

R 3147

**CLARK**

**RANGER**

**OPERATOR'S  
MANUAL**

**INTENTIONALLY BLANK**

## TO OWNERS

The purpose of this manual is to serve as a guide to the proper operation and minor adjustment of the CLARK RANGER Skidder. Study this manual carefully before starting or operating the machine for the first time. Become familiar with all the controls and procedures, and keep the manual on the machine for handy reference.

You have purchased this CLARK RANGER Skidder with the expectation that it would give you long and faithful service. In its construction we have taken every reasonable precaution to see that you get an efficient, long-lived, satisfactory machine. It is our sincere hope that you derive from its operation the full measure of value and utility which you looked forward to when purchasing it.

Your CLARK RANGER Skidder will always respond best with considerate treatment and care. The outlay in personal attention and cost required to give regular and proper lubrication; inspection at stated intervals, and such adjustments as may be indicated, will repay you in lower cost operation and more trouble-free service.



**This safety alert symbol indicates important safety messages in this manual. When you see this symbol, be alert to the possibility of personal injury and carefully read the message that follows.**

**CLARK EQUIPMENT OF CANADA LIMITED**  
ST. THOMAS, ONTARIO, CANADA, N5P 1H2

# **WARRANTY**

Clark Equipment Company (CLARK) has warranted to the Distributor (Seller) who, pursuant to agreement with CLARK, hereby, on its own behalf, warrants to the Buyer each new CLARK product to be free from defects in material and workmanship under normal use and maintenance as herein provided.

Distributor's sole obligation under this warranty shall be limited to repairing, replacing or allowing credit for, at Distributor's option, any part which under normal and proper use and maintenance proves defective in material or workmanship within six (6) months after delivery to or one thousand (1000) hours of use by Buyer, whichever shall occur first, provided, however, that (i) the product is placed in use not later than one year after shipment from CLARK'S plant; (ii) that notice of any such defect and satisfactory proof thereof is promptly given by Buyer to Distributor; and (iii) such material shall have been returned to Distributor, with transportation charges prepaid and found by Distributor to have been defective.

This warranty does not apply in respect of damage to or defects in any product caused by overloading or other misuse, neglect or accident, nor does this warranty apply to any product which has been repaired or altered in any way which, in the sole judgment of Distributor, affects the performance, stability or general purpose for which it was manufactured.

**THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES (EXCEPT OF TITLE), EXPRESSED OR IMPLIED, AND THERE ARE NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL DISTRIBUTOR BE LIABLE FOR CONSEQUENTIAL OR SPECIAL DAMAGES.**

This warranty does not apply to parts of trade accessories not manufactured by CLARK, or attachments not manufactured or sold by CLARK, Buyer shall rely solely on the existing warranties, if any, of the respective manufacturers thereof.

## **IMPROVEMENTS**

It is CLARK'S policy to constantly strive to improve its products. The right therefore is reserved to make changes in design and improvements whenever it is believed the efficiency of the product will be improved thereby, but without incurring any obligation to incorporate such improvements in any product which has been shipped or is in service.

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## NOTES

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# GENERAL DESCRIPTION

Clark machines are constructed for rugged, heavy duty industrial and commercial applications. They are specifically engineered for maximum ease of operation to move the greatest amount of material in the shortest possible time.

Power comes from the engine through a Clark torque converter having a 3 to 1 torque multiplication factor, to a power shifted, full reversing type transmission, to the axle assemblies. Universal slip joint drive shaft assemblies are used between the power transfer units.

The axle assemblies are Clark all wheel drive, full floating, spiral bevel ring gear and pinion, with further reduction provided by planetary gear sets within the wheel hubs.

The Ranger has an articulated type frame which provides the steering of the machine.

The machine serial number plate is mounted on the right hand side of the seat support below the operator's seat. This plate gives the model number and serial number of the machine. Fig. 1-1.

The serial number of the machine is also stamped in half inch numerals on the right hand side at the rear of the front frame.

**IMPORTANT: ALWAYS GIVE THE SERIAL NUMBER OF THE MACHINE WHEN ORDERING PARTS.**

## TRANSMISSION AND TORQUE CONVERTER SERIAL NUMBER PLATE.

The transmission serial number plate is located on the right hand side at the rear of the transmission. The torque converter serial number plate is centrally located at the top side of the converter.

Both plates are identical except for the model number and serial number stamped on each plate to correctly identify the units. The plate is shown in Fig. 1-2.

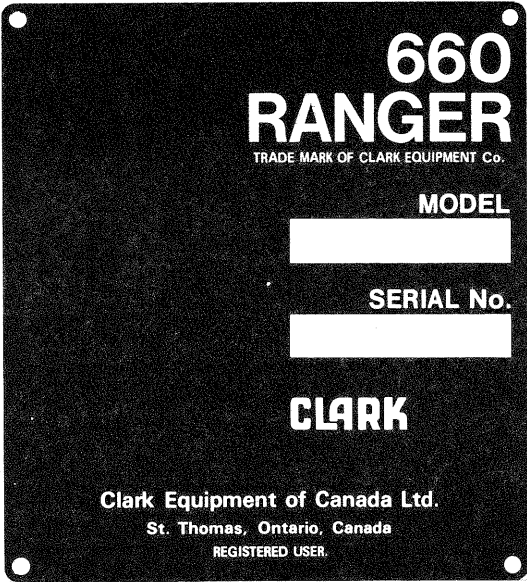


Fig. 1-1 Machine Serial Number Plate

For more complete specifications, refer to the Specifications in Section 15 of this manual.

## MACHINE SERIAL NUMBER PLATE

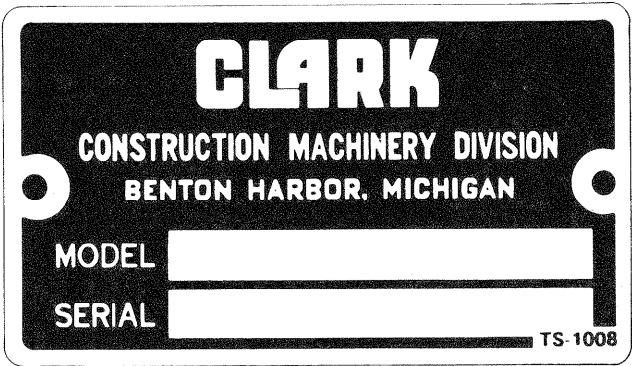


Fig. 1-2 Transmission or Torque Converter Serial Number Plate

Data plates and decals used throughout the machine aid in its safe, efficient operation; others give service instructions. Read all instruction plates and decals before starting and operating the machine.

## NOTES

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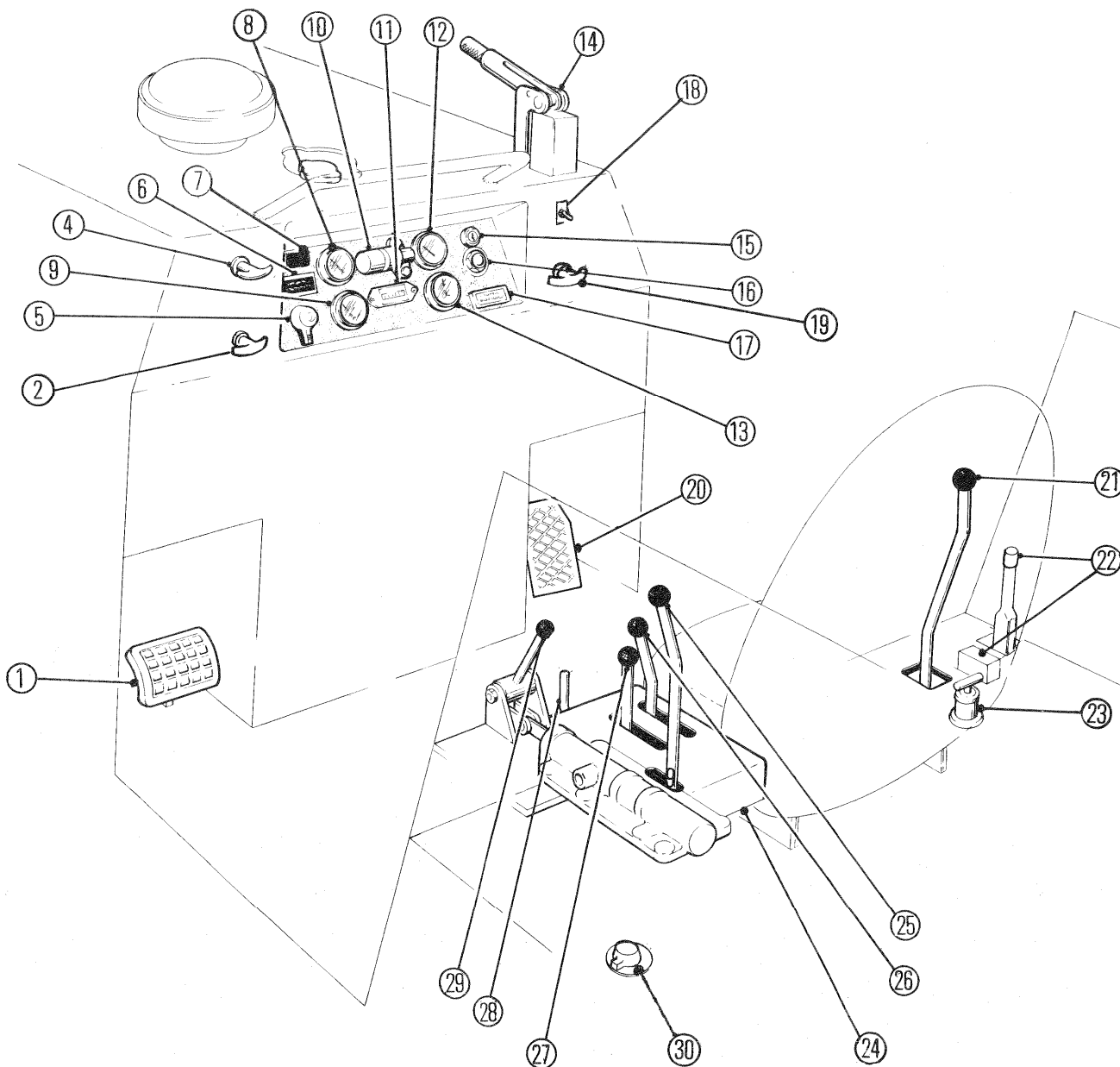


Fig. 2-1 OPERATING CONTROLS

- |   |  |
|---|--|
| 1. Brake Pedal                                  | 16. Starter Switch   |
| 2. Emergency Engine Stop (GM Only)              | 17. Parking Brake Light  |
| 3. Circuit Breaker (not shown)                  | 18. Light Toggle Switch  |
| 4. Hand Throttle (optional)                     | 19. Standard Engine Stop (GM only)                                   |
| 5. Auxiliary Steering Switch (optional)         | 20. Accelerator Pedal  |
| 6. Auxiliary Steering Light (optional)          | 21. Steer and Blade Control  |
| 7. Engine Oil Pressure Warning Light (optional) | 22. Emergency Brake Lever (optional)<br>(inc. Master Brake Cylinder) |
| 8. Water Temperature Gauge                      | 23. Transmission Dipstick  |
| 9. Oil Pressure Gauge                           | 24. Seat Adjustment Lever  |
| 10. Air Cleaner Service Indicator               | 25. Forward and Reverse Control Lever                                |
| 11. Hourmeter                                   | 26. High and Low Gear Control Lever                                  |
| 12. Transmission Oil Temperature Gauge          | 27. Work and Travel Control Lever                                    |
| 13. Ammeter                                     | 28. Neutral Lock Lever   |
| 14. Parking Brake Lever                         | 29. Winch Control Lever  |
| 15. Ignition Switch                             | 30. Battery Disconnect Switch  |

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## OPERATING CONTROLS

1. **Brake Pedal** — is located on the left side of the cockpit. Application of the brake will provide braking to the drive line.
2. **Emergency Engine Stop [G.M. ONLY]** — is only to be used in case of an emergency. Misuse of this control may result in damage to the engine.
3. **Circuit Breaker** — is located inside the operator's compartment behind the firewall. It is used to protect the electrical wiring and components, by interrupting short circuits or overloads. Its operation is similar to that of a fuse, except the circuit breaker can be reset and used repeatedly. If there is a short circuit or an electrical component malfunctioning causing an overload, the circuit breaker reset button will spring out cutting off the electrical power. When this occurs, wait until the system has cooled down then reset the circuit breaker button by pushing the button in. If the reset button springs out again, further trouble shooting of the electrical system will be required to determine the cause of failure.
4. **Hand Throttle [Optional]** — Pull out to over-ride the accelerator pedal. When the desired engine speed is reached, turn the hand control one quarter turn clockwise to lock the engine speed at the desired setting. To return the engine speed to idle, turn the hand throttle control one-quarter turn counter-clockwise and push to its closed position.
5. **Auxiliary Steering Switch [Optional]**—should the engine or main steering pump fail, turn the auxiliary steering switch to the ON position, and bring the machine to a safe stop immediately, otherwise the auxiliary steering may become depleted. Switch OFF the auxiliary steering switch when it is not in use.  
Use the Auxiliary Steering only to provide steering while bringing the machine to an immediate stop after a pump or engine failure. Do not test Auxiliary steering system with main control valve in neutral position.
6. **Auxiliary Steering Light [Optional]**—when turned ON, indicates the Auxiliary Steering has been activated.
7. **Engine Oil Pressure Warning Light** — warns operator of low oil pressure in engine lubricating system. If warning light remains on for over 10 to 15 seconds, stop the engine immediately and determine cause.
8. **Water Temperature Gauge** — indicates the engine water temperature. Under normal operating conditions, the gauge should register between 170°F. and 185°F.
9. **Oil Pressure Gauge** — indicates the oil pressure in the engine. Operating pressures are found in the rear of this manual.
10. **Air Cleaner Service Indicator** — indicates when to service the air cleaner element and reset indicator.  
  
Dirt trapped by the filter element gradually increases the pressure drop across the cleaner. As the resistance increases, the Red Flag of the indicator gradually rises in the window. When the flag reaches the top position it will lock in place regardless of whether or not the engine is running. Service filter element at this time.
11. **Hourmeter** — shows the number of hours the engine has run.
12. **Transmission Oil Temperature Gauge** — indicates the temperature of the oil in the torque converter, transmission and Clark winch. When the temperature approaches the 250°F. shift to a lower operating range.
13. **Ammeter** — indicates the charge or discharge rate of the electrical system.
14. **Parking Brake Lever** — to set the brake, pull up and back on the lever. This applies the brake located on the transmission output shaft. To release the brake, push the lever forward and down.
15. **Ignition Switch** — energizes all gauges and switches on instrument panel, and starting motor circuit. Turn switch to right for ON position.
16. **Starter Switch** — energizes cranking motor to start engine. Press to operate; release when engine starts. Do not crank engine continuously for more than 30 seconds to avoid damage to cranking motor. Pause a few minutes between cranking cycles. If difficulty is encountered, refer to Section 4, under Cold Weather Starting.
17. **PARKING Brake Light** — indicates parking brake is on and must be released before driving the vehicle.
18. **Light Toggle Switch [Optional]**—Lift up the switch to operate the head and tail lights.
19. **Standard Engine Stop [G.M. ONLY]** — Should be used to stop the engine in normal circumstances. To stop the engine, pull the stop handle out and hold until the engine has stopped. Then push the handle in and return the ignition switch to the "OFF" position. Before restarting the engine, always make sure the engine stop handle has been pushed completely in.

- 20. **Accelerator Pedal** — this pedal will control the engine speed.
- 21. **Steering and Blade Control Lever** — controls the turning of the machine to the left and right and controls up and down movement of the utility blade. Tilting the lever to the right will steer the machine right, tilting the lever to the left will steer the machine left. Pulling back on the lever will raise the blade, pushing the lever forward will lower the blade.  
  
On Swamp Buggy vehicles the blade function of the control lever is eliminated.
- 22. **Emergency Brake Lever [Optional]** — is applied by pulling the handle forward, and is released by letting go of it. The spring will return the handle.
- 23. **Transmission Dipstick**
- 24. **Seat Adjustment Levers** — The operator's seat can be shifted forward or backward to suit the individual, by moving the lever on the left hand side of the seat forward and shifting the seat to the desired position. Fig. 2-2. An additional adjustment in the height of the seat is offered. This can be done by removing the seat bracket mounting bolts and raising or lowering the seat to the desired position. Oiling of the release mechanism, track assemblies and pivot points will keep them operating freely.

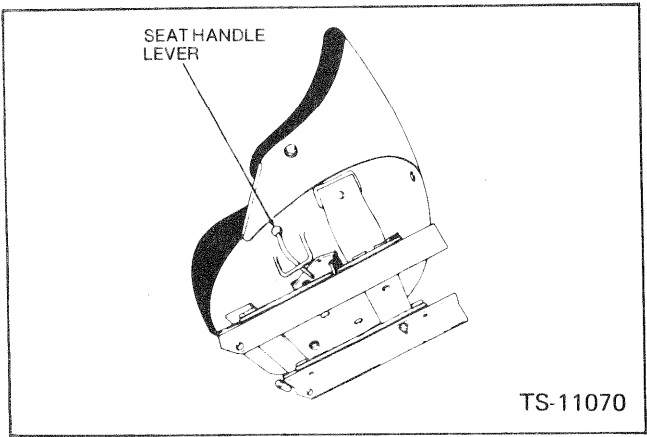


Fig. 2-2 Operators Seat Adjust Lever

- 25. **Forward and Reverse Control Lever** — provides three positions, Forward, Neutral and Reverse to control the direction of the machine travel. Pushing the lever forward permits the machine to travel forward; pulling the lever backwards permits the machine to travel backwards.

**CAUTION:** Do not use the engine as a down-hill brake by operating the vehicle with the transmission in reverse.

*If this precaution is not adhered to, there is a good possibility the engine will stall. When the engine stalls, the hydraulic pumps stops; thus, you will not be able to control the steering.*

CLARK SHALL NOT BE LIABLE FOR ANY CONTINGENT OR SPECIAL DAMAGES OR LIABILITIES, OR ANY FAILURES, OR DAMAGES TO ANY PRODUCTS, ARISING OUT OF OPERATING THE MACHINE DOWNHILL WITH THE TRANSMISSION IN REVERSE FOR BRAKING THE MACHINE.

- 26. **High and Low Gear Control Lever** — provides three positions, Low, Neutral and High to control the travel speed of the machine. Pushing the lever forward engages the lower speed range, pulling the lever backward engages the higher speed range.
- 27. **Work and Travel Control Lever** — The lever has two positions: Working range, and Travel range. These positions control the high and low range in the transmission. Pulling the lever backward engages the travel range (transmission in high range). Pushing the lever forward engages the working range (transmission in low range).

It is important that when shifting the range control, the machine should be stationary and the forward-reverse control and the high-low control levers are in the neutral positions.

The working range should be used when the machine is under load. The travel range should be used when driving the machine with a load.

**NOTE:** All machines are equipped with a fourth gear Lockout. The combination of high low control and work and travel control makes available a choice of three speed ranges providing selection of power requirements for any operation condition.

- First — Low — Work
- Second — Low — Travel
- Third — High — Work

**Caution:** Do not remove fourth gear lockout from control console. If this safety feature is removed the machine will be capable to travel at high speeds.

CLARK SHALL NOT BE LIABLE FOR ANY CONTINGENT OR SPECIAL DAMAGES OR LIABILITIES, OR ANY FAILURES IN, OR DAMAGE TO, OR DEFECTS IN ANY PRODUCTS, ARISING OUT OF THE USE OF THE TRANSMISSION WITHOUT THE FOURTH GEAR LOCKOUT.

- 28. **Neutral Lock** — holds the forward-reverse lever in the neutral position. This Lock is on the machine for your safety. It is to be used whenever you get off the machine.



29. **Winch Control** — has three positions. Handle forward is the “Free Spooling” position necessary for paying out the main line. Handle in neutral is “Skidding” position; handle back is the “Winching In” position.
30. **Battery Disconnect Switch** — is located inside the operator’s compartment to the left of the operator’s seat. This switch, when in the “OFF” position, will cut off the electrical supply from the battery to the starter solenoid and other circuits.

## NOTES

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

**CAUTION**

THIS STRUCTURE DESIGN HAS BEEN TESTED TO MEET PERFORMANCE CRITERIA LISTED ON NOTICE OF CERTIFICATION. ANY MODIFICATION, ALTERATION OR STRUCTURAL DAMAGE DUE TO ABUSE OR ROLLOVER MAY RENDER STRUCTURE UNSAFE AND WILL VOID ALL CERTIFICATES PERTAINING TO THIS STRUCTURE.

1922794

**WARNING**

- NO ROOM FOR MAN IN THIS AREA WHEN VEHICLE IS TURNING OR MOVING
- MAN IN THIS AREA NOT VISIBLE TO OPERATOR
- DO NOT STAND OR WORK IN THIS AREA WHEN ENGINE IS RUNNING
- USE SAFETY LINK WHEN SERVICING, LIFTING OR TRANSPORTING

1922797

**CAUTION**

TRAINED PERSONNEL ONLY MAY OPERATE THIS VEHICLE. REFER TO OPERATORS MANUAL FOR DETAILED OPERATING AND MAINTENANCE INSTRUCTIONS.

