# AL 140
**(SN 11257 and Up)**

# AL 240(EU)
**(SN 21244 and Up)**

# AL 340
**(SN 31365 and Up)**

# AL 440(EU)
**(SN 41250 and Up)**

# AL 540
**(SN 51242 and Up)**

## Articulated Loader
# Operator's Manual

**918496 Rev. L 02/20**
Supersedes 918447

# CHAPTER 1

# GENERAL INFORMATION

## Safety Symbol

**Manitou Group, in cooperation with the Society of Automotive Engineers, as adopted this safety alert symbol. This symbol identifies potential safety hazards, which, if not properly avoided, could result in injury. When you see this symbol in this manual or on the machine, your are reminded to BE ALERT! Your personal safety is involved!**

## Contents and Use of this Manual

This operator's manual provides detailed operating procedures for safe, effective and proper machine use. Safe operation is detailed in the *Safety* chapter of this manual, beginning on page 9. Specification, maintenance and troubleshooting information is also included in this manual.

Improper operation, inspection and maintenance of the machine can result in injury or death. Read and understand the contents of this manual completely and become familiar with the machine before operation. Contact your authorized dealer with any questions about information in this manual, if extra manuals are required, or about availability of manuals in other languages.

Throughout this manual, information is provided set in or *italic* type and introduced by the words ***Notice*** or ***Important***. Carefully read and follow these messages to improve operating and maintenance efficiency, to avoid breakdowns and damage, and extend the life of the machine.

***Note:*** *Because of ongoing product improvements, illustrations and listings in this manual may not exactly match the machine. Manitou Group reserves the right to modify and improve products at any time without notice.*

A storage box (A, *Fig. 1*) behind the seat is provided for manual storage. Store the operator's manual in this box at all times.

***Note:*** *AL500 Series machines with air conditioning use a cylindrical manual storage container located next to the operator's seat.*

This manual is considered a permanent part of the machine and should be with the machine at all times. Replace this manual promptly if it becomes damaged, lost, or stolen.

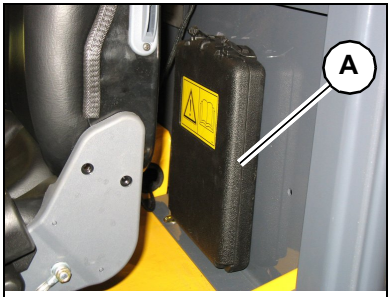



**Figure 1 – Manual Storage Location (except AL500 Series with air conditioning)**

11. On machines equipped with the optional battery disconnect switch, always turn the switch to the “OFF” position when parking the machine inside an enclosure.

ONLY when these precautions have been taken can you be sure it is safe to proceed. Failure to follow this procedure could result in death or serious injury.

## Before Starting

- Do not remove or modify the Roll-Over Protective Structure (“ROPS”) unless instructed to do so in approved installation instructions. Modifications, such as welding, drilling or cutting, can weaken the structure and reduce the protection it provides. A damaged ROPS cannot be repaired – it must be replaced.
- Never operate the machine without a ROPS or FOPS installed.
- To ensure safe operation, replace damaged or worn-out parts with genuine service parts.
- The machine is designed and intended to be used only with approved attachments. To avoid possible personal injury, equipment damage and performance problems, use only attachments that are approved for use on and within the operating capacity of the machine (see weights and capacity information, starting on page 35). Contact the Manitou Group service department for information on attachment approval and compatibility with specific machine models. Manitou Group cannot be responsible if the machine is used with a non-approved attachment.
- Remove all trash and debris from the machine every day, especially in the engine compartment, to minimize the risk of fire.
- Always face the machine and use the hand holds and steps when entering and exiting the machine. Do not jump off the machine. See “Entering and Exiting” on page 73.
- Never use starting aids. Engine pre-heating is used for cold weather starting. Engine pre-heating can cause either or other starting fluid to detonate, causing injury or damage.
- Walk around the machine and inspect it before using it. Look for damage, loose or missing parts, leaks, etc.
- Warn all nearby personnel before starting the machine.
- Check for proper tire pressure in all four tires before operating the machine and add air if necessary. Improperly pressurized tires adversely affect machine stability. Regularly check wheel fasteners for tightness. See “Wheel Fastener Torque” on page 40.
- Contact the proper local authorities for utility line locations BEFORE starting to dig. In North America, contact the North American One-Call Referral System at 8-1-1 in the U.S., or 1-888-258-0808 in the U.S. and Canada.

