OPERATOR'S MANUAL

FOR

SCRAPER, TRACTOR: ELEVATING
SELF-PROPELLED, 11 CUBIC YARD,
SECTIONALIZED AND NONSECTIONALIZED

MODEL 613BSS
(NSN 3805-01-144-8837)

MODEL 613BSS1
(NSN 3805-01-267-4177)

MODEL 613BSNS
(NSN 3805-01-267-2992)

MODEL 613BSNS1
(NSN 3805-01-267-4178)

OPERATOR INSTRUCTIONS

LUBRICATION INSTRUCTIONS

SECTIONALIZED UNIQUE MAINTENANCE INFORMATION

SUPPLEMENTAL MAINTENANCE INSTRUCTIONS

HEADQUARTERS, DEPARTMENT OF THE ARMY

DECEMBER 1990

WARNING

CARBON MONOXIDE

Carbon monoxide is colorless, odorless, DEADLY POISONOUS gas which, when breathed, deprives the body of oxygen and causes SUFFOCATION. Exposure to air contaminated with carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, apparent drowsiness, or coma. Permanent BRAIN DAMAGE or DEATH can result from severe exposure.

Carbon monoxide occurs in the exhaust fumes of fuel-burning heaters and internal-combustion engines and becomes DANGEROUSLY CONCENTRATED under conditions of INADEQUATE VENTILATION. The following precautions MUST be observed to insure the safety of personnel whenever the engine is operated for maintenance purposes.

- DO NOT operate the engine in an enclosed area unless it is ADEQUATELY VENTILATED.
- DO NOT operate the engine in an enclosed area such as a test cell without properly fitted and functioning exhaust ducts.
- BE ALERT at all times during engine operation for exhaust odors and exposure symptoms. If either are present, IMMEDIATELY VENTILATE the work area. If symptoms persist, remove affected personnel from the work area and treat as follows: expose to fresh air; keep warm; DO NOT PERMIT PHYSICAL EXERCISE; if necessary, administer artificial respiration as described in FM 21-11.

WARNING

HANDLING WEIGHTS

This manual considers short-term, non-repetitive lifts of equipment weighting up to 190 pounds to heights of about 3 feet. Under these condition, this manual assigns one man for each 47-pound increment of weight up to a total of four men to accomplish the required lifts. If local conditions mandate higher lifts, repetitive lifts, or carries greater than 9 feet, refer to MIL-STD-1472 for a guideline on the number of personnel needed.

WARNING

DO NOT USE EMERGENCY BRAKE AS A PARKING BRAKE

After an emergency stop, do not leave machine without blocking the wheels. Emergency brakes will release after a period of time.

WARNING

MECHANICAL HAZARDS

Mechanical systems and components used on this equipment are energized, under pressure, or have sharp edges.

Use all precautions to de-energize a system, bleed pressure, and to protect yourself from sharp edges when working on the equipment. Failure to do so may cause serious PERSONAL INJURY or DEATH.

Shearing protection must be worn when working within 33 feet of the Tractor-Scraper.

WARNING

HIGH NOISE DANGER

Your hearing can be PERMANENTLY DAMAGED if you are exposed to constant high noise levels of 85 dB(A) or greater. Wear approved hearing protection devices when working in high noise level areas. Personnel exposed to high noise levels shall participate in a hearing conservation program in accordance with TB MED 501.

WARNING

USE OF COMPRESSED AIR TO DRY PARTS

DO NOT exceed 15 psig nozzle pressure when drying parts with compressed air. DO NOT direct compressed air against human skin. Failure to do so may result in SERIOUS INJURY or DEATH.

WARNING

FLAMMABLE LIQUIDS

Dry cleaning fluid, mineral spirits paint thinner, alcohol, acetone, methylethyl ketone and trichloroethylene are flammable solvents. Use these materials only in well-ventilated areas away from open flames and other heat sources that could cause ignition. The minimum safety measures described below must be observed in the handling and use of solvents:

- Fire extinguishers should be nearby when these materials are used.
- Cloths or rags saturated with cleaning solvents must be disposed of in accordance with authorized facilities procedures.
- The use of diesel fuel, oil, gasoline or benzine (benzol) is PROHIBITED for cleaning purposes.
- Fuel vapors can ignite and cause an explosion. Do not allow smoking or an open flame within 50 feet (16 meters).

WARNING

PROPER MACHINE OPERATION

This equipment must be operated only by authorized personnel who have satisfactorily completed a program of training which must include familiarity with safe operating procedures, characteristics, and a knowledge of applicable codes, regulations, and facilities directives. Untrained personnel subject themselves and others to the possibility of DEATH or SERIOUS INJURY from the improper operation of this machine. Understand the equipment, its function, and the controls before operations are begun.

WARNING

HANDLING CLEANING AGENTS

Toxic solvents are used in cleaning the equipment. Methylethyl ketone TT-M-261 is a highly flammable solvent containing toxic characteristics that may irritate the skin and cause burns or internal disorders if fumes are repeatedly inhaled.

Trichloroethylene is a flammable solvent that has a chloroform odor. Inhaling concentrated fumes can cause unconsciousness. Inhaling fumes for a prolonged time can cause headache and drowsiness. Solvent absorbed by the skin can also result in internal disorders.

P-D-680 (Type II) is a flammable solvent that is potentially dangerous to personnel. Inhaling fumes for a prolonged time can cause headache and drowsiness. Solvent absorbed through the skin can also result in internal disorder.

The safety measures described below should be observed in the handling and use of solvents.

- Avoid prolonged or repeated breathing of vapors.
- Use only in a well-ventilated area.
- Keep away from heat, sparks, or open flames.
- Avoid contact with skin, eyes, and clothing. The use of gloves is advised to prevent irritation or inflammation of the skin. If contact with the skin or eyes does occur, quickly wash the affected area with water for at least 15 minutes. For eyes, seek medical attention immediately after flushing eyes with water.

TECHNICAL MANUAL
No. 5-3805-260-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., *27 December 1990*

OPERATOR'S MANUAL

FOR

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**MODEL 613BSS
(NSN 3805-01-144-8837)**

**MODEL 613BSS1
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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual, direct to: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MB, Warren, MI 48397-5000. A reply will be furnished to you.

This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content specified in AR 25-30, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

Approved for public release; distribution is unlimited.

Table of Contents

HOW TO USE THE TECHNICAL MANUAL

Introduction

The 613B Series Tractor-Scraper machines are available in four configurations:

- 613BSNS and 613BSNS1 — Type I - Nonsectionalized
- 613BSS and 613BSS1 — Type II - Sectionalized

The Type I configurations are air transportable by three methods:

- Drive On/Drive Off*
- Low Altitude Parachute Extraction (LAPES)
- Low Velocity Air Drop (LVAD)

* Requires load transfer (weight distribution).

The Type II configurations, in addition to the three methods listed above, may be sectionalized (divided into two sections) and transported by helicopter.

Manual Identification

The Operator's Manual is divided into four parts. Each Chapter/Appendix is preceded with a table of contents, identifying specific items contained within that Chapter/Appendix.

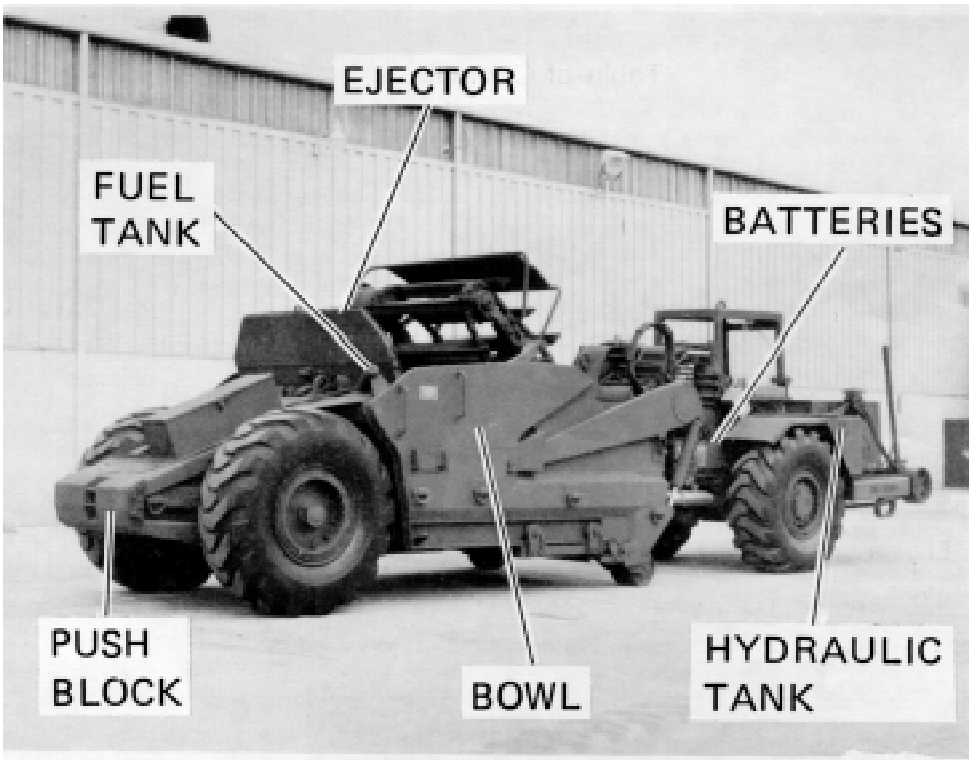
- Chapter 1: Operation information common to both the 613BSNS and 613BSNS1 Type I (Nonsectionalized) vehicle and 613BSS and 613BSS1 Type II (Sectionalized) vehicle.
- Chapter 2: Lubrication information common to both the 613BSNS Type I (Nonsectionalized) vehicle and 613BSS and 613BSS1 Type II (Sectionalized) vehicle.
- Chapter 3: Maintenance information unique to the 613BSS and 613BSS1 Type II (Sectionalized) vehicles.
- Appendix A: Supplemental Operating Information common to all vehicles.

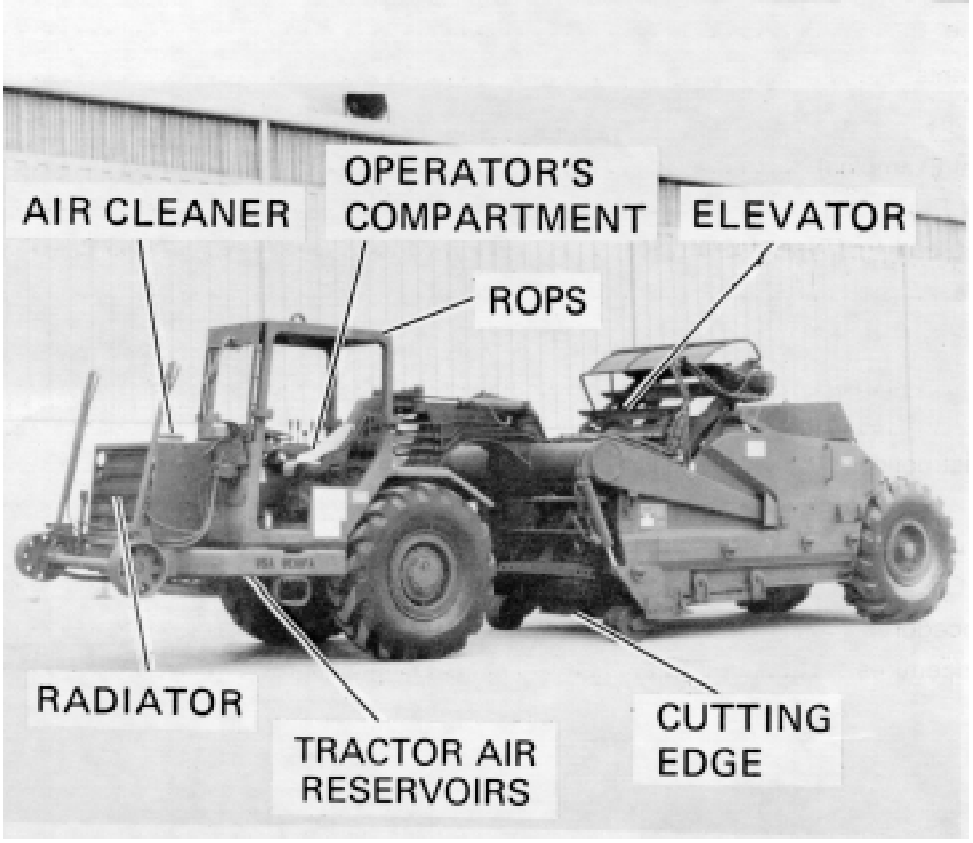
CHAPTER 1

OPERATOR INSTRUCTIONS

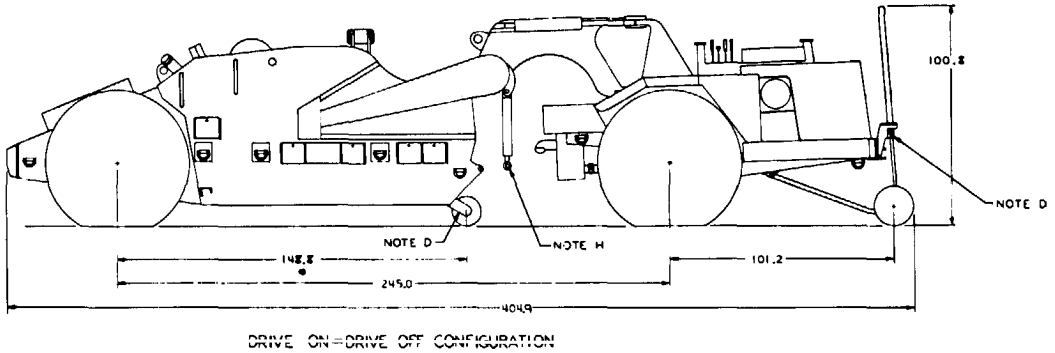
Table of Contents

CHAPTER 1 OPERATION
613BSNS AND 613BSNS1 TRACTOR-SCRAPER





NOTE A: DIMENSION WILL DEPEND ON THE POSITION OF THE BOWL
NOTE B: REMOVE FOR AIR DROP
NOTE C: FOLD DOWN INTO BOWL
NOTE D: USE IN DRIVE ON-DRIVE OFF MODE ONLY
NOTE E: TIEDOWN EYES
NOTE F: PARACHUTE SUSPENSION EYES
NOTE G: PARACHUTE EXTRACTION EYE
NOTE H: REMOVE PIN DURING DRIVE ON-DRIVE OFF
NOTE J: ATTACH DURING AIR DROP



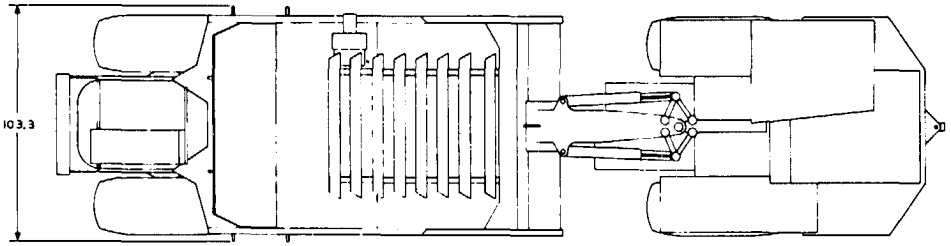
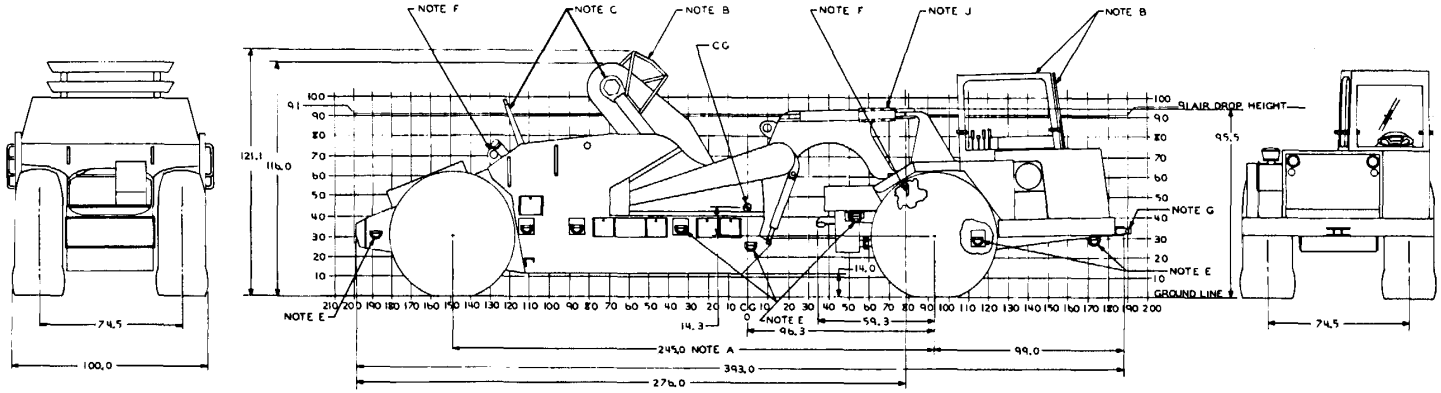


Figure 1. Tractor-Scraper Air Transport, (Models 613BSNS and 613BSNS1).
See Chapter 3 for Model 613BSS and 613BSS1 Air Transport Information.

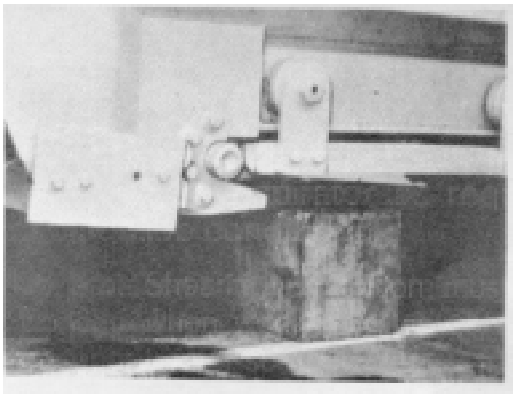


SAFETY

THIS SYMBOL, USED IN CONJUNCTION WITH THE WORD WARNING, WARNS OF POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE

Wear a hard hat, safety glasses and respirator as required by job conditions.

Shearing protection must be worn when working within 33 feet of the tractor-scraper.



Block raised bowl and floor if working in this area.

General

Do not wear loose clothing or jewelry that could catch on controls.

Do not smoke while fueling.

Lower scraper bowl and stop engine before servicing.

Know the hand signals and who gives them.

Preparing to Operate

Report needed repairs.

Be sure machine is equipped with clearance lights if required by law.

Make certain all safety guards and covers are secured in place.

Clear personnel from machine and area.

Clear obstacles from path of machine - note hazards such as wires and ditches.

Start engine only in well ventilated area.

Be particularly careful on machines you do not usually operate.

Fasten seat belt.

Checking Controls

Have improperly operating vehicle system repaired before operating vehicle.

Check all controls for proper operation.

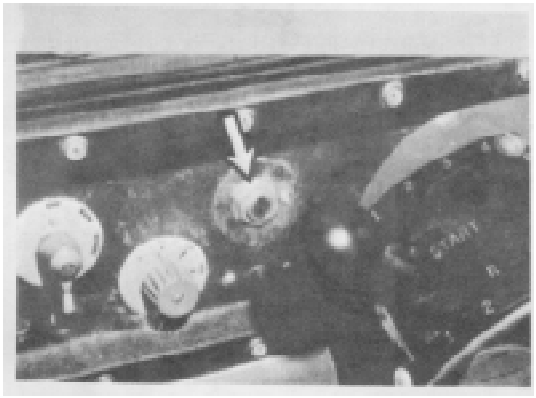
Test right and left steering while moving slowly.

Listen for unusual noises.

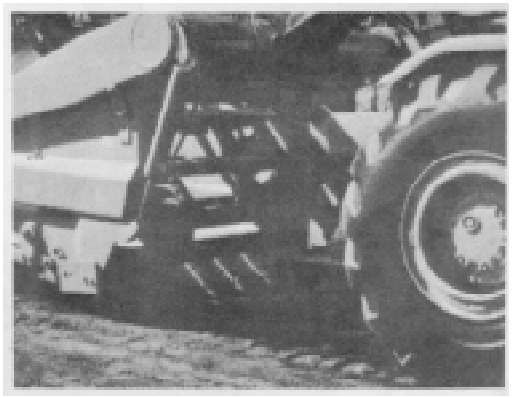
Test brakes.

Test engine accelerator.

Check function of safely devices, such as lights, back-up alarms, etc.



Turn disconnect switch OFF. Remove key if leaving machine.



Always lower scraper bowl and close floor before dismounting.

Operating

No riders.

Look behind machine before backing.

Observe all gauges frequently - investigate improper readings.

Stay clear of overhangs, electric wires, slide areas or other danger areas.

Use extra caution in crossing side hills, ridges, ditches and other obstructions.

Use extreme care to avoid tipping when working on hills, banks or slopes.

Stay safe distance from edge of cliff or overhang.

Match speed with job conditions - do not coast.

Know your stopping distance at any given speed. Regulate travel speed accordingly.

Keep machine under control - do not try to work machine over capacity.

Stop machine frequently at night - walk around and inspect machine - stay alert.

Report needed repairs noted during operation.

Know traffic pattern of the job and obey flagmen, road signs and signals.

Mounting and Dismounting

Do not jump off of machine. Use steps and grab irons.

Shut off engine before leaving machine.

Move all controls to HOLD or NEUTRAL before starting engine.

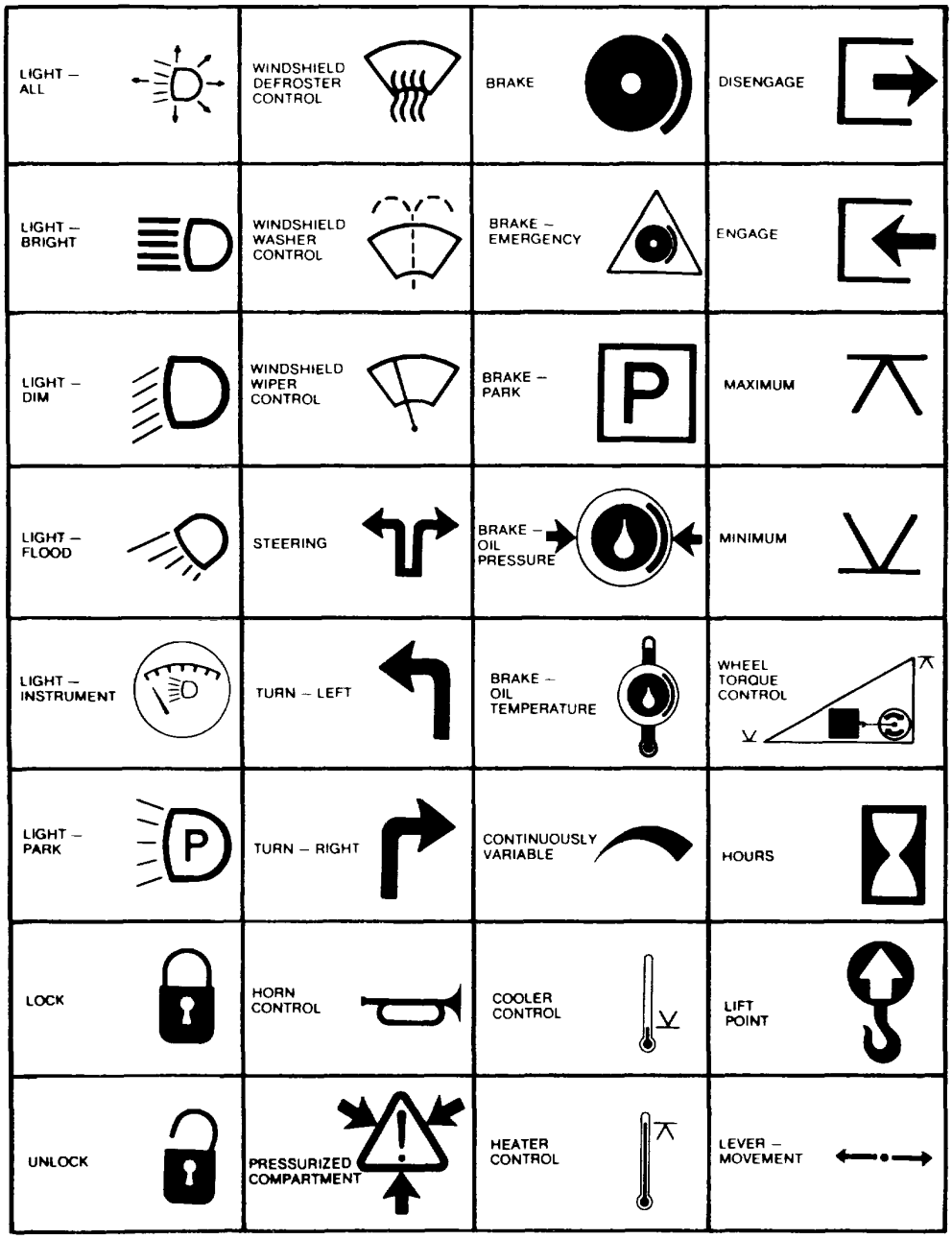
Use steps and grab irons when mounting machine.

SYMBOL IDENTIFICATION

THESE PAGES EXPLAIN THE MEANING OF SYMBOLS THAT APPEAR ON YOUR MACHINE.

WARNING

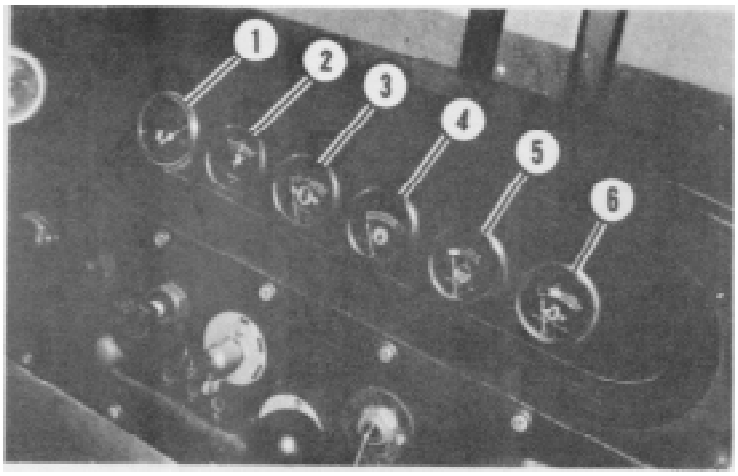
THIS SYMBOL WILL BE USED IN CONJUNCTION WITH THE WORD WARNING WHERE PERSONAL INJURY OR PROPERTY DAMAGE MAY BE INVOLVED.



TRANSMISSION OR CONVERTER	ENGINE HEAT	FUEL TANK	INSIDE AIR CIRCULATION
TRANSMISSION OR CONVERTER OIL	ENGINE OIL	FUEL FILTER	OUTSIDE AIR CIRCULATION
TRANSMISSION CONTROL OIL PRESSURE	ENGINE OIL FILTER	FUEL LEVEL	AIR FILTER
TRANSMISSION OR CONVERTER OIL FILTER	ENGINE OIL LEVEL	FUEL PRESSURE	AIR PRESSURE
TRANSMISSION OR CONVERTER OIL LEVEL	ENGINE OIL PRESSURE	FUEL SHUTOFF	AMMETER OR ALTERNATOR
RETARDER OIL TEMPERATURE	ENGINE – START OR RUNNING	VOLUME – FULL	OIL PRESSURE
TRANSMISSION OR CONVERTER OIL PRESSURE	ENGINE – STOP OR NOT RUNNING	VOLUME – ONE HALF FULL	COOLANT FLOW
TRANSMISSION OR CONVERTER OIL TEMPERATURE	HYDRAULIC OIL FILTER	VOLUME – EMPTY	COOLANT LEVEL
TRANSMISSION DRIVE OIL LEVEL	HYDRAULIC OIL LEVEL	OFF	COOLANT PRESSURE
TRANSMISSION DRIVE OIL TEMPERATURE	HYDRAULIC OIL TEMPERATURE	ON	COOLANT TEMPERATURE

Operator's Compartment

Indicators



① Fuel Level Gauge — Indicates the amount of fuel in the fuel tank.

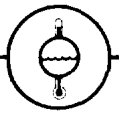
② Ammeter — Indicates the condition of the battery charging circuit. In normal operation the needle should be at ZERO.

Immediately after starting the engine, the needle should read on the (+) side of zero. This indicates the battery is being recharged.

③ Air Pressure Gauge — Indicates the air pressure in the reservoirs. The normal pressure is in the GREEN range.

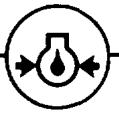
④ Converter Oil Temperature Gauge — Indicates the temperature of the converter oil. The normal temperature is in the GREEN range.

⑤ Coolant Temperature Gauge

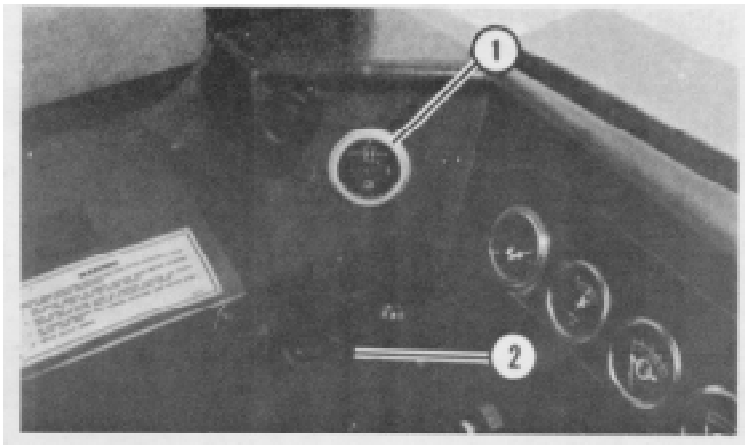


Indicates the temperature of the engine coolant. The normal temperature is in the GREEN range.

⑥ Engine Oil Pressure Gauge



Indicates the engine oil pressure. The GREEN range is normal at full load speed of the engine. The WHITE range is normal at low idle engine speed.



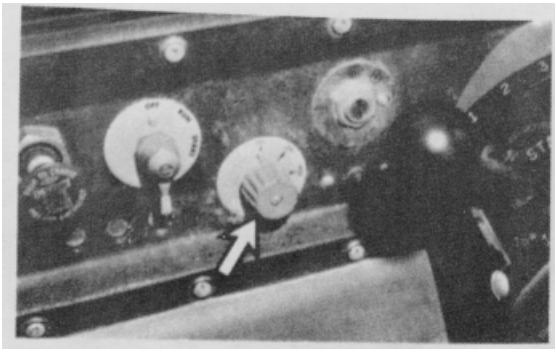
① Service Meter

Indicates the total service hours on the engine. It should be used to determine service intervals.

② Air Cleaner Service Indicator

Indicates if the air flow to the engine is restricted. Service the air cleaner any time the red band is visible in the indicator.

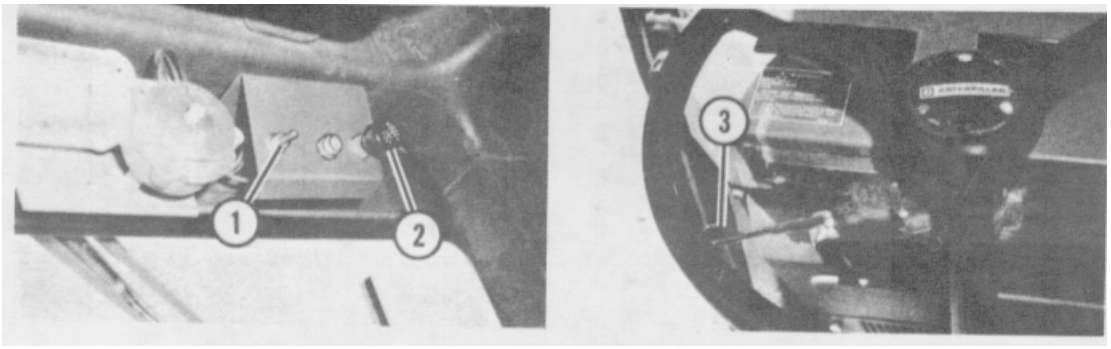
Push the button at the bottom of the indicator to reset it after servicing the elements.



Light Switch

Turn the switch to the right, to the first position, to turn on the dash light, low beam headlights and flood light.

Turn the switch to the second position to turn on the high beam head lights. The dash and flood lights will remain on.



① Windshield Wiper Switch

Move the switch down for slow wiper operation. Move the switch up for fast operation. The wiper is off when the switch is centered.

② Windshield Washer Switch

Push the button in to spray washer fluid onto the windshield.

③ Turn Signal

Push the lever forward to signal a right turn.

Center the lever to turn the signals off.

Pull the lever back to signal a left turn.

Blackout Lighting Switch (Models 613BSNS1, 613BSS1 Only)

The blackout lighting switch is located to the right of the steering wheel, on the dash panel.

The mechanical lock should be engaged at all times to ensure that the switch remains in the position selected.

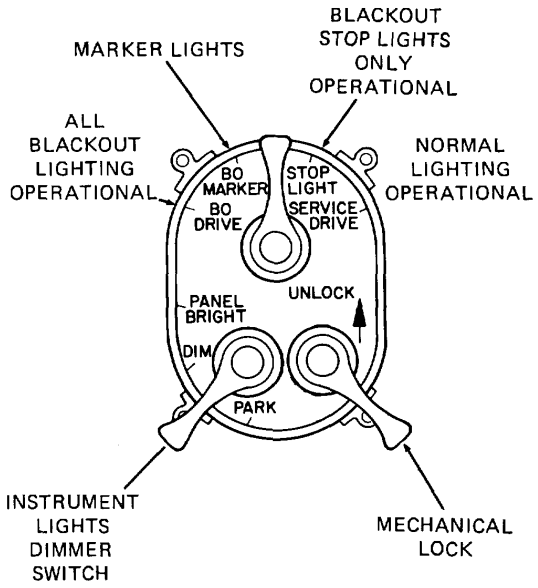
Selecting the "BO DRIVE" position turns off normal lighting and activates all blackout lighting.

Selecting the "STOP LIGHT" position turns off all other lighting but leaves the stop lights activated.

Selecting "SERVICE DRIVE" restores normal lighting to the equipment.

Selecting "BO MARKER" turns off all lighting except for the blackout markers.

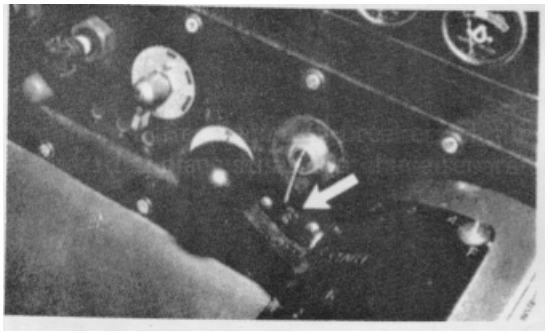
The lever marked "PANEL" will select the level of instrument lighting that is required.



Circuit Breakers and Fuses

Reset circuit breakers if they open. Replace fuses that have separated elements.

Check for fuses that have separated elements when an electrical circuit fails. Replace the fuse. If the element of a new fuse fails, have the circuit checked.



Push the button to reset the electrical system breaker.

NOTE

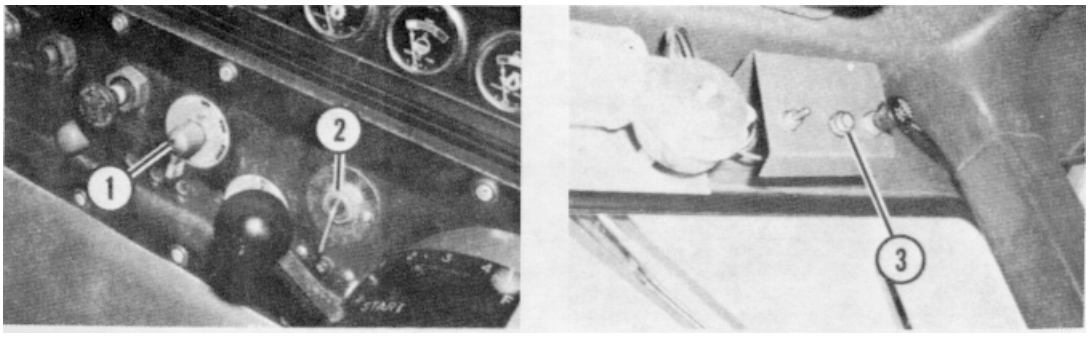
If a breaker opens again, have the circuit checked.

CAUTION

Always replace a fuse with the same capacity and type that was removed.

Controls

Tractor



① Start-Run Switch

Turn the switch to the right (START) to crank the engine. Release the switch when the engine starts. It will return to the (RUN) position.

Turn the switch to the left to stop the engine.

② Battery Disconnect Switch

Disconnects all electrical components from the power source.

Insert the key and turn the switch to the right (ON), to activate the electrical system.

Turn the disconnect switch to the left (OFF), and remove the key, when parking the machine. This will prevent battery drain.

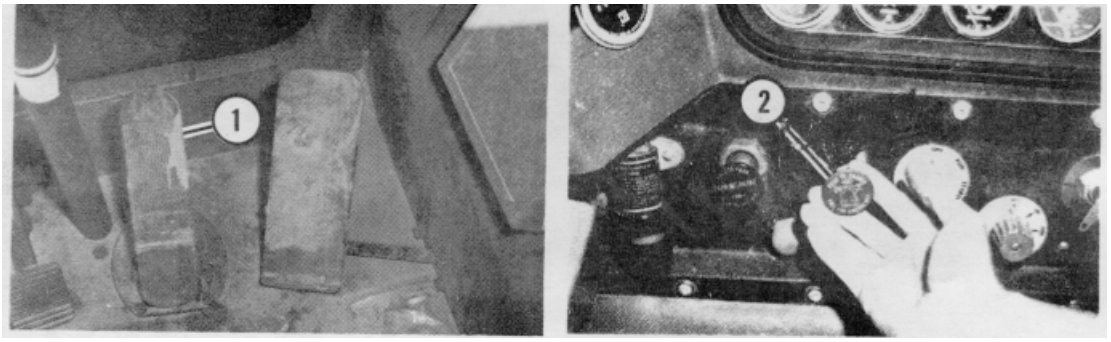
③ Starting Aid Button

For aid in starting below 0°C (32°F), push the button to inject a metered amount of starting fluid (ether) into the intake manifold.

The button must be released and pushed again if more starting fluid is required.

CAUTION

Inject ether ONLY while cranking the engine. Use ether sparingly, excessive ether can cause piston and ring damage. Use ether for cold starting purposes only.



① Service Brakes

Push the pedal down to apply the brakes and stop the machine.

Release the pedal to release the brakes.

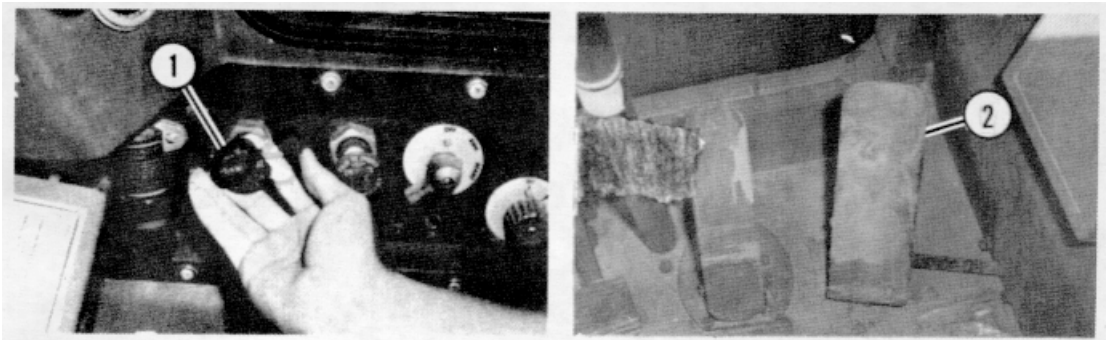
② Emergency Brake

Pull out the button to apply the brake and stop the machine if the service brakes fail.

The emergency brake will apply automatically if air pressure drops below the safe operating pressure.

To release the brake, the air pressure gauge must read in the GREEN range. Push the button in.

The button must stay in to keep the brake released.



① Parking Brake

Pull the button out to apply the parking brake.

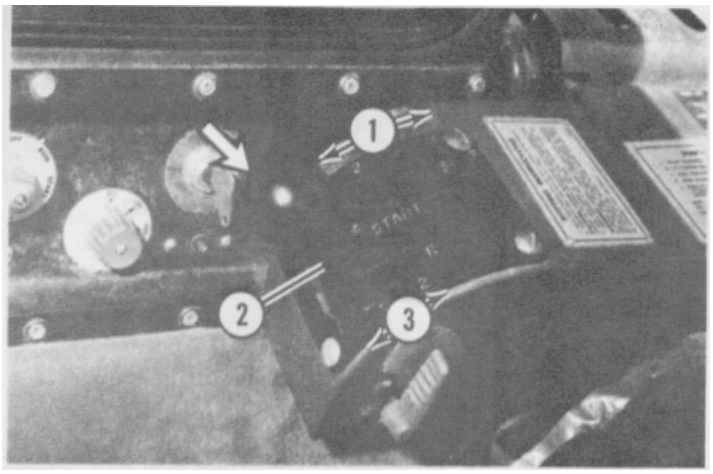
To release the brake, the air pressure must read in the GREEN range. Push the button in.

The button must stay in to keep the brake released.

② Accelerator

Push down the accelerator to increase the engine speed.

Release the pedal to slow the engine speed.

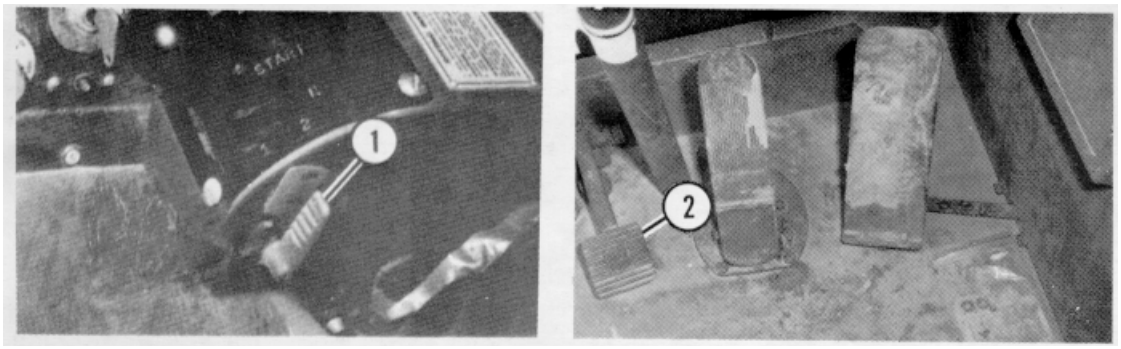


Transmission Range Selector

① **Forward** — To move forward, move the lever to the right of the console, to one of four forward speeds.

② **Neutral** — Move the lever to the front of the console to shift the transmission to neutral.

③ **Reverse** — To move in reverse, move the lever to the left of the console to one of the two reverse speeds.



① Transmission Neutral Lock

To lock the transmission in NEUTRAL, shift the transmission to NEUTRAL. Push in the lock lever and move it forward to LOCK.

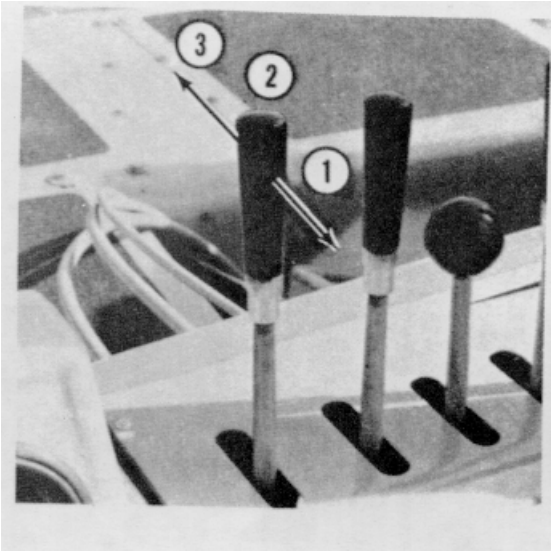
This will prevent accidental transmission engagement.

To move the shift lever, push the lock lever in and move it to the rear to OFF.

② Differential Lock

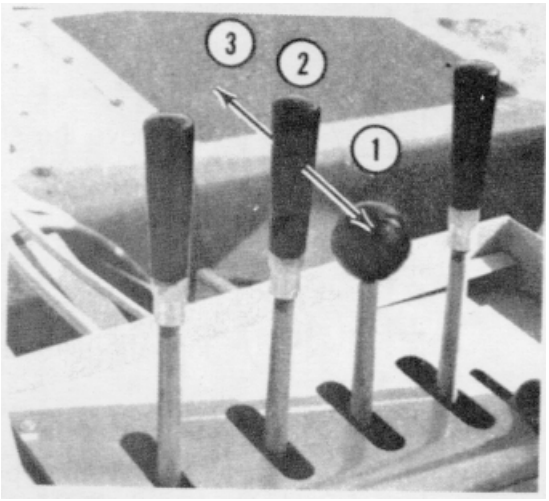
Depress the pedal with the left foot to lock the differential.

Release the pedal to unlock the differential. Turning slightly, or decreasing speed slightly, may be necessary to aid in unlocking the differential.



Bowl Control

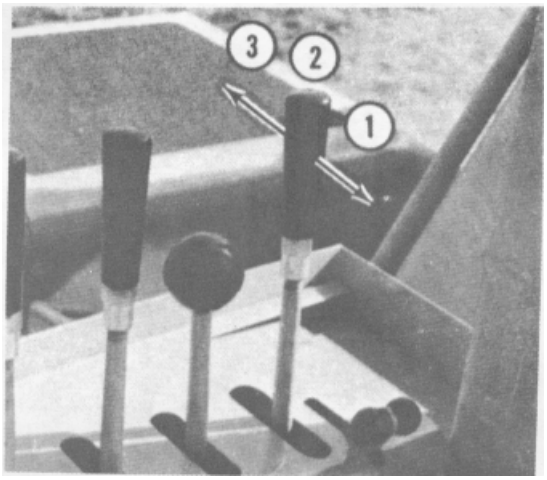
❶ **Bowl Raise**	Pull the lever to the left to raise the bowl. The lever will return to HOLD when it is released.
❷ **Bowl Hold**	With the lever centered, the bowl will not move up or down.
❸ **Bowl Lower**	Push the lever to the right to lower the bowl. The lever will return to HOLD when it is released.



Ejector-Floor Control

❶ **Eject**	Pull the lever to the left to move the ejector forward and open the floor. The lever will return to hold when released.
❷ **Hold**	With the lever centered, the ejector or the floor will not move.
❸ **Return**	Push the lever to the right to detent position. The lever will return to hold when the ejector is to the rear, and the floor is closed.

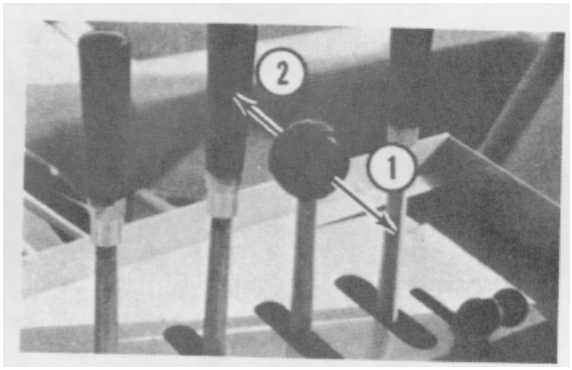
Controls



Elevator Directional Control

❶ **Forward**	For forward elevator operation, pull the direction lever to the left. The lever will remain in position until moved manually.
❷ **Hold**	The elevator will not operate.
❸ **Reverse**	For reverse elevator operation, push the direction lever to the right. The lever will remain in position until moved manually.

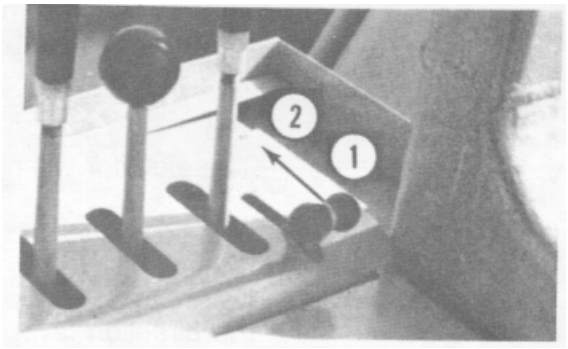
Controls



Elevator Speed Control

❶ **High Elevator Speed** — Pull the lever to the left to permit elevator operation at high speed.

❷ **Low Elevator Speed** — Push the lever to the right to permit the elevator to operate at low speed.



Elevator Lock Control

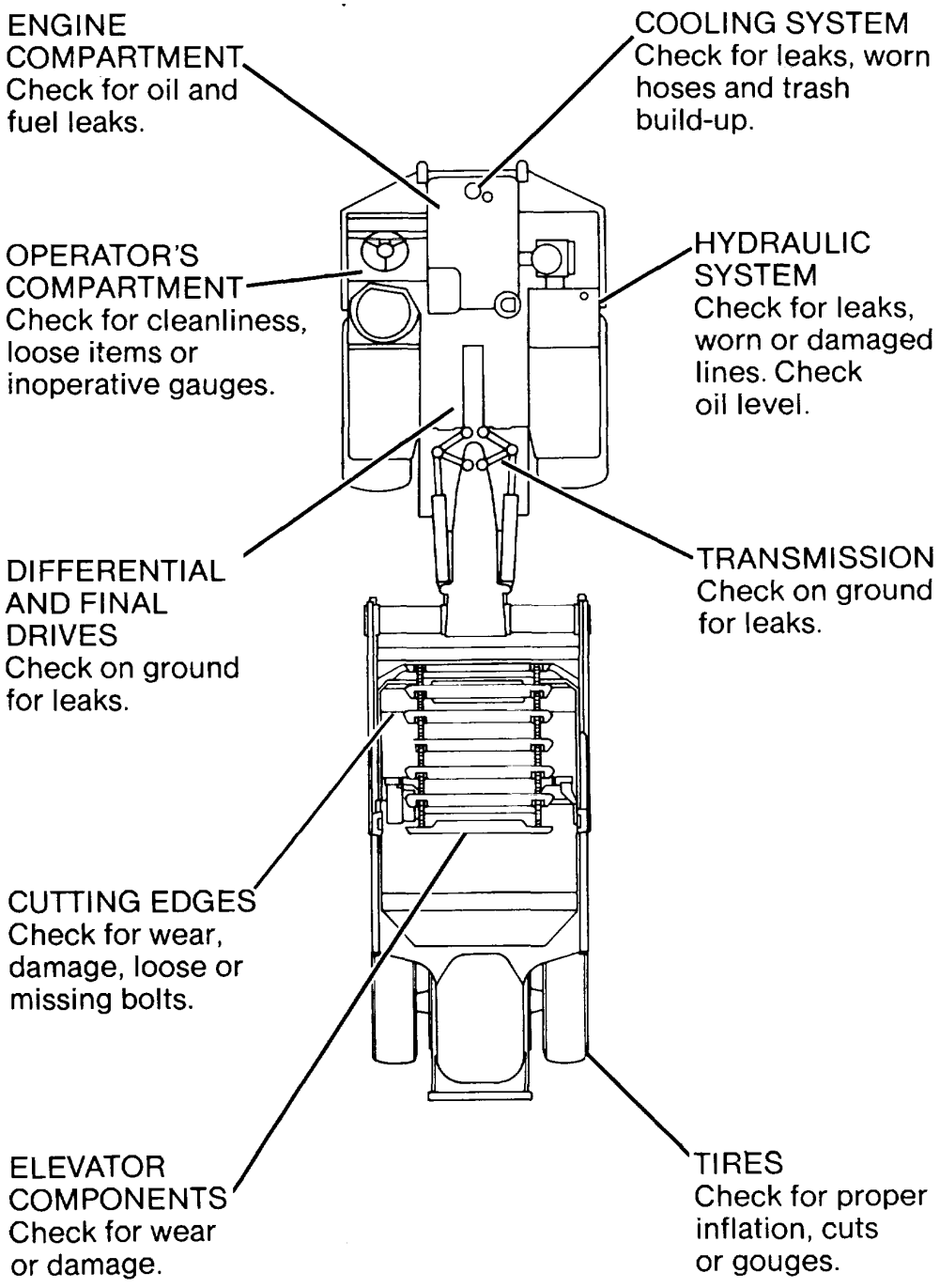
❶ **Forward** — Pull the lever to the left to permit the elevator to be operated in the forward direction.

❷ **Reverse** — Push the lever to the right to permit reverse elevator operation.

BEFORE STARTING

Walk-Around Checks

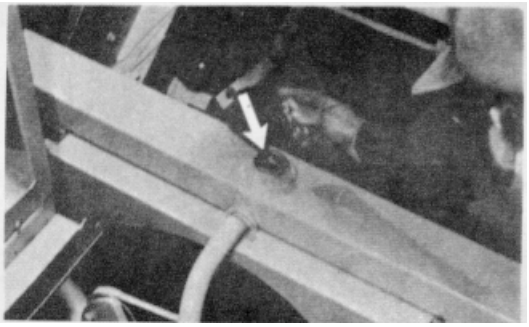
For your own safety and maximum service life of the tractor-scraper, make a thorough walk-around inspection before mounting the tractor- scraper or starting the engine. Check for such items as loose bolts, trash build-up, oil or coolant leaks, condition and inflation of tires, condition of cutting edges, cutting edge teeth and elevator flights. Report all leaks, worn, damaged or unserviceable components to organizational maintenance for repair.



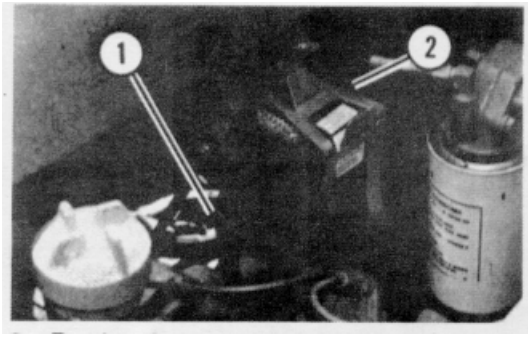
Before Starting the Engine

Operator Checks

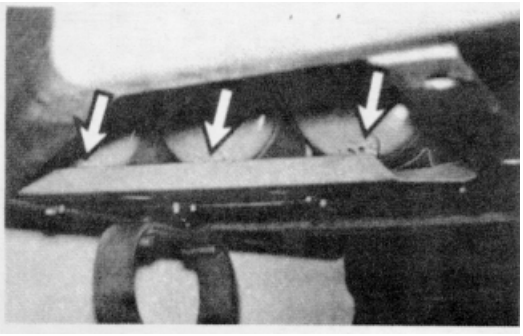
1. Check the engine crankcase oil level. The level should be between the ADD and FULL marks on the dipstick.



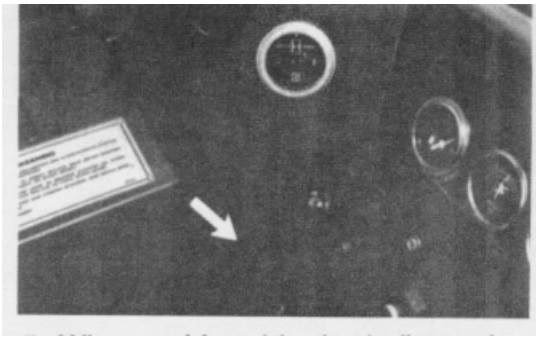
2. Maintain the engine coolant level to within 1 cm (1/2 inch) of the bottom of the fill pipe.



3. Drain the water from the water separator. Open drain valve 1 and vent valve 2. Allow the water to drain. Close the valves.

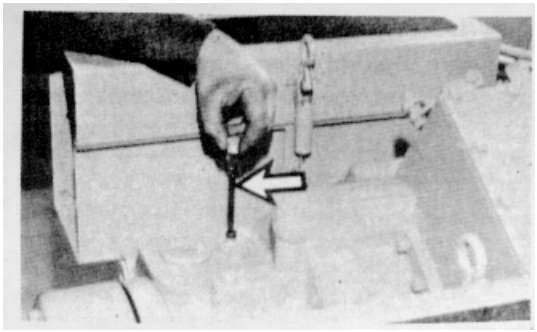


4. Open the three air tank drain valves. Allow moisture and sediment to drain. Close the valves.

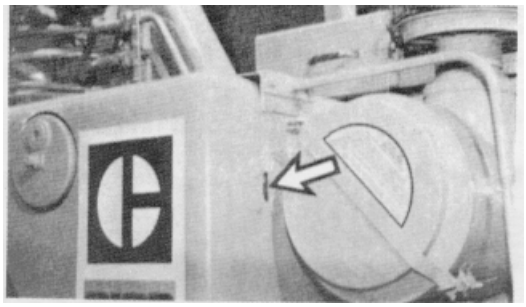


5. When red band in the indicator is visible, have the air cleaner serviced.

6. When the dust level reaches the full mark in the air intake precleaner, remove for cleaning/service.



7. Transmission oil should show on the dipstick. Add oil if necessary.



8. Check the hydraulic oil level with the bowl lowered. The level must be above the ADD mark on the sight gauge, or on the dipstick in the fill opening.

9. Visually check the tires for cuts, gouges and proper inflation.

WARNING

Improperly inflated tires can cause excessive heat buildup, resulting in blowouts.

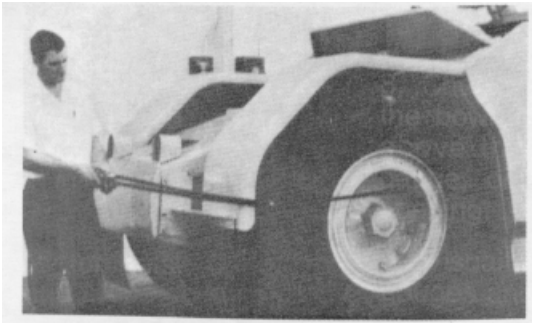
CAUTION

Over or under inflated tires can cause excessive or uneven tire wear, or rim damage.

Keep the valve caps on to prevent dirt from entering the valve stems. Otherwise valve damage can occur.

Consult your tire dealer for the correct operating tire pressure for your operating conditions.

Measure the tire pressure if a tire appears improperly inflated. Check the tire pressure cold, at outside operating temperature.



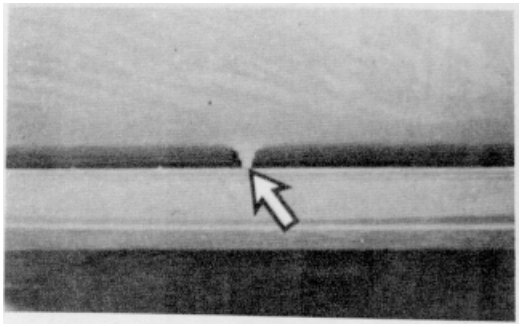
WARNING

Use a self attaching air chuck and stand behind the tread of the tire when inflating.

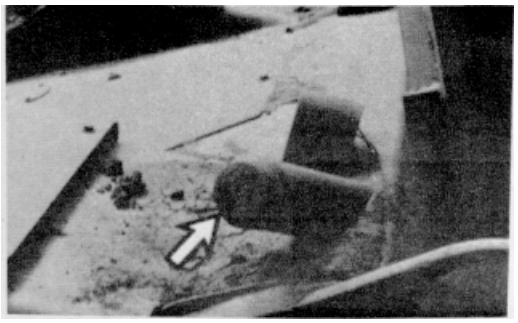
TIRE INFLATION INFORMATION

CONDITION	MANUFACTURER	PLY RATING	PRESSURE
SHIPPING	FIRESTONE	12	35 PSI (2.5 kg/cm2)
	GENERAL	12	40 PSI (2.8 kg/cm2)
	FIRESTONE	16	45 PSI (3.2 kg/cm2)
	GENERAL	16	45 PSI (3.2 kg/cm2)
OPERATION ROADING	FIRESTONE	12	35 PSI (2.5 kg/cm2)
	GENERAL	12	40 PSI (2.8 kg/cm2)
	FIRESTONE	16	45 PSI (3.2 kg/cm2)
	GENERAL	16	45 PSI (3.2 kg/cm2)
STORAGE	FIRESTONE	12	20 PSI (1.4 kg/cm2)
	GENERAL	12	15 PSI (1.1 kg/cm2)
	FIRESTONE	16	25 PSI (1.8 kg/cm2)
	GENERAL	16	20 PSI (1.4 kg/cm2)

Before Starting the Engine

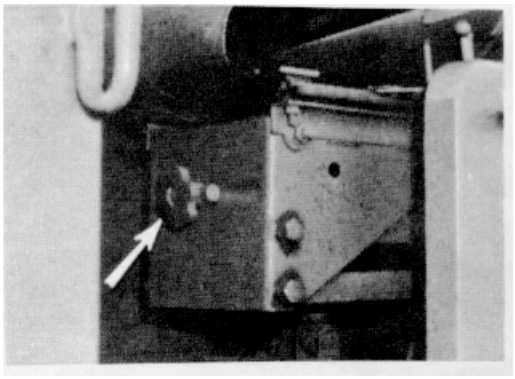


10. Drain the moisture and sediment from the fuel tank.



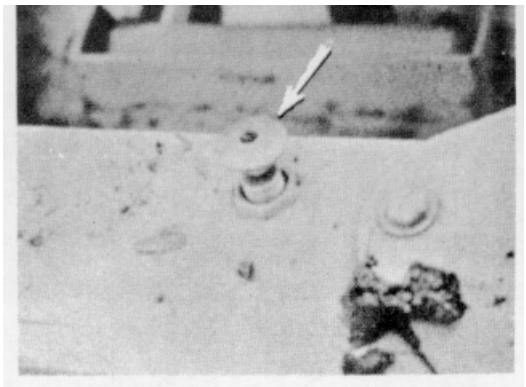
11. The fuel tank should be full at the beginning of each shift.

Positioning Seat

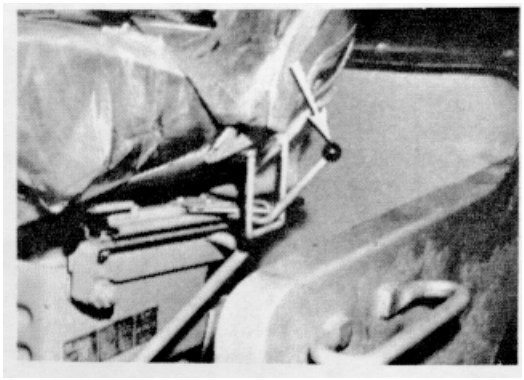


1. To raise seat turn control knob clockwise.

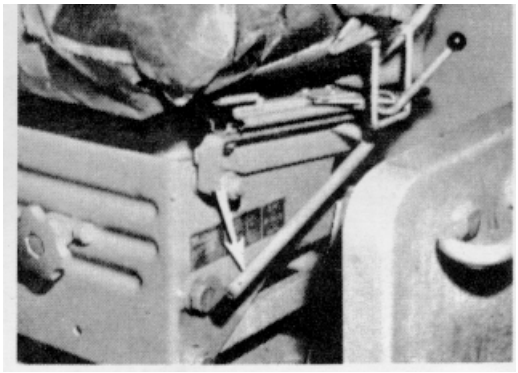
To lower seat turn control knob counterclockwise.



2. Push to increase shock absorber charge. Pull to decrease shock absorber charge.



3. Push lever to adjust seat forward or backward.



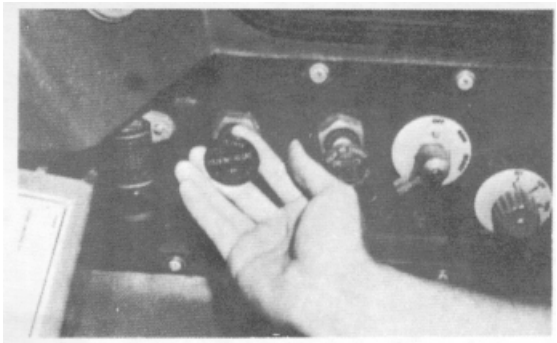
4. Pull lever to adjust angle forward or backward.

