



NH₃

Precision Anhydrous Ammonia Application for SurePoint Commander II



396-2853Y1



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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 (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 hygroscopic (water loving) that one cubic foot of water will dissolve 1300 cubic feet of ammonia vapor making water the primary weapon for first responders.

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

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

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

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

Ammonia Fast Facts

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.

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!

