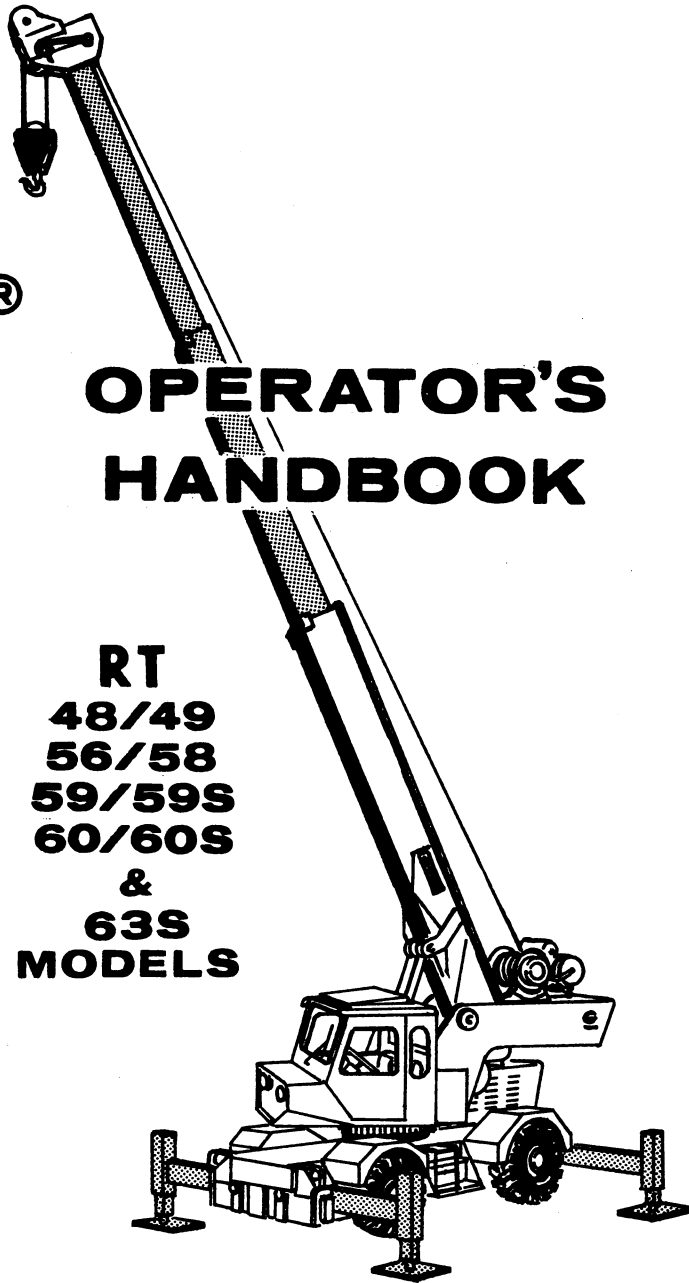
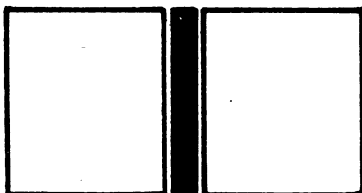


**OPERATING
INSTRUCTIONS**



**OPERATOR'S
HANDBOOK**

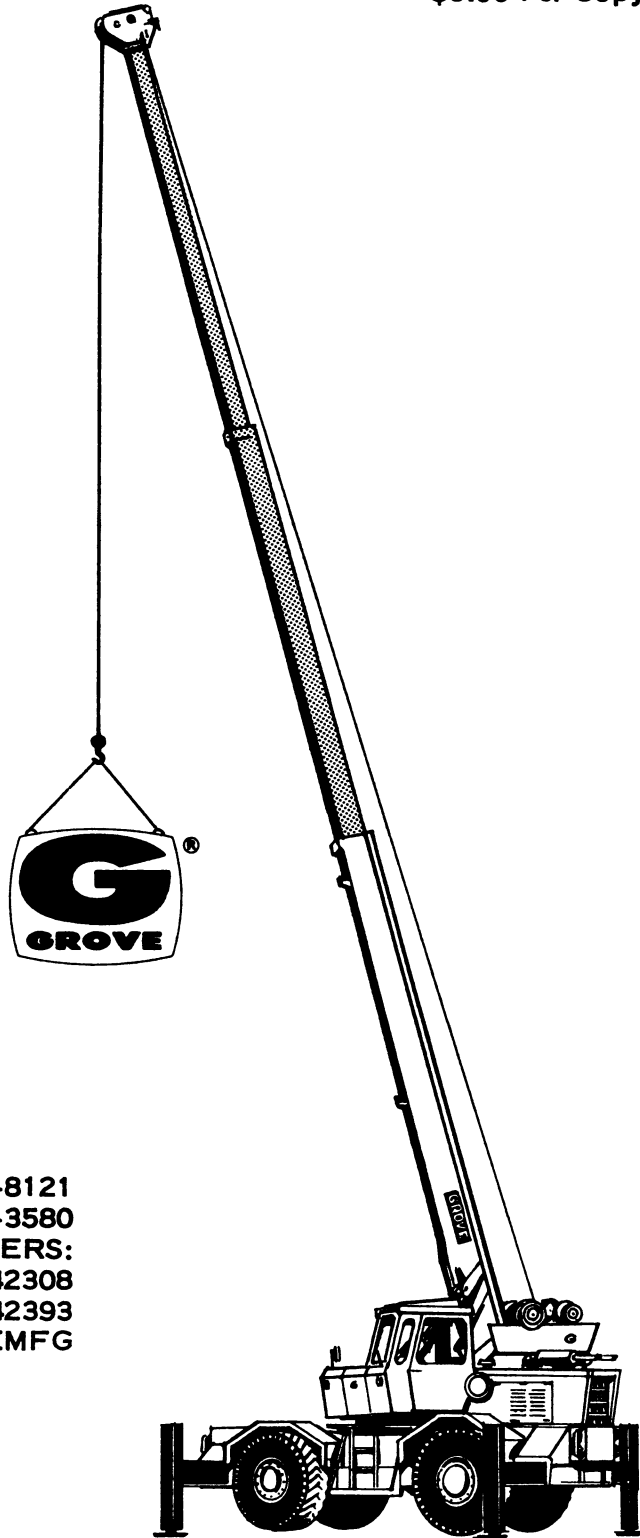
**RT
48/49
56/58
59/59S
60/60S
&
63S
MODELS**

**FULL HYDRAULIC
CRANES**

1 March 1973



\$5.00 Per Copy



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SERVICE 842393
CABLE: GROVEMFG

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SHADY GROVE, PENNSYLVANIA 17256
A DIVISION OF WALTER KIDDE & COMPANY, INC.

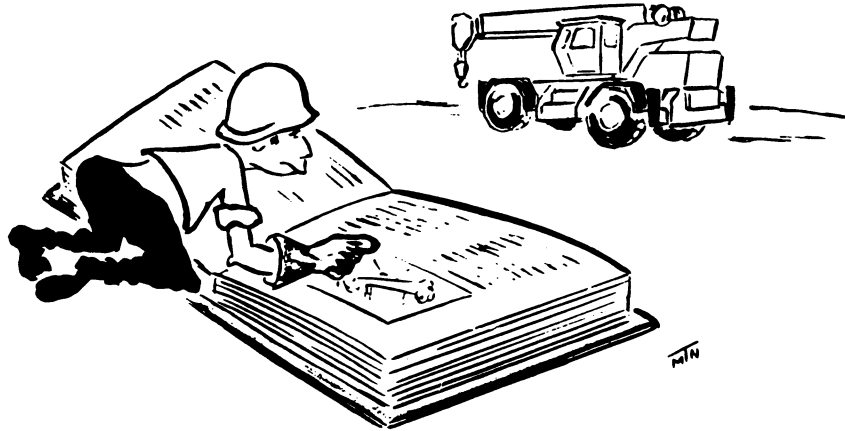
NOTICE TO OWNER/USER

Should this crane become involved in an accident, please contact your local Grove distributor immediately and relate details of the incident so he can notify Grove Worldwide. If the distributor is unknown and/or cannot be reached, please contact:

Grove Worldwide Product Safety & Reliability
1565 East Buchanan Trail
Shady Grove, PA 17256-0021
Telephone: 888-777-3378 (888-PSR-DEPT)
Facsimile: 717-593-5074
Email: psafety@groveworldwide.com

STOP!

read this



FOREWORD

The purpose of this handbook is to familiarize the operator with Grove RT hydraulic crane characteristics and operational applications. The descriptive material and procedures provide the information necessary to enable qualified personnel to operate the machine in a safe and efficient manner.

Before attempting to operate the machine, carefully read all sections of this handbook. Pay special attention to all **NOTES**, **CAUTIONS**, and **WARNINGS**, as they are essential in safeguarding both you and the machine.

REMEMBER — THE KEY TO GOOD PERFORMANCE OF ANY PIECE OF EQUIPMENT IS THE EFFICIENCY OF THE OPERATOR AND THOSE WHO MAINTAIN IT.

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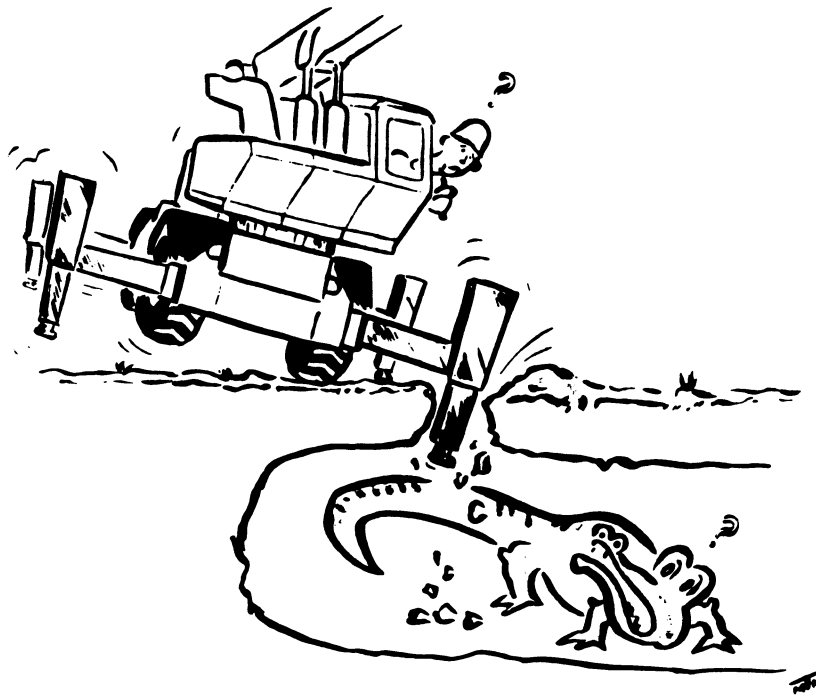
SAFETY PRECAUTIONS

It is impossible to compile a list of safety items covering all situations. However, there are basic safety precautions that should be followed during your daily routine. Safety is **YOUR PRIME RESPONSIBILITY**, since any piece of equipment is only as safe — **AS THE MAN BEHIND THE CONTROLS.**

With this thought in mind, the following list of safety precautions will help you use the equipment in a safe and efficient manner, along with promoting the safety of others.

REMEMBER, failure to follow just one safety precaution can cause that accident, to men or machine.

Keep Away From Dangerous Banks. Do not leave or work the machine near a bank that is liable to cave in.



DON'T PUT YOUR TRUST IN THE LAND



SAFETY PRECAUTIONS

Never Swing Over Ground Personnel. Never swing over ground personnel, regardless of whether or not a load is suspended from, or attached to, the boom.

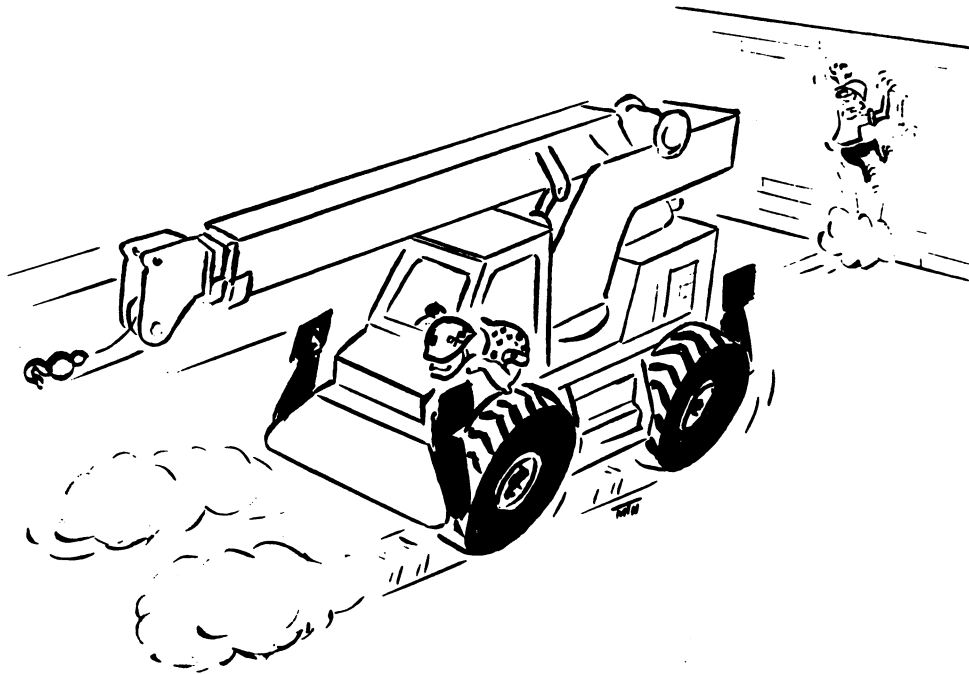


BE PEOPLE CONSCIOUS



SAFETY PRECAUTIONS

Never Back Up Without Aid of Signalman. Never back up without the aid of a signalman to verify that the area behind the machine is clear of obstructions and/or personnel.

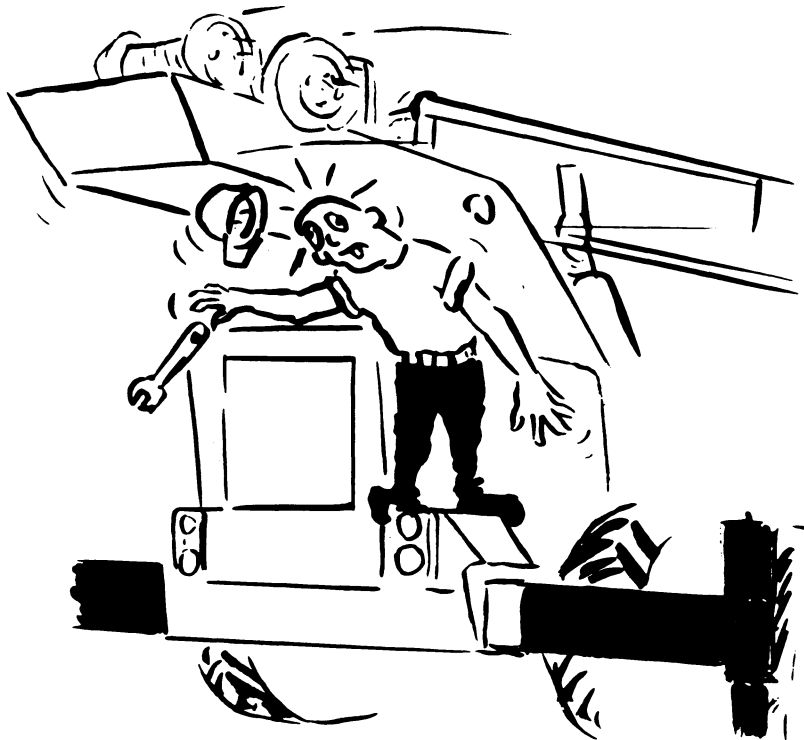


MAKE SURE THE WAY IS CLEAR BEFORE BACKING



SAFETY PRECAUTIONS

Never Get On or Off a Machine in Motion. Never get on or off a moving machine. When getting onto or alighting from a machine, use both hands and be assured of your footing.

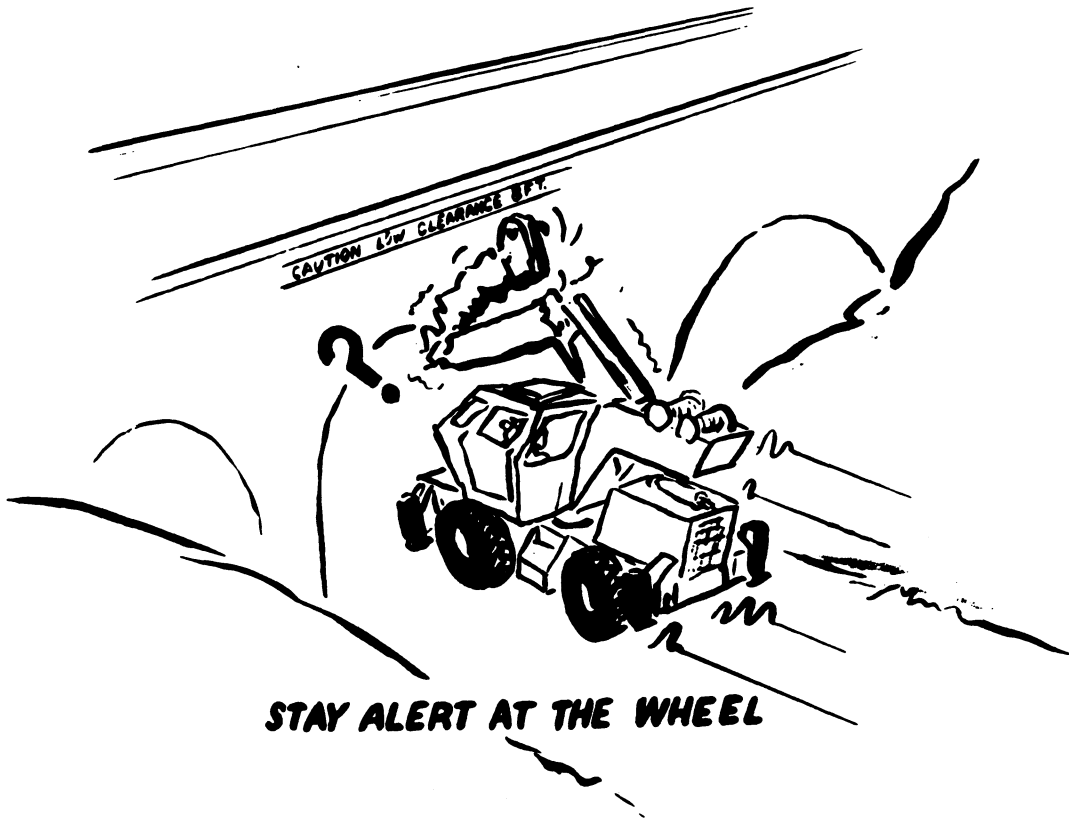


MAKE YOUR MOVE AFTER IT STOPS



SAFETY PRECAUTIONS

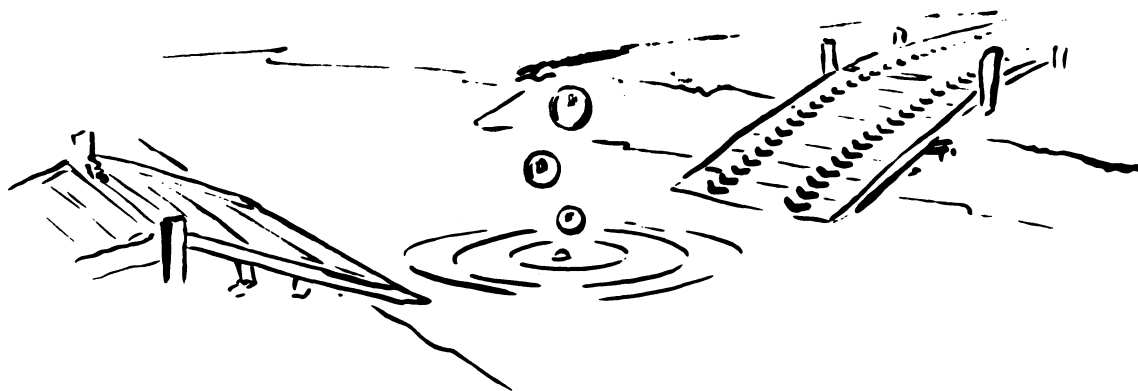
Watch Clearances When Traveling. Avoid running into overhead or side obstructions. When moving in tight quarters, post a look-out to help guard against collisions or bumping of structures.





SAFETY PRECAUTIONS

Check Load Capacities of Bridges. Before traveling across bridges, check to assure that they will carry a load — greater than the machine's weight.