WARNING

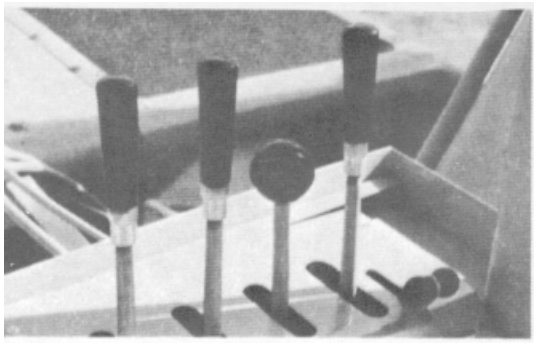
Seat adjustment must be checked at the beginning of each shift and when operators change. Always check condition of seat belt. See page 243, step 35.

Starting the Engine

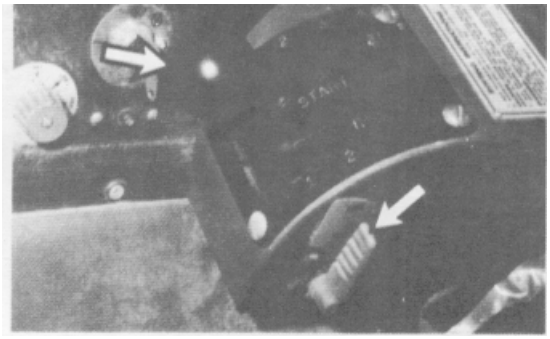
Above 0°C (32°F)



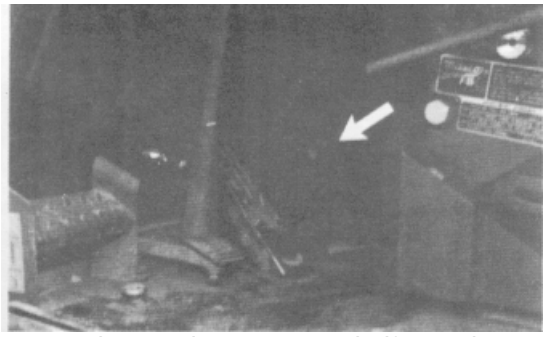
1. Pull out the button to engage the parking brake.



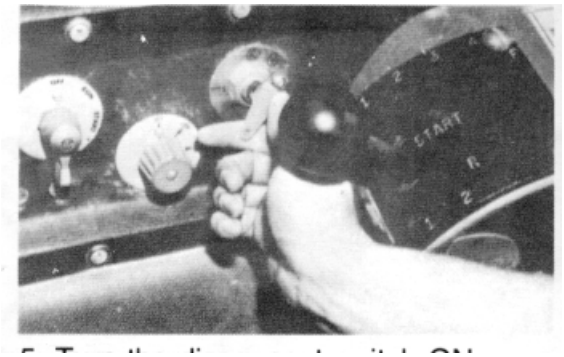
2. Move all scraper hydraulic controls to HOLD



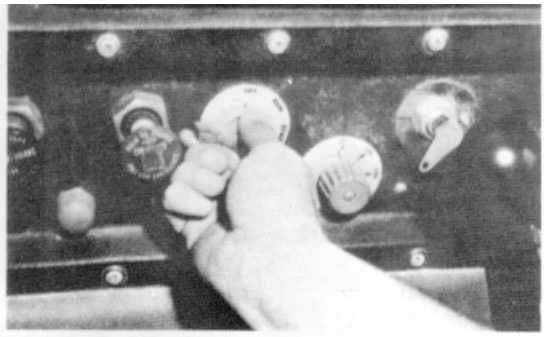
3. Move the transmission control to NEUTRAL. Engage the lock lever.



4. Depress the accelerator to one half speed.



5. Turn the disconnect switch ON.



6. Push in and turn the start-run switch to START. Release the switch when the engine starts.

CAUTION

Do not crank the engine for more than 30 seconds. Allow the starter to cool for 2 minutes before cranking again.

BELOW 0°C (32°F)

1. Repeat steps 1 thru 6 as outlined in the topic, "Above 0°C (32°F)."

2. After cranking begins, push the starting aid button. A metered amount of fluid sufficient to help start the engine is released each time the starting aid button is pushed. Repeat every 2 seconds until the engine starts.

CAUTION

Do not use the starting aid excessively during starting or when the engine is running.

Do not use starting aid when the engine is warm and running.

NOTE: For starting below -18°C (0°F), the use of additional optional starting aids is recommended. Heating of the coolant and/or use of extra battery capacity may be required.

Starting With A Boost

WARNING

When starting from another machine, make sure the machines do not touch. This prevents sparks near the battery, which could ignite the hydrogen gas given off by the battery, causing the battery to explode.

Always wear eye protection when starting a machine with a boost.

To prevent possible personal injury, use care when removing the cables from the machine that has been started. Do not allow the cable ends to contact each other or the machine.

Electrolyte is an acid and can cause personal injury if it contacts skin or eyes.

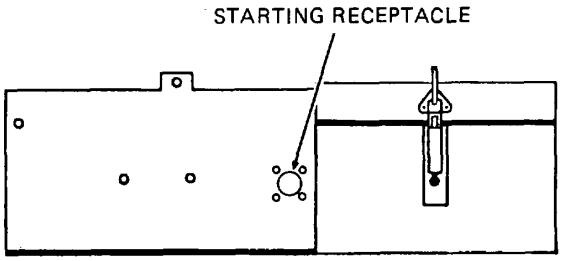
The machine to be started should be parked on level ground with all equipment lowered.

If this is not possible, the wheels must be blocked securely, so that the machine cannot move.

CAUTION

These machines have a 24 Volt starting system. Use only the same voltage (24 Volt) for boost starting. Use of a welder or higher voltage will damage the electrical system.

NATO Slave Starting Receptacle (613BSNS1 and 613BSS1 Only)



1. Remove protective covers from the slave receptacles.

2. Connect the slave cable to the slave receptacle on the charging vehicle first, then to the slave receptacle on the vehicle to be started.

3. Start the engine using standard starting procedures.

4. After the engine starts, disconnect the slave cable and install protective covers on slave receptacles.

Boost Cables

WARNING

Connect the batteries in parallel: negative (-) to negative (-) and positive (+) to positive (+). Attach the positive booster cable, from the positive post of the booster battery to the positive post of the battery of the machine to be started. Attach the negative booster cable from the negative post of the booster battery to the starter ground terminal or to the disconnect switch ground terminal of the vehicle to be started.

Disconnect the ground cable first when removing the booster cables. This will prevent sparks near the battery.

1. Attach one cable to the POSITIVE (+) terminal of the battery on the left side of the machine to be started .

2. Attach the opposite end of the cable to the POSITIVE (+) terminal of the boost source.

3. Attach the second cable to the NEGATIVE (-) terminal of the boost source.

4. Attach the remaining cable end to the starter ground terminal or to the disconnect switch ground terminal of the machine to be started.

5. Start the engine. See "Starting the Engine" (page 1-25).

6. After the engine starts, remove the cable from the starter ground terminal or from the disconnect switch ground terminal first.

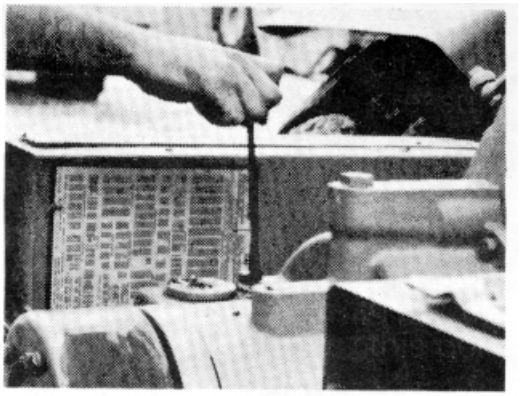
7. Remove the opposite end of the cable from the boost source.

8. Remove the cable from the POSITIVE (+) terminal of the battery of the machine that was started. Remove the opposite end of the cable from the boost source.

AFTER STARTING

1. Keep engine speed low until oil pressure registers. If oil pressure does not register, stop engine and notify maintenance personnel.

2. Operate engine under light load for 5 minutes. Do not engage hydraulic controls during this period.



3. Check transmission oil level with engine at low idle, machine level and oil warm. Oil level should be between ADD OIL and FULL marks on dipstick.

4. Check air cleaner service indicator. If RED piston is locked in the visible position, have air cleaner serviced.

Check gauges frequently during operation. All gauges must read in the NORMAL operating range. The ammeter is normal when the indicator is at or on the (+) side of zero.

MOVING THE TRACTOR-SCRAPER

WARNING

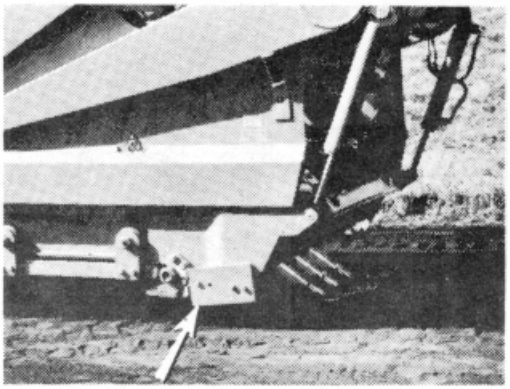
Do not move machine without normal air pressure.

Shearing protection must be worn when working within 33 feet of the tractor-scraper.

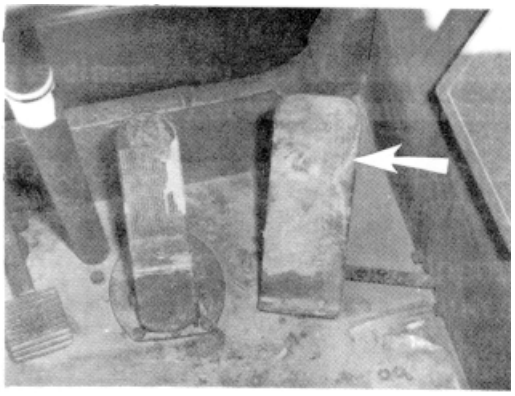
NOTE

It is possible to start the engine when the transmission selector lever is in other than NEUTRAL, but the machine will not move. Should this happen, move the selector lever to NEUTRAL, then to the desired speed range.

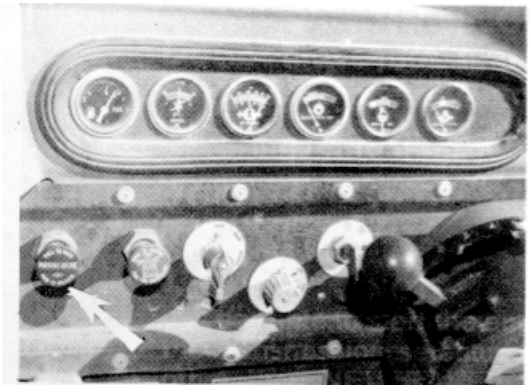
1. Be sure seat belt is fastened.



3. Raise scraper bowl just high enough to clear obstructions.



5. Depress accelerator.



2. Push parking brake button.

WARNING

Do not move tractor-scraper until air pressure registers normal and brake button remains depressed.

4. Release safety lock. Move transmission speed selector to first speed.

WARNING

Check to be sure area is clear of personnel and obstructions.

6. Turn at slow speed to check steering.

7. Operate under light load for 5 minutes.

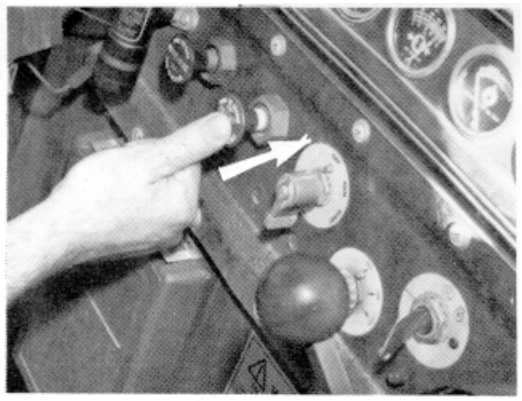
8. Check brakes in safe area before traveling any distance.

NOTE

In an emergency the tractor-scraper can be moved in first gear with the emergency brake applied.

Emergency Brake System

1. Pull emergency brake control button to engage emergency brakes.



2. Push brake control button to release emergency brake. Do not move machine until button remains depressed and air pressure gauge registers normal.

Emergency Stops

If low air pressure emergency warning horn sounds, stop the tractor-scraper immediately.

CAUTION

Do not leave machine without blocking wheels, as emergency brakes will release after a period of time.

Do not use emergency brake as a parking brake.

To stop the tractor-scraper if the service brakes do not; pull emergency button.

NOTE

In an emergency the tractor-scraper can be moved in first gear with the emergency brake applied.

WARNING

Brakes will automatically apply if air pressure drops below safe operating pressure.

If the tractor-scraper is stopped on a steep grade by the emergency system, do not release brakes.

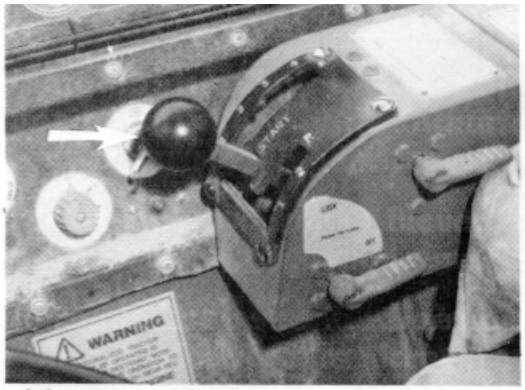
After an emergency stop, wait until air pressure gauge registers NORMAL before moving the tractor-scraper. If air pressure gauge will not register NORMAL, have air system checked.

Parking Brake System

1. Pull parking brake control to engage parking brake.

2. Push parking brake control to release parking brake. Do not move machine until button remains depressed and air pressure registers normal on gauge.

Changing Gear Speed and Direction



Machine must be stopped and engine at low idle before pushing transmission control into REVERSE.

All forward and reverse speeds are selected manually.

WARNING

Improper downshifting can cause sudden reduction in travel speed.

Never coast downgrade. Keep transmission engaged.

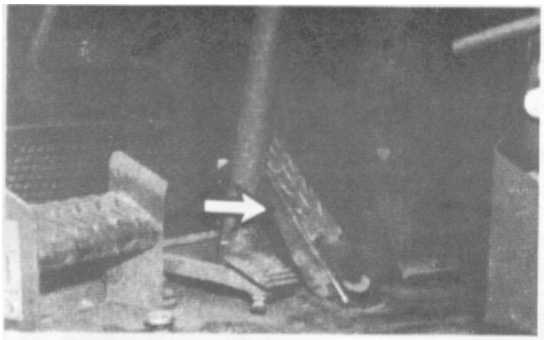
Use service brakes to reduce travel speed before entering sharp turns, fill areas and downgrades.

CAUTION

Never downshift with engine speed at high RPM. Downshift only one speed at a time.

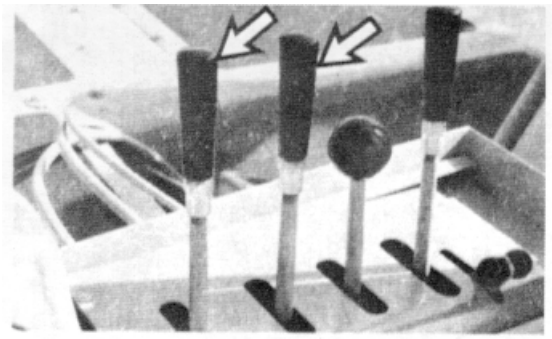
Parking the Machine

Stopping the Machine



1. Move the machine to a safe level location. Reduce the travel speed. Use the service brakes to stop the machine.

2. Shift the transmission to NEUTRAL and move the transmission neutral lock to LOCK position.



3. Close the ejector floor and lower the bowl.

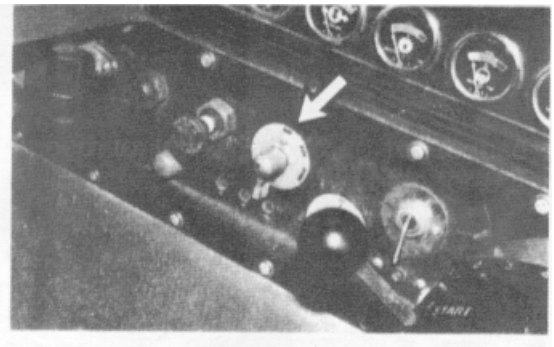
4. Pull the button to engage the parking brake.

CAUTION

If it is not possible to park on level ground, block the wheels.

Stopping the Engine

1. Reduce the engine speed to low idle for 5 minutes.

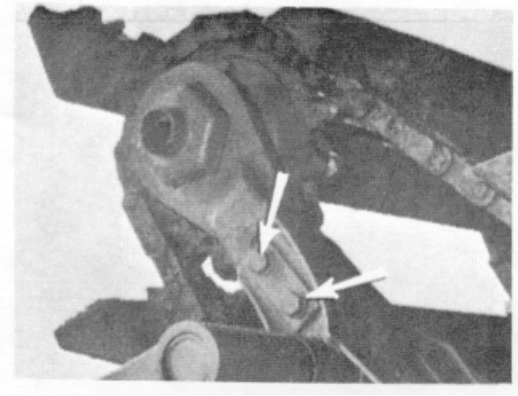


2. Turn the start-run switch to OFF.

OPERATING ADJUSTMENT'

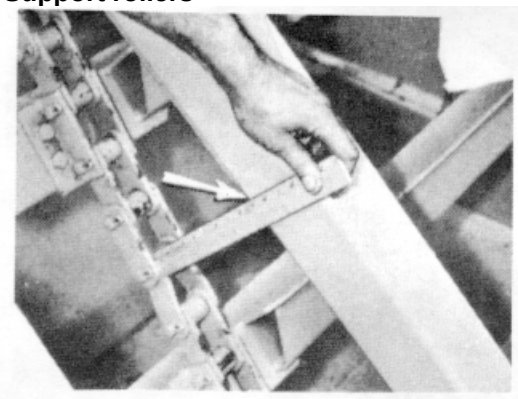
Elevator Drive Sprocket

Before making any adjustments, stop tractor-scraper engine and set brakes.

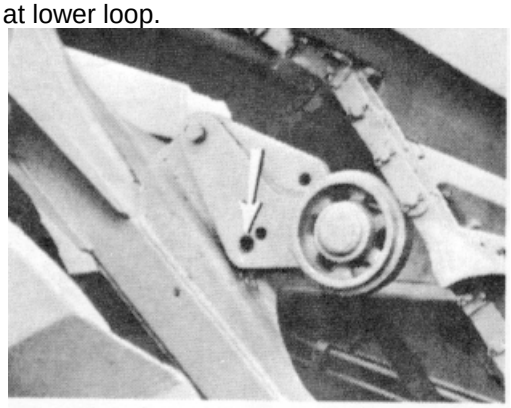


1. Top shaft should remain parallel with bottom shaft. If adjustment is necessary loosen Chain Support Rollers

Chain Support rollers

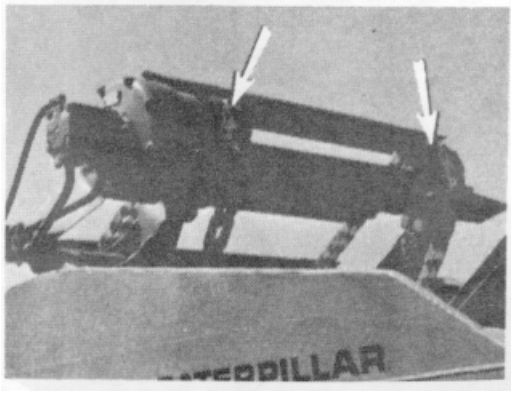


1. Chain should have 6 to 9 inches (150 to 230 mm) of slack, measured midway between upper and lower rollers at lower loop.

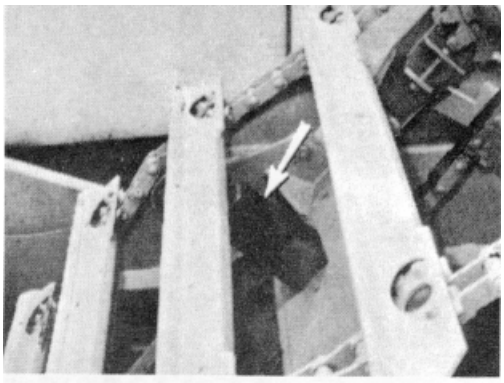


3. Remove lower bolt from bracket.

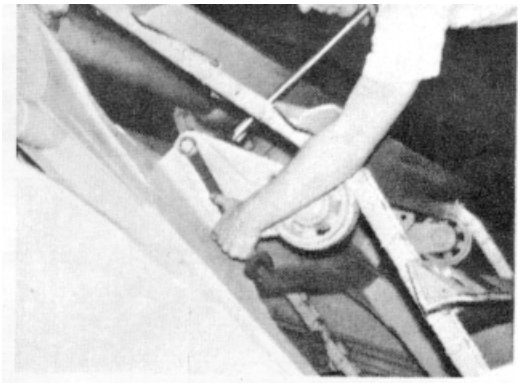
bracket mounting bolts. Move assembly up or down as required.



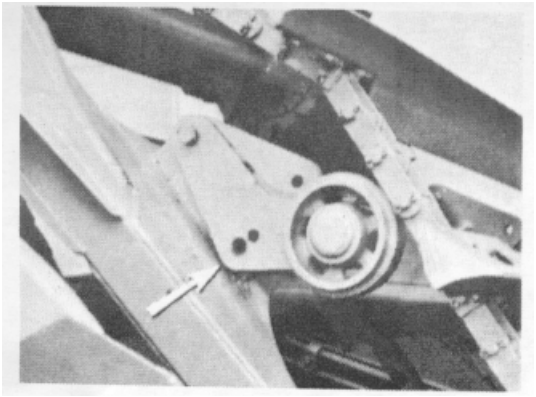
2. Both sprockets should be adjusted, if necessary, to align chain assembly.



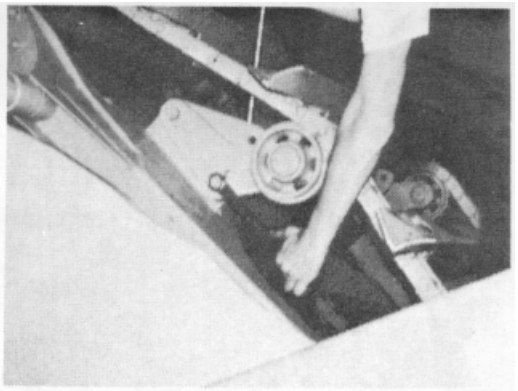
2. Block under chain to relieve weight on roller.



4. Loosen bracket upper bolt.

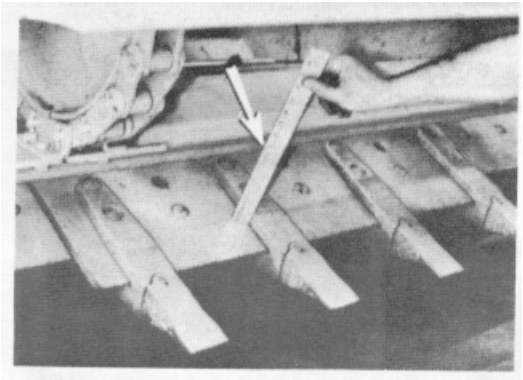


5. Move bracket and roller to align alternate holes in bracket.

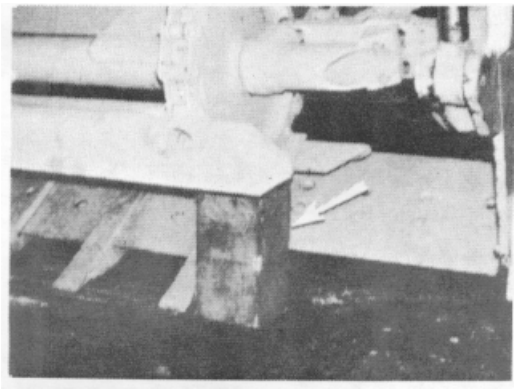


6. Install lower bolt and tighten upper bolt. For adjustments over 3 inches, replace a link with a half link.

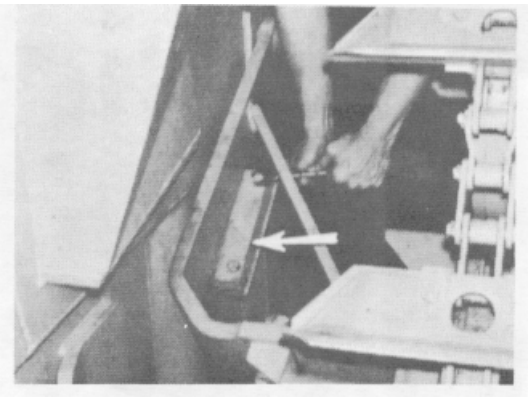
Opening at Cutting Edge

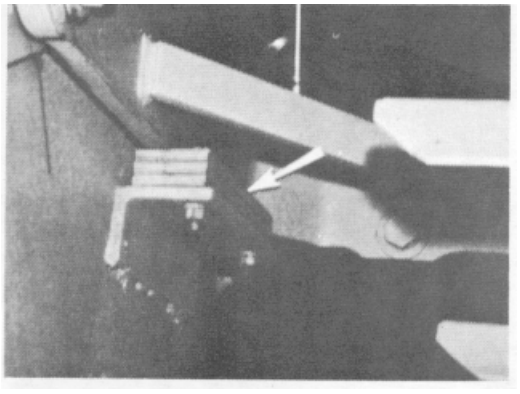


1. Opening between cutting edge and elevator flights can be adjusted from 1 inch (25 mm) to 16 inches (400 mm).



2. Block elevator to keep it from moving.

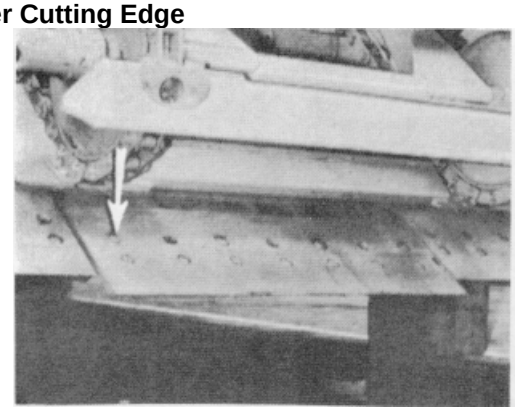




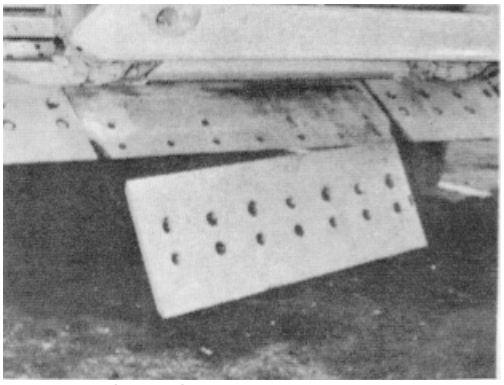
3. Remove bolts from elevator lower support blocks. Remove shims to decrease opening. Add shims to increase opening. Install bolts.

Smaller opening is helpful in retaining loose materials such as sand.

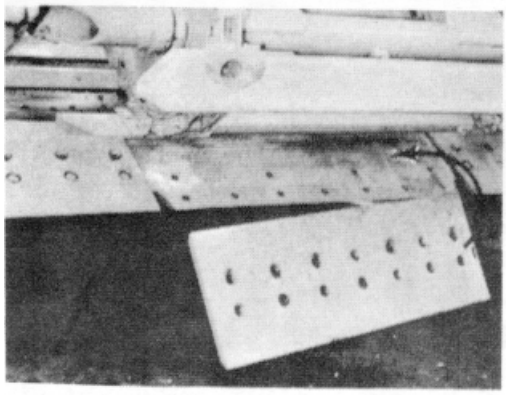
Center Cutting Edge



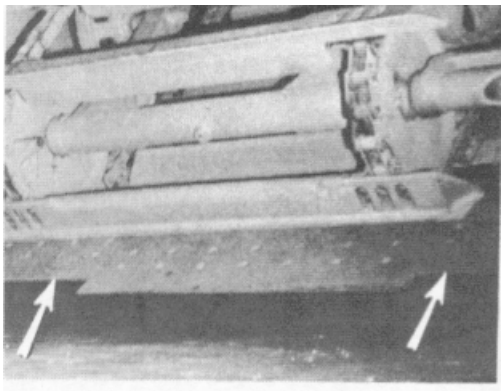
1. Remove center cutting edge mounting bolts.



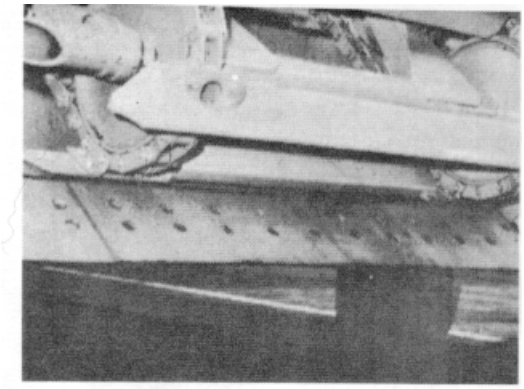
2. Remove cutting edge.



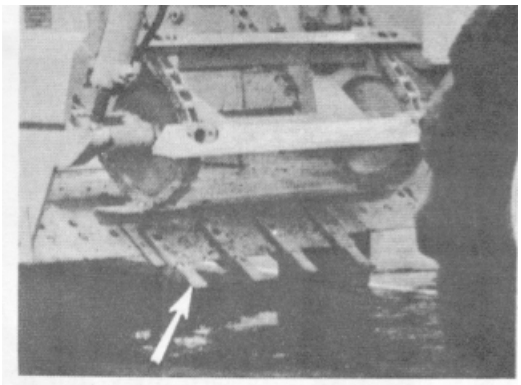
3. Reverse cutting edge for additional life.



4. For offset center cutting edge move end cutting edges to front bolt position.



5. Align end cutting edges with center cutting edge for finish work.



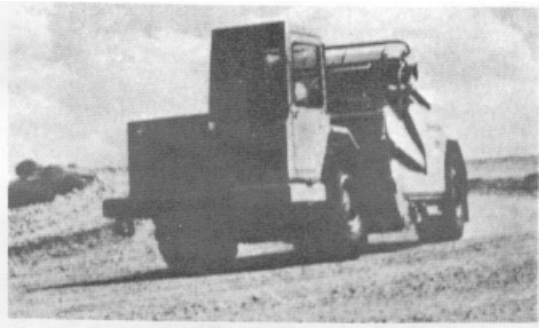
6. Bolt-on cutting edge teeth can be installed for easier penetration of material.

Operating Techniques

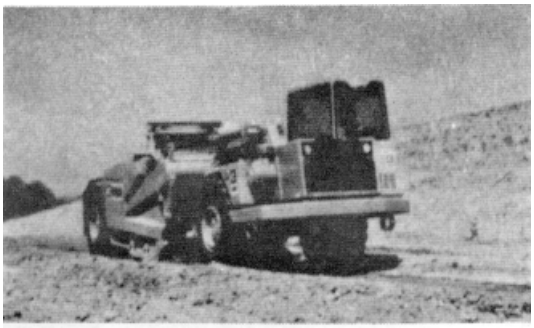
Loading (Typical Examples)

WARNING

Shearing protection must be worn when working within 33 feet of the tractor-scraper.



1. Reduce your travel speed when entering the cut. To prevent carryover of the material being loaded, load on the level or on an uphill grade.

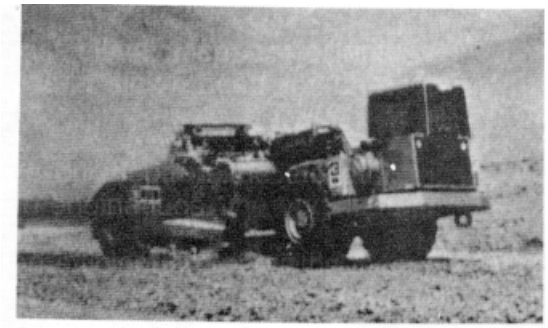


2. Move the ejector to the rear and close the floor. Start the elevator.

3. Downshift to first speed and lower the bowl to an efficient cutting depth.

4. Use a shallow cut for hard material. Use a deeper cut for soft material.

5. Keep the engine rpm high for efficient loading.



6. Do not force material into the bowl. Allow the elevator to sweep in the material.

7. Use a fast elevator speed for soft material. Use a slow speed for hard material.

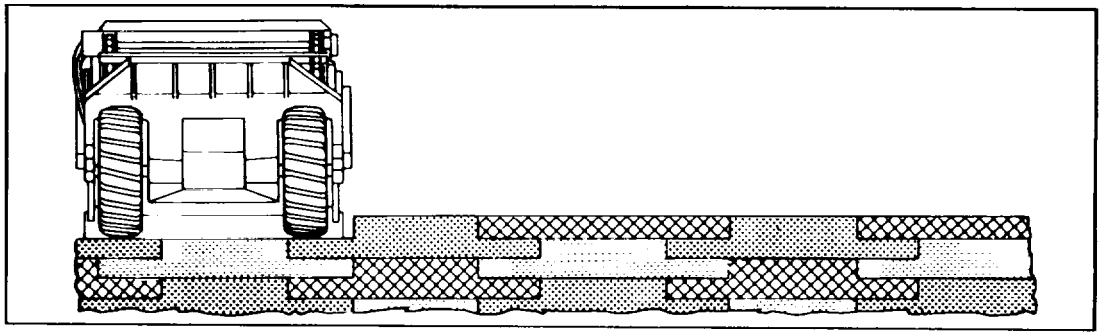
8. Decrease cut depth if the elevator stalls, or the engine lugs.

9. Gauge an efficient cut depth by the depth of the router bits. Use this depth in successive passes.

Straddle Loading (Typical Examples)

WARNING

Shearing protection must be worn when working within 33 feet of the tractor-scraper.



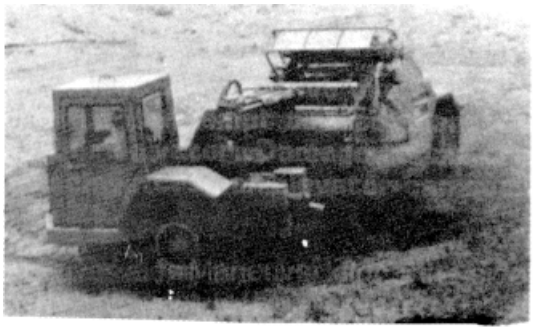
Leave a ridge about 1.5 to 1.8 m (5 to 6 feet) wide for the entire width of the cut. On succeeding passes, pick up the ridges at a depth below previous cuts. Repeat this cycle until finished depth is reached.

Large Objects

CAUTION

Do not drive over large objects, or attempt to load them with the elevator. Damage to the transmission case or elevator can occur.

1. Maneuver along the side of the object to be picked up. Raise the bowl and open the floor.



2. Turn the tractor sharply. When the bowl is over the object, lower the bowl and close the floor to trap the object.

3. To unload the object, open the floor and raise the bowl.

4. Turn the tractor sharply to the left or right.

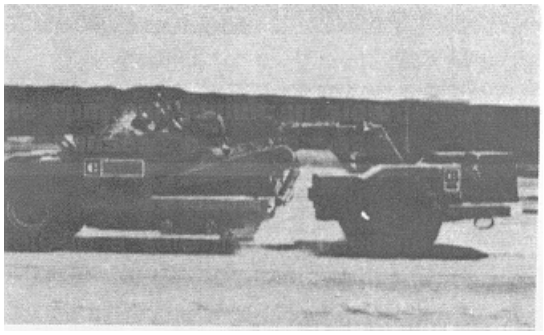
5. When the bowl clears the object, close the floor.

Operating Techniques

Hauling (Typical Examples)

WARNING

Shearing protection must be worn when working within 33 feet of the tractor-scraper.



1. For best load retention, do not operate the elevator when hauling. Carry the bowl only high enough to clear obstacles.

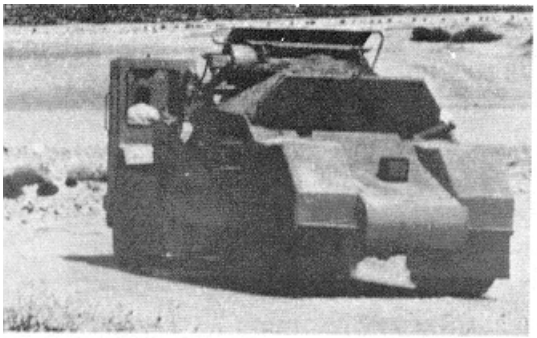
3. When approaching a downgrade, slow the machine, then shift to a lower gear. On a downgrade, use the brakes to avoid overspeeding the engine.

5. Downshift on an upgrade to avoid lugging the engine.

WARNING

Low engine rpm can result in slow steering response.

2. Accelerate to a safe travel speed. Keep engine rpm high.



4. Slow down when entering turns, especially on a downgrade, to prevent the machine from turning over.

WARNING

Do not attempt to turn the machine with the lock applied.

6. In poor footing the differential lock can prevent wheel slip.

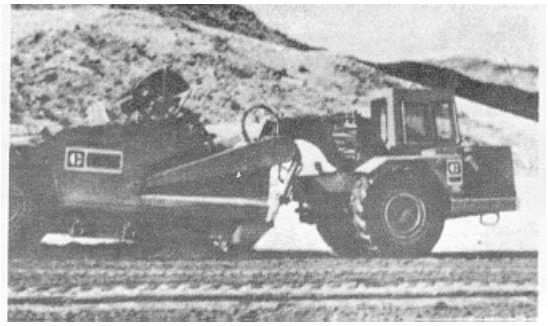
CAUTION

Do not engage the differential lock with the wheels spinning.

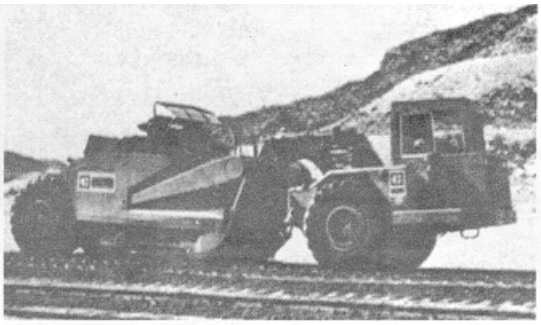
Dumping and Spreading (Typical Examples)

WARNING

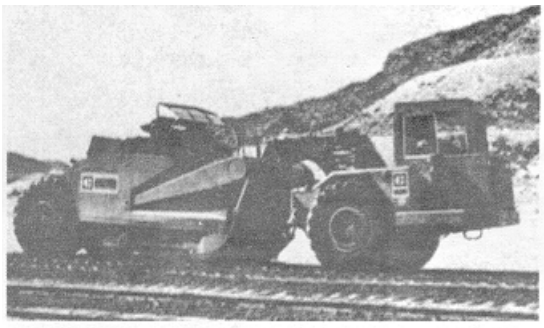
Shearing protection must be worn when working within 33 feet of the tractor-scraper.



1. Dump and spread material at the highest practical travel speed. Approach the fill in line with the dump area.

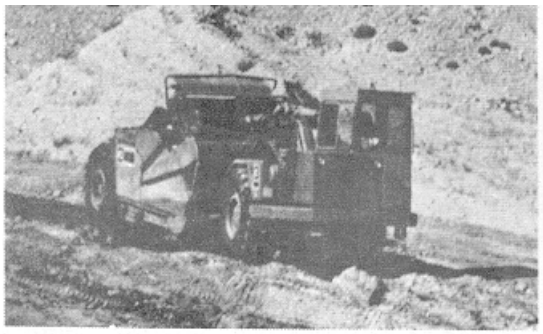


2. Lower the bowl to the desired spread height. At the start of the dump area, open the floor and move the ejector forward.

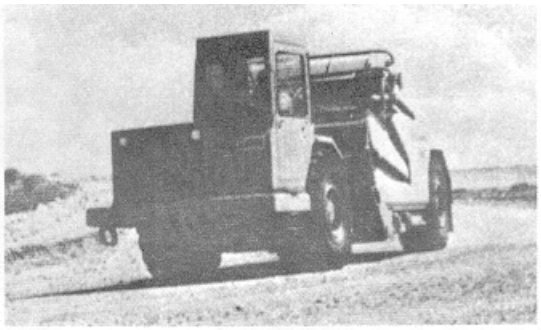


3. If material tends to stick in the bowl, operate the elevator in reverse.

4. While unloading, keep the machine moving, and maintain high engine rpm.

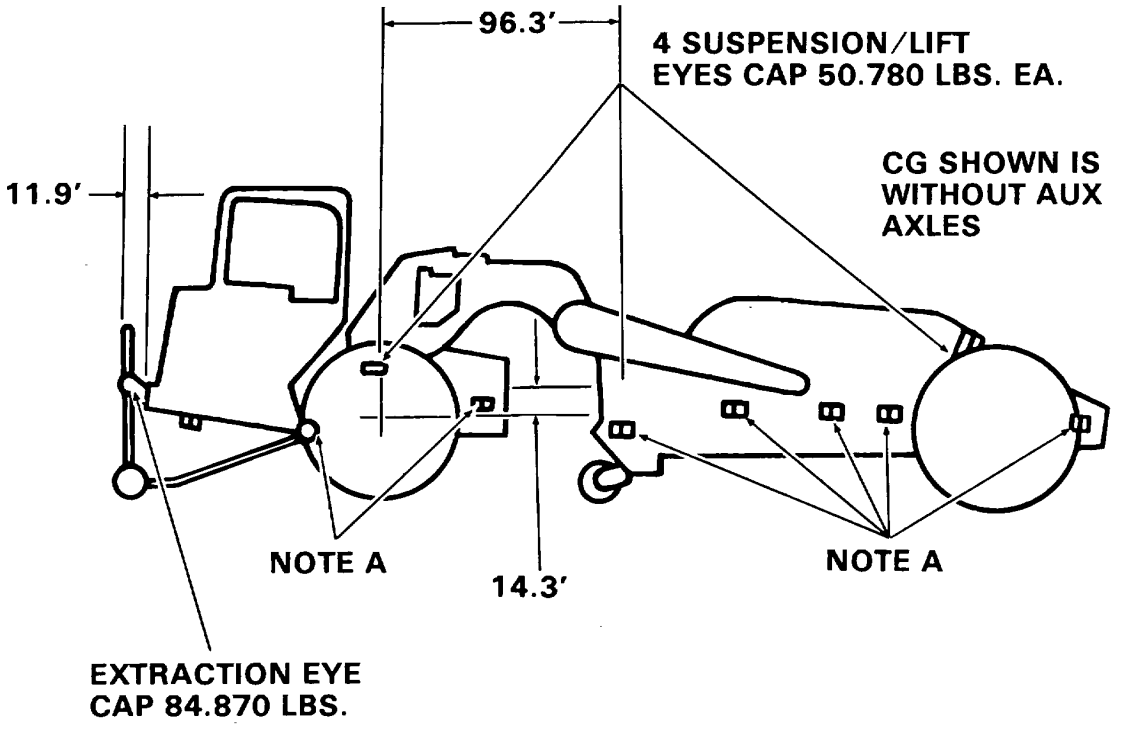


5. When the bowl is empty raise it slowly to leave the cut smooth. Raise it just high enough to clear obstacles.



6. Close the floor and move the ejector to the rear.

TRANSPORTATION DATA



NOTE A: 17 TIEDOWN EYES CAP 20,000 LBS. EA.

OVERHAUL LENGTH W/O FRONT AUXILIARY AXLE = 393.0 IN.
OVERHALL HEIGHT = 121.1 IN. SHIPPING TONNAGE = 71
OVERHALL HEIGHT = 103.3 IN. SHIPPING WEIGHT = 31.140 LB
SHIPPING CUBAGE = 2845 FT^3

NOTE

See Page 1-3, Figure 1 for additional transportation data.

TRANSPORTATION HINTS

Roading

CAUTION

Inspect the machine thoroughly before roading.

When roading, reduce the ground speed before downshifting.

1. Perform daily walk-around inspection. See page 2-12.

2. Perform lubrication and maintenance service items 1 through 16 and 42 through 57. See page 2-17.

3. Measure the tire inflation pressure. Inspect the tires for damage. See page 1-23.

4. Clean the windshield, side and rear glass.

5. Clean ail lights and reflectors.

6. Make certain the headlights, taillights, turn signals and hazard warning lights function properly.

7. Make certain that the steering functions properly.

8. Make certain the brakes function properly.

9. Make certain all the controls, indicators and gauges function properly.

10. Have a fire extinguisher, flares and safety reflectors with the machine.

11. Obey all traffic regulations.

12. If any of the indicators come on, stop the machine. Investigate and correct the cause.

CAUTION

Do not exceed 20 mph (32 kmph) when roading.

13. Stop every 95 km (60 miles) or 3 hours, for 30 minutes. Inspect the machine and allow the machine parts to cool. See page 2-12.

14. When traveling long distances, lubricate the machine at recommended intervals.

15. If necessary to leave the machine unattended:

a. Lower the bowl.

b. Move the transmission control lever to NEUTRAL.

c. Set the parking brake.

d. Stop the engine. Turn the disconnect switch OFF and remove key.

e. At night, set out flares and/or safety reflectors.

TRANSPORTATION HINTS

Shipping

NOTE

If transporting by air, or delivering by air drop (LVAD or LAPES), see page 1-44 for air transport preparation instructions and refer to the appropriate Army approved bulletins that outline air transport rigging and tie-down instructions. 1. Block the trailer or rail car wheels before loading. Carefully back the machine on the trailer or rail car.

2. Lower the bowl, move transmission control lever to NEUTRAL and set parking brake.

3. Attach articulation collars to steer cylinders. See page 1-3, note J.

4. Open the three air reservoir drains. Allow the air and water to drain. Close the drains.

5. Block the wheels and secure the machine with tie-downs. Use as many of the tie-down locations as possible.

6. Cover the exhaust opening to prevent turbocharger "windmilling" in transit.

7. Cover the seat to protect the cushion.

8. Turn the disconnect switch off and remove the key.

9. Lock all possible compartments.

10. In freezing weather, make certain that the cooling system is protected with antifreeze to the lowest expected ambient temperature or is drained completely.

11. Check state and local laws governing weight, width and length of load.

WARNING

CHECK TRAVEL ROUTE FOR OVERPASS CLEARANCES. MAKE SURE THERE WILL BE ADEQUATE CLEARANCE.

AIR TRANSPORT INSTRUCTIONS

INTRODUCTION. These air transport instructions have been written to help personnel prepare the Tractor-Scraper for various air transport requirements. Basically, air transport can be divided into two primary categories, air drop and drive on/drive off.

AIR DROP. The 613BS Tractor-Scrapers are designed for air delivery by Low Velocity Air Drop (LVAD) and Low Altitude Parachute Extraction (LAPES) methods.

a. Preparation For Air Drop. Eight procedures are necessary to ready the Tractor-Scraper for air drop.

(1) Removal of rollover protective structure (ROPS) with windshield. Contract Organizational maintenance.

(2) Removal of elevator rock guard. Contract Organizational maintenance.

(3) Removal of both left and right elevator chain rollers. Contact Organizational maintenance.

(4) Removal of the cutting edge teeth, if equipped.

(5) Installation of all drive on/drive off load transfer equipment (load transfer axle and jacks, and cutting edge load transfer wheels) if attached. See Drive On Procedures, Installing Load Transfer Equipment (page 1-48).

(6) Attach articulation collars to steer cylinders. See Figure 1 note J, page 1-3.

(7) Securing Tractor-Scraper with tie-downs to a 32 foot pallet and attachment of parachute slings. See Army approved bulletins for appropriate parachute slinging instructions.

(8) Preparing and securing a separate overpack box for the ROPS, elevator rock guard, chain rollers, cutting edge teeth and hardware.

b. Preparation After Air Drop. Seven procedures are necessary to ready the Tractor-Scraper for operation after air drop.

(1) Removal of parachute slings and tiedowns from Tractor-Scraper and overpack.

(2) Removal of articulation collar from steer cylinders.

(3) Removal of Tractor-Scraper from pallet.

(4) Installation of cutting edge teeth, if equipped.

(5) Installation of both left and right elevator chain rollers. Contact Organizational maintenance.

(6) Installation of elevator rock guard. Contact Organizational maintenance.

(7) Installation of rollover protective structure (ROPS) with windshield. Contact Organizational Maintenance.

DRIVE ON/DRIVE OFF. The 613BS Tractor-Scrapers can be air transported (drive on/drive off under own power) with the air of a special load transfer package.

a. Preparation For Drive On/Drive Off. Nine preliminary procedures are necessary to ready the Tractor-Scraper for drive on/drive off.

(1) Removal of rollover protective structure (ROPS) with windshield. Contract Organizational maintenance.

(2) Removal of elevator rock guard. Contract Organizational maintenance.

(3) Removal of cutting edge teeth, if equipped.

(4) Installation of load transfer equipment (load transfer axle and jacks, and cutting edge load transfer wheels). See Drive On Procedures, Installing Load Transfer Equipment (page 1-48).

(5) Drive On preparation (disconnecting bowl lift cylinders at the bottom (weight transfer) and lowering the elevator mechanism (height reduction)). See Drive On Procedures, Preparation (page 1-50).

(6) Driving Tractor-Scraper on aircraft. See Drive On Procedures, Driving (page 1-54).

(7) Preparing a separate overpack box for the ROPS, elevator rock guard, chain rollers, cutting edge teeth and hardware.

(8) Securing the Tractor-Scraper and overpack to the aircraft with tiedowns. See Army approved bulletins for approved aircraft tiedown procedures.

(9) Driving Tractor-Scraper off aircraft. See Drive Off Procedures, Driving (page 1-56).

b. Preparation After Drive On/Drive Off. Five procedures are necessary to ready the Tractor-Scraper for operation after drive on/drive off.

(1) Connecting bowl lift cylinders at the bottom and raising the elevator mechanism. See Drive Off Procedures, Preparation For Operation (page 1-57).

(2) Removal of load transfer equipment (load transfer axle and jacks, and cutting edge bad transfer wheels). See Drive Off Procedures, Removing Load Transfer Equipment (page 1-59).

(3) Installation of cutting edge teeth, if equipped.

(4) Installation of elevator rock guard. Contact Organizational maintenance.

(5) Installation of rollover protective structure (ROPS) with windshield. Contact Organizational maintenance.

DRIVE ON PROCEDURES

a. Personnel and Tools Required. Drive on make-ready can be accomplished by two people in two (2) hours. A third person could expedite some of the procedures.

Refer to Table A for a listing of drive on equipment.

The following standard hand tools are required for drive on and are stored in the tool box:

Combination box and open end wrenches in 1/2, 9/16, 3/4, 15/16, 1-1/8, and 1-1/2 in. sizes

Wrench sockets with 1/2 in. drive in 1/2, 9/16, 3/4, 15/16, 1-1/8, and 1-1/2 in. sizes.

Ratchet wrench with 1/2 in. drive

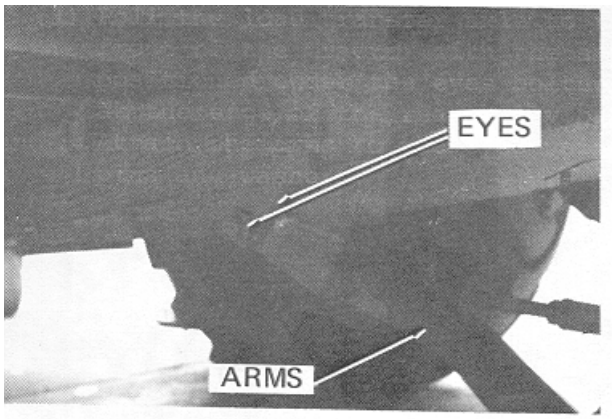
Socket wrench extension with 1/2 in. drive by 5 in. long

Table A. Drive On Equipment.

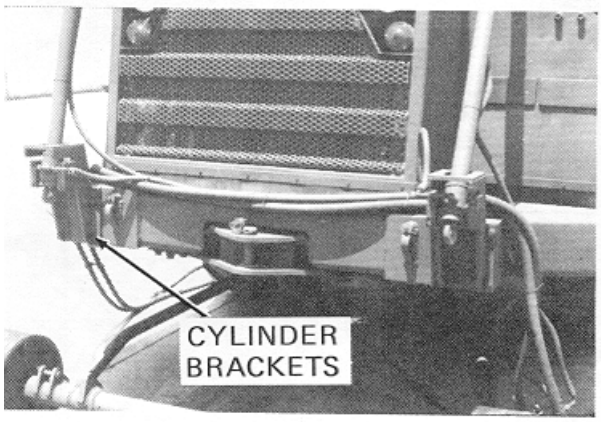
QUANTITY	PART NO.	DESCRIPTION	WHERE USED
1	5R5618	Articulation Stop GP	Steer Cylinders
1	5R5863	Extraction Link	Tractor
2	5R5604	Jack Assembly	Load Transfer Axle
1	5R5610	Inflation GP	Tires
1	1P0545	Air Gage	
1	5R7380	Hose Assembly	Load Transfer Removal
1	2T1537	Cover	Speed Reducer
1	8J6226	Cover	Hydraulic Motor
2	1H9456	Bolt	Speed Reducer Cover Storage
2	5P8247	Washer	

b. Installing Load Transfer Equipment. Nine procedures are necessary for installation of load transfer equipment.

(1) Roll the load transfer axle to the front of the tractor with the arms positioned under the eyes bolted at the edge of the rear belly pan. Attach the arms to the eyes using pins and washers.



(2) Attach cylinder brackets to bumper.



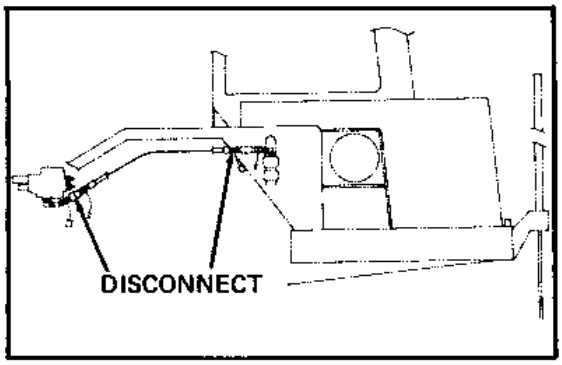
(3) Attach the load transfer valve (with mounting bracket) to the front of the tractor. Move valve handle from stowed position to operating position.

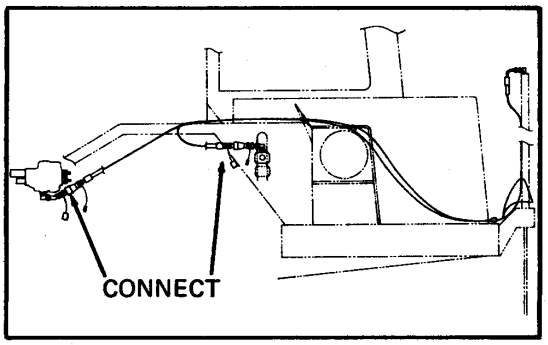
(4) Disconnect jumper hose from fittings on right side of tractor near fender. Store in tool box.

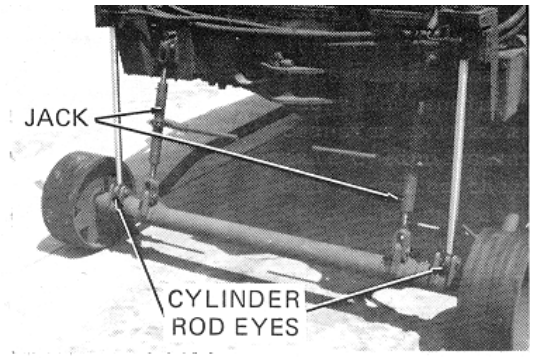
(5) Connect the two larger hoses coming from the load transfer valve to the fittings that the jumper hose was removed from.

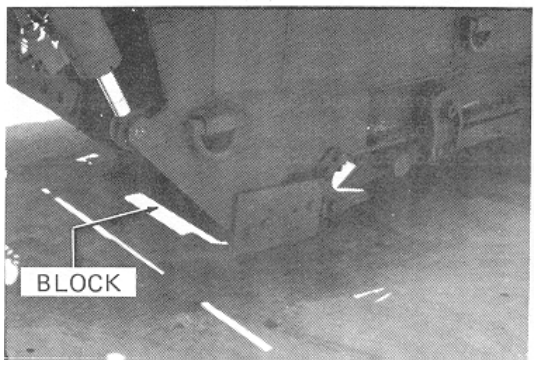
(6) Install two jacks between the lugs on the front frame and the lugs on the load transfer axle. Start the engine. Using the load transfer axle valve, lower the axle cylinders until their eyes are close to the lugs on the axle. Stop the engine. Using the jacks to align the cylinder eyes with the lugs, install the cylinder pins.

(7) Start the engine. Raise the bowl about one foot. Open the bowl floor about six inches back from the closed position. Place a hardwood block under the cutting edge.

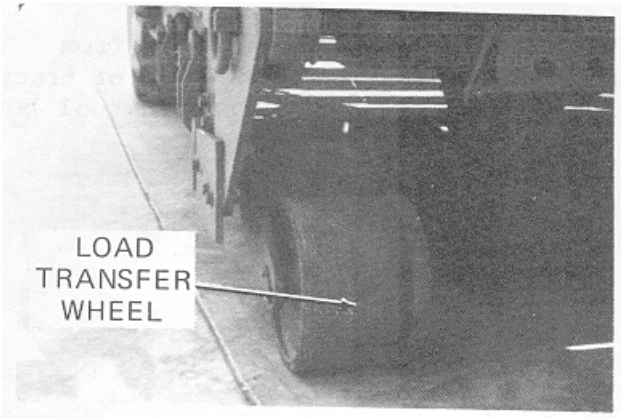




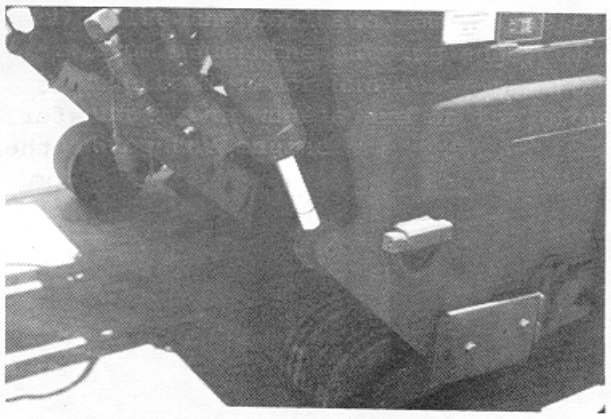




(8) Install a load transfer wheel on each end of the cutting edge. Tighten retaining screw.

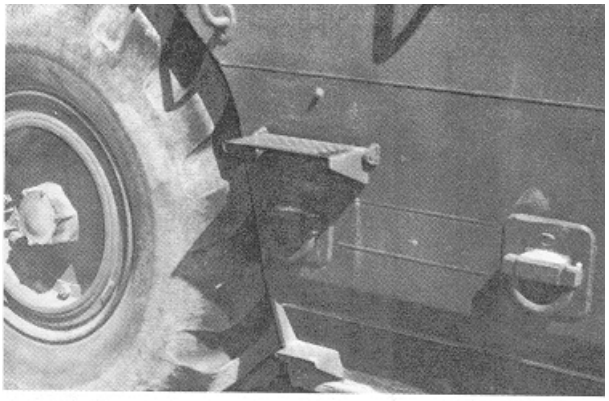


(9) Raise the bowl and remove the block from under the cutting edge, close the bowl floor and lower the bowl until the wheels are on the ground. Stop the engine.

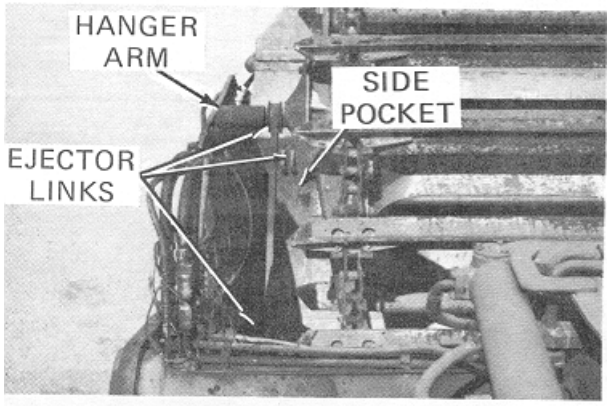


c. Preparation (Drive On). Sixteen procedures are necessary to ready the Tractor-Scraper for drive on.

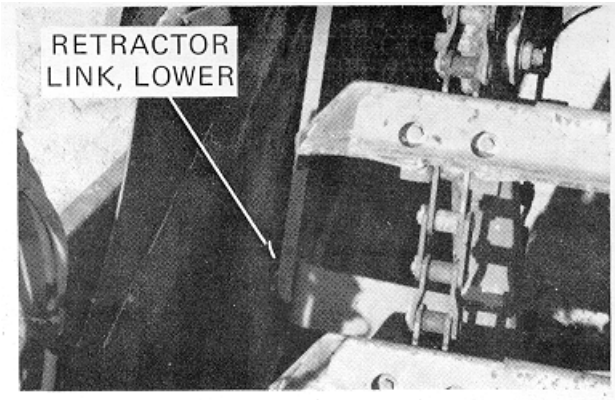
(1) Fold down steps on both sides of the bowl.



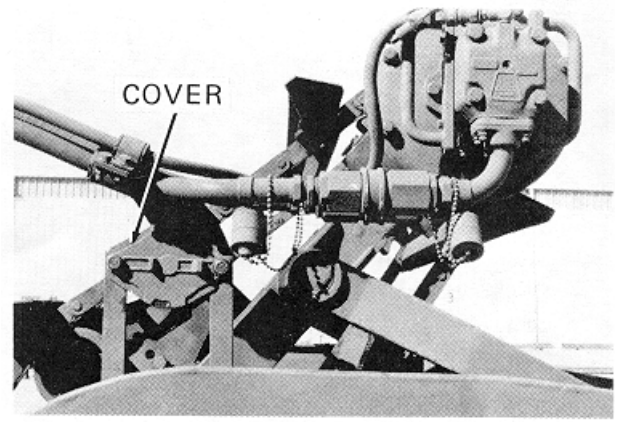
(2) Clean any dirt from elevator hanger arms, ejector links and side pockets of bowl.



(3) Disconnect the lower end of the retractor links (access from steps on side of bowl) and allow to hang loose.

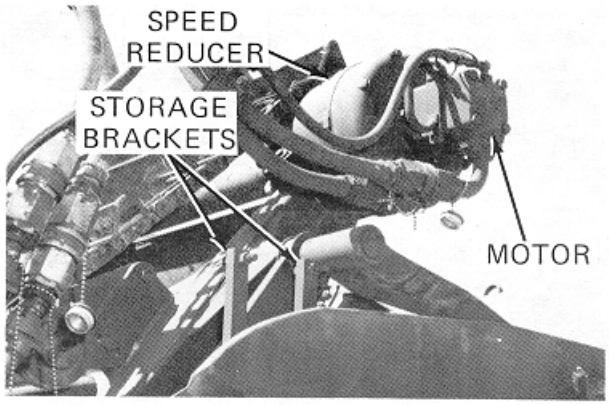


(4) Remove speed reducer cover from motor storage brackets.

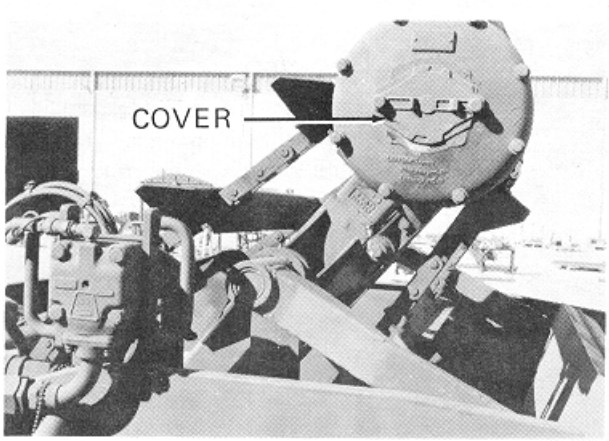


(5) Remove the motor (87 lbs.) from the speed reducer and lower the motor with the hydraulic lines. Do not disconnect the hoses.

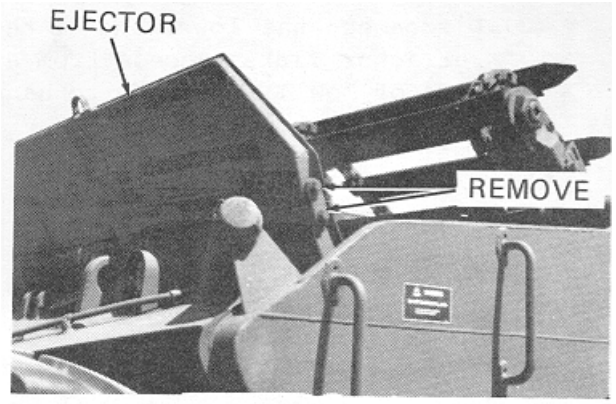
(6) Attach cover and gasket to motor. Place motor on storage brackets and fasten to lugs using nuts provided.



