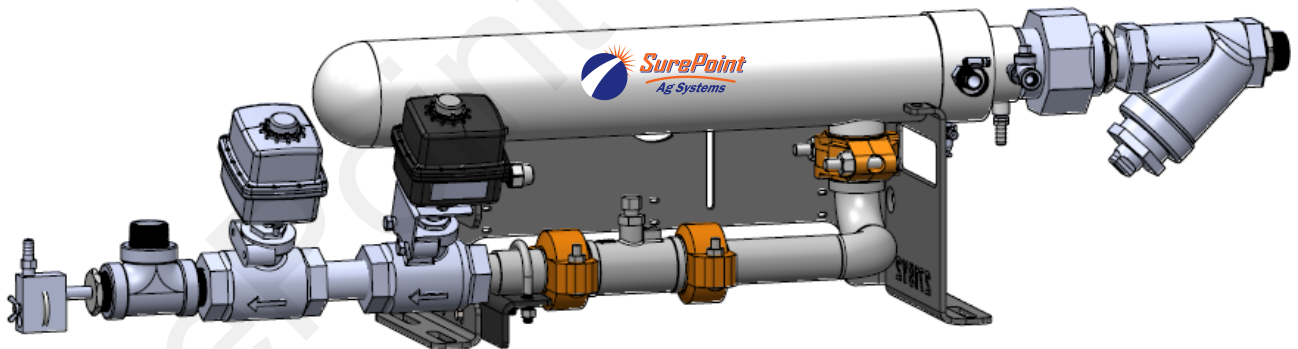


396-5750Y1



NH₃ Precision Anhydrous Ammonia

Sentinel Rate Control Installation and Service Manual



NOTICE

Operator should read this manual before operating the system.

SurePoint Ag Systems



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For additional parts drawings or product manuals, go to 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.



Safety

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.

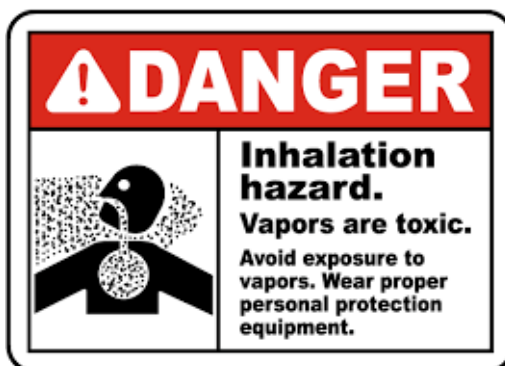


WARNING: Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.



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 NH₃ lines are empty, including the lines connected to the Torpedo.
- Make sure the system is completely drained of NH₃. It can hide in low areas of the system. Look for frost on the hose or equipment. That usually means there is NH₃ 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 not by the wheel or latch.
- Always make sure you are upwind of potential NH₃ release points.
- When you park, position NH₃ 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.

NH₃ is a very dangerous product. It can kill you or blind you or worse. If you have not taken an approved NH₃ Safety class, do not work around NH₃. If you have had the course, follow ALL safety precautions ALL the time.

BE CAREFUL !

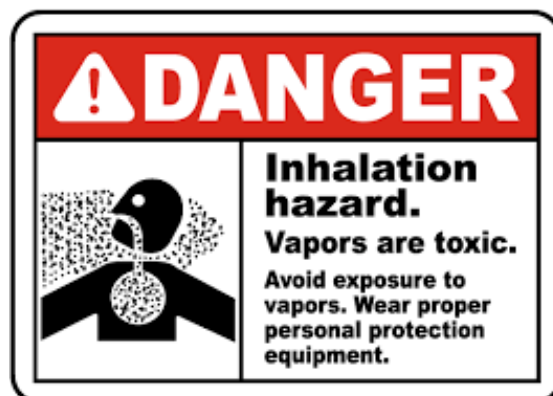
NOTICE

Before you start applying NH₃—

- 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 NH₃ 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.



Things to Know About Anhydrous Ammonia (NH₃)

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 NH₃. 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.

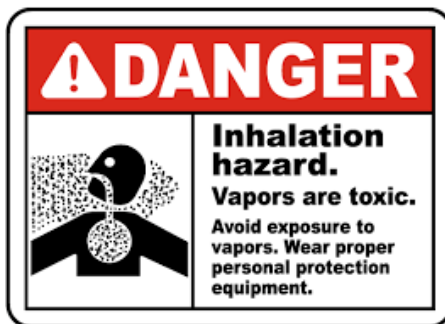
The pressure on the tank is the vapor pressure and remains the same whether the tank is 10% full or 80% full. This pressure is dependent on the temperature of the NH₃.

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

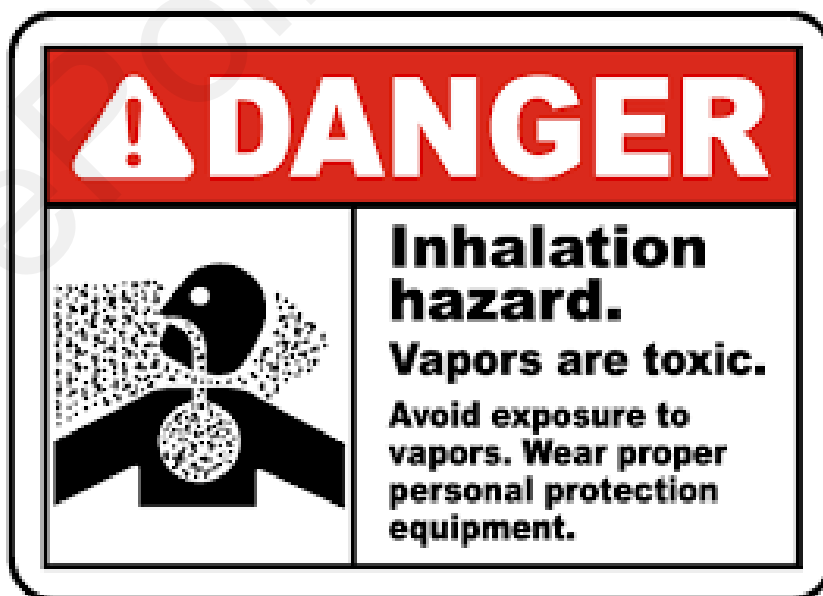
Precision application of anhydrous ammonia starts with a proper metering system. It is crucial to be sure the metering and control system is applying what is required.

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.



General Installation Guideline

Follow these to optimize your SurePoint Torpedo™ NH₃ system you will find supplemental information in this manual to help you answer these guidelines. If you need more information, please reach out to your authorized SurePoint dealer or SurePoint Support. <https://support.surepointag.com/>

General Information

Check all components for damage from shipping and receiving.
Always use approved components for Anhydrous Ammonia systems
These include:

- Schedule 80 forged steel pipe fitting for high pressure lines.
- Approved pipe thread sealant– SurePoint recommends Reactoseal #5
- Anhydrous Ammonia approved high pressure hose, that falls within allotted time frame, between any components that can trap anhydrous ammonia and build pressure.
- Hydrostatic pressure relief valve, that is within allotted time frame, between any components that can trap anhydrous ammonia and build pressure.
- Ethyl Vinyl Acetate (EVA) plastic tubing for open end discharge. Not intended for anhydrous ammonia under high pressure.

Tank Connections

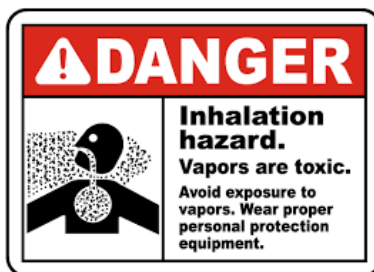
- Proper sized tank valve
- Make high pressure supply lines from tank to cooler as short as possible and avoid elbows that can cause pressure drops
- Use correct size ACME fitting to maximize flow through supply lines to reach rate.
- Equal length of supply lines if using dual tanks.
- Emergency shut-off valve
- Use EVA tubing to connect bleed valve to move NH₃ gas away from operator when connecting ACME fittings
- Mount breakaway couplers in accordance with manufactures guidelines.
- Make sure that supply lines from tanks won't kink or get caught on the toolbar or hitch.
- Avoid tight bends in supply lines to maximize the amount of flow for the hose.

Torpedo™

- Mount Torpedo™ on toolbar where it won't interfere with use of the implement or cover any of the manufacture's safety information.
- Mount strainer to Torpedo™
- Utilize vapor discharge on equipment or weld on supplied vapor tubes according to instructions with tubes.
- Use equal lengths of EVA tubing for vapor discharge.
- Connect adjustable orifice valve to cooler– Adjust orifice according to flow needed
- Use EVA tubing to connect bleed valve with hose moving NH₃ gas away from operator
- Mount splitter on Torpedo™ assembly or remotely if needed. (Pay attention to implement fold interference)
- Utilize equal length high pressure hose on systems with section valves from splitter to manifold and pay special attention to fold points.
- For systems without section valves utilize EVA tubing to manifolds

Manifolds

- Mount section manifolds so they won't interfere with use of toolbar. (Pay attention to fold interference)
- Make sure to follow manifold manufacturers recommendation for orientation of mounting and spacing of hose barbs to maximize components intended use.
- Connect EVA tubing in equal lengths from manifold to knife.
- EVA tubing should lay flat so that it doesn't trap Anhydrous Ammonia in coils during storage



Setting Up Your System

The following pages show some of the calculations needed to determine the specific components of your SurePoint Torpedo™ NH₃ system.

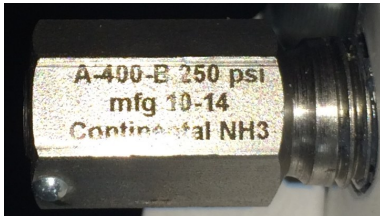
First, the **width, rate, and speed** will be used to determine the amount of NH₃ your system will need to deliver. With this information, the **tank withdrawal valves, NH₃ hose(s), and Torpedo™ heat exchanger** can be selected.

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.

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



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

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.



153-A-411-HB

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:

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.

BE CAREFUL WITH THIS STUFF!

Sizing System components

The SurePoint Torpedo system is available in four 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 SurePoint Torpedo™ model.

SurePoint Torpedo™ Model # 100, 200, 250 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 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
250	35	10800	230	150	43	13500	285	190
300	50	15450	330	220	64	20000	427	285

Calculating NH₃ Flow

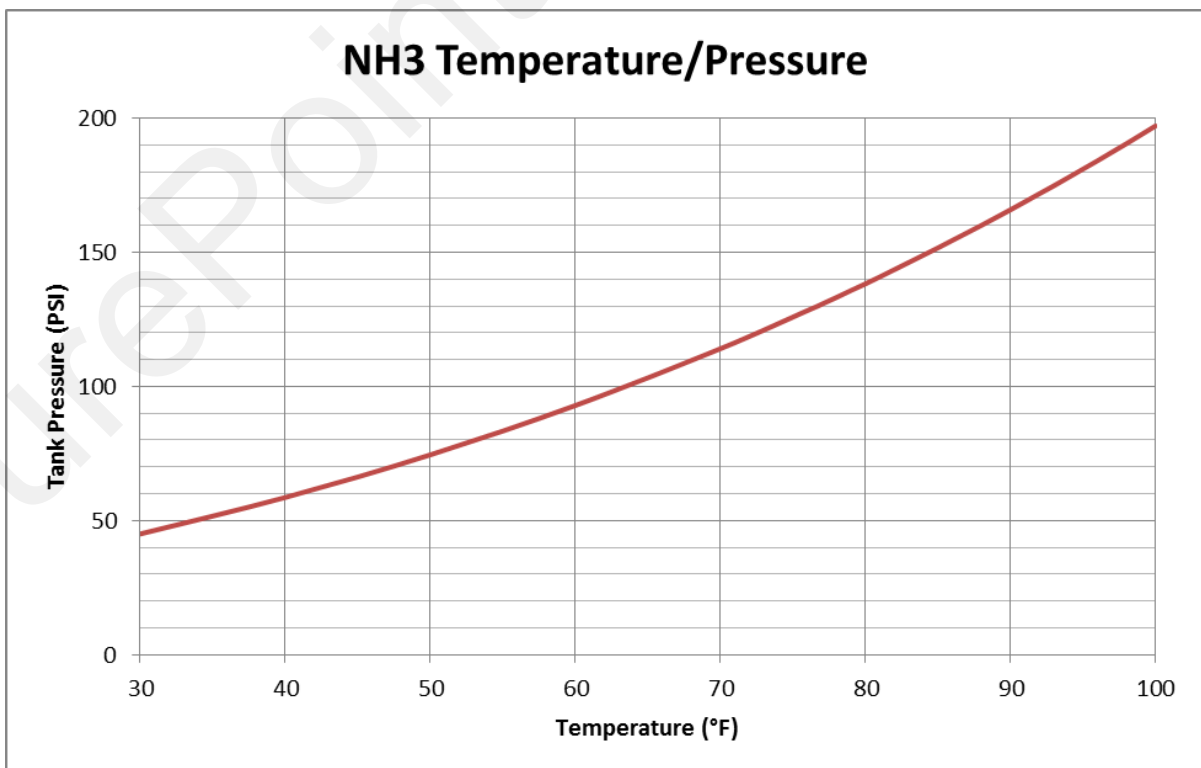
Do the following calculation to determine the proper Torpedo Model for your application:

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

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

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

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



Installation and Setup Instruction Tags-See 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 to use.

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

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

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

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

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.

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.

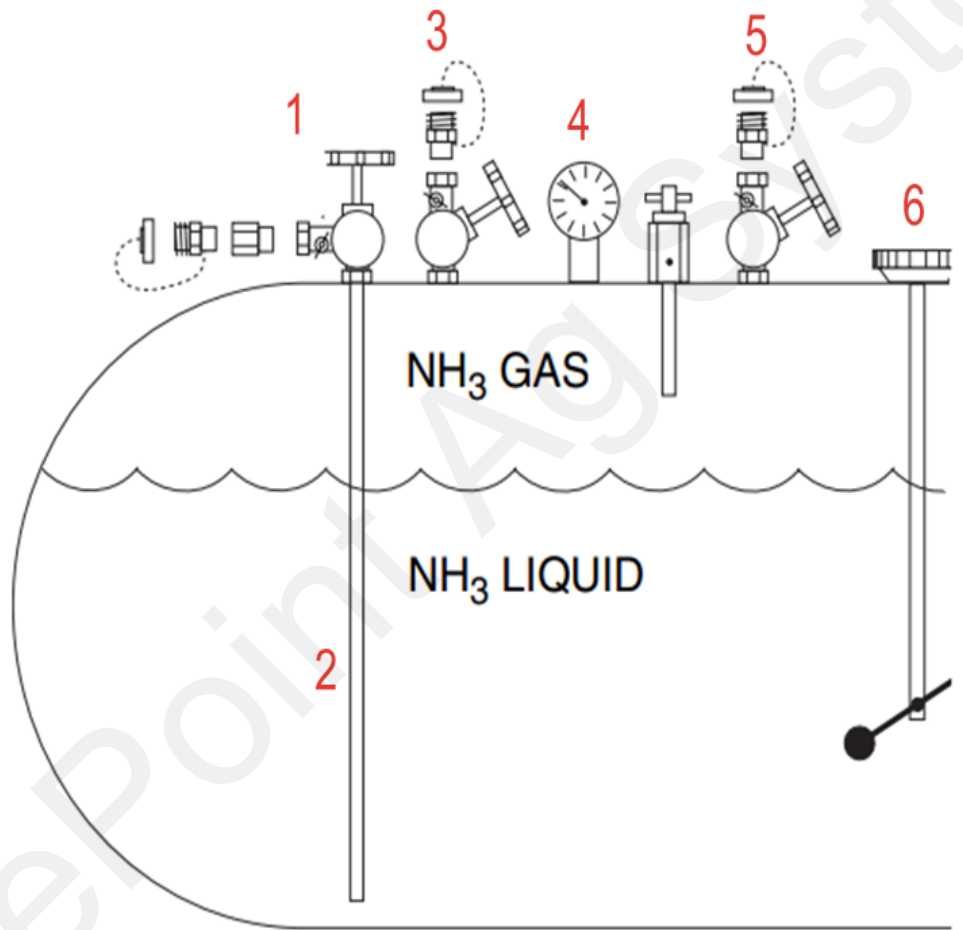
Open valve **SLOWLY** when bleeding system.

PN 398-10-2810Y1



NH₃ 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.

NH₃ 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-

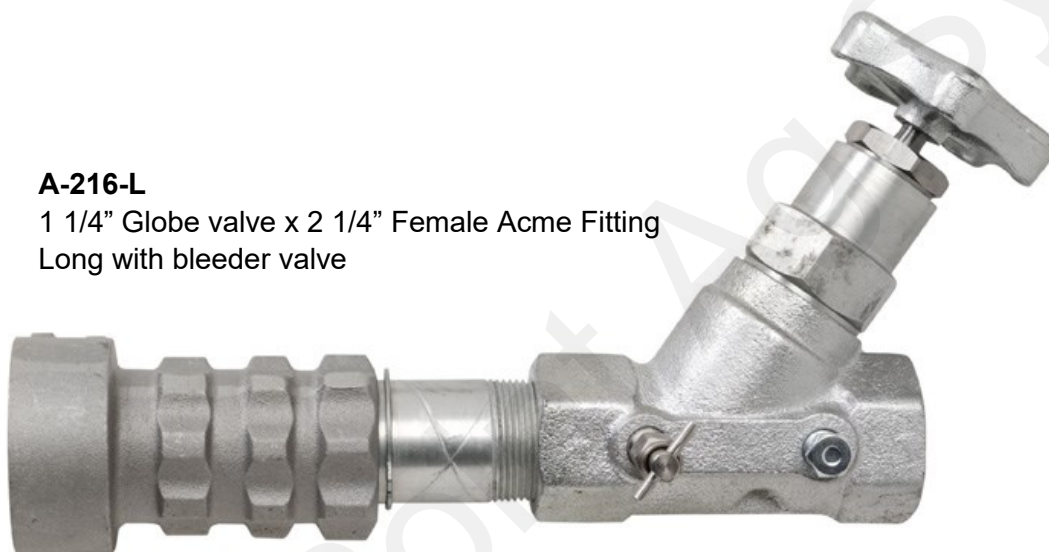
A-215-L

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

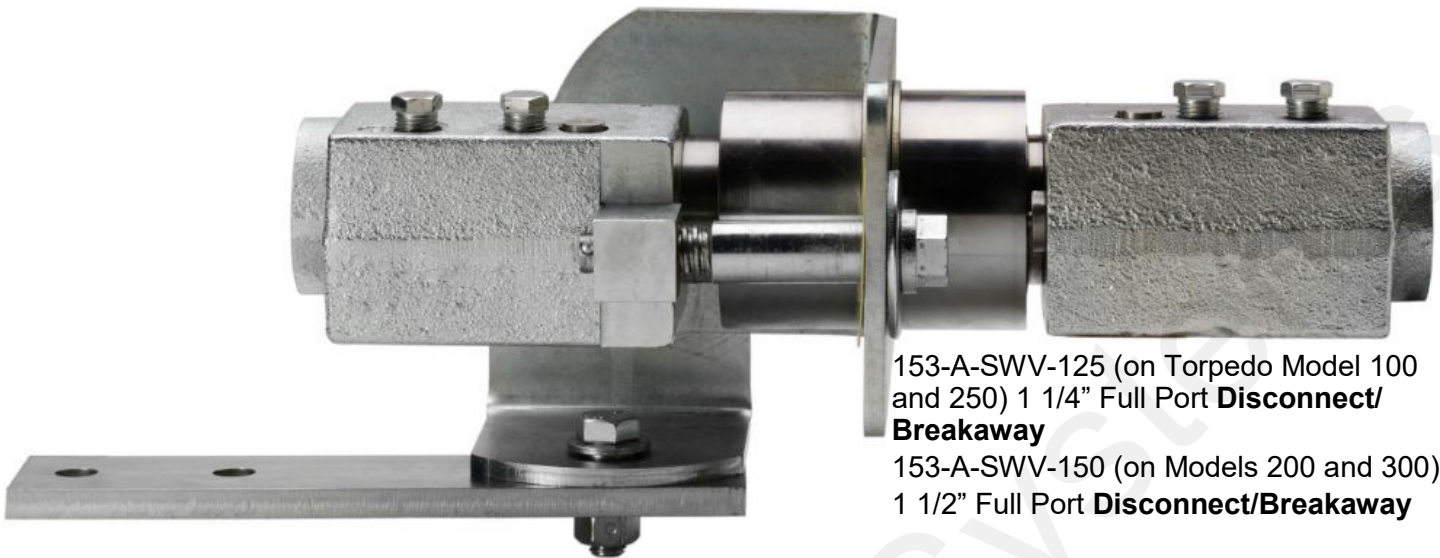


A-217-L

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 NH₃ Hose and SuperFlow NH₃ Assembly

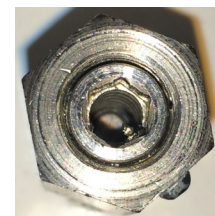
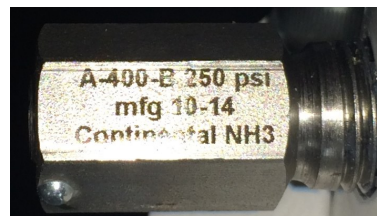


153-A-SWV-125 (on Torpedo Model 100 and 250) 1 1/4" Full Port **Disconnect/Breakaway**

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

- <http://www.continentalnh3.com/pdfs/SWV-125-INSTALLATION-INSTRUCTIONS.pdf>
- 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**

You can find a copy of the installation and operating instructions by scanning the QR Code



End view

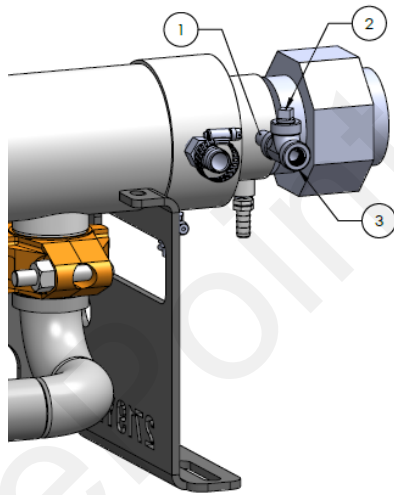
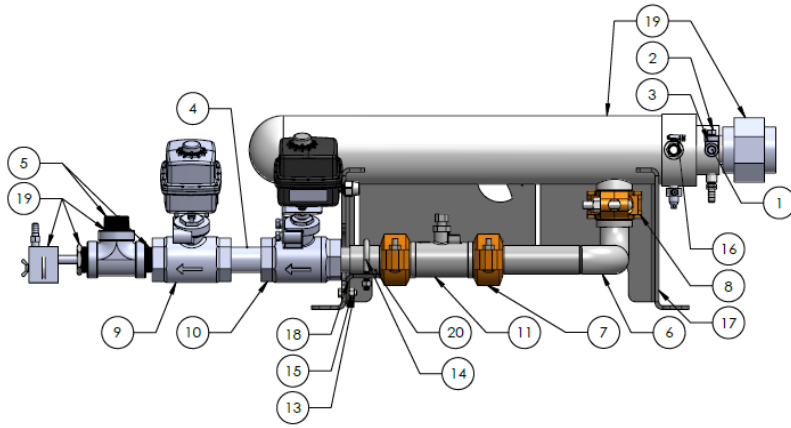
153-A-400-B 1/4" **Hydrostat Relief Valve**—250 PSI—(Keep the black cap on)
Used in various segments of the system as a safety relief valve. This component has a **MFG Date** stamped on it. Replace within 5 years.

