



GRADALL®
MATERIAL HANDLERS

534B-9 OPERATION & LUBRICATION MANUAL



IMPORTANT

Read and understand this manual and the Gradall Material Handler Safety Manual before starting, operating or performing maintenance procedures on this machine.

KEEP THESE MANUALS IN CAB.

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 instrucciones de seguridad!

VORSICHT!

Wen Sie kein Englisch lesen, bitten Sie ihren Vorgesetzten um die Sicherheitsvorschriften!

IMPORTANT SAFETY NOTICE

Safe operation depends on reliable equipment and proper operating procedures. Performing the checks and services described in this manual will help to keep your Gradall Material Handler 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.

Danger, Warning and Caution notes in this manual and the FIEI Rough Terrain Forklift Safety Manual will help you avoid injury and damage to the equipment. These notes are not intended to cover all eventualities; it would be impossible to anticipate and evaluate all possible applications and methods of operation for this equipment.

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 Material Handler Distributor before operating.

Do not modify this machine without written permission from The Gradall Company.

NOTICE

The Gradall Company retains all proprietary rights to the information contained in this manual.

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

Gradall is a registered mark for hydraulic excavators, hydraulic material handlers and attachments manufactured by The Gradall Company.

The Gradall Company

406 Mill Avenue, S.W., New Philadelphia, Ohio 44663

INTRODUCTION

General

The manual provides important information to familiarize you with safe operating procedures and operator maintenance requirements for the Gradall/534B-9 Material Handler.

If you have any questions regarding the material handler, contact your Gradall Material Handler Distributor.

Operator Qualifications

Operators of the material handler must be in good physical and mental condition, have normal reflexes and reaction time, good vision and depth perception and normal hearing. He/she* must not be using medication which could impair his abilities nor be under the influence of alcohol or any other drug during the work shift.

The operator should also possess a valid, applicable driver's license and must have completed a course of training in the safe operation of this type of material handling equipment.

In addition, the operator must read, understand and comply with instructions contained in the following material furnished with the material handler:

- This Operator's Manual
- FIEI Rough Terrain Forklift Safety Manual
- Gradall Material Handler Safety Manual
- All instruction decals and plates
- Any optional equipment instructions furnished

The operator must also read, understand and comply with all applicable Employer, Industry and Governmental rules, standards and regulations.

Regardless of previous experience operating similar equipment, the operator must be given sufficient opportunity to practice with the 534B-9 Material Handler in a safe, open area (not hazardous to people or property) to develop the skills and "feel" required for safe, efficient operation.

* Though no offense or discrimination is intended, only the masculine pronouns will be used throughout the remainder of this manual.

Orientation

When used to describe location of components in the material handler, the directions front, rear, right and left relate to the orientation of a person sitting in the operator's seat.

Related Manuals & Decals

Separate publications are furnished with the material handler to provide information concerning safety, replacement parts, maintenance procedures, theory of operation and vendor components. Replacement manuals, decals and instruction plates can be ordered from your Gradall Material Handler Distributor.

Serial Number Location

Specify Model and Serial Numbers when ordering parts and when discussing specific applications and procedures with your distributor. The model/serial number plate is located on the right cab wall.

GRADALL MATERIAL HANDLER
MODEL 534B-8
SERIAL NO
WEIGHT (WITHOUT ATTACHMENT) 21,215 LBS.
AS RELEASED FROM FACTORY THIS TRUCK MEETS THE REQUIREMENTS OF THE AMERICAN NATIONAL STANDARD FOR TRUCKS PART III: AMERICAN NATIONAL STANDARD Z90.1-1972
CAPACITY WITH STANDARD ATTACHMENT

CAP. X1000	A	B	C	D
8	34"	36"	24"	0"
6	34"	36"	24"	0"
4	34"	36"	24"	0"
2	34"	36"	24"	0"
0	34"	36"	24"	0"

ADD 2,000 LBS. WITH LIFTING DEVICES

ATTACHMENT	CAP. X1000	TRUCK & ATTACHMENT WEIGHT	A	B	C	D
48" CARRIAGE P/N 9045-5007	8	21,986	34"	24"	24"	0"
64" CARRIAGE P/N 9045-5008	8	22,066	34"	24"	24"	0"
48" CARR. W/ FORK P/N 9045-5012	8	22,131	34"	24"	24"	0"
BUCKET P/N 9103-5019	4	21,360	36"	---	---	0"
BUCKET P/N 9045-5013	3	21,610	36"	---	---	6"
TRUSS BOOM P/N 9045-5011	1.6	21,820	45"	---	---	15.5"
5' WAST 48" CARR. P/N 9045-5038	4	22,660	42"	24"	24"	2"
5' WAST 64" CARR. P/N 9045-5037	4	22,740	42"	24"	24"	2"
64" CARR. W/ 88 & 99 P/N 9045-5010	7.7	22,235	34"	24"	24"	0"
SWING FORK (100") P/N 9045-5044	8	22,796	34"	24"	24"	0"

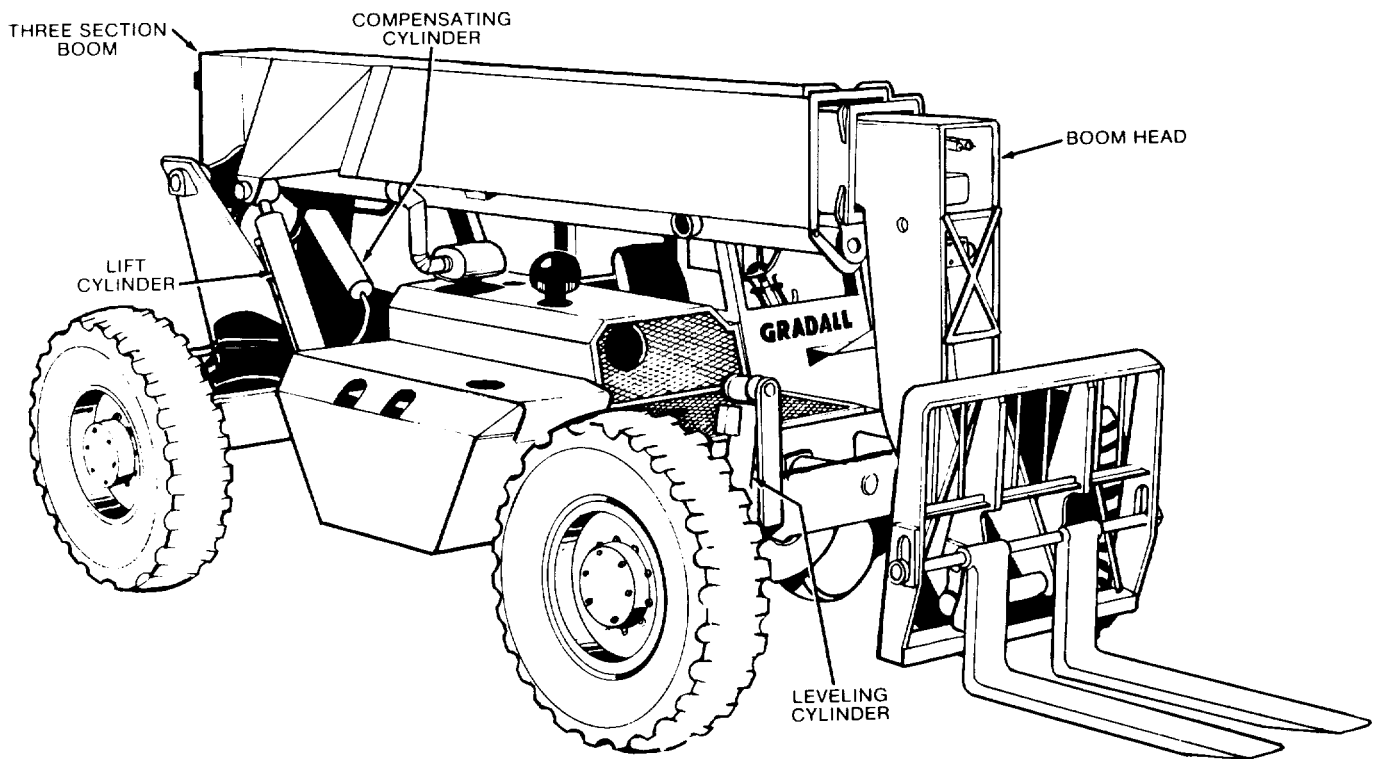
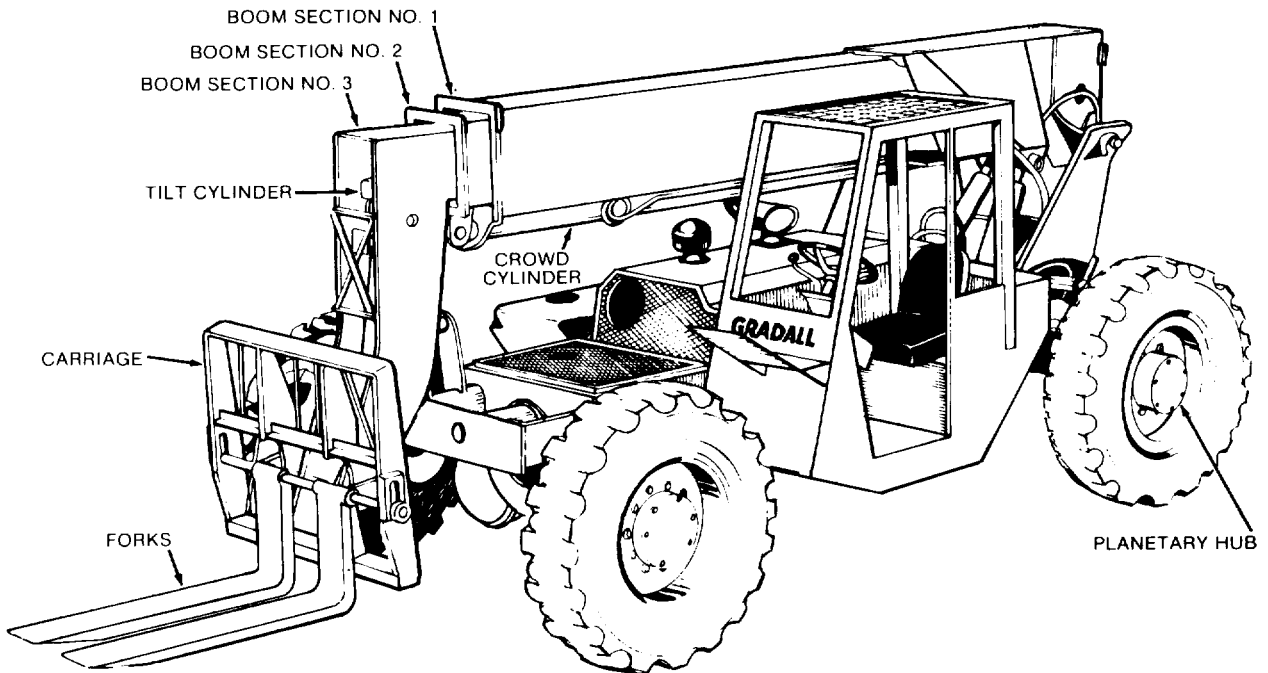
HEIGHTS ARE BASED ON LIFTING 3/4 X 8 X 48" FORKS (APPROX 3600 LBS PER PAIR)
TRUSS BOOM & WAST DIMENSIONS (A & D) REFER TO HOOK CENTER
BUCKET DIMENSIONS (A & D) REFER TO BUCKET LIP HEIGHT
FORKS RATED LESS THAN THE ATTACHMENT CAPACITY SHOWN ABOVE DECREASE CAPACITY OF ATTACHMENT TO THAT OF FORKS. FORKS RATED MORE THAN ATTACHMENT CAPACITY DO NOT INCREASE ATTACHMENT CAPACITY

9103-3279

Nomenclature

The illustrations on page 3 include nomenclature applied to major components of the material handler. The term "handler" will be used throughout the balance of this manual in place of the words "material handler".

NOMENCLATURE



SAFETY HIGHLIGHTS

Read and understand this manual, the Gradall Material Handler Safety Manual and all instructional decals and plates before starting, operating or performing maintenance procedures on this equipment.

Most safety notes included in this manual involve characteristics of the Model 534B-9 Material Handler. Refer to the FIEI Rough Terrain Forklift Safety Manual and the Gradall Material Handler Safety Manual for safety precautions relating to general material handling procedures and practices.

Operators of this equipment must have successfully completed a training program in the safe operation of this type of material handling equipment.

Regardless of previous experience operating similar equipment, the operator must be given sufficient opportunity to practice with the 534B-9 Material Handler in a safe open area(not hazardous to people or property)to develop the skills and"feel"required for safe, efficient operation.

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



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

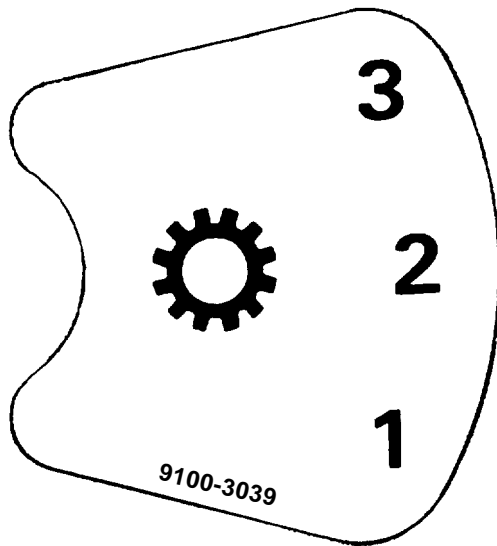


This symbol indicates a hazard which could result in death or serious injury if proper precautions are not taken.

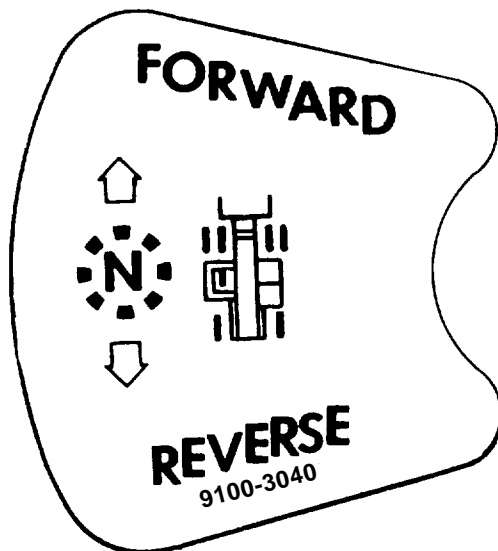


This symbol indicates a hazard which could result in injury or damage to equipment or property if proper precautions are not taken.

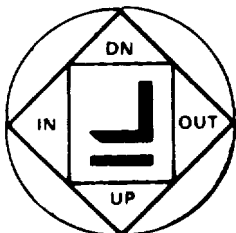
Decals



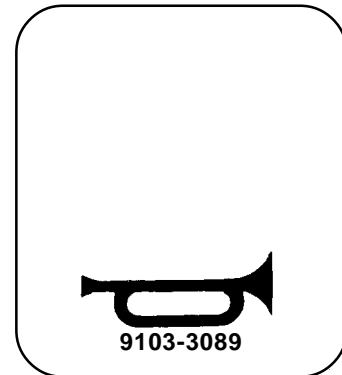
Located on Dashboard
Part No. 9100-3039



Located on Dashboard
Part No. 9100-3040



Located on Boom Lever Knob
Part No. 9100-3044



Located on Dashboard
Part No. 9103-3089

GRADALL GRADALL IS A REGISTERED TRADEMARK FOR GRADALL CORPORATION, 1000 N. 10TH ST., PHILADELPHIA, PA. 19107, U.S.A.