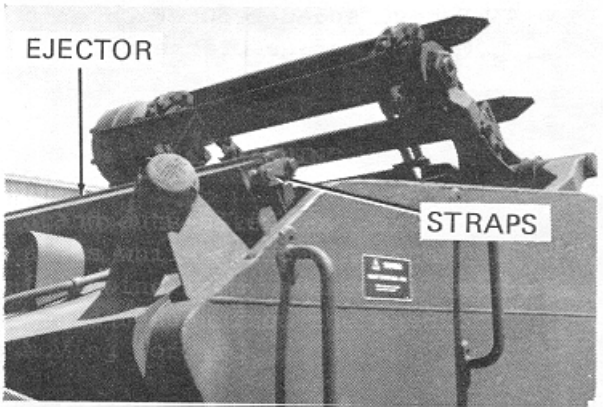
(7) Attach cover to speed reducer (O-ring stays in speed reducer).



(8) Remove both bolts from the straps located on both sides of the ejector hinge.



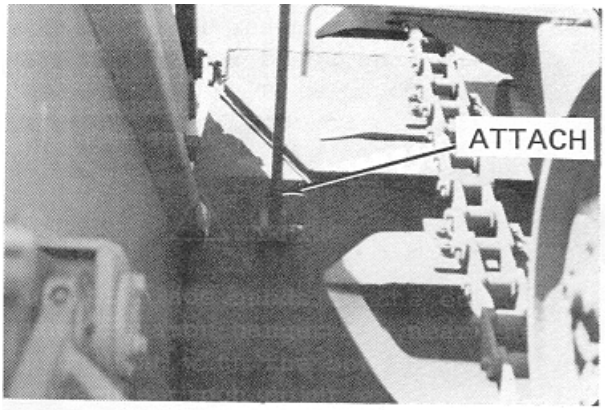
(9) Fold ejector down and reinstall the straps.



WARNING

Stand outside of bowl area on the steps while performing the following item. Personal injury could result from the ejector moving forward.

(10) Start engine. Move ejector into position and attach links to the ejector using the clevis pins (access from steps on the side of the bowl). Stop engine.



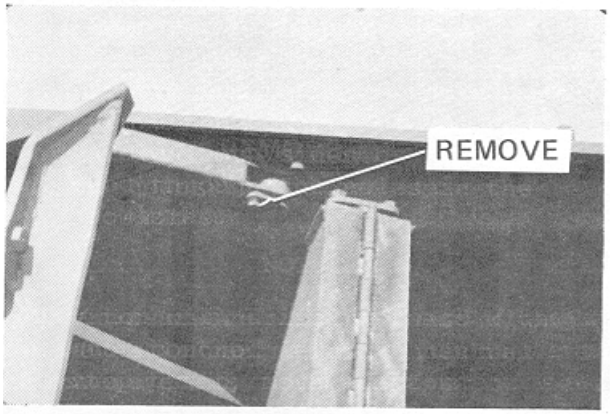
WARNING

Do not place hands at the end of the elevator hanger arm near the pin joint with the bowlside. A possible pinch point exists which could result in personal injury.

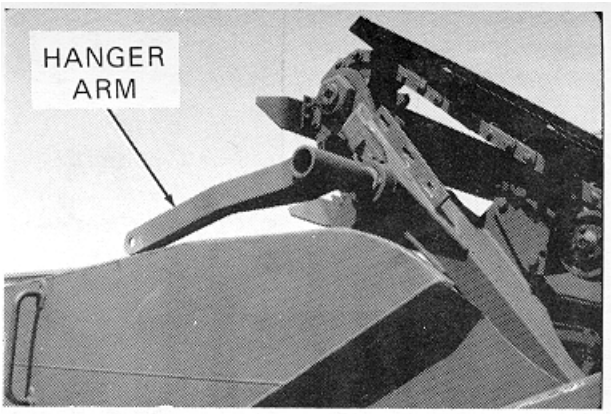
(11) Remove the bolt from rear end of the elevator hanger arm pin and remove the nut from the pin. Drive the pin out of the hanger arm on both sides by inserting rod through the holes in the bowlside.

NOTE

Elevator will drift rearward with ejector control lever in neutral. To stop drift, move ejector control lever slightly into "ejector open" position.

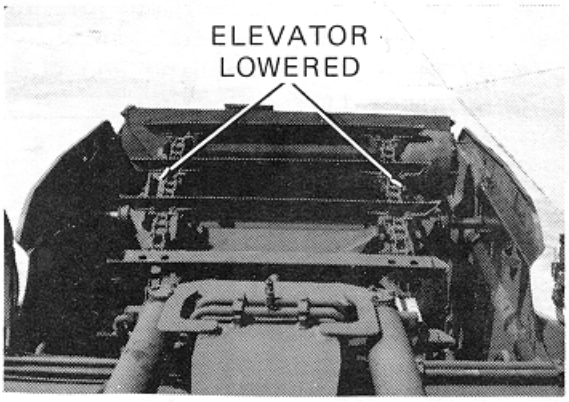


(12) Start the engine and remove both top elevator hanger arms by moving the ejector carefully. Store elevator hanger arms in the tool box.



(13) Lower the elevator by moving the ejector rearward and close the moveable floor. Stop the engine.

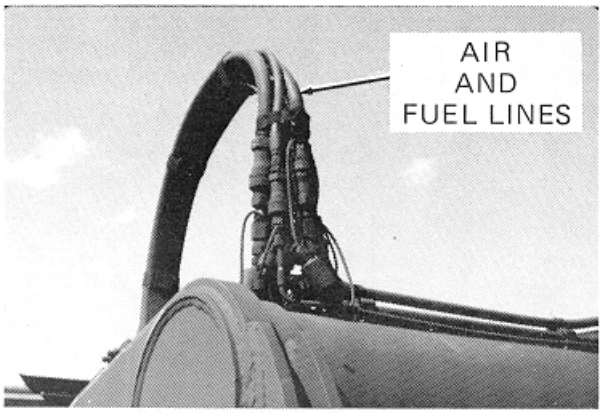
(14) Using suitable material, secure ejector to bowl sides.



(15) Use heavy string to tie the air and fuel lines to the front, right side of the bowl to reduce height.

NOTE

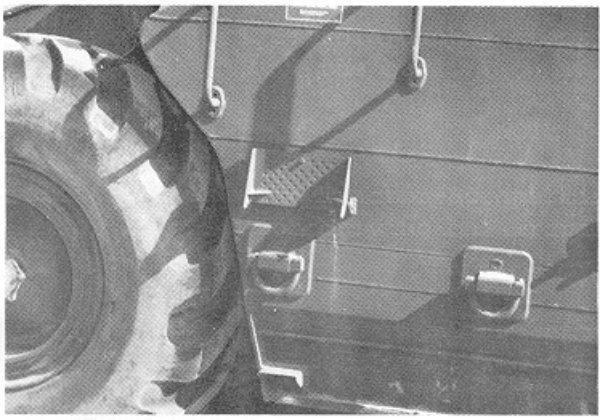
Wiper control panel (removed earlier from ROPS) must be strapped to right front support leg of ROPS.



(16) Fold up the steps on each side of the bowl.

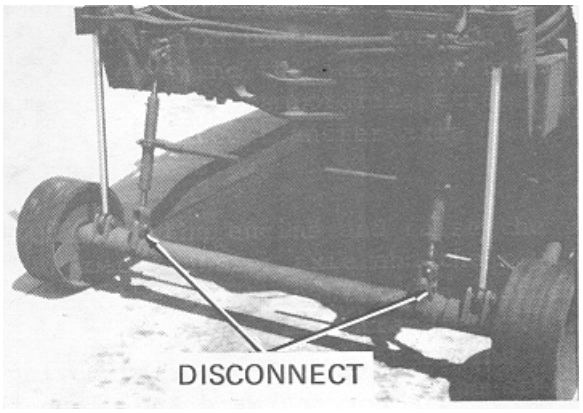
NOTE

The Tractor-Scraper is now ready for driving on aircraft.



d. Driving (On). The following steps describe how to drive the machine into the aircraft and to balance the load on the aircraft floor.

(1) Disconnect the lower ends of the jacks from the load transfer axle, swing the jacks all the way up and temporarily strap them to the transfer axle cylinders.

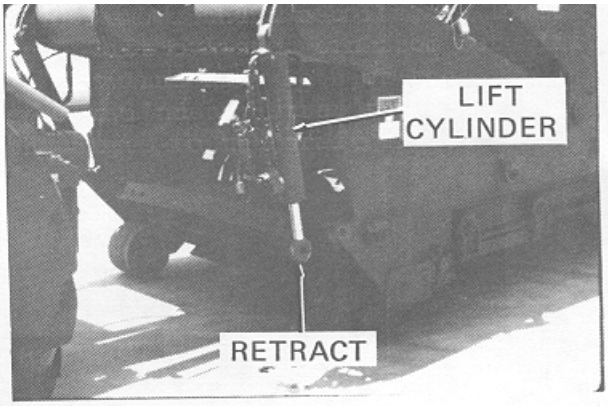


(2) Start the engine and raise the load transfer axle and the bowl so the two transfer axle wheels and the bowl load transfer wheels are well clear of any ground obstructions in the area between the machine and the aircraft.

(3) Drive the machine to the aircraft ramp, aligning the machine with the aircraft so the machine can be backed into the aircraft with little or no steering. Set parking brake.

(4) Power down load transfer axle and the bowl.

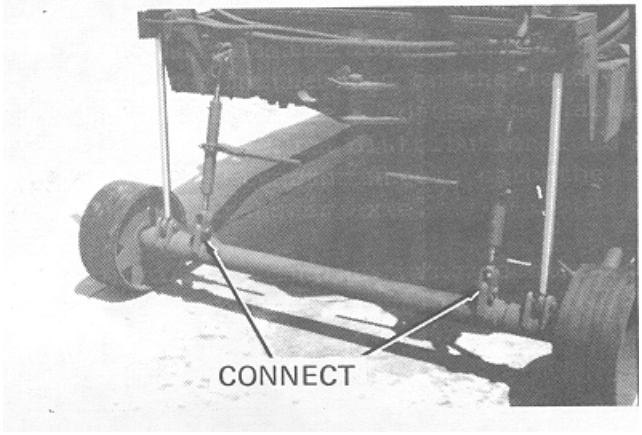
(5) Remove the two bolts and lower lift cylinder pin from both lift cylinders. Retract the cylinders, strap the cylinder eyes to the draft frame arms.



(6) Release parking brake and back the machine into the aircraft.

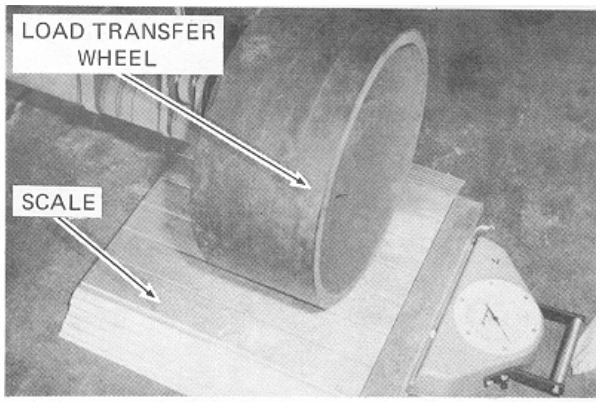
(7) Reinstall the lower ends of the jacks in the lugs on the load transfer axle. Adjust the jacks to maintain a distribution load of the tractor wheels onto the load transfer axle.

(8) Stop the engine. The machine is now ready for lashing to the aircraft.

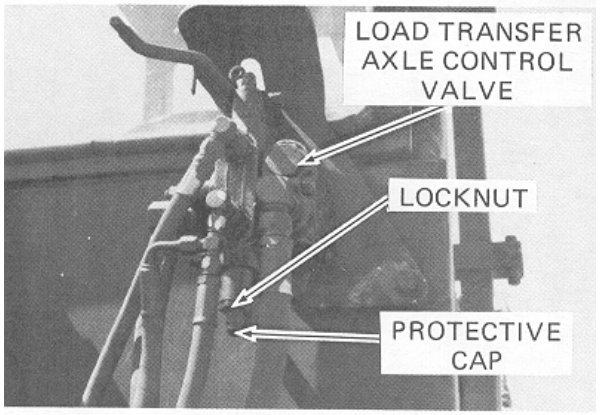


e. Adjustment Of Axle Loading. The following steps describe how to change the loading of the load transfer axle, if necessary.

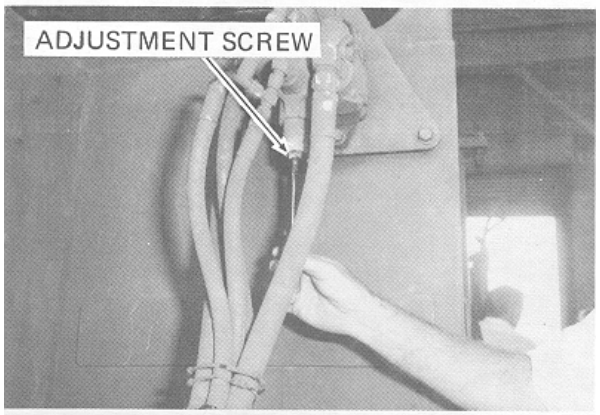
(1) Position scales under each load transfer axle wheel. Carefully lower axle onto scales. Observe indicated scale load.



(2) Remove the protective cap from the load transfer axle control valve. Loosen locknut on adjustment screw.

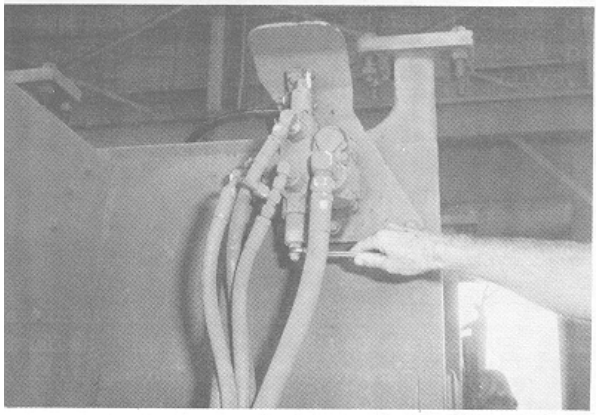


(3) While watching the indicated scale load, turn adjustment screw counterclockwise to increase or clockwise to decrease axle loading until desired load is achieved.



(4) Tighten locknut on adjustment screw. Install protective cap on control valve.

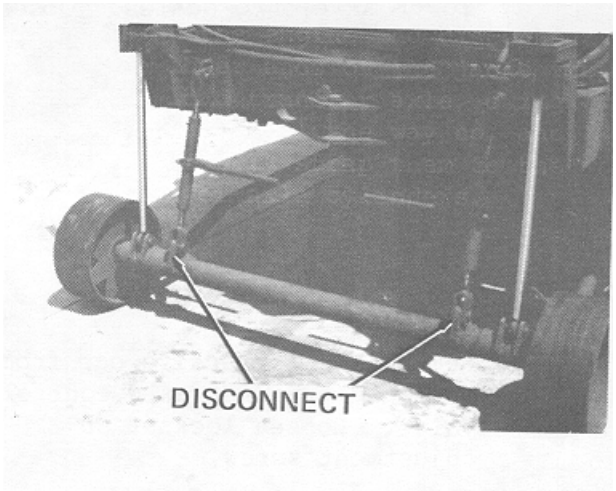
(5) Lift load transfer axle and remove scales. Lower load transfer axle and bowl.



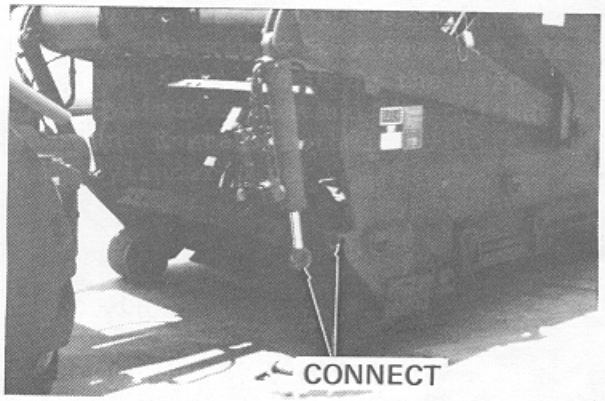
DRIVE OFF PROCEDURES

a. Driving (Off). The following steps describe how to drive the machine off the aircraft after air transport.

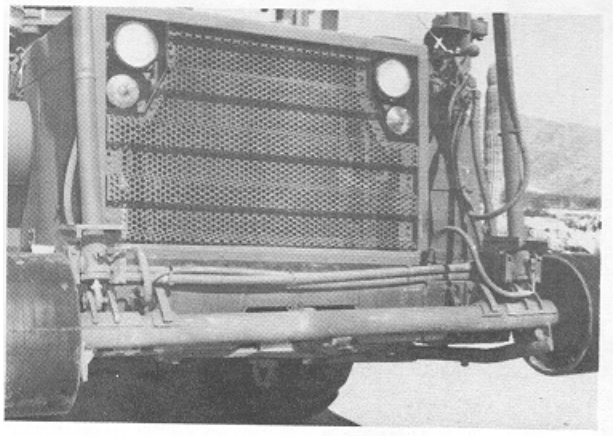
(1) Start the engine and disconnect the lower ends of the jacks from the load transfer axle, swing the jacks all the way up, and temporarily strap them to the transfer axle cylinders.



(2) Drive the machine straight out of the aircraft a few feet off the ramp. Unstrap the lift cylinders, extend the cylinders, and install both lower lift cylinder pins.

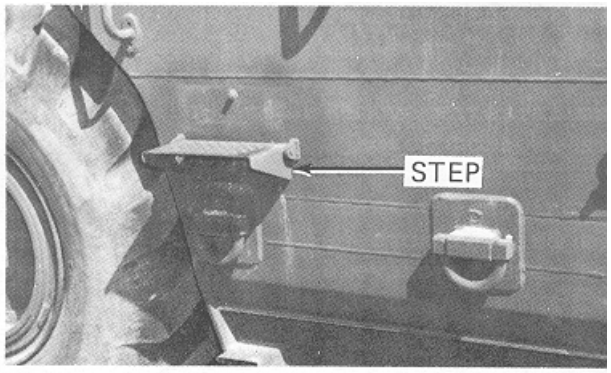


(3) Raise the load transfer axle and the bowl, and drive the machine away from the flight path to a convenient work area for the following procedures. If the machine is not to be prepared for immediate use, lower the load transfer axle and the bowl and stop the engine.



b. Preparation For Operation. The following procedures describe the steps necessary to prepare the machine for work after air transport.

(1) On each side of bowl fold down the step.

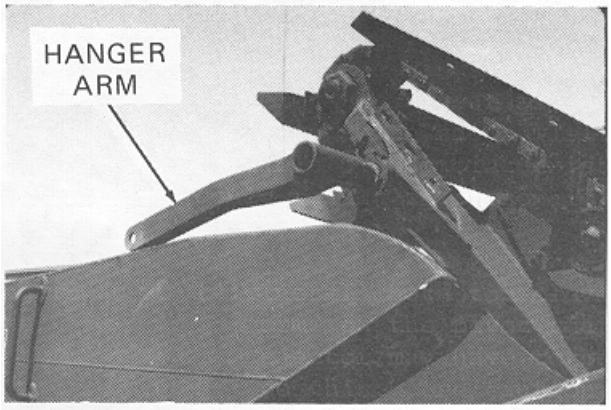


(2) Remove material used to strap ejector to bowl sides.

(3) Start the engine. Move the ejector forward to raise the elevator. Open the moveable floor.

WARNING

Do not place hands at the end of the elevator hanger arm near the pin joint with the bowlside. A possible pinch joint exists which could result in personal injury.

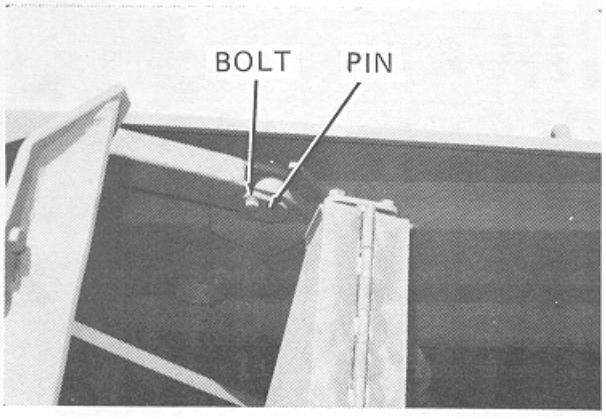


(4) Install both top elevator hanger arms on the pivot shafts. The ejector may have to be moved to do this. Use caution if movement is required.

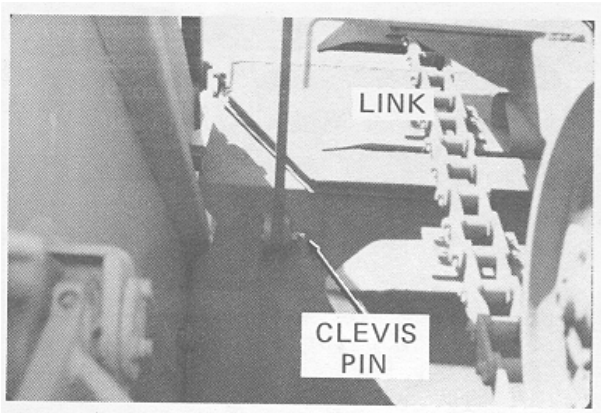
(5) Drive pins into hanger arm on both sides. Attach bolt to the rear end of the elevator hanger arm pin.

WARNING

Stand outside of bowl area on the steps while performing the following step. Personal injury could result from the ejector moving forward.



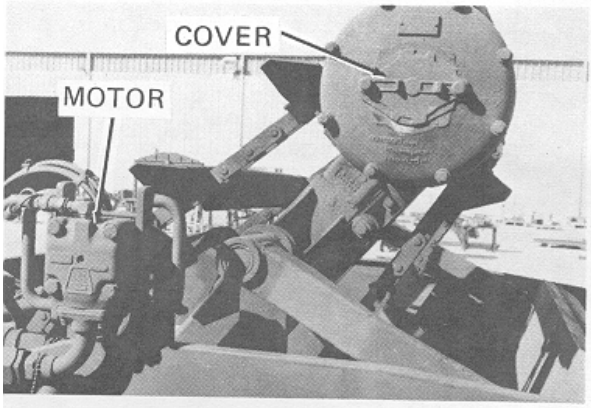
(6) Remove links from the ejector by removing clevis pins (access from steps on the side of the bowl).



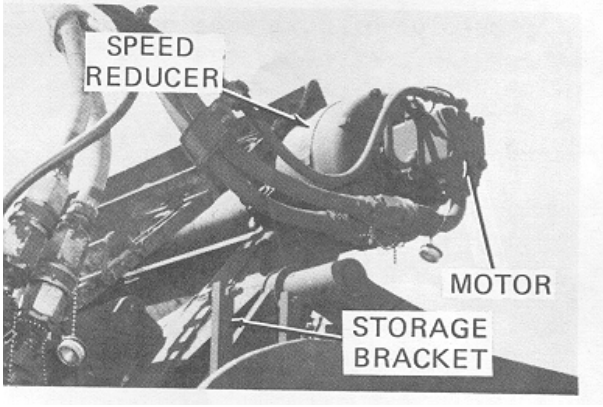
(7) Remove straps from the ejector and fold ejector up. Re-install straps on both sides of ejector hinge.

(8) Remove the cover from the speed reducer.

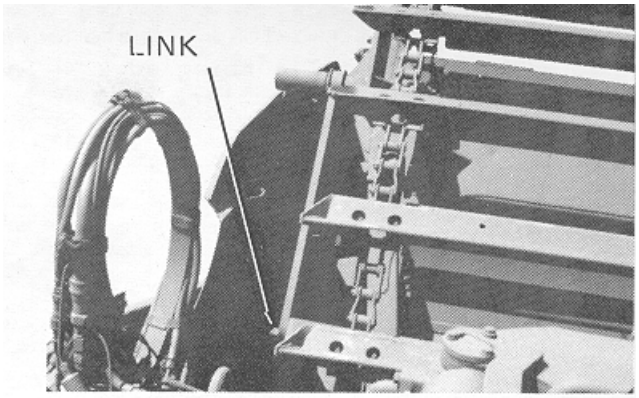
(9) Remove motor from mounting bracket. Remove cover from motor.



(10) Raise the motor and attach to the speed reducer. Put motor cover in tool box and attach reducer cover to storage bracket.



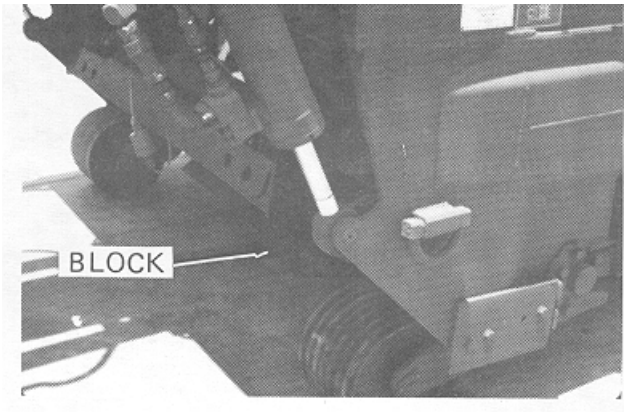
(11) Attach the lower end of the retractor links (access from steps on side of bowl)



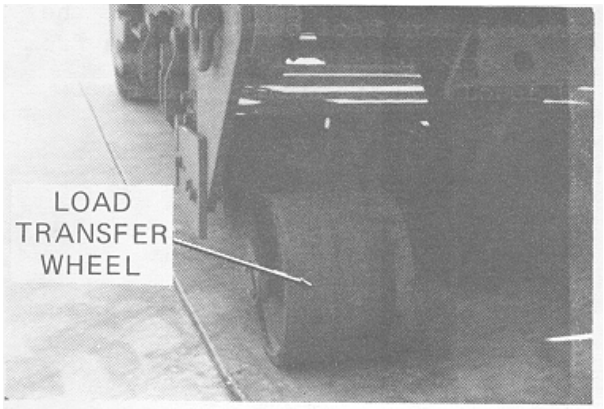
(12) Fold up steps on both sides of the bowl.

c. Removing Load Transfer Equipment. Nine procedures are necessary to remove load transfer equipment.

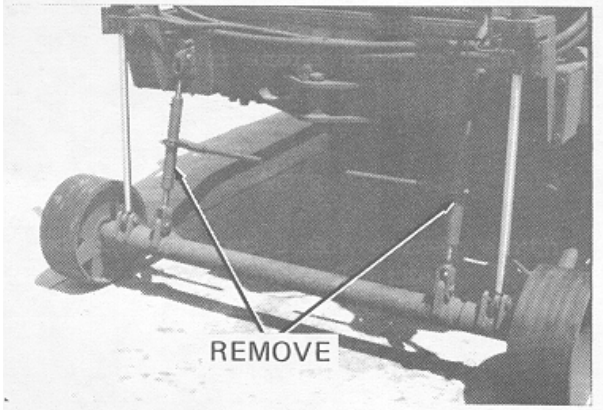
(1) Start the engine, raise the bowl about one foot and open the bowl floor about six inches. Place a block under the cutting edge to keep the load transfer wheels off the ground. Lower the load transfer axle. Stop the engine.



(2) Remove the two load transfer wheels from the bowl cutting edge. Raise bowl and remove block. Lower bowl.



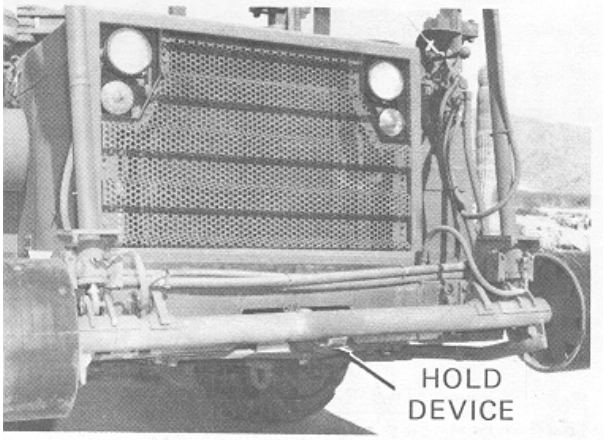
(3) Remove the load transfer axle jacks and store them in tool box.



NOTE

Proceed to step 5 for normal earth moving operations. If the Tractor-Scraper must be roaded with load transfer axle in place, refer to step 4.

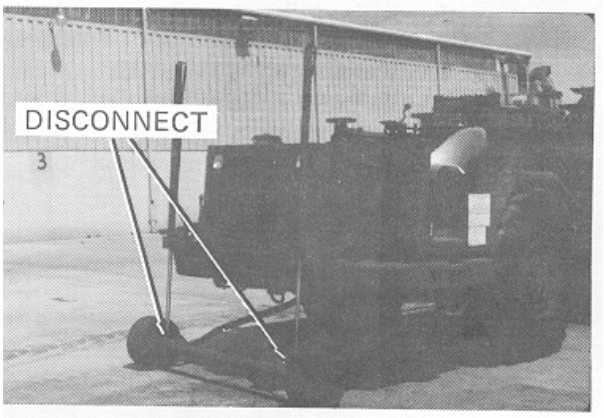
(4) Raise the load transfer axle to its highest point. Swing the hold device under the axle to prevent self-lowering during operation. The tractor-scraper is now ready for operation.



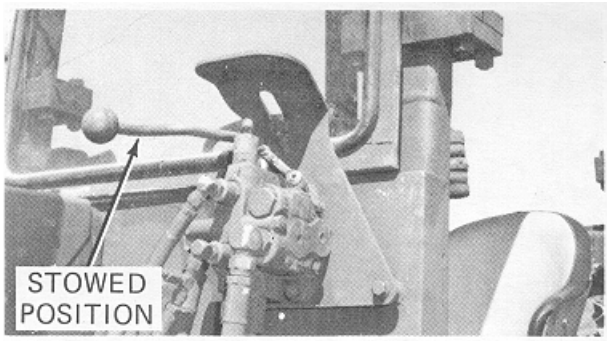
WARNING

Do not proceed with steps 5 through 9 if step 4 was performed.

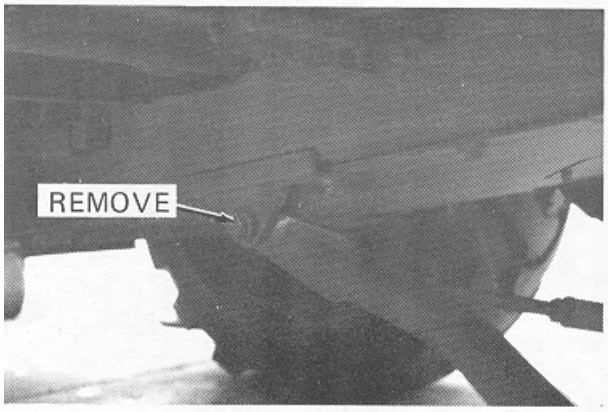
(5) Disconnect the load transfer axle cylinder eyes from the lugs on the axle. Start the engine, retract the cylinders, and stop the engine.



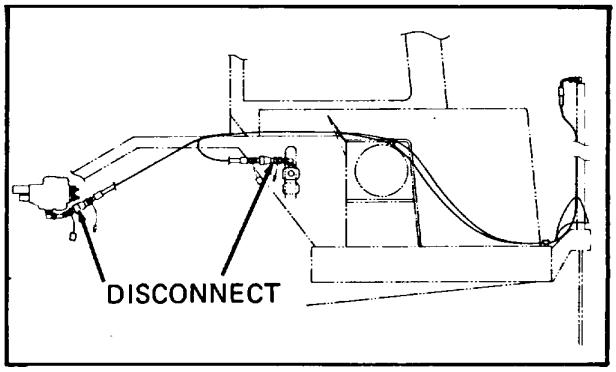
(6) Detach the load transfer valve handle from the valve and reattach the handle in its stowed position.



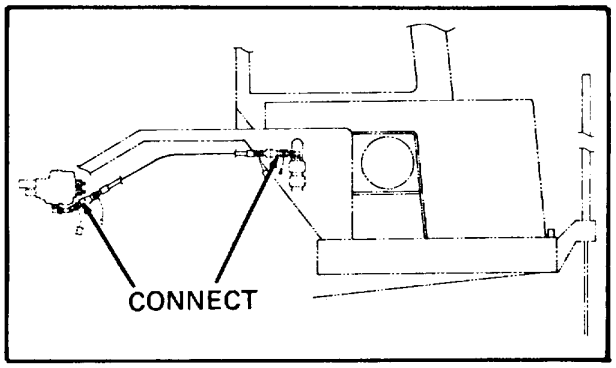
(7) Remove the pins and washers holding the load transfer axle arms to the bottom of the tractor, and roll the axle away to a secure area.



(8) Disconnect two hoses; one from the dump and lift valve, and one from the fitting under the walkplate near the right front fender. Strap the loose hose ends to other lines.



(9) Attach jumper hose to fitting under walkway and to dump and lift valve. The tractor-scraper is now ready for operation.



CHAPTER 2

LUBRICATION INSTRUCTIONS

Table of Contents

IMPORTANT SAFETY NOTICE

Periodic and proper lubrication and maintenance is important to the safe and reliable operation of this machine. This Guide outlines recommended procedures, some of which require the use of special tools or work methods.

Improper lubrication and maintenance of this machine can be dangerous and could result in injury or death.

READ AND UNDERSTAND ALL SAFETY PRECAUTIONS AND WARNINGS BEFORE PERFORMING LUBRICATION OR MAINTENANCE ON THIS MACHINE.

Basic safety precautions are outlined in the safety section of this manual and in the description of operations were hazards exist. Warning labels have also been put on the machine to provide instructions and to identify specific hazards which if not heeded could cause bodily injury or death to you or other persons. These warnings in the manual and on the machine labels are identified by the symbol

Operations that may result only in machine damage are identified by CAUTION labels on the machine and in the manual.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this manual and on the machine are therefore not all inclusive. If a procedure, tool or work method not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and others and the machine will not be damaged or made unsafe by the procedures you choose.

Do not operate this machine unless you have read and understand the instruction in the manual. Improper machine operation is dangerous and could result in injury or death. Proper operation is your responsibility.

Foreword

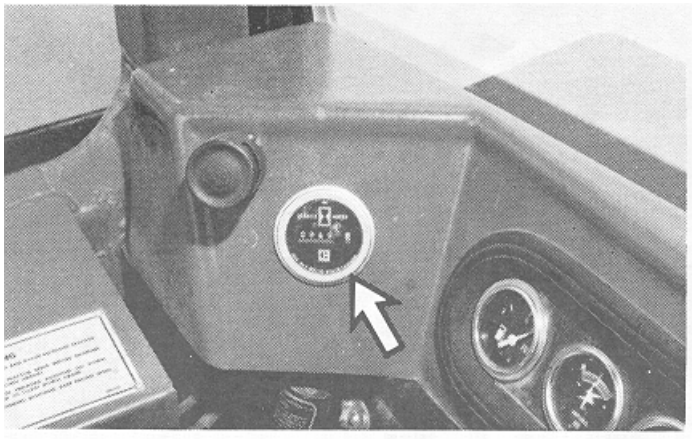
This section is a guide to equipment care. The illustrated step-by-step instructions are grouped by servicing intervals; items not having specific intervals are listed under WHEN REQUIRED.

Circled numbers in the LUBRICATION AND MAINTENANCE CHART are to key the charted items to the instructions.

Use the service meter to determine servicing intervals. Calendar intervals (daily, weekly, monthly, etc.) shown may be used instead of service meter intervals, if it provides more convenient servicing schedules; and approximates the indicated service meter reading.

NOTE

Under extremely severe, dusty or wet operating conditions, more frequent lubrication than Is specified in the LUBRICATION AND MAINTENANCE CHART may be necessary.



Service Meter

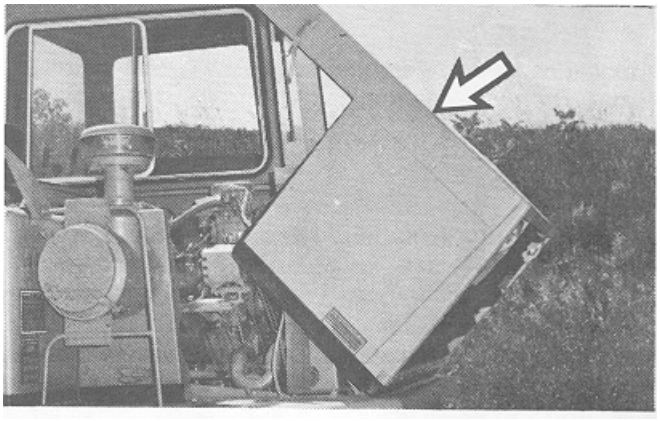
Perform previous interval items at multiples of the original requirements. For example, at EVERY 250 SERVICE HOURS OR MONTHLY, also perform those items listed under EVERY 50 SERVICE HOURS OR WEEKLY and EVERY 10 SERVICE HOURS OR DAILY.

SAFETY

THIS SYMBOL WARNS OF POSSIBLE PERSONAL INJURY

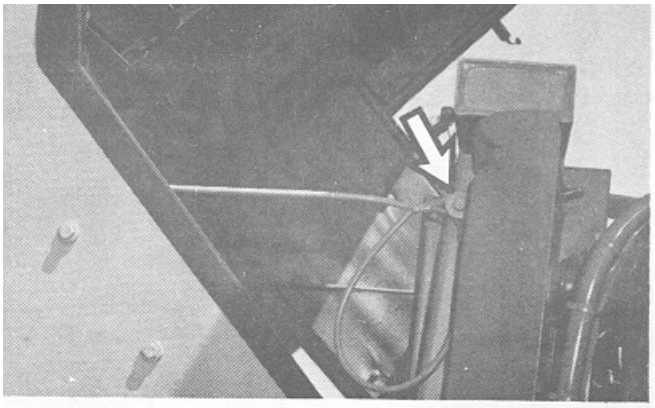
WARNING

Lubrication and maintenance or repair of this machine can be dangerous, unless performed properly. Each person must satisfy himself that he has the necessary skill and information, proper tools and equipment, and that his work method is safe and correct.



Under certain conditions, such as high winds, parked uphill on steep slopes, or heavy snow loads, the hood retaining springs may not be sufficient to keep the hood from falling.

To Extend Cable:



Remove the bolt that holds the cable to the radiator bracket. Put the cable in the longest position. Install the bolt. Repeat for the opposite side of the hood.

This will provide better access to the engine area components.

Attach DO NOT OPERATE tags on the controls while the machine is being serviced.

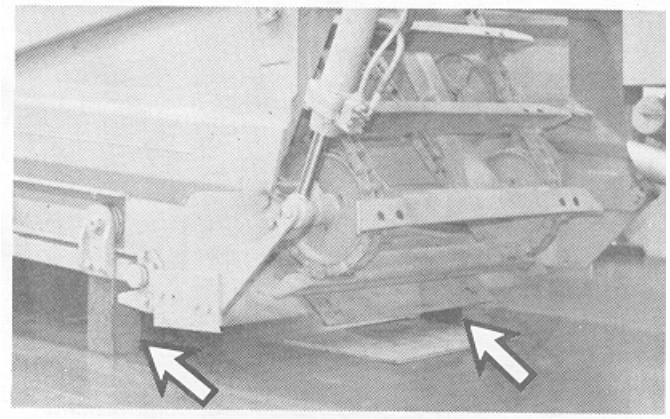
To prevent possible personal injury under these conditions, while performing maintenance under a raised hood, block or brace the hood to keep it from falling.

The hood can be opened further by extending the restraining cables to the longer position.

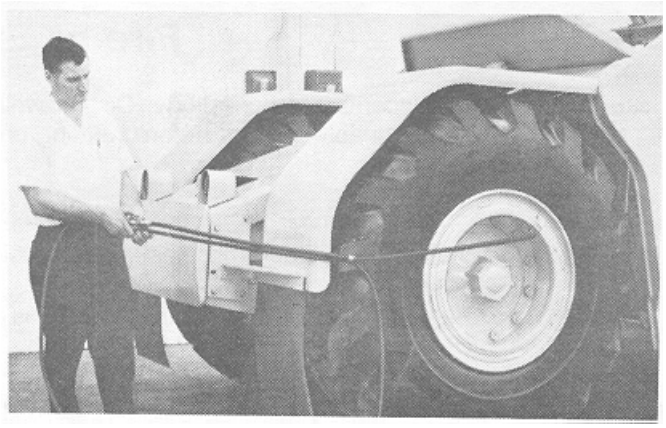
Use steps, grab irons and walkways provided when mounting, dismounting or moving around on the machine.

Face the machine when mounting or dismounting. Do not use the steering wheel as a handhold. The machine could articulate.

Safety



Lower the bowl onto blocks when changing cutting edges or router bits.



Use a self attaching air chuck and stand behind the tread when inflating tires.

There are certain hazards which must be recognized as potential causes of personal injury. Be aware of these hazards and follow the recommendations which are listed below. The recommendations are grouped to avoid:

Crushing or Cutting

Never attempt adjustments while the machine is moving or the engine is running.

Any implement can fall if a control is moved, or a line breaks.

To avoid possible weakening of the ROPS (Rollover Protective Structure), do not alter the ROPS in any way. The protection offered by the ROPS will be impaired if it has been subjected to structural damage, or has been involved in an overturn incident.

Support equipment when working beneath it. Do not depend on hydraulic cylinders to hold it up.

The fan blades will throw or cut any object, or tool, that comes in contact with them.

Drive shafts and universal joints can catch loose clothing, wipe cloths, or hair.

Wear gloves when handling cable. Do not use kinked or frayed cable, it is weakened.

Wear protective glasses when hammering on steel, drifts, punches or chisels. Chips can fly from steel objects or the hammer.

Burns

The radiator and all lines to the engine contain hot water or steam. Remove the radiator cap slowly to avoid burns. Allow cooling system components to cool before draining the coolant.

Lubricants will be hot enough to cause serious burns after the machine compartments are up to normal operating temperature. Allow the compartments to cool before draining the lubricants.

The hydraulic system will be pressurized, by hot air in the top of the tank. Remove the hydraulic tank cap slowly to relieve tank pressure. Allow the tank to cool before draining it.

Fire or Explosion

Diesel fuel and all lubricants are flammable. Do not weld on pipes or tubes that contain fuel or oil. Clean them thoroughly with non-flammable solvent before welding on them.

Do not smoke when refueling.

Clean up oil spills, and steam clean the machine, to avoid fires.

The vapor (hydrogen gas) from a charging battery is explosive. Do not smoke when checking, or working around batteries.

When jump starting a vehicle, use a special starter adapter. See the OPERATOR'S GUIDE for special precautions in jump starting. A spark at a connection near the battery can cause an explosion.

Fluids

Cooling system conditioners contain alkali. Do not drink them or get them in eyes.

Battery electrolyte is an acid and it will harm skin and eyes.

Keep all lubricants stored in properly marked containers. Store them away from children.

Never put maintenance fluid in glass bottles or glasses.

Safety Equipment

Wear a hard hat, protective shoes and protective glasses when performing lubrication and maintenance operations.

Use a maximum pressure of 30 psi (205 kPa) when cleaning with air. Never point an air nozzle toward anyone.

Know the rating on cable, chains and slings before using them.

Use a "DO NOT OPERATE" tag on the vehicle controls whenever you are working on a machine. Engine start up, or control movement, could cause injury.

Use steps and grab irons when servicing the machine.

Store rags that have oil, or other flammable material on them, in a safety type container, away from open fires, welding or flame cutting areas.

Operate the engine only in a well ventilated area.

Maintenance Recommendations

Cooling System

CAUTION

Never add coolant to an overheated engine. Allow the engine to cool first.

Measure the specific gravity of antifreeze solution frequently in cold weather to ensure adequate protection.

When permanent type antifreeze and water solutions are used in the cooling system, drain and replace the solution EVERY 2000 SERVICE HOURS OR YEARLY.

If the machine is shipped to, or stored in an area with freezing temperatures, the cooling system must either be protected to the lowest expected temperature or drained completely.

The engine cooling system is protected to -20°F (-30°C), with permanent type antifreeze, when shipped from the factory.

NOTE

Pure undiluted antifreeze will freeze at -10°F (-23°C).

Use clean water that is low in scale forming minerals--not softened water.

When refilling the cooling system, always check the coolant level when the engine reaches normal operating temperature.

Filling the cooling system at over a 5 gpm (19 liters/min) rate can cause air pockets in the cooling system.

When measuring the coolant level inspect the filler cap gasket. Replace the gasket if it is damaged.

Premix antifreeze to provide protection to the lowest expected temperature.

Operate with a thermostat in the cooling system all year round. Cooling system problems can arise without a thermostat.

Engine Air Cleaner

Inspect the air cleaner precleaner daily for accumulation of dirt and debris.

Service the air cleaner when the red band is visible in the air cleaner indicator.

Fuel System

CAUTION

Fill the fuel tank at the end of each day of operation to drive out moisture laden air and to prevent condensation.

Drain water and sediment from the tank at the start of each shift or after the tank has been filled and allowed to stand 5 to 10 minutes. Drain moisture and sediment from the tank as required by prevailing conditions.

Drain water and sediment from the main fuel storage tank weekly, also before the tank is refilled. This will help prevent water and sediment from being pumped into the machine fuel tank.

After changing fuel filters, always bleed the fuel system.

Electrical System

WARNING

When jump starting this unit you should always use the emergency starting receptacle unless circumstances absolutely will not permit this method of starting.

CAUTION

When using an external electrical source to start the machine, turn the disconnect switch off and remove the key before attaching the cable to the emergency starting receptacle. The emergency starting receptacle is provided on the side of the unit for use with other Army vehicles equipped with this feature.

When using jumper cables be sure to connect in parallel: POSITIVE (+) TO POSITIVE (+) AND NEGATIVE (-) to NEGATIVE (-).

Hydraulic System

CAUTION

Make-up hydraulic fluid must mix with the fluid in the tank. Use only military recommended products.

Water or air from a malfunction in the hydraulic system will cause pump failure. Small air pockets caused by air breaking into the system do not create a problem because the system is self-purging.

If the hydraulic oil is cloudy, water or air is entering the system. Drain and refill the hydraulic tank. Operate all hydraulic system components several times. Drain and refill the hydraulic tank. Tighten hydraulic suction hose clamps and flanges.

Scheduled Oil Sampling

Use scheduled oil sampling or monitor machine condition and maintenance requirements.

Each sample should be taken when the oil is hot and well mixed. This will ensure that the sample is representative of the oil in the compartment.

Use military guidance and assistance in establishing a scheduled oil sampling program for your equipment.

General

Wipe all fittings, caps and plugs before servicing.

Drain moisture and sediment from the air reservoirs at the beginning of each day of operation.

Refill Capacities

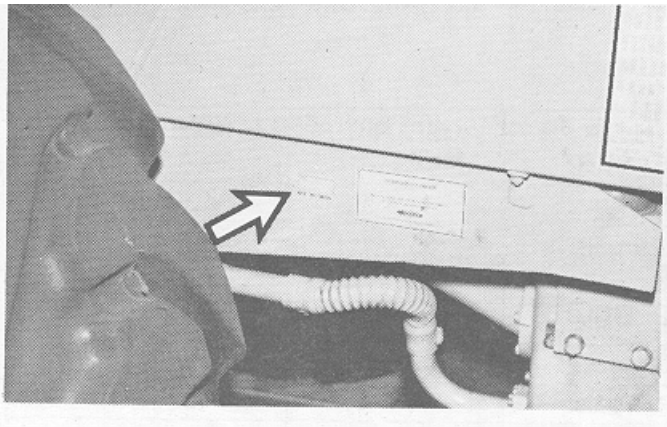
These refill capacities are approximate and are not intended for exacting purposes, such as billing. They are for use as a guide when filling systems. Follow the recommendations in the guide when checking the levels of compartments or systems.

COMPARTMENT OR SYSTEM	U.S. MEASURE	METRIC MEASURE	IMPERIAL MEASURE
Engine Crankcase	3 gals.	11.4 ltr.	2.5 gals.
Transmission System	9.25 gals.	35 ltr.	7.7 gals.
Hydraulic Tank	24 gals.	91 ltr.	20 gals.
Fuel Tank	65 gals.	246 ltr.	54.1 gals.
Elevator Speed Reducer	1 gals.	3.8 ltr.	8 gal.
Final Drives (each)	1.5 gals.	5.7 ltr.	1.2 gals.
Differential	5 gals.	19 ltr.	4.2 gals.
Cooling System	10 gal.	38. ltr.	8.3 gals.

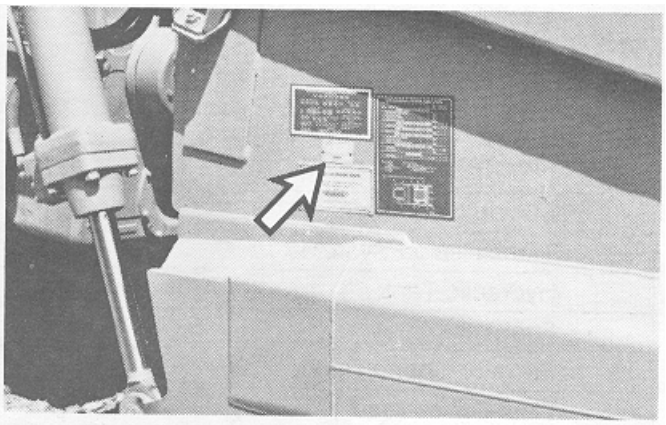
BOLT SIZE		RECOMMENDED TORQUE*	
inch	mm	lb. ft.	N.m
5/8	16	195 $\pm$ 25	265 $\pm$ 34
3/4	19	350 $\pm$ 50	470 $\pm$ 70
7/8	22	565 $\pm$ 85	770 $\pm$ 115
1	25	900 $\pm$ 110	1220 $\pm$ 150

*These values are applicable only to Caterpillar plow bolts.

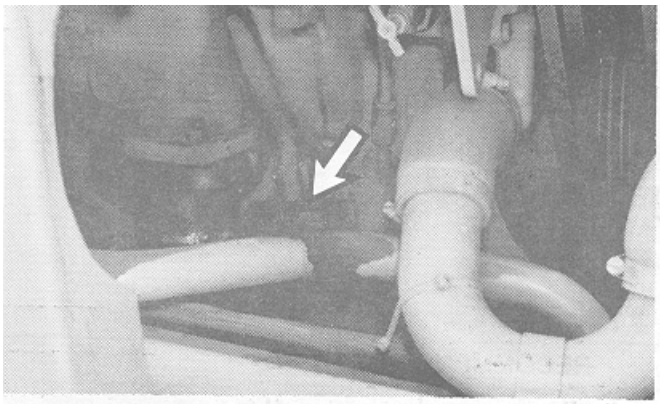
Serial Number Locations



TRACTOR (Left, rear of frame behind tire)



SCRAPER (Left, middle side of scraper)



ENGINE (Lower right front of engine block)

TRACTOR AND ENGINE (Left, front floor of cab)

Tire Inflation Information

CONDITION	MANUFACTURER	PLY RATING	PRESSURE
SHIPPING	FIRESTONE	12	35 PSI (2.5 kg/cm2)
	GENERAL	12	40 PSI (2.8 kg/cm2)
	FIRESTONE	16	45 PSI (3.2 kg/cm2)
	GENERAL	16	45 PSI (3.2 kg/cm2)
OPERATION	FIRESTONE	12	35 PSI (2.5 kg/cm2)
	GENERAL	12	40 PSI (2.8 kg/cm2)
	FIRESTONE	16	45 PSI (3.2 kg/cm2)
	GENERAL	16	45 PSI (3.2 kg/cm2)
ROADING	FIRESTONE	12	35 PSI (2.5 kg/cm2)
	GENERAL	12	40 PSI (2.8 kg/cm2)
	FIRESTONE	16	45 PSI (3.2 kg/cm2)
	GENERAL	16	45 PSI (3.2 kg/cm2)
STORAGE	FIRESTONE	12	20 PSI (1.4 kg/cm2)
	GENERAL	12	15 PSI (1.1 kg/cm2)
	FIRESTONE	16	25 PSI (1.8 kg/cm2)
	GENERAL	16	20 PSI (1.4 kg/cm2)

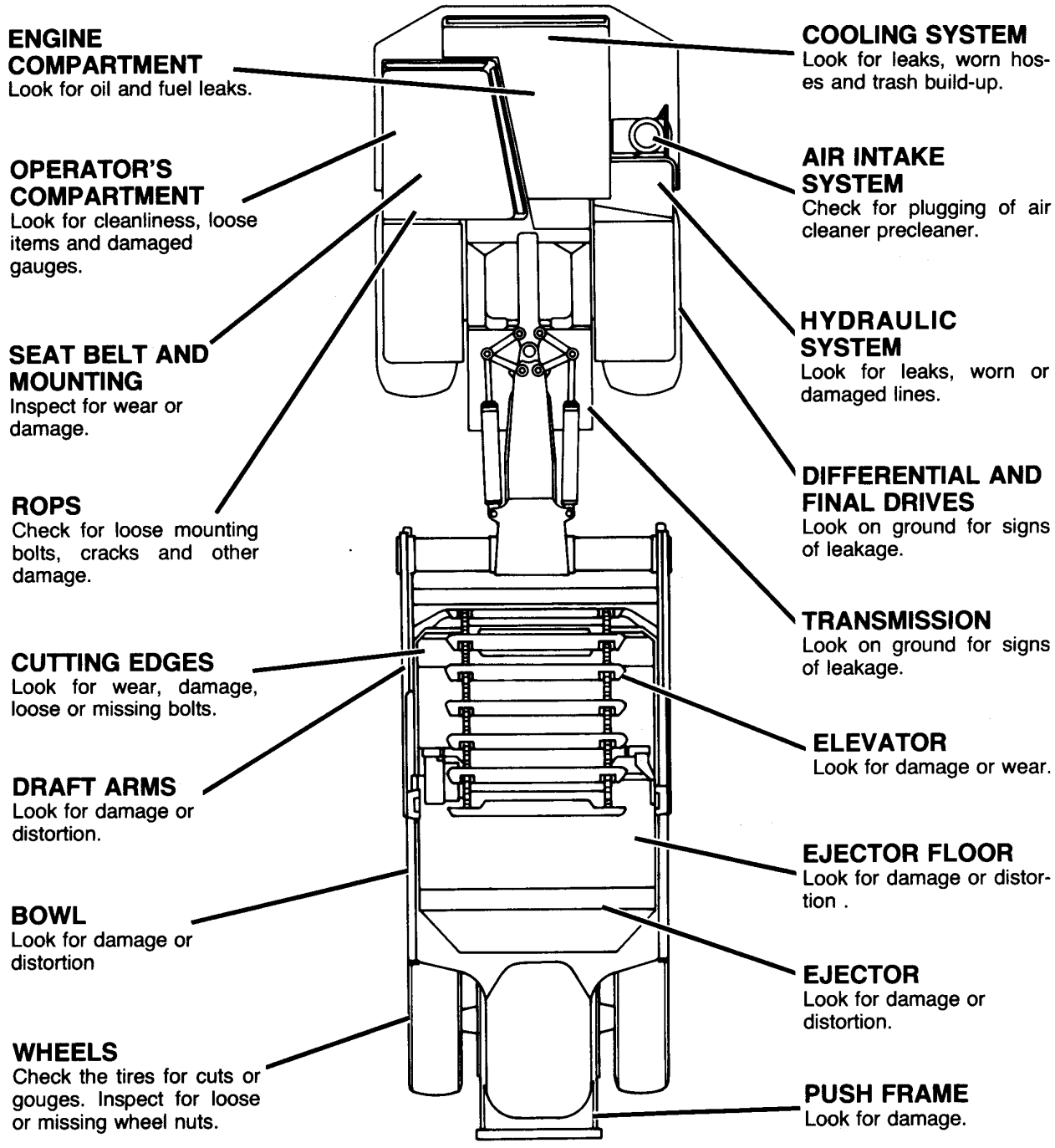
Adjusted Inflation Pressures

Use this chart when inflating tires indoors at 65ºF (18ºC) if the machine is to be operated at a cooler out-side temperature.

Recommended Inflation Pressure		Adjusted Inflation Pressure For Ambient Operating Temperature of:							
		30ºF (-1ºC)		0ºF (-18ºC)		-20ºF (-29ºC)		-40ºF (-40ºC)	
psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa
30	205	33	230	36	250	39	270	41	285
35	240	38	260	42	290	45	310	47	325
40	280	44	3005	48	330	51	350	54	370
45	310	49	340	53	365	57	395	660	4158
50	345	55	380	59	405	62	430	66	460
55	380	60	415	65	450	68	470	72	500
60	415	65	450	71	490	74	510	79	550
65	450	71	490	76	520	80	550	85	590
70	480	76	520	82	570	86	590	91	630
75	520	81	560	88	610	92	630	97	670
80	550	87	600	93	640	98	680	104	720

Walk-Around Inspection

For maintenance and operator personnel safety, and maximum service life of the machine, make a thorough walk-around inspection when doing lubrication and maintenance work. Look under and around the machine for such items as loose bolts, trash build-up, oil or coolant leaks, condition and inflation of tires and condition of the cutting edge and cutting edge teeth. Have faulty condition repaired.



Lubricants-Fuels-Coolants

Engine Oils, Transmission and Clutch Oils

Engine oils conforming and qualified under Military Specification MIL-L-2104 (Lubricating Oil, Internal Combustion Engine, Tactical Service) are to be used for these lubrication points. These engine oils, in addition to their meeting the required engine performance classification of CD, also meet commercial transmission system requirement such as the Caterpillar TO-2 and Allison C-3.

Hydraulic Oil

Use OE/HDO-10 meeting MIL-L-2104 in the hydraulic system.

Lubricating Oil, Gear, Multipurpose (GO)

Use gear oil meeting MIL-L-2105 (GO).

Lubricating Grease (GAA)

Use MIL-G-10924, Grease, Automotive and Artillery (GAA). This grease is suitable for all temperatures.

Brake Fluid (BFS)

Brake fluid meeting MIL-B-46176, Brake Fluid, Silicone, All Weather, Operational and Preservative shall be used in the hydraulic brake system.

LUBRICANT CHART

Lubricants	Refill Capacity	Expected Temperatures: Above 15°F (Above -10°C)	Expected Temperatures: +40° to -15°F (+5° to -25°C)	Expected Temperatures: +40° to -65°F (+5° to -55°C)	FOR ARCTIC OPERATION REFER TO FM 9-207	Change Intervals
OE/HDO-Lubricating Oil, ICE Tactical (MIL-L-2104) (See Note 1)	3 gals. (11.4 ltr.)	OE/HDO 30	OE/HDO 10 (See Note 2)			250 Hours
OEA-Lubricating Oil, ICE, Arctic (MIL-L-46167)	3 gals. (11.4 ltr.)			OEA		250 Hours
- Transmission	6.5 gals. (25 ltr.)	OE/HDO 10	OE/HDO 10	OEA		1,000 Hours
- Hydraulic Oil	24 gals. (91 ltr.)	OE/HDO 10	OE/HDO 10	OEA		2,000 Hours
GO - Lubricating Oil, Gear, Multipurpose (MIL-L-2105)	As Required	GO 85-145	GO 80-90	GO 75		When Required
GAA - Grease Automotive and Artillery (MIL-G-10924)	As Required	All Temperatures				When Required
BFS - Brake Fluid Silicone, Automotive All Weather, Operational and Preservative (MIL-B-46176) (See Note 3)	As Required	All Temperatures				When Required

NOTES:

1. For operation of equipment at temperatures above +5ºF multiviscosity oil (OE/HDO 15W-40 can be used in lieu of OE/HDO 30.

2. If OEA is required to meet the temperature ranges prescribed in the Key, then the OEA lubricant is to be used in place of OE/HDO 10 lubricant for all temperature ranges.

3. See TB 43-0002-87 for conversion procedures from HB to BFS.

Lubricants-Fuels-Coolants

Fuel Specifications

Types of Fuel

Fuel Oil, Diesel Federal Specification VV-F-800 shall be used as the primary fuel. Temperature limits are listed below:

Fuel Requirements - Temperature Limits (VV-F-800)

Grade DF-2	For use above -12ºC (+10ºF)[1]
Grade DF-12	For use below -12ºC (+10ºF) to above -29ºC (-20ºF)
Grade DF-A	For use below -29ºC (-20ºF)

[1]Usage temperature may vary dependent on the Cloud Point of the actual DF-2 fuel being supplied in the geographical area.

[2]DF-1 is not normally procured in CONUS or OCONUS. Refineries will blend DF-2 with Kerosene or further refine distillate fractions to meet temperature requirements of DF-1.

Alternate and emergency fuels shall be used according to AR 703-1.

Engine Coolant

Use a mixture of fill water and antifreeze.

Fill Water

Acceptable water for use in the ethylene glycol-type antifreeze and water mixture is shown on the chart below:

ACCEPTABLE WATER		
WATER CONTENT	**50% OR MORE ANTIFREEZE**	**LESS THAN 50% ANTIFREEZE**
Chlorides	100 ppm or less	50 ppm or less
Sulfates	100 ppm or less	50 ppm or less
Hardness as Ca Co_3	200 ppm or less	100 ppm or less
Dissolved Solids	500 ppm or less	250 ppm or less
pH	6.5 or higher	6.5 or higher

ppm = parts per million

Antifreeze

Use MI L-A-46153, Antifreeze, Ethylene Glycol, Inhibited, Heavy Duty and follow the instructions for use in TB-750-651, Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems.

Item	Service	Lubricant	Page No.
Every 10 Service Hours or Daily			
① Cooling System	Check the coolant level		2-20
② Air Precleaner	Inspect—clean		2-20
③ Air Reservoirs	Drain moisture and sediment		2-21
④ Fuel Tank	Drain moisture and sediment		2-21
⑤ Engine Crankcase	Check the oil level	OEA	2-22
⑥ Elevator Idler Rollers	Lubricate 2 fittings	GAA	2-22
⑦ Elevator Sprocket Shaft Support	Lubricate 1 fitting	GAA	2-23
⑧ Door Rollers	Lubricate 4 fittings	GAA	2-23
⑨ Elevator Link Pins	Lubricate 2 fittings	GAA	2-23
⑩ Steering Link Bearings	Lubricate 10 fittings	GAA	2-24
⑪ Kingbolt Bearings	Lubricate 5 fittings	GAA	2-24
⑫ Horizontal Pivot Bearings	Lubricate 2 fittings	GAA	2-24
⑬ Tires	Visually inspect inflation and for cuts and gouges		2-25
⑭ Water Separator	Drain water		2-25
⑮ Back-up Alarm	Test		2-26
⑯ Low Air Pressure Warning Horn	Test		2-26
Every 50 Service Hours or Weekly			
⑰ Hydraulic System	Check oil level[1]	OEA	2-27
⑱ Ejector Channel Rollers	Lubricate 2 fittings	GAA	2-27
⑲ Bowl Lift Cylinders	Lubricate 4 fittings	GAA	2-27
⑳ Batteries	Check electrolyte levels		2-28
⑳ a Tires	Check the inflation pressures		2-28
Do item ㉘ after the first 50 Service Hours on a new or rebuilt machine.			
Every 250 Service Hours or Monthly			
㉑ Engine Crankcase	Change oil and filter[2]	OEA	2-29
㉒ Brake Master Cylinders	Check fluid levels	BFS	2-30
㉓ Brakes	Check wear—test		2-31
㉔ Elevator Center Rollers	Lubricate 2 fittings	GAA	2-33
㉕ Elevator Chain Adjuster Rollers	Lubricate 2 fittings	GAA	2-33
㉖ Belts	Check—adjust		2-33

[1]Check frequently if leakage is suspected.

