



# OPERATOR'S MANUAL

**9s Series**  
**VRT AIR CART**



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# Section 1: Safety

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# Safety

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## SAFETY-ALERT SYMBOL



Watch for this symbol. It identifies potential hazards to health or personal safety. It means:

ATTENTION - BE ALERT.  
Your Safety is involved.

Familiarize yourself with the location of all decals. Read them carefully to understand the safe operation of your machine.

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## Signal Words

The words **DANGER**, **WARNING** or **CAUTION** are used with the safety alert symbol. Learn to recognize the safety alerts, and follow the recommended precautions and safe practices.

Three words are used in conjunction with the safety-alert symbol:



**DANGER**

Indicates an imminently hazardous situation that, if not avoided, will result in **DEATH OR SERIOUS INJURY**.



**WARNING**

Indicates a potentially hazardous situation that, if not avoided, could result in **DEATH OR SERIOUS INJURY**.



**CAUTION**

Indicates a potentially hazardous situation that, if not avoided, may result in **MINOR OR MODERATE INJURY**.

Replace any **DANGER**, **WARNING**, **CAUTION** or instructional decal that is not readable or is missing. The location and part number of these decals is identified later in this section of the manual.

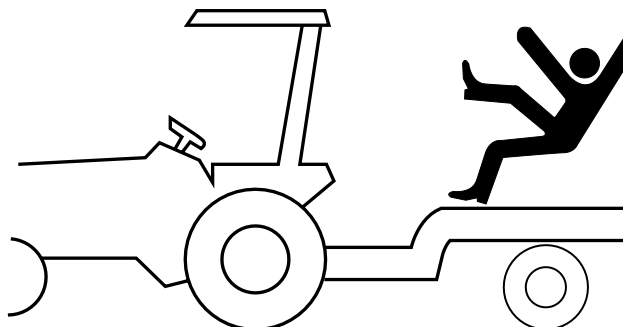
The words **Important** and **Note** are not related to personal safety but are used to give additional information and tips for operating or servicing this equipment.

**IMPORTANT:** Identifies special instructions or procedures which, if not strictly observed could result in damage to, or destruction of the machine, process or its surroundings.

**NOTE:** Indicates points of particular interest for more efficient and convenient repair or operation.

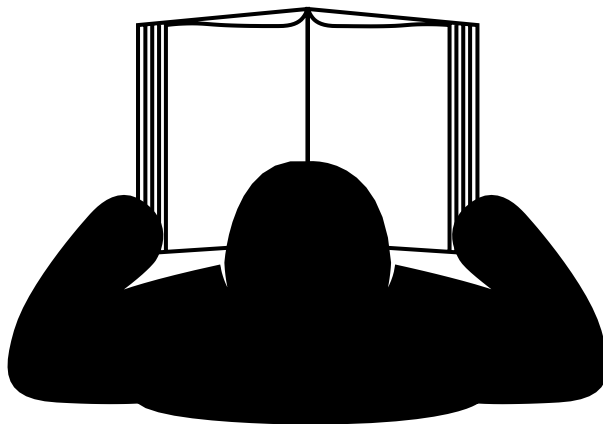
## General Operation

- **DO NOT RIDE!!** Do not allow riders on the implement when in motion.
- Do not allow extra riders in the tractor unless an instructor seat and seat belt are available.
- **Check behind** when backing up.
- **Reduce speed** when working in hilly terrain.
- Never allow anyone within the immediate area when operating machinery.
- **Keep all shields in place**, replace them if removed for service work.
- Always lock auger attachment in raised position.
- Keep hands clear of tank opening when closing lid. Keep lid seal clean to ensure proper sealing.
- **Do Not enter tank unless another person is present and the tractor engine has been shut off.**



## Tractor Operation

- Be aware of the correct tractor operating procedures, when working with implements.
- Review tractor operator's manual.
- Secure hitch pin with a retainer and lock drawbar in centre position.



# Safety

## Chemicals

- **Use extreme care** when cleaning, filling or making adjustments.
- **Always read** granular chemical or treated seed manufacturer's warning labels carefully and remember them.
- Wear close fitting clothing and appropriate personal protective equipment for the job as specified by the chemical and/or seed manufacturer.
- **Always wear** safety goggles, breathing apparatus and gloves when handling with granular chemical or treated seed.
- **Do not feed** any treated seed to livestock. Treated seed is poisonous and may cause harm to persons or livestock.
- **Wash exposed skin immediately** - do not leave chemicals on your skin.
- **Properly store** chemicals in original containers with labels intact per the manufacturer's instructions.
- Always follow the manufacturer's operating instructions and warning labels when operating an ammonia tank with the equipment.
- **Do Not enter tank unless another person is present and the tractor engine has been shut off.**



## Danger

**Failure to comply may result in death or serious injury.**

Read Operator's Manual and decals on **Ammonia** tank before operating Air Drill.  
Become familiar with all warnings, instructions, and controls.

**Always** wear gloves and goggles when transferring or handling ammonia.

**Always** stay clear of hose and valve openings.

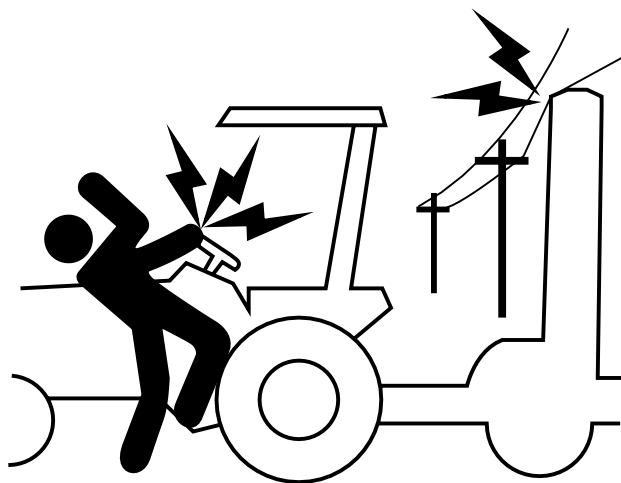
**Always** be sure pressure is relieved before disconnecting hoses or parts.

**Always** secure connecting parts and safety chains before towing ammonia trailer.

**Always** have ample water available in case of exposure to ammonia liquid or gases.

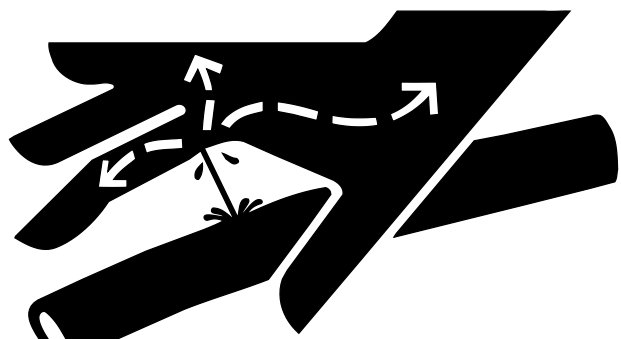
## Transporting

- **Be aware** of the height, length and width of implement. Make turns carefully and be aware of obstacles and overhead electrical lines.
- Empty tanks before transporting. Do Not Exceed 20 M.P.H. (32 kph) with an empty air cart.
- Use an agricultural tractor that is large enough with sufficient braking capacity so that the weight of the loaded equipment towed does not exceed 1.5 times the weight of the tractor.
- Use flashing amber warning lights, turn signals and SMV emblems when on public roads.
- Do not transport in poor visibility.
- The slow moving vehicle (SMV) emblem and reflectors must be secured and be visible on the machine for transport.
- Avoid soft surfaces, the additional wing weight on the centre wheels could cause the machine to sink.
- Ensure safety chain is attached correctly to the towing vehicle and the hitch of the air cart.
- Check that wings are firmly seated in transport wing stops, and lock pins installed.
- Secure transport locks on depth control cylinders.
- Be familiar with and adhere to local laws.



## Hydraulics

- **Do not** search for high pressure hydraulic leaks without hand and face protection. A tiny, almost invisible leak can penetrate skin, thereby requiring immediate medical attention.
- Use cardboard or wood to detect leaks - never your hands.
- Double check that all is clear before operating hydraulics.
- **Never** remove hydraulic hoses or ends with machine elevated. Relieve hydraulic pressure before disconnecting hydraulic hoses or ends.
- Maintain proper hydraulic fluid levels.
- Keep all connectors clean for positive connections.
- Ensure all fittings and hoses are in good condition.
- Do not stand under wings.

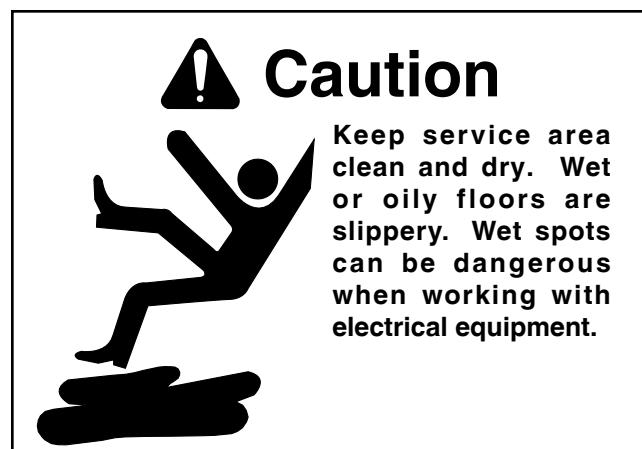
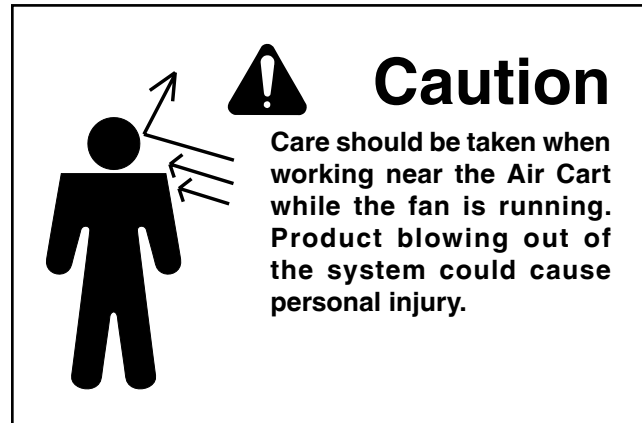


# Safety

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## Maintenance

- **Shut tractor engine off** before making any adjustments or lubricating the machine.
- **Block** machine securely to prevent any movement during servicing.
- Wear close fitting clothing and appropriate personal protective equipment for the job.
- **Always wear** safety goggles, breathing apparatus and gloves when working on seeder filled with granular chemical or treated seed per the manufacture's instructions.
- Do not modify the machine.



## Storage

- Store implement away from areas of main activity.
- Level implement and block up securely to relieve pressure on jack.
- Do not allow children to play on or around implement.

## Safety Signs

### Transmission Side

#### Tow Behind Shown



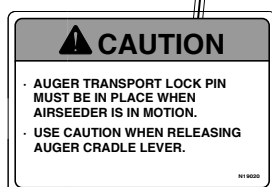
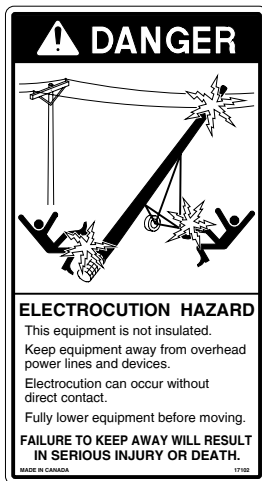
**Note:** The Transmission Chain Guards are not shown in order to show Safety Signs. Transmission Chain Guards must be in place before operation of machine.

# Safety

## Safety Signs - Continued

### Auger Side

#### Tow Behind Shown



## Safety Signs - Continued

### Fan

#### Tow Behind Shown



# Safety

## Lighting and Marking

MORRIS recommends the use of the correct lighting and marking to meet the ASAE standard for roadway travel. Be familiar with, and adhere to, local laws.

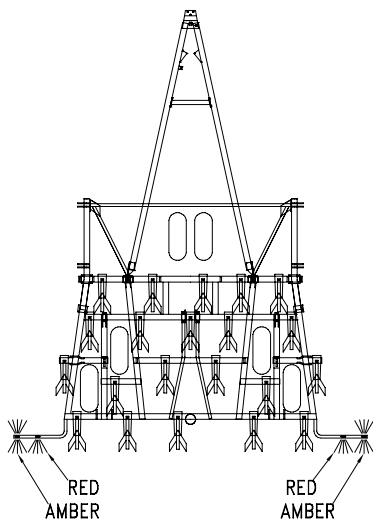
Amber warning and red tail lights secured on the machine promote correct transportation of this implement.

**Note: Always replace missing or damaged lights and/or connectors.**

Amber warning and red tail lights must be mounted to the rear of the implement and be visible from front and rear. The lights must be within 16 inches (41 cm) of the extremities of the machine and at least 39 inches (99 cm) but not over 10 feet (3 m) above ground level.

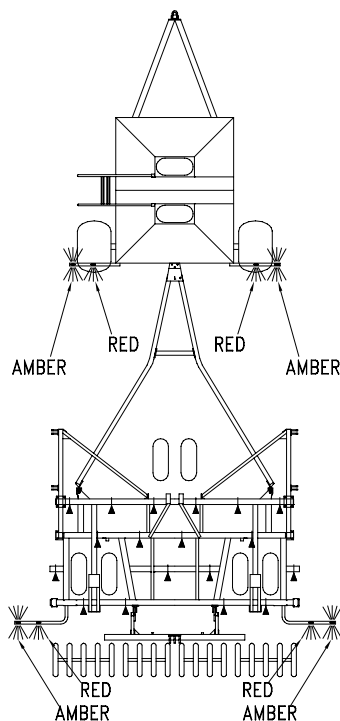
**Note: Always replace missing or damage front, side, rear reflectors and SMV emblem.**

**Tillage Unit**



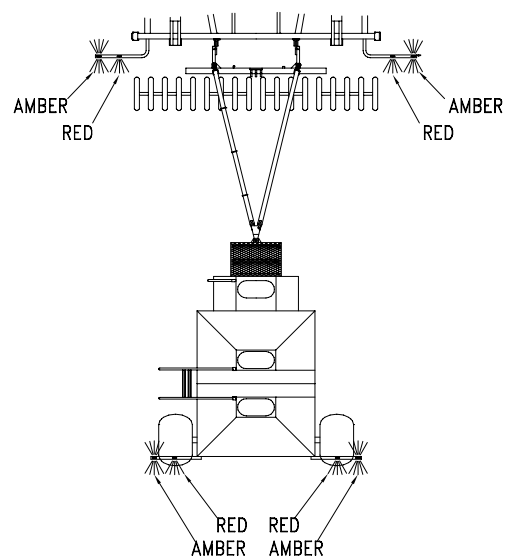
**Seeding Unit**

**Tow Between**



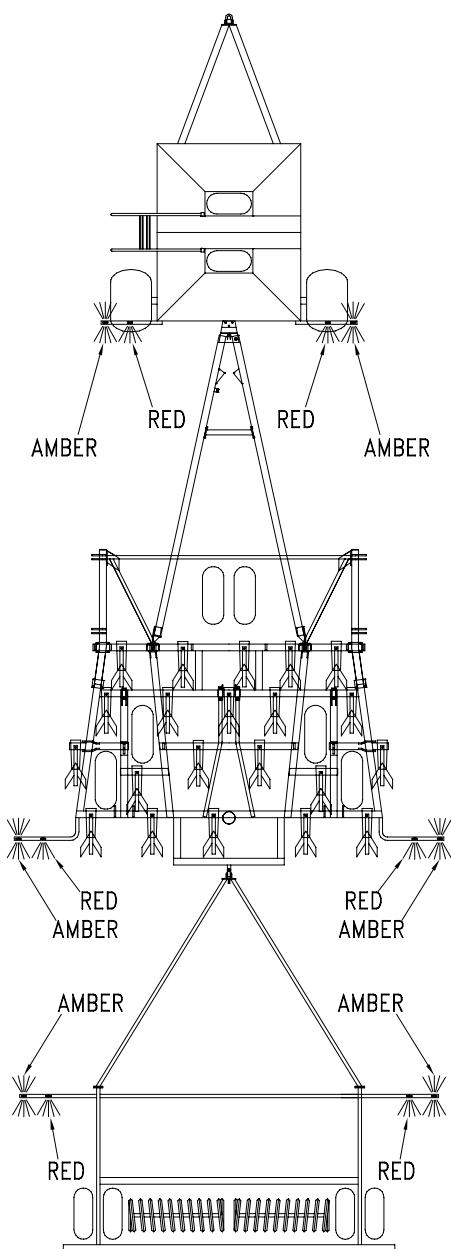
**Seeding Unit**

**Tow Behind**

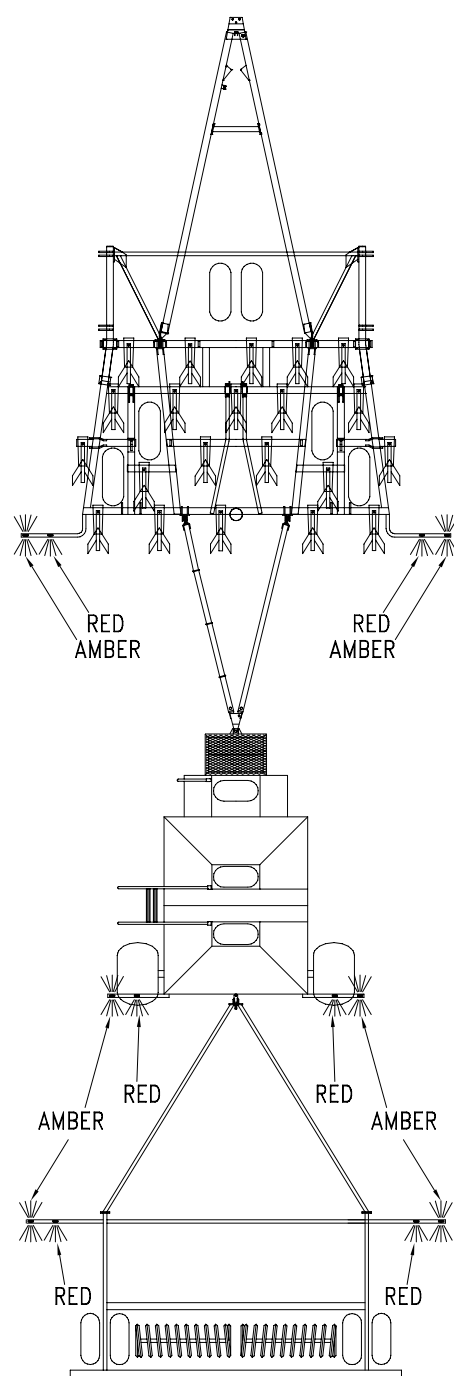


## Lighting and Marking - Continued

**Seeding Unit - Tow Between  
with Packer Bar**



**Seeding Unit - Tow Behind  
with Packer Bar**



# Safety

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Notes

# Section 2: Specifications

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# Specifications

## 9240s Specifications and Options

Model	9240	9240
Configuration	<b>Tow Behind</b>	<b>Tow Between</b>
Length - with auger	25' 8" (7.82 m)	26' 10" (8.18m)
Height	11' 4" (3.45 m)	11' 4" (3.45 m)
Width	12' (3.66 m)	12' (3.66 m)
Weight (Hydraulic Drive)	7,315 lbs (3,325 kg)	6,825 lbs (3,071 kg)
Safety Lights	Standard	Standard
Safety Chain	Standard	Standard
Rear Tow Hitch	Optional	Standard
Tank Capacity    - Tank 1 - Tank 2 - Tank 3 - Total	95 bu (3,460 l)	95 bu (3,460 l)
	145 bu (5,270 l)	145 bu (5,270 l)
	Optional 40 cu.ft. (1,129 l)	Optional 40 cu.ft. (1,129 l)
	<b>240 bu (8,730 l)</b>	<b>240 bu (8,730 l)</b>
Tank Screens	Optional	
Tank Access Ladder - Right Hand Side	Standard	
Fan Impeller Diameter	17" (43 cm) - Up to 5,000 r.p.m.	
Hydraulic Drive (Closed Centre or Closed Centre Load Sensing systems required) Hydraulic requirements for Air Cart only at Rated Fan Speed.	12cc - piston type orbit motor 15.5 U.S. gal./min. (59 l/min) at 2,100 p.s.i. (14,469 kpa) VRT requires an additional 5.5 U.S. gal/min (21 l/min)	
Loading Auger	Standard (8" Dia x 20 ft) (20.32 cm Dia x 609.6 cm)	
Tires        - Standard (Front)  - Standard (Rear)  - Optional (Front) - Optional (Rear)	(2) 21.5 x 16.1 AWT - 10 ply rating Distance Center-Center 38" (97 cm) Optional 3M Axles Center-Center 118" (3 m)	
	(2) 23.1 x 26 AWT - 12 ply rating Distance Center-Center 121" (307cm) Optional 3M Axles Center-Center 118" (3 m)	
	(2) 21.5 x 16.1 Rice - 12 ply rating	
	(2) 23.1 x 26 Rice- 10 ply rating	
3 Meter Axles	Optional	
Metering    - Ground Driven - Variable Rate (VRT) - GPS Compatible VRT	Standard	
	Optional	
	Optional	
Meter Shut Off	Electric	
Number Secondary Runs - Single Shoot	21 to 80	
Number Secondary Runs - Double Shoot	42 to 160	
Primary Hose - Diameter	2 1/2" (6.4 cm)	
Secondary Hose - Diameter	Standard - 15/16" (2.4 cm) Optional - 1 1/8" (2.8 cm)	
Frame - Trussed	4" x 8" (10 cm x 20 cm) tubing	
Easy Clean Out System	Standard	
<b>Meter Drive Options</b> - Second Clutch (For spot fertilizing on the go)	Standard	
<b>Monitor</b> (Shaft Motion (3), Bin Level (3), Fan Speed, Acre Tally, Ground Speed)	Standard Optional Seed Flow	
Work Switch (Mounted to Seeding Machine)	Optional	

# Specifications

9252s Specifications and Options		
Model	9252	9252
Configuration	Tow Behind	Tow Between
Length - with auger	25' 8" (7.82 m)	26' 10" (8.18m)
Height	11' 4" (3.45 m)	11' 4" (3.45 m)
Width	12' (3.66 m)	12' (3.66 m)
Weight (Hydraulic Drive)	8,828 lbs. (4,013 kg)	8,348 lbs. (3,795 kg)
Safety Lights	Standard	Standard
Safety Chain	Standard	Standard
Rear Tow Hitch	Optional	Standard
Tank Capacity    - Tank 1 - Tank 2 - Tank 3 - Total	71.3 bu (2580 l)	71.3 bu (2580 l)
	71.3 bu (2580 l)	71.3 bu (2580 l)
	109 bu (3,970 l)	109 bu (3,970 l)
	<b>252 bu (9,130 l)</b>	<b>252 bu (9,130 l)</b>
Tank Screens	Optional	
Tank Access Ladder - Right Hand Side	Standard	
Fan Impeller Diameter	17" (43 cm) - Up to 5,000 r.p.m.	
Hydraulic Drive (Closed Centre or Closed Centre Load Sensing systems required) Hydraulic requirements for Air Cart only at Rated Fan Speed.	12cc - piston type orbit motor 15.5 U.S. gal./min. (59 l/min) at 2,100 p.s.i. (14,469 kpa) VRT requires an additional 5.5 U.S. gal/min (21 l/min)	
Loading Auger	Standard (7" Dia x 18.5 ft) (18 cm Dia x 564 cm)	
Tires        - Standard (Front)  - Standard (Rear)  - Optional (Front) - Optional (Rear)	(2) 21.5 x 16.1 AWT - 10 ply rating Distance Center-Center 38" (97 cm) Optional 3M Axles Center-Center 118" (3 m)	
	(2) 23.1 x 26 AWT - 12 ply rating Distance Center-Center 121" (307cm) Optional 3M Axles Center-Center 118" (3 m)	
	(2) 21.5 x 16.1 Rice - 12 ply rating	
	(2) 23.1 x 26 Rice- 10 ply rating	
3 Meter Axles	Optional	
Metering    - Ground Driven - Variable Rate (VRT) - GPS Compatible VRT	Standard	
	Optional	
	Optional	
Meter Shut Off	Electric	
Number Secondary Runs - Single Shoot	21 to 80	
Number Secondary Runs - Double Shoot	42 to 160	
Primary Hose - Diameter	2 1/2" (6.4 cm)	
Secondary Hose - Diameter	Standard - 15/16" (2.4 cm) Optional - 1 1/8" (2.8 cm)	
Frame - Trussed	4" x 8" (10 cm x 20 cm) tubing	
Easy Clean Out System	Standard	
<b>Meter Drive Options</b> - Second Clutch (For spot fertilizing on the go)	Standard	
<b>Monitor</b> (Shaft Motion (3), Bin Level (3), Fan Speed, Acre Tally, Ground Speed)	Standard Optional Seed Flow	
Work Switch (Mounted to Seeding Machine)	Optional	

# Specifications

## 9300s Specifications and Options

Model	9300	9300
Configuration	<b>Tow Behind</b>	<b>Tow Between</b>
Length - with auger	25' 8" (7.82 m)	26' 10" (8.18m)
Height	12' (3.66 m)	12' (3.66 m)
Width	12' (3.66 m)	12' (3.66 m)
Weight (Hydraulic Drive)	7,770 lbs. (3,479 kg)	7,325 lbs. (3,296 kg)
Safety Lights	Standard	Standard
Safety Chain	Standard	Standard
Rear Tow Hitch	Optional	Standard
Tank Capacity    - Tank 1 - Tank 2 - Tank 3 - Total	120 bu (4,360 l)	120 bu (4,360 l)
	180 bu (6,550 l)	180 bu (6,550 l)
	Optional 40 cu.ft. (1,129 l)	Optional 40 cu.ft. (1,129 l)
	<b>300 bu (10,910 l)</b>	<b>300 bu (10,910 l)</b>
Tank Screens	Optional	
Tank Access Ladder - Right Hand Side	Standard	
Fan Impeller Diameter	17" (43 cm) - Up to 5,000 r.p.m.	
Hydraulic Drive (Closed Centre or Closed Centre Load Sensing systems required) Hydraulic requirements for Air Cart only at Rated Fan Speed.	12cc - piston type orbit motor 15.5 U.S. gal./min. (59 l/min) at 2,100 p.s.i. (14,469 kpa) VRT requires an additional 5.5 U.S. gal/min (21 l/min)	
Loading Auger	Standard (8" Dia x 20 ft) (20.32 cm Dia x 609.6 cm)	
Tires                - Standard (Front)   - Standard (Rear)   - Optional (Front) - Optional (Rear)	(2) 21.5 x 16.1 AWT - 10 ply rating Distance Center-Center 38" (97 cm) Optional 3M Axles Center-Center 118" (3 m)	
	(2) 23.1 x 26 AWT - 12 ply rating Distance Center-Center 121" (307cm) Optional 3M Axles Center-Center 118" (3 m)	
	(2) 21.5 x 16.1 Rice - 12 ply rating	
	(2) 23.1 x 26 Rice- 10 ply rating	
3 Meter Axles	Optional	
Metering    - Ground Driven - Variable Rate (VRT) - GPS Compatible VRT	Standard	
	Optional	
	Optional	
Meter Shut Off	Electric	
Number Secondary Runs - Single Shoot	21 to 80	
Number Secondary Runs - Double Shoot	42 to 160	
Primary Hose - Diameter	2 1/2" (6.4 cm)	
Secondary Hose - Diameter	Standard - 15/16" (2.4 cm) Optional - 1 1/8" (2.8 cm)	
Frame - Trussed	4" x 8" (10 cm x 20 cm) tubing	
Easy Clean Out System	Standard	
<b>Meter Drive Options</b> - Second Clutch (For spot fertilizing on the go)	Standard	
<b>Monitor</b> (Shaft Motion (3), Bin Level (3), Fan Speed, Acre Tally, Ground Speed)	Standard Optional Seed Flow	
Work Switch (Mounted to Seeding Machine)	Optional	

# Section 3: Checklist

## Section Contents

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# Checklist

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## SAFETY-ALERT SYMBOL



Watch for this symbol. It identifies potential hazards to health or personal safety. It points out safety precautions. It means:

**ATTENTION - BE ALERT.**  
**Your safety is involved.**

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### Manuals

**Note:** Pre-Delivery Inspection Form must be completed and submitted to Morris Industries within 30 days of delivery date.

**Warranty Void if Not Registered**

**Parts Manual**

Order Part Number N58348

**Assembly Manual**

Order Part Number N58347

## Checklist

Please read the Operator's Manual carefully and become a "SAFE" operator.

Adopt a good lubrication and maintenance program.

### General

- \_\_\_ Check if assembled correctly.
- \_\_\_ Proper chain tension.
- \_\_\_ Check hose connections
- \_\_\_ Ensure cleanout door and tank lid are connected correctly.

### Lubrication: Grease

- \_\_\_ Metering Drive
- \_\_\_ Axle Pivots
- \_\_\_ Auger Pivots

### Lubrication: Oil

- \_\_\_ Drive chains

### Tire Pressure:

- \_\_\_ See maintenance, section 7

### Transport:

- \_\_\_ Tighten wheel bolts.
- \_\_\_ Check hose connections.

## OWNER REFERENCE

Model: \_\_\_\_\_  
Serial No: \_\_\_\_\_  
Dealer: \_\_\_\_\_  
Town: \_\_\_\_\_ State: \_\_\_\_\_  
Phone: \_\_\_\_\_  
OWNER/OPERATOR \_\_\_\_\_  
Date: \_\_\_\_\_



**TAKE SAFETY SERIOUSLY.**

**DO NOT TAKE  
NEEDLESS CHANCES!!**

# Checklist

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Notes

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## Section 4: Introduction

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# Introduction

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## Introduction

This Operator's Manual has been carefully prepared to provide the necessary information regarding the operation and adjustments, so that you may obtain maximum service and satisfaction from your new MORRIS 9s Series Air Cart.

To protect your investment, study your manual before starting or operating in the field. Learn how to operate and service your 9s Series Air Cart correctly, failure to do so could result in personal injury or equipment damage.

If you should find that you require information not covered in this manual, contact your local MORRIS Dealer. The Dealer will be glad to answer any questions that may arise regarding the operation of your MORRIS 9s Series Air Cart.

MORRIS Dealers are kept informed on the best methods of servicing and are equipped to provide prompt efficient service if needed.

Occasionally, your 9s Series Air Cart may require replacement parts. Your Dealer will be able to supply you with the necessary replacement parts required. If the Dealer does not have the necessary part, the MORRIS Factory will supply the Dealer with it promptly.

Your MORRIS 9s Series Air Cart is designed to give satisfaction even under difficult conditions. A small amount of time and effort spent in protecting it against rust, wear and replacing worn parts will increase the life and trade-in value.



**Keep this book handy for ready reference at all times.** It is the policy of Morris Industries Ltd. to improve its products whenever it is possible to do so. The Company reserves the right to make changes or add improvements at any time without incurring any obligation to make such changes on machines sold previously.

The MORRIS 9s Series Air Cart represents the latest in Air Cart design technology. There are three sizes available, a 240 bushel (8,730 liters) cart, a 252 bushel (9,130 liters) cart and a 300 bushel (10,910 liters) cart with hydraulic fan drive. The carts incorporate a four wheel, wide-stance high clearance frame. The high clearance frame gives easy access to the metering wheels and cleanout. The 9240 and 9300 carts have a 60:40 tank split. The 9252 cart has a 30:30:40 tank split. The tank lids are easily accessed by the convenient stairs and tank walk-through.

Each tank has its own metering system and metering drive. Included with the unit is a sample collector box that an operator can use to confirm seeding rates.

The metering system incorporates spiral fluted wheels. The size of the metering wheel is matched to the number of outlets on the secondary divider giving the best in accuracy. The spiral fluted metering wheels combined with the multi-range transmission allows a full range of products such as Canola to peas to be seeded without having to change the metering wheels.

The VRT system enables the operator the ability to increase or decrease application rates from the tractor seat by pressing a button. Application rates can be changed on the go in increments of 5% from the operator set application rate (Max/Min - 50%). This enables the producer the ability to match application rates to varying soil requirements.

The VRT monitor with its easy to read display and Smart Sensors make basic operation effortless with unmatched reliability. Advanced functions are simple to program and the monitor can be quickly plugged into the harness at the Air Cart for ease of calibration. The monitor constantly monitors shaft rotation and bin levels, and with just a push of a button displays; fan speed, ground speed, field acres seeded, total acres seeded and actual application rates per acre. Real time actual application rate of two tanks can be displayed simultaneously on the monitor display.

Each metering shaft (up to three) is independently driven by a hydraulic motor. The hydraulic motors are independently controlled through electric solenoid valves. The VRT system senses ground speed and adjusts the hydraulic valves to maintain precise meter shaft rotation vs ground speed at a frequency of 20 times per second. The VRT system has the flexibility to allow the use of either tank for fertilizer or seed as well as the third tank or granular tank.

# Introduction

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**Notes**

# Section 5: Operation

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# Operation

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## CAUTION



**BE ALERT**

## SAFETY FIRST

**REFER TO SECTION 1 AND REVIEW ALL SAFETY RECOMMENDATIONS.**

## Application

The Morris 9s Series Air Cart applies a wide range of seed and granular fertilizer products. It has the capacity to single shoot or double shoot. With the addition of the 9s Series Granular Applicator the Morris 9s Series Air Cart can apply granular herbicide or other fine seeds. With the addition of the Third Tank the Morris 9s Series Air Cart can apply seed and starter fertilizer, while deep banding additional fertilizer at the same time.

## Tractor

### Tires

- Proper ballast and tire pressure are required when pulling heavy implements.
- Consult your tractor operator's manual and follow all recommended procedures.

### Hydraulics

- Wipe all hydraulic fittings and couplers with a clean cloth to avoid contaminating the system.
- Check that hydraulic reservoir is filled to the proper level.

### Drawbar

- Centre and pin in a fixed position for easier hitching and greater stability.

## Warning

**Do not permit smoking, sparks or an open flame where combustible fuels are being used. Keep the work area well ventilated.**

## Warning

**Do not search for high pressure hydraulic leaks without hand and face protection. A tiny, almost invisible leak can penetrate skin, that requires immediate medical attention.**

# Operation

## Monitor Installation

### X30 Monitor

1. Install AGA5072 Power / Comms Harness on tractor.  
Connect directly to the tractor battery.

**Important:** Battery leads from the Harness must be connected directly to the battery.

**Do not connect directly to starter switch.**

2. Mount monitor in tractor cab in an easily visible position.
3. Connect AGA5072 Power / Comms Harness to X30.
4. Refer to X30 manual N55777 for more details.

## Important

Some tractors have a 24 volt starting system. Neither the monitor nor the VRT control will operate if they are connected to a 24 volt system. If in doubt, always connect to one battery only.



