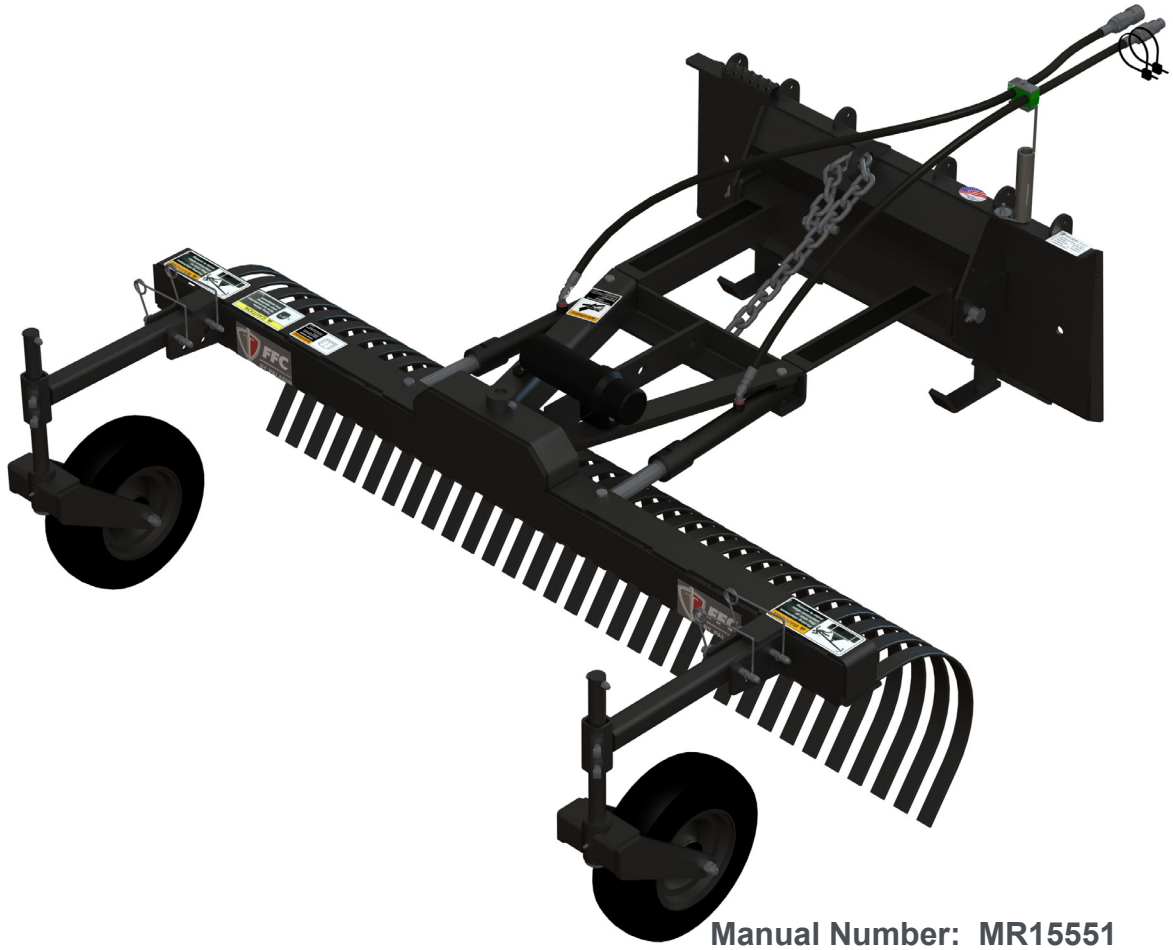
FFC
BY PALADIN

OPERATOR'S MANUAL

GRADER RAKE



SERIAL NUMBER: _____

MODEL NUMBER: _____

Manual Number: MR15551
Part Number: LAF6682, LAF6692, LAF6697 & LAF6602
Release Date: December 2018
Rev. 4

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PREFACE

GENERAL COMMENTS

Congratulations on the purchase of your new product! 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.

This manual has been designed to help you do a better, safer job. Read this manual carefully and become familiar with its contents.

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 forward.

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 this 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 the manufacturer to obtain further assistance. Keep this manual available for reference. Provide the 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 for 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 not possible 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

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.

DANGER — **THIS SIGNAL WORD INDICATES A HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.**

WARNING — **THIS SIGNAL WORD INDICATES A HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.**

CAUTION — **THIS SIGNAL WORD INDICATES A HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN MINOR OR MODERATE INJURY.**

NOTICE — **NOTICE IS USED TO ADDRESS PRACTICES NOT RELATED TO PHYSICAL INJURY.**

GENERAL SAFETY PRECAUTIONS

WARNING! READ MANUAL PRIOR TO INSTALLATION

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 ensure 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.

GENERAL SAFETY PRECAUTIONS

WARNING! PROTECT AGAINST FLYING DEBRIS

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

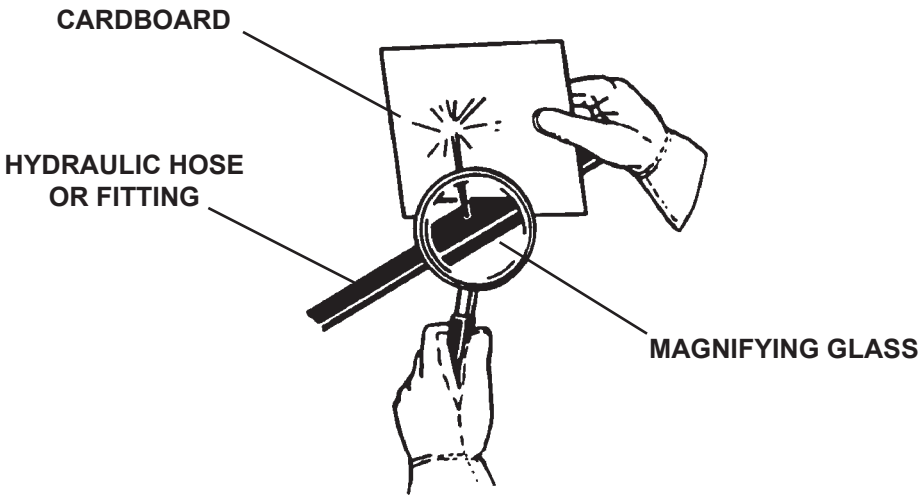
WARNING! LOWER OR SUPPORT RAISED EQUIPMENT

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.

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.**



GENERAL SAFETY PRECAUTIONS

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 Protective Structure) 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 tools 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.

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 operator's position.
- Never leave equipment unattended with the engine running, or with this attachment in a raised 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!

CALIFORNIA PROPOSITION 65 WARNING

This product may contain a chemical known to the state of California to cause cancer, or birth defects or other reproductive harm. www.P65Warnings.ca.gov

EQUIPMENT SAFETY PRECAUTIONS

WARNING!

KNOW WHERE UTILITIES ARE

Observe overhead electrical and other utility lines. Be sure equipment will clear them. When digging, call your local utilities for location of buried utility lines, gas, water, and sewer, as well as any other hazard you may encounter.