[2]

FUEL SULPHUR CONTENT	OIL AND FILTER CHANGE INTERVAL
0% to 0.4%	Every 250 Service Hours
0.5% to 1.0%	Every 125 Service Hours
1.1% to 1.5%	Every 62 Service Hours

Item	Service	Lubricant	Page No.
Every 500 Service Hours or 3 Months			
(27) Hydraulic System	Change the filter element	OEA	2-36
(28) Transmission System	Change the filter element	OEA	2-37
(29) Cooling System	Follow the instructions in TB-750-651		2-38
(30) Fuel Tank	Wash cap—inspect seal—oil element —clean strainer		2-39
Every 1000 Service Hours or 6 Months			
(31) Transmission System	Change oil[1]—Wash screens—clean magnetic strainer—replace breather	OEA	2-40
(32) Drive Shaft Universal Joints	Lubricate 5 fittings	GAA	2-42
(33) Engine Valve Lash	Check—adjust		2-42
(34) ROPS Mounting Bolts	Tighten		2-43
(35) Seat Belt	Inspect—replace at least every 3 years		2-43
(35A) Air Dryer	Inspect-replace desiccant if too much water is in air reservoirs		
Every 2000 Service Hours or Yearly			
(36) Hydraulic System	Change oil—wash the filler strainer	OEA	2-44
(37) Differentials and Final Drives	Change lubricant	GO	2-45
(38) Elevator Speed Reducer	Change lubricant	GO	2-46
(39) Scraper Wheel Bearings	Pack bearings—adjust	GAA	2-47
(40) Cooling System	Follow the instructions in TB-750-651		2-48
(41) PVC Valve	Replace the diaphragm		2-50
When Required			
(42) Air Cleaner	Service when the red band in the indicator locks in the visible position		2-51
(43) Fuel System	Change the filter if the engine lacks power		2-55
(44) Cooling System	Drain and clean if the engine overheats or the solution is dirty according to the procedures in TB-750-651		2-56
(45) Cooling System Relief Cap	Clean or replace the cap if coolant loss or overheating is experienced		2-58
(46) Transmission System	Check the oil level if leakage is apparent or suspected	OEA	2-58
(47) Differentials and Final Drives	Check the lubricant level if leakage is apparent or suspected	GO	2-59

[1]Change oil anytime it becomes thick and black. Change it at the time of overhaul.

Item When Required	Service	Lubricant	Page No.
(48) Elevator Speed Reducer	Check the oil level frequently if leakage is apparent or suspected	GO	2-59
(49) Cutting Edges and Router Bits	Change or rotate before the mounting surfaces become worn		2-60
(50) Elevator Chain	Adjust if the chain sag is not between 7 to 10 inches (18 to 25 cm) from the bottom of the elevator frame		2-62
(51) Elevator Upper Shaft	Adjust if the upper shaft is not parallel to the lower shaft		2-63
(52) Cutting Edge Opening	Adjust the opening to a wide position for coarse material or a narrow position for fine material		2-64
(53) Circuit Breakers and Fuses	Replace fuses or reset circuit breakers if an electrical failure occurs		2-65
(54) Water Separator	Replace the element if it becomes contaminated enough that the water level cannot be seen		2-66
(55) Ether Starting Aid	Change the bottle when empty		2-67
(56) Windshield Washer and Wiper	Fill the washer bottle - replace worn wiper blades		2-68
(57) Engine and Transmission Oil Samples	Refer to TB 43-0210		2-69

Every 10 Service Hours or Daily

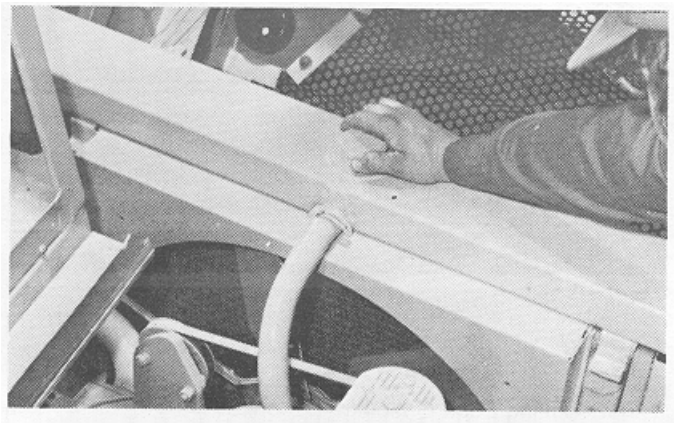
(1) Cooling System

WARNING

Always inspect the cooling system with the engine stopped.

Remove the radiator cap slowly to relieve pressure. Steam can cause personal injury.

1. Raise the hood.



2. Remove the radiator cap slowly to relieve pressure.

ATTN: EDITOR
INSERT MISSING PICTURE

3. Keep the coolant level within 1/2 inch (1 cm) of the bottom of the fill pipe.

4. Install the radiator cap. Close the hood.

If it is necessary to add coolant daily, inspect for leaks.

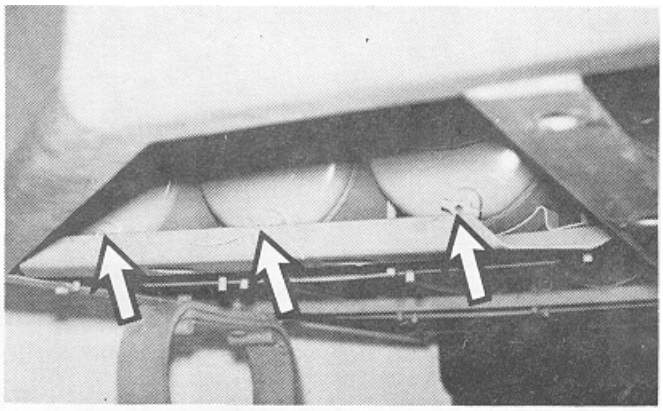
(2) Air Precleaner

Inspect for dust in the precleaner. If the dust level is up to the FULL mark, remove and empty the cup.

When it is dirty, remove and wash the entire precleaner in water.

Every 10 Service Hours or Daily

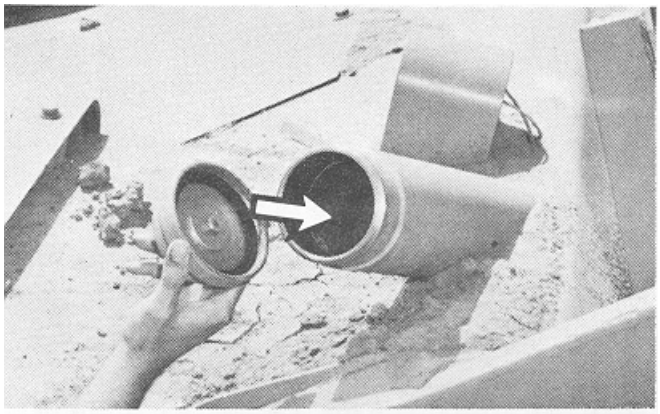
③ Air Reservoirs



1. Open the three air reservoir bleed valves.

2. Allow moisture and sediment to drain. Close the valves

④ **Fuel Tank**

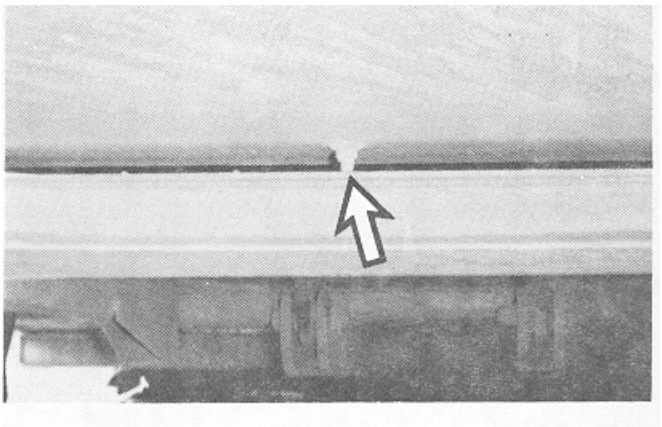


1. Fill the tank at the end of the day to drive out moisture laden air.

CAUTION

Do not overfill the tank. Fuel expands when it gets warm and can overflow.

2. Drain moisture and sediment from the tank at the start of each shift, or after it is filled and allowed to stand 5 to 10 minutes. Perform this only if ambient temperature is 32ºF (0ºC) or above.

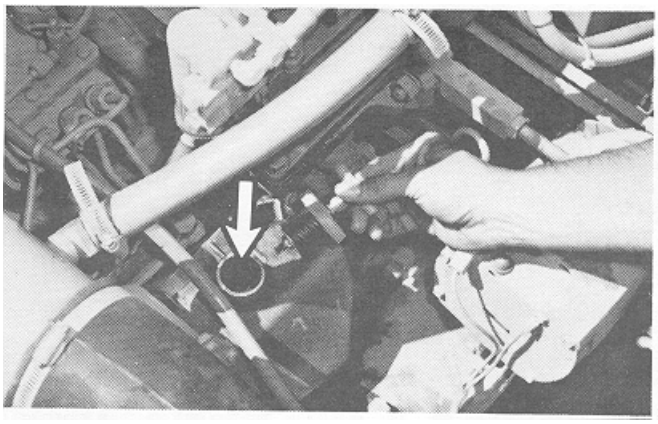


3. Open the drain valve. Allow the moisture and sediment to drain. Close the valve.

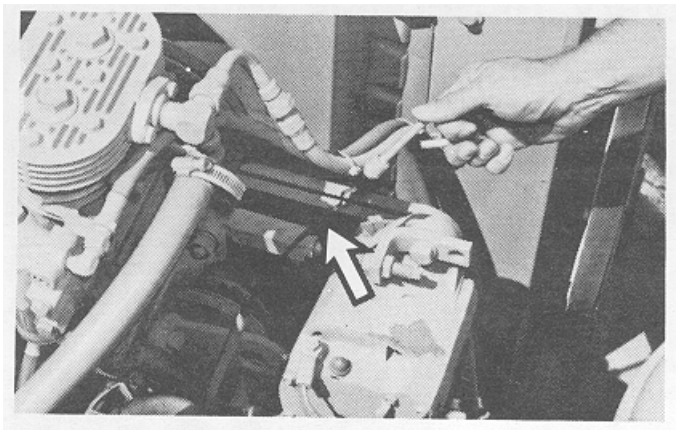
(5) Engine Crankcase

The machine must be level with the bowl lowered, the parking brake applied and the engine stopped.

1. Raise the hood.



3. If oil must be added, remove the fill tube plug.



2. Keep the oil level between the ADD and FULL marks on the dipstick.

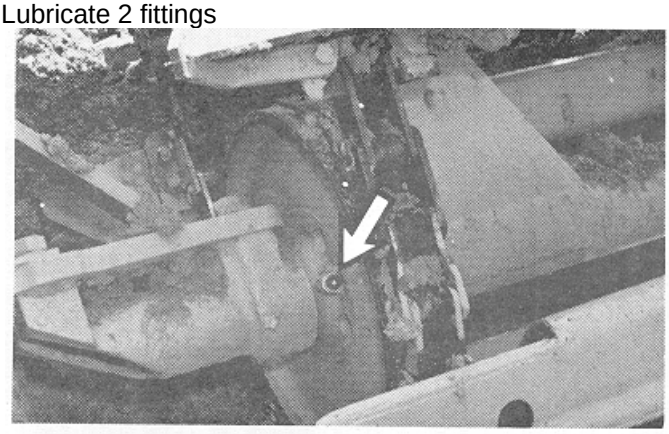
CAUTION

Do not overfill the engine crankcase.

4. Install the fill plug. Close the hood.

(6) Elevator Idler Rollers

Lubricate 2 fittings

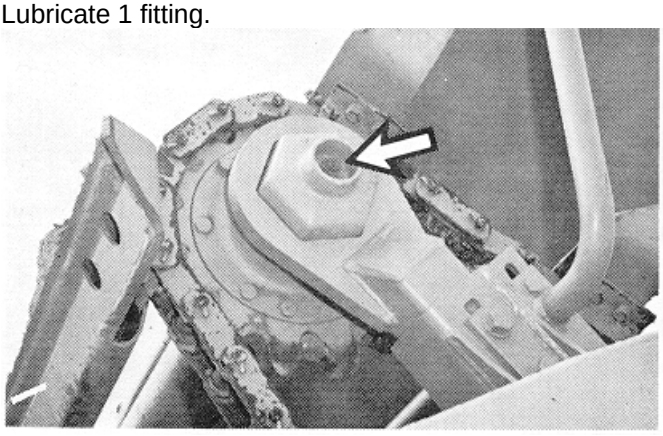


Lubricate 1 fitting on each idler roller.

Every 10 Service Hours or Daily

(7) Elevator Sprocket Shaft Support

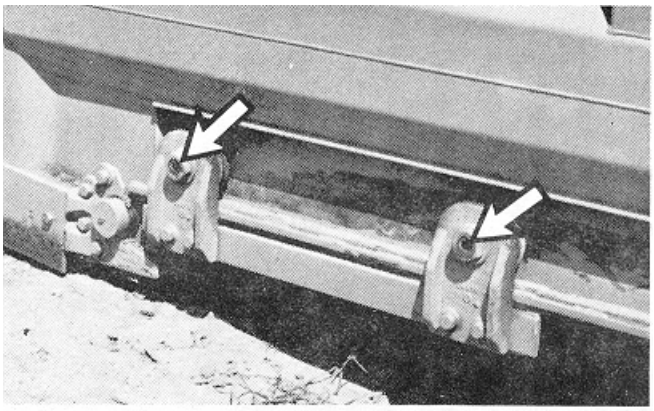
Lubricate 1 fitting.



Lubricate 1 fitting at the right hand sprocket shaft support.

(6) Floor Rollers

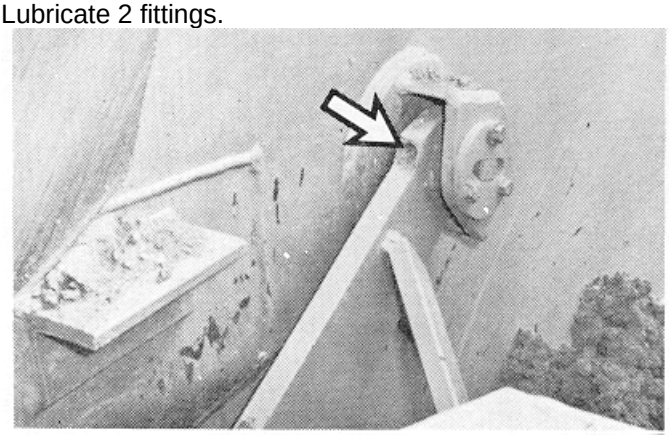
Lubricate 4 fittings.



Lubricate 2 fittings on each side of the floor.

(9) Elevator Link Pins

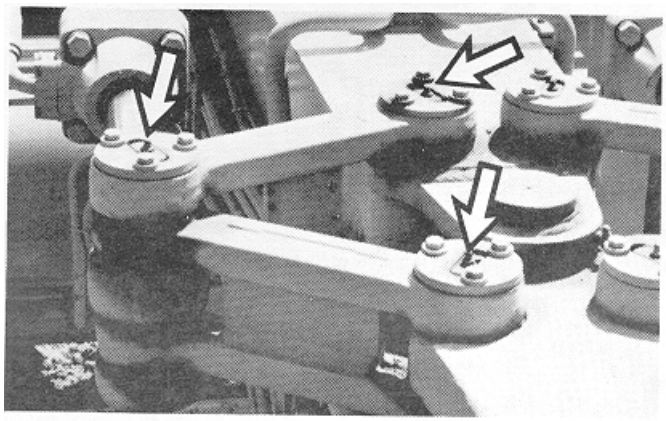
Lubricate 2 fittings.



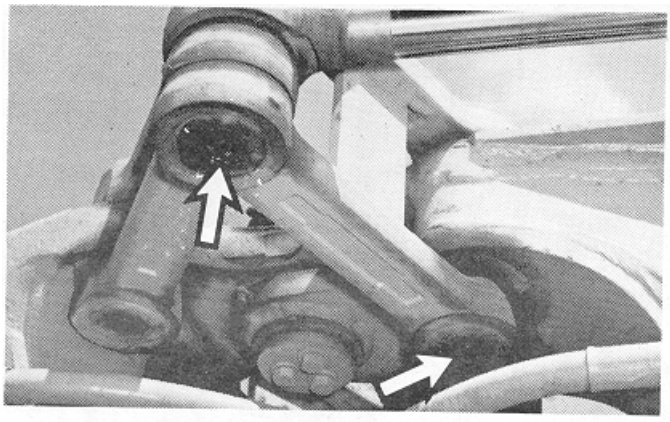
Lubricate 1 fitting on each side.

(10) Steering Link Bearings

Lubricate 10 fittings.



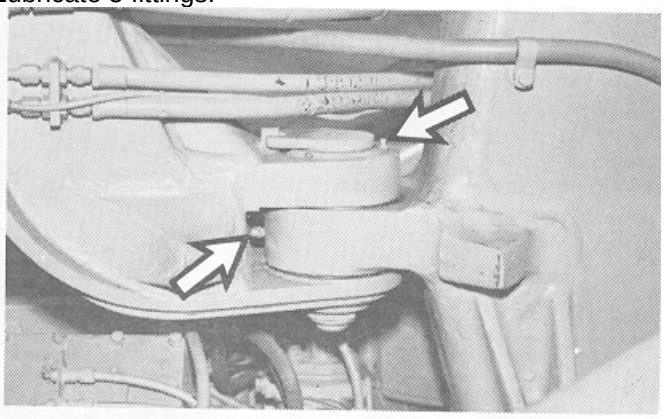
Lubricate 3 fittings on each side.



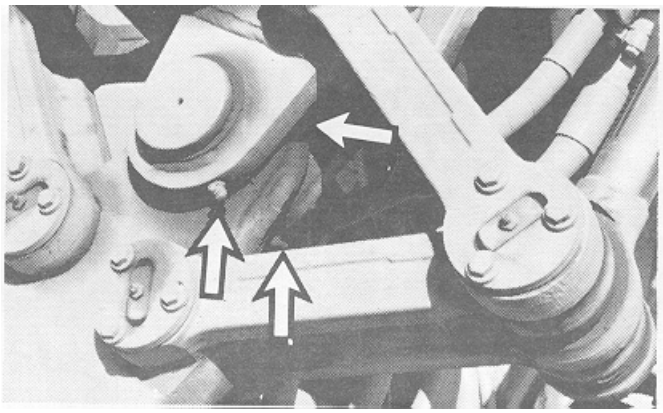
Lubricate 2 fittings on each side.

(11) Kingbolt Bearings

Lubricate 5 fittings.



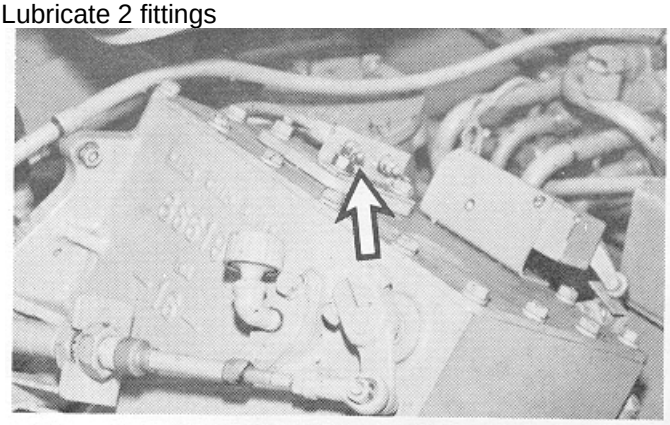
Lubricate 2 fittings for the lower kingbolt bearings.



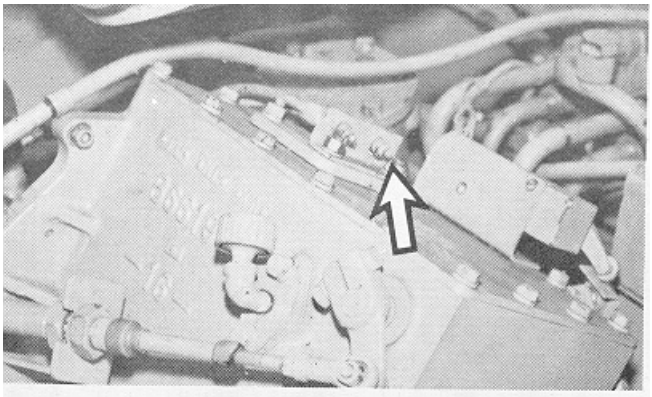
Lubricate 3 fittings for the upper kingbolt bearings.

(12) Horizontal Pivot Bearings

Lubricate 2 fittings



Lubricate 1 fitting for the front horizontal pivot bearing.



Lubricate 1 fitting for the rear horizontal pivot bearing

Every 10 Service Hours or Daily

(13) Tires

WARNING

Improperly inflated tires can cause excessive heat build-up. This will result in blowouts.

Visually inspect the tires for proper inflation, and for cuts, gouges, blisters or tread separation.

Check the tire pressure if a tire appears over or under inflated.

CAUTION

Over or under inflated tires can cause a drastic reduction in tire and rim life.

Keep the valve caps on to prevent dirt from entering the valves. Valve damage can occur.

(14) Water Separator

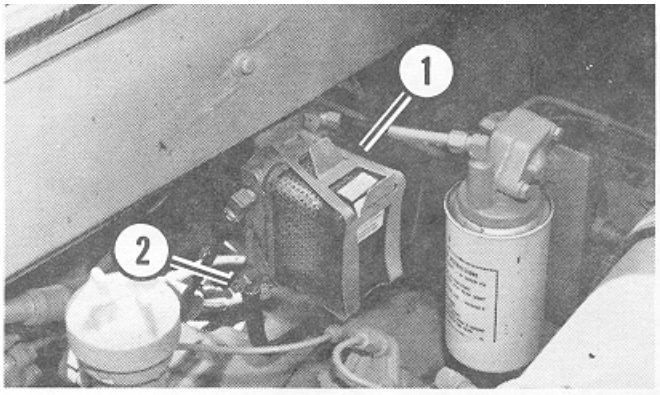
CAUTION

Drain any water in the water separator before starting the engine.

Anytime the water separator becomes one-half full, stop the engine and drain the separator.

When the cover is dirty enough that the water level cannot be seen, the element must be changed. See WATER SEPARATOR in WHEN REQUIRED.

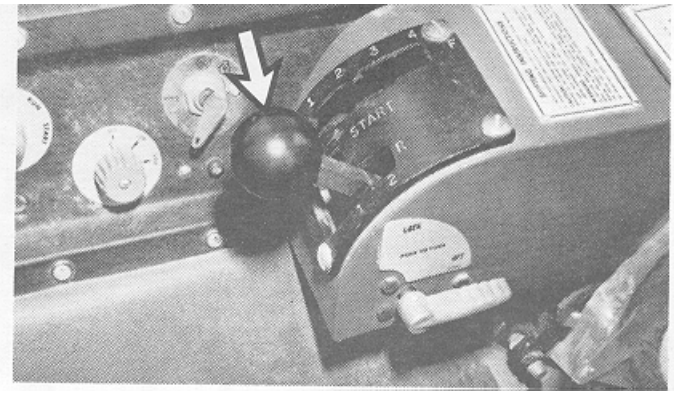
1. Open the hood.



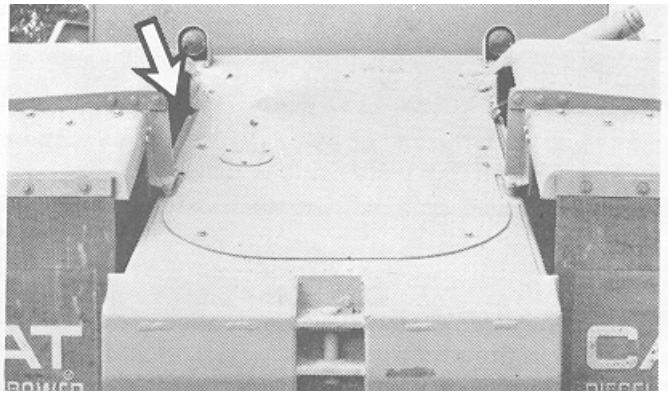
2. Open vent valve (1). Open drain valve (2) and allow the water to drain.

3. Close the valves.

(15) Back-Up Alarm

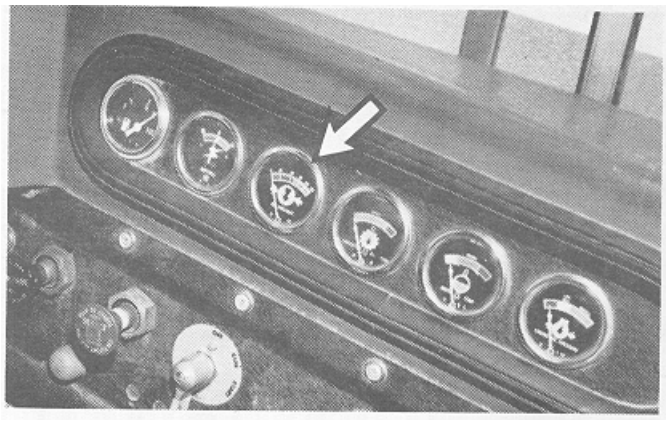


Start the engine. Apply the service brake. Unlock the transmission control lever. Move it to the reverse position.



The back-up alarm, at the rear of the scraper, should sound.

(16) Low Air Pressure Warning Horn



1. Start the engine. Allow the air pressure to reach the normal range on the gauge.

2. Stop the engine.

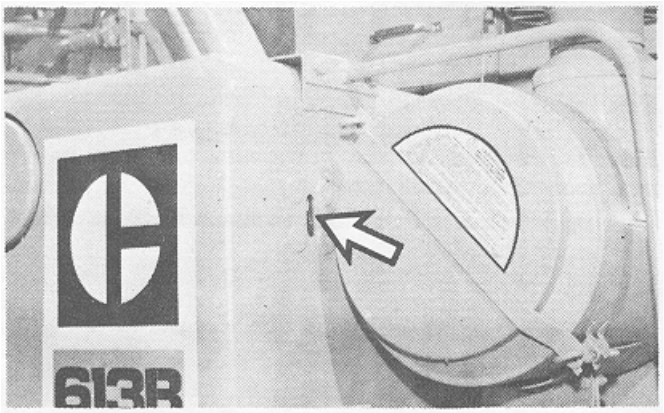
3. Leave the disconnect switch on. Pump the service brake slowly. When the air pressure drops to 60 psi (415 kPa), the electric warning horn should sound.

4. Make any necessary repairs before operating the machine.

Every 50 Service Hours or W

(17) Hydraulic System

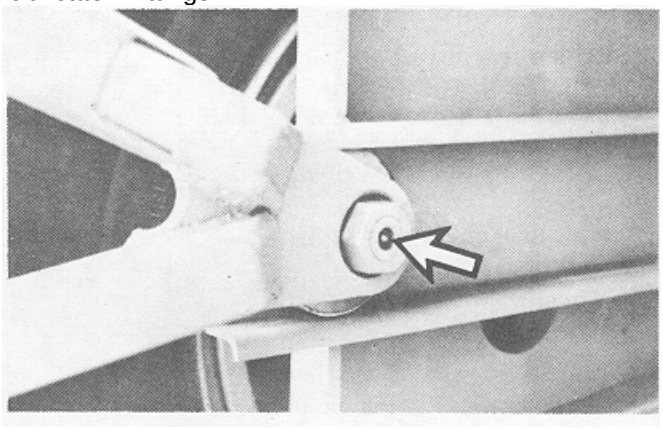
The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine. The hydraulic oil must be cold.



Keep the oil level between the ADD and FULL marks on the sight gauge.

(18) Ejector Channel Rollers

Lubricate 2 fittings



Lubricate 1 fitting at each roller.

(19) Bowl Lift Cylinders

Lubricate 4 fittings

Lubricate 2 fittings on each lift cylinder.

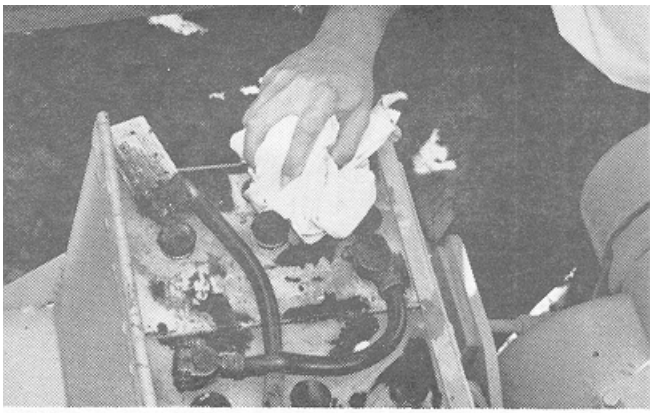
(20) Batteries

WARNING

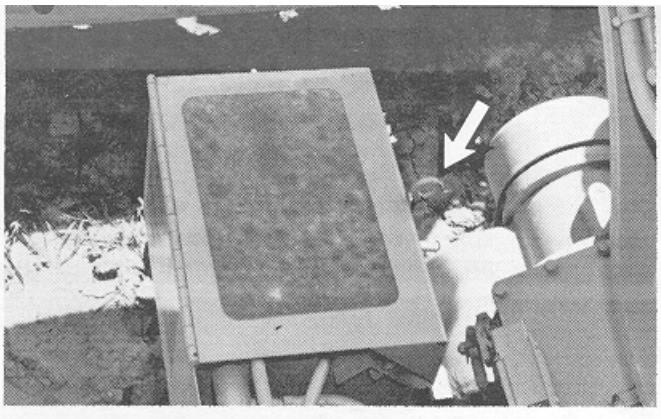
Batteries give off flammable fumes that can explode. Do not smoke when observing electrolyte levels.

Electrolyte is an acid. It can cause personal injury if it contacts skin or eyes.

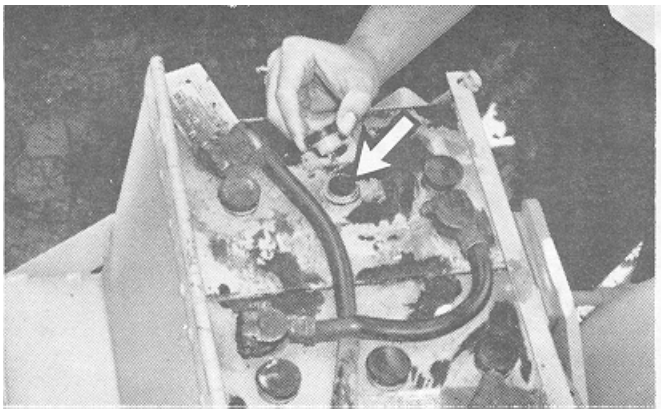
At the proper charging rate, in a moderate climate, a battery should not require more than 1 ounce (30 cc) of water per cell per week.



2. Clean the top of the batteries. Clean the posts and coat them with GAA.



1. Unlatch and open battery box.



3. Check the electrolyte level in each battery cell. Keep the level to the bottom of the fill opening with distilled water. Close the covers.

(20)a Tires--Check Pressure

WARNING

Use self-attaching air chuck and stand behind the tread of a tire when inflating.

Check the tire pressure cold at operating ambient temperature. Use a Caterpillar Part Number 9S6524 or 1P545 Tire Pressure Gauge.

If you are inflating a tire in a heated area, but the machine will operate in a cooler temperature, see the Adjusted Inflation Pressure Chart on page 2-11.

See Tire Inflation Information Chart, page 2-11, for the correct inflation pressure for your job conditions.

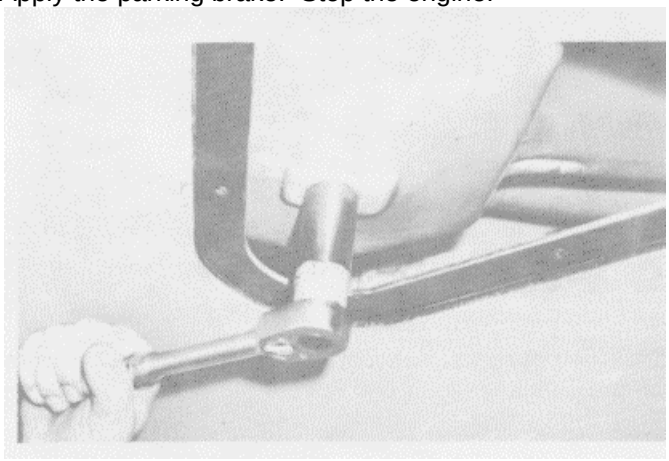
Every 250 Service Hours or Monthly

(21) Engine Crankcase

WARNING

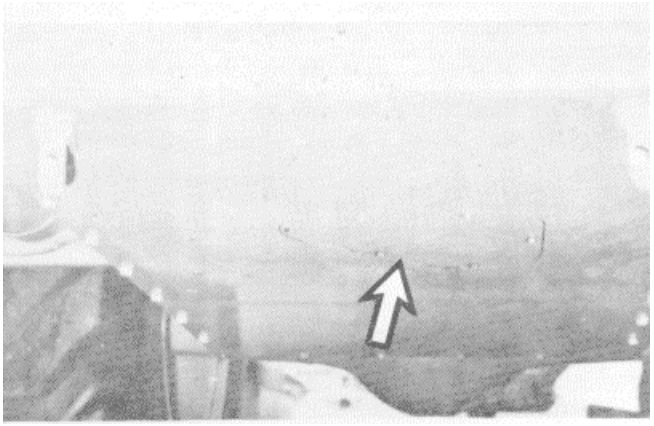
Hot oil or components can cause personal injury. Do not allow hot oil or components to contact skin.

The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine.

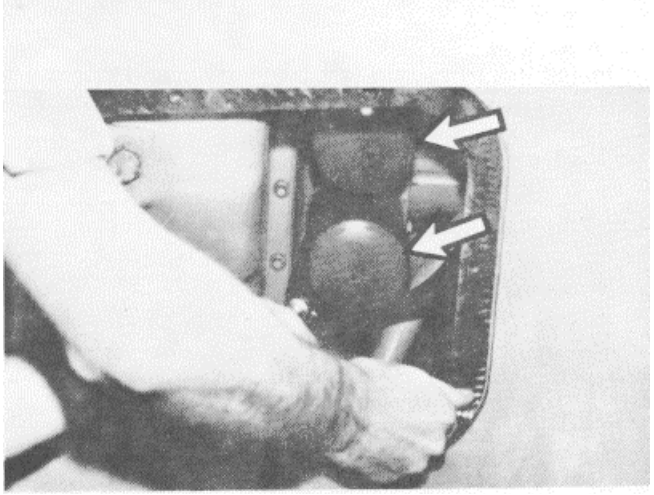


2. Remove the drain plug. Allow the oil to drain.

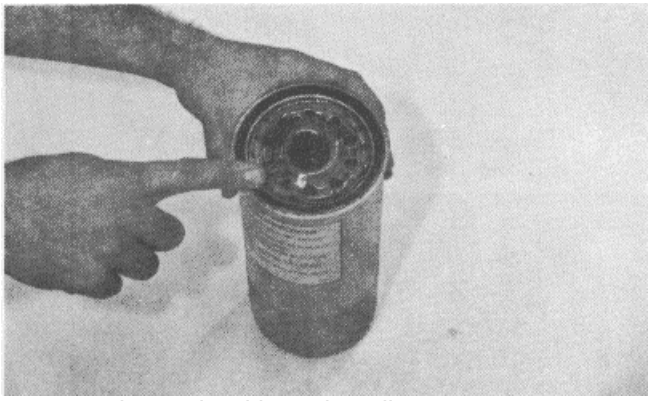
4. Clean the filter base. Be sure all of the used seals are removed.



1. Remove the crankcase drain plug access plate.



3. Remove the two used filters.



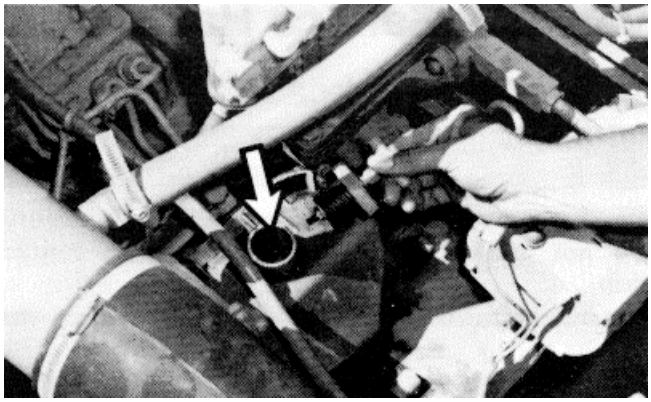
5. Coat the seals with engine oil.

6. Install the new filters by hand. When the seal contacts the base, tighten an additional 3/4 turn.

CAUTION
Do not overtighten the filters.

Use the index marks on the filter as a guide for proper tightening.

7. Install the crankcase drain plug. Install the access plate.



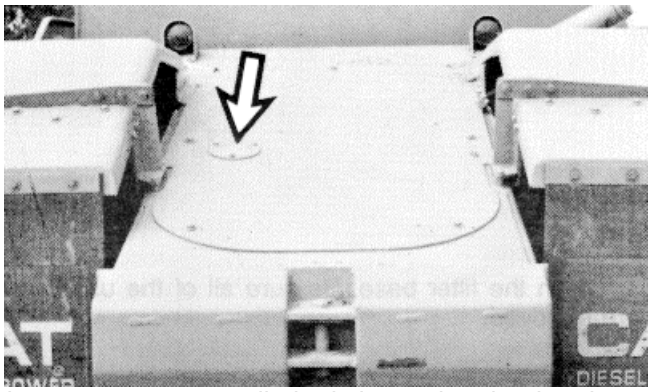
8. Raise and block the hood. Remove the fill plug. Fill the crankcase with oil. See Refill capacities.

9. Install the fill plug. Start the engine and operate at low idle.

10. Check for leaks.

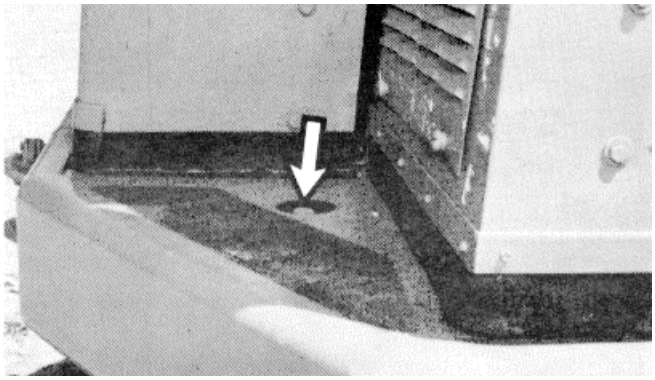
11. Stop the engine. Check the oil level.

12. Keep the level between the ADD and FULL marks on the dipstick. Close and secure the hood.



The scraper master cylinder is located under the plate at the rear of the scraper.

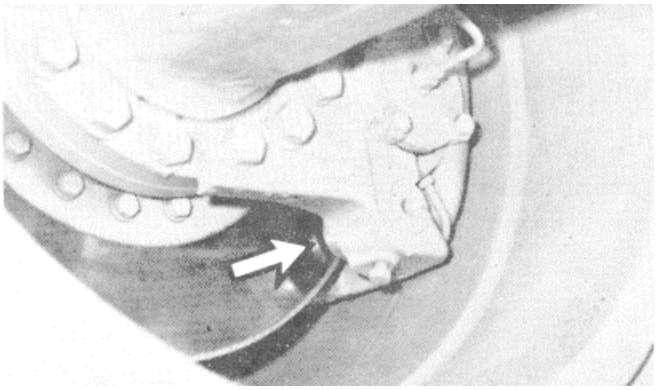
(22) Brake Master Cylinders



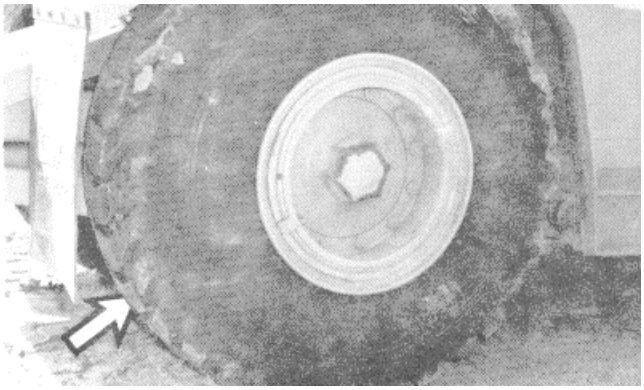
Remove the fill plugs from the tractor and the scraper brake master cylinders. Keep the fluid level to the bottom of the plug openings. Install the plugs.

Every 250 Service Hours or Monthly

(23) Brakes



1. Inspect the tractor brake pads for excessive wear. (The brakes are self-adjusting).



2. Inspect the scraper brake pads for excessive wear. Have worn brake pads replaced.

To Test the Parking and Emergency Brakes

WARNING

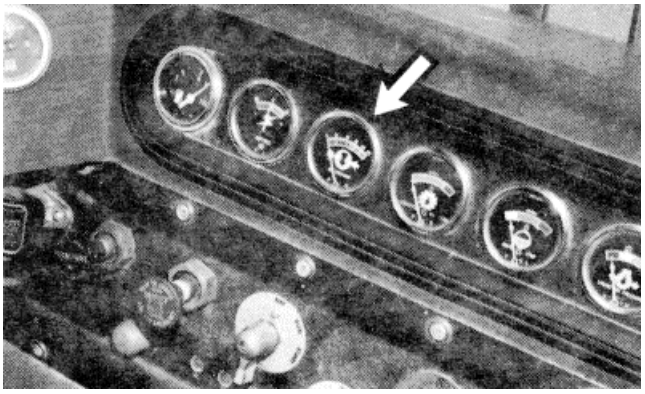
Be sure the machine area is free of personnel and obstacles.

Fasten the seat belt.

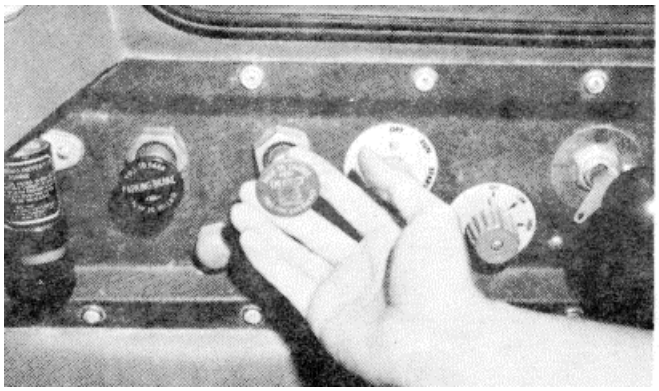
Make needed repairs an any brake system before operating the machine.

The machine must be on level ground. The bowl must be lowered. Apply the parking brake.

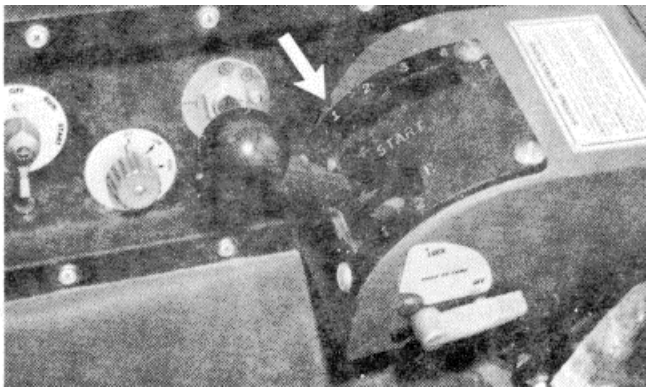
Emergency Brake:



1. Start the engine. Allow the air pressure to reach the normal operating range.



2. Pull the button to apply the emergency brake.



3. Apply the service brake. Shift the transmission to 1st speed.

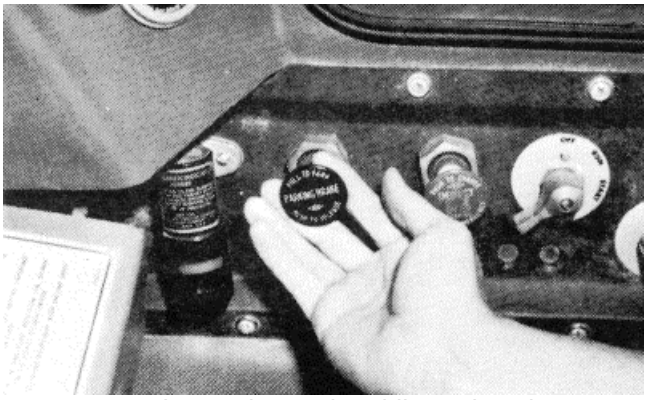
4. Push the button to release the parking brake. Be sure the button stays in.

5. Operate the engine at low idle. Raise the bowl. Release the Service brake. The Emergency brake should prevent machine movement.

6. Apply the service brake. Shift the transmission to NEUTRAL. Apply the parking brake.

7. Push the button to release the emergency brake. Be sure it stays in.

Parking Brake:

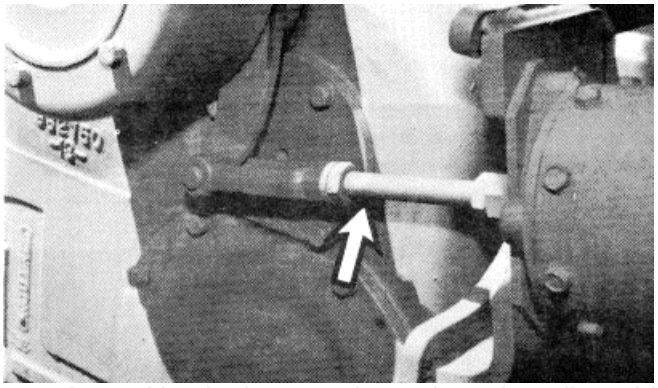


1. Operate the engine at low idle. The air pressure must be in the operating range. Release the emergency brake. Apply the service brake. Pull the button to apply the parking brake.

2. Raise the bowl. Move the transmission control to 1st speed.

3. Release the service brake. The parking brake should prevent the machine from moving.

4. Apply the service brake. Shift the transmission to NEUTRAL. Lower the bowl. Stop the engine.



5. The parking brake actuating rod can be adjusted if the linings are worn.

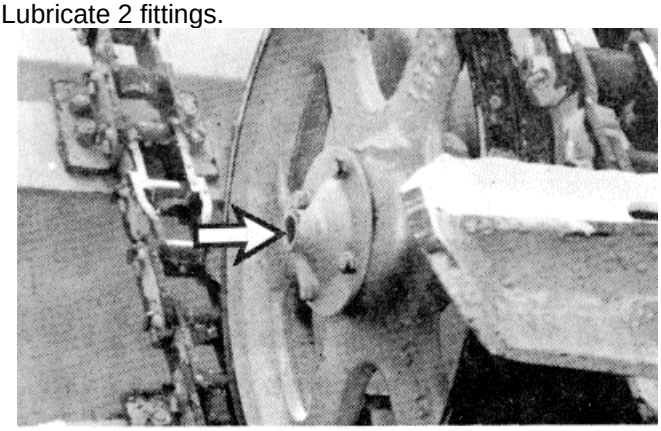
To adjust the brake, remove the cotter and pin from the rod end. Turn the rod end counterclockwise to reduce rod travel. Connect the rod end to the brake with the pin and cotter.

6. Have repairs made if the adjustment cannot be made or any brake system is damaged.

Every 250 Service Hours or Monthly

(24) Elevator Center Rollers

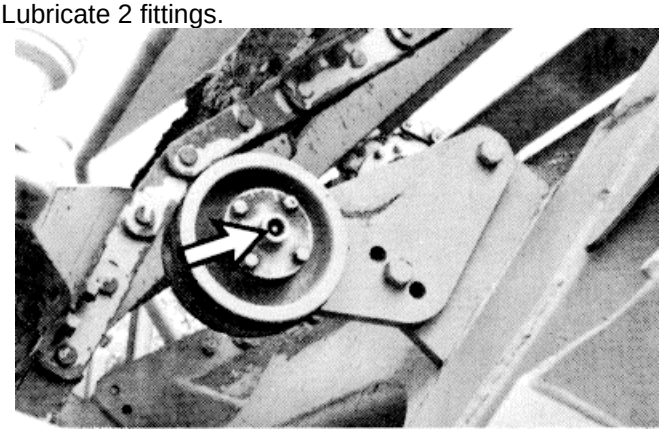
Lubricate 2 fittings.



Lubricate 1 fitting on each roller.

(25) Elevator Chain Adjuster Rollers

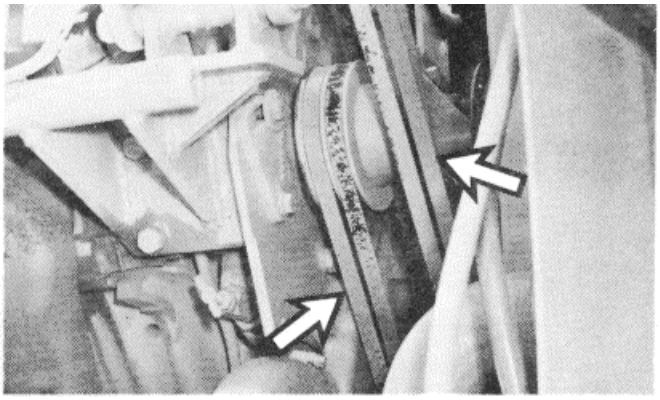
Lubricate 2 fittings.



Lubricate 1 fitting on each roller.

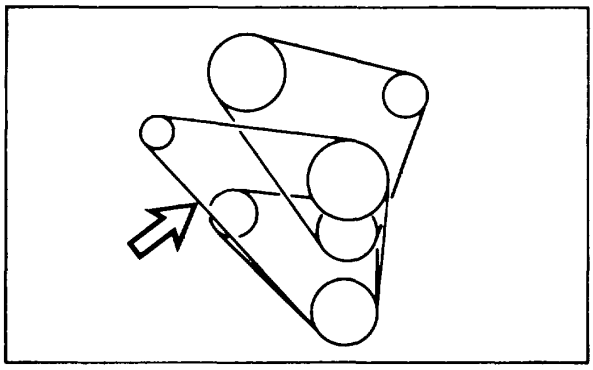
(26) Belts

Stop the engine. Raise the hood.

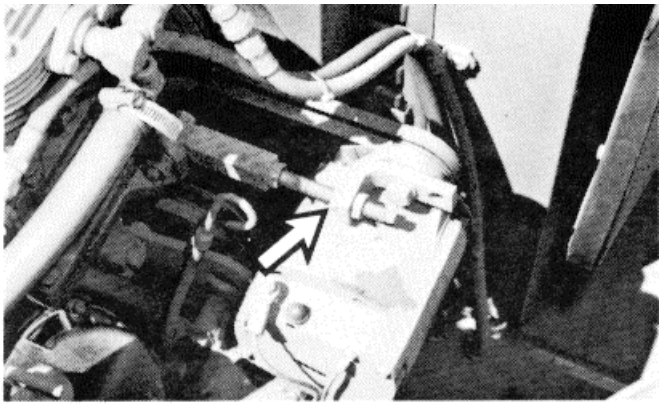


Check the condition and adjustment of the belts. Replace the fan and alternator, or water pump belts only as sets.

Fan and Alternator Belts

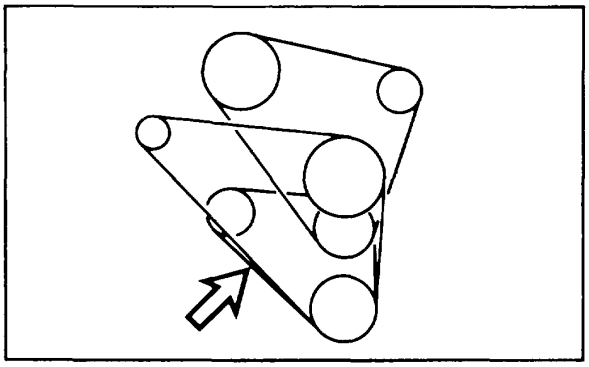


Apply a 25 lb. (110 N) force midway between the pulleys on each belt. Each belt should deflect between 9/16 and 13/16 inches (14 to 20 mm). Adjust the belts if necessary.



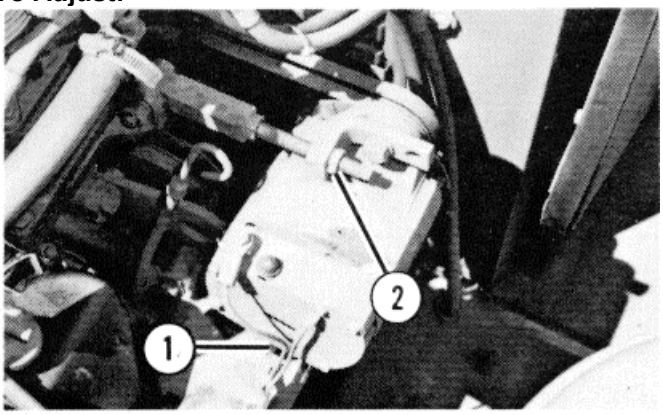
2. Move the adjusting nut in or out to obtain the correct adjustment.

Water Pump Belts



Apply a 25 lb. (110 N) force midway between pulleys on each belt. Each belt should deflect between 9/16 and 13/16 inches (14 to 20 mm). Adjust the belts if necessary.

To Adjust:

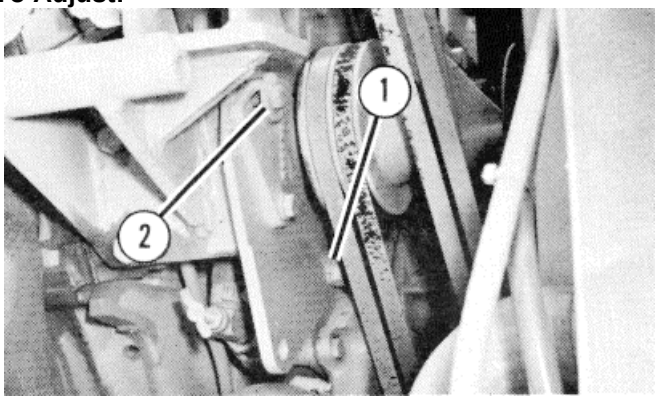


1. Loosen the alternator mounting bolt (1) and the adjuster locknut (2).

3. Tighten the adjuster locknut and the alternator mounting bolt.

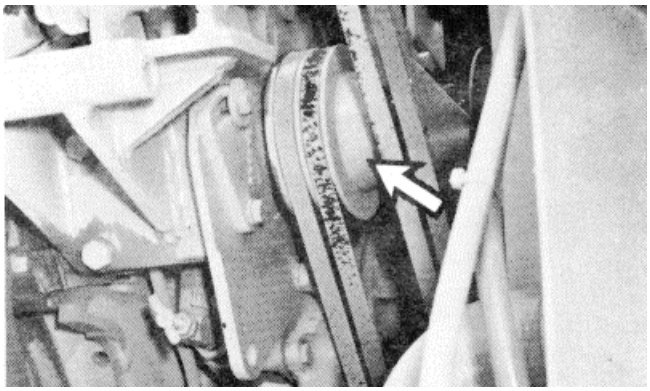
4. Recheck the adjustment.

To Adjust:



1. Loosen the idler pulley bracket mounting bolt (1) and the adjustment bolt (2).

Every 250 Service Hours or Monthly

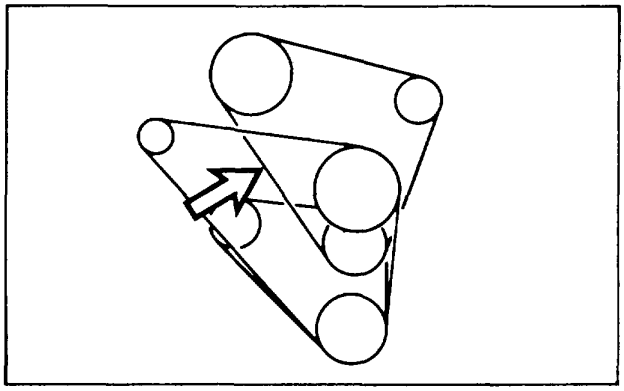


2. Move the pulley to tighten or loosen the belts.

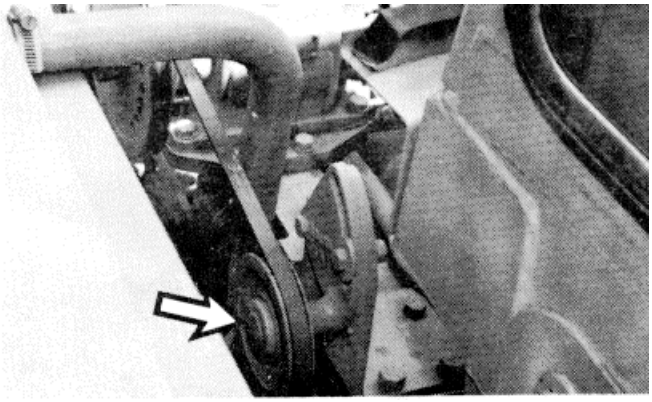
3. Tighten the adjustment bolt and bracket mounting bolt.

4. Recheck the adjustment.

Air Compressor Belt

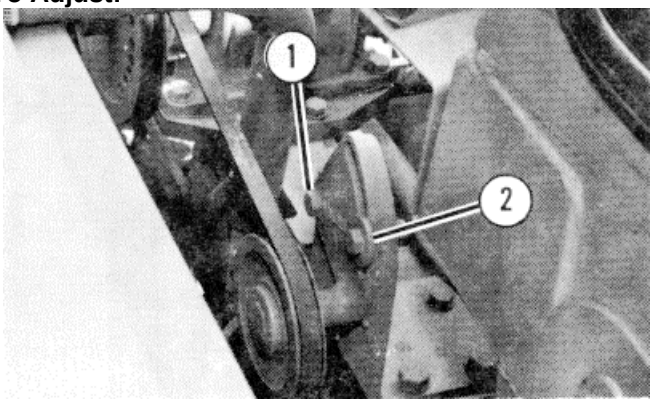


Apply a 25 lb. (110 N) force midway between pulleys. The belt should deflect 9/16 to 13/16 inch (14 to 20 mm). Adjust the belt if necessary.



2. Move the pulley as required to tighten or loosen the belt.

To Adjust:



1. Loosen the idler pulley mounting bolt (1) and the adjustment bolt (2).

3. Tighten the adjustment bolt and the bracket mounting bolt.

4. Recheck the adjustment.

Every 500 Service Hours or 3 Months

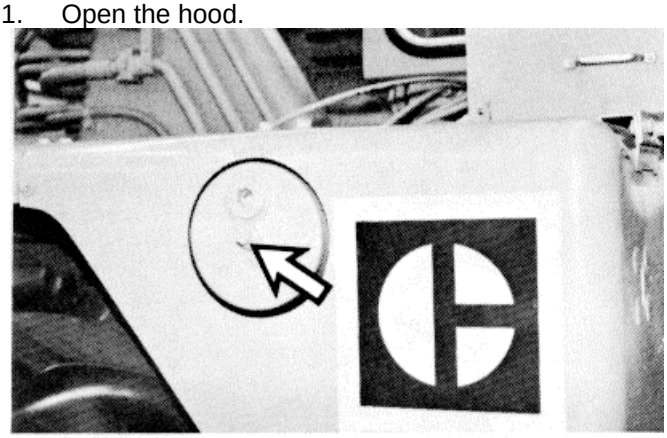
(27) Hydraulic System

WARNING

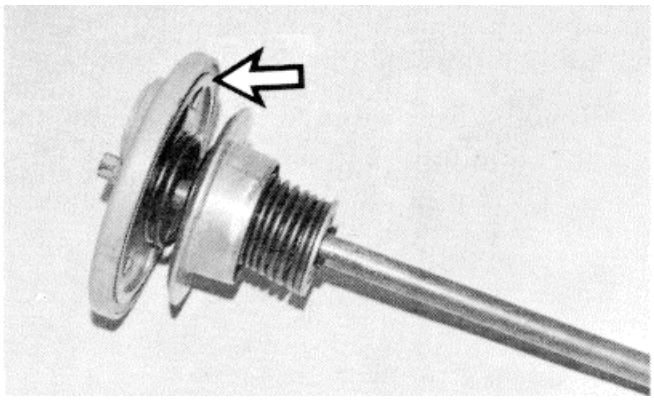
Hot oil or components can cause personal injury. Do not allow hot oil or components to contact skin.

The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine.

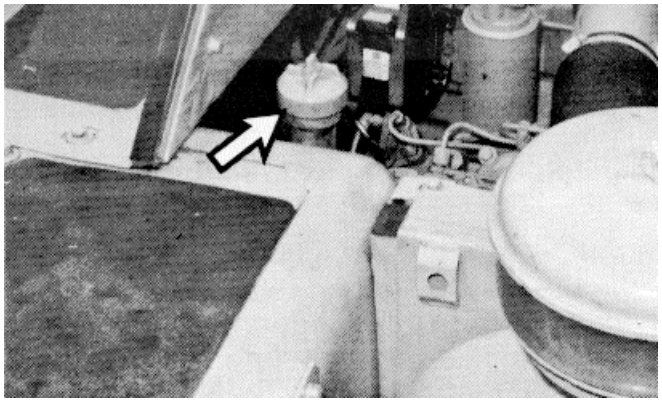
1. Open the hood.



3. Loosen the cover bolt. Remove the cover and the filter elements from the tank.

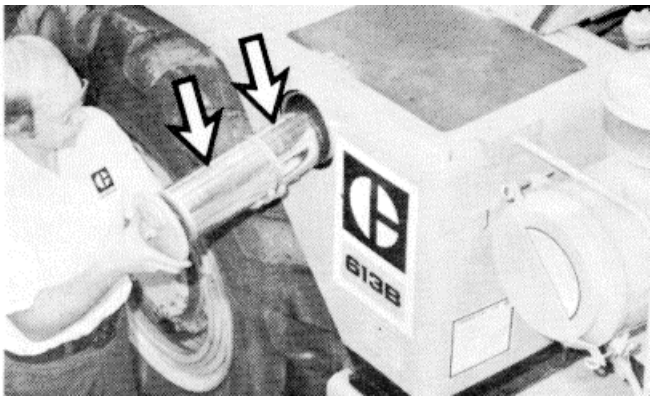


5. Replace the cover gasket if it is damaged.



2. Remove the hydraulic tank fill cap slowly to relieve pressure.

4. Wash the cover assembly in clean, non-flammable solvent. Allow it to dry.



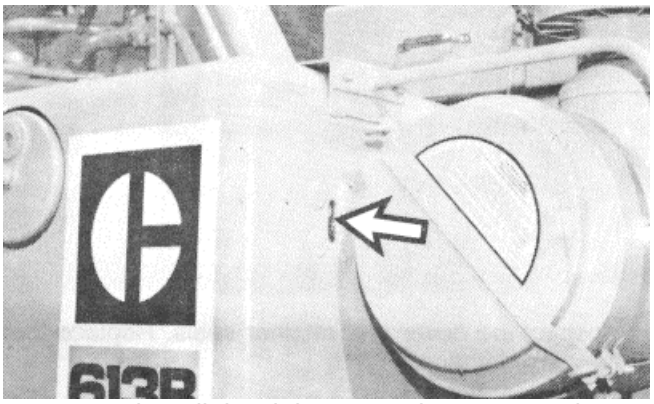
6. Install two new filters and the cover assembly in the tank. Tighten the cover bolt to 60 $\pm$ 5 lb. ft. (80 $\pm$ 7N.m).

Every 500 Service Hours or 3 Months

7. Clean and install the fill cap.

8. Start the engine and operate at low idle to allow the hydraulic oil to circulate.

9. Stop the engine.



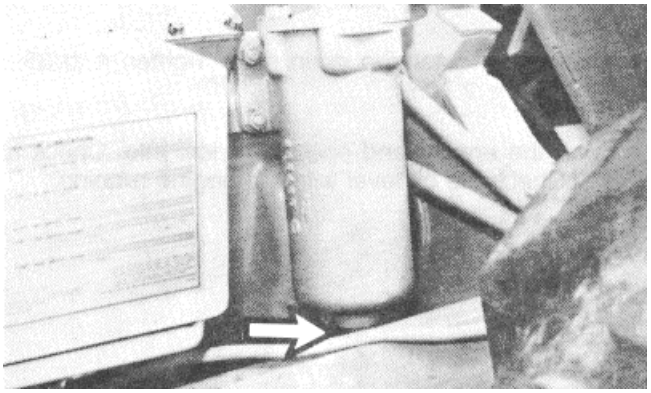
10. Keep the oil level between the ADD and FULL marks on the sight gauge.

