PALADIN™
POWERFUL ATTACHMENT TOOLS

OPERATOR'S HANDBOOK

POWER BOX RAKE®

Serial Number: _____

Model Number: _____

Original
Manual Number: 51-4610-X
Rev. 1

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Notes

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PREFACE

GENERAL INFORMATION

This product was carefully designed and manufactured to give you many years of dependable service. Only minor maintenance (such as cleaning and lubricating) is required to keep it in top working condition. Be sure to observe all maintenance procedures and safety precautions in this manual and on any safety decals located on the product and on any equipment on which the attachment is mounted.

WARNING!  **Never let anyone operate this unit without reading the "Safety Precautions" and "Operating Instructions" sections of this manual. Always choose hard, level ground to park the vehicle on and set the brake so the unit cannot roll.**

Unless noted otherwise, right and left sides are determined from the operator's control position when facing the attachment.

NOTE: The illustrations and data used in this manual were current (according to the information available to us) at the time of printing, however, we reserve the right to redesign and change the attachment as may be necessary without notification.

BEFORE OPERATION

The primary responsibility for safety with equipment falls to the operator. Make sure the equipment is operated only by trained individuals that have read and understand this manual. If there is any portion of this manual or function you do not understand, contact your local authorized dealer or manufacturer to obtain further assistance. Keep this manual available for reference. Provide this manual to any new owners and/or operators.

SAFETY ALERT SYMBOL

This is the "Safety Alert Symbol" used by this industry. This symbol is used to warn of possible injury. Be sure to read all warnings carefully. They are included for your safety and the safety of others working with you.

SERVICE

Use only manufacturer replacement parts. Substitute parts may not meet the required standards. Record the model and serial number of your unit on the cover of this manual. The parts department needs this information to insure that you receive the correct parts.

SOUND AND VIBRATION

"Sound pressure levels and vibration data for this attachment are influenced by many different parameters; some items are listed below (not inclusive):

- prime mover type, age, condition, with or without cab enclosure and configuration
- operator training, behavior, stress level
- job site organization, working material condition, environment

Based on the uncertainty of the prime mover, operator, and job site, it is impossible to get precise machine and operator sound pressure levels, or vibration levels for this attachment."

NOTE: A list of all Paladin Patents can be found at http://www.paladinattachments.com/patents.asp.

SAFETY STATEMENTS

DANGER! **THIS SIGNAL WORD IS USED WHERE SERIOUS INJURY OR DEATH WILL RESULT IF THE INSTRUCTIONS ARE NOT FOLLOWED PROPERLY.**

WARNING! **THIS SIGNAL WORD IS USED WHERE SERIOUS INJURY OR DEATH COULD RESULT IF THE INSTRUCTIONS ARE NOT FOLLOWED PROPERLY.**

CAUTION! **THIS SIGNAL WORD IS USED WHERE MINOR INJURY COULD RESULT IF THE INSTRUCTIONS ARE NOT FOLLOWED PROPERLY.**

NOTICE! **NOTICE INDICATES A PROPERTY DAMAGE MESSAGE.**

THIS SYMBOL BY ITSELF OR WITH A WARNING WORD THROUGHOUT THIS MANUAL IS USED TO CALL YOUR ATTENTION TO INSTRUCTIONS INVOLVING YOUR PERSONAL SAFETY OR THE SAFETY OF OTHERS. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN INJURY OR DEATH.

GENERAL SAFETY PRECAUTIONS

WARNING! **READ MANUAL PRIOR TO INSTALL**

Improper installation, operation, or maintenance of this equipment could result in serious injury or death. Operators and maintenance personnel should read this manual as well as all manuals related to this equipment and the prime mover thoroughly before beginning installation, operation, or maintenance. **FOLLOW ALL SAFETY INSTRUCTIONS IN THIS MANUAL AND THE PRIME MOVER'S MANUAL(S).**

READ AND UNDERSTAND ALL SAFETY STATEMENTS

Read all safety decals and safety statements in all manuals prior to operating or working on this equipment. Know and obey all OSHA regulations, local laws and other professional guidelines for your operation. Know and follow good work practices when assembling, maintaining, repairing, mounting, removing or operating this equipment.

KNOW YOUR EQUIPMENT

Know your equipment's capabilities, dimensions and operations before operating. Visually inspect your equipment before you start, and never operate equipment that is not in proper working order with all safety devices intact. Check all hardware to assure it is tight. Make certain that all locking pins, latches, and connection devices are properly installed and secured. Remove and replace any damaged, fatigued or excessively worn parts. Make certain all safety decals are in place and are legible. Keep decals clean, and replace them if they become worn or hard to read.

WARNING! **PROTECT AGAINST FLYING DEBRIS**

Always wear proper safety glasses, goggles or a face shield when driving pins in or out, or when operation causes dust, flying debris, or any other hazardous material.

WARNING! **LOWER OR SUPPORT RAISED EQUIPMENT**

Do not work under raised booms without supporting them. Do not use support material made of concrete blocks, logs, buckets, barrels or any other material that could suddenly collapse or shift positions. Make sure support material is solid, not decayed, warped, twisted, or tapered. Lower booms to ground level or on blocks. Lower booms and attachments to the ground before leaving the cab or operator's station.

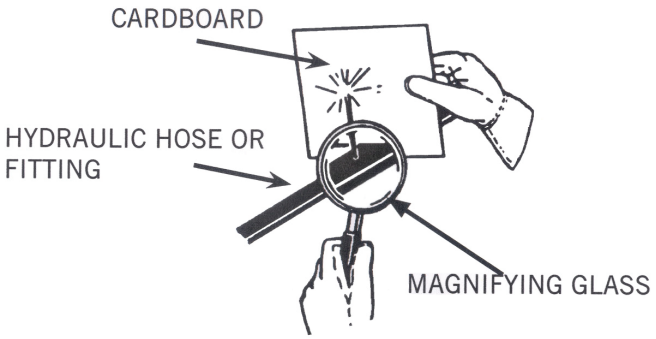
GENERAL SAFETY PRECAUTIONS

WARNING! **USE CARE WITH HYDRAULIC FLUID PRESSURE**

Hydraulic fluid under pressure can penetrate the skin and cause serious injury or death. Hydraulic leaks under pressure may not be visible. Before connecting or disconnecting hydraulic hoses, read your prime mover's operator's manual for detailed instructions on connecting and disconnecting hydraulic hoses or fittings.

- Keep unprotected body parts, such as face, eyes, and arms as far away as possible from a suspected leak. Flesh injected with hydraulic fluid may develop gangrene or other permanent disabilities.
- If injured by injected fluid, see a doctor at once. If your doctor is not familiar with this type of injury, ask him to research it immediately to determine proper treatment.
- Wear safety glasses, protective clothing, and use a piece of cardboard or wood when searching for hydraulic leaks.

DO NOT USE YOUR HANDS! SEE ILLUSTRATION.



WARNING! **DO NOT MODIFY MACHINE OR ATTACHMENTS**

Modifications may weaken the integrity of the attachment and may impair the function, safety, life and performance of the attachment. When making repairs, use only the manufacturer's genuine parts, following authorized instructions. Other parts may be substandard in fit and quality. Never modify any ROPS (Roll Over Protection System) or FOPS (Falling Object Protective Structure) equipment or device. Any modifications must be authorized in writing by the manufacturer.

WARNING! **SAFELY MAINTAIN AND REPAIR EQUIPMENT**

- Do not wear loose clothing, or any accessories that can catch in moving parts. If you have long hair, cover or secure it so that it does not become entangled in the equipment.
- Work on a level surface in a well-lit area.
- Use properly grounded electrical outlets and tools.
- Use the correct tool for the job at hand. Make sure they are in good condition for the task required.
- Wear the protective equipment specified by the tool manufacturer.