Safety Reminder

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



SurePoint Torpedo™ NH3 Model 100,200,250, &300 Parts Breakout

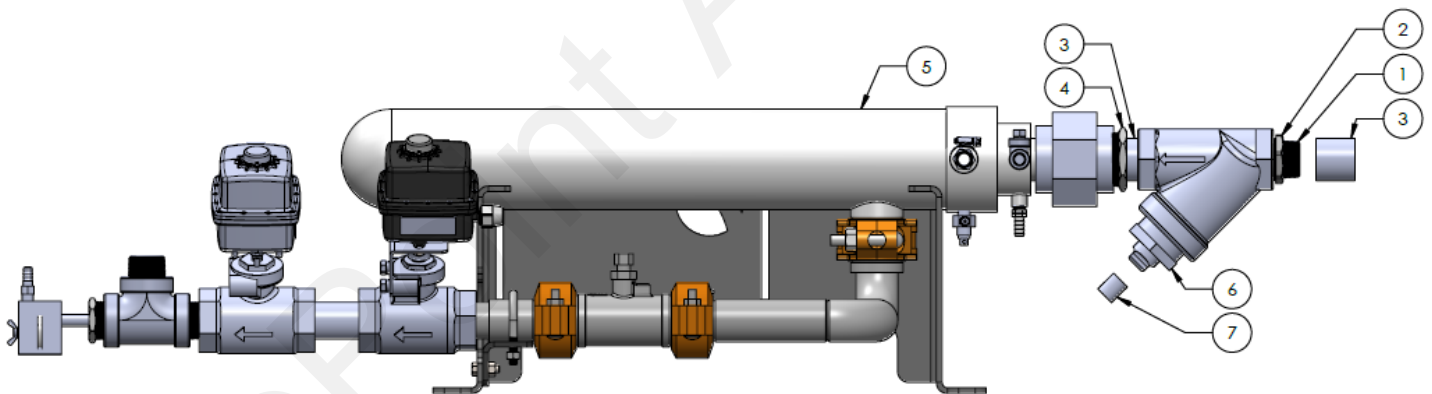
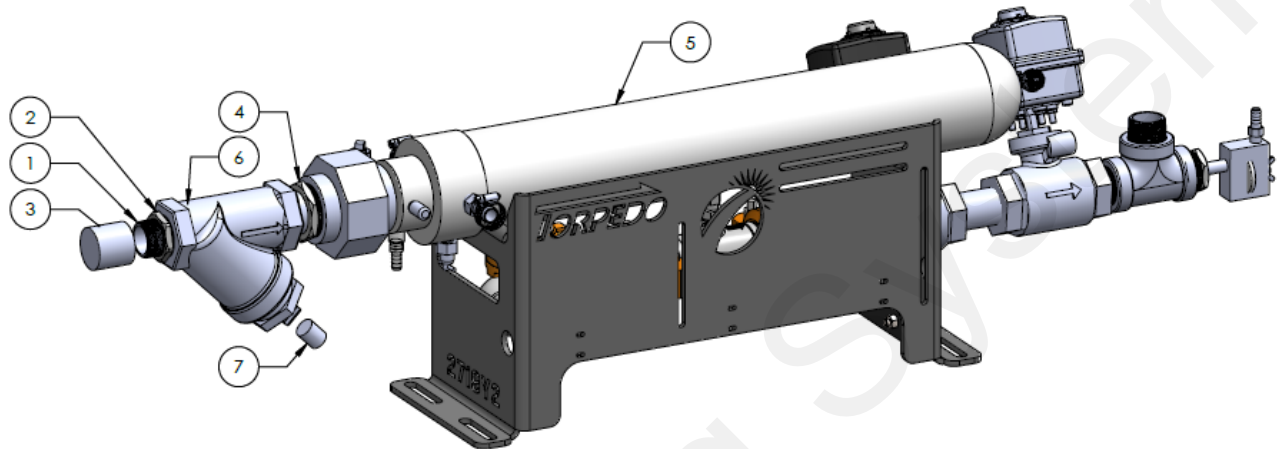


Item	Part Number & Description	Qty
1	150-025NIP-2-S80 Seamless Sch 80 Black Iron - 1/4" x 2" Nipple	1
2	150-025PLG-S80 Forged Steel - 1/4" Plug	1
3	150-025TEE-S80 Forged Steel - 1/4" FPT Tee	1
4	150-125NIP-4-S80 Seamless Sch 80 Black Iron - 1-1/4" x 4" Nipple	1
5	150-125NIP-SH-S80 Seamless Sch 80 Black Iron - 1-1/4" x Short Nipple	2
6	154-02-5537Y1 Victaulic Torpedo Outlet Pipe - 2" - OGS Double Elbow x 1-1/2" - OGS	1
7	154-04-200150 Victaulic Clamp - 2" x 1-1/2" Reducer	2
8	154-04-200200 Victaulic Clamp - 2"	1
9	202-2691Y1 SurePoint 1 1/4" NH3 Servo Valve - 7 sec. 118 degree open/close - 3-pin WP tower (2wire)	1
10	202-5520Y1 * 1-1/4" Full Port NH3 Master Valve Assembly (EH3 Actuator / Continental Valve)	1
11	204-02-5533Y1 Raven Grooved End Turbine NH3 Flowmeter	1
13	300-050100-5 5/16" x 1" Hex Head Bolt - G5	2
14	302-0602080300-5 3/8" Round Bend U-Bolt - 2-1/2" x 3"	1
15	323-05 5/16" Flange Nut	2
16	350-1608 SS Hose Clamp - Size 16 - 1-1/2" Diameter (fits 1" AG200)	4
17	462-2719Y2-BK Torpedo Heat Exchanger Base - Victaulic	1
18	462-5692Y1-BK Round U-Bolt Pipe Support Bracket for Torpedo	1
19	762-A-SF-3000Y2-S-VIC Continental Victaulic SuperFlow - Adj. Orifice valve, 2" Union, Exchanger, Vapor Tubes	1
20	154-01-150125-4 1 1/2" Grooved End x 1 1/4" MNPT x 4" Long Fitting	1





Torpedo™ NH3 Models 100 and 200 Strainer Breakdown

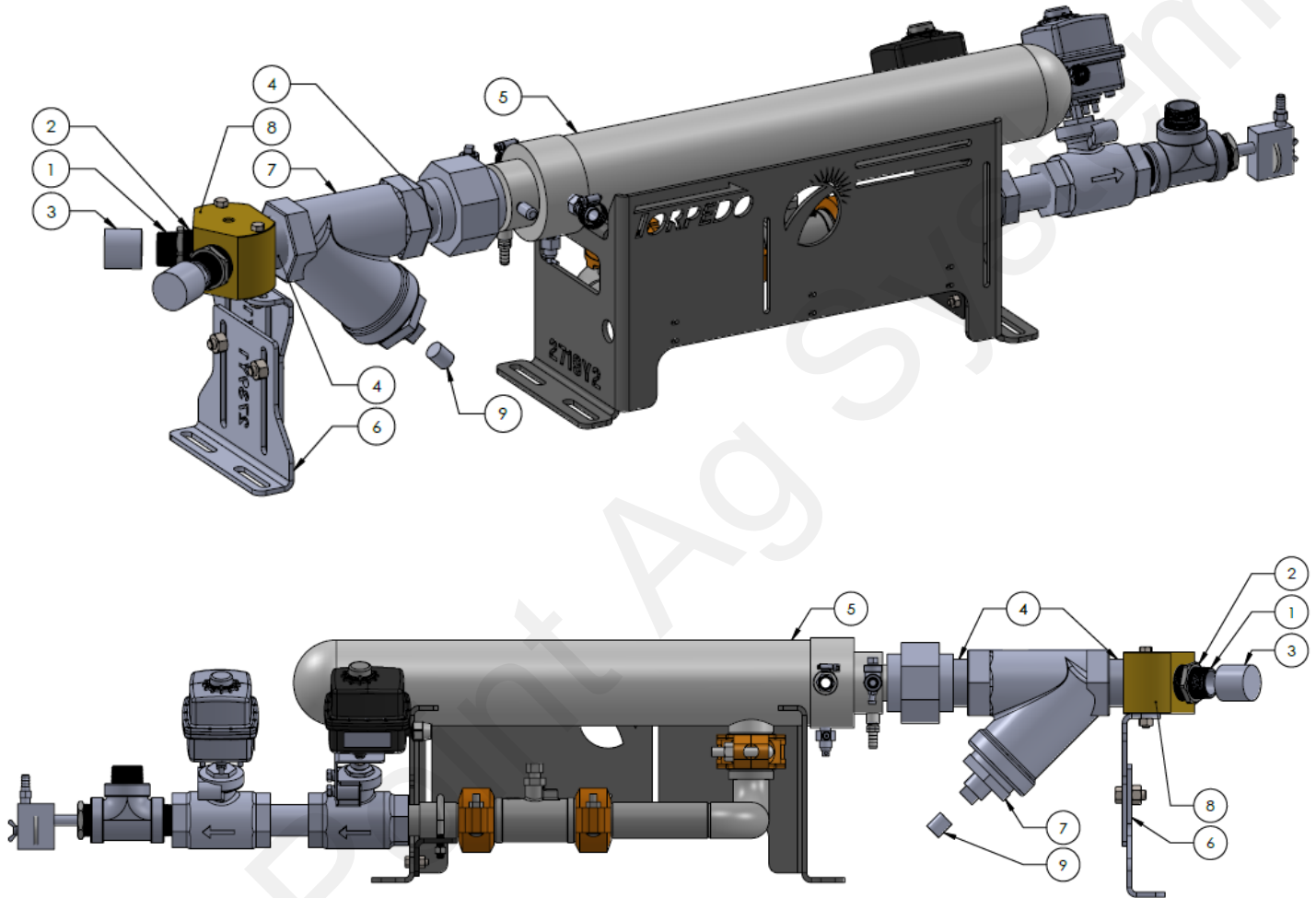


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	150-125NIP-SH-S80	Seamless Sch 80 Black Iron - 1-1/4" x Short Nipple	1
2	150-150125RB-S80	Forged Steel - 1-1/2" MPT x 1-1/4" FPT Reducer Bushing	1
3	150-150NIP-SH-S80	Seamless Sch 80 Black Iron - 1-1/2" Short Nipple	2
4	150-200150RB-S80	Forged Steel - 2" MPT x 1-1/2" FPT Reducer Bushing	2
5	202-2693Y2	Torpedo NH3 Assembly - Victaulic Exchanger, Flowmeter, Control	1
6	762-A1SD-1.5	1-1/2" NH3 Strainer	1
7	762-Y-MAGNET	Magnets for NEW Continental Filter	3





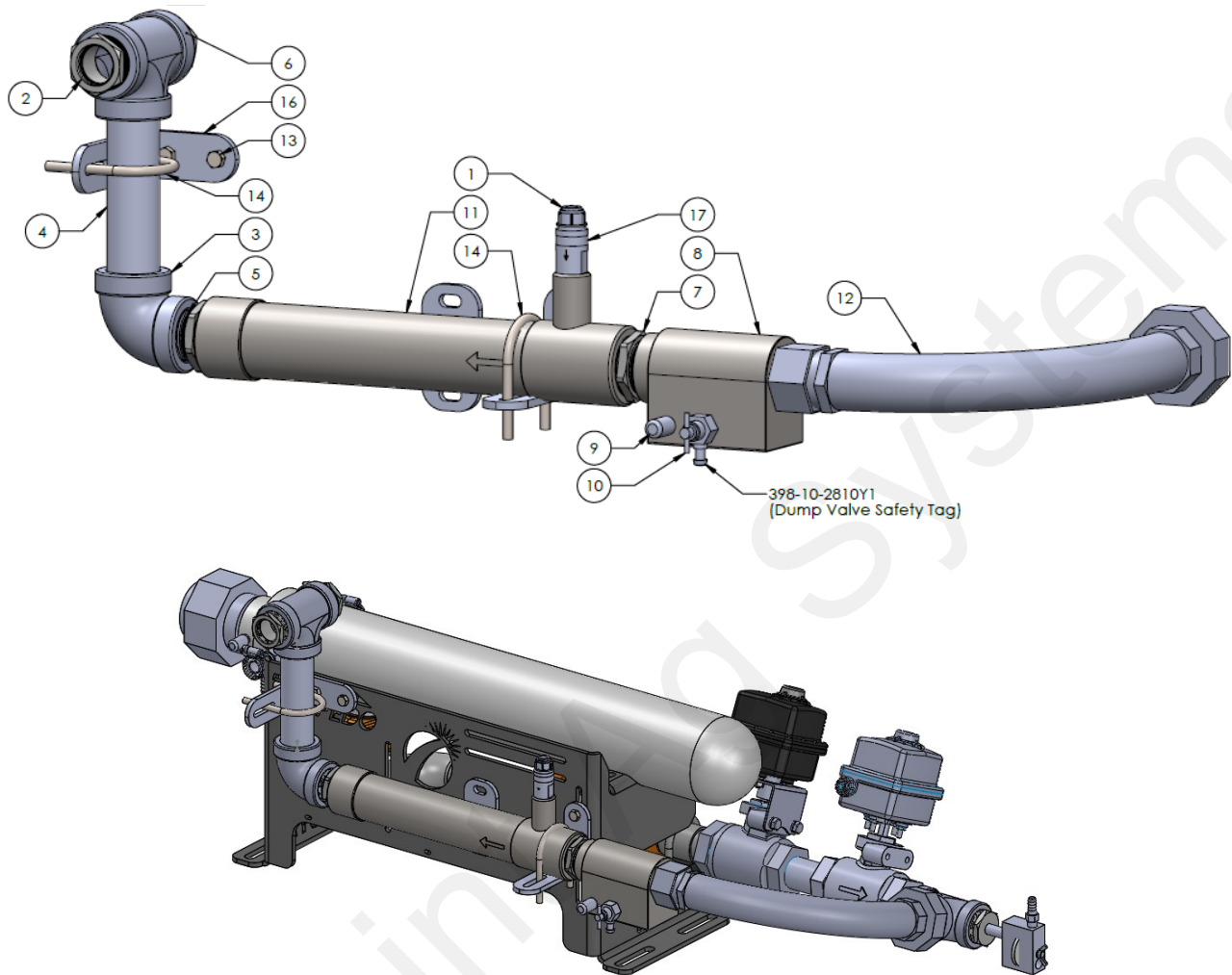
Torpedo™ NH3 Models 250 and 300 Strainer Breakdown



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	150-125NIP-SH-S80	Seamless Sch 80 Black Iron - 1-1/4" x Short Nipple	2
2	150-150125RB-S80	Forged Steel - 1-1/2" MPT x 1-1/4" FPT Reducer Bushing	2
3	150-150NIP-SH-S80	Seamless Sch 80 Black Iron - 1-1/2" Short Nipple	2
4	150-200150RB-S80	Forged Steel - 2" MPT x 1-1/2" FPT Reducer Bushing	2
5	202-2693Y2	Torpedo NH3 Assembly - Victaulic Exchanger, Flowmeter, Control Valve and Master Valve	1
6	202-2740Y1	NH3 Y Splitter Support Assembly	1
7	762-A1SD-2	2" NH3 Strainer	1
8	762-BBY200150	Continental Hi-Flow Y for the inlet of SuperFlow - 2 @ 1-1/2" and 1 @ 2" outlet	1
9	762-Y-MAGNET	Magnets for NEW Continental Filter	5



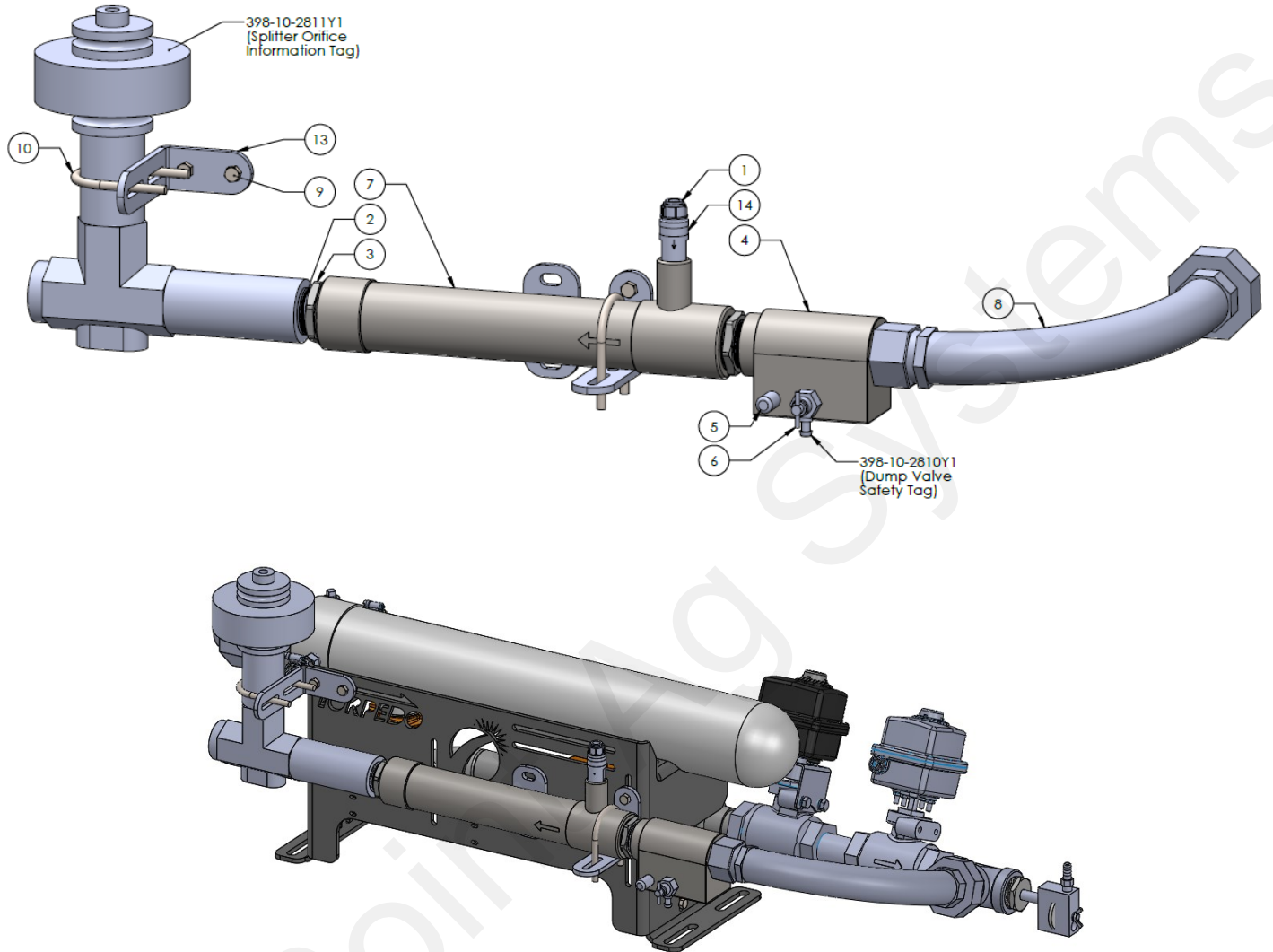
Injection Kit 159-10-300225



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	113-06-038050-P	QC to MPT - 3/8" QC x 1/2" MPT	1
2	150-125100RB-S80	Forged Steel - 1-1/4" MPT x 1" FPT Reducer Bushing	2
3	150-125EL-90-S80	Forged Steel - 1-1/4" Elbow 90 Degree	1
4	150-125NIP-6-S80	Seamless Sch 80 Black Iron - 1-1/4" x 6" Nipple	1
5	150-125NIP-SH-S80	Seamless Sch 80 Black Iron - 1-1/4" x Short Nipple	2
6	150-125TEE-S80	Forged Steel - 1-1/4" FPT Tee	1
7	150-150125RB-S80	Forged Steel - 1-1/2" MPT x 1-1/4" FPT Reducer Bushing	2
8	153-A-14BC	1-1/4" NH3 Check Valve	1
9	153-A-400-B	1/4" RELIEF VALVE - 250 PSI	1
10	153-A-411-HB	Remote Bleed Down Valve with 3/8" Hose Barb	1
11	153-A-MXC-150	1-1/2" SS NH3 Mixing Chamber w/ 1/2" FPT Injection Port	1
12	283-125-5699Y1	New Victaulic Torpedo SS Braided Hose	1
13	300-050100-5	5/16" x 1" Hex Head Bolt - G5	4
14	302-0502040308	5/16" x 2-1/4" Round Bend U-Bolt	2
15	323-05	5/16" Flange Nut	4
16	462-2721Y1	Splitter Support Bracket	2
17	716-333-0011-102	1/2" SS N-Serve Checkvalve - 12 PSI w/ Extreme Viton	1
18	398-90-3483Y1	Flow Director for Air Whistle	1