(28) Transmission System

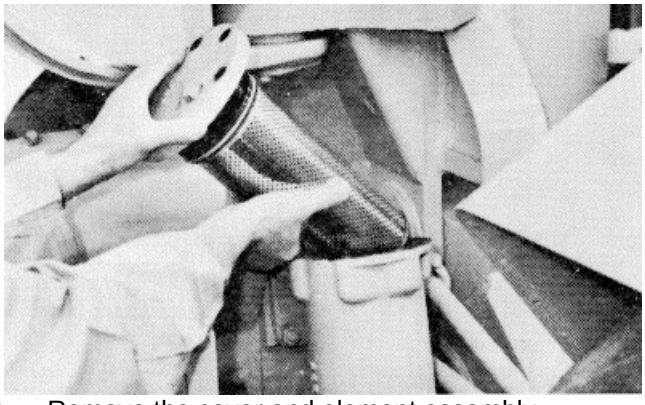
WARNING

Hot oil or components can cause personal injury. Do not allow hot oil or components to contact skin.

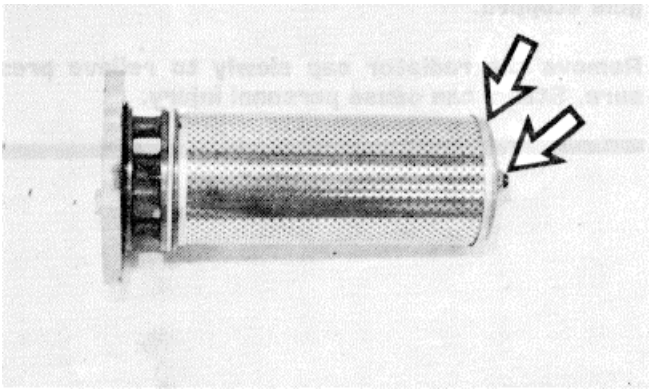
The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine.



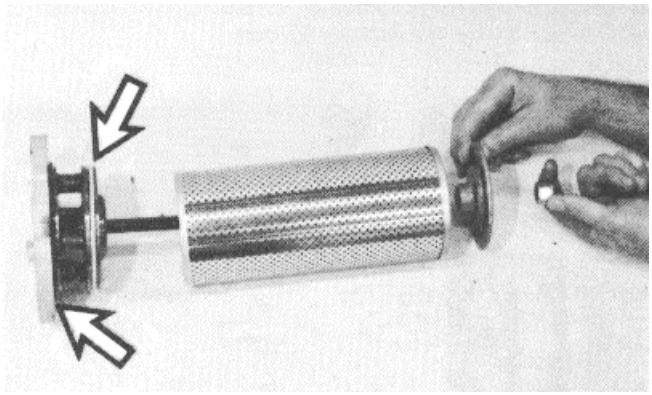
1. Remove the filter drain plug. Allow the oil to drain.



2. Remove the cover and element assembly.



3. Remove the retaining nut and the retainer. Remove the used filter element. Wash the cover and retainer in clean non-flammable solvent. Allow them to dry.



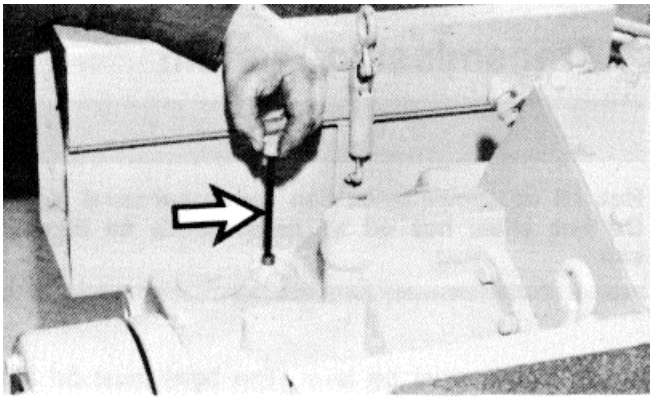
4. Inspect the cover and retainer seals. Replace them if they are damaged.

5. Assemble the new element to the cover. Install the retainer and nut. Torque the nut to 12 $\pm$ 2 lb. ft. (17 $\pm$ N.m).

6. Install the cover and element assembly carefully to avoid seal damage.

7. Clean and install the drain plug. Tighten it to 35 $\pm$ 5 lb. ft. (45 $\pm$ 7 N.m).

8. Start the engine and operate at low idle. Check for leaks. Check the oil level with the engine running.



9. Keep the level between the ADD and FULL marks on the dipstick.

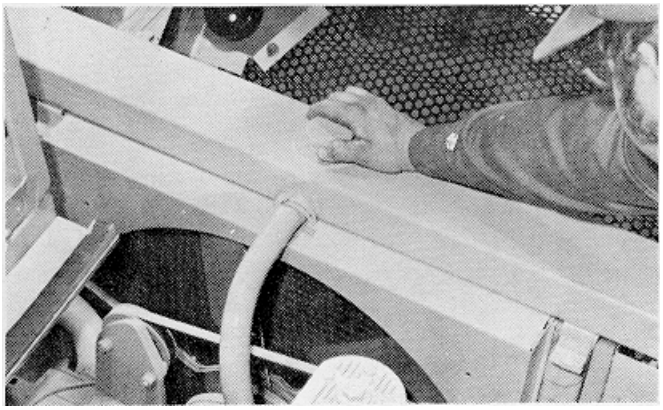
(29) Cooling System

WARNING

Always inspect the cooling system with the engine stopped.

Remove the radiator cap slowly to relieve pressure. Steam can cause personal injury.

Every 500 Service Hours or 3 Months

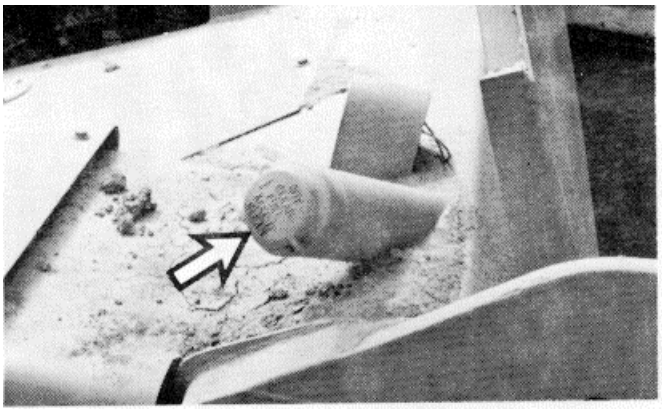


1. Raise the hood. Remove the radiator cap slowly to relieve pressure in the system.

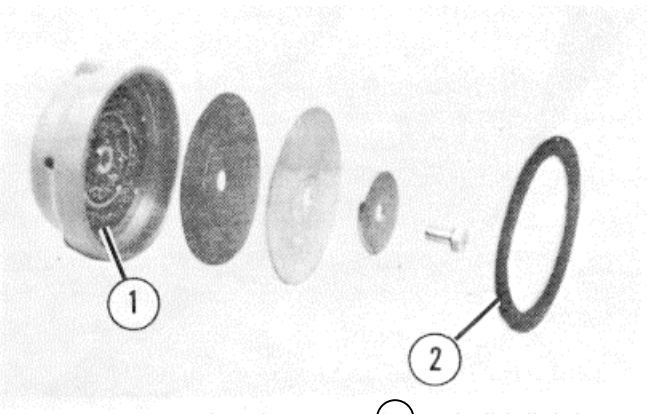
2. Follow the directions in TB-750-651 for checking and maintaining the cooling system coolant.

3. Replace the radiator cap if the seal is damaged. Install the cap.

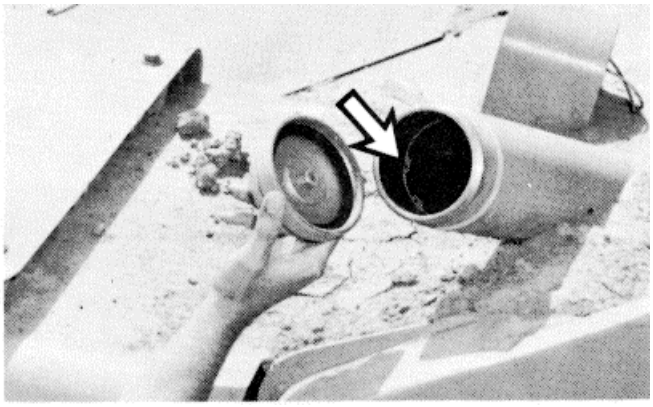
(30) Fuel Tank



1. Remove the fuel tank cap. Disassemble the cap and wash the parts in clean non-flammable solve



2. Squeeze the element 1 dry and oil it lightly. Inspect the seal 2 . Replace it if it is damaged. Reassemble the cap.



3. Remove the lockring and strainer from the opening. Wash the strainer in clean non-flammable solvent.

4. Install the strainer and lockring. Install the tank cap.

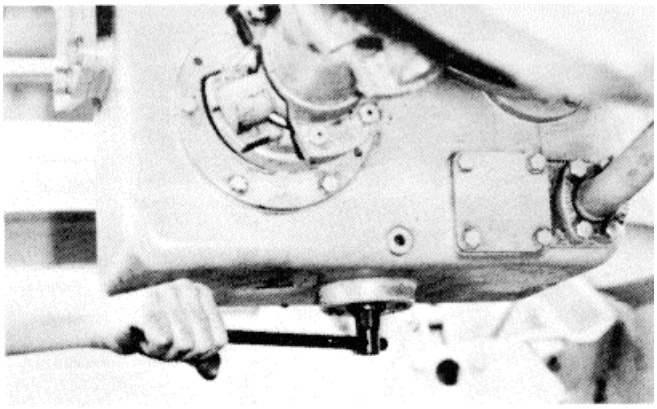
Every 1, 000 Service Hours or 6 Months

(31) Transmission System

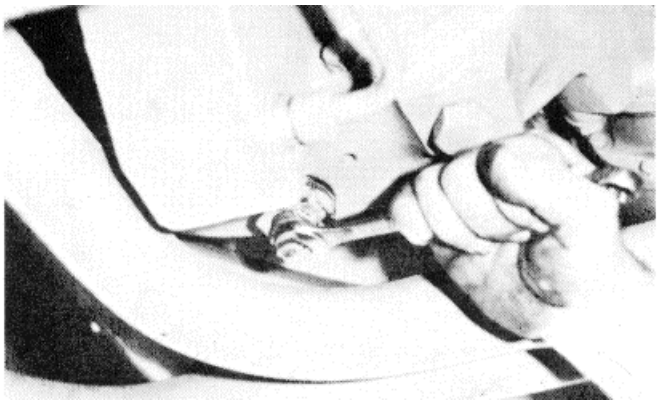
WARNING

Hot oil or components can cause personal injury. Do not allow hot oil or components to contact skin.

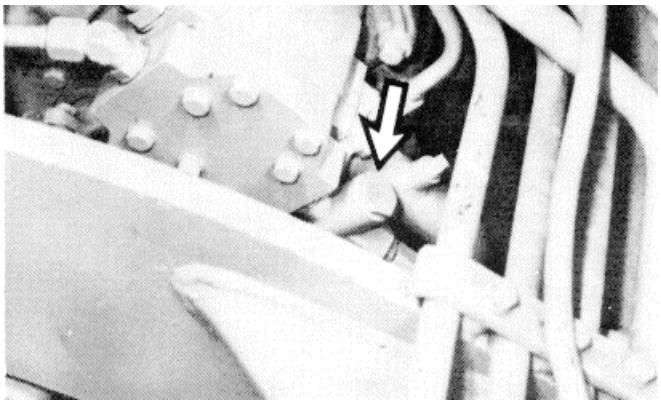
The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine.



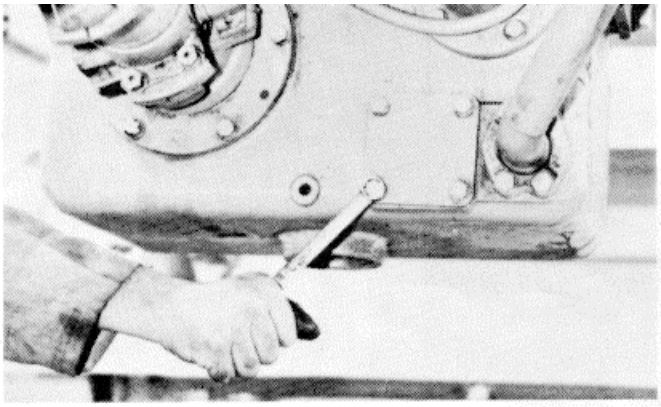
1. Remove the plug from the bottom of the transfer case. Allow the oil to drain.



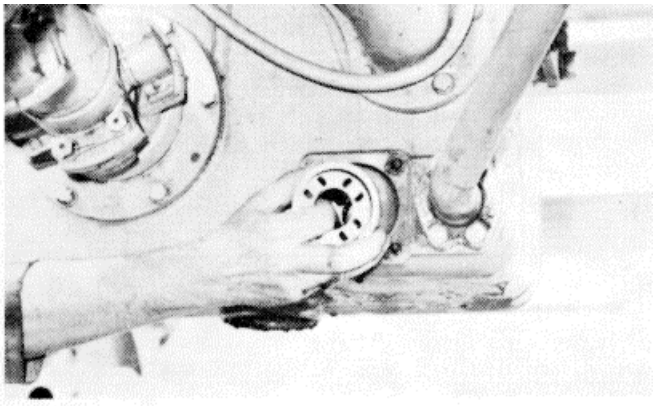
2. Remove the crankcase guard. Remove the converter sump drain plug. Allow the oil to drain.



3. Remove the cap and screen from the tee in the converter scavenge line. Wash the parts in clean nonflammable solvent. Install the screen and cap.



4. Remove the cover at the lower front of the transfer case.



5. Remove the screen and magnet assembly.

Every 1, 000 Service Hours or 6 Months

6. Separate the magnets from the screen. Wash the parts in clean non-flammable solvent.

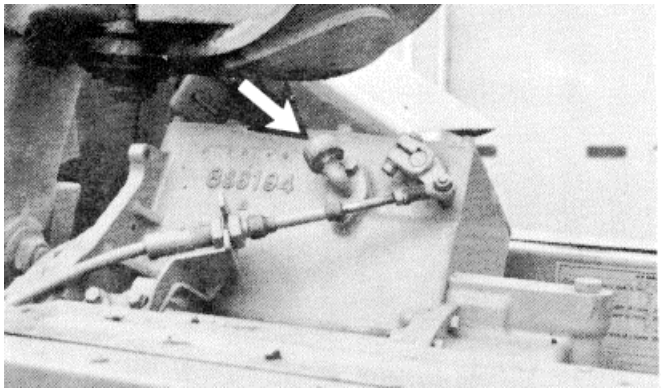
CAUTION

Do not rap the magnets on hard objects. Replace the magnetic filter if it is damaged.

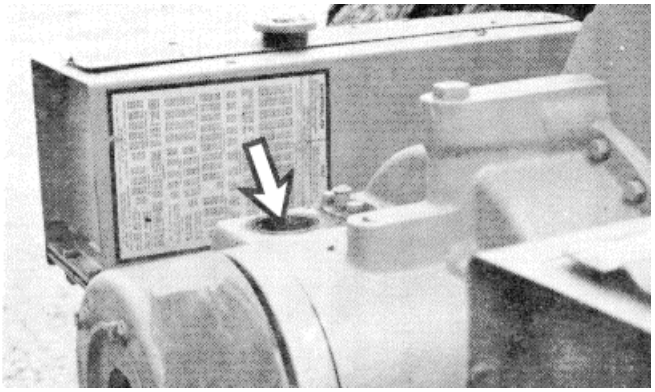
7. Clean the magnets with a cloth or stiff brush.

8. Insert the magnets inside the screen. Install the screen and magnet assembly and the cover.

9. Install the transfer case and converter sump drain plugs.



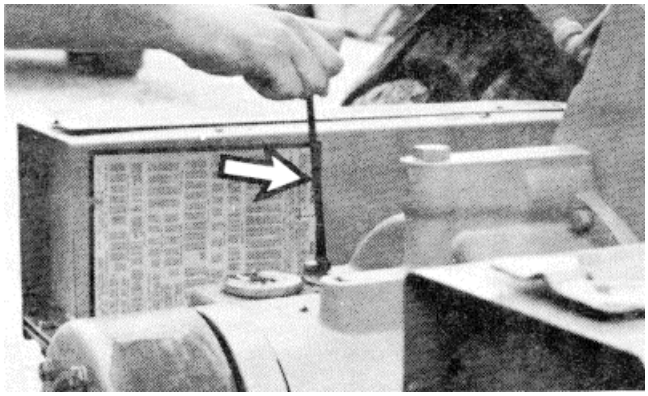
10. Remove the transmission breather. Install a breather.



11. Fill the transmission with oil. See Refill Capacities (page 2-9).

12. Start the engine. Allow the oil to circulate.

13. Check for leaks. Check the oil level with the engine running.



14. Maintain the level between the ADD and FULL marks on the dipstick.

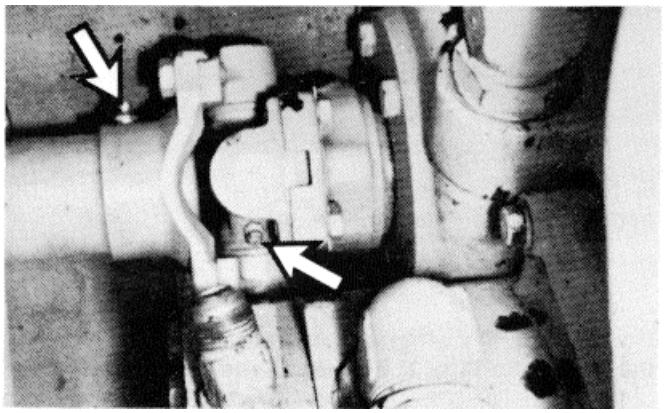
(32) Drive Shaft Universal Join

Lubricate 5 fittings.

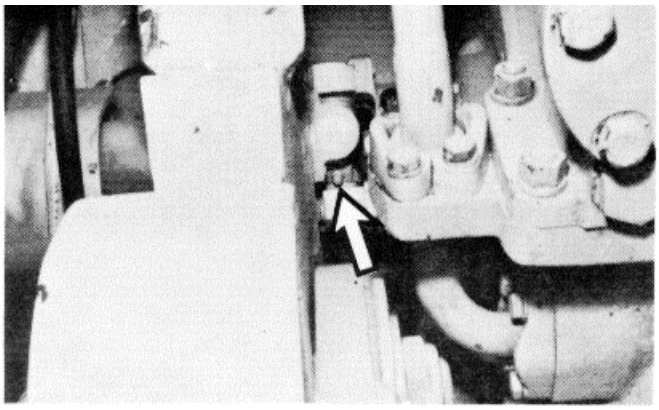
CAUTION

Slowly lubricate the universal joints with a lever-type hand gun. The use of pressure-type lubricating equipment will cause the seals to be damaged.

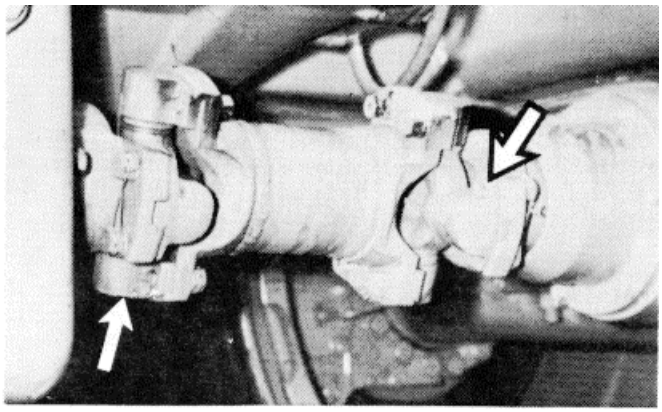
The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine.



Lubricate 2 fittings at front joint of the upper shaft.



Lubricate 1 fitting at the rear joint of the upper shaft.

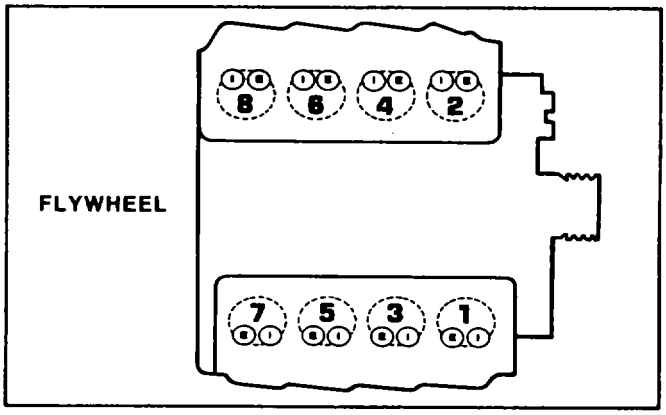


Lubricate 1 fitting at each joint of the lower shaft.

(33) Engine Valve Lash

Use Caterpillar Part No. 5P7307 Engine Turning Tool to turn the flywheel. Do not use the starter. Contact Organizational maintenance for correct valve adjustment procedure.

Resetting the valve lash is not necessary if the lash is within .003 inch (0.08 mm) of the clearance shown.



(I) = INLET VALVES
0.015 inch (0.38 mm) clearance.
(E) = EXHAUST VALVES
0.025 inch (0.64 mm) clearance.

Every 1, 000 Service Hours C

(34) Rops Mounting Bolts

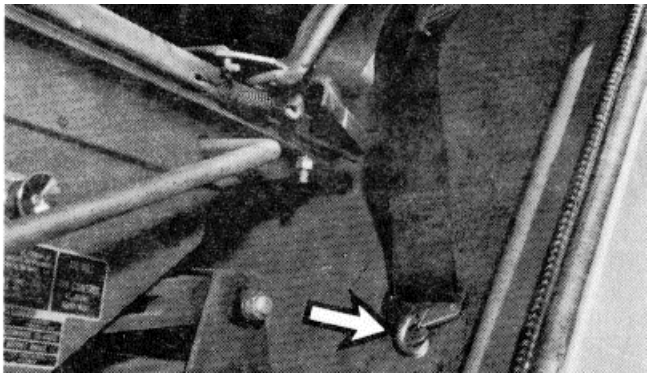
Tighten one bolt on each corner of the cab.

Torque the bolts to 50 ± 5 lb. ft. (70 ± 7 N.m).

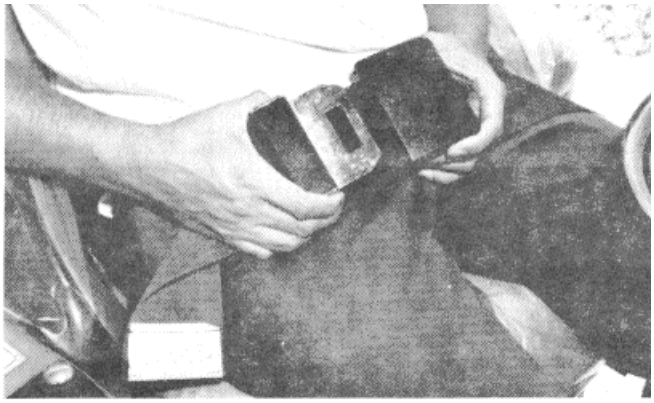
(35) Seat Belt

WARNING

The seat belt must be replaced every 3 years regardless of appearance.



Inspect the seat belt mounting hardware.



Inspect the belt. Replace it if it is damaged or frayed.

Replace the mounting eye bolts or the fasteners if they are worn or damaged. Be sure the mounting bolts are tight.

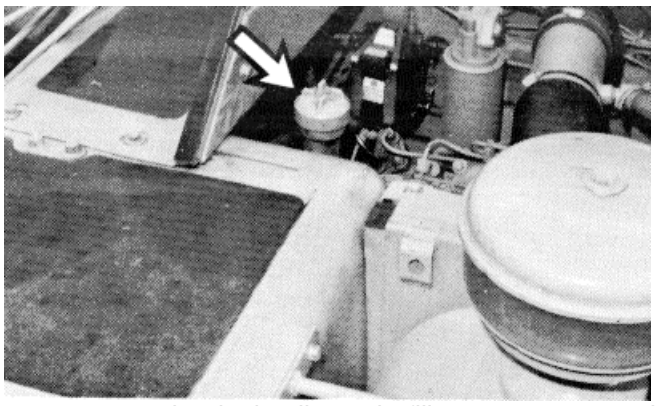
Every 2, 000 Service Hours or Yearly

(36) Hydraulic System

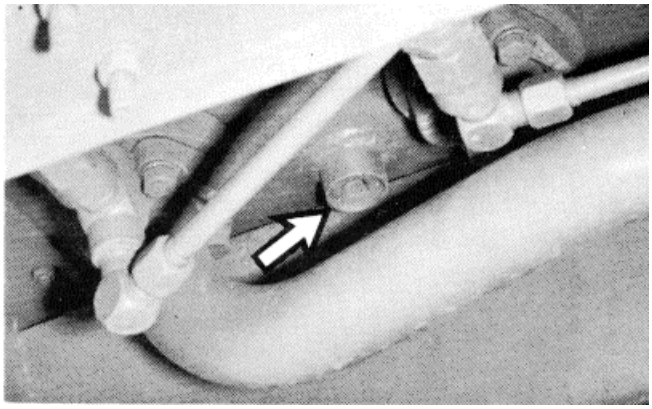
WARNING

Hot oil or components can cause personal injury. Do not allow hot oil or components to contact skin.

The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine.



1. Remove the hydraulic tank fill cap. Remove it slowly to relieve any pressure in the tank.

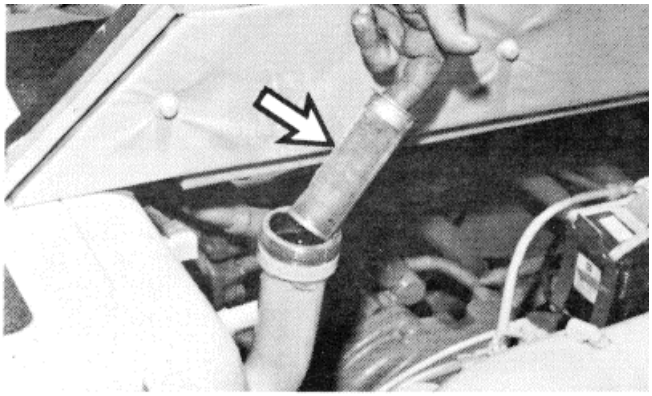


2. Remove the tank drain plug. Allow the oil to drain.

3. Change the hydraulic filter elements. See item (28).

4. Clean and install the tank drain plug.

5. Inspect hydraulic suction hoses and clamps. Replace swollen or cracked hoses. Tighten the hose clamps.



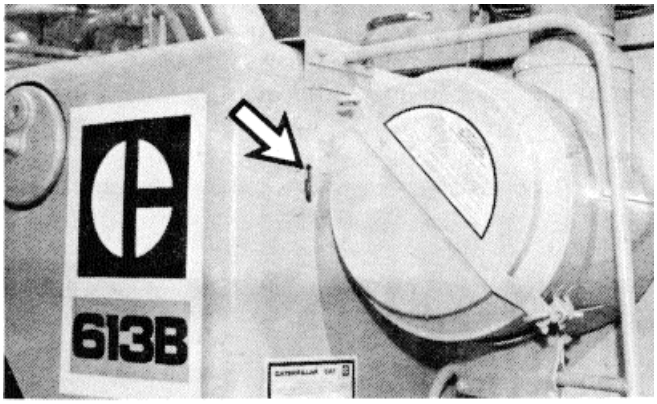
6. Remove the strainer from the fill pipe. Wash the strainer in clean non-flammable solvent. Allow it to dry. Install the screen.

7. Fill the hydraulic tank with oil. See Refill Capacities (page 2-9).

Every 2, 000 Service Hours or Yearly

8. Start the engine. Allow the oil to circulate. Check for leaks.

9. Stop the engine. Check the oil level.



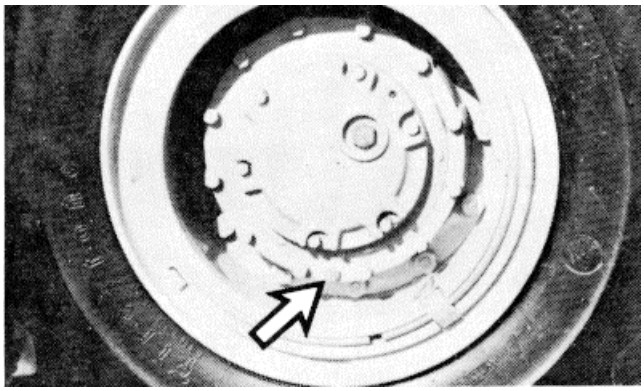
10. Keep the level between the ADD and FULL marks on the sight gauge.

(37) Differential And Final Drives

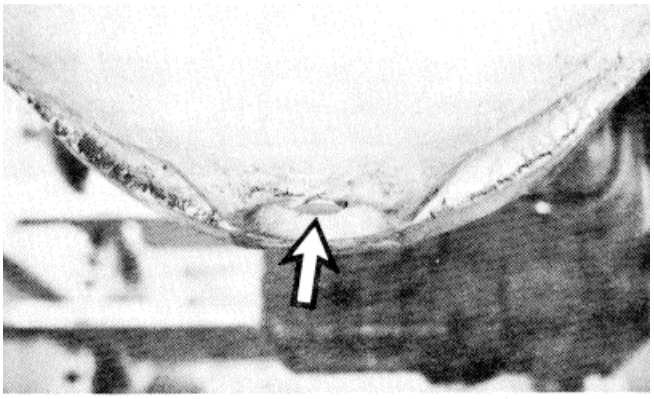
WARNING

Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.

The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine.



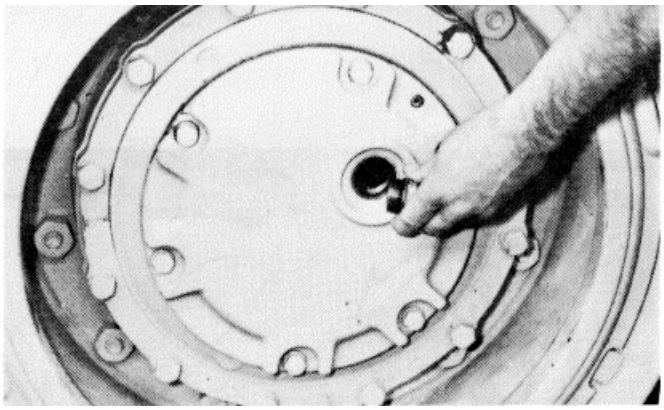
2. Position each tractor wheel with the differerential drain plug at the bottom. Remove the drain plugs. Allow the lubricant to drain.



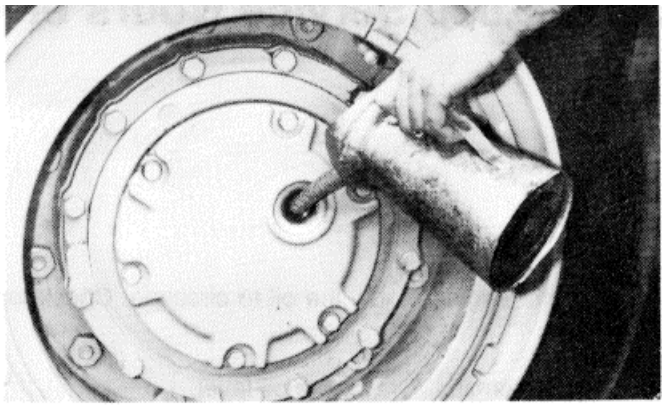
1. Remove the differential drain plug. Allow the lubricant to drain.

3. Clean all of the drain plugs.

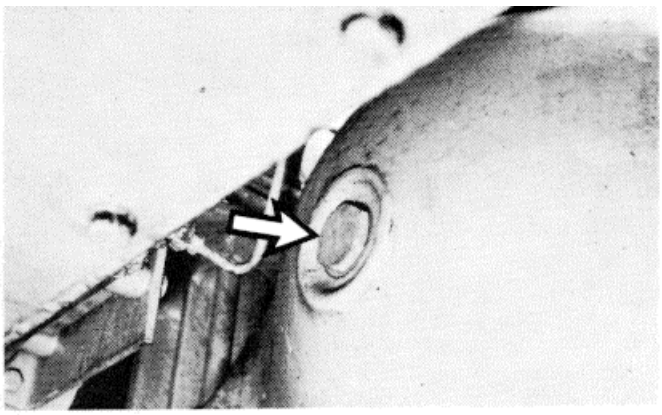
4. Install the differential and final drive drain plugs.



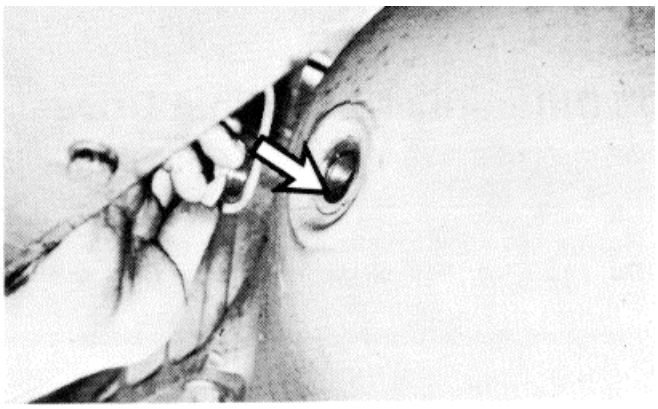
5. With the final drain plugs at the bottom, remove the fill plugs.



6. Fill the final drives to the bottom of the plug openings. See Refill Capacities (page 2-9). Clean and install the plugs.



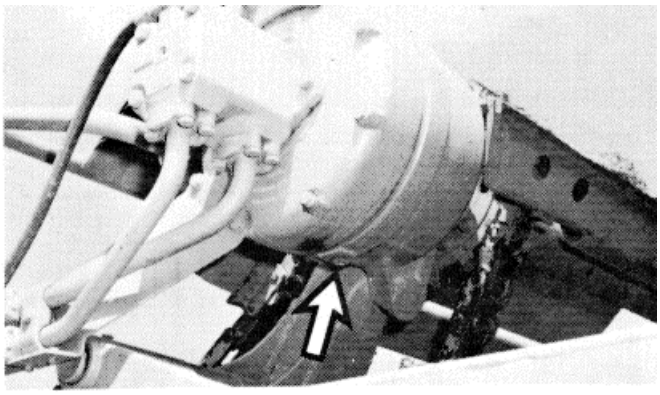
7. Remove the differential fill plug.



8. Fill the differential to the bottom of the plug opening. See Refill Capacities (page 2-9). Clean and install the plug.

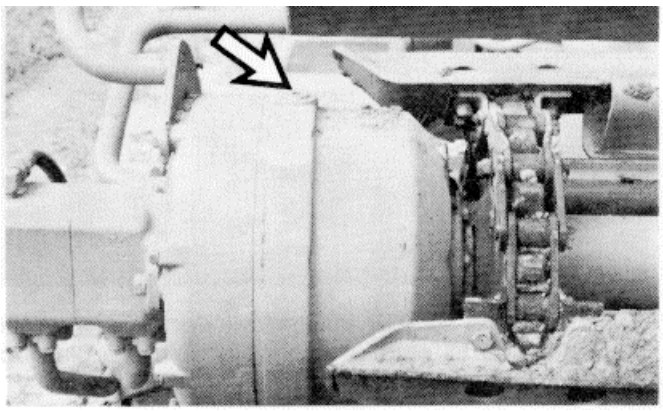
(38) Elevator Speed Reducer

The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine.

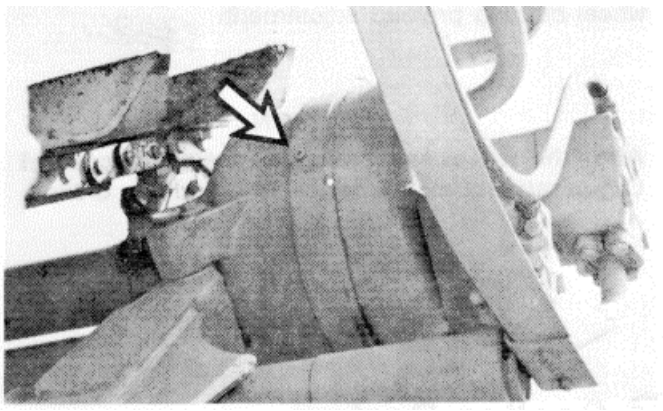


1. Remove the drain plug. Allow the oil to drain. Clean and install the plug.

Every 2, 000 Service Hours or Yearly

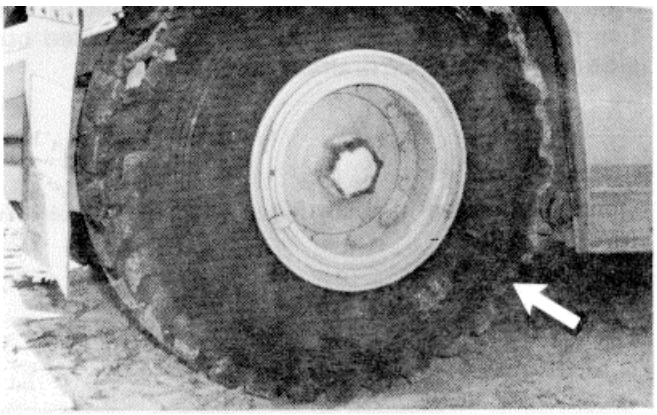


2. Remove the fill plug at the top of the housing. Remove the level plug at the side of the housing.

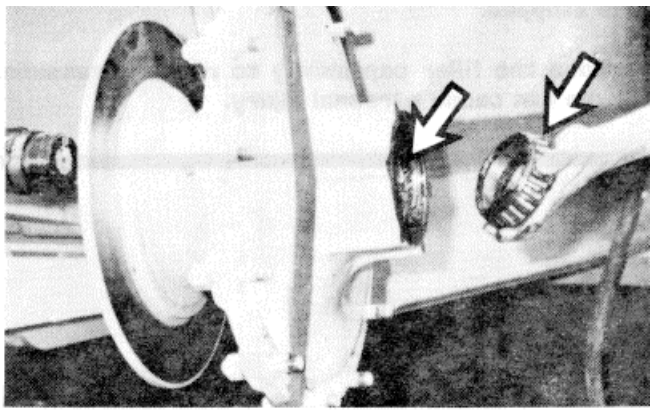


3. Fill the speed reducer to the bottom of the level plug opening. See Refill Capacities (page 2-9). Clean and install the fill and level plugs.

(39) Scraper Wheel Bearings

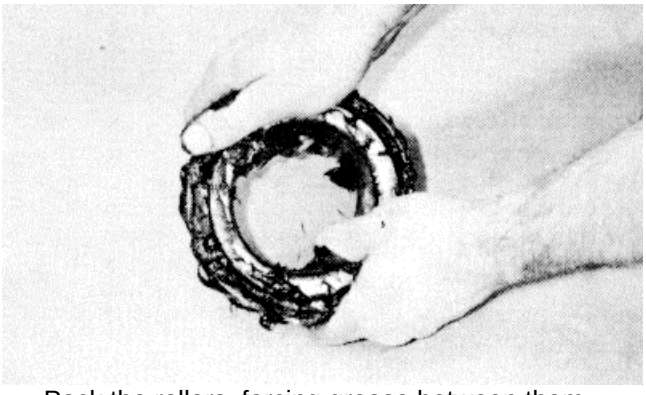


The Scraper wheels must be removed. Contact Organizational maintenance for the correct wheel removal procedure.



1. Clean the bearing cups and cones with clean nonflammable solvent. Inspect the bearings.

2. A small amount of abrasion or pitting is permissible Replace the bearing if worn enough to allow excess end play. Replace the bearing if it is badly pitted or bruised. Replace it if grooves appear in the roller or races. A bearing that is only corroded or stained can be used if it can be cleaned with fine emery cloth.



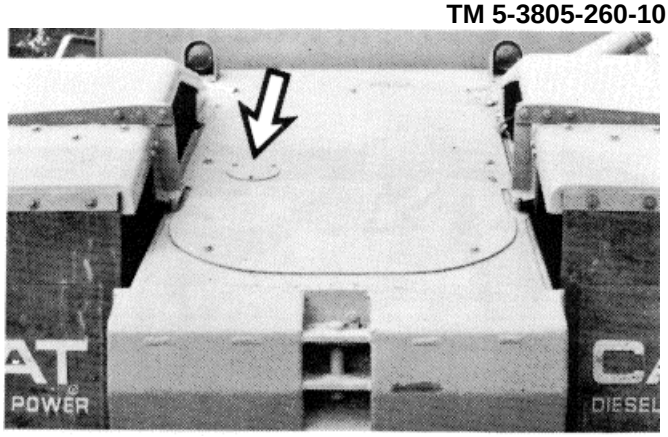
3. Pack the rollers, forcing grease between them.

4. Replace any damaged seals.

5. Contact Organizational maintenance for assembly and installation of the wheel and brake. Also for wheel bearing preload adjustment.

CAUTION

After the wheel and brake are installed, contact Organizational maintenance to bleed the brakes.



6. Maintain the scraper master cylinder oil level to the bottom of the fill plug opening. Remove the plate for master cylinder plug access.

(40) Cooling System

WARNING

Always inspect the cooling system with the engine stopped.

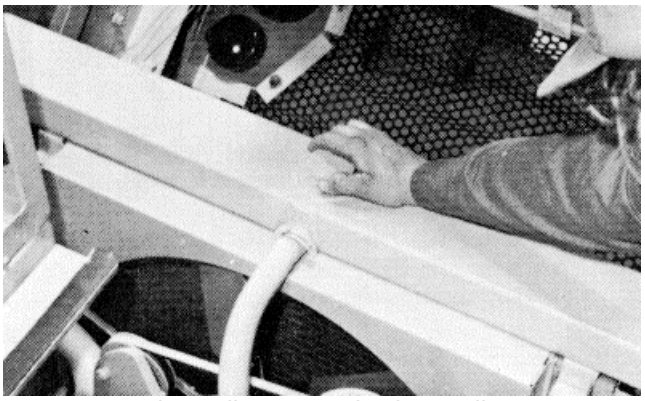
Remove the filler cap slowly to relieve pressure. Steam can cause personal injury.

CAUTION

If the machine is to be shipped to or stored in an area with freezing temperatures, the cooling system must be protected to the lowest expected outside temperature or drained completely.

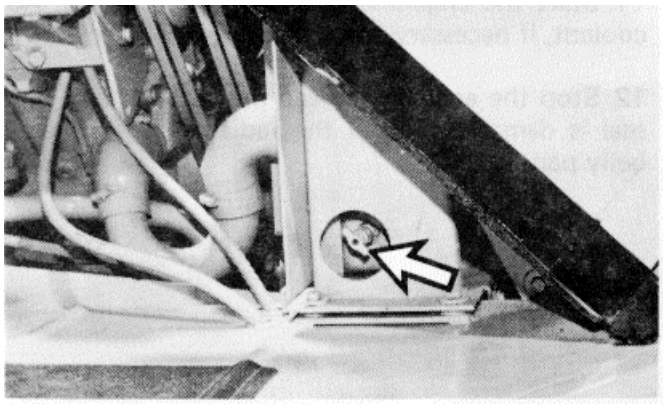
Check antifreeze in accordance with the procedures in TB-750-651.

The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine. Remove the belly pan.

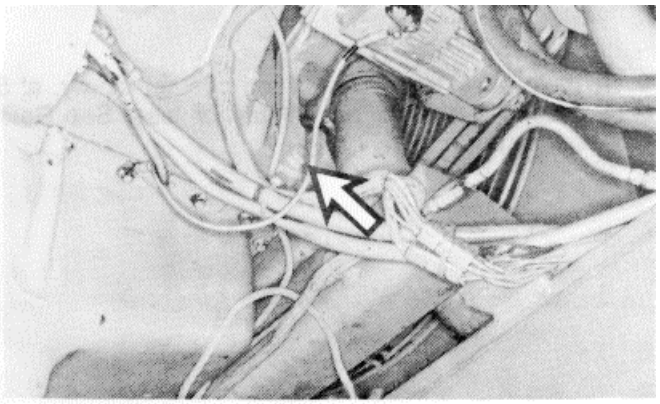


1. Remove the radiator cap slowly to relieve pressure.

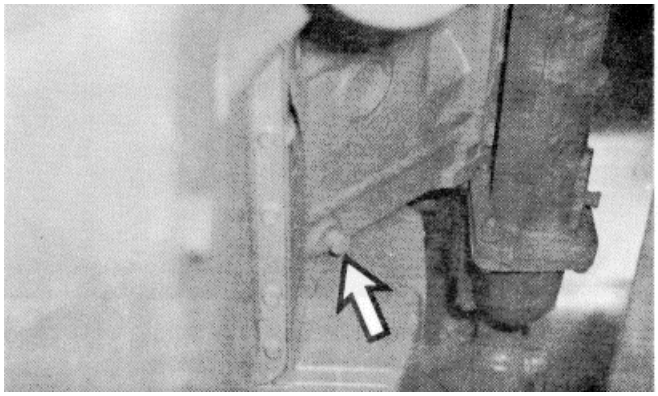
Every 2, 000 Service Hours or Yearly



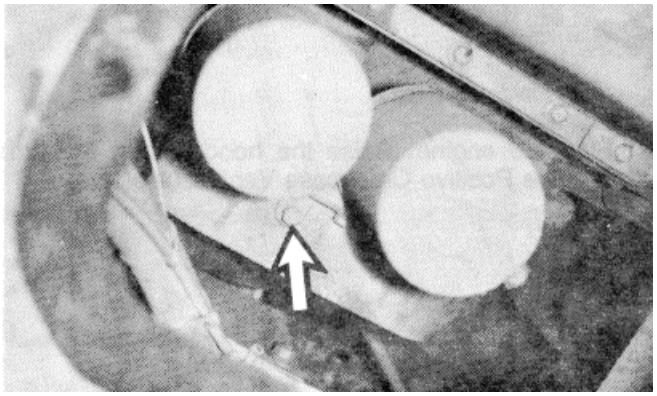
2. Open the radiator drain valve. Allow the coolant to drain.



3. Remove the plug from the right side of the block. Allow the coolant to drain.



4. Remove the plug from the left side of the block. Allow the coolant to drain.



5. Remove the plug from the bottom of the oil cooler. Allow the coolant to drain.

6. Remove the plug from the water inlet elbow on the front of the engine. Allow the coolant to drain.

7. Close the drain valve. Clean and install all drain plugs.

8. Follow the directions contained in TB 750-651 for checking and maintaining cooling system coolant.

9. To help avoid air pockets, add coolant slowly, at 5 U.S. gallons (19 liters) per minute or less. See Refill Capacities (page 2-9).

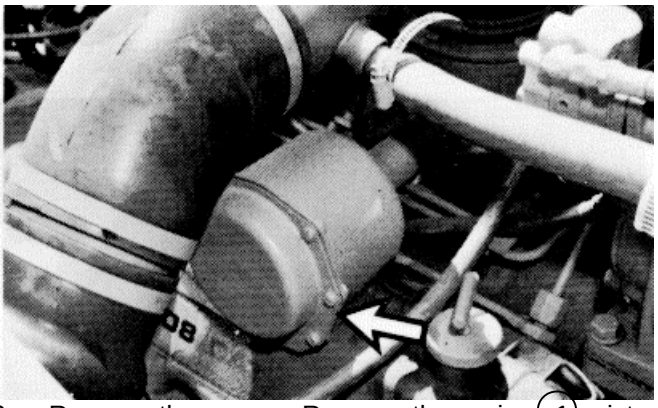
10. Bring the coolant level to within 1/2 inch (1 cm) of the bottom of the fill pipe.

11. Start the engine with the radiator cap off. Add coolant, if necessary, when the level stabilizes.

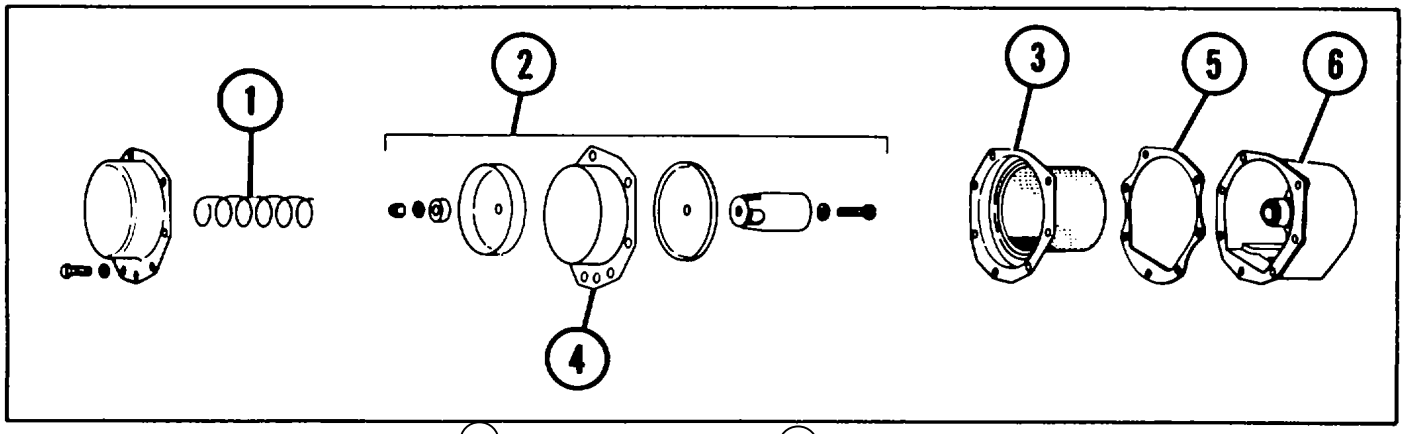
12. Stop the engine. Replace the radiator cap if the seal is damaged. Install the radiator cap. Re-install belly pan.

(41) PCV Valve

1. Stop the engine. Raise the hood. Clean the area around the Positive Crankcase Ventilation Valve.



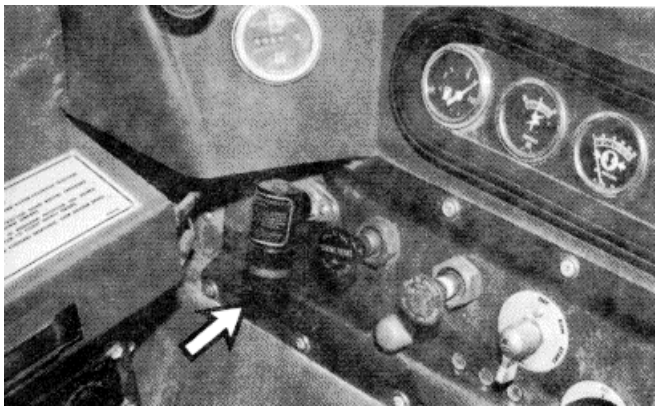
2. Remove the cover. Remove the spring (1) piston assembly (2) and sleeve (3). See below.



3. Disassemble the piston assembly (2). discard the diaphram (4). Wash all parts in clean non-flammable solvent. Replace any parts, or the gasket (5), if damaged. Assemble the piston assembly (2). Use a new diaphram (4). Coat both flange sides of the diaphram (4) and both sides of the gasket 5, (with) gasket cement. Install the valve parts in the housing 6. Install the cover.

When Required

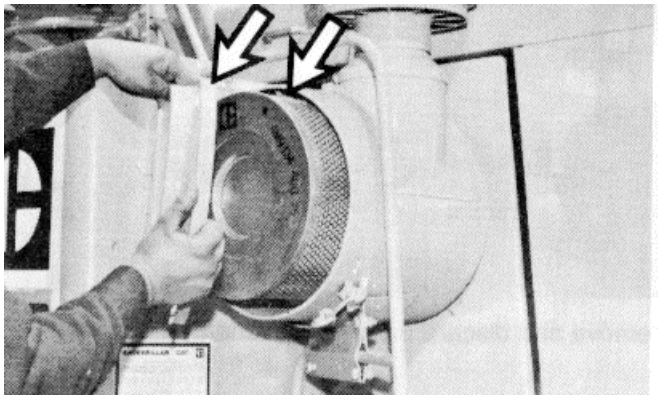
(42) Air Cleaners



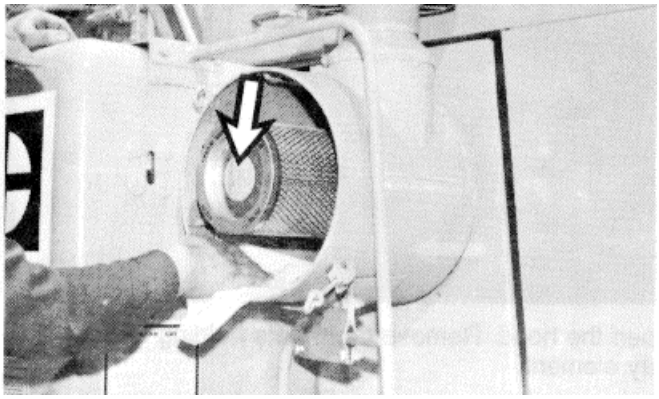
Service the air cleaner when the red band in the indicator locks in the visible position.

CAUTION
Service the air cleaner with the engine stopped.

Servicing the Primary Element



1. Remove the cover and primary element.



2. Clean inside of housing. Remove a tab from the secondary element.

3. Clean and inspect the filter element. See Cleaning Air Cleaner Elements (page 2-3).

The filter element should be replaced after being cleaned a maximum of 6 times, or at least once a year.

CAUTION
Always inspect the primary element after cleaning it. Replace it if rips or tears are found.

4. Install a clean filter element and the cover. Tighten the cover retaining bolts finger tight.

If the indicator shows red shortly after installation of a clean primary element, and the element has been cleaned 6 times, change to another clean element.

CAUTION
Do not use a tool to tighten.

5. Reset the filter change indicator.

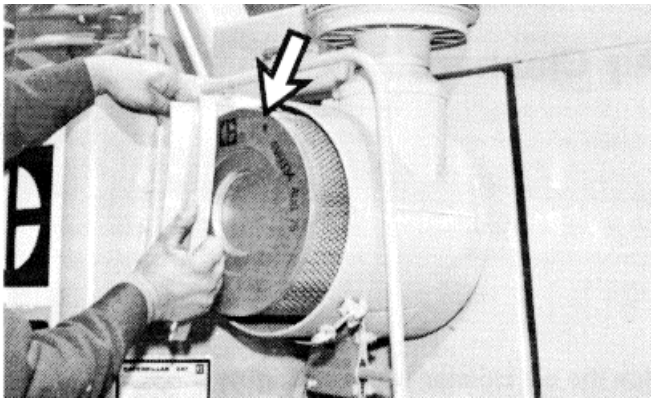
If the indicator still shows red after changing primary elements, change the secondary element.

Replacing the Secondary Element

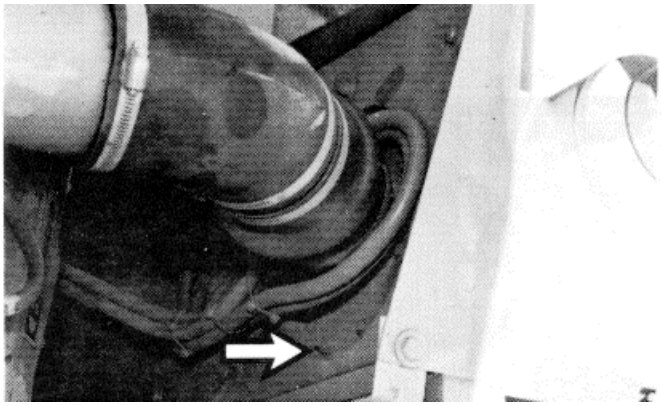
The secondary element should be changed at the time the primary element is cleaned for the third time, or when the third tab is removed from the element.

CAUTION

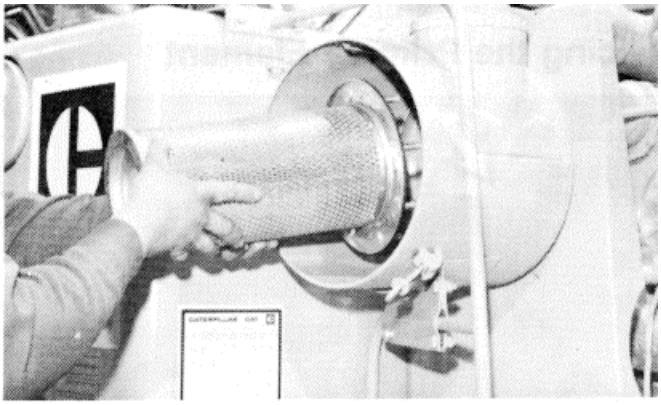
Always replace the secondary element. Never attempt to reuse it by cleaning.



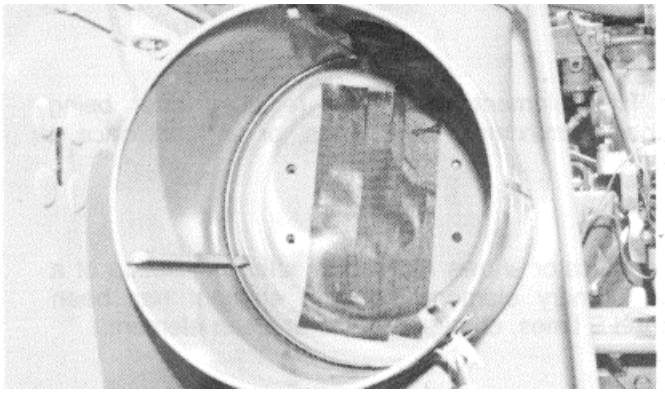
1. Remove the cover and primary element.



2. Open the hood. Remove the 8 nuts holding the secondary element.



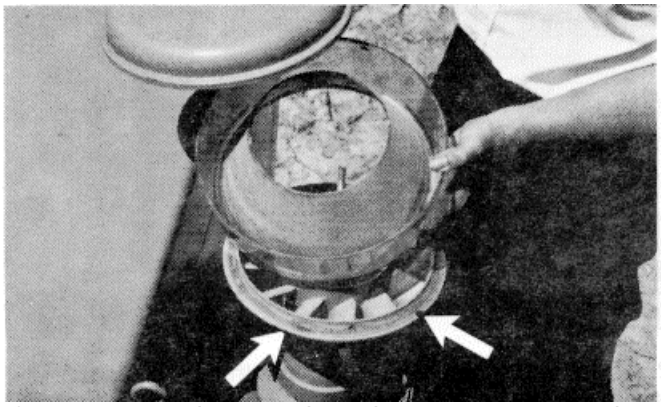
3. Remove and discard the used secondary element.



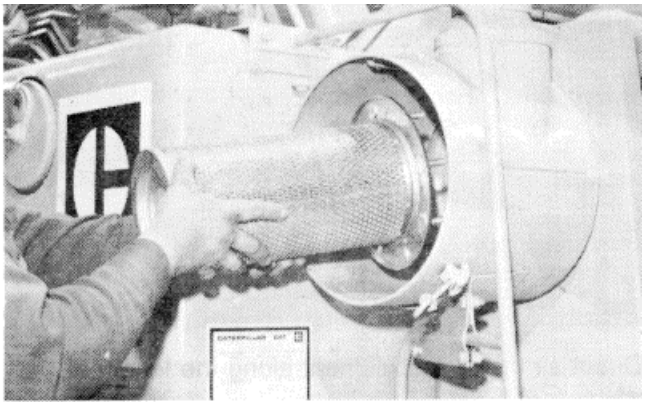
4. Cover the engine air inlet pipe.

5. Check the precleaner for dirt and debris.

When Required

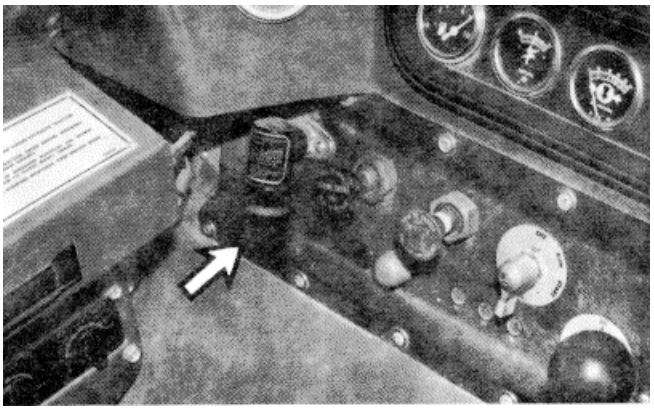


6. If necessary, loosen the clamp, remove and disassemble the precleaner. Wash the parts in clean warm water. Allow them to dry. Assemble and install precleaner.



7. Clean the housing. Uncover the air inlet opening. Install a new secondary element.

8. Replace the housing gasket if it is damaged. Install the nuts to the studs on the element. Close the hood.



9. Install the primary element and cover. Reset the filter change indicator.

Cleaning Air Cleaner Elements

WARNING

When using pressure air, wear a face shield and protective clothing. Use a maximum pressure of 30 psi (205 kPa) for cleaning purposes.

CAUTION

When cleaning with pressure water, use 40 psi (280 kPa) maximum pressure to prevent element damage.

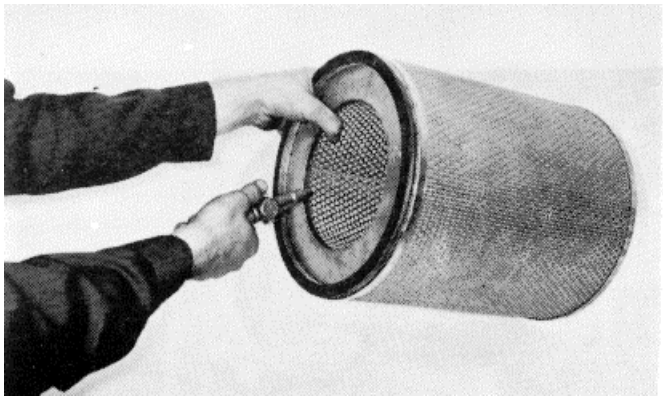
CAUTION

Do not clean elements by bumping or tapping them on hard objects.

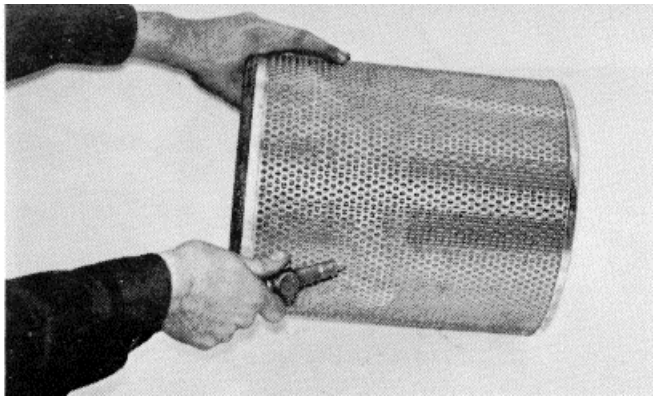
Inspect an element after cleaning. Do not use an element with damaged pleats, gaskets or seals.

Have spare elements on hand to use when cleaning used ones.

Pressure Air-30 psi (205 kPa) Maximum

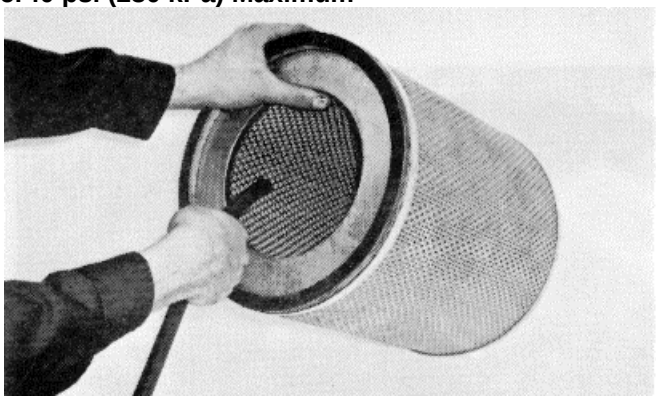


1. Direct air inside the element along the length of the pleats.

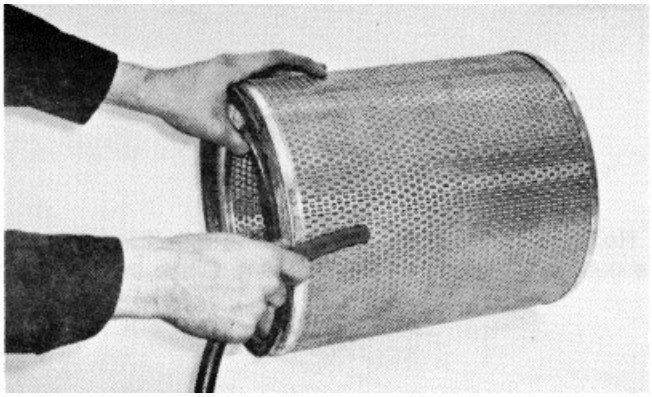


2. Direct air outside along the length of the pleats. Direct air inside along the length of the pleats. Inspect the element.

