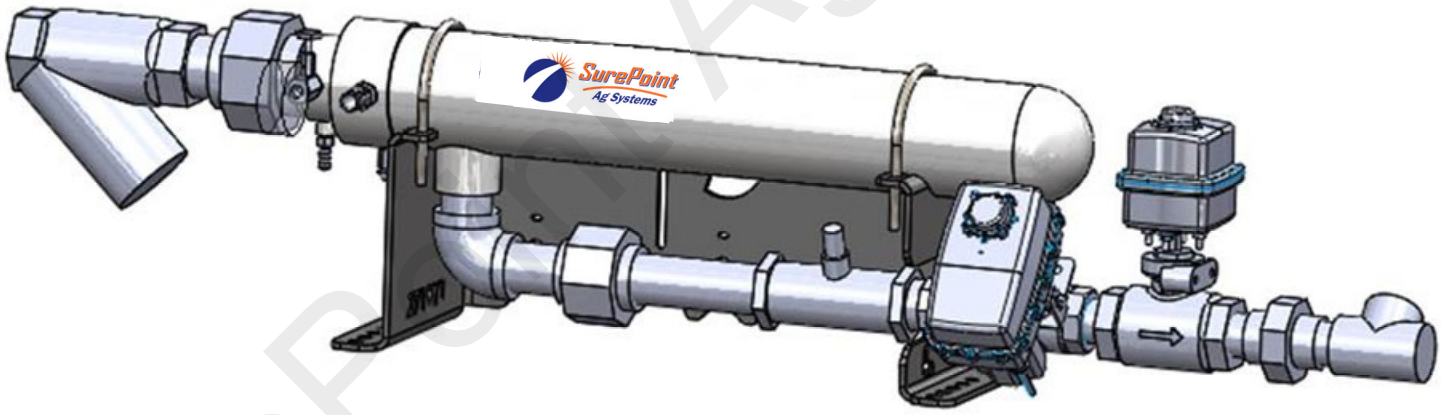
TORPEDO™

NH_3

Precision Anhydrous Ammonia Application for

CASE IH AGRICULTURE AFS AccuControl



396-2862Y1

SurePoint Ag Systems

Table of Contents

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.

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.
- The operator should have a small squeeze bottle of fresh water with him at all times.

Inspection

- 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?

Be Careful With This Stuff!

Things to Know About Anhydrous Ammonia (NH_3)

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_3. 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 hydroscopic (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

NH3 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.

NH3 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 liquid pressure and remains the same whether the tank is 10% full or 80% full. This pressure is dependent on the temperature of the NH3.

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 NH3 as a liquid it must be kept below –28°F or maintained under pressure. If the temperature of the NH3 increases above –28°F some of the liquid changes to a gas as the NH3 begins to boil. Application equipment typically uses tank pressure to deliver NH3 to the soil. An increase in tank pressure would tend to force more NH3 through the distribution lines. The actual pounds of NH3 being applied decreases or increases as tank pressure fluctuates unless continuous adjustments are made to the meter.

If NH3 is released into the atmosphere it will expand rapidly to occupy a volume 850 times greater than the original liquid. NH3 readily changes from liquid to gas in the nurse tank and distribution system. Consequently the ratio of NH3 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 NH3 very difficult to do consistently and accurately.

Automatic NH3 controls utilizing the **SurePoint Torpedo™ NH3 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 SurePoint Torpedo™ system uses a **heat exchanger to convert the NH3 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**, **NH3 delivery hose and breakaway coupler**, and **heat exchanger** with adequate capacity.* The components of a SurePoint 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 SurePoint 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 SurePoint Torpedo™ NH3 system.

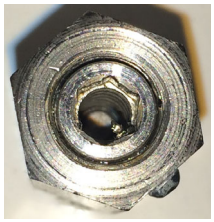
First, the **width, rate, and speed** will be used to determine the amount of NH3 your system will need to deliver. With this information, the **tank withdrawal valves, NH3 hose(s), and Torpedo™ heat exchanger** can be selected.

Next, the distribution system will be set up. This takes into account the **row spacing, number of rows, amount of NH3 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 NH3 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 SurePoint Torpedo™ NH3 system is designed to provide safe, reliable, dependable, and accurate distribution of NH3. 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 following table shows the flow and application rates that are attainable with each SurePoint Torpedo™ model.

SurePoint Torpedo™ Model # 100, 200 or 300 Kit

	34 degrees F (50 PSI)		Max App Rate Lbs N / acre		60 degrees F (93 PSI)		Max App Rate Lbs N / acre	
Model #	GPM	Lbs NH_3 per hour	40’ at 8 MPH	60’ at 8 MPH	GPM	Lbs NH_3 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_3 Flow

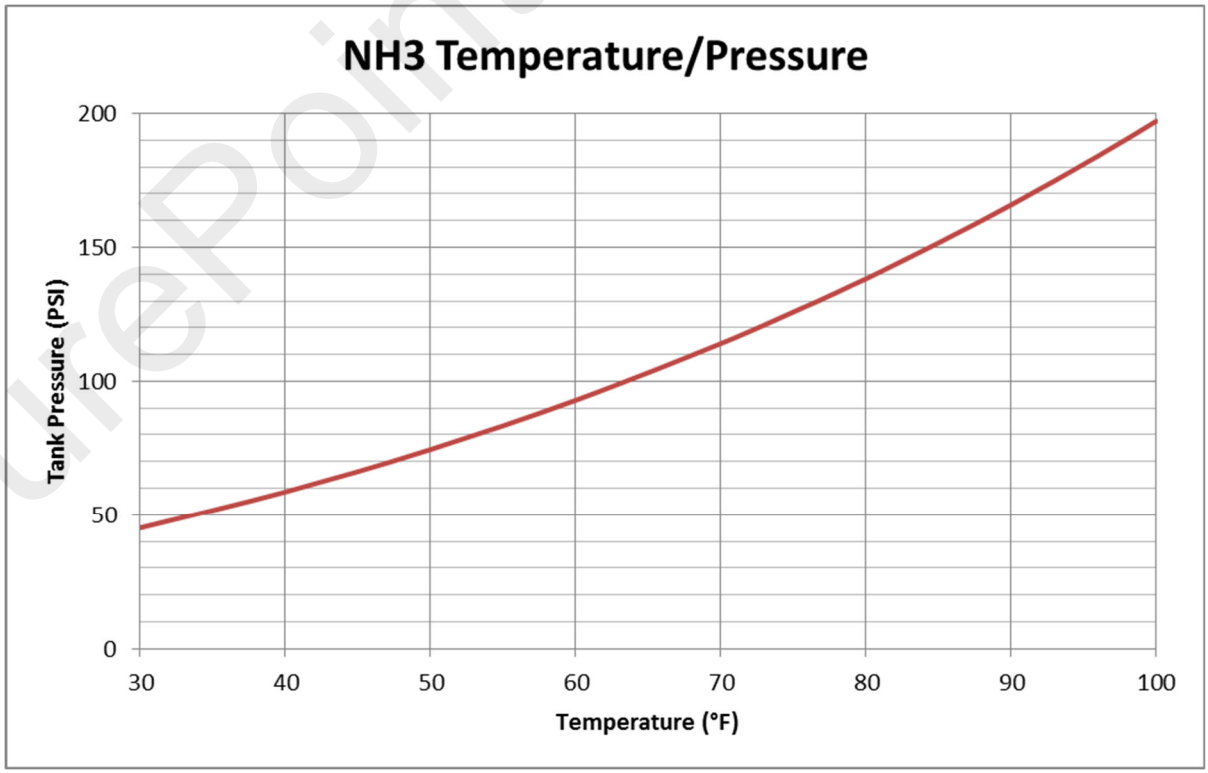
Do the following calculation to determine the proper Torpedo Model for your application:

Rate (**lbs of N**) per acre X Speed X Width (feet) X 0.1212 / 0.82 = **NH_3** Lbs / hr

NH_3 lbs/hr / 60 min/hr / 5.15 lbs/gal = GPM (**NH_3**)