Injection Kit for A-360SP Splitter

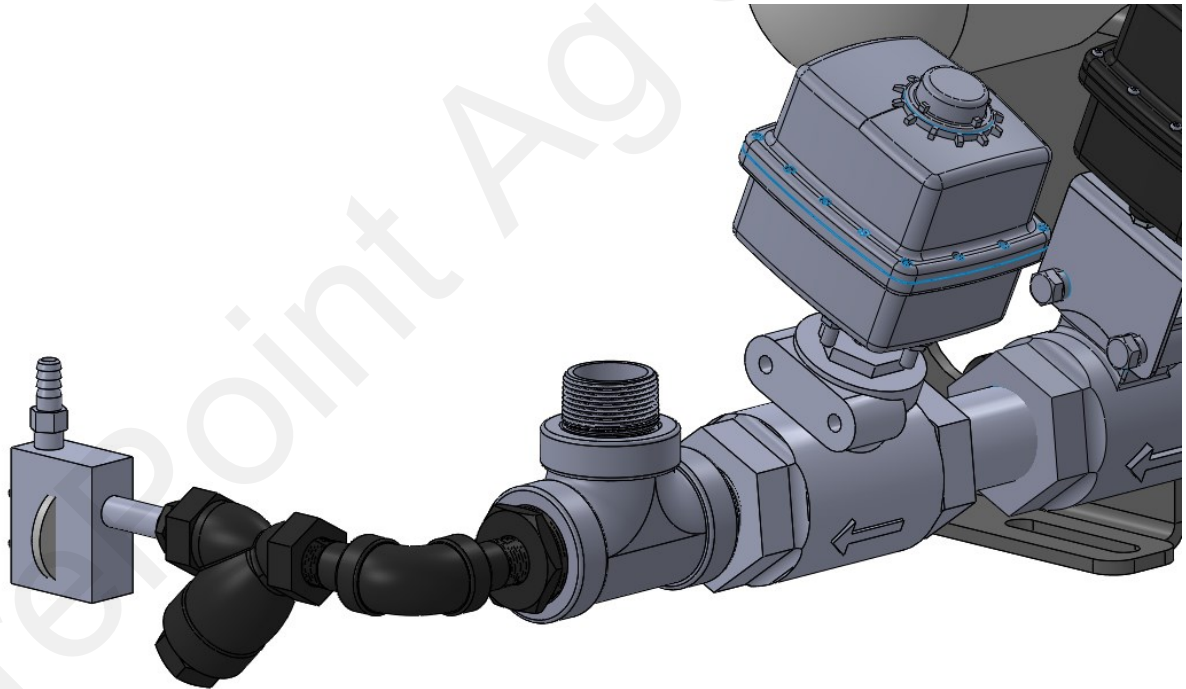
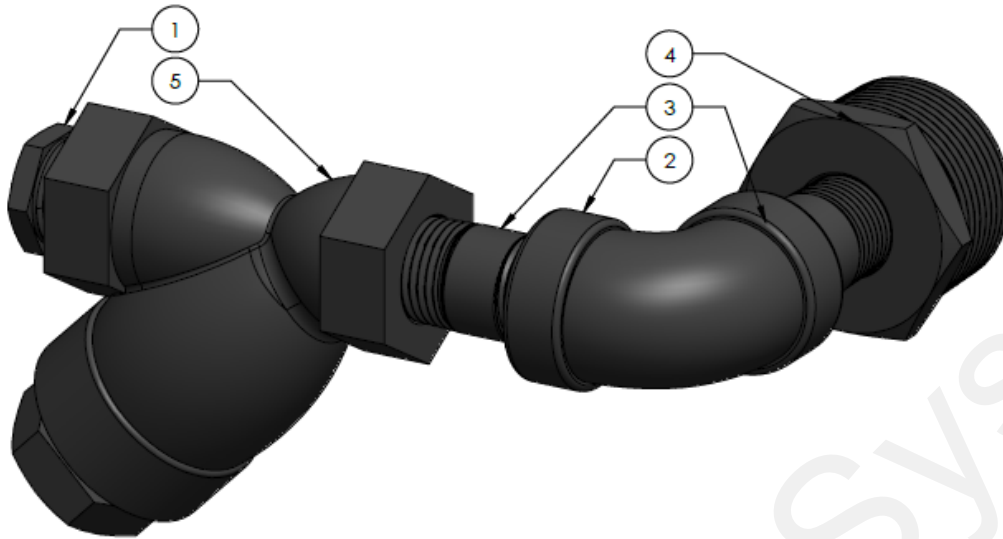
159-10-300525



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	113-06-038050-P	QC to MPT - 3/8" QC x 1/2" MPT	1
2	150-125NIP-SH-S80	Seamless Sch 80 Black Iron - 1-1/4" x Short Nipple	2
3	150-150125RB-S80	Forged Steel - 1-1/2" MPT x 1-1/4" FPT Reducer Bushing	2
4	153-A-14BC	1-1/4" NH3 Check Valve	1
5	153-A-400-B	1/4" RELIEF VALVE - 250 PSI	1
6	153-A-411-HB	Remote Bleed Down Valve with 3/8" Hose Barb	1
7	153-A-MXC-150	1-1/2" SS NH3 Mixing Chamber w/ 1/2" Injection Port	1
8	283-125-5699Y1	New Victaulic Torpedo SS Braided Hose	1
9	300-050100-5	5/16" x 1" Hex Head Bolt - G5	4
10	302-0502040308	5/16" x 2-1/4" Round Bend U-Bolt	2
11	323-05	5/16" Flange Nut	4
12	398-90-3483Y1	Flow Direction Arrow Label	1
13	462-2721Y1	Splitter Support Bracket	2
14	716-383-0011-102	1/2" SS N-Serve Check Valve - 12 PSI w/ Extreme Viton	1

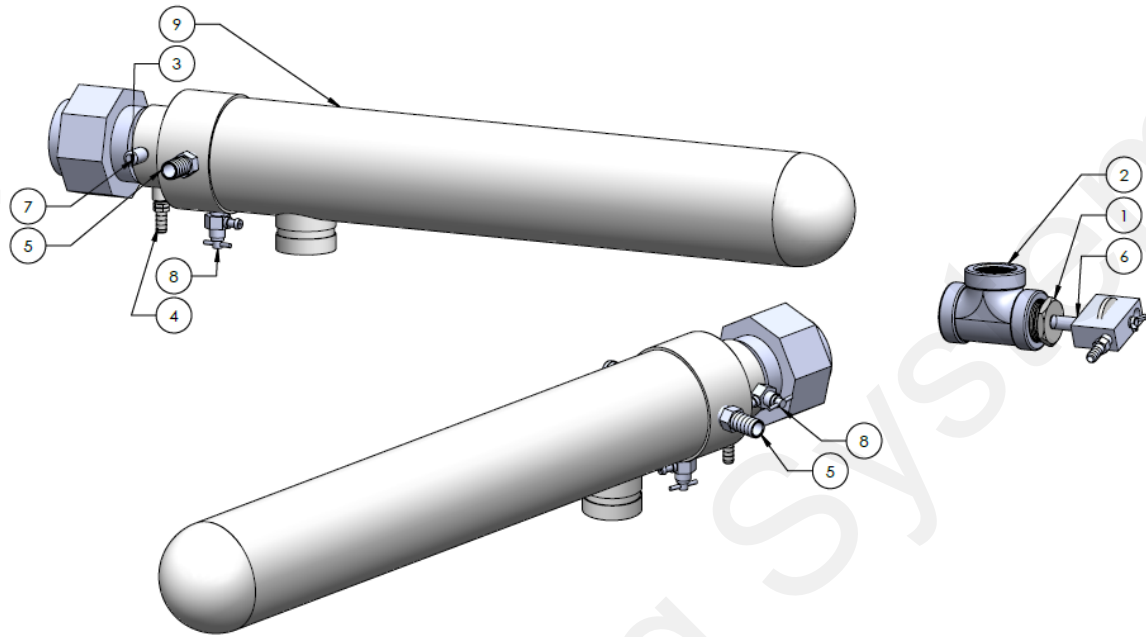


Adjustable Orifice Strainer Kit 159-01-050100



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	150-050025RB-S80	Forged Steel - 1/2" MPT x 1/4" FPT Reducer Bushing	1
2	150-050EL-90-S80	Forged Steel - 1/2" Elbow 90 Degree	1
3	150-050NIP-2-S80	Seamless Sch 80 Black Iron - 1/2" x 2" Nipple	2
4	150-125050RB-S80	Forged Steel - 1-1/4" MPT x 1/2" FPT Reducer Bushing	1
5	153-02-A1SD-1/2D	A1SD-1/2D - 1/2" FPT Y Strainer for NH3	1

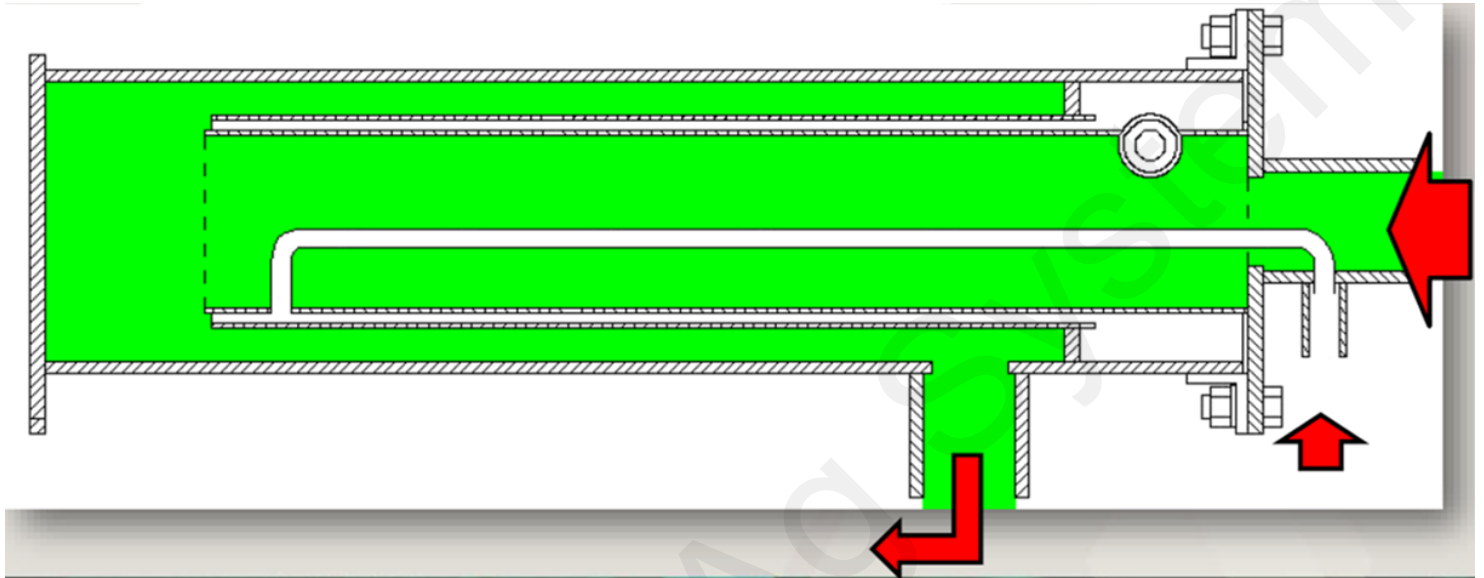




Item No.	Part Number	Description	QTY
1	150-125025RB-S80	Forged Steel - 1-1/4" MPT x 1/4" FPT Reducer Bushing	1
2	150-125TEE-S80	Forged Steel - 1-1/4" FPT Tee	1
3	150-200UN-S80	Forged Steel - 2" Union	1
4	151-025038	1/4" MPT x 3/8" Hose Barb	1
5	151-050075	1/2" MPT x 3/4" Hose Barb	2
6	152-A-SF-OV	1/4" Adjustable Orifice Valve	1
7	153-A-400-B	1/4" Relief Valve - 250 PSI	1
8	153-A-411-HB	Remote Bleed Down Valve with 3/8" Hose Barb	2
9	153-A-SF-3000GH-2-VIC	2" Exchanger	1

SurePoint Torpedo (Heat Exchanger)

1. Turns the NH₃ 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 NH₃ 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.



SurePoint 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

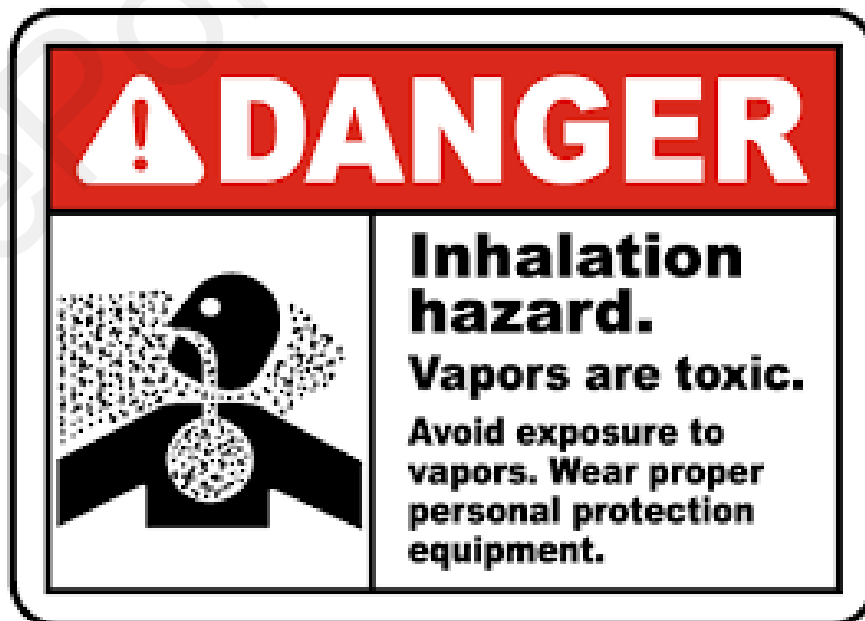
Always bleed all segments of the system before working on or around the system.

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.

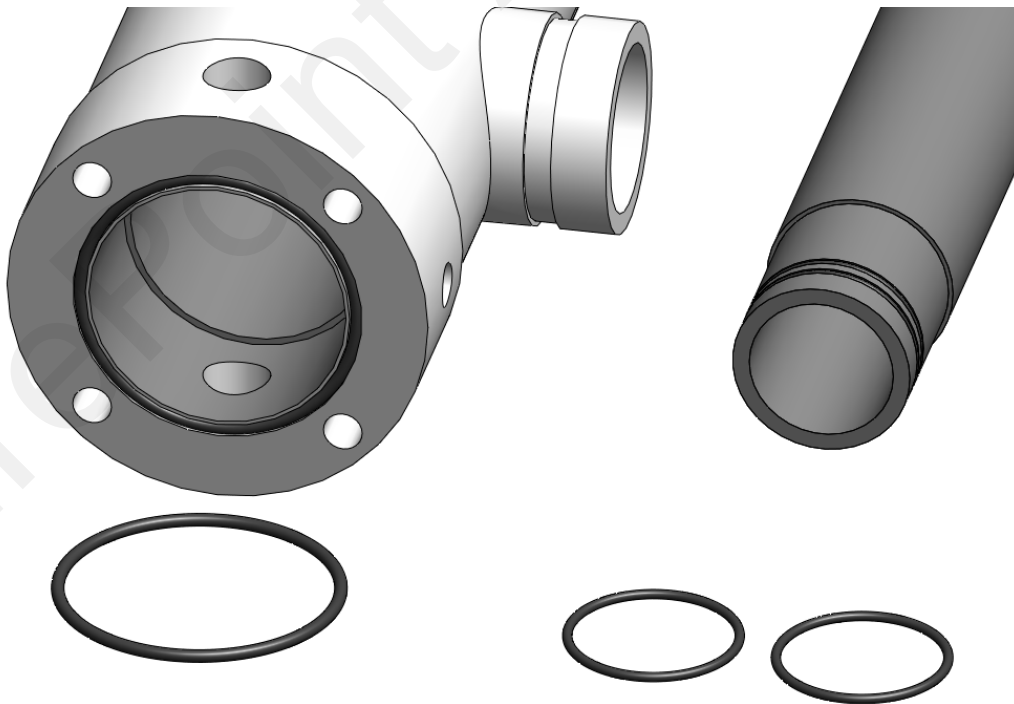


SurePoint Torpedo Repair and Service

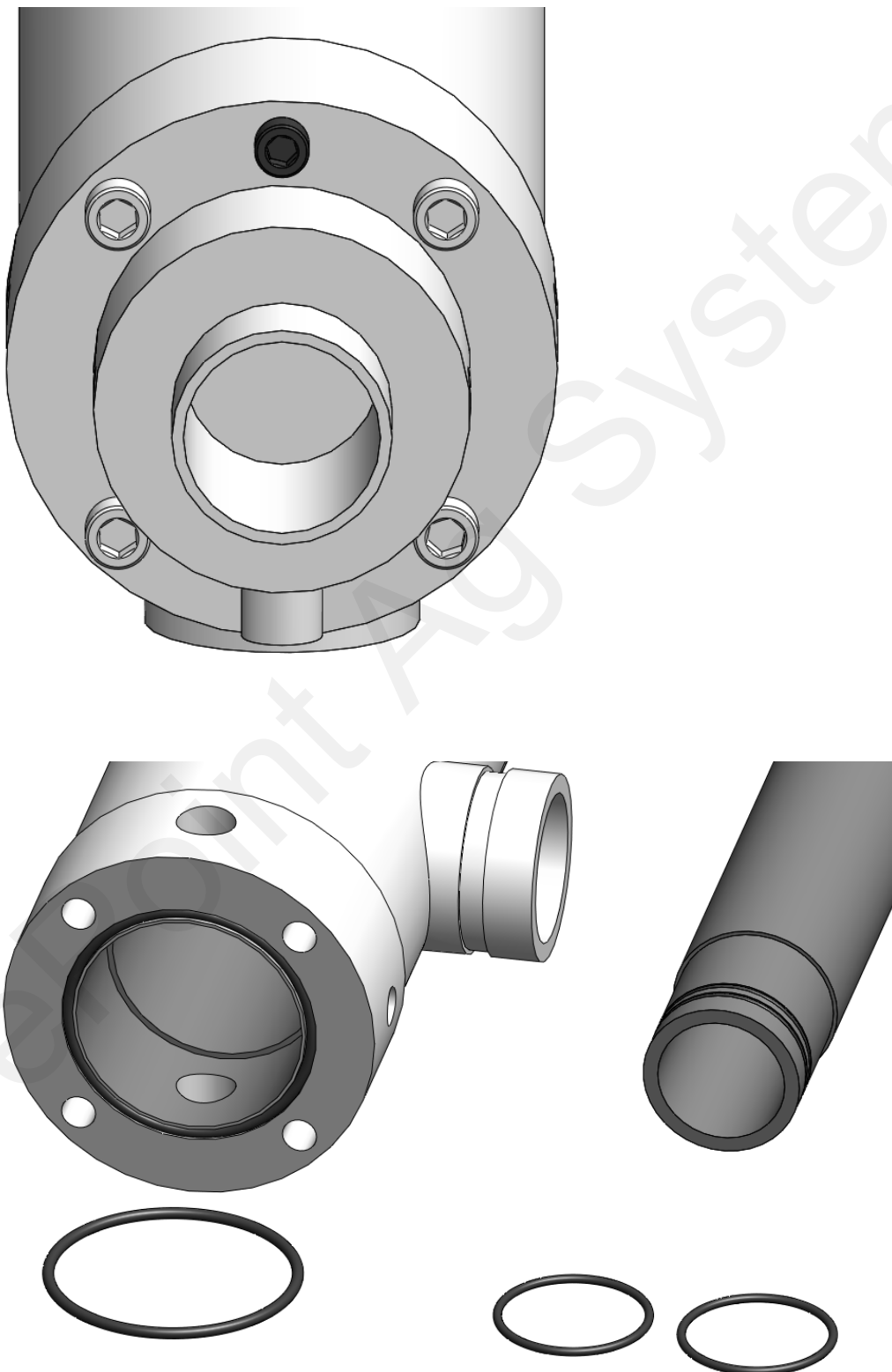
1. Remove the 4 Allen screws on the end of the Torpedo tube and pull the inner tube assembly out of the outer tube assembly. Use the breakdown bolt (5) to assist in separating the inner tube assembly from the outer tube assembly.

