
MILLER PRO

Twin Rotary Rake

MODEL: 2650

OPERATOR'S MANUAL

DO NOT OPERATE THIS EQUIPMENT UNTIL THIS
MANUAL HAS BEEN READ AND UNDERSTOOD.

Part Number: 17.01103A
June 2005



MILLER-ST.NAZIANZ, INC.
P.O. BOX 127
ST. NAZIANZ, WI 54232
920/773-2121
FAX: 920/773-1200

INTRODUCTION

This Operator's Manual is provided to acquaint the operator with the safety and operation of the Miller Pro 2650 Twin Rotary Rake. Complete Assembly, Operation, Lubrication and Maintenance procedures are provided. Following the recommended procedures will help you achieve many years of dependable service. (For single rake operation, refer to 1350 Operator's Manual supplied with each rake).

This manual is considered part of your machine and should remain with the machine at all times.

Make sure the operator reads and understands the manual before placing the rake into operation.

Failure to follow the recommended procedures may result in injury and equipment damage, and could void the warranty.

MACHINE SERIAL NUMBERS

The Swing Frame serial number is located on the side of the frame near the Operator's Manual storage tube. The Rake serial numbers are located on the side of the rake frame near the Operator's Manual storage tube. For your convenience refer to these numbers and your product model numbers when requiring service or parts information. Record the machine serial number, date of purchase and dealership name in the space provided below.

Date Purchased _____
2650 Swing Frame Serial No. _____
1350 Rake #1 Serial No. _____
1350 Rake #2 Serial No. _____
Dealership: _____

Right and Left Hand sides are determined from a position standing at the rear of the rake looking toward the direction of travel.

A "Right Hand Rake" discharges to the right (swath screen is on the right side). A "Left Hand Rake" discharges to the left. (Swath screen is on the left side).

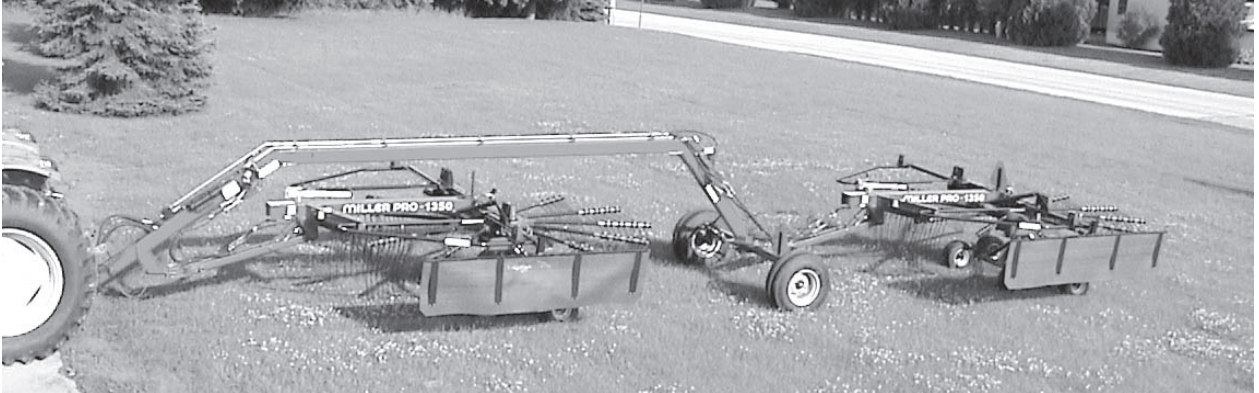
The Delivery and Warranty Registration Card found in the front of this manual must be completed and signed to validate your warranty protection. You must read and understand the places where you attest to having received instructions as to care, adjustments, safe operation and applicable warranty policy. The terms and conditions of the warranty are specified on the rear cover of this manual.



WARNING

SOME PHOTOGRAPHS USED HEREIN MAY SHOW DOORS, GUARDS AND SHIELDS OPENED OR REMOVED. BE SURE THAT ALL DOORS, GUARDS AND SHIELDS ARE FASTENED IN THEIR PROPER POSITION BEFORE MACHINE IS OPERATED!

OVER ALL MODEL VIEW



Fully assembled 2650L (left discharge)

This page intentionally left blank.

Contents

SAFETY PRECAUTIONS	5
SAFETY DECALS	7
Reflective Decals	10
CONTROLS AND SAFETY EQUIPMENT	12
Operator's Manual Storage	12
Hydraulic Hose and Light Cord Storage	12
Hydraulic Pump and Hitch Jack Storage	13
Adjustable Drawbar	13
Steerable Axle	16
Hydraulic Lift System	16
Hydraulic Drive System	16
Adjustable Cam	17
Swath Screen	17
Transport Lights	17
TRACTOR/RAKE PREPARATION	18
Tractor Set-Up for PTO Pump	18
Pump Attachment Procedure	19
Hydraulic Lift Hook-up	19
Connecting Rake Hydraulics to Swing Frame	20
Connecting Rake Lights to Swing Frame	20
Rake Height/Level Adjustment	21
Swath Screen Adjustments	22
Cam Adjustment	23
TRANSPORTING RAKE	24
Transport Lighting	24
SMV Emblem and Reflectors	24
Safety Chain	24
OPERATION	25
Pre-operation Checklist	25
General	25
Windrow Placement	26
LUBRICATION AND MAINTENANCE	28
Hydraulic Reservoir	28
Gear Box	29
Swing Frame	29
Rake Frame	30
Tires and Wheels	30
General Maintenance	31
Storage	31
RAKE ASSEMBLY	32
OPTIONS AND ACCESSORIES	36
SPECIFICATIONS	36
TROUBLESHOOTING	37
TORQUE SPECIFICATIONS	38

2650 Rotary Rake

PRE-DELIVERY CHECK LIST

After the Rake has been completely set-up, the following inspections **MUST** be made before delivering it to the customer. Check off each item after prescribed action is taken.

- ☐ NO parts of the unit have been damaged in shipment. Check for such things as dents and loose or missing parts; correct or replace components as required.
- ☐ All bolts and fasteners are in place and tightly secured.
- ☐ As applicable, the Cylinders, Hoses and Fittings are NOT damaged, leaking or loosely connected.
- ☐ Swing frame is filled to proper oil level; All Grease Fittings have been properly lubricated; see Lubrication chapter of this manual.
- ☐ Cam adjusters operate freely and are positioned correctly.
- ☐ Wheels are properly mounted and securely attached and Tires are properly mounted and inflated to the appropriate pressure.
- ☐ All Guards, Shields and Decals are in place and securely attached.
- ☐ Model and Serial Numbers for this unit are recorded in space provided on this page and inside the front cover.

Hook the rake to the appropriate (540) RPM tractor and test run it while checking that proper operation is exhibited by all components.

DO NOT OPERATE WITH GUARDS FOLDED UP.

Check that:

- ☐ Transport lights operate properly.
- ☐ All Drives and Mechanisms are operating smoothly and properly adjusted.
- ☐ Hydraulic lift system operates properly.

I acknowledge that pre-delivery service was performed on this unit as outlined.

Dealership's Name

Dealer Representative's Name

Date Checklist Filled Out

Model Number Frame Serial Number

Rake # 1 S/N _____

Rake # 2 S/N _____

DELIVERY CHECK LIST

The following check list is an important reminder of valuable information that **MUST** be passed on to the customer at the time the unit is delivered. Check off each item as you explain it to the customer.

- ☐ Give the customer their Operator's Manual. Instruct them to be sure to read and completely understand its contents **BEFORE** attempting to operate the unit.
- ☐ Explain the warranty.
- ☐ Direct customer on how to use the Table of Contents of this manual as a quick page number locating guide.
- ☐ Explain and review with customer the Safety information in this manual.
- ☐ Explain and review with customer the Controls and Safety Equipment chapter of this manual.
- ☐ Explain that regular lubrication and proper adjustments are required for continued proper operation and long life. Review with the customer the Lubrication and Maintenance chapters of this manual.
- ☐ Completely fill out Owner's Registrations for the swing frame **AND** for each rake, including customer's signature, and return them to the Company. (The cards for each rake can be found in the Operator's Manual supplied with each rake.)

I acknowledge that above points were reviewed with me at the time of delivery.

Customer's Signature

Date Delivered

(Customer Copy)

2650 Rotary Rake

PRE-DELIVERY CHECK LIST

After the Rake has been completely set-up, the following inspections **MUST** be made before delivering it to the customer. Check off each item after prescribed action is taken.

- ☐ NO parts of the unit have been damaged in shipment. Check for such things as dents and loose or missing parts; correct or replace components as required.
- ☐ All bolts and fasteners are in place and tightly secured.
- ☐ As applicable, the Cylinders, Hoses and Fittings are NOT damaged, leaking or loosely connected.
- ☐ Swing frame is filled to proper oil level; All Grease Fittings have been properly lubricated; see Lubrication chapter of this manual.
- ☐ Cam adjusters operate freely and are positioned correctly.
- ☐ Wheels are properly mounted and securely attached and Tires are properly mounted and inflated to the appropriate pressure.
- ☐ All Guards, Shields and Decals are in place and securely attached.
- ☐ Model and Serial Numbers for this unit are recorded in space provided on this page and inside the front cover.

Hook the rake to the appropriate (540) RPM tractor and test run it while checking that proper operation is exhibited by all components.

DO NOT OPERATE WITH GUARDS FOLDED UP.

Check that:

- ☐ Transport lights operate properly.
- ☐ All Drives and Mechanisms are operating smoothly and properly adjusted.
- ☐ Hydraulic lift system operates properly.

I acknowledge that pre-delivery service was performed on this unit as outlined.

Dealership's Name

Dealer Representative's Name

Date Checklist Filled Out

Model Number

Frame Serial Number

Rake # 1 S/N _____

Rake # 2 S/N _____

DELIVERY CHECK LIST

The following check list is an important reminder of valuable information that **MUST** be passed on to the customer at the time the unit is delivered. Check off each item as you explain it to the customer.

- ☐ Give the customer their Operator's Manual. Instruct them to be sure to read and completely understand its contents **BEFORE** attempting to operate the unit.
- ☐ Explain the warranty.
- ☐ Direct customer on how to use the Table of Contents of this manual as a quick page number locating guide.
- ☐ Explain and review with customer the Safety information in this manual.
- ☐ Explain and review with customer the Controls and Safety Equipment chapter of this manual.
- ☐ Explain that regular lubrication and proper adjustments are required for continued proper operation and long life. Review with the customer the Lubrication and Maintenance chapters of this manual.
- ☐ Completely fill out Owner's Registrations for the swing frame **AND** for each rake, including customer's signature, and return them to the Company. (The cards for each rake can be found in the Operator's Manual supplied with each rake).

I acknowledge that above points were reviewed with me at the time of delivery.

Customer's Signature

Date Delivered

(Dealer Copy)

Safety Precautions



This symbol is used to call your attention to instructions concerning your personal safety. Be sure to observe and follow these instructions. Take time to be careful!



DANGER

“DANGER” indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

“WARNING” indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

“CAUTION” indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also alert against unsafe practices.