GENERAL SAFETY PRECAUTIONS

WARNING! **SAFELY OPERATE EQUIPMENT**

- Do not operate equipment until you are completely trained by a qualified operator in how to use the controls, know its capabilities, dimensions, and all safety requirements. See your machine's manual for these instructions.
- Keep all step plates, grab bars, pedals, and controls free of dirt, grease, debris, and oil.
- Never allow anyone to be around the equipment when it is operating.
- Do not allow riders on the attachment or the prime mover.
- Do not operate the equipment from anywhere other than the correct operators position.
- Never leave equipment unattended with the engine running or with this attachment in a raise position.
- Do not alter or remove any safety feature from the prime mover or this attachment.
- Know your work site safety rules as well as traffic rules and flow. When in doubt on any safety issue, contact your supervisor or safety coordinator for an explanation.

WARNING! **EXPOSURE TO RESPIRABLE CRYSTALLINE SILICA DUST ALONG WITH OTHER HAZARDOUS DUSTS MAY CAUSE SERIOUS OR FATAL RESPIRATORY DISEASE.** It is recommended to use dust suppression, dust collection and if necessary personal protective equipment during the operation of any attachment that may cause high levels of dust.

WARNING! **REMOVE PAINT BEFORE WELDING OR HEATING.**

Hazardous fumes/dust can be generated when paint is heated by welding, soldering or using a torch. Do all work outside or in a well ventilated area and dispose of paint and solvent properly. Remove paint before welding or heating.

When sanding or grinding paint, avoid breathing the dust. Wear an approved respirator. If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

WARNING! **END OF LIFE DISPOSAL.**

At the completion of the useful life of the unit, drain all fluids and dismantle by separating the different materials (rubber, steel, plastic, etc.). Follow all federal, state and local regulations for recycling and disposal of the fluid and components.

SAFETY SIGNS & LABELS

There are several specific signs on this sweeper. The exact location of hazards and description of hazards are reviewed.

Placement or replacement of Safety Signs

1. Clean area of application with nonflammable solvent, wash same area with soap and water.
2. Allow surface to dry.
3. Remove backing from safety sign, exposing adhesive surface.
4. Apply safety sign to position shown in diagram smooth out bubbles.

Instructions

1. Keep all safety signs clean and legible.
2. Replace all missing, illegible, or damaged safety signs.
3. Replacement parts, for parts with safety signs attached, must have safety signs attached.
4. Safety signs are available, free of charge, from your dealer or Paladin.

SAFETY SIGNS & LABELS

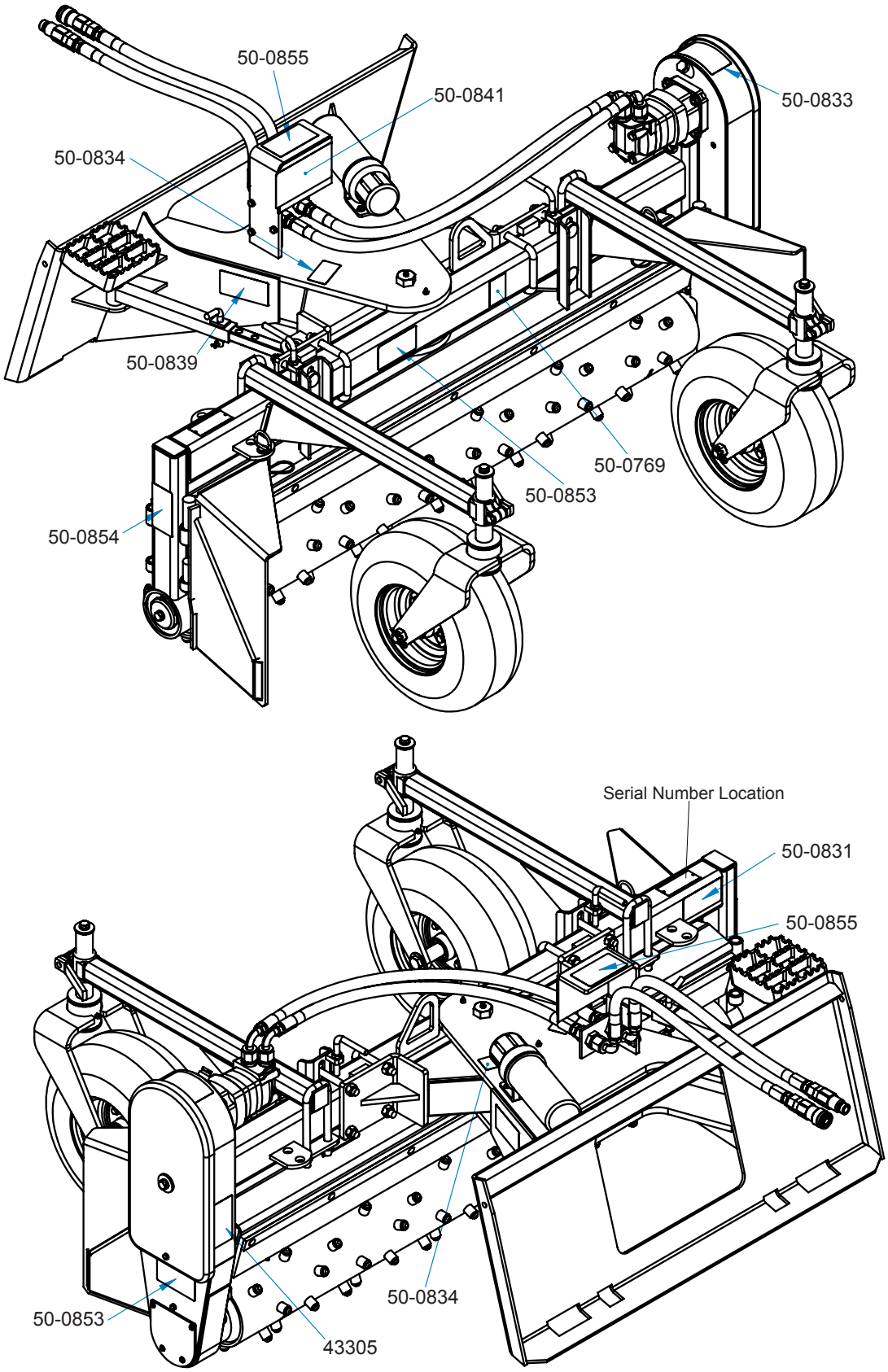


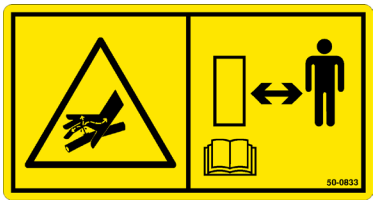
Figure 1

SAFETY SIGNS & LABELS

50-0855

***HAZARD:* WARNING! FLYING OBJECTS HAZARD**

***AVOIDANCE*:** *Personal Protection Equipment or cab door required. Failure to heed this warning could result in serious injury or death.*



50-0833

***HAZARD: WARNING!* HIGH PRESSURE FLUID HAZARD.** Escaping hydraulic fluid can have enough pressure to penetrate skin. Consult physician immediately if skin penetration occurs.