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.

OPERATING THE ATTACHMENT

- Do not exceed the lifting capacity of your prime mover.
- Operate only from the operator's station.
- When operating on slopes, drive up and down, not across. Avoid steep hillside operation, which could cause the prime mover to overturn.
- Reduce speed when driving over rough terrain, on a slope, or turning, to avoid overturning the vehicle.
- An operator must not use drugs or alcohol, which can change his or her alertness or coordination. An operator taking prescription or over-the-counter drugs should seek medical advice on whether or not he or she can safely operate equipment.
- Before exiting the prime mover, lower the attachment to the ground, apply the brakes, turn off the engine and remove the key
- Always lift the rake before backing up
- Never place your hands between the tines when attempting to dislodge debris.
- Do not attempt to straighten a bent tine. Straightening will cause localized reduction in strength.
- Do not attempt to adjust the wheel arm by repositioning the set screws if the weight of the unit is supported by the wheels or tines. Keep your hands off the fork stem and your feet out from under the tire when loosening.

EQUIPMENT SAFETY PRECAUTIONS

TRANSPORTING THE ATTACHMENT

- Travel only with the attachment in a safe transport position to prevent uncontrolled movement. Drive slowly over rough ground and on slopes.
- When transporting on a trailer: Secure attachment at recommended tie down locations using tie down accessories that are capable of maintaining attachment stability.
- When driving on public roads use safety lights, reflectors, Slow Moving Vehicle signs etc., to prevent accidents. Check local government regulations that may affect you.
- Do not drive close to ditches, excavations, etc., cave in could result.
- Do not smoke when refueling the prime mover. Allow room in the fuel tank for expansion. Wipe up any spilled fuel. Secure cap tightly when done.

MAINTAINING THE ATTACHMENT

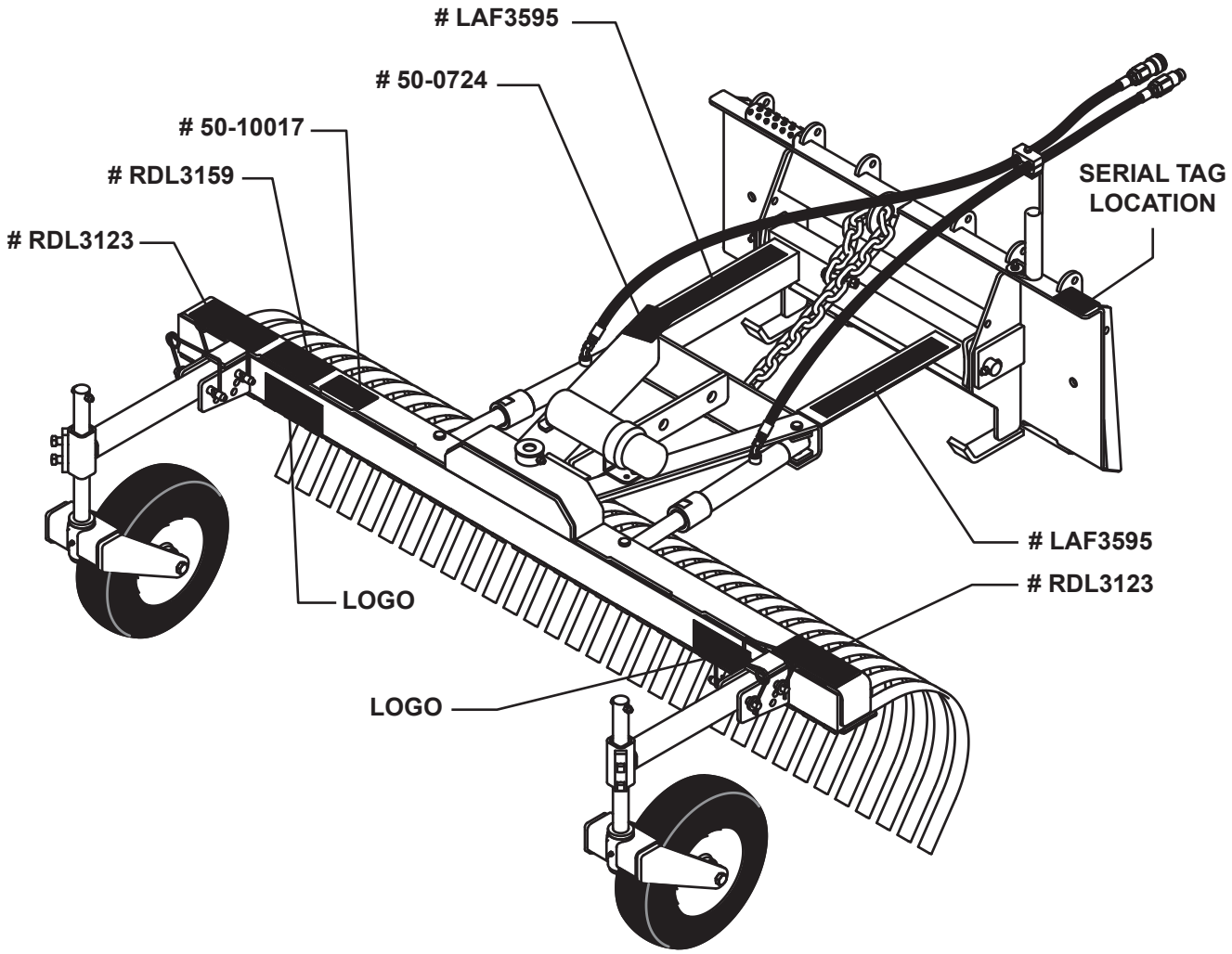
- Before performing maintenance lower the attachment to the ground, apply the brakes, turn off the engine and remove the key.
- Never perform any work on the attachment unless you are authorized and qualified to do so. Always read the operator service manuals before any repair is made. After completing maintenance or repair, check for correct functioning of the attachment. If not functioning properly, always tag “DO NOT OPERATE” until all problems are corrected.
- Worn, damaged, or illegible safety decals must be replaced. New safety decals can be ordered from Paladin.
- Never make hydraulic repairs while the system is under pressure. Serious personal injury or death could result.
- Never work under a raised attachment.

DECALS

DECAL PLACEMENT

GENERAL INFORMATION

The diagram on this page shows the location of the decals used on your attachment. The decals are identified by their part numbers, with reductions of the actual decals located on the following page. Use this information to order replacements for lost or damaged decals. Be sure to read all decals before operating the attachment. They contain information you need to know for both safety and product longevity.