BEFORE you attempt to operate this machine, read and study the following safety information. In addition, **MAKE SURE** that every individual who operates or works with this equipment, whether family member or employee, is familiar with these safety precautions. Miller-St. Nazianz provides guards for exposed moving parts for the operator’s protection; however, some areas cannot be guarded or shielded in order to assure proper operation. The **OPERATOR’S MANUAL AND DECALS** on the machine itself warn you of dangers and **SHOULD BE READ AND OBSERVED CLOSELY**.

POWER SOURCE SHUTDOWN PROCEDURE

Before cleaning, unclogging, adjusting, lubricating or servicing this machine:

1. Disengage the tractor PTO.
2. Deactivate tractor hydraulic controls.
3. Shut off the tractor engine, remove the starter key and take it with you.
4. Wait for all machine motion to stop.
5. Remove the PTO Driven Pump and ALL power connections from the tractor.

Failure to follow these precautions could result in death or serious injury.



SAFETY PRECAUTIONS, continued

Some photographs used herein may show doors, guards and shields opened or removed. **BE SURE** that all doors, guards and shields are fastened in their proper position before machine is operated.

Know how to stop rake operation **BEFORE** starting it.

BE ALERT for people and/or animals in front of or around machine, when about to start machine.

KEEP hands, feet and clothing away from tine arms and PTO when they are moving!

DO NOT wear loose or baggy clothing when operating this unit!

DO NOT allow people other than a qualified operator near the unit!

DO NOT allow minors to be near the machine unless properly supervised.

KEEP riders off rake.

DO NOT unclog, adjust, lubricate or service your rake until you disengage the tractor PTO and shut off the tractor engine. Failure to follow this procedure may result in serious bodily injury!

AVOID high pressure fluids. Escaping fluid under pressure can penetrate skin causing serious injury.

DO NOT exceed a maximum towing speed of 20 MPH (32 KPH) while transporting the rake.

REDUCE speed on rough or hilly ground.

BE EXTRA careful when going through fence gates or nearing confined quarters.

ALWAYS follow state and local regulations regarding use of a safety chain, slow moving vehicle signs and transport lighting, when towing farm equipment on public highways.

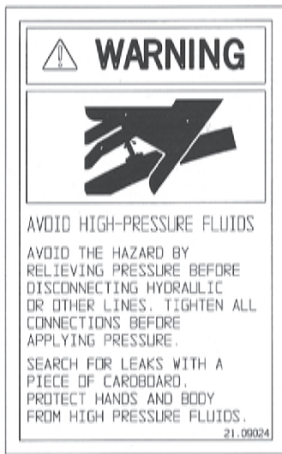
ALWAYS engage the tractor parking brake before dismounting.

BE SURE the hitchjack locking pin is completely engaged and that the machine is properly blocked and prevented from rolling **BEFORE** disconnecting the rake from the tractor.

Safety Decals

THE DECALS ARE FOR YOUR PROTECTION. IF YOUR SAFETY DECALS ARE NOT READABLE OR ARE MISSING, CONTACT YOUR DEALER FOR REPLACEMENTS.

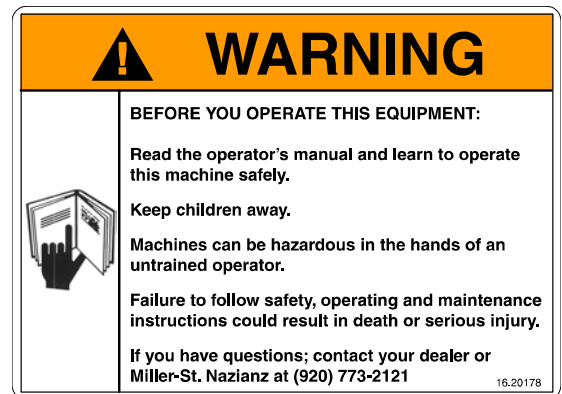
907220
Yellow Reflectors
(Both sides)



21.09024



17.01155



16.20178

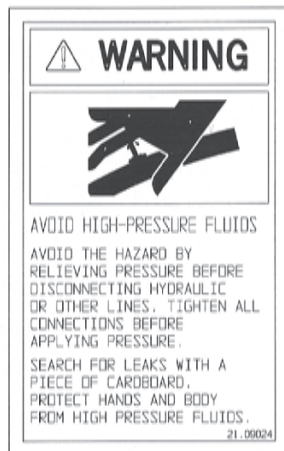
Safety Decals (continued)



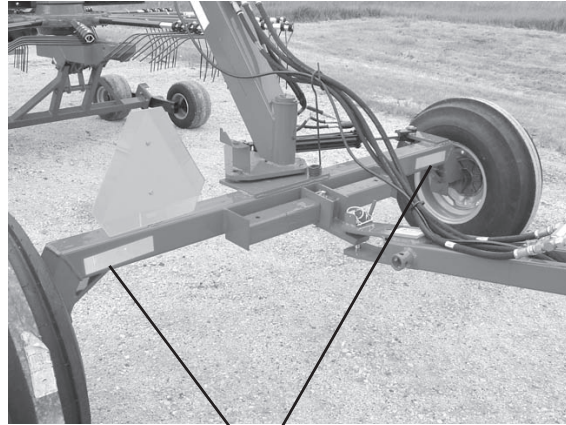
17.00421 Caution (both sides)



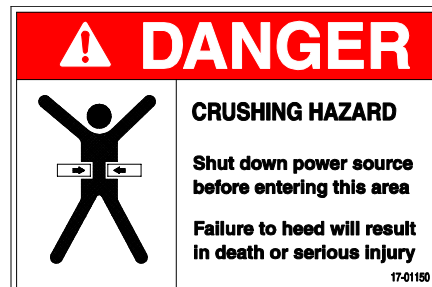
**907220
Yellow Reflector
(both sides)**



21.09024

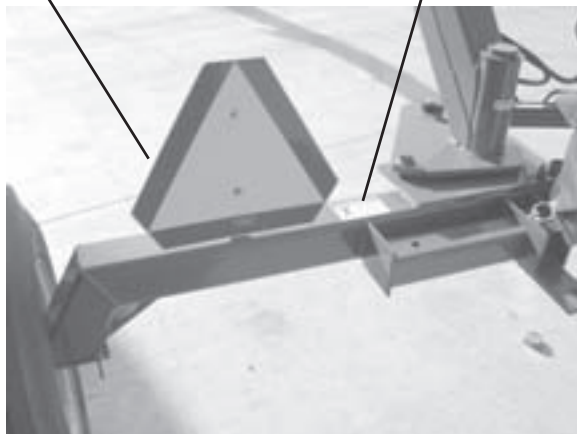


**907219
Red Reflector**



17.01150

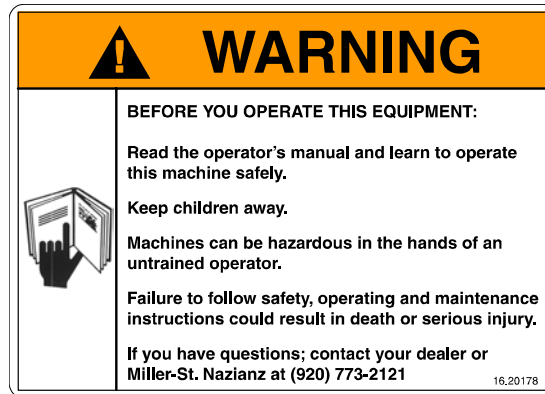
907224 SMV Emblem



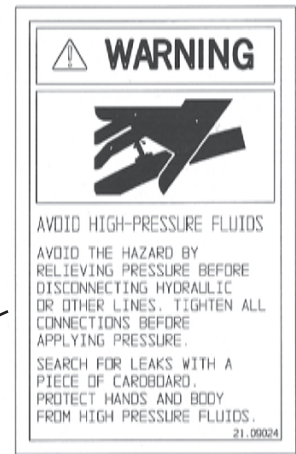
! Safety Decals (continued)



16.20177



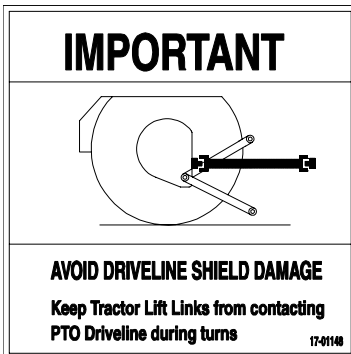
16.20178



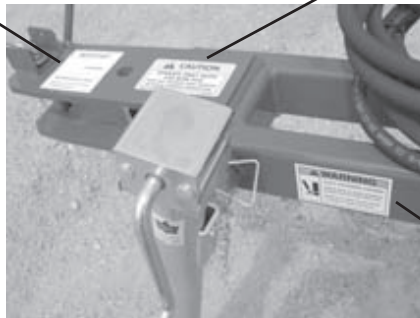
21.09024



340248B1

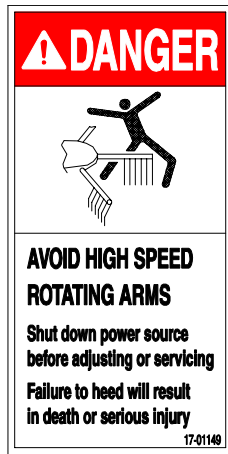


17.01148



17.01155

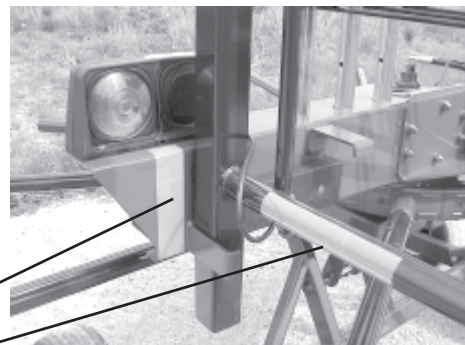
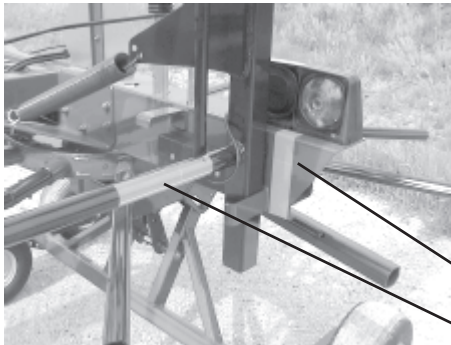
Safety Decals (continued)