***AVOIDANCE*:** *Keep safe distance away from hazard. Relieve pressure before disconnecting lines. DO NOT use hands to check for leaks.. Failure to heed this warning could result in serious injury or death.*

43305

***HAZARD: WARNING!* GUARD COVERING MOVING PARTS**

***AVOIDANCE*:** *Guards and covers must be in place. Read Operator's Manual. Failure to heed this warning could result in serious injury or death.*

50-0834

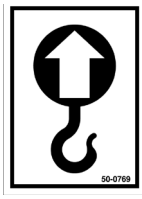
***HAZARD*: *WARNING!* PINCH POINT HAZARD**

***AVOIDANCE*:** *Keep hand safe distance away from hazard. Failure to heed this warning could result in serious injury or death.*

50-0831

***HAZARD*: GENERAL WARNING.**

***AVOIDANCE*: READ HANDBOOK - DO NOT OPERATE OR SERVICE UNLESS YOU HAVE READ AND UNDERSTAND THE INSTRUCTIONS AND SAFETY INFORMATION IN THE OPERATOR'S HANDBOOK AND ALL PRIME MOVER MANUALS.** *Failure to follow the instructions or heed the warnings could result in serious injury or death.*



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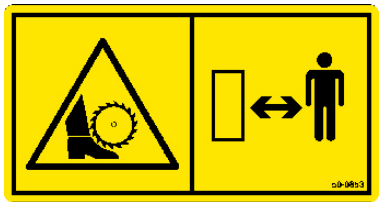
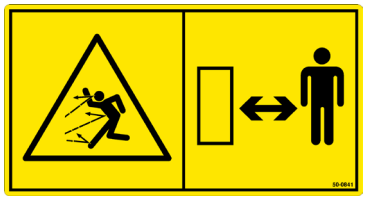


50-0853

***HAZARD: DANGER!* ENTANGLEMENT HAZARD**

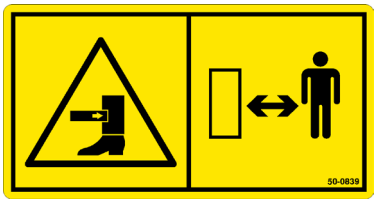
***AVOIDANCE*:** *Keep safe distance away from hazard. Failure to heed this warning will result in serious injury or death.*



50-0841

***HAZARD: WARNING!* FLYING OBJECTS HAZARD**

***AVOIDANCE*:** *Keep safe distance away from hazard. Remove all people, animals and property that could be injured or damaged by flying debris from the area. Failure to heed this warning could result in serious injury or death.*



50-0839

***HAZARD: WARNING!* CRUSH HAZARD**

***AVOIDANCE*:** *Keep safe distance away from hazard. Failure to heed this warning could result in serious injury or death.*

INSTALLATION & SET-UP

STRAIGHT MODEL ASSEMBLY PROCEDURE

Tools Required
15/16 inch combination wrench

1. Stand rake frame upright and position one end plate on each side of frame to stabilize rake.
2. Attach two gauge wheel assemblies to main frame using two 5/8 inch U-bolts and locking nuts.
3. Position attachment mount plate on frame and clamp in place with four 5/8 inch U-bolts and locking nuts.
4. Check oil level in chain case.

ANGLING MODEL (NON-FLOAT) ASSEMBLY PROCEDURE

Tools Required
15/16 inch combination wrench

1. Stand rake frame upright and install endplates on attachment side of frame to stabilize.
2. Attach two gauge wheel assemblies to main frame using two 5/8 inch U-bolts and locking nuts.
3. Install power cord by connecting red clamp to a positive 12 volt power source and black clamp to ground. The power cord includes an in-line fuse and spring-loaded battery clamps. The red (positive) cable is fused and should always be connected to positive side of the battery to ensure proper operation of electrical circuit. Be careful when routing cable that sharp edges or moving parts will not damage it.
4. Check oil level in chain case.

ANGLING MODEL (WITH FLOAT)

Tools Required
15/16 inch combination wrench

1. Raise front of rake up so pivot frame is horizontal.
2. Mount left and right endplates.
3. Move attachment mounting plate into position.
4. Attach four link arms to attachment plate (lower arms first).
5. Tighten nuts after all four arms are in place.
6. Replace the 3/4 inch X 4-3/4 inch pins in either “lockout” or “float” positions.
7. Attach two gauge wheel assemblies to main frame with two 5/8 inch U-bolts and locking nuts.
8. Check oil level in chain case.

INSTALLATION & SET-UP

Skid-steers must be equipped with auxiliary hydraulic system capable of supplying continuous flow for hydraulic motor operation. This manual contains information for straight and angling models. Refer to information for specifications and adjustments.

ATTACHING POWER RAKE TO SKID-STEER
Read skid-steer Operator's Manual connecting and removing instruction.

Position hydraulic hoses so they will not be pinched when connecting power rake.

Skid-steer coupler handles should be in unlocked position and lock pins retracted.

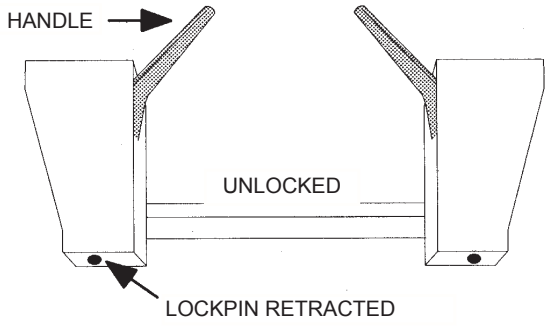


Figure 2

Move to skid-steer operator seat and start engine.

Lower skid-steer lift arms to lowest position.

Carefully move and align skid-steer to power rake. Top of skid-steer coupler must index into power rake flange, see Figure 3.

Roll skid-steer coupler into power rake so coupler handles can be engaged.

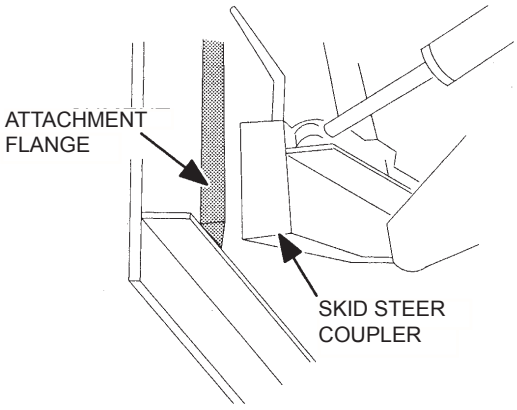


Figure 3

Shut off engine, set brake, and remove key. Dismount skid-steer.

INSTALLATION & SET-UP

Move skid-steer coupler handles to locked position. Lock pins must be completely extended and secured into slots on power rake, see **Figures 4** and **5.**

Connect hydraulic hoses to skid-steer auxiliary quick couplers.

For hydraulic angling models, mount angle control switch in convenient location. Switch bracket is magnetic and will attach to any flat steel surface. Connect power cord to cable coming from switch. Be careful that sharp edges or moving parts will not damage cable.

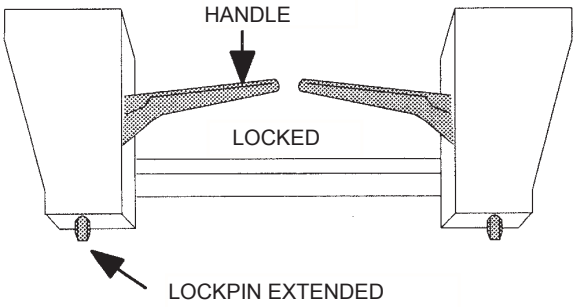


Figure 4

Back View of Attachment

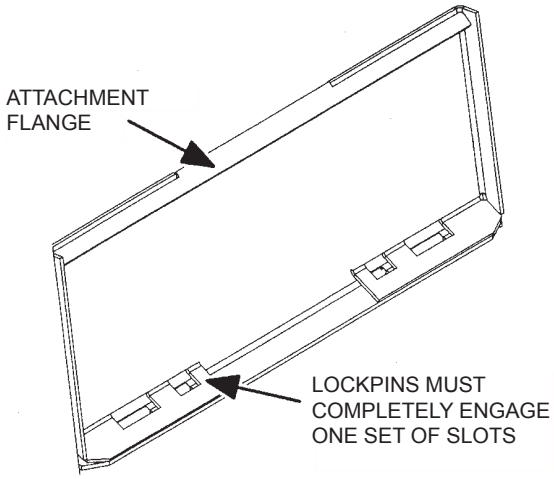


Figure 5

POWER RAKE FUNCTION

Power rake hydraulic motor drives the roller, which digs into the ground, cultivating and pulling up rocks, roots, and debris.

