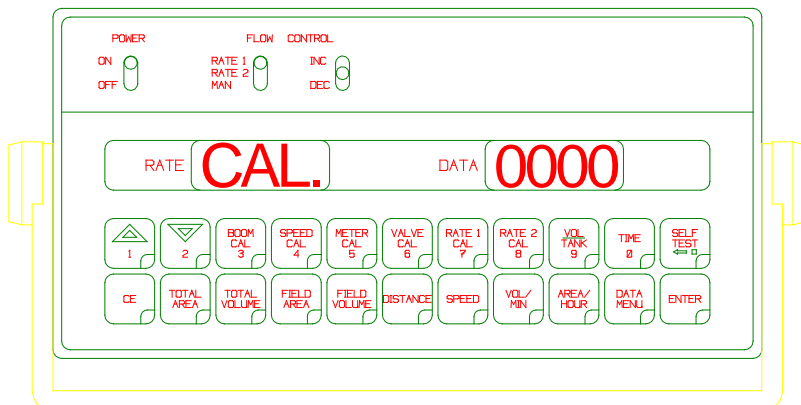
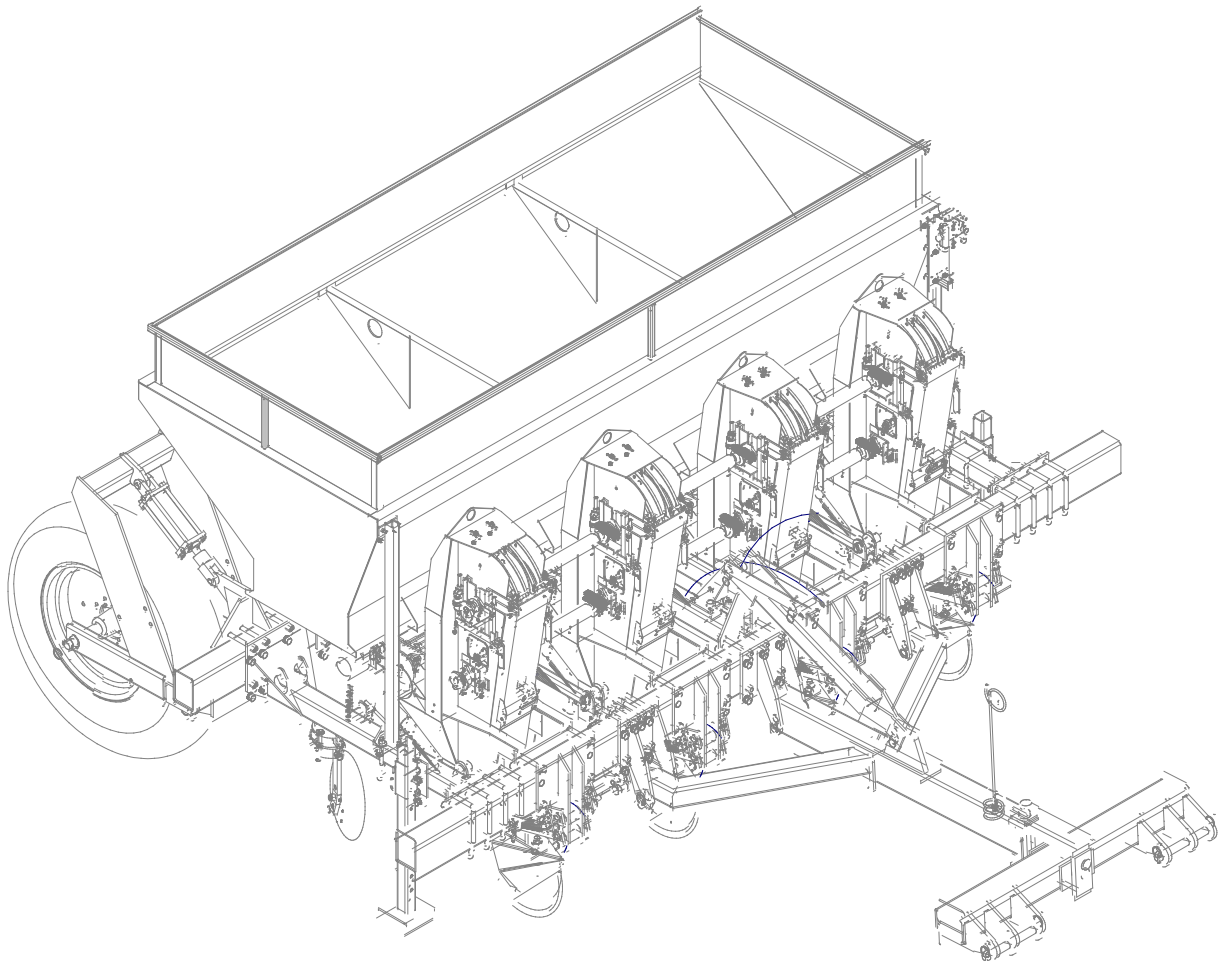


HARRISTON CUP POTATO PLANTER



2010
RAVEN
662

LIMITED WARRANTY

Harriston Industries, hereinafter called Harriston, extends a Limited Warranty on the products it manufactures to be free from defects in material and workmanship for a period of one (1) year from the date of sale to the original purchaser. Under this Warranty, parts and labor are covered for replacement of warrantable parts or components as determined by Harriston. Exclusions to the warranty include normal wear items and the following parts: tires, planter picks, and accessories installed which are not of Harriston's manufacture. No warranty is extended to paint and regular service items such as lubricants. All warranty work must be done by an authorized Harriston dealer.

The Warranty is void if the product has been subjected to abuse, misuse, misapplication, neglect (including but not limited to improper maintenance), accident, submersion, improper installation, modification (including but not limited to use of unauthorized parts), and improper adjustment or repair. Component parts furnished with Harriston products which are not manufactured by Harriston are not warranted by Harriston, but are warranted according to the manufacturer of the component part.

THIS WARRANTY IS IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES. IMPLIED WARRANTIES INCLUDING THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED TO A PERIOD OF ONE YEAR. Under no circumstances shall Harriston be obligated for incidental or consequential damages. This Warranty gives you specific legal rights, and you may also have other rights which may vary from state to state and country to country. Some states and countries do not allow the exclusion or limitation of incidental or consequential damages, so certain limitations or exclusions under this Warranty may not apply to you.

It is expressly understood that the liability of Harriston for its products, whether due to breach of warranty, negligence, strict liability, or otherwise, is limited to the furnishing or repair of such replacement parts. Harriston is not liable for any other injury, loss, damage, or expense, whether direct or consequential, including but not limited to loss of use, income, profit, or increased cost of operation.

Any operation prohibited in the Operator's Manual or any other manuals furnished with the product, or any adjustment or assembly procedure not recommended or authorized in the operating or service instructions shall void such warranty.

No one is authorized to modify this Warranty or to make additional warranties on behalf of Harriston. Harriston reserves the right to change, modify, or improve its products without obligation to retrofit existing models.

Harriston is not liable for any accidents or damage which may occur from the operation of its equipment. The purchaser assumes all responsibility for proper use, care, maintenance, and safe operation.

This Warranty is void if the signed warranty registration form is not returned to Harriston within 30 days of purchase or if serial number has been removed or altered in any way.

Service parts sold and distributed by Harriston carry a 90 day warranty from date of sale.

All warranty claims should be made through the dealer it was purchased from and proof of serial number and purchase date must be provided when the warranty claim is made. All warranty claims must be preauthorized by Harriston.

Warranty void if product is not registered.

HARRISTON CUP PLANTER RAVEN 662
ALL ELECTRICAL CONNECTIONS MUST BE MADE DIRECTLY
TO BATTERY

INITIAL PROGRAM

US = Acres

SP2 = Radar

LI = For Potato Planter

C – P = Pulse Width Modulated Valve (PWM)

CONSOLE SETTINGS

BOOM CAL = Row Spacing (") x Number of Rows

SPEED CAL = 600 (Initial Setting)

METER CAL Product 1 4 Row Planter = 4630
 5 Row Planter = 3673
 6 Row Planter = 3087
 8 Row Planter = 2315

VALVE CAL = 23

 Product 2 (Granular) = 23

 Product 2 (Liquid) =

RATE CAL 1 & 2 = Chart on reverse side

DATA MENU

Rate Alarm = ON

Display Smoothing = ON

Off Rate Percent = 30

High PWM Offset = 160

Low PWM Offset = 36

PWM Frequency = 122

Planter Rows = Number of Planter Rows

Seed GAP = 16

PWM Preset Offset = 75

		Row Spacing (“)			
		34	36	38	40
Seed Spacing (“)	5	369.0	348.5	330.1	313.6
	6	307.5	290.4	275.1	261.4
	7	263.6	248.9	235.8	224.0
	8	230.6	217.8	206.3	196.0
	9	205.0	193.6	183.4	174.2
	10	184.5	174.2	165.1	156.8
	11	167.7	158.4	150.1	142.6
	12	153.7	145.2	137.6	130.7
	13	141.9	134.0	127.0	120.6
	14	131.8	124.5	117.9	112.0
	15	123.0	116.2	110.0	104.5
	16	115.3	108.9	103.2	98.0
	18	102.5	96.8	91.7	87.1
	19	97.1	91.7	86.9	82.5
	20	92.2	87.1	82.5	78.4
	21	87.9	83.0	78.6	74.7
	22	83.9	79.2	75.0	71.3

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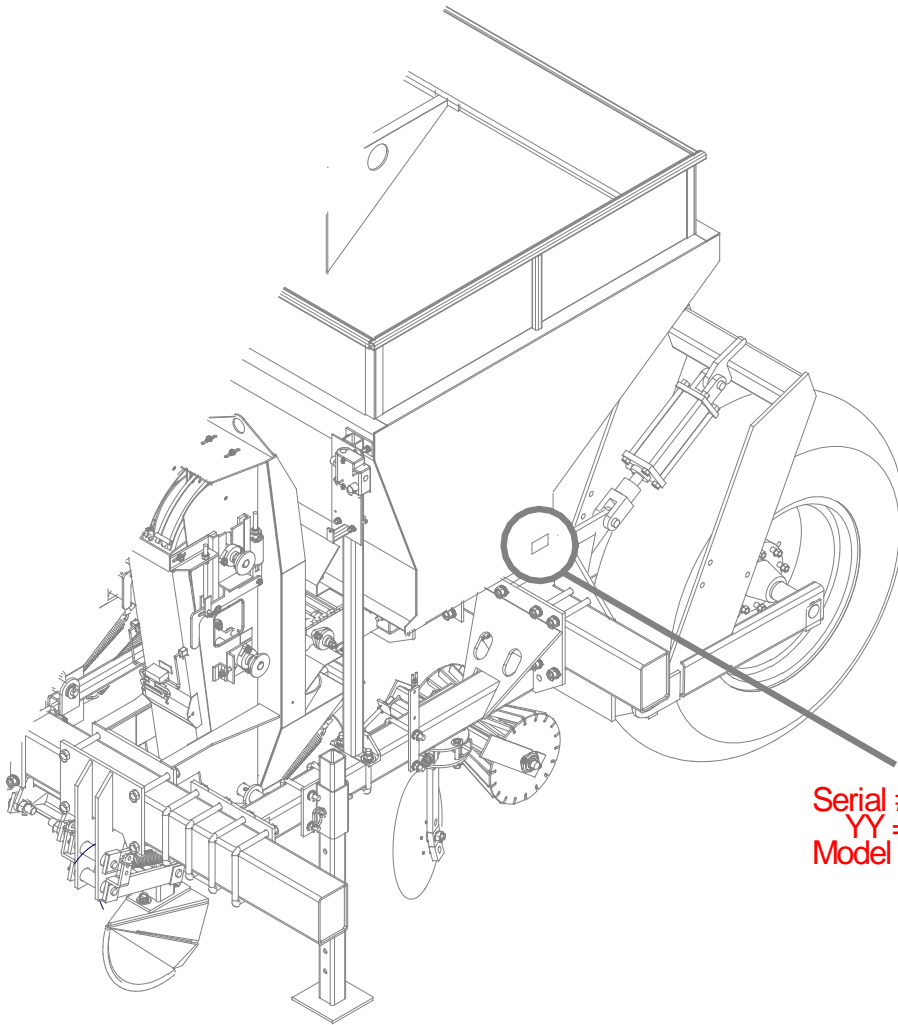
1 INTRODUCTION

Congratulations on your choice of a Harriston Cup potato planter to complement your farming operation. This equipment has been designed and manufactured to meet the needs of a discerning potato industry for the efficient planting of potatoes.

Safe, efficient, and trouble-free operation of your Harriston planter requires that you and anyone else who will be operating or maintaining the Planter read and understand all of the safety, operation, maintenance, and trouble shooting information contained in this Operator's Manual.

This manual covers the 4, 6, and 8 row models. Differences are covered and explained where appropriate.

Keep this manual handy for frequent reference and to pass on to new operators and owners. Call your Harriston dealer or distributor if you need assistance, information, or additional copies of the manual.



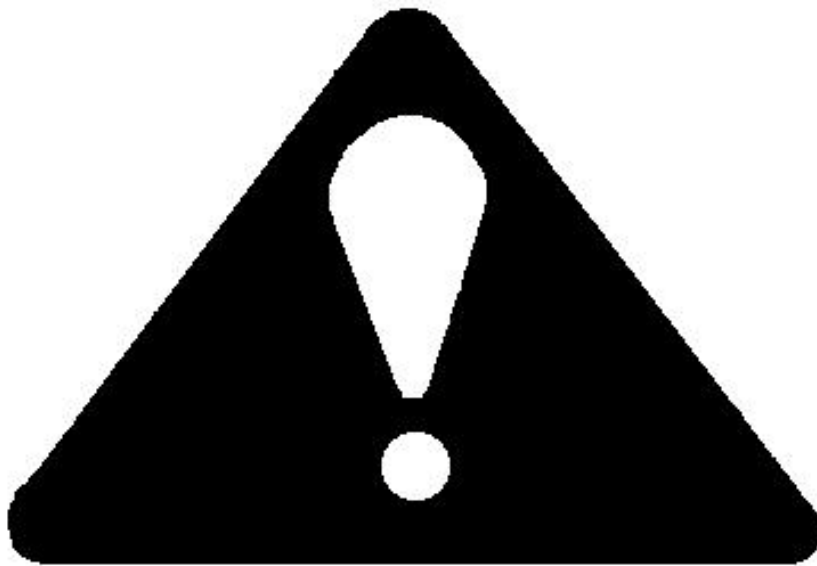
Serial # 40YYXX
YY = Year of Manufacture
Model #4004 (4 Row Pull-Type)
#4006 (6 Row Pull-Type)
#4008 (8 Row Pull-Type)
#4014 (4 Row Semi-Mount)
#4016 (6 Row Semi-Mount)

OPERATOR ORIENTATION - The directions left (driver's side), right (passenger side), front, and rear, as mentioned throughout the manual, are as seen from the driver's seat and facing in the direction of travel

SAFETY ALERT SYMBOL

This Safety Alert symbol means **ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!**

The Safety Alert symbol identifies important safety messages on the Harriston Planter and in the manual. When you see this symbol, be alert to the possibility of personal injury or death. Follow the instructions in the safety message.



Why is SAFETY Important to you?

3 Big Reasons

**Accidents Disable and Kill
Accidents Cost
Accidents Can Be Avoided**

SIGNAL WORDS:

Note the use of the signal words **DANGER**, **WARNING**, AND **CAUTION** with the safety messages. The appropriate signal word for each message has been selected using the following guidelines:

- DANGER** - An immediate and specific hazard, which WILL result in severe personal injury or death if the proper precautions are not taken.
- WARNING** - A specific hazard or unsafe practice, which COULD result in severe personal injury or death if proper precautions are not taken.
- CAUTION** - Unsafe practices which could result in personal injury if proper practices are not taken, or as a reminder of good safety

SAFETY

YOU are responsible for the **SAFE** operation and maintenance of your Harriston Potato Planter. **YOU** must ensure that you and anyone else who is going to operate, maintain, or work around the Planter be familiar with the operating and maintenance procedures and related **SAFETY** information contained in this manual. This manual will take you step-by-step through your working day and alerts you to all good safety practices that should be adhered to while operating the planter.

Remember, **YOU** are the key to safety. Good safety practices not only protect you but also the people around you. Make these practices a working part of your safety program. Be certain that **EVERYONE** operating this equipment is familiar with the recommended operating and maintenance procedures and follows all the safety precautions. Most accidents can be prevented. Do not risk injury by ignoring good safety practices.

Planter owners must give operating instructions to operators or employees before allowing them to operate the Planter, and at least annually thereafter per OSHA (Occupational Safety and Health Administration) regulation 1928.57.

The most important safety device on this equipment is a **SAFE** operator. It is the operator's responsibility to read and understand **ALL** safety and operating instructions in the manual and to follow them. Most accidents can be avoided.

A person who has not read and understood all operating and safety instructions is not qualified to operate the machine. An untrained operator exposes himself and bystanders to possible serious injury or death.

Do not modify the equipment in any way. Unauthorized modification may impair the function and/or safety and could affect the life of the equipment.

Think **SAFETY!** Work **SAFELY!**

2.1

GENERAL SAFETY

1. Read and understand the Operator's Manual and all safety signs before operating, maintaining, or adjusting the planter.



2. Provide a first-aid kit for use in case of an accident. Store in a highly visible place.



3. Provide a fire extinguisher for use in case of an accident. Store in a highly visible place.



4. Wear appropriate protective gear. This list includes, but is not limited to:

- A hard hat
- Protective shoes with slip resistant soles
- Protective glasses or goggles
- Heavy gloves
- Wet weather gear
- Hearing protection
- Respirator or filter mask



5. Install and secure all guards before starting.

6. Do not allow riders.

7. Wear suitable ear protection for prolonged exposure to excessive noise.



8. Stop tractor engine, lower machine to the ground, place all controls in neutral, set park brake, remove ignition key, and wait for all moving parts to stop before servicing, adjusting, repairing, or unplugging.

9. Clear the area of people, especially small children, before starting the unit.

10. Review safety related items annually with all personnel who will be operating or maintaining the planter.

2.2 OPERATING SAFETY

1. Read and understand the Operator's Manual and all safety signs before operating, servicing, adjusting, repairing, unplugging, or filling.
2. Do not allow riders.
3. Install and secure all guards and shields before starting or operating.
4. Keep hands, feet, hair, and clothing away from moving parts.
5. Stop tractor engine, lower machine to the ground, place all controls in neutral, set park brake, remove ignition key, and wait for all moving parts to stop before servicing, adjusting, repairing, unplugging, or filling.
6. Place all tractor controls in neutral before starting.
7. Operate machine only while seated on the tractor seat.
8. Clear the area of bystanders, especially small children, before starting.
9. Keep all hydraulic lines, fittings, and couplers tight and free of leaks before using.
10. Clean reflectors, slow moving vehicle sign, and lights before transporting.
11. Add extra lights and use pilot vehicle when transporting during times of limited visibility.
12. Use hazard flashers on tractor when transporting.
13. Install safety chain when attaching to tractor.
14. Follow chemical manufacturers' handling and safety instructions exactly when using chemicals with machine.
15. Review safety instructions with all operators annually.

2.3 MAINTENANCE SAFETY

1. Follow all the operating, maintenance, and safety information in the manual.
2. Support the machine with blocks or safety stands when changing tires or working beneath it.
3. Stop tractor engine, lower machine to the ground, place all controls in neutral, set park brake, remove ignition key, and wait for all moving parts to stop before servicing, adjusting, repairing, unplugging, or filling.
4. Make sure all guards are in place and properly secured when maintenance work is completed.
5. Never wear ill-fitting, baggy, or frayed clothing when working around or on any of the drive system components.
6. Before applying pressure to a hydraulic system, make sure all lines, fittings, and couplers are tight and in good condition.
7. Install safety rod and pin securely in position on hitch cylinder frame before working under frame.
8. Relieve pressure from hydraulic circuit before servicing or disconnecting from tractor.
9. Keep hands, feet, hair, and clothing away from moving or rotating parts.
10. Clear the area of bystanders, especially small children, when carrying out any maintenance and repairs or making adjustments.
11. Wear appropriate protective gear when contacting chemical handling components on machine.

2.4 CHEMICAL SAFETY

1. Some agricultural chemicals are among the most toxic substances known to man. Minute quantities can contaminate clothing, machinery, the workplace, and the environment. Follow the chemical manufacturers' instructions exactly. Death can result from their improper use.

2. Misuse, including excessive rates, uneven application, and label violations, can cause injury to crops, livestock, people, and the environment.

3. Do not breathe, touch, or ingest chemicals or the dust. Always wear protective clothing and follow safe handling procedures.

4. Follow the manufacturers' instructions for chemical storage. Avoid unnecessary storage by purchasing only the quantity needed for the crop year.

5. Keep all chemicals out of the reach of children and away from livestock and animals.

6. Store chemicals only in their original containers in a locked area.

7. Check with local authorities regarding the disposal of small quantities of chemicals, chemical containers and wash water.

8. Do not burn the containers or leave them lying in the field or ditches. Take them to your local container disposal site.

9. Wash thoroughly before eating. Use detergent to remove all chemical residue. Rinse carefully and dry with disposable towels.

10. Do not eat in the field where chemicals are being applied.

11. In case of chemical poisoning, get immediate medical attention.

12. Know the Poison Control Emergency telephone number for your area before using agricultural chemicals.

United States – 1-800-222-1222

Alberta – 1-800-332-1414

Manitoba – (204)-787-2591

Ottawa – 1-800-267-1373

13. Thoroughly wash clothing and equipment contaminated by chemicals.

14. Wash the applicators immediately after field work. Dispose of wash water in an environmentally safe manner. Wash water can contaminate the soil or a clean water supply.

2.5 HYDRAULIC SAFETY

1. Make sure that all components in the hydraulic system are kept in good condition and are clean.
2. Replace any worn, cut, abraded, flattened, or crimped hoses and metal lines.
3. Do not attempt any makeshift repairs to the hydraulic lines, fittings, or hoses by using tape clamps, or cements. The hydraulic system operates under extremely high pressure. Such repairs will fail suddenly and create a hazardous and unsafe condition.

4. Wear proper hand and eye protection when searching for a high-pressure hydraulic leak. Use a piece of wood or cardboard



as a backstop instead of hands to isolate and identify a leak.



5. If injured by a concentrated high-pressure stream of hydraulic fluid, seek medical attention immediately. Serious infection or toxic reaction can develop from hydraulic fluid piercing the skin surface.

6. Before applying pressure to the system, make sure all components are tight and that lines, hoses, and couplings are not damaged.

2.6 TRANSPORT SAFETY

1. Make sure you are in compliance with all local regulations regarding transporting equipment on public roads and highways.
2. Make sure the SMV (Slow Moving Vehicle) emblem and all the lights and reflectors that are required by the local highway and transport authorities are in place, are clean, and can be seen clearly by all overtaking and oncoming traffic.
3. Do not allow anyone to ride on the Planter or tractor during transport.
4. Do not exceed 32 km/h (20 mph). Reduce speed on rough roads and surfaces.
5. Do not transport with a full seed tank.

2.7 STORAGE SAFETY

1. Store away from areas of human activity. Do not permit children to play on or around the stored machine.
2. Make sure the unit is sitting, or blocked up firm and solid and will not tip or sink into a soft area.
3. Cover with a weather - proof tarpaulin and tie down securely.

2.8 TIRE SAFETY

1. Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion, which may result in serious injury or death.
2. Do not attempt to mount a tire unless you have the proper equipment and experience to do the job.
3. Have a qualified tire dealer or repair service perform required tire maintenance.

2.9 ASSEMBLY SAFETY

1. Assemble in an area with sufficient space to handle the largest component and access to all sides of machine.
2. Use only lifts, cranes, jacks, and tools, with sufficient capacity for the load.
3. Use two people to handle the large bulky components.
4. Do not allow spectators in the working area.

2.10 SAFETY DECALS

1. Keep safety decals and signs clean and legible at all times.
2. Replace safety decals and signs that are missing or have become illegible.
3. Replaced parts that displayed a safety sign should also display the current sign.
4. Safety decals or signs are available from your Dealer Parts Department.

HOW TO INSTALL SAFETY DECALS:

1. Be sure that the installation area is clean and dry.
2. Decide on the exact position before you remove the backing paper.
3. Remove the smallest portion of the split backing paper.
4. Align the decal over the specified area and carefully press the small portion with the exposed sticky backing in place.
5. Slowly peel back the remaining paper and carefully smooth the remaining portion of the decal in place.

Small air pockets can be pierced with a pin and smoothed out using the piece of decal backing paper.

2.11 SIGN-OFF FORM

Harriston Industries follows the general Safety Standards specified by the American Society of Agricultural Engineers (ASAE) and the Occupational Safety and Health Administration (OSHA). Anyone who will be operating and/or maintaining the Potato Planter must read and clearly understand ALL Safety, Operating, and Maintenance information presented in this manual.

Do not operate or allow anyone else to operate this equipment until such information has been reviewed. Annually review this information before the season start-up.