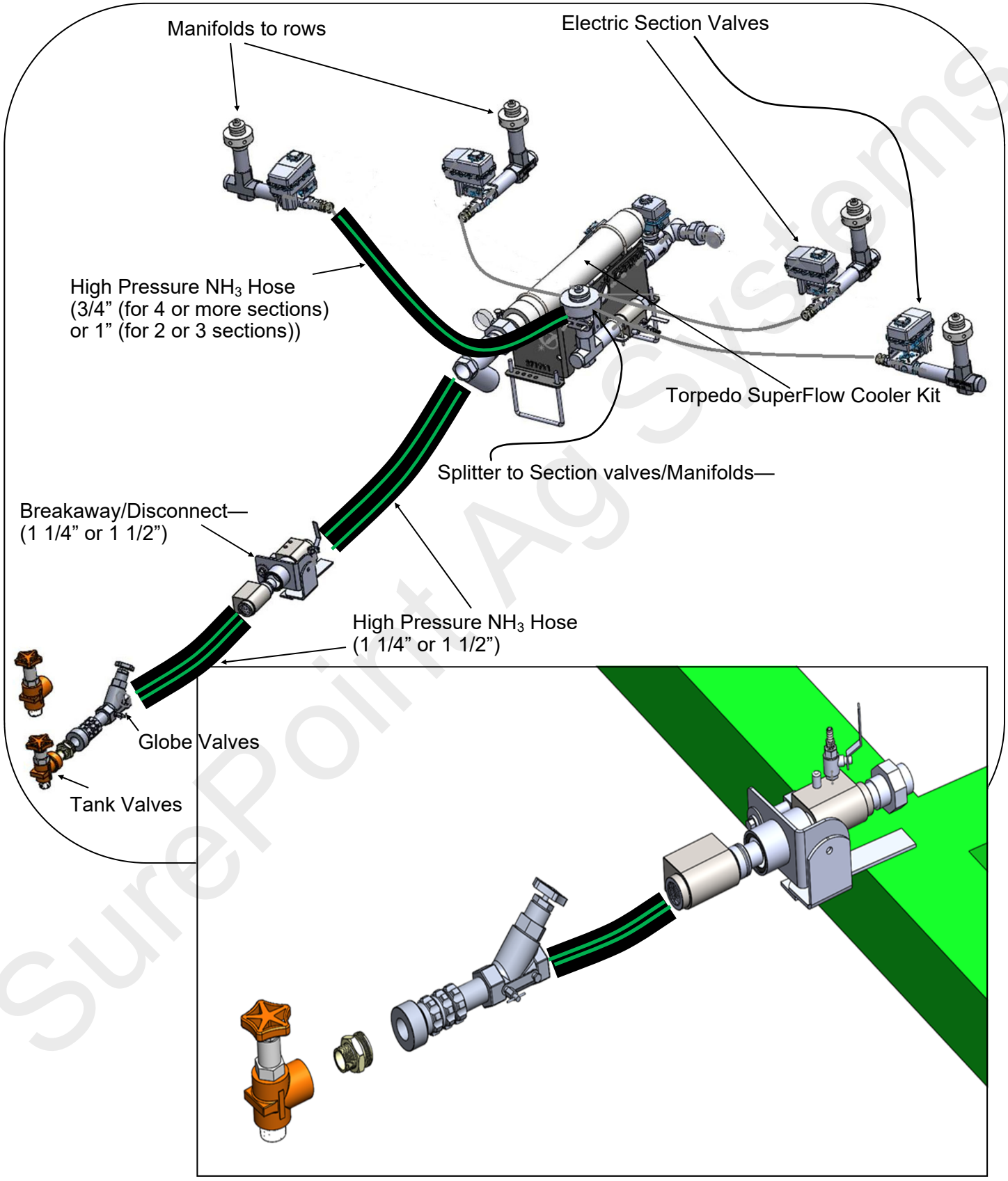
Lbs of **NH_3** X 0.82 = Lbs of **N**

Lbs of **NH_3** = Lbs of **N** / 0.82



System Overview with 4 electric Section Valves

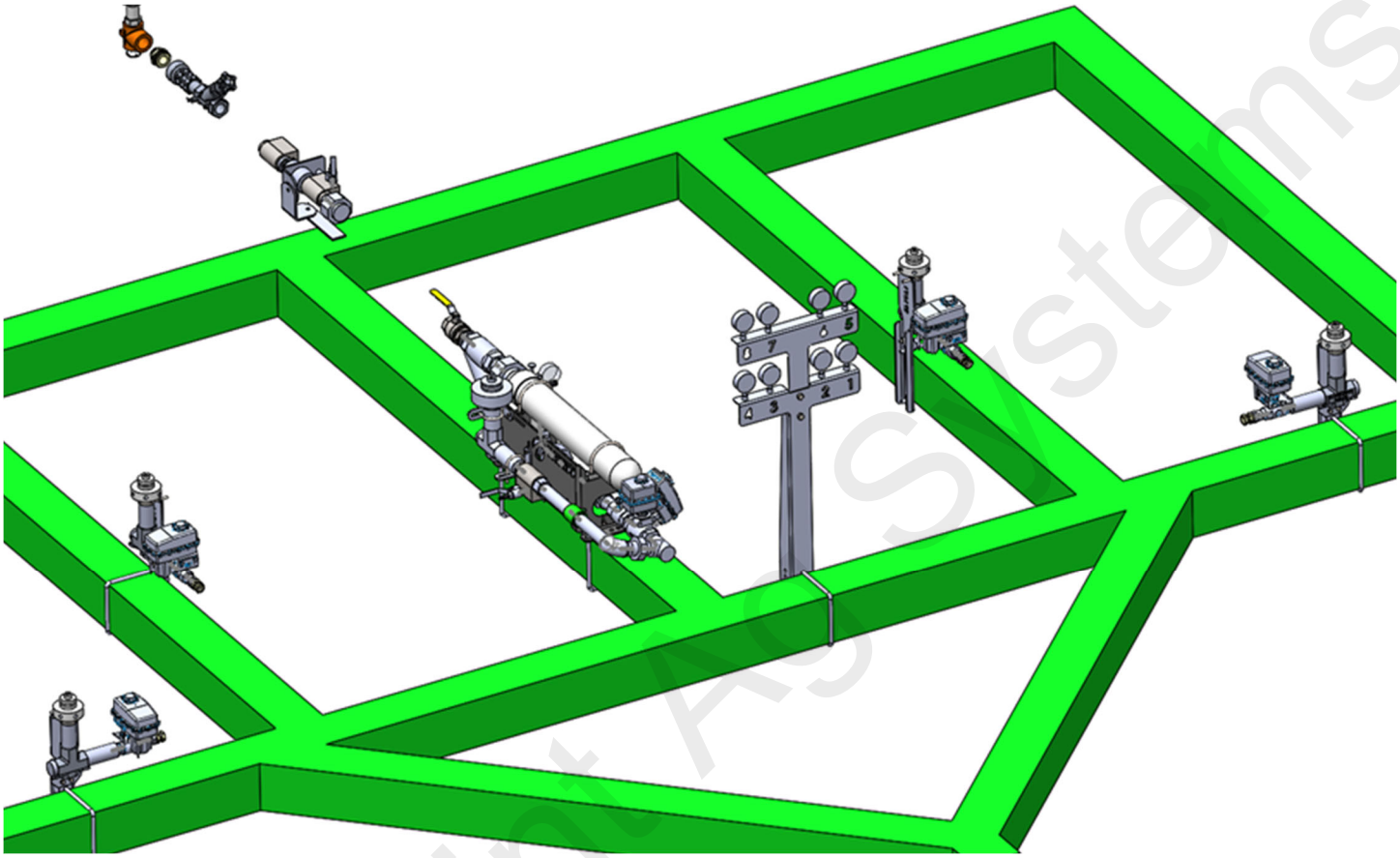
Torpedo™ Model 100 and Model 200

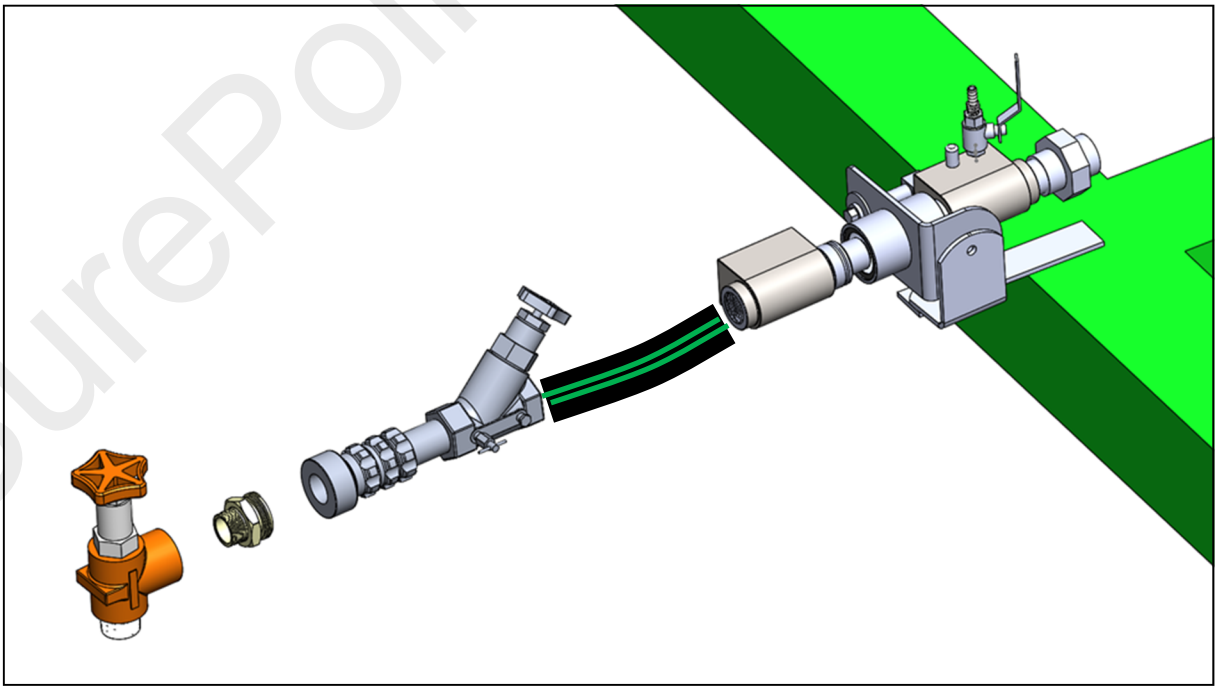


System Overview with 4 Electric Section Valves

Torpedo™ Model 100 and Model 200

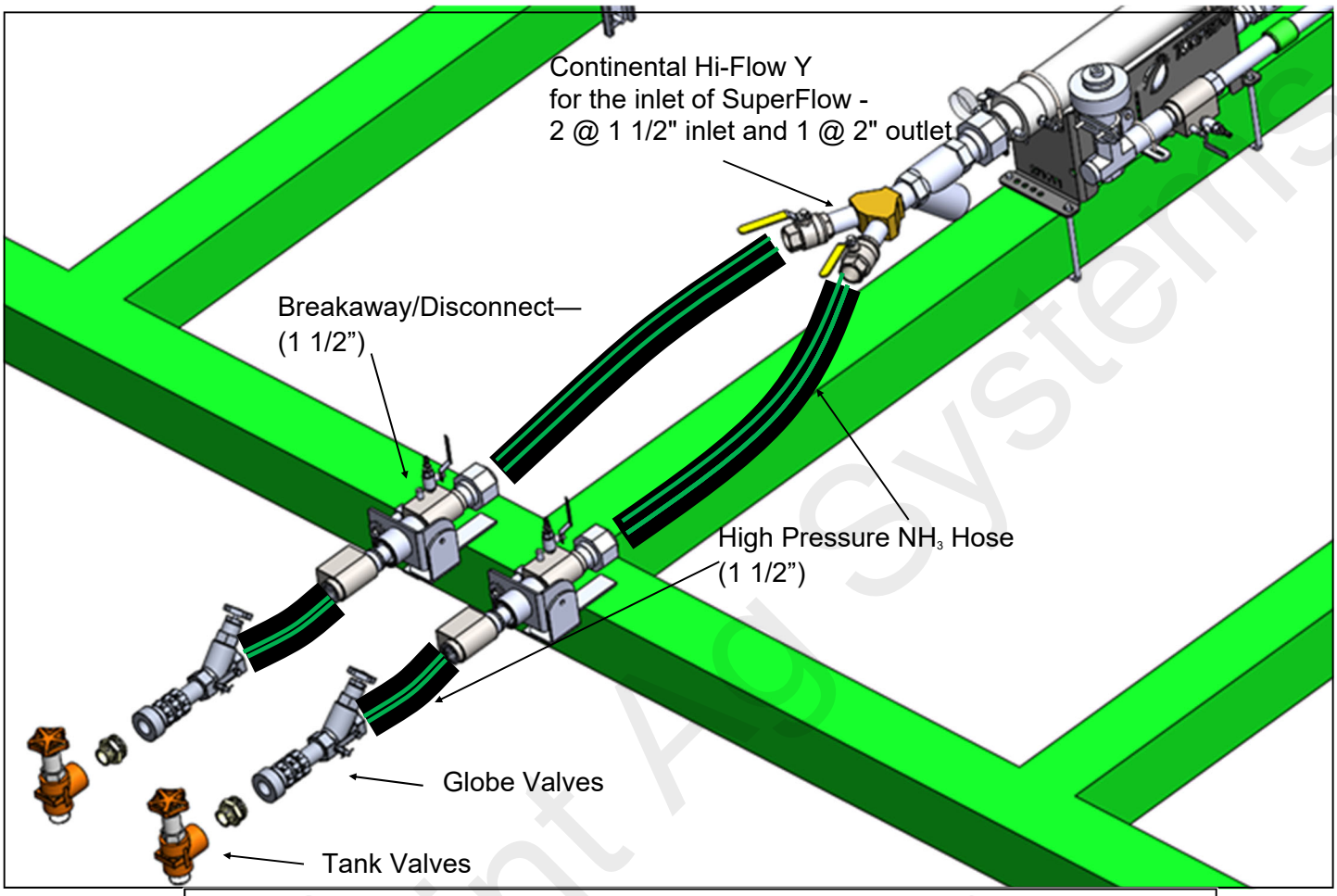
Optional Gauge Tree shown

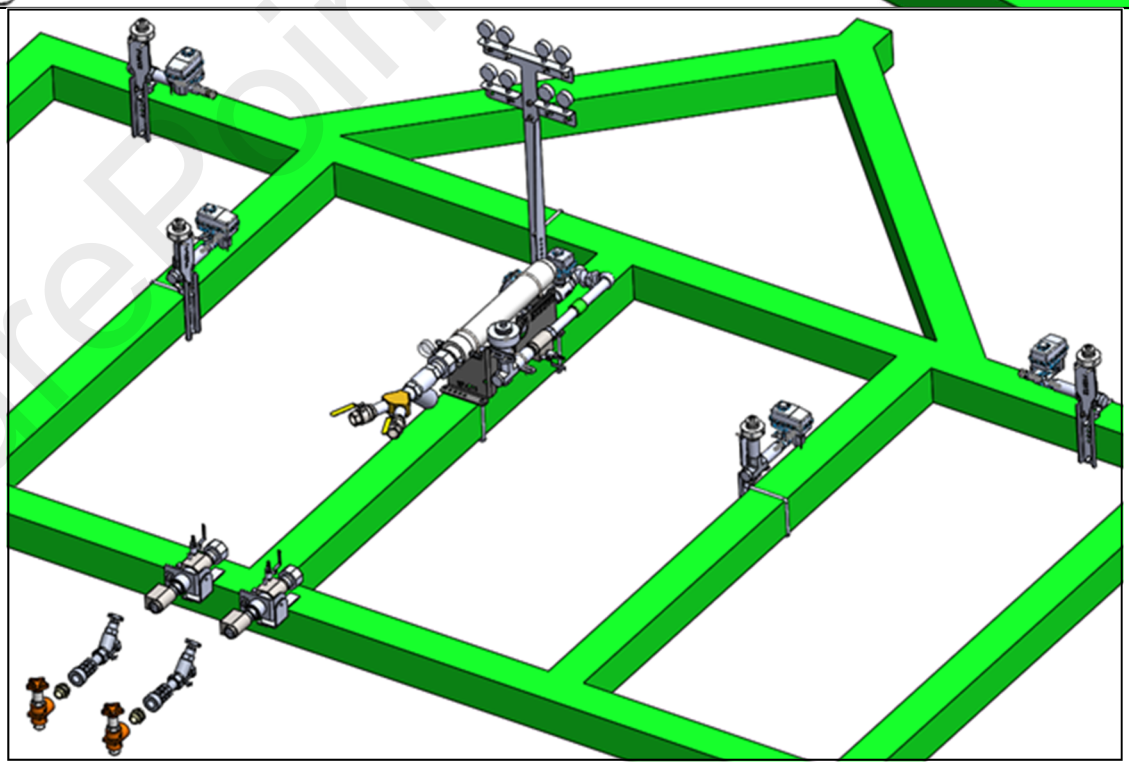




System Overview with Torpedo™ Model 300

159-00-200150





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

DUMP ORIFICE HOSE BARB

To minimize the amount of ammonia going out the dump lines use the chart to determine the hose barb size to use.

1-12 GPM	13-18 GPM	19-26 GPM	27-33 GPM	34-Up GPM
A	B	C	D	E

Tool bar width in feet X Speed
X Actual lbs N per acre X 0.1212
/ 0.82 / 5.14 / 60 = **GPM**

PN 398-10-2807Y1

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 Per Outlet	Up to 7 GPM	Up to 5 GPM	.302
	5 to 12 GPM	4 to 9 GPM	.437

#NH3 per acre **X** speed **X** tool bar width in feet **X** .1212 ÷ 5.14 ÷ 60 ÷ number of manifolds = **GPM per outlet**
Or
#N per acre **X** speed **X** tool bar width in feet **X** 0.1212 ÷ 0.82 ÷ 5.14 ÷ 60 ÷ number of manifolds **= GPM per outlet**

Bleeder Valve Installation Instructions

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

PN 398-10-2810Y1

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

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.

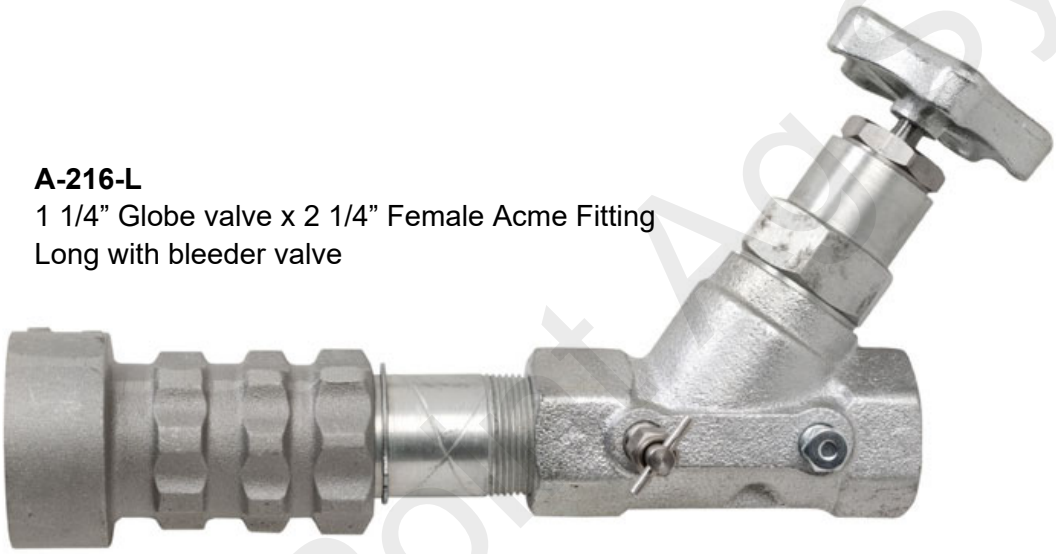
NH_3 Inlet Plumbing Kit from Nurse Tank to Breakaway 158-00-

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-

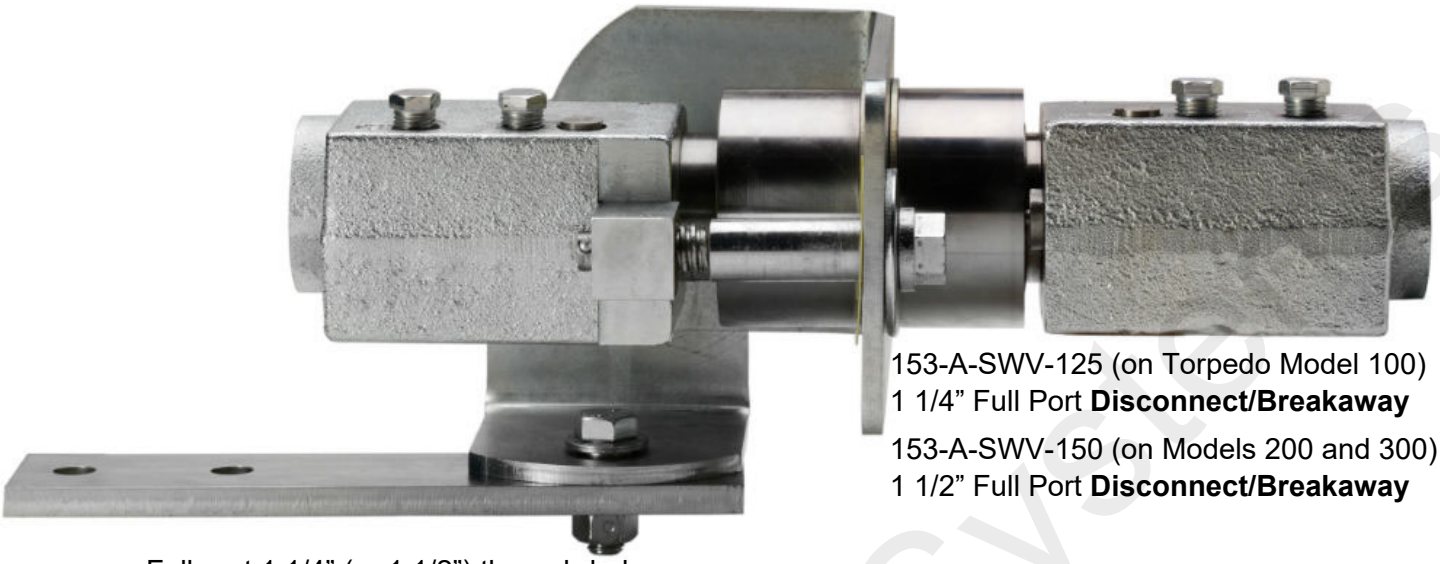
A-215-L
1 1/4” Globe valve x 1 3/4” Female Acme Fitting
Long with bleeder valve