Clean soil goes between roller and barrier, rocks, roots, and debris work to the side in a windrow.

With endplates mounted in working position and rake straight (endplates parallel with skid-steer tires), material can be moved along, filling in low spots. Rocks, roots, and debris can be collected and moved to another location for hauling away.

OPERATION

Intended Use

This power rake is designed solely for removing rock, small debris, and thatching. Use in any other way is considered contrary to intended use. Compliance with and strict adherence to operation, service and repair conditions, as specified by the manufacturer, are essential elements of intended use.

Start prime mover engine.

Lower power rake slowly to ground.

Engage hydraulic control lever for auxiliary implements.

Increase engine rpm to give desired rpm at roller. Normal operating speed is approximately 270 rpm. If operating in heavy rock, reduce speed slightly.

Move prime mover forward or backward as desired. For roller to operate effectively, it must rotate in opposite direction of prime mover wheels, see **Figure 6**. Roller rotation direction is controlled by prime mover hydraulic controls.

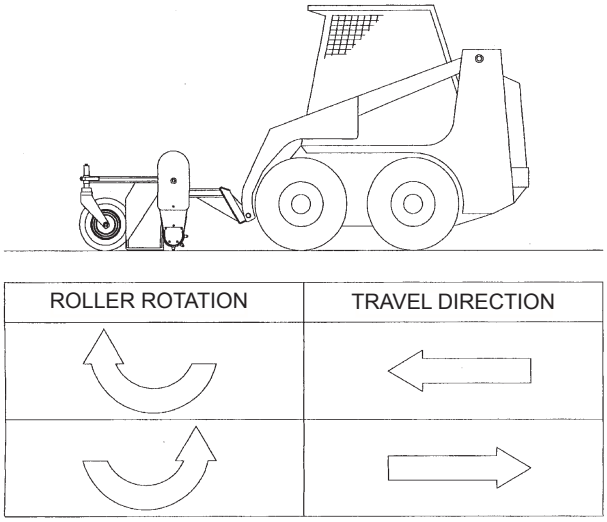


Figure 6

Ground Speed
Ground speed should be between 3 and 5 mph (5 and 8 kph) under normal conditions. In heavy rock, reduce ground speed to 1 to 3 mph (2 to 5 kph).

Direction Control Switch (HYDRAULIC ANGLING MODEL ONLY)
A three position switch is provided to angle rake left or right. The switch is equipped with a magnetic mount and may be attached to a steel surface near operator. The direction valve uses a small amount of hydraulic oil from the roller drive motor and will only operate with prime mover auxiliary hydraulic system engaged and with roller turning clockwise.

With the prime mover auxiliary hydraulic system engaged, move spring loaded switch in one direction and rake will angle left or right. Return switch to center position and rake will maintain angle selected. Pivot rake to place the windrow left or right of skid-steer.

OPERATION

Hydraulic Drive Motor
The hydraulic drive motor runs off the auxiliary circuit of prime mover. Power rake should be run at 30% power for one hour to break in motor.

Power Roller
Roller should be level with ground. Power rake should be level with ground front to back. To do this, raise or lower gauge wheels and/or use prime mover tilt cylinder.

To allow roller to penetrate deeper into ground, loosen handle and raise gauge wheels. To do the opposite, lower gauge wheels.

The chain case end of roller weighs 60 lbs. (27 kg) more than the other end of roller. Set tire closest to chain case down 3/4 inches (2 cm) lower than opposite tire. This will give an even grade when landscaping.

During operation, further depth control can be achieved by tilting rake forward on gauge wheels to raise roller, or by tilting rake back to raise gauge wheels and allow more roller penetration.

Be sure to check air pressure in each tire regularly for an even, consistent grade.

The normal gap between roller and barrier for average conditions is about 1.25 inches (3.2 cm). This gap can be adjusted either wider or narrower by loosening the 3/8" U-bolts (2) that holds the barrier mount and sliding it up or down. A wider opening will allow more dirt and rock to pass through. For finer raking, reduce the gap. Be careful not to let roller hit barrier. The gap should be the same all the way across. Barrier adjustment is shown in **Figure 7**.

You can operate roller both clockwise and counter-clockwise. The roller operates most efficiently when it rotates in the opposite direction of the prime mover wheels.

Operating Depth
When power raking, depth determines how much dirt is carried ahead of the roller. Ideal depth varies with conditions and can be anywhere from skimming the surface to about 3 inches (7.6 cm) deep. See instructions in **Power Roller** above to set roller depth.

When making the first windrow (angling model only), level of dirt may be halfway up on barrier. When moving windrow two or three times, level of the dirt may be to top of barrier. Try to prevent material from flowing over the top.

The power rake allows fast raking of large areas of ground by being able to move windrows several times. The volume or density of material being raked will dictate how many times a windrow can be moved.

Endplates
The function of endplates is to contain material in front of the roller while clean material passes between roller and barrier.

With endplates mounted in working position and roller straight (parallel with prime mover), material can be moved, filling in low spots.

OPERATION

By decreasing the gap between the roller and barrier, more material can be pulled. Barrier adjustment is shown in **Figure 7**.

These plates can be mounted to the front or back of the power rake, depending on raking direction. When you move endplates from front to back, you must move the left one to the right side and the right one to the left side.

Make sure power rake is stored on a hard, level surface. Use endplates mounted on attachment side of rake for stability.

Operator Production
Successful operation of the power rake will come with operator experience. Rake's performance also depends on type and size of the prime mover.

NOTICE! ***Do not drop power rake to the ground with the roller turning. Sudden high speed jolts multiply stress to the drive line and can cause extreme damage.***

Application Techniques
The power rake is capable of many applications. The following are some of the common applications:

Pulverizing Topsoil
For breaking up compacted soil or conditioning hardened baseball diamonds, the attachment plate is rolled back to take guide wheels off the ground so only the toothed roller is in contact with ground. Maintain sufficient RPM to avoid stalling toothed roller in its progress. Rake can be straight or angled, but endplates should not be mounted in order to allow material to move out of the way and not slow process.

Debris Removal
Once surface has been loosened, process of removing debris can begin. The prime mover attachment plate is tilted forward until guide wheels control depth of toothed roller. Roller can be angled at this time for windrowing debris or roller can be set straight with both endplates installed to collect debris. Prime mover travel speed should be increased for this process.

Finish Grading
Rake is tilted forward until teeth of the toothed roller are barely touching soil. Prime mover speed can be increased for this operation, to collect material from the high spots and leave it in the low areas.

Spreading Fill and Topsoil
Position rake so it is tilted on gauge wheels, since depth of cut is not important. Endplates can be installed and windrow angle set as needed to control material movement.

Changing Grade
Grade modification can be accomplished during finish grading by angling rake to collect and windrow maximum amount of material toward targeted areas.

OPERATION

Thatching Existing Grass Areas
Prime mover attachment plate should be tilted forward to support rake on front gauge wheels and toothed roller raised so teeth are just grazing surface. Travel speed should be slow.

Shutting Down
Stop engine.

Lower lift arms and power rake to ground.

Purge any air in system. Hydraulic system leak down, hydraulic system failures, mechanical failures, or movement of control levers can cause equipment to drop or rotate unexpectedly.

Shut off engine, set brake, remove key, remove seat belt, and release operator restraint before leaving prime mover operator's seat.

Removing Power Rake From Prime Mover
Install endplates on attachment side of power rake as shown in **Figure 7** .

On a hard level surface, lower attachment to ground.

Shut off engine, set brake, remove key, remove seat belt, and release operator restraint before leaving prime mover operator's seat.

