

# **RANGER**

# **668D**

## **OPERATORS INSTRUCTION MANUAL**

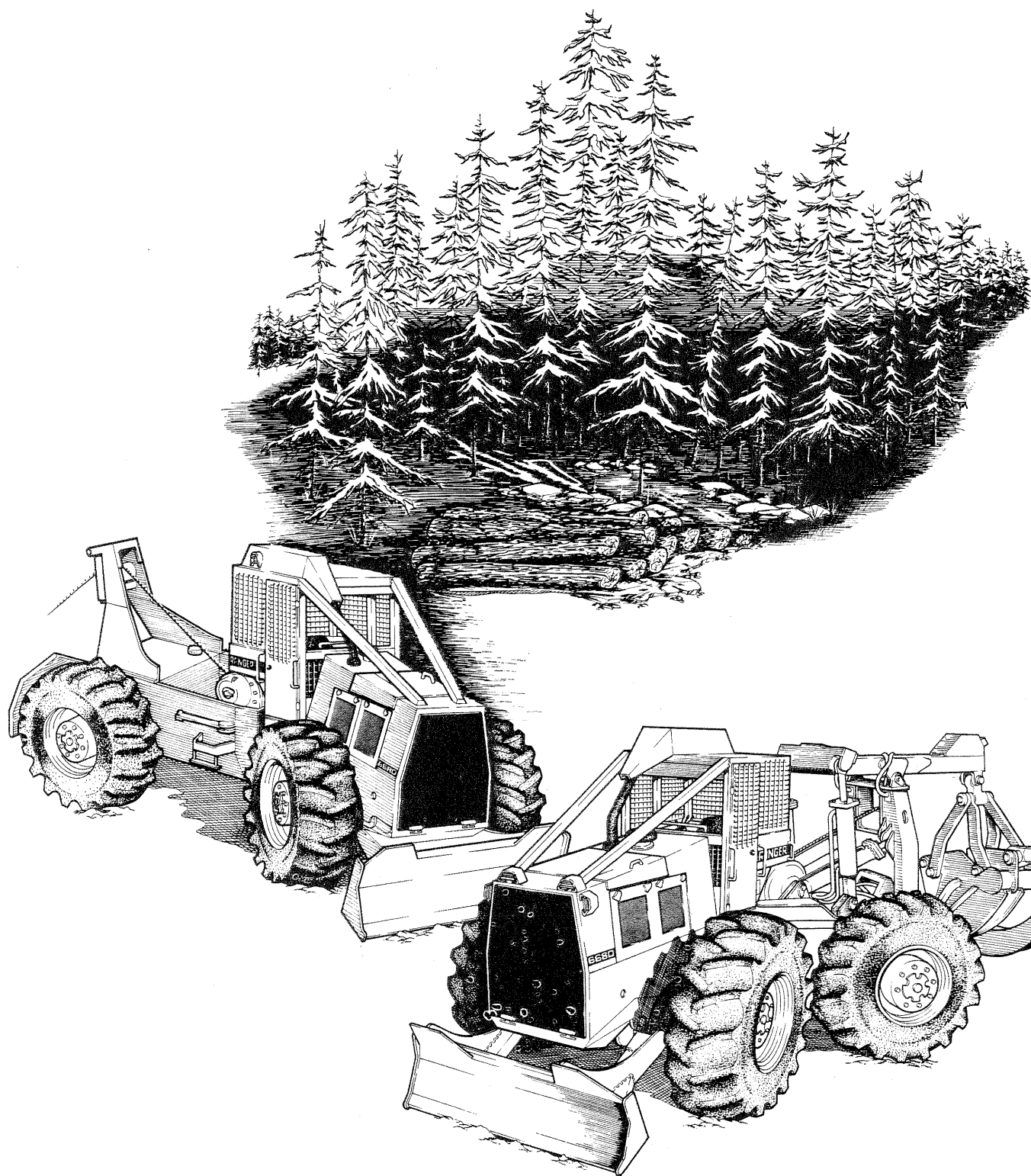
### **PUBLICATION NO. 6406**

**FOR MACHINE  
SERIAL NUMBERS**

**668D CABLE CUMMINS 507E  
668D WELDCO CARRIER CUMMINS 532E  
668D ESCO CARRIER CUMMINS 539E**

**RECORD YOUR MACHINE  
SERIAL NUMBER HERE**

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# RANGER

## TO OWNERS

The purpose of this manual is to serve as a guide to the proper operation of Ranger Log Skidders. Study this manual carefully before starting or operating the machine for the first time. Become familiar with all controls and procedures, and keep the manual in the machine for handy reference.

You have purchased this Ranger Log Skidder machine with the expectation that it will give you long and faithful service. In its construction, we have taken every precaution to see that you get an efficient, 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.

For these reasons, we take the liberty of suggesting that your Ranger Log Skidder will always respond at its best with considerate treatment and care. The slight outlay in personal attention and the cost required to give it regular and proper lubrication, inspection, and such adjustments as may be necessary, will repay you many times in low cost operation and trouble-free service.

Whenever repair or replacement of component parts is required, only the approved parts as listed in the applicable parts manual should be used. The use of "will-fit" or non-approved parts may endanger proper operation and performance of the equipment. The Clark Michigan Company does not warrant repair or replacement parts, nor failures resulting from the use thereof, which are not supplied by or approved by the Clark Michigan Company.

Operating instructions for many options are given in this manual. The photographs and illustrations in this manual may show optional equipment.



**This SAFETY ALERT SYMBOL will appear at various points in this manual and on the machine to accompany WARNING statements. When it appears, PAY ATTENTION, BECOME ALERT, YOUR PERSONAL SAFETY IS INVOLVED.**

## IMPORTANT

### UNAUTHORIZED MODIFICATION OF ROLL-OVER PROTECTIVE STRUCTURES (ROPS)

Do not make unauthorized modifications or alterations to the ROPS such as: welding on fire extinguisher brackets, CB antenna brackets, or fire suppression systems. Unauthorized modifications will affect the structural limits of the ROPS and will void the certification.

The Roll-Over Protective Structures (ROPS) manufactured and sold by the Clark Michigan Company have been certified to meet specified test requirements. These certifications are required by the Canada Standards Association under CSA B352 and by the U.S. Department of Labor under OSHA Regulation 1926.1000.



















Any planned modification or change must be reviewed in advance by the Engineering Department of the Clark Michigan Company, to determine if the modification or change can be made within the limits of the certifying tests.

It is important that each person in your organization, including management, be made fully aware of these rules involving the ROPS.

Whenever anyone sees a machine ROPS with unauthorized modifications or changes, both the customer and the factory should be notified in writing.

**NOTES**

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**NOTES**

## INTRODUCTION

Your **RANGER** Log Skidder is designed and manufactured for rugged, heavy duty logging applications. A powerful diesel engine supplies power to the Clark drive train components.

Power from the engine comes through a Clark torque converter with a three to one torque multiplication factor to a Clark Power Shift, full reversing transmission and finally to the Clark winch and axle assemblies. All components are joined with universal slip joint drive shaft assemblies.

The axle assemblies are Clark all wheel drive units with further reduction provided by planetary gear sets in the wheel hubs.

Steering is controlled by a single lever which articulates the machine at a mid point by two hydraulic cylinders. The blade and grapple assemblies are also hydraulically operated.

This manual contains valuable periodic service information to keep your machine trouble-free and operating at its peak of performance. Read and understand the instructions in this manual **BEFORE** you attempt to operate this machine. Any problems and/or adjustments not in this manual can be handled by the Service Department at your **RANGER** Distributor.

A number of checks and adjustments are recommended to be done at Operating Temperature. The operating temperature of the engine is 66°C (150°F), as indicated on the engine temperature gauge. The operating temperature of the transmission/conver-

ter system is between 82°C and 93°C (180°F and 200°F) as indicated by the converter oil temperature gauge. The operating temperature of the hydraulic system is between 66°C and 77°C (150°F and 170°F). These temperatures will be reached after the recommended warm-up procedures.

### **Warm the engine as follows:**

Run the engine at idle for three to five minutes, then at 1000 RPM for three minutes and at 1800 RPM for three minutes.

**NOTE: If the machine is equipped with a hand throttle, lock the throttle at the desired position to facilitate warm-up.**

**NOTE: DO NOT accelerate the engine to its maximum RPM until it has reached its operating temperature.**

### **Warm the transmission/converter oil as follows:**

Put the transmission control levers in the FORWARD and THIRD positions, stalling the converter with the service brake applied and the wheels blocked. Stall the converter at one third throttle until the converter temperature reaches the operating range. Do not actuate the parking brake.

### **Warm the hydraulic oil as follows:**

With the engine operating between 1400 and 1500 RPM, raise the blade and hold the lever in the RAISE position to bring the main hydraulic system over relief pressure, for five seconds every 10 seconds.

**NOTES**

## OPERATING SAFETY INSTRUCTIONS



**This SAFETY ALERT SYMBOL will appear at various points in this manual and on the machine to accompany WARNING statements. When it appears, PAY ATTENTION, BECOME ALERT, YOUR PERSONAL SAFETY IS INVOLVED.**

Your **RANGER** Log Skidder is heavy equipment and must be treated with care and respect. Be a careful and efficient operator and observe the following simple but fundamental rules of safety to avoid unnecessary and careless accidents. Read and understand this manual before you operate the machine.

**The following personal safety rules should be followed to protect yourself and your co-workers.**

1. Allow only trained operators to use the machine.
2. ALWAYS obey ALL safety decals; they are there for your protection and the protection of others.
3. NEVER wear jewellery or loose fitting clothing such as scarves, loose cuffs or fringed jackets.
4. Know and understand all the safety equipment on your job site and use it when you need it.
5. Know and understand all the hand signals used on the job and always obey the signalman.

**Before you enter the operator's compartment, observe the following instructions:**

1. Walk around the machine and warn all persons in the area before you enter the operator's compartment.
2. Report or correct all apparent machine malfunctions.
3. Note all hazards and obstructions such as ditches, electrical wires and wheel blocks.
4. Ensure proper ventilation if you are going to start the machine indoors.
5. Be particularly careful if this is not the machine you normally operate.
6. Remove the steering frame lock and fasten it in position on the rear frame.

**As you enter the operator's compartment, observe the following instructions:**

1. Make sure all steps and handles are free of grease, oil and mud. Keep hands, floor and all controls clean.
2. Check the seat belt for wear or damage and replace the belt if necessary.

3. Remove or secure all maintenance or personal items such as lunch boxes, chains, and tools.
4. Adjust the operator's seat to allow convenient access to all control levers and pedals.
5. Fasten the seat belt.

**As you start the machine, observe the following instructions:**

1. Test the power brake warning system (See Page 4-2).
2. ALWAYS apply both the service brake and the parking brake before you start the machine.
3. Start the engine from the operator's seat only.

**Before you put the machine in motion, make the following checks:**

1. Check all gauges and instruments for incorrect or abnormal operating conditions. Report or repair any problems.
2. Operate the machine slowly in the forward direction and test the steering system. Steer completely to the left and right and report or repair any problems.
3. Test the service brake system against the power of the engine and report or repair any problems.

**When you are operating the machine (See Sec. 5), observe the following instructions:**

1. If you are about to operate the machine in conditions that will require good brake operation, the brake warning system should be tested with the test switch before proceeding.
2. ALWAYS put the transmission in the NEUTRAL mode, engage the neutral lock, lower the blade and actuate the parking brake when you leave the operator's compartment.
3. NEVER leave or enter the operator's compartment when the machine is moving.
4. Be careful not to strike persons or vehicles with the machine.
5. Be careful when operating the machine on steep grades to avoid sudden tipping.

6. Be aware of the hazards from tree limbs and other overhead obstructions. Watch out for stumps and all ground obstructions.
7. NEVER use the transmission as a downhill brake, (operating the transmission in reverse when travelling forward down a hill). The engine can stall and the steering system will not operate.
8. NEVER carry passengers in your machine; there is only one seat and it should carry only one person.
9. Take special care when operating in wet or icy conditions.
10. NEVER use the blade as a brake when travelling.
11. NEVER travel in the NEUTRAL mode when you operate on a grade.
12. ALWAYS operate your machine at speeds that are safe for the conditions of each job.
13. ALWAYS actuate the parking brake and lower the blade when you park the machine. Block the wheels when you park on a grade.
14. At the end of the work shift, or when the machine is not to be operated, turn the battery disconnect switch and the fuel shut-off valve to the OFF position.
15. Do not leave your machine with any hydraulic implements (blade or grapple assemblies) in their raised positions.

### The Service Position

Before doing any work on your machine, make sure that you follow these instructions to put your machine in the **SERVICE POSITION**. For your safety and the safety of those around you, we recommend the positions as follows:



Fig 2-1

SP-10000

1. Park the machine on level ground if it is to be serviced away from the shop.

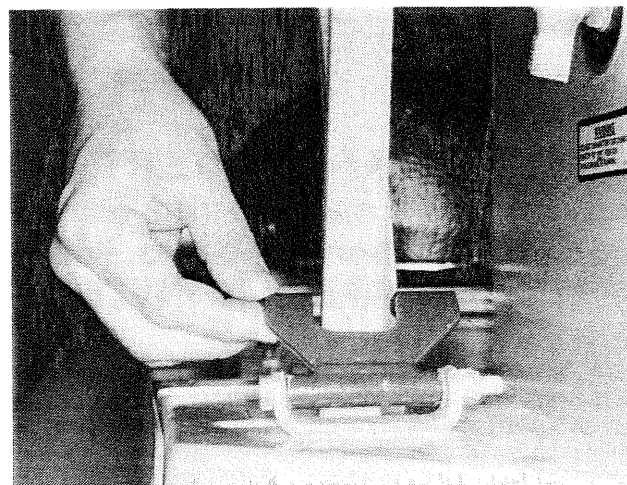


Fig 2-2

SP-1000

2. Put the direction control lever in the NEUTRA position and engage the neutral lock mechanism.



Fig 2-3

SP-1000

3. Actuate the parking brake.

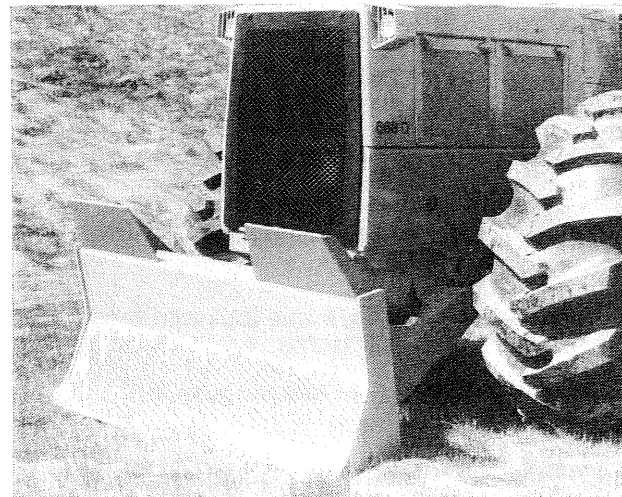


Fig 2-4

SP-1000

4. Lower the blade (and grapple assembly) to the ground.



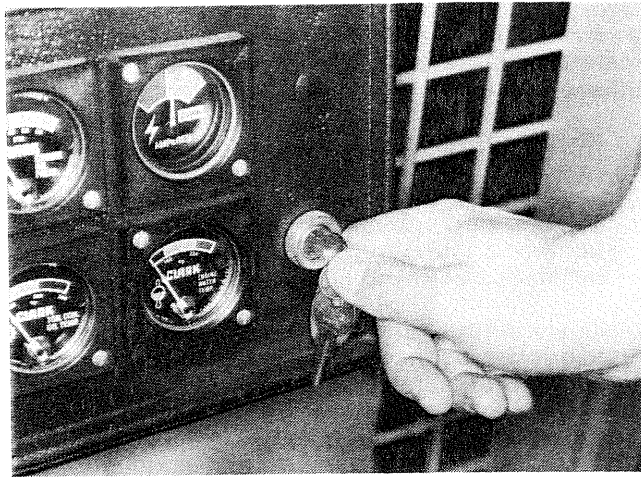


Fig 2-5

SP-10004

5. Stop the engine and remove the key from the ignition switch.



Fig 2-6

SP-10005

6. Turn the battery disconnect switch to the OFF position.

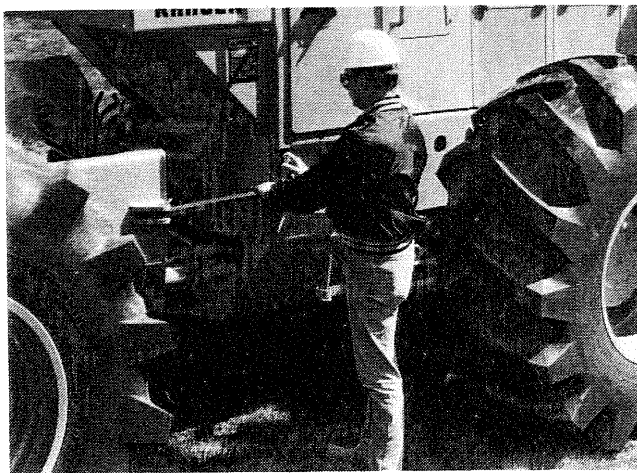


Fig 2-7

SP-10006

7. Fasten the steering frame lock between the frames.

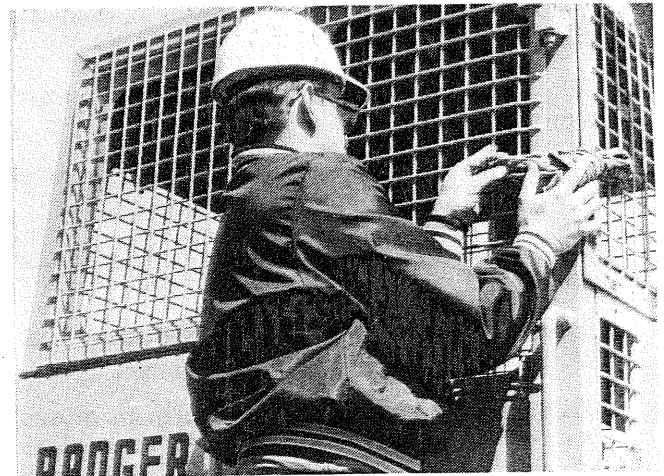


Fig 2-8

SP-10007

8. Fasten a red warning flag to the canopy upright to indicate that the steering frame lock is fastened.

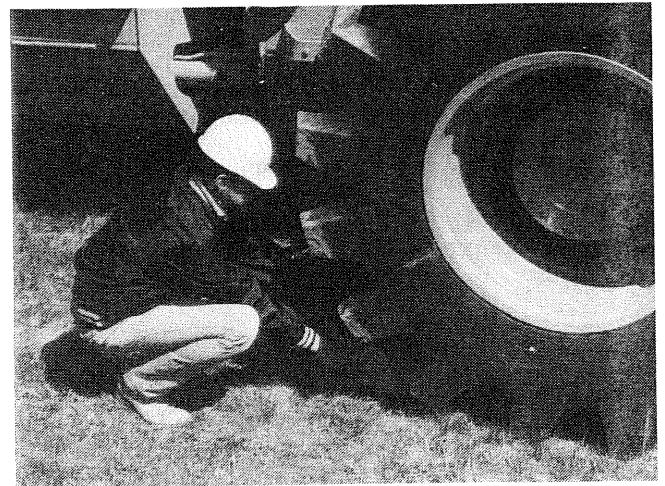


Fig 2-9

SP-10008

9. Block the tires.

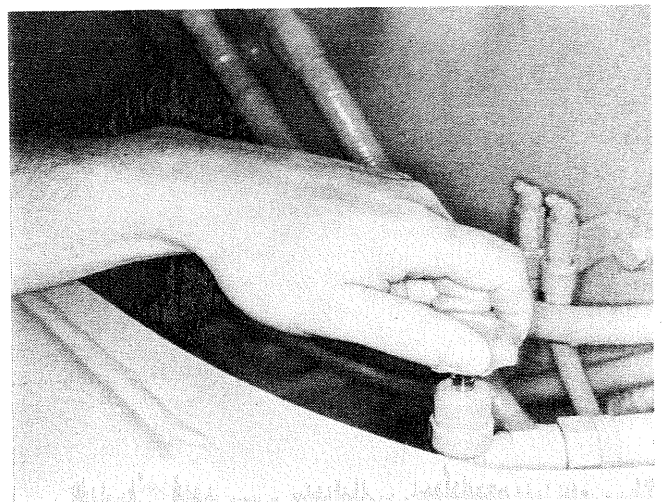


Fig 2-10

SP-10009

10. Turn the fuel shut-off valve to the OFF position.

**When you do any service on the machine, observe the following instructions:**

1. NEVER stand in the articulation area when the engine is running.
2. When you are filling tires, stand away from them to avoid serious injury in case of a rupture.
3. Use extreme caution when removing radiator caps, tank filler caps, and drain plugs.
4. DO NOT attempt repairs you do not understand, ask for help if you need it.
5. When compressed air must be used to dry or clean parts use EXTREME CAUTION to protect the skin (especially cuts and open sores) from the air jet. Serious injury or death can result if air and/or foreign material should penetrate the skin.
6. The same precaution must be taken with fluid under pressure. Oil escaping from an orifice can enter the skin and can cause serious injury or death.
7. NEVER adjust a pressure relief valve to a pressure higher than the specified value.
8. Take care to clean up any spilled fluids.
9. ALWAYS relieve the hydraulic pressure from the power brake system before doing any brake service.

**Forest fires are both costly and dangerous. Fire prevention must be foremost in the mind of a skidder operator. Follow these instructions to reduce the chance of fire:**

1. Keep your hand fire extinguishers charged and in good working order at all times.
2. Make periodic checks of all electrical connections and make note of any frayed or broken wires. Repair any electrical faults immediately.
3. Check all fuel and hydraulic lines for damage and loose connections. Repair these promptly and clean up any leaked fluid.
4. Clean all debris such as leaves, needles and twigs after each work shift. Periodic steam cleaning of the frames and articulation area will help prevent build-up of flammable materials.
5. Take care to clean up any spilled fluids to reduce the chance of a fire.

## OPERATING CONTROLS

The controls on the left hand side of the operator's seat are as follows:

### Winch Control Lever

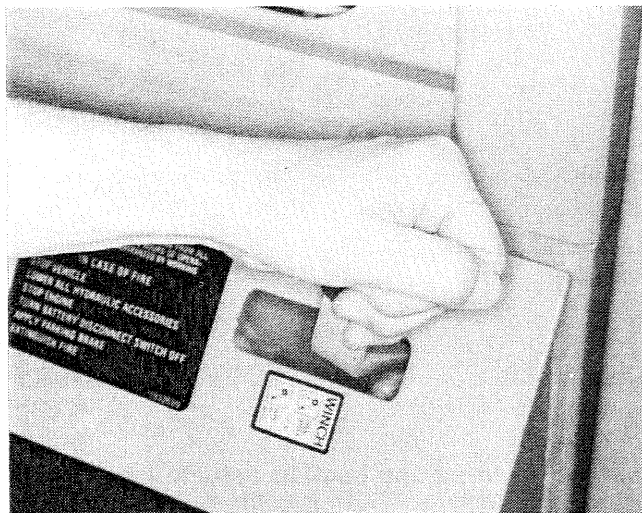


Fig 3-1

SP-10010

This lever actuates the winch control valve to operate the winch. When the lever is moved to the detented FREE-SPOOL position, the winch mainline can be pulled out from the winch cable drum. When the lever is moved to the WINCH IN position, the winch cable drum will rotate and pull the load to the machine's butt pan. When the lever is in the detented center LOCK position, the cable drum is held in the SKIDDING mode and the load can be transported to its destination.

### Direction Control Lever



Fig 3-2

SP-10011

This lever is connected to the transmission control valve and controls the transmission's FORWARD and REVERSE functions and has a center NEUTRAL position.

### Neutral Lock Latch

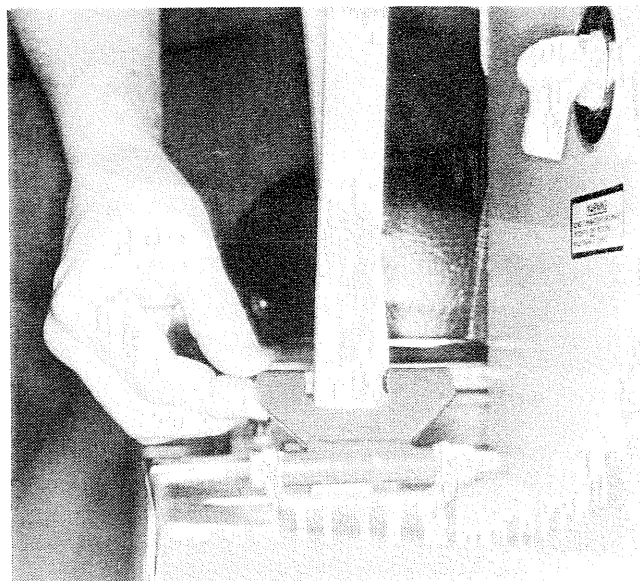


Fig 3-3

SP-10001

Turn this latch to the right when the Direction Control Lever is in the NEUTRAL position to lock the lever in that position.

### Speed Range Control Lever

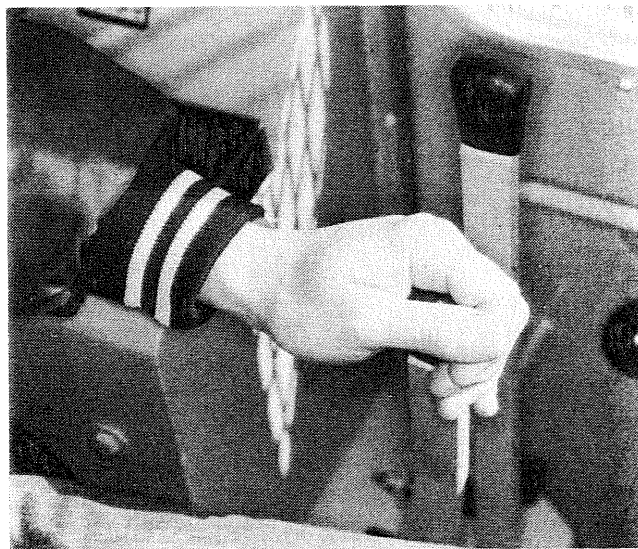


Fig 3-4

SP-10012

This lever is also connected to the transmission control valve and controls the transmission's FIRST, SECOND and THIRD Speed Ranges. The lower the range selected, the less strain is put on the engine when the machine is pulling a load.



### Battery Disconnect Switch

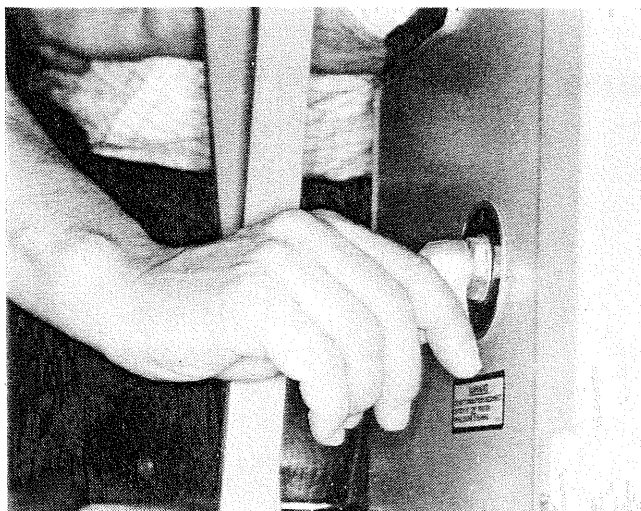


Fig 3-5

SP-10005

Turn this switch to the OFF position to disconnect the current supply from the battery to the electrical system. This switch should be in the OFF position when you do any arc welding on the machine.

**IMPORTANT NOTE: DO NOT turn this switch to the OFF position when the engine is operating. Serious damage to the alternator and electrical system can result.**

**IMPORTANT NOTE: Turn the battery disconnect to the OFF position at the end of the workshift or when the machine is not to be operated.**

The controls on the right hand side of the operator's seat are as follows:

### Steer and Blade Control Lever

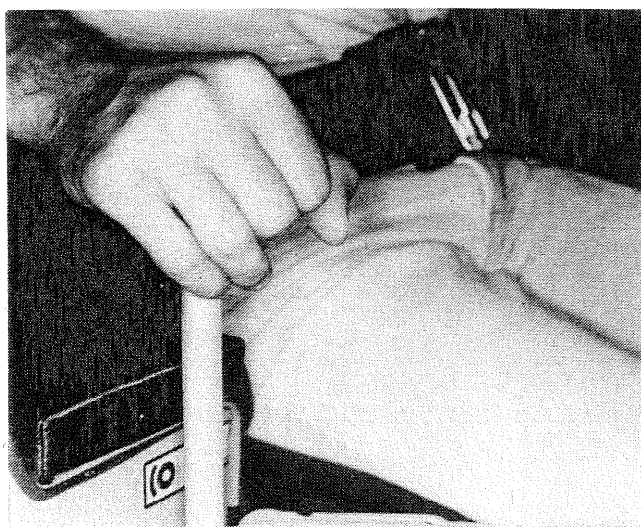


Fig 3-6

SP-10013

This lever is connected to the steer and blade control valve and controls both functions. Moving the lever to the left and right, steers the machine to the left and right. Pulling the lever straight back, lifts the blade and pushing it straight forward, lowers it.

### Parking Brake Lever

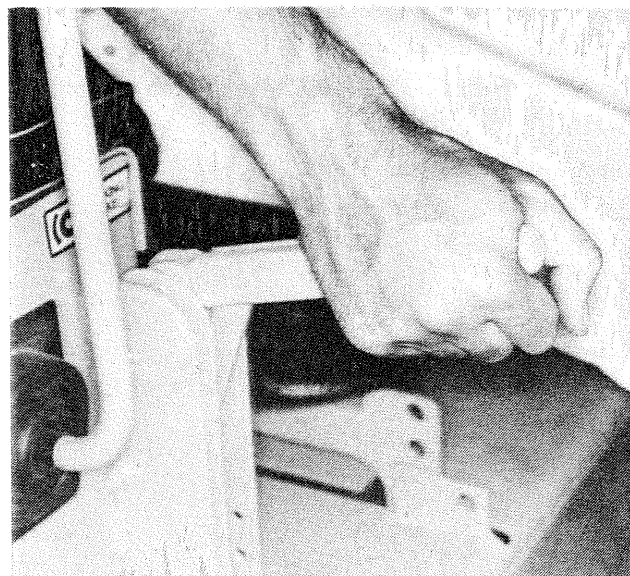


Fig 3-7

SP-10011

Pull this lever up and back to actuate the parking brake mechanism. 668D machines are equipped with a transmission de-clutch provision that actuates when this lever is applied.

### Grapple Rotating Head Control Lever

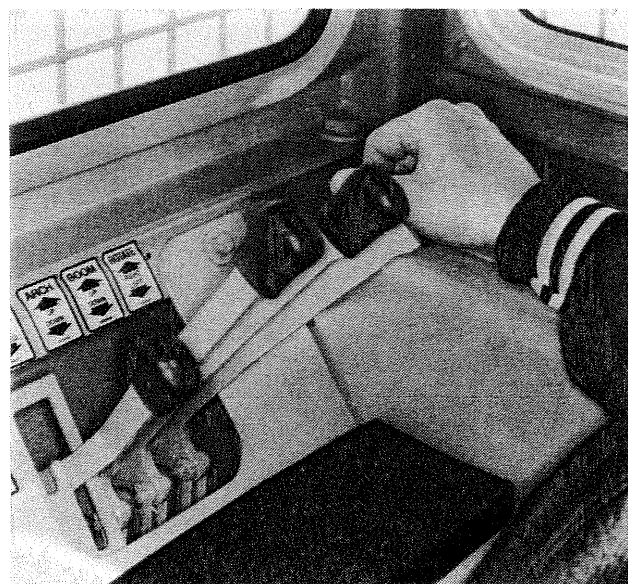


Fig 3-8

SP-10015

This lever rotates the grapple assembly to the left or right to position it on a pile of logs.

## Boom Control Lever (Weldco Grapple Only)

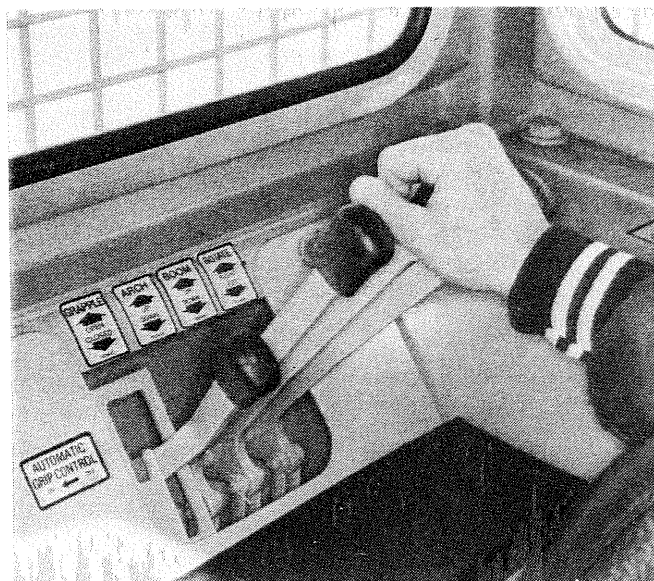


Fig 3-9

SP-10016

This lever raises or lowers the grapple assembly to position the load.