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_3 Hose and SuperFlow NH_3 Assembly

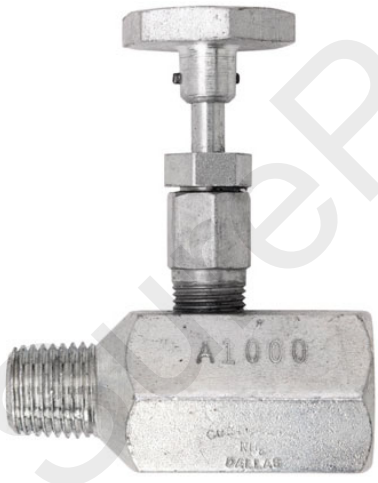


153-A-SWV-125 (on Torpedo Model 100)
1 1/4" Full Port **Disconnect/Breakaway**

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_3 **Needle Valve**--
can attach pressure gauge or transducer here



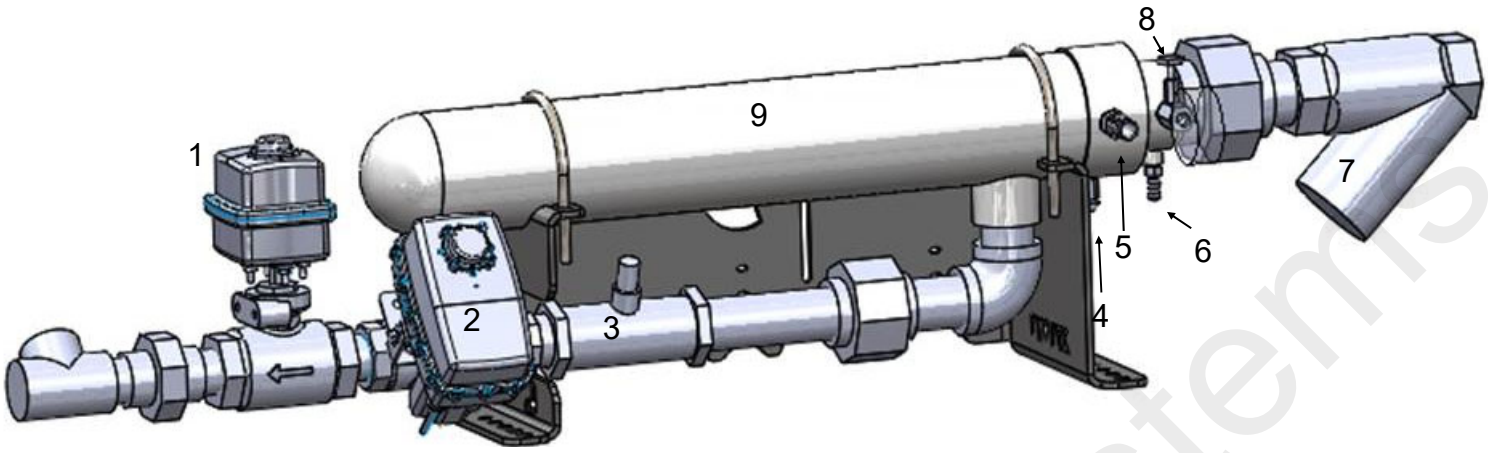
End view

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.

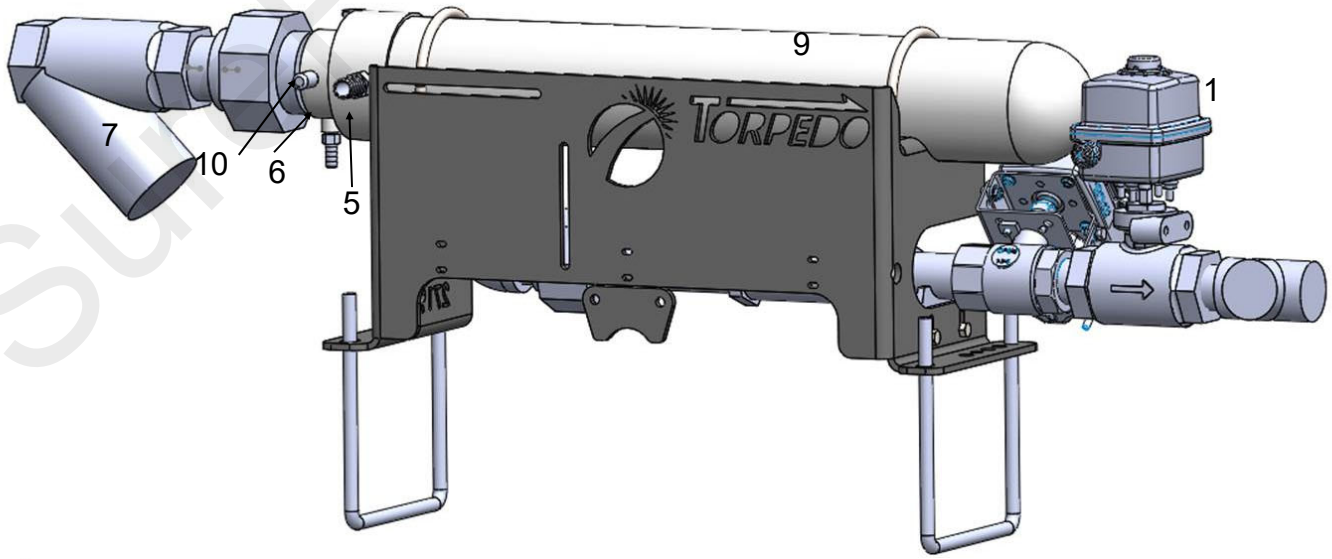
Safety Reminder

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

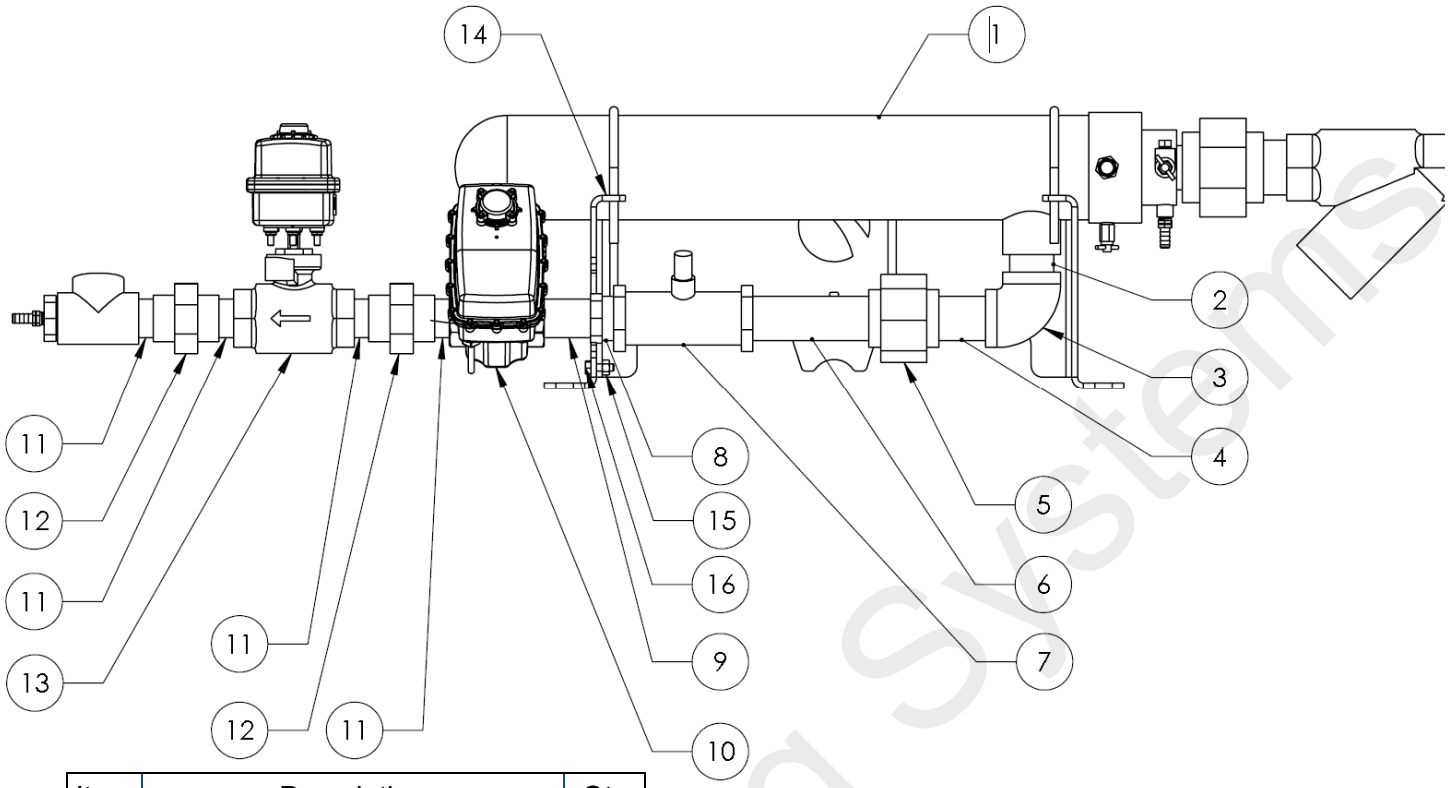
Torpedo™ SuperFlow NH_3 Assembly 202-2693Y1



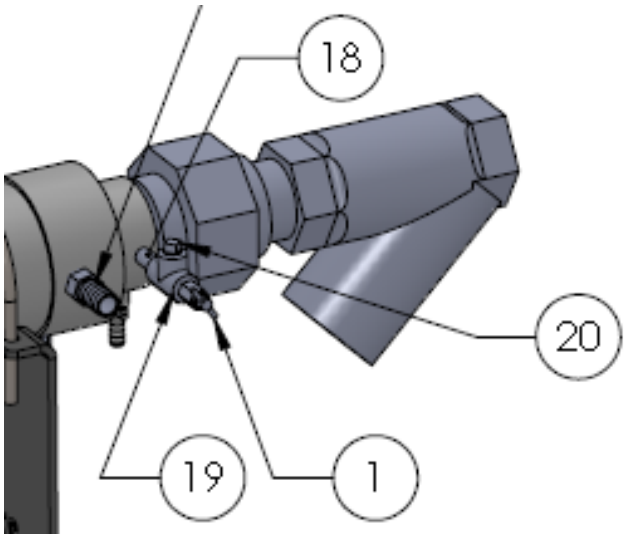
1	202-2691Y1	SurePoint 1 1/4" NH_3 **Servo Valve**—7 sec. 118 degree open/close - 3-pin WP tower (2-wire)
2	202-KZ67GY	1 1/4" SS KZ NH_3 **shut-off valve** with 3-pin WP shroud
3	204-02-2692Y1	Raven SS RFM 60S **Flowmeter** 1 to 60 GPM with 3-pin MP 150 shroud
4	153-A-411	1/4" Bleeder valve
5	151-050075	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_3 **Needle Valve**--can attach pressure gauge or transducer here
9	762-A-SF-3000Y2-S	Continental **SuperFlow Exchanger** and vapor tubes/ etc.
10	153-A-400-B	1/4" **Hydrostat Relief Valve**—250 PSI—(Keep the dust cap on)