BEFORE OPERATING VEHICLECHECK

- SAFETY LINK REMOVED AND PROPERLY RETAINED
- ALL GUARDS AND COMPARTMENT COVERS IN PLACE
- FIRE EXTINGUISHER CHARGED
- SEAT BELT ON
- PARKING BRAKE OFF
- BRAKE AND STEERING CONTROLS OPERABLE

BEFORE LEAVING VEHICLE

- LOWER ALL HYDRAULIC ACCESSORIES
- ENGAGE PARKING BRAKE
- ENGAGE NEUTRAL LOCK
- TURN ENGINE OFF
- TURN BATTERY MASTER SWITCH OFF
- CLEAN DEBRIS FROM ALL GUARDS AND COMPARTMENTS

1922795

**CAUTION**

THIS MACHINE EQUIPPED WITH AUXILIARY STEERING. IF ENGINE OR MAIN STEER PUMP FAILS.

- TURN AUXILIARY STEERING SWITCH ON
- BRING MACHINE TO IMMEDIATE STOP
- USE ONLY WHILE BRINGING MACHINE TO IMMEDIATE AND SAFE STOP. OTHERWISE STEERING MAY BECOME DEPLETED
- TURN SWITCH OFF WHEN NOT IN USE
- ENSURE BATTERIES ARE PROPERLY MAINTAINED
- TEST AUXILIARY STEERING FREQUENTLY

TEST PROCEDURE

- SHUT ENGINE OFF
- TURN AUXILIARY STEERING ON
- STEER MACHINE LEFT AND THEN RIGHT TO HYDRAULIC RELIEF.
- TURN AUXILIARY STEERING SWITCH OFF

1922793

**CAUTION  
NEGATIVE GROUND****CAUTION**

ENGINE CONTAINS 20-20 W OIL CHANGE TO OIL RECOMMENDED BY ENGINE MFR. FOR APPLICABLE AMBIENT TEMP.

REMOVE DECAL AFTER OIL CHANGE.

**CAUTION****KEEP VEHICLE CLEAN**

TO REDUCE FIRE HAZARDS REMOVE DEBRIS FROM ALL COMPARTMENTS AFTER EACH 8 HOURS OF OPERATION. OR MORE OFTEN IF WARRANTED BY WORKING CONDITIONS.

**IN CASE OF FIRE**

- STOP VEHICLE
- LOWER ALL HYDRAULIC ACCESSORIES
- STOP ENGINE
- TURN BATTERY DISCONNECT SWITCH OFF
- APPLY PARKING BRAKE
- EXTINGUISH FIRE

1922792

**EMERGENCY  
BRAKE****WARNING**

DO NOT TURN BATTERY DISCONNECT SWITCH TO "OFF" POSITION WHILE ENGINE IS RUNNING

**WARNING**

ALWAYS CONNECT, POSITIVE TO POSITIVE — NEGATIVE TO NEGATIVE WHEN USING BATTERY CHARGER OR BOOSTER TO PREVENT DAMAGE TO ELECTRICAL SYSTEM

## OPERATING SAFETY PRECAUTIONS

After the machine has been properly checked, and the operator has familiarized himself with the location and function of the various controls, the machine should be operated according to the instructions in the following paragraphs.



### SAFETY PRECAUTIONS

A careful and efficient operator of equipment of this nature must be guided by simple and fundamental rules of safety. He must take the necessary precautions to insure the safety of others as well as himself, and must avoid careless operating habits which cause damaging accidents.

The use of this machine is subject to certain hazards that cannot be met by mechanical means, but only by exercising intelligence, care, and common sense.

The following are a few of the primary sources of injury to operators and other workmen.

1. Repairing and servicing the equipment in dangerous positions.
2. Striking other persons or vehicles with the machine.
3. Unexpected violent tipping of the equipment.
4. Unexpected violent shocks or jars to the machine.
5. Uncontrolled traffic involving other vehicles.
6. Hazards from limbs of trees or overhead obstructions.
7. Leaving equipment in dangerous positions, unattended.
8. Disregarding instructions on safety decals. See Fig. 3-1.

In order to help prevent accidents the following safety rules should be observed at all times.

1. Personal:
  - a. Avoid loose clothing, particularly cuffs and scarves.
  - b. Know the safety equipment required for the job and use it.
  - c. Know the hand signals used on the job and who has responsibility for signaling.
  - d. Allow only trained operators to use the machine.
  - e. Read this manual thoroughly prior to attempting to start and operate the machine.
2. Prepare Machine For Starting:
  - a. Warn all personnel who may be in machine area. Walk completely around machine before entering operators compartment.

- b. Correct or report all apparent machine defects.
- c. Note all hazards and obstructions such as ditches, overhead electrical wires, wheel blocks, etc.
- d. Insure proper ventilation if machine is started indoors.
- e. Be particularly careful if this is not the machine you would normally operate.

#### 3. Mounting and Demounting:

- a. Maintain all steps and grab handles free from grease and mud. Keep hands, floor and all controls free from water, grease and mud.
- b. Never leave machine unattended with engine running.
- c. Always place the control levers in neutral, and apply parking brake and neutral lock before dismounting.
- d. Always apply parking brake when you park machine. If on a slope block wheels also.
- e. Never get on or off a machine in motion.

#### 4. Starting and Stopping:

- a. Remove or secure all maintenance or personal items such as lunch boxes, chains, shovels, etc.
- b. Start the engine only from operators seat.
- c. Always place controls in neutral and lock brakes before starting the machine.
- d. Do not operate the machine without instruments. Each gauge on the instrument panel serves as an important check point for operating condition of the machine.

#### 5. Machine Control Check:

- a. Test steering both left and right while moving slowly.
- b. Test brakes against engine power.
- c. Check function of safety devices; emergency brake, auxiliary steering, etc.


#### 6. Operation:

- a. Do not permit riders on machine.
- b. Operate the machine at speeds consistent with the conditions on the particular job. Extra caution should be used if wet or icy conditions exist.
- c. Do not use the blade as a brake when negotiating a slope.
- d. Always keep skidder in gear when going down hill. Do not coast.

#### 7. Maintenance:

- a. Except when specified, lower all attachments to the ground, apply the parking brake and neutral lock, shut down the engine, remove the ignition

key, turn the disconnect switch to the "OFF" position, block the wheels, engage the articulation lock, and tie a red warning flag on the canopy upright; when servicing the machine.

- b.  **WARNING** — Service personnel must stay out of the hinge area between the front and rear frames when the engine is running or the machine is in motion as there is not enough space for a man when machine is turned.
- c. When airing tires stand away to the side of the tire.
- d. Use extreme caution in removing radiator caps, drain plugs, grease fittings or pressure taps.
- e. Wear gloves when handling winch cable.
- f. Shut off engine before refueling. Never smoke while filling tank.
- g. Block wheels and axles securely when working under machine.
- h. Do not attempt repairs you do not understand. There is no disgrace in asking for help.

#### 8. Fire Prevention:

- a. Your skidder is equipped with a fire extinguisher. Know how to use it and keep it charged.
- b. Check electrical wiring and connections frequently for exposed wires and loose connections which could short out and cause a spark.
- c. Check hydraulic and fuel lines and connections frequently for worn hoses and leaking components.
- d. Clean out accumulation of inflammable material daily.
- e. Disengage parking brake before moving machine.

#### 9. Seat Belts:

- a. Under almost all operating conditions the use of a seat belt is recommended.

#### 10. Miscellaneous:

- a. Special attention must be emphasized when inspecting the components of the oil system, fuel system and cooling system. If any unusual or unexplained traces of oil, fuel or water are found on or below the components of the respective systems, locate and correct any such leaks immediately.

Unexplained oil streaks on or below the engine, transmission, torque converter and axle assemblies must be carefully investigated. Such indications may be the evidence of cracks, loose mounting bolts, damaged seals or gaskets, which (if neglected) may result in complete failure and major damage to the engine and drive line.

- b. Keep the machine clean and free from dirt. Whenever the machine is working in muddy or swampy areas, or whenever it begins to collect broken branches, pine needles or excessive dirt, this debris should be cleaned out. Remove the access covers, where available, and remove all

such foreign material, by using a rake, hoe or any other type of tool that will accommodate. Particular attention should be taken to maintain clean areas around the front frame, front axle and cradle, engine compartment, hinge, rear frame and fuel tank.

If dirt or other foreign material is allowed to accumulate, it will find its way into the various systems when plugs, covers or caps are removed, or during a unit replacement. Such problems can and will eventually cause premature failure of the units components and will result in costly downtime.

If available, steam is the most effective and recommended method of cleaning a dirty machine. If unavailable, a spray of mineral spirits or a similar solvent, non-harmful to exposed hoses, lines and electrical wiring, can be used.

**NOTE: PRIOR TO STEAM CLEANING, COVER ALL ALTERNATOR AND CRANKING MOTOR OPENINGS TO PROTECT THEM FROM THE FORCE OF THE STEAM JET.**

- c. Check and repair drive line noises. Operating noises in the drive line components can usually be found by a process of elimination. In general the unit cause or source of most noises will be quite evident.

When any such noise develops, note the travel speed of the machine. Did it occur going forward or in reverse? Was the machine travelling straight or in a turn? Was the machine being braked, coasting, under acceleration, or being worked stationary?

Did any gauges indicate overheating? Was the noise progressive, or did it just happen? Was there any vibration, chattering or shaking of the machine? Did the machine pull to one side?

Prop shaft failures are generally indicated by excessive noise or vibration only at certain speeds. Above or below these speeds the noise lessens or completely disappears.

The transmission can be checked by disconnecting the prop shaft to the front axle. Check the gear train in all speed ranges with the hydraulic controls (forward and reverse control shaft lever) in neutral. Engage the control lever to apply the clutches and connect them to the gear train.

The engine and torque converter noises can be isolated by removing the prop shaft from the torque converter to the transmission. Most engine and torque converter problems are generally preceded by low power and overheating. These indications should be observed at the time

and corrected before mechanical difficulties arise.

- d. Inspect the frames. The frames are the basic backbone of the entire machine and provide structural support directly or indirectly for completely mounting all assemblies, sub-assemblies and individual components necessary for the machine construction and operation.

The frame structures and all supporting assemblies such as cradle, pedestal, stake-arms, cross-members, reinforcing gussets and brackets should be periodically inspected for cracks, bends, broken welds, warping or any other signs of damage that would endanger the correct operation.

## NOTES


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# STARTING INSTRUCTIONS

## PRE-STARTING CHECKS

Before starting the engine at the beginning of the work shift, or any time the machine has been shut down for adjustment or time-off period, perform the following checks:


 **WARNING:** Except when specified, lower attachments to the ground, applying the parking brake, shut down the engine, remove the ignition key, turn the disconnect switch to the "OFF" position, block the wheels, engage the articulation lock, and tie a red warning flag on the canopy upright; when servicing the machine.

*NOTE: Disengage the articulation lock prior to moving the machine. A machine with the articulation lock engaged cannot be steered.*

1. Engine oil level.
2. Engine air cleaner indicator.
3. Hydraulic system oil level. (Refer to Sec. 11)
4. Cooling system.
5. Fuel supply.
6. Tire pressures.
7. Battery electrolyte levels.

Service units at this time if inspection indicates the necessity.

Normal Starting Above 40°F. (4.4°C) G.M. & 50°F (10°C) Cummins.

 **CAUTION:** Walk around the machine. Make certain that no one is in the "danger area" before entering the operator's compartment.

1. Set the control lever (forward and reverse control lever) in NEUTRAL and lock.
2. Make sure that the engine stop control is properly set (GM only).
3. Turn the ignition switch to the on position, then press the starter button to start the engine. Do not crank the starting motor more than 30 seconds at a time to avoid overheating the motor.

**CAUTION:** If the engine fails to start, wait until the cranking motor stops rotating before repeating the starting operation. Serious damage may result if this precaution is not followed. If the engine fails to start after four periods of cranking, refer to the operation and maintenance manual of the engine manufacturer.

4. After the engine starts, check the oil pressure gauge. If no pressure or less than 10 P.S.I. (29.26 kg. cm./sq.) is indicated within 15 seconds, shut down the engine and determine the cause. Refer to your Engine Service Manual.
5. Allow the engine to reach operating temperature before driving or operating the machine.

## Cold Weather Starting

Extensive preparation is not required for cold weather operation beyond addition of a permanent type anti-freeze to the cooling system, and a change of engine oil to a viscosity suitable for anticipated temperatures in which the machine is to operate. At temperatures below 0°F. (17.8°C) a change of oil in the main hydraulic system, torque converter and transmission as recommended on Lubrication Charts will aid starting (Refer to Sec. 16). Probably the most important item to insure prompt starting is proper maintenance of the electrical system, especially the batteries.

Batteries must be kept fully charged at all times, since in cold weather the capacity to deliver full power is greatly reduced. A full charged battery at 15°F. (-9.3°C) is capable of delivering only 70% of its rated amperage, and at lower temperatures becomes even less efficient. Service batteries weekly as follows:

1. Add distilled water to cover the plates but do not overfill. Overfilling causes dilution of the electrolyte, and sputtering during the charging cycle. This may result in the battery freezing and terminals corroding.
2. Keep the terminals clean and the connections tight. Dirty or loose connections offer high resistance.
3. Keep the vent plugs in place, and tight, to prevent the entrance of foreign material into cells.
4. Check the specific gravity regularly with a hydrometer, and recharge or replace batteries that continually show a low reading. Refer to Sec. 15 for charge test.

Service the other electrical components as follows:

1. Visually check all the wiring for worn or cracked insulation and loose terminal connections.
2. Clean the connections of the cranking motor, alternator, voltage regulator, solenoid switch, relays and sender units.
3. Clean and tighten the external ground straps and replace if badly frayed or corroded.

To avoid unnecessary cranking because of air locks in cold fuel oil, change the fuel filters only when the engine is hot; then start and run the engine after the filter change, and check that there is no fuel restriction nor leakage.

When not in use, the machine should be parked or stored in a closed garage or building during cold weather to reduce the cranking effort when starting a cold engine. It is particularly important in starting the engine, that it is not accelerated to the governed speed, or a load applied until the oil has become warm enough to circulate to all bearing surfaces.

Cold Starting (Below 40°F. (4.5°C) For G.M., and 50°F (10°C) for Cummins.)

*NOTE: Starting aids are available from your Engine Distributors as explained in your engine parts and Service manuals.*

Remember: starting aids are not intended to compensate for low battery charge, heavy oil, or other conditions which cause hard starting. They are to be used only when all other conditions are normal, but the air temperature is too cold for the heat of compression to ignite the fuel-air mixture.

The following procedures are to be used with an Ether spray can or a Quick Start kit.

1. Set all the control levers in their NEUTRAL positions and turn the ignition switch ON.
2. Depress the accelerator to the full throttle position.
- 3a. Direct Application Of Starting Fluid (Ether spray cans) - press the starter button and simultaneously direct the starting fluid into the air intake.
- 3b. Quick Start kit — Press the starter button and simultaneously pull out the Quick Start knob, which will direct the starting fluid into the air intake manifold.

**IMPORTANT:** Always start cranking engine before applying ether. Use of too much fluid will cause excessively high pressure and detonation. Never use with preheater systems as serious damage to the engine can result.

Ether fumes will be drawn into intake manifolds and a cold engine should start without difficulty.



**CAUTION: Do not store ether in vehicle cab.**

*Note: Only one shot of starting fluid is to be used per start, [hold the knob out for one or two seconds*

*Note: Only one shot of starting fluid is to be used per start. [hold the knob out for one or two seconds maximum] excessive use of the fluid will damage the engine.*

*Do not operate the cranking motor for more than 30 seconds at a time to avoid overheating the motor.*

**IMPORTANT:** If the engine fails to start, wait until the cranking motor stops rotating before repeating the starting operation. Serious damage may result if this precaution is not followed. If the engine fails to start after four periods of cranking, refer to the maintenance manual of the engine manufacturer.

4. After the engine starts, check the oil pressure gauge. If no pressure is indicated within 15 seconds, shut down the engine and determine the cause.
5. Allow the engine to reach operating temperature before driving or operating the machine.

### Warm-Up Checks

Hold the engine at idle speed for approximately two minutes after starting; then, while the engine continues to warm up for the next few minutes, perform the following checks: (Refer to Sec. 6, under 250 hours Operation for Warm-up procedures.

1. Engine Oil Pressure Gauge 10 to 25 P.S.I. (29.26 to 73.16 kg. cm. sq.) at engine idle. If less than 10 P.S.I. is registered after 15 seconds of running, shut down the engine and refer to your Engine Service manual to correct.
2. Ammeter — high rate of charge to the Battery at engine start; charging rate will decline as the charge is restored in the batteries.
3. Air Cleaner Indicator — Check that the red flag indicator is not at its top position, or a new filter or cleaning of this filter is required. Refer to Sec. 6 under 500 hour Operations for cleaning instructions. Check indicator when engine is at high idle.
4. Converter & Transmission oil temperature gauge 130°F. to 200°F. (54.4°C. to 93.3°C.) is operating temperature.  
Engine Water Temperature Gauge 170°F. to 185°F. (77.0°C to 85.0°C) is operating temperature.

Converter & Transmission Fluid level — checked at operating temperature as per instructions in Sec. 9 under 10 hour operations.

Visually check for leaks at the drain and fill plugs in the axle assemblies, torque converter and transmission, and at all hose couplings and fittings in the hydraulic, fuel, air intake, brake and cooling systems. Correct all leaking conditions, and repair or replace the gauges that are not functioning before continuing the operation of the machine.

### SHUTTING DOWN THE ENGINE

It is important to idle the engine 3 to 5 minutes before shutting it down. This will allow the lubricating oil and

water to carry heat away from the combustion chambers, cylinder head, bearings, and shafts.

Residual heat can damage many parts, ranging from valves to fuel pumps. The latter suffer from gums and deposits remainings after vaporization of the lighter ends. In addition, the physical stresses from expansion and contraction can cause distortion, permanent warping, and gasket failures. In some cases, the oil seals and the cylinder sleeve seals suffer badly, although the results may not appear until much later.

**IT IS GOOD PRACTICE TO IDLE ANY ENGINE FOR AT LEAST 5 MINUTES TO REDUCE EXTREME TEMPERATURES.**

### G.M. DIESEL

To shut down a G.M. Diesel, turn the ignition switch off; then pull the standard engine stop control (this operation cuts off the fuel supply). Hold this control out until the engine stops operating. After the engine is stopped, replace the control to its original position.

If after pulling the standard engine stop control, the engine continues to operate, the emergency engine stop must be used. By pulling the emergency stop control, the air supply to the engine is cut off, thus choking and stopping it. (Fig. 4-1 for the position of the emergency engine stop.)

When this operation has been performed, it will be necessary to re-set the butterfly plate located in the engine air intake. To do this, the right hand side panel (looking from the operator's seat) must be removed, thus exposing the emergency stop cable, lower arm, and latch. After the emergency engine stop control has been used, the latch handle will have rotated in a counter-clockwise direction to the position shown in Fig. 4-1.

To re-set, push the latch handle clockwise toward the engine, thus rotating the latch until the lever arm springs into place on the latch, as shown in Fig. 4-2.

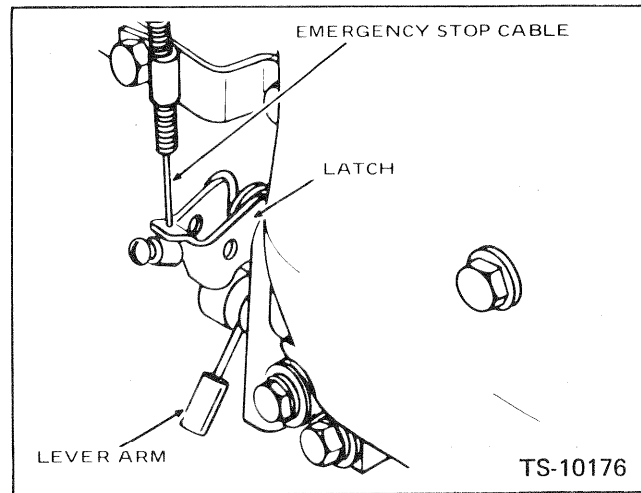


Fig. 4-1 Latch Handle Rotated

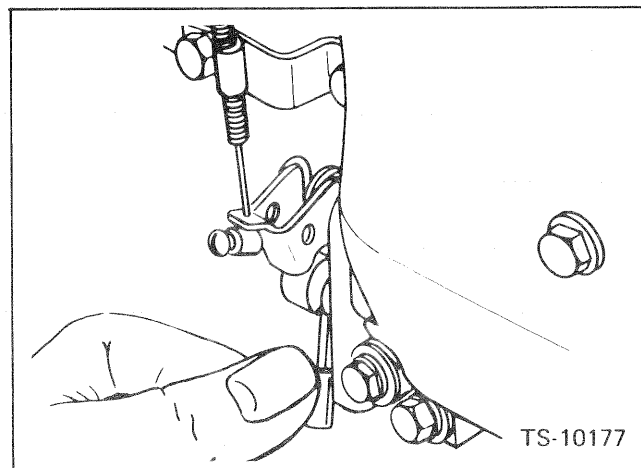


Fig. 4-2 Resetting the Latch Handle

This operation re-opens the butterfly plate, allowing air to pass through to the engine.

### Cummins Diesel

To shut down a Cummins Diesel engine, turn the ignition key to its OFF position.