Move attachment coupler latches to unlocked position (lock pins must be disengaged).

Disconnect hydraulic hoses from quick couplers. Install dust plugs and couple hoses together for storage. Disconnect direction control switch from prime mover power cord and remove switch.

Move to prime mover seat and start engine. Release brake and roll attachment coupler until it is disengaged from attachment. Attachment should rest in a stable position for storage.

OPERATION

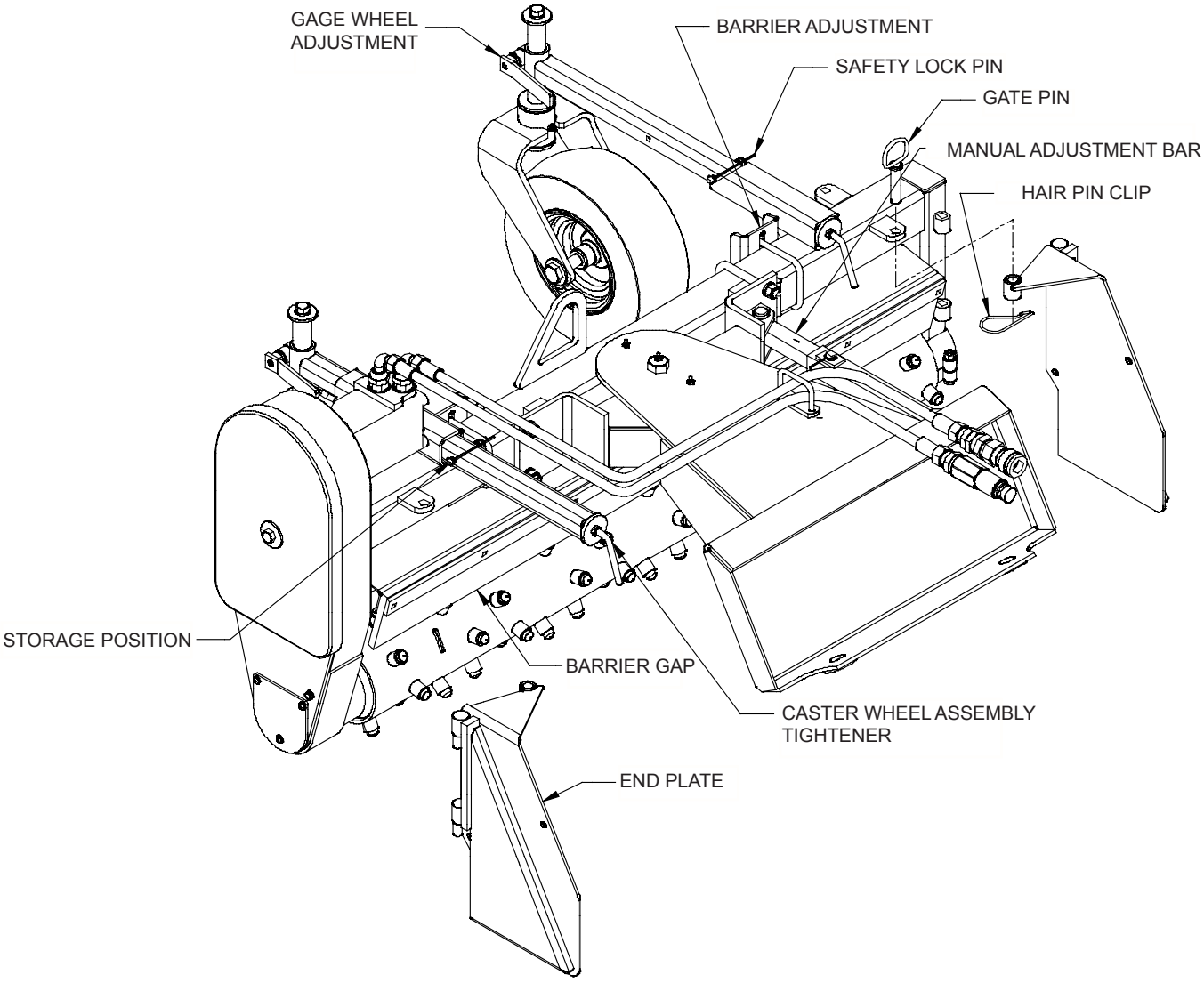


Figure 7

OPERATION

STORAGE

Make sure disconnected power rake is stored on a hard, level surface. Endplates mounted on attachment side of rake increase stability.

General Storage:

Storage:

- Clean the unit thoroughly, removing all snow, dirt and grease.
- Inspect for visible signs of wear, breakage or damage. Order any parts required and make the necessary repairs to avoid delays upon removal from storage.
- Tighten loose nuts, capscrews and hydraulic connections.
- Coat exposed portions of the cylinder rods with grease.
- Lubricate grease fittings.
- Seal hydraulic system from contaminants and secure all hydraulic hoses off the ground to help prevent damage.
- Store unit in a dry and protected place. Leaving the unit outside will materially shorten its life.

Additional Precautions for Long Term Storage:

- Touch up all unpainted surfaces with paint to avoid rust.
- Inflate tires to recommended tire pressure.
- Fill fuel tank and hydraulic oil tank to maximum.
- Check antifreeze properties and drain fluids as appropriate.

Removal from Storage:

- Remove cover.
- Wash unit and replace any damage and/or missing parts.
- Lubricate grease fittings.
- Check hydraulic hoses for damage and replace as necessary.

OPERATION

LIFT POINTS

Lifting points are identified by lifting decals where required. Lifting at other points is unsafe and can damage attachment. Do not attach lifting accessories around cylinders or in any way that may damage hoses or hydraulic components. See diagram:

- Attach lifting accessories to unit at recommended lifting points.
- Bring lifting accessories together to a central lifting point.
- Lift gradually, maintaining the equilibrium of the unit.

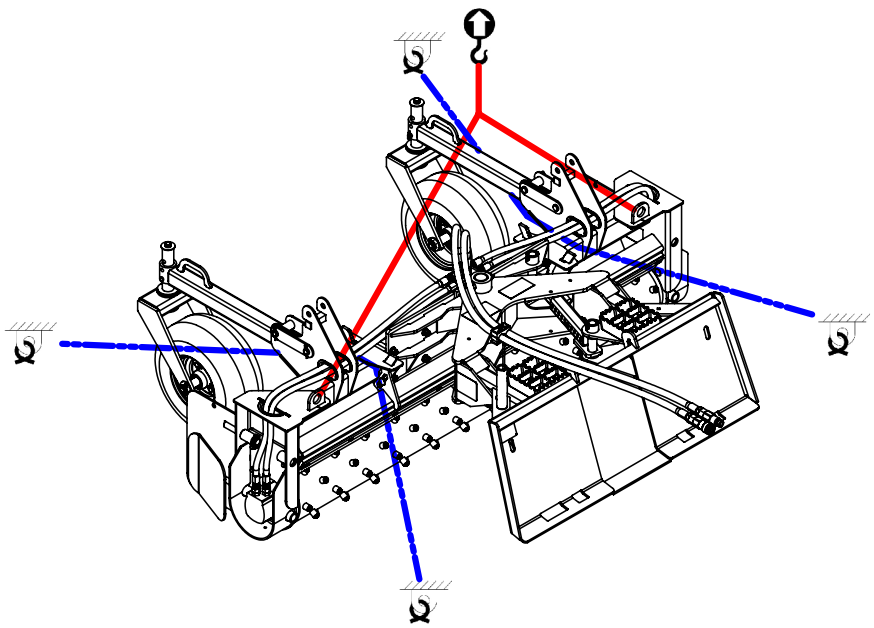
WARNING! **USE LIFTING ACCESSORIES (CHAINS, SLINGS, ROPES, SHACKLES AND ETC.) THAT ARE CAPABLE OF SUPPORTING THE SIZE AND WEIGHT OF YOUR ATTACHMENT. Secure all lifting accessories in such a way to prevent unintended disengagement. Failure to do so could result in the attachment falling and causing serious personal injury or death.**

TIE DOWN POINTS

Tie down points are identified by tie down decals where required. Securing to trailer at other points is unsafe and can damage attachment. Do not attach tie down accessories around cylinders or in any way that may damage hoses or hydraulic components. See diagram:

- Attach tie down accessories to unit as recommended.
- Check unit stability before transporting.