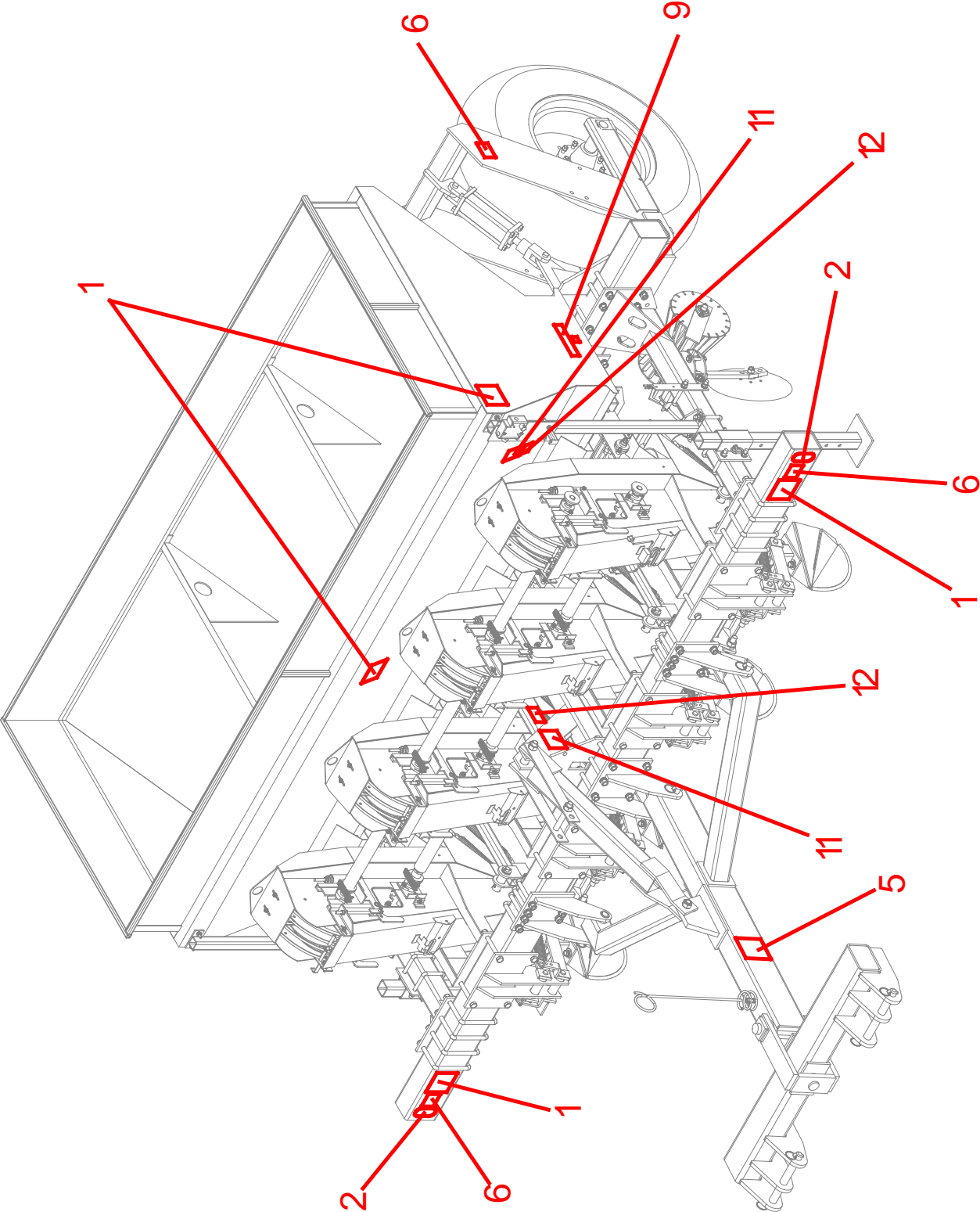
Make these periodic reviews of Safety and Operation a standard practice for all of your equipment. We feel that an untrained operator is unqualified to operate this machine.

A sign-off sheet is provided for your record keeping to show that all personnel who will be working with the equipment have read and understand the information in the Operator's Manual and have been instructed in the operation of the equipment.

SIGN OFF FORM

Date	Employees Signature	Employers Signature

3 SAFETY DECAL LOCATIONS



3 SAFETY DECAL LOCATIONS

The types of decals and locations on the equipment are shown in the illustration below. Good safety requires that you familiarize yourself with the various Safety Decals, the type of warning, and the area or particular function related to that area, that requires your SAFETY AWARENESS.

5



1. Read Operator's Manual before using machine.
2. Stop tractor engine, lower machine to the ground, place all controls in neutral, set park brake, remove ignition key, and wait for all moving parts to stop before servicing, adjusting, repairing, unplugging, or filling.
3. Install and secure all guards before starting.
4. Keep hands, feet, hair and clothing away from moving parts.
5. Do not allow riders.
6. Keep all hydraulic lines, fittings, and couplers tight and free of leaks before using.
7. Clean reflectors, SMV, and lights before transporting.
8. Install safety rod and pin securely in position on hitch cylinder frame before working under frame or transporting machine.
9. Add extra lights and use pilot vehicle when transporting during times of limited visibility.
10. Use hazard flashers on tractor when transporting.
11. Install safety chain when attaching to tractor.
12. Follow chemical manufacturers' handling and safety instructions exactly when using chemicals with machine.
13. Review safety instructions with all operators.

1

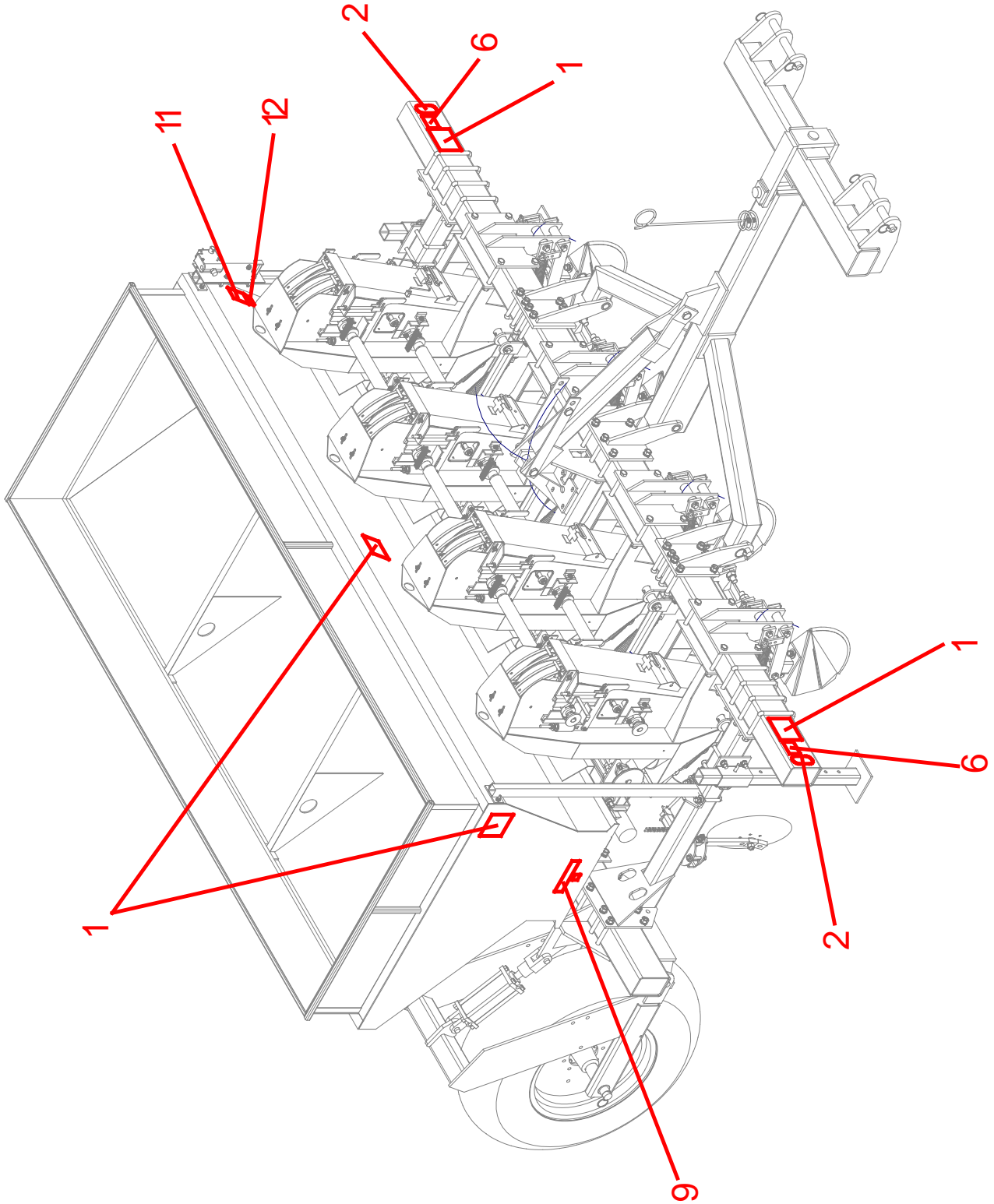


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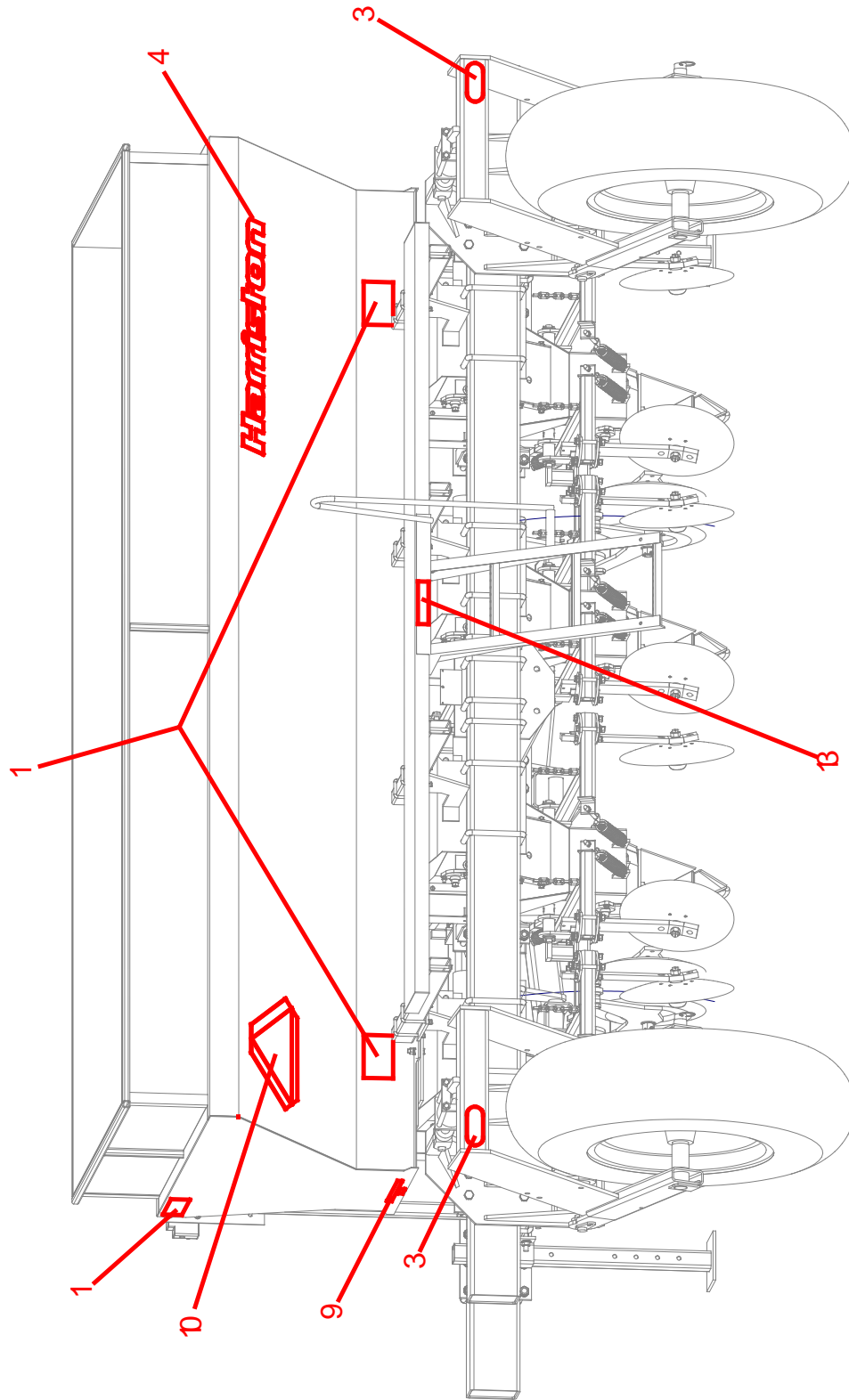


REMEMBER - If Safety Decals have been damaged, removed, become illegible, or parts replaced without decals, new decals must be applied. New decals are available from your authorized dealer.

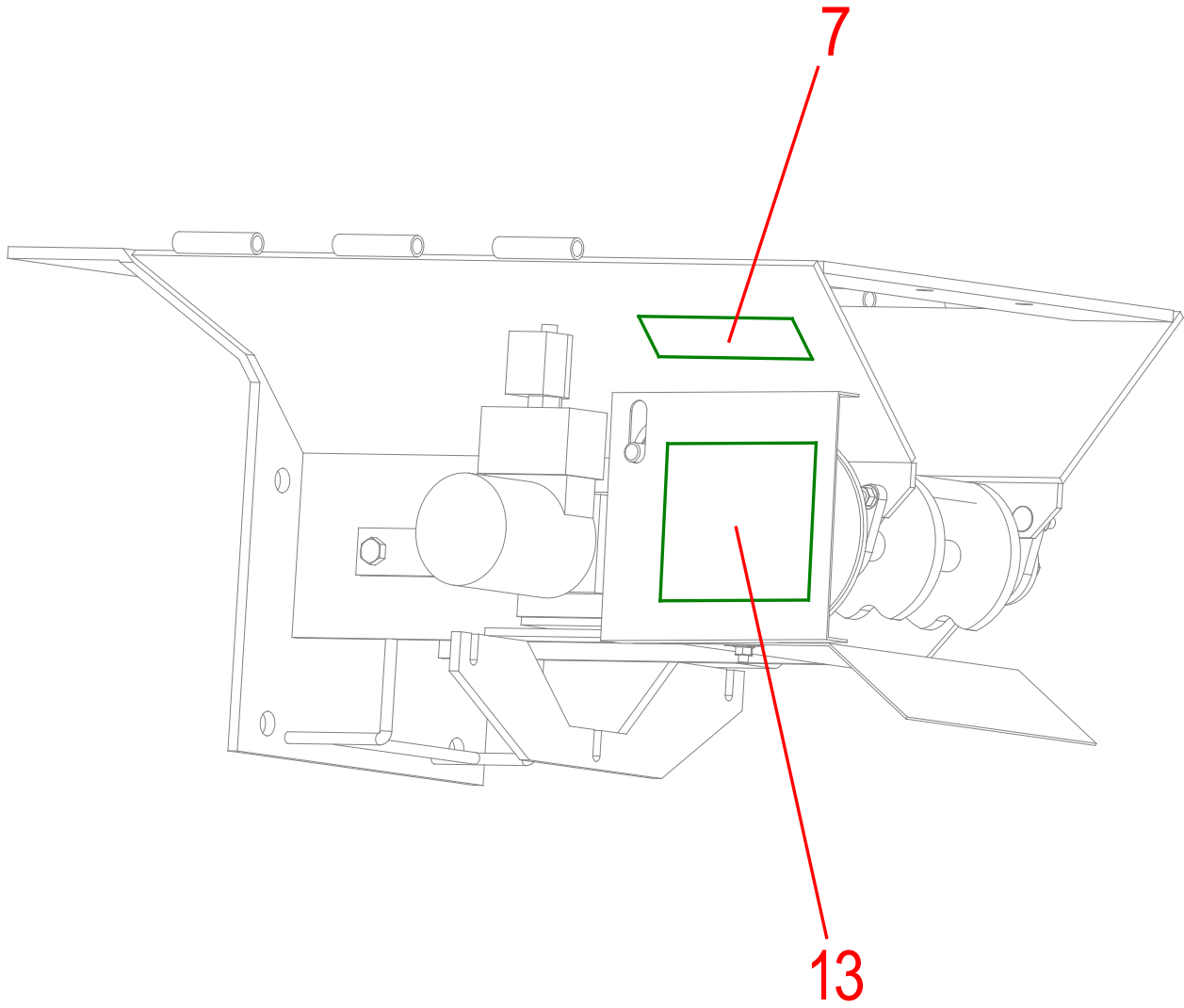
SAFETY DECAL LOCATIONS



SAFETY DECAL LOCATIONS



SAFETY DECAL LOCATIONS



The types of decals and locations on the equipment are shown in the illustration below. Good safety requires that you familiarize yourself with the various Safety Decals, the type of warning, and the area, or particular function related to that area, that requires your SAFETY AWARENESS

8



15



16

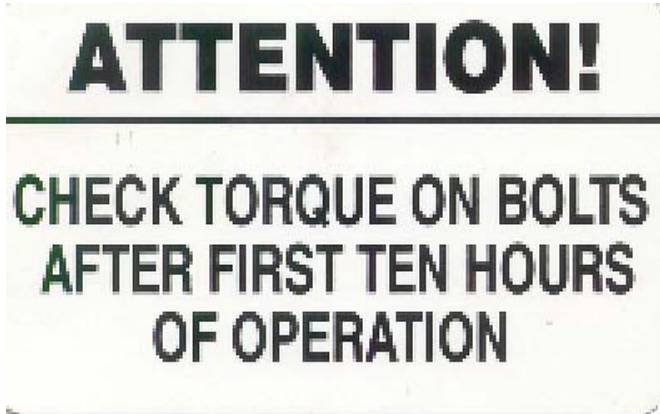


REMEMBER - If Safety Decals have been damaged, removed, become illegible, or parts replaced without decals, new decals must be applied. New decals are available from your authorized dealer.

13



6



12



1	093006	Warning Falling Hazard
2	080021	Decal Yellow Reflector
3	080020	Decal Red Reflector
4	093057	Decal Harriston Large
5	093001	Decal Caution (Hitch)
6	093052	Decal Attention Check Torque
7	093056	Decal Made with Pride
8	093003	Decal Missing Shield
9	093055	Decal Harriston Quality
10	093058	Decal Slow Moving Sign
11	093005	Decal Warning High Pressure
12	093020	Attention Alteration to Hydraulic
13	093016	Decal Warning Falling Hazard Small
14	093009	Serial Number Plate
15	093002	Warning Rotating Parts
16	093004	Danger Toxic Chemical
17	093018	Warning – Empty Seed Tank for Transport
18	093019	Warning – Rotating Parts Hazard
19	093023	Notice : Minimize Corrosion
20	093014	Warning Frame Pinch Point

4 OPERATION



1. Read and understand the Operator's Manual and all safety signs before operating, servicing, adjusting, repairing, unplugging, or filling.
2. Do not allow riders.
3. Install and secure all guards and shields before starting or operating.
4. Keep hands, feet, hair, and clothing away from moving parts.
5. Stop tractor engine, lower machine to the ground, place all controls in neutral, set park brake, remove ignition key, and wait for all moving parts to stop before servicing, adjusting, repairing, unplugging, or filling.
6. Place all tractor controls in neutral before starting.
7. Operate machine only while seated on the tractor seat.
8. Clear the area of bystanders, especially small children, before starting.
9. Keep all hydraulic lines, fittings, and couplers tight and free of leaks before using.
10. Clean reflectors, SMV, and lights before transporting.
11. Add extra lights and use pilot vehicle when transporting during times of limited visibility.
12. Use hazard flashers on tractor when transporting.
13. Install safety chain when attaching to tractor.
14. Follow chemical manufacturers' handling and safety instructions exactly when using chemicals with machine.
15. Review safety instructions with all operators annually.

4.1 TO THE NEW OPERATOR OR OWNER

Harriston Potato Planters are designed to quickly and efficiently plant potatoes with almost any row spacing and in a variety of seed placement spacings. The ground or hydraulic drive ensures accurate placement of seed at any reasonable speed.

Many features incorporated into this machine are the result of suggestions made by customers like you. Read this manual carefully to learn how to operate the machine safely and to set it to provide maximum field efficiency. By following the operating instructions in conjunction with a good maintenance program, your planter will provide many years of trouble-free service.

4.2 PRINCIPLE COMPONENTS

The Harriston Potato planter uses a large hopper (A) to carry potato seed over the field for planting. A small hydraulically powered feed chain (B) moves the seed into the seed bowl. The speed of the feedbox chain is controlled by a flow control (C), mounted on the left side of the planter. An electrical switch (D) in the bowl activates the feed box potato chain when more seed is required. A deflector (E) is mounted below the feedbox opening to direct the flow of seed.

A vertical belt with cups (F) moves up through the bowl and the cup carries up a seed piece. On the upward movement of the belt a rotating shaker (G) bumps the belt. This helps to reduce the amount of extra seed pieces that may be in the cup. On the downward movement of the belt the seed piece falls onto the top of the next cup and rests against the front chute. At the top of the belt, a curved guide (H) keeps the seed piece from going over the cup in front of it.

The seed piece moves through a short area that is offset from the chute. The optional seed sensor eyes (I) are mounted there to indicate whether each cup has a seed piece.

The cup rolls around the bottom roller (J) and allows the seed piece to fall into the furrow. A side deflector is located at the bottom of the row unit to keep seed pieces within the width of the open furrow.

An opening shoe (K) ahead of the row unit creates a furrow for the seed piece. This shoe is on a linkage (L) which is mounted to the toolbar. The linkage allows the shoe to follow the ground contour and go over obstructions. Each shoe is equipped with two tension springs to assist in maintaining consistent depth. Travel stops are located on the linkage flats for up and downward travel. Two shoe bottoms are available. The rounded or half-moon shoe is normally used in irrigated areas with dry, lighter soils with low residue. The angled shoe bottom is normally used in heavier, wetter soils with heavier residue. The angled shoes are recommended for bed planting.

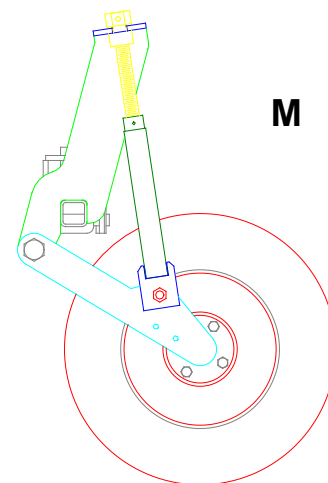
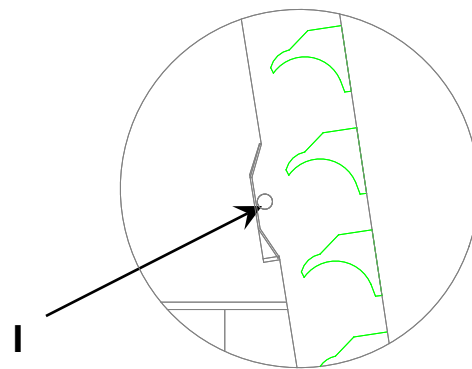
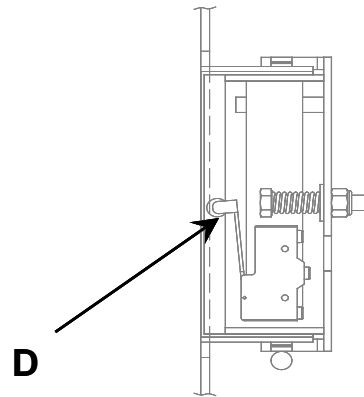
An adjustable gauge wheel (M) allows the operator to set the depth of the shoe (seed). One gauge wheel is used for every two rows. A floating linkage system allows each planting shoe to work independently. If one shoe hits an obstruction it will not affect the other shoe until the shoe limit is reached on the floating linkage.

Before starting to work, all operators should familiarize themselves with the location and function of the controls on the planter and tractor.

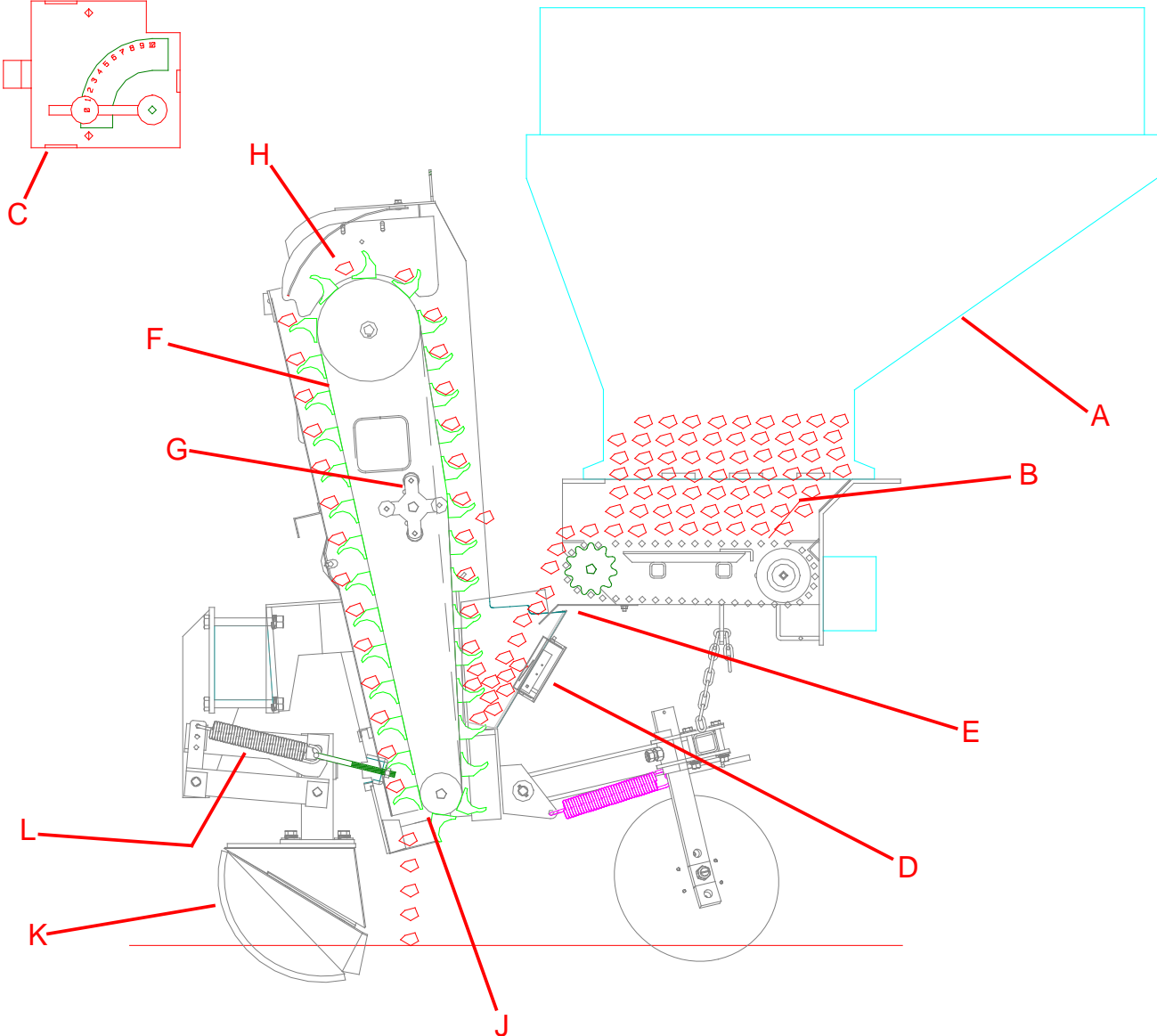
The Harriston Cup Planter is offered with three different drive systems: Raven 662 Hydraulic, Dickey John IntelliAg hydraulic, and Ground (Mechanical)

ALL ELECTRICAL CONNECTIONS MUST BE MADE DIRECTLY TO THE BATTERY WITH 'CLEAN' LEADS. GROUND WIRE MUST BE FREE FROM CORROSION.