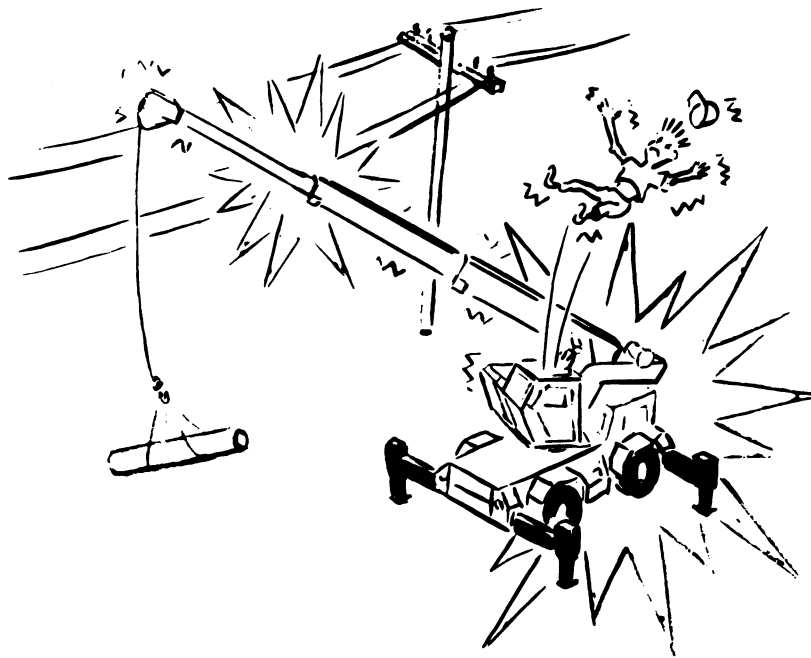


KNOW LOAD LIMITATIONS BEFORE CROSSING



SAFETY PRECAUTIONS

Avoid Electrical Lines and Overhead Cables. If boom should come in contact with electrical lines or overhead cables, stay on the machine, until boom is freed or current is cut off. Keep everyone, on the ground, away from the machine. If you must leave the machine — **JUMP** — do not step off.

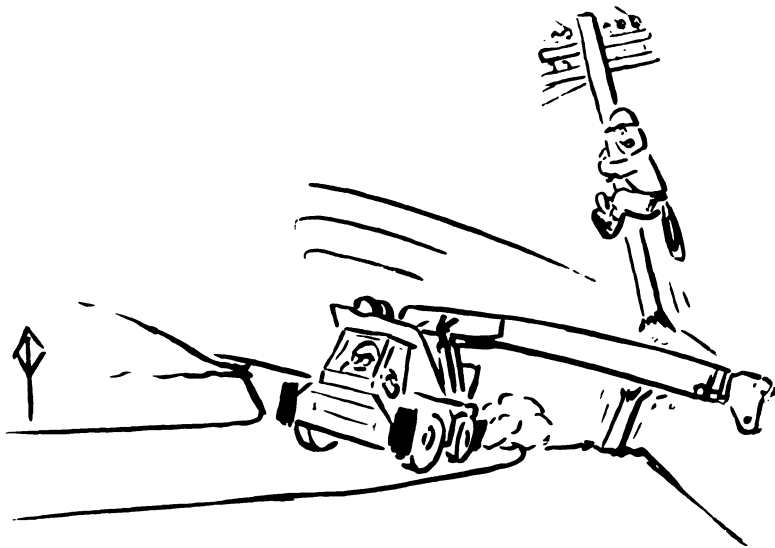


AVOID HIGH WIRE ACTS



SAFETY PRECAUTIONS

Always Secure Turntable Before Initiating Any Crane Travel. Use swing (house) lock, if applicable, or lower boom to travel position (horizontal) to prevent swing.



SECURE TURNABLE BEFORE TRAVELING W/ CRANE



SAFETY PRECAUTIONS

Permit No One to Ride Loads, Slings, Hooks, Etc. Permit no one to ride loads, slings, hooks, buckets, etc., for any reason.



ALLOW NO ONE TO HITCH A RIDE



SAFETY PRECAUTIONS

Keep Mud and Grease Cleaned from Your Shoes. Before entering control cab, clean any mud or grease from your shoes. This will reduce the possibility of your foot slipping off a control pedal, resulting in an accident.

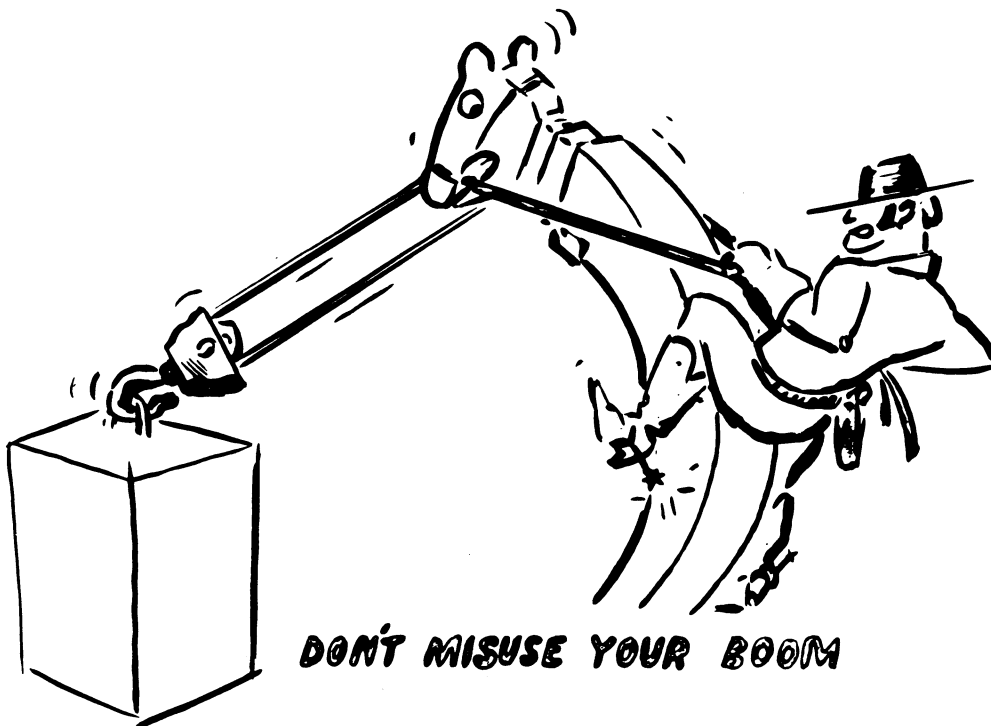


DON'T MUDDY THE RUG



SAFETY PRECAUTIONS

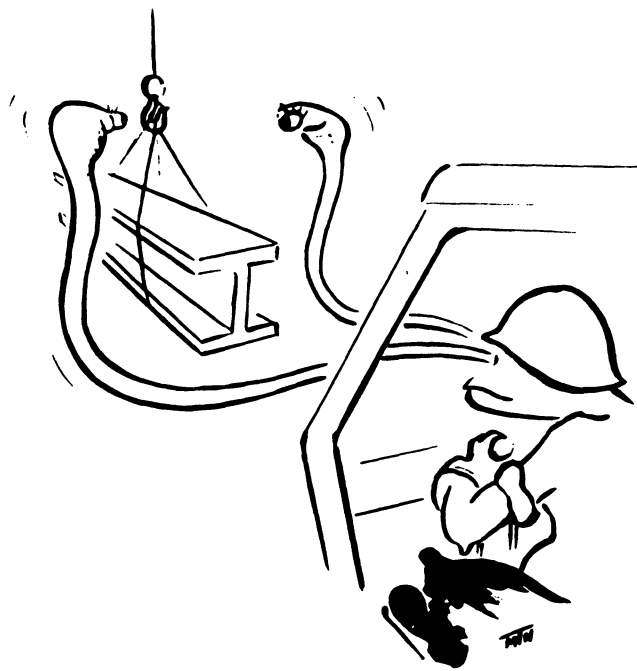
Never Pull or Push with a Boom. Never pull sideways with a boom or use a boom as a ram. Crane booms are not designed for side loading or opposing pressure against the telescope cylinders. Excessive pressures will cause the boom to fail.





SAFETY PRECAUTIONS

Watch Load at All Times. Watch the load while it is moving. In case you have to look in another direction, stop operation at once.

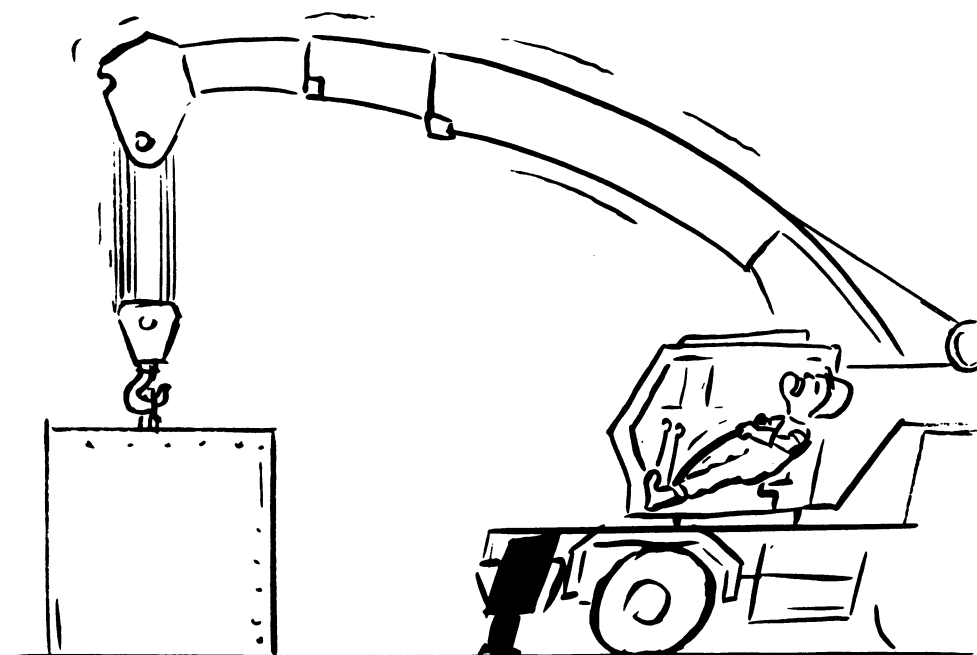


ALWAYS KEEP YOUR EYES ON THE LOAD



SAFETY PRECAUTIONS

Do Not Exceed Machine Rating. Do not rely on machine tipping stability to determine maximum lifting capacity. Do not exceed capacities shown on the load chart in cab, including weight reductions for lifting devices (headache ball, hook block, jib, etc.).

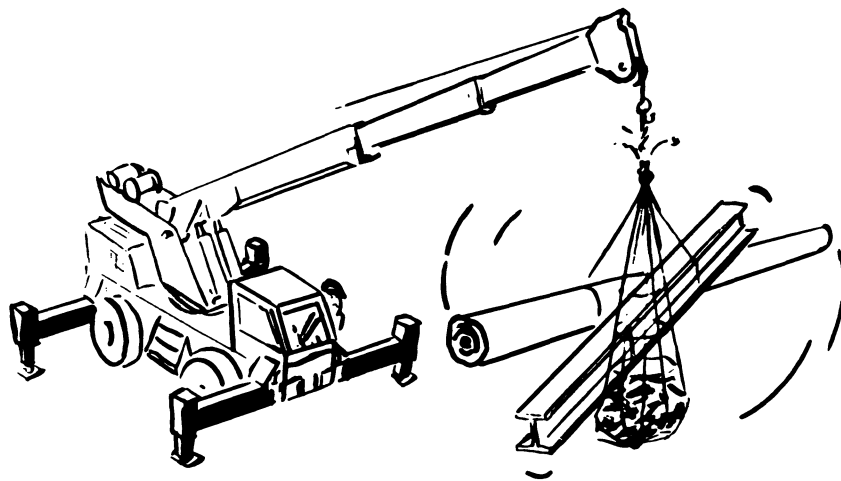


IT IS POSSIBLE TO BEND STEEL WITH YOUR BARE HANDS



SAFETY PRECAUTIONS

Lift One Load at a Time. Do not lift two or more separately rigged loads at one time, even if the loads combined are within the rated capacity.

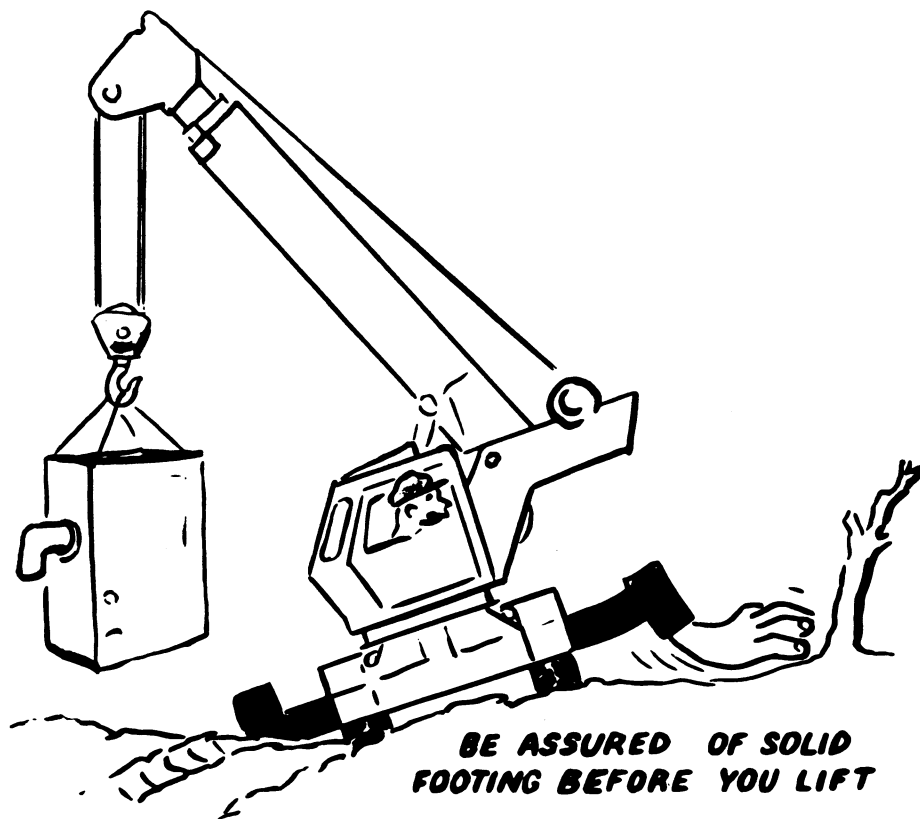


NEVER HANDLE MORE THAN ONE LOAD AT A TIME



SAFETY PRECAUTIONS

Check Machine Stability Before Lifting Loads. Assure that outriggers (or tires, if lifting on rubber) are firmly positioned on solid surfaces, the machine leveled, carrier brakes are set, and that the load is properly rigged and attached to the hook. Lift load slightly off ground and recheck stability before proceeding with lift.

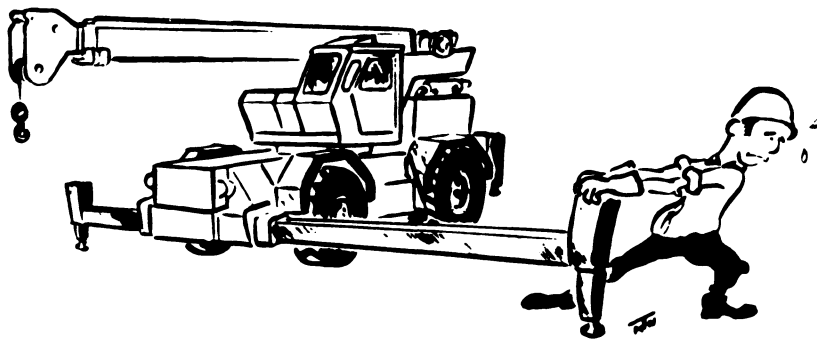


**BE ASSURED OF SOLID
FOOTING BEFORE YOU LIFT**



SAFETY PRECAUTIONS

Use Outriggers. Unless lifting within “on rubber” capacities, operate with outriggers fully extended so as to remove ALL weight from the machine’s tires.

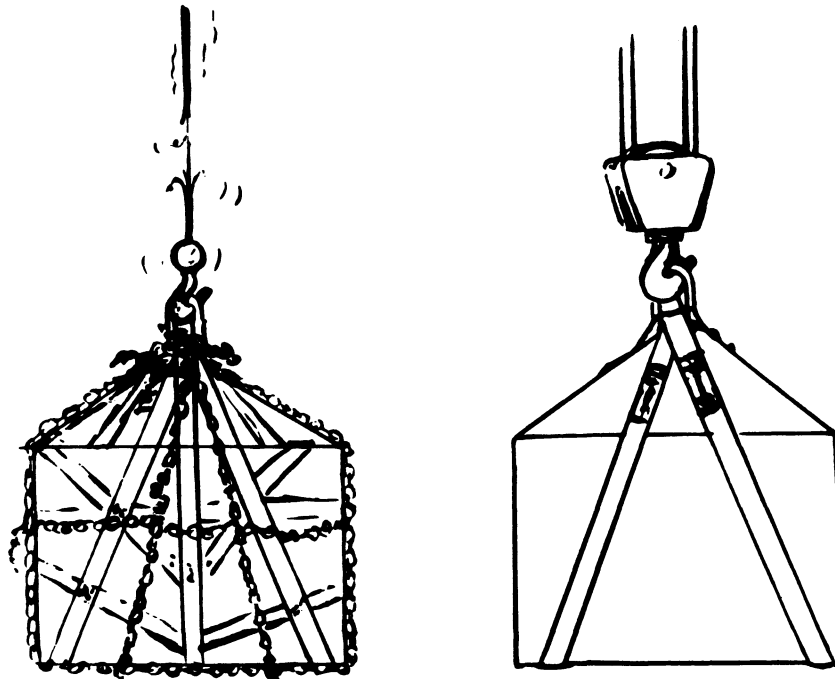


FULLY EXTENDED AND SET W/ SAFETY LOCKS ENGAGED



SAFETY PRECAUTIONS

Use Enough Parts of Line for Heavy Lifts and Check All Rigging for Proper Attachment. To obtain maximum lifting capacities the hook block must be rigged with sufficient parts of line. When operating with multi-part reeving, **NO LESS THAN TWO WRAPS** should remain on hoist drum. When slings, ties, hooks, etc., are used, assure that they are properly positioned and secured before raising or lowering loads.

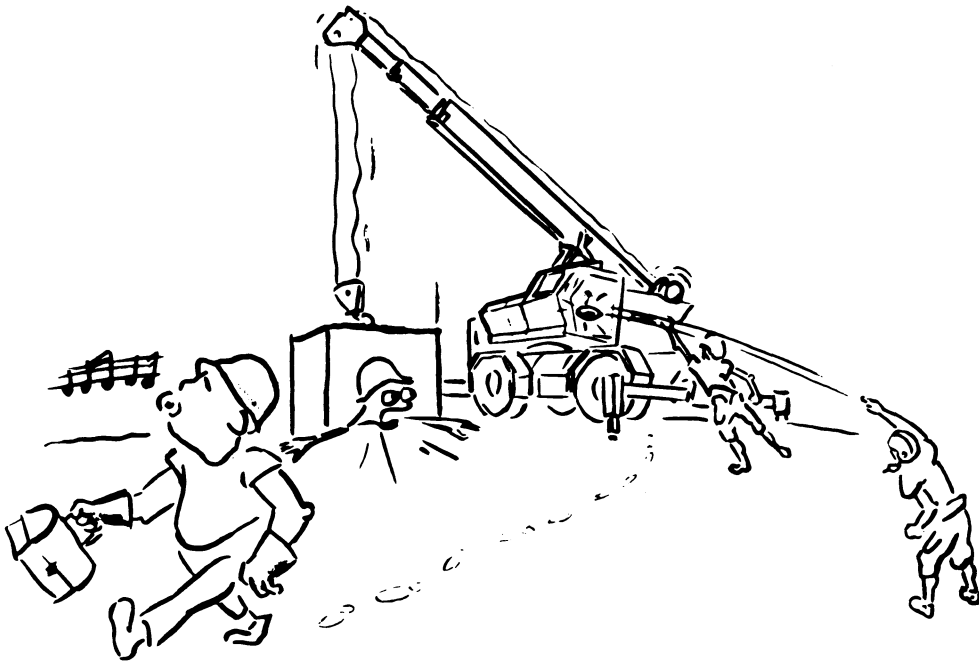


RIG TO SUIT THE LIFT



SAFETY PRECAUTIONS

Never Leave Machine With Load in the Air. Do not leave the machine with a raised load — if you must leave the machine — lower load to ground and shut down engine before leaving cab.



LOWER LOAD BEFORE LEAVING CONTROLS

Keep Everyone Away From Suspended Loads. Do not allow persons or equipment in the areas around or under suspended loads.



BE ALERT - STAY ALERT



SAFETY PRECAUTIONS

Check Capacity Load Chart in Cab. Always refer to capacity load chart in the cab before making any lifts. Adjust position of boom to radius recommended — then lift load.