## Grapple (A.G.C.) Control Lever

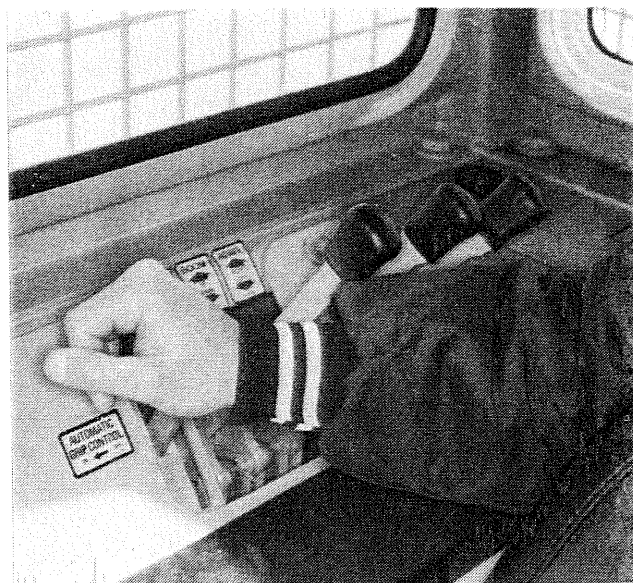


Fig 3-11

SP-10018

This lever opens and closes the grapple arms to pick up or drop a load. All machines are equipped with a Grapple Automatic Grip Control System that is actuated by inserting this lever into the center detent position. This system is described on page 5-2 in this manual.

## Arch Control Lever



Fig 3-10

SP-10017

This lever moves the arch forward or back to position the grapple assembly.

The instruments and controls on the instrument panel from left to right are as follows:

## Tachometer

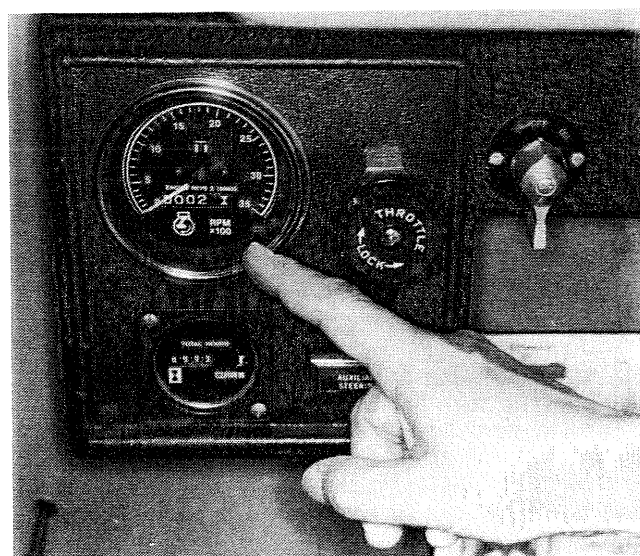


Fig 3-12

SP-10019

The tachometer shows the operating speed in RPM (revolutions per minute) of the engine. The engine will operate most efficiently at a certain speed.

### Hourmeter

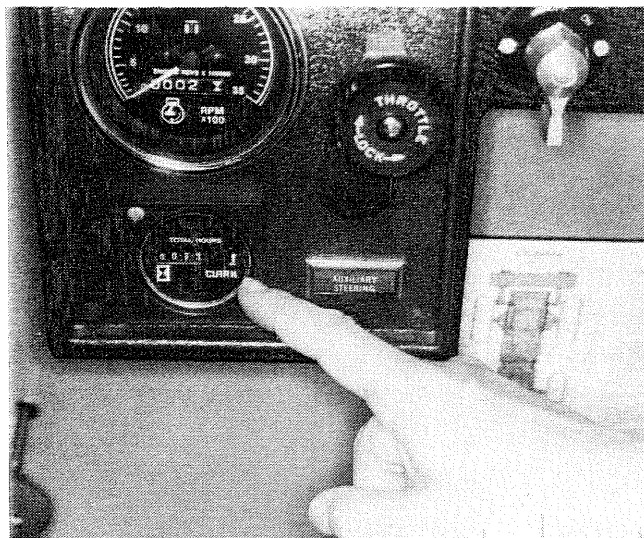


Fig 3-13

SP-10020

The hourmeter indicates the number of hours of operation that the machine has worked. Monitor the hourmeter closely to enable periodic lubrication and maintenance operations to be done at the recommended operating intervals. This will contribute to longer trouble-free operation of your **RANGER** Log Skidder.

### Hand Throttle Control

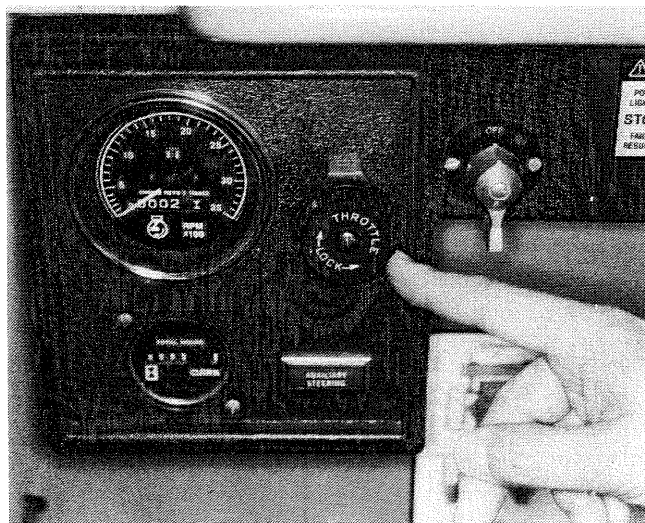


Fig 3-14

SP-10021

Pull the handle out until the desired engine speed is reached and turn the handle clockwise to lock the control in the desired throttle position for a constant engine speed. Turn the handle counterclockwise to release the control and push the handle in to return the engine to low idle RPM.

**WARNING:** DO NOT use the hand throttle while travelling. When this control is locked, the accelerator pedal is locked as well and will not be released by the service brake. Release the lock to restore control to the accelerator pedal for use while travelling.

### Auxiliary Steering Switch



Fig 3-15

SP-10022

In the event that the engine or main pump fails and the steering system will not operate, turn this switch to the ON position to restore steering. DO NOT use this system any longer than necessary. Bring the machine to a safe stop to avoid system depletion.

### Auxiliary Steering Light

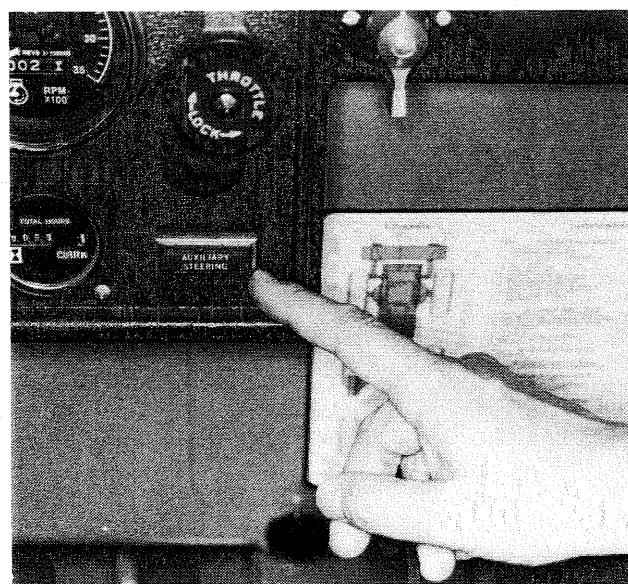


Fig 3-16

SP-10023

This light glows to indicate that the auxiliary steering system is activated.



## Auxiliary Brake Knob



Fig 3-17

SP-10024

This knob is used to test the operating condition of the inverted shuttle valve in the power brake circuit. See Sec. 13 for important power brake maintenance information.

## Brake Warning Lights

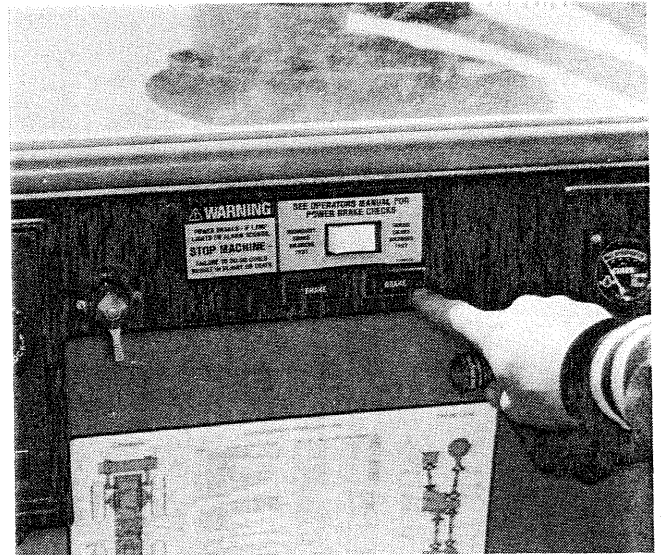


Fig 3-19

SP-10026

A loss of hydraulic pressure in either (or both) brake system(s) will cause one or both of these warning lights to glow and the buzzer under the dash to sound. If this occurs, stop the machine IMMEDIATELY because there is a fault in the power brake system that MUST be corrected. This warning system should be tested at the beginning of each work shift before the machine is started (See Sec. 4) and any time during the shift before the machine is to be operated in conditions that will require good brake operation.

## Brake Warning System Test Switch

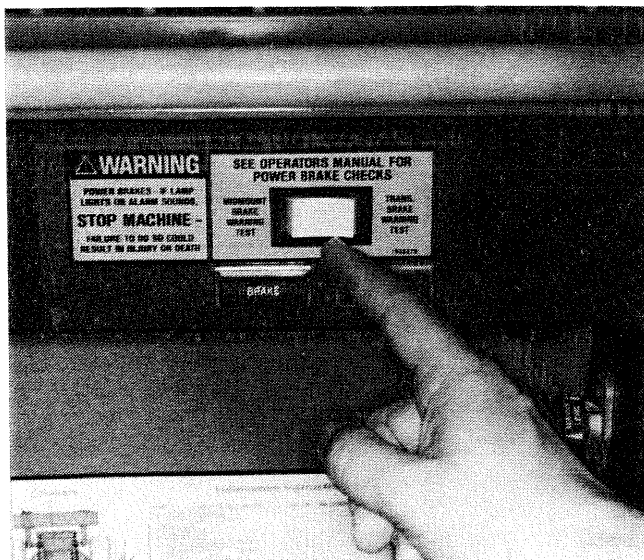


Fig 3-18

SP-10025

Pushing this switch to the left and right sounds the brake warning buzzer and light the left and right brake warning lights to ensure they are in good working order.

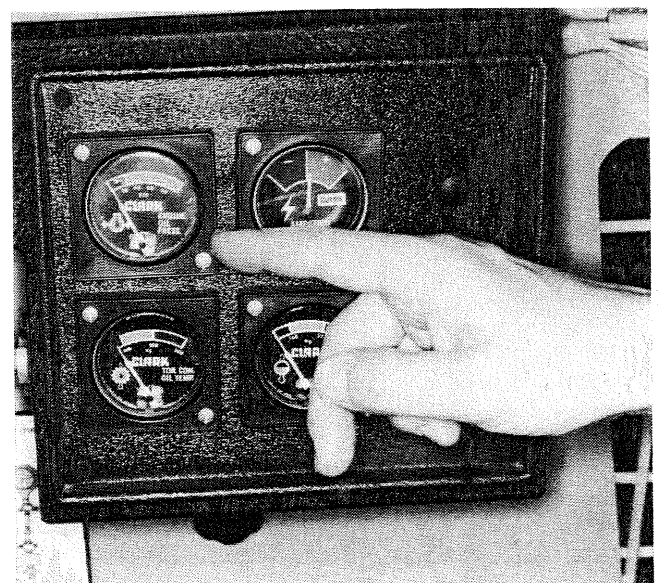
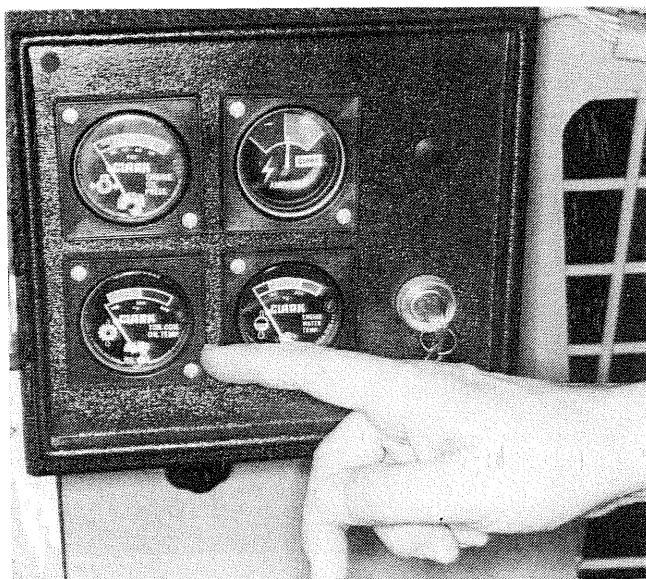


Fig 3-20

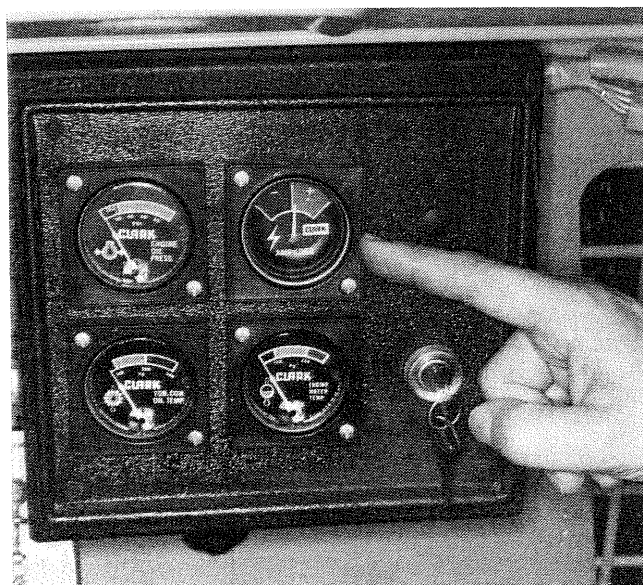
SP-10027

This gauge allows the operator to monitor the operating pressure of the engine lubrication system. After 15 seconds of operation, the gauge should read 10 PSI minimum at low idle RPM. If the pressure is below 10 PSI, shut down the engine immediately and determine the cause.

**Converter Temperature Gauge****Fig 3-21**

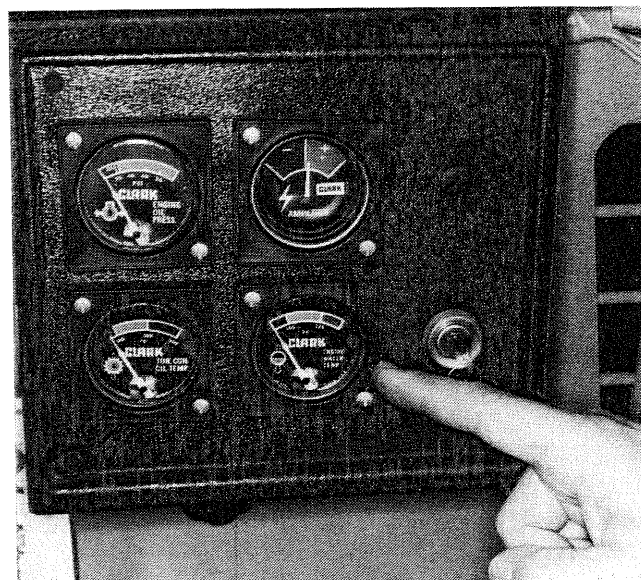
SP-10028

This gauge allows the operator to monitor the temperature of the converter/transmission operating fluid. DO NOT allow the indicator needle to enter the red zone on the gauge or serious damage to the system can result. If the system begins to overheat, choose a lower transmission speed range. If the system continues to overheat, stop the engine and determine the cause (See Sec. 8).

**Ammeter****Fig 3-22**

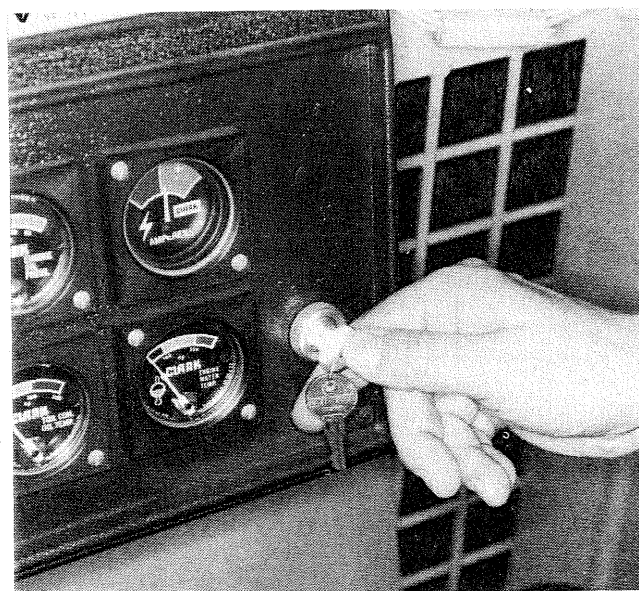
SP-10029

The ammeter indicates the current entering or leaving the battery except when starting the engine. The indicator needle should show a slight charge during the machine's operation. If the needle indicates either excessive charge (+) or discharge (—) for an extended period of time, the electrical charging system will have to be checked for faults.

**Engine Water Temperature Gauge****Fig 3-23**

SP-10030

This gauge allows the operator to monitor the temperature of the engine coolant. Do not allow the indicator needle to enter the red zone on the gauge or serious damage to the engine and its components can result. If overheating does occur, check the fan belt tension (See Sec. 6) and check the radiator for debris that can be restricting air flow.

**Ignition (Key) Switch****Fig 3-24**

SP-10031

Insert the key into the Ignition Switch, put the direction control lever in the NEUTRAL position and turn the key to the right (ON) position to start the engine. If, for any reason, the engine stops cranking while starting, push the circuit breaker reset button inside the engine compartment (See Sec. 14) and try again. If the engine will not crank, further troubleshooting will be required.



## Windshield Wiper/Washer Switch

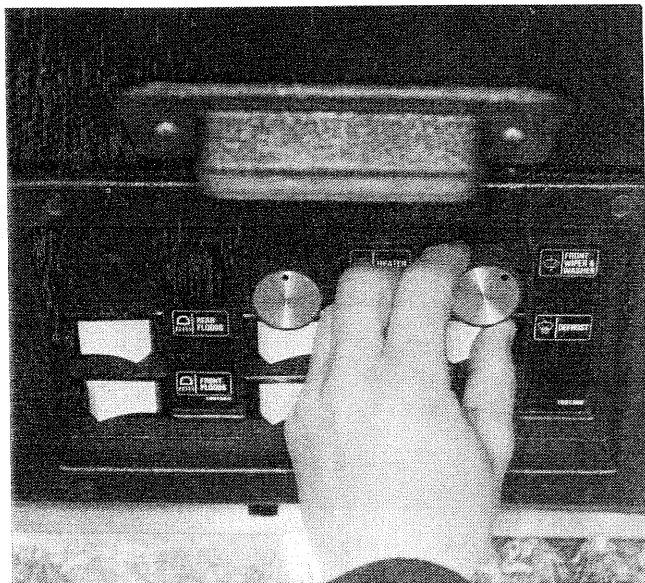


Fig 3-25

SP-10032

Turn the switch clockwise one or two positions to actuate the windshield wiper. Turn the switch counterclockwise to turn the wiper OFF. Press the switch to actuate the windshield washer.

**NOTE:** Use only clean windshield washer solvent in the washer reservoir. Use a quality brand of windshield washer anti-freeze if the ambient temperature falls below 0° C (32° F).

## Heater Switch

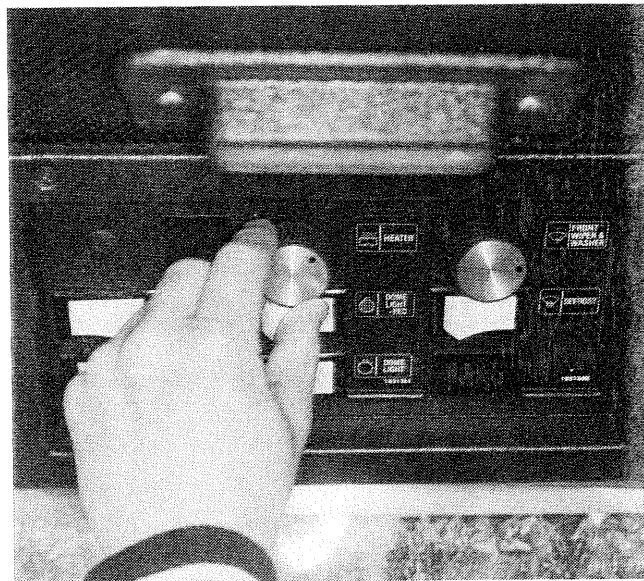


Fig 3-27

SP-10034

Turn the switch clockwise to the FIRST position for LOW fan speed and to the SECOND position for HIGH speed. Turn the switch counterclockwise to turn the heater OFF.

## Defroster Fan Switch

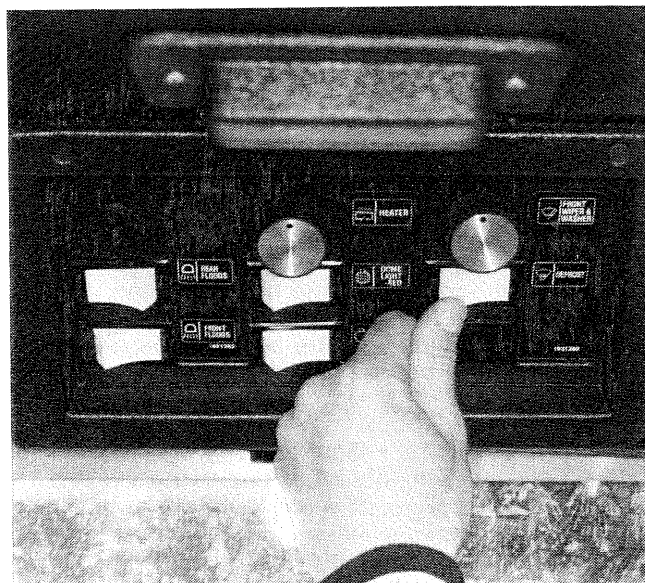


Fig 3-26

SP-10033

This switch turns the windshield defroster fan ON and OFF to clear condensation and frost from the windshield.

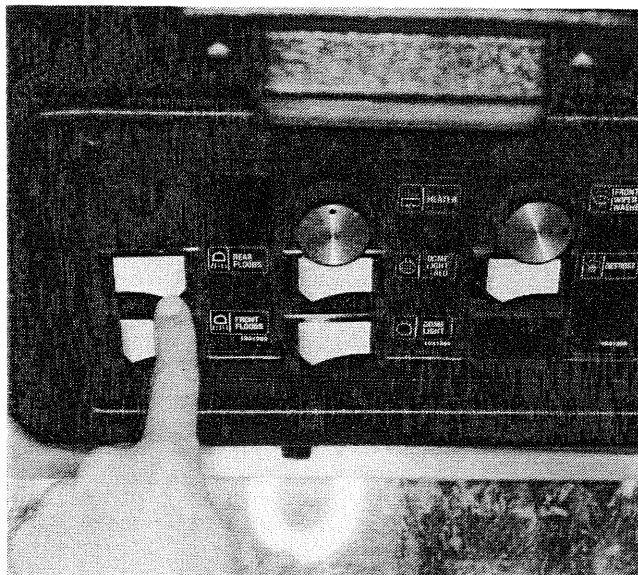
## Dome Light Switch



Fig 3-28

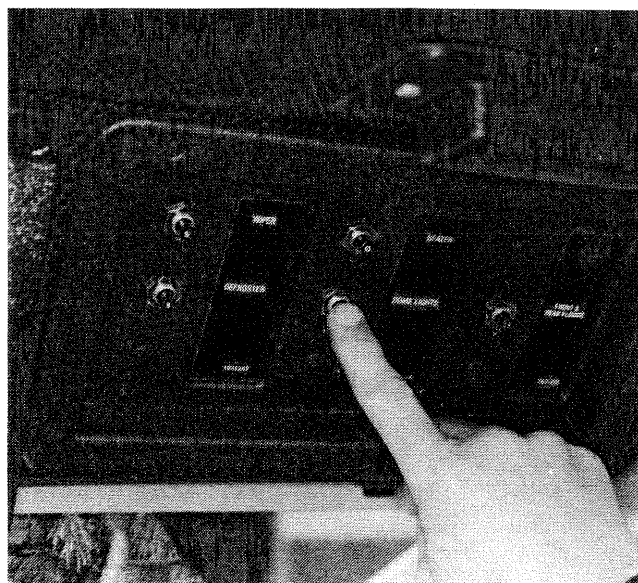
SP-10035

The "RED" dome light switch turns the red cab dome light ON for use at night for safe travel. The Dome Light switch below turns the white cab dome light ON for use at night ONLY when the machine is stationary.

**Front and Rear Flood Light Switches****Fig 3-29**

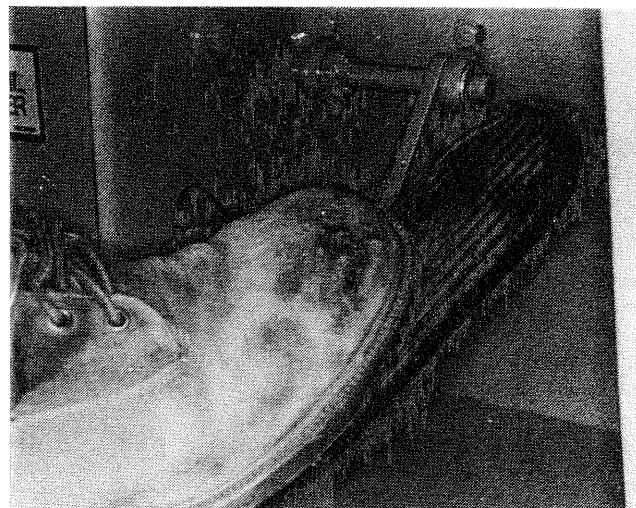
SP-10036

These switches actuate the front and/or rear flood lights for operating the machine at night.

**Accessory Circuit Breaker Panel****Fig 3-30**

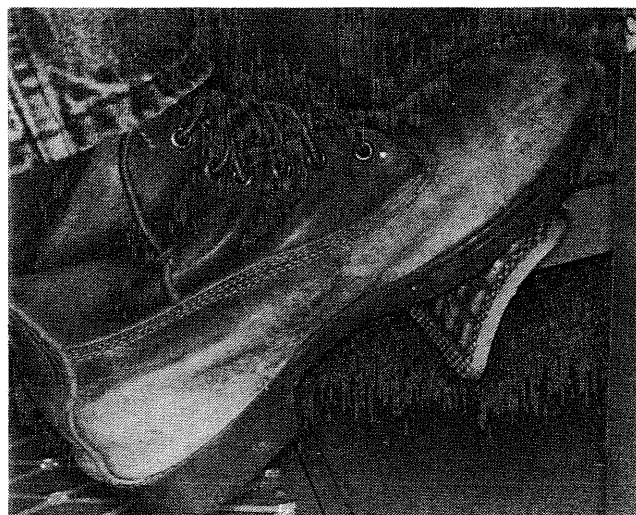
SP-10037

If for any reason, any of the controls on the accessory panel do not work, push the appropriate circuit breaker reset button and try the control switch again. If this fails to correct the problem, further troubleshooting will be required.

**Accelerator Pedal****Fig 3-31**

SP-10038

This pedal is located on the floorboard on the right hand side of the firewall and controls the engine throttle. Depress the pedal to increase the speed of the machine, and release it to decrease the speed.

**Service/Secondary Brake Pedal****Fig 3-32**

SP-10039

This pedal is located on the floorboard on the left hand side of the firewall and controls the hydraulic brake systems. Depress the pedal to decrease the speed of the machine or to stop the machine completely.

**IMPORTANT NOTE:** The failure of one of the two brake systems will force the remaining system to assume the function of a secondary brake. When this happens there should be adequate operation to bring the machine to a safe stop.

**WARNING:** NEVER operate the machine with only one brake system operative except to bring the machine to a safe stop when the failure of the other system occurs. Find the problem and correct it before continuing.

## Seat Adjustment Lever

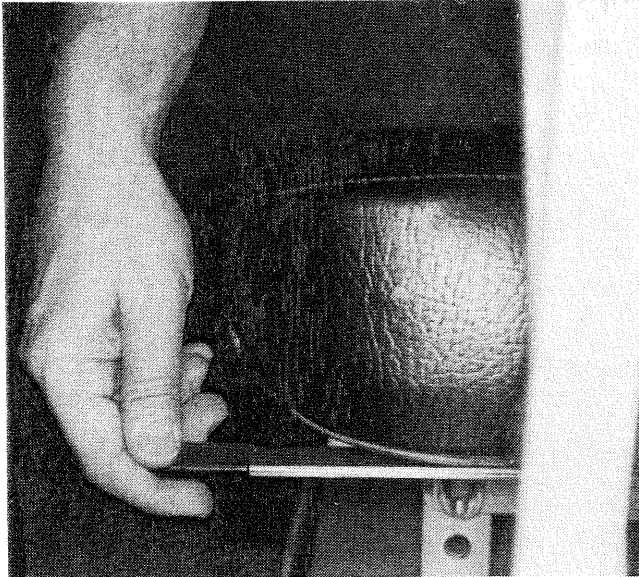


Fig 3-33

SP-10040

This lever is located below the operator's seat and allows the operator to position the seat for his operating comfort.

## Fire Extinguishers

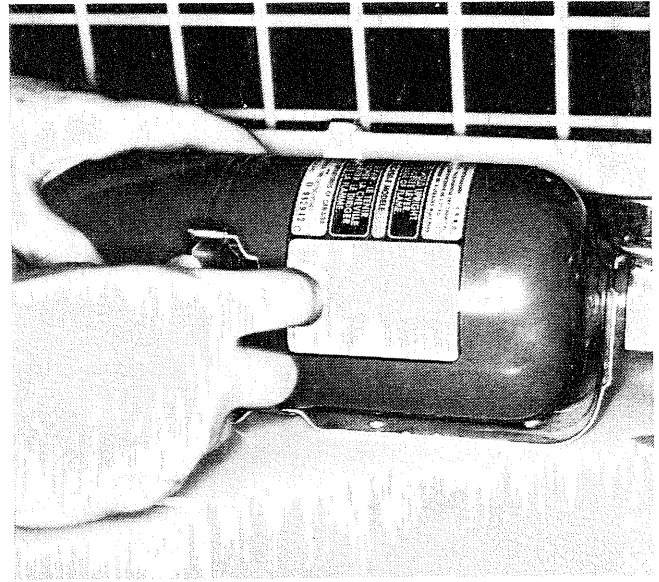


Fig 3-35

SP-10042

Your machine is equipped with two 2.3 kg (5 lb) hand operated fire extinguishers mounted inside the operator's compartment behind the seat. Read and understand the instructions printed on the canister and learn how to remove the canisters from the mounting brackets in the shortest possible time and how to operate them.

## Seat Belt



Fig 3-34

SP-10041

ALWAYS fasten your seat belt when operating the machine. Adjust the belt so that it fits snugly around the hips.

## Instruction Plates and Decals



Fig 3-36

SP-10043

Locate all instruction plates and decals in and around the operator's compartment. These contain important safety, operation and service information. Read ALL of these instructions carefully and understand them fully for trouble-free operation of your **RANGER** Log Skidder.