ANY SYSTEM MALFUNCTIONS CAUSED BY CONNECTION OF ELECTRICAL LEADS TO ANY OTHER POWER SOURCE WILL NOT BE COVERED BY HARRISTON INDUSTRIES.



Seed Feeding Components



4.3 PRE-START AND BREAK IN

Although there are no operational restrictions on the Planter when it is used for the first time, it is recommended that the following mechanical items be checked.

PRE-START INSPECTION

1. Read the Operator's Manual.
2. Tighten wheel bolts to 140 ft-lbs (24 N.m) torque.
3. Check that tires are inflated to their specified pressure.
4. Check that the hydraulic lines and electrical harness are routed where they will not contact moving parts. Be sure all components are clipped, taped, or tied securely in place.
5. Check that all guards are installed and secured.
6. Tighten all mounting bolts on rear ladder and loading platform, if so equipped.
7. Check that all cups are in place and in good condition. Replace as required.
8. Check each belt when running. Belt must track straight without cups rubbing. Adjust belt as necessary.
9. Check that all required nuts and bolts are installed and tightened to their specified torque.
10. Lubricate the machine.

AFTER OPERATING FOR 2 HOURS

1. Re-torque all wheel bolts.
2. Check tire pressure.
3. Re-torque all other fasteners and hardware.
4. Check that no hoses are being pinched, crimped, or are rubbing. Reroute as required.
5. Check that the wiring harness is not being pinched, crimped, or rubbing. Reroute as required.
6. Check the tension and alignment of all drive and feed chains. Adjust as required.
7. Check the condition of the cups and belts on each row unit.
8. Lubricate the machine.

AFTER OPERATING FOR 10 HOURS

1. Re-torque all wheel bolts.
2. Re-torque all fasteners and hardware.
3. Check the routing of hydraulic lines and the wiring harness. Reroute as required to prevent pinching, crimping, binding or rubbing.
4. Check the tension and alignment of all drive and conveyor chains. Adjust as required.
5. Check the condition of the cups and belts on each row unit.
6. Go to the normal Service and Maintenance schedule.

RE-TORQUE WHEEL BOLTS EVERY 50 HOURS.

4.4 PRE OPERATION CHECKLIST

Efficient and safe operation of the Harriston Planter requires that each operator reads and understands the operating procedures and all related safety precautions outlined in this section. A pre-operation checklist is provided for the operator. It is important for both personal safety and maintaining the good mechanical condition of the machine that this checklist is followed.

Before operating the planter and each time thereafter, the following areas should be check off:

1. Lubricate the machine per the schedule outlined in the Maintenance Section.
2. Check the drives for entangled material.
3. Check that the cups and belts are in good condition. Replace or adjust as required.
4. Check the chains and sprockets for proper tension and alignment. Adjust as required.
5. Ensure that all bearings turn freely.
6. Make sure all guards and shields are in place, secured, and functioning as designed.
7. Check that all hydraulic fittings and connections are tight and in good condition.

4.5 EQUIPMENT MATCHING

The Harriston potato planter is designed to be used on large 2 wheel drive or front wheel assist agricultural tractors. To ensure good field performance, the following list of specifications must be met:

HYDRAULICS

The towing tractor must be capable of certain g.p.m. @ 2000 p.s.i. to operate the planter depending on configuration.

Flow must be provided for the following:

Hydraulic Drive Raven 760 (10 gallons) @ 2000 psi

Hydraulic Drive Raven 662 (5 gallons) @ 2000 psi

Ground Drive (6 gallons)

Rear Lift (3 gallons)

Markers (2 gallons) optional

Fertilizer (5 gallons) optional

Air Insecticide (4 gallons) optional

THREE POINT HITCH

With 2 Point semi-mount attaching systems, a Cat III 3 point is recommended.

HORSEPOWER

	Level, Firm Soil	Rolling, Soft Soil	3 Point Lift Cap.
4 Row	90 HP	110 HP	6000 LBS.
4 Row W/ FERT.	110 HP	130 HP	8500 LBS.
6 Row	140 HP	160 HP	8000 LBS.
6 Row W/ FERT.	160 HP	180 HP	11000 LBS.
8 Row	165 HP	200 HP	10000 LBS.
8 Row W/ FERT.	200 HP	225 HP	13500 LBS.

TIRE CONFIGURATION

It is recommended that a tire width be used on the tractor that will allow the tire footprint to fit between the rows being planted. The row spacing of the Planter can be adjusted. Tires that are too wide for the available space will compact the seedbed and affect plant growth.

TRACTOR WEIGHT

By following the recommendations for tractor power, the tractor will have sufficient weight to provide stability for the unit during field operations or transporting. It is also recommended that each tractor be equipped with a full complement of suitcase weights on the front of the tractor. This will provide the required weight on the front for turning as well as extra traction if equipped with front wheel assist.

ELECTRICAL

Each machine requires a 12 volt 20 amp power supply to operate the solenoid for the feed chain into the seed bowl. An additional 12 volt 5 amp supply is required for the hydraulic drive models. The switch is routed into the cab for easy access during operation.

4.6 RAVEN 662 HYDRAULIC CONTROL SYSTEM

The hydraulic drive planter is a single series hydraulic system controlled by an electronic pulse width modulated (PWM) control valve. Hydraulic oil flow and pressure is supplied by the tractor. This valve controls how fast the picker wheels turn, which in turn, determines seed spacing. The system can be operated as either an open or closed system.

PRESSURE- FLOW COMPENSATED SYSTEM

Most modern tractors use a pressure flow compensated hydraulic system. Flow is adjusted with the tractor flow control. It is recommended that flow be set to deliver only the g.p.m. required to operate the planter at the desired rate and speed, usually 10-15 g.p.m. is sufficient. Excess flow could damage the planter control system. When planting, the pressure will be the tractor operating system pressure (usually 300 p.s.i.) plus the pressure required to operate the planter. This varies greatly depending on planter size and configuration.

With the planter stopped, tractor running, and hydraulic valve engaged, pressure will return to tractor operating pressure (300-600 p.s.i) if the bypass valve (A) is in the **OPEN** (HANDLE IS IN LINE WITH THE VALVE BODY) position. When the bypass valve is in the **CLOSED** (HANDLE IS 90° TO THE VALVE BODY) position, there will be no flow when planter is stopped and hydraulics engaged, but the pressure will be as high as 3000 p.s.i. between the tractor valve and planter control valve. To reduce the chance of injury from a blown hydraulic hose or fitting and valve leakage (which causes planter creep), Harriston recommends the bypass valve be open on compensated systems.

These systems have a very high flow, some in excess of 40 g.p.m. To reduce overheating and possible damage to planter hydraulic system, set the flow to deliver only the g.p.m. to operate the planter. Some compensated hydraulic systems have a pressure-sensing line available as an option. Consult your tractor dealer about this option.

When the planter is not moving, or operating in manual mode, there will be no flow or pressure after the pwm valve (B). When the planter begins to move, or the increase/decrease switch is moved to start the planter, the control console receives a signal from the radar gun and begins to open the pwm valve. Oil will begin to flow from the CF (controlled flow) port (C) of the valve to the cup belt hydraulic motor (D). As the hydraulic motor begins to turn, oil will flow from the motor to the shaker pwm valve (E) and on to the shaker motor (F). Excess oil from the shaker motor & the pwm valve flows into the feedbox flow control valve (G) and on to the feedbox motors (H). See Page 57 for more information on motor solenoids / oil flow.

If the feed box motor solenoid is open (potatoes below bowl switch level), oil will bypass the feedbox motors in the valve block below the solenoid and continue to the other feedbox motors. If the feed box motor solenoid is closed (bowl switch detecting potatoes), oil will flow through and turn the motor. Any motor that has a closed solenoid will turn as long as the main drive motor is turning. Set the flow control on #2 or #3 when starting. See Page 40 for setting bowl seed level. Oil flows from the last feedbox motor and returns to the tractor (I).

Flow or Gallons Per Minute (G.P.M) is regulated by the tractor flow control. Flow should be set so that sufficient flow is provided to operate planter at the desired planting speed. Usually this will be 10 to 15 g.p.m or less. Flow should never be above 15 g.p.m. A check valve is located after the hydraulic tip on the tractor pressure line to prevent the planter from running in reverse.

RAVEN 662 CONTINUED

OPEN HYDRAULIC

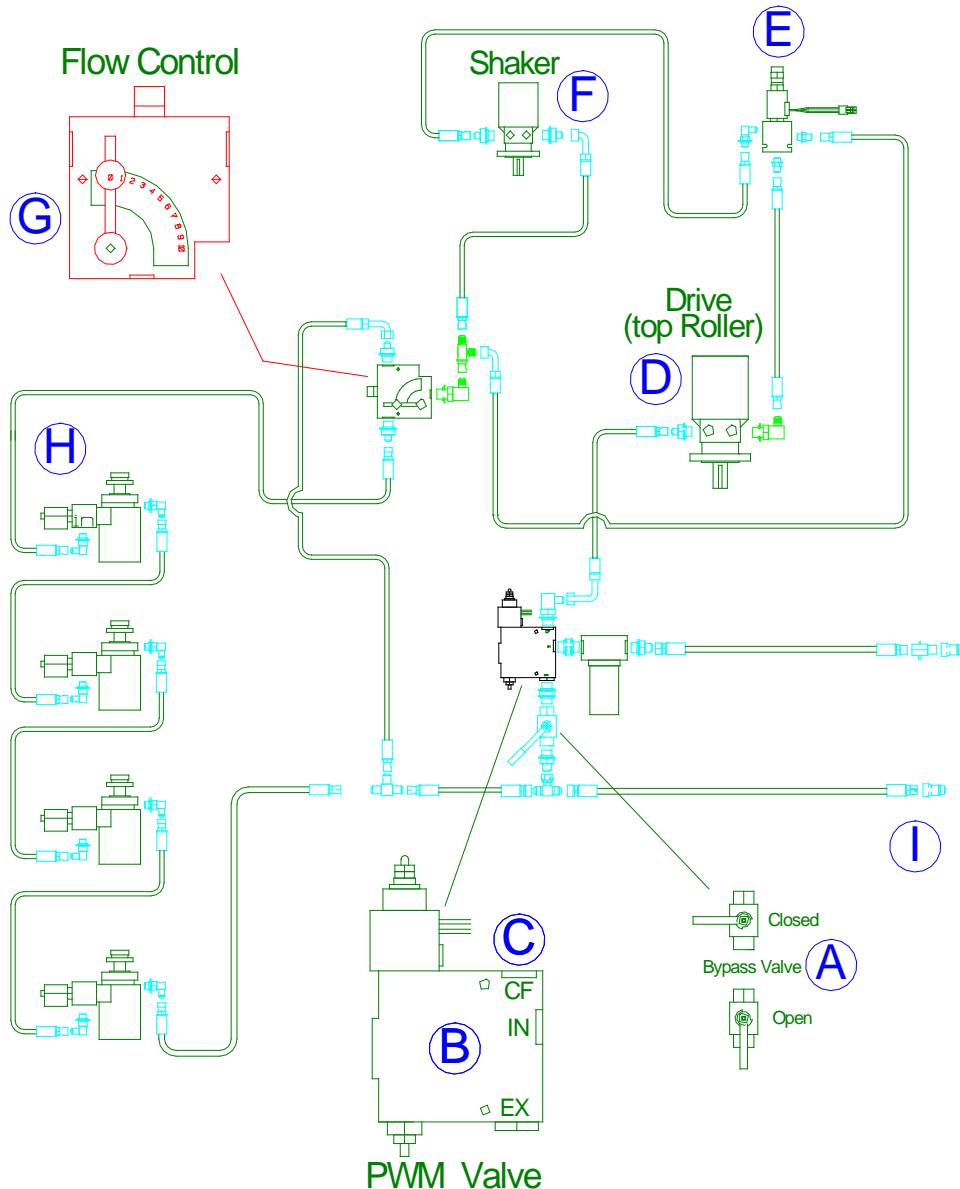
In an OPEN SYSTEM, the bypass valve is **OPEN** (Handle is in line with the valve body). In an open hydraulic system, the tractor usually is not equipped with any type of built-in flow control. The flow (g.p.m.) will be whatever the tractor provides on the hydraulic valve being used. No flow control or restrictor should be used between the tractor valve and the planter system. A restrictor or flow control used on an open system could cause overheating or damage to the hydraulic system.

There will be very little hydraulic pressure when the planter is not operating and the control valve on the tractor is open (usually 150 p.s.i or less). In the operating or manual mode, pressure will be whatever is required to operate the planter at the time. This will vary greatly depending on planter size and configuration (usually 1200-2200 p.s.i).

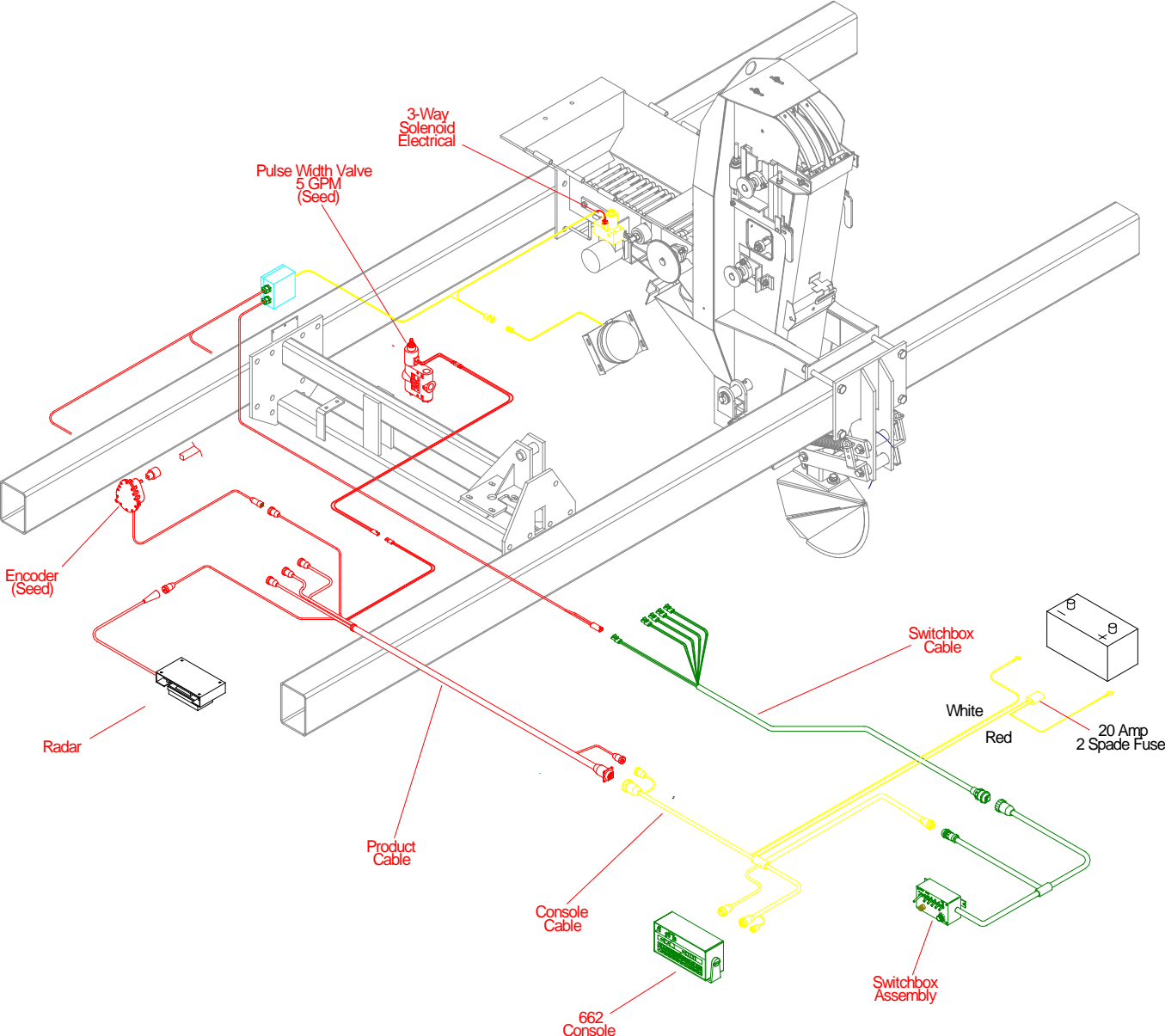
Any flow beyond what is required to operate will return to the tractor through the bypass line. It is recommended that a flow of 10 to 15 g.p.m. be provided. If tractor provides less than 10 or more than 15 g.p.m. consult your tractor dealer to have the flow adjusted. Open hydraulic systems are generally found on older or smaller tractors.

CLOSED SYSTEM

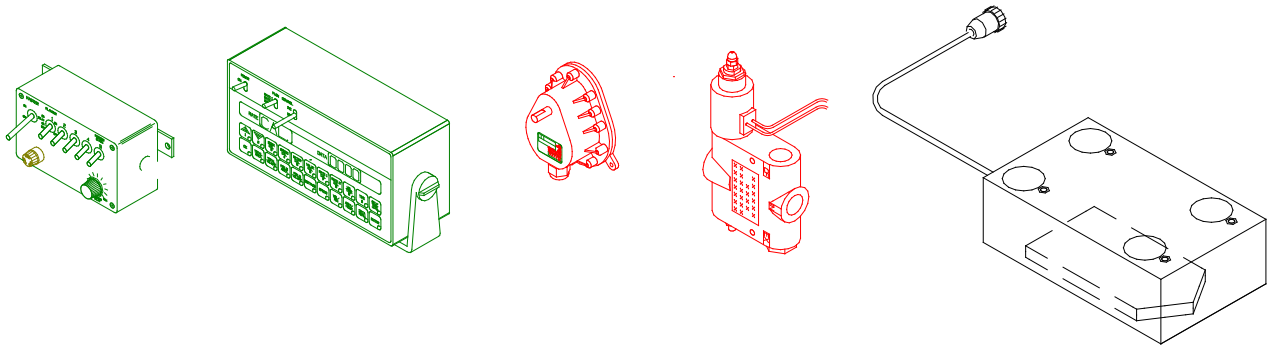
In a CLOSED SYSTEM, the bypass valve is **CLOSED** (handle is 90° to the valve body). With the tractor running and hydraulic valve engaged, there is always high system pressure from the tractor to the pwm valve (B), with a typical pressure of 2250 to 3000 p.s.i.



4.7 RAVEN 662 COMPONENTS



RAVEN 662 CONTINUED



PULSE WIDTH MODULATED VALVE

The pulse width modulated valve (PWM) uses electric current to raise and lower a valve, which controls the amount of oil flow. It is usually mounted on the center crossmember.

The main components of the valve are the valve body, spool, compression spring, electronic solenoid, and an actuator rod. The valve also contains a pressure compensator to keep oil flow steady regardless of pressure. A compression spring holds the spool in the closed position. The solenoid and operating rod are located on the opposite end of the spool from the compression spring. When the electronic solenoid is energized it creates a magnetic field, which pushes the operating rod against the spool. This overcomes the compression spring and the valve begins to open, allowing oil to flow from the tractor to the hydraulic drive motor. When the master switch is shut off, or ground speed stops, the compression spring closes the valve. The valve needs power to stay open. If there is any malfunction or power loss the valve will close.

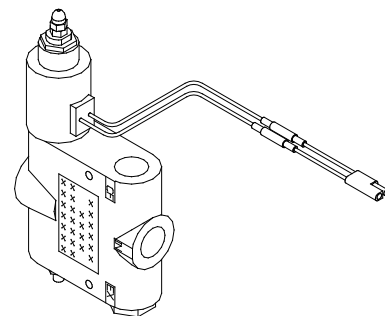
The PWM Valve requires a very exact voltage to operate properly. Therefore **ALL HYDRAULIC CONTROL SYSTEMS MUST BE CONNECTED TO THE BATTERY WITH A "CLEAN" POWER AND GROUND WIRE.** Convenience outlets in the cab or outside the cab are **NOT** acceptable power sources. Radios, telephones, tractor radar, or any other electrical devices cannot be connected to the same power and ground wires. **ANY SYSTEM MALFUNCTIONS CAUSED BY CONNECTION OF THE POWER AND GROUND WIRES TO ANY SOURCE OTHER THAN DIRECTLY TO THE BATTERY WILL NOT BE COVERED BY WARRANTY.**

If the PWM valve fails to operate properly, use a voltage meter to check the voltage between the two lines on the valve. Disconnect the radar, and with the console in the manual position, have an assistant hold the increase/decrease switch in the increase position. **CAUTION: STAY CLEAR OF THE CUP BELT TO AVOID ENTANGLEMENT.** There should be 11.6 to 12.6 volts. If this voltage cannot be maintained, check

wiring harness for breaks or a loose connection. If a reading of 12 volts is found, and valve still does not work properly after performing the servicing procedure on Page 55, replace the valve.

The VALVE CAL is a two-digit number that determines how the valve will operate. The first digit is the valve response time. A lower first digit will make the valve respond faster on startup, speed change, and stopping. If the planter is slow to respond when planter starts moving, or runs when stopping, enter a smaller number. If the first digit is too low the planter may surge.

The Raven 760 system has a smoothing function that ignores minor temporary variations in the speed or mechanical operation of the planter. A rate adjustment will not occur as long as the planter is within a percentage of the target rate for 10 seconds or less. The target rate, or "deadband" percentage, is determined by the second digit in the VALVE CAL number. The factory setting for the VALVE CAL is 23. If the planter stays within 3 percent of the target rate for 10 seconds or less no rate adjustment will be made. The system will make an immediate correction if a rate adjustment greater than 3 percent is called for due to a change in speed, or if the target rate is not returned to within 10 seconds. The "deadband" can be changed by entering a new VALVE CAL number. (21=1%, 29=9%). Setting the second digit too low may cause the planter to surge or pulsate. A number that is too high may cause sluggish operation. If the smoothing display is shut off, the valve will react to all variations.



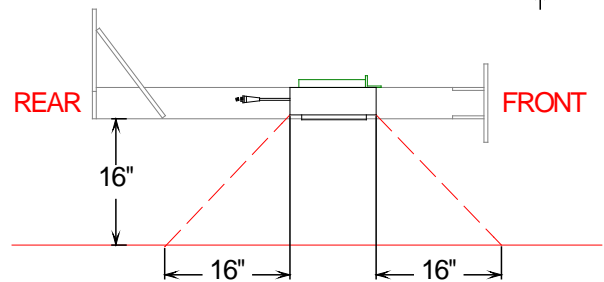
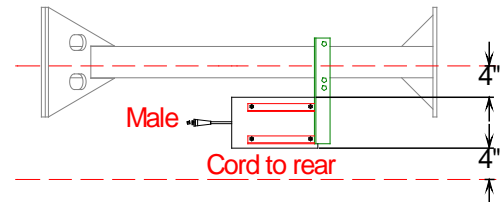
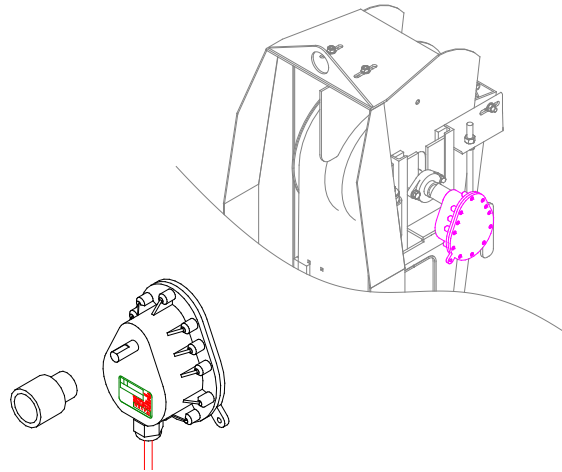
ENCODER

The encoder counts the rotation of the shaft that drives the top drive rollers. It is a 180 pulse per revolution encoder. One revolution of the top drive roller turns the encoder shaft 1 revolution. The encoders are normally mounted on the right side of planter on the end row unit mounted directly to the top roller. It is not recommended that the encoder be moved.

ANY MALFUNCTION CAUSED BY CHANGING THE ENCODER POSITION WITHOUT PRIOR APPROVAL BY HARRISTON INDUSTRIES WILL NOT BE COVERED BY WARRANTY.

RAVEN RADAR

The radar provides the console with the speed that the planter is traveling. The raven radar unit is usually mounted on the hitch for 6 & 8 row planters. On semi-mount or 4 row planters it should be mounted on the end crossmember. Mount the radar with the cord to the rear. The raven radar reads both to the front and the back to provide a constant signal to the console. It must be mounted 16" above the ground and horizontal to the ground. It must have 16" of clear view to the front and rear and also 4" of clear view to the sides. **NOTE: Anything that is moving (dust, weeds, hands or feet) will cause the radar to "see movement" and send a signal to the console.**



WARNING

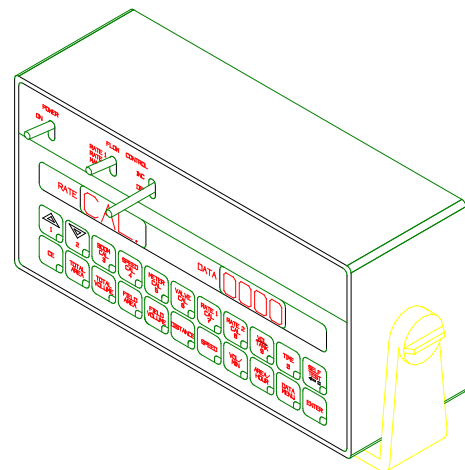
Always shut hydraulics off before working on Planter

RAVEN 662 CONSOLE

The Raven console must always be connected directly to the battery. The ground wire should be free of corrosion. The power lead must use a 'clean' line, no other accessories should be connected with it. **ANY MALFUNCTION CAUSED BY IMPROPER BATTERY CONNECTION WILL NOT BE COVERED BY WARRANTY.**

The Raven 662 has a seed drop monitor in the console. At this time, the monitor is used with Dickey-John sensors located on the side of the row unit. The potatoes falling through the offset area of the chute break a beam transmitted across the seed chute.

The monitor will continually sequence through each row if the power switch is turned on (with no forward movement). When planting, if all rows are functioning, the monitor will go into a passive or standby mode. When a row stops planting for a predetermined time, the failed row will be displayed in the RATE display. An alarm will also sound. The sensitivity of the monitor can be adjusted with the GAP setting in the DATA menu. The higher the GAP number the less sensitive the monitor is. The factory GAP number is 16.