MATERIAL HANDLER
400 N. 10TH ST., PHILADELPHIA, PA. 19107

MODEL 534B

SERIAL NO

WEIGHT (WITHOUT ATTACHMENT) 21,400 LBS.

AS RELEASED FROM FACTORY THIS TRUCK MEETS THE DESIGN SPECIFICATIONS ESTABLISHED IN AMERICAN NATIONAL STANDARDS FOR POWERED INDUSTRIAL TRUCKS PART III ANSI B-56.4-1968

CAPACITY WITH STANDARD 48" & 66" CARRIAGE.

CARRIAGE X1000	9	6
A	34ft.	36ft.
B	24in.	24in.
C	24in.	24in.
D	Opt.	Opt.

☐ ADD 2,000# WITH

TRUCK & ATTACHMENT WEIGHT

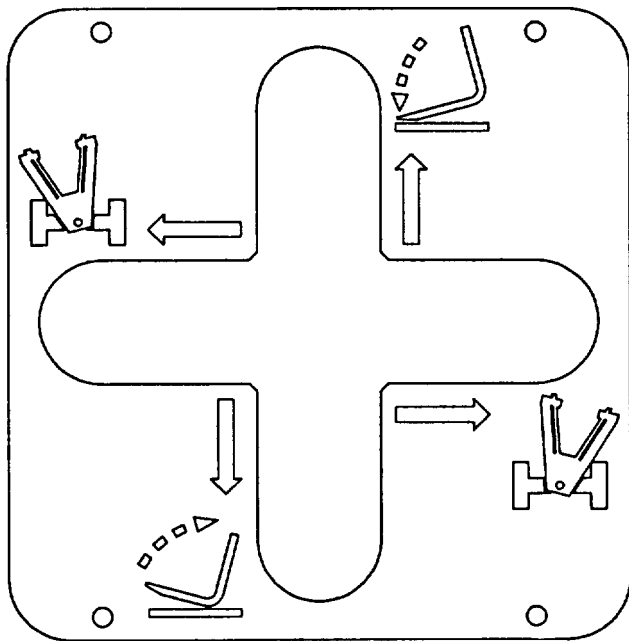
ATTACHMENT	A	B	C	D
48" CARRY P/N 9045-3030	9	22,176	34ft.	24in.
66" CARRY P/N 9045-3031	9	22,256	34ft.	24in.
48" CARRY P/N 9045-3032	9	22,240	34ft.	24in.
WITCH P/N 9103-3079	4	21,550	36ft.	Opt.
3/4 YD BUCKET P/N 9045-3049	3	21,800	36ft.	6in.
TRUSS BOOM P/N 9045-3011	1.6	22,010	45ft.	15.5ft.
6' MAST 48" CARR. P/N 9045-3033	4	22,850	42ft.	24in.
6' MAST 66" CARR. P/N 9045-3037	4	22,930	42ft.	24in.
66" CARR. W/SS & PP P/N 9045-3010	7.7	22,425	34ft.	24in.
SWING FORCE (100') P/N 9045-3044	8	22,986	34ft.	24in.
1 1/4 YD BUCKET P/N 9045-3050	3	22,043	36ft.	6.5ft.
6' SWING MAST P/N 9045-3047	4	23,815	30.5ft.	24in.

WEIGHTS ARE BASED ON LIFTING 1 3/4 X 6 X 48" FORKS (APPROX. 3640 LBS PER PAIR)
TRUSS BOOM & WITCH DIMENSIONS (A & D) REFER TO HOOK CENTER.
BUCKET DIMENSIONS (A & D) REFER TO BUCKET LIP HEIGHT.
FORKS RATED LESS THAN THE ATTACHMENT CAPACITY SHOWN ABOVE DECREASE CAPACITY OF ATTACHMENT TO THAT OF FORKS. FORKS RATED MORE THAN ATTACHMENT CAPACITY DO NOT INCREASE ATTACHMENT CAPACITY.

9103-3279

Located on Right Cab Wall
Part No. 9103-3279

Decals (cont.)



Located on Dashboard
Part No. 9103-3341

GRADALL HANDLER SERVICE INSTRUCTIONS FOR: 534B-9 & 544B	SERVICE INTERVALS						TYPE OR EQUIVALENT
	100 HRS	200 HRS	300 HRS	400 HRS	500 HRS	600 HRS	
DIESEL ENGINE							
AIR CLEANER ELEMENT						CHANGE	
FUEL FILTER					CHANGE		
OIL (12 QT.)					CHANGE		SAE 15W-40-CD ***
DIESEL FUEL (40 GAL.)					FILL		DIESEL FUEL #2
HYDRAULIC SYSTEM							
OIL (40 GAL.)					INSPECT		ISO GRADE 46 OR EQUIV.
FILTER						CHANGE	
HYDRAULIC & FUEL BREATHING/FILLER CAPS					CHECK		
AXLES							
FRONT & REAR WHEEL END LUBE (4 PT.)					CHECK		CL-5 80-90
FRONT DIF. HOUSING LUBE (40 PT.)					CHECK		77 PT. 8-15 80-90 & 1 PT. LUBIZOL 60/70
BRAKE HOUSINGS (2 PT.)					CHECK		AMOCO 1000 320V
TRANSMISSION							
FILTER (5 GAL.)						CHANGE	ATF-FW DEXRON QUALIFIED FLUID
RADIATOR							ETHYLENE GLYCOL
3 GAL. WATER/3 GAL. ANTI-FREEZE							ANTI-FREEZE
TIRES 65 PSI (RADIALS 70 PSI)							
WHEEL NUT TORQUE 350-400 FT-LBS						TORQUE	
BATTERY							
CYLINDER FITTINGS EACH END					GREASE		EP 2 H-152
DRIVE SHAFT (2) FITTINGS					GREASE		EP 2 H-152
REAR AXLE (12) FITTINGS					GREASE		EP 2 H-152
FRONT AXLE PIVOT (2) FITTINGS					GREASE		EP 2 H-152
BOOM BEARINGS & SLIDE PATHS					CHECK		EP 2 H-152
BOOM PIVOT (2) FITTINGS					GREASE		EP 2 H-152
HEAD PIN (2) FITTINGS					GREASE		EP 2 H-152
QUICK SWITCH (1) FITTING					GREASE		EP 2 H-152
PUSH BEAM SHEAVE PIN							
(2) FITTINGS REAR (1) FRONT					GREASE		EP 2 H-152
PEDAL & CONTROL LEVER LINKAGE							
(5) FITTINGS					GREASE		EP 2 H-152
RETRACT & EXTEND CABLE							
TORQUE TO 75 FT-LBS.					CHECK		

THIS CHART MUST BE USED IN CONJUNCTION WITH SERVICE MANUAL AND RECOMMENDED PROCEDURE
 * CHECK POP UP INDICATOR ON HYDRAULIC TANK. CHANGE FILTER IF NECESSARY.
 ** CHECK AIR CLEANER RESTRICTION INDICATOR. CLEAN OR CHANGE IF NECESSARY.
 ***CONSULT DEALER FOR RECOMMENDATIONS AT EXTREME TEMPERATURES.
 ****DAILY SERVICE MAY BE REQUIRED FOR OPTIMUM LIFE DEPENDING UPON APPLICATION SEVERITY.
 IT IS RECOMMENDED THAT FILTER ELEMENTS BE CHANGED AFTER 50 HRS ON NEW OR REBUILT UNITS.

9103-3396

Located on Left Cab Wall
Part No. 9103-3396

CAUTION

FOR LONGER TURBOCHARGER LIFE, IDLE ENGINE AT LEAST 1 MINUTE AFTER START-UP AND BEFORE SHUT-DOWN.

TO PREVENT ENGINE RING GEAR DAMAGE, WAIT 10 SECONDS AFTER ENGINE STOPS BEFORE ATTEMPTING TO RESTART.

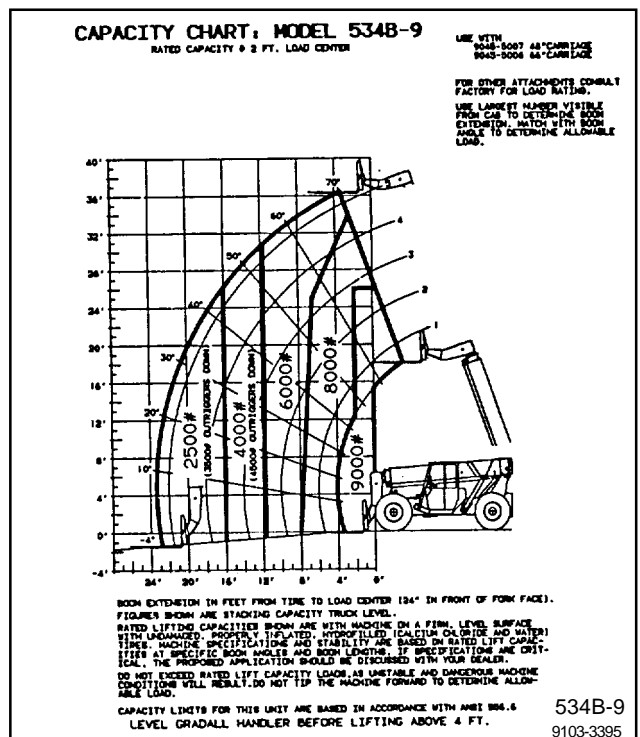
FOR OPTIMUM CONTROL AND BRAKE LIFE, USE LOW GEAR WHEN DESCENDING STEEP GRADES.

Located on Dashboard
Part No. 9103-3443

WHEN TRAVELLING AT HIGH SPEEDS FOR OVER 2 MILES, DISENGAGE REAR HUBS BY REVERSING SMALL COVER PLATE AT HUB CENTER.

9103-3418

Located on Dashboard
Part No. 9103-3418



Located on Mudguard
Part No. 9103-3395

Decals (cont.)

IMPORTANT

To prevent damage to the electrical system when using booster battery or charger, always connect

- (+) POSITIVE TO POSITIVE
- (-) NEGATIVE TO NEGATIVE

Located on Battery Cover
Part No. 7702-3007



Located on Engine Cover
Part No. 7734-3018

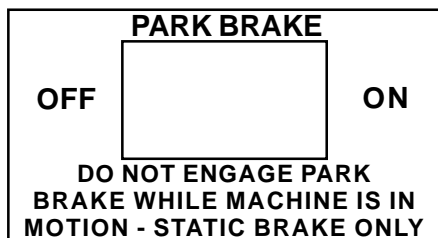


FOR MINIMUM CLEARANCES OF HIGH VOLTAGE LINES IN EXCESS OF 30,000 VOLTS, SEE YOUR LOCAL, STATE AND FEDERAL REGULATIONS. DO NOT DETACE OR REMOVE THIS SIGN FROM THIS MACHINE.

Located on Mudguard
Part No. 8360-1011

PARK BRAKE
PULL TO SET
PUSH TO RELEASE

Located on Seat Pedestal
Part No. 9104-3129

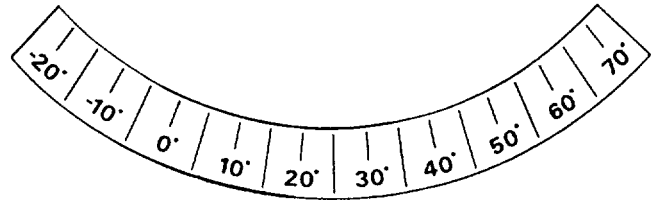


Located on Dashboard (Recent units)
Part No. 9108-3269

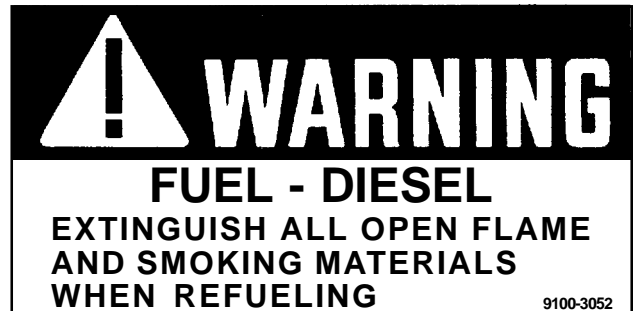
HYDRAULIC OIL

7702-3006

Located on Hydraulic Reservoir
Part No. 7702-3006

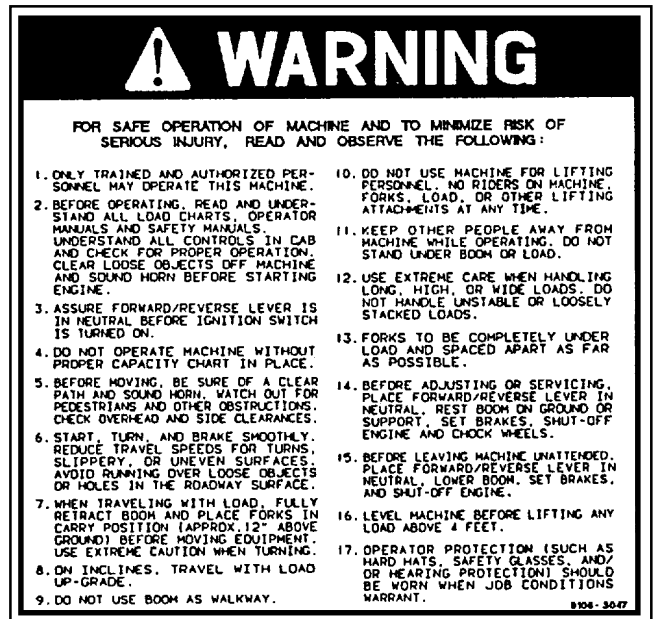


Located on Boom
Part No. 9100-3031



9100-3052

Located on Fuel Tank
Part No. 9100-3052

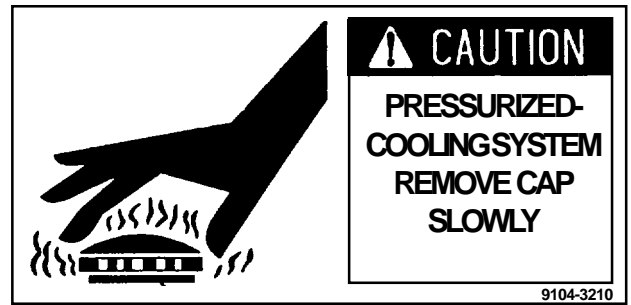


Located on Right Cab Wall
Part No. 9106-3047

Decals (cont.)