**NOTES**



## STARTING INSTRUCTIONS

At the beginning of the work shift before you start the machine, make the following PRE-START checks:

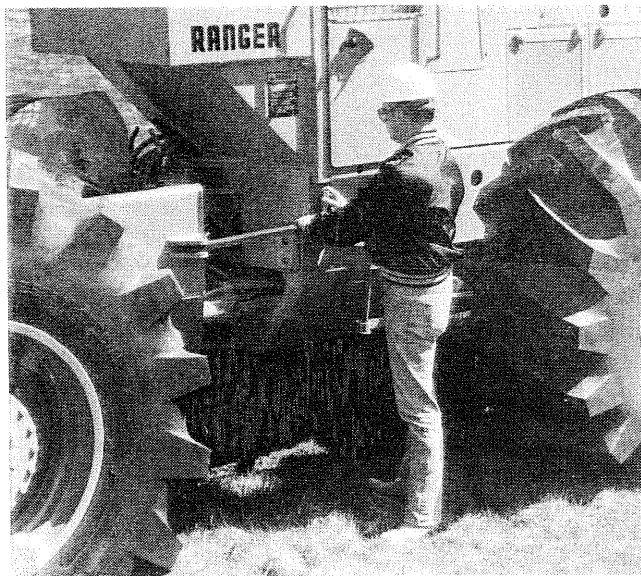


Fig 4-1

SP-10006

1. Put the machine in the Service Position (See Sec. 2).

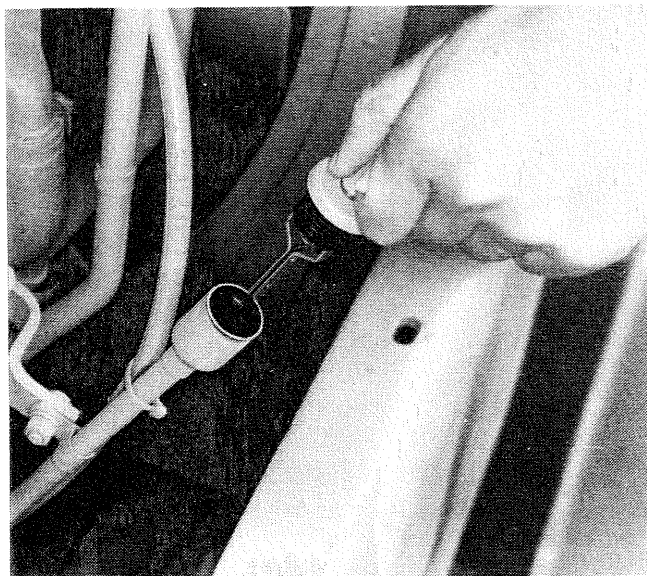


Fig 4-2

SP-10044

2. Check the engine oil level.

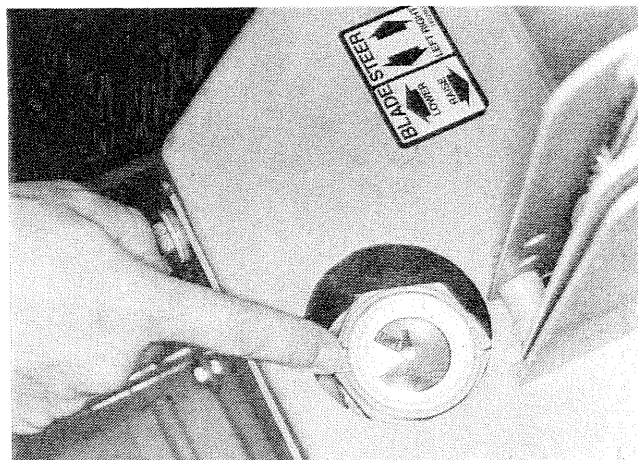


Fig 4-3

SP-10045

3. Check the hydraulic oil level (See Sec. 10).



Fig 4-4

SP-10046

4. Check the fuel level.

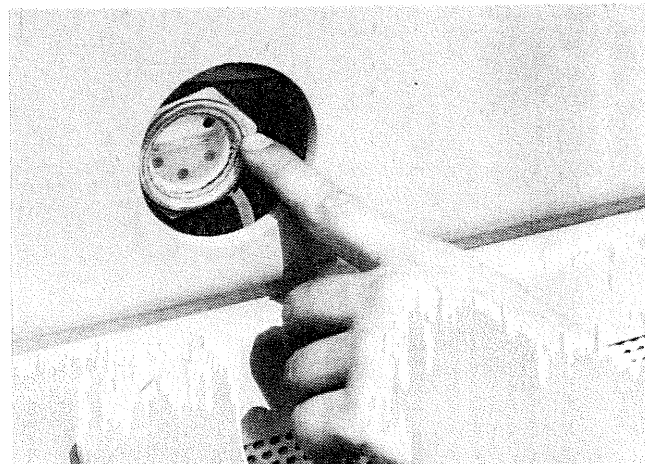


Fig 4-5

SP-10047

5. Check the engine coolant level.

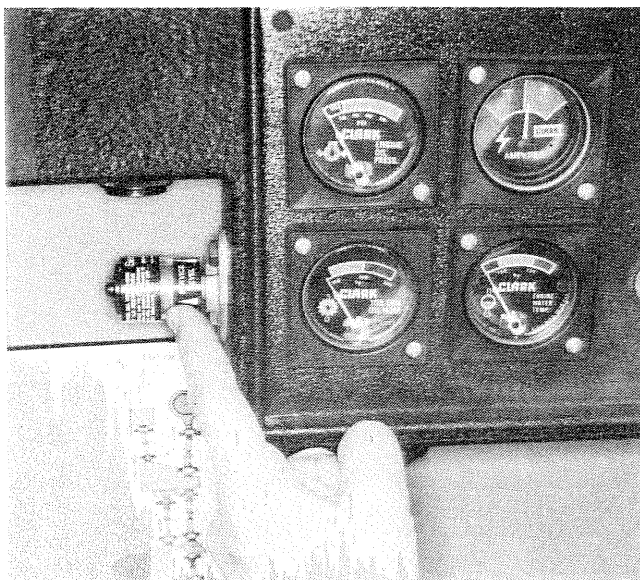


Fig 4-6

SP-10048

6. Check the flag on the air cleaner service indicator.

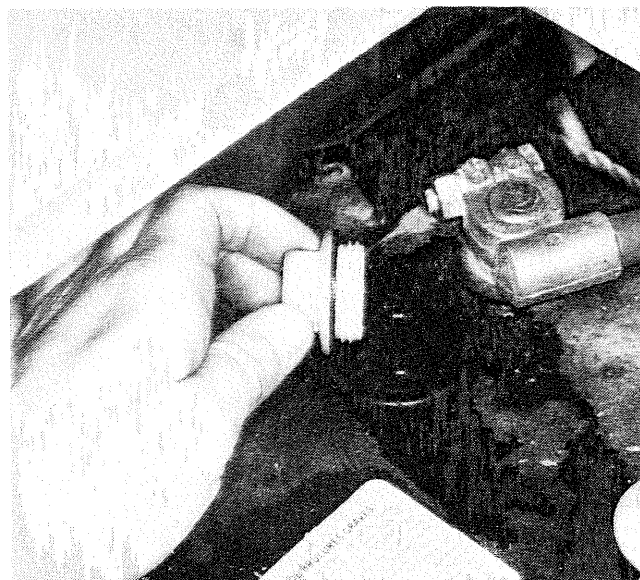


Fig 4-8

SP-10050

8. Check the battery electrolyte levels.

**WARNING:** DO NOT smoke while servicing the batteries. Batteries give off flammable gases.

If these checks reveal any problems or potential problems, make sure they are corrected before you start your work shift.

ALWAYS walk around the machine and make sure that no one is in the immediate area BEFORE you enter the operator's compartment.

**Normal Starting Procedure** (If temperatures are above 5°C (40°F).

**Test the power brake warning system as follows:**

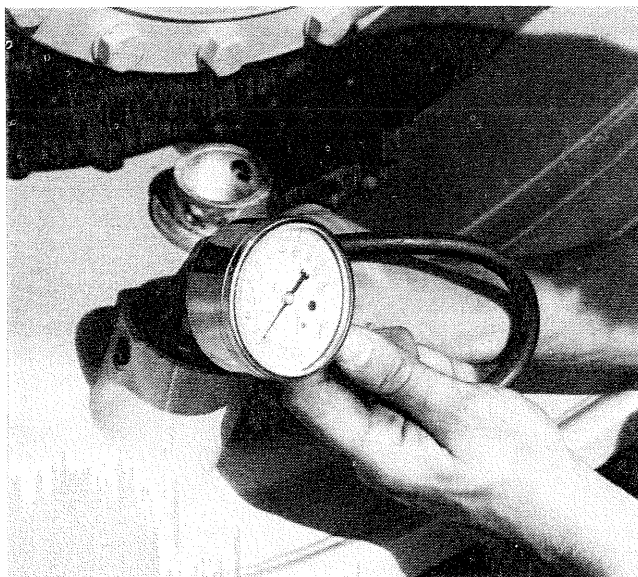


Fig 4-7

SP-10049

7. Check the tire pressures.

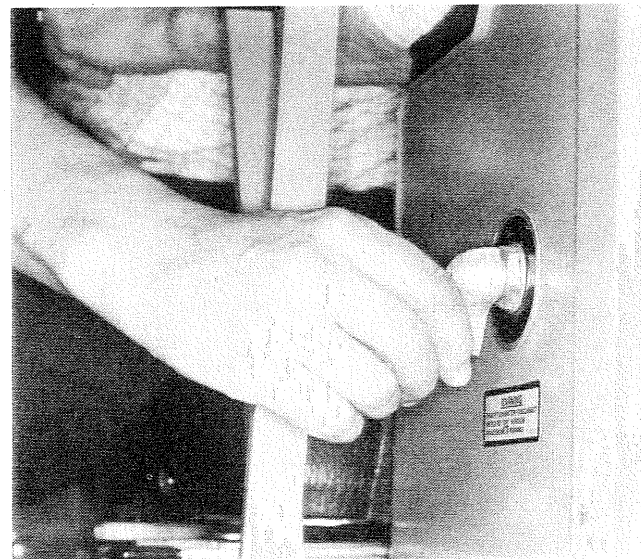


Fig 4-9

SP-10051

1. Turn the battery disconnect switch to the ON position.

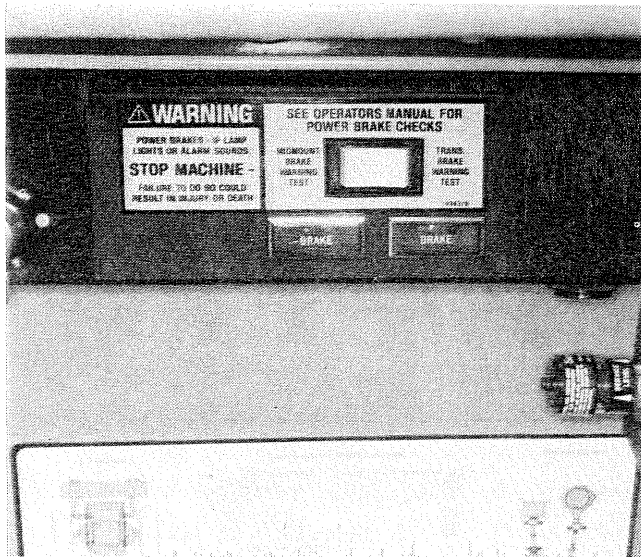


Fig 4-10

SP-10052

2. Turn the key in the ignition switch to the ON position (but do not start the engine) and check to see that both brake warning lights glow and the buzzer sounds.

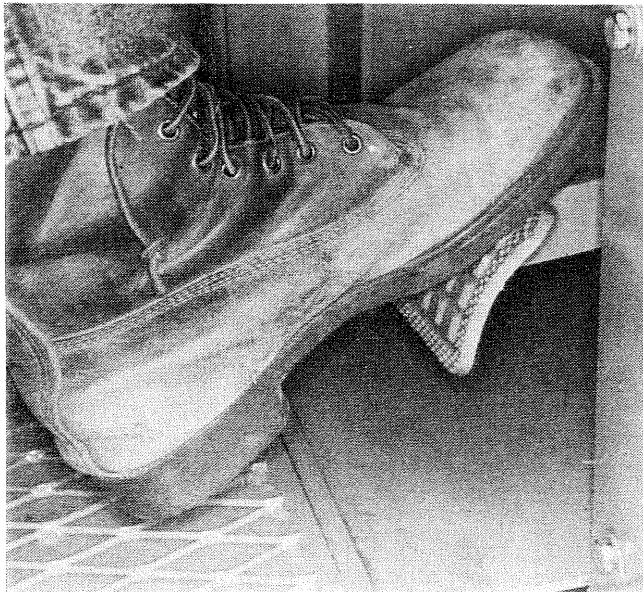


Fig 4-11

SP-10039

3. If the lights and the buzzer do not operate, apply and release the brake pedal several times (to discharge any brake pressure still in the accumulators) until the warning system is actuated.

**⚠ WARNING:** If the brake warning system does not work properly (both lights and the buzzer) the electrical wiring and connections should be checked and the fault repaired **BEFORE** you start the machine.

**IMPORTANT NOTE:** If the machine has been worked and shut down during a work shift, the warning system should be tested using the brake test switch with the ignition switch in the ON position (See Page 3-5/Fig. 3-18).

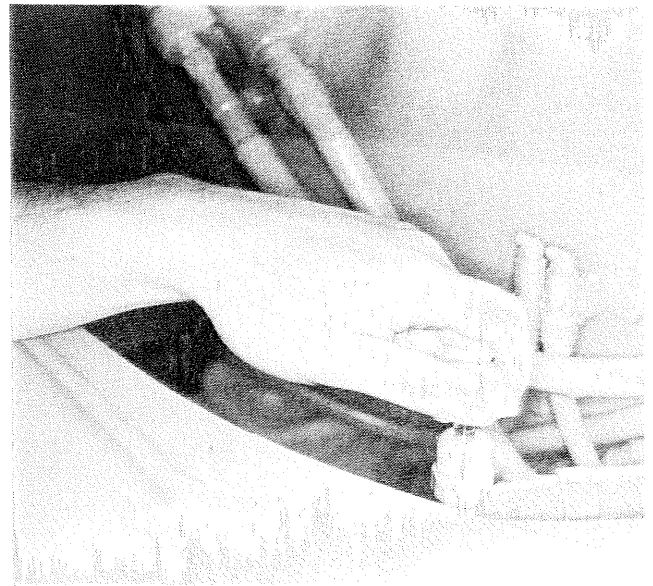


Fig 4-12

SP-10009

4. Turn the fuel shut-off valve to the ON position.

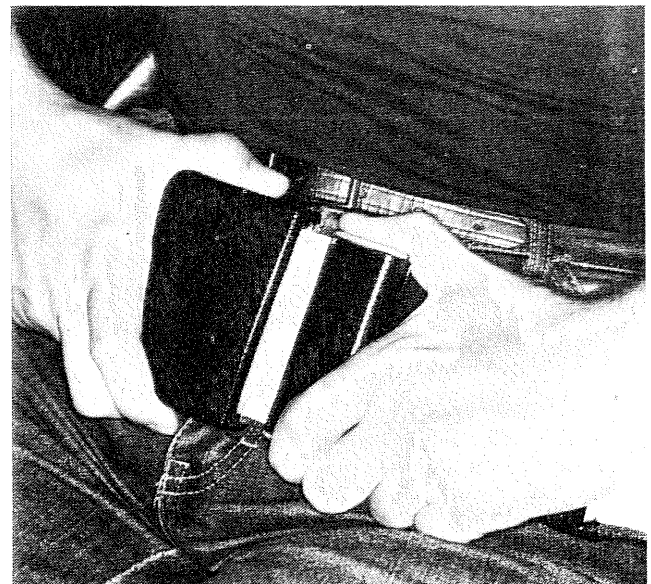


Fig 4-13

SP-10041

5. Fasten your seat belt.



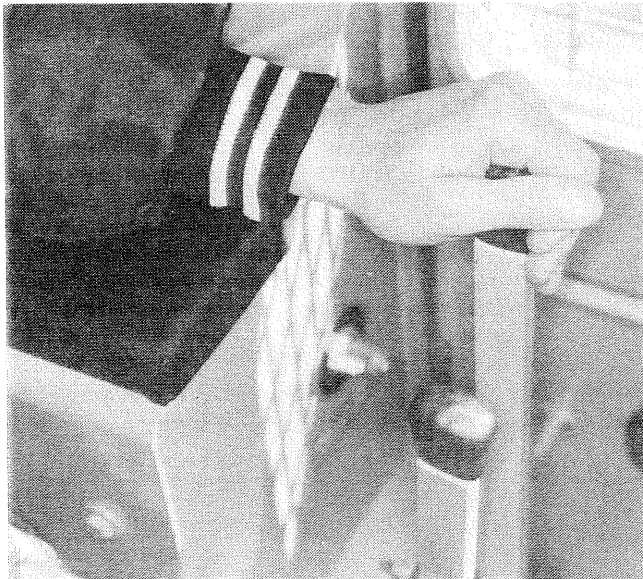


Fig 4-14

SP-10011

6. Put the Direction Control Lever in the NEUTRAL position.

**NOTE:** If the machine is equipped with a hand throttle, make sure that it is pushed in.

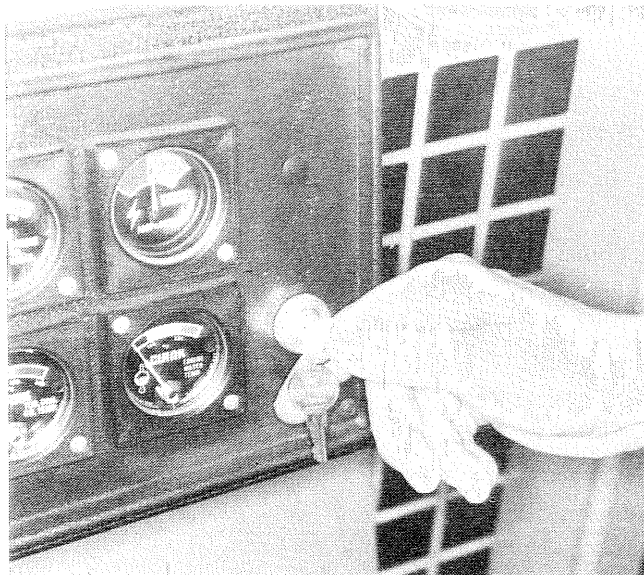


Fig 4-15

SP-10031

7. Turn the key in the ignition switch to the ON position (clockwise) to start the engine.

**IMPORTANT NOTE:** DO NOT actuate the starter for longer than 30 seconds if the engine fails to start promptly. Wait until the starter motor stops rotating before you repeat this step. Serious damage to the starter motor and the flywheel drive gear on the engine can result.

**WARNING:** DO NOT operate the machine until both brake warning lights go out and the buzzer stops. It can take up to 30 seconds to fully charge the brake system.

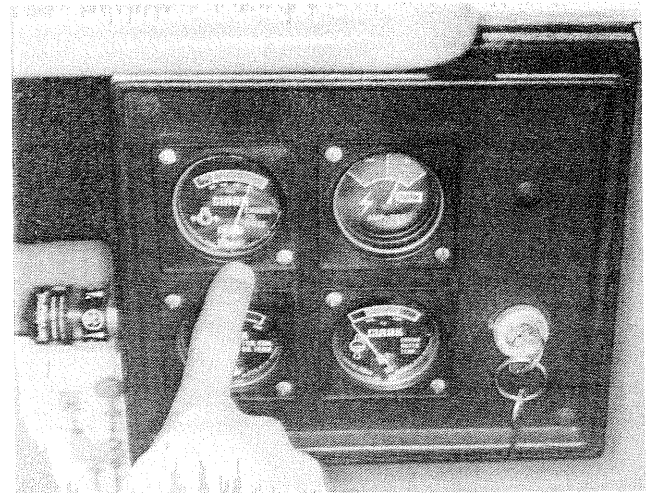


Fig 4-16

SP-10051

8. When the engine starts, release the ignition key and immediately check the engine oil pressure gauge. If no more than 10 PSI oil pressure is shown on the gauge after 15 seconds of operation, shut down the engine immediately and determine the cause.

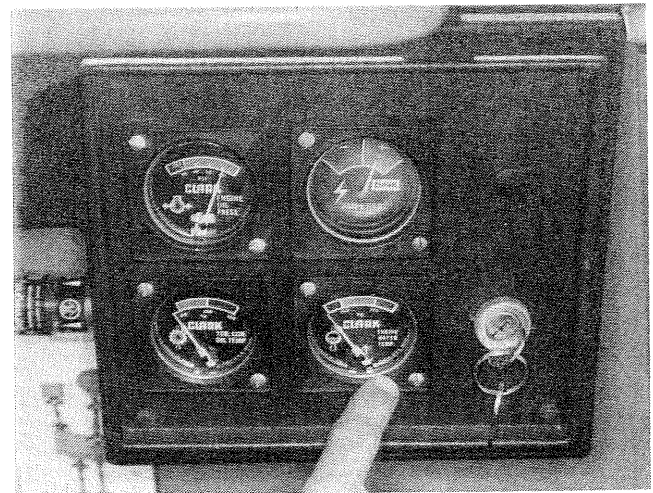


Fig 4-17

SP-10052

9. Allow the engine to reach its operating temperature before you operate the machine (See Sec. 1).

### Cold Weather Operation

Other than the use of a suitable low temperature motor oil and a suitable anti-freeze mixture in the cooling system, extensive preparation is not required for cold weather starts. For operation at temperatures below  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ), a change of oil in the main hydraulic system to the lubricant recommended in the lubrication chart will aid starting by reducing resistance in the main pump. Choose a good quality brand of winter diesel fuel. It may be necessary to change the lubricant in the drive axle planetary and differential housings (See Sec. 16). The most important item for cold weather starting is proper maintenance of the electrical system, especially the batteries. (See Sec. 14).



## OPERATING THE MACHINE

BEFORE you put the machine in motion, make sure that the steering frame lock has been removed and has been secured to the rear frame so the machine can be steered.

Remove all blocks from the tires.

Make sure all persons are clear of the immediate area.

Always fasten your seat belt.

Raise the blade (and grapple assembly) to its operating height.

Put the transmission in the desired direction and speed range positions.

Release the parking brake.

Depress the accelerator pedal to put the machine in motion.

Your **RANGER** Log Skidder employs a Clark power-shift transmission which allows a shift to a higher speed range even at full throttle. When shifting to a lower speed range, accelerate the engine to reduce the drag from the wheels.

As you move to the work area, take care to avoid any obstructions such as rocks and stumps that could cause the machine to upset. Check all gauges to see at a glance if all systems are operating correctly.

Pay attention to the surrounding terrain and notice if there is a quicker and easier way to return. Remember, the skidder will behave much differently with a load. The change in mobility may make it necessary to choose a different return route.

**IMPORTANT NOTE:** If you are about to operate the machine in conditions that will require good brake operation, the brake warning system should be tested with the test switch before proceeding (See Page 3-5/Fig. 3-18).

### Work The Cable Skidder As Follows:

When you enter the stump area, make a slow turn to see the best position to approach the logs with the least amount of effort and time. Avoid obstructions that can snag or tangle the load.

Put the direction control lever in the NEUTRAL position, apply the neutral lock latch, lower the blade and apply the parking brake.

**NOTE:** Your machine is equipped with a parking brake DE-CLUTCH mechanism that disengages the transmission when the parking brake lever is applied.

Put the winch control lever in the FREE-SPOOL position.

Remove your seat belt and dismount from the operator's compartment

Go to the rear of the machine and pull the mainline and chokers from the winch cable drum to the ends of the logs to be skidded.



**WARNING:** When handling winch cables, ALWAYS use protective gloves.

Attach the chokers to the logs about 60 cm (24 in) from the ends and pull them snug.

**NOTE:** The size and number of logs you can skid at one time depends on the terrain and conditions in which you are working and on the nature of the wood itself. Only experience and common sense can tell you the load you should skid at one time.

With the chokers secured, remount the skidder and fasten your seatbelt.

Before you pull in the logs, make sure that the machine is in line with the general direction of the logs' travel.

Lift the blade and release the parking brake.

Put the winch control lever in the WINCH-IN position, and pull the logs towards the rear of the machine. Remember, the speed of the cable drum is controlled by the engine RPM, so accelerate the engine to increase the speed of the mainline. As the logs move, they will be bunched together. Make sure the logs are bunched tightly and pull them snug against the butt pan. Put the winch control in the LOCK position and return to the landing.

As you approach the landing, make sure to watch for co-workers in your path and advise them to stand clear.

### Winching Techniques:

**Bunching:** When the logs are winched-in to the butt pan, they will bunch together. Increasing the speed of the mainline can help pull the load easier over obstructions but you must use common sense to avoid breaking the cable(s) on large stumps and rocks, or even overturning the machine. Bunching can be done with the machine in motion if necessary. This can help to bunch the logs under certain conditions.

**Drop-Winching:** If the skidder loses traction due to soft or muddy underfooting, or due to obstructions, quickly put the winch control lever in the FREE-SPOOL position and drive the machine to more stable or clear ground. Remember not to exceed the length of your mainline. When the machine is on safe ground, winch-in the load, put the winch control lever in the LOCK position and proceed to the landing.

**Reverse-Winching:** If the machine becomes stuck and cannot be freed in either direction, fasten the winch cable to a large tree or similar stationary object and with the direction control lever in the REVERSE position, winch in the cable under power to free the machine. The Clark powertrain will provide equal power to the winch and drive axles and provide uniform speed to the mainline and the wheels.

Once you have reached the landing, pull the logs onto the pile and while still moving forward, put the winch control lever in the FREE-SPOOL position when the logs are piled correctly.

Put the direction control lever in the NEUTRAL position, and apply the neutral lock lever. Apply the parking brake, lower the blade to the ground, unfasten your seatbelt, and dismount from the machine.

Pull the mainline from the cable drum so that the chokers are loose enough to remove easily.

**IMPORTANT NOTE: Remember your gloves.**

After you have removed all of the chokers, remount the skidder and fasten your seatbelt.

Put the winch control lever in the WINCH-IN position and pull in the mainline until the chokers are just on the fairlead mainroller.

Release the parking brake lever, and raise the blade. Position the machine so that the butts of the logs can be evenly piled with the blade.

If you are to make a pile (decking), approach the pile in first gear, so that the most amount of power possible can be supplied to the hydraulic system to ensure adequate lifting with the blade, and pile the logs evenly.

Make periodic checks to see that the mainline and chokers are in good working condition. If they are worn or damaged they could break under stress and cause serious bodily injury to yourself or your co-workers. Replace badly worn or damaged cables promptly.

**Work the Grapple Skidder As Follows:**

Observe all safety precautions given for the cable skidder and remember, ALWAYS use your seatbelt.

As with the cable skidder, make note of the surrounding terrain and look for the easiest route back to the landing.

With the transmission in the REVERSE mode, approach the log pile with the grapple in its highest position and the grapple arms open.

Lower the grapple so that it contacts the logs about 1 meter (3 feet) from the ends so that it will not lose any logs that are not evenly bunched. Make sure that the grapple is centered on the pile and put the transmission in the NEUTRAL mode. Apply the parking brake.

**NOTE: Your machine is equipped with a parking brake DE-CLUTCH mechanism that disengages the transmission when the parking brake lever is applied.**

Close the grapple arms while accelerating the engine to allow sufficient power to the hydraulic system to roll the logs into a neat, compact bundle.

When the grapple arms have closed on the bundle, put the grapple control lever in the central neutral position. All Grapple machines are equipped with a grapple AUTOMATIC GRIP CONTROL system. Put the grapple control lever in the center A.G.C. detent position to actuate the system and provide a periodic pulse of hydraulic pressure to the grapple cylinder(s) if the load should shift during travel or if the system pressure should drop due to internal leakage.

Before you proceed to the landing, move the load forward to the butt pan of the machine. The load should be lowered if you travel down a steep grade, especially when turning. The load should be carried as high as possible in muddy areas and when you approach the landing.

If you are to add to a pile, move along the side of the pile with the grapple in its highest position. When the load is just past the butts of the existing logs in the pile, put the transmission in the REVERSE mode and back the load onto the pile.

Open the grapple arms and release the load on the pile. Drive forward away from the pile and close the grapple arms. Put the grapple as close to the rear of the machine and as low as possible and return to the stump area for another load.

Remember, your grapple skidder has a Clark winch and equipped with a winch cable you can perform the same winching techniques described earlier in this section as the needs arise.

**IMPORTANT NOTE: When shutting down the machine it is important to let the engine idle for at least three minutes to allow proper cooling before shut-down.**

## ENGINE SYSTEMS

**NOTE:** Check the Cummins Diesel Engine Operator's Manual for further lubrication and maintenance instructions for the engine and its accessories.

**Every 10 Hours of Operation:**

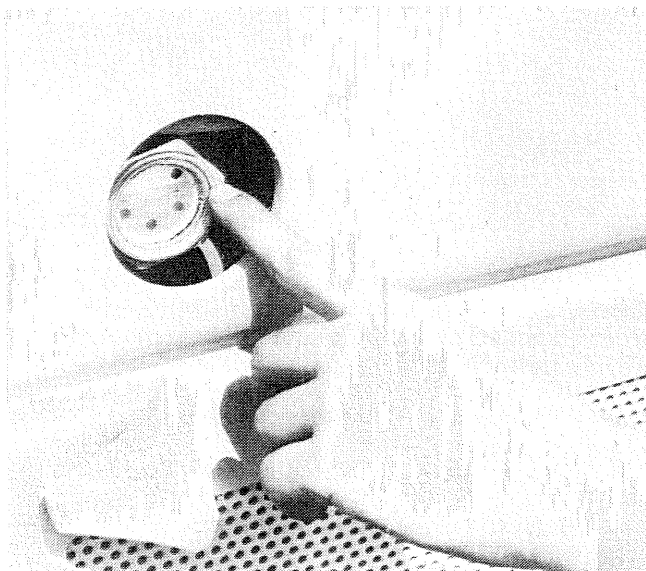


Fig 6-1

SP-10047

Check the coolant level at the sight gauge on the right hand frame rail at the surge tank.

**NOTE:** The cooling system of your **RANGER** Log Skidder is factory-filled with permanent anti-freeze. The factory recommends the use of this coolant for improved cooling, low temperature protection and to reduce corrosion.

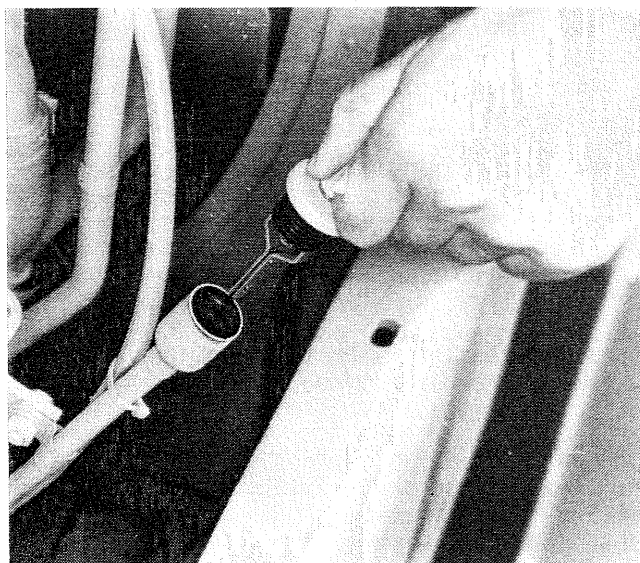
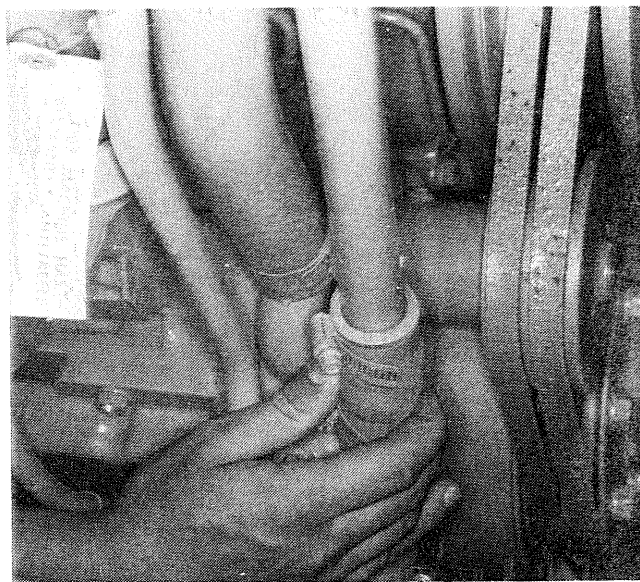


Fig 6-2

SP-10044

Check the engine lube level on the crankcase dipstick on the side of the engine and add oil as required.

**Every 50 Hours of Operation:**



SP-10053

Fig 6-3

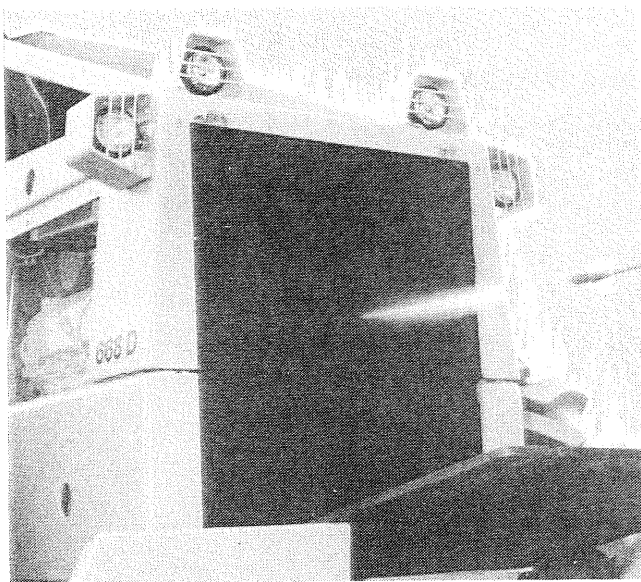
Check the cooling system for leaks. Inspect the radiator core as well as all hoses, clamps and fittings in both the engine cooling system and the transmission/converter oil cooler at the bottom of the radiator assembly. Clean the radiator if necessary.



SP-10054

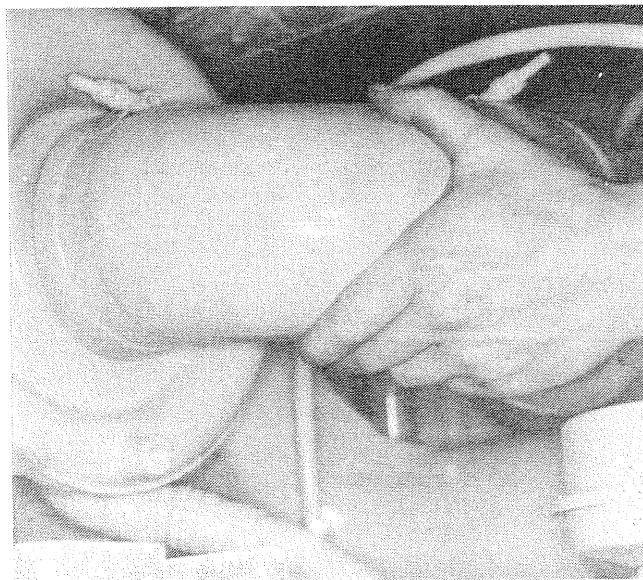
Fig 6-4

Check the freezing point of the coolant with an anti-freeze hydrometer. If the freezing point is not low enough to protect the engine, drain some of the coolant (if the surge tank is full) and add anti-freeze to lower the freezing point. The factory recommends the use of a solution of equal parts of Ethylene Glycol and water for maximum protection.