X30 Monitor - Shown

## Important

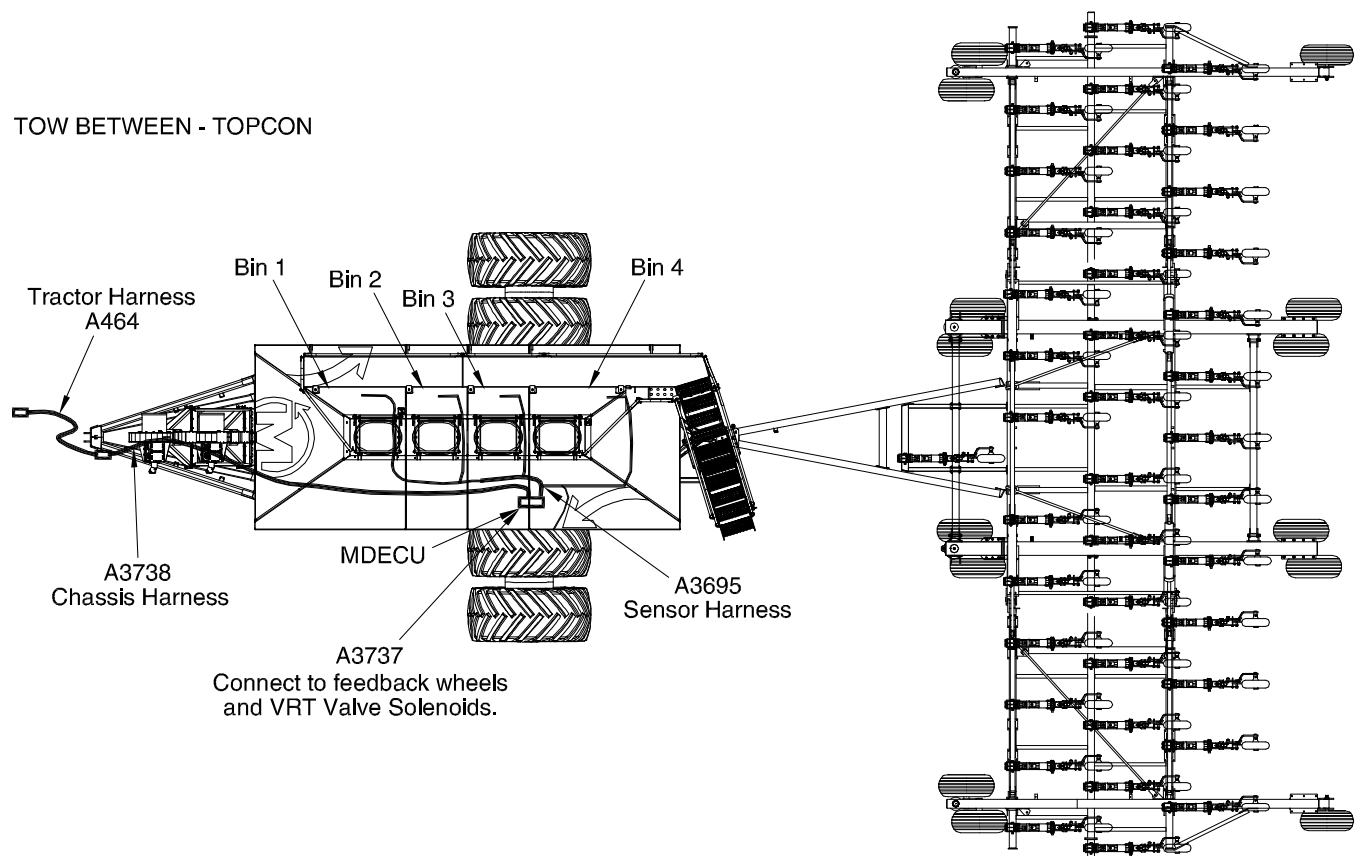
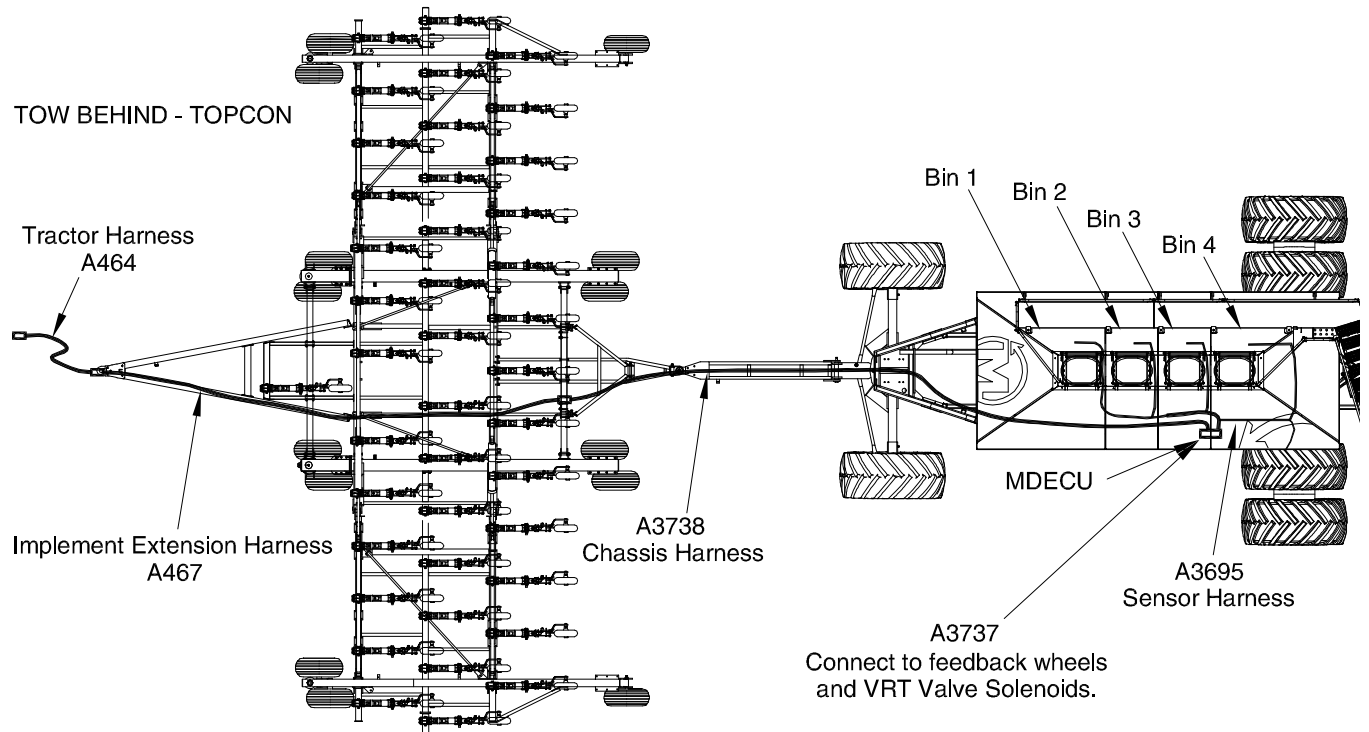
Ensure harness extensions, when routed over the seeding tool and air cart, are clear of moving parts and protruding objects that may cut wires.



AGA5072 POWER / COMMS HARNESS

## Monitor Installation - Continued

### Monitor Harness



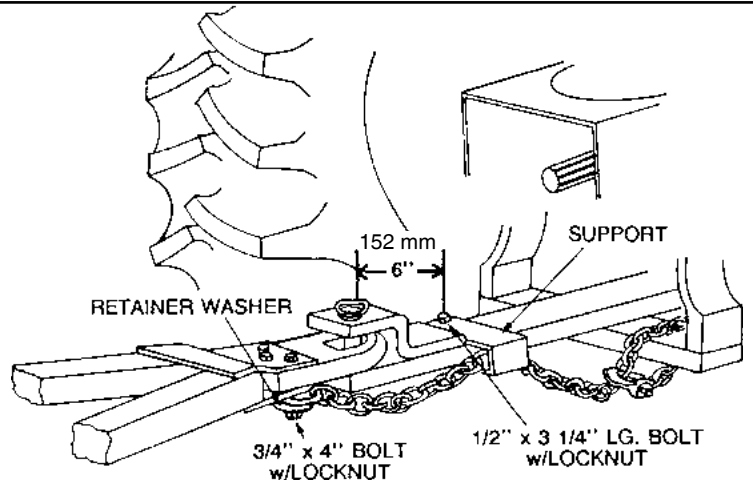
# Operation

## Hitching



### Caution

A safety chain will help control towed machines should it accidentally separate from the drawbar while transporting. A runaway machine could cause severe injury or death. Use a safety chain with a strength rating equal to or greater than the gross weight of the towed machines.



Attach safety chain to the tractor drawbar support or other specified anchor location with the appropriate parts.

## Hitching to Tractor (Seeding Tool or Tow Between Cart)

- Ensure swinging drawbar is locked in the centre position.
- Insure hitch pin is in good condition.
- Level clevis with tractor drawbar using hitch jack.
- Back tractor into position and attach hitch clevis to drawbar, using an adequate hitch pin.
- Lock hitch pin in place with a hairpin or other proper locking device.
- After tractor to implement connection is made, relieve pressure off the hitch jack.
- Place hitch jack in raised position.
- Route Safety Chain through chain support and drawbar support.
- Lock safety hook onto chain.

**Note:** Provide only enough slack in chain to permit turning.

- Ensure hydraulic hose quick couplers are dirt free.
- Inspect all fittings and hoses for leaks and kinks. Repair as necessary
- Connect the hydraulic hoses to the tractor quick couplers.



### Caution

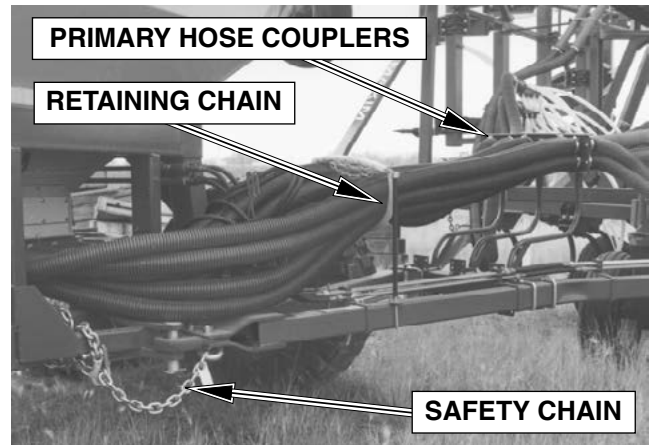
Dirt in the hydraulic system could damage O-rings, causing leakage, pressure loss and total system failure.

## Hitching to Seeding Tool (Tow Between Cart)

- Connect seed cart to tractor.
- Back seed cart into position, aligning seeding tool hitch with seed cart.
- Attach hitch to seed cart with 1 1/2" x 6 1/2" pin and retain with a 1/4" hair pin.
- Attach Safety Chain to seed cart.

**Note: Provide only enough slack in chain to permit turning.**

- Connect hydraulic hose quick couplers.
- Connect the primary hose couplers.
- Loop retaining chain around the primary hoses with the secondary hose over the bottom half of the chain.



Primary Hose Coupler - Tow Between Shown

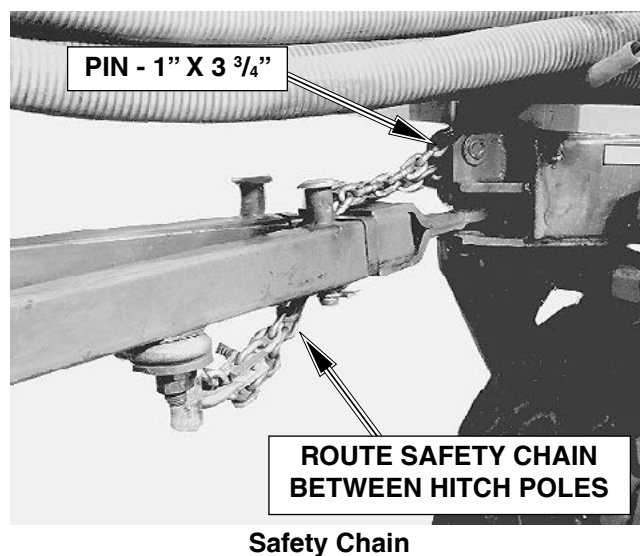
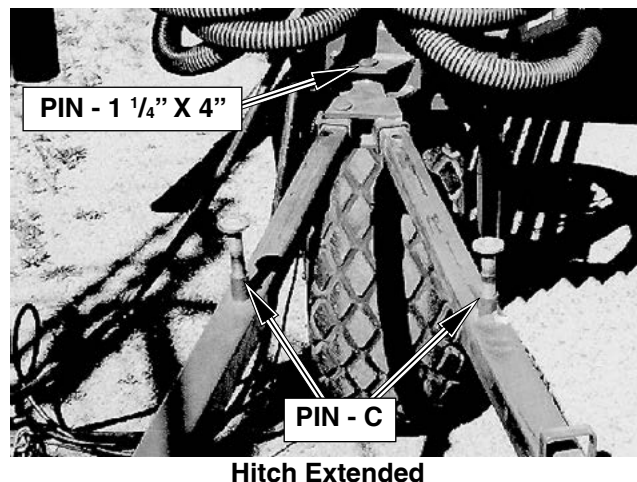
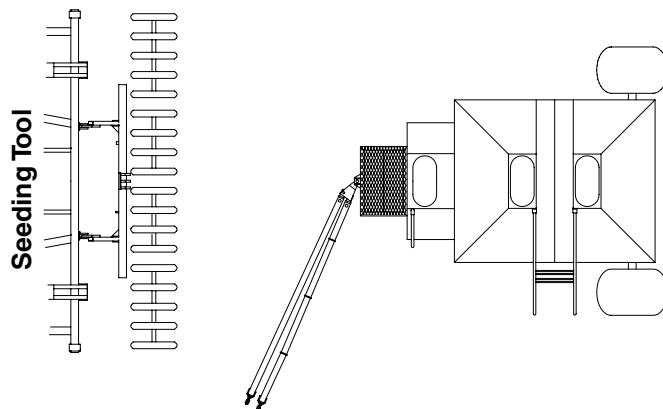
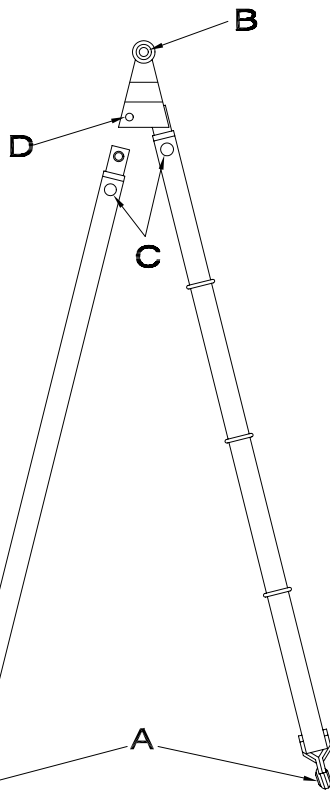
# Operation

## Hitching to Seeding Tool (Tow Behind Cart)

- Connect seeding tool to tractor.
- Attach hitch to air cart with 1 1/4" x 4" pin.
- Back seeding tool into position with seed cart.
- Extend the telescopic hitch arms and connect the seed cart to seeding tool using 1 1/8" x 3 11/16" pins.
- Block the tires of the seed cart and insert the 1" x 5 13/32" pins into their bushings.
- Slowly back seeding tool toward seed cart until the telescopic arms are fully retracted and the pins drop through the hitch tube locking the hitch poles.
- Retain the pins with Click Pins.
- Attach Safety Chain to seed cart.

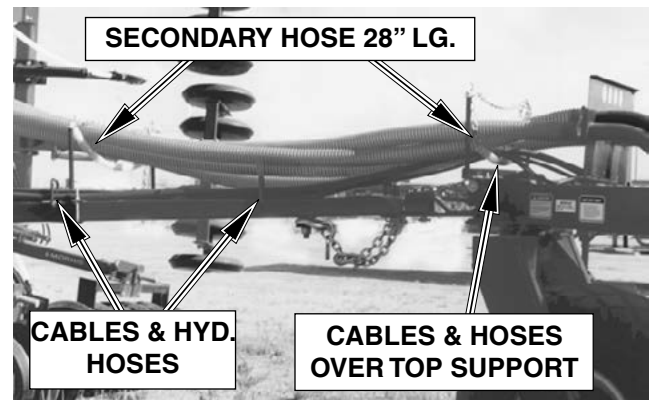
**Note:** Provide only enough slack in chain to permit turning.

Pin Size	
A	1 1/8" x 3 11/16"
B	1 1/4" x 4"
C	1" x 5 13/32"
D	1" x 3 3/4"



## Hitching to Seeding Tool (Tow Behind Cart) - Continued

- Route clutch and monitor wires and hydraulic lines through rear retaining chain with the secondary hose over the bottom half of the chain.
- Route clutch and monitor wires through the loops on the left hand hitch pole.
- Route the hydraulic lines (if any) through the loops on the left hand hitch pole.
- Connect the primary hose couplers.
- Loop retaining chain around the primary hoses with the secondary hose over the bottom half of the chain.
- Connect the monitor and clutch quick connectors at both the tractor/seeding tool and the seeding tool/air cart connections.



Hoses with correct amount of sag



Primary Hose Coupler - Tow Between Shown

# Operation

## Hitching to Seeding Tool (Tow Behind Cart) - Continued

### Hydraulic Connections

- Connect the monitor and clutch quick connectors at both the tractor/seeding tool and the seeding tool/air cart connections.
- **If hydraulic fan drive**, then connect the fan hydraulic quick couplers at both the tractor/seeding tool and the seeding tool/air cart connections. Ensure couplers are clean and dirt free.



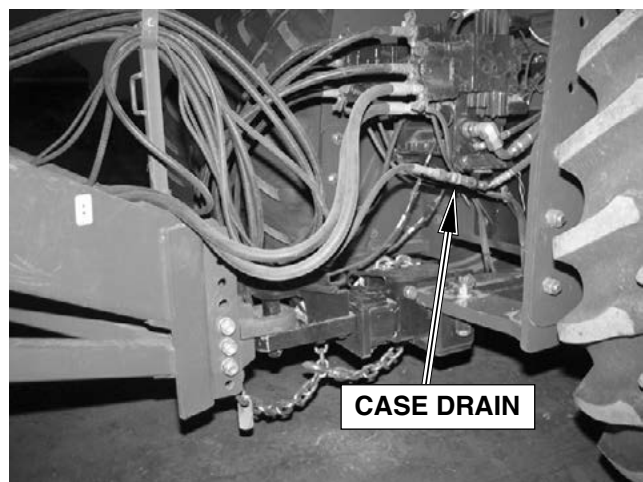
## CAUTION

Hydraulic oil under pressure can penetrate the skin causing serious injury. Avoid personal injury by relieving all pressure, before disconnecting hydraulic hoses.



Seeding Tool Coupling

**Note:** The 3/8" (10 mm) diameter hose must be run directly into the hydraulic tank otherwise damage will occur to the seal in the motor. If the hose is run through the filler cap then ensure the cap is *VENTED*. A quick coupler can still be used between the tractor and the seeding tool.



Hydraulic Coupling on Tractor

## Unhitching from Tractor (Seeding Tool or Tow Between Cart)

- Pin hitch jack in storage position.
- Lower hitch jack taking the weight off the air cart clevis.

**Note:** For added Safety it is recommended to unload any material that may be in the tanks.

- Ensure all transport locks are properly secured. Refer to seeding tool manual for more details.
- Relieve pressure in the hydraulic hoses by positioning tractor hydraulic lever in “float” position or turn tractor engine off and cycle lever back and forth several times.
- Disconnect the hydraulic hoses.
- Disconnect the clutch and monitor cables.
- Remove the safety chain.
- Remove the drawbar pin.
- Slowly move tractor away from seeding tool or tow between cart.



**Tow Between Cart**

## Unhitching from Seeding Tool (Tow Between Cart)

- Lower hitch jack taking the weight off the seeding tool hitch poles.
- Relieve pressure in the hydraulic hoses by positioning tractor hydraulic lever in “float” position or turn tractor engine off and cycle lever back and forth several times.
- Disconnect the primary hose couplers.
- Disconnect the hydraulic hoses.
- Remove the hitch pin.
- Slowly move seed cart away from seeding tool.

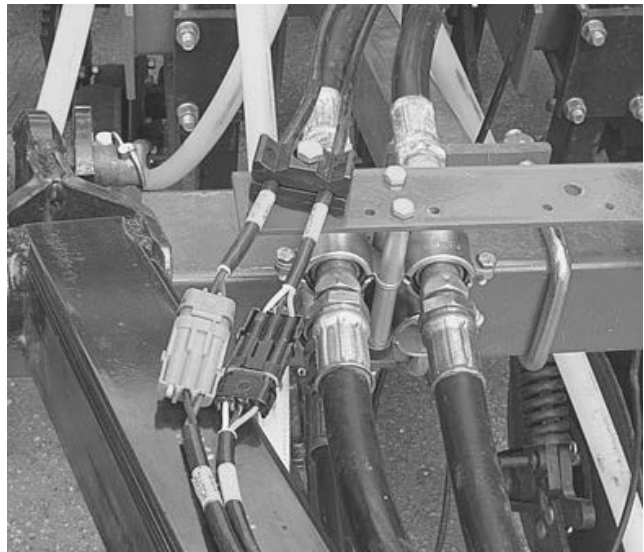
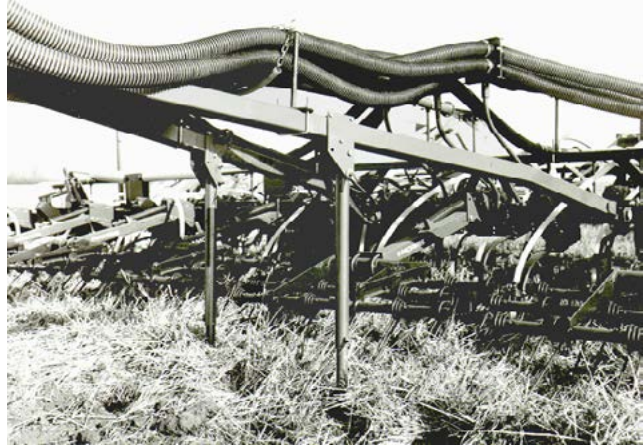


**Tow Between Cart**

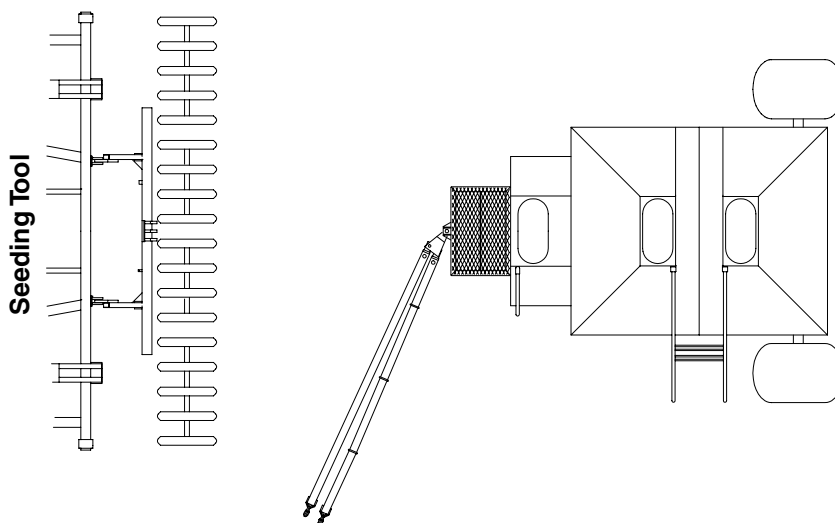
# Operation

## Unhitching from Seeding Tool (Tow Behind Cart)

- Lower hitch stands, if so equipped, taking the weight off the hitch poles.
- Relieve pressure in the hydraulic hoses by positioning tractor hydraulic lever in “float” position or turn tractor engine off and cycle lever back and forth several times.
- Disconnect the primary hose couplers.
- Disconnect the hydraulic hoses.
- Disconnect the clutch and monitor cables.
- Remove the hitch pins.
- Move hitch poles to the side of seed cart, if not equipped with hitch stands.
- Slowly move seeding tool away from seed cart.



**Seeding Tool Coupling**



## Transport

Observe all applicable safety precautions under transport heading in Safety, Section 1.

- Refer to Specifications, Section 2 for weight, transport height and width.
- Transport with tractor only!
- Use Tow Hitch when transporting without seeding tool. (Tow Behind Units)
- Always connect safety chain provided to the towing vehicle and the hitch of the seed cart.
- Do not transport with the fan running.
- Disconnect main drive chain when towing air cart a long distance.
- Ensure all transport pins are secured.

## Speed

- Always travel at a safe speed. Do Not Exceed 20 M.P.H. (32 kph) with an empty air cart.
- The combined weight of the implements being towed, including material in tank, **must not exceed 1.5 times** the weight of towing vehicle.
- **REDUCE SPEED** with material in tank. **Do Not** Exceed a speed of 10 M.P.H. (16 kph).
- Use additional caution when towing loads under adverse surface conditions, when turning, and on inclines.

## Lights

- Ensure proper reflectors are in place, refer to Safety Section 1.
- Be familiar with and adhere to local laws.

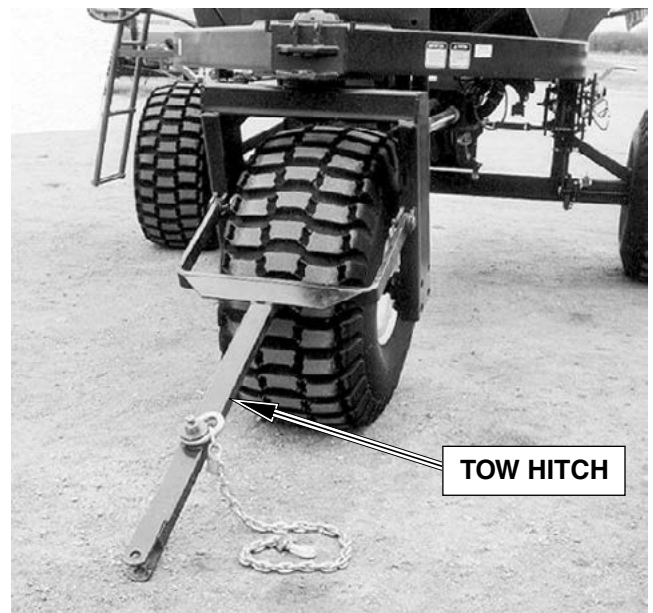
## Tow Hitch (Tow Behind Units)

- Attach tow hitch to front axle with two 1" x 2 1/4" pins.
- Retain the pins with klik-pins.
- Use tow hitch when towing without seeding tool.
- **Do not** use tow hitch with material in tank.
- **Do not install transport lock pin in front castor fork when using tow hitch.**

**MORRIS INDUSTRIES LTD. WILL NOT BE RESPONSIBLE FOR ANY DAMAGES OR OPERATOR INJURY RESULTING FROM NON-USE OR IMPROPER USE OF TRANSPORT LOCKS.**

## Important

**When the machines are being towed by a semi tractor or trucks of any description, the units HAVE to be towed separately from seeding tool with tow hitch provided.**



Tow Hitch

## Important

**DO NOT EXCEED 20 M.P.H. (32 kph)**

**The front castor tire will contact the mud scraper if towing speeds exceed 20 M.P.H. (32 kph) causing severe damage to the tire and mud scraper.**

# Operation

## Metering System

The 9s Series Air Cart uses a combination of metering wheels and spacers shown below. The metering wheel is individually sized to correspond to the number of outlets at the connected secondary head and the spacers make up the space between the wheel and the body. Some openings may be blanked off depending on the number of secondary divider heads used on the seeding tool.

The 9s Series Air Cart can meter all types of seeds and fertilizers by simply adjusting the slider plates. See “Slider Settings” for more details.

Different rates are easily obtained using the selection of quick change sprockets that attach to either of the two meter transmissions.

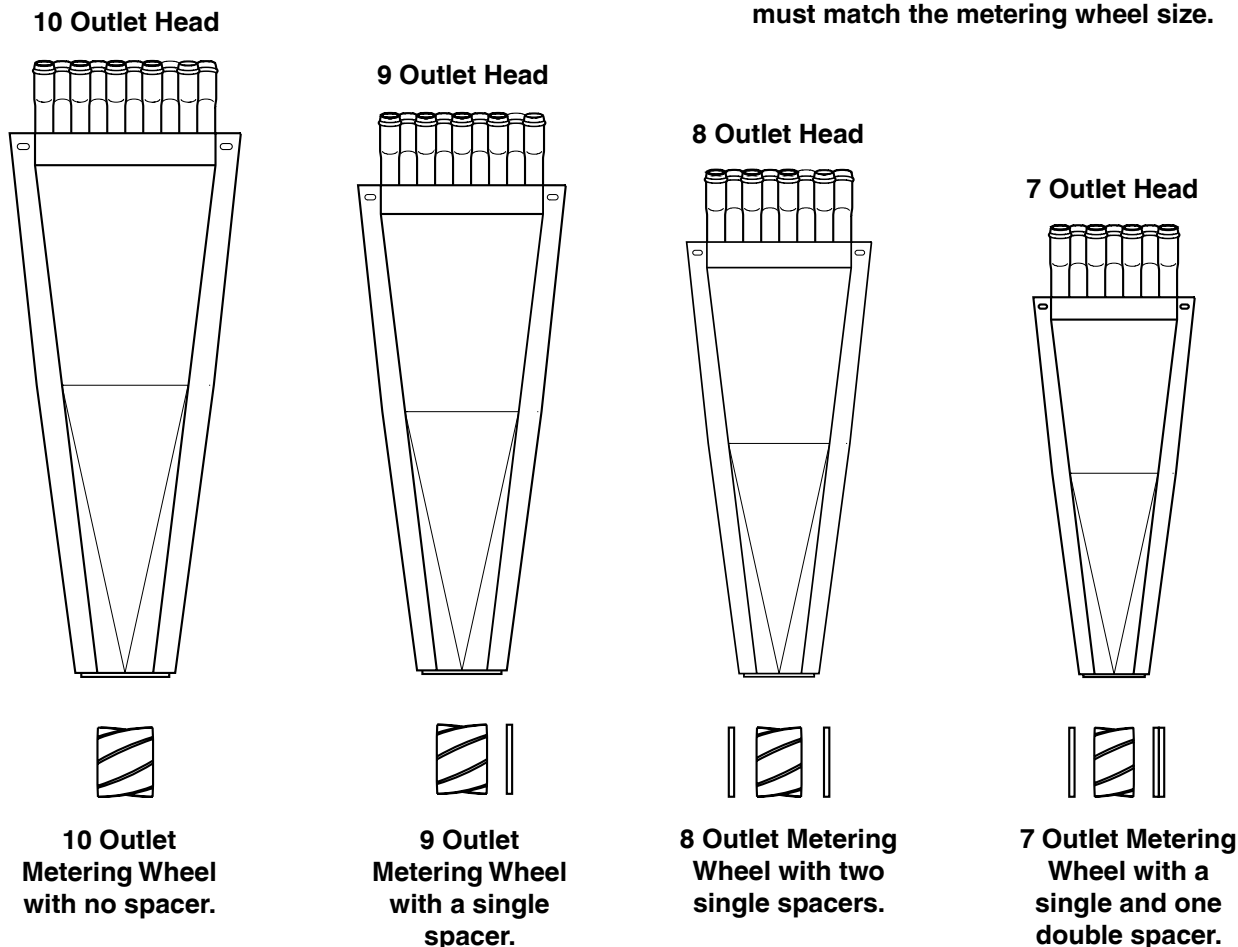
**Note: Before putting product into the tanks check the following:**

- (a) The slider plates are set correctly for product being applied.
- (b) The Clean-out doors are fully closed and sealed.
- (c) The plastic bag covering the fan is removed.

## Important

**Ensure distribution system is balanced. It is very important that head outlets only vary by one . (i.e. use only 7 and 8 together, 8 and 9 together, 9 and 10 together)**

**Note: The number of outlets on the divider head must match the metering wheel size.**



## Metering System - Continued

### Secondary Hose Installation

The lengths of the 15/16" (24 mm) diameter hoses are **very important**.

For Accurate distribution the secondary hoses have to be arranged by length symmetrically about the centre line.

The **longest** hoses **have to be** in the **centre** of the divider head. These hoses would normally feed the openers furthest away from the head.

- Ensure that the secondary hoses 15/16" (24 mm) diameter do not run higher than 3" (76 mm) above the height of the flat fan divider head.
- Allow an extra 3" (76 mm) of hose before cutting secondary hose for fitting in the seed boot.
- Always ensure that the secondary hoses are sufficiently long to accommodate tripping of trips.
- **Avoid sharp bends** in any of the hoses.
- Check for pinch points and clearances when folding in and out of transport.

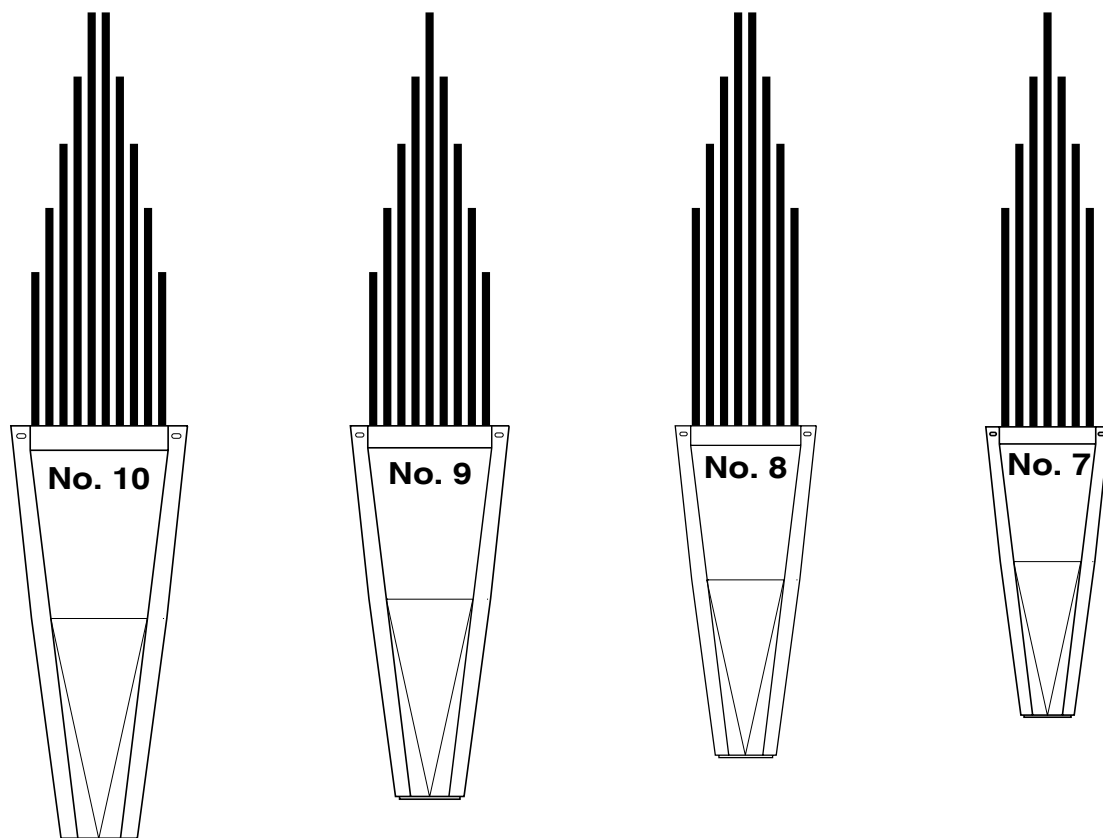
## Important

**Hot water is the only acceptable lubricant for the installation of the secondary hose.**

The supplier advised MORRIS that WD-40 or any other lubricant (i.e. liquid detergent) will have a negative effect on the chemical stability of the hose, resulting in the degradation and failure of the hose due to Environmental Stress Cracking.

