

1 INTRODUCTION

Congratulations on your choice of an AgriMetal Self-Propelled Greens Roller to complement your operation. This equipment has been designed and manufactured to meet the needs of a discerning turf care industry.

Safe, efficient and trouble free operation of your AgriMetal Greens Roller requires that you and anyone else who will be operating or maintaining the machine, read and understand the Safety, Operation, Maintenance and Trouble Shooting information contained within the Operator's Manual.



This manual covers the AgriMetal Model GR-660 Self-Propelled Greens Roller. Use the Table of Contents or Index as a guide to locate required information.

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

OPERATOR ORIENTATION - The directions left, right, front and rear, as mentioned throughout this manual, are as seen from the driver's seat and facing forward.

2 SAFETY

SAFETY ALERT SYMBOL

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



The Safety Alert symbol identifies important safety messages on the AgriMetal Self-Propelled Greens Roller and in the manual. When you see this symbol, be alert to the possibility of personal injury or death. Follow the instructions in the safety message.

Why is SAFETY important to you?

3 Big Reasons

Accidents Disable and Kill
Accidents Cost
Accidents Can Be Avoided

SIGNAL WORDS:

Note the use of the signal words DANGER, WARNING and CAUTION with the safety messages. The appropriate signal word for each message has been selected using the following guide-lines:

SI NO LEE INGLES, PIDA AYUDA
A ALGUIEN QUE SI LO LEA PARA
QUE LE TRADUZCA LAS
MEDIDAS DE SEGURIDAD.

DANGER - Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations typically for machine components which, for functional purposes, cannot be guarded.

WARNING - Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.

CAUTION - Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

If you have any questions not answered in this manual or require additional copies or the manual is damaged, please contact your dealer at AgriMetal Inc., 1006 Rue Principale, Wickham, Quebec, Canada, J0C 1S0. Phone (819) 398-6883 or fax (819) 398-5311.

SAFETY

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

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

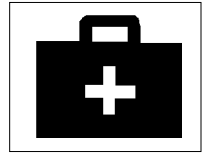
- Greens Roller owners must give operating instructions to operators or employees before allowing them to operate the machine, and at least annually thereafter.
- The most important safety device on this equipment is a SAFE operator. It is the operator's responsibility to read and understand ALL Safety and Operating instructions in the manual and to follow these. Most accidents can be avoided.
- A person who has not read and understood all operating and safety instructions is not qualified to operate the machine. An untrained operator exposes himself and bystanders to possible serious injury or death.
- Do not modify the equipment in any way. Unauthorized modification may impair the function and/or safety and could affect the life of the equipment.
- Think SAFETY! Work SAFELY!

2.1 GENERAL SAFETY

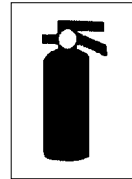
1. Read and understand the Operator's Manual and all safety signs before operating, maintaining, adjusting or unplugging the Greens Roller.



2. Have a first-aid kit available for use should the need arise and know how to use it.



3. Have a fire extinguisher available for use should the need arise and know how to use it.



4. Do not allow riders.

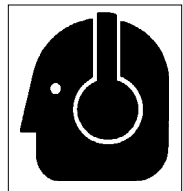
5. Wear appropriate protective gear. This list includes but is not limited to:

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



6. Install and secure all guards before starting.

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




8. Slow engine to low idle, stop engine, remove ignition key and wait for all moving parts to stop before servicing, adjusting, repairing or unplugging.
9. Clear the area of people, especially small children, before starting the unit.
10. Review safety related items annually with all personnel who will operating or maintaining the Greens Roller.

2.2 EQUIPMENT SAFETY GUIDELINES

1. Safety of the operator and bystanders is one of the main concerns in designing and developing a machine. However, every year many accidents occur which could have been avoided by a few seconds of thought and a more careful approach to handling equipment. You, the operator, can avoid many accidents by observing the following precautions in this section. To avoid personal injury or death, study the following precautions and insist those working with you, or for you, follow them.
2. In order to provide a better view, certain photographs or illustrations in this manual may show an assembly with a safety shield removed. However, equipment should never be operated in this condition. Keep all shields in place. If shield removal becomes necessary for repairs, replace the shield prior to use.
3. Replace any safety sign or instruction sign that is not readable or is missing. Location of such safety signs is indicated in this manual.
4. Never use alcoholic beverages or drugs which can hinder alertness or coordination while operating this equipment. Consult your doctor about operating this machine while taking prescription medications.
5. Under no circumstances should young children be allowed to work with this equipment. Do not allow persons to operate or assemble this unit until they have read this manual and have developed a thorough understanding of the safety precautions and of how it works. Review the safety instructions with all users annually.
6. This equipment is dangerous to children and persons unfamiliar with its operation. The operator should be a responsible, properly trained and physically able person familiar with machinery and trained in this equipment's operations. If the elderly are assisting with work, their physical limitations need to be recognized and accommodated.
7. Never exceed the limits of a piece of machinery. If its ability to do a job, or to do so safely, is in question - DON'T TRY IT.
8. Do not modify the equipment in any way. Unauthorized modification result in serious injury or death and may impair the function and life of the equipment.
9. In addition to the design and configuration of this implement, including Safety Signs and Safety Equipment, hazard control and accident prevention are dependent upon the awareness, concern, prudence, and proper training of personnel involved in the operation, transport, maintenance, and storage of the machine. Refer also to Safety Messages and operation instruction in each of the appropriate sections of the tow vehicle and machine Manuals. Pay close attention to the Safety Signs affixed to the tow vehicle and the machine.

2.3 SAFETY TRAINING

1. Safety is a primary concern in the design and manufacture of our products. Unfortunately, our efforts to provide safe equipment can be wiped out by a single careless act of an operator or bystander.
2. In addition to the design and configuration of equipment, hazard control and accident prevention are dependent upon the awareness, concern, prudence and proper training of personnel involved in the operation, transport, maintenance and storage of this equipment.
3. It has been said, "The best safety feature is an informed, careful operator." We ask you to be that kind of an operator. It is the operator's responsibility to read and understand ALL Safety and Operating instructions in the manual and to follow these. Accidents can be avoided.
4. Working with unfamiliar equipment can lead to careless injuries. Read this manual, and the manual for your tractor, before assembly or operating, to acquaint yourself with the machines. If this machine is used by any person other than yourself, or is loaned or rented, it is the machine owner's responsibility to make certain that the operator, prior to operating:
 - a. Reads and understands the operator's manuals.
 - b. Is instructed in safe and proper use.
5. Know your controls and how to stop engine and machine quickly in an emergency. Read this manual and the one provided with your tow vehicle.
6. Train all new personnel and review instructions frequently with existing workers. Be certain only a properly trained and physically able person will operate the machinery. A person who has not read and understood all operating and safety instructions is not qualified to operate the machine. An untrained operator exposes himself and bystanders to possible serious injury or death. If the elderly are assisting with work, their physical limitations need to be recognized and accommodated.

2.4 SAFETY SIGNS

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

How to Install Safety Signs:

- Be sure that the installation area is clean and dry.
- Be sure temperature is above 50°F (10°C).
- Determine exact position before you remove the backing paper.
- Remove the smallest portion of the split backing paper.
- Align the sign over the specified area and carefully press the small portion with the exposed sticky backing in place.
- Slowly peel back the remaining paper and carefully smooth the remaining portion of the sign in place.
- Small air pockets can be pierced with a pin and smoothed out using the piece of sign backing paper.

2.5 PREPARATION

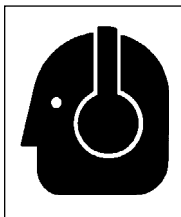
1. Never operate the tractor and machine until you have read and completely understand this manual, the tow vehicle Operator's Manual, and each of the Safety Messages found on the safety signs on the tow vehicle and machine.

2. Personal protection equipment including hard hat, safety glasses, safety shoes, and gloves are recommended during assembly, installation, operation, adjustment, maintaining, repairing, removal, or moving the implement. Do not allow long hair, loose fitting clothing or jewelry to be around equipment.



3. **PROLONGED EXPOSURE TO LOUD NOISE MAY CAUSE PERMANENT HEARING LOSS!**

Tractors with or without equipment attached can often be noisy enough to cause permanent, partial hearing loss. We recommend that you wear hearing protection on a full-time basis if the noise in the Operator's position exceeds 80db. Noise over 85db on a long-term basis can cause severe hearing loss. Noise over 90db adjacent to the Operator over a long-term basis may cause permanent, total hearing loss. NOTE: Hearing loss from loud noise (from tractors, chain saws, radios, and other such sources close to the ear) is cumulative over a lifetime without hope of natural recovery.



4. Clear working area of stones, branches or hidden obstacles that might be hooked or snagged, causing injury or damage.
5. Operate only in daylight or good artificial light.
6. Be sure machine is properly mounted, adjusted and in good operating condition.
7. Ensure that all safety shielding and safety signs are properly installed and in good condition.

2.6 MAINTENANCE SAFETY

1. Good maintenance is your responsibility. Poor maintenance is an invitation to trouble.

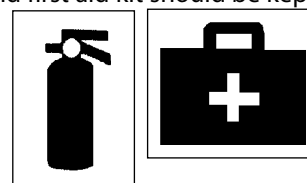
2. Follow good shop practices.

- Keep service area clean and dry.
- Be sure electrical outlets and tools are properly grounded.
- Use adequate light for the job at hand.



3. Make sure there is plenty of ventilation. Never operate the engine of the towing vehicle in a closed building. The exhaust fumes may cause asphyxiation.
4. Before working on this machine, shut off the engine, set the brake, and turn fuel valve off.
5. Never work under equipment unless it is blocked securely.
6. Always use personal protection devices such as eye, hand and hearing protectors, when performing any service or maintenance work. Use heavy gloves when handling sharp components.
7. Where replacement parts are necessary for periodic maintenance and servicing, genuine factory replacement parts must be used to restore your equipment to original specifications. The manufacturer will not be responsible for injuries or damages caused by use of unapproved parts and/or accessories.

8. A fire extinguisher and first aid kit should be kept readily accessible while performing maintenance on this equipment.



9. Periodically tighten all bolts, nuts and screws and check that all cotter pins are properly installed to ensure unit is in a safe condition.
10. When completing a maintenance or service function, make sure all safety shields and devices are installed before placing unit in service.

