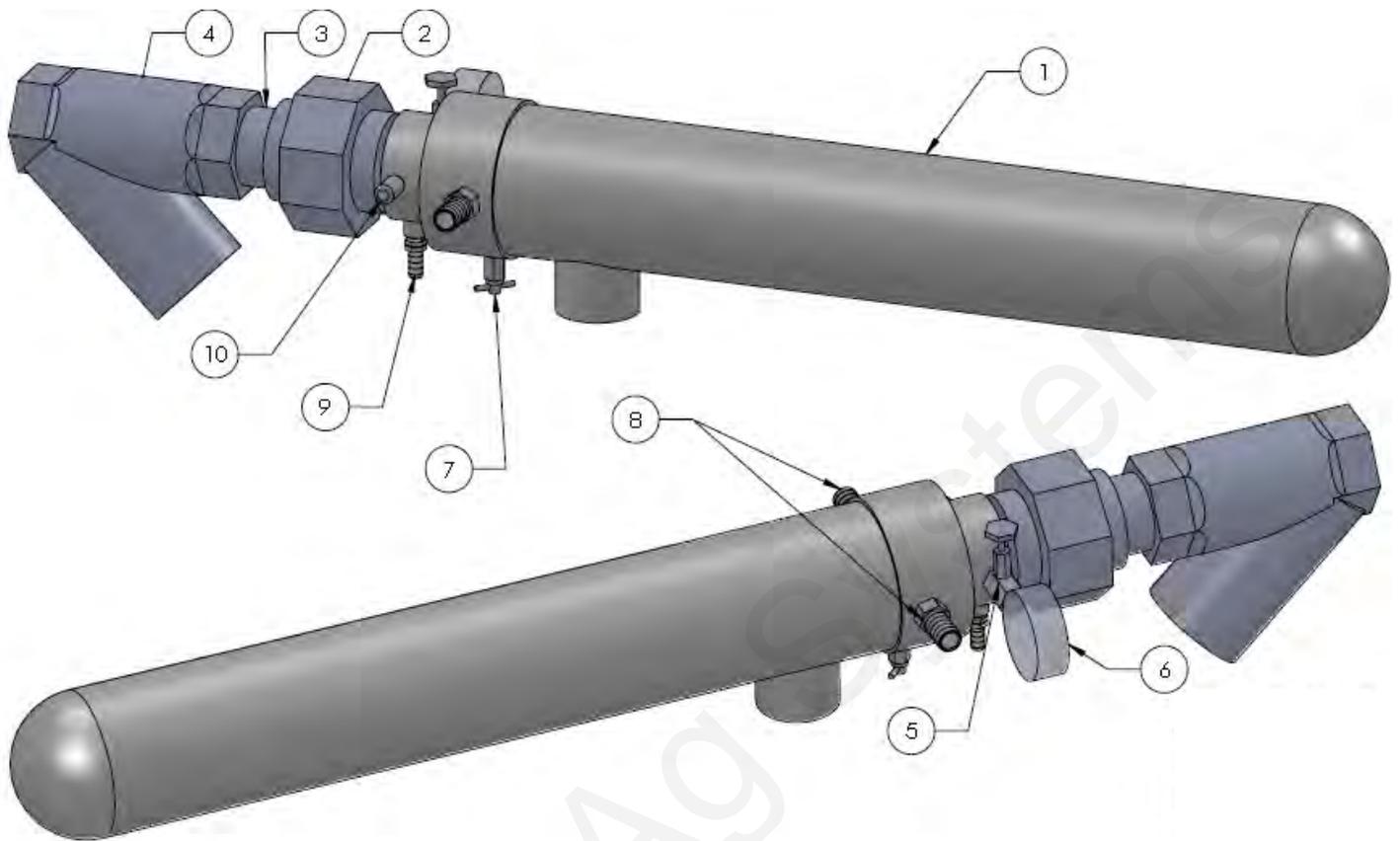
# SureFire Torpedo NH3



Item	Description	Qty
1	Heat Exchanger	1
2	Nipple	1
3	Elbow	1
4	Nipple	1
5	Union	1
6	Nipple	1
7	Flowmeter	1
8	Reducer Bushing	1
9	Nipple	1
10	On/Off Valve	1
11	Nipple	4
12	Union	2
13	Control Valve	1
14	Heat Exchanger Base	1
15	5/16" Flange Nut	2
16	5/16" x 1" HCS G5	2
18	Nipple	1
19	Tee	1
20	1/4" Plug	1



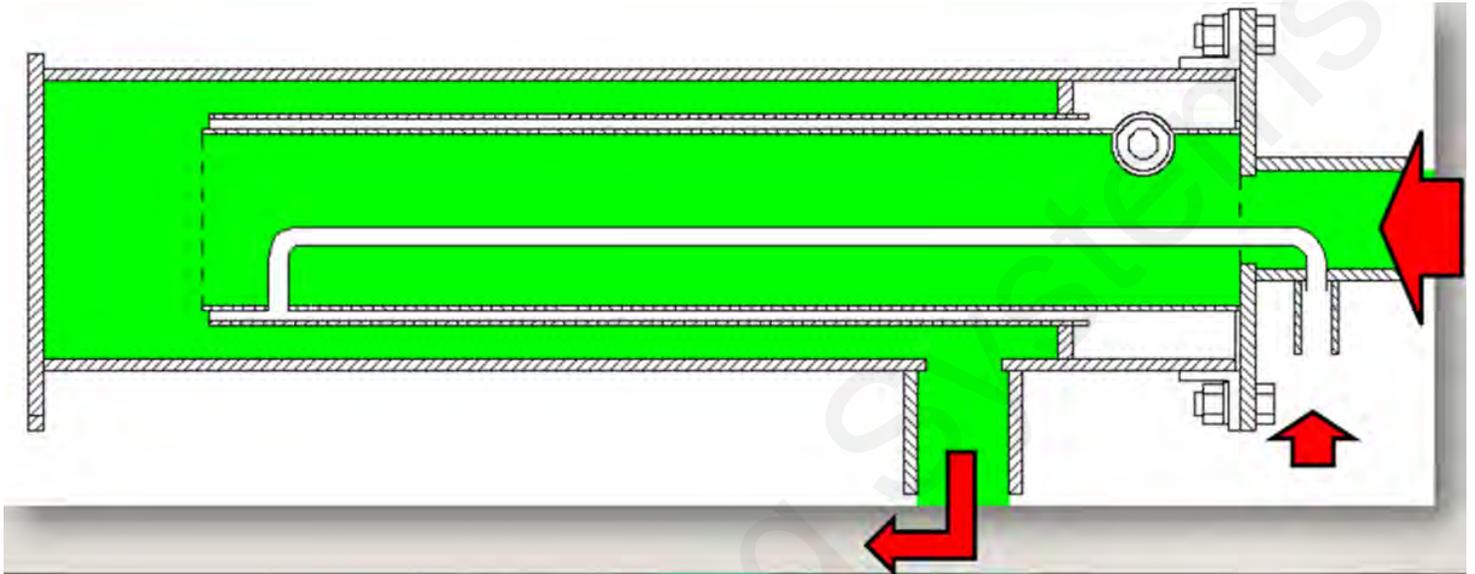
# Torpedo™ SuperFlow NH<sub>3</sub> Assembly 202-2693Y1



Item No.	Part Number	Description	QTY
1	153-A-SF-3000GH-2	2" Exchanger	1
2	150-200UN-S80	2" Union-Schedule 80	1
3	150-200NIP-SH-S80	2" X SH Nipple-Schedule 80	1
4	762-A1SC-2	2" Y Filter	1
5	153-A-1000	1/4" MPT X 1/4" FPT NH3 Needle Valve	1
6	137-ASG400	Pressure Gauge (Optional)	1
7	153-A-411	1/4" Bleeder Valve-Continental	1
8	151-050075	1/2" MPT X 3/4" Hose Barb	2
9	151-025038	1/4" MPT X 3/8" Hose Barb	1
10	153-A-400-B	1/4" Relief Valve-250 PSI	1

# SureFire Torpedo (Heat Exchanger)

1. Turns the NH<sub>3</sub> vapor back to a liquid so the flowmeter can accurately measure the amount
2. How it works—A small amount (2-4%) of liquid ammonia downstream of the control valve is returned to the center of the cooling chamber. This central chamber is open to the outside via the vapor tubes. As the liquid in this chamber turns to vapor it cools the entire chamber enough so that all of the NH<sub>3</sub> in the Torpedo is turned back to a liquid. It stays in liquid form until it passed through the flowmeter where it is accurately measured.



## SureFire Torpedo Features

1. A break-down bolt helps separate the unit for easy maintenance.
2. All internal tubes, the o-ring bonnet, and feed tube are stainless steel.
3. Only has 3 standard O-rings for easy repair.
4. The control valve is a 120-degree slotted servo valve for precise and accurate control.
5. The system uses high quality KZ valves and actuators.
6. The system has an adjustable orifice on the return line so the correct amount of ammonia is used for cooling.
7. Has an internal drain valve to empty the ammonia for easy and safe maintenance.

### *Safety Reminder*

*Always bleed all segments of the system before working on or around the system.*

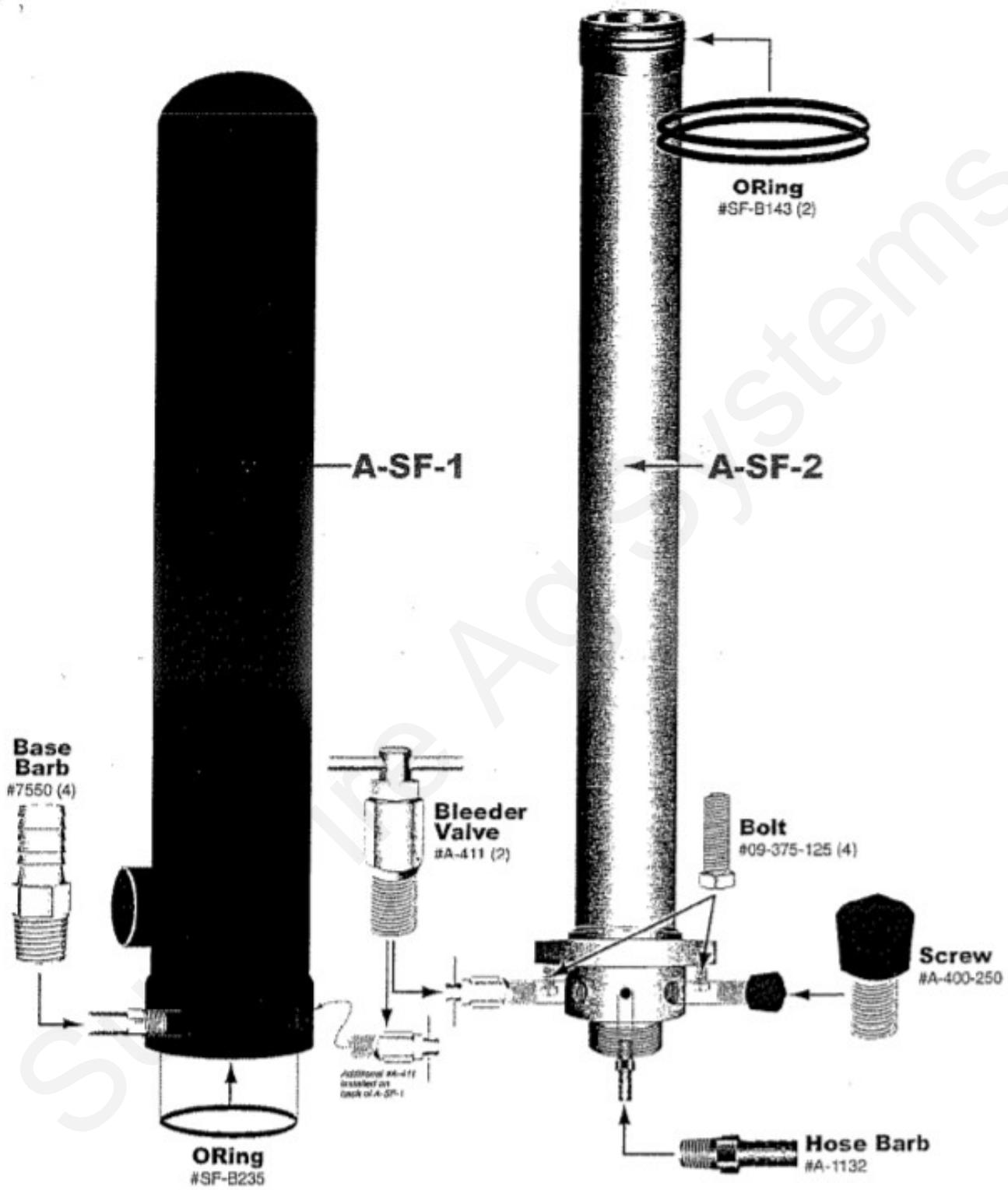
# SureFire Torpedo Repair and Service

1. Remove the 4 Allen screws on the end of the Torpedo tube and pull the inner tube assembly out of the outer tube assembly. Use the breakdown bolt (5) to assist in separating the inner tube assembly from the outer tube assembly.