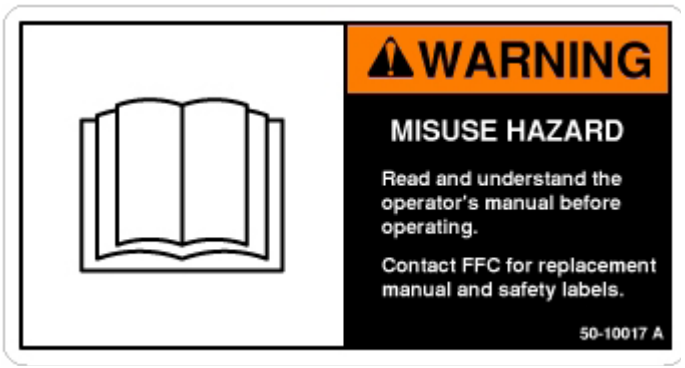


IMPORTANT: Keep all safety decals clean and legible. Replace all missing, illegible, or damaged safety decals. When replacing parts with safety decals attached, the safety decals must also be replaced. Safety decals are available, free of charge, from your local dealer or Paladin.

REPLACING SAFETY DECALS: Clean the area of application with nonflammable solvent, then wash the same area with soap and water. Allow the surface to fully dry. Remove the backing from the safety decal, exposing the adhesive surface. Apply the safety decal to the position shown in the diagram above and smooth out any bubbles.

DECALS

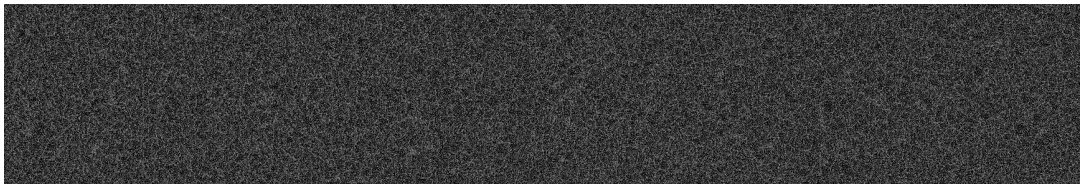
 # 50-0724 WARNING! HIGH PRESSURE FLUID



 # 50-10017 WARNING! READ MANUAL

 # RDL3123 WARNING! PIVOTING ATTACHMENT

 # RDL3159 CAUTION! FLYING DEBRIS



 # LAF3595 NON-SKID TAPE

NOTE: CONTACT YOUR LOCAL DEALER FOR MODEL NUMBER AND LOGO DECALS

INSTALLATION

GENERAL INFORMATION

The following instructions will help you to mount your grader rake onto your prime mover. The grader rake uses the quick-attach system for ease of installation. Therefore, if you know how to attach your loader bucket, attaching the grader rake should prove no problem.

Remember to read all safety warnings, decals and operating instructions before operating the attachment. If there is any portion of this manual that you do not understand, contact your dealer.

WARNING! When this product is not attached to a loader, do not lift the bottom of the loader attachment plate more then 2' above the bottom of the rake tines (when wheels are off or in the vertical position, this could suddenly flip forward.) Failure to obey this warning could result in death or serious injury.

INSTALLATION

NOTICE! Lubricate all grease fittings before connecting this product to your prime mover's hydraulic system. Refer to Lubrication page and follow the instructions.

1. Remove any attachment from the front of the prime mover.
2. Place this product on a firm, level surface that is large enough to safely accommodate this product, your prime mover and all workers involved in the mounting process. Your Grader Rake should rest on the rake tines and the base of the mounting plate. Refer to Initial Set-Up for first time installation.
3. Following all standard safety practices and the instructions for installing an attachment in your prime mover operator's manual, install the attachment onto your prime mover.

WARNING! To avoid serious personal injury, make sure the attachment is securely latched to the attachment mechanism of your unit. Failure to do so could result in separation of the attachment from the prime mover.

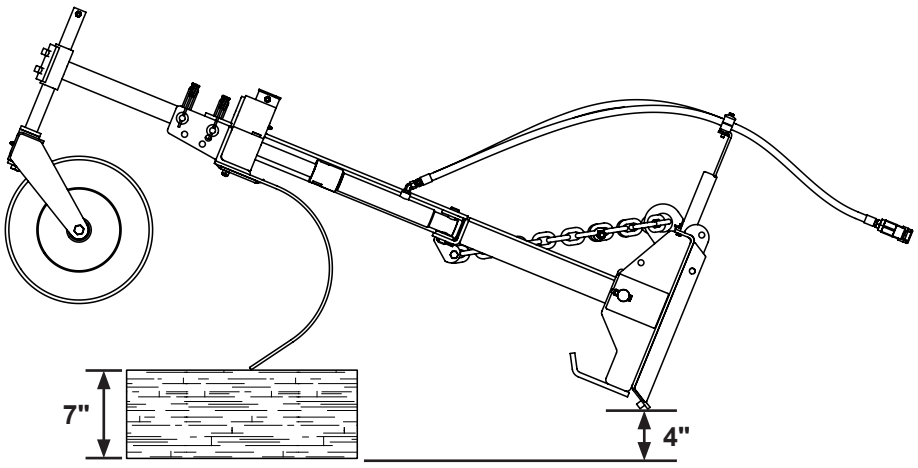
4. Lower the unit to the ground and relieve pressure to the auxiliary hydraulic lines.
5. Following the safety shut down procedure for your prime mover, shut down and exit the prime mover.
6. After making sure that the hydraulic couplers are free from any foreign material or contaminants, connect the couplers to the auxiliary hydraulic system of your prime mover.
7. Following the standard start up procedure for your prime mover, start the prime mover and run all cylinders on the attachment to purge any air from the system. Check for proper hydraulic connection, hose routing and hose length.
8. Attachment installation is complete.

INSTALLATION

INITIAL SET-UP

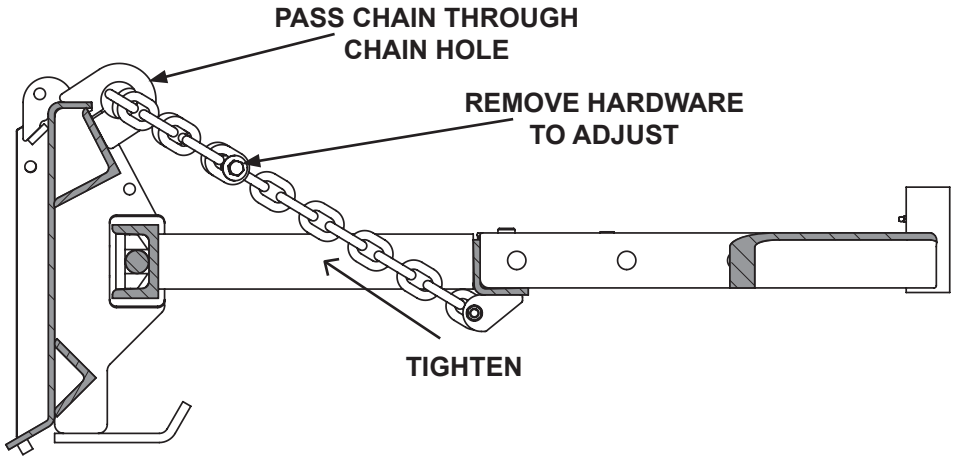
1. Place the rake on a hard level surface with the tines supported on each end with 7” tall blocking. (A 3' piece of 2x6 nailed to a 3' piece of 6x6 placed perpendicular to the rake under each end of the rake should be sufficient if sound wood is used.)
2. Place your prime mover in park and engage the parking brake.
3. Lower the loader completely or until the bottom of the mounting plate is a minimum 4” above the surface. See Figure #1

FIGURE #1



4. Roll back toolbar, shut off your engine and remove the key.
5. If the lift chain is tight and supporting some of the weight off of the tires, go to step 8. If there is slack in the lift chain continue to step 6.
6. Remove the hardware securing the end of the lift chain back to itself.
7. Pull the lift chain through the chain hole in the mounting plate until the lift chain is tight. If the chain has any slack when reinstalling the bolt pull the lift chain through the chain hole one more link to further tighten the chain. See Figure #2

FIGURE #2



If necessary: Restart your prime mover and roll out the toolbar to provide enough slack in the chain to achieve adequate tightening. Make sure to shut off your engine and remove the key before leaving the operator’s station.

