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.
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.

<table>
<thead>
<tr>
<th>Model Number</th>
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<tbody>
<tr>
<td>Serial Number</td>
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<tr>
<td>Machine Height</td>
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<td>Machine Length</td>
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<td>Year of Construction</td>
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<td>Delivery Date</td>
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<tr>
<td>First Operation</td>
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<tr>
<td>Accessories</td>
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</tbody>
</table>

Dealer Contact Information

Name: ________________________________
Street: ______________________________
City/State: __________________________
Telephone: ___________________________
Email: ______________________________
Dealer's Customer No.: __________________

WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov
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<thead>
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<th>Table of Contents</th>
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Important Safety Information

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.
Be Familiar with Safety Decals

▲ Read and understand “Safety Decals,” page vii, thoroughly.
▲ Read all instructions noted on the decals.

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.

Shutdown and Storage

▲ Lower drill, put tractor in park, turn off engine, and remove the key.
▲ Secure drill using blocks and supports provided.
▲ Detach and store drill in an area where children normally do not play.

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.
Transport Machinery Safely

Maximum transport speed for implement is 20 mph. Some rough terrains require a slower speed. Sudden braking can cause a towed load to swerve and upset.

▲ Do not exceed 20 mph. 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.
▲ Comply with state and local laws.
▲ Do not tow an implement that, when fully loaded, weighs more than 1.5 times the weight of towing vehicle.
▲ Carry reflectors or flags to mark drill 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,” page lxvi.

Avoid High Pressure Fluids

Escaping fluid under pressure can penetrate the skin, causing serious injury.

▲ 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, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
Practice Safe Maintenance

▲ Understand procedure before doing work. Use proper tools and equipment. Refer to this manual for additional information.
▲ Work in a clean, dry area.
▲ Lower the drill, put tractor in park, turn off engine, and remove key before performing maintenance.
▲ Make sure all moving parts have stopped and all system pressure is relieved.
▲ Allow drill to cool completely.
▲ Disconnect battery ground cable (−) before servicing or adjusting electrical systems or before welding on drill.
▲ 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 drill before operation.

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.

Wear Protective Equipment

▲ Wear protective clothing and equipment.
▲ Wear clothing and equipment appropriate for the job. Avoid loose-fitting clothing.
▲ Because prolonged exposure to loud noise can cause hearing impairment or hearing loss, wear suitable hearing protection such as earmuffs or earplugs.
▲ Because operating equipment safely requires your full attention, avoid wearing radio headphones while operating machinery.
Handle Chemicals Properly

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

▲ Read and follow chemical manufacturer’s instructions.
▲ Wear protective clothing.
▲ Handle all chemicals with care.
▲ Avoid inhaling smoke from any type of chemical fire.
▲ Store or dispose of unused chemicals as specified by chemical manufacturer.

Use A Safety Chain

▲ Use a safety chain to help control drawn machinery should it separate from tractor drawbar.
▲ Use a chain with a strength rating equal to or greater than the gross weight of towed machinery.
▲ Attach chain to tractor drawbar support or other specified anchor location. Allow only enough slack in chain to permit turning.
▲ Replace chain if any links or end fittings are broken, stretched or damaged.
▲ Do not use safety chain for towing.

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.
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 drill functions.
▲ Operate machinery from the driver’s seat only.
▲ Do not leave drill unattended with tractor engine running.
▲ Do not dismount a moving tractor. Dismounting a moving tractor could cause serious injury or death.
▲ Do not stand between the tractor and drill during hitching.
▲ Keep hands, feet and clothing away from power-driven parts.
▲ Wear snug-fitting clothing to avoid entanglement with moving parts.
▲ Watch out for wires, trees, etc., when folding markers or raising drill. Make sure all persons are clear of working area.
▲ Do not turn tractor too tightly, causing drill to ride up on wheels. This could cause personal injury or equipment damage.
Safety Decals

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

▲ Read and follow decal directions.
▲ 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**

818-055C (S/N 1044UU-)

Center of box;
One decal total.

818-055C (S/N 1045UU+)

Mounted on centered bracket below walkboards;
One decal total.
Red Reflectors
838-266C

Reflectors on outside ends of center section walkboard;
Two reflectors total.

Amber Reflectors
838-265C (S/N 1044UU-)

Reflectors on outside ends of wings and center sections,

Reflectors on both sides of tongue;
Six reflectors total.
Amber Reflectors
838-265C (S/N 1045UU+)

Reflectors on outside ends of wings and center sections,

Reflectors on both sides of tongue,

Reflectors on the outside of center section;
Eight reflectors total.

Daytime Reflectors
838-267C

Reflectors on inside ends of wing sections;
Two reflectors total.
Negative Tongue Hazard
818-019C

On top of the tongue;
One decal total.

Excessive Speed
818-188C

On top of the tongue;
One decal total.
Cannot Read English
818-557C

On top of the tongue;
One decal total.

High Pressure Hazard
818-339C

On top of the tongue;
One decal total.

Crushing Hazard
818-590C

On top of the tongue;
One decal total.
General Instructions
818-587C

On top of the tongue;
One decals total.

General Instructions
818-078C

On both sides of tongue;
Two decals total.

Tongue Weight
818-475Ct

On both sides of tongue;
Two decals total.
Pinch Point Hazard
818-045C

On both sides of tongue;
Two decals total.

Tires Not A Step
818-398C

On the front of tire mount;
Four decals total.

For Rib Tire 8-Ply
(818-855C)

On gauge wheel tires;
Four decals total.
For Skid Steer Tire
838-092C

**CAUTION**

To Avoid Injury or Machine Damage from Improper Tire Inflation or Torquing of Wheel Bolts:
- Maximum inflation pressure of tires is 60 psi.
- Torque wheel bolts to 90 - 105 ft-lb.

On gauge wheel tires;
Four decals total.

For Rib Tire 20-Ply
838-259C

**CAUTION**

To Avoid Injury or Machine Damage from Improper Tire Inflation or Torquing of Wheel Bolts:
- Maximum inflation pressure of tires is 99 psi.
- Torque wheel bolts to 170 lb-ft.

On transport tires;
Four decals total.

For Skid Steer Tire
838-426C

**CAUTION**

To Avoid Injury or Machine Damage from Improper Tire Inflation or Torquing of Wheel Bolts:
- Maximum inflation pressure of tires is 60 psi.
- Torque wheel bolts to 105 ft-lb.

On transport tires;
Four decals total.

Falling Hazard
838-102C

**WARNING**

To avoid serious injury or death:
- Watch your step when climbing ladder or walking on walkboard

On ends of walkboards;
Two decals total.
Crushing Hazard

818-682C

To prevent serious injury or death from pinning or crushing:
* Stay away from equipment when they are in motion.
* Keep others away.

Two decals on first section of each optional marker;
Four decals total.
Introduction

Great Plains welcomes you to its growing family of new product owners. This drill 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 3N-3010 and 3N-3020 are pull-type seeding implements outfitted with no-till coulters for use in no- or minimum-till conditions. The 3N-3010 is outfitted with 10 series, parallel-arm openers. The 3N-3020 is outfitted with 20 series, side-depth-control openers. Both models fold for transport.

Intended Usage

Use the drill to seed production-agriculture crops only. Do not modify the drill for use with attachments other than Great Plains options and accessories specified for use with the drill.

Using This Manual

This manual will familiarize 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.

Definitions

The following terms are used throughout this manual.

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.

**NOTICE**

A crucial point of information related to the preceding topic. For safe and correct operation, read and follow the directions provided before continuing.

\[\text{NOTE:} \] Useful information related to the preceding topic.
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.

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. The serial-number plate is located on the wing frame tube on the left end of the drill as shown.

Record your drill 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 3N-3010 & 3N-3020. 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.
Preparation and Setup

This section will help you prepare your tractor and drill for use. Before using the drill in the field, you must hitch the drill to a suitable tractor (see “Tractor Requirements,” page lxvi) and level the drill.

Prestart Checklist

1. Read and understand “Important Safety Information,” page i.
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. Refer to “Lubrication,” page lvi.
4. Check that all safety decals and reflectors are correctly located and legible. Replace if damaged. See “Safety Decals,” page vii.
5. Inflate tires to pressure recommended and tighten wheel bolts as specified. See “Appendix,” page cvii.

**WARNING**

Escaping fluid under pressure can have sufficient pressure to penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic lines. Use a piece of paper or cardboard, NOT BODY PARTS, to check for leaks. Wear protective gloves and safety glasses or goggles when working with hydraulic systems. If an accident occurs, see a doctor immediately.
Hydraulic Hose Hookup

Current Style Color Coded Hose Handles

Great Plains hydraulic hoses have color coded handle grips 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>Hydraulic Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray</td>
<td>Fold</td>
</tr>
<tr>
<td>Blue</td>
<td>Lift</td>
</tr>
<tr>
<td>Green</td>
<td>Marker Cylinders</td>
</tr>
</tbody>
</table>

Older Style Hoses with Color Ties

Hoses that go to the same remote valve are marked with the same color tie.

<table>
<thead>
<tr>
<th>Color</th>
<th>Hydraulic Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>Fold</td>
</tr>
<tr>
<td>Blue</td>
<td>Lift</td>
</tr>
<tr>
<td>Orange</td>
<td>Marker Cylinders</td>
</tr>
</tbody>
</table>

To distinguish hoses on the same hydraulic circuit, refer to plastic hose label. Hose under extended-cylinder symbol feeds cylinder base end. Hose under retracted-cylinder symbol feeds cylinder rod end.
Hitching Tractor to Drill

⚠️ DANGER ⚠️

You may be severely injured or killed by being crushed between the tractor and drill. Do not stand or place any part of your body between drill and moving tractor. Stop tractor engine and set park brake before installing the hitch pin.

1. Use the drill jack to raise or lower the tongue as needed. Hitch the drill to the tractor using a hitch pin of adequate strength (at least one inch in diameter).

2. Install a retaining clip on the hitch pin to prevent it from working up. Securely attach drill safety chain to tractor drawbar.

JUnit:

⚠️ WARNING ⚠️

Escaping fluid under pressure can have sufficient pressure to penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic lines. Use a piece of paper or cardboard, NOT BODY PARTS, to check for leaks. Wear protective gloves and safety glasses or goggles when working with hydraulic systems. If an accident occurs, see a doctor immediately.

3. Connect hydraulic hoses to tractor remotes. Refer to "Hydraulic Hose Hookup," page xix.

4. Plug the drill light cable to the tractor. If outfitted with an optional population monitor, connect monitor lead to monitor harness.

5. Plug electric clutch cable to the switch control box cable.

Note: Switch control box should be mounted in your tractor cab in a location with easy access. Route wiring harness with enough slack to allow for tractor movement, especially articulating tractors.

6. Crank the jack until tongue weight is resting on the tractor drawbar. Unpin the tongue jack from the hitching stob. Pin the jack to the stob on top of the tongue.
Hitch Height Adjustment

For proper operation, the drill tongue must run parallel to the ground in field position. Follow these instructions to adjust the drill hitch to match your tractor drawbar height.

Refer to Figure 1

1. Check the distance from the bottom of the tongue to the ground as shown. Using the drill jack, adjust the tongue up or down until the distance is about 45 inches.
2. Back the tractor drawbar up to the drill hitch. Determine how much adjustment is needed for the drill to match drawbar height.

Refer to Figure 2

3. Unbolt the hitch from the tongue. Rebolt the hitch so the drill matches drawbar height.

NOTICE

When hitching the drill to a different tractor, check for differences in drawbar heights and re-adjust the drill hitch accordingly.
Bleeding Hydraulics

**WARNING**

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 medical assistance from a doctor that is familiar with this type of injury. Foreign fluids in the tissue must be surgically removed within a few hours or gangrene will result.

**Bleeding Lift Hydraulics**

The lift system is equipped with rephasing hydraulic cylinders that require a special procedure for bleeding air from the system. Read and follow the procedure carefully.

1. Check hydraulic fluid level in tractor reservoir and fill to proper level. Add fluid to system as needed while cycling new cylinders.
2. Lower drill to ground.
3. Unpin rod ends of wheel cylinders. Pivot cylinders up and wire or otherwise safely support rod ends higher than base ends. You may need to remove the gauge-wheel cylinders from the rockshaft so you can orient them with rod ends higher than base ends.
4. With the tractor engine at idle speed, energize the lift hydraulics. When the cylinders have extended completely, hold the remote lever on for one minute. Check all hydraulic hoses, cylinders and fittings for leaks.
5. Retract the cylinder rods. Extend the rods again and hold the remote lever on for one more minute. Repeat this step two more times.
6. Again, check all hydraulic hoses, cylinders and fittings for leaks. Recheck the tractor hydraulic reservoir. Fill to the proper level.
7. Repin all cylinders.

**Bleeding Fold Hydraulics**

Check hydraulic fluid level in tractor reservoir and fill to proper level. Add fluid to system as needed while cycling new cylinders.

If drill fold cylinders have not been extended:

1. Crack fittings at base end of cylinders. Extend cylinders to purge air from system.
2. Crack fittings at rod end of cylinders. Retract cylinders to purge remaining air from system.
3. Tighten all fittings. Extend cylinders and pin to drill lugs.
If drill cylinders have been extended:

1. Unfold drill so that fold cylinders are completely extended. Lower drill to ground. Unpin rod ends of fold cylinders.
2. Crack fittings on rod end of cylinders. Purge air from cylinders by retracting cylinder rods.
3. Crack fittings at base end of cylinders. Extend cylinders to purge remaining air from system.
4. Tighten all fittings. Repin cylinders to drill.

**Bleeding Marker Hydraulics**

To fold properly, the marker hydraulics must be free of air. If the markers fold in jerky, uneven motions, follow these steps.