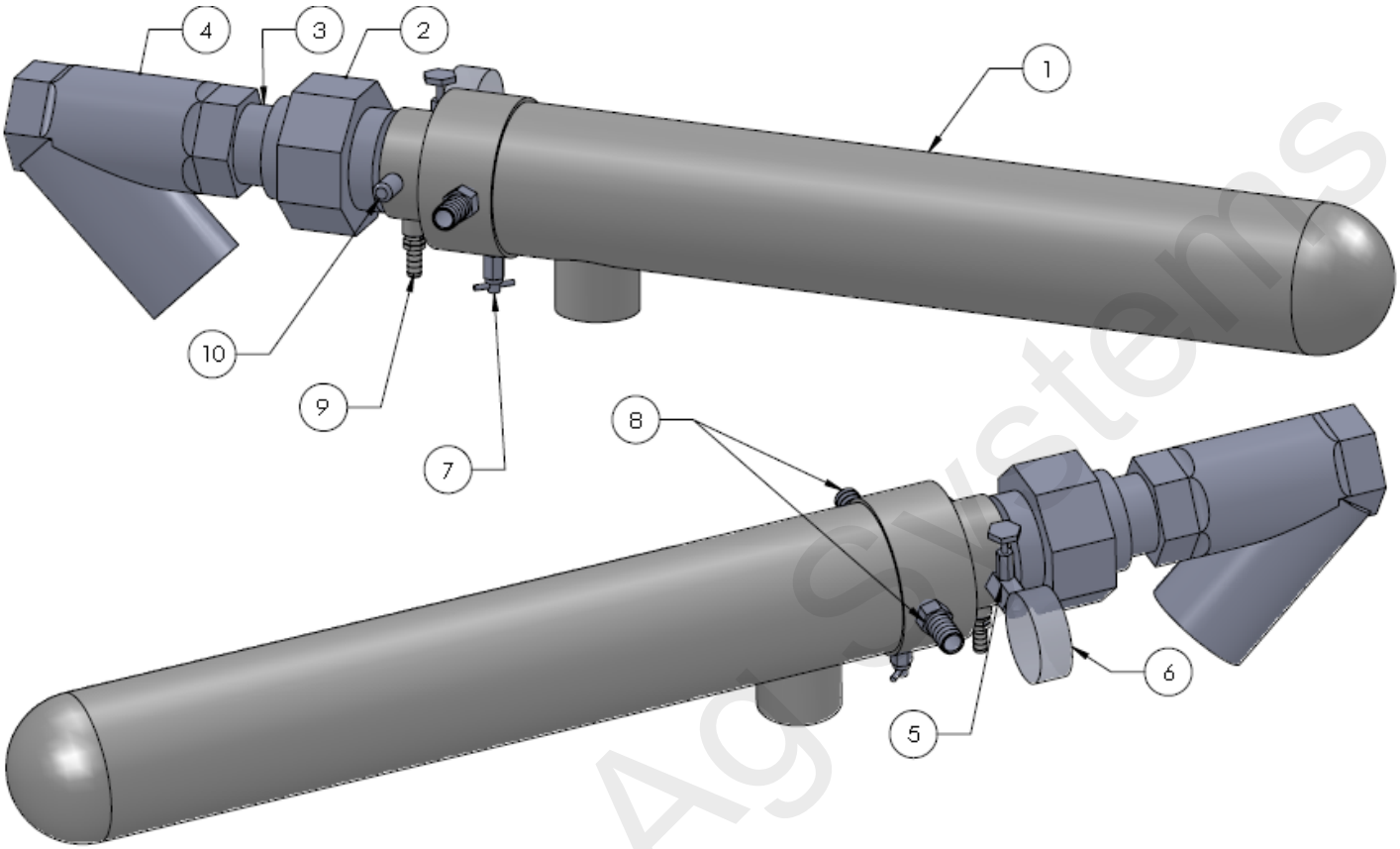
SurePoint Torpedo NH3



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

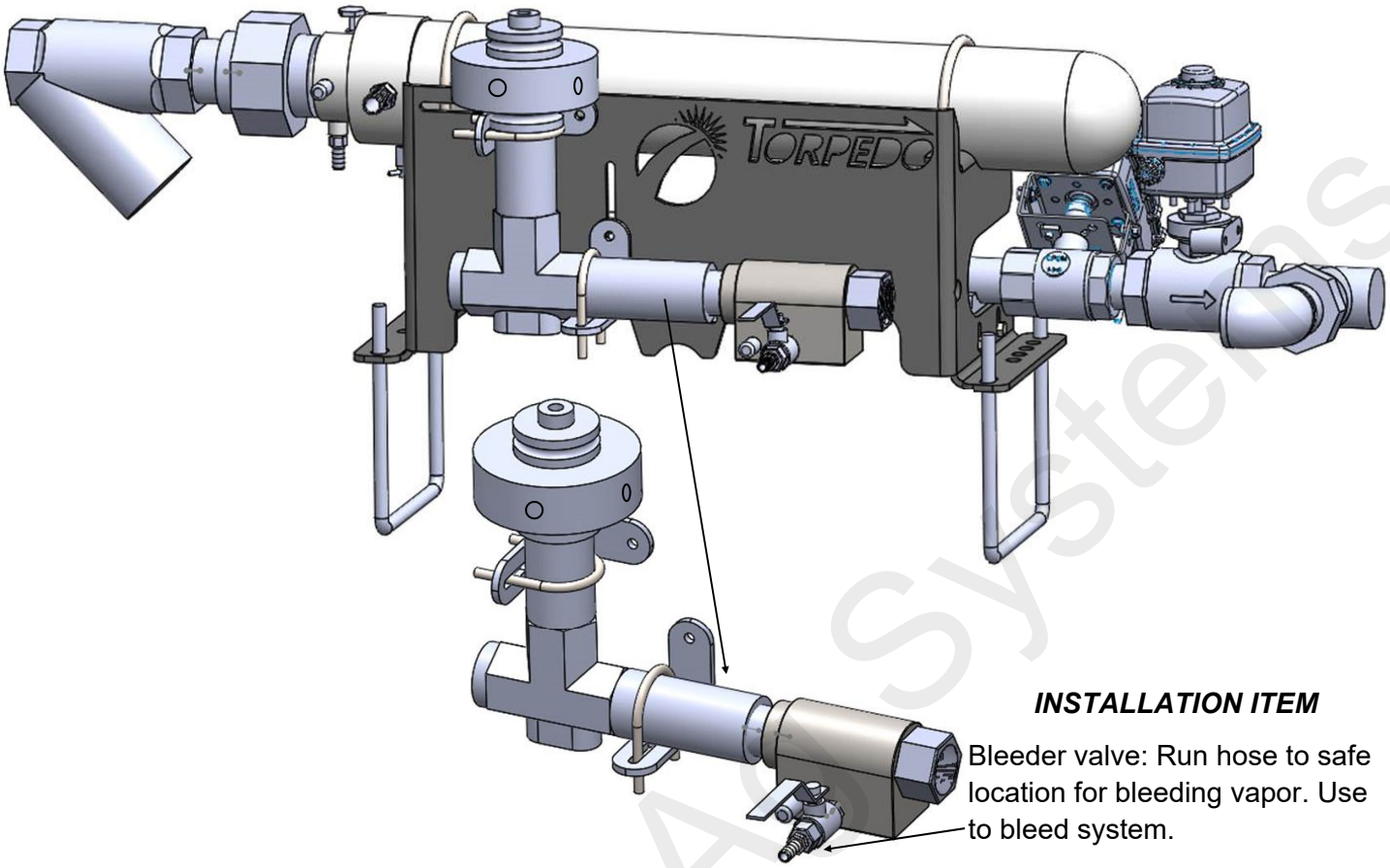


Torpedo™ SuperFlow NH_3 Assembly 202-2693Y1



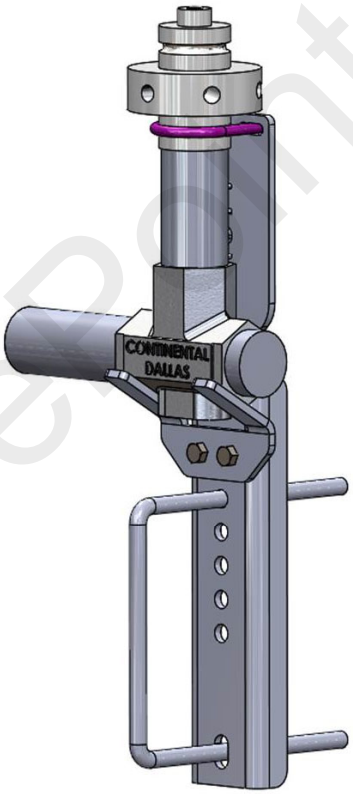
Item No.	Part Number	Description	QTY
1	153-A-SF-3000GH-2	2” Exchanger	1
2	150-200UN-S80	2” Union-Schedule 80	1
3	150-200NIP-SH-S80	2” X SH Nipple-Schedule 80	1
4	762-A1SC-2	2” Y Filter	1
5	153-A-1000	1/4”MPT X 1/4”FPT NH3 Needle Valve	1
6	137-ASG400	Pressure Gauge (Optional)	1
7	153-A-411	1/4” Bleeder 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

Splitter Options-mounted to Torpedo or mounted remotely



INSTALLATION ITEM

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



A-360 Bracket Kit 159-11-100500

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.

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

	100 PSI tank	50 PSI tank	Model Number
NH3	Up to 12 GPM	Up to 9 GPM	A-360SP
GPM per outlet	12 to 25 GPM	9 to 18 GPM	A-360SP-J

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**

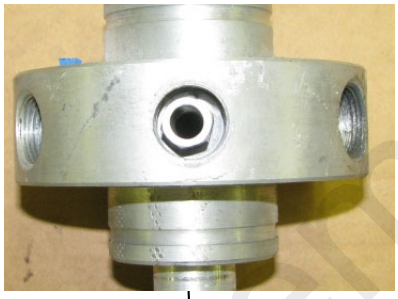
#N per acre **X** speed **X** tool bar width in feet **X** 0.1212 ÷ 0.82 ÷ 5.14 ÷ 60 ÷ number of manifolds **= GPM per outlet**

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.

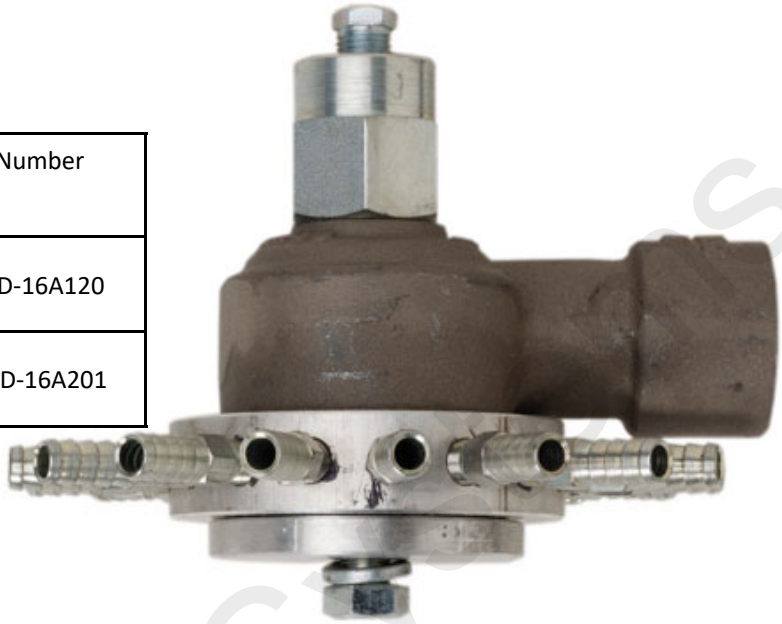
See the complete Continental NH3 Products *Installation, Operation, Repair and Maintenance Instructions* that came with the splitter and manifold for further tips and information.

Optional Vertical Dam Manifold

Continental Vertical Dam Manifold
Each manifold has 16 of 3/8” HB outlets

	100 PSI tank	50 PSI tank	Model Number
NH3 Lbs/hr per outlet	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.

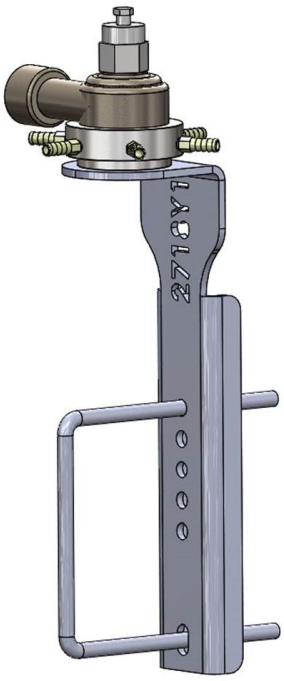


Features of A-MVD Vertical Dam Manifold

- 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.

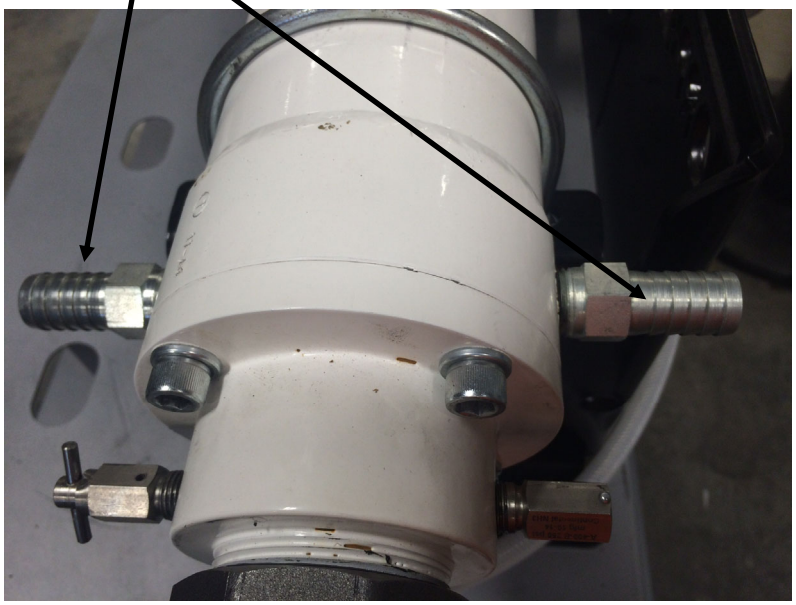
MVD Bracket Kit
159-11-200500

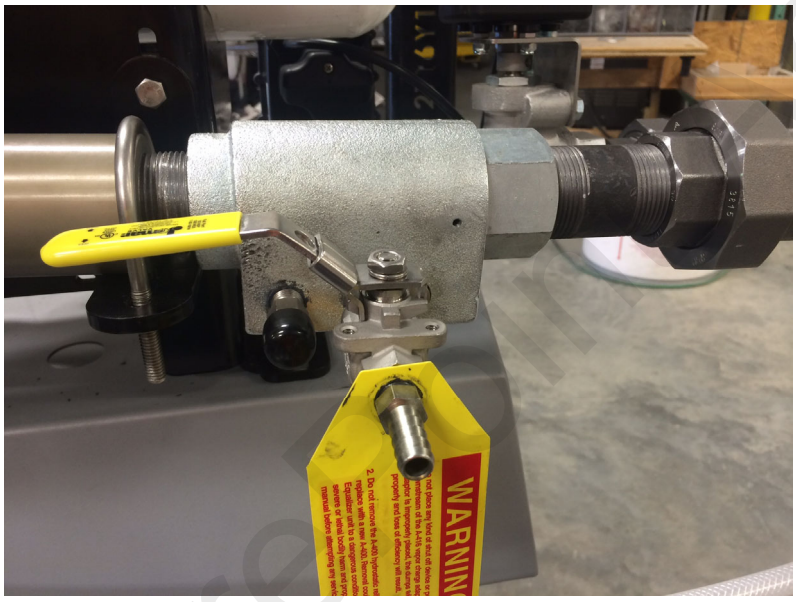


Be Careful Out There!

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.

INSTALLATION ITEM

Dump Orifice Hose Barb: This 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. The letter indicating the orifice size is stamped on one of the hex sides.

GPM	1-12	13-18	19-26	27-33	34-UP
Orifice	A	B	C	D	E

Flowmeter 204-02-2692Y1

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

The flowmeter calibration number is **72 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.