Switchbox

The switchbox consists of a master switch and five product switches. The master switch controls all products and is an on/off switch.

Switches #1 and #5 are dedicated switches to the Harriston planter and may not be used for any additional products. Switch #5 controls the planter potato feedbox chains.

Switch #1 is a three-position switch (On, Off and Delay On). The “Delay On” position is used in conjunction with the planter delay dial. The delay dial allows other products to start slightly ahead of the planter. This ensures the first seeds dropped to receive fertilizer or other chemicals. The amount of delay may be set from .25 seconds to 2 seconds. Placing switch #1 in the “On” position will bypass the delay function.

Switch #5 allows the operator to shut off the potato feedbox chains. This is used to empty the bowls and row units while there are potatoes in the seed tank.

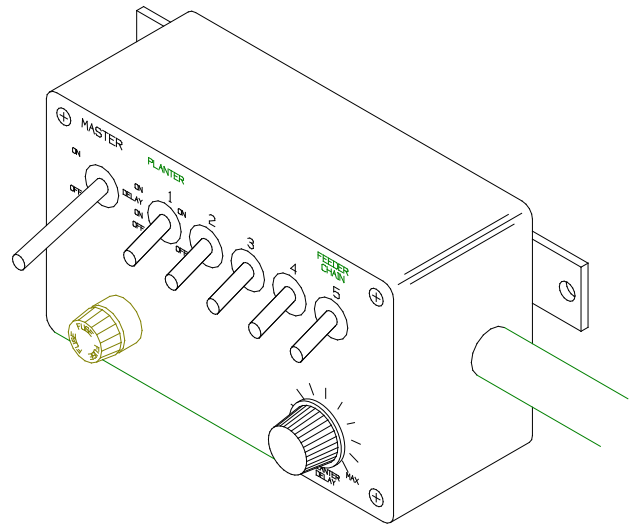
Switch #2 is dedicated to the Harriston Dry Fertilizer option – if so equipped.

Switches #3 and #4 can be used to operate additional products. Do not use these switches to operate other functions that are not controlled by the Raven console. Consult your Raven or Harriston dealer on using the switches to control other products.

NOTE: THE USE OF THESE SWITCHES TO OPERATE UNAUTHORIZED FUNCTIONS MAY AFFECT OPERATION OF THE CONTROL SYSTEM AND VOIDS ALL WARRANTY.

Harness Cables

The product cable contains the plug-ins for the seed sensors, radar, planter valve, and planter shaft sensor. The product cable plugs into the console cable. Adding another product cable can control other functions. The console cable plugs into the console and has the power leads and a lead to the switchbox. See Page 25 for an illustration of cables.



4.8 RAVEN 662 INITIAL PROGRAMMING

(Pre-programmed at Harriston)

The console is initially programmed at Harriston Industries. When the console is powered off these settings should remain. If for some reason they are 'lost', the following settings must be entered in order for the Raven system to work.

If the console is powered on and "CAL" flashes in the RATE display, the console must be programmed. If an entry error is made when programming the console, do the following:

Turn the power off. Place all switches on console and console switchbox to "Off" position.

Depress and hold  while turning the power on. **THIS RESETS THE CONSOLE**

"CAL" will be flashing in the RATE display and the DATA display will show "US" – Volume Per Acre


YOU ARE NOW READY TO PROGRAM THE CONSOLE

1. Choose between US (acres), SI (hectares), or

TU (1000 sq ft). Depressing  will step through the options. When the display in DATA shows **US**,


depress 

2. Choose between SP1 (Wheel Sensor) or SP2

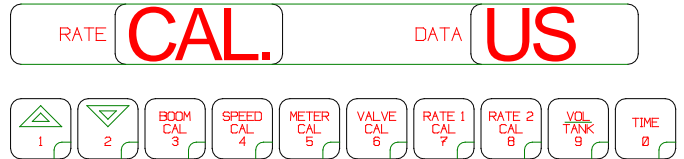
(Radar). Depress  to step through the options.

When the display in DATA shows SP2, depress 

3. Choose between LI (Liquid Sprayer), GR1 (Servo Valve) or GR2 (Split bed belt). Depress

 to step through the options. When the display in

DATA shows **LI**, depress 



4. Choose between C-Sd (Standard Valve), C-F (Fast Valve), C-FC (Servo Valve Fast Close) or C-P

(Pulse Width). Depress  to step through the options. When the display in DATA shows C-P, depress


. The display in DATA should now indicate .00

The initial programming is now complete.


CONSOLE PROGRAMMING

When entering data (numbers) into the console, the sequence is always the same.

Depress the key in which you wish to enter data (ex. boom cal).

Depress . An "E" will appear in the DATA display.

Depress the number key corresponding to the number you wish to enter. The numbers will be displayed as they are entered.

Complete the entry by depressing .

BOOM CAL


The BOOM CAL number is the row spacing multiplied by the number of rows.

example: 4 Row 36" = 144, 6 row 36" = 216

For uneven row spacing add the row spacings including the guess row.

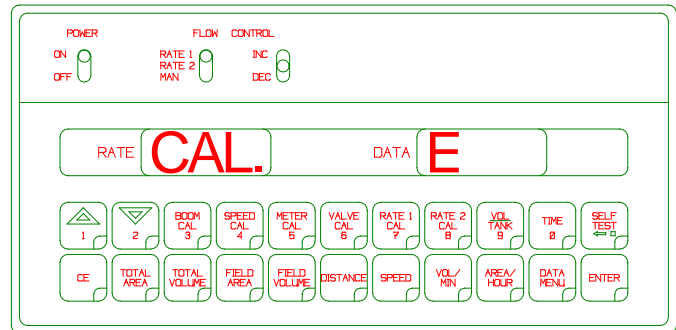
4 Row 34"	= 136
4 Row 36"	= 144
4 Row 38"	= 152
4 Row 40"	= 160
6 Row 34"	= 136
6 Row 36"	= 216
6 Row 38"	= 228
6 Row 40"	= 240
8 Row 34"	= 272
8 Row 36"	= 288
8 Row 38"	= 304
8 Row 40"	= 320

1. Depress .

Depress . An "E" will appear in the DATA display.




Enter the numbers from above.

Depress .



SPEED CAL


The initial Speed Cal number when using a Raven Radar is 600.

1. Depress the . Depress the . An "E" will appear in the DATA display.
2. Enter the numbers from above. Depress the .

On tractors equipped with an accurate speedometer, Depress the SPEED key when the tractor is moving. Tractor speed and Raven 662 speed numbers should be the same. If they are not, raise or lower SPEED CAL number until they match.


This number can be refined by completing the following steps:

3. Set POWER switch to ON, all other switches to OFF.

Enter "0" in the .

4. Drive 1 mile. To achieve the most accurate calibrations, accelerate and decelerate slowly.

**Do not use vehicle odometer to determine distance.
Use section lines or highway markers.**

5. Read the distance by depressing the  .

The value should be approximately 5280. If it reads between 5260-5300 the SPEED CAL is correct. If the value is not within the range, perform the following calculation:

Example: After driving a known distance of one mile, the distance on the console shows 5000.

Corrected SPEED CAL =

$$\frac{\text{Old SPEED CAL} \times 5280}{\text{Distance}}$$

Example: $\frac{600 \times 5280}{5000} = 633.60$ (Enter 633)

6. Enter the new number in the SPEED CAL
7. Recheck the new SPEED CAL by using the steps from above.

METER CAL

How the METER CAL number is derived:

Information required:

1. Number of pulses from the encoder per revolution of the top (drive) roller.
2. Number of planter cups per revolution of drive roller (9.8 @ 3.5" spacing).
3. Number of rows

The Raven encoder 063-0171-071 has 180 pulses per revolution.

METER CAL =

$$\frac{\text{Encoder pulses per 1 revolution of drive roller} \times 10}{\# \text{ of cups per rev. of drive roller} \times \text{number of rows}}$$

Multiply the result of the above formula by 100 for the rate per 100 plants

Example: 4 row planter

$$\frac{180 \times 10}{9.8 \times 4} = \frac{1800}{39.2} = 45.92$$

$$45.92 \times 100 = 4592$$

METER CAL:


4 ROW PLANTER=4592

6 ROW PLANTER = 3061

8 ROW PLANTER = 2296

1. Depress  .

31

2. Depress  . An "E" will appear in the DATA display.

3. Enter the numbers from above.

4. Depress  .

VALVE CAL


The VALVE CAL number is 23.


The valve calibration number is used to control response time of the motor control to the change in vehicle speed. After operating the system, you may desire to refine this number.

The first digit is the valve response time. The lower the value, the faster the valve will respond on startup, speed changes, and stopping.

The second digit is the deadband number. This is the allowable difference between target and actual application rate, where rate corrections are not performed. The second digit from above indicates that planter speed can change 3% up or down in 10 seconds without a change in rate.

A value too low may cause the planter to surge or pulsate. A number too high may cause sluggish operation.

1. Depress  .

2. Depress  . An "E" will appear in the DATA display.

3. Enter the number from above.

4. Depress  .

RATE CAL

The RATE CAL number is the number of plants per acre at a given seed spacing and row width. Rate 1 and Rate 2 are required to have an entry. If only one rate is to be used, enter the same rate in Rate 1 and Rate 2.

How the RATE CAL is calculated:

$$\text{SQ. FT per PLANT} = \frac{\text{Plant spacing} \times \text{row spacing}(\text{"})}{144}$$

$$\text{PLANTS PER ACRE} = \frac{43560}{\text{SQ. FT per PLANT}}$$




$$\text{RATE CAL} = \frac{\text{PLANTS PER ACRE}}{100}$$

Example = 5" seed spacing for a 36" row spacing

$$\text{SQ. FT PER PLANT} = \frac{5 \times 36}{144} = 1.25$$

$$\text{PLANTS PER ACRE} = \frac{43560}{1.25} = 34848$$

$$\text{RATE CAL} = \frac{34848}{100} = 348.48$$

1. Depress  .
2. Depress  . An "E" will appear.
3. Enter the number from above.
4. Depress  .

If you frequently switch seed spacings, a different seed spacing may be entered for RATE 2. If the seed spacing is to always be the same, enter the same rate in RATE 1 and RATE 2.

**ALL NECESSARY ENTRIES HAVE BEEN MADE.
IF THE CAL IS DISPLAYED IN THE RATE DISPLAY
AREA AND FLASHING-NOT ALL
FUNCTIONS HAVE BEEN PROGRAMMED**

To check the required programming, depress and hold the SELF-TEST key. The DATA display should show US, SP-2, LI, and C-P. If all of these entries are correct, continue below. If they are not, the console must be reprogrammed (see page 29).












Check the BOOM CAL, SPEED CAL, METER CAL, VALVE CAL, RATE CAL 1, RATE CAL2. All of these functions must have the correct number entered.







Seed Spacing				
	34	36	38	40
5	369.0	348.5	330.1	313.6
6	307.5	290.4	275.1	261.4
7	263.6	248.9	235.8	224.0
8	230.6	217.8	206.3	196.0
9	205.0	193.6	183.4	174.2
10	184.5	174.2	165.1	156.8
11	167.7	158.4	150.1	142.6
12	153.7	145.2	137.6	130.7
13	141.9	134.0	127.0	120.6
14	131.8	124.5	117.9	112.0
15	123.0	116.2	110.0	104.5
16	115.3	108.9	103.2	98.0
18	102.5	96.8	91.7	87.1
19	97.1	91.7	86.9	82.5
20	92.2	87.1	82.5	78.4
21	87.9	83.0	78.6	74.7
22	83.9	79.2	75.0	71.3

DATA MENU

The DATA MENU contains many functions. The operation of the potato planter uses the **LOW PWM OFFSET**, **HIGH PWM OFFSET**, **RO**, and **GAP**. GAP is used if a seed monitor system is installed. Any functions not listed below need to be turned "off" or given a "0" value. Incorrect values may affect operation of the console and give false alarms.




The **LOW PWM OFFSET** and **HIGH PWM OFFSET** numbers narrow the range that the valve works. The low pwm allows the valve to open to a certain point when the master switch is turned on. The valve should open enough to begin planter as soon as movement is sensed on the radar. A low PWM offset that is too low may cause planter delay on startup. If the belts continue to run after the master switch is shut off, the **LOW PWM OFFSET** number is too high. The **HIGH PWM OFFSET** is the setting for the maximum speed that you want the belts to run. This setting prevents the belts from rotating too fast, which can break the shear bolts and/or damage the belts.

1. Depress  .
2. Depress  until **Rate Alarm** appears.
Depress  to toggle on or off (factory setting is "ON").
3. Depress  until **Display Smoothing** appears. Depress  to toggle on or off (factory setting is "ON").
4. Depress  until **Rate Change Alarm** appears. Depress  to toggle on or off (factory setting is "ON").
5. Depress  until **OFF Rate Percent** appears. This value is the percent of the programmed rate that you allow before the Off rate alarm will sound. Factory setting is 30 (alarm will sound if sensors show rate is 30% off of programmed rate).
6. Depress  until **High PWM Offset** appears. This is the number used to control the upper limit of oil flow beyond the valve. The factory setting for this function is 160. To change the setting, depress  . An "E" will appear. Enter 160. Depress  .




7. Depress  until **Low PWM Offset** appears. This is the number used to control the lower limit of oil flow beyond the valve. If the planter continues to run (creep) after the tractor stops, lower the setting by 2 points until creeping stops. The factory setting for this function is 36. If the planter hesitates when starting, raise the setting by 5 points at a time until the planter starts creeping, then lower the setting by 2 points at a time until creeping stops. To change the setting, depress  . . An "E" will appear. Enter desired number.
Depress  .
8. Depress  until **PWM Frequency** appears. This number is determined by the brand & type of PWM valve. The default setting for this function is 122. **DO NOT** change this setting unless you are changing the brand or type of PWM valve. To change the setting, depress  .
An "E" will appear. Enter 122. Depress  .



DATA MENU - Continued


If the planter is equipped with seed sensors, the RO number should equal the number of planter rows. If seed sensors are not installed, enter 0.

9. Depress  until **RO** appears. Depress  . . An "E" will appear. Enter the number of planter rows. Depress .

If planter is installed with seed sensors the GAP function must also be programmed. The higher the GAP number, the less sensitive the monitor is.

10. Depress  until **GAP** appears. Depress  . An "E" will appear. Enter 16 (factory setting). Depress .

11. Depress  until **Preset Offset** appears. Depress  . An "E" will appear. Enter 75 (factory setting).

Depress  . Consoles are preprogrammed with 75 as Preset Offset number. The Preset Offset helps reduce planter hesitation at startup. Increase this number in 5 point increments to as high as 95. Do not go higher than necessary. A number too high may start the planter so fast it will break the row unit shear bolts.

ALL PROGRAMMING NECESSARY FOR PLANTER
OPERATION IS NOW COMPLETE

SELF-TEST

Self test allows speed simulation for testing the system while the planter is not moving.

UNPLUG RADAR FROM HARNESS WHILE IN SELF-TEST MODE. THE SELF-TEST SPEED WILL CLEAR IF RADAR DETECTS MOVEMENT.

1. Depress



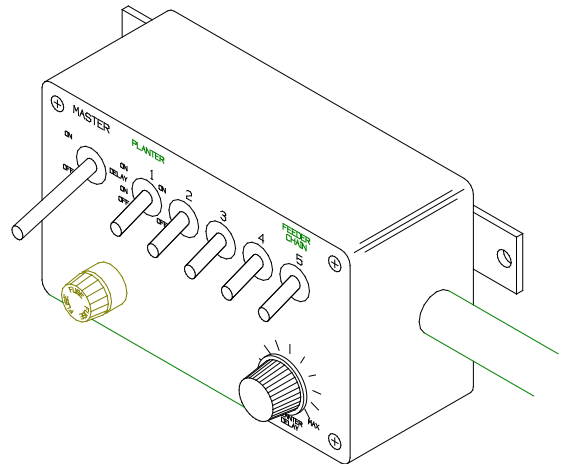
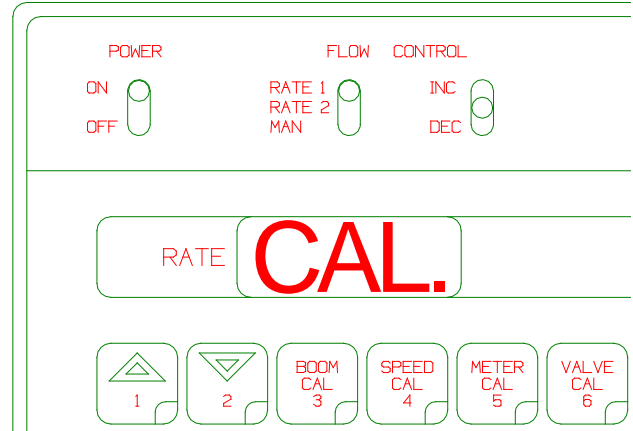
2. Enter 3 (3 miles per hour). **DO NOT** go above 6 m.p.h. or the shear bolts for the clutch may break.

3. Verify the Speed by depressing



To run the planter:

1. Place the MASTER switch on the control box to "ON".
2. Place the PLANTER switch on the control box to "ON".
3. Move the INC lever until planter is running.
4. Move the INC/DEC lever to see rate changes.
5. Place the FEEDER CHAIN switch on control box to "On".
6. Move the DEC lever until planter stops.
7. Place PLANTER switch on the control box to "OFF".
8. Place FEEDER CHAIN switch on control box to "OFF".
9. Place MASTER switch on control box to "OFF".
10. Plug radar into harness. The self-test speed will clear when the radar detects motion.



4.9 ATTACHING TRACTOR

When attaching the planter to a tractor, follow this procedure:

1. Clear the area of bystanders, especially small children.
2. Make sure there is enough room and clearance from obstacles to safely back up to the planter.
3. Back up slowly and align the link arms as required for your machine.
4. Two point attachment with Quick Hitch.
 - a. Align the claws on the Quick Hitch slightly below the mounting pins on the planter.
 - b. Back up until the pins on the planter are above the claws.
 - c. Raise the 3-point hitch until the pins "seat" in the claws.
 - d. Be sure the retainers are released to hold the pins in the claws.
 - e. Adjust the turnbuckle on the top link to position the Quick Hitch frame vertically when the lower lift arms are horizontal.
 - f. Set the 3-point hitch in the non-sway position.
 - g. Set the lower links on the tractor in the free float position.

IF YOUR TRACTOR IS NOT EQUIPPED WITH A QUICK HITCH, IT WILL BE NECESSARY TO INSTALL THE MOUNTING PINS THROUGH EACH BALL ON THE 3-POINT HITCH. BE SURE TO INSTALL THE RETAINER ON EACH PIN.

5. Connect the hydraulic circuits.
6. Route the electrical switch box and control console into the cab. Route the electrical cord over the hitch and secure in position with clips, tape, or plastic ties. Be sure the wire doesn't dangle and contact the ground or become pinched. Allow enough slack for turning.

7. Mount Raven 662 console in tractor. Be sure console location does not interfere with other controls.

CONNECT POWER CABLE DIRECTLY TO TRACTOR BATTERY. DO NOT CONNECT TO TRACTOR CONVENIENCE OUTLETS. HARRISTON WILL NOT BE RESPONSIBLE FOR ANY CONSOLE MALFUNCTIONS IF CONNECTED TO A CONVENIENCE OUTLET.

8. Connect console cable (tractor) to product (planter) cable. Connect switchbox to cable on planter.
9. Program or check program numbers in console.
7. Start the tractor and raise machine.
8. Remove pin from frame stands. Raise stand into storage position and re-pin.
9. Raise and lower machine a couple of times to be sure hydraulic hoses and wires are secured properly and are not binding or pinching.
10. Check rear lift wheels for function and operation.

4.10 DAILY INSPECTION

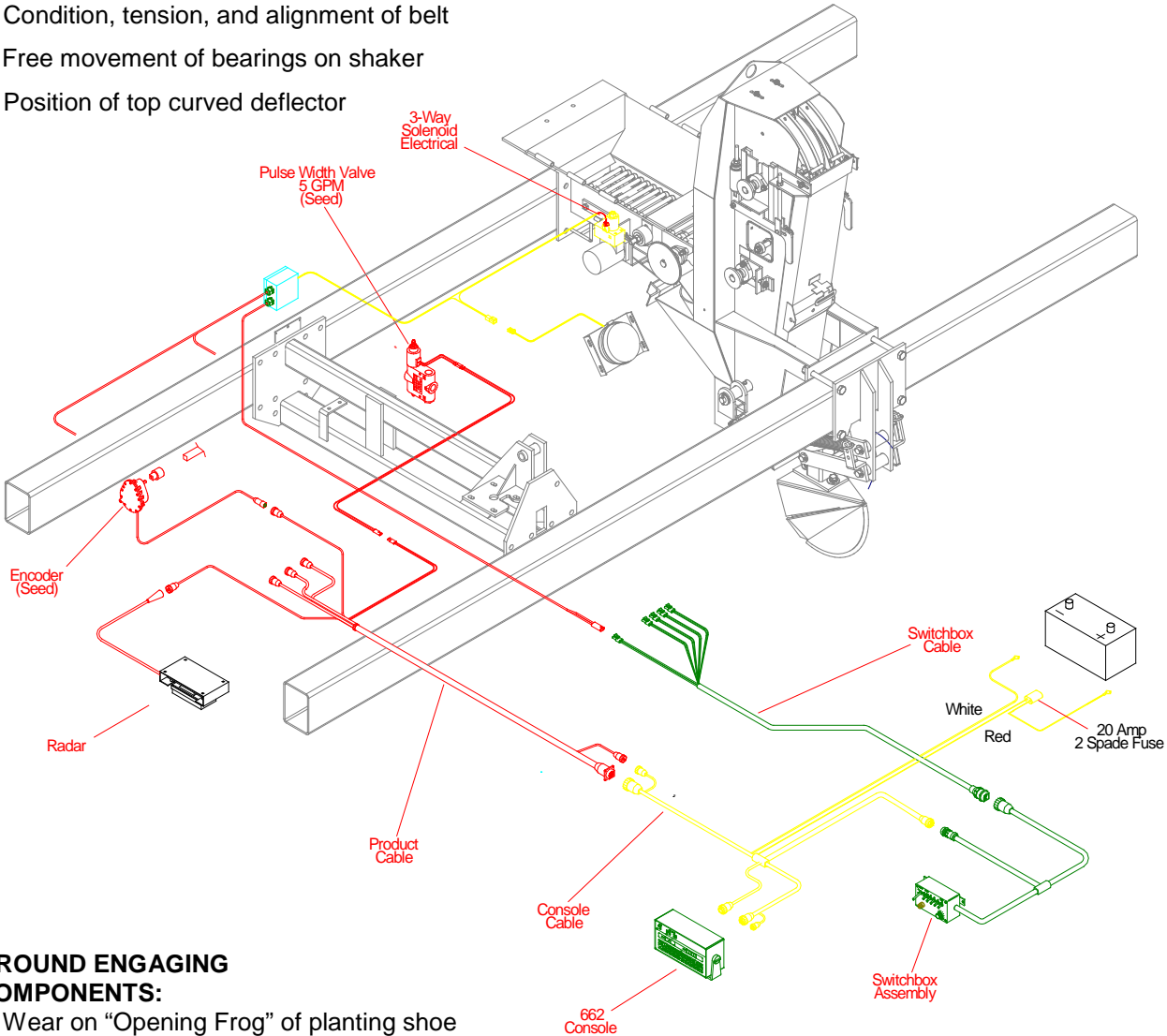
The planter should be thoroughly inspected at the start of each working day to ensure that all parts and systems are in good condition and working properly. If this inspection is not done, minor problems could result in poor planting performance in the field.

PLANTING COMPONENTS:

- Cups - Broken or missing, dirt buildup
- Condition, tension, and alignment of belt
- Free movement of bearings on shaker
- Position of top curved deflector

ELECTRICAL SYSTEM:

- Damage to wiring harness components
- Damage to connections at solenoids.
- Function of seed bowl ultrasonic sensors
- Condition of switch on electrical box and power connections



GROUND ENGAGING COMPONENTS:

- Wear on "Opening Frog" of planting shoe
- Damaged closing disc or worn bearings

HYDRAULIC SYSTEM:

- Routing and condition of all components
- Tighten or repair all leaking components
- Make sure all electrical connections are tight

HYDRAULIC DRIVE:

- Radar gun is secured in
- Drive motor and chain turn smoothly

It is very important to correct each problem found during the inspection before starting to work. This will insure good field performance. Small problems won't become big problems, and the machine will perform as expected.

4.11 MACHINE SETTINGS

During the recommended daily machine inspection, it is the operator's responsibility to check each machine setting to ensure that they are properly set for the operating conditions. All settings for the planter are listed in the following section.

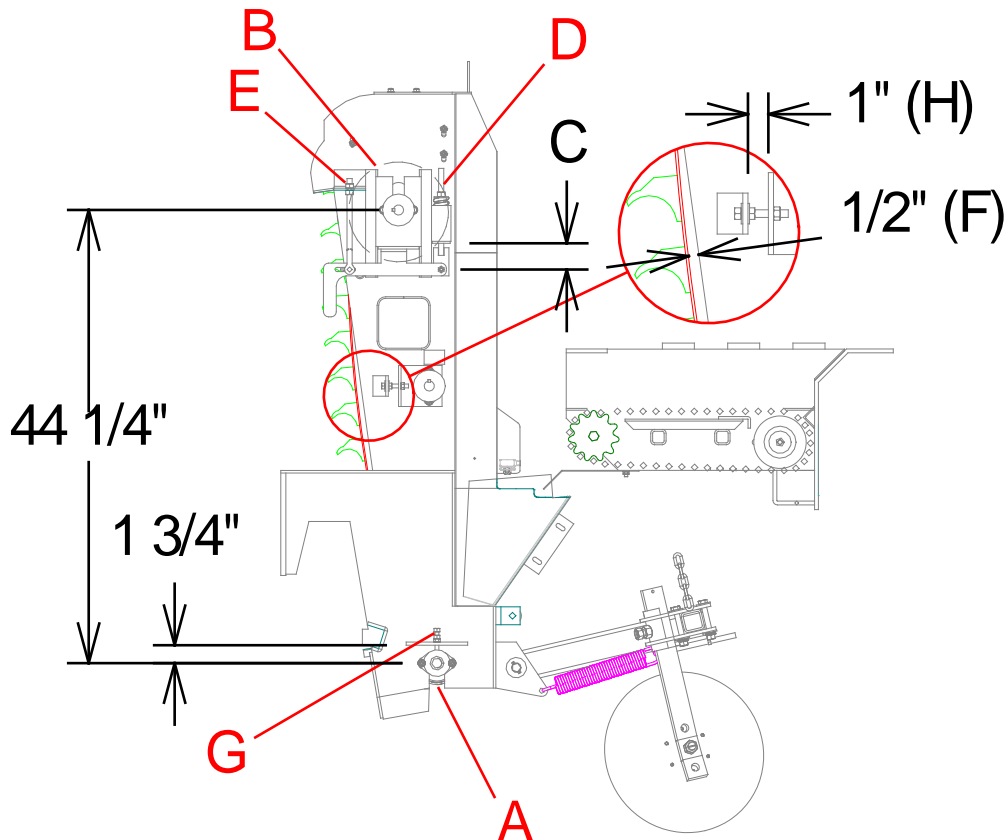
4.11.1 Bottom Roller (A): The factory setting for the bottom roller (idle) is 1 3/4" from the bottom of the adjusting flat to the center of the roller. This measurement may change when tracking belt. The bottom roller is tapered to help belt track. This roller has a scraper to agitate dirt and prevent heavy buildup on roller. The holes at the end of the roller allow dirt and debris to fall out of row unit.