- Do not lift the machine by the cab. Attach the rigging equipment only at the lift points identified by this symbol:

- Lift the machine according to “Crane Lifting” on page 106.

*Note: Refer to Fig. 5 on page 28 for decal locations.*

AA


**General Operating Warnings**

- **Located on the control column, facing the operator.**

**A) Check machine before operating. Service according to Operator's Manual. Contact dealer (or manufacturer) for information and service parts.**

**B) Maintain 3-point contact during entry and exit. Do not grasp steering wheel during entry and exit.**

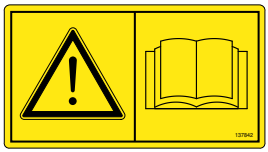
**C) Inspect work area. Avoid all hazards. Look in the direction of travel. Keep children and bystanders away.**

**D) Start and operate machine only from operator's seat.**

**E) Keep away from power lines.**

**F) Wear personal protective equipment as needed. Do not wear loose clothing while operating or servicing machine.**

BB




**WARNING: Read Operator's Manual**

- **Located behind the operator's seat on the document box cover.**
- **Be sure all users are instructed on safe use and maintenance. Service machine according to the Operator's Manual. Contact dealer (or manufacturer) for information and service parts.**

CC


**EARLY 2-POST ROPS MACHINES ONLY -- NOT AVAILABLE IN EUROPE**

**WARNING: Falling Object Hazard**

- **Located under the parking brake lever.**
- **For 2-Post ROPS machines only.**
- **Falling-Object Protective Structure (FOPS) must be installed if there is a risk of falling objects.**

## Wheel/Tire Sets

| Description | Model | Machine Width Millimeters (Inches) |
|---|---|---|
| 27x8.50-15, 8-ply | AL 100 Series | 1044 (41.1) |
| 27x10.50-15, 8-ply | AL 100 Series | 1049 (41.3) |
| 27x10.50-15, 10-ply (turf) | AL 100 Series | 1049 (41.3) |
| 30.5x12.5-16.5, 8-ply | AL 300 Series | 1280 (50.4) |
| 10x16.5, 8-ply | AL 300 Series | 1280 (50.4) |
| 29x12.5-15 8-ply (turf) | AL 300 Series | 1285 (50.6) |
| 33x15.5-16.5 | AL 500 Series | 1400 (55.1) |
| 12x16.5 | AL 500 Series | 1200/1346 (47.2/53.0) |
| 33x13.5-16 NHS 12-ply (turf) | AL500 Series | 1368 (53.9) |

| (EU Only) | | |
|---|---|---|
| W/T Set 27x10.50-15 | AL 100 Series<br>AL 200 Series | 958/1079 (37.7/42.5) |
| W/T Set 27x10.50-15 (wide-stance wheel option) | AL 100 Series<br>AL 200 Series | 990/1010 (39.0/39.8) |
| W/T Set 27x10.50-16 | AL 100 Series<br>AL 200 Series | 988/1050 (38.9/41.3) |
| W/T Set 10.0x16.5 | AL 100 Series<br>AL 200 Series | 948/1097 (37.3/43.2) |
| W/T Set 10.0x16.5 | AL 300 Series | 1145/1274 (45.1/50.2) |
| W/T Set 29x12.50-15 | AL 300 Series | 1150/1349 (45.3/53.1) |
| W/T Set 31x15.50-16.5 | AL 300 Series | 1325/1372 (52.2/54.0) |
| 31x15.5-16.5 | AL 500 Series<br>AL 400 Series | 1282/1415 (50.5/55.7) |
| 12x16.5 | AL 500 Series<br>AL 400 Series | 1200/1346 (47.2/53.0) |
| 31x15.5-15 | AL 500 Series<br>AL 400 Series | 1282/1415 (50.5/55.7) |

