GRADALL®

# OPERATOR'S MANUAL

# XL4100 UPPER
# XL4200

24604139

July 2002
Starting S/N
Remote Control Units - 0418249
Crawler Units - 0425250
Also Covers 0419242, 0413249, 0415249 & 0412249

Form #29618 Original Issue 8/96

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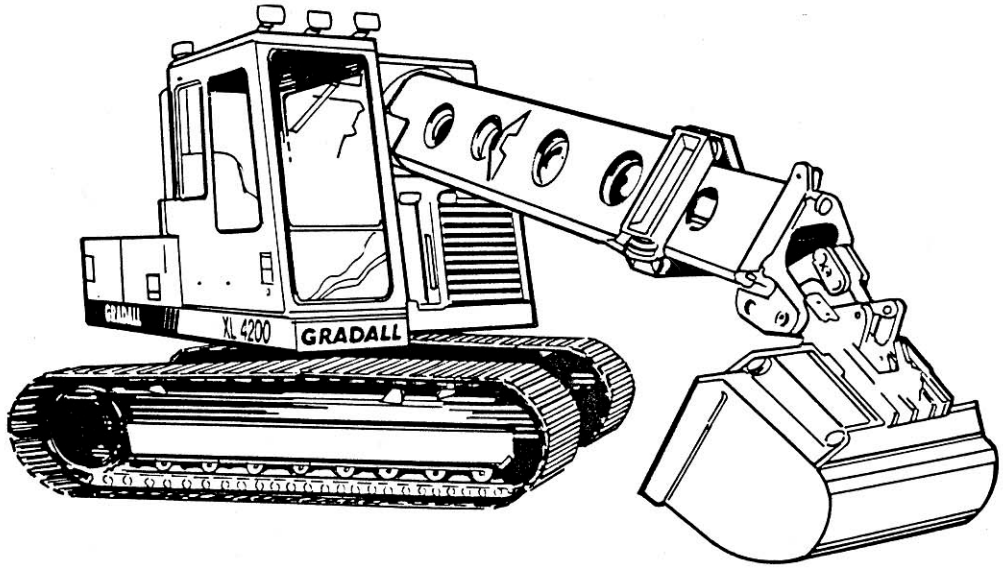
# GRADALL®

HYDRAULIC EXCAVATORS

# XL 4100 & XL 4200 UPPERSTRUCTURE OPERATION & LUBRICATION MANUAL




## IMPORTANT!

Read and understand this Manual, the GRADALL XL 4100 6X4 & 6X6 Carrier Operation and Lubrication Manual, the Gradall and EMI Hydraulic Excavator Safety Manuals before starting, operating or performing maintenance procedures on this machine.

## KEEP THESE MANUALS IN CAB

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**AVERTISSEMENT!** Si vous ne lisez pas l'Anglais, demandez a votre surveillant de vous donner les instructions de securite!

**ATENCION!** Si no lee Ingles, preguntele a su supervisor para las instricciones de seguridad!

**VORSICHT!** Wen Sie kein Enlisch lesen, bitten Sie ihren Vorgesetzten um die Sicherheitsvorschriften!

COVERS UNITS STARTING SERIAL NUMBER:
REMOTE CONTROL UNITS - 0418249
CRAWLER UNITS - 0425250
ALSO COVERS - 0419247, 0412249, 0413249 & 0415249

Form No. 29618

Part No. 2460-4139

# IMPORTANT SAFETY NOTICE

**Safe operation depends upon reliable equipment and proper operating procedures. Performing the checks and services described in this manual will help to keep your Gradall® Excavator in reliable condition and use of the recommended operating procedures can help you avoid accidents. Because some procedures may be new to even the experienced operator we recommend that this manual be read, understood and followed by all who operate the unit.**

**Strict attention to, and compliance with, instructions provided in this manual, the XL4100 6x4 & 6x6 Carrier Operation & Lubrication Manual, as well as the EMI & Gradall Hydraulic Excavator Safety Manuals and all instructional decals and plates affixed to the machine, will help you avoid personal injury and damage to the equipment. The information provided is not intended to cover all situations; it would be impossible to anticipate and evaluate all possible applications and methods of operation for this unit.**

**Any procedure not specifically recommended by The Gradall Company must be thoroughly evaluated from the standpoint of safety before it is placed In practice. If you aren't sure, contact your Gradall Excavator Distributor before operating.**

**Do not modify this machine without written permission from The Gradall Company. Use only genuine Gradall replacement parts.**

## OTHER NOTICES



**The Company also reserves the right to change specifications without notice.**



**The Gradall Company**
**406 Mill Avenue, S.W., New Philadelphia, Ohio 44663**

# TABLE OF CONTENTS

# INTRODUCTION

## General

This manual provides important information to material familiarize you with required operator maintenance and with safe operating procedures for the Gradall Hydraulic Excavator.

Because two operators are sometimes assigned to the unit, operator information for the upperstructure and for the undercarriage is provided in separate manuals.

The upperstructure includes a separate operator's station for control of excavator functions and is equipped with a separate engine to power the upperstructure.

## Related Manuals & Decals

Separate publications are furnished with the excavator to provide information concerning safety, replacement parts, maintenance procedures, theory of operation and vendor components. A kit containing all decals for your machine is available from your Gradall Distributor. He can also furnish additional manuals for your machine.

## Operator Qualifications

This excavator has been designed for operators weighing from 104 to 220 pounds (47 to 100 kg) and from 59 to 73 inches (150 to 185 cm) tall. Potential operators beyond these limits should be observed while operating and driving the unit in a safe area to determine their ability for safe, efficient operation.

The operator must hold a valid, applicable driver's license which requires acceptable age, vision, hearing, manual dexterity and response. He must also be in acceptable physical and mental condition (not undergoing medical treatment or using drugs or alcohol which would violate traffic laws.)

Before driving the unit on the highway or operating the excavator at a worksite, the driver/operator must familiarize himself with the machine by practicing in a safe, open area not hazardous to people or property.

The upperstructure operator must read, understand and comply with instructions contained in the following material furnished with the excavator.

- This Operation & Lubrication Manual
- Gradall Hydraulic Excavator Safety Manual
- EMI Hydraulic Excavator Safety Manual
- All Instructional decals and plates
- Any optional equipment instructions furnished

**If operator will also drive carrier:**

- XL4100 & XL4200 6x4 & 6x6 Carrier Operation & Lubrication Manual

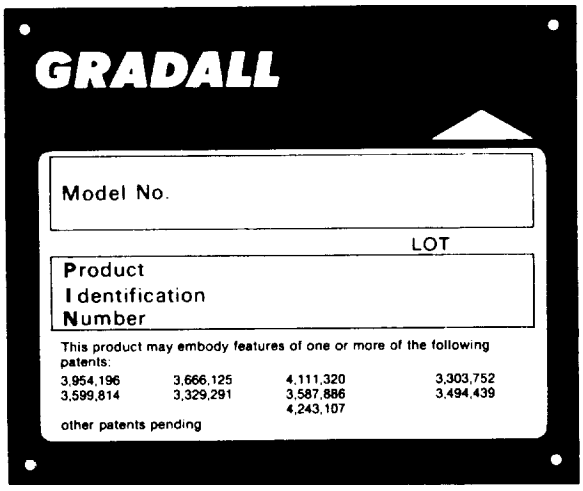
## Orientation

When used to indicate direction or location, the terms front, rear, left and right relate to the orientation of a person sitting in the upperstructure operator's seat.

In relation to the carrier, front, rear right and left are determined by the orientation of a person in the drivers seat.

## P I N Location (Product Identification No.)

Specify PIN and lot number number when ordering parts and when discussing specific applications and procedures with your distributor. The PIN plate is located on front, center portion of upperstructure frame.




## Models Covered

- XL4100 - wheeled carrier mounted excavators
- XL4200 - crawler mounted excavators

# SAFETY HIGHLIGHTS

**Read and understand this manual, XL4100 6x4 & 6x6 Carrier Operator's Manual, EMI Safety Manual, Gradall Hydraulic Excavator Safety Manual and all instructional decals and plates before starting, operating or performing maintenance procedures on this equipment. Keep these manuals in cab.**

## Watch for these symbols; they are used to call your attention to safety notices.

**⚠ DANGER**

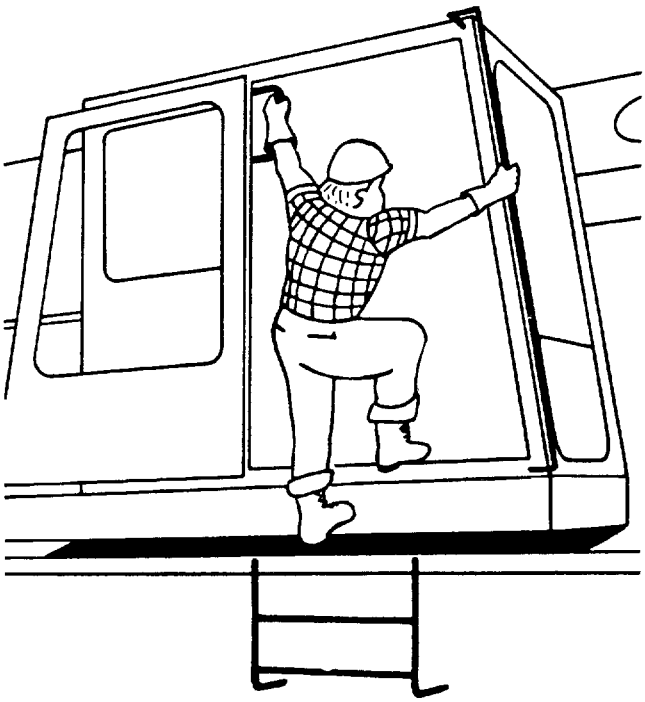
**This symbol indicates an extreme hazard which would result In high probability of death or serious injury if proper precautions are not taken.**

**⚠ WARNING**

**This symbol indicates a hazard which could result in death or serious Injury if proper precautions are not taken.**

**⚠ CAUTION**

**This symbol indicates a hazard which could result in injury or damage to equipment or property if proper precautions are not taken.**



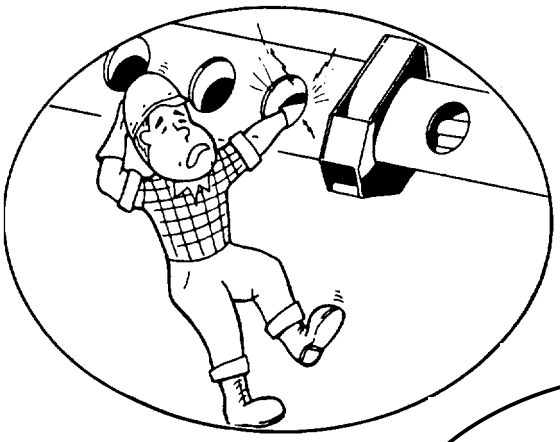
**Maintain three point contact** with grab handles and steps when climbing on and off the machine. **Never jump from the machine**.

**Repair or replace damaged steps and grab handles.**

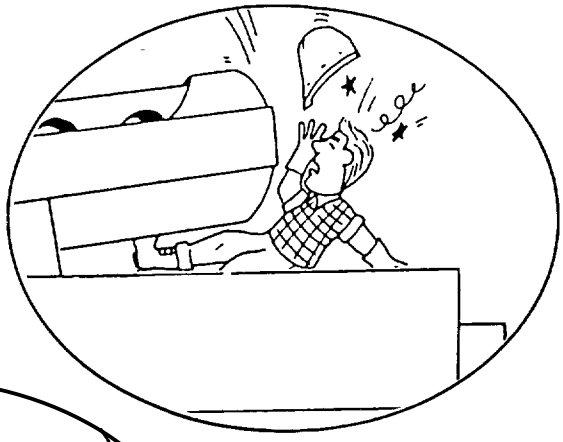
Perform all "CHECKS & SERVICES BEFORE STARTING ENGINE" (pages 19 & 20) and all "WARM-UP & OPERATIONAL CHECKS" (page 23) at beginning of your shift. **Complete all required maintenance before operating or driving the unit.**

# SAFETY HIGHLIGHTS

## Learn to recognize 'PINCH POINTS'

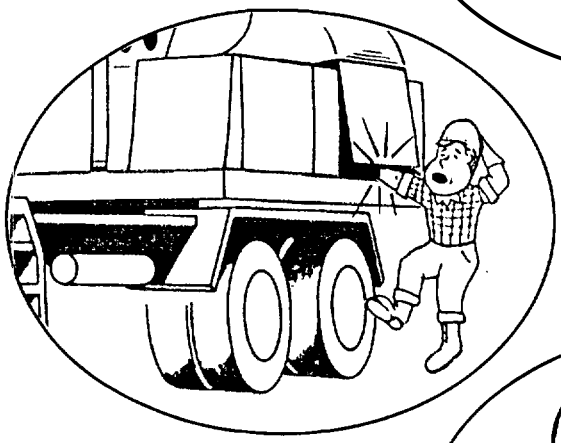


Boom Holes

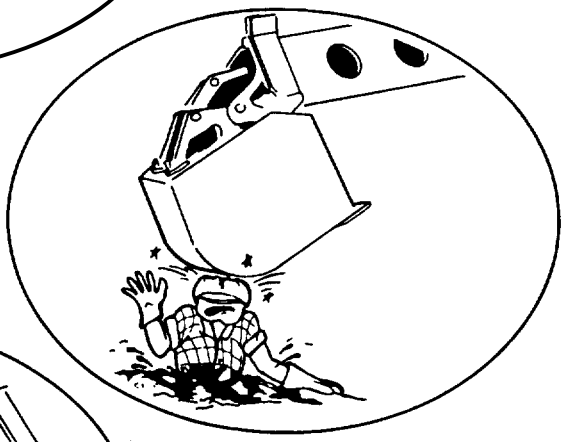


Boom Cradle

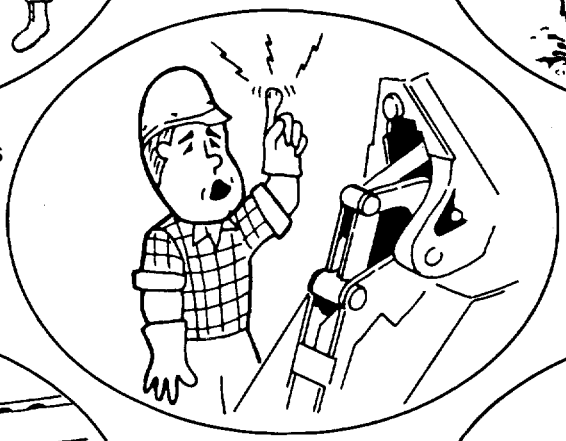
**Stay clear of PINCH POINTS. Getting caught in a pinch point can cause serious injury or death.**



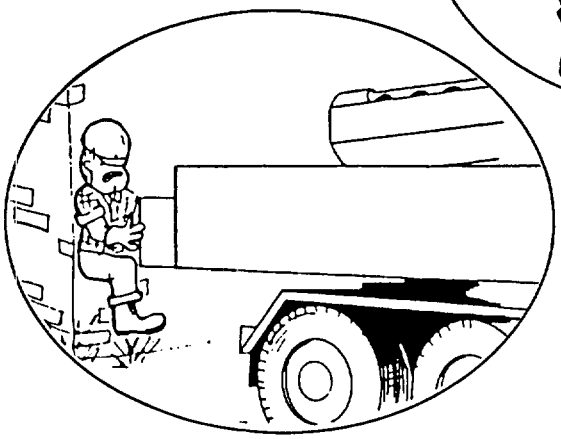
Access Covers



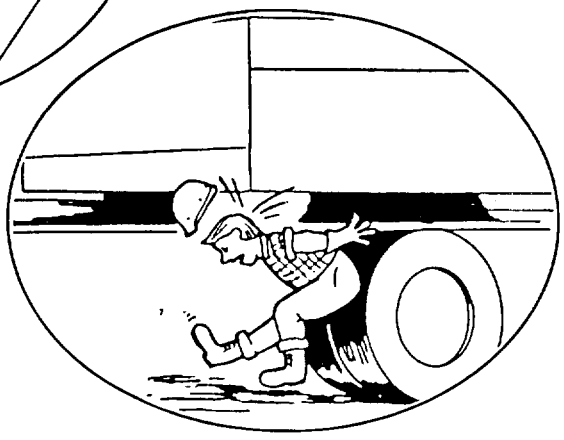
Boom



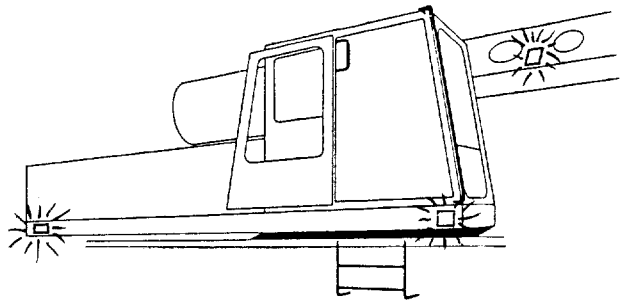
Bucket & Linkage



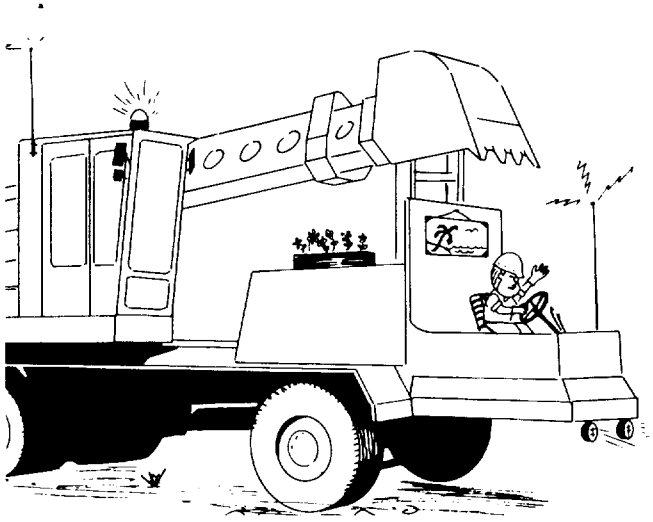
Counterweight & Another Object



Upperstructure & Carrier



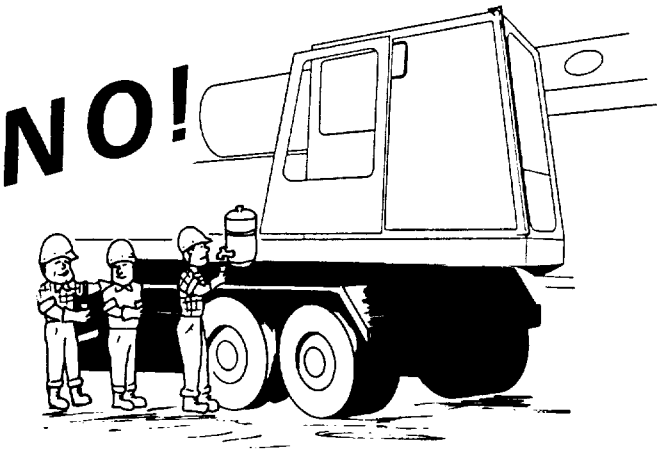
Check to be sure all **DANGER, WARNING, CAUTION** and **INSTRUCTION DECALS** are in place and can be read. Clean or replace decals as required.



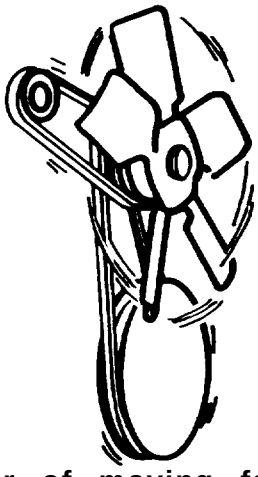
**Some owners alter their machines.** Check to be sure your machine fits the pictures and description in this manual. If it differs, or if you aren't sure, contact your Gradall distributor before you run your unit.


**Keep everyone off of the machine while it is operating.** Be alert for those who may be working near the excavator.

Keep steps and deck areas free of mud, oil, grease and other foreign material. Replace non-skid surface material as required.

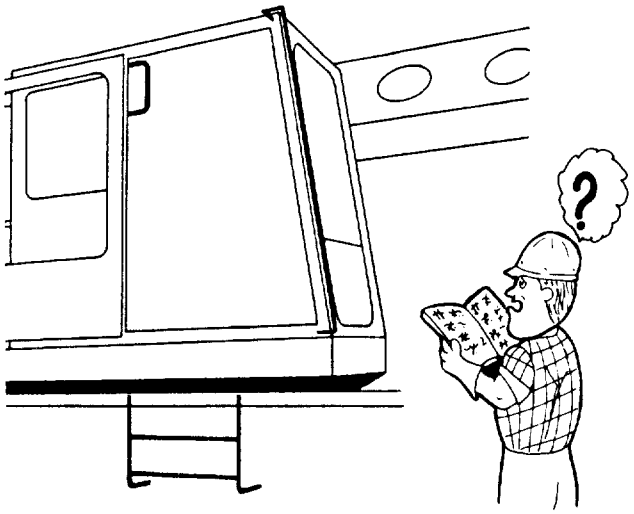



**Never carry a water can, equipment, or other worker's tools or personal Items on the machine.** Such items can cause other workers to approach the machine without your knowledge and result in serious injury or death.