2.7 OPERATING SAFETY

1. Please remember it is important that you read and heed the safety signs on the Self-Propelled Greens Roller. Clean or replace all safety signs if they cannot be clearly read and understood. They are there for your safety, as well as the safety of others. The safe use of this machine is strictly up to you the operator.
2. All things with moving parts are potentially hazardous. There is no substitute for a cautious, safe-minded operator who recognizes potential hazards and follows reasonable safety practices. The manufacturer has designed this Greens Roller to be used with all its safety equipment properly attached, to minimize the chance of accidents. Study this manual to make sure you have all safety equipment attached.
3. If a safety shield or guard is removed for any reason, it must be replaced before the machine is again operated.
4. When the use of hand tools is required to perform any part of assembly, installation, adjustment, maintaining, repairing, removal, or moving, be sure the tools used are designed and recommended by the tool manufacturer for that specific task.
5. Personal protection equipment including hearing protection, hard hat, safety glasses, safety shoes, and gloves are recommended during assembly, installation, operation, adjustment, maintaining, repairing, removal, or moving. Do not allow long hair, loose fitting clothing, or jewelry to be around moving parts.
6. Always use two people to handle heavy, unwieldy components during assembly, installation, removal or moving.
7. Never place any part of your body where it would be in danger if movement should occur during assembly, installation, operation, maintaining, repairing, removal or moving.
8. Read Operator's Manual before starting. Review safety instructions annually.
9. Stop engine, place all controls in neutral, set park brake, remove ignition key and wait for all moving parts to stop before servicing, adjusting, repairing or unplugging the machine.
10. Do not climb on the machine or place hands in any opening when the engine is running.
11. Do not smoke when refuelling.
12. Do not exceed a safe transport speed.
13. Secure access ramps before moving or transporting machine.
14. Never use alcoholic beverages or drugs which can hinder alertness or coordination while operating this equipment. Consult your doctor about operating this machine while taking prescription medications.
15. Never allow children to operate or be around this machine.
16. Clear the work area of objects which might be picked up and snagged or entangled in the machine.
16. Keep hands, feet, hair, jewelry, and clothing away from all moving and/or rotating parts.

2.8 TRANSPORT SAFETY

1. The machine is not designed or equipped to travel on public roads. Do not drive or transport on public roads
2. Use the trailer when moving from place to place.
3. Do not exceed 16 kph (10 mph) when moving.
4. Plan your route to avoid rough terrain.
5. Always use a tow vehicle of less than 24 horsepower when moving the unit.
7. Use a drawbar pin with provisions for a retainer. Install the retainer. Attach safety chain between tow vehicle and machine before moving.
8. Do not drink and drive.
9. Never allow riders on either tow vehicle or machine.

2.9 STORAGE SAFETY

1. Store the unit in an area away from human activity.
2. Do not permit children to play on or around the stored machine.
3. Store the unit in a dry, level area. Support the hitch and wheels with planks if required.

2.10 REFUELLING SAFETY

1. Handle fuel with care. It is highly flammable.
2. Allow engine to cool for 5 minutes before refuelling. Clean up spilled fuel before restarting engine.
3. Do not refuel the machine while smoking or when near open flame or sparks.
4. Fill fuel tank outdoors.
5. Prevent fires by keeping machine clean of accumulated trash, grease and debris.



2.11 TIRE SAFETY

1. Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion which may result in serious injury or death.
2. Do not attempt to mount a tire unless you have the proper equipment and experience to do the job.
3. Have a qualified tire dealer or repair service perform required tire maintenance.
4. When replacing worn tires, make sure they meet the original tire specifications. Never undersize.

2.12 GAS MOTOR SAFETY

BEFORE STARTING ENGINE, READ AND UNDERSTAND THE OPERATING AND MAINTENANCE INSTRUCTIONS THAT CAME WITH YOUR ENGINE.

WARNING: DO NOT

1. DO NOT run engine in an enclosed area. Exhaust gases contain carbon monoxide, an odorless and deadly poison.
2. DO NOT place hands or feet near moving or rotating parts.
3. DO NOT store, spill, or use gasoline near an open flame, or devices such as a stove, furnace, or water heater which use a pilot light or devices which can create a spark.
4. DO NOT refuel indoors where area is not well ventilated. Outdoor refuelling is preferred.
5. DO NOT fill fuel tank while engine is running. Allow engine to cool for 5 minutes before refueling. Store fuel in approved safety containers.
6. DO NOT remove fuel tank cap while engine is running.
7. DO NOT operate engine if gasoline is spilled. Move machine away from the spill and avoid creating any ignition until the gasoline has evaporated.
8. DO NOT smoke when filling fuel tank.
9. DO NOT choke carburetor to stop engine. Whenever possible, gradually reduce engine speed before stopping.
10. DO NOT run engine above rated speeds. This may result in injury.
11. DO NOT tamper with governor springs, governor links or other parts which may increase the governed engine speed.
12. DO NOT tamper with the engine speed selected by the original equipment manufacturer.
13. DO NOT check for spark with spark plug or spark plug wire removed. Use an approved tester.

14. DO NOT crank engine with spark plug removed. If engine is flooded, place throttle in "FAST" position and crank until engine starts.
15. DO NOT strike flywheel with a hard object or metal tool as this may cause flywheel to shatter in operation. Use proper tools to service engine.
16. DO NOT operate engine without a muffler. Inspect periodically and replace, if necessary. If engine is equipped with muffler deflector, inspect periodically and replace, if necessary with correct deflector.
17. DO NOT operate engine with an accumulation of grass, leaves, dirt or other combustible materials in the muffler area.
18. DO NOT use this engine on any forest covered, brush covered, or grass covered unimproved land unless a spark arrester is installed on the muffler. The arrester must be maintained in effective working order by the operator. In the State of California the above is required by law (Section 4442 of the California Public Resources Code). Other states may have similar laws. Federal laws apply on federal lands.
19. DO NOT touch hot muffler, cylinder or fins because contact may cause burns.
20. DO NOT run engine with air cleaner or air cleaner cover removed.

WARNING: DO

1. ALWAYS DO remove the wire from the spark plug when servicing the engine or equipment TO PREVENT ACCIDENTAL STARTING. Disconnect the negative wire from the battery terminal if equipped with a 12 volt starting system.
2. DO keep cylinder fins and governor parts free of grass and other debris which can affect engine speed.
3. DO examine muffler periodically to be sure it is functioning effectively. A worn or leaking muffler should be repaired or replaced as necessary.
4. DO use fresh gasoline. Stale fuel can gum carburetor and cause leakage.
5. DO check fuel lines and fittings frequently for cracks or leaks. Replace if necessary.

2.13 SIGN-OFF FORM

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

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

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

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

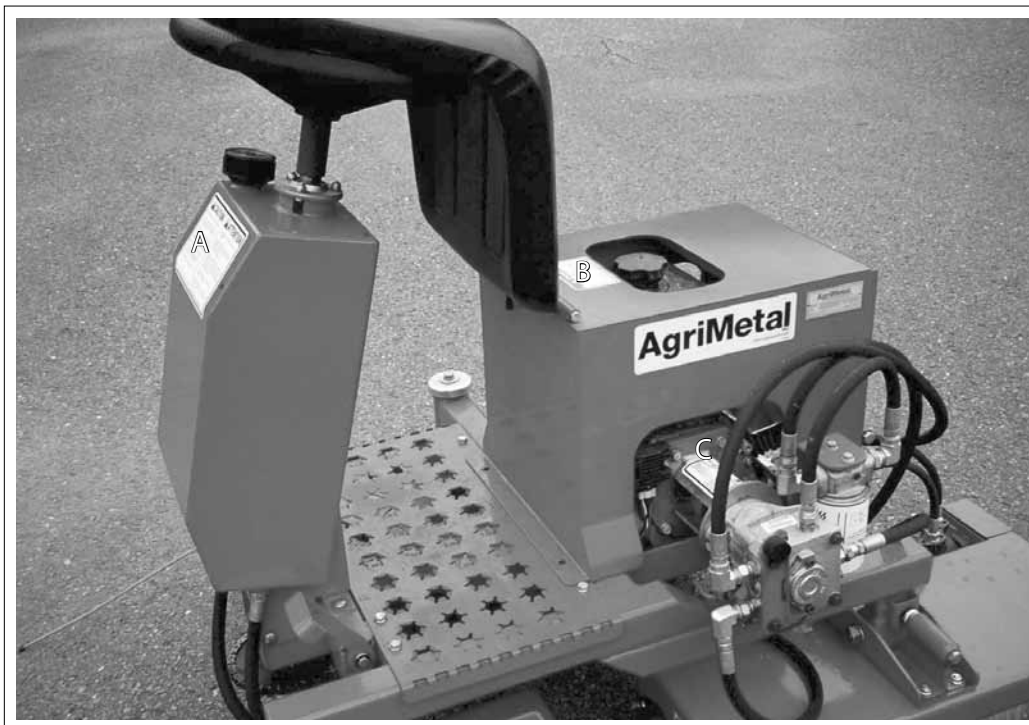
SIGN-OFF FORM

[illegible]



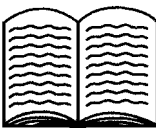
3 SAFETY SIGN LOCATIONS

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

- Think SAFETY! Work SAFELY!



A

 CAUTION	 ATTENTION
<ol style="list-style-type: none">1. Read Operator's Manual before starting. Review safety instructions annually. 2. Stop engine, place all controls in neutral, set park brake, remove ignition key and wait for all moving parts to stop before servicing, adjusting, repairing or unplugging the machine.3. Do not climb on the machine or place hands in any opening when the engine is running.4. Do not smoke when refuelling.5. Do not exceed a safe transport speed.6. Secure access ramps before moving or transporting machine.	<ol style="list-style-type: none">1. Lire attentivement le manuel d'operation avant la mise en marche. Réviser annuellement le manuel d'operation2. Arrêter le moteur, placer tous les controles à la position "neutre", enlever la clé du contact et attendre que toutes les pièces soient au point mort avant de faire tout ajustement, réparation ou de débloquer la machine.3. Ne pas grimper sur la machine et ne jamais placer les mains dans toute ouverture lorsque le moteur est en marche.4. Ne jamais fumer lors du plein d'essence.5. Ne pas excéder une vitesse de transport sécuritaire.6. Bien sécuriser les rampes avant d'effectuer le transport de la machine.