Located on Engine Cover
Part No. 9103-3011



Located on Engine Cover
Part No. 9104-3210



Located on Accumulator
Part No. 9104-3206



Located at Cab Entrance &
on Engine Cover
Part No. 9104-3211



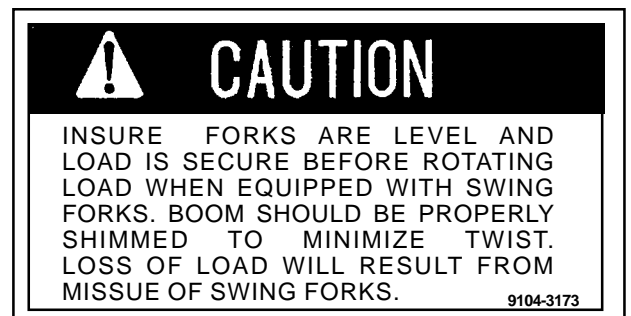
Located on Rear of Frame
Part No. 9104-3209



Located on Mudguard
Part No. 9104-3215

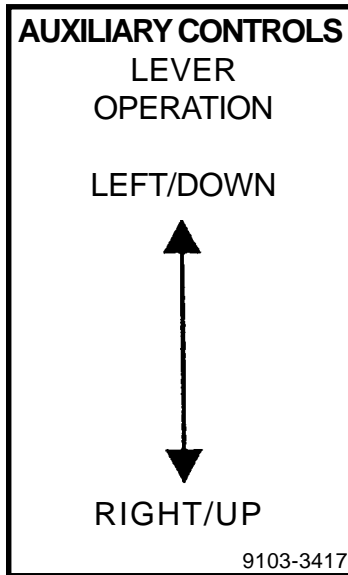


Located on each side of boom
Part No. 7702-3009

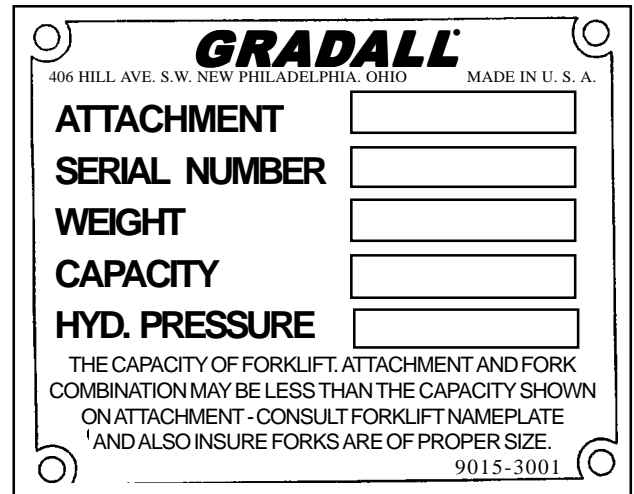


Located on left cab wall
Part No. 9104-3173

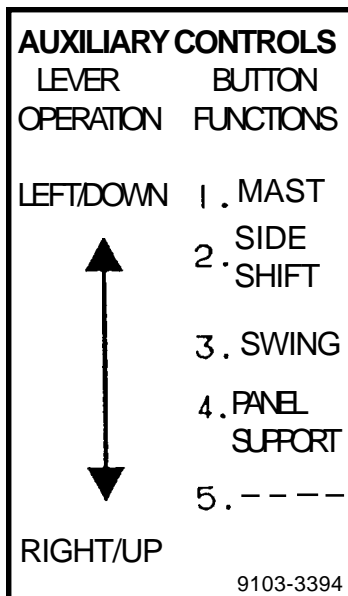
Optional Equipment Decals



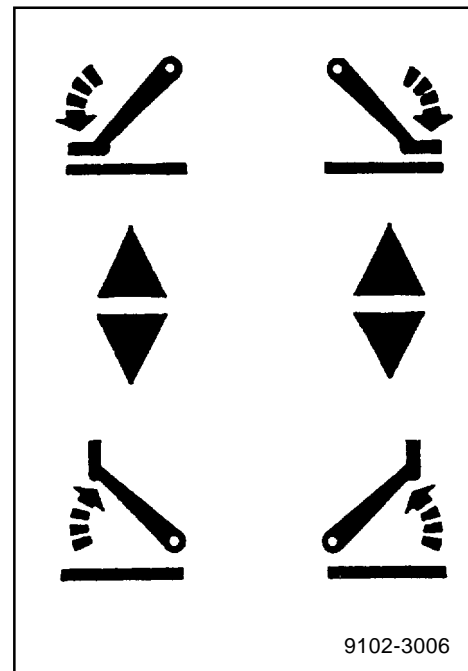
Located on Instrument Console
Part No. 9103-3417



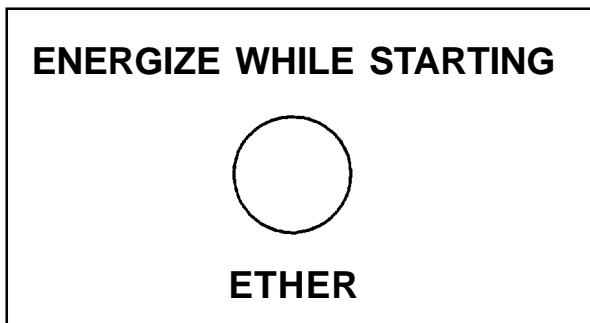
Located on Attachment
Part No. 9015-3001



Located on Instrument Console
Part No. 9103-3394



Located on Seat Pedestal
Part No. 9102-3006



Located on Dashboard
Part No. 9108-3363



Located on Boom Head
Part No. 9103-3023

OPERATOR'S CAB

The standard cab is open on three sides and includes an overhead guard to provide protection from falling objects.



A fully enclosed cab with windows and a lockable door is available as an option. The cab door can be sure the door is fully secured when operating the handler.

The operator's seat is equipped with a seat belt and includes fore and aft adjustment to compensate for

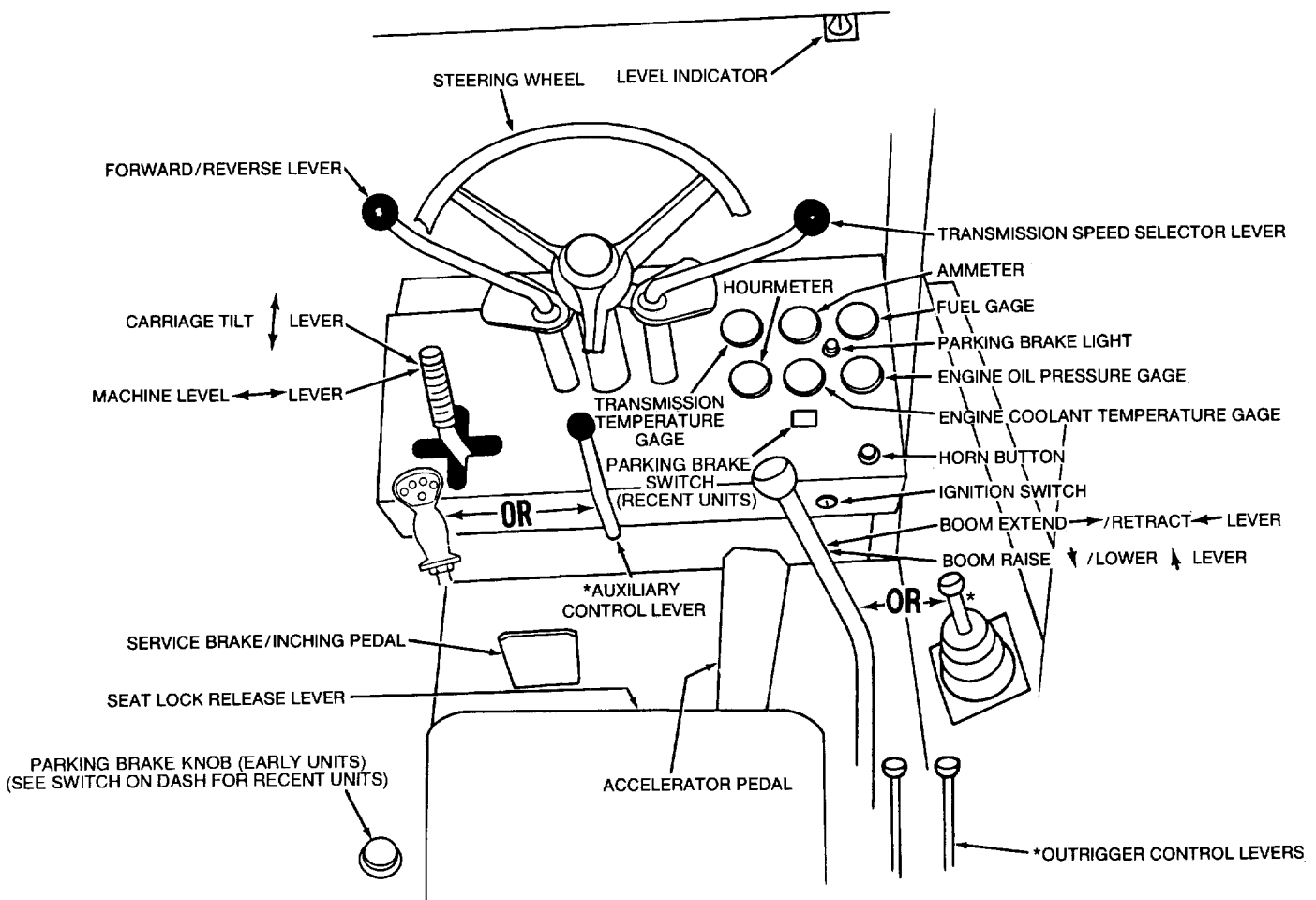
variations in operator size. The adjustment release/lock lever is located beneath front edge of seat. Wear seat belt at all times.

An optional windshield wiper is available for use with enclosed cabs. An ON/OFF control switch is located on the wiper motor.

A variable speed defroster fan is available for use with enclosed cabs. An ON/OFF control switch and speed control are located on the base of the fan.

An optional variable speed heater fan is available for use with units equipped with a heater. An ON/OFF/SPEED CONTROL knob is located on the dashboard. Hot water to the heater can be controlled by a valve at the engine.

CONTROL AND INSTRUMENT IDENTIFICATION



*Items preceded by an asterisk are optional and may not be furnished on your handler



WARNING

A brief description of controls and instruments is provided here as a convenience for the operator. These descriptions **DO NOT** provide complete operating instructions. Read and understand this manual and the FIEI Rough Terrain Forklift Safety Manual before operating the handler.

NOTE: These descriptions are provided in alphabetical sequence in accordance with the nomenclature shown on the facing page.

Accelerator Pedal: The accelerator pedal is connected to the engine speed control by a cable to provide engine speed control. Depress pedal to increase speed and release pedal to decrease speed.

Ammeter: The ammeter indicates the charge/discharge rate of the battery charging system. With the engine running, a discharge reading or a continuing high charge rate indicates a problem in the system.

Auxiliary Control Lever (optional): This lever is used to control optional hydraulic attachments. Follow decal instructions for lever/handler movements.

Boom Extend/Retract Lever: This lever controls boom extension and retraction. Speed is proportional to lever actuation. Move lever to right to extend boom or to left to retract boom.

Boom Raise/Lower Lever: This lever controls raising and lowering the boom. Speed is proportional to lever actuation. Pull lever to rear to raise boom or push lever forward to lower boom.

Carriage Tilt Lever: This lever controls tilt of the fork carriage. Speed is proportional to lever actuation. Push lever forward to tilt down or pull lever to rear to tilt up.

Engine Coolant Temperature Gage: This gage displays engine coolant temperature. Normal operating temperature is 180-200°F. (82-93°C.).

Engine Oil Pressure Gage: This gage displays engine oil pressure. Normal operating pressure is 35-50 psi (241-345kPa).

Forward/Reverse Lever: This lever engages forward or reverse travel. Push lever fully forward for forward travel; pull lever fully to rear for reverse travel or move lever to centered position for neutral.

Fuel Gage: This gage displays level of fuel in fuel tank.

Heater Fan Switch (optional): This rotary switch controls heater fan. Rotate clockwise to start fan. Continued clockwise rotation controls fan speed.

Horn Button: Depress button to sound horn.

Hourmeter: This meter indicates total time of engine operation in hours and tenths of hours.

Ignition Switch: This switch is actuated by a key. In ON position (turned clockwise) voltage is available for all electrical functions. Full clockwise position engages starter motor. Turn key counterclockwise to stop engine and remove voltage from all electrical functions.

Level Indicator: This indicator (a bubble level) enables the operator to determine the left to right level condition of the handler.

Machine Level Lever: This lever controls the vertical relationship of the handler frame to the front axle. Move the lever to the right to tilt frame to right or move lever to left to tilt frame to left.

Outrigger Levers: These levers raise and lower outriggers. Move levers forward to lower or pull levers to rear to raise outriggers.

Parking Brake Light: This light glows to indicate that parking brake is applied or that there is insufficient pressure to release brake.

Parking Brake Knob: The park brake control knob is located to the left of the operator and is used to apply and release the parking brake. To apply the parking brake, pull the knob up. To release the parking brake, push the knob down.

Rotating Beacon Switch (optional): This switch controls operation of rotating beacon.

Seat Lock Release Lever: This lever unlocks and locks seat position adjustment. Lift lever to unlock and release lever to lock adjustment.

Service Brake/Inching Pedal: The brake/inching pedal provides service brake control and inching control. To activate the brakes, push the pedal down. To release the brakes, remove foot from pedal. When full brakes are applied, the rear hydraulic drive is disconnected. When partial brake/inching pedal movement is used, the front wheel drive is disconnected from the transmission. The inching feature of the rear wheel drive system provides for smooth machine operation at low speeds and high engine rpm.

Steering Wheel: The steering wheel controls the angle of rear axle wheels. Turning the steering wheel to the Forward/Reverse Lever: This lever engages forward right causes a right turn by angling rear wheels to left. A left turn is caused by angling rear wheels to right.

Transmission Speed Selector Lever: This lever permits selection of three speed ranges for forward and reverse travel.

Transmission Temperature Gage: This gage displays temperature of transmission fluid. Normal operating temperature is 180-200°F. (82-93°C.).

CHECKS AND SERVICES BEFORE STARTING ENGINE

(To be performed at beginning of each work shift)



WARNING

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

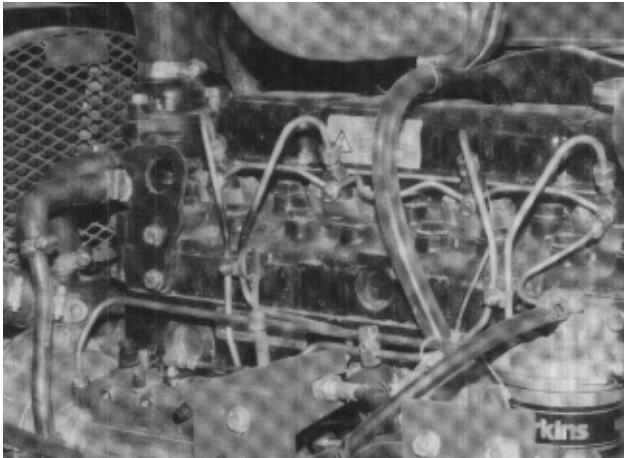
Before removing filler caps or fill plugs, wipe all dirt and grease away from the ports. If dirt is allowed to

enter these ports, it can shorten the life of o-rings, seals, packings and bearings.

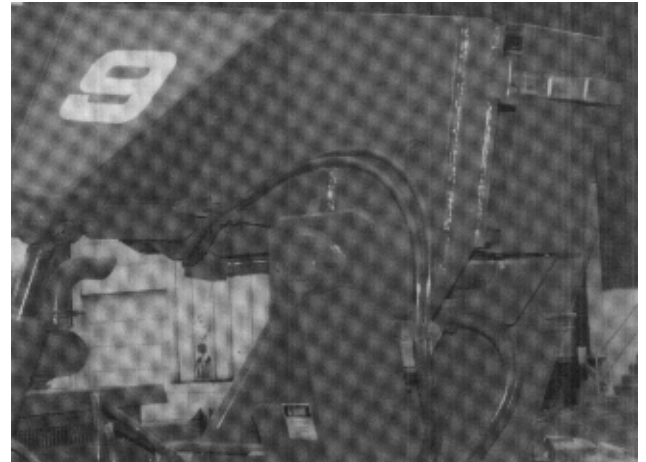
When adding fluids or changing filter elements, refer to the lubrication section of this manual to determine the proper type to be used.

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

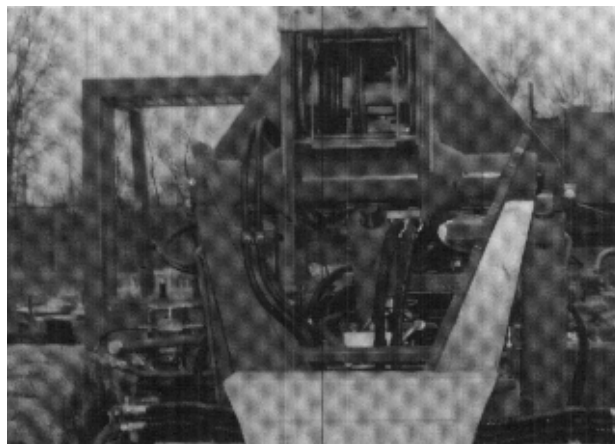
Complete all required maintenance before operating unit.