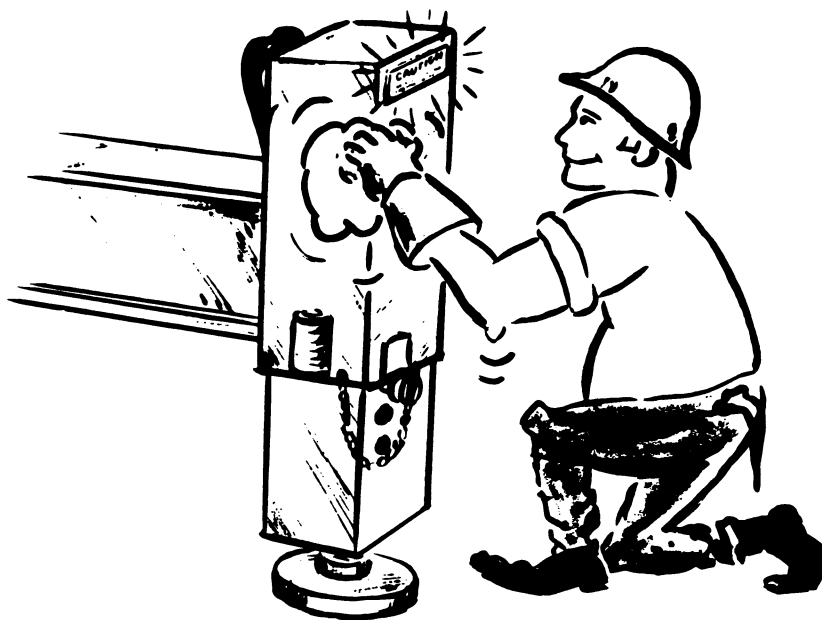


READ IT - AND HEED IT



SAFETY PRECAUTIONS

Strictly Adhere to All Placards. Comply with all requirements set forth in Safety and Operation placards.

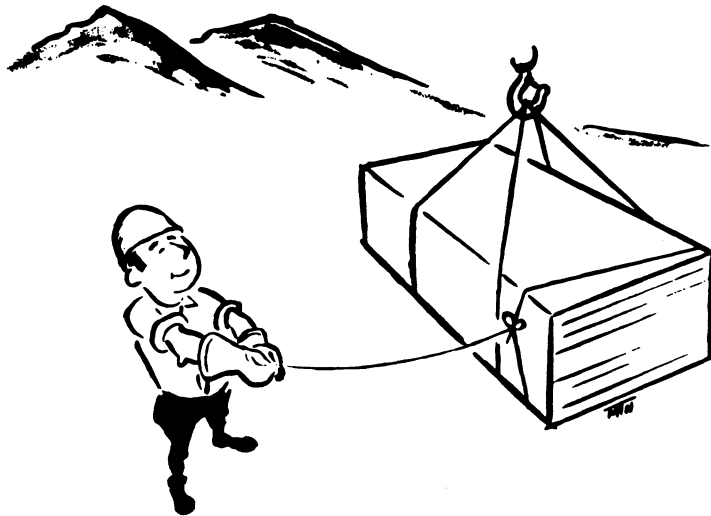


KEEP 'EM CLEAN - DO WHAT THEY SAY



SAFETY PRECAUTIONS

Check All Braking and Restraining Devices Prior to Operation.
Perform an operational check of all braking (wheel & swing) and safety restraining (tag lines, slings, etc.) devices prior to initiating any craning or traveling operations.



CONTROL LOAD AT ALL TIMES



WARNING, CAUTION, AND NOTE DEFINITIONS

Because safety of the operator and ground personnel, and proper use of the equipment are main points of concern, **WARNINGS**, **CAUTIONS**, and **NOTES** are strategically inserted throughout this handbook, as necessary. They are defined as follows:

WARNING: AN OPERATING PROCEDURE, PRACTICE, ETC., WHICH, IF NOT CORRECTLY FOLLOWED, COULD RESULT IN PERSONAL INJURY.

CAUTION: AN OPERATING PROCEDURE, PRACTICE, ETC., WHICH, IF NOT STRICTLY OBSERVED, COULD RESULT IN DAMAGE TO OR DESTRUCTION OF EQUIPMENT.

NOTE: AN OPERATING PROCEDURE, PRACTICE, ETC., WHICH IS ESSENTIAL TO HIGHLIGHT.

CAUTION EMERGENCY PROCEDURE: ALTHOUGH HIGHLY IMPROBABLE IF PROPER MAINTENANCE AND FREQUENT INSPECTIONS ARE ACCOMPLISHED, THERE REMAINS THE POSSIBILITY THAT THE EQUALIZER LINE COULD FAIL. IF THIS OCCURS THERE ARE RESTRICTING DEVICES PROVIDED THAT WILL ALLOW CONTINUED OPERATIONS OF THE CRANE. ALL CRANE FUNCTIONS REMAIN OPERABLE UNTIL THE HYDRAULIC OIL IN THE RESERVOIR IS DEPLETED. RECOMMENDED PROCEDURE FOR OPERATING THE CRANE IF THE EQUALIZER LINE FAILS IS AS FOLLOWS:

1. Remain at operator's station (DO NOT PANIC) as all functions can be accomplished.
2. Accelerate engine to normal operating RPM.
3. Maintain boom attitude (elevation) by activating boom elevation control. While holding boom at desired attitude, activate swing, retract telescoped sections, operate hoist, as necessary, until load is safely lowered to ground.

Operating radius is the horizontal distance from the axis of rotation to the centerline of the hoist line or tackle with loads applied.

*Indicates maximum capacity of extended fly section, regardless of boom length.

Capacities appearing above the bold line are based upon structural strength and not on machine stability.

Measured from center of boom pivot pin to center of boom nose sheave pin.

Operating radius is the horizontal distance from the axis of rotation to the centerline of the hoist line or tackle with loads applied.

OUTRIGGERS FULLY EXTENDED — 360°

Radius in Feet	Boom Length in Feet — Manual Fly Section Retracted							Manual Fly Extd.	
	32	38	44	50	56	62	68		71
12	60,000	50,000	45,500	42,500	40,000				
15	46,500	42,000	40,000	37,000	34,500	28,000	26,000		
20	34,000	32,500	31,000	29,500	28,000	25,500	22,000	20,000	
25	23,000	22,000	21,000	20,000	19,000	18,000	17,000	15,000	11,500
30	16,300	16,300	16,300	16,300	16,300	16,000	15,500	15,000	11,000
40	11,000	11,000	11,000	11,000	10,500	10,000	10,000	10,000	9,300
50					6,700	6,600	6,500	6,500	6,500
60							4,100	4,100	4,100
70									3,300
80									2,300
88									1,500

EXAMPLE

Capacities appearing below bold line are based on tipping or machine stability.

A6-829-000540

CAPACITIES NEVER EXCEED 85% OF TIPPING LOADS.

NEVER ATTEMPT ANY LIFT WITHOUT FIRST REFERRING TO YOUR LOAD CHART INSTALLED IN THE CAB.





KNOW YOUR MACHINE CAPACITIES

JIB CAPACITIES IN POUNDS

24 ft. JIB

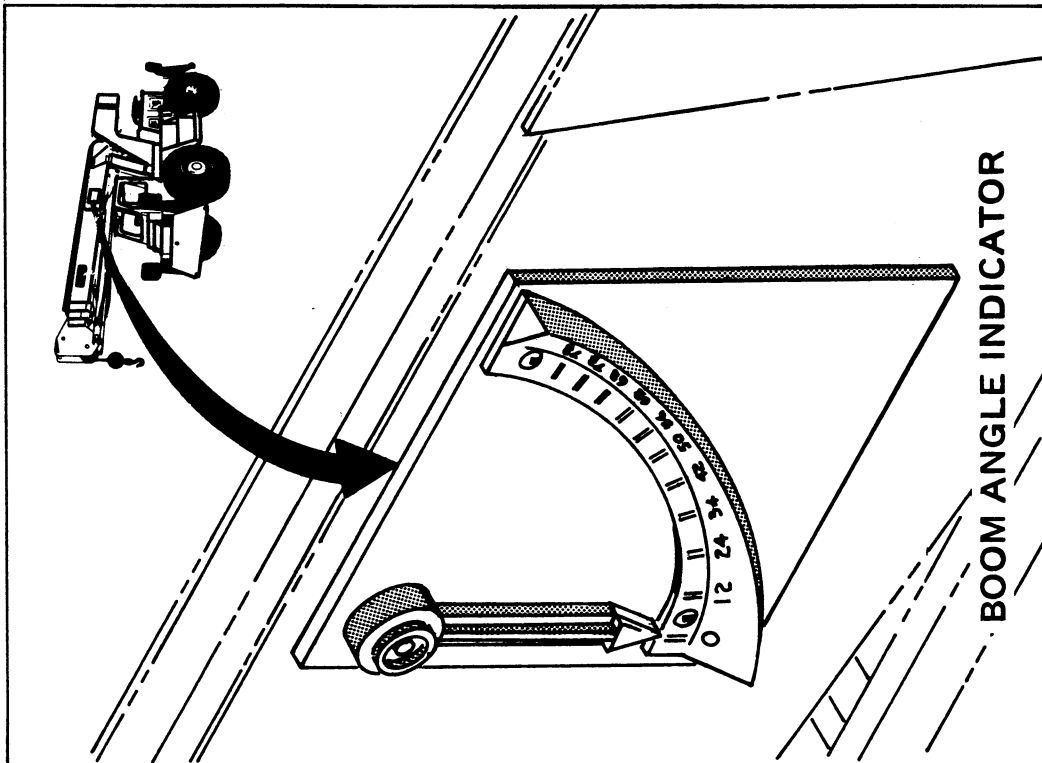
MIN. BOOM ANGLE	NO. OFFSET	MAX. OFFSET 26°
75	4000	1800
70	3750	1700
68	3500	1550
60	3250	1475
55	3000	1350
50	2750	1250
45	2500	1150
40	2250	1000
35	2000	900
30	1750	800
26	1500	675

example

A6-829-000219

Make frequent reference to boom angle indicator, in addition to your range diagram, to assure that you are within the rated lifting capacities of your jib.

READING YOUR LOAD CHARTS (CONT)





KNOW YOUR MACHINE CAPACITIES

The following NOTES TO LIFTING CAPACITIES are standardized for load charts supplied with all Grove cranes. Carefully read all notes before engaging in any load lifting operation.

NOTES TO LIFTING CAPACITIES

1. Rated lifting capacities are based on freely suspended loads. They are the maximum covered by the manufacturer's warranty with the machine leveled and standing on a firm supporting surface. Ratings with outriggers are based on outriggers being extended to their maximum positions.
2. Practical working loads for each particular job shall be established by the user depending on operating conditions; including the supporting surface, wind and other factors affecting stability, hazardous surroundings, experience of personnel, handling of load, etc.
3. Operating radius is the horizontal distance from the axis of rotation to the centerline of the hoist line or tackle with loads applied.
4. "On Rubber" lifting (if permitted) depends on proper tire inflation, capacity, and condition. "On Rubber" loads may be transported at a maximum vehicle speed of 2.5 mi./hr. (4 km./hr.) on a smooth and level surface only.
5. Jibs may be used for single-part line lifting crane service only. Jib capacities are based on structural strength of jib or main boom. Jib loads must not exceed main boom lifting capacities for the actual operating radius.
6. Operation is not intended or approved for any conditions outside of those shown. Handling of personnel from the boom is not authorized except with equipment furnished and installed by Grove Manufacturing Company.
7. For clamshell or concrete bucket operation, weight of bucket and load must not exceed 90% of rated lifting capacities.
8. Power-telescoping boom sections must be extended equally at all times. Long cantilever booms can create a tipping condition when in extended and lowered position.
9. The maximum load which may be telescoped is limited by hydraulic pressure, boom angle, boom lubrication, etc. It is safe to attempt to telescope any load within the limits of rated lifting capacity chart.
10. With certain boom and hoist tackle combinations, maximum capacities may not be obtainable with standard cable lengths.
11. With certain boom and load combinations, raising of load with boom lift cylinders may not be possible. Operational safety is not affected by this condition.
12. Keep load handling devices a minimum of 12 inches (30 cm) below boom head when lowering or extending the boom.
13. If actual boom length is between rated lengths shown, use lifting capacity for the next longer rated length.

The line pull and reeving information appearing on your load chart (example following page) is most important. The "permissible line pulls" are based on the actual breaking strength of the applicable cable, including a minimum safety margin of 3.5.



KNOW YOUR MACHINE CAPACITIES

WARNING: NEVER EXCEED MAXIMUM SINGLE LINE CAPACITY OF ANY CABLE AND ADHERE TO RECOMMENDED MULTI-PART REEVING (*) INFORMATION ACCOMPANYING THIS CHART.

LINE PULLS & REEVING INFORMATION

HOISTS	CABLE SPECS.	PERMISSIBLE LINE PULLS
MAIN * 5090 MECR	5/8 in. - 6x37, IWRC	9,700 lbs.
	5/8 in. - 19x7, PS, Strand	8,700 lbs.
AUXILIARY 40 SECR	1/2 in. - 6x37, EIPS, IWRC	7,200 lbs.
	1/2 in. - 19x7, EIPS, Strand	6,150 lbs.

* For multiple part reeving, use one line for each 7,500 lbs. of load or portion thereof.

WARNING: REDUCTION IN CAPACITIES ON LOAD CHART (EXAMPLE GIVEN ON PAGE 29) FOR LOAD HANDLING DEVICES MUST BE STRICTLY ADHERED TO; FAILURE TO ALLOW FOR WEIGHT OF A LOAD HANDLING DEVICE MAY RESULT IN EXCEEDING LOAD CAPACITIES OF THE MACHINE.

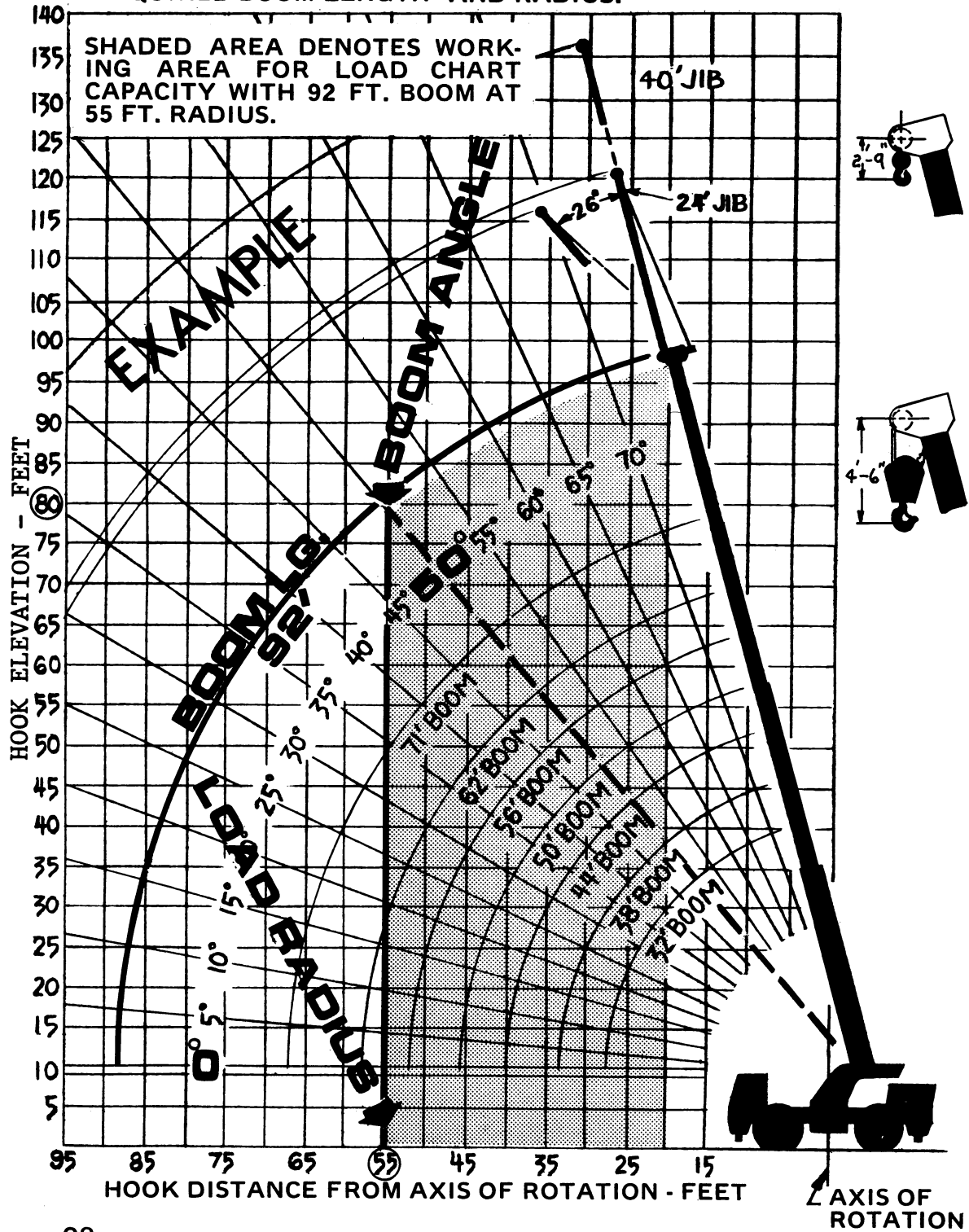


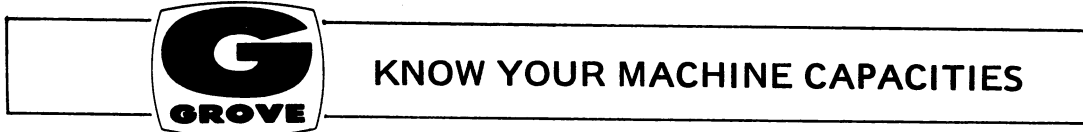
KNOW YOUR MACHINE CAPACITIES

READING YOUR RANGE DIAGRAM

NOTE: BOOM ANGLE AND BOOM LENGTH DETERMINE LOAD RADIUS.

REFER TO LOAD CHART FOR LIFTING CAPACITY AT REQUIRED BOOM LENGTH AND RADIUS.





KNOW YOUR MACHINE CAPACITIES

**WEIGHT REDUCTION FOR
LOAD HANDLING DEVICES**

HOOK BLOCKS	
8 Ton, 1 Sheave	180 lbs.
20 Ton, 3 Sheave	430 lbs.
25 Ton, 4 Sheave	630 lbs.
30 Ton, 3 Sheave	640 lbs.
30 Ton, 4 Sheave	640 lbs.
Auxiliary Boom Head	175 lbs.
5 Ton, 9 in. dia. Headache Ball	100 lbs.
5 Ton, 1 1/4 in. dia. Headache Ball .	200 lbs.
7 Ton, Headache Ball	300 lbs.

24 ft. JIB WITH 29 ft. - 92 ft. BOOM	
JIB STORED	370 lbs.
JIB ERECTED	1385 lbs.

NOTE: All Load Handling Devices and Boom Attachments are Considered Part of the Load and Suitable Allowances **MUST BE MADE** for Their Combined Weight.

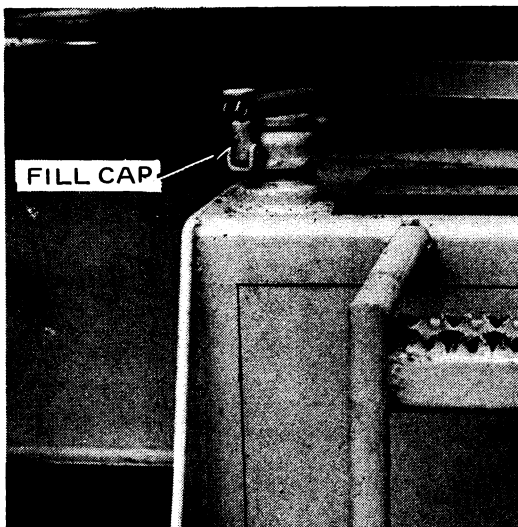
Weights are for Grove furnished equipment.



DAILY PREOPERATIVE CHECKLIST

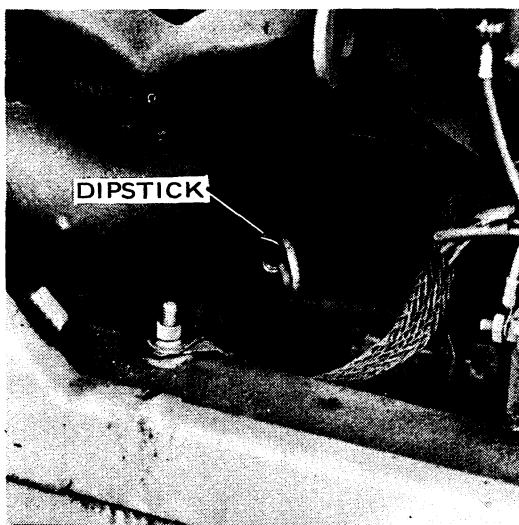
The following "Checklist" items are provided specifically for the operator's benefit in assuring that his machine is mechanically serviceable prior to starting the day's work.

If difficulty is encountered upon checking any of the listed items, refer to the Service and Maintenance Manual for detailed corrective action.



Check Fuel Supply.

FUEL SUPPLY. Check that fuel tank is full.

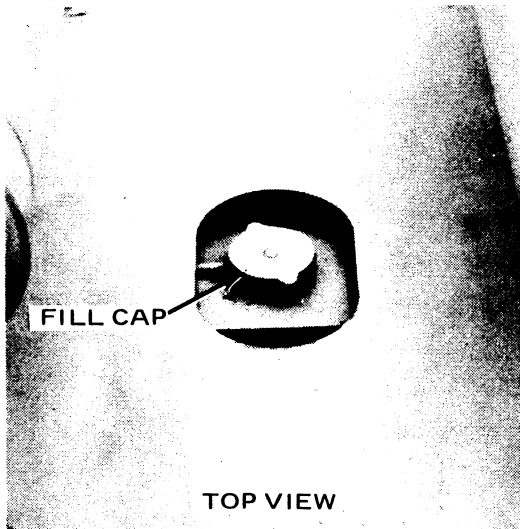


Check Oil Level.