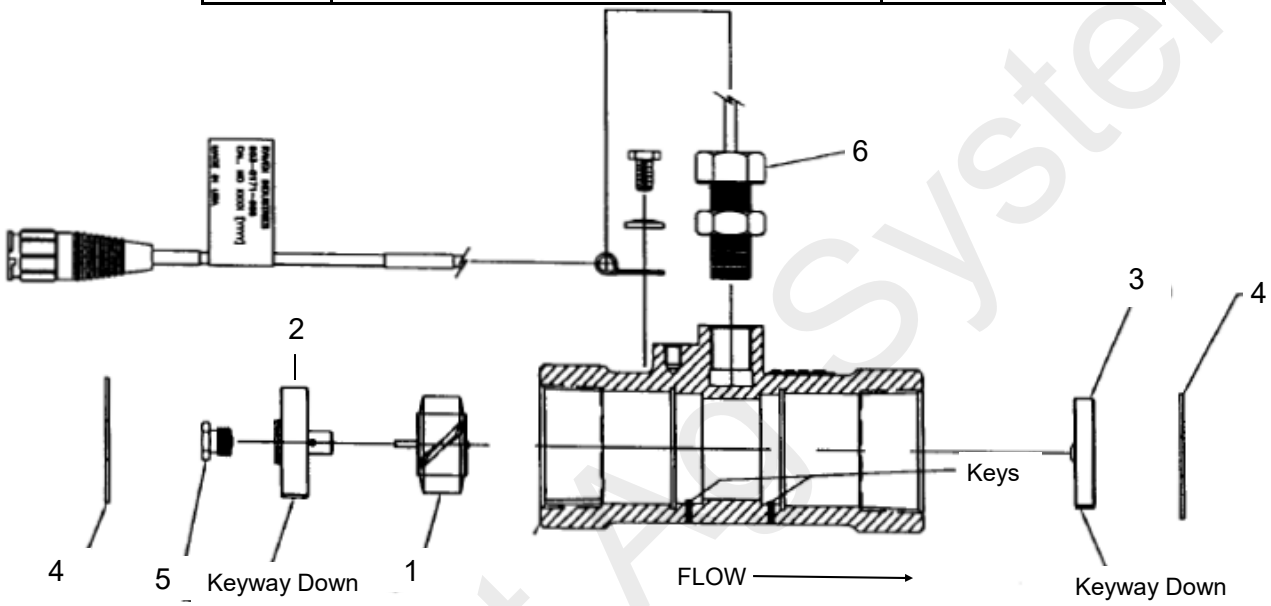
Use the following formula to adjust the flow cal number:

(Initial flow cal x Volume shown on screen) / Weigh ticket amount = new flow cal

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

RFM 60S Flowmeter

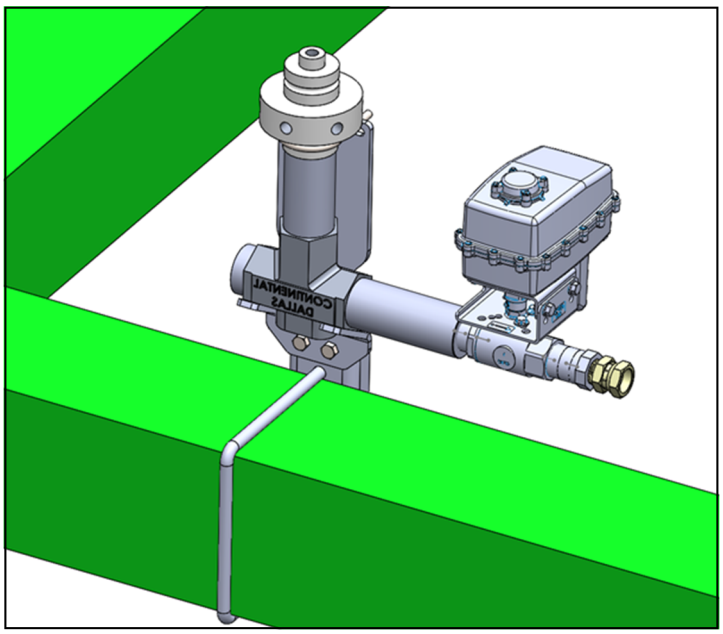
Item	Description	Raven Part #
1	Rotor / Magnet Assembly	063-0171-673
2	Hub / Bearing Assy, Upstream	063-0171-674
3	Hub Assembly, Downstream	063-0171-769
4	Ring, Retaining, Internal	335-0000-278
5	Stud Bearing	063-0173-062
6	Sensor Assembly	063-0171-669



RFM 60S Flowmeter Maintenance and Adjustment Procedure

1. Be sure all NH3 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-KZ67FY

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 -

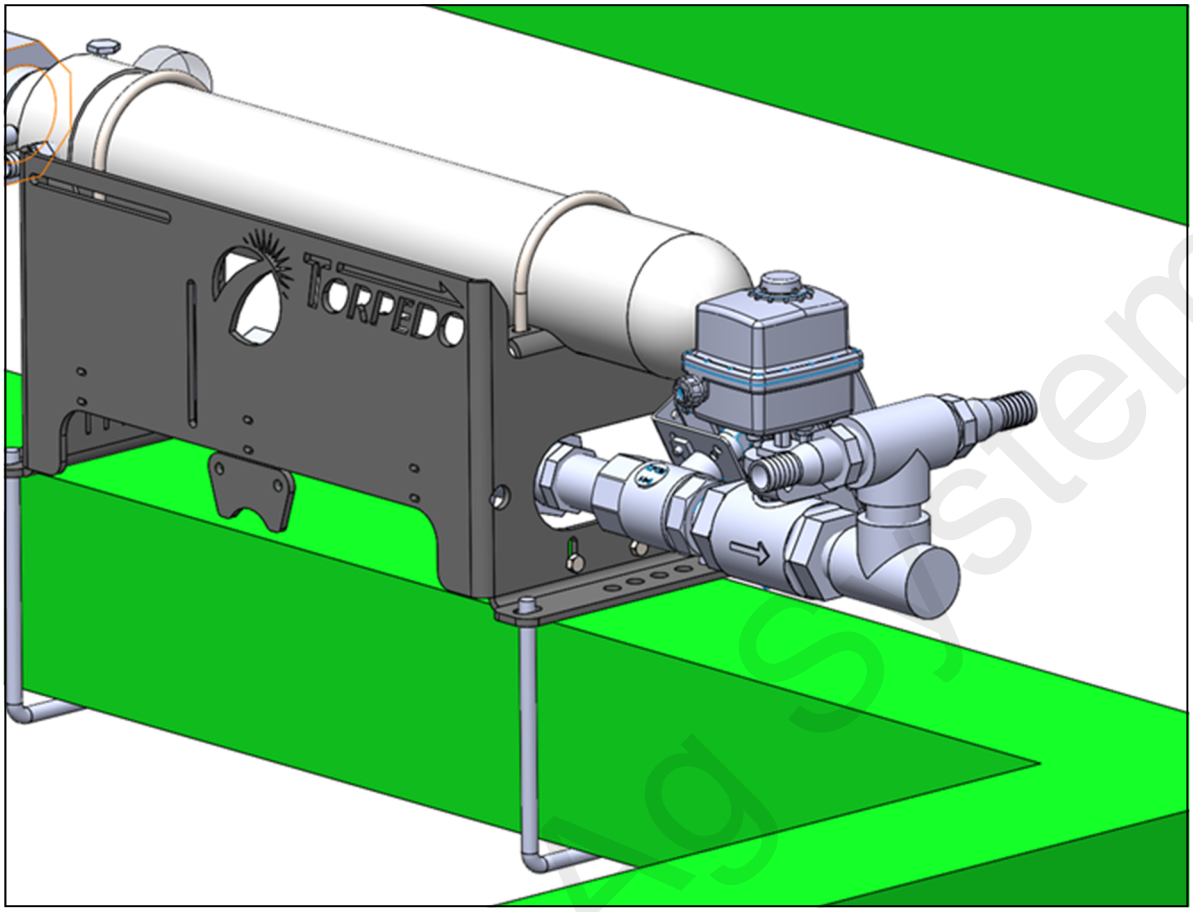
Pin C—White, Signal

12V=on ; 0V=off

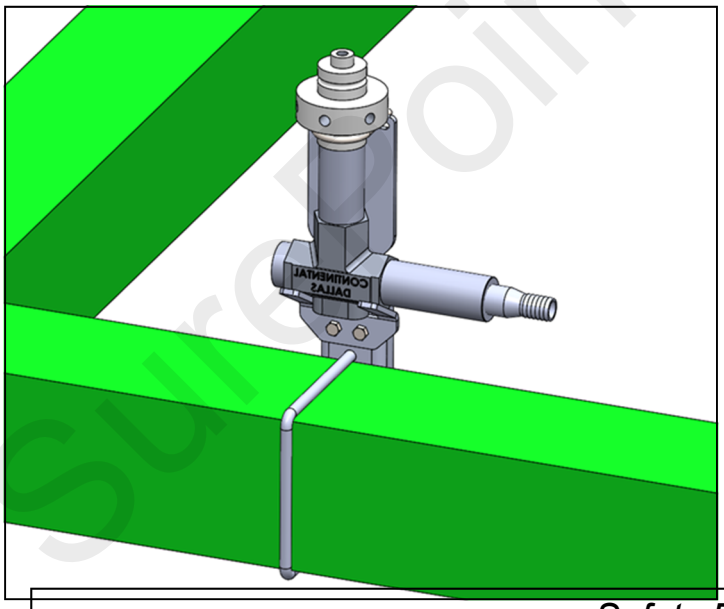
Pressure gauges and sensors

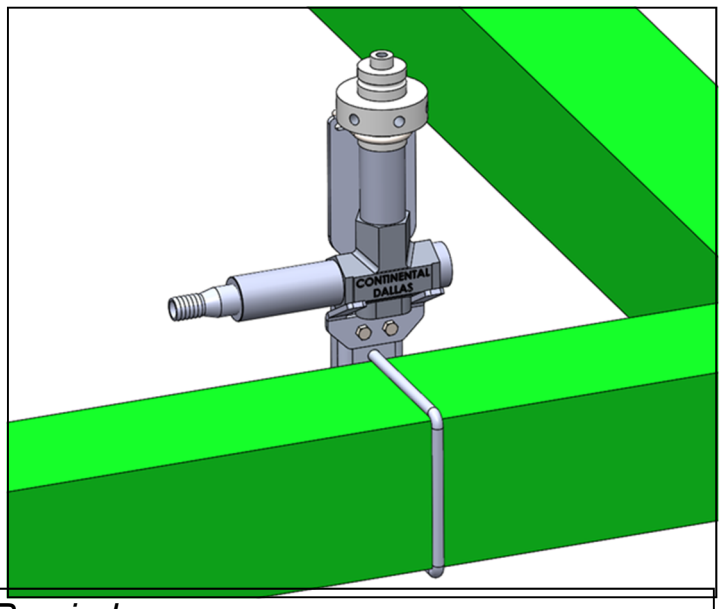
137-ASG60	2 1/2” Silicone Filled Stainless Gauge-60 PSI For manifolds (optional)
137-ASG400	2 1/2” Silicone Filled Stainless Gauge-400 PSI For Torpedo SuperCooler (optional)
Or	
521-05-050400	NH3 400 PSI 3-wire pressure sensor (0-5 V DC 12.5 mv/PSI) with 3-pin 150 MP Tower For Torpedo SuperCooler (optional)

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).