**Every 100 Hours of Operation:****Fig 6-5**

SP-10055

Steam clean the radiator core. Direct the steam jet in the opposite direction to the flow of air from the fan. A clogged radiator can cause overheating due to the restricted air flow.

**Fig 6-6**

SP-10056

Check the condition of the flexible tubes between the air cleaner and the engine air intake. If they are cracked or show signs of leakage, they must be replaced to prevent dirt from entering the engine. Check all intake connections for leaks and tighten clamps where required. If the air cleaner assembly is loose, tighten the mounting bolts.

**Fig 6-7**

SP-10057

Check the condition of the alternator belt. If it is worn, cracked or shows signs of glaze or grease, it should be replaced.

**Every 250 Hours of Operation:****Check the engine RPM specifications (See Sec. 15):**

Use the tachometer to check the low and high idle RPM with no load on the engine.

**IMPORTANT NOTE: DO NOT accelerate the engine to its maximum RPM until it has reached its operating temperature (See Sec. 1).**

Check the converter and hydraulic stall RPM to ensure that the engine is developing its rated power. The oil in the transmission/converter system should be at its operating temperature (See Sec. 1) and the main hydraulic relief setting should be correct (See Sec. 10).

1. Put the direction control lever in the NEUTRAL position, engage the neutral lock mechanism and block the tires. Do not actuate the parking brake.
2. Follow the engine, converter and hydraulic system warm-up procedures in Sec. 1.
3. Put the transmission control levers in the FORWARD and THIRD speed range positions and fully depress the service brake pedal.
4. Accelerate the engine to full throttle and record the maximum tachometer reading - this is the converter stall RPM.

**IMPORTANT NOTE: DO NOT HOLD the engine/converter in this stall condition for more than 30 seconds or if the reading on the converter temperature gauge enters the red zone.**

5. Raise the blade and hold the blade control lever in its raised position with the converter stalled and the parking brake OFF and record the maximum tachometer reading - this is the hydraulic stall RPM.



Compare the stall speed readings of your machine with the readings in Sec. 15. If your readings are not within the allowable readings, further troubleshooting will be required. See your **RANGER** dealer.

### Check the drive belt tension as follows:

Use a belt tension gauge (Cummins Diesel No. ST-1274) to check the engine drive belt tension. The correct Fan Drive belt tension is 49,9 to 52,2 kg (110 to 115 lb). The correct Alternator Drive belt tension is 36,3 to 45,4 kg (80 to 100 lb). Where drive belt sets are used, the belt tension given is for each belt.

**NOTE:** Drive belts must be replaced in sets to ensure an even distribution of load. New belts should be installed to a tension of 63,5 to 68,0 kg (140 to 150 lb) and then the engine should be operated for ten minutes because the new belts will stretch. After ten minutes of operation, the belt tension should be rechecked and adjusted to the correct value if necessary.

Check the throttle linkage to see that all levers, rods and bell cranks operate freely in all positions to ensure that the accelerator pedal fully controls the engine throttle. Adjust the linkage as follows:

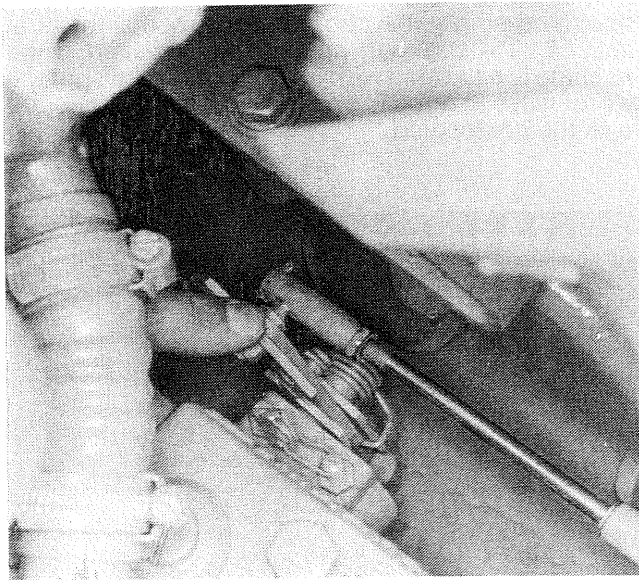


Fig 6-8

SP-10058

1. Unhook the spring from the accelerator linkage and disconnect the clevis from the throttle lever.
2. Have a helper hold the accelerator pedal to the pedal stop on the floorboard.
3. Turn the throttle lever fully clockwise (to its full throttle position).
4. Adjust the ball joint on the end of the accelerator rod until the threaded part aligns with the hole in the throttle lever (with no force required). Further adjustment is available at the other end of the accelerator rod.
5. Reconnect the ball joint to the throttle lever and check the movement of the linkage.

### Every 500 Hours of Operation:

### Service the Air Cleaner Elements as Required:

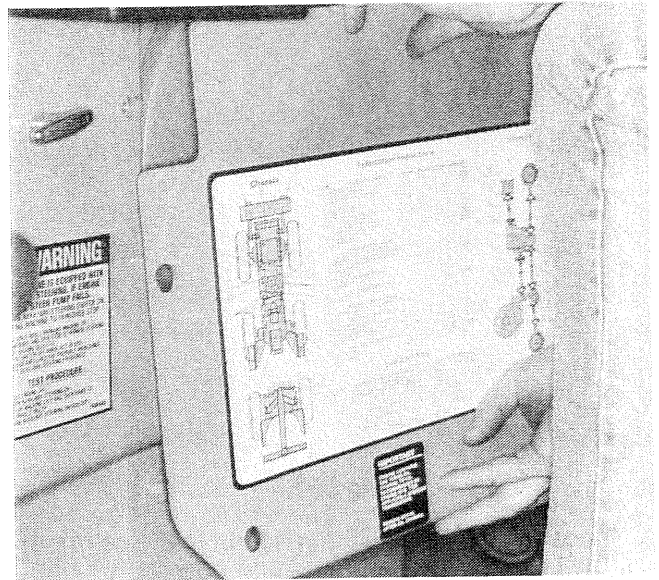


Fig 6-9

SP-10059

When the red flag appears in the air service indicator the air cleaner elements should be serviced. Locate the air cleaner assembly inside the engine compartment in front of the firewall.

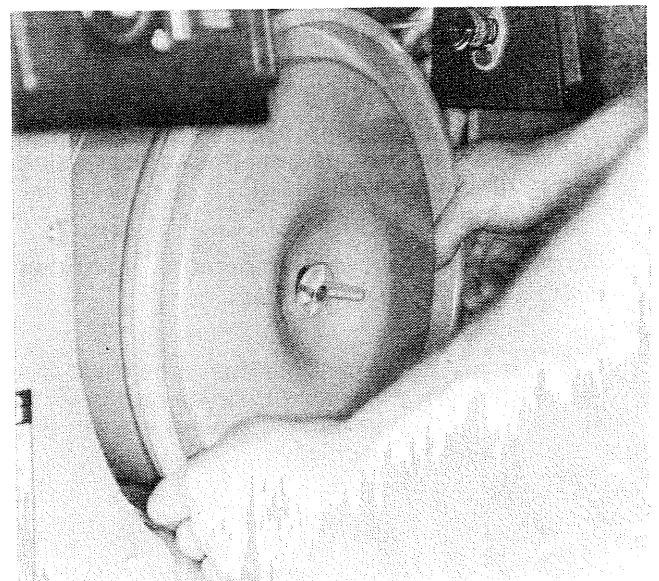


Fig 6-10

SP-10060

1. Loosen the wing nut on the end of the air cleaner assembly and remove the end cap.

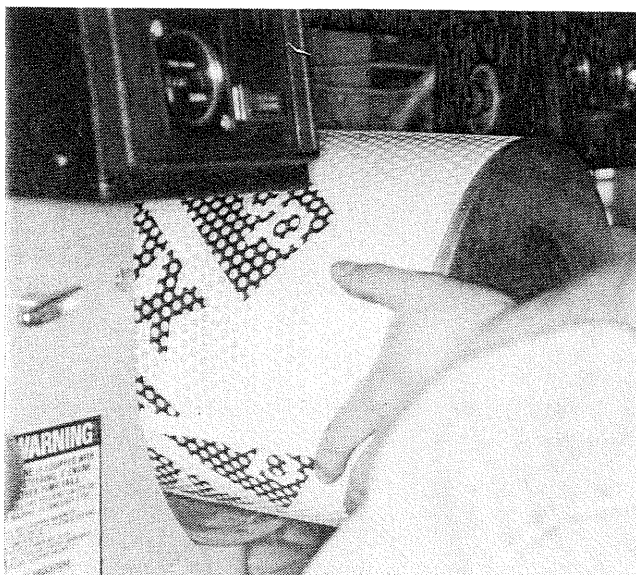


Fig 6-11

SP-10061

2. Loosen and remove the wing nut in the centre of the primary filter element and remove the filter element from the air cleaner body.
3. Use compressed air (690 kPa/100 PSI maximum) to remove dirt particles from the element. Direct the air from the inside of the element.
4. Wash the PRIMARY element in a non-sudsing detergent for about 15 minutes.

**IMPORTANT NOTE: DO NOT** wash the safety filter element (left inside the air cleaner body). Replace the safety element when the primary element is washed for the third time or if the primary element ruptures. Replace the primary element after six cleanings or 2000 Hours of Operation, more often if required.

5. Rinse the element with warm tap water from inside, then the outside until the water passing through the element is clean.
6. Air dry the element at a temperature no higher than 70°C (160°F).
7. Shine a bright light from the inside of the element and check it for pin holes, ruptures or thin spots. If any of these conditions exist, the element should be replaced.
8. Clean the filter case thoroughly, removing all foreign matter.
9. Re-install the element into the air cleaner body, position the end cap correctly and install the clamp snugly.

### Every 1000 Hours of Operation:

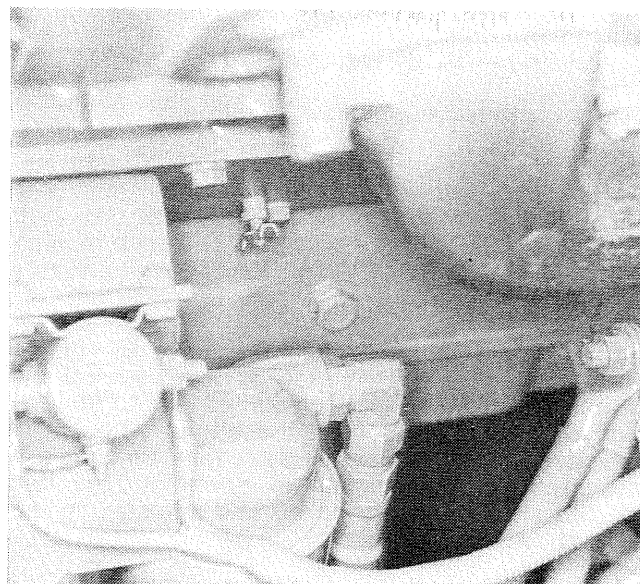


Fig 6-12

SP-10062

Drain and flush the engine cooling system. Open the draincocks at the bottom of the radiator and engine block and empty the coolant into a container of at least 55 l (14 U.S. gal) and flush the system. If the machine is equipped with an optional heater, put the heater valve in the ON position to drain the coolant from the heater also.

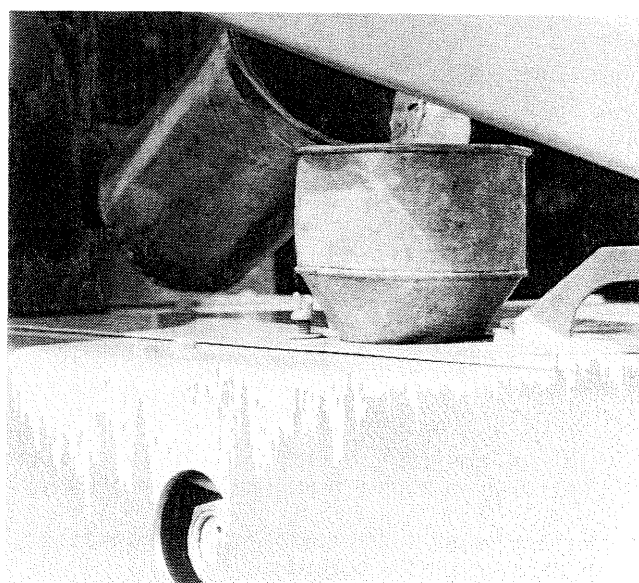


Fig 6-13

SP-10063

Close the draincocks and fill the cooling system until the correct level is reached.

**NOTE: Operate the engine until the coolant becomes warm enough to open the thermostat, shut down the engine and recheck the level.**

See Every 10 Hours of Operation in this section for information on anti-freeze.

## FUEL SYSTEM

**IMPORTANT NOTE:** DO NOT attempt to adjust the fuel controls on the engine. They are factory calibrated and should only be adjusted by a qualified mechanic.

### Every 10 Hours of Operation:

Refill the fuel tank as required AND at the end of each work shift. The fuel tank filler is located on the fuel tank behind the winch. Make sure the area around the filler hole is clean before removing the cap. If the strainer screen is clogged or dirty, clean it in a solvent and blow dry with compressed air.

**WARNING:** DO NOT smoke while refueling.

**IMPORTANT NOTE:** Use only clean fuel to prevent engine damage.

**NOTE:** The factory recommends the use of #2 diesel fuel. Refill the tank after each work shift to prevent condensation in the fuel tank.

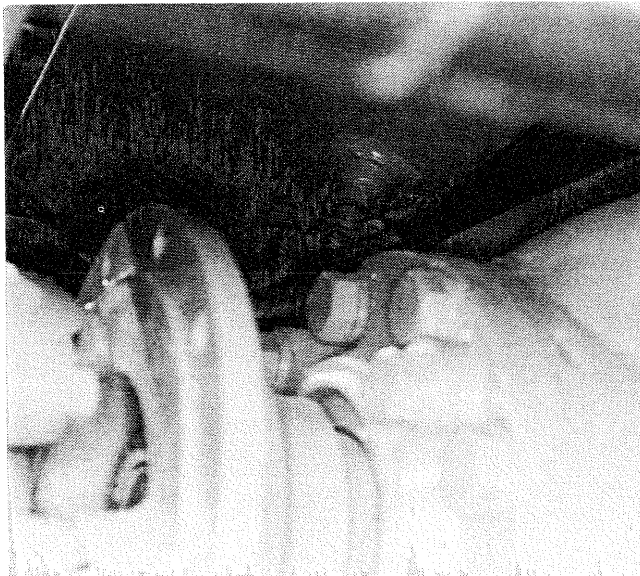


Fig 7-1

SP-10064

Before each work shift, open the draincock on the bottom of the fuel tank and drain sufficient fuel to remove any sediment and water. When clean fuel begins to flow, close the draincock.

**WARNING:** Drain fuel into an appropriate container and dispose of it in a safe place.

### Every 50 Hours of Operation:

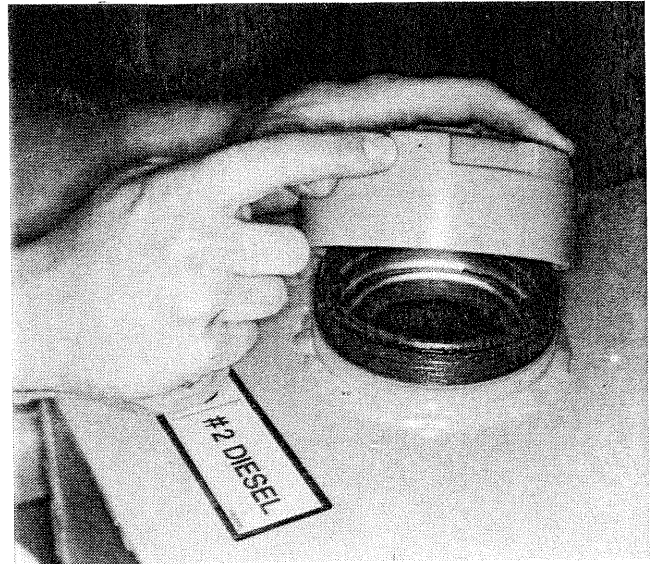


Fig 7-2

SP-10065

Remove the fuel filler cap and check to see that the vent hole is free from obstruction. Clear the hole if it becomes plugged.

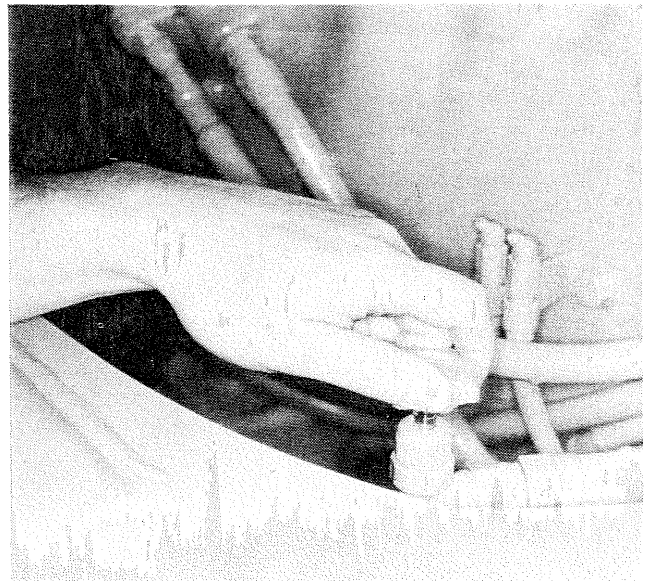


Fig 7-3

SP-10009

**IMPORTANT NOTE:** Your machine is equipped with a fuel line shut-off valve on the right hand side of the fuel tank. Use this valve in case of fire or if the fuel tank must be removed.

### Every 1000 Hours of Operation:

Drain the fuel tank (See Fig 7-1). Do this at the end of a shift or when the tank is almost empty. When the fuel has drained, remove the cover at the bottom of the tank and clean the magnet.

**NOTES**



## TRANSMISSION/CONVERTER SYSTEM

Every 10 Hours of Operation:

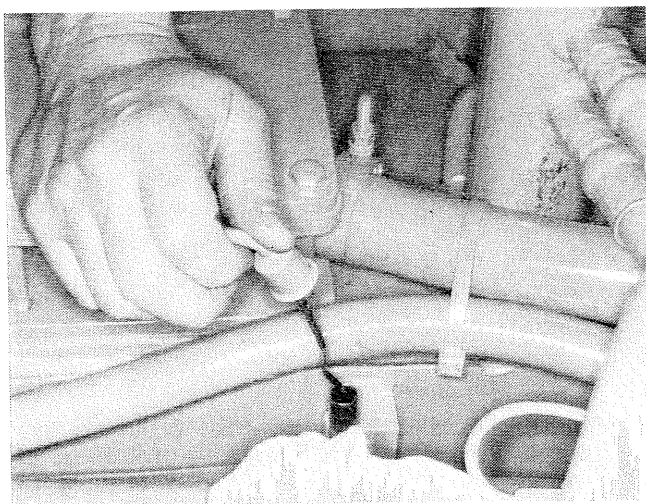


Fig 8-1

SP-10066

Check the fluid level in the system with the transmission/converter dipstick located under the floorboard between the transmission case and the hydraulic reservoir.

**IMPORTANT NOTE:** When you do this check, the engine should be running and the battery disconnect switch and fuel shut-off valve must be in their ON positions but the machine must otherwise be in the Service Position (See Sec. 2). The fluid in the system must be at its Operating Temperature (See Sec. 1).



Fig 8-2

SP-10067

If the level on the dipstick is low, add Approved Automatic Transmission Fluid to the filler hole on top of the transmission until the correct level is reached.

**IMPORTANT NOTE:** The factory recommends the use of DEXRON II Automatic Transmission Fluid to fill this system.

Every 250 Hours of Operation:



Fig 8-3

SP-10068

Remove the breathers on top of the transmission and converter housings, wash them in a solvent, blow dry with compressed air and re-install the breathers. The transmission has a two-way and the converter has a one-way breather.

**Check the transmission/converter pressures with the oil in the system at its Operating Temperature (See Sec. 1) as follows:**

**NOTE:** These checks should also be performed if the system overheats or if the machine does not perform properly.

**NOTE:** DO NOT apply the service brake pedal during these tests or accurate readings cannot be obtained.

**Check the converter IN pressure:**

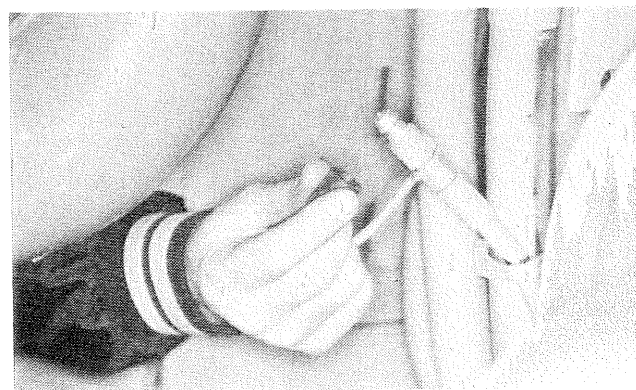
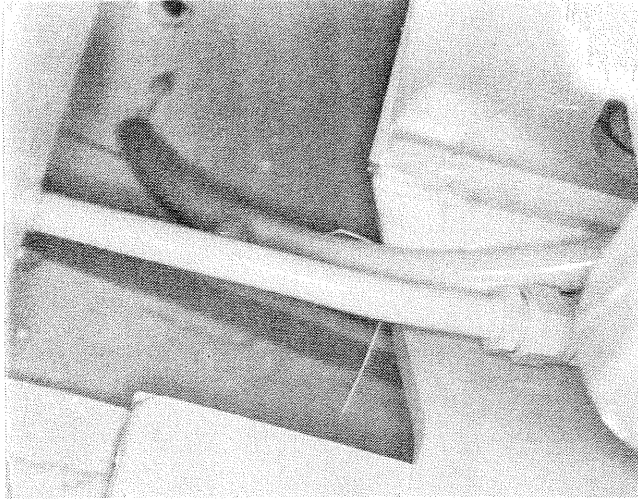


Fig 8-4

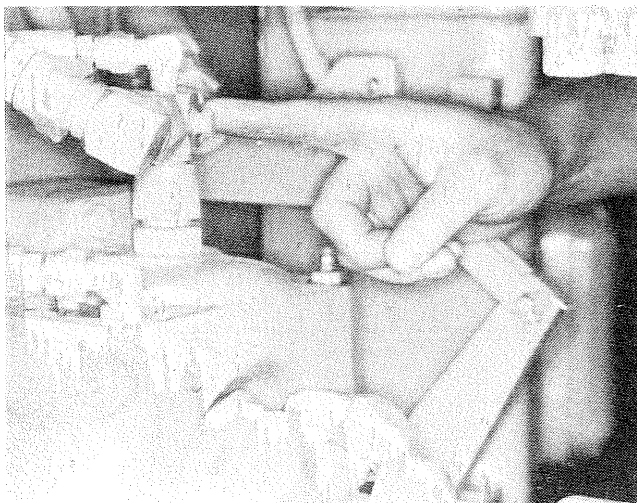
SP-10069

1. Connect a 1.000 kPa (150 PSI) pressure test gauge to the converter IN pressure port on the hose on top of the transmission.
2. With the engine operating at full throttle but the machine otherwise in the Service Position (See Sec. 2), record the reading on the gauge. The pressure reading should be no more than 825 kPa (120 PSI).

**Check the converter OUT pressure:****Fig 8-5**

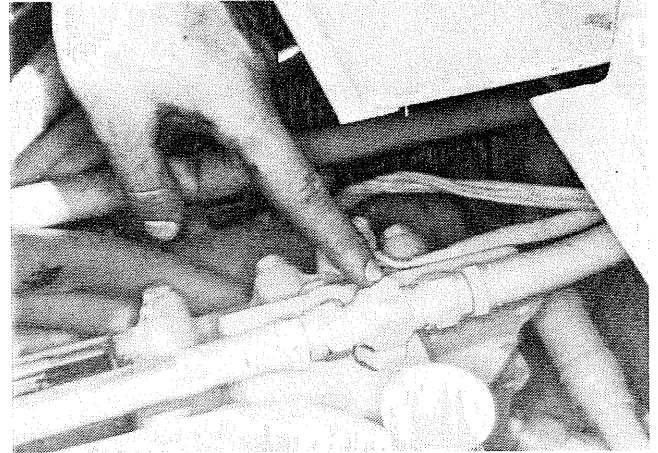
SP-10070

1. Connect the test gauge to the converter OUT pressure port on the oil cooler supply line on the left hand side of the engine.
2. With the engine operating at 2,000 RPM but the machine otherwise in the Service Position (See Sec. 1), record the reading on the gauge. The pressure reading should be 170 kPa (25 PSI).
3. Increase the engine RPM to full throttle and record the reading on the gauge. The pressure reading should be no more than 480 kPa (70 PSI).

**Check the system lube pressure:****Fig 8-6**

SP-10071

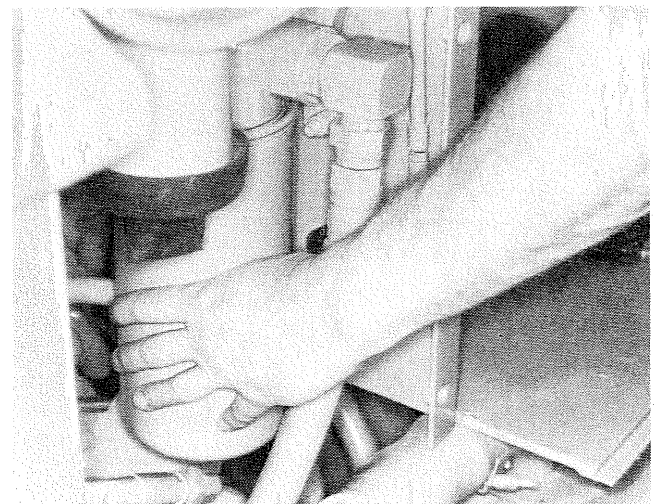
1. Connect the test gauge to the system lube pressure port on the T-connector on top of the hydraulic brake housing.
2. With the engine operating at 2,000 RPM but the machine otherwise operating in the Service Position (See Sec. 1), record the reading on the gauge. The pressure reading should be 105 to 170 kPa (15 to 25 PSI).

**Check the transmission/winich clutch pressure:****Fig 8-7**

SP-10072

1. Connect a 2,000 kPa (300 PSI) pressure test gauge to the clutch pressure port on the top of the transmission.
2. With the engine operating at low idle RPM but the machine otherwise in the Service Position (See Sec. 2), record the readings on the gauge in ALL speed ranges, both forward and reverse, and all winch operations. The pressure readings should be 1.655 to 1.930 kPa (240 to 280 PSI) with no more than 35 kPa (5 PSI) difference between the readings.

If any of the above transmission/converter pressure readings are not within the acceptable limits, contact your **RANGER** distributor for further troubleshooting.

**Every 500 Hours of Operation:****Replace the transmission/converter filter element:****Fig 8-8**

SP-10073

Replace the transmission/converter filter element. This element must also be replaced whenever the converter pump, transmission, converter or winch is repaired or overhauled. Remove the existing filter element with a filter band wrench and discard it.

Lightly oil the gasket on a new filter element with Approved Automatic Transmission Fluid and install the element into the filter housing. Tighten the element to a torque of 27 to 34 N.m (20 to 25 lbf.ft) taking care not to damage the filter case.

Clean the filter base casting thoroughly and install the new replacement filter element and a new case gasket.

Use only a Genuine Clark replacement filter element. The use of elements other than those supplied or approved by the Clark Michigan Company can interfere with the proper operation of the system.

Operate the engine for five minutes at 1500 RPM and check the gasket for leaks using a piece of cardboard. Check the fluid level in the system and add fluid as required.

## Every 1000 Hours of Operation:

Drain the transmission/converter system. This should also be done if the converter pump, transmission, converter or winch is repaired or overhauled. Bring the oil in the system to its Operating Temperature (See Sec. 1). Hot oil runs more freely and carries more foreign material than cold oil. Drain the system as follows:

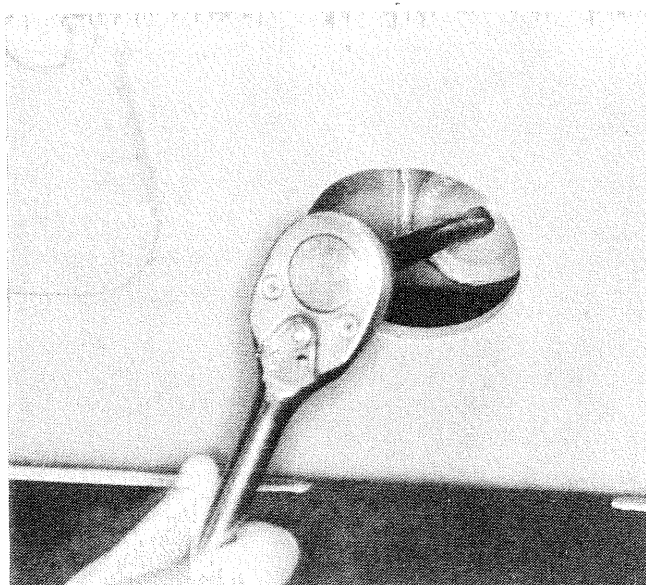


Fig 8-9

SP-10074

1. With the machine in the Service Position (See Sec. 1), remove the drain plug and sump screen from the rear of the transmission housing and drain the oil in the sump into a container of at least 40 l (10.6 U.S. gal). Clean the sump screen in a solvent and blow dry the screen with compressed air and install the screen, a new gasket, and the drain plug.

**NOTE:** If the screen is damaged, it should be replaced.

2. Overfill the system with Approved Automatic Transmission Fluid.



Fig 8-10

SP-10075

3. Disconnect the return oil cooler line from the oil cooler assembly. Direct the end of the hose into a container of at least 20 l (5 U.S. gal).
4. Start the engine and flush the system at low idle RPM until approximately 18 l (4.8 U.S. gal) has been drained or until clean oil flows from the hose.

**IMPORTANT NOTE:** DO NOT operate the engine for more than 60 seconds with the oil cooler disconnected or serious damage to the transmission/converter unit can result.

5. Reconnect the oil cooler line. Bring the oil in the system to the correct level and check the connections for leaks with a piece of cardboard.

**IMPORTANT NOTE:** NEVER use flushing oil or compounds to clean this system. Use only Approved Automatic Transmission Fluid.

Check and adjust the transmission control linkage:

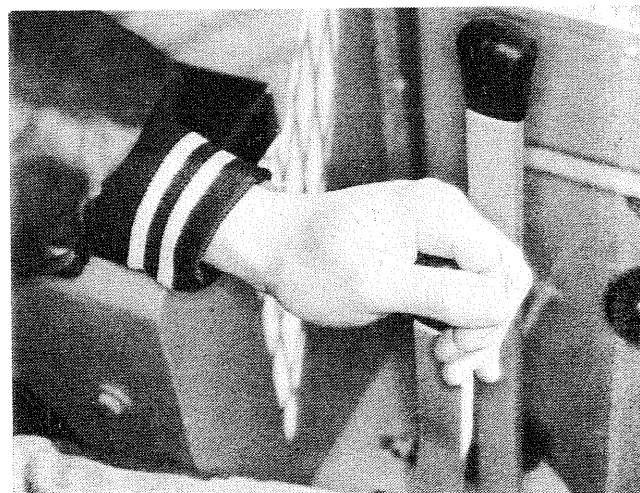


Fig 8-11

SP-10012

Operate the transmission control levers to see that all parts move freely. Check all rods, bell cranks, and ball joints for wear and damage and repair if necessary.

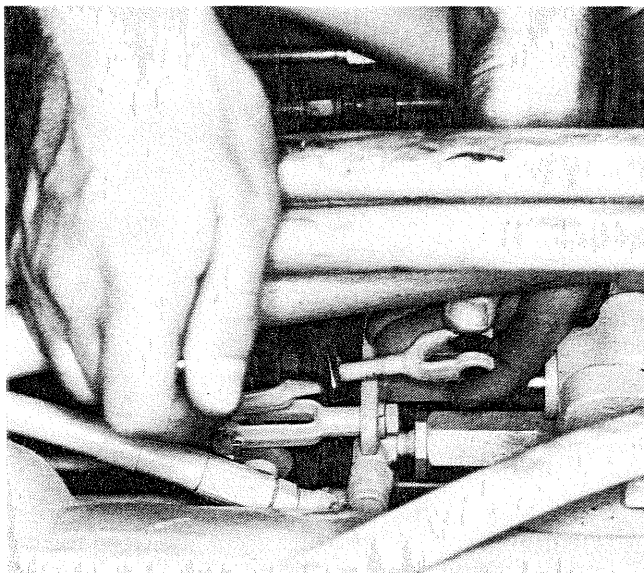


Fig 8-12

SP-10076

1. With the direction control lever in the NEUTRAL position and the speed range control lever in SECOND remove the cotter pins from the linkage at the transmission control valve, loosen the locknuts and adjust the clevises until the holes in the clevises and the holes in the control valve spools align.
2. Install the clevis pins and new cotter pins and recheck the operation of the levers. Both levers should go into all detent positions without interference.