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



Inspect all structural members, including attachment, for signs of damage.



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.

NOTE: If engine is being started at beginning of work shift be sure to perform all “CHECKS AND SERVICES BEFORE STARTING ENGINE” (page 12).

Starting Engine

1. Check to be sure that all controls are in neutral and that all electrical components (lights, heater, defroster, etc.) are turned off. Set parking brake.
2. Depress accelerator pedal approximately 1/4 to 1/3 of travel from top.
3. Insert ignition key and turn clockwise to ON position.



CAUTION

Engaging starter motor while engine fly-wheel is rotating can cause serious damage to engine and/or starting motor.

NOTE: If temperature requires the use of a starting aid, depress ether button one

time while cranking engine. Repeat if necessary. If you use a different starting aid, be sure to follow manufacturer's instructions carefully. Excessive ether may damage engine.

4. Turn key fully clockwise to engage starting motor. Release key immediately when engine starts. If engine fails to start within 20 seconds, release key and allow starting motor to cool for a few minutes before trying again.
5. After engine starts, observe oil pressure gage. If gage remains on zero for more than ten seconds, stop engine and determine cause. Correct cause of malfunction before restarting engine. Normal engine oil pressure (warm) should be in range of 35 - 50 psi (241 - 345 kPa).
6. Warm up engine at approximately 1/2 throttle until engine coolant temperature reaches operating range of 180 - 200°F. (82 - 93°C.).

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

Observe gages frequently to be sure all engine systems are functioning properly.

The ammeter shows the charge/discharge rate of the battery charging system. With the engine running, a discharge reading (-) or a continuing high charge reading (+) indicates a problem in the battery charging system.

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 (if furnished).

Stopping the Engine

Operate engine at idle speed for a few minutes before turning it off. This allows engine coolant and lubricating oil to carry excessive heat away from critical engine areas.

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



CAUTION

Allow engine to run at idle for a few minutes to allow the turbo components to cool. Turn key counterclockwise to stop position and remove key from ignition switch before leaving cab.

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 unit will be increased by performing by an asterisk(*) are optional and may not be furnished on your machine.

Checks items during warm-up period.

- *1. Heater, defroster and windshield wiper
- *2. Operating lights and rotating beacon
- 3. Low brake pressure light - should go out with engine running above idle
- 4. Ammeter - should show low charging rate after charging system has replaced starting drain

When engine warms to operating range, check the following items:

- 5. Service brake and parking brake.

- 6. Forward and reverse travel in all gears
- 7. “Inching” travel - should be smooth through full pedal travel
- 8. Horn and back-up alarm
- 9. All boom and attachment functions - full stroke in both directions
- 10. Hydraulic Filter Condition Indicator - observe transmission torque converter temperature gage after starting normal operation. when needle has been in operating range for an hour or so, stop handler in a safe area and set parking brake. With engine running at full RPM, check hydraulic filter condition indicator. When yellow flag fills indicator window, filter is clogged and hydraulic oil is bypassing filter. Filter must be changed before reaching bypass condition (change before yellow flag reaches midpoint of window).



CAUTION

Continued operation with hydraulic fluid by-passing the filter (yellow flag showing) can cause severe damage to hydraulic system components.

BRAKE SYSTEM

General

The brake system furnished on the handler includes a service brake and parking brake.

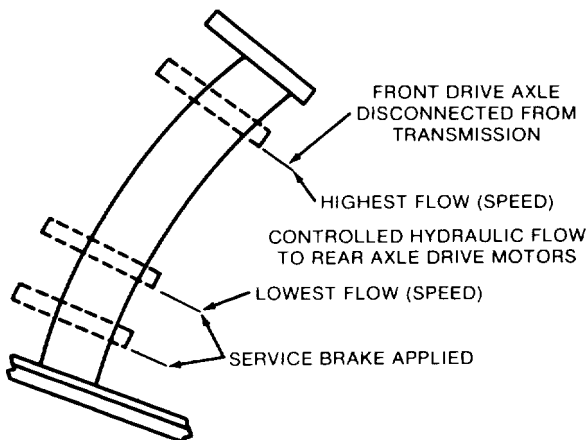
Because service braking and “inching” (slow travel) functions overlap, some features of inching will be discussed here. Refer to Drive Train Section for additional information on inching travel.

Inching Travel

Overlap between service braking and inching occurs because the same foot pedal controls both functions, and also because both functions control travel speed. However, the methods of controlling travel speed are quite different: service braking involves a controlled stopping force applied to the front wheels while inching involves a controlled driving force applied to the rear wheels.

The service brake/inching pedal has three separate functions

1. It disconnects front drive axle from transmission.
2. It controls hydraulic flow to rear axle drive motors (hydraulic flow regulates speed).
3. It applies service brake.



As illustrated, the three functions occur in sequence as service brake/inching pedal is depressed from top to bottom of stroke.



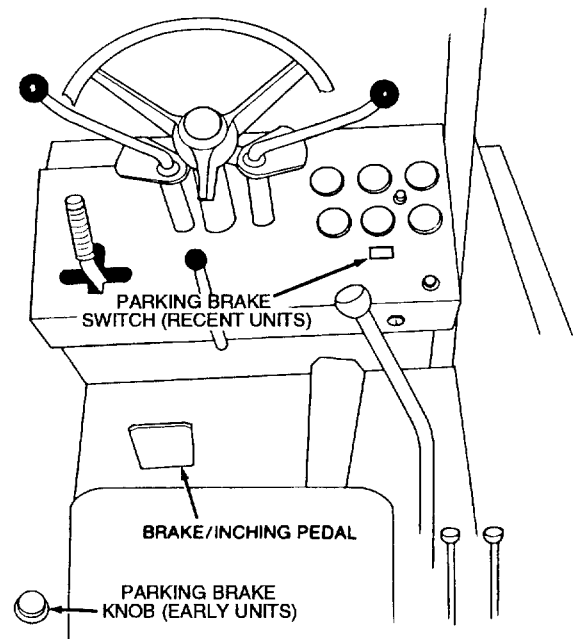
WARNING

Practice inching/braking in a safe, open area until you are thoroughly familiar with response of machine to pedal travel.

Service Brakes

The service brake is applied to the front wheels of the handler.

Oil for the brakes comes from the pilot circuit pump, thru an accumulator charging valve and the accumulator. When the service brake/inching pedal is depressed far enough to actuate the brake valve, the hydraulic oil flows to the wet disc brakes in both front wheel hubs. The pressure compresses the brake discs.



Parking Brakes

Because the parking brake is spring-applied and hydraulically released, the engine must be running to provide pressure to release parking brake.

On early units the parking brake is applied and released by a control valve knob located to the left of the operator's seat. Raise knob to apply brake and push knob down to release brake.


On recent units the parking brake is applied and released by a switch located on the dashboard. Depress right side of switch to apply brake and depress left side of switch to release brake.

Always be certain to apply parking brake, stop engine and remove key from ignition switch before leaving operator's cab.

STEERING SYSTEM

Ninety degree rear wheel power steering is provided to reduce operator fatigue and to permit high maneuverability in close quarters.

It is important that the operator practice maneuvering the handler in a safe, open area until he becomes thoroughly familiar with steering response and clearance required for tailswing and load when turning.

**WARNING**

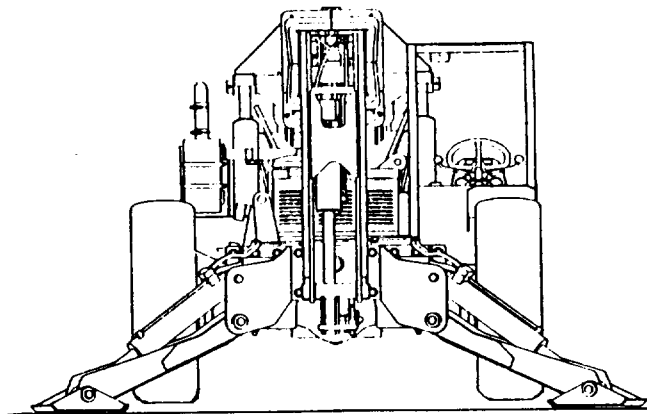
Be alert for any increase in effort needed to steer. If any difference is noted, notify maintenance personnel immediately for correction. If power assist feature should fail for any reason IT WOULD BECOME VERY DIFFICULT TO STEER. For this reason it is extremely important that you NEVER TURN ENGINE OFF WHILE TRAVELING.

In the event power steering fails, stop as soon as possible. Do not drive unit until problem has been corrected.

FRONT OUTRIGGERS (2) (OPTIONAL)

Front outriggers are provided in order to raise the front tires off of the ground level while working, thus improving the overall stability of the handler.

Two outrigger control levers are located to the right hand side of the operator's seat. Pushing forward on the lever lowers the outriggers, and pulling back on the lever raises them.



DRIVE TRAIN

General

The drive train provides two and four wheel drive includes the engine torque converter transmission drive shaft and front and rear driving axles.

Inching travel is directly related to drive train functions and will be discussed in this section.

Two & Four Wheel Drive

The drive train is designed to provide two wheel drive (front axle driving? or four wheel drive (both front and rear axles driving).

Under certain conditions changing from four wheel drive to two wheel drive may cause a difference in the way the machine responds to steering braking and drive controls. Always be aware of which travel mode you are using.

There are two ways to disengage rear wheel drive:

1. Shift to third gear (rear axle drive is engaged only in first and second gears)
2. Disengage rear planetary hubs (refer to Rear Drive Axle heading in this section).

NOTE: Rear drive axle can also be disengaged in response to overload in associated electrical circuitry causing automatic reset type circuit breaker to trip (open). Breaker will close again in approximately ten seconds.

Torque Converter

There are no operator controls for the torque converter. It functions automatically to permit starting from a standstill in any transmission speed range.

An oil temperature gage is provided to indicate Operating temperature of torque converter/transmission. Normal operating temperature is 180 - 200 ° F. (82 - 93 ° C.). If overheating occurs attempt to lower temperature by traveling in a lower gear. If necessary stop and allow torque converter to cool with engine running and gear selector in neutral. Be sure oil cooler radiator fins are clean.



CAUTION

Continued operation of overheated torque converter/transmission can cause serious damage to these components.

Transmission

The transmission provides three speed ranges for both forward and reverse travel.

Gear	1st	2nd	3rd	3rd*
mph	2.8	6.0	15.9	17.9
kmph	4.5	9.6	25.6	28.8

*With rear planetary hubs disengaged

There are three operator controls for the transmission:

1. Gear Selector Lever (for 1st 2nd and 3rd gears).
2. Direction Selector Lever (for forward neutral and reverse).
3. Service Brake/Inching Pedal (refer to Inching Travel heading in this section).

To Operate Transmission:

1. Release parking brake and hold handler in position using service brake.
2. Move gear selector to appropriate speed range (1st 2nd or 3rd gear). The gear selector may be shifted while traveling. When traveling downhill, use the same gear needed to travel up the hill.



WARNING

Never shift gear selector or direction selector to cause a sudden change of travel speed or direction. Such a change could cause load to shift or machine to tip over. Reversing direction while traveling can also damage transmission.

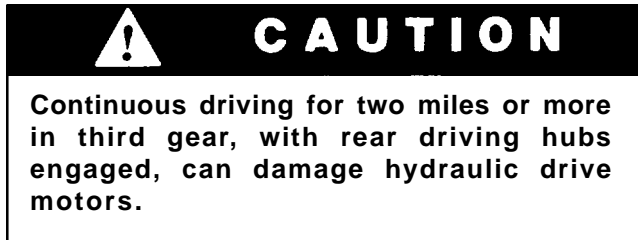
3. Move direction selector to forward or reverse position as required.
4. Release service brake and depress accelerator to attain appropriate speed.
5. Stop handler by releasing accelerator and applying service brake.
6. Move direction selector to neutral position.
7. Apply parking brake.

Front Driving Axle

The front driving axle includes a differential and planetary drive hubs and is powered by a drive shaft from the transmission. The service brake/inching pedal is the only operator control for the front axle (refer to inching travel heading).

Rear Driving Axle

The rear driving axle includes planetary hubs which are powered by hydraulic motors mounted on the inner face of the hubs. Hydraulic flow to drive motors is provided only in first and second gear speed ranges. Drive motors are free-floating in third gear.



To Disengage Rear Driving Hubs:

1. Apply parking brake and remove key from ignition switch.
2. Remove cap screws from pin keeper plate.
3. Remove and rotate plate (cup out - engaged - cup in - disengaged).
4. Secure plate using cap screws.
5. Repeat procedure for other hub.

To engage Rear Driving Hubs: Repeat procedure.

NOTE: If machine is move with pin keeper plate removed, input shaft pin will pop out.

Hydraulic flow to rear axle drive motors is controlled electrically. An automatic reset type breaker is included to prevent damage from overload. **If circuit breaker trips (opens) rear axle drive will be inoperative for approximately ten seconds until breaker resets. Notify maintenance personnel if circuit breaker trips repeatedly.**

To determine whether circuit breaker has tripped, attempt to move machine using inching travel. If machine does not respond to inching travel pedal, circuit breaker is open.

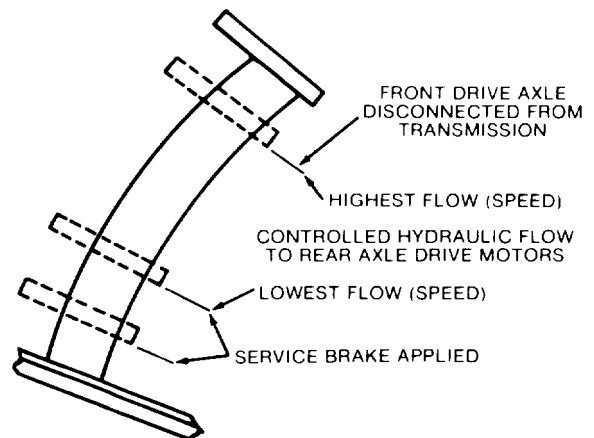
Inching Travel

Inching travel is provided to permit very slow travel while maintaining high engine speed for other functions. Because inching travel depends on hydraulic flow to rear axle drive motors, inching

travel functions only in first and second gears. There is no hydraulic flow to drive motors in third gear.

Inching travel is controlled by the service brake/inching travel pedal. This pedal has three separate functions:

1. It disconnects front drive axle from transmission.
2. It controls hydraulic flow to rear axle drive motors (hydraulic flow equals speed).
3. It applies service brake.



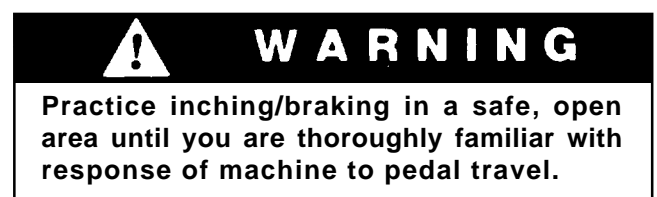
As illustrated, the three functions occur in sequence as pedal is depressed from top to bottom of stroke.

To Engage Inching Travel:

1. Depress service brake/inching travel pedal approximately 1-1/2 inches to disengage front driving axle from transmission. At this point rear drive motors are receiving full flow and travel speed will not have changed.
2. Continue to depress pedal to reduce speed - the more pedal travel, the less speed.
3. To stop, depress pedal fully.