ENGINE OIL. Check oil level in crankcase; fill to FULL mark on dipstick. Do not over-fill.

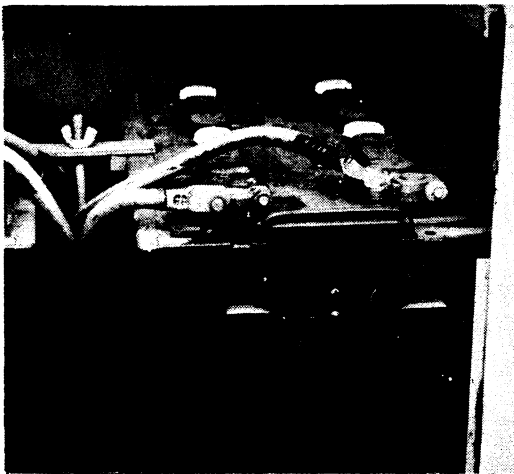


DAILY PREOPERATIVE CHECKLIST



Check Coolant Level.

ENGINE COOLANT. Check coolant level in radiator; fill to proper level — do not overfill.



Check Battery Electrolyte .

BATTERIES. Check batteries for proper electrolyte level and cables for security, visible damage, and corrosion. Add only clean distilled water — avoid overfilling.

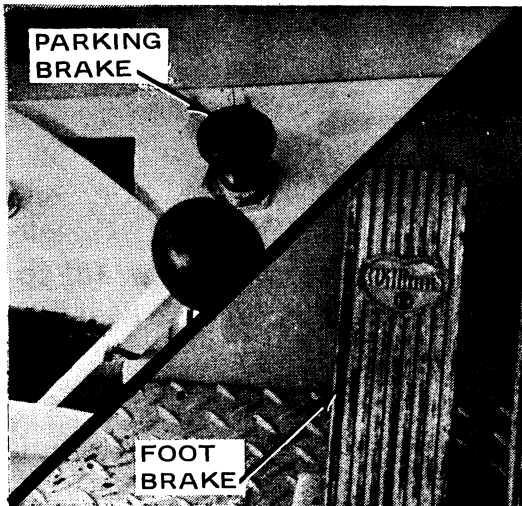


Check Lights.

SIGNAL AND RUNNING LIGHTS. Check all signal and running lights for proper operation. Replace burned out lamps with those of the same number, or equivalent.

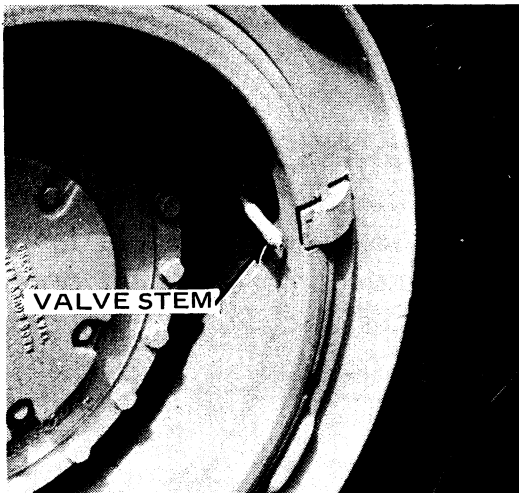


DAILY PREOPERATIVE CHECKLIST



Check Brakes.

FOOT AND PARKING BRAKES. Check foot and parking brakes for proper operation.



Check Tires.

TIRES. Check tires for security, severe cuts, foreign objects imbedded in treads, and for correct inflation pressures.

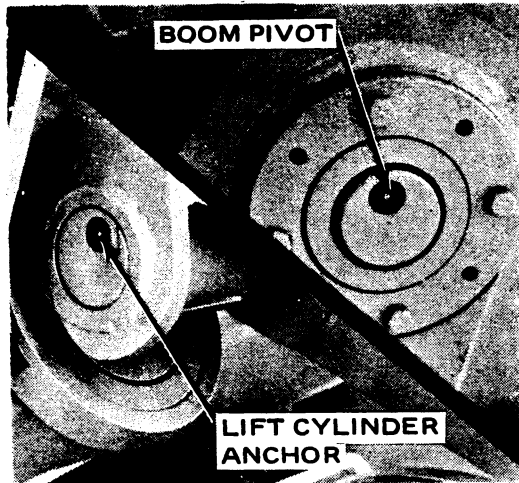


Check Reservoir Level.

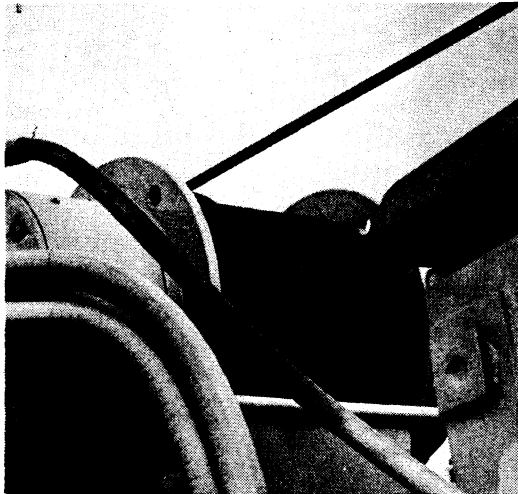
HYDRAULIC RESERVOIR. With all systems shut down (cylinders retracted), check level in reservoir; fill to HIGH mark on dipstick.



DAILY PREOPERATIVE CHECKLIST



Daily Lubrication Points.



Check Wire Rope.

DAILY LUBRICATION. Assure that all components requiring daily lubrication have been serviced. (Refer to applicable lubrication chart for specific details.)

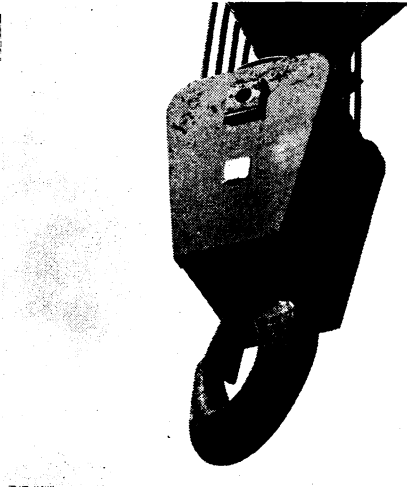
WIRE ROPE. Visually inspect all running ropes in continuous service. The following conditions would warrant concern for wire rope safety and consideration for replacement.

1. Corrosion.
2. More than one broken wire in any one strand.
3. More than one broken wire near attach fitting.
4. Excessive wear and/or broken wires in rope sections under sheaves where rope travel is limited.
5. Evidence of noticeable reduction in original rope diameter after allowance for normal stretch and diameter reduction of a newly rigged rope.
6. Excessive abrasion, scrubbing and peening of outside wires; pitting, bird-caging (deformation), or other mechanical damage resulting in physical changes to the rope structure.
7. Cracked, bent, worn, or improperly installed end connections (wedge socket, turnbuckles, etc.).

Sheaves, guards, guides, drums, flanges, etc., and any other surfaces that come in contact with the rope should be inspected for any defective areas that could cause possible damage to the rope.



DAILY PREOPERATIVE CHECKLIST



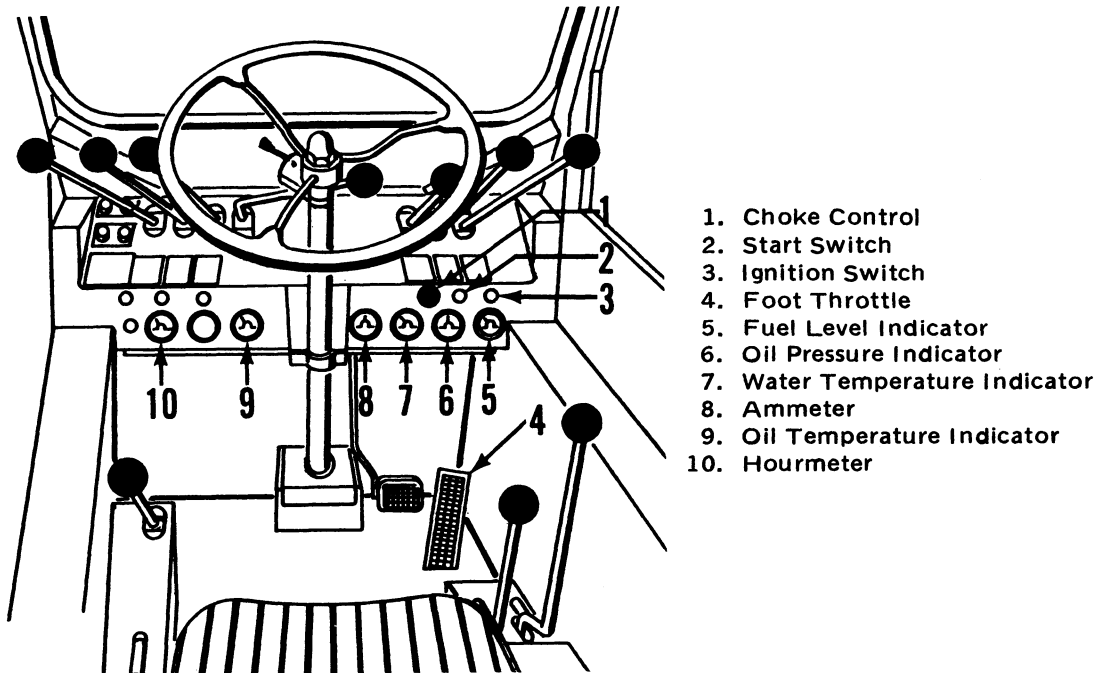
HOOK BLOCK. Visually inspect hook block for nicks, gouges, cracks, and evidence of any other damage. Replace a hook containing cracks or showing evidence of excessive deformation of the hook opening (including twist).

Check Hook Block.



ENGINE CONTROLS AND INDICATORS

ENGINE CONTROLS AND INDICATORS – TYPICAL.



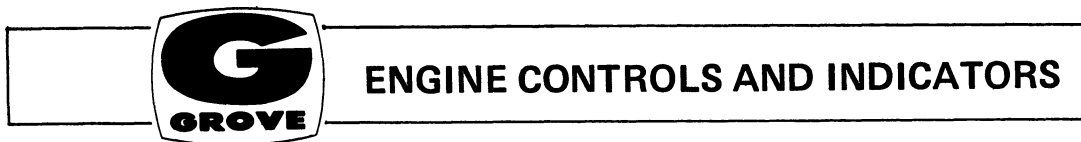
Engine Controls and Indicators – RT48, 49, 56, and 58 Models.

IGNITION SWITCH. An on/off switch, on the control panel, supplies electrical power to the STARTER switch when positioned “on”.

STARTER SWITCH. A button-type STARTER switch, on the control panel, completes the electrical circuit to the starter solenoid when depressed.

THROTTLE LOCK. (Fixed Cab Models.) A lever-type throttle lock, installed on the console, is mechanically linked to the foot throttle. The control allows the operator to maintain the engine rpm (lever static locks when positioned) after speed has been adjusted with the foot throttle.

HAND THROTTLE. (RT59S/60S and 63S Models.) A lever-type hand throttle, installed on the console, is pneumatically linked to the foot throttle. The control allows the operator to select and maintain the engine rpm (lever static locks when positioned) during crane operation.



CHOKE. (Gasoline Engines.) A manual CHOKE control, on the control panel, is used during engine starting, as necessary, to restrict the air supply to the carburetor.

HOURMETER. An hourmeter, on the control panel, (or console) records the engine operating time.

WATER TEMPERATURE INDICATOR. A water temperature indicator, on the control panel, presents a visual display of the engine's coolant temperature.

OIL PRESSURE INDICATOR. An oil pressure indicator, on the control panel, presents a visual display of the engine's oil pressure.

OIL TEMPERATURE INDICATOR. An oil temperature indicator, on the control panel, presents a visual display of the engine's oil temperature.

TACHOMETER. (Diesel Engines.) A tachometer, on the control panel, presents a visual display of the rpm at which the engine is operating.

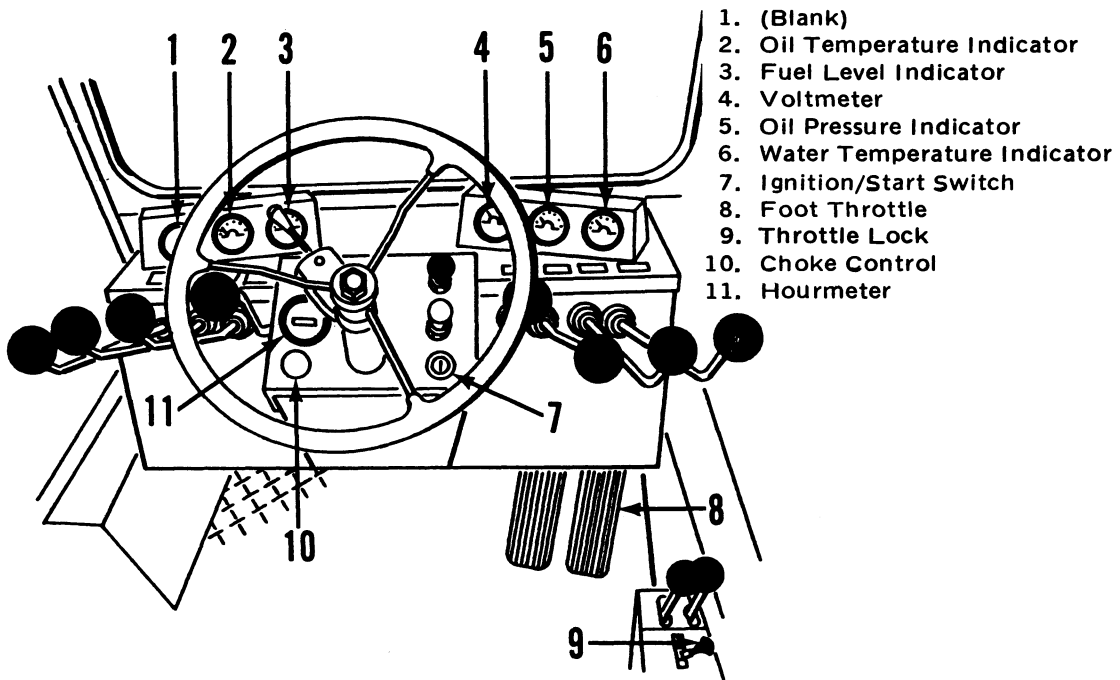
AMMETER. An ammeter, on the control panel, presents a visual display of the battery's state of charge, i.e., charging, charged, or discharging.

VOLTMETER. (Later Models.) A voltmeter, on the control panel, presents a visual display of the battery output voltage.

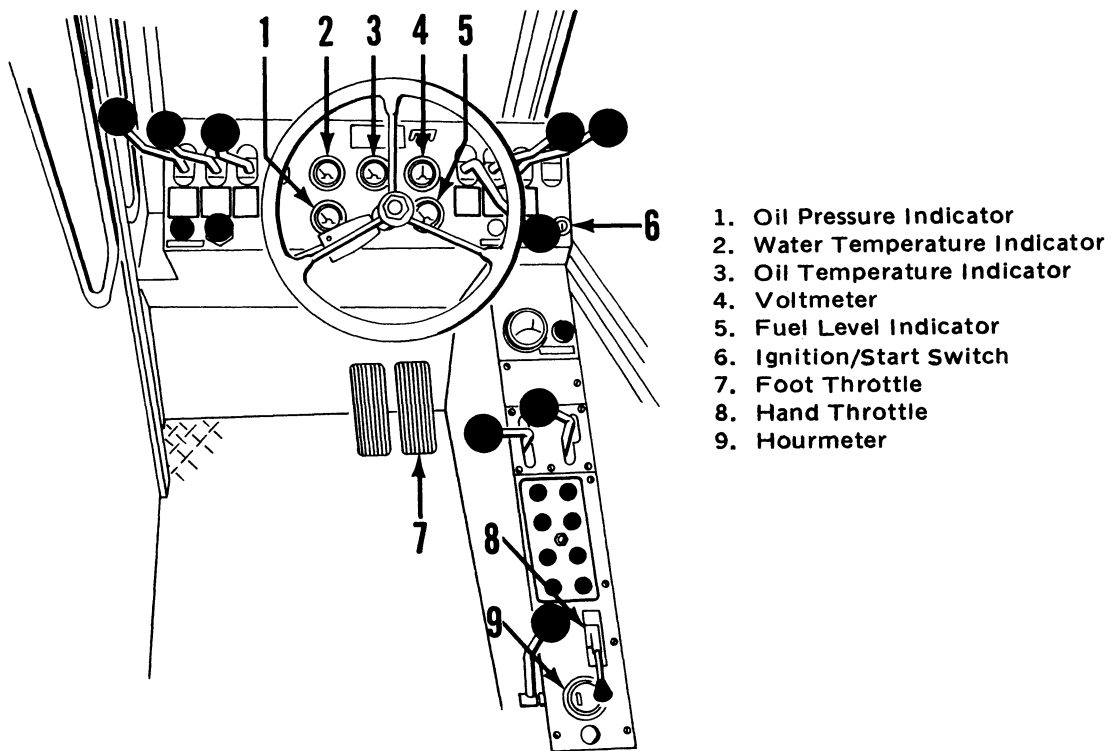
FUEL LEVEL INDICATOR. A fuel level indicator, on the control panel, presents a visual display of the fuel level in the fuel tank.



ENGINE CONTROLS AND INDICATORS

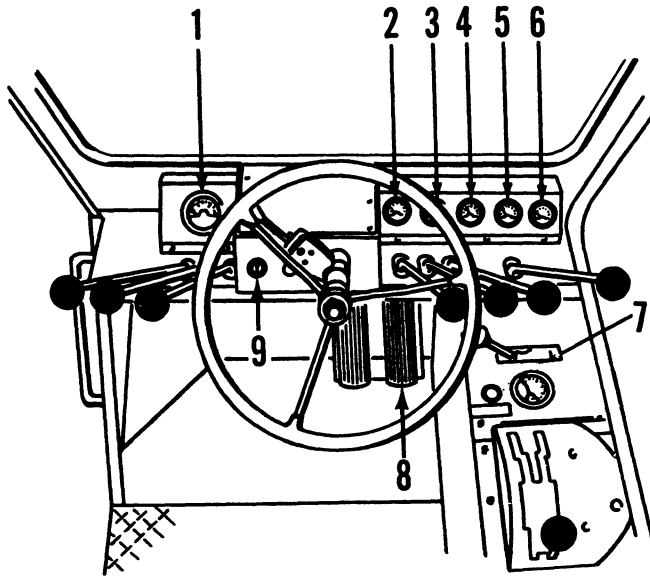


Engine Controls and Indicators — RT59/60 Models — Typical.



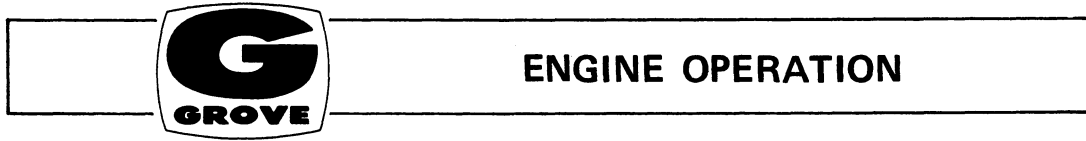
Engine Controls and Indicators — RT59S/60S Models — Typical.

G GROVE ENGINE CONTROLS AND INDICATORS



- 1. Tachometer
- 2. Oil Pressure Indicator
- 3. Water Temperature Indicator
- 4. Voltmeter
- 5. Fuel Level Indicator
- 6. Oil Temperature Indicator
- 7. Hand Throttle
- 8. Foot Throttle
- 9. Ignition/Start Switch

Engine Controls and Indicators -- RT63S Models -- Typical.



STARTING PROCEDURES.

Starting and shutdown procedures for most gasoline engines, as well as those for most diesel engines, generally follow the same pattern. Therefore, the procedures can be applied to the respective engines, except where specific differences are noted. (Refer to applicable engine manufacturer's manual for detailed procedures.)

GASOLINE ENGINES.

WARNING: BEFORE STARTING ENGINE, ASSURE THAT PARKING BRAKE AND SWING (HOUSE) LOCK ARE ENGAGED.

NOTE: IN WARM WEATHER, USE OF THE CHOKE DURING STARTING MAY NOT BE NECESSARY.

DURING COLD WEATHER STARTING, PULL CHOKE ALL THE WAY OUT UNTIL ENGINE STARTS. ADJUST CHOKE TO OBTAIN SMOOTH OPERATION; PUSH CHOKE ALL THE WAY IN WHEN ENGINE REACHES OPERATING TEMPERATURE.

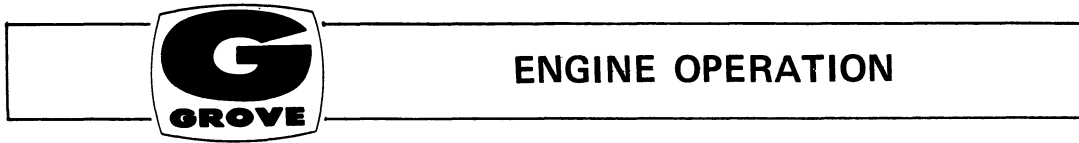
1. Pull choke out approximately half way.

CAUTION: IF ENGINE DOES NOT START PROMPTLY, STOP CRANKING FOR A BRIEF INTERVAL BEFORE ATTEMPTING ANOTHER START.