Water40 psi (280 kPa) Maximum

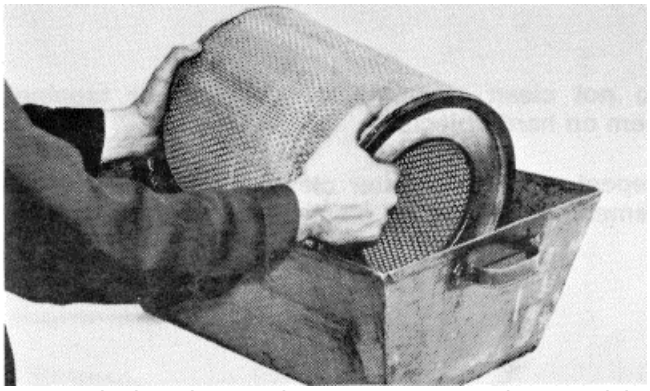


1. Direct water inside along the length of the pleats.



2. Direct water outside along the length of the pleats. Air dry and inspect the element.

Detergent



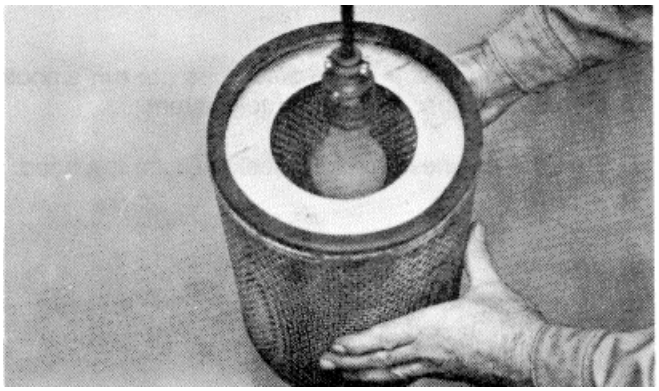
1. Wash the element in warm water and nonsudsing household detergent.

2. Rinse it with clean water.

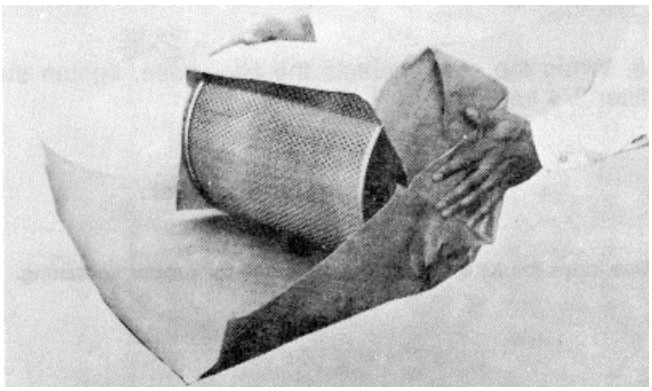
3. Air dry and inspect the element.

When Required

Inspecting Elements



1. Insert a light inside the clean and dry element. Discard the element if rips or tears are found.

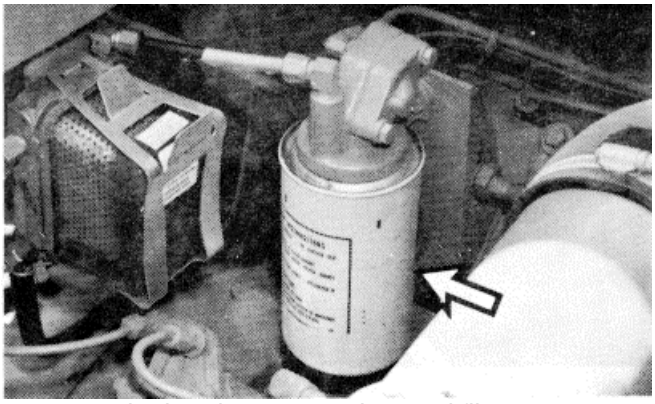


2. Wrap and store good elements in a clean dry place.

(43) Fuel System

Change fuel filters when the engine lacks power.

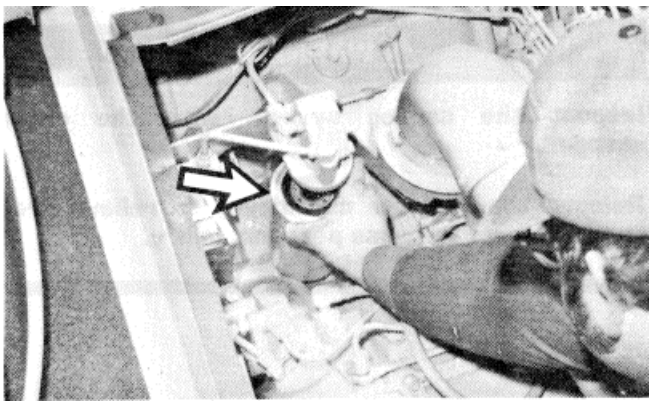
Stop the fuel flow by turning off the disconnect switch.



1. Open the hood. Remove the used filter.

2. Clean the filter base. Make sure all of the used filter seal is removed.

3. Coat the seal of a new filter with clean diesel fuel.



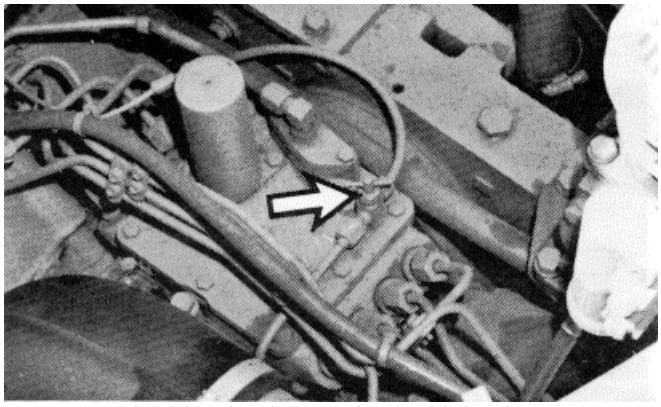
4. Install the filter by hand.

5. When the seal contacts the filter base, tighten the filter 3/4 turn more.

CAUTION
Do not overtighten the filter.

NOTE
Use index marks on the filter as a guide for proper tightening.

Bleeding the Fuel System



1. Open the bleed valve on the fuel injection pump

6. Start the engine. If the engine does not run smoothly, stop the engine. Bleed the fuel system.

7. Start the engine. Check for leaks. Close the hood.

2. Turn the disconnect switch on.

3. When fuel flows from the bleed valve free of air bubbles, close the valve.

(44) Cooling System

WARNING

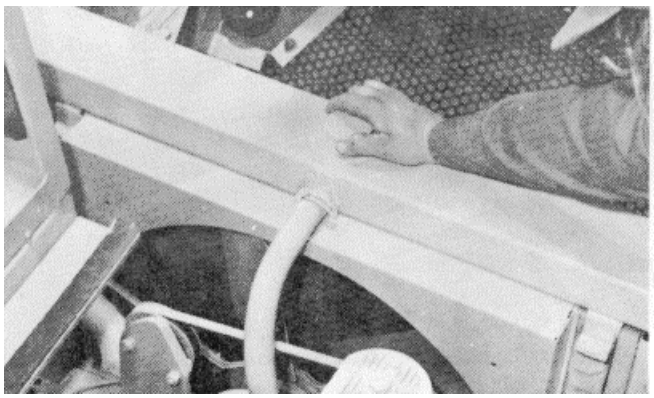
Inspect the cooling system with the engine stopped.

Remove the radiator cap slowly to relieve pressure. Steam can cause personal injury.

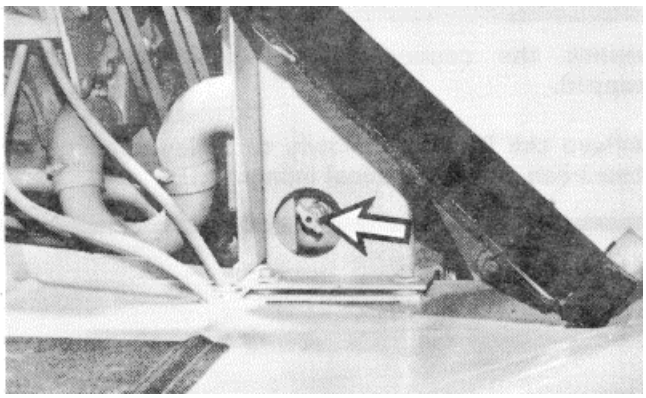
CAUTION
If the machine is to be shipped to, or stored in, an area with freezing temperatures the cooling system must either be protected to the lowest expected outside temperature or drained completely.

The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine.

When Required



1. Open the hood. Remove the radiator cap slowly to relieve pressure.



2. pen the radiator drain valve. Allow the coolant to drain.

3. Close the drain valve. Follow procedures in TB 750-651 for cleaning radiator and replacing coolant.

WARNING

Use all cleaning solutions with care.

NOTE

Most commercial cooling system cleaners may be used.

4. If commercial cleaner is used, follow these steps.

   a. Close the drain valve. Fill cooling system with cleaning solution.(1)

   b. Start and operate the engine for 1/2 hour. Stop the engine and drain the cleaning solution.

   c. Flush the system with clean water until the draining water is clear. Do not operate the engine while flushing.

   d. Close the drain valve. Fill the system with neutralizing solution(2)

   e. Start and operate the engine for 10 minutes. Stop the engine and drain the neutralizing solution.

   f. Flush the system with clean water until the draining water is clear. Do not operate the engine while flushing.

   g. Close the drain valve.

5. Mix antifreeze solution to provide protection to the lowest expected outside temperature, per TB 750-651.

6. To avoid air locks, add coolant slowly at 5 U.S. gallons (19 litres) per minute or less. See Refill Capacities (page 2-9).

7. Start and operate the engine, with the radiator cap removed. Allow the coolant level to stabilize. Add coolant, if necessary, to bring the coolant level to within 1/2 inch (1 cm) of the bottom of the fill pipe.

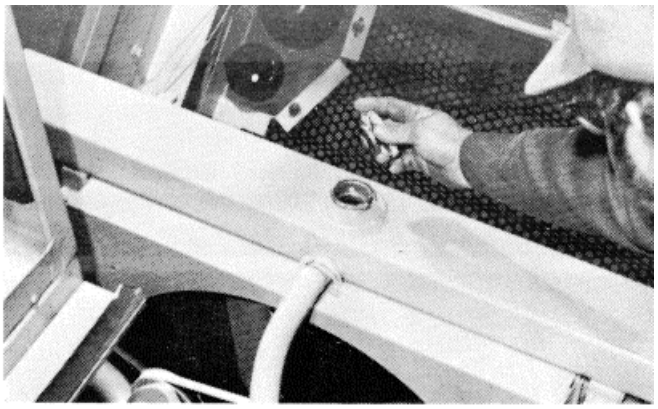
8. Replace the radiator cap if the gasket is damaged. Install the cap.

(45) Cooling System Relief Cap

WARNING

Inspect the cooling system with the engine stopped.

Remove the filler cap slowly to relieve pressure. Steam can cause personal injury.



1. Raise the hood. Remove the radiator cap slowly to relieve pressure.

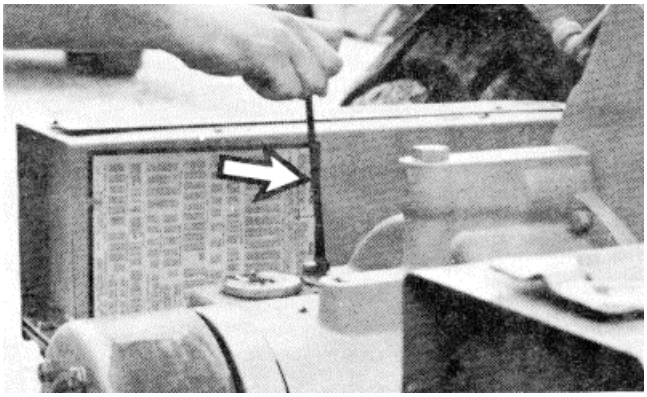
2. Inspect the cap for damage, deposits or foreign material.

3. Clean the cap with a clean cloth, or replace it, as necessary.

4. Install the cap.

(46) Transmission System

The machine must be level. The bowl must be lowered. Apply the parking brake. Operate the engine low idle.

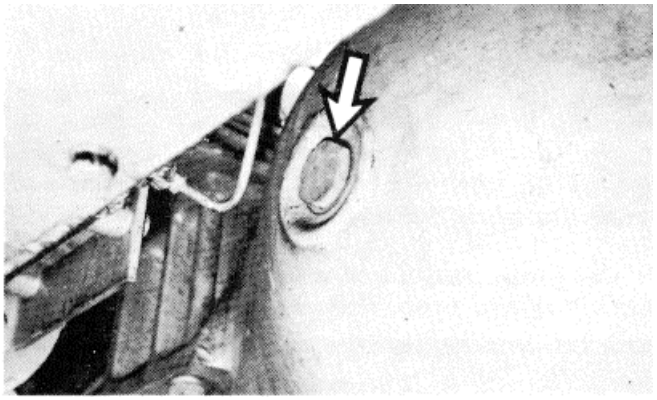


Keep the oil level between the ADD and FULL marks on the dipstick.

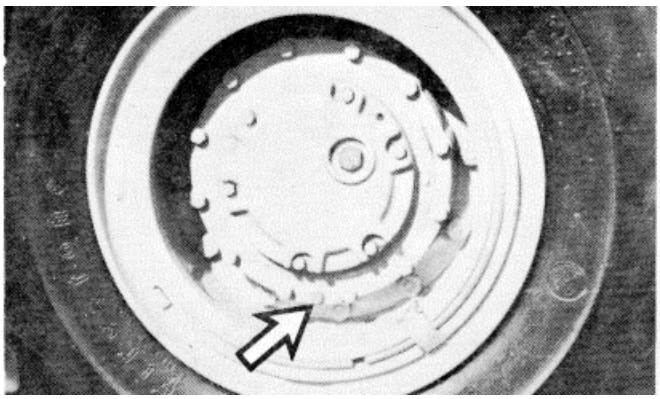
When Required

(47) Differential And Final Drives

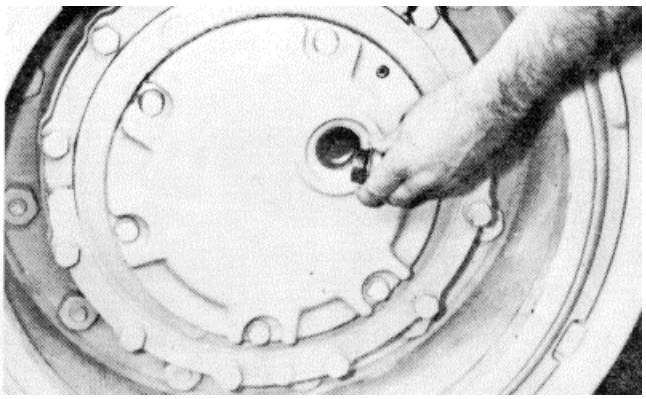
Operate the machine on level ground for a few minutes. Stop the machine in a level area. Lower the bowl. Apply the parking brake. Stop the engine.



1. Remove the differential fill plug. Keep the oil level to the bottom of the plug opening clean and install the plug.



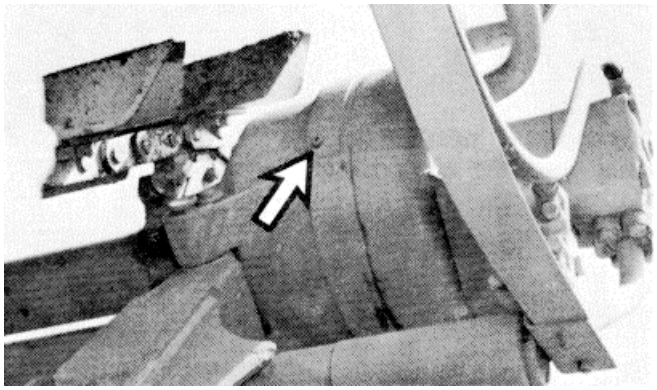
2. Position each wheel with its final drive drain plug at the lowest point.



3. Remove the fill plugs. Keep the oil level to the bottom of the plug openings. Clean and install the plugs.

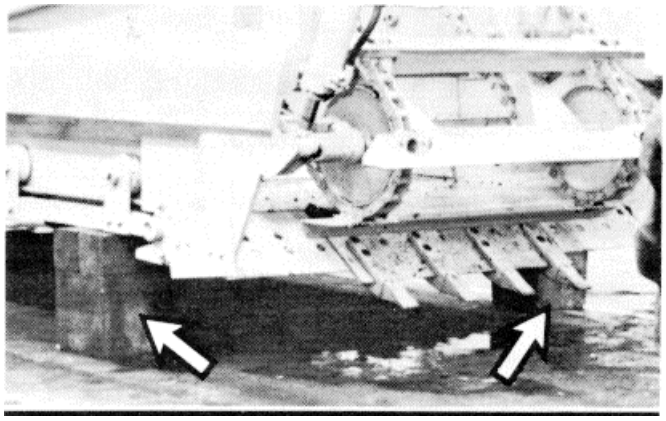
(48) Elevator Speed Reducer

The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine.



Remove the level plug. Keep the oil level to the bottom of the plug opening. Clean and install the plug.

(49) Cutting Edges And Router Bits



WARNING

Block the bowl when working in the bowl area.

WARNING

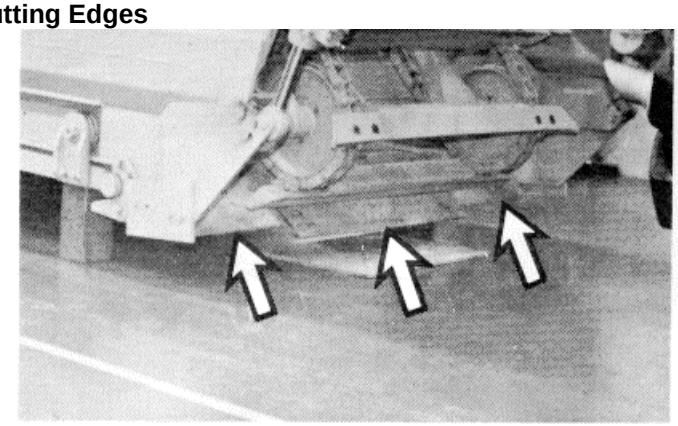
Support the cutting edges before removing the mounting bolts.

CAUTION

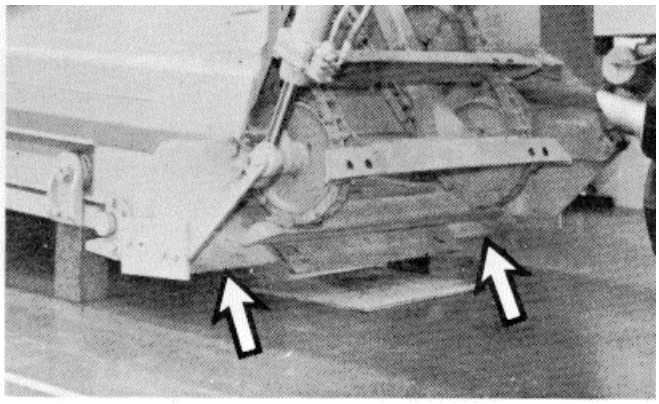
Do not attempt to increase wear life by welding on cutting edges. This could result in premature failures.

Change or rotate the cutting edges or router bits before the mounting surfaces become worn

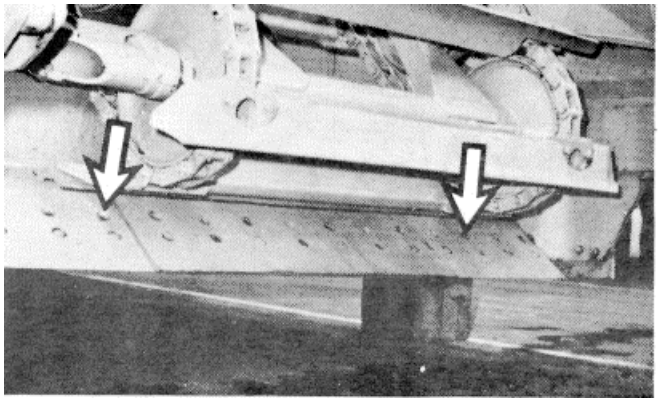
Cutting Edges



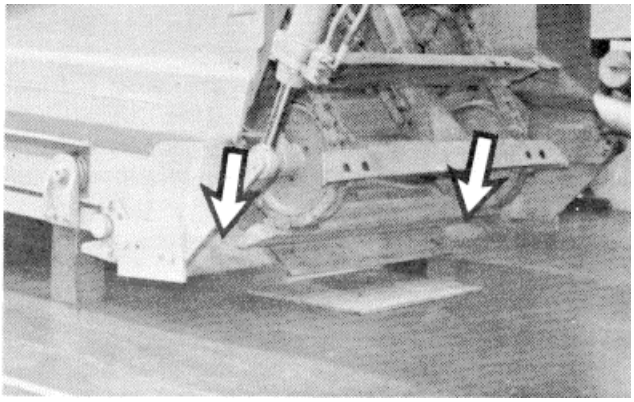
With two edges to each section, double wear can be obtained by rotating them 180º.



By exchanging sides, the two end sections can be used four times.

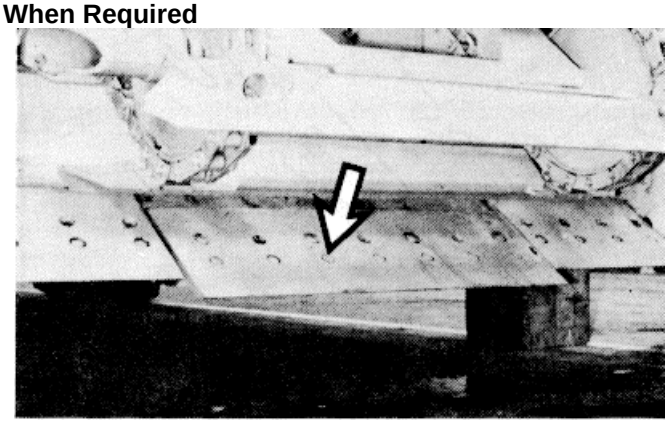


For finish work align the cutting edges. Move both end sections forward and use the rear mounting bolt holes.



For the best penetration when digging, mount the end sections through the front mounting holes. The center edge is always in the same location. Both rows of bolts should be used in the center edge in all cases.

When Required



1. Support the cutting edge to be removed. Remove the mounting bolts.

2. Remove the edge.

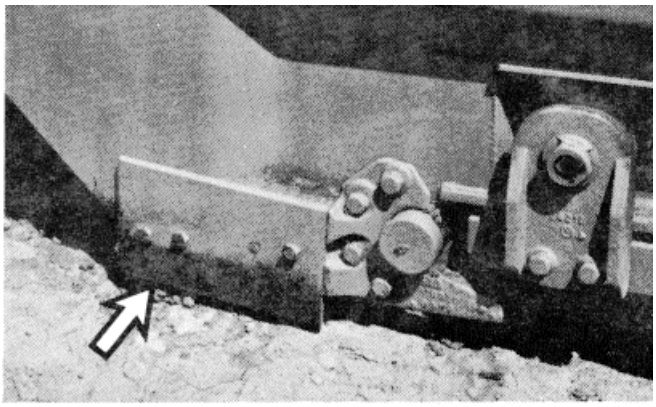
3. Clean all mounting surfaces.

4. Change or rotate the cutting edge.

5. Install the cutting edge and all of the mounting bolts.

6. Remove the support. See Bolt Torques for Ground Engaging Tools, (page 2-9) torque the bolts.

Router Bits



With two edges to each bit, double wear can be obtained by rotating the bits 180°.

1. Remove the three mounting bolts and the router bit.

2. Clean the mounting surfaces.

3. Rotate or change the router bit.

4. Install the bit and the mounting bolts.

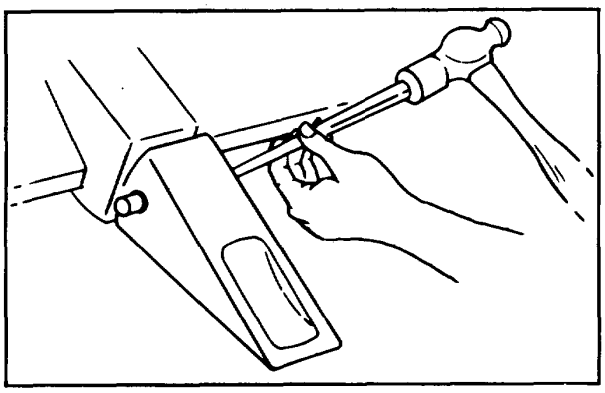
5. Torque the bolts. See Bolt Torques for Ground Engaging Tools, (page 2-9).

Cutting Edge Teeth

WARNING

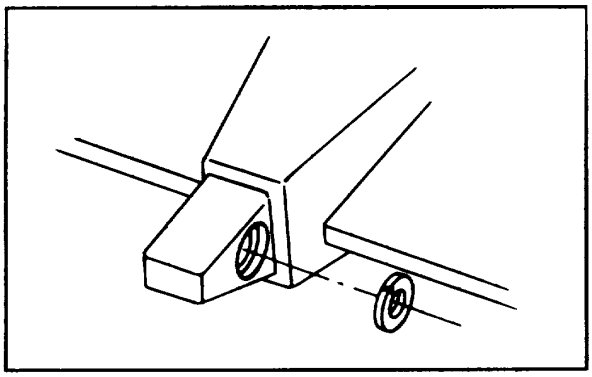
To prevent personal injury to eyes, wear protective glasses when striking pins.

A pin, when struck, can fly out and cause personal injury.

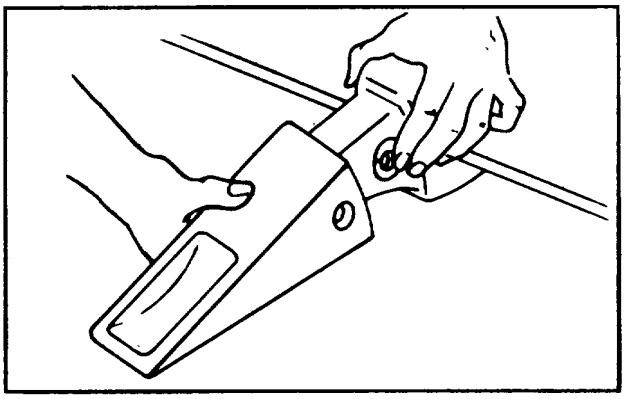


1. Drive the pin out of the tooth through the side opposite the washer.

Change the teeth before the adapters become worn.

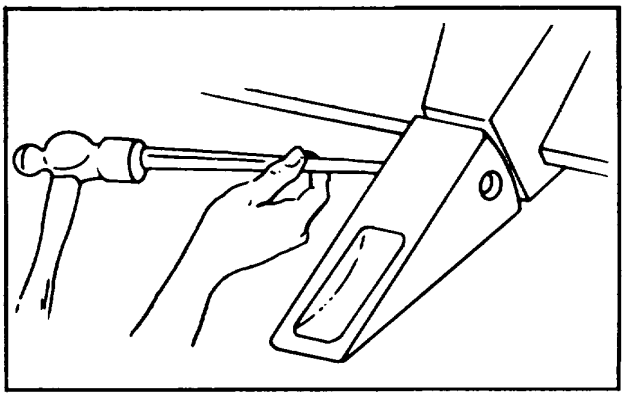


2. Clean the shank, pin and washer.



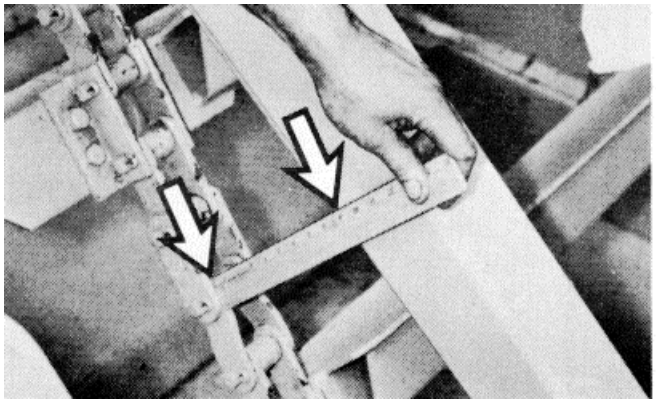
3. Install the washer in the groove. Install the tooth.

The tooth may be rotated 180° for more or less penetration, as required.

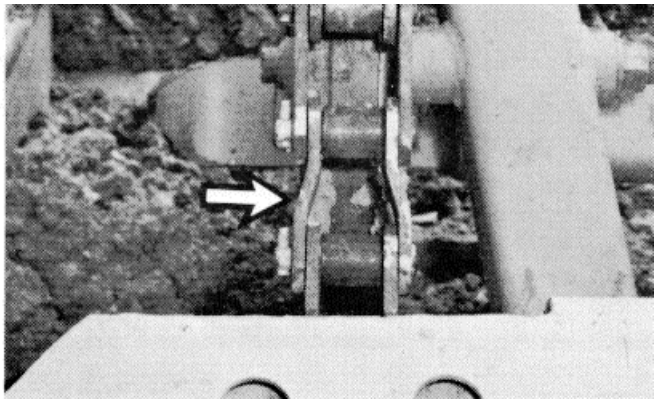


4. Install the pin from the side of the tooth opposite the washer. Center the pin in the tooth.

(50) Elevator Chain



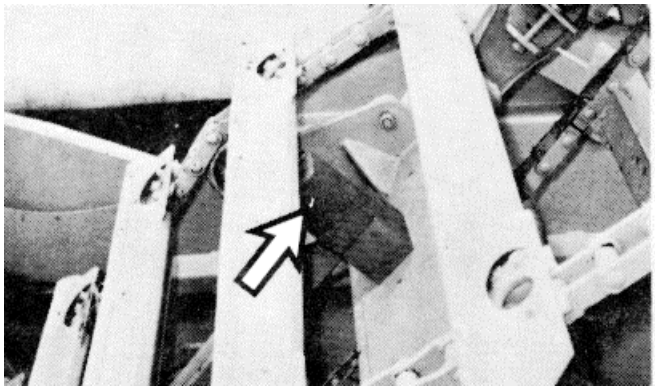
Maintain 7 to 10 in. (18 to 25 cm) between the chain and the frame. Measure midway between the upper and lower rollers. Also, adjust the chain if the sag differs more than 2 in. (5 cm) from one side to the other.



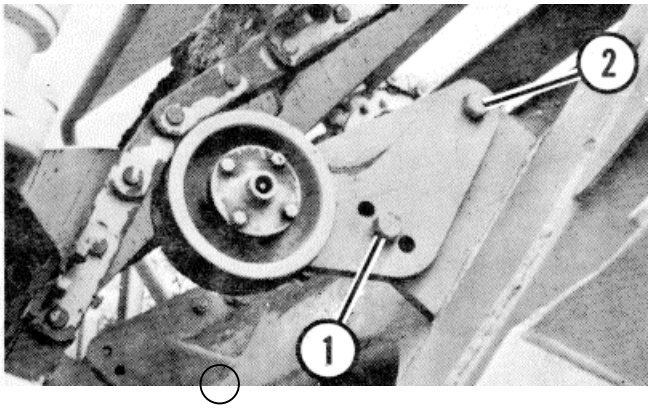
If a chain must be taken up more than 3 in. (8 cm), use an offset link to replace 2 links. If it must be let out more than 3 in. (8 cm), insert an off set link between two links. Use offset links in pairs, one on each chain, between the same two elevator flights.

When Required

To Adjust:

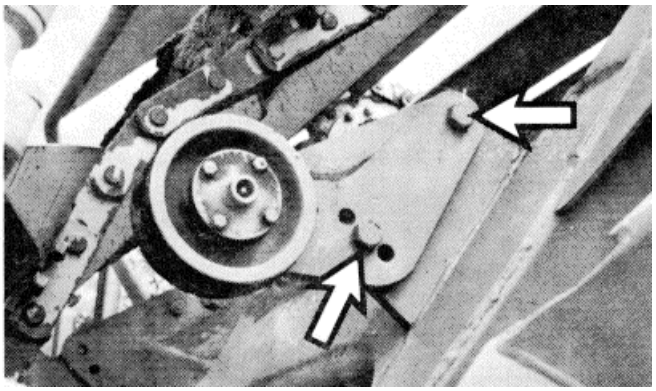


1. Raise and block the chain above the adjuster roller.



2. Remove the lower bolt (1) from the bracket. Loosen the upper bolt 2 .

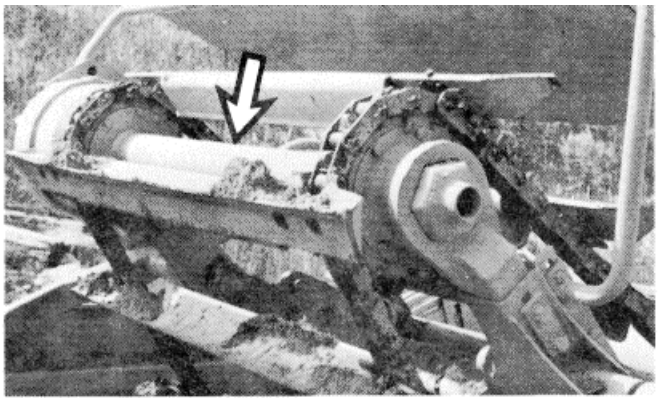
3. Move the roller to align alternate holes in the bracket.



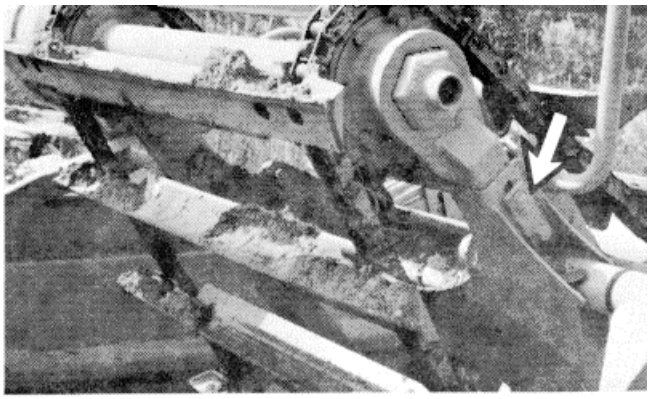
4. Install the lower bolt. Tighten the upper bolt. Remove the blocking. Check the adjustment.

(51) Elevator Upper Shaft

To Adjust:



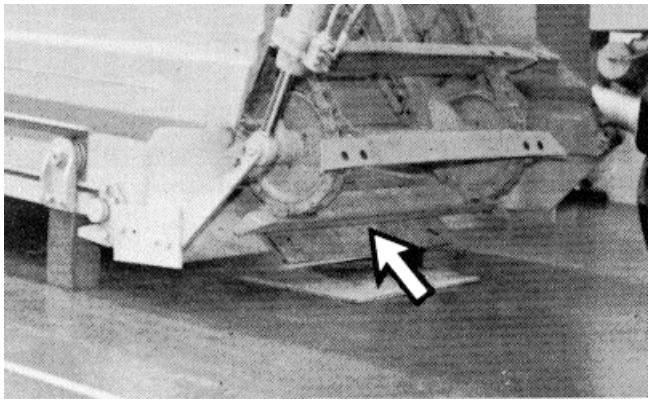
The sprocket shaft should be parallel to the bottom shaft.



Loosen the two bolts on the clamp on one side of the frame. Move the end of the shaft up or down. Align the shafts. Tighten the bolts.

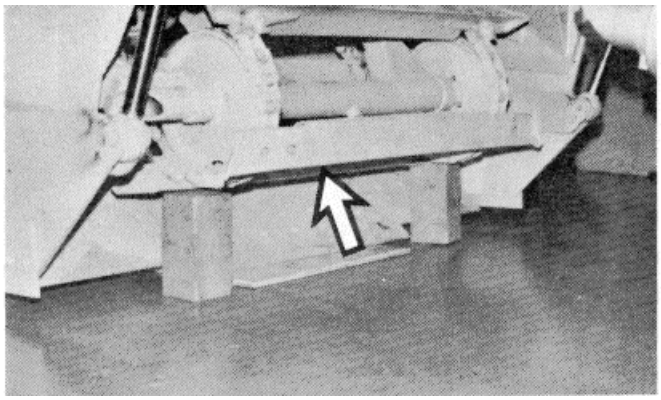
(52) Cutting Edge Opening

The machine must be level. The bowl must be lowered. Apply the parking brake. Stop the engine.

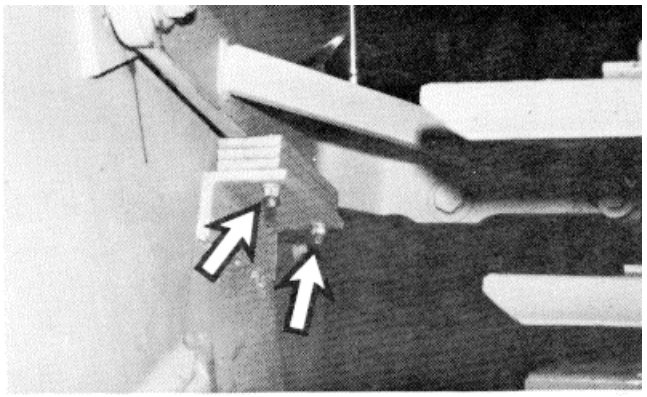


The opening between the cutting edge and the elevator can be adjusted. Use a small opening for fine material, or a large opening for heavy material.

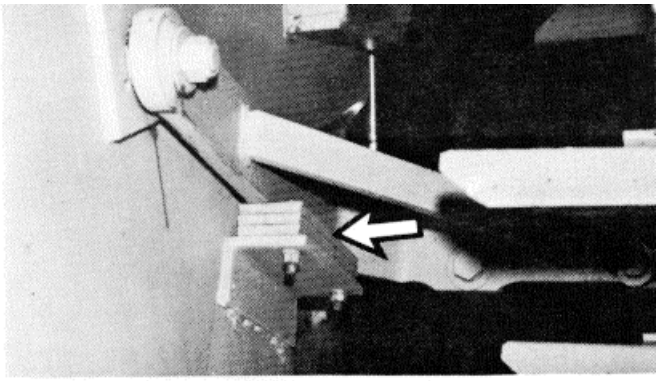
To Adjust:



1. Raise and block the elevator.



2. Remove the bolts from the elevator support blocks on each side of the bowl.



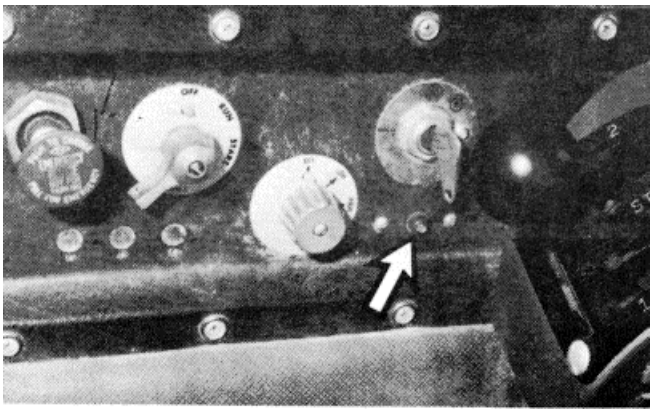
3. Add shims to increase, or remove shims to decrease, the size of the opening.

4. Add or remove the same amount of shims on each side of the bowl.

5. Install the retaining bolts.

(53) Circuit Breakers And Fuses

Reset circuit breakers if they open. Replace blown fuses. See Volume II for location of fuses.



Push the button to reset the electrical system breaker.

If a breaker opens again, have the circuit checked for blown fuses. If the new fuse blows, have the circuit checked.

CAUTION

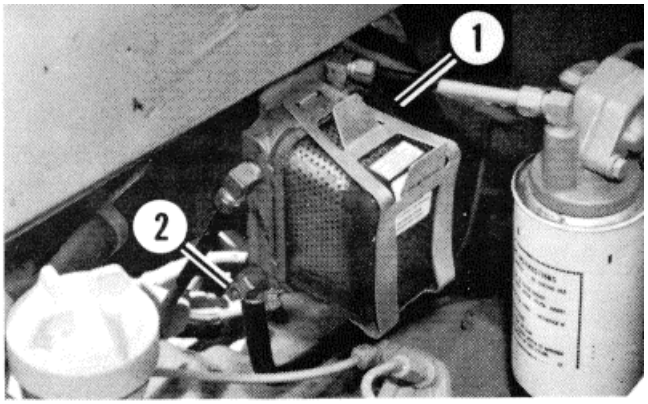
Always replace fuses with the same capacity and type that was removed.

When Required

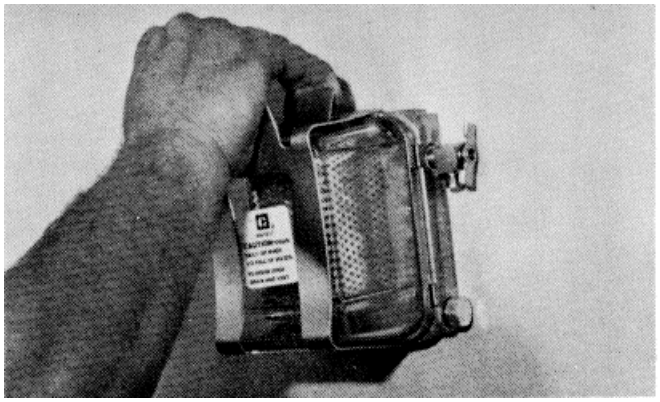
(54) Water Separator

When the inside of the water separator becomes dirty enough that the water level cannot be seen through the cover, install a new element.

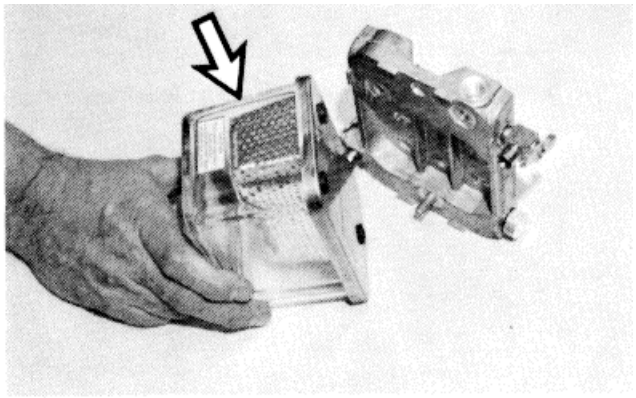
1. Stop the engine. Turn the disconnect switch OFF.



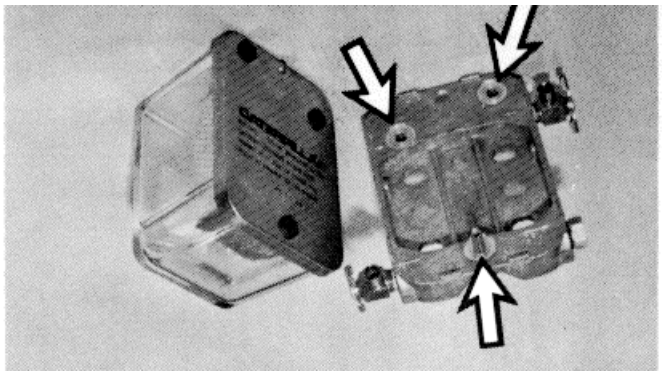
2. Remove the dirt from the water separator and the surrounding area. Open the vent valve (1) and the drain valve (2). Allow the water to drain. Close the drain and vent valves.



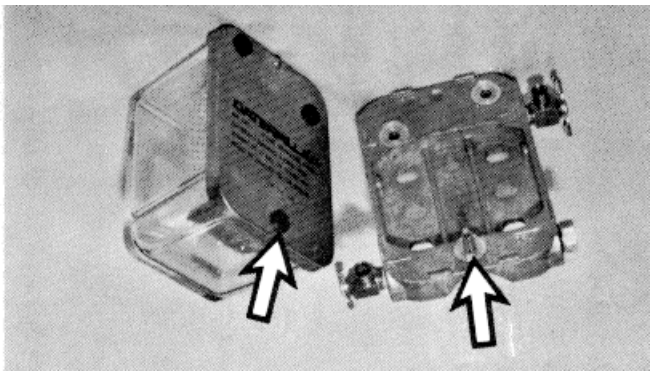
3. Depress the extended tab on the cover retaining clamp with the heel of the hand. Lift the slotted tab from the locking slot.



4. Pull off and discard the used element assembly.



5. Clean and inspect the three sealing surfaces on the separator base.



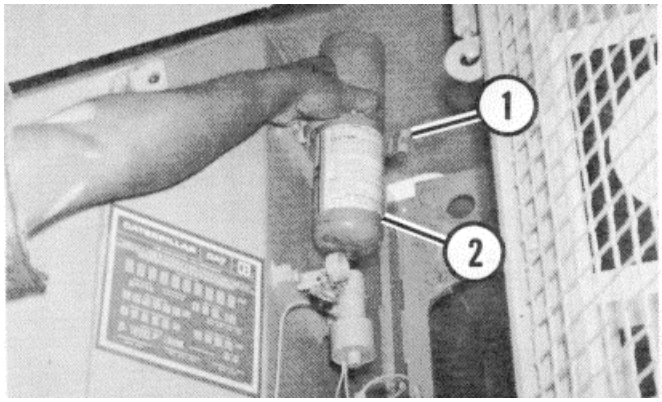
6. Make sure the seals are in the new element. Align the locating pin in the base with the locating hole in the new element. Install the element and the clamp.

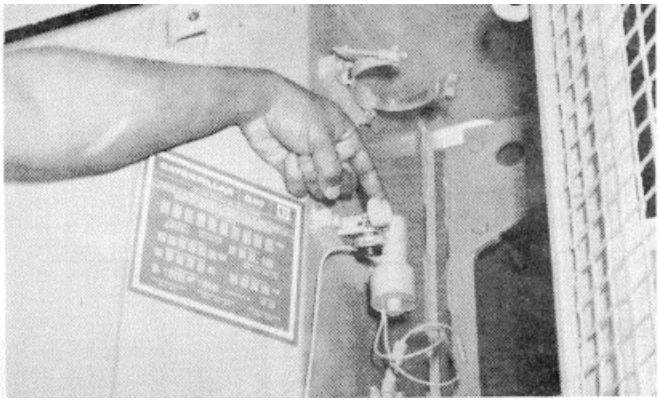
(55) Ether Starting Aid-Changing the Cylinder

WARNING

Ether is poison and flammable.
Do not smoke while changing cylinder.
Use only in well ventilated areas.
Use with care to avoid fires.
Do not store replacement ether cylinders in living areas or in operator's compartment-keep out of the reach of children.
Avoid breathing of vapors or repeated contact with skin.
Do not store cylinders at temperatures above 120°F (48.9ºC).
Do not use cylinders in environments above 200°F (93.3°C).
Do not store cylinders in direct sunlight.
Do not puncture or burn cylinders.
Discard cylinders in a safe place.

Typical Photographs





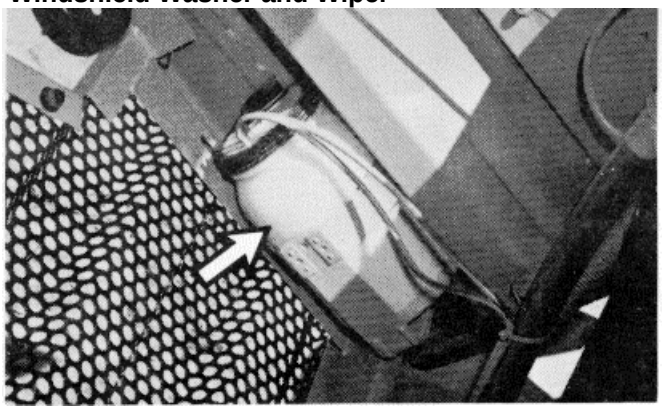
1. Loosen the clamp 1 and unscrew the ether cylinder 2 .

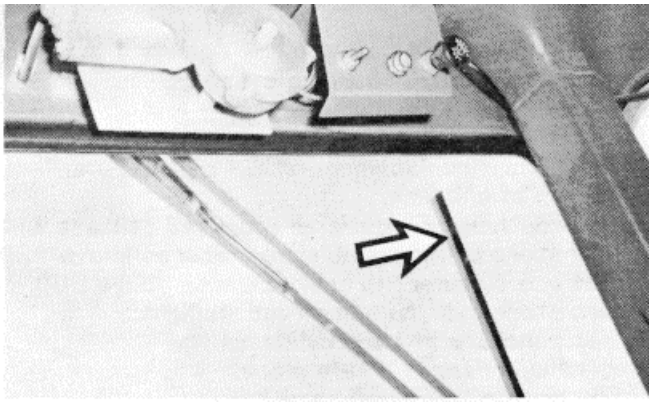
2. Remove the used gasket and install the new gasket provided by with each new cylinder.

3. Install the new Caterpillar Part Number 7N296 cylinder. Tighten the cylinder hand tight. Refasten the cylinder clamp securely around the cylinder.

When Required

(56) Windshield Washer and Wiper

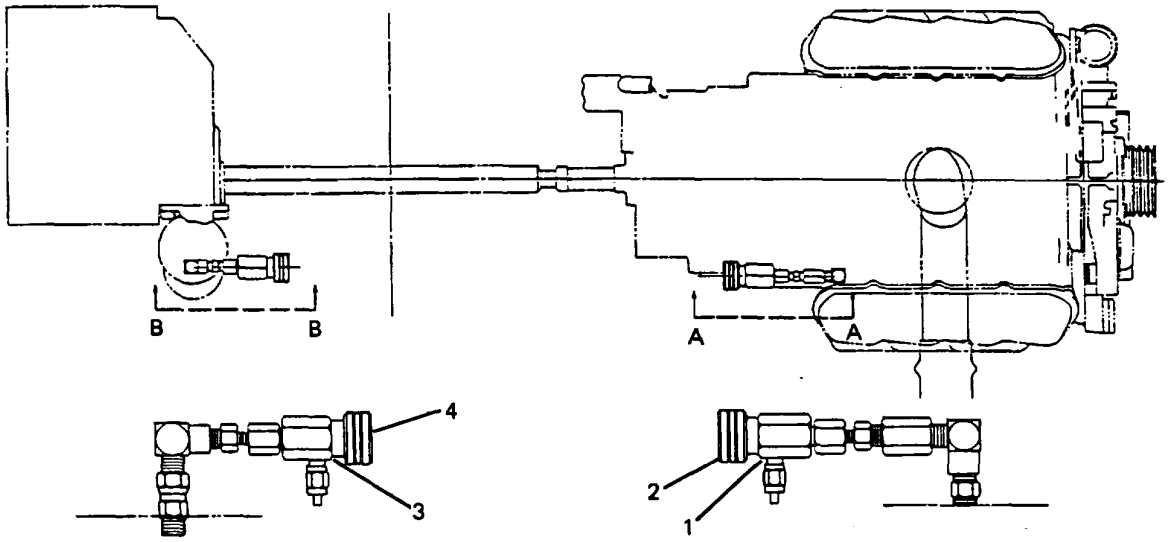




Fill the windshield washer bottle, located under the hood, when it is empty. Use a non-freezing window washer solvent in freezing temperatures.

Inspect the windshield wiper blades. Replace them if they are worn or damaged, or if streaking occurs.

(57) Engine and Transmission Oil Samples



VIEW B–B
TRANSMISSION

VIEW A–A
ENGINE

Refer to technical bulletin TB 43-0210, for proper oil sample intervals and detailed sampling procedures.

CAUTION

Do not take samples after oil has been added. Operate the machine for at least 8 hours before taking a sample.

CAUTION

Keep sampling supplies (tubing, bottle, caps, etc.) free of any contamination. Be sure to mark sample bottles clearly for easy identification.

To Take Engine Oil Sample

1. Clean the engine oil sampling valve (1) thoroughly. Start the engine and bring up to normal operating temperature.

2. With the engine at idle, remove the dust cap (2) on the oil sampling valve. Attach an appropriate size hose to the valve if desired. Place a vessel under the valve opening (or hose if used) and pull or turn ring to drain about one pint of oil. Release ring to close valve.

3. Place a sample bottle under the valve opening (or hose if used) and fill bottle to 1/2" from top and cap the bottle immediately. Replace the dust cap on the sampling valve and return drained oil to the reservoir.

4. Mark, pack and ship the sample bottle as described in TB 43-0210.

To Take Transmission Oil Sample

1. Clean the transmission oil sample valve (3) thoroughly. Start the engine and drive the machine for one mile to bring the transmission to normal operating temperature. With the engine still running, lock the transmission in neutral and set the parking brake.

2. Remove the dust cap (4) on the sampling valve. Attach an appropriate size hose to the valve if desired. Place a vessel under the valve opening (or hose if used) and pull ring to drain about one pint of oil. Release ring to close valve.

3. Place a sample bottle under the valve opening (or hose if used) and fill bottle to 1/2" from top and cap bottle immediately. Replace the dust cap on the sampling valve and return the drained oil to the transmission.

4. Mark, pack and ship the sample bottle as described in TB 43-0210.

CHAPTER 3
SECTIONALIZED UNIQUE MAINTENANCE INFORMATION

Table of Contents

INTRODUCTION. The 613B series tractor-scraper is provided in two configurations; a 613BSNS, 613BSNS1 (Type I), and a 613BSS, 613BSS1 (Type II). Both types of tractor-scraper can be transported using Drive On/Drive Off, Low Altitude Parachute Extraction (LAPES), or Low Velocity Air Drop (LVAD) techniques. The 613BSS and 613BSS1 (Type II) were developed to permit transport by helicopter.

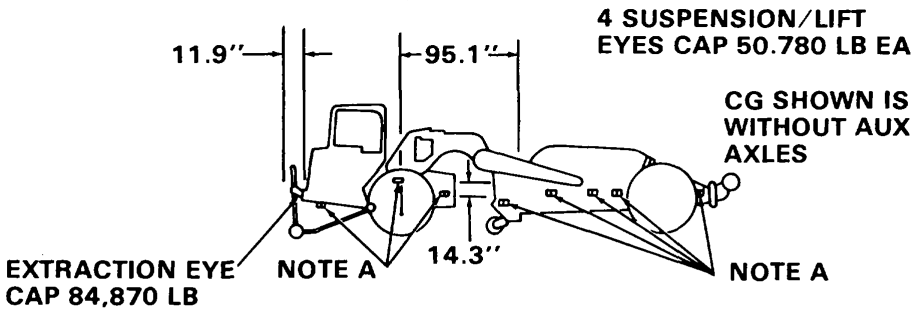
For helicopter lift, the 613BSS and 613BSS1 must be separated into two sections, and only the 613BSS and 613BSS1 (Type II) can be sectionalized. The two sections are: tractor (lower steer axle to draft frame connection), and bowl (scraper cutting edge to bowl rear). After separating the tractor from the bowl, certain procedures are required to insure proper weight distribution. Each section must weigh less than 16,000 lbs in order to accomplish helicopter transport.

GENERAL DIMENSIONS. Study Figures 1 and 2. Dimensions for Drive On/Drive Off and for helicopter transport are shown. Also, locations for lifting and tie down eyes, as well as storage locations for weight distribution items and transportation data are shown.

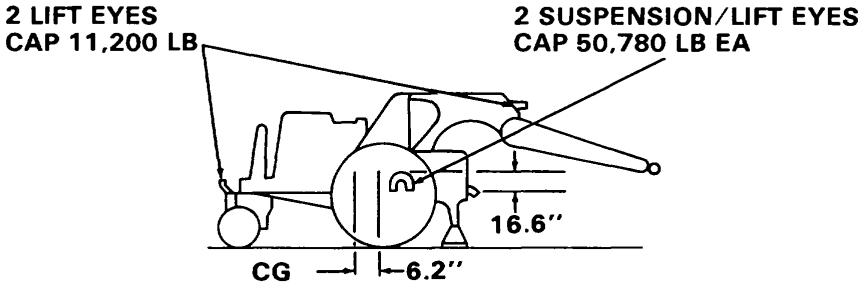
INTERCHANGEABILITY. The tractor of the 613BSS Tractor-Scraper is interchangeable with the tractor of the 613WDS Tractor-Water Distributor. The tractor from a 613BSS can be coupled to the Water Distributor of the 613WDS, and vice versa.

AIR TRANSPORT

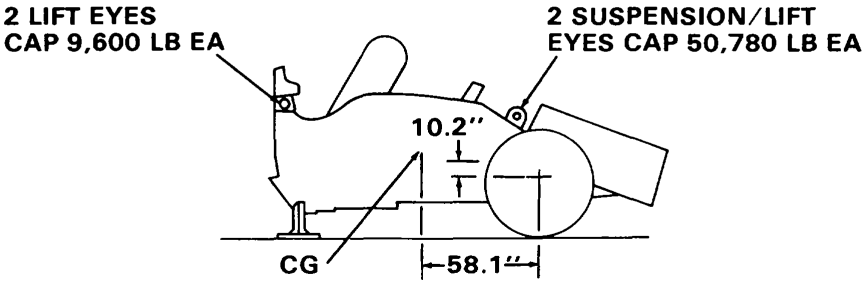
TRANSPORTATION DATA



OVERALL LENGTH W/O FRONT AUXILIARY AXLE = 424.4 IN.
OVERALL HEIGHT = 121.1 IN. SHIPPING TONNAGE = 77
OVERALL WIDTH = 103.3 IN. SHIPPING WT = 33,200 LB
SHIPPING CUBAGE = 3,072 FT^3



OVERALL LENGTH 277.0 IN. SHIPPING WEIGHT = 15,880 LB
OVERALL HEIGHT = 95.0 IN. SHIPPING TONNAGE = 38
OVERALL WIDTH = 100.0 IN.
SHIPPING CUBAGE = 1,523FT^3



OVERALL LENGTH = 228.0 IN. SHIPPING WEIGHT = 15,890 LB
OVERALL HEIGHT = 116.0 IN. SHIPPING TONNAGE = 40
OVERALL WIDTH = 103.3 IN.
SHIPPING CUBAGE = 1,581 FT^3

Figure 1. Transportation Data.

MISSING PICTURE

Figure 2. General Dimensions (1 of 2).

MISSING PICTURE

Figure 2. General Dimensions (2 of 2).

WARNING

Eye protection must be worn while performing the necessary tasks prior to and after transport.

WARNING

Hearing protection must be worn whenever the engine is started.

WARNING

Use more than one person to lift parts in excess of 50 lbs, and more than two when lifting in excess of 100 lbs.

WARNING

Fold the steps down and use whenever climbing on and off Scraper.

CAUTION

Clean all hydraulic hose dust caps, plugs, and quick disconnects immediately before disconnecting hoses, and install dust caps and plugs immediately after.

NOTE

Preparation for helicopter transport should be done on a level and firm surface. If on soft surface, then level areas in front and behind tires in the disassembly/assembly area for easier drive away or drive-up.

NOTE

After removing each component, reinstall and tighten the hardware to prevent loss due to vibration. Store all removed parts either in the tool box or as directed.

a. Preparation for Helicopter Transport. Nine procedures are required to ready the tractor-scraper for helicopter transport.

(1) Removal of rollover protective structure (ROPS) with windshield. Contact Organizational maintenance.

(2) Removal of elevator rock guard. Contact Organizational maintenance.

(3) Removal of right and left elevator chain rollers. Contact Organizational maintenance.

(4) Removal of every other elevator flight (8 total). Contact Organizational maintenance.

(5) Removal of load transfer equipment. See Chapter 3, Preparation For Helicopter Transport, Removing Load Transfer Equipment (page 3-13).

(6) Sectionalization procedures (install steer axle and sectionalize). See Preparation For Helicopter Transport, Sectionalization Procedures (page 3-14).

(7) Weight distribution procedures. Additional components must be removed and mounted in their storage position for proper weight distribution. The fuel tank must be filled to 25 percent capacity before proceeding with sectionalization procedures. See Preparation For Helicopter Transport, Weight Distribution (page 3-24).

(8) Install helicopter lift slings. See Figures 1 and 2 (pages 3-3 and 3-4), and appropriate Army approved bulletins for helicopter slinging procedures.

(9) Prepare a separate overpack box for the ROPS, elevator rock guard, elevator chain rollers, the elevator flights, and hardware.

b. Preparation For Operation After Helicopter Transport. Six procedures are required to prepare the Tractor-Scraper after helicopter transport.

(1) Preparation for reconnection. See Assembly After Helicopter Transport, Preparation For Reconnection (page 3-29).

(2) Reconnect tractor and bowl sections. See Reconnection (page 3-33).

(3) Install 8 elevator flights. Contact Organizational maintenance.

(4) Install rock guard. Contact Organizational maintenance.

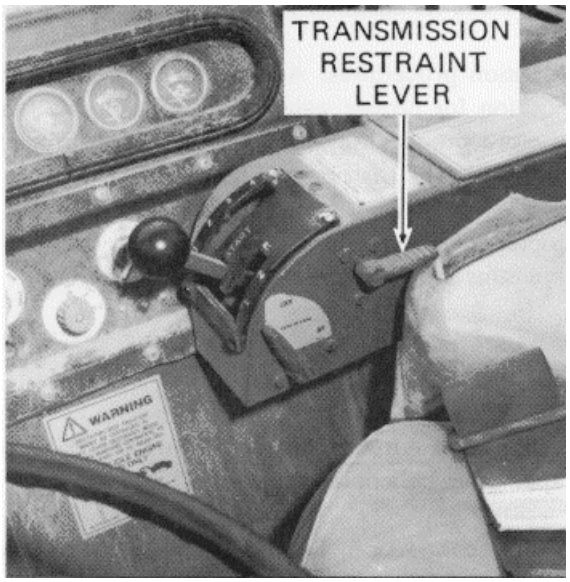
(5) Install elevator chain rollers. Contact Organizational maintenance.

(6) Install rollover protective structure. Contact Organizational maintenance.

PREPARATION FOR HELICOPTER TRANSPORT

a. Controls. The controls for the 613BSS and 613BSS1 provide the same functions as the controls of the 613BSNS and 613BSNS1. For a complete discussion of these controls, see Controls (page 1-13).

However, the 613BSS and 613BSS1 has one additional control, a transmission restraint lever, used only for sectionalization.



Restraint "ON" — To engage the transmission restraint, shift the transmission to NEUTRAL. Push in the lock lever and move it clockwise.

This will prevent gears higher than 1st gear forward, Neutral and 1st gear reverse from being engaged.

Restraint “Off ” — To disengage the transmission restraint, push the lock lever in and move it counterclockwise.

b. Personnel and Tools Required. Sectionalization of the 613BSS and 613BSS1 can be accomplished in four hours by four people. To expedite the procedures, one person must be designated crew leader. Refer to Table A for a listing of standard tools, and to Table B for a listing of components of end item.

Table A. Standard Hand Tools - Helicopter Transport.

TOOL	SIZE	QTY
Wrench, Combination box and open end	5/16 in.	1
	3/8 in.	1
	7/16 in.	2
	1/2 in.	2
	9/16 in.	2
	3/4 in.	1
	15/16 in.	1
	1-1/8 in.	1
Socket, 1/2 in. drive	7/16 in.	2
	1/2 in.	2
	9/16 in.	2
	3/4 in.	1
	15/16 in.	1
	1-1/8 in.	1
Wrench, Ratchet, 1/2 in. drive		1
Extension, Socket, 1/2 in. drive	6 in.	1
Wrench, Torque, 1/2 in. drive	250 ft-lb	1
Screwdriver	6 in.	1
Hammer	1 lb.	1
Hammer	3 lb.	1
Iron, Tire	24 in.	1
Driftpin	12 in.	1
Hoist	1/4 ton capacity	1

NOTE

The Type II is equipped with all equipment needed for air transport sectionalization. All equipment needed is on or mounted to the machine.

Table B. Components Of End Item - Helicopter Transport.