2. Replace both inner o-ring dump seals and body o-ring seal. Repair kit part number 153-01-A-SF-RK.





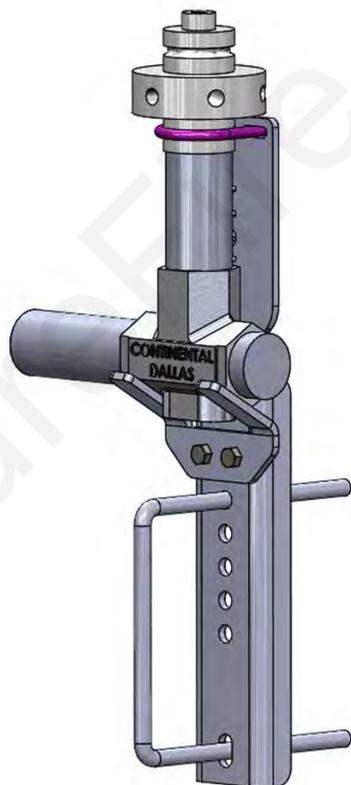
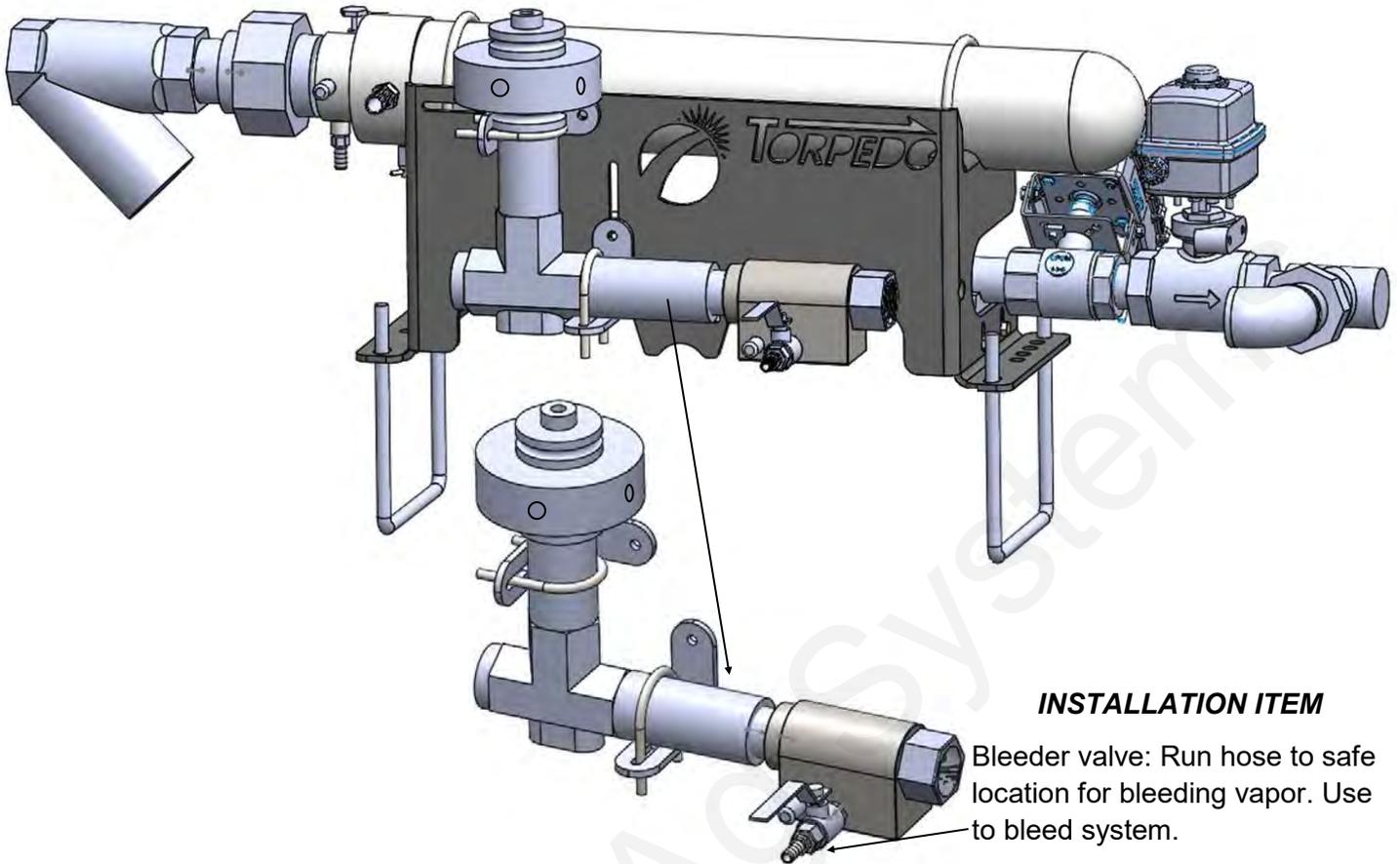
## MAINTENANCE of TORPEDO COOLER (Heat Exchanger)

1. Check unit regularly for leaks and wear.
2. Clean unit annually if possible and store it out of the weather. This will prolong the life of the heat exchanger as well as any other equipment you may have.
3. If leaking from a weld seam remove from service immediately and get it repaired.
4. If leaking from a pipe thread connection try tightening the connection with a wrench. If this fails replace the unit or part that is leaking.
5. If leaking from the upper and lower body, or from the dump knives when not running install a repair kit or replace unit immediately.

## REPAIR

1. Remove unit from service.
2. Open both bleeder valves located at the bottom of the Torpedo cooler to help drain the system.
3. Remove the 4 Allen screws 09-375-125 located at the bottom or end of the Torpedo cooler and pull the upper body off of the lower body.
4. Replace the 2 upper o-rings SF-B133 and the 1 lower o-ring SF-B235. Coat the O-rings with some grease to prevent them from being cut when you reassemble the two pieces.
5. Reassemble the upper and lower body and screw the 4 Allen screws back into the Torpedo and tighten firmly with Allen wrench
6. Reinstall unit back into service. Test carefully for leaks.

# Splitter Options-mounted to Torpedo or mounted remotely



## A-360 Splitter Remote Mount

If the splitter is mounted remotely from the Torpedo, you will need an appropriate length of 1 1/4" high pressure hose from the Torpedo to the splitter if using electric section valves or 1" EVA hose if not using electric section valves.

A-360 Bracket Kit 159-11-100500

### *Safety Reminder*

*Check all hoses and fittings and immediately replace any that show signs of wear or are out of date.*

# Manifolds and Splitters



A-360 Manifold

A-360-MA-(W,C,or J)- *Medium, Large, or Jumbo*



A-360 Splitter

A-360-SP-(3-9) *Regular*

or

A-360-SP-J (3-4) *Jumbo*

**INSTALLATION ITEM**

Must install correct orifices in Splitter during installation. See the next page or see the instructions with the Splitter.

## Features of A-360 Manifolds and Splitters

Patented step down injector technology mixes and accelerates the ammonia into an upper chamber, the tee, and the lower manifold chamber. These features mix the vapor and liquid so each outlet gets an equal amount of both.

- As close as 1 to 3 percent row-to-row variation
- Includes SS hose barbs on manifolds (Half-rate orifice hose barbs are available for half-rate end-rows)
- Manifold outlets available from 3 to 16 for medium (W), 3 to 13 for large (C), and 3 to 10 for jumbo (J)
- Splitter outlets available from 3 to 9 outlets (3 or 4 outlets on Jumbo)
- Pressure gauge port on both manifolds and splitters
- Can be mounted upside down

### Splitter Selection

**NH<sub>3</sub>**  
**GPM per outlet**

100 PSI tank	50 PSI tank	Model Number
Up to 12 GPM	Up to 9 GPM	A-360SP
12 to 25 GPM	9 to 18 GPM	A-360SP-J

To determine your GPM per outlet use one of the following formulas

$$\#NH_3 \text{ per acre} \times \text{speed} \times \text{tool bar width in feet} \times .1212 \div 5.14 \div 60 \div \text{number of manifolds} = \text{GPM per outlet}$$

$$\text{Gallons per minute} \div \text{number of manifolds} = \text{GPM per outlet}$$

$$\#N \text{ per acre} \times \text{speed} \times \text{tool bar width in feet} \times 0.1212 \div 0.82 \div 5.14 \div 60 \div \text{number of manifolds} = \text{GPM per outlet}$$

# A-360SP Splitter

The splitter was designed to have stainless steel threaded orifices on the outlet ports of the manifold. See picture below.

**Correct orifice must be installed before use.**



Threaded orifice not installed



Threaded orifice installed

Use a 5/8" socket wrench to install or remove them when necessary. See picture below.



These orifices can be swapped out for different sizes depending on your application needs. Select the correct orifice based on your application needs by referring to the chart below.



NH3 GPM per outlet 100 psi tank	GPM per outlet 50 psi tank	Orifice
Up to 7 GPM	Up to 5 GPM	.302
5 to 12 GPM	4 to 9 GPM	.437
12 to 25 GPM	9 to 18 GPM	JUMBO

To determine your GPM per outlet use one of the following formulas

#NH3 per acre X speed X tool bar width in feet X .1212 ÷ 5.14 ÷ 60 ÷ number of manifolds = **GPM per outlet**

Gallons per minute ÷ number of manifolds = **GPM per outlet**

#N per acre X speed X tool bar width in feet X .1212 ÷ .82 ÷ 5.14 ÷ 60 ÷ number of manifolds = **GPM per outlet**

As a general guideline, manifold pressures greater than 2/3 of tank pressure may restrict total system flow. Manifold pressures less than 30 PSI may result in increased row-to-row variation. Manifold pressures will change as rate, speed, and tank pressure (temperature) change.

# A-360 Manifold



## Manifold Selection

To choose the correct manifold, use one of the formulas below to determine your lbs NH3 per outlet (per hour) and look on the chart to see which is the correct manifold for that application range.