4.11.2 Top Roller (B): The factory setting for the top roller (drive) is 44 1/4" from the center of the top roller shaft to the center of the bottom roller shaft. This measurement may change after tracking belt and/or when belt stretches after use. The top roller has a center belt riveted on to help tracking.

4.11.3 Top Roller Spring Adjustment : The bottom of the spring pocket to the center of the pivot bolt should measure 2 7/8" with no belt tension (C). This setting is done with the Spring Adjusting Bolt (D). Tighten the Front Adjusting Bolt (E) so that the measurement from the bottom of the spring pocket to center of pivot bolt is 3" (C).

4.11.4 Belt Tension: Remove the front chute. At shaker height, pull out on belt (F). Belt should be approximately 1/2" past front edge of belt tower. Tighten or loosen nuts equally on front adjusting bolts to achieve this measurement.

4.11.5 Belt Alignment: Rotate row unit belt assembly several revolutions to check belt alignment. **THIS IS VERY IMPORTANT AS A MISALIGNED BELT CAN DAMAGE CUPS AND THE BELT.** Loosen bolts on lower bearing (G). Adjust one bearing up or down to align belt. Moving bearing down will move belt away from the side you are adjusting. Moving bearing up will move belt toward the side you are adjusting. If belt will not track after following this procedure check the top roller spring adjustment from above. If this is correct you may have to fine-tune the front adjusting bolt on top roller. Tightening will move belt away from the side you are adjusting.



MACHINE SETTINGS - Continued

4.11.6 Shaker Adjustment: The shaker can be adjusted in three separate areas explained below. All shakers are connected together and driven by a hydraulic motor mounted on the outer left side row unit. Shaker speed is determined by the amount of oil supplied to the motor by the PWM valve (Figure 1). The PWM valve is adjusted by turning the knob on the in-cab control box (Figure 2). Turn the knob clockwise to increase the speed of the shakers. Shakers may be turned off/on with the switch on the control box.

Shaker speed does not vary with ground speed or seed spacing adjustments. Shaker speed has to be monitored and adjusted for seed cut, seed spacing, and ground speed variations. On hydraulic drive planters, shaker control is on the same hydraulic circuit as the planter drive. Shaker motor will stop when planting stops.

a. Belt Deflection

Set the adjusting bolt on both sides of the row unit to 1" between adjusting angle and the shaker mount (H on previous page). Adjust all rows the same.

b. Shaker Speed

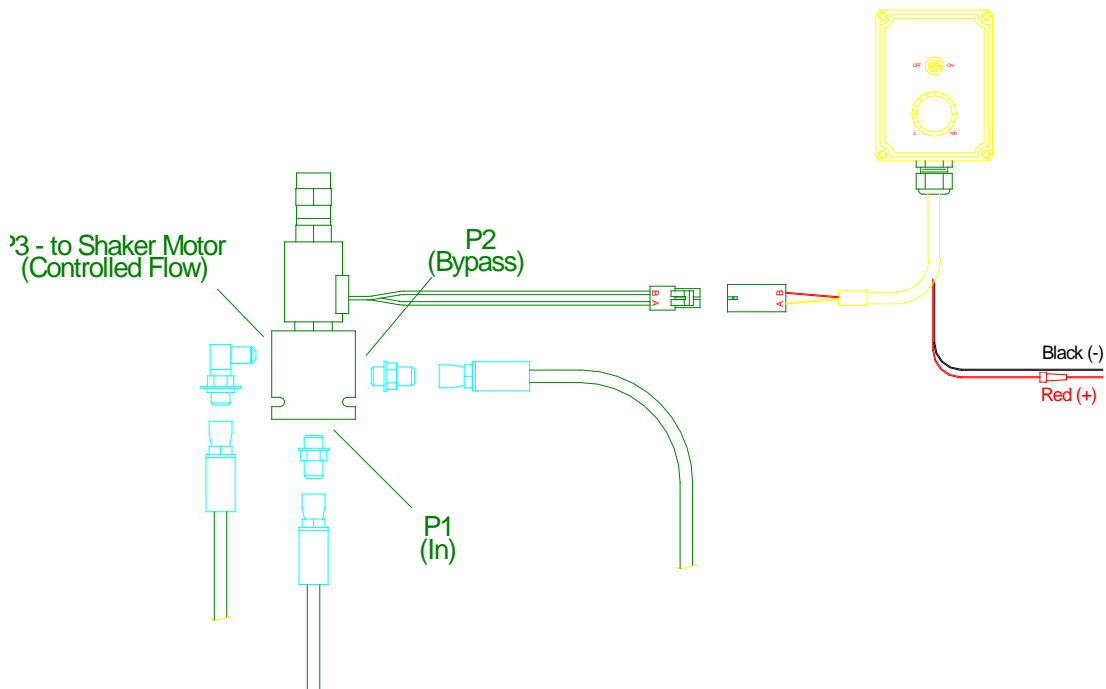
While observing planter operation, set the shaker speed to achieve one seed piece in each cup. Observe all rows before making speed changes to allow for variations in seed size. Increase speed if there are too many doubles, decrease if there are too many skips. Start with shaker at slow speed (approx. 70-80 rpm). Increase speed in small increments.

Once shaker speed is set, continual adjustment should not be necessary unless there is a large change in planting speed or seed size.

Note or mark shaker setting in the event knob is accidentally turned.

c. Direction of Shaker Rotation

Normal shaker rotation is in the same direction of belt rotation. On hydraulic drive planters, when using wide seed spacing (above 12") or at slower speeds (less than 3 M.P.H.) oil flow may not be enough to give desired shaker action. It may be desirable to change shaker rotation to get a more aggressive shaker action. This can be accomplished by switching hydraulic hose positions on the shaker motor. This is not recommended at closer seed spacing (less than 10") or higher speeds (above 4.5 M.P.H.) since it makes the shaker speed adjustment harder to set.



MACHINE SETTINGS – Continued

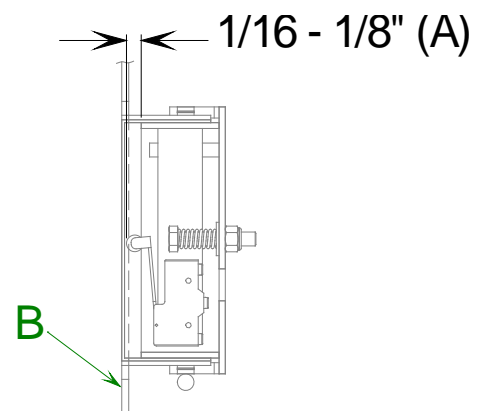
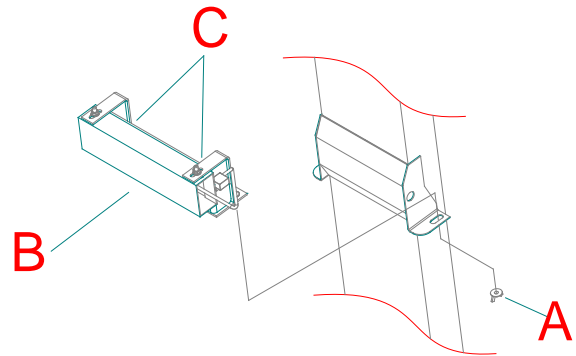
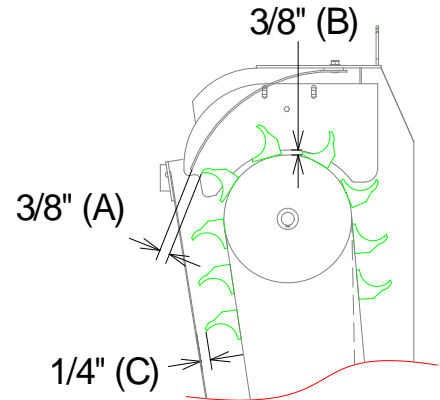
4.11.7 Top Cup Guides: The top curved guides should be set with approximately 3/8" of clearance between the top of the cup and guide when measured at the lower end of the curve (A). The guides prevent the seed piece from the following cup from skipping over the cup as it is going around the top drive roller.

4.11.8 Center Divider: With proper tension on the belt, there should be approximately 3/8" clearance between the belt and divider at the top of the drive roller (B). This divider keeps the seed pieces divided before going into the front chute.

4.11.9 Front Chute: There should be approximately 1/4" clearance between edge of cup and inside of shield (C). If doing maintenance or repair – track belt before installing front chute. After installing chute check cup clearance on sides and at the center.

4.11.10 Seed Monitor Eyes: Shut off all hydraulics. Remove wing nuts (A) from monitor eye bracket (B). Pull bracket off front cover. Turn 662 Console on. Console will cycle through row failures & alarm will sound for all rows because eyes will not see any seed. Have a co-worker place a solid object (cardboard or small piece of sheet metal) between eyes (C). Watch Console cycle through "Row 1, Row 2, Row 3, etc.". The row that is being tested should be skipped as the display goes through its cycle. All other rows will continue to appear in the display & the alarm will sound as the cycle runs through. Remove object from between eyes. All rows will again be displayed as the cycle continues. This indicates eyes are working correctly. Repeat on each row, waiting until test row appears in the cycle on the display before continuing on to next row.

4.11.11 Bowl Level Switch: The bowl switch is installed from the factory 1/16" to 1/8" above the top edge of the housing (A). Slight finger pressure should activate the switch. When finger pressure is removed, the switch must return to the original position. The switch should make a clicking sound. Recheck the switch after tightening rubber cover clamp. The cover clamp must be installed with the adjusting screw at the top of the switch bracket to match the cutout in the seed bowl on the row unit. Install the switch hanger assembly in the seed bowl so the rubber cover is even with the plastic bowl liner (B). Check the switch action after installing. If adjustment is necessary, turn the nut on the back of switch bracket.



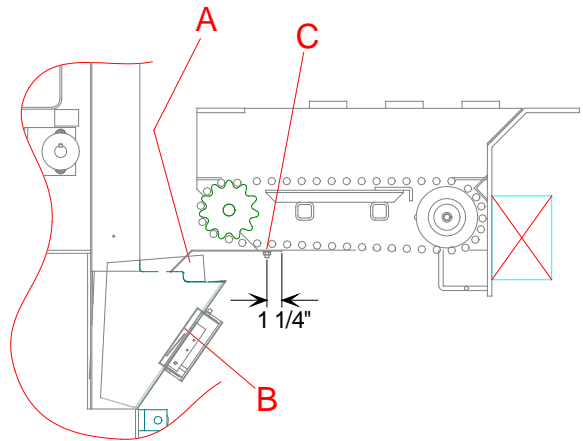
MACHINE SETTINGS – Continued

4.11.12 Feed Chain Speed

When starting to plant, set feed chain flow control to 2 or 3. Observe seed bowls to make certain feed chains run just fast enough to keep an adequate supply to prevent planter from skipping. Tests have shown the planter performs best when seed bowl load is kept to a minimum. Feed chain speed should be slow enough so that chains run as close to continuously as possible.

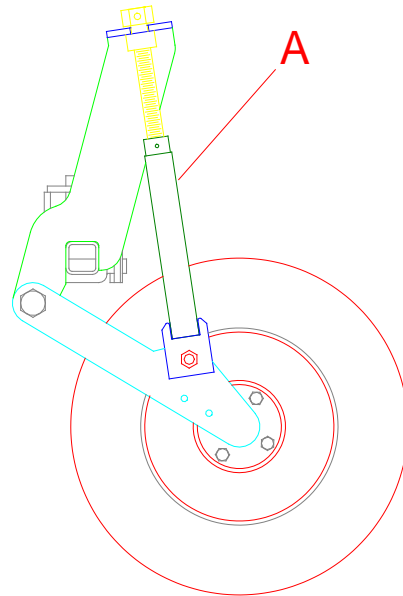
4.11.13 Seed Deflector Plate

A deflector plate (A) is mounted below the discharge end of the feed chain to direct seed into the bowl. If seed is deflecting onto belt, move deflector back slightly (loosen bolt "B" on each side to adjust). The plate is installed initially so that the back edge is 1 1/4" from the bolts as shown.



4.11.14 Gauge (Depth Control) Wheels

An adjusting screw and gauge wheel assembly is used to set planting depth. One gauge wheel controls the depth of two rows. Extending the adjusting screw (A) decreases depth, retracting the adjusting screw increases depth. The handle hangs down and keeps it from turning when the planter is operating. The floating linkage allows each planter shoe to work independently.



MACHINE SETTINGS – Continued

4.11.15 Shoe Depth Control Springs

Each planter shoe is equipped with two tension springs (A) to help maintain a consistent planting depth. Spring pressure can be adjusted by placing the front hook of the spring in one of three mounting holes (B). Positioning the spring in the top hole will put the most downward pressure on the shoe; consequently the lowest hole will have the least pressure. With the appropriate spring pressure, the gauge wheel will effectively control the planting depth. Inadequate spring pressure will cause the shoe depth to vary excessively. Too much spring pressure in loose soils may cause the gauge wheel to push soil and result in deeper than desired planting depth.

Initial Adjustment:

Top Hole: medium to heavy soils. Firm seed bed, heavy residue.

Center Hole: medium to light soils. Loose seed bed, medium to light residue.

Bottom Hole: light soils, loose seed bed. Light or no residue. Pre-formed beds.

With planter in raised position, connect spring in proper hole for desired spring tension. Note: Spring should have a least 1/4" of extension when planter is in raised position.

4.11.16 Planting Speed

Planting speed is determined by planter performance at a given seed spacing. Optimum seed spacing can only be obtained by following the following general rules;

1. As plant population increases (closer seed spacing), planting speed must decrease
2. Faster planting speeds = Slower shaker speed
3. Planter performs best at speeds of 2.5 M.P.H. to 4.0 M.P.H.

4.11.17 Closing Disc Adjustments

Each closing disc can be adjusted in a vertical direction and spaced from the center of the row. Use these features when adjusting;

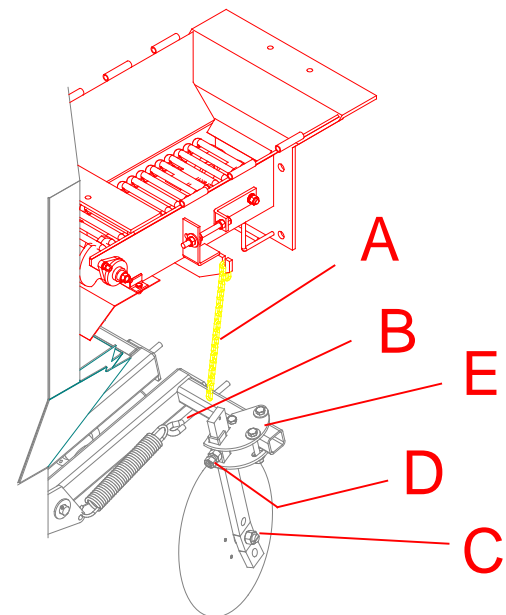
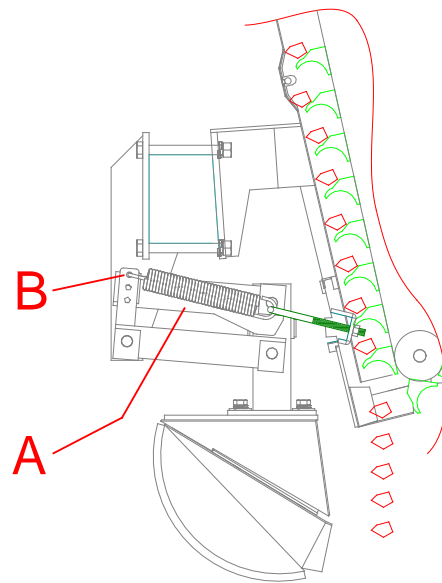
- A. Lift Chains
Adjust lift chains (A) so that the arms are level when the planter is in the raised position
- B. Spring Tension
The tension is set with the eyebolt (B) on the top and should be set so the spring is just snug when the planter is out of the ground.
- C. Tilt adjustment
Three holes are located in the disc shank for tilt adjustment (C).

D. Vertical Position

A setscrew (D) is located through the mounting frame of the shank that is used to raise or lower the shank/disc assembly. Position shank so there is approximately 1" of slack in the lift chains when operating. Tighten the setscrew to its specified torque after adjusting.

E. Disc Angle/Horizontal Adjustment

The disc clamp (E) is slotted for changing disc angle. This angle determines the size of the hill. All clamps should be set at the same angle. Set disc angle shape hill properly without throwing dirt into the shoe. The clamp can also be moved horizontally on tube.

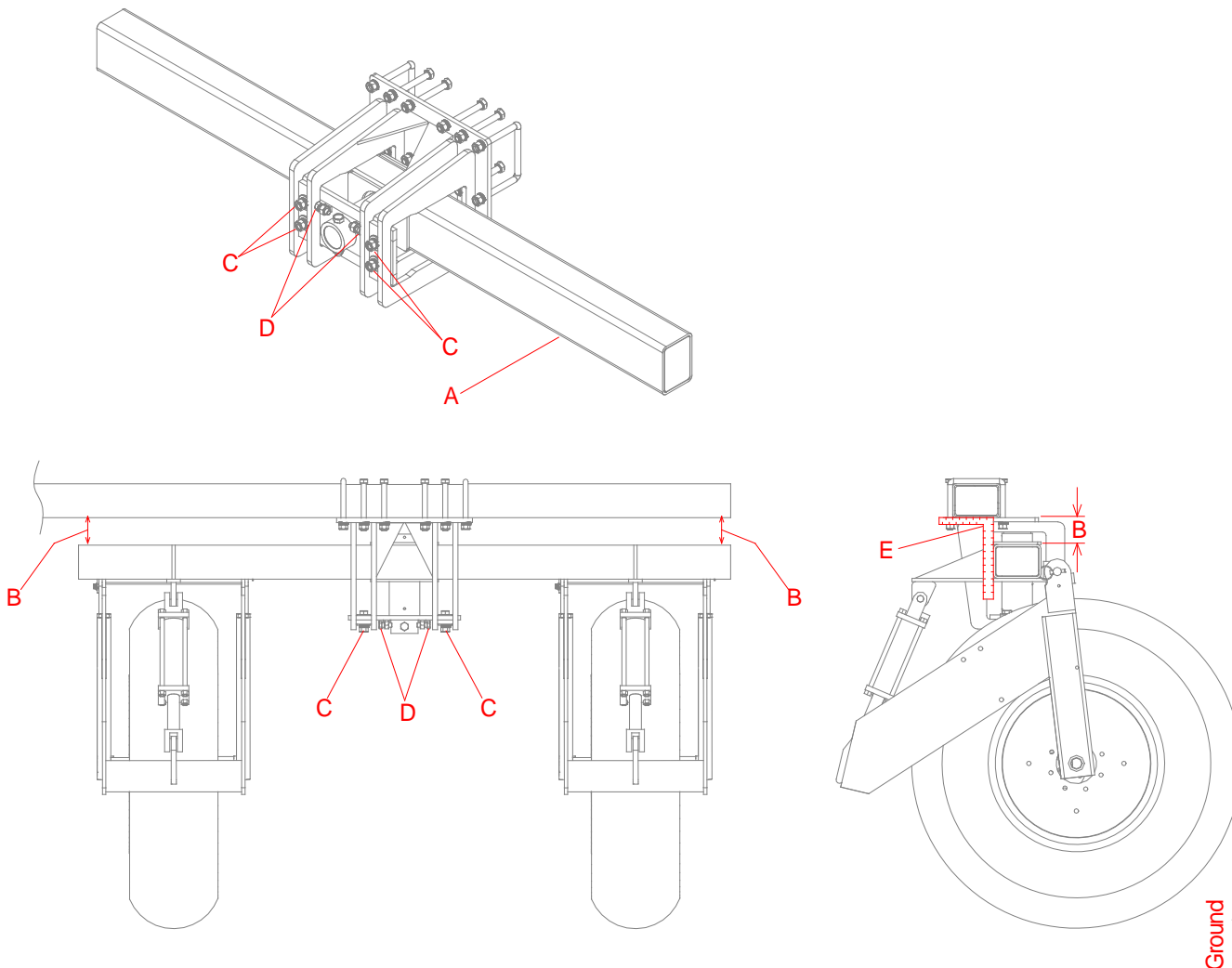


MACHINE SETTINGS – Continued

4.11.18 Walking Beam Tracking/Adjustment

The walking beams must be adjusted to make the planter track properly (pull straight) behind the tractor. The walking beams must be parallel to the tool bar under the tank. Follow this procedure to adjust walking beams:

1. Seed tank should be empty prior to adjusting walking beams (A).
2. Position planter on smooth firm surface.
3. The goal is for the measurement at (B) to be equal at both ends of each walking beam.
4. Loosen (DO NOT REMOVE) 4 bolts (C) on walking beam frame.
5. Using a method of tightening one adjusting bolt (D) and loosening the other one, adjust until measurement is the same at both ends of walking beam.
6. Use a square as shown (E) or a tape measure if a square is not available. After adjusting, tighten bolts to recommended torque, move planter forward 50 – 100' and recheck measurements.



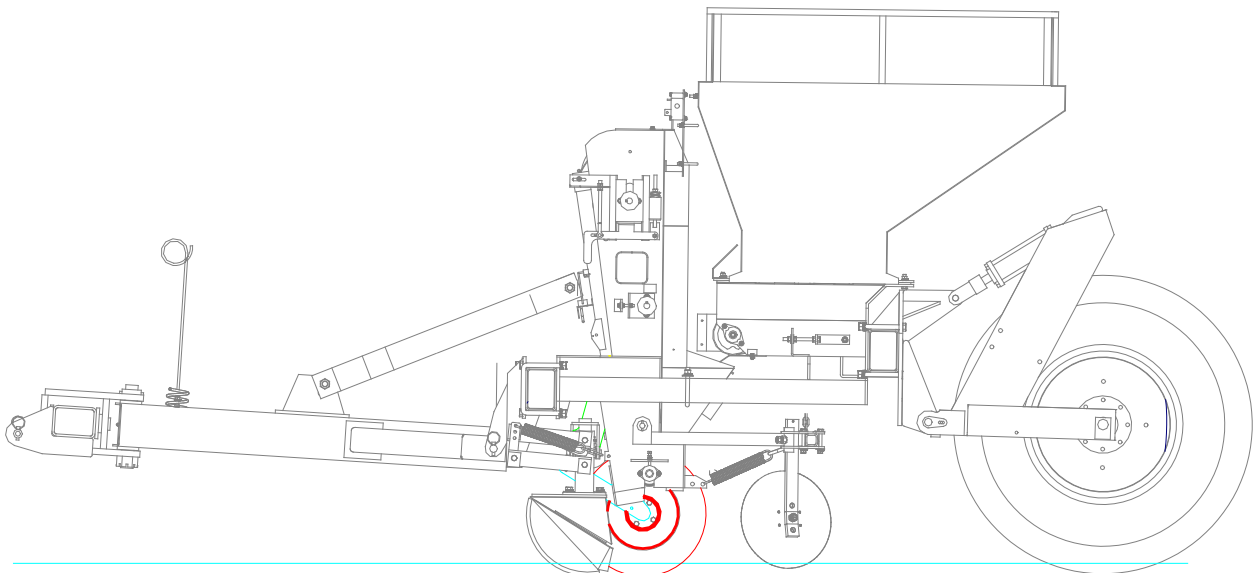
MACHINE SETTINGS – Continued

When operating the machine in the field, follow this procedure:

- 1 Clear the area of bystanders, especially small children, before starting.
- 2 Check that components, systems, and the machine are set appropriately for the operating conditions.
- 3 Transport the machine to the field. See Safety Section on Page 4
- 4 After arriving at the field, fill the hopper with seed. For optimum planter performance it is essential that uniform high quality seed be used. Dirty, sprouted, oversized seed cannot be properly cut. Poorly cut seed can greatly affect planter performance. Optimum seed size is generally considered to be 2 oz. to 2 1/2 oz. in size. Undersize seed may result in the planting of too many doubles. Oversize, partial cuts, slabs, and long cut seed may result in a large number of skips. Seed cutters must be adjusted to properly cut a given seed size.
- 5 Fill the pesticide hoppers if your machine is equipped with that option.
- 6 Move the vehicles or equipment away from the working area.
- 7 Align the machine with the edge of the field if just starting or with the previously planted row.
- 8 Lower the machine to the ground.
- 9 Set rear cylinder stops so that it measures 21 1/2" center to center on planter with 14.9 x 24 tires. On planters with 11.2 x 24 tires, cylinder should measure 22 1/2".
- 10 Lower tractor 3-point hitch until crossmembers are parallel to ground or 1" up in the front.
- 11 Drive approximately 30 feet in typical ground conditions and check planting depth. Adjust gauge wheel to desired depth. See Page 41

NOTE

IT IS NOT RECOMMENDED THAT THE MACHINE BE TRANSPORTED WHEN THE HOPPER IS FILLED. THE EXTRA LOAD ON THE MACHINE CAN CAUSE ADVERSE HANDLING CHARACTERISTICS AND LEAD TO STRUCTURAL FAILURES AT FASTER SPEEDS.