⚠️ **CAUTION**

*You may be injured if hit by a folding or unfolding marker. Markers may fall quickly and unexpectedly if the hydraulics fail. Never allow anyone near the drill when folding or unfolding the markers.*

Check that the tractor hydraulic reservoir is fill.

1. With both markers lowered into field position, loosen hydraulic-hose fittings at rod and base ends of marker cylinders. If applicable, loosen fittings on back side of sequence valve.

**NOTICE**

*Never bleed an O-ring fitting. Instead, bleed a nearby pipe or JIC fitting.*

2. With tractor idling, activate tractor hydraulic valve until oil seeps out around a loosened fitting. Tighten that fitting.

**NOTICE**

*JIC fittings do not require high torque. JIC and O-ring fittings do not require sealant. Always use liquid pipe sealant when adding or replacing pipe-thread fittings. To avoid cracking hydraulic fittings from over tightening, do not use plastic sealant tape.*

3. Reactivate tractor hydraulic valve until oil seeps out around another loosened fitting. Tighten that fitting. Repeat process until all loosened fittings have been bled and tightened.
Leveling Frame Side-to-Side

All frame sections must be level to maintain even seeding depth. Before using the drill in the field, follow these steps to make sure the drill is level side-to-side.

Periodic frame-leveling adjustments should not be necessary, but if you are having problems with uneven depth, check drill levelness and follow these procedures.

Complete the steps under “Bleeding Fold Hydraulics,” page xxii, before proceeding.

Refer to Figure 3

1. Locate the threaded eye bolt at the base end of the gauge-wheel cylinders. The eye bolt is locked in place by a jam nut. Observe the amount of thread exposed above the upper nut and below the lower nut. If the exposed threads are roughly equal, no initial adjustment is needed. Go to step 3.

2. If the exposed threads above and below the nuts are not equal, loosen and adjust the jam nuts until the amount of exposed thread is about the same above and below. Repeat for other end of drill.

3. Move the drill to a level area. With the drill unfolded, raise the drill to its highest position with the lift cylinders. With the tractor idling, rephase the cylinders by holding the hydraulic lever on for an additional 30 seconds. Immediately lower the boxes until the coulters and openers are just ready to touch the ground.

4. Move the gauge-wheel eye bolts until the openers on the outside end of the drill are the same height as the center openers.

   NOTE: Eye-bolt adjustments are easier if the drill is first lowered to the ground to remove some of the force on the cylinders.

5. Repeat the steps above until the drill is level end-to-end when drilling in actual seeding conditions.
Box Alignment

To check and adjust box alignment:

1. Place a block ahead of each wing gauge wheel. Pull drill forward against blocks to rock frames back. Pull forward until stop bolts are firmly against toolbars.

Refer to Figure 5

2. Check for proper alignment by running a string line across back of drill toward outer ends of wings. For proper alignment, outside ends of boxes (dimension A) should be 1/4-inch to 1/2-inch ahead of inside ends (dimension B).

Refer to Figure 4

3. To adjust box alignment, shorten or lengthen stop bolts to change the contact point with the toolbars. Adjust stop bolts (1) in or out until dimension A is 1/4-inch to 1/2-inch greater than dimension B.

Figure 4
Stop Bolt

Figure 5
Box Alignment
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.

Prestart Checklist

**WARNING**

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 medical assistance from a doctor that is familiar with this type of injury. Foreign fluids in the tissue must be surgically removed within a few hours or gangrene will result.

1. Carefully read “Important Safety Information,” page i.
2. Lubricate drill as indicated under “Lubrication,” page lvi.
3. Check all tires for proper inflation. See “Appendix,” page cvii.
4. Check all bolts, pins and fasteners. Torque as shown in “Appendix,” page cvii.
5. Check drill for worn or damaged parts. Repair or replace parts before going to the field.
6. Check hydraulic hoses, fittings and cylinders for leaks. Repair or replace before going to the field.
7. Rotate both gauge wheels to see that the drives are working properly and free from foreign material.
Folding the Drill

**WARNING**

Pinch Point and Crushing Hazard. To prevent serious injury or death:

- Always use transport locks when drill is folded.
- Fold only if hydraulics are bled free of air and fully charged with hydraulic oil.
- Stay away from frame sections when they are being raised or lowered.
- Keep away and keep others away when folding or unfolding drill.

Fold the drill on level ground with the tractor in neutral. If your drill has markers, be certain they are folded and their control switches are off before folding.

**Refer to Figure 6**

1. Raise drill with lift cylinders until cylinders are fully extended.
2. Install lock channels over extended wheel-cylinder rods on center section.

**Refer to Figure 7**

3. Move handle on fold latch ahead into road position.
4. Active hydraulics and slowly fold drill until wings trigger the spring-loaded fold latch and are secure in the latch.

**Rephasing Lift System**

Over a period of normal use the cylinders may get out of phase. This will cause some drill sections to run higher than others. To rephase cylinders:

1. Raise the implement completely and hold the hydraulic remote lever on for several seconds until all cylinders are fully extended. Do this every time you raise drill out of ground.
2. When all cylinders are fully extended, momentarily reverse hydraulic remote lever to retract system 1/2 inch to maintain levelness.
Unfolding the Drill

**WARNING**

This drill has negative tongue weight when unfolded and raised. Unhooking the drill from the tractor when the drill is unfolded could cause the drill tongue to raise suddenly, hitting or crushing bystanders. Be certain the drill is hitched securely to your tractor drawbar and the hitch safety chain is securely attached to the tractor before raising or unfolding the drill.

**WARNING**

To prevent serious injury or death:

▲ Always use transport locks when drill is folded.

▲ Fold only if hydraulics are bled free of air and fully charged with hydraulic oil.

▲ Stay away from frame sections when they are being raised or lowered.

▲ Keep away and keep others away when folding or unfolding drill.

1. Unfold the drill on level ground with the tractor transmission in neutral.

**Refer to Figure 8**

2. Move handle on fold latch back into field position.

3. Activate hydraulics to unfold the drill.

**NOTE:** The latch is spring loaded. Pressure on the latch may prevent the mechanism from releasing. If latch will not release, activate hydraulics to fold boxes to take pressure off latch, then unfold drill.

**Refer to Figure 9**

4. Remove lock channels from center-section wheel cylinders. Store lock channels on frame gusset as shown.

5. Lower drill.
Field Operation

**DANGER**

*You may be severely injured or killed by being crushed between the tractor and drill. Do not stand or place any part of your body between drill and moving tractor. Stop tractor engine and set park brake before installing pins.*

1. Hitch drill to a suitable tractor. Refer to “Hitching Tractor to Drill,” page xx.
2. Before operation, make sure you are using the correct sprockets for the seed you are using.
3. Set seeding rate as explained under “Seeding Rate,” page xl.
4. Record acremeter readout. Subtract initial reading from later readings to determine acres drilled.
5. If your drill has been exposed to the elements for a period of time with seed in the boxes, check to make sure the seed in the seed tubes and cups has not become wet.
6. Pull forward, lower drill and begin seeding.
7. Always lift drill out of the ground when turning at row ends and for other short-radius turns. Seeding will stop automatically as drill is raised.
Electric Clutch Operation

This unit is equipped with an electric clutch mounted on each drive. This allows the operator to selectively shut off one side of the drill at a time to accommodate point row seeding.

The control box is mounted in the tractor cab and has two on/off toggle switches with red indicator lamps.

This unit is also equipped with an electric clutch switch that automatically shuts off seeding to both sides whenever the unit is raised out of the ground.

For information on “Electric Clutch Switch Adjustments” see page xliii.

Opener Operation

**NOTICE**

*Do not back up with openers in the ground. To do so will cause severe damage and opener plugging.*

For information on opener adjustments, refer to “Opener Adjustments,” page xxxvi. For more information on troubleshooting opener problems, see “Troubleshooting”, page xlix.

Marker Operation

Optional marker attachments are available from your Great Plains dealer. Before operating markers, make sure hydraulics are properly bled as described under “Marker Adjustments”, page xlv.

Dual markers equipped with a sequence valve are powered off the same hydraulic circuit. Starting with both markers folded, the folding sequence is:

1. Activate lever - Right unfolds; left stays folded.
2. Reverse lever - Right folds; left stays folded.
3. Activate lever - Left unfolds; right stays folded.
4. Reverse lever - Left folds up; right stays folded.
5. Sequence repeats.

You can adjust marker folding speed. Refer to “Marker Adjustments”, page xlv, and adjust folding speed to a safe rate. Folding markers at high speed can damage markers.
Transporting

**WARNING**
*Towing the drill at high speeds or with a vehicle that is not heavy enough could lead to loss of vehicle control. Loss of vehicle control could lead to serious road accidents, injury and death. To reduce the hazard, do not exceed 20 mph.*

Before transporting the drill, follow and check these items:

Un**load seed box.** Unload seed box before transporting if at all possible. To do so:

- Place tarp under drill or a bucket under each opener.

*Refer to Figure 10*

- Use large bucket to empty box as much as possible. For seed cup cleanout, move handle to the fourth position.

The drill can be transported with a full box of grain, but the added weight will increase stopping distance and decrease maneuverability.

Road rules. Comply with all federal, state and local safety laws when traveling on public roads.

Clearance. Remember that the drill is wider than the tractor. Allow safe clearance.

Transporting with Markers

Always transport markers in the folded position.
Parking

For information on long-term storage, refer to “Storage”, page iv.

**WARNING**

*This drill has negative tongue weight when unfolded. Unhooking the drill from the tractor when the drill is unfolded could cause the drill tongue to raise suddenly, hitting or crushing bystanders. To avoid serious injury or death, never unhook the drill from the tractor when the drill is unfolded.*

1. Fold the drill. Refer to “Folding the Drill,” page xxvi.

Refer to Figure 11

2. Park the drill on a level, solid area.
3. Securely block the tires to prevent rolling.
4. Remove the jack from its storage stob. Pin the jack in parking position. If the ground is soft, place a board or plate under the jack.
5. Extend the jack until tongue weight is off the drawbar.
6. Unplug the hydraulic lines from the tractor. Do not allow hose ends to rest on the ground.
7. Unplug the drill light cable from the tractor. If outfitted with an optional monitor, unplug monitor harness from console.
8. Remove hitch pin and safety chain from tractor drawbar.
No-Till Seeding

To get full performance from your no-till drill, you need a good understanding of coulter, opener and press wheel operation.

Coulters

A no-till coulter is mounted directly ahead of each opener. The coulters cut through heavy trash and till a small strip so the openers can penetrate the soil easily. To maintain even seeding depth, the coulters must cut below the openers.

The coulters are mounted directly on the box frame. Consequently, the cutting depth of all coulters changes as the drill is lifted and lowered.

The cutting depth of the coulters is controlled by an adjustable hydraulic depth stop. Coulters that run directly in tire tracks can be lowered individually. Refer to “Coulter Adjustments,” page xxxiv, for information on how to make these adjustments.

Openers

Each opener is mounted on the drill with parallel arms. This parallel-action mounting allows the opener to move up and down while staying in-line with a coulter. Opener double disks widen the coulter groove, making a seed bed. A seed tube mounted between the disks delivers seed to the trench. The down force needed to cut and widen the coulter groove is supplied by two springs nested in the parallel linkage. Adjusting these springs changes opener down-force. Refer to “Opener Down Pressure,” page xxxvi, for information on how to make this adjustment.

Press Wheels

Attached to the rear of each opener is one of several press-wheel options. The press wheels provide two important functions.

First, the press wheels close the furrow, gently pressing the soil over the seed. To provide consistent seed firming, the press wheels are free to move downward from their normal operating position. This system maintains pressing action even if the opener arm is lifted when the disks encounter obstructions.

Second, the press wheels provide opener depth control. The higher the press wheels run relative to the double disks, the deeper seed will be placed. To maintain a consistent depth, upward press-wheel movement is restricted by an independently adjustable stop on each opener. Refer to “Opener Seeding Depth,” page xxxvii, for information on how to make this adjustment.
Coulter Adjustments

The drill is assembled so that when the coulters are at two inches deep, the seeding depth is about one inch. This is a good baseline setting for most seeding operations. As field conditions warrant, you can change settings on the entire drill or individual coulters.

**NOTICE**

To prevent uneven seeding depth and excess opener wear, run coulters at least 1 inch below seeding depth.

Hydraulic Depth Control

Refer to Figure 12

The field-lift cylinder on the left transport wheel is equipped with a hydraulic valve that regulates coulter depth. Use the valve and knob shown to adjust coulter depth.

Turn the knob clockwise to lower the coulters. Each clockwise rotation will lower the coulters about 3/32 inches. Make depth adjustments with the implement slightly raised. After adjusting the valve, raise and lower the implement several times and recheck coulter depth.

The depth stop regulates depth on all coulters. If the ends of either box run higher or lower than the center, the field-lift system may be out of phase or have air in it, or the frame sections may not be level. Refer to “Rephasing Lift System,” page xxvii, “Bleeding Lift Hydraulics,” page xxii, or “Leveling Frame Side-to-Side,” page xxiii.
Weights

**WARNING**

Transport Hazard. Adding more than the recommend weight to the drill frame could cause a tire to blow during transport, leading to a serious road accident and personal injury. Do not add more than 2000 pounds to the drill frame.

If more weight is required for coulters to penetrate the soil, weight bracket kits are available from your Great Plains dealer. Refer to “Weight Bracket,” page lxv for part numbers and ordering information.

Refer to the charts for the results of adding weights to your drill. Always add an equal amount of weight to each frame section.

NOTE: Markers, harrow, and seed will add weight to the drill.

Coulter Springs

The coulter spring length is preset at 10 inches, giving the coulter an initial operating force of 400 pounds. This setting is adequate for many difficult no-till conditions. For lighter no-till conditions where rocks or other obstructions are a problem, you can lengthen the springs to protect the coulters from impact. In heavier conditions, shortening the spring will increase coulter force. Refer to the chart below for adjusting the coulter springs.