17.01149



Reflective Decals

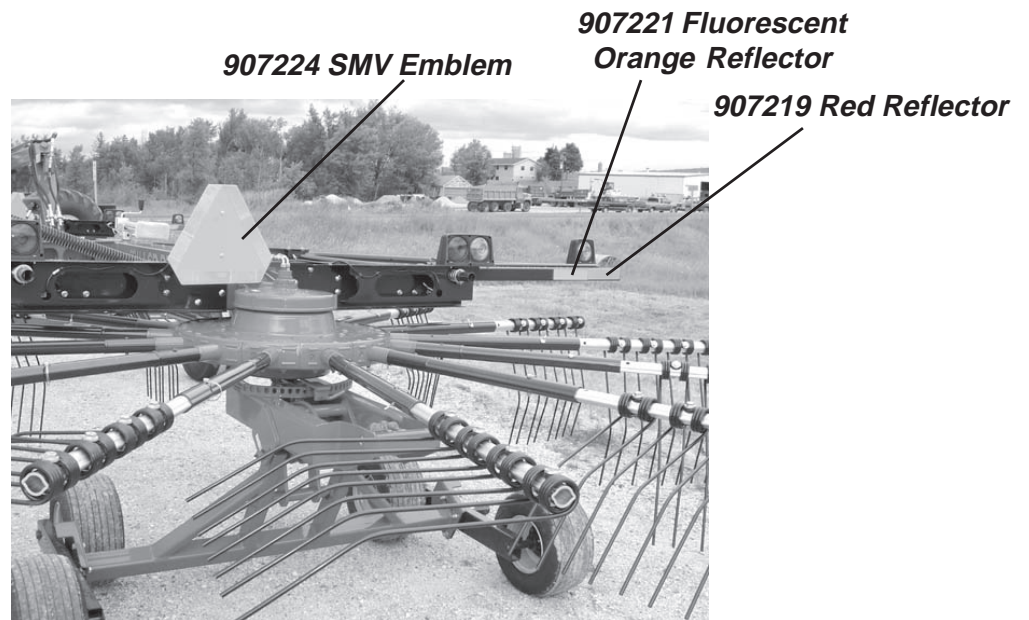


907220 Yellow Reflector

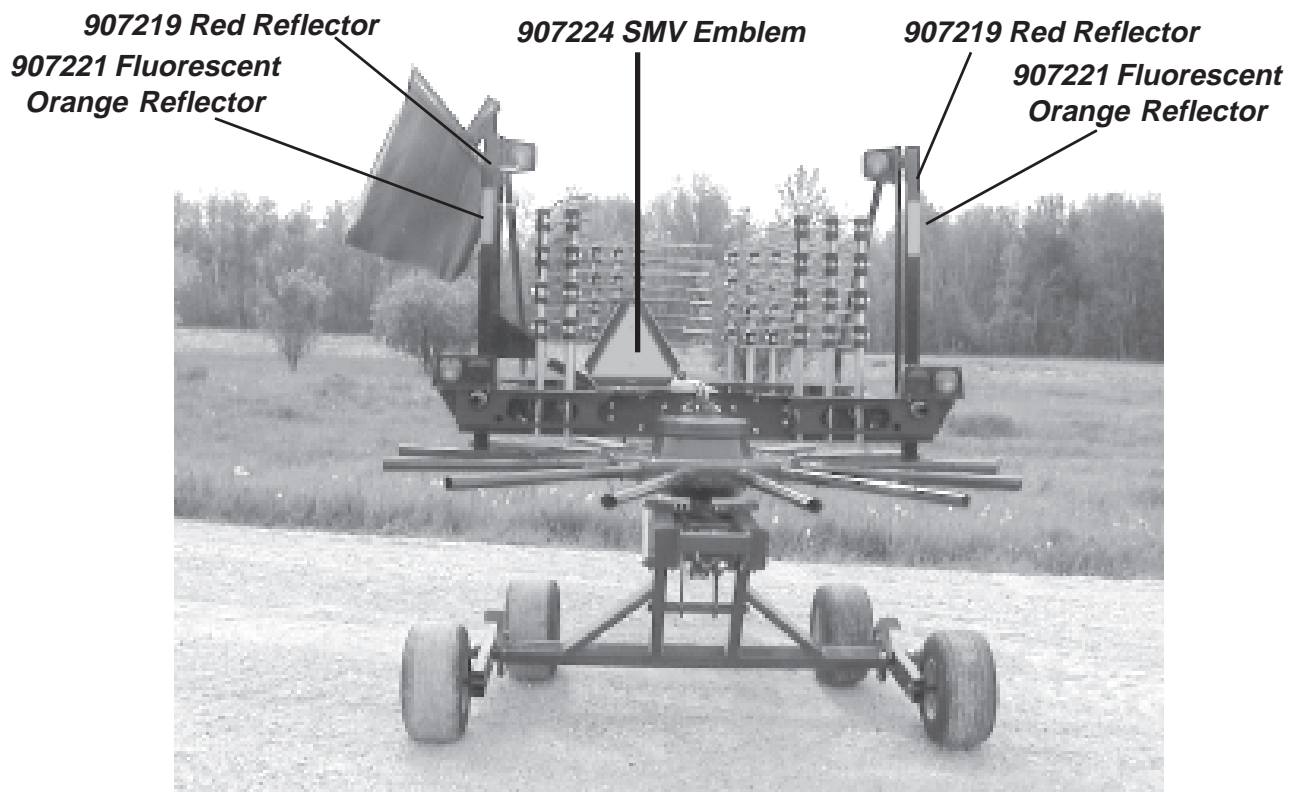


Safety Decals (continued)

Reflective Decals



Rake shown in working configuration



Rake shown in transport configuration (when transported as single rake only)

Controls And Safety Equipment



CAUTION

Become familiar with and know how to use all **SAFETY DEVICES** and controls **BEFORE** attempting to operate this equipment. Know how to stop the unit **BEFORE** starting it!



WARNING

DO NOT operate this equipment unless **ALL** shields and guards are properly secured in place!

DO NOT lubricate, adjust and/or service unless **POWER SOURCE SHUT DOWN PROCEDURE** (page 5) has been exercised.

Wherever possible and without affecting machine operation, shields and guards have been used on this machine to protect potentially hazardous areas. In many places, decals are also provided to warn of potential dangers as well as to display special operating procedures.

Operator's Manual Storage

The Operator's Manual for the Twin Rake should be stored in the weatherproof canister attached to the swing frame. The Operator's Manual for each rake should be kept with the rake.

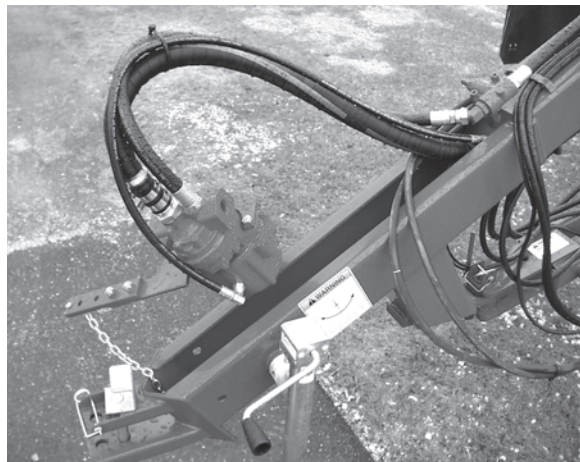


Hydraulic Hose and Light Cord Storage

Storage locations are provided for the light cord and hydraulic hoses. They are for storage only. When transporting rake, couple cord and hoses to tractor and swing frame.

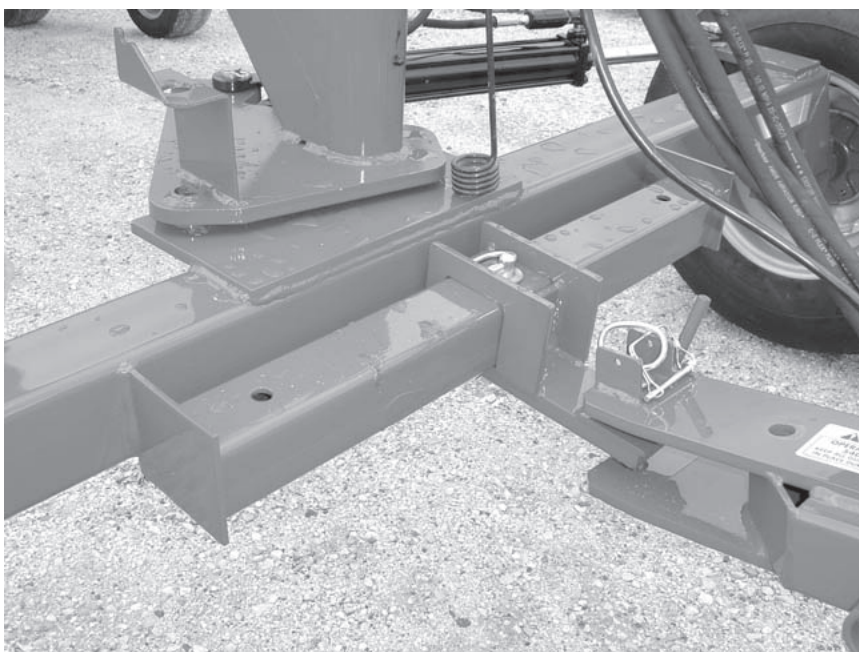
Hydraulic Pump and Hitch Jack Storage

Storage locations are provided for the PTO pump and the hitch jack. The pump storage pin is for storage only. When transporting the twin rake (or swing frame), install pump onto tractor PTO or fasten securely to swing frame.



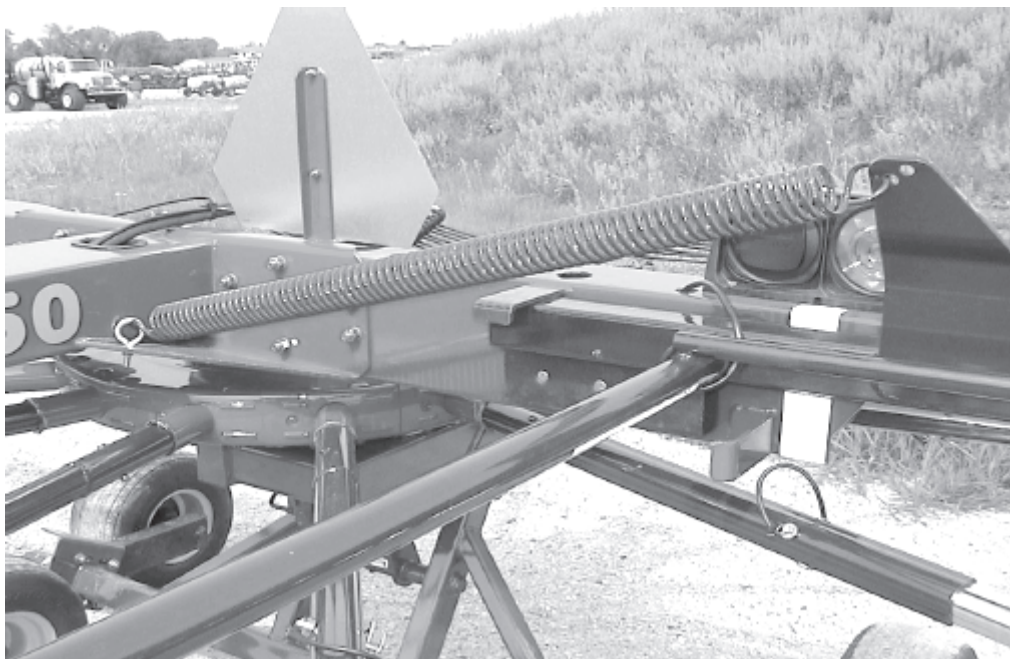
Adjustable Drawbar

The rear drawbar on the swing frame can be repositioned to the left or right to keep the swing frame tires off the windrow.