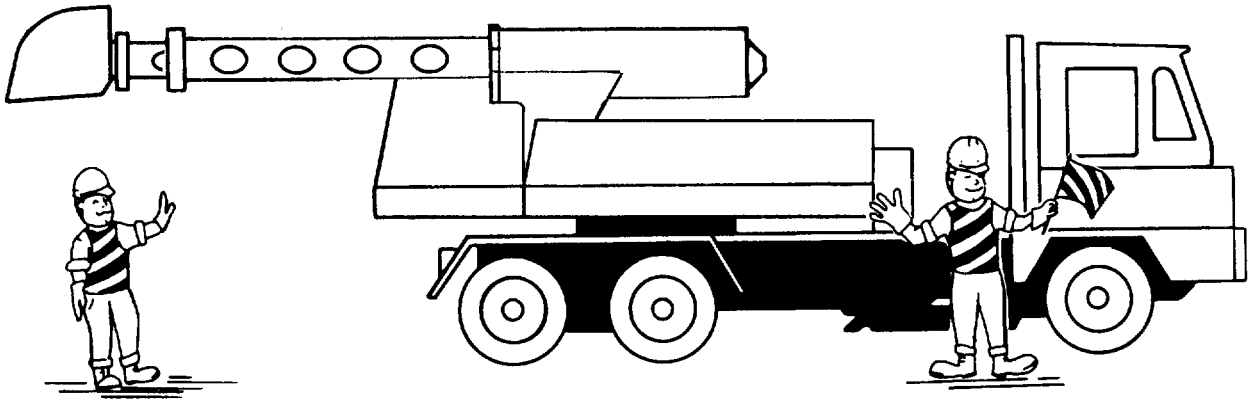
**Stay clear of moving fan, belts, pulleys, meshing gears, drive shafts and other moving parts**. Do not operate without covers and guards in place.

# SAFETY HIGHLIGHTS



**Be particularly careful** if this is not the machine you usually operate. **Read the manuals** listed on page 2 and then **operate the unit** in **a safe, open area** to become familiar with the controls.


Learn and **follow your employer's safety rules.**



**REPOSITION UNIT FOR EXCAVATOR OPERATION ONLY UNDER FOLLOWING CONDITIONS:**

**Signal persons positioned to observe and signal operator for safe travel and guide traffic.**

**Boom fully retracted, horizontal and centered over front or rear in direction of travel**

**Bucket positioned for maximum visibility**

**No load attached to any part of machine**

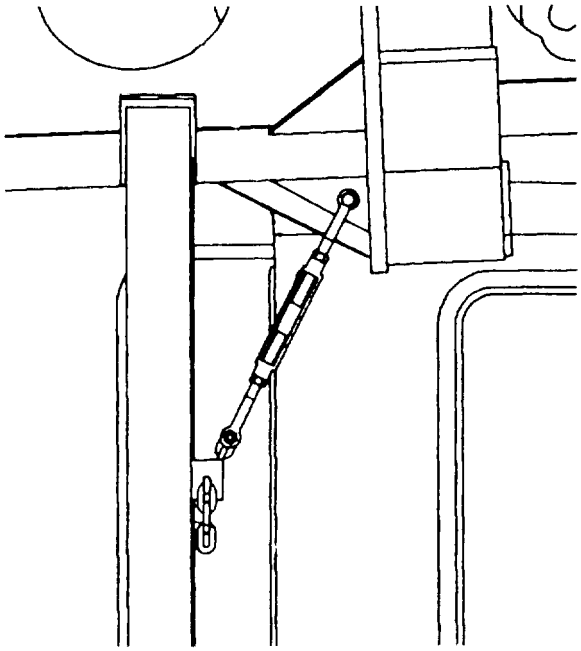
**Transmission in proper range**

**Tires properly inflated**

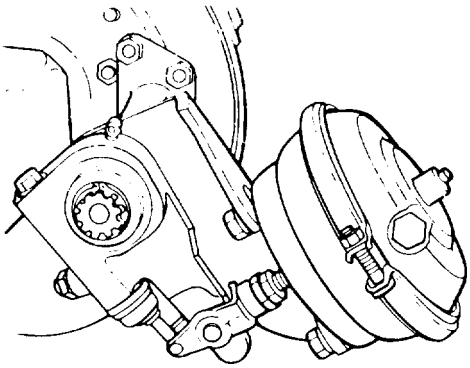
**Door secured in open or closed position**

**Be sure area is clear of bystander**

**Sound horn before moving**



**Use boom tie-down device to secure boom** in rack when traveling between jobsites. **Secure bucket as shown on page 40.**



**Inspect brakes before driving carrier after digging.**

**NOTE:** This illustration shows a typical automatic slack adjuster. Refer to instructions provided on inside back cover of this manual

1. Apply digging brake and stop engines.
2. Check the following for apparent damage:
   - Brake actuator chambers and rods
   - Brake actuator brackets
   - Slack adjusters
3. With brake applied, actuator rod should form an approximate right angle with slack adjuster.
4. **Do not drive unit** until any damage or malfunction has been repaired.

**⚠ WARNING**

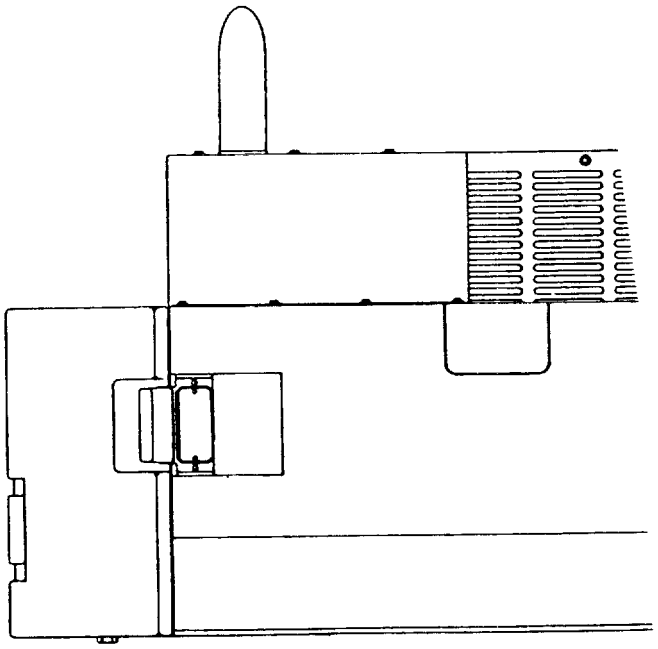
**Travel on off-highway grades is recommended only under the following conditions:**
**Boom secured in rest**
**tires properly inflated**
**Surface is firm enough to support unit**
**Surface provides adequate traction to prevent slipping**
**Surface is not rough enough or steep enough to cause tipping**
**Transmission is in LO LO gear range**

**⚠ DANGER**

**Whenever rotating equipment (such as a mower or mixer) is installed on machine, adequate shielding must be installed to prevent flying debris.**

**Never operate such equipment with other persons within range of possible flying debris. Be certain that mower discharge is never aimed at persons, equipment or structures.**

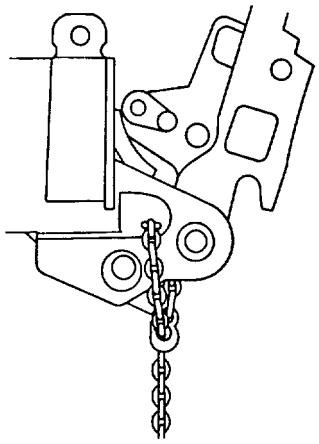
**As an additional precaution, safety glass and appropriate window guards must be installed on machine.**



**Check operation of all swing warning lights.**

# SAFETY HIGHLIGHTS

**Watch out for carrier cab when swinging.** Position unit so that it won't be necessary to swing close to cab.



With load attached as shown, **be certain chain is securely locked on itself.**

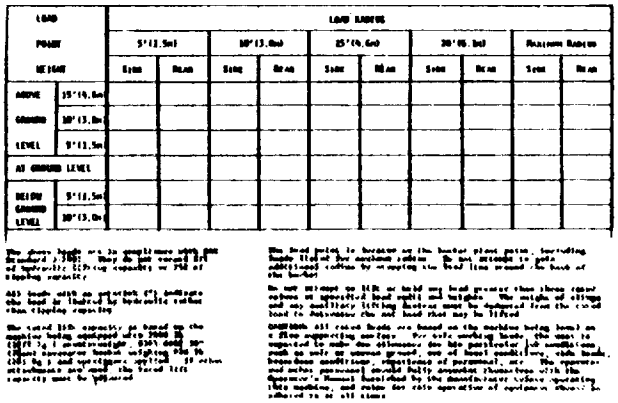
Sound Horn

Always sound horn to warn others of unexpected machine movements.

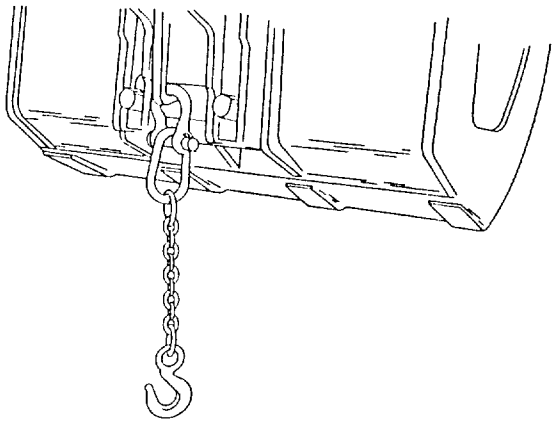
The unit is also equipped with an automatic **back-up alarm** to warn others of reverse travel during conventional carrier travel.

An automatic **travel alarm** is also provided to warn of remote control or crawler travel in either direction.

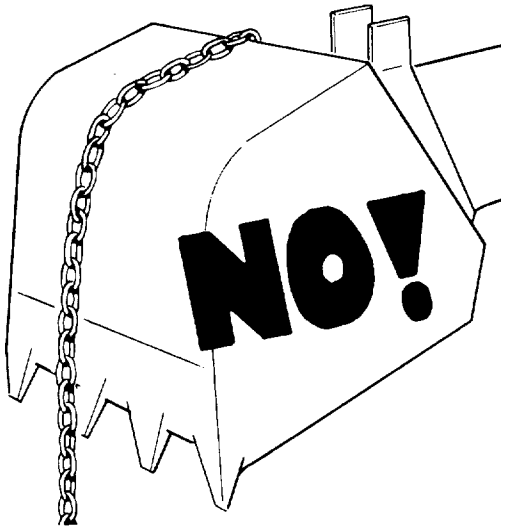
**GRADALL LIFTING CAPACITIES**
**RATED LIFT CAPACITY**



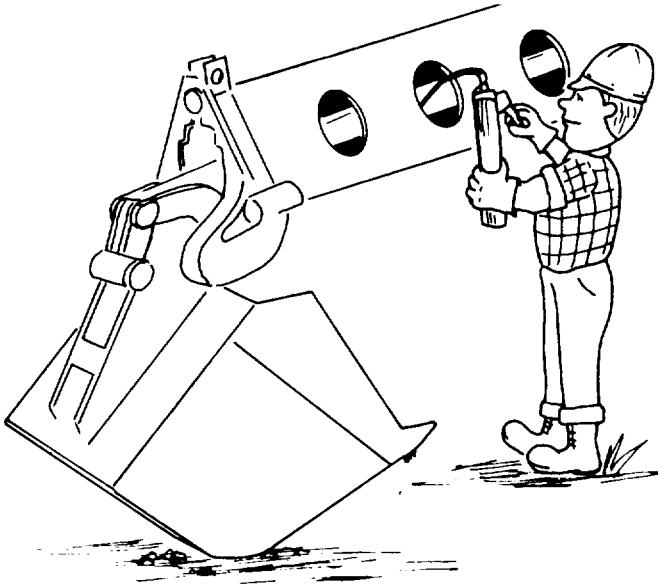
**Always check Lift Capacity Chart and plan lift** (pages 33 & 34) to be sure lift can be performed safety.



With load attached as shown, boom must be **level from side-to-side** and bucket adapter must be **closed against stops.**




**Never pass load line over open bucket.** Relief valves in bucket circuit could cause unexpected, dangerous movement of the load. Bucket linkage could also be damaged.

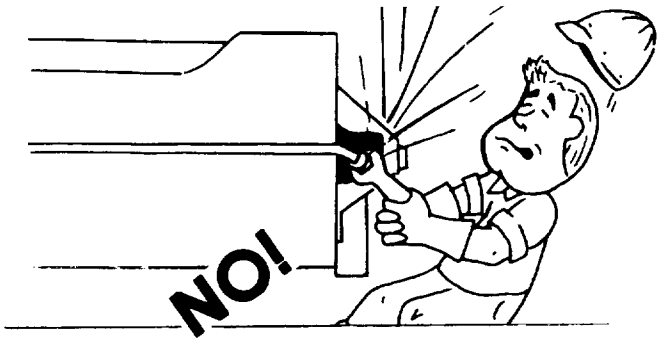


Always **be sure bucket is resting firmly in boom rest or on ground** and that **engine is stopped** before performing lubrication or maintenance procedures inside boom.


**Do not operate with bystanders or other workers near machine.**

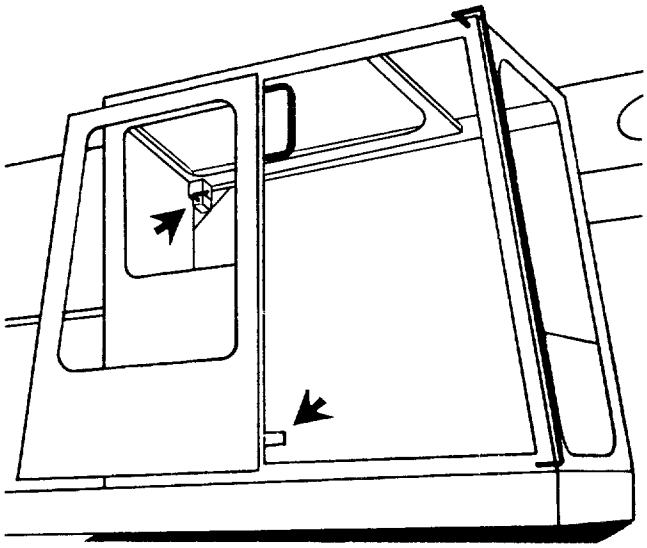
**⚠ WARNING**

**Avoid injury! Always relieve pressure trapped in circuits before disconnecting, removing or installing hydraulic components.**




Pressure can be maintained in hydraulic circuits long after the engine has been shut down. This pressure can cause oil (or items such as pipe plugs) to "shoot out" at high speed **if pressure is not released correctly.**

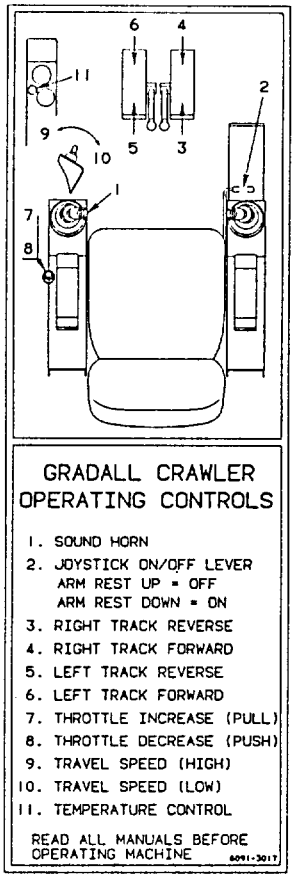
**Refer to service manual for procedure to relieve hydraulic pressure trapped in circuits.**



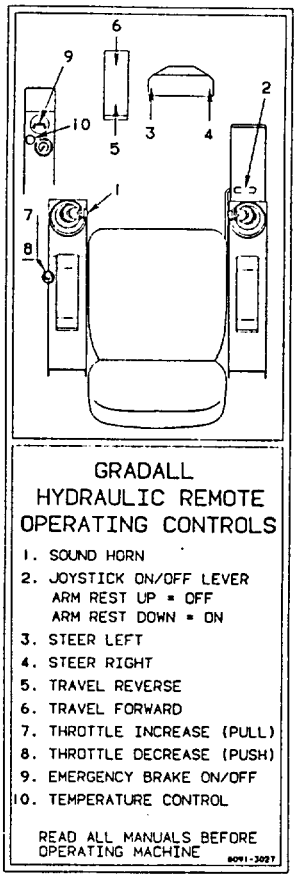
Be sure windows and doors are **securely latched** in open or closed position when operating. Replace **defective latches** and **weak** access cover support struts **immediately.**

Always **stop engine and apply emergency brake before leaving upperstructure cab**. However, emergency brake must be released before conventional carrier operation.

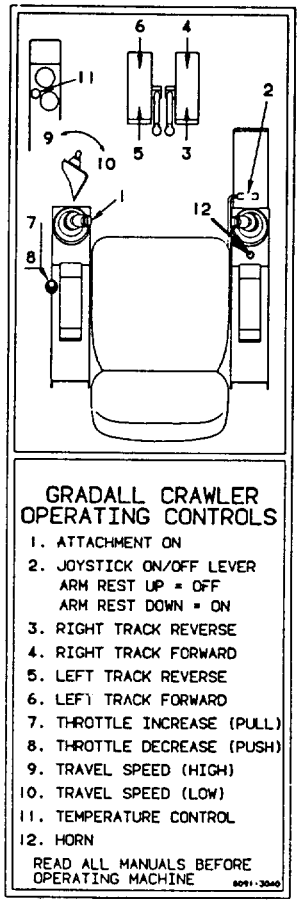
# Decals Inside Cab



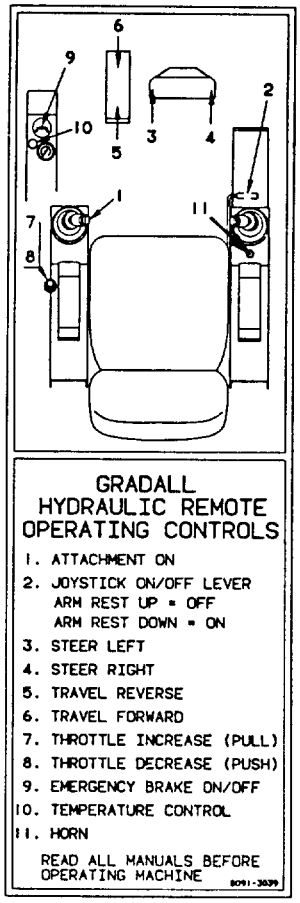

Located on left cab wall
(crawler units only)
Part No. 8091-3017



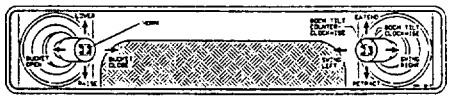

Located on left cab wall
(remote units only)
Part No. 8090-3027



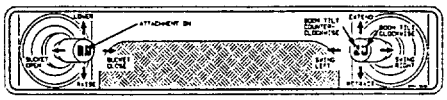

Located on left cab wall
(crawler units only)
Part No. 8091-3040)
(for aux. hyd.)




Located on left cab wall
(remote units only)
Part No. 8091-3039
(for aux. hyd.)

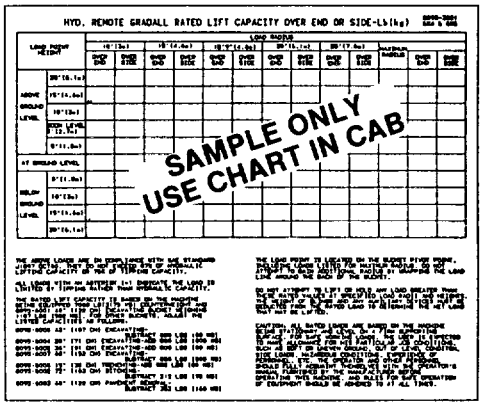


Located on left cab wall
Part No. 8091-3019
(standard)

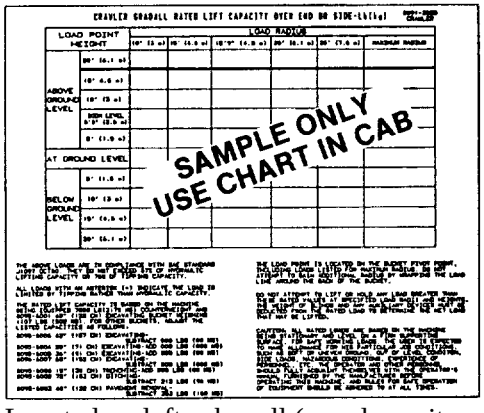


Located on left cab wall
Part No. 8091-3038
(for aux. hyd.)

Located on left cab wall
Part No. 8091-3041
(for SAE controls)




Located on left cab wall (remote units only)
Part No. 8090-3001 (5100 units)
Part No. 8060-3005 (4100 units)




Located on left cab wall (crawler units only)
Part No. 8091-3025 (5200 units)
Part No. 8061-3012 (4200 units)

## ⚠ WARNING

FOR SAFE OPERATION OF MACHINE AND TO MINIMIZE RISK OF SERIOUS INJURY:

1. BEFORE OPERATING.READ OPERATOR AND SAFETY MANUALS. UNDERSTAND ALL CONTROLS IN CAB AND CLEAR LOOSE OBJECTS OFF MACHINE . SOUND HORN BEFORE STARTING ENGINE.
2. STABILITY IS DECREASED DURING TRAVEL DO NOT TRAVEL WITH BOOM EXTENDED OVER SIDE.
3. DO NOT LIFT PERSONNEL OR OPERATE WITH OTHER PEOPLE ON MACHINE.
4. KEEP OTHER PEOPLE AWAY FROM MACHINE WHILE OPERATING. NEVER ALLOW PERSONNEL UNDER BOOM OR SUSPENDED LOAD.
5. BEFORE SWINGING, SOUND HORN WHEN NEEDED.
6. USE A FLAGMAN IF VISIBILITY IS LIMITED.
7. BEFORE MOVING. BE SURE OF A CLEAR PATH AND SOUND HORN.
8. BEFORE ADJUSTING OR SERVICING. REST BOOM ON GROUND AND STOP ENGINE
9. BEFORE LEAVING CAB, REST BOOM ON THE GROUND. AND SHUT ENGINE DOWN.