8. Secure the end of the lift chain back to itself using the existing hardware.
9. Restart your prime mover, raise the loader enough to lift the rake off the blocking, move away from the blocking to a clear level surface, place your prime mover in “Park”, and engage the parking brake.
10. Lower the loader as described in step 2.
11. Use the toolbar to let the rake down so that the rake tines lightly touch the level surface.
12. Shut off your engine, remove the key.
13. With the two set screws on the wheel arm loosened, install the wheel arm on the top front and the top rear holes of the rake head frame using the Caster Wheel Installation instructions.
14. Pivot the wheel fork back toward the loader in a normal trailing position with the tire resting on the level surface. In some cases, the tire may be supported by the bolt at the top of the pivot shaft and will not touch the level surface.
15. While lifting up on the wheel arm enough to remove all slack from the snap-lock pins, firmly secure with the 2 set screws and torque to 95 ft-lbs., + or - 2.0 ft-lbs. Repeat for the other wheel arm. If proper adjustment procedures are followed, setscrews should never need to be repositioned except to compensate for tine wear or unusual conditions.

CASTER WHEEL INSTALLATION

1. Park your prime mover and Grader Rake on a level surface with your prime mover in “Park” and with the parking brake engaged.
2. With your prime mover’s loader fully lowered, shut off your engine, remove the key, and relieve all pressure in the hydraulic lines.
3. Insert a snap-lock pin through the lower front holes of the rake head frame.
4. Rest the wheel arm tube on that pin.
5. Secure the wheel arm tube to the top front holes of the rake head frame using a second snap-lock pin.
6. Raise the front of the wheel arm enough to allow for the first pin to be removed from the lower front holes and reinstalled in one of the 3 rear holes to fully secure wheel arm to the rake head frame.

For removal of a wheel, the process should be reversed with the pin installed during step 5 above being stored in the lower rear holes after removal.

DETACHING

1. Before exiting the prime mover, lower the attachment to the ground, apply the brakes, shut off the engine, and remove the key.
2. Follow prime mover operator’s manual to relieve pressure in the hydraulic lines.
3. Disconnect power and return hoses from the auxiliary hydraulics.
4. Follow your prime mover operator’s manual for detaching (removing) an attachment.
5. Connect hydraulic couplers together or install caps to prevent contaminants from entering the hydraulic system. Store hoses off of the ground to help prevent damage.

OPERATION

OPERATION

Simplicity of operation is one of the key features of the grader rake. The rake uses the quick-attach system to mount to your prime mover. Due to this arrangement, thorough knowledge of the prime mover controls is necessary for rake operation. Read the prime mover and rake manuals for information regarding safety and operation before attempting to use the rake.

Prior to starting the job, take time to check for and mark any hidden obstructions such as sidewalk edges, water and gas shut offs, etc. Hitting such obstructions when operating the rake, especially at higher speeds, could cause injury to the operator or damage to the obstruction, rake, and/or prime mover.

Take notice of ground conditions and operate accordingly. Be aware of soft ground, icy or rocky conditions. Additional attention may be necessary for proper traction. Drive slow when traveling on slopes, hilly ground or turning.

The rake is designed for scarifying, grading material, and spreading debris for site cleanup. If grading shoulders/ditches the best results are usually angling and tilting the rake towards the ditch. For grading driveways you will find the best results are usually obtained with the rake straight.

WARNING! Failure to obey the following procedures could result in death or serious injury.

- **Never allow anyone to get between the rake and any part of this product or your prime mover.**
- **Never lift this product above (a) the operator's eye level or (b) to a height where visibility is obstructed, whichever is lower.**
- **Keep all bystanders a safe distance from this product.**

CAUTION! Failure to obey the following procedures may result in personal injury.

- **Always wear eye protection (minimum, full face protection preferred) and protective clothing.**
- **Always lift the rake before backing up.**
- **Do not attempt to adjust the wheel arm by repositioning the set screws if the weight of the unit is supported by the wheels or tines. Keep your hands off the fork stem and your feet out from under the tire when loosening.**

1. Position the attachment with the A-frame level with the ground, tires lightly touching the ground and the tines 1"-3" off the ground.
2. With the rake straight (not angled) use the loader toolbar to raise and lower the rake tines.
3. Additional slack in the chain may be required depending on the terrain. This is best obtained by raising the loader arms and rolling out the toolbar to restore the rear of the A-frame to its original height.

IMPORTANT! Rolling out the toolbar until the mounting plate contacts the A-frame CAN result in damage to this product and WILL void all Paladin warranties.

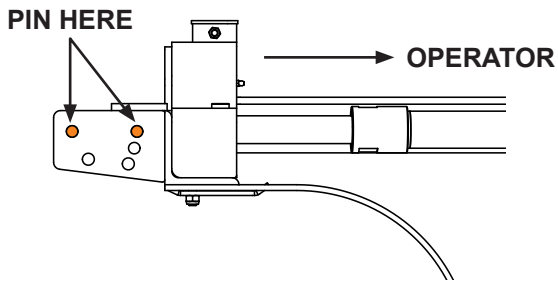
OPERATION

OPERATING ADJUSTMENTS

Normal Operation

- The rake can be straight or angled.
- Attach the wheel arms to the rake head frame using the top front and the top rear holes. See Figure #1

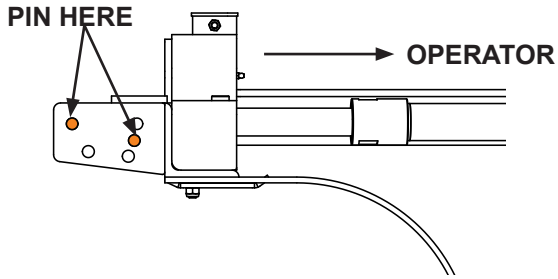
FIGURE #1



Rough Leveling Or Scarification

- The rake can be straight or angled.
- Attach the wheel arms to the rake head frame using the top front and the center rear holes. See Figure #2