***Note:*** *See tire sidewall for inflation pressures, except where noted.*

***Important:*** *AL 500 Series machines with fluid-filled rear tires have increased load capacities.*

## Common Materials and Densities

| Material | Density | |
|---|---|---|
| | lbs./ft.$^3$ | kg/m$^3$ |
| Ashes | 35-50 | 560-800 |
| Brick-common | 112 | 1792 |
| Cement | 110 | 1760 |
| Charcoal | 23 | 368 |
| Clay, wet-dry | 80-100 | 1280-1600 |
| Coal | 53-63 | 848-1008 |
| Concrete | 115 | 1840 |
| Cinders | 50 | 800 |
| Coal-anthracite | 94 | 1504 |
| Coke | 30 | 480 |
| Earth-dry loam | 70-90 | 1121-1442 |
| Earth-wet loam | 80-100 | 1281-1602 |
| Granite | 93-111 | 1488-1776 |
| Gravel-dry | 100 | 1602 |
| Gravel-wet | 120 | 1922 |
| Gypsum-crushed | 115 | 1840 |
| Iron ore | 145 | 2320 |
| Lime | 60 | 960 |
| Lime stone | 90 | 1440 |
| Manure-liquid | 65 | 1040 |
| Manure-solid | 45 | 720 |
| Peat-solid | 47 | 752 |
| Phosphate-granular | 90 | 1440 |
| Potash | 68 | 1088 |
| Quartz-granular | 110 | 1760 |
| Salt-dry | 100 | 1602 |
| Salt-rock-solid | 135 | 2160 |
| Sand-dry | 108 | 1728 |
| Sand-wet | 125 | 2000 |
| Sand-foundry | 95 | 1520 |
| Shale-crushed | 90 | 1440 |
| Slag-crushed | 70 | 1120 |
| Snow | 15-50 | 240-800 |
| Taconite | 107 | 1712 |

***Note:*** *The densities listed are average values and intended only as a guide for bucket selection. For a material that is not in the table, obtain its density value before selecting the appropriate bucket.*

## Operator's Seat Adjustment

**⚠ WARNING Never adjust the operator's seat when the engine is running.**

Adjust the operator's seat so all controls are easy to reach and the pedals can be completely depressed with your back against the seat back (*Fig. 12*).

A. **Forward/rearward adjustment:** Pull the lever up, adjust the seat and release the lever. Check that the seat is locked in place.

**B. Weight adjustment:** While sitting in the seat, rotate the knob until the desired tension is reached.

**C. Recline adjustment:** On later machines, rotate the knob on the right side of the seat. On early machines, pull lever (C) on the left side of the seat up, recline the seat back as desired and release the lever. Check that the seat is locked in place.

**D. Height adjustment (AL 400/500 Series):** Rotate knob until the desired seat height is reached.

**E. Seat Belt:** See the following section.

**F. Seat tension indicator (AL 100/200/300 Series):** Adjust weight adjustment knob (B) until seat tension indicator is centered.