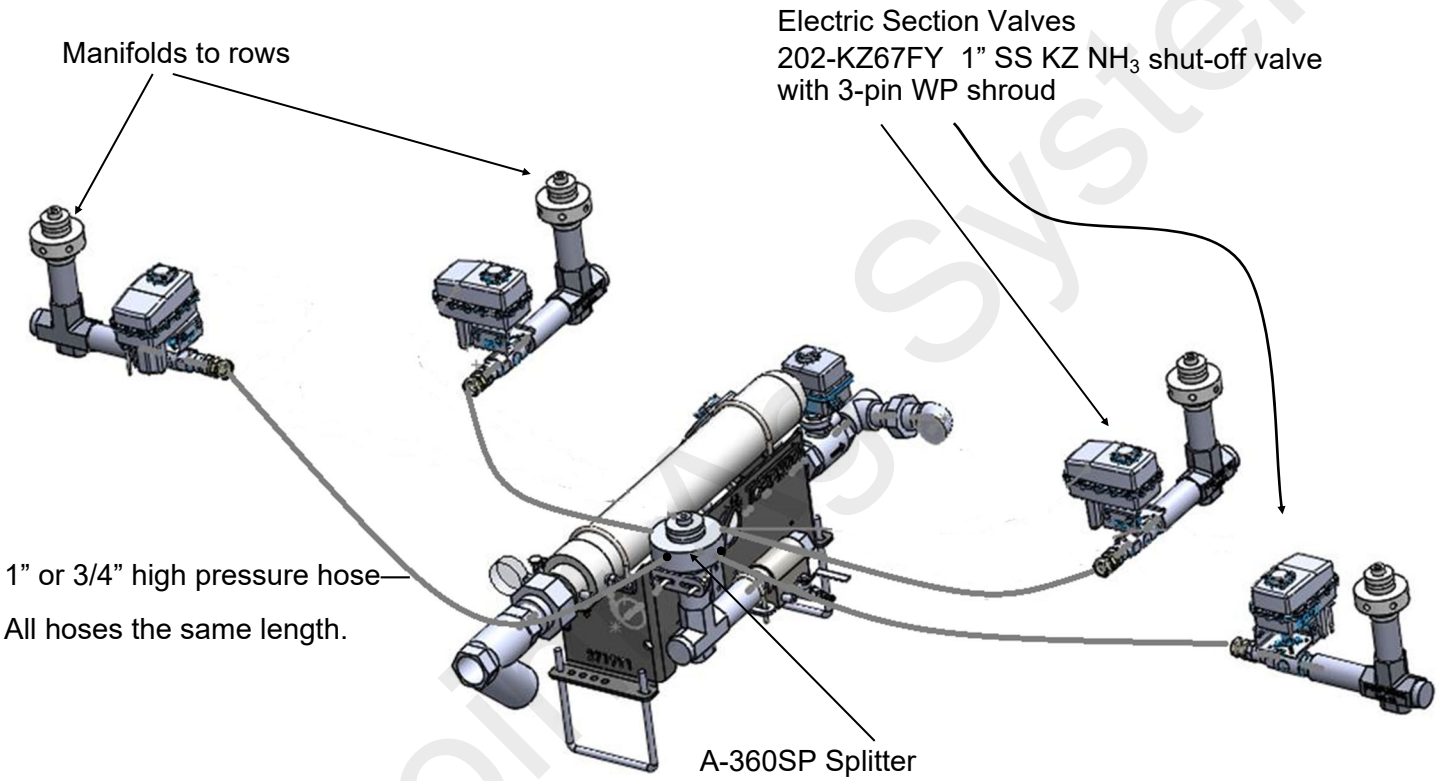


Safety Reminder

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

Electric Valve Kits for doing multiple sections

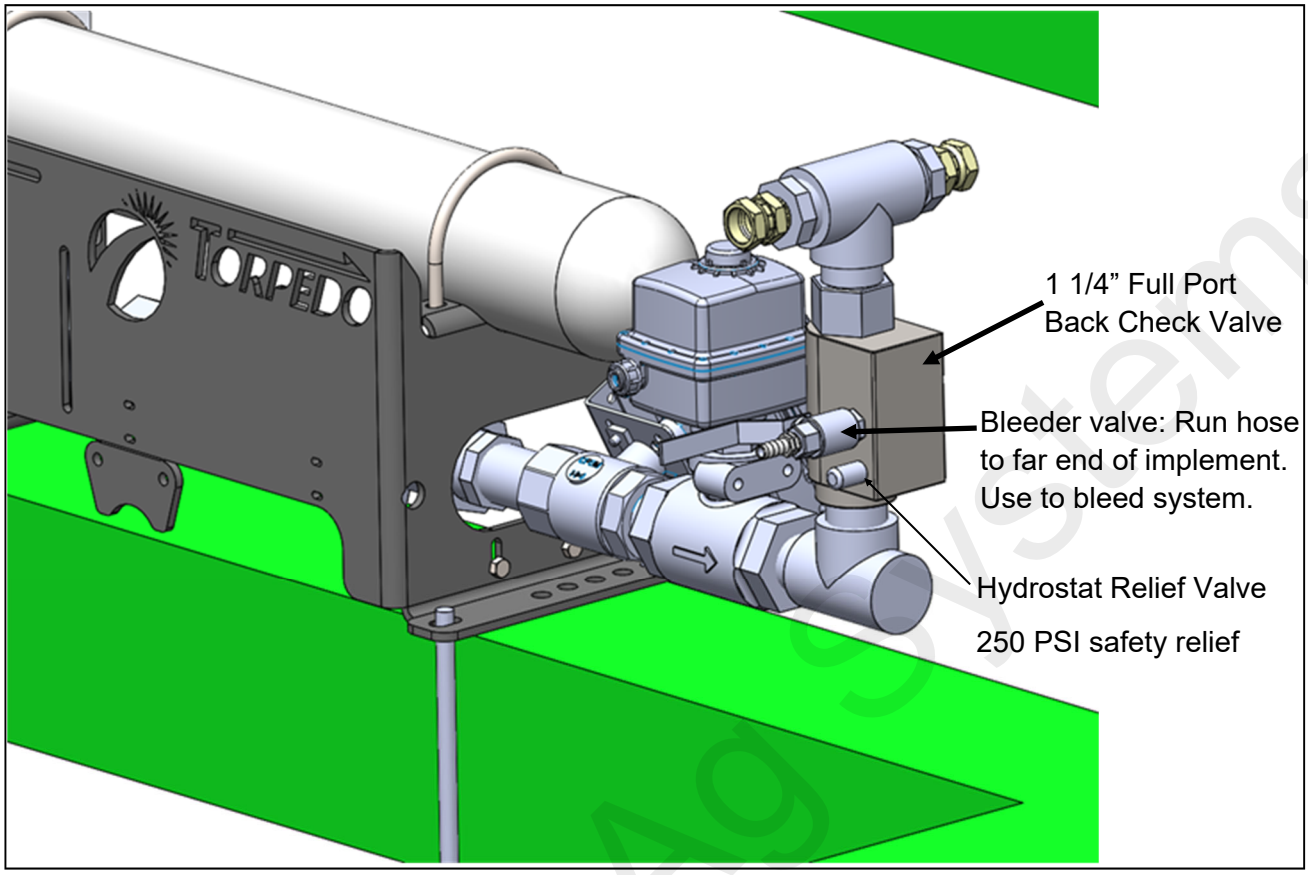
When using electric section valves, you must use high pressure hose from the Splitter to the section manifolds. These hoses must be the same length. Recommended hose is 1” high pressure hose for 3 sections or less and 3/4” high pressure hose for 4 or more sections.



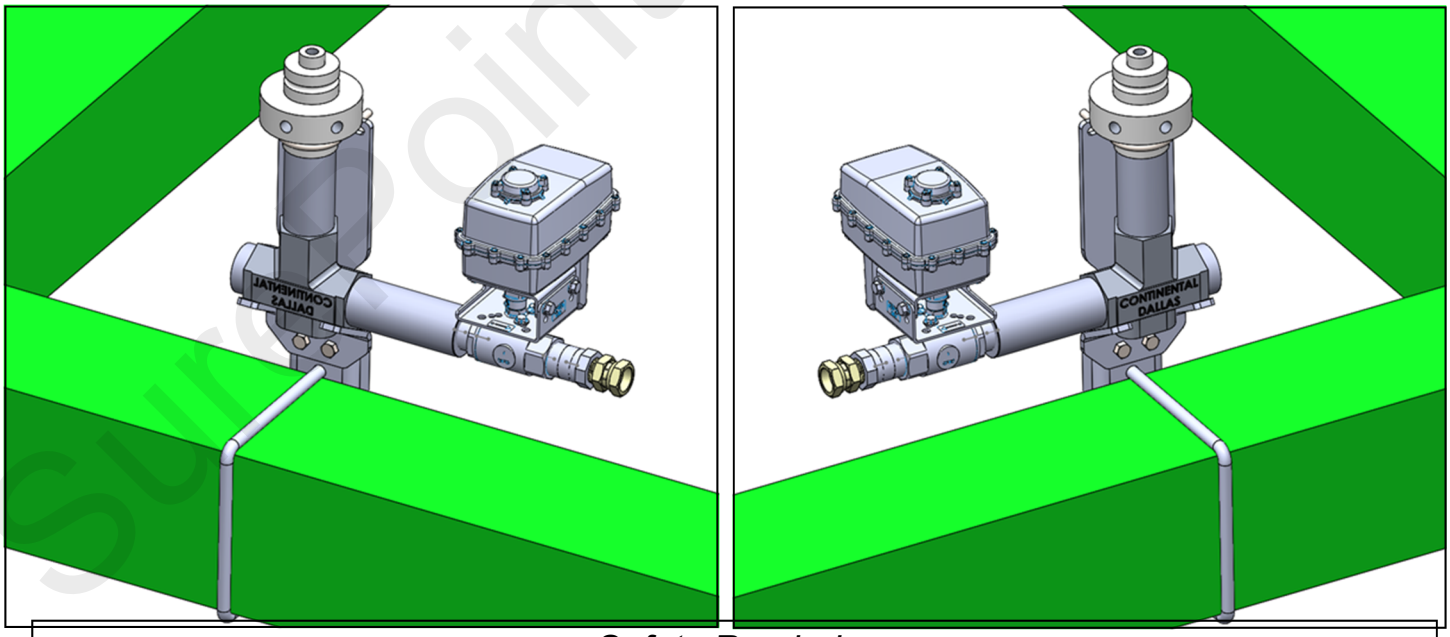
Safety Reminder

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

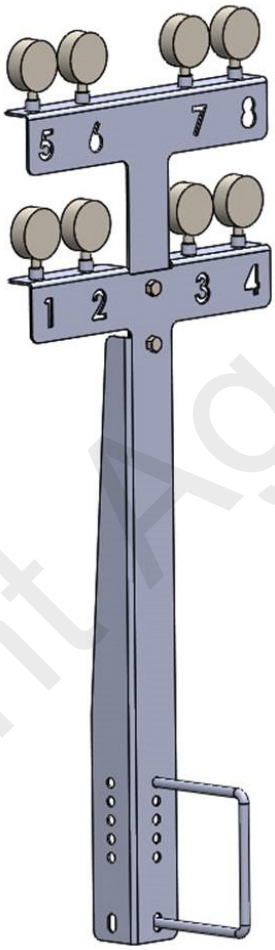
Always know the wind direction and park in an appropriate direction when servicing the system or changing tanks. The wind is your friend.

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-ASG60 2 1/2” Silicone Filled Stainless Gauge-60 PSI-one per manifold



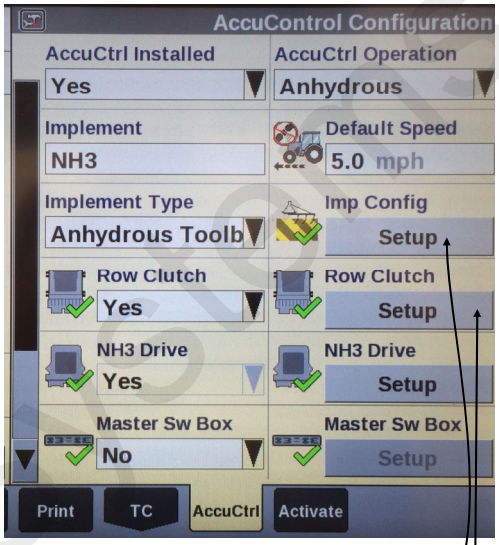
Safety Reminder

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

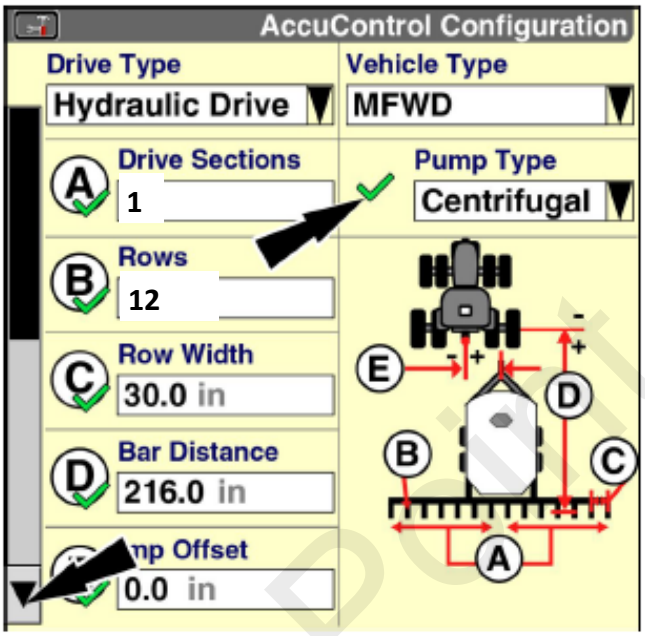
Torpedo™ and Pro 700 AccuControl Setup for NH_3

Your system may vary from the screens shown here. See the *AFS AccuControl Rate Controller Software Operating Guide* for additional information about configuring your system. The setup may not always happen in the order shown here.

All personnel working with an anhydrous ammonia application system must be properly trained about the dangers of anhydrous ammonia and appropriate safety precautions that must be observed. Study and understand the setup and operation of your system.

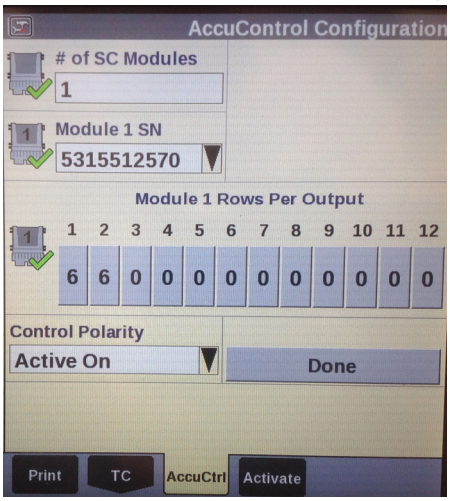


1. Create an Operator (**Toolbox > Oper**)
2. Check GPS Status (**Toolbox > GPS**)
3. Create Implement (**Toolbox > Impl**)
4. Set up Product (**Toolbox > Product**)
5. Set up Container (Optional) (**Toolbox > Container)**
6. Basic Setup (**Toolbox > AccuCtrl**)
   - A. Select AccuCtrl Operation (Anhydrous)
   - B. Select AccuCtrl Installed (Yes)
   - C. Select Implement Type (Anhydrous Toolbar)



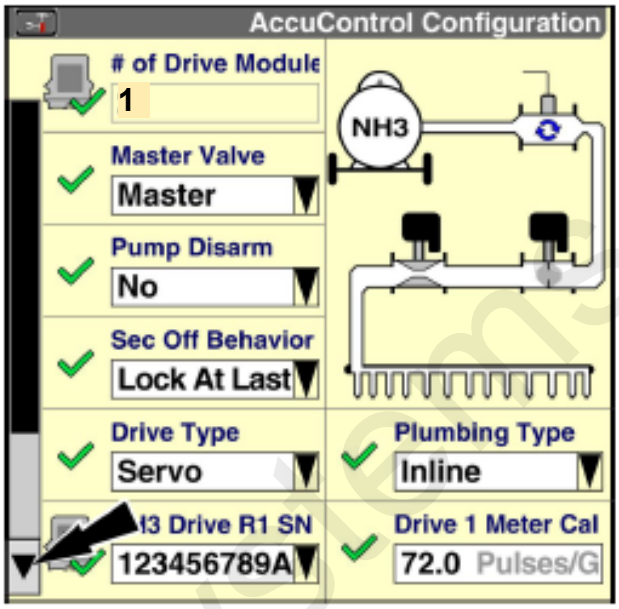
4. Implement Configuration (**Toolbox > AccuCtrl > Imp Config**)
   - A. Press 'Setup'
   - B. Select Drive Type (will be Hydraulic Drive)
   - C. Select Vehicle Type
   - D. Set Number of Drive Sections (A) **Always = 1**
   - E. Pump Type will be set at Centrifugal
   - F. Set Total Number of Rows (B)
   - G. Enter Row Width (C)
   - H. Enter Bar Distance in Inches (axle to knife) (D)
   - I. Measure Implement Right/Left Offset
   - J. Scroll down to Enter Rows per Drive Section (same as Total Number of Rows)
   - K. Press 'Done'

5. Section Control Setup *(If equipped with Section Shutoff Valves)* ***Toolbox > AccuControl > Row Clutch***
   - A. Select Row Clutch (Yes)
   - B. Press 'Setup'
   - C. Assign Module Serial Numbers
   - D. Assign Rows per Output (number of rows per Section)
   - E. Select Control Polarity (Active On)
   - F. Select 'Done'
6. Overlap/ Boundary Control (**Toolbox > Overlap**)
   - A. Turn Overlap Control and Boundary Control ON.
   - B. Adjust values as desired.