CRAWLER
8091 - 3026

Located on left cab wall (crawler units only)
Part No. 8091-3026

## ⚠ WARNING

FOR SAFE OPERATION OF MACHINE AND TO MINIMIZE RISK OF SERIOUS INJURY:

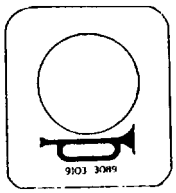
1. BEFORE OPERATING, READ OPERATOR AND SAFETY MANUALS. UNDERSTAND ALL CONTROLS IN CAB AND CLEAR LOOSE OBJECTS OFF MACHINE. SOUND HORN BEFORE STARTING ENGINE.
2. STABILITY IS DECREASED DURING REMOTE TRAVEL. DO NOT TRAVEL WITH BOOM EXTENDED OVER SIDE.
3. DO NOT LIFT PERSONNEL OR OPERATE WITH OTHER PEOPLE ON MACHINE.
4. KEEP OTHER PEOPLE AWAY FROM MACHINE WHILE OPERATING. NEVER ALLOW PERSONAL UNDER BOOM OR SUSPENDED LOAD.
5. BEFORE SWINGING. SOUND HORN WHEN NEEDED.
6. USE A FLAGMAN IF VISIBILITY IS LIMITED.
7. BEFORE MOVING. BE SURE OF A CLEAR PATH AND SOUND HORN.
8. BEFORE ADJUSTING OR SERVICING. REST BOOM ON GROUND AND STOP ENGINE. SET BRAKES.
9. BEFORE LEAVING CAB. REST BOOM IN BOOM REST OR ON THE GROUND. SET EMERGENCY BRAKE AND SHUT ENGINE DOWN.

HYD. REMOTE 8090-3003

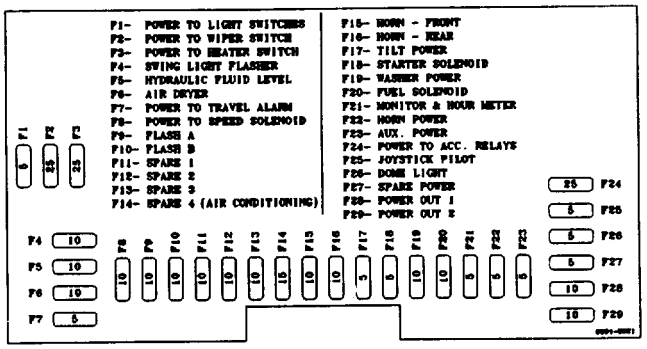
Located on left cab wall (remote units only)
Part No. 8090-3003

# MANUALS

Located on manual holder
Part No. 8321- 1037



Located on right arm rest
Part No. 9103-3089
(for aux. hyd.)




Located on fuse cover
Part No. 8091-3021

## Decals Inside Cab (cont.)

TO OPERATE CARRIER FROM UPPERSTRUCTURE

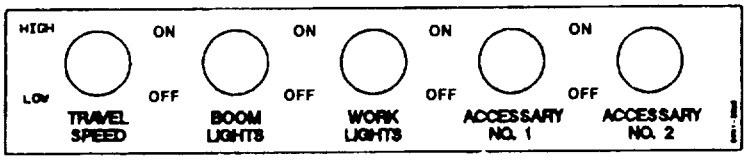
(A) FORWARD-REVERSE CONTROL PEDAL MUST BE IN NORMAL (NEUTRAL) POSITION.
(B) START UPPERSTRUCTURE POWER UNIT.
(C) WHEN AIR GAUGE SHOWS OPERATING PRESSURE (125 PSI), RELEASE EMERGENCY BRAKE.
(D) CONTROL AND DIRECTION OF CARRIER TRAVEL IS NOW DETERMINED BY POSITION OF FORWARD-REVERSE CONTROL PEDAL.
(E) WHEN UNDER UPPERSTRUCTURE POWER, SPEED RANGE MUST BE SELECTED BEFORE LEAVING CARRIER,
(F) DIGGING BRAKES ARE AUTOMATIC WITH FORWARD-REVERSE CONTROL PEDAL IN NEUTRAL.

NOTE! SET EMERGENCY BRAKE WHEN LEAVING CAB.

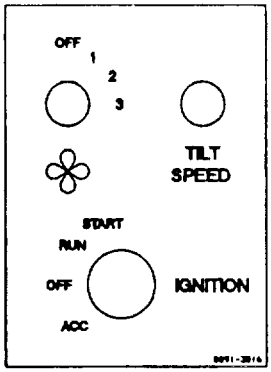
BRAKE LEVER MUST BE IN NORMAL POSITION FOR OPERATION FROM CARRIER CAB

8364-3036

Located on left window (remote units only)
Part No. 8364-3035




Located on control console
Part No. 8091-3020



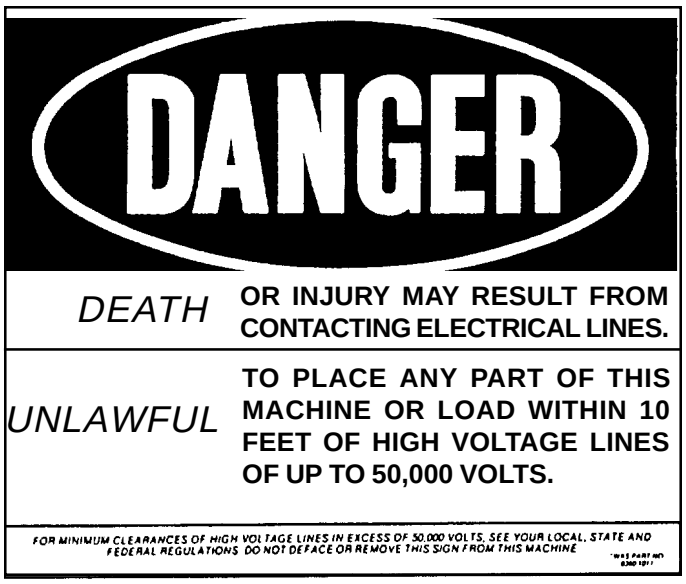

Located on control console
Part No. 8091-3016

## Decals Outside Cab


Located on reservoir & beside power fill port
Part No. 9114-3288


Located on reservoir & inside engine cover
Part No. 8090-3004

## Decals Outside Cab

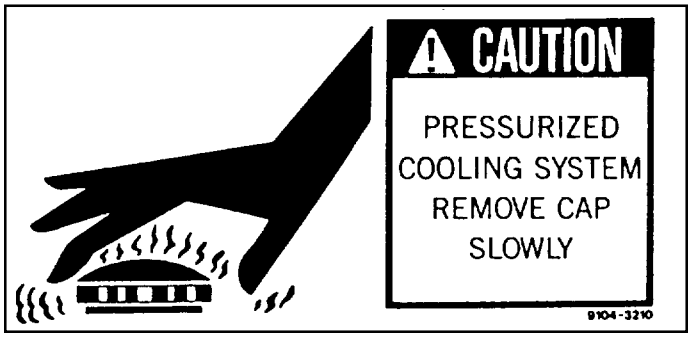



Located on both sides of boom & on left cab wall
Part No. 8360-1011

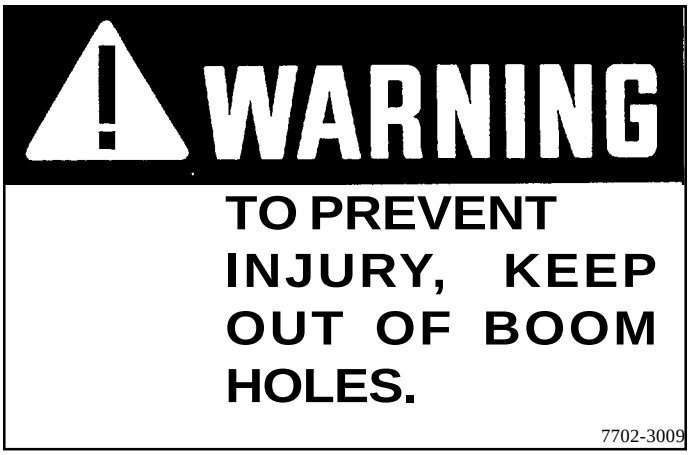

Located on engine compartment & inside valve cover
Part No. 7702-3004


Located on cab door
Part No. 7702-3003


Located on each side of frame at rear
& each side of boom
Part No. 8360-1018



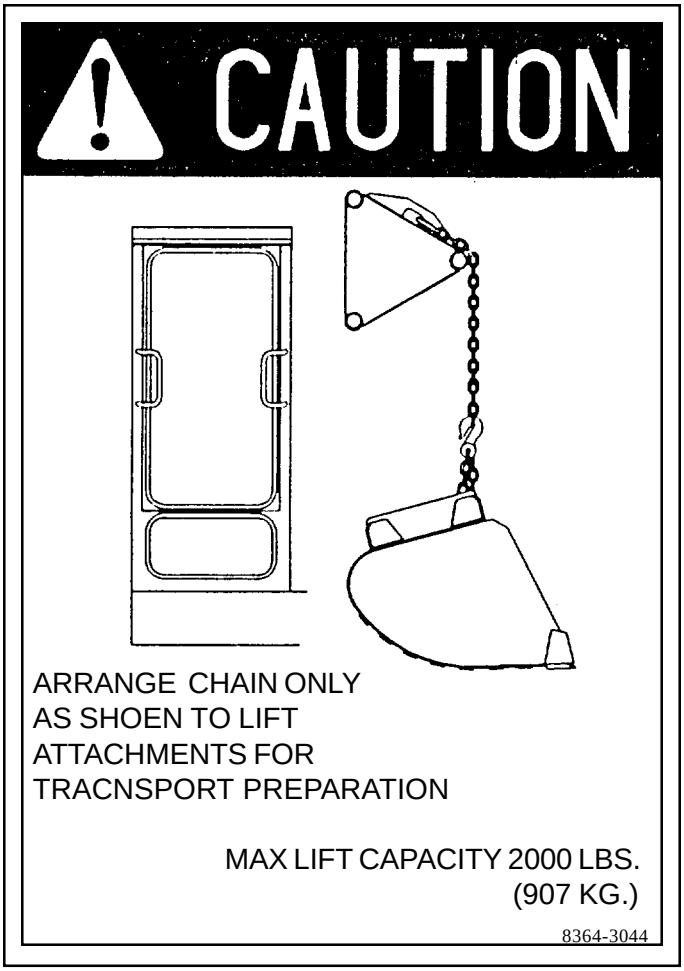

Located inside coolant filler cover
Part No. 9104-3210



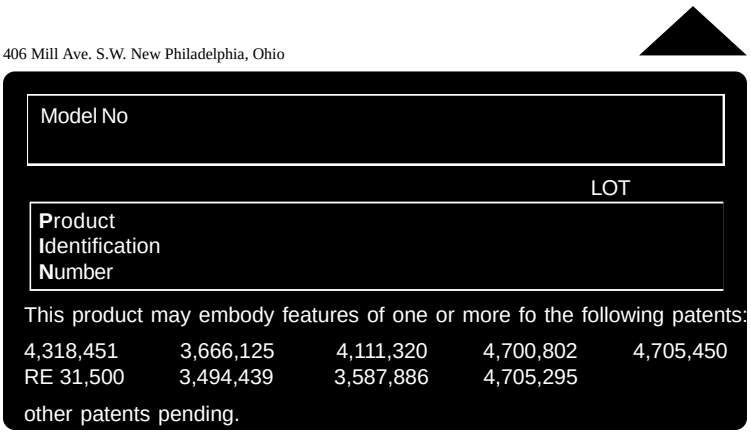

Located on each side of boom
Part No. 7702-3009


Located on fuel filler cover
Part No. 7702-3008

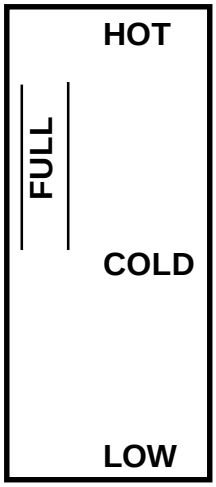
## Decals Outside Cab (cont.)




Located on right side of boom
Part No. 8364-3044

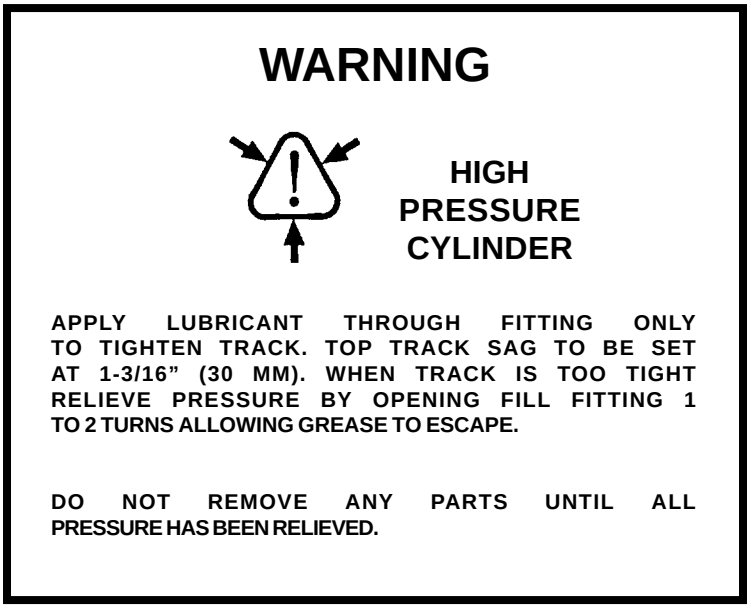



Located at front center of frame
Part No. 7733-3047

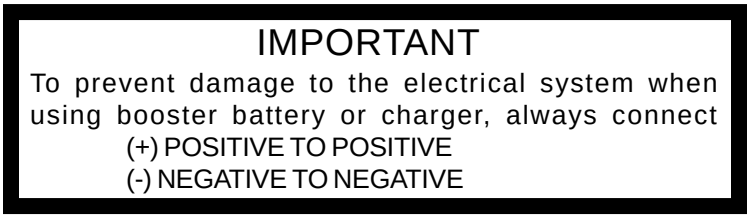



Located on hydraulic reservoir
Part No. 8697-1197


Located on hydraulic reservoir & return tube
Part No. 7702-3006

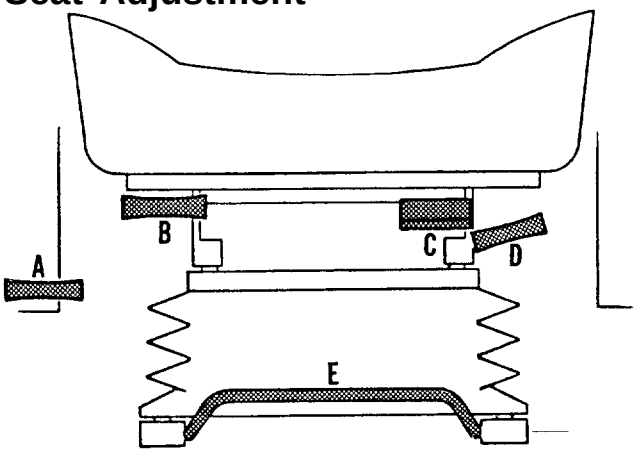



Located on track adjustment Covers
(Crawler Only)
Part No. 8396-3003




Located inside battery box cover
part No. 7702-3007

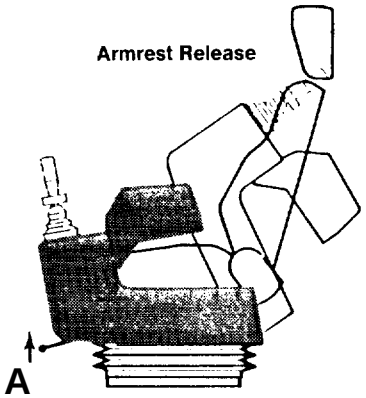
## Seat Adjustment




**⚠ WARNING**

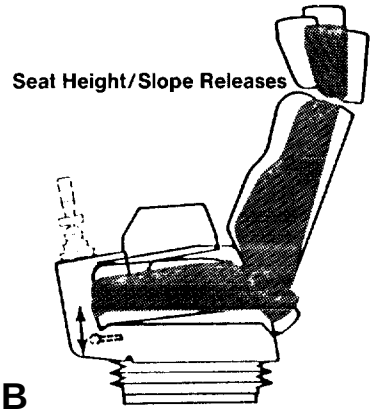
**Perform all seat adjustment with engine stopped. Accidental actuation of controls can cause serious accidents.**

**It may become necessary to revise some adjustments to find the most comfortable operating position. Be sure to stop engine first.**



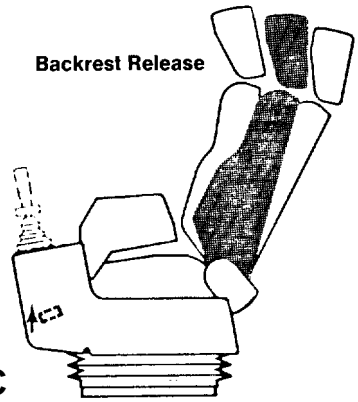

**A**

Raise lever to unlock and raise armrest for entry and exit. Joysticks and pedals are de-energized.



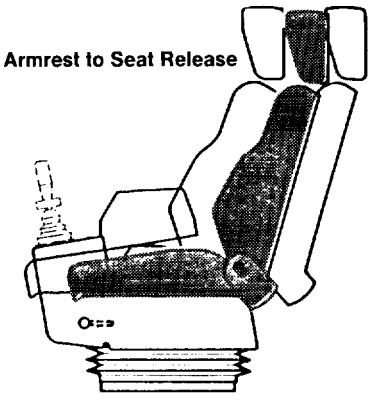

**B**

Raise to unlock raise or lower front of seat. Depress lever to unlock and raise or lower rear of seat



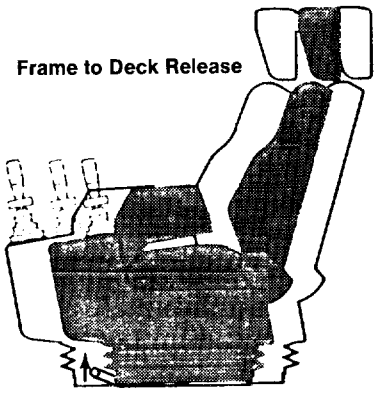

**C**

Raise lever to unlock and adjust angle of backrest. Headrest has no release lever but can be adjusted from to rear as well as up and down.



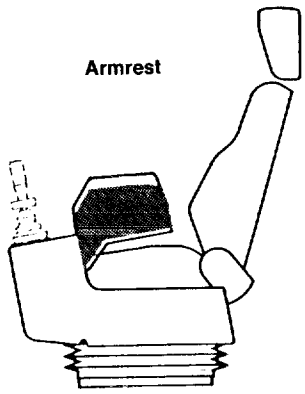

**D**

Raise lever to unlock and move seat to front or rear to obtain comfortable relationship to armrests and joysticks.




**E**

Raise lever to unlock and move seat/frame to front or rear to obtain comfortable relationship to pedal.




Height and separation of armrests can be adjusted by loosening mounting hardware.

The operator's seat includes several adjustments to increase comport and reduce fatigue. Adjust seat to suit your individual characteristics before starting engine.

## Heater

The cab is equipped with a heater located behind operator's seat. Engine coolant supply to heater is controlled by a valve on engine block and a push/pull knob located on instrument/control console. Raise knob fully for maximum heat or depress knob fully for no heat. Blower must be operated to circulate heated air.

## Air Conditioner (optional)

An air conditioner can be furnished as optional equipment. The air conditioner is controlled by a toggle switch located on instrument/control console. Air conditioner will operate only when blower switch is positioned in an operating position (High, Medium or Low). Turn off engine coolant at engine block for maximum cooling.

## Defrosting

Window defrosting can be accomplished by aiming dome-type air deflectors toward front and rear windows while operating blower. Defrost action can be increased by operating heater. Maximum defrosting is accomplished by operating both heater and air conditioner to provide warm, and air to deflectors.

## Blower

The blower is located within heater housing and is controlled by a rotary switch located on instrument/control console. It provides three levels of air circulation for heating, defrosting and air conditioning (High, Medium or Low).

Air is supplied to blower thru a vent in cab floor. Two air filter elements are provided to clean air flowing to blower. Service element as indicated in Lubrication & Maintenance Diagram. Operating conditions may require more frequent element washing/replacement. A noticeable reduction of air flow from deflector vents indicates a need to service filter elements.

## Ventilation

In addition to heating, defrosting and air-conditioning functions, the cab is equipped for varying degrees of natural ventilation:

**⚠ WARNING**

**Be sure to position boom in boom rest or on ground and stop engine before opening or closing door or front window. Accidental actuation of controls can cause serious accidents.**

Door and/or windows must be latched in fully open or closed position during upperstructure operation.

- Cab door can be latched in fully opened position.
- Front window can be latched in storage position. (latch is located at center of top of window). Be sure side latches are also engaged.
- Window in right cab wall can be opened.
- Optional hatch in cab roof can be opened for ventilation and/or to improve vision.

## Fire Extinguisher

A fire extinguisher is located on the left cab wall.

Read and understand the instructions printed on the extinguisher regarding its care and operation as well as to the type of fires on which it may be used. Check often to be sure the extinguisher is fully charged.

## 12VDC Accessory Outlets

Four pairs of 12VDC accessory terminals are located in left console behind operator's seat.

The upper pair of circuits is protected by a 10 amp fuse (F27); a second 10 amp fuse (F28) protects lower pair of circuits. Exceeding a total of 10 amps for either pair of circuits will blow associated fuse.

Strip 3/8" of insulation from ends of accessory wires, depress appropriate lock tabs (red for power and black for ground) and insert wires in appropriate terminals.