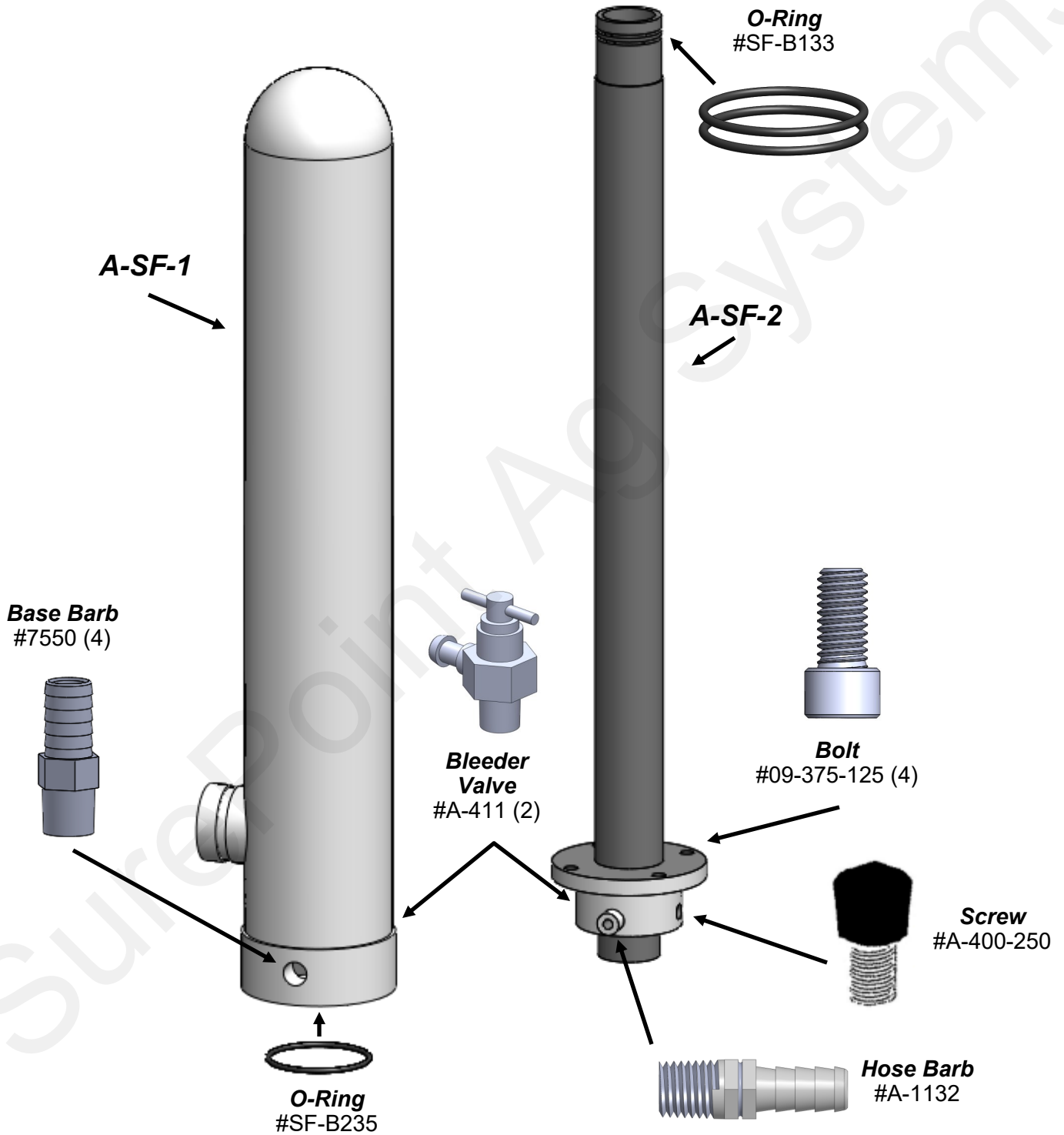


2. Replace both inner o-ring dump seals and body o-ring seal. Repair kit part number 153-01-A-SF-RK. Lubricate the O-rings before installing them in the Toppedo tube and torque the bolt to 35 ft-lbs.



396-5750Y1 Renderings:

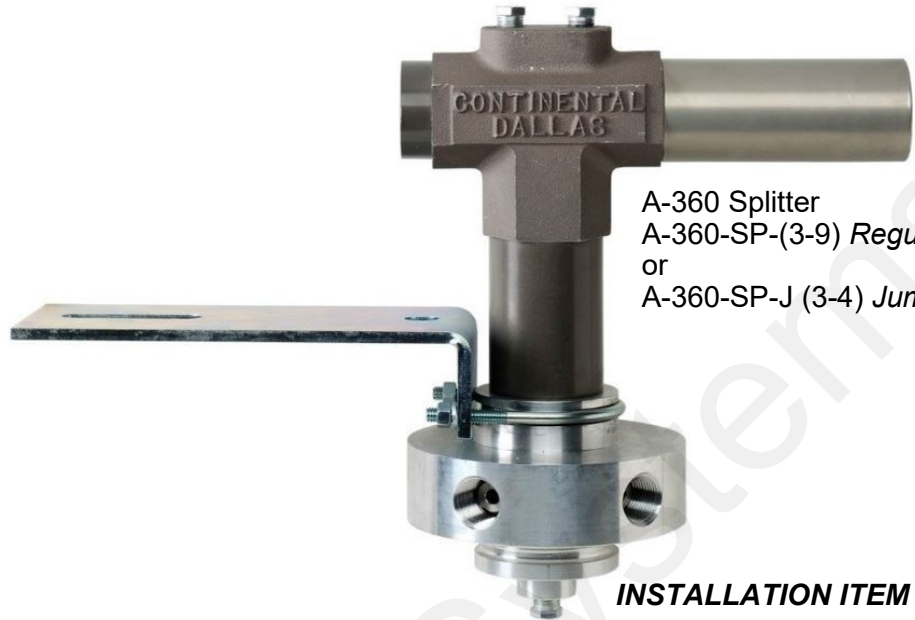




Manifolds and Splitters



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
Up to 12 GPM	Up to 9 GPM	A-360SP
12 to 25 GPM	9 to 18 GPM	A-360SP-J

**NH₃
GPM per
outlet**

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

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

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

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

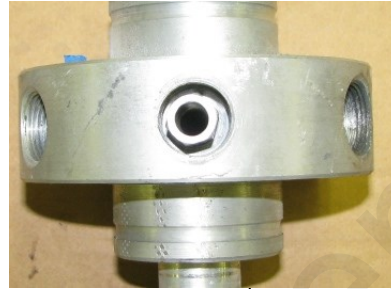
A-360SP Splitter

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.

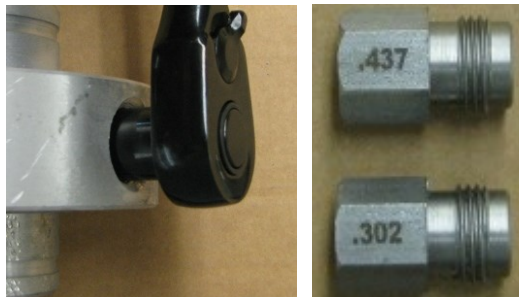


Threaded orifice not installed



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**

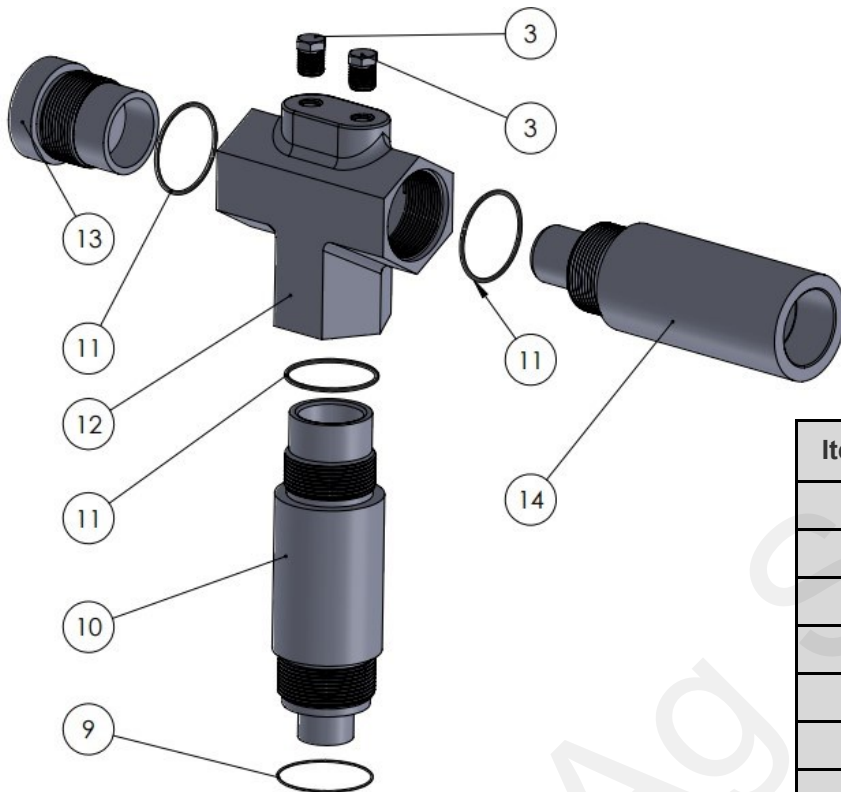
Gallons per minute ÷ number of manifolds = **GPM per outlet**

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

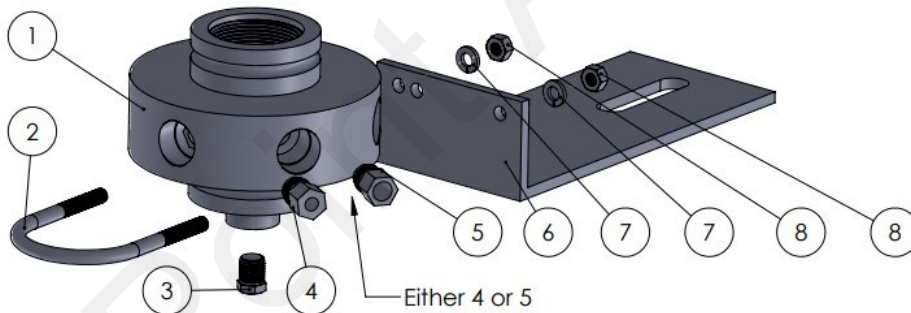
As a general guideline, manifold pressures greater than 2/3 of tank pressure may restrict total system flow. Manifold pressures less than 30 PSI may result in increased row-to-row variation. Manifold pressures will change as rate, speed, and tank pressure (temperature) change.

Large Continental A-360 NH3 Splitter - 6 of 3/4" Outlet - **P/N: 152-A-360SP-06**

*** Repair Kit P/N: 152-01-A-360SP-RK**



Item No.	Part Number & Description	Qty.
3	A-1135	2
9	*360-SP-134	1
10	360-SP-LI	1
11	*360-T-132	3
12	360-SP-T	1
13	360-SP-UCC	1
14	360-SP-UI	1

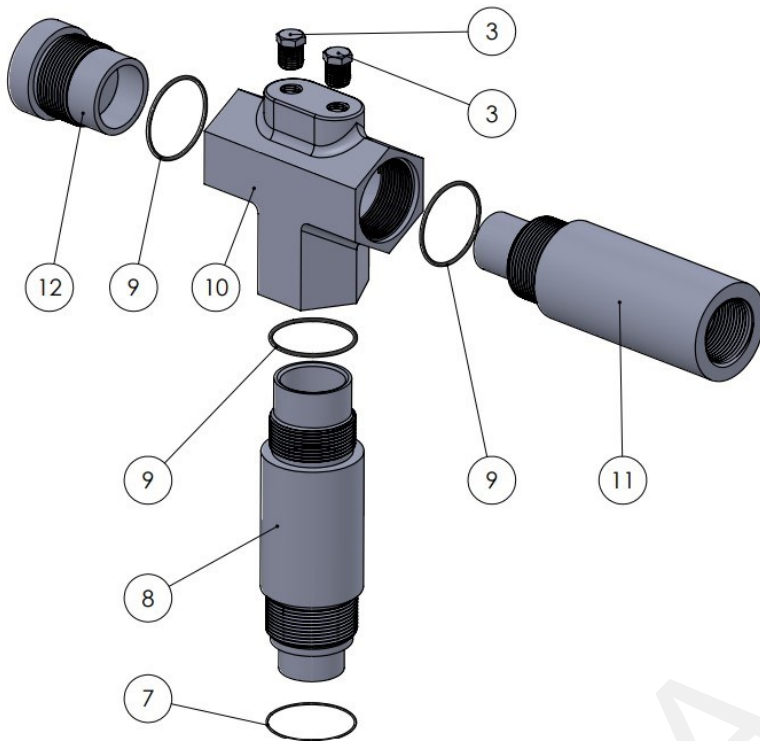


Item No.	Part Number & Description	Qty.
1	360-SP-(3-9)	1
2	360-SP-U	1
3	A-1135	1
4	360-SP-302	6
5	360-SP-437	6
6		1
7	320-05 5/16" Nut	2
8	331-05 5/16" Lock Washer	2

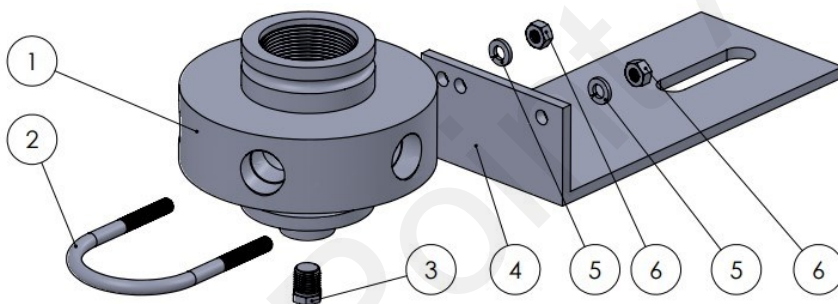
For additional parts drawings or product manuals, go to continentalnh3.com/product-manuals.html.

Continental Jumbo A-360 NH3 Splitter - 6 of 3/4" Outlet - **P/N: 152-A-360SP-06-J**

*** Repair Kit P/N: 152-01-A-360SP-RK**

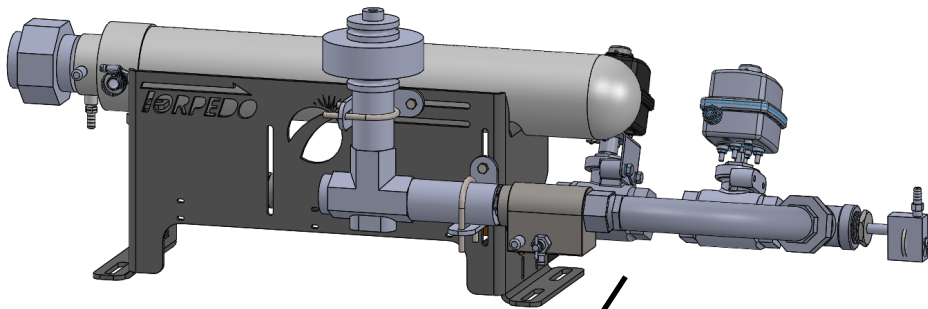


Item No.	Part Number & Description	Qty.
3	A-1135	2
7	*360-SP-134	1
8	360-SP-J-LI	1
9	*360-T-132	3
10	360-SP-T	1
11	360-SP-J-UI	1
12	360-SP-UCC	1

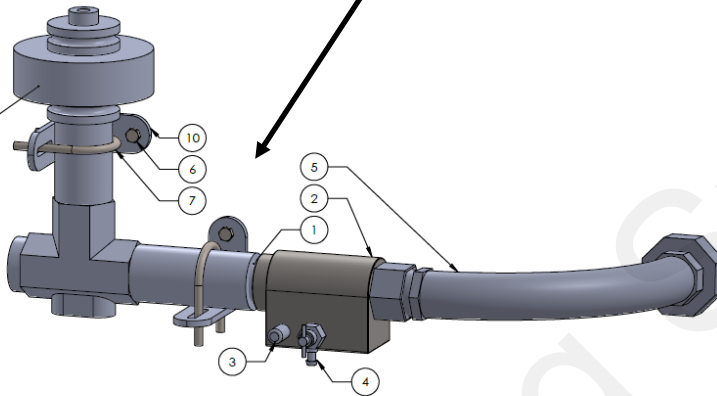


Item No.	Part Number & Description	Qty.
1	360-SP-J-(2-5)	1
2	360-SP-U	1
3	A-1135	1
4		1
5	331-05 5/16" Lock Washer	2
6	320-05 5/16" Nut	2

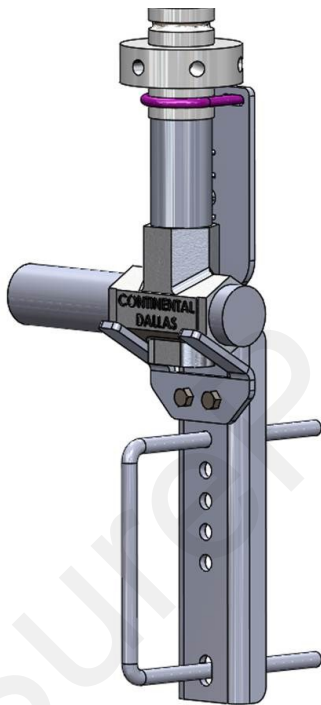
Splitter-mounted to Torpedo or mounted remotely



398-10-2811Y1
(Splitter Orifice
Information Tag)



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



A-360 Bracket Kit 159-11-100500

ITEM	PART NUMBER	DESCRIPTION	QTY
1	150-125NIP-SH-	Seamless Sch 80 Black Iron - 1-1/4" x	1
2	153-A-14BC	1-1/4" NH3 Check Valve	1
3	153-A-400-B	1/4" RELIEF VALVE - 250 PSI	1
4	153-A-411-HB	Remote Bleed Down Valve with 3/8" Hose	1
5	283-125-5699Y1	New Victaulic Torpedo SS Braided Hose	1
6	300-050100-SS	5/16" x 1" HCS SS	4
7	302-0502040308	5/16" x 2-1/4" Round Bend U-Bolt	2
8	323-05-SS	5/16" Flange Nut SS	4
9	398-10-2811Y1	A-360 Splitter Orifice Info Tag BOM	1
10	462-2721Y1	Splitter Support Bracket	2

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

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# NH ₃	Up to 127# NH ₃	A-360MA-W
170-422# NH ₃	127-316# NH ₃	A-360MA-C
Above 422# NH ₃	Above 316# NH ₃	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.

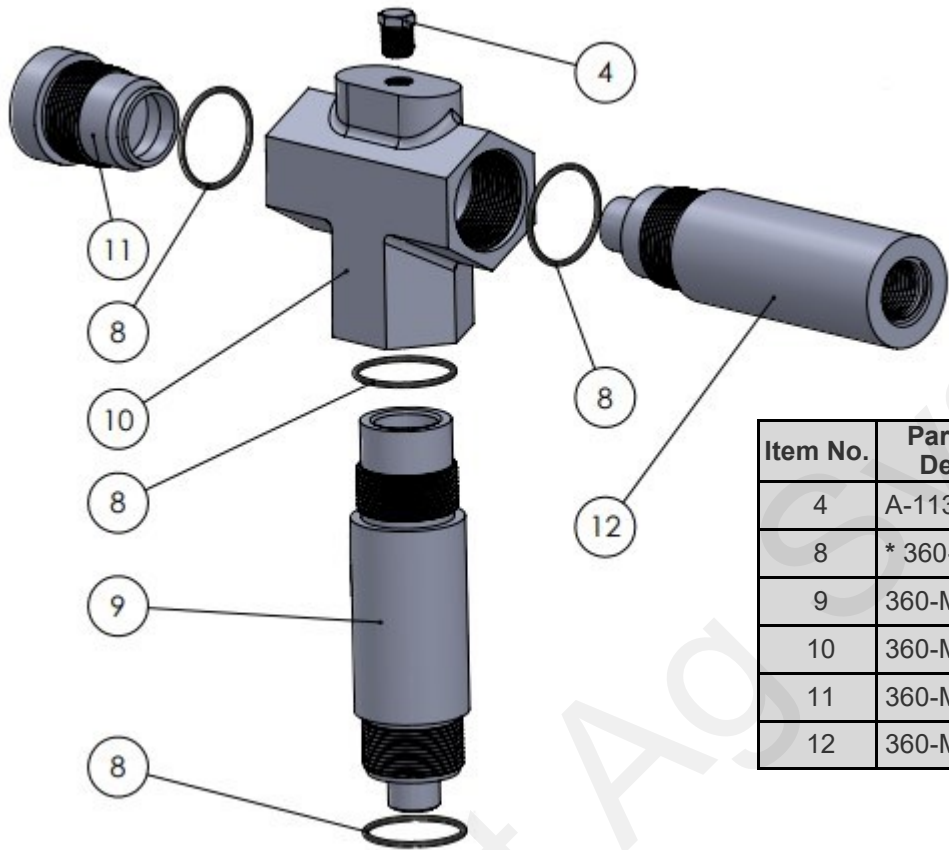
As a general guideline, manifold pressures greater than 2/3 of tank pressure may restrict total system flow. Manifold pressures less than 30 PSI may result in increased row-to-row variation. Manifold pressures will change as rate, speed, and tank pressure (temperature) change.

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.

