Read the operator manual entirely. When you see this symbol, the subsequent instructions and warnings are serious - follow without exception. Your life and the lives of others depend on it!

Illustrations may show optional equipment not supplied with standard unit, or may show models where the topic function is identical.
Machine Identification

Record your machine details in the log below. If you replace this manual, be sure to transfer this information to the new manual.

If you or the dealer have added options not originally ordered with the machine, or removed options that were originally ordered, the weights and measurements are no longer accurate for your machine. Update the record by adding the machine weight and measurements with the option(s) weight and measurements.

| Model Number |  |
| Serial Number |  |
| Machine Height |  |
| Machine Length |  |
| Machine Width |  |
| Machine Weight |  |
| Year of Construction |  |
| Delivery Date |  |
| First Operation |  |
| Accessories |  |

---

Dealer Contact Information

Name: ____________________________

Street: __________________________

City/State: _______________________

Telephone: ______________________

Email: __________________________

Dealer’s Customer No.: ______________

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⚠️ WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov
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Printed in the United States of America

Great Plains | 417-477M | 2020-08-05
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Important Safety Information

Anhydrous Ammonia Safety

The NP2330 Nutri-Pro® applicator includes several manuals in addition to this Operator manual that contain crucial safety information:

- 407-551M Using Anhydrous Ammonia Safely
- 016-0159-403 Raven AccuFlow™ Operator manual
- 016-0159-831 Raven SCS-450 Installation, Operation and Service manual
- FVC062 Squibb-Taylor Flo-Max™ manual (breakaway coupler)

Read all of these manuals. If you do not have the current edition of one or more, contact Great Plains for a replacement copy.

**EPA EHS (Extremely Hazardous Substance):**

Despite the common odor, anhydrous ammonia properties are dramatically different from those of household ammonia cleaning solutions (dilute ammonium hydroxide).

An uncontrolled release of NH\textsubscript{3} anhydrous ammonia can easily be fatal or cause permanent disabling injury.

If you are new to NH\textsubscript{3} operations, study everything you can about this chemical and how to use it safely.

**Suffocation, Blinding, Burning, Freezing, Disabling and Disfigurement Hazards:**

Your life and health, the lives and health of your workers and community, the continued commercial availability of anhydrous ammonia, and continuation of agricultural NH\textsubscript{3} transport exceptions depend on you conducting *meticulously careful* operations.

**Read All Manuals**

The Anhydrous Safety manual (407-551M), this manual, the meter manual and the breakaway coupler manual (FVC062) are required reading for safe operations. All operators of this equipment must read these manuals.

Even if you are an experienced anhydrous ammonia operator, read the "Using Anhydrous Ammonia Safely" manual (407-551M).

---

1. AccuFlow™ is a trademark of Raven Industries.
2. Flo-Max™ is a trademark of Squibb-Taylor, Inc.
Look for Safety Symbol

The SAFETY ALERT SYMBOL indicates there is a potential hazard to personal safety involved and extra safety precaution must be taken. When you see this symbol, be alert and carefully read the message that follows it. In addition to design and configuration of equipment, hazard control and accident prevention are dependent upon the awareness, concern, prudence and proper training of personnel involved in the operation, transport, maintenance and storage of equipment.

Be Aware of Signal Words

Signal words designate a degree or level of hazard seriousness.

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

WARNING indicates a potentially hazardous situation which, 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 which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Prepare for Emergencies

▲ Be prepared if a fire starts.
▲ Keep a first aid kit and fire extinguisher handy.
▲ Keep emergency numbers for doctor, ambulance, hospital and fire department near phone. Know the reporting requirement for spills or releases of the chemicals you are using. Have contact numbers available.
▲ For anhydrous ammonia operations, have additional contact information for:
  • national response center
  • regional (state) response center
  • local response center
▲ If a fire threatens an anhydrous ammonia tank, evacuate the area. The tank may heat up faster than the relief valve can vent the rising pressure, resulting in a catastrophic gas release and possibly an explosion.

Be Familiar with Safety Decals

▲ Read and understand “Safety Decals” on page 9 thoroughly.
▲ Read all instructions noted on the decals.
▲ Keep decals clean. Replace damaged, faded and illegible decals.
Wear Protective Equipment (PPE)

- Wear clothing and equipment appropriate for the job. Avoid loose-fitting clothing.
- Waterproof, wide-brimmed hat
- Face shield, goggles or full face respirator.
- Prolonged exposure to loud noise can cause hearing impairment or loss. Wear suitable hearing protection such as earmuffs or earplugs.
- Avoid wearing entertainment headphones while operating machinery. Operating equipment safely requires the full attention of the operator.
- See manual 407-551M for specific requirements and recommendations for NH₃ PPE.
- Goggles with side shields or a full face respirator are required if handling or applying dusts, wettable powders, or granules or if being exposed to spray mist.
- Cartridge-type respirator approved for pesticide vapors unless conventional liquid fertilizer label specifies another type of respirator.
- Waterproof, unlined gloves. Neoprene is recommended.
- Cloth coveralls/outer clothing changed daily; waterproof items if there is a chance of becoming wet with spray.
- Waterproof apron
- Waterproof boots or foot coverings
- Do not wear contaminated clothing. Wash protective clothing and equipment with soap and water after each use. Personal clothing must be laundered separately from household articles.
- Clothing contaminated with certain pesticides must be destroyed according to state and local regulations. Read chemical label for specific instructions.

Avoid High Pressure Fluids

Escaping fluid under pressure can penetrate the skin, causing serious injury. This applicator requires a Power-Beyond port, which is always under pressure when the tractor is running.

- Avoid the hazard by relieving pressure before disconnecting hydraulic lines.
- Use a piece of paper or cardboard, NOT BODY PARTS, to check for suspected leaks.
- Wear protective gloves and safety glasses or goggles when working with hydraulic systems.
- If an accident occurs, seek immediate medical attention from a physician familiar with this type of injury.
Minimize Radiation Exposure

The optional DICKEY-john® RVS II and RVS III Radars are intentional radiators of RF energy. Although its radiated energy level is far below the limits set by EN 61010-1:1993 A2:1995-Chapter 12.4, it is advisable not to look directly into the face of the unit.

The radar must radiate toward the ground and at least 20 cm (8 inches) away from a human during use to comply with the RF human exposure limits as called out in FCC 47 CFR Sec.2.1091. DO NOT RE-MOUNT OR USE THE RADAR IN A MANNER INCONSISTENT WITH ITS DEFINED USE.

Keep Riders Off Machinery

Riders obstruct the operator’s view. Riders could be struck by foreign objects or thrown from the machine.

▲ Never allow children to operate equipment.

▲ Keep all bystanders away from machine during operation.

Use Safety Lights and Devices

Slow-moving tractors and towed implements can create a hazard when driven on public roads. They are difficult to see, especially at night.

▲ Use flashing warning lights and turn signals whenever driving on public roads.

▲ Use lights and devices provided with implement.

Tires Not a Step

Do not use gauge wheel or lift-assist tires as steps. A tire could spin underfoot, resulting in a fall onto the applicator or ground, possibly causing serious injury.

▲ The gauge wheel tires can be in poor ground contact at any time, even with the applicator lowered in the field. They can appear to be in ground contact, and spin easily, in multiple conditions.

▲ The lift-assist tires can be in poor ground contact, or out of ground contact, whenever the applicator is lowered.
Remain Clear of Overhead Lines

▲ If the applicator contacts a power line, lethal voltage may be present on all metal parts. At higher voltage, the applicator does not need to be in line contact for the hazard to exist. Maintain at least 10 foot (3 m) clearance.

▲ Electrocution can occur without direct contact between the energized applicator and a person near the applicator.

▲ Watch for sagging, damaged or low electrical lines. The folded applicator could contact lines lower than 13 feet 2 inches (4 m). Overhead lines at farm structures are a particular hazard.

▲ Watch for all electrical lines during folding and unfolding operations. Use a spotter during folding and unfolding. Know the location and height of all lines during transport and in fields.

▲ If an electrical hazard is observed while on the ground near the applicator, hop at least 100 feet (30 m) away with both feet together and summon professional help. At higher voltage, lethal voltage gradients can also be present at the soil surface.

▲ Consult your tractor manual for advice on how to respond to an electrical hazard event while in the cab.
Transport Machinery Safely

Maximum transport speed for applicator is 20 mph (32 kph), 13 mph (22 kph) in turns. Some rough terrains require a slower speed. Sudden braking can cause a towed load to swerve and upset.

▲ Do not transport an applicator that weighs over 20,000 pounds (9060 kg). Loading liquid fertilizer tanks or transporting with a nurse tank hitch to the applicator can easily exceed this limit.

▲ Tow nurse tank separately. Do not tow a nurse tank in train with the applicator on public roads.

▲ Never park an anhydrous ammonia tank on public roads or anywhere near sites with high occupancy or high-risk populations, such as shopping areas, events, schools, hospitals, retirement communities, etc.

▲ Avoid transporting an anhydrous ammonia tank through populated areas.

▲ Do not tow a lift-assisted 2-point applicator or nurse tank that, when fully loaded, weighs more than 1.5 times the weight of towing vehicle.

▲ Do not transport a 2-point applicator that exceeds the capacity or ballasting of the tractor. There may not be enough front wheel traction for safe steering.

▲ Carry reflectors or flags to mark applicator in case of breakdown on the road.

▲ Keep clear of overhead power lines and other obstructions when transporting. Refer to transport dimensions under “Specifications and Capacities” on page 135

▲ Do not exceed 20 mph (32 km/h). Never travel at a speed which does not allow adequate control of steering and stopping. Reduce speed if towed load is not equipped with brakes.

▲ Reduce speed on rough roads.

▲ Comply with national, regional and local laws.

▲ Do not fold or unfold the applicator while the tractor is moving (other than field lift).
Handle Chemicals Properly

See manual 407-551M for specific requirements and recommendations for NH₃.

For Conventional Liquid Materials

Agricultural chemicals can be dangerous. Improper use can seriously injure persons, animals, plants, soil and property.

▲ Read and follow chemical supplier instructions.
▲ Wear protective clothing.
▲ Handle all chemicals with care.
▲ Agricultural chemicals can be dangerous. Improper use can seriously injure persons, animals, plants, soil and property.
▲ Inhaling smoke from any type of chemical fire is a serious health hazard.
▲ Store or dispose of unused chemicals as specified by the chemical manufacturer.
▲ If chemical is swallowed, carefully follow the chemical manufacturer’s recommendations and consult with a doctor.
▲ If persons are exposed to a chemical in a way that could affect their health, consult a doctor immediately with the chemical label or container in hand. Any delay could cause serious illness or death.
▲ Dispose of empty chemical containers properly. By law rinsing of the used chemical container must be repeated three times. Puncture the container to prevent future use. An alternative is to jet-rinse or pressure rinse the container.
▲ Wash hands and face before eating after working with chemicals. Shower as soon as application is completed for the day.
▲ Apply only with acceptable wind conditions. Wind speed must be below 5 mph (8 km/h). Make sure wind drift of chemicals will not affect any surrounding land, people or animals.
▲ Never wash out a tank within 100 feet (30 m) of any freshwater source or in a car wash.

Shutdown and Storage

▲ Lower applicator, put tractor in park, turn off engine, and remove the key.
▲ Secure applicator using locks and supports provided.
▲ Detach and store applicator in an area where children normally do not play.
▲ Park an anhydrous ammonia applicator downwind of occupied areas until it is purged of NH₃ residues.
▲ Do not leave NH₃ nurse tanks unattended.
Important Safety Information

Tire Safety

Tire changing can be dangerous and should be performed by trained personnel using correct tools and equipment.

▲ When inflating tires, use a clip-on chuck and extension hose long enough for you to stand to one side—not in front of or over tire assembly. Use a safety cage if available.

▲ When removing and installing wheels, use wheel-handling equipment adequate for weight involved.

Practice Safe Maintenance

▲ Understand procedure before doing work. Use proper tools and equipment. Refer to this manual.

▲ Work in a clean, dry area.

▲ Lower the applicator, put tractor in park, turn off engine, and remove key before performing maintenance. If work must be performed with applicator raised, use blocks or jack stands rated for the applicator weight.

▲ Make sure all moving parts have stopped and all system pressure is relieved.

▲ Allow applicator to cool completely.

▲ Disconnect battery ground cable (-) before servicing or adjusting electrical systems.

▲ Welding: Disconnect battery ground. Avoid fumes from heated paint.

▲ Inspect all parts. Make sure parts are in good condition and installed properly.

▲ Remove buildup of grease, oil or debris.

▲ Remove all tools and unused parts from applicator before operation.

Safety At All Times

Thoroughly read and understand the instructions in this manual before operation. Read all instructions noted on the safety decals.

▲ Be familiar with all applicator functions.

▲ Operate machinery from the driver’s seat only.

▲ Do not leave applicator unattended with tractor engine running.

▲ Do not stand between the moving tractor and applicator during hitching.

▲ Keep hands, feet and clothing away from power-driven parts.

▲ Wear snug-fitting clothing to avoid entanglement with moving parts.

▲ Make sure all persons are clear of working area.
Safety Decals

Safety Reflectors and Decals

Your implement comes equipped with all lights, safety reflectors and decals in place. They were designed to help you safely operate your implement.

▲ Read and follow decal directions.
▲ Keep lights in operating condition.
▲ Keep all safety decals clean and legible.
▲ Replace all damaged or missing decals. Order new decals from your Great Plains dealer. Refer to this section for proper decal placement.
▲ When ordering new parts or components, also request corresponding safety decals.

To install new decals:
1. Clean the area on which the decal is to be placed.
2. Peel backing from decal. Press firmly on surface, being careful not to cause air bubbles under decal.

Slow Moving Vehicle Reflector
818-055C

On a mount attached to the transport rest assembly; 1 total

Red Reflectors
S/N C1051A-
838-266C

On the rear face light bracket, and rear face of lift assist mount carrier tube; 4 total

Red Reflectors
S/N C1052A+
838-266

On the rear face light bracket, and rear face of lift assist mount carrier tube, above daytime reflectors; 4 total
Amber Reflectors
S/N C1051A-838-265C

On the outside faces of casters, on the outside faces of lift assist braces, 4, 5 or 6 total.

Amber Reflectors
S/N C1052A+838-265C

On the outside faces of casters, front face of light brackets; 4, 5 or 6 total.

Daytime Reflectors
S/N C1051A-838-267C

On the rear face of light bracket, below red reflectors, rear face of lift assist mount carrier tube, outboard of red reflectors; 4 total.

Daytime Reflectors
S/N C1052A+838-267C

On the rear face of light brackets, inboard of red reflectors, rear face of lift assist mount carrier tube, below red reflectors; 4 total.
Danger: Ammonia
Raven 039-0159-034 (Option)

On front or back side of Raven AccuFlow™;
2 or 4 total
Order replacement from Raven Industries.

Danger: Bleed System
115527-01 (Option)

On top of CDS-John Blue Impellicone® flow divider;
1 total

Danger: Possible Chemical Hazard
818-323C

NH₃ models: On decal mount near Flo-Max™ coupler:
1 total
See “NH₃ Operations” page 56. Also see separate manual, Using Anhydrous Ammonia Safely” manual (407-551M).

See “Liquid Operations” on page 70.

Conventional Models: On decal mount at optional rear hitch and/or on front face of each center tank leg;
1 total
See “Liquid Operations” on page 70.
Danger: Hitch Crush
818-590C

On front of frame tube, both sides of hitch; 2 total

Danger: Electrocution
818-599C

On front of frame tube, outside parking stands; 2 total

Danger: Safety Coupler (Option)
848-534C  
(Squibb-Taylor FM125-2000)

On decal mount near Flo-Max™ coupler; 1 total

This decal summarizes the mechanical procedure for coupler re-connection after a breakaway event. Rely on these instructions only if the Squibb-Taylor Flo-Max™ manual is not available. See “NH3: Breakaway Event” on page 67.
Warning: Speed
818-337C

On front face of front tool bar, right of center; 1 total

Warning: High Pressure Fluid Hazard
818-437C

On front face of front tool bar, left end, on each lift-assist mount; 3 total
Warning: Towing
848-551C

On decal mount near Flo-Max™ coupler:
1 total


Warning: Ball Valve (Option)
(no part number)

This decal should not apply to 2013+ NP2330A applicators, but might be encountered on nurse tank valves, or if repairs are made with old-stock after-market parts. See “Avoid Ball Traps” on page 102.

Older unvented ball valves can trap fluid inside the ball if closed with the line fully charged. Great Plains ball valves shipped in 2011 and later have a bleed orifice on the downstream side of the valve ball and do not require this decal.
Caution: Ammonia (Option)  
Raven 039-0159-035  
Order replacement from Raven Industries.

Warning: Tank Installation and Use  
Snyder 997176 (Option)  
On upper front face of each tank:  
0 or 2 total  
Replacement decals available from Snyder Industries:  
www.snydernet.com

Caution: Tires Not a Step  
818-398C  
Outside faces of manual gauge wheel arms;  
2 total
Caution: Read Operator’s Manual

818-587C

On front face of front tool bar, right of center; 1 total

Caution: Read Operator’s Manual

818-719C

On front face of front tool bar, right of center; 2 total

Caution: Tire Pressure and Bolt Torque

838-092C

Each lift-assist tire rim; 2 total
Caution: Transport Locks
838-380C

On rear face of caster weldments, above red reflectors; 2 total
See “Important Safety Information” on page 1.

Caution: Tire Pressure and Bolt Torque
838-595C

Inside faces of manual gauge wheel arms; 2 total

Caution: General
848-736C

On front face of front tool bar, both sides; 2 total
General Safety: First Aid Water (Option)  
848-539C  
+ FIRST AID + WATER  
On left and right sides of the wash water tank; 2 total  

Notice: Check Torque  
858-457C  
NOTICE  
CHECK TORQUE AFTER INITIAL 20 HOURS OF USE GRADE 9 - 375 FT LBS  
RE-CHECK PERIODICALLY  
On front of front frame tube right of hitch; 1 total  
See “Lubrication and Scheduled Maintenance” on page 120.
Introduction

Great Plains welcomes you to its growing family of new product owners. The 30-Foot Fertilizer Applicator (NP2330) has been designed with care and built by skilled workers using quality materials. Proper setup, maintenance, and safe operating practices will help you get years of satisfactory use from the machine.

Description of Unit

The Nutri-Pro® is an applicator implement for conventional liquid fertilizer, anhydrous ammonia (NH₃) or both. It has a working width (swath) of 30 feet (9.1 m). The applicator has single or triple coulters with tines for sub-soil application from optional on-board or user-provisioned tanks. The NP2330 has a lift-assisted 2-point hitch.

When configured for conventional liquid fertilizer, the NP2330 model is designed for use with an optional variable-rate Ace hydraulic drive pump, or a user-provisioned pump.

When configured for anhydrous ammonia the NP2330 model relies on NH₃ vapor pressure from a separately provisioned trailing nurse tank.

A Raven SCS 450 console is available for sectional and variable-rate control.

Models Covered

Conventional Liquid Fertilizer Models
NP2330LL-12V30 30-Foot, 12-Row, 30 inch
NP2330LL-18V20 30-Foot, 18-Row, 20 inch

Anhydrous Model (configurable for two materials)
NP2330AA-12C30 30-Foot, 12-Row, 30 inch
NP2330AA-12C30+SD 32.5-Foot, 13-Row, 30-inch

Intended Usage

Use the NP2330 Applicator to apply compatible fertilizers. Do not modify Great Plains-provisioned components, or install user-provisioned components, except as authorized or recommended by Great Plains.

Document Family

417-477M NP2330 Operator/Rate Manual (this document)
417-477P NP2330 Parts manual

Manuals for Options:

407-551M Using Anhydrous Ammonia Safely
12-M-29 CDS-John Blue® IP-1300/1800 Impellicone® parts
016-0159-403 Raven AccuFlow™ Operator manual
016-0159-831 Raven SCS-450 Installation, Operation and Service manual
FVC062 Squibb-Taylor Flo-Max™ manual
12-M-43 CDS-John Blue NGP Pump Parts and Instructional manual
HYD-MAN Ace Pump Instruction manual

Dealer QRC

The QR Code (Quick Response) to the left will take you to available dealers for Great Plains products. Refer to the Parts Manual QR Locater for detailed instructions.
Using This Manual

This manual familiarizes you with safety, assembly, operation, adjustments, troubleshooting, and maintenance. Read this manual and follow the recommendations to help ensure safe and efficient operation.

The information in this manual is current at printing. Some parts may change to assure top performance.

“Option” refers to components not part of the standard product, and not “optional” steps. If the component is installed, the instructions apply.

NOTICE

Identifies an Economic (not a Safety) Risk:
NOTICE provides a crucial point of information related to the current topic. Read and follow the instructions to avoid damage to equipment and ensure desired field results.

This form sets off useful information about the current topic, or forestalls possible misunderstanding.

Right-hand and left-hand as used in this manual are determined by facing the direction the machine will travel while in use unless otherwise stated. An orientation rose in some line art illustrations shows the directions of: Up, Back, Left, Down, Front, Right.

Single-digit and single-letter callouts refer to local illustrations. The callout numbers/letters may be re-used for different items on other pages.

Two-digit callouts in the range A01 to A36 and L11 to L8 refer to the same tank and Nutri-Pro® plumbing system components throughout this manual. “A00” references are for Anhydrous. “L00” references are for conventional Liquid.

Callouts A and above refer to parts of Options (see Appendix C).
Owner Assistance

If you need customer service or repair parts, contact a Great Plains dealer. They have trained personnel, repair parts and equipment specially designed for Great Plains products.

Refer to Figure 2

Your machine’s parts were specially designed and should only be replaced with Great Plains parts. Always use the serial and model number when ordering parts from your Great Plains dealer.

Record your applicator model and serial number here for quick reference:

Model Number: ____________________________
Serial Number: ____________________________

Further Assistance

Great Plains Manufacturing, Inc. and your Great Plains dealer want you to be satisfied with your new fertilizer applicator. If for any reason you do not understand any part of this manual or are otherwise dissatisfied, please take the following actions first:

1. Discuss the matter with your dealership service manager. Make sure they are aware of any problems so they can assist you.

2. If you are still unsatisfied, seek out the owner or general manager of the dealership.

If your dealer is unable to resolve the problem or the issue is parts related, please contact:

Great Plains Service Department
1525 E. North St.
P.O. Box 5060
Salina, KS 67402-5060

Or go to www.greatplainsag.com and follow the contact information at the bottom of your screen for our service department.
Application Overview

Tank, plumbing and setup requirements differ for anhydrous (A) and conventional systems (L). The next few pages provide an overview of both systems.

Anhydrous: System Components

Single-Cooler Section Control Configuration - see page 140 through page 138 for alternates.

Legend:

- Liquid NH₃
- NH₃ Vapor
- Liquid Flow
- Vapor Flow
- Direction of Flow
- Exception Flow

Callout numbers A11 through A36 identify the same applicator and tank components throughout this manual.

Figure 3
Anhydrous Ammonia (NH₃) Plumbing (Single-Cooler w/ Section Control)
NH₃ System Narrative

This list describes a single-cooler anhydrous system with section control. A dual-cooler system has two of components A1 through A28, and two additional dual-tube tines A49. A single-section system lacks components A35 through A39 and has only one of A49.

Refer to Figure 4 on page 29

A11. Acme cap

![CAUTION](image1)

Suffocation, Blinding and Burning Hazards:
See “NH₃: Safing Applicator Before Cart Hitch” on page 57, for safe opening procedure.

This captive cap protects the inlet when no nurse tank is connected. NH₃ might be sealed behind this cap.

A12. Acme inlet

The nurse tank hose coupler (A7) connects here and must have 1 3/4-4 female Acme1 swivel coupler. See page 60 for nurse tank connection.

A13. Coupler Inlet Bleed Valve

![CAUTION](image2)

Suffocation, Blinding and Burning Hazards:
See “About Bleed Valves:” on page 33.

This fitting is carefully opened at normal and abnormal disconnects, to bleed NH₃ liquid and vapor from the hoses (or to bleed just the nurse tank hose upon breakaway). It is also opened prior to Acme cap removal to verify that the line is discharged. See “NH₃: Making Nurse Tank Connections” on page 60, “NH₃: Unhitching Nurse Tank” on page 69 and “NH₃: Breakaway Event” on page 67.

A14. Breakaway Coupler

![DANGER](image3)

Upon Event: Probable Chemical Hazard:
See “NH₃: Breakaway Event” on page 59.

This assembly is designed to separate and seal the lines if between 300 to 400 pounds of pull force is applied to the nurse tank hose. In normal operations, this does not happen.

Should the hitch fail, and both safety chains fail, or an operator makes serious basic safety errors, the breakaway separates to protect the hoses from rupture. Spring-loaded checks inside the breakaway seal both ends of the now-broken connection. If the line was charged, 60 cc of liquid NH₃ is released on breakaway.

Resetting a parted breakaway coupler is a complex operation requiring tools. Consult the breakaway manual for details. More significant matters are safing the applicator and nurse tank, then correcting the cause of the breakaway. See “NH₃: Breakaway Event” on page 67.

A15. Breakaway Hydrostatic Relief Valve

In normal operation, this valve does not activate. It is designed to open at 375 psi, well above the 250-265 PSI operating pressure of the nurse tank’s main pressure relief valve.

Operator action is periodic inspection, and to replace this hydrostatic relief valve, a time-dated part, when it reaches the end of its operating life (see page 110). See “Hydrostatic Relief Valve Maintenance” on page 108 for maintenance.

Valve function: when operating valves are closed on both sides of the breakaway (or on just the applicator side upon a breakaway event), NH₃ can be trapped in the breakaway coupler. As the NH₃ warms, it could create dangerously high pressure. This relief valve opens to vent excess pressure.

---

1. Acme refers to the ANSI/ASME B1.5-1997 screw thread, which has a trapezoidal thread profile.
A16. Coupler Outlet Bleed Valve

**CAUTION** 30  ANHYDROUS AMMONIA 100S

*Suffocation, Blinding and Burning Hazards:*

*See “About Bleed Valves:” on page 33.*

This fitting is kept closed in normal operations. When the breakaway is properly coupled, the inlet bleed valve \[A13\] bleeds the entire assembly, and applicator supply hose. On breakaway, this valve is used to bleed the applicator side of the disconnection. See “NH3: Breakaway Event” on page 67.

A17. Supply Hose

This connects the breakaway coupler to the emergency shut-off valve. Operator action is to replace this hose, a time-dated part, when it reaches the end of its operating life (see page 110).

A18. Emergency Shut-off Valve

The handle of this is valve has a rope which is routed to the tractor cab (see page 33). Closing this valve stops NH3 flow to the cooler, metering system and tines. There can still be a substantial amount of NH3 in the system, for some time, with this valve closed. See the “Using Anhydrous Ammonia Safely” manual (407-551M) for emergency operation.

A19. Strainer

This filter contains a 20 mesh screen and two ceramic magnets to remove debris from the NH3 flow.

A20. Strainer Magnets

These capture ferrous metal debris of any size. They need to be cleaned every 4 to 5 tank loads. See page 113.


For effective application, NH3 needs to remain in the liquid state until released underground. This is accomplished by refrigeration. Some of the flow is tapped \[A22\], fed back to the cooler at \[A24\], vaporized and used to chill the fluid passing from \[A22\] to \[A28\].

A22. Cooler Intake

Liquid NH3 enters the cooler here.

A23. Cooler Hydrostatic Relief Valve

In normal operation, this valve never activates. NH3 can get trapped in the system between the emergency shut-off valve \[A18\] and the On/Off valve \[A31\], if both valves are closed while the system is charged. As the liquid warms and pressure rises, this valve protects the system with periodic releases. This valve is set to activate at 350 psi, higher than the nurse tank’s relief valve.

Operator action is periodic inspection, and to replace this hydrostatic relief valve, a time-dated part, when it reaches the end of its operating life (see page 111). See “Hydrostatic Relief Valve Maintenance” on page 108 for maintenance.

A24. Cooler Outlet

Chilled liquid NH3 exits the cooler here.

A25. Flow Meter

This fitting converts fluid flow to pulses for the SCS 450 controller. It has a range of 1-60 gpm. A tag on the cable lead provides a “METER CAL” number specific to the installed meter (and accurate only for NH3 fluid flow, and not NH3 vapor flow).

A26. Drain Cap

The plumbing cross and lower cap below the temperature gauge are provided to allow the gauge probe to be exposed to the full NH3 stream. This cap does not require periodic clean-out.

A27. Temperature Gauge

This gauge reports the temperature of the chilled, flowing, NH3. When NH3 is not flowing, this gauge slowly drifts up to ambient temperature.

Checking the temperature and pressure \[A28\] gauges against the chart in the “Using Anhydrous Ammonia Safely” manual (407-551M), or in the Raven AccuFlow™ manual, indicates whether the flowing NH3 is in a liquid state.

Normal field temperatures of the chilled flowing NH3 are in the range 20 to 83°F (-7 to 28°C).
A28. Pressure Gauge
This gauge reports the pressure of the NH₃ after it exits the cooler. If line valves are closed, a pressure reading above zero indicates NH₃ is present between the emergency shut-off valve A18 and the On/Off solenoid valve A31 (the Control Valve A30 does not completely close).

Checking the pressure and temperature [A27] against the chart in the “Using Anhydrous Ammonia Safely” manual (407-551M), or in the Raven AccuFlow™ manual, indicates whether the flowing NH₃ is in a liquid state.

When valves are open but NH₃ is not flowing, this gauge normally reads within 5 psi of the nurse tank pressure gauge [A17]. If they are materially different at zero flow, one of the gauges may be defective.

When NH₃ is flowing, the pressure reported by this gauge [A28] is lower than the tank pressure.

A29. Cooler Bleed Valve

<table>
<thead>
<tr>
<th>CAUTION</th>
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<tbody>
<tr>
<td>ANHYDROUS AMMONIA INGREDIENT HAZARD</td>
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</table>

Suffocation, Blinding and Burning Hazards:
See “About Bleed Valves:” on page 33.

This valve is normally closed. It is used to bleed trapped NH₃ from the cooler system when valves are closed. It can also be used to accelerate clearing the cooler system for maintenance.

A30. Control Valve
This is a variable electronic valve controlled by the SCS 450. It is the primary control point for application rate. When power is off, this valve remains at its most recent setting.

This valve has a visible indicator above the valve ball casing, indicating whether open, closed or in between.

When commanded to a rate of zero, this valve does not completely close. Use shut-off valves to completely stop flow. A full slew from fully open to minimum takes approximately 9 seconds.

A31. Master Shut-Off Valve
This is the normal control for starting and stopping total application flow in the field (for turns, etc.). This component is an open/close solenoid valve controlled by the “MASTER” switch on the SCS 450. When power is off, this valve remains at its most recent setting.

This valve has a visible indicator above the valve ball casing, indicating whether open or closed.

Operation of this valve is essentially instantaneous. Its valve ball is equipped with a downstream relief orifice.

A32. Refrigerant Tap
A small amount of the NH₃ flow is taken at this point to provide refrigeration at the cooler. There are no operational items for this fitting.

A33. Refrigerant Line
This tubing passes tapped refrigerant NH₃ to the cooler. Operator action is to replace this tubing, a time-dated part, when it reaches the end of its operating life. See page 111.

A34. Cooler Refrigerant Inlet
Tapped refrigeration flow enters the cooler at this fitting, and is vaporized to chill the liquid entering at fitting. There are no operational items for this fitting.

A35. Section Control Check Valve
(Section Control Option Only)
This prevents back flow when section shut-off valves A39 are off with NH₃ present. There are no operational items for this fitting.

A36. Section Control Bleed Valve

<table>
<thead>
<tr>
<th>CAUTION</th>
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<tbody>
<tr>
<td>ANHYDROUS AMMONIA INGREDIENT HAZARD</td>
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</table>

Suffocation, Blinding and Burning Hazards:
See “About Bleed Valves:” on page 33.

(Section Control Option Only)
This valve is normally closed. It is used to bleed trapped NH₃ from the section control system if all section valves A39 are closed.

A37. Section Control Relief Valve
(Section Control Option Only)
In normal operation, this valve never activates. NH₃ can get trapped in the system between the section control check valve A35 and the section shut-off valves A39, if all section valves are closed while the system is charged. As the liquid warms and pressure rises, this relief valve protects the system with periodic releases.

This valve is set to activate at 350 psi.

Operator action is periodic inspection, and to replace this hydrostatic relief valve, a time-dated part, when it reaches the end of its operating life (see page 111). See “Hydrostatic Relief Valve Maintenance” on page 108 for maintenance.

A38. Section Flow Divider
(Section Control Option Only)
This is a CDS-John Blue® Impellicone® manifold. It evenly splits the NH₃ flow for distribution through the row flow dividers A40. There are no operational items for this component.

A39. Section Shut-Off Valves
(Section Control Option Only)
These are the normal controls for suspending
per-section application flow in the field (for point rows, pass overlap, etc.). These are open/close solenoid valves controlled by the “BOOMS” switches on the SCS 450.

When used with the SCS 450 or other suitable sectional application controller, shutting off a section causes the total flow to be reduced by 1/3 of the all-sections-on rate, keeping the rate constant for the section(s) still active.