**NH3**  
**Lbs/hr**  
**per outlet**

100 PSI tank 64° F	50 PSI tank 34° F	Model Number
Up to 170# NH3	Up to 127# NH3	A-360MA-W
170-422# NH3	127-316# NH3	A-360MA-C
Above 422# NH3	Above 316# NH3	A-360MA-J

### To determine your NH3 per outlet use one of the following formulas:

(#NH3 per acre X speed X tool bar width in feet X 0.1212 ÷ total number of outlets on the bar = **NH3 per outlet**)

(Gallons per minute X 5.14 X 60 ÷ total number of outlets on the bar = **NH3 per outlet**)

(#N per acre X speed X tool bar width in feet X 0.1212 ÷ 0.82 ÷ total number of outlets on the bar = **NH3 per outlet**)

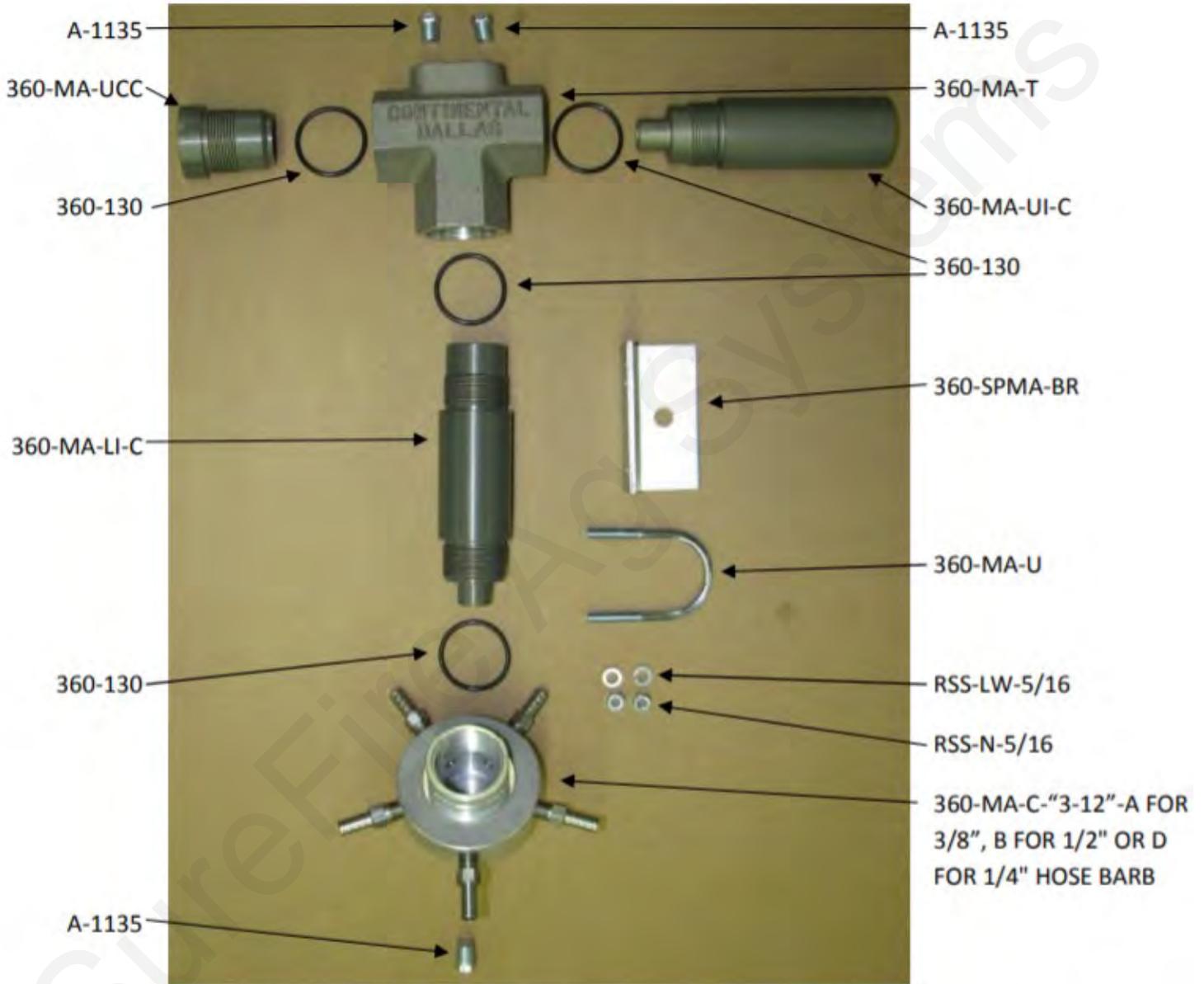
**Note: All manifolds must be within one outlet of each other. For example, if you have 17 rows split into 3 sections, your manifolds must have 6, 6, and 5 outlets. You cannot have 5, 5, and 7.**

*As a general guideline, manifold pressures greater than 2/3 of tank pressure may restrict total system flow. Manifold pressures less than 30 PSI may result in increased row-to-row variation. Manifold pressures will change as rate, speed, and tank pressure (temperature) change.*

**Nitrogen stabilizers, such as N-serve, added to the ammonia may corrode aluminum and may also leave crystal-like deposits which could eventually clog up the orifices. To avoid problems, disassemble and thoroughly clean the manifolds at the end of each application season.**

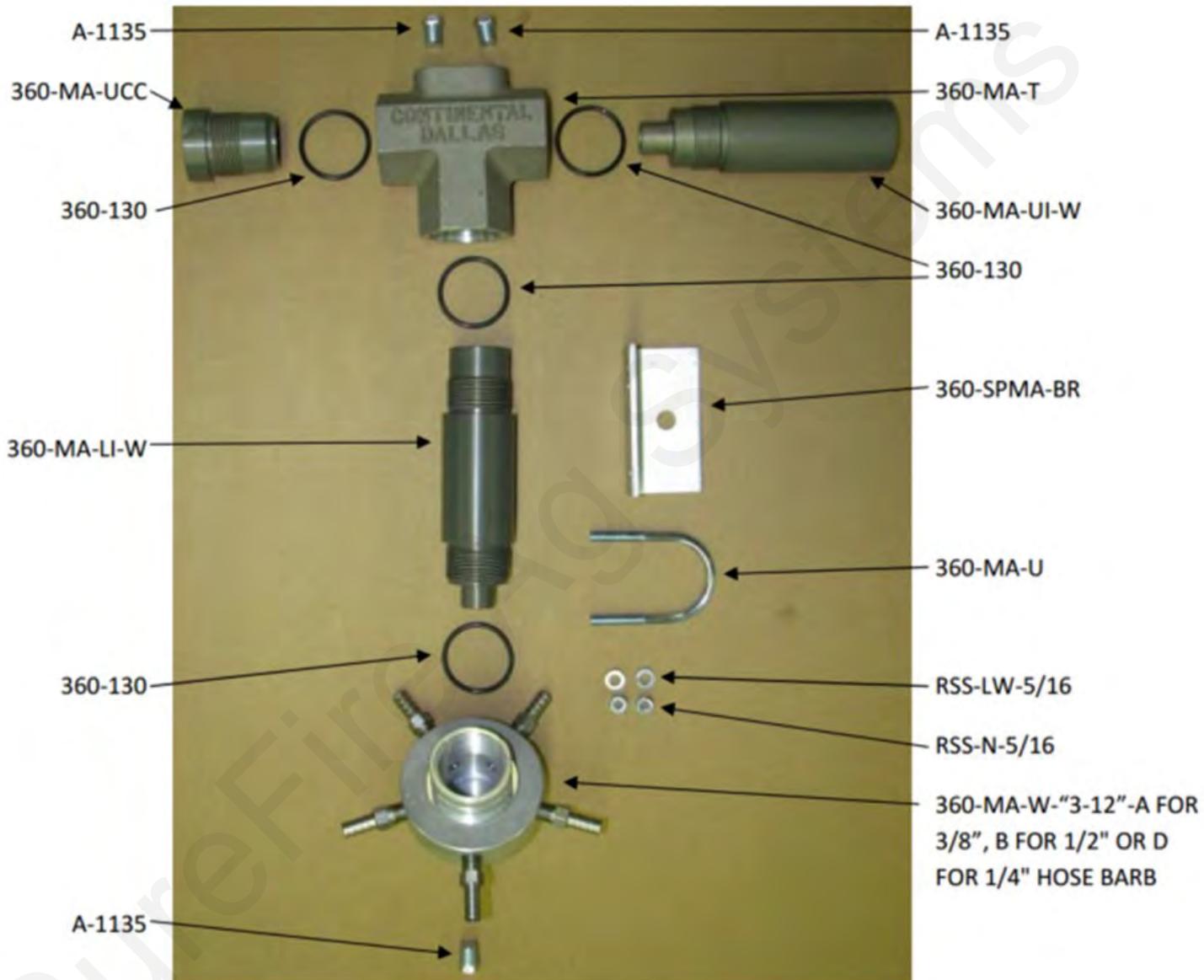
**See the complete Continental NH3 Products *Installation, Operation, Repair and Maintenance Instructions* that came with the splitter and manifold for further tips and information.**

# A-360MA-C PART BREAKDOWN



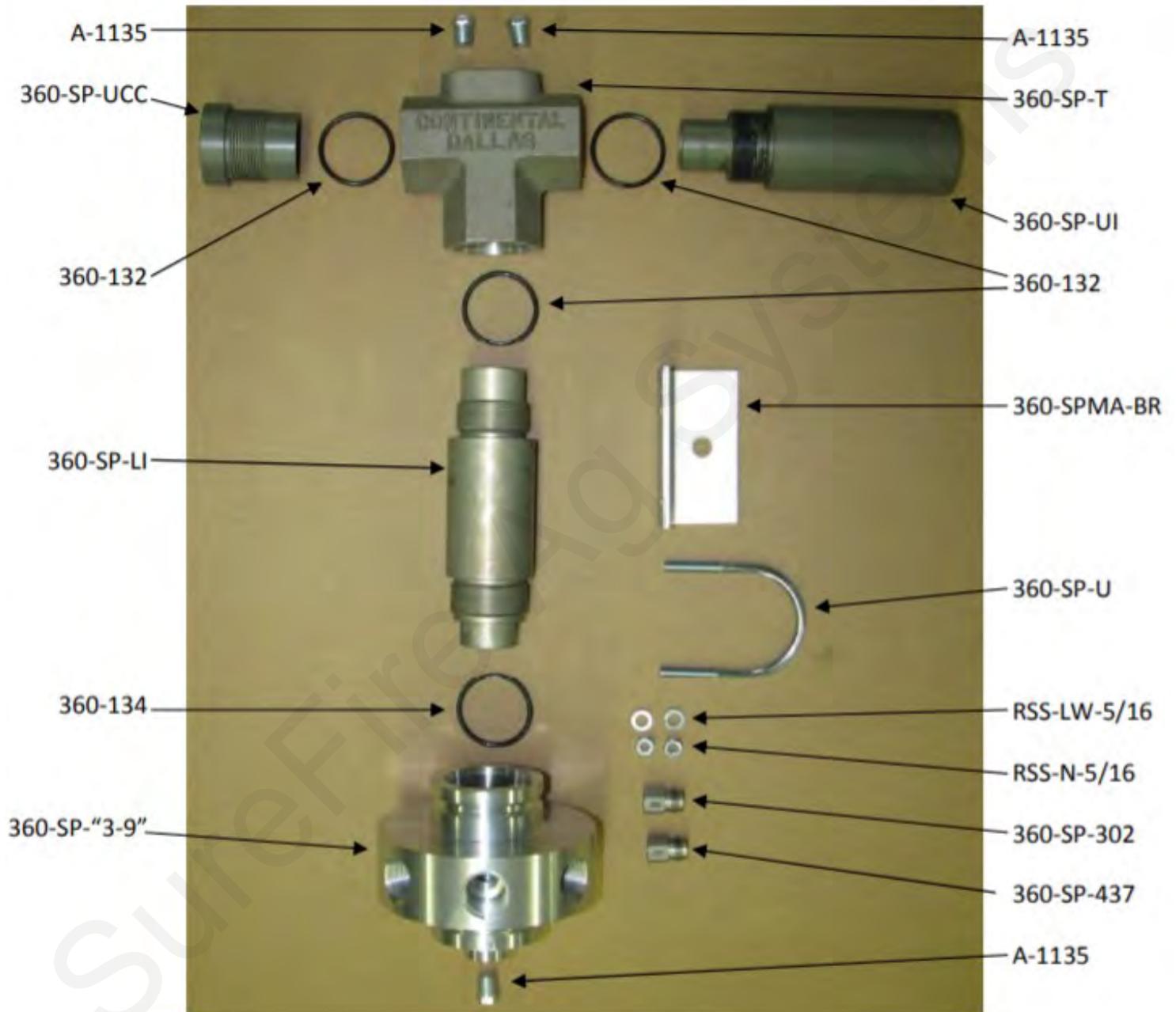
For additional parts drawings or product manuals, go to [continentalnh3.com/product-manuals.html](http://continentalnh3.com/product-manuals.html).