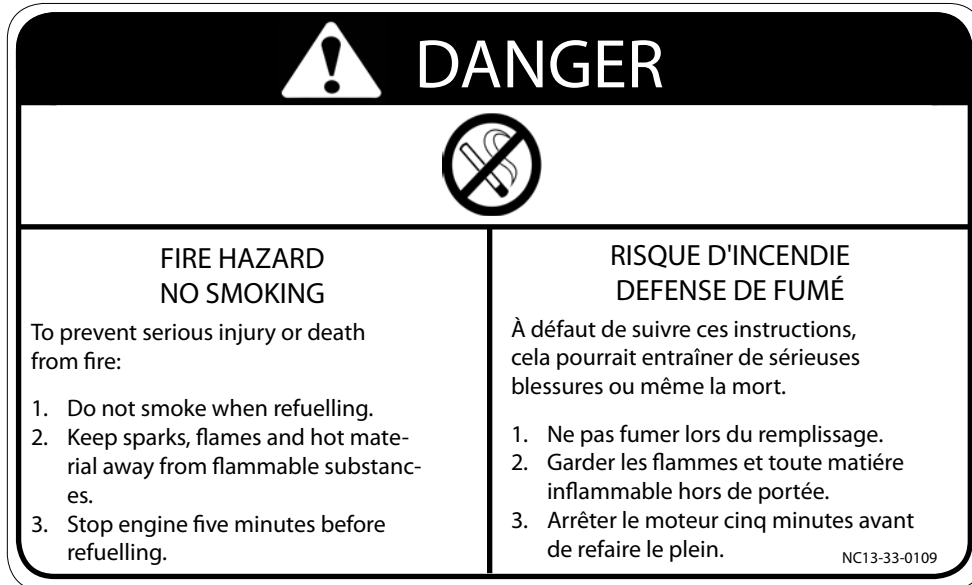
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REMEMBER - If safety signs have been damaged, removed, become illegible or parts replaced without safety signs, new signs must be applied. New safety signs are available from your authorized dealer.

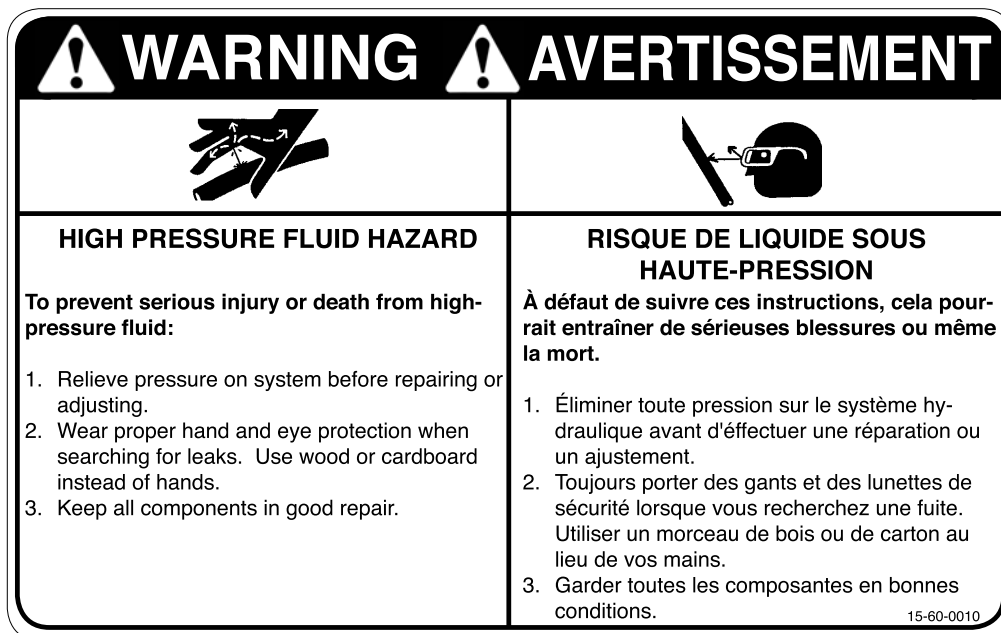
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- Think SAFETY! Work SAFELY!

B



C



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

4 ASSEMBLING

4.1 MACHINE ASSEMBLY

The machine is shipped from the factory in a partially disassembled configuration and attached to a pallet that provides for easy moving and handling. Always use tools, equipment and forklifts of appropriate size and capacity for the job. Always use 2 men when lifting, moving and assembling the machine.

When the machine is shipped, follow this procedure when preparing for the customer:

1. Clear the area of bystanders especially small children before starting.
2. Remove the pallet tie-downs.
3. Use a forklift to lift the pallet/machine from the truck. Carry the load close to the ground as it is moved to the assembly area and positioned.
4. Cut and remove the straps securing the roller and trailer to the pallet.



Strapped



Cut

Fig. 1 SHIPPING

5. Remove the screws holding the hitch to the pallet.



Strapping Removed



Screws



Screws Removed

Fig. 2 HITCH

6. Lay out hitch.

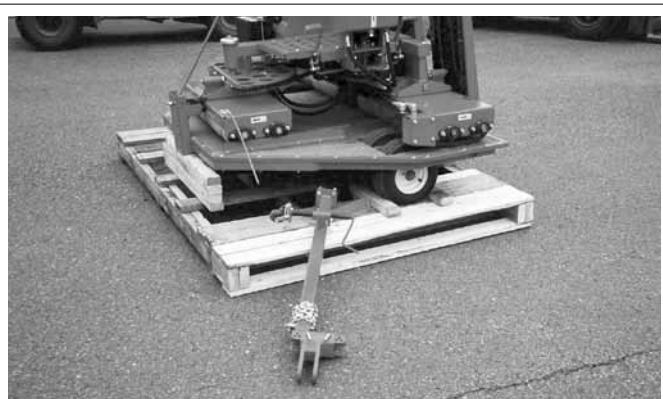
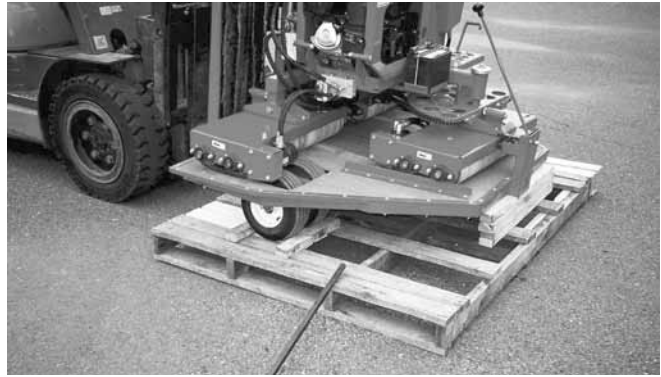


Fig. 3 HITCH

8. Bring a 5 foot (1525 mm) steel rod to span components under the frame.



Steel Rod

9. Drive the forklift under the frame with the steel rod on top of the front of the forks.



Forks

10. Raise the machine enough to clear the pallet.



Raising

11. Back away until the machine is clear of the pallet.

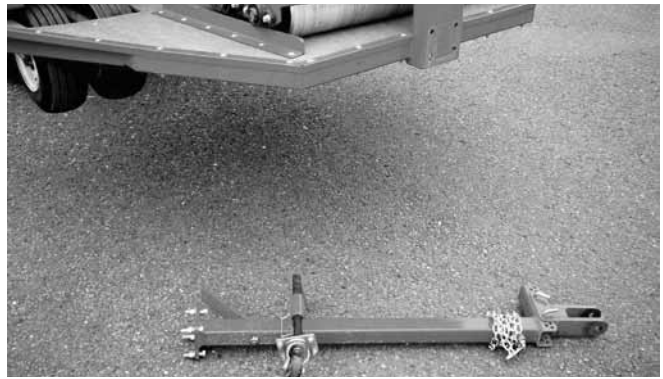


Backing Away

Fig. 4 LIFTING

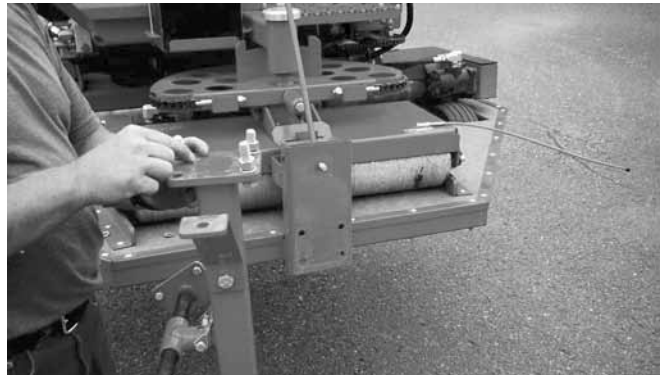
12. Install the hitch.

- a. Bring the hitch up to the front of the frame.



Lay-Out

- b. Remove the fasteners.



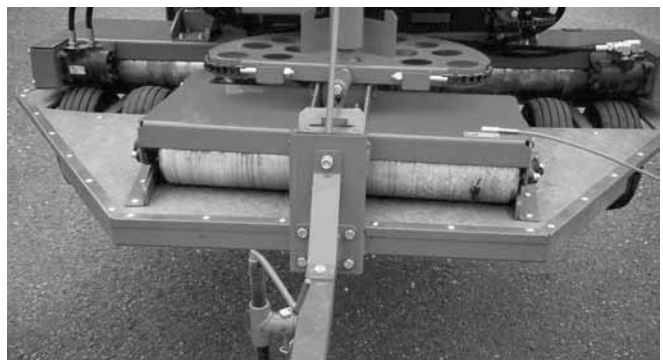
Fasteners

- c. Mount hitch to frame and secure with fasteners.



Mounting

- d. Tighten fasteners to their specified torque.



Tightened

Fig. 5 HITCH

13. Lower to ground.

5 OPERATION



OPERATING SAFETY

- Read Operator's Manual before starting. Re-view safety instructions annually.
- If a safety shield or guard is removed for any reason, it must be replaced before the machine is again operated.
- When the use of hand tools is required to perform any part of assembly, installation, adjustment, maintaining, repairing, removal, or moving, be sure the tools used are designed and recommended by the tool manufacturer for that specific task.
- Always use two people to handle heavy, unwieldy components during assembly, installation, removal or moving.
- Never place any part of your body where it would be in danger if movement should occur during assembly, installation, operation, maintaining, repairing, removal or moving.
- Stop engine, place all controls in neutral, set park brake, remove ignition key and wait for all moving parts to stop before servicing, adjusting, repairing or unplugging the machine.
- Do not climb on the machine or place hands in any opening when the engine is running.
- Do not smoke when refuelling.
- Do not exceed a safe transport speed.
- Secure access ramps before moving or transporting machine.
- Never use alcoholic beverages or drugs which can hinder alertness or coordination while operating this equipment. Consult your doctor about operating this machine while taking prescription medications.
- Never allow children to operate or be around this machine.
- Clear the work area of objects which might be picked up and snagged or entangled in the machine.
- Keep hands, feet, hair, jewelry, and clothing away from all moving and/or rotating parts.