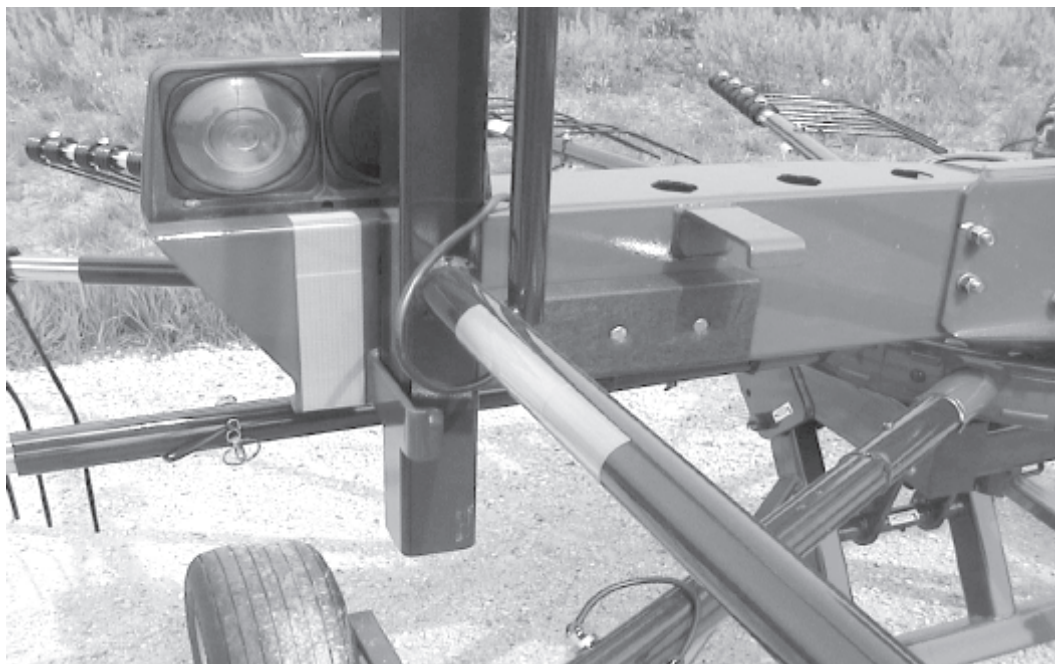




Guard in transport position (Delivery Side). Left Hand Delivery rake shown.
Pull guard forward and down to unfold guard to field position.
DO NOT operate rake in this position.



Guard in field position (Delivery Side). Left Hand Delivery rake shown.
Pull guard forward and lift to fold guard to transport position.



Guard in transport position (Non Delivery Side). Left Hand Delivery rake shown.
Pull guard forward and down to unfold guard to field position.
DO NOT operate rake in this position.

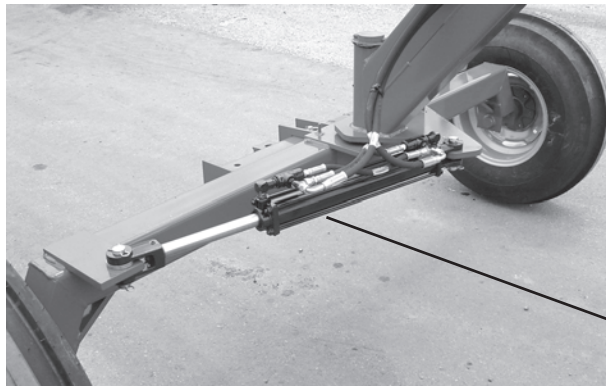


Guard in field position (Non Delivery Side). Left Hand Delivery rake shown.
Pull guard forward and lift to fold guard to transport position.

Steerable Axle

The hydraulically steered axle on the swing frame is used to position the rear rake during operation. It is also used to control the rear rake while backing.

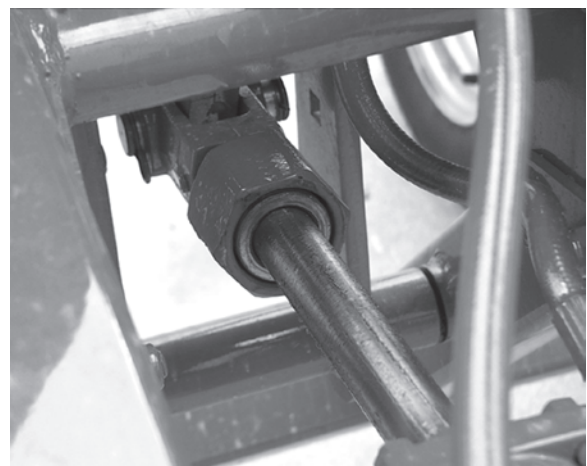
Note: For transporting the swing frame, place the steerable axle with the wheels in a straight forward position. The load holding check valves on the rod and base end of the cylinder trap the oil in the cylinder and hold the wheels in a straight forward position for transport. These load holding check valves eliminate the need for a mechanical locking device for transport.



Steer Cylinder

Hydraulic Lift System

The hydraulic lift system consists of two 2-way hydraulic cylinders on each rake operated by one tractor remote hydraulic valve. Both cylinders are equipped with adjustable stops which are used to control the working height and to level the rake front to rear. The cylinders work together to keep the rake level while raising and lowering the rake.

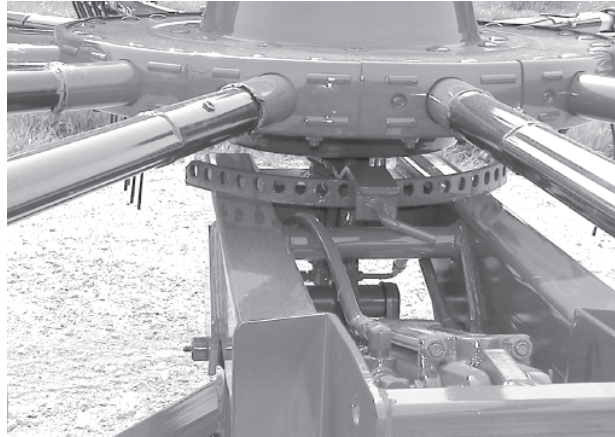


Hydraulic Drive System

The drive system consists of a PTO driven gear pump, a relief valve, a flow divider valve, a hydraulic motor and check valve at each rake, and a return line oil filter. (The check valves act as overrunning clutches to protect the drive system). The operating speed of the rakes is controlled by the tractor PTO speed.

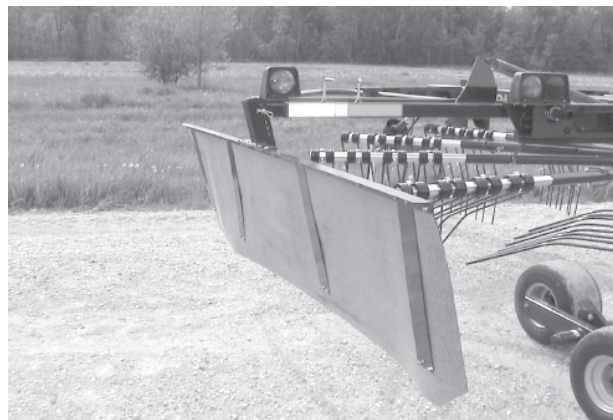
Adjustable Cam

The cam in the 1350 Rotary Rake gearbox can be adjusted for optimal raking performance and windrow creation. Moving the cam lever left or right rotates the cam inside the enclosed gearbox. Rotating the cam will move the point where the tines release the gathered crop. (It moves the point where the tines begin to lift).



Swath Screen

The swath screen acts as a "back stop" for the windrow. Adjusting the swath screen outward will create wider windrows and adjusting it inward will create narrower (and taller) windrows. The swath screen can also be adjusted forward if the raked crop is being thrown in front of the swath screen. (This can occur when rotor speed is high and ground speed is low).



Transport Lights

Transport lights, for use when towing rake on public highways, are standard on all Model 1350 and 2650 Rotary Rakes.



Tractor/Rake Preparation



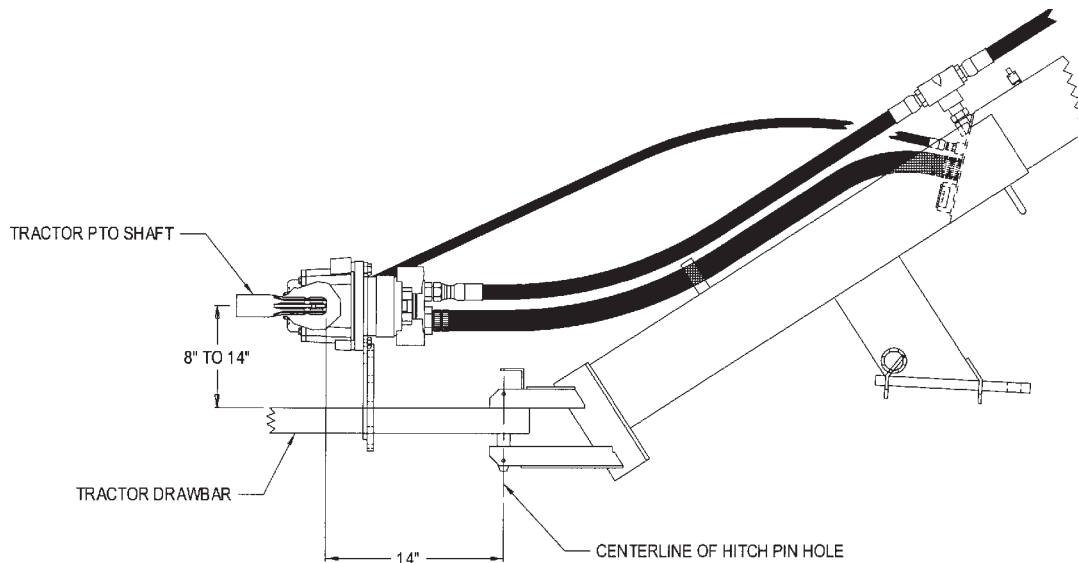
CAUTION

Use **ONLY** a 540 RPM tractor PTO shaft.
DO NOT use a 1000 RPM tractor PTO shaft!

Tractor Set-Up for PTO Pump

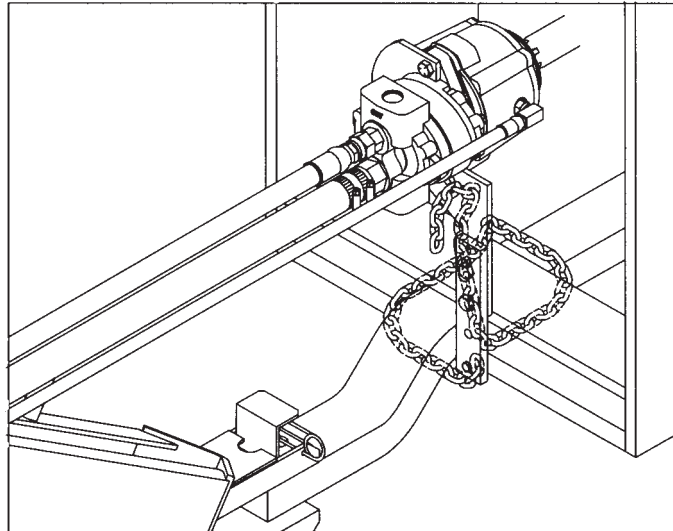
The following tractor hookup provisions should be made:

- The hitch point of the tractor drawbar should be 14" behind the end of the PTO shaft.
- The hitch point of the tractor drawbar should be set at least 8" but no more than 14" below the tractor PTO shaft.
- The hitch point of the tractor drawbar should be at least 13" but no more than 22" above the ground.
- Looking from the rear of the tractor, the tractor drawbar should be in line with the tractor PTO shaft (centered).