NEVER CRANK ENGINE FOR MORE THAN 30 SECONDS DURING AN ATTEMPTED START.

2. Position ignition/start or ignition switch to starting position, and hold, until engine starts.
3. After engine start is accomplished, adjust choke, as necessary, for fast-idle warm-up.

NOTE: IF ENGINE IS HOT OR FLOODED AND DOES NOT START PROMPTLY, PUSH CHOKE ALL THE WAY IN AND CONTINUE CRANKING UNTIL ENGINE STARTS.



GASOLINE ENGINES. (CONT)

4. Check engine instruments for proper indications.

CAUTION: IF OIL PRESSURE AND/OR TEMPERATURE INDICATORS DO NOT DISPLAY PROPER READINGS, SHUT DOWN ENGINE AND CORRECT MALFUNCTION BEFORE CONTINUING OPERATIONS.

NOTE: TEMPERATURE INDICATOR SHOULD BEGIN TO REGISTER AFTER APPROXIMATELY FIVE MINUTES OF ENGINE OPERATION.

CAUTION: ALLOW ENGINE TO WARM UP APPROXIMATELY FIVE MINUTES AT FAST-IDLE BEFORE APPLYING LOAD.

DIESEL ENGINES.

WARNING: BEFORE STARTING ENGINE, ASSURE THAT PARKING BRAKE AND SWING (HOUSE) LOCK ARE ENGAGED.

CAUTION: IF ENGINE FAILS TO START PROMPTLY, STOP CRANKING FOR A BRIEF INTERVAL BEFORE ATTEMPTING ANOTHER START.

NEVER CRANK ENGINE FOR MORE THAN 30 SECONDS DURING AN ATTEMPTED START. IF ENGINE FAILS TO START AFTER 30 SECONDS, ALLOW STARTER MOTOR TO COOL FOR APPROXIMATELY TWO MINUTES BEFORE ATTEMPTING ANOTHER START.

IF ENGINE FAILS TO START AFTER FOUR ATTEMPTS, CORRECT MALFUNCTION BEFORE ATTEMPTING ANY FURTHER RESTARTS.

1. Position ignition/start or ignition switch to starting position, and hold, until engine starts.



ENGINE OPERATION

CAUTION: IF OIL PRESSURE AND/OR TEMPERATURE INDICATORS DO NOT DISPLAY PROPER READINGS, SHUT DOWN ENGINE AND CORRECT MALFUNCTION BEFORE RESUMING OPERATION.

2. When start has been accomplished, check engine instruments for proper indications.

NOTE: TEMPERATURE INDICATOR SHOULD BEGIN TO REGISTER AFTER APPROXIMATELY FIVE MINUTES OF ENGINE OPERATION.

CAUTION: ALLOW ENGINE TO WARM UP APPROXIMATELY FIVE MINUTES BEFORE APPLYING A LOAD.

SHUTDOWN PROCEDURES.

GASOLINE ENGINES.

1. Set rpm at fast-idle speed and allow engine to operate approximately five minutes; this allows for heat dissipation.
2. Position throttle lever to idle, if applicable.
3. Position ignition/start or ignition switch to "off".

Emergency Shutdown.

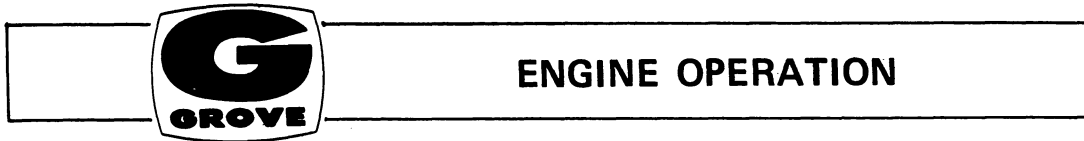
CAUTION: NEVER PULL CHOKE, AS RAW FUEL WILL BE INTRODUCED INTO COMBUSTION CHAMBERS, WASHING OIL FROM CYLINDER WALLS.

Position ignition/start or ignition switch to "off".

CAUTION: CORRECT MALFUNCTION PROMPTING EMERGENCY SHUTDOWN BEFORE RESUMING ANY OPERATION.

DIESEL ENGINES.

1. Remove all load and allow engine to operate at a maximum of one-half speed for approximately five minutes; this allows for heat dissipation.



DIESEL ENGINES.(CONT)

2. Position ignition/start or ignition switch to "off" (or depress stop switch, if applicable).
3. (Detroit Diesel only.) Pull engine PULL TO STOP control up.

Emergency Shutdown.

NOTE: STEPS (1) AND (2) APPLY TO DETROIT DIESEL ONLY.

1. Pull engine PULL TO STOP control up.
2. Pull engine EMERGENCY ONLY control up.
3. Position ignition/start or ignition switch to "off".

WARNING: IF AN OVERHEATING CONDITION REQUIRES AN EMERGENCY SHUTDOWN, EXERCISE EXTREME CAUTION WHEN CHECKING RADIATOR. USE A HEAVY CLOTH OR GLOVES WHEN REMOVING RADIATOR CAP. LOOSEN CAP TO RELIEVE PRESSURE BEFORE REMOVING IT FROM RADIATOR.

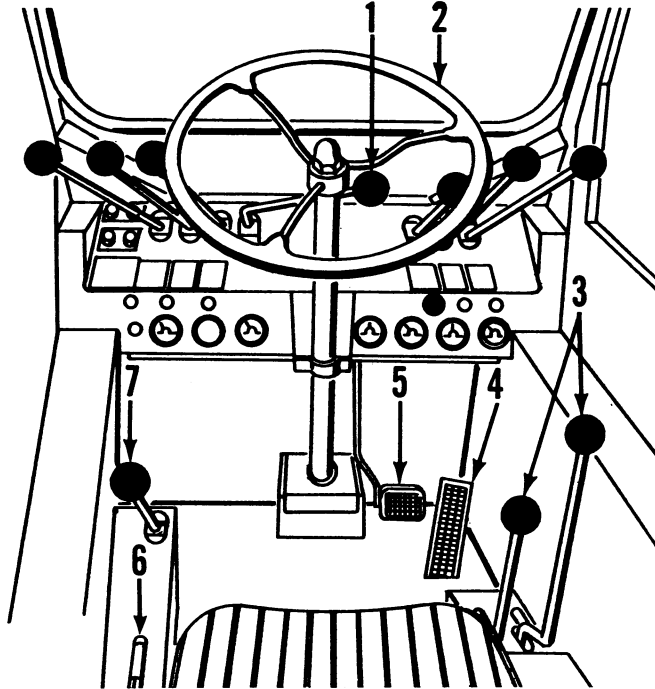
CAUTION: CORRECT MALFUNCTION PROMPTING EMERGENCY SHUTDOWN BEFORE RESUMING ANY OPERATION.

NOTE: ON DETROIT DIESEL ENGINES, THE EMERGENCY STOP AIR SHUTOFF VALVE, LOCATED ON THE RIGHT SIDE OF THE ENGINE AT THE AIR INTAKE MANIFOLD, MUST BE MANUALLY RESET BEFORE THE ENGINE CAN BE RESTARTED.



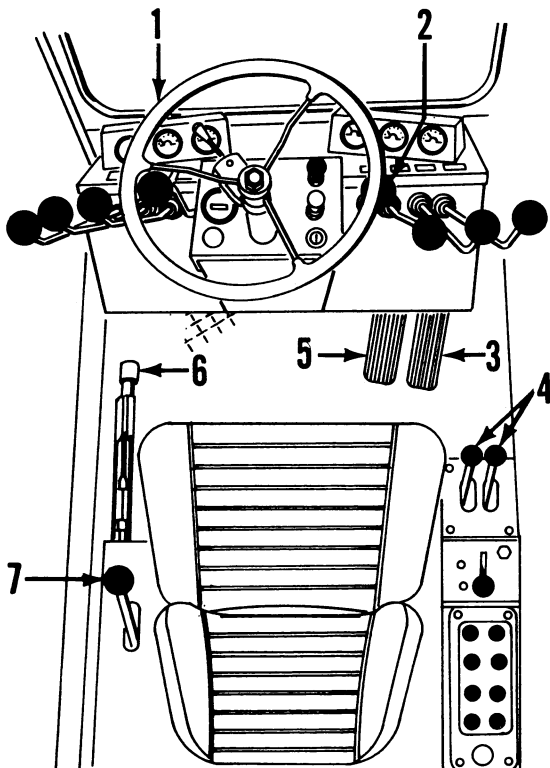
TRAVELING CONTROLS AND INDICATORS

TRAVELING CONTROLS



1. Rear Steer Control
2. Steering Wheel
3. Transmission Shifting Levers
4. Foot Throttle
5. Foot Brake
6. Parking Brake Lever
7. Two/Four-Wheel Drive Selector

Traveling Controls – RT48, 49, 56, and 58 Models – Typical.

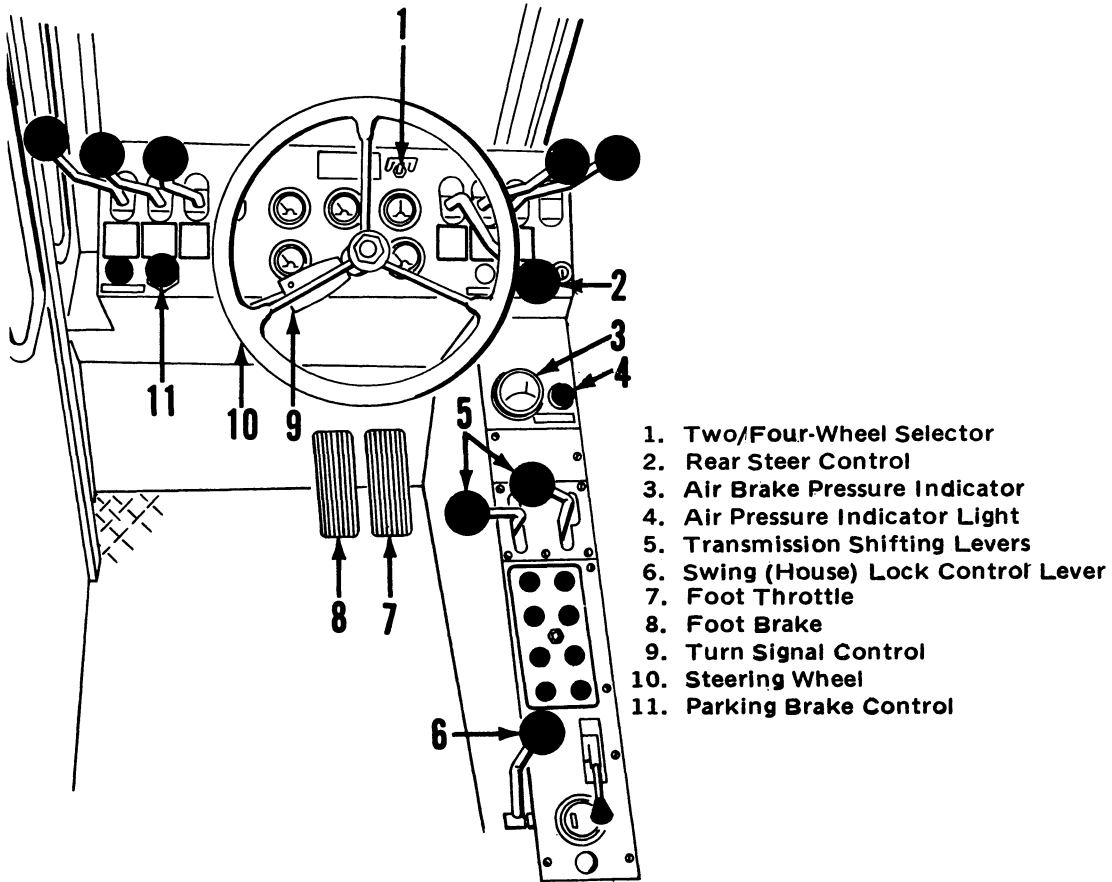


1. Steering Wheel
2. Rear Steer Control
3. Foot Throttle
4. Transmission Shifting Levers
5. Foot Brake
6. Parking Brake Lever
7. Two/Four-Wheel Drive Selector

Traveling Controls – RT59/60 Models – Typical.



TRAVELING CONTROLS AND INDICATORS



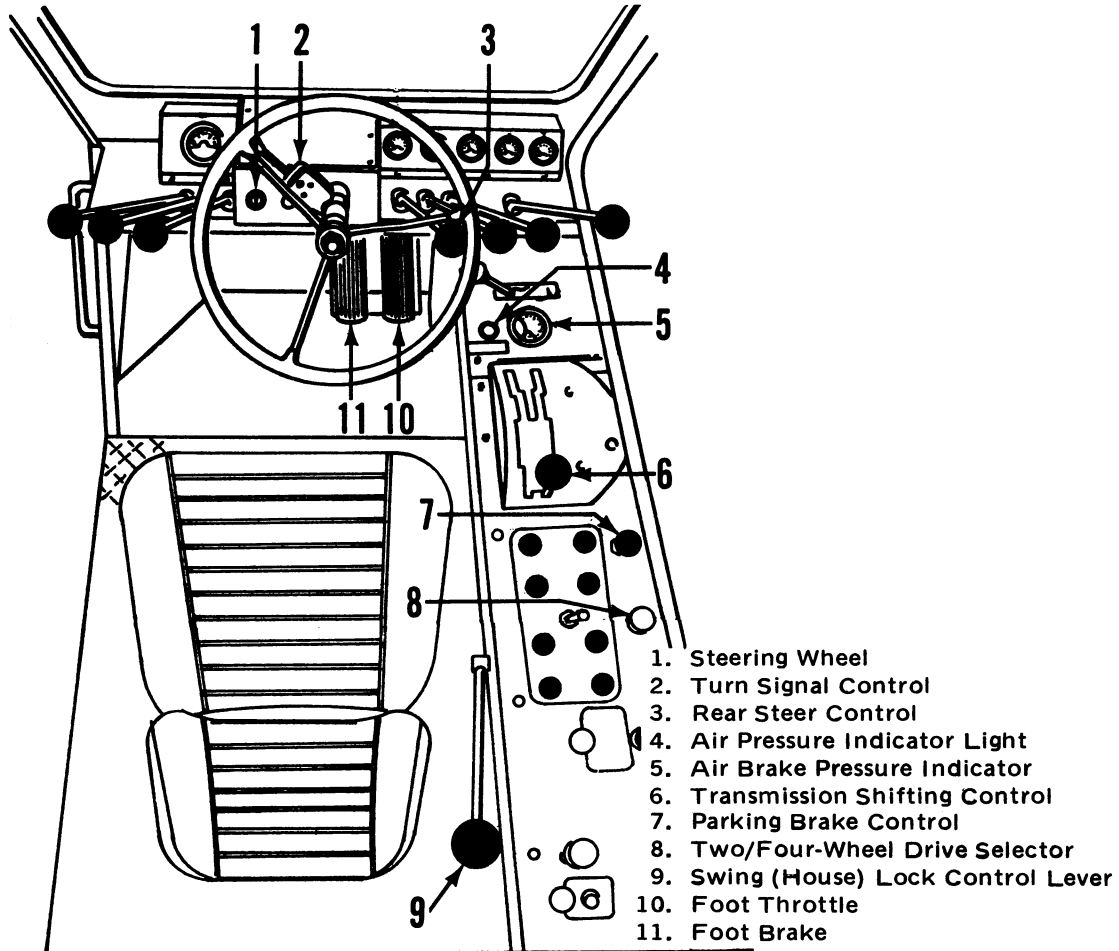
Traveling Controls and Indicators – RT59S/60S Models – Typical.

FOOT THROTTLE. A conventional foot throttle, located on the right side of the cab floor, is used to adjust engine speed (rpm) during crane traveling and for crane operation.

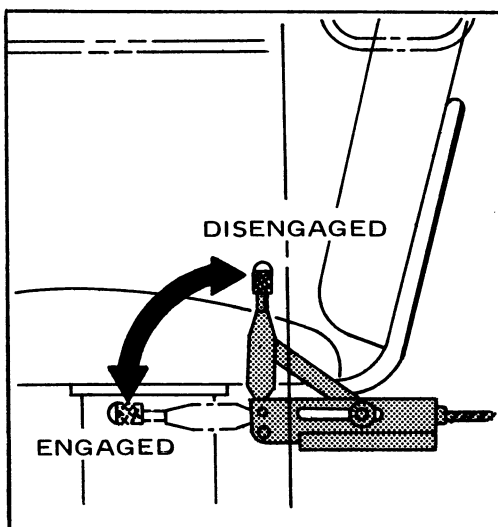
FOOT BRAKE. The foot brake, located to the left of the foot throttle on the cab floor, activates the machine's brake system when actuated.



TRAVELING CONTROLS AND INDICATORS



Traveling Controls and Indicators – RT63S Models – Typical.

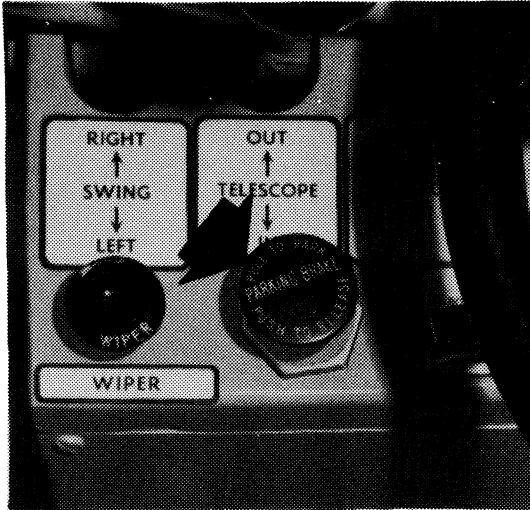


Mechanical Parking Brake Operation.

MECHANICAL PARKING BRAKE. (RT48, 49, 56, 58, 59, and 60 Models.) A parking brake control lever is located on the left side of the operator's seat. The brake is actuated when the lever is "pushed down" to the horizontal position and released when the lever is "pulled up" to the vertical position. (Brake adjustment is accomplished by rotating the control lever knob clockwise.)



TRAVELING CONTROLS AND INDICATORS



Air-Operated Parking Brake.

AIR-OPERATED PARKING BRAKE. (RT59S/60S and RT 63S Models.) The PARKING BRAKE control is located on the control panel (or console). PULL TO PARK for actuation of the air-operated parking brake; PUSH TO RELEASE for deactivation of the brake.

CAUTION: DO NOT ATTEMPT TO MOVE MACHINE UNLESS AIR PRESSURE INDICATOR REFLECTS A MINIMUM OF 75 PSI (95-125

NORMAL), AS AUTOMATIC SPRING BRAKE WILL NOT BE FULLY RELEASED UNTIL AIR PRESSURE REACHES 71 PSI.

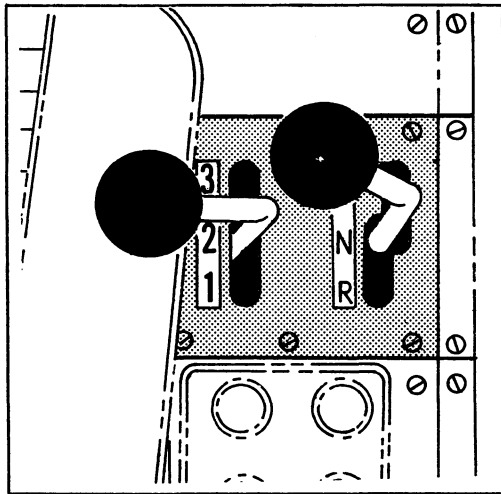
MAIN STEERING CONTROL. A conventional steering wheel, column-mounted in the cab, provides left and right front wheel control of the machine from 0° to 30° .

REAR STEERING CONTROL. A REAR STEER control, located on the control panel, permits independent rear steering for greater machine maneuverability.

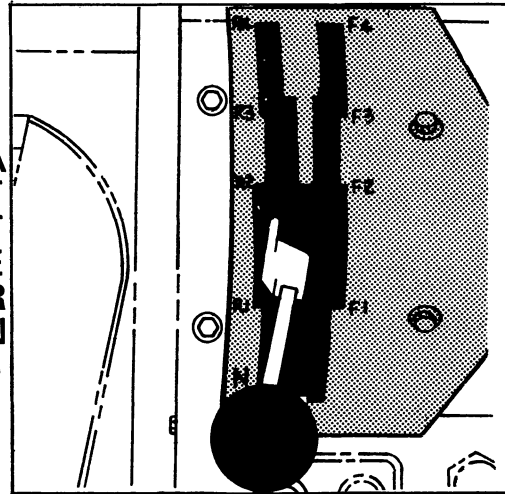


TRAVELING CONTROLS AND INDICATORS

TRANSMISSION SHIFTING CONTROL. The transmission shifting lever(s), located on the right of the operator's seat, afford(s) the operator a selection of forward and reverse gear ranges during crane traveling. (Refer to applicable illustration for shifting pattern.)