Each section valve has a visible indicator above the valve ball casing, indicating whether open or closed. Operation of each section valve is essentially instantaneous. However, there is considerable residual NH$_3$ in the section flow divider and delivery tubes after shut-off. When console power is off, the valves remain at their most recent setting. The valve balls are equipped with a downstream relief orifice.

**A40. Row Flow Divider(s)**
This is a CDS-John Blue® Impellicone® manifold. It evenly splits the NH$_3$ flow for distribution through the delivery tubes. There are no operational items for this component.

**A41. Flow Divider Manifold Inlet**
NH$_3$ liquid flow enters the flow divider here.

**A42. Flow Divider Pressure Gauge**
This gauge reports the pressure prior to flow division. It normally reads lower than the cooler and nurse tank pressure gauges.

**A43. Flow Divider Outlet**
Each of these ports receives an equal fraction of the NH$_3$ liquid flow.

**A44. Flow Divider Plug**
Unused ports are plugged with a steel NPT plug. Unused ports do not affect flow balance at the other ports.

**A45. Delivery Tube**
This tubing passes NH$_3$ liquid flow to the tines. Operator action is to replace this tubing, a time-dated part, when it reaches the end of its operating life. See page 112.

**A46. Coulter Tine (Single)**
Tines inject the liquid NH$_3$. All but two (or four) of the rows are equipped with tines having a single smaller liquid delivery tube. Tines need frequent inspection for wear and damage.

**A47. Cooler Vapor Outlets (2)**
Two vapor outlets direct the now-gaseous refrigerant flow (that entered at A34) to two special tines per cooler.

**A48. Vapor Tube**
This tubing passes NH$_3$ vapor flow to the dual tines. Operator action is to replace this tubing, a time-dated part, when it reaches the end of its operating life. See page 112.

**A49. Coulter Tine (Dual)**
There are two of these special tines per cooler (four total on a dual-cooler applicator). They direct the vaporized refrigerant NH$_3$ gas into the soil at the larger rear vapor tube. They are otherwise identical to the single-tube tines.

The following callouts are for trailing nurse tank cart components. See the “Using Anhydrous Ammonia Safely” manual (407-551M) for all nurse tank callouts. The present manual lists only those required for applicator field operations.

**A6. Acme Parking Plug**
A threaded stud (or other means) for storage of the outlet hose when not coupled to the applicator.

---

**Excess NH$_3$ Release Hazard:**
If the outlet hose is entirely dismounted (both ends free) for transport and storage, and both ends are 13/4-4 Acme, be sure about which end is which. Installing a hose backwards can result in needless excess NH$_3$ release at unhitching, or a line segment unprotected by bleed and/or relief valves.

**A7. Acme Female Hose Coupler**
This end of the hose connects the tank withdrawal valve to the leading applicator inlet at the breakaway coupler. For use with a Nutri-Pro® applicator, the outlet end of the hose must be equipped with a 13/4-4 female Acme fitting.

The outlet end of the hose has a swivel collar or shroud containing the female Acme fitting. This allows connection without needing to twist the hose. Acme hose couplers are intended for hand tightening only. Do not use tools to make the cart-applicator connection. A liquid-tight seal is made by the gasket in the male Acme fitting on the applicator break-away coupler.

For dual-tank carts, each tank usually has its own hose.

**A8. Outlet Hose Assembly**
The hose may have zero, one or two operating valves, one or more bleed valves, and a

---

1. Acme collars may be aluminum, but all internal coupler components must be NH$_3$-safe, typically stainless steel.
hydrostatic relief valve. The outlet end may have an Acme plug.

Hose valves are typically hand wheel valves, or lever valves. Read any documents provided for the valves. Have the terminal or dealer explain how the valves work.

**WARNING**

**Suffocation, Blinding and Burning Hazards:**

Never test an anhydrous ammonia hose valve unless you are absolutely certain the hose and valve bodies are empty, or both hose ends are securely connected to sealed systems.

- A two-valve hose can contain a substantial amount of NH₃ even when completely disconnected. See “Avoid Line Traps” on page 101.
- Older ball valves can contain NH₃ inside the ball when closed, even though disconnected at both ends. See “Avoid Ball Traps” on page 102.

Follow instructions for bleeding and checking. Never use a valve handle as a carrying handle. Keep hands clear of bleed valves when carrying a hose.

**A9. Nurse Tank Hose Body**

NH₃ hoses are time-dated components. Operator action is to replace the assembly when it reaches the end of its operating life.

**A10. Hose Valve(s)**

The hose may have zero, one or two operating valves.

**CAUTION**

**Excess NH₃ Release and Trapping Hazards:**
Understand hose and tank withdrawal valve functions and sequencing. This manual presumes a hose with a single outlet-end shut-off valve and a tank outlet with a withdrawal valve. If the hose in use is different, have the hose provider explain the correct order for operations.

**A11. Bleed Valve(s)**

**CAUTION**

**Suffocation, Blinding and Burning Hazards:**
See “About Bleed Valves” on page 33.

Hose valves typically have bleed valves. Have the hose provider explain exactly what is bled by each bleed valve.

The purpose of a bleed valve is to perform a controlled release, via an orifice, of any fluid or gas trapped in the closed line prior to disconnect at a nearby Acme fitting.

A single bleed valve may be located on the inlet or outlet side of the valve, and only protects that side of the circuit when the valve is closed. More rarely, a shut-off valve has bleed valves on both sides of the valve. An older ball valve may have a bleed valve for the ball itself.

**A15. Withdrawal Valve**

In field operations, this valve is opened first, and closed first.

**CAUTION**

**Ammonia Release Hazard:**

Never open the withdrawal valve unless:

a. all other valves and bleed valves, are closed, or;

b. the applicator is configured and ready for use.

Always be on the up-wind side for valve operation.

Always open slowly.

Always check for signs of release when opening this valve.

The withdrawal valve is the application outlet valve. It is usually located on the tank top, but may be located on the bottom. It is color coded red or orange.

**A17. Pressure Gauge**

This gauge reports the pressure (usually in psi) of the NH₃ gas at the top of the tank. The reading varies with tank and ammonia temperature.
Nutri-Pro® Rear Hitch (Option)

Refer to Figure 4 on page 29

Items L1 through L3 are part of the rear hitch Option (page 126).

L1. Tongue Release Handle
Frees rear hitch tongue (L3) for alignment with nurse tank tongue. See "Liq: Hitching Conventional Nurse Tank" on page 72.

L2. Chain Anchor
Two anchor points are provided for nurse tank safety chains.

L3. Rear Hitch Tongue
Accepts a 1 inch (2.6 cm) hitch pin.

L4. Cart Hitch
A nurse tank cart must have a clevis hitch with a 1 inch locking pin. The tongue must be able to elevate to a hitch height of 48 inches (122 cm) above ground with the high clearance rear hitch, and 38 1/2 inches (97.7 cm) with the drop hitch.

L5. Safety Chain
A minimum of one safety chain is required. Each chain must be rated for the total weight of a fully loaded cart. The optional nurse cart hitch on the applicator has anchor points for two chains.

L6. Tank Supply Hose Quick-Coupler
The supply inlet of the NP2330 applicator is a 2 inch male cam-lock quick coupler (MCL). The tank supply hose fitting must be, or be adapted to 2 inch FCL.

L7. Tank Supply Hose Shut-off Valve
This Nutri-Pro® manual mentions only a single shutoff valve for the tank supply hose. Your tank may have additional shutoff and/or flow management valves. Consult your tank manual.

L8. Tank Supply Hose
The tank supply hose must be large enough to support the application rates intended. A hose ID of 1 1/2 inch or larger suffices.
Trailing Nurse Tank Components

Refer to Figure 4 on page 29

L11. Application Tank  (user provisioned)
Consult tank documents for details of tank operation. This manual presumes only that the tank has a compatible coupler and shut-off valve. This manual also presumes that an applicator-mounted pump is in use.

L12. Vented Tank Lid  (user provisioned)
L16. Supply Inlet  (user provisioned)
Great Plains supplies an inlet coupler, valve and hose only with the on-board tank Option. In all other configurations, the inlet connection (which might be to pump or directly to boom) is field-installed.

L17. Inlet Shut-Off Valve    (user provisioned)

Hitch (Option) and Nurse Tank Components (User-Provisioned)
See page 28 and 29 for callout descriptions

![Figure 4 Trailing Nurse Tank Hitch](image)
Preparation and Setup

This section helps you prepare your tractor and applicator for use, and covers tasks that need to be done seasonally, or when the tractor/applicator configuration changes.

Before using the applicator in the field, you must hitch it to a suitable tractor, inspect systems, level the applicator, and then hitch a suitable nurse tank to the applicator. Before using the applicator for the first time, and periodically thereafter, certain adjustments and calibrations may be required.

Anhydrous Ammonia Exposure Hazard:
NP2330A models: Do not modify the NH$_3$ system of this applicator. Designing NH$_3$ systems, selecting and installing components is serious engineering. Testing a custom system could be extremely hazardous [and field Personal Protective Equipment (PPE) is inadequate for such testing]. Malfunction of a custom system could result in a major release of NH$_3$ gas or liquid.

Anhydrous Ammonia Release Hazard:
Use only the Great Plains rear hitch for a trailing nurse tank cart. A custom hitch and/or mount, including any safety chain anchors, could fail entirely, resulting in a tank cart upset. Consequences could include a catastrophic release of NH$_3$. At the very least expect a breakaway event and cart damage.

Initial Setup

Other first-time/infrequent setup tasks include:

• Set lift assist valve (page 149).
• Install meter console in tractor (page 151).
• Install any Options not factory- or dealer-installed.

Post-Delivery/Seasonal Setup

On initial delivery, use with a new tractor, and seasonally, check and as necessary, complete these items before continuing to the routine setup items:

• Bleed hydraulic system (page 118).
• De-grease exposed cylinder rods if so protected at last storage.
• Verify that all time-dated components are within their service lives.
Get Expert Advice

Anhydrous ammonia is 82% Nitrogen, the highest of any fertilizer. The compound NH$_3$ is normally a gas at ambient temperatures. It is retained in the soil only by chemical reactions and physical mechanisms, primarily reactions with soil moisture.

Consult with your agronomist about optimal application timing, rate and depth, based on proposed crop, soil temperature, soil moisture content and ambient temperature. Non-optimal applications can result in NH$_3$ loss to the atmosphere, soil drying, and undesired long term changes in soil pH.

Pre-Application Setup

Complete this checklist before routine setup:

- Read and understand “Important Safety Information” on page 1.
- Check that all working parts are moving freely, bolts are tight, and cotter pins are spread.
- Check that all grease fittings are in place and lubricated. See “Lubrication and Scheduled Maintenance” on page 120.
- Check that all safety decals and reflectors are correctly located and legible. Replace if damaged. See “Safety Decals” on page 9.
- Inflate tires to pressure recommended and tighten wheel bolts as specified. See “NP2330LL-18V20” on page 137.

Hitching Tractor to Applicator

This manual presume the following (recommended) operations sequence:

1. Hitch tractor to applicator for transport: below
2. Transport applicator separately from a trailing nurse tank: page 55.
3. Hitch a trailing nurse tank to applicator at field: page 72.

To prevent soil compaction on rows, set tractor wheels between rows, for example: 60 inches center-to-center. For hillsides and steep slopes, set tractor wheels as wide as possible for maximum stability.
2-Point Hitching

**DANGER**

Crushing Hazard:
Do not stand or place any body part between applicator and moving tractor. You may be severely injured or killed by being crushed between the tractor and applicator. Stop tractor engine and set parking brake before attaching cables and hoses.

The NP2330 is engineered to be used with Category II or Category III tractors.

Refer to Figure 5
This implement is factory set for Category III tractors. Category II requires an optional hitch pin kit (see page 123).

In addition, the following bushings (not supplied by Great Plains) may be needed to fit your quick hitch or tractor’s 3-point arms:

- Lower Links:
  1. Adjust tractor lower links to maximize lifting height.
  2. Normally the lower arms engage pins in the lower holes of the applicator’s three point lugs. You may use the upper holes if necessary.
  3. Set tractor sway blocks to minimize side sway. Set tractor hitch lift control to Float.
  4. Back tractor up to implement. Align lower links with the lower hitch clevis on implement. Adjust hitch bushings and spacers supplied with implement according to the category of your tractor. Lock pins in place.
  5. Set hitch for Depth Control mode.

ขาว 1 Remove shipping brace stops before folding or unfolding. Damage to hinges may occur.
Emergency Shut-Off Rope

This part of hitching requires operating the emergency shut-off valve. If the applicator was correctly shut down and discharged after last use, there is no anhydrous ammonia liquid in the system, and only small amounts of vapor, at low pressure. If the applicator was improperly shut down, checking the emergency valve could be hazardous.

Possible Chemical Hazard:
Wear your NH$_3$ PPE$^1$. Be up-wind of any possible release points. Residual NH$_3$ (possibly in dangerous quantities) may be present in the applicator systems, from the inlet Acme cap $^{AT4}$ to the On/Off solenoid valve (not shown). Unprotected exposure could result in permanent lung/eye injury or death.

Refer to Figure 7
At each cooler inlet emergency shut-off valve $^{AT1}$:

Check System Discharged
1. Check that both halves of the breakaway coupler $^{AT4}$ are fully mated. If they are not, STOP.
   Treat this as a breakaway event (see page 67).

Refer to Figure 8
About Bleed Valves:
The purpose of a bleed valve is to perform a controlled release, via an orifice $\phi$, of any fluid or gas trapped in the closed line prior to operating other valves or uncapping at a nearby Acme fitting.

If the line is discharged, opening the valve may have no result, or may release a small amount of NH$_3$ vapor at low pressure. If there is a low pressure release, leave the valve open at the current position. Move away up-wind. Return when the release concludes.

If the line was not discharged, opening a bleed valve may release NH$_3$ vapor at high pressure, or may release NH$_3$ liquid, most likely as a spray.

If the there is liquid in the line segment, completion of a bleed can take a long time. As the fluid turns to vapor, it chills the remaining fluid, slowing evaporation.

If opening a bleed valve results in an unexpected large discharge, immediately close the valve and follow the instructions for discharging the system (page 103).

$^1$ PPE: Personal Protective Equipment
**Refer to Figure 9**

2. Check the pressure gauge \( A_{28} \). If it is not 0, STOP.
   Discharge the system before resuming hitching. See page 103.

3. From up-wind, and with the bleed valve orifice pointing away from you, slowly open the cooler bleed valve \( A_{29} \). If any liquid appears, or vapor at high pressure, close valve and STOP.
   Discharge the system before resuming hitching. See page 103.
   Once there is no vapor flow at the bleed valve, close it and continue at the next step.

**Refer to Figure 10**

4. Check the state of the emergency shut-off valve \( A_{18} \).
   If the valve \( A_{18} \) is closed, \( \text{NH}_3 \) may be trapped on the cooler side of the valve. Continue at step 5.
   If the valve \( A_{18} \) is open, step 3 above has already verified that the line is discharged on both sides of valve \( A_{18} \). Close bleed valve and continue at step 6.

5. Standing up-wind, and with the bleed valve orifice pointing away from you, slowly open the breakaway coupler inlet bleed valve \( A_{18} \). If any liquid appears, or vapor at high pressure, close valve and STOP.
   Discharge the system before resuming hitching. See page 103.
   Once there is no vapor flow at the bleed valve, close it and continue at the next step.

**Refer to Figure 10 (which depicts the shut-off valve closed)**

6. If the emergency shut-off valve \( A_{18} \) was closed, open it.

7. Locate the emergency rope ①.

8. Inspect the attachment of the rope to the valve handle, and the rope itself. Replace the rope if cut, frayed or worn. If the handle connection is not secure, take corrective action.

9. Uncoil the rope. Remove any knots.

10. Route the rope forward and above the plumbing center-line (but otherwise near center-line), toward the tractor cab. Avoid having the rope rest on or rub against any applicator or tractor parts that could cause a snag or abrasion. Avoid running too far sideways, or operation may bend the handle.

11. Route the rope into the tractor cab.

12. **Test each rope.** Make sure each rope can quickly and smoothly close its valve.
Electrical Hookup

Refer to Figure 11

Your applicator is equipped with systems that require separate electrical connections. For future reference, note any optional connectors on this checklist.

- ① Lighting connector (standard)
- ② Console flow harness connector (optional)
- ③ Console pressure connector (variable rate only)
- ④ Console speed connector (optional, and only if sensor/radar mounted on implement)

Make sure tractor is shut down with accessory power off before making connections.

These connections may be made in any order. The key requirement is that all connections be made prior to applicator movement.
Hydraulic Hose Hookup

**WARNING**

*High Pressure Fluid Hazard:*
Shut down tractor before making hydraulic connections.
Only trained personnel should work with system hydraulics.

Escaping fluid under pressure can have sufficient pressure to penetrate the skin causing serious injury. If an accident occurs, seek immediate medical assistance from a physician familiar with this type of injury.

*Use paper or cardboard, NOT BODY PARTS, to check for leaks. Wear protective gloves and safety glasses or goggles when working with hydraulic systems.*

**Refer to Figure 12**

On implements with more than one hydraulic circuit, hydraulic hoses are color coded to help you hookup hoses to your tractor outlets. Hoses that go to the same remote valve are marked with the same color.

<table>
<thead>
<tr>
<th>Color</th>
<th>Function</th>
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<tbody>
<tr>
<td>Red</td>
<td>Lift, Fold, Down-Pressure</td>
</tr>
<tr>
<td>Black</td>
<td>Hydraulic Pump Drive (Option)</td>
</tr>
</tbody>
</table>

To distinguish hoses on the same hydraulic circuit, refer to hose label.

- The hose under an extended-cylinder symbol feeds a cylinder base end, or the return side of a hydraulic motor.
- The hose under a retracted-cylinder symbol feeds a cylinder rod end, or the pressure side of a hydraulic motor.

Connect either hose to either side of the remote. Use a regular remote and not a dedicated tractor 3-point remote.

Secure hoses and cables so that they have sufficient slack for hitch movements, but cannot get caught between moving parts of applicator. Failure to safely route and secure hoses and cables could result in damage requiring component repair/replacement, and lost field time.

---

1. The 2-Point implement has a merged hydraulic circuit in which different cylinders are extending and retracting at the same time, and thus cannot meaningfully use the hose label. Determine by testing which lever direction lifts/folds and lowers/unfolds.
2. Some tractors provide a special remote pair at the 3-point hitch arms. On some tractor models, this circuit has specific flow and/or pressure-sensing behavior intended for certain implements (other than Nutri-Pro®). Nutri-Pro® lift and/or fold may not function on this type of circuit.

---

**NOTICE**

*Machine Function Risk:*
The weight transfer system requires a tractor with closed center hydraulics. Open center hydraulics are incompatible.
Hydraulic Pump Hookup

The hydraulic motor used is a 7 gpm (23 liter/min.) motor. If the tractor used does not have the capabilities to adjust the remotes down to this flow, then a Hydraulic Flow Divider Kit must be installed so that flow can be controlled to prevent operating the pump at excessive speeds. See a Great Plains dealer for more information.

If the tractor has only one circuit capable of continuous flow or only one capable of adjustable continuous flow, reserve that circuit for the pump, and use another for the main sprayer functions.

1. Connect the pump hydraulic hoses to suitable tractor remotes.

Refer to Figure 13

2. The pressure hose coming out of the tractor remotes must be connected to the motor inlet port: “I”, Base end on hose label), and the return line connected to the motor outlet: “O”, Rod end on hose label.

3. Before operating, place a stop in the neutral position for the tractor hydraulics so that the hydraulic lever can only be moved to the float and down positions. Refer to the tractor operator manual or tractor dealer on information for the neutral stop.

4. See page 74 for setting flow rate.

Raise Parking Stands

Refer to Figure 14

**CAUTION**

Heavy Object Hazard:
Use the lifting handle ②. Push leg against frame while raising or lowering. The leg weighs approximately 45 pounds (20 kg). The leg could cause injury if you lose control of it while raising or lowering.

1. Use tractor 2-point hitch and the lift-assist circuit to slightly raise the implement. See “Raising/Lowering Applicator” on page 47.

2. Remove cotters from pins ①.

3. Grasp the lifting handle. Use an assistant or shoulder to hold leg against frame and inside flanges.

4. Remove the pins ①.

5. Lift or lower the stand straight up or down.


**NOTICE**

Equipment Damage Risk:
DO NOT move the hydraulic lever into the Neutral position while the hydraulic pump is running. To do so may cause damage to the hydraulic pump.
Leveling Implement
During initial setup and periodically throughout the season, check that the implement runs level. When applying fertilizer, the top of the main frame should be parallel to the ground, and level left to right.

Set Application Depth
Before checking or correcting side-to-side or front-to-back level, set the application depth (which is controlled by tool bar height).

The Nutri-Pro® Liquid Fertilizer is designed for application at:
0 to 6 in. (0 to 15.3 cm)
For adjustment, see “Vantage I Coulter Adjustments” on page 85
To check level, lower the implement into the ground in representative conditions.

2-Point Front-to-Back Level (Spacers)
The rear lift-assist assembly must be set to match the gauge wheels and 2-point hitch in front. Lift-assist lowered height is controlled by (provided) spacers on the lift cylinder rods.
To set:
1. Lower implement until lift assist wheels are just off the ground.
2. Raise implement until wheels touch ground just firmly enough to resist spinning.

Refer to Figure 16
3. Insert a combination of spacers to fill the space on the rod between the cylinder end and clevis.
4. Raise and lower implement. Pull forward and check coulter depth and front-to-back level. Adjust spacers as required to achieve desired application depth.
Meter / Variable Rate Setup (Option)

This topic presumes that the Nutri-Pro® applicator has one or more Raven SCS 450 consoles, speed radar, flow meter, pressure sensor, section control valves, and, for anhydrous models, single or dual Raven AccuFlow™ metering system. It also presumes that the console has been installed in the tractor cab per “Console Installation” on page 151.

**NOTICE**

If the Nutri-Pro® applicator has dealer- or user-provisioned controller or metering, carefully follow supplier documentation for installation, setup, use and maintenance. This Nutri-Pro® manual (417-477M) cannot describe your system. Great Plains cannot assume any liability for results with equipment not supplied by Great Plains.

Before first field use of the SCS 450, it must be programmed with data specifying the system configuration, consisting of various “CAL” numbers and user elected “RATE” numbers. See the Raven SCS 450 manual for display interpretation, and see the manual or the Calibration Card for the keystroke sequence for setting each of these values.

This data is retained as long as the SCS 450 remains connected to battery power. If power is removed for electrical work, long term tractor parking or welding, the data is lost and must be re-entered.

**SCS 450: BOOM CAL**

Anhydrous models without section control have one “boom section” (BOOM 1, whether single- or dual-cooler). The BOOM CAL number is simply the applicator swath on single-section applicators. See the table on page 41.

Hydraulic pump models and anhydrous models with section control have three boom sections. See the table on page 41.

**SCS 450: SPEED CAL**

A speed sensor connection to the Raven SCS 450 is required. Perform a calibration per the manuals for the sensor and the SCS 450.

A speed sensor input allows the SCS 450 to determine and control application rates at arbitrary field speeds.

- The Great Plains Raven AccuFlow™ and SCS 450 bundles do not include a speed sensor, nor the cable necessary to connect a Raven-compatible sensor or radar to the SCS 450. See page 131 for an available radar kit. See page 140 for harness cables available from Great Plains or Raven.
- Two-product applicators using two SCS 450 consoles usually require an additional Y-cable.
**SCS 450: METER CAL**
This is the pulse-vs.-rate calibration number for the flow meter ([AR] or [CL] in system diagrams in this manual).
Obtain this number from the tag affixed to the meter. Enter it into the SCS 450 and record it on the Calibration Card.

**SCS 450: VALVE CAL**
This is the response time calibration number for the control valve ([AS] or [CL] in system diagrams in this manual).
Obtain this number from the tag affixed to the valve. Enter it into the SCS 450 and record it on the Calibration Card.

**SCS 450: PRESSURE CAL**
Conventional Liquid Fertilizer only:
This DATA MENU sequence sets zero for the pressure transducer ([EL] in system diagrams in this manual).
Perform this operation only when lines are at zero pressure.

**SCS 450: RATE 1 CAL**
This is your primary desired application rate, typically in gallons per acre.

**SCS 450: RATE 2 CAL**
This is your secondary desired application rate, typically in gallons per acre. If you have no alternate rate preferred, set this to RATE 1 CAL, so that the control valve won’t slew if you need to switch to MAN mode.

**SCS 450: TANK VOL**
Optional. If entered, the material consumed (as measured by the flow meter) is continuously subtracted from this number, and may be used to signal a low tank alarm. The number needs to be re-entered at each refill.

**SCS 450: TIME**
Optional. The SCS 450 (which is always in 24:00 hour time format) defaults to 00:00 (and resets to that after 10 days of inactivity). You may use this menu to set the actual time.
SCS 450 Setup Data

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>BOOM CAL</th>
<th>SPEED CAL</th>
<th>METER CAL</th>
<th>VALVE CAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 (LH)</td>
<td>2 (CTR)</td>
<td>3 (RH)</td>
<td></td>
</tr>
<tr>
<td>NP2330LL-12V30</td>
<td>30-Foot, 12-Row, 30 inch</td>
<td></td>
<td>360.0 in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NP2330AA-12C30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NP2330LL-18V20 w/o Section Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NP2330AA-12C30 w/ Section Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- b. This value is printed on a durable tag attached to the meter cable.
- c. This value, for example “2123”, is printed on the label on the valve body.

Wash Water

Refer to Figure 18

Empty the 10 gallon applicator First Aid Water tank. Refill it with fresh clean water. If the nurse tank cart is at hand, refill the nurse tank wash water as well.

The water needs to be changed daily. Water absorbs ammonia vapor from the air, and becomes an ammonium hydroxide solution over time.

![First Aid Water Station](image)

When emptying wash tanks, use the time and water to train operators on tank operations, and first aid rinsing procedures.

Sealer Setup (NP2330AA)

From the factory, sealers are preset for optimal shipping configuration. The factory default settings are not likely to be suitable for your field conditions.

Adjustments may also be required for different fields and from season to season.

See “NH3 Sealer Adjustments” on page 83.
### Operating Instructions

This section covers general operating procedures. Experience, machine familiarity and the following information will lead to efficient operation and good working habits. Always operate farm machinery with safety in mind.

#### Pre-Start Checklist

**WARNING**

*High Pressure Fluid Hazard:*
Escaping fluid under pressure can have sufficient pressure to penetrate the skin. Check all hydraulic lines and fittings before applying pressure. Fluid escaping from a very small hole can be almost invisible. Use paper or cardboard, not body parts, and wear heavy gloves to check for suspected leaks. If injured, seek immediate medical attention from a physician familiar with this type of injury.

This checklist presumes that the nurse tank is not yet connected.

- Carefully read "**Important Safety Information**" on page 1.
- Empty the applicator’s 10 gallon wash water tank, refill it with fresh clean water.
- Review the Safety Data Sheet (SDS) for the anhydrous ammonia.
- Check that all time-dated applicator components are still within their specified service lives.
- Check all plumbing components, hose, tubing and fittings are in satisfactory working condition.
- Lubricate applicator as indicated under “**Lubrication and Scheduled Maintenance**” on page 120.
- Check all tires for proper inflation. See “**NP2330LL-18V20**” on page 137.
- Check all bolts, pins, and fasteners. Torque as shown in See “**Torque Values Chart**” on page 139.
- Check applicator for worn or damaged parts. Repair or replace parts before going to the field.
- Check hydraulic hoses, fittings, and cylinders for leaks. Repair or replace before going to the field.

**CAUTION**

*Spill hazard/Tank damage risk:*
Periodically check the tension of the straps for the fertilizer tank. Strap tension will change as outside air temperature changes. Adjust tension as necessary to prevent personal injury or damage to the fertilizer tank.

---

To Avoid Injury or Machine Damage:
- Read and understand owner’s manual before operating applicator.
- Check applicator to ensure NOSERC fitting limits.
- Do not transport applicator with liquid in tanks. Add liquid at the field.
- NOSERC transporting, follow appropriate safety steps.
- NOSERC Idle or off applicator.
- Escaping hydraulic fluid can cause serious injury when equipped with hydraulic components.
Raising/Lowering Applicator
NP2330 2016 Models, S/N C1050A+

Operate the tractor hitch in “position” or “depth” control mode, regardless of applicator hitch type. The applicator may be raised and lowered while folded.

Raise For Transport (Folded)
These steps presume an applicator parked or stored folded, already raised, but on lift-assist locks and parking stands. No use of the applicator hydraulics is required.

1. Verify that lock channels are installed on the lift-assist cylinders (page 38).
2. Raise the tractor 3-point hitch just enough to lift the parking stand bases off the ground. Set the hitch circuit to Neutral. Shut off the tractor.
3. Raise the parking stands (page 37).

The FOLD / FIELD switch may be in any position for lift while folded.

Raise Pre-Folding (from Unfolded)
These steps presume an applicator parked or stored unfolded, already raised, but on lift-assist locks at rear, on extended gauge wheels at wing tips, and on parking stands at hitch.

1. Verify that lock channels are installed on the lift-assist cylinders (page 38) and that the hydraulic harness is connected at the hitch (page 35).

Equipment Damage Risk:
Do not fully fold or fully unfold while lowered. Perform complete fold and unfold only when fully raised. When lowered, the wing coulters near the wing pivots may be damaged by bending or ground dragging.

2. Raise the tractor 3-point hitch enough to lift gauge wheels, coulters, and the parking stand bases off the ground. Set the hitch circuit to Neutral.

Refer to Figure 19
3. Set the FOLD / FIELD switch to FIELD. This arrests fold at field lift.
4. Retract the fold/lift circuit until lift-assist and wing fold operations each their stops. Set fold/lift circuit to Neutral. Shut off the tractor engine, leaving the FOLD / FIELD switch powered-up 1.
5. Raise the parking stands (page 37).

1. If the FOLD / FIELD switch is wired directly to the tractor battery, the tractor may be shut off completely. Otherwise leave the ACC active.
Field Lift (Gull Winging)
These steps presume an unfolded applicator in field configuration (lift-assist locks out, spacers in, coulters in ground).

Refer to Figure 21
1. Set the FOLD / FIELD switch to FIELD. This arrests fold at field lift and locks the outer wings at level.

NOTICE
Equipment Damage Risk:
Do not fully fold or fully unfold while lowered. Perform complete fold and unfold only when fully raised. When lowered, the wing coulters near the wing pivots may be damaged by bending or ground dragging.
2. Raise the tractor 3-point hitch.

Refer to Figure 22
3. Raise the applicator by Retracting the fold/lift circuit to retract the wing fold cylinders and extend the lift-assist. Wing sections partially fold.
4. Set hitch and fold/lift circuits to Neutral for extended turns or field moves.

Wing Angle Adjustment

NOTICE
Adjustments are meant for rear sensors only. DO NOT adjust the front sensors on your machine! Rows can become damaged from being lowered too low and making contact with the ground.

When using field lift, you may need to set the wings of your machine to a higher angle to clear growing crops. Follow these steps to adjust the wings’ lifted height.

Refer to Figure 23
1. Go to the rear of the machine and locate the sensor brackets on the left- and right-hand wings.
2. Unscrew the bolt to loosen the bracket. Adjust and set the bracket at the desired angle.
3. Retighten bolt. Repeat for the opposite wing of the machine. For optimal performance, keep adjustments the same.
Lower While Folded
These steps presume that the intention is parking or storage, on lift-assist locks and parking stands.
1. Verify that the lift lock channels are installed on the lift-assist cylinders (page 49).
2. Extend the fold/lift circuit to lower the lift-assist cylinders onto their locks.
3. Raise the tractor three-point hitch until the applicator mainframe is level front-to-rear, or the front is slightly higher than the rear. Set the hitch circuit to Neutral. Shut off the tractor.
4. Deploy the parking stands. Pin them so that the frame will be level when lowered onto the stands.
5. Start the tractor. Lower the tractor hitch until the applicator is supported by the parking stands.

Lower While Unfolded
These steps presume that the applicator is presently folded with lift-assist lock channels installed, and parking stands deployed, and that the intention is to park, store or service the applicator. For field lower and field adjustments, see topic “Field Lower” following.
1. Perform a Lower While Folded operation (page 45).
2. Set the lift/fold/circuit to Neutral or Float.

Refer to Figure 24
3. Set the FOLD / FIELD switch to FOLD / UNFOLD
   This arrests unfolding at wings-level.
4. Extend the fold/lift wing to unfold the wings, until wings-level.
5. To keep all coulters off the ground when unfolded and lowered, crank the gauge wheels to full extension.
6. If the tractor hitch is raised, lower it until the applicator rests on the parking stands at front.
7. Set the FOLD / FIELD switch to FIELD
   This allows the wings to move below level.
8. Extend the fold/lift wing to further unfold the wings until the gauge wheels touch the ground, then set the circuit to Float (to relieve pressure at hitch hoses).
   The counterbalance valve holds the inner wings at their current position.
9. Set the FOLD / FIELD switch to PARK

Tip-Over and Crushing Hazard:
Never unhitch without using parking stands, particularly while folded. A folded applicator without parking stands deployed may tip forward immediately upon unhitching. Anyone at the hitch or in the tractor could be seriously injured or killed. The tractor cab may be crushed.