## NOTES

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## OPERATING THE MACHINE

### SETTING MACHINE IN MOTION

The steps below give the correct procedure for setting the machine in motion. Once the engine has warmed up, the articulation lock is in the "off" position, and personnel around the area are clear.

1. Fasten the seat belt.
2. Raise the blade to its carry position, by pulling backward on the steer and blade control lever.
3. When operating the machine without a load, the travel range should be selected. This gear should be selected with the machine stationary and the directional and high and low gear control lever in neutral.
4. Place the forward and reverse control lever in position for the desired travel direction. When shifting from forward into reverse, or vice-versa, always decrease the engine R.P.M. and stop the machine momentarily while making the shift.
5. Depending on the terrain, the operator should select high or low gear.

High range should be used when roading the machine on smooth pavement for comparatively long distances without a load.

A shift from low speed to high speed can be made while the machine is in motion, by momentarily letting up on the accelerator, making the shift, and again depressing the accelerator.

When making a downshift, accelerate the engine to synchronize the engine and drive shaft speeds when the transmission clutch re-engages.

There are available to the operator a selection of three speeds in both forward and reverse direction. This is accomplished by use of the range shift lever and the speed range shift lever. A choice of low or high speed is possible in the working range, and in the travel range the low speed only is available.

6. Release the mechanical parking brake.
7. Depress the accelerator pedal slowly.

### WORKING THE MACHINE

As the unit now moves out to the stump area with the operator taking care to notice any obstructions, i.e. stumps, rocks, dead falls, etc., that might cause the skidder to upset; as he may have to manoeuvre around them. The operator should notice at a glance all the instruments as he moves along, to see if all systems are

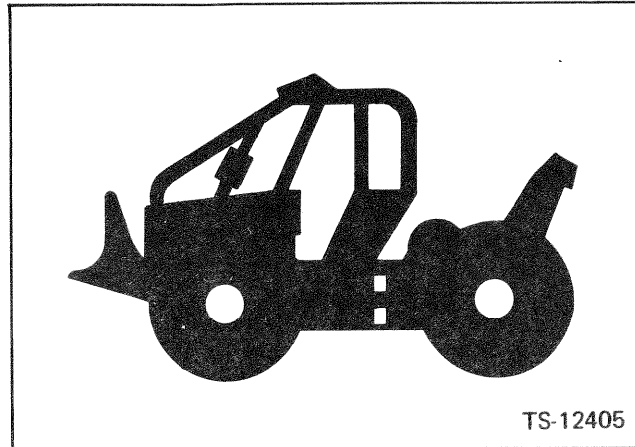


Fig. 5-1 Machine in motion position.

still operating properly. Also he should notice the general direction at which he approaches the stump area, with the thought in mind that there is a quicker and better way back. Remember, once the skidder has the load, the mobility factor changes greatly. (Definition, Mobility Factor: Steer, traverse, or maneuverability on the terrain.)

Once in the stump area a slow turn should be made so that the operator is able to spot the best position to place his machine to gather logs in the least amount of delay and effort (look out for stems that are blocked by large stumps, windfalls, rocks, or that are cross-felled on each other).

Shift the forward reverse lever to neutral; apply Neutral Lock; place the winch control in free spool; then the hand brake is set and the seat belt removed to enable the operator to dismount. Then pull the mainline and chokers to the butt of the trees to be skidded. Very often a full load can be hooked (or choked) in one "set", however, if the slash is heavy or the snow too deep, the operator should move the unit along side the next few logs rather than spend a great deal of time and energy fighting the mainline and chokers. The chokers are attached about 24" (61 cm) from the butt, or end of the logs. It would not be appropriate to try to tell you how many trees must be hooked each time, however, once you operate for a few days you can begin to determine what the payload should be. The payload might be greater for the skidder in the latter part of the day if it is wet and muddy, or better in the early morning if it is still frozen. Only time and experience can help you get the most economical production from your unit.

The operator now remounts the skidder to begin the return trip to the deck. As he mounts the unit, buckling the seat belt and releasing the hand brake, he should notice the general line of travel the logs will take when the mainline is "run in" and have his machine

paralleled to the line pull. The foot brake is held as the winch control lever is moved from the "free-spool" through the neutral position, to the winch-in position toward the rear of the skidder. The mainline will begin to "run in" slowly. It is important to remember that the mainline "run in" is controlled by the engine speed - a few R.P.M.'s on the engine will give instant response on the winch mainline, and as the "drag" from the load builds up from the logs being "bunched" together, more engine R.P.M. will be required to bring in the load. Care should be taken to ensure that the butts of the logs are "bunched" enough to be snugged up near the rear fenders. Once the logs are winched up to the rear fenders, place the winch control to neutral and you are ready to proceed to the landing.

Shift the forward reverse lever into forward position and begin the return trip to the deck. On the skid-way to the deck, short turns must be avoided, along with stumps, rocks or windfalls which might slow the skidder down. The skidder could become immobile if care is not taken to avoid these obstructions, and drop-winchin would be required which will, of course, waste a great deal of time. Winching techniques will be discussed a little later. As the skidder approaches the landing, care should be taken during the approach if co-workers are present, or any other bystander who might be struck by logs if they jam up or jackstraw beneath the skidder wheels.

Once the pile is started the operator should travel to the butt end of the logs and release the winch mainline while moving forward slowly a few feet to enable the chokers to slack off to facilitate their release. The operator shifts the forward reverse lever into neutral and applies neutral lock, sets the parking brake to dismount, releases the seat belt and proceeds to detach the chokers. After all the chokers are released he then mounts the skidder, fastens the seat belt, releases the brake and runs in the mainline until the chokers are just onto the fairlead main roller. He shifts into forward and makes a short turn to blade up the last skid of logs. The pile should be approached in first gear to enable the engine to speed up so that the hydraulics for the blade will provide plenty of lift to build a high deck. The butts should be evened up with the blade to facilitate the loading operation. The operator is now ready to make another "turn" to the stump area.

## WINCHING TECHNIQUES

### 1. Bunching

When winching the skid of logs in for the first time, it is important to remember that a little "speed" on the main cable will allow the logs to "hop" over high stumps or rocks; however, if suddenly the bunched logs hang up, the results will be broken main cable chokers, or even worse yet — tip the unit on it's side; particularly if care has not been taken to ensure that the skidder has been properly "lined up" with the logs you are trying to move. In bunching a reasonable load the unit can sometimes move ahead and winch in at

the same time. This technique allows a few seconds gained on the cycle time, but also helps the logs to "bundle" together just as they are snugged up to the fenders.

### 2. Drop-Winchin

As previously mentioned, dropwinching on the skid trail can be quite an advantage, and necessary under operating conditions; however when this technique is necessary a lot of valuable productive time is lost.

- a. As the skidder begins to slow down its forward movement due to soft underfooting or a large rock or stump, the winch control lever should be quickly pushed into the free spool (detent) position to enable the mainline and chokers to "run-out" as the unit moves to a better and more stable area.
- b. Once good ground conditions are found or if it is more than 50 to 60 feet away the unit should be stopped, shift transmission to neutral and the payload "run in" in a similar manner as "bunching" described in Step No. 1 of our previous discussion. It is important to remember that the unit should always be in a straight line with the payload because side winching can sometimes tip the skidder on it's side.

### 3. Reverse Winching

This technique is normally used when you can no longer go in either direction under power from the wheels. Select a good size tree, or any object to act as an anchor. The mainline and chokers will have to be pulled out and hooked. By placing the forward reverse lever in the neutral position and skidder can be "winched" out in the normal manner for winching; however, it is usually easier if the wheels turned under power to help free the stuck unit. The torque converter matches power for the winch and wheels. This feature allows the skidder to back up and winch in at the same time. By moving the forward reverse lever to the reverse position while at the same time move the winch lever from the free spool position to the "run in" position, the unit will back up and winch in. The engine speed is turned up and the winch line speed will match the wheel speed as the skidder is moved backwards from the immobile area.



## WARNING — TOWING THE MACHINE

If at any time it is necessary to tow the machine any appreciable distance, observe the following precautions:

1. Set all the control levers in neutral.
2. Remove both the propeller shafts from the transmission to the front axle assembly and from the transmission to the mid-mount bearing.

3. Attach articulation lock.

**IMPORTANT:** Note the correct assembly of the propeller shafts before removing them. Reassemble them in the same position. [The tubular end is always the driving end.] Do not separate the two ends of the assembly due to the wear pattern and balancing characteristics. Wire the spider and bearing assemblies to the propeller shaft flanges and wrap the assemblies in a lint-free cloth.

When the machine is being towed, the torque converter charging pump is not operating. There is a danger of

bearing or gear damage in the torque converter and transmission if the propeller shafts are not removed.

When replacing the propeller shafts, use only the special heat treated bolts provided. Tighten the attaching bolts to torque specified in the bolt torque chart.

4. When towing an articulated machine, do not use a chain, use a solid tow-bar, or it may be best to raise one end of machine with articulation attached since machine cannot be steered without engine operating.



## NOTES

[illegible]

## ENGINE

**⚠ WARNING:** Except when specified, lower all attachments to the ground, apply the parking brake, shut down the engine, remove the ignition key, turn the disconnect switch to the "OFF" position, block the wheels, engage the articulation lock, and tie a red warning flag on the canopy upright; when servicing the machine.

*NOTE:* Disengage the articulation lock prior to moving the machine. A machine with the articulation lock engaged cannot be steered.

### 10 Hour or Daily

**Engine and Accessories** — Refer to the Operation and Maintenance Manual of the engine manufacturer for the lubrication and maintenance instructions of the engine and its accessories.

**Radiator and Surge Tank** — Daily check the site gauge mounted on the right hand side of the surge tank. (see Fig. 6-1). If the water level is low add clean soft water or anti-freeze as necessary depending on the ambient temperature. (see Fig. 6-2 for location of filler neck.)

**⚠ CAUTION:** Before removing the surge tank cap be sure that the engine has been shut off and that the cooling system has had time to cool.

**Spark Arrester** — Examine the outside of the spark arrester visually for cracks, holes or corrosion.

### 50 Hour or Weekly

**Check the Cooling System for Leaks** — Check the radiator, hoses, oil cooler, water pump and drain cocks for leaks and correct where necessary. Loss of coolant due to ruptured hoses, loose clamps, leaking pump or open drain cocks will result in expensive repairs or replacement of the engine components.

**Check the Anti-Freeze Protection** — At specified intervals, or whenever anticipating extremely cold weather, use a hydrometer to check the freezing point of the solution (permanent type anti-freeze) when it is at the operating temperature (170°F. to 180°F) (76.7°C to 82.2°C.) If necessary add additional anti-freeze according to the manufacturer's instructions to maintain a safe level beyond the freezing point.

**Tighten the Air Cleaner Connections** — Tighten the elbow clamps and air cleaner mounting bracket bolts. Check the elbow between the air cleaner and the engine for cracks or leaks, which will permit dust-laden air to bypass the air cleaner, entering into the engine, causing severe and costly damage to the engine.

**Check and Adjust the Belt Tension** — Each 50 operating hours, inspect all the drive belts for serviceable condition and the correct tension. Neglect and incorrect tension often leads to inadequate cooling, ball bearing failures, as well as short belt life.

*NOTE:* Due to older belts having been stretched, through use, beyond their original length thus causing the newer belts to carry most of the load, it will be necessary to replace all the belts as a matched set when one belt in a set is worn or damaged beyond a serviceable condition.

Whenever new belts are installed, and at specified intervals, check and re-tension the belts as follows:

1. Measure the span length.
2. At the center of the span, apply a force with a spring scale (at right angles to the span) large enough to deflect the belt 1/64 of an inch per inch (.016 cm. per cm.) of span Fig. 6-1.

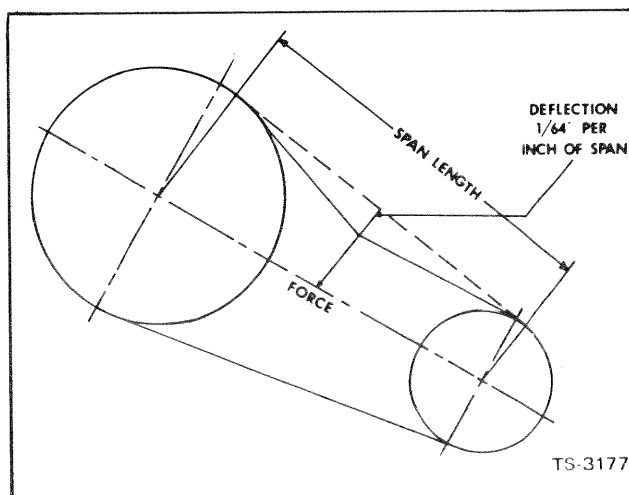


Fig. 6-1 Check Belt Tension

3. For a correct tensioned drive, the force should be within the listed range. New belts should initially be tensioned to the upper limit of the range. All new belts will loosen after operating for a day or two and must be re-checked and re-tensioned (if necessary).

#### Outside diameter of small sheave

7" to 11" (17.8 to 27.9 cm.)  
11½" to 16" (29.2 to 40.6 cm.)

#### Deflection force

8 to 12 lbs. (3.6 to 5.4 kg.)  
10 to 15 lbs. (4.5 to 6.8 kg.)

Periodically belts should be cleaned to remove any grease and glaze, by wiping them with a cloth saturated with brake fluid. This in most instances will eliminate any squeak and will extend the service life of the belts.

## 100 Hour or 2 Weeks

**Clean and Tighten the Air Cleaner Connections** — Tighten all hose clamps and air cleaner mounting parts. Note any sign of damage that might impair the operating efficiency.

The re-usable filter element is very efficient and its service life will be governed by the operating conditions. A service indicator is provided and will show when the air cleaner element should be serviced.

**Clean the Radiator Core** — External surfaces of the radiator core must be kept clean, straight and unobstructed to prevent blocking the air flow and causing overheating.

Flying objects such as sand, dust, leaves, twigs, bugs or other debris that plug the core or adhere to water or oil streaks, impair the cooling efficiency.

Use compressed air, steam or a high pressure water stream and remove such objects opposite the air flow through the core assembly. Oil streaks should be removed using a solvent not harmful to hoses and wiring insulation. Straighten bent fins, being careful not to puncture or enlarge the openings.

**Spark Arrester** — service the carbon trap.

**IMPORTANT:** This must be done in an area where there is no danger of starting a fire due to flying sparks or hot carbon particles.

1. Shut down the engine and allow the exhaust system to cool.
2. Remove the clean out plug with a wrench. If a crust has formed over hole, break it loose with a screwdriver or similar tool.
3. Start the engine and run it at idle to blow collected particles out of the clean out hole. If particles are slow to discharge momentarily cover the end of the exhaust system.



**CAUTION:** Use a large asbestos cloth to prevent possible burns.

4. Stop the engine and replace the cleanout plug securely.

## 250 Hours or Monthly

**Engine BY-PASS Filter [For Cummins Machines Only]**— Replace the filter element every 200 operating hours and whenever the engine is repaired or overhauled for any reason. Thoroughly clean the filter case before inserting a new element. The By-Pass filter is located on right hand side of engine compartment.

**NOTE:** For servicing instructions on the engine Full Flow Filter, refer to the operation and maintenance manual of the engine manufacturer.

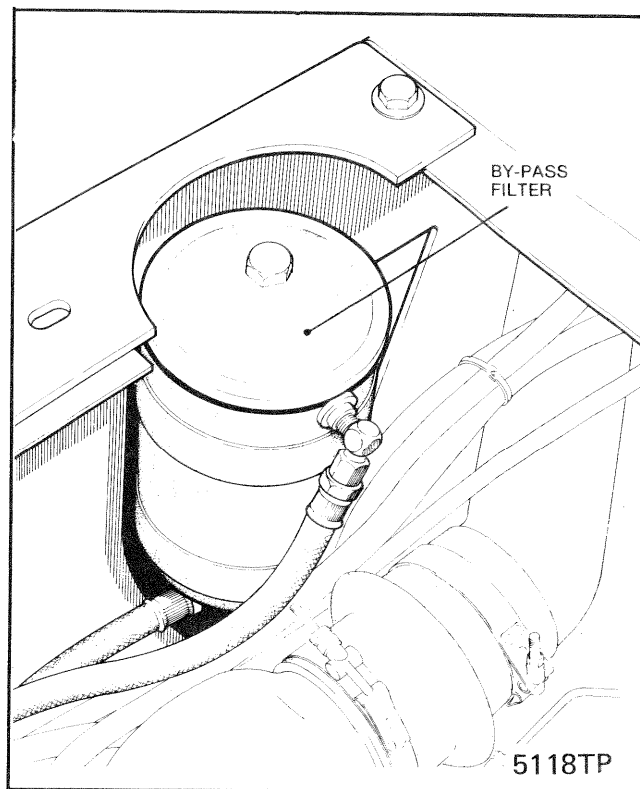


Fig. 6-2 By-Pass Filter Location

**Check the throttle linkage** — to ensure a wide open throttle when the accelerator is fully depressed, also a closed throttle when the accelerator is released. The accelerator and linkage should operate freely in all positions.

Occasionally the control rods, control levers or bell cranks loosen or become damaged, impairing the operating efficiency of the engine. Insufficient power is frequently caused by the throttle linkage being out of adjustment.

Fuel controls are accurately calibrated at the factory to insure the correct low idle and high idle speeds.

**DO NOT ADJUST THE GOVERNOR ASSEMBLY WITHOUT CONSULTING THE OPERATION AND MAINTENANCE MANUAL OF THE ENGINE MANUFACTURER.**

The linkage adjustment for the engine is as follows:

1. Unhook the spring from the accelerator linkage and disconnect the ball joint assembly from the governor throttle control lever. This will enable the governor throttle lever to return to the spring loaded idle position.
2. Depress the accelerator until it contacts the stop in the floorboard.
3. Rotate the governor throttle control lever to the extreme (full throttle) position and adjust the ball


joint at the front of the accelerator rod, to obtain a slip fit in the governor throttle lever just before the accelerator bottoms. If a slip fit cannot be obtained, adjust the clevis at the other end of the accelerator rod.

4. Reinstall and secure the clevis to the governor throttle lever and reconnect the accelerator spring.
5. Release and depress the accelerator, and check that the linkage will properly rotate the throttle control lever from the idle to the full throttle position without interference.

The pressure required to depress the accelerator is controlled by a spring attached from the accelerator linkage to the anchor lug. This spring also insures that the engine will return to the idle speed when the accelerator pedal is released.

**Check the Engine RPM** — The engine speeds should be checked regularly against the specifications to determine the engine efficiency and the machine performance. Correct speeds insure safe operating limits for the engine and maintain correct operating speeds for the torque converter, and transmission.

**[a] Low Idle and High Idle RPM** — These speeds are the free operating limits of the engine under no load conditions. They are determined by the amount of fuel delivered to the engine. See the Specifications Data in Section 15.

 **CAUTION: Do not accelerate to maximum RPM until the engine is at its operating temperature.**

**[b] Stall RPM** — The engine and torque converter act as a unit to deliver power to the transmission. A stall check should be performed to insure that the engine is developing the rated power and that the torque converter is operating efficiently.

**IMPORTANT: Check the stall RPM only when the torque converter fluid is hot [180°F. to 200°F] [82.2°C to 93.3°C.] the engine is at the operating temperature and the steering and blade relief valve setting is correct.**

1. Install a tachometer on the engine.
2. Apply the parking brake, block the wheels, and place the directional and speed range levers in NEUTRAL and apply Neutral Lock.
3. Start the engine and raise the blade a few inches above the ground.
4. Engine Warm-Up Procedures — No Engine stall, or acceleration checks, nor any acceleration to maximum R.P.M. to be performed until the engine is properly warmed up.
  - a. Start the Engine and Operate at low idle R.P.M. for three (3) to five (5) minutes.

- b. Increase the R.P.M. to 1000 and hold for three (3) minutes.
- c. Increase the R.P.M. to 1800 and hold for three (3) minutes.

The Engine water temperature gauge should now register approximately 150°F. (65.6°C.)

5. Transmission & Converter oil warm up procedure.
  - a. Shift levers into Forward, Hi and Work Range. Accelerate the Engine to 1400 — 1500 R.P.M. and stall the converter for thirty (30) seconds minimum. Then shift transmission to neutral for fifteen (15) seconds minimum and repeat until the converter oil temperature registers between 180°F. to 200°F. (82.2°C. to 93.3°C.).
6. Steer & Blade oil Warm up Procedure.
  - a. Operate the Engine at 1400-1500 R.P.M.
  - b. Operate hydraulic system by extending or retracting the various cylinders and holding them closed or open while operating against the relief valve for five (5) seconds maximum every ten (10) seconds until the system reaches between 150°F. to 170°F. (65.6°C. to 76.7°C.).

*NOTE: As there is no gauge to record hydraulic oil temperatures, immerse a recording device in the oil at the hydraulic oil reservoir.*

7. Check the Main Relief Pressure on the steer and blade control valve. Refer to Sec. 11 under 500 hour operations for instructions.
8. Shift levers into FORWARD, HI and WORK RANGE (and accelerate to full throttle) holding converter stall torque with both the parking and service brake engaged, and blocked wheels. The converter stall speed is the maximum engine R.P.M. obtainable in this condition.

*NOTE: The stall condition is never to be held for more than thirty [30] seconds or if the converter temperature exceeds 250°F. [121.1° C.]. Always idle engine after stall check long enough to bring converter temperature down to 200°F. [93.3° C].*

9. The stall speed with the main pump over relief is obtained by activating a hydraulic cylinder to its full closed position and hold with the machine in the converter stall condition. The stall speed with the main pump over relief is the maximum engine R.P.M. obtained in this situation.