Pump Attachment Procedure

Slide the hydraulic pump onto the PTO shaft of the tractor. Adjust the torque arm so that it rests on the right side of the tractor drawbar. Route the pump retainer chain under the drawbar and along the left side of the drawbar through the drawbar support. Pass the chain above or below the drawbar to the right side of the drawbar and pass the chain rearward along the right side of the drawbar, through the drawbar support, to the keyhole in the torque arm.



Hydraulic Lift Hook-up

Connect the two hoses for the steering cylinder and the two hoses for the hydraulic lift system to the appropriate remote hydraulic valves on the tractor. Lift hoses are identified with yellow and green to match rake hoses. See tractor Operator's Manual for recommended circuit hook-up.

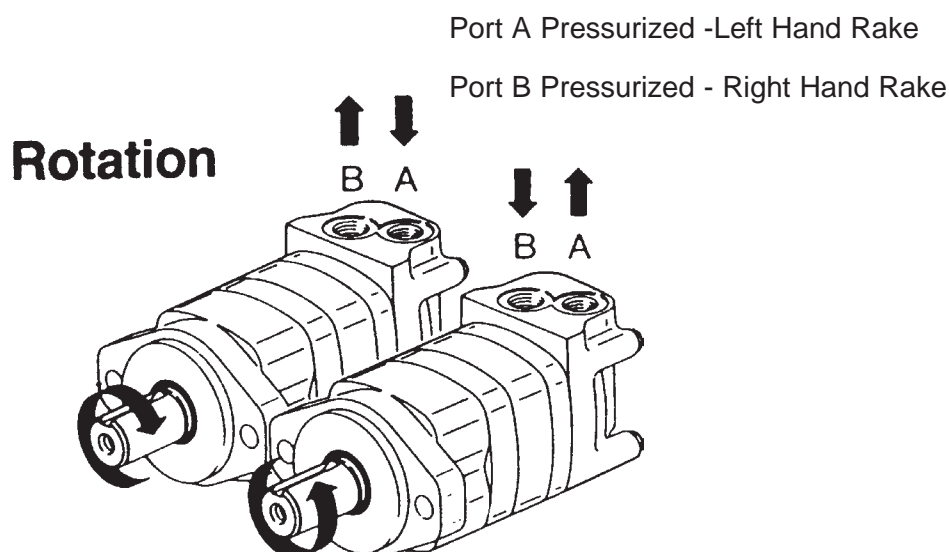
IMPORTANT: If the hydraulic lift system has not been charged with oil, charge the system with oil **BEFORE** removing the cylinder locking channels used for shipping purposes.



Connecting Rake Hydraulics to Swing Frame

Hydraulic hoses on the rakes and swing frame have colored plastic ties installed near the couplers. Connect hoses together according to the colored ties: red to red, blue to blue, yellow to yellow, green to green.

- Red Tie Return line for hydraulic drive
- Blue Tie Pressure line for hydraulic drive
- Yellow Tie Lift line (pressurize to raise rakes)
- Green Tie Lower line (pressurize to lower rakes)



Connecting Rake Lights to Swing Frame

Electrical sockets are provided on the swing frame to attach light harnesses for both rakes.

Rake Height/Level Adjustment

Working height and leveling the rake is controlled by the adjustable stops on the two hydraulic lift cylinders on each rake.

To adjust (Adjust rakes separately; disconnect hoses on one rake while adjusting the other):

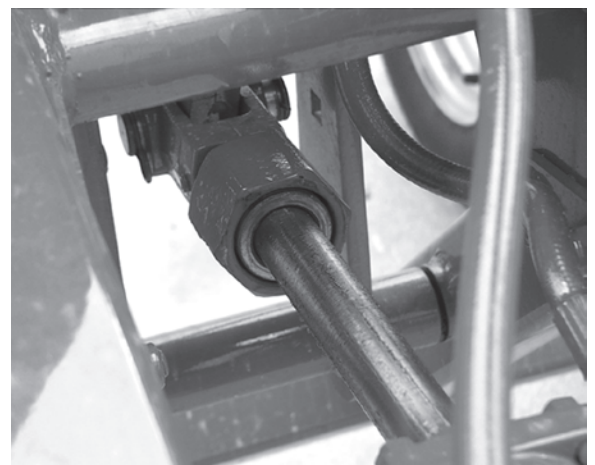


WARNING

DO NOT perform any adjustments on this machine unless POWER SOURCE SHUT DOWN PROCEDURE (page 5) has been exercised.

1. Lower rake until tines on far left and right sides of the rake are just touching the top of the crop stubble.
2. Turn the large nut on the rear hydraulic cylinder until it is tight against the cylinder body.
3. Turn the large nut on the front hydraulic cylinder to adjust rake to be level with ground.
 - a. If front of rake is low, operate tractor hydraulics slowly to raise front of rake until rake is level. Turn nut on front cylinder against cylinder body.
 - b. If front of rake is high, turn nut away from cylinder body, operate tractor hydraulics slowly to lower front of rake until rake is level. Turn nut against cylinder body.

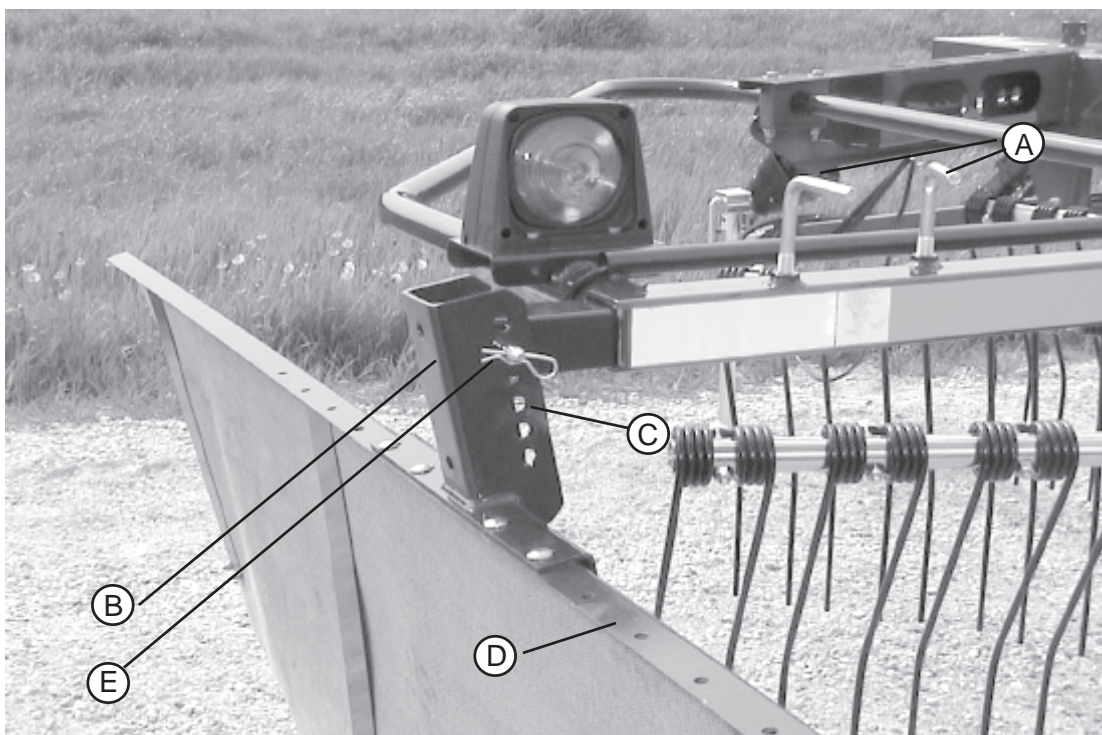
NOTE: Setting the working height near the top of the crop stubble will ensure optimum rake performance and highest quality crop. Some crops, however, will require a much lower working height to gather the windrow completely. Note that operating the rake with the tines continuously digging in the ground will reduce tine life, reduce gearbox life, reduce crop quality, and increase the potential for stones in the windrow.



Swath Screen Adjustments

There are three adjustments that can be made on the swath screen.

1. Width - Adjusting the swath screen inward or outward controls the width of the windrow. Lock the swath screen in the desired location by tightening the threaded pins (A).
2. Height - Adjust the height of the swath screen by aligning a different hole in the swath screen support (B) with the hole in the adjuster tube (C). With the rake in operating position the bottom of the swath screen should just touch the top of the crop stubble.
3. For/Aft Adjustment - Some crop conditions may require the swath screen to be moved forward or rearward. This is accomplished by relocating the swath screen support (B) on the swath screen angle (D). If the swath screen is adjusted more than 3 inches for or aft, replace the swath screen pin (E) with a 1/2" x 3" bolt and locknut to tighten swath screen support onto adjuster tube. This will reduce swath screen bouncing.



Cam Adjustment

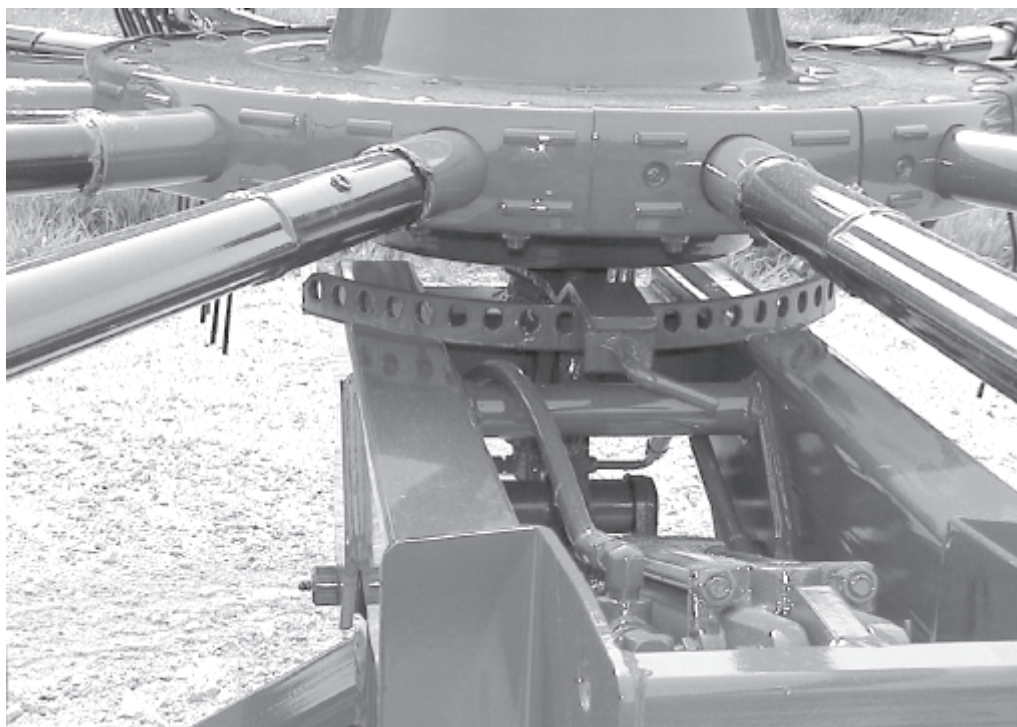
The best cam setting will be determined by crop type, crop density, and swath width. Normally, in short, light crops, the cam should be moved to the right (moved to the left on right hand rakes) causing the tines to release the crop later. This will create a neater windrow without "tails" along the inside edge. In long, heavy crops, the cam lever should be moved to the left (right on right hand rakes) causing the tines to release the crop earlier. This will create a wider, fluffier windrow for better drying. Adjusting the cam also affects the width of crop actually lifted off the ground. Moving the cam lever to the right (releasing the crop later) will increase the width of crop being lifted and the distance the crop is moved to the side.