NOTE: Any attempt to reset the coulter spring length shorter than 9 3/4 inches may contribute to premature failure of parts and warranty will be voided. If additional force is necessary, add weights to the implement.

Individual Coulters

Refer to Figure 13

When coulters follow in tire tracks and do not give satisfactory depth, individual coulters can be lowered by loosening the mounting clamps and adjusting the coulter to the desired setting.

To retighten clamps, snug the hex-head clamp bolts (1) just until the u-bolts are tight on each side of the spring bar. Tighten nuts on u-bolts (2), then finish tightening the hex-head clamp bolts.

NOTE: There may be as much as a 1/8-inch gap between the clamp plates even when the coulter is mounted securely.

<table>
<thead>
<tr>
<th>Weight Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 3N-3010</strong></td>
</tr>
<tr>
<td>Pounds per coulter, no weights</td>
</tr>
<tr>
<td>Pounds per coulter, brackets and 1000 lbs. added</td>
</tr>
<tr>
<td>Pounds per coulter, brackets and 2000 lbs. added</td>
</tr>
</tbody>
</table>

| **Model 3N-3020** | 7.5-In. Rows | 10-In. Rows |
| Pounds per coulter, no weights | 467 | 571 |
| Pounds per coulter, brackets and 1000 lbs. added | 488 | 600 |
| Pounds per coulter, brackets and 2000 lbs. added | 509 | 628 |

<table>
<thead>
<tr>
<th>Coulter Down-Pressure Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spring Length</strong></td>
</tr>
<tr>
<td>10 1/4 in.</td>
</tr>
<tr>
<td>10 in.</td>
</tr>
<tr>
<td>9 3/4 in.</td>
</tr>
</tbody>
</table>

![Figure 13: Coulter Adjustment](image)
Opener Adjustments

Opener Down Pressure

*Refer to Figure 14*

Opener springs provide the down pressure necessary for opener disks to open a seed trench. The springs allow the openers to float down into depressions and up over obstructions.

You can adjust down pressure individually for each opener. This is useful for penetrating hard soil and planting in tire tracks.

Use enough down pressure to cut the seed trench and maintain proper soil-firming over seed. Excessive opener down force will lead to premature wear on opener components.

*Refer to Figure 15*

To adjust down pressure, use adjustment tool stored under walkboard. Position tool in hole on spring mounting plates, and pull down as shown. Move adjustment cam to the new setting.

*Refer to Figure 16*

Minimum and maximum settings are indicated by position of adjustment cam.
Opener Seeding Depth

A press wheel attached to each opener body controls seeding depth. To maintain consistent depth, the relationship between the bottom of the opener disks and press wheel is fixed upwardly.

The press wheels also close the seed trench and gently press soil over seed. To provide consistent soil firming, press wheels are free to move down from normal operating position. This maintains pressing action even if opener disks encounter obstructions or hard soil.

Refer to Figure 17

Set opener seeding depth by adjusting T-handles. To adjust, first raise openers slightly, then lift and slide T-handles on top of openers as shown. Adjust all T-handles to the same setting.

- For shallower seeding, slide T-handles forward toward drill.
- For deeper seeding, slide T-handles back away from drill.

Figure 17
Seed Depth Adjustment
Press Wheel Adjustments
(20 Series Openers Only)
An adjustable spring in the press-wheel mechanism creates the down pressure needed to close the seed trench. The amount of force needed will vary with field conditions.

Refer to Figure 18
To adjust, move adjustment handle as shown.
- For less down pressure, move handle forward toward drill.
- For more down pressure, move handle back away from drill.

NOTE: Increased press wheel spring force may require increased opener down force to maintain depth.

Refer to Figure 19

NOTE: The factory setting on the press wheel is staggered to achieve optimum residue flow. If you want to adjust press wheels from staggered to even, remove 5/8 inch bolt (1), lock washer (2) and nut (3). Reinstall spacer (4), press wheel (5) and hardware to the other hole location.
**Side Gauge Wheels 20 Series Openers**

*Refer to Figure 20*

The side gauge wheels have two, interrelated adjustments:

- angle of side gauge wheel, and
- distance between side gauge wheel and row unit disk.

*Refer to Figure 21*

Adjust side-gauge-wheel angle so the wheels contact the row unit disks between 4 and 8 o’clock at the bottom of wheel. At the same time, keep the side gauge wheels close to the opener disks so openers do not plug with soil or trash but far enough out so the disks and wheels turn freely.

*Refer to Figure 22*

To adjust side gauge wheels:

1. Raise drill slightly to remove weight from side gauge wheels.
2. Loosen hex-head bolt (1). Move wheel and arm out on o-ring bushing.
3. Loosen pivot bolt (2). Turn hex adjuster (3) so roll pin (4) is at 1 o’clock. Use this as the starting point for adjustment.
4. Move wheel arm in so side gauge wheel contacts row unit disk. Tighten hex-head bolt (1) to clamp arm around bushing and shank.
5. Check the wheel-to-disk contact. Lift wheel and arm. When let go, the wheel should fall freely.

- **If wheel does not contact disk from 4 to 8 o’clock**, move hex adjuster until wheel is angled for proper contact with disk.
- **If wheel does not fall freely**, loosen hex-head bolt (1) and slide wheel arm out just until wheel and arm move freely. Retighten hex-head bolt.
6. Keep turning hex adjuster and moving wheel arm until the wheel is adjusted properly. When satisfied, tighten pivot bolt to 110 foot-pounds. Tighten pivot bolt (2).
Seeding Rate
Adjusting the seeding rate requires the following:
• changing drive sprockets,
• setting seed-rate handle,
• positioning seed-cup doors, and
• checking seeding rate.

Drive Speed
Range Sprockets
Select the correct drive speed range sprockets for your seed by referring to “Seed Rate Charts,” beginning on page ci.

Refer to Figure 23
Loosen idler bolt (1) and remove chain. Remove retaining pins from shafts and install speed range sprockets as necessary.

NOTE: Make sure the correct sprockets have been installed in the DRIVER and DRIVEN locations as shown.

Reroute chain over sprockets and idlers as shown. Move idler into chain so chain has 1/4-inch to 1/2-inch slack in its longest span. Tighten idler and install retaining pins.
Set the same drive range sprocket combination on both sides of drill.
For correct drive type, refer to seed-rate charts beginning on page ci. The charts list drive types as 1, 2, 3 or 4.
Refer to Table 1 for correct sized sprocket for each drive type.

<table>
<thead>
<tr>
<th>Drive Type</th>
<th>Driver Sprocket</th>
<th>Driven Sprocket</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>15-tooth</td>
<td>60-tooth</td>
<td>Slowest</td>
</tr>
<tr>
<td>Type 2</td>
<td>15-tooth</td>
<td>30-tooth</td>
<td>2 times faster than type 1</td>
</tr>
<tr>
<td>Type 3</td>
<td>22-tooth</td>
<td>30-tooth</td>
<td>3 times faster than type 1</td>
</tr>
<tr>
<td>Type 4</td>
<td>30-tooth</td>
<td>25-tooth</td>
<td>5 times faster than type 1</td>
</tr>
</tbody>
</table>

Table 1
Setting Seed Rate Handle

Refer to Figure 24

There is a seed rate adjustment handle for each drill section. Position handles to the setting indicated on the seed-rate charts.

To adjust handle, loosen wing nut under handle and slide handle until indicator lines up with correct setting.

Positioning Seed Cup Doors

Refer to Figure 25

For wheat and other small seeds, move seed cup door handles to highest position. For soybeans and other large seeds, lower handles to second position. If excessive seed cracking occurs, lower handles to third position. For seed cup clean out, move handles to fourth position, wide open. Make sure all handles are in the same position before drilling.

NOTE: Do not open seed cup door to wide open position with seed in the box unless complete cleanout is desired. The door may be difficult to close off once it is opened.
Checking Volumetric Seeding Rate

The seed charts are based on cleaned seed and 12.5 x 15, rib implement transport tires and 13 x 5.00 - 6 contact drive wheel tires. Factors including foreign material, seed treatment, seed size, seed weight, field conditions and tire pressure will affect seeding rate. Set and check the seeding rate, then readjust the rate as necessary.

1. Record the weight of an empty container large enough to hold seed from three seed cups for one acre.
2. Place several pounds of seed over three seed cups on an outside end of the drill box.

Refer to Figure 26

3. Turn contact drive wheel clockwise a few turns to fill seed cups with seed and until seed drops to ground from all three openers.
4. Place a container under the three openers to gather seed as it is measured.
5. Turn contact drive wheel clockwise 420 revolutions. Check to make sure seed cups have plenty of seed covering them.
6. Weigh measured seed. Subtract initial weight of empty container. Divide by three for the amount measured by each cup, then multiply by the number of drill openers for the pounds-per-acre seeding rate.
7. If seeding rate is different than desired:
   • Double check drive range sprocket combinations.
   • Check for seed cup malfunction.
   • Check that all three rows are getting seed.
   • Adjust seed-rate handle accordingly.
   • Refer to “Troubleshooting,” page xlix.

Equations for calibrating volumetric seeding rate:

\[
\text{measured seed} - \text{empty container} \div 3 \times \text{number of openers} = \text{pounds per acre}
\]
Electric Clutch Switch Adjustment
To adjust the height at which seed is turned off, follow these steps.

Refer to Figure 27
1. Locate the height switch at center of rockshaft.
2. Lower the implement until it is at a height where seeding should start (usually just above the ground). Securely support frame at this height with jack stands or blocks.
3. Turn off the tractor and remove the key.

Refer to Figure 28
4. Loosen the cam clamp (1) on the rockshaft and turn until the switch roller (2) is just starting to make contact with the ramp surface.

Refer to Figure 29
5. Raise the implement fully and check that the switch is compressed as shown.
Marker Adjustments

Folding Speed with Needle Valves

Refer to Figure 30

A needle valve controls the folding speed of markers that are plumbed separately. The needle valve is near the rod end of the marker cylinder.

With tractor idling at a normal operating speed, adjust marker folding to a safe speed. Turn adjustment knob clockwise to reduce folding speed or counterclockwise to increase folding speed. Excessive folding speed could damage markers and void the warranty.

Folding Speed with Sequence Valve

Refer to Figure 31

If markers are tied together with a sequence valve, adjust folding speed with hex adjustment screws on the sequence-valve body. There is one adjustment screw for raising speed (1) and one for lowering speed (2). Identify adjustment screws by markings stamped in valve body.

With tractor idling at a normal operating speed, adjust marker folding to a safe speed. Turn adjustment screws clockwise to decrease folding speed and counterclockwise to increase folding speed. Excessive folding speed could damage markers and void the warranty.

After adjusting the folding speed, tighten jam nuts on hex adjustment screws to hold settings.

Marker Disk Adjustment

Changing Disk Angle

Refer to Figure 32

If mark left by marker disk is not clearly visible, adjust disk angle to make a wider mark. Loosen two 1/2 inch bolts (1) holding disk assembly (2). Rotate disk assembly as desired.
Leveling Marker Disk

If the marker disk is not square with the ground when the marker is lowered in the field, or if the marker arm tends to fold up while lowered in the field, adjust the marker mount.

*Refer to Figure 33*

To adjust, loosen 1/2-inch bolts (1) and rotate marker mount (2) until marker disk is square with the ground (3).

---

Seed-Lok Lock Up

Optional Seed-Lok firming wheels provide additional seed-to-soil contact. The wheels are spring loaded and do not require adjusting. In some wet and sticky conditions the wheels may accumulate soil.

*Refer to Figure 34*

- **NOTE**: Side gauge wheel is removed for clarity.

To lock up Seed-Lok wheels, raise drill. Rotate lock-up handle (1) 90 degrees down on top of opener body. Push up on Seed-Lok wheel (2) until wheel arm latches up.

---

**CAUTION**

*Opener disk blades may be sharp. Use caution when making adjustments in this area.*

To unlock Seed-Lok wheels, pull up lock-up handle (1). Seed-lok is spring loaded so it will snap back into place.
Marker Width

Refer to Figure 35

You will need to adjust marker width to account for your row spacing. First determine the correct marker width from the table and diagram on these pages, then adjust the marker to the correct width. Finally, check the actual marker width in the field and make further adjustments as necessary.

To adjust marker width, loosen jam nuts (1) and 1/2-inch set screws (2). Move marker disk tube (3) in or out to get the proper dimension.

To check that the marker is adjusted to the correct width, lower drill in the field and drive forward a few feet. Measure from the middle of the outside row to the mark in the ground made by the marker disk. The measurement should match those shown in the diagrams. Make further adjustments as necessary.

The diagram below shows marker width for 7 1/2-inch, 10-inch and opener spacing with all cups open.
Wider row spacing can be achieved by shutting off certain cups. The figure below shows which rows to shut off, which to leave on, and the marker width to use.
Harrow Adjustment

Harrow Frame Tube

Refer to Figure 36

The harrow setting shown has been successful in no- and minimum-till conditions. Because of different soil moisture, trash levels and trash types, you may need to reposition the tube frame or tines.

Refer to Figure 37

To adjust the frame tube. Loosen four hex nuts (1) on the u-bolts (2) and rotate the frame tube (3).

To adjust the tines, loosen four 1/2-inch hex nuts (4) on the 1/2-inch u-bolts (5) on the support bar (6). Rotate tine tubes (7) so the tines (8) are against the stop bushings (9), and are at the desired angle. Retighten hex nuts on u-bolts.