## Important

**Distribution uniformity will be adversely affected if hoses are incorrectly installed.**



# Operation

## Slider Setting

The slider plates come in 4 different sizes. Each slider plate matches a specific metering wheel.

**Note: The slider plates must match the metering wheel size.**

The slider plates have three positions to allow all types of seeds and fertilizers to be metered.

The slider plate positions are **closed**, **open**, and **removed** as indicated on diagrams. (See next page)

- Position slider as indicated below and tighten nut to hold slider tightly in place.
- Position cover plate as indicated below and tighten wing nuts to hold cover plate in place.

**Note: For Oats or Coarse Grains, if it appears bridging is occurring, remove sliders and recalibrate.**

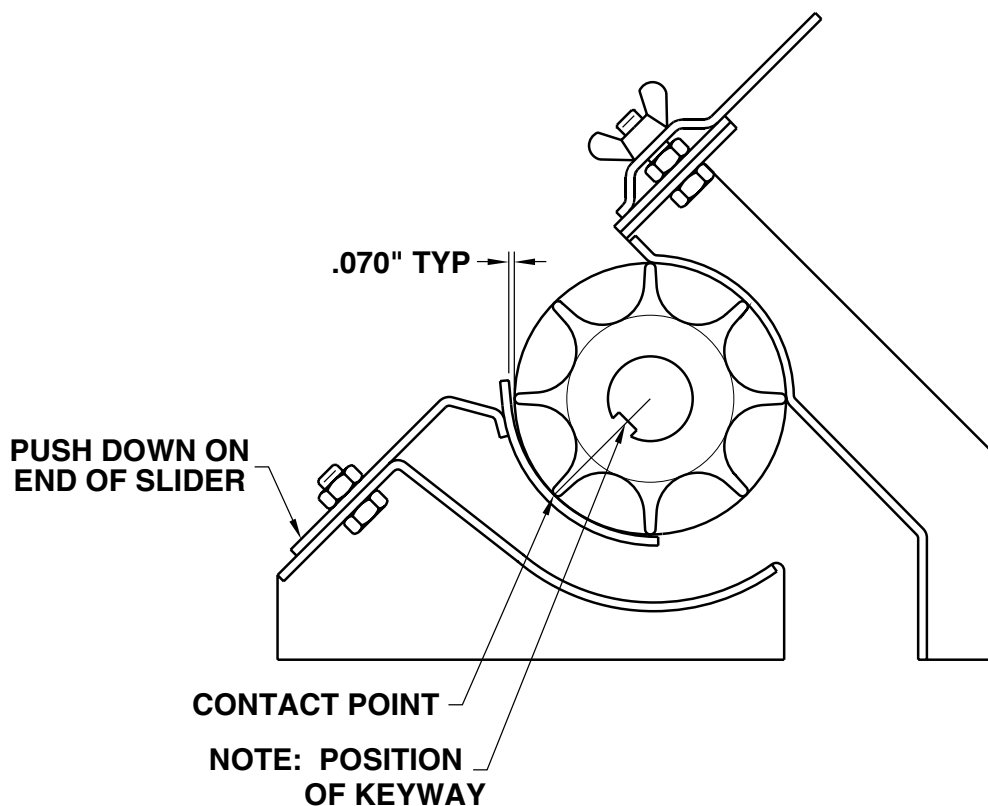
## Important

When adjusting the sliders to the closed position follow the procedures below:

- 1) Locate the key-way in the metering wheel. Rotate shaft until high spot is located, this is the key-way location. Mark shaft for future reference.
- 2) Rotate metering shaft until key-way is in location shown below.
- 3) Keep the slider mounting plate flat on the metering body surface. See diagram A.

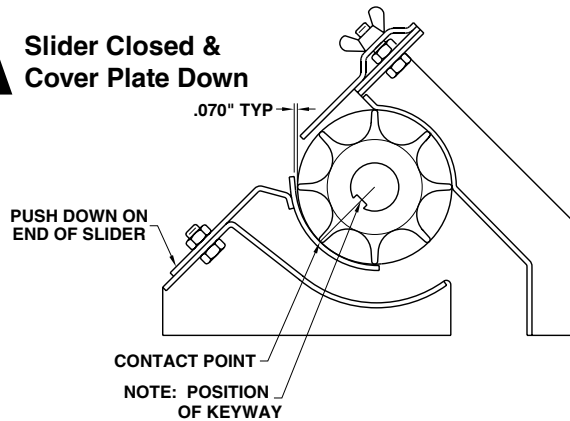
If the slider is tipped up when set to the closed position interference with the metering wheel will occur.

**Note: In the closed position there is a gap of .070" (1.778 mm) between the metering wheel and the top edge of the slider plate.**



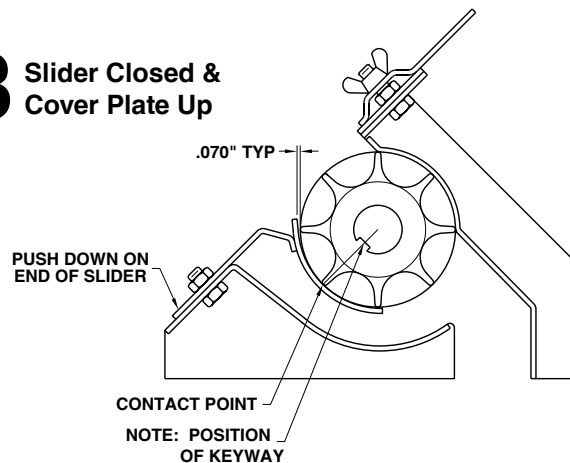
## Slider Setting - Continued

### A Slider Closed & Cover Plate Down

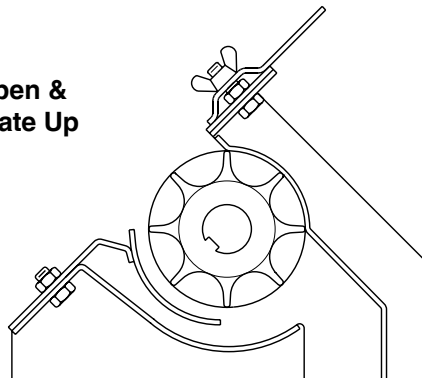


**Note:** For Oats or Coarse Grains, if it appears bridging is occurring, remove sliders and recalibrate.

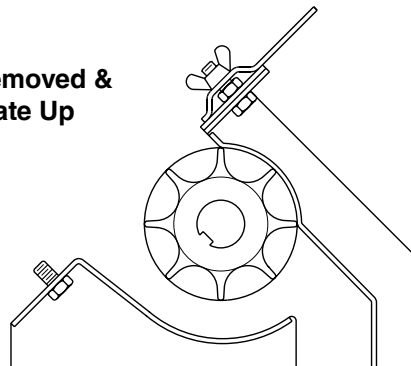
### B Slider Closed & Cover Plate Up



### C Slider Open & Cover Plate Up



### D Slider Removed & Cover Plate Up



**Slider Setting Chart**

Diagram	Product	Slider Setting	Cover Plate
<b>A</b>	Canola Flax Mustard	Closed	Down
<b>B</b>	Nitragin Nodulator	Closed	Up
<b>C</b>	Barley Lentils Milo Oats Rice Wheat Fine Fertilizer	Open	Up
<b>D</b>	Beans Peas Soybeans Sunflowers 10-46-0-0 11-51-0 Fertilizers containing Sulphur and/or Potash	Removed	Up

# Operation

## Preparing VRT

### Zero Shaft Hydraulic Motor Solenoids

Upon initial setup the preload of the solenoid valves must be set to match the tractor hydraulics.

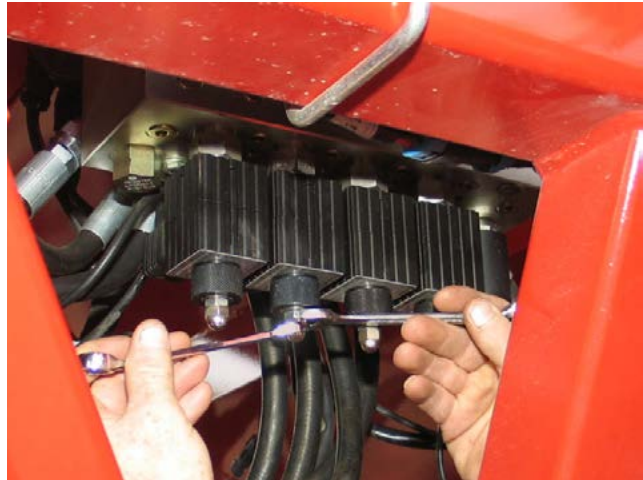
**Note: Tanks must be empty during this process.**

Zero the shaft of the hydraulic motors by using the following procedure:

- Ensure there is no product in any tanks.
- Warm up hydraulic system by running fan system for 5-10 minutes. Hydraulic hoses at fan motor should be warm to touch.
- **Turn OFF** Monitor, VRT Console and Controller.
- Start with **all** adjusting screws **turned out fully**.
- Adjust each valve individually by following the procedure below:
  - Start with rear tank first adjusting screw '3' for three valve bank or screw '4' for four valve bank.
  - Remove cap nut and then loosen jam nut.
  - Turn adjusting screw IN until motor starts to turn.
  - Allow motor to turn for 1-2 minutes to allow for motor to reach optimal operating temperature.
  - Then turn adjusting screw OUT until motor stops turning.
  - Tighten jam nut to secure adjusting screw in place. Replace cap nut.
- Repeat the above procedure for the other valves.

**Note: It is recommended to check the zero of the valves at the start of each season or if a different tractor is used on the system.**

**Note: If Air Cart is *NOT* equipped with a Third Tank or Granular Tank solenoid '1' must be unplugged and the adjusting Knob turned out fully.**



**Remove Cap Nut and Loosen Jam Nut**



**Adjusting Screw**

## Preparing VRT - Continued

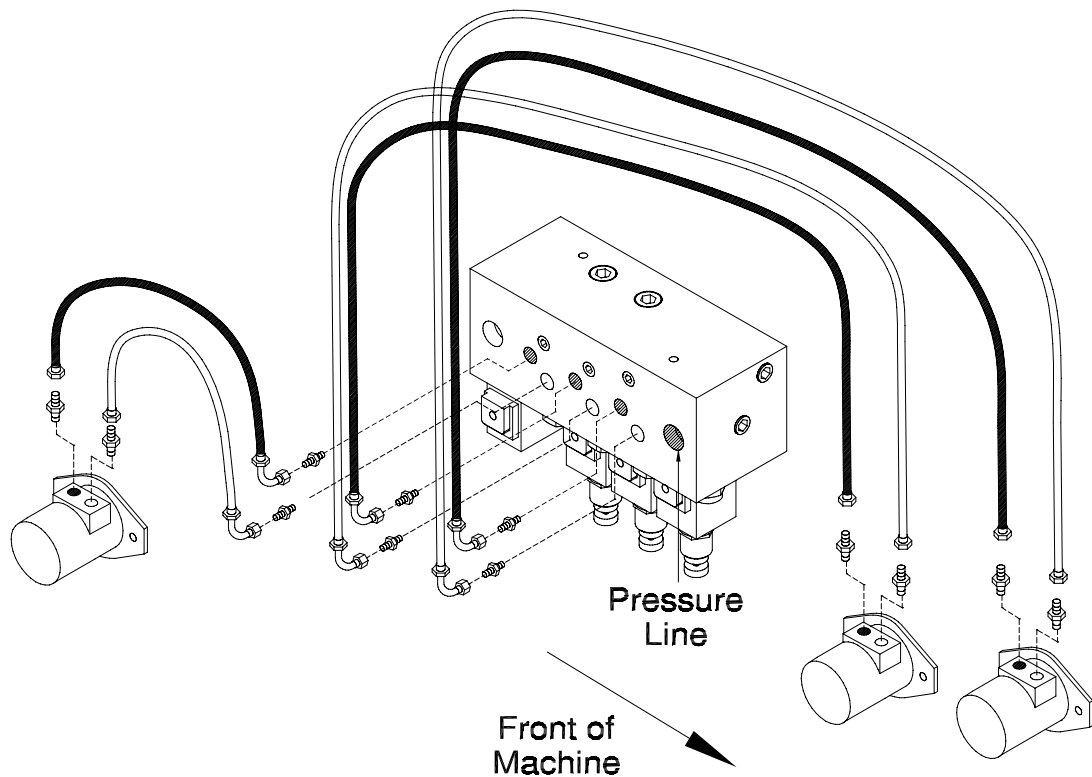
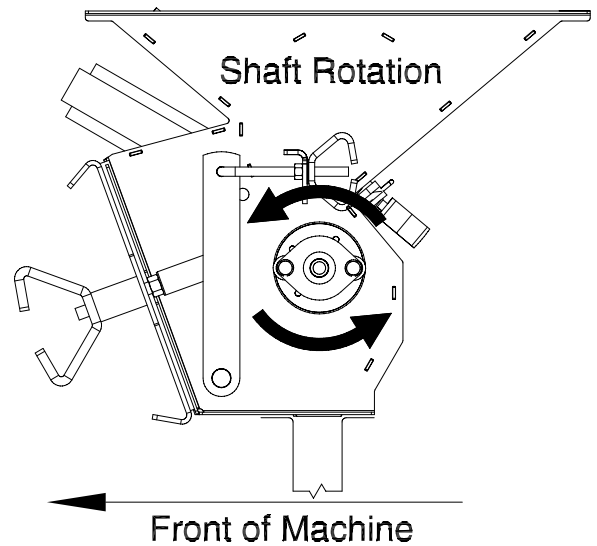
### Verify VRT Hydraulic Assembly

VRT system should be run to confirm correct rotation of meter shafts.

The diagram below illustrates the correct hose orientations for the VRT valve body.

**Note:** The pressure line from the tractor is the front port of the valve body.

To ensure correct hose installation, the meter shafts will turn counterclockwise when viewed from transmission side during system operation.



# Operation

## Filling Tank

The Morris 9s Series Air Cart is equipped with 2 or 3 tanks. Typically the front tank is for seed and the middle and rear tank is for fertilizer. However, ALL tanks can be used for the same product.

The capacity of the air cart tanks are listed in the specification tables in Section 2.

- Open lid fully on tank being filled.
- Check and remove any debris inside tank.
- Remove clean-out door.
- Check for debris inside metering body.
- Check for sheared metering wheels.
- Check the slider plates are set correctly.
- Fully close and seal the Clean-out door.
- Ensure the auger screen is in place.
- Always use screen to filter debris when filling.
- Adjust bin level sensor to desired alarm point.

**Note:** Even small fertilizer lumps can cause problems with plugging. All possible precautions should be taken to prevent lumpy fertilizer from entering the tank.

## Important

**Before putting product into the tanks check the following:**

- (a) The slider plates are set correctly for product being applied.
- (b) The clean-out doors are fully closed and sealed.
- (c) The plastic bag covering the fan is removed.
- (d) Inspect all augers used in handling the products for seeding. Run augers to clean out any debris inside auger so it does not get transferred to air cart tanks.



Tank Lids



## Warning

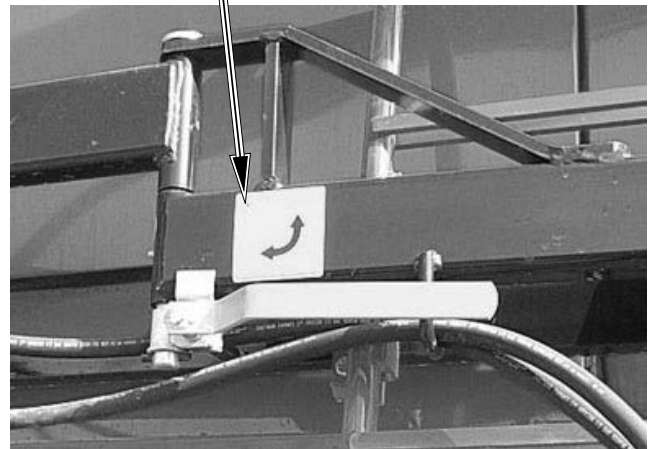
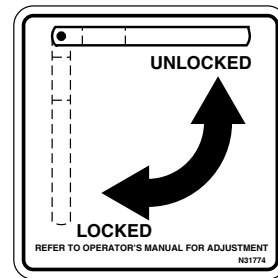
**Do not enter tank unless another person is present.**



Inspect Metering Body

## Filling Tank - Continued

- Position right hand access ladder in line with the tank walkway.
- Position auger as described below, if so equipped.
- Unlock auger arm lock. (Located 7240, 7252 & 7300 only)
- Unlatch the auger from its transport position.
- Swing out the auger making sure the motor end of the auger is still engaged at the arm pivot.
- Once the auger pivot is central to the Air Cart, tilt auger and swing into position with spout centrally located over the walkway.
- Lock auger arm lock. (Located 7240, 7252 & 7300 only)

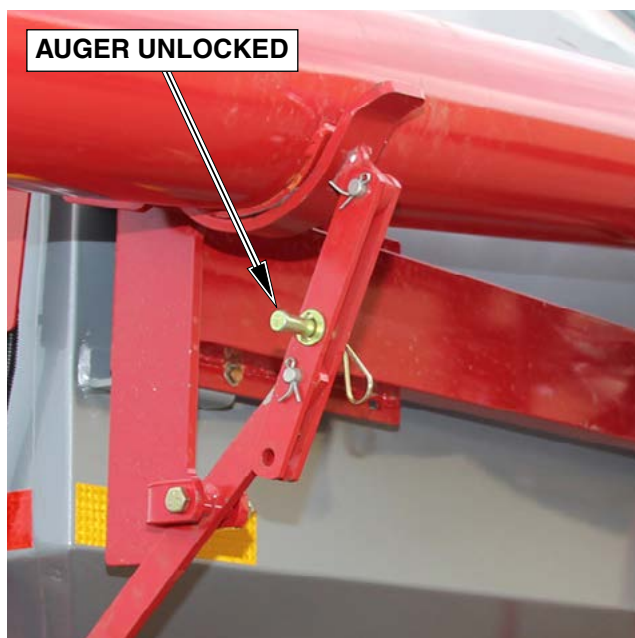


**Auger Arm Lock**

## Important

**Check Metering Wheel keyways in the event the primary lines plug.**

**Keyways may shear if the collector becomes plugged.**



**Auger Cradle**



**Front Pivot**

# Operation

## Filling Tank - Continued

- Open lids on tank and insert spout.
- Back truck to the hopper and engage the hydraulic motor on the auger.
  1. If hydraulic fan drive then ensure selector valve is in correct position for auger operation and engage tractor hydraulics.
  2. If engine fan drive then engage tractor hydraulics to operate auger.
- Auger product into tank until product is visible in site glass.
- Stop the flow of product into the auger and allow auger to empty. The tank should be close to full.



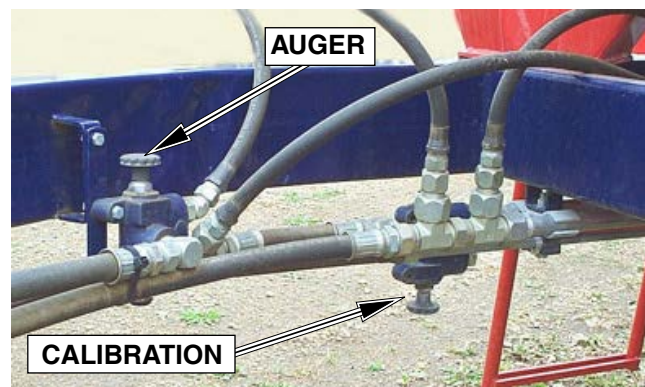
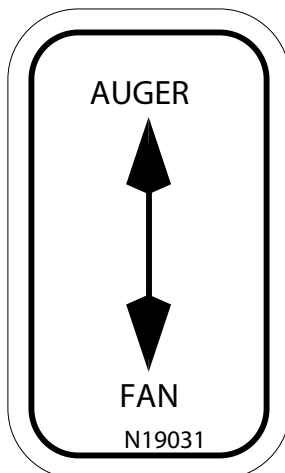
**Auger Positioned**

## Important

**Do not exceed 10 mph with tanks full.**



**Site Glass**



**Selector Valves**

## Filling Tank - Continued

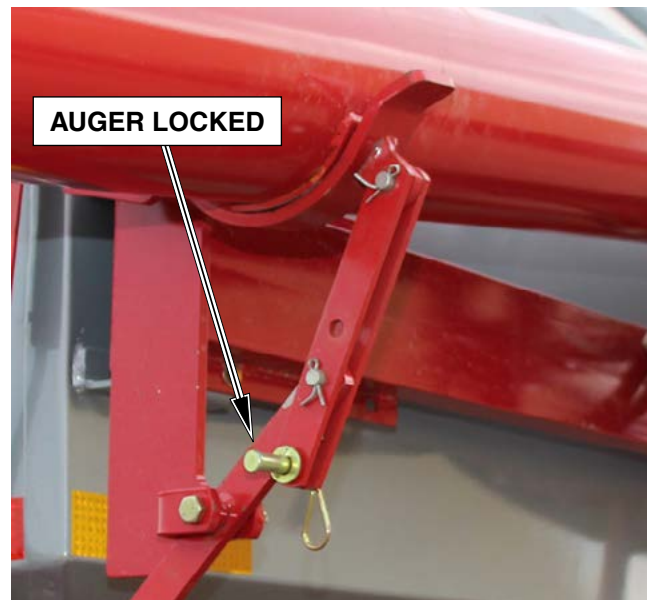
- Clean lid seal and ensure lid seal is positioned correctly before closing tank lid.
- Reverse the auger to clean out the hopper.
- Unlock auger arm lock.
- Swing auger out making sure the motor end of the auger engages the arm pivot.
- Secure auger in transport position.
- Lock auger arm lock.
- Remove the plastic bag covering fan.
- Check lid for air leaks with your hands once Air Cart fan is operational. See Section 7
- Check metering body for air leaks.



**Auger screen installed**



**Note:** Before seeding it is recommended that after a rain or dew that fan be run for a few minutes to eliminate moisture in the system.



**Auger Cradle**

# Operation

## Unloading Tanks

Emptying tanks is quick and easy to do.

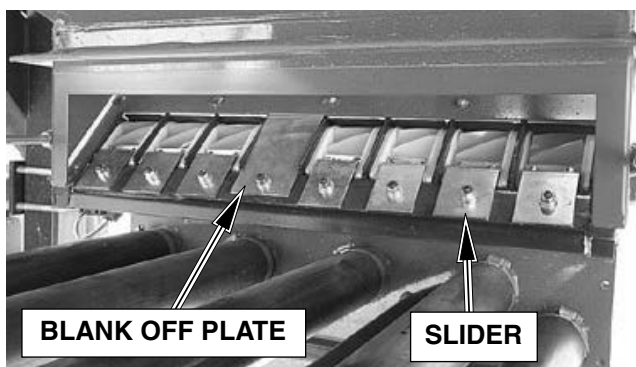
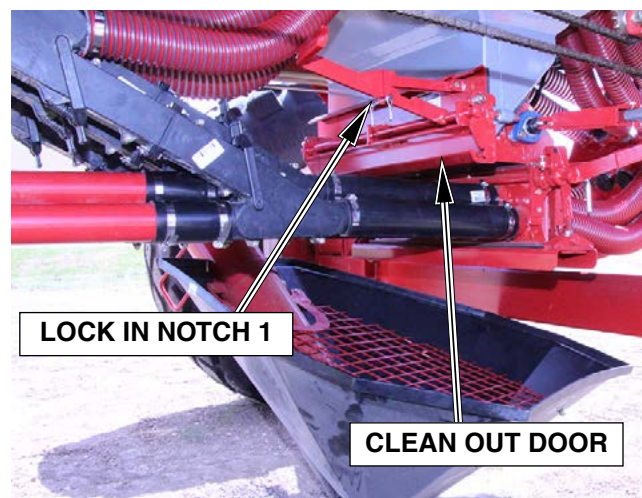
- Move access ladder forward.
- Position auger under the tank to be emptied.
- Start auger.
- Loosen Clean-out door on metering body by moving lock to notch 1.
- Regulate flow from the tank by loosening or tightening Clean-out door as required.
- Once all material stops flowing, remove Clean-out door completely and brush out remaining material in the corners.

### Complete Clean-out:

- Remove all sliders and blank off plates.
- Remove the collector bottom.
- Run fan until all remaining material has been blown out of the system.
- Reinstall the sliders, blank off plates, collector bottom, and clean-out doors.

## Danger

Keep all shields in place. Keep hands, feet and clothing away from auger intake, failure to do so will result in serious injury or death.



Collector Bottom

## Rate Calibration

The practice of doing a rate calibration is strongly recommended, as it will confirm the **actual** amounts of product dispensed per motor revolution (**Weight/Rev**).

**Weight/Rev** (Calibration Factor) is used by the monitor to determine the shaft motor rpm required to deliver the correct application rate.

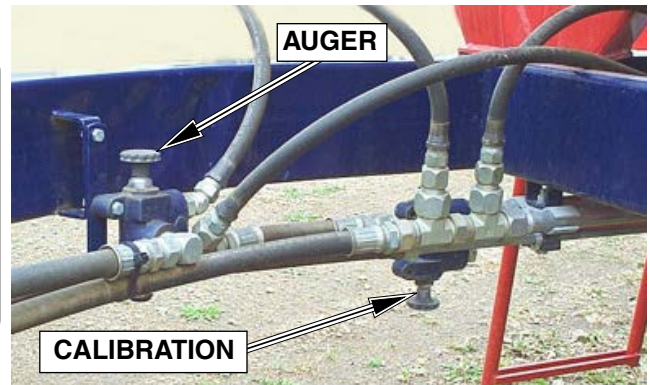
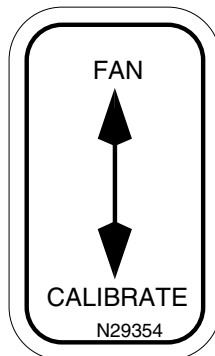
The following procedure should be followed for every change of product.

- Engage hydraulic lever to run air cart.
- **Turn off fan** by switching selector valve (located in the fan supply line) to calibration position.
- Open collector bottom.
- Slide rate check box on the collector body.
- **Prime metering wheels first** by using the run switch on the Run-Reset Box to start and stop the meter drive. Allow the drive to run until material begins to fall through the collector body. Press the rest button for 5 seconds to zero monitor count before collecting sample.

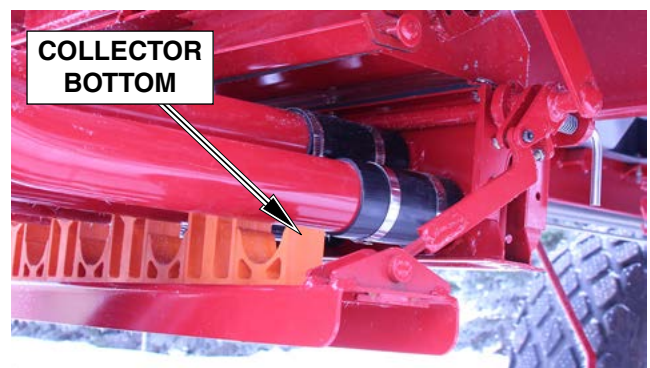
**Note:** The Topcon monitor must be turned ON in order for the primer switch to work.

**Note:** *Ensure the fan is not running.*

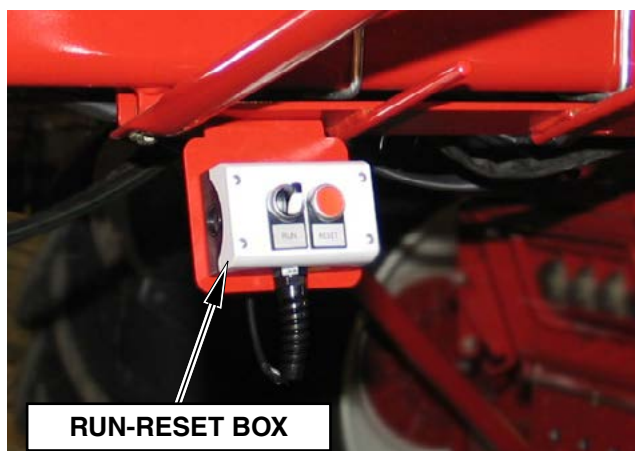
- Empty material from rate check box and reinstall it on the same collector.



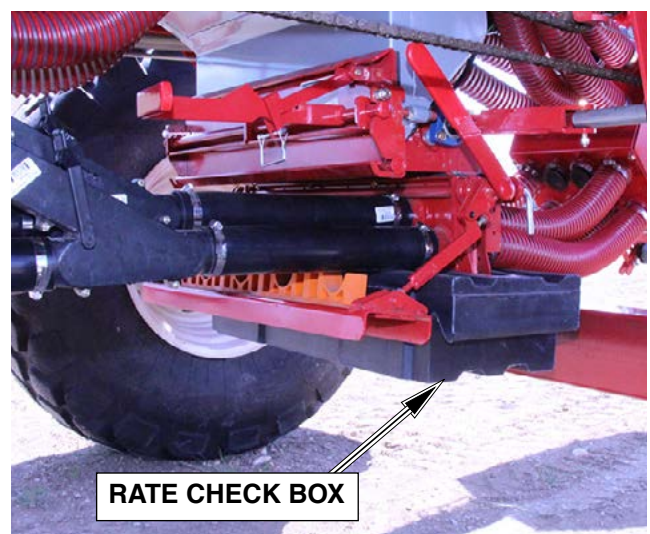
Selector Valves



Collector Bottom



Mount to Ladder



Rate Check Box

# Operation

## Rate Calibration - Continued

- Perform calibration as outlined in the Topcon manual.
- Remove the rate check box from the collector body.  
Weigh the sample by using tarp straps to hook rate check box to spring scale.

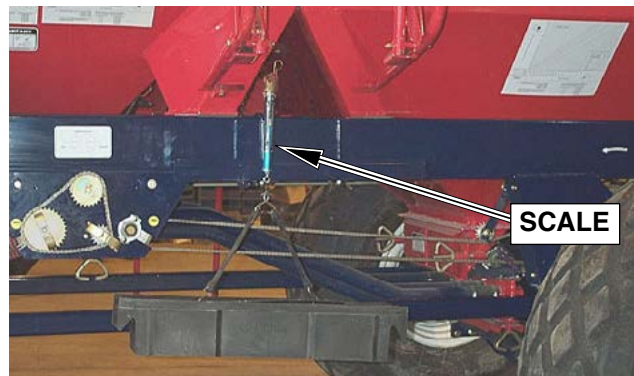
**Note: Remember to subtract the weight of the rate check box from the total sample weight.**

- Enter "Weight" of product collected as outlined in the Topcon manual.

**Note: The Calibration Factor (Weight/Rev) is automatically calculated for the value being entered.**

- Remove rate calibration insert and close collector bottom ensuring that the seals are free from debris and leaks.
- Place rate check box into storage bracket.

Follow the above procedure to check the rate of the other tanks.