# A-360MA-W PART BREAKDOWN



For additional parts drawings or product manuals, go to [continentalnh3.com/product-manuals.html](http://continentalnh3.com/product-manuals.html).

# A-360SP SPLITTER PART BREAKDOWN



For additional parts drawings or product manuals, go to [continentalnh3.com/product-manuals.html](http://continentalnh3.com/product-manuals.html).

# Optional Vertical Dam Manifold

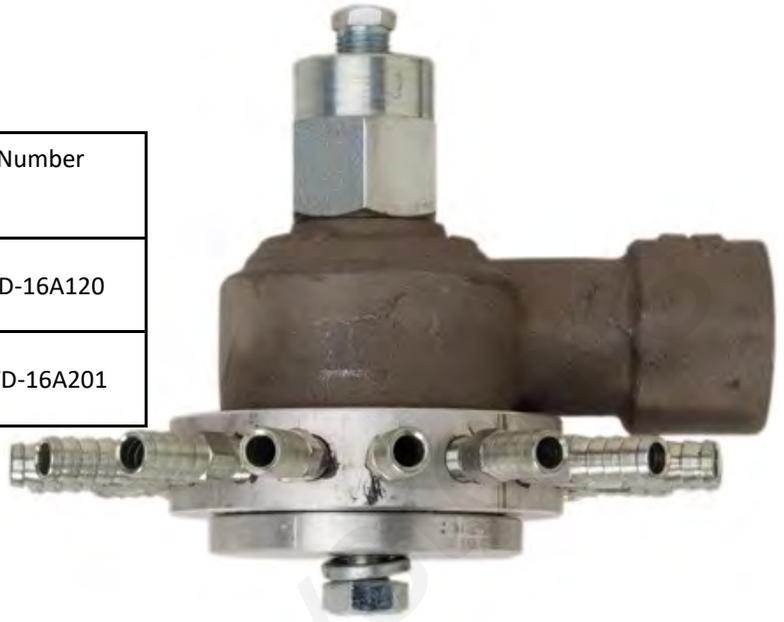
## Continental Vertical Dam Manifold

Each manifold has 16 of 3/8" HB outlets

**NH3**  
Lbs/hr  
per outlet

100 PSI tank 64° F	50 PSI tank 34° F	Model Number
24-183	18-137	152-A-MVD-16A120
Above 183	Above 137	152-A-MVD-16A201

See the formulas on the previous page to calculate the NH3 lbs/hr per outlet.

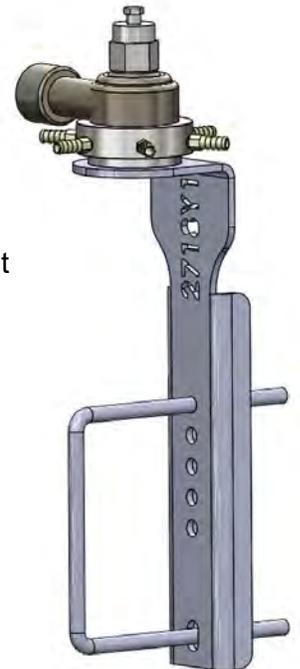


## Features of A-MVD Vertical Dam Manifold

- Get within 6 to 8% row-to-row accuracy
- Better accuracy than traditional manifold
- Plug outlets you don't need
- Half-rate orifice hose barbs are available if needed for half-rate end rows

*As a general guideline, manifold pressures greater than 2/3 of tank pressure may restrict total system flow. Manifold pressures less than 30 PSI may result in increased row-to-row variation. Manifold pressures will change as rate, speed, and tank pressure (temperature) change.*

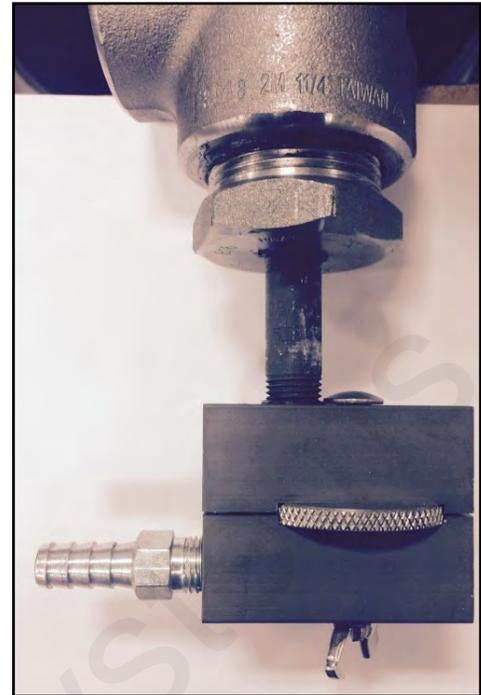
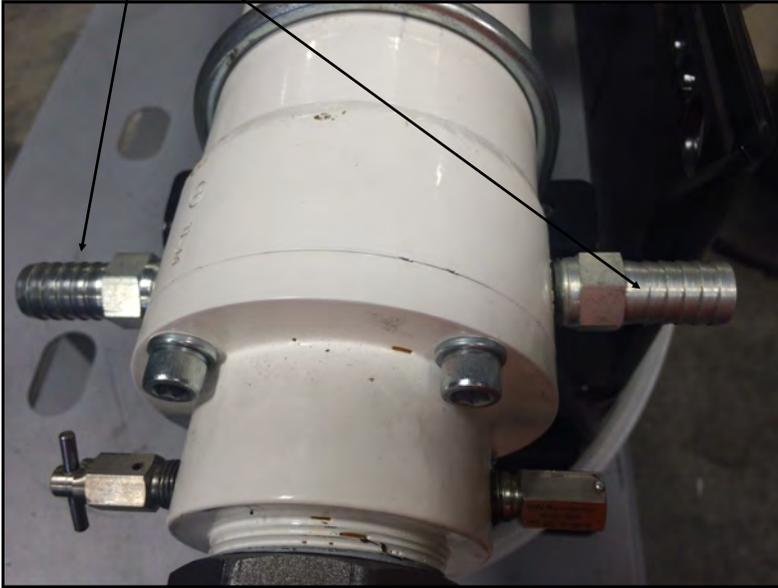
MVD Bracket Kit  
159-11-200500



# BE CAREFUL OUT THERE!

## INSTALLATION ITEM

**Dump Hose Barbs:** Plumb 3/4" hose to vapor tube dump knives.



## INSTALLATION ITEM

**Bleeder valve:** Run hose to safe location for bleeding vapor. Use to bleed system.

*Open valve slowly when bleeding system.*

$$(\# \text{ N per acre}) \times \text{speed} \times \text{width} / 2090.6 = \text{GPM}$$

("D" orifice is only for users having problems with N-Serve plugging up the heat exchanger.)

## INSTALLATION ITEM ↑

**Variable Dump Orifice:** The dump orifice draws a small amount of liquid ammonia and returns it to the center of the heat exchanger to do the cooling. The variable dump orifice controls the amount of ammonia that is used to cool the exchanger. Using too small of an orifice may result in some vapor still being in the system when it goes through the flowmeter. Using too large an orifice will cause more ammonia than necessary to be dumped through the vapor tube dump knives. Be sure the letter indicating the desired orifice size is showing in the window cutout and tighten the wingnut.

GPM	1-10	11-20	21+	N-Serve
Orifice	A	B	C	D

**TORPEDO™**



**SureFire**

**Ag Systems**

# Flowmeter 204-02-2692Y1

Raven SS RFM 60S Flowmeter 1 to 60 GPM with 3-pin MP 150 shroud



The flowmeter calibration number is **148 pulses per gallon**.

Verify accuracy of flowmeter by comparing the Volume shown on the display with actual weigh tickets.

If the weigh ticket amount is more than shown on the display, LOWER the flow cal number.

Use the following formula to adjust the flow cal number:

$$(\text{Initial flow cal} \times \text{Volume shown on screen}) / \text{Weigh ticket amount} = \text{new flow cal}$$

*(If you need MORE, INCREASE the flow calibration number. If you need LESS, DECREASE the flow cal.)*

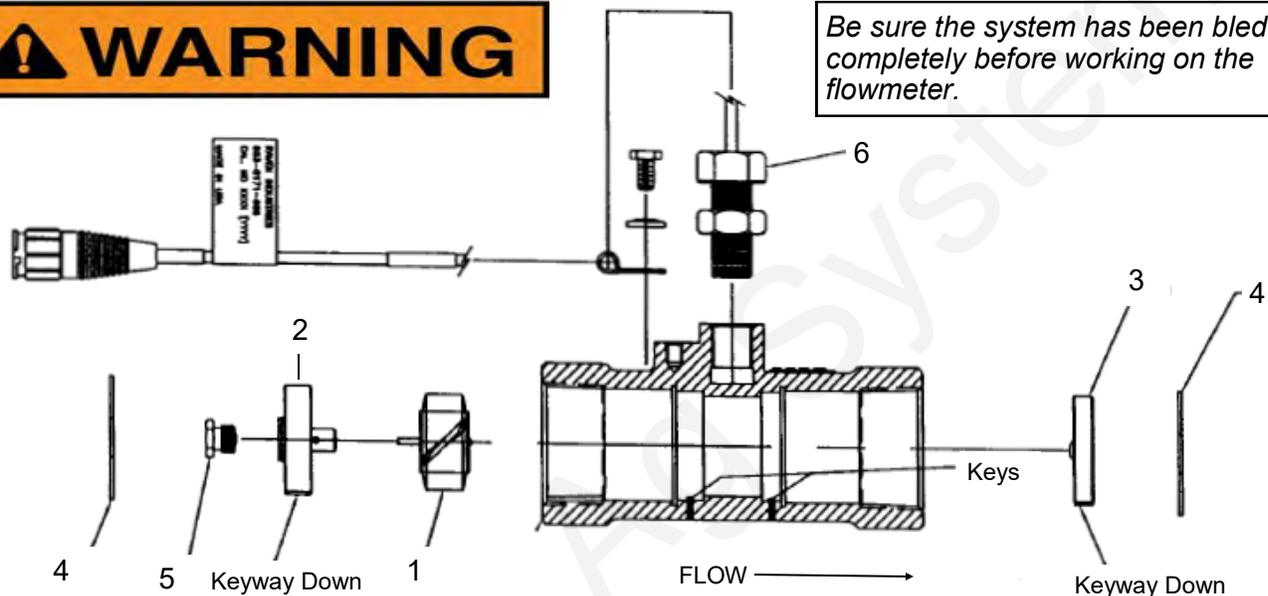
See the next page for flowmeter parts, repair and maintenance.