To adjust the cam, pull out on the spring-loaded cam lever pin and rotate the cam lever to the left or right. Start with the cam lever centered (for most conditions). Move the lever one hole at a time until the optimal setting has been reached. Be sure the pin is locked into one of the holes after adjusting.



WARNING

DO NOT perform any adjustments on this machine unless **POWER SOURCE SHUT DOWN PROCEDURE** (page 5) has been exercised.



Transporting Rake

Transport Lighting

Model 1350 and 2650 Rotary Rakes are equipped with transport lighting for transporting the unit on public highways. The light cords on the rakes and swing frame have standard seven prong plugs. The light cords on both rakes should be plugged into the receptacles provided on the swing frame. The plug on the swing frame should be plugged into the tractor. Contact your tractor dealer if your tractor does not have the appropriate receptacle.

SMV Emblem and Reflectors

Rakes and swing frame are also provided with reflector strips and slow moving vehicle (SMV) emblems. Unless prohibited, always use a SMV emblem.

Safety Chain (Order Part Number 329946B91)

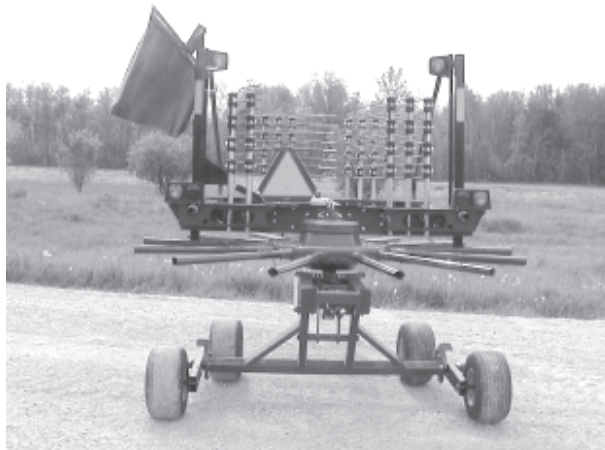
Rakes and swing frame can be equipped with safety chains for travel on public highways. Contact your dealer to order the appropriate size chains. When attaching chains, be sure to allow enough slack for turning.

IMPORTANT: Never exceed a maximum towing speed of 20 MPH (32 KMH). Reduce speed when turning or traveling on rough or hilly terrain.

IMPORTANT: Before leaving the field:

1. Raise the rakes to the transport position by using the tractor hydraulics to fully extend the lift cylinders. **Note:** As the lift mechanism moves from the working position through the over center feature to the transport position it will lower the rake slightly after the rake reaches the peak height.
2. Slide the swath screen assemblies completely into the guard tube and tighten the threaded pins.

Note: The rear rake can be folded into the transport position and the tine shafts can be put into the storage holders. ***This can only be done on the rear rake.***



Operation



CAUTION

BEFORE operating the rake, review and understand the Safety Precautions section and the Controls and Safety Equipment section of this manual.

The Operator must become familiar with the tractor remote control levers that control the steering cylinder and the lift cylinder on the rakes. The Operator must BE AWARE of what happens when these control levers are activated and how it affects the machine position when the tractor moves forward. BE CAREFUL when operating Tractor Remote Controls.

Pre-operation Checklist

Make sure:

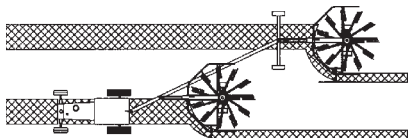
- All guards are in place.
- There are no bystanders around rake .
- All connections are properly made between rakes and swing frame and between swing frame and tractor.
- Tractor 3-point arms are positioned to avoid contact with the swing frame.
- Hydraulic hoses are not hanging where the rear tractor tire could catch them during turns.

General

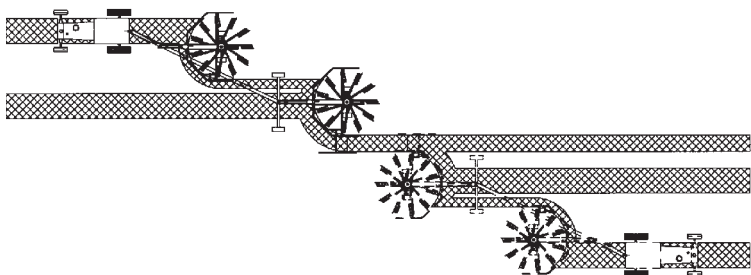
- The tractor PTO on-off lever controls the PTO driven pump and each rake gearbox. Increasing tractor engine speed will increase each rake rotor's RPM's.
- Do not over speed hydraulic pump. Continuously overspeeding pump will cause excessive wear on pump components.
- Ground speed and rake RPM should be selected to move the crop with minimal losses. Ground speed may need to be reduced significantly in areas where the crop is denser or higher in moisture content.
- For ease of operation, turn away from side that the rear rake is on. For example: If the rear rake is swung over to the right, turn to the left.
- When mowing fields, mow an adequate number of end rows for turning the twin rake.
- It is usually better to rake the outside rounds and end rows of a field last.
- If the swing frame tires are tramping windrows, adjust the rear rake drawbar to a different position on the axle frame.
- When backing rake, steer the front rake with the tractor and steer the rear rake with the swing frame steerable axle.

Windrow Placement

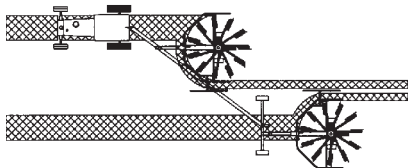
The twin rake can be used to create single windrows or to combine two or more windrows. The size and shape of the windrow(s) is controlled by the ground speed, the PTO speed, the cam setting and the swath screen setting. Several windrow placements are possible with each model (L,R, or C). Crop density, swath width, mower width, and baler or forage harvester pickup width will determine which placement to use.



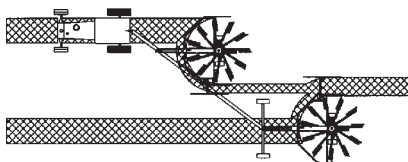
Raking two windrows to the left with rakes to right side of tractor. (2650L)



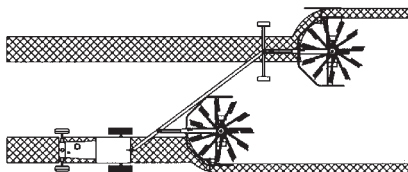
Raking four (or five) windrows into one windrow with rakes to left side of tractor. (2 passes required, 2650L)



Rakes two windrows inward with rakes to left side of tractor. (2650C)



Raking two windrows into one center windrow with rakes to left side of tractor. (2650C)

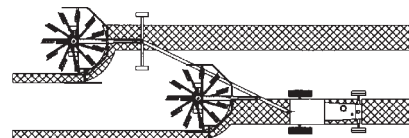


Raking two windrows outward with rakes to right side of tractor. (2650C)

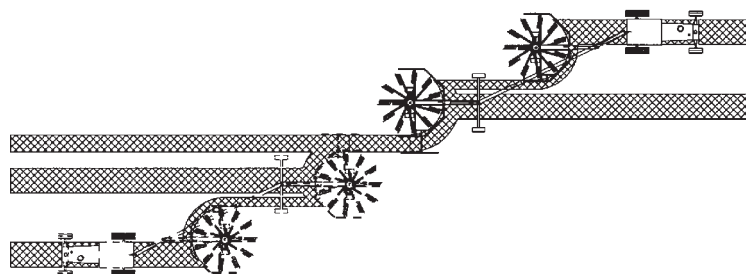
Note: Front and rear rakes can be switched if you prefer the rakes to be on the opposite side of the tractor. (2650C)

Windrow Placement, continued

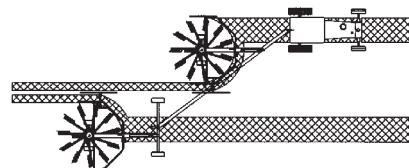
Raking two windrows to the right with rakes to left side of tractor (2650R).



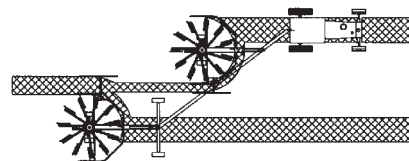
Rakes four (or five) windrows into one windrow with rakes to right side of tractor. (2 passes required, 2650R)



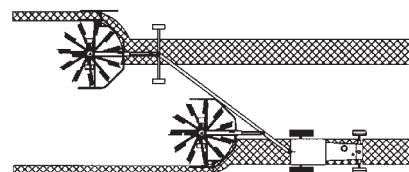
Raking two windrows inward with rakes to right side of tractor (2650C).



Raking two windrows into one center windrow with rakes to right side of tractor (2650C).



Raking two windrows outward with rakes to left side of tractor (2650C).



Note: Front and rear rakes can be switched if you prefer the rakes to be on the opposite side of the tractor. (2650C)

Lubrication And Maintenance



WARNING

NEVER attempt to service the rake unless the POWER SOURCE SHUT DOWN PROCEDURE (page 5) has been exercised.

Hydraulic Reservoir

- Change oil filter after first 20 hours of operation and annually thereafter.
(Order Part # 17.00392 from your Miller Pro Dealer)



CAUTION

Always check the hydraulic reservoir oil level when the machine is cold. Operating the machine causes the oil temperature to increase which pressurizes the reservoir. This pressure can cause oil to spray out of the filler cap if removed.

- Maintain the hydraulic reservoir oil level between the add and full marks on the dipstick (Be sure to never overfill). The level should be checked with the rake parked on a level surface and the front hitch approximately 18" above the ground. Use Amoco 1000 or compatible hydraulic oil.
- Drain Interval: Annually
- Fill Level: Fill to Full mark on dipstick
- Drain Plug: Located at front of frame
- Oil Type: Amoco 1000 or compatible hydraulic oil
- Oil Capacity: Approximately 31 gallons (117.3 L)

*Oil Fill Cap with
Dipstick*



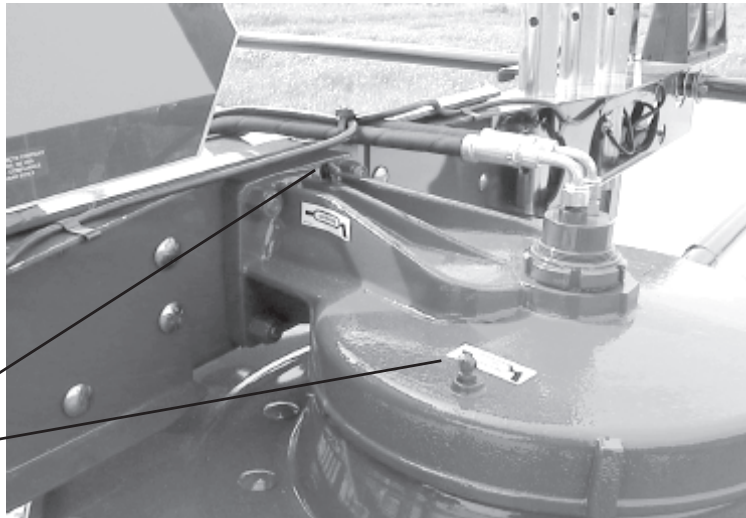
Greasing

- Use a good grade of lithium base grease.
- Wipe dirt from the grease fittings before greasing.
- Replace any missing or damaged fittings.
- Lubricate all fittings daily for the first week of operation.