## Important

**Proper measurement of sample weight is critical for application rate accuracy.**

**Prime metering wheels before taking actual sample.**

**Remember to subtract the weight of the rate check box from the total sample weight.**



## Calibration Chart - Imperial

### 9s SERIES AIR CART - VARIABLE RATE - CALIBRATION CHART WT/REV (LBS/REV)

GRANULAR APPLICATOR										SEED TANK / FERTILIZER TANK / THIRD TANK													GRANULAR APPLICATOR: SLOW SPEED DRIVE									
SLOW SPEED DRIVE										DIRECT DRIVE													CALIBRATION MATERIAL									
GA-1	GA-2	GA-3	GA-4	GA-5	GA-6	OUTLETS	SSD-1	SSD-2	SSD-3	SSD-4	SSD-5	SSD-6	SSD-7	DD-1	DD-2	DD-3	DD-4	DD-5	DD-6	DD-7	DD-8	DD-9	DD-10	DD-11	DD-12	DD-13	SLOWER POSITION	DENSITY LBS/FT <sup>3</sup>	CHART COLUMN			
21	0.25	0.27	0.29	0.32	0.40	0.55	21	0.23	0.27	0.29	0.32	0.34	0.36	0.35	21	116	166	210	260	302	305	326	330	368	418	443	458	550	NONE	38	GA-1	
22	0.26	0.29	0.31	0.33	0.42	0.57	22	0.24	0.29	0.31	0.33	0.35	0.37	0.60	22	121	174	220	273	317	319	341	345	385	438	464	480	576	-	40	53	
23	0.28	0.30	0.32	0.35	0.44	0.60	23	0.25	0.30	0.32	0.35	0.37	0.39	0.60	23	127	182	230	285	331	334	357	361	403	458	485	501	603	-	40	-	
24	0.29	0.31	0.34	0.36	0.46	0.62	24	0.26	0.31	0.34	0.36	0.38	0.41	0.62	24	132	190	240	298	346	348	372	377	420	478	506	523	629	NONE	50	GA-2	
25	0.30	0.33	0.35	0.38	0.48	0.65	25	0.28	0.33	0.35	0.38	0.40	0.43	0.65	25	138	198	250	310	360	363	388	393	438	498	526	545	655	NONE	54	GA-3	
26	0.31	0.34	0.36	0.39	0.49	0.68	26	0.29	0.34	0.36	0.39	0.42	0.44	0.68	26	143	205	260	322	374	377	403	408	455	517	549	567	681	ALFAFA SUNFLOWER SRIHARI MILLET	42	54	
27	0.32	0.35	0.38	0.41	0.51	0.70	27	0.30	0.35	0.38	0.41	0.43	0.46	0.70	27	149	213	270	335	389	392	419	424	473	537	570	589	707	SWEET CLOVER	45	58	
28	0.34	0.36	0.39	0.42	0.53	0.73	28	0.31	0.36	0.39	0.42	0.45	0.48	0.73	28	154	221	280	347	403	406	434	440	490	557	591	610	734	EDGEFIN	69	GA-5	
29	0.35	0.38	0.41	0.44	0.55	0.75	29	0.32	0.38	0.41	0.44	0.46	0.49	0.75	29	160	229	290	360	418	421	450	455	508	577	612	632	760	HERITAGE TREFLAN ORIS	85	GA-6	
30	0.36	0.39	0.42	0.45	0.57	0.78	30	0.33	0.39	0.42	0.45	0.48	0.51	0.78	30	165	237	300	372	432	435	465	471	525	597	633	654	786	NONE	85	-	
31	0.37	0.40	0.43	0.47	0.59	0.81	31	0.34	0.40	0.43	0.47	0.50	0.53	0.81	31	171	245	310	384	446	450	481	487	543	617	654	676	812	NONE	85	-	
32	0.38	0.42	0.45	0.48	0.61	0.83	32	0.35	0.42	0.45	0.48	0.51	0.54	0.83	32	176	253	320	397	461	464	496	502	560	637	675	698	838	SEED TANK/THIRD TANK: SLOW SPEED DRIVE	25	32	
33	0.40	0.43	0.46	0.50	0.63	0.86	33	0.36	0.43	0.46	0.50	0.53	0.56	0.86	33	182	261	330	409	475	479	512	518	578	657	696	719	865	CALIBRATION MATERIAL	31	40	
34	0.41	0.44	0.48	0.51	0.65	0.88	34	0.37	0.44	0.48	0.51	0.54	0.58	0.88	34	187	269	340	422	490	493	527	534	595	677	717	741	891	CANAWAY	45	56	
35	0.42	0.46	0.49	0.53	0.67	0.91	35	0.39	0.46	0.49	0.53	0.56	0.60	0.91	35	193	277	350	434	504	508	543	550	613	697	739	763	917	NITROGEN INOCULANT	44	56	
36	0.44	0.47	0.50	0.54	0.68	0.94	36	0.40	0.47	0.50	0.54	0.58	0.61	0.94	36	198	284	360	446	518	522	558	565	630	716	760	785	943	CANARY-SEED CANOLA	42	54	
37	0.44	0.48	0.52	0.56	0.70	0.96	37	0.41	0.48	0.52	0.56	0.59	0.63	0.96	37	204	292	370	459	533	537	574	581	648	736	781	807	969	ALFAFA	45	58	
38	0.46	0.49	0.53	0.57	0.72	0.99	38	0.42	0.49	0.53	0.57	0.61	0.65	0.99	38	209	300	380	471	547	551	589	592	665	756	802	828	996	SWEET CLOVER YELLOW MUSTARD	44	56	
39	0.47	0.51	0.55	0.59	0.74	1.01	39	0.43	0.51	0.55	0.59	0.62	0.66	1.01	39	215	308	390	484	562	566	605	612	683	776	823	850	1022	11-51-0	56	-	
40	0.48	0.52	0.56	0.60	0.76	1.04	40	0.44	0.52	0.56	0.60	0.64	0.68	1.04	40	220	316	400	496	576	580	620	628	700	796	844	872	1048	NONE	56	-	
41	0.49	0.53	0.57	0.62	0.78	1.07	41	0.45	0.53	0.57	0.62	0.66	0.70	1.07	41	226	324	410	508	590	595	636	644	718	816	865	894	1074	NITROGEN INOCULANT	37	-	
42	0.50	0.55	0.59	0.63	0.80	1.09	42	0.46	0.55	0.59	0.63	0.67	0.71	1.09	42	231	332	420	521	605	609	651	659	735	836	886	916	1100	CANARY-SEED CANOLA	44	56	
43	0.47	0.56	0.60	0.65	0.82	1.12	43	0.47	0.56	0.60	0.65	0.69	0.73	1.12	43	237	340	430	533	619	624	667	675	753	856	907	937	1127	ALFAFA	42	54	
44	0.48	0.57	0.62	0.66	0.84	1.14	44	0.48	0.57	0.62	0.66	0.70	0.75	1.14	44	242	348	440	546	634	638	682	691	770	876	928	959	1153	SWEET CLOVER YELLOW MUSTARD	45	58	
45	0.50	0.59	0.63	0.68	0.86	1.17	45	0.50	0.59	0.63	0.68	0.72	0.77	1.17	45	248	356	450	558	648	653	698	702	788	896	950	981	1179	SEED TANK/THIRD TANK: SLOW SPEED DRIVE	25	32	
46	0.55	0.60	0.64	0.69	0.87	1.20	46	0.55	0.60	0.64	0.69	0.74	0.78	1.20	46	253	363	460	570	662	667	713	722	805	915	971	1003	1205	CALIBRATION MATERIAL	31	40	
47	0.56	0.61	0.66	0.71	0.89	1.22	47	0.56	0.61	0.66	0.71	0.75	0.80	1.22	47	259	371	470	583	676	682	729	738	823	935	992	1025	1231	CANAWAY	45	56	
48	0.58	0.62	0.67	0.72	0.91	1.25	48	0.58	0.62	0.67	0.72	0.77	0.82	1.25	48	264	379	480	595	691	696	744	754	848	958	1013	1046	1284	NITROGEN INOCULANT	37	-	
49	0.59	0.64	0.69	0.74	0.93	1.27	49	0.59	0.64	0.69	0.74	0.78	0.83	1.27	49	270	387	490	607	705	710	760	769	858	975	1034	1068	1298	CANARY-SEED CANOLA	44	56	
50	0.65	0.70	0.75	0.80	0.95	1.30	50	0.65	0.70	0.75	0.80	0.85	1.30	50	275	395	500	620	720	725	775	785	875	985	1055	1090	1310	ALFAFA	42	54		
51	0.66	0.71	0.77	0.82	0.97	1.33	51	0.66	0.71	0.77	0.82	0.87	1.33	51	281	403	510	632	734	740	791	801	893	1015	1076	1112	1336	SWEET CLOVER YELLOW MUSTARD	45	58		
52	0.67	0.73	0.78	0.83	0.98	1.35	52	0.67	0.73	0.78	0.83	0.88	1.35	52	286	411	520	645	749	754	806	816	910	1035	1097	1134	1362	SEED TANK/THIRD TANK: SLOW SPEED DRIVE	25	32		
53	0.68	0.74	0.80	0.85	1.00	1.38	53	0.68	0.74	0.80	0.85	0.90	1.38	53	292	419	530	657	763	768	822	832	928	1055	1118	1155	1389	CALIBRATION MATERIAL	31	40		
54	0.69	0.76	0.81	0.86	1.02	1.56	54	0.69	0.76	0.81	0.86	0.92	1.40	54	297	427	540	670	778	783	837	848	945	1075	1139	1177	1415	CANAWAY	45	56		
55	0.66	0.72	0.77	0.83	0.98	1.43	55	0.66	0.72	0.77	0.83	0.88	1.43	55	303	435	550	682	792	798	853	864	963	1095	1161	1199	1441	NITROGEN INOCULANT	37	-		
56	0.67	0.73	0.78	0.84	1.06	1.46	56	0.67	0.73	0.78	0.84	0.90	1.46	56	308	442	560	694	806	811	868	879	980	1114	1182	1221	1467	CANARY-SEED CANOLA	44	56		
57	0.68	0.74	0.80	0.86	1.08	1.48	57	0.68	0.74	0.80	0.86	0.91	1.48	57	314	458	580	707	821	827	883	895	998	1134	1203	1243	1493	ALFAFA	42	54		
58	0.70	0.75	0.81	0.87	1.10	1.51	58	0.70	0.75	0.81	0.87	0.93	1.48	58	319	458	580	719	835	841	899	911	1015	1154	1224							

# Operation

## Metering Rate Adjustment

The metering rate adjustment for all tanks is done in the same manner. A new rate is achieved by changing the APPLICATION RATE and or the Calibration Factor as outlined in the Topcon manual.

**Note:** It is recommended to set “Calibration Factor” by doing a “Rate Calibration”.

## Seeding Fine Seeds (Canola, Mustard, etc.)

When seeding fine seeds such as canola or mustard, the slow speed transmission has to be engaged to ensure the low rates required for these products.

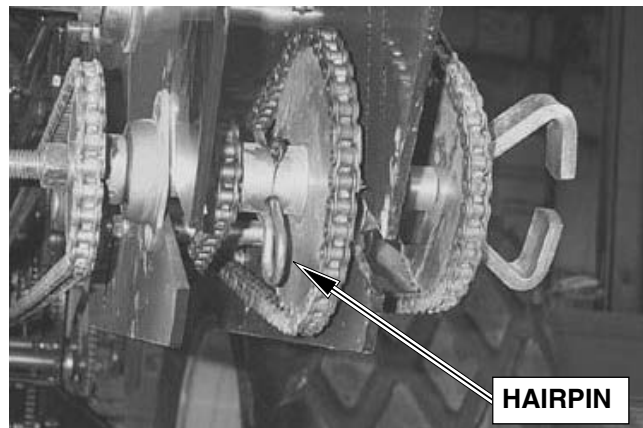
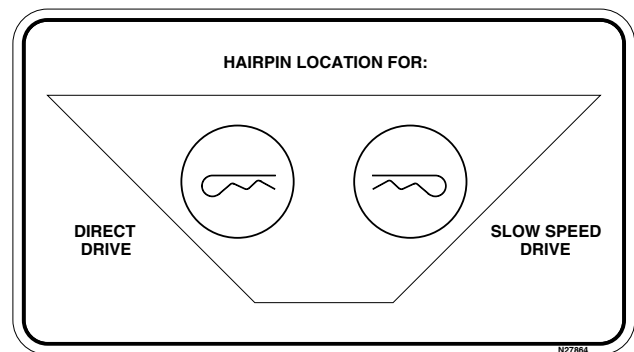
The slow speed transmission is incorporated in the **FRONT** Posi-Drive Transmission.

- To engage the slow speed, remove the large hairpin from the front shaft and install through the sleeve and shaft located at the rear of the transmission.

**Note:** Shaft will have to be rotated to align holes for pin insertion.

- To disengage the slow speed, reverse the above procedure.
- Rate checks can be performed the same way as for other seeds.
- Usually it is necessary to reduce the fan rpm when seeding fine seeds. See *Fan Speed* for specific fan speeds.

**Note:** Seed must be placed in the front tank.



## Applying Inoculant

When inoculant is applied at the time of seeding, then once the Air Cart has been filled, the fill-lids should be left open and the fan run for 5-10 minutes at full rpm to dry the seed.

Calibration must be done after the seed is dried, otherwise the calibration will be incorrect.

**Note:** If the seed is not dried then the seed will have a tendency to bridge and not meter into the air stream.

## Hydraulic Fan Drive

The piston type orbit motor on the fan requires tractor to have either a load sensing hydraulic system or a closed center hydraulic system with flow control.

The flow required is 18 U.S. gpm (68 liters) for the 12 cc motor at a pressure of 2,750 p.s.i. (18,960 kPa) However, smaller flows can be used depending on the product being metered.

**Note:** An additional 6 gpm (23 liters/min) is required for the VRT system.

For correct operation of the fan the hydraulic motor must be coupled to the priority valve (if tractor is so equipped) in the hydraulic valve bank.

Check with the tractor manual or manufacturer to determine if or which spool is a “priority valve”.

Speed fluctuations will result if the fan is not connected to the priority valve if hydraulic system is equipped with a priority valve.

Ensure couplers are free of dirt and are clean when connecting the fan hydraulics to the tractor.

Fan speed is adjusted by increasing the amount of oil being delivered to the motor by adjusting the respective flow control valve until the desired rpm is displayed on the monitor.

**Note:** There is a one-way check valve installed in the hydraulic circuit. If the fan does not rotate, then move hydraulic lever in the opposite direction; this will engage the fan. This valve prevents damage to the hydraulic systems when the fan is shut OFF, by allowing the fan to freewheel.

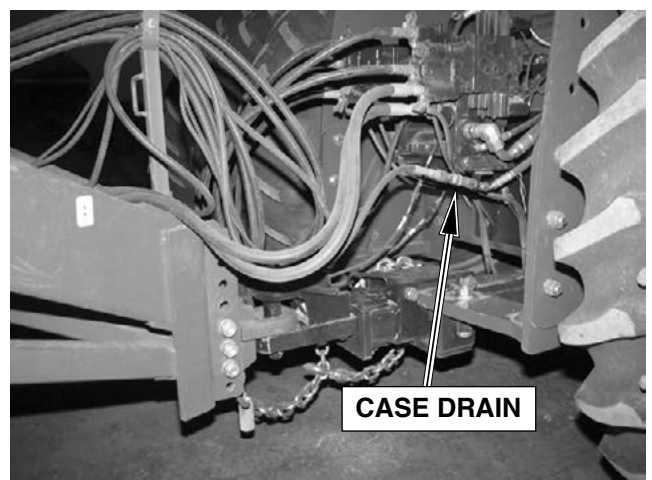
A piston motor creates leakage past the internal components for lubrication. This oil needs to go back to the oil reservoir at the lowest pressure possible. The motor has a 3/8" diameter case drain line. This line must be connected directly into the tractor hydraulic reservoir to ensure that there is zero back pressure in the drain line; otherwise damage will result to the motor.



Orbit Motor Drive

## IMPORTANT

Run hydraulic fan drive at lowest rpm possible (1,000-2,000) for 5-10 minutes before operating at set rpm. This is required to warm up the hydraulic fluid. Cold hydraulic fluid will cause pressure spikes in the system that will damage the case drain seal in the orbit motor.



Hydraulic Coupling on Tractor

# Operation

## Fan Speed

Adequate air volume is necessary at all times to carry the product in the air stream. Air volume can be controlled by adjusting hydraulic oil flow on hydraulic fan drives or adjusting engine speed on engine fan drive models.

Air volume hence fan speed requirements will vary with:

- (a) Ground speed
- (b) Metering rate
- (c) Number of primary runs
- (d) Width of machine
- (e) Density and size of material

Excessive fan speed can cause seed damage, seed bouncing and premature wear of the system.

Generally fan speed is adequate if product flows through the hoses without surging and the hoses empty quickly and evenly when the system shuts down.

The table lists *suggested minimum fan speeds* for certain products. **The table should be used only as a guide.** If plugging or surging occurs increase the fan speed to eliminate the problem.

**Note:** It is recommended that after a rain or dew the fan be run two to three minutes to expel any moisture in the system.

## Important

**Keep fan impeller blades clean at all times.**

**Note:** Once fan speed is properly set, be sure to adjust the monitor fan alarm setting accordingly. See Monitor Section "Monitor Programing".

Suggested Fan RPM @ 5 mph (8 kph) on a 41 ft unit				
Product	Application Rate		Fan Speed Setting	
	Seed	Fertilizer	Single Shoot	Double Shoot
Fine Seeds	All Rates	50 lbs/acre 56 kg/ha	3400 RPM	3000 RPM
		100 lbs/acre 112 kg/ha	3800 RPM	3400 RPM
		> 150 lbs/acre 168 kg/ha	4300 RPM	3800 RPM
Lentils	All Rates	All Rates	3800 RPM	3800 RPM
Coarse Grains	90 lbs/acre 100 kg/ha	50 lbs/acre 56 kg/ha	4300 RPM	3800 RPM
	90 lbs/acre 100 kg/ha	100 lbs/acre 112 kg/ha	4500 RPM	3800 RPM
	90 lbs/acre 100 kg/ha	> 150 lbs/acre 168 kg/ha	4800 RPM	4000 RPM
Large Seeds	180 lbs/acre 200 kg/ha	40 lbs/acre 45 kg/ha	4400 RPM	4000 RPM
Fertilizer Light	*****	<100 lbs/acre 112 kg/ha	4000 RPM	*****
Fertilizer Heavy	*****	> 100 lbs/acre 112 kg/ha	4500 RPM	*****
<b>Note:</b> Fan Speeds given are when applying product. It is normal for fan speed to drop when not applying product.				

## Double Shoot Settings

Double Shooting is done with a few simple adjustments as follows:

1. Plenum Setting
2. Diverter Setting
3. Quick Coupler Position (Tow Behind Only)

### Plenum Damper Settings

Adequate air volume is necessary at all times to carry the product in the air stream. Air volume can be controlled by adjusting the plenum damper settings.

The table below lists initial plenum damper settings for certain products.

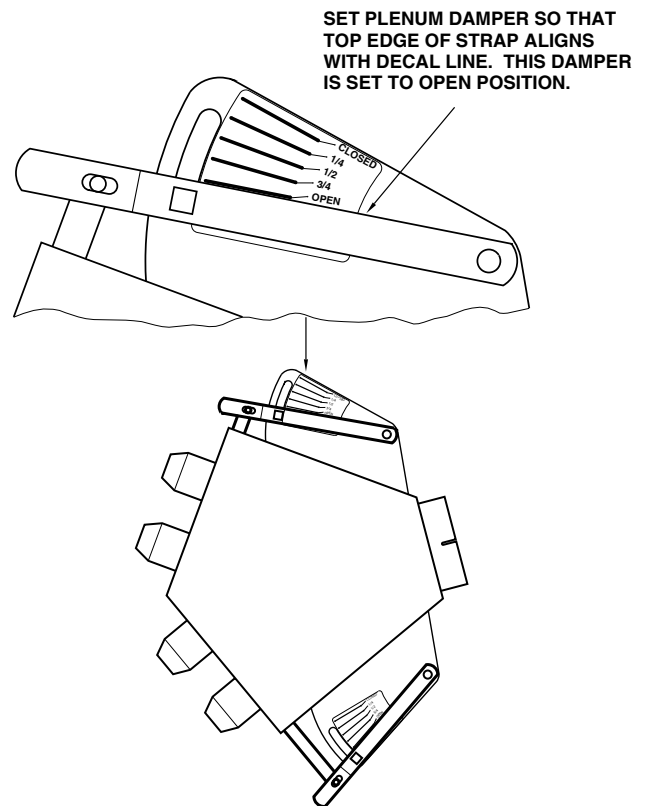
**Note:** The settings in table should be used only as a guide.

- If **fertilizer** plugging or surging occurs **decrease** the seed damper setting to eliminate the problem.
- If **seed** plugging or surging occurs **increase** the seed damper setting to eliminate the problem.

### Diverter Settings

Located between the metering bodies in each primary line are two diverter valves. The diverters must be correctly set in order for product to flow correctly as outlined on next two pages.

1. Double Shoot - Handles in Double Shoot Position.
2. Single Shoot - Handles in Single Shoot Position.



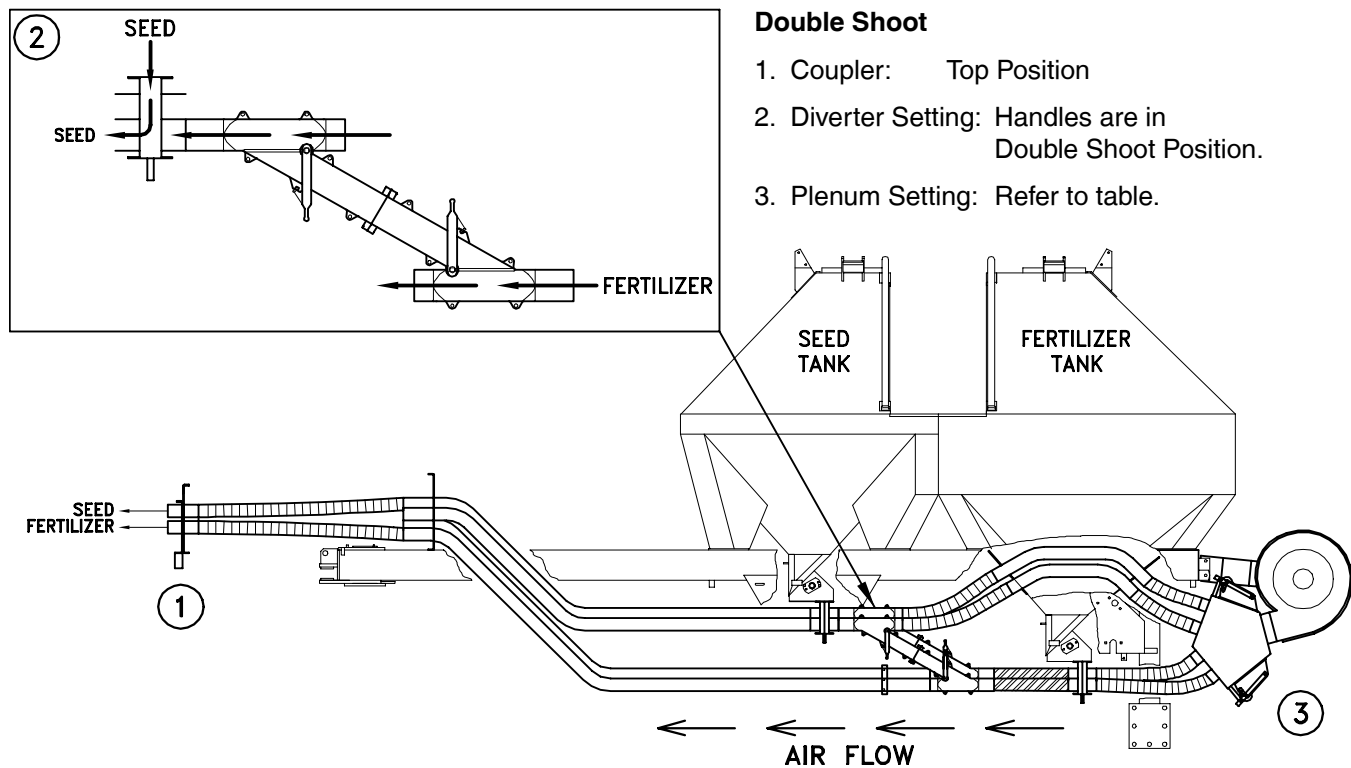
Suggested Plenum Settings				
Product	Seed		Fertilizer	
	Rate lb/acre	Damper Setting	Rate lb/acre	Damper Setting
<b>Fine Seeds</b>	All Rates	1/4	All Rates	Open
<b>Coarse Grains</b>	90 lb (100 kg/ha)	Open	50 lb (56 kg/ha)	1/2
	90 lb (100 kg/ha)	Open	100 lb (112 kg/ha)	Open
	90 lb (100 kg/ha)	1/4	150 + lb (168 kg/ha)	Open
<b>Large Seeds</b>	180 lb (200 kg/ha)	Open	40 lb (45 kg/ha)	1/4
<b>Single Shoot</b>	<b>Tow Behind</b> - Top Damper Closed - Bottom Damper Open			
	<b>Tow Between</b> - Top Damper Open - Bottom Damper Closed			

**Note:** See “Fan Speeds” for Fan RPM.

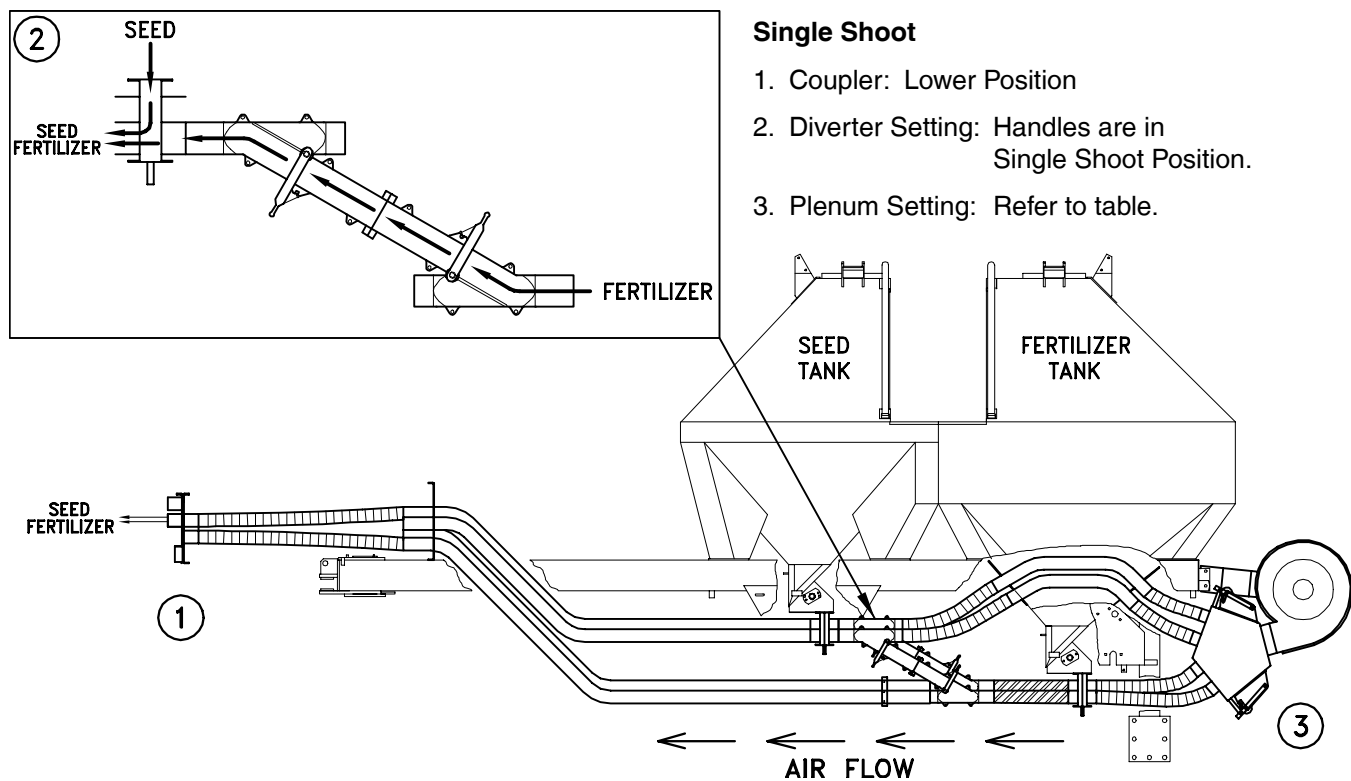
# Operation

## Double Shoot Settings - Continued

### Double Shoot Tow Behind

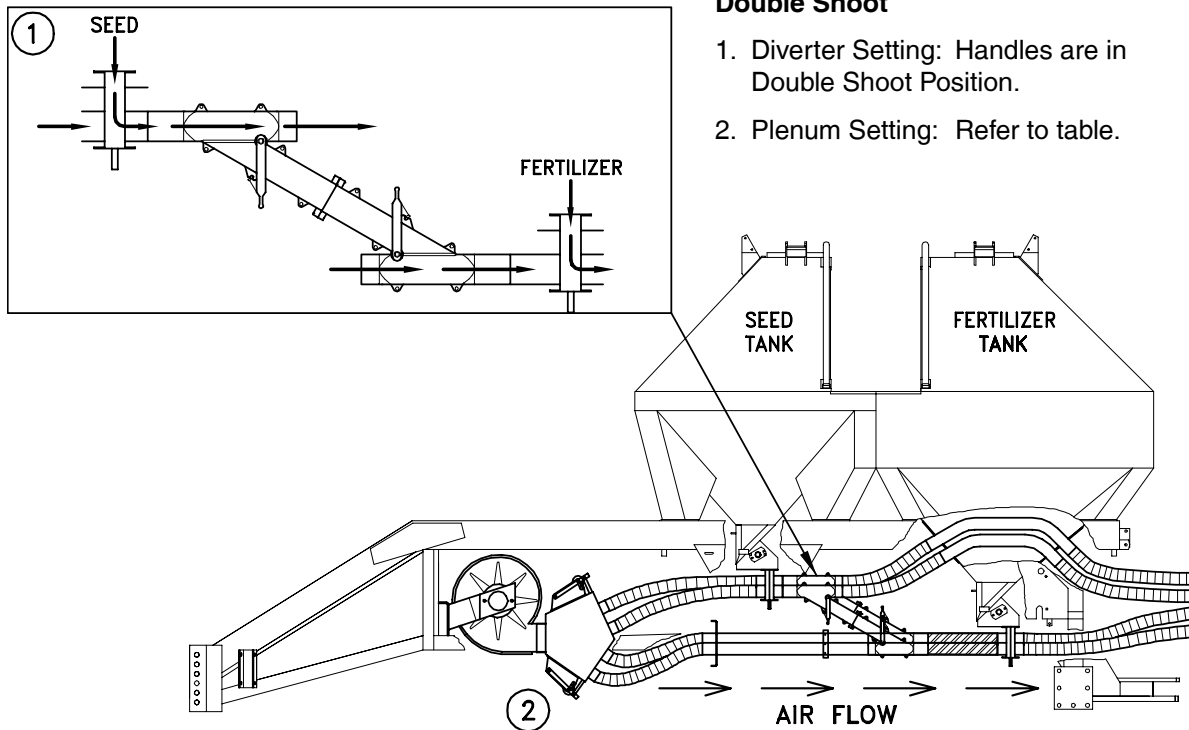


### Single Shoot Tow Behind

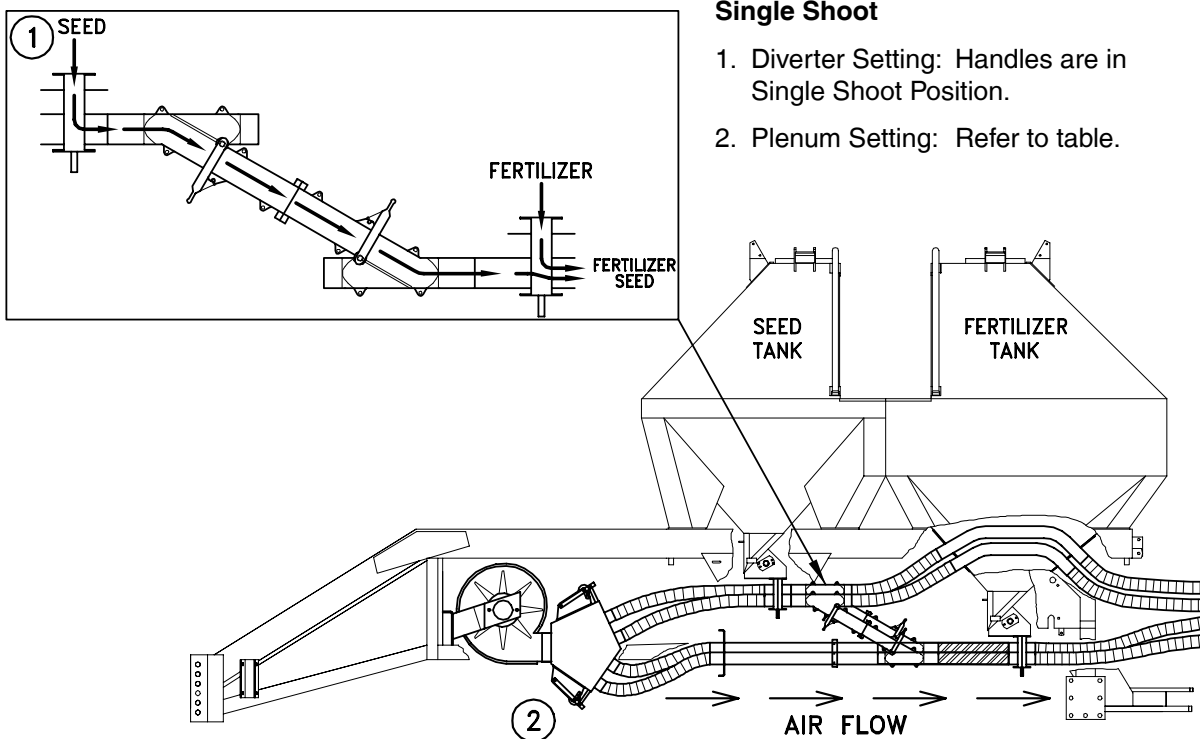


## Double Shoot Settings - Continued

### Double Shoot Tow Between



### Single Shoot Tow Between



# Operation

## Operating Guidelines

There are a number of areas that can cause problems when seeding. Listed below are specific points that should be addressed at all times. Following these guidelines will ensure better crop emergence and consequently the potential for better yields.

An improperly levelled seeding tool cause uneven depth which could result in poor emergence.

It is important that the seeding tool is levelled both side to side and front to back.

### Check Tire Pressures

- Ensure all tires are inflated to their specified pressure. Incorrect tire pressure can cause depth variations.

### Level Seeding Tool Side to Side

- Check the depth of each shovel on the back row.
- Adjust side to side level as necessary. See seeding tool manual for more details.

### Level Seeding Tool Front to Rear

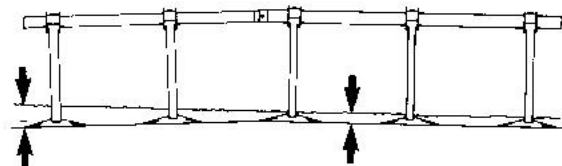
- Poor front to rear levelling causes ridging as shown.
- Check the depth of two adjacent shanks normally one on the front row and one on the rear row.
- Adjust level as necessary. See seeding tool manual for more details.

### Worn Seeding Tool Parts

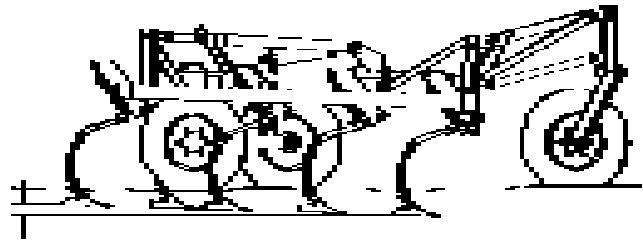
- Shanks that are bent cause uneven depth and they should be repaired or replaced.
- Trip mechanisms that are worn can also cause poor depth control and any worn parts should be repaired or replaced.

### Packing

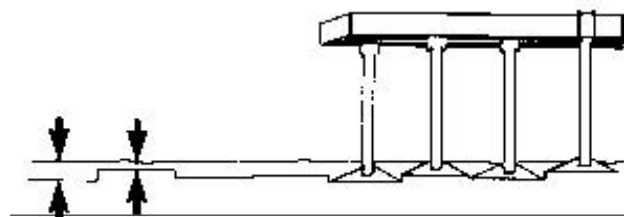
- Packing behind the seeding unit is strongly recommended. This improves germination and helps reduce moisture loss and erosion.
- In wet conditions the head land should be done last to prevent over packing.



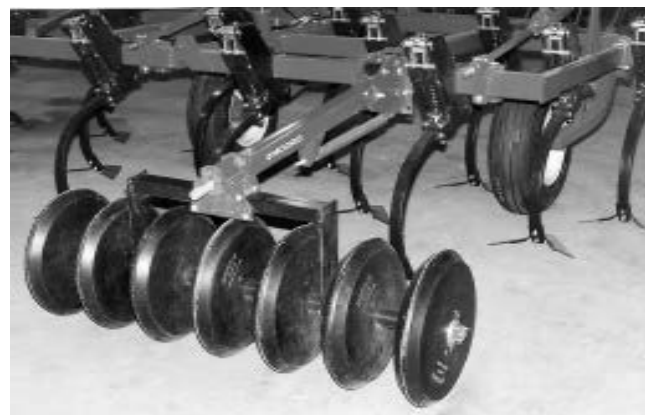
Side to Side Level



Front to Back Level



Ridging Front to Back



Mounted Packers

## Operating Guidelines - Continued

### Turning

- Avoid sharp turns. Backing up of the outer wings with the seeding tool in the ground has a tendency to plug the seed boot with soil.
- Raise seed boots fully before making sharp turns or backing machine.