**DO NOT STALL THE CONVERTER MORE THAN 30 SECONDS AT ANY ONE TIME.**

If the stall rpm is not within the specifications, trouble shooting of the engine or torque converter by a qualified mechanic is required. See the Specifications Data in Section 15.

**NOTE:** The stall RPM specified in Section 15 is applicable to an altitude of 600 ft. [182.9 m.] and ambient temperature of 70°F [21.1°C.]. Due to the many combinations of altitude and temperature possible in the field. Space does not permit the publishing here all the corrections necessary to the stall RPM indicated to accommodate such variation. It is suggested the engine manufacturer's distributor be contacted to determine the correction necessary for the altitude and temperature in your application.

### 500 Hour or Two Months

**Tighten all Mounting Bolts** — the mounting bolts will occasionally work loose and cause the supports and brackets to wear rapidly. Alignment difficulty may also develop. (Refer to Sec. 15 for torque specs.)

**Service the Air Cleaner Element** — It should be understood that no set rule can be established to service the filter element, because its service life is governed by the operating conditions. The service indicator will show the condition of the element and establish when to service.

To change the element, remove the air cleaner access cover on the side of the firewall assembly. Loosen the clamp assembly on the air cleaner and remove the cup assembly. Unscrew the wing nut in the center of the filter element and remove the element. Fig. 6-3. Blow out the element with compressed air (pressure should not exceed 100 p.s.i.), to remove dust, blow in the opposite direction of air flow. Wash the element in a non-sudsing detergent, for about 15 minutes and rinse both the inside and outside surfaces of the element until the run off water is clear. The air cleaner element should be air dried or oven dried at 160°F. (71.3 degrees C) or less.

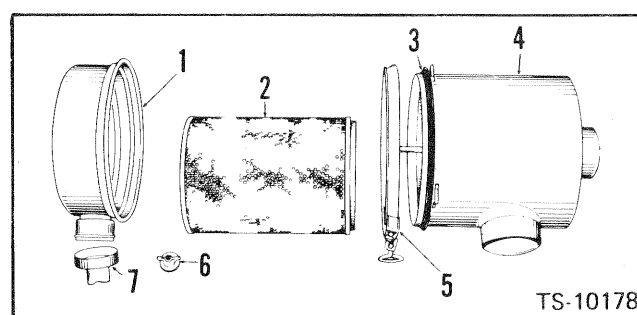
Clean inside the air cleaner housing, cup assembly and cap removing all dust and foreign material. Inspect the O-ring making sure that it is not damaged in any way, replace if necessary.

Careful final inspection is recommended after the element has dried, check top sealing gasket for looseness or damage. A loose gasket may be recemented. Inspect the element for damage by placing a bright light inside the element. Thin spots, pin holes, or the slightest rupture will render the element unfit for use. Discard any damaged element.

Re-insert the filter element in the housing and assemble the cup assembly. Tighten all clamps and check all hoses.

Reset the service indicator by pushing down on the reset button located on top of the indicator.

**NOTE: REPLACE THE FILTER ELEMENT AFTER SIX CLEANINGS OR ONE YEAR OF SERVICE — WHICHEVER OCCURS FIRST.**



- |                     |                   |
|---------------------|-------------------|
| 1. Cup Assembly     | 5. Clamp Assembly |
| 2. Filter Element   | 6. Wing Nut       |
| 3. O-Ring           | 7. Vacuator Valve |
| 4. Air Cleaner Body |                   |

Fig. 6-3 Air Cleaner Assembly

### 1000 Hour or Six Months

**Radiator:** Twice a year, drain, flush and refill the cooling system. Add permanent type antifreeze according to the manufacturer's instructions when the air temperature is 32°F. (0°C) or lower, or when there is danger of the water freezing in the system. Always use a hydrometer to check the freezing point of solution when it is at operating temperature.

## FUEL SYSTEM

**⚠ WARNING:** Except when specified, lower all attachments to the ground, apply the parking brake, shut down the engine, remove the ignition key, turn the disconnect switch to the "OFF" position, block the wheels, engage the articulation lock, and tie a red warning flag on the canopy upright; when servicing the machine.

*NOTE: Disengage the articulation lock prior to moving the machine. A machine with the articulation lock engaged cannot be steered.*

### 10 Hour or Daily

**Fuel Tank** — Check the fuel level several times each day observing the following conditions:

1. Machine must be LEVEL.
2. Engine must be SHUT DOWN.
3. Area round the fuel cap must be CLEAN.
4. Strainer in the fuel tank filler neck must be clean and free from foreign material. Clean if necessary.

**Fuel Oil** — For all operating conditions with regard to the load, speed, idling time or ambient air temperature refer to the fuel oil specifications recommended by the engine manufacturer.

The fuel tank should be filled when the machine is shut down, to prevent condensation.

Before starting the engine at the beginning of the shift, it is advisable to drain a pint of fuel from the fuel tank and approximately one quarter pint of fuel from the filters daily to remove the sediment and water. Drain cocks are provided at the fuel tank and at the bottom of the fuel filters. Fuel should be drained into a container and disposed of in a safe place.

Check all the fuel lines, fuel pumps, filters and shut-off cocks for leaks and correct where necessary.

*NOTE: This machine is equipped with a fuel line shut off located in the rear frame. If there is an engine fire - turn this valve to the "OFF" position.*

### 50 Hours or Weekly

**Drain the Fuel Tank Sediment** — Open the drain cock at the bottom of the fuel tank to drain the accumulated water sediment.

**Fuel Tank and Breathers** — The Fuel system is equipped with a breather. The breather is incorporated in the filler cap to admit only clean filtered air.

**Each 50 operating hours** — Remove the filler cap, wash in a solvent, blow dry with compressed air and reinstall the cap in the reservoir.

### 100 Hours or 2 Weeks

—NIL—

### 250 Hours or Monthly

Fuel controls are accurately calibrated at the factory to insure the correct low idle and high idle speeds.

**DO NOT ADJUST THE GOVERNOR ASSEMBLY WITHOUT CONSULTING THE OPERATION AND MAINTENANCE MANUAL OF THE ENGINE MANUFACTURER.**

The linkage adjustment for the engine is as found in Sec. 6 under 250 hour operation.

### 500 Hours or Two Months

—NIL—

### 1000 Hours or Six Months

**Fuel Tank** — Every 1,000 operating hours or more often if required, drain and clean the fuel tank. The fuel tank should be drained and cleaned when the tank is relatively low on fuel.

1. Open the drain cock at the bottom of the filters, when provided, and drain off any accumulated water or sediment. Close the drain cock.
2. Open the drain cock at the bottom of the fuel tank, and drain.
3. Remove the cover and clean any foreign material from the bottom of the fuel tank. Remove the magnet from the bottom of the fuel tank and clean thoroughly. Replace the magnet and reinstall the cover and close the drain cock.
4. Clean the fuel tank strainer screen.
5. Refill the fuel tank with clean fuel handled in clean containers as specified under "Service Daily". Use a good brand procured from a reliable company. For all operating conditions with regard to load, speed, idling time or ambient air temperature refer to the fuel oil specifications recommended by the engine manufacturer.

## NOTES

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## TORQUE CONVERTER

**WARNING:** Except when specified, lower all attachments to the ground, apply the parking brake, shut down the engine, remove the ignition key, turn the disconnect switch to the "off" position, block the wheels, engage the articulation lock and tie a red warning flag on the canopy upright; when servicing the machine.

**NOTE:** Disengage the articulation lock prior to moving the machine. A machine with the articulation lock engaged cannot be steered.

### 10 Hours or Daily

**Torque Converter** — Check the fluid level daily, observing the following conditions: As per Sec. 9 under 10 hour operations.

### 50 Hours or Weekly

Each 50 operating hours unscrew the breathers, wash in a solvent, blow dry with compressed air and reinstall.

### 100 Hours or 2 Weeks

—NIL—

### 250 Hours or Monthly

Replace the filter element each 250 operating hours. Refer to transmission, Sec. 9 under 250 hours.

Check converter stall R.P.M. Refer to stall R.P.M. in Sec. 6 under 250 hour operations.

**Converter Out Pressure** — Periodically or whenever the machine has evidence of an overheating condition, inspect and check for collapsed or ruptured hoses that might cause overheating. Correct as necessary. If overheating conditions still exist, check the converter OUT pressure to determine whether the oil cooler at the bottom of the radiator has or is becoming plugged with foreign material.

The pressure check must be made with the fluid hot (180° F. to 200° F.) using an accurate gauge at 2,000 rpm.

1. Install a tachometer on the engine.
2. Install a gauge at the converter OUT pressure port located below the sender unit on the rear of the converter. Fig. 8-1.
3. Apply the parking brake; shift the forward and reverse into NEUTRAL position and apply neutral lock.
4. With the aid of a helper, read the gauge at a steady 2,000 rpm. The gauge reading must not exceed 40 p.s.i.

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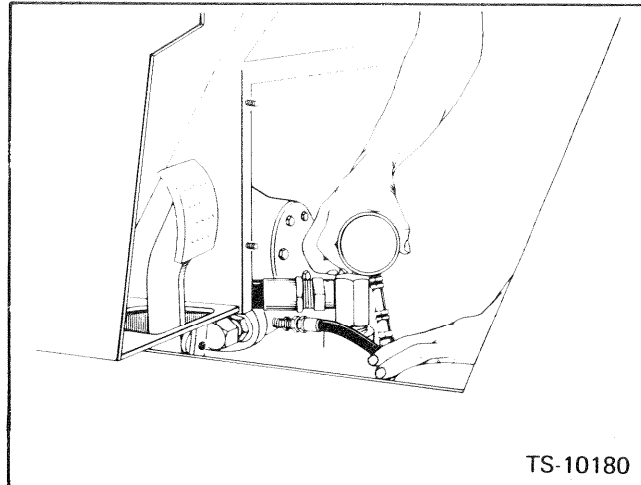


Fig. 8-1 Check Converter OUT Pressure

If the pressure reading exceeds 40 p.s.i. it will be necessary to clean or replace the hoses, the oil cooler, and/or the radiator assembly. To further pinpoint the problem, see "oil cooler pressure drop", under 500 Hours Operation.

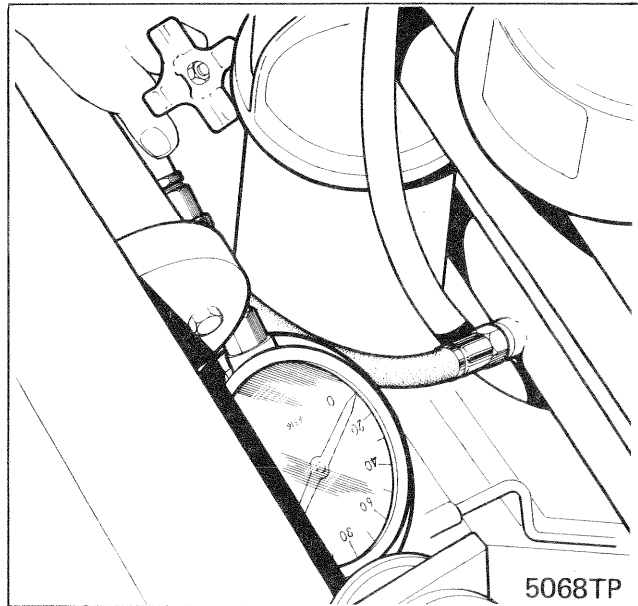


Fig. 8-2 Oil Cooler "OUT" Pressure Check

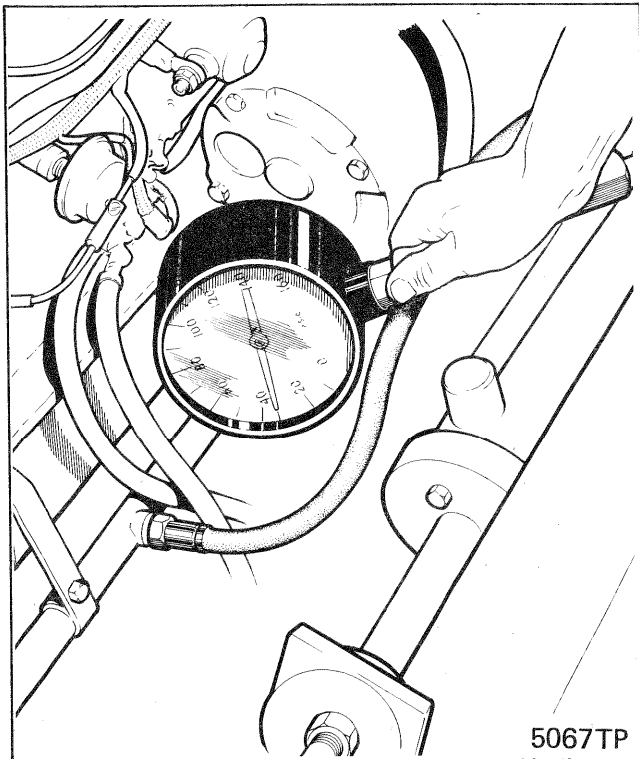
### 500 Hours or 2 Months

#### Oil Cooler Pressure Drop

The drop in pressure across the oil cooler at the bottom of the radiator will indicate whether the oil cooler and/or the cooler hose has or is becoming plugged with foreign material, causing overheating.

1. Install a tachometer on the engine (Disregard this operation if the machine is equipped with a tachometer). Install a gauge at the oil cooler IN pressure check point located on the oil cooler





**Fig. 8-3 Oil Cooler in Pressure Check**

supply tube on the left side of the engine compartment. Fig. 8-3. Install a gauge at the oil cooler OUT pressure check point located on the oil cooler supply tube on the right hand side of the engine compartment. Fig. 8-2.

2. Apply the parking brake and shift the forward and reverse lever into NEUTRAL and apply neutral lock.
3. With the aid of a helper, read the gauges at a steady 2,000 rpm, and subtract the oil cooler OUT pressure from the oil cooler IN, to get the pressure drop. The pressure drop should be between 5 p.s.i. and 20 p.s.i.

If the pressure difference equals or exceeds 20 p.s.i., it will be necessary to thoroughly clean or replace the cooler hose, oil cooler and/or the radiator assembly.

*NOTE: When this pressure check is made, the brake pedal must not be depressed as this will interfere with the pressure readings. If the brake is to be applied, apply the mechanical hand brake only.*

Drain and refill the torque converter hydraulic system every 500 operating hours and whenever, for any reason, the torque converter or any other component within the torque converter system is repaired or overhauled. (Refer to Section 9.)

Tighten all mounting bolts as they will occasionally work loose and cause the supports and brackets to wear rapidly. Alignment difficulty may also develop.

## TRANSMISSION

**WARNING:** Except when specified, lower all attachments to the ground, apply the parking brake, shut down the engine, remove the ignition key, turn the disconnect switch to the "OFF" position, block the wheels, engage the articulation lock, and tie a red warning flag on the canopy upright; when servicing the machine.

**NOTE:** Disengage the articulation lock prior to moving the machine. A machine with the articulation lock engaged cannot be steered.

### 10 Hours or Daily

**Transmission** — Check the fluid level daily, observing the following conditions.

1. Machine must be LEVEL.
2. Fluid must be HOT (operating temperature of 180°F. to 200°F. or 82.2°C. to 93.3°C.)
3. Engine must be IDLING.
4. Area around the filler opening must be CLEAN.
5. Transmission must be in NEUTRAL.
6. Parking brake must be applied.

Check using the dipstick located on the right hand side of operator seat (See Fig. 9-1 for the position). Pull out dipstick and wipe with a clean, lint free cloth. Re-insert to check the fluid level, pushing the dipstick down firmly. The fluid level must be at the FULL mark on the dipstick. If the fluid level is below the FULL mark, fill as necessary then re-check oil level.

Use only the type of fluid specified in Sec. 16 of this manual. See "250 Hour Operations" for filter change.

### 50 Hours or Weekly

**Clean the Transmission Breather** — The transmission hydraulic system is equipped with a breather located on top of the transmission.

### 100 Hours or 2 Weeks

—NIL—

### 250 Hours or Monthly

**Transmission, Torque Converter and Clark Winch** — The torque converter, transmission & winch hydraulic system is protected by full flow replaceable element type filter assembly. The filter is mounted on the right hand side of frame channels under floor board (See Fig. 9-2 for filter position) all fluid leaving the converter pump passes through the filter providing clean fluid to the torque converter, transmission, and Clark winch.

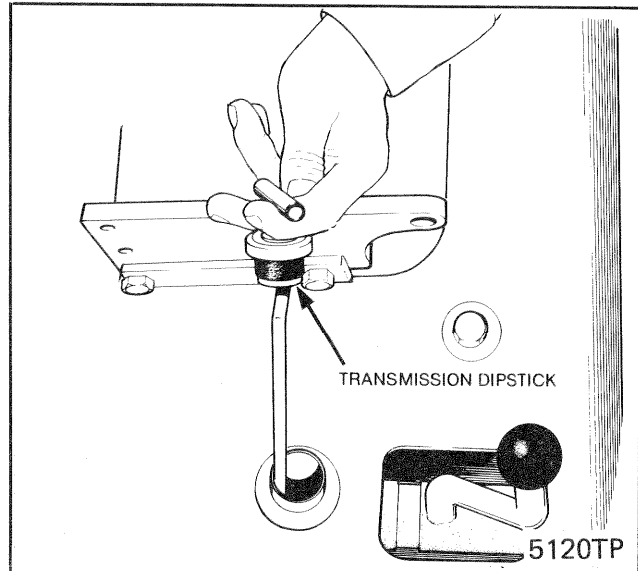


Fig. 9-1 Transmission Filler Neck and Dipstick

Replace the filter element every 250 operating hours and whenever the converter pump, transmission, torque converter or winch is repaired or overhauled for any reason. Thoroughly clean the filter case and base casting, before inserting a new element. Use new gaskets in the base casting, tighten the center bolts to 30 ft. lbs. (4.15 kg. m.) torque.

Run the engine 5 minutes at approximately 1,500 rpm checking the assembly, hoses and connections for leaks. Re-check the transmission fluid level when it is at operating temperature (180°F. to 200°F. 82.2°C to 93.3°C.) (as described under "10 Hour Operations".)

**NOTE:** The filter element is especially designed to withstand the pressure and flow rate requirements. Use only the replacement filter element called for in the applicable Parts Manual. Use of a "will-fit" or a substitute element will endanger the correct operation of the transmission and torque converter and cause costly repairs and down time.

### 500 Hours or 2 Months

**Transmission, Torque Converter and Clark Winch** — Drain and refill the transmission, torque converter and winch hydraulic system every 500 operating hours and whenever, for any reason, the converter pump, transmission, torque converter or winch is repaired or overhauled.

1. Securely block the wheels of the machine and apply the parking brake. Place the gear control lever in high speed range and the forward and reverse control lever in FORWARD.
2. Always drain the system while the fluid is at the operating temperature (180°F. to 200°F. 82.2°C to 93.3°C.)

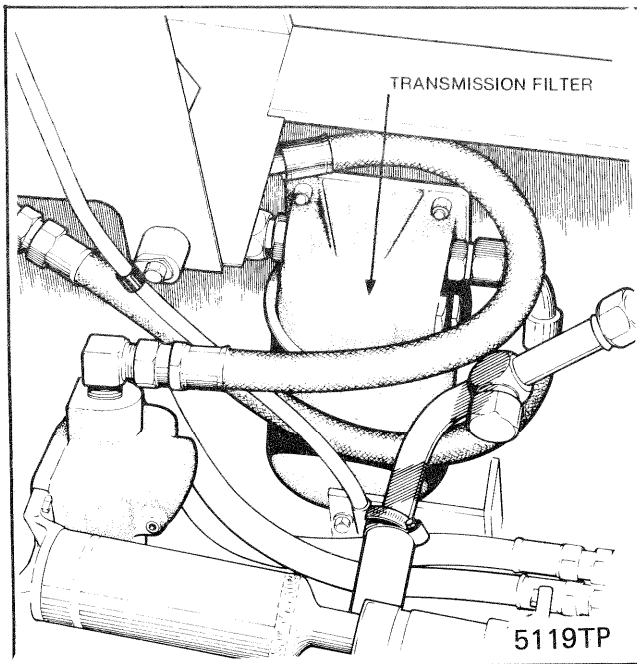


Fig. 9-2 Transmission Filter Location

3. Remove the drain plug from the transmission, torque converter, and winch housing and drain thoroughly.
4. Remove the transmission suction screen, clean in a solvent, dry, and reinstall using a new O-Ring. Reinstall the reducing bushing to the dipstick and transmission.
5. Replace the element in the transmission and torque converter filter assembly. (See Fig. 9-2 for the position of the filter assembly.) Thoroughly clean the filter case and base casting before installing a new element. Use a new gasket in the base casting and tighten the center bolt to 30 ft. lbs. (4.15 kg. m.) torque.
6. Remove the breathers from the top of the torque converter, transmission and winch. Wash in a solvent, blow dry with compressed air and reinstall.
7. Refill the transmission, torque converter and winch with the type of fluid specified in this manual through the filler neck (Fig. 9-1.) until the correct level shows on the dipstick. Approximate capacity — 4.5 gallons (Imperial measure), 5.4 gallons (U.S. measure), 20.5 litres.
8. Disconnect the return oil cooler hose from the radiator (located on the right hand side of the machine) and direct the open end into a waste drum with a capacity of at least 3 gallons (Imperial measure); 3.6 gallons (U.S. measure), 13.6 litres.