# RFM 60S Flowmeter

Item	Description	Raven Part #
1	Rotor / Magnet Assembly	063-0171-673
2	Hub / Bearing Assy, Upstream	063-0171-674
3	Hub Assembly, Downstream	063-0171-769
4	Ring, Retaining, Internal	335-0000-278
5	Stud Bearing	063-0173-062
6	Sensor Assembly	063-0171-669



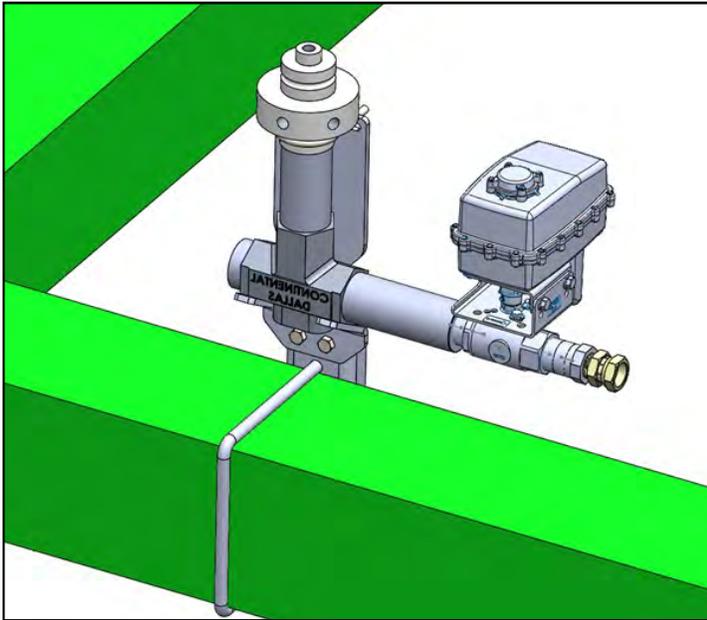
*Be sure the system has been bled completely before working on the flowmeter.*



## RFM 60S Flowmeter Maintenance and Adjustment Procedure

1. Be sure all NH<sub>3</sub> has been bled from the system before starting maintenance.
2. Remove flowmeter, brush away any debris and flush with clean water.
3. Remove the retaining rings carefully. Remove the bearing hub, turbine hub, and turbine from inside flowmeter housing.
4. Clean the turbine and hubs of metal filings and any other foreign material. Use pressurized air to blow metal filings out of both hubs and turbine. Confirm that the turbine blades are not worn. Hold turbine and bearing hub in your hand and spin turbine. It should spin freely with very little drag.
5. If bearing hub stud is adjusted or replaced, verify the turbine fit before reassembling. Put turbine hub and retaining ring in place. Put bearing hub with turbine against turbine hub inside the flowmeter housing. (Stud keys inside flowmeter housing must be lined up in the groove on the hub.) Put the retaining ring into the groove to lock bearing hub in place. Spin turbine by blowing on it. Tighten bearing hub until turbine stalls. Loosen the stud 1/3 of a turn. The turbine should spin freely.
6. Use a low pressure (5 PSI) jet of air through flowmeter in the direction of flow and again in the opposite direction to verify the turbine spins freely. If there is drag, loosen the stud on the bearing hub 1/16 turn until the turbine spins freely.
7. If turbine spins freely and the cables have checked out, but the flowmeter is not totalizing properly, verify that the sensor assembly is threaded all the way into the flowmeter body, and the orientation groove on top of the sensor is parallel with flowmeter body. If flowmeter still does not totalize, replace Sensor Assembly.

# Electric Section Valves



202-4137Y1

1" SS KZ NH3 shut-off valve with 3-pin WP shroud

The valves have a 3-pin weather pack electrical connector. This has a power, ground, and switched wire. The power measured to ground should have 12 volts when the controller is on. The switched wire will have 12 volts to turn the valve on, and 0 volts to turn the valve off.

### Wiring Connector:

Pin A—Red, 12 Volts +

Pin B—Black, Ground -

Pin C—White, Signal

12V=on ; 0V=off

## Pressure gauges and sensors

137-ASG60 2 1/2" Silicone Filled Stainless Gauge-60 PSI

For manifolds (optional)

137-LFG160 2 1/2" Silicone Filled Stainless Gauge-160 PSI

137-LFG400 2 1/2" Silicone Filled Stainless Gauge-400 PSI

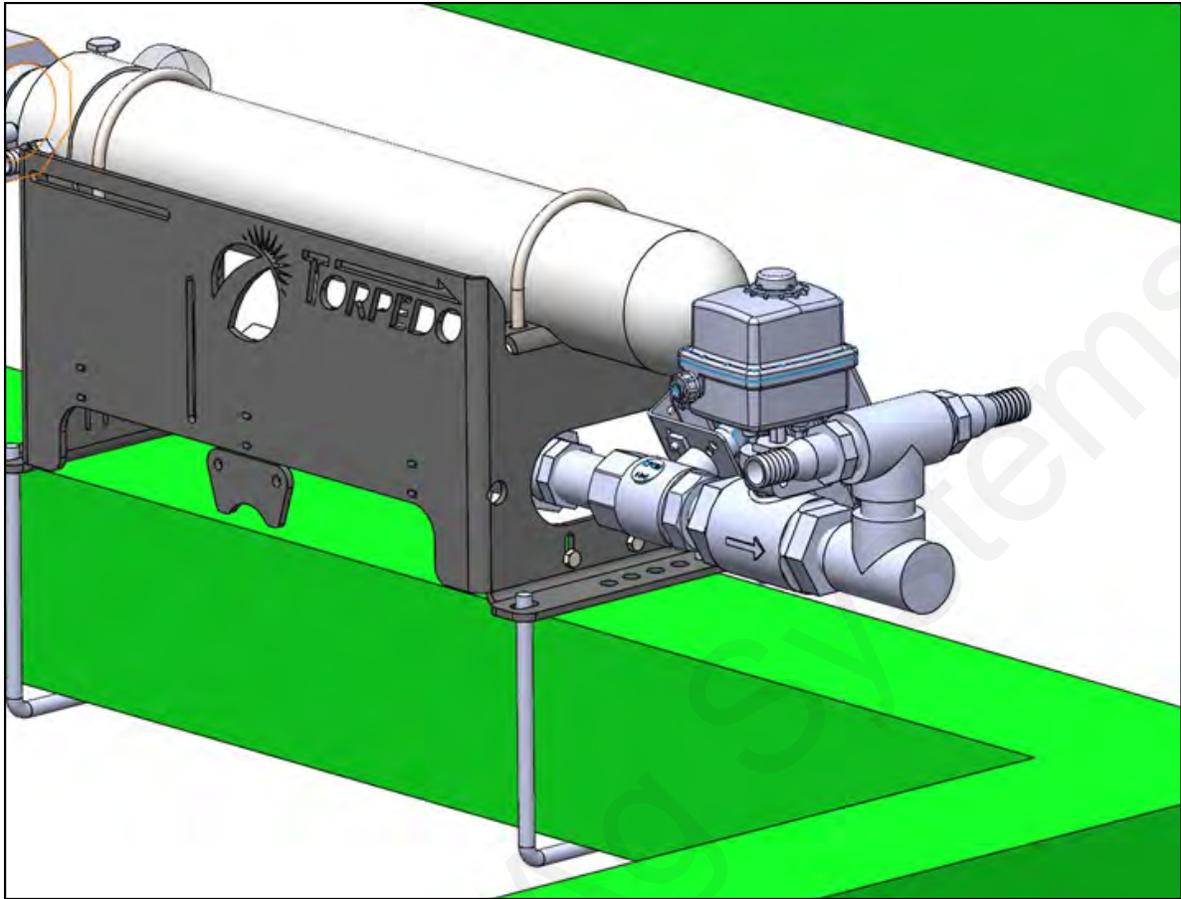
For Torpedo SuperCooler (optional)

Or

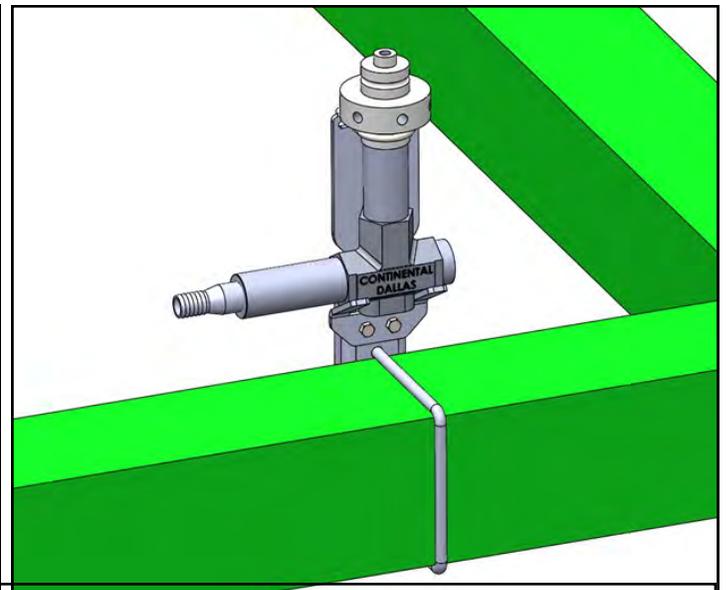
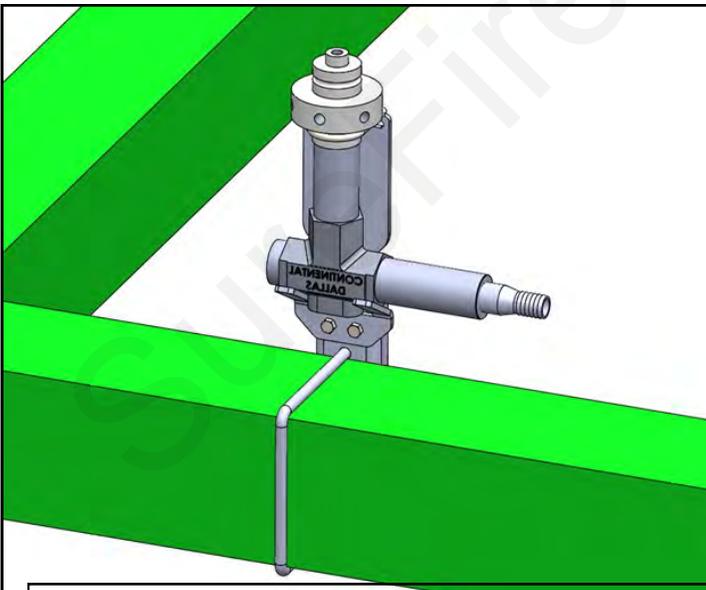
521-05-050400 NH3 400 PSI 3-wire pressure sensor (0-5 V DC  
12.5 mv/PSI) with 3-pin 150 MP Tower

For Torpedo SuperCooler (optional)

159-10-200200 SuperCooler Splitter Kit for 2 manifolds (NO ELECTRIC SECTIONS)



To split the flow to 2 manifolds a Tee is used. If going to 2 manifolds with no electric section valves 1" reinforced EVA hose is used (equal length to each manifold).