Harrow Height

Refer to Figure 38

To set harrow height adjust chain (10) by removing 3/8-inch bolt (11), and positioning chain as necessary. Reinstall bolt.
## Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planting too much</strong></td>
<td>Incorrect seed rate or drive type.</td>
<td>Check seed rate information on page ci or in the Veris section beginning on page lxvii.</td>
</tr>
<tr>
<td></td>
<td>Seed size and weight may vary.</td>
<td>Adjust seed rate handle.</td>
</tr>
<tr>
<td></td>
<td>Actual field size is different.</td>
<td>Verify field size.</td>
</tr>
<tr>
<td></td>
<td>Irregular shaped field.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incorrect tire size or air pressure.</td>
<td>Correct tire size and air pressure, page cix.</td>
</tr>
<tr>
<td></td>
<td>Seed cup door open too much.</td>
<td>Refer to page xli.</td>
</tr>
<tr>
<td><strong>Planting too little</strong></td>
<td>Incorrect seed rate or drive type.</td>
<td>Check seed rate information beginning on page ci.</td>
</tr>
<tr>
<td></td>
<td>Excessive field speed.</td>
<td>Reduce field speed.</td>
</tr>
<tr>
<td></td>
<td>Seed size and weight may vary.</td>
<td>Adjust seed rate handle.</td>
</tr>
<tr>
<td></td>
<td>Incorrect tire size or air pressure.</td>
<td>Correct tire size and air pressure, page cix.</td>
</tr>
<tr>
<td></td>
<td>Check seed level in seed box.</td>
<td>Fill seed box.</td>
</tr>
<tr>
<td></td>
<td>Actual field size is different.</td>
<td>Verify field size.</td>
</tr>
<tr>
<td></td>
<td>Excessive gaps between drill passes.</td>
<td>Adjust marker, page xlv.</td>
</tr>
<tr>
<td></td>
<td>Build up of seed treatment in seed cups.</td>
<td>Clean out seed cups.</td>
</tr>
<tr>
<td></td>
<td>Plugged opener seed tube.</td>
<td>Lift drill, expose bottom of seed tube and clean out.</td>
</tr>
<tr>
<td></td>
<td>Obstruction in seed cup from foreign matter or unclean seed.</td>
<td>Clean seed cup.</td>
</tr>
<tr>
<td></td>
<td>Thrown or worn drive chains</td>
<td>Check drive chains.</td>
</tr>
<tr>
<td></td>
<td>Worn sprockets and/or chain idlers.</td>
<td>Replace sprockets and/or chain idlers.</td>
</tr>
<tr>
<td><strong>Uneven seed spacing.</strong></td>
<td>Excessive field speed.</td>
<td>Reduce field speed.</td>
</tr>
<tr>
<td></td>
<td>Unclean seed.</td>
<td>Use clean seed.</td>
</tr>
<tr>
<td></td>
<td>Build up of seed treatment in seed cup.</td>
<td>Clean out seed cup.</td>
</tr>
<tr>
<td></td>
<td>Seed-Lok plugging.</td>
<td>Lock up Seed-Lok, page xlv.</td>
</tr>
<tr>
<td><strong>Uneven seed spacing (cont’d)</strong></td>
<td>Damaged or missing seed flap.</td>
<td>Replace seed flap.</td>
</tr>
<tr>
<td></td>
<td>Opener disks not turning.</td>
<td>See “Opener disks not turning freely” in this Troubleshooting chart.</td>
</tr>
<tr>
<td></td>
<td>Plugged opener seed tube.</td>
<td>Lift drill, expose bottom of seed tube and clean out.</td>
</tr>
<tr>
<td></td>
<td>Worn/rusted sprockets and/or chain idler.</td>
<td>Check and replace any worn/rusted sprockets or chain idlers.</td>
</tr>
<tr>
<td></td>
<td>Opener not penetrating low spots.</td>
<td>Adjust opener, see instructions beginning on page xxxvi.</td>
</tr>
<tr>
<td></td>
<td>Drive type too slow.</td>
<td>Use faster drive type and readjust seed rate handle.</td>
</tr>
<tr>
<td></td>
<td>Seed cup flutes are open too far.</td>
<td>Close flutes to a more narrow position.</td>
</tr>
<tr>
<td>Problem</td>
<td>Cause</td>
<td>Solution</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------------------------------------</td>
<td>----------------------------------------------------</td>
</tr>
<tr>
<td>Uneven seed depth</td>
<td>Excessive field speed.</td>
<td>Reduce field speed.</td>
</tr>
<tr>
<td></td>
<td>Planting conditions too wet.</td>
<td>Wait until drier weather.</td>
</tr>
<tr>
<td></td>
<td>Seed-Lok building up with dirt.</td>
<td>Lock up Seed-Lok, page xlv.</td>
</tr>
<tr>
<td></td>
<td>Damaged or missing seed flaps.</td>
<td>Replace seed flaps.</td>
</tr>
<tr>
<td></td>
<td>Partially plugged opener seed tube.</td>
<td>Lift up drill, expose bottom of seed tube and clean out.</td>
</tr>
<tr>
<td>Opener disks not turning freely.</td>
<td>Opener plugged with dirt.</td>
<td>Clean opener.</td>
</tr>
<tr>
<td></td>
<td>Planting conditions too wet.</td>
<td>Wait until drier weather.</td>
</tr>
<tr>
<td></td>
<td>Seed-Lok is plugging opener.</td>
<td>Lock up Seed-Lok, page xlv.</td>
</tr>
<tr>
<td></td>
<td>Failed disk bearings.</td>
<td>Replace disk bearings.</td>
</tr>
<tr>
<td></td>
<td>Bent or twisted opener frame.</td>
<td>Replace opener frame.</td>
</tr>
<tr>
<td></td>
<td>Partially plugged opener seed tube.</td>
<td>Lift up drill, expose bottom of seed tube and clean out.</td>
</tr>
<tr>
<td>Acremeter does not measure accurately</td>
<td>Incorrect tire size or air pressure.</td>
<td>Correct tire size or air pressure, page cix.</td>
</tr>
<tr>
<td>NOTE: Acremeter is most accurate</td>
<td>Excessive overlap or gaps between passes.</td>
<td>Avoid overlap or gaps. Adjust marker.</td>
</tr>
<tr>
<td>when seeding back and forth with</td>
<td>Soil conditions.</td>
<td>Loose soil and slippage will cause variations in acres registered.</td>
</tr>
<tr>
<td>markers with few headlands, curves and</td>
<td>Acremeter not for your width of drill.</td>
<td>Refer to drill parts manual.</td>
</tr>
<tr>
<td>pointrows.</td>
<td>Actual field size different.</td>
<td>Verify field size.</td>
</tr>
<tr>
<td>Press wheels not compacting the soil as desired.</td>
<td>Too wet or cloddy.</td>
<td>Wait until drier weather or rework ground.</td>
</tr>
<tr>
<td></td>
<td>Not enough hydraulic down pressure.</td>
<td>Increase hydraulic down pressure, see instructions beginning on page xxxviii.</td>
</tr>
<tr>
<td></td>
<td>Incorrect press wheel depth.</td>
<td>Reset press wheel depth, page xxxviii.</td>
</tr>
<tr>
<td>Excessive seed cracking.</td>
<td>Excessive field speed.</td>
<td>Reduce field speed.</td>
</tr>
<tr>
<td></td>
<td>Unclean seed.</td>
<td>Use clean seed.</td>
</tr>
<tr>
<td></td>
<td>Damaged, old or dry seed.</td>
<td>Use clean, new seed.</td>
</tr>
<tr>
<td></td>
<td>Seed cup flutes not open enough.</td>
<td>Open seed cup flutes.</td>
</tr>
<tr>
<td></td>
<td>Seed cup door handle not open enough.</td>
<td>Refer to page xli.</td>
</tr>
<tr>
<td>Drill boxes do not empty evenly.</td>
<td>Drive types not the same on all boxes.</td>
<td>Correct drive types.</td>
</tr>
<tr>
<td></td>
<td>Opener seed tube plugged.</td>
<td>Lift up drill, expose bottom of seed tube and clean out with wire.</td>
</tr>
<tr>
<td></td>
<td>Drive chains missing or damaged.</td>
<td>Replace drive chains.</td>
</tr>
<tr>
<td></td>
<td>Planting around fields vs. back-and-forth.</td>
<td>Correct planting operation.</td>
</tr>
<tr>
<td></td>
<td>Rough field conditions may move seed in the box.</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Seed cup(s) are shut off.</td>
<td>Open seed cup(s).</td>
</tr>
<tr>
<td></td>
<td>Some models do not have the same number of seed cups between each bulkhead divider. The section with more seed cups will empty sooner.</td>
<td>Verify number of seed cups in each box.</td>
</tr>
<tr>
<td>Problem</td>
<td>Cause</td>
<td>Solution</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Press wheel or openers plugging</td>
<td>Planting conditions too wet.</td>
<td>Wait until drier weather.</td>
</tr>
<tr>
<td></td>
<td>Too much hydraulic pressure on openers.</td>
<td>Reduce hydraulic down pressure on openers.</td>
</tr>
<tr>
<td></td>
<td>Backed up with drill in the ground.</td>
<td>Clean out and check for damage.</td>
</tr>
<tr>
<td></td>
<td>Failed disk bearings.</td>
<td>Replace disk bearings.</td>
</tr>
<tr>
<td></td>
<td>Disk blades worn.</td>
<td>Replace disk blades.</td>
</tr>
<tr>
<td></td>
<td>Scraper worn or damaged.</td>
<td>Replace scraper.</td>
</tr>
<tr>
<td>Seed cup sprockets locked up or seed drive shaft twisted.</td>
<td>Foreign matter lodged in seed cup sprockets.</td>
<td>Clean out seed cup sprockets.</td>
</tr>
<tr>
<td></td>
<td>Build-up of dried liquid insecticide in seed cups.</td>
<td>Remove build-up by disassembling each seed cup and scraping the foreign substance from turning surfaces.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic marker functioning improperly</td>
<td>Air or oil leaks in hose fittings or connections.</td>
<td>Check all hose fittings and connections for air or oil leaks.</td>
</tr>
<tr>
<td></td>
<td>Low tractor hydraulic oil level.</td>
<td>Check tractor hydraulic oil level.</td>
</tr>
<tr>
<td></td>
<td>Loose or missing bolts or fasteners.</td>
<td>Check all bolts and fasteners.</td>
</tr>
<tr>
<td></td>
<td>Needle valve plugged.</td>
<td>Open needle valve, cycle markers slowly and reset needle valve, refer to page xlv.</td>
</tr>
<tr>
<td></td>
<td>Needle valve(s) in sequence valve plugged.</td>
<td>Open needle valves, cycle markers slowly and reset needle valves, refer to page xlv.</td>
</tr>
<tr>
<td>Marker disk does not mark</td>
<td>Marker folding linkage does not have enough slack to allow marker disk to drop into field depressions.</td>
<td>Maximum down float should be limited by the slot at the rod end of the marker cylinder, refer to page xlv.</td>
</tr>
<tr>
<td>Drill does not fold or unfold fully</td>
<td>Use all locks.</td>
<td>Adjust fold cylinders, refer to page xxii</td>
</tr>
<tr>
<td>Drill wanders back and forth in transport</td>
<td>Use all locks.</td>
<td>Adjust fold cylinders, refer to page xxii.</td>
</tr>
</tbody>
</table>

Note: For Veris Drive monitor troubleshooting refer to page lxvis.
Proper servicing and maintenance is the key to long implement 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.

⚠️ WARNING
You may be severely injured or killed by being crushed under the falling implement. Always have transport locks in place and frame sufficiently blocked up when working on implement.

⚠️ WARNING
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 medical assistance from a doctor that is familiar with this type of injury. Foreign fluids in the tissue must be surgically removed within a few hours or gangrene will result.

1. After using drill for several hours, check all bolts to be sure they are tight.
2. Lubricate areas listed under “Lubrication”, page lvi.
3. Adjust idlers to remove excess slack from chains. Clean and use chain lube on all roller chains as needed.
Opener Maintenance

20 Series Opener Side Wheels

Refer to Figure 39

1. Lift opener side wheel off the ground. Move tire in and out to check for end play. Check for roughness in bearing by rotating wheel. If the bearings are rough, inspect and replace if necessary.

2. Check for the correct number of flat washers (1) and machine washer (8) between the side gauge wheel (2) and the wheel arm (3). There must be three flat washers (1) and one machine washer (8) between the wheel bearing and arm with the machine washer (8) next to the arm. There should be three flat washers (1) and one lock washer (9) on the outside of the wheel. When installed, the wheel should turn freely and not hit the arm at the curve. Do not add any more washers than necessary.

3. Disassemble side-gauge-wheel arm from unit. Remove bushing (4) from sleeve (5) and check bushing for wear. Replace bushing if necessary.

4. When reinstalling side gauge wheels, align tab on hex adjustment (6) with notch in bushing. Replace bolt and tighten.

5. To prevent plugging loosen clamp bolt (7) and slide arm inward to take up gap between side wheel and disk blade.


Opener Disks

Refer to Figure 40

1. On 20 Series openers, remove side gauge wheel arm and wheel assembly by removing 5/8 inch bolt (4) to access opener disks and spreaders.

2. Check disk blades for wear.

3. When reinstalling disk blades, put two shims (4) between bearing and shank on one blade and two shims under bolt. Tighten bolt. On opposite side, reinstall blade with two shims between bearing and shank and two shims under bolt. Tighten bolt.

CAUTION

Disk edges are sharp. Be careful when working in this area.

4. Check contact point between disk blades. Place a piece of paper in top gap between disk blades. Bring paper down until it stops. In lower gap place another piece of paper. Bring paper up until it stops. The distance must be between 1/2 and 1 3/4 inches. Add or remove shims as needed to get the correct contact point.
20 Series Opener Disk Spreader

*Refer to Figure 41*

1. On 20 Series openers, remove side gauge wheel arm and wheel assembly by removing 5/8 inch bolt (4) to access opener disks and spreaders.