FIGURE #2



Crowning

- The rake should be angled.
- Attach the leading wheel arm to the rake head frame using the top front and the top rear holes. See Figure #3
- Attach the trailing wheel arm to the rake head frame using the top front and the center or lower rear holes. See Figure #4

FIGURE #3

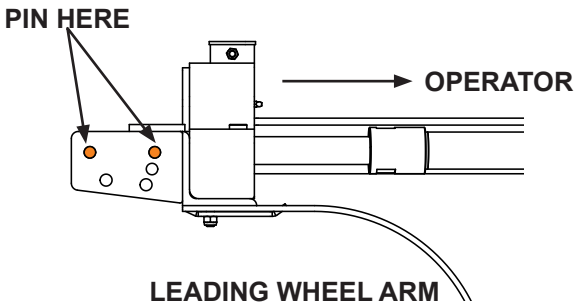
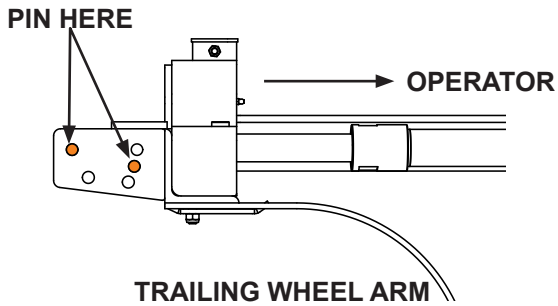


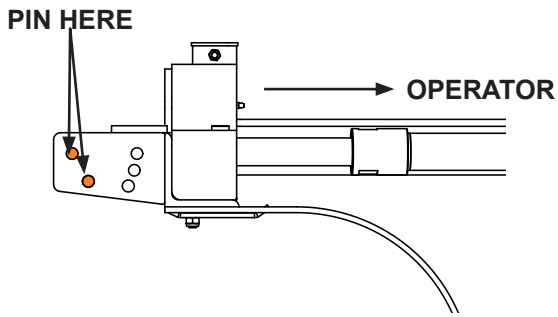
FIGURE #4



Pushing Large Quantities Of Loose Material

- The rake should be straight.
- Attach the wheel arms to the rake head frame using the top front hole and rotate the wheel arms up until the pins can be inserted in the lower front holes on what was, prior to rotation, the top side of the wheel arm tubes. See Figure #5

FIGURE #5



IMPORTANT! Grading without the wheels (wheels in the PUSHING position) CAN result in damage to this product and WILL void all Paladin warranties.

OPERATION

OPERATING TIPS

- Do not exceed 12 mph when operating. Reduce your ground speed if the rake head begins to “bounce”.
- The recommended crown for a gravel road is .50” per foot of road width. (i.e. The center of a 20’ wide road should be 5” higher than each edge of the road.)
- The CROWNING position can be used to taper the backfill around a concrete pad or to dig a shallow trench.
- Grade gravel and sub bases when the materials are damp to reduce dust and improve workability.
- Grade topsoil only when the materials are dry so that the amount of compaction can be reduced.

STORAGE

- Clean the unit thoroughly, removing all mud, 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.
- Replace decals that are damaged or in unreadable condition.
- 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 prevent rust.

REMOVAL FROM STORAGE

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

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.

- 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.

- 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.**

TRANSPORTING

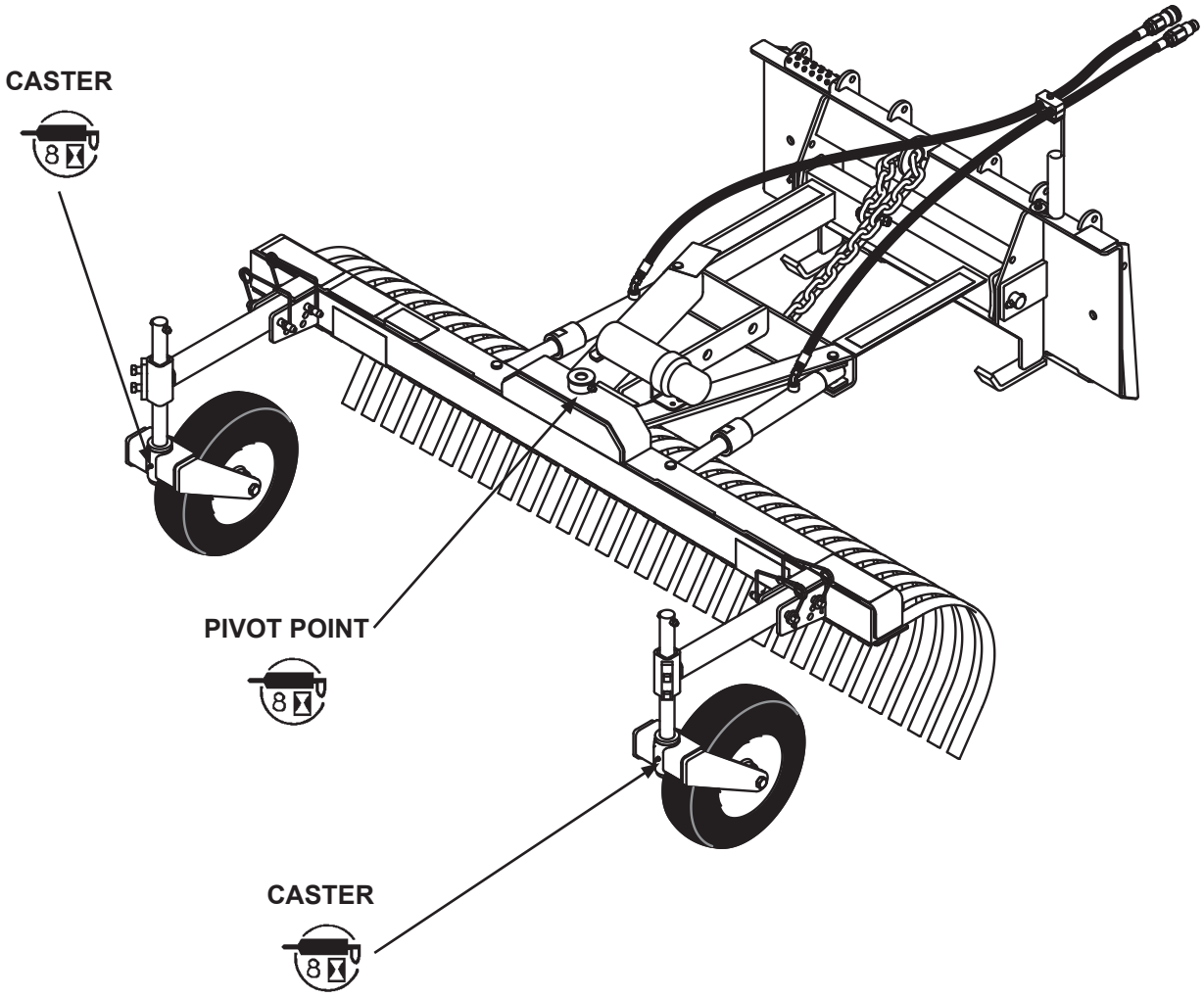
Follow all local government regulations that may apply along with recommended tie down points and any equipment safety precautions at the front of this handbook when transporting your attachment.