**IMPORTANT:** Draining the trapped oil in the converter cavity and oil cooler must be accomplished within 60 seconds with the return oil cooler hose disconnected. Serious damage to the transmission will result if this precaution is not complied with.

9. Start the engine and maintain an idling speed to force any trapped oil in the torque converter and oil cooler out through the open end of the return oil cooler hose. Drain approximately 4 gallons (Imperial measure), 4.8 gallons (U.S. measure), 18.2 litres of fluid to insure clean fluid flow; then shut down the engine immediately and reconnect the return oil cooler hose.
10. Refill the transmission, torque converter and winch. Restart and run the engine for 5 minutes at approximately 1,500 rpm, checking the filter assemblies, drain plug, hoses and connections for leaks. Recheck the transmission fluid level when it is at operating temperature (180°F. to 200°F or 82.2°C. to 93.3°C.). Add fluid as necessary. Fig. 9-1.

This check is to be performed with the engine idling. **UNDER NO CIRCUMSTANCES USE ANY FLUSHING OIL OR COMPOUNDS FOR CLEANING THE SYSTEM.**

**Check and Adjust the Transmission Shift Linkage —** Inspect all the mechanical control linkages to make sure that all the rods, cross shafts, bell cranks, ball joints and operating arms are in a serviceable condition and are correctly adjusted. Correct any questionable condition such as loose or bent linkage, worn pins or evidence of binding or rubbing of any of the linkage components.

Adjustments for the shift linkages are as follows:

**[a] Forward and Reverse and High and Low Gear Control Shift Levers —** Check and adjust the forward and low gear control shift levers to ensure full engagement into all detent positions without interference.

1. Place the High and Low gear control and the Forward and Reverse control levers in the **NEUTRAL POSITION**, engage the neutral lock.
2. Loosen the lock nuts and adjust the clevises and locknuts on the ends of both shift rods as necessary until the levers in the operator's compartment are correctly aligned.
3. Tighten the locknuts and check that the levers will shift into all detent positions without interference from the floorboard or transmission.

*NOTE: When reassembling the transmission control valve, the declutch spool must be installed with the letter "R" in the upright position.*

**4TH GEAR LOCKOUT —** This machine is equipped with a simple device in the transmission control box that prevents the transmission from being shifted into travel range-high gear at the same time. The available speed ranges are listed in section 2. The fourth gear lockout requires no maintenance or adjustment.

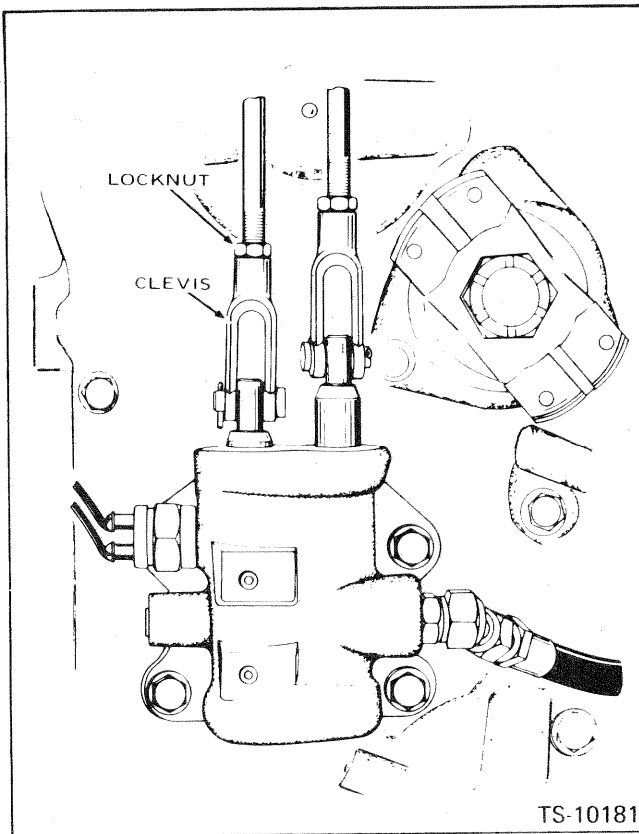


Fig. 9-3 Adjust Linkage at the Transmission

**CAUTION:** Do not attempt to defeat the purpose of the fourth gear lockout. It is on the machine for your safety.

#### Transmission Clutch Pressure

Periodically or whenever the machine has evidence of incorrect operation in any one of the speed ranges in forward or reverse direction, a check of the clutch operating pressures should be made.

Using test gauge of at least 300 p.s.i. capacity, a check should be made at the check plug on the clutch pressure and check hose mounted on transmission clutch. Remove the check plug and attach the test gauge as shown in Fig. 9-4.

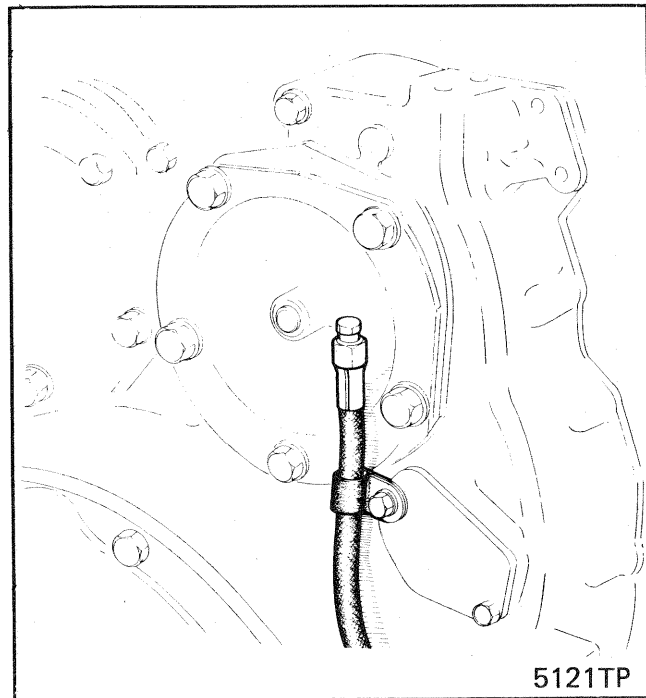


Fig. 9-4 Clutch Pressure Check Point

The pressure check should be taken with the transmission fluid at the operating temperature (180°F. to 200°F.). The wheels of the machine should be securely blocked and the parking brake applied. The pressure check should be made in all the speed ranges in both forward and reverse. With the engine idling and at the operating temperature (180°F. to 200°F.) pressure should be as follows:

Minimum 250 p.s.i. (17.6 Kg./sq. cm)  
Maximum 300 p.s.i. (21.1 Kg./sq. cm)


If the pressure is not within the specifications, further trouble shooting of the transmission and torque converter by a qualified mechanic will be required.

**Tighten all Mounting Bolts** — The mounting bolts will occasionally work loose and cause the supports and brackets to wear rapidly. Alignment difficulty may also develop.

## NOTES

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

## WINCH-CLARK

 **WARNING:** Except when specified, lower all attachments to the ground, apply the parking brake, shut down the engine, remove the ignition key, turn the disconnect switch to the "OFF" position, block the wheels, engage the articulation lock, and tie a red warning flag on the canopy upright; when servicing the machine.

*NOTE: Disengage the articulation lock prior to moving the machine. A machine with the articulation lock engaged cannot be steered.*

**10 Hours or Daily**

**Grease Fitting** — Grease the fitting on the winch control lever.

**50 Hours or Weekly**

Clean the Winch Breather. The winch is equipped with a breather located on top of the housing.

Each 50 operating hours unscrew the breather, wash in a solvent, blow dry with compressed air and reinstall.

**100 Hours or 2 Weeks**

Adjust, if necessary, the mechanical free spool adjustment. An adjustment should be performed whenever unsatisfactory spooling is encountered.

To adjust the tension on the cable drum, turn the adjusting handle, located on the right hand side of the

winch. To increase tension, turn the adjusting handle clockwise; to decrease tension, turn the adjusting handle counter clockwise.

**250 Hours or Monthly**

Replace the filter element each 250 operating hours. See the section on the transmission for removing and replacing the filter. (Section 9)

Check the wear button in the mechanical free spool adjustment every 250 hours, or whenever unsatisfactory spooling is encountered.

1. Remove the set screw, set screw spring and set screw lock bolt.
2. Remove adjusting handle, spring and wear button.
3. Check the wear button for cracks and wear.
4. Reassemble and adjust for proper spooling tension.


**500 Hours or 2 Months**

Drain and refill the hydraulic system every 500 operating hours and whenever, for any reason, the winch or any component within the winch system is repaired or overhauled.

Refer to the transmission Section (9) for drain and refill.

**1000 Hours or 6 Months**

—NIL—

 **WARNING:** For disassembly of the winch, refer to the disassembly instructions in the winch shop manual. **DO NOT** attempt to disassemble or make any repairs inside the winch, before first reading and understanding the disassembly and reassembly instructions.

## NOTES

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## HYDRAULICS

**WARNING:** Except when specified, lower all attachments to the ground, apply the parking brake, shut down the engine, remove the ignition key, turn the disconnect switch to the "OFF" position, block the wheels, engage the articulation lock, and tie a red warning flag on the canopy upright; when servicing the machine.

**NOTE:** Disengage the articulation lock prior to moving the machine. A machine with the articulation lock engaged cannot be steered.

### 10 Hours or Daily

**Hydraulic Reservoir** — Check the oil level daily observing the following conditions:

1. Machine must be LEVEL.
2. Blade must be in the UP POSITION.
3. Engine must be SHUT DOWN.
4. Area around the reservoir cap must be CLEAN.

Remove the reservoir cap and dipstick and wipe with a clean, lint-free cloth. Replace the cap and dipstick to check the oil level. Maintain the oil level to the FULL mark on the dipstick. Fig. 11-1

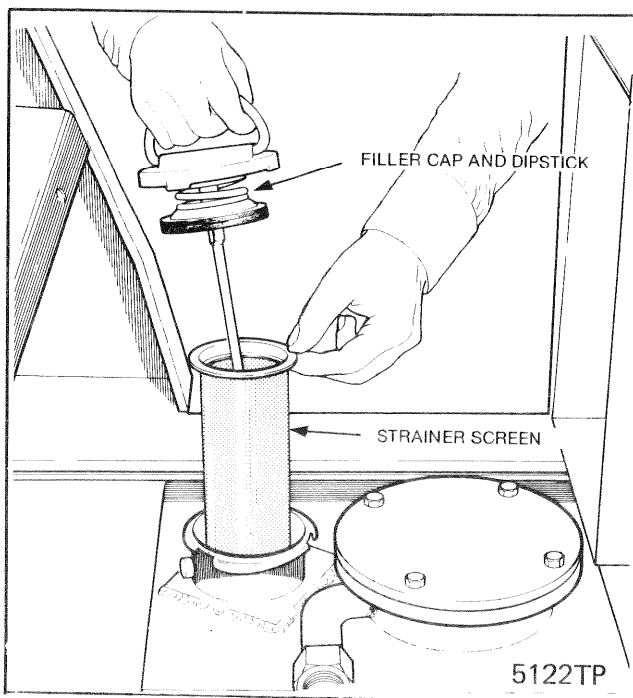


Fig. 11-1 Hydraulic Reservoir Cap, Filler Neck Strainer and Filter

Use the type of fluid specified in Sec. 16 of this manual. In order to prevent pump wear at high speeds and high pressure, anti-scuff and anti-wear additives are contained in these specifications.

See "500 Hour Operations" for replacing the Hydraulic Filter Assembly Element, and "1,000 Hour Operations" for the Drain and Refill of the reservoir.

**IMPORTANT:** When replacing oil in the hydraulic system do not interchange Dexron Automatic Transmission fluid with military spec., MIL-L-2104A, Supp. 1 or New MIL-L-2104B. The system must be drained and flushed, using only the oil to be added as the flushing agent.

DO NOT flush with a cleaning or flushing oil before adding a different oil as some converter units cannot be completely drained and a considerable amount of oil remains trapped in the converter elements. Entrapped flushing oil will contaminate the refill.

### 50 Hours or Weekly

#### Auxiliary Steering Test

1. Place the machine on a clean level area.
2. With the engine "OFF" and the ignition switch "ON", turn the auxiliary switch to the "ON" position.
3. Steer the machine left, and right, full against the steer stops, then turn the auxiliary steer switch to the "OFF" position.

**NOTE:** The total running time of the auxiliary steer system should not exceed two minutes, [to minimize battery drain].

If the auxiliary steering fails to respond satisfactory to the above test, check the condition of your battery; all hydraulic connections, and main relief pressures. If a problem still exists, have a mechanic check out the system.

**Hydraulic Reservoir Breather** — The hydraulic system is equipped with a breather. The breather is incorporated in the filler neck to admit only clean filtered air.

Each 50 operating hours remove the filler cap and breather, wash in a solvent, blow dry with compressed air and reinstall.

**Clean the Cylinder Rods** — Wipe the blade and steering cylinder rods with a clean cloth saturated in hydraulic oil. Check the rods for nicks or burrs which would damage the packings or seals. Remove any such nicks or burrs with a fine grained hand stone or crocus cloth.

### 100 Hours or 2 Weeks

—NIL—

### 250 Hours or Monthly

—NIL—

### 500 Hours or 2 Months



**Service the Hydraulic Reservoir Filter** — The main hydraulic system is protected by a full flow 10 micron replaceable element type filter, located on the top side of the hydraulic reservoir. (See Fig. 11-2). All fluid returning to the reservoir passes through the filter, providing clean fluid for distribution throughout the system.

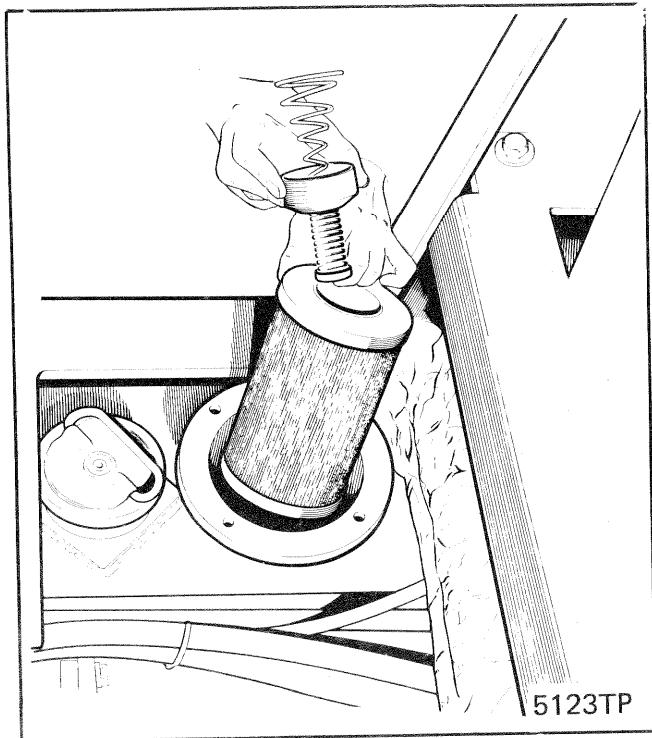


Fig. 11-2 Hydraulic Reservoir Filter

Replace the element every 500 operating hours. Thoroughly clean the cover before inserting a new element. Check all gaskets and replace if necessary.

*NOTE: The filter element is specially designed to withstand pressure and flow rate requirements. Use only the replacement filter called for in the applicable parts manual. Use of "will-fit" or substitute elements will endanger the correct operation of the hydraulic system and can cause costly repairs and down time.*

**Check the Main Relief Pressure on the Steering and Blade Control Valve** — The main hydraulic pump is coupled to the drive line and operates as soon as the engine is started. This pump draws fluid from the reservoir and forces it under pressure into the steering and blade (main) control valve.

The Ranger is so designed that only one operation is required to check the pressure in the system.

1. Remove the floor panel and attach a hydraulic gauge of at least 3,000 p.s.i. (8779.2 kg./cm. sq.) capacity to the hose fitting on the main control valve. Fig. 11-3.
2. Disengage the articulation lock, remove the blocks

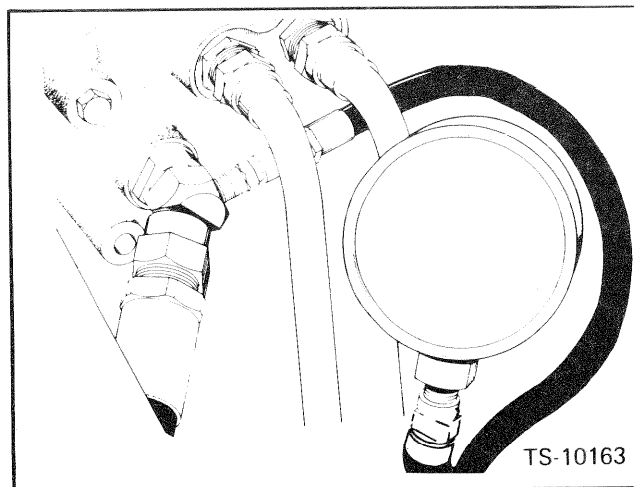


Fig. 11-3 Main Relief Valve Pressure check  
from the wheels, turn the disconnect switch to the "ON" position, release the parking brake and place the transmission levers in the neutral position.

3. Place a shield across the frame to protect the operator from the revolving propshaft. The shield must be designed in a similar manner as the floor panel with a hump to clear the revolving prop shaft.
4. Start the engine and allow the machine to warm up to operating temperatures. (Refer to Warm-up checks in Sec. 4).
5. Put the machine in a full turn and hold. Accelerate the engine R.P.M. up to 2,000, the hydraulic gauge on the control valve should register 1,600 p.s.i.

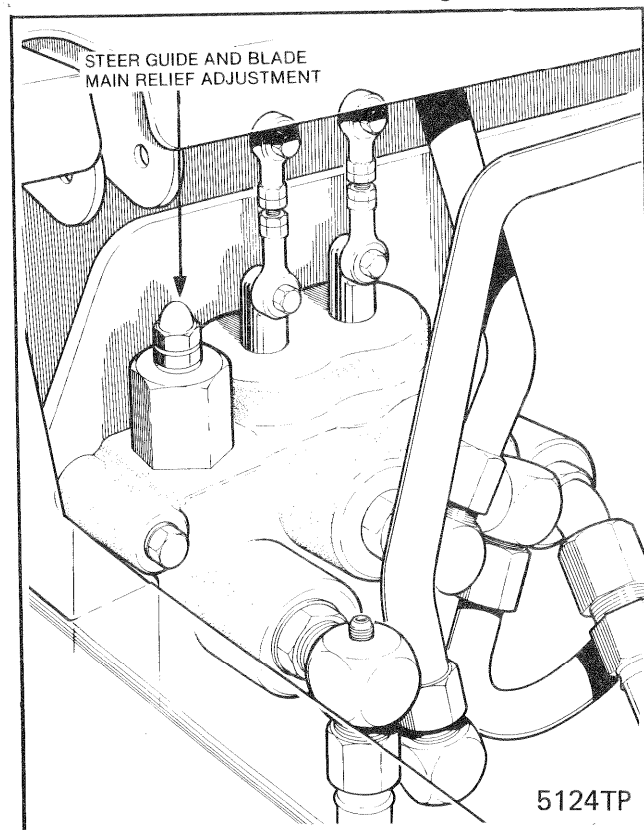


Fig. 11-4 Main Relief Pressure Port and Adjust Main Relief

4682.2 kg. cm./sq.). If it does not; decelerate the engine R.P.M. to idle, and release the steer control lever.

6. To adjust the main relief, remove the acorn nut, loosen the jam nut and adjust the set screw located on the top of the main control valve assembly until 1,600 p.s.i. registers on the gauge per step number 5. Fig. 11-4

#### 1000 Hours Operation

**Hydraulic Reservoir** — Drain, clean, and refill the hydraulic oil system every 1,000 hours of operation, or more often if required. When operating under severe dusty and dirty conditions, clean the system more often to prevent excessive wear or premature failure of valve, pump, or cylinder parts.

1. Always drain the system after working the machine, and while the oil is at operating temperature. Hot oil flows more freely and carries more foreign material with it.
2. Raise the dozer blade to its maximum position and **SECURELY BLOCK IN PLACE** to facilitate draining of these cylinders.
3. Have the machine in a service condition explained in the first paragraph of this section.
4. Remove the drain plug at the bottom of the reservoir and drain the reservoir.
5. Disconnect the steer and blade cylinder hoses at their lowest points to drain these cylinders.
6. Remove the cover from the top of the reservoir and clean all foreign material from the tank. Remove

the magnet inside the reservoir and clean thoroughly. Replace the magnet, then reinstall the cover and drain plug securely.

7. Replace the hydraulic reservoir filter element as specified under "Service the Hydraulic Reservoir Filter Assembly".
8. Reconnect all hoses and unions.
9. Refill the reservoir to the indicated **FULL** mark on the dipstick. Make sure the reading is taken on the correct side of the dipstick. Reinsert the dipstick and secure the reservoir cap.
10. Place a shield across the frame to protect the operator from the revolving prop-shaft. The floor plate would be acceptable.
11. Be sure all the control levers are in **NEUTRAL** position. Start the engine and run it at an idling speed for a few minutes.
12. Place the blade control lever in maximum raise position to pump oil into the blade cylinders.
13. After the oil has ceased to aerate, add oil to the reservoir to bring the level to the indicated **FULL** mark on the dipstick. This will replace the oil drawn into the cylinders and hoses.
14. Check all connections for leaks and make certain the reservoir cap is properly secured.