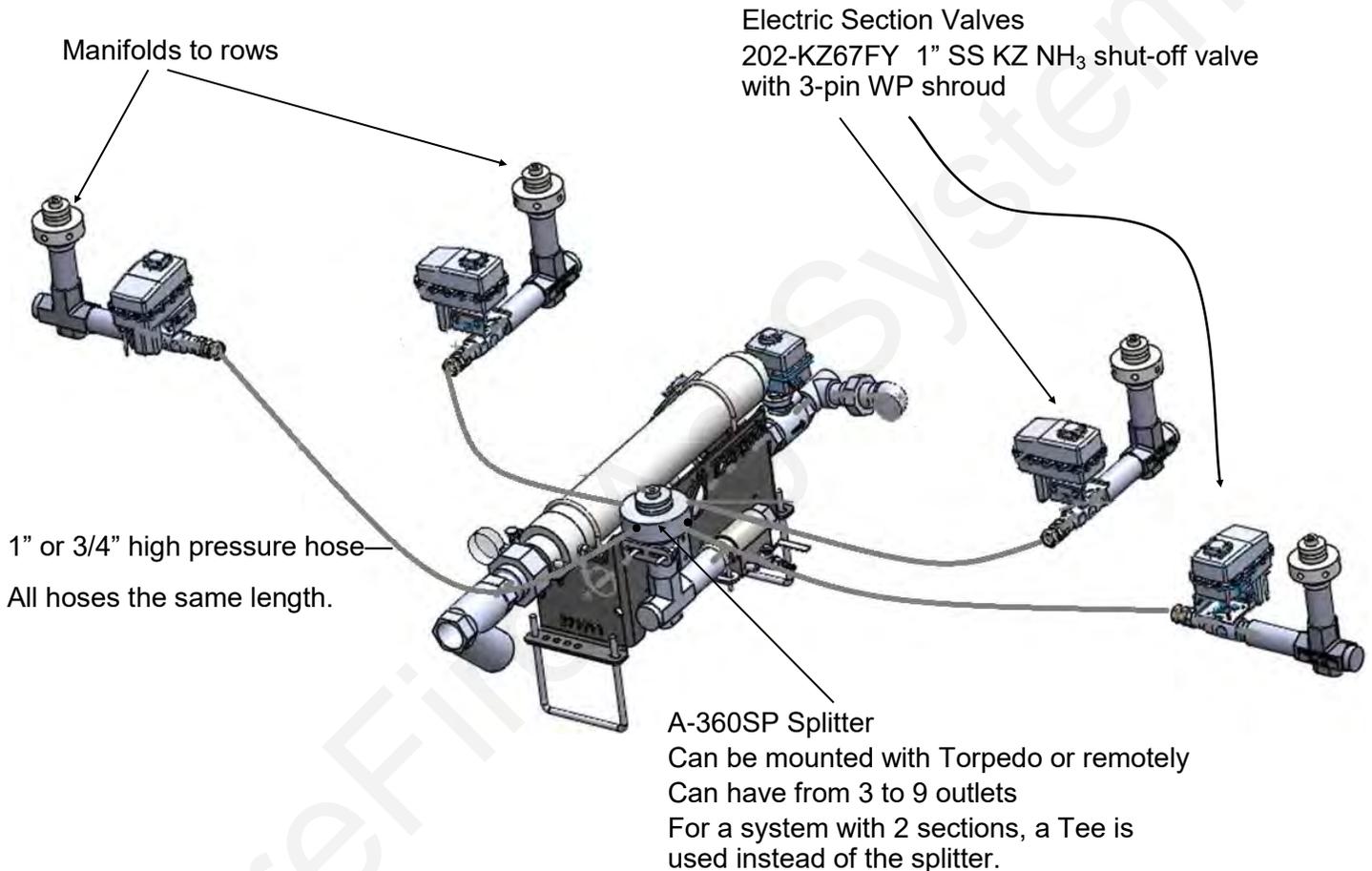


**Safety Reminder**

*Flush with water for at least 15 minutes if exposed to anhydrous ammonia.*

# Electric Valve Kits for doing multiple sections

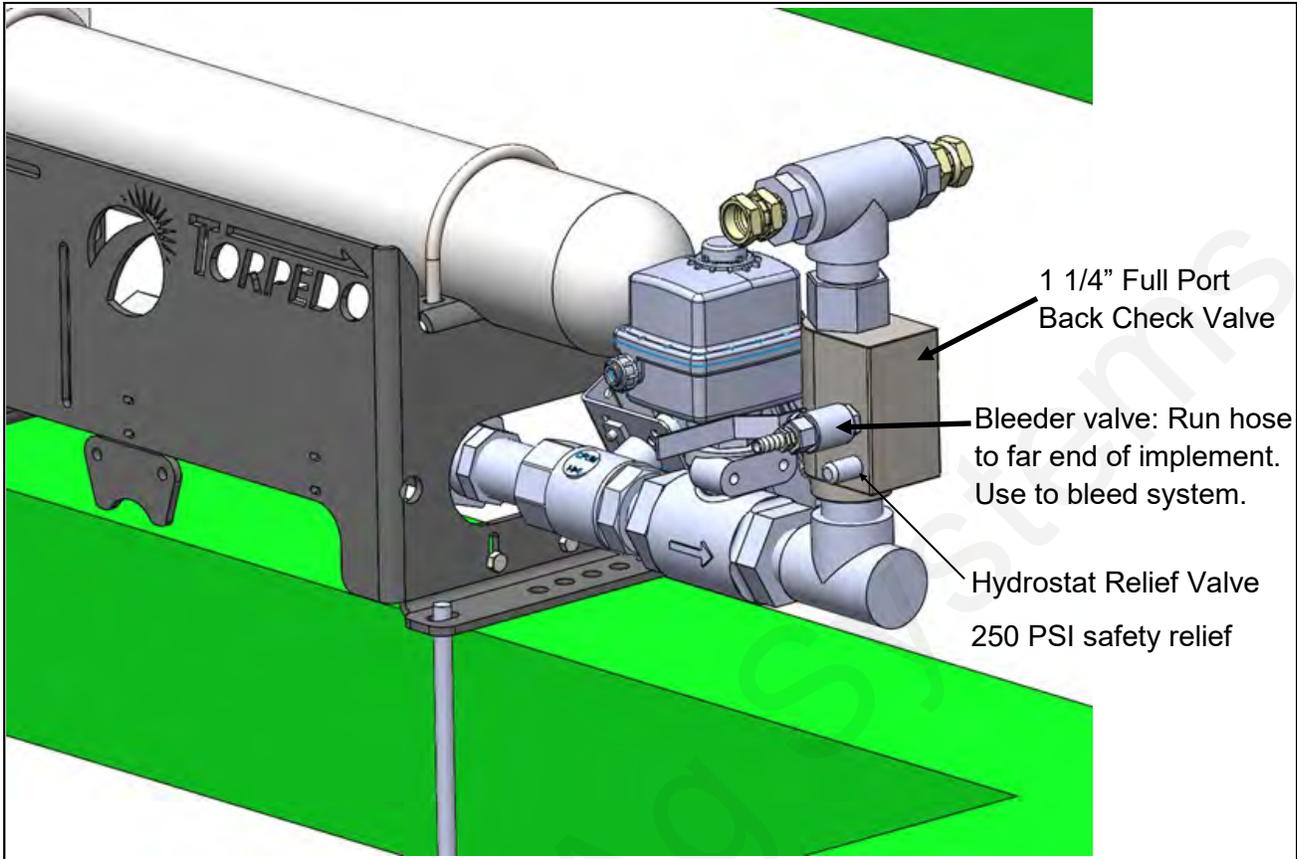
When using electric section valves, you must use high pressure hose from the Splitter to the section manifolds. These hoses must be the same length. Recommended hose is 1" high pressure hose for 3 sections or less and 3/4" high pressure hose for 4 or more sections.



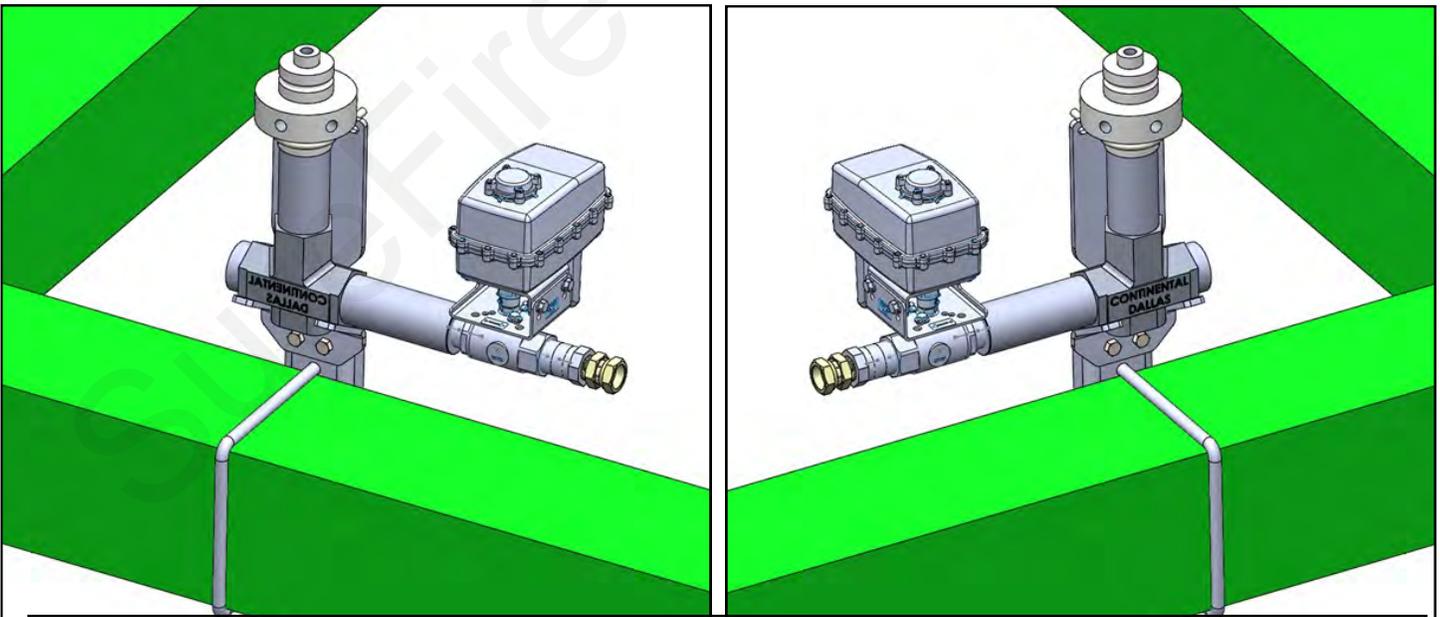
## Safety Reminder

*Make sure the nurse tank has 5 gallons of fresh clean water.*

# 159-10-100200 SuperCooler Splitter Kit for 2 ELECTRIC SECTIONS



To split the flow to 2 manifolds a Tee is used. If going to 2 manifolds with electric section valves 1" high pressure hose is used (equal length to each manifold).



## Safety Reminder

*Always know the wind direction and park in an appropriate direction when servicing the system or changing tanks. The wind is your friend.*

## Gauge Tree Assembly (Optional)

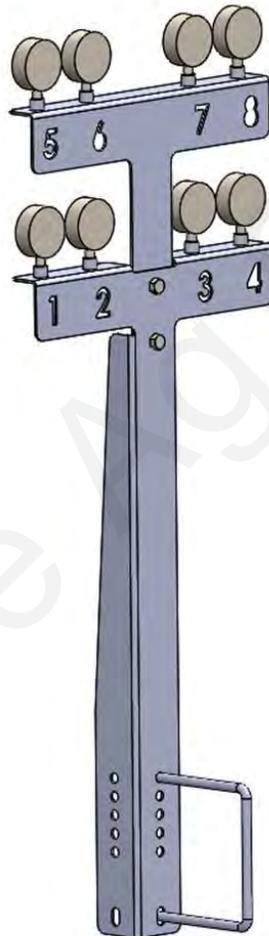
159-11-500500 Black Gauge Tree Kit for 1-4 gauges with 7x7 u-bolt

159-11-500600 Black Add-on Gauge Tree Kit for 5-8 gauges w/ mounting hardware  
(Gauges not included)

Use 137-LFG60 2 1/2" Silicone-Filled Stainless Gauge-60 PSI-one per manifold

Or

137-LFG160 2 1/2" Silicone-Filled Stainless Gauge-160 PSI-one per manifold



### **Safety Reminder**

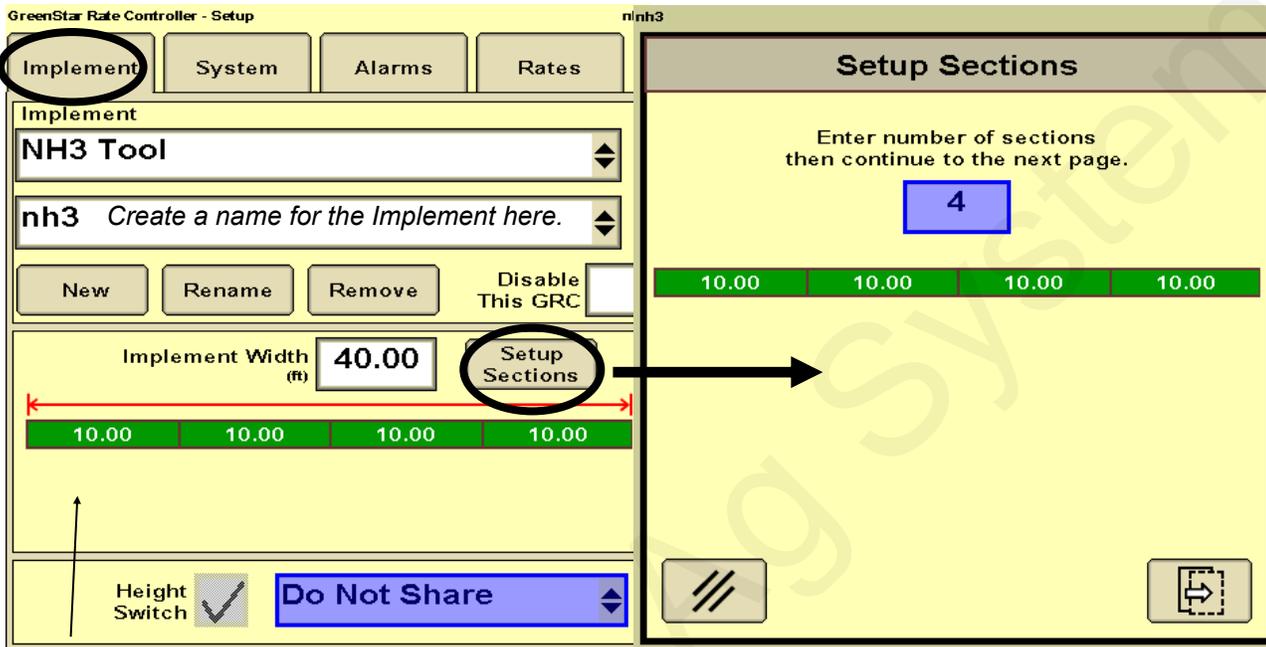
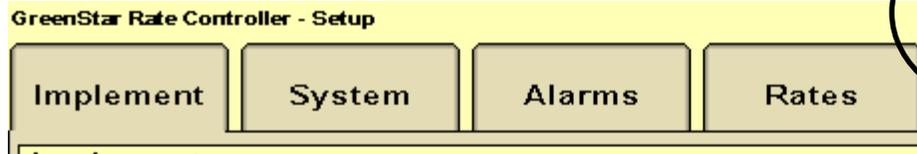
*Anyone working around anhydrous ammonia should keep a small squeeze bottle of fresh water with him at all times.*