## CLARK WINCH

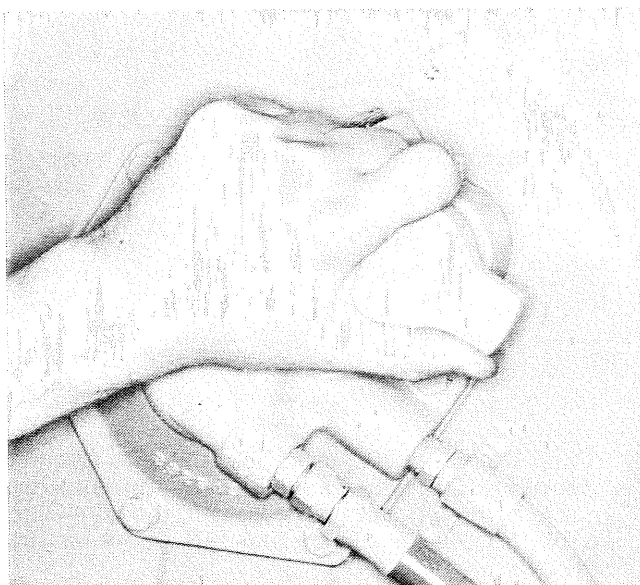
**Every 100 Hours of Operation:**

Fig 9-1

SP-10077

Check the operation of the winch free-spool drag adjustment. If the operation of the free-spool provision is unsatisfactory, loosen the lock-screw on the free-spool adjusting handle and turn the handle clockwise to increase the tension or counterclockwise to decrease the tension.

**Every 250 Hours of Operation:**

Fig 9-2

SP-10078

Remove the breather on top of the winch housing, to the left of the winch cable drum. Clean the breather in a solvent, blow dry it with compressed air and reinstall it on the winch. The winch has a one-way breather.



Fig 9-3

SP-10079

Check the condition of the wear button. Remove the lock-screw, spring and lock button from the free-spool adjustment provision.

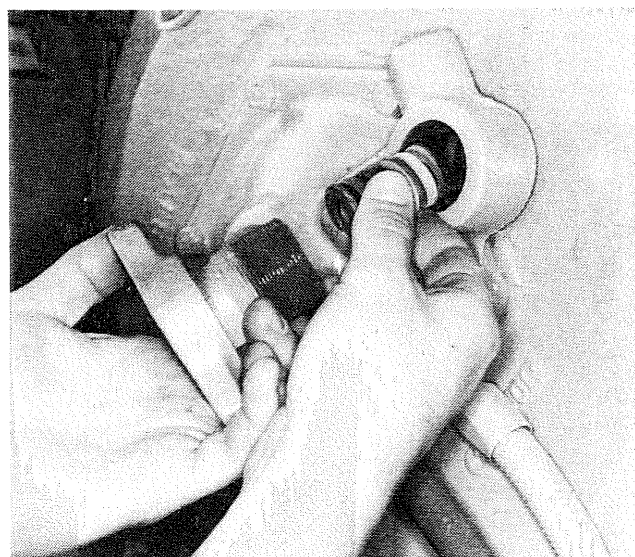


Fig 9-4

SP-10080

Remove the adjusting handle, spring and wear button to check its condition.

**IMPORTANT NOTE:** See your Clark Winch Maintenance and Service Manual for all troubleshooting and overhaul instructions. **DO NOT** attempt to disassemble or make any repairs to the inside of the winch before **FIRST** reading and understanding the instructions in the manual.

**NOTE:** The winch hydraulic system is integral with the transmission/converter system. Anytime the winch is overhauled, the transmission/converter/winches hydraulic system will have to be drained and refilled.



## Installing the Winch Cable:

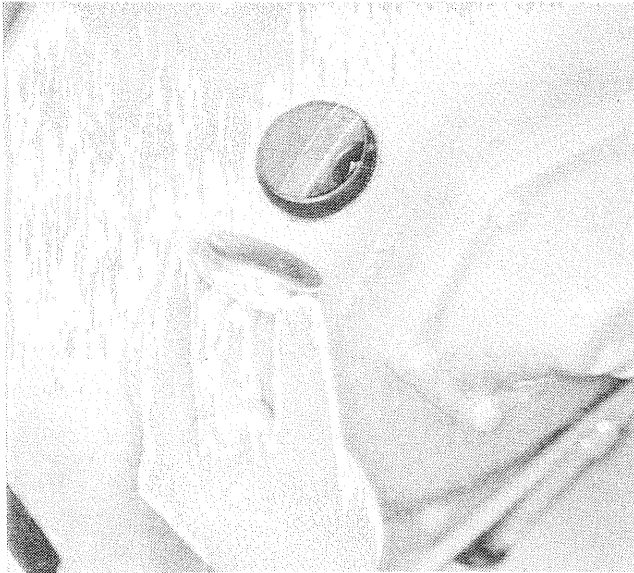


Fig 9-5

SP-10120

1. Remove the access plug from the upper right hand side of the winch housing.

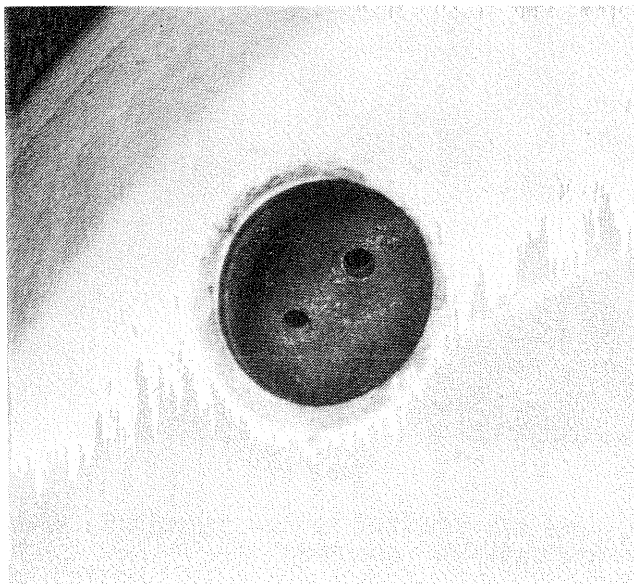


Fig 9-6

SP-10081

2. Put the winch control lever in the FREE-SPOOL position and rotate the cable drum until the cable anchor wire holes are seen through the access hole. Put the lever in the center LOCK position and return the machine to the Service Position (See Sec. 2).
3. Choose a gauge of anchor wire that will insert in the holes and install both ends of the wire through the holes. Install the access plug.

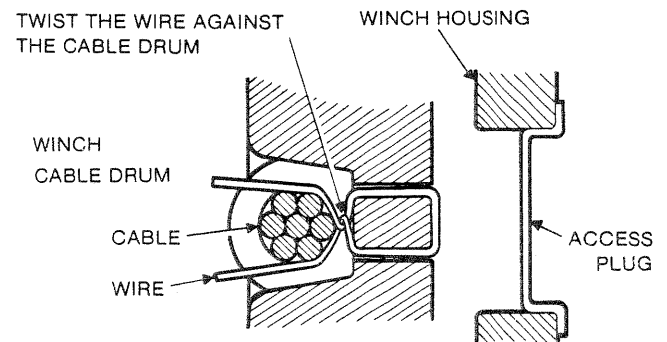


Fig 9-7

SP-10082

4. Twist the wire ends to tighten the wire against the cable drum and install the mainline in the cable groove between the ends of the wire. The cable ferrule should be inserted in the ferrule groove.

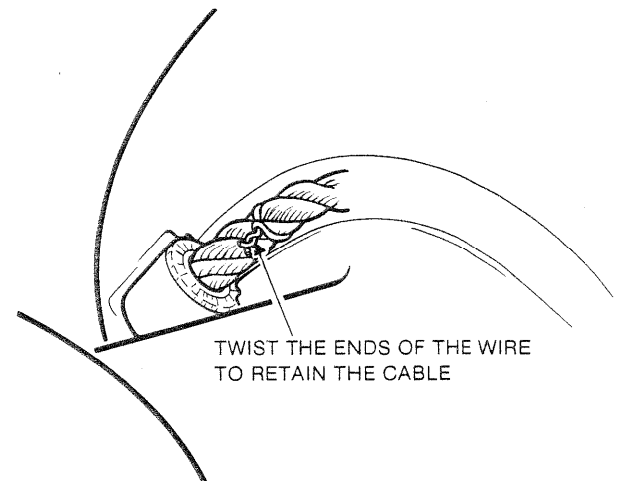


Fig 9-8

SP-10083

5. Twist the ends of the wire together to hold the cable in place.
6. Start the engine and put the winch control lever in the WINCH-IN position to wind the mainline onto the cable drum.

**IMPORTANT NOTE:** Installing the winch cable in this manner provides a means to hold the cable ferrule in place during normal operation and acts as a safety break-away function to prevent the machine from being pulled over should the load fall down a grade.



**WARNING:** It is imperative that the operator put the winch in the FREE-SPOOL mode if the load should begin to fall for this provision to be effective.

## HYDRAULIC SYSTEM

Every 10 Hours of Operation:

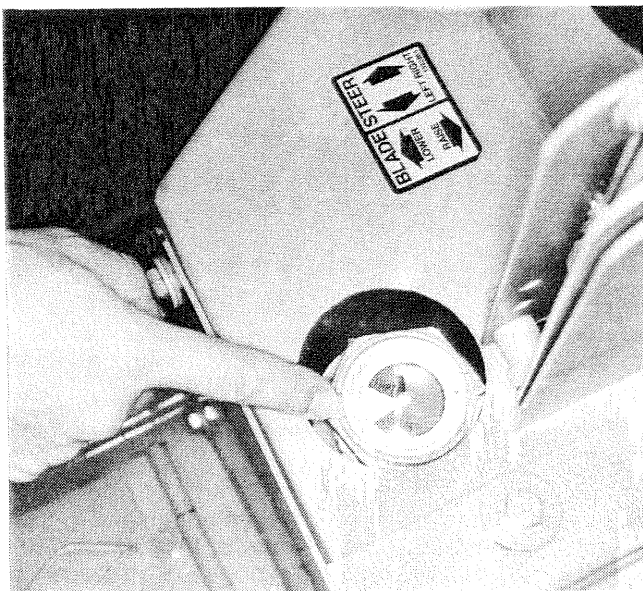


Fig 10-1

SP-10045

Check the oil level in the hydraulic reservoir. There is a dipstick on the filler cap below the floorboard panel on the left hand side of the operator's compartment.

**NOTE:** All hydraulic cylinders should be retracted when doing this check.

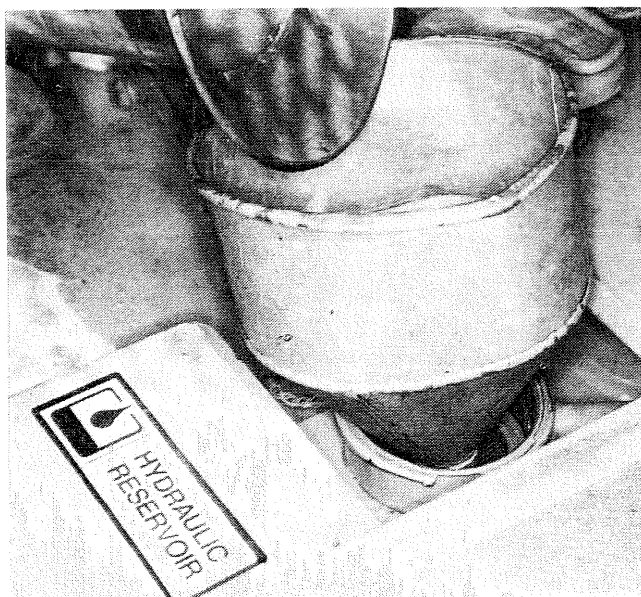


Fig 10-2

SP-10084

If the level is low, add only SAE 10W oil, API Class SD or SE, MIL-L-2104C lubricant to the filler hole.

Every 50 Hours of Operation:



Fig 10-3

SP-10085

Clean the hydraulic cylinder rods with a clean cloth soaked in the same oil as in the hydraulic system. Remove any burrs or nicks on the rods with a fine grained hand stone or crocus cloth.

**Test the auxiliary steering system in a level area free from obstructions:**

1. Turn the ignition switch to the ON position but do not start the engine. Turn the auxiliary steering switch to the ON position.



Fig 10-4

SP-10013

2. Make complete left and right turns until the hydraulic system reaches relief pressure.
3. Turn the auxiliary steering switch and the ignition switch to the OFF positions.

**IMPORTANT NOTE:** The auxiliary steering system is powered by the machine's batteries. DO NOT operate the system for longer than two minutes to prevent excessive battery drain and damage to the electrical system.

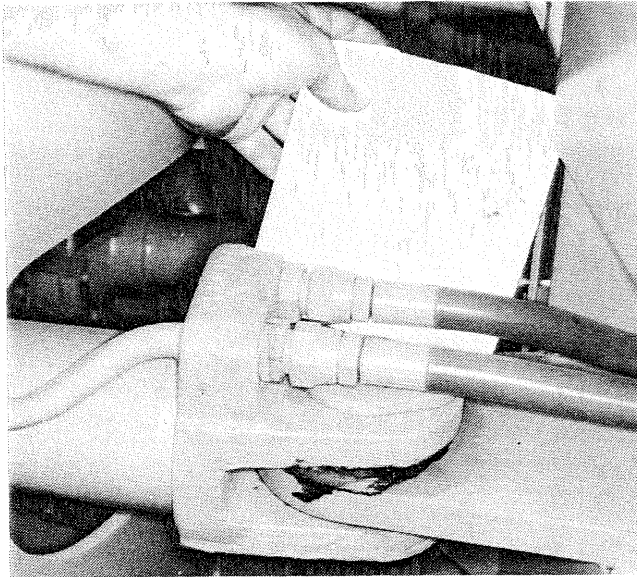


Fig 10-5

SP-10086

If the auxiliary steering does not respond properly to the test, check all hydraulic and electrical connections as well as the main relief pressure (See Every 500 Hours of Operation:). See your **RANGER** distributor if you cannot locate the problem.

**WARNING:** DO NOT use your hands to check for oil leaks. Escaping oil under pressure can penetrate the skin. Use a piece of cardboard.

**Every 500 Hours of Operation:**

**Replace the main hydraulic filter element.**

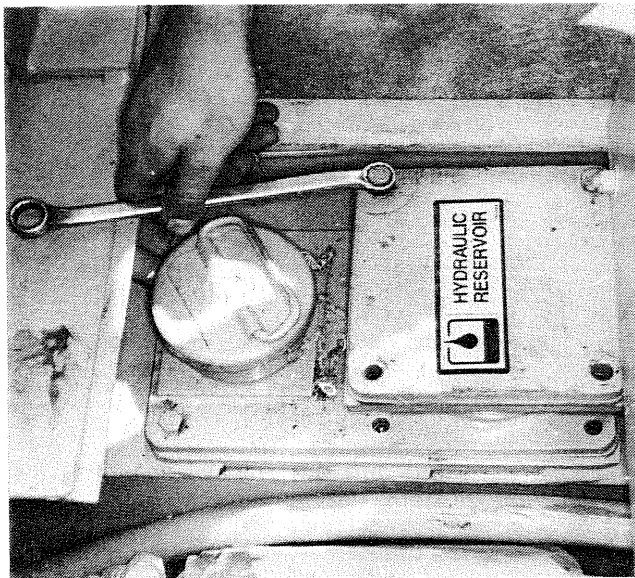


Fig 10-6

SP-10087

Locate the element under the cover plate on top of the hydraulic tank. Remove the plate mounting bolts and remove the plate making sure no dirt enters the system.

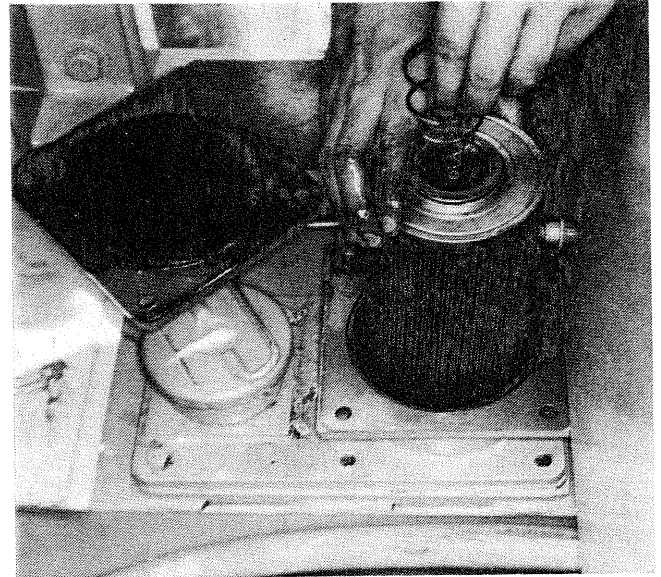


Fig 10-7

SP-10088

Remove and discard the old filter element and install a new Clark replacement element. Install the filter plate and tighten the mounting bolts to a torque of 55 to 65 N.m (40 to 50 lbf. ft).

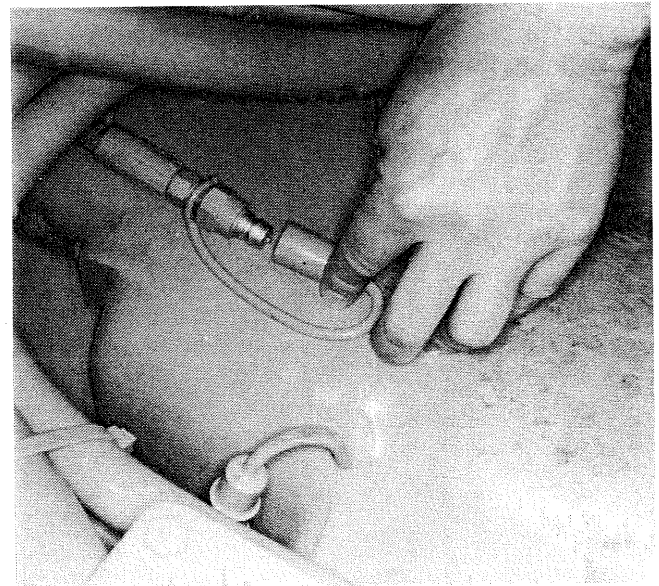


Fig 10-8

SP-10089

Check the main relief pressure with a 20.000 kPa (3,000 PSI) pressure test gauge connected to the main relief pressure port on the top of the transmission. With the engine operating at maximum RPM, and the blade held in its highest position (to put the hydraulic system over relief), the gauge should read between 12.070 and 12.760 kPa (1,750 and 1,850 PSI) on the cable skidder and 14.130 and 14.820 kPa (2,050 and 2,150 PSI) on the grapple skidder.



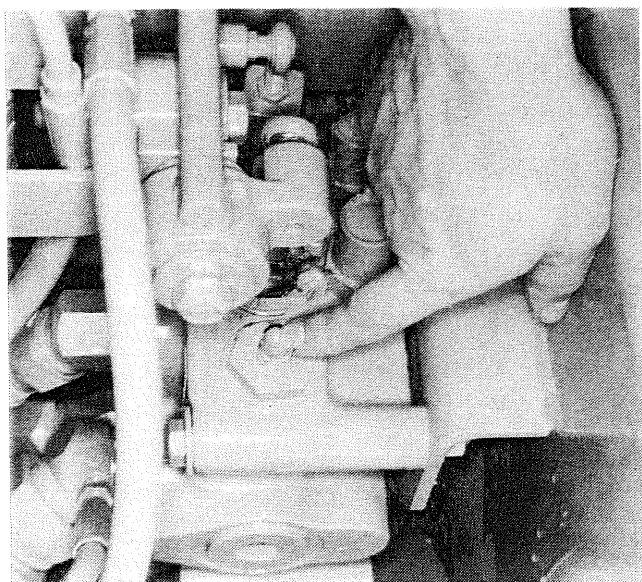


Fig 10-9

SP-10090

If the reading on the gauge is not 13.790 kPa (2,000 PSI), remove the acorn nut on the main control valve, loosen the locknut below it and turn the adjusting nut until the reading is correct. If the relief valve cannot be properly adjusted, see your **RANGER** distributor.

### Every 1000 Hours of Operation:

Drain the main hydraulic system. This should also be done if the main hydraulic pump fails and must be removed and overhauled. Bring the oil in the system to its Operating Temperature (See Sec. 1). Hot oil runs more freely and carries more foreign material than cold oil. Drain the system as follows:



Fig 10-10

SP-10093

1. Remove the hydraulic reservoir filler cap. Remove the drain plug at the bottom of the hydraulic reservoir and drain the oil into a container of at least 100 l (26 U.S. gal).

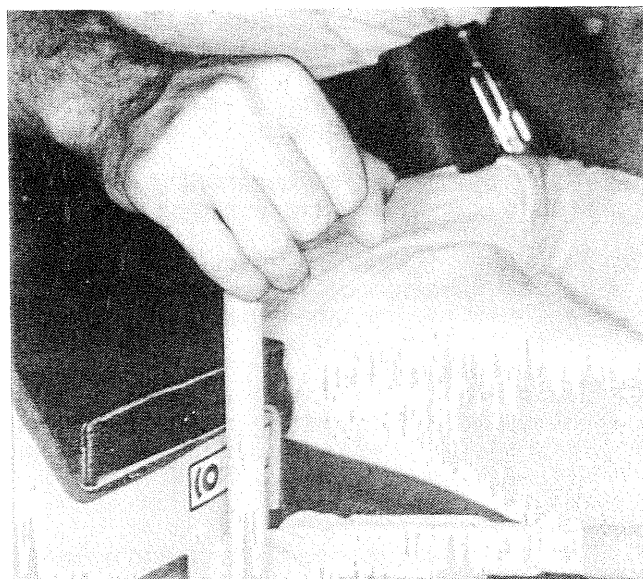


Fig 10-11

SP-10013

2. Slowly lower the blade, (boom) and arch and close the grapple arms to force the oil in the cylinders back to the reservoir.

**WARNING:** Use Extreme Caution to avoid serious bodily injury that can occur if struck by the blade or grapple assembly. Make sure all tools and other personal property are clear of these attachments as they lower.

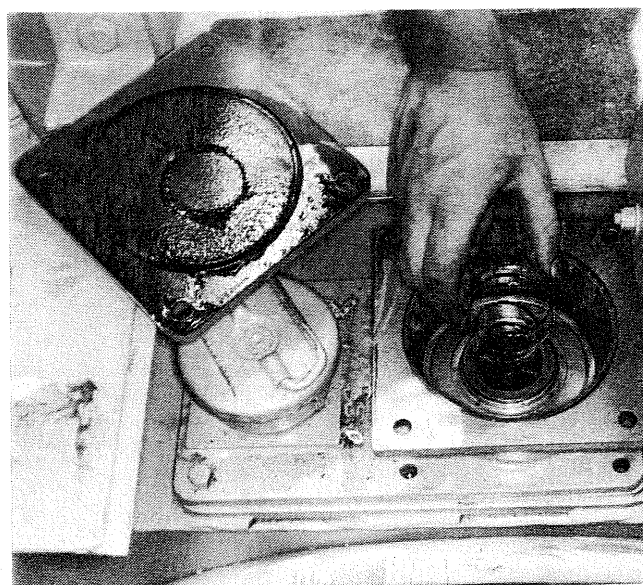


Fig 10-12

SP-10094

3. Remove the filter access cover on top of the hydraulic tank. Discard the old filter. Clean the inside of the tank and remove the magnet at the bottom of the tank. Clean the magnet thoroughly and replace it in the tank.



4. Remove the hydraulic tank suction screen located on the end of the suction tube to the pump, inside the reservoir. Wash the screen in a solvent, blow dry it with compressed air, and install the screen on the suction tube.

**NOTE: If the screen is damaged, it should be replaced to prevent dirt from damaging the pump.**

5. Replace the hydraulic filter element, install the plug at the bottom of the reservoir and refill the system with the recommended fluid (See Every 10 Hours of Operation:).
6. With the machine in the Service Position, with the exception of the battery disconnect switch and the fuel shut-off valve, start the engine and operate the engine at low idle RPM for a few minutes.
7. Raise the blade, (boom) and arch and open the grapple arms to fill the cylinders with oil.
8. Put the machine in the Service Position (See Sec. 2), and allow the system to stand for a few minutes so any air will escape from the oil. Bring the level in the reservoir to the full line on the dipstick (to replace the oil in the blade cylinder) and replace the filler cap securely.

**IMPORTANT NOTE: NEVER use flushing oil or compounds to clean the system, use only the recommended operating fluid.**

## AXLES AND PROPSHAFTS

### Every 50 Hours of Operation:



Fig 11-1

SP-10095

Check the lubricant level in the front and rear axle differentials. Remove the check plug in the centre of each differential housing. The lubricant level should be up to the bottom of the check hole. If the level is below the hole, add the recommended lubricant to the check hole (See Sec. 16).

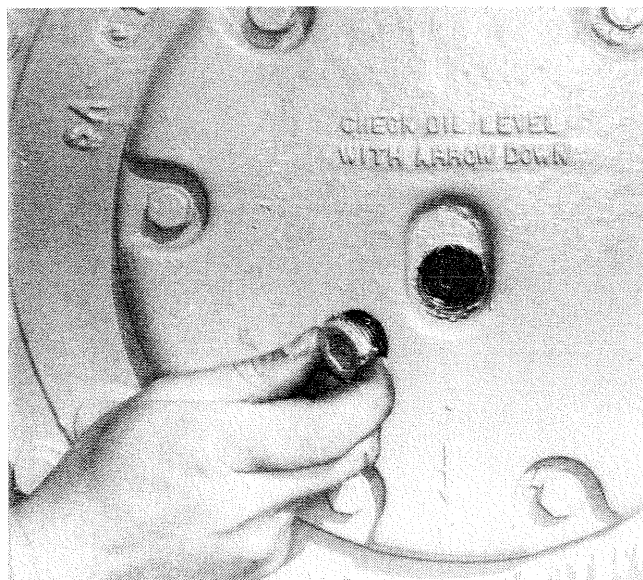


Fig 11-2

SP-10096

Check the lubricant level in the front and rear axle planetary hubs. Turn the wheel until the check plug on the hub is pointing upwards. Remove the check plug. The lubricant level should be up to the bottom of the check hole. If the level is below the hole, add the recommended lubricant to the check hole (See Sec. 16).

### Every 100 Hours of Operation:

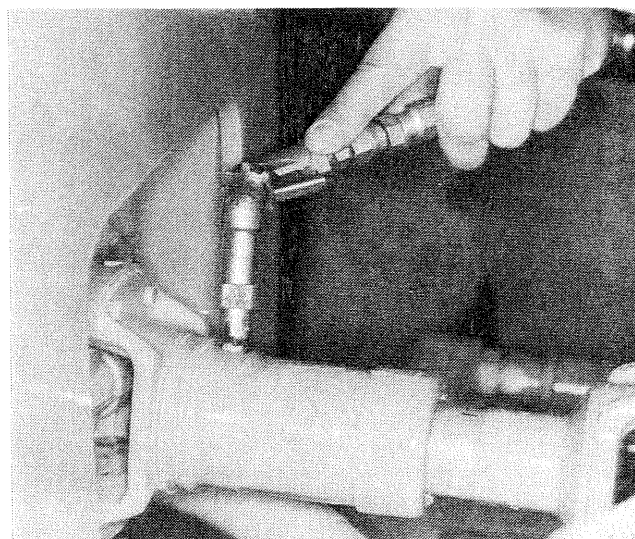


Fig 11-3

SP-10097

Grease all propshaft slip joints with Extreme Pressure Molybdenum Disulphide Grease. Use a hand grease gun and grease all fittings sparingly. When the machine is operated at temperatures above  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ) use a grade 2 lubricant. When operating in temperatures below  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ) use a grade 0 lubricant.

### Every 500 Hours of Operation:

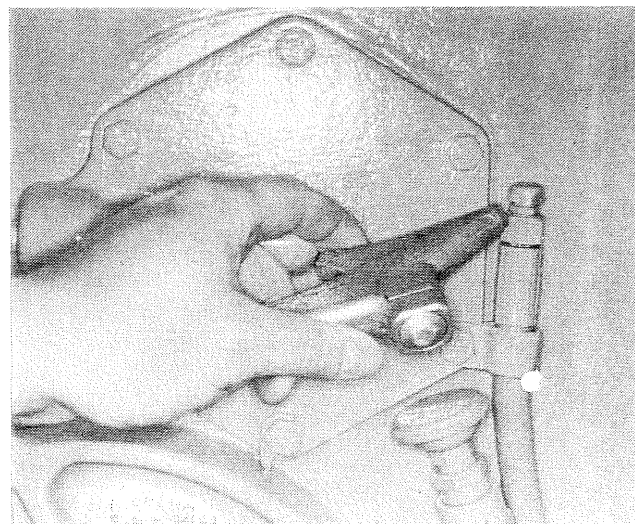
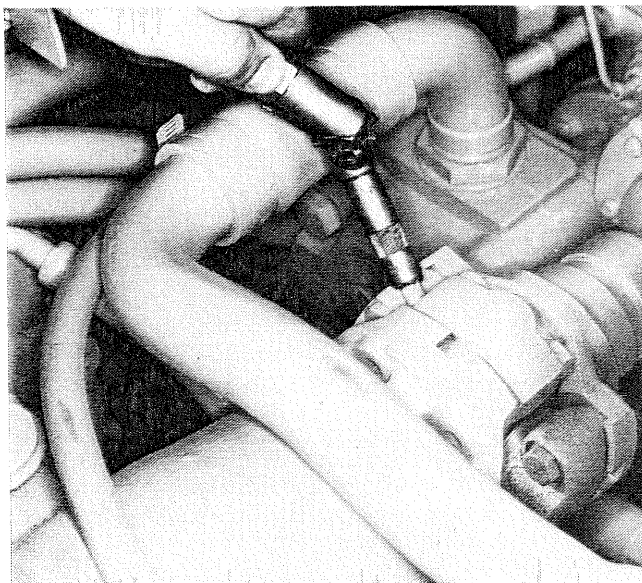


Fig 11-4

SP-10098

Locate the front and rear axle breathers on the hoses fastened to the left hand rear of the torque converter and to the left hand side of the winch. Rotate the cap on each breather to free the air passages and blow the breathers with compressed air to remove any debris.

**NOTE:** Every 50 Hours of Operation, the breather caps should be rotated to clear the passages also.

**Every 1000 Hours of Operation:****Fig 11-5**

SP-10099

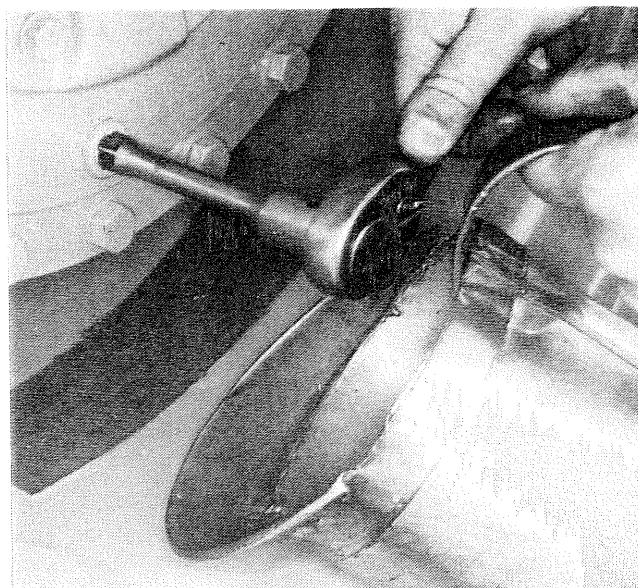
Grease all propshaft universal joint lubrication points with Extreme Pressure Molybdenum Disulphide Grease. Use a hand grease gun and grease all fittings sparingly.

When the machine is operated at temperatures above  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ) use a Grade 2 lubricant. When the machine is operated below  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ) use a Grade 0 lubricant.

**Fig 11-6**

SP-10100

Drain the front and rear axle differentials. Locate and remove the drain plugs at the bottom of each differential and drain the old gear lube into a container of at least 12 l (3.2 U.S. gal). Re-install the drain plugs and fill each differential check hole with the recommended fluid (See Sec. 16).

**Fig 11-7**

SP-10101

Drain the front and rear axle planetary hubs. Locate the drain plug on the outer rim of each hub. Rotate each wheel until the drain plug is at the bottom of its rotation. Remove the drain plug and drain the old gear lube into a container of at least 9 l (2.4 U.S. gal). Re-install the drain plug. Remove the check plug. Rotate the wheel until the check plug is pointing upwards. Fill each hub through its drain plug with the recommended fluid. Re-install the check plugs.

**NOTE:** It may be necessary to change the lubricant in the differentials and planetaries more often when operating the machine in heavy mud and/or water.