NOTICE
Equipment Damage Risk:
Although it is possible to fully lower the applicator while folded, this is not recommended. This can place the full weight of the machine on the center coulters, exceeding their spring capability.

If wing lock pins are installed, the FOLD / FIELD switch may be in any position for lowering while folded.
Field Lower

These steps are for lowering in the field after initial line-up and after turns. Lift-assist lock channels (page 49) are presumed to have been replaced by spacers (page 38). The down-pressure/weight transfer system (page 88) is presumed to be adjusted.

The key objectives for an optimal lowering are:

- avoid side loads on coulter discs or tines by avoiding lowering with drooped wing tips, and
- avoid tine plugging by avoiding any reverse motion of the tines at the ground.

Being in slow forward motion during lower avoids both of these risks. The following instructions presume a lowering while stationary.

Refer to Figure 25

1. Verify that the FOLD / FIELD switch is set to FIELD
2. Check that wings are partially folded in field lift, or at least level. If they are drooping, retract the fold cylinders to correct.
3. Lower the tractor 3-point hitch to the preset field height. Set the hitch circuit to Position or Depth Control.
4. Extend the fold/lift circuit to lower the wings below level into down-pressure mode, and to retract the lift-assist cylinders to their spacers.
   You may lower the hitch and lift-assist simultaneously, but avoid lowering the lift-assist before the hitch.
5. Pull forward.
6. Leave the fold/lift circuit active in the lower/unfold position, to supply oil to the down-pressure system.
Raising/Lowering Applicator
NP2330 Pre-2016 Models, S/N C1049A-

Operate the tractor hitch in “position” or “depth” control mode, regardless of implement hitch type.

The implement may be raised and lowered while folded.

Raise/Lower

Refer to Figure 26 and Figure 27

The implement front height is controlled entirely by the lower two tractor 3-point arms (not visible in figure).

The rear height of the implement is controlled by two lift-assist cylinders. Spacers are provided to limit the “lowered” position.

The lift-assist and wing fold cylinders share the same hydraulic circuit. When correctly adjusted, the wings partially fold just prior to lift. Self-engaging lock channels prevent complete folding during field operations. The lowered height of the wings is controlled by manually-set wing gauge wheels (page 53).

Raising (Field, Unfolded)

These instructions presume that the intention is to lift without folding, that the implement is unfolded, and that the wing fold locks auto-engaged at the last unfold, and have not been reset. If the intention is to lift and fold, see “Folding” on page 54.

1. Open the lift-assist shut-off valve (3).
2. To raise the implement, first raise the tractor hitch. This at least partially raises the coulters (and, if completely stopped, raises them with a slight forward motion to avoid plugging).
3. Extend the lift-assist cylinders (normally with an Extend operation of the tractor remote).

The wings fold partially. When arrested by the stops, the rear lift-assist cylinders extend. This feature prevents wing droop in field turns.

4. When fully raised, set both hitch and lift/fold remotes to Neutral.

Raising (When Folded)

If the implement is already folded:

- Raise it with the 2-point and lift-assist circuits in any order. The fold circuits are supplied with oil, but since the wings are already folded, they do not move. The adjustment valve (page 149) then diverts all oil to the lift cylinders.
- Hold at raised with Neutral circuits.
- Install rear lift-assist lock channels (page 49).
- Deploy parking stands (page 37).

If the implement is unfolded, and the intention is to lift and fold, see “Folding” on page 54.

Notice

Equipment Damage Risk:
Do not fully fold or fully unfold while lowered. Perform complete fold and unfold only when fully raised. When lowered, the wing coulters near the wing pivot may be damaged by bending or ground dragging.

Caution

Gradual Crushing Hazard:
Do not rely on hydraulic pressure alone to keep the implement raised. Use parking stands (page 37) and transport/lift locks (page 49) when working around a raised implement. The tractor hitch may settle. The bypass orifices in the implement lift-assist re-phasing system cause it to slowly lower.
Lowering (Field, Unfolded)

1. If lock channels are engaged on the rear lift-assist cylinders, raise the implement, disengage the channels (page 49), and insert the desired number of spacers (page 38).
2. Open the lift-assist shut-off valve (page 47).
3. To lower the implement, lower the tractor hitch and retract the lift-assist cylinders (normally with a Retract operation of the tractor remote).
4. The front of the implement lowers until the hitch movement is stopped by your control, or by any depth stop set on that control.
5. The rear of the implement lowers until the cylinders are stopped by the installed spacers, or until fully retracted if there are no spacers. If the coulters are not in the ground, the lift-assist wheels come off the ground until you pull forward into the field.
6. The wings (if unfolded) lower to the height set by the wing gauge wheels (page 53) or onto the coulters.
7. Set the lift/fold circuit to Float.

Lower (Service/Parking, Folded)

This topic presumes that the intention is to lower a folded implement without unfolding. If the intention is to both lower and unfold, see “Unfolding” on page 53.

1. Open the lift-assist shut-off valve (page 47).
2. Raise the implement. Set circuits to Neutral.
3. Remove spacers and install lift-assist lock channels. Deploy parking stands (page 37) as desired.
4. Lower front of implement with 3-point.
5. Slowly lower rear of implement with lift/fold circuit. Stop as soon as rear cylinders are fully retracted or on spacers/locks.
6. If the wings began to unfold, reverse the circuit just long enough to put the wings back on the transport rest.
7. Set circuits to Float.

First Pass Lowering:

- If lock channels are engaged on the rear lift-assist cylinders, raise the implement, disengage the channels (page 49), and insert the desired number of spacers (page 38).
- If the wings are drooped, retract the fold circuit (page 54) to bring the wings into contact with the wing locks, or to wings level. Set fold circuit to Neutral until lowered to ground.

CAUTION

Overhead Sharp Crushing Object Risk:
Clear the area near the implement. Lower with caution when folded. Once the lift-assist cylinders retract against locks or spacers, oil flows to the fold cylinder bases, and the wings begin to unfold. Anyone under the wings may not be expecting an unfold, and could be struck, injured or killed.

NOTICE

Equipment Damage Risk:
Fully fold before lowering onto parking stands. Parking stands support only the center section. If unfolded, wings will droop, and coulters will strike the ground.
Lift Cylinder Locks

Use transport locks to hold the applicator at raised for transport, adjustments, maintenance and storage.

**CAUTION**

*Falling Hazard:*
Do not climb or stand on tires or wheels. Even at full extension on level ground, tires may not be in firm ground contact. They could spin without warning. A fall could result in injury.

*Refer to Figure 28*

Transport locks are present on all wheel assemblies with hydraulic cylinders. To install cylinder stops:

1. Open the lift-assist shut-off valve (page 47).
2. Fully raise implement (page 47). Set lift circuit to Neutral.
3. Remove and store lift-assist spacers (page 38).
4. Place channel on lift cylinder rod of each cylinder to be locked.
5. Re-install locking pin and secure with cotter pin.
6. Lower applicator onto lock channels.
7. Set lift circuit to Float.
Unfolding and Folding
NP2330 2016 Models, S/N C1050A+

Unfolding (At Field)
These instructions presume the applicator has just completed transport, is raised, and transport locks are installed. It is being unfolded for field use.

Refer to Figure 29
8. Set the FOLD / FIELD switch to FOLD / UNFOLD.
9. Extend the fold/lift circuit to unfold the wings
10. Retract the fold/lift circuit slightly to raise the lift-assist off the lock channels.
11. Set all circuits to Neutral. Shut off the tractor.
12. Remove the lift-assist lock channels (page 38). Install the spacers (page 38).
13. If wing gauge wheels were extended, crank them to field height.
14. Lower the hitch to field height.

Notes about normal unfold:
• Wings do not unfold to below wings-level.

Machine Damage Risk:
Set the switch to UNFOLD. If set to PARK or FIELD, the wings may unfold to below level and drag inward on the ground.
Unfolding (Parking, Storage, Service)
To unfold, off field, for parking, storage or servicing, unfold with the center section fully raised.
1. Hitch to a suitable tractor.
2. Retract the fold/lift circuit to fully raise the applicator lift-assist.
3. Raise the tractor 3-point hitch.
4. If lift-assist lock channels are not installed, set circuits to Neutral. Shut off the tractor. Remove spacers (page 38). Install lock channels (page 49). Re-start the tractor.

Refer to Figure 31
5. Set the Fold switch to FOLD / UNFOLD
6. Extend the fold/lift circuit to unfold the wings.
7. Set all circuits to Neutral.
8. Shut off the tractor.
9. Unless using blocks or stands under wings, fully extend wing gauge wheels.
10. Deploy parking stands at desired or maximum height.
11. Start the tractor. Lower the 3-point hitch until the applicator rests on the parking stands at front.
12. If wings stop above horizontal, move switch to FIELD position, and Extend fold/lift to further unfold.
13. Extend until the gauge wheels contact the ground or the wings stop. Set the fold/lift circuit to Float.

Notes about normal unfold:
- Wings do not unfold to below wings-level.

**NOTICE**

Machine Damage Risk:
Set the switch to UNFOLD. If set to PARK or FIELD, the wings may unfold to below level and drag inward on the ground.
Folding

These instructions presume that the applicator is unfolded and lowered.

Refer to Figure 33

1. Set the Fold switch to FOLD / UNFOLD.

CAUTION

Electrocution and Overhead Collision Hazards:
Do not fold with switch in FIELD position. In FIELD, the outer wing sections cannot fold. The folded applicator would be over 21 feet (6.2 m) high. This dramatically increases the risk of electrocution from overhead lines, with or without direct contact. It is also too high for safe transport.

Refer to Figure 34

2. Raise the hitch.
3. Retract the fold/lift circuit to simultaneously raise and fold the applicator. Observe the fold sequence. Lift and fold do not start and end at the same time.
4. Set the fold/lift circuit to Neutral.
5. Remove spacers (page 38). Install lift-assist cylinder locks (page 38).
6. Extend fold/lift to lower lift-assist cylinders onto lock channels. Set fold/lift circuit to Float. Shut off tractor.

For parking/storage/service, lower the applicator onto parking stands.
Unfolding and Folding

- **NP2330 Pre-2016 Models, S/N C1049A-**
  Nutri-Pro® implements have a merged lift/fold circuit. The lift-assist cylinders usually require reconfiguring just prior to unfold and fold. Wing locks require reset prior to fold. See “Unfolding”, below.

Unfolding
The implement should only be unfolded in the field, or fully supported by parking stands and lift-assist cylinder transport locks.

Unfolding (At Field)
These instructions presume the implement has just completed transport, is raised, and transport locks are installed. It is being unfolded for field use.

1. Open the lift-assist shut-off valve (page 47).
2. Lower the lift-assist circuit. Leave the 2-point hitch at raised.
   
   Because the transport lock channels are in place, the lowering is arrested, and the wings unfold.

3. Stop the unfold when the wings are approximately level.
4. Raise the lift-assist circuit just enough to raise the lift cylinders off the lock channels. Before the lift occurs, the wings fold up against the wing locks. Set circuit to Neutral.
5. Remove the transport locks (page 49).
6. Install the spacers (page 38).

The implement is now raised in field configuration. To lower for nurse tank connections, continue…

7. Lower the 2-point hitch.
8. Lower the lift-assist circuit. The wings continue to unfold, and the lift cylinders lower onto the spacers. The implement lowers to or into the ground.
9. Set the hitch and lift/fold circuits as follows depending on the next operation required:
   - Nurse Tank Hitching:
     Set the hitch and lift-assist circuits to Float.
   - Field Application (Weight Transfer Adjusted):
     Set the hitch to depth control. Set the lift/fold circuit to lower/unfold (active weight transfer).
   - Field Application (Weight Transfer NOT Adjusted):
     Set the hitch and lift/fold circuit to lower/unfold per “Weight Transfer Adjustment” on page 88.

Unfolding (Service)
To unfold, off field, for servicing, unfold with the center section fully raised. Unless the wing gauge wheels have been previously extended to maximum height, or extra stands or supports are used, the wing end coulters will reach the ground first. Take precautions if parking surface damage is a concern.

10. Set lift/fold circuit to Float.
11. Raise the 2-Point hitch.
12. If transport locks are not yet installed, open the lift-assist shut-off valve and perform a lift-assist raise operation. Wing fold is supplied with oil, but being folded, the wings do not move.
14. Deploy parking stands. Set them to desired or maximum height.
15. Lower lift-assist circuit. Wings unfold first, then lift-assist lowers onto lock channels.
16. As the wings near level, set circuit to Neutral. Close the lift-assist shut-off valve.
17. Unless using blocks or stands, fully extend the gauge wheels to maximum height.
18. Resume unfolding until gauge wheels are on ground.
19. Lower the 2-point hitch.
20. Set hitch and lift/fold circuits to Float.
Folding
These instructions presume that the implement is unfolded and lowered.

1. Set lift/fold circuit to Float.
2. Raise the 2-Point hitch.
3. Raise the lift-assist circuit. The wings begin to fold, and are stopped by the wing locks. The lift-assist then raises.
4. Set the lift/fold circuit to Neutral to hold at lift.
5. Remove spacers (page 38).
   Install lift-assist transport locks (page 49).
6. Deploy parking stands if the implement is to be parked at the folding spot.
7. Lower the lift-assist circuit (which causes unfolding), just until the wings are level. Set the fold circuit to Neutral.

Refer to Figure 35 and Figure 36

8. Swing the wing locks up and out of their engaged positions, and into their reset positions.
9. To secure wing locks during transport, lower down into transport lock holder and slide pin through holder and wing lock handles. Secure with cotter pin.
10. Raise lift-assist circuit once more, which causes the wings to fully fold. When they have folded, the lift-assist raises cylinders to raise the implement rear.

For parking/storage/service, lower the implement onto parking stands. For transport, the lift-assist circuit may be left in Neutral fully raised, or lowered onto the lock channels and set to Float or Neutral.

For parking:

11. Lower the lift circuit just until the cylinders rest on the lock channels. If the wings begin to unfold, reverse the circuit briefly.
12. Lower the 2-point hitch.
13. Set the lift/fold and 2-point hitch circuits to Float.

Transport

⚠️ DANGER ⚠️

Braking and Loss of Control Hazard:
Do not exceed 20 mph (32 kph).

⚠️ DANGER ⚠️

Loss of Control Hazard:
Do not transport applicator with material in on-board tanks. Add liquid fertilizer at field. Full tanks add 3000 pounds (1400 kg) to the weight of the implement, almost all of it borne by the tractor 2-point hitch. This can substantially reduce tractor steering. The implement rear casters are free to swivel, and cannot provide protection against under-steer in turns.
**DANGER**

**Loss of Control Hazard:**
Never use the applicator to tow a nurse tank on public roads. Tow the tank to the field with a separate vehicle. The applicator cannot provide sufficient lateral control of a trailing cart at highway speeds. The total weight of the train can also easily exceed the steering and/or braking capability of the tractor. A tank upset could occur during normal highway maneuvers. The resulting accident or spill could cause serious injury or death.

**Loss of Control Hazard:**
Never tow a 2-point implement that weighs more than 150% of the tractor (transport tractor must weigh at least 67% of implement). Ensure that the towing vehicle is adequate for the task. Using an inadequate tow vehicle is extremely unsafe, and can result in loss of control, serious injury and death.

Tractor weight matters. For field configuration (after transport), tractor must weigh at least 150% of the implement plus the loaded nurse tank. This weight is substantially higher than the required transport weight.

**Typical NP2330 Weights by Configuration**

<table>
<thead>
<tr>
<th>Model Configuration</th>
<th>NP2330LL-12V30</th>
<th>NP2330LL-18V20</th>
<th>NP2330AA-12S30</th>
<th>NP2330AA-12C30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tankless</td>
<td>Dual Tank</td>
<td>Tankless</td>
<td>Dual Tank</td>
</tr>
<tr>
<td>Minimum Empty</td>
<td>8200 lbs. (3719 kg)</td>
<td>10100 lbs. (4581 kg)</td>
<td>8700 lbs. (3946 kg)</td>
<td>10600 lbs. (4808 kg)</td>
</tr>
<tr>
<td>Maximum Empty</td>
<td>12200 lbs. (5534 kg)</td>
<td>14100 lbs. (6395 kg)</td>
<td>12700 lbs. (5760 kg)</td>
<td>14600 lbs. (6622 kg)</td>
</tr>
<tr>
<td>Maximum Full</td>
<td>-</td>
<td>20700 lbs. (9389 kg)</td>
<td>-</td>
<td>21200 lbs. (9616 kg)</td>
</tr>
</tbody>
</table>

^ Weights are approximate, and can vary by hundreds of pounds based on options, accessories and user modifications.

**Transport Steps**

Know your applicator weight. See page 55 for a list of approximate weight of various configurations.

If tractor capabilities are marginal, check actual weight of applicator at a scale.

1. Check that applicator is securely hitched to a sufficient tractor (page 32)
2. Verify correct operation of lights.
3. Raise applicator (page 47).
4. Install lift cylinder locks (page 49).
5. Fold applicator if unfolded (page 54).
6. Plan the route. Avoid steep hills.
7. Always have lights on for highway operation.
8. Do not exceed 20 mph (32 km/h). Comply with all national, regional and local laws when traveling on public roads.
9. Remember that the applicator may be wider than the tractor. Allow safe clearance.
10. Transport slowly over uneven or rough terrain.

**WARNING**

DO NOT EXCEED THIS IMPLEMENT’S MAXIMUM TRANSPORT SPEED OF 20 MPH.

EXCEEDING THIS SPEED MAY RESULT IN LOSS OF CONTROL DURING BRAKING AND SERIOUS INJURY OR DEATH.

TRANSPORT ONLY WITH PROPERLY BALLASTED TRACTOR AND A PROPERLY ATTACHED SAFETY TOW CHAIN.

TRACTOR WEIGHT MUST BE GREATER THAN 1.5 TIMES COMBINED INTERMEDIATE IMPLEMENT AND TOWED IMPLEMENT WEIGHT.

TOWED IMPLEMENT WEIGHT NOT TO EXCEED 20,000 LBS.

MAXIMUM ALLOWABLE TONGUE WEIGHT: 100 LBS.

**CAUTION**

Spill hazard/Tank damage risk:
Periodically check the tension of the straps for the fertilizer tank. Strap tension will change as outside air temperature changes. Adjust tension as necessary to prevent personal injury or damage to the fertilizer tank.
Final Applicator Setup
Prior to hitching nurse tank, make and check final implement adjustments. This could include:

- Coulter (Option) depth and castering, page 81.
- Tine condition.
- Sealer adjustments, page 83.
- Application depth, page 86.
- Application Rate, page 90.
- Row cleaner adjustments, page 84.
- Make a dry run to check applicator functions, running depth and sealing.

For nurse cart hitching, the implement may be raised or lowered, folded or unfolded. However, raised and folded hastens departure if any nurse tank problems are discovered before cart hitching.

NH₃ Operations
Operations for convention liquid fertilizer begin on page 70.

NH₃ Nurse Tanks
Use nurse tanks with proper current safety certification, and current safety equipment and features.
Consult with your anhydrous ammonia supplier for safety information and correct safe handling, transport and use of anhydrous ammonia.
Consult with local and regional authorities on safe and legal use of anhydrous ammonia, including emergency and environmental contacts, and release reporting requirements.
Review any decals and manuals available for your nurse tank cart, and for any of its components. There may be separate manuals for the tank, running gear, indicators, valves and fittings.

This (Nutri-Pro® applicator) manual covers typical operations for a representative NH₃ nurse tank cart. Your cart is likely to vary. See the "Using Anhydrous Ammonia Safely" manual (407-551M) for further information about nurse tank carts.
NH₃: Safing Applicator Before Cart Hitch

Close Line Valves
1. If any emergency shut-off valve is open, use the rope to close it. This also tests the rope and path.

Refer to Figure 38
2. Close solenoid valves:
   a. Set console MASTER switch OFF
   b. Set BOOM 1 BOOM 2ᵃ and BOOM 3ᵃ switches OFF.
   c. Turn POWER switch ON.
      If the valves were open, setting either MASTER or all BOOM switches off closes the On/Off Valve (A31).
   d. Wait 10 seconds.
      The Control Valve (A30) goes to minimum due to zero speed. It does not completely close.
   e. Set POWER switch OFF.
      a. If the applicator has a single-section boom, only switch BOOM 1 needs to be operated.

NH₃: Check Hydrostatic Relief Valves
3. Check that the plastic cap is in place at each valve. In the Great Plains configuration, this would be:
   - (A23) at each cooler
   - (A15) at the outlet side of the breakaway coupler

Caution
Ammonia Exposure and Loss Hazards:
Understand the reason for any lifted or missing hydrostatic relief valve caps. If a cap is out of place, that line section may have been closed with liquid NH₃ present, which later vented, dislodging the cap. It is also possible that the valve disc has deteriorated and is venting at normal operating pressures.

NH₃: Close Bleed Valves
4. Put on goggles and gloves. Approach the applicator from up-wind.
5. Check that all bleed valves are closed:
   - at the pressure/temperature gauges.
   - at the outlet side of the breakaway coupler.
   - at the inlet side of the breakaway coupler.

**NH₃:** Check Hose Discharged

6. Visually check the general condition of the breakaway connection (A14). If the two halves appear mated, use the inlet side bleed valve (A13) for the next step. Otherwise treat this as a breakaway event (page 67).

7. Orient the bleed valve orifice so that it points away from you and down-wind.

8. Wearing rubber chemical gloves, slowly open the bleed valve (A13) by rotating the T-handle counter-clockwise.

   Check for signs that there may be residual NH₃ in between the Acme cap and the shut-off valve:
   - strong ammonia odor
   - hissing of escaping gas
   - valve getting cold
   - dripping or spraying fluid

9. If there are any signs of residual NH₃, leave the bleed valve open until the ammonia has vented, and the inlet fittings have re-warmed to ambient temperature. This could take tens of minutes if the applicator was recently and improperly shut down.

10. Close the bleed valve.

---

**WARNING**

Possible Chemical Hazard: Wear your NH₃ PPE¹. On a connection, residual NH₃ (possibly in dangerous quantities) may be present in the applicator systems, from the inlet Acme cap to the tines. NH₃ could also be present in dangerous quantities between the Acme cap and the cart shutoff valve. Unprotected exposure could result in permanent lung/eye injury or death.

---

¹ PPE: Personal Protective Equipment
NH₃: Hitching Nurse Tank
Consult with the nurse tank supplier, and all available nurse tank documents, before hitching for the first time.

**CAUTION**

NH₃: Possible Chemical Hazard:
Clear all non-essential personnel from the area at this time. Take normal NH₃ field precautions. Although ammonia release is not expected for mechanical hitching, the tank could be venting small amounts, or large amounts if mis-configured, or if a component fails. On a re-hitch, the applicator may also be venting residual material. Unprotected exposure could cause serious lung or eye irritation.

Hitch a nurse tank to the applicator only at the field, and not prior to transport.

If taking delivery of a tank at the field, complete an inspection (see "Using Anhydrous Ammonia Safely" manual (407-551M) before accepting the tank.

**NH₃: Mechanical Cart Hitching**

1. Spot the applicator. Three objectives are:
   - Spot to avoid reverse moves after cart hitching.
   - Face the tractor and applicator basically up wind, but with a cross-wind component such that:
     - the hose connection(s) and valve operations will be made down-wind of where you stand for those operations.

Refer to Figure 41

2. Bring the applicator rear hitch tongue and nurse tank cart tongue into close proximity (a few inches).
3. Push down on the red tongue release handle ①. This frees the applicator rear hitch tongue to extend 7 inches (17.8 cm) to the rear, and 9 inches (23 cm) to either side, to assist with cart tongue alignment.
4. Align the cart clevis hitch with the applicator pull bar. Insert and secure the 1 inch hitch pin.
5. Securely attach the cart’s safety chains to the hitch chain anchors ②.
6. Optionally re-seat the applicator rear hitch tongue, at this time, by using the tractor to move the applicator backward several inches, until the latch on the hitch re-engages.
NH₃: Making Nurse Tank Connections

These instructions presume an applicator with Great Plains-supplied Squib-Taylor Flo-Max™ coupler and Raven AccuFlow™ application system.

1. Perform the steps at “NH₃: Safing Applicator Before Cart Hitch”, page 57.

**WARNING**

Anhydrous Ammonia Exposure Hazard:
Do not skip step 1. Wear your PPE. Never open a line without first performing a bleed to check it. If the applicator was improperly shut-down, the hose can contain more NH₃ than your PPE can handle. Lung damage, burning, blindness and death are possible.

Refer to Figure 42

2. Check that the two halves of the breakaway coupler (A14) are firmly mated at the swivel bracket. If not, see the Squibb-Taylor Flo-Max™ manual for re-connection instructions.

3. Check that the break-away coupler bracket (7) is free to swivel, relative to pointing directly rearward horizontal, by at least:
   - 80° to each side,
   - 45° up, and;
   - 20° down.

4. Remove, the Acme cap (A11) on the inlet side of the break-away coupler.

Refer to Figure 43

5. Inspect the inlet Acme threads (A12). Clean away any debris or other contamination.

**CAUTION**

Blinding, Choking and Respiratory Hazard:
Never look directly into an ammonia hose or fitting. Use a mirror. Always assume that ammonia is present in the system. There are many ways it can hide, and surprise you later. See “Avoid Trapped Anhydrous” on page 101

6. Using a hand mirror, inspect the gasket (2) inside the fitting (A12). If there is no sign of ammonia, and no odor, you can remove the gasket by hand for closer inspection.

   This gasket makes the liquid-tight seal between the hose and break-away coupler. Inspect it for a smooth face, no cracks, chips or weathering, and no sign of permanent compression. Replace gasket as needed for a tight seal.

---

1. PPE: Personal Protective Equipment
**NH₃: Connect Cart Hose**

*Refer to Figure 44*

Continue wearing your NH₃ PPE¹.

7. Verify that the nurse tank hose withdrawal valve (A15) is closed. Hand tighten only. Do not use tools.

8. Verify that any hose valves (A10), not shown here) are also closed. Hand tighten only. Do not use tools.

9. Check for signs that there may be residual NH₃ in between the Acme plug and the outlet shut-off valve:
   - strong ammonia odor
   - hissing of escaping gas
   - fitting getting cold
   - dripping or spraying fluid

   If there are any signs of residual NH₃, leave the plug in, but loose, until the ammonia has vented, and the Acme fitting has re-warmed to ambient temperature. This could take tens of minutes if the cart was improperly configured during or after filling.

10. Disconnect the outlet end of the hose (A7) from the Acme parking plug, or remove the Acme plug. Inspect the outlet Acme threads. Clean away any debris or other contamination.

11. Route the cart hose along the cart tongue, securing it to any clamps or caddies provided.

   Do not clamp or tie the hose within 3 feet (92 cm) of the breakaway coupler inlet (A12).

   Allow at least 13 inches (33 cm) slack in the hose within the first 3 ft. Do not allow excess slack that could allow the hose to snag or drag on the ground.

12. Bring the hose outlet (A7) and applicator inlet (A12) into contact. Hand tighten the swivel collar or shroud on the hose fitting. Do not use tools. You only need to adequately compress the gasket in the applicator inlet.

**NH₃: Dry Run**

Before activating the NH₃ delivery, cautious practice is to make one dry run pass, including a turn in each direction. This assures that tine depth is set correctly, hydraulics are working correctly, the nurse tank cart is tracking without issue, proper slack exists for all hoses and harnesses, and the meter console is reporting correct field speed.

---

¹. PPE: Personal Protective Equipment
NH₃: Pass Planning

If field requirements permit, you can minimize exposure to NH₃ vapor with the following recommendations:

Refer to Figure 45

- Check the wind direction.
- Plan passes to be cross-wind and turns up-wind.
- Plan first pass on down-wind side of field.
- Choose your first pass to allow you to be up-wind while operating valves at the nurse tank and applicator. Opening the emergency shut-off valve (A18) typically requires climbing on the applicator from the right. Starting with the wind from the right is optimal.

**CAUTION**

Anhydrous Ammonia Exposure Hazard:

If field requirements result in any down-wind operations:

- Use only a tractor with an enclosed cab.
- Have an escape route (up-wind turn) available for all down-wind operations.
- Conduct end-of-pass operations to minimize above-ground releases.
- Be mindful of the risks of olfactory fatigue. You can “get used to” the odor and fail to notice when concentrations get dangerously high.

NH₃: Start of Pass Planning

Ideally, you want NH₃ to begin flowing out of the tines right at the start of a pass, with the tines already in the ground. This minimizes atmospheric releases.

Depending on wind direction, tractor capability, available headlands, and field conditions, there are several ways to start each pass.

A. Capable Tractor:
   Lower applicator into ground at start of pass. Pull forward to set them to operating depth. Start meter flow. Do not start moving until flow divider pressure gauge nears typical operating value.

B. Headlands Available, Any Tractor:
   Lower applicator to ground some distance ahead of the application area. Move forward slowly. As tines enter ground, start meter flow.

C. No Headlands, Marginal Tractor:
   Lower applicator to ground at start of pass. Start forward movement, then meter flow. Move slowly until console rate display nears target rate.

The procedures at left are not operating instructions or checklists. They are outlines for planning pass starts. See the step details starting on page 56 and the checklists on page 78.
NH₃: Monitor Operation

Refer to Figure 46

The optional SCS 450 console monitors NH₃ flow, monitors field speed, and operates the (rate) control valve to deliver anhydrous ammonia at your desired rate.

Once setup for the applicator and preferences, and configured for the rates/limits, the monitor is typically used in the “RATE 1” or “RATE 2” FLOW CONTROL modes.

POWER: must be ON
FLOW CONTROL: as desired
BOOMS: 1 or 1, 2 and 3 ON, all others don’t-care (suggest OFF)
MASTER: OFF except when in field and in ground POWER Switch: Ammonia Release Hazard:
The MASTER switch only controls the On/Off valve (A31) if the POWER switch is ON (and power is supplied to the console). If you turn the POWER switch off with the MASTER and BOOM 1(2 and/or 3) switch on, the On/Off valve(s) (A31) remain OPEN, the Control Valve (A30) retains its setting, and ammonia may continue to flow from the nurse tank to the tines.

See SCS 450 manual for monitor operation details.

NH₃: Field Application

NH₃: Starting Tank Flow

13. Spot the applicator at the start of the first pass.
14. If the tractor has adequate power, lower the tines into the ground and pull forward to fully seat them.

Refer to Figure 46

15. Check console MASTER switch OFF.
16. Put on your chemical gloves and goggles.

Refer to Figure 47

17. Check all applicator and nurse tank valves closed (all in-line valves and all bleed valves).
18. From up-wind, open the tank withdrawal valve (A15).
   Check for leaks and open valves.
   Expect NO ammonia odor at this time.
19. Open the applicator emergency shut-off valve (A18).
   Check for leaks and open valves.
   Expect NO ammonia odor at this time.
20. Open hose inlet end valve (ATTB, if any - tank depicted in Figure 34 has no hose valves). Check for leaks and open valves. Expect NO ammonia odor at this time.

21. Open hose outlet end valve (ATTD, if any - tank depicted has no hose valves). Check for leaks. In an all-Great Plains configuration, if there has been no odor so far, there should be no odor now, as flow is blocked at the On/Off valve (ATTF) (not visible).

**Refer to Figure 48**

22. At the meter gauges, pressure gauge (A28) should read within 5 psi of the nurse tank gauge. The flow divider gauge (A42) should be zero. The temperature gauge (A27) is likely to be below ambient.

**NH₃: Starting Application**

23. Enter the tractor cab.

24. Check the emergency shut-off rope. Make sure you know where it is. Make sure the rope cannot slip away. Leave enough slack in the line for uneven ground.

**Refer to Figure 49**

25. At the console, set the POWER switch ON.

26. Set the MASTER switch to ON.

27. Set the BOOMS 1 or BOOMS 1,2 & 3 switches on to ON.

28. Select the desired RATE preset.

29. Lower applicator to operating depth (if not already lowered) and begin first pass.

---

**CAUTION**

**NH₃: Possible Chemical Hazard:**

Anhydrous ammonia is now flowing into the ground. Some routinely escapes to the atmosphere. Check for leaks. Take action if strong odor is detected or a leak seen. Turn up wind. Turn off flow. Check gauges from tractor cab. Engage emergency shut-off valve if a leak is detected.

Minor odor during application is normal, particularly if the tractor cab is ever down wind of recent passes.

Strong or irritating odor indicates a problem. Conditions may not be suitable for application (soil too dry, cloddy and deeply cracked, for example), or there may be a system problem.