**Note:** It is strongly recommended to consult local agricultural extension offices for allowable product rates, which are dependent on soil moisture and type.

### Seed Rate Settings

- Remove any caked-on material from sliders and metering wheels.
- Ensure all sliders are properly set and wheels turn freely.
- Check product rates carefully by performing a calibration check.

**Note:** If equipped with a granular tank, the lines must be blocked off when not in use.

### Fertilizer Application

- Avoid using fertilizers that absorb moisture readily, especially during periods of high humidity.
- Also avoid fertilizers that contain a high percentage of fine dust, as these materials can plug metering wheels and coat the inside of seed distribution system.

### Fan Setting

- Run fan at recommended speed. If plugging or surging occurs increase the fan speed to eliminate the problem.
- Allow tractor hydraulic oil to warm-up thoroughly prior to seeding. Cold oil will cause slower fan speeds (Hydraulic driven fan).

### Product Application

- Control product application with the clutch switch in tractor.
- Have machine moving forward before lowering seed boots to avoid plugging.
- To prevent skipping, allow 15 feet of forward travel to ensure air system has delivered product to seed boots.

**Note:** Do not attempt to meter product when fan is not running. Damage to the metering wheels may occur.

# Operation

## Operating Guidelines - Continued

### Adjustments and Operational Checks

- When changing fields and periodically throughout the day the seeding tool should be checked for level and depth and the seed boots for blockage.

### Checking Seed Flow

The following procedure should be implemented throughout the day typically at each fill of the air cart:

- Raise the seeding tool out of the ground.
- With the fan running and monitor off, engage meter drives with the primer switch, rotating meter drives 4 to 5 times.
- Seed and/or fertilizer should appear at each outlet on the ground.
- If no seed or fertilizer appears on the ground at any of the openers check for hose blockage in both the 15/16" (24 mm) diameter secondary and the 2 1/2" (64 mm) diameter primary hose, as well as in the flat fan divider.
- See Trouble Shooting Section for possible causes of the blockage.

### Moisture Alert

- Whenever Air Cart has been standing for an hour or more during period of high humidity or damp, rainy days, or after sitting overnight, run fan at recommended rpm, with machine stationary for 5 minutes.

### Air Leaks

It is imperative that no air leaks occur in the Air Cart tank as even the smallest air leak from the lid will lead to material bridging in the tank thereby causing misses in the field.

Check the following areas for air leaks:

- Tank clean-out door
- Metering body assembly seals
- Collector assembly seals
- Tank lid

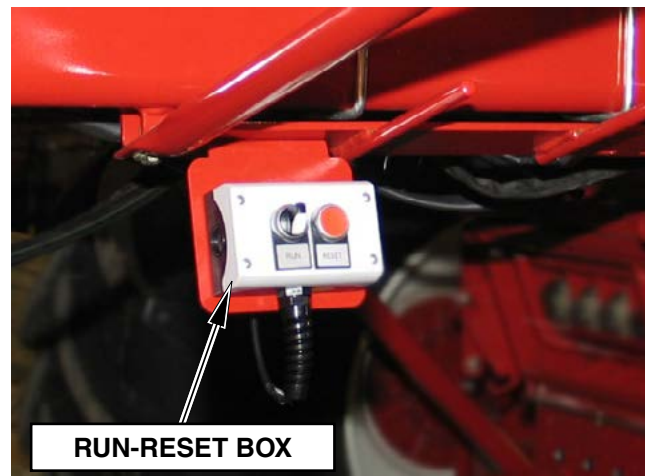
### Tank Low in Product

- Refill tank before metering wheels are exposed.
- The metering wheels must be completely covered to avoid unseeded strips.

## Important

**Check Metering Wheel flutes in the event the primary lines plug.**

**Flutes may shear if the collector becomes plugged.**



**Mount to Ladder**

**Note : Check Seed Flow as described above, after running fan for 5 minutes.**

## Operating Guidelines - Continued

### Monitor

- Familiarize yourself with all monitor functions as outlined in the Topcon manual.
- Ensure all monitor “*settings*” are correctly set for the air cart/seeding tool combination.
- Recognize and correct alarm conditions as indicated on the monitor.
- Check all wire harness connections for corrosion and use a dielectric spray to clean. Inspect all sensors for proper gap.



X30 Monitor - Shown

## General Field Operation

- Follow guidelines outlined in “*Operating Guidelines*”.
- Switch monitor on as outlined in the Monitor Section.
- Start Fan.

**Note:** Load sensing hydraulic systems require “*warming up*” before they function smoothly. See “*Hydraulic Fan Drive*” for more details.

- Move forward with seeding tool.
- Engage metering systems as outlined in the “Monitor Section” under “*Identifying Variable Rate Console Switches*”.
- Lower seeding tool into ground.
- Rates can be varied accross field as desired by useing the boost and cut buttons for the appropriate product. See “*Identifying Variable Rate Console Switches*” under Monitor Section.
- Turning at headland: Switch metering systems off with the Master On/Off Switch, immediately raise seeding tool fully rephasing hydraulics (see seeding tool manual).
- Once turned engage metering systems with the Master On/Off Switch and lower seeding tool into ground.

**Note:** Do not attempt to meter product when fan is not running. Damage to the metering wheels may occur.

**Note:** Engage console master switch early enough to avoid misses. Forward travel should be equal to half the width of the seeding tool. [i.e. for a 40 ft (14 m) wide seeding tool the forward travel should be a minimum of 20 feet (7 m).]

# Operation

## Manual Override

If the variable rate control system fails, the independent manual override system can be used to maintain seeder operation.

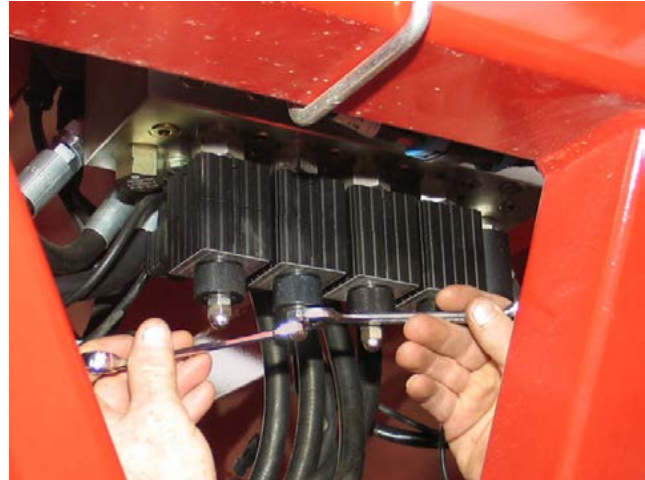
The manual override system provides the ability to run the hydraulic motors at a fixed rate (**not proportional to ground speed**) and to turn the manual system ON and OFF from the tractor cab.

## Rate Setting

To set the manual override system use the following procedure:

- Turn Monitor OFF.
- Empty product from tanks or close tank shut-offs.
- Refer to the appropriate “*Ground Speed Chart*” on the following pages or use the calculations below to determine the meter shaft RPM for the desired product.
- Adjust meter shaft RPM using following procedure:
  - Place hand held tachometer onto meter shaft.
  - Remove cap nut and then loosen jam nut.
  - Turn adjusting screw IN (Clockwise) until meter shaft turns desired RPM.
  - Tighten jam nut to secure adjusting screw in place. Replace cap nut.
- Repeat the above procedure for the other meter shafts.

**Note: Re-zero shaft hydraulic motors once normal operation of system is resumed.**



**Remove Cap Nut and Loosen Jam Nut**



**Adjusting Screw**

## Calculating Meter Shaft RPM

If it is desired to calculate the exact rpm for a more specific ground speed use the following:

### Know parameters:

Working Width	The operating width of seeding tool. (feet)
Working Speed	Operating ground speed. (mph)
Application Rate	Weight of product. (lbs/acre)
Product WT/REV	Known from calibration mode or can determine from Calibration Chart. (lbs/rev)

## Manual Override - Continued

### Calculating Meter Shaft RPM

Determine in the following order:

- 1) Travel Distance (feet per acre) =  $43560 \text{ ft}^2 / \text{Working Width (ft)}$
- 2) Travel Speed (feet per minute) =  $\text{Working Speed (mph)} \times 5280 \text{ ft/mile} / 60 \text{ min/hr}$
- 3) Travel Time (minutes per acre) =  $\text{Travel Distance ft/acre} / \text{Travel Speed (ft/min)}$
- 4) Motor revs per acre =  $\text{Application rate (lbs/acre)} / \text{WT/REV (lbs/rev)}$
- 5) Motor RPM =  $\text{Motor Revs (revs/acre)} / \text{Travel Time (min/acre)}$

#### 6) Meter Shaft RPM

Direct Drive =  $\text{Motor RPM} / 2$

Slow Speed Drive =  $\text{Motor RPM} / 16$

## Operating in Manual Override

- Connect Manual Override switch to AUX connection on monitor harness.
- Refill tanks or open the tank shut-offs.
- Ensure Manual Override switch is in the OFF position, this will shut off the shaft motors.
- Start Fan.
- Move forward with seeding tool at desired speed.

**Note: It is important to maintain a constant ground speed since product application rate will not adjust to any changes in ground speed.**

- Engage metering system by turning ON the Manual Override switch.
- Lower seeding tool into ground.
- Turning at headland:
  - Disengage metering system by turning OFF the Manual Override switch, immediately raise seeding tool fully rephasing hydraulics (see seeding tool manual).
  - Once turned engage metering system by turning ON the Manual Override switch, and lower seeding tool into ground.

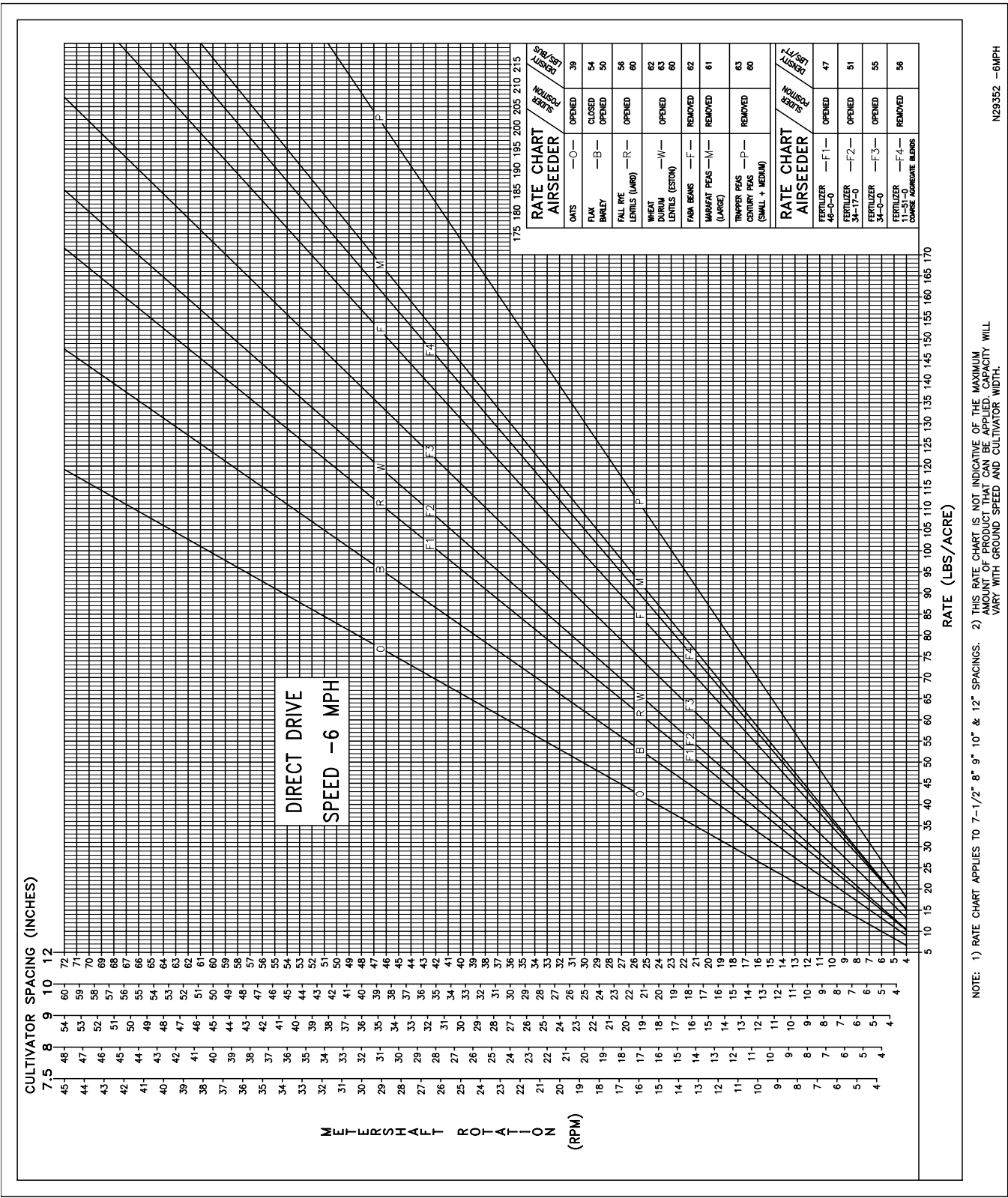
**Note: Re-zero shaft hydraulic motors once normal operation of system is resumed.**



# Operation

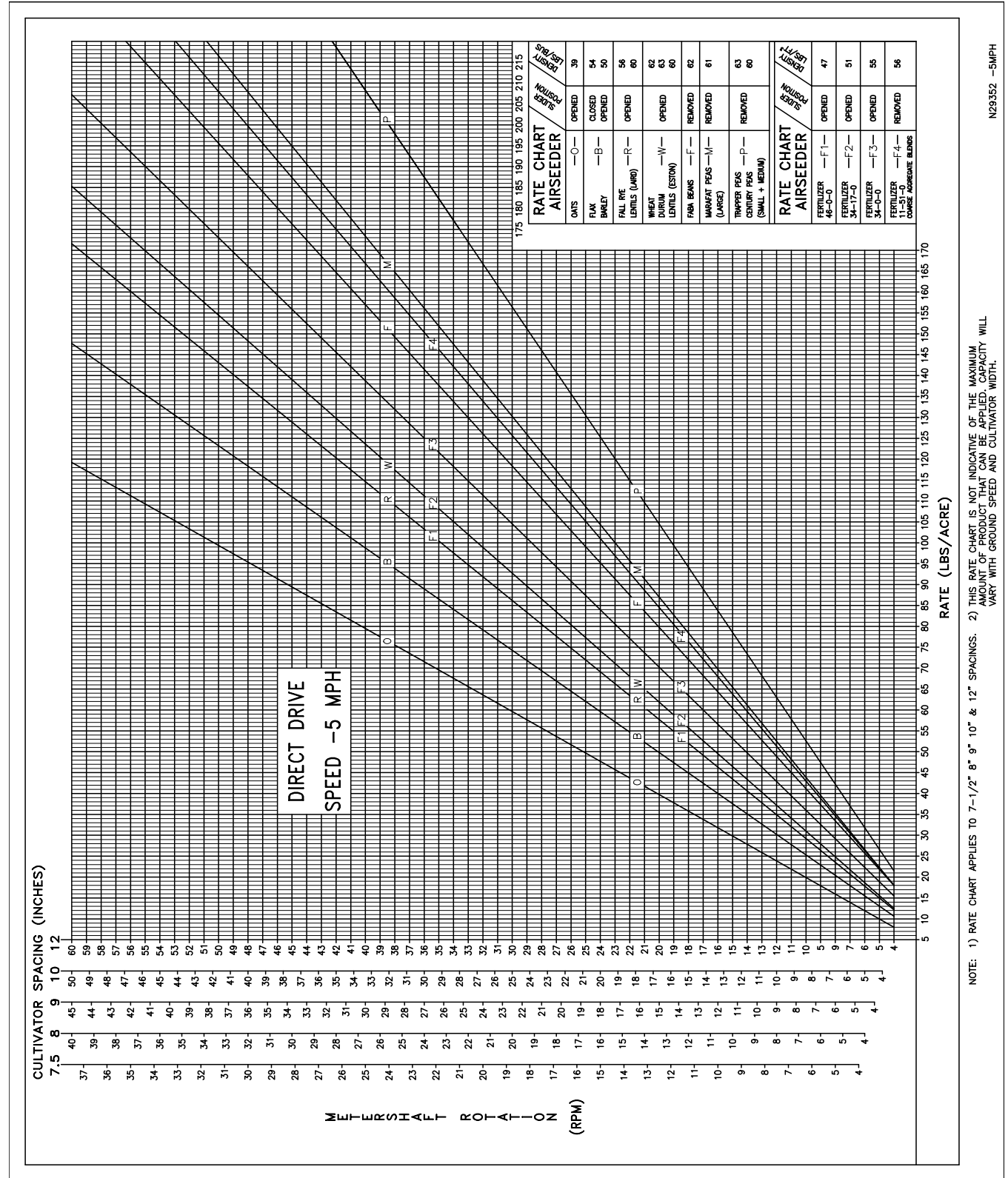
## Manual Override - Continued

### Ground Speed Chart - Direct Drive 6 mph



## Manual Override - Continued

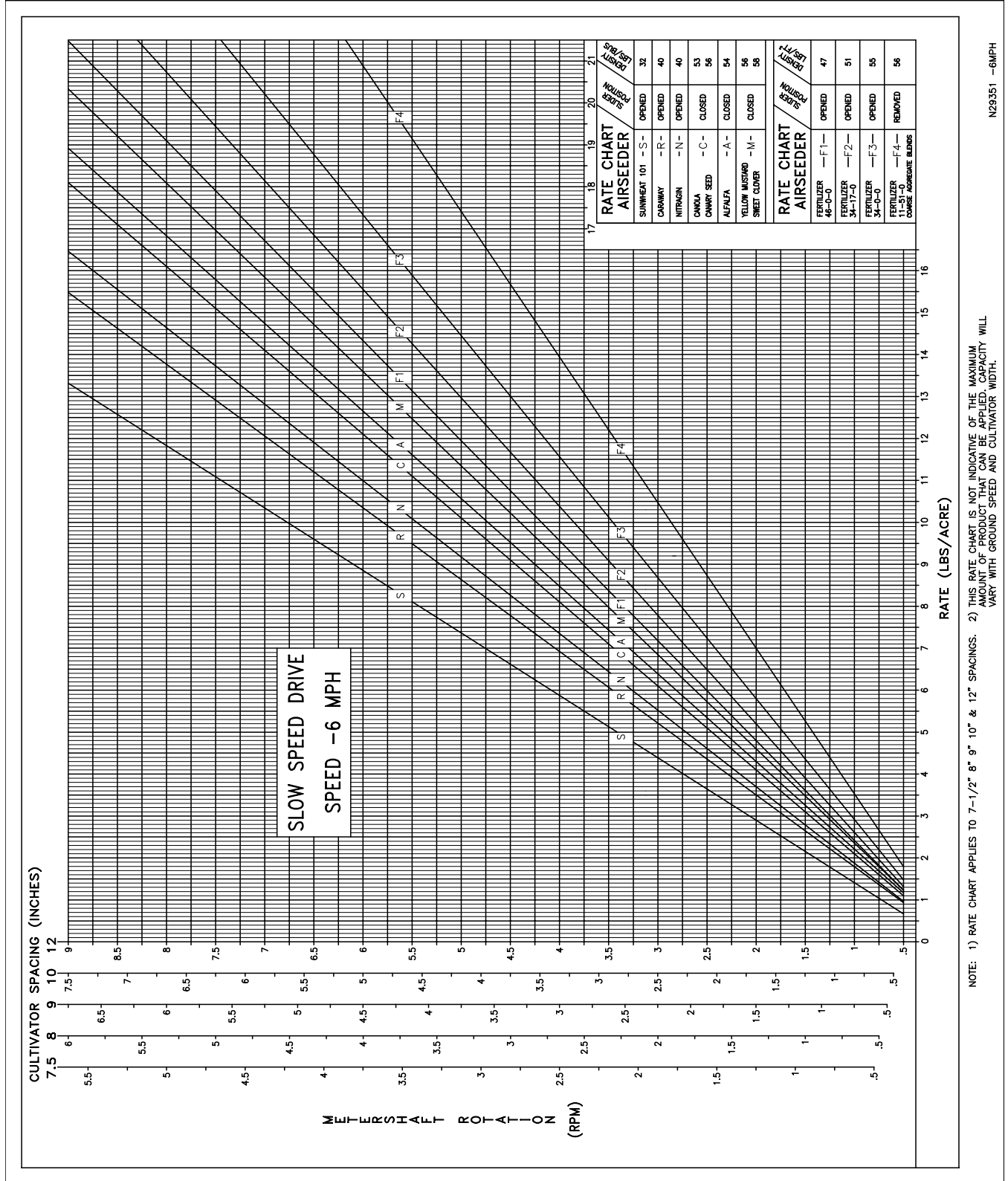
### Ground Speed Chart - Direct Drive 5 mph





## Manual Override - Continued

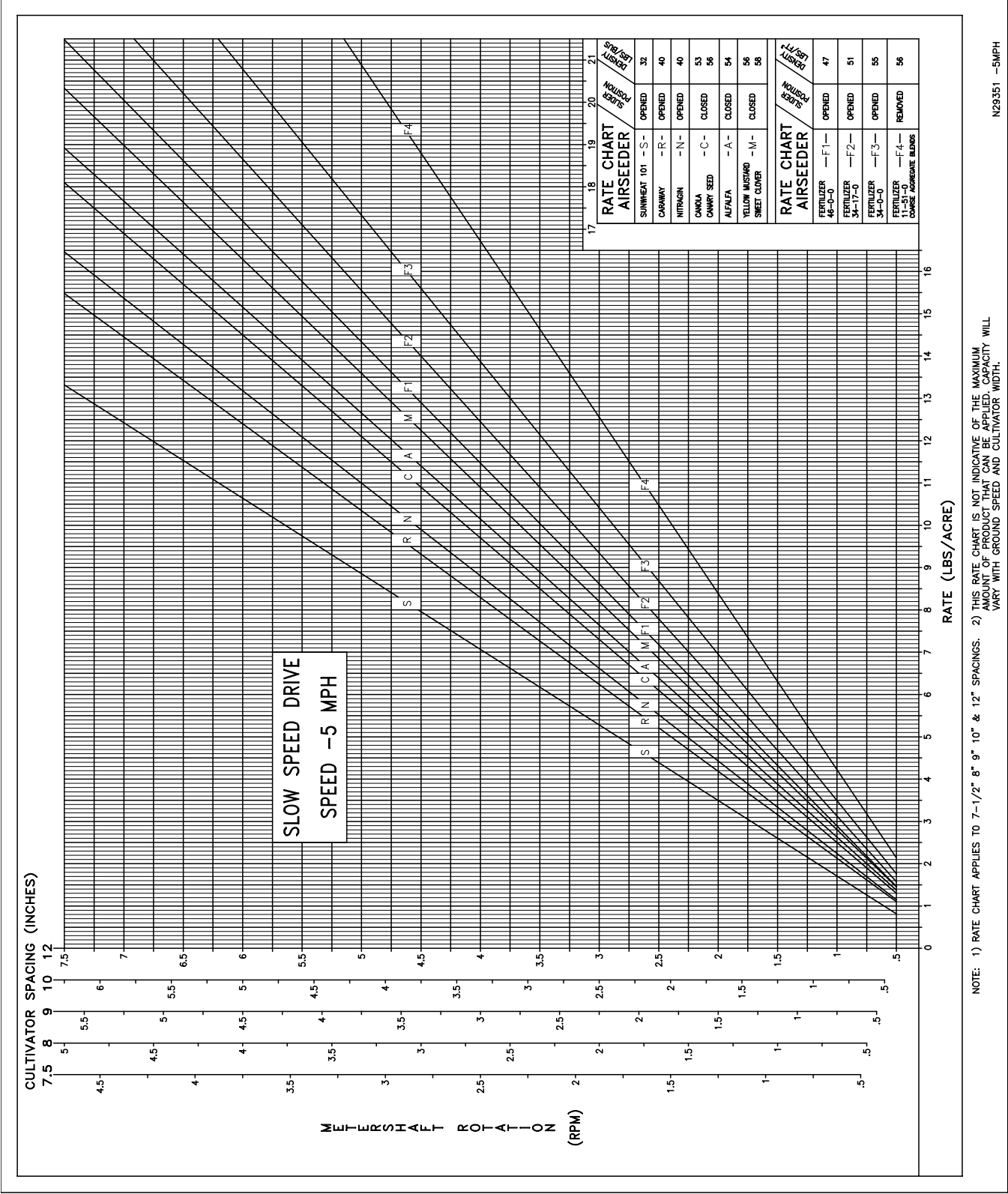
### Ground Speed Chart - Slow Speed 6 mph



# Operation

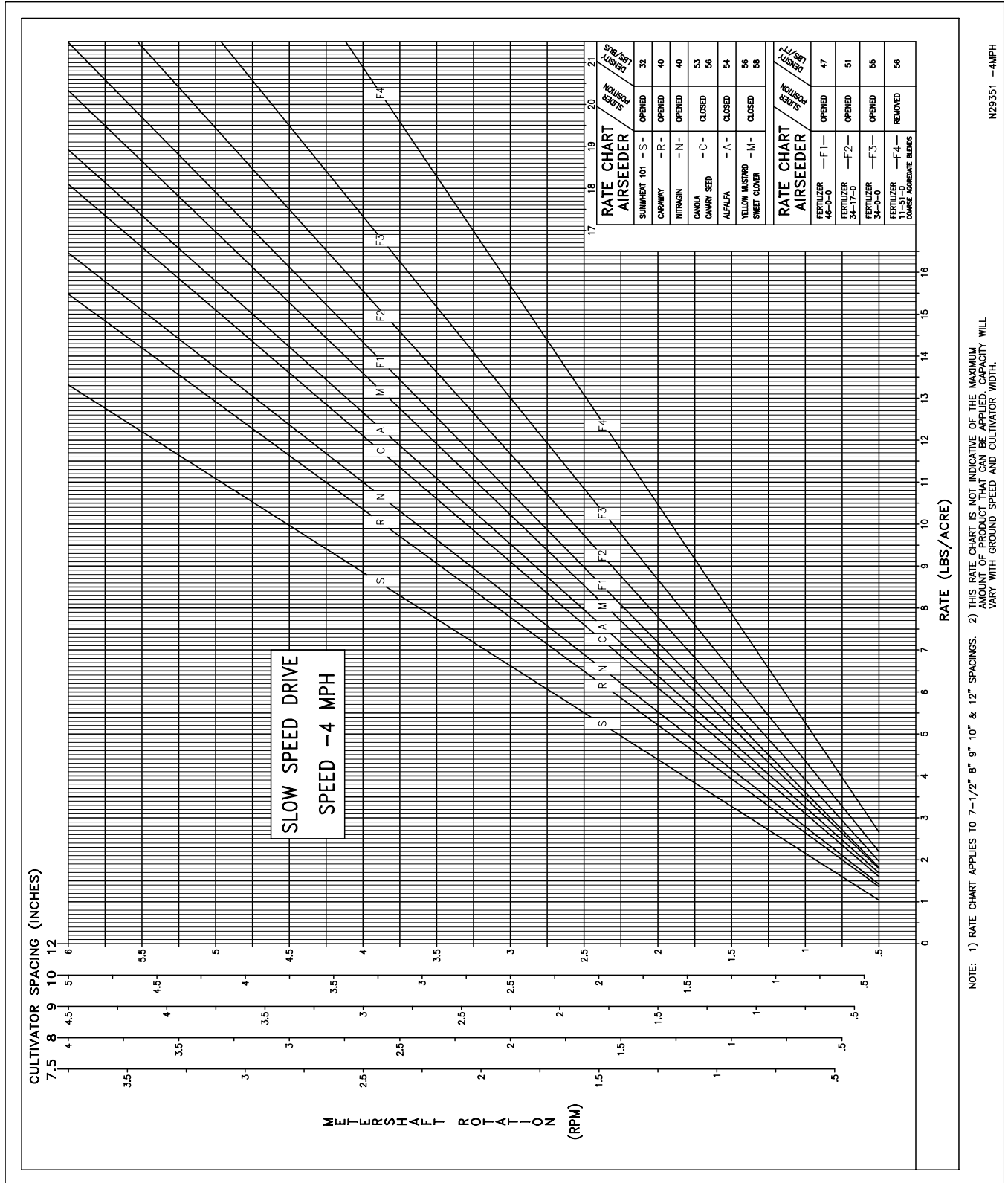
## Manual Override - Continued

### Ground Speed Chart - Slow Speed 5 mph



## Manual Override - Continued

### Ground Speed Chart - Slow Speed 4 mph



# Operation

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Notes

# Section 6: Maintenance

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# Maintenance

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## CAUTION



**BE ALERT**

## SAFETY FIRST

**REFER TO SECTION 1 AND REVIEW ALL SAFETY RECOMMENDATIONS.**

### General

This section deals with two goals, maximum life and dependable operation. Adopt a regular maintenance and lubrication program. Care and sufficient lubrication is the best insurance against delays.

### Safety

- Always shut off the tractor and remove key before dismounting.
- Guard against hydraulic high pressure leaks with hand and face protection.
- Never work under the Implement unless it is in the down position or transport lock pins are in place and secured with hair pins. Do not depend on the hydraulic system to support the frame.
- Always wear safety goggles, breathing apparatus and gloves when working on seeder filled with chemical. Follow manufactures recommended safety procedures when working with chemicals or treated seeds.
- Do not feed left over treated seed to livestock, treated seed is poisonous and may cause harm to persons or livestock.



## Warning

**Securely support any machine elements that must be raised for service work.**



## Caution



**Keep service area clean and dry. Wet or oily floors are slippery.**



# Maintenance

## Tighten Bolts

- Before operating the Air Cart.
- After the first two hours of operation.
- Check tightness periodically thereafter.
- Use Bolt Torque Chart for correct values on various bolts.
- Note dashes on hex heads to determine correct grade.

**Note: DO NOT use the values in the Bolt Torque Chart if a different torque value or tightening procedure is given for a specific application.**

- Fasteners should be replaced with the same or higher grade. If higher grade is used, only tighten to the strength of the original.

Bolt Torque Chart				
Grade 5 Bolt Marking 		Bolt Size	Grade 8 Bolt Marking 	
Nm	lb. ft.		lb. ft.	Nm
11	8	1/4	12	16
23	17	5/16	24	33
41	30	3/8	45	61
68	50	7/16	70	95
102	75	1/2	105	142
149	110	9/16	155	210
203	150	5/8	210	285
366	270	3/4	375	508
536	395	7/8	610	827
800	590	1	910	1234
1150	850	1-1/8	1350	1850
1650	1200	1-1/4	1950	2600
2150	1550	1-3/8	2550	3400
2850	2100	1-1/2	3350	4550

## Tires

- Inspect tires and wheels daily for tread wear, side wall abrasions, damaged rims or missing lug bolts and nuts. Replace if necessary.
- Tighten wheel bolts - refer to Bolt Torque Chart.
- Check tire pressure daily, when tires are cold.
- Correct tire pressure is important.
- Do not inflate tire above the recommended pressure.

Tire Specifications			
Tire Size	Tire Style	Rating	Pressure
21.5L x 16.1	Softac II	10 ply	28 psi
	Sure Grip Traction	12 ply	32 psi
23.1L x 26	AWT (Implement)	12 ply	24 psi
	Rice (TD8 Sure Grip)	10 ply	28 psi



## Caution

Tire replacement should be done by trained personnel using the proper equipment.

## Daily Maintenance

- Check for and remove any water in primary collectors after rainy weather. Remove both front and rear clean-out doors and collector bottom to drain water from the tanks and collectors.
- Reinstall collector bottoms and clean-out doors.

**Important:** Care must be taken when reinstalling collector bottoms to prevent damage to the inside of the collector.

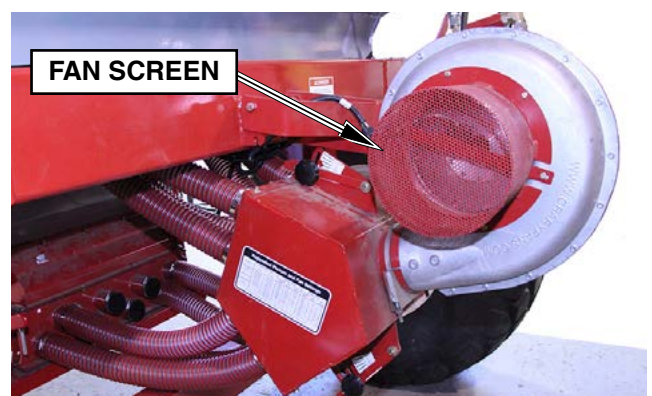
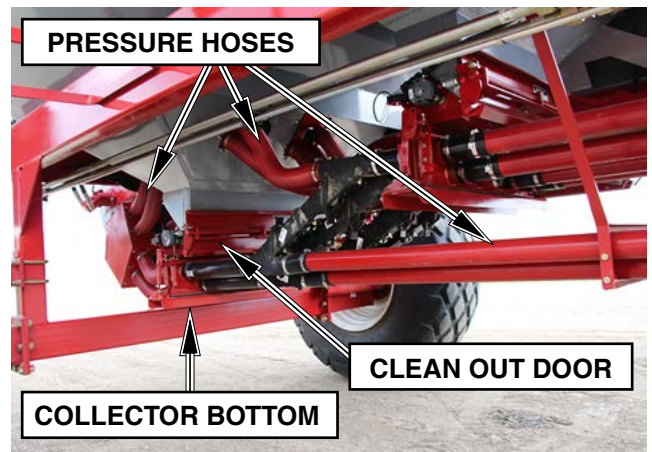
- Assure fan screen is clear of debris.

**Note:** Start fan and run for 3 - 5 minutes prior to loading machine to get rid of accumulated moisture.

- Check lid seals for damage, and that they are sitting properly on steel ring.
- Check tank pressure hoses for leaks, cracks or plugging.
- Check the following **areas for air leaks**:
  - Tank clean-out door
  - Metering body assembly seals
  - Collector assembly seals
  - Tank lid

Refer to "Air Leak Check" under Air System Maintenance.

- Check monitor wiring that all sensor wires are properly routed and retained.
- Check for plugged hoses.
- Assure drive chains are cleared of debris.
- Inspect wheel bolts for looseness.