2. With the unit raised, check blade spreader (1) for wear. Replace spreader if it is 7/16 inch wide or narrower, or if opener is plugging with dirt. To replace, remove disk blade (3). Drive out roll pins (2) and install a new spreader.

![Figure 41]

- NOTE: Disk spreaders are loose to move freely.

Seed Flap Replacement *(S/N 1022UU-)*

*Refer to Figure 42*

To replace a seed flap use a needle nose or similar tool and squeeze together the tabs, as shown. Pull plastic seed flap down out of metal bracket.

If replacing with 817-349C: Push new seed flap up through metal bracket until tabs on seed flap snap in place.

![Figure 42]

Seed Flap Replacement *(S/N 1023UU+)*

*Refer to Figure 43*

If replacing with 816-302C seed flap ① use a needle nose pliers or similar tool to grasp "T" top of flap. Pull upward to pull flap up out of metal bracket ②.

Push new seed flap ① down through metal bracket ② until flap snaps into place with "T" top resting on top of bracket.

![Figure 43]
Drive System

For proper operation and to prevent downtime and repair, keep drive chains properly adjusted and lubricated. Regularly check drive chains for excess slack and wear. Adjust idlers to remove any excess slack from chains.

 NOTE: Be sure chain is installed with the chain connector link retainer towards the centerline and the clip opening (split end) facing the opposite way of the chain travel.

Overtightening chains will reduce bearing, chain and sprocket life.

Marker Maintenance

Refer to Figure 44

The marker arm is attached to marker body with a 3/8-inch, grade 2, shear bolt. If this shear bolt breaks, replace it with a grade 2 bolt.

 Note: Failure to replace the shear bolt with a grade 2 bolt can cause marker damage.

If grease-seal cap for marker-disk-hub bearings is damaged or missing, disassemble and clean hub. Repack with grease and install a new seal or grease cap.

Storage

Store the drill where children do not play. If possible, store the drill inside for longer life.

1. Unload seed box:
   • Place tarp under drill or a bucket under each opener.
   • Use a large bucket to empty box as much as possible. For seed cup cleanout, move handle to the fourth position, see page xli.
2. Thoroughly clean seed and seed-treatment residue from boxes and seed cups.
3. Store flat and out of the weather.
4. Remove any dirt and debris that can hold moisture and cause corrosion.
5. Lubricate and adjust all roller chains.
7. Inspect drill for worn or damaged parts. Make repairs and service during the off season.
8. Use spray paint to cover scratches, chips and worn areas on the drill to protect the metal.
9. Cover with a trap if stored outside.
Lubrication

Drive Chains

Type of Lubrication: Chain Lube

Quantity = Coat thoroughly
Rockshaft to Frame Pivots

Three pivot points; one zerk per pivot point

Type of Lubrication: Grease

Quantity = Until grease emerges

Gauge Wheel Arms to Frame Pivots

Two zerks per gauge wheel arm

Type of Lubrication: Grease

Quantity = Until grease emerge
Horizontal Pivot Pins

Left and right pins; one zerk per pin

Type of Lubrication: Grease

Quantity = Until grease emerges

Vertical Pivot Pins

Left and right pins; one zerk per pin

Type of Lubrication: Grease

Quantity = Until grease emerges
Inner Fold Lug

Left and right lug; one zerk per lug

Type of Lubrication: Grease

Quantity = Fill until grease emerges

Transfer Drive Shaft

Type of Lubrication: Grease

Quantity = Until grease emerges
Coulter Arm Pivots

Grease zerk bank on each drill section

Type of Lubrication: Grease

Quantity = About five pumps per zerk

Wheel Hub Bearings

Type of Lubrication: Grease

Quantity = Repack

Seasonally
Coulter Hub Bearings

Type of Lubrication: Grease

Quantity = Repack

Marker Hinge Points

Type of Lubrication: Grease

Quantity = Until grease emerges
Marker Disk Bearings

Type of Lubrication: Grease

Quantity = Repack

20 Series Side Wheel Bushing

On both sides of each opener

Type of Lubrication: Grease

Quantity = Until grease emerges
Markers

Hydraulic markers are available. The units have a cast hub, tapered roller bearings and a bolt-on blade to leave a mark for you to follow on the next field pass. Each marker requires a hydraulic circuit for operation. A sequence valve is available so markers can be operated on the same hydraulic circuit.

For information on how to operate the markers, refer to "Marker Operation", page xxx. For information on transporting the markers, refer to "Transporting with Markers", page xxxi. For information on how to adjust the markers, refer to "Marker Adjustments", page xlv.

To order the markers, contact your Great Plains dealer.

<table>
<thead>
<tr>
<th>Marker Packages</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>3N-30 LH NO-TILL MARKER</td>
<td>113-735A</td>
</tr>
<tr>
<td>3N-30 DUAL NO-TILL MARKER</td>
<td>113-736A</td>
</tr>
</tbody>
</table>

Wheel Scraper

To order the opener wheel scraper, contact your Great Plains dealer.

<table>
<thead>
<tr>
<th>Scraper Packages</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 Series Side Wheel Scraper Kit</td>
<td>198-960A</td>
</tr>
</tbody>
</table>

Seed-Lok Firming Wheels

The optional spring-loaded Seed-Lok firming wheel presses seed directly into the bottom of the seed bed. The Seed-Lok option provides more even emergence since seeds are planted and firmed at the same depth.

To order the Seed-Lok firming wheels, contact your Great Plains dealer.

<table>
<thead>
<tr>
<th>Seed-Lok Packages</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 Series Opener Seed-Lok Assembly</td>
<td>122-251K</td>
</tr>
<tr>
<td>10 Series Opener Seed-Lok Assembly</td>
<td>122-252K</td>
</tr>
</tbody>
</table>
Harrow Attachment
The coil-tine harrow finishes no-till surfaces by leveling and distributing residue for enhanced seed emergence.
For information on how to adjust the harrow, refer to “Harrow Adjustment”, page xlviii.

To order the harrow attachment, contact your Great Plains dealer.

<table>
<thead>
<tr>
<th>Harrow Packages</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>3N-30 HARROW ASSEMBLY</td>
<td>116-208A</td>
</tr>
</tbody>
</table>

Small Seeds Option
The small-seeds attachment mounts behind the main drill box and allows you to evenly seed very fine seeds.
For information on how to adjust the seed rate, refer to “Seed Rate Charts”, page ci.
To order the small seeds attachment, contact your Great Plains dealer.

<table>
<thead>
<tr>
<th>Harrow Packages</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>3N-30 7 1/2” Small Seeds Option</td>
<td>133-210A</td>
</tr>
<tr>
<td>3N-30 10” Small Seeds Option</td>
<td>133-211A</td>
</tr>
</tbody>
</table>

Veris Drive
The Veris Drive is a precision population controller which uses a hydraulic drive to operate the seeding system.
For Information on how to operate the Veris Drive refer to the Veris Drive section starting on page lxvii.
For information on ordering the Veris Drive contact your Great Plains dealer.
Weight Bracket

**WARNING**

Transport Hazard. Adding more than the recommend weight to the drill frame could cause a tire to blow during transport, leading to a serious road accident and personal injury. Do not add more than 2000 pounds to the drill frame.

If soil conditions require more weight for coulter penetration, weight bracket kits are available. Each kit contains four weight brackets – one for each wing and two for the center section. Each bracket holds up to five, 100-pound suitcase weights commonly available through tractor dealers.

For information on how additional weights will affect seeding depth, refer to "Weights," page xxxv.

To order weight brackets, contact your Great Plains dealer.

<table>
<thead>
<tr>
<th>Weight Bracket Package</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>3N-30 WEIGHT BRACKET PKG</td>
<td>197-158A</td>
</tr>
</tbody>
</table>

Coulter Tine

To order the coulter tine, contact your Great Plains dealer.

<table>
<thead>
<tr>
<th>Coulter Tine Packages</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 1/2&quot; Coulter Tine Package</td>
<td>249-028A</td>
</tr>
<tr>
<td>10&quot; Coulter Tine Package</td>
<td>249-029A</td>
</tr>
</tbody>
</table>

Separator and Fertilizer Tube Weldment

Separator and fertilizer tube weldments are available for the application of liquid starter fertilizer.

To order the Separator and Fertilizer Tube Weldments, contact your Great Plains dealer.

<table>
<thead>
<tr>
<th>Separator and Fertilizer Tube Weldment Package</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001 and Before 10 Series Openers</td>
<td>122-257H</td>
</tr>
<tr>
<td>All 20 Series Openers</td>
<td></td>
</tr>
<tr>
<td>2002 10 Series Openers</td>
<td>122-258H</td>
</tr>
</tbody>
</table>
### Specifications and Capacities

<table>
<thead>
<tr>
<th></th>
<th>3N-3010</th>
<th>3N-3020</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Row Spacing, Inches</strong></td>
<td>7 1/2</td>
<td>10</td>
</tr>
<tr>
<td><strong>Rows Per Drill</strong></td>
<td>48</td>
<td>36</td>
</tr>
<tr>
<td><strong>Weight, Pounds</strong></td>
<td>19,150</td>
<td>18,125</td>
</tr>
<tr>
<td><strong>Working Width</strong></td>
<td>30 feet</td>
<td></td>
</tr>
<tr>
<td><strong>Transport Width</strong></td>
<td>15 feet 10 inches</td>
<td></td>
</tr>
<tr>
<td><strong>Transport Height without Markers</strong></td>
<td>6 feet 3/4 inches</td>
<td></td>
</tr>
<tr>
<td><strong>Seedbox Capacity</strong></td>
<td>2.4 bushel/foot; 72 bushels total</td>
<td></td>
</tr>
<tr>
<td><strong>Transport Tires</strong></td>
<td>12L-15, 20-ply, 8-bolt</td>
<td></td>
</tr>
<tr>
<td><strong>Gauge Wheel Tires</strong></td>
<td>11L-15, 8-ply, 6-bolt</td>
<td></td>
</tr>
<tr>
<td><strong>Contact Drive Wheel Tires</strong></td>
<td>13 x 5.00 - 6</td>
<td></td>
</tr>
<tr>
<td><strong>Tractor Requirements</strong></td>
<td>225 - 300 horsepower</td>
<td></td>
</tr>
</tbody>
</table>
Important Safety Information

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 medical assistance from a doctor that is familiar with this type of injury. Foreign fluids in the tissue must be surgically removed within a few hours or gangrene will result.

**WARNING**

Return hydraulic valve to neutral position before exiting tractor cab.

**NOTICE**

Do not weld on drill unless electronic components are removed.
### Drive Operational Requirements

<table>
<thead>
<tr>
<th>Drive Operational Requirements:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydraulic System:</strong></td>
<td>Closed center, pressure compensated or load sensed systems only</td>
</tr>
<tr>
<td></td>
<td>Drive will not operate an open-centered hydraulic system</td>
</tr>
<tr>
<td><strong>Minimum Hydraulic Pressure:</strong></td>
<td>2200 psi</td>
</tr>
<tr>
<td><strong>Maximum Hydraulic Pressure:</strong></td>
<td>3000 psi</td>
</tr>
<tr>
<td><strong>Maximum Required Flow:</strong></td>
<td></td>
</tr>
<tr>
<td>15-24'</td>
<td>8.5 gpm</td>
</tr>
<tr>
<td>30'</td>
<td>10.75 gpm</td>
</tr>
<tr>
<td><strong>Electrical System:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Voltage:</strong></td>
<td>12 Volt DC</td>
</tr>
<tr>
<td><strong>Amperage:</strong></td>
<td>4 amperes</td>
</tr>
</tbody>
</table>
Tractor Hookup

Hydraulics:
1. Connect pressure hose (P) to retraction outlet.
2. Connect motor return hose (T) to motor return port (if available) or to extension outlet.
3. Set flow rate at maximum.
4. If tractor is equipped with electro-hydraulic valves set timer to “constant” flow.

Electrical:
Power can be connected in three different manners:

**Option 1: Power Port Adapter (P/N VER-19676)**
*Refer to Figure 45*
1. Connect harness to power wire from implement.

**Option 2: Connect to the Battery:**
*Refer to Figure 46*
1. Connect female socket to power port adapter.
2. Connect red wire eyelet to 5 amp post.
3. Connect black wire eyelet to center (ground) post.

**Option 3: Connect to 12V Power Box (P/N 823-202C).**
1. Connect female socket to power port adapter.
2. Connect red wire eyelet to 5 amp post.
3. Connect black wire eyelet to center (ground) post.
Controller Menu

**KEY**
- cab console LCD screen
- Condition for progressing to next screen
- Adjust number up/down or toggle between selections using the ** Keys on cab console
- Refer to the troubleshooting section of the manual for a description of error messages.
Veris Console Monitor
Set to Main Operating Screen, in Manual Mode

On/VR key: turns drive system on. Press twice for VR mode. NOTE: Engage key must also be pressed to start drive operation.

Off key: used to shut off Console.

Function key: used in calibration mode and to program Console for VR recipes.

Up/Down arrow keys: used to change rates manually, to set calibration numbers, and VR controller options.

Engage key: press to start drive. NOTE: drive will not run unless light above key is illuminated.
Drive Calibration Number

1. Turn on Veris Console Monitor by pressing ON/VR key. Green light above ON/VR key will illuminate when power is on.
2. Adjust desired metering rate by pressing the Up/Down arrow keys. Refer to Figure 47

3. Press Function key until Calibration Number window appears. Refer to Figure 48

4. Use Up/Down arrow keys to set Calibration Number. Refer to Figure 49

NOTE: Select drive Calibration Number based on row spacing and metering wheel, from chart on page 81.
5. On the first window that appears in the Calibration Mode, the default selection is acre/ft or you may use the Up arrow key to switch to metric settings.