**⚠ CAUTION**

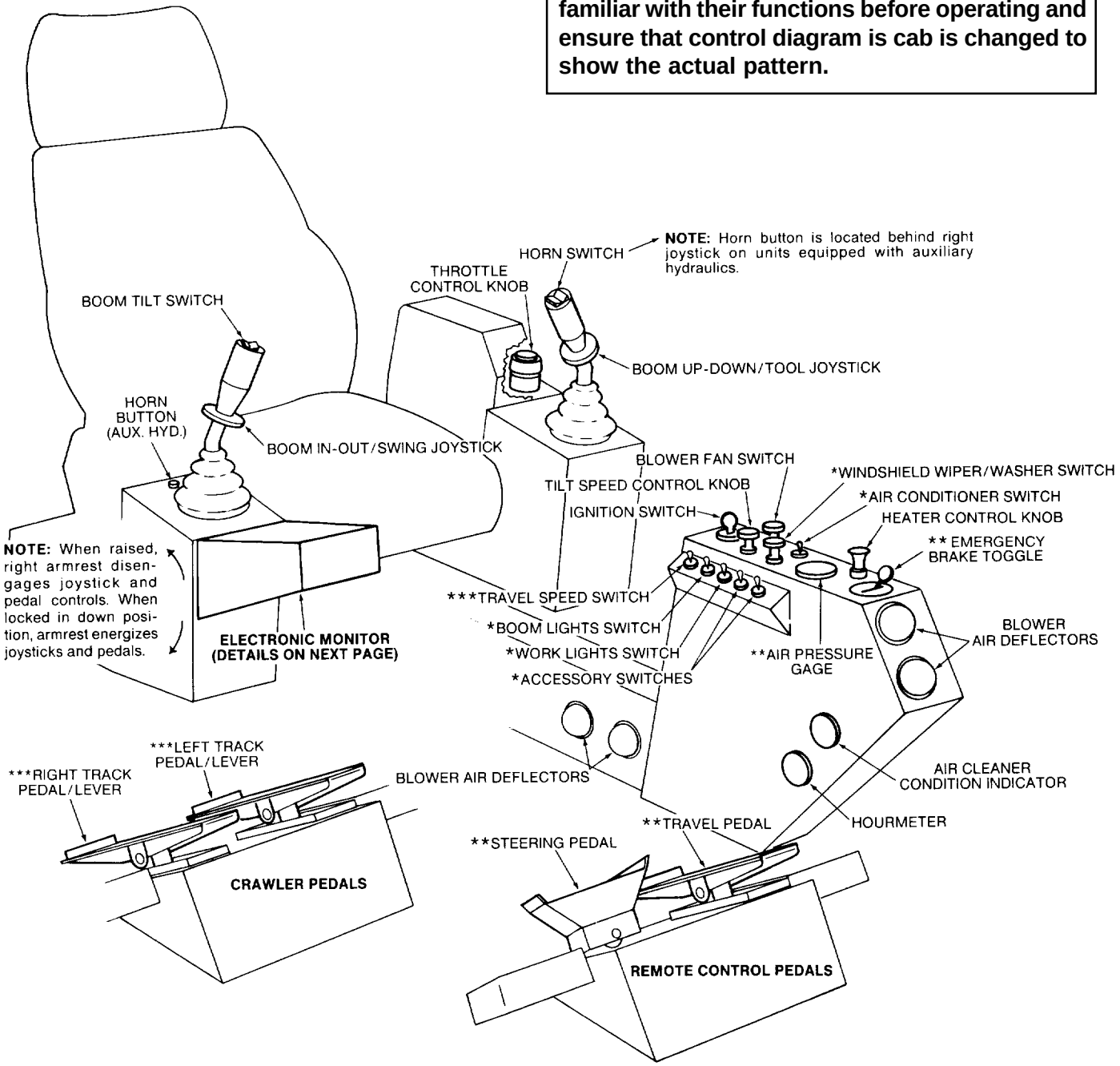
**Connecting accessories to other portions of system can damage electrical components.**

# CONTROL AND INSTRUMENT IDENTIFICATION

**(Common to all units unless noted)**

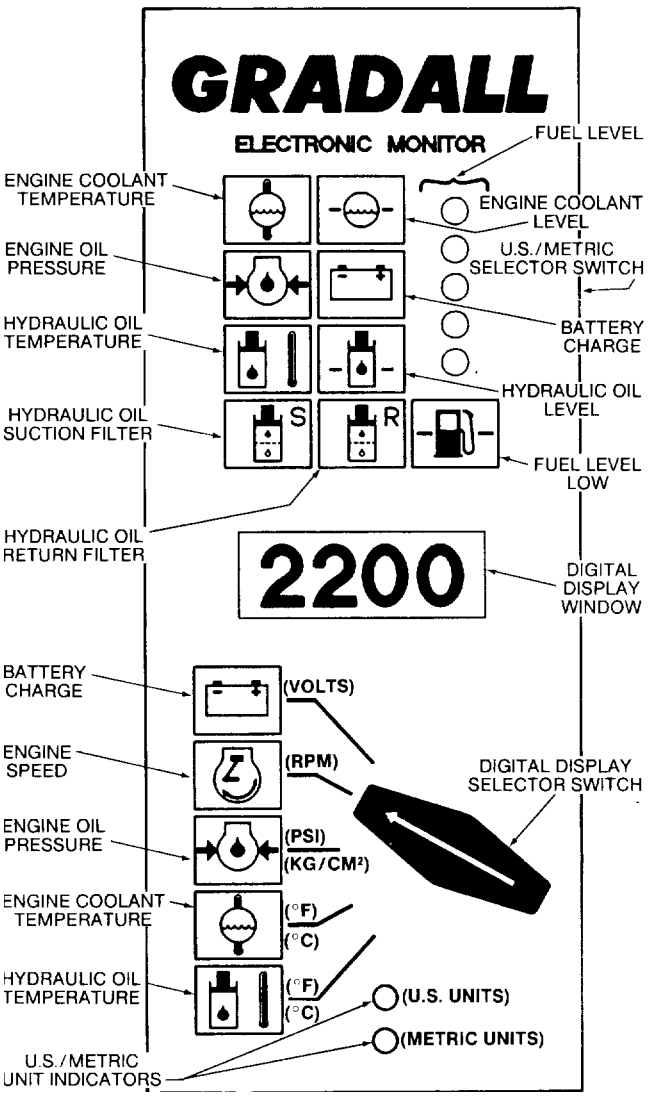
**WARNING**

**Test your controls before operating. The control pattern illustrated is the standard Gradall control pattern. If your machine controls have been modified to any other pattern, be certain you are familiar with their functions before operating and ensure that control diagram is cab is changed to show the actual pattern.**




*INOPERATIVE UNLESS OPTION IS FURNISHED
**FOR REMOTE CONTROL UNITS ONLY
***FOR CRAWLER UNITS ONLY

## Electronic Monitor




**Digital Display Selector Switch & Symbols:** This switch permits operator to choose which operating value will be shown in digital display windows: battery charge, engine, engine oil pressure, engine coolant temperature or hydraulic oil temperature.

Appropriate symbol will glow (green) to indicate which value has been selected.

If value displayed flashes on the off, value is outside normal operating range.

**U.S./Metric Unit Indicators:** The operator may choose to have engine oil pressure, engine coolant temperature and hydraulic oil temperature shown in U.S. or Metric units as defined beside symbols.

Selection of units to be shown is made by a switch (not shown) located on bottom surface of monitor. Move switch as appropriate for U.S. units or for metric units.

U.S. or Metric mode must be selected with ignition switch in OFF position. Indicator light will glow (green) to show which mode has been selected.

**CAUTION**

**An electronic monitor caution signal indicates a condition which could cause serious damage to your unit. Correct cause of signal before continuing operation.**

### CAUTION SYMBOLS & ALARM

**Battery Charge:** Symbol glows (red) in response to low battery charge (below 11.6 VDC).

**Engine Coolant Level:** Symbol glows (red) and alarm sounds if coolant level falls below acceptable operating level.

**Engine Coolant Temperature:** Symbol glows (red) if coolant temperature exceeds 214 F. (101 C.). Alarm sounds if temperature reaches 220 F. (104 C.).

**Engine Oil Pressure:** Symbol glows (red) if oil pressure falls below 10 psi (.7 Kg/cm. ). Alarm sounds if pressure remains below 10 psi (.7 Kg/cm) for 10 seconds or longer.

**Fuel Level:** These five lights glow (green) to indicate approximate fuel level. For example if all five are glowing tank is full; if only the bottom three are glowing tank is approximately half full. With no lights glowing tank is less than 10% full.

**Fuel Level Low:** Symbol glows (red) if fuel level falls below 15 % full.

**Hydraulic Oil Level:** Symbol glows (red) and alarm sounds if oil level falls below acceptable operating level.

**Hydraulic Oil Return Filter:** Symbol glows (yellow) in response to excessive resistance to flow. Cold oil can cause symbol to glow. Refer to Warm-Up & Operational Checks (page 23) for details.

Hydraulic Oil Suction Filter: Symbol glows (yellow) and alarm sounds in response to a few conditions. Refer to Warm-Up & Operational Checks (page 23) for details.

**Hydraulic Oil Temperature:** Symbol glows (yellow) in response to excessive hydraulic temperature (180 F/82 C).

**Check fuel level** symbols on electronic monitors and replenish as necessary. It is recommended that the unit be refueled at the end of the work shift to minimize condensation.

**Check engine coolant level** symbol on electronic monitor and replenish as necessary. Be sure anti-freeze solution is adequate for expected temperatures. Be sure radiator and cooler fins are clean.

# CHECKS AND SERVICES
# BEFORE STARTING ENGINE

**(To be performed at beginning of each work shift)**

## Complete all required maintenance before operating unit.

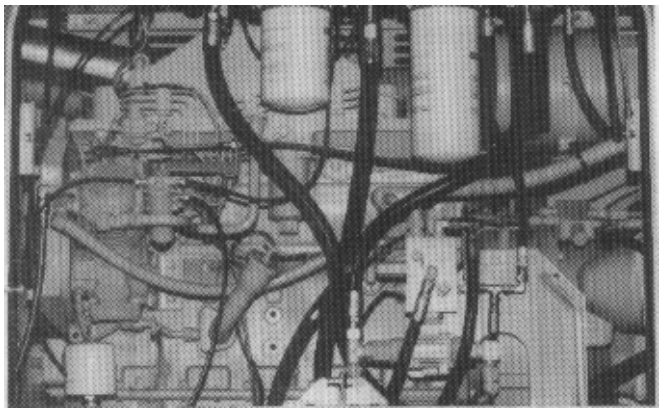
**⚠ WARNING**

**Use extreme caution when checking items beyond your normal reach. Use an approved safety ladder.**

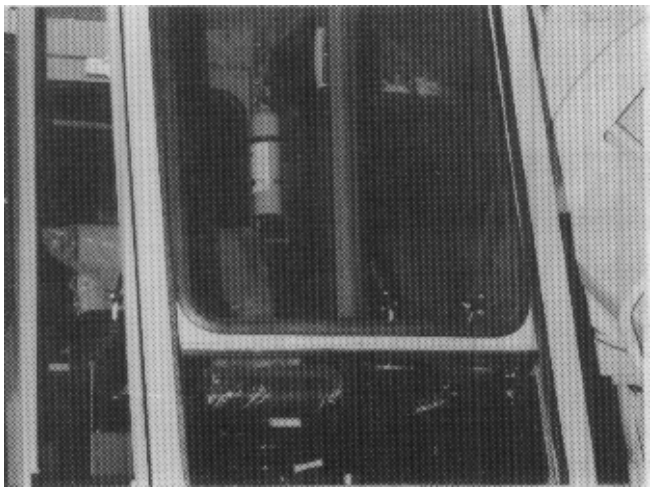
Before removing filler caps or fill plugs,wipe all dirt and grease away from the ports. If dirt is allowed to enter these ports, it can shorten the life of o-rings, seals, packings and bearings.

When adding fluids or changing filter elements, refer to the lubrication section of this manual to determine the proper type to be used.

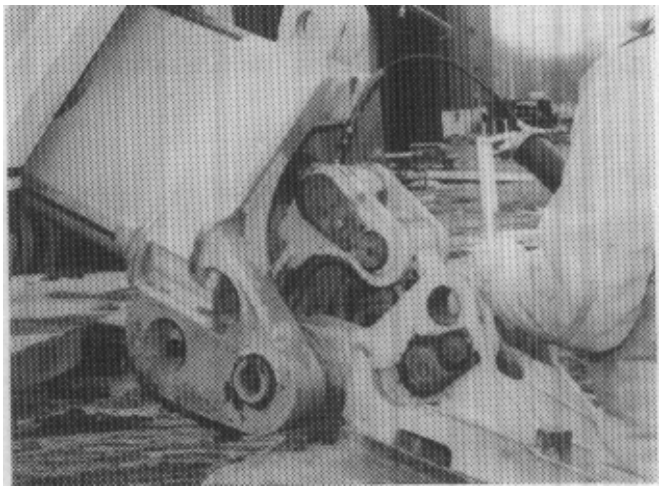
If spark arrestors are required, be sure they are in place and in good working order.



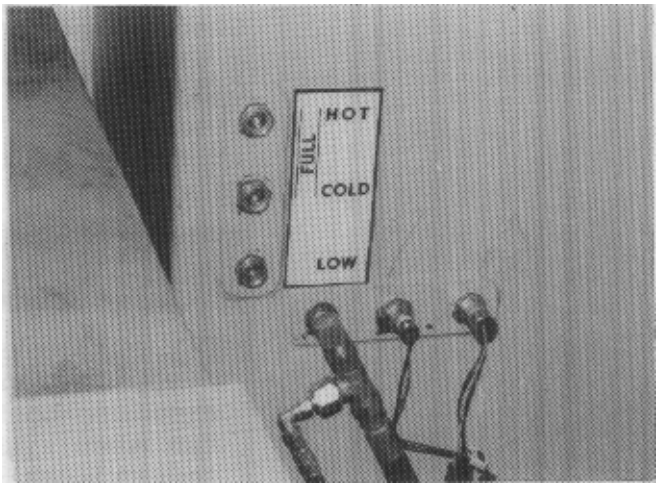
**Inspect unit for obvious damage, vandalism and needed maintenance.** Check for signs of fuel, lubricant, coolant and hydraulic leaks. Open all access doors and look for loose fittings, clamps, components and attaching hardware. Replace hydraulic lines that are cracked, brittle, cut or show signs of abrasion.



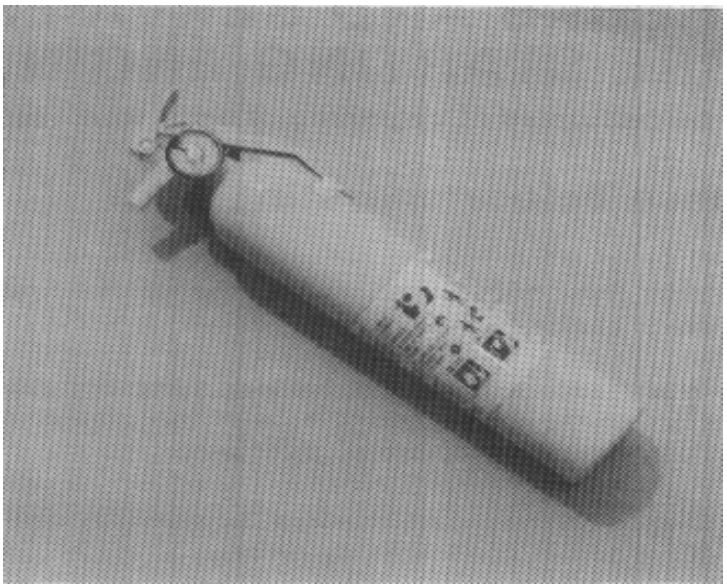
Check to **be sure windows are clean.**



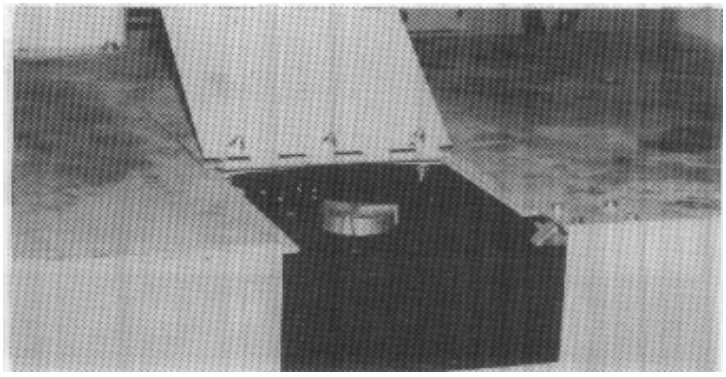
Service the unit in accordance with the lubrication and maintenance schedule.




Check **hydraulic fluid level** in reservoir with boom extended half way and bottom of bucket flat on ground. Refill reservoir as necessary using proper fluid.



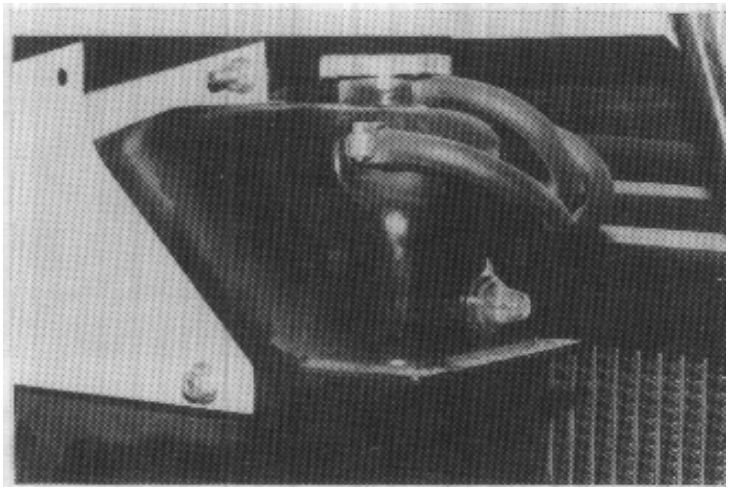
Check for presence of fully charged **fire extinguisher** on wall behind seat in cab. Replace as necessary. Read and understand instructions regarding use and application (on fire extinguisher).



**Check fuel level** symbols on electronic monitor and replenish as necessary. It is recommended that the unit be refueled at the end of the work shift to minimize condensation.

**⚠ WARNING**

**Engine should be turned off while refueling. Be sure the area is free of open flame, sparks or any condition which could cause fuel to ignite.**



**Check engine coolant level** symbol on electronic monitor and replenish as necessary. **Add coolant <u>ONLY</u> to coolant expansion container** (shown above). Check to be sure anti-freeze solution is adequate for expected temperatures. Be certain radiator fins are clean.

**⚠ WARNING**

**<u>DO NOT</u> replenish coolant at radiator. Always replenish coolant at coolant expansion container. Removing radiator cap when system is hot could cause serious burns. Refill coolant system thru radiator cap <u>ONLY</u> when system has been drained for annual service.**

**NOTE:** If engine is being started at beginning of work shift be sure to perform all"CHECKS AND SERVICES BEFORE STARTING ENGINE" (pages 19 and 20).

**⚠ CAUTION**

**Turning ignition switch to START position while engine flywheel is rotating can cause serious damage to engine and/or starting motor.**

## Starting Cummins Engine

1. Insert ignition key and turn clockwise to RUN position while observing electronic monitor.

   All monitor symbols should glow briefly as a bulb check. Following bulb check, symbols for **battery charge, engine oil pressure, fuel level** and **hydraulic oil suction filter** should continue to glow and alarm should sound.

   If any other symbols continue to glow, correct cause before starting engine.

2. At temperatures above 32 F. (0 C.) throttle should be at low idle. At temperatures below 32°F, (0° C.) apply full throttle when cranking.

3. Sound horn as a warning before starting engine.

4. Turn ignition switch key clockwise to START position to engage starter motor. Release key immediately when engine starts. If engine fails to start within 30 seconds, release key and allow starter motor to cool before trying again.

5. After engine starts, reduce speed to low idle and observe **engine oil pressure** caution symbol on electronic monitor. Symbol should go out to indicate proper engine oil pressure. If symbol continues to glow for more than fifteen seconds, stop engine and determine cause. Correct cause of malfunction before restarting engine.

6. Observe **battery charge** caution symbol. Symbol should go out to indicate that charging system is functioning properly.

7. Observe **hydraulic oil suction filter** caution symbol. Symbol may go out in a few seconds to indicate hydraulic reservoir is pressurized and oil is flowing thru suction filter properly. Cold hydraulic oil may cause suction filter symbol to continue to glow and alarm to sound. Continue to step 8.

8. Adjust engine speed to approximately 1500 RPM and perform warm up and operational checks in next section of manual.

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## Cold Weather Starting Aids

Diesel engine ignition is accomplished by heat generated when fuel/air mixture is compressed within the cylinders. Because this heat may be insufficient to start a cold engine in cold weather, the use of starting aids has become common practice.

Because of the wide variety of starting aids available it would be impractical to attempt to provide specific instructions for their use in this manual. Carefully follow instructions furnished with your starting aid.

**If you use a starting aid employing ether or a similar substance pay particular attention to manufacturer's warnings.**

## Normal Engine Operation

**WARNING**

**Always operate with engine at full throttle to prevent possibility of stalling under heavy load.**

**Observe electronic monitor frequently to be sure all engine systems are functioning properly.**

Engine Oil Pressure (minimum):
Cummins - 10 to 30 psi (69 to 207 kPa)

Engine Operating Temperature:
Cummins - 160 to 200 °F. (71 to 93 C)

Battery charge indication of alternator output: Approximately 14 volts with engine running at 2000 RPM.

**Be alert for unusual noises or vibration.** When an unusual condition is noticed, stop machine in a safe position and shut off engine. Determine cause and correct problem before continuing.

**Avoid prolonged idling.** Idling causes engine temperature to drop and this permits formation of heavy carbon deposits and dilution of lubricating oil by incompletely burned fuel. If the engine is not being used, turn it off.

**CAUTION**

**Always keep engine covers closed while engine is running.**

## Stopping the Engine

**Operate engine at idle speed for 3 to 5 minutes before turning it off.** This allows engine coolant and lubricating oil to carry excessive heat away from critical engine areas. This is especially important for turbocharged engines.

**Do not "gun" engine before shut down;** this practice causes raw fuel to remove oil film from cylinder walls and dilute lubricant in crankcase.

CUMMINS ENGINE: To stop the Cummins engine, allow engine to idle for 3 to 5 minutes. Turn ignition switch key to "OFF". Remove key if leaving equipment.