Gear Box

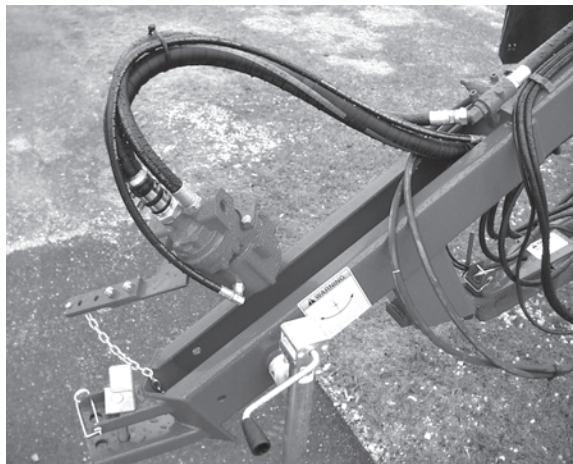
- Every 20 hours lubricate ring gear and pinion bearings

***Gear Box
Lubrication
Points***



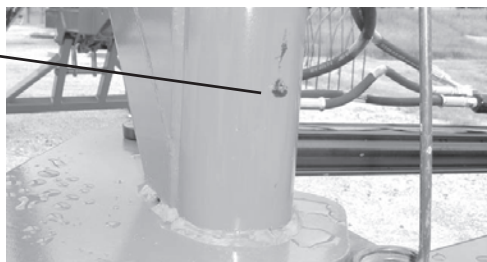
Swing Frame

- Every 20 hours lubricate PTO pump splines.



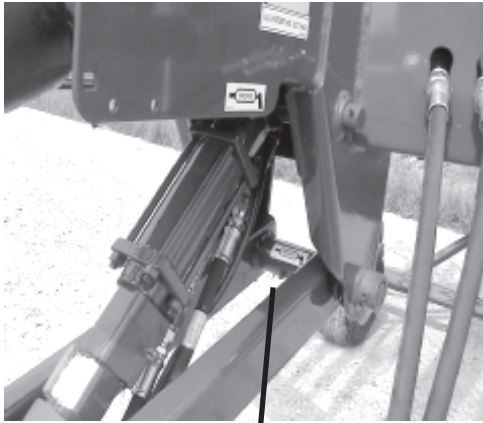
- Every 20 hours lubricate steerable axle pivot.

***Steerable Axle
Lubrication
Point***

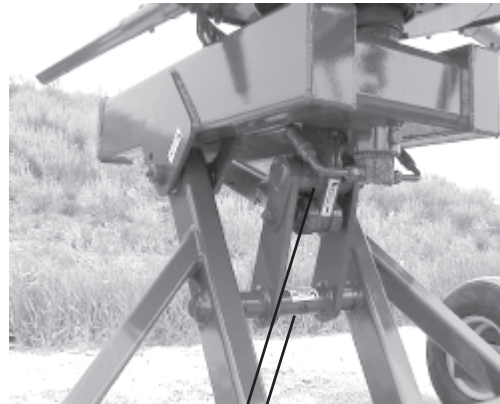


Rake Frame

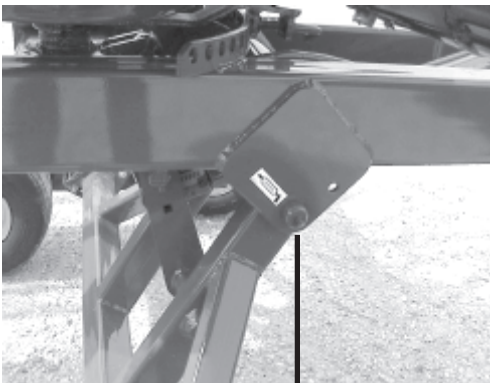
- Lubricate every 20 Hours



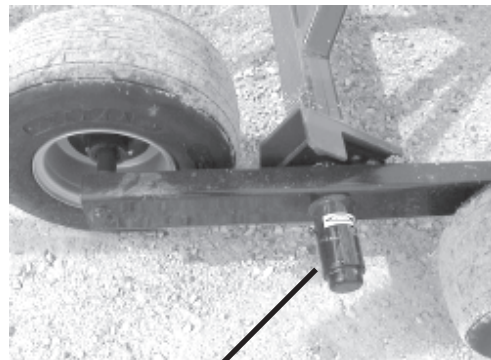
Hitch Pivot



Lift Linkage



Axle Pivot



Tandems

Tires and Wheels

- Clean and repack wheel bearings annually (Rake and Swing Frame).
- Maintain rake tire pressure at 15-20 psi.
- Maintain swing frame tire pressure at 30 psi. max.
- Swing frame tires filled with 150 lbs calcium chloride solution. (Special tire gauge required for pressure checking)
- Tighten wheel lug bolts to 85 ft-lb. (Rake and Swing Frame).

General Maintenance

After the first hour of use check all fasteners and tighten any that are loose. Thereafter, check all fasteners every 20 hours of operation.

- Repair or replace any broken or damaged parts immediately.
- Replace any missing or damaged safety and operating decals.

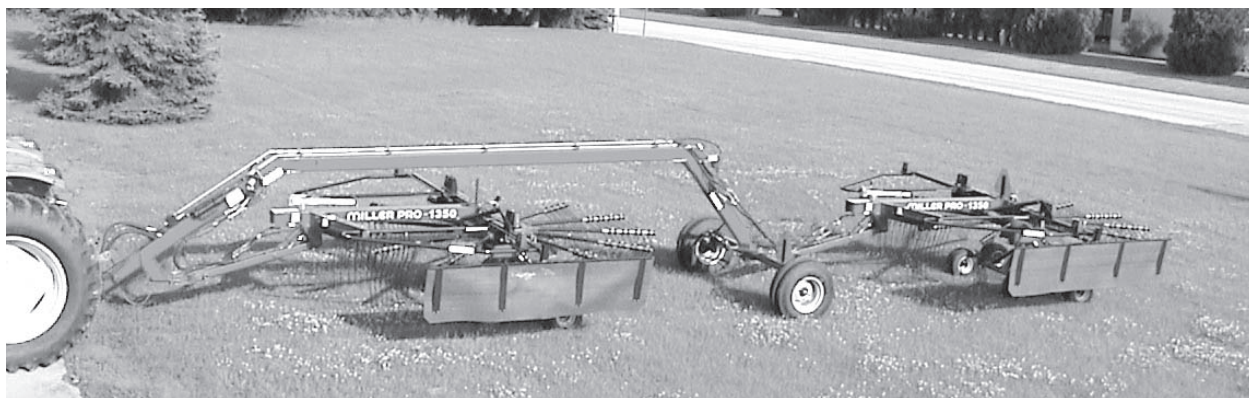
Storage

- Clean the rake of dirt, and plant material.
- Apply a coating of oil or grease to the cylinder rods to prevent rusting.
- Repaint surfaces where paint has worn off.
- Store in the transport position.
- Store in a dry, protected place.

Rake Assembly



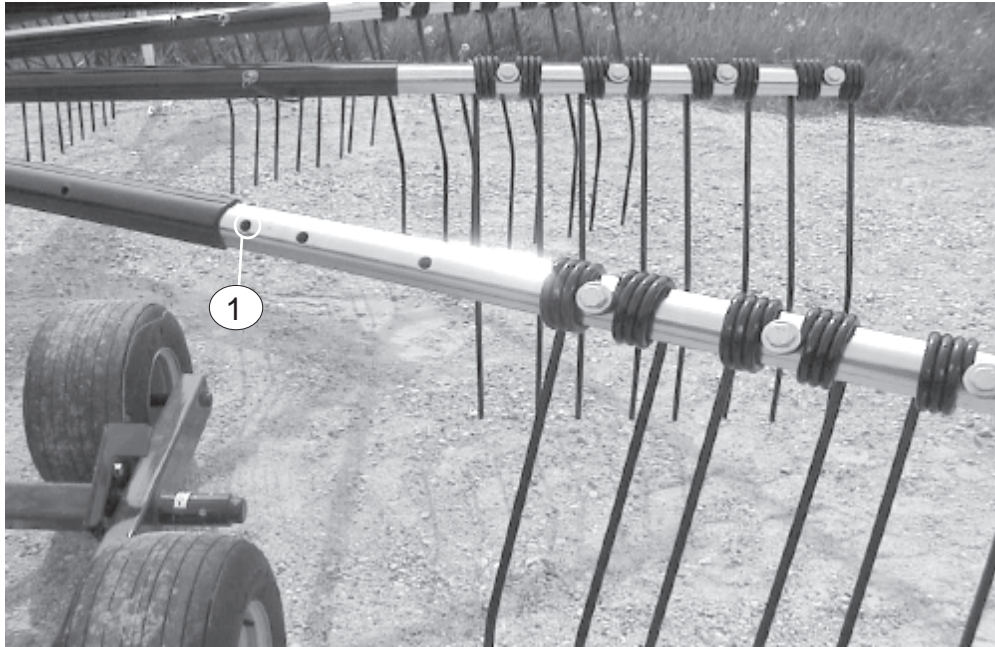
Fully assembled left hand delivery rake.
(right hand delivery rake not shown).



Fully assembled 2650L (left discharge)

Rotary Rakes are shipped in the transport position with the swath screen removed. Be sure to read the assembly instructions to make sure your rake is properly assembled and ready for operation.

Install tine arm assemblies (use hole #1).



Install clip and pin as shown.

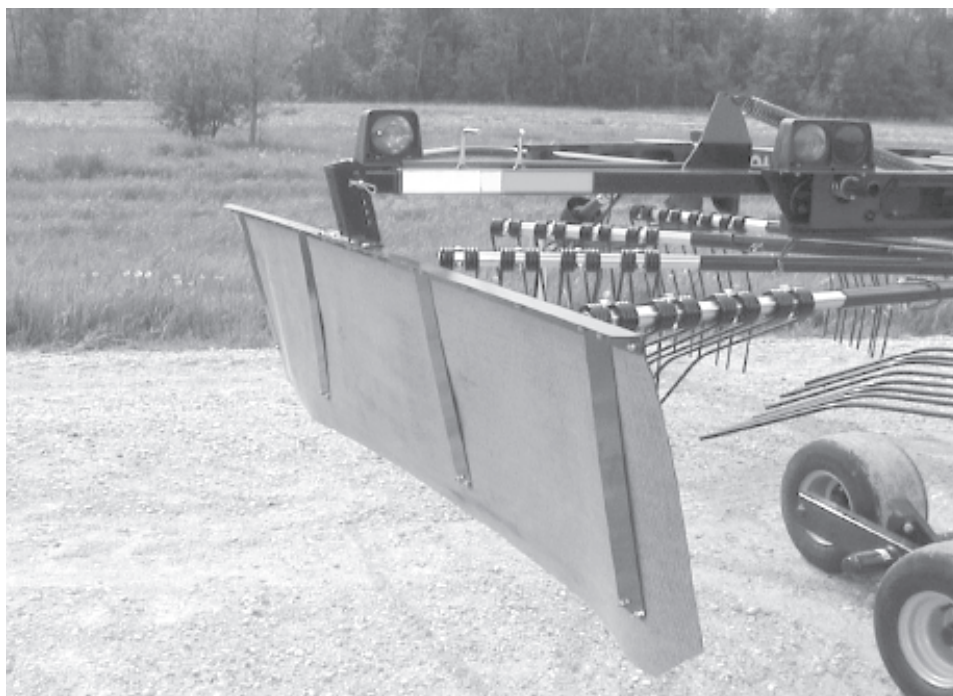


Install swath screen.