**NEVER UNDER ANY CIRCUMSTANCES USE ANY FLUSHING OIL OR COMPOUND FOR CLEANING THE SYSTEM.**

## NOTES

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## AXLE, PROP SHAFTS & MIDMOUNT BEARING



**WARNING:** Except when specified, lower all attachments to the ground, apply the parking brake, shut down the engine, remove the ignition key, turn the disconnect switch to the "OFF" position, block the wheels, engage the articulation lock, and tie a red warning flag on the canopy upright; when servicing the machine.

**NOTE:** Disengage the articulation lock prior to moving the machine. A machine with the articulation lock engaged cannot be steered.

### 10 Hours or Daily

**Check the Tire Pressures and Casings** — Check the air pressure in all the tires. See specifications and service data in this manual for the correct air pressures. Particular attention must be emphasized when checking hydro-inflated tires as there is less volume of air to provide cushioning. Be sure that the valve caps are in place to prevent dirt, moisture, and foreign material from damaging the valve core.

Keep all tires free from oil and grease and repair any cuts immediately to prolong the tire life. Check the tire pressures in the morning when the tires are cold. Do not remove increased pressures caused by the operation of the machine.

**Midmount, Grease the Fitting Located on Rear Frame and Connected to Midmount**

### 50 Hours or Weekly

**Tighten the Wheel Nuts and Inspect the Tires** — All wheel nuts should be checked regularly and kept tight. Loose wheel nuts will cause undue tire wear, strain the axle assemblies, and affect the steering load distribution. Apply a lubricant on the threads of the wheel studs only and tighten the wheel nuts to 475 ft. lbs. torque. Do not lubricate the spherical seat on the threaded portion of the wheel nuts.

Check the rims for bent or damaged flanges and repair or replace as needed.

**Front Axle Differential** — Check the lubricant level each 50 operating hours at the differential fill and level plug in the center of the axle assembly. Add SAE 90 or SAE 75 Extreme Pressure Gear Lube (\*SCL Type) until the lubricant is level with the plug opening.

See "1,000 Hour Operations" for Drain and Refill.

**Front Axle Planetary Hubs** — Check the lubricant level each 50 operating hours at the fill and level plug located slightly off center of the thrust cap. The drain plug is located in the external diameter of the hub assembly. Rotate the wheel until the drain plug is at the top center;

this will position the fill and level plug in the thrust cap slightly below the center of the wheel.

Remove the fill and check plug and check the lubricant level. If necessary, add SAE 90 EP or SAE 75 EP gear lube (\*SCL Type) through the fill and level plug opening.

See "1,000 Hour Operations" for Drain and Refill.

**Rear Axle Differential** — Check the lubricant level each 50 operating hours at the differential fill and level plug in the center of the axle assembly. Add SAE 90 EP or SAE 75 EP gear lube (\*SCL Type) until the lubricant is level with the plug opening.

**Rear Axle Planetary Hubs** — Check the lubricant level each 50 operating hours at the fill and level plug located slightly off center of the thrust cap. The drain plug is located in the external diameter of the hub and drum assembly. Rotate the wheel until the drain plug is at the top center; this will position the fill and level plug in the thrust cap slightly below the center of the wheel.

Remove the fill and level plug and check the lubricant level. If necessary, add SAE 90 EP or SAE 75 EP gear lube (\*SCL Type) through the fill and level plug opening until the lubricant is level with the plug opening.

*\*"SCL" signifies Sulfo-Chloro-Lead type. Factory fill is made with SCL type lube and it is recommended that the same type be used when adding or refilling.*

See "1,000 Hour Lubrication Operations" for Drain and Refill.

### 100 Hours or 2 Weeks

**PROP SHAFTS** — Grease the slip yoke tube on all prop shafts every 100 hours.

**NOTE:** When greasing use a hand gun and apply Lithium base Multi-Purpose Grease, [LBG]. Care must be taken not to blow the seals; grease sparingly until the grease is visible at all four bearing caps.

### 250 Hours or Monthly

—NIL—

### 500 Hours or 2 Months

**Axle Breathers** — The breather for the front axle housing is located at the top on the right hand side. The rear axle housing breather is located at the top on the left hand side. The housing breathers have a loose fitting cap that should be rotated so that the breather air passages are unobstructed by foreign material.

Oil leakage past the breathers, thrust caps, carrier housing or pinion cap seals indicates that the breathers may be clogged. Unscrew the breathers, wash in a solvent, dry and reinstall.

### 1000 Hours or 6 Months

**Front Axle Differential** — Drain the differential every 1,000 operating hours through the drain plug opening in the bottom center of the axle assembly. Refill the differential with SAE 90 EP or SAE 75 EP gear lube (\*SCL Type) through the fill and gear level plug opening at the center of the axle assembly until the lubricant is level with the plug opening.

**Front Axle Planetary Hubs** — Drain the planetary hubs every 1,000 operating hours through the drain plug opening in the external diameter of the hub and drum assembly. Rotate the wheel until the drain plug in the external diameter of the hub and drum assembly is at the top center; this will position the fill and level plug in the thrust cap slightly below center of the wheel.

**Rear Axle Differential** — Drain the differential every 1,000 operating hours through the drain plug opening in the bottom center of the axle assembly.

Refill the differential with SAE 90 EP or SAE 75 EP gear lube (\*SCL Type) through the fill and level plug opening at the center of the axle assembly until the lubricant is level with the bottom of the plug opening.

**Rear Axle Planetary Hubs** — Drain the planetary hubs every 1,000 operating hours through the drain plug opening in the external diameter of the hub and drum assembly. Rotate the wheel until the drain plug in the external diameter of the hub and drum assembly is at the top center; this will position the fill and level plug in the thrust cap slightly below center of the wheel.

Refill the planetary hubs with SAE 90 EP or SAE 75 EP gear lube (\*SCL Type) through the fill and level plug opening in the thrust cap until the lubricant is level with the plug opening.

*\*"SCL" signifies Sulfo-Chloro-Lead type. Factory fill is made with SCL type lube and it is recommended that the same type be used when adding or refilling.*

**PROPELLER SHAFTS** — Double propeller shafts used on the Ranger machines have three points of lubrication, one on each spider and bearing assembly and one on the slip yoke assembly. Single propeller shafts used on the Ranger machines have only one lubrication point, the spider and bearing assembly. When greasing use a hand gun and apply Lithium base Multi-Purpose Grease, (LBG), be careful not to blow the seals; grease sparingly until the grease is visible at all the four bearing caps on each spider and bearing assembly. Use the grade of lubricant specified below according to ambient temperatures.

#### Temp. Range

0° F. and Above  
Below 0° F.

#### Grease Consistency

Heavy oil base — Grade 2  
Light oil base — Grade 0

**PROP SHAFTS** — Grease spider and bearing assemblies every 1000 hours.

## BRAKE SYSTEMS

**WARNING:** Except when specified, lower all attachments to the ground, apply the parking brake, shut down the engine, remove the ignition key, turn the disconnect switch to the "OFF" position, block the wheels, engage the articulation lock, and tie a red warning flag on the canopy upright; when servicing the machine.

**NOTE:** Disengage the articulation lock prior to moving the machine. A machine with the articulation lock engaged cannot be steered.

10 Hours or Daily

—NIL—

50 Hours or Weekly

—NIL—

100 Hours or 2 Weeks

—NIL—

250 Hours or Monthly

**Maintenance Operations of Service and Emergency Brakes** — The service brake assembly is located at the mid mount bearing in the rear frame. The emergency brake assembly is located on the rear axle input shaft. Each assembly consists of 2 identical brake heads mounted on each side of the disc. Each head contains one puck or lining, piston automatic retractors and self adjusters. The pistons and linings are forced outward towards the disc when the brake is applied. The automatic retractors pull the pucks clear of the disc when the brake is released. The self adjusters compensate for wear in the linings without need for manual adjustment.

**Service of Emergency Brake Master Cylinder** — The function of the master cylinder assembly is to displace fluid for brake applications, to constantly maintain the correct volume of fluid in the system under all temperature conditions, to automatically replace fluid lost through gravity seepage or slight leaks, and to add fluid or supercharge the system on the return stroke of the pedal or handle after each brake application.

The Service Brake Master Cylinder is located below firewall on the left hand side (see Fig. 13-1)

The Emergency Brake Master Cylinder is located on the right hand side of the operator seat. (see Fig. 13-2)

Maintain the fluid level to within  $\frac{1}{4}$  inch ( $\frac{1}{2}$  cm.) from the top of the reservoirs. Add only the proper type of fluid called for in Lubrication Chart shown in Sec. 16.

The vent hole in the filler cap must be open at all times.

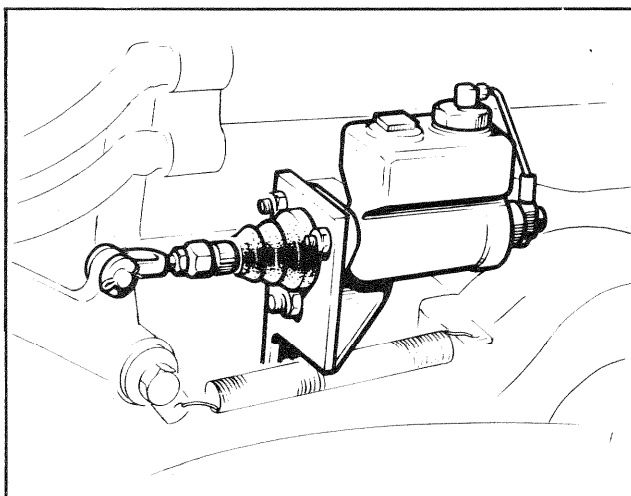


Fig. 13-1 Brake Master Cylinder

### Master Cylinder Adjustment

The master cylinder is equipped with a relief valve. This relief valve is factory set for specific braking applications. Field adjustment of the relief valve should not be attempted.

Check the master cylinder frequently to insure an ample supply of fluid.

Inadequate braking may indicate a need to replenish the fluid in the master cylinder, adjust the pedal free travel, or to bleed the brake lines.

#### [a] Pedal Free Travel

The brake pedal free travel is the distance the pedal moves before the push rod touches the master cylinder piston. Excessive free motion reduces the effective travel. Insufficient free motion may cause blocking of the compensating port and prevents the brake from releasing.

Always check and adjust the pedal free travel as follows: Fig. 13-1.

1. Depress the pedal by hand, noting the distance the pedal moves before resistance is offered. The correct travel is  $\frac{1}{2}$  inch free travel. As measured at the brake pad.
2. Loosen the locknut and turn the adjusting nut clockwise to decrease the free travel, counter-clockwise to increase the travel.
3. Tighten the locknut securely and recheck the pedal free travel.

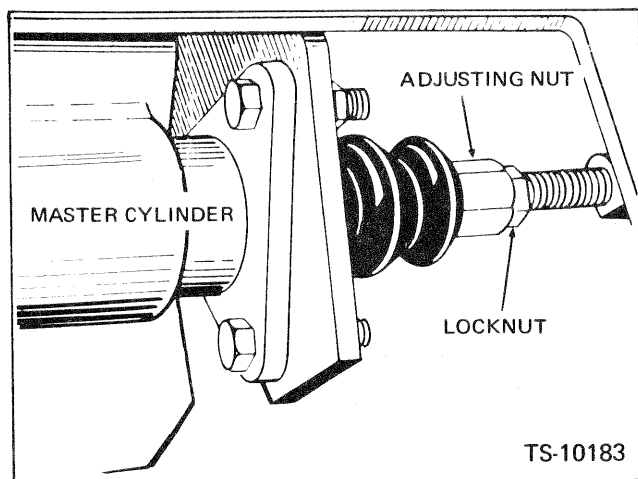


Fig. 13-2 Adjust Brake Pedal Free Travel

**[b] Bleed the Brake**

The correct operation of hydraulic brakes requires a solid column of fluid without air bubbles at all points in the pressure system. Because of loose fittings, leaking cylinder or low fluid level in the master cylinder, it is necessary to "bleed" the system in order to expel any air bubbles which have become mixed with the fluid. The necessity of bleeding is indicated by a soft or spongy pedal.

The brake system must be bled in the following order:

1. Fill the master cylinder with fluid.
2. With the aid of a helper, open the bleed screw on the brake housing in Fig. 13-3 and depress the brake pedal to expel any air and fluid from the lines.

When the pedal reaches its maximum stroke, close the bleed screw before releasing the pedal.

3. Repeat this procedure until solid fluid, free from bubbles, comes from the bleed screw.

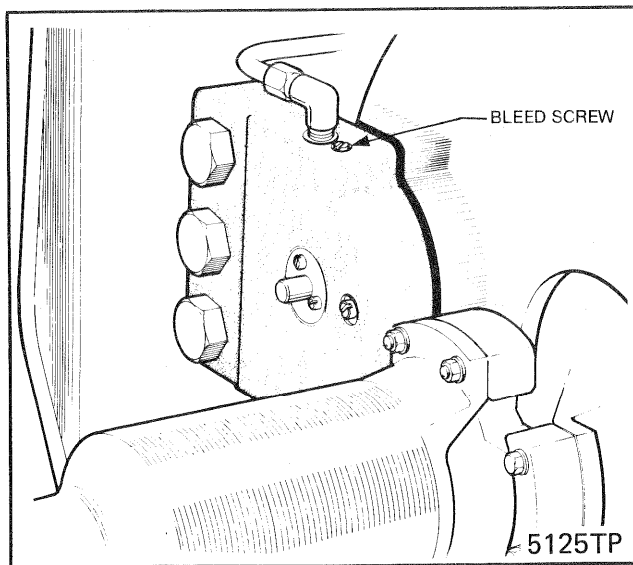


Fig. 13-3 Bleed Screw Location

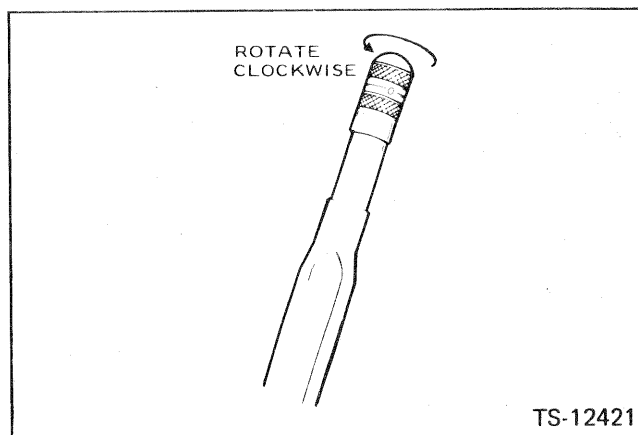
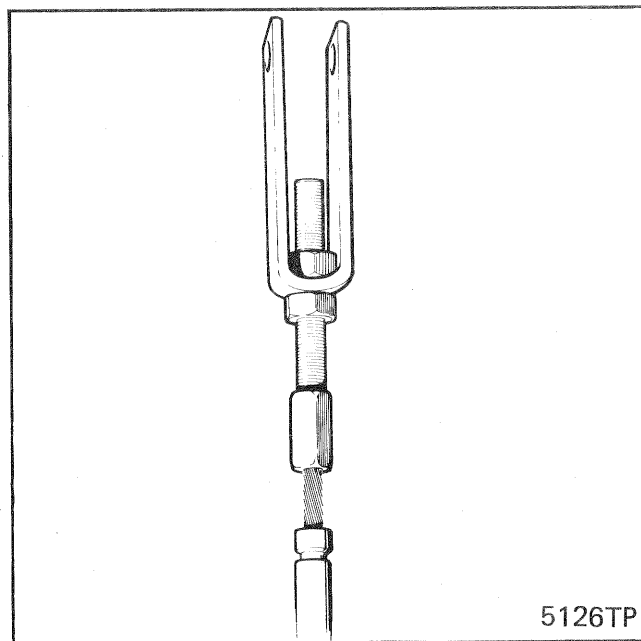


Fig. 13-4 Parking Brake

**Adjust Parking Brake:** When slack develops in the parking brake cable, perform the following adjustments:

1. With lever in release position, turn acorn on end of handle clockwise as shown in Fig. 13-5.
2. Test for good resistance over center, when handle is pulled up to applied position.
3. If adjustment on handle is used up then re-adjust the cable at caliper head after turning the acorn completely counterclockwise. (Fig 13-5)

Fig. 13-5 Adjust Brake Cable at Caliper Head  
250 Hours or Monthly

**Brake Master Cylinder** — Remove the left-hand side panel from the machine. For location of the master cylinder see Fig. 13-1. Maintain the fluid level to within .25 inch (6.4 mm.) from the top of the reservoir. Add only, do not change the fluid. Use fluid specified in Section 16.

The vent hole in the filler cap must be open at all times.

ELECTRICAL

**⚠ WARNING:** Except when specified, lower all attachments to the ground, apply the parking brake, shut down the engine, remove the ignition key, turn the disconnect switch to the "OFF" position, block the wheels, engage the articulation lock, and tie a red warning flag on the canopy upright; when servicing the machine.

**NOTE:** Disengage the articulation lock prior to moving the machine. A machine with the articulation lock engaged cannot be steered.

10 Hours or Daily

—— NIL ——

50 Hours or Weekly

**Check the Lights and Fuses** — The 20 ampere fuse for the lights is located on the wire between the ignition switch and the toggle switch. The total electrical system is protected by the circuit breaker.

**A. Floodlamps** — The machine may be equipped with floodlamps that disperse light in a gradual downward pattern. These floodlamps are located underneath the top of the canopy, and are mounted on welded brackets.

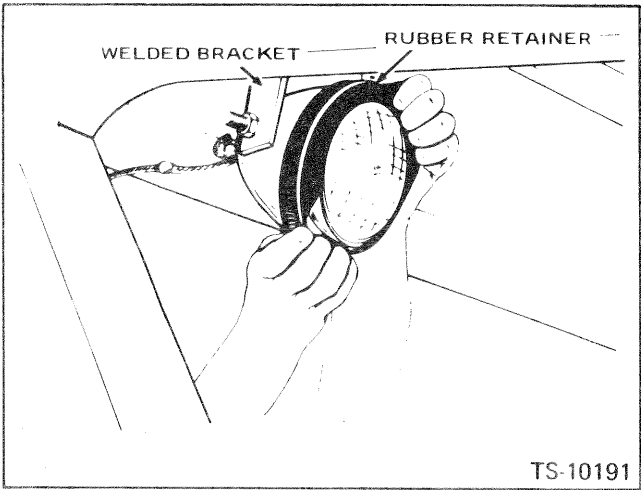


Fig. 14-1 Lamp Replacement

- 1. Loosen the locknut that secures the floodlamp to the canopy.
- 2. Rotate the floodlamp to adjust the angle of the beam, then retighten the locknut securely.

If it is necessary to replace the floodlamps, depress the lamp and spread the lip of the rubber retainer outward, forcing the lamp out as shown in Fig. 14-1. Disconnect the terminals. Reconnect the terminal on the new lamp and reinstall the retainer.

**B. Tail Lamp** — The tail lamp is the same assembly as the floodlamps, and is mounted at the rear hand side of the canopy on a welded bracket. To replace the tail lamp, follow the same instructions as the floodlamps.

**C. Other lamps** may be installed and in all cases lamp units should be replaced with the same type and model as originally fitted.

**Service the Batteries** — The batteries are located in the battery compartment at the back of the front frame. Keep the terminals clean and the connections tight, and be sure that when distilled water is added, all the plates are covered. Do not overfill.

Refer to Sec. 15 for battery charge readings and recommendations.

To prevent damage to the electrical system components when recharging or replacing the batteries in the charging system:

REMEMBER


- 1. When installing the batteries, **MAKE SURE** the batteries and polarities are the same.
- 2. Booster batteries **MUST BE** paralleled.
- 3. Battery-charger and battery polarities **MUST AGREE**.
- 4. **IMPORTANT:** Before doing any welding, **DISCONNECT THE GROUND CABLE FROM THE BATTERIES AND THE ELECTRICAL LEAD FROM THE BATTERY TERMINAL ON THE ALTERNATOR, OR SERIOUS DAMAGE TO THE ALTERNATOR MAY RESULT.**

IMPORTANT

**ALWAYS CONNECT POSITIVE TO POSITIVE — NEGATIVE TO NEGATIVE WHEN USING A BATTERY CHARGER TO PREVENT DAMAGE TO THE ELECTRICAL SYSTEM.**



## PROCEDURE TO JUMP-START A MACHINE USING A SECOND VEHICLE

1. DO NOT jump batteries of different voltages.
2. DO NOT attempt to jump the batteries on machines with different electrical grounding systems.
3. Drive the second machine up parallel to the disabled vehicle so that both are facing in the same direction. DO NOT permit machines to touch each other as this could cause a ground connection and counteract the benefits of the following procedure.
4. Lower all hydraulic attachments to the ground. Apply parking brake, place all control levers in neutral and shut down engine. When engine has completely stopped switch battery disconnect switch to "OFF" position. Repeat this procedure on the disabled machine.
5.  **CAUTION:** Never expose battery to open flame (also cigarettes, cigars, etc.) or electric spark. Battery action generates hydrogen gas which is flammable and explosive. Don't allow battery fluid to contact skin, eyes or fabrics, fluid is a sulfuric acid solution which could cause serious personal injury or property damage. Wear eye protection when working with batteries. Remove rings, metal watchband and other metal jewelry before jump starting or working around a battery and be careful in using metal tools, if such metal should contact the positive battery terminal (or metal in contact with it) and any other metal on the machine a short circuit may occur which could cause personal injury.
6. Make sure that both units have the same voltage rating and have the same grounding system. Otherwise the battery of one of the units may erupt and cause personal or property damage. If you cannot determine how the machine is grounded (negative or positive ground) we recommend that you do not attempt to jump-start the disabled machine.
7. All Clark Ranger Skidders have a 12 volt system (two 12 volt batteries connected in parallel) except the Ranger Model 880 which has a 24 volt system (two 12 volt batteries connected in series). All Clark Ranger Skidders are negative ground except for the 664 and 666 machines with the following serial numbers:—

C9014-101 through C9014-999

C9016-101 through C9016-999

8. Remove vent caps from both the discharged and the booster batteries and insure that the fluid level is at the full mark. Batteries low on water should be replenished. Do not attempt to jump-start a machine with a frozen battery as it may rupture or explode.
9. Place a piece of cloth over the uncapped vent holes of all batteries. The sudden surge of current when the battery is charged might cause the electrolyte to bubble and splash. The material over the vent holes will keep the acid from splashing on your skin and clothes.