---

1. This 5 psi correlation is only true under no-flow conditions. When NH₃ application begins, the pressure reading at the cooler gauge drops, due to the reduced temperature of the cooled fluid, and pressure losses due to flow in plumbing.
**NH₃: Suspending Application**

These instructions are for brief stops in the field, for example, to make a phone call. See also “NH₃: Stopping Application” on page 66.

a. What is the wind direction?

b. Turn MASTER switch OFF.  
This turns On/Off Valve (A33) off.  
With On/Off (A33) off, there is still a substantial amount of liquid NH₃ downstream of all valves, in the flow divider, row application tubing, and row applicators. When stopped, in ground, this slowly warms, vaporizes, and is expelled into the soil. See warning at right.

c. Continue field application until the Flow Divider pressure gauge (A42) reads zero. Wait at least another 5 minutes.

d. Turn up-wind.

e. Leave the applicator in the ground. There is still considerable NH₃ vapor in the lines that are open to the soil. There may also be a modest amount of liquid in cold tubing loops.

**NH₃: Field Turns**

a. Before the turn, set the MASTER switch OFF. Leave the applicator in the ground, and continue forward movement.

b. Lift the applicator (page 47) at the turn point.

<table>
<thead>
<tr>
<th>WARNING</th>
<th>ANHYDROUS AMMONIA</th>
<th>I005</th>
</tr>
</thead>
</table>

**Choking Hazard:**  
Never raise a recently operated applicator when you are down-wind of the applicator. Be facing up-wind or turn up-wind if it is necessary to raise a working applicator. Wear your goggles. A substantial amount of anhydrous ammonia is rapidly released if you do not allow time for it to bleed off underground. The concentration could be high enough to cause irritation, breathing difficulty or asphyxiation.

<table>
<thead>
<tr>
<th>DANGER</th>
<th>ANHYDROUS AMMONIA</th>
<th>I005</th>
</tr>
</thead>
</table>

**Major Spill / Equipment Damage Hazards:**  
Do not turn too tightly. The nurse tank could strike the applicator, be upset, and leak. On 2-Point and Pull-Type, the nurse tank tongue could strike the caster tires. On 3-Point, the nurse tank tires could strike sealers or tine shanks.

c. Turn up-wind for the next pass.

d. Line up per your start of pass plan.

e. Lower the applicator into the ground.

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<tr>
<th>WARNING</th>
<th>ANHYDROUS AMMONIA</th>
<th>I005</th>
</tr>
</thead>
</table>

**Ammonia Vapor Release Occurs at Turns:**  
Avoid down-wind turns.
Do not raise for turns if unprotected individuals or sensitive livestock are immediately down-wind of the turn. Stop instead.

Turning off NH₃ flow prior to raising for turns does deplete some of the liquid ammonia in the delivery lines, but not all of it, and considerable vapor remains. At turns, there will be some release of NH₃ vapor, and possibly some NH₃ liquid. Be prepared for it. Minimize exposure to yourself and others.

Turn up-wind immediately if a hazardous concentration of fumes reaches the tractor cab.
**NH₃: Stopping Application**

Plan your stops. A safe stop requires depleting the anhydrous, from the nurse tank withdrawal valve to the tines.

a. What is the wind direction?

b. Suspend application per “NH₃: Suspending Application” on page 65.

c. Put on your chemical gloves. Be wearing your goggles.

d. Carefully approach the nurse tank from up-wind. Expect some ammonia odor, but if it is extremely strong, there may be an above-ground release in progress due to malfunction or part failure. If so, remain clear until the release subsides.

e. When safe to do so, shut off the nurse tank withdrawal valve (A₁₅).

f. Re-enter the tractor cab.

g. Turn MASTER switch ON.

h. Resume field application until reported rate begins to fall. Increase rate to maximum (to fully open Control Valve (A₃₀)).

i. Continue field application until both cooler and divider pressure gauges read zero.

j. Facing into the wind, raise the applicator and stop.

k. Set the MASTER switch to OFF.

l. Wait at least 1 minute for row line vapor to dissipate.

m. Turn so that the wind is directly from the right.

n. Open all bleed valves. Standing up-wind of each, and making sure orifices point away from you, slowly open bleed valves at:
   • nurse tank hose inlet end (A₁₁)
   • nurse tank hose outlet end (A₁₁)
   • breakaway valve (A₁₃) or (A₁₆), whichever is safer
   • cooler temperature gauge (A₂₀).

o. Close all remaining operating valves:
   • nurse tank hose inlet end (A₁₀)
   • nurse tank hose outlet end (A₁₀)
   • emergency shut-off valve (A₁₀).

p. Wait at least one hour before moving applicator to any spot near unprotected people or livestock. It will continue to out-gas ammonia vapor for some time.

---

**Ball Valves: Trapped NH₃ Hazard:**

Avoid routinely closing ball valves (other than the nurse tank withdrawal valve) with liquid NH₃ in the lines. Fluid is trapped in the line above the valve, may trigger relief valves, and can get trapped inside the valve ball unless it has a bleed port (not yet common on nurse tank hoses). See “**Avoid Line Traps**” on page 101 and “**Avoid Ball Traps**” on page 102.

A typical ball valve can trap enough NH₃ to make a room the size of a two-car garage uninhabitable (concentrations above IDLH in moments). When the ball valve is later opened, while warm, the NH₃ is expelled at high pressure. If the line is pointed at your face, you could receive a fatal exposure.
NH₃: Breakaway Event

Initially treat a breakaway coupler separation event as you would any other field emergency. Perform the steps at “Ammonia Emergency Action” in the “Using Anhydrous Ammonia Safely” manual (407-551M). Only then consider performing the steps on this page.

Although the breakaway coupler is designed to separate, such breakaways are not routine events.

Upon a breakaway, what to do about the breakaway coupler itself is the last consideration. Priorities are:

1. Protect: Perform basic field emergency action, which may include summoning emergency responders if a major release is in progress, or the nurse tank is tipped over, or is otherwise at risk of a major release.

2. Assess: If the nurse tank appears intact, sound and stable, determine the cause of the breakaway. It is unlikely to be something simple that will allow a timely re-coupling and resumption of application.

If, and only if, the nurse tank is safe to approach, take the next steps to discharge both sides of the breakaway.

Discharge Applicator:

3. Perform the steps at “NH₃: Stopping Application” on page 66. Remain up wind and clear of nurse tank while doing this.

4. With the orifice pointing away from you, and down-wind, slowly open the coupler bleed valve [A16] at the applicator half of the breakaway coupler(s). If you closed the emergency shutoff(s) after breakaway, each bleed will release liquid NH₃, under pressure, most likely as a spray.

Discharge Nurse Tank Hose(s):

5. Position the tractor and applicator near the nurse tank. Stop up-wind of the tank, but slightly cross-wind of the tank (so that you are not exposed to residual applicator fumes while working around the tank). Face the tractor into the wind.

6. From up-wind, approach the nurse tank.

7. Close the nurse tank withdrawal valve [A75].

8. From up-wind, approach the nurse tank hose outlet end [A7].

9. Locate a bleed valve [A73] on the nurse tank half of a coupler. Be careful not to touch or loosen the Acme coupler [A7]. Bleed only one hose at a time.

10. Position the outlet such that the bleed valve orifice points both away from you AND points down-wind AND can be opened and left pointing that way unattended. If this is not possible, get expert help.

**Upon Event: Probable Chemical Hazard:**

A 60cc NH₃ liquid release to air has already occurred. Assume a major release is also in progress or imminent. Act accordingly. Request assistance from trained experts rather than risk blindness, disfiguring/disabling injury or death.

A breakaway event is most likely due to a major equipment failure (such as nurse tank running gear fracture), or a gross operator error (such as towing/turning too fast, or departing level ground). These cases can result in an immediate serious spill, or result in a damaged tank at risk of leak at any time.

Even in the case of a basic operator error (such as movement with only the nurse tank hose connected) both applicator systems and nurse tank hose(s) at breakaway are fully charged with liquid NH₃ right up to the checks in the breakaway halves. The nurse tank side is under full tank pressurization. The applicator hose(s) may be under pressure.

This was an unplanned event. Wind direction may not be favorable for discharging and re-coupling. **If the wind is light or calm, do not attempt to bleed the breakaway coupler halves. Your field PPE¹ is not sufficient for the releases necessary.**

---

1. PPE: Personal Protective Equipment
11. Opening this bleed valve WILL release the substantial amount of liquid NH$_3$ presently trapped in the hose, most likely as a spray. Open the valve very slowly, just until some fluid appears. Leave the valve just slightly open.

12. Walk away, up-wind. Stay away until the release concludes. Carefully open bleed valve completely to confirm hose is discharged. For dual-cooler, repeat step 9 through step 12 for the other hose.

13. Close all breakaway bleed valves (AT3 and AT8), and any nurse tank hose valves (AT0). Disconnect the nurse tank half of the breakaway coupler at the Acme coupler (AT).

14. Correct the cause of breakaway, only if trivial to do in the field.

15. Consult the breakaway manual for re-coupling instructions.

---

Before Re-connection: Elevated Exposure Hazard:
Exercise extreme care. Even if the nurse tank is undamaged, sound and upright, a breakaway event is not a normal re-hitch situation. A substantial NH$_3$ bleed is required that WILL release a flow of liquid anhydrous ammonia under pressure. If the wind is calm or light, do not attempt to bleed the nurse tank hose(s). Your field PPE$^1$ is not sufficient.

---

1. PPE: Personal Protective Equipment
NH₃: Unhitching Nurse Tank

The procedure is different for exchanging tanks vs. concluding application.

NH₃: Exchanging Nurse Tanks

Consult with the nurse tank supplier, and all nurse tank documents, before unhitching or exchanging tanks.

a. Suspend NH₃ application per "NH₃: Suspending Application" on page 65.

The purpose of this step is to minimize atmospheric NH₃ vapor while working at the rear hitch, because you may not be able to conduct all unhitching and re-hitching steps from up-wind of all the tines.

b. Position the applicator cross-wind, with the wind from the right, tines in ground.

c. Use the rope to close the emergency shut-off valve.

d. Put on your goggles and rubber gloves.

e. Shut off the nurse tank withdrawal valve (A15). Leave the nurse tank hose valves (A10, if any), open.

f. From up-wind, and with the orifice facing away from you, slowly open the breakaway coupler inlet bleed valve (A13).

g. Stand clear and wait for the hoses to discharge.

h. From the up-wind side, unscrew the nurse tank hose outlet coupler (A7). Secure the hose using whatever means the cart provides.

i. Close all opened bleed valves.

j. Release the nurse tank safety chains.

k. Remove the nurse tank hitch pin.

NH₃: Final Nurse Tank Unhitch

a. Conclude NH₃ application per "NH₃: Stopping Application" on page 66.

The purpose of this step is to minimize atmospheric NH₃ vapor while working at the rear hitch, because you may not be able to conduct all unhitching steps from up-wind of all the tines.

b. From the up-wind side, unscrew the nurse tank hose outlet coupler (L8) on page 29.

c. Secure the outlet coupler with the nurse tank’s Acme parking plug.

d. Close all opened bleed valves.

e. Release the nurse tank safety chains.

f. Remove the nurse tank hitch pin.

g. Remove nurse tank from behind applicator.

Control Variation Hazard:
If you are using multiple nurse tanks, study each one separately. Unless they are owned by you, and known to be identical, there is a high probability that there are differences between them, even if they are all from the same terminal.
Liquid Operations
Operations for anhydrous nitrogen fertilizer begin on page 49.

Liq: Filling On-Board Tanks
The tanks may be loaded from the quick-fill inlet, or from the lids (page 71).
If the fertilizer solution has any tendency to settle, sediment, gel, coagulate, precipitate or stratify, load material immediately prior to application. The tank system has no agitators for sustaining suspensions.

Apply fertilizer soon after material loading. Clean out unused materials promptly. Fertilizer allowed to remain in the tanks for an extended period can settle, resulting in excessive or insufficient concentrations during application. System plugging can also occur.

1. Hitch the applicator to a tractor. Filling an unhitched applicator is not recommended, as it can increase parking stand loads above the bearing capacity of the soil.
2. Inspect the tanks from the lids.
3. Drain excess condensation from the tank, so that this water does not dilute the material to be loaded. See "Material Clean-Out (Liquid)" on page 114.
4. Flush the tank if there is other residue present.

Liq: Tank Quick-Fill
Refer to Figure 4 on page 29

5. Position the applicator on level ground, or tanks may fill unevenly.
6. Connect the nurse-tank hose to the quick-fill coupler located at the left end of the left tank. Lock hose in place with cam-lock levers.
7. Open the discharge valve (not shown) of each tank to be filled. If filling must be performed on unlevel ground, fill one tank at a time.
8. Set the selector valve to "FILL" (handle arrow pointing forward, toward elbow from inlet).
10. Open any supply valve and fill tanks. Tanks are marked with fill levels.
11. Close valve at supply, then quick-fill coupler, and disconnect the nurse tank hose.
12. Set selector valve to OFF, or to PUMP if applying immediately.
**Liq: Tank Lid Fill**

Employ two persons for top fill; one to secure the hose at the tank, the other to control a supply line shut-off valve. These steps presume completion of step 1 through step 5 on page 70.

**Refer to Figure 51 and Figure 4 on page 29**

13. Close selector valve \( \text{\textsuperscript{[13]}} \) (or set to PUMP; there is no risk of material leakage through the boom until the pump is operating).

14. Open both tank discharge valves \( \text{\textsuperscript{[13]}} \) to the selector valve, if cross-filling from one tank to the next is desired.

15. Open the lid \( \text{\textsuperscript{[13]}} \) of the tank to be filled.

   The tank lid completely unscrews for a 7 in. (18 cm) opening.

16. Insert the supply hose.

17. Open the supply line valve. Monitor tank level. Fill to desired level. Close supply valve.

18. Remove hose. Close and secure the tank lid. The lid has twin threads. Make sure that both are evenly engaged when tightening the lid, and that the lid is fully seated.

---

**Chemical Hazard - Tank Lid:**

For top loading, wear gloves and any other protective equipment indicated for any materials that have ever been used in the tank (not just the materials recently loaded or presently being loaded). Normal operations splash material on the underside of the lid. It is likely to be coated with residues that could be highly concentrated, whether dry, damp or wet. Remove the lid slowly to avoid throwing off material toward yourself.
Liq: Hitching Conventional Nurse Tank
Hitch a nurse tank to the applicator only at the field, and not prior to transport.

Liq: Mechanical Cart Hitching
1. Spot the applicator to avoid reverse moves after cart hitching.

Refer to Figure 52
2. Bring the applicator rear hitch tongue and nurse tank cart tongue into close proximity (a few inches).
3. Push down on the red tongue release handle. This frees the applicator rear hitch tongue to extend 7 inches (17.8 cm) to the rear, and 9 inches (23 cm) to either side, to assist with cart tongue alignment.
4. Align the cart clevis hitch with the applicator pull bar. Insert and secure the 1 inch (2.6 cm) hitch pin.
5. Securely attach the cart’s safety chain(s) to the hitch chain anchor(s).
6. Optionally re-seat the applicator rear hitch tongue, at this time, by using the tractor to move the applicator backward several inches, until the latch on the hitch re-engages.

Liq: Making Nurse Tank Connections
1. Close shut off valves on all hoses of both tank and applicator.
2. Route tank supply hose to applicator inlet. Allow ample slack for tight field turns and uneven ground. Do not leave so much slack that the hose can reach the ground.
3. Remove plug from applicator inlet, and any cap on tank supply hose.
4. Inspect and clean connector fittings.
5. Mate connectors of tank and applicator supply hoses. Fold cam levers forward to lock. Leave valves closed.
6. If the tank has additional hoses, secure them at the tank.

Equipment Damage Risk:
Use only pre-mixed liquid fertilizer.

WARNING
DO NOT EXCEED THIS IMPLEMENT’S MAXIMUM TRANSPORT SPEED OF 20 MPH.
EXCEEDING THIS SPEED MAY RESULT IN LOSS OF CONTROL DURING BRAKING AND SERIOUS INJURY OR DEATH.
TRANSPORT ONLY WITH PROPERLY BALLANCED TRACTOR AND A PROPERLY ATTACHED SAFETY TOW CHAIN.
TRACTOR WEIGHT MUST BE GREATER THAN 1.5 TIMES COMBINED INTERMEDIATE IMPLEMENT AND TOWED IMPLEMENT WEIGHT.
TOWED IMPLEMENT WEIGHT NOT TO EXCEED 20,000 LBS.
MAXIMUM ALLOWABLE TONGUE WEIGHT: 100 LBS.
**Liq: Hydraulic Drive Start-Up**

Prior to first use, determine the hydraulic remote circuit flow rate setting per the procedure on page 94.

1. Set console MASTER switch OFF.
2. Set console POWER switch ON.
3. Select FLOW CONTROL RATE1 or RATE2 as desired, and verify rate setting.
4. Set console BOOMS\(^1\) switch 1 ON.
5. Set the flow rate for the hydraulic remote circuit as established by the procedure on page 94.
6. Activate the circuit by moving the lever to Retract. You may hear the pump operating, but with the MASTER switch off, no material flows to rows.
7. Set the MASTER switch ON. Check for material flow at the tines. Prime second hydraulic pump as required.
8. Begin field operations. Monitor the fertilizer pressure gauge (or PSI display on optional console).

**Liq: Field Operations (Either Pump)**

1. Monitor the fertilizer manifold pressure (gauge or PSI display on optional console).
2. Mind the fertilizer tank levels while planting, both to:
   a. confirm expected consumption rate, and;
   b. avoid running the pump dry.
3. If residual fertilizer is not recovered at end of planting, apply it to the last field planted.
4. Clean out fertilizer system per page 114.

**Liq: Pauses and Turns**

**Hydraulic Drive Pauses and Turns**

If the applicator has the optional hydraulic drive system, pauses cause the speed sensor to report zero speed, which causes the console to close the flow control valve. Set the pump hydraulic remote to Float if stopping for and extended period.

For turns and field moves, set the MASTER switch OFF to avoid material loss. If the factory configuration of the plumbing has been modified for section control, use the BOOM switches as desired for point row applications.

---

1. The standard configuration uses only Valve 1. If optional section control is installed, also engage BOOMS switches 2 and 3.
**Liq: Fertilizer Operation**

For an aftermarket pump system, consult the pump or system documentation. These pages describe the available Great Plains systems. See page 29 through page 29 for callout references.

**Liq: Hydraulic Drive Operation**

The centrifugal pump [22] is driven by an integrated hydraulic motor. The output of the pump is under pressure whenever the hydraulic motor circuit is activated. Rate is regulated by a flow control valve [29], and monitored by a flow meter [30], both connected to a Raven SCS 450 console (or other compatible Raven console).

**Liq: Boom Operation**

The liquid fertilizer boom system is designed to operate (ideally) between 15 and 40 psi. Several system elements affect system pressure, and need initial setup, periodic maintenance, and adjustment.

**Liq: Start-Up Preparation (Either Pump)**

1. Check that ample fertilizer has been loaded into the tanks. The liquid level must be higher than the hydraulic pump for pump priming. Close and cap or plug any tank fill inlet valves (such as [17] in the Great Plains plumbing system).

2. Check that tank valves (such as discharge, transfer, selector) are configured and ready for use. In the Great Plains tank plumbing system, this would be: [19] tank discharge valves open to selector valve [18] selector valve open to tanks and pump

3. On suitable ground, raise the applicator.

**Liq: Monitor Operation (Option)**

Refer to Figure 53

With the optional hydraulic drive pump, the optional SCS 450 console monitors fertilizer flow, field speed, and manifold pressure. It operates the control valve to deliver fertilizer at your desired rate.

Once setup for the applicator and preferences, and configured for the rates/limits, the monitor is typically used in the “RATE 1” or “RATE 2” FLOW CONTROL modes.

**Liq: Starting Application with Console**

1. Enter the tractor cab.

Refer to Figure 53

2. At the console, set the POWER switch ON.
3. Set the MASTER switch to ON.

4. Set the BOOMS 1 or BOOMS 1,2&3 switch\(^1\) on to ON all others don't-care (suggest OFF).

5. Select the desired RATE preset.

6. Engage the remote for the hydraulic drive pump. Advance lever to preset for +35% of desired rate.

7. Lower applicator to operating depth (if not already lowered) and begin first pass.

See SCS 450 manual for monitor operation details.

**Suspending Application**

With the hydraulic drive pump option, material continues to flow if the implement is raised while in motion. To conserve material and prevent unintended application, set the MASTER switch to OFF when raising.

When stopping, operating the MASTER switch is not usually necessary, if the console has an active speed sensor data source.

If suspending application for more than a minute, also set the pump motor hydraulic circuit to Float.

**Liq: Stopping Application**

1. If possible, plan final passes so that they occur prior to tank run-out. This keeps the pump wet. If you do exhaust the material, refill with water.

2. At completion of application, apply almost all of the remaining fertilizer on the last field. Refill the tank with clean water.

3. Set application rate to maximum to shorten the remaining steps:
   - Hydraulic Drive: Set the console (Option) for maximum rate.

4. Apply the water to the final field to flush system.

5. Close shut-off valves on both sides of all hose connections.

**Liq: Unhitch Liquid Nurse Tank**

6. Disconnect all tank-applicator couplers.

7. Disconnect the safety chains.

8. Remove the hitch pin. Move the trailer hitch off the applicator’s draw bar.

---

\(^1\) The standard configuration uses only Valve 1. If optional section control is installed, also engage BOOMS switches 2 and 3.
### Field Set-Up Checklists

Use the following tables to develop a final checklist for your tractor/applicator configuration. Additional or fewer steps may be necessary depending on tractor features, applicator options and planting accessories.

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<td>Verify electrical hookups solid</td>
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<tr>
<td>Turn optional console POWER switch to ON.</td>
<td>a</td>
</tr>
<tr>
<td>Check console and observe any diagnostic messages</td>
<td>a</td>
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a. Refer to console manual.

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<td>Make hydraulic connections</td>
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<td>Check tubing connections to tines</td>
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<td>NH₃: Check tine outlet behind shoes</td>
<td></td>
</tr>
<tr>
<td>NH₃: Check shoe condition</td>
<td></td>
</tr>
<tr>
<td>NH₃: Check tine shoes all at same height</td>
<td></td>
</tr>
<tr>
<td>NH₃: Check tine shank alignment</td>
<td></td>
</tr>
<tr>
<td>Liq: Check outlet behind arms</td>
<td>-</td>
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<tr>
<td>Check coulter blade condition</td>
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<tr>
<td>Check coulter depth</td>
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<td>Check NH₃ sealer adjustments</td>
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<td>Check spider condition</td>
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<td>Raise implement.</td>
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<td>Check front-to-rear level</td>
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<td>Set application height</td>
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<th>NH₃ System Checklist (Cart Unhitched)</th>
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<tr>
<td>Emergency shut-off valve closed</td>
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<tr>
<td>On/off solenoid valve closed</td>
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</tr>
<tr>
<td>Control valve closed</td>
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</tr>
<tr>
<td>Control valve closed</td>
<td>57</td>
</tr>
<tr>
<td>Console POWER switch off</td>
<td>57</td>
</tr>
<tr>
<td>All bleed valves closed (3 or more)</td>
<td>57</td>
</tr>
<tr>
<td>Breakaway coupler mated (visual check)</td>
<td>57</td>
</tr>
<tr>
<td>All hydrostatic relief valve caps seated</td>
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<td>Liq: Orifice plate size matches rate</td>
<td>91</td>
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<tr>
<td>Fittings all secure</td>
<td>-</td>
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<tr>
<td>Liq: Relief valve adjusted</td>
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</tr>
<tr>
<td>Liq: Strainer recently cleaned</td>
<td>115</td>
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<tr>
<td>Liq: Inlet shut-off valve closed</td>
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<tr>
<th>Mechanical Checklist (Cart Hitching)</th>
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<tr>
<td>Nurse tank hitched</td>
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<td>Hitch pin locked</td>
<td></td>
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<tr>
<td>Safety chains secured</td>
<td>72</td>
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<tr>
<td>NH₃ Checklist (Cart Hitched)</td>
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<td>----------------------------</td>
<td>------</td>
</tr>
<tr>
<td>☐ Check breakaway firmly mated</td>
<td>60</td>
</tr>
<tr>
<td>☐ Check breakaway swivel function</td>
<td>60</td>
</tr>
<tr>
<td>☐ Remove inlet Acme cap.</td>
<td>60</td>
</tr>
<tr>
<td>☐ Inspect inlet with mirror.</td>
<td>60</td>
</tr>
<tr>
<td>☐ Check withdrawal valve and all nurse tank hose valves closed</td>
<td>61</td>
</tr>
<tr>
<td>☐ Check for signs of liquid NH₃ in hose</td>
<td>61</td>
</tr>
<tr>
<td>☐ Separate hose and Acme plug</td>
<td>61</td>
</tr>
<tr>
<td>☐ Route hose to breakaway</td>
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<tr>
<td>☐ Connect hose to breakaway</td>
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<thead>
<tr>
<th>Plumbing Checklist</th>
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</thead>
<tbody>
<tr>
<td>☐ Tank(s) loaded</td>
<td>-</td>
</tr>
<tr>
<td>☐ Supply hose shut-off valve closed</td>
<td>60</td>
</tr>
<tr>
<td>☐ Liq: Discharge valve(s) open to pump</td>
<td>60</td>
</tr>
<tr>
<td>☐ Liq: Vent (if any) open</td>
<td>61</td>
</tr>
<tr>
<td>☐ Tank hose(s) routed to applicator connectors, mated and locked</td>
<td>61</td>
</tr>
<tr>
<td>☐ Hose slack adjusted</td>
<td>61</td>
</tr>
<tr>
<td>☐ Unused hoses secured</td>
<td>-</td>
</tr>
</tbody>
</table>
Field Operation Checklists
Perform all steps in "Pre-Start Checklist" on page 42 and "Field Set-Up Checklists" on page 76. The applicator is presumed to be unfolded and raised.

**CAUTION**

Spill hazard/Tank damage risk:
Periodically check the tension of the straps for the fertilizer tank. Strap tension will change as outside air temperature changes. Adjust tension as necessary to prevent personal injury or damage to the fertilizer tank.

<table>
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<td>1 Raise applicator.</td>
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<tr>
<td>1 Unfold, if not already unfolded.</td>
<td>53</td>
</tr>
<tr>
<td>2 Line-up at pass start per plan.</td>
<td>-</td>
</tr>
<tr>
<td>3 Pull forward and stop.</td>
<td>-</td>
</tr>
<tr>
<td>4 Check console. POWER switch ON, BOOM* switch(es) ON and MASTER switch OFF</td>
<td>74</td>
</tr>
<tr>
<td>5 NH₃: Re-check all line valves and bleed valves closed.</td>
<td>63</td>
</tr>
<tr>
<td>6 NH₃: Open tank withdrawal valve. Check for zero releases.</td>
<td>63</td>
</tr>
<tr>
<td>7 NH₃: Open applicator emergency shut-off valve. Check for zero releases.</td>
<td>63</td>
</tr>
<tr>
<td>8 NH₃: Open nurse tank hose inlet valve (if any). Check for zero releases.</td>
<td>64</td>
</tr>
<tr>
<td>9 NH₃: Open nurse tank hose outlet valve (if any). Check for zero releases.</td>
<td>64</td>
</tr>
<tr>
<td>10 Liq: Open tank supply hose outlet valve.</td>
<td>29</td>
</tr>
<tr>
<td>11 Liq: Open applicator supply inlet shut-off valve.</td>
<td>29</td>
</tr>
<tr>
<td>12 NH₃: Check meter pressure gauge matches tank pressure gauge.</td>
<td>64</td>
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<tr>
<td>13 NH₃: Enter tractor cab. Check ropes present with nominal slack.</td>
<td>74</td>
</tr>
<tr>
<td>14 Console (Option): POWER on MASTER on RATE as desired</td>
<td>74</td>
</tr>
<tr>
<td>15 Lower applicator: a. hitch (lower, then Depth Control) b. wings (extend, then low rate continuous extend)</td>
<td>48</td>
</tr>
<tr>
<td>16 Begin first pass, setting switch MASTER to ON.</td>
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</tr>
<tr>
<td>17 Liq: Hydraulic remote for hydraulic pump to preset</td>
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<tr>
<th>First Pass Operation Checklist</th>
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<tbody>
<tr>
<td>18 Monitor the console (Option) for expected reports of application rate/speed, and any alarms.</td>
<td>-</td>
</tr>
<tr>
<td>19 Periodically check the applicator gauges for expected pressures and temperatures.</td>
<td>-</td>
</tr>
<tr>
<td>20 Pay attention to odors. Watch for leaks.</td>
<td>-</td>
</tr>
<tr>
<td>a. BOOM 1, or BOOM 1,2,&amp;3 (section control)</td>
<td></td>
</tr>
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<tr>
<th>Pass Turn® Operation Checklist</th>
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<tbody>
<tr>
<td>1 Set console MASTER switch OFF some distance before end of pass, or stop at end of pass.</td>
<td>65</td>
</tr>
<tr>
<td>21 NH₃: To minimize vapor release, wait for flow divider pressure gauge to read zero during final pass distance or while waiting at end of pass.</td>
<td>48</td>
</tr>
<tr>
<td>22 While slowing at end of pass, or stopped</td>
<td>-</td>
</tr>
<tr>
<td>23 Fold and lift (to partially fold wings)</td>
<td>53</td>
</tr>
<tr>
<td>24 Raise 3-point hitch</td>
<td>-</td>
</tr>
<tr>
<td>25 Turn up-wind if possible. Turn slowly to avoid tank cart upset. Do not turn too tightly.</td>
<td>65</td>
</tr>
<tr>
<td>26 Make turn. Line up for next pass.</td>
<td>-</td>
</tr>
<tr>
<td>27 Lower applicator (same as step 16) for First Pass, at left.</td>
<td>-</td>
</tr>
<tr>
<td>28 Begin pass, setting switch MASTER to ON.</td>
<td>74</td>
</tr>
<tr>
<td>29 Begin next pass</td>
<td>-</td>
</tr>
</tbody>
</table>

These are merged anhydrous (NH₃) and conventional liquid (Liq) lists. NH₃/Liq: refer to material-specific operations. Some steps may refer to Optional equipment.
Short-Term Parking

1. Conclude application per “NH3: Stopping Application” on page 66 and/or “Liq: Stopping Application” on page 75.

2. Unhitch nurse tank per “NH3: Final Nurse Tank Unhitch” on page 69 or “Liq: Unhitch Liquid Nurse Tank” on page 75.

3. Choose an applicator parking location with level firm ground. Do not unhitch on a steep slope.

4. Recover emergency shutoff rope from tractor. Store on applicator.

5. Fully raise applicator (page 42).

6. Fold applicator (page 45).

7. Engage lift-assist transport locks (page 44), and deploy parking stands (page 36).

8. Lower applicator onto locks/stands.

9. Set FOLD / FIELD switch to PARK.

10. Set all hydraulic circuits to Float.

11. Shut off tractor.

12. Disconnect hydraulic lines. Secure them so that they do not touch the ground.

13. Disconnect electrical cables, capping where provisioned.


Long-Term Storage

**Notice**

*Equipment Damage Risk:*
Keep the pump wet. Fertilizer suffices for short-term parking. Flush with water for longer term parking. Add RV antifreeze for winter storage. See page 106. Failure to properly care for your pump and other cart components can lead to serious equipment damage in a relatively short span of time.

1. Conclude application per “NH3: Stopping Application” on page 66 and/or “Liq: Stopping Application” on page 75.

2. Unhitch nurse tank per “NH3: Final Nurse Tank Unhitch” on page 61 or “Liq: Unhitch Liquid Nurse Tank” on page 75.

3. Choose an applicator parking location with level firm ground. Do not unhitch on a steep slope.

4. Fully raise applicator (page 42).

5. Flush and fill pump per page 106. If possible, remove pump from applicator and store indoors above freezing temperatures.

6. Clean applicator of mud, dirt, excess oil and grease.

7. Lubricate all points listed in Maintenance.

8. Apply grease to exposed cylinder rods to prevent rust.

9. Inspect applicator for worn or damaged parts. Make repairs and service during off season.

10. Use spray paint to cover scratches, chips, and worn areas on the applicator to protect the metal.

11. Fold applicator (page 45).

12. Cover applicator with a tarp if stored outside.
To get full performance from your NP2330 applicator, you need an understanding of all component operations, and many provide adjustments for optimal field results. Some of these have been covered earlier in this manual.

Even if your planting conditions rarely change, some of these items need periodic adjustment due to normal wear.

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<th>Page</th>
<th>The Adjustment Affects</th>
</tr>
</thead>
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<td>Tractor compatibility</td>
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<tr>
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<td>Application height consistency</td>
</tr>
<tr>
<td>Frame Level, front to back</td>
<td>38</td>
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<td>Wing Level</td>
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<td>Application depth consistency</td>
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<td>Anhydrous Fertilizer Rate</td>
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<td>Minimize cavitation and orifice clogging.</td>
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<td>Hydraulic Drive: Pump Pressure</td>
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<td>133</td>
<td>Application between rows</td>
</tr>
</tbody>
</table>

Row Adjustments
Anhydrous Coulter Application Depth

Applies to model NP2330A only.

Refer to Figure 54 and Figure 55

Tine release depth ① is set by tool bar height ② above the ground, coulter shank height ③ and tine height ④.

**CAUTION**

Chemical Hazard:
Adjust height dry. Make adjustments before charging the metering system with anhydrous ammonia, or after thoroughly discharging the system. With the tines out of the ground, there could otherwise be releases of ammonia at dangerous concentrations.