5.1 TO THE NEW OPERATOR OR OWNER

AgriMetal Self-Propelled Greens Rollers are designed to efficiently roll over a grass-covered surface to keep it level and trim. It works well on most grass surfaces including golf course greens.

In addition to the design and configuration of equipment, hazard control and accident prevention are dependent upon the awareness, concern, prudence and proper training of personnel involved in the operation, transport, maintenance and storage of equipment. It is the responsibility of the owner or operator to read this manual and to train all other operators before they start working with the machine.

Follow all safety instructions exactly. Safety is everyone's business. By following recommended procedures, a safe working environment is provided for the operator, bystanders and the area around the worksite. Untrained operators are not qualified to operate the machine.

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

5.2 MACHINE COMPONENTS

The AgriMetal Greens Roller is a self-propelled machine designed to roll over golf course greens to keep them even for consistent putting. It is powered by a small gas engine that turns a hydraulic pump that provides pressurized oil to drive the rollers. The operator sits at right angles to the direction of travel to provide good operating visibility in each direction. The steering wheel turns the right roller assembly to maneuver the machine where the operator wants to go. Foot pedals on each side of the console allow the operator to select the direction of travel.

A trailer is provided with the roller to provide a convenient way to move the machine. A latch at the front of the trailer locks the greens roller in place and the loading ramp latches in the upright position for transport.



Fig. 6 PRINCIPLE COMPONENTS

- | | | | |
|---|------------------------|---|-------------------------------|
| A | Trailer | G | Steering Roller |
| B | Loading Ramp | H | Roller Hydraulic Drive Motor |
| C | Transport Lock Bracket | J | Steering Drive System |
| D | Engine | K | Hydraulic Pump |
| E | Loading Ramp Lock | L | Direction Control Foot Pedals |
| F | Rollers | M | Battery |

5.3 BREAK-IN

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

A. After operating for 1 hour:

1. Check alignment of chains and sprockets. Align as required.
2. Check chain tension. Adjust as required.
3. Torque all fasteners and hardware.
4. Check condition of drive bearings.
5. Check the rollers and rotating parts for entangled material. Remove any entangled material.
6. Check trailer tire pressure. Inflate as required.
7. Check engine fluid levels. Top up as required.

B. After operating for 10 hours:

1. Repeat steps 1 through 7 listed above. (Section A).
2. Change engine oil.
3. Go to the normal servicing and maintenance schedule as defined in the Maintenance Section.

5.4 PRE-OPERATION CHECKLIST

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

Before operating the Greens Roller and each time thereafter, the following areas should be checked off:

1. Lubricate the machine per the schedule outline in the Maintenance Section.
2. Check the tension and alignment of the belts and chains. Adjust tension and align as required.
3. Check the rollers and rotating parts. Remove any twine, wire or other material that has become entangled.
4. Check that all bearings turn freely. Replace any that are rough or seized.
5. Make sure that all guards and shields are in place, secured and functioning as designed.
6. Check engine fluid levels. Top up as required.

5.5 CONTROLS

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

1. Gas Engine:

A small Kohler gas engine is used with the unit. Always read the engine Operator's manual supplied with the machine for the detailed operating procedures.

a Ignition Switch:

This key operated switch controls the electrical power to start the engine.

OFF - Turn the key fully counterclockwise to stop the fuel flow and turn the engine off.

RUN - Turn clockwise to detent on the run position. This is the position where the engine will continue to run.

START - Turn fully clockwise to the last spring-loaded detent position to engage the starter solenoid and start the engine. Release the key when the engine starts and it will return to the RUN position.

b. Fuel Shut-Off Valve:

Each engine is equipped with a valve between the fuel tank and carburetor. Slide the fuel valve toward the block to turn ON and away for OFF. Turn the fuel OFF when not in use or before transporting.

c. Choke:

This lever controls the position of the choke. Move the lever rearward to close the choke for starting when the engine is cold. Move the lever forward to open the choke as the engine warms. Always move the lever fully forward when operating the machine.

d. Throttle :

This lever, through a push-pull cable, sets the throttle position. Move the lever forward to set the engine speed at maximum RPM. Move the lever rearward to set the engine speed at low idle.



Fig. 7 ENGINE CONTROLS

e. Starting Rope:

This retracting rope and T bar is used to turn the engine over for starting. Grasp the T bar firmly and pull the rope sharply to start the engine.

2. **Steering Wheel:**
The steering wheel sets and controls the direction of the machine movement by turning the right roller. Turn wheel clockwise to turn to the right and counterclockwise to turn to the left. Use in conjunction with the direction of movement (below) when turning.
3. **Directional Foot Pedals:**
The machine is designed with two spring-loaded-to-neutral pedals that determine the machine's direction and speed of movement.
 - a. Depress and hold the right pedal to move to the right. Depress further to increase speed to the right.
 - b. Depress and hold the left pedal to move the machine to the left. Depress further to increase speed to the left.

Release the pedals and they will return to neutral and the machine will stop.



Fig. 8 OPERATOR STATION CONTROLS

5.6 ATTACHING/UNHOOKING

The Greens Roller on its trailer should always be located on a level, dry area that is free of debris and other foreign objects. When attaching the machine to a utility cart or similar tow vehicle, follow this procedure:

1. Clear the area of bystanders, especially small children.
2. Make sure there is enough room and clearance to safely back up to the machine.
3. While backing up, align the hitch with the drawbar.
4. Stop tow vehicle, remove ignition key and wait for all moving parts to stop before dismounting.
5. Use a drawbar pin with provisions for a mechanical retainer. Install the retainer.
6. Attach the safety chain around the drawbar cage to prevent unexpected separation.
7. Retract jack, remove anchor pin, rotate 90°, re-pin jack and secure with retainer.
8. Reverse the above procedure when unhooking from tow vehicle.



Aligning



Pin / Retainer



Safety Chain



Attached

Fig. 9 ATTACHING

5.7 LOADING GREENS ROLLER ON TRAILER

The Greens Roller is designed with a trailer that allows it to be easily and conveniently moved from location to location behind a 4 wheeler or similar tow vehicle. When loading, follow this procedure:

1. Clear the area of bystanders, especially small children.
2. Make sure there is enough room and clearance to drive up to the trailer.
3. Align the machine with the ramp.
4. Drive to the right up the ramp.
5. Align the frame of the center roller with the trailer latch mechanism.
6. Drive in and engage the latch.



Aligning



Ramps



Latching



Latched

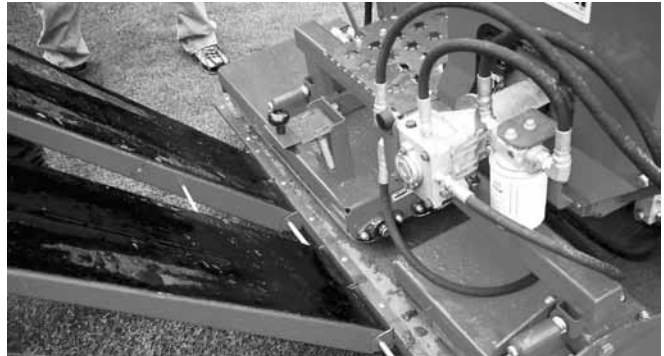
Fig. 10 DRIVING ONTO TRAILER

7. Be sure the latch is fully engaged to the frame.
8. Drive on trailer until left two rollers are fully on the trailer.
9. Stop engine and wait for all moving parts to stop before dismounting.



Latched

10. Raise and latch the loading ramps to the front left roller frame.



Fully Loaded

11. Ensure the ramp latch is positively engaged.



Rear Latch

Fig. 11 LOADING

12. Reverse the above procedure when unloading.

5.8 FIELD OPERATION



OPERATING SAFETY

- Read Operator's Manual before starting. Re-view safety instructions annually.
- If a safety shield or guard is removed for any reason, it must be replaced before the machine is again operated.
- When the use of hand tools is required to perform any part of assembly, installation, adjustment, maintaining, repairing, removal, or moving, be sure the tools used are designed and recommended by the tool manufacturer for that specific task.
- Always use two people to handle heavy, unwieldy components during assembly, installation, removal or moving.
- Never place any part of your body where it would be in danger if movement should occur during assembly, installation, operation, maintaining, repairing, removal or moving.
- Stop engine, place all controls in neutral, set park brake, remove ignition key and wait for all moving parts to stop before servicing, adjusting, repairing or unplugging the machine.
- Do not climb on the machine or place hands in any opening when the engine is running.
- Do not smoke when refuelling.
- Do not exceed a safe transport speed.
- Secure access ramps before moving or transporting machine.
- Never use alcoholic beverages or drugs which can hinder alertness or coordination while operating this equipment. Consult your doctor about operating this machine while taking prescription medications.
- Never allow children to operate or be around this machine.
- Clear the work area of objects which might be picked up and snagged or entangled in the machine.
- Keep hands, feet, hair, jewelry, and clothing away from all moving and/or rotating parts.