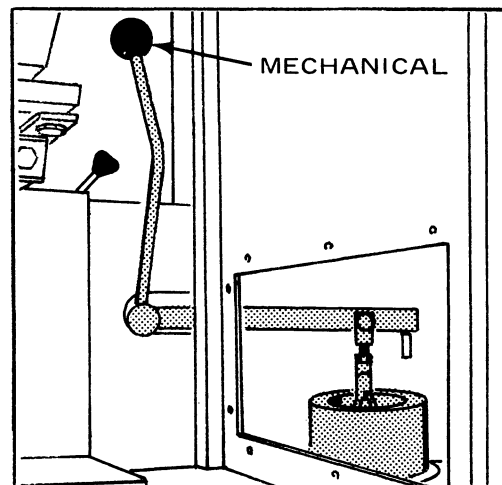
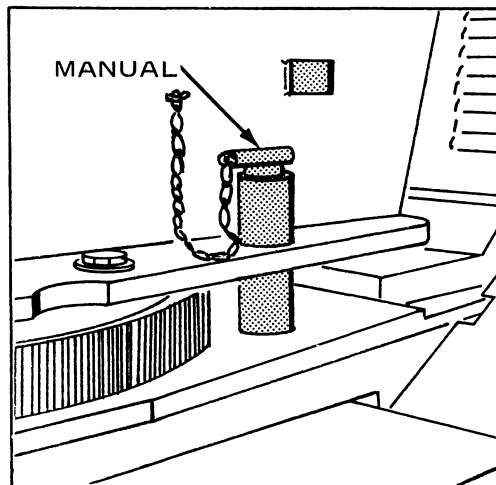
All Models Except RT63S.



RT63S Models.

SHIFTING
PATTERNS

SWING (HOUSE) LOCK. A pin-type lock, located on the left side of the turntable base plate, enables the turntable to be mechanically secured to the carrier when roading the machine. The pin is manually inserted on fixed cab models. The lock is engaged mechanically, by a control lever in the superstructure cab, on RT59S, 60S, and 63S models.



Swing (House) Lock Operation.



TRAVELING CONTROLS AND INDICATORS

TWO/FOUR-WHEEL DRIVE SELECTOR. (Fixed Cab Models.) A lever-type, two/four-wheel drive selector, located on the left side of the operator's seat, affords two or four-wheel drive (HIGH RANGE and LOW RANGE, respectively) operation during crane traveling, as required.

TWO/FOUR-WHEEL DRIVE SELECTOR. (RT59S/60S Models.) A two-position RANGE switch, located on the control panel, affords the operator four-wheel drive operation with the switch positioned to LOW. In HIGH, conventional two-wheel drive is provided.

TWO/FOUR-WHEEL DRIVE SELECTOR. (RT63S Models.) A push-pull type, two/four-wheel drive selector is located on the console. With the selector pulled "up", four-wheel drive is engaged. Conventional two-wheel drive is provided when the selector is pushed "down" (normal position).

WINDSHIELD WIPER CONTROL. A WIPER control, located on the control panel, starts the wiper operation.

LIGHT SWITCH. A push-pull type LIGHT switch, located on the control panel (or console), activates the head and running light circuits.

TURN SIGNAL CONTROL. A turn signal control unit is located on the left side of the steering column. The unit provides conventional signaling capabilities during machine traveling.

HORN CONTROL. A button-type switch, located on the steering column, completes the electrical circuit to the horn.

TRAVELING INDICATORS.

AIR PRESSURE INDICATOR. On models equipped with air brakes, an AIR PRESSURE indicator is located on the console. The indicator shows the air pressure available to the brake system.



AIR PRESSURE INDICATOR LIGHT. On models equipped with air brakes, a **LOW AIR PRESSURE WARNING LIGHT** is located on the console. The light illuminates when the system's air pressure has depleted to 75 psi or below. Pressure required for safe operation of the system is 95-125 psi.

STEERING.

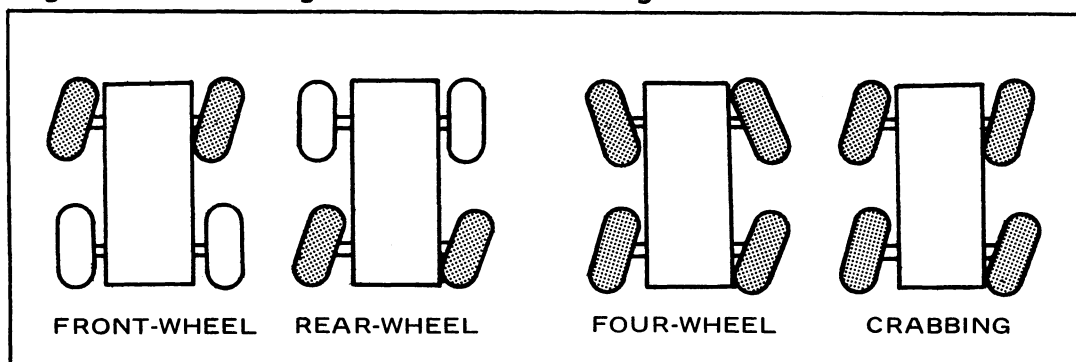
Steering is accomplished by the steering wheel and the rear steer control. These controls, used singly or together, provide front wheel steering, rear wheel steering, four-wheel steering, and crabbing capabilities.

Front Wheel Steering. Conventional front wheel steering is accomplished with the steering wheel. This method of steering should always be used when traveling at higher speeds.

Rear Wheel Steering. Rear wheel steering is controlled by a rear steer control lever. Actuating the control to the desired position activates the rear steer cylinders, thereby steering the machine in the selected direction.

Four-Wheel Steering. Four-wheel steering is accomplished by using both the steering wheel and the rear steer control. Depending upon which direction the operator wishes to travel, the steering wheel is turned in the opposite direction of the rear steer control position. This method of steering allows the machine to turn or maneuver in close, restricted areas.

Crabbing. Crabbing is also accomplished by using both the steering wheel and the rear steer control. Depending upon which direction the operator wishes to travel (crab), the steering wheel is turned in the same direction in which rear steer control is positioned. This method permits traveling the machine forward or in reverse at an angle from 180 degrees — in a “crabbing” manner.



Steering Methods.



CRANE TRAVELING

TRAVELING — GENERAL .

Hydraulic Pump Disconnect.

CAUTION: HYDRAULIC PUMP SHOULD BE DISENGAGED ONLY FOR EXTENDED TRAVELING OR COLD WEATHER STARTING.

Disengaging Hydraulic Pump.

WARNING: ASSURE ENGINE IS SHUT DOWN BEFORE ATTEMPTING TO DISENGAGE HYDRAULIC PUMP.

Push lever back; assure that lever seats in “disengaged” detent.

Engaging Hydraulic Pump.

WARNING: ASSURE ENGINE IS SHUT DOWN BEFORE ATTEMPTING TO ENGAGE HYDRAULIC PUMP.

CAUTION: NEVER FORCE LEVER TO ENGAGE.

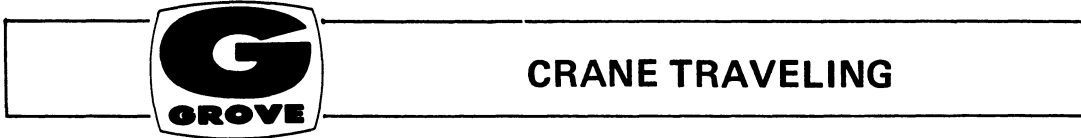
NOTE: IF SHAFT DOES NOT ALIGN WITH, AND ENGAGE PTO, “BUMP” START SWITCH TO GAIN ALIGNMENT — DO NOT ALLOW ENGINE TO START.

THE HOUSING COVER WILL HAVE TO BE REMOVED TO CHECK FOR ALIGNMENT IF LEVER WILL NOT ENGAGE.

Pull lever forward, engaging PTO; assure lever seats in “engaged” detent.

CAUTION: AFTER EVERY TWO HOURS OF TRAVELING, STOP AND ALLOW TIRES TO “COOL OFF” FOR A 30-MINUTE PERIOD.

RT machines are subject to the same road regulations as any truck, regarding local gross weight and length limitations.



WARNING: MODELS EQUIPPED WITH AIR BRAKES ARE EXTREMELY SENSITIVE TO BRAKE PEDAL PRESSURE. APPLY BRAKES SLOWLY UNTIL A “FEEL” OF THE BRAKE IS OBTAINED.

Although RT machines are specifically designed for rough terrain applications, the operator should be extremely cautious and aware of the terrain in which he is operating.

WARNING: DO NOT TRAVEL MACHINE WITH OSCILLATION LOCKOUTS ACTIVATED, AS MACHINE IS SUBJECT TO TIPPING ON UNEVEN SURFACES.

DO NOT TRAVEL WITH EMPTY HOOK IN A POSITION WHERE IT CAN SWING FREELY.

AVOID HOLES, ROCKS, EXTREMELY SOFT SURFACES, AND ANY OTHER OBSTACLES WHICH MIGHT SUBJECT THE MACHINE TO UNDUE STRESSES OR POSSIBLE OVERTURN.

CAUTION: DO NOT TRAVEL MACHINE WITH LIFT CYLINDERS BOTTOMED.

Use four-wheel drive only when greater traction is necessary. (Refer to FOUR-WHEEL DRIVE OPERATION, this section, for operating instructions.)

CAUTION: SHOULD THE MACHINE BECOME IMMOBILIZED, GET A TOWING SERVICE TO FREE THE VEHICLE. SEVERE DAMAGE TO THE TRANSMISSION OR AXLES MAY OCCUR IF THE OPERATOR ATTEMPTS TO FREE THE MACHINE UNASSISTED.

TRAVELING — FORWARD.

WARNING: ASSURE THAT SWING (HOUSE) LOCK IS ENGAGED BEFORE STARTING EXTENDED TRAVELING.

1. After the engine has warmed up, release the parking brake.



CRANE TRAVELING

2. Position transmission shifting lever in first forward speed; depress foot throttle until maximum first gear forward speed is attained.
3. Shift transmission lever to next forward speed; accelerate until maximum range speed is attained.
4. Continue shifting through forward positions, as applicable, until final forward range is attained.
5. Accelerate to desired travel speed.

CAUTION: DO NOT DOWNSHIFT TO A LOWER GEAR IF CRANE IS TRAVELING AT A GREATER ROAD SPEED THAN THE MAXIMUM SPEED OF THE LOWER GEAR.

TRAVELING — REVERSE.

WARNING: OPERATE REAR STEER ONLY FOR ADDED JOB SITE MANEUVERABILITY.

CAUTION: APPLY SERVICE BRAKES AND BRING MACHINE TO A COMPLETE STOP BEFORE SHIFTING TRANSMISSION INTO REVERSE.

Traveling in reverse is accomplished the same way as traveling forward, except for shifting the lever to the reverse ranges. (Refer to TRAVELING — FORWARD.)

FOUR-WHEEL DRIVE OPERATION.

If more traction is required due to slipping or spinning wheels, engage rear axle, activating four-wheel drive. Engage four-wheel drive as follows:

CAUTION: WHEN SHIFTING FROM TWO-WHEEL DRIVE TO FOUR-WHEEL DRIVE (OR FOUR BACK TO TWO), STOP MACHINE UNTIL SHIFTING IS ACCOMPLISHED.

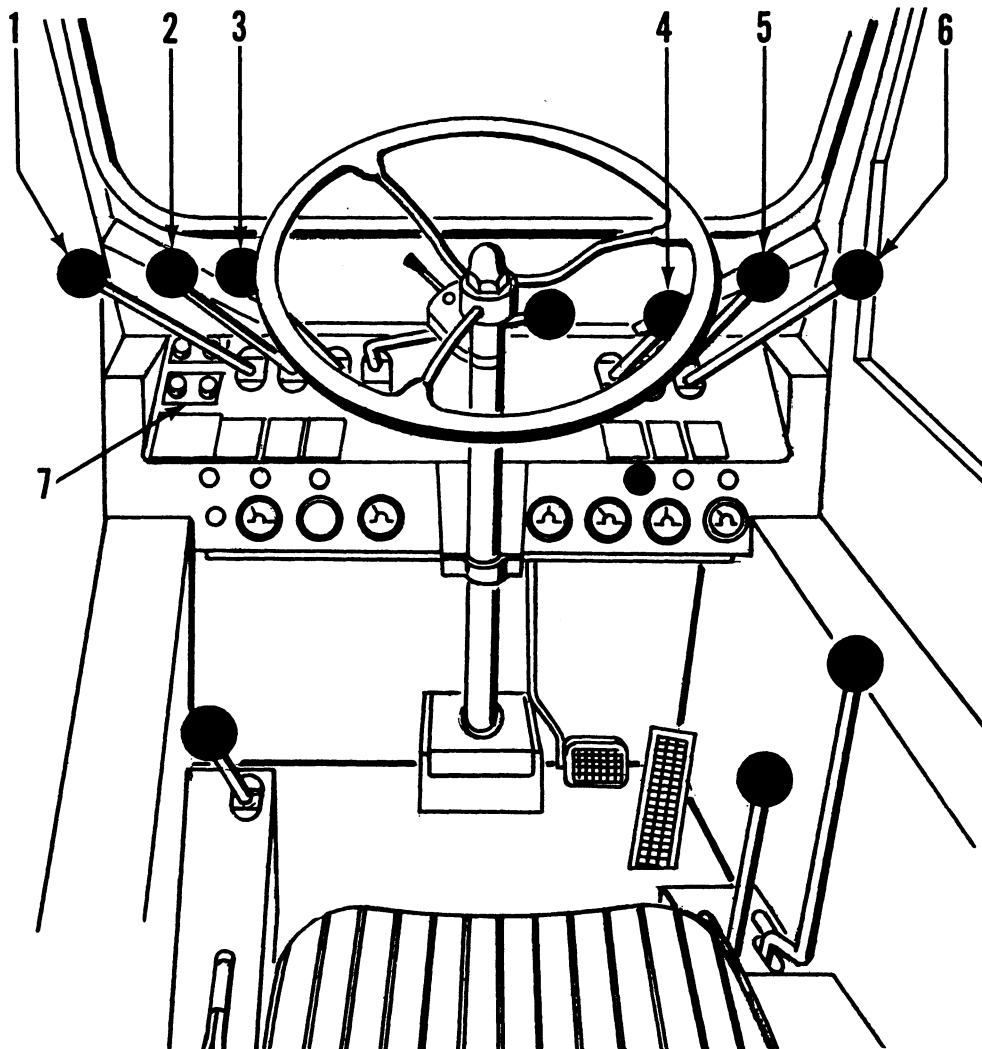
1. Position two/four-wheel drive selector to four-wheel drive position.
2. Return two/four-wheel drive selector to two-wheel drive position when full traction is attained.



OPERATING CONTROLS

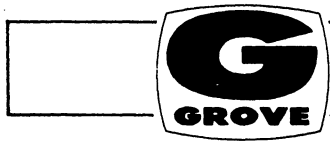
CRANE CONTROL INSTRUCTION PLACARDS.

A control instruction placard is located adjacent to each of the basic crane operating controls. Each placard denotes the function of its corresponding control. Study these placards carefully before attempting to operate the crane.

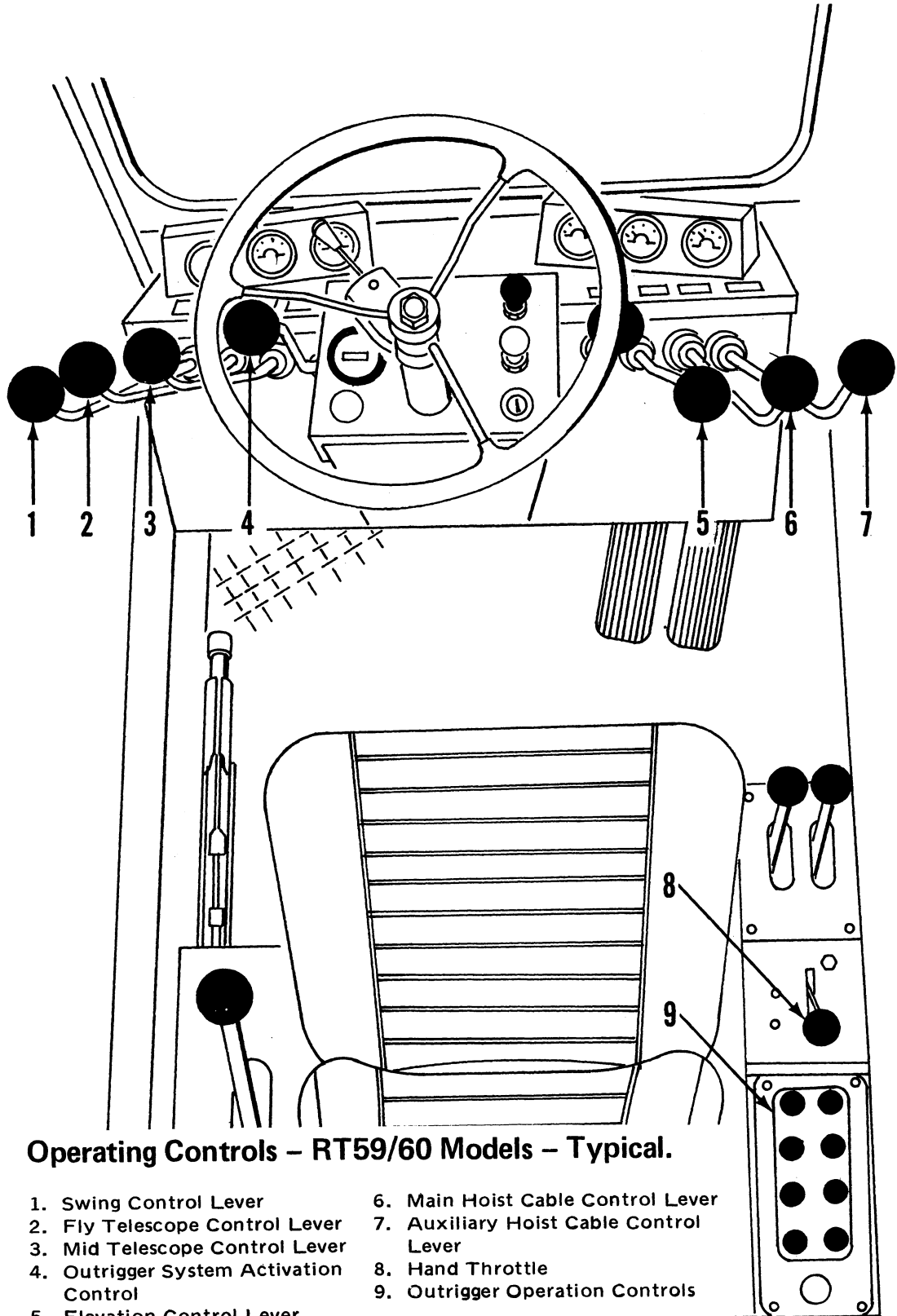


Operating Controls – RT48, 49, 56, and 58 Models – Typical.

- | | |
|--|---------------------------------|
| 1. Swing Control Lever | 5. Elevation Control Lever |
| 2. Fly Telescope Control Lever | 6. Hoist Cable Control Lever |
| 3. Mid Telescope Control Lever | 7. Outrigger Operation Controls |
| 4. Outrigger System Activation Control Lever | |



OPERATING CONTROLS

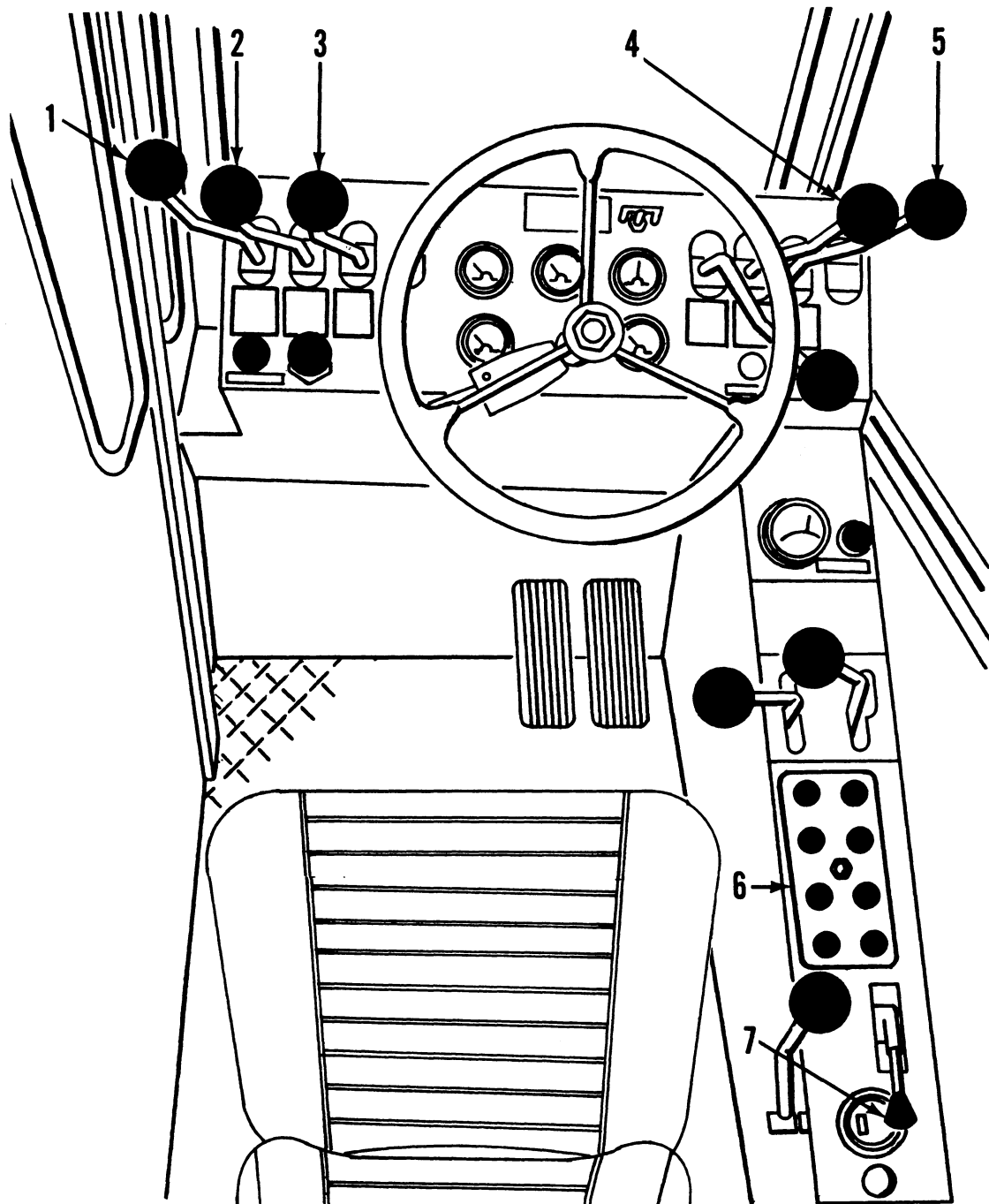


Operating Controls – RT59/60 Models – Typical.