WARNING! **VERIFY THAT ALL TIE DOWN ACCESSORIES (CHAINS, SLINGS, ROPES, SHACKLES AND ETC.) ARE CAPABLE OF MAINTAINING ATTACHMENT STABILITY DURING TRANSPORTING and are attached in such a way to prevent unintended disengagement or shifting of the unit. Failure to do so could result in serious personal injury or death.**



MAINTENANCE

CHAIN MAINTENANCE

Drive chain should be inspected monthly. New chain has a tendency to stretch, it is necessary to check the chain tension to prevent potential problems.

Chain tension is preset with the extension spring. If chain becomes excessively loose, it may be necessary to remove one link (two pitches). If unable to reassemble, add an offset link to lengthen chain.

NOTICE! Replacement chain should be only high quality original equipment chain for longer life.

When being stored for a long period or at end of season, change the oil, adding #00 fluid gear grease, and rotate roller several times allowing chain to be coated with lubricant, prolonging chain life. Rotate roller periodically to maintain lubrication. In order to rotate roller and chain, connect the two hydraulic hoses together.

SPROCKETS

Sprockets should be checked to be sure slotted hex nut or hex bolt is tight, cotter pin is in place, and sprocket cannot move on shaft.

QUALIFIED TECHNICIAN MAINTENANCE

HYDRAULIC MOTOR

Removal

Remove chain from top sprocket. Then remove top sprocket by removing hex bolt and washers.

Reassemble

Apply a liberal amount of silicone sealer to inside of flange. Attach hydraulic motor to chain case with two bolts, lock washers and nuts. Replace collar and snap ring over shaft.
Carefully insert snap ring into groove on collar as collar slides past spline. Slide top sprocket (sprocket teeth first) onto shaft. Use machine bushings on the inside or outside of sprocket for proper alignment.

BEARINGS

Highest quality bearings are used on the power rake. Only triple-seal bearings are used on roller which operates down in the dirt. Lubrication of the bearings will vary considerably with conditions. As a rule, bearings should be under-lubricated rather than over-lubricated. Over lubrication can cause seals to blow out.

NOTICE! Replacement bearings should be only high quality original equipment bearings for longer life.

Install new complete bearing housing if needed or just replace the bearing insert. The shafts should be straight, free of burrs, and up to size. If shaft is worn, replace or have the shaft built up to standard prior to completing assembly.

MAINTENANCE

Protective Collars
The special protective collars protect bearings from vine and wire wrap, and dirt buildup next to the bearing seal. The bearing protector is sandwiched onto the shaft which rotates within a close clearance from the outer race of the bearing. Grease coming from bearing oozes into protecting collar, keeping dust and particles from entering seal area, increasing bearing life.

Left Roller Bearing
1. Remove drive chain. Then remove lower sprocket by removing cotter pin, slotted hex nut, and washers.
2. Remove two bolts holding chain case to frame.

NOTICE! Have roller blocked up or supported.

3. Slide chain case and bearing off roller shaft.
4. Loosen bolt on bearing tube that holds cartridge bearing in place.
5. Remove bearing and O-ring.

To replace, reverse procedure. Be sure all parts and wear surfaces are thoroughly clean and in good condition.

When replacing bearing, first put O-ring on bearing. Apply coat of grease on O-ring. Slide bearing in and apply moderate pressure on bearing so O-ring will seat and spread slightly, keeping the oil in chain case from escaping through the bearing.

Right Roller Bearing
1. Remove hex bolt and bearing cap from outside of bearing.
2. Loosen bolt on bearing tube that holds cartridge bearing in place.
3. Pry bearing tube apart to free bearing assembly.

NOTICE! Have roller blocked up or supported.

To replace, reverse the procedure. Be sure all parts and wear surfaces are thoroughly clean and in good condition.

ROLLER REPLACEMENT

NOTICE! It will be necessary to have a lifting device or additional help while removing and replacing roller. Roller weighs approximately 80 lbs (36 kg).

1. Remove upper and lower chain case covers.
2. Remove tension spring and drive chain.
3. Remove lower sprocket by removing cotter pin, slotted nut, and washers.
4. Remove spacers behind sprocket that was just removed.
5. Remove two bolts holding chain case to frame and slide chain case, with hydraulic motor attached, off roller shaft. Roller bearing will stay in chain case.
6. Loosen bolt on bearing tube of non-drive end.

MAINTENANCE

7. Slide roller and bearing out of frame.
8. Remove hex bolt, bearing cap, bearing, and protective collar from roller.
9. On roller to be installed, place machine bushing and protective collar against end plate on roller.
10. Place bearing and bearing cap on end of roller shaft and clamp in place with hex bolt and lock washer.
11. Slide roller and bearing into bearing tube on non-drive end of frame. Do not tighten bearing tube at this time.
12. Place spacer, protective collar, and O-ring from splined end of removed roller onto replacement roller. Check O-ring for cuts and nicks.
13. Apply sealant to bearing area on shaft.
14. Slide chain case back onto roller and bolt to frame.
15. Replace sleeve, sprocket, and washers on drive shaft.
16. Clamp solid with 3/4” slotted jam nut.
17. Check that roller clears frame on both ends (adjust, if required).
18. Tighten 3/8” bolt in bearing tube on non-drive end of frame.
19. Reinstall chain and tension spring.
20. Replace lower cover, being careful not to pinch the O-ring.
21. Fill chain case with 1.5 pints (710 ml) of #00 fluid gear grease
22. Replace upper cover.
23. Run power rake and watch for any interference with roller frame.

MAINTENANCE

DIRECTIONAL CONTROL VALVE (HYDRAULIC ANGLE MODEL ONLY)

A three position switch (normally open) is used to operate the direction control valve. Control power (12 volt) is supplied by power cord attached to prime movers electrical system. Switch wires are connected to direction control valve as shown in **Figure 9.**

Direction control valve uses hydraulic oil from roller drive motor. Prime movers auxiliary hydraulic system must be connected and engaged to adjust angle direction. Roller must be rotating clockwise.