AccuControl Setup for NH_3

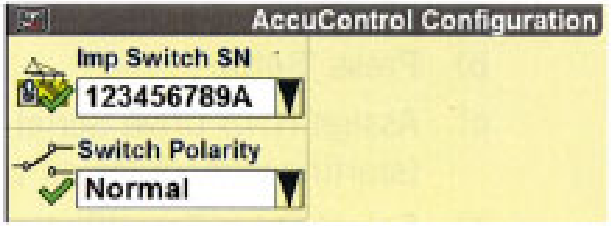
6. NH3 Drive Setup ***Toolbox > AccuControl > NH3 Drive***
   - A. Select NH3 Drive (Yes)
   - B. Press 'Setup'
   - C. Assign NH3 Drive Serial Numbers
   - D. Select Drive Type (**Servo**)
   - E. Select Master Valve Type (**Master**)
   - F. Select Pump Disarm (**No**)
   - G. Select Sec Off Behavior (**Lock At Last**)
   - H. Enter Drive Meter Cal Number (**72** pulses/gal)
   - I. Press 'Done'

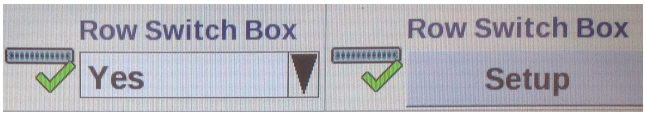


Optional Master Switch Box and Foot Switch

7. Master Switch Box (If equipped with External Switch Box)
   - A. Select Master Sw Box (Yes or No)
   - B. Press 'Setup'
   - C. Verify Serial Number
   - D. Select Foot Swiitch (if installed)
   - E. Press 'Done'

8. Implement Switch (if installed)
   - A. Select Imp Switch (Yes)
   - B. Press 'Setup'
   - C. Select Imp Switch Serial Number
   - D. Select Switch Polarity (Determine this by raising and lowering the implement and watch the Implement Status Arrow in Status/ Warning Area for proper operation.)
   - E. Press 'Done'





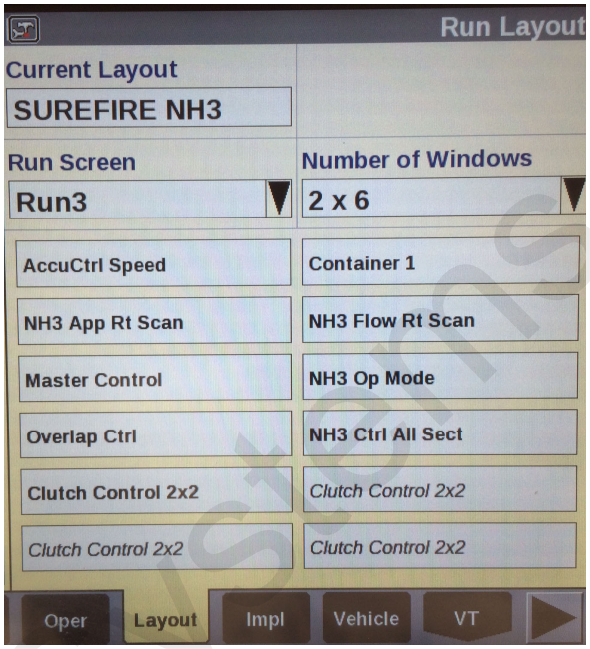
9. Row Switch Box (If system is equipped with External Section Switch Box or desire *Manual Valve Section Control through Run Screens*).
   - A. Select Row Switch Box (Yes)
   - B. Press 'Setup'
   - C. Select Config Mode (Auto)
   - D. Verify Sw Box Serial Number (if equipped)

If no external switchbox is installed, User Defined Windows can be assigned to a Run Screen (Toolbox>Layout).

Create A Layout

Go to **Toolbox>Layout**
Select Current Layout and then select New.
Name the Layout. Under Run Screen select a screen.
In the white boxes consider adding the following items to a **Run Screen**:

- AccuControl Speed
- Master Control
- NH3 Op Mode
- NH3 Control
- NH3 App Rate Scan Container
- NH3 Flow Rt Scan
- Section Control
- Overlap Ctrl Overlap Control
- Clutch Control (may want this if the system has electric section valves)



The Run Screen Layout is largely a matter of operator preference. Some of these items may be added to the Left Hand Area is space is available there or more than one Run Screen can be set up.

Valve Calibration

Work Condition > Valve Cal > Advanced Valve Calibration

There are three calibrations that must be set to allow AccuControl to know how the valve responds and to set the correct values.

1. **Breakout** or Minimum Response: This is the amount of servo voltage that must be applied to get the valve to move. **(Set Default value to 10**. Adjust as necessary.)
2. **DeadZone** or Allowable Error: This is the percent amount of error away from the target rate before the Rate/Section Control Module will attempt to adjust flow. **(Set at 2%-3%)**
3. **Gain:** This sets how quickly the valve responds when making an adjustment. **Proportional Gain** is the value used for servo valves. To make smoother adjustments to rate lower the gain. To make quicker adjustments increase the gain. **(Start with Proportional Gain at 5. Adjust as needed.)**

Additional Tips for Getting Started

1. Set **the Flow Error Timeout at 45 second**s until you get the system adjusted and operating correctly. The default is 5 seconds. This may result in the application being shut down before you have a chance to see how it is operating. After the system is operating correctly, this can be set lower to give you a quicker warning if something is wrong. **(Work Condition > Valve Cal > Advanced Calibration > Scroll down to 2nd page and Flow Error Timeout)**

2. **Set the Fault Speed to Slow or Off** until you get the system adjusted and operating correctly. The default is Normal. ***(Work Condition > Operate > Fault Speed)*** After the system is operating correctly, this can be set back to Normal. You can run this at Slow if the system gives too many Fault Warnings at Normal.

3. Set the **Proportional Gain at 5, Breakout at 10, and DeadZone at 2** for starting values. Increase the Proportional Gain to make the control valve respond quicker. Decrease the Proportional Gain if the control valve is repeatedly overshooting and undershooting. ***Work Condition > Valve Cal > Advanced Calibration***

AccuControl Operation for NH3 Application

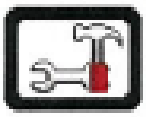
To start applying product:

Go to **Toolbox>AccuCtrl>Default Speed**

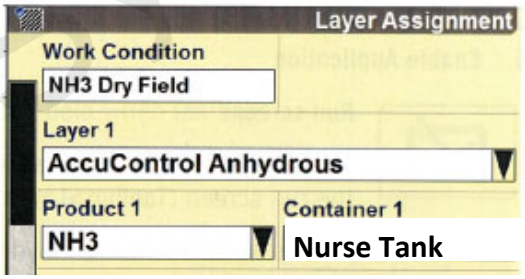
Enter a default speed. The applicator will default to this speed if all ground speed sources are lost.

The **Master Apply** button may need to be cycled twice to start the application.

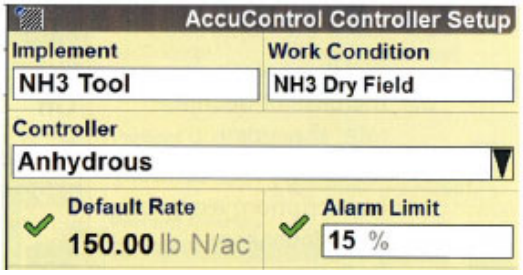
1. Preparation
   - A. Insert a data card in the display.
   - B. Create or Select a Grower/Farm/Field/Task & Crop Type (Performance>Profile)
2. Product Setup: **Toolbox>Product**



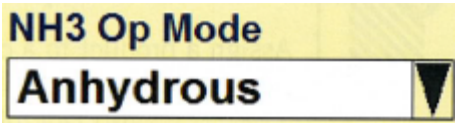
   - A. Name the product (NH3)
   - B. Select the form for the product (Granular)
   - C. Select Usage (Fertilizer)
   - D. Enter Default Application Rate
   - E. Enter Minimum and Maximum Application Rate in **pounds of actual nitrogen**, not pounds of NH3.
3. Product Layer Assignment: **Work Condition>Layer** to assign a product to a control section of the applicator



   - A. Select or Create a Work Condition.
   - B. Select Layer 1 Control Type (AccuControl Anhydrous)
   - C. Select Product for Layer 1 Control
   - D. Select Container if using the Container
   - E. Assign additional layers if needed.
4. Controller Setup—Anhydrous: **Work Condition>Control**

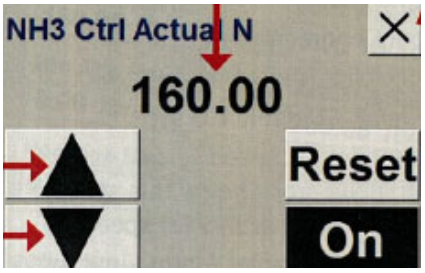


   - A. Verify Implement
   - B. Verify Work Condition
   - C. Select Controller—Anhydrous
   - D. Product Delay-Default is 1 .0 sec.
   - E. Enter the Minimum Speed (if the speed drops below this, the applicator will keep applying at this speed)
   - F. Enter a value for Off-target Alarm Limit (probably 15-20%)
5. Enable Application: Run Screens



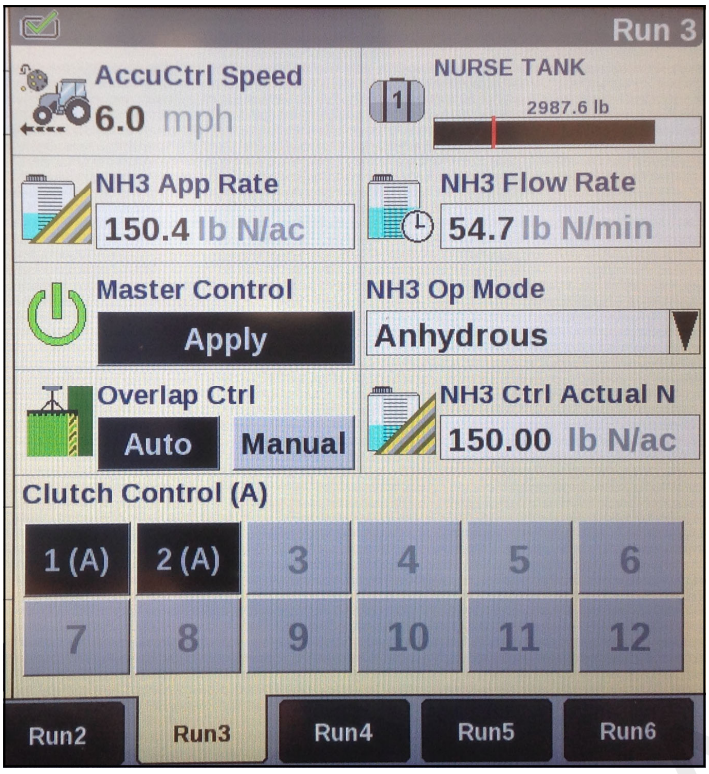
   - A. NH3 Op Mode—Select Anhydrous
   - B. Read the safety message and press Accept.
   - C. Master Control—Press Apply on display or switch on Master Switch on switchbox (if equipped)

6. Anhydrous Rate Control



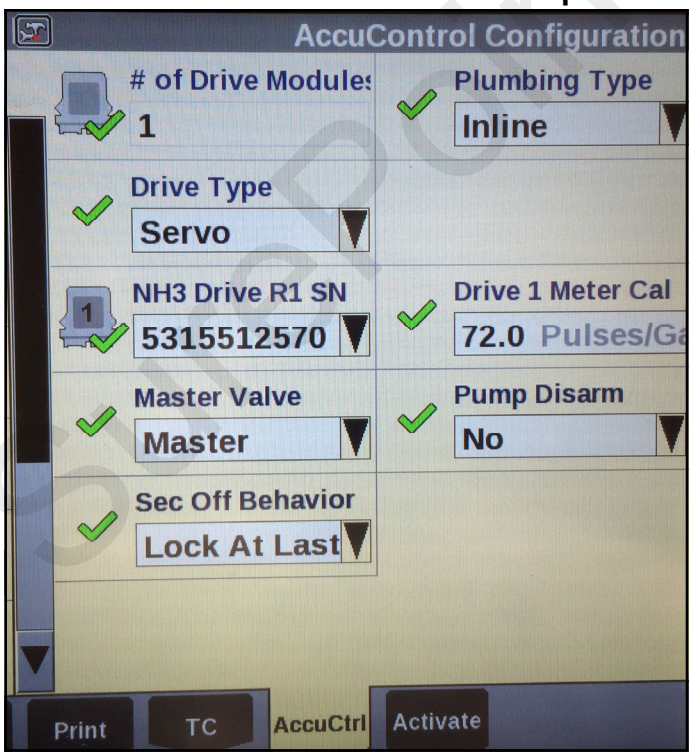
   - A. NH3 Control defaulted to ON
   - B. Increase or decrease rate if needed
   - C. Automatic rate control (prescription) is assigned in **Performance>Rx Setup**.

Possible Run Screen Layout for system with 2 electric section valves

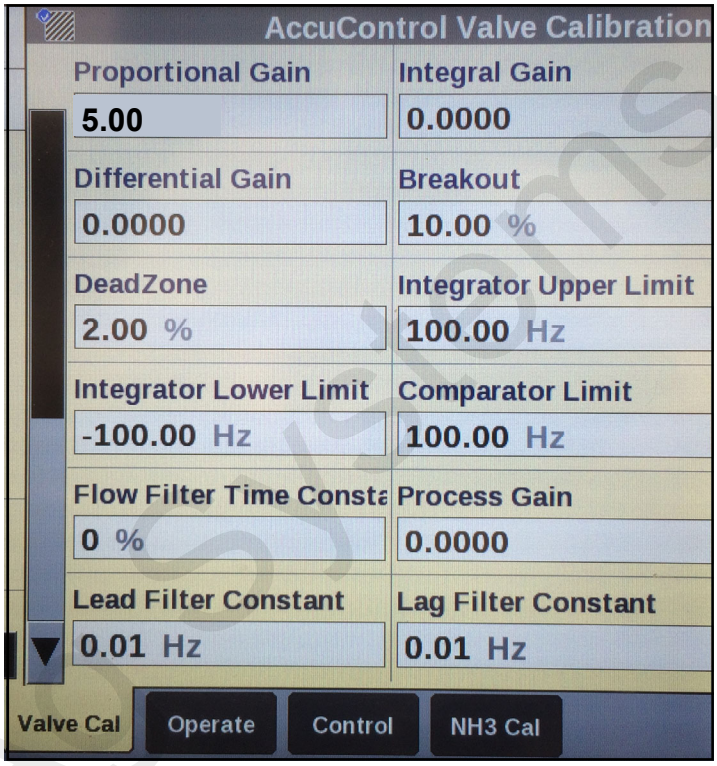


To use default AccuCtrl speed, turn Radar off.