MACHINE SETTINGS – Continued

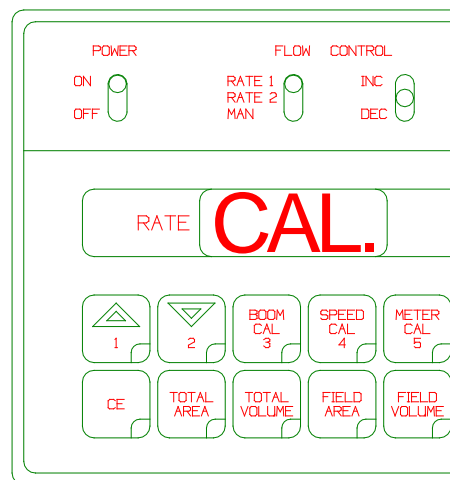
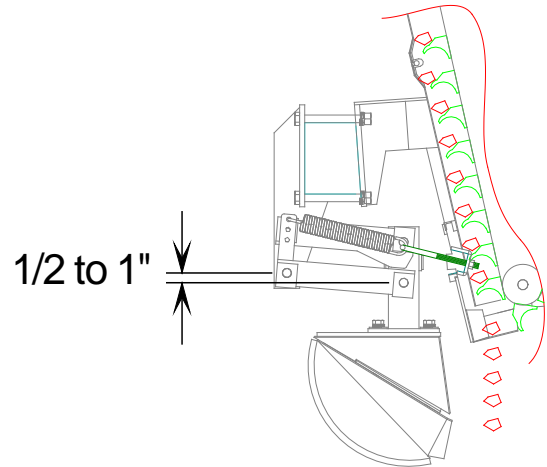
- 12 After seed depth is obtained, observe angle of shoe linkages. Linkage should be approximately 1/2" to 1" lower in the rear when planting.
- 13 Raise or lower 3-point hitch and rear cylinders to obtain proper angle on shoe linkage while maintaining planter frame angle. Adjust rear cylinder and 3-point lever stop accordingly.
- 14 Lower the marker if your machine is so equipped. The sequencing valve supplied with the optional marker controls its operation.

To operate the markers, connect the hose to give the following sequences:

- a. Move the hydraulic lever to the "raise" position to raise both markers.
 - b. Move the lever to the "lower" position to lower one marker.
 - c. Move the lever to the "raise" position to raise the marker.
 - d. Move the lever to the "lower" position to lower the other marker.
 - e. To lower both markers, move the hydraulic lever to the "lower" position / momentarily to the "raise" position, and then back to the "lower" position. Both markers will be lowered.
 - f. Move the hydraulic lever to the "raise" position to raise both markers. The valve will then return to its normal sequencing cycle.
 - g. Raise or lower markers as required for operation and transporting.
- 15 Engage hydraulic lever for planter hydraulic system.
 - 16 Put Power switch on Raven console to "ON"

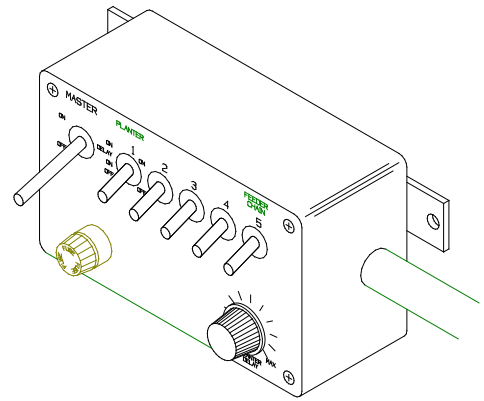
To preload cups and bowl:

- a. Put rate switch to "MAN".
 - b. Put planter switch to "ON".
 - c. Put feeder chain switch to "ON".
 - d. Put Master switch to "ON".
 - e. Use the Increase/Decrease switch until the belts turn (seed feedboxes should be filling bowl). When all cups are loaded with potatoes, move switch from MAN to AUTO.
- 17 Planter row unit belts will turn when radar gun senses movement.



MACHINE SETTINGS – Continued

- 18 Recommended planting speed is 3.5 to 4 mph to obtain the most consistent planter performance.
- 19 Slow down at the end of the round and put the Master switch to "OFF" before turning. Raise the machine and the marker as the shoes cross into the headland area.
- 20 Swing wide to minimize excess frame loads while turning. When using duals on tractor with front stabilizer wheels, be sure duals do not contact stabilizer wheel when making turns.
- 21 Lower machine to pre-set depth and lower the markers.
- 22 Before quitting, empty out seed bowls. Move feeder chain switch to "OFF" before coming to the end.



**THE RAVEN MONITOR HAS AN AUTOMATIC
SAFETY FEATURE
THAT WILL SHUT DOWN IF SPEED IS BELOW .8
MPH FOR MORE THAN 10 SECONDS**

CYCLE MASTER SWITCH TO BEGIN OPERATION

4.13 Transporting



1. Make sure you are in compliance with all local regulations regarding transporting equipment on public roads and highways.
2. Make sure the SMV (Slow Moving Vehicle) emblem and all the lights and reflectors that are required by the local highway and transport authorities are in place, are clean, and can be seen clearly by all overtaking and oncoming traffic.
3. Do not allow anyone to ride on the planter or tractor during transport.
4. Do not exceed 32 km/h (20 mph). Reduce speed on rough roads and surfaces.
5. Do not transport with tank(s) loaded.

When transporting the machine, review and follow these instructions:

1. Be sure all bystanders are clear of the machine.
2. Ensure that the machine is securely attached to the tractor and all retainer pins are installed.
3. Raise the machine and install the transport lock before transporting.
4. Clean the SMV emblem and all lights and reflectors before starting.
5. Be sure that all lights required by the local highway authorities are in place, clean and functioning, so they can be seen by oncoming and overtaking traffic.
6. If transporting during times of limited visibility or dusk, install extra lights or use pilot vehicles.
7. Always use hazard flashers on the tractor when transporting unless prohibited by law.
8. Keep to the right and yield the right of way to allow faster traffic to pass. Drive on the road shoulder, if permitted by law.
9. Do not allow riders on the machine.
10. Do not transport when the machine is loaded.
11. Never exceed a safe travel speed.
12. Always shift to a lower gear when going down hills to use the engine as a retarding force.
13. Apply the brakes carefully to prevent jackknifing.
14. Never disengage tractor drive train and coast down hills. Always keep tractor in gear.
15. Never tow the machine faster than 20 mph (32 km/h). The ratio of the tractor weight to the planter weight plays an important role in defining acceptable travel speed.

4.14 STORAGE

PLACING IN STORAGE

At the end of the planting season, the machine should be thoroughly inspected and prepared for storage. Repair or replace any worn or damaged components to prevent any unnecessary down time at the beginning of the next season. Follow this procedure:

NOTE

DO NOT point high pressure directly on wire connections or encoders

1. Thoroughly wash the machine using a pressure washer to remove all dirt, mud, debris, or residue. During the final rinse, add a good disinfectant to the pressure washer tank to disinfect the machine.
2. If a disinfectant is not used, fungus and mildew will grow during the storage period and could contaminate next year's crop.
3. Inspect the following components:

Soil Engaging Components:

- a. Check for worn or damaged planting shoes. Look for signs of wear on "opening frog" of shoe. If wear is detected, rebuild or replace planting shoe.
- b. Check closing discs for damaged or worn bearings. Replace disc or bearings as required.

Planting Components:

- a. Check for bent or broken cups. Replace as required.
- b. Check condition of belt and lacing. Replace as required.
- c. Check bearings on shaker for damage. Replace as required.
- d. Inspect and lubricate double roller chain on row unit drive. Replace damaged or worn roller chain as required.
- e. Inspect shear bolts on row unit drive hubs. Replace as required.
- i. Repack gauge wheels on each row unit. Replace bearings with damaged seals.
- j. Lubricate all grease points. (see Service Section Page 50).

Electrical system:

- a. Check the wiring harness and all wiring for damaged or worn areas. Check for cracked or worn insulation. Replace any components that have come in contact with moving parts and route to prevent damage in the future.
 - b. Check all seed bowl sensors for proper operation. Repair or replace any damaged or malfunctioning sensors or wiring harness.
 - c. Check all hydraulic solenoids for loose or damaged wires. Repair or replace as required.
4. Make a list of all parts needed for repairs and order them immediately. Repairs can then be done when time permits to prevent unnecessary down time at the start of next season.
 5. Lubricate all grease points to remove any water residue from the washing and prevent rusting during the storage period. Rotate all moving parts to distribute lubricant to all surfaces.
 6. Coat roller chain with a good quality chain lubricant to prevent rusting. Rotate the chain slowly by hand to cover all surfaces.
 7. Remove material that has become entangled in any drives.
 8. Touch up all paint nicks and scratches to prevent rusting.
 9. Move the machine to its storage area.
 10. Select an area that is dry, level, and free of debris.
 11. Place planks or blocks under the hitch pole on the pull-type model.
 12. Unhook the machine from the tractor (Refer to Section 4.9 on Page 36)
 13. Place all wiring harness and hydraulic line components in a safe place on the hitch to prevent damage and keep clean during the storage period.
 14. If the machine cannot be stored inside, cover with a waterproof tarpaulin and tie securely in place.
 15. Store out of the way of human activity.
 16. Do not allow children to play around stored unit.

REMOVING FROM STORAGE

When removing from storage and preparing to use, follow this procedure:

1. Clear the area of bystanders, especially small children.
2. Remove the tarpaulin from the machine if it was covered.
3. Attach the tractor to the machine (See Page 36).
4. Check:
 - a. Tire pressure. Add as required.
 - b. Re-torque all wheel bolts.
 - c. Re-torque all hardware.
 - d. Routing and securing of all hydraulic lines and wiring harness. Adjust as required.
5. Rotate all components and systems by hand to see that none are seized. Loosen any seized components with penetrating oil before starting.
6. Lubricate all grease points, roller chains, and shaft surfaces with sliding sprockets.
7. Review and follow all items on the Pre-Operation Checklist and Daily Inspection before starting.

5 SERVICE AND MAINTENANCE



MAINTENANCE SAFETY

1. Follow all the operating, maintenance, and safety information in the manual.
2. Support the machine with blocks or safety stands when changing tires or working beneath it.
3. Stop tractor engine, lower machine to the ground, place all controls in neutral, set park brake, remove ignition key, and wait for all moving parts to stop before servicing, adjusting, repairing, unplugging, or filling.
4. Make sure all guards are in place and properly secured when maintenance work is completed.
5. Never wear ill-fitting, baggy, or frayed clothing when working around or on any of the drive system components.
6. Before applying pressure to a hydraulic system, make sure all lines, fittings, and couplers are tight and in good condition.
7. Install safety rod and pin securely in position on hitch cylinder frame before working under frame. Make sure safety rod is unhooked before resuming operation.
8. Relieve pressure from hydraulic circuit before servicing or disconnecting from tractor.
9. Keep hands, feet, hair, and clothing away from moving or rotating parts.
10. Clear the area of bystanders, especially small children, when carrying out any maintenance and repairs or making any adjustments.
11. Wear appropriate protective gear when contacting chemical handling components on machine.

5.1 SERVICE

5.1.1 FLUIDS AND LUBRICANTS

1. Grease
Use an SAE multi-purpose high temperature grease for all applications. Also acceptable is an SAE multi-purpose lithium base grease.
2. Roller Chain Lubricant
Use WD-40, LPS-2, or equivalent to coat roller chains and bushings to prevent rusting or seizing.
3. Storing Lubricants
Your machine can operate at top efficiency only if clean lubricants are used. Use clean containers to handle all lubricants. Store them in an area protected from dust, moisture, and other contaminants.
4. **When pressure washing, do not directly spray the side (seal) of the bearing. This will damage the seal and reduce the life of the bearing.**

5.1.2 GREASING

Refer to Section 5.1.1 for recommended grease. Use the Maintenance Checklist provided to keep a record of all scheduled maintenance.

1. Use only a hand-held grease gun for all greasing. Air powered greasing systems can damage the seals on bearings and lead to early bearing failure.

IMPORTANT

Over-greasing can damage bearing seals. A damaged seal will lead to early bearing failure. Replace all bearings with damaged seals immediately.

2. Wipe grease fitting with a clean cloth before greasing, to avoid injecting dirt and grit.
3. Replace and repair broken fittings immediately.
4. If a fitting will not take grease, remove and clean thoroughly. Also clean lubricant passageway. Replace fitting if necessary.

SEALED BEARINGS

Sealed bearings are used at several locations on this machine. All sealed bearings are lubricated at the factory. The seals retain the grease inside the bearing and prevent dirt and other contaminants from getting inside. The life of the seal is virtually limitless provided it is not damaged in any way. When sealed bearings are greased, the grease is introduced next to the outer face of the seal. When a hand held grease gun is used, the grease slips in next to the seal without damaging it. An air powered greasing system will inject the grease so fast that it is not uncommon for them to damage a seal. Once the seal is damaged, the factory installed grease comes out and the bearing runs dry. Seizing will then occur in a short time.

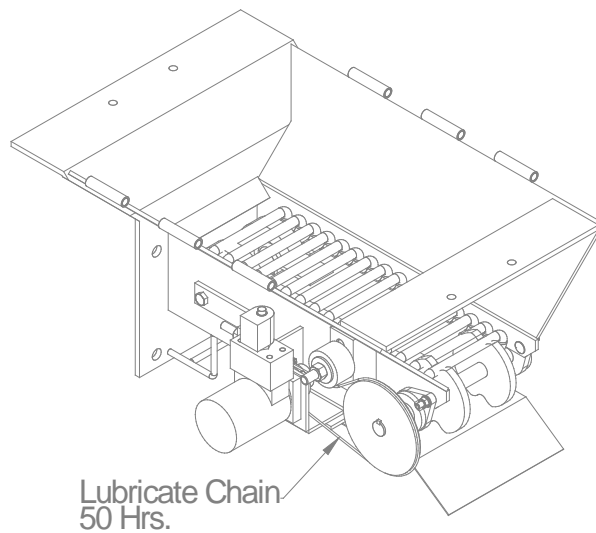
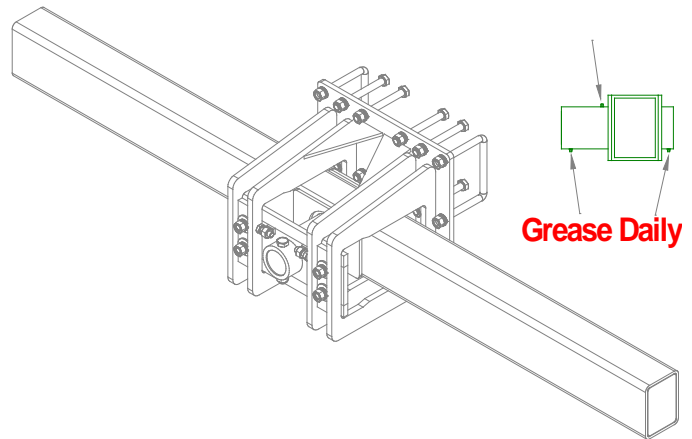
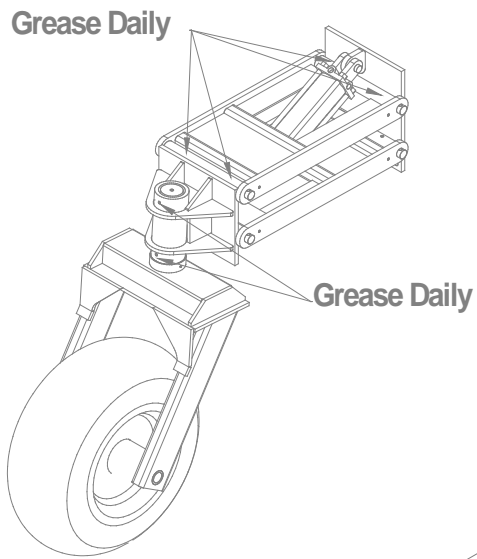
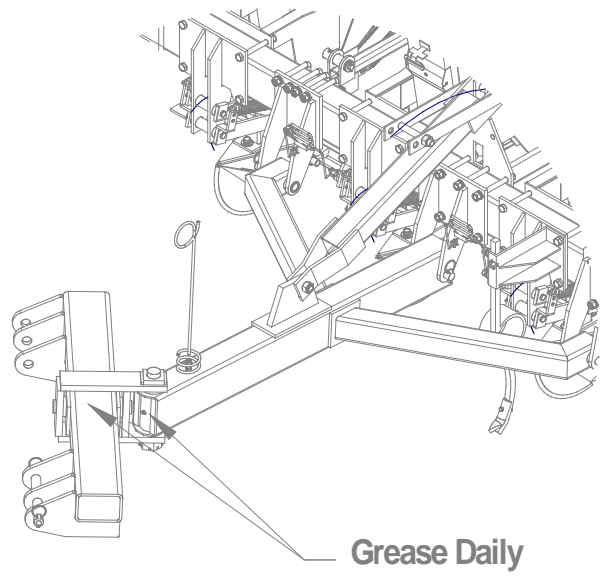
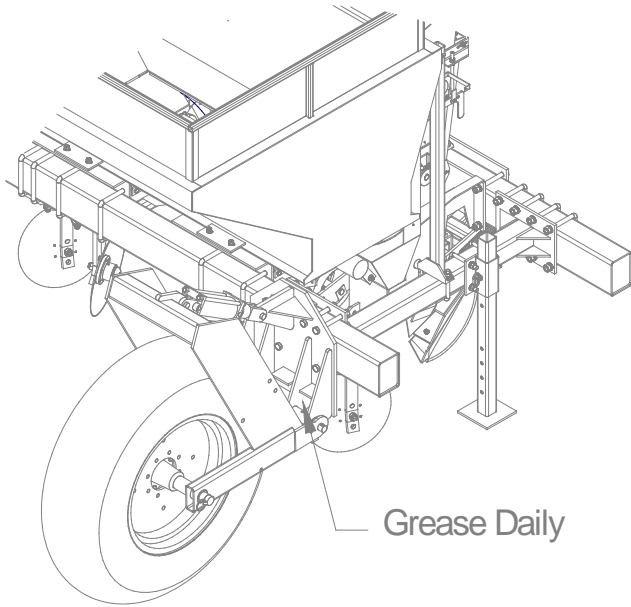
Occasional greasing of sealed bearings is required to remove moisture and contaminants from the space next to the seals. It is not recommended that sealed bearings on the machine be greased more often than once every season after the machine is washed and then only give them one shot. More frequent lubrication runs the risk of damaging the seals and causing bearing failure. The exception to this rule is at the beginning and end of the season. At those times, each bearing should be given only one shot of grease to remove moisture or water next to the seal that can accumulate during washing or storage.

Should you notice that a seal is damaged, replace the bearing immediately to prevent problems at a later time.

Action Code L = Lubricate R = Repack G=Grease
 CL = Clean D = Disinfect

Maintenance	Hours Serviced By																		
Daily																			
G	Walking Beam																		
G	Rear Wheel Pivots																		
G	Vertical Pin on Hitch																		
G	Swivel Hitch																		
Annually																			
L	Feeding System Drive Chain																		
R	Rear Wheel Bearings																		
R	Gauge Wheel Bearings																		
CL & D	Machine																		

5.1.3 SERVICE INTERVALS

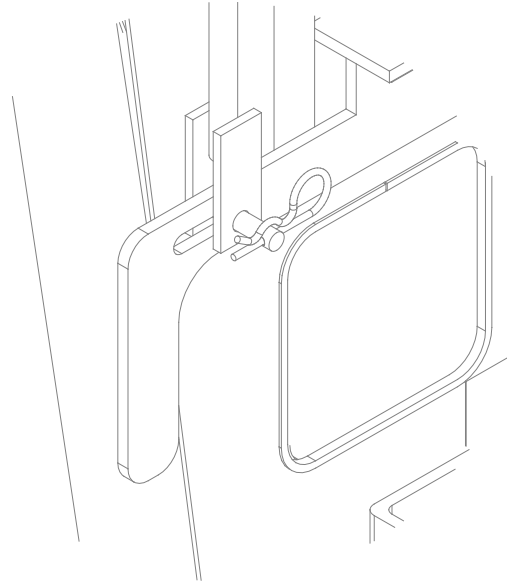


5.2 Maintenance

5.2.1 Cup Replacement

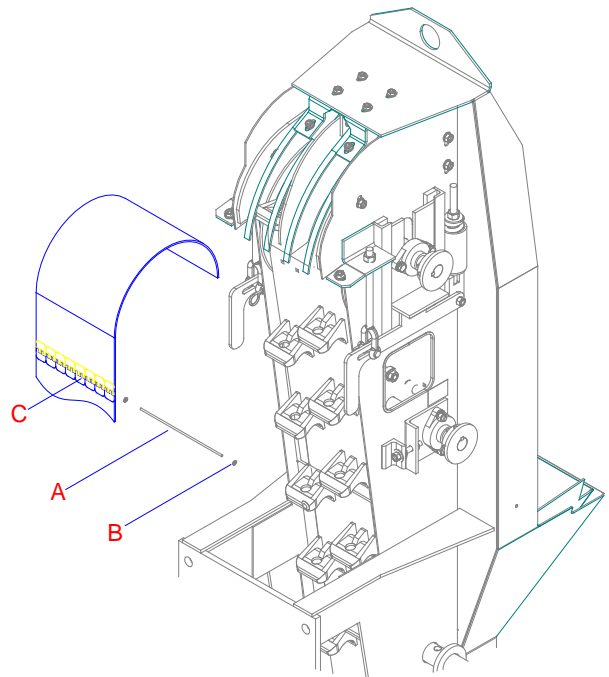
To release the tension on the belt:

1. Remove hairpin on 3/8" clevis pin.
2. Insert handle extension over L-shaped tightener on row unit.
3. Pull up on handle to release tension on clevis pin. Remove clevis pin.
4. Repeat on opposite side.
5. Belt should now be free to spin. Spin belt to gain access to damaged cup(s).
6. Replace damaged cup(s), taking care not to leave any hardware on bottom roller.
7. Inspect belt for damage.
8. Reverse steps 1 – 4 to tighten belt. Unless there is damage to the belt, tracking adjustment should not be necessary.



5.2.2 Belt Removal

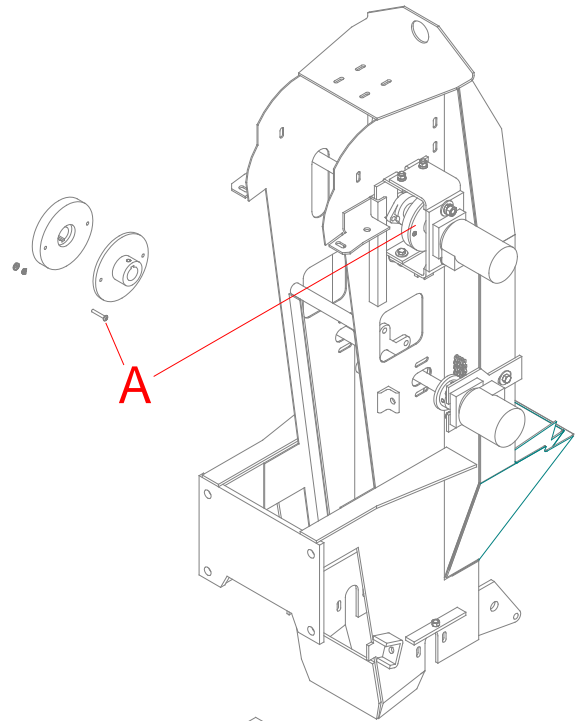
1. Follow steps 1 – 4 above to release tension on the belt.
2. Rotate belt to gain access to retaining rod (A).
3. Remove keepers (B) on rod.
4. Pull belt out.
5. Install new belt, taking care to have the cups positioned correctly.
6. Join belt end together by pushing retaining rod through lacing (C).
7. Install new rod keepers.
8. Re-tension belt.
9. Follow instructions on Page 38 to align belt.



5.2.3 Row Unit Shear Bolt

The drive of all row units is protected by two shear bolts (A) on a split hub mounted on the hydraulic drive motor on the left end row unit. If an obstruction gets in any row unit assembly and the shear bolts break, remove obstruction and replace shear bolts as follows:

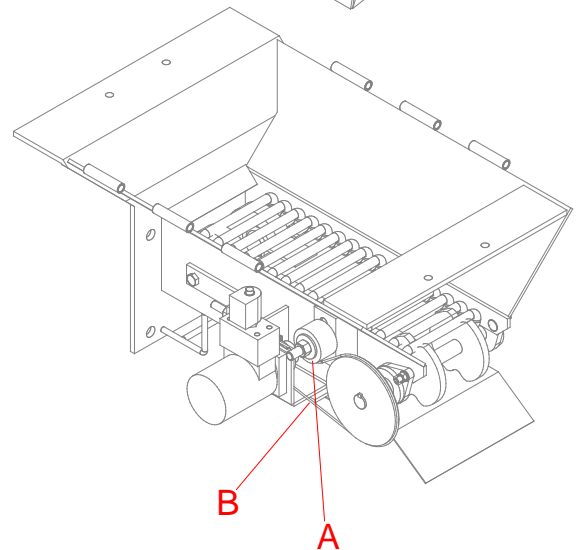
1. Place all controls in NEUTRAL, stop engine, place tractor in PARK, remove key.
2. Carefully remove remaining pieces of bolts (if necessary) using a hammer and punch. Do not enlarge holes.
3. Install/tighten two new shear bolts (3/16" x 1-1/4" machine screws)



5.2.4 Feedbox Roller Chain Drive

Each feed chain is driven by a hydraulic motor / roller chain. To adjust chain tension, follow this procedure:

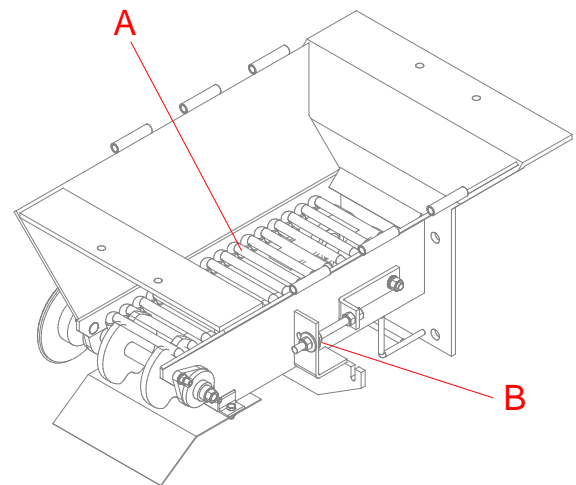
1. Place all controls in NEUTRAL, stop engine, place tractor in PARK, remove key.
2. Loosen the nut securing the idler roller (A).
3. Slide or tap the idler into its required position.
4. The chain should have approx. 1/4" slack on the long span (B).
5. Tighten the nut securing the idler roller.
6. Repeat procedure for each row unit.