Tool bar height is controlled by the tractor hitch in the center section. Wing tool bar height is set to match the center using a crank-assisted manual adjustment (page 87).

Tine height ⑤ is adjusted at the mount ⑥. This requires adjustment as the coulter blades wear. Loosen the nuts on the U-bolts ⑦. Lower the shank and re-tighten.

S/N C1052A and above - Tines are to be installed as high as possible on the tine mount and within 1/8 inch of the back of the blade.

Design coulter operating depth is 3 to 7 in. (7.6 to 18 cm). Operation below 7 in. (18 cm) is not recommended, as high rates of disc wear are likely.

Application depth is unaffected by the coulter spring ⑧ (page 117) and sealer spring ⑨ (page 83) settings.

Depth Reference Information

These are the factory settings.

Shank height below tool bar is:
① 11 11/16 in. (29.7 cm)

Overall height of the tool bar base to coulter edge is:
② 32 9/32 in. (79.5 cm)

At factory settings, NH₃ is released from the tube at:
③ 3/8 in. (9.7 mm) above the lower coulter edge.
For a precise release depth, subtract this amount from the total coulter depth ⑧.
Anhydrous Coulter Castering
Coulters may be operated locked in-line, or with limited free castering.

Refer to Figure 56 and Figure 57

To lock the coulter, loosen the jam nut at @. Align the coulter front to back. Tighten the set screw at @, then the jam nut.

To unlock the coulter, loosen the jams nut at @. Loosen the set screw bolts at @, then tighten the jam nuts.

Do not loosen the stop bolts @.

Anhydrous Coulter Blade Wear
Blade wear is normal and the rate of wear varies with field conditions and operating depth. Consider replacing the blade when the initial diameter has been reduced by 1 to 2 inches.

Although a nominal 22 inches in diameter, blades are lightly larger.
**NH₃ Sealer Adjustments**

The standard NP2330AA spider sealers have three adjustments. You may need to alter these from factory settings, based on soil conditions, crop residue and application speed.

Refer to Figure 58 and Figure 59

1. Down-pressure: Handles ① set the arm spring tension. The adjustment plates ② have 3 settings.
2. Spacing: The arm weldments have bolt holes ② allowing setback positions and spacing positions.
3. Angle: The sealer mount plates ③ have in-line holes ⑤, and slightly offset holes ⑥, providing an angle adjustment.

These adjustments are most easily made with the applicator raised. The down-pressure adjustment may be made with rows in the ground, with some extra effort.

---

**Chemical Hazard:**

Adjust sealers with rows dry. Make adjustments before charging the metering system with anhydrous ammonia, or after thoroughly discharging the system. With the tines out of the ground, there could otherwise be releases of ammonia at dangerous concentrations.

---

**Sealer Down-Pressure Adjustment**

The following trip down-pressures are available. These values are per sealer arm, and are with the coulters in the ground, and arms slightly raised per nominal factory assumptions (as depicted in Figure 54 on page 81).

With the applicator raised, position ① has minimal spring tension.

<table>
<thead>
<tr>
<th>Handle Slot</th>
<th>Down-Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>① Rear/Lowest</td>
<td>12 pounds 5.4 kg</td>
</tr>
<tr>
<td>② Mid/Medium</td>
<td>17 pounds 7.7 kg</td>
</tr>
<tr>
<td>③ Forward/Max.</td>
<td>28 pounds 12.7 kg</td>
</tr>
</tbody>
</table>

---

**Sealer Spacing or Setback Adjustment**

For in-line (parallel) sealer wheel running, use the center holes ⑤ in the mount plates ③. In-line orientation is recommended for high-residue fields.

**Sealer Angle Adjustment**

10° of leading toe-out (20° total) is available by using the inner center hole of the mount plate and the leading offset hole ⑥. No setback adjustment is available when using toe-out. Toe-out is not recommended for high-residue fields.
Terra-Tine™ Adjustments (Option)

_all adjustments must be made with the applicator in the fully raised position.

Refer to Figure 60

**NOTICE**

_Excess Wear Risk:_

Check that the Terra-Tine™ Row Cleaner tines DO NOT touch the coulter blade or any other attachments. Such contacts cause excess wear to all parts involved. At least \( \frac{1}{2} \) in. (13 mm) clearance is recommended.

1. When the blade is out of the soil, adjust the lock collar height to set the height of tine fingers flush with the bottom of coulter blade.

2. Side-to-side alignment can be done by rotating the shank mount around the vertical shaft and tightening the square head set screw.

3. The factory setting for Terra-Tine™ height is a distance of 5.4 in. (13.7 cm) from frame bottom to top of Terra-Tine™ mount.

   Height may be adjusted at the mount set screw, or at the frame clamp. Changing arm angle also changes tine height.

4. The factory setting for arm angle is minimum (pivot mount hole closest to Terra-Tine™ mount).

Terra-Tine™ Down Force

Refer to Figure 61

A series of three holes in the spring adjuster and pivot mount plate provide five combinations for different levels of spring tension. The following table shows the down-force levels available.

<table>
<thead>
<tr>
<th>Terra-Tine™ Spring Tension (per Tine Disc)</th>
<th>Position</th>
<th>Newtons</th>
<th>Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>53</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>76</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>98</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>120</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>138</td>
<td>31</td>
<td></td>
</tr>
</tbody>
</table>

Changing force also changes height.
Vantage I Coulter Adjustments

Applies to model NP2330 with optional liquid capability.
Fertilizer release height is normally at or just above the ground, and is controlled by three adjustments:

Refer to Figure 62

1. Tool bar height:
   This affects coulter depth. The procedure for setting tool bar height varies with hitch type:
   See page 87

2. Fertilizer arm height (page 86):
   This affects arm height relative to the coulter. This adjustment is primarily to compensate for blade wear.

3. Coulter height (page 86):
   This affects coulter height relative to the tool bar, and is normally not adjusted.

Factory settings:
25 in. (63.5 cm) above ground at 4 in. coulter depth
7.5 in. (19.1 cm) coulter shank distance
1 in. (2.5 cm) release height

Vantage I Coulter Force

Coulter springs are set to 400 pounds (181 kg). In normal operation at target running depth, the spring is at full extension. It compresses briefly as obstructions are encountered.

- In heavy no-till conditions, you may observe the springs in compression most of the time. This means that the blades are not reaching the desired coulter depth. If applicator weight is available, you can increase the spring down-force to compensate.
- In light but rocky conditions, the factory spring setting may be higher than needed. You can extend blade life by reducing the force at which the blades ride up over obstructions.

Applicator weight, in almost all applicator configurations, is generally sufficient to load the coulters to the full 400 pound factory setting.

Setting all springs above 400 pounds might require the optional weight kit with some lighter triple-couler configurations.

To adjust the coulter spring:

Refer to Figure 62

1. Raise the applicator and install transport locks. See “Raising/Lowering Applicator” on page 47.

2. Determine the new spring length desired.

<table>
<thead>
<tr>
<th>Spring Length</th>
<th>Force at Blade</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.25 in. (26.0 cm)</td>
<td>300 lbs. (146 kg)</td>
</tr>
<tr>
<td>10.0 in. (25.4 cm)</td>
<td>400 lbs. (181 kg)</td>
</tr>
<tr>
<td>9.75 in. (24.8 cm)</td>
<td>525 lbs. (238 kg)</td>
</tr>
</tbody>
</table>

3. Measure the current length of the spring(s) to be changed. If already as short as 9 3/4 in. (24.8 cm), or as long as 10 1/4 in. (26 cm), do not further adjust them.

4. Loosen the jam nut.

5. Rotate the adjuster nut until the spring is at the new length. Tighten the jam nut.

If all springs are continuously in compression, the coulters can lift the wing frames off the ground (at the gauge wheels), resulting in uneven coulter depth and/or uneven seed depth. If the applicator is already operating at maximum down-pressure, reduce coulter depth.
Vantage I Coulter Height and Castering

Coulter height is the main control for application height. Coulters may need to be lowered for rows in tracks. Coulters applicator-wide need adjustment as blades wear.

If desired coulter depth cannot be achieved due to challenging soil conditions, consider installing the optional weight kit (page 134 and page 162). Coulters may also be set for rigid row alignment, or limited castering.

Refer to Figure 63

1. The factory setting for coulter height is a distance of 7.5 in. (19.1 cm) from frame bottom to top of coulter mount casting.

   At a tool bar height of 25 in. (63.5 cm) above ground, this is a blade depth of 4 in. (10.2 cm).

2. For fields where frequent sharp turns are unavoidable, you can reduce coulter plowing by allowing the coulters to caster at the pivot casting. Loosen the jam nuts at . Loosen the set screws just enough to allow the casting to swivel. Re-tighten the jam nuts. Do not remove the center stop screw.

3. As blades wear, keep the release height constant by raising the applicator weldment on the coulter arm. Loosen the bolts . Slide the weldment up. Tighten the bolts.

   If the application height is still too low after this adjustment, the coulter blades may be worn and in need of replacement.

Refer to the Vantage I manual (204-376M) for further coulter adjustments.

Vantage I Blade Wear

Refer to Figure 64

Blade wear is normal and the rate of wear varies with field conditions and operating depth. Consider replacing the blade when the initial diameter has been reduced by 1 to 2 inches.

Although a nominal 20 inches in diameter, blades are lightly larger and vary slightly with blade style.
Tool Bar Height Adjustment

Center section tool bar height is set by the tractor hitch. Lift-assist spacers (page 38) must be selected and in place to assure front-to-back level.

Wing end tool bar height is set by independent gauge wheels on each wing end. Wings are maintained at level in the field with the weight-transfer system (page 88).

1. Move to smooth level ground with soil as similar as possible to field conditions. Set tractor brakes.
2. Determine the desired coulter depth.
3. Unfold the applicator (page 53).
4. Raise the applicator to bring the wing coulters off the ground, and the wings slightly above level.

Refer to Figure 65

5. At each gauge wheel, use the crank ① to remove tension at the pin ②. Remove the pin.
6. Use the crank to extend the wheels far enough to keep the wing coulters off the ground.
7. Unfold the wings until the gauge wheels are on the ground. Set fold/lift circuit to Float.
8. Use the 2-point hitch to lower the applicator until the center section coulters are just at ground level.
9. Check frame front-to-back level and adjust spacers (page 38) as necessary.
10. Adjust the gauge wheel heights to bring the wing coulters to the same height as the center section (just above the ground).
11. Measure the length ③ of exposed gauge wheel tube.

12. Crank the wheel up by the desired coulter depth (exposed tube length becomes length ③ minus the coulter depth). Capture this setting by re-inserting and securing the pin ②.
13. Crank the wheel up until the tube solidly contacts the pin. This transfers wheel loads to the pin, and not to the crank.
14. At the center section, measure the tool bar height above the ground. Operating height is this distance less the desired coulter depth.
15. Pull forward, lowering the 2-point hitch to operating height. Set a stop on the 2-point circuit to capture this height.
16. Adjust weight-transfer (page 88) to hold wings level at this coulter height for these field conditions.

NOTICE

Equipment Damage Risk:
Use the pin ②. Crank the tube up against the pin. Wheel loads transmitted to the crank can damage the crank.

Prior to folding, fold the jack handle down alongside the jack body. This retains the jack handle and prevents it from hitting the fertilizer tanks when folded (if so equipped).

Figure 65
Gauge Wheel Adjustment

Figure 66
Jack Handle Adjustment
Weight Transfer Adjustment

Weight Transfer Safety Information

⚠️ DANGER ⚠️

**Crushing and High Pressure Fluid Hazards:**
This adjustment requires working near the unfolded and lowered implement with the hydraulic system active. Assign two people to this task, one in the tractor, ready to shut down on hand signal from adjuster or any unplanned event.

⚠️ WARNING ⚠️

**High Pressure Fluid Hazard:**
Escaping fluid under pressure can penetrate the skin causing serious injury. Use a piece of paper or cardboard, NOT BODY PARTS, to check for suspected leaks. Wear protective gloves and safety glasses or goggles when working with hydraulic systems. If an accident occurs, seek immediate medical attention from a physician familiar with this type of injury.

⚠️ WARNING ⚠️

**Crushing Hazard:**
Keep body parts clear of wings, row cleaners and coulters while adjusting. Keep all bystanders well away. You will be seriously injured or killed if you are caught between lowering row implements and ground.

Refer to Figure 67

Wing fold cylinders can extend, during field operation, to push the wings down using mainframe/center weight. Weight transfer is controlled by two adjustment valves (1) and (2). See circuit diagram on page 146.

The fold circuit is set to continuous flow (in unfold mode) to maintain the active weight transfer.

The pressure reducing valve (1) controls the flow to the cylinders.

The bypass valve (2) returns excess oil to the tractor.

Adjust the weight transfer to achieve consistent coulter depth, while keeping the wings level with the center section. If insufficient weight is transferred, outside (wing) coulters may run higher than center section. If too much weight is transferred, center section may run high.

If adjusted when the tractor is cold, re-adjustment may be required when the oil warms. Monitor the pressure gauge during early field operations.

---

![Figure 67 Weight Transfer Valves](image_url)
Refer to Figure 67 and Figure 68

1. In field conditions, unfold (page 53), lower implement (page 48), and set or check coulter depth (page 86).
2. Pull forward to put coulters in ground.
3. Put tractor in Park and set parking brake.
4. Open the 90° ball valve ③.
5. Release the bypass valve lock disc ⑧. Turn the bypass valve knob ⑤ fully clockwise to shut-off all bypass oil flow. Tighten lock disc.
6. Set tractor to half throttle. Adjust tractor flow control valve so that wings fold/unfold at a reasonable speed. Keep tractor running for step 7 through step 10.

On 2-point implements, fold and unfold are followed by lift and lower operations.
7. Set tractor remote circuit for unfold. Lock lever for continuous operation.
8. At the pressure reducing valve ①, release the lock disc ⑥.
9. Adjust the knob ⑦ for an initial value of 800 psi on the gauge ⑥. Tighten the lock disc.
10. At the bypass valve ②, release the lock disc ⑧. Adjust the bypass valve knob counter-clockwise until the pressure reading just begins to fall from the value set at step 9. Turn the knob clockwise 1/4 turn. Tighten the lock disc.

11. Observe implement operation, and re-adjust down-pressure as necessary after oil warm-up. Repeat step 7 through step 10. The bypass valve needs to be closed prior to any adjustment to increase weight transfer.
Fertilizer Rates

Anhydrous Fertilizer Rate
Rate setting for anhydrous ammonia is controlled entirely by the console. For the Raven SCS 450 available from Great Plains, see page 39.

Conventional Liquid Fertilizer Rate
Rate setting is materially different for each pump type:

- Hydraulic Drive: rate is set on the console. The console operates a flow control valve. The valve adjusts the rate up to the peak value available at the current setting for hydraulic pump rpm. Make adjustments to orifice plates to provide back-pressure, keeping the boom within a specific safe pressure range that assures consistent delivery.

Rate Setting Steps:
1. Determine the rate (below).
2. Install suitable orifice plates (page 82).
3. Check strainer screen size (page 84).

   Hydraulic Drive: Set the pump pressure (page 85); set the desired rate on the console (see 016-0159-831 Raven SCS-450 Installation, Operation and Service manual).

Determining Application Rate
Great Plains recommends checking with your local agronomist as soil conditions vary. Soil conditions in your area may need less or more fertilizer than represented in the chart.

If your target rate is weight per area, you need to know the material density to convert it to liquid volume measure:

\[ \text{Volume per Area} = \frac{\text{Weight per Area}}{\text{Density}} \]

If you want to use the slide chart, and have only a metric rate value, convert it to U.S.customary units:

\[ \text{Gallons per Acre} = 0.107 \times \text{Liters per Hectare} \]
VisaGage II Operation

The VisaGage II flow monitor enables instant visual confirmation of liquids:

- When the color-coded indicator balls are floating in line, the flow is proceeding at a uniform rate
- When an indicator ball floats lower, the hose or opener supplied by that flow monitor may be blocked
- An indicator ball floating higher than the others is a visual signal that a hose or fitting connected to that specific flow monitor may be leaking or broken.

Each gage is made up of several parts:
- Push outlet adapter
- O-ring
- Ball screen
- Ball
- Gage
- Retainer clip

Before performing field operations, make sure that you have chosen the correct float ball for your particular application.
The following text information is supplied from CDS-John Blue Company publication 12-M-49 Rev. 7/2012:

**WARNING**

Use of this product for any purposes other than its original intent, abuse of the product, and/or modification to the original product is strictly prohibited by CDS-John Blue Company. CDS-John Blue Company reserves the right to deny warranty or liability claims in any/all situations involving misuse, abuse or modification. The original intent of this product does not include use where the maximum allowed pressure or temperature is exceeded, and it does not include applications utilizing fluids that are not compatible with the product’s component materials. Do not use this product with flammable or combustible fluids such as gasoline, kerosene, diesel, etc. Do not use in explosive atmospheres, and do not use with anhydrous ammonia (NH3). Failure to follow this notice may result in serious injury and/or property damage and will void the product warranty. If in doubt about your application, contact your stocking dealer or the CDS-John Blue Technical Staff at 1-800-253-2583.

Use only glass or stainless steel ball with acid fertilizer.

The maximum flow allowed through each column is 3.8 GPM (water).

For solutions other than water, apply the appropriate conversion factor to the flow table values.

<table>
<thead>
<tr>
<th>FLOW RATE TABLE FOR WATER (in GPM) (WATER = 8.34 LBS/GAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LEVEL</strong></td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOLUTION WEIGHT (LBS/GAL)</th>
<th>CONVERSION FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.0</td>
<td>0.96</td>
</tr>
<tr>
<td>10.0</td>
<td>0.91</td>
</tr>
<tr>
<td>11.0</td>
<td>0.87</td>
</tr>
<tr>
<td>12.0</td>
<td>0.83</td>
</tr>
<tr>
<td>14.0</td>
<td>0.77</td>
</tr>
<tr>
<td>16.0</td>
<td>0.72</td>
</tr>
</tbody>
</table>
Operating Instructions:
1. Maximum allowed system pressure is 100 psi, and the maximum allowed liquid temperature is 140°F.
2. The adapters and body of the standard flow monitors are made of Polypropylene and PVC. You must verify that the fluids you plan to use are compatible with these materials. Note that for the fumigant flow monitor models, PMP (Polymethylpentene, or “TPX®”) is used instead of PVC.
3. During use, the balls in each column should be approximately even. If they are not, check the lines for blockage or restriction.
4. If the balls are at the very top of the monitor during operation, it is recommended to change the ball to lower its operating level in order to avoid flow restriction from the ball itself.
5. Various types of liquid fertilizer will give different flow values than what is shown in the flow rate table. You may use the conversion table to adjust the flow values according to your fertilizer’s lbs/gallon measurement, but it may be best to experiment with different balls to determine which one works best in your application.

Table Example:
- For fertilizer weighting 11 lbs./gal., the conversion factor is 0.87
- If you want to run 0.47 GPM through each monitor, you need to divide 0.47 by 0.87 (=0.54)
- Then you choose from the Flow Rate Table the best fit to the new number - which is the blue glass ball. The ball should hover at approximately level #5.

Storage and Cleaning:
1. After use, flush the monitor columns for a few minutes with a solution that will neutralize the liquid last used (refer to that manufacturer’s instructions). The columns may be disassembled to ease cleaning.
2. To protect monitor columns from freezing, drain completely after flushing.
3. Although the flow monitor’s materials have an additive to increase UV resistance, to prolong their life it is suggested that you protect the flow monitors from sunlight during storage.

End of used text from CDS-John Blue Company publication 12-M-49 Rev. 7/2012.
Hydraulic Drive: Pump Pressure

These steps presume an applicator with optional on-board tanks and optional Raven SCS 450 console.

Flow-Based Adjustment

This adjustment verifies pump pressure, fertilizer flow and boom pressure.

1. Fill tank(s) with water.
2. Verify that the drop line orifice plates are the correct size for the intended application rate (see page 82).
3. Move applicator to a location where water and residual material in system is harmless to soil.
4. Set hydraulic remote circuit for pump to Float. Set flow rate to minimum.
5. Set tank discharge and selector valves to enable material flow from tank(s) to the pump.

Refer to Figure 71

6. Set the Console FLOW switch to MAN.
7. Set MASTER switch OFF.
8. Set the POWER switch to ON.
9. Verify that the BOOM CAL, SPEED CAL, METER CAL, VALVE CAL, and RATE CALs have been entered correctly into the console.
10. Press the SELF TEST button.
11. Enter the applicator’s expected field speed.
12. Turn MASTER switch and BOOMS 1,2&3 ON.
14. Increase the circuit flow rate until the console pressure reading is between 15 and 45 psi.
15. Operate the FLOW CONTROL switch to the INC position until the RATE is about 35% higher than the intended field rate. Increase the hydraulic flow as needed to keep the psi in the 15-to-45 range.
16. Reduce the RATE (via the DEC switch) to the desired field rate. Verify that the pressure is still in the 15-to-45 range.
17. Make a record of the flow rate setting for the hydraulic circuit.
18. Set pump hydraulic circuit to FLOAT.
19. Set console switches: MASTER to OFF. FLOW switch to RATE 1.

Dead-Head Adjustment

This adjustment verifies only pump pressure, but is quicker than the flow-based adjustment, and delivers no material to the tines.

1. Fill tank(s) with water or fertilizer.
2. Set hydraulic remote circuit for pump to Float. Set flow rate to minimum.
3. Set tank discharge and selector valves to enable material flow from tank(s) to the pump.
4. Set the Console FLOW switch to MAN.
5. Set MASTER switch OFF.
6. Set the POWER switch to ON.
7. Push the FLOW CONTROL to the INC position and hold it there for several seconds to open the valve.
8. Turn the MASTER switch ON and BOOMS 1,2&3 OFF.
10. Increase the circuit flow rate until the console pressure reading is 45 psi.
11. Make a record of the flow rate setting for the hydraulic circuit.
12. Set pump hydraulic circuit to FLOAT.
13. Set console switches: MASTER to OFF. FLOW switch to RATE 1.

---

1. Hydraulic oil heating causes the pump performance to gradually decline by 30% over several hours. Setting the remote to have a 35% excess capability assures that adequate flow will be available for the duration of application.
Troubleshooting

General Applicator Troubleshooting .........................95
NH3 Metering System Troubleshooting .......................96
General Application Troubleshooting .........................97
Hydraulic Drive Pump Troubleshooting .......................99

The topics in this section presume that the applicator has a Raven SCS 450 console, Raven AccuFlow™ metering system, and CDS-John Blue® Impellicone® flow divider.

If also equipped with conventional liquid capability, the topics in this section presume that the applicator is equipped with a CDS-John Blue® pump or a hydraulic pump and Raven SCS 450 console.

Troubleshooting sections are also found in the following component manuals:
016-0159-403
Raven AccuFlow™ Operator manual
016-0159-831
Raven SCS-450 Installation, Operation and Service manual
12-M-43
CDS-John Blue NGP Pump Parts and Instructional manual

General Applicator Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fold or unfold jerky or imbalanced</td>
<td>Air in lines</td>
<td>Bleed fold/lift circuit (page 118).</td>
</tr>
<tr>
<td>Lift jerky or imbalanced</td>
<td>Air in lines</td>
<td>Bleed fold/lift circuit (page 118).</td>
</tr>
<tr>
<td>Lift-Assist casters oscillating</td>
<td>Caster stabilizer too lightly set</td>
<td>Increase spring tension on caster stabilizer piston (page 119).</td>
</tr>
<tr>
<td>Uneven application depth</td>
<td>Excessive field speed.</td>
<td>Reduce field speed.</td>
</tr>
<tr>
<td></td>
<td>Coulters set too deep, lifting entire applicator</td>
<td>Reduce coulter depth.</td>
</tr>
<tr>
<td></td>
<td>Rough application conditions</td>
<td>Rework the field.</td>
</tr>
<tr>
<td></td>
<td>Worn tines inadequately preparing trench</td>
<td>Replace worn tines.</td>
</tr>
<tr>
<td>Wings too Shallow</td>
<td>Insufficient weight transferred to wings</td>
<td>Increase weight transfer (page 88).</td>
</tr>
<tr>
<td>Center too Shallow</td>
<td>Excess weight transferred to wings</td>
<td>Decrease weight transfer (page 88).</td>
</tr>
<tr>
<td>Sealers not compacting the soil as desired</td>
<td>Sealer adjustment not optimal.</td>
<td>Adjust sealer (page 83).</td>
</tr>
<tr>
<td></td>
<td>Not level front to rear.</td>
<td>Check applicator front-to-back level (page 38).</td>
</tr>
<tr>
<td></td>
<td>Too wet or cloddy</td>
<td>Wait until drier weather or rework ground.</td>
</tr>
<tr>
<td>2-Point Lift-Assist slow</td>
<td>Adjustment valve not fully open.</td>
<td>Open valve (page 149).</td>
</tr>
</tbody>
</table>
## NH₃ Metering System Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Spikes (no alarm)</td>
<td>Plugged tine or tines</td>
<td>Stop application per page 66. Lift applicator and inspect tines. Clear any plugging per “Clearing Plugged Tines” on page 105.</td>
</tr>
<tr>
<td>Flow divider pressure sag</td>
<td>Open line or lines</td>
<td>Stop application per page 66. Lift applicator and inspect tines for open line plugging. Clear any plugging per “Clearing Plugged Tines” on page 105.</td>
</tr>
<tr>
<td>Temperature Rise (no alarm)</td>
<td>Plugged refrigerant vapor line</td>
<td>Stop application per page 66. Lift applicator and inspect tines. Clear any plugging per “Clearing Plugged Tines” on page 105.</td>
</tr>
<tr>
<td>Rate Alarm, Low</td>
<td>System not fully charged</td>
<td>Expect early rate alarms until the cooler is ensuring that all meter flow is liquid.</td>
</tr>
<tr>
<td>Rate Alarm, Low</td>
<td>One or more manual valves not fully open</td>
<td>Suspend operations (per page 65). Check all manual valves from nurse tank withdrawal valve to emergency shut-off valve.</td>
</tr>
<tr>
<td>Rate Alarm, Low</td>
<td>Solenoid or control valve malfunction or harness status</td>
<td>Suspend operation (page 65). Close emergency shut-off valve. Discharge line from emergency shut-off valve to tines. Wait for applicator to be safe to approach. Check harness connections and fuses. Use console SELF-TEST mode to command Raven valves open. Check valve ball indicators at valves.</td>
</tr>
<tr>
<td>Rate Alarm, Low</td>
<td>Field speed too high (higher than available pressure can supply NH₃)</td>
<td>Slow down, or wait for warmer conditions.</td>
</tr>
<tr>
<td>Rate Alarm, Low</td>
<td>Tank pressure low</td>
<td>Ambient or tank temperature may be too low to provide sufficient delivery pressure. Wait for tank to warm, or wait for warmer weather.</td>
</tr>
<tr>
<td>Rate Alarm, High</td>
<td>Incorrect VALVE CAL for Control Valve or METER CAL for flow meter.</td>
<td>Recheck console setup against values provided for components (page 39).</td>
</tr>
<tr>
<td>Rate Alarm, High</td>
<td>Control Valve failed, or harness status</td>
<td>Suspend operation (page 65). Close emergency shut-off valve. Discharge line from emergency shut-off valve to tines. Wait for applicator to be safe to approach. Check harness connections and fuses. Use console SELF-TEST mode to command rate to zero open. Check valve ball indicators at valves.</td>
</tr>
<tr>
<td>Excess NH₃ Remaining (but no alarms)</td>
<td>Incorrect console setup</td>
<td>Re-check METER CAL and BOOM CAL.</td>
</tr>
<tr>
<td>Excess NH₃ Remaining (but no alarms)</td>
<td>Field size different.</td>
<td>After ruling out metering problems, re-check geography.</td>
</tr>
<tr>
<td>Excess NH₃ Remaining (but no alarms)</td>
<td>Excessive gaps between applicator passes.</td>
<td>Gap between opposing pass end trenches should be one row space (e.g. 30 inches)</td>
</tr>
<tr>
<td>Excess NH₃ Remaining (but no alarms)</td>
<td>Flow meter malfunction</td>
<td>Consult dealer.</td>
</tr>
<tr>
<td>NH₃ Consumption Too High (but no alarms)</td>
<td>Incorrect console setup</td>
<td>Re-check METER CAL and BOOM CAL.</td>
</tr>
<tr>
<td>NH₃ Consumption Too High (but no alarms)</td>
<td>Field size different.</td>
<td>After ruling out metering problems, re-check geography.</td>
</tr>
<tr>
<td>NH₃ Consumption Too High (but no alarms)</td>
<td>Excessive overlap</td>
<td>Gap between opposing pass end trenches should be one row space (e.g. 30 inches). Also check tracks for unintended re-applications, particularly if relying on GPS mapping.</td>
</tr>
<tr>
<td>NH₃ Consumption Too High (but no alarms)</td>
<td>Tank or system Leak</td>
<td>Suspend application. Carefully approach applicator and nurse tank from up-wind. Check for leaks in</td>
</tr>
<tr>
<td>NH₃ Consumption Too High (but no alarms)</td>
<td>Flow meter malfunction</td>
<td>Consult dealer.</td>
</tr>
<tr>
<td>Rows Not Fertilized</td>
<td>Check for plugged row-unit tube</td>
<td>Stop application per page 66. Lift applicator and inspect tines. Clear any plugging per “Clearing Plugged Tines” on page 105.</td>
</tr>
<tr>
<td>Rows Not Fertilized</td>
<td>Failed or malfunctioning aftermarket section control.</td>
<td>Consult system supplier documentation.</td>
</tr>
<tr>
<td>Problem</td>
<td>Cause</td>
<td>Solution</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>No Fertilizer Flow</td>
<td>Strainer plugged</td>
<td>Close all valves. Inspect strainer (page 113). Clean screen and magnets as needed.</td>
</tr>
<tr>
<td></td>
<td>Material run-out</td>
<td>Check tank level.</td>
</tr>
<tr>
<td></td>
<td>Temperature too low</td>
<td>Wait for warmer conditions.</td>
</tr>
<tr>
<td></td>
<td>On/Off solenoid valve failure or open circuit.</td>
<td>Suspend operation (page 65). Close emergency shut-off valve. Discharge line from emergency shut-off valve to tines. Wait for applicator to be safe to approach. Check harness connections and fuses. Use console SELF-TEST mode to command Raven valves open. Check valve ball indicators at valves.</td>
</tr>
</tbody>
</table>