6. Press Function key to advance to the next window.
   Refer to Figure 50

7. Use the Up/Down arrow keys to enter the drill width.

8. Press Function key to advance to the next window.
   Refer to Figure 51

Use the Up/Down arrow keys to enter the number of rows.

9. Press Function key to advance to the next window.
   Refer to Figure 52
10. Use the Up/Down arrow keys to enter your planned planting speed.

11. Press Function key to advance to the next window.

Refer to Figure 53

- NOTE: Calibration Mode will not accept a speed more than 10 mph.

12. Use the Up/Down arrow keys to enter the amount of seed you want to measure.

13. Press Function key to advance to the next window.

Refer to Figure 54

- NOTE: For volumetric measuring, this should be at least 1/4 of a pound. For singulated metering, at least 100 seeds should be selected.

The Veris Console Monitor will display in the window the time the drive will be operating in order to meter, based on your selections, to include the amount of seed you have requested, at the calibration rate, drill width, and the number of rows you have selected.

Refer to Figure 55
NOTE: If the Veris Console Monitor reads to TIME TOO LOW or TIME TOO HIGH, you will need to increase the amount of seed that you will count or measure. For calibration accuracy, the Controller Firmware will not allow to calibrate at settings that would result in the drive rotating for less than 4 seconds or more than 255 seconds.

Refer to Figure 56

14. Press Function key to advance to the next window.

DANGER

The Drive is about to operate, meaning there is a danger of entanglement if anyone is in the drive area. Be sure to verify that no one is near the drive area, before advancing to the next step.

Refer to Figure 57

15. Set the three position toggle switch on the Electric Clutch control box to the “CAL” position.

This overrides the cam switch located on the rockshaft allowing the drives to operate while the drill is in the up position.

DANGER

The Drive is about to operate, verify the drive area is clear before advancing to the next step to prevent the danger of entanglement.

Press the Down arrow key to exit Calibration Mode if the drive area is not clear.
16. Press the Up arrow key to initiate Calibration Mode.
17. Continue to verify that the drive area is clear.

18. Press the Engage key to start drive rotation.
Refer to Figure 58

Pressing the Function key will exit the Calibration Mode.

While the meter drive is rotating, the display window shows the time remaining and the “Out” rate.
Refer to Figure 59

CAUTION

Continue to monitor drive area during drive rotation. Press the Engage key (or the Off key) to stop drive during calibration.

After the calibration meter rotation has been completed a window will appear and the user will be prompted to enter the amount collected.
19. Use the Up/Down arrow keys to enter the actual amount metered.
20. Press Function key to advance to the next window.
Refer to Figure 60
A new Calibration Number is suggested, along with the old Calibration Number.

21. Press Function key to advance to the next window. **Refer to Figure 61**

![Figure 61](image1.png)

22. Press Down arrow key if you wish to keep the old Calibration Number, perhaps to re-run the calibration procedure. Press Up arrow key to accept the new Calibration Number. **Refer to Figure 62**

![Figure 62](image2.png)

The Monitor Console window will now display the calibration number you have selected. This signals to the user has returned back to the beginning of the Calibration Mode. **Refer to Figure 63**

![Figure 63](image3.png)

To re-run the Calibration procedure, follow the steps outlined above. It is suggested that you perform the Calibration Mode at least twice. Additional replications may be needed if Target and Actual amounts vary significantly.
Speed Calibration
In order for the Controller to meter the proper amount of material, it must have an accurate field speed input. Speed be supplied by radar or by wheel pickup sensor. For the Controller to convert the pulses that it is receiving from the speed input into accurate speed, it must be calibrated for speed.

1. Press the Function key until the Calibrate Speed mode option is displayed in the window.

Refer to Figure 64

2. Press the Up arrow key to initiate new speed calibration.

The user may press the Down arrow key to restore factory default setting.

Refer to Figure 65

3. Set two flags 400’ apart (or 100 meters apart if in metric mode).
4. Drive at normal field speed.
5. Press the Engage key when the tractor passes the first flag.

Refer to Figure 66
The window will display the distance traveled.

Refer to Figure 67

Refer to Figure 68

6. Press the Engage key, for a second time, when the tractor passes the second flag to display the distance error, if any.

Refer to Figure 69

If this is the first time the unit has been calibrated, this error has the potential to be large.
Recalibrate the speed until the distance error is 5% or less; it may take several attempts before user is able to meet this safe operation standard.

7. Press the Up arrow key to recalibrate or press the Down arrow key if the distance error is 5% or less.

Refer to Figure 70

NOTE: The Speed Calibration has been successfully completed for safe operation when the error is 5% or less.
Prior to Field Operational Use

Once the calibration procedures previously detailed been followed, Console will store the calibration and rate information until new information has been entered.

1. Turn on Console by pressing ON/VR key.

   Green light above ON/VR key will illuminate when power is on.

   **NOTICE**

   If the ON/VR key is pressed twice the unit will be put in VR (Variable Rate) mode. Leave Console in manual mode.

   **NOTE:** For units with P/N 21567 skip step 3.

2. To double-check calibration before planting, follow same procedure as for mechanical ground drives as outlined in Great Plains Precision Seeding System Operator's Manual, with these differences:

   - Volumetric: use extreme caution when performing this calibration to prevent injury due to drive entanglement. Also, turn drive gauge wheel with a consistent speed of at least 30 rpm for maximum calibration accuracy.
   - Singulated: Rather than calibrating from a standing start, measure the distance as listed in the GP manual, and set two flags. Start driving far enough in advance of the first flag that your unit is operating at field speed (minimum 3 mph) during the calibration distance.

Field Operational Use

1. Turn on Console by pressing ON/VR key.

   **Refer to Figure 71**

   Green light above ON/VR key will illuminate when power is on.

   Pressing the ON/VR key twice will put the unit in VR mode. VR will appear on the screen along with the Rate that is being sent from the computer. Press ON/VR key again to toggle back to manual mode. (Mode and rate changes take effect with the release of the key).

   To change rates manually whether in manual or in VR mode, simply touch the Up/Down arrow keys. This will change the Controller to the rate you select manually. To return to VR, simply touch the ON/VR key to toggle back to VR mode.

2. Engage the hydraulic flow by pushing FORWARD on the tractor remote hydraulic lever. The remote lever must be LOCKED OPEN in this position to provide constant flow to the drive motor.
• **John Deere tractors with Sound-Gard® body:** Use lever lock clip to lock lever forward. See your tractor dealer for lock purchase and installation.

• **John Deere 7000 Series tractors:** Rotate valve detent selector to motor position to lock lever in forward position.

• **John Deere 8000 Series tractors:** Set timer to continuous. Push lever forward until detent clicks.

• **Case-IH Magnum tractors:** Lock lever forward in detent position. You may need to turn up detent pressure to its maximum setting. Do not tie hydraulic lever past detent position with a strap. See your tractor dealer for details.

• **Other tractors:** Lock lever forward in detent position. You may need to turn detent pressure to maximum or use a mechanical detent holder to hold lever forward. See your tractor dealer for proper means of providing constant flow.

3. Press Engage key to activate drive.

⚠️ Green light above Engage key will illuminate.

**NOTICE**

*NOTE: If you do not move within 10 seconds, the automatic disengagement feature will disengage the drive. To begin planting again, you must press the Engage key.*

⚠️ The Console display shows two numbers while operating: “Set” rate is the rate you tell the system to plant, and the “Out” rate is the calculated rate based on the actual rotations of the drive. The “Out” reading is monitoring the drive system; it isn’t monitoring population. It verifies that the drive system is functioning properly.

⚠️ **NOTE:** The “Out” readings will normally fluctuate within 5% of the “Set” rates. This fluctuation is evidence of the drive system compensating for minor fluctuations in ground speed.

**NOTICE**

*If “Out” rate varies from the “Set” rate by more than 20%, an audible alarm will sound.*

⚠️ If Controller is powered directly from the battery or via unswitched power port, make sure to power Console off when tractor is shut down, in order to prevent tractor battery drain.
# Calibration Table

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* Extremely high rates using these meters on this row spacing may require lower ground speed; see GP manual for additional information.

*** Field speed may affect actual rate per acre with volumetric meters. Once you enter the calibration number you must then operate the drive in the Calibration to ensure that you are obtaining the desired rate per acre. Refer to instructions for operation of the Calibration Routine.

****817-529C Flow Gate must be used in conjunction with 403-095C and 403-142D rice wheels.

NOTE: When calibrating, make sure that you choose a calibration speed that is representative of your average planting speed.
Varying Rates with Pre-set Function

The Great Plains Precision Population Controller allows you to pre-set three different rates, and then change rates on-the-go by toggling from one rate to another rate with the Up or Down arrow keys.

To enter the three pre-set rates:
1. Press Function key until Pre-set Menu screen appears.

Refer to Figure 72
2. Use Up/Down arrow keys to toggle from manual mode to pre-set mode.

3. Press Function key to move to the next pre-set screen, and the Up/Down arrow keys to set the pre-set rates.

4. When in Pre-set mode, the main operating screen shows the pre-set rate currently being applied.

Refer to Figure 73

When you are in Pre-set mode, the Up/Down arrow keys only toggle between pre-set rates.

Operating Screen using Pre-set rates.

Refer to Figure 74
GPS- Based Seeding

Settings for **FarmWorks SiteMate** used with Great Plains Precision Population Controllers - QUICK REFERENCE GUIDE

(Create a .shp recipe file in FarmWorks Site Pro, SMS 2.0, SSToolbox, or other software that will create a .shp file, and transfer it to SiteMate.)

SiteMate Settings: (version 8.12)

1. Select CONFIGURE tab. Select SETTINGS. Select VARIABLE RATE SETUP. Select NEW. Type in GP PPC. Under CONTROLLER TYPE, select Rawson from the scroll-down list. Under COMM PORT select the port number for the serial card or flash jacket port.

2. Select MAP tab. Enter DEFAULT rate. This will be the rate that SiteMate will call for if GPS signal is lost or you are outside the map area. GP Controller will continue applying rate it was set at when signal was interrupted, until signal is regained, or another rate is set manually. If power to the SiteMate is interrupted, you will need to restart the recipe to return to VR. In the CONVERSION window, enter the conversion rate as follows: if your recipe (.shp file) is written using the entire number as the desired rate, i.e. 30,000 seeds/acre on the recipe means 30,000 seeds/acre is the desired rate, enter both the Map Unit and Controller Unit as 1. If the recipe is written using a different number, i.e. 30 on the recipe means a population of 30,000, then you will need to enter the conversion multiple - in that case 1 Map Unit = 1,000 Controller Units.

3. Under the APP tab, enter the Feed Delay as 3 seconds. Enter the distance from the GPS antenna to the Great Plains Mfg, Inc meter. Enter the Swath Width of the Great Plains unit.

4. Under the CTRL tab, enter the Nominal Rate as follows: Divide the highest rate on your recipe by 1.6. This is your Nominal rate. For example, if your highest rate is 200,000 the nominal is 125,000. If your highest rate is 32, your nominal rate is 20. Enter the Step as 4%. Exit VRA Controller Setup by clicking OK button to save the settings.

5. Under FILE, Open VRT and select the Rx Map (recipe) for the field. Press the SETUP button and select the GP PPC controller option that you have set up using these Settings instructions.

6. Press GO. The Rx rate window shows the rate that is being sent to the GP Precision Population Controller. The APPLIED window shows the rate that the GP Controller is applying.
Settings for Great Plains Precision Population Controllers:

1. Connect SiteMate computer to Console using 9-pin serial cable.

Refer to Figure 75

2. Follow instructions to set Calibration Number based on row spacing and metering wheel.

3. Press Function key and go to Rawson mode. Press Function key until the Nominal Rate appears on the display. Using the Up/Down arrow keys, set the Nominal Rate to the same number as you set the PF3000. Once Nominal Rate is set, press Function key until the main operating screen appears.

4. Press On/VR key again to toggle to VR mode. VR should appear on the screen along with the Rate that is being sent from the SiteMate computer. Verify that the rate shown on the GP Controller Console is the same as the recipe sent from SiteMate. Press Engage key to activate the Precision Population Controller.

5. To change rates manually when in VR mode, simply touch the Up/Down arrow keys. This will change the Controller to the rate you select manually. To return to VR, simply touch the On/VR key to toggle back to VR mode.

Troubleshooting GPS-Based Seeding with SiteMate

1. No Rx rate appears on SiteMate
   - Has field been selected? Select VRT file.
   - Check recipe to verify that it is valid by viewing Attributes for each zone in SiteMate.
   - If recipe calls for zero rate as the default, do you have GPS signal, or are you outside of field?

2. Rx rate appears on SiteMate, but no Applied Rate
   - Make sure “Go” button on SiteMate is pressed (button should read “Stop” when recipe is being sent to GP Console).
   - you must be planting in order for Applied Rate to appear

3. Rx rate appears on SiteMate but not on GP Controller Console
   - Make sure GP Controller Console is set to VR Mode.
   - Double-check all cable connections.
   - Check Nominal rates on both the SiteMate (SiteMate Settings, Step 4), and on the GP Controller Console (GP Settings, Step 2). These must be set to the same number.

4. Rates on GP Controller Console and on SiteMate do not match
• Check Nominal rates on both the SiteMate (SiteMate Settings, Step 4), and on the GP Controller Console (GP Settings, Step 2). These must be set to the same number.
• Re-check GP calibration number with metering wheel and row spacing.
• The recipe rates from SiteMate are in 4% increments. If the two rates are within this 4% range, the units are operating normally.
• Check the Conversion number (SiteMate Settings, Step 2). If the recipe requires a target conversion number, i.e. the recipe is for 25 which means 25,000 seeds/acre, the target conversion number will be 1000. In this case the Nominal rate in SiteMate and the GP Console should be near 25,000. See SiteMate Setting, Step 4 for calculating Nominal Rate.