5.2.5 Feed Chain Tension

The Feed Chain (A) moves seed pieces from the hopper into the seed bowls. To adjust the tension, follow this procedure:

1. Place all controls in NEUTRAL, stop engine, place tractor in PARK, remove key.
2. Loosen the chain idler bolts on both sides of the feed chain. (B)
3. Adjust both sides evenly until there is approx. 1" of sag on the loose side (underneath) of chain.
4. Tighten the chain idler bolts on both sides of the feed chain to their specified torque.
5. Adjust all other feed chains as required.

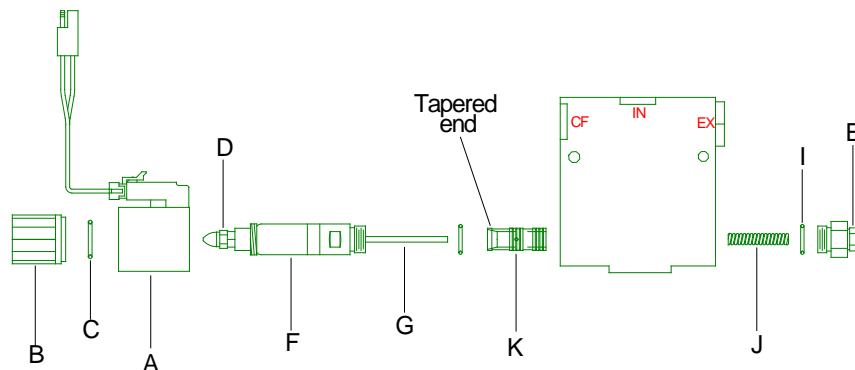


5.2.6 Servicing Pulse Width Modulating (PWM) Valve

In rare cases, contamination may enter the PWM Valve and cause the valve piston spool to stick, which will result in the valve malfunctioning. If that happens, it is necessary to disassemble the valve and clean the PWM Valve. Tolerances on the valve are very close. Any contamination, no matter how small, may cause the valve to malfunction. Follow these steps closely to disassemble/clean the valve.

DO NOT ATTEMPT IN FIELD

1. Clean area near valve. Wipe/use compressed air.
2. Remove valve from planter. Plug all hose connections or wrap tape over connections to prevent contamination.
3. Find a clean area to disassemble. Place the valve in a vise or clamp with the solenoid (A) in a horizontal position.
4. Lay out a clean cloth to place parts on.
5. Remove plastic nut (B), O-Ring (C), and electric solenoid from solenoid valve stem. **ATTENTION:** DO NOT remove capnut (D) from solenoid valve stem or adjusting screw lock nut (E) from opposite end of valve. These are used to adjust balance between compression spring and solenoid valve. Any change in this adjustment could make the valve inoperable.
6. Using a 3/4" wrench, loosen solenoid valve stem (F). Unscrew and remove – Note actuator pin (G) in solenoid valve stem.
7. Place solenoid valve stem on clean cloth.
8. Using a 7/8" wrench, loosen compression spring nut (H) on opposite end of valve body. **SLOWLY** remove nut, O-Ring (I), and compression spring (J). Lay these parts on clean cloth.
9. Using a clean/burr-free punch, **SLOWLY** push piston spool (K) out of valve body noting which direction spool is inserted (tapered end toward actuator pin). Place piston spool on clean cloth.
10. Using compressed air, blow through valve body cavity. Clean all disassembled parts with



compressed air. It is not recommended the parts be cleaned with solvent. This could make the parts dry & difficult to reassemble. Check all parts for contamination & damage. Check valve body and piston spool for scoring. If any scoring is noted on piston spool or in valve body, valve must be replaced. **DO NOT** Attempt to interchange parts between valves.

11. Valve reassembly. Using clean hydraulic oil, lubricate valve body cavity and piston spool. Note orientation of tapered end of spool. **SLOWLY** slide spool into valve body. **IMPORTANT:** Because of extremely close tolerance, exposure to heat or even handling may expand piston spool enough to make it difficult to slide back into valve body. Under no circumstances should the piston spool be forced into the valve body. Forcing the piston spool into the valve body will likely result in irreparable damage. Blow compressed air on piston spool to cool it or if possible place spool in a cool place such as a refrigerator for a few minutes. After cooling, re-lubricate spool with clean hydraulic oil, check for proper orientation and slide into valve body.
12. Lubricate compression spring, place spring in nut and screw nut into valve body
13. **CAREFULLY** screw solenoid valve stem (with actuator pin) into valve body. Solenoid goes in the same side of valve body with the CF port. Tighten compression spring nut and solenoid valve stem. Re-install electric solenoid, O-ring, and plastic nut. **Note:** On earlier valves, the valve actuator pin is separate from the solenoid valve stem. Extreme care must be taken on these early valves to make sure the actuator pin is fully inserted into solenoid valve body. Failure to do so could jam actuator pin piston spool, making valve inoperable.
14. Re-install valve on planter, making sure no contamination enters system. If this procedure does not correct valve malfunction, valve must be replaced.

5.2.7 Operation of Feedbox Motor Control Solenoid

On Harriston planters, the feedbox providing seed to the planter bowl is controlled by an electric solenoid mounted on a hydraulic motor. Oil for the hydraulic motor flows from the return side of the planter shaker drive motor. Oil flow is regulated by a manual flow control. An electric sensor in the feed bowl provides 12 V.D.C. to the solenoid for control of oil flow for each individual feedbox. When the seed bowl is being filled, the electric sensor is closed, which sends current to the solenoid. The solenoid closes the by-pass line in the motor manifold, which directs oil to the hydraulic motor.

In Figure 1, electric current is off, the by-pass is open, which diverts hydraulic oil away from motor; therefore the motor does not run.

In Figure 2, Electric current activates magnetic solenoid. The solenoid closes the by-pass and directs oil flow to the hydraulic motor (motor runs).

All feedbox motors are connected in a hydraulic series, which means hydraulic oil flows from one motor to the next. Oil flow is the same regardless of how many motors are in the circuit. As the number of motors (rows) increase, oil pressure increases proportionally. Example:

one motor requires 150 P.S.I., 4 motors require 600 P.S.I. Motors that are operating require pressure. Motors that are not operating (because solenoid has opened by-pass) will not increase pressure. Pressure will continuously vary, depending upon how many motors are operating at any given time. Because all motors are connected in a series, if one stalls because of a jammed feed chain, all motors will stall because oil flow will be blocked.

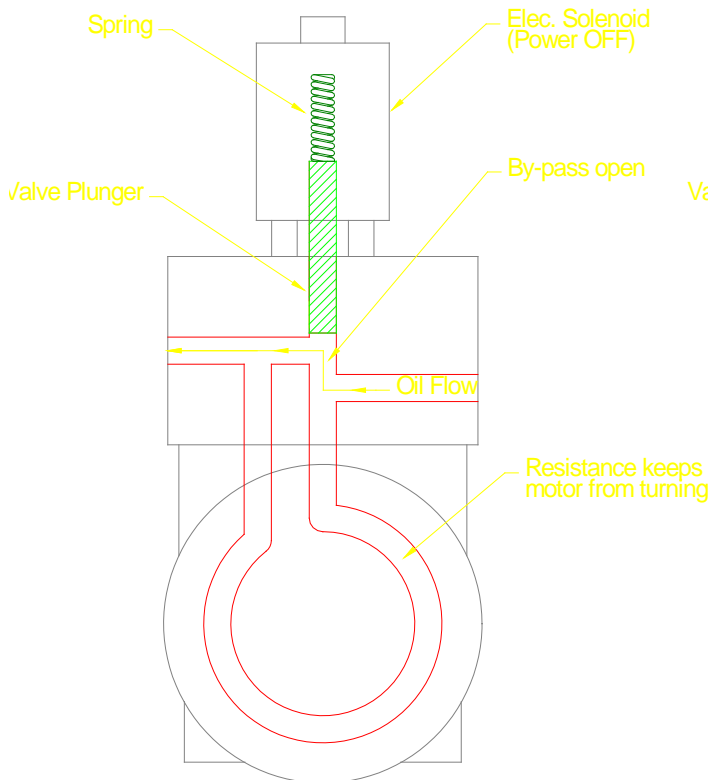


Fig. 1

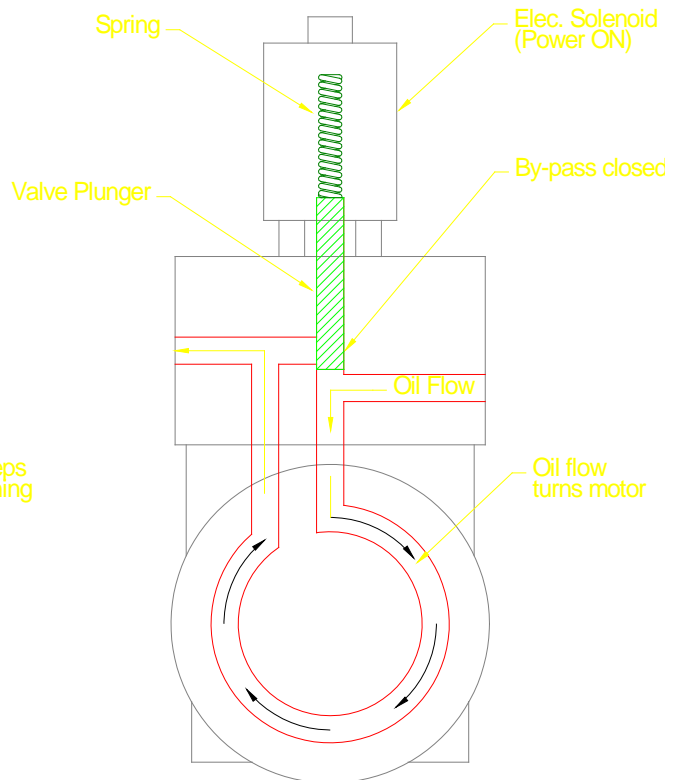
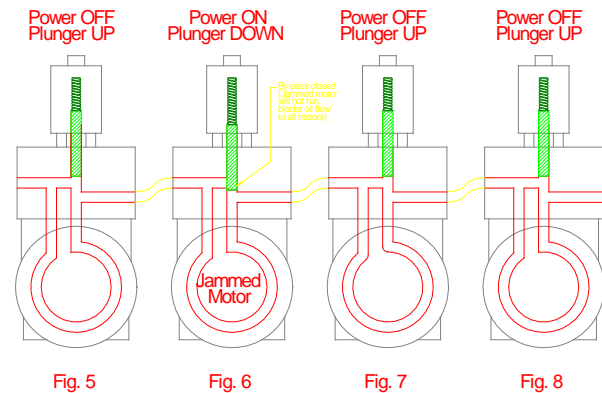
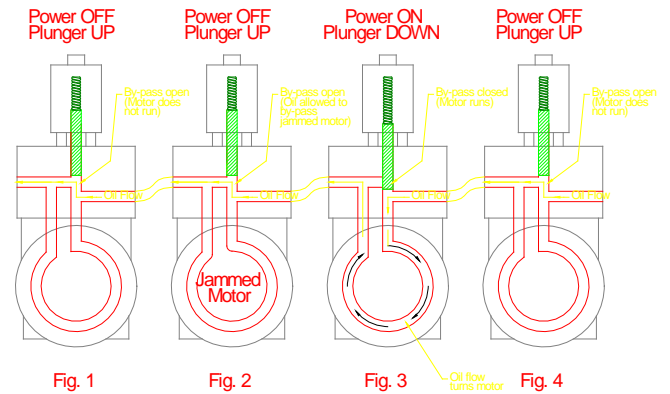


Fig. 2

5.2.8 Feedbox Motor Testing

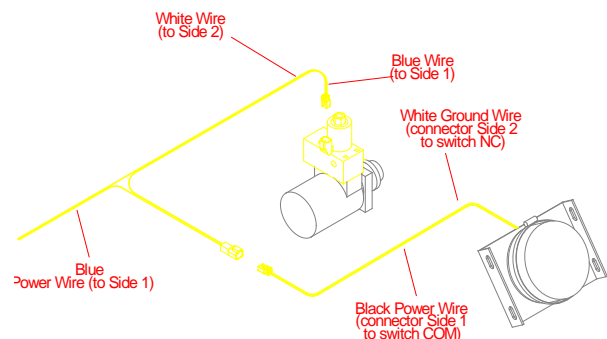
If a piece of seed or foreign material jams one feedbox motor, oil flow will be stopped, therefore all motors will stop. To determine which motor is jammed, follow this procedure:

1. Empty out all feedboxes so the bowl switches are closed (calling for seed).
2. Turn feed chain switch **OFF** on switchbox in cab.
3. Disconnect power wire connectors from all feedbox solenoids.
4. Turn hydraulic system on & set row units to run as slow as possible to have oil flow to the feedbox motors.
5. Turn feedbox chain switch **ON**.
6. **STAND BEHIND THE PLANTER!** Starting at one end of the planter, use a tester to verify 12 volts between the terminals on the connector. If no power is present without pressure on the bowl switch, replace bowl switch as explained on next page. Connect one feed box solenoid power connector. If feedbox runs, it is **NOT** the jammed motor. Disconnect the power connector and move on to the next feedbox solenoid.
7. Repeat step 6 until you encounter a motor that **DOES NOT** run when you connect the power connector. This is the jammed motor. Oil will not flow through a jammed motor. Refer to the diagrams below to visualize how the oil flow is directed by the solenoids.
8. Place all controls in NEUTRAL, stop engine, place tractor in PARK, remove key.
9. Remove the object that is causing the problem.
10. Repeat step 6 to check feedbox that was jammed. If it functions now, reconnect all other feedbox solenoids and continue planting.



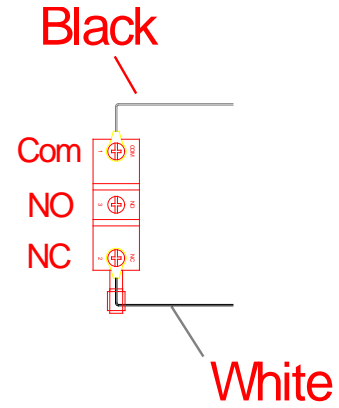
In Figures 1-4 to the right, Figure 2 is jammed. Power is connected to solenoid on Figure 3, which makes motor run. Oil can flow past jammed motor in Figure 2. Every motor that is not jammed will run when power is present at solenoid.

In Figures 5-8, Figure 6 is jammed. Power is connected to solenoid on Figure 6. Plunger is pushed down, attempting to force oil through the motor. Motor does not run. Because the motor is jammed, oil cannot flow through it.



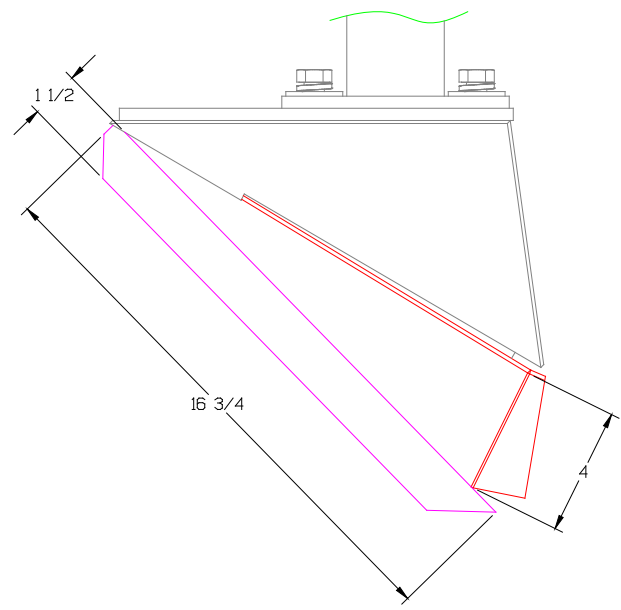
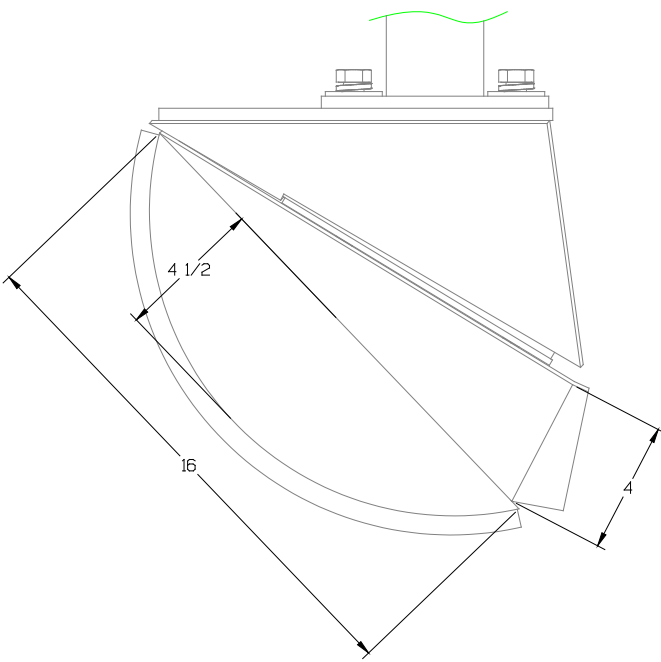
5.2.9 Replacing Bowl Switch

Pictured to the right is the wiring schematic for the bowl switch. Re-connect wiring harness connector to the new switch. Mount new switch in bracket readjust (See page 40)



5.2.10 Re-Building Shoes

If you wish to build up worn planter shoes, the following figures show the approximate dimensions of new shoes.



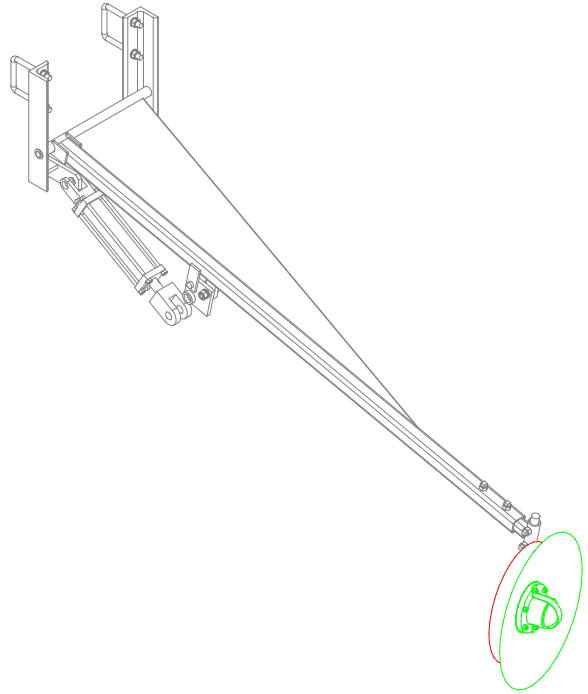
6 OPTIONAL EQUIPMENT

Optional equipment is available from your dealer or the factory. It can be part of the machine at the time of purchase or installed in the field. Optional equipment includes:

6.1 Row Markers

Row markers are used by the operator to define the required spacing when making the next pass.

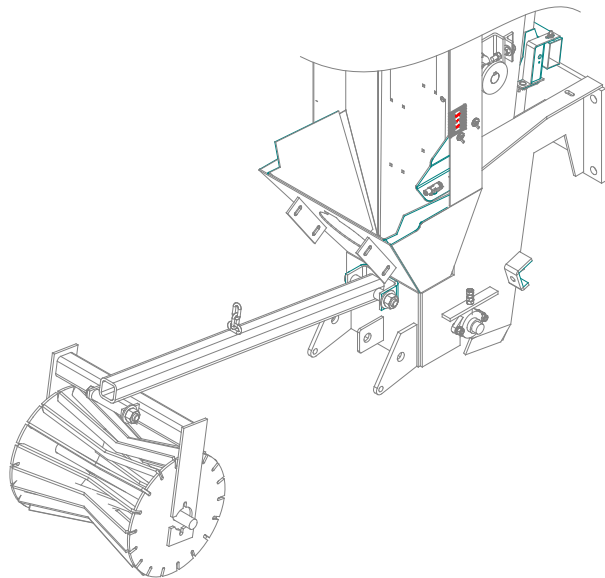
1. They are mounted on the outside frame behind the frame stand.
2. Be sure the mounting bolts are tightened to their specified torque.
3. Route the hydraulic hoses along the frame and secure with clips or plastic ties to prevent damage.
4. Connect the hoses to the sequencing valve that comes with the package. It allows the markers to operate with only one hydraulic circuit.



6.2 Hill Rollers

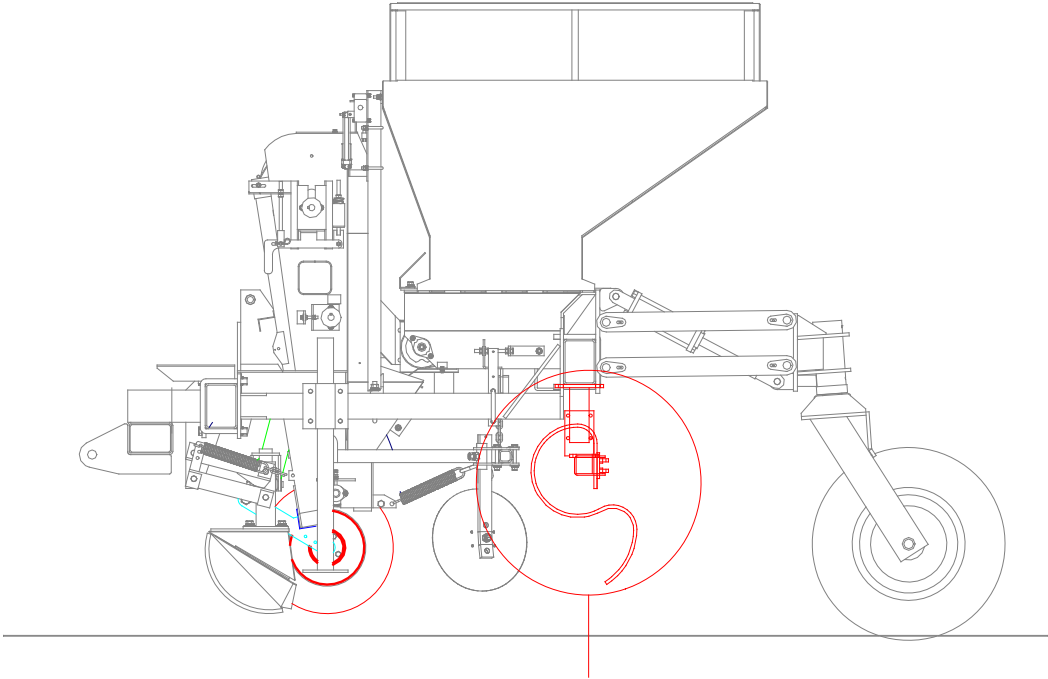
Hill Rollers are mounted behind closing discs to help form and compact the rows. The roller floats behind the discs and is suspended on an adjustable chain.

The use of hill rollers improves germination in loose, dry soil conditions.

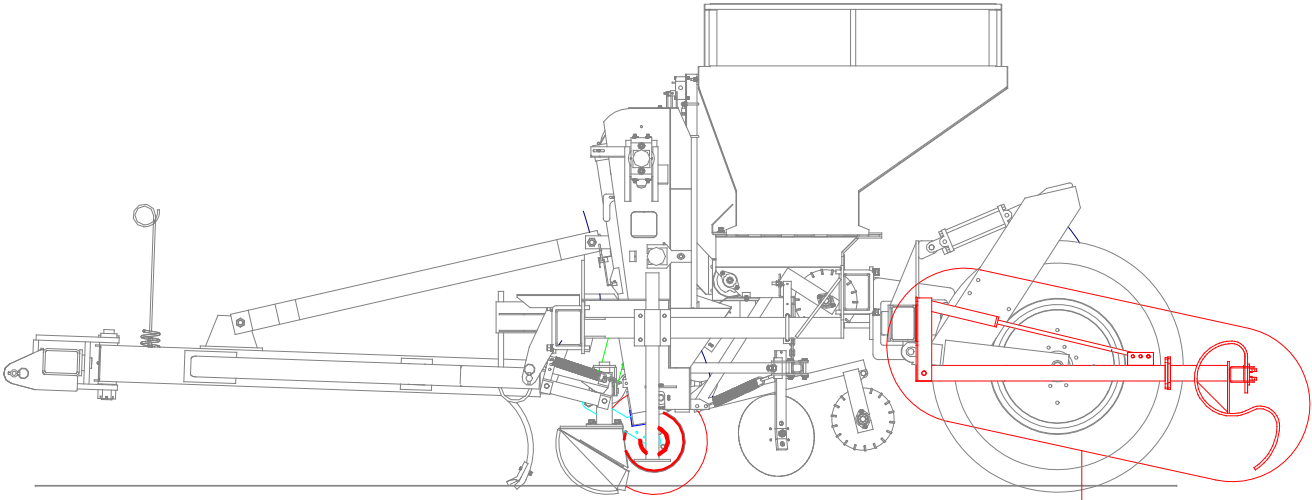


6.3 Rear Ripper

This S-Tine is used to break up the tire track or break up the ground between all the rows.



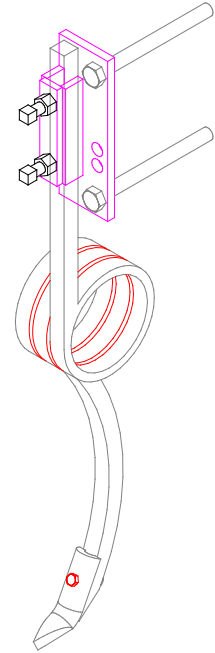
**Semi Mount
Rear Ripper**



**Pull-Type
Rear Ripper**

6.4 Trash Shank

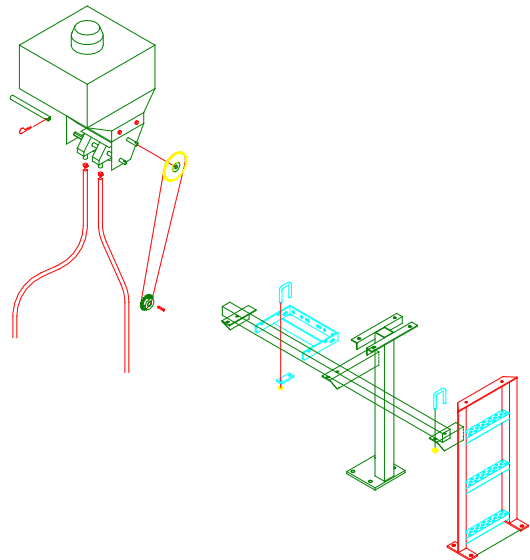
In hard soil or heavy trash conditions, a toolbar mounted 1" coil shank can be used in front of each row unit. They are attached with an adjustable bracket.