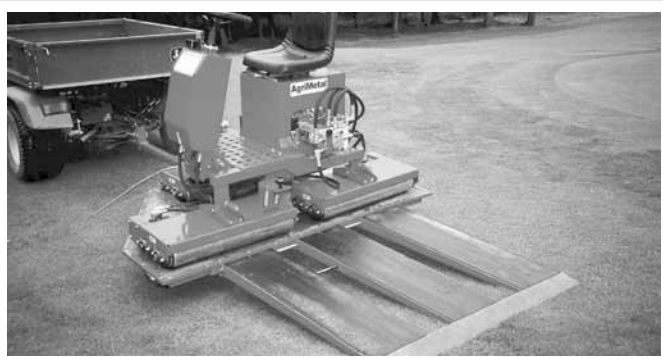
Although the Greens Roller is easy to use, each operator should review this section to familiarize himself with the detailed safety and operating procedures. When using the machine, follow this procedure:

1. Clear the area of bystanders, especially small children.
2. Move or transport machine to working area.



Fig. 12 MOVING / TRANSPORTING

3. Release loading ramp lock and lower ramp.



Lower Ramp

4. Start engine.



Start Engine

5. Release transport lock.



Release Transport lock

6. Drive to the left off trailer.



Drive Down Ramp

7. Drive to the green.

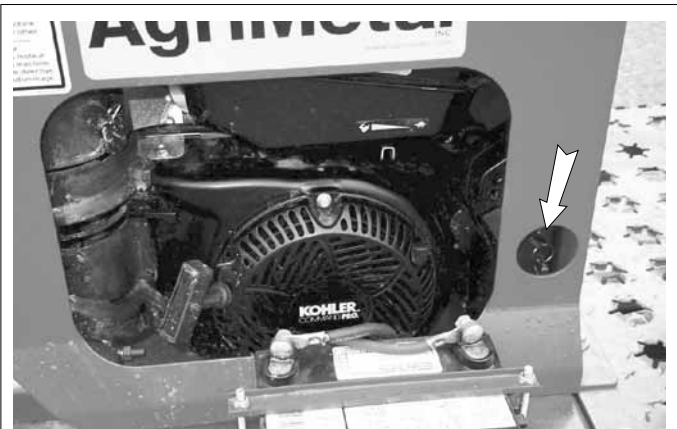


Unloaded

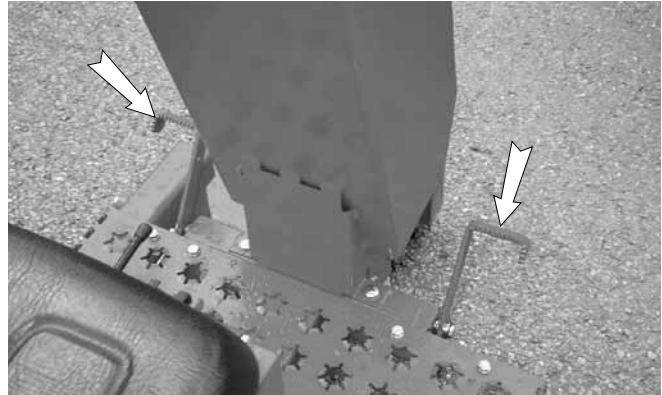
Fig. 13 UNLOADING

5. Starting Engine:

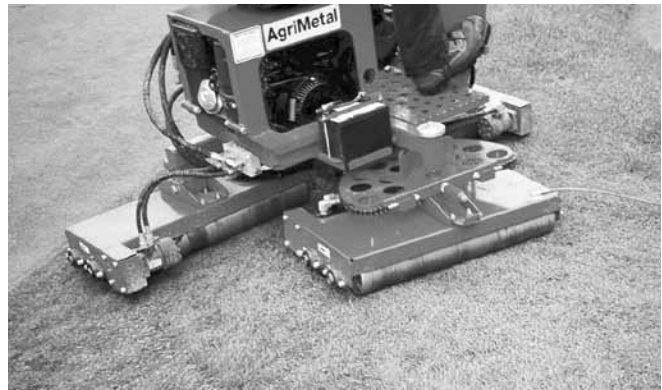
- a. Remove feet from foot pedals to be sure machine is stationary.
- b. Close the choke if the engine is cold.
- c. Move the throttle to its 1/2 throttle position.
- d. Use ignition key to start engine.
- e. Run the engine for a few minutes to allow it to warm.
- f. Gradually open the choke.
- g. Increase throttle setting to maximum speed for operation.
- h. Use the foot pedals and steering wheel to move and maneuver machine.



Ignition Switch



Foot Pedals



Grass

Fig. 14 STARTING / STOPPING

6. Stopping:

- a. Slow engine to low idle.
- b. Stop engine by turning ignition switch OFF.

7. Emergency Stopping:

Stop forward motion and stop machine engine if an emergency occurs. Correct emergency situation and disengage control lever before starting engine and resuming work.

8. Drive to the working area.

9. Travel Speed:
Set the travel speed appropriate for the job being done. Do not exceed 5 mph (8 kph) to minimize bouncing while rolling.



Fig. 15 WORKING

10. Travel Pattern:
A variety of driving patterns can be used when rolling a green. However each operator is responsible to develop their own pattern appropriate for the shape of the green.

Start by rolling back and forth from side to side and turning at the edge of the green.



Left



Right



Left

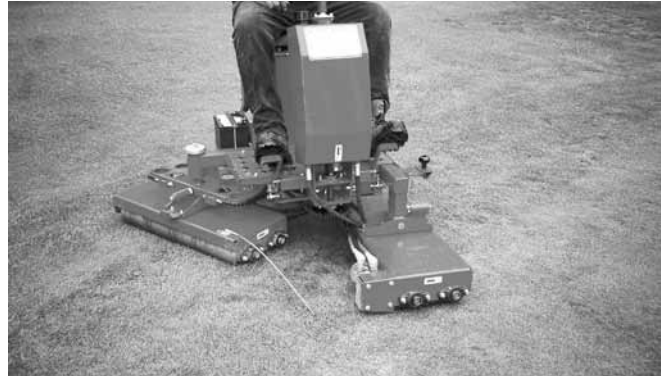
Fig. 16 TRAVEL PATTERN

11. Turning:

Use the steering wheel in combination with the directional pedals to pivot the right roller and turn the machine.



Right



Left

Fig. 17 PLANTING PATTERN

12. Pin:

Remove the pin from the hole when rolling to prevent any damage. Replace it after rolling the area.



Removing



Replaced

Fig. 18 PIN

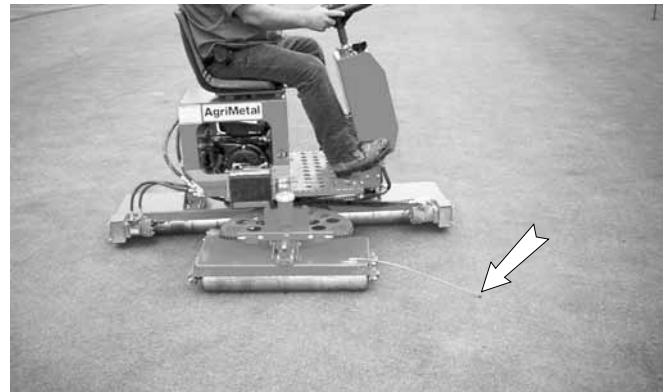
13. Pass Marker:

The Greens Roller is designed with a fibre-glass pole attached to the front side of the right roller. It droops down and just skims the grass surface as it passes. Use the mark as a guide to where you have rolled and plan the next pass accordingly.

The pass marker is particularly effective in marking on a dew-covered green.



Green

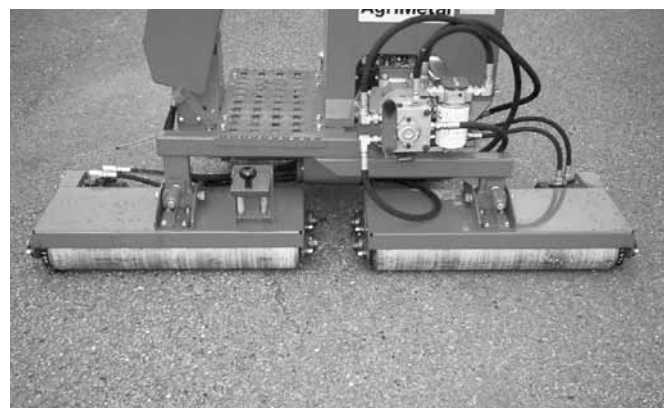


Edge

Fig. 19 PASS MARKER

14. Cleaning:

It is recommended that each roller head be thoroughly washed after each use to eliminate the chance of debris building up in the roller assembly.



Left Roller



Right Roller

Fig. 20 CLEANING

15. Operating Hints:

- a. Do not allow riders.
- b. Travel at 3 to 5 mph (5 to 8 kph) to get the best results and eliminate bouncing.

NOTE

Better and more consistent results are obtained when driving at a slower speed when rolling.



Fig. 21 WORKING

- c. Use the pass marker as a guide on what part has been roller and plan the next pass accordingly.
- d. When rolling terrain with a steep slope, the machine has better traction when the single roller is pointing up the slope.

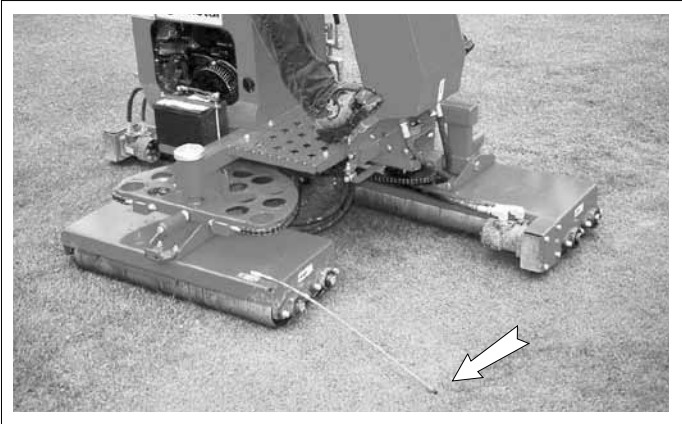


Fig. 22 MARKER

5.9 TRANSPORTING



TRANSPORT SAFETY

- The machine is not designed or equipped to travel on public roads. Do not drive or transport on public roads
- Use the trailer when moving from place to place.
- Do not exceed 16 kph (10 mph) when moving.
- Plan your route to avoid rough terrain.
- Always use a tow vehicle of less than 24 horsepower when moving the unit.
- Use a drawbar pin with provisions for a retainer. Install the retainer. Attach safety chain between tow vehicle and machine before moving.
- Do not drink and drive.
- Never allow riders on either tractor or machine.
- Never allow riders on either tow vehicle or machine.

When transporting the machine, review and follow these instructions:

1. Clear the area of bystanders, especially small children.
2. Do not drive on a public road as the machine is not equipped with the required lights and reflectors.
3. Use a trailer to move the Greens Roller from work-site to work-site.
4. Insure that the trailer is securely attached to the tow vehicle with a mechanical retainer through the drawbar pin. Always use a safety chain between the tow vehicle and trailer.
5. Do not allow riders.
6. Never exceed a safe travel speed.



Fig. 23 TRANSPORTING

5.10 STORAGE



STORAGE SAFETY

- Store the unit in an area away from human activity.
- Do not permit children to play on or around the stored machine.
- Store the unit in a dry, level area. Support the frame with planks if required.

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

1. Thoroughly wash the machine with a pressure washer or water hose to remove all dirt, mud, debris or residue.
2. Make sure all the water drains out of all areas of the machine.
3. Lubricate all grease points to remove any water residue from washing.
4. Remove any material that has become entangled around any moving part.
5. Touch up all paint nicks and scratches to prevent rusting.
6. Move the machine to its storage area.
7. Store in a dry, level spot.
8. Store in an enclosed building if possible. If space is not available, cover with a water-proof tarpaulin and tie down securely.
9. Unhook trailer from the tow vehicle (see Section 5.8).
10. Place planks under the wheels and hitch for added support if required.
11. Store in an area away from human activity.
12. Do not allow children to play around the stored unit.