### General Application Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Excess Material Remaining</strong></td>
<td>Field size different.</td>
<td>After ruling out metering problems, re-check geography.</td>
</tr>
<tr>
<td></td>
<td>Excessive gaps between applicator passes.</td>
<td>Gap between opposing pass end trenches should be one row space (e.g. 30 inch)</td>
</tr>
<tr>
<td><strong>Material Consumption Too High</strong></td>
<td>Field size different.</td>
<td>After ruling out metering problems, re-check geography.</td>
</tr>
<tr>
<td></td>
<td>Excessive overlap</td>
<td>Gap between opposing pass end trenches should be one row space (e.g. 30 inch). Also check tracks for unintended re-applications, particularly if relying on GPS mapping.</td>
</tr>
<tr>
<td><strong>Rows Not Fertilized</strong></td>
<td>Check for plugged row-unit tube</td>
<td>Stop application. Lift applicator and inspect tines.</td>
</tr>
<tr>
<td><strong>No Fertilizer Flow</strong></td>
<td>Strainer plugged</td>
<td>Close all valves. Inspect strainer (page 113). Clean screen as needed.</td>
</tr>
<tr>
<td></td>
<td>Material run-out</td>
<td>Check tank level.</td>
</tr>
<tr>
<td><strong>Tines plugging frequently</strong></td>
<td>Tine tips too low for coulter depth</td>
<td>Raise tine weldment (page 81).</td>
</tr>
<tr>
<td></td>
<td>Coulter blades too worn</td>
<td>Replace coulter blades.</td>
</tr>
<tr>
<td></td>
<td>Field too wet</td>
<td>Wait for drier conditions.</td>
</tr>
<tr>
<td></td>
<td>Applicator not level from front to rear</td>
<td>Check applicator front-to-back level (page 38).</td>
</tr>
<tr>
<td></td>
<td>Tractor rocking backward during stops, or lift sequence pushing tines backward</td>
<td>Refine stopping and/or lifting technique to avoid reverse coulter motion in ground.</td>
</tr>
<tr>
<td><strong>Excessive NH₃ loss to atmosphere (all rows)</strong></td>
<td>Application depth too shallow</td>
<td>Check/adjust tractor hitch (page 38), lift-assist spacers (page 37) and gauge wheel height (page 87).</td>
</tr>
<tr>
<td></td>
<td>Coulters set too deep; lifting tines</td>
<td>Reduce coulter depth to tine depth (page 81).</td>
</tr>
<tr>
<td></td>
<td>Insufficient sealing</td>
<td>Adjust sealers (page 83). Test running dry. Try multiple settings on different rows at the same time if the adjustment needed is not obvious. Check applicator front-to-back level.</td>
</tr>
<tr>
<td></td>
<td>Application rate too high for soil or weather conditions</td>
<td>Consult with agronomist on optimal rate and conditions.</td>
</tr>
<tr>
<td></td>
<td>Field speed too high</td>
<td>Slow down.</td>
</tr>
<tr>
<td><strong>NH₃ loss to atmosphere (some rows)</strong></td>
<td>Wings not level</td>
<td>Check tire pressures.</td>
</tr>
<tr>
<td></td>
<td>Check wings level (page 118).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fold cylinders locked in Neutral, and unable to follow terrain</td>
<td>Set fold/lift circuit to continuous Extend (unfold/lower) for field application.</td>
</tr>
<tr>
<td>Problem</td>
<td>Cause</td>
<td>Solution</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>----------</td>
</tr>
<tr>
<td>NH$_3$ loss to atmosphere (one row)</td>
<td>Plugged tine</td>
<td>See “Clearing Plugged Tines” on page 105. If tines are plugging frequently, check: coulter setup, application depth, tine wear. Field conditions and weather may also be unsuitable at the moment.</td>
</tr>
<tr>
<td></td>
<td>Disconnected delivery or vapor line</td>
<td>Treat this as tine plugging (page 105) until the cause is determined. If the cause is tall tough field trash, consider re-working the field if disconnects are frequent.</td>
</tr>
<tr>
<td></td>
<td>Sealer mis-adjusted or failed (such as a broken spring)</td>
<td>Check sealer. Adjust (page 83) or repair.</td>
</tr>
<tr>
<td></td>
<td>Rows in tractor tracks too shallow</td>
<td>Reset tractor wheel spacing to avoid rows.</td>
</tr>
<tr>
<td>Tines plugging frequently</td>
<td>Tines worn</td>
<td>Replace worn tines.</td>
</tr>
<tr>
<td></td>
<td>Field too wet</td>
<td>Wait for drier conditions.</td>
</tr>
<tr>
<td></td>
<td>Tractor rocking backward during stops, or lift sequence pushing tines backward</td>
<td>Refine stopping and/or lifting technique to avoid reverse tine motion.</td>
</tr>
<tr>
<td>Sealers plugging</td>
<td>Conditions too wet.</td>
<td>Wait for drier conditions.</td>
</tr>
<tr>
<td></td>
<td>Too much pressure on row-units.</td>
<td>Reduce spring pressure.</td>
</tr>
<tr>
<td></td>
<td>Sealers running at an angle</td>
<td>Adjust sealers to run straight.</td>
</tr>
<tr>
<td></td>
<td>Coulters set too deep, bring up excess dirt and moisture.</td>
<td>Check coulter adjustment.</td>
</tr>
<tr>
<td></td>
<td>Applicator not level from front to rear</td>
<td>Check applicator front-to-back level (page 38).</td>
</tr>
<tr>
<td></td>
<td>Failed bearings</td>
<td>Replace bearings.</td>
</tr>
<tr>
<td>Low Manifold Pressure</td>
<td>Rate, speed or material viscosity too low for orifice plate size</td>
<td>Re-check pump rate determination. If correct, replace orifice plates with a smaller size (page 127).</td>
</tr>
<tr>
<td></td>
<td>Strainer clogged</td>
<td>Clean strainer, and possibly use coarser screen size (page 115).</td>
</tr>
<tr>
<td></td>
<td>Boom leak</td>
<td>Repair boom.</td>
</tr>
<tr>
<td></td>
<td>Tank vent closed or plugged; pump cavitating</td>
<td>Check tank lid. check pump prime.</td>
</tr>
<tr>
<td></td>
<td>Material run-out</td>
<td>Refill.</td>
</tr>
<tr>
<td>High Manifold Pressure</td>
<td>Orifice plate size too small</td>
<td>Replace orifice plates (page 127).</td>
</tr>
<tr>
<td></td>
<td>Tine nozzle orifice smaller than orifice plate.</td>
<td>Remove nozzle.</td>
</tr>
<tr>
<td></td>
<td>Orifice plates plugged</td>
<td>Clean plates. Check sizing.</td>
</tr>
</tbody>
</table>
# Hydraulic Drive Pump Troubleshooting

The Ace Pump Instruction manual (HYD-MAN) and the Raven SCS-450 Installation, Operation and Service manual (016-0159-831) have additional troubleshooting information.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rate Alarm, Low</strong></td>
<td>System not fully charged</td>
<td>Prime system. Check for blocked air bleed line on standard first pump. Open petcock on user-plumbed second pump.</td>
</tr>
<tr>
<td></td>
<td>One or more manual valves not fully open</td>
<td>Suspend operations. Check all manual valves from nurse tank withdrawal valve (if any) to inlet shut-off valve.</td>
</tr>
<tr>
<td></td>
<td>Control valve malfunction or harness status</td>
<td>Check harness connections and fuses. Use console SELF-TEST mode to command rate to zero. Check indicator at control valve. Command rate to maximum. Check valve open.</td>
</tr>
<tr>
<td><strong>Rate Alarm, High</strong></td>
<td>Incorrect VALVE CAL for Control Valve or METER CAL for flow meter.</td>
<td>Recheck console setup against values provided for components (page 39).</td>
</tr>
<tr>
<td></td>
<td>Control Valve failed, or harness status</td>
<td>Check harness connections and fuses. Use console SELF-TEST mode to command rate to zero. Check indicator at control valve. Command rate to maximum. Check valve open.</td>
</tr>
<tr>
<td><strong>Low Manifold Pressure</strong></td>
<td>Pump not primed</td>
<td>Factory-installed pump: check bleed line for plugging. Second pump: open petcock valve or check bleed line.</td>
</tr>
<tr>
<td></td>
<td>Mis-adjusted bypass valve in pump motor</td>
<td>Close valve or re-adjust for Open Center system (see pump manual)</td>
</tr>
<tr>
<td></td>
<td>Impeller or volute worn</td>
<td>Repair pump.</td>
</tr>
<tr>
<td><strong>Excess Material Remaining (but no alarms)</strong></td>
<td>Incorrect console setup</td>
<td>Re-check METER CAL and BOOM CAL.</td>
</tr>
<tr>
<td></td>
<td>Flow meter malfunction</td>
<td>Consult dealer.</td>
</tr>
<tr>
<td><strong>Material Consumption Too High (but no alarms)</strong></td>
<td>Incorrect console setup</td>
<td>Re-check METER CAL and BOOM CAL.</td>
</tr>
<tr>
<td></td>
<td>Flow meter malfunction</td>
<td>Consult dealer.</td>
</tr>
<tr>
<td><strong>No Fertilizer Flow</strong></td>
<td>Pump not primed</td>
<td>Factory-installed pump: check bleed line for plugging. Second pump: open petcock valve or check bleed line.</td>
</tr>
<tr>
<td></td>
<td>Strainer plugged</td>
<td>Close all valves. Inspect strainer (page 115). Clean screen as needed.</td>
</tr>
<tr>
<td></td>
<td>Material run-out</td>
<td>Check tank level.</td>
</tr>
</tbody>
</table>
Maintenance and Lubrication

Proper servicing and maintenance is the key to long applicator life. With careful and systematic inspection, you can avoid costly maintenance, downtime and repair. Always turn off and remove the tractor key before making any adjustments or performing any maintenance.

**Suffocation, Blinding, Burning, Freezing, Disabling and Disfigurement Hazards:**
Do not perform maintenance with anhydrous ammonia in the system. Fully discharge the system of NH₃ liquid and vapor before working on the applicator. See page 103.

**Crushing Hazard:**
Always have transport locks in place and/or use stands when working on applicator. You may be severely injured or killed by being crushed under a falling applicator.

**High Pressure Fluid Hazard:**
Check all hydraulic lines and fittings before applying pressure. Fluid escaping from a very small hole can be almost invisible. Use paper or cardboard, not body parts, and wear heavy gloves to check for suspected leaks. Escaping fluid under pressure can have sufficient pressure to penetrate the skin. If an accident occurs, seek immediate medical assistance from a physician familiar with this type of injury.

1. After using your applicator for several hours, check all bolts to be sure they are tight.
2. Maintain proper air pressure in tires.
3. Hydraulic Pump: Keep pump full of liquid at all times.
4. Clean applicator on a regular basis. Regular and thorough cleaning will lengthen equipment life and reduce maintenance and repair.
5. Lubricate areas listed under “Lubrication and Scheduled Maintenance” on page 120.
6. Replace any worn, damaged, or illegible safety labels by obtaining new labels from your Great Plains dealer.

**Spill hazard/Tank damage risk:**
Periodically check the tension of the straps for the fertilizer tank. Strap tension will change as outside air temperature changes. Adjust tension as necessary to prevent personal injury or damage to the fertilizer tank.
Avoid Trapped Anhydrous

Before servicing anhydrous equipment, or storing it near untrained individuals, be absolutely certain that there is no liquid NH₃ trapped in the system, and no NH₃ vapor present (or only trace amounts).

Follow bleeding and discharge instructions carefully. Beware of places in the systems where NH₃ can be trapped.

Avoid Line Traps

Refer to Figure 72

Any two line valves in the system, if both closed with NH₃ present, can trap that ammonia indefinitely. Line valves include:
- tank withdrawal (A15),
- nurse tank hose valves(s) (A10),
- check valves at a disconnected breakaway (A14),
- emergency shut-off valve (A18),
- control valve at rate zero (A30),
- On/Off solenoid valve (A31), and
- aftermarket section valves.

In a properly designed system, segments not open to the atmosphere are protected by hydrostatic relief valves, but the operation of such valves only releases a small portion of the trapped ammonia.

Normal shut-down instructions, after closing the tank withdrawal valve, are intended to bleed most of the system NH₃ into the soil. However, there can still be substantial vapor in the system after that. If shut-down procedures were not followed, liquid may be present. If the state of the equipment is not known with certainty at the time of servicing, you need to assume that a closed valve represents a risk of trapped NH₃.

The illustration at right depicts a nurse tank hose (A8) in use, and shut-off while still full of liquid NH₃. If this hose is removed to an enclosed space, then opened, it represents an extreme hazard. Vapor concentrations could rise to well above IDLH¹ levels in moments.

This example system line segment is equipped with relief orifice-equipped ball valves (A10), but that only bleeds the downstream side of a valve ball, the outlet valve in this example. See page 102 for information about ball traps.

The downstream side of this system line segment is equipped with a bleed valve (A31). The upstream side of the inlet valve is equipped with a hydrostatic relief valve (A12).

If this line segment warms, pressure can rise high enough to cause periodic releases at the relief valve. This protects the segment from rupture, but does not clear the line.

Clearing a Line Trap

To clear a line segment with possible trapped NH₃:
- Move the equipment outdoors.
- If calm, wait for wind.
- Stand up-wind of the bleed valve.
- Point the bleed valve orifice down-wind and away from all personnel.
- If it’s a hose bleed valve, make sure you can set the hose down with the valve still pointing in a safe direction.
- Open the bleed valve very slowly. Once any discharge is observed, (set any hose down) depart up-wind.
- Remain up-wind until the discharge completes.

---

¹ IDLH: Immediately Dangerous to Life and Health
Avoid Ball Traps

**DANGER**

**IDLH Anhydrous Ammonia Exposure Hazard:**
Beware of closed ball valves. A ball valve can trap liquid NH₃. If opened when disconnected, this liquid is likely at extreme pressures, is emitted forcefully and vaporizes rapidly. A 1 1/4 in ball valve can trap enough NH₃ to reach IDLH¹ vapor concentrations, within moments, in a space the size of a two car garage. Anyone present could be burned, blinded, or receive serious or permanent lung injury. If this happens in an enclosed space, the consequences could be fatal.

Refer to Figure 73

Always assume a closed ball valve contains liquid NH₃ under high pressure.

The flow gate of a traditional ball valve is a solid steel ball with a hole through it. When closed, the hole cavity is sealed by the side walls of the valve body.

If closed with the line full, the ball cavity is full of NH₃. If the valve is well constructed, that fluid remains there indefinitely, presenting future field and service hazards.

If the valve has a bleed valve and/or relief valve, those safety valves do not vent the ball cavity when a solid ball valve is closed. One of them may vent just the downstream side of an orifice ball with the ball closed.

The emergency shut-off valve (A18) supplied on Great Plains applicators in October 2010 and later has a relief orifice on the downstream (strainer) side of the valve. See note on page 14 regarding valve Warning decal.

Nurse tank hoses are likely to have solid ball valves indefinitely. Treat all ball valves as potential traps.

▲ Wear your PPE² when servicing lines and fittings that are in an uncertain status.
▲ Fully bleed all lines prior to servicing.
▲ Never carry a valve by the operating wheel or handle.
▲ Open ball valves when both sides of their lines are bled.
▲ Re-check the bleed on at least one side of the opened valve.
▲ If closing a ball valve for storage or parking, first wait for the valve to warm to ambient temperature to ensure that no liquid NH₃ remains.
▲ Never point a hose at your face.
▲ Treat all closed valves as possible traps.

---

1. IDLH: Immediately Dangerous to Life and Health
2. PPE: Personal Protective Equipment
Never open a closed valve in an enclosed area. In addition to the exposure hazard, a release of NH₃ could result in a concentration level that is flammable or explosive.

Never point a closed valve at your face.

If replacing a ball valve, don’t just check that the new valve is specified for NH₃ service: Replace orifice ball valves only with orifice ball valves.

Replace solid ball valves with orifice ball valves.

Install an orifice ball valve correctly. The orifice side points down-stream (in the direction of flow).

System Discharge

These steps are for clearing an applicator for service or for storage near untrained persons. These instructions presume that you have followed the steps at: “NH₃: Stopping Application” on page 66, and the nurse tank is unhitched, per: “NH₃: Final Nurse Tank Unhitch” on page 69.

For a breakaway event, follow the instructions on page 67 up through breakaway re-connection. Then perform a normal shutdown (other than nurse tank steps), per page 66.

The challenges in system discharge are:

- NH₃ liquid can remain in the system after the recommended stopping procedures.
- NH₃ liquid self-cools as it evaporates, slowing evaporation. It can take a long time for all of it to turn to vapor, particularly in cooler weather.
- Once there is only vapor in the system, there is usually little gas movement to drive the rest of it out.
- The delivery tubing loops are usually the last to clear, and may not fully clear. See sidebar.

Even if no ammonium hydroxide forms, the NH₃ vapor in the system dilutes slowly with air. Harmless trace amounts, noticed as occasional odor, may remain indefinitely.

The delivery tubes are open to the atmosphere at the tines. When they don’t clear immediately, they are likely to absorb atmospheric moisture, forming ammonium hydroxide (NH₄OH) in the tubes. This liquid is highly caustic, and can persist for weeks or months, but remains liquid at ambient temperatures, is harmless to the tubing, and emits ammonia vapor slowly. If there is liquid in the tubes, and it is not cold, it is likely to be an NH₄OH solution, and not pure NH₃.
Normal Discharge

At the completion of stopping application and nurse tank unhitching, all line valves are closed and all bleed valves are open, and have been that way for at least an hour. Transport may also have occurred, which aids clearing.

1. Verify that all line valves are closed, and all bleed valves open. If this is not the case, there is risk of trapped ammonia. See “Clearing a Line Trap” on page 101.

2. Carefully walk down-wind of the applicator. Check for ammonia odor. If pungent, there is at least some pure NH\(_3\) vapor in the system, and possibly some liquid. Give the applicator some time to vent.

3. From up-wind, check all the fittings and lines. If any are cold (more than a few degrees below ambient temperature), liquid evaporation is still in progress or has only recently completed. Give the applicator more time to vent.

Steps continue on next page...

System Blow-Out

4. To rapidly reduce the vapor in the system to trace amounts, use compressed air at the Acme inlet (A12).

   a. You will need to have the console connected to the meter harness and powered up. Have the console up-wind of the applicator.

   b. If liquid NH\(_3\) is suspected to be present, lower the tines into the ground.

   c. Connect the air hose to the Acme inlet (A12). Use hose extensions as needed to perform this blow-out outdoors. You also need a connection at the Acme inlet that does not rely on a person standing there to maintain it.

   d. Open all line valves. Open the emergency shut-off valve (A19).

   e. Set the air source regulator to no more than 150 psi.

   f. Flow air through the system until odor falls to acceptable levels.

If there is ammonium hydroxide (NH\(_4\)OH) fluid (or merely condensed water) in the delivery loops, this blow-out procedure may remove some, but not all, of that fluid.
Loop Clearing

5. Loop fluid: If it has been more than a day, with the temperature above freezing, since application completed, and there is still fluid in the loops, it is probably ammonium hydroxide (NH₄OH). If necessary to clear it from the lines, follow these steps:

a. You will need a funnel with tip O.D. smaller than the delivery tube I.D. (\(\frac{3}{8}\) inch, 9.5 mm), and a fresh water source.

b. Face the applicator into the wind.

c. Disconnect a delivery line (∆) at a flow divider outlet (∆).

d. Connect the funnel to the line.

e. Add water until it appears at the tines. Then add one more gallon (4 liters). This results in a NH₄OH solution that is more dilute than household cleaning ammonia.

f. Blow out the line if air is available. Do not exceed 150 psi.

g. Reconnect the line at the flow divider.

h. Repeat step 5a through step 5f for all tubes.

Clearing Plugged Tines

Tines can get plugged at release ports ①, due to sticky soil, reverse movement and other causes. Routinely check tines for evidence of plugging just prior to nurse tank hitching. More rarely, unusual field debris can cause a tubing disconnect at a tine. Treat it as a plugged line until you confirm otherwise.

**WARNING**

Elevated Ammonia Exposure Hazard:

Follow clearing instructions carefully. Wear your PPE. Plugged delivery lines with tubing still attached can hold significantly greater than normal NH₃ liquid which is not likely to be mitigated by the normal Discharge procedures. Hastily disconnecting a charged line will release a dangerous amount of NH₃ liquid and vapor. Your PPE is not designed to protect you against such a release. Burning, respiratory injury, blinding or death could result.

Refer to Figure 75

Clearing Plugged Application Tubes

A plugged application tube ① often results in the delivery tubing (∆) lifting off the tine tubing at the clamp (an “open line plug”). The disconnect is usually easy to spot in the field as a condensation cloud from the row.

---

1. PPE: Personal Protective Equipment
The row is likely to be taking more than its equal share of NH₃ from the flow divider. You may see a drop in pressure at the flow divider gauge (A42) on page 63.

If the plugged line remains closed (“closed line plug”), the tubing may be completely full of liquid NH₃ by the time you detect the problem. You may notice an increase in pressure at the flow divider gauge (A42), or pressure pulses, as trapped liquid warms, periodically vaporizes, and blows back into the flow divider (A40) on page 63.

Clearing Open Line Application Plugs
1. Stop operation (page 66).
2. Discharge the system (page 103).
3. If the tine tubing is cold, wait for it to warm to ambient temperature (and vaporize any liquid NH₃ inside).
4. Use a thin flexible tool (a coat hanger wire may suffice) to clear the tine tube from above or below.
5. Reconnect the application tubing. Squeeze the spring clamp ②. Slide it up the delivery tubing. Push the delivery tubing onto the tine tube about 3/4 inch (19 mm). Slide the spring clamp to centered in the overlap.

Clearing Closed Line Application Plugs
1. Review the WARNING at the top of this page.
2. Stop operation (page 66).
3. Discharge the system (page 103). The standard discharge is not likely to adequately discharge any plugged or closed lines. Expect continuing vapor release at non-plugged rows. The plugged line discharges back through the flow divider, and out the other rows.
4. Wait until the plugged tine has warmed to ambient temperature, and the liquid level in the plugged loop is about the same as in the open loops.
5. Squeeze the spring clamp ②. Slide it up the tubing. Pull the delivery tubing off the tine tubing.
6. Use a thin flexible tool (a coat hanger may suffice) to clear the tine tube from above or below.
7. Reconnect the application tubing. Squeeze the spring clamp. Slide it up the delivery tubing. Push the delivery tubing onto the tine tube about 3/4 inch (19 mm). Slide the spring clamp to centered in the overlap.
Clearing Plugged Vapor Tubes

**Elevated Ammonia Exposure Hazard:**
Follow clearing instructions carefully. Wear your PPE\(^1\). Plugged vapor tubes still attached can contain significantly greater than normal \(\text{NH}_3\) vapor, which is not likely to be mitigated by normal Discharge procedures. Disconnecting a charged line releases a dangerous amount of \(\text{NH}_3\) vapor. PPE is not designed to protect against such a release. Burning, respiratory injury, blinding or death could result.

Refer to Figure 76
A plugged vapor tube (A48) often usually does not result in the vapor tubing lifting off the tine tubing at the clamp (it is a “closed line plug”).

Ensure that the \(\frac{1}{2}\) inch clear tubing @ is inserted in the vapor tube A48.

If only one vapor line is plugged, the symptom may be an elevated temperature at the cooler gauge (A27) on page 63, and possibly a rate alarm if cooling is insufficient. If both vapor lines at a cooler are plugged (at moderate or warm ambient temperatures) the temperature gauge rises higher, and more quickly. Cooling ceases. Cooler pressure rises. Flow divider pressure falls. Rate alarm is likely. Normal Discharge may not clear the line.

If the plugged line disconnects (“open line plug”), you may see little change from normal operations. Odor is elevated, if you drive down-wind of application. The vapor line may not cause a cloud. The change in cooler pressure may be minor. You are most likely to detect an open line plugging of a vapor line during routine row inspection at re-hitch.

Clearing Closed Line Vapor Plugs
1. Review the WARNING at the top of this page.
2. Stop operation (page 66).
3. Discharge the system (page 103). The standard discharge is not likely to adequately discharge any plugged, closed, vapor lines. Expect continuing vapor release at non-plugged rows. The plugged line discharges back through the cooler, then through the flow divider and out the other rows.
4. Wait until the plugged tine has warmed to ambient temperature, and there is no liquid in the vapor line.
5. Loosen the screw clamp @. Slide it up the vapor tubing. Pull the vapor tubing off the tine tubing.
6. Use a thin flexible tool (a coat hanger wire may suffice) to clear the tine tube from above or below.
7. Reconnect the vapor tubing. Push the vapor tubing onto the tine tube about \(\frac{3}{4}\) inch (19 mm). Slide the screw clamp to centered in the overlap and secure.

Clearing Open Line Vapor Plugs
1. Stop operation (page 66).
2. Discharge the system (page 103).
3. If the tine tubing is cold, wait for it to warm to ambient temperature (and vaporize any liquid \(\text{NH}_3\) inside).
4. Use a thin flexible tool (a coat hanger may suffice) to clear the tine tube from above or below.
5. Reconnect the vapor tubing. Push the vapor tubing onto the tine tube about \(\frac{3}{4}\) inch (19 mm). Slide the screw clamp to centered in the overlap and secure.

---

1. PPE: Personal Protective Equipment
Hydrostatic Relief Valve Maintenance

Relief valves require scheduled replacement and periodic inspection.

Relief Valve Inspection

Inspect relief valves seasonally, and during periodic maintenance. Check for cap present (step 2) prior to each application from a fresh tank of anhydrous.

1. Bleed the line at a relief valve before a detailed inspection. See "System Discharge" on page 103.

Refer to Figure 77 (depicting cooler relief valve (A23))

2. Check that the rain/dust cap is in place and fully seated.

Do not operate with a missing cap. The cap keeps the spring mechanism, outlet (vent port) ① and weep holes ② free of contaminants that could prevent valve operation in an over-pressure situation.

A missing or dislodged cap also indicates that the valve may have operated, or may be malfunctioning. Understand and correct the reason for a dislodged or missing cap prior to field operations.

Replacement caps are:
breakaway: Continental 400-DC
cooler: Squibb-Taylor 1325-8.

3. Carefully remove the dust cap.

4. Check the replace-by date ③ stamped on the valve. If it has passed, replace the valve before next use.

5. Clean any clogged weep holes ②. If they cannot be cleaned, replace the valve.

Ammonia Exposure Hazards:

- Wear safety equipment when inspecting or performing maintenance on relief valves. Even if the line is bled, NH₃ liquid or vapor may still be present.
- Always bleed the system before removing a relief valve cap or performing any more detailed inspection or valve maintenance.
- Never stand in front of or look directly into a relief valve. Use a mirror. If an overpressure event or valve malfunction is imminent or in progress, you can expect multiple valve activations. The initial activation can blow debris as well as liquid ammonia into your face.
- Follow inspection and replacement instructions carefully. Use the instructions on these two pages only if no separate instructions were supplied with the original and/or replacement valve.

In severe conditions (such as exposure to salt, corrosive chemicals or pollutants), or if a valve has fully opened, you may need to replace a hydrostatic relief valve sooner than 5 years.
6. Inspect for dirt, sand, grease, paint, damage, corrosion, signs of tampering or insect activity. If visible, check the metal surface of the spring.

   If debris cannot be easily cleared, replace the valve.
   If there are signs of damage, replace the valve.
   If there is any question, replace the valve.

7. If a valve is venting at normal operating pressures, replace the valve.

8. Never force a valve closed. If a valve has remained open after operating, or is leaking, it is seriously contaminated or failed. Replace the valve.

9. Never attempt to protect a valve orifice with grease. Grease can harden over time, and/or collect contaminants. Either factor could prevent valve operation in an overpressure situation.

   Never plug a relief valve outlet. Relief valves are economical defense against serious ruptures and major releases. Help a valve do its job of protecting you.

Valve Replacement

The safest source for a replacement valve is Great Plains. Check the latest edition of the Parts manual (417-477P) or the Great Plains internet parts lookup. This assures a correct and compatible part that reflects any engineering enhancements.

Ammonia Exposure Hazard:
Fully discharge the system (page 103) before removing an old valve. Wear protective equipment. If the applicator was recently used, or ammonia was trapped, there could still be NH\textsubscript{3} liquid or vapor behind the valve.

Do not attempt to repair or adjust a relief valve. Hydrostatic relief valves are factory-set and tested, on specialized equipment, to discharge at a specific pressure.

On the component being protected by the valve, inspect the threaded hole after removing the valve. If there are signs of corrosion, replace the entire component.

Use pipe sealant when installing a replacement valve. Use only pipe sealant specified for use with anhydrous ammonia, such as RectorSeal No. 5. Do not use tape.

Record the replace-by date of the new valve in the “Replacement Log” section of this manual (beginning on page 110).

Ammonia Exposure and Rupture Hazards:
Always replace a relief valve with a valve:
\begin{itemize}
  \item that is an external “hydrostatic relief valve”;
  \item that is specified for anhydrous ammonia service,
  \item that has the same NPT pipe thread size, and;
  \item that is rated for the same discharge pressure as the valve removed (or as otherwise specified by Great Plains or the manufacturer of the protected component).
\end{itemize}

Discharge pressure is specific to the valve location in the system.

Using a valve rated too high could result in bursting of system components and a major liquid NH\textsubscript{3} release.

Using a valve rated too low could result in unexpected...
Replacement Log

Certain components and fittings used with anhydrous ammonia service have limited service lives.

The service life of components originally installed by Great Plains is pre-printed in the tables. The life of replacement parts may vary.

Once past their expiration dates, they must be replaced before the applicator is used again to apply anhydrous, even if they appear to be in excellent condition.

Use this page, or a copy, to record the replacement schedule and history for your applicator.

Be sure to remove and save these pages, or transfer the data, if you update the manual itself.

### Breakaway Coupler Hydrostatic Relief Valve

<table>
<thead>
<tr>
<th>Part ID</th>
<th>Service Life</th>
<th>Date Life Started</th>
<th>Replace Before Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Plains 891-203C</td>
<td>5 years: the replace-by date is stamped on the valve.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Supply Hose

<table>
<thead>
<tr>
<th>Part ID</th>
<th>Service Life</th>
<th>Date Life Started</th>
<th>Replace Before Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Plains 891-196C</td>
<td>10 years: replace-by date is molded in hose data stripe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great Plains 891-197C</td>
<td>10 years: replace-by date is molded in hose data stripe</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Cooler Hydrostatic Relief Valve

<table>
<thead>
<tr>
<th>Part ID</th>
<th>Service Life</th>
<th>Date Life Started</th>
<th>Replace Before Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raven or Great Plains</td>
<td>5 years: the replace-by date is stamped on the valve.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>334-0002-005</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Refrigerant Line

This is the same tubing used for row delivery.

<table>
<thead>
<tr>
<th>Part ID</th>
<th>Service Life</th>
<th>Date Placed in Service</th>
<th>Replace Before Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Plains 990-259R</td>
<td>Varies upon conditions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Row Delivery Tubing

It might be necessary to replace it before the life if the tine end is damaged by harsh field conditions.

When replacing delivery tubing:

- Use the same length of tubing as removed. This length is identical for all rows of a specific applicator model. This is required to ensure equal rate at each tine from the flow divider.
- Coil excess length. Secure it to the rear tool bar at the row. For wing rows, coil inboard of the row, so that the coil is below the tine when the applicator is folded.

### Row Delivery Tubing Table

<table>
<thead>
<tr>
<th>Part ID</th>
<th>Service Life</th>
<th>Date Life Started</th>
<th>Replace Before Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Plains 990-259R</td>
<td>Varies upon conditions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Row Vapor Tubing

This is a different (larger ID) tubing compared to the row delivery and refrigerant.

It might be necessary to replace it before the 10 year life if the tine end is damaged by harsh field conditions.

### Row Vapor Tubing Table

<table>
<thead>
<tr>
<th>Part ID</th>
<th>Service Life</th>
<th>Date Life Started</th>
<th>Replace Before Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Plains 990-261R</td>
<td>Varies upon conditions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Metering System Maintenance

Fully discharge system before performing any maintenance. See “System Discharge” on page 103.

If any system components are removed from plumbing, when replacing or re-installing them, use only a pipe sealant specified for use with anhydrous ammonia, such as RectorSeal #5.

Strainer Maintenance

Clean magnets every 4 to 5 tank loads. Check strainer screen at that time.

Ceramic magnets scavenge ferrous metal debris from the flow, preventing this material from contaminating the magnets in the flow meter.

The 20 mesh screen filters out non-magnetic particles that could interfere with both accurate flow metering and flow control. If the screen cannot be cleaned, or is damaged, the replacement is Raven part number 339-9000-032.

Cooler Maintenance

Manual 016-0159-403, the Raven AccuFlow™ Operator manual, has specific recommendations for seasonal cooler storage, cleaning, and preserving the interior of the supercooler.

Cooler Hydrostatic Relief Valve

This is a limited life part (page 111). Check for expiration whenever servicing the cooler.

Flow Meter Maintenance

If flow meter readings are irregular, or consistently low relative to the amount of NH₃ known to have flowed from the tanks, remove the meter for cleaning and inspection. Refer to 016-0159-403, the Raven AccuFlow™ Operator manual, for details.

Suffocation, Blinding, Burning, Freezing, Disabling and Disfigurement Hazards:

Do not perform maintenance with anhydrous ammonia in the system. Fully discharge the system of NH₃ liquid and vapor before working on the applicator.

Tank Failure Early Warning:

An excessive build-up on the magnets suggests that or more nurse tanks, employed since the most recent magnet cleaning, is/are deteriorating internally. Notify the tank cart provider. If you own the tanks used, take steps to identify the failing tank.

Equipment Damage Risk:

Periodic cleaning is essential if NH₃ additives have been used, such as Dow Chemical N-Serve or Amoco ACA.
Material Clean-Out (Liquid)

With proper attention to maintenance, end of day clean-out, end of season clean-out and winterizing, you can substantially increase the life and reliability of your conventional liquid fertilizer system. Protect the pump, clean the tanks, strainers, lines and nozzles, and you can avoid costly and time-consuming repairs at the next season.

Fertilizers are usually highly corrosive to metals other than stainless steel. Suspension fertilizers can clog system components in storage.

1. Flush entire system with clean water.
2. Remove end caps from check valves and flush out with water. Drain and replace end caps.
3. Remove strainer and drain it out. Drain all lines and tanks completely to prevent freezing damage.
5. Wash all spilled fertilizer off the applicator.

Tank Clean-Out

Refer to Figure 78 - which depicts the discharge valves open to the selector valve (not shown)

For bulk recovery of unused material, or for rinsing out tanks, dump line elbows are provided at the tank discharge valves LT3.

For connection of collection hoses, the elbows require a hose with 11₄ inch inside diameter.

Possible Chemical Hazard:
Operate the valves from above. Wear chemical gloves. Inspect the valves from below only when flow is shut off. Wear eye protection when working under the tanks.

The valve operating handles have the word “FLOW” and a raised arrow that point in the open direction of flow. This provides tactile indication of handle orientation.

1. Connect any drain or collection hoses to the elbows LT4.
2. Check that the selector valve LT9 is closed.
3. Rotate one or both tank discharge valve LT3 operating handles to the elbows.
4. As desired, rinse out tanks from open lids.

Parts of the tank plumbing system (to the selector valve) are below the elbows. These lines must be disconnected to completely drain them.

Possible Chemical Hazard:
Wear proper protective equipment as required by chemical manufacturer. Avoid prolonged breathing of chemical fumes. Wear respirator as required by chemical manufacturer. Some chemicals will cause serious burns, lung damage, and death. Avoid contact with skin or eyes. Seek medical assistance immediately if accident occurs. Know what to do in case of an accident.