**G. Air Suspension adjustment (AL 400/500 Series):** Adjust seat suspension stiffness using button (G).

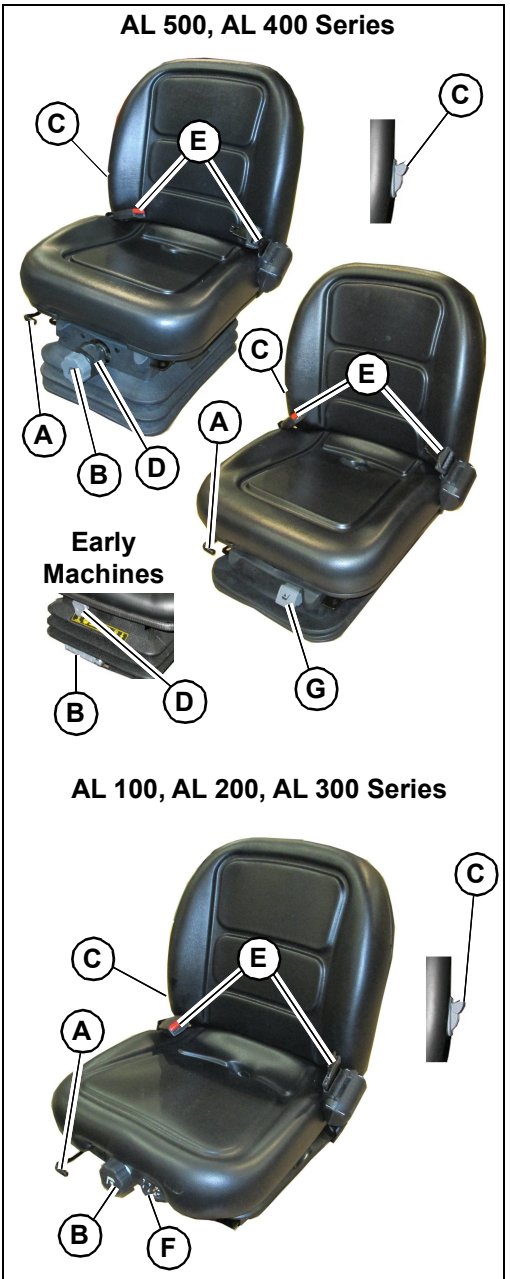



**Figure 12 – Operator's Seat Adjustment (Later Machines Shown; Early Machines Similar)**

4. Insert the clevis pins (both sides) (*U*).
5. Insert the cotter pins (both sides) (*T*).

**Not Available in Europe**

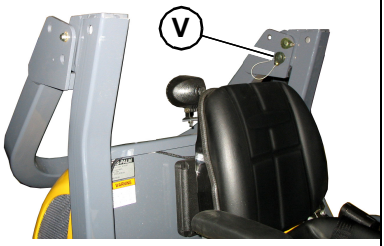



**Figure 27 – ROPS Folded Position**

## Lift Arm Down-Stop

The lift arm down stop is designed to limit lift arm downward travel. This feature is useful when changing tire sizes, or when driving the machine over long distances.

1. Empty the bucket (if applicable).
2. Position the lift arm above the down stop hole (*C*, *Fig. 42*) position where you want to limit travel, and also high enough to allow removal of the down-stop lock bar (*B*).
3. Perform the "Mandatory Safety Shut-down Procedure" on page 10.
4. Remove the lock pin (*A*), and pull the lock bar (*B*) from the machine.
5. Slide the lock bar (*B*) all the way through the desired down-stop holes (*C*).
6. Replace the lock pin (*A*) into the lock bar.

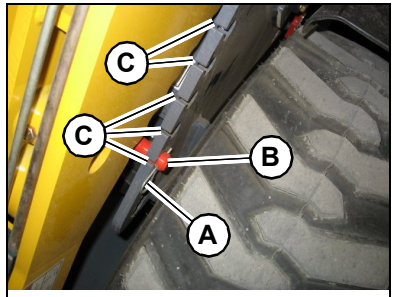



**Figure 42 – Lift Arm Down-Stop**

## Travel

**⚠ WARNING** **Do not move the drive direction switch (*Fig. 44*) while traveling. The machine may react suddenly, causing an accident.**

**Change drive direction only when stopped. Refer to the drive direction lamps when changing travel direction. See "Controls and Switches" on page 54, and "Instrument Panel and Indicators" on page 56.**

***Important:*** *If the optional backup alarm is installed, and the parking brake is released, the backup alarm activates when the drive direction switch is in reverse.*

1. Be sure that the area around the loader is clear of bystanders and obstacles.
2. Using the multi-purpose joystick, raise the lift arm/attachment. Keep the attachment as near to the ground as possible for good stability and visibility. See "Load Handling" on page 84.
3. Release the parking brake. Lift lever (*G, Fig. 43*) slightly and press button (*F*) and press lever (*G*) downward. Release the button.

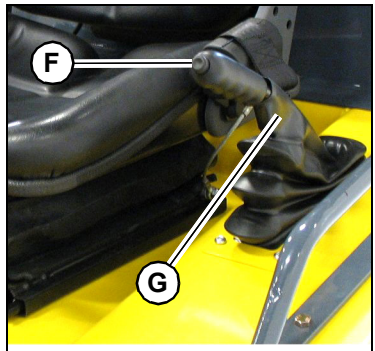



**Figure 43 – Parking Brake**

3. Push the side of the Power-A-Tach® system hitch lock switch (*L, Fig. 59*) to lock the attachment onto the hitch.
   a. **AL 100 Series machines only:** Press and hold the bottom auxiliary hydraulics control button (*Z, Fig. 60*) and then push the side of the Power-A-Tach® system hitch lock switch (*L, Fig. 59*) to lock the attachment onto the hitch.