- 1. Swing Control Lever
- 2. Fly Telescope Control Lever
- 3. Mid Telescope Control Lever
- 4. Outrigger System Activation Control
- 5. Elevation Control Lever
- 6. Main Hoist Cable Control Lever
- 7. Auxiliary Hoist Cable Control Lever
- 8. Hand Throttle
- 9. Outrigger Operation Controls



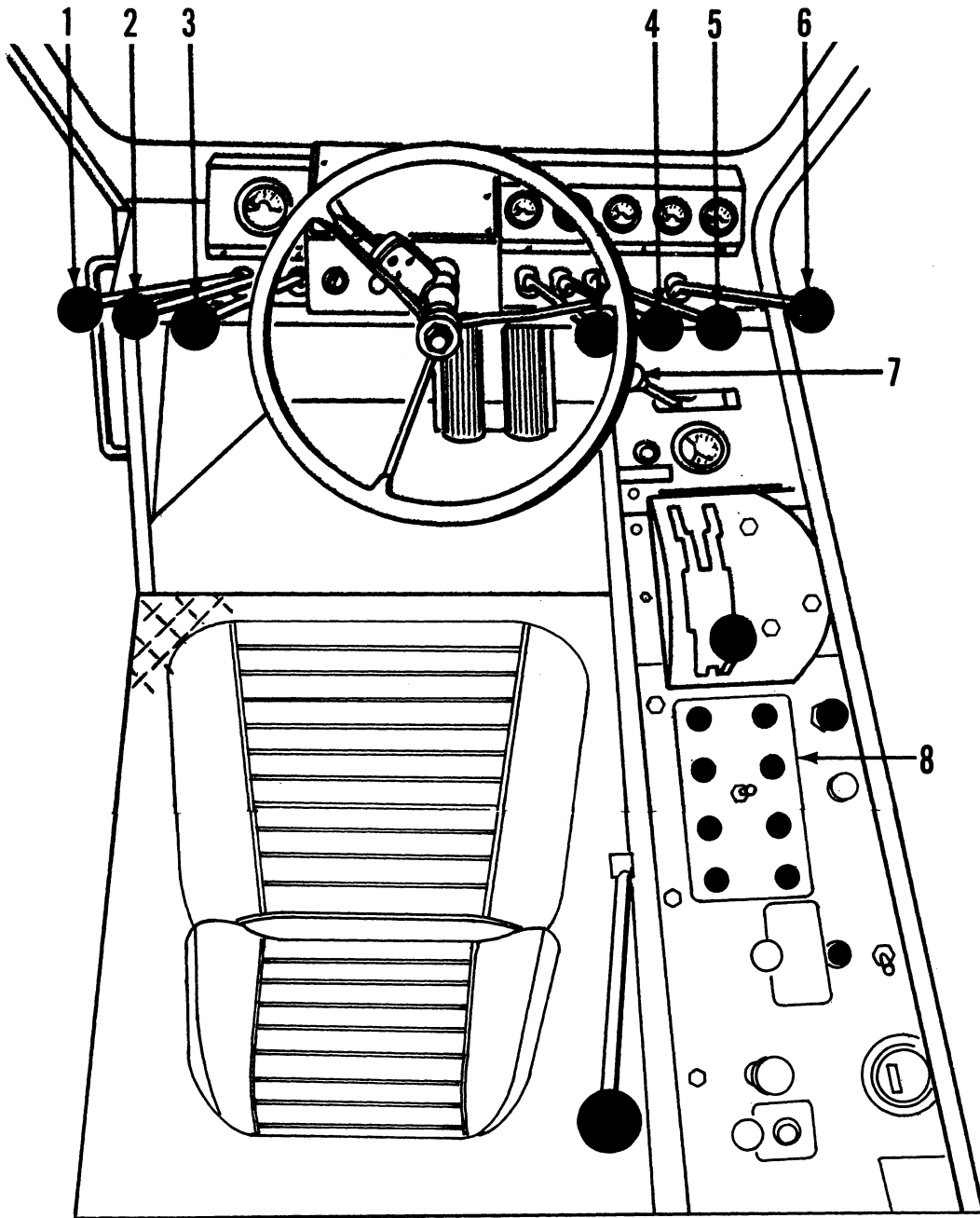
OPERATING CONTROLS



Operating Controls – RT59S/60S Models – Typical.

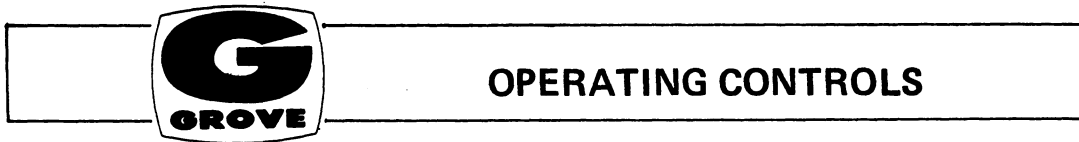
1. Swing Control Lever
2. Fly Telescope Control Lever
3. Mid Telescope Control Lever
4. Elevation Control Lever

5. Hoist Cable Control Lever
6. Outrigger Controls
7. Hand Throttle



Operating Controls – RT63S Models – Typical.

- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Swing Control Lever 2. Fly Telescope Control Lever 3. Mid Telescope Control Lever 4. Elevation Control Lever | <ul style="list-style-type: none"> 5. Main Hoist Cable Control Lever 6. Auxiliary Hoist Cable Control Lever 7. Hand Throttle 8. Outrigger Controls |
|--|--|



SWING CONTROL. The boom SWING control lever, when positioned to LEFT or RIGHT, permits 360 degree continuous rotation in the desired direction.

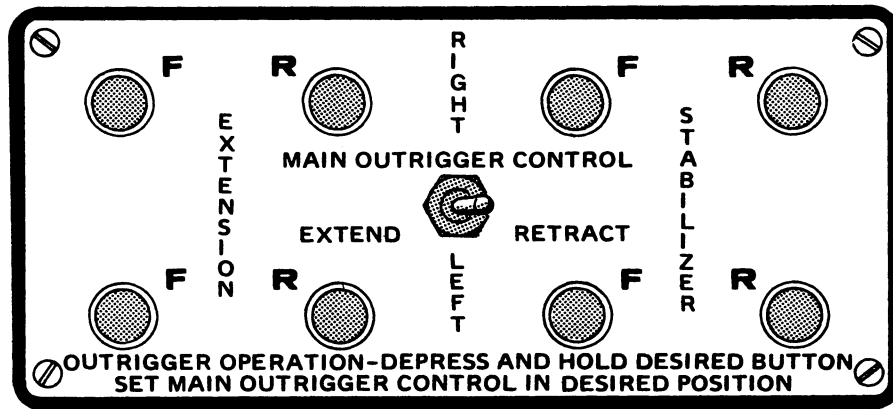
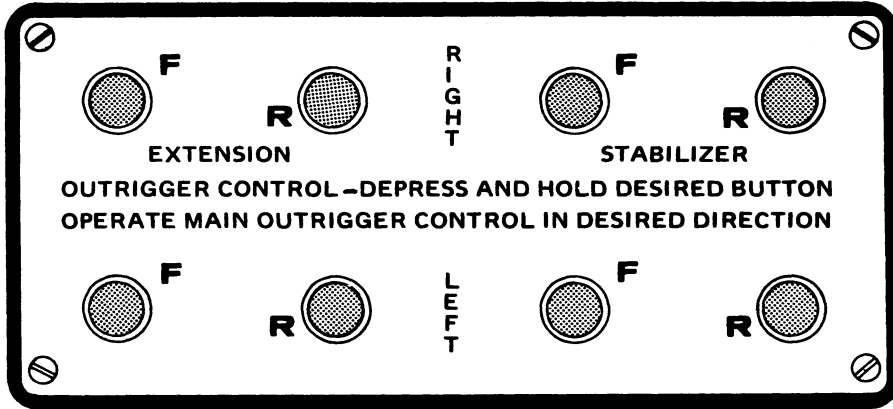
TELESCOPE CONTROLS. The boom TELESCOPE control levers, when positioned to OUT or IN, permit extension or retraction of the boom sections as desired.

BOOM ELEVATION CONTROL. The boom ELEVATION control lever, when positioned to UP or DOWN, controls raising and lowering of the boom as desired.

MAIN HOIST CONTROL. The MAIN HOIST cable control lever permits UP and DOWN (raising and lowering) of the main hoist cable when actuated.

AUXILIARY HOIST CONTROL. The AUXILIARY HOIST cable control lever permits UP and DOWN (raising and lowering) of the auxiliary hoist cable when actuated.

OUTRIGGER SYSTEM ACTIVATION CONTROL. The outrigger system is activated by one of two methods, depending upon crane model. Either a lever-type control, or a two-position switch on the outrigger control panel, initiates system operation.



Outrigger Controls.

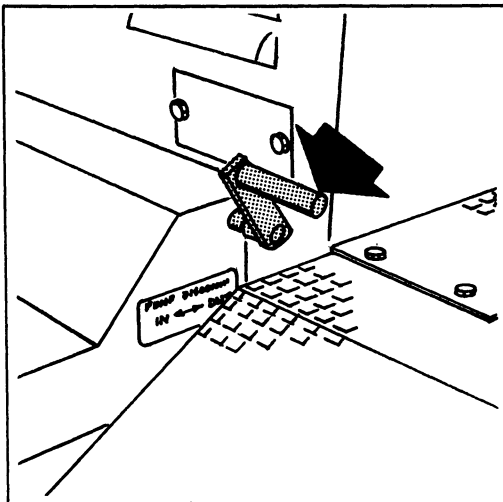
OUTRIGGER OPERATION CONTROLS. The outrigger operation control panel incorporates individual, button-type switches which control positioning of each outrigger as desired.

OSCILLATION LOCKOUT OVERRIDE CONTROL. An override control, located on the console, permits release of the rear axle oscillation lockouts, should operating conditions warrant such action.



PUMP DISCONNECT OPERATION.

The hydraulic pump is installed on the torque converter PTO and operates any time the engine is running, unless pump disconnect is disengaged. Operate pump disconnect as follows:

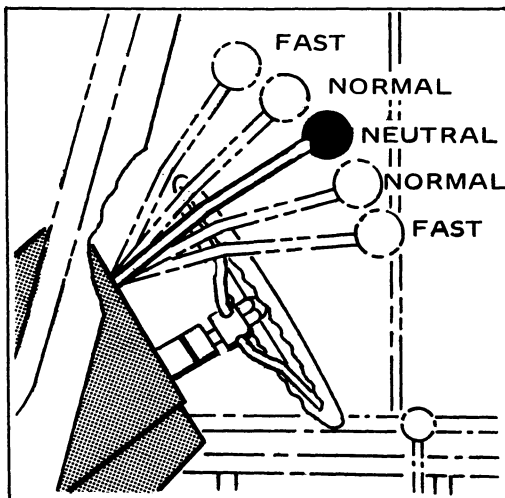


Hydraulic Pump Disconnect.

CAUTION: SHUT DOWN ENGINE BEFORE DISENGAGING OR ENGAGING.

1. To disengage pump, position PUMP DISCONNECT lever to OUT (aft) position.
2. To engage pump, position PUMP DISCONNECT lever to IN (forward) position.

CONTROL LEVER OPERATION.



Control Lever Operation.

Control lever operation for crane functions is standard, i.e., the closer the lever is to neutral (center), the slower the system responds. This applies to both forward and aft movement of the applicable lever.



CRANE OPERATION

NOTE: ALWAYS OPERATE CONTROL LEVERS WITH SLOW, EVEN PRESSURE.

CRANE FUNCTIONS.

SWINGING THE BOOM.

WARNING: BEFORE INITIATING ANY SWING OPERATIONS, ASSURE THAT AREA IN SWING PATH OF HOOK AND/OR LOAD, AS WELL AS TAIL SWING AREA, IS CLEAR OF ALL OBSTRUCTIONS AND PERSONNEL.

WARNING: WHEN SWINGING A LOAD FROM OVER-THE-FRONT TO OVER-THE-SIDE OF A MACHINE, REFER TO OVER-THE-SIDE LOAD CHART TO ASSURE THAT APPLICABLE CAPACITY IS NOT EXCEEDED.

CAUTION: ASSURE THAT SWING (HOUSE) LOCK IS IN UNLOCKED POSITION PRIOR TO INITIATING ANY SWING OPERATIONS.

NOTE: AUTOMATIC OSCILLATION LOCKOUTS WILL ACTIVATE WHEN BOOM IS SWUNG FIVE (5) DEGREES RIGHT OR LEFT OF MACHINE CENTERLINE.

To swing the boom, the SWING control lever is “pushed forward”, away from the operator, for RIGHT swing and “pulled back”, toward the operator, for LEFT swing. Always operate the control lever with a slow, even pressure.

NOTE: TO DECREASE SWING SPEED, CONTROL LEVER IS MOVED CLOSER TO NEUTRAL (CENTER). TO INCREASE SWING SPEED, CONTROL LEVER IS MOVED FURTHER AWAY FROM NEUTRAL (CENTER). (POSITION OF CONTROL LEVER DETERMINES METERED APPLICATION OF AUTOMATIC SWING BRAKE.)



CRANE OPERATION

RAISING AND LOWERING THE BOOM.

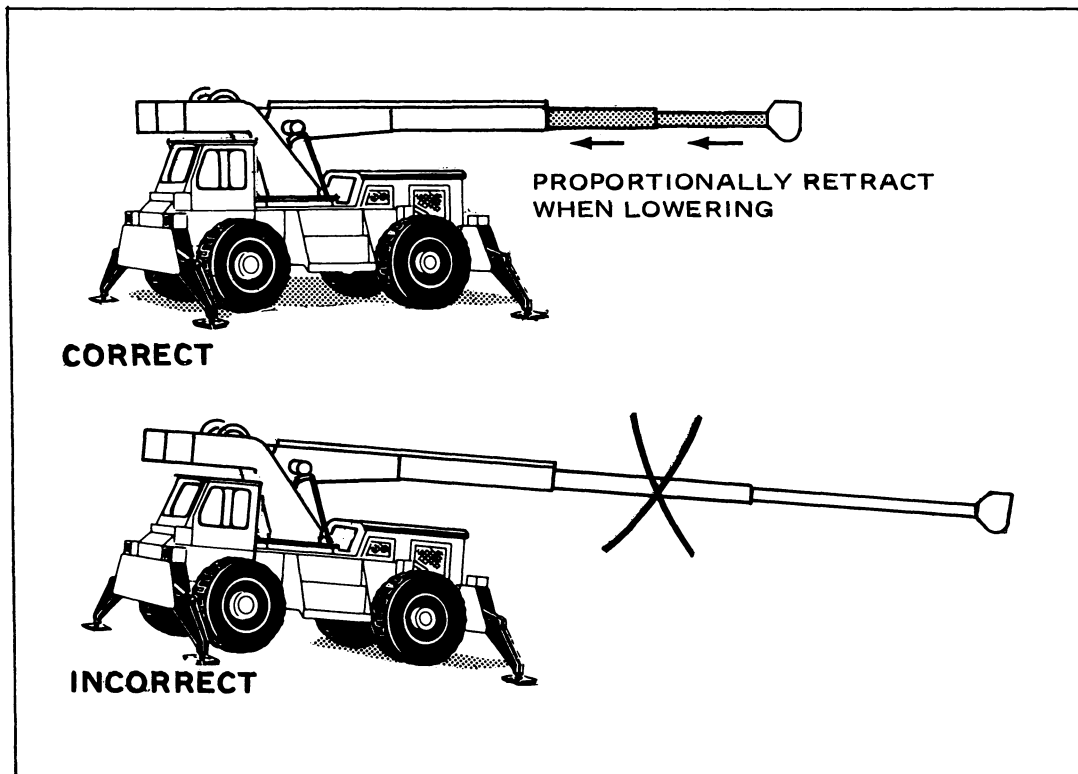
WARNING: BEFORE RAISING BOOM, ASSURE THAT AREA ABOVE AND BENEATH BOOM IS CLEAR OF ALL OBSTRUCTIONS AND PERSONNEL.

NOTE: CONTROL LEVER DISTANCE FROM NEUTRAL (CENTER) DETERMINES BOOM RAISING AND LOWERING SPEED.

Raising the Boom. To raise the boom, the BOOM control lever is "pulled back", toward the operator, to the UP position and held until boom reaches desired elevation.

WARNING: BEFORE LOWERING BOOM, ASSURE THAT AREA BENEATH BOOM IS CLEAR OF ALL OBSTRUCTIONS AND PERSONNEL.

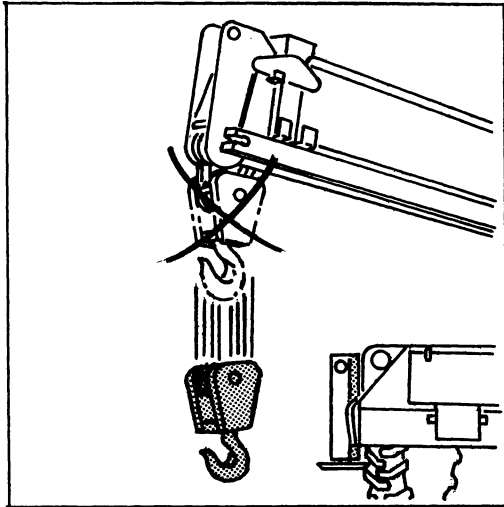
LONG CANTILEVER BOOMS CAN CREATE A TIPPING CONDITION WHEN IN EXTENDED AND LOWERED POSITIONS. RETRACT BOOM PROPORTIONALLY WITH REFERENCE TO CAPACITY OF THE APPLICABLE LOAD CHART.



Proper Boom Lowering.



CRANE OPERATION

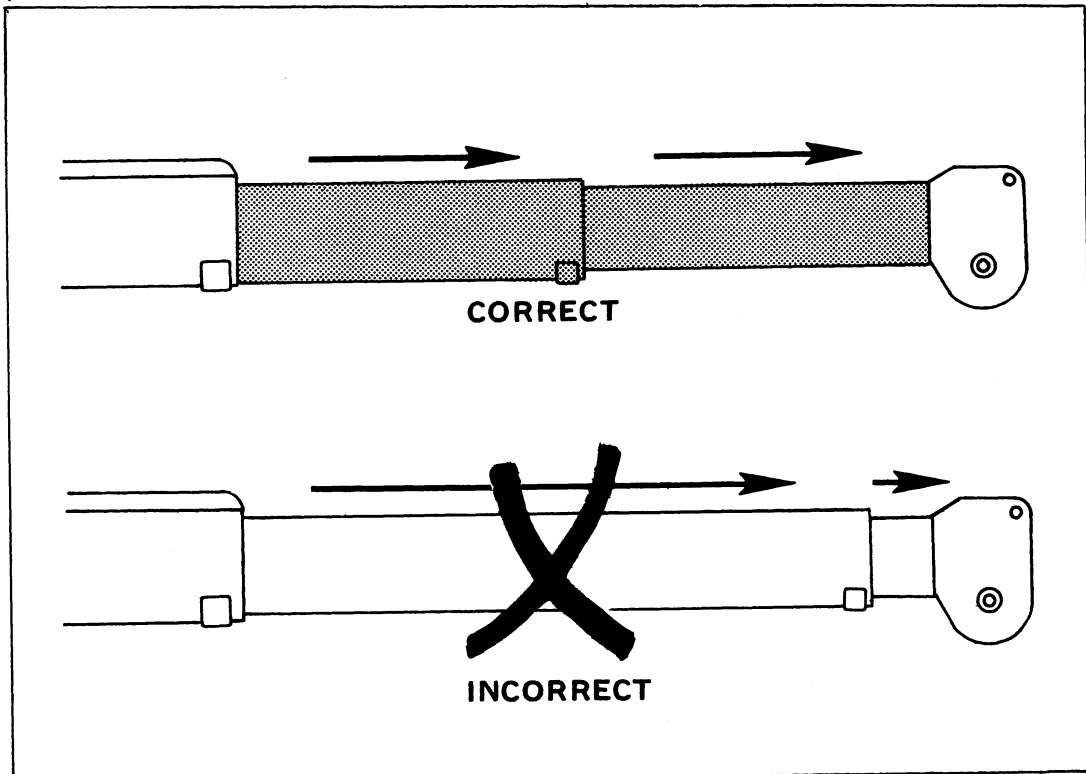


Avoid Two-Blocking.