OR

To resume normal travel, release service brake inching travel pedal. Depress accelerator pedal to attain appropriate speed.



LEVELING THE HANDLER



WARNING

Raising the boom (loaded or unloaded) when handler is leaning to the side can cause machine to tip over with little or no warning and cause serious injury or death.

“LEVELING” means positioning the handler so that it is level from side to side (left to right with respect to a man sitting in operator’s seat).

A level indicator is located on upper portion of front window frame to permit operator to determine that handler frame is, or is not, level.

There are four very important things to remember about handler travelling:

1. Never engage a load or lift a load more than four feet above ground level unless the handler is level.
2. A handler with the boom raised and/or an attachment installed is a partially loaded handler.
3. Once the handler frame has been leveled, and has raised a load more than four feet above ground level, it must not be moved from its position if such movement could change the level condition.
4. The combination of side tilt and load can cause the handler to tip over.

There are two ways to level the handler:

1. The surface which will support the handler can be leveled. This method must be chosen if it will be necessary to move the handler from its position after the load has been raised over four feet from ground level - **AND** - such movement could change the level condition.

Remember, the supporting surface must be large enough, smooth enough and firm enough to keep handler level when it is moved from its position.

2. The handler may be leveled by means of the frame leveling system. This method may be chosen when it will not be necessary to move the handler from its position after the load has been raised above four feet from ground level - **OR** - when such movement will not change the level condition of the handler.

Always determine best positions for handler to raise load from its present location and also to position load at its destination. **THEN**, determine which method of leveling will be required at each location.

FINALLY, consider terrain between present location of load and its destination. Never attempt to transport a load across terrain which could cause handler to tip over.

Leveling Handler Frame:

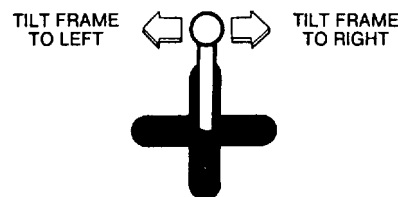
The handler is designed to permit tilting main frame eight degrees to left or right to compensate for uneven ground conditions.

The rear axle pivots at the midpoint of the main frame to help assure that wheels will remain in contact with ground. A hydraulic cylinder provides a rigid connection between front axle and main frame to help assure a solid work platform and permit tilting main frame to left or right.

Procedure:

Position machine in best location to lift or place load and apply parking brake.

Observe level indicator to determine whether machine must be leveled. Note position indicator for later realignment.



FRAME
LEVELING LEVER

If necessary to level handler, position boom in carry position and move machine level lever to level machine.

Lift or place load as appropriate.

Retract and lower boom to carry position.

Realign frame to position noted in step 2.



WARNING

If handler cannot be leveled using leveling system, do not attempt to raise or place load. Have surface leveled.

OPERATING PROCEDURES & TECHNIQUES

This section highlights some common procedures discusses areas which may be new to even the experienced operator.

Hydraulic Controls

All boom and attachment movements are governed by hydraulic controls will cause rapid, jerky movement of the load. Such movements can cause the load to shift or fall or may cause the machine to tip over.

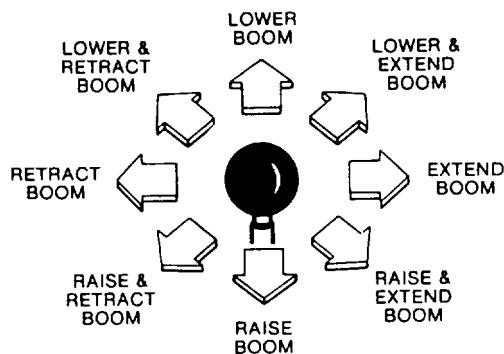
Feathering

Feathering is a control operation technique used for smooth load handling. To feather controls, move control lever very slowly until load begins to move, then gradually move lever further until load is moving at desired speed. Gradually move lever toward neutral as load approaches destination.

Continue to reduce load speed to bring load to a smooth stop. Feathering effect can be increased by lowering engine speed at beginning and near end of load movement.

Boom Control Lever

The boom control lever can be positioned to cause individual boom movements or combinations of boom movements as illustrated.



With boom raised above horizontal, forks can be inserted under a load by moving boom control lever forward and to the right until forks move forward horizontally.

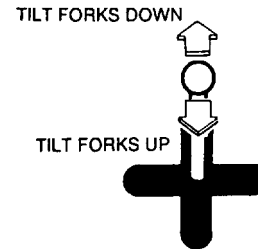
With boom raised above horizontal, forks can be removed from a load by moving boom control lever back and to the left until forks move rearward horizontally.

With boom lowered below horizontal, fork can be inserted under a load by moving boom control lever back and to the right until forks move forward horizontally.

With boom lowered below horizontal, forks can be removed from load by moving boom control lever forward and to the left until forks move rearward horizontally.


The closer the boom to horizontal, the less boom raise/lower movement required for inserting and removing forks.

Carriage Tilt Lever



CARRIAGE
TILT LEVER


Move lever forward to tilt forks down and move lever to rear to tilt forks up.

**WARNING**

Always move boom to carry position (horizontal or below) before leveling frame. attempting to level machine with boom raised may cause it to tip over.

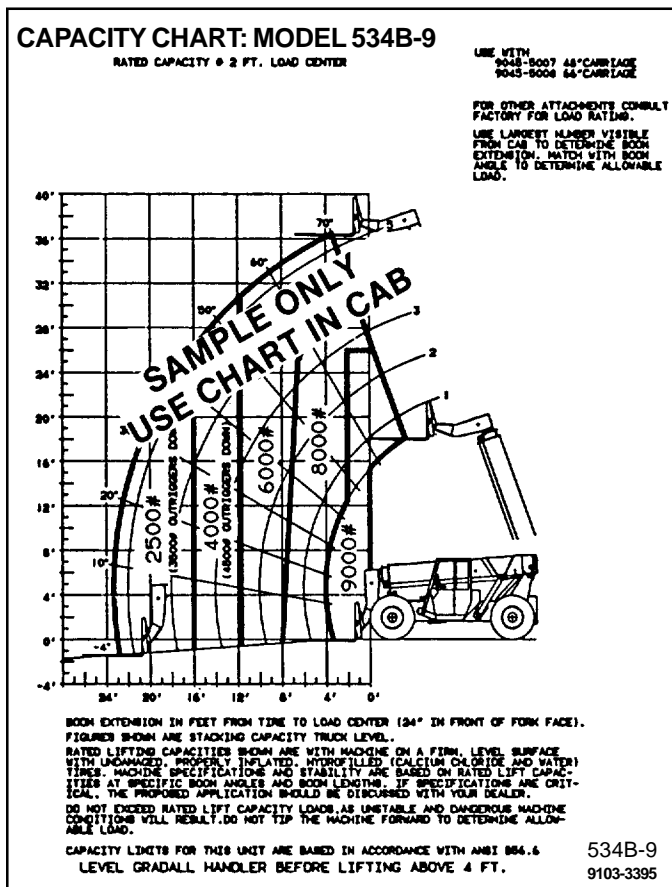
Rated Capacity Chart

The rated capacity chart, located on dashboard, indicates maximum load capacities for handlers equipped with Gradall-furnished carriage/fork combination. These capacities apply to the standard carriage/fork combinations except as stated on the capacity chart.

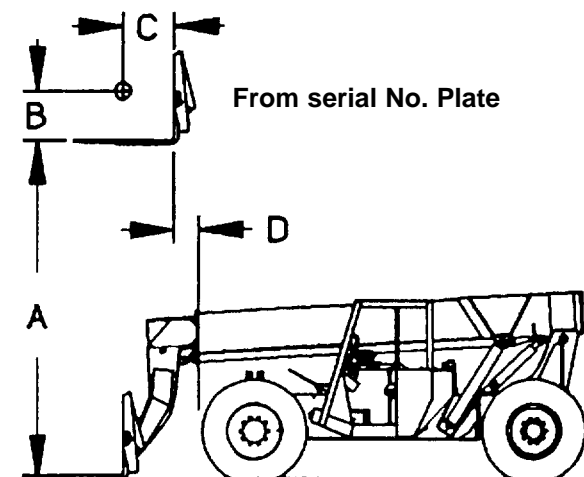
**WARNING**

All loads shown on rated capacity chart are based on machine being on firm, level ground; the forks being positioned evenly on carriage; the load being centered on forks; proper size tires being properly inflated; and the handler being in good operating condition.

Elevation:



Numbers at left side of sample chart (-4' to 40') represent elevation to top of horizontal forks as measured from level ground. Elevation relates to dimension "A" shown on serial number plate located on right cab wall.



Boom Extension

Numbers across bottom of sample chart (0' to 24') and numbers parallel to boom (1 to 5) represent boom reach as measured from front of tires to extended position.

Number decals on boom (1,2,3,4 & 5) relate directly to boom extension. The largest number which can be read from operator's seat indicates total boom extension and must be matched with boom angle to determine capacity.

Boom extension relates to dimension "D" shown on serial number plate.

Boom Angle

Numbers at ends of angle lines (-4° to 70°) represent angle of boom to horizontal as measured from horizontal plane. Maximum angles are 4° below horizontal with boom fully lowered to 70° above horizontal with boom fully raised.

A boom angle indicator is located on left side of boom section number one to show boom angle. Be sure machine is level from front to rear or indicator will provide incorrect reading.

Load Center

Load shown on rated capacity chart are based on the load center being two feet above and two feet forward of surfaces of horizontal forks as indicated by dimensions "B" and "C" on serial number plate.

The load center of a load is the center of gravity of the load. For regularly shaped loads of the same material, such as a pallet of blocks, the center of gravity can be located by measuring the load to find its center. For irregular loads, or loads of dissimilar materials, keep the heaviest part of the load as close to the heel of the forks as possible.

In all cases, the load center must be centered between the forks.

Load Limits

Some capacity shown on the rated capacity chart are based on machine stability and some are based on hydraulic lift capacity. the "common sense" or "feel" an experienced operator might apply in regard to tipping loads **DOES NOT APPLY to hydraulic load limits.** Exceeding load limits can cause damage or in some cases, the machine to tip over.

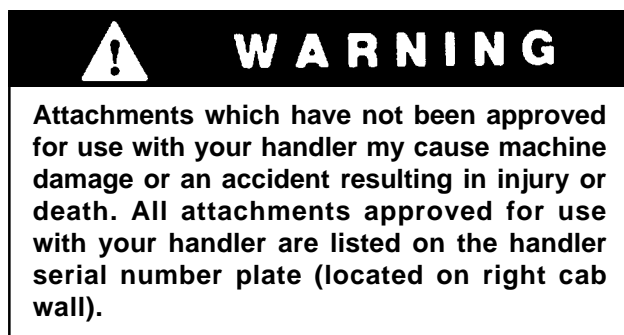
ATTACHMENTS

Approved Attachments

Although the carriage/fork combination is most frequently used, several other Gradall-approved attachments are available for use with these material handlers. Contact your Gradall Material Handler Distributor for information on approved attachments designed to solve special material handling problems.

Refer to serial number plate for list of attachments approved for use with your handler.

Non-Approved Attachment



Use of non-approved attachments is **strongly discouraged** for the following reasons:

- Gradall cannot establish range and capacity limitations for “will fit”, homemade, altered or other non-approved attachments.
- An overextended or overloaded handler can tip over with little or no warning and cause serious injury or death to the operator and/or those working near the handler.
- Gradall cannot assure the ability of a non-approved attachment to perform its intended function safely.
- Non-approved attachments may cause structural or other damage to the handler. Such damage could cause dangerous operating conditions resulting in serious injury or death.

Carriage/Fork Capacities

The standard carriage/fork capacity chart (located on the dashboard) indicates maximum reach and load capacities for handlers equipped with an approved carriage fork combination. **These limitations apply to standard, approved carriage/fork combination except as stated on the capacity chart.**

Non standard carriage/fork combinations (greater or lesser capacity) may be furnished by the Gradall Co. at customer request or may be available for installation because they were furnished for a different application.

If a carriage/fork combination of lesser capacity is used, **the overall machine capacity is reduced** to carriage/fork capacity as indicated on carriage/fork serial number plate.

If a carriage/fork combination of greater capacity is used the overall machine capacity may be reduced because of additional attachment weight and/or other considerations. Contact your local Gradall Distributor to determine capacity limitations.

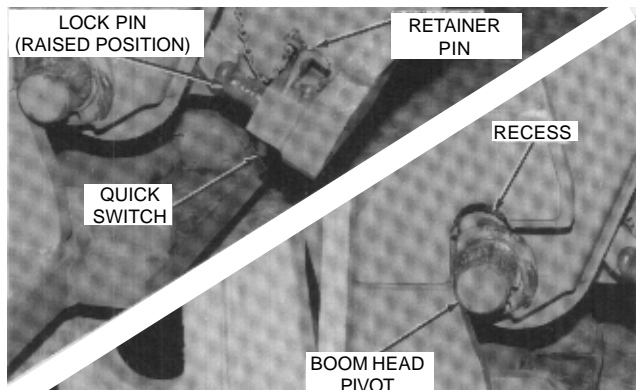
Other Attachment Capacities

A serial number/capacity plate is attached to all Gradall-furnished attachments. **Do not assume that any Gradall attachment may be used on any Gradall Material Handler.**

First, check the listing of approved attachments on handler serial number plate (located on right cab wall). If the attachment in question is not included in the list, it was **not approved for use** at time of machine shipment. Contact your local Gradall Distributor for possibility of use with special limitations.

Next, **if the attachment is approved for use** with your handler, compare maximum capacity from approved **attachment** serial number plate to maximum capacity for that attachment as indicated on **material handler** serial number plate. **The smallest of these capacities is correct for your handler.**

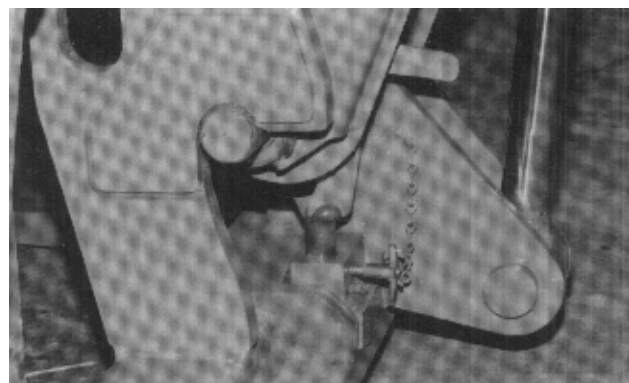
Attachment Installation



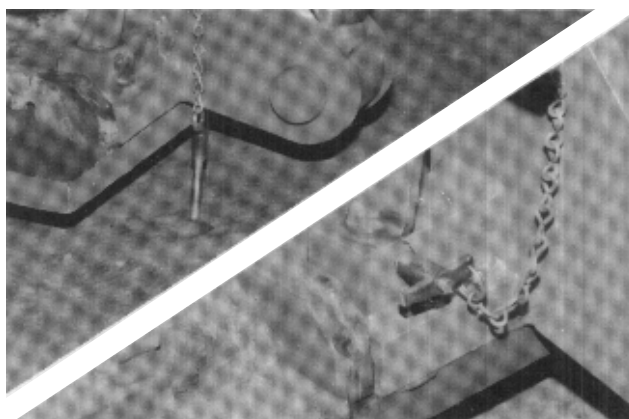
1. Retract quick switch (attachments tilt lever forward) to provide clearance. Check to be sure lock pin is secured in raised position with retainer pin.
2. Align boom head pivot with recess in attachment.



3. Raise boom slightly to engage boom head pivot in recess.



4. Engage quick switch (attachments tilt lever to rear).



5. Remove retainer pin and lower lock pin fully.
6. Secure lock pin in locked position using retainer pin.

Attachment Operation

Operation of the handler equipped with carriage/fork combination is covered in the Gradall Material Handler Safety Manual, the FIEI Rough Terrain Forklift Safety Manual and this manual.