5. Population Monitor rate does not match GP Controller Console

• Make certain that SiteMate and GP Controller Console agree. If not, see Troubleshooting Step 4 above.
• Re-check GP calibration number with metering wheel and row spacing.
• Re-check planter monitor settings: calibration number, row spacing, number of rows, swath width, seed, etc.
• On small seeds and/or high rates, if population monitor consistently indicated a lower population than the GP Controller Console, contact monitor manufacturer for performance specs for that application.

6. GPS signal is not being received by SiteMate

• Verify that GPS serial port (which is also the docking port) is not set to PC connection only (Start/Settings/Communications/PC Connections).
• Check GPS settings in Configure/Settings/GPS settings/COM (typically COM 1, 4800 Baud, 8 data bits, Parity None, and Stop Bits 1).
• Click Data tab to view GPS details.

**Settings for Ag Leader PF3000 Monitors used with Great Plains Precision Population Controllers - QUICK REFERENCE GUIDE**

(Create a.tgt recipe file in SMS 2.0 or FarmWorks Site Pro, or other software that will create a.tgt file, and copy it to an SRAM or Flash card that is compatible with the PF 3000.)

PF3000 Settings:

1. Press SETUP key. Press SWATH key. Set swath to that of your Great Plains Precision Seeding System.
2. Press SETUP key. Press VEHICLE key. Set Primary speed sensor to GPS.

3. Press SETUP key. Press CARD key. Set the following:
   • Log Device: None.

4. Press SETUP key. Press APP RATE key. Set the following:
   • Application Control: On
   • Look Ahead: On
   • Current Target File: press Edit to view the files you have on the card; select the one you wish to use.

5. Press SETUP key. Press CONTROLLER key. Select controller as Rawson Accu-Rate. Press EDIT SETTINGS. Set the following:
   • Number of Pulses/10 Revolutions: 500
   • Nominal Rate: Divide the highest rate on your recipe by 1.6. This is your Nominal rate. For example, if your highest rate is 200,000 the nominal is 125,000. If your highest rate is 32, your nominal rate is 20.
   • Percent Rate Change: set to 4%
   • Area Count: Set to Standard
   • Stop Height: Set to 8
   • Actual Rate Recording Method: Set to Sensor
   • Controller Time Delay: Set to 4 sec
   • Application offset from GPS antenna to your Great Plains Mfg, Inc Meter
   • Serial Port: Port 3

6. Press SETUP key. Press PRODUCT key. Select product and press EDIT SETTINGS. Set the following:
   • Controller Device: Rawson Accu-Rate
   • Calibration No for Actual Rate: Set to 0
   • Actual Rate Scale Factor: Set to 1.000
   • Target Rate Units: Set to Seeds
   • Actual Rate Units: Set to Seeds
   • Target Conversion Number: If your recipe (.tgt file) is written using the entire number as the desired rate, i.e. 30,000 seeds/acre on the recipe means 30,000 seeds/acre is the desired rate, enter a 1.000. If the recipe is written using a different number, i.e. 30 on the recipe means a population of 30,000, then you will need to enter the conversion multiple - in that case 1,000.

   Target Rate Increment: Determines the increment value by which you can change the manual target rate with each press of the arrow keys.

**Settings for Great Plains Precision population Controllers:**

1. Connect PF3000 to Console using 9-pin serial cable.
2. Set Calibration Number based on row spacing and metering wheel.
3. Press Function key and go to Rawson mode. Press Function key until the Nominal Rate appears on the display. Using the Up/Down arrow keys, set the Nominal Rate to the same number as you set the PF3000 in step 5 above. Once Nominal Rate is set, press Function key until the main operating screen appears.
4. Press On/VR key again to toggle to VR mode. VR should appear on the screen along with the Rate that is being sent from the PF3000. Press Engage key to activate the Precision Population Controller.
5. To change rates manually when in VR mode, simply touch the Up/Down arrow keys. This will change the Controller to the rate you select manually. To return to VR mode, simply touch the ON/BVR key to toggle back to VR mode.

**Troubleshooting GPS-Based Seeding with PF3000**

1. No Target Rate appears on the PF3000
   - Has field been selected? Select target file (see PF3000 settings, Step 4).
   - Check recipe to verify that it is valid.
   - If recipe calls for zero rate as the default, do you have GPS signal, or are you outside of field?
2. No Actual Rate appears on PF3000
   - Actual rate cannot be logged using the PF3000 with the Great Plains Precision Population Controller.
3. Target Rate appears on PF3000 but not on GP Controller Console
   - Make sure GP Controller Console is set to VR Mode.
   - Double-check all cable connections.
   - Check Nominal Rates on both the PF3000 and on the GP Controller Console. These must be set to the same number.
4. Rates on GP Controller Console and on PF3000 do not match
   - Check Nominal Rates on both the PF3000 and on the GP Controller Console. These must be set to the same number.
   - Re-check GP calibration number with metering wheel and row spacing.
• The recipe rates from the PF3000 are in 4% increments. If the two rates are within this 4% range, the units are operating normally.
• Check the target conversion number (PF3000 Settings, Step 6). If the recipe requires a target conversion number, i.e. the recipe is for 25 which means 25,000 seeds/acre, the target conversion number will be 1000. In this case the Nominal Rate on the PF3000 and on the GP Console should be near 25,000. See PF3000 Settings, Step 5 for calculating Nominal Rate.

5. Population Monitor rate does not match GP Controller Console

• Make certain that PF3000 and GP Controller Console agree. If not, see Troubleshooting, Step 4 above.
• Re-check GP calibration number with metering wheel and row spacing.
• Re-check planter monitor settings: calibration number, row spacing, number of rows, swath width, seed, etc.
• When planting small size seeds and/or at high rates, if population monitor consistently indicates a lower population than the GP Controller Console, contact monitor manufacturer for performance specs for that application.

Maintenance
As with any hydraulic system, contamination is the most common cause of performance problems and premature wear.

NOTICE
Make a special effort to properly clean quick couplers prior to attaching the hoses to tractor:

• Filter - All fluid is filtered through the high pressure filter (P/N 18574) and it will provide protection to the hydraulic components of your drive if properly maintained. It is equipped with a pop-out indicator to alert that the replaceable element is clogged, and should be changed immediately if this situation occurs. Normal service life of the element will vary based on the precautions that you take to minimize contamination at the couplers and routine service of the tractor filtration.

Refer to Figure 76

To change the element:

a. Unscrew lower canister from filter, catching and disposing of used fluid.
6. Remove and discard element.
7. Install new element (P/N 19856)
8. Clean canister threads and lube o-ring with hydraulic fluid, then re-install.
9. Reset pop-out indicator if necessary.

Refer to Figure 77

- It is a good idea to keep a filter element on hand, and we recommend changing at a minimum on an annual basis.
- Between planting seasons, store cab console inside a relatively stable and dry environment.
- Avoid direct spray from high pressure washers on the motor encoder and the external controller box. These units are sealed from normal moisture, but high pressure could inject water into the housing.
- Keep electrical connects free from dirt and grease. It's a good idea to occasionally spray the terminals with contact cleaner to ensure proper connection.

Troubleshooting

- If the Drive will not rotate, see Troubleshooting flow chart and electronics overview.
- Check cab console.
- No power to cab console - check with voltmeter.
  1. Upper line (set) is visible but no lower line (out rate and speed) on display: move to Communication troubleshooting below.
  2. 1 or 10 amp fuse on power cable may be blown.
  3. Engage button is not on - check to see if green indicator light is on.
  4. Use Cab Console Power Tester (P/N 27857) to check power out of cab console. Install tester on round 7 pin power/com cable from cab console. Turn drive on. Green LED shows power to external controller. Red LED shows power to solenoid. If LED lights are not lit, double-check power and connections; replace cab console if needed.

- Check Communication between cab console and drive
  a. Check to see if power and communication cable (main harness) is properly connected.
  b. If no lower line on cab console appears (speed and output rate), and drive will not rotate in calibration mode, use Cable Continuity Tester (P/N 27859) to test power and communication to external controller.

WARNING

WARNING: TO PREVENT DAMAGE TO COMPONENTS, DISCONNECT POWER/COM CABLE FROM CAB CONSOLE AND EXTERNAL CONTROLLER BEFORE INSTALLING THIS TESTER. Install 4-pin test plug on end of 4-pin power/com cable before powering the Cable Continuity Tester - remove before reattaching power/com cable directly to cab console.
c. If Cable Continuity Tester shows power is getting to external controller, turn power off and remove Cable Continuity Tester and 4-pin test plug from ends of power/com cable. Reattach power/com cable to cab console and external controller.

d. If power/com cable tester shows power and communication is reaching external controller from cab console, and no lower line appears on cab console, replace chip or external controller. Call Service Department.

e. If Cable Continuity Tester (P/N 27859) isn’t available, check cable with voltmeter at connection at control module.

- Test Relay inside external controller
  a. Use Relay Output Tester (P/N 27860) to test relay inside external controller. Install tester to weather-pak solenoid connector from external controller. With tractor engine off, start drive calibration function. Auditory alarm should buzz for 1.5 seconds when drive is engaged in calibration mode. If alarm does not sound, relay or external controller may need to be replaced. Call Service Department.

- Check Hydraulics:
  a. Check to see if hydraulic lever is in detent position.
  b. Hydraulic lever is in wrong detent direction - a check valve at outlet of motor prevents reverse rotation.
  c. Make sure that both hoses are properly connected to tractor remotes.
  d. Inadequate system pressure. Place pressure gauge at filter and check reading. If system pressure is below tractor specifications, check system.

**DANGER**

_DANGER: RAPID DRIVE ROTATION MAY OCCUR AND CAUSE SERIOUS INJURY. KEEP CLEAR OF DRIVE AREA._

e. Power solenoid directly.
   ▲ Disengage hydraulics.
   ▲ Reduce flow to 30-50%.
   ▲ Power solenoid directly by connecting power weather-pak connector to solenoid weather-pak connector. If drive doesn’t rotate, Proportional Coil (P/N 19799) may be defective. Check continuity with meter, or energize with 12v power and check for magnetic pull with small screwdriver. Double-check connections on solenoid cable. If solenoid energizes but drive does not rotate when powered directly, tractor hydraulics are not properly engaged.
f. Excessive torque in drive system. Disconnect main drive chain to check for rotation under zero load. Check for a problem with the mechanical portion of drive, such as foreign material wedged in meter, frozen bearings, misaligned chains, or swelled grain in meter. Install pressure gauge at motor inlet. Pressure should be 1000-1500 psi. If pressure is above 2000 psi, significant torque problems are present.

**DANGER**

*DANGER: RAPID DRIVE ROTATION MAY OCCUR AND CAUSE SERIOUS INJURY. KEEP CLEAR OF DRIVE AREA*

- Check Speed signal (if drive rotates in calibration mode but not when planting):
  
  a. No signal from speed sensor - check connection at sensor and at drive controller.
  b. Excessive gap between wheel sensor and sensor plate - readjust to .030.
  c. Use Speed Simulator (P/N #27858) to troubleshoot speed loop. Leave tractor stationary and drive hydraulics do not need to be engaged.
  d. Test speed sensor and hall effect sensor; replace sensor if simulated speed appears on cab console.
  e. Test speed cable between speed sensor and hall effect module; replace cable if simulated speed appears on cab console.

Test hall effect module and cable to external controller; replace module and cable if simulated speed appears on cab console. If speed does not appear with speed simulator, external controller or chip may need replacement. Call Service Department.

Drive rotates but at desired speed:

- Drive (out rate) fluctuating erratically:
  
  - If indicated field speed on drive is also fluctuating erratically, troubleshoot speed signal loop.
  - If field speed is steady, check for loose set screws on motor encoder, contamination of proportional valve, or mechanical binding of chain on row unit.

- Indicated speed fluctuating erratically:
  
  a. Use speed simulator to troubleshoot speed loop. Leave tractor stationary and drive hydraulics do not need to be engaged. If steady speed between 4-10 mph appears on cab console using speed simulator, troubleshoot radar, wheel pickup sensor, hall effect module. If steady speed does not appear with speed simulator, external controller may need replacement. Call Service Department.
  b. Check radar gun angle.
  c. Check gap between wheel sensor and pickup plate.
d. Check power to system < 12 volt power will cause drive to behave erratically - often problem manifests itself in speed loop.

- Drive Shuts off while planting:
  a. If it occurs after 20 seconds of not planting, such as turning on headlands, operation is normal safety shutoff (on units with radar speed signal).
  b. Check setting of speed signal interrupter switch - reposition as necessary to keep actuator from disengaging while planting.
  c. 1.5 second delay shutting off drive - causes: chain binding, inadequate hydraulics.

- Drive will not achieve desired rate:
  a. Recheck calibration number and rerun calibration procedure if necessary.
  b. Check to make sure that your desired rate is within the range of the meter that is installed.
  c. Inadequate hydraulic flow. Adjust flow control to higher position. Check with flow meter if flow is suspect.
  d. Field speed too high. Check maximum planting rate in seed chart for rate that you are planting.
  e. Check sprocket combinations; see Assembly and Parts Manuals for the planter you are operating (30P and 40P models).
  f. Check speed shown on cab console against other speedometer - tractor, planter monitor. If drive speed is significantly higher, recalibrate speed on drive.

- Drive plants significantly higher than desired rate:
  a. Recheck calibration number and rerun calibration procedure if necessary.
  b. Ensure that you have installed the correct seed meter.
  c. Check sprocket combinations; see Assembly and Parts Manuals for the planter you are operating (30P and 40P models).
  d. Check speed shown on cab console against other speedometer - tractor, planter monitor. If drive speed is significantly higher, recalibrate speed on drive.