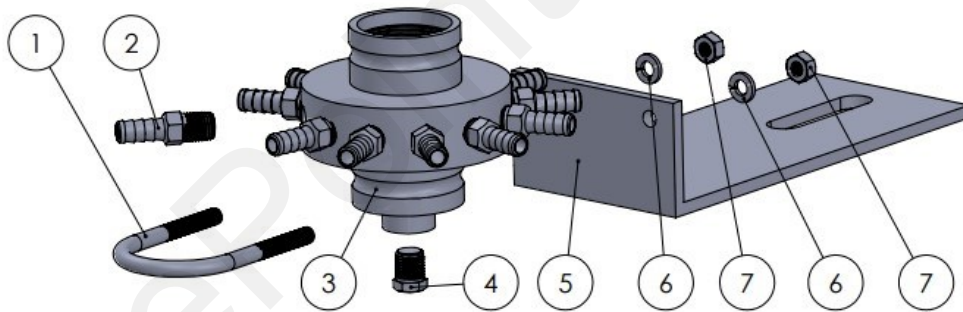
See the complete Continental NH₃ Products *Installation, Operation, Repair and Maintenance Instructions* that came with the splitter and manifold for further tips and information.

Continental A-360 NH3 Manifold -Large - 12 of 3/8" HB Outlet **P/N: 152-A-360-MA-C-12A**

***Repair Kit P/N: 152-01-A-360MA-RK**



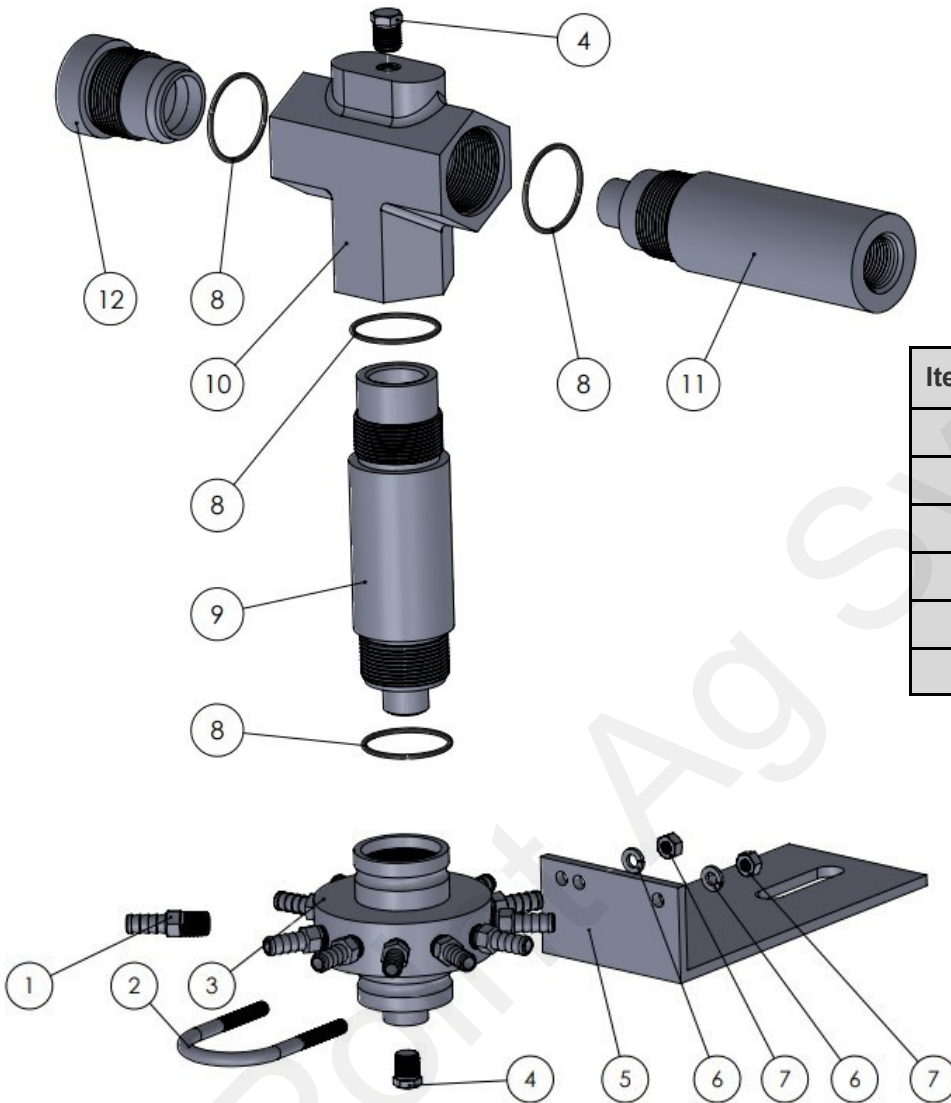
Item No.	Part Number & Description	Qty.
4	A-1135	1
8	* 360-MA-130	4
9	360-MA-LI-C	1
10	360-MA-T	1
11	360-MA-UCC	1
12	360-MA-UI-C	1



Item No.	Part Number & Description	Qty.
1	360-MA-U	1
2	1132SS-201	12
3	360-MA-C-WP	1
4	A-1135	1
5		1
6	331-05 5/16" Lock Washer	2
7	320-05 5/16" Nut	2

Jumbo - P/N: A-360MA-J-12A

***Repair Kit P/N:152-01-A-360MA-RK**



Item No.	Part Number & Description	Qty.
4	A-1135	1
8	* 360-MA-130	4
9	360-MA-LI-C	1
10	360-MA-T	1
11	360-MA-UI-C	1
12	360-MA-UCC	1

Item No.	Part Number & Description	Qty.
1	1132SS-234	12
2	360-MA-U	1
3	360-MA-C-WP	1
4	A-1135	1
5		1
6	331-05 5/16" Lock Washer	2
7	320-05 5/16" Nut	2

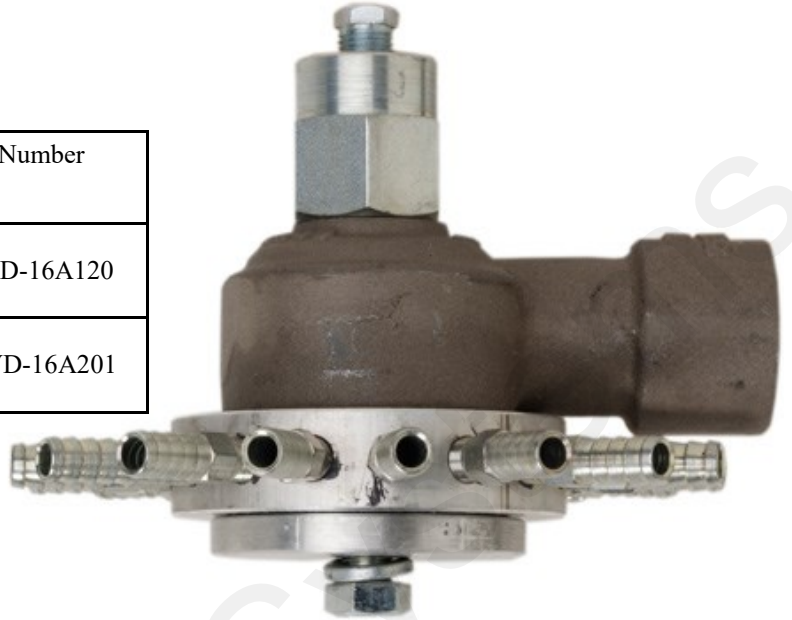
Optional Vertical Dam Manifold

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.

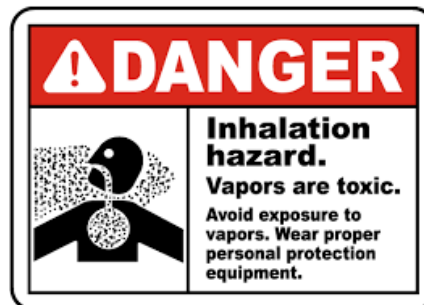
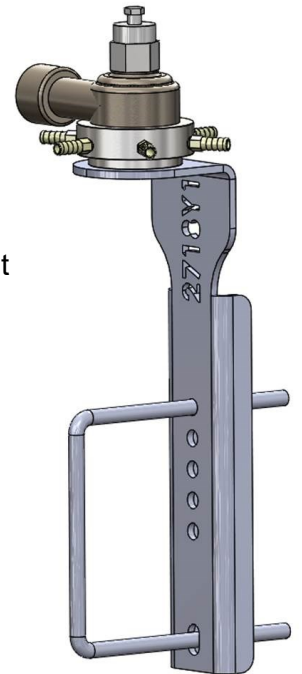


Features of A-MVD Vertical Dam Manifold

- 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

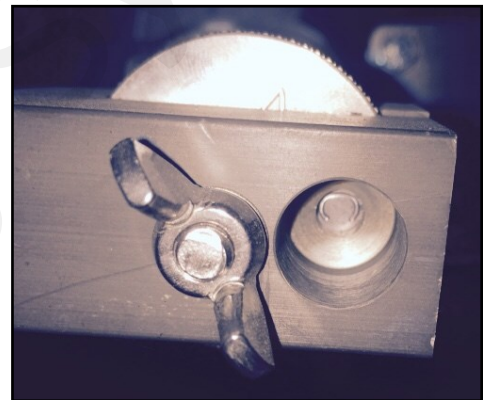
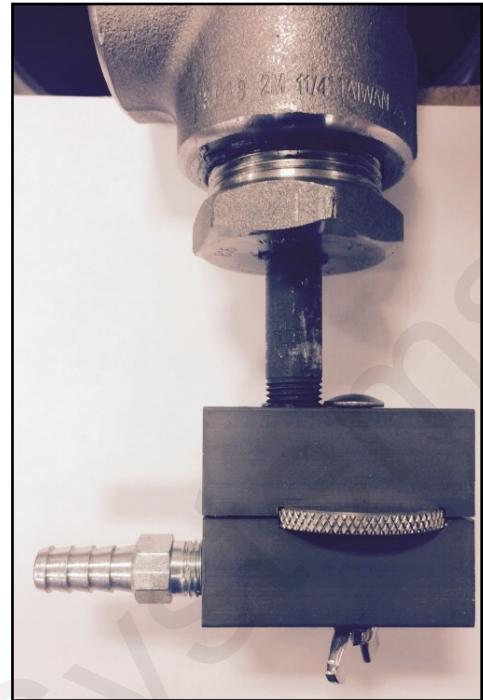
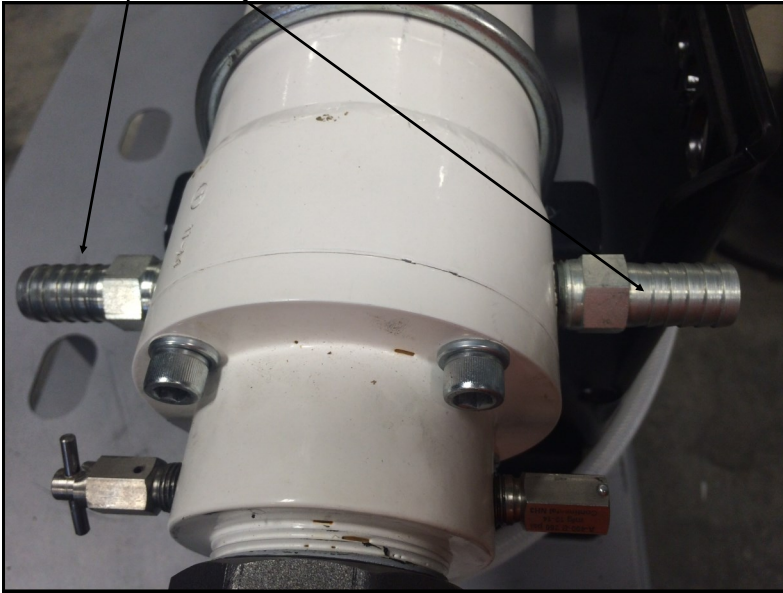
As a general guideline, manifold pressures greater than 2/3 of tank pressure may restrict total system flow. Manifold pressures less than 30 PSI may result in increased row-to-row variation. Manifold pressures will change as rate, speed, and tank pressure (temperature) change.

MVD Bracket Kit
159-11-200500



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.*

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.

$(\# \text{ N per acre}) \times \text{speed} \times \text{width} / 2090.6 = \text{GPM}$
 ("D" orifice is only for users having problems with N-Serve plugging up the heat exchanger.)

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

Flowmeter 204-02-5533Y1
Raven Grooved End Turbine NH3 Flowmeter with 3-pin MP 150 shroud



148 pulses per gallon

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:

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

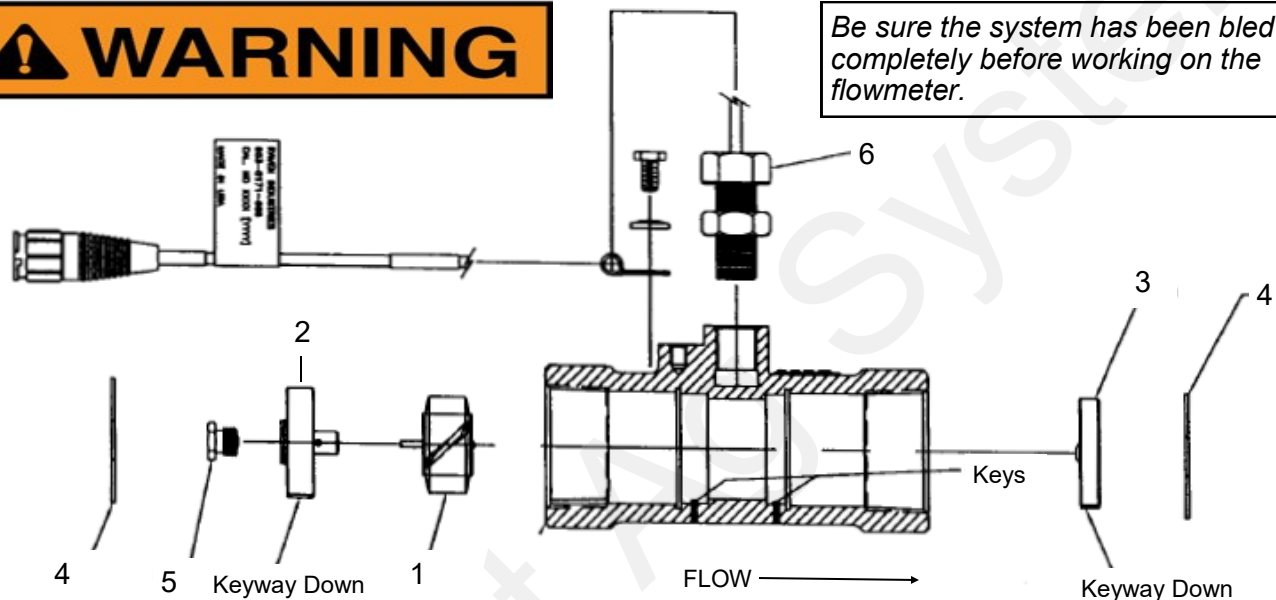
(If you need MORE, INCREASE the flow calibration number. If you need LESS, DECREASE the flow cal.)
See the next page for flowmeter parts, repair and maintenance.

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



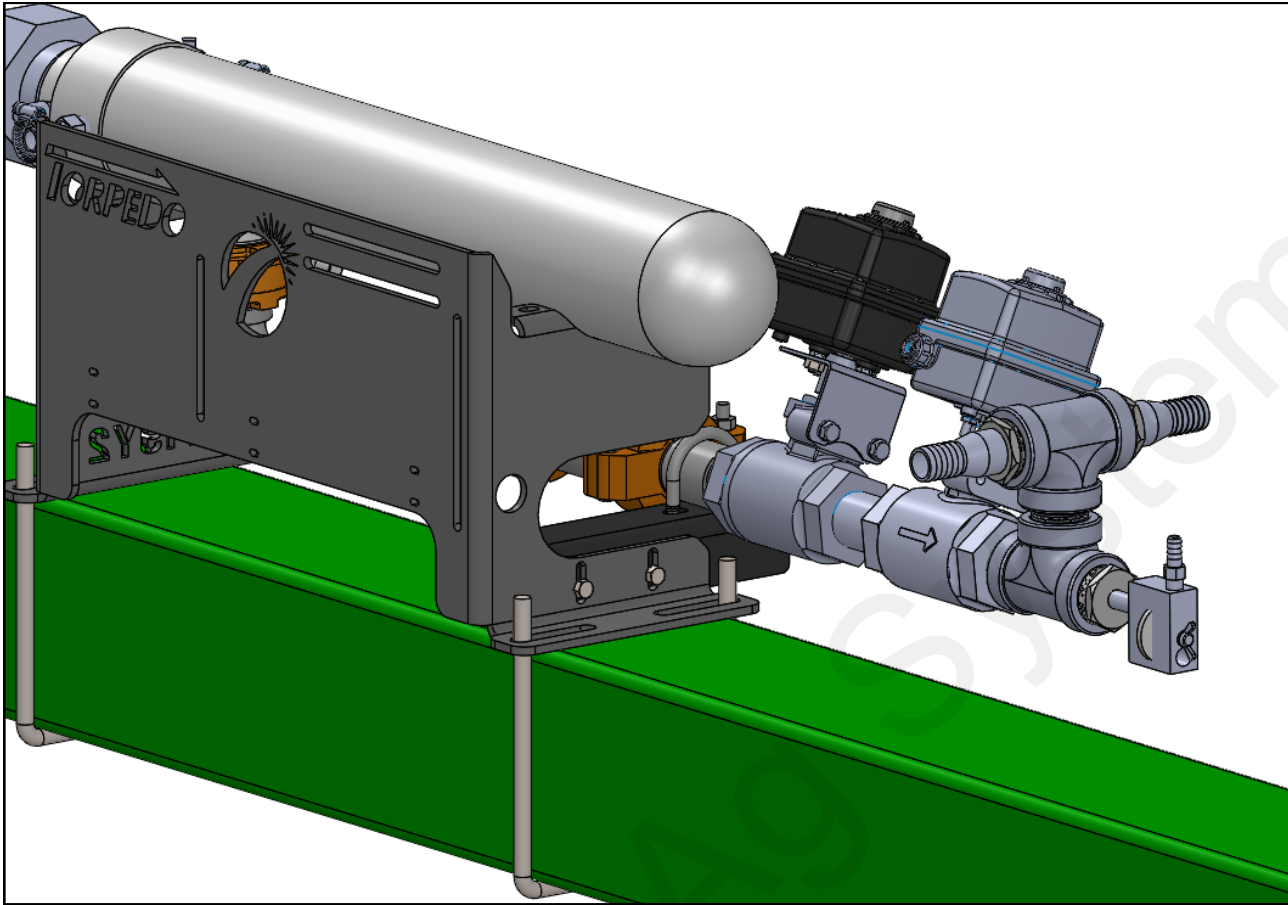
Be sure the system has been bled completely before working on the flowmeter.



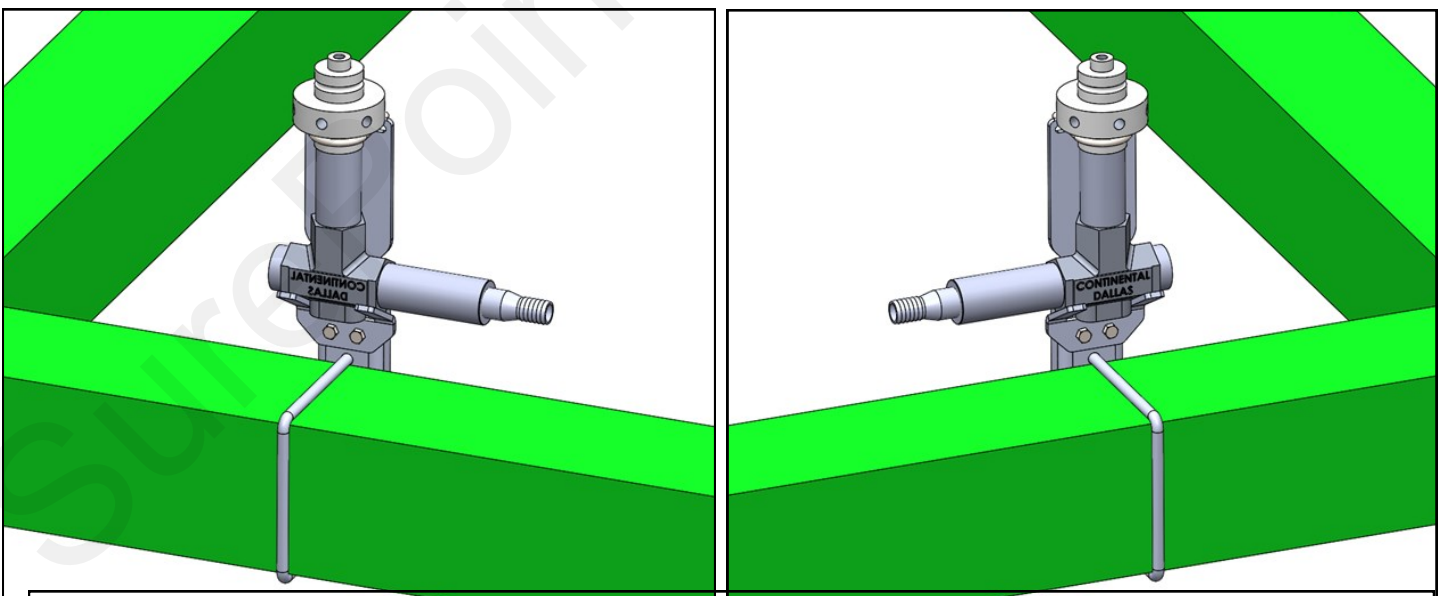
RFM 60S Flowmeter Maintenance and Adjustment Procedure

1. Be sure all 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.

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



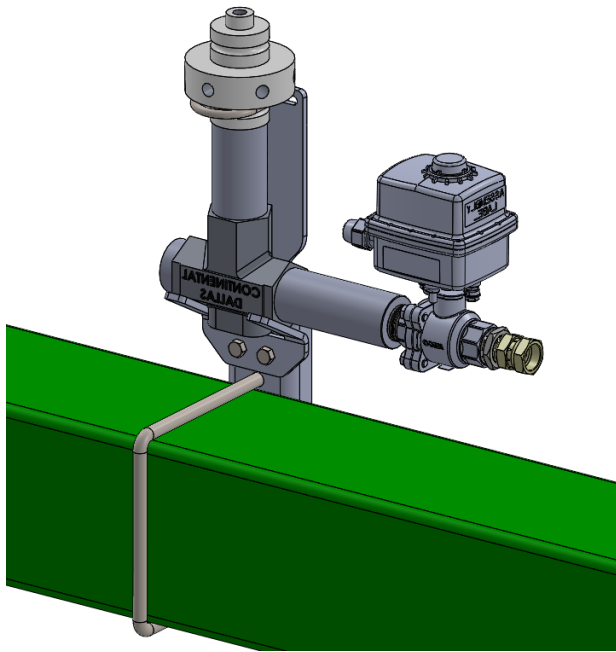
To split the flow to 2 manifolds a Tee is used. If going to 2 manifolds with no electric section valves 1" reinforced EVA hose is used (equal length to each manifold).