Operation of the handler when equipped with other approved attachments is covered in this section or in separate instructions furnished with the attachment. Such separate instructions must be kept in manual holder with operator's manual.

When an attachment is installed on the handler, take extra care when engaging, securing, manipulating, transporting and positioning the load.

Operate a handler equipped with an attachment as a partially loaded handler. Pay special attention to capacity and range limits for the handler/attachment combination.

Practice operation of handler and attachment in a safe, open area, not hazardous to yourself, other persons, equipment or property. Become thoroughly familiar with response of handler and attachment to controls before operating in a work situation.

Always consider terrain between present location of load and delivery point. Never attempt to transport a load across terrain which could cause handler to tip over.

FORK POSITIONER

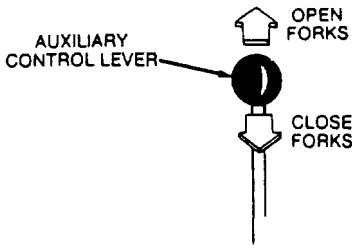
PRECAUTIONS

- Always adjust fork position before engaging load.
- As with all other attachments, handler must be level before handling a load more than four feet above ground level (refer to page 19).

Capacity:

Maximum load capacity for fork positioner carriage is the same as standard carriage without fork positioner (refer to basic Capacity Chart located on dashboard.) Capacity varies with boom extension and elevation positions.

Controls:



If your unit is equipped with a multi-function auxiliary control lever, refer to page 30.

The auxiliary control lever is used to adjust fork position. Pull lever to rear to close forks and push lever forward to open forks.

Procedure:

1. Remove standard carriage/fork combination or other attachment from boom head (refer to Attachment Installation - page 23).
2. Install carriage/fork combination with positioner.
3. Connect auxiliary hydraulic hoses to positioner cylinders.



WARNING

Observe all precautions and load capacity limits (listed previously) when handling loads with carriage/fork positioner.

4. Always adjust fork position before engaging load. Moving forks after engaging load could cause load to fall from forks.

LIGHT MATERIAL BUCKET

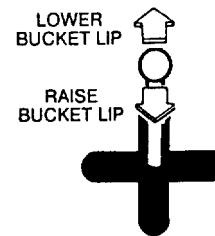
PRECAUTIONS

- Handler must be level when handling a load more than four feet above ground level (refer to page 19).
- Retract boom fully before loading bucket. Loading bucket with boom extended could damage structural members or extension cables.
- Avoid shock loads; drive into stockpile smoothly to load bucket.
- Do not use bucket as a lever to pry heavy material. Excessive prying forces could damage the bucket.

Capacity:

Maximum capacity of light material bucket is shown on serial number plate (located on right cab wall) and may be used in areas where it **does not exceed** capacities shown on standard carriage/fork capacity chart. **Capacity must be reduced** for areas where maximum bucket capacity would exceed standard carriage/fork capacity chart.

Controls:



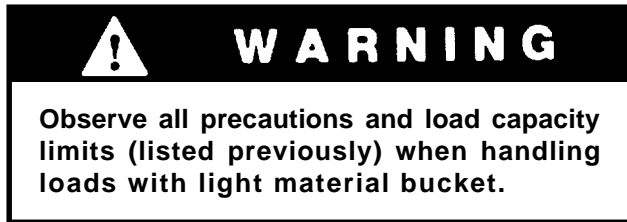
CARRIAGE
TILT LEVER

Because the carriage tilt cylinder is used to tilt the bucket, the carriage tilt lever is used to control the bucket. Pull lever to rear to raise bucket lip and push lever forward to lower bucket lip.

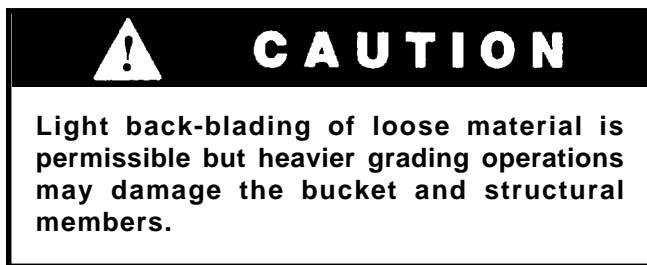
Procedure:

1. Remove carriage/fork combination or other attachment from boom head (refer to Attachment Installation - page 23).

2. Install light material bucket on boom head.



3. Retract boom fully and tilt bucket up or down as required to position bottom of bucket parallel with ground.
4. Raise or lower boom to appropriate height for loading material from stockpile.
5. Align handler with face of stockpile and drive slowly and smoothly into pile to load bucket.
6. Tilt bucket up far enough to retain load and back away from pile.
7. Lower bucket to carry position (approximately one foot above ground) and travel carefully to unloading point. Tilt bucket down to dump load.



MAST (6' with 48" or 66" carriage)

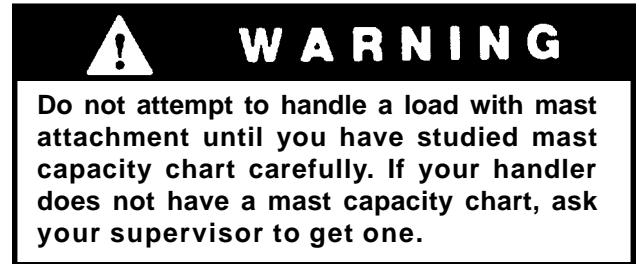
PRECAUTIONS

- Read additional capacity information under Capacity heading.
- Because the mast increases lift height, it is especially important to level the handler before lifting a load more than four feet above ground level (refer to page 19).

Capacity:

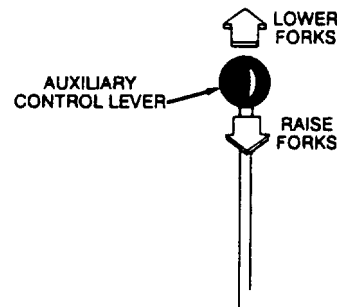
Maximum lift capacity for the mast is shown on serial number plate (located on right cab wall). However, maximum lift capacity applies only to certain areas within boom extension/elevation pattern of handler/

mast combination. A separate capacity chart must be used for handlers equipped with mast. Study this chart carefully before attempting to handle a load with mast attachment.



Controls:

The carriage tilt cylinder is used to tilt the mast and the carriage tilt lever controls mast tilt.



If your unit is equipped with a multi-function auxiliary control lever, refer to page 30.

The auxiliary control lever is used to raise and lower the forks in the mast. Pull lever to rear to raise forks and push lever forward to lower forks.

Procedure:

1. Remove carriage fork combination or other attachment from boom head (refer to Attachment Installation - page 23).
2. Install mast on boom head.
3. Connect auxiliary hydraulic hoses to mast cylinder.
4. Always level the handler before raising the boom or the forks, with or without a load.
5. To travel with a load, lower forks fully in mast and lower boom to position load approximately one foot above ground.
6. Use mast as required to increase vertical reach of handler.
7. Use a signal man to assist in positioning the load if necessary.


SWING FORKS

PRECAUTIONS

- **Read additional capacity information under Capacity heading.**
- **Always level forks (horizontally) before swinging load to side. Swinging un-leveled forks may result in load slipping from forks.**
- **Because the swing forks can swing the load to the side, it is especially important that the handler be level when handling a load more than four feet above ground level (refer to page 19).**

Capacity:

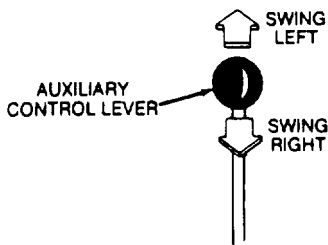
Maximum lift capacity for swing forks is shown on serial number plate (located on right cab wall). However, maximum lift capacity applies only to certain areas within boom extension/elevation pattern of handler/swing fork combination. A separate capacity chart must be used for handlers equipped with swing forks. Study this chart carefully before attempting to handle a load with swing fork attachment.

**WARNING**

Do not attempt to handle a load with swing fork attachment until you have studied swing fork capacity chart carefully. If your handler does not have a swing fork capacity chart, ask your supervisor to get one.

Controls:

The carriage tilt cylinder is used to tilt the swing forks up and down and the carriage tilt lever controls fork tilt.




If your unit is equipped with a multi-function auxiliary control lever, refer to page 30.

The auxiliary control lever is used to swing the forks to the left and right. Pull lever to rear to swing forks right and push lever forward to swing forks left.


Procedure:

1. Remove carriage/fork combination or other attachment from boom head (refer to Attachment Installation - page 23).
2. Install swing fork attachment on boom head.
3. Connect auxiliary hydraulic hoses to swing fork attachment.

**WARNING**

Observe all precautions and load capacity limits (listed previously) when handling loads with swing fork attachment.

4. Always position forks straight ahead before engaging load.
5. To travel with a load, keep forks in straight ahead position and lower load to approximately one foot above ground.
6. Inspect supporting surface at delivery point and have it leveled if necessary.

**WARNING**

Always bring forks to level (horizontal) position before swinging load to side. Swinging unleveled forks may result in load slipping from forks.

7. Use a signal man to assist in positioning the load if necessary.

SLOPE PILE CARRIAGE

PRECAUTIONS

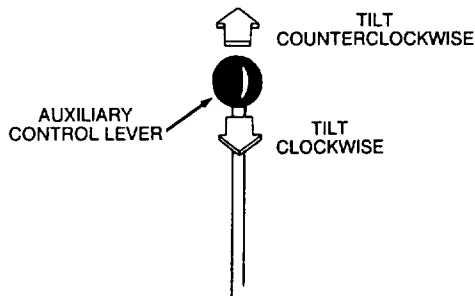
- **Level handler before tilting carriage to engage load (refer to page 19).**
- **Always level handler before lifting a load more than four feet above ground.**

Capacity:

Maximum load capacity for slope pile carriage is shown on serial number plate (located on right cab wall). However, maximum capacity may be used only in areas where it does not exceed capacities shown on standard carriage/fork capacity chart (located on dashboard). Follow standard chart to determine capacities for other areas of boom extension/elevation pattern.

Controls

The carriage tilt lever controls carriage tilt.



If your unit is equipped with a multi-function auxiliary control lever, refer to page 30.

The auxiliary control lever is used to tilt slope carriage. Push lever forward to tilt carriage counter-clockwise or pull lever to rear to tilt clockwise.

Procedure:

1. Approach load with forks centered on load and stop handler.
2. Level handler before tilting carriage to engage load.
3. Tilt carriage to left or right to align forks with load and engage load.
4. Raise load slightly and then level carriage.
5. Travel with load lowered to travel position (load approximately one foot above ground).

QUICK - SWITCH MOUNTED WINCH

PRECAUTIONS

- **Maximum winch load capacity is reduced from normal carriage/fork load rating (refer to next heading - Capacity).**
- **Always level the handler before lifting a load more than four feet above ground level (refer to page 19).**
- **Travel with load and boom lowered to travel position (load approximately one foot above ground).**
- **Always lower load to rest before leaving handler.**

Capacity:

The winch maximum load capacity is shown on serial number plate (located on right cab wall). However, maximum capacity may be used only in areas where it does not exceed capacities shown on standard carriage/fork capacity chart (located on dashboard). Also note that maximum winch capacity is less than carriage/fork maximum capacity. Capacity rating is based on load being lifted and suspended vertically from the boom and with no load on forks.



WARNING

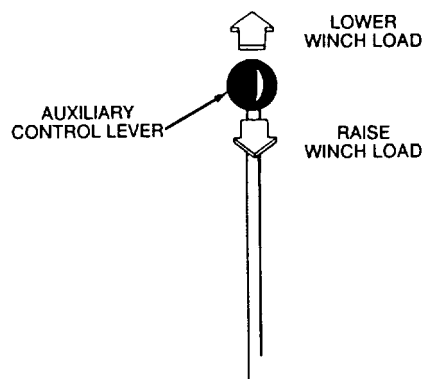
A side load or a swinging load can cause the handler to tip over and/or damage the boom.

Observe the following Special Precautions:

SPECIAL PRECAUTIONS

- **Never drag the load; lift vertically.**
- **Use tag lines to guide and steady a suspended load whenever possible. Tag lines must be long enough to keep helpers clear of load.**
- **Beware of wind; wind can cause a suspended load to swing and cause dangerous side loads - even with tag lines.**
- **Start, travel, turn and stop slowly to prevent load from swinging.**
- **Weight of all rigging (slings, etc.) must be included as part of load.**

Controls:



If your unit is equipped with a multi-function auxiliary control lever, refer to page 30.

The auxiliary control lever is used to control the winch. Pull the lever to rear to raise winch load and push the lever forward to lower winch load.

Procedure:

1. Remove carriage/fork combination or other attachment.
2. Install winch on boom head and connect hydraulic hoses at winch motor.
3. Position winch hook directly above balance point of load and secure using appropriate rigging.
4. Attach tag lines to load as appropriate and transport load to delivery site.
5. While helpers guide load with tag lines, position load at delivery point.

TRUSS BOOM & TRUSS BOOM WITH WINCH

PRECAUTIONS

- Because the truss boom extends the reach of the handler, maximum load capacity is reduced (refer to next heading - Capacity).
- Because of extended reach, it is especially important to level the handler before lifting a load more than four feet above ground level (refer to page 19).
- Travel with load and boom lowered to travel position (load approximately one foot above ground).
- Always lower load to rest before leaving handler.

Capacity:

Maximum lift capacity for the truss boom (with or without winch) is shown on serial number plate (located on right cab wall). However, maximum lift capacity applies only to certain areas within boom extension/elevation pattern of handler/truss boom combination. Refer to standard capacity chart. Study this chart carefully before attempting to handle a load with truss boom.



WARNING

A side load or a swinging load can cause the handler to tip over and/or damage the boom.

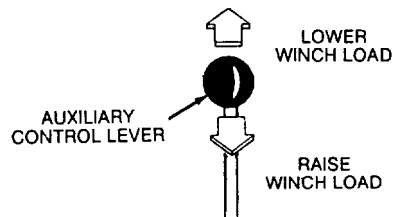
Observe the following Special Precautions:

SPECIAL PRECAUTIONS

- Never drag the load; lift vertically.
- Use tag lines to guide and steady a suspended load whenever possible. Tag lines must be long enough to keep helpers clear of load.
- Beware of wind; wind can cause a suspended load to swing and cause dangerous side loading - even with tag lines.
- Start, travel, turn and stop slowly to prevent load from swinging.
- Weight of all rigging (slings, etc.) must be included as part of load.

Controls

The carriage tilt cylinder is used to tilt the truss boom up and down from the handler boom head. The carriage tilt lever controls truss boom tilt.



If your unit is equipped with a multi-function auxiliary control lever, refer to page 30.

The auxiliary control lever is used when the truss boom is furnished with a winch. Pull the lever to rear to raise winch load and push the lever forward to lower winch load.

Procedure:

1. Remove carriage/fork combination or other attachment from boom head (refer to attachment installation - page 23).
2. Install truss boom on boom head.
3. If truss boom winch is furnished, connect auxiliary hydraulic hoses to winch.
4. Approach truss or truss bundle with boom above and parallel to load.
5. Position truss boom approximately parallel with main boom.
6. Position truss boom/winch hook as close as possible to balance point of load and secure load to boom using short slings or other rigging. Be sure rigging will not allow load to slip in any direction.
7. Open clamps at heel of truss boom far enough to clear load and tilt truss boom up until truss/bundle contacts heel of truss boom.
8. Close clamps to hold load lightly and secure clamps.
9. Transport load to delivery site and attach tag lines if load will be freely suspended.