Slide the swath screen adjuster into the adjuster base with angle cut on tube as shown. Lock in place with the bent threaded pins.



Fasten the swath screen to the adjuster using the pin and clip provided.



Charge hydraulic system with oil.

Charge the lift system with oil prior to removing cylinder locks used for shipping.

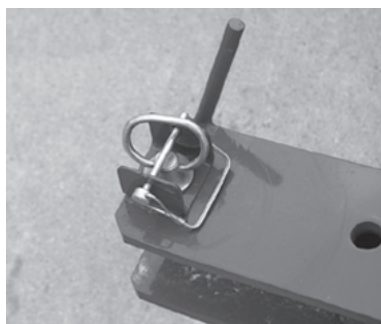


Level Rake (side to side).

Park on level ground. Use tractor hydraulics to lower the rake to the field position. Measure distance from tine tip to ground on left & right side. Jack up one side of the rake & support it. (Place jack under rake axle). Loosen 4 fastening bolts and slide spindle mount half the difference in vertical distance of tine tip to ground between left & right side of rake. Tighten hardware.



Install hitch pin and clip.



The individual rakes can now be assembled to the swing frame. Refer to the "Tractor and Rake Preparation" for assembly instructions.

Options And Accessories

ITEM NO.	DESCRIPTION
17.00979	Tine Saver Kit (52 Total)- 2 kits req'd
17.00945	Tine Saver (single)
17.00908	10 Ply Tire & Wheel Assembly
17.00940	10 Ply Tube & Tire

Specifications

2650 Twin Rotary Rakes		
	2650L (2 Left Hand Rakes) 2650R (2 Right Hand Rakes)	2650C (1Left & 1 Right Hand Rake)
Working Width Per Rotor	15' 6" per rotor creating two separate windrows	
Working Width Combined	24' 6" plus windrow	25' plus windrow
Raking Width Per Rotor	12' 6"	
Transport Width & Length	13' 9" wide & 44' long	
Number of Tine Arms	13 per rotor	
Number of Tines	52 double teeth per rotor	
Tractor Requirements	80 HP with 540 RPM PTO	
Tractor Hydraulics Required	Two sets of remotes with minimum of 1800 psi	
Weight	Approximately 5900 pounds	
Tires (Rakes)	18 x 9.5 x 8 10 ply flotation	
Tires (Swing frame)	11L - 15 SL, 8 ply, 3 Rib w/Tube - Fluid Filled	
Reservoir Oil Capacity	31 gallons (117.3 L)	
Pump Capacity	3000 PSI 22 G.P.M.	

Miller-St. Nazianz, Inc. reserves the right to change its products or this description at any time without notice or obligation.

Troubleshooting







PTO PUMP TROUBLE SHOOTING

<u>Problem</u>	<u>Possible Cause</u>	<u>Correction</u>
1. Noisy pump caused by cavitation.	a. Low hydraulic fluid. b. Suction line plugged. c. Cold weather/cold oil	a. Check & add fluid as necessary. b. Clean line. c. Operate at reduced RPM until oil is warm.
2. Oil heating	a. Oil supply low or too full. b. Contaminated oil. c. Setting of relief valve too high. d. Dirty filter.	a. Check & adjust fluid level as necessary. b. Drain reservoir and refill with clean oil. c. Set to correct pressure. d. Replace.
3. Pump shaft seal leakage	a. Worn pump shaft seal. b. Excessive internal wear.	a. Replace pump shaft seal. b. Inspect parts and replace as needed.
4. Foaming oil	a. Low oil level. b. Air leaking into suction line.	a. Check & add fluid as necessary. b. Tighten fittings.
5. Oil leaking by filler cap, or by suction hose.	a. Gasket in filler cap torn. b. Oil level in reservoir too high.	a. Replace filler cap gasket. b. Adjust oil level to specifications.
6. Rake does not rotate when PTO engaged.	Motor drive hoses reversed.	Reverse motor drive hoses at quick disconnects.

Torque Specifications

NOTE: Use these torque values when tightening hardware (excluding: locknuts and self tapping, thread forming and sheet metal screws) unless specified otherwise.

All torque values are in lb-ft except those marked with an (*) which are lb-in (for metric torque value Nm, multiply lb-ft value by 1.355 or for lb-in multiply by 0.113).

Unified National Thread	Grade 2 		Grade 5 		Grade 8 	
	Dry	Lubed	Dry	Lubed	Dry	Lubed
8-32	19*	14*	30*	22*	41*	31*
8-36	20*	15*	31*	23*	43*	32*
10-24	27*	21*	43*	32*	60*	45*
10-32	31*	23*	49*	36*	68*	51*
1/4-20	66*	50*	9	75*	12	9
1/4-28	76*	56*	10	86*	14	10
5/16-18	11	9	17	13	25	18
5/16-24	12	9	19	14	25	20
3/8-16	20	15	30	23	45	35
3/8-24	23	17	35	25	50	35
7/16-14	32	24	50	35	70	55
7/16-20	36	27	55	40	80	60
1/2-13	50	35	75	55	110	80
1/2-20	55	40	90	65	120	90
9/16-12	70	55	110	80	150	110
9/16-18	80	60	120	90	170	130
5/8-11	100	75	150	110	220	170
5/8-18	110	85	180	130	240	180
3/4-10	175	130	260	200	380	280
3/4-16	200	150	300	220	420	320
7/8-9	170	125	430	320	600	460
7/8-14	180	140	470	360	660	500
1-8	250	190	640	480	900	680
1-14	270	210	710	530	1000	740
Metric Course Thread	Grade 8.8 		Grade 10.9 		Grade 12.9 	
	Dry	Lubed	Dry	Lubed	Dry	Lubed
M6-1	8	6	11	8	13.5	10
M8-1.25	19	14	27	20	32.5	24
M10-1.5	37.5	28	53	39	64	47
M12-1.75	65	48	91.5	67.5	111.5	82
M14-2	103.5	76.5	145.5	108	176.5	131
M16-2	158.5	117.5	223.5	165.5	271	200

Tightening Hydraulic Fittings



CAUTION

Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pin holes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. **DO NOT** use your hand.

Tightening O-Ring Fittings*

1. Inspect O-ring and seat for dirt or obvious defects.
2. On angle fittings, back the locknut off until washer bottoms out at top of groove.
3. Hand tighten fitting until backup washer or washer face (if straight fitting) bottoms on face and O-ring is seated.
4. Position angle fittings by unscrewing no more than one turn.
5. Tighten straight fittings to torque shown.

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

Thread Size	Nut Size Across Flats	Torque Value*		Recommended Turns To Tighten (After Finger Tightening)	
		(Nm)	(lb-ft)	(Flats)	(Turns)
3/8	1/2	8	6	2	1/3
7/16	9/16	12	9	2	1/3
1/2	5/8	16	12	2	1/3
9/16	11/16	24	18	2	1/3
3/4	7/8	46	34	2	1/3
7/8	1	62	46	1-1/2	1/4
1-1/16	1-1/4	102	75	1	1/6
1-3/16	1-3/8	122	90	1	1/6
1-5/16	1-1/2	142	105	3/4	1/8
1-5/8	1-7/8	190	140	3/4	1/8
1-7/8	2-1/8	217	160	1/2	1/12

Tightening Flare Type Fittings*

1. Check flare and flare seat for defects that might cause leakage.
2. Align hose end with fitting before tightening.
3. Lubricate connection and hand tighten swivel nut until snug.
4. To prevent twisting the hose, use two wrenches. Place one wrench on the hose end body and with the second wrench, tighten the swivel nut to the torque shown in this chart.

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

Tube Size OD	Nut Size Across Flats	Torque Value*		Recommended Turns To Tighten (After Finger Tightening)	
		(Nm)	(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

WARRANTY

MILLER-ST. NAZIANZ, INC. warrants each new Miller Rotary Rake to be free from defects in material and workmanship under recommended use and service, as stated in the Operator's Manual, as follows:

Warranty: Miller will replace, F.O.B. St. Nazianz, Wisconsin, or repair, as Miller elects, any part of a new Miller Rotary Rake which is defective in material or workmanship:

- (a) without charge for either parts or labor during the first year following delivery to the original retail customer; and
- (b) without charge for parts only (not labor) during the second year following delivery to the original retail customer.
- (c) Notwithstanding the above, Miller does not warrant teeth against wear and breakage as this item is expected to wear and extent of wear or breakage depends on field conditions and operating practices.

The warranty period for equipment used for commercial, industrial, lease, rental and custom operation or any non agricultural use is limited to 90 days from date of delivery to the first retail purchaser.

All warranties on the new Miller Rotary Rake shall apply only to the original retail purchaser from an authorized Miller dealer.

Repair Parts

Miller warrants that it will replace, F.O.B. St. Nazianz, Wisconsin, or repair, as Miller elects, without charge, any genuine Miller spare part purchased after the expiration of the new Rotary Rake warranty, or to any subsequent owners, that is defective in material or workmanship, within ninety (90) days of the installation date.

Misuse

The provisions of this warranty shall not apply to any Miller Rotary Rake which has been subject to misuse, negligence, alteration or accident, or which shall have been repaired with parts other than those obtainable through Miller.

Authorized Dealer

Repairs eligible for labor warranty must be made by Miller or an authorized Miller dealer. The purchaser is responsible for transportation of the equipment to the dealership for warranty service or for any service call expense.

Exclusive Effect of Warranty and Limitation of Liability

The remedies of the customer set forth herein are exclusive. Miller neither assumes nor authorizes any person to assume any other obligation or liability in connection with the sale of covered equipment. Correction of defects and malfunctions in the manner and for the applicable period of time provided above, shall constitute fulfillment of all responsibilities of Miller to the customer and Miller shall not be liable for negligence, under contract, or in any other manner with respect to such equipment. IN NO EVENT SHALL THE OWNER BE ENTITLED TO RECOVER FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES SUCH AS BUT NOT LIMITED TO: LOSS OF CROPS, LOSS OF PROFITS OR REVENUE, OTHER COMMERCIAL LOSSES, INCONVENIENCE OR COST OF RENTAL OF REPLACEMENT EQUIPMENT.

THIS WARRANTY IS IN LIEU OF ALL WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PURPOSE OR OTHER WARRANTIES, EXPRESS OR IMPLIED.

Warranty Requirements

To be covered by warranty, each machine must be properly registered with Miller within 30 days of date of original retail delivery.



© 2005 by Miller-St. Nazianz, Inc.