## WHEELS AND TIRES

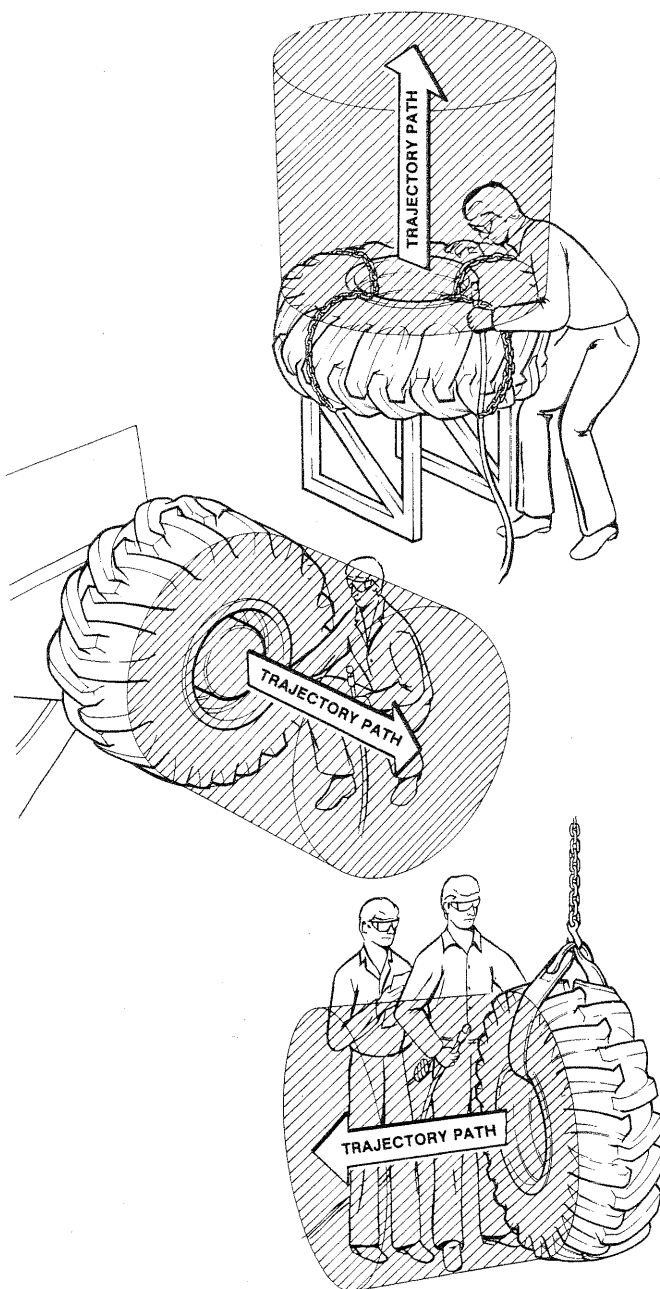


Fig 12-1

SP-10102

**WARNING:** When doing ANY tire service, especially inflation, NEVER stand in the TRAJECTORY PATH. Serious injury or death can result if an explosion should occur.

ALWAYS use a self-attaching air chuck with a hose long enough to avoid standing in the trajectory path when inflating a tire.

ALWAYS use an inflation cage, safety cables or chains when inflating tires.

NEVER cut or weld on a wheel rim except to replace damaged split rim coupling studs.

NEVER use damaged rim parts or parts not specified for use on the actual wheel rim.

COMPLETELY DEFLATE a tire before removing foreign material from the tire bead or tread. Keep your fingers away from bead breakers and stay out of the trajectory path when removing foreign material. If a bead breaker disengages, it will do so with enough force to cause serious personal injury or death.

### Every 10 Hours of Operation:

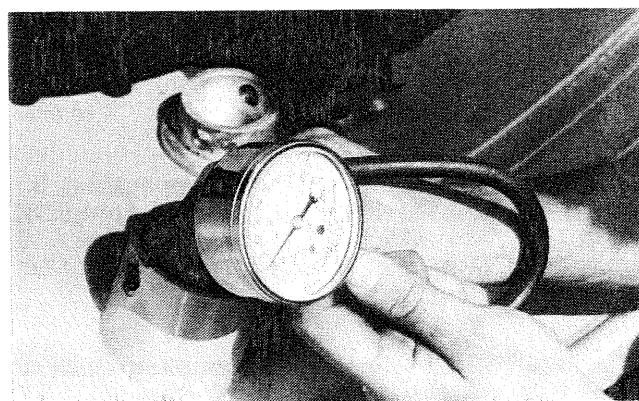


Fig 12-2

SP-10049

Check the air pressure of the tires. Examine the valves and make sure all valve caps are in place. See the tire pressure chart in this section for the correct tire pressure.

**WARNING:** NEVER check tire pressures with a load (of logs) in place.

### Every 50 Hours of Operation:

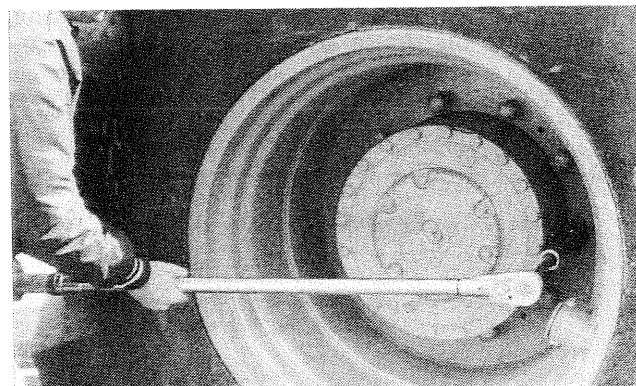


Fig 12-3

SP-10103

Check the wheel and wheel nuts for damage. Tighten the wheel nuts as required to a torque of 575 to 645 N.m (425 to 475 lbf.ft) for SPHERICAL wheel nut seats (See Fig 12-4).

**WARNING:** IF ANY wheel studs or wheel nuts are missing or damaged, they MUST BE REPLACED.



## Split Rim Examples

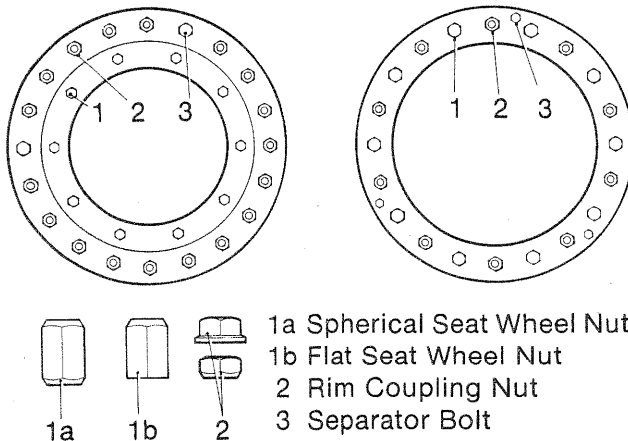


Fig 12-4

SP-10104

Check the rim coupling nuts (if applicable) for damage. Tighten the rim coupling nuts to a torque of 575 to 645 N.m (425 to 475 lbf.ft) for 3/4 in - 16 threads OR 980 to 1085 N.m (725 to 800 lbf.ft) for 1 in - 14 threads.

**WARNING:** IF ANY rim coupling studs or nuts are missing or damaged, they **MUST BE REPLACED**.

**WARNING:** USE Extreme Caution when you remove or install wheels and tires. Improper handling can cause serious personal injury or death. Always wear eye protection. Read and understand the following instructions completely before proceeding.

**Tire changing can be dangerous, and should be done by trained personnel using proper tools and procedures.**

## Repairing Tires on Split Wheel Rims:

1. Put the machine in the Service Position, **SECURELY** blocking the wheels (See Sec. 2).
2. Use a jack of sufficient capacity to jack the machine and securely block the machine in place.
3. Use tire tongs or another suitable tire lifting device to support the rim and remove the **WHEEL STUD NUTS** (See Item 1 in Fig 12-4). Remove the assembly from the machine.

**WARNING:** IF YOU HAVE ANY DOUBT that the nuts you are to remove **ARE THE WHEEL STUD NUTS**, **COMPLETELY DEFLATE THE TIRE BEFORE YOU REMOVE ANY NUTS**.

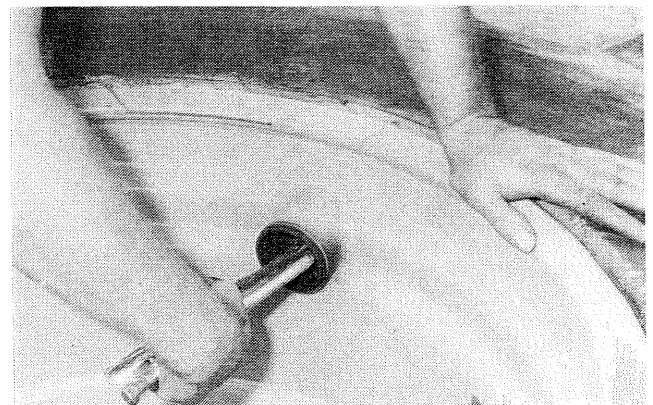


Fig 12-5

SP-10105

4. Remove the valve protection cap and carefully remove the valve stem to deflate the tire and allow the tire to deflate **COMPLETELY**. Use a piece of tire chalk to mark the tire adjacent to the valve stem as a reference point to locate the cause of the puncture.

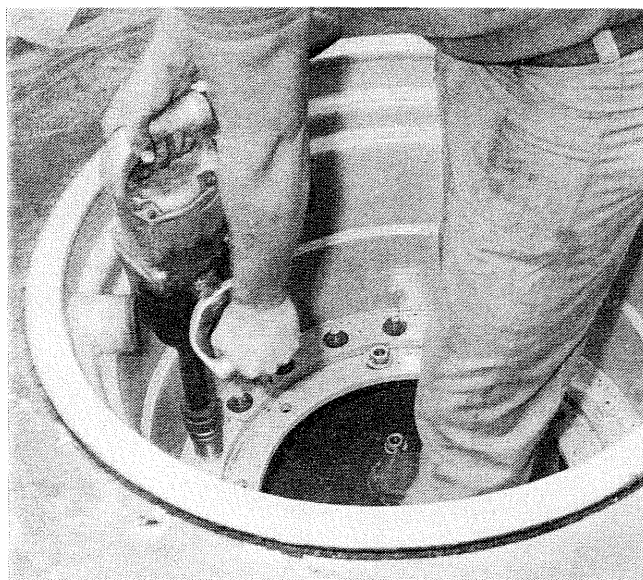


Fig 12-6

SP-10106

5. Drive a bead unseating tool between the tire bead and the rim flange taking care not to damage the bead. When the bead is completely unseated, turn the tire over and unseat the other bead.

**WARNING:** **DO NOT** begin to unseat the bead until the tire is completely deflated.



**Fig 12-7**

SP-10107

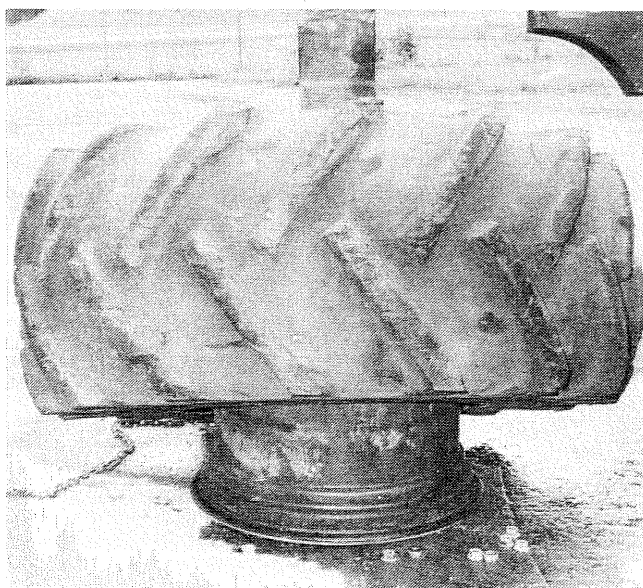
6. Mark the wheel halves to facilitate reassembly and remove the rim coupling nuts.



**Fig 12-9**

SP-10109

8. Remove the tube from the tire and inspect it to see if it is in good enough condition to repair or if it should be replaced. Repair or replace the tube as required.



**Fig 12-8**

SP-10108

7. Use a suitable tire lifting device to lift the tire and the top rim half from the bottom rim half.



**Fig 12-10**

SP-10110

9. Clean the interior of the tire to remove any foreign material that could damage the tube.



Fig 12-11

SP-10111

10. Thoroughly clean the mating surfaces of each rim half and remove any nicks or burrs that could interfere with proper mating. Inspect the parts for damage and **REPLACE** any damaged rim parts.



Fig 12-13

SP-10113

12. Install the tire on the bottom rim half and install the tube in the tire making sure that the valve will align with the opening in the wheel. Install the valve stem.



Fig 12-12

SP-10112

11. Lubricate the tire bead and rim flange with a rubber lubricant that is recommended for this application.

**NOTE:** Never use silicone or petroleum base lubricants.



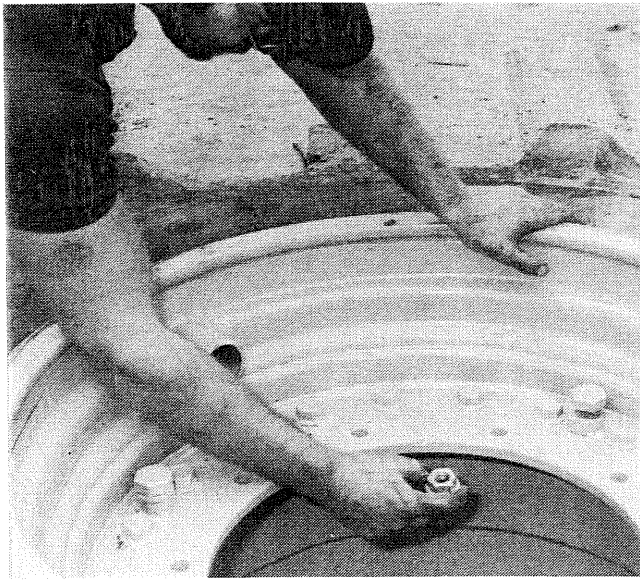
Fig 12-14

SP-10114

13. Lubricate the other tire bead and rim flange with a rubber lubricant that is recommended for this application and install the top rim half using the marks from Step 6.

**NOTE:** Never use silicone or petroleum base lubricants.

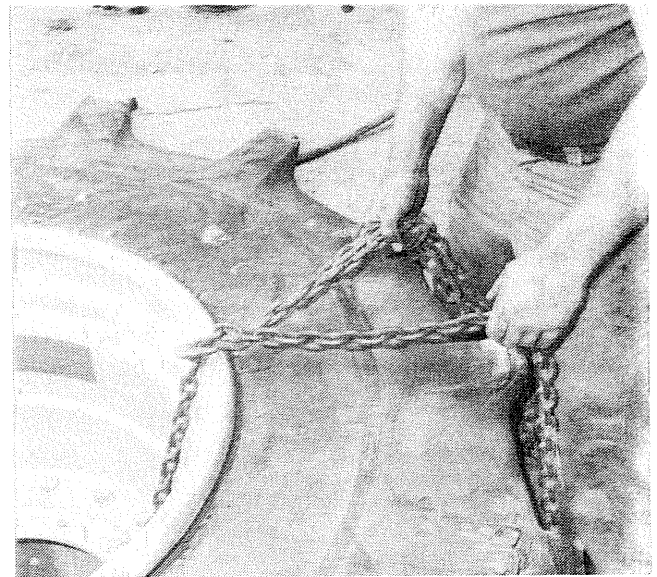




**Fig 12-15**

SP-10115

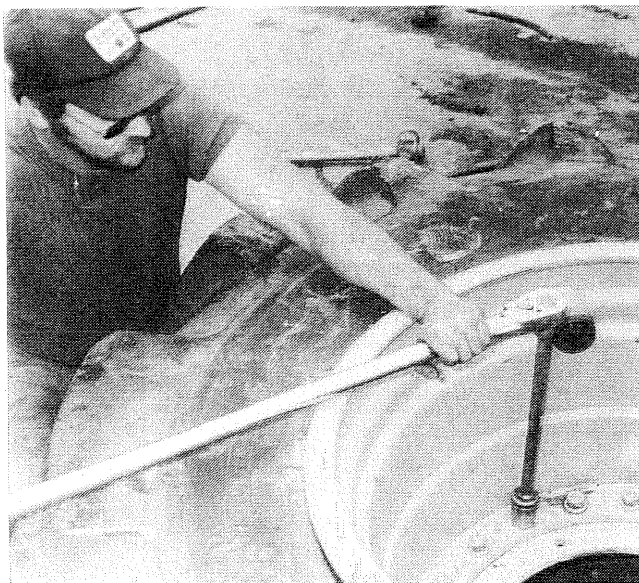
14. Inspect all of the rim coupling nuts and studs and replace any that are worn or damaged. Install all of the coupling nuts so the assembly can be turned over.



**Fig 12-17**

SP-10117

16. Securely fasten four sets of tire safety chains through the center of the rim and around the tire.

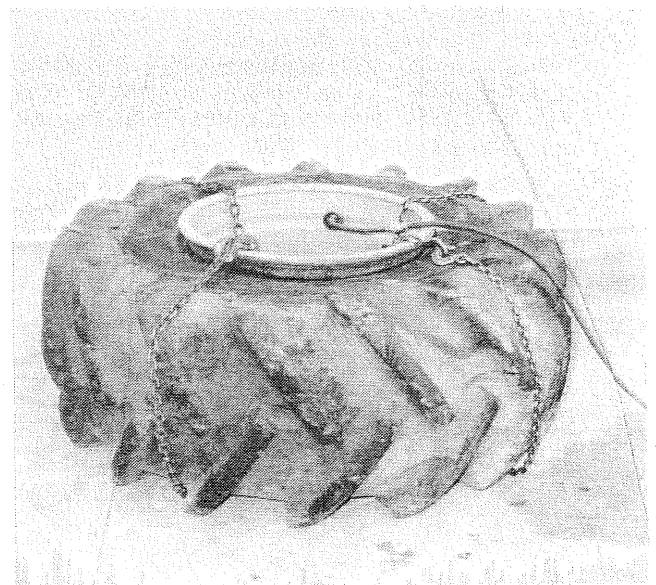


**Fig 12-16**

SP-10116

15. Tighten the rim coupling nuts alternately (across the hub opening) to a torque of 575 to 645 N.m (425 to 475 lbf.ft) for 3/4 in - 16 threads or 980 to 1085 N.m (725 to 800 lbf.ft) for 1 in - 14 threads.

**IMPORTANT NOTE:** Recheck the torque on the rim coupling nuts after the first 50 Hours of machine operation.



**Fig 12-18**

SP-10118

17. Attach a self-locking air chuck to the valve stem and inflate the tire to seat the beads. **DO NOT EXCEED 240 kPa (35 PSI) inflation pressure to seat the beads.**

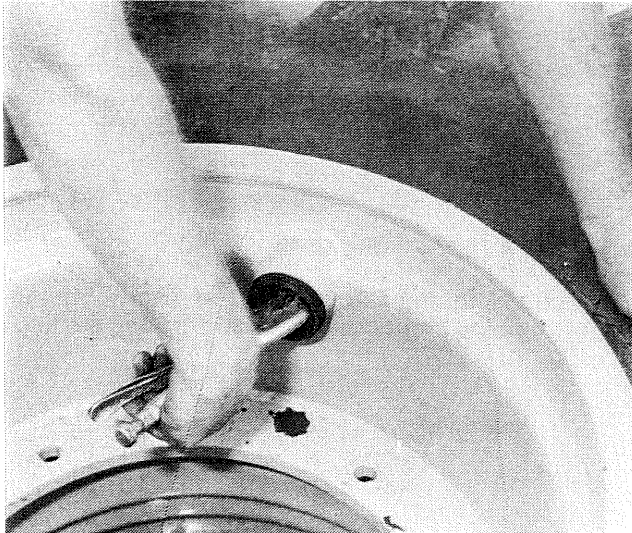


**WARNING:** Stand well away from the tire and rim while it is inflating to avoid serious injury if there should be an explosion.



**Repairing Tires on Single Piece Wheel Rims:**

1. Put the machine in the Service Position, **SECURELY** blocking the wheels.
2. Use a jack of sufficient capacity to jack the machine and securely block the machine in place.
3. Use tire tongs or another suitable tire lifting device to support the rim and remove the wheel stud nuts. Remove the wheel/tire assembly from the machine.

**Fig 12-19**

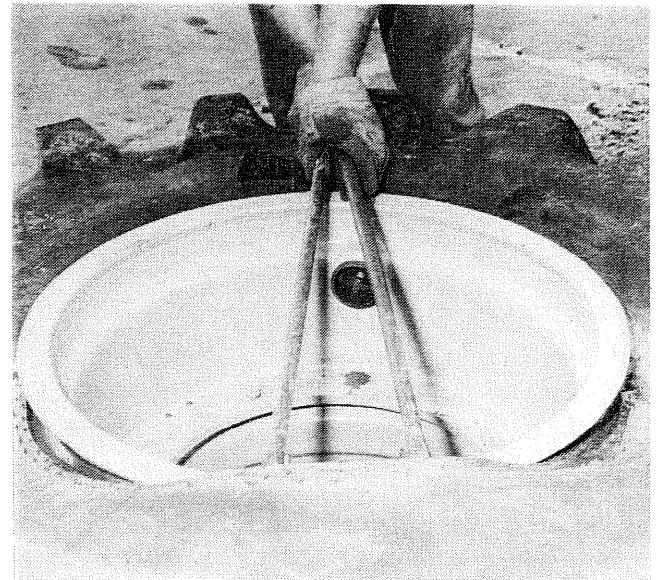
SP-10119

4. Remove the valve protection cap and carefully remove the valve stem to deflate the tire and allow the tire to deflate **COMPLETELY**. Use a piece of tire chalk to mark the tire adjacent to the valve stem as a reference point to locate the cause of the puncture.

**Fig 12-20**

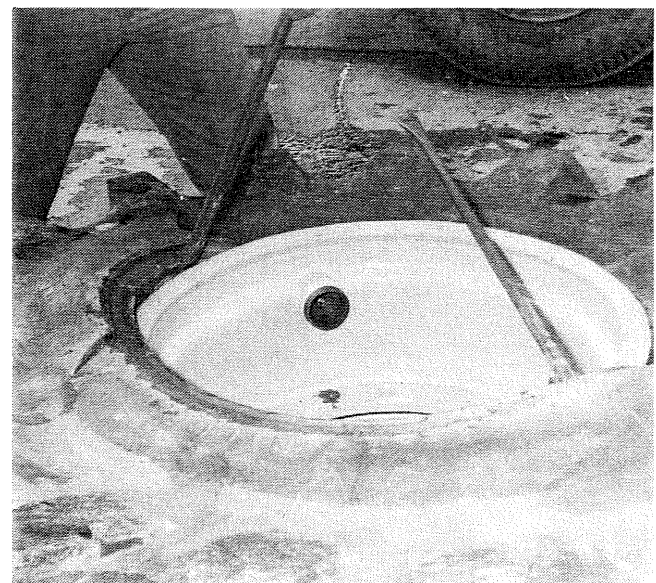
SP-10106

5. Drive a bead unseating tool between the tire bead and the rim flange taking care not to damage the bead.

**Fig 12-21**

SP-10121

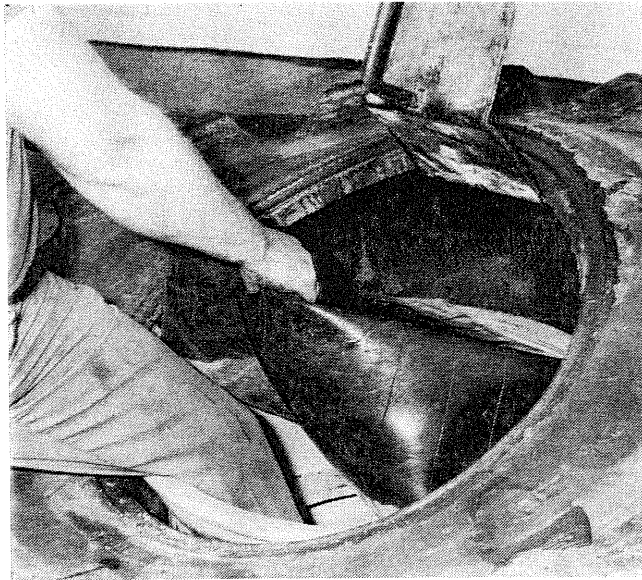
6. Use tire irons to pry the bead over the rim flange.

**Fig 12-22**

SP-10122

7. Leave one tire iron in the original position and pry the bead (in small sections) from the rim flange until the bead is completely unseated.

**IMPORTANT NOTE:** Prying too large a bead section at one time can damage the bead.



**Fig 12-23**

SP-10123

8. Use a suitable lifting device to lift the tire bead enough to remove the tube. Remove the tube and inspect it to see if it is in good enough condition to repair or if it should be replaced. Repair or replace the tube as required.



**Fig 12-25**

SP-10125

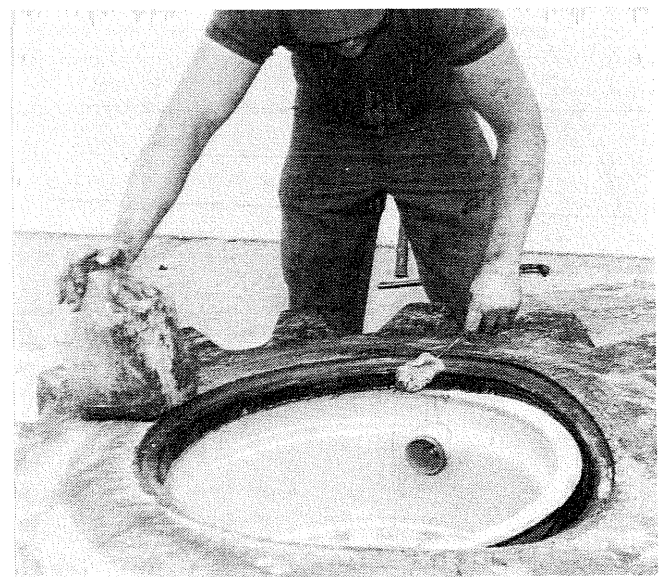
10. Install the tube in the tire making sure that the valve will align with the opening in the wheel. Install the valve stem.



**Fig 12-24**

SP-10124

9. Clean the interior of the tire to remove any foreign material that could damage the tire.



**Fig 12-26**

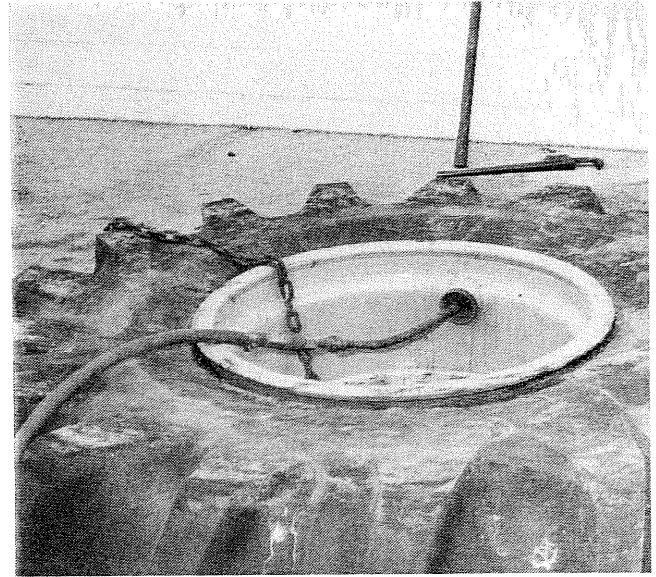
SP-10126

11. Lubricate the tire bead and rim flange with a rubber lubricant that is recommended for this application.

**Fig 12-27**

SP-10127

12. Use a tire iron to pry the bead onto the rim flange using a self-locking tool to keep the first bead section from unseating.

**Fig 12-28**

SP-10128

13. Attach a self-locking air chuck to the valve stem and inflate the tire to seat the beads. **DO NOT EXCEED 240 kPa (35 PSI) inflation pressure** to seat the beads.



**WARNING:** Stand well away from the tire and rim while it is inflating to avoid serious injury if there should be an explosion.

### RECOMMENDED PRESSURES

TIRE SIZE	Ply Rating	(Minimum)		(Maximum)	
		kPa	PSI	kPa	PSI
30.5 x 32	12	105	15	140	20
30.5 x 32	16	105	15	170	25



## BRAKES

**WARNING:** The power brake system on 668D machines uses brake pressure accumulators that store fluid under high pressure. **BEFORE** doing any service on the brake system, the brake pedal should be pumped with the machine in the Service Position (See Sec. 2) until the system is completely discharged. If the accumulator(s) are to be disassembled, the nitrogen precharge pressure must also be discharged completely.

Every 50 Hours of Operation:

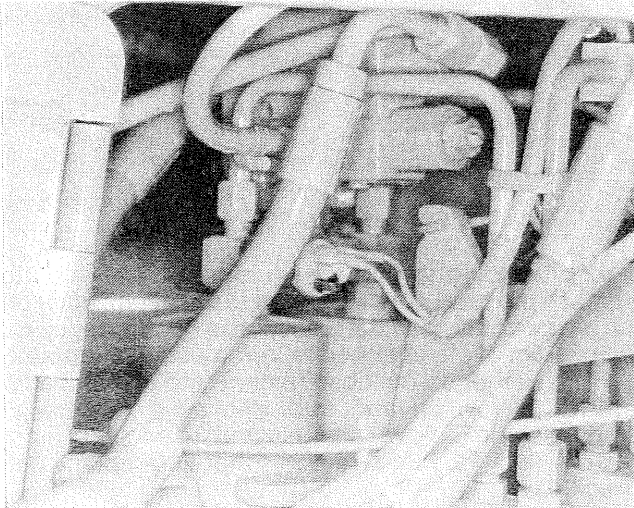


Fig 13-1

SP-10129

Make a thorough visual inspection of the power brake hydraulic system for leaks and correct any that are found.

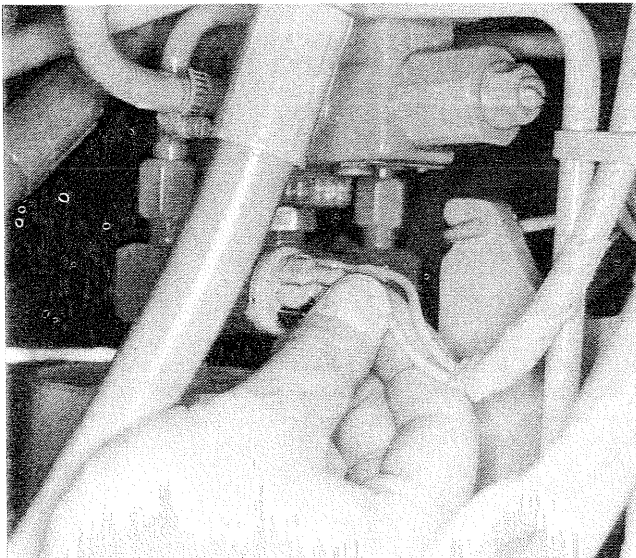


Fig 13-2

SP-10130

Make a thorough visual inspection of the power brake electrical wiring for wear, breakage or corrosion. Make sure that all wiring is properly fastened in place and that all connections are good.

To ensure safe and efficient operation of the power brake system, the following test procedure should be performed:

1. Start the engine and operate it at Low Idle RPM for 30 seconds to charge the accumulators and shut down the engine.
2. Return the machine to the Service Position (See Sec. 2) but put the ignition switch in the ON position (leaving the engine shut down).



Fig 13-3

SP-10024

3. PULL and release the auxiliary brake knob several times until the right hand brake warning light glows and the buzzer sounds to indicate the inner (transmission) brake accumulator is discharged.

**NOTE:** DO NOT PUSH the brake knob to release it or you will discharge the outer (transmission) brake accumulator.



Fig 13-4

SP-10131

4. Observe the left hand brake light for one minute. If the left hand brake light glows (and the buzzer sounds), there is a fault in the inverted shuttle valve and the valve must be replaced.



5. Start the engine and operate it at half throttle for 15 seconds to recharge the accumulator then shut down the engine (but return the ignition switch to the ON position).



Fig 13-5

SP-10132

6. PUSH and release the auxiliary brake knob several times until the left hand brake light glows and the buzzer sounds to indicate the outer (midmount) brake accumulator is discharged.

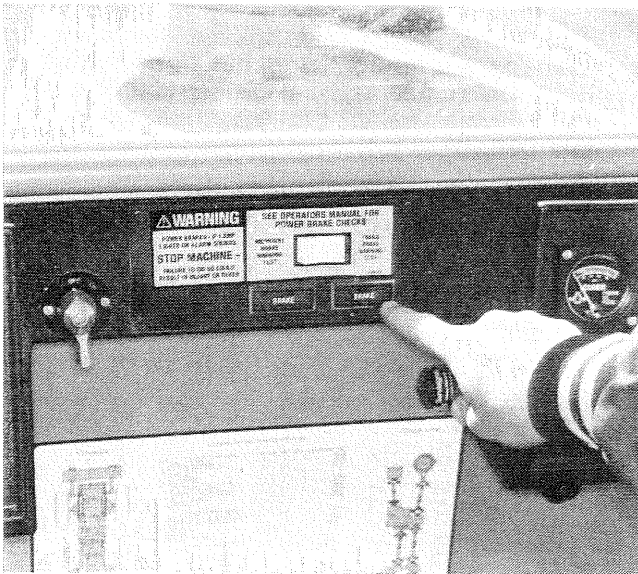


Fig 13-6

SP-10026

7. Observe the right hand brake light for one minute. If the right hand brake light glows (and the buzzer sounds), there is a fault in the inverted shuttle valve and the valve must be replaced.

**IMPORTANT NOTE:** Due to the nature of this power brake system, a fault in the system will not be detected by the feel of the brake pedal as in a system with master cylinders.