# John Deere Rate Controller Setup for NH<sub>3</sub>

**Read the GreenStar Rate Controller Operator's Manual for complete setup and operation instructions.**

From the Rate Controller main screen, select the Setup arrow on the right side.

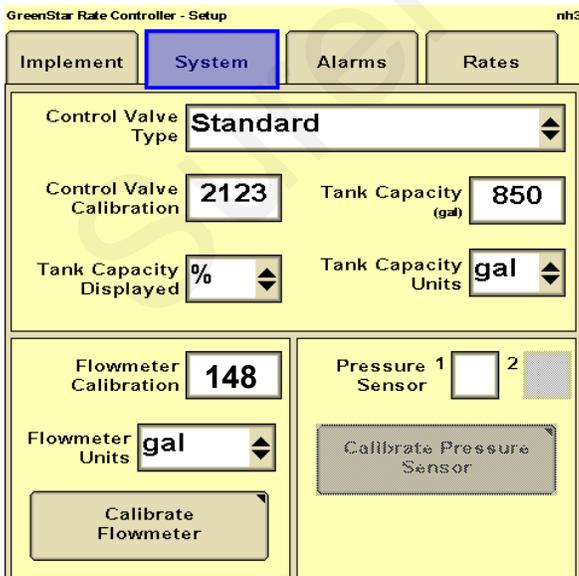
There will be 4 tabs at the top of the Setup screen.



Press the **Implement** tab. On the Implement pull-down menu, select **NH3 Tool**. Then, select or create a New name for the implement.

Fill in the **Implement Width**. If there are electric section valves, press **Setup Sections** and enter the number of sections. The section widths will automatically set up as equal widths. If section widths are not equal, set up the widths on the next screen.

**Height Switch:** Must be checked for NH<sub>3</sub> setup. Indicate whether this switch will be **Do Not Share**, **Send**, or **Receive**.



**System tab:**

**Control Valve Type: Standard**

**Control Valve Calibration: 2123**

**Tank Capacity:** optional (Can be set up in gal or lbs)

**Flowmeter Calibration: 148**

**Flowmeter Units: gal**

**Do not Calibrate Flowmeter here.**

**Pressure Sensor:** optional (Check the box if installed and Calibrate Pressure Sensor. 400 PSI sensor is 12.5 mv/PSI).

Tank Capacity (lbs) **4370**

Tank Capacity Units **lbs**



## GreenStar Rate Controller Setup (Continued)

**Alarms** can be set according to the operator's preference.

GreenStar Rate Controller - Setup nh3

Implement System **Alarms** Rates

Low Tank Level (%)  Alarm?

High Alarm (% above target rate)

Low Alarm (% below target rate)

---

Pressure Sensor 1

Alarm?

Minimum (psi)

Maximum (psi)

11:26am

GreenStar Rate Controller - Setup nh3

Implement System Alarms **Rates**

Notice: lbs N / acre.

Rate 1

Rate 2

Rate 3

Rate Smoothing   %

Actual Nitrogen  Percent Nitrogen

**Rates:** Rates can be set up in lbs N / acre or lbs NH<sub>3</sub> / acre

The two screens below are actually set to apply the same amount of product.

GreenStar Rate Controller - Setup nh3

Implement System Alarms Rates

Notice: lbs NH<sub>3</sub> / acre.

Rate 1

Rate 2

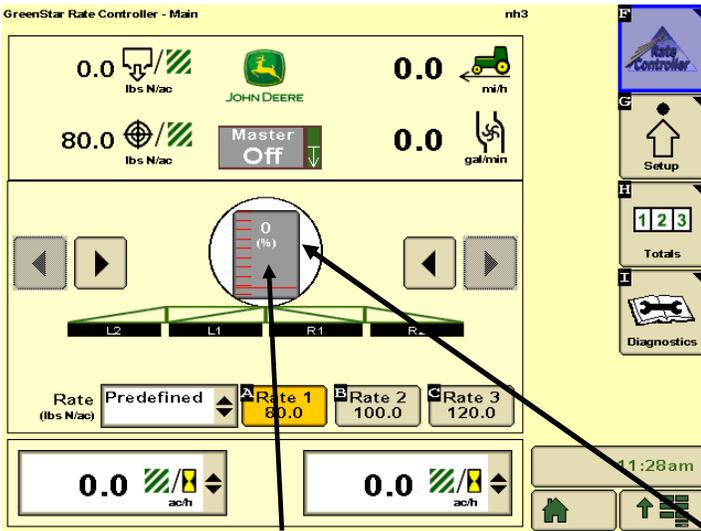
Rate 3

Rate Smoothing   %

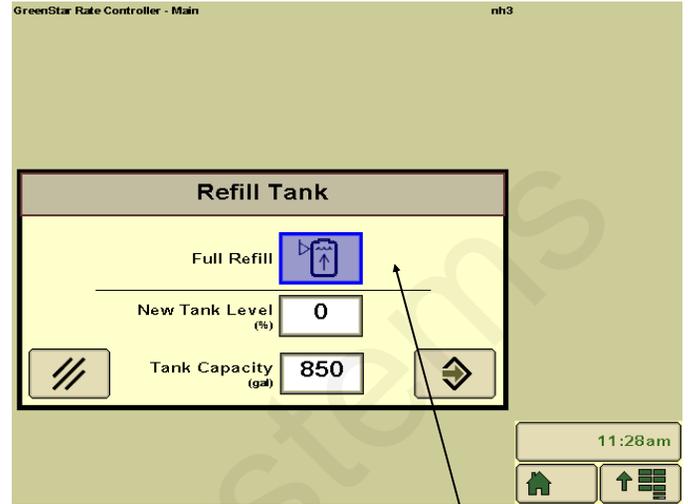
Actual Nitrogen

GreenStar Rate Controller Setup (Continued)

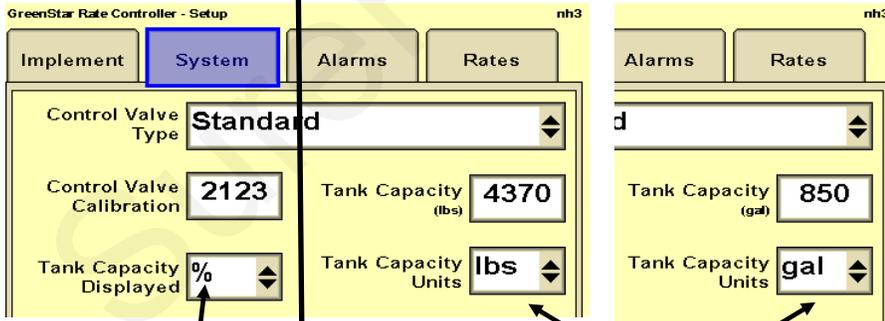
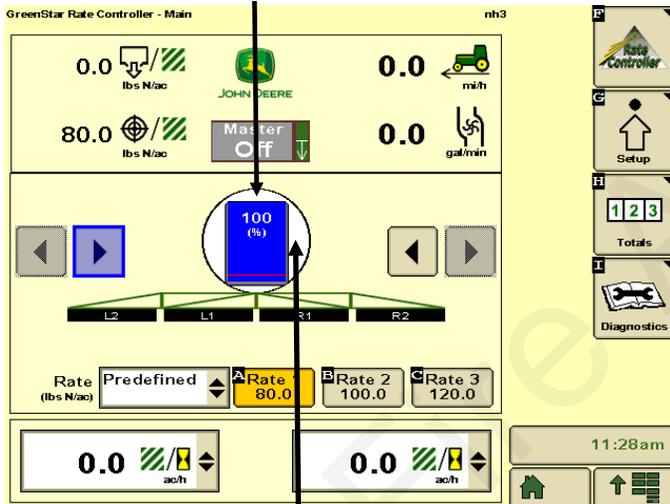
The **Tank Level** can be monitored on the Rate Controller Main Screen.



**Tank Empty  
Tank Full**



Press the tank to bring up the **Refill Tank** screen.