LUBRICATION

LUBRICATION

All parts provided with grease fittings should be lubricated as indicated. If any grease fittings are missing, replace them immediately. Clean all fittings thoroughly before using grease gun.

Lubricate daily or every 8 hours of operation, whichever comes first, with SAE Multi-Purpose Lubricant or an equivalent SAE Multi-Purpose type grease.



IMPORTANT: Avoid excessive greasing. Dirt collects on exposed grease and greatly increases wear. After greasing, wipe off excessive grease from fittings.

MAINTENANCE AND SERVICE

GENERAL INFORMATION

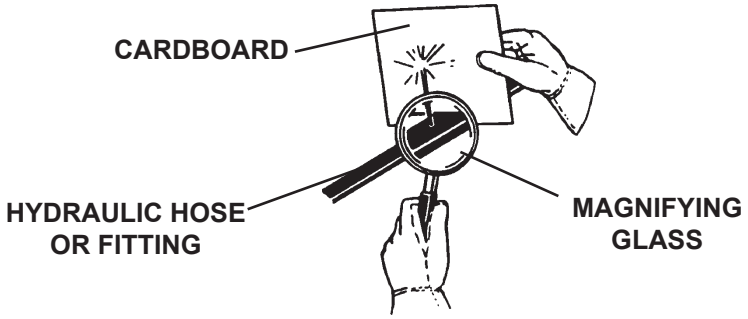
Regular maintenance is the key to long equipment life and safe operation. Maintenance requirements have been reduced to an absolute minimum. However it is very important that these maintenance functions be performed as described below.

Procedure	Every 8 Hours (Daily)	Every 1000 Hours (Yearly)
Check prime mover hydraulic system to ensure an adequate level and cleanliness of hydraulic oil.	✔	
Check for missing or loose hardware. Replace or tighten as necessary. See Bolt Torque Specifications	✔	
Check hydraulic system for leaks and tighten as necessary. Check for damage and replace as needed.	✔	
Check for missing or damaged safety decals and replace as necessary.	✔	
Check tire pressure. (60 psi cold)	✔	
Inspect attachment for any worn parts or cracked welds. Repair as required.	✔	
Lubricate grease fittings.	✔	
Fully cycle & retract all possible cylinder rods.	✔	
Repack the bearings in the wheels.		✔

WARNING! **Escaping hydraulic / diesel fluid under pressure can penetrate the skin causing serious injury. Fluid escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood, rather than hands to search for suspected leaks.**

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.

Stop the engine and relieve pressure before connecting or disconnecting lines. Tighten all connections before starting engine or pressurizing lines.



MAINTENANCE AND SERVICE

IMPORTANT! When replacing parts use only factory approved replacement parts. Manufacturer will not claim responsibility for use of unapproved parts or accessories and/or other damages as a result of their use.

RAKE TINE REPLACEMENT

1. Park the attachment on a hard level surface.
2. Place your prime mover in “Park” and engage the parking brake.
3. Lower this product onto two pieces of blocking that are positioned under each end of the rake. Use a 2' piece of 4x4 (minimum) for each piece of blocking.
4. Shut off your engine, remove the key, and relieve all pressure in the hydraulic lines.
5. From the front of your grader rake, reach over the rake head frame and loosen the nut from the rake tine that is to be replaced while holding the capscrew with wrench. Remove the hardware.
6. Loosen the hardware that is on each side of where the nut and capscrew was just removed.
7. Slide the tine back until the tine is clear of the rake head frame. Properly dispose of any bent, damaged, or excessively worn rake tines and any worn or damaged bolts or nuts.

CAUTION **Failure to obey the following procedures may result in personal injury.**

Do not attempt to straighten a bent rake tine. Straightening will cause a localized reduction in strength, which could cause a sudden failure of the tine during the straightening process or while operating.

8. If the remaining rake tines have significant wear, trim off the end of the new rake tine with an abrasive wheel or torch.

WARNING! **Wear Gloves, safety glasses and any additional PPE required for your particular grinder. Ensure all safety shields are in place and bystanders are a safe distance away from your work area. When grinding paint, avoid breathing the dust. Wear an approved respirator.**

9. Make sure the tine plate is positioned correctly and secure in place. Torque to 54 ft. lbs., + or - 4.0 ft. lbs.
10. Repeat for other rake tines as necessary.

REPLACING WHEEL BEARINGS

1. Make sure that there is no weight on the wheels. If the wheels are partially supporting the weight of this product, restart your prime mover and lift the wheels off the ground. Repeat the shutdown procedure.
2. Remove each wheel using two wrenches. Remove the bearing components from the wheels.
3. Clean the bushings and using a high quality, waterproof grease repack the new bearing and components in the hub.
4. Reassemble using a new seal.

REMOVING WEDGED DEBRIS

1. Lower the rake onto two pieces of blocking that are positioned under each end of the rake. Use a 2' piece of 4x4 (minimum) for each piece of blocking.

CAUTION! **Failure to obey the following procedures may result in personal injury.**

Never place your hands between the tines when attempting to dislodge debris that is caught between the tines. In certain circumstances, the debris could give way suddenly and allow the tines to spring back to the normal position.

2. Use a hammer to drive the debris forward and down off the tines or use other methods as may be appropriate for the type of debris encountered.

MAINTENANCE AND SERVICE

CYLINDER SEAL REPLACEMENT

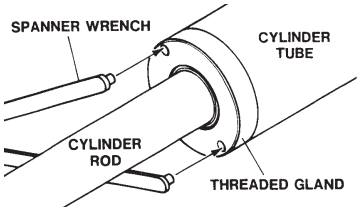
The following information is provided to assist you in the event you should need to repair or rebuild a hydraulic cylinder. When working on hydraulic cylinders, make sure that the work area and tools are clean and free of dirt to prevent contamination of the hydraulic system and damage to the hydraulic cylinders. Always protect the active part of the cylinder rod (the chrome section). Nicks or scratches on the surface of the rod could result in cylinder failure. Clean all parts thoroughly with a cleaning solvent before reassembly.

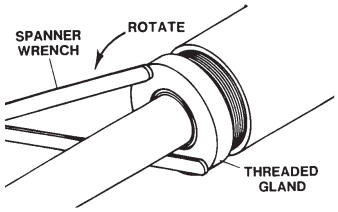
DISASSEMBLY PROCEDURE

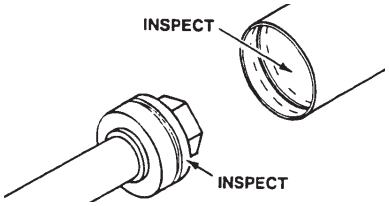
IMPORTANT: Do not contact the active surface of the cylinder rod with the vise. Damage to the rod could result.