## 10. NEGATIVE GROUND SYSTEMS

- a. Attach one end of one jumper cable to the positive terminal of the booster battery (identified by a red colour, "+", "P", or "POS" on the battery case, post or clamp), as shown in Figure 14-2. Attach the other end of the same cable to the positive terminal of the discharged battery.
- b. Attach one end of the second jumper cable to the negative terminal of the booster battery (identified by black colour, "-", "N", or "NEG" on the battery case, post or clamp) as shown in Fig. 14-2. Take care that the clamps do not touch the clamps of the other cable. Connect the other end of the cable to the engine block, alternator or any other accessible metallic part attached to the engine block that is not painted, chrome plate, heavily rusted, or covered with grease. This last connection should be made at least a foot or more from the dead battery so that any sparking when the cable is connected or disconnected is away from any hydrogen gas produced by the battery.

## 11. POSITIVE GROUND SYSTEMS

- a. Attach one end of one jumper cable to the negative terminal of the booster battery (identified by black colour "-", "N", or "NEG" on the battery case, post, or clamp) as shown in Fig. 14-1. Attach the other end of the same cable to the negative terminal of the discharged battery.
- b. Attach one end of the second jumper cable to the positive terminal of the booster battery (identified by a red colour "+", "P", or "POS" on the battery case, post or clamp) as shown in Fig. 14-2. Attach the other end of the cable to the engine block, alternator or any other accessible metallic part attached to the engine block that is not painted, chrome plated, heavily rusted

or covered with grease. This last connection should be made at least a foot or more from the dead battery so that any sparking when the cable is connected or disconnected is away from any hydrogen gas probed by the battery.

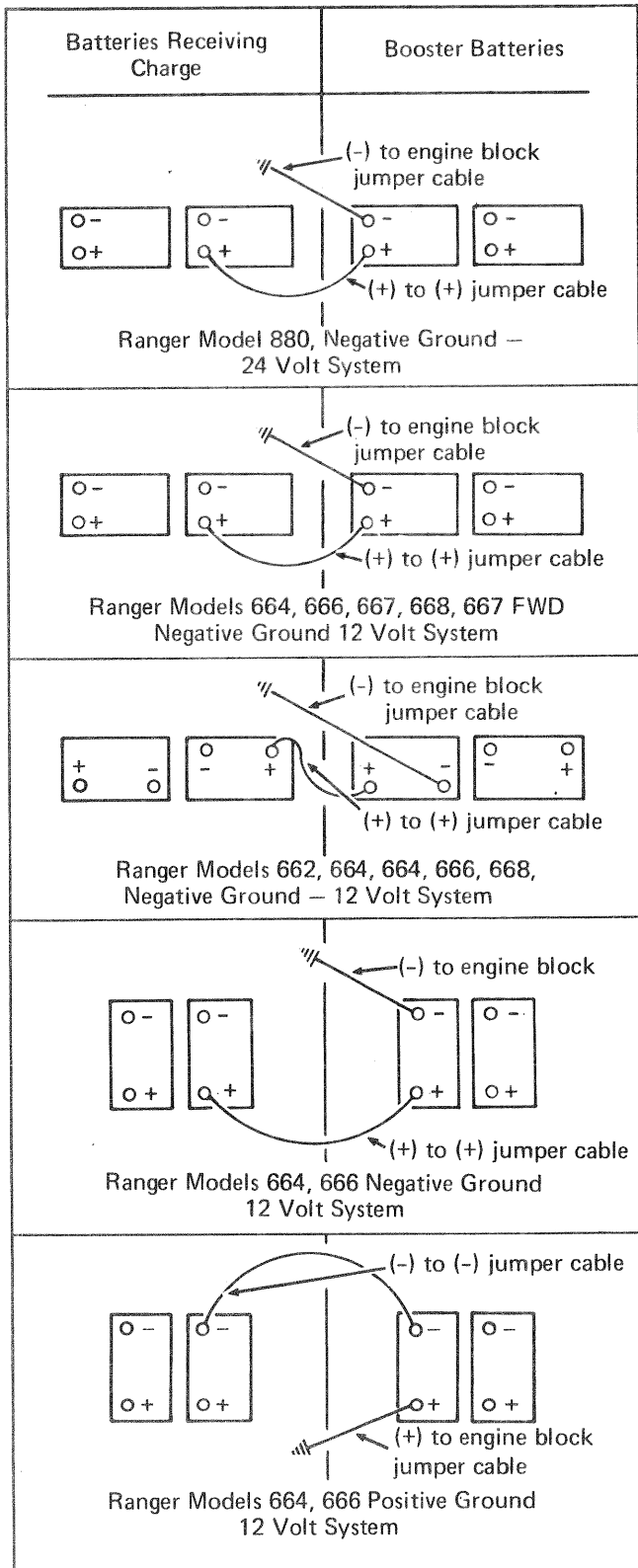


Fig. 14-2 Battery Jump-Start

12. Switch the battery disconnect switch to the "ON" position in the disabled unit.
13. Engage starter of the disabled machine. If it does not start immediately, turn ignition key off. Switch battery disconnect switch in booster unit to "ON" position and start engine to avoid excessive drain on its batteries. Engage starter of disabled machine.
14. After the disabled machine is running normally, remove the cable connection at the engine block first. Disconnect other end of same cable. Disconnect second jumper cable. Replace vent caps and discard cloths covering vent holes as they may be contaminated with corrosive acid.

**WARNING:** If acid should contact eyes, skin or clothing flush immediately with large amounts of water. In case of eye contact see a physician.

*NOTE: If you are unable to obtain a response from the starter do not assume that the battery is dead. In many cases, the problem is only bad connections at the battery terminals. If you keep the terminals clean you may never need to jump the batteries.*

#### 100 Hour Or Two Weeks

————— NIL —————

#### 250 Hour Or Monthly

————— NIL —————

#### 500 Hour Or Two Months

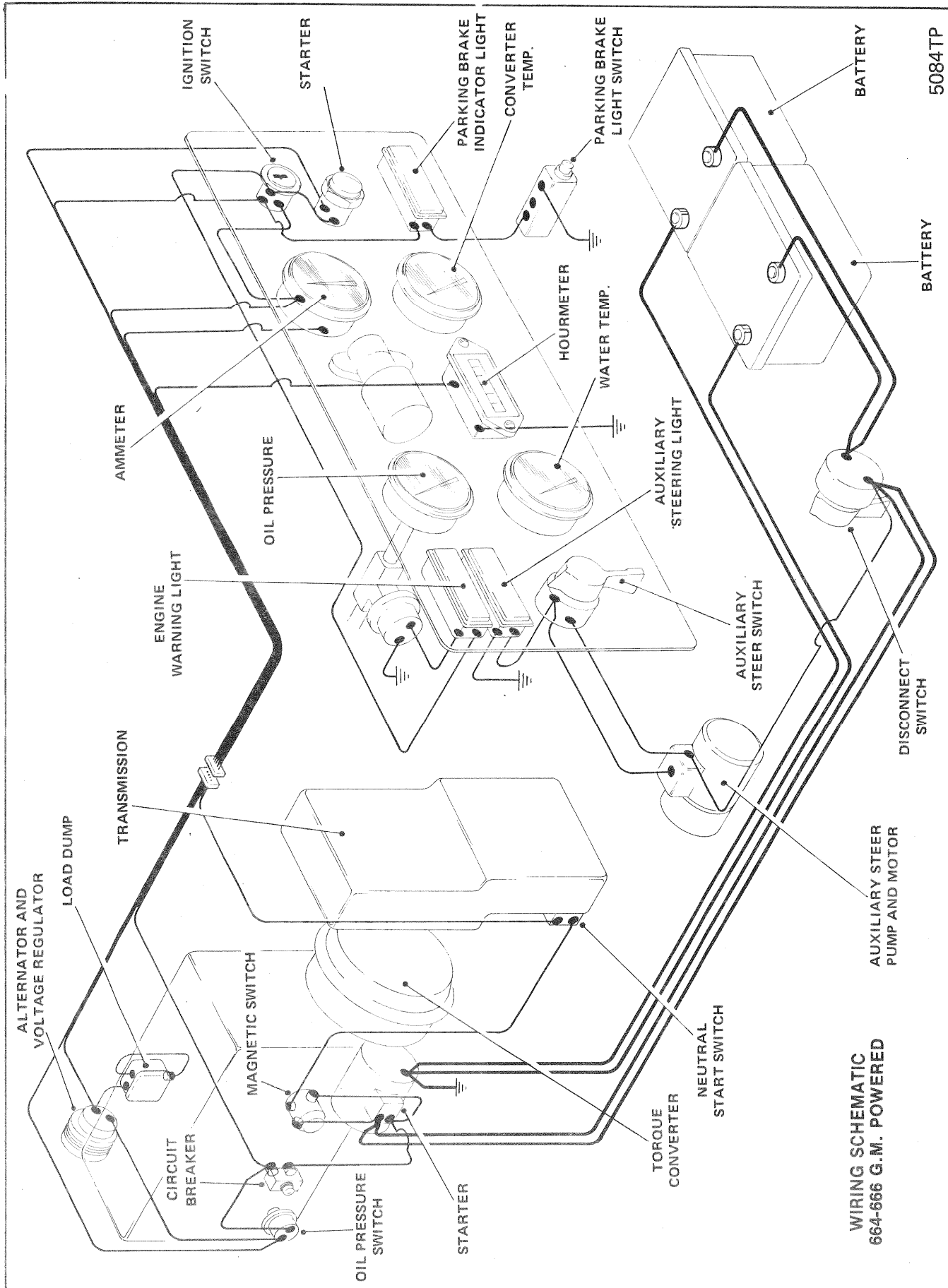
**Clean the Alternator** — Every 500 hours clean the alternator. To clean, use compressed air, (20 p.s.i. to 30 p.s.i.), or a low pressure water spray, (20 p.s.i. to 30 p.s.i.) and direct the flow through the rear of the alternator.

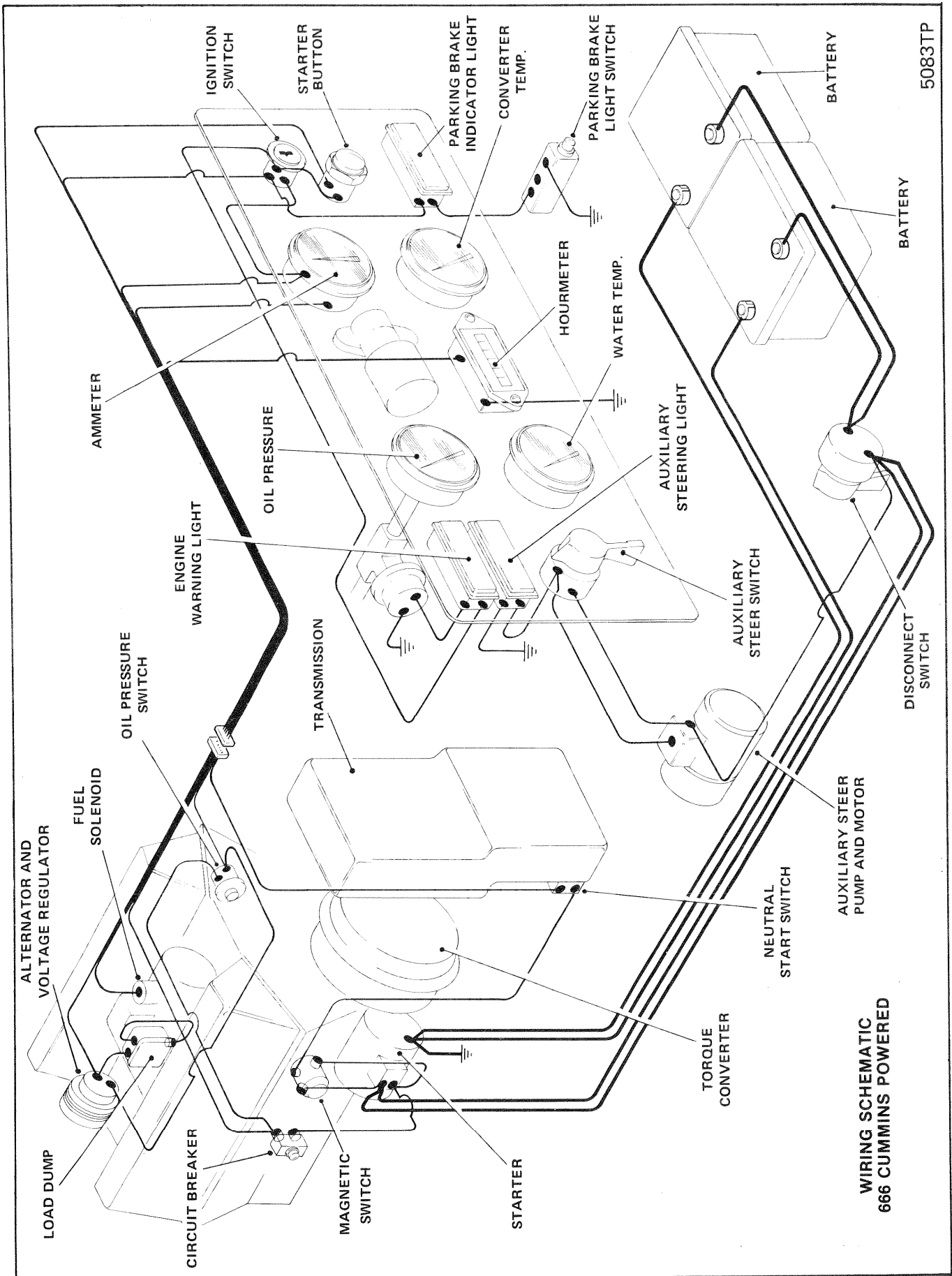
**Clean and Tighten the Electrical Connections** — Periodically inspect and check all wiring and connections on the electrical components such as the batteries, cranking motor, voltage regulator, alternator, solenoid switch, relays, instruments and switches for worn, cracked, broken or frayed insulation and loose terminal connections. Check for frayed or corroded external ground straps and corrosion on the battery posts.

Where inspection reveals dirt, looseness or damage, clean, tighten and adjust or replace as necessary depending on the existing conditions.

**1000 Hour or Six Months**

**Inspect, Test and Lubricate the Electrical Units —** Maintenance performed on the various electrical components usually consists of cleaning, lubricating, minor testing and adjusting, and replacing defective or worn out parts.





SPECIFICATION DATA

	664 G.M.	666 G.M.	666 Cummins
Engine	Diesel	Diesel	Diesel
Make	G.M.	G.M.	Cummins
Model	3-53	4-53	V-378
Number of Cylinders	3	4	6
Bore and stroke	3.88 in. (98.6) x 4.5 in. (114.3)	3.88 (98.6) x 4.5 (114.3)	4.625 (117.5) x 3.75 (95.2)
Displacement, cu. inches	159 (2.60)	212.3 (3.48 liters)	378
*Maximum torque, ft. lbs.	205 ft.lbs.(28.3Kg-m) at 1800 RPM	270 ft. lbs. (36.2 Kg-m) at 1800 RPM	255 ft. lbs. (35.3 Kg-m) at 1900 RPM
*Governed horsepower	98	127 at 2800 rpm	122 at 2700 rpm
Governed RPM (Full Load)	2800	2800 rpm	2700
Low Idle RPM	575-625	575-625	600-650
High Idle RPM	2860-2960	2860-2960	2910-3030
Hydraulic Stall, with main valve at 1600 psi (112.5 Kg sq.cm.)	1920-2080 rpm	2250-2400 rpm	2040-2400 rpm
Converter Stall	2300-2460 rpm	2500-2660 rpm	2450-2700 rpm
*Maximum torque, ft. lbs.			
*Governed horsepower			
*S.A.E. Standard Ambient Conditions -85 degrees F. and 500 ft.			

NOTE: The stall RPM is the maximum obtainable RPM with oil at the operating temperature of [180° F. to 200° F.] brake applied, the wheels blocked, the directional and speed range shift levers in forward 3rd. [high] and the machine turned full against stops.

The stall speed is applicable to an altitude of 600 ft. and ambient temperatures of 70°F. Due to the many combinations of altitude and temperature possible in the field, space does not permit publishing here all the corrections necessary to the stall RPM indicated to accommodate such variations. It is suggested that the engine manufacturer's distributor be contacted to determine the correction necessary for the altitude and temperature in your application.

ELECTRICAL SYSTEM

- Fuses:
- Lights 20 amp
- Lamps:
- Front and rear lamps 12 volt
- Instruments:
- Panel gauges 12 volt
  - Sender Units 12 volt
- Alternator:
- Motorola RA-12N negative ground
  - 12 volt 35 amp.

- Voltage Regulator: 12 volt
- Starting Motor: 12 volt
- Circuit Breaker 40 amp

BATTERIES

- G.M. Number Required: One
- Cum. Number Required: 2 (Parallel connected)
- Electrical System: 12 volt
- Grounded Terminal: — Negative

Battery charge Test

Voltage Test Readings —

- 2.10 volts — Fully charged
- 2.07 volts — 3/4 charge (Fair)
- 2.03 volts — 1/2 charge (recharge)
- 2.00 volts — 1/4 charge (unsatisfactory)

NOTE: Individual cells in the same battery must not vary more than 0.05 volts.

Hydrometer test readings —

- 1.260 — Fully charged
- 1.230 — 3/4 charge (fair)
- 1.200 — 1/2 charge (recharge)
- 1.170 — 1/4 charge (unserviceable)

NOTE: Readings between cells must be within 0.050.

PRESSURES

- Engine Oil: GM - 30 PSI (87.8 Kg sq./cm.)
- Cum. - 45-65 PSI (31.5 - 45.6 Kg sq./cm.) at governed r.p.m.

Transmission Clutches: 240 to 280 PSI (169-197 Kg/sq. cm.) at low idle in all speed ranges in both forward and reverse directions and at an oil temperature of 180° F. to 200° F. (No more than 5 PSI variation between all clutches.)

**Steering and Blade Hydraulic System:** Main relief valve  
1,600 PSI.

### TIRES PRESSURES

Front 16 psi. (1.12 Kg sq./cm.)  
Rear 18 psi (1.26 Kg sq./cm.)

These figures are nominal only since these are many different makes, types and ply ratings used in industry. Tire manufacturers recommendations should be followed.