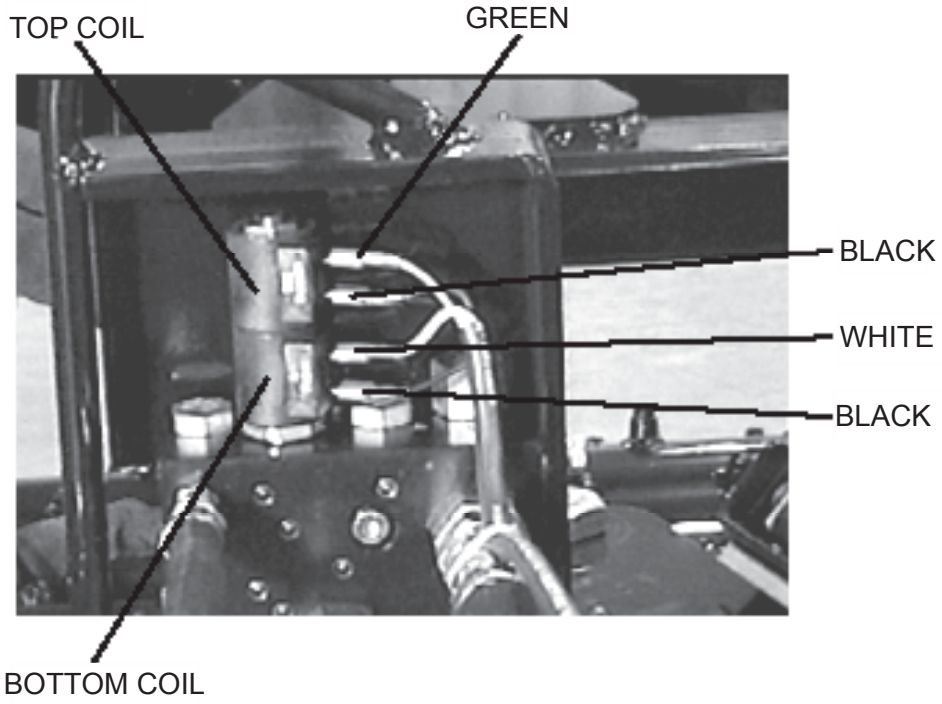


Figure 9

MAINTENANCE

Procedure	Before Each Use	Weekly	Monthly	Quarterly	See Prime Mover Manual
Check and repair any hydraulic oil leaks	✓				
Grease zerk fittings (See Lubrication Points)		✓			
Check tire pressure		✓			
Inspect drive chain			✓		
Check oil level in chain case			✓		
Change lubrication in chain case				✓	
Check hydraulic oil level (Prime Mover)					✓
Check and tighten all hardware	✓				

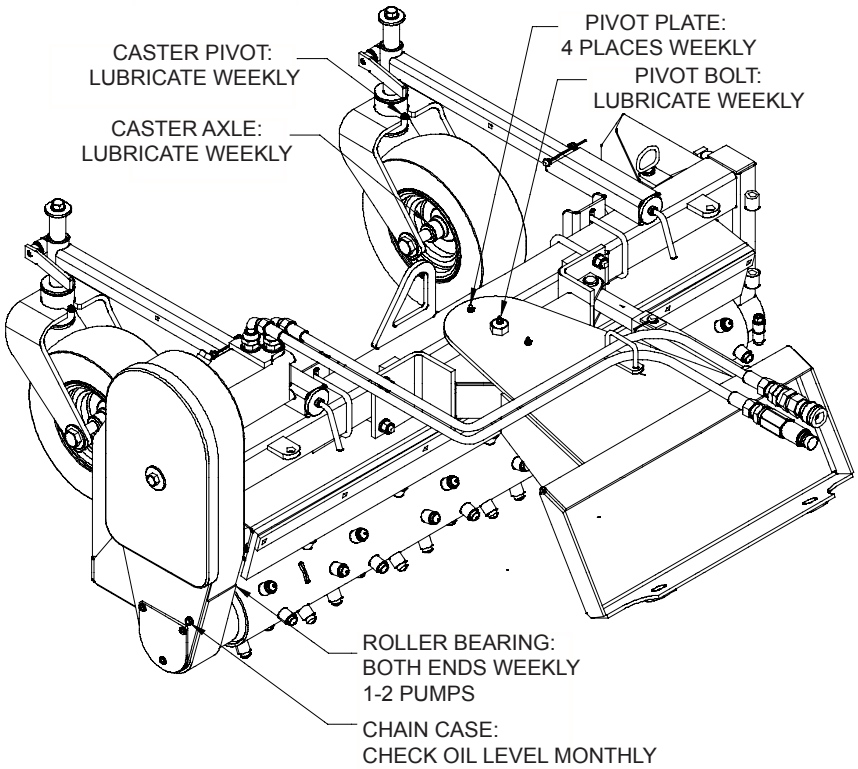


Figure 8

TROUBLESHOOTING

Problem	Possible Cause	Possible Solution
Roller will not turn	Hydraulic valve on skid steer not engaged	See skid steer operator's manual for operation procedure
	Relief valve setting on skid steer not properly adjusted	Have skid steer dealer set relief valve at correct pressure
	Worn, damaged, insufficient or inadequate pump	Repair or replace hydraulic pump
	Insufficient oil in system	Service the skid steer hydraulic reservoir
	Hose ends not completely engaged	Check hose coupling and engage properly
	Air in hydraulic lines	Cycle skid steer auxiliary system several times to remove air from lines
	Obstruction between roller and barrier	Reverse roller to clear obstruction
	Chain off	Repair or replace chain
Oil leaks	Worn or damaged seal	Replace leaking seal
	Loose or damaged hoses	Replaced damaged hoses and secure loose hoses
	Loose or damaged fittings	Replace damaged hose connections and tighten loose fittings
	Worn or damaged housing	Replace damaged housing
	Roller out of position	Loosen bearing collars on frame and chain case, force roller toward chain case, then re-tighen bearing collars.
Angle cylinder will not extend or retract	Electrical failure	See skid steer operator's manual
	Hydraulic system not activated	Engage roller drive motor before attempting to move angle cylinder
Angle cylinder will not hold position	Check valve in manifold malfunctioning	Repair or replace check valve
	Solenoid cartridge not returning to closed position	Repair or replace solenoid cartridge

SPECIFICATIONS

M4 SPECIFICATIONS

Raking Width ..... 48 inches (122 cm)
Roller Type ..... Tooth Roller Standard 7 inches (18 cm) Diameter
Roller Angle (ANGLING MODEL ONLY) ..... 20 Degrees Both Directions
Gap (Tube to Barrier) ..... 1.125 - 1.75 inches (2.86 - 4.45 cm) Adjustable
Skid-steer Lift Capacity Requirement ..... SAE Lift Capacity 500 lbs (227 kg)
Skid-steer Hydraulic Requirement ..... 8 gpm (30 lpm) @ 2200 psi (152 bar)(min.)
Tires ..... 13 inches x 5 inches (33 cm x 13 cm)
Tire Pressure ..... 20 psi (1 bar)
Weight Straight Rake ..... 450 lbs (204 kg)
Angling Rake ..... 510 lbs (231 kg)
Oil Capacity of Chain Case ..... Approximately 1.5 Pints (710 ml)

M5 SPECIFICATIONS

Raking Width ..... 62 inches (157 cm)
Roller Type ..... Tooth Roller Standard 9 inches (23 cm) Diameter
Roller Angle (ANGLING MODEL ONLY) ..... 20 Degrees Both Directions
Gap (Tube to Barrier) ..... 1.125 - 2.5 inches (2.86 - 6.35 cm) Adjustable
Skid-steer Lift Capacity Requirement ..... SAE Lift Capacity 1,200 lbs (544 kg)
Skid-steer Hydraulic Requirement ..... 13 gpm (49 lpm) @ 2500 psi (172 bar)(min.)
Tires ..... 16.5 inches x 6.5 inches x 8 inches (42 cm x 17 cm x 20 cm)
Tire Pressure ..... 60 psi (4 bar)
Weight Straight Rake ..... 798 lbs (362 kg)
Angling Rake ..... 938 lbs (425 kg)
Oil Capacity of Chain Case ..... Approximately 1.5 Pints (710 ml)

M6 SPECIFICATIONS

Raking Width ..... 72 inches (183 cm)
Roller Type ..... Tooth Roller Standard 9 inches (23 cm) Diameter
Roller Angle (ANGLING MODEL ONLY) ..... 20 Degrees Both Directions
Gap (Tube to Barrier) ..... 1.125 - 2.5 inches (2.86 - 6.35 cm) Adjustable
Skid-steer Lift Capacity Requirement ..... SAE Lift Capacity 1,200 lbs (544 kg)
Skid-steer Hydraulic Requirement ..... 13 gpm (49 lpm) @ 2500 psi (172 bar) (min.)
Tires ..... 16.5 inches x 6.5 inches x 8 inches (42 cm x 17 cm x 20 cm)
Tire Pressure ..... 60 psi (4 bar)
Weight Straight Rake ..... 785 lbs (356 kg)
Angling Rake ..... 925 lbs (420 kg)
Oil Capacity of Chain Case ..... Approximately 1.5 Pints (710 ml)