Safety Reminder

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

Electric 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)

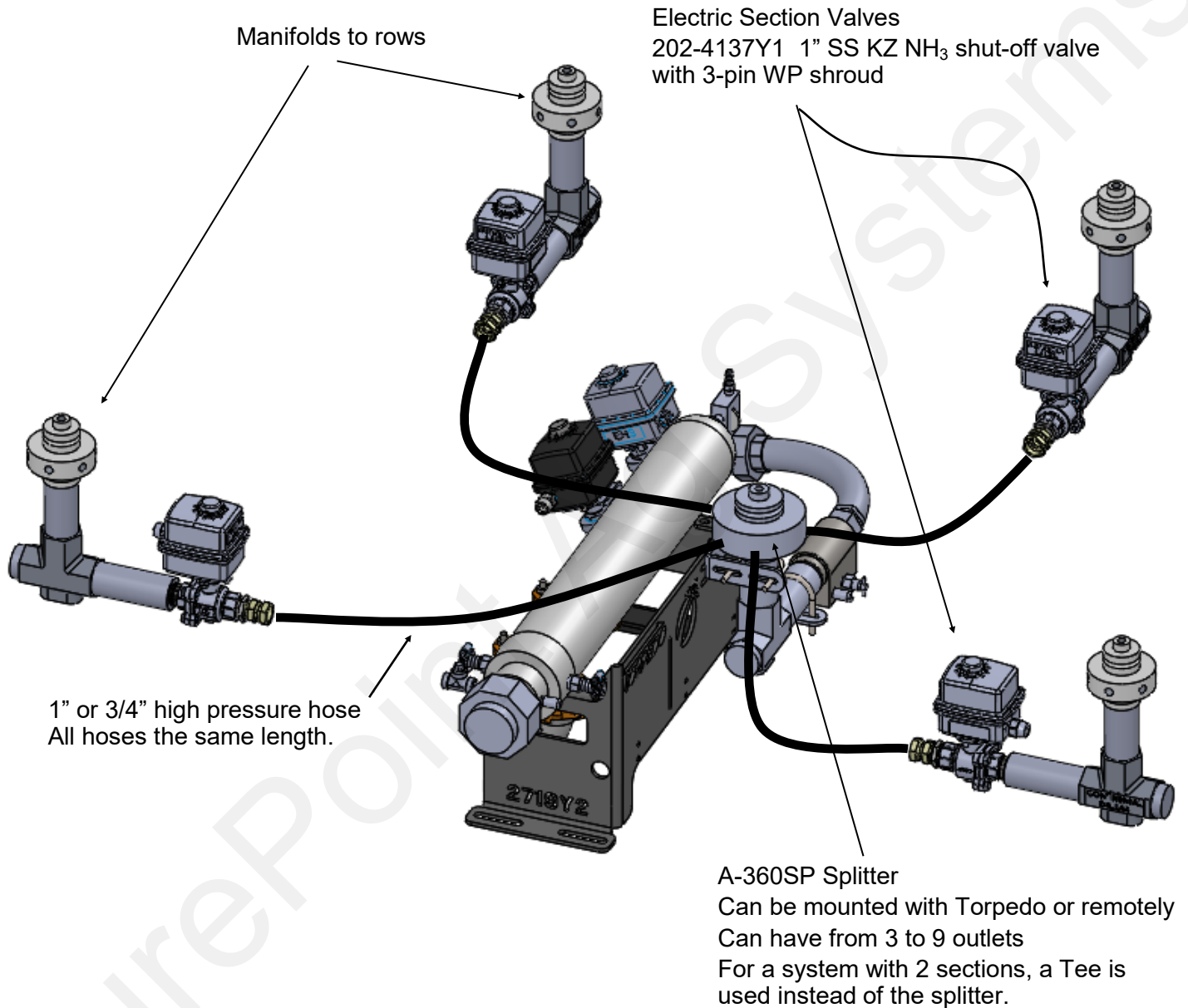
Or

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)

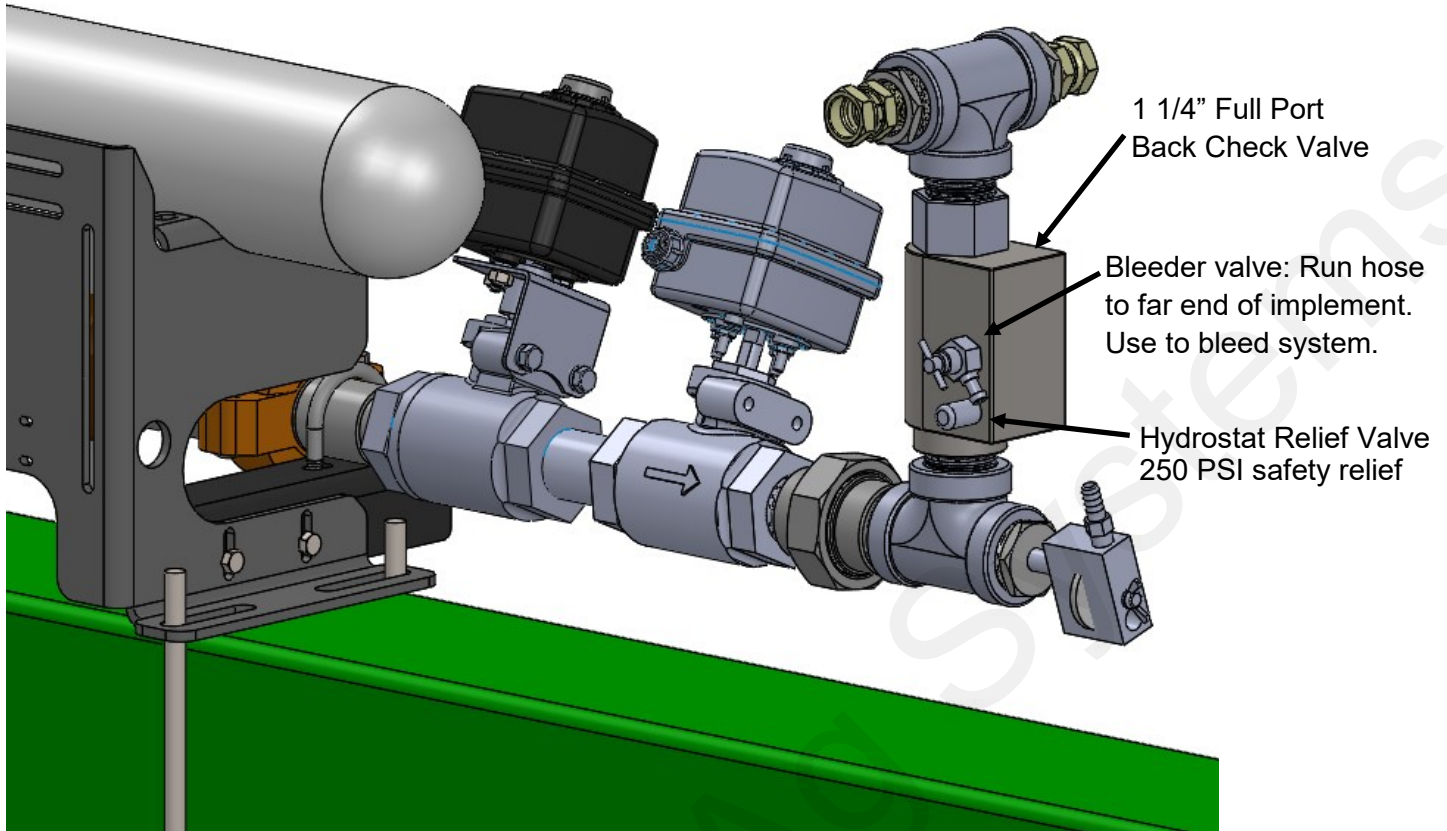
Electric Valve Kits for doing multiple sections

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.

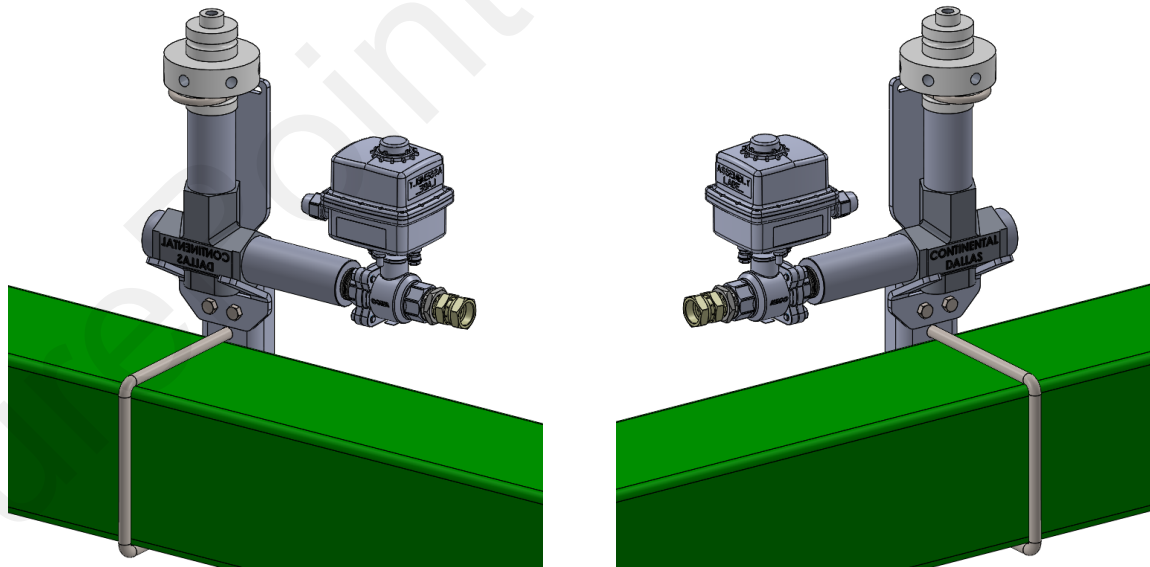


Safety Reminder
Make sure the nurse tank has 5 gallons of fresh clean water.

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)

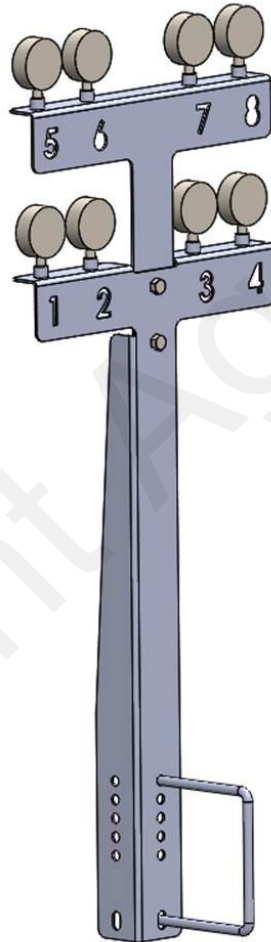
159-11-500500 Black Gauge Tree Kit for 1-4 gauges with 7x7 u-bolt

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.



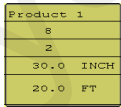
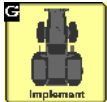

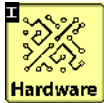

Sentinel Setup and Configuration

Set-up and Configuration for Rate Control

The following pages will guide you through the initial set-up and configuration of your Sentinel system for Rate Control. Below is an overview of the steps necessary to fully configure the system before operation. Each subsequent page outlines the page features as well as the sequence of buttons used to navigate to that page from the HOME screen.

Basic Steps for Initial System Set-up for Rate Control

For detailed information on a step, go to the referenced page

REFERENCE Page #	STEP	
	1.	Press the HOME button 
50	2.	Go to the settings page by touching the SETTINGS button 
50	3.	On the settings page, specify the number of products being monitored (maximum of 4)
50	4.	Configure each product by touching the PRODUCT button 
50-51	5.	Select DEVICE - NH3 Rate Control and set up each product with requested information for sections, rows, tolerance, etc.....
51	6.	Select MORE , select Rate Mode , enter Rate and Smoothing (10%).
51	7.	When finished, use the BACK arrow to go back to the SETTINGS menu.
52	8.	Set up the implement dimensions by touching the IMPLEMENT button. 
52	9.	Choose a speed source by selecting the SPEED button. 
52	10.	Select system control options (task control, lift switch, etc.) under HARDWARE . 
53	11.	RATE SETUP - Select the Rate Mode Rx or User Def and enter Rates. 
54	12.	RATE CONTROL SETUP (Control Speed, Flow Cal, PWM Settings, etc..)and OPERATION information
	13.	Customizable Toolbar and Totalizer Counters
	14.	Rate Control Operation and Setup Summary

Sentinel Setup and Configuration

Home Screen Navigation for Rate Control

Sentinel Home Screen for Rate Control.

Identifies this screen as showing Product 2.

If an implement height switch is plugged into the Sentinel harnessing, there is an arrow showing the current implement height status.

Target and Actual Rate shown. Green buttons indicate product is ON.

Operate, Setup, & Diagnostic tabs for Rate Control setup, operation, and troubleshooting diagnostics.

BUTTONS: Wheat & Row Bar

The wheat button takes you to the Multi-Product RUN SCREEN (below). This button appears on the right side of the screen. Pressing it puts the Operate > Setup > Diagnostic view on the bottom third of the screen, with the Rate Control information in the center section (see above).

The SENTINEL ROW BAR button appears when using Row Flow Monitoring. If using Rate Control without Row Monitoring, this button will not be used.

Customizable Toolbar (Screen Settings)

Touching this gear button will allow you to set up the icons on this **Customizable Toolbar** row of the screen. When you press this button you will see three rows of icons. The top row shows what is on your screen now. To change an icon, press on that icon on the top row and then press on the icon you want there on the 2nd or 3rd row. Click OK.

Toggle between product screens by touching the **NEXT PRODUCT** button.

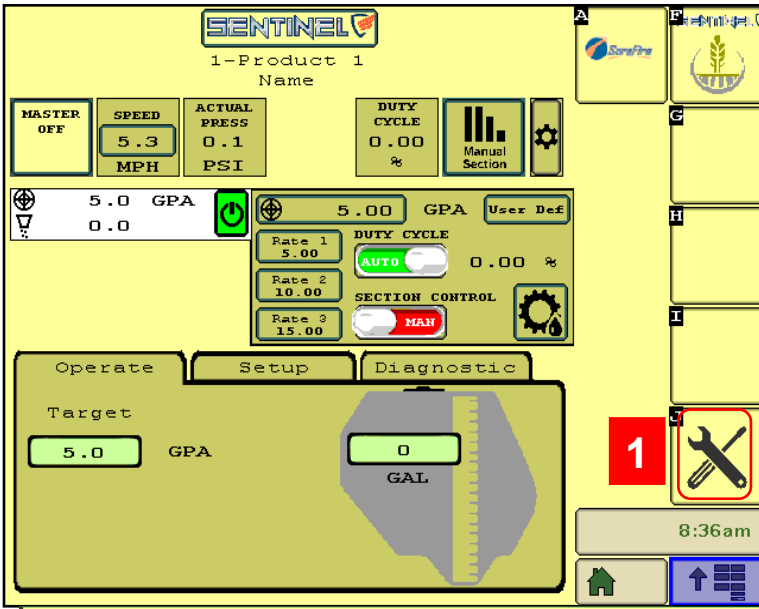
The **SETTINGS TOOLS** button will be used to access the system configuration pages for Product setup and to change individual product alarm, tolerance, and rate settings.

The **MASTER ON/OFF** button enables and disables the Sentinel system. This must be **GREEN (MASTER ON)** for Sentinel to work.

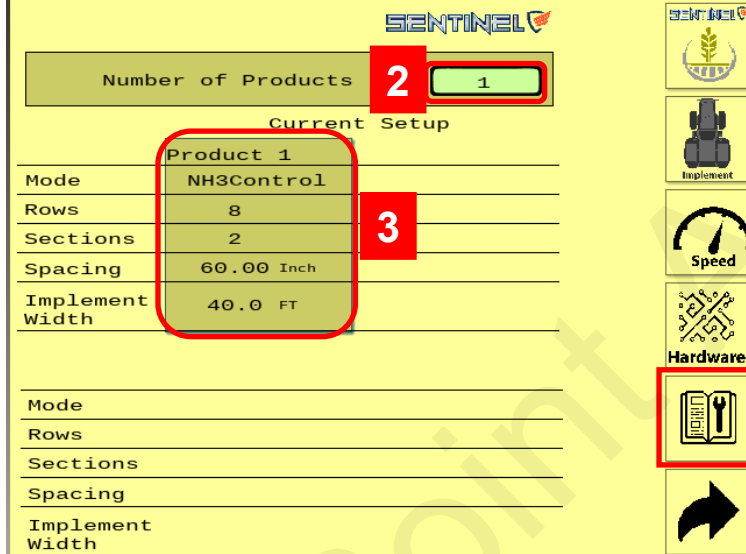
ARROW indicates implement position when using Implement Switch with Sentinel



SETUP for Rate Control - Settings - Product Setup - Device Type



1.) Press the **SETTINGS** Tools button to go to the System Configuration screens.



2.) Enter the **number of products** that will be monitored or controlled with the Sentinel.

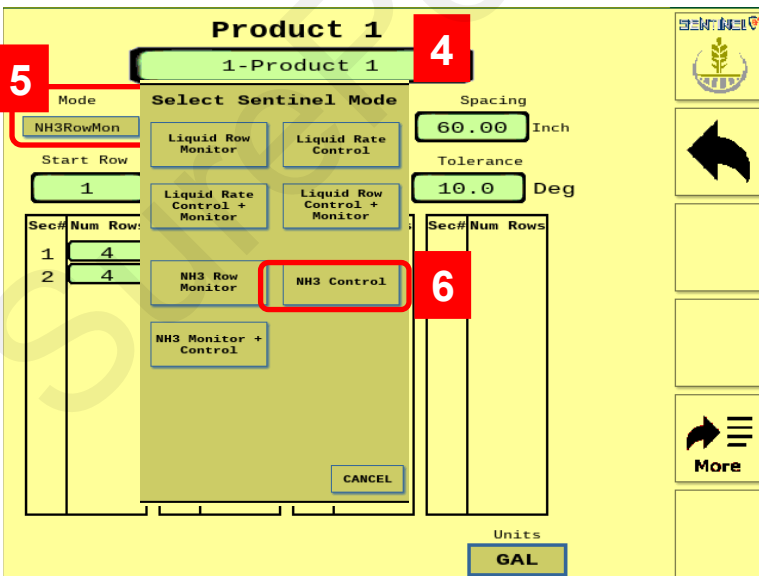
3.) Press the big **Product 1** box.

(If the system has two products, there will be a Product 2 box to the right of Product 1. Set up Product 2 in a similar fashion to what is shown for Product 1.)



Versions 1.4.0 and later will have the **SETUP GUIDE** button.

Press the **SETUP GUIDE** and you will be navigated through the setup screens.



4.) Enter a name for the Product.

5.) Press the box under **“Mode”**.

6.) Select **“NH3 Control”** to use the Sentinel ECU to do rate control for the NH3 system.

SETUP for Rate Control - Product Setup - Rate Mode Setup -

- 7.) Enter the number of **ROWS** for this product.
- 8.) Enter the number of **SECTIONS** for this product.
- 9.) Enter the row spacing in **INCHES**.
- 10.) **Start Section** = 1 for Product 1.
Product 2 Start Section will typically be 1 more than the number of sections on Product 1.
- 11.) Enter **Implement Width** in FT.
- 12.) **Tolerance** - start at 10%. This only applies when using NH3 Temperature Monitoring
- 13.) Verify the number of rows in each section.
- 14a.) Check this box for **Metric Units**.
- 14b.) Press **More** to go to the next screen.

Product 1
1-Product 1

Mode: NH3RowMon | Total Rows: 8 | Sections: 2 | Spacing: 60.00 Inch

Start Row: 1 | Implement Width: 40.0 FT | Tolerance: 10.0

Sec#	Num Rows	Sec#	Num Rows	Sec#	Num Rows	Sec#	Num Rows
1	4						
2	4						

Units: GAL

More

- 15.) See below: **Rate Mode** - For rate control, set this to **Rx** (for prescriptions) or to **User Def** to enter preset rates. Enter the main target rate in **Rate**.