      ***Note:*** *Due to ongoing product improvement and variations during production, it may be necessary to hold the top auxiliary hydraulics control button instead of the bottom button to enable the hitch lock switch on AL 100 Series machines.*

4. Make sure the attachment is securely locked onto the hitch: the locking handles (*K, Fig. 55*) must be horizontal, with the lip on the attachment completely engaged over the top of the hitch, and the hitch pins on the bottom of the hitch fully engaged down into the attachment.

***Note:*** *4-point hitch (EU only) locking pins engage out through the sides of the attachment.*

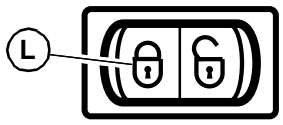



**Figure 59 – Hydraulic Power-A-Tach® System Hitch Lock Switch**


**Figure 60 – AL 100 Series Bottom Auxiliary Hydraulics Control Button (Power-A-Tach® System Hitch Lock Switch Enable Button)**

**⚠ WARNING** **Do not use the loader for towing (other vehicles, trailers, equipment, etc.).**

***Important:*** *The machine cannot be tow-started because there is no direct mechanical connection between the wheels and the engine. Attempting to tow-start the machine may damage the drive system.*

### *Precautions*

Only tow the loader if the steering and brakes are functional, if it cannot be repaired on-site, and if it cannot be transported using any other method. Only tow the loader until it is moved to a location where it can be safely repaired.

***Important:*** *If moving the loader more than a few hundred meters, use a flatbed truck or similar vehicle to transport the loader, to prevent overheating the hydraulic system. See "Loading and Transporting" on page 104.*

## Towing AL 100 Series Machines

### *Preparation*

1. Perform the "Mandatory Safety Shut-down Procedure" on page 10.
2. Tilt up the operator's platform. See "Tilting Up the Platform" on page 114.
3. Loosen the hydraulic system bypass valve (*D, Fig. 69*) one to two turns.

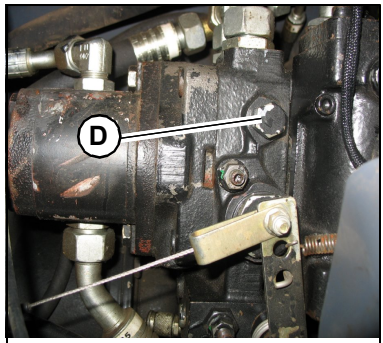



**Figure 69 – Hydraulic System Bypass Valve (AL 100 Series)**

**⚠ CAUTION** **Do not loosen the bypass valve bolts more than one to two turns. The bypass valve can come out of the pump, resulting in a rapid loss of hydraulic fluid.**

4. Tilt and secure the operator's platform back into the operating position. See "Tilting the Platform Down" on page 115.

## Check, Clean and Inspect

| Service Procedure | Maximum Interval | | | | |
|---|---|---|---|---|---|
| | 10 Hours (or daily) | 50 Hours (or weekly) | Monthly | 250 Hours (or every six months) | 500 Hours (or annually) |
| Check coolant system for leaks, dirt and debris; hoses for cracks/damage | | X | | | |
| Check battery electrolyte level (if applicable) | | X | | | |
| Check engine and engine mounts | | X | | | |
| Check for hydraulic system for leaks, proper routing | | | X | | |
| Check anti-freeze mixture | | | X | | |
| Check V-belt tension and condition | | | X | | |
| Check engine cover lock | | | X | | |
| Check engine idle | | | X | | |
| Replace fuel filter | | | | X | |
| Check hinge pins, joint bushings, pivot bolts and bearings | | | | | X |
| Check for exhaust system damage | | | | | X |
| Clean battery terminals | | | | | X |
| Check timing belt | | | | | X |
| Check fuel injectors | | | | | X |
| Check electrical system for damage, wiring routing | | | | | X |