#### 666 G.M. & CUMMINS

F.D. & R.D. 17800 Series Axles		
	Tire Size	Hydroinflation Per Tire
OPT.	18.4 x 26	1000 pounds
OPT.	18.4 x 34	650 pounds
STD.	23.1 x 26	650 pounds
OPT.	28.1 x 26	NONE
OPT.	24.5 x 32	NONE

#### 664 G.M.

F.D. & R.D. 17600 Series Axles		
	Tire Size	Hydroinflation Per Tire
OPT.	18.4 x 26	650 pounds
STD.	18.4 x 34	650 pounds
OPT.	23.1 x 26	650 pounds
F.D. & R.D. 17800 Series Axles		
	Tire Size	Hydroinflation Per Tire
OPT.	18.4 x 26	1000 pounds
STD.	18.4 x 34	1000 pounds
OPT.	23.1 x 26	1000 pounds
OPT.	24.5 x 32	NONE
OPT.	28.1 x 26	NONE

### MODEL 664 G.M.

#### CAPACITIES [Approximate]

	Imperial	U.S.	Metric
Engine Crankcase and System .....	12.8 qts.	15.4 qts.	14.5 Litres
Cooling System .....	25.0 qts.	30.0 qts.	28.4 Litres
Front Drive Axle Differential .....	6.25 qts.	7.50 qts.	7.1 Litres
Front Drive Axle Planetary Hubs (ea.) ....	4.2 qts.	5.0 qts.	4.7 Litres
Fuel Tank .....	29 gals.	35 gals.	132.0 Litres
Hydraulic System .....	12 gals.	14.4 gals.	54.5 Litres
Rear Drive Axle Differential .....	6.25 qts.	7.50 qts.	7.1 Litres
Rear Drive Axle Planetary Hubs (ea.) ....	4.2 qts.	5.0 qts.	4.7 Litres
Torque Converter, Transmission and winch	6.5 gals.	7.8 gals.	29.5 Litres

### MODEL 666 G.M.

#### CAPACITIES [Approximate]

	Imperial	U.S.	Metric
Engine Crankcase and System .....	12.8 qts.	15.4 qts.	14.5 Litres
Cooling System .....	25.0 qts.	43.2 qts.	34.0 Litres
Front Drive Axle Differential .....	6.25 qts.	7.50 qts.	7.1 Litres
Front Drive Axle Planetary Hubs (ea.) ....	4.2 qts.	5.0 qts.	4.7 Litres
Fuel Tank .....	29 gals.	35.0 gals.	132.0 Litres
Hydraulic System .....	12 gals.	14.4 gals.	54.5 Litres
Rear Drive Axle Differential .....	6.25 qts.	7.5 qts.	7.1 Litres
Rear Drive Axle Planetary Hubs (ea.) ....	4.2 qts.	5.0 qts.	4.7 Litres
Torque Converter, Transmission and winch	6.5 gals.	7.8 qts.	29.5 Litres

### MODEL 666 CUMMINS

#### CAPACITIES [Aproximate]

	Imperial	U.S.	Metric
Engine Crankcase and System .....	22.0 qts.	26.4 qts.	25.0 Litres
Cooling System .....	36.0 qts.	43.2 qts.	34.0 Litres
Front Drive Axle Differential .....	6.25 qts.	7.50 qts.	7.1 Litres
Front Drive Axle Planetary Hubs (ea.) ....	4.2 qts.	5.0 qts.	4.7 Litres
Fuel Tank .....	29 gals.	35.0 gals.	132.0 Litres
Hydraulic System .....	12 gals.	14.4 gals.	54.5 Litres
Rear Drive Axle Differential .....	6.25 qts.	7.50 qts.	7.1 Litres
Rear Drive Axle Planetary Hubs (ea.) ....	4.2 qts.	5.0 qts.	4.7 Litres
Torque Converter, Transmission and Winch	6.5 qts.	7.8 qts.	29.5 Litres

## BOLT TORQUE CHART FT.-LBS.

LOCATION	THREAD	TORQUE
Front Engine Mount to Engine G.M.	3/8-16	30-35
Front Engine Mount to Engine Cum.	1/2-13	60-70
Front Engine Mount to Frame	5/8-11	160-175
Front Engine Mount to Pedestal Mount	5/8-11	160-175
Side Frame Mount to Engine	1/2-13	60-70
Side Engine Mount to Frame	5/8-11	160-175
Torque Converter to Flywheel Housing	3/8-16	23-25
Transmission Bracket to Transmission	3/4-10	282-310
Transmission Bracket to Frame	3/4-16	315-345 *
Upper Drive Shaft	5/16-24	20-25
Lower Drive Shaft	3/8-24	35-40
Winch to Cradle	1-1/4-7	850-1000
Winch Cradle to Frame	1-8	685-750
Rear Axle to Frame	7/8-14	501-550
Mid-mount bearing to Rear Frame	7/16-14	50-55
Brake Disc to Flange - Service Brake	1/2-20	90-100
Brake Disc to Flange - Parking Brake	3/8-24	35-40
Brake Disc to Flange - Emergency Brake	7/16-20	60-65
Wheel Nuts	3/4-16	475
Alternator Pulley	5/16-18	45
Hydraulic Pump to Torque Converter	3/8-24	20
Hydraulic Tank Filter Mounting Bolts	5/16-24	40-50 in.lbs.

All bolts are grade 8.

The wheel nut spherical seat in the wheel disc must be concentric with the stud —  
ream if necessary.

\*BOLTS NOT LISTED ARE TO BE DRAWN UP TIGHT IN A MANNER CONSISTANT  
WITH GOOD WORKMANSHIP.

\*When replacing these mounting bolts, use SAE No. 30 oil on the threads.



## NOTES

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

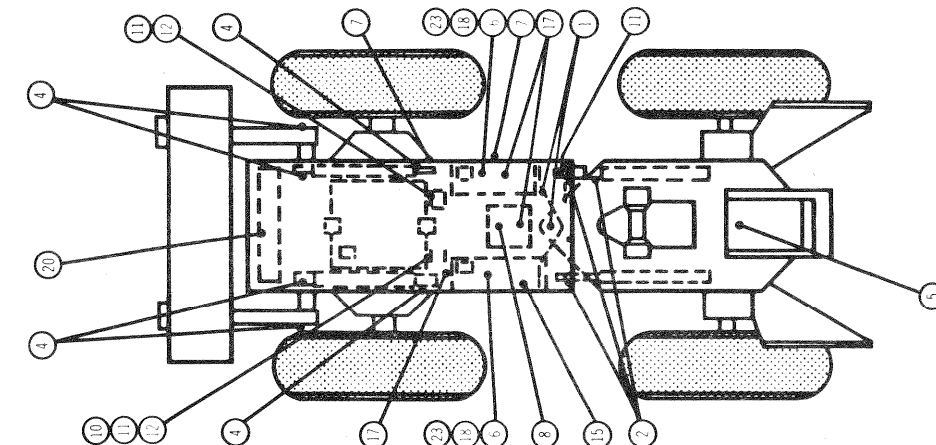
HOURLY LUBRICATION & MAINTENANCE SCHEDULE



**WARNING:** Except when specified, lower all attachments to the ground, apply the parking brake, shut down the engine, remove the ignition key, turn the disconnect switch to the "OFF" position, block the wheels, engage the articulation lock, and tie a red warning flag on the canopy upright; when servicing the machine.

SYSTEM	OPERATION	TEXT LOCATION	HOUR INTERVALS					
			10	50	100	250	500	1000
Engine, Controls, Cooling System and Accessories	Engine Maintenance	See Engine	•					
	Check and refill Radiator as required	Sec. 6		•				
	Check Cooling System for Leaks	Sec. 6		•				
	Check Anti-Freeze Protection	Sec. 6		•				
	Check and Adjust Belt Tension	Sec. 6		•				
	Tighten Air Cleaner Connections	Sec. 6			•			
	Engine By-Pass Filter (Cummins Only) 200 hrs.	Sec. 6						
	Check Engine RPM	Sec. 6				•		
	Clean Radiator Core	Sec. 6					•	
	Service Air Cleaner Element and Body	Sec. 6					•	
Fuel Tank and Accelerator	Drain Fuel Tank Sediment	Sec. 7		•				
	Check Fuel System for Leaks	Sec. 7		•				
	Clean Fuel Tank Filter Cap	Sec. 7		•				
	Check Accelerator linkage, adjust as required	Sec. 7				•		
	Drain and clean fuel tank	Sec. 7						•
Torque Converter Transmission and Winch Hydraulic System	Check fluid level daily, at the transmission	Sec. 9	•					
	Clean Torque Converter and Transmission Breathers	Sec. 8 & 9		•				
	Check and Adjust the Clark Winch Free Spool	Sec. 10			•			
	Check Clark Winch Free Spool Wear Button	Sec. 10				•		
	Replace the Filter Element	Sec. 9				•		
	Check System for Leaks	Sec. 9				•		
	Check Converter out pressure	Sec. 8				•		
	Check and Adjust Transmission Shift Linkage	Sec. 9					•	
	Drain and Refill Transmission, Converter, Winch, Hydraulic System	Sec. 9					•	
	Check Transmission Clutch Operating Pressures	Sec. 9					•	
Steer & Blade Hydraulic System	Check Fluid Level Daily	Sec. 11	•					
	Clean Reservoir Breather	Sec. 11		•				
	Clean Cylinder Rods	Sec. 11		•				
	Check and Adjust as required Control Valve Relief Pressures	Sec. 11					•	
	Replace Filter Element	Sec. 11					•	
	Drain, Clean & Refill Hydraulic Oil Reservoir	Sec. 11						•
Axle Prop Shafts and Wheels	Check tire pressures and castings	Sec. 12	•					
	Tighten wheel nuts & inspect rims	Sec. 12		•				
	Check Fluid Level of Differential & Planetary	Sec. 12		•				
	Clean Breathers	Sec. 12					•	
	Drain and Refill Differential & Planetary	Sec. 12						•
	Check for and repair Drive Line noises	Sec. 12	•					
Brake System	Check and Adjust as Required, Brake Pedal and Linkage	Sec. 12				•		
	Check and Adjust Parking Brake	Sec. 13				•		
	Check Fluid Level in Master Cylinder	Sec. 13				•		
Electrical System	Check Lights & Fuses	Sec. 14		•				
	Service the Batteries	Sec. 14		•				
	Clean the Alternator	Sec. 14					•	
	Clean and Tighten the Electrical Connections	Sec. 14					•	
	Inspect, Test, & Lubricate the Electrical Units	Sec. 14						•
	Check Cranking Motor Operation	Sec. 14						•

CLARK Lubrication Instructions RANGER Drive Line



ITEM	10 HOUR OR DAILY SERVICE	664	666	667	668	CHECK	LUBE	CHANGE	KEY
1	CRADLE & HINGE PINS	X	X	X	X				EPMD
2	STEER CYLINDER PINS	X	X	X	X				EPMD
3	MID MOUNT	X	X	X	X				EPMD
4	UTILITY BLADE & CYLINDER PINS	X	X	X	X				EPMD
5	FUEL TANK	X	X	X	X				DF
6	OIL RESERVOIR	X	X	X	X				DX
7	COOLANT LEVEL	X	X	X	X				
<b>50 HOUR OR WEEKLY SERVICE</b>									
8	TORQUE CONVERTER & TRANSMISSION	X	X	X	X				DX
9	MID-MOUNT BEARING								DX
10	MASTER CYLINDER SERVICE	X	X	X	X				DX
11	MASTER CYLINDER-EMERGENCY	X	X	X	X				DX
12	MASTER CYLINDER SERVICE	X	X	X	X				BF
13	DIFFERENTIAL	X	X	X	X				EPGL
14	PLANETARY	X	X	X	X				EPGL
15	WINCH LEVER	X	X	X	X				EPMD
<b>100 HOUR OR 2 WEEKS SERVICE</b>									
16	SLIP JOINT	X	X	X	X				EPMD
<b>250 HOUR OR MONTHLY SERVICE</b>									
17	TORQUE CONVERTER & TRANSMISSION FILTER	X	X	X	X				
<b>500 HOUR OR 2 MONTH SERVICE</b>									
18	HYDRAULIC TANK FILTER	X	X	X	X				
19	TORQUE CONVERTER & TRANSMISSION	X	X	X	X				DX
20	CLEAN RADIATOR CORE	X	X	X	X				
<b>1,000 HOUR OR 6 MONTH SERVICE</b>									
21	UNIVERSAL JOINTS	X	X	X	X				EPMD
22	MID-MOUNT BEARING	X	X	X	X				EPMD
23	OIL RESERVOIR	X	X	X	X				DX

Lubricant Key

EPMD	Extreme Pressure Molybdenum Disulfide Grease			DF	Diesel Fuel -- See Engine Manual		
	Ambient Temp Range		Lubricant To Be Used		Ambient Temp Range	Extreme Pressure Gear Lube ("SCL Type)	
	SAE Grade	API Class	Military Spec				
DX	Above -23°C (1)	10W	CC	L 2104B	Below -23°C (-10°)	SAE Grade 75	
	(-10°F) 2)	10W	CC	L 2104C	-18°C to -23°C (0° - F) to (-10° F)	SAE Grade 80	
					-18°C to +38°C (0° F) to (+100° F)	SAE Grade 90	
	Above -34° C (-30°F)		Dexron or Dexron II Automatic Transmission Fluid		Above 38° C (100° F)	SAE Grade 140	
	Above -54° C (-65°F)		Dexron or Dexron II Automatic Transmission Fluid				
			CONOCO DN 600 Fluid				
				BF	Heavy Duty Brake Fluid SAE J1703		

\*\*SCL signifies SULFO CHLORO-lead type factory fill is made with #90 SCL type lube  
It is recommended that the same type be used when adding or refilling

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## CHASSIS LUBRICATION

		TEXT LOCATION	HOURS						KEY
			1000	500	250	100	50	10	
1	Steer Cylinder Pin — Rear							●	LBG
2	Steer Cylinder Pin — Front							●	LBG
3	Pivot Hinge Pin — 1 each top and bottom							●	LBG
4	Transmission Levers — 2	Sec. 9					●		LBG
5	Clark Winch Control Lever	Sec. 10					●		LBG
6	Oil Reservoir	*Sec. 11						●	DX
7	Brake Pedal Bushing	Sec. 13					●		LBG
8	Master Cylinder	Sec. 13					●		BA
9	Engine Governor Lever (Grease very sparingly)	See Engine					●		LBG
10	Utility Blade Pins — 2							●	LBG
11	Utility Blade Cylinder Pins — Front — 2							●	LBG
12	Axle Cradle Bushings — 2							●	LBG
13	Utility Blade Cylinder Pins — Rear — 2						●		LBG
14	Transmission Work and Travel Range Lever Bushing	Sec. 9				●			LBG
15	Steering and Blade Control Levers						●		LBG

## LUBRICATION KEY

LBG	Lithium Base Multi-Purpose Grease			
	0° F. and above — Grade 2			
	Below 0° F.                      Grade 0			
EPGL	Extreme Pressure Gear Lube (**SCL Type) SAE 75, SAE 90 or H.D. 90			
DX	Ambient Temp. Range	Lubricant to be used		
	1) Above 0° F.	SAE Grade	API Class	Military Spec.
		10W	+MS DM	MIL-L-2104A, Supp. 1 or New MIL-L-2104B
	2)	Dexron Automatic Transmission Fluid		
	Below 0°	Dexron Automatic Transmission Fluid		
		+ Sequence Tested		
BA	Heavy Duty Brake Fluid	SAE J 1703 or equivalent		
DA	Shell Darina "AX" Grease — Or Equivalent			

\*\*\*"SCL" Signifies Sulfo-Chloro-Lead type. Factory fill is made with SCL type lube and it is recommended that the same type be used when adding or refilling.

EPMD Signifies extreme pressure Molybdenum Disulphide

## DRIVE LINE LUBRICATION

		TEXT LOCATION	HOURS						KEY
			1000	500	250	100	50	10	
17	Universal Joints	Sec. 12	●						LBG
18	Split Joints	Sec. 12				●			LBG
19	Torque Converter	*Sec. 8 & 9						●	DX
20	Differential Check & Fill Plug — 2	*Sec. 12					●		EPGL
21	Differential Drain Plug	*Sec. 12					●		EPGL
22	Planetary Drain, Fill and Check Plug	*Sec. 12					●		EPGL
23	Transmission	*Sec. 9						●	DX
24	Midmount Grease Line	*Sec. 13						●	EPMD

\*See Text

## NOTES

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

## WHEELS

### Wheel Removal Procedure For Split Rims

1. Shut down the engine. When the engine has completely stopped, turn the battery disconnect switch to the "OFF" Position. Place transmission control levers in neutral and apply a holding brake.
2. Before placing a hydraulic jack in position, **BLOCK THE WHEELS OF THE MACHINE.**
3. Take off the valve protection cap, then remove the valve core carefully and exhaust all the air from the tire. Run a piece of wire through the valve system to make sure it is not plugged. **NOTE: If the tire is hydro-inflated, stand clear of the spray.**

**WARNING:** You must deflate the tire and drain as much hydro-inflation as possible before any further work can be done. This step is especially important in the case of split rims.

4. Attach tire tongs to the rim, to facilitate hoisting the wheel assembly off the axle end, when the rim stud nuts are removed.
5. Remove the rim stud nuts. Refer to Fig. 17-1 for the correct location of the rim stud nuts.

*NOTE: Example 1, in Fig. 17-1 visually shows the Rim coupling nuts facing the outside of the rim. The current rims of this style have the coupling nuts facing the inside of the rim. Both styles have the wheel stud nuts facing the outside of the rim.*

6. Remove and lay the wheel assembly down with the rim coupling nuts side up.
7. Punch mark the two halves of the split rim assembly to facilitate correct reassembly.

8. **CAUTION:** Always place the wheel assembly into an inflation cage, or use safety cables or chains before removing the split rim coupling nuts.

9. Remove the split rim coupling nuts. **WARNING. The tire must be deflated before removing these nuts.**

10. With the separator bolt lock washers removed, alternately thread in the separator bolts to brake the rim halves apart. Fig. 17-2

11. Service the rim, tire and tube as required.

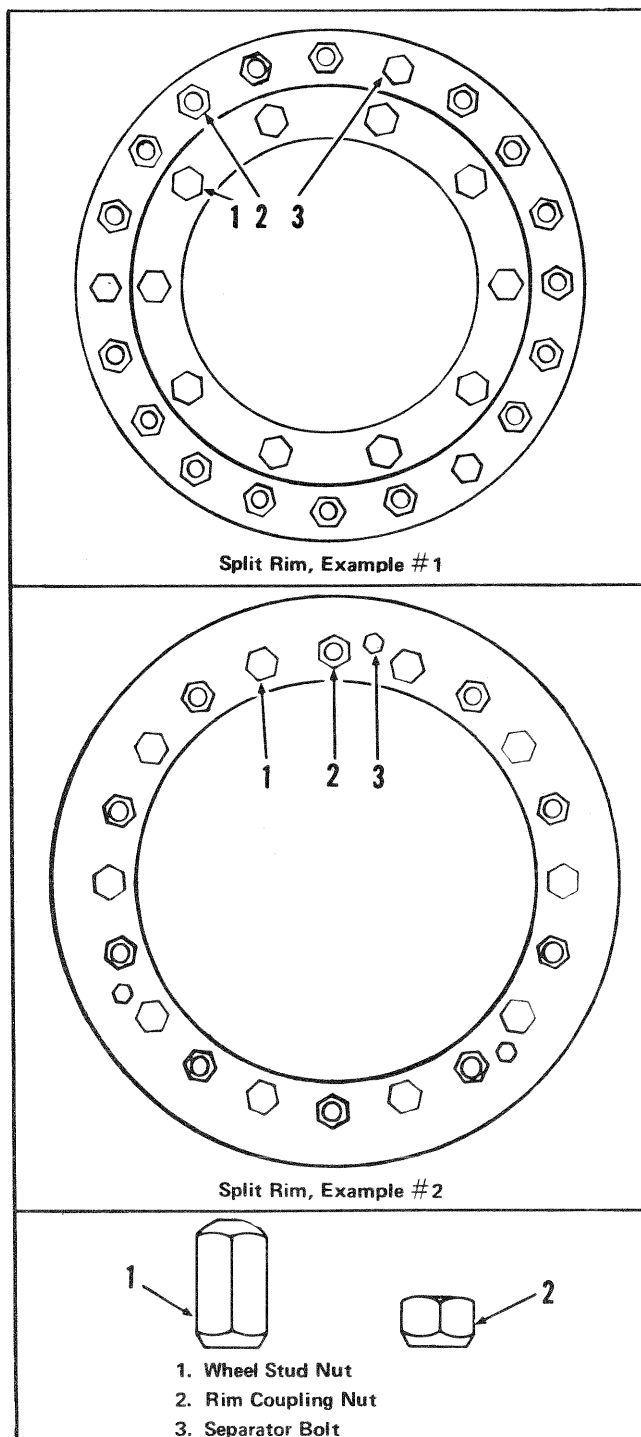


Fig. 17-1 Split Rims

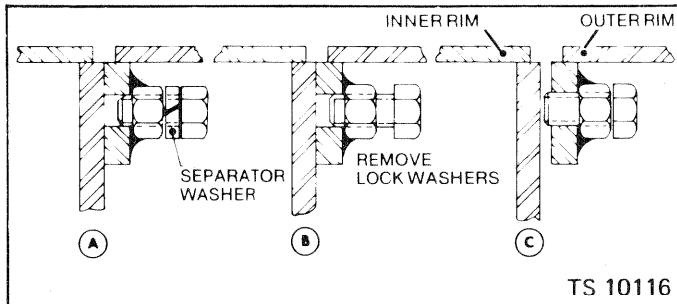


Fig. 17-2 Separator Bolt Operation

**Wheel Assembly Procedure — Split Rims**

1. Lay the rim half containing the welded rim coupling bolts on a flat surface.
2. Place the rubber tire on this half, and insert tube (if the wheel assembly has a tube) in the tire making sure the tube valve will line up with the rim valve opening.
3. Place the second rim half on the first making certain the punch marks made in disassembly on each rim half are lined up.
4. Tighten the split rim coupling nuts to 475 ft. lbs. (65.69 kg. meters) torque. **NOTE:** Be certain the separator bolts have the lockwashers back in place to allow the rim halves to fit flush.

5. **WARNING:** Place the wheel assembly back in the tire inflation cage, or use safety cables or chains around tire and rim.
6. Add approved hydro-inflation as specified in Section 15, if required.
7. Replace the valve core and with the use of a self locking chuck, inflate the tire to the approved pressure as specified in Section 15.

**WARNING:** Inflate a spare tire only enough to keep rim parts in place. A fully inflated tire may explode when it is not installed on a vehicle. Use care if you must transport a fully inflated tire, a safety chain will be required.

8. Replace the valve protection cap.
9. Place the wheel assembly back on the axle end and torque the wheel stud nuts to 475 ft. lbs. (65.69 kg. meters).
10. Remove the hydraulic jack.





**INTENTIONALLY BLANK**