SWING MAST

PRECAUTIONS

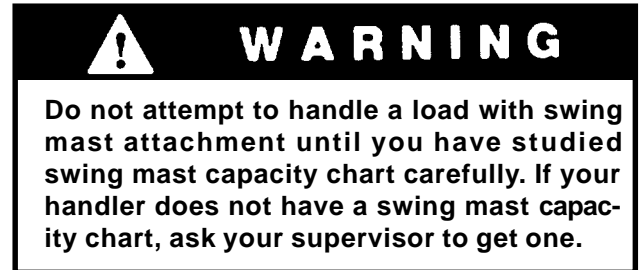
- **Always level forks (horizontally) before swinging load to side. Swinging un-leveled forks may result in load slipping from forks.**
- **The swing mast attachment has a smaller load capacity than the standard carriage/fork attachment. Study the swing mast capacity chart carefully before handling a load with swing mast.**
- **Read additional capacity information under Capacity heading.**
- **Because the swing mast increases lift height and can swing load to side it is especially important to level handler before lifting a load more than four feet above ground level (refer to page 19).**

Capacity

Maximum lift capacity is shown on serial number plate (located on right cab wall). However, maximum lift capacity applies only to certain areas within boom extension/elevation pattern of handler/swing mast combination. A separate capacity chart must be used for handlers equipped with swing mast. Study this

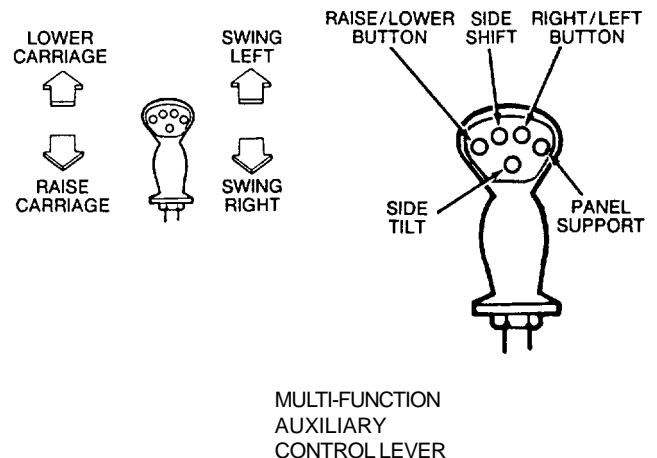
chart carefully before attempting to handle a load with swing mast attachment.

NOTE: When swing mast is equipped with an optional panel handler attachment, additional restrictions in operation and capacity will apply. Refer to Swing Mast Capacity Chart or contact your Gradall Material Handler Distributor for complete instructions and restrictions on use.



Controls:

The carriage tilt cylinder is used to tilt mast and the carriage tilt lever controls mast tilt.



A special auxiliary control lever is furnished on units equipped with swing mast attachment. The lever handle includes five push-button switches. Two of these switches are used for swing mast operation.

To raise or lower fork carriage, depress Raise/Lower button (No.1) and hold while moving lever in appropriate direction as shown.

To swing forks to left or right, depress Right/Left button (No.3) and hold while moving lever in appropriate direction as shown.

Procedure:

1. Remove carriage/fork combination or other attachment from boom head (refer to Attachment Installation (page 23).

2. Install swing mast on boom head and connect auxiliary hydraulic hoses to swing mast diversion valve hoses. Also connect electrical cable at boom head.

WARNING

Observe all precautions and load capacity limits (listed previously) when handling load with swing mast.

3. Always lower carriage fully in mast and position forks straight ahead before engaging load.
4. To travel with a load, keep forks straight ahead and lower load to approximately one foot above ground.

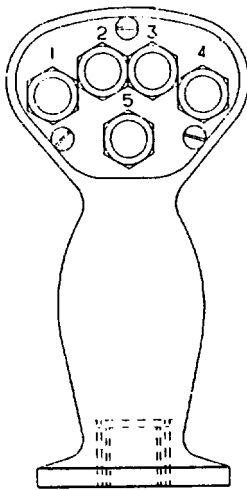
5. Inspect supporting surface at delivery point and have it leveled if necessary.

6. Level handler before raising load.

7. If necessary, perform a “dry-run” (unloaded) of delivery to determine best position for handler.

8. Use a signal man to assist in positioning the load if necessary.

MULTI-FUNCTION AUXILIARY CONTROL LEVER



AUXILIARY LEVER OPERATION	CONTROLS BUTTON FUNCTIONS
LEFT/DOWN	1 . MAST
↑	2 . SIDE SHIFT
↑	3 . SWING
↑	4 . PANEL SUPPORT
↓	5 . -----
RIGHT/UP	

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DECAL FOR PANEL HANDLER

If your unit is equipped with a multi-function auxilliary control lever, it is not necessary to depress button/s for single function attach-ments.

Recommended Lubricants & Capacities

APPLICATION	SYMBOL	WHEN USED	GRADE	SPECIFICATION	CAPACITY*	
					ENGLISH	LITERS
Boom Slide Brg. Paths	MG (extreme pres. moly lube)	All Year	HLGI #1	Chemlyth MY-IB	-	-
Engine Cooling System	50% Anti-freeze/50% water	All Year	Permanent	-	24 quarts	22.7
Engine Crankcase	EO (engine oil)	All Year	15 W-40-CD	MIL-L-2104D	12 quarts	11.4
Fuel Tank	DF (diesel fuel)	All Year	#2	-	40 gallons	151.4
Grease Fittings	CG (extreme pressure lube)	All Year	NLGI #1	H-152	-	-
Hydraulic System	HF (hydraulic fluid)	All Year	46	ISO**	40 gallons	151.4
Rear Hubs	GO (multi-purpose lube)	All Year	EP 80-90	A.P.I. GL-5	44 ounces	1.5
Transmission	ATF (auto. trans. fluid)	All Year	-	ATF-FM Dexron	20 quarts	18.9
SOMA FRONT AXLE ONLY (EARLY UNITS)						
Diff. & Wheel Ends	GO (multi-purpose lube)	All Year	EP 80-90	A.P.I. GL-5	15 quarts	14.2
ROCKWELL FRONT AXLE ONLY (RECENT UNITS)						
Brake Housings	TF (tractor fluid)	All Year	***	***	2.5 pints ea.	1.2
Differential	SL (special lube)	All Year	****	****	****	****
Wheel Ends	GO (multi-purpose lube)	All Year	EP 80-90	A.P.I. GL-5	2 pints ea.	.9

*Capacities are approximate - check level to be sure.

****Hydraulic Fluid Specifications:**

ISO Grade 46, Pour Point F -20 to -40

SSU @ 100 F, 200-240

Flash Point, COC, F 280 min.

Approved Supplier & Type: Union 46, Conoco Grade 46 or Citgo

Grade 46

*****Approved Lubricants:**

Gradall Wet Brake Housing Fluid 1440-4535 or

Mobil #424

******Fill to Level Using Mixture of:**

6 pints (2.8 Liters) Gradall Dif. Lube Additive 1440-4534 or

Lubrizol #6178

34 pints (16.1 Liters) GL-5-80-90

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	FREQUENCY *	THREAD SIZE (GRADE)	TORQUE (lubricated)			
			POUND/FEET		NEWTON/METRES	
			MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
BOOM SLIDE BRGS. (front)	5 Weeks (250 Hours)	¾-24 (5)	32	37	43	50
	5 Weeks (250 Hours)	½-20 (5)	68	78	92	106
BOOM SLIDE BRGS. (rear)	**	¾-25 (5)	32	37	43	50
	**	½-20 (5)	68	78	92	106
BOOM EXTEND CABLE (at rear)						
Adjusting Nut	5 Weeks (250 Hours)	1-8 (-)	50	75	68	102
Jam Nut	5 Weeks (250 Hours)	1-8 (-)	200	250	272	340
Wheel Lug Nuts	3 Months (500 Hours)	-	350	400	476	544

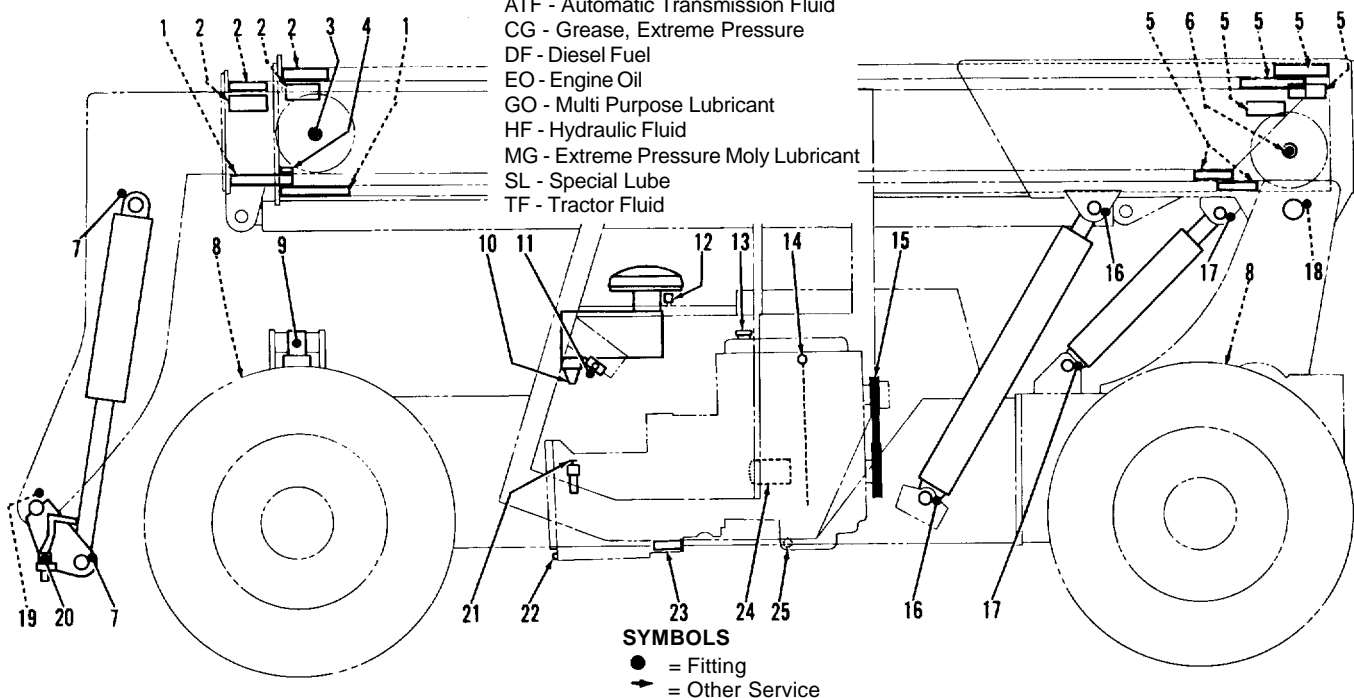
* Torque at whichever interval occurs first.

** Check torque of rear slide bearings if front bearings have become loose.

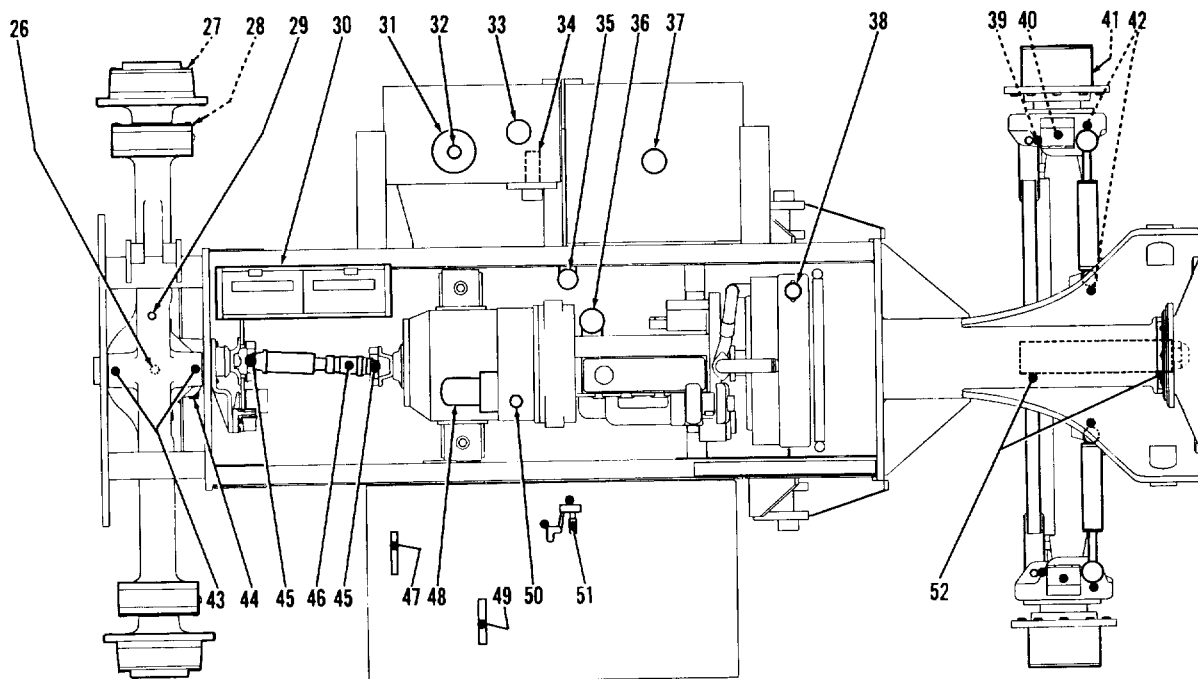
LUBRICATION & MAINTENANCE DIAGRAM

LUBRICANT SYMBOLS

ATF - Automatic Transmission Fluid
CG - Grease, Extreme Pressure
DF - Diesel Fuel
EO - Engine Oil
GO - Multi Purpose Lubricant
HF - Hydraulic Fluid
MG - Extreme Pressure Moly Lubricant
SL - Special Lube
TF - Tractor Fluid



**SEE MANUFACTURER'S COMPONENT LITERATURE
FOR ADDITIONAL LUBRICATION AND MAINTENANCE INFORMATION**



Lubrication Notes

- Lubricate points indicated by dotted leaders on both sides of unit.
- Intervals shown are for normal (8 hour day) usage and conditions.
- Adjust intervals for abnormal usage and conditions.
See recommended lubricants (page 31).
- Apply a light coating of engine oil to all linkage pivot points.
- Clean lubrication fittings before lubricating.
- Clean filter housings using diesel fuel. Dry components thoroughly using a lint free cloth.
- Check lubricant levels when lubricant is cool. Also check appearance for contamination.
- Drain engine and gear cases only after operation when lubricant is hot.
- Refer to page 34 for procedure to obtain oil sample for analysis.