0- Bgdbj adenqd ehqrs t rd `mc dudqx sv n gnt qr `esdq shf gsdmhmf t mskke`rsdmdq snopt d rs`ah-khydr: dudqx l nmsg sgdqd`esdq-

## Leakage Check

| Service Procedure | Maximum Interval | | | | |
|---|---|---|---|---|---|
| | 10 Hours (or daily) | 50 Hours (or weekly) | Monthly | 250 Hours (or every six months) | 500 Hours (or annually) |
| Check engine for oil/coolant leaks | X | | | | |
| Check cooling system for leaks | X | | | | |
| Check hydraulic system for leaks | | X | | | |
| Check axles for leaks | | X | | | |

### *Accessing the Outer and Inner Filter Elements*

1. Perform the “Mandatory Safety Shutdown Procedure” on page 10.
2. Open the engine cover.
3. Unlatch the clamps on the air cleaner housing and remove the element cover.
4. Clean any debris from the cover.

### *Changing the Filter Elements*

1. Perform the “Mandatory Safety Shutdown Procedure” on page 10.
2. Carefully remove the outer filter element (*F, Fig. 89*). Do not remove the inner filter element (*G*) unless it is to be replaced. If the inner filter element will not be replaced, skip to step 8.
3. Before removing inner filter element (*G*) from the housing, clean away any dirt built up in the housing. Leave the inner filter element installed during this step to prevent debris from entering the engine intake manifold.
4. Remove the inner filter element.
5. Clean dust and debris from housing (*E*) and cover (*C*). Leave the inner filter element installed during this step to prevent debris from entering the engine intake manifold.
6. Check the inside of the housing for any damage that may interfere with the elements.
7. Remove the old inner filter element and install the new inner filter element.
8. Reinstall/replace the outer filter element.
9. Latch clamps (*D*) to secure cove (*C*).
10. Check the hose connections and be sure they are all clamped and tightened properly.

### *Changing Hydraulic Oil and Filter*

***Note:*** *The hydraulic oil filter can be changed without changing the hydraulic oil or draining the hydraulic reservoir.*

Replace the hydraulic oil if it becomes contaminated, after major repairs, and after 500 hours or one year of use.

1. Perform the "Mandatory Safety Shutdown Procedure" on page 10.
2. Open the hood.
3. Slowly remove the oil fill cap (*V, Fig. 100*). Allow the pressure to escape before completely removing the cap.
4. Position a waste oil collection container with a capacity of at least 45 liters (11 gallons) underneath the hydraulic oil reservoir.

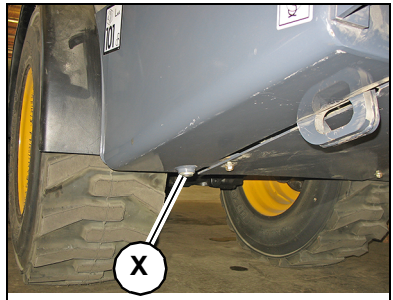


**Figure 102 – Hydraulic Oil Drain**

***Important:*** *Always dispose of hydraulic fluids according to environmental laws or take to a recycling center for proper disposal. DO NOT pour onto the ground or down a drain.*

5. Remove the drain plug (*X, Fig. 102*) and allow the oil to drain completely.
6. Unscrew the filter cover (*W, Fig. 100*).
7. Remove the old filter element (*Y, Fig. 103*). Cover the filter opening on the filter housing with a clean rag while adding oil.
8. Refill the reservoir until the oil is between the two lines on the dipstick (*U, Fig. 100*).
9. Remove the rag from the filter opening and clean the surface of the filter housing where the element seal contacts the housing. Put clean oil on the rubber gasket of the new filter element (*Y, Fig. 103*).
10. Install the new filter element (*Y, Fig. 103*).
11. Reinstall the drain plug.
12. Reinstall the filter cover.