Equipment Damage Risk:
Do not leave fertilizer or fertilizer residue in pump. Do not allow air to enter pump. Even for short periods of storage, the entrance of air into the pump causes RAPID and SEVERE CORROSION.
Liquid Fertilizer Strainer Maintenance

Refer to Figure 80

The fertilizer system uses an in-line strainer to keep damaging particulates out of the pump. The strainer becomes clogged over time, reducing pump rate. Plan to clean the strainer several times per season. Don’t wait for application rates to fall below target. Higher quality liquid fertilizers may require less frequent cleaning.

Disassemble and clean the strainer prior to storage to prevent caking.

In Season Filter Cleaning
1. Shut off the ball valve at the filter, to minimize product spill.
2. Unscrew and remove the bottom canister of the filter.
3. Wash the filter cartridge with water, or replace with new cartridge if necessary.
4. Reinstall the cartridge, canister, and turn on the ball valve.

End of Season Filter Cleaning
1. Load 10 to 15 gallons (40 to 60 liters) of clean water in each supply tank.
2. Pump most of it through the system. With valves open, remove the canister. Clean strainer and canister.
3. Drain lines. Remove boom end-caps to drain wings.
4. Re-install strainer and canister.
5. Add 2 pints (1 liter) of RV antifreeze to the tank. Pump until tank is just empty (which leaves some fluid in strainer).
6. Open supply line at pump inlet. Introduce RV antifreeze, and operate pump until pump is filled.
Pump Maintenance and Repair
Ace Hydraulic Pump
The Ace pump is designed for long life and service. Through the years, it may be necessary to replace the mechanical seal or service components of the pump. A mechanical seal may weep slightly, but if it starts to drip, the pump will have to be disassembled. Before disassembly, be sure to wash it out with fresh water.
If the pump leaks, before removal from applicator, run the pump with adequate water in tank to diagnose the actual pump problem.
Refer to the Ace Pump Instruction manual (HYD-MAN) for disassembly instructions.

Coulter Disc Replacement
22 Inch Coulters - NH3 Coulter
Replace 22 in. (56 cm) coulter blades when adjusting application depth and/or applicator level becomes difficult. Signs that blade replacement is indicated are:
• Coulter blade diameter is close to, or below, 20 in. (51 cm).
• Height adjustment, when level, requires no lift-assist spacers (page 38).
• Tine height adjustment is at the upper limit (page 81).

20 Inch Coulters
Replace 20 in. (51 cm) coulter blades when adjusting application depth and/or applicator level becomes difficult. Signs that blade replacement is indicated are:
• Coulter blade diameter is close to, or below, 18 in. (46 cm).
• Height adjustment, when level, requires no lift-assist spacers (page 38).
• Fertilizer arm adjustment is at the upper limit (page 85).

See page 124 for replacement blades.
NH₃ Coulter Spring Setting

If the NH₃ coulter is ever disassembled for maintenance, reset the spring length to factory setting. Raise the applicator to ensure that the coulter is relaxed.

Refer to Figure 82

At the rear end of the spring ①, loosen the outer jam nut. Adjust the inner nut for a spring length ② of:

② 10\textfrac{3}{8} inches (26.4 cm)

This corresponds to a vertical trip force of 1557 pounds (705 kg).

**NOTICE**

Machine Damage Risk:

Do not attempt to compensate for extreme field conditions by adjusting the springs to higher forces (shorter springs). Higher trip force is not likely to improve penetration, and results in premature blade wear, higher risk of blade damage, and may simply lift the applicator.
Hydraulic Maintenance

**WARNING**

*High Pressure Fluid Hazard:*
Escaping fluid under pressure can have sufficient pressure to penetrate the skin causing serious injury. Check all hydraulic lines and fittings before applying pressure. Use paper or cardboard, not body parts, and wear heavy gloves to check for suspected leaks. If injured, seek immediate medical attention from a physician familiar with this type of injury.

**WARNING**

*High Pressure Fluid Hazard:*
Do not attempt to make hydraulic system repairs. Great Plains strongly recommends that all hydraulic system repairs to be completed by a trained professional who is knowledgeable about how to safely complete hydraulic system work. Compromising a closed hydraulic system can cause serious injury or death.

Contamination is the most common cause of performance problems and premature wear with hydraulic systems. Make sure to properly clean quick couplers before attaching the hoses to the tractor. Never let the hoses fall on the ground.

**Wing Leveling**

Before checking wing level, check that the center section is level left to right ("Rear Eyebolt Adjustment"). Rear eyebolts above the rear casters can affect left-right level if out of adjustment.

Wing level is controlled entirely by gauge wheel height. If wings are not running level, adjust gauge wheels.

**Rear Eyebolt Adjustment**

Side to side level at rear is controlled by eyebolts at the lift cylinder bases. On 2-point, rear height is set by spacers (page 38).

Check that both eyebolts are set to the same reveal ①.

*Refer to Figure 84*

The factory setting is a distance of:
① 4.5 in. (11.4 cm)
from the end of the eyebolt to the top face of the lug tube.

To adjust the eyebolt, loosen the hose guide nut ②, then the jam nut ③. Rotate the adjust nut ④ to set bolt reveal.

Check that the hose loop ⑤ is on top.
Tighten jam nut ③, then hose guide nut ②.
Caster Brake Adjustment

Refer to Figure 85

The rear lift-assist wheels each have independent adjusters for the caster pivot brake. The piston 1 acts as a pivot brake, and helps prevent caster oscillation during transport. The adjustments will vary depending on different field-to-field conditions as well as road transport conditions.

If the caster is oscillating during transport turns or in field use, adjust the pressure plate bolt 5.

Pressure Plate Adjustment

Refer to Figure 85 and Figure 86

The factory setting for a new piston is:

1. Loosen the jam nut 3.
2. Turn the bolt 6 counterclockwise until the bolt is turning freely.
3. Drive screw in (down) until it contacts spring plate 4.
4. Drive screw in until the bolt reveal (from top of welded nut to bottom of bolt head) is:
   - 2.0 inches (5.1 cm)
5. Tighten the jam nut.

Use more or less tension as needed to eliminate caster vibration during highway transport. Adjust as needed to compensate for piston wear.

Replace UHMW piston 1 if its length is less than 1 1/4 in. (3.2 cm). Also replace piston if missing, damaged, tilted, or top of piston is visible.
Lubrication and Scheduled Maintenance

Wing Pivots

1 zerk each pin,
2 pins per wing;
4 zeks total
Type of Lubrication: Grease
Quantity: Until grease emerges

Caster Pivots

1 zerk each caster;
2 zeks total
Type of Lubrication: Grease
Quantity: Until grease emerges

Lift- Assist Parallel Arms

(2 zerks each arm,
2 arms per caster,
2 casters per implement;
8 zeks total
Type of Lubrication: Grease
Quantity: Until grease emerges
Torque on Hitches

2 hitches; 8 bolts each hitch; 16 nuts total
Amount of Torque: 375 ft-lbs

Vantage I Coulter Hubs (Option)

1 zerk per coulter, 12, 13 or 36 total
Type of Lubrication: Grease
Quantity: Until grease emerges

Vantage I Coulter Pivots

1 grease bank zerk per coulter pivot, 3 grease banks; 12 or 13 zerks total
Type of Lubrication: Grease
Quantity: Until grease emerges

Tire Pressures

4 tires
Check tire pressures more frequently on a new implement, and with new tires. Check tire pressures before making any level adjustments, and whenever there are application problems.
Gauge Wheel Hubs

1 zerk each hub,
2 hubs per implement;
2 zerk total
Type of Lubrication: Grease
Quantity: Until resistance is felt

Caster Stabilizers

One UHMW brake piston each caster;
2 total.
See page 119 for inspection and adjustment.
**Options**

The base Nutri-Pro® NP2330 is 2-point/lift-assist tool bar with a choice of:

front frame (tanks or no tanks) .................................. 135
coulters (single or triple-row; without nozzles) .......... 124

**Discretionary options include:**

VisaGage ............................................................. 126
coulters applicators (three choices) ......................... 124
trailing hitch ......................................................... 131

These options are installed prior to delivery if ordered with the applicator.

**Accessories available include:**

Category II hitch pins ............................................ 123
controller console ................................................. 130
side dress extension (three choices) ......................... 133
speed sensor .......................................................... 131
a variety of speed sensor cables, for new or existing sensors. ......................................................... 131

**Category II Hitch Pin Kit**

This kit adapts the applicator for use with tractors having Category II hitches.

<table>
<thead>
<tr>
<th>Option Packages</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT 2 HITCH PIN KIT</td>
<td>596-060A</td>
</tr>
</tbody>
</table>
Row Cleaners

Terra-Tine™ Row Cleaners

These row cleaners are frame-mounted ahead of the forward single coulters. If row cleaners are used during side dress application, order one 207-254S for the 13th row.

<table>
<thead>
<tr>
<th>Packages</th>
<th>Original Option</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>NP DBL TERRA TINE ASY</td>
<td>-</td>
<td>207-254S</td>
</tr>
</tbody>
</table>

See “Terra-Tine™ Adjustments (Option)” on page 84.

Coulters, Blades and Tines

Anhydrous Coulters

Figure at right shows a coulter with Turbo blade and spider sealers.

At time of publication, a single anhydrous coulter configuration was offered:

NH₃ (22 Inch) Coulters

Order replacement blades as:

<table>
<thead>
<tr>
<th>Package</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic knives/tines - All knives/tines liquid</td>
<td>417-396H (Gen 1 w/foot)</td>
</tr>
<tr>
<td>Basic knives/tines - All knives/tines liquid</td>
<td>417-487H (Gen 2 w/foot)</td>
</tr>
<tr>
<td>Dual Tine</td>
<td>417-292H (Gen 2 w/foot)</td>
</tr>
<tr>
<td>Dual Tine</td>
<td>417-397H (Gen 1 w/o foot)</td>
</tr>
</tbody>
</table>
Quick-Attach Update Kit

For applicators manufactured prior to late 2012, the clamp style coulter mounts may be updated to quick-attach mounts.

The coulter is dismounted by removing two bolts ①, and lifting via a built-in hoist loop ②. The mount ③ remains in place. This dramatically speeds dismount/remount and eliminates the need to reset shank height as well as mark or re-align row stations.

Order one kit per row.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUICK ATTACH MOUNT ASSY</td>
<td>417-207A</td>
</tr>
</tbody>
</table>

Vantage I Attachment Kits

These kits include applicator tubing weldments, fittings and hardware. For side dress application, if no rear applicators are available for relocation, order one each 204-261K and 204-262K for the 13th row.

<table>
<thead>
<tr>
<th>Manifold Package</th>
<th>Original Option</th>
<th>Part Bundle</th>
</tr>
</thead>
<tbody>
<tr>
<td>RH FERT - TINE ASSY</td>
<td>-</td>
<td>204-261K</td>
</tr>
<tr>
<td>LH FERT - TINE ASSY</td>
<td>-</td>
<td>204-262K</td>
</tr>
</tbody>
</table>

Coulter Blades

<table>
<thead>
<tr>
<th>Single Blade</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.3in fluted blade (9 / 16 in. wave)</td>
<td>820-074C</td>
</tr>
<tr>
<td>20.2in turbo blade (3 / 4 in. wave)</td>
<td>820-180C</td>
</tr>
</tbody>
</table>
Coulter Nozzles

<table>
<thead>
<tr>
<th>Nozzle Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid Stream H1/4U-SS0002, size 2</td>
<td>828-036C</td>
</tr>
<tr>
<td>Solid Stream H1/4U-SS0003, size 3</td>
<td>828-037C</td>
</tr>
<tr>
<td>Solid Stream H1/4U-SS0004, size 4</td>
<td>828-038C</td>
</tr>
<tr>
<td>Solid Stream H1/4U-SS0005, size 5</td>
<td>828-039C</td>
</tr>
<tr>
<td>Solid Stream H1/4U-SS0006, size 6</td>
<td>828-040C</td>
</tr>
<tr>
<td>Solid Stream H1/4U-SS0008, size 8</td>
<td>828-041C</td>
</tr>
<tr>
<td>Solid Stream H1/4U-SS0010, size 10</td>
<td>828-042C</td>
</tr>
</tbody>
</table>

VisaGage and Accessories

Liquid fertilizer manifolds are not standard. Select one or two manifolds and attachment kits depending on row tines installed. Order pumps separately.

Manifolds

Manifolds are installed before delivery if ordered (as options) with the applicator. If a pump is also ordered, only the front manifold is plumbed to the pump. Manifolds include drop lines, but not row tines.

Fertilizer Orifice Plates

The manifold systems, and the side dress accessory include size 28, 34 and 48 plates. To order alternate plates, use the table on page 128. Order one per row unit.
Select and Install Orifice Plates

If using VeriFlow nozzles, orifice plate instructions do not apply. However, the topic “Tramlines and Doubled Rows” on page 128 applies to all types of nozzles.

**DANGER**

*Agricultural Chemical Hazard:*

Wear protective gloves when changing orifice plates. Consult material manufacturer or supplier documents for proper handling and steps to take if skin contact occurs.

**Refer to Figure 87**

Orifice plates ① at each drop line nozzle provide back-pressure that balances flow in the manifolds, assuring that each row obtains the same flow rate. For a given rate, there may be more than one orifice size that provides the recommended back-pressure.

Plates are provided with the system in three sizes. Additional sizes are available. In general, the orifice needs to be small enough to create a minimum pressure in the manifold but large enough to prevent the manifold pressure from exceeding the maximum: 15 psi min., 15-40 optimal, 65 psi max.

Using an orifice size too large can result in unequal flow at rows. Using a size too small can cause excess back-pressure resulting in material dumping at the relief valve.

**Determine Orifice Size**

The chart below shows rate ranges for each Great Plains orifice size and row spacing. You may need to change to the next higher or lower orifice for a different fertilizer solution density and/or a different ground speed.

To reduce orifice plugging and pump wear, use the largest orifice practical for your fertilizer application rate.

---

**Orifice Plate Size**

<table>
<thead>
<tr>
<th>Orifice Plate Size</th>
<th>20</th>
<th>28*</th>
<th>34*</th>
<th>48*</th>
<th>59</th>
<th>80</th>
<th>98</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nozzle Spacing</strong></td>
<td><strong>Recommended Rate Range in Gallons per Acre. Range is 15 - 40 PSI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 inch single</td>
<td>2.2 - 3.6</td>
<td>4.2 - 6.9</td>
<td>6.3 - 10</td>
<td>12 - 20</td>
<td>19 - 30</td>
<td>34 - 56</td>
<td>54 - 88</td>
</tr>
<tr>
<td>30 inch single</td>
<td>1.1 - 1.8</td>
<td>2.1 - 3.4</td>
<td>3.2 - 5.2</td>
<td>6.1 - 10</td>
<td>9.3 - 15</td>
<td>17 - 28</td>
<td>27 - 44</td>
</tr>
</tbody>
</table>

*These sizes standard in most Great Plains fertilizer systems.

---

**Notice**

**Material Loss or Misapplication Risks:**

Orifice size must be appropriate for rate selected. Drop line orifice plates do not affect rate. If orifice size is too small, over-pressure in system may result in material loss at relief valve. An orifice size too large may result in uneven application across all rows.
Install Orifice Plates

Orifice plates are used only with the standard (TeeJet®) nozzles.

Refer to Figure 88

Insert the plate 1 inside the gasket 2 supplied with the nozzle 3. Insert the gasketed plate with the legend side facing out the nozzle outlet (typically up).

In general, the orifice needs to be small enough to create enough pressure in the manifold to operate the check valves in the boom clamps, but not so much that the system dumps product at the boom relief valve.

The recommend operating pressure is: 15 to 40 psi

Using an orifice size too large can result in unequal flow at rows, intermittent flow, and flow stoppage at rows where pressure falls below the 8 psi required to open the clamp check valve. Using a size too small can cause excess back-pressure resulting in material dumping at the boom relief valve.

Use the same size at all active rows.

**NOTICE**

Excess Back-Pressure Risk:
If using a size of 0.048 in. or larger, remove the 828-046C nozzle from the outlet of the coulter tine.

Tramlines and Doubled Rows

If your operations result in row units running in the same row (or rows) in opposing passes, take steps to avoid double application (run those rows at half rate).

- For doubled rows using standard nozzles, use orifice plates having $\frac{1}{2}$ (or slightly more than $\frac{1}{2}$) the Port Area of the other rows. See the table at right, right-most column, for the Port Area of each plate call size.

- For doubled rows using VeriFlow nozzles, install 829-150C half-rate nozzles on those rows.

For either nozzle type, an adjustment to the rate calculation is required to compensate for the half-rate rows. Reduce the applicator swath by $\frac{1}{2}$ row space for each row set to half rate.

**NOTICE**

Misapplication or Material Loss Risk:

Do not apply materials after row shut-off or row turn-on without first reviewing setup. Merely changing the number of active rows does not change the application rate. If pump and/or orifice size changes are not also made, pressures could be too low or too high.

---

**DANGER**

Agricultural Chemical Hazard:

Wear protective gloves when changing orifice plates and strainer screens. Consult material manufacturer or supplier documents for proper handling and steps to take if skin contact occurs.

Replacement nozzles include gaskets. Gaskets may also be ordered separately as Great Plains part number CP18999-EPR.
Strainer Adjustment

A Banjo brand strainer is supplied, and plumbed before the CDS-John Blue pump. The standard 80 mesh screen should be suitable for most applications. A 50 mesh screen is available from Great Plains. Other screen sizes are available from Banjo Corporation.

If changing screen sizes, keep in mind the following.

- A smaller mesh (100) keeps very small manifold orifice plates from plugging as often. However, the screen requires cleaning more often.
- If using variable rate nozzles, Spray Target recommends use of a 50 mesh screen with the VeriFlow nozzles available from Great Plains (part number LST-1550).
- A larger mesh (50) or (30) passes more material but should only be considered when using large manifold orifice plates.
- Mesh sizes below 30 are not recommended for use with CDS-John Blue pumps.
- A plugged or partially plugged screen starves the pump resulting in a reduced application rate.
- Mesh sizes: (Smallest) 100, 80, 50, 30 (Largest)

Variable Rate Nozzles

These SprayTarget VeriFlow regulators replace the standard nozzles and orifice plates. They provide consistent back-pressure over a wide range of rates. This eliminates changing orifice plates, and enables prescriptions (varying rates during application).

<table>
<thead>
<tr>
<th>Description</th>
<th>Color Code</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOZZLE HI-VERIFLOW1</td>
<td>GRN/YEL</td>
<td>829-149C</td>
</tr>
<tr>
<td>NOZZLE VERIFLOW1</td>
<td>BLU</td>
<td>829-150C</td>
</tr>
</tbody>
</table>

Order one 829-149C per full-rate row. Order one 829-150C per half rate (double-pass) row. See "Tramlines and Doubled Rows" on page 128.

SprayTarget recommends a 50 mesh strainer screen, available from Great Plains as part LST-1550.
Pumps

Pumps are not standard. One pump may be installed prior to delivery if ordered as an option. If a second pump is desired, order the bundle part number.

Hydraulic Drive Pumps

Hydraulic drive pump bundle 407-633A and 407-644A include hydraulic hoses from the hitch, Ace 150F-Hyd-206 hydraulic motor, fittings and impeller pump, plumbing for on-board tanks (tanks ordered separately), three-section solenoid valves, pressure sensor, flow meter, electronic control valve and harnesses compatible with Raven SCS 440 or SCS 450 consoles (console not included).

Pump bundle 407-644A has shorter hydraulic hoses, and is intended for use on applicators without on-board tanks.

The Ace pump includes all fittings needed for use with open center and load-sensing (LS) or pressure-compensating (PC) closed center hydraulic systems. Fitting removal and/or needle valve adjustment is required prior to first use (see page 150).

Hydraulic drive pump bundles (23) 407-633A and 407-644A and require a new or existing Raven SCS 440 or SCS 450 controller, and a new or existing compatible speed sensor.

User-Provisioned Tanks

For tractor-mounted or trailing nurse tanks, some customer-provisioned plumbing is required.

For trailing nurse tank, also order a rear hitch (page 131).

Second Pump Note:

A second pump requires user-provisioned plumbing to the tractor tank, trailing nurse tank, or to one of the on-board tanks. A second hydraulic pump requires a second controller console.

A second hydraulic pump requires a user-configured air bleed line for priming. The supplied fitting and tubing may be incompatible with the tanking used. Replace the topmost \( \frac{3}{8} \) inch NPT plug with a \( \frac{1}{8} \) inch NPT petcock valve.

Console

The Raven SCS 450 is used only with a hydraulic pump. It controls and adjusts application rate based on flow meter input, ground speed, and operator rate settings. This console is sold separately from the cooler system (above) or hydraulic pump system (page 130), which includes the implement harnesses, flow meter and valves.

This kit includes only the console and cab mounting hardware.

<table>
<thead>
<tr>
<th>Console Package</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAVEN 450 CONSOLE</td>
<td>823-211C</td>
</tr>
</tbody>
</table>

This console package does not include a speed sensor or speed sensor cable. The SCS 450 may be compatible with a speed sensor, radar or GPS speed output already installed on the tractor.
Speed Sensor Cable
If your existing or purchased speed sensor is compatible with the Raven 115-0159-539 cable (intended for use with a Raven radar), you may order it from Raven, or from Great Plains:

<table>
<thead>
<tr>
<th>Cable Package</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radar Power Cable</td>
<td>115-0159-539</td>
</tr>
</tbody>
</table>

Speed Sensor
The Raven SCS 450 accepts speed inputs from traditional magnet sensors, speed radars, and GPS receivers that provide compatible speed outputs. If the tractor does not already have a compatible speed data source, Great Plains offers DICKEY-john® radar.

<table>
<thead>
<tr>
<th>Cable Package</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radar Kit</td>
<td>509-289A</td>
</tr>
</tbody>
</table>

This kit includes the radar transceiver and a Raven 115-0159-526 power and data cable.

Shiftable Rear Hitch Assembly
This option is intended for use with applicators that might be converted to side dress. It provides hitch receivers at frame center-line, and at side dress swath center-line.

<table>
<thead>
<tr>
<th>Rear Hitch Package</th>
<th>Original Option</th>
<th>Accessory Kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-inch Shiftable Rear Hitch</td>
<td>28</td>
<td>417-317S</td>
</tr>
<tr>
<td>20-inch Shiftable Rear Hitch</td>
<td>28</td>
<td>417-409S</td>
</tr>
</tbody>
</table>

MonTag Connection Kit 417-516A is available for use on Van I, 20-series coulter machines.
Nurse Tank Light Harness

For extra safety in the field, this harness provides an SAE J560b 7-pin receptacle at the applicator rear hitch (option), interconnected with the applicator lighting system.

<table>
<thead>
<tr>
<th>Lighting Harness</th>
<th>Accessory Kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse Tank Light Kit</td>
<td>417-357A</td>
</tr>
</tbody>
</table>

**WARNING**

**Loss of Control / Braking Hazards:**
Do not use the lighting harness for highway transport of nurse tanks or trailers behind an applicator. At transport speeds on roads, an urgent or emergency deceleration will result in a “jackknife” upset of a trailer. Even normal braking above field speed risks loss of control. The entire train can exceed the braking capability of the tractor, particularly if a full tank is towed. An accident is likely to result in serious injury or death, and major equipment damage.

*Compatible with 2014+ Nutri-Pro® applicators, and earlier models having an LED lighting system. Requires an applicator rear hitch (not included - drop or high-clearance hitches are compatible).*
Side Dress Extension

These accessory kits provide a left wing extension to support an additional (13th) forward single coulter and forward boom drop line. The kit is user-installed, and conversion between pre-emergence and side dress modes requires user re-configuration of the implement.

<table>
<thead>
<tr>
<th>Accessory Package</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Liquid Side Dress</td>
<td></td>
</tr>
<tr>
<td>SIDEDRESS OPTION 5/16 FLUTED</td>
<td>407-609A</td>
</tr>
<tr>
<td>SIDEDRESS OPTION TURBO</td>
<td>407-626A</td>
</tr>
<tr>
<td>SIDEDRESS OPTION W/O COULTER</td>
<td>407-636A</td>
</tr>
<tr>
<td>Anhydrous Side Dress</td>
<td></td>
</tr>
<tr>
<td>SIDEDRESS OPTION NH3 COULTER</td>
<td>417-124A</td>
</tr>
<tr>
<td>SIDEDRESS OPTION NH3 COULTER-TURBO</td>
<td>417-567A</td>
</tr>
<tr>
<td>SIDEDRESS OPTION NH3 COULTER-FLUTED</td>
<td>417-568A</td>
</tr>
</tbody>
</table>

407-609A, 407-626A and 417-124A Notes: These coulters do not include row cleaners. If row cleaners are desired order one 207-254S.

The conventional kits include a single VisaGage for the 13th outlet, and one set of orifice plates (sizes 28, 34 and 48). If a different size is required, order one or more plates. See page 128.

407-636A Note: Order the without-couler part number for use on triple-couler implements that have both rear coulters and applicator attachments on the rear coulters. All of the rear coulters are removed during conversion to side dress; one coulter, its nozzle and drop line, and its grease bank tubing, is relocated to the wing extension.

417-124A, 417-567A and 417-568A Note: This kit includes one anhydrous coulter, all hardware and tubing necessary to connect it to a spare port on the section flow divider. Coulter spacing is 30 inches, center-to-center.

See "Appendix D - Accessory Installation" on page 152 for installation and use instructions.
Weight Kit

Standard applicator configurations provide sufficient weight for conventional till and most no-till conditions. For challenging no-till conditions, a weight set is available. It adds 1460 pounds (660 kg) at the rear sub-frame.

The weight stacks are available as an Option with the original applicator order, or as a separate kit.

<table>
<thead>
<tr>
<th>Description</th>
<th>Opt.</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>NP3000 WEIGHT KIT</td>
<td>(70)</td>
<td>407-904A</td>
</tr>
</tbody>
</table>

See "Weight Kit Installation" on page 162.
## Specifications and Capacities

### NP2330LL-12V30

<table>
<thead>
<tr>
<th>NP2330L012V30</th>
<th>With On-Board Tanks</th>
<th>Tankless</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard</td>
<td>Side Dress</td>
</tr>
<tr>
<td>Row Count</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Row Spacing</td>
<td>30 in.</td>
<td></td>
</tr>
<tr>
<td>Transport Width</td>
<td>17 ft. 2 in.</td>
<td></td>
</tr>
<tr>
<td>Swath</td>
<td>32 ft. 0 in.</td>
<td>32 ft. 0 in.</td>
</tr>
<tr>
<td>Metering System</td>
<td>Option: Raven Control/Section Valves, Pressure Sensor &amp; RFM60P Flow Meter</td>
<td></td>
</tr>
<tr>
<td>Controller Console*</td>
<td>Option: Raven SCS 450</td>
<td></td>
</tr>
<tr>
<td>Length, Transport</td>
<td>13 ft. 4 in.</td>
<td>13 ft. 4 in.</td>
</tr>
<tr>
<td>Length, Field</td>
<td>14 ft. 0 in.</td>
<td>14 ft. 0 in.</td>
</tr>
<tr>
<td>Working Height</td>
<td>9 ft. 7 in.</td>
<td></td>
</tr>
<tr>
<td>Transport Height (Folded)</td>
<td>11 ft. 1 in.</td>
<td>12 ft. 7 in.</td>
</tr>
<tr>
<td>Transport Clearance</td>
<td>16 in. nominal, depends on tractor hitch</td>
<td></td>
</tr>
<tr>
<td>Wing Down Flex</td>
<td>10°</td>
<td></td>
</tr>
<tr>
<td>Min. Tractor HP Req.¹</td>
<td>145 - 180 hp</td>
<td></td>
</tr>
<tr>
<td>Hydraulic Circuits Req.</td>
<td>1 or 2 Circuits, 2250 PSI, 4 to 17 gal./min.</td>
<td></td>
</tr>
<tr>
<td>Weight, Maximum, Empty</td>
<td>14100 lbs.</td>
<td>14400 lbs.</td>
</tr>
<tr>
<td>Weight, Maximum, Full</td>
<td>20700 lbs.</td>
<td>21000 lbs.</td>
</tr>
<tr>
<td>Transport Tire Size</td>
<td>265/70B16.5 (10-16.5) (NHS 8-Ply Skid Loader 4140 lbs. @ 5 mph)</td>
<td></td>
</tr>
<tr>
<td>Wing Gauge Wheel Tire</td>
<td>20.5X8.0-10 (Load Rating E, 1520 Pounds)</td>
<td></td>
</tr>
<tr>
<td>Operating Depth</td>
<td>0 to 6 in. Do not exceed 6.5 in. (Release depth is 4.5 in. above coulter depth.)</td>
<td></td>
</tr>
<tr>
<td>Rear Hitch (Optional)</td>
<td>Schuck Model 750</td>
<td></td>
</tr>
<tr>
<td>Nurse Tank Capacity</td>
<td>3000 Gallons</td>
<td></td>
</tr>
</tbody>
</table>

¹ Power requirements vary significantly with conditions and practices.
### NP2330AA-12C30

<table>
<thead>
<tr>
<th>NP2330LL-12V30</th>
<th>With On-Board Tanks</th>
<th>Tankless</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard</td>
<td>Side Dress</td>
</tr>
<tr>
<td>Row Count</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Transport Width</td>
<td>17 ft. 2 in.</td>
<td></td>
</tr>
<tr>
<td>Swath</td>
<td>30 ft. 0 in.</td>
<td>32 ft. 6 in.</td>
</tr>
<tr>
<td>Metering System</td>
<td>Raven Accuflow™ with CDS-JohnBlue Impellicone (Optional)</td>
<td></td>
</tr>
<tr>
<td>Controller Console*</td>
<td>Option: Raven SCS 450</td>
<td></td>
</tr>
<tr>
<td>Length, Transport</td>
<td>13 ft. 4 in.</td>
<td></td>
</tr>
<tr>
<td>Length, Field</td>
<td>14 ft. 0 in.</td>
<td></td>
</tr>
<tr>
<td>Working Height</td>
<td>9 ft. 7 in.</td>
<td></td>
</tr>
<tr>
<td>Transport Height (Folded)</td>
<td>11 ft. 1 in.</td>
<td>12 ft. 7 in.</td>
</tr>
<tr>
<td>Transport Clearance</td>
<td>16 in. nominal, depends on tractor hitch</td>
<td></td>
</tr>
<tr>
<td>Wing Down Flex</td>
<td>10°</td>
<td></td>
</tr>
<tr>
<td>Min. Tractor HP Req.¹</td>
<td>145 - 180 hp</td>
<td></td>
</tr>
<tr>
<td>Hydraulic Circuits Req.</td>
<td>1 Circuit, 2250 PSI, 5 gal./min.</td>
<td></td>
</tr>
<tr>
<td>Weight, Maximum, Empty</td>
<td>13000 lbs.</td>
<td>13300 lbs.</td>
</tr>
<tr>
<td>Weight, Maximum, Full</td>
<td>19600 lbs.</td>
<td>19900 lbs.</td>
</tr>
<tr>
<td>Transport Tire Size</td>
<td>265/70B16.5 (10-16.5) (NHS 8-Ply Skid Loader 4140 lbs. @ 5 mph)</td>
<td></td>
</tr>
<tr>
<td>Wing Gauge Wheel Tire</td>
<td>20.5X8.0-10 (Load Rating E, 1520 Pounds)</td>
<td></td>
</tr>
<tr>
<td>Operating Depth</td>
<td>3 to 7 in. Do not exceed 7.0 in. (Release depth is 3/4 in. above coulter depth.)</td>
<td></td>
</tr>
<tr>
<td>Rear Hitch (Optional)</td>
<td>Schuck Model 750</td>
<td></td>
</tr>
<tr>
<td>Nurse Tank Capacity</td>
<td>3000 Gallons</td>
<td></td>
</tr>
</tbody>
</table>
### NP2330LL-18V20