# Maintenance

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## Lubrication

Greasing pivot points prevents wear and helps restrict dirt from entering. However, once dirt does enter a bearing, it combines with the lubricant and becomes an abrasive grinding paste, more destructive than grit alone.

- Apply new lubricant frequently during operation to flush out old contaminated lubricant.
- Use a good grade of lithium based grease.
- Use a good grade of machine oil.
- Clean grease fittings and lubricator gun before applying lubricant.

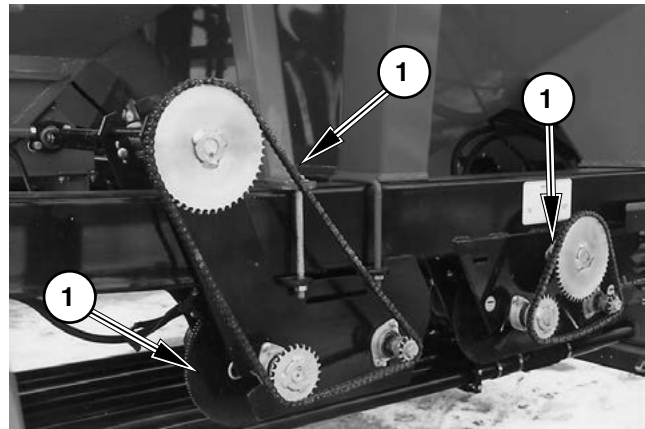
Refer to the photos on page 7-6 and 7-7 for grease fitting locations.

### 1. Drive Chains

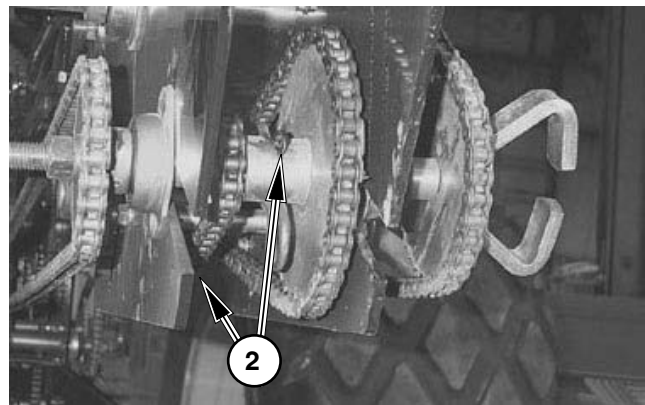
- Oil every 50 hours.

### 2. Slow Speed Drive

- Grease every 50 hours.



1. Drive Chains



2. Slow Speed Drive

## Lubrication - continued

### 3. Front Castor Wheel Bearings

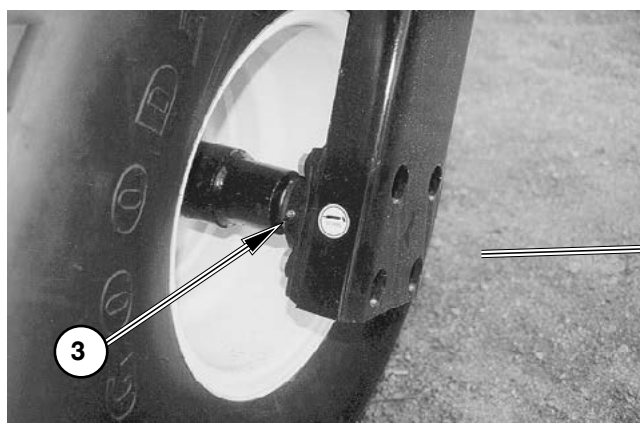
- Grease every 50 hours.

### 4. Castor Fork Pivot

- Grease every 50 hours.

### 5. Auger Pivots

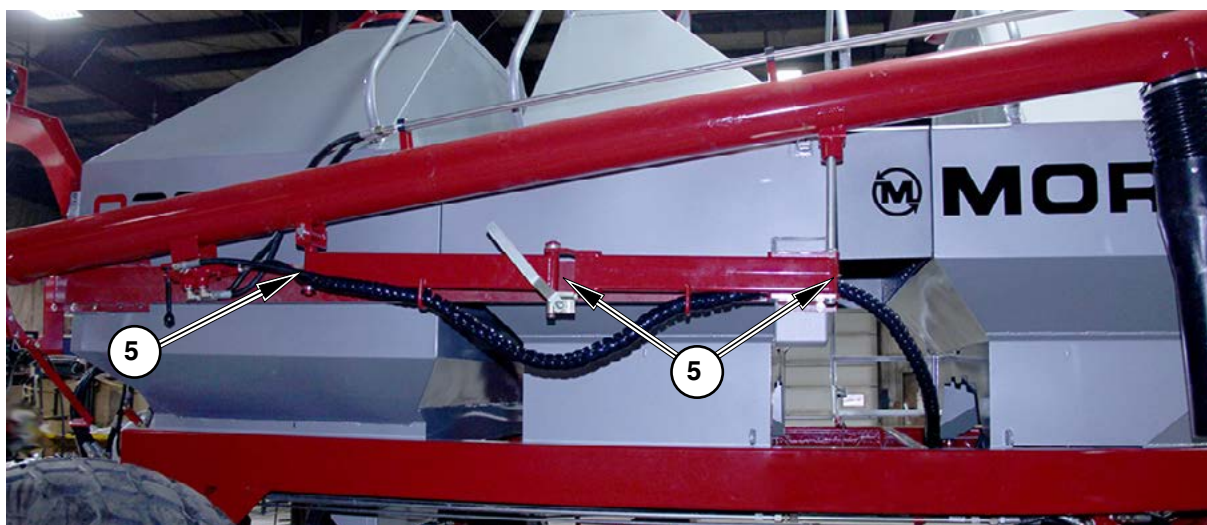
- Grease every 100 hours.



3. Front Castor Wheel bearings



4. Castor Fork Pivot (3 Meter Cart)



5. Auger Pivots

# Maintenance

## Air Delivery System

### General

The air delivery system of all Air Carts is extremely important for the proper metering of product to the openers. The metering system on all pressurized Air Carts is sensitive to air leaks. **Loss of tank air pressure could affect feed rates, which could become erratic or even stop.**

- Regularly check that all hoses are free from kinks or blockages throughout the day. To check for blockages raise seeding tool out of the ground and with the fan running turn crank a couple of turns. Equal amounts of material should be deposited under each boot if not check the following for blockage:
  1. Seed openers and secondary hoses.
  2. Divider heads by removing access doors.
  3. Primary hoses and collectors.
  4. Metering wheels for damage to key-way and the flutes of the wheel.
- Keep fan inlet screen clear and free from debris.
- Place a plastic bag over the fan when the unit is not in use. This helps prevent moisture from entering the system.
- Check periodically and at the end of each season for air leaks at hose connections.
- Check periodically and at the end of each season for air leaks at the following:
  1. Tank Lid Seals.
  2. Metering body shaft seals.
  3. Metering body to tank seals.
  4. Collector to metering body seals.
  5. Fan to plenum.
  6. Plenum to collector.
  7. Clean-out doors, for leaks and loss of seal memory.
  8. Collector door seals.
  9. Diverter Valves.
  10. Couplers between seeder and cultivator.
  11. Access Doors on Divider Heads.

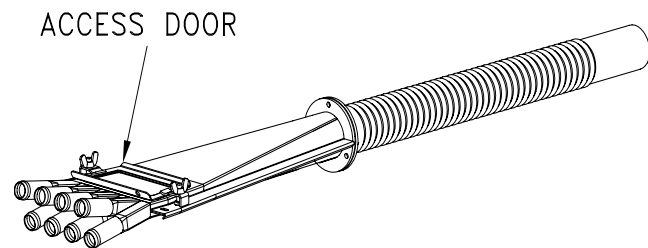
**Note: There must not be any air leaks from the tank. This air leakage causes air turbulence in the tank which can result in inaccurate metering rates.**

- Once a year check for wear of primary and secondary hoses.

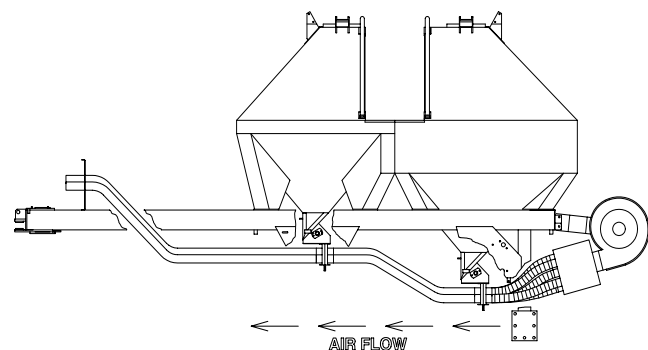


## Caution

Care should be taken when working near the Air Cart while the fan is running. Product blowing out of the system could cause personal injury.



**Note: Extended life can be obtained if the hoses are rotated 1/4 turn once a year.**



## Air Delivery System - Continued

### Tank Lids

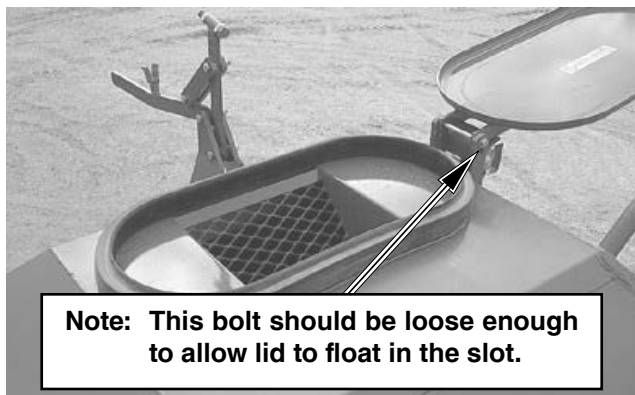
The lid seal is probably the area that sees the most abuse due to the activity associated with filling the tanks.

With each fill the lid seals should be inspected for cuts, abrasions, debris in the seal and ensure the seal is positioned properly on the steel rim around the tank opening.

### Tank Lid Adjustment

Check Tank Lid tension on *all tanks* at beginning of each season and periodically during season for air leaks. The following checks and adjustments must be made to prevent air leaks from occurring:

- Check for any foreign material embedded into seal. Clean out foreign material from seal surface.
- Check seal for cuts and abrasions. If seal is cut or severely worn, then replace seal.
- Ensure seal is positioned properly on steel rim around tank opening.
- Use a 0 - 100 lb. (45 kg) spring scale to check the tank lid opening force. With the lid closed place one end of the scale one inch from the end of the tank lid lever. Pull straight up on the scale and note the maximum force it takes to open the lid. The force needed to open the lid **must be greater than 65 lbs (29 kg)**. Adjust the lid latch adjusting bolt as necessary. The lid latch should close with a **snap**. This will ensure that the lid is sufficiently tight and prevent any leaks.
- Re-check for leaks. If lids still leak turn down bolt one or two more turns. Re-check for leaks.



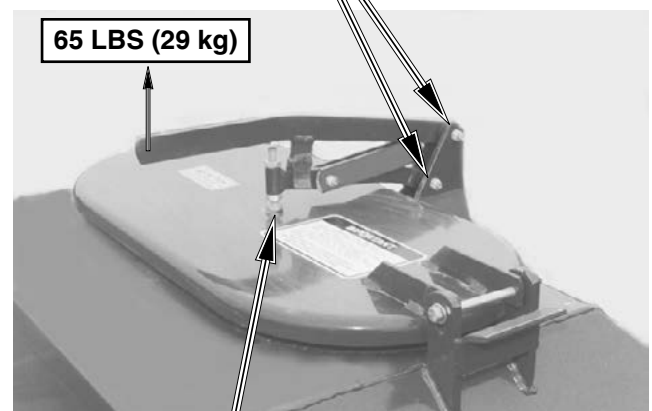
**Note:** This bolt should be loose enough to allow lid to float in the slot.

## Important

**It is imperative that no air leaks occur in the Air Cart tank as even the smallest air leak from the lid will lead to material bridging in the tank thereby causing misses in the field.**

**Note:** When Air Cart is not in use, leave lid latches loose to help maintain resilience of the seals.

**These bolts and lock nuts must be tightened to maintain a friction fit so the lid latch stays stationary when in open position.**



**Adjust the lid latch adjusting bolt to obtain a force *greater than 65 lbs (29 kg)* to open the lid.**

# Maintenance

## Air Delivery System - Continued

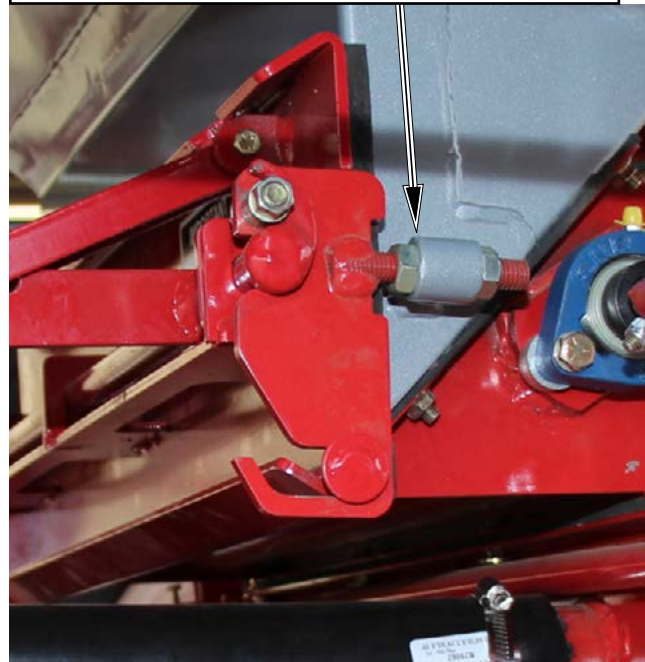
### Inspection Door Adjustment

Check Inspection Door on *all metering bodies* at beginning of each season and periodically during season for air leaks. The following checks and adjustments must be made to prevent air leaks from occurring:

- Check for any foreign material embedded into seal. Clean out foreign material from seal surface.
- Check seal for cuts and abrasions. If seal is cut or severely worn, then replace seal.
- Ensure seal is positioned properly on steel rim around tank opening.
- Use a 0-100 lb. (0-45 kg) spring scale to check the tank lid closing force. With the Door near the closed position, place one end of the scale *on* the Door handle. Pull down on the scale and note the maximum force it takes to latch handle lock. The force needed to latch handle lock **must be 25 lbs to 30 lbs (12-14 kg)**.
- Adjust the door latch adjusting bolts as necessary. This will ensure that the lid is sufficiently tight and prevent any leaks.
- Re-check for leaks. If Doors still leak adjust latch bolts one or two more turns. Re-check for leaks.



**Adjust the latch bolts to obtain a force of 25 lbs to 30 lbs (12-14 kg) to close the Door.**

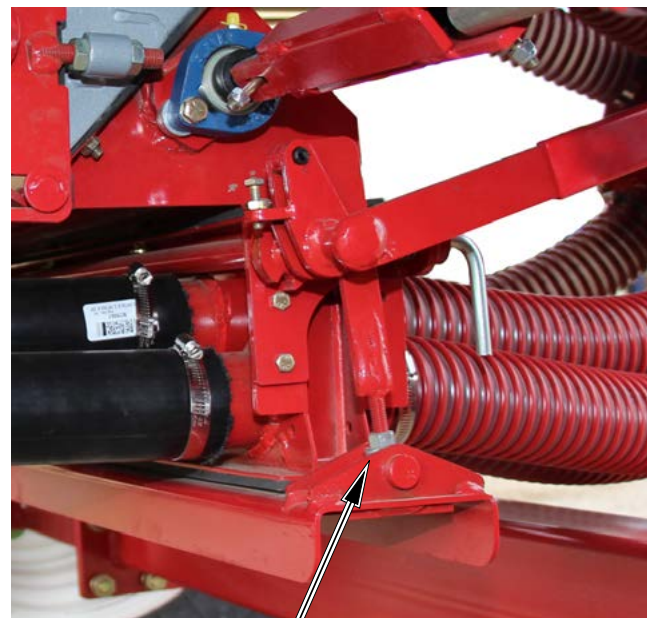
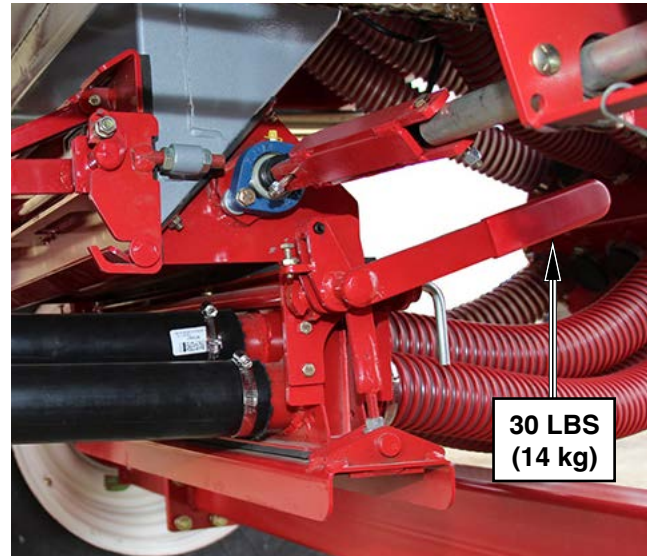


## Air Delivery System - Continued

### Clean Out Door Adjustment

Check Clean Out Door on *all metering bodies* at beginning of each season and periodically during season for air leaks. The following checks and adjustments must be made to prevent air leaks from occurring:

- Check for any foreign material embedded into seal. Clean out foreign material from seal surface.
- Check seal for cuts and abrasions. If seal is cut or severely worn, then replace seal.
- Ensure seal is positioned properly on steel rim around tank opening.
- Use a 0-100 lb. (0-45 kg) spring scale to check the tank lid closing force. With the Door near the closed position, place one end of the scale *on* the Door handle. Pull down on the scale and note the maximum force it takes to latch handle lock. The force needed to latch handle lock **must be 25 lbs to 30 lbs (12-14 kg)**.
- Adjust the door latch adjusting bolts as necessary. This will ensure that the lid is sufficiently tight and prevent any leaks.
- Re-check for leaks. If Doors still leak adjust latch bolts one or two more turns. Re-check for leaks.



Adjust the latch bolts to obtain a force of 25 lbs to 30 lbs (12-14 kg) to close the Door.

# Maintenance

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## Air Delivery System - Continued

### Air Leak Check

It is **imperative that no air leaks occur** in the Air Cart tank. Any air leaks could cause loss of tank air pressure affecting feed rates, which could become erratic or stop.

To prevent this from occurring, it is strongly recommended that a pressure test be conducted prior to seeding time. This can be performed very easily and simply by completing the following steps:

- Clean fan impeller and adjust tank lids.
- Disconnect the 2 1/2" (64 mm) diameter primary hoses from the rear of the cultivator at the primary hose coupler(s) by loosening the four 3/8" bolts.
- Install the blank off plate that is supplied with the Air Cart at each coupler and retighten the 3/8" bolts. If the blank off plates are not readily at hand a piece of cardboard can be used in its place.
- Once the blank off plates have been installed, start the fan and run at 4,500 rpm.

Check the following areas for air leaks:

1. Tank lid seals.
2. Metering body shaft seals.
3. Metering body to tank seals.
4. Collector to metering body seals.
5. Fan to plenum and plenum to collector.
6. Clean-out doors, for leaks and loss of seal memory.
7. Collector door seals.
8. Diverter valves and double shoot mounting plates.
9. Tanks union plate.
10. Tank site glasses.

Air leaks can be detected by spraying a soapy water solution onto the seal area. If bubbling of soap occurs, the seal has a leak. Another method is to use your hand to feel for any air movement around the seal. This method requires a calm day, as the wind can make it difficult to detect a small leak.

- If any of the above areas leak, remove the parts and replace the seal. Ensure upon reassembly that the parts are tightened sufficiently to prevent air leakage.
- Remove the blank off plates before using the Air Cart.

Once the pressure test is complete, check the following areas for air leaks:

11. Couplers between seeder and cultivator.
12. Access doors on divider heads.

## Important

**It is imperative that no air leaks occur in the Air Cart tank, as even the smallest air leak will lead to material bridging in the tank, thereby causing misses in the field.**

**Note: When Air Cart is not in use leave lid latches and clean-out doors loose to help maintain resilience of the seals.**

## Air Delivery System - Continued

### Fan

Debris can build up on the fan screen and blades causing reduced output of the fan. The lack of air flow even at higher fan speeds will cause material plugging of the air system.

The build up of material during operation can cause the following:

1. Fan rpm will increase without increasing oil flow to orbit motor.
2. Air Cart distribution system plugging from a lack of air flow (Increasing fan rpm has little or no effect).

### Fan Screen

- Ensure fan screen is clear of debris. Check periodically through the day.

### Fan Impeller

The fan blades may become plugged under high humidity/dusty conditions/high insect counts.

Under severe conditions the fan blades should be inspected daily and cleaned as required.

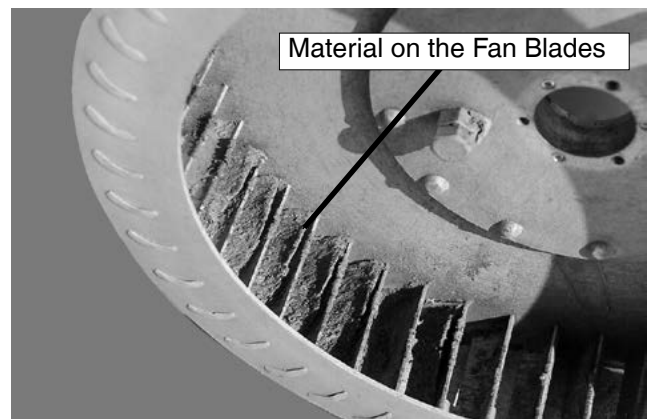
Under normal conditions the fan should be inspected and cleaned at least once a season.

- Care should be taken in cleaning all fan blades thoroughly to restore the fans peak performance.
- Ensure that the balance clips located on the fan blades are not removed, as this will put the fan out of balance.

### Storage

To prevent water entering the air system, cover the fan intake with a plastic bag, whenever the seeder is not in use.

**Note:** Be sure to remove fan cover prior to starting fan. Serious damage could result to the fan.



**Note:** Material build up on the fan blades could cause the fan to be out of balance. The added vibration of the out of balance impeller will reduce the life of the fan components.

# Maintenance

## Air Delivery System - Continued

### Impeller Clearance

The impeller should be centred inside the housing to avoid contact between the impeller and housing.

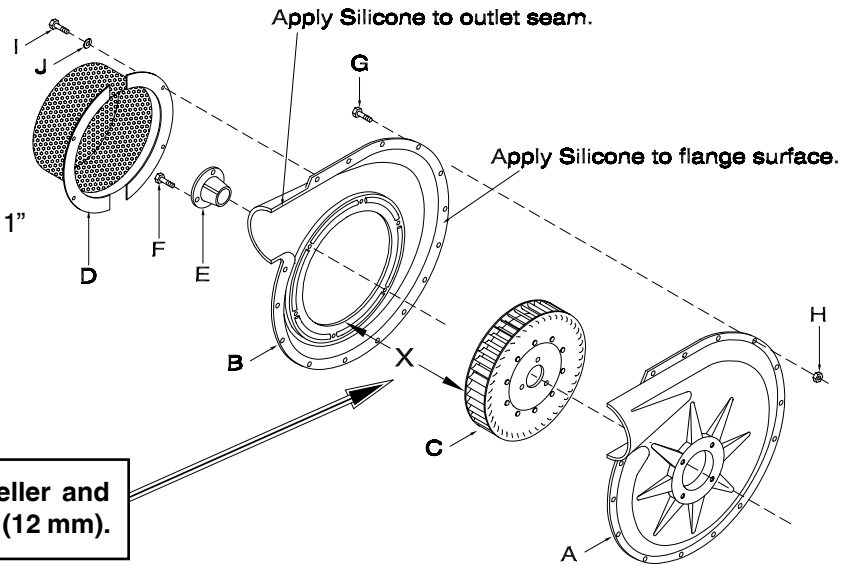
The distance "X" between the impeller and housing inlet, when centred, will be approximately 3/8" (9 mm) to 1/2" (12 mm).

When assembling fan ensure flange surfaces of housing are clean.

Apply a 1/4" (6 mm) silicone bead to one flange surface of housing including outlet seam.

Mate surfaces and secure in place with 1/4" x 1" hex bolts (G) and 1/4" serrated lock nuts (H).

**Note:** Torque 1/4" bolts to 49 in. lb.



### Hoses

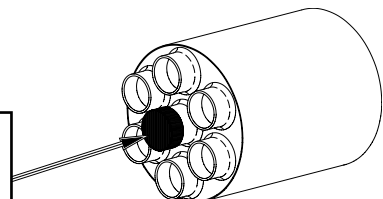
Inspect air delivery hoses for wear and replace as required. Check areas where hoses maybe exposed to moving parts such as hitch hinge area. At the Air Cart hitch area, place a piece of 2 1/2" (64 mm) hose 12" (305 mm) long over top of the two hitch extension pins to protect air hoses from contacting pins.

Also, inspect hoses for blockage as rodents/birds may nest in hoses that have not been properly capped during storage.

To optimize the 9s Series Air Cart air system on single shoot units the difference in length between the longest primary hose and the shortest primary hose **should not exceed six feet**.

In conjunction with this, it is important to eliminate the use of the centre port of the plenum. Check plenum hose routing, if centre port of the plenum is used change hose location.

**DO NOT USE  
CENTRE PORT ON  
ALL PLENUMS**



## Hydraulic Orbit Motor

The motor requires no maintenance itself.

It does, however, require clean oil so the tractor hydraulic filters must be replaced regularly.

### Repair/Replacement

- Remove orbit motor from the fan.

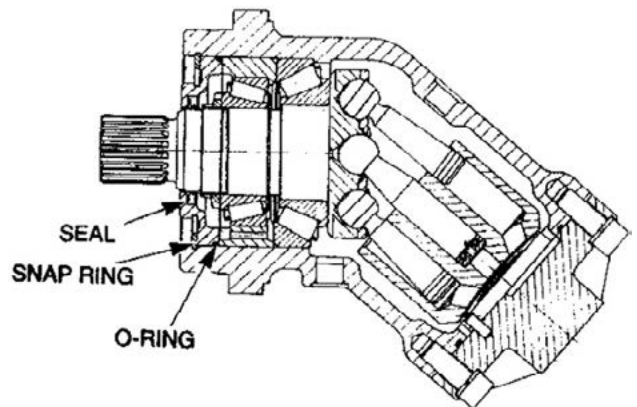
**Note:** The shaft should never be hammered on or forced in as this will result in motor damage upon startup.

- Remove the snap ring and front cover.
- Push out the old shaft seal and press in the new one.

**Note:** The bearings should never be removed from the shaft as they are pretensioned to the shaft with the motor spinning.

- Replace the O ring.
- Both the O ring and shaft seal should be greased with a “very clean” grease.
- Care must be taken when the front cover is installed so the shaft seal is not damaged.
- Reinstall the snap ring.
- Fill the motor case with “clean” oil before running.

**Note:** Any time a motor is replaced the case must be filled with oil before it is started, if not, a bearing failure could occur.



# Maintenance

## Hydraulics

Refer to Section 1 regarding hydraulic safety. In addition:

- Inspect hydraulic system for leaks, damaged hoses and loose fittings.
- Damaged Hoses and hydraulic tubing can only be repaired by replacement. **DO NOT ATTEMPT REPAIRS WITH TAPE OR CEMENTS.** High pressure will burst such repairs and cause system failure and possible injury.
- Leaking cylinders - install a new seal kit.
- Fittings - use liquid Teflon on all NPT hydraulic joints. **Do not use liquid Teflon or Teflon tape on JIC or ORB ends.**
- Hydraulic Hose Connections - when connecting the hoses to the cylinders, tubing, etc. always use one wrench to keep the hose from twisting and another wrench to tighten the union. Excessive twisting will shorten hose life.
- Keep fittings and couplers clean.
- Check the Tractor Manual for proper filter replacement schedule.

Refer to the Trouble Shooting Section.

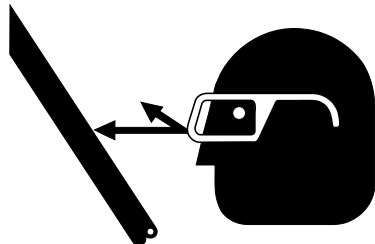


Contact your nearest Dealer for genuine repair parts. Dealers carry ample stocks and are backed by the manufacture and regional associations.

### **Caution**

**Dirt in the hydraulic system could damage O-rings, causing leakage, pressure loss and total system failure.**

**Note: Extreme care must be taken to maintain a clean hydraulic system. Use only new hydraulic fluid when filling reservoir.**



### **Warning**

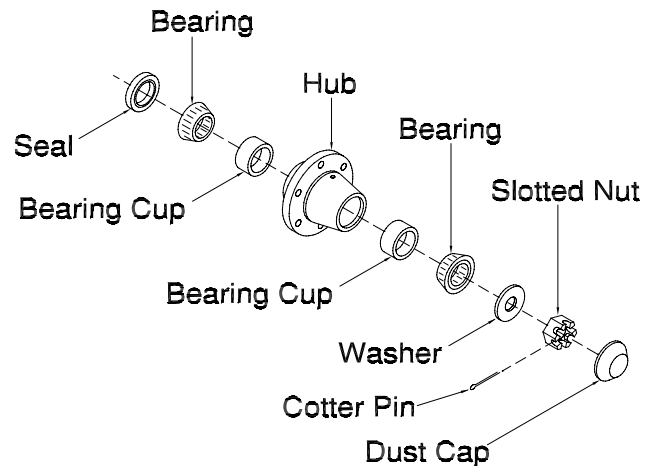
#### **HIGH-PRESSURE FLUID HAZARD**

**To prevent serious injury or death:**

- **Relieve pressure on hydraulic system before servicing or disconnecting hoses.**
- **Wear proper hand and eye protection when searching for leaks. Use wood or cardboard instead of hands.**
- **Keep all components in good repair.**

## Wheel Bearings

- Shut tractor off and remove key.
- Block wheel on tractor.
- Raise the Air Tank wheels enough to clear the surface.
- Securely block Air Tank frame.
- Remove wheel from hub.
- Remove the dust cap, cotter pin, and the slotted nut and washer.
- Be careful when pulling the hub off as not to drop the outer bearing.
- Clean spindle and bearing components with solvent.
- Inspect for wear on bearings, spindle and cups, replace parts as required.
- Do not reuse old seals. Use only new seals when assembling.
- Pack inner hub with bearing grease.
- Be sure bearing and cup are dry and clean.
- Work grease into the bearing rollers, until each part of the bearing is completely full of grease.
- Install inner bearing and cup first, then press new seals in place.
- Place hub on spindle.
- Install outer bearing, washer and slotted nut.
- Tighten nut while turning the wheel until a slight drag is felt.
- Back nut off one slot and install a cotter pin. Bend cotter pin up around nut.
- Pack grease inside the dust cap and tap into position.



# Maintenance

## Front Castor Brake Adjustment

The Dual Axle Front Castor is equipped with a brake which prevents the tires from shimmy under normal operation. It is important the front castor brake be properly adjusted. If the brake is not adjusted correctly the tires will shimmy excessively and may cause the axle assembly to fail.

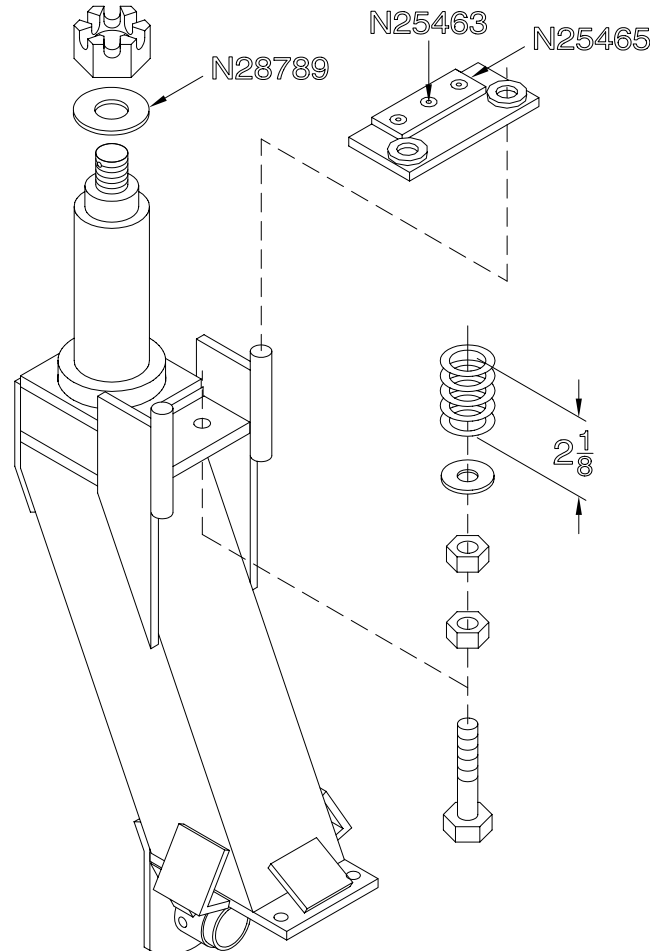
Adjust the castor brake as follows:

- Check and ensure there is no paint/grease where the brake pad rides, as the paint/grease will reduce the effectiveness of the brake.
- Inspect brake pad (N25465) ensuring it is not damaged or worn, replace if required.

**Note: Maximum allowable wear is 1/8" (6 mm). (New pad is 3/8" (9 mm) thick)**

- Check and ensure the hex socket brake pad mounting screws (N25463) are securely tightened.
- Check preload on castor fork top pivot bearings (with brake pad assembled loosely). Tighten as required using wheel bearing tightening procedure (springs will compress to a length of approximately 2 3/8"[60 mm]).
- Adjust the jam nuts until the spring length is 2-1/8" (54 mm). See Below.
- Increase the spring pressure on the brake to stop the castor wheels from shimmying in the field or on the road.

**Note: Do not overtighten the springs. Excessive spring pressure will prevent wheels from castoring.**



**Note: Tighten jam nuts until the spring length is 2 1/8" (54 mm)**

## Important

Dual wheel brake will provide sufficient pressure to stabilize castor at all travel speeds up to 18 m.p.h. (28 kph). Avoid setting more pressure on brake pad than required to maintain stability. Tow only with all tanks empty. If a unit must be towed loaded over a short distance, the *transport speed must be reduced* to 10 m.p.h. (16kph) or slower.

## Metering

The metering wheels come in 4 different sizes. Each wheel matches to a specific distribution head mounted on the Seeding Tool.

If the metering wheel and distribution head are not matched correctly, the distribution accuracy will be adversely affected.