Fig. 24 STORED

6 SERVICE AND MAINTENANCE



MAINTENANCE SAFETY

- Good maintenance is your responsibility. Poor maintenance is an invitation to trouble.
- Follow good shop practices.
 - Keep service area clean and dry.
 - Be sure electrical outlets and tools are properly grounded.
 - Use adequate light for the job at hand.
- Make sure there is plenty of ventilation. Never operate the engine of the towing vehicle in a closed building. The exhaust fumes may cause asphyxiation.
- Before working on this machine, shut off the engine, set the brake, and turn fuel valve off.
- Never work under equipment unless it is blocked securely.
- Always use personal protection devices such as eye, hand and hearing protectors, when performing any service or maintenance work. Use heavy gloves when handling sharp components.
- Where replacement parts are necessary for periodic maintenance and servicing, genuine factory replacement parts must be used to restore your equipment to original specifications. The manufacturer will not be responsible for injuries or damages caused by use of unapproved parts and/or accessories.
- A fire extinguisher and first aid kit should be kept readily accessible while performing maintenance on this equipment.
- Periodically tighten all bolts, nuts and screws and check that all cotter pins are properly installed to ensure unit is in a safe condition.
- When completing a maintenance or service function, make sure all safety shields and devices are installed before placing unit in service.

6.1 SERVICE

6.1.1 FLUIDS AND LUBRICANTS

1. Grease:
Use an SAE multipurpose high temperature grease with extreme pressure (EP) performance. Also acceptable is an SAE multipurpose lithium base grease.
2. Engine Oil:
Use an SAE 10W30 or 10W40 multi-viscosity oil meeting the American Petroleum Institute (API) classification of SF, SG, SH or SJ for normal operating temperatures. Consult the engine manual for unusual operating conditions. Do not mix oil types or viscosities.

Crankcase Capacity: 1.0 L (1.0 US qt)

3. Engine Gasoline:
Use a standard automotive super unleaded gasoline for all operating conditions.

Fuel Tank Capacity: 1.0 US gal (3.7 liter)

4. Hydraulic Oil:
Use a heavy duty hydraulic oil for all applications.

Reservoir Capacity: 7.0 US gal (26.0 liter)

5. Storing Lubricants:
Your machine can operate at top efficiency only if clean lubricants are used. Use clean containers to handle all lubricants. Store them in an area protected from dust, moisture and other contaminants.

6.1.2 GREASING

Use the Maintenance Checklist provided to keep a record of all scheduled maintenance.

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

IMPORTANT

Over-greasing may damage bearing seals. If seals are damaged, replace bearings immediately.

6.1.3 SERVICING INTERVALS

8 Hours or Daily

1. Check engine oil level.

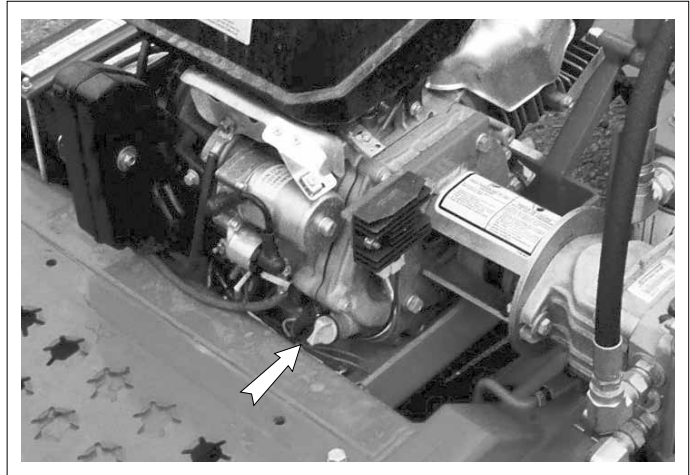


Fig. 25 ENGINE OIL

2. Check engine fuel level.



Fig. 26 GAS TANK

3. Wash roller heads after each use.

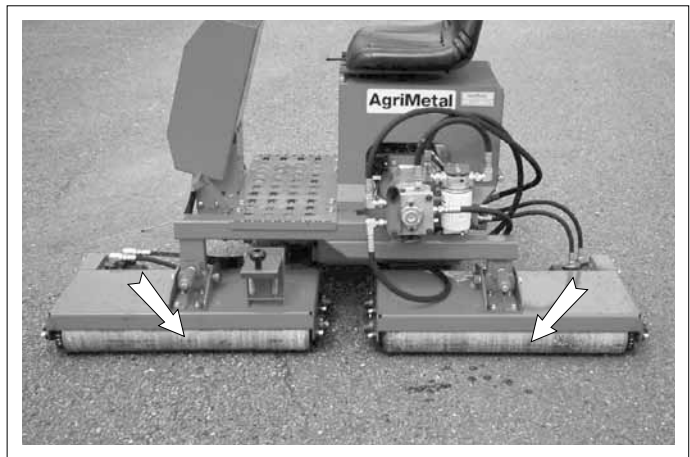
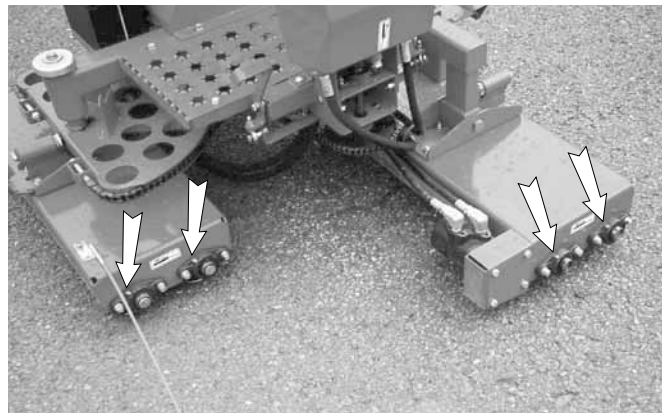


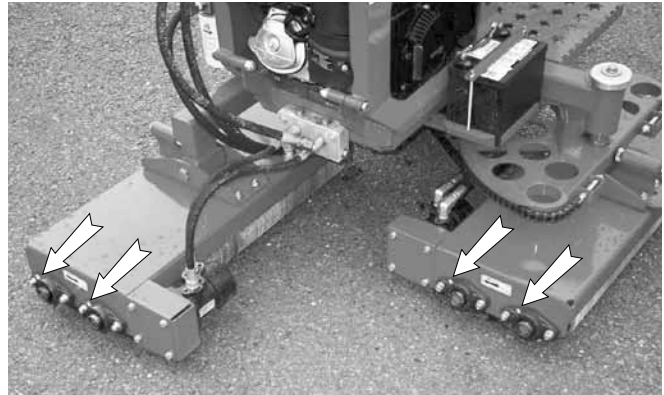
Fig. 27 ROLLER HEADS

40 Hours or Weekly

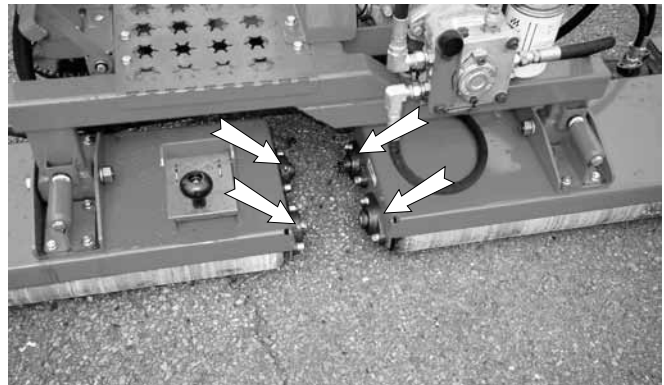
1. Grease the roller shaft bearings with 1 shot of grease.