# WARM UP & OPERATIONAL CHECKS

**(To be performed at beginning of each work shift)**

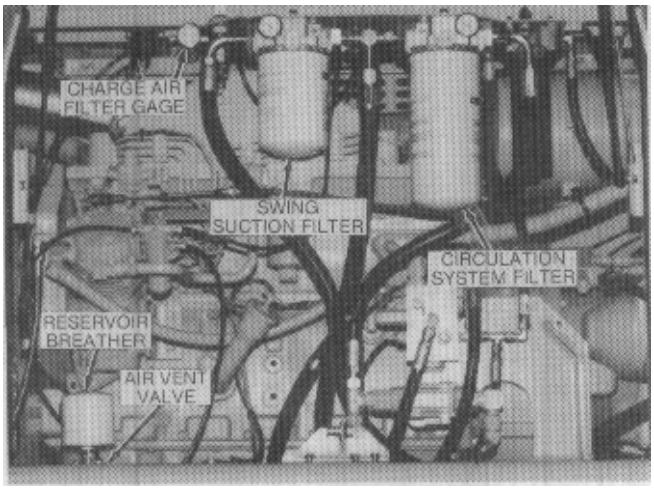
## Complete all required maintenance before operating unit.

The safety, efficiency and service life of your excavator will be increased by performing the following operational checks while the engine and hydraulic oil are warming to operating temperature.

1. Observe air pressure gage (remote control units only). System should build and maintain 125 psi (862 kPa).
2. Observe electronic monitor digital display for appropriate values while switching to each position. Leave switch positioned for hydraulic oil temperature display.

**NOTE:** Wait approximately two minutes after starting engine to perform step 3. This provides sufficient time for compressor to pressurize hydraulic reservoir.

3. Observe **hydraulic oil suction filter** caution symbol. If symbol continues to glow after two minutes of engine operation, perform following procedure:




a. Stop engine and open engine compartment.

b. Charge air filter gage should indicate approximately 5 to 10 psi. If not, check for clogged air filter or leak in feed line or air vent valve.

c. Check to be sure reservoir breather and hoses are firmly attached.

d. With engine running at high idle, suction filter gage should remain in green area. Replace filter element as required.

e. Stop engine and notify maintenance personnel if system will not build and maintain 5 to 10 psi reservoir pressure.

**NOTE:** Step 4 requires that hydraulic oil be at least 60 F.(15.6 C). Stall boom extend function to speed warming.

4. Observe **hydraulic oil return filter** caution symbol. If symbol is still glowing, observe hydraulic oil temperature value on digital display. Normally, symbol will go out when hydraulic oil reaches approximately 60 F. (15.6 C.).

   If symbol continues to glow with oil at or above this temperature, perform the following procedure:

a. Stop engine and open engine compartment.

b. With engine running at high idle, circulation system filter gage should remain in green area. Replace filter element as required.

**NOTE:** There is **no flow** from main hydraulic pump until there is a demand from circuits served by pump rest, there is **no return flow** from main pump to reservoir. With light or no return flow, a clogged return filter **will not** cause return filter caution symbol to glow.

c. A clogged main return filter element **will not** cause return filter caution symbol to glow **with machine at rest**. If symbol **flashes on and off during operation,** main return filter element is clogged and **must be replaced;**

5. Check operation of all excavator functions in both directions.
6. Remote control travel alarm in both directions.
7. Remote control travel and braking in both directions.
8. Remote control steering in both directions.
9. Remote control emergency braking from upperstructure (attempt to travel with brake applied).

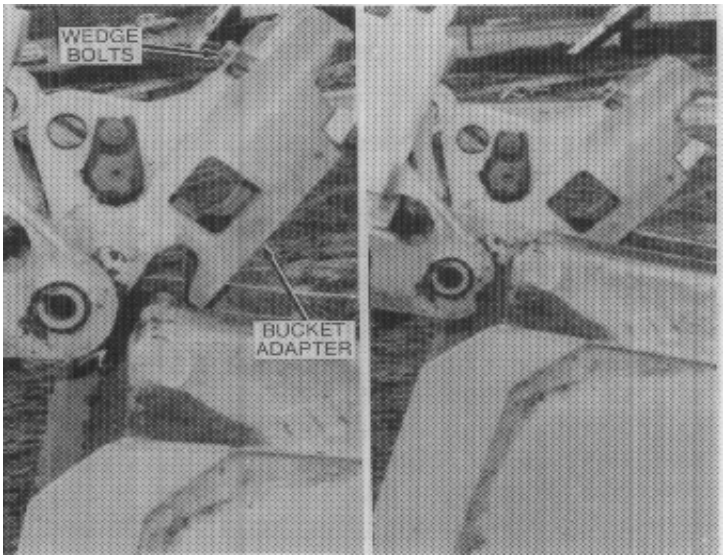
# ATTACHMENT INSTALLATION

**WARNING**

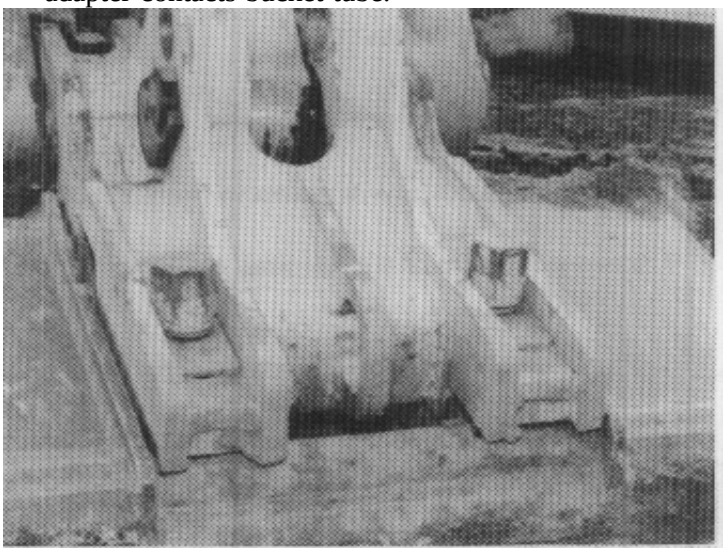
**Keep boom in fully extended position while Installing bucket. Stay clear until bucket adapter has been fitted to bucket as shown in step 2.**

**CAUTION**

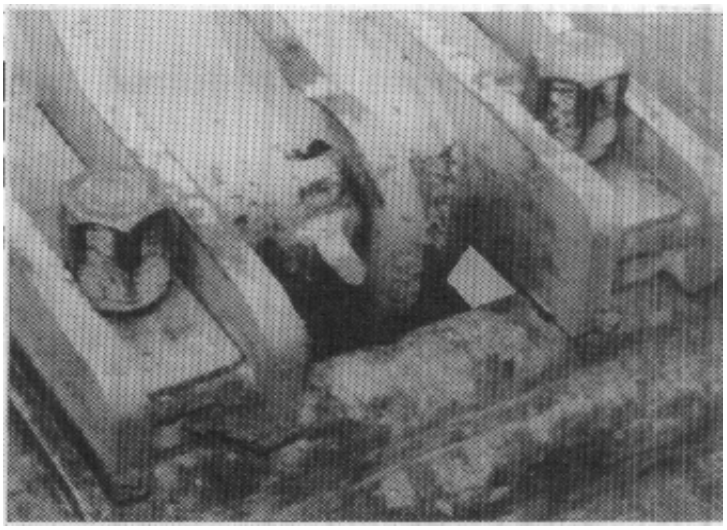
**Digging with a loose or an improperly fitted bucket can shear adapter bolts and cause excessive wear.**



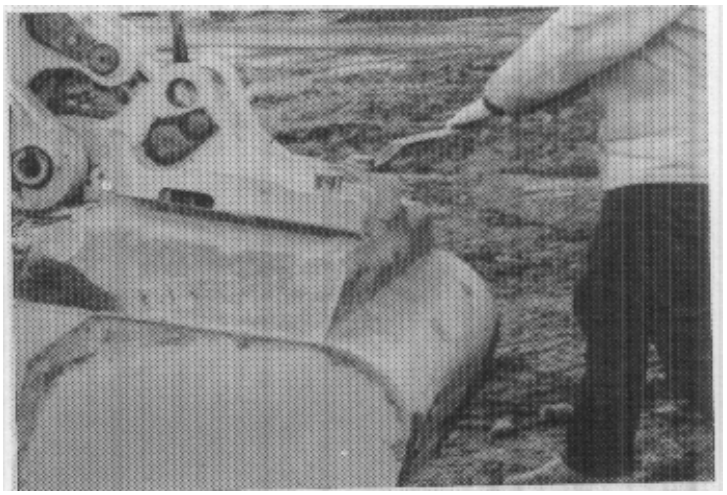

1. Be sure- wedge bolts are secured (finger-tight) in position shown and position bucket adapter above bucket tube. Lower boom until concave section of adapter contacts bucket tube.



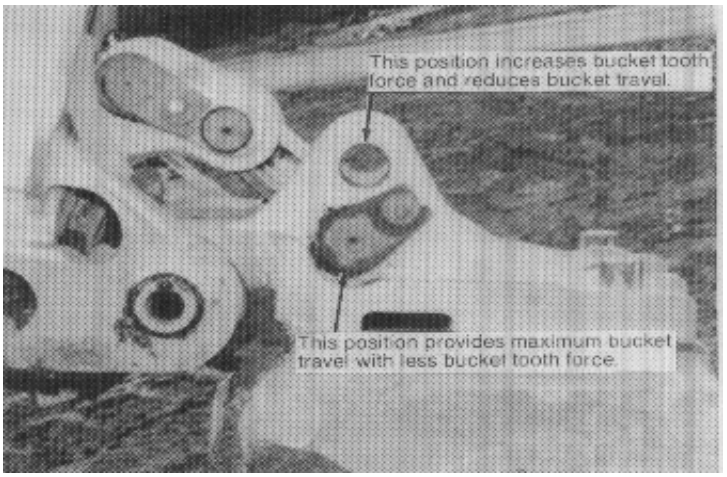
2. Move adapter toward “bucket close” position until outer end of adapter contacts bucket.



3. Move wedge bolts forward and up until wedge contacts bar and tighten finger-tight. Be sure wedge surfaces are flush against tube and adapter.



4. Raise boom until bucket just clears ground and tighten bolts. Jog tool control to shake bucket and retighten bolts. Check often to be sure bolts remain tight.




5. Position bucket linkage as described.

**NOTE: Remote control is to be used for positioning unit at job site, not for over-the-road travel.**

## Preparing Carrier for Remote Control Operation

1. With carrier on level surface, apply parking brake.

2. Start carrier engine and develop full brake system pressure in front and rear portions of system (125 psi/862 kPa.).

3. With engine running, depress clutch and shift transmission to Lo Lo or LO gear range. Use Lo Lo if operating on a grade. First gear may be used if operating on hard, level surface. Move inter-axle differential and differential lock toggles to LOCK position for off-road conditions and for digging over side. When sure of complete engagement, stop engine and release clutch.

**⚠ WARNING**

**Be sure to keep feet clear of clutch pedal when moving DIGGING BRAKE toggle to ON position (step 4).**

4. Move DIGGING BRAKE toggle to ON position. This applies digging brake, disengages carrier engine clutch and engages remote drive power take-off.

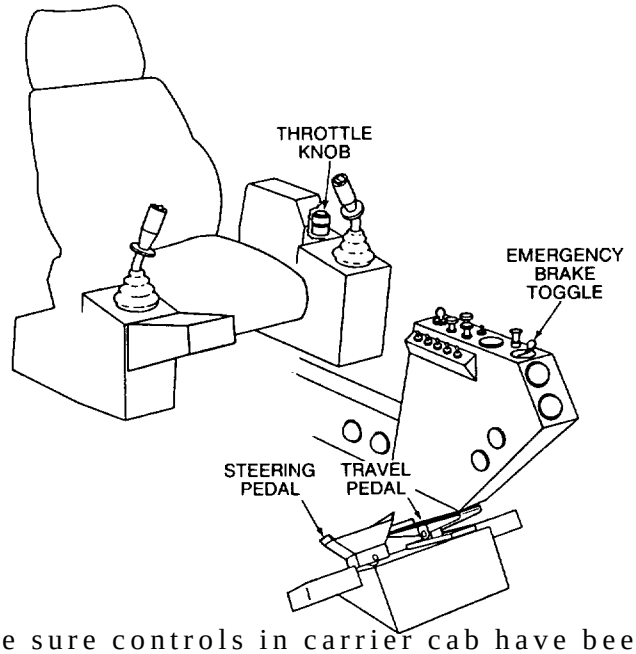
5. Release parking brake.

**⚠ CAUTION**

**Serious damage can occur to engine and clutch if carrier engine is permitted to run with digging brake engaged.**

## Preparing Upperstructure for Remote Control Operation

REMOTE CONTROLS IN UPPERSTRUCTURE




1. Be sure controls in carrier cab have been properly set for remote control operation (above).

2. Be sure joystick and foot pedal controls are in neutral position.

3. Start upperstructure engine and develop full brake system pressure (125 psi/862 kPa).

4. With emergency brake applied, perform following procedure to be sure power take-off is fully engaged.

a. Adjust upperstructure engine speed to low idle.

b. Very gently engage travel pedal to cause a slight rotation of power take-off gear.

c. If step b caused gears to clash, power take-off was not engaged. Repeat step b.

If step b caused engine to reduce speed, power take-off is fully engaged. **Increase engine speed to full throttle for upperstructure operation.**

5. Move EMERGENCY BRAKE control to NORMAL position.

## Precautions for Remote Control Operation

**Be sure of clear visibility in direction of travel; use a signalman to compensate for blind spots.**

**Be sure all Warm-Up and Operational Checks have been performed.**

**Be sure of clear path for carrier, boom and counterweight before starting to move. Be especially watchful for people, overhead wires and traffic.**

**Never tow load using remote control drive.**

**Always give audible signal before moving unit.**

**Never permit bucket to drag while moving unit.**

**Rotation of steering wheel will occur during remote operation. KEEP CLEAR!**

**Be sure travel alarm functions properly.**

**Over the side stability is reduced during remote travel because front axle lock cylinders automatically unlock when traveling.**

## Driving carrier from upperstructure cab

**⚠ WARNING**

**Avoid confusion! Before actuating remote control steering and travel pedals, think about the direction you are facing with respect to the direction the carrier is facing. Confusion could cause you to travel in the direction opposite that expected.**

1. Be sure controls in carrier and upperstructure cabs have been properly set for remote control operation (see previous page).

2. Carrier speed is controlled by gear selection and amount of pedal actuation.

3. Travel pedal controls forward and reverse travel. Depressing front of pedal releases digging brake and causes forward travel. Depressing rear of pedal releases digging brake and causes reverse travel. Gear range selection, engine speed and extent of pedal depression determine travel speed. Digging brake is applied automatically when travel pedal is released.

4. Steering pedal controls left and right turns. Depressing right side of pedal causes right turn and depressing left side of pedal causes left turn.

5. Use EMERGENCY BRAKE to stop carrier if automatic digging brake fails. Move emergency brake toggle to ON position.

**EMERGENCY BRAKE IN UPPER CAB MUST BE RELEASED TO MOVE CARRIER.**

## Preparing Upperstructure for Conventional Carrier Operation

1. Inspect brakes before driving carrier after digging (refer to page 7).

2. With bucket opened fully, retract boom (watch bucket clearance) and position in boom rest as shown on page 7. Secure boom and bucket using hold-down devices as necessary.

3. Allow engine to cool by running at idle speed for a few minutes. Stop engine.

4. Be sure travel and steering pedals are in neutral position and emergency brake is released.

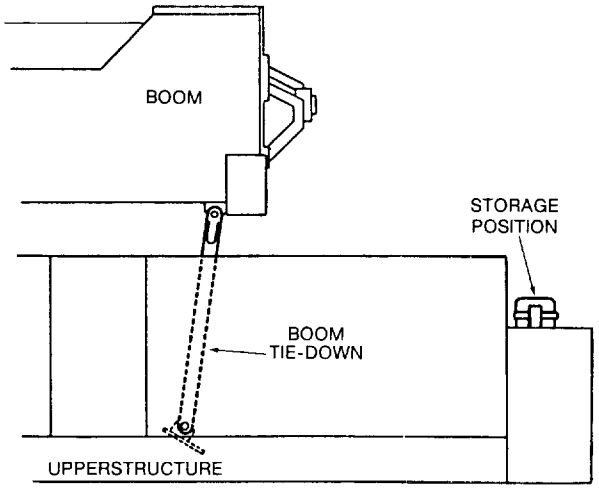
## Preparing Carrier for Conventional Operation

1. Apply parking brake.
2. Shift transmission to neutral.
3. Move DIGGING BRAKE toggle to OFF position.
4. If conditions permit, move inter-axle differential and differential lock toggles to UNLOCK position.
5. Shift transfer case to engage or disengage front drive axle as appropriate for driving conditions (if so equipped).

## Use Your Crawler Properly

Crawler undercarriages are furnished to enable the Gradall to travel over rough terrain and reach work sites which would not be accessible to the ordinary wheeled-carrier mounted Gradall.

1. Travel in forward direction whenever possible (with track drive motors at rear). Traveling in reverse increases wear on sprockets and rollers.
2. Plan your work to equalize left and right turns. Constantly turning in one direction will cause track components to wear unevenly.
3. Apply power to both tracks when turning. When power is applied to only one track it becomes necessary for the driving track to overcome the drag of the other track.
4. Hard digging in one spot can cause as much track wear as frequent moves. Do not neglect service to tracks and sprockets because of infrequent moves.
5. Rough operation and operation on uneven ground can cause unnecessary wear and damage to track components. Reasonable operation and regular maintenance will extend track life significantly.
6. Mud, frozen mud and debris can prevent rollers from turning and cause flat spots. Clean track components as often as necessary.
7. Never park crawler units on a steep incline or on the inside of a hill. This can distort roller seals and cause a loss of lubricant which could ruin the rollers.
8. **Only** use boom tie down (shown below) when transporting. Secure boom to tie down using hardware provided. **Do not tie down front of boom.**




## Crawler Controls

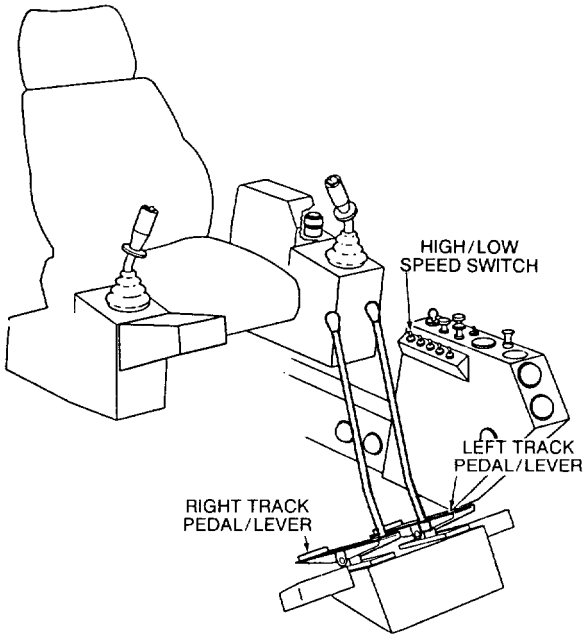
**TRACK DRIVE PEDALS/LEVERS:** Track drive pedals/levers permit independent control of each track and its brake. Brake is released when pedal lever is actuated and applied when pedal/lever is released. Use of controls is illustrated on next page.

**SPEED CONTROL:** Your crawler is equipped with a toggle switch to select crawler speed range.

**HIGH SPEED -** Move switch to left.

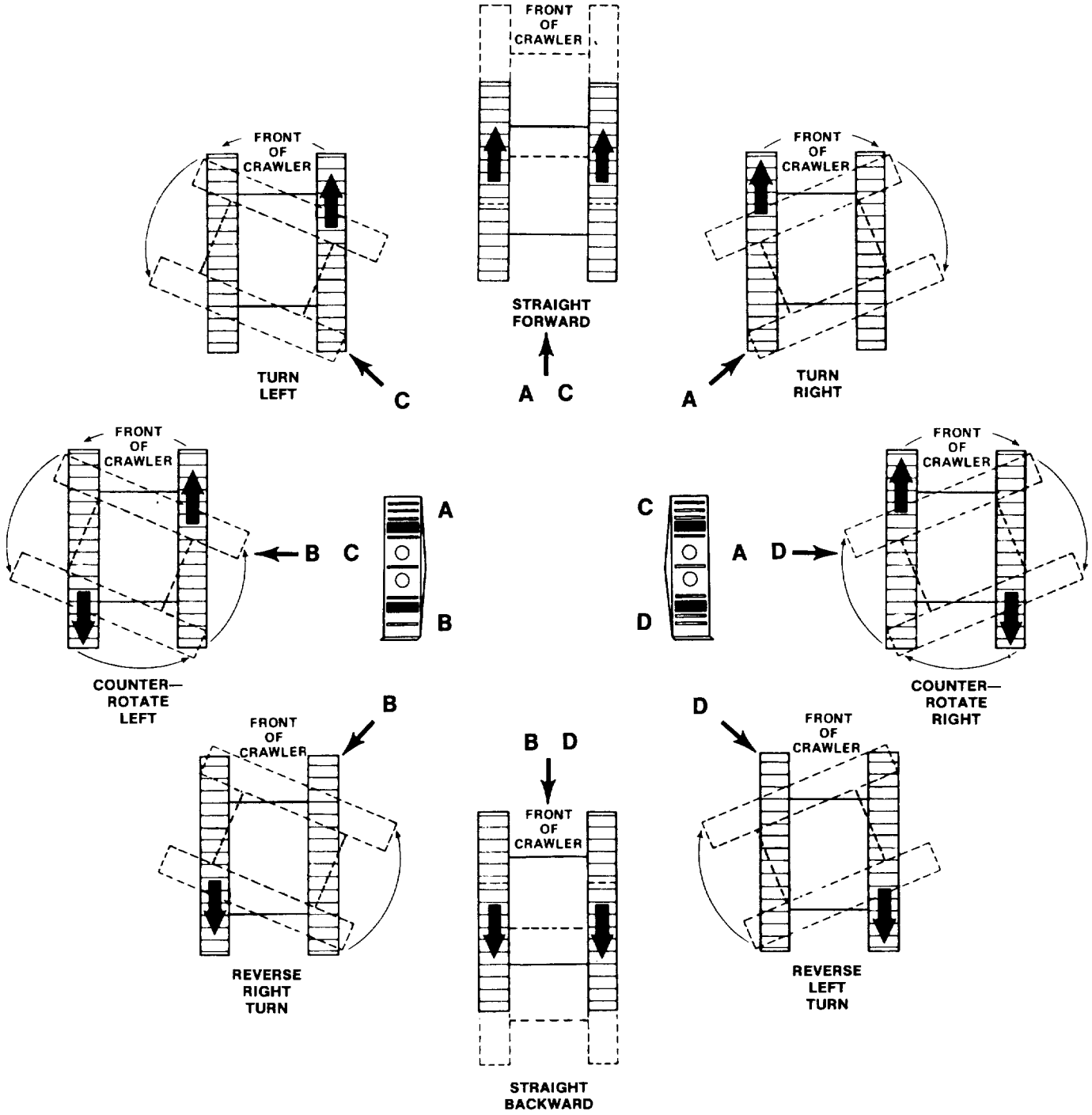
**LOW SPEED -** Move switch to right. (for maximum traction and maneuverability in tight quarters).