QUANTITY	PART NO.	DESCRIPTION	WHERE USED
1	5R5874	FOOT L-H	TOOL GP
1	5R5875	FOOT R-H	
1	5R5862	PULLER AS	
1	5R5871	PIN AS ALIGNM1ENT	
1	5R7380	HOSE AS	
1	5R5700	COUPLING ASSY.	
1	5R5701	COUPLING ASSY.	
1	5R5718	PLUG	
1	5R5719	CAP	
2	5R5809	STRAP	
4		WEB STRAP	
1	5R5839	STRAP	
1	5R5886	SPRING AS	STEERING AXLE STORAGE
1	5R5895	CABLE AS	
1	5R5896	CABLE AS	
4	1J8855	PIN	
4	5P8837	PIN LOCK	
1	5R5772	TANK ASSY	FUEL TANK STORAGE
1	5R5775	HOSE ASSY	
1	5R5725	COUPLING ASSY.	
1	SR5726	CAP	
1	5R5783	BAR	
2	±5R5757	ROD “J”	
2	**5N2894	WASHER	

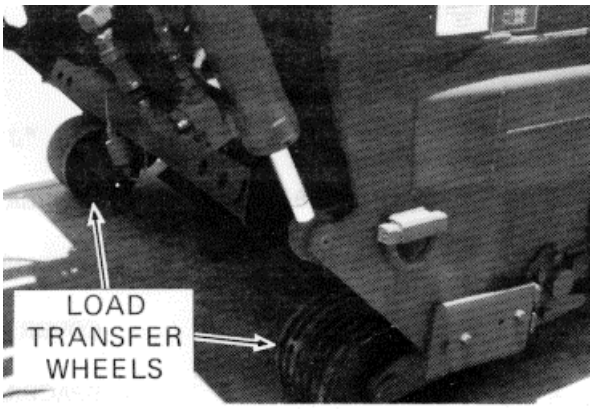
Table B. Components Of End Item - Helicopter Transport (Cont).

QUANTITY	PART NO.	DESCRIPTION	WHERE USED
2	*3K6060	LOCK NUT	
2	±5R5757	ROD "J"	BATTERY STORAGE
2	**5M2894	WASHER	
2	*3K6060	LOCK NUT	
1	5R5818	COVER	AIR CLEANER STORAGE
1	5R5702	SPACER	
8	++S1591	BOLT	
16	**5M2894	WASHER	
8	1D4717	NUT	
2	*3K6060	LOCK NUT	
4	S509	BOLT	SEAT STORAGE
4	9L9132	WASHER	
1	++S1591	BOLT	HOOD STORAGE
1	9F2978	NUT	
1	**5M2894	WASHER	

SYMBOLS *, **, ±, ++ indicate use in more than 1 group.

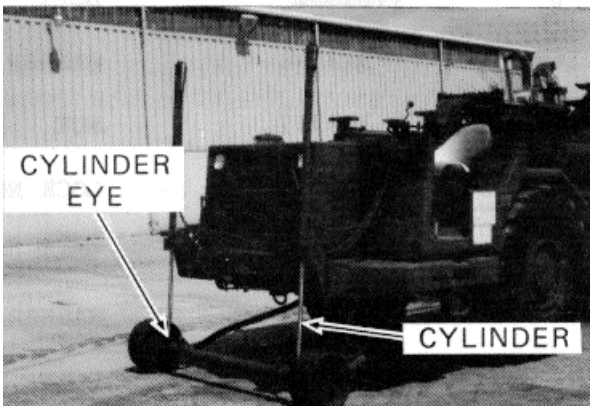
c. Removing Load Transfer Equipment. Eight. procedures are necessary to remove load transfer equipment.

(1) Start the engine, raise the bowl about one foot and open the bowl floor about six inches. Place a block under the cutting edge to keep the load transfer wheels off the ground. Lower the load transfer axle. Stop the engine.

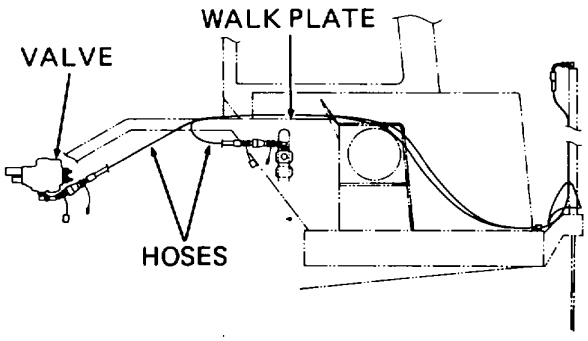


(2) Remove the two load transfer wheels from the bowl cutting edge.

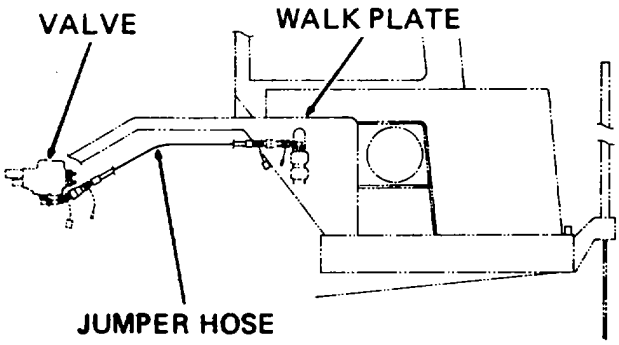
(3) Disconnect the load transfer axle cylinder eyes from the lugs on the axle. Start the engine, retract the cylinders, and stop the engine.



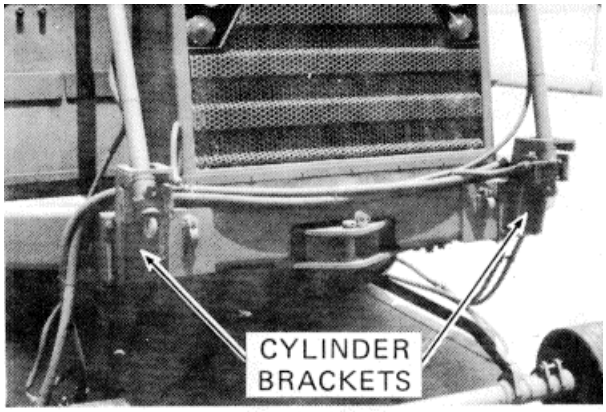
(4) Disconnect two hoses; one from the dump and lift valve, and one from the fitting under the walkplate near the right front fender.



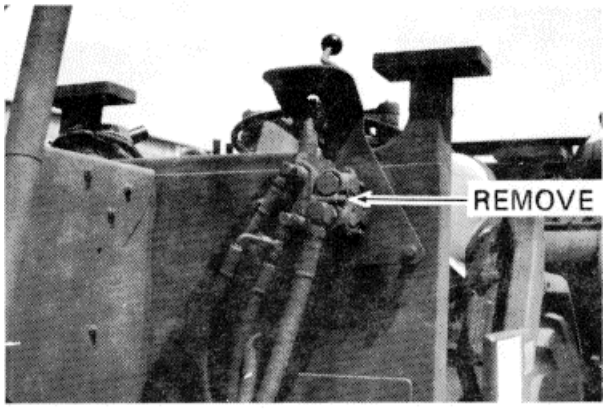
(5) Attach jumper hose to fitting under walkway and to dump and lift valve.



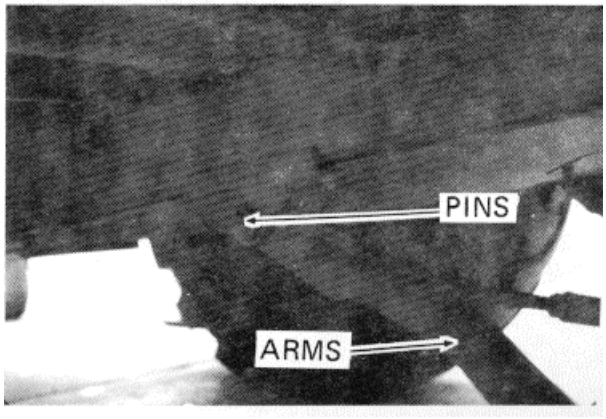
(6) Disconnect cylinder brackets from the bumper.



(7) Remove the load transfer axle valve from the front of the operator's compartment. Store cylinder brackets and valve in a secure area.

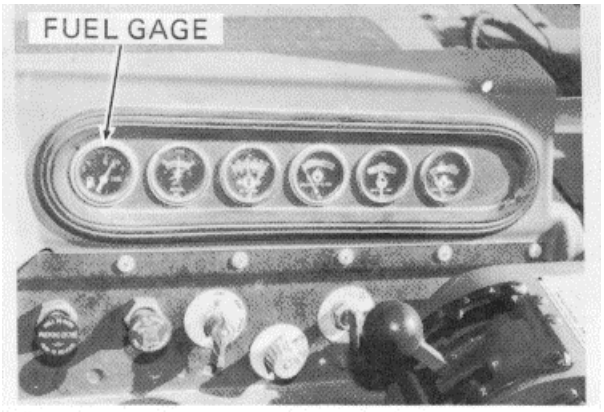


(8) Remove the pins and washers holding the load transfer axle arms to the bottom of the tractor, and roll the axle to a secure area.



d. Sectionalization Procedures.

(1) Check fuel gage before beginning. To maintain weight allowance for helicopter transport, fuel tank should be 1/4 full. Check and fill the auxiliary fuel tank. Auxiliary fuel tank must be full for sectionalization.



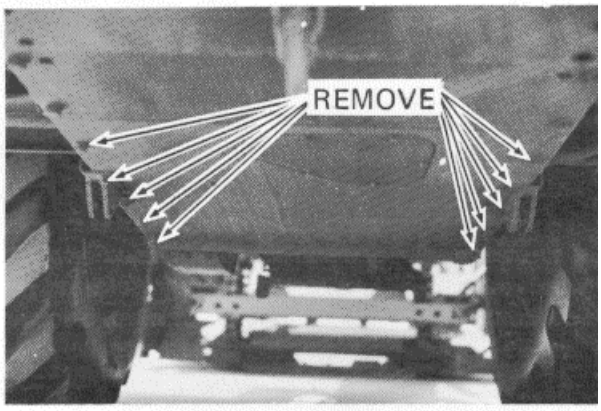
NOTE

See page 3-42 for tightening torques of various size bolts.

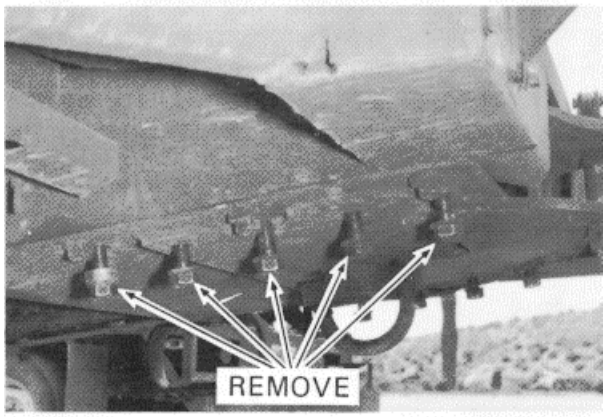
WARNING

Belly pan weighs 50 lbs. (22.7 Kgs). Support its weight when removing to prevent personal injury.

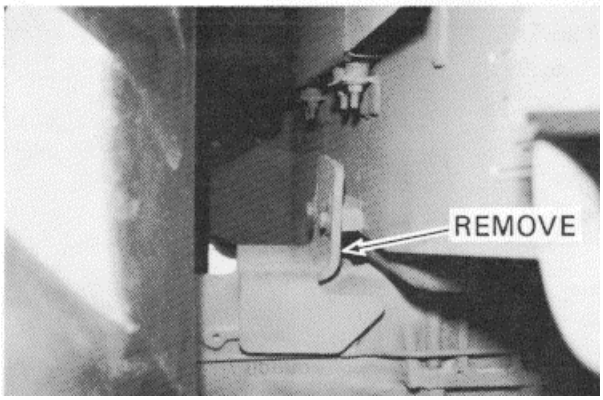
(2) Remove bolts supporting belly pan rear half, and the load transfer arm brackets. Remove the rear belly pan. Reinstall the load transfer brackets. Reinstall all but 4 bolts; set belly pan and 4 bolts to side.



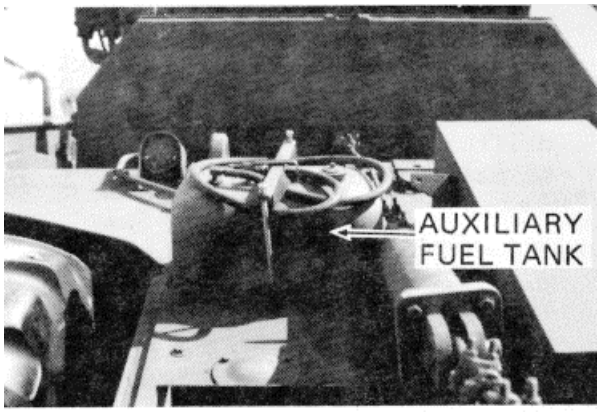
(3) Remove 5 bolts from the insider row of bolts on each side of the front belly pan. Set bolts aside for late connection of steer axle to tractor.



(4) Remove the front axle guards from the front axle and put in tool box.



(5) Remove the auxiliary fuel tank from the rear cover.



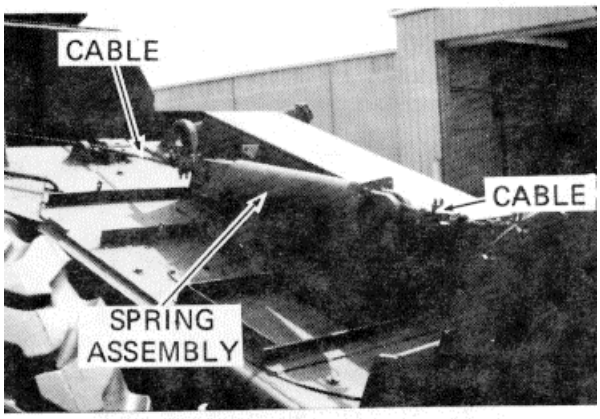
WARNING

Be sure the emergency brake is set when running the engine.

Hearing protection must be worn when running the engine.

(6) Start the engine. Raise the bowl to the fully raised position.

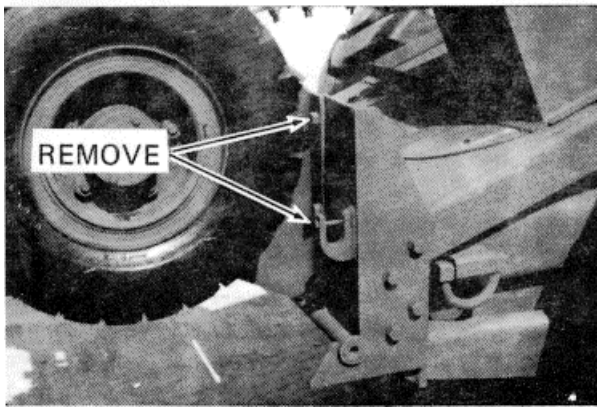
(7) Move the ejector back to the rear of the bowl. Connect the spring assembly to cables. Connect cables to lugs on back of ejector and to lugs o the steering axle. Bring the ejector forward until the spring assembly starts to stretch.



WARNING

Ejector may drift under the weight of the steer axle. Slight pressure on the ejector control lever will help to keep the ejector in place.

(8) Remove the bolts securing the steering axle to the storage brackets.



WARNING

The weight of the steering axle, 1150 lbs 521.6 Kg) will cause the ejector to drift. A slight pressure on lever must be maintained to hold ejector in place.

CAUTION

Before lowering wheels, be sure bowl is in fully raised position.

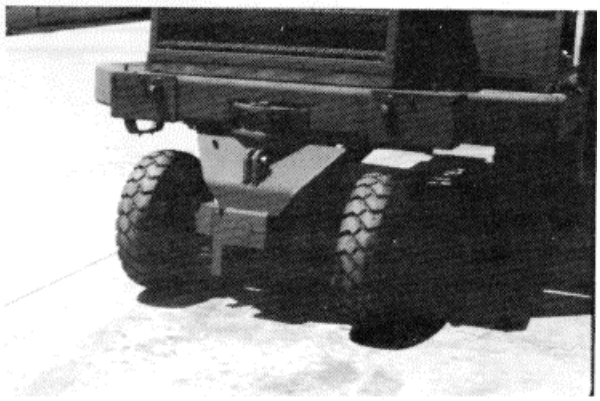
(9) Move the ejector back to lower steering axle to the ground. When axle is safely on the ground, lower stabilizing skid pad. Reinstall bolts to storage brackets. Detach cable.

(10) Store cables and 2 pins from spring assembly in the tool box. Store spring assembly on two brackets on left side of rear frame.

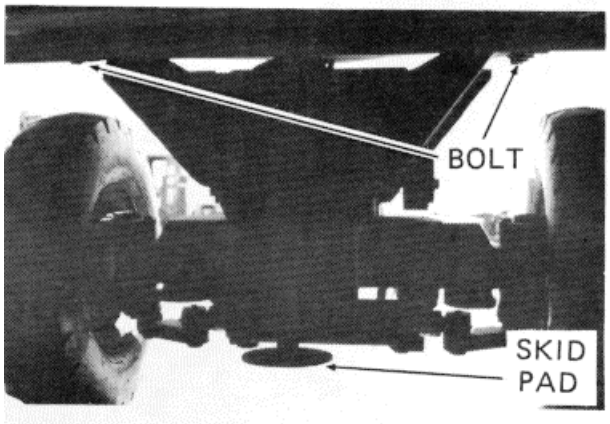
NOTE

The quick disconnects on the steer axle should be facing forward.

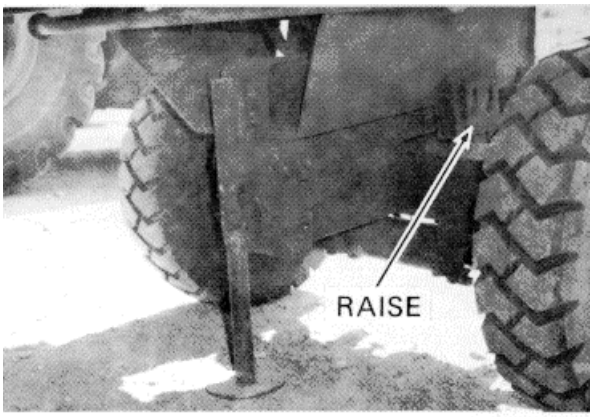
(11) Roll axle up to front of tractor. Lower the bowl to raise the front of the tractor enough to provide clearance for steering axle installation. Roll the steer axle under the front belly pan. Position holes in the axle frame in line with the holes of the tractor frame.



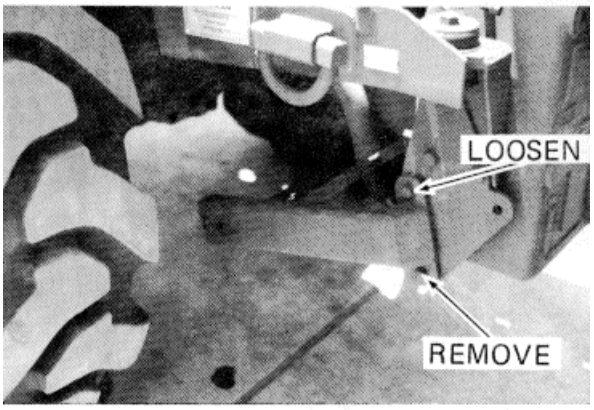
(12) Raise the bowl enough to bolt axle to tractor. Stop Engine. Raise stabilizing skid pad.



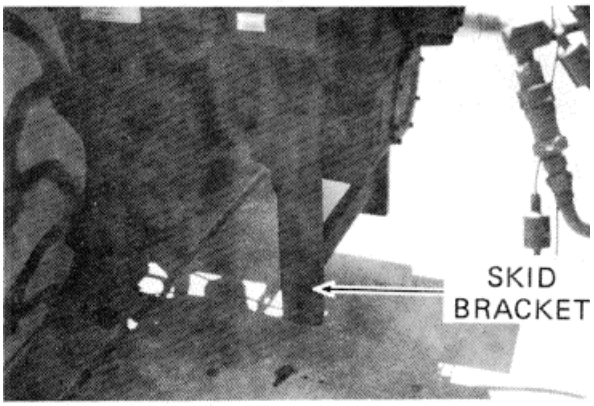
(13) Raise oscillation control pads on each side of the steering axle frame.



(14) Remove lower bolt and loosen top bolt on both sides of the transmission skid bracket.

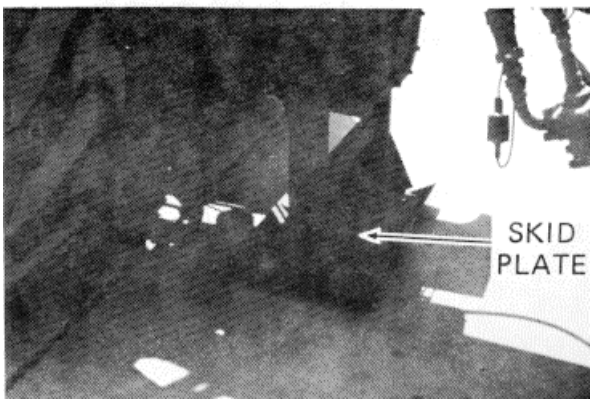


(15) Swing brackets down to vertical position and install bolts.



(16) Remove the skid plate from the top of the tool box.

(17) Install the transmission skid plate on the bracket.

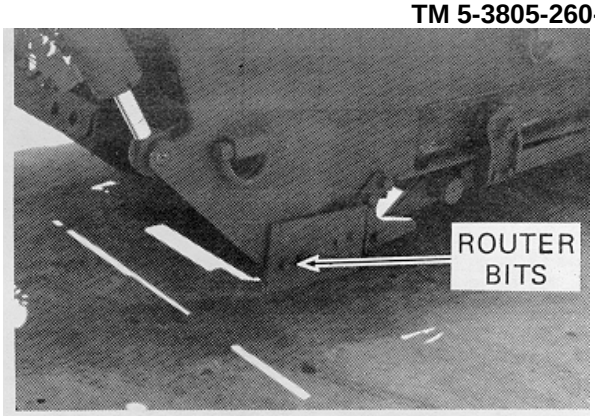


WARNING

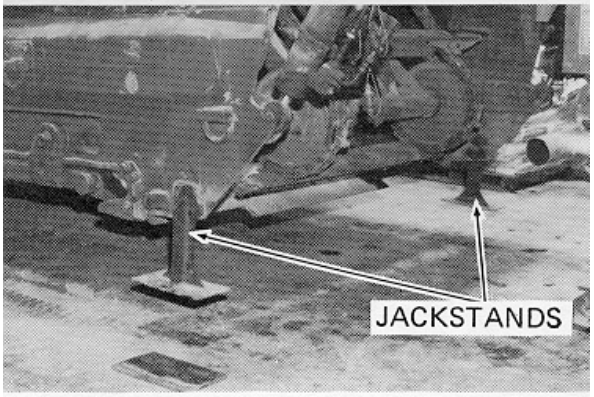
Be sure the emergency brake is set when running the engine.

Hearing protection must be worn when running the engine.

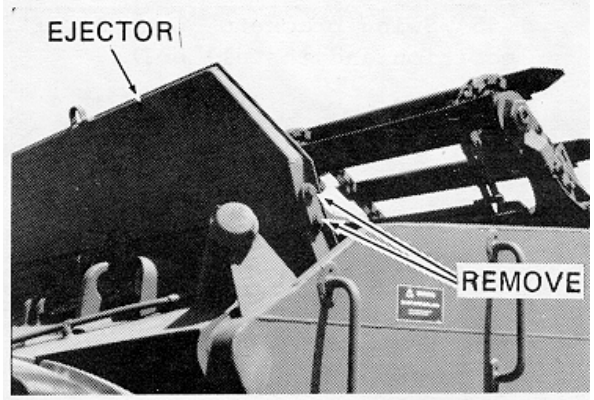
(18) Start the engine. Raise the bowl and move the bowl floor about one foot to the rear. Remove router bits.



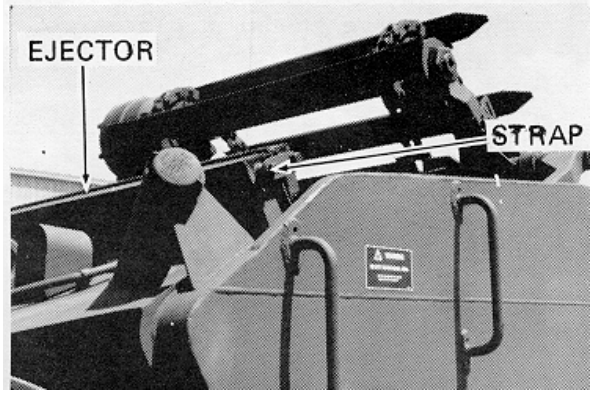
(19) Install the jack stands with longer bolt in top hole. Lower the bowl and stop the engine.



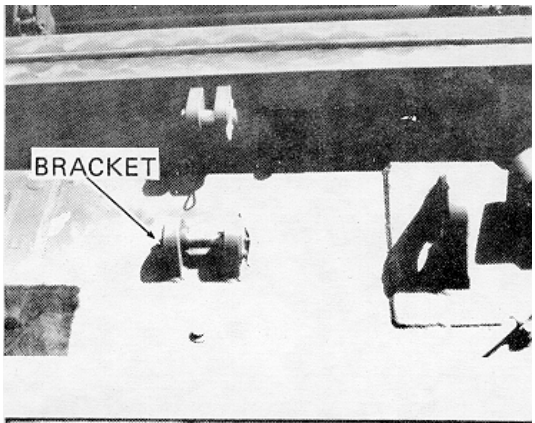
(20) Remove both bolts from the straps located on both sides of the ejector hinge.



(21) Fold the ejector down and reinstall the straps.



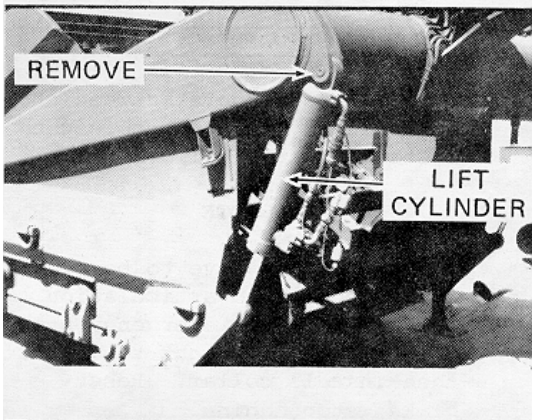
(22) Immobilize the ejector by strapping it to the bracket on the cover of the rear frame using suitable strapping material.



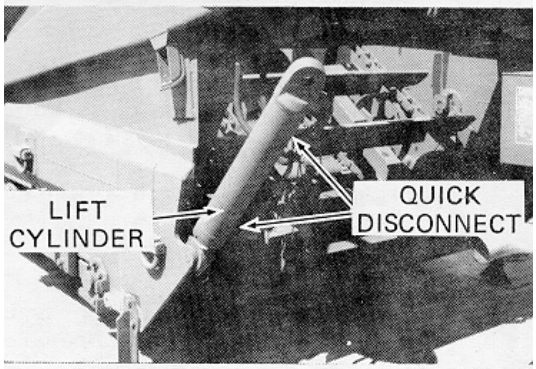
NOTE

Be prepared to slowly lower lift cylinders until their weight rests on their lines.

(23) Remove the pins holding the lift cylinders to the draft frame. Slowly lower cylinders until their weight rests on their lines. Reinstall pins in the draft frame. Move lift lever back and forth to relieve pressure on pins.



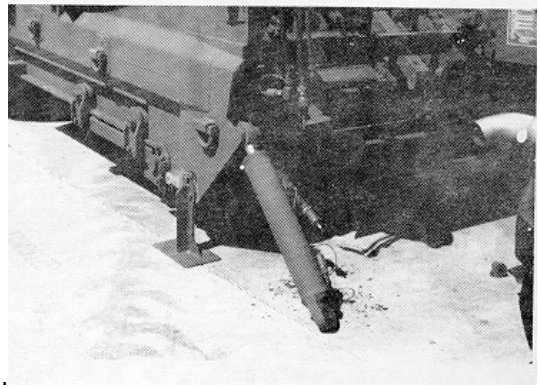
(24) Start the engine and carefully retract the cylinders. STOP THE ENGINE. Operate lift lever in both directions to relieve pressure in hydraulic lines.



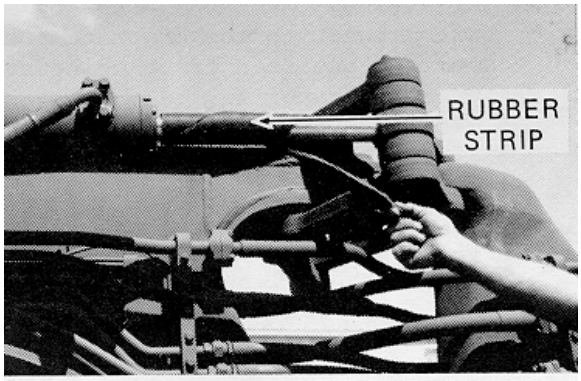
CAUTION

Clean all hose dust caps and plugs and all quick disconnects immediately before disconnecting hoses, and install dust caps and plugs immediately after.

(25) Two people are needed to disconnect the hose lines from the lift cylinders. Allow cylinders to rest on the ground



(26) Cover the steering cylinder rods with protective rubber seal strips.



WARNING

Don't place fingers between stop collars and cylinder stops when installing stop collars.

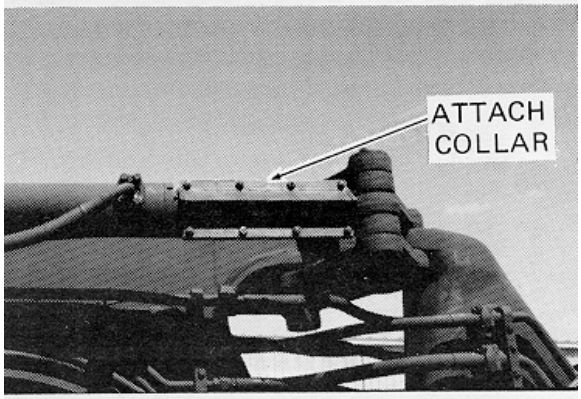
NOTE

The engine may have to be started to attach second articulation collar. Release emergency brake, turn to left or right to align, then install collar. Reset brake, stop engine.

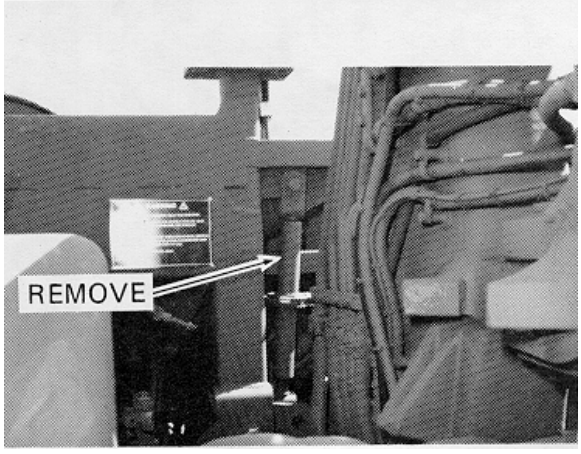
NOTE

Do not tighten stop collars until both are installed.

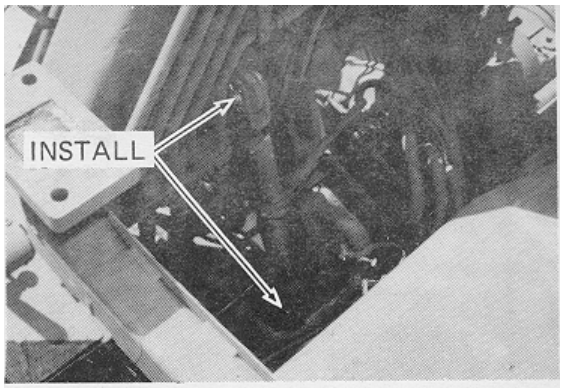
(27) Attach the articulation stop collars.



(28) Remove the jack which is behind and to the right of the operator's platform.



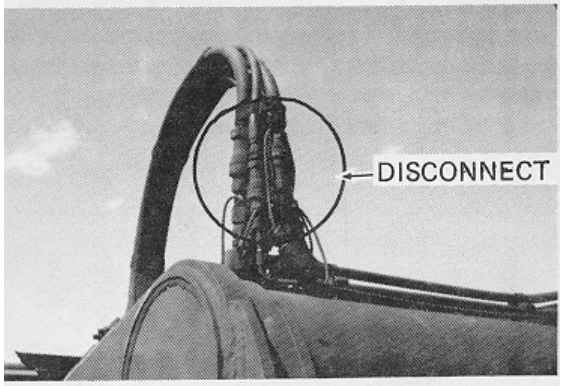
(29) Install the jack between the eyes on the hitch and the tractor frame.



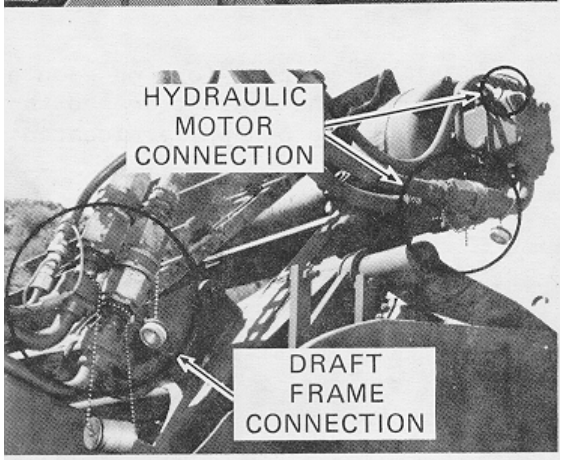
CAUTION

Clean all hose dust caps and plugs and all quick disconnects immediately before disconnecting hoses, and install dust caps and plugs immediately after.

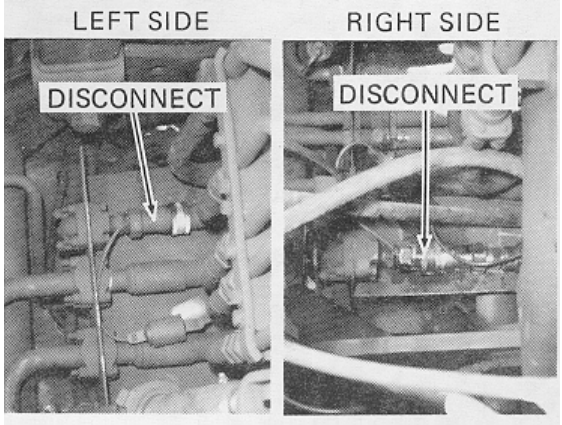
(30) Disconnect the air, electrical, fuel and hydraulic quick disconnect lines. Remove the metal hose strap and hardware and place in tool box. Attach caps and plugs to lines. Run lines along the inside of the bowl and secure.



(31) Disconnect three hoses at draft frame connection and at hydraulic motor connection. Store hoses in tool box.



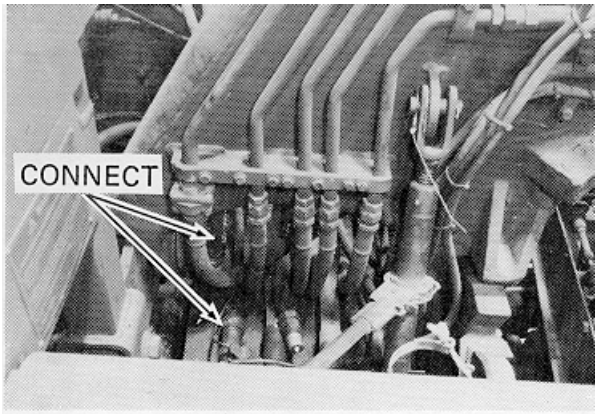
(32) Disconnect the steering cylinder hoses at base of hitch.



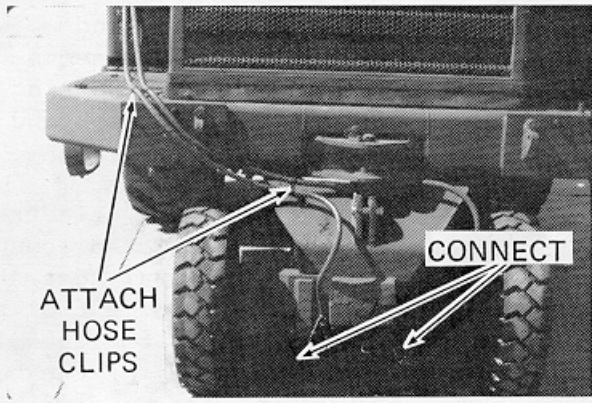
CAUTION

Route second hose behind hose with elbow away from drive shaft.

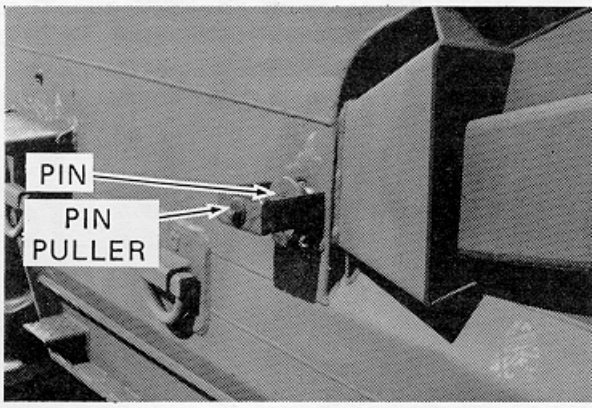
(33) Connect the hose with elbow to the right side in hitch area and the other hose to the left side.



(34) Attach hose clips to the boss at the right front corner of the frame and to the weld stud at the steering axle. Connect the two hydraulic hoses to the quick disconnects on the steering axle.



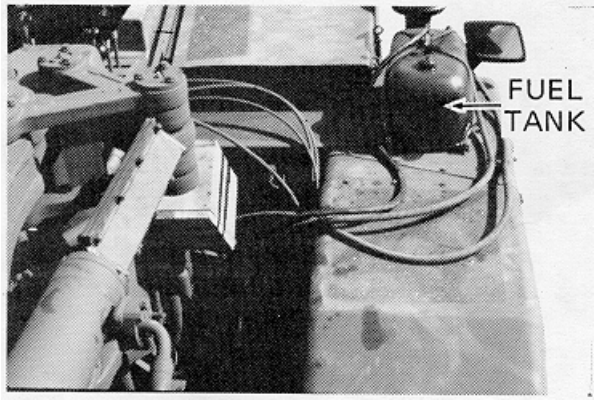
(35) Remove pins (one on each side), securing the draft frame to the bowl, using pin puller located in tool box.



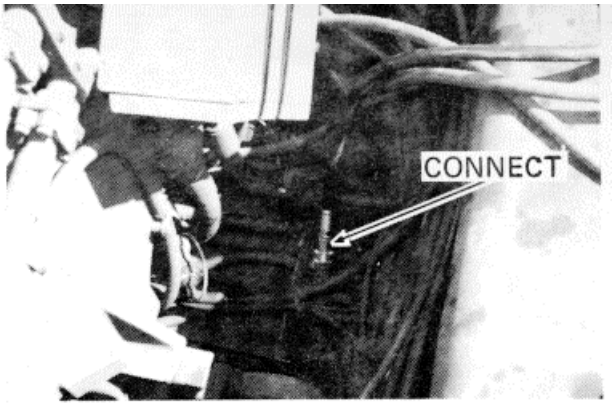
(36) Install the auxiliary fuel tank on top of the hydraulic oil reservoir.

NOTE

Engine will not get fuel if vent on top of auxiliary fuel tank is not open.



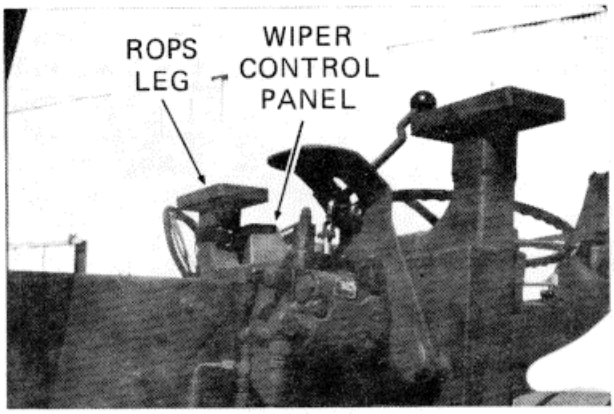
(37) Connect the auxiliary fuel tank line to the tractor fuel line located at base of hitch. Secure the tank with hold-down straps, and open the vent on top of the tank cap.



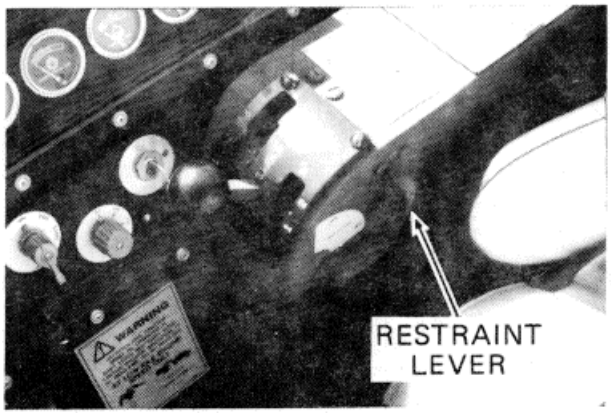
CAUTION

Transmission restraint must be engaged before moving the tractor.

(38) Strap the windshield wiper control panel to the front right hand ROPS leg beneath the mounting flange.



(39) Engage the transmission restraint lever to sectionalization position and start the engine.

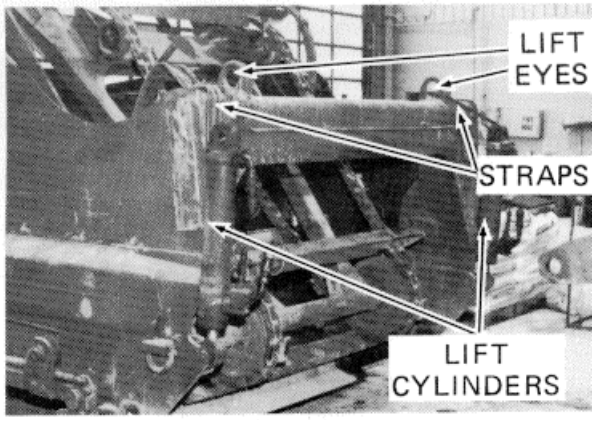


CAUTION

Drive straight and slow to avoid damage to the bowl.

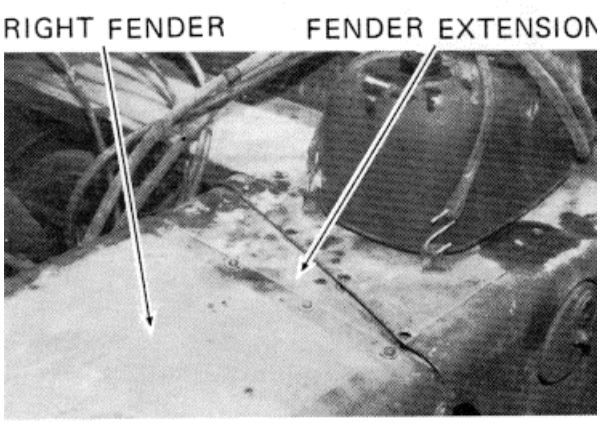
(40) Drive the front section forward and stop the engine.

(41) Using suitable material, strap cylinders to lift eyes. Install the draft pins in the scraper holes. Sectionalization is now complete.

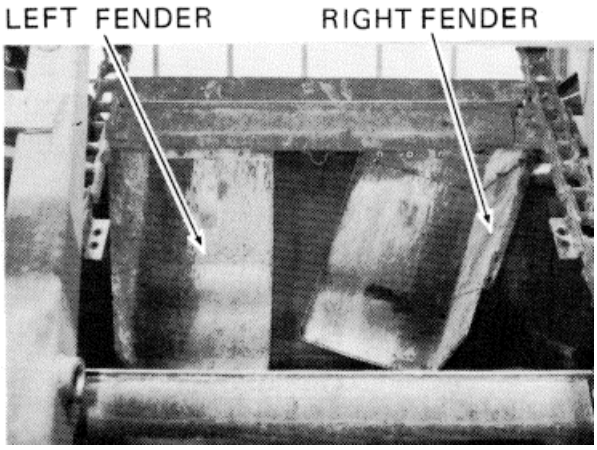


e. Weight Distribution. Nineteen steps are required to distribute weight so that both the tractor and the bowl will each weigh less then 16, 000 lbs.

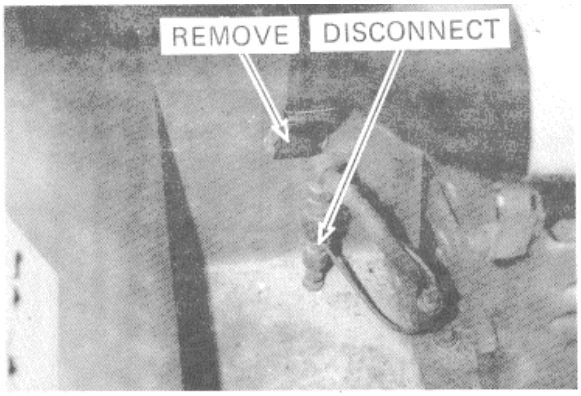
(1) Remove the right fender, with extension 58 lbs (26.3 Kg); and the left fender, 55 lbs (24.9 Kg).

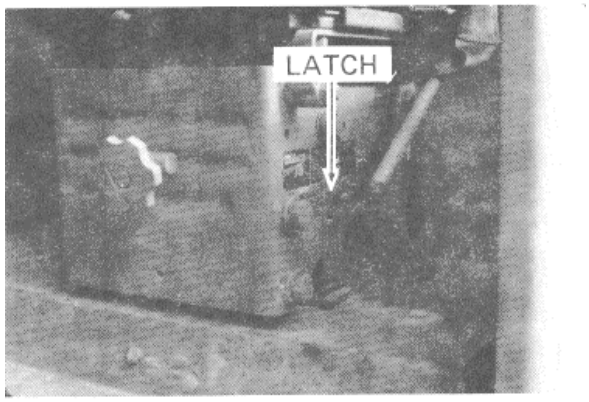


(2) Store fenders by attaching to hinged ejector plate. Fenders will be inside bowl.

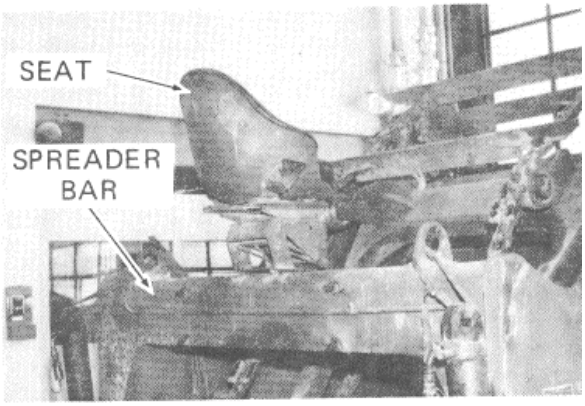


(3) Raise the operator's seat to the highest level. Remove the seat belt anchor and the quick disconnect air hose line from the seat base. compress seat base and latch in position. Remove bolts securing base of seat.

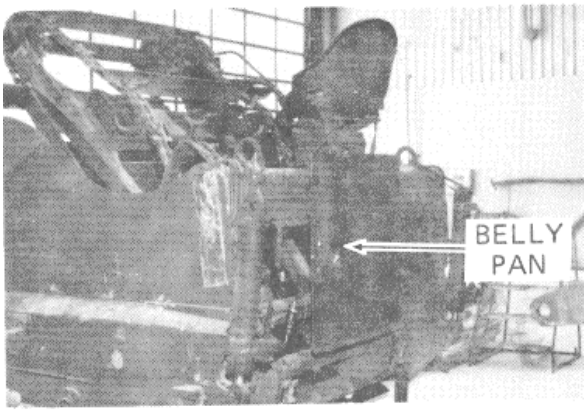




(4) Remove the operator's seat, 97 lbs (44 Kg) and store on center of the bowl crosstube.



(5) Bolt rear belly pan (removed earlier) to bowl crosstube.

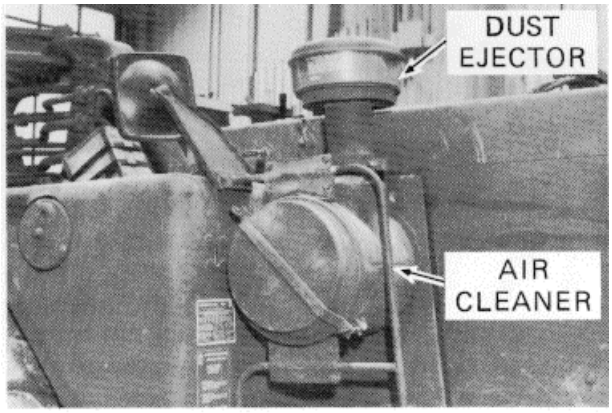


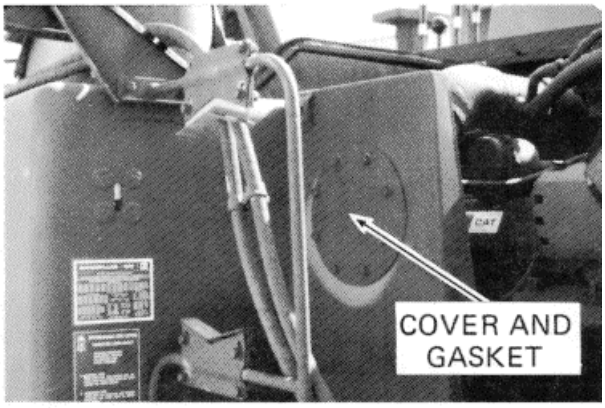
CAUTION

Engine must not be run, even for brief periods, without the air cleaner assembly securely in place on the air inlet.

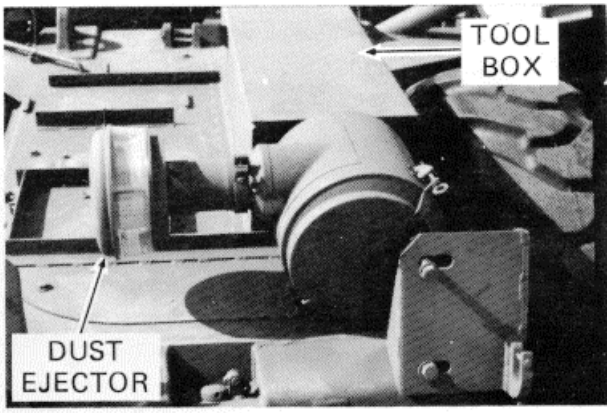
When the air intake is covered the tractor cannot be started.

(6) Remove the dust ejector. Remove the air cleaner, 33 lbs (15 Kg) from the right hand side of the tractor. Bolt cover and gasket to air intake.

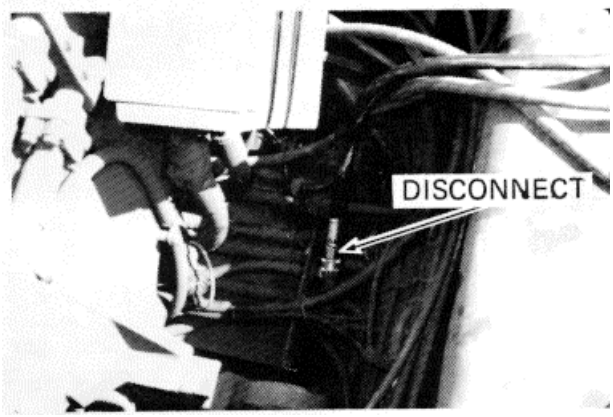




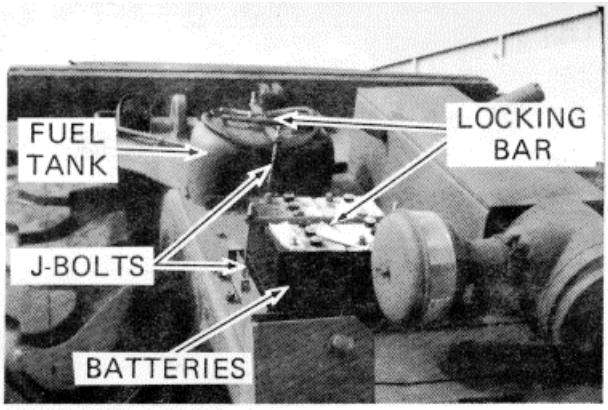
(7) Store the air cleaner by mounting it to the end of the tool box with furnished spacer ring. Re-attach the dust ejector.



(8) Disconnect the auxiliary fuel tank line from the tractor fuel line located at base of hitch.



(9) Remove the hold-down straps securing the auxiliary fuel tank. Remove the tank and store on the rear cover with locking bar and two J bolts. Close the vent on the auxiliary fuel tank cap.



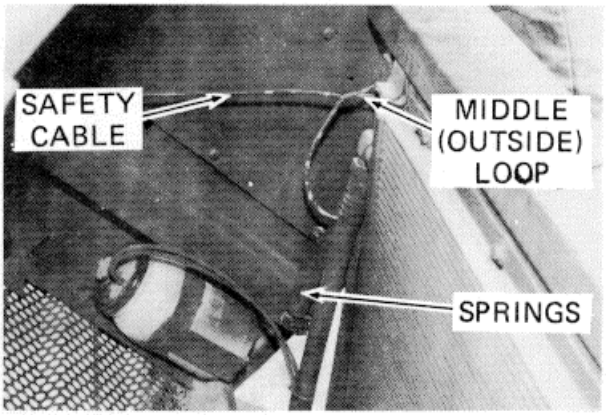
WARNING

Remove batteries slowly to avoid tipping. Battery acid can escape and burn personnel.

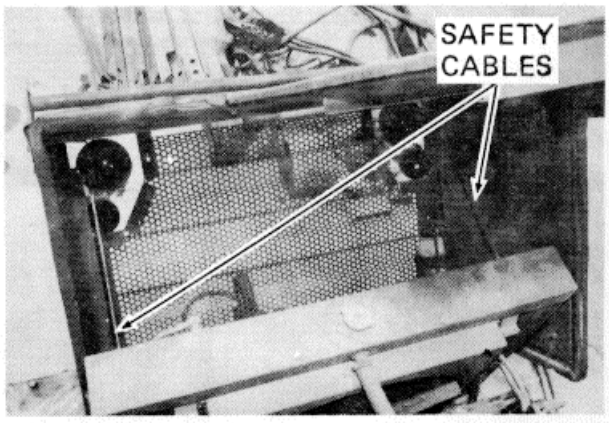
(10) Remove batteries, 122 lbs (55.3 Kg) with a strap, and store on the rear cover, securing with a locking bar and J-bolts.

(11) Disconnect the wiring harness and the windshield washer bottle hoses from the engine hood.

(12) Detach springs from hood.



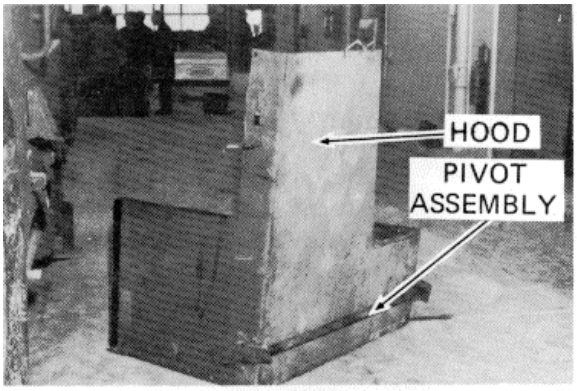
(13) Remove capscrews and detach the hood safety cables from the machine frame.



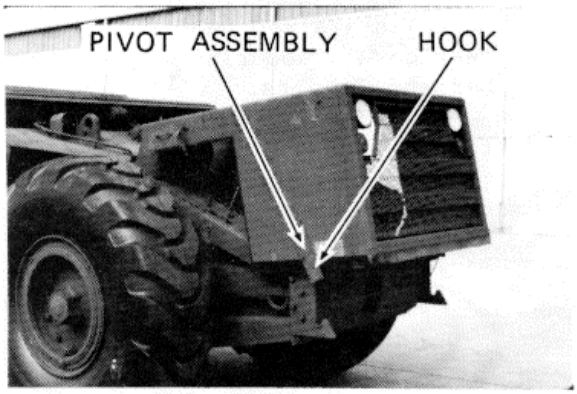
CAUTION

Be sure not to damage headlights when placing hood on ground.

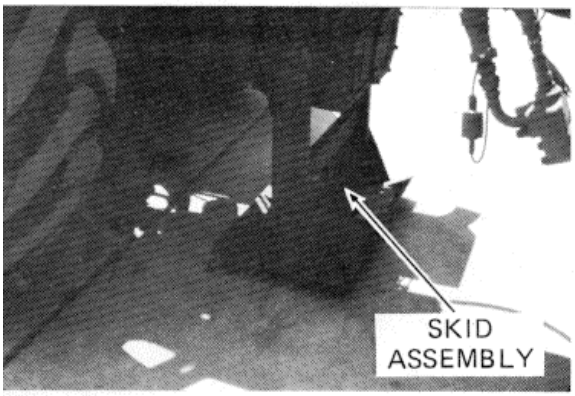
(14) Remove hood, 181 lbs (82 Kg) from the hanger brackets. Relocate hood pivot assembly to bottom of hood.



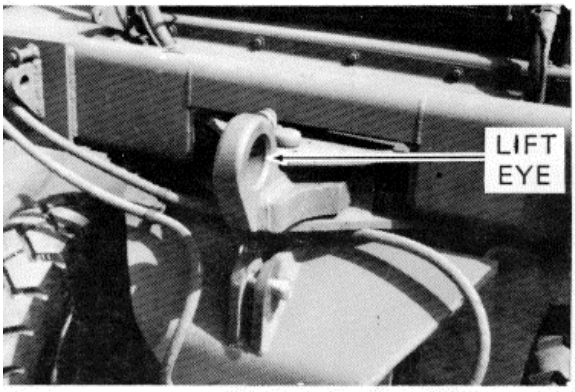
(15) Store the hood with pivot assembly laying in upper hooks on the rear frame and secure hood to bracket on the tool box.



(16) Remove transmission skid assembly and store inside bowl on right wall.



(17) Install the helicopter lifting eye on the tractor frame.

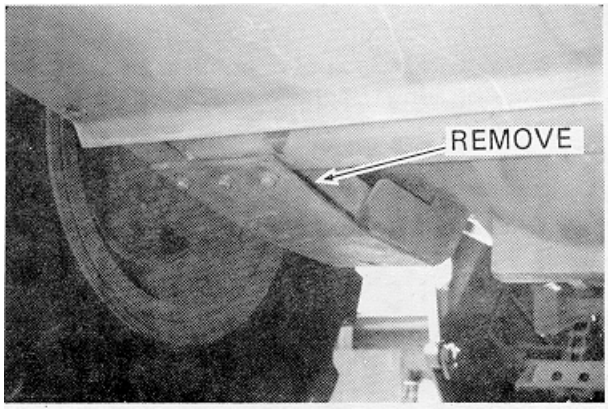


WARNING

Muffler and guard may be hot.

(18) Remove the muffler guard beneath frame, inside right front wheel. Store muffler guard on front of ejector.

(19) Remove muffler and store next t to muffler guard on ejector.



NOTE

Weight distribution is now complete, proceed with slinging.

PREPARATION FOR OPERATION AFTER HELICOPTER TRANSPORT

a. Preparation for Reconnection. The following eleven procedures are necessary to make the tractor operational.

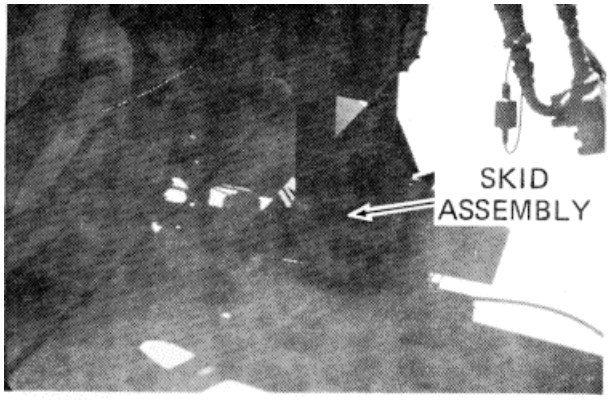
CAUTION

Do not run the engine without the muffler installed.

CAUTION

Engine must not be run without the air cleaner assembly securely in place on the air inlet.

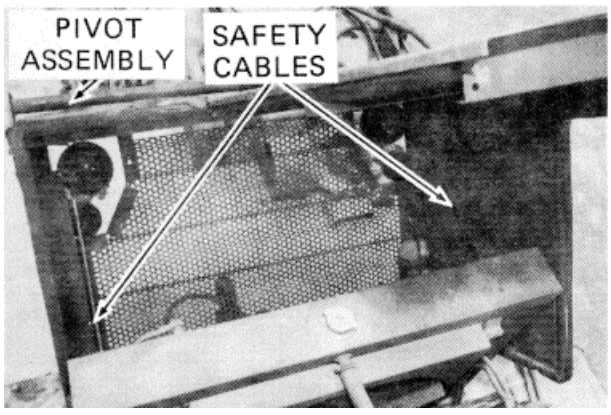
(1) Remove transmission skid assembly from inside bowl and install on rear of tractor.



WARNING

Hood weighs 181 lbs. (82 Kgs).

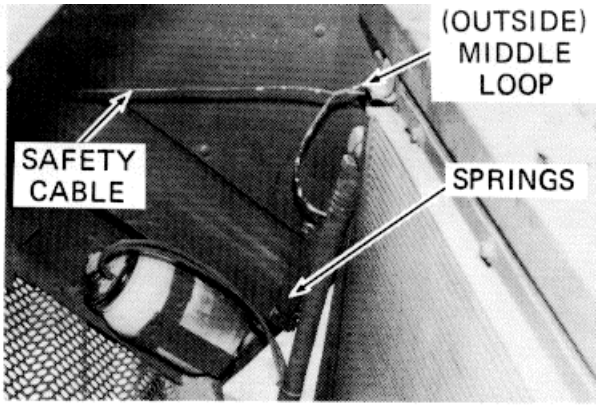
(2) Remove the engine hood from the rear frame and relocate pivot assembly on top of hood. Attach hood to hanger brackets on the tractor, secure the safety cables and attach the hood springs.



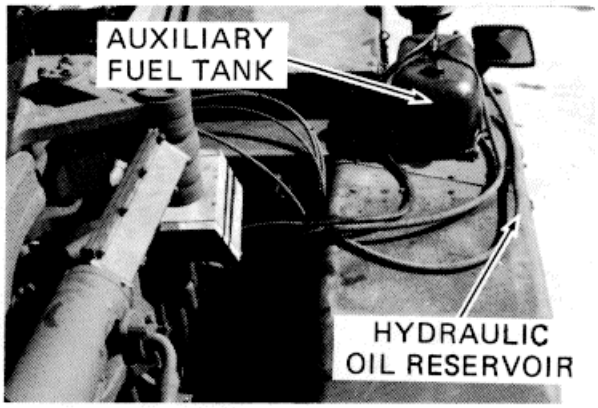
NOTE

When securing the safety cables, be sure the middle loop of each cable is on the outside.

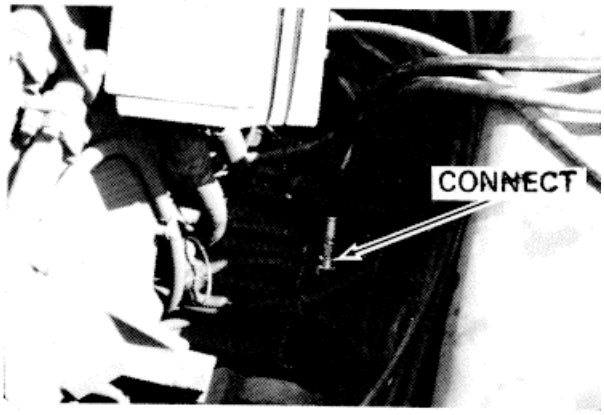
(3) Connect the wiring harness and the windshield washer bottle hoses to the engine hood.



(4) Remove the auxiliary fuel tank from rear cover storage and install tank on top of the hydraulic oil reservoir.



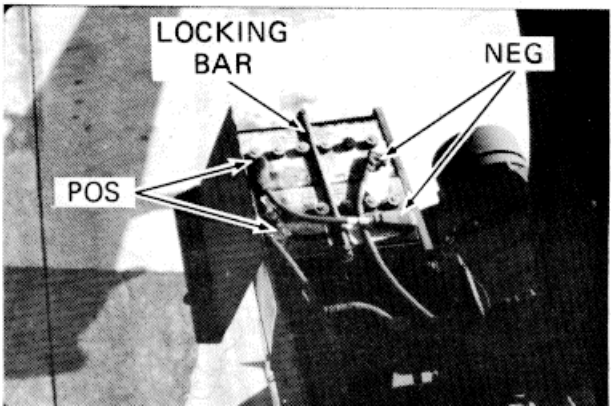
(5) Connect the auxiliary fuel tank line to the tractor fuel line located at base of hitch. Secure the tank with hold down straps and open the vent on top of the tank cap.