THREADED TYPE GLAND

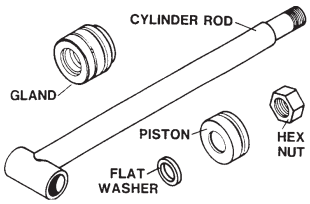
1. Rotate the gland with a spanner wrench counterclockwise until the gland is free of the cylinder tube.
2. Pull the cylinder rod from the cylinder tube and inspect the piston and the bore of the cylinder tube for deep scratches or galling. If damaged, the piston AND the cylinder tube must be replaced.

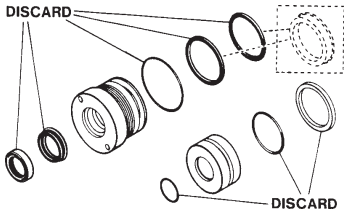






3. Remove the hex nut, piston, flat washer or spacer tube (if so equipped), and gland from the cylinder rod. If the cylinder rod is rusty, scratched, or bent, it must be replaced.
4. Remove and discard all the old seals.



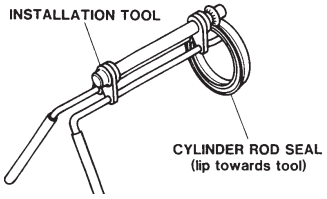


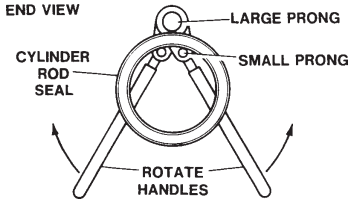
ASSEMBLY PROCEDURE

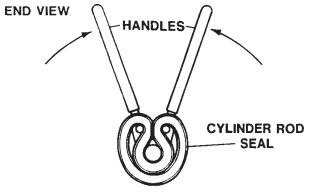
IMPORTANT: Replace all seals even if they do not appear to be damaged. Failure to replace all seals may result in premature cylinder failure. NOTE: Seal kits will service most cylinders of similar bore size and rod diameter.

1. Install the cylinder rod seal in the gland first. Be careful not to damage the seal in the process, as it is somewhat difficult to install.

NOTE: A special installation tool (Part #65349) is available to help with installing the seal. Simply fit the end of the tool over the seal so that the large prong of the tool is on the outside of the seal, and the two smaller prongs on the inside. The lip of the seal should be facing towards the tool. Rotate the handles on the tool around to wrap the seal around the end of the tool.



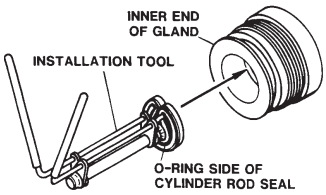




Rotate the handles on the tool around to wrap the seal around the end of the tool.

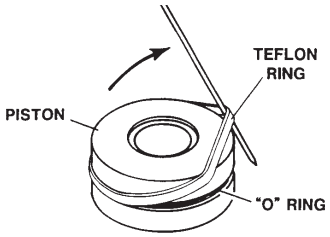
MAINTENANCE AND SERVICE

Now insert the seal into the gland from the inner end. Position the seal in its groove, and release and remove the tool. Press the seal into its seat the rest of the way by hand.



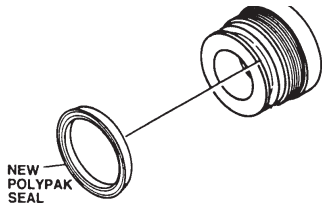
2. Install the new piston ring, rod wiper, O-rings and backup washers, if applicable, on the piston.

   Be careful not to damage the seals. Caution must be used when installing the piston ring. The ring must be stretched carefully over the piston with a smooth, round, pointed tool.



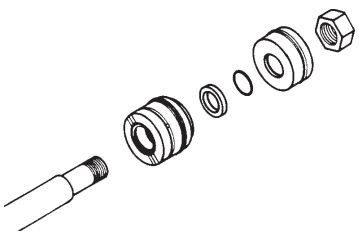
3. After installing the rod seal inside the gland, as shown in step #1, install the external seal.

NOTE: Threaded glands may have been equipped with a separate O-ring and backup washer system or a polypak (all in one) type seal. Current seal kits contain a polypak (all in one) type seal to replace the discarded seal types on ALL THREADED GLANDS.



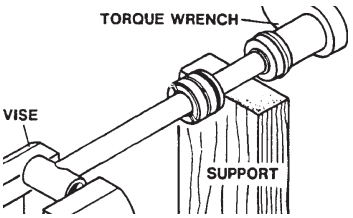
4. Slide the gland onto the cylinder rod, being careful not to damage the rod wiper. Then install the spacer, or flat washer (if so equipped), small o-ring, piston, and hex nut onto the end of the cylinder rod.

5. Secure the cylinder rod (mounting end) in a vise with a support at its center. Torque the nut to the amount shown for the thread diameter of the cylinder rod (see chart).



Thread Diameter	POUNDS - FEET
7/8"	150-200
*1"	230-325
1-1/8"	350-480
1-1/4"	490-670
1-3/8"	670-900

*** 1" Thread Diameter WITH 1.25" Rod Diameter**
Min. 230 ft. lbs. Max. 250 ft. lbs.



IMPORTANT: Do not contact the active surface of the cylinder rod with the vise. Damage to the rod could result.

6. Apply a lubricant (such as Lubriplate #105) to the piston and teflon ring. Insert the cylinder rod assembly into the cylinder tube.

IMPORTANT: Ensure that the piston ring fits squarely into the cylinder tube and piston groove, otherwise the ring may be damaged and a leak will occur.

7. Use a spanner wrench to rotate the gland clockwise into the cylinder. Continue to rotate the gland with the spanner wrench until it is tight.

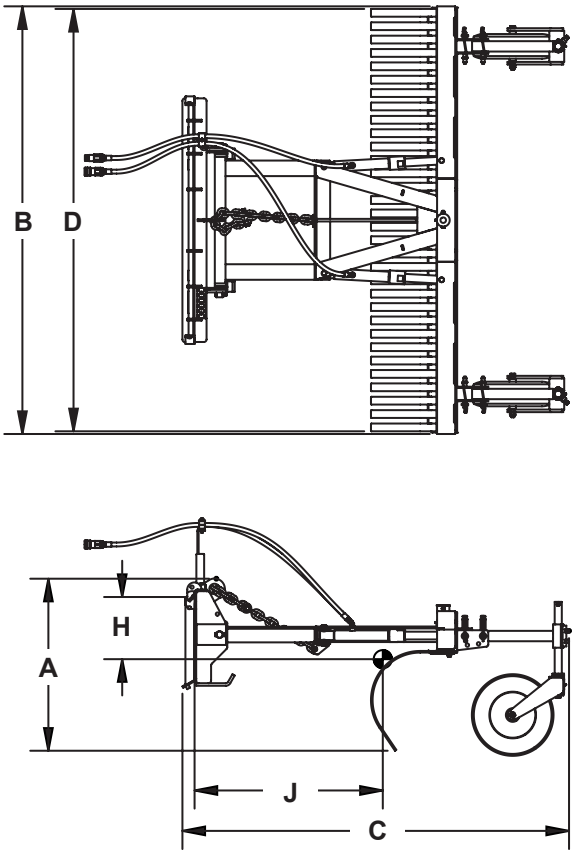
WARNING! **Cylinders serviced in the field are to be tested for leakage prior to the attachment being placed in work. Failure to test rebuilt cylinders could result in damage to the cylinder and/or the attachment, cause severe personal injury or even death.**