**AL 500 Series shown (other machines similar)**

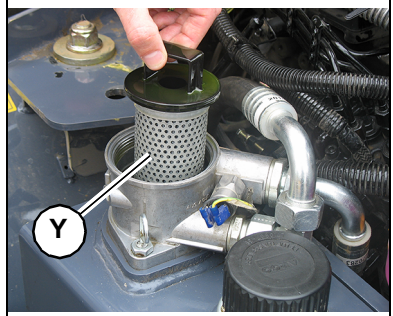


**Figure 103 – Hydraulic Oil Service**

***Note:*** *Do not mix different types/grades of hydraulic fluids.*

13. Start the engine and operate the hydraulic controls.
14. Stop the engine and check for leaks at the hydraulic oil filter and reservoir drain plug.
15. Check the oil level and add oil if necessary.

**AL 200/300 Series Shown (AL 100 Series Similar)**


J. Articulation Pivot - Upper Front
K. Articulation Pivot - Upper Rear
L. Steering Cylinder - Front
M. Articulation Pivot - Lower
N. All-Tach® System Pins (2)
O. All-Tach® System Pivots - Lower (2)
P. Steering Cylinder - Rear
Q. Drive Shaft Ends
R. Drive Shaft Center Telescoping Section (AL 300 Series)

**Figure 116 – AL300/200/100 Series–Grease Every 10 Hours (or daily)**

**⚠ WARNING When the engine is running, components in the engine compartment rotate. Before removing the jumper cables, be sure that no loose clothing can become caught in the rotating components.**

7. After the engine is running, remove the negative jumper cable connected to the booster machine ground.

***Important:*** *DO NOT allow the booster cable ends to touch when removing them. Arcs and direct short circuits can cause severe damage to the electrical system.*

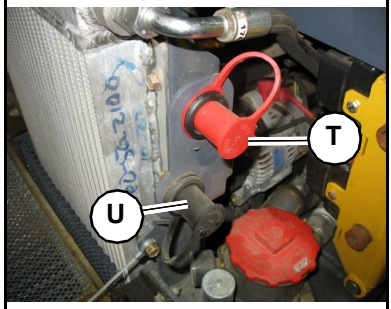
8. Disconnect the jumper cables from the machine with the discharged battery.
9. Remove the positive jumper cable from the booster battery.
10. Close the engine cover and confirm it is latched securely.
11. Allow the machine to run for at least 30 minutes to re-charge the battery.

### *Remote Battery Terminal*

The optional remote battery terminal allows access to the battery terminals for jump-starting purposes.

Open the engine hood to access the remote battery terminal. Remove cap (*T, Fig. 122*) for access to the remote connection for the positive battery terminal stud. Stud (*U*) provides a remote connection to the machine ground.

**AL 100 Series**




**AL 500/400/300/200 Series**

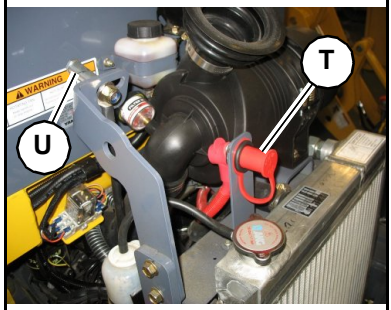



**Figure 122 – Optional Remote Battery Terminal**

## Engine Troubleshooting

| Problem | Possible Cause | Corrective Action |
|---|---|---|
| Engine overheating | Crankcase oil level incorrect | Adjust oil level |
| | Cooling air circulation restricted | With engine off, remove restriction |
| | Fan shroud improperly positioned | Contact dealer |
| | Improper oil grade or oil excessively dirty | Change engine oil—see “Fluid Capacities/Lubricants” on page 33 for proper oil grade |
| | Exhaust restricted | Allow exhaust to cool; remove restriction |
| | Air filter restricted | Replace filter(s) |
| | Low coolant level | Add coolant |
| | Loose fan belt | Tighten fan belt |
| | Dirty radiator | Clean radiator |
| | Thermostat malfunction | Replace thermostat |
| Engine running but loader will not drive | Parking brake applied | Release parking brake |
| | Parking brake switch malfunction | Replace parking brake switch |
| | Blown fuse | Check circuit and replace fuse |
| | Joystick drive direction slider switch malfunction | Replace joystick handle |
| | (AL 400/500 Series) Drive system component malfunction | Check drive controller error code |
| | Operator not in seat | Sit in operator seat |

# INDEX