CAUTION

Be sure to attach battery cables correctly.

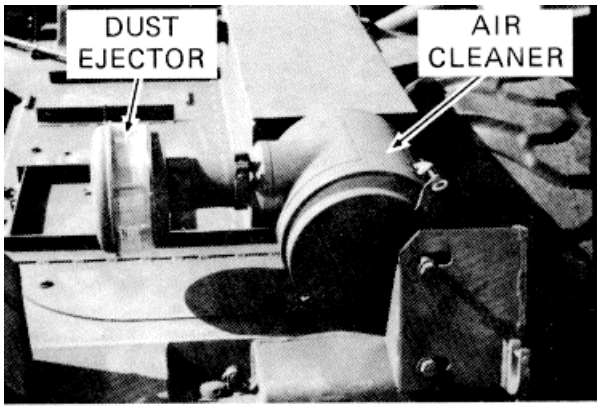
(6) Remove stored batteries with a strap from the rear cover and install in the tractor battery box with a locking bar.

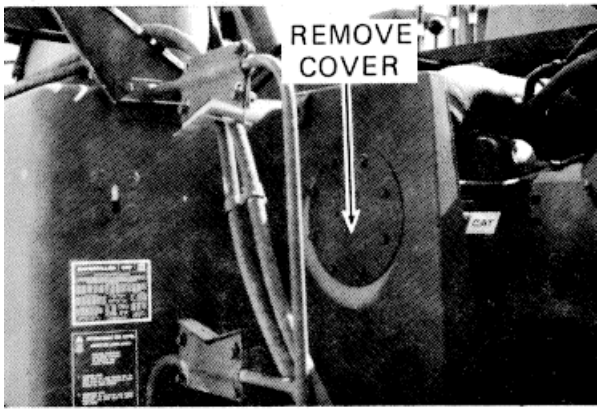


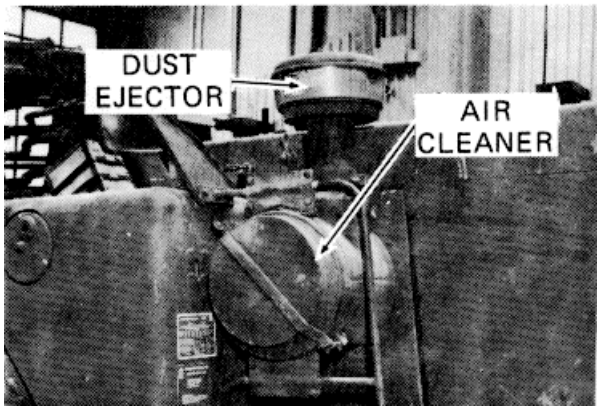
NOTE

Dust ejector will have to be removed to attach air cleaner. Be sure to attach the dust ejector once the air cleaner is installed.

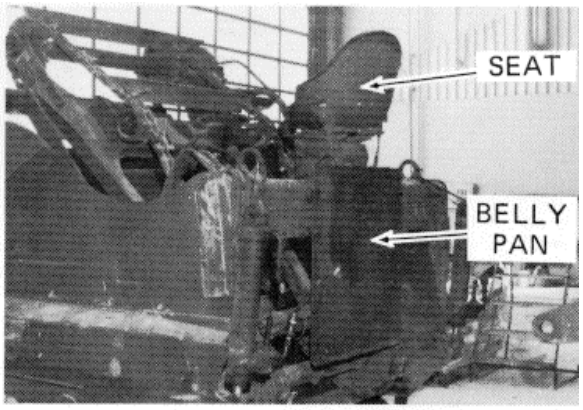
(7) Remove the air cleaner stored on tool box lid. Remove the cover and gasket from the air intake on right hand side of tractor. Install the air cleaner. Store the cover, gasket, and spacer on the lid of the tool box.







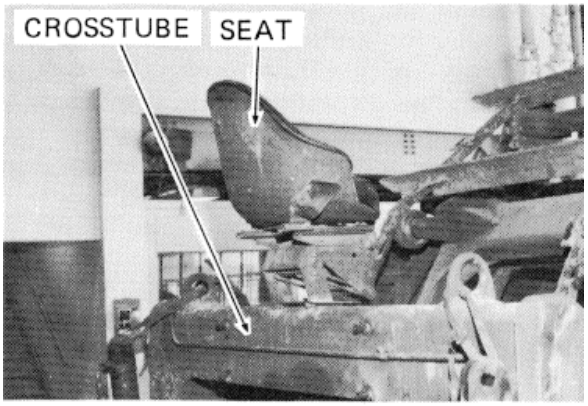
(8) Remove belly pan from bowl cross tube, and set to side. It will be attached later.

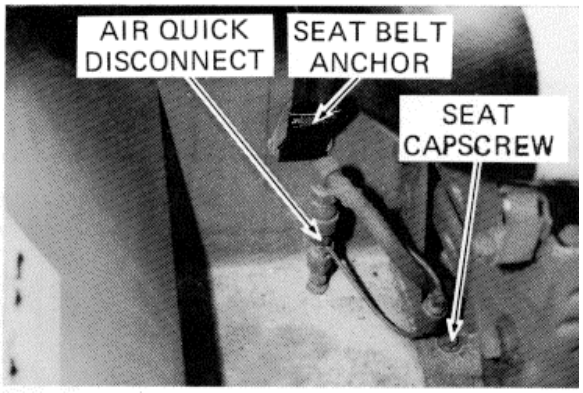


(9) Remove the operator's seat from storage on center of bowl crosstube Install and bolt the seat to cab floor and anchor the seat belt. Unlatch the base and connect the quick disconnect air hose line.

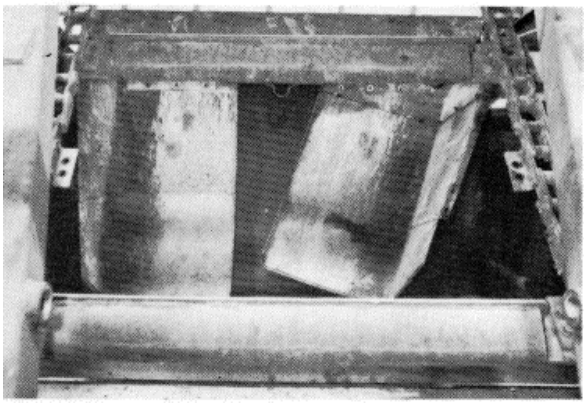
CAUTION

Before installing fenders, restrap the hoses and cables in area of tires to prevent rubbing.

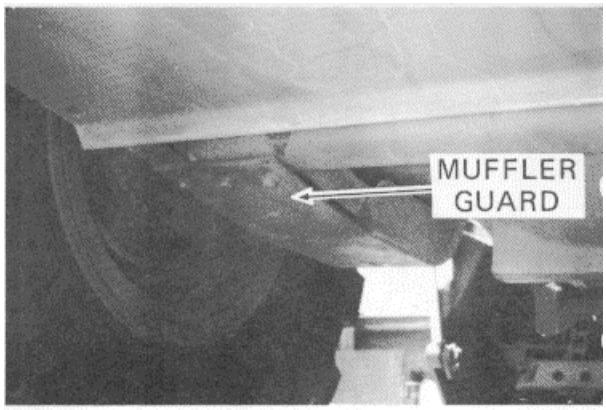




(10) Remove the fenders from ejector and reinstall on tractor. Right fender has extension attached.

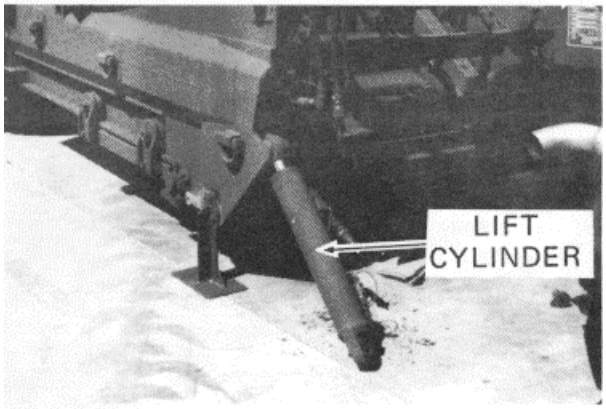


(11) Remove muffler and muffler guard from ejector and install on tractor.



b. Reconnection.

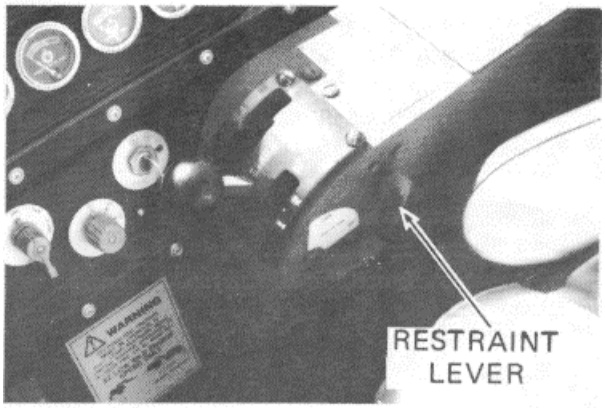
(1) Unstrap lift cylinders and lay on ground. Remove the draft pins from the scraper holes.



WARNING

Hearing protection must be worn while running the engine.

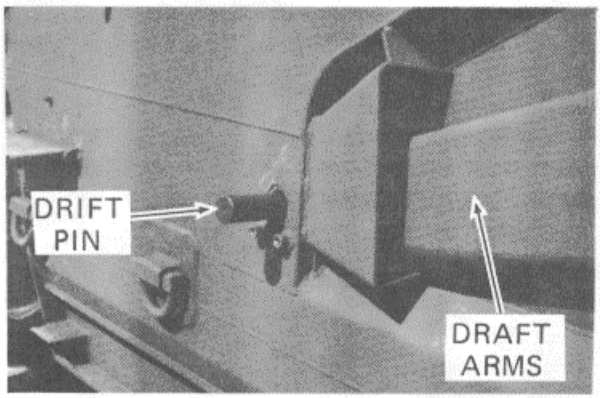
(2) Move the transmission restraint lever to the sectionalization position and start engine.



NOTE

The screw jack can be used to tip the draft frame from side to side, to facilitate the pin insertion.

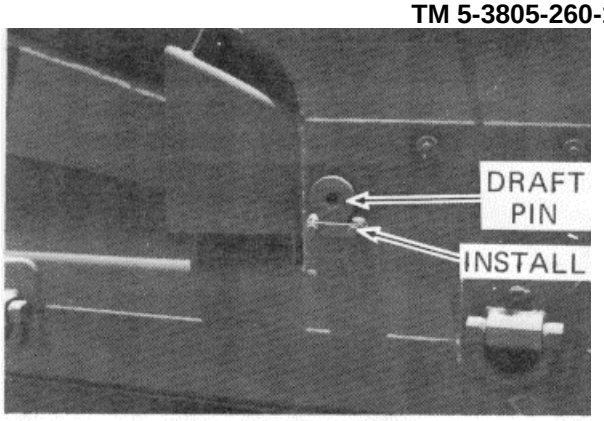
(3) Carefully backing the tractor section, align draft frame arms into the bowl connection area. Insert drift pin to facilitate hole alignment.



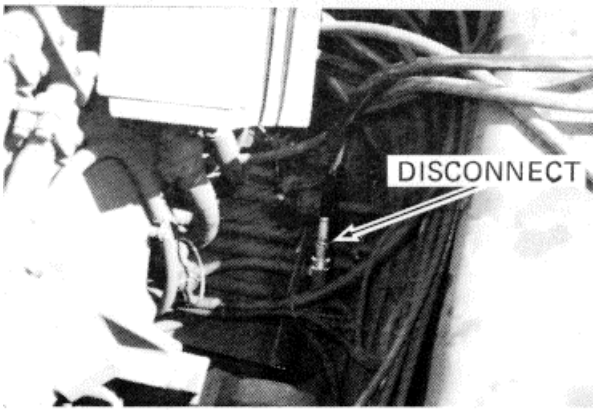
CAUTION

Care must be exercised when installing draft pins to prevent damage to draft frame bushings.

(4) Install the connecting pin and hardware on both sides of the bowl and stop the engine.



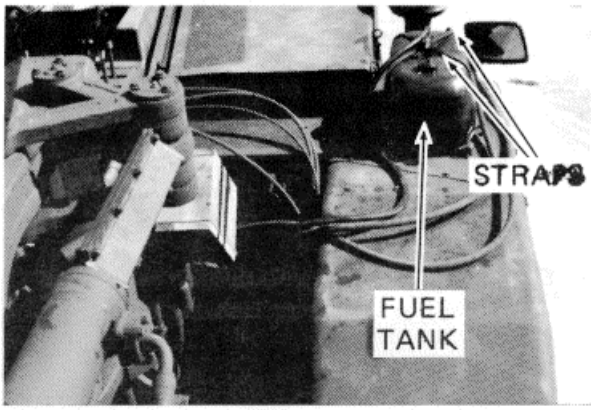
(5) Disconnect the auxiliary fuel tank line from the tractor fuel line located at base of hitch.



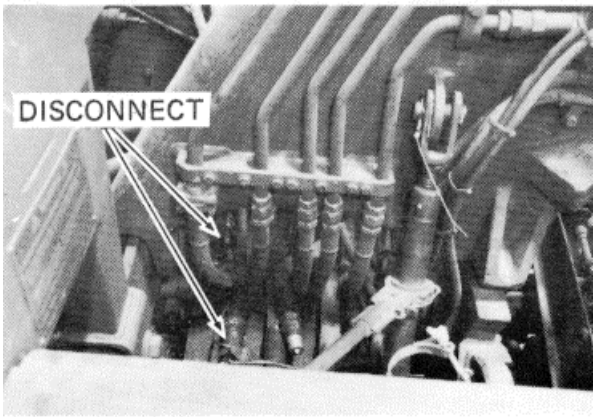
(6) Remove the hold-down straps securing the auxiliary fuel tank. Remove the tank and put aside to be stored after the steer axle is stored. Close the vent on top of the auxiliary fuel tank cap.

NOTE

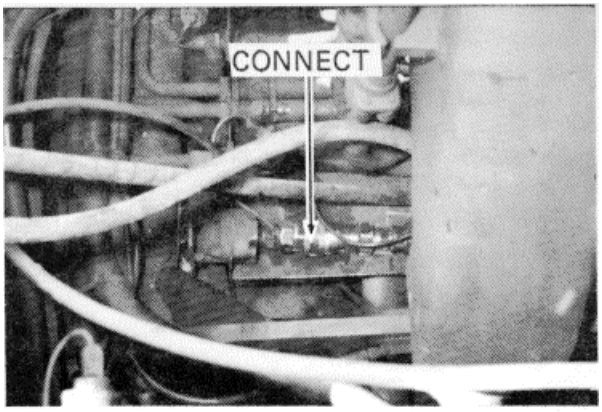
Be sure the steering wheels are in the straight ahead position before removing hoses.



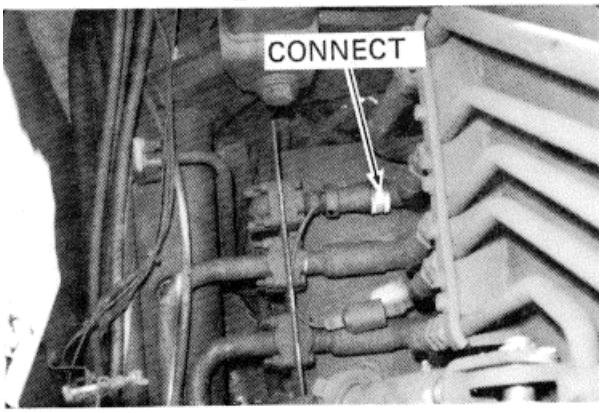
(7) Disconnect and remove two hydraulic hoses located between the hitch base and the steering axle.



(8) Connect the existing steering cylinder hoses at the base of the hitch.



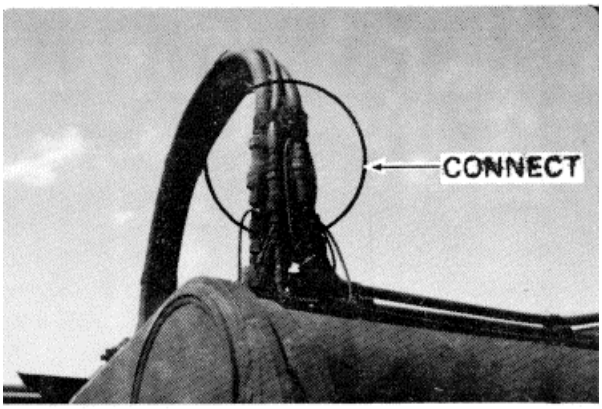
LEFT SIDE



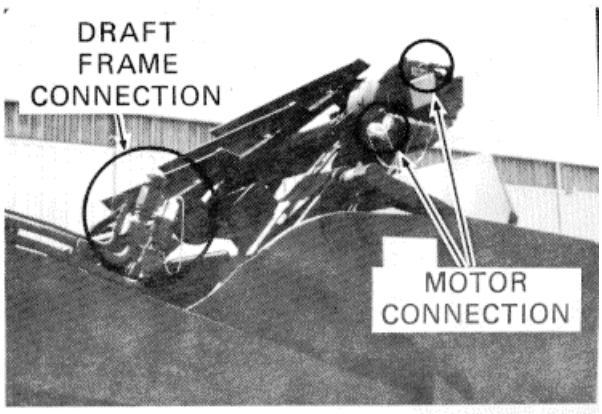
CAUTION

Be sure the lines are matched: fuel to fuel, oil to oil, air to air. The type of line is stamped into the quick disconnects.

(9) Connect the air, electrical, fuel and hydraulic quick disconnect lines. Attach the metal hose strap and hardware.



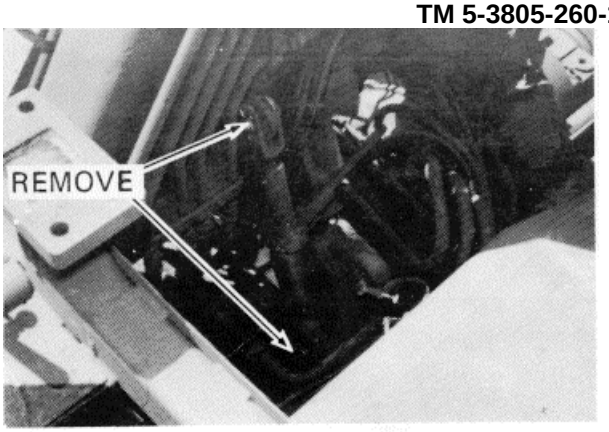
(10) Connect three hoses to connections on draft frame and on hydraulic motor.



CAUTION

Damage can occur to the hitch and/or the jack if the jack is not removed.

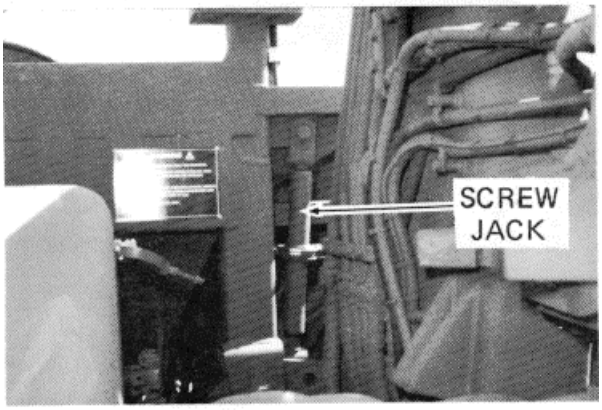
(11) Remove the jack between the eyes on the hitch and the tractor frame.



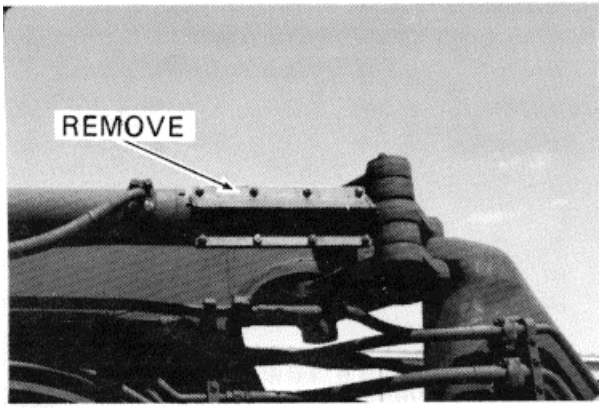
NOTE

The jack will need to be screwed down (made shorter) until it fits in its storage position.

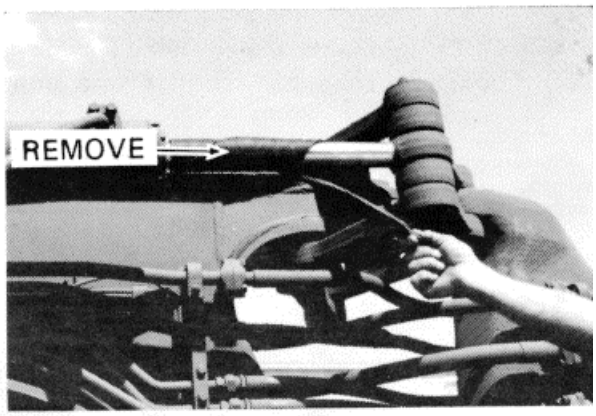
(12) Store the jack behind and to the right of the operator's platform.



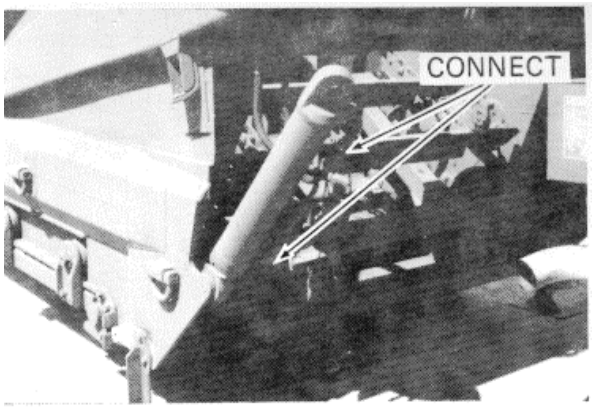
(13) Remove the articulation stop collars from the steering cylinder rods.



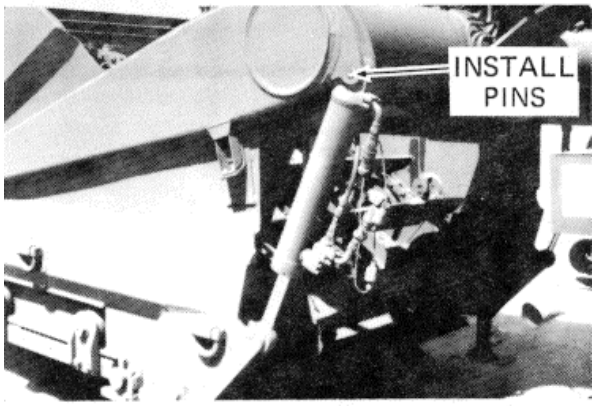
(14) Remove the protective rubber seal strips from the steering cylinder rods.



(15) Connect the lift cylinder hose lines to the lift cylinders. Remove the stored connecting pins from draft frame.

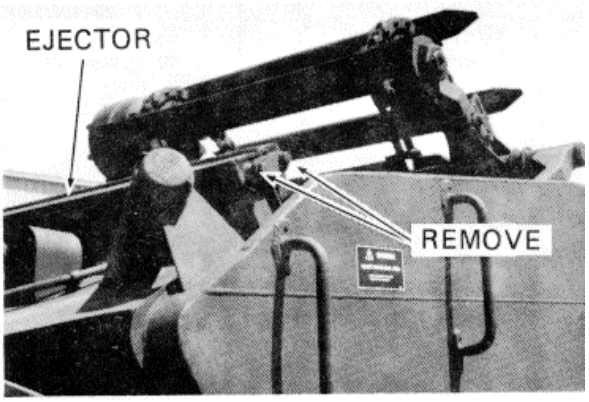


(16) Start the engine and extend the cylinder until the cylinder blind end aligns with the draft frame pin connection. Install the pins and STOP THE ENGINE.

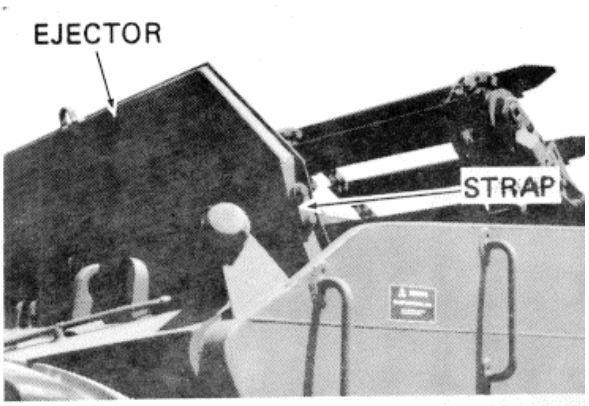


(17) Ejector was strapped to make it immobile during transport. Remove material used to secure ejector.

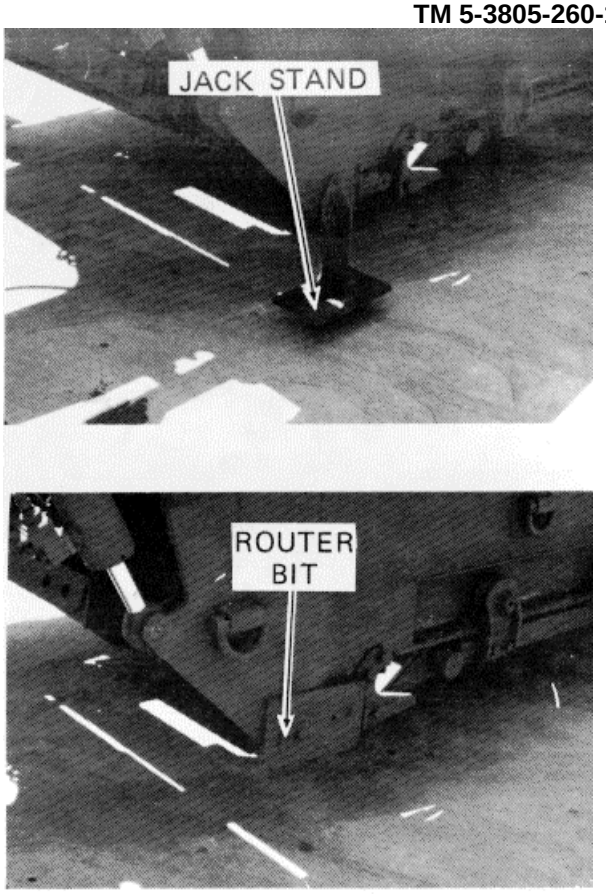
(18) Remove both bolts from the straps on both side of the hinged ejector.



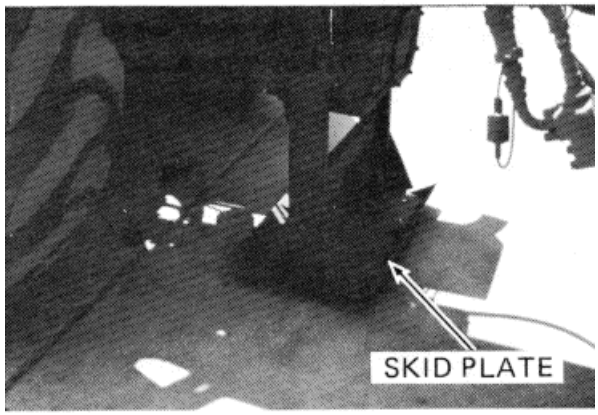
(19) Fold the ejector up and reinstall the straps.



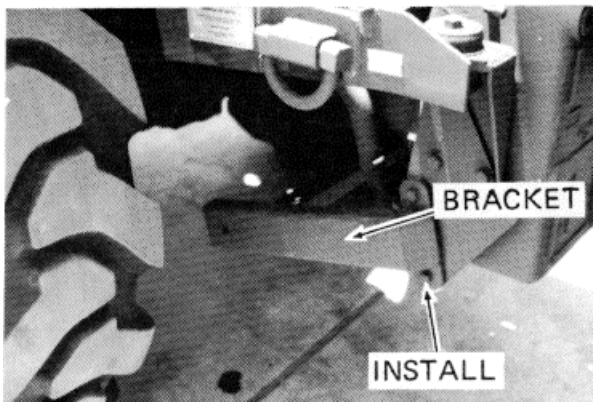
(20) Start the engine, raise the bowl and move the floor about one foot rearward. STOP THE ENGINE. Remove the jack stands and reinstall the router bits. Lower bowl to ground.



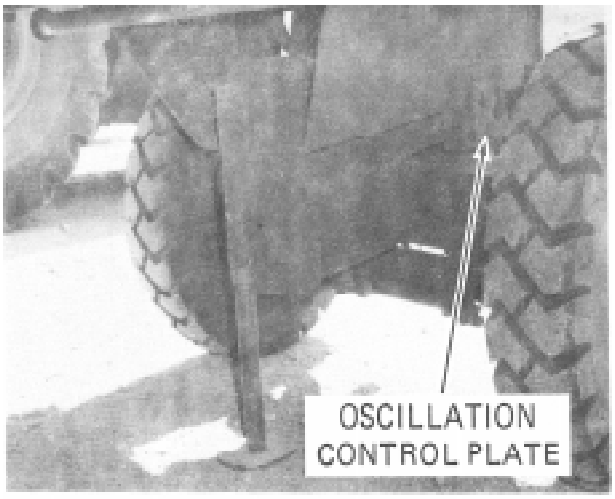
(21) Remove the transmission skid plate from the skid brackets and store on the top of the tool box.



(22) Position skid brackets in a horizontal position under transmission and bolt in place.



(23) Lower oscillation control plates on each side of the steer axle.



(24) Lower stabilizer skid pad. Remove the bolts holding the steering axle to the front belly pan. Start the engine and lower the bowl to raise the front of the tractor to provide clearance for steering axle removal. Roll the steering axle out from under the tractor and STOP THE ENGINE.

NOTE

Use two people to roll axle to storage position on rear of bowl.

(25) Position the steering axle bar into the lower hooks on the rear frame. Start the engine and move the ejector back to rear of bowl.

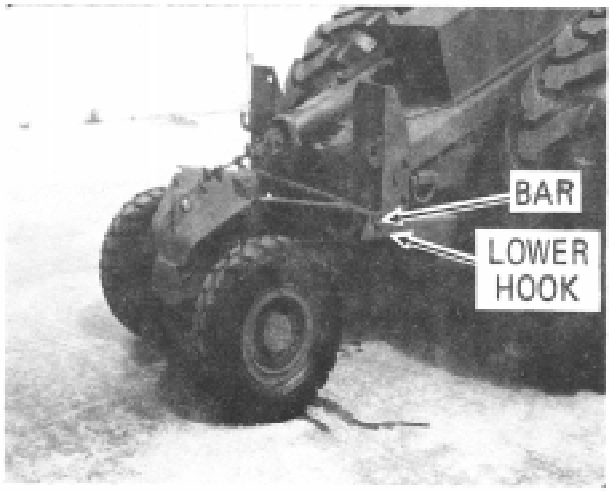
(26) Connect the spring assembly with cables to steer axle and ejector.

WARNING

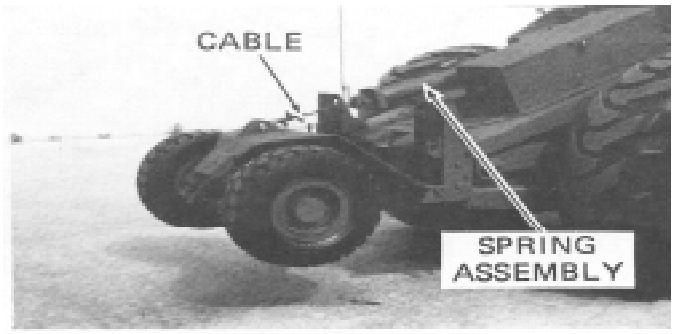
Spring bar may catch on battery or fuel tank storage brackets and cause cable to break free. Stand clear until axle is in attaching position.

CAUTION

Before raising steering axle, be sure bowl is in fully raised position.



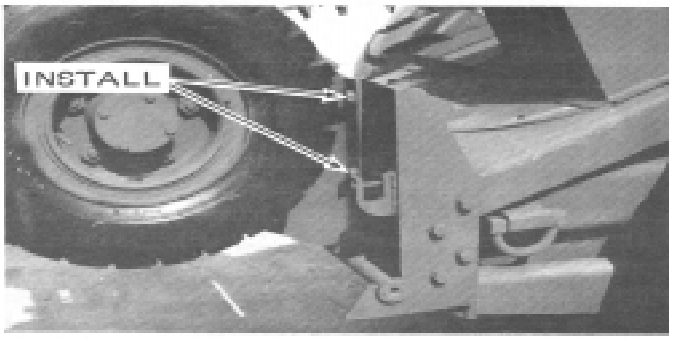
(27) Move the ejector forward to raise the steering axle.



WARNING

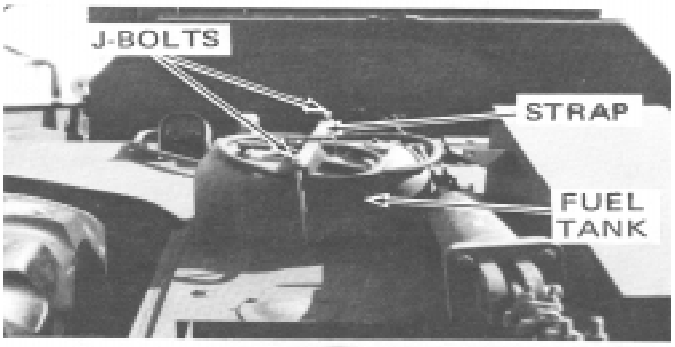
A slight pressure on ejector control lever must be manintained to hold the ejector in place.

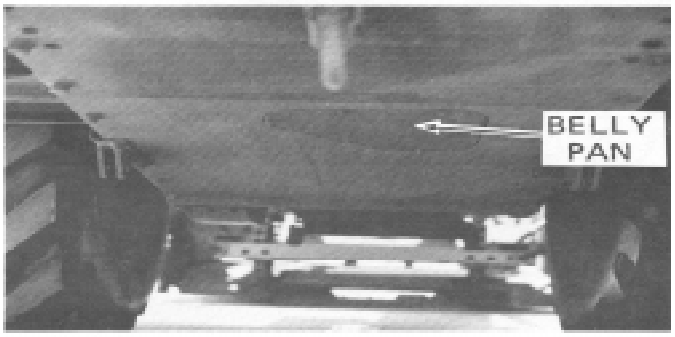
(28) Install bolts to secure the steering axle to the storage brackets. Move ejector back and detach the lifting equipment. STOP THE ENGINE. Store cables and pins in tool box. Spring assembly attaches to two brackets on left side of rear frame.



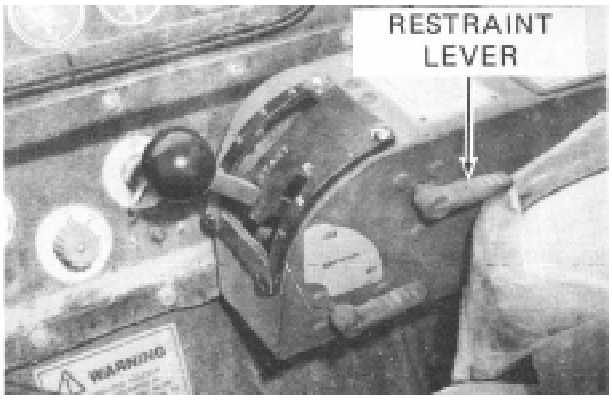
(29) Place auxiliary fuel tank in storage position. Install hold-down strap and J-bolts.

(30) Remove load transfer arm brackets and bolts from tractor. Install belly pan and reinstall load transfer arm bracket to tractor.





(31) Move lever up to disengage transmission restraint.



NOTE

Install ROPS, attach wiper control panel, elevator rock guard, elevator chain rollers, and 8 elevator flights. Fold up steps. The scraper is now operational.

GENERAL TIGHTENING TORQUE FOR BOLTS AND NUTS

The following charts give the standard torque values for bolts, nuts and taperlock studs of SAE Grade 5 or better quality. Exceptions are given in other sections of the Service Manual where needed.

THREAD DIAMETER		STANDARD TORQUE	
Inches	**millimeters**	**lb. ft.**	**N·m**
Standard thread 		**Use these torques for bolts and nuts with standard threads.**	
1/4	6.35	9 ± 3	12 ± 4
5/16	7.94	18 ± 5	24 ± 7
3/8	9.53	32 ± 5	43 ± 7
7/16	11.11	50 ± 10	68 ± 14
1/2	12.70	75 ± 10	100 ± 14
9/16	14.29	110 ± 15	150 ± 20
5/8	15.88	150 ± 20	205 ± 27
3/4	19.05	265 ± 35	360 ± 47
7/8	22.23	420 ± 60	570 ± 80
1	25.40	640 ± 80	870 ± 110
1-1/8	28.58	800 ± 100	1085 ± 135
1-1/4	31.75	1000 ± 120	1355 ± 165
1-3/8	34.93	1200 ± 150	1625 ± 205
1-1/2	38.10	1500 ± 200	2035 ± 270
		Use these torques for bolts and nuts on hydraulic valve bodies with standard threads.	
5/16	7.94	13 ± 2	18 ± 3
3/8	9.53	24 ± 2	33 ± 3
7/16	11.11	39 ± 2	53 ± 3
1/2	12.70	60 ± 3	80 ± 4
5/8	15.88	118 ± 4	160 ± 5
Taperlock stud 		**Use these torques for studs with Taperlock threads.**	
1/4	6.35	5 ± 2	7 ± 3
5/16	7.94	10 ± 3	14 ± 4
3/8	9.53	20 ± 3	27 ± 4
7/16	11.11	30 ± 5	40 ± 7
1/2	12.70	40 ± 5	55 ± 7
9/16	14.29	60 ± 10	80 ± 14
5/8	15.88	75 ± 10	100 ± 14
3/4	19.05	110 ± 15	150 ± 20
7/8	22.23	170 ± 20	230 ± 27
1	25.40	260 ± 30	355 ± 40
1-1/8	28.58	320 ± 30	435 ± 40
1-1/4	31.75	400 ± 40	540 ± 55
1-3/8	34.93	480 ± 40	650 ± 55
1-1/2	38.10	550 ± 50	745 ± 68

APPENDIX A

SUPPLEMENTAL MAINTENANCE INSTRUCTIONS

Table of Contents

PURPOSE

The purpose of Appendix A is to provide the end user and support personnel supplemental information that has special application to the Tractor-Scraper.

SCOPE

This Appendix applies to DA Units, Organizations, and Activities that use or support the Airborne/Airmobile Tractor-Scraper, Sectionalized and Nonsectionalized Models 613BSS, 613BSS1, 613BSNS, and 613BSNS1.

CCE

This term, as used in this Appendix, reefers to a standard commercial item of Construction Equipment that is approved, procured and supported under the CCE acquisition plan. This plan allows for the maximum utilization of the Civilian Construction Industries' competitive research, development, and production capabilities.

DESCRIPTION

The Tractor-Scraper is a commercial elevating model with diesel engine, pneumatic tires, two axles, articulated steering, two single driving front wheels and two single non-driving rear wheels. The Tractor-Scraper has a minimum heaped capacity of eleven cubic yards and is equipped with power shift transmission.

OPERATIONAL CONCEPT

The Tractor-Scraper shall withstand the usage encountered in military operations such as: self-loading, handling, dumping and spreading soil, crossing rough terrain, fording streams, and negotiating steep longitudinal and slidehill slopes, without damage. The Tractor-Scraper shall be capable of driving at maximum travel speed in transport, being towed by another vehicle, limited towing of other equipment, and for airborne and air assault operations. The Tractor-Scraper shall be capable of self-loading undistributed or recompacted soil to a heaped capacity in less that one minute.

PERSONNEL AND TRAINING

a **MOS Requirements.**

(1) Operator. MOS 62E (Heavy Construction Equipment Repairer).

(2) Organizational Maintenance. MOS 62B (Construction Equipment Repairer).

(3) Direct/General Support (DS/GS) Maintenance. MOS 62B (Construction Equipment Repairer).

b. **New Equipment Training**. New Equipment Training Teams (NETTs) are available to major field commands. Request for NETTs should be forwarded to Commander, U.S. Army Tank-Automotive Command (TACOM), ATTN: AMSTA-MLT, Warren, Ml 48397-5000. Training teams should be requested only when trained personnel are not available in the command to operate and/or maintain the Tractor-Scraper.

LOGISTICS ASSISTANCE

a. Tank-Automotive Command Field Maintenance Technicians stationed at the receiving Installations will be fully qualified and available to furnish on-site training and/or assistance concurrent with receipt of the Tractor-Scraper.

b. Assistance can be obtained by contacting the Logistics Assistance Office listed in Appendix B of AR 700-4, Logistics Assistance Program.

MAINTENANCE CONCEPT

The Tractor-Scraper will not require any new or special maintenance consideration. All maintenance functions can be accomplished within the current maintenance concepts established for construction equipment.

a. **Operator/Crew Maintenance**. Operator and crew maintenance is limited to daily preventive maintenance checks and services.

b. **Organizational Maintenance**. Organizational maintenance consists of scheduled preventive maintenance services, minor repairs, and adjustments.

c. **Direct Support (DS) Maintenance.** Direct support maintenance consists of repairs on-site or in direct support unit's shop. Repairs are accomplished with a minimum of tools and test equipment. Maintenance is performed on a repair-and-return-to-user basis, and organizational maintenance repair parts are supplied to using units.

d. **General Support (GS) Maintenance**. General support maintenance units receive equipment for repair and overhaul from direct support units, collection points, supply units, and other activities for which they are assigned maintenance support responsibilities. GS units operate on a repair/overhaul and return to supply system principle.

e. **Depot Maintenance**. The primary purpose of Depot maintenance is to augment stocks of serviceable assets which require maintenance that is beyond the capability of General Support Maintenance Activities. Depot maintenance is usually accomplished in fixed shops and facilities that are government owned and operated, government owned and contractor operated, or contractor owned and operated.

MAINTENANCE ALLOCATION CHART (MAC)

Maintenance will be performed as necessary by the category indicated in the Maintenance Allocation Chart (TM 5-3805-260-24) to retain or restore serviceability. All authorized maintenance within the capability of a using organization will be accomplished before referring the item to support maintenance. Higher categories will perform the maintenance functions of lower categories when required or directed by the appropriate commanders. Using and support units may exceed their authorized scope and functions in the MAC when approval is granted by the next higher support Maintenance Commander.

QUALITY DEFICIENCY REPORT (QDR)

Standard Form 368 (Quality Deficiency Report) was adopted for Equipment Improvement Recommendations (EIRs) reporting. This action was taken to standardize reporting within all governmental services. Submissions are to be in accordance with DA Pam 738-750.

MAINTENANCE EXPENDITURE LIMITS

The average life expectancy for the Tractor-Scraper is 14 years. After last date shown, use 25% repair limit until type classified obsolete.

REPAIR LIMIT	YEAR
50%	4
45%	6
40%	8
35%	10
30%	12
20%	14

SHIPMENT AND STORAGE

a. Refer to TB 740-97-2, *Preservation of USAMECOM Mechanical Equipment for Shipment and Storage.*

b. Refer to TM 740-90-1, *Administrative Storage of Equipment.*

DESTRUCTION TO PREVENT ENEMY USE

Refer to TM 750-244-6, *Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use.*

FIRE PROTECTION

a. A hand operated fire extinguisher may be installed at the discretion of the using unit.

b. Refer to TB 5-4200-200-100, *Hand Portable Fire Extinguishers Approved for Army Users.*

BASIC ISSUE ITEMS/ITEMS TROOP INSTALLED OR AUTHORIZED LISTS

A list of items which accompany the equipment, or are required for installation, operation, or operator maintenance is supplied on page A-7.

MODIFICATIONS

Modifications will not be made without the approval of U.S. Army Tank-Automotive Command (TACOM), AMSTA-MVB, Warren, MI 48397-5000.

MAINTENANCE AND OPERATING SUPPLY LIST

A listing of maintenance and operating supplies required for initial operation is supplied on page A-8.

TOOL AND TEST EQUIPMENT REQUIREMENTS

See Section III of the Maintenance Allocation Chart (MAC) in TM 5-3805-260-24.

MAINTENANCE FORMS AND RECORDS

Refer to DA Pam 738-750, *The Army Maintenance Management System (TAMMS).*

MIXTURE OF INCH AND METRIC FASTENERS

This notice applies to all Caterpillar products.

The use of worldwide sources for components has made it possible for Caterpillar products to have a mixture of inch and metric fasteners. For example, metric fasteners may be used in electric starting motors, alternators, and other components. It is possible that the internal bolts on a component may be metric while the mounting bolts may be inch size.

To help mechanics know when metric fasteners are used on a product, future service publications such as Parts Books, Operation and Maintenance Guides, and Service Manuals will use a notice similar to the one that follows:

NOTICE

Caution must be taken to avoid mixing metric and inch (customary) fasteners. Mismatched or incorrect fasteners can result in vehicle damage or malfunction, or possible personal injury. Original fasteners removed from the vehicle should be saved for assembly when possible. If new ones are required, caution must be taken to replace with one that is of same part no. and grade or better.

BASIC ISSUE ITEMS LIST

(1) MFR PART NO.	(2) MFR FED NO.	(3) DESCRIPTION	(4) UNIT OF ISSUE	(5) QUANTITY FURNISHED w/EQUIP
		NONE		

ITEMS TROOP INSTALLED OR AUTHORIZED LIST

(1) SMR CODE	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION Ref No & MFR Code	Usable On Code	(4) UNIT OF MEASURE	(5) QTY AUTH
PAOZZ	4930-00-253-2478	859866 (11083)	Lubricating Hand Gun	EA	1
PAOZZ	4240-00-052-3776	GSA	Goggles Industrial	EA	2
PCOZZ	7520-00-559-9618	MIL-C-11743 (81349) Complete with Maintenance Forms	Container	EA	1

USER MAINTENANCE SUPPORT PLAN

MAINTENANCE AND OPERATING SUPPLY LIST

NOMENCLATURE: Scraper, Tractor, Elevating, Self-Propelled	**MAKE:** Caterpillar Tractor Company	**MODEL:** 613BSNS/613BSS
MFR PART NO.: 613BSNS: 5R5488, 613BSS: 5R5489	**NSN:** 613BSNS: 3805-01-267-2992 613BSS: 3805-01-144-8837	**SERIAL NO. RANGE:** -TO-	**DATE:** March 1984

(1) COMPONENT APPLICATION	(2) MFR PART NO OR NAT'L STOCK NO.	(3) DESCRIPTION	(4) QTY REQ F/INITIAL OPN	(5) QTY REQ F/8 HRS OPN	(6) NOTES
ENGINE	OIL, LUBRICATING (MIL-L-2104C)				
9150-00-188-9858	OE/HDO 30	3.0 GAL	AR	Above +15ºF (Above -9ºC)	
9150-00-186-6668	OE/HDO 10	3.0 GAL	AR	+40ºto-15ºF (+4º to -26ºC)	
9150-00-402-2372 (MIL-L-46167)	OEA (ARCTIC)	3.0 GAL	AR	+40º to -65ºF (+4º to -54ºC)	
FUEL SYSTEM		DIESEL FUEL OIL			
9140-00-286-5296	DIESEL DF-2 (2)	65 GAL	(1)39GAL	(1) 4.9GAL/HR@MEDLOADFAC	
9140-00-286-5286	DIESEL DF-1 (3)	65 GAL	39 GAL	(2) REGULAR GRADE	
9140-00-286-5282	DIESEL, DF-A (4)	65 GAL (4) ARCTIC GRADE	39 GAL	(3) WINTER GRADE	
COOLING SYSTEM		COOLANT			(5) FOR PROTECTION AGAINST
ANTIFREEZE (5) (MIL-A-46153)			FREEZING IN AMBIENT TEMP-ERATURE AS LOW AS -55ºF,		
6850-00-181-7933	AFC	10 GAL VOLUME WITH WATER.	AR	DILUTED TO 60% BY	
TRANSMISSION		OIL, LUBRICATING			
9150-00-188-9858	OE/HDO 30	6.5 GAL	AR	Above +15ºF (Above -9ºC)	
9150-00-186-6668	OE/HDO 10	6.5 GAL	AR	+40º to -15ºF (+4º to -26°C)	
9150-00-402-2372	OEA (ARCTIC)	6.5 GAL	AR	+40º to -65ºF (+4º to -54ºC)	

USER MAINTENANCE SUPPORT PLAN

MAINTENANCE AND OPERATING SUPPLY LIST

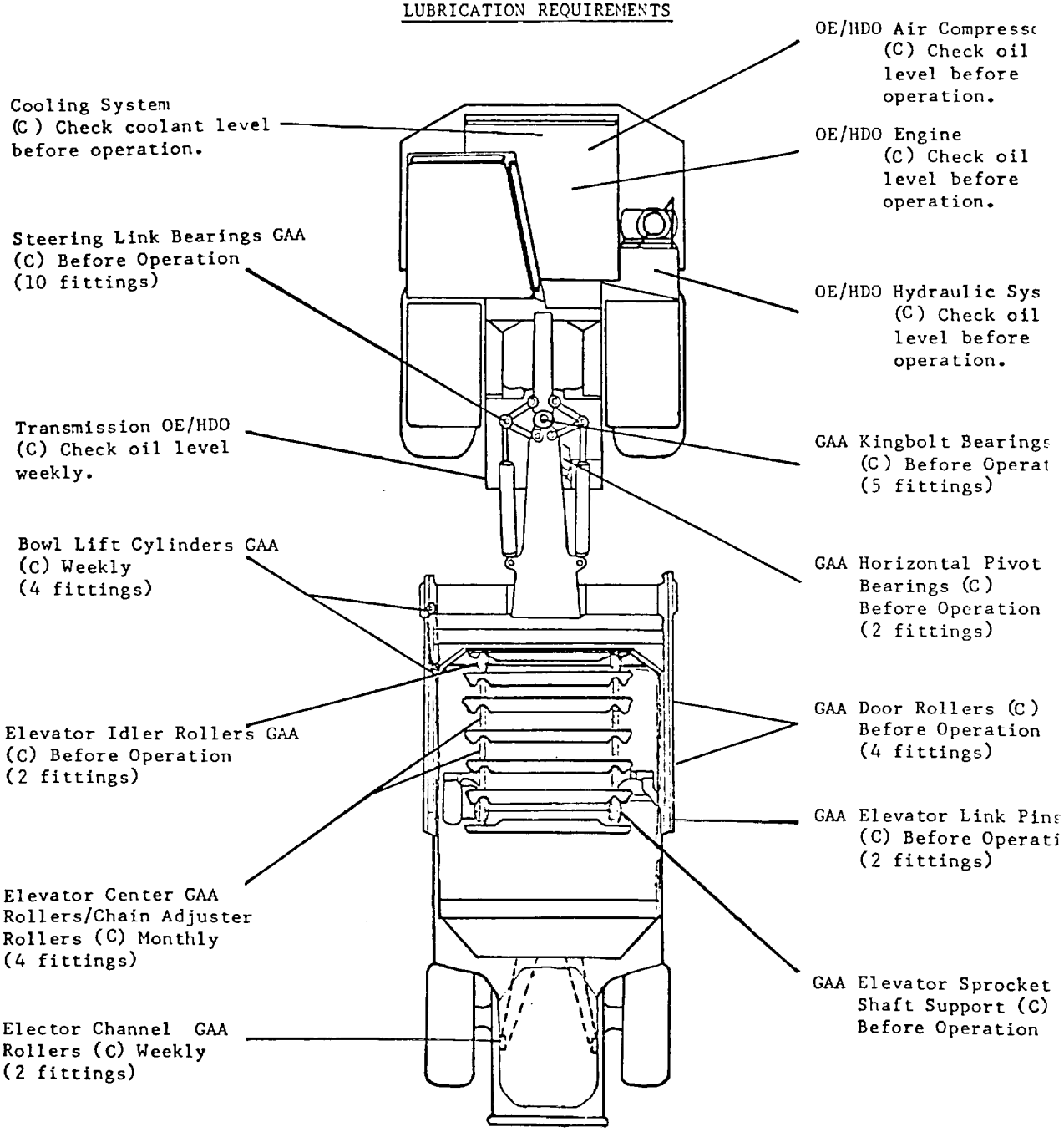
(1) COMPONENT APPLICATION	(2) MFR PART NO OR NAT'L STOCK NO.	(3) DESCRIPTION	(4) QTY REQ F/INITIAL OPN	(5) QTY REQ F/8 HRS OPN	(6) NOTES
SPEED REDUCER, DIFFERENTIALS GAL		LUBRICANT, MULTIPURPOSE GEAR			(6) SPEED REDUCER - 1
AND FINAL DRIVES 1 QT CAN	9150-01-035-5392	GO 80/90 (6)	9.0 GAL	AR	DIFFERENTIAL - 5 GAL FINAL DRIVES (EA) - 1.5 GAL
9150-01-035-5393	.5 GAL CAN				
9150-01-035-5394	55 GAL DRUM				
HYDRAULIC SYSTEM	9150-00-191-2772	OIL, LUBRICATING OE/HDO 10	24 GAL	AR	
LUBE POINTS GAA, (MIL-G-10924C)		GREASE, AUTOMOTIVE			
9150-00-190-0904	1 LB CAN				
9150-00-190-0905	5 LB CAN				
9150-00-190-0907	35 LB CAN				
CLEANING SOLVENT, DRY CLEANING SD-2 (P-D680)	7920-00-148-9666	RAGS, WIPING OIL 50 LB BALE	1	1	USE AS REQUIRED
6850-00-664-5685	1 QT CAN				
6850-00-281-1985	1 GAL CAN				
6850-00-264-9038	5 GAL DRUM				
6850-00-285-8012	55 GAL DRUM				

USER MAINTENANCE SUPPORT PLAN

MAINTENANCE AND OPERATING SUPPLY LIST

(1) COMPONENT APPLICATION	(2) MFR PART NO OR NAT'L STOCK NO.	(3) DESCRIPTION	(4) QTY REQ F/INITIAL OPN	(5) QTY REQ F/8 HRS OPN	(6) NOTES
BRAKES		BRAKE FLUID SILICONE			
BFS (MIL-B-46176)					
9150-01-102-9455	1 GAL		AR		
9150-01-123-3152	5 GAL		AR		
7690-01-111-2265 Part Number 12302516 (19207)	DECAL FOR MASTER CYLINDER			1 EA	Reference: TB43-0002-87
AIR COMPRESSOR		OIL LUBRICATING (MIL-L-2104C)			
OE/HDO 30	0.5 QTS	AR	Above +15ºF (Above -9ºC)		
OE/HDO 10	0.5 QTS	AR	+40º to -15ºF (+4º to -26ºC)		
OEA (ARCTIC) (MIL-L-46 167)	0.5 QTS	AR	+40º to -65ºF (+4º to -54ºC)		

LUBRICATION REQUIREMENTS



OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

GENERAL

Every mission begins and ends with the paperwork. There isn't much of it, but you have to keep it up. The forms and records you fill out have several uses. They are a permanent record of the services, repairs, and modifications made on your vehicle. They are reports to Organizational maintenance and to your commander. And they are a checklist for you when you want to know what is wrong with the vehicle after its last use, and whether those faults have been fixed. For the information you need on forms and records, see to DA PAM 738-750.

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

a. Do your BEFORE (B) preventive maintenance just before you operate the vehicle. Pay attention to the WARNINGs and CAUTIONs.

b. DURING (D) checks and services of preventive maintenance will be performed while the equipment and/or its component systems are in operation. Pay attention to the WARNINGs and CAUTIONs.

c. Do your AFTER (A) preventive maintenance right after operating the vehicle. Pay attention to the WARNINGs and CAUTIONs.

d. Do your WEEKLY (W) preventive maintenance weekly.

e. Do your MONTHLY (M) preventive maintenance once a month.

f. If something doesn't work, troubleshoot it with the instructions in this manual or notify your supervisor.

g. Always do your preventive maintenance in the same order so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry.

h. When you do your preventive maintenance, take along a rag or two.

i. While performing PMCS, observe caution, notes, and warning paragraphs preceding those operations which could endanger your safety or result in damage to the equipment.

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100ºF-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes with water and get medical aid.

j. If anything looks wrong and you can't fix it, write it on your DA Form 2404. The number column is the source for the numbers used on the TM Number Column on DA Form 2404. If you find something seriously wrong, report it to Organizational maintenance RIGHT NOW.

(1) Keep It Clean. Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (P-D-680) to clean metal surfaces. Use soap and water when you clean rubber or plastic material.

(2) Bolts, Nuts, and Screws. Check that they are not loose, missing, bent, or broken. You can't try them all with a tool, of course, but look for chipped paint, bare metal, or rust around bolt heads. Tighten any that you find loose. Report it to Organizational maintenance if you can't tighten it.

(3) Welds. Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to Organizational maintenance.

(4) Electric Wires and Connectors. Look for cracked or broken insulation, bare wires, and loose or broken connectors. Report damaged or loose wiring to Organizational maintenance.

(5) Hoses and Fluid Lines. Look for wear, damage, and leaks. Make sure clamps and fittings are tight. Wet spots show leaks, of course, but a stain around a fitting or connector can also mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report to Organizational maintenance (see Maintenance Allocation Chart).

k. It is necessary for you to know how fluid leaks affect the status of your equipment. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your equipment. Learn and be familiar with them, and REMEMBER - when in doubt, notify your supervisor!

LEAKAGE DEFINITIONS FOR OPERATOR/CREW PMCS

Class I	Seepage of fluid (as indicated by wetness or discoloration) not enough to form drops.
Class II	Leakage of fluid great enough to form drops, but not enough to cause drops to drip from item being checked/inspected.
Class III	Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

Equipment operation is allowable with minor leakages (Class I or II). Of course, consideration must be given to the fluid capacity in the item/system being checked/inspected. When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS. Class III leaks should be reported to your supervisor or to Organizational maintenance.

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - BEFORE D - DURING A - AFTER W - WEEKLY M - MONTHLY

ITEM NO	INTERVAL B	D	A	W	ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED	EQUIPMENT IS NOT READY/AVAILABLE IF:
					PERFORM WEEKLY AS WELL AS BEFORE PMCS IF: a. You are the assigned driver but have not operated scraper since last weekly. b. You are operating the scraper for the first time. NOTE THIS PMCS IS TO BE USED AS A SUPPLEMENT TO THE WALK AROUND INSPECTION AND LUBRICATION AND MAINTENANCE CHART IN YOUR OPERATOR'S MANUAL FOR CATERPILLAR MODEL 613BSNSAND 613BSS TRACTOR-SCRAPER.	
1		X			MAKE THE WALK AROUND INSPECTION CAUTION DO NOT EXCEED THE MANUFACTURER'S MAXIMUM COLD AIR INFLATION PRESSURE MARKED ON INDIVIDUAL TIRE.	
	X				Check inflation pressure of tires weekly, before operating the scraper, when cold. Have tires inflated if air pressure is below pressure specified in Operator's Manual.	
2			X		AIR COMPRESSOR Check Oil Level. Maintain oil level between bottom of dipstick threads and bottom of dipstick.	
3			X		BRAKES Test service, park and emergency brakes for proper operation. Refer to Operator's Manual.	Brakes will not hold.

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - BEFORE D - DURING A - AFTER W - WEEKLY M - MONTHLY

ITEM NO	INTERVAL B	D	A	W	ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED	EQUIPMENT IS NOT READY/AVAILABLE IF:
4					INSTRUMENTS AND GAUGES After reaching operating temperature: Check instruments for normal indication (green zone):	Gauges do not indicate GREEN zone.
CAUTION					IF NO OIL PRESSURE - STOP ENGINE IMMEDIATELY	
X					a. Oil Pressure Gauge 30-80 psi	
X					b. Water Temperature Indicator 160º - 225ºF	
X					c. Oil Temperature Indicator 150º - 270ºF	
X					d. Air Pressure Gauge 75 - 150 psi	
X					e. Amp Meter Gauge 0 - +30 amps	
					WARNING BATTERIES GIVE OFF FLAMMABLE FUSES THAT CAN EXPLODE. DO NOT SMOKE WHEN OBSERVING ELECTROLYTE LEVELS. ELECTROLYTE IS AN ACID. IT CAN CAUSE PERSONAL INJURY IF IT CONTACTS SKIN OR EYES.	

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - BEFORE D - DURING A - AFTER W - WEEKLY M - MONTHLY

ITEM NO	INTERVAL B	D	A	W	ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED	EQUIPMENT IS NOT READY/AVAILABLE IF:
CAUTION					IN COLD WEATHER OPERATIONS, CHARGE BATTERIES IMMEDIATELY AFTER ADDING WATER. WATER MUST COMBINE WITH THE ELECTROLYTE BY MEANS OF CHARGING. DELAY IN CHARGING COULD RESULT IN FROZEN BATTERIES.	
5					BATTERIES	
	X				Check batteries, battery box and cables for damage. Insure battery clamps are secure. Battery clamps are loose.	Batteries are damaged or missing.
6					BELTS	
	X				Check belts for damage. Belts are cracked, frayed or missing.	

Tire Inflation Information

Shipping Pressures

CAUTION

These tire pressures are for shipping only. Consult your tire dealer for the operating pressures for your job conditions.

TIRE		SHIPPING PRESSURE			
		TRACTOR		SCRAPER	
SIZE	TYPE AND PLY/ STAR RATING	psi	kPa	psi	kPa
18.00 x 25	12 ply bias	30	205	—	—
18.00 x 25	16 ply bias	40	275	40	275
23.5 x 25	16 ply bias	35	240	35	240
18.00 x 25	Michelin Radial one (*) star rating	60	415	70	480
23.5 x 25	Michelin Radial one (*) star rating	45	310	50	345
23.5 x 25	Goodyear Radial one (*) star rating	40	275	50	345

By Order of the Secretary of the Army

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

THOMAS F. SIKORA
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25-E. Block 2305, Operator maintenance requirements for TM-5-3805-260-10.

☆U.S. GOVERNMENT PRINTING OFFICE: 1995-387-868/32281

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5825-270-10	23 Jul 81	Radio Frequency R-2176/FRN

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.—IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches

1 Meter = 100 Centimeters = 1,000 Millimeters = 39.37 Inches

1 Kilometer = 1,000 Meters = 0.621 Miles

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches

1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet

1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

CUBIC MEASURE

1 Cu Centimeter = 1,000 Cu Millimeters = 0.06 Cu Inches

1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces

1 Liter = 1,000 Milliliters = 33.82 Fluid Ounces

TEMPERATURE

5/9 (°F -32) = °C

212° Fahrenheit is equivalent to 100° Celsius

90° Fahrenheit is equivalent to 32.2° Celsius

32° Fahrenheit is equivalent to 0° Celsius

9/5 C° +32 = F°

WEIGHTS

1 Gram = 0.001 Kilograms = 1,000 Milligrams = 0.035 Ounces

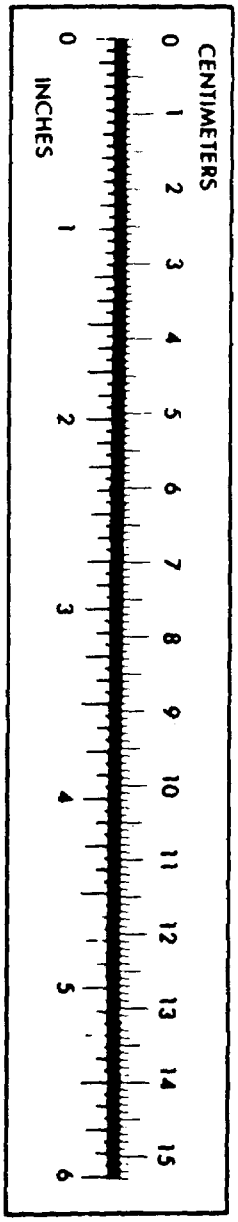
1 Kilogram = 1,000 Grams = 2.2 Lb.

1 Metric Ton = 1,000 Kilograms = 1 Megagram = 1.1 Short Tons

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds Per Square Inch	Kilopascals	6.895
Miles Per Gallon	Kilometers Per Liter	0.425
Miles Per Hour	Kilometers Per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds Per Square Inch	0.145
Kilometers Per Liter	Miles Per Gallon	2.354
Kilometers Per Hour	Miles Per Hour	0.621



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