Spacer plates are used to take up the extra space in each metering cup. These spacer plates vary in size according to the size of the metering wheel.

### Metering Wheel Replacement

- Remove the monitor donut from the Right Hand Side of the metering body.
- Disconnect meter shaft coupler from the meter shaft and transmission drive shaft.
- Loosen the locking collars on the meter shaft bearings.
- Remove the bolts holding the meter shaft bearings and remove both bearings.
- Remove the meter shaft from the Right Hand Side.
- Remove the slider plates from all cups with metering wheels.
- Remove the metering wheels. Inspect wheels and replace if required.
- Clean cups in metering body thoroughly prior to re-assembly.
- Smear a very-very thin layer of silicone on the pin side of the spacer plates for the 7, 8 and 9 metering cups.

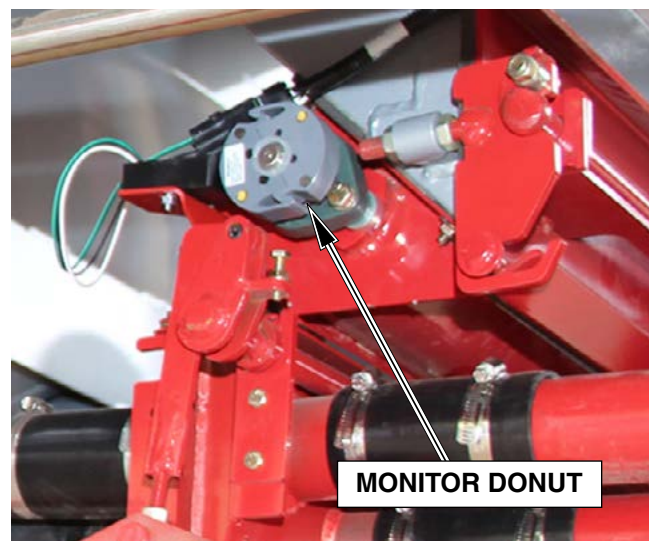
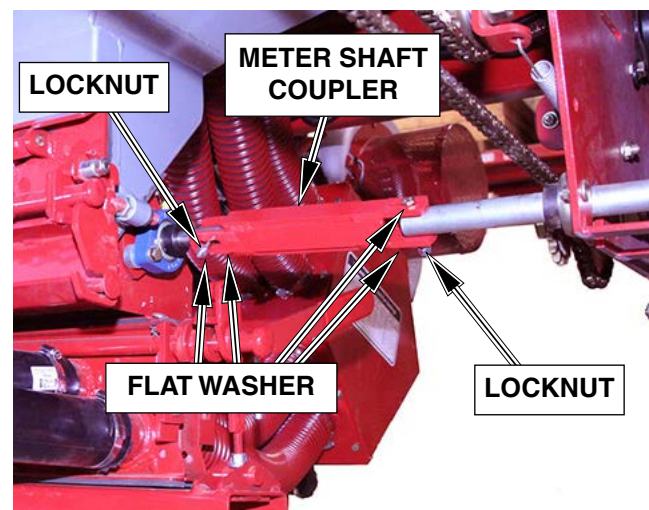
**The side with the silicone must be installed against the metering body.**

- Place all metering wheels and spacers back into the metering body in the same order they came out of.

**The location of each primary run and wheel size must be the same for both metering bodies.**

**Assembly Hint:** Mark the metering wheels on the outside of the rib that is next to the key.

Table 1				
Divider Head	Metering Wheel		Spacer	
Outlets	Number	Width	Qty	Width
7	7	1 3/4" (45 mm)	2	1/2" (13 mm) 1/4" (6.4 mm)
8	8	2" (51 mm)	2	1/4" (6.4 mm) 1/4" (6.4 mm)
9	9	2 1/4" (57 mm)	1	1/4" (6.4 mm)
10	10	2 1/2" (64 mm)	-	-

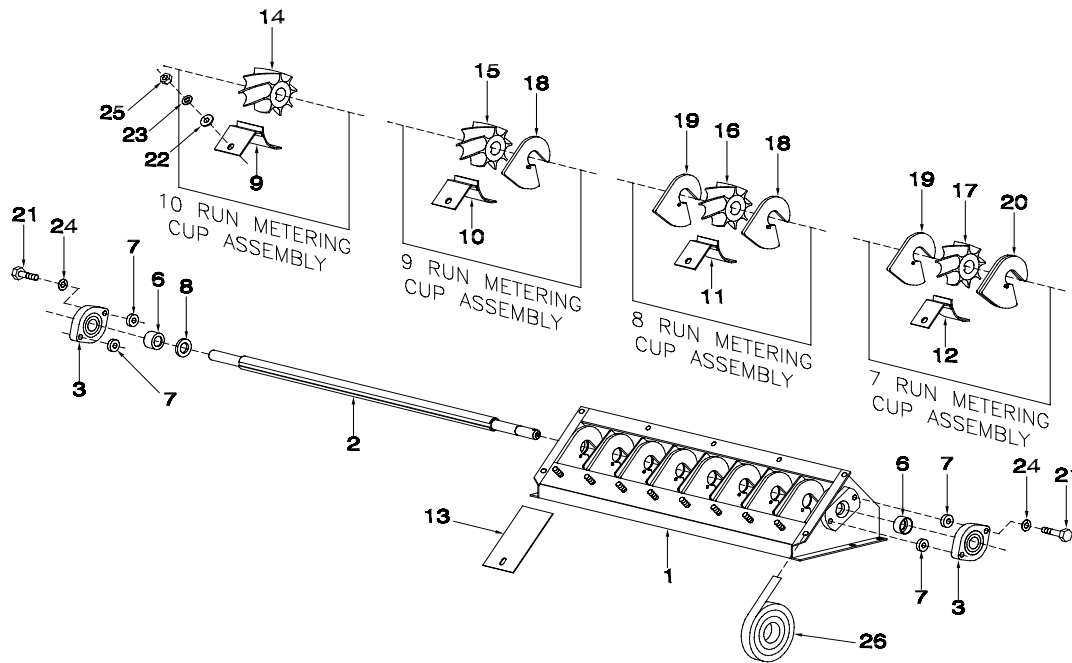


# Maintenance

## Metering - Continued

### Standard Metering Body

**Note:** The metering wheels can be installed with the metering body mounted to the Air Cart.

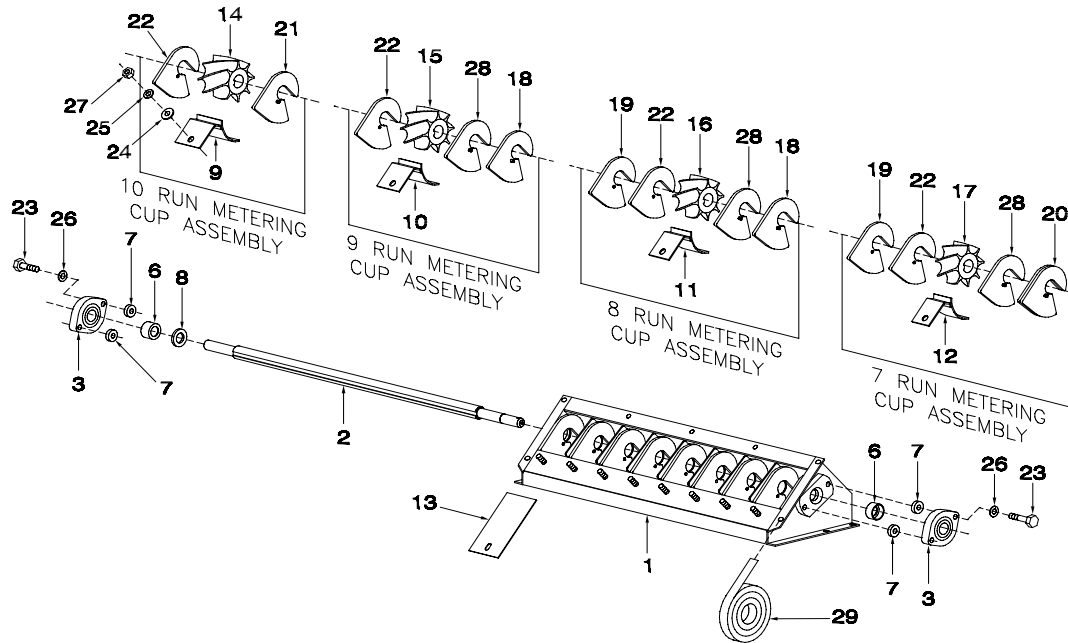


Item	Part No.	Description	Qty
1	N27100	Metering Body .....	1
2	N19687	Metering Shaft - 8 Outlet .....	1
3	N19269	Bearing Assembly - NTN - 2 Bolt Flange.....	2
6	N21659	Seal .....	2
7	N21602	Spacer .....	4
8	N21612	Backing Washer.....	1
9	N27090	Slider - #10 Wheel .....	Asreq
10	N27089	Slider - #9 Wheel .....	Asreq
11	N27088	Slider - #8 Wheel .....	Asreq
12	N27087	Slider - #7 Wheel .....	Asreq
13	N27605	Cover - Blank Off .....	Asreq
14	N42130	Wheel - #10 Metering (Cream Colored) (2.50 width) .....	Asreq
15	N42129	Wheel - #9 Metering (Cream Colored) (2.25 width) .....	Asreq
16	N42128	Wheel - #8 Metering (Cream Colored) (2.00 width) .....	Asreq
17	N42127	Wheel - #7 Metering (Cream Colored) (1.75 width) .....	Asreq
18	N27099	Spacer Plate - #9 Wheel (Single - Left) .....	Asreq
19	N27098	Spacer Plate - #8 Wheel (Single - Right) .....	Asreq
20	N27097	Spacer Plate - #7 Wheel (Double - Left) .....	Asreq
	N28492	Roll Pin - used in Spacer Plates (Not Shown) .....	Asreq
21	W-477	Hex Bolt - 3/8 x 1 1/2 Lg .....	4
22	D-5488	Flatwasher - 5/16 .....	8
23	W-522	Lockwasher - 5/16 .....	8
24	W-523	Lockwasher - 3/8 .....	4
25	N15114	Hex Nut - 5/16 Stainless Steel .....	8
26	N15716	Seal Strip - 1/4 x 1 x 152 Lg (Bulk/Ft).....	8 ft
	N28831	Cover Plate - Shown on Hopper Assemblies .....	

## Metering - Continued

### Coated Metering Body

**Note:** The metering wheels can be installed with the metering body mounted to the Air Cart.



Item	Part No.	Description	Qty
1	N28928	Metering Body .....	1
2	N19687	Metering Shaft - 8 Outlet .....	1
3	N19269	Bearing Assembly - NTN - 2 Bolt Flange.....	2
6	N21659	Seal .....	2
7	N21602	Spacer .....	4
8	N21612	Backing Washer.....	1
9	N27090	Slider - #10 Wheel .....	Asreq
10	N27089	Slider - #9 Wheel .....	Asreq
11	N27088	Slider - #8 Wheel .....	Asreq
12	N27087	Slider - #7 Wheel .....	Asreq
13	N27605	Cover - Blank Off .....	Asreq
14	N42130	Wheel - #10 Metering (Cream Colored) (2.50 width) .....	Asreq
15	N42129	Wheel - #9 Metering (Cream Colored) (2.25 width).....	Asreq
16	N42128	Wheel - #8 Metering (Cream Colored) (2.00 width).....	Asreq
17	N42127	Wheel - #7 Metering (Cream Colored) (1.75 width) .....	Asreq
18	N27099	Spacer Plate - #9 Wheel (Single - Left) .....	Asreq
19	N27098	Spacer Plate - #8 Wheel (Single - Right).....	Asreq
20	N27097	Spacer Plate - #7 Wheel (Double - Left).....	Asreq
21	N28927	Plastic Spacer - Wheel (Left) .....	8
22	N28929	Plastic Spacer - Wheel (Right).....	1
	N28492	Roll Pin - Used in Spacer Plates (Not Shown).....	Asreq
23	W-477	Hex Bolt - 3/8 x 1 1/2 Lg .....	4
24	D-5488	Flatwasher - 5/16.....	8
25	W-522	Lockwasher - 5/16 .....	8
26	W-523	Lockwasher - 3/8 .....	4
27	N15114	Hex Nut - 5/16 Stainless Steel .....	8
28	N28924	Plastic Spacer - Wheel (Without Pin).....	7
29	N15716	Seal Strip - 1/4 x 1 x 152 Lg (Bulk/Ft).....	8 ft
	N29457	Kit Coated Metering Body Assy (Includes 1, 2, 3, 6, 21, 22, 28 & 29)	

# Maintenance

## Metering - Continued

**Assembly Hint:** Mark metering wheel size on the metering body. This will help in connecting the main distribution hose and secondary divider heads.

- Align the shaft keyway with the marks on the metering wheels. Slide the metering shaft through the metering wheels.

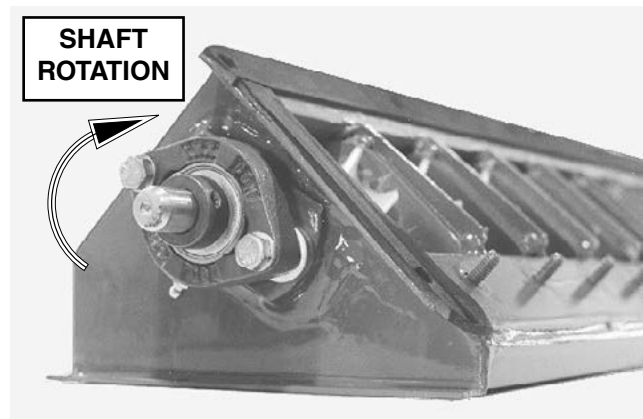
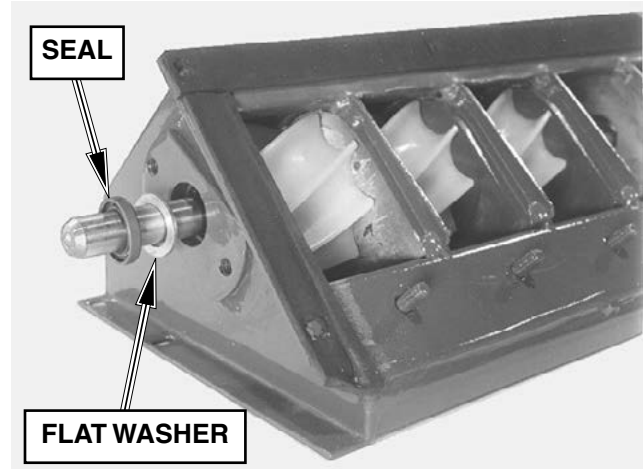
**Note:** Care must be taken that the key ways are aligned, otherwise damage to the key in the wheels may occur.

- The metering shaft must be pushed through until the shoulder on the shaft hits the side of the metering body.
- Install the washer on the shaft and into the housing on the Right Hand Side of the metering body.

**Important:** The seal must be installed as shown, with open side of the seal to the outside. Care must be taken when installing the seal. It is recommended that a brass drift be used to minimize any damage to the seal.

**Note:** The Left Hand Side seal is installed at the factory.

- Reinstall both meter shaft bearings and spacers with the grease fitting towards the rear of the machine.



## IMPORTANT

### PREVENT CORROSION

Clean the Metering Body (Including Air Passages) and the Collector Body. A light coating of Silicone Lubricant or WD-40 or Penetrating Oil should be applied before storage.

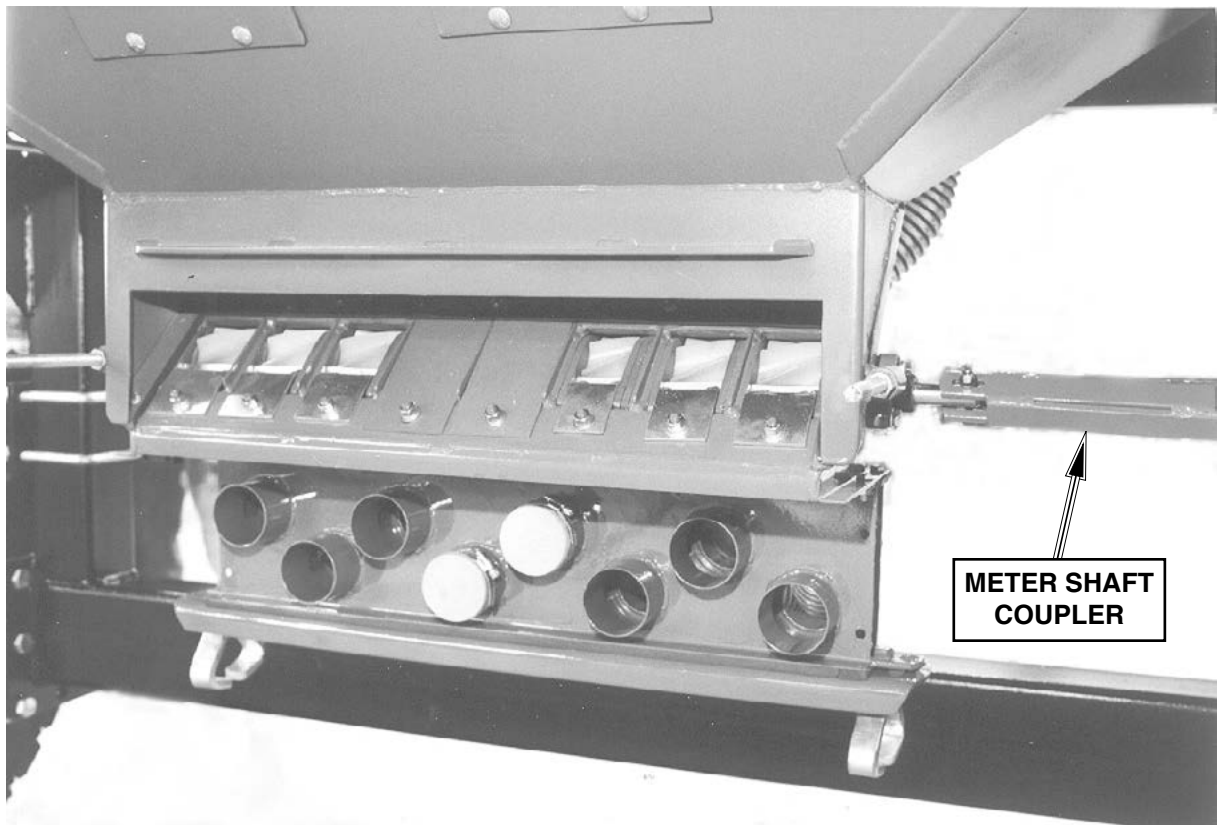
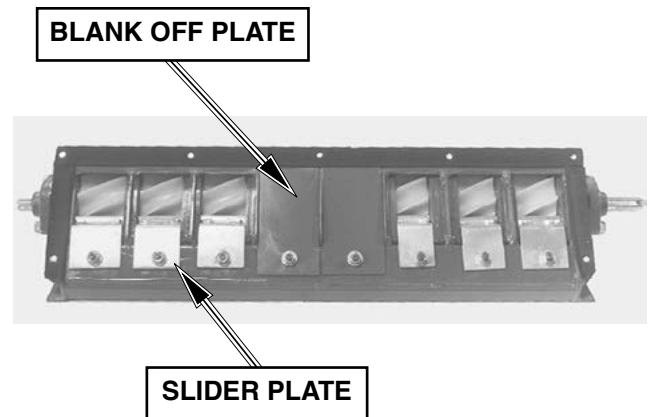
N21604

## Metering - Continued

- Tighten locking collars by turning the collars in the direction of the shaft rotation. Lock the collar by tapping the collar with a punch in the direction of rotation of the shaft.
- Reinstall monitor donut on shaft. Ensure donut is centred to the pick-up. The gap between the pick-up and the donut must not exceed 1/8" (3 mm).
- Install the slider plates to all cups with metering wheels.

**Note: Install blank-off covers on cups without wheels. Insert the top of the blank-off plate under the tank lip.**

- Set sliders to top of slot. Tighten sliders with 5/16" stainless steel nut, lockwasher and flatwasher. (See "Slider Setting" under Operation Section for correct procedure)
- Attach meter shaft coupler over the meter shaft and transmission drive shaft.
- Install the 1/4" x 2 1/4" Special bolt with two -flatwashers and locknut. Tighten locknuts to bottom of threads.

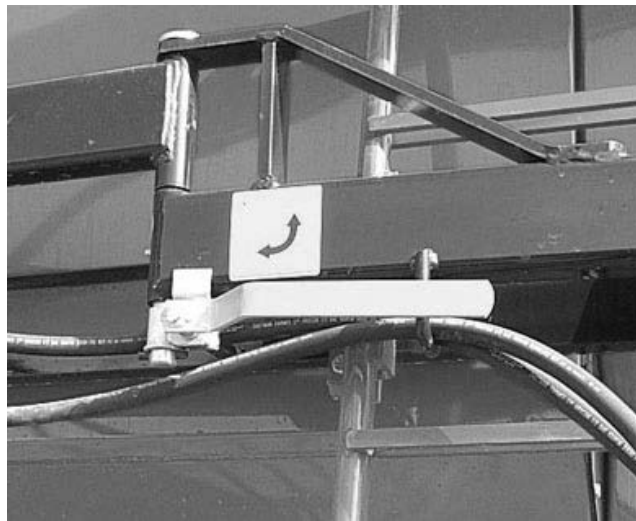
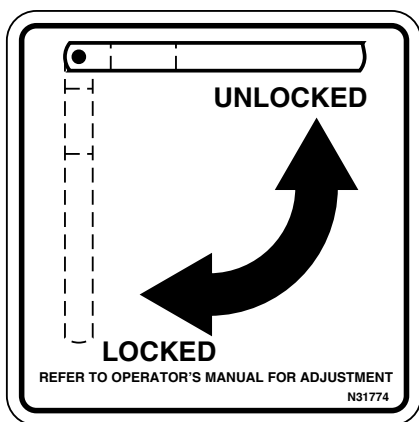


# Maintenance

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## Auger Arm Lock

Adjust 5/8 nuts such that the auger arm is unlocked when the handle is horizontal and locked when the handle is pulled down 90 degrees.



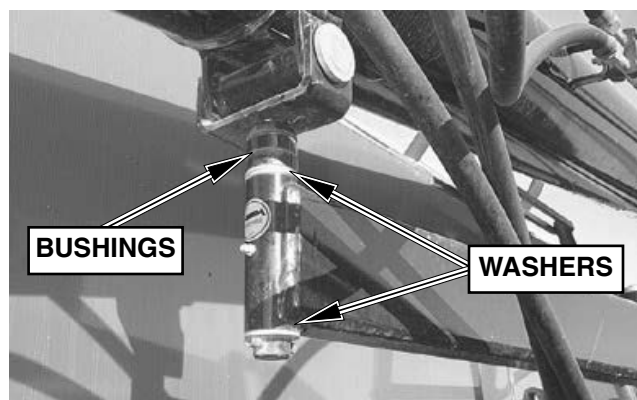
Auger Arm Lock

## Auger Pre-Load Adjustment

The pre-load must be adjusted to firmly seat the auger on the front pivot pin when locked into storage position.

To adjust the pre-load on the auger the Middle Pivot Saddle washers/bushings must be moved as follows:

- To **decrease** the pre-load move washers/bushings from bottom to the top of arm.
- To **increase** the pre-load move washers/bushings from top to the bottom of arm.



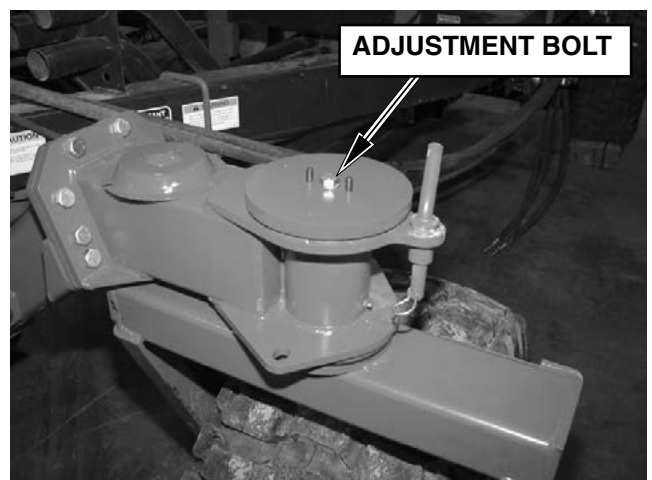
Middle Pivot Saddle

## 2-3 Meter Cart

### Castor Fork Adjustment

Adjust castor wheel action to prevent excessive movement.

- Remove dust cap from castor axle.
- Tighten bolt to adjust pressure on castor drag plate to restrict excess castor movement.
- Loosen bolt to adjust pressure on castor drag plate to increase castor movement.
- Check tire pressures. Tires must be inflated evenly to ensure correct tracking.



# Maintenance

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Notes

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# Section 7: Storage

## Section Contents

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# Storage

## Preparing for Storage

### General

- To insure longer life and satisfactory operation, store the 9s Series Air Cart in a shed.
- If building storage is impossible, store away from areas of main activity on firm, dry ground.
- Clean machine thoroughly.
- Inspect all parts for wear or damage.
- Avoid delays - if parts are required, order at the end of the season.
- Lubricate grease fittings. (Refer to Lubricating Section).
- Tighten all bolts to proper specifications (Refer to Bolt Torque Chart).
- To prevent corrosion and damage by rodents, clean the hopper boxes and metering systems thoroughly and wash with mild soapy water solution. Rinse with water and dry thoroughly. **Refer to Metering Body Storage.**
- A light coating of silicone lubricant or WD-40 should be applied to all metal metering system components before storage.
- Avoid lubricant contact with grain and fertilizer tubes.
- Loosen fan tension adjusting bolt. (Engine Drive Only)
- Relieve tension on tank lids.
- Loosen clean-out doors.
- Remove all chains and store in clean oil.
- Relieve pressure from hydraulic system.
- Raise frame, block up and relieve weight from the tires.
- Cover tires with canvass to protect them from the elements when stored outside.
- Paint any surfaces that have become worn.



## Warning

**Do not allow children to play  
on or around the machine.**

### MORRIS PAINT

Part Number	Description
N53713	Red MORRIS Touch-Up Pen
N53714	Silver MORRIS Touch Up Pen
N53715	Red MORRIS Aerosol Can
N53716	Silver MORRIS Aerosol Can
N31087	Sky White MORRIS Aerosol Can

## Preparing for Storage - Continued

### Metering Body Storage

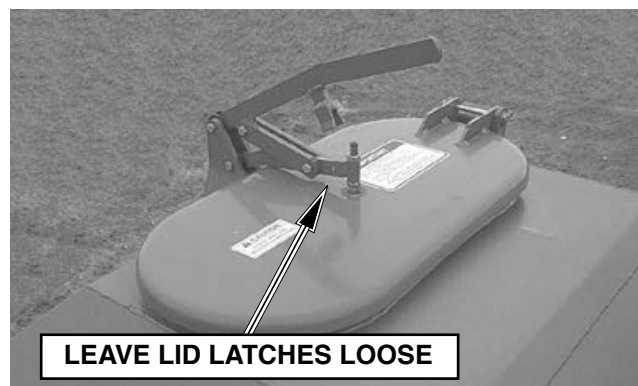
It is extremely important that the metering system is thoroughly cleaned before storing for any length of time.

The following procedure should be followed for both tanks:

- Empty tanks. (Refer to Unloading Tanks)
- Remove all sliders and blank off plates.
- Remove cover plate.
- Remove the collector bottom.
- Run fan.
- Wash the interior of both tanks and metering system with soapy water. Wash the collector.
- Rinse with cold water and let the unit air dry.
- Coat metal parts with silicone lubricant or WD-40.

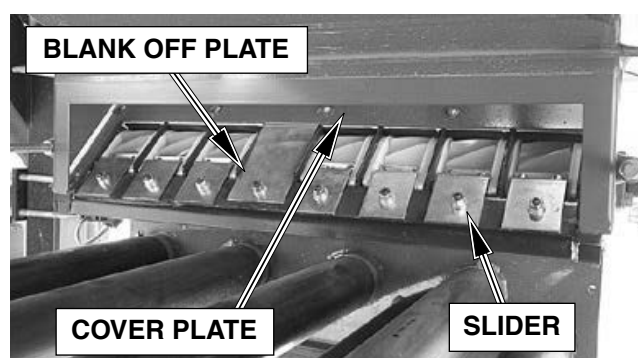
**Note: Diesel fuel will harm seals.**

- Reinstall all sliders and blank off plates in the same order they were removed.
- Reinstall cover plate.
- Replace the clean-out door and the bottom of the collector.
- Start the fan and operate for 5 minutes to dry out any remaining moisture in the system.
- Leave clean-out doors loose to help prevent condensation building up inside the tank.
- Leave lid latches loose to help maintain resilience of the seals.



## Important

**At no time should corrosive fertilizer or similar materials be allowed to remain in the tank or metering body cavity.**

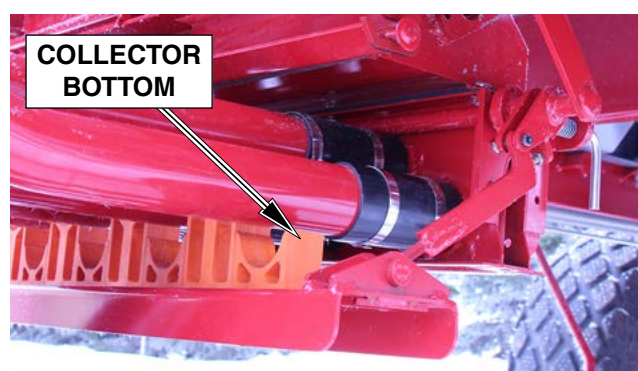


## IMPORTANT

### PREVENT CORROSION

**Clean the Metering Body (Including Air Passages) and the Collector Body. A light coating of Silicone Lubricant or WD-40 or Penetrating Oil should be applied before storage.**

N21604



**Collector Bottom**

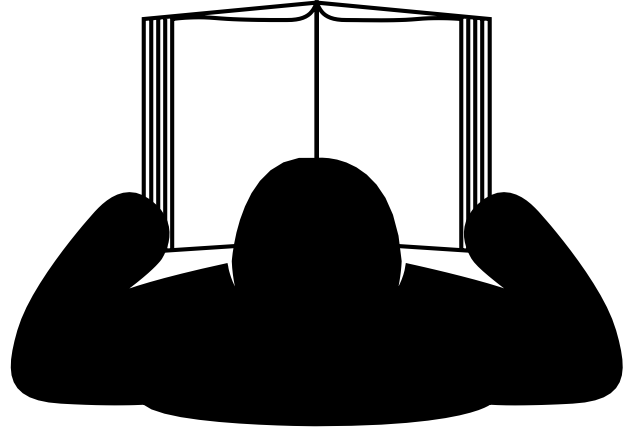
# Storage

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## Removing From Storage

### General

- Review Operator's Manual.
- Check tire pressure (Refer to Tire Pressure List)
- Clean machine thoroughly.
- Tighten lid latches.
- Tighten fan tension adjusting bolt. (Engine Drive Only)
- Lubricate and install chains.
- Spray internal parts or the metering body with WD-40 to loosen any corrosion buildup.
- Check for leaks. (Refer to Maintenance Section)
- Lubricate grease fittings. (Refer to Lubricating Section).
- Tighten all bolts to proper specifications (Refer to Bolt Torque Chart).



### Monitor

Familiarize yourself with all monitor functions. Ensure all monitor “*settings*” are correctly set for the Air Cart/ Seeding Tool combination. Recognize and correct alarm conditions as indicated on the machine. See Monitor Section for more details.

Check all wire harness connections for corrosion and use a dielectric spray to clean. Inspect all sensors for proper gap. See Monitor Section for more details.

### Clutch

Check friction plates for corrosion and buff with a wire wheel if necessary. Check the resistance of the clutch. See Maintenance Section for more details.

### Auger

Inspect all augers used in handling the products for seeding. Run augers to clean out any debris inside auger so it does not get transferred to the tank.

# Section 8: Troubleshooting

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# Troubleshooting

Problem	Cause	Correction
<b>General</b>		
Delivery hoses plugged.	Insufficient air flow.	Clean fan impeller blades. Clean fan intake screen. Increase fan rpm.
	Hose sag.	Shorten hoses or add additional supports.
	Seed boots plugged with dirt.	Clean seed boots. See “Seed Boot Plugging” below.
	Hose obstruction.	Remove obstruction from hose.
	Air delivery hose partly off manifold.	Reinstall hose properly on manifold.
	Kinked hoses.	Straighten hoses and properly secure them to framework.
	Obstruction in divider head.	Remove access door and clear obstruction from appropriate outlets - be sure to use appropriate screens when filling.
	Exceeding machine's delivery capabilities.	Reduce ground speed and speed up fan.
Hydraulic fan will not turn	Poorly mounted hoses.	Reroute hoses.
	Selector valve in wrong position.	Switch the selector to fan position.
	Hydraulic hoses not connected properly to tractor.	Reverse hydraulic hoses.
Fan turning too slow	Insufficient oil flow.	Perform flow test.
	Flow to hydraulic motor.	Increase flow control setting.
	Low hydraulic pressure.	Check hydraulic pressure 2100 psi.(14469 kPa) min.
Front Castor moving too freely. (7240 & 7300)	Brake Not adjusted properly.	Adjust brake as necessary. See “Brake Adjustment” in Maintenance Section.
	Worn brake pad.	Replace brake pad. See “Brake Adjustment” in Maintenance Section.

# Troubleshooting

Problem	Cause	Correction
Material flowing thru system when unit is stationary and the fan running.	Damaged metering wheel.	Replace metering wheel.
	Sliders not adjusted correctly.	Adjust as required. See <i>"Slider Settings"</i> .
	Small seed plate not installed.	Adjust as required. See <i>"Slider Settings"</i> .
Material not being divided in distribution head.	Head partially blocked.	Remove blockage and reinstall hose.
	Kinked hose running to shank	Straighten or replace hose.
	Damaged distribution section on head.	Replace head with new one.
	Bent or damaged diffuser pipe.	Straighten or replace diffuser pipe.
	Secondary hose length.	See "Secondary Hose" in Operation Section.
Clutch slipping.	Low power supply.	Ensure good connections at the power supply. Battery voltage must be 12V.
	Metering drive torque load too high.	See Maintenance Section.
	Corroded, rusty, dirty clutch.	Clean and inspect clutch.
	Faulty clutch.	Replace clutch.
Material not being metered out.	Metering clutch not engaged.	Engage switch in tractor cab.
	Metering Clutch slipping.	See <i>"Clutch Slipping"</i> below.
	Main drive chain not installed.	Install drive chain properly on Drive Sprocket.
	Drive chain or chains broken.	Install new chain. Ensure connecting link is installed correctly. Curved part of spring clip should face the direction of chain travel.
	Massive air leak in tank, resulting in material being blown up out of the metering cup.	Repair the air leak. See "Air Leaks" in Maintenance Section. See "Tank Lid Adjustment" in Maintenance Section.
	Key sheared on metering wheel.	Change metering wheel and check for cause of metering wheel shearing.