These speed changes can be made while machine is in motion or stationary.



# HOW TO OPERATE THE CRAWLER

**Practice with travel controls in a safe, open area.**




**WARNING**

**Avoid confusion! Before actuating track drive pedals, think about the direction you are facing with respect to the direction the crawler is facing. (Drive sprockets are at rear of crawler). Confusion could cause you to travel in the direction opposite that expected.**

# A TYPICAL GRADALL DIGGING CYCLE

1. Position unit for efficient digging cycle and apply digging brake.

**WARNING**

**Avoid accidental actuation of the controls. Always stop engine before repositioning door and windows.**

2. Stop engine and secure door and windows in desired position for ventilation. Remove boom and bucket holding devices.

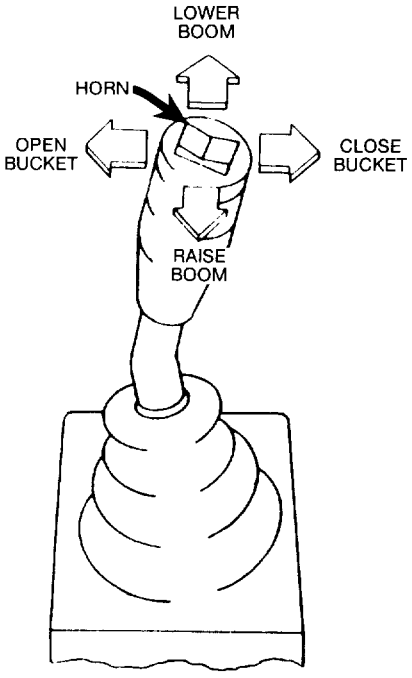
3. Warm up engine and hydraulic oil and then move throttle lever to full throttle position.

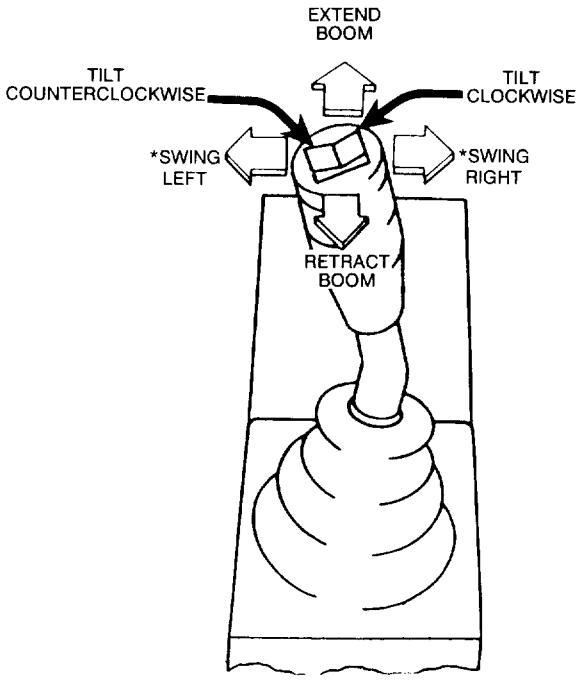
**WARNING**

**Always operate with engine at full throttle to present stalling under heavy load.**

4. Be sure right armrest is locked in down position to energize joysticks and pedals.

**Practice with controls in a safe, open area.**

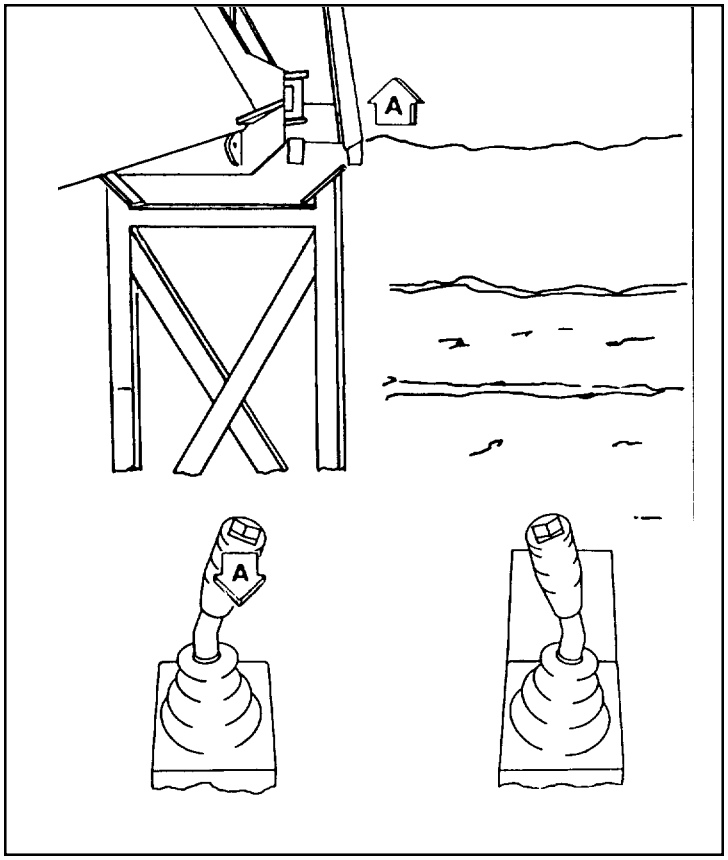


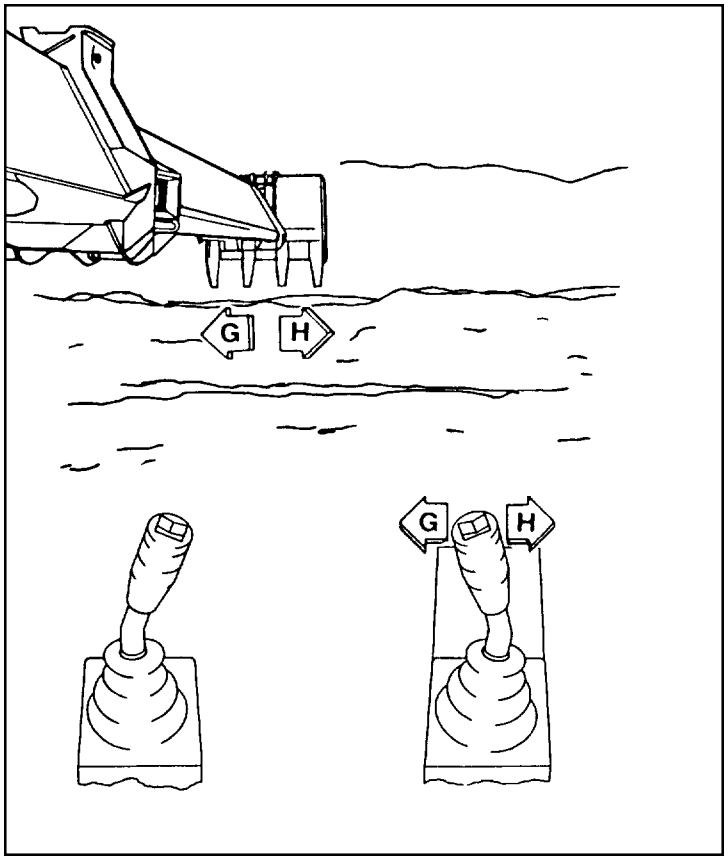

***Swing torque is proportional to degree of joystick actuation.**

**Joysticks & pedals return to neutral position when released.**

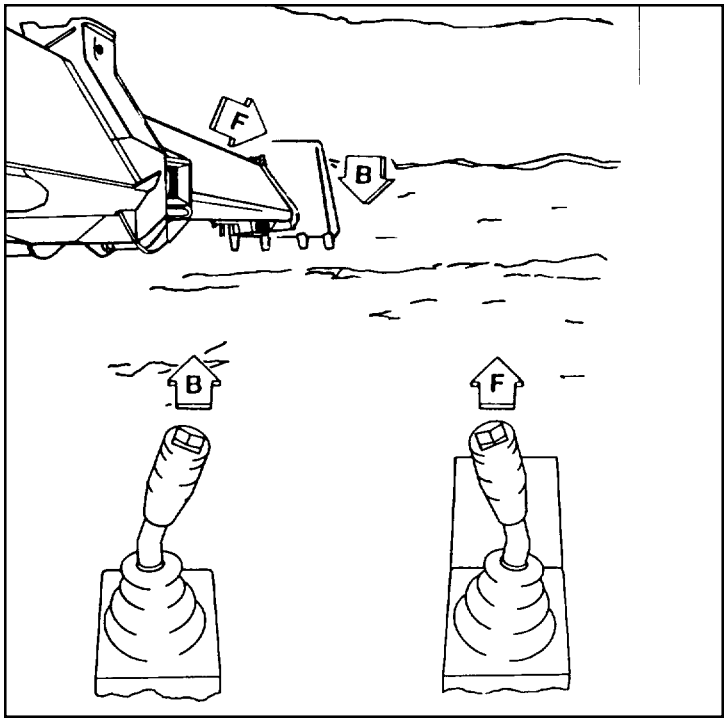
# A TYPICAL GRADALL DIGGING CYCLE



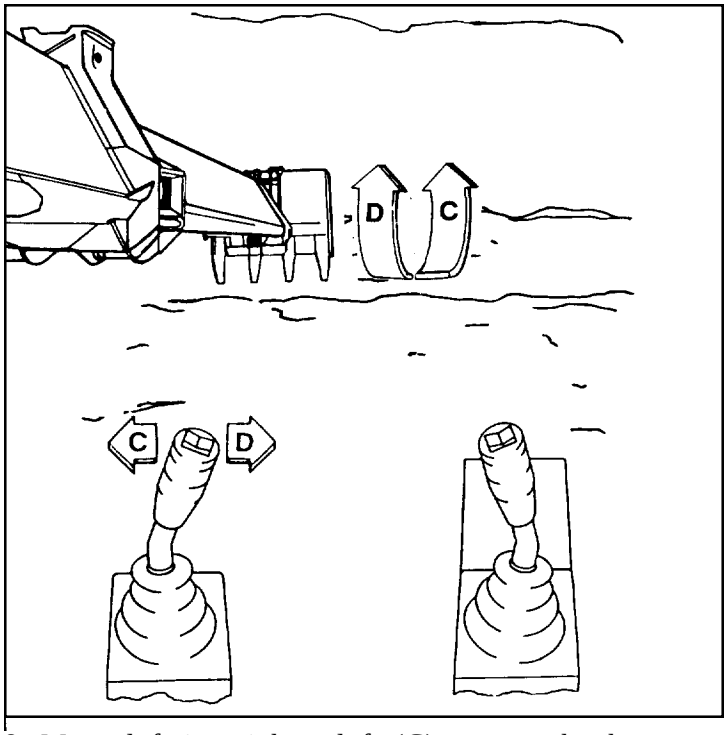

5. Pull back on left joystick (A) to raise boom from boom rest. Be sure to raise boom far enough to clear all obstructions.




6. Move right joystick to left (G) to swing left or to right (H) to swing right to digging site.

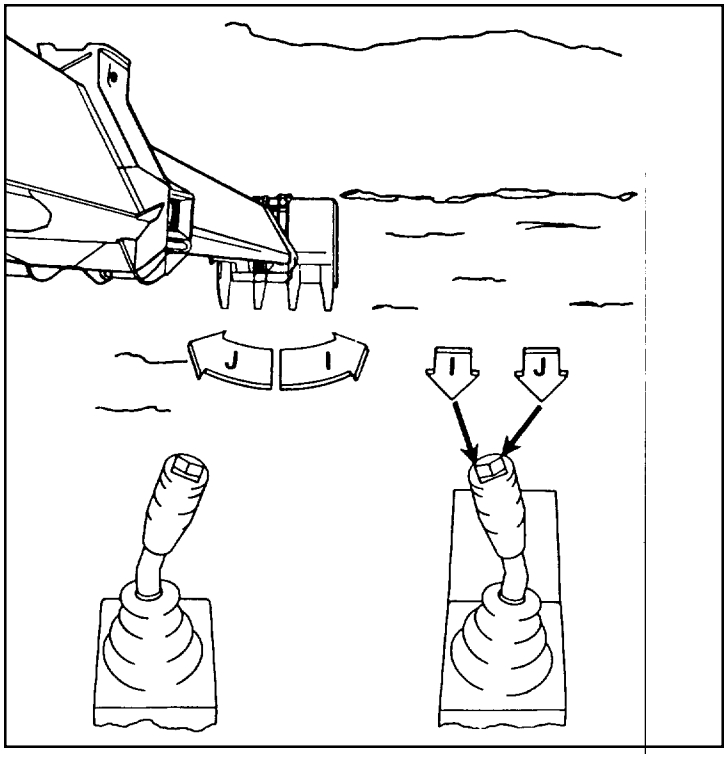



7. While pushing right joystick forward (F) to extend boom, push left joystick forward (B) to lower boom to position for start of cut.

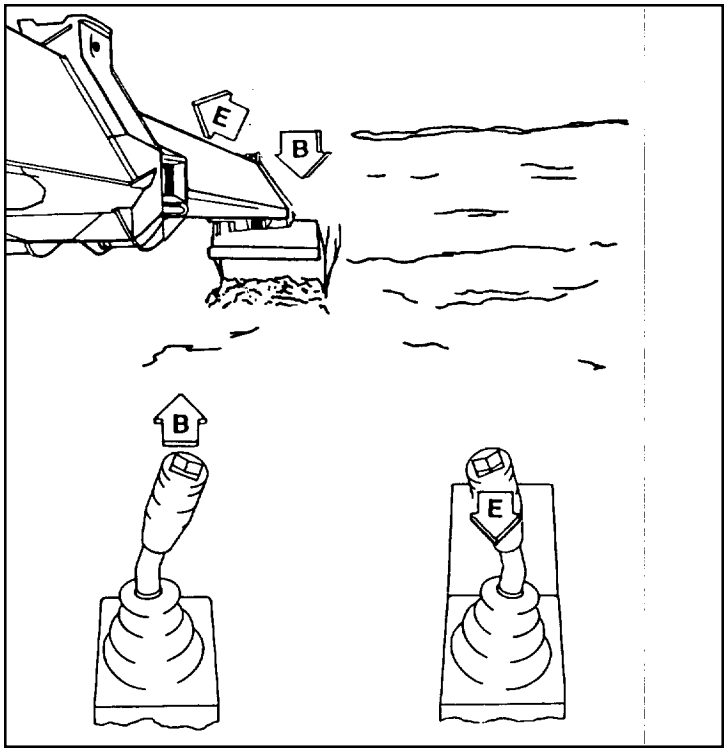



8. Move left joystick to left (C) to open bucket or to right (D) to close bucket for correct penetration. Teeth should angle downward slightly (about (5 ). Angle may be greater for soft digging.

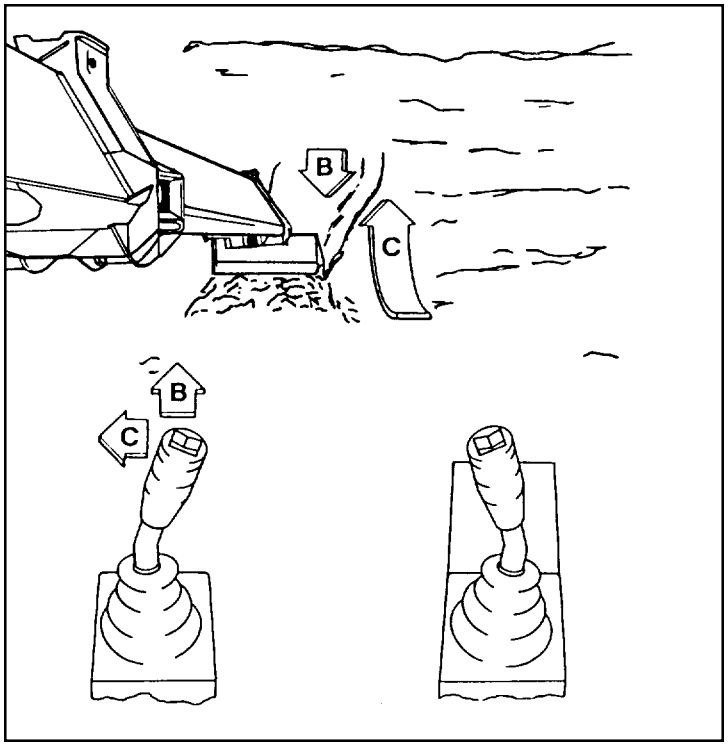
# A TYPICAL GRADALL DIGGING CYCLE



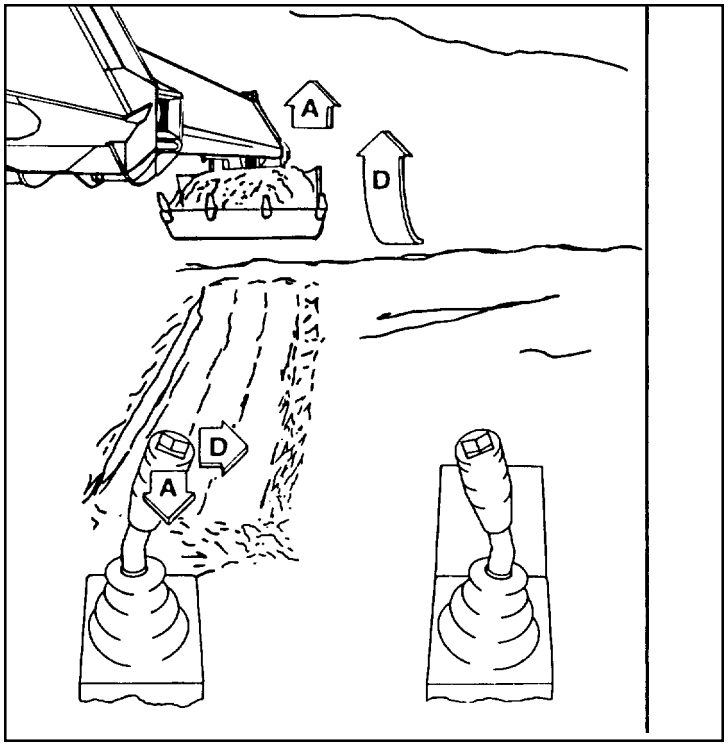

9. If required, press left side of tilt switch (I) to tilt counterclockwise or right side of switch (J) to tilt clockwise.




10. While pushing forward on left joystick (B) to lower boom and force bucket into ground, pull back on right joystick (E) to retract boom and fill bucket.

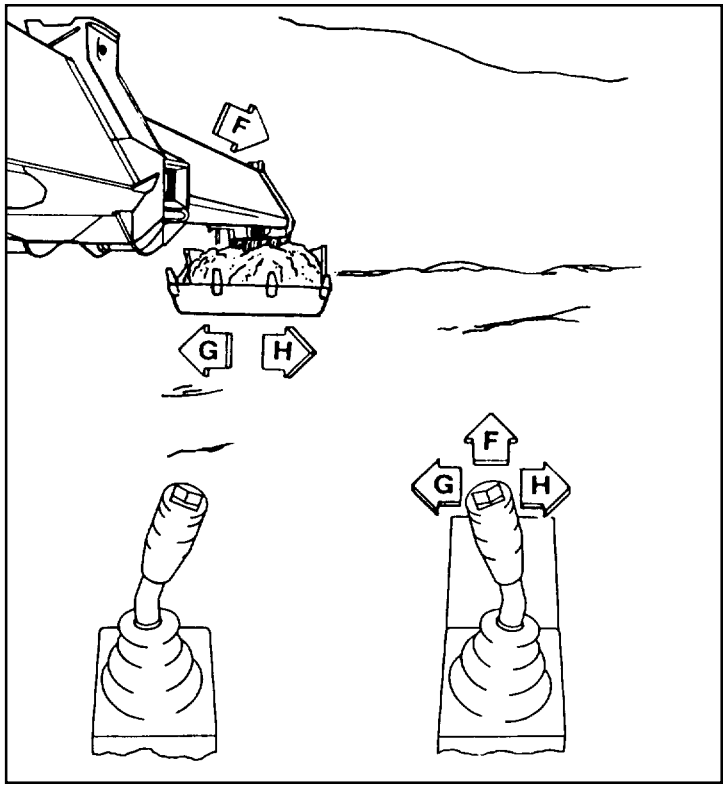



11. As bucket is filling, jog left joystick forward (B) to lower boom and maintain depth of cut. At same time jog left joystick to left (C) to open bucket and maintain proper bucket angle.