Screen showing AccuControl NH3 Drive Setup
Toolbox > AccuCtrl > NH3 Drive Setup

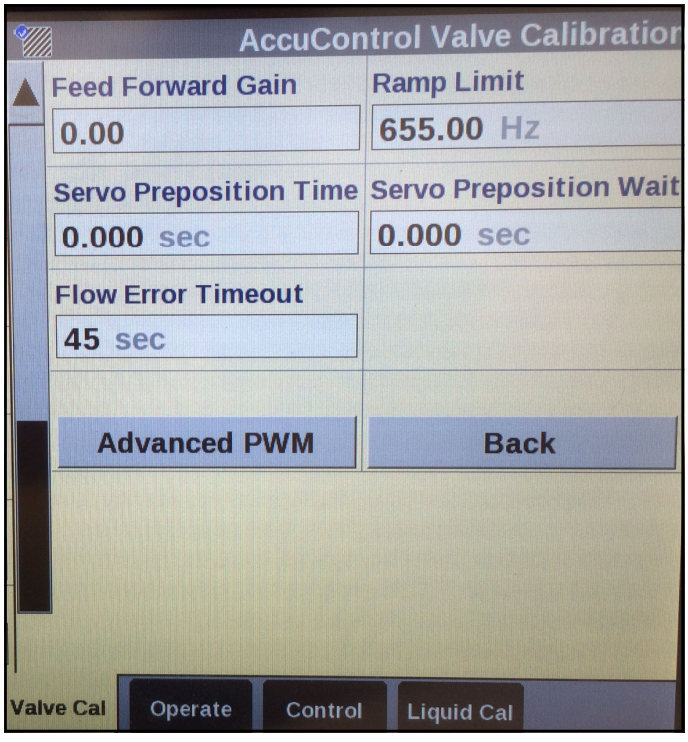


Start with these Valve Cal settings
Work Condition > Valve Cal > Advanced Calibration

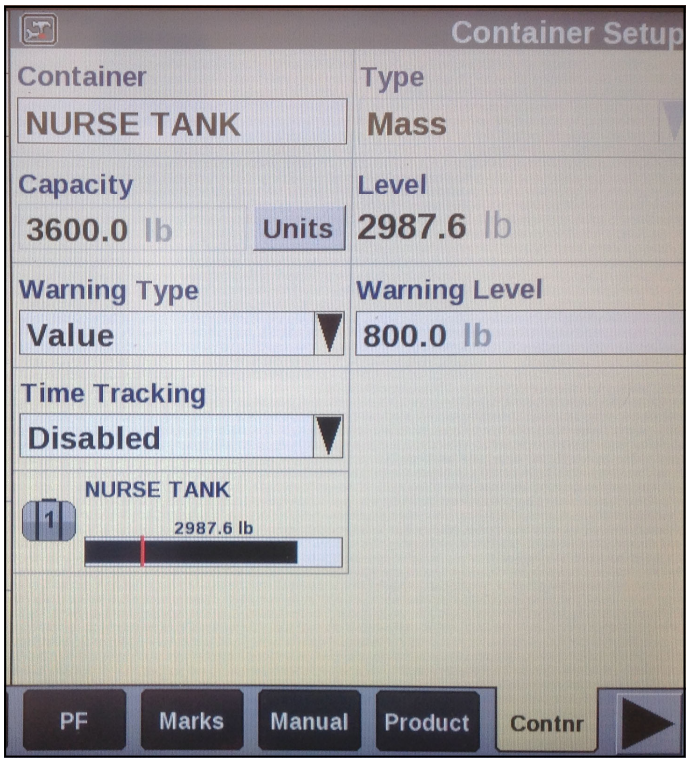


Screen showing Flow Error Timeout set to 45 sec

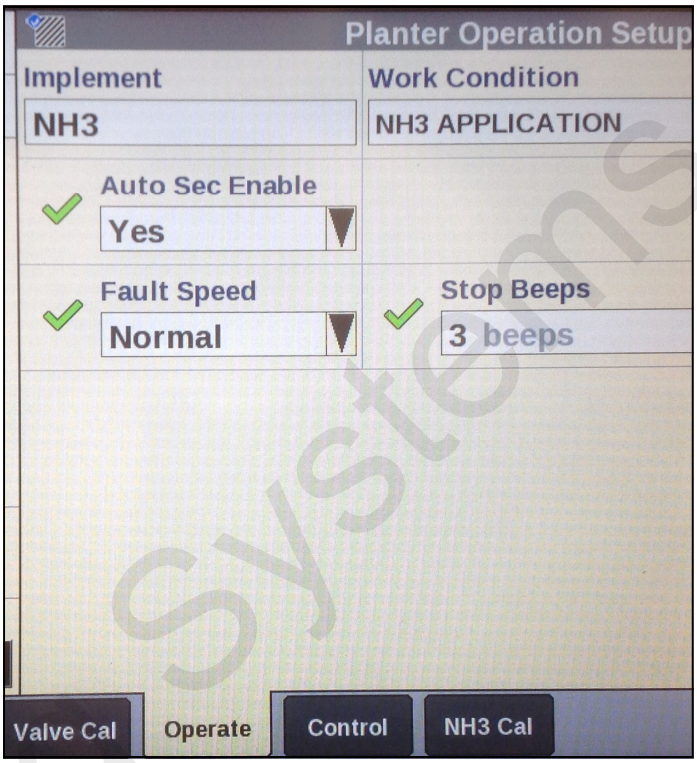
Work Condition > Valve Cal > Advanced Calibration > Scroll down to 2nd page and Flow Error Timeout)



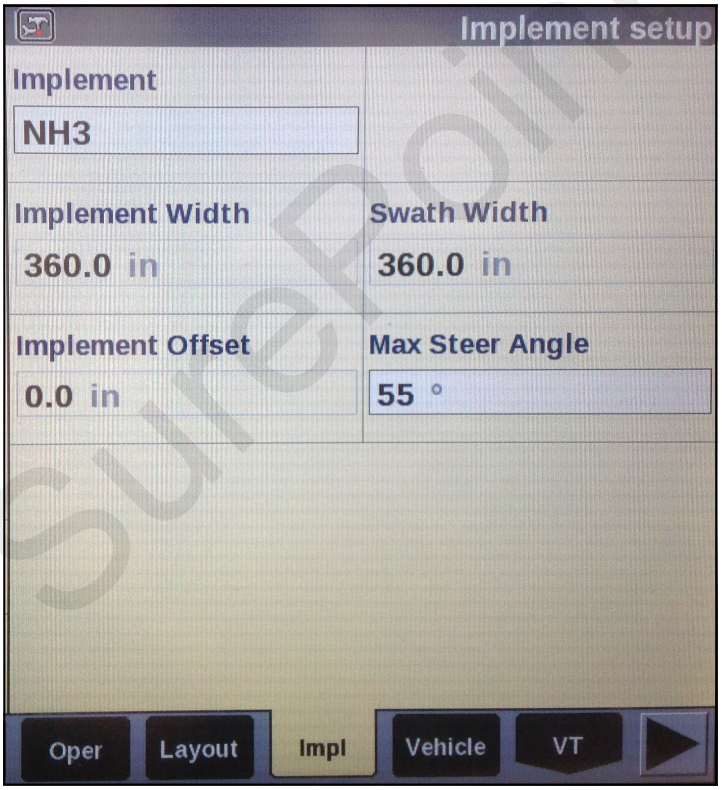
Container Setup (Sample)
Toolbox > Contnr



Fault Speed, Beeps, etc...
Toolbox > Operate



Implement Setup (Sample)
Toolbox > Impl



Your system setup may vary from the screenshots shown here. There may be other setup items that need to be completed for your system. Your system may not require all the setups shown here.

See the manuals from Case IH for the Pro 700 display and for AFS AccuControl for more information about setup and operation of your system.

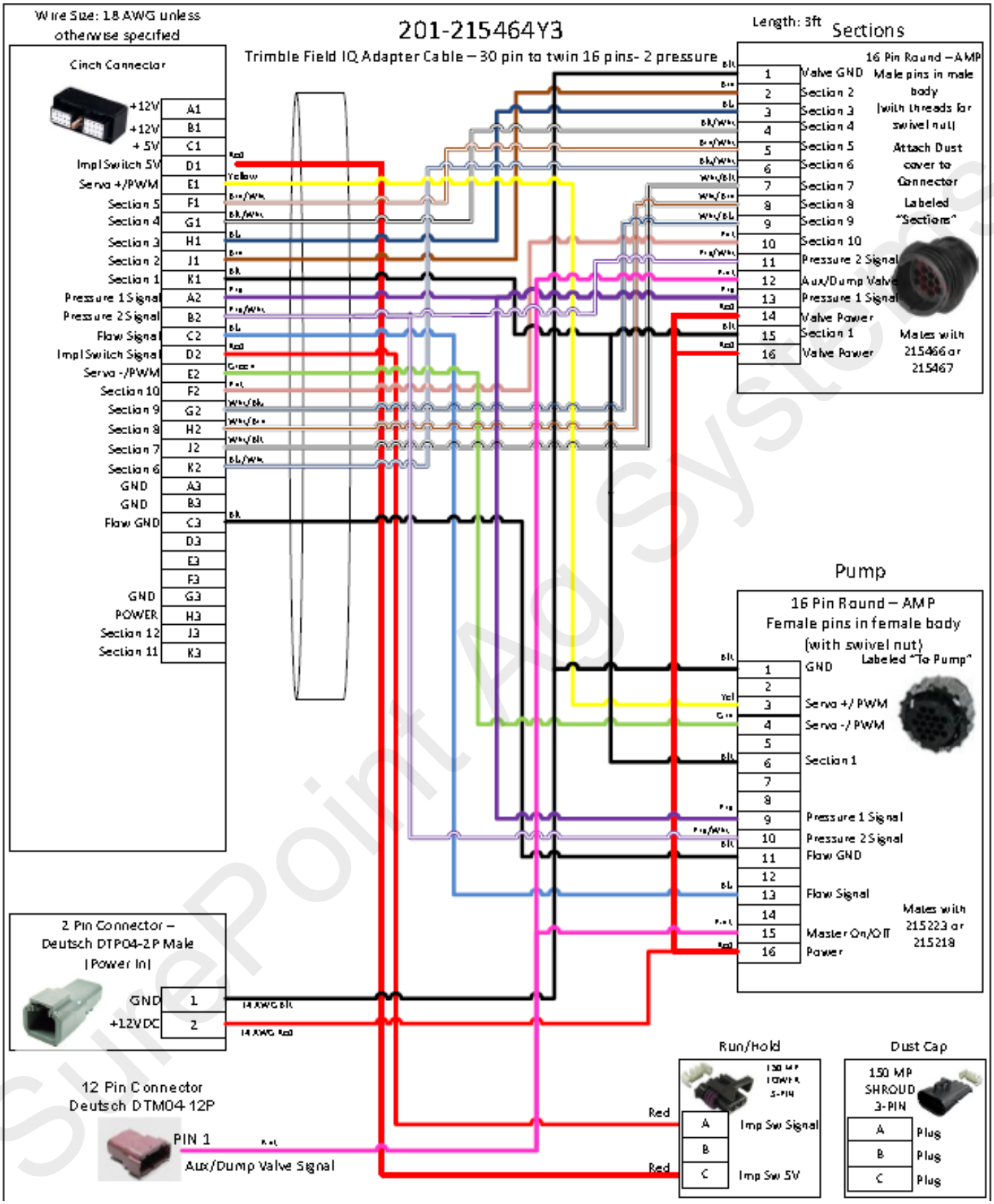
Any personnel that are working with anhydrous ammonia must be properly trained before they begin work with anhydrous ammonia.

Anhydrous ammonia can be very dangerous. It can cause serious injuries and/or death.

All hoses and components must be inspected regularly and anything that is worn or damaged or out of date must be replaced immediately.

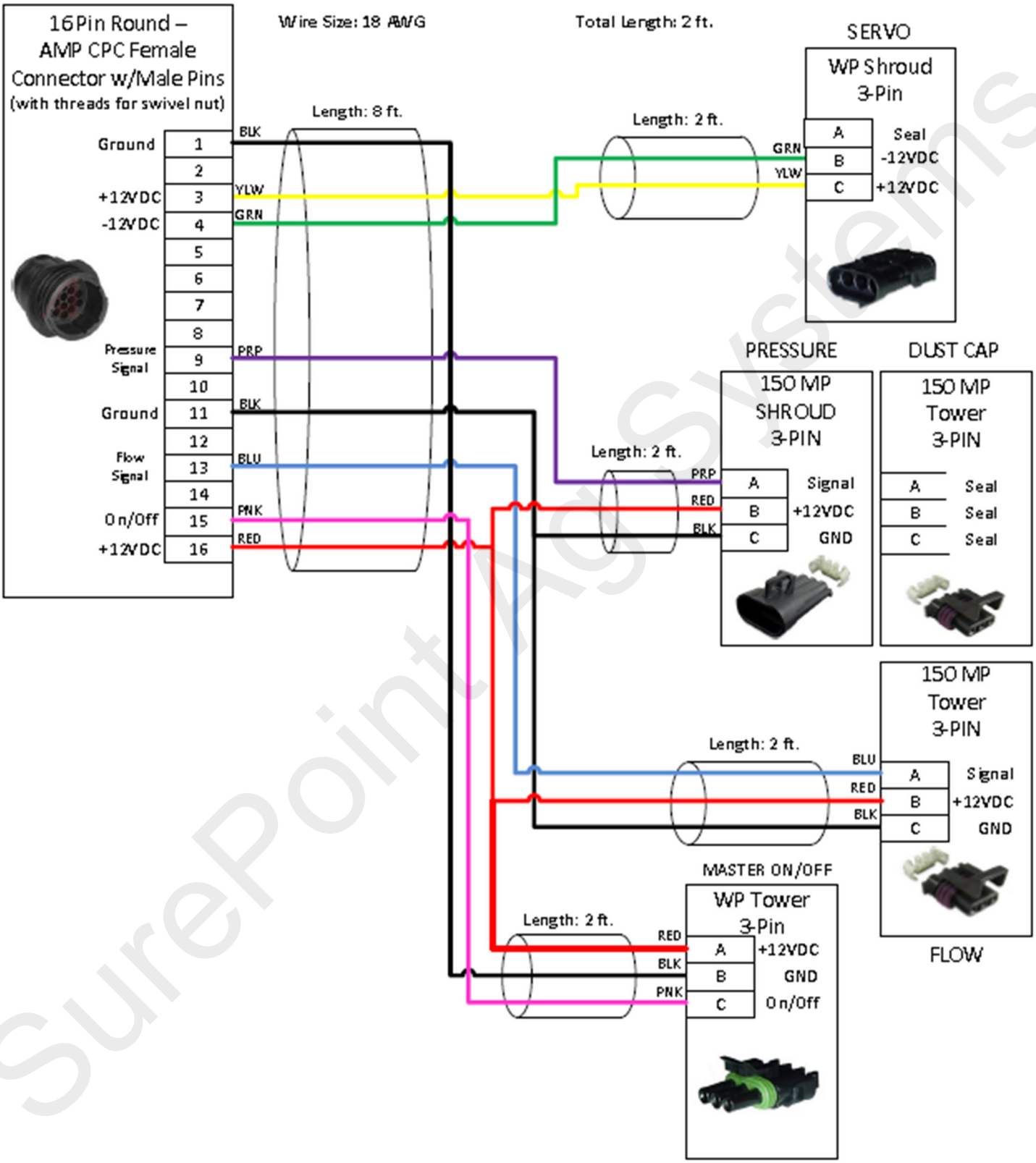
Anyone working around anhydrous ammonia should wear gloves and non-vented goggles and should have a bottle of fresh water with them.

Make sure the nurse tank has five gallons of clean water.



207-2292Y1

NH3 Control Cable- Flow Meter, Servo, Master On/Off, & Pressure



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.