6.5 Pesticide Applicator

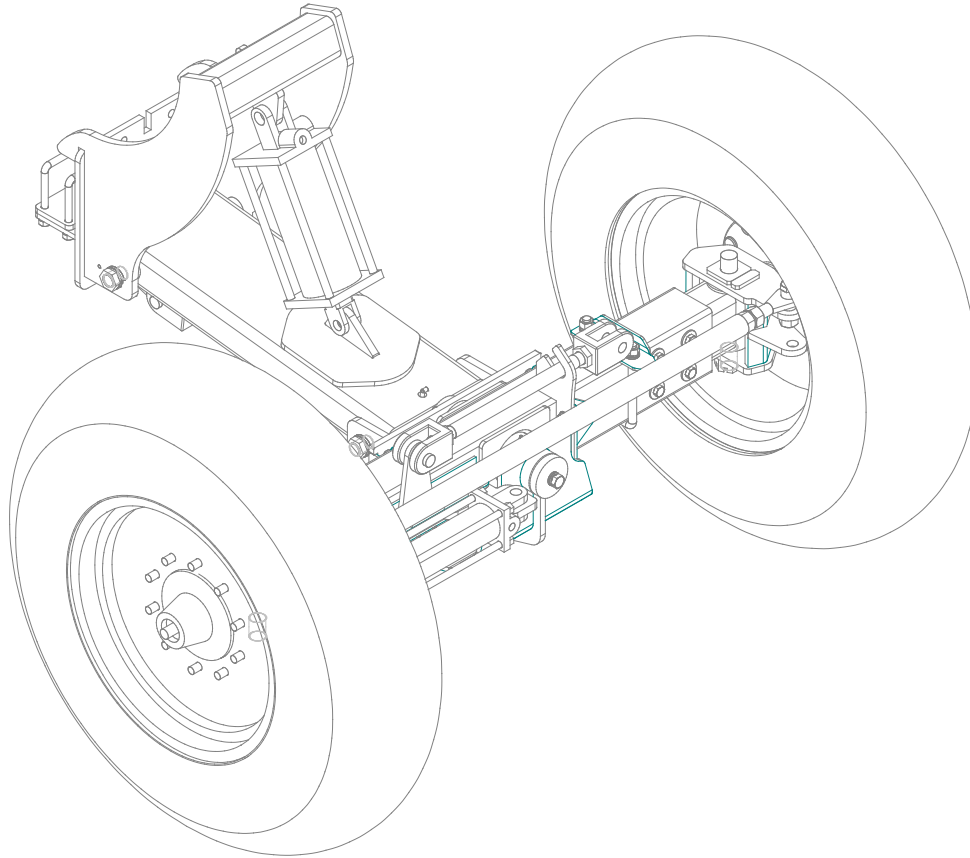
The package consists of a 90 lb (40 kg) box for one or two rows (must be specified at the time of purchase), mounting frame, and drive system. Mounting may differ depending on planter options installed; platforms, etc.

1. Install the mounting frame to the planter frame so the boxes are positioned above the parallel linkage arms.
2. Tighten mounting bolts to their specified torque.
3. Install the drive system on the left side of the machine. A sprocket is installed on the shaft and a roller chain transmits the power to the common metering shaft. (see applicator instructions).
4. Install the applicator boxes on the frame.
5. Install the metering shaft between each box.
6. Install the material tubes to the bottom of the boxes.
7. Tighten all mounts and fasteners.
8. Install all shields.



6.6 Rear Steer

A rear steer option is available for pole-type hitch planters. Rear steer can be utilized to help reduce side draft on side slopes. System can be operated manually or with a GPS system. Owner is responsible for setting up operation of rear steer system.



7 TROUBLE SHOOTING

If you encounter a problem that is difficult to solve, even after having read through this trouble shooting section, please call your local dealer or the factory. Before you call, please have this Operator's Manual and the serial number from your planter ready.

7.1 MACHINE TROUBLE SHOOTING

PROBLEM	CAUSE	SOLUTION
Feedboxes and Shakers do not run	Hydraulic lever on tractor in neutral position.	Place hydraulic lever in work position.
NOTE: this will not indicate an electrical problem	Hydraulic hose not connected.	Plug hose into tractor
NOTE: Hydraulic feed is equipped with a one way check valve to prevent system from running in reverse	Operator is attempting to operate hydraulic drive in reverse.	Run hydraulic drive in proper direction.
	One way check valve malfunctioning	Replace check valve. (Valve is located behind hydraulic coupler on inlet line).
	Malfunctioning hydraulic coupler.	Check coupler for foreign object, replace if necessary
	Malfunctioning tractor hydraulic coupler	Plug couplers into another valve if available, check with tractor dealer.
	Hydraulic flow control set too low or shut off.	Increase Tractor hydraulic flow
One hydraulic drive does not run, all others O.K.	Malfunctioning control switch or solenoid valve on hydraulic motor	Check for power at Solenoid with Switch ON. If there is no power, replace ultrasonic sensor. If power is present, replace solenoid
	Malfunctioning hydraulic motor	Replace hydraulic motor
	Broken drive chain	Repair or replace chain

MACHINE TROUBLE SHOOTING

PROBLEM	CAUSE	SOLUTION
Fuse blows when Feedbox Switch is turned on	Faulty solenoid coil	Remove all wires from solenoid coils. Replace fuse. If fuse does not blow, re-connect wires to solenoid one at a time to locate faulty solenoid coil.
	Feedbox wire shorted out	If fuse still blows without wires connected, disconnect all bowls sensor wires, replace fuse. If fuse blows, examine all feedbox wires from junction box at center of planter to each bowl sensor wire. Replace or repair shorted wire.
	Faulty bowl sensor	Replace Bowl Sensor See page 40
One feedbox hydraulic drive does not run, all others O.K (Continued)	(No power at bowl sensor). Broken or unplugged wire between junction box and bowl sensor	Plug wire back in. Repair broken wire. Correct problem that broke wire.
	(Power at bowl sensor). Faulty sensor	Replace sensor
	(Power at bowl sensor, no power at solenoid). Broken wire between junction box and solenoid.	Repair broken wire, correct problem that broke wire.
One feedbox runs continuously, All other feedboxes & shakers work properly	Bowl sensor out of adjustment	Adjust bowl sensor See page 40
	Faulty bowl sensor	Replace sensor See page 40
	Defective solenoid valve body	Replace solenoid valve body (See procedure previously mentioned to determine whether to replace sensor or solenoid)
All hydraulic drives will not run NOTE: When checking for electrical problems, it is suggested that a continuity tester and test light be used.	Main wire harness broken, unplugged Fuse blown.	Repair broken wire. Plug wire back in. Replace fuse, check for reason fuse blew.
	Defective ON-OFF switch	Replace switch


MACHINE TROUBLE SHOOTING

PROBLEM	CAUSE	SOLUTION
Planter stops/Shear Bolts break	Shaker Roller fell off into Lower Drive Roller	Re-install Shaker Roller Remove all bolts, nuts, etc. Check for belt damage, replace if necessary Replace shear bolt
	Broken or loose Seed Cup	Replace Seed Cup, look for cause of Cup damage See page 53 Replace shear bolt
	Foreign object in Seed Bowl or Planter Drive	Remove object Replace shear bolt
	Too much seed in seed bowls	Reduce speed of feed chains See page 41
	Faulty bowl sensor(s)	Replace/readjust bowl sensor(s) See page 40
	Missing or loose Shaker Bearing	Replace missing Bearing Tighten all Bearings
Feed chains constantly over-fills seed bowls.	Feed chains running too fast	Reduce speed of feed chains See page 41
Excessive Skips/few or no Doubles	Shaker speed too fast	Reduce Shaker speed slightly See page 39
	Seed size too large	Adjust Seed Cutter for more uniform seed size. Resize seed
	Very Large or uncut seed in bowl	Remove large seed pieces from bowl(s), check seed cutter
	Seed level too low, bowl running empty	Check feed chain operation Increase feed chain speed slightly See page 41
	Broken or missing seed cups	Replace missing cups See page 53 Look for cause of cup damage
	Closing discs are set too deep (moving seed in furrow).	Set closing discs to a shallower/less aggressive setting. See page 42

MACHINE TROUBLE SHOOTING

PROBLEM	CAUSE	SOLUTION
Depth Control Wheel not holding even depth	Spring tension on shoe set too high Seedbed too soft	Adjust spring tension See page 42 Rework field to firm soil
Planting depth uneven, Shoe lifting Depth Control Wheel	Insufficient spring tension Seedbed too hard	Increase spring tension Rework field to Loosen soil
Planting depth uneven	Closing discs set too close together or at too much of an angle (filling in seed furrow before seed drops).	Readjust closing discs. See page 42
Planting depth uneven, planter pulls hard	Front of planter frame is too low.	Raise tractor 3-point Side crossmember should be 1” to 2” higher in front than rear
Planter does not trail properly	Hitch of planter too low Rear wheels of planter not riding on ridge left by hiller discs Walking Beam out of alignment (6 & 8 Row only) Low Pressure in Rear Tire Bent or loose wheel Loose / failed wheel bearing Tractor wheel spacing does not correlate to planter wheel spacing	Raise tractor 3-point hitch If problem cannot be corrected by repositioning hiller discs, a rear ripper package may be necessary Realign Walking Beam See page 43 Check tire pressure, all tires must have the same pressure. Tighten all wheel bolts Tighten, replace, or repack wheel bearing Adjust tractor wheel spacing to match planter

7.2 RAVEN CONTROL SYSTEM TROUBLE SHOOTING

PROBLEM	CAUSE	SOLUTION
Console will not turn on	Console not connected to 12V.	Console must be connected to 12V. Console must be connected directly to battery. Do not connect to convenience outlet in tractor.
	Broken wire.	Check all connections. Repair broken wire.
	Poor or corroded connection	Clean connection. Always coat electrical connections with dielectric grease Replace corroded wire.
	Blown fuse	Find cause of blown fuse. Replace fuse.
Console comes on momentarily, no display	Poor battery connections	Clean / repair connections as needed.
	Weak tractor battery	Console must have 12 V. D.C. Charge or replace battery as needed.
	Console not programmed	Turn console power on, hold up  until display appears. See Console Program section (page 29) to program console.
Console turns on, no response from "Increase/Decrease Switch"	"Select Switch" in "OFF" or "AUTO" Position	"Select Switch" must be in "Manual" position.
	No hydraulic flow	Be sure tractor hydraulics are on. Check for hydraulic flow. Hoses must be plugged into tractor correctly (check-valve is on inlet hose).
	Main cable or valve wire disconnected	Check all wire connections.
	Console not properly programmed	Check all program numbers. Check initial program by depressing "Utility Menu". Check program by depressing "Data Menu".
	Console wires not connected to battery.	Console must be connected directly to battery. Do not connect to convenience outlet in tractor.
	"Master Switch" and/or "Product Switch" off	Turn "Master Switch" & appropriate "Product Switch" on.
Console works in "Manual", not in "Auto"	No "Test Speed" in program	See programming section (Page 29) for help programming a "Test Speed"

RAVEN CONTROL SYSTEM TROUBLE SHOOTING

PROBLEM	CAUSE	SOLUTION
Planter will run with console in manual mode, will run with test speed, but will not run when tractor is moving.	Radar disconnected	Connect radar cable
	Radar not properly mounted	Check Raven manual for proper radar mounting procedure. Radar must have clear view. See page 27
Planter runs properly in test speed, does not respond to forward movement	Radar disconnected	Check radar cable.
	Defective radar	Replace radar.
	Defective interface cable (when using tractor radar)	Repair or replace interface cable.
Raven console speed does not read the same as tractor speed, seed spacing does not match rate chart	Incorrect Speed Cal	See programming section (page 29) for help programming Speed Cal value.
Planter runs correctly in "Manual", but overspeeds in "Auto". Off Rate warning/ "0's" in rate window	Encoder wire disconnected	Re-connect encoder wire.
	Encoder shaft coupling loose	Tighten encoder shaft coupling.
	Defective encoder	Replace encoder.
Planter runs correctly in manual - starts, stops, or does not hold constant speed in "Auto"	Encoder shaft coupling loose	Tighten encoder shaft coupling.
	Defective encoder	Replace encoder.

RAVEN CONTROL SYSTEM TROUBLE SHOOTING

Console does not maintain constant speed in field	Poor connection on radar cable	Check/clean connection on radar cable.
	Radar incorrectly mounted	See radar mounting instructions on page 27.
	Defective or incorrect radar interface cable from tractor radar	Contact Harriston Industries for correct interface cable.
	Defective radar	Replace radar.
System does not respond to increase in field speed – console shows “Off Rate” when field speed increases	Tractor oil flow set too low	Increase tractor oil flow approx. 10%.
	High PWM Offset value set too low	Increase value 10 points at a time until problem is corrected. See programming section (page 29) for help programming High PWM Offset value.
Planter does not stop completely when tractor stops, does not correlate with ground speed when slowing down	Tractor oil flow set too high	Reduce oil flow from tractor in approx. 10% increments until problem is corrected. Oil flow should be set at 10 G.P.M.
	PWM Valve defective	Replace PWM Valve.
Planter creeps when tractor stops, planter stops creeping when Master Switch is turned off	Low PWM Offset value set too high	Decrease value by 5 points until problem is corrected. See programming section (page 29) for help programming Low PWM Offset value
Planter creeps when stopped. Does not help to reduce Low PWM Offset	Tractor hydraulic system may be causing over pressure	Turn Open/Close bypass valve to open. Most tractors with pressure/flow compensated system can be safely operated with valve in open position. Check with Harriston Service Depart.
	Tractor hydraulic flow set too high	Reduce hydraulic flow from tractor.
	Defective hydraulic valve	Replace hydraulic valve.

RAVEN CONTROL SYSTEM TROUBLE SHOOTING

PROBLEM	CAUSE	SOLUTION
Planter creeps when Master Switch is off (Tractor standing still)	Tractor oil flow set too high	Reduce tractor oil flow by approx. 10%
	Defective PWM Valve	See section on servicing PWM Valve (page 55) or ... Replace defective valve
Planter delays on startup	Planter switch set on "Delay"	Put planter switch to "ON" position
Planter drive does not work or works incorrectly after rain or period of non-use	Loose or corroded wire connections	Disconnect and clean all connections with electrical contact cleaner. Coat all connections with dielectric grease. Reconnect & tighten all connections
	Moisture has entered damaged wiring cable	Locate damaged cable, repair or replace as required. Coat all connections with dielectric grease.
Planter starts slow, plants & stops properly	Low PWM Offset too low	Increase Low PWM Offset 5 points at a time until planter creeps when tractor stops moving, then decrease Low PWM Offset by 2 points or until planter stops creeping
	Preset Offset too low	Increase Preset Offset by 5 points until planter starts properly. Do not increase above 95
Planter will not stay at target rate when speed increases	Hydraulic oil flow too low	Increase Hydraulic oil flow in 10% increments until planter stays at target rate at desired planting speed. Do not set higher than necessary.
"ro" warning flashes/ alarm sounds	One or more rows not planting	Correct planting problem Check seed level Check feed chain Check row unit drive
	Monitor eye(s) dirty Setting for monitor feature incorrect	Clean eye(s) If monitor feature is not used, "0" must be entered in the ro area in the Data Menu. If monitor feature is used, the number in the ro area in the Data Menu must match how many rows your planter has.

Harriston Service Department
1-800-437-8205

Raven Service Department
1-800-243-5435

8 SHIPPING AND ASSEMBLY

If the machine is shipped by truck, certain components are removed to bring the unit to the legal transport width. Although the machine is heavy, it is not difficult to handle by following this procedure:

1. Clear the area of bystanders.
2. Spread the forks on the forklift as wide as possible to match the frame clearance points.
3. Drive the forklift to the machine and slide the forks under the frame but away from moving parts. Do not lift on any of the row units or drives.
4. Attach a couple of chains or slings between the frame and mast to prevent tipping.
5. Lift slightly to tighten the chains.
6. If using a crane or hoist, attach chains to frame at 3 or 4 locations to prevent tipping.
7. Lift slightly to tighten the chain.
8. Loosen and release all machine tie-downs.
9. Slowly raise the machine to lift it slightly above the truck bed.
10. Be sure the unit is balanced before moving.
11. Raise until the truck bed is cleared.
12. Back slowly always and carefully move to the assembly area. Carry close to the ground when moving to minimize the tendency to tip.
13. Lower the machine to the ground at the assembly site but do not unhook until the rear wheels are mounted.

ASSEMBLY

1. Open the crate and cartons containing the attaching components and mounting hardware.
2. Determine the machine row spacing required.
3. Mark the center of the frame and measure toward each end to establish the positions for the rear wheels.
4. Install the rear wheels and tighten the U-bolts to their specified torque.
5. Be sure the frame stands are pinned in their supporting position.

6. Lower machine to the ground and remove chains or slings.
7. Tighten all U-bolts to their specified torque.
8. Install the rear platform and ladder and tighten mounting bolts to their specified torque.
9. Install optional equipment as required. The Harriston Potato Planter uses ground wheels or hydraulic drive to transmit power to a series of cups that select and meter seed for planting. It is a simple and reliable system that requires minimal maintenance.



CAUTION

1. Keep bystanders away.
2. Use a forklift, crane, or hoist with adequate lift capacity and stability to handle the machine.
3. Securely chain the frame to the lifting device before moving.
4. Use 2 men when handling the machine.

9 SPECIFICATIONS

9.1 BOLT TORQUE

CHECKING BOLT TORQUE

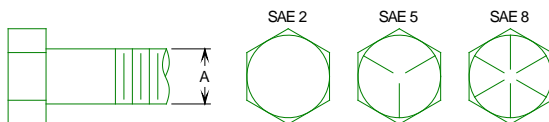
The tables shown below give correct torque values for various bolts and capscrews. Tighten all bolts to the torques specified in chart below unless otherwise noted. Check tightness of bolts periodically, using bolt torque chart as a guide. Replace hardware with the same strength bolt.

ENGLISH TORQUE SPECIFICATIONS

Bolt Diameter "A"	SAE 2		Bolt Torque SAE 5		SAE 8	
	N.m.	(lb-ft)	N.m.	(lb-ft)	N.m.	(lb-ft)
1/4"	8	(6)	12	(9)	17	(12)
5/16"	13	(10)	25	(19)	36	(27)
3/8"	27	(20)	45	(33)	63	(45)
7/16"	41	(30)	72	(53)	100	(75)
1/2"	61	(45)	110	(80)	155	(115)
9/16"	95	(70)	155	(115)	220	(165)
5/8"	128	(95)	215	(160)	305	(220)
3/4"	225	(165)	390	(290)	540	(400)
7/8"	230	(170)	570	(420)	880	(650)
1"	345	(225)	850	(630)	1320	(970)

Torque figures indicated above are valid for non-greased or non-oiled threads and heads unless otherwise specified. Therefore, do not grease or oil bolts or capscrews unless otherwise specified in this manual. When using locking elements, increase torque values by 5%.

* Torque value for bolts and capscrews are identified by their head markings.



9.2 HYDRAULIC FITTING TORQUE

TIGHTENING FLARE TYPE TUBE FITTINGS *

1. Check flare and flare seat for defects that might cause leakage.
2. Align tube with fitting before tightening.
3. Lubricate connection and hand tighten swivel nut until snug.

Tube Size OD (Inch)	Nut Size Across Flats (Inch)	Torque Value*		Recommended Turns to tighten (After finger tight)	
		(N.m.)	(lb-ft)	(Flats)	(Turns)
3/16	7/16	8	6	1	1/6
1/4	9/16	12	9	1	1/6
5/16	5/8	16	12	1	1/6
3/8	11/16	24	18	1	1/6
1/2	7/8	46	34	1	1/6
5/8	1	62	46	1	1/6
3/4	1-1/4	102	75	3/4	1/8
7/8	1-3/8	122	90	3/4	1/8

4. To prevent twisting the tube(s), use two wrenches. Place one wrench on the connector body and with the second, tighten the swivel nut to the torque shown.

* The torque values shown are based on lubricated connections as in reassembly.

9.3 MECHANICAL

		4 Row	6 Row	8 Row
Shipping Height	Standard Tank	7' 3" (2.2m)	7' 3" (2.2m)	7' 3" (2.2m)
	With Hopper Ext.	8' 3" (2.5m)	8' 3" (2.5m)	8' 3" (2.5m)
Transport Height	Standard Tank	8' 4" (2.5m)	8' 4" (2.5m)	8' 4" (2.5m)
	With Hopper Ext.	9' 4" (2.8m)	9' 4" (2.8m)	9' 4" (2.8m)
Width		16' 8" (5.0m)	21' 8" (6.6m)	36" Rows 25' 4" (7.8m) 40" Rows 28' 0" (8.5m)
Length (Field Position, Front to Rear)	Semi-Mount	12' (3.7m)	12' (3.7m)	N/A
	Pull-Type	16' 8" (5.1m)	18' 6" (5.6m)	18' 6" (5.6m)
Weight	Semi-Mount Empty (Estimated)	6,800 lbs. (3,084 kg)	10,300 lbs. (4,672 kg)	N/A
	Pull-Type Empty (Estimated)	9,700 lbs. (4,400 kg)	11,800 lbs. (5,352 kg)	15,700 lbs. (7,121 kg)
Seed Capacity (Without Ext.) (With Ext.)		70 Cwt.	112 Cwt.	150 Cwt.
		79 Cwt.	121 Cwt.	159 Cwt.
Recommended Minimum Tractor H.P. Level, Firm Soil Rolling, Soft Soil		90	140	165
		110	160	200
Tires (Ground Drive) (Hydraulic Drive)		12.4 x 24 Lug Tread 32 psi (220 kPa)	12.4 x 24 Lug Tread 32 psi (220 kPa)	N/A
		11.25 x 24 Implement 32 psi (220 kPa) 14.9 x 24 Diamond 35 psi (240 kPa)	11.25 x 24 Implement 32 psi (220 kPa) 14.9 x 24 Diamond 35 psi (240 kPa)	11.25 x 24 Implement 32 psi (220 kPa) 14.9 x 24 Diamond 35 psi (240 kPa)
Tires (Gauge Wheel)		16.5 x 6.5 70 psi (480 kPa)	16.5 x 6.5 70 psi (480 kPa)	16.5 x 6.5 70 psi (480 kPa)
Seed Spacing		Hydraulic Optional or Ground Drive	Hydraulic Optional or Ground Drive	Hydraulic Optional or Ground Drive
Planting Capacity		Up to 6.5 acres/hour (2.6 ha/hour)	Up to 10 acres/hour (4 ha/hour)	Up to 12 acres/hour (5 ha/hour)
Planting Speed		2.5 to 4.5 mph (4 to 7.2 km/h) recommended speed		

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

CUP BELT RPM

The following table shows the ideal Speed for various seed spacing. The planter performs best when the cup belt is turning approximately 11.5 RPM

Harriston Cup Planter Belt RPM											
Seed Spacing (inches)											
Speed (MPH)	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
2.50	11.8	10.3	9.2	8.3	7.5	6.9	6.3	5.9	5.5	5.2	4.9
2.60	12.3	10.7	9.5	8.6	7.8	7.2	6.6	6.1	5.7	5.4	5.0
2.70	12.7	11.1	9.9	8.9	8.1	7.4	6.9	6.4	5.9	5.6	5.2
2.80	13.2	11.6	10.3	9.2	8.4	7.7	7.1	6.6	6.2	5.8	5.4
2.90	13.7	12.0	10.6	9.6	8.7	8.0	7.4	6.8	6.4	6.0	5.6
3.00	14.1	12.4	11.0	9.9	9.0	8.3	7.6	7.1	6.6	6.2	5.8
3.10	14.6	12.8	11.4	10.2	9.3	8.5	7.9	7.3	6.8	6.4	6.0
3.20	15.1	13.2	11.7	10.6	9.6	8.8	8.1	7.5	7.0	6.6	6.2
3.30	15.6	13.6	12.1	10.9	9.9	9.1	8.4	7.8	7.3	6.8	6.4
3.40	16.0	14.0	12.5	11.2	10.2	9.4	8.6	8.0	7.5	7.0	6.6
3.50	16.5	14.4	12.8	11.6	10.5	9.6	8.9	8.3	7.7	7.2	6.8
3.60	17.0	14.9	13.2	11.9	10.8	9.9	9.1	8.5	7.9	7.4	7.0
3.70	17.4	15.3	13.6	12.2	11.1	10.2	9.4	8.7	8.1	7.6	7.2
3.80	17.9	15.7	13.9	12.5	11.4	10.5	9.6	9.0	8.4	7.8	7.4
3.90	18.4	16.1	14.3	12.9	11.7	10.7	9.9	9.2	8.6	8.0	7.6
4.00	18.9	16.5	14.7	13.2	12.0	11.0	10.2	9.4	8.8	8.3	7.8
4.10	19.3	16.9	15.0	13.5	12.3	11.3	10.4	9.7	9.0	8.5	8.0
4.20	19.8	17.3	15.4	13.9	12.6	11.6	10.7	9.9	9.2	8.7	8.2
4.30	20.3	17.7	15.8	14.2	12.9	11.8	10.9	10.1	9.5	8.9	8.3
4.40	20.7	18.2	16.1	14.5	13.2	12.1	11.2	10.4	9.7	9.1	8.5
4.50	21.2	18.6	16.5	14.9	13.5	12.4	11.4	10.6	9.9	9.3	8.7
4.60	21.7	19.0	16.9	15.2	13.8	12.7	11.7	10.8	10.1	9.5	8.9
4.70	22.2	19.4	17.2	15.5	14.1	12.9	11.9	11.1	10.3	9.7	9.1
4.80	22.6	19.8	17.6	15.8	14.4	13.2	12.2	11.3	10.6	9.9	9.3
4.90	23.1	20.2	18.0	16.2	14.7	13.5	12.4	11.6	10.8	10.1	9.5
5.00	23.6	20.6	18.3	16.5	15.0	13.8	12.7	11.8	11.0	10.3	9.7
5.10	24.0	21.0	18.7	16.8	15.3	14.0	12.9	12.0	11.2	10.5	9.9
5.20	24.5	21.5	19.1	17.2	15.6	14.3	13.2	12.3	11.4	10.7	10.1
5.30	25.0	21.9	19.4	17.5	15.9	14.6	13.5	12.5	11.7	10.9	10.3

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