Forward



Rearward



Left Center

Fig. 28 ROLLER SHAFT BEARINGS

2. Grease the steering shaft bearings with 1 shot of grease.

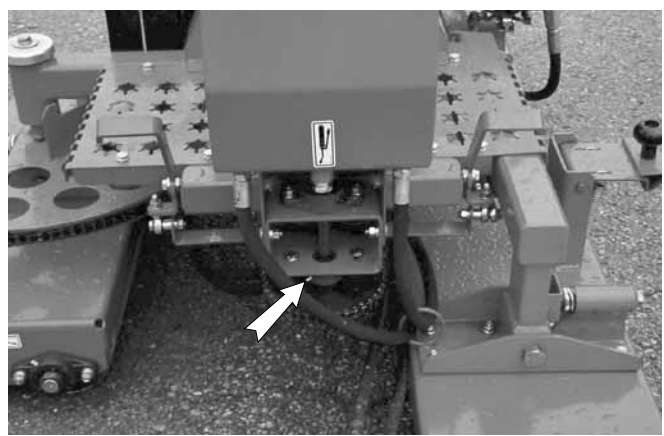


Fig. 29 STEERING SHAFT BEARINGS

3. Check the oil level in the hydraulic tank.

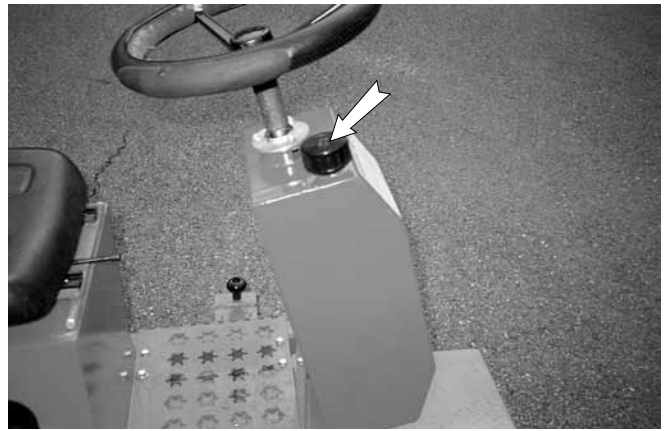


Fig. 30 SIGHT GLASS

4. Clean engine air cleaner.

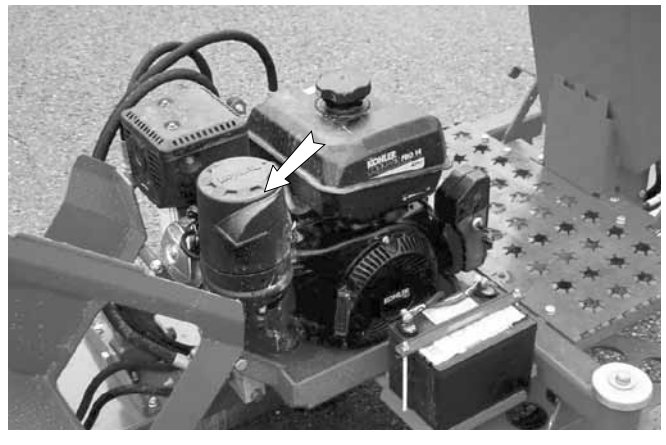


Fig. 31 AIR CLEANER

100 Hours or 3 Months:

1. Change engine oil.

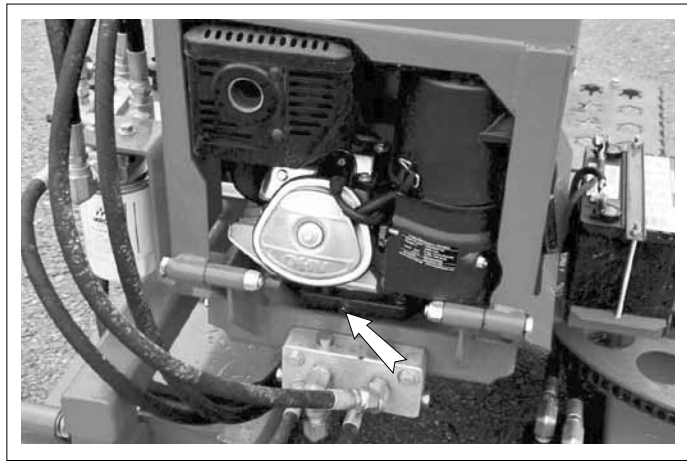


Fig. 32 DRAIN PLUG

2. Check tire pressure.

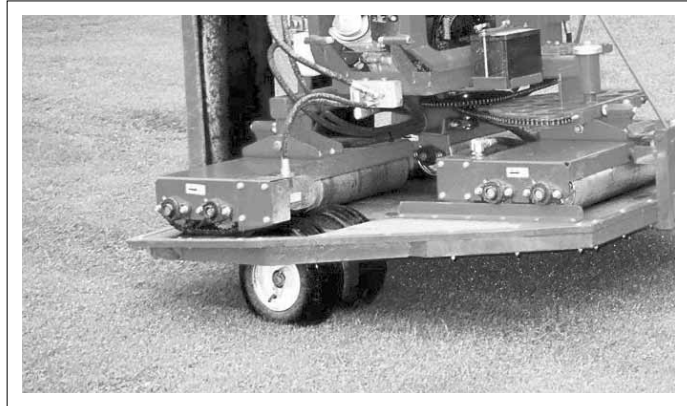


Fig. 33 TIRES

3. Change hydraulic system oil filter.

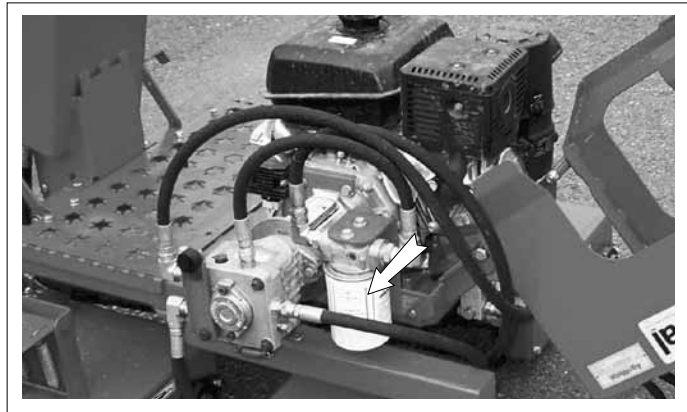


Fig. 34 HYDRAULIC FILTER

4. Check tension of roller chain between hydraulic motors and rollers.

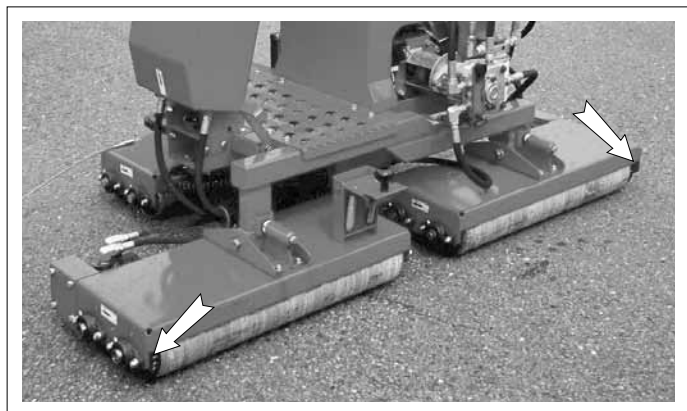


Fig. 35 ROLLER CHAINS (Typical)

Annually

1. Clean machine.



Fig. 36 MACHINE

2. Check tension of steering roller chains.

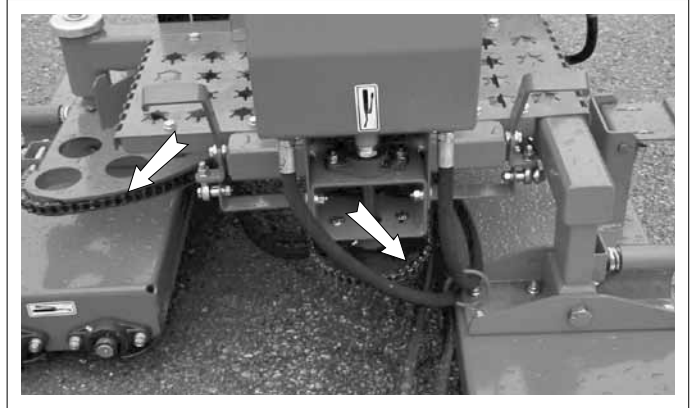


Fig. 37 STEERING ROLLER CHAIN

Bi-Annually or Every 2 Years

1. Change oil in hydraulic system.

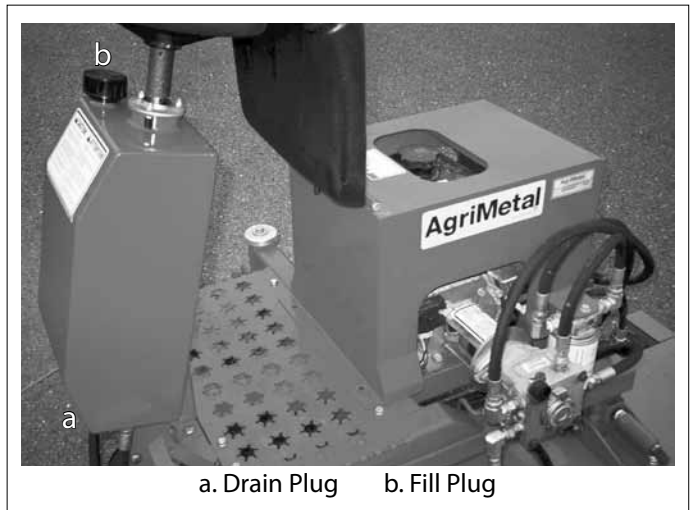


Fig. 38 STEERING ROLLER CHAIN

6.1.4 SERVICE RECORD

See Lubrication and Maintenance sections for details of service. Copy this page to continue record.

ACTION CODE:	CK	CHECK	CL	CLEAN
	G	GREASE	CH	CHANGE

[illegible]

6.2 MAINTENANCE

By following a careful service and maintenance program for your machine, you will enjoy many years of trouble-free operation.

6.2.1 CLEANING AIR CLEANER

1. Review the Operator's Manual for the engine.
2. Place all controls in neutral, stop engine and turn ignition off before maintaining.
3. Remove the cover over the air cleaner.
4. Remove the foam from the engine.
5. Use an air hose to blow the dust and debris out of the foam.
6. Install foam.
7. Install and secure the cover.

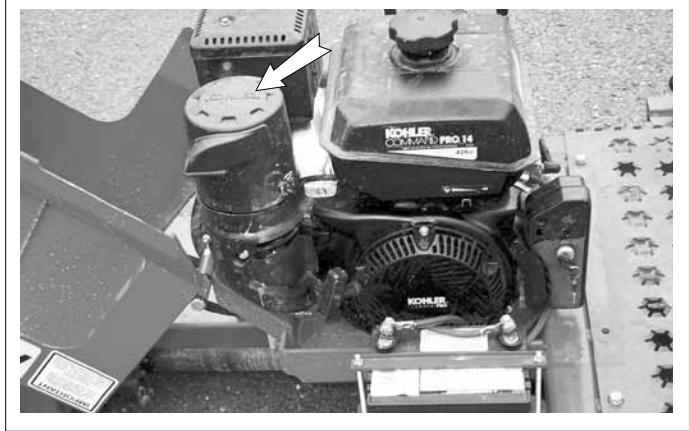


Fig. 39 AIR CLEANER

6.2.2 CHANGING ENGINE OIL

1. Review the Operator's Manual for the engine.
2. Place all controls in neutral, stop engine and remove ignition key before maintaining.
3. Allow the engine to cool before changing the oil. Hot oil can cause burns if it contacts exposed skin. It is best to change oil while the engine is warm to keep the contaminants in suspension.
4. Place a pan under the drain plug.
5. Remove the drain and allow the oil to drain for 10 minutes.
6. Install and tighten the drain plug.
7. Dispose of the used oil in an approved container.
8. Fill the crankcase with specified oil.
9. Run the engine for 1-2 minutes and check for oil leaks.
10. If leaks are found around the drain plug, tighten slightly.
11. Check engine oil level. Top up as required.