# Troubleshooting

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Problem	Cause	Correction
Material not being metered out.	Material caked up in tank.	Remove material and completely clean out the tank.
	Excessively wet material in tank.	Remove wet material and use reasonably dry material.
	Coupler bolt sheared	Replace with Grade 8 bolt.
Plugged seed boots	Backing up with openers near or in the ground.	Lift machine all the way up before backing up.
	Turning very sharp with openers near or in the ground.	Lift machine all the way up when making sharp turns.
	Lowering machine without any forward motion.	Always have forward motion when lowering machine.
	Worn openers or sweeps.	Replace openers.
	Severely bent or damaged boots.	Straighten or replace as required.
	Excessively wet conditions.	Change openers, operate when drier.
	Opener Adjustment.	See <i>“Opener Adjustment”</i> in Operation Section.
Material not being accurately metered out of the metering body.	Air delivery hoses loose, cracked or pulled off.	Tighten the hoses, replace cracked hoses or install hoses pulled off their respective locations.
	Metering Clutch slipping.	See <i>“Clutch Slipping”</i> below.
	Inlet screen to fan blocked off.	Clean off material that is blocking the fan screen.
	Metering wheel slider plate adjusted incorrectly.	Adjust sliders so they are all the same for the product being metered. See Operation Section for correct clearances.
	Material caked up above one or more of the metering cups.	Clean out caked up material.
	Excessively damp material in tank.	Use reasonably dry, fresh material only.
	Foreign obstruction in tank above metering wheels.	Remove obstruction, and always fill tanks through the screen.

# Troubleshooting

Problem	Cause	Correction
Material not being accurately metered out of the metering body.	Caked up metering wheels on some or all of the metering cups.	Clean out the metering cups and wheels.
	Damaged metering wheels.	Replace broken metering wheels.
	Metering wheels mismatched to secondary outlet.	Install correct wheels to head. 1 3/4" wide wheel for 7 outlet head. 2" wide wheel for 8 outlet head. 2 1/4" wide wheel for 9 outlet head. 2 1/2" wide wheel for 10 outlet head. Be sure appropriate spacers are also used.
	Incorrect spacing sprocket.	Install correct sprocket on back of transmission. See Maintenance Section.
	Crank rotated wrong way when taking sample.	Crank must be rotated counter clockwise.
	Double Shooting hoses not routed correctly.	See Set-Up Section.
	Air Leak in System.	Adjust lids and doors as necessary. Replace damaged seals. See Maintenance Section.

## 3 Meter Cart

Castor Axles have excessive movement.	Drag plate adjustment.	Adjust pressure on drag plate.
Not tracking straight.	Tire Pressure uneven.	Inflate tires to correct pressure.

# Troubleshooting

Problem	Cause	Correction
<b>Monitor</b>		
Monitor lights up but does not seem to work.	Faulty monitor	Replace monitor.
	Completely disconnected harness.	Connect harness.
No fan display.	Incorrect gap between sensor and target.	Gap should be 0.030" (0.76 mm).
	Faulty sensor.	Replace sensor.
	Broken or shorted wire.	Replace or repair harness.
No ground speed display	Sensor to magnet gap too large.	Gap should be 0.030" (0.76 mm).
	Faulty sensor.	Replace sensor.
	Broken or shorted wire.	Replace or repair harness.
No meter speed display.	Sensor to magnet gap too large.	Gap should be 0.030" (0.76 mm).
	Faulty sensor.	Replace sensor.
	Broken or shorted wire.	Replace or repair harness.
	Switched off	Replace or repair harness.
No display, no back light.	Poor power connections at the battery.	Switch unit on.
	Battery below 8 volts.	Ensure good connections.
No display, no back light.	Temperature below -10C or above +40C.	Check battery voltage.
	Broken wire.	Operate between -10C and +40C.
Bin indicates always empty.	Faulty sensor.	Repair wire.
	Wires not hooked to sensor.	Replace sensor.
		Hook up correctly.

# Troubleshooting

Problem	Cause	Correction
Bin indicates always full.	Blocked light beam on photoelectric sensor.	Remove object blocking the beam.
	Wire shorted to ground	Repair or replace wire.
	Faulty sensor	Replace sensor.
Blown fuse.	Power hooked up backwards.	Hook up correctly. <b>RED</b> to positive terminal.

## VRT System

Motors will not turn in Manual Mode (Controller OFF)	Not equipped with a Third Tank.	Disconnect wire harness from solenoid '1' and turn adjusting knob fully out.
	Selector valve (Fan/Auger).	Switch selector valve to fan position.
	Hydraulic oil flow.	Ensure hydraulic lever is properly engaged.
Motors will not turn in Operation Mode (Controller ON)	Not equipped with a Third Tank.	Disconnect wire harness from solenoid '1' and turn adjusting knob fully out.
	Selector valve.	Switch selector valve to fan position.
	Hydraulic oil flow.	Ensure hydraulic lever is properly engaged.
	VRT Sensor Gap.	Gap should be 0.030" (0.76 mm).
Motors turn continuously in Operation Mode	Shaft Motor Solenoids.	Zero Shaft Motors.
	VRT Sensor Gap.	Gap should be 0.030" (0.76 mm).
Motors turn continuously in Calibration Mode	VRT Sensor Gap.	Gap should be 0.030" (0.76 mm).

# Troubleshooting

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Notes

## Section 9: Options Assembly

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# Options Assembly

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## Hitch Stand Kit (Tow Behind)

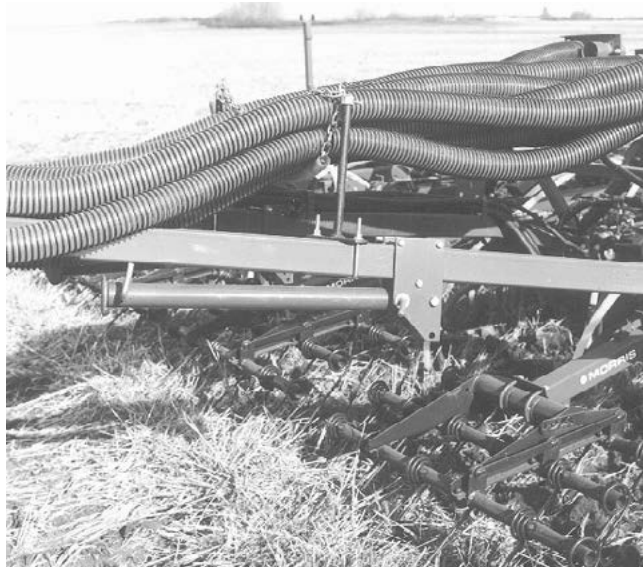
- Attach the mounting plates to the hitch pole using three - 3/8" x 4" bolts, lockwashers and nuts.

**Note: Locate hitch stands in a position which will clear any attachments on the Seeding Tool. (i.e. Mounted Harrows, Packers, etc.)**

- Mount the outer tube between mounting plates with a 1/2" x 4 1/2" bolt, lockwasher and nut.
- Slide inner tube into outer tube retaining with the tightener.
- Retain stand with a 5/8" pin and hair pin.



**Attached/Detached Position**



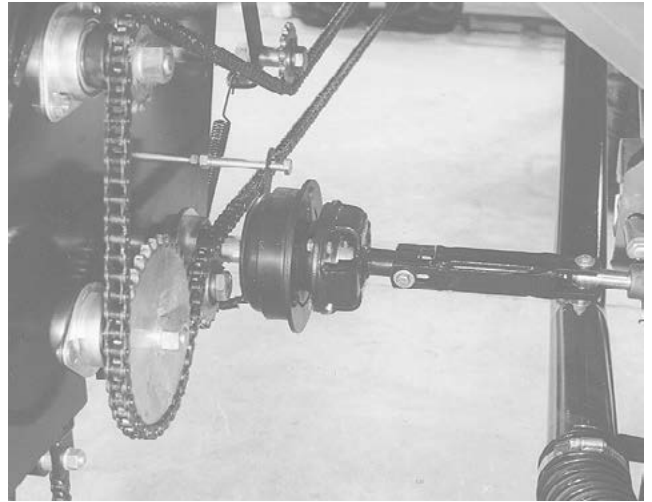
**Transport Position**

## Second Clutch

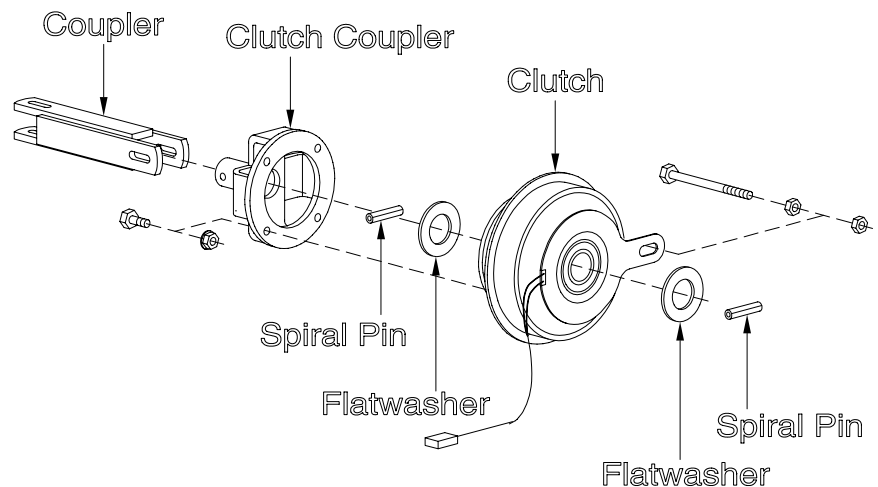
- Remove the metering shaft coupler from the rear metering shaft.
- Mount coupler to the clutch using 1/4" x 3/4" bolts.
- Install the clutch and coupler to the transmission output shaft with a 1/4" x 1 1/2" spiral pin on either side of the clutch.

**Note: Install extra flatwashers as required to eliminate excess clearance between clutch components.**

- Install the short metering shaft coupler.
- Install the 3/8" x 4" bolt into the hole in the rear transmission plate.
- Run the cable down the left hand Air Seeder hitch pole.
- Run the extension cable along the left hand hitch pole of the Seeding Tool.
- Connect cable to the auxiliary clutch switch quick coupler.

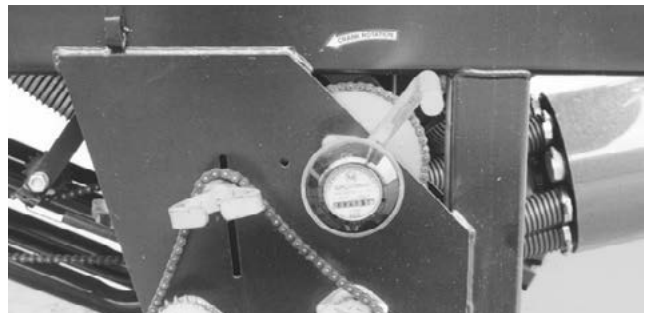


**Second Clutch**



## Acre Tally

- Install the tamper proof acre tally to the crank handle shaft as shown.



**Acre Tally**

# Options Assembly

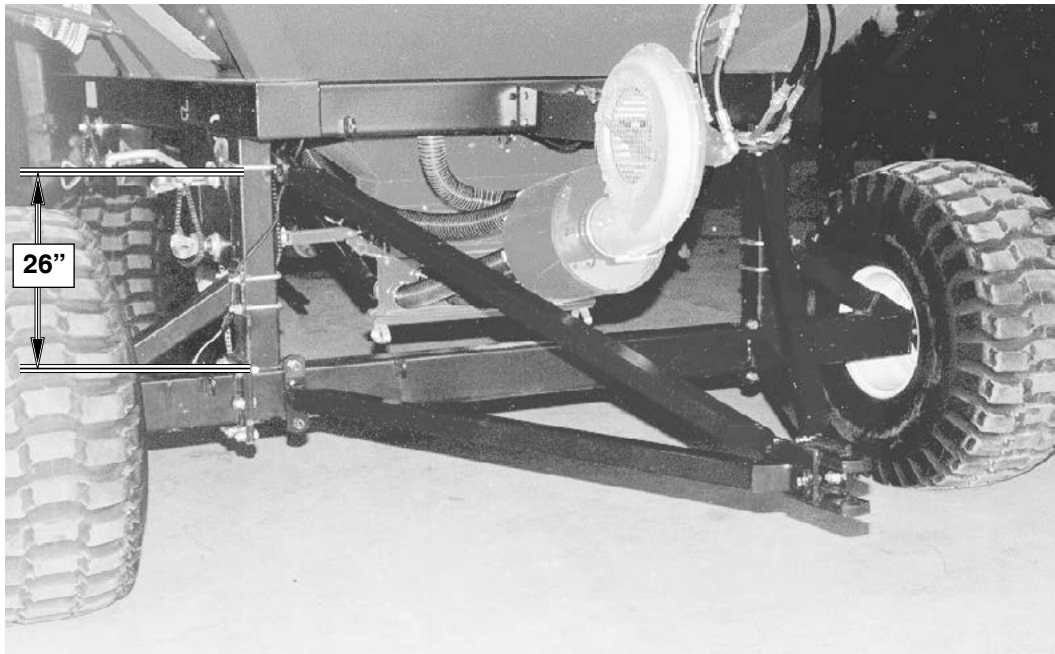
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## Rear Tow Hitch (Tow Behind)

### Standard Hitch

- Attach the upper brackets to the Air Cart frame with a 5/8" x 4" x 5 9/16" U-bolt, lockwashers and nuts. (Approximately 26" above lower frame member)
- Attach the lower brackets to the Air Cart frame with a 5/8" x 6" x 5 1/2" U-bolt, lockwashers and nuts.
- Attach the hitch tubes to the brackets using 3/4" x 2 1/4" bolts, lockwashers and nuts.
- Install the hitch clevis between the tubes using 3/4" x 2 1/4" bolts, lockwashers and nuts.
- Level hitch clevis and hitch tubes.
- Tighten all bolts securely.

**Note:** Leave all bolts loose for initial assembly.



## Rear Tow Hitch (Tow Behind)

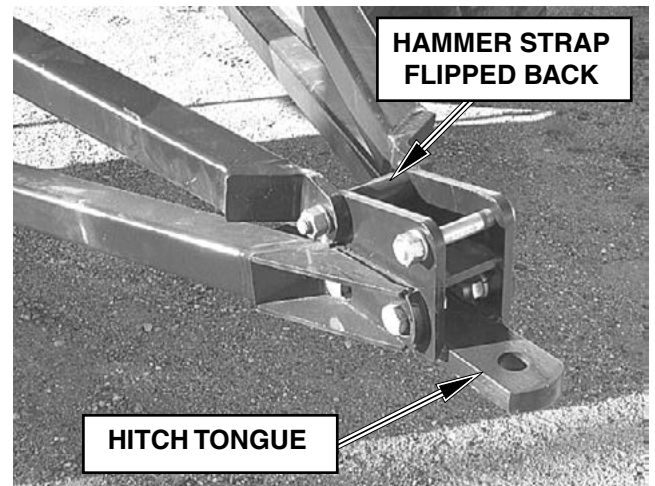
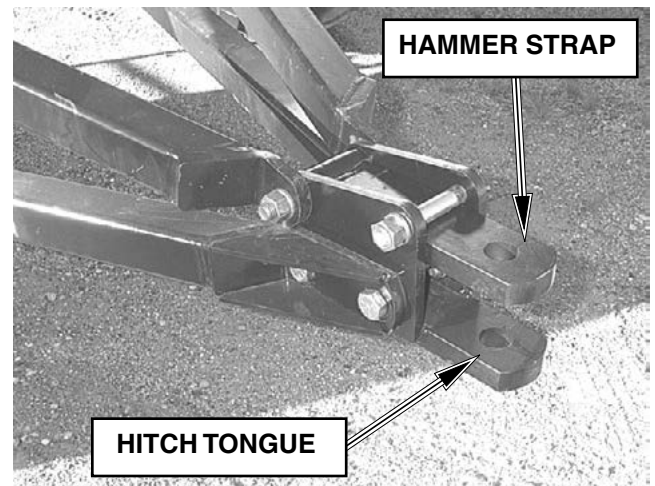
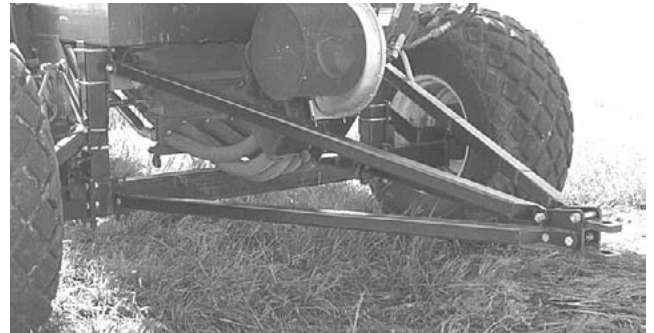
### Extended Hitch

- Attach the upper brackets to the Air Cart frame with a 5/8" x 4" x 5 9/16" U-bolt, lockwashers and nuts. (Approximately 26" above lower frame member)
- Attach the lower brackets to the Air Cart frame with a 5/8" x 6" x 5 1/2" U-bolt, lockwashers and nuts.
- Attach the hitch tubes to the brackets using 3/4" x 2 1/4" bolts, lockwashers and nuts.
- Install the hitch tongue between the lower hitch tubes using 3/4" x 2 1/4" bolts, lockwashers and nuts.
- Install the hammer strap to hitch tongue between the upper hitch tubes using a 3/4" x 6 1/2" bolt, bushing - 1 1/4" OD x 3 1/16" lg, lockwasher and nut.
- Secure hammer strap above hitch tongue with a 3/4" x 5 bolt, lockwasher and nut.

**Note: Hammer strap can be flipped back to accommodate different hitches.**

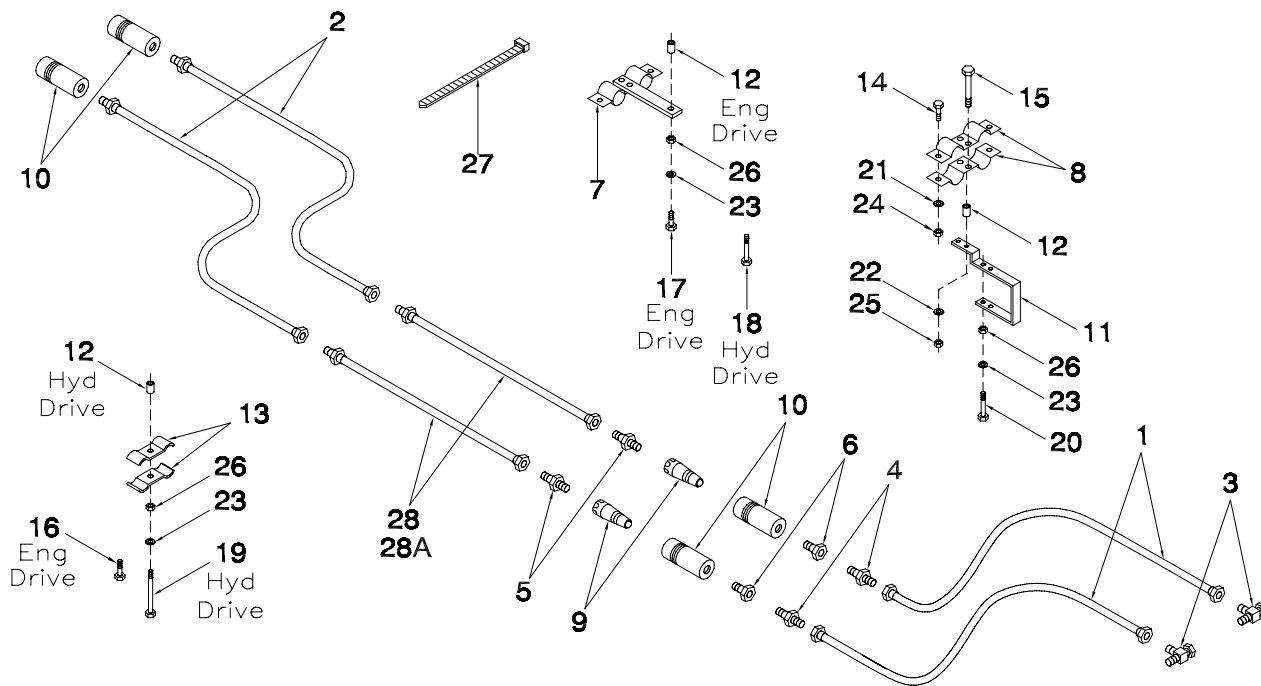
- Tighten all bolts securely.

**Note: Leave all bolts loose for initial assembly.**



# Options Assembly

## Rear Tow Hitch (Tow Behind)



Item	Part No.	Description	Qty
1	H18267	Hyd Hose - 1/4 x 96 Lg w/9/16-18 FJIC .....	2
2	N15041	Hyd Hose - 1/2 x 293 Lg w/7/8-14 FJIC x 1/2 MNPT .....	2
3	C-4403	Tee - (2) 9/16-18 MJIC x (1) 9/16-18 FJIC .....	2
4	C-4405	Connector - 9/16-18 MJIC x 3/8 MNPT.....	2
5	C-4399	Connector - 7/8-14 MJIC x 1/2 MNPT .....	2
6	C-719	Reducer - 1/2 MNPT x 3/8 FNPT .....	2
7	S-1379	Pioneer Coupler Assembly .....	1
8	N16608	Pioneer Clamp.....	2
9	C-817	Male Pioneer Tip - 1/2 FNPT .....	2
10	C-818	Pioneer Coupler - 1/2 FNPT.....	4
11	N21691	Mounting Bracket.....	1
12	N16257	Spacer .....	3
13	D-4808	Oil Line Clamp.....	2
14	W-469	Hex Bolt - 1/4 x 3/4 .....	2
15	W-473	Hex Bolt - 5/16 x 1 1/2 .....	2
16	W-187	Hex Bolt - 3/8 x 1 1/4 .....	1
17	W-619	Hex Bolt - 3/8 x 1 3/4 .....	1
18	D-5249	Hex Bolt - 3/8 x 3 1/4 .....	1
19	S-1299	Hex Bolt - 3/8 x 4 1/2 .....	1
20	C-3918	Hex Bolt - 3/8 x 5.....	1
21	W-521	Lockwasher - 1/4 .....	2
22	W-522	Lockwasher - 5/16 .....	2
23	W-523	Lockwasher - 3/8 .....	3
24	W-512	Hex Nut - 1/4 .....	2
25	W-513	Hex Nut - 5/16.....	2
26	W-514	Hex Nut - 3/8 .....	3
27	D-4838	Tie Strap .....	6
28	C15310	Hyd Hose - 1/2 x 72 Lg w/7/8-14 MJIC x 7/8-14 FJIC 9240 / 9252 / 9300 .....	2
	H25645	Kit - Hydraulic Extension - 9240 / 9252 / 9300 (Includes All Items) (ORDER THROUGH WHOLEGOODS)	

## Hitch Extension (Tow Between)

- Attach extended hitch to Air Cart hitch with a 1 1/2" x 6 1/2" UL pin and #19 Hair Pin.
- Secure extended hitch to Air Cart frame with 5/8" x 6" bolts, lockwashers, nuts and mounting plates.



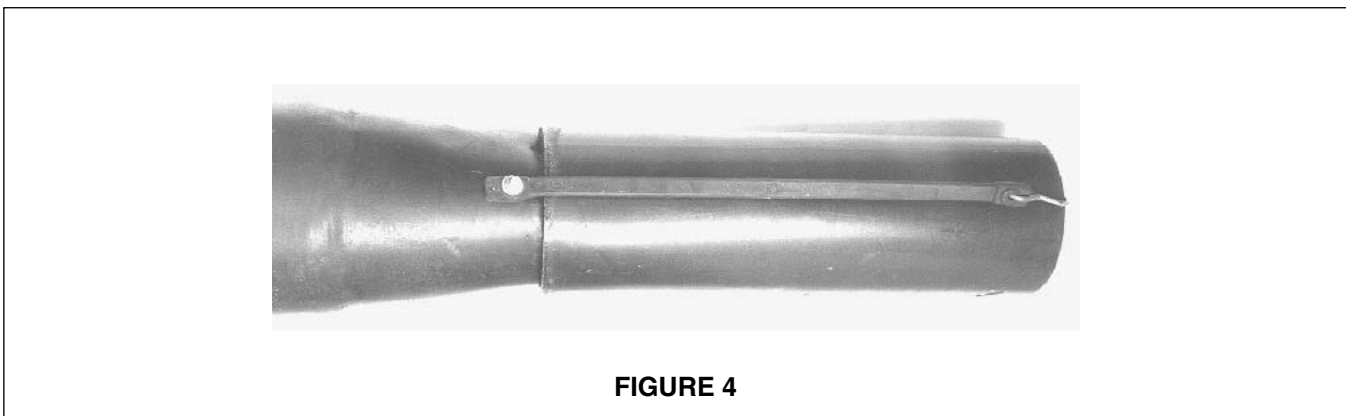
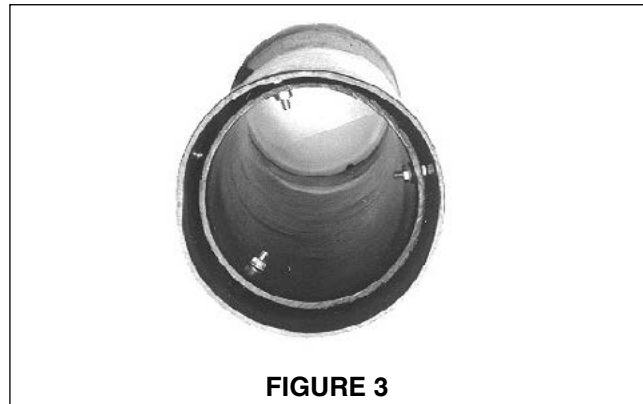
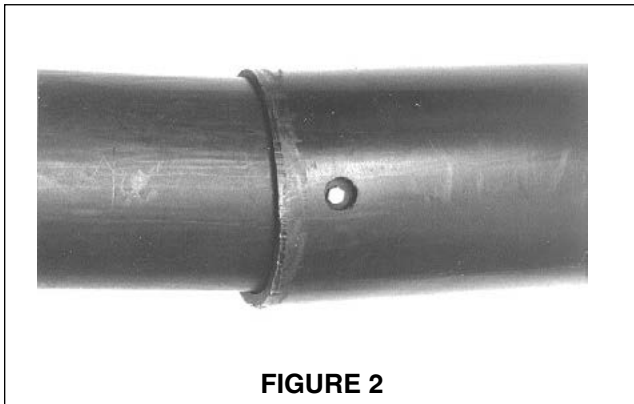
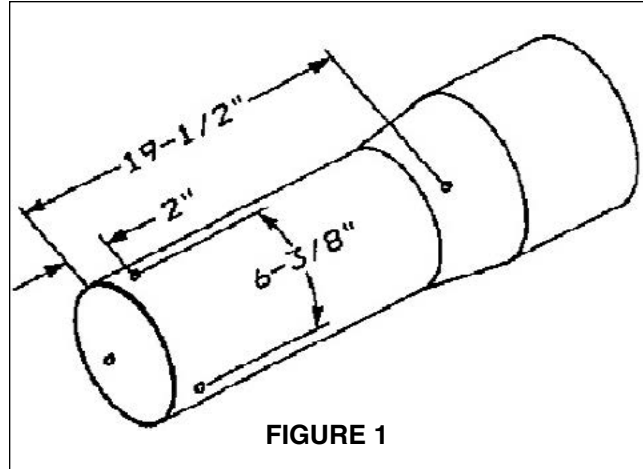
# Options Assembly

## Auger Spout Extension Kit

- Remove existing spout from the auger.
- Drill three 1/4" diameter holes 2" from edge of spout and approximately 6 3/8" apart. See fig. 1
- Slide extension onto the spout and install three 1/4" x 3/4" bolts with 1/4" locknuts through the hole in the extension. See fig. 2 & 3

**Note:** Flatwashers may be required to shim the bolt heads for desired fit.

- Attach the tarp strap to the spout with a 1/4" x 1 1/4" bolt, flatwasher and locknut. See fig. 4
- Install spout assembly onto the auger.



# Section 10: Metric

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Calibration Chart - Metric

9s SERIES AIR CART - VARIABLE RATE - CALIBRATION CHART

WT/REV (KGS/REV)

GRANULAR APPLICATOR										SEED TANK / FERTILIZER TANK / THIRD TANK													GRANULAR APPLICATOR: SLOW SPEED DRIVE									
SLOW SPEED DRIVE										DIRECT DRIVE													CALIBRATION MATERIAL									
OUTLETS	GA-1	GA-2	GA-3	GA-4	GA-5	GA-6	OUTLETS	SSD-1	SSD-2	SSD-3	SSD-4	SSD-5	SSD-6	SSD-7	OUTLETS	DD-1	DD-2	DD-3	DD-4	DD-5	DD-6	DD-7	DD-8	DD-9	DD-10	DD-11	DD-12	DD-13	DENSITY KGS/M <sup>3</sup>	SLIDER POSITION	CHART COLUMN	
21	011	012	013	014	018	025	21	001	002	003	004	005	006	007	21	002	005	009	018	024	031	038	048	050	056	067	070	081	082	083	084	
22	012	013	014	015	019	026	22	001	003	004	005	006	007	008	22	005	009	010	019	026	033	040	048	051	057	068	071	082	083	084	085	
23	012	014	015	016	020	027	23	002	004	005	006	007	008	009	23	005	008	014	029	036	043	050	058	060	066	077	080	081	082	083	084	
24	012	014	015	016	021	028	24	002	004	005	006	007	008	009	24	006	008	010	015	022	029	036	044	047	053	064	067	068	069	070	071	
25	013	015	016	017	022	030	25	003	005	006	007	008	009	010	25	006	009	011	014	016	018	020	022	024	026	028	029	030	031	032	033	
26	014	015	017	018	022	031	26	003	005	007	008	009	010	011	26	006	009	011	014	016	018	020	022	024	026	028	029	030	031	032	033	
27	015	016	017	018	023	032	27	004	006	007	008	009	010	011	27	007	009	012	015	017	018	020	022	024	026	028	029	030	031	032	033	
28	015	017	018	019	024	033	28	004	007	008	009	010	011	012	28	007	010	012	015	017	018	020	022	024	026	028	029	030	031	032	033	
29	016	017	019	020	025	034	29	005	007	008	009	010	011	012	29	007	010	012	015	017	018	020	022	024	026	028	029	030	031	032	033	
30	016	018	019	020	026	035	30	005	008	009	010	011	012	013	30	007	010	012	015	017	018	020	022	024	026	028	029	030	031	032	033	
31	017	018	020	021	027	037	31	006	009	010	011	012	013	014	31	007	011	014	017	020	024	028	032	036	040	044	048	052	056	060	064	
32	017	019	020	022	028	038	32	006	009	010	011	012	013	014	32	008	011	014	018	022	026	030	034	038	042	046	050	054	058	062	066	
33	018	019	021	022	028	039	33	007	010	011	012	013	014	015	33	008	011	015	019	023	027	031	035	039	043	047	051	055	059	063	067	
34	018	020	022	023	029	040	34	007	010	011	012	013	014	015	34	008	012	015	019	023	027	031	035	039	043	047	051	055	059	063	067	
35	019	021	022	024	030	041	35	008	011	012	013	014	015	016	35	008	012	015	019	023	027	031	035	039	043	047	051	055	059	063	067	
36	019	021	023	024	031	042	36	008	011	012	013	014	015	016	36	009	012	015	019	023	027	031	035	039	043	047	051	055	059	063	067	
37	020	022	024	025	032	044	37	009	012	013	014	015	016	017	37	009	012	015	019	023	027	031	035	039	043	047	051	055	059	063	067	
38	021	022	024	026	033	045	38	009	012	014	015	016	017	018	38	009	012	015	019	023	027	031	035	039	043	047	051	055	059	063	067	
39	021	023	025	027	034	046	39	010	013	015	016	017	018	019	39	009	012	015	019	023	027	031	035	039	043	047	051	055	059	063	067	
40	022	024	026	027	034	047	40	010	013	015	016	017	018	019	40	010	013	015	019	023	027	031	035	039	043	047	051	055	059	063	067	
41	022	024	026	028	035	048	41	011	014	016	017	018	019	020	41	010	013	015	019	023	027	031	035	039	043	047	051	055	059	063	067	
42	023	025	027	029	036	050	42	011	014	016	017	018	019	020	42	011	014	016	019	023	027	031	035	039	043	047	051	055	059	063	067	
43	023	025	028	029	037	051	43	011	014	016	017	018	019	020	43	010	013	015	019	023	027	031	035	039	043	047	051	055	059	063	067	
44	024	026	028	030	038	052	44	012	015	017	018	019	020	021	44	011	014	016	019	023	027	031	035	039	043	047	051	055	059	063	067	
45	024	027	029	031	039	053	45	012	015	017	018	019	020	021	45	011	014	016	019	023	027	031	035	039	043	047	051	055	059	063	067	
46	025	027	029	031	040	054	46	012	015	017	018	019	020	021	46	011	014	016	019	023	027	031	035	039	043	047	051	055	059	063	067	
47	025	028	030	032	040	055	47	012	016	018	019	020	021	022	47	011	014	016	019	023	027	031	035	039	043	047	051	055	059	063	067	
48	026	028	031	033	041	057	48	012	016	018	019	020	021	022	48	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
49	026	029	031	033	042	058	49	012	016	018	019	020	021	022	49	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
50	027	030	032	034	043	059	50	012	016	018	019	020	021	022	50	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
51	028	030	033	035	044	060	51	012	016	018	019	020	021	022	51	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
52	028	031	033	035	045	061	52	012	016	018	019	020	021	022	52	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
53	029	031	034	036	046	063	53	012	016	018	019	020	021	022	53	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
54	029	032	035	037	046	064	54	012	016	018	019	020	021	022	54	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
55	029	032	035	037	047	065	55	012	016	018	019	020	021	022	55	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
56	030	033	036	038	048	066	56	012	016	018	019	020	021	022	56	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
57	031	034	036	038	049	067	57	012	016	018	019	020	021	022	57	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
58	031	034	037	039	050	068	58	012	016	018	019	020	021	022	58	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
59	032	035	038	040	051	070	59	012	016	018	019	020	021	022	59	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
60	032	035	038	041	052	071	60	012	016	018	019	020	021	022	60	012	015	018	021	024	028	032	036	040	044	048	052	056	060	064	068	
61	033	036	039	041	052	072	61	012	016	018	019	02																				





[www.morris-industries.com](http://www.morris-industries.com)

Corporate Head Office  
and Training Centre:

2131 Airport Drive  
Saskatoon, Saskatchewan  
S7L 7E1 Canada  
Phone: 306-933-8585  
Fax: 306-933-8626

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