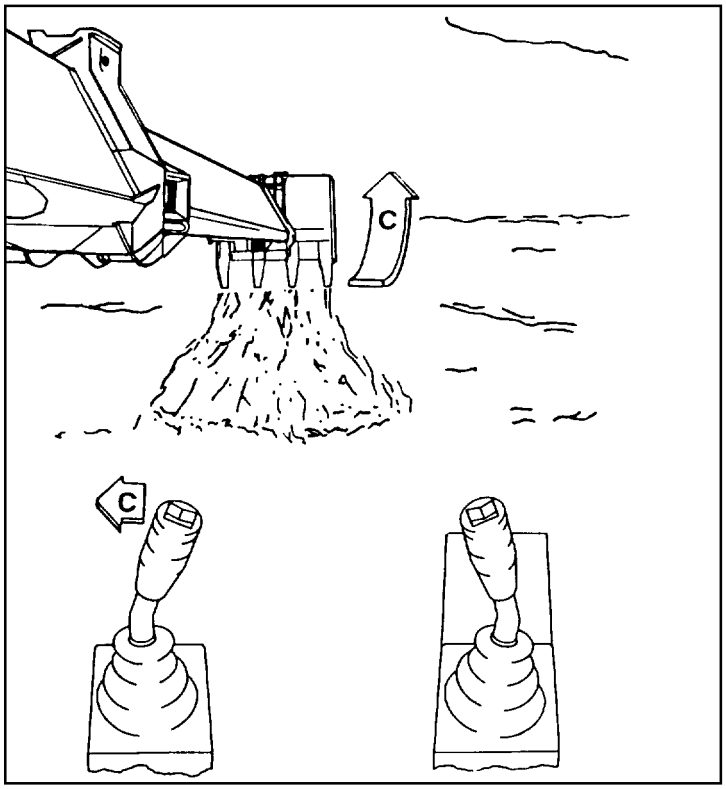



12. When bucket is full or when boom is fully retracted, move left joystick to right (D) to close bucket. At same time pull left joystick back (A) to raise boom. Raise boom only far enough to clear obstructions.

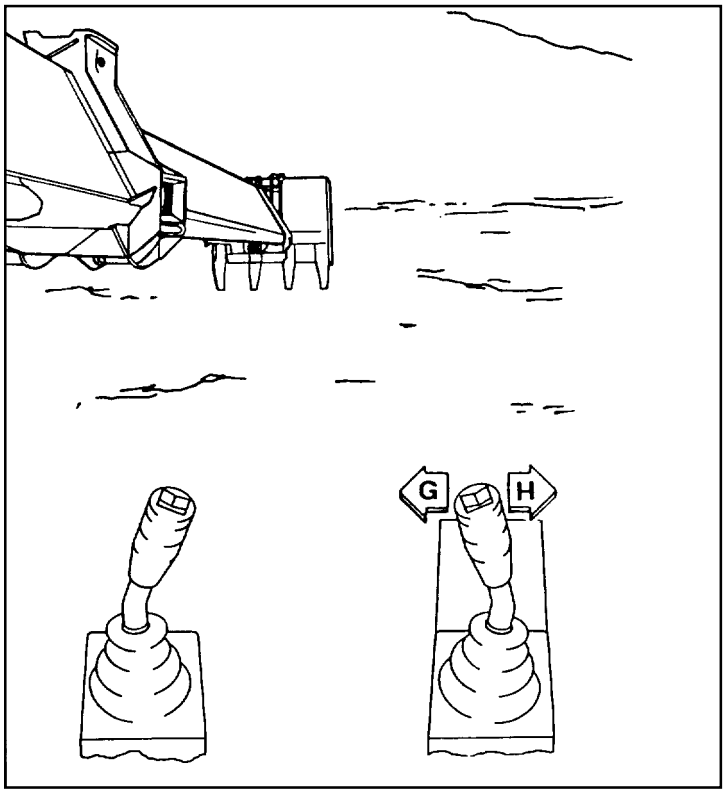
# A TYPICAL GRADALL DIGGING CYCLE




13. Move right joystick to right (H) to swing right or to left (G) to swing left to dump site. If necessary, extend boom by pushing right joystick forward (F).




14. Move left joystick to left (C) to empty the bucket.




15. Move right joystick to left (G) or right (H) to align boom for next cut. Repeat steps 7 thru 15.

# LIFTING AND POSITIONING A LOAD

## Precautions

**Do not depend on machine tipping as a warning of overload.** Some load ratings are based on hydraulic lift capacity, not stability.

Hydraulic **relief valve settings must be correct** when lifting and positioning loads.

**Suspend loads only as shown.** Passing load line over open bucket can cause uncontrolled movement of load. Boom must be tilted to **level position.**

**Always operate at full engine RPM** when handling a heavy load. This prevents stalling under load.

**Keep everyone clear of machine** (especially the boom and suspended load). Use guide ropes to position load.

**Do not travel with a suspended load.** Excavators are not designed for pick and carry lifts.

**Sudden swing braking can cause unexpected movement of the load and tip the machine.**

**Be sure tires are properly inflated** before handling a load.

**Keep load line vertical.** Side loads can cause structural damage and tip the machine.

Use appropriate lift capacity chart **if unit has a boom extension attached.**

**Be thoroughly familiar with excavator hand signals** (shown at end of manual).

---

## General

The excavator can lift and position loads safely **ONLY IF YOU PLAN THE LIFT PROPERLY.**

**DANGER**

**Failure to plan a lift properly can cause death or serious injury.**

There is a great lift capacity difference between the excavator's best and worst lift positions. Just because it can lift a load from one point does not mean it can safely move the load to any other point.

For example, the best lifting position is over the rear with the excavator level and the boom fully retracted. Assume that you have just lifted the maximum rated load from a truck with the unit in this position. The only things you can safely do with the load are raise, lower or swing it over the rear. Swinging over the side or extending the boom will exceed the rated capacity of the unit.

The "common sense" and "feel" an experienced operator might apply in regard to "tipping loads" **DOES NOT APPLY** to loads limited by hydraulic lift capacity. Some loads shown on the chart in cab are Hydraulic Lift Capacities. Exceeding these capacities can cause a relief valve to open allowing the load to fall, or in some cases, the machine to tip.

To avoid exceeding capacities, the entire lift must be planned.

## Positioning Machine For A Lift

Before discussing the steps in planning a lift, let's consider the most favorable excavator positions for making a lift.

The shorter the load radius, the greater the lift capacity. Position the unit to minimize boom extension while keeping a safe distance from obstructions and excavations.

Position the unit to minimize boom extension and swing.

Capacity over-the-rear is greater than capacity over-the-side.

Finally, position unit for maximum visibility. If conditions do not permit a clear view of the load through entire lift, use a signal man.

## Planning A Lift

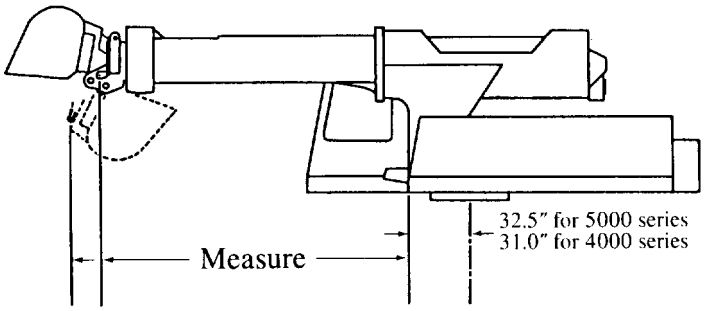
1. Determine the weight of the load. Weight of slings, chains and auxiliary lifting devices must be added as part of the load. Refer to lift capacity chart for weight adjustment required for bucket.

NOTE: Lift capacities are based on machine being on a firm level surface and also on load being freely suspended as shown.

2. Move the machine to the best probable position for making the lift.

3. Perform an unloaded trial run of the lift to determine maximum load radius required and maximum boom height and depth required to complete the lift.

Measure load radius from front center of upper-structure frame to vertical load fine and add distance from front of frame to center of rotation (31.0 or 32.5 inches as appropriate).




**Measuring Load Radius**

Measure boom height/depth from bucket adapter pivot shaft to ground level (same plane as bottom of tires). Be sure to allow for length of sling and height of load.

4. Refer to lift capacity chart column for the required load radius. If the required radius falls between columns, use the column for the next larger radius.

5. Check the appropriate capacities for the required boom height and depth. The smaller of these capacities is the maximum load permitted for lift conditions.

To determine practical working load limits the operator must also consider wind, hazardous conditions, experience of personnel and proper load handling.

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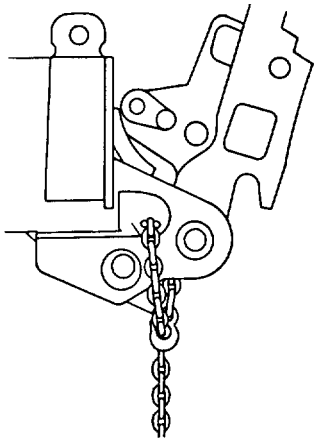
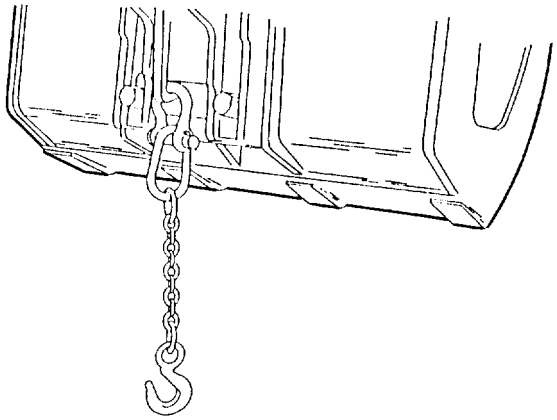
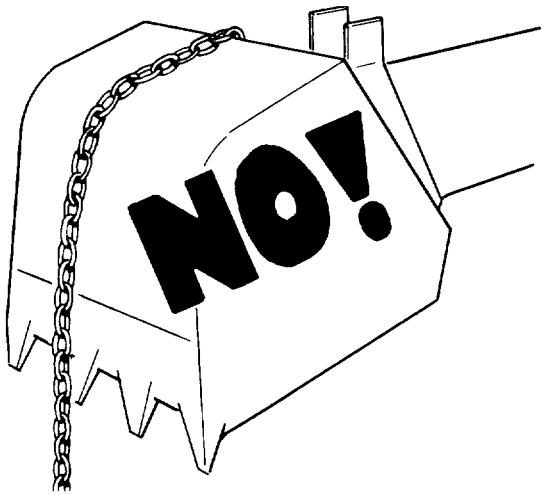


With load attached as shown, **be certain chain is securely locked on itself.**

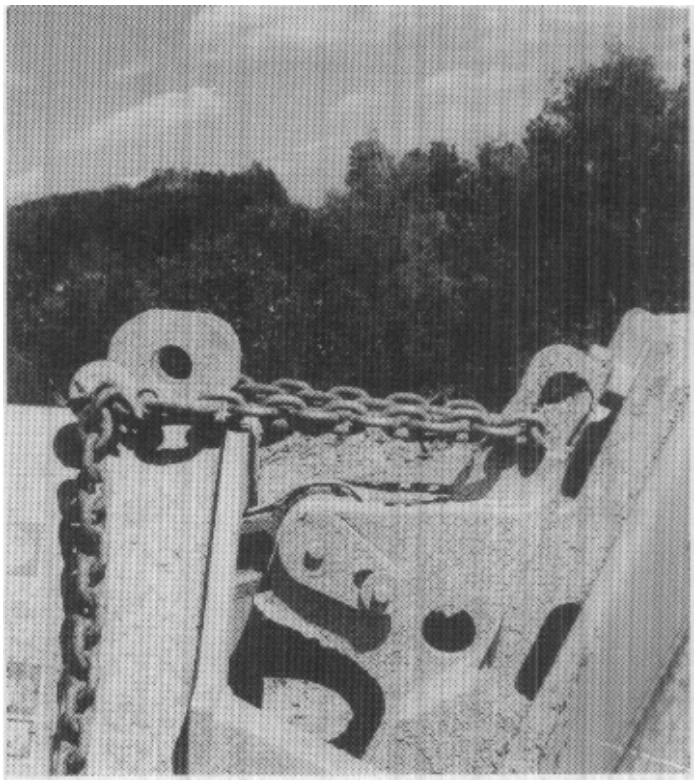


With load attached as shown, boom must be **level from side-to-side** and bucket adapter must be **closed against stops.**

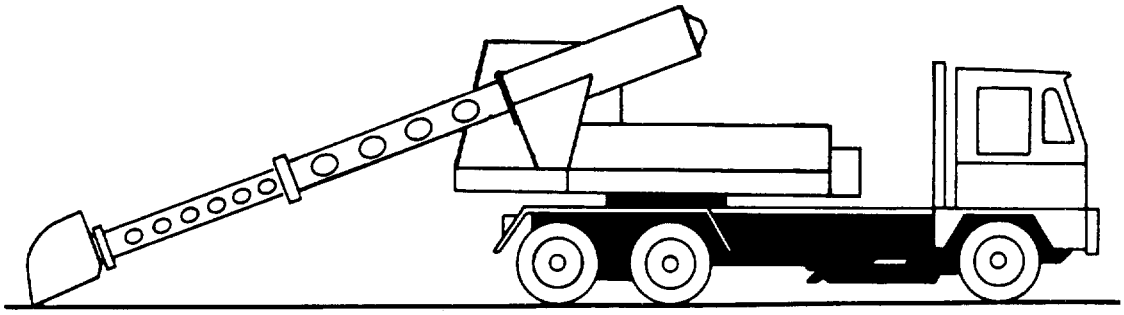



**Never pass load fine over open bucket.** Relief valves in bucket circuit could cause unexpected, dangerous movement of the load. Bucket linkage could also be damaged.

# SECURING BOOM & ATTACHMENT FOR TRAVEL



# IF YOU GET STUCK



If unit becomes stuck in soft ground you can use the boom to help free it.

Position carrier and upperstructure controls for remote control operation.

Position boom over rear of carrier (centered over rear to prevent tipping) and imbed bucket in ground.

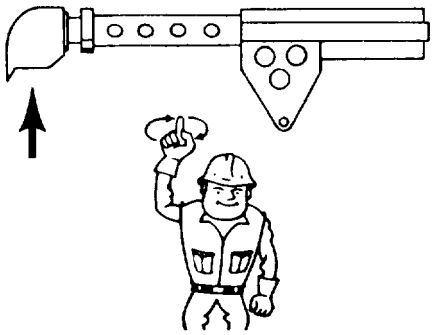
While actuating travel pedal in appropriate direction, extend or retract boom as required to help push or pull unit to solid ground. Raise or lower boom as necessary to keep rear wheels in proper contact with ground.

# EXCAVATOR HAND SIGNALS

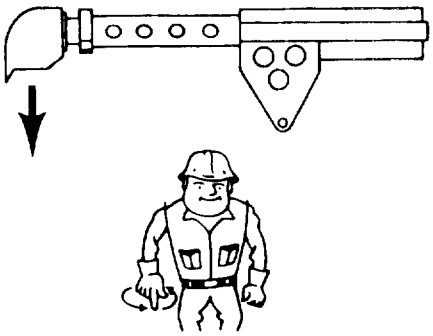
**Standard Signals** - When excavator work conditions require hand signals, they shall be provided or posted conspicuously for the use of both signalman and operator. No excavator motions shall be made unless signals are clearly understood by both signalman and operator.

**Special Signals** - When signals for auxiliary equipment functions or conditions not covered are required, they shall be agreed upon in advance by the operator and signalman.

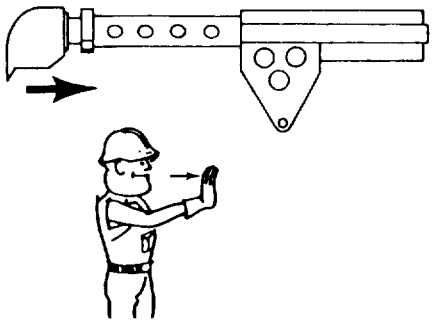
**Instructions** - When it is desired to give instructions to the operator other than provided by the established signal system, all excavator motions shall first be stopped.



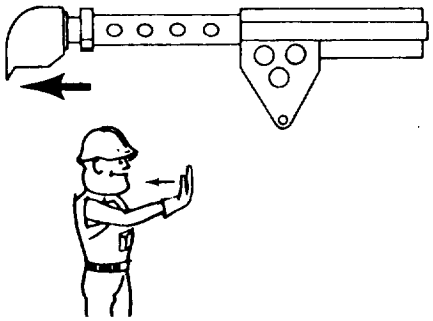
RAISE LOAD VERTICALLY - With either forearm vertical, forefinger pointing up, move hand in small horizontal circle.



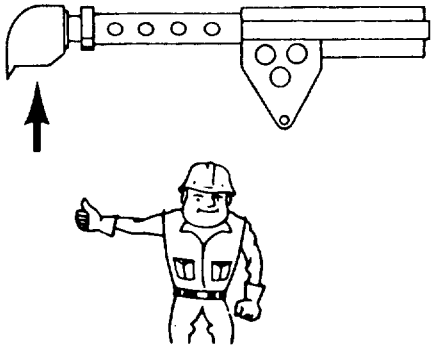
LOWER LOAD VERTICALLY - With either arm extended downward, forefinger pointing down, move hand in small horizontal circle.



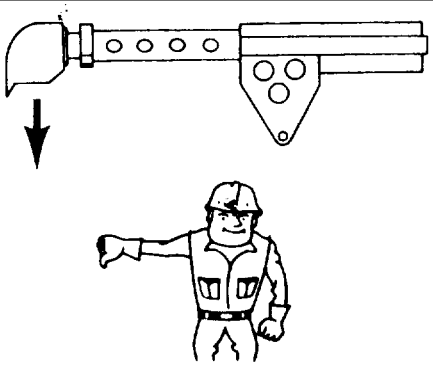
MOVE LOAD IN HORIZONTALLY - With either arm extended, hand raised and open toward direction of movement, move hand in direction of required movement.



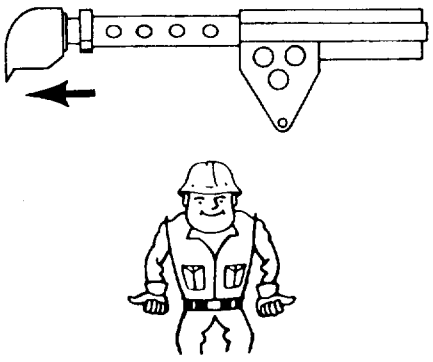
MOVE LOAD OUT HORIZONTALLY - With either arm extended, hand raised and open toward direction of movement, move hand in direction of required movement.



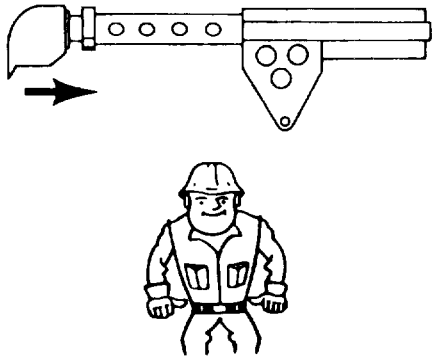
RAISE BOOM - With either arm extended horizontally, fingers closed, point thumb upward.



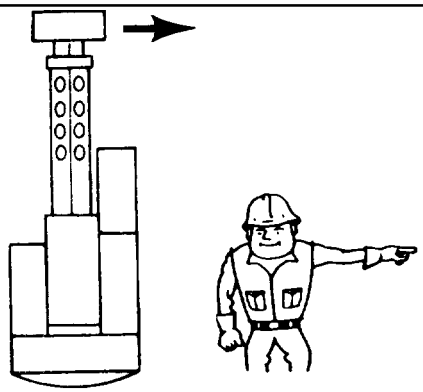
LOWER BOOM - With either arm extended horizontally, fingers closed, point thumb downward.



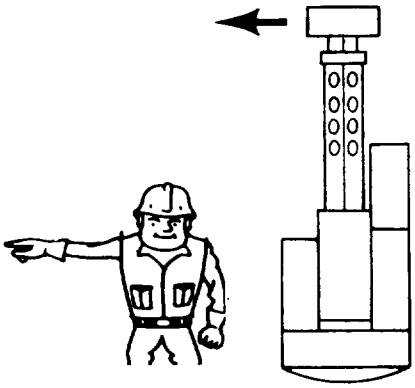
EXTEND TELESCOPIC BOOM - With both hands clenched, point thumbs outward.



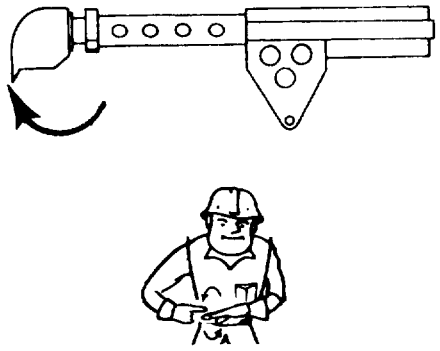
RETRACT TELESCOPIC BOOM - With both hands clenched, point thumbs inward.



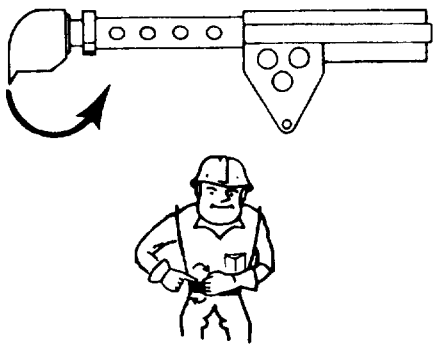
SWING - With either arm extended horizontally, point with forefinger to direction of swing rotation.



SWING - With either arm extended horizontally, point with forefinger to direction of swing rotation.

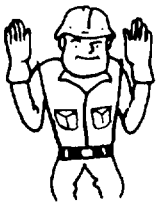


OPEN BUCKET - Hold one hand open and stationary. Rotate other hand in small vertical circle with forefinger pointing horizontally at open hand.

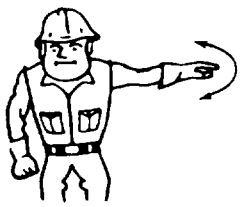


CLOSED BUCKET - Hold one hand closed and stationary. Rotate other hand in small vertical circle with forefinger pointing horizontally at closed hand.

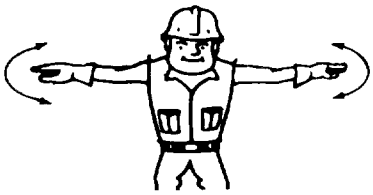
MOVE SLOWLY - Place one hand motionless in front of hand giving motion signal. (Raise load slowly is shown.)