- 16.) **Smoothing** - Start with 10%. If the actual rate at any time is within this % of the Target Rate, the display will show the Actual Rate as being equal to the Target Rate.
- 17.) You can enter up to 3 user-defined rates. These can also be entered on the Rate Setup screen.
- 18.) **Rate for Outside Rows** is typically "X 1.0".
Some applications may be "X 0.5" (half-rate) or "X 1.5" (rate and a half) for outside rows.
- 19.) **Control Integral** - 5.00
- 20.) Press the **Back Arrow**.

Product 1
1-Product 1

Rate Mode: User Def | Rate: 100.00 | Rate Smooth: 10%

Avg: Rx | Totals: Row Smooth: 10%

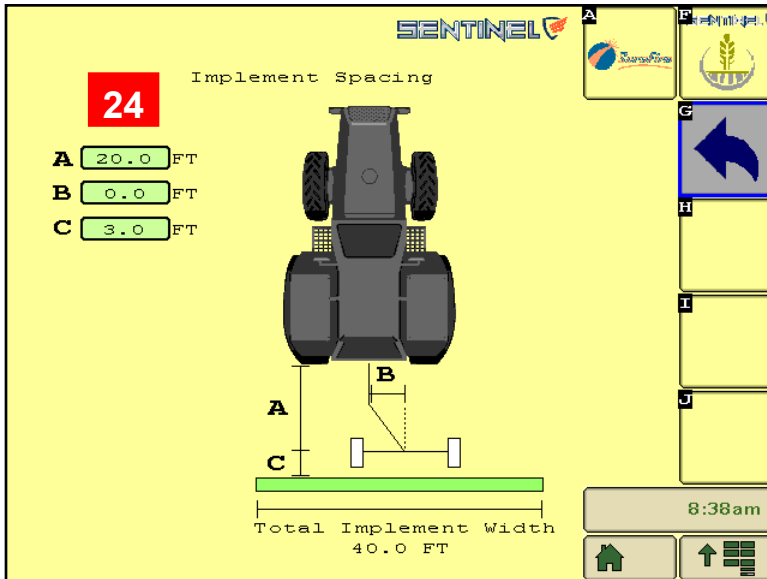
User Defined Manual Rates: 100.00 | 150.00 | 200.00

Outside Row Rates: First: X 1.0 | Last: X 1.0

Control Integral (Ki): 5.00

Back Arrow

SETUP for Rate Control and Temperature Monitoring - Implement - Speed - Hardware

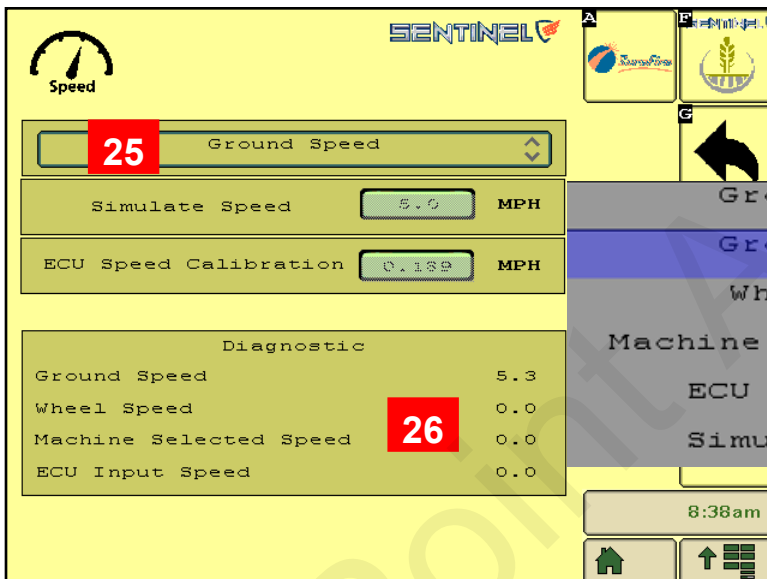


24.) Press **Implement** to enter and verify the Implement geometry.

The Implement dimensions are used when Task Control is enabled. Task Control is normally enabled for Rate Control. Task Control is needed for Section Control and Mapping.

A = distance from Hitch to implement pivot (axle)
 B = implement offset (left or right)
 C = distance from Implement pivot (axle) to application point
 (This combines with the geometry set up in the controller for the position of the GPS in relation to the hitch)

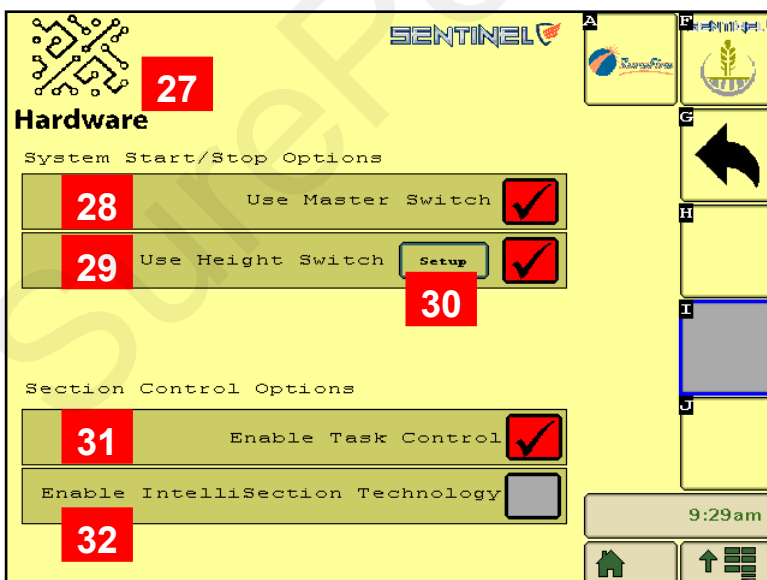
Press the Back Arrow when finished.



25.) On the right side, Press **Speed**.

Press the top box to select the Speed Source. This is typically Ground Speed.

26.) Look at this box while moving to see which speed sources are reporting.



27.) On the right side, press **Hardware**.

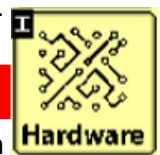
28.) **Use Master Switch** - check this box if a dedicated Master Switch (Foot Switch) is plugged into Sentinel. Quite often used for Rate Control.

29.) **Use Height Switch** - Check this only if the Sentinel has a dedicated height switch. Quite often used for Rate Control.

30.) **Setup** - to set up a height sensor or to change orientation of switch.

31.) **Enable Task Control** - normally used for Rate Control. Also, must activate Task Control on display.

32.) **Enable IntelliSection Technology** - not usually used for Rate Control when Task Control is used.



SETUP for Rate Control - Rate Setup - 2 Products - Version Number - Auxiliary Settings

Product 1
1-Product 1

Rate: **33** User Def, 6.00, Rate Smooth: 10 %

Flow Adjustment: **34** 1.00, Reset Totals: **35**, Row Smooth: 10 %

User Defined Manual Rates: 6.00, 7.00, 8.00

Outside Row Rates: First X 1.0, Last X 1.0

Control Integral (Ki): 0.10

LiquiShift Enable:

LiquiShift A/B Close On Stop:

9:00am

33.) For Rate Control, the Setting should be **Rx** or **User Def**. Smoothing usually starts at 10%. You can enter a Target Rate here. Press **Presets** to enter up to 3 User-Defined rates.



34.) **Flow Adjustment** - Only used with Sentinel flowmeter modules.

35.) **Reset Totals** - Press to bring up Gallons, Time and Acres totalizers.

35

Reset Total Volume: 107.5 GAL

Reset Total Time: 0.7 HR

Reset Total Acre: 15.58 AC

Done

SETUP for 2 products with Rate Control

SENTINEL

Number of Products: **2**

Current Setup

	Product 1	Product 2
Device	LiqRateCont	LiqRateCont
Rows	16	16
Sections	2	2
Spacing	30.0 INCH	30.0 INCH
Implement Width	40.0 FT	40.0 FT

Device: _____
Rows: _____
Sections: _____
Spacing: _____
Implement Width: _____

3:35pm

Product 2
2-Product 2

Device: LiqRateCont, Sections: 2, Total Rows: 16, Spacing: 30.0 Inch

Start Section: 3, Implement Width: 40.0 FT, Tolerance: 25.0 %

Sec#	Num Rows	Sec#	Num Rows	Sec#	Num Rows
1	8				
2	8				

Reset Total

Metric Units:

3:35pm

If you are setting up Sentinel to do Rate Control on 2 products your screen will look like this (above). You will need to go through the setup steps for both Product 1 and Product 2.

Auxiliary Settings Screen

37 Point Ag Systems

Sentinel ECU Version: V.1.1.4.4M

Sentinel ECU Serial #: 250184

008120000000000000000000BR549

A00A80005D40000A

0001D00D6E04A002

36

36.) Press the SureFire(Point) icon to see the Sentinel ECU version information.

37.) Press the square by the sunburst to see the **Auxiliary Settings Screen**. **DO NOT CHANGE** these unless directed by SurePoint Support.

Auxiliary Settings Screen

WARNING: Do not change without consulting with SurePoint Ag!

37

Rate/Target At Boom:

Rate/Target At Bin:

Rate/Target At Section:

Rate/Target At Row:

Bin Enabled:

Register As Sprayer:

Use Prod2 As Fan Control:

Use LS Conn For Press:

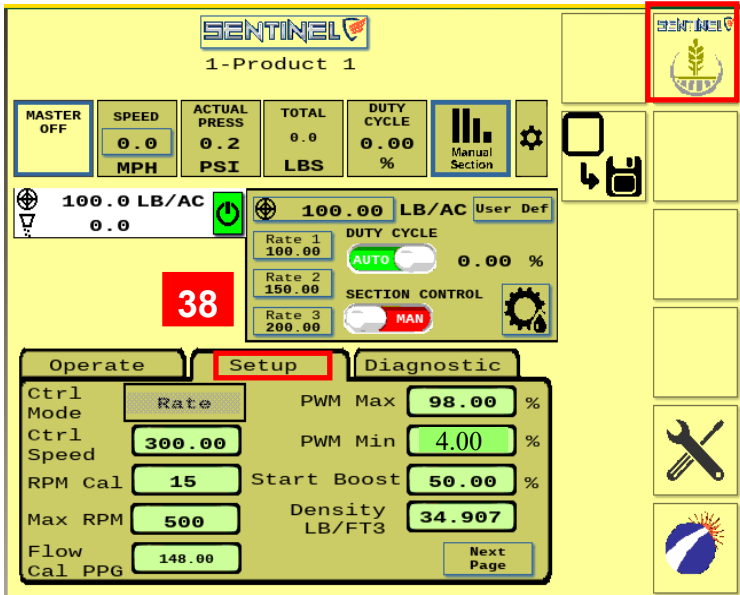
Simulate Flow (Demo):

Turn Compensation X Axis:

Bus Update Interv: 1000 MSEC

ENTER UNLOCK CODE | RESET CONTROLLER | DEFAULT SETTINGS

SETUP for Rate Control - SETUP - Control Speed - Flow Cal - PWM Max and Min



38. From the Sentinel HOME screen, press the center **SETUP** tab.

Start with the following settings. Adjust as needed.

Ctrl Mode - RATE

Ctrl Speed - 300.00

Adjust as needed in the field. Increase the Ctrl Speed if the rate is slow to adjust. Decrease the Ctrl Speed if the rate fluctuates and will not lock on to the rate going across the field. If you are seeing jumps of 5% or larger slow down the control speed.

RPM Cal - 15

RPM - 500

Flow Cal - 148

(Flow cal number is on serial number sticker on side of flowmeter)

PWM Max - 98.00%

PWM Min - 4.00%

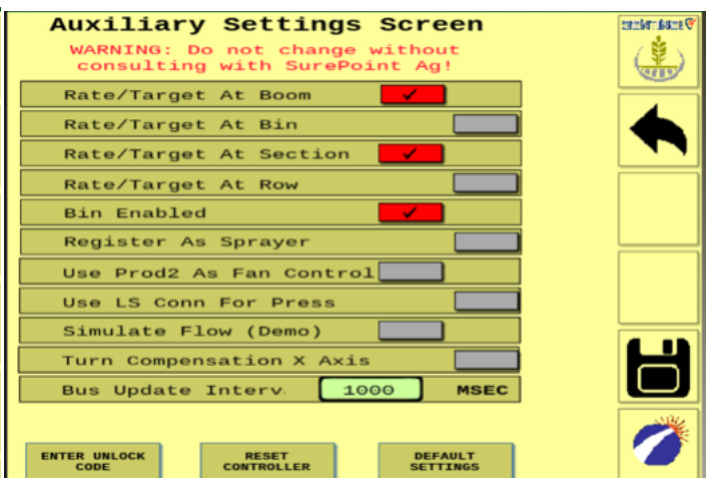
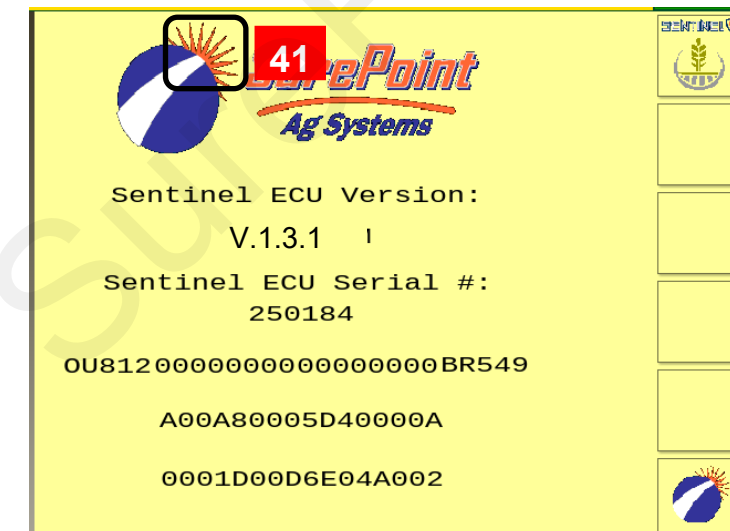
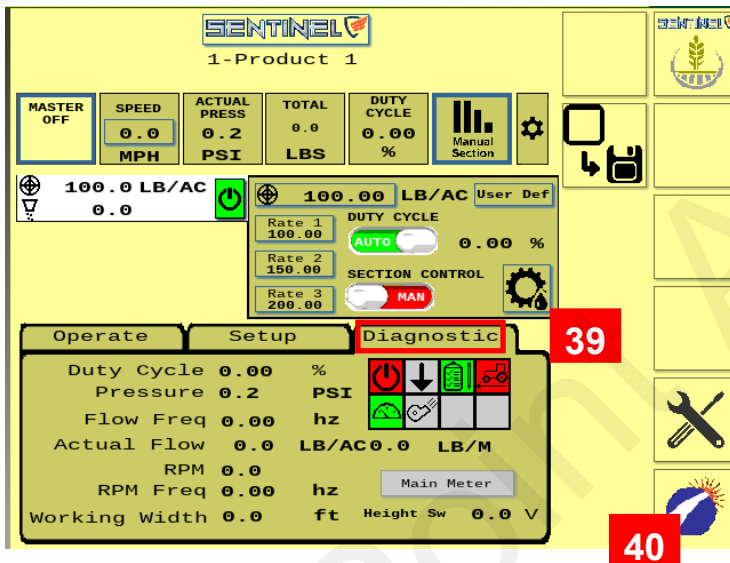
Start Boost - 50.00% so that the control valve can move to open or close

Density—Default is **34.907** to reflect lbs of N. If lbs of NH3 is desired, enter the density of NH3 —**42.57**. This will change rates and totals to NH3 instead of N (this includes the as applied sent to the display)

39. **DIAGNOSTIC TAB** - Observe the system parameters during operation.

40. Press SurePoint to see software version information.

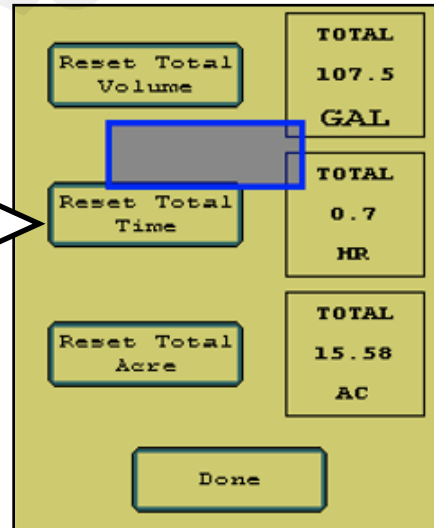
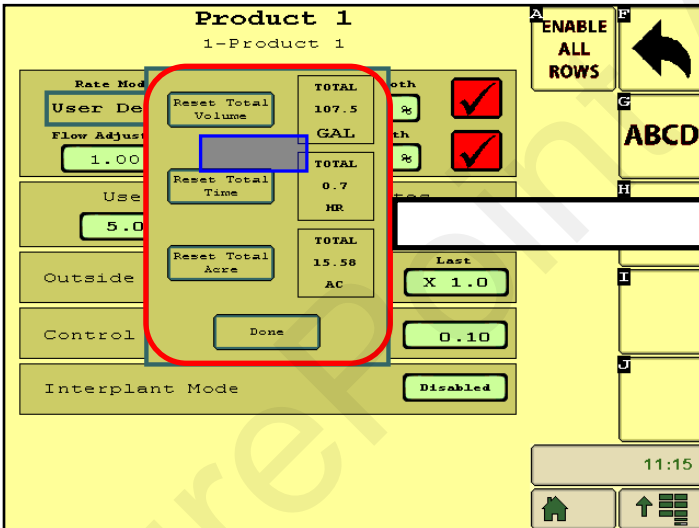
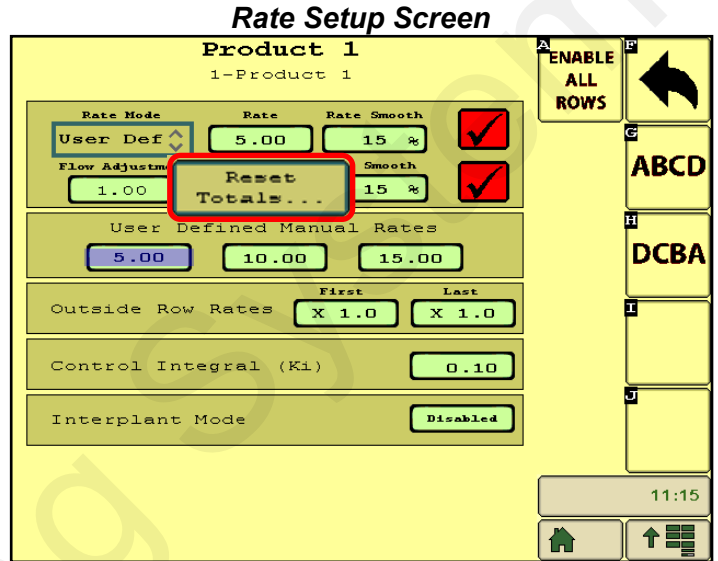
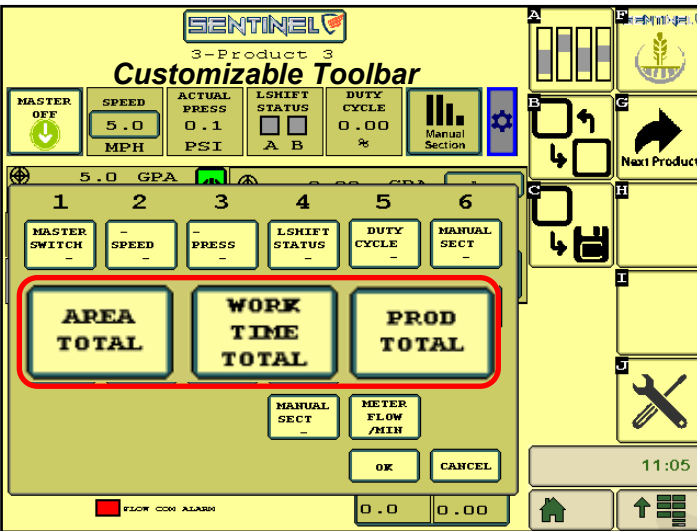
41. Press Sunburst for **Auxiliary Settings**. Normal Settings are Shown Below.



Customizable Toolbar & Totalizer Counters - Acres - Hours - Gallons

Sentinel has 3 totalizer counters to keep track of acres, hours, and gallons.

Any of these may be set up on the Customizable Toolbar near the top of the Product Run Screen. If these are not on the Customizable Toolbar, the values may still be seen by pressing the *Reset Totals* button on the Rate Setup screen. The items may be individually reset to 0 by pressing the Reset Total button for that item, or the totals may be left unchanged by returning to the Run Screen without resetting the values.



Push any of the **Reset** buttons to reset that total to 0.
To return without changing any of the totals, press **Done**.

Sentinel Rate Control Operation

Once the Sentinel has been set up in the display, little is required of the user to operate the Sentinel. The system can be started with an Implement Switch that will turn the system on when the implement is lowered. It can be turned on and off with a Master On/Off Switch (footswitch or on-screen). The system can also be turned on and off using Task Control to turn the system (or sections) on and off as the implement enters the field or overlaps previously applied areas using GPS location information.



Sentinel Wheat (Home) Button

On the HOME screen, the **top row (1)** is a Customizable Toolbar with options to display several different system parameters.

The **center section (2)** shows the Rate Control operation for each product. The user defined rates are available for selection on the go.