<table>
<thead>
<tr>
<th></th>
<th>With On-Board Tanks</th>
<th>Tankless</th>
</tr>
</thead>
<tbody>
<tr>
<td>Row Count</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Row Spacing</td>
<td>30 in.</td>
<td></td>
</tr>
<tr>
<td>Transport Width</td>
<td>17 ft. 2 in.</td>
<td></td>
</tr>
<tr>
<td>Swath</td>
<td>30 ft. 0 in.</td>
<td></td>
</tr>
<tr>
<td>Metering System</td>
<td>Option: Raven Control/Section Valves, Pressure Sensor &amp; RFM60P Flow Meter</td>
<td></td>
</tr>
<tr>
<td>Controller Console*</td>
<td>Option: Raven SCS 450</td>
<td></td>
</tr>
<tr>
<td>Length, Transport</td>
<td>13 ft. 4 in.</td>
<td>11 ft. 1 in.</td>
</tr>
<tr>
<td>Length, Field</td>
<td>14 ft. 0 in.</td>
<td>11 ft. 9 in.</td>
</tr>
<tr>
<td>Working Height</td>
<td>9 ft. 7 in.</td>
<td></td>
</tr>
<tr>
<td>Transport Height (Folded)</td>
<td>11 ft. 1 in.</td>
<td></td>
</tr>
<tr>
<td>Transport Clearance</td>
<td>16 in. nominal, depends on tractor hitch</td>
<td></td>
</tr>
<tr>
<td>Wing Down Flex</td>
<td>10°</td>
<td></td>
</tr>
<tr>
<td>Min. Tractor HP Req.¹</td>
<td>145 - 180 hp</td>
<td></td>
</tr>
<tr>
<td>Hydraulic Circuits Req.</td>
<td>1 or 2 Circuits, 2250 PSI, 4 to 17 gal./min.</td>
<td></td>
</tr>
<tr>
<td>Weight, Maximum, Empty</td>
<td>14600 lbs.</td>
<td>12700 lbs.</td>
</tr>
<tr>
<td>Weight, Maximum, Full</td>
<td>21200 lbs.</td>
<td>N/A</td>
</tr>
<tr>
<td>Transport Tire Size</td>
<td>265/70B16.5 (10-16.5) (NHS 8-Ply Skid Loader 4140 lbs. @ 5 mph)</td>
<td></td>
</tr>
<tr>
<td>Wing Gauge Wheel Tire</td>
<td>20.5X8.0-10 (Load Rating E, 1520 Pounds)</td>
<td></td>
</tr>
<tr>
<td>Operating Depth</td>
<td>3 to 7 in. Do not exceed 7.0 in. (Release depth is 3/4 in. above coulter depth.)</td>
<td></td>
</tr>
<tr>
<td>Rear Hitch (Optional)</td>
<td>Schuck Model 750</td>
<td></td>
</tr>
<tr>
<td>Nurse Tank Capacity</td>
<td>3000 Gallons</td>
<td></td>
</tr>
</tbody>
</table>
Dimensions

Field 115

Transport (Folded, Raised)
133 Standard
151 Side Dress

Tanks
168
141 Tankless

Dimensions

inch

120
90

355
383
## Torque Values Chart

<table>
<thead>
<tr>
<th>Bolt Size</th>
<th>Bolt Head Identification</th>
<th>Bolt Size</th>
<th>Bolt Head Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>in-tpia</td>
<td>Grade 2</td>
<td>Grade 5</td>
<td>Grade 8</td>
</tr>
<tr>
<td>in-tpia</td>
<td>N·m</td>
<td>ft·lb</td>
<td>N·m</td>
</tr>
<tr>
<td>1⁄4-20</td>
<td>7.4</td>
<td>5.6</td>
<td>11</td>
</tr>
<tr>
<td>1⁄4-28</td>
<td>8.5</td>
<td>6.3</td>
<td>13</td>
</tr>
<tr>
<td>5⁄16-18</td>
<td>15</td>
<td>11</td>
<td>24</td>
</tr>
<tr>
<td>3⁄16-24</td>
<td>17</td>
<td>13</td>
<td>26</td>
</tr>
<tr>
<td>3⁄8-16</td>
<td>27</td>
<td>20</td>
<td>42</td>
</tr>
<tr>
<td>3⁄8-24</td>
<td>31</td>
<td>24</td>
<td>47</td>
</tr>
<tr>
<td>5⁄16-14</td>
<td>43</td>
<td>32</td>
<td>67</td>
</tr>
<tr>
<td>5⁄16-20</td>
<td>49</td>
<td>36</td>
<td>75</td>
</tr>
<tr>
<td>1⁄2-12</td>
<td>66</td>
<td>49</td>
<td>105</td>
</tr>
<tr>
<td>1⁄2-20</td>
<td>75</td>
<td>55</td>
<td>115</td>
</tr>
<tr>
<td>9⁄16-12</td>
<td>95</td>
<td>70</td>
<td>150</td>
</tr>
<tr>
<td>9⁄16-18</td>
<td>105</td>
<td>79</td>
<td>165</td>
</tr>
<tr>
<td>5⁄8-11</td>
<td>130</td>
<td>97</td>
<td>205</td>
</tr>
<tr>
<td>5⁄8-18</td>
<td>150</td>
<td>110</td>
<td>230</td>
</tr>
<tr>
<td>3⁄8-10</td>
<td>235</td>
<td>170</td>
<td>360</td>
</tr>
<tr>
<td>3⁄4-16</td>
<td>260</td>
<td>190</td>
<td>405</td>
</tr>
<tr>
<td>3⁄4-20</td>
<td>225</td>
<td>165</td>
<td>585</td>
</tr>
<tr>
<td>3⁄4-9</td>
<td>250</td>
<td>185</td>
<td>640</td>
</tr>
<tr>
<td>3⁄4-14</td>
<td>340</td>
<td>250</td>
<td>875</td>
</tr>
<tr>
<td>1-12</td>
<td>370</td>
<td>275</td>
<td>955</td>
</tr>
<tr>
<td>11⁄8-7</td>
<td>480</td>
<td>355</td>
<td>1080</td>
</tr>
<tr>
<td>11⁄8-12</td>
<td>540</td>
<td>395</td>
<td>1210</td>
</tr>
<tr>
<td>11⁄8-14</td>
<td>680</td>
<td>500</td>
<td>1520</td>
</tr>
<tr>
<td>11⁄8-12</td>
<td>750</td>
<td>555</td>
<td>1680</td>
</tr>
<tr>
<td>13⁄8-6</td>
<td>890</td>
<td>655</td>
<td>1990</td>
</tr>
<tr>
<td>13⁄8-12</td>
<td>1010</td>
<td>745</td>
<td>2270</td>
</tr>
<tr>
<td>11⁄2-6</td>
<td>1180</td>
<td>870</td>
<td>2640</td>
</tr>
<tr>
<td>11⁄2-12</td>
<td>1330</td>
<td>980</td>
<td>2970</td>
</tr>
</tbody>
</table>

Torque tolerance + 0%, -15% of torquing values. Unless otherwise specified use torque values listed above.

---

## Tire Information Chart

<table>
<thead>
<tr>
<th>Wheel</th>
<th>Tire Size</th>
<th>Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lift-Assist</td>
<td>265/70B16.5</td>
<td>60 psi (415 kPa)</td>
</tr>
<tr>
<td>Wing Gauge</td>
<td>20.5X8.0-10</td>
<td>90 psi (620 kPa)</td>
</tr>
</tbody>
</table>

## Tire Warranty Information

All tires are warranted by the original manufacturer of the tire. Tire warranty information is found in the brochures included with your Operator’s and Parts Manuals or online at the manufacturer’s web sites listed below. For assistance or information, contact your nearest Authorized Farm Tire Retailer.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Web site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firestone</td>
<td><a href="http://www.firestoneag.com">www.firestoneag.com</a></td>
</tr>
<tr>
<td>Goodyear</td>
<td><a href="http://www.goodyearag.com">www.goodyearag.com</a></td>
</tr>
<tr>
<td>BKT</td>
<td><a href="http://www.bkt-tires.com/en">www.bkt-tires.com/en</a></td>
</tr>
<tr>
<td>Gleason</td>
<td><a href="http://www.gleasonwheel.com">www.gleasonwheel.com</a></td>
</tr>
<tr>
<td>Titan</td>
<td><a href="http://www.titan-intl.com">www.titan-intl.com</a></td>
</tr>
</tbody>
</table>

---

<sup>a. in-tpi = nominal thread diameter in inches-threads per inch
b. N·m = newton-meters
c. mm x pitch = nominal thread diameter in mm x thread pitch
d. ft·lb = foot pounds</sup>
Controller System Diagrams

Anhydrous Single Section Controller

Accessories sold separately

** WIDE VARIETY OF WHEEL DRIVE, SPEEDOMETER AND RADAR ADAPTER CABLES. CONSULT SALES REPRESENTATIVE FOR PART NUMBERS **
Hydraulic Pump Controller

CONTROL CONSOLE
5CS 469 063-0171-220
GP: 823-211C

PRESSURE SENSOR CABLE
12: 115-0159-539
GP: 823-218C

CONSOLE CABLE
12: 115-0171-085
GP: 823-212C

MESS CABLE
12: 115-0171-080
GP: 823-222C

TO SWITCHED POWER CABLE
12: 115-0171-292
GP: 823-216C

EXTENSION CABLE CABLE
12: 115-0159-426
GP: 823-215C

FLOW CABLE
12: 115-0171-005
GP: 823-237C

POLARITY CABLE
550010-415
GP: 823-216C

FLOW METER
603-0171-90
GP: 823-207C

Accessories sold separately

SPEED SENSOR
(115-0159-539)

PRESSURE SENSOR CABLE
(115-0171-151)

POLARITY CABLE
(115-0171-928)

POLARITY CABLE
(115-0171-894)

POLARITY CABLE
(115-0159-415)

POLARITY CABLE
(603-0171-894)

POLARITY CABLE
(103-0159-820)

Polarity Cables sold separately

Accessories sold separately

** OPTIONAL CONSOLE FLOW AND EXTENSION CABLES AVAILABLE—CONSULT A HANDEL SALES REPRESENTATIVE FOR PART NUMBERS **
Hydraulic Diagrams
Lift-Assist Hydraulics

[Diagram of hydraulic system with labels U, R, F, B, L, D]
Fold Hydraulics
2-Point Lift-Assist with Fold and Down Pressure Hydraulics
Lift-Assist, Weight-Transfer and Fold Hydraulics for S/N C1050A+
Pump Hydraulics (Option)
Appendix B - Initial Setup

This Appendix covers setup tasks performed only once, or at infrequent intervals. Routine setup tasks are covered in "Initial Setup" on page 30. Some of these items may already have been done by your Great Plains dealer:

a. Field lift partial fold adjustment (page 54)
b. Flow controller console installation (Option, page 151)
c. Parking stand clearance
d. Frame-mounted row options
   (see manual supplied with accessory)
e. Row drop line connections.

Post-Delivery Checklist

1. Read and understand "Important Safety Information" on page 1.
2. Check that all working parts are moving freely, bolts are tight, and cotter pins are spread.
3. Check that all grease fittings are in place and lubricated. See “Lubrication and Scheduled Maintenance” on page 120.
4. Check that all safety decals and reflectors are correctly located and legible. Replace if damaged. See “Safety Decals” on page 9.
5. Inflate tires to pressure recommended and tighten wheel bolts as specified. See “NP2330LL-18V20” on page 137.

Component Replacement Dates

(anhydrous models only)

Record replace-by dates on the “Replacement Log”, pages 110 to 112.

If the implement has Great Plains-installed metering, several components of that system have limited service lives, and must be replaced before specific dates.

Where these dates are stamped on metal parts, normal oxidation, and the corrosive effects of extended field exposure to low levels of anhydrous ammonia vapor, can render these dates difficult to read soon after the implement is placed in service.

![Figure 89 REP (Replace-By) Date on Valve](image-url)
Lift-Assist Valve Setup

This adjustment establishes fold priority in the combined lift-fold hydraulic system.

1. The implement is presumed to be unfolded.
   Hitch the implement to a tractor.
   Raise the implement (as for parking).
2. Open the lift-assist shut-off valve ① (located at the weight transfer valve assembly).
3. Locate the one-way restrictor valve ② at the tee that supplies the rear cylinder base ends.
4. Turn the knob fully counterclockwise, then clockwise one turn.
5. Start a lift/fold operation. Initially, the lift occurs before the fold. Stop. Lower.
6. Turn the valve clockwise one turn.
7. Start a lift/fold. Stop. Lower.
   If the lift occurred before the fold, repeat step 6.
   If the fold occurred before the lift, back the valve off (counterclockwise) a partial turn, and re-test lift/fold.
8. Find the point at which the wings fold to the wing locks prior to lift commencing.

Figure 90
Lift-Assist Valves
Appendix C - Option Setup

Hydraulic Pump Setup

Pump Fittings and Needle Valve

**NOTICE**

*Equipment Performance Risk:*

Prior to first use, the pump fittings must be configured for the type of hydraulic system provided by the tractor. If the system is Open Center, the needle valve must also be adjusted.

As delivered, the hydraulic pump includes all fitting necessary for use with any hydraulic system, but the as-shipped pump configuration is suitable for use with no system. Configure the pump before first use.

1. Have the Ace Pump Instruction manual (HYD-MAN) at hand for fitting use and adjustment details.

**Refer to Figure 91 and table at right**

2. Determine the tractor hydraulic system type. Consult the tractor operator manual.

3. Remove one or both fittings (1 or 2), and as necessary, adjust the needle valve 3), based on the system type.

Follow the instructions in the Ace manual.

For needle valve adjustment, obtain “dead head” pressure by using the controller console to command the flow control valve to closed (rate zero).

<table>
<thead>
<tr>
<th>Tractor Hydraulic System Type</th>
<th>Pump Configuration Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed Center, Load Sensing (LS Closed)</td>
<td>Restrictor Orifice 1 OUT Flow Limiter 2 IN Needle Valve 3 closed</td>
</tr>
<tr>
<td>Closed Center, Pressure Compensating (PC Closed)</td>
<td>Restrictor Orifice 1 IN Flow Limiter 2 OUT Needle Valve 3 closed</td>
</tr>
<tr>
<td>Open Center</td>
<td>Restrictor Orifice 1 OUT Flow Limiter 2 OUT Needle Valve 3 adjusted</td>
</tr>
</tbody>
</table>
Console Installation

Refer to Figure 92

The applicator’s optional Raven SCS-450 flow controller system includes a console ① that needs to be mounted in the cab of the tractor to be used with the applicator.

The monitor includes cables for power ②, speed sensor ③ and sensor harness ④. Installation instructions are found in the included 016-0159-831 Raven SCS-450 Installation, Operation and Service manual.

Power color code is:
+ positive: red
- negative: black

The included bracket ⑤ requires customer-supplied fasteners.

The SCS 450 requires some initial data about your sprayer and tractor prior to first use. See “SCS 450 Setup Data” on page 41.

This data is retained as long as the SCS 450 remains connected to battery power. If power is removed for electrical work, long term tractor parking or welding, the data is lost and must be re-entered.

Consult the Raven manual for display interpretation and keyboard procedures.

CAUTION

Transport and Field Safety Risk:
Mount the module so it is easy to monitor during application, but does not interfere with safe operation of the tractor in the field or on public roads.
Appendix D - Accessory Installation

Side Dress Installation

Side Dress accessory kits provide a left wing extension to support an additional (13th) forward single coulter and forward boom drop line. The kit is user-installed, and conversion between pre-emergence and side dress modes requires user re-configuration of the implement.

See page 133 for ordering information.

Conventional Liquid Side Dress

Installing / Changing to Side Dress

For reverting to pre-emergence, continue at page 161.

Resources required:

- Stands or blocks support the rear frame
- Hoist or lift for supporting casters during shift
- one fertilizer orifice plate, sized to \( \frac{1}{2} \) of the rate intended, or a 829-149C VeriFlow nozzle (if 829-150C nozzles are used on the main rows)
- three dozen cable ties
- one poly bag or sheet of polyethylene per rear row, plus a rubber band or cable tie per row.
- all-purpose grease and grease gun
- basic hand tools

Prepare Implement

1. Discharge NH\(_3\) system (page 103), if the applicator is also equipped for anhydrous.
2. Move implement to a level clear surface with adequate illumination.
3. Raise implement.
4. Unfold wings.
5. Fully extend wing gauge wheels.
6. Install parking stands.
7. Place stands or blocks under the rear frame.
8. Retract the lift-assist cylinders to lift the caster tires off the ground.
9. Lower implement onto stands.
10. Unhitch tractor.
11. Install Wing Extension

Refer to Figure 94 and Figure 95

If the wing extension is already installed, continue at “Dismount Rear Vantage I Coulters” on page 153.

12. Select one new:
   407-331H BOLT ON WING FRAME
   and eight sets new:
   802-055C HHCS 5/8-11X2 GR5

407-636A Liquid, no coulter, for NP2330LL-12V30 ... 133
407-609A Liquid, fluted, for NP2330LL-12V30 .......... 133
407-626A Liquid, turbo, for NP2330LL-12V30 .......... 133
417-124A Anhydrous for NP2330AA-12C30............. 156
417-567A NH3 Shank Side Dress Kit Turbo 12C30 .. 156
417-568A NH3 Shank Side Dress Kit Fluted 12C30 .. 156
13. With the Great Plains decal to the left, and the amber reflector front, attach the extension to the end of the left wing.

Once installed, the extension itself never needs to be removed, unless you need to reduce the higher overall height when folded.

Install Quick-Attach Coulter Mount

This applies only to kit 407-636A and three-coulters configurations, or applicators updated to quick-attach. For other kits, or if the applicator rear coulters have traditional clamp mounts, continue at “Dismount Rear Vantage I Coulters” on page 153.

If the applicator is a triple-coulter configuration manufactured in late 2012 or later, the rear coulters are on Great Plains quick-attach mounts (see page 125 for an illustration). The Side Dress kit includes a quick-attach mount for this situation.

Refer to Figure 95

14. Select one new:
   407-972H QUICK-ATTACH MNTNG WELDMENT
   two new:
   806-016C U-BOLT 5/8-11 X 6 1/32 X 5 3/4
   and four sets new:
   804-022C WASHER LOCK SPRING 5/8 PLT
   803-021C NUT HEX 5/8-11 PLT

15. Position the mount, ears forward, on the rear face of the front tool bar of the wing extension. Loosely secure it with U-bolts, lock washers and nuts.

16. Slide the mount along the tool bar until its center is one row space from the left-most forward coulter.

Dismount Rear Vantage I Coulters

This applies only to kit 407-907A and three-coulters configurations. For single-coulters configurations, skip to “Install Liquid Couler” on page 155.

17. Using a grease pencil, note the locations of any coulters using offset shanks.

Refer to Figure 96

Possible Agricultural Chemical Hazard:
Wear chemical gloves while handling disconnected drop lines. Hose may contain residual amounts of chemical fluids. Consult SDS for material most recently applied.
18. At each rear coulter pivot, disconnect the tubing from the grease bank. Use a cable tie to secure all but the left-most row’s grease bank tubing to a U-bolt at the front coulter clamp.

19. If installed, disconnect any fertilizer drop lines at rear coulters. Disconnect at the push-pull fitting.

Refer to Figure 97

20. Replace nozzles with caps at each disconnected nozzle, except the left-most nozzle.

21. At the left-most nozzle, adapt it for half rate:

   If using orifice plates, replace the existing plate with a smaller size, having a port area of \( \frac{1}{2} \), or slightly larger than \( \frac{1}{2} \) of the port area of the existing plate. See page 128 for a table of plates and ports.

Transfer Liquid Coulter

This applies only to kit 407-907A and three-coulter configurations. For single-coulter configurations, continue at “Install Liquid Coulter” below.

Refer to Figure 98

22. Attach the hoist line to the loop at the top of the quick-attach casting.

23. At the casting bottom, remove and save two sets:

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>803-021C</td>
<td>NUT HEX 5/8-11 PLT</td>
</tr>
<tr>
<td>804-022C</td>
<td>WASHER LOCK SPRING 5/8 PLT</td>
</tr>
<tr>
<td>802-053C</td>
<td>HHCS 5/8-11X1 3/4 GR5</td>
</tr>
<tr>
<td>804-095C</td>
<td>WASHER FLAT 5/8 HARD ASTM F436</td>
</tr>
</tbody>
</table>

24. Use the hoist to remove the coulter assembly. Set one assembly (with a straight shank) aside for use as the side dress coulter.

25. Leave quick-attach mounts in place.

26. Move the selected coulter to the quick-attach coulter mount on the side dress wing extension. It may be necessary to rotate the coulter shank 180° in the quick-attach weldment.

1. Safety Data Sheet
Continue at “Close-Out Side Dress Liquid Coulter” below.

**Install Liquid Coulter**

This applies to kit 407-940A or 407-941A and single- or 2-coulter configurations. For 3-coulter configurations, see “Transfer Liquid Coulter” above.

**Refer to Figure 99**

27. Select one each new:
   - 149-584D COULTER CLAMP 6H X 4W
   - 204-691K NP COULTER ASSY RH
   
   two new:
   - 806-016C U-BOLT 5/8-11 X 6 1/32 X 5 3/4
   
   and four sets new:
   - 804-022C WASHER LOCK SPRING 5/8 PLT
   - 803-021C NUT HEX 5/8-11 PLT

28. Align the coulter shank 29 and clamp 28 at the position marked at step 12 on page 87. Loosely secure with U-bolts 65, lock washers 65 and nuts 51.

29. Adjust the coulter height to match the rest of the applicator. Secure the clamp nuts.

**Close-Out Side Dress Liquid Coulter**

30. Connect the grease bank and fertilizer delivery tubing previously on the left-most rear row.

31. Skip to “Shift 2-Point Hitch” on page 158.

32. Note change in swath for rate calculations.

---

**CAUTION**

*Possible Agricultural Chemical Hazard:*

Wear chemical gloves while handling disconnected drop lines. Hose may contain residual amounts of chemical fluids. Consult the Safety Data Sheet (SDS) for the material most recently applied.
Anhydrous \((NH_3)\) Side Dress

These instructions apply to kits 417-124A, 417-567A and 417-568A.

Side Dress accessory kits provide a left wing extension to support an additional (13th) rear single anhydrous coulter, tine and delivery tubing. The kit is user-installed, and conversion between pre-emergence and side dress modes requires user re-configuration of the applicator.

See page 133 for ordering information. 417-124A, 417-567A and 417-568A Side Dress Kits are compatible only with model NP2330AA-12C30.

Prepare Applicator

1. Discharge \(NH_3\) system (page 103).
2. Move applicator to a level clear surface with adequate illumination. An outdoor location, or well-ventilated indoor location is recommended.
3. Raise applicator (page 47).
4. Install lift assist cylinder locks (page 49).
5. Unfold wings (page 53).
6. Fully extend wing gauge wheels (page 87).
7. Install parking stands (page 37).
8. Lower applicator onto parking stands.
9. Unhitch tractor.
10. Wear PPE\(^1\). A discharged system can still contain \(NH_3\) or \(NH_4OH\) at irritating levels.

Anhydrous Coulter Side Dress Kits

See “Install Wing Extension” on page 152 for installation instructions.

---

1. PPE: Personal Protective Equipment
Install Anhydrous Coulter

Refer to Figure 102

11. Measure a distance of one anhydrous row space @ from the center-line of the left wing outside row unit. Use a grease pencil or similar means to mark the position for the side dress row unit on the extension weldment.

12. Select one each new:
   - 417-121D FORMED SHANK CLAMP, 2 OD
   - 417-121L NH3 COULTER ROW UNIT ASSY

   two new:
   - 806-123C U-BOLT 3/4-10 X 6 1/32 X 6 3/4

   and four sets new:
   - 804-023C WASHER LOCK SPRING 3/4 PLT
   - 803-027C NUT HEX 3/4-10 PLT

13. Align the coulter shank 46 and clamp 47 at the position marked at step 11 above. Loosely secure with U-bolts 66, lock washers 65 and nuts 69.

14. Adjust the coulter height to match the rest of the applicator. Make sure that the flat on the shank is flush with the tool bar. Secure the clamp nuts.

Add NH₃ Divider Port

Refer to Figure 103

15. Wear PPE. Verify that the system has been discharged (see “System Discharge” on page 103).

16. Locate the flow divider 43 for the left wing. Verify that the pressure gauge 42 is reading zero.

17. Select one new:
   - 830-406C AD 1/4MNPT X 3/8 HB SS

18. Choose any plug 43 on the divider. Position yourself up-wind of the plug. Begin to slowly unscrew the plug, watching for signs of pressure or residual ammonia bleed-off. If any ammonia is detected, wait for it to bleed off before continuing.

19. Replace the plug with the adapter 44. Use pipe sealant when installing a port fitting. Use only pipe sealant specified for use with anhydrous ammonia, such as RectorSeal No. 5. Do not use tape.

---

1. PPE: Personal Protective Equipment
Cut New Tubing

Connect Side Dress Tubing

Refer to Figure 104 and Figure 105

20. Disconnect the delivery tubing at row 1, the existing left-most row. Release any coiled-up length from ties at the row. Make sure that there is enough slack for a tube of this length to reach the side dress row. If not, have your dealer contact the factory.

21. Release the remaining length of row 1 tubing all the way back to the section divider. Do not disconnect it from the divider.

   Measure the length of this tubing from divider port to row end cut. Re-route and reconnect it to row 1. Do not re-tie until step 25.

22. Select one new:

   990-259R EVA TUBING 3/8 ID

   Cut this tubing to the length measured at step 21.

23. Select two new:

   800-400C HOSE CLAMP NO.10 .593 ID SS

   Slide one over each end of the new tubing.

24. Connect the new tubing to the adapter installed in step 19. Route the tubing along the rear tool bar, passing through the pin axis at the wing hinge. Coil up excess behind or around the tool bar. Connect the wing end to the coulter tine. Secure both ends with clamps.

25. Secure all tubing with ties provided.

26. Note change in swath for rate setting.

Shift 2-Point Hitch

Refer to Figure 105, Figure 106 and Figure 107

This machine comes from the factory at the pre-emergent setting of 16.09 inches from machine center.

1. Avoid tight bends and kinks if wrapping around the tool bar. Make coils nearly circular.
1. For side dress installation, loosen or remove all six nuts per hitch.
2. Move each hitch to align on the frame as shown in Figure 106.
3. Tighten nuts to torque specification shown on decal.
Re-Space Caster Pivots

Caster Angle Adjustment

Refer to Figure 108 and Figure 109

Your operations may require that the lift-assist tires be in-row (on 90 inch centers) or out-of-row (on 120 inch). Post-emergence (side-dress), for example, requires out-of-row placement. The forward caster parallel arm weldments may be pivoted and pinned for either spacing.

90 Inch (In Row) Spacing

With the caster pins the through leading outside holes ① of the lift assist frame, and through the outside tubes of the forward caster pivot weldment, the caster arms are in straight trail, and provide a 90 inch (2.29 m) wheel spacing. The wheels are directly behind 30 inch rows.

120 Inch (Out of Row) Spacing

With the caster pins the through inside holes ② of the lift assist frame, and through the inside tubes of the forward caster pivot weldment, the caster arms are angled out, and provide a 120 inch (3.05 m) wheel spacing. The wheels are in between 30 inch rows.

**WARNING**

Loss of Control and Machine Damage Risks:

Never operate with one or both pins removed, or with pins installed but not in a caster weldment tube. Always install pin ③ from the top, in case the cotter is lost. If the caster arms are free to pivot at both ends, they can strike other implement components, and directional control is substantially reduced. This could contribute to a road accident, resulting in serious injury or death.

Changing Spacing

This is a two person operation. If the applicator frame is not exactly level, the caster arms may be difficult to control with one hand.

1. Hitch the applicator to a suitable tractor (page 31).
2. Raise the applicator. Move to a level, and firm or hard surface.
3. While raised, remove any lift lock channel or spacers on the lift-assist cylinder.
4. Lower the applicator until the caster tires are just out of ground contact. Set the lift circuit to Neutral and shut off the tractor.
5. Remove the hairpin cotter ③ at a caster pin ④. Have one person control the caster position. Remove the pin.
6. Reposition the caster as desired for the new spacing. Insert the pin. Secure with cotter. Repeat for other caster.
Reverting to Pre-Emergence
For converting to pre-emergence, continue at page 152.
Resources required:
- all-purpose grease and grease gun
- basic hand tools
- One shut-off cap or plug.
  Conventional liquid fertilizer:
  - 832-042C NOZZLE SHUT OFF CAP W/ GASKET
  Anhydrous:
  - 830-407C PL 1/4 MNPT STAINLESS

Prepare Implement
7. Move implement to a level clear surface with adequate illumination.
8. Raise implement.
9. Unfold wings.
10. Fully extend wing gauge wheels.
11. Install parking stands.
12. Place stands or blocks under the rear frame.
13. Retract the lift-assist cylinders to lift the caster tires off the ground.
14. Lower implement onto stands.
15. Unhitch tractor.
16. Restore caster spacing.
17. Re-center 2-point hitch.
18. Note change in swath for rate setting.

Revert Liquid to Pre-Emergence
1. Disconnect the drop line from the check valve and the side dress coulter. Cap the check valve.
2. Disconnect the grease line at the grease bank. Remove the zerk from the plate to prevent dirt build up; re-attach zerk to line. Coil up the grease line at the coulter.
3. Dismount side dress coulter. If a quick-attach type, leave the mount plate installed. Frame extension may be left in place.
4. Re-install rear coulters (if removed). Reconnect drop and grease lines.

Revert NH₃ Side Dress to Pre-Emergence

DANGER
Suffocation, Blinding, Burning, Freezing, Disabling and Disfigurement Hazards:
Do not perform this installation reversion without PPE or without verifying system discharge. This process requires opening a flow divider port to the atmosphere. This system segment could contain liquid anhydrous ammonia (NH₃). It would overwhelm your PPE and could be fatal.

1. Discharge system (see "System Discharge" on page 103).
2. Disconnect side dress delivery tubing at divider and coulter. Leave tubing in place on frame.
3. Replace adapter at divider with plug.
4. Dismount coulter. Frame extension may be left in place.

1. PPE: Personal Protective Equipment
Weight Kit Installation

These instructions apply to an installation of an optional 407-904A weight kit.

Tools Required:

- Lift or hoist with a capacity of at least 750 pounds (340 kg). Two lift lines, each with a capacity of at least 750 pounds (340 kg).
- Tractor for raising and unfolding the applicator.
- Basic hand tools.

1. Raise and unfold the applicator. Leave it hitched or install parking stands.

**WARNING**

Heavy Overhead Object Hazard:
Move only one weight stack at a time. Use an adequate hoist. Use two or more lines, each rated for the full weight of a single weight stack. Inspect lines for wear and damage. If the hoist fails or tips, or a line fails, a weight could fall or swing, causing serious injury or death.

Refer to Figure 111

2. Locate one:

![Diagram of weight kit installation](image)

- 160-296S NTA WEIGHT BRACKET ASSY

Observe that a weight stack is not symmetrical. The weight base has a long (outside) notch ① and a short (inside) notch ②.

3. As needed, orient the weight stack prior to line attachment, so that it is in the correct orientation when placed on the frame.

4. Connect hoist lines to the weight mounts ⑤.

5. With the longer notch ① toward the wings, and the shorter notch ② to machine center, place the weight in the openings of the rear sub-frame. Push it fully to the rear before releasing the lines.

6. Select two sets:

   - 407-991D BRACKET STOP
   - 802-226C HHCS 1/2-13X2 3/4 GR5
   - 804-015C WASHER LOCK SPRING 1/2 PLT
   - 803-020C NUT HEX 5/8-11 PLT

Assemble the stop pair on either side of the weight support bar ⑥. Snug against weight stack ②. Secure with bolts ④, lock washers ⑤ and nuts ⑥.

7. Repeat step 2 through step 6 for second weight stack.

**CAUTION**

Heavy Overhead Object Hazard:
Do not stand to either side of an elevated weight stack. Keep body parts away from gaps between the stack and other machine parts. Remain behind and out from under the elevated weight stack. Move the stack slowly and carefully. Assume a line could fail, and that the weights could swing down and to the side.

**NOTICE**

Machine Damage Risk:
Do not install a single weight on either side. Do not leave weight pairs uncoupled on either side. Always install or remove all four weights. When installed, always use provided fasteners to couple front and rear weights at their mounts ⑥. Weights are held in place largely by gravity. A single weight, or uncoupled pair, could tip forward during a sudden stop, causing machine damage.
Great Plains (a division of Great Plains Manufacturing, Inc.) warrants to the original purchaser that this Great Plains machine will be free from defects in material and workmanship for a period of one year (Parts & Labor) from the first use date when used as intended for personal use; ninety days for custom/commercial or rental use.

Second year limited warranty covers Parts ONLY (personal usage only, excluding labor and wear items). This warranty is limited to the replacement of any defective part by Great Plains. Great Plains reserves the right to inspect any equipment or part which are claimed to have been defective in material or workmanship.

The following items and/or conditions are NOT COVERED UNDER WARRANTY:
Failures resulting from the abuse or misuse of the equipment, failures occurring as a result of accidental damage or Force Majeure, failures resulting from alterations or modifications, failures caused by lack of normal maintenance as outlined in the operator’s manual, repairs made by non-authorized personnel, items replaced or repaired due to normal wear (such as wear items and ground-engaging components including, but not limited to, disc blades, chisel points, tires, bushings, and scrapers), repeat repair due to improper diagnosis or improper repair by the dealer, temporary repairs, service call and/or mileage to and from customer location, overtime premium, or unit hauling expenses. The warranty may be voided if the unit is towed at speeds in excess of 20 miles per hour (32 kilometers per hour), or failures occurring from soils with rocks, stumps, or other obstructions.

Great Plains reserves the right to make changes in materials or design of the product at any time without notice. The warranty shall not be interpreted to render Great Plains liable for damages of any kind, direct or consequential or contingent to property. Furthermore, Great Plains shall not be liable for damages resulting from any cause beyond its control. This warranty does not extend to crop loss, losses caused by planting or harvest delays or any expense or loss of labor, supplies, rental machinery, or for any other reason.

No other warranty of any kind whatsoever expressed or implied, is made with respect to this sale; and all implied warranties of merchantability and fitness for a particular purpose which exceed the obligations set forth in this written warranty are hereby disclaimed and excluded from this sale.

This warranty is not valid unless registered by a certified Great Plains dealer.

Effective July 15, 2020
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