- Drive continues to rotate after tractor has stopped:
  a. Contamination or wear in Proportional Valve (P/N#19798). Remove and inspect. Blow out with compressed air. Check o-rings and reinstall. Replace if necessary.

- Fluid weeping from motor shaft seal:
  a. Excessive back pressure in return hose. Check quick coupler connection. Use motor control port for return if available.
Calibration Troubleshooting

- If the time to run for calibration is less than 4 seconds, the cab console will display TIME TOO LOW. Pressing the FUNCTION key will bring up the ENTER TARGET AMOUNT screen. The target should be raised to increase the calibration time. If the time is greater than 255 seconds, the cab console will display TIME TOO HIGH. Pressing the FUNCTION key will bring up the ENTER TARGET AMOUNT screen. The target should be lowered to decrease the calibration time.

- While rate calibration is running, one of four error messages may be displayed:

<table>
<thead>
<tr>
<th>Message</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMM TIMEOUT</td>
<td>Power to or communication with the external controller was interrupted during calibration.</td>
<td>Check power and communication connections from the cab console to the external controller and rerun calibration.</td>
</tr>
<tr>
<td>TIME OVER LIMIT</td>
<td>The external controller ran too long in calibration.</td>
<td>Rerun calibration. If the same message appears, call technical support.</td>
</tr>
<tr>
<td>USER TERMINATED</td>
<td>The engage key was pressed during calibration.</td>
<td>Rerun calibration.</td>
</tr>
<tr>
<td>CALIBRATE ERROR</td>
<td>The drive did not turn when calibration began.</td>
<td>Check encoder cable and connection, solenoid cable and connection, and hydraulic lever position.</td>
</tr>
</tbody>
</table>

Press Function key will exit rate calibration from these error screens.
DRIVE ELECTRONICS TROUBLESHOOTING OVERVIEW

KEY:
- SOLID LINES -- DRIVE ELECTRONICS CABLES
- DASHED LINES -- TROUBLESHOOTING ITEMS

[Diagram of the drive electronics with labels and connections]

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Table of Contents Index

Great Plains | 100
Seed Rate Charts

Use the seed rate charts beginning on page 64 to determine
• Range sprocket combination
• Maximum planting speed

Note: For your row spacing and desired seeding rate. Refer to "Seeding Rate," page xl, for more information on setting and checking and seeding rate.
## Seed Rate Charts

(Pounds per acre)

| Setting number | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
|----------------|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Alfalfa        | 7.5" | 2 | 4 | 7 | 10 | 12 | 15 | 18 | 22 | 25 | 29 | 33 | 36 | 40 | 43 | 47 | 51 | 55 | 59 | 63 | 65 | 67 |
| Drive Type 1   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 2   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 3   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Buck Wheat     | 7.5" | 7 | 17 | 31 | 42 | 58 | 72 | 88 | 105 | 121 | 139 | 155 | 170 | 188 | 204 | 222 | 240 | 260 | 279 | 297 | 301 | 306 |
| Drive Type 1   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 2   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 3   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Flax or Su-    | 7.5" | 0 | 3 | 7 | 9 | 11 | 14 | 17 | 20 | 23 | 26 | 29 | 32 | 34 | 37 | 40 | 43 | 47 | 50 | 54 | 55 | 57 |
| dansian        |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 1   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 2   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 3   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Millet         | 7.5" | 1 | 4 | 7 | 9 | 13 | 16 | 19 | 22 | 25 | 29 | 32 | 35 | 39 | 42 | 46 | 49 | 53 | 57 | 61 | 62 | 63 |
| Drive Type 1   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 2   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 3   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Oats           | 7.5" | 0 | 4 | 10 | 14 | 19 | 25 | 31 | 37 | 44 | 51 | 58 | 64 | 70 | 77 | 84 | 90 | 97 | 104 | 111 | 112 | 112 |
| Drive Type 3   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 1   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Peas           | 7.5" | 0 | 0 | 15 | 27 | 42 | 55 | 67 | 82 | 95 | 110 | 123 | 136 | 149 | 161 | 175 | 188 | 201 | 213 | 225 | 226 | 227 |
| Drive Type 3   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 1   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Pinto Bean     | 7.5" | 0 | 0 | 7 | 10 | 14 | 19 | 24 | 28 | 33 | 38 | 42 | 47 | 51 | 55 | 60 | 65 | 68 | 73 | 77 | 77 | 77 |
| Drive Type 1   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 2   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |
| Drive Type 3   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 10" |

*Based on 60#bu*
# Seed Rate Charts

(Pounds per acre)

<table>
<thead>
<tr>
<th>Setting number</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
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<th>45</th>
<th>50</th>
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<th>75</th>
<th>80</th>
<th>85</th>
<th>90</th>
<th>95</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rice</strong> Short Grain Drive Type 3 (Based on 43#/bu)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Setting number</strong></td>
<td><strong>Spacing</strong></td>
<td>7.5^*</td>
<td>2</td>
<td>9</td>
<td>14</td>
<td>23</td>
<td>31</td>
<td>37</td>
<td>44</td>
<td>51</td>
<td>59</td>
<td>67</td>
<td>77</td>
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(Pounds per acre)

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<td>7.5&quot;</td>
<td>1</td>
<td>2.25</td>
<td>35</td>
<td>5</td>
<td>6.5</td>
<td>8</td>
<td>9.5</td>
<td>10.5</td>
<td>12</td>
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<tr>
<td></td>
<td>10&quot;</td>
<td>--</td>
<td>1.75</td>
<td>2.5</td>
<td>3.5</td>
<td>4.5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td><strong>German Millet</strong>&lt;br&gt;Row Space</td>
<td>7.5&quot;</td>
<td>2.25</td>
<td>4.5</td>
<td>8.5</td>
<td>13</td>
<td>16.5</td>
<td>19.5</td>
<td>24</td>
<td>28.5</td>
<td>33</td>
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<tr>
<td></td>
<td>10&quot;</td>
<td>1.75</td>
<td>3.5</td>
<td>6</td>
<td>10</td>
<td>12</td>
<td>14.5</td>
<td>18</td>
<td>21</td>
<td>25</td>
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<tr>
<td><strong>Sudan Grass</strong>&lt;br&gt;Row Space</td>
<td>7.5&quot;</td>
<td>2.25</td>
<td>4.5</td>
<td>8.5</td>
<td>13</td>
<td>16.5</td>
<td>18</td>
<td>25</td>
<td>29.5</td>
<td>34.5</td>
</tr>
<tr>
<td></td>
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<td>.175</td>
<td>3.5</td>
<td>6</td>
<td>10</td>
<td>12</td>
<td>15.5</td>
<td>19</td>
<td>22</td>
<td>26</td>
</tr>
</tbody>
</table>
Small Seeds Attachment

To set and calibrate the seeding rate on the optional small seeds attachment, follow these steps.

1. Set the seed-rate handle on the small seeds attachment as indicated by the Small Seeds Rate Chart, this page.
2. Set the range sprockets on both sides of the drill to 15 driver and 60 driven.
Checking Volumetric Seeding Rate

The seed charts are based on cleaned seed and 11L x 15 rib implement tires and 13 x 5.00-6 contact drive wheel tires. Factors including foreign material, seed treatment, seed size, seed weight, field conditions and tire pressure will affect seeding rate. Set and check the seeding rate, then readjust the rate as necessary.

1. Record the weight of an empty container large enough to hold seed measured from three cups for one acre.
2. Place several pounds of seed over three seed cups on an outside end of the small seeds box. Raise drill off the ground.
3. Remove hose ends from the openers of the three seed cups being measured.
4. Turn contact wheel clockwise a few turns to fill cups with seed and until seed drops to ground from all three hoses.
5. Place a container under the three hoses to gather seed as it is measured.
6. Turn contact wheel clockwise 420 revolutions. Check in box to make sure seed cups have plenty of seed covering them.
7. Weigh measured seed. Subtract initial weight of empty container. Divide by three for the amount measured by each cup, then multiply by the number of drill openers for the pounds-per-acre seeding rate.
8. If seeding rate is different than desired:
   - Double check drive range sprocket combinations.
   - Check to be sure all three seed cups are covered with seed.
   - Adjust seed-rate handle accordingly.
9. When finished reconnect seed hoses to openers.

Equations for calibrating volumetric seeding rate:

\[
\frac{\text{measured seed} - \text{empty container}}{3 \times \text{(number of cups measured)}} = \text{pounds per cup}
\]

\[
\text{pounds per cup} \times \text{number of openers} = \text{pounds per acre}
\]
## Torque Values Chart

<table>
<thead>
<tr>
<th>Bolt Size (Inches)</th>
<th>Bolt Head Identification</th>
<th>Bolt Size (Metric)</th>
<th>Bolt Head Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grade 2</td>
<td>Grade 5</td>
<td>Grade 8</td>
</tr>
<tr>
<td></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>6.5</td>
<td>13</td>
</tr>
<tr>
<td>5/16 - 18</td>
<td>15</td>
<td>11</td>
<td>24</td>
</tr>
<tr>
<td>5/16 - 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>22</td>
<td>47</td>
</tr>
<tr>
<td>7/16 - 14</td>
<td>43</td>
<td>32</td>
<td>67</td>
</tr>
<tr>
<td>7/16 - 20</td>
<td>49</td>
<td>36</td>
<td>75</td>
</tr>
<tr>
<td>1/2 - 13</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>3/4 - 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>7/8 - 9</td>
<td>225</td>
<td>165</td>
<td>585</td>
</tr>
<tr>
<td>7/8 - 14</td>
<td>250</td>
<td>185</td>
<td>640</td>
</tr>
<tr>
<td>1 - 8</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>1/16 - 9</td>
<td>480</td>
<td>355</td>
<td>1080</td>
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<tr>
<td>1/16 - 12</td>
<td>540</td>
<td>395</td>
<td>1210</td>
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<tr>
<td>1/4 - 7</td>
<td>680</td>
<td>500</td>
<td>1520</td>
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<tr>
<td>1/4 - 12</td>
<td>750</td>
<td>555</td>
<td>1680</td>
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<tr>
<td>1/3 - 8</td>
<td>890</td>
<td>655</td>
<td>1990</td>
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<td>1/3 - 12</td>
<td>1010</td>
<td>745</td>
<td>2270</td>
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<tr>
<td>1/2 - 6</td>
<td>1180</td>
<td>870</td>
<td>2640</td>
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<tr>
<td>1 1/2 - 12</td>
<td>1330</td>
<td>980</td>
<td>2970</td>
</tr>
</tbody>
</table>

1 in-tpi = nominal thread diameter in inches-threads per inch  
2 N·m = newton-meters  
3 ft·lb = foot pounds  
4 mm x pitch = nominal thread diameter in millimeters x thread pitch  

Torque tolerance + 0%, -15% of torquing values. Unless otherwise specified use torque values listed above.

TP-71244
Hydraulic Schematic
Tire Inflation Chart

<table>
<thead>
<tr>
<th>Tire Size</th>
<th>Inflation PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 x 5.00 - 6</td>
<td>40</td>
</tr>
<tr>
<td>9.0 x 22.5 10-Ply Highway Service 70</td>
<td>70</td>
</tr>
<tr>
<td>9.0 x 24 8-Ply Rib Implement</td>
<td>40</td>
</tr>
<tr>
<td>9.5L x 15 6-Ply Rib Implement</td>
<td>32</td>
</tr>
<tr>
<td>9.5L x 15 8-Ply Rib Implement</td>
<td>44</td>
</tr>
<tr>
<td>9.5L x 15 12-Ply Rib Implement</td>
<td>60</td>
</tr>
<tr>
<td>265/70B16.5 NHS Skid Steer</td>
<td>60</td>
</tr>
<tr>
<td>11L x 15 6-Ply Rib Implement</td>
<td>28</td>
</tr>
<tr>
<td>11L x 15 8-Ply Rib Implement</td>
<td>36</td>
</tr>
<tr>
<td>11L x 15 12-Ply Rib Implement</td>
<td>52</td>
</tr>
<tr>
<td>12.5L x 15 8-Ply Rib Implement</td>
<td>36</td>
</tr>
<tr>
<td>12.5L x 15 20-Ply Rib Implement</td>
<td>90</td>
</tr>
<tr>
<td>16.5L x 16.1 10-Ply Rib Implement</td>
<td>36</td>
</tr>
<tr>
<td>395/55B 16.5 NHS Skid Steer</td>
<td>60</td>
</tr>
</tbody>
</table>

NOTE: All tires are warranted by the original manufacturer of the tire. Tire warranty information can be found in the brochures included with your Operator’s and Parts Manuals or online at the manufacturer’s websites. For service assistance or information, contact your nearest Authorized Farm Tire Retailer.

<table>
<thead>
<tr>
<th>Tire Manufacturer</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titan</td>
<td><a href="http://www.titan-intl.com">www.titan-intl.com</a></td>
</tr>
<tr>
<td>Goodyear</td>
<td><a href="http://www.goodyearag.com">www.goodyearag.com</a></td>
</tr>
<tr>
<td>Firestone</td>
<td><a href="http://www.firestoneag.com">www.firestoneag.com</a></td>
</tr>
</tbody>
</table>
Warranty

Great Plains (a division of Great Plains Manufacturing, Inc.) warrants to the original purchaser that this Great Plains unit will be free from defects in material and workmanship for a period of one year from the first use date when used as intended and under normal service and conditions for personal use; ninety days for custom/commercial or rental use. This Warranty is limited to the replacement of any defective part by Great Plains and the installation by the dealer of any such replacement part. 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 abuse or misuse of the equipment, failures occurring as a result of accidental damage or acts of God, 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), repeat repair due to improper diagnosis or repair by the dealer, temporary repairs, service calls 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 is used in 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 express 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 the unit is registered with Great Plains within 10 days from the date of the original purchase.
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