THIS FAR TO GO - With hands raised and open inward, move hands laterally, indicating distance to go.

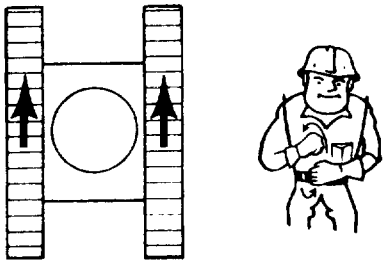


STOP - With either arm extended laterally, hand open downward, move arm back and forth.

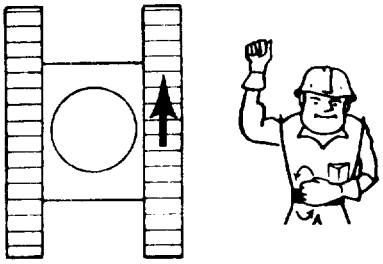


EMERGENCY STOP - With both arms extended laterally, hands open downward, move arms back and forth.

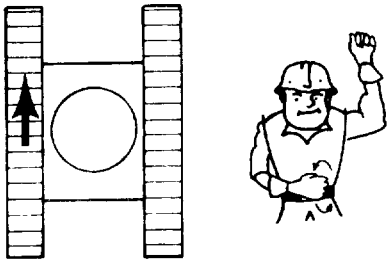
STOP ENGINE - Draw thumb or forefinger across throat.



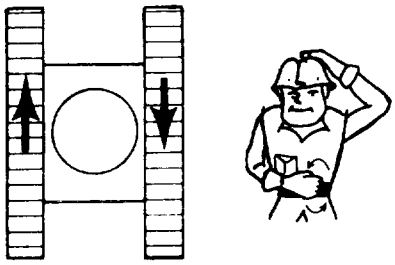
TRAVEL - Move fists in vertical circle about each other in direction of track or wheel rotation.



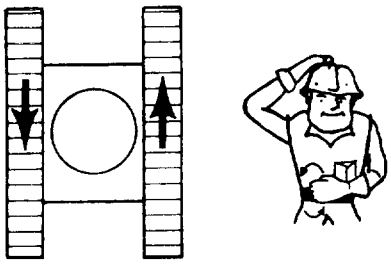
TURN - Raise forearm with closed fist indicating inside of turn. Move other fist in vertical circle indicating direction of track or wheel rotation.



TURN - Raise forearm with closed fist indicating inside of turn. Move other fist in vertical circle indicating direction of track or wheel rotation.



COUNTER ROTATE - Place hand on head indicating side of reverse track or wheel rotation. Move other hand in vertical circle indicating forward rotation of other track or wheel.



COUNTER ROTATE - Place hand on head indicating side of reverse track or wheel rotation. Move other hand in vertical circle indicating forward rotation of other track or wheel.

# LUBRICATION & MAINTENANCE DIAGRAM

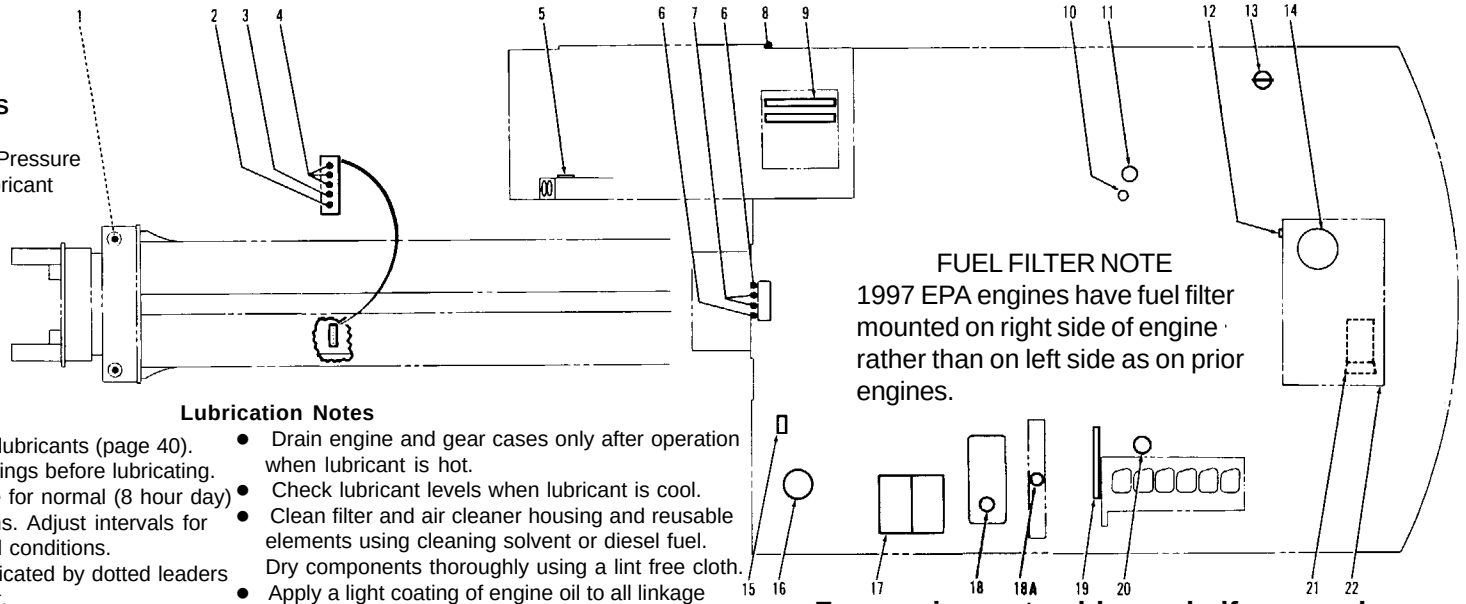
**SYMBOLS**

- **= Fitting**

➔ **= Other Service**

**LUBRICANT SYMBOLS**

AF - Anti-Freeze
CG - Grease, Extreme Pressure
GO - Multi-Purpose Lubricant
EO - Engine Oil
MC - Molycote
GL - Open Gear Lube
HF - Hydraulic Fluid

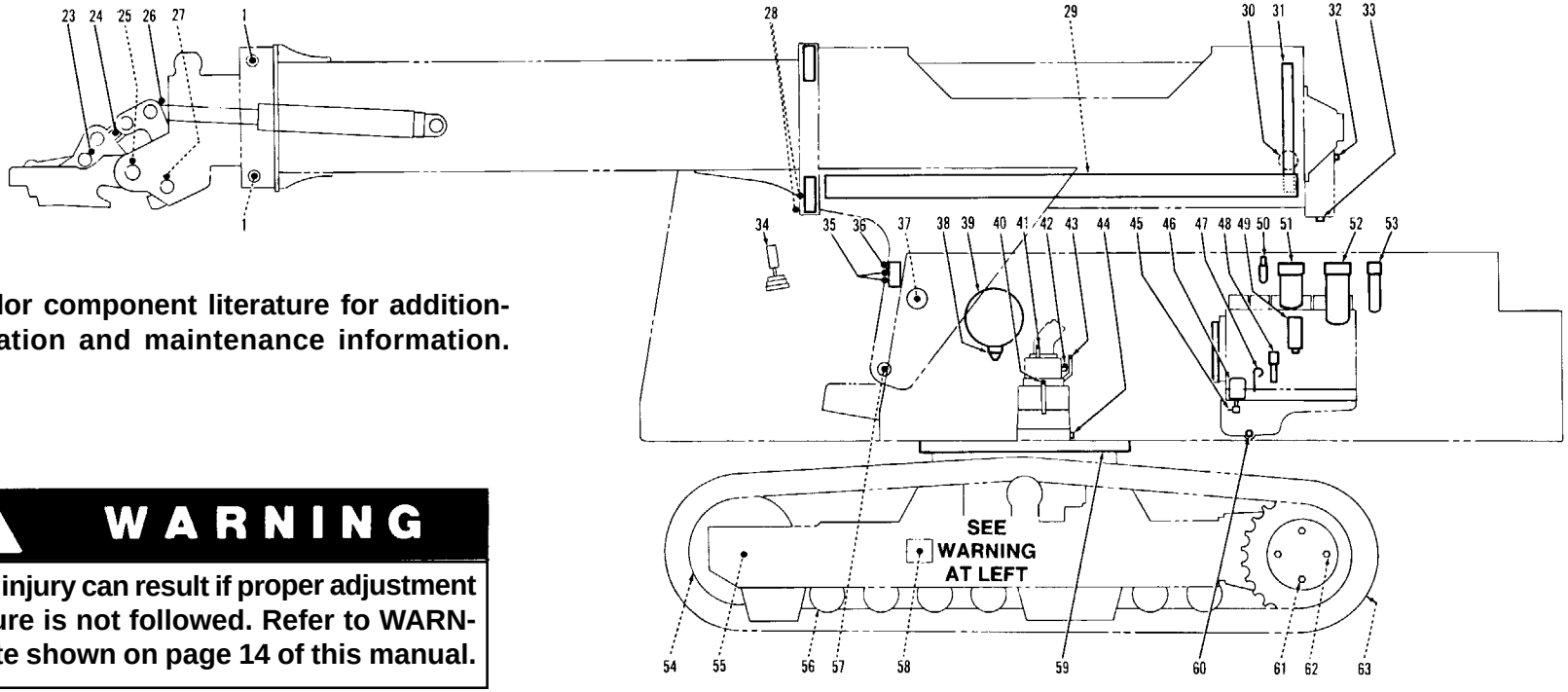



FUEL FILTER NOTE
1997 EPA engines have fuel filter mounted on right side of engine rather than on left side as on prior engines.

**Lubrication Notes**

- See recommended lubricants (page 40).
- Clean lubrication fittings before lubricating.
- Intervals shown are for normal (8 hour day) usage and conditions. Adjust intervals for abnormal usage and conditions.
- Lubricate points indicated by dotted leaders on both sides of unit.
- Drain engine and gear cases only after operation when lubricant is hot.
- Check lubricant levels when lubricant is cool.
- Clean filter and air cleaner housing and reusable elements using cleaning solvent or diesel fuel. Dry components thoroughly using a lint free cloth.
- Apply a light coating of engine oil to all linkage pivot points.

**For service, extend boom half way and rest bottom of bucket flat on ground.**




**See vendor component literature for additional lubrication and maintenance information.**

**WARNING**

**Serious injury can result if proper adjustment procedure is not followed. Refer to WARNING plate shown on page 14 of this manual.**

**CAUTION**

**Service intervals are based on machine usage of 1500 hours annually. Use of your unit may vary significantly and you must adjust service frequency for your usage to obtain maximum service life. Frequency headings in the following schedule indicate a calendar limit and an operating hour limit. Perform service at whichever interval occurs first.**

| | Item | ube Symbol | No. of Points |
|---|---|---|---|
| | **Daily or Shift (10 Hour Maximum) Lubrication & Maintenance** | | |
| 1. | Boom Roller Pivots | CG | 5 |
| 2. | Tool Cylinder Base Pivot | CG | 1 |
| 3. | Extension Cylinder Support Bushing | CG | 1 |
| 4. | Extension Boom Roller Pins | CG | 3 |
| 5. | Air Cleaner Condition Indicator (observe with engine running at full throttle - clean or replace as required - item 39 is air cleaner) | - | 1 |
| 6. | Hoist Cylinder Base Pivots | CG | 2 |
| 7. | Swing Bearing | CG | 2 |
| 12. | Hydraulic Fluid Level (check with machine level, boom extended half way & bottom of bucket flat on ground - if req'd, stop engine & vent reservoir by unseating vent valve stem [45] refill thru pressure fill port [10] using adapteR P/N 8364-1564 OR refill thru main return filter [14]) | HF | 1 |
| 13. | Fuel Filler Cap (fill daily at end of work shift to minimize condensation) | - | 1 |
| 23. | Tool Link Pivot (at adapter) | CG | 1 |
| 24. | Tool Link Pivot (at curved link) | CG | 1 |
| 25. | Adapter Pivot Pin | CG | 2 |
| 26. | Tool Cylinder Rod Pivot | CG | 1 |
| 27. | Curved Link Pivot | CG | 2 |
| 28. | Boom Tilt Rollers | CG | 4 |
| 37. | Cradle Pivots | CG | 2 |
| 47. | Crankcase Dipstick (check lubricant level & refill as req'd - [47 is filler cap]) | EO | 1 |
| 55. | Idler Slide Paths (inside & outside each track frame) | CG | 4 |
| 57. | Hoist Cylinder Rod Pivots | CG | 2 |
| | Weekly (50 Hour Maximum) Lubrication & Maintenance (include all previous periodic services) | | |
| 11. | Fuel/Water Separator (drain water) | - | 1 |
| 17. | Battery (check electrolyte level & refill as req'd) | - | 2 |
| 18. | Coolant Expansion Tank (check level & refill as req'd) | AF | 1 |
| 32. | Tilt Gear Box Fill & Level Plug (check level & refill as req'd) | GO | 1 |
| 35. | Tilt Bearing | CG | 2 |
| 36. | Extension Cylinder Retainer | CG | 1 |
| 38. | Air Cleaner Vacuator Valve (check for damage - should be empty with engine stopped) | - | 1 |
| 40. | Swing Transmission Fill & Level Plug (check level & refill as req'd) | GO | 1 |
| 42. | Swing Brake Fill & Level Plug | HF | 1 |
| 49. | Fuel/Water Separator (drain water) | - | 1 |
| 51. | Suction Filter (check condition indicator when oil is warm & with engine running at full RPM - replace element as req'd) | - | 1 |
| 52. | Circulation System Filter (check condition indicator when oil is warm & with engine running at full RPM - replace element as req'd) | - | 1 |
| 53. | Pilot Filter (check condition indicator when oil is warm & with engine running at full RPM - replace element as req'd) | - | 1 |
| 54. | Track Idler (observe for leakage - repair or replace leaking idler - add 8.3 ounces (.25 liter) of SAE 30 or 40 to repaired idler) | EO | 2 |
| 56. | Track Rollers (observe all rollers for leakage - repair or replace leaking rollers - add 14.9 ounces (.44 liter) of SAE 30 or 40 to repaired roller) | EO | 18 |
| 59. | Swing Bull Gear (apply open gear lubricant) | GL | 1 |
| 62. | Planetary Gear Level Plug (check level with plugs in position shown & refill as necessary) | GO | 2 |
| | **At End of First 30 Days** | | |
| 44. | Swing Transmission Drain Plug (drain & refill) | GO | 1 |
| 61. | Planetary Gear Drain Plug (drain & refill to level with plugs in position shown) | GO | 2 |



| | Items | Lube Symbol | No. Of Points |
|---|---|---|---|
| | **At End of First 30 Days (continued** | | |
| ● | Check torque of all items listed in torque table (page 40) | - | - |
| | **Monthly (125 Hour Maximum) Lubrication & Maintenance (include all previous periodic services)** | | |
| 16. | Air Drier (remote units only) (observe for air discharge when compressor unloader valve cycles - refer to page 20 of carrier operator's manual) | - | 1 |
| 19. | Drive Belt (check condition & alignment- replace as req'd) | - | 1 |
| 29. | Hose Trough Guide Wear Strips (spray with dry type graphite lubricant) | MC | 2 |
| 31. | Tilt Gear (remove access closure[30] at right side of cradle and apply open gear lubricant) | GL | 1 |
| 63. | Track (check for proper track tension - there should be 1-3/6" [30 mm] sag between top of drive sprocket & upper support roller - item 58 is adjustment fitting- **adjustment must be made only by qualified maintenance person)** | - | 2 |
| | **Every 250 Hour Lubrication & Maintenance (include all previous periodic services)** | | |
| 9. | Heater Air Filter (inspect & clean or replace as req'd) | - | 2 |
| 20. | Engine Oil Filter (replace element at 250 hour intervals) | - | 1 |
| 60. | Crankcase Drain Plug (change oil at 250 hour intervals) | EO | 1 |
| | **Every Four Months (500 Hour Maximum) Lubrication & Maintenance (include all previous periodic services)** | | |
| 11. | Fuel/Water Separator (replace element) | - | 1 |
| 49. | Fuel/Water Separator (replace element) | - | 1 |
| | **Semi-Annual (750 Hours Maximum) Lubrication & Maintenance (include all previous periodic services)** | | |
| 14. | Hydraulic Return Filter (replace element & clean magnets if element has not been replaced in previous 750 hours) | - | 1 |
| 15. | Air Compressor Air Filter (check condition & clean or replace as req'd) | - | 1 |
| 22. | Hydraulic System (have hydraulic fluid analyzed to determine condition - use test port mini-check to obtain sample) (if req'd, drain, flush replenish & bleed system per XL Series Hyd. Excavator Tech. Manual [Part No 2460-4122] also clean suction screen [21] when system is drained) | HF | 1 |
| 41. | Swing Brake Breather (remove, clean or replace) | - | 1 |
| 43. | Swing Transmission Breather (remove, clean or replace) | - | 1 |
| 51. | Hydraulic Suction Filter (replace element n n has not been replaced in previous 750 hours) | - | 1 |
| 52. | Circulation System Hydraulic Filter (replace element if it has not been replaced in previous 750 hours) | - | 1 |
| 53. | Pilot System Hydraulic Filter (replace element if it has not been replaced in previous 750 hours) | - | 1 |
| ● | Check torque of all items listed in torque table (page 40) | - | - |
| | **Annual (1500 Hour Maximum Lubrication & Maintenance (include all previous periodic services)** | | |
| 8. | Door Hinges | CG | 2 |
| 15. | Air Compressor Air Filter (replace element if it has not been replaced in previous 1500 hours) | - | 1 |
| 16. | Air Drier (replace cartridge - refer to carrier operators manual) | - | 1 |
| 18A. | Engine Cooling System (drain & refill cooling system based on period suggested by anti-freeze manufacturer) | AF | 1 |
| 22. | Hydraulic System (unless hydraulic fluid is analyzed semi-annually to check level of contamination, system must be drained, flushed, replenished & bled per XL Series Hyd. Excavator Tech. Manual [Part No. 2460-4122] on annual basis - also clean suction screen [21] when system is drained) | HF | 1 |
| 33. | Tilt Transmission Drain Plug (drain & refill) | GO | 1 |
| 34. | Joystick Plungers (raise boot & lube rounded top of each plunger) | CG | 8 |
| 44. | Swing Transmissin Drain Plug (drain & refill) | GO | 1 |
| 46. | Hydraulic Reservoir Breather (replace element) | - | 1 |
| 50. | Air Regulator Filter (replace element) | - | 1 |
| 61. | Planetary Gear Drain Plug (drain & refill) | GO | 2 |

# LUBRICATION & MAINTENANCE

## TORQUE CHART

**Check torque using an accurate torque wrench to apply maximum torque value shown. DO NOT EXCEED MAXIMUM TORQUE. Exceeding maximum torque may cause failure of fastener.**

| ITEM | QTY. | THREAD SIZE (GRADE) | TORQUE (lubricated) | | | |
|---|---|---|---|---|---|---|
| | | | POUND/FEET | | NEWTON/METRES | |
| | | | MINIMUM | MAXIMUM | MINIMUM | MAXIMUM |
| Telescope Boom Roller Eccentric Keepers | 6 | ½-13 (8) | 100 | 110 | 136 | 150 |
| Main Boom Roller Eccentric Keepers | 5 | ⅜-16 (8) | 40 | 45 | 54 | 61 |
| Extension Cylinder Support | 9 | ⅝-11 (5) | 70 | 75 | 95 | 102 |
| Swing Bearing | 80 | ⅝-11 (8) | 200 | 215 | 272 | 292 |
| Swing Motor | 4 | ½-13 (5) | 75 | 85 | 102 | 116 |
| Swing Transmission | 8 | ¾-10 (8) | 340 | 365 | 462 | 496 |
| Tilt Gear Box | 4 | ⅝-11 (8) | 140 | 155 | 190 | 211 |
| Tilt Motor | 2 | ½-13 (8) | 140 | 155 | 190 | 211 |

## Recommended Lubricants & Capacities

| Application | Symbol | Grade | Specifications | Capacities*** | |
|---|---|---|---|---|---|
| | | | | English | Liters |
| Engine Crankcase: (Cummins) | EO (engine oil) | 15W-40 | MIL-L-2104E | 15 quarts | 14.2 |
| Engine Cooling System (Cummins) | AF (anti-freeze) | 50/50 mix | Permanent | 25 quarts | 23.7 |
| Track Rollers<br>Track Idler | EO (engine oil) | SAE 30-40 | - | 14.9 ounces<br>8.3 ounces | .44<br>.25 |
| Swing Transmission<br>Tilt Gear Box | GO (multi-purpose lubricant) | EP 85/140 | MIL-L-2105D | 9 pints<br>8 quarts | 4.26<br>7.57 |
| Crawler Planetary | GO (multi-purpose lubricant) | EP 80/90 | MIL-L-2105D | 6.3 quarts (ea.) | 6 |
| Hose Guide Wear Strips | MC (Molycote) | - | Part No. 8664-1475 | - | - |
| Swing Bull Gear<br>Tilt Gear | GL (open gear lubricant) | - | Part No. 8664-1304 | - | - |
| Grease Fittings | CG (extreme pressure lube) | No. 2 | - | - | - |
| Hydraulic System<br>Swing Brake | HF (hydraulic fluid) | - | ** | 95 gallons<br>12 ounces | 360<br>.36 |

** Specific hydraulic fluid specifications are shown.

*** Capacities are approximate - check level to be sure.

**Hydraulic Fluid Specifications:**
Tractor Hydraulic Fluid
Pour Point -46° F.; SSU @ 100° F. 275; Flash Point 442° F.
**Approved Supplier & Type:**
Mobile Mobifluid 424 OR Citgo Tractor Hyd. Fluid. #33310

**CALIFORNIA**

**Proposition 65 Warning**

**Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.**

**Wash hands after handling.**

**CALIFORNIA**

**Proposition 65 Warning**

**Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.**

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