**Tank Capacity Displayed** can be set for either % or lbs

**Tank Capacity** can be set for either lbs or gal.

213-00-4561Y1

Rate Controller Adapter Cable 37-pin to 12-pin NH3 and 14-pin Sections

Wire 18AWG  
unless otherwise  
specified

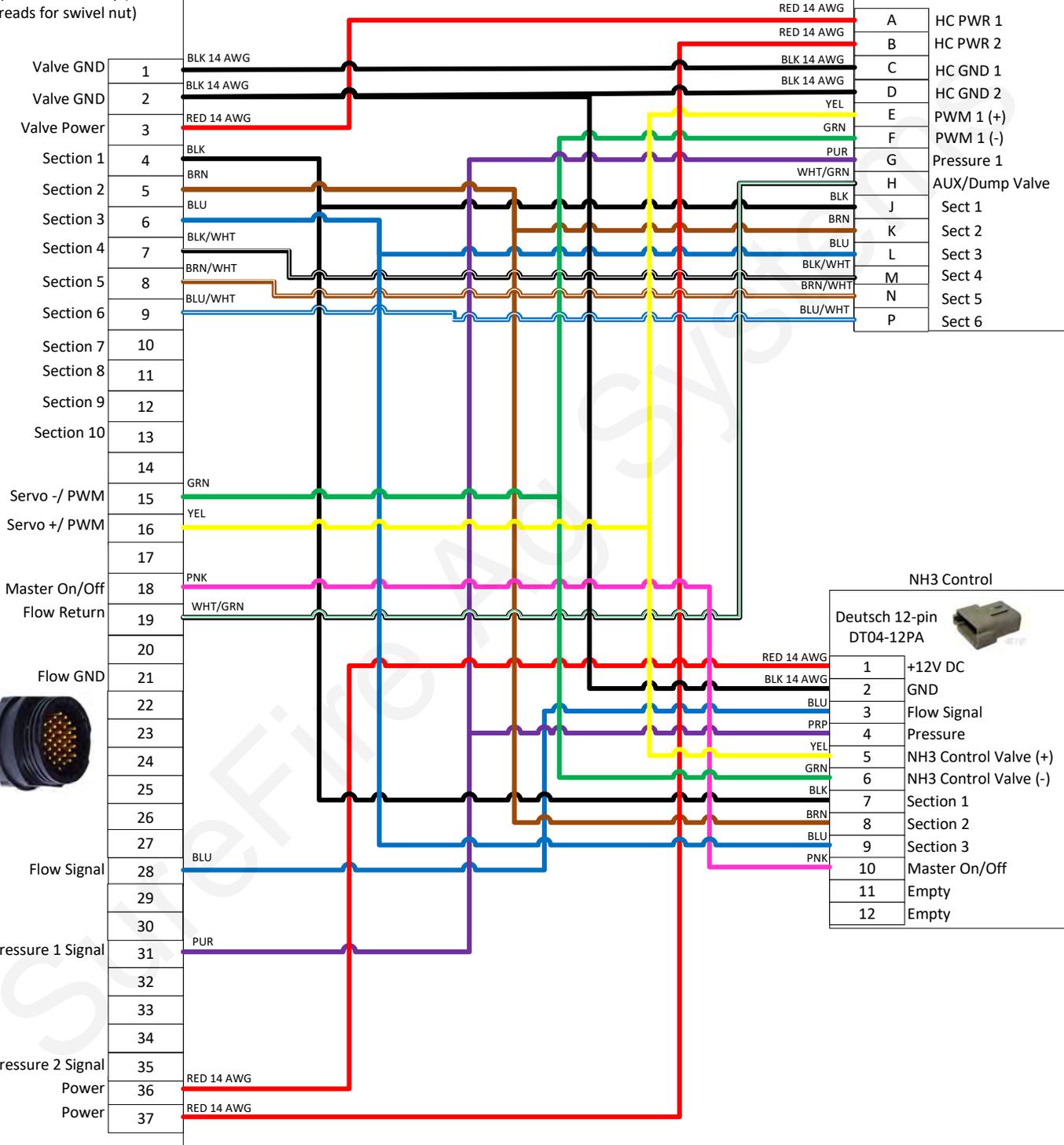
SECTIONS 1-6

14-pin Deutsch HDP24-18-14PE



GRC

37 Pin Round – AMP  
Male pins in male body (with  
threads for swivel nut)



NH3 Control

Deutsch 12-pin  
DT04-12PA



1	+12V DC
2	GND
3	Flow Signal
4	Pressure
5	NH3 Control Valve (+)
6	NH3 Control Valve (-)
7	Section 1
8	Section 2
9	Section 3
10	Master On/Off
11	Empty
12	Empty



Part No:

213-00-4561Y1

Drawn By:

Matthew Fritz

Description:

Rate Controller Adapter Cable 37-pin to 12-pin NH3 and 14-pin Sections

Last Edit Date:

4/16/2020

Revision

A-01

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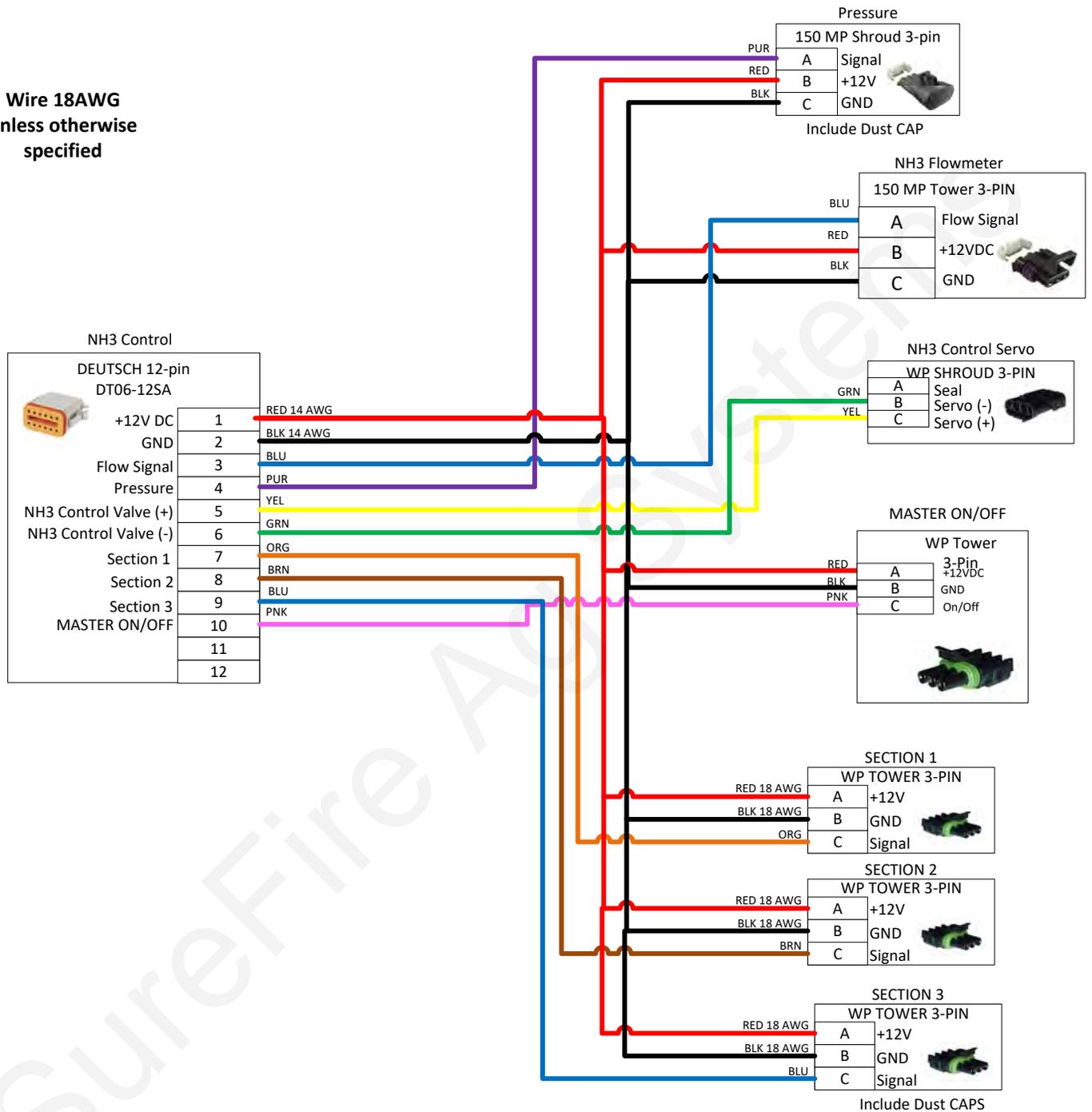
46



207-3496Y1

NH3 Final Harness with Sections 1-3

Wire 18AWG  
unless otherwise  
specified

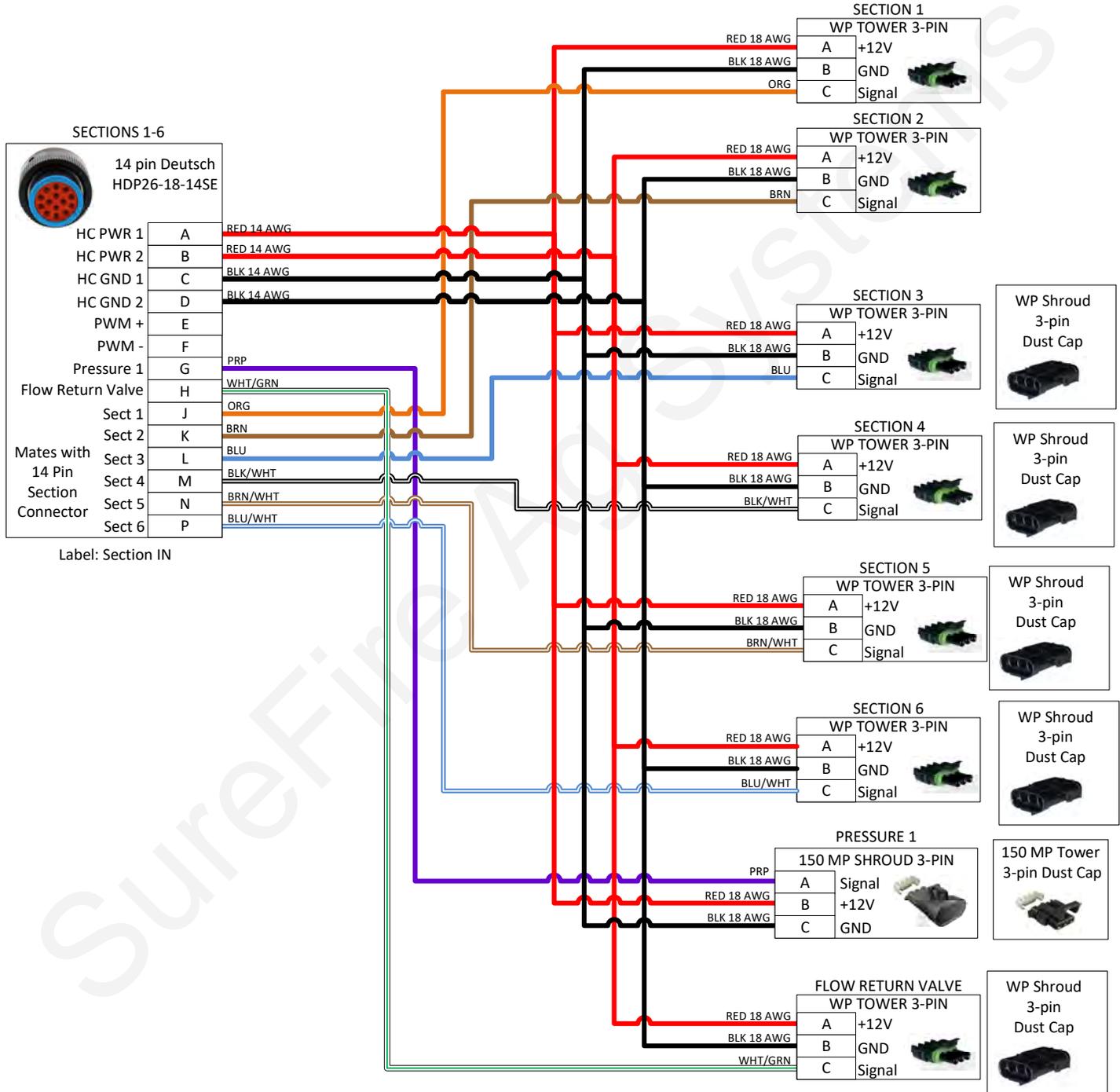


Part No:	207-3496Y1	Drawn By:	Mark Wolters		
Description:	NH3 Final Harness with Sections 1-3	Last Edit Date:	12/9/2016	Revision	A-01
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# 207-3463Y1

## 14-Pin 6 Section Final Cable (6 sections, flow return, pressure)

**Wire 18AWG  
unless otherwise  
specified**



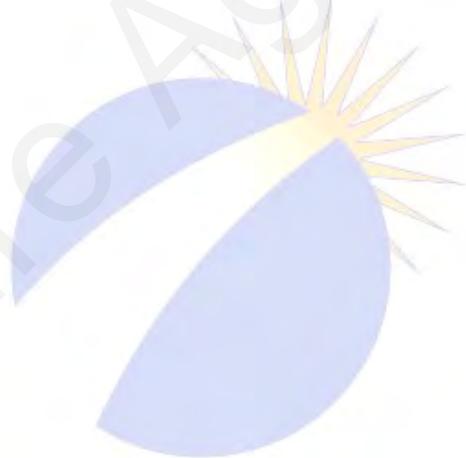
	Part No:	207-3463Y1	Drawn By:	Brandon Cavenee		
	Description:	14-Pin 6 Section Final Cable (6 sections, flow return, pressure)	Last Edit Date:	6/4/2021	Revision	A-02
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*Read and save all product literature, installation instructions, and operating instructions that accompany this system.*

*Make sure all personnel that will be operating or working around this system have been properly trained in safe anhydrous ammonia practices.*

*On first use with anhydrous ammonia, be certain that all personnel are in a safe place as the nurse tank valve is opened and as each segment of the system is filled with anhydrous ammonia. Verify that all joints and connections are tight and that proper shut-off and control of the system is working.*

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