Center Section - If operating more than one product, the Target and Actual Rate for each product will be shown on the left side.

The **bottom section (3)** has 3 tabs. Watching the information on the Diagnostic tab will help the user become familiar with normal operating parameters. Knowing what is normal can help the operator diagnose and fix the issue if a problem occurs.

Normal operation is with Duty Cycle and Section Control set to AUTO.

To run, there must be SPEED, Height Switch down, Master ON, Product ON, target rate set, and a working width.

Toggle between Rate 1, 2, and 3 on the go, or press the top Target Rate box and

enter a different target. Press the gear/teardrop on the bottom right to go to the Rate Setup screen.

To operate manually, press **Speed**, enter a speed, select **DUTY CYCLE MAN**, enter a **DC%** (minimum of 15 for electric, minimum of 30 for hydraulic),

Section Control: MAN. Master: ON.

Height switch: DOWN (if used)

To test the system, you can change the Duty Cycle % as the pump is running. Observe the Flow (GPM) and Pressure with each Duty Cycle %. On an electric pump system, you can do this with one pump plugged in at a time to verify the operation of each pump. Look at the *Diagnostic* tab on the *Operate / Setup / Diagnostics* section for more information.

Sentinel HOME Screen for Rate Control

MANUAL Operation

PWM to Servo Module Diagnostics

If no lights are on the Module you need to check and see if you have power signal coming to the module.

The control status light on the PWM to Servo module can be used to determine what signal is being sent to the servo:

Normal Operations– yellow/blue changing as you go through the field

Red: Either master is off or the PWM signal is too low and the valve will remain in the same position. If the minimum PWM is being commanded, the minimum PWM setting may need adjusted up (.5% at a time)

Yellow: The valve is being commanded to shut

Blue: The valve is being commanded to open

Yellow/Blue/Red (quickly changing): The PWM isn't changing much, close to target, valve is closing/opening/stopping. If the minimum PWM is being commanded, the minimum PWM setting may need adjusted down(.5% at a time).

If a customer calls in on Sentinel NH3 control and they aren't on target rate but the rate is remaining steady we probably have a Minimum PWM signal that isn't correct. This will probably appear as a overrate issue and the duty cycle will show little to no change.

The issue is the PWM to Servo module thinks that it is in the correct position due to a margin of error in our module software and we have our minimum PWM set to low. Have them increase the minimum PWM .5% at a time until it makes correct rate. (Should be a red light if they can see it from the cab)

Duty Cycle Diagnostics-

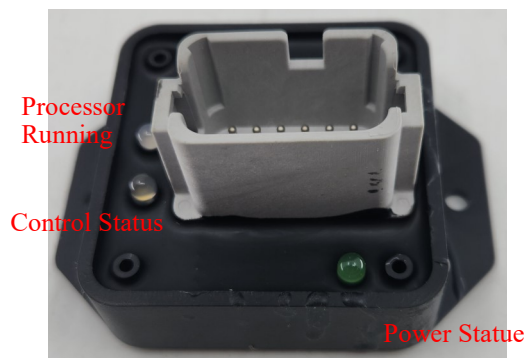
- *Little to no DC change = no valve change
- *PWM at max or making 2% changes means the valve should be opening
- *PWM at min or making -%2.....valve closing
- *PWM at 0 means no change and master should be off

Troubleshooting:

Before doing any of this, manually isolate NH3 flow from the system and follow proper bleed off procedure. Also can unplug our Master valve when closed. After this, the system can be started (simulate speed, etc if needed). Place duty cycle into manual and set PWM to the minimum percent. The module diagnostics light should show yellow and the valve should close. Adjust duty cycle to max and the module diagnostics light should go blue and the valve should open.

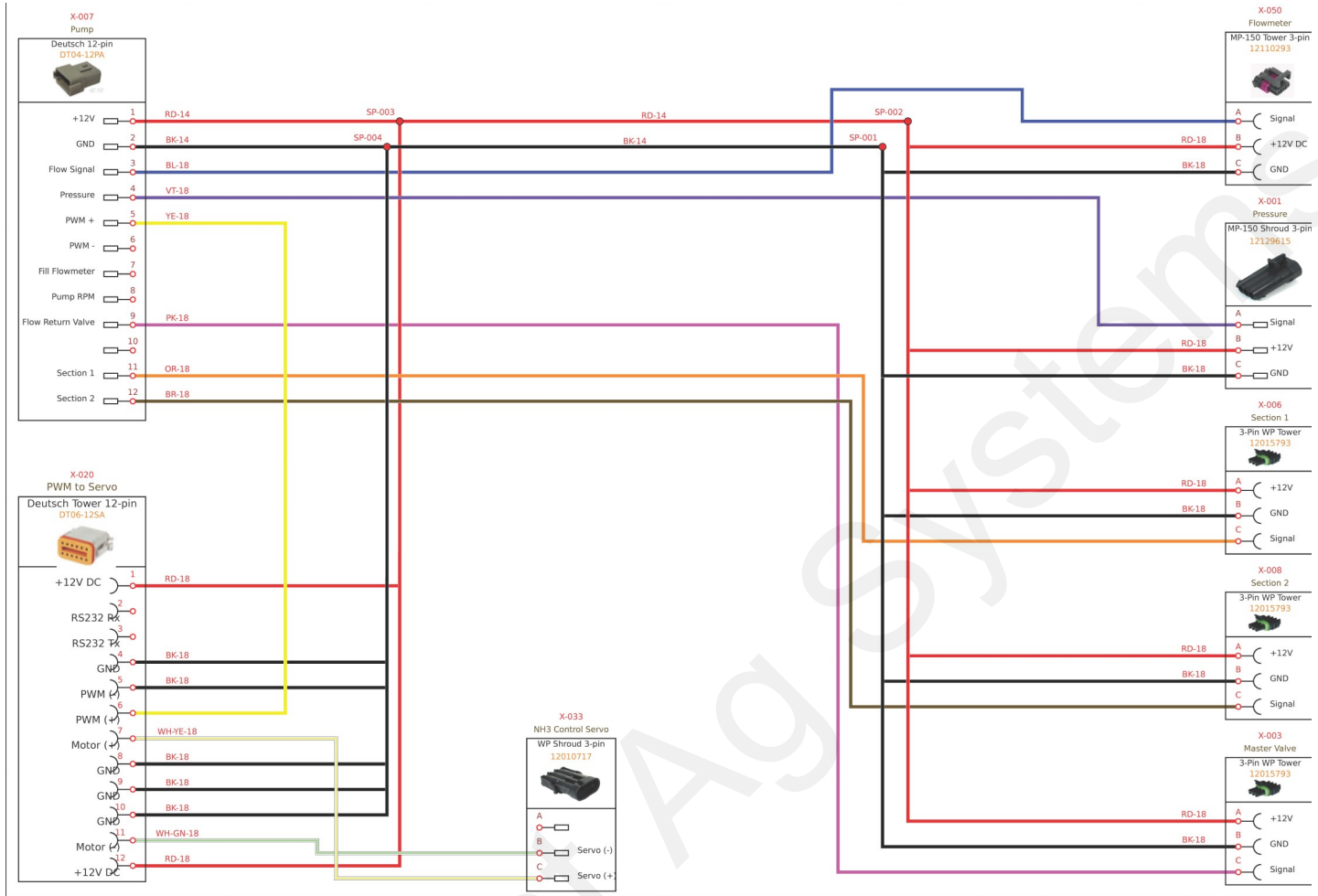
(1.5.0 will have a + and – button instead of a percentage and they can be pushed to test diagnostics light and actuation).

PWM to Servo Module
Part Number 208-06-5566Y1



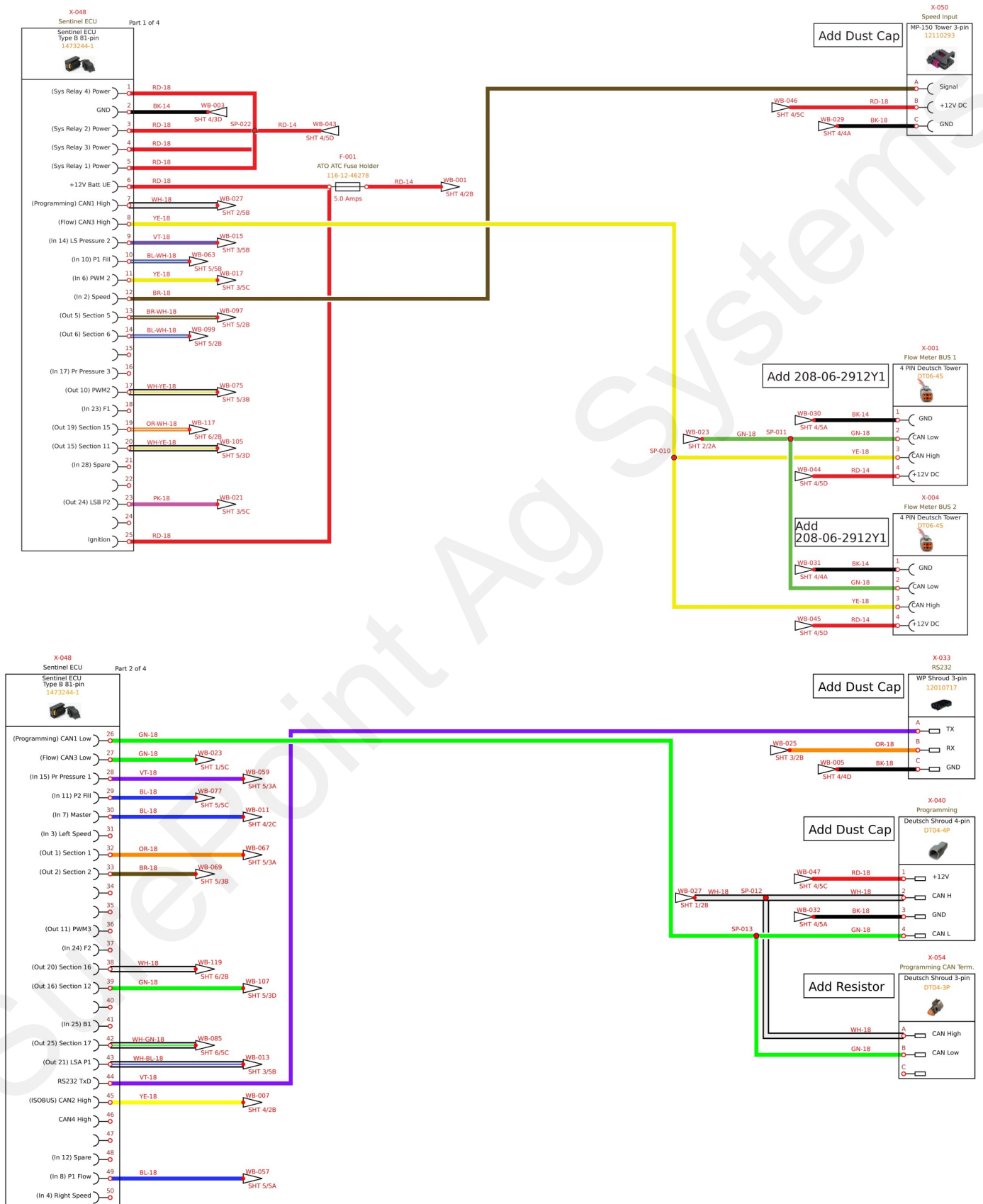
Sentinel Rate Control NH3 Final Harness

Part Number 207-5503Y2



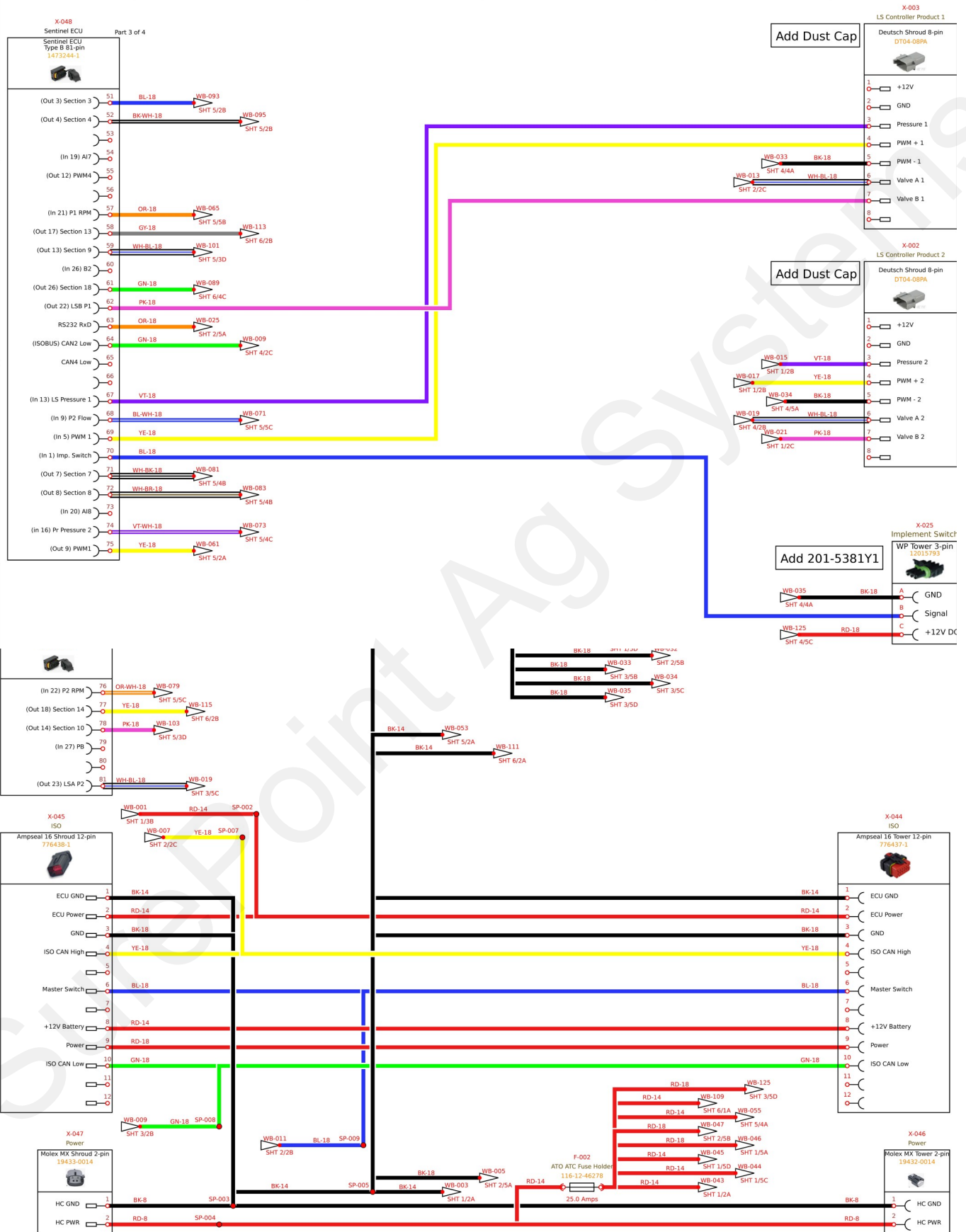
Sentinel Row Control and Flow Monitoring ECU Harness

Part Number 208-06-5022Y1



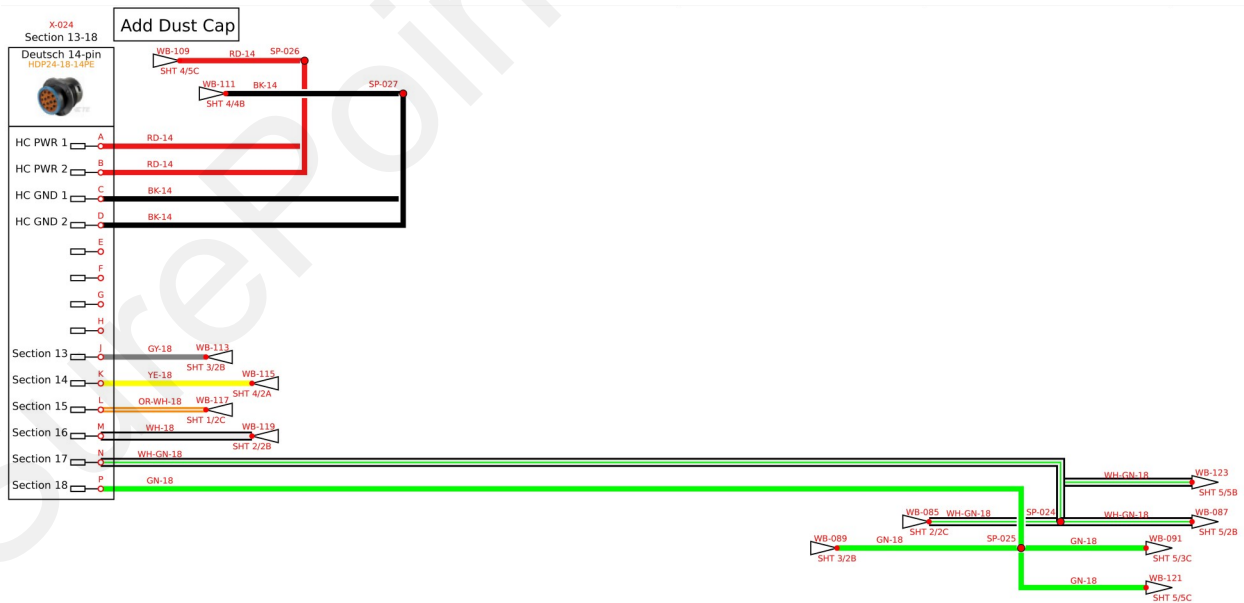
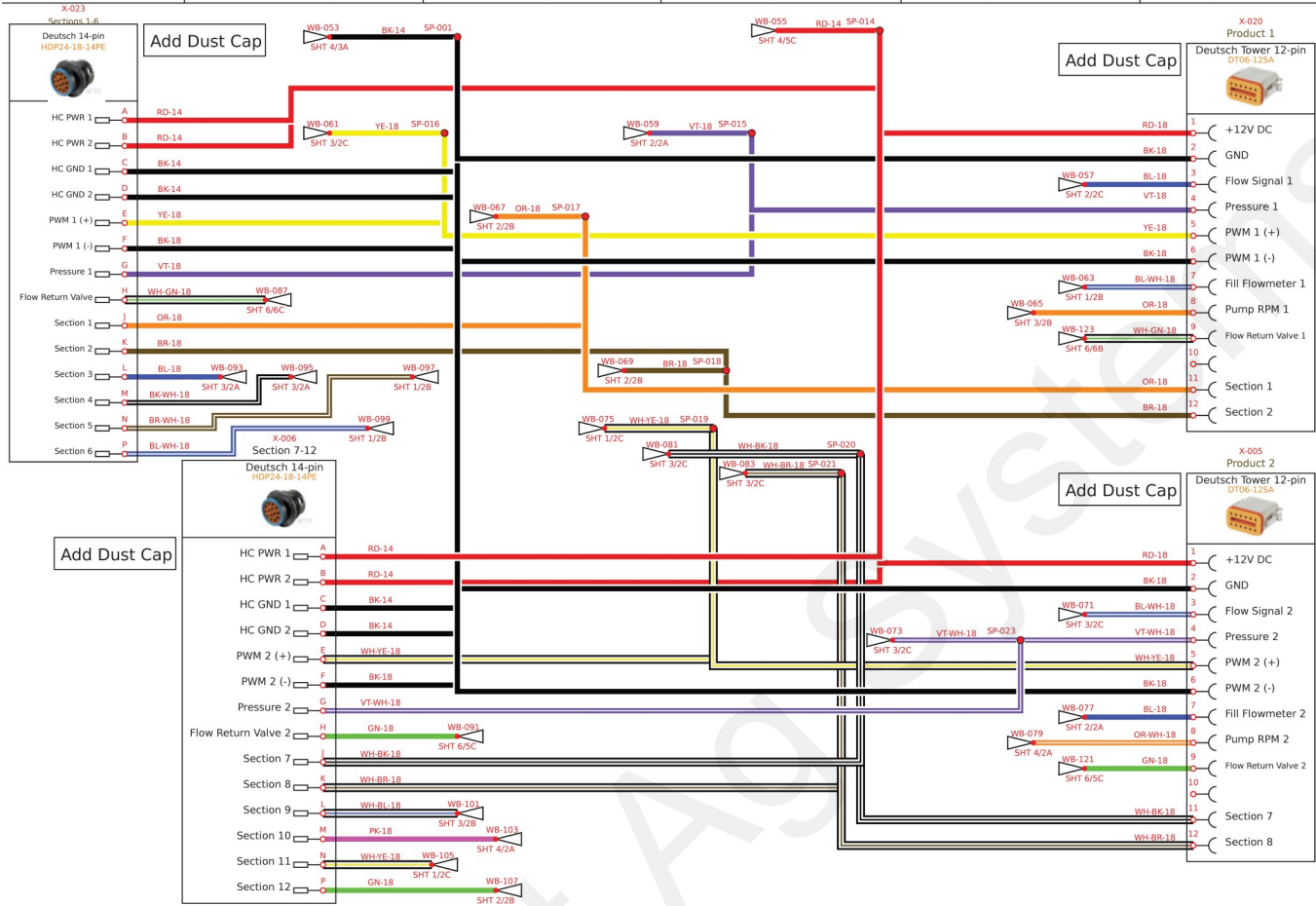
Sentinel Row Control and Flow Monitoring ECU Harness

Part Number 208-06-5022Y1



Sentinel Row Control and Flow Monitoring ECU Harness

Part Number 208-06-5022Y1



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.

TORPEDO™