### Every 100 Hours of Operation:

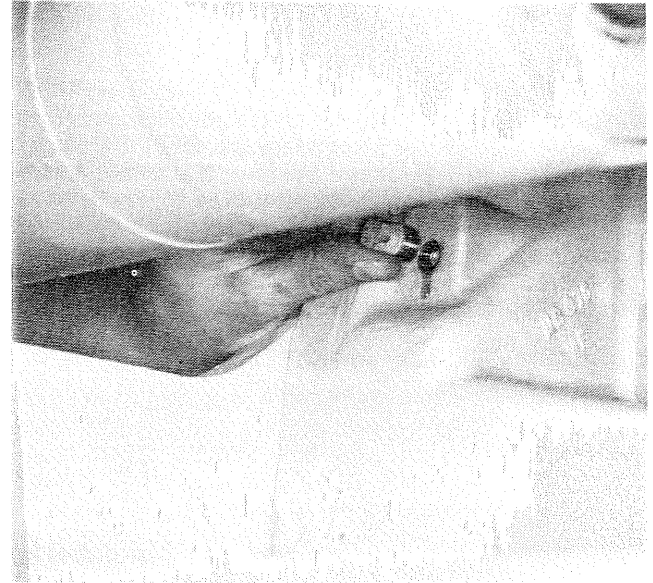


Fig 13-7

SP-10133

Check the fluid level in the midmount brake unit. Remove the level check plug on the left hand side of the brake housing. If the level of the fluid is not up to the bottom of the check hole, remove the midmount brake breather on the hose fastened to the left hand side of the winch and add Approved Automatic Transmission Fluid to the hose until the correct fluid level is reached. Install the breather and replace the check plug.

### Adjust the transmission brake as follows:

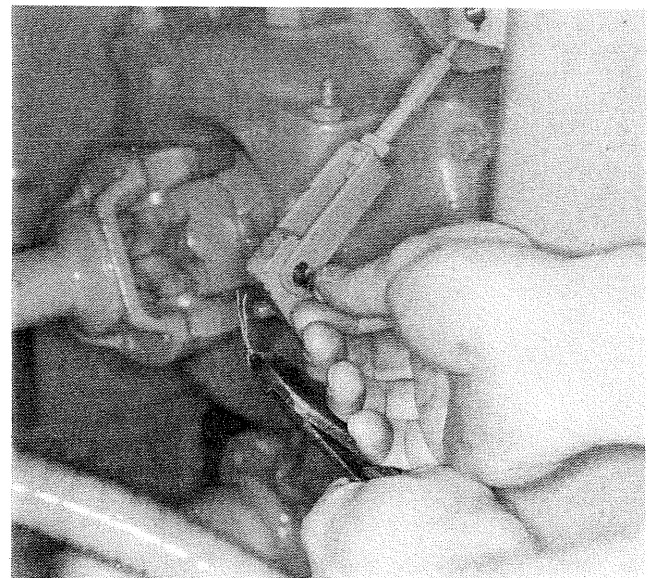
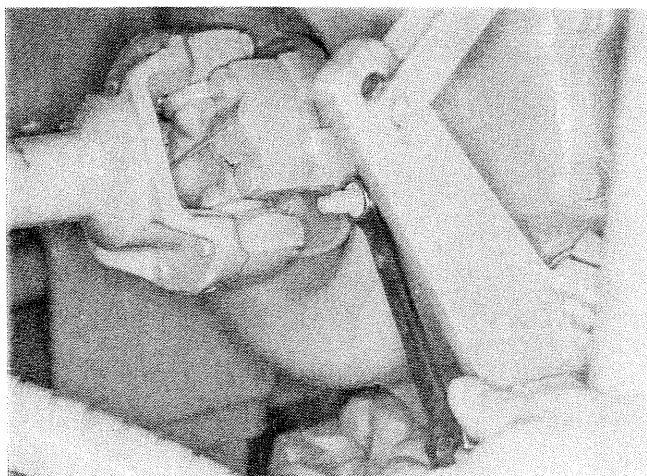


Fig 13-8

SP-10134

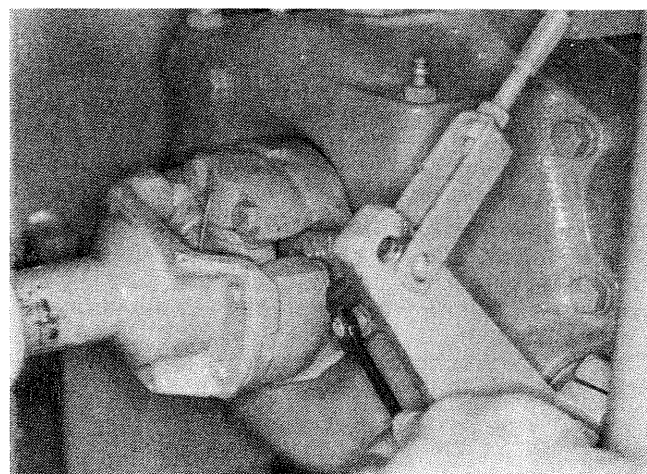
Disconnect the linkage from the parking brake clevis to the brake lever arm.



**Fig 13-9**

SP-10135

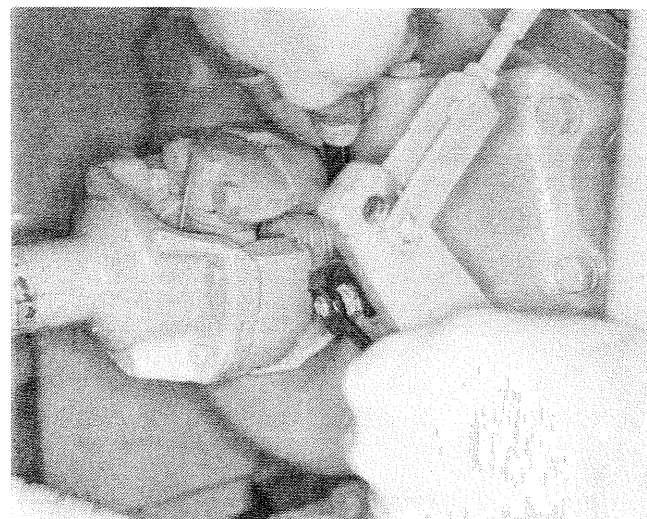
Loosen the locknut on the brake adjusting screw.



**Fig 13-10**

SP-10136

Turn the brake adjusting screw until it tightens against the brake yoke.



**Fig 13-11**

SP-10137

Loosen the adjusting screw two turns, hold the adjusting screw and tighten the jam nut.



**Fig 13-12**

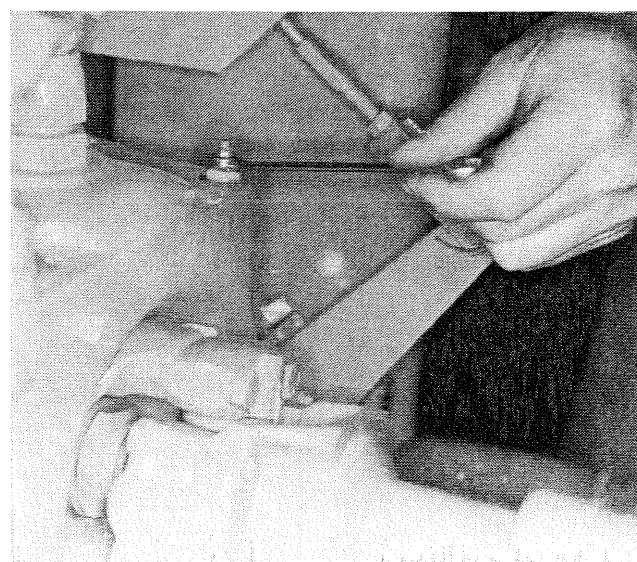
SP-10138

Connect the parking brake linkage to the brake lever arm.

**NOTE:** Adjust the midmount brake the same way; however the instructions referring to the parking brake should be omitted. Adjust both brake systems at the same time.

Routine brake bleeding is not required on the power brake system of the 668D. If a brake system component is replaced for any reason, air will enter the fluid system and should be removed as follows:

The midmount and transmission brake systems are totally separate fluid systems and should be thought of as two individual systems.



**Fig 13-13**

SP-10139

Have a helper hold the service brake pedal applied and open each bleeder screw on the transmission brake unit (separately) until a clean stream of fluid flows from the bleeder screws and close the bleeder screws.



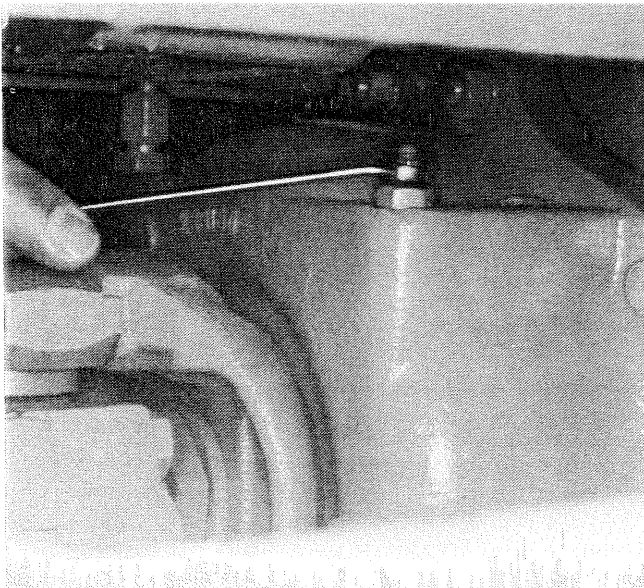


Fig 13-14

SP-10140

Repeat the procedure with the bleeder screw on the midmount brake.

**NOTE:** When the brake bleeding is complete, check the oil level in the hydraulic reservoir and add oil if required.

#### Every 500 Hours of Operation:

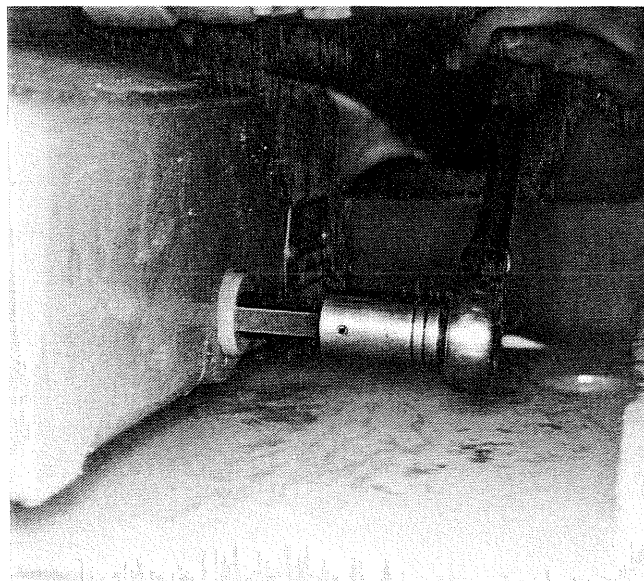


Fig 13-15

SP-10141

Drain the midmount brake unit. Locate the drain plug at the rear of the brake housing. Remove the drain plug and drain the old fluid into a container of at least 11 l (3 U.S. gal). Install the drain plug and refill the brake unit with Approved Automatic Transmission Fluid until the correct fluid level is reached (See Fig 13-7).

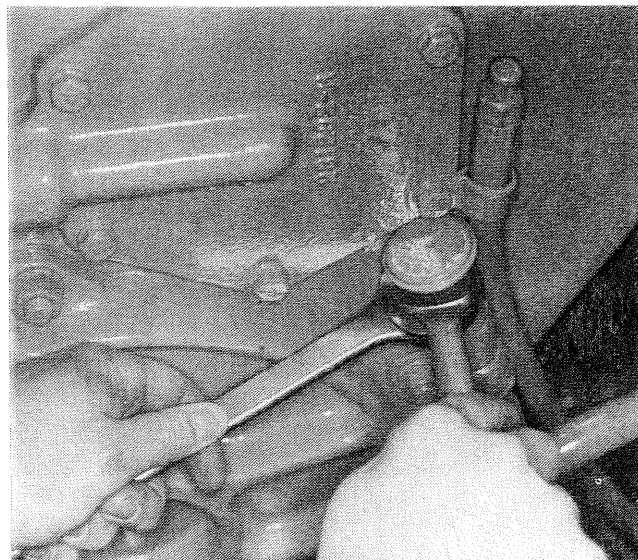


Fig 13-16

SP-10142

When the breather is removed to refill the midmount brake unit, wash the breather in solvent and blow dry it with compressed air. Install the breather.

The power brake system uses brake pressure accumulators to store hydraulic pressure as on a back-up in the event of a fault in the system. If a fault should occur, and the accumulators are operating correctly, there will be adequate pressure in the accumulator(s) for a few safe brake applications.

**Check the precharge pressure of the brake accumulators as follows:**



Fig 13-17

SP-10132

1. With the engine shut down, push the Auxiliary Brake Knob several times to discharge the midmount brake accumulator noting the number of applications required to COMPLETELY release the hydraulic pressure.

**IMPORTANT NOTE:** The hydraulic pressure is completely discharged when fluid can no longer be heard when the brake knob is applied.

2. Repeat the procedure to discharge the transmission brake accumulator by pulling the Auxiliary Brake Knob to COMPLETELY release the hydraulic pressure.

**NOTE:** If there was a difference of more than ten brake knob applications required to discharge the hydraulic pressure from both accumulators, a fault could exist in the system that should be corrected.

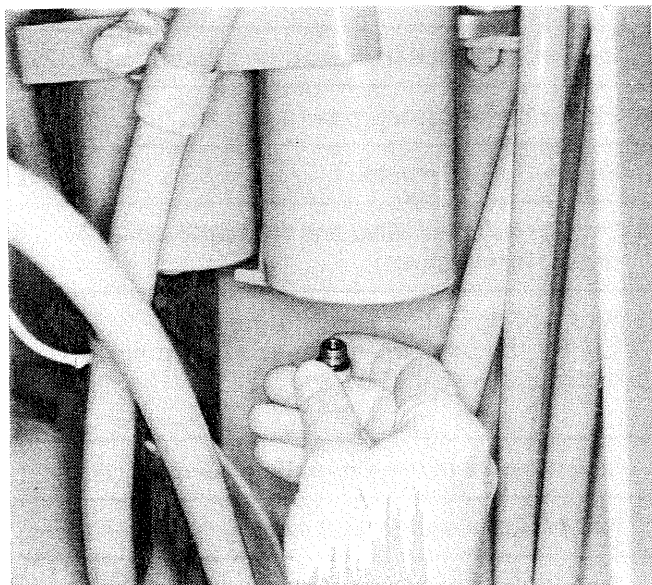


Fig 13-18

SP-10143

3. Remove the plug from the bottom of the outer (midmount) brake accumulator. Making sure that the hydraulic pressure was completely released from the accumulator, install a 24.000 kPa (3500 PSI) gas pressure test gauge to the test port on the bottom of the accumulator using a test gauge adaptor.

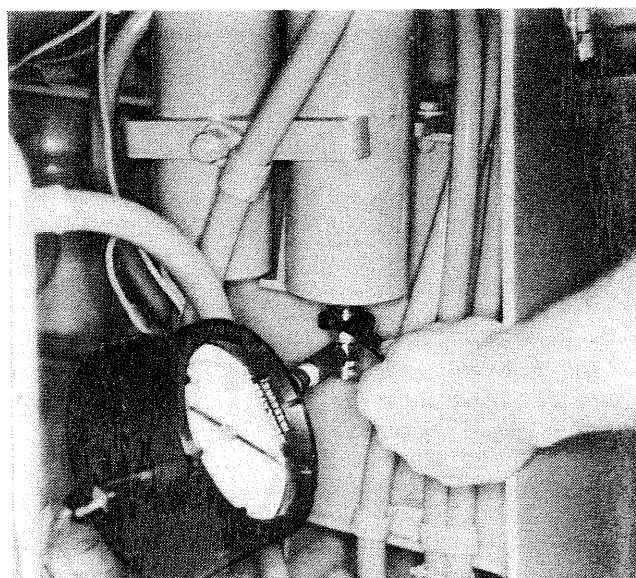


Fig 13-19

SP-10144

4. Loosen the valve (lower) nut on the adaptor and check the reading on the gauge. The correct nitrogen gas precharge pressure is 6.900 kPa (1000 PSI). Tighten the valve nut, remove the gauge/adaptor from the test port. Add or remove dry nitrogen as required and install the plug in the bottom of the accumulator.



**WARNING: NEVER USE OXYGEN OR COMPRESSED AIR to precharge the brake accumulators. USE ONLY DRY NITROGEN to ensure safe, efficient brake operation.**

**IMPORTANT NOTE:** An increase or decrease of 22C° (40F°) in ambient temperature will increase or decrease the accumulator precharge approximately 690 kPa (100 PSI). If there is a prolonged change in ambient temperature, the precharge pressure should be checked.



**WARNING: NEVER disassemble accumulators without FIRST releasing the hydraulic and precharge pressures COMPLETELY.**



**BRAKE SYSTEM TROUBLESHOOTING CHART**

<b>Indicator</b>	<b>Brake Pedal Applied/Released</b>	<b>Possible Problem</b>
One brake warning light glows and the buzzer sounds continuously.	Applied or Released	Faulty brake system test switch.
	Applied Only	Faulty brake pressure switch.
		External leakage in one brake circuit.
One (or both) brake warning light(s) glow(s) and the buzzer sounds but stop(s) after a short period of time.	Applied or Released	Faulty brake pressure switch(es).
		Faulty unloader valve.
		Faulty unloader valve and (a) faulty brake pressure switch(es).
Both brake warning lights glow and the buzzer sounds but stops after the hydraulic oil warms up.	Applied or Released	Ambient operating temperature is too low for the oil chosen for use in the main hydraulic system (See Sec. 17).
Both brake warning lights glow and the buzzer sounds continuously.	Applied or Released	Low oil level in the hydraulic reservoir.
		Faulty brake system test switch.
		Two faulty brake system pressure switches.
		Leaky suction line to the brake pump.
		Faulty unloader valve.
		Faulty brake pump.
	Applied Only	External leakage in both circuits.
		External leakage in one brake circuit and excessive internal leakage in the inverted shuttle valve.
Buzzer sounds but no lights glow.	Applied or Released	Any of the above brake malfunctions and one (or two) faulty brake warning light(s).
One (or both) brake warning light(s) glow(s) but no buzzer sounds.	Applied or Released	Any of the above brake malfunctions and a faulty buzzer.
Little or no reserve brake applications.	Applied only	One (or both) brake unit(s) is out of adjustment.
		Air is in the fluid system of one (or both) brake system(s).
		Brake accumulators are not correctly precharged.
		External leakage in one (or both) brake system(s).
		Faulty brake pump.

## ELECTRICAL

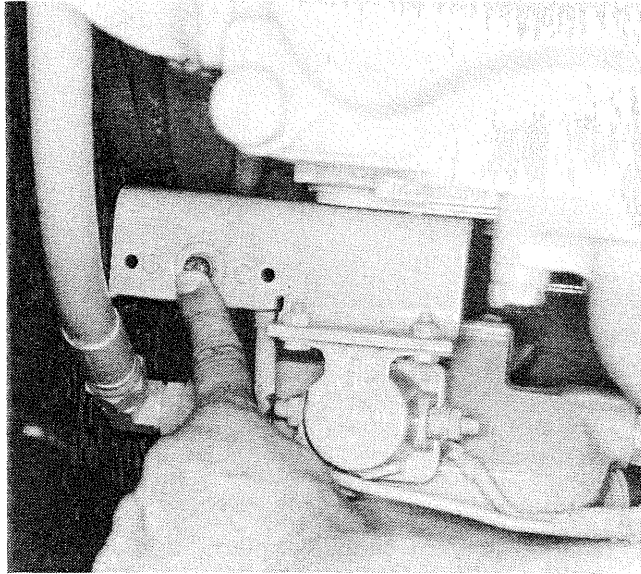


Fig 14-1

SP-10143

The electrical system in the 668D is protected from overload by a circuit breaker located on the left hand side of the engine. If there are sudden surges of current, the circuit breaker will actuate and prevent damage to the system. Push the red button to reset it.

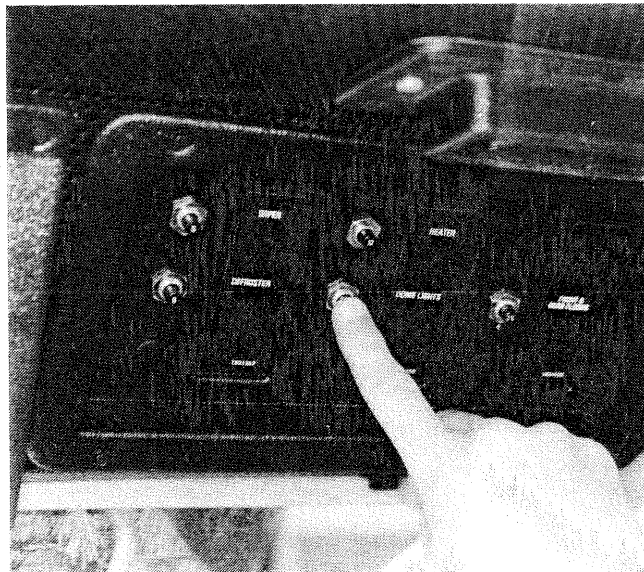


Fig 14-2

SP-10037

On 668D machines with enclosed cabs and optional dome lights, heater, defroster fan and/or windshield wiper and washers the operating controls are located on the inside of the enclosed cab above the windshield. Each option is protected by a circuit breaker located to the right of the controls. Push the appropriate button to reset the circuit breaker if it has been actuated.

Optional lights on your machine are located on the grill shroud (four) and on the rear of the canopy (four).

The angles of the beams are adjustable by loosening the mounting nuts and turning the lamps to the desired position.

Replace the lamps by pushing the lamp in and spreading the lip of the rubber retainer.

With the rubber lip spread, remove the lamp, unplug the harness and replace the lamp.

### Every 500 Hours of Operation:

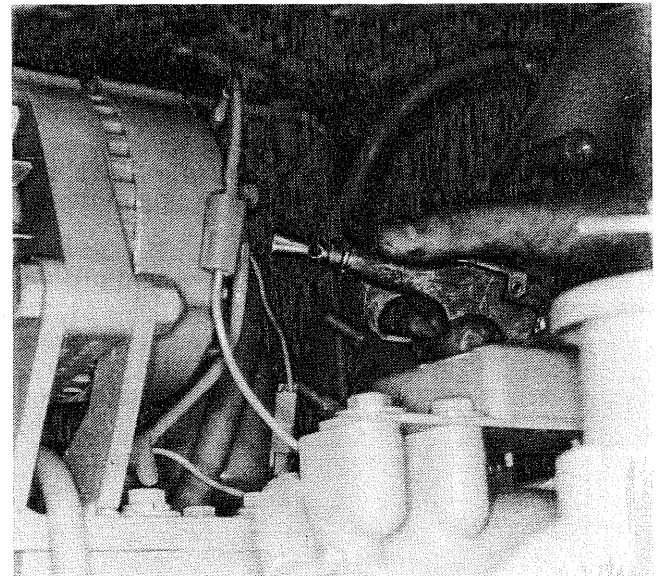


Fig 14-3

SP-10144

Clean the alternator with compressed air (140 to 200 kPa/20 to 30 PSI).

Clean and tighten the electrical connections. Periodically inspect all wiring and connections to 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, adjust or replace where required. Make sure that wires do not rub on rough surfaces or sharp edges.

Batteries must be kept clean and fully charged at all times. In cold weather their ability to deliver full power is greatly reduced. A fully charged battery at  $-10^{\circ}\text{C}$  ( $15^{\circ}\text{F}$ ) can deliver only 70% of its rated amperage. At lower temperatures, its output is substantially reduced. Service the batteries every 500 Hours as follows:

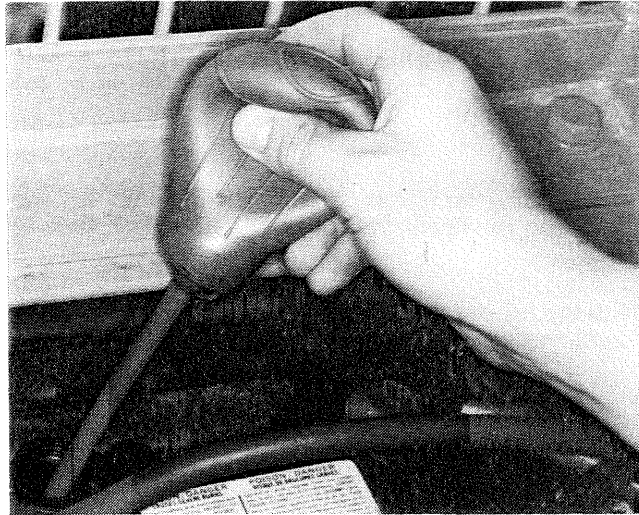


Fig 14-4

SP-10145

1. Add distilled water to cover the plates, but do not overfill the cells. Overfilling dilutes the electrolyte, and causes spattering in the electrolyte. Diluted electrolyte can freeze or cause corrosion in the terminals.

**WARNING:** ALWAYS use eye protection, as battery electrolyte will cause serious eye injury and DO NOT smoke while servicing batteries.

**NOTE:** Add water during the work shift to allow the charging system to mix the electrolyte and prevent the water from freezing.

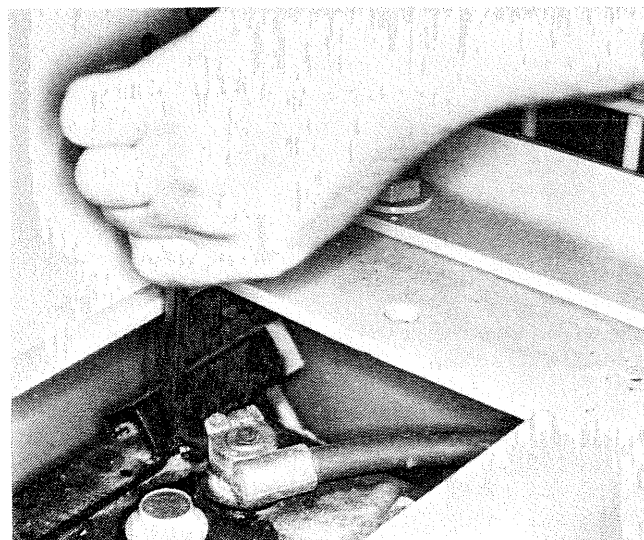


Fig 14-5

SP-10146

2. Keep the terminals and batteries clean and make sure the connections are tight. Loose or dirty terminals restrict current flow.



Fig 14-6

SP-10147

3. Keep the vent plugs in place, and installed tightly to keep foreign material from the cells.

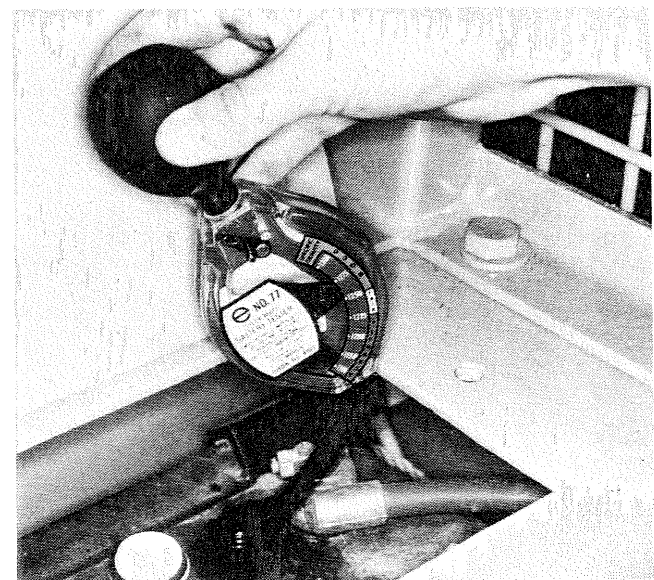


Fig 14-7

SP-10148

4. Check the specific gravity of the electrolyte regularly with a hydrometer. Recharge or replace batteries that show continual low readings.

**NOTE:** If periodic checks show that the specific gravity is consistently low, have the electrical system checked. The starter, alternator, voltage regulator, or batteries themselves may be at fault.

## BATTERY VOLTAGE AND SPECIFIC GRAVITY CHART

Open Circuit Volts	Specific Gravity at 27° C (80° F)	% Charge	% Discharge
12.60	1.265	100%	0%
12.56	1.257	95%	5%
12.52	1.249	90%	10%
12.48	1.241	85%	15%
12.44	1.233	80%	20%
12.40	1.225	75%	25%
12.36	1.218	70%	30%
12.32	1.211	65%	35%
12.28	1.204	60%	40%
12.24	1.197	55%	45%
12.20	1.190	50%	50%
12.16	1.183	45%	55%
12.12	1.176	40%	60%
12.08	1.169	35%	65%
12.04	1.162	30%	70%
12.00	1.155	25%	75%
11.70	1.120	Discharged	100%

## BATTERY LOAD TEST CHART

Electrolyte Temperature	Minimum Voltage for a 15 Second Carbon Pile Load Test
21° C (70° F)	9.6
16° C (60° F)	9.5
10° C (50° F)	9.4
4° C (40° F)	9.3
-1° C (30° F)	9.1
-7° C (20° F)	8.9
-12° C (10° F)	8.7
-18° C ( 0° F)	8.5

Service the other electrical components as follows:

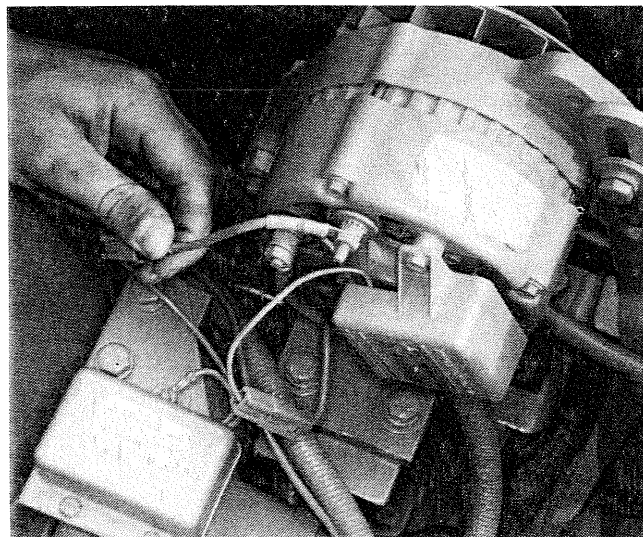


Fig 14-8

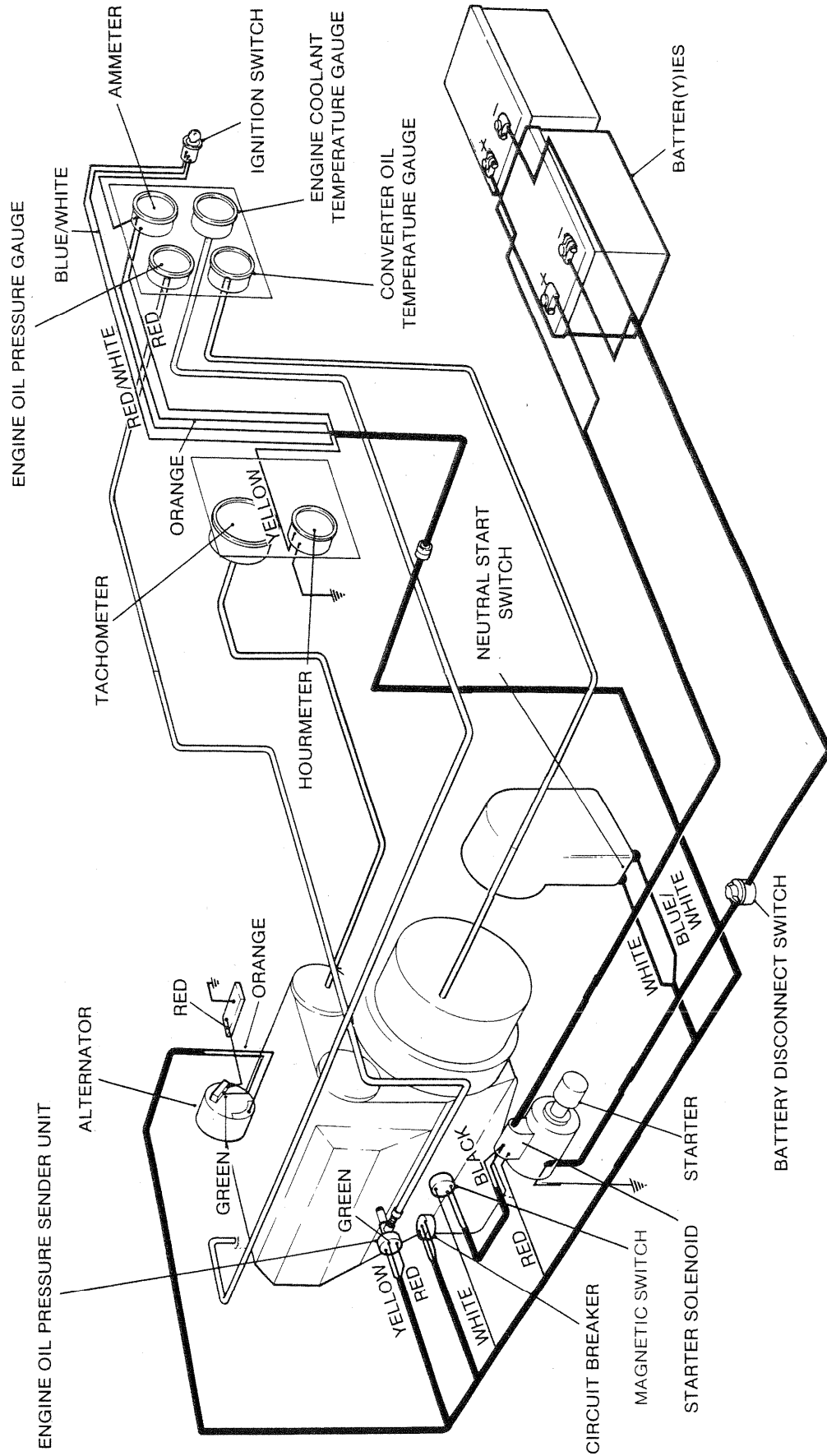
SP-10149

1. Visually check the wiring for worn or damaged insulation and loose terminal connections.
2. Clean the connections to the starter motor, alternator, voltage regulator, solenoid switch, relays and sender units. Clean and tighten the external ground strap and replace it if it is badly frayed or corroded.
3. Check to see that any wires are not in danger from burrs or wear points and make sure that all grommets are in place.