Item	Lube Symbol	No. of Points
Daily (or 10 Hour) Lubrication & Maintenance (Service at whichever interval occurs first)		
12. Air Cleaner Element Condition Indicator (check for clogged condition (red band showing) & clean or replace element as required)	-	1
14. Engine Crankcase Dipstick (check level & refill as required - item 13 is filler cap)	EO	1
21. Transmission Dipstick (check level & replenish as required)	ATF	1
32. Hydraulic Filter Condition Indicator (check indicator with oil at normal operating temperature and engine running at full throttle - replace element before by-pass indication is reached or at least annually)	-	1
33. Hydraulic Reservoir (level handler, retract all other cylinders & check dipstick - refill as required)	HF	1
37. Fuel Filler Cap (fill at end of workshift to minimize condensation)	DF	1

Weekly (or 50 Hour) Lubrication & Maintenance (Service at whichever interval occurs first) (includes all previous services)		
1. Boom Front Bottom Slide Bearings (extend boom fully and lube all wear paths - retract and extend boom fully three times and wipe excess lube from bearings):	MG	4
3. Front Extend Sheave Pin	CG	1
6. Rear Extend Sheave Pin	CG	2
7. Carriage Tilt Cylinder Pivots	CG	2
8. Tires (check for damage & proper pressure) (tires are filled to minimum of 75% with calcium chloride solution to total wheel & tire weight of 715-815 pounds): Standard - 13.00 x 24, 12 ply - 65 psi Optional - 13.00 x 24R - 70 psi	-	4
9. Leveling Cylinder Pivots	CG	2
10. Carriage Tilt/Machine Level Lever Pivots	CG	1
16. Boom Hoist Cylinder Pivots	CG	2
17. Compensating Cylinder Pivots (twin fittings)	CG	4
18. Boom Pivot	CG	2
19. Boom Head/Carriage Pivot	CG	2
20. Quick Switch Latch	CG	1
30. Battery (check electrolyte level & refill as req'd)	-	1
35. Fuel/Water Separator (drain water)	-	1
38. Radiator Fill Cap (check level & refill as required)	-	1
39. Tie Rod Ends	CG	2
40. King Pins	CG	4
42. Steering Cylinder Pivots	CG	4
43. Front Axle Pivot	CG	2
47. Accelerator Pedal Pivot (under cab)	CG	1
49. Brake Pedal Pivot (under cab)	CG	1
51. Boom Lever Linkage (under cab)	CG	3
52. Rear Axle Pivot	CG	2

At End of FIRST 30 Days Only		
• Check torque of ALL ITEMS listed in Torque Table (page 31)		
28. Service Brake Housings (drain and refill to level)	TF	2

5 Week (or 250 Hour) Lubrication & Maintenance (Service at whichever interval occurs first) (includes all previous services)		
1. Boom Front Bottom Slide Bearings (to be performed by experienced maintenance person-check for damage, and excessive wear - none permitted past bevel - maximum clearance measured at top bearings is in., shim or replace as required; when these bearings require service, check all other slide bearings; shims are 1/16" thick):		4

Item	Lube Symbol	No. of Points
5Week (or 250 Hour) Lubrication & Maintenance (Cont.)		
2. Boom Front Top & Side Slide Bearings (extend boom fully and lube all wear paths - retract & extend boom fully three times & wipe excess lube from bearings):	MG	8
4. Front Extend Sheave Slide Bearing (inspect for damage and secure mounting)	-	1
5. Boom Rear Slide Bearings (lube paths):	MG	12
11. Air Cleaner Vacuator Valve (rubber cone on bottom - check to be sure cone is clear and undamaged)	-	1
15. Drive Belts (check condition & tension - replace or adjust as required)	-	1
24. Engine Oil Filter (replace at 250 Hours):	-	1
25. Engine Crankcase Drain Plug (drain & refill to level at 250 Hours)	EO	1
27. Front Planetary Hub (check level & refill as required)	GO	2
28. Service Brake Housings recent units only (check level & refill as required)	TF	2
33. Hydraulic Reservoir Breather Cap (check & clean or replace as required)	-	1
41. Rear Hub (check level & refill as required)	GO	2
44. Drive Axle Differential Level Plug (check level & refill as required)	GO	1
45. Drive Shaft Universal Joints	CG	2
46. Drive Shaft Spline	CG	1
• Check torque of ITEMS INDICATED in torque table (page 31)	-	-

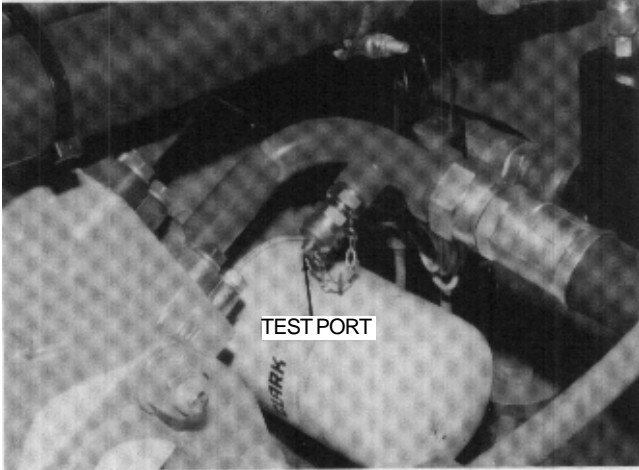
Quarterly (or 500 Hour) Lubrication & Maintenance (Service at whichever interval occurs first) (includes all previous services)		
33. Hydraulic System (we recommended that hydraulic fluid be analyzed to determine condition - drain & refill reservoir if required.)	HF	1
34. Hydraulic Reservoir Screen (remove, clean & install when hydraulic oil is drained)	-	1
35. Fuel/Water Separator (replace element at 500 hours)	-	1
36. Fuel Filter (replace element at 500 hours)	-	1
48. Transmission Filter (replace)	-	1
• Check torque of ITEMS INDICATED in torque table (page 31)		

Semi-Annual (or 1000 Hour) Lubrication & Maintenance (Service at whichever interval first) (includes all previous services)		
22. Transmission Drain Plug (drain and refill to level)	ATF	1
23. Transmission Screen (clean)	-	1
26. Front axle Differential Drain Plug (drain and refill to level)	GO	1
27. Front Planetary Hubs (drain and refill to level)	GO	2
28. Service Brake Housings (drain & refill to level)	TF	2
29. Front Axle Breather (clean or replace)	-	1
41. Rear Hubs (drain & refill to level)	GO	2
50. Transmission Breather (clean)	-	1

Annual (or 1500 Hour) Lubrication & Maintenance (Service at whichever interval first) (includes all previous services)		
31. Hydraulic Filter (replace element)	-	1
33. Hydraulic System (unless fluid is analyzed quarterly to determine degree of contamination, reservoir must be drained & refilled on annual basis)	HF	1
34. Hydraulic Reservoir Screen (remove, clean & install when hydraulic oil is drained)	-	1
38. Engine Cooling System (drain, flush & refill on basis of period suggested by anti-freeze manufacturer)	-	1

Obtaining Hydraulic Oil Sample for Analysis

1. Operate unit until hydraulic oil reaches normal operating temperature.
2. Apply parking brake and observe hydraulic filter by-pass indicator with engine running at full throttle. Replace filter elements if necessary.
3. Obtain a container to receive waste oil and a **CLEAN** container to receive oil sample.



4. With gage removed from hose, attach mini-check and hose to test port near main hydraulic pump. Hose end must be positioned in waste oil container.

5. Allow at least one pint of oil to flow into waste oil container to eliminate any contamination from hose.
6. Move hose to **CLEAN** container to collect sample for analysis.
7. Return hose to waste oil container and disconnect adapter from mini-check test port.
8. Cover sample container immediately with **CLEAN** cap.
9. Stop engine and check oil level in reservoir and replenish as required.
10. Contact your Gradall Distributor for information concerning oil analysis.

Oil sample containers are available from several sources:

- Oil companies
- Oil suppliers
- Sampling labs

OIL CLEANLINESS IS A MUST.

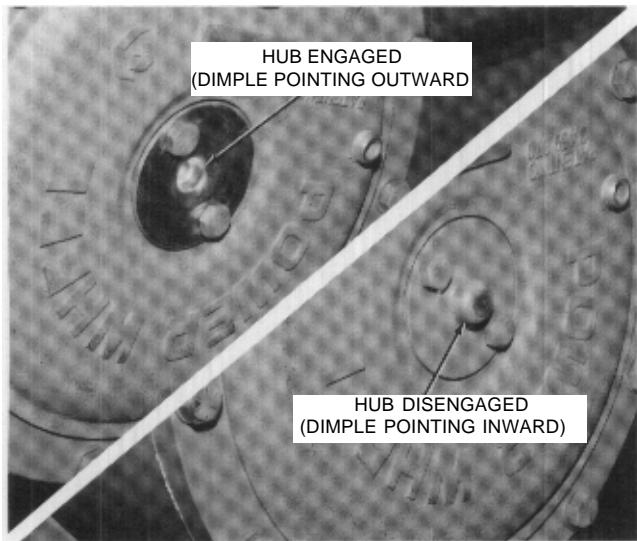
MOVING HANDLER IN EMERGENCY

The following procedure assumes that handler cannot be moved under its own power.

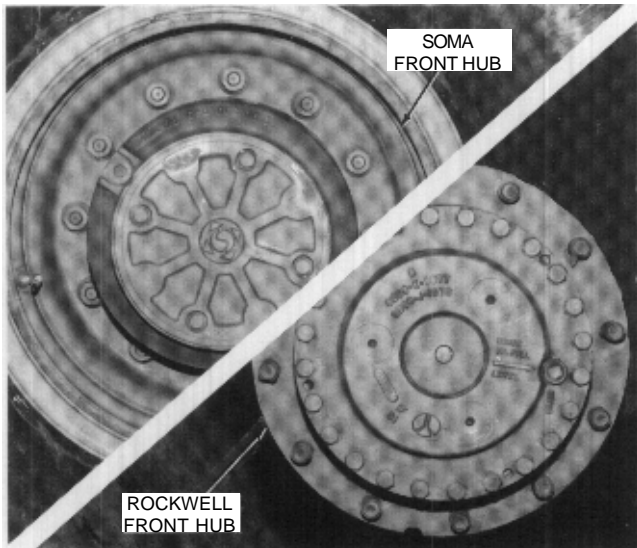
The safest way to move a disabled handler is to use a tow truck of sufficient capacity to raise front wheels clear of ground - **OR** - use a ramp/flatbed vehicle of sufficient capacity.

The next safest is pushing the unit and least safe is towing the unit.

Whichever method is used, certain preliminary steps must be taken. Perform following procedure as appropriate for method selected.

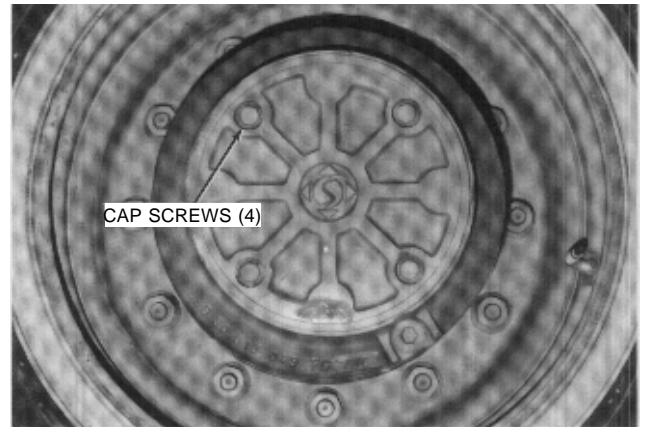


1. Secure both hub engage/disengage plates with dimple pointing outward to disengage rear drive hubs. This is the only preparation required if unit will be towed with front wheels off ground.
2. Position chocks at all wheels to prevent movement.



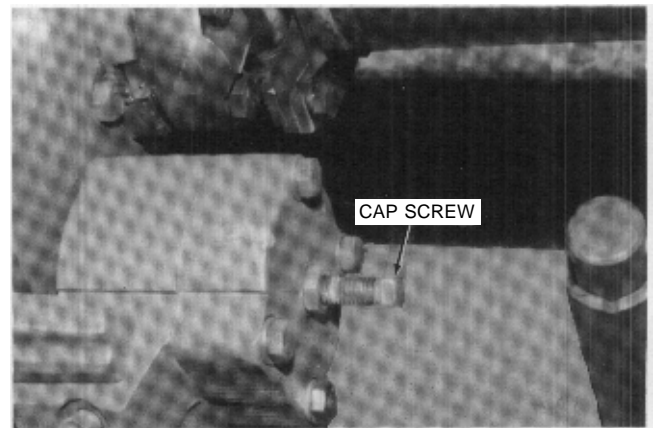
NOTE: Early 534B-9 units were equipped with SOMA front drive axles and recent units are equipped with Rockwell front drive axles. Be sure to follow proper instructions for your unit.

For SOMA Axle Only



3. Loosen four cap screws evenly to obtain a 1/4 inch gap between hub and cover plate at both ends of axle. This releases parking brakes.

For Rockwell Axle Only



3. Loosen cap screws to remove all spring tension from caliper. This releases parking brake.

Steps 1. thru 3. are the only preparations required if unit is to be carried on a flatbed vehicle.

4. If unit is to be pushed or towed, the drive shaft between front axle and transmission must be removed to prevent damage to transmission.



WARNING

Pushing or towing handler with engine stopped, accumulator drained and parking brake released can be dangerous because there are **NO BRAKES**.

Although manual steering is possible without power assist, **STEERING WILL BE SLOW AND DIFFICULT**.

PUSH OR TOW SLOWLY TO MAINTAIN CONTROL.

5. If handler is to be pushed, secure unit to pushing vehicle to prevent handler from rolling on its own with **NO BRAKES**.

If handler is to be towed, use a rigid connection to prevent rear end collision with handler having **NO BRAKES**.

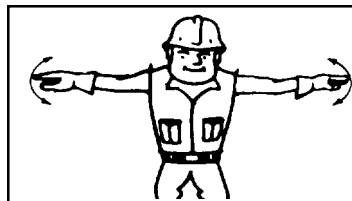
TRAVEL SLOWLY TO MAINTAIN CONTROL.

HAND SIGNALS

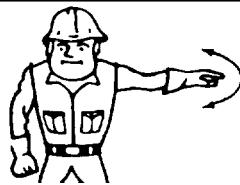
Standard Signals - When handler work conditions require hand signals, they shall be provided or posted conspicuously for the use of both signalman and operator. No handler motions shall be made unless signals are clearly understood by both signalman and operator.

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.

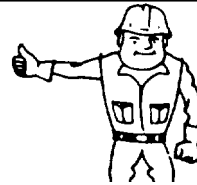
Instructions - When it is desired to give instructions to the operator other than provided by the established signal system, all handler motions shall first be stopped.



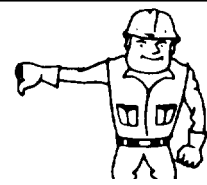
EMERGENCY STOP - With both arms extended laterally, hands open downward, move arms back and forth.



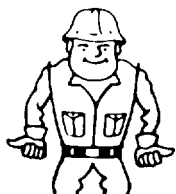
STOP - With either arm extended laterally, hand open downward, move arm back and forth.



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.



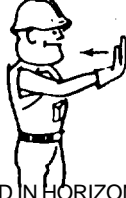
RAISE LOAD VERTICALLY - With either forearm vertical, forefinger pointing up, move hand in small horizontal circle.



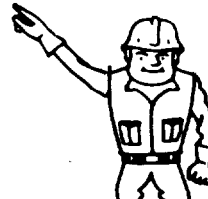
LOWER LOAD VERTICALLY - With either arm extended downward, forefinger pointing down, move hand in small horizontal circle.



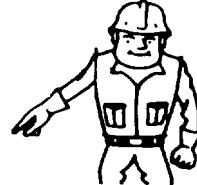
MOVE LOAD OUT HORIZONTALLY - With either arm extended, hand raised and open toward direction of movement, move hand in direction of required movement.



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



TILT FORKS UP - With one arm held at side, extend other arm upward at about 45°.



TILT FORKS DOWN - With one arm held at side, extend other arm downward at about 45°.



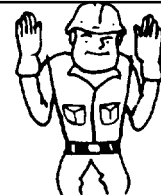
CLOSE BUCKET - Hold one hand closed and stationary. Rotate other hand in small vertical circle with forefinger pointing horizontally at closed hand.



OPEN BUCKET - Hold one hand open and stationary. Rotate other hand in small vertical circle with forefinger pointing horizontally at open 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 ENGINE - Draw thumb or forefinger across throat.

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.

GRADALL

Hydraulic Equipment

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