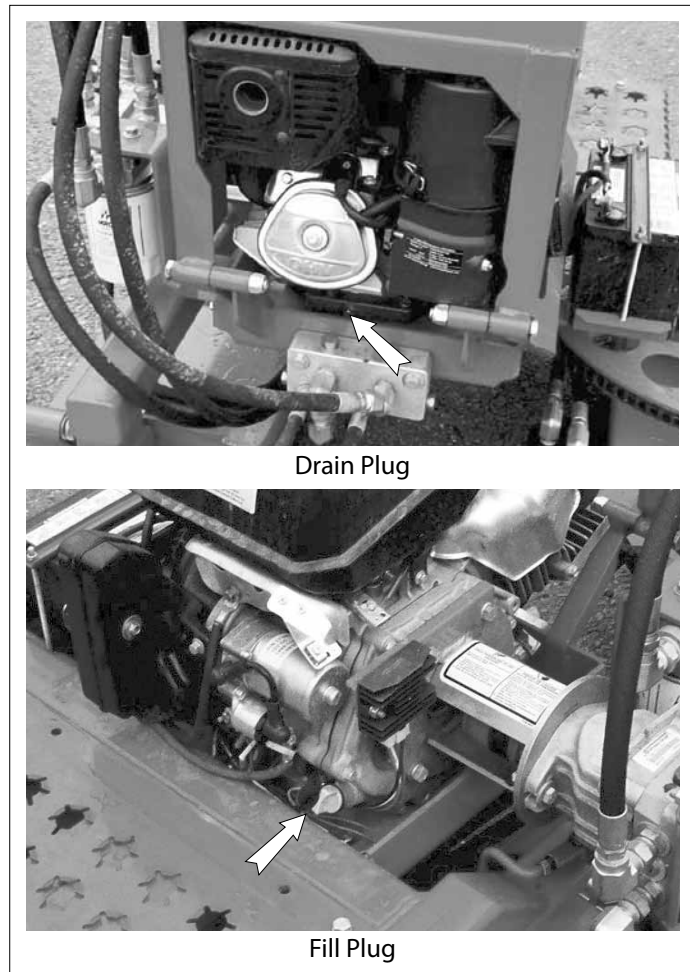
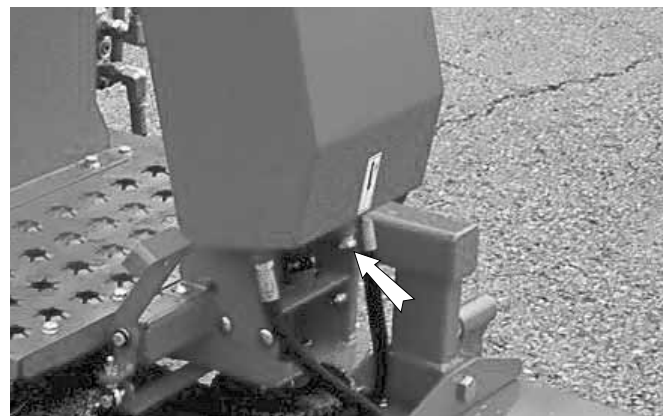


Fig. 40 ENGINE

6.2.3 CHANGING HYDRAULIC OIL AND FILTER

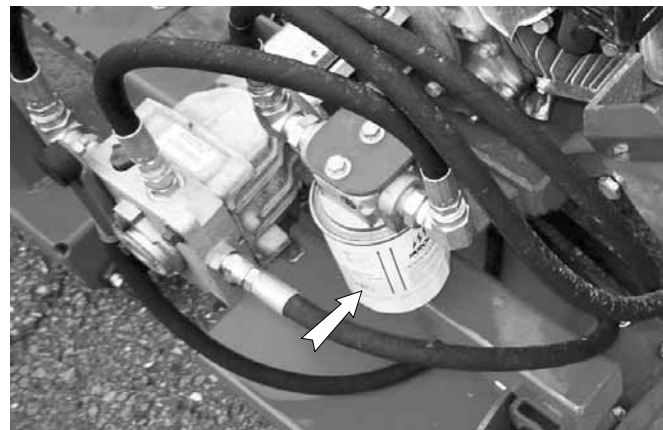
1. Review the Operator's Manual for the engine.
2. Place all controls in neutral, stop engine, turn off ignition and wait for all moving parts to stop before changing oil and filter.
3. Allow the engine to cool before changing the oil. Hot oil can cause burns if it contacts exposed skin. It is best to change oil while the engine is warm to keep the contaminants in suspension.
4. Place a pan under the drain plug.
5. Remove the drain and allow the oil to drain for 10 minutes.
6. Install and tighten the drain plug.
7. Dispose of the used oil in an approved container.
8. Remove hydraulic oil filter.
9. Apply a light coat of oil to the O ring and install the replacement filter. Snug up by hand and then tighten another 1/2 turn.
10. Fill the hydraulic oil reservoir with specified oil.
11. Run the engine for 1 to 2 minutes and check the hydraulic system for oil leaks.
12. If leaks are found around the drain plug or filter, tighten slightly. Repeat step 11.
13. Check oil level in reservoir. Top up as required.



Drain Plug



Fill Plug



Hydraulic System Oil Filter

Fig. 41 HYDRAULIC SYSTEM

6.2.4 ROLLER CHAIN TENSION AND ALIGNMENT

Two sets of roller chains transmit rotational power to the pivoting roller. They must be kept properly tensioned and the sprockets aligned to obtain the expected performance and life.

To check the tension and alignment, follow this procedure:

1. Clear the area of bystanders, especially small children.
2. Place all controls in neutral, stop engine, turn off ignition and wait for all moving parts to stop before servicing.
3. Each roller chain should have a slight amount of slack when properly set.
4. Touch each roller chain 6 inches (150 mm) when checking for slack.
5. The chain tension is set by adjuster bolts on the end of the chains.
6. Always check and maintain sprocket alignment. Lay a straight edge across the sprocket faces to check the alignment. Adjust alignment if sprocket faces vary more than 1/32 inch (.7 mm).

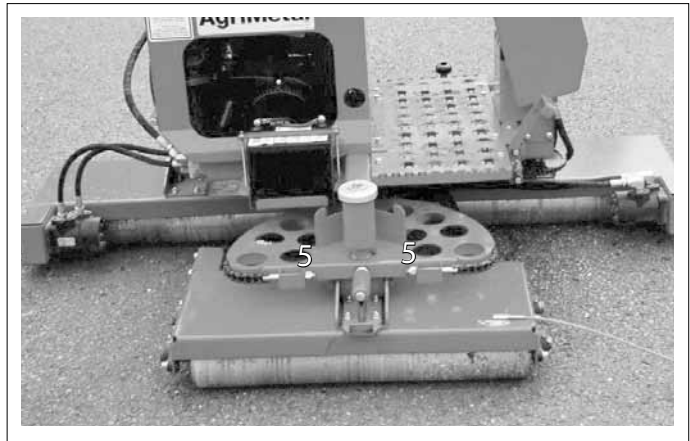


Fig. 42 ROLLER CHAIN ADJUSTERS (Typical)

7 TROUBLE SHOOTING

The AgriMetal Self-Propelled Greens Roller is designed to roll over a grass area, particularly golf greens, to level them and keep them smooth and even. It is a simple system that requires minimal maintenance.

In the following Trouble Shooting section, we have listed many of the problems, causes and solutions that can help you to solve the problems that you might encounter.

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

PROBLEM	CAUSE	SOLUTION
Engine won't run.	No fuel.	Fill fuel tank.
Machine doesn't move.	Low hydraulic oil level.	Check oil level and top up as required.
	Plugged hydraulic oil filter.	Change oil filter.

8 SPECIFICATIONS

8.1 MECHANICAL

	GR-660
WORKING WIDTH	
HEIGHT	
WIDTH	
LENGTH	
ENGINE	
MACHINE WEIGHT	
SHIPPING WEIGHT	
SHIPPING DIMENSIONS	

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

8.2 HYDRAULIC FITTING TORQUE

Tightening Flare Type Tube Fittings *

1. Check flare and flare seat for defects that might cause leakage.
 2. Align tube with fitting before tightening.
 3. Lubricate connection and hand tighten swivel nut until snug.
 4. To prevent twisting the tube(s), use two wrenches. Place one wrench on the connector body and with the second tighten the swivel nut to the torque shown.
- The torque values shown are based on lubricated connections as in reassembly.

Tube Size OD	Nut Size Across Flats	Torque Value•		Recommended Turns To Tighten (After Finger Tightening)	
		(N.m)	(lb-ft)	(Flats)	(Turn)
3/16	7/16	8	6	1	1/6
1/4	9/16	12	9	1	1/6
5/16	5/8	16	12	1	1/6
3/8	11/16	24	18	1	1/6
1/2	7/8	46	34	1	1/6
5/8	1	62	46	1	1/6
3/4	1-1/4	102	75	3/4	1/8
7/8	1-3/8	122	90	3/4	1/8

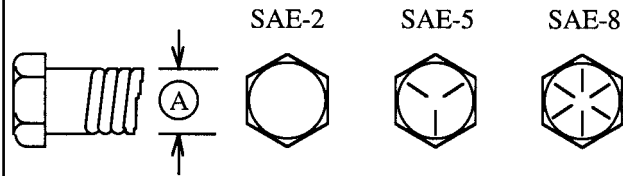
8.3 BOLT TORQUE

CHECKING BOLT TORQUE

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

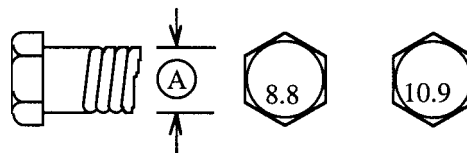
ENGLISH TORQUE SPECIFICATIONS

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



METRIC TORQUE SPECIFICATIONS

Bolt Diameter "A"	Bolt Torque*			
	8.8		10.9	
	(N.m)	(lb-ft)	(N.m)	(lb-ft)
M3	.5	.4	1.8	1.3
M4	3	2.2	4.5	3.3
M5	6	4	9	7
M6	10	7	15	11
M8	25	18	35	26
M10	50	37	70	52
M12	90	66	125	92
M14	140	103	200	148
M16	225	166	310	229
M20	435	321	610	450
M24	750	553	1050	774
M30	1495	1103	2100	1550
M36	2600	1917	3675	2710



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

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

9 INDEX

A		PAGE
Assembling	13	
Machine Assembly	13	
I		
Introduction	1	
O		
Operation	17	
Attaching/Unhooking	21	
Break-In	19	
Controls.....	20	
Field Operation	25	
Loading onto Trailer	22	
Machine Components.....	18	
Pre-Operation Checklist.....	19	
Storage.....	33	
To the New Operator or Owner	17	
Transporting.....	32	

S	PAGE
Safety	2
Equipment Safety	4
Gas Motor Safety.....	9
General Safety.....	3
Maintenance Safety	6
Operating Safety	7
Preparation	6
Refuelling Safety	8
Safety Signs.....	5
Safety Training	5
Sign-Off Form.....	10
Storage Safety.....	8
Tire Safety	8
Transport Safety	8
Safety Sign Locations	11
Service and Maintenance	34
Maintenance.....	41
Changing Engine Oil	43
Changing Hydraulic Oil & Filter	44
Cleaning Air Cleaner	42
Roller Chain Tension & Alignment	45
Service	34
Fluids and Lubricants.....	34
Greasing	34
Service Record.....	40
Servicing Intervals	35
Specifications.....	46
Bolt Torque.....	48
Hydraulic Fitting Torque	47
Mechanical.....	46

T

Trouble Shooting..... 45