SPECIFICATIONS

MX7 SPECIFICATIONS

Raking Width		84 inches (213 cm)
Roller Type		Tooth Roller Standard 9 inches (23 cm) Diameter
Roller Angle (ANGLING MODEL ONLY)		20 Degrees Both Directions
Gap (Tube to Barrier)		1.125 - 2.5 inches (2.86 - 6.35 cm) Adjustable
Skid-steer Lift Capacity Requirement		SAE Lift Capacity 1,500 lbs (680 kg)
Skid-steer Hydraulic Requirement		15 gpm (57 lpm) @ 2500 psi (172 bar)(min.)
Tires		16.5 inches x 6.5 inches x 8 inches (42 cm x 17 cm x 20 cm)
Tire Pressure		60 psi (4 bar)
Weight	Straight Rake	855 lbs (388 kg)
	Angling Rake	1050 lbs (476 kg)
Oil Capacity of Chain Case		Approximately 1.5 Pints (710 ml)

MX8 SPECIFICATIONS

Raking Width		90 inches (229 cm)
Roller Type		Tooth Roller Standard 9 inches (23 cm) Diameter
Roller Angle (ANGLING MODEL ONLY)		20 Degrees Both Directions
Gap (Tube to Barrier)		1.125 - 2.5 inches (2.86 - 6.35 cm) Adjustable
Skid-steer Lift Capacity Requirement		SAE Lift Capacity 2000 lbs (907 kg)
Skid-steer Hydraulic Requirement		17 gpm (64 lpm) @ 2500 psi (172 bar)(min.)
Tires		20.5 inches x 8 inches x 10 inches (52 cm x 20 cm x 25 cm)
Tire Pressure		60 psi (4 bar)
Weight	Straight Rake	1125 lbs (510 kg)
	Angling Rake	1320 lbs (599 kg)
Oil Capacity of Chain Case		Approximately 1.5 Pints (710 ml)

BOLT TORQUE CHART

GENERAL TORQUE SPECIFICATION TABLES

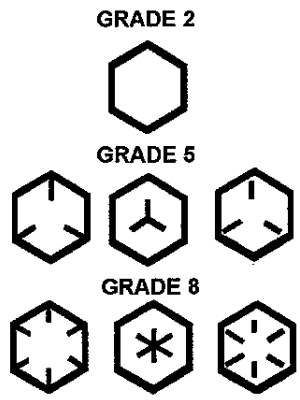
Use the following charts when determining bolt torque specifications when special torques are not given. Always use grade 5 or better when replacing bolts.

SAE BOLT TORQUE SPECIFICATIONS

NOTE: The following torque values are for use with extreme pressure lubricants, plating or hard washer applications Increase torque 15% when using hardware that is unplated and either dry or lubricated with engine oil.

Bolt Size		SAE GRADE 5 TORQUE				SAE GRADE 8 TORQUE			
		Pounds Feet		Newton-Meters		Pounds Feet		Newton-Meters	
Inches	Millimeters	UNC	UNF	UNC	UNF	UNC	UNF	UNC	UNF
1/4	6.35	8	9	11	12	10	13	14	18
5/16	7.94	14	17	19	23	20	25	27	34
3/8	9.53	30	36	41	49	38	46	52	62
7/16	11.11	46	54	62	73	60	71	81	96
1/2	12.70	68	82	92	111	94	112	127	152
9/16	14.29	94	112	127	152	136	163	184	221
5/8	15.88	128	153	174	207	187	224	254	304
3/4	19.05	230	275	312	373	323	395	438	536
7/8	22.23	340	408	461	553	510	612	691	830
1	25.40	493	592	668	803	765	918	1037	1245
1-1/8	25.58	680	748	922	1014	1088	1224	1475	1660
1-1/4	31.75	952	1054	1291	1429	1547	1700	2097	2305
1-3/8	34.93	1241	1428	1683	1936	2023	2312	2743	3135
1-1/2	38.10	1649	1870	2236	2535	2686	3026	3642	4103

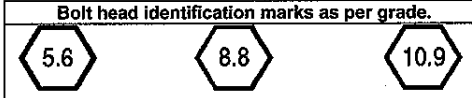
Bolt head identification marks as per grade.
NOTE: Manufacturing Marks Will Vary



METRIC BOLT TORQUE SPECIFICATIONS

NOTE: The following torque values are for use with metric hardware that is unplated and either dry or lubricated with engine oil. Reduce torque 15% when using hardware that has extreme pressure lubricants, plating or hard washer applications.

Bolt head identification marks as per grade.



Size of Bolt	Grade No.	Pitch (mm)	Pounds Feet	Newton-Meters	Pitch (mm)	Pounds Feet	Newton-Meters
M6	5.6	1.0	3.6-5.8	4.9-7.9	-	-	-
	8.8		5.8-.4	7.9-12.7		-	-
	10.9		7.2-10	9.8-13.6		-	-
M8	5.6	1.25	7.2-14	9.8-19	1.0	12-17	16.3-23
	8.8		17-22	23-29.8		19-27	25.7-36.6
	10.9		20-26	27.1-35.2		22-31	29.8-42
M10	5.6	1.5	20-25	27.1-33.9	1.25	20-29	27.1-39.3
	8.8		34-40	46.1-54.2		35-47	47.4-63.7
	10.9		38-46	51.5-62.3		40-52	54.2-70.5
M12	5.6	1.75	28-34	37.9-46.1	1.25	31-41	42-55.6
	8.8		51-59	69.1-79.9		56-68	75.9-92.1
	10.9		57-66	77.2-89.4		62-75	84-101.6
M14	5.6	2.0	49-56	66.4-75.9	1.5	52-64	70.5-86.7
	8.8		81-93	109.8-126		90-106	122-143.6
	10.9		96-109	130.1-147.7		107-124	145-168
M16	5.6	2.0	67-77	90.8-104.3	1.5	69-83	93.5-112.5
	8.8		116-130	157.2-176.2		120-138	162.6-187
	10.9		129-145	174.8-196.5		140-158	189.7-214.1
M18	5.6	2.0	88-100	119.2-136	1.5	100-117	136-158.5
	8.8		150-168	203.3-227.6		177-199	239.8-269.6
	10.9		175-194	237.1-262.9		202-231	273.7-313
M20	5.6	2.5	108-130	146.3-176.2	1.5	132-150	178.9-203.3
	8.8		186-205	252-277.8		206-242	279.1-327.9
	10.9		213-249	288.6-337.4		246-289	333.3-391.6

PALADIN CONSTRUCTION GROUP

CE

EU DECLARATION OF CONFORMITY

I, the undersigned, on behalf of:

Manufacturer/Technical Document Holder

Paladin Construction Group
2800 N. Zeeb Road
Dexter, MI 48130 USA
Phone: 734-996-9116
Fax: 734-996-9014

hereby declare that the following product:

Description of Equipment: **Hydraulically operated Landscape rake for skid steer loader applications. Used for removing rock, small debris and for thatching.**

Attachment Model: **M4, M5, M6, MX7, and MX8**

Serial Number: _____

Conforms to: **2006/42/EC Machinery Directive EN982:2008; EN ISO 474-1:2009; EN ISO 12100-1:2009; EN ISO 12100-2:2003; EN ISO 1412-1:2007; EN ISO 2860:1992; ENISO 2867:2006**

Certification method: **Self-certified, per Annex V of the Directive**

Name and address of the person in the Community authorized to compile the technical construction file:

GENESIS GmbH
Alpenstrasse 71
Memmingen, GERMANY D – 87700

At Dexter, Signature, Title, Date

Signature: _____

Title: _____

Date: _____

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