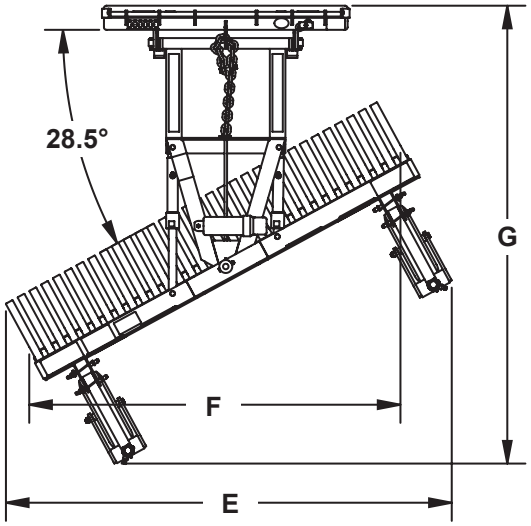
TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTION
RAKE WILL NOT SWING IN ONE DIRECTION	Hydraulic hoses or fittings are loose or damaged.	Tighten or replace hoses or fittings.
RAKE SWINGS IN WRONG DIRECTION	Hoses installed incorrectly.	Switch hoses at the cylinders.
RAKE WILL NOT SWING	Axillary hydraulics control on prime mover is activated in the wrong position.	Refer to prime mover operator's manual.
	Hoses from attachment to prime mover incorrectly connected.	Refer to prime mover operator's manual.
	Hydraulic hoses are obstructed.	Remove obstruction and replace if necessary.
	Worn or damaged housing.	Replace damaged housing.
SLUGGISH RAKE OPERATION	Insufficient oil flow from prime mover.	Check compatibility between attachment hydraulic flow requirements and prime mover.
		Increase throttle.
	Hoses pinched or obstructed.	Check hose routing, remove obstruction and replace if necessary.
	Prime mover hydraulic filter is dirty.	Refer to prime mover operator's manual.
HYDRAULIC QUICK COUPLER LEAKS	Quick coupler loose or damaged.	Tighten or replace quick couplers.
OIL LEAKS FROM THE CYLINDER	Seals on hydraulic fittings damaged.	Replace hydraulic fitting.
	Hydraulic fittings loose or damaged.	Tighten or replace as required.
	Hydraulic lines loose or damaged.	Tighten or replace as required.
EXCESSIVE HYDRAULIC OIL TEMPERATURE	Low hydraulic oil level on the prime mover.	Refer to prime mover operator's manual.
	Hydraulic hoses are obstructed.	Remove obstruction and replace if necessary.
	Hydraulic oil is dirty.	Refer to prime mover operator's manual.
	Quick couplers are loose.	Tighten or engage quick couplers. Replace if necessary.

SPECIFICATIONS

GRADER RAKE SPECIFICATIONS





SPECIFICATIONS AND DESIGN ARE SUBJECT TO CHANGE WITHOUT NOTICE AND WITHOUT LIABILITY THEREFOR.

DESCRIPTION	82"	92"	97"	102"
A. Overall Height	33.20″	33.20″	33.20″	33.20″
B. Overall Width	82.50″	92.80″	97.90″	103.10″
C. Overall Length	74.60″	74.60″	74.60″	74.60″
D. Raking Width	81.50″	97.80″	97.00″	102.10″
E. Overall Width @ 28.5°	86.00″	90.50″	92.80″	95.10″
F. Raking Width @ 28.5°	71.60″	80.60″	85.30″	89.80″
G. Overall Length @ 28.5°	88.30″	88.30″	88.30″	88.30″
H. Center of Gravity - Horizontal	36.30″	36.60″	36.70″	36.80″
J. Center of Gravity - Vertical	12.00″	12.00″	12.10″	12.10″
Cutting Depth - for Crowning	5.25″	5.88″	6.19″	6.50″
Weight (lbs)	715#	750#	775#	790#
Hydraulic Pressure				4000 PSI

BOLT TORQUE SPECIFICATION

GENERAL TORQUE SPECIFICATION TABLES

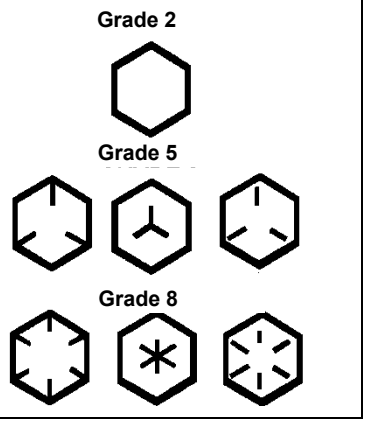
Use the following charts when determining bolt torque specifications, when special torques are not given. Always use grade 5 or better when replacing bolts.

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			
		Ft-lbs		Newton-Meter		Ft-lbs		Newton-Meter	
Inches	mm	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

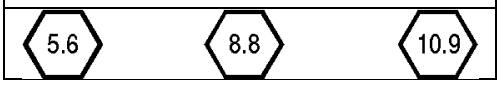
Bolt head identification marks as per grade.
NOTE: Manufacturing Marks Will Vary



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.



Bolt Size	Grade No.	Pitch (mm)	Ft-lbs	Newton-Meter	Pitch (mm)	Ft-lbs	Newton-Meter
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

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PARTS

In order to provide you with the most UP-TO-DATE part information, all parts for this attachment have been moved to our website at ***www.paladinattachments.com/Manuals***. Please use these diagrams and parts lists to locate replacement parts.

When servicing your attachment, remember to use only original manufacturer replacement parts. Substitute parts may not meet the standards required for safe, dependable operation.

To facilitate parts ordering when contacting the factory, please have the product control number (PCN or C/N) or model and serial number of your product ready to ensure that you receive the correct parts for your specific attachment.

The product control number, model and serial number for your attachment should be recorded in the space provided on the cover of this manual. This information may be obtained from the serial number identification plate located on your attachment.

NOTE: Most daily and emergency parts orders (in stock) received by 10:30 A.M. (Eastern Standard Time) will be shipped UPS Ground the same day received. UPS Next Day orders must be received by 1:30 PM (Eastern Standard Time.)

SERVICE DEPARTMENT
(734) 996-9116
(800) 456-7100

For Fax and E-mail Orders
PLC_Sales@paladinattachments.com
(734) 996-9014

WARRANTY

In order to provide you with the most UP-TO-DATE Warranty information, Paladin Warranty Statement and Warranty Procedures along with Warranty Registration and Claim Forms have been moved to our website at ***www.paladinattachments.com***.