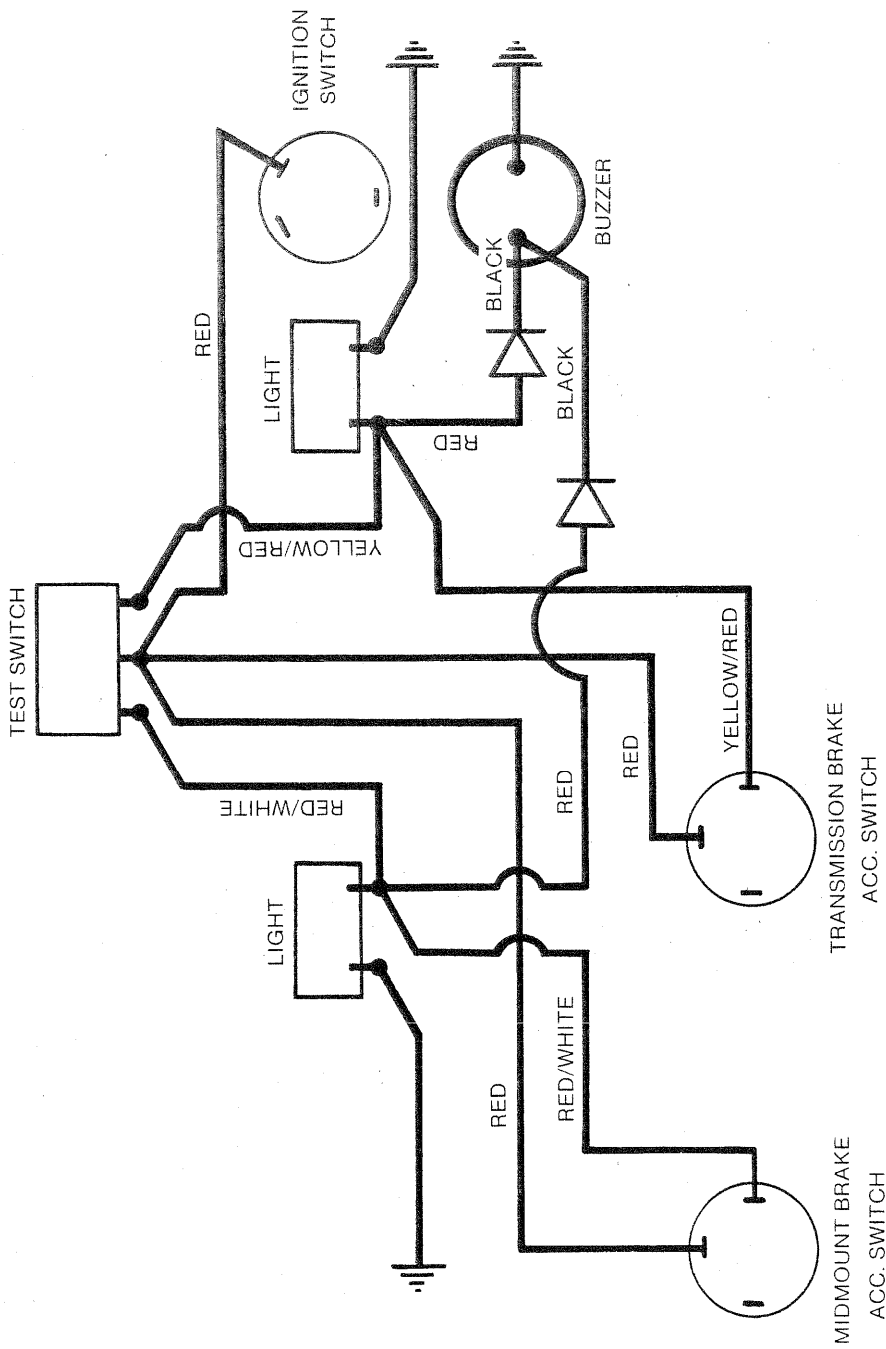
### Every 1000 Hours of Operation:

Inspect, test and lubricate the electrical units. Replace any defective or worn out parts.





WIRING SCHEMATIC 668 CUMMINS



WIRING SCHEMATIC - POWER BRAKES

**NOTES**

## MISCELLANEOUS

### Every 500 Hours of Operation:

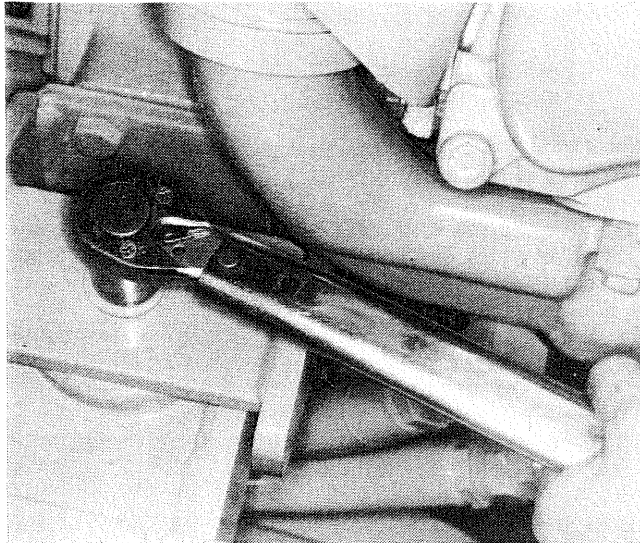


Fig 15-1

SP-10152

Tighten all component mounting bolts to the torques specified in Sec. 16. Wear and breakage can result from improperly installed or loosened mounting bolts (or nuts). If no torque values are given, bolts should be tightened in a manner consistent with good workmanship - See Sec. 16 - BOLT TORQUE CHART, GENERAL.

**NOTE:** Do not overtighten.

### If you must tow the machine:

Put all control levers in their NETRUAL positions.

Remove the driveshafts that connect the front and rear drive axles to the transmission.

**NOTE:** Never separate the propshaft halves because of the balance and wear characteristics of each assembly.

**IMPORTANT NOTE:** With the engine shut down, the transmission/converter charging (lubricating) pump is inoperative. Serious damage to the transmission will result if it is driven by the wheels with no lubrication.

**WARNING:** ALWAYS fasten the steering frame lock between the frames and install a red warning flag to the canopy upright to indicate that the steering frame lock is fastened.

Use a solid tow bar, or raise one end of the machine to tow it because with the steering frame lock fastened, and the engine shut down, the machine cannot be steered.

When you replace the driveshafts, use only the special bolts provided and tighten them to the torque specified in Sec. 16.

### If you must transport the machine:

Load and unload the machine on a level surface.

Always center the machine on the trailer bed.

Always put the machine in the Service Position (See Sec. 2).

Use adequate chains, blocks and cables to safely fasten the machine to the floor of the trailer.

Measure the overall height and width of the machine on the trailer.

**NOTE:** It is very important that you know the overall height, width and weight when you transport the machine.

Be especially careful in foggy, dusty or stormy weather conditions.

### If you must store the machine:

Thoroughly steam clean the machine to reduce the chance of fire and use touch-up paint where necessary to prevent rust.

Put the machine in the Service Position (See Sec. 2).

Check all fluid levels as shown in this manual and check the freezing point of the engine coolant. Add fluids as required.

FILL the fuel tank and the hydraulic oil reservoir.

Apply a coating of grease to all unpainted metal parts such as cylinder rods, propshaft splines, valve spools and control linkages. Use a rustproof spray on exposed pin ends and lock plates.

Cover the exhaust opening on the muffler.

Disconnect the ground cable(s) from the battery(ies).

Make a visual inspection for any oil or coolant leaks.

Check the air cleaner and air intake tubes for cracks or damage that would allow foreign material to enter and damage the engine.

Check the condition of the fan belt(s).

Grease ALL lubrication points thoroughly (See Sec. 17).

Remove the ignition key and keep it in a safe place.

Tilt the operator's seat against the handrail and cover the instruments and controls with a water-proof cover.



If possible, raise and block the machine to remove the load from the tires and reduce the tire inflation pressure to 105 kPa (15 PSI) and cover the tires to protect them from sunlight and weather.

If the machine cannot be raised, increase the inflation pressure 35 kPa (5 PSI) above the operating pressure and check the pressure every two weeks to maintain it. The tires should also be covered for protection. Do not leave tires standing on oil or fuel spills or any oil stabilized surface such as blacktop.

**Start and operate the machine every 30 days as follows:**

1. Check to see that the battery(ies) is (are) fully charged and reconnect the ground cable(s) to the negative battery terminal(s).
2. Clean any hardened grease from the cylinder rods.
3. Remove the covers from the tires (and lower the machine if it is raised).
4. Remove the cover from the exhaust opening on the muffler.
5. Make sure the fuel tank is kept full when the machine is stored.
6. Start the engine at Low Idle RPM.
7. Test the power brake warning system to see that it is operating correctly.
8. Check all gauges, lights and circuit breakers for proper operation.
9. Operate the engine at Low Idle RPM for approximately 15 minutes.
10. Release the parking brake and check the operation of the brake system(s) in an area free from obstructions.
11. Operate the transmission in both directions and all speed ranges for at least ten tire revolutions in each direction.
12. Operate the steering, blade (and grapple if applicable) hydraulic systems.

Stop the engine and return the machine to the Service Position (See Sec. 2). Tilt the operator's seat forward and reinstall the waterproof cover. Grease all exposed cylinder rods and check for leaks. Disconnect the ground cable(s), reinstall the cover on the muffler opening and cover the tires.

# SPECIFICATIONS AND SERVICE DATA

Engine	Cummins Diesel
Engine Model	VT-555
Engine Configuration	V8-Turbo
Bore X Stroke, cm (in)	11,75 X 10,46 (4.63 X 4.12)
Displacement, l (in <sup>3</sup> )	9,1 (555)
Maximum Torque, N.m (lbf.ft) @ RPM	617 (445) @ 1900
Gross Power, kW (hp) at governed RPM	168 (225)
Governed RPM (under Full Load)	2850
Low Idle RPM	775-825
High Free Idle RPM	3000-3100
Converter Stall RPM	2320-2520
Hydraulic Stall RPM	2000-2200

**NOTE:** The above Converter Stall RPM readings are the maximum engine RPM obtained with oil at its Operating Temperature (See Sec. 1), the Direction Control Lever in its Forward position, the Speed Range Control Lever in its Third position and the Service Brake applied. On 668D machines, the parking brake should not be actuated when doing stall checks due to the de-clutch mechanism.

These Stall Specifications are applicable to an altitude of 150 m (500 ft), ASL at an ambient temperature of 30°C (85°F). The numerous combinations of altitude and temperature make it difficult to publish Stall Specifications for all conditions. Contact your local engine distributor for the corrections required to calculate the Stall RPM values for your specific application.

## PRESSURE READINGS

At Operating Temperature (See Sec. 1)  
- kPa (PSI).

### Engine Lube Oil:

70 to 170 (10 to 25) at Low Idle RPM.  
345 to 515 (50 to 75) at Operating RPM.

### Transmission/Winch Clutches:

1.655 to 1.930 (240 to 280) in both Directions, all  
Speed Ranges and all Winch Modes at Low and  
High Idle RPM with no more than 35 kPa  
(5 PSI) difference between all readings.

### Main Hydraulic Relief:

14.480 (2,100)

### Power Brake Accumulator Precharge:

6.900 (1,000)

## BATTERY AND ELECTRICAL SYSTEM

12V negative ground system  
with 35 amp. alternator.

### Battery Charge Test:

Carbon Pile test method should be used to  
test the battery under load.

## CAPACITIES (Approximate)

	Litres	U.S. Gallons
Engine Cooling System .....	52	13.2
Engine Lube Oil System .....	32	8.4
Fuel Tank - Cable .....	295	78
Fuel Tank - Grapple .....	310	82
Main Hydraulic System - Cable .....	73	19.2
Main Hydraulic System - Grapple .....	96	25.2
Transmission/Converter Hydraulic System .....	38	9.9
Midmount Brake Unit .....	10	2.6
Axle Differentials - Front .....	16	4.3
Axle Differentials - Rear .....	25	6.5
Axle Planetary Hubs - Front .....	9	2.4
Axle Planetary Hubs - Rear .....	7	1.9

<b>BOLT TORQUE CHART, APPLICATION</b>	<b>Thread</b>	<b>N.m</b>	<b>lbf.ft</b>
* Wheel Nuts - Rim to Axle - SPHERICAL SEAT	.750-16	575-645	425-475
Front Engine Mount to Pedestal Mount	.625-18	120-150	90-110
Front Pedestal Mount to Frame	.625-11	230-300	170-220
** Front Engine Mount to Engine	.500-13	80-110	60-80
** Rear Engine Mount to Engine	.625-11	160-215	120-160
Rear Engine Mount to Frame	.625-11	120-135	90-100
Converter to Engine Flywheel Housing	.375-16	45-60	35-45
Transmission Mount to Transmission	.750-10	380-420	280-310
** Transmission Mount to Frame	.750-10	390-515	290-380
Upper Propshaft Mounting Bolts	.375-24	45-60	35-45
Lower Propshaft Mounting Bolts	.500-20	120-155	90-115
Front Axle to Cradle	1.00-8	950-1255	700-925
Rear Axle to Frame	1.25-12	2000-2500	1450-1850
Winch to Frame	1.25-7	1150-1355	850-1000
** Hinge and Cradle Pin to Frame Capscrews	.500-13	110-115	80-85
** Hinge and Cradle End Plate to Pin Capscrews	.625-18	245-250	180-185
** Hinge and Cradle Bushing Retaining Cap Capscrews	.500-13	40-45	30-35
Midmount Brake to Frame	.750-10	380-420	280-310

When you install the above mounting bolts, lubricate the threads with SAE No. 30 oil unless otherwise instructed.

\*The spherical wheel nut seat in the rim must be concentric with the stud - ream the hole if necessary.

\*\*When you install these mounting bolts, apply Loctite - 271 or equivalent to the threads.

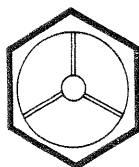
BOLTS NOT LISTED ARE TO BE DRAWN UP TIGHT IN A MANNER CONSISTANT WITH GOOD WORKMANSHIP — See BOLT TORQUE CHART - GENERAL.

## BOLT TORQUE CHART - GENERAL

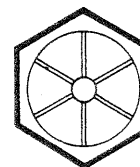
**NOTE:** Use this chart only if the torque is not shown on the BOLT TORQUE CHART, APPLICATION.

Thread Diameter		GRADE 5		GRADE 8		Socket Head and 12 Point Head Capscrews	
		Part Number Prefixes Coarse Thread 1C,15C,61D Fine Thread 2C,16C,62D		Part Number Prefixes Coarse Thread 17C,23C,63D Fine Thread 18C,24C,64D		Part Number Prefixes Coarse Thread 25C,73G,93G Fine Thread 26C,74G,94G	
Fraction	Decimal	N.m	lbf.ft	N.m	lbf.ft	N.m	lbf.ft
1/4	0.2500	10	7	12-14	9-10	15-16	11-12
5/16	0.3125	20-22	15-16	24-27	18-20	31-34	23-25
3/8	0.3750	34-38	25-28	50-55	34-40	60-65	45-50
7/16	0.4375	55-60	40-45	80-90	60-65	95-100	70-75
1/2	0.5000	90-95	65-70	125-135	90-100	150-160	110-120
9/16	0.5625	125-135	90-100	170-190	125-140	205-225	150-165
5/8	0.6250	170-190	125-140	240-255	175-190	285-310	210-230
3/4	0.7500	300-330	220-245	405-445	300-330	490-540	360-400
7/8	0.8750	450-490	330-360	645-710	475-525	815-880	600-650
1 in	1.0000	645-710	475-525	985-1085	725-800	1220-1355	900-1000
1-1/8	1.1250	880-975	650-720	1425-1595	1050-1175	1760-1965	1300-1450
1-1/4	1.2500	1220-1355	900-1000	2000-2205	1475-1625	2510-2710	1850-2000
1-3/8	1.3750	1630-1830	1200-1350	2710-2980	2000-2200	3320-3660	2450-2700
1-1/2	1.5000	2035-2235	1500-1650	3523-3865	2600-2850	4270-4680	3150-3450
1-5/8	1.6250	2710-2980	2000-2200	4680-5150	3450-3800	5630-6240	4150-4600
1-3/4	1.7500	3390-3730	2500-2750	5830-6510	4300-4800	6910-7730	5100-5700
1-7/8	1.8750	4270-4745	3150-3500	7460-8270	5500-6100	8810-9760	6500-7200
2 in	2.0000	5150-5965	3800-4200	8810-9760	6500-7200	10575-11660	7800-8600

**NOTE:** The torque values shown are for fasteners coated with zinc phosphate and oil, and used with hardened plain or zinc phosphate and oil coated washers.



Grade 5 Identification  
3 Radial Lines 120° Apart  
on Heads of Bolts.



Grade 8 Identification  
6 Radial Lines 60° Apart  
on Heads of Bolts.



**NOTES**

# HOURLY LUBRICATION & MAINTENANCE SCHEDULE

SYSTEM	OPERATION	TEXT LOCATION	INTERVALS					
			10	50	100	250	500	1000
Engine Cooling System and Accessories	Engine Maintenance (See Engine Manual)							
	Check & 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			•			
	Check Engine RPM	Sec. 6				•		
	Clean Radiator Core	Sec. 6					•	
	Service Air Cleaner Element and Body	Sec. 6						
Fuel System	Drain Fuel Tank Sediment	Sec. 7		•				
	Check Fuel System for Leaks	Sec. 7		•				
	Clean Fuel Tank Filter Cap	Sec. 7		•				
	Drain & Clean fuel tank	Sec. 7						•
Transmission /Converter Hydraulic System	Check fluid level daily, at the transmission	Sec. 8	•					
	Clean Transmission Breather	Sec. 8		•				
	Check Converter out Pressure	Sec. 8				•		
	Check & Adjust Transmission Shift Linkage	Sec. 8					•	
	Replace the Filter Element	Sec. 8					•	
	Check Transmission Clutch Operating Pressures	Sec. 8					•	
	Drain & Refill Transmission/Converter System	Sec. 8						•
Winch	Check & Adjust the Clark Winch Free Spool	Sec. 9			•			
	Check Clark Winch Free Spool Wear Button	Sec. 9				•		
Steer & Blade Hydraulic System	Clean Cylinder Rods	Sec. 10		•				
	Check and Adjust Relief Pressures	Sec. 10					•	
	Replace Filter Element	Sec. 10					•	
	Drain, Clean & Refill Hydraulic Oil Reservoir	Sec. 10						•
Axles, Propshafts & Pillow Blocks	Check Fluid Level of Differential & Planetary	Sec. 11		•				
	Clean Breathers	Sec. 11					•	
	Drain & Refill Differential & Planetary	Sec. 11						•
	Check For and Repair Drive Line noises	Sec. 11						
Wheels & Tires	Check Tire Pressures & Casings	Sec. 12	•					
	Tighten Wheel Nuts & Inspect Rims	Sec. 12		•				
Brakes	Check Power Brake Inverted Shuttle Valve	Sec. 13		•				
	Check Fluid Level in Midmount Brake Unit	Sec. 13			•			
	Check & Adjust Brake Units	Sec. 13				•		
	Drain & Refill Midmount Brake Unit	Sec. 13					•	
	Check Power Brake Accumulator Precharge	Sec. 13					•	
Electrical System	Service the Batteries	Sec. 14					•	
	Check Lights & Fuses	Sec. 14		•				
	Clean the Alternator	Sec. 14					•	
	Clean & Tighten Electrical Connections	Sec. 14					•	
	Inspect, Test, & Lubricate Electrical Units	Sec. 14						•
	Check Cranking Motor Operation	Sec. 14						•
Miscellaneous	Tighten Component Mounting Bolts	Sec. 15					•	

## HYDRAULIC FLUID SPECIFICATIONS

### Main (and Power Brake) Hydraulic System

#### PREVAILING AMBIENT TEMPERATURE

-18°C (0°F) and Above

#### FLUID TO BE USED

1. Clark Hydraulic Fluid P/N 885385-0,95 l (1 U.S. qt) P/N 885382-3,8 l (1 U.S. gal).
2. SAE 10W Engine Oil, API Class SD, SE, CC or CD, MIL-L-2104C or MIL-L-46152B.

-18°C (0°F) and Below

1. Conoco Polar Start DN-600 Fluid.
2. Automatic Transmission Fluid (can be used only if it meets the following specifications):
  - A. Contains the types and contents of anti-wear compounding found in API Class SD, SE, CC or CD engine oils or have passed pump tests similar to those used in developing anti-wear type hydraulic fluids.
  - B. Have enough chemical stability for mobile hydraulic system service.
  - C. Meets the viscosity requirements of API Class SD SE, CC or CD engine oil - Grade SAE 10W.

-34°C (-30°F) and Below

The following should be used as a guide in consultation with a reputable oil supplier. Any fluid may be used which meets the following requirements.

1. Oil to be used must contain anti-wear properties and rust oxidation inhibitors plus anti-foam agents equal to that found in API Class SD, SE, CC or CD engine oils or have passed pump tests similar to those used in developing anti-wear type hydraulic oils.
2. Oil must have a Saybolt Universal Viscosity of 145 to 225 seconds at 38°C (100°F) and viscosity of not less than 42 seconds at operating temperature. The oil selected should have a high shear stability to insure that the viscosity remains within recommended limits. Viscosity Index should not be less than 90.
3. Have a pour point of 11°C (20°F) below start-up temperature.
4. Diesel fuel, kerosene, transformer oil, etc., MUST NOT be used to dilute normal fluids.

### Transmission/Converter/Winch Hydraulic System and Midmount Brake

#### PREVAILING AMBIENT TEMPERATURE

-1°C (30°F) and Above

#### FLUID TO BE USED

C-3 Grade 30 Transmission Fluid

-23°C (-10°F) and Above

C-3 Grade 10 Transmission Fluid

-34°C (-30°F) and Above

Clark Transmission/Converter Fluid Part Number 962669-19 l (5 U.S. gal), 962672-208 l (55 U.S. gal). Texaco TL8790 (Canada), Texaco TL8570 (U.S.A.), or Texaco TL6673A (Europe).

-34°C (-30°F) and Below

Contact the Service Department, Clark Michigan Company.

Hydraulic fluid must be kept clean. Any fluid added to the reservoir must be filtered through a 100 mesh screen. It is important to service filters and breathers at the correct hourly intervals.

Any time oil is added to top up the fluid level, the same oil as is already in the system must be used. If the same fluid is not available, another approved fluid (for the given temperature range) can be added if the fluid is supplied by the same manufacturer and the amount added is not greater than 50% of the system capacity. If these conditions cannot be met, the system must be drained completely and refilled.

When the fluid is changed because of changes in ambient temperature, the system must be drained and the fluid replaced.

Because of the many types and brands of fluids that are available, it is not practical to test each one. Selecting the correct fluid should be done with the help of a reputable oil supplier who is responsible for the quality of the fluid. It is important to change fluids and filter elements at the intervals specified in this manual.

## LUBRICANT SPECIFICATIONS

### Front and Rear Axle Differential and Planetary Hubs

PREVAILING AMBIENT TEMPERATURE	LUBRICANT TO BE USED
37°C (100°F) and Above	SAE 140, 80W-140 or 85W-140 Extreme Pressure Sulfo-Chloro-Lead or MIL-L-2105C (API-GL-5).
-18°C (0°F) to 37°C (100°F)	SAE 90, 80W-90 or 80W-140 Extreme Pressure Sulfo-Chloro-Lead or MIL-L-2105C (API-GL-5).
-23°C (-10°F) to -18°C (0°F)	SAE 80, 80W-90 or 80W-140 Extreme Pressure Sulfo-Chloro-Lead or MIL-L-2105C (API-GL-5).
Below -23°C (-10°F)	SPECIAL POLAR MIL-L-2105C 75W Grade.

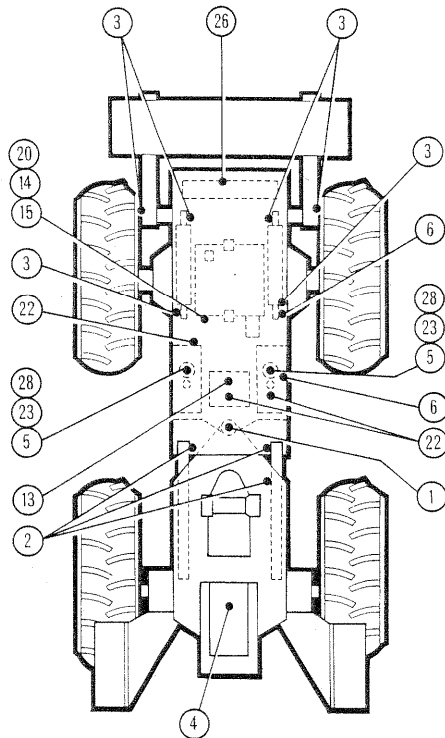
### Chassis Pin and Propshaft Lubrication

PREVAILING AMBIENT TEMPERATURE	LUBRICANT TO BE USED
-18°C (0°F) and Above	NLGI Grade 2 Extreme Pressure Molybdenum Disulphide Grease.
Below -18°C (0°F)	NLGI Grade 0 Lithium Base Extreme Pressure Multi-Purpose Grease



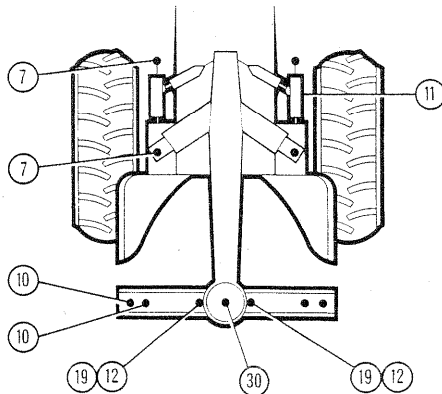
## LUBRICATION INSTRUCTIONS

## CHASSIS



ITEM	EVERY 10 HOURS OF OPERATION	666	667	668	CHECK	LUBE	CHANGE	KEY
1	HINGE & CRADLE PINS	X	X	X		•		EPML
2	STEER CYLINDER PINS	X	X	X		•		EPML
3	UTILITY BLADE & CYLINDER PINS	X	X	X		•		EPML
4	FUEL TANK	X	X	X	•			DF
5	HYDRAULIC OIL RESERVOIR	X	X	X	•			DX
6	ENGINE COOLANT LEVEL	X	X	X	•			
7	ARCH & CYLINDER PINS	X	X			•		EPML
10	GRAPPLE & CYLINDER PINS	X	X			•		EPML
11	BOOM CYLINDER PINS		X			•		EPML
EVERY 50 HOURS OF OPERATION								
13	TRANSMISSION/CONVERTER HYD FLUID	X	X	X	•			DX
14	MASTER CYL-ENCLOSED SERVICE BRAKE(S)	X	X		•			DX
15	MASTER CYLINDER-SECONDARY BRAKE	X			•			DX
16	AXLE DIFFERENTIALS	X	X	X	•			EPGL
17	AXLE PLANETARY HUBS	X	X	X	•			EPGL
18	ENCLOSED MIDMOUNT BRAKE		X	X	•			DX
19	SNUBBER ADJUSTMENT	X	X		•			
20	POWER BRAKE SYSTEM			X	•			
EVERY 100 HOURS OF OPERATION								
21	PROPSHAFT SLIP JOINTS	X	X	X		•		EPML
EVERY 500 HOURS OF OPERATION								
22	TRANSMISSION/CONVERTER HYD FILTER	X	X	X			•	
23	HYDRAULIC TANK FILTER	X	X	X			•	
25	ENCLOSED MIDMOUNT BRAKE		X	X			•	DX
26	CLEAN RADIATOR CORE	X	X	X	•			
12	SNUBBER PINS	X	X			•		EPML
EVERY 1000 HOURS OF OPERATION								
27	PROPSHAFT UNIVERSAL JOINTS	X	X	X		•		EPML
28	HYDRAULIC OIL RESERVOIR	X	X	X			•	DX
29	TRANSMISSION/CONVERTER HYD FLUID	X	X	X			•	DX
30	GRAPPLE ROTATING HEAD BEARING	X	X			•		EPML

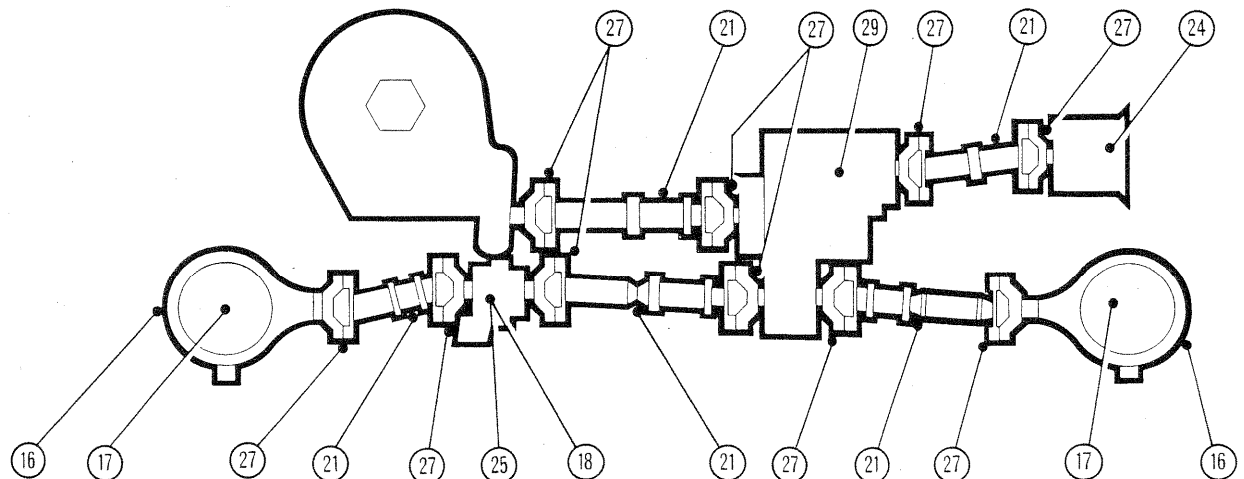
## LUBRICANT KEY



EPMD	Extreme Pressure Moly-Disulphide Grease				DF	#2 Diesel Fuel	
DX	Ambient Temp Range	Lubricant To Be Used			EPGL	Ambient Temp Range	Extreme Pressure Gear Lube (*SCL Type) or MIL 2105C
	Above -23°C 1) (-10°F) 2)	SAE Grade	API CC	Military Spec		Below -23°C (-10°F)	SAE Grade 75
		10W	CD	L-2104C			
	Dexron or Dexron II Automatic Transmission Fluid			-18°C to -23°C (0°F) to (-10°F)		SAE Grade 80	
	Above -34°C (-30°F)	Dexron or Dexron II Automatic Transmission Fluid					-18°C to -30°C (0°F) to (+100°F)
						Above 38°C (100°F)	SAE Grade 140

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

## DRIVE LINE



SP-10091

SP-1009

## SERVICE PUBLICATIONS

All new **RANGER** Log Skidders are supplied with a Service Publication package consisting of one Parts, one Operator's and one Engine Manual to be delivered to the customer at no charge at the time of the delivery. Additional manuals are available at a nominal cost from your **RANGER** distributor. The machine serial number should be supplied along with the publication order. Prices may be obtained from your distributor. Where manuals have been updated, and the publication number changed, the latest issue will be sent.

## SHOP MANUALS

The following are the component Shop Manuals for your machine.

	Manual No.
300 and 400 Series Master Winch .....	2561
C-270 Converter .....	2249
R-28,320 Transmission .....	2485
28,000 Transmission Mounted Hydraulic Brake .....	HB-280
Enclosed Midmount Brake .....	6960
19,000 Series Drive Axle .....	6956
33,000/37,000 Series Drive Axle .....	6957
Hydraulic Cylinders .....	3275

## PARTS MANUALS

All Parts Manuals must be ordered by specific machine serial number.

## MACHINE DATA

Model \_\_\_\_\_ Serial No. \_\_\_\_\_ Unit No. \_\_\_\_\_  
 Engine \_\_\_\_\_ Serial No. \_\_\_\_\_  
 Distributor \_\_\_\_\_  
 \_\_\_\_\_  
 Telephone \_\_\_\_\_ Parts Manager \_\_\_\_\_ Service Manager \_\_\_\_\_

**NOTES**





**INTENTIONALLY BLANK**