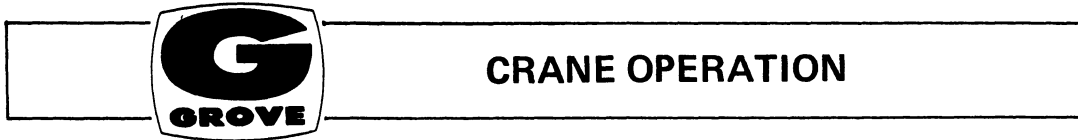
CAUTION: WHEN LOWERING BOOM, LET OUT CABLE SIMULTANEOUSLY TO PREVENT TWO-BLOCKING BOOM NOSE AND HOOK BLOCK.

THE CLOSER THE LOAD IS CARRIED TO THE BOOM NOSE, THE MORE IMPORTANT IT BECOMES TO SIMULTANEOUSLY LET OUT CABLE AS BOOM IS LOWERED.

Lowering the Boom. To lower the boom, the BOOM control lever is "pushed forward", away from the operator, to the DOWN position and held until boom is lowered to desired position.



Proper Boom Telescoping.



TELESCOPING THE BOOM.

NOTE: CONTROL LEVER DISTANCE FROM NEUTRAL (CENTER) DETERMINES BOOM TELESCOPING SPEED.

CAUTION: POWER TELESCOPING SECTIONS MUST BE EXTENDED EQUALLY AT ALL TIMES. LONG CANTILEVER BOOMS CAN CREATE A TIPPING CONDITION WHEN IN EXTENDED AND LOWERED POSITION.

WHEN EXTENDING BOOM, LET OUT CABLE SIMULTANEOUSLY TO PREVENT TWO-BLOCKING BOOM NOSE AND AND HOOK BLOCK.

CHECK LOAD CHART FOR MAXIMUM LOAD AT GIVEN RADIUS, BOOM ANGLE AND LENGTH BEFORE EXTENDING BOOM WITH A LOAD.

Extending the Boom. To extend the boom, the TELESCOPE control levers are “pushed forward” away from the operator, to the OUT position and held until boom extends to desired length.

WARNING: WHEN RETRACTING BOOM, LOAD WILL LOWER UNLESS CABLE IS TAKEN IN SIMULTANEOUSLY.

Retracting the Boom. To retract the boom, the TELESCOPE control levers are “pulled back”, toward the operator, to the IN position and held until boom retracts to desired length.

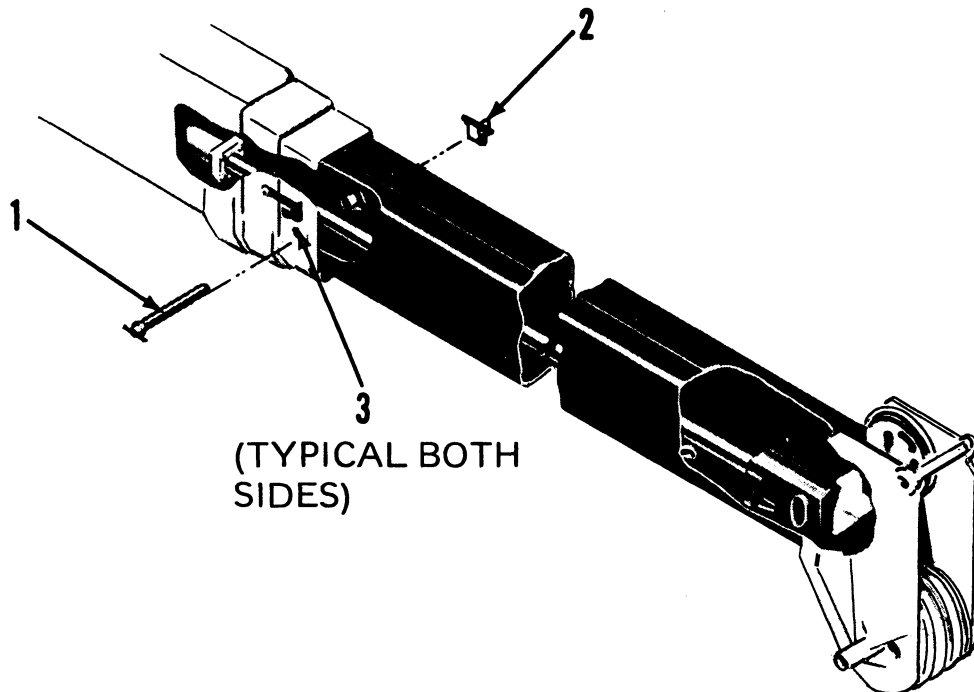
EXTENDING AND RETRACTING MECHANICAL FLY SECTION. (Optional on RT56, 59/59S, 60/60S, and 63S Models.)

Extending Mechanical Fly Section. On machines equipped with mechanical fly section, extend fly in accordance with the following procedure:

1. Position inner/outer-mid section lock (3) forward to engaged position.
2. Remove safety pin (2) from cylinder rod end lock pin (1);

remove lock pin.

NOTE: REMOVING LOCK PIN DISCONNECTS TELESCOPE CYLINDER ROD FROM OUTER-MID SECTION.



Mechanical Fly Section Operation.

3. Extend fly section by actuating outer-mid TELESCOPE control lever.
4. After fly section has been fully extended, retract outer-mid telescope cylinder rod.

NOTE: PINNING HOLE IN AFT END OF FLY SECTION SHOULD BE ALIGNED WITH HOLE IN FORWARD END OF OUTER-MID SECTION.

5. Reinsert cylinder rod and lock pin, locking fly section in extended position (also reconnects outer-mid telescope cylinder); secure with safety pin.



CRANE OPERATION

Extending Mechanical Fly Section. (Cont)

CAUTION: RELEASE INNER/OUTER-MID SECTION LOCK. FAILURE TO RELEASE LOCK WILL PREVENT TELE-SCOPING OF OUTER-MID SECTION, RESULTING IN DAMAGE TO LOCKING MECHANISM.

Retracting Mechanical Fly Section. On machines equipped with mechanical fly section, retract fly in accordance with the following procedure:

1. Remove safety pin (2) from cylinder rod end lock pin (1); remove lock pin.

CAUTION: NEVER ATTEMPT TO RAISE BOOM, ALLOWING GRAVITY TO RETRACT FLY SECTION.

2. Actuate HOIST control, slowly taking in cable. This will two-block the boom nose and hook block, thereby retracting the fly section.
3. Reinsert cylinder rod end lock pin, securing rod end to outer-mid section; secure with safety pin.

LOWERING AND RAISING THE CABLE.

CAUTION: WHEN STARTING OR STOPPING HOIST, DO NOT JERK CONTROL LEVER. JERKING LEVER CAUSES LOAD TO BOUNCE, WHICH COULD RESULT IN POSSIBLE DAMAGE TO MACHINE.

NOTE: CONTROL LEVER DISTANCE FROM NEUTRAL (CENTER) DETERMINES HOIST LINE SPEED.

WHEN LOAD IS STOPPED AT DESIRED HEIGHT, THE AUTOMATIC BRAKE WILL ENGAGE AND RETAIN LOAD AS LONG AS CONTROL LEVER REMAINS IN NEUTRAL.

WARNING: BEFORE LOWERING OR RAISING CABLE (LOAD) ASSURE THAT AREA BENEATH LOAD IS CLEAR OF ALL OBSTRUCTIONS AND PERSONNEL.



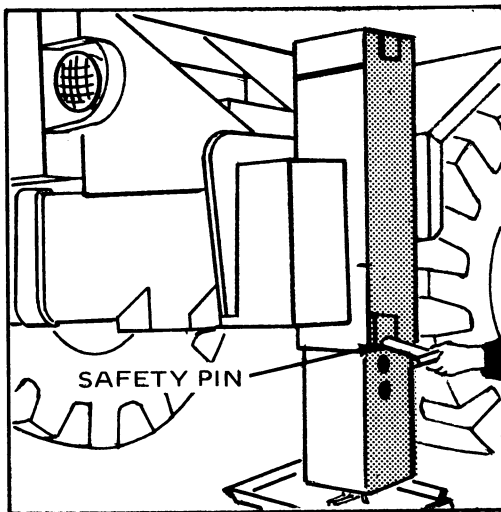
CRANE OPERATION

Lowering the Cable. To lower the cable, the MAIN HOIST or AUXILIARY HOIST control lever is “pushed forward”, away from the operator, to the DOWN position and held until load is lowered to desired height.

Raising the Cable. To raise the cable, the MAIN HOIST or AUXILIARY HOIST control lever is “pulled back”, toward the operator, to the UP position and held until load is raised to desired height.

OUTRIGGER OPERATION.

WARNING: WHEN OPERATING WITH OUTRIGGERS EXTENDED AND DOWN, ALL WHEELS MUST BE OFF THE GROUND WITH OUTRIGGERS SUPPORTING MACHINE.



Pin-Type Outrigger Locks.

IF OUTRIGGERS INCORPORATE PIN-TYPE LOCKS, ASSURE THAT ALL FOUR PINS ARE INSERTED BEFORE LIFTING LOAD.

DO NOT ALLOW SAFETY PINS TO SUPPORT MACHINE'S WEIGHT. PINS SHOULD HAVE FREE MOVEMENT WHEN INSTALLED.

WARNING: DO NOT SET OUTRIGGERS NEAR HOLES, OR ON ROCKY, OR EXTREMELY SOFT SURFACES. THIS MAY CAUSE MACHINE TO OVERTURN, RESULTING IN INJURY TO PERSONNEL.

CAUTION: ACTIVATING OUTRIGGER SYSTEM PRIOR TO OPENING INDIVIDUAL CONTROL CIRCUITS CAN RESULT IN SYSTEM PRESSURE RESTRICTING CIRCUIT VALVES FROM OPENING.



CRANE OPERATION

OUTRIGGER OPERATION. (CONT)

Setting the Outriggers. To set the outriggers, first the applicable outrigger control button(s) is/are depressed, then either the system activation lever is actuated or the MAIN OUTRIGGER CONTROL switch is positioned to EXTEND, as applicable.

CAUTION: BEFORE INITIATING STOWING OPERATIONS, ASSURE THAT ALL SAFETY PINS ARE REMOVED.

Stowing the Outriggers. To stow the outriggers, first the applicable outrigger control button(s) is/are depressed, then either the system activation lever is actuated, or the MAIN OUTRIGGER CONTROL switch is positioned to RETRACT, as applicable.

PRELOAD CHECK.

After the crane has been readied for service, an operational check of all crane functions (with no load applied) should be performed. Accomplish the Preload Check as follows:

CAUTION: OPERATE ENGINE AT OR NEAR GOVERNED RPM DURING PERFORMANCE OF ALL CRANE OPERATIONS.

NOTE: CAREFULLY READ ALL CRANE OPERATING INSTRUCTIONS BEFORE ATTEMPTING "PRELOAD CHECK" AND OPERATING MACHINE UNDER LOAD.

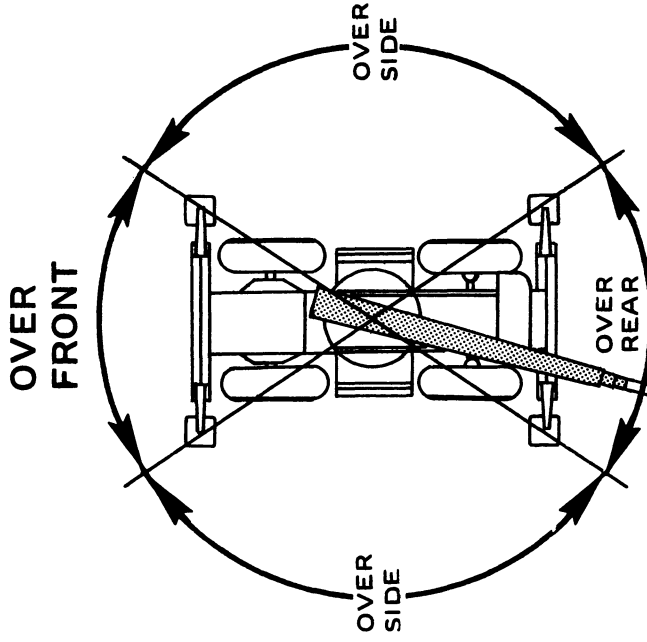
1. Raise, lower, and swing boom right and left a minimum of 45 degrees.
2. Telescope boom in and out; be sure to extend and retract sections proportionally.
3. Raise and lower cable a few times at various boom lengths, assuring that there is no kinking or binding.

HANDLING THE LOAD.

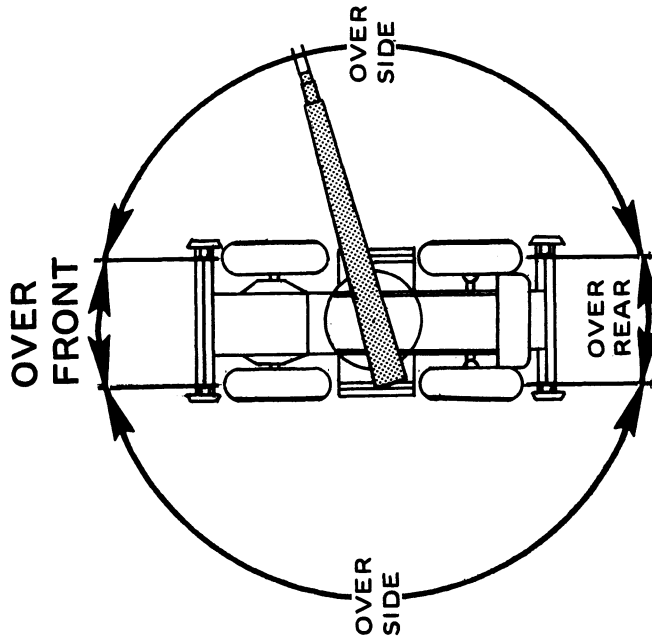
Safety of the operator and ground personnel holds top priority in load handling operations. The following safety rules should take precedence with the operator.



CRANE OPERATION



LIFTING AREAS ON OUTRIGGERS



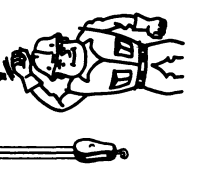
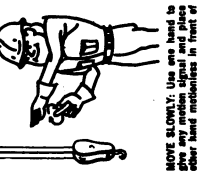
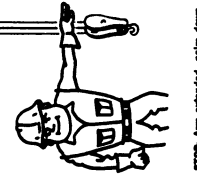
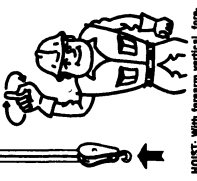
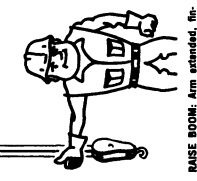
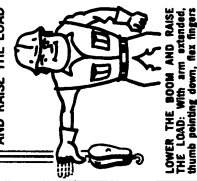
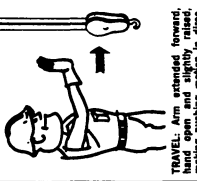
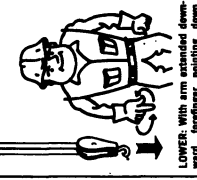
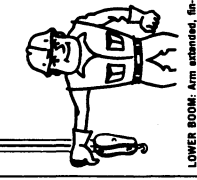
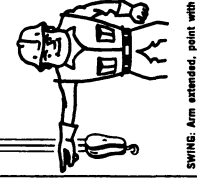
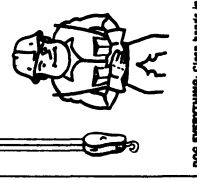
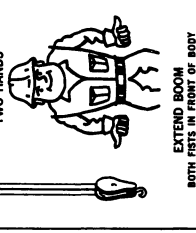
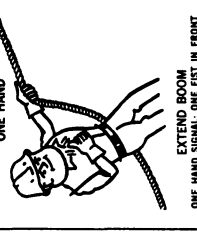
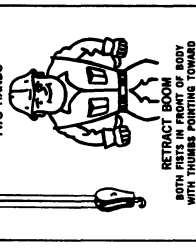
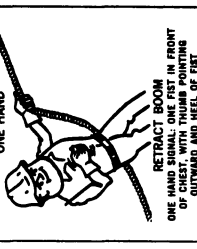
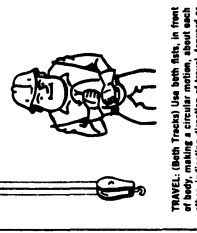
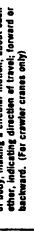
LIFTING AREAS ON RUBBER

(FOR MACHINES WITH PUBLISHED "ON RUBBER" CAPACITIES)

Lifting Areas.



CRANE OPERATION

<p>CRANE SIGNALS ALWAYS STAND IN CLEAR VIEW OF YOUR CRANE HOIST ENGINEER BE SURE TO STAY A SAFE DISTANCE FROM HOOK, BLOCK OR BOOM</p> <p>Published by CRANE & RIGGING SECTION HEAVY SPECIALIZED CARRIERS CONFERENCE In Accordance with U.S. OF AMERICA STANDARDS INSTITUTE</p>	<p>USE MAIN HOIST: Tap foot on head, then use regular signal.</p> 	<p>MOVE SLOWLY: Use one hand to give any motion signal and place other hand motionless in front of chest, indicating direction of movement. (Refer slowly shown as example)</p> 	<p>STOP: Arm extended, palm down, hand motion rigidly.</p> 	<p>HOIST</p>  <p>HOIST: With forearm vertical, forefinger pointing up, move hand in small horizontal circles.</p>	<p>RAISE BOOM</p>  <p>RAISE BOOM: Arm extended, fingers closed, thumb pointing upward.</p>	<p>LOWER THE BOOM AND RAISE THE LOAD</p>  <p>LOWER THE BOOM AND RAISE THE LOAD: With arm extended, thumb pointing down, forefinger pointing up, move hand in small horizontal circles.</p>	<p>TRAVEL</p>  <p>TRAVEL: Arm extended forward, hand open and slightly raised, making pushing motion in direction of travel.</p>	<p>LOWER</p>  <p>LOWER: With arm extended downward, forefinger pointing down, move hand in small horizontal circles.</p>	<p>LOWER BOOM</p>  <p>LOWER BOOM: Arm extended, fingers closed, thumb pointing downward.</p>	<p>SWING</p>  <p>SWING: Arm extended, with hand open, in direction of swing of boom.</p>	<p>DOG EVERYTHING</p>  <p>DOG EVERYTHING: Clasp hands in front of body.</p>
<p>CRANE SIGNALS FOR A TELESCOPING BOOM</p> <p>Published by CRANE & RIGGING SECTION HEAVY SPECIALIZED CARRIERS CONFERENCE In Accordance with U.S. OF AMERICA STANDARDS INSTITUTE</p>	<p>TELESCOPING BOOM TWO HANDS</p>  <p>EXTEND BOOM TWO HANDS: BOTH THUMB POINTING OUTWARD</p>	<p>TELESCOPING BOOM ONE HAND</p>  <p>EXTEND BOOM ONE HAND: ONE HAND WITH THUMB POINTING OUTWARD WITH THUMB TAPPING CHEST</p>	<p>TELESCOPING BOOM TWO HANDS</p>  <p>RETRACT BOOM TWO HANDS: BOTH FISTS IN FRONT OF BODY WITH THUMB POINTING TOWARD EACH OTHER</p>	<p>TELESCOPING BOOM ONE HAND</p>  <p>RETRACT BOOM ONE HAND: ONE HAND SIGNAL ONE FIST IN FRONT OF CHEST WITH THUMB POINTING OUTWARD WITH THUMB TAPPING CHEST</p>	<p>CRAWLER CRANE SIGNALS</p> <p>Published by CRANE & RIGGING OPERATIONS SECTION - HEAVY SPECIALIZED CARRIERS CONFERENCE In Accordance with U.S. OF AMERICA STANDARDS INSTITUTE</p>	<p>TRAVEL (Both Tracks)</p>  <p>TRAVEL (Both Tracks): Use both feet, in front of body, making a circular motion, about each other, indicating direction of travel; forward or backward. (For crawler cranes only)</p>	<p>TRAVEL (One Track)</p>  <p>TRAVEL (One Track): Use the track on side of body, making a circular motion, about each other, indicating direction of travel; forward or backward. (For crawler cranes only)</p>				

Standard Hand Signals..



CRANE OPERATION

HANDLING THE LOAD. (CONT)

1. Do not lift a load if machine is not firmly positioned on rubber or fully extended outriggers.
2. Assure that the area around and beneath load is clear, and kept clear, of all obstructions and personnel.
3. Always use proper chains or slings applicable to type of load.
4. Assure that all ground crew personnel are wearing approved head gear.
5. Long cantilever booms can create a tipping condition when in extended and lowered positions. Retract boom proportionally with reference to capacity of applicable load chart.
6. Refer to applicable capacity load chart before lifting loads.
7. When operating with single or multi-part line, no less than two wraps should remain on hoist drum.

The operator should also be aware of the following important precautions in order to avoid subjecting his machine to undue stresses and strains.

1. DO NOT perform any crane operations with engine at idle. Operate engine at specified rpm during performance of ALL operations.
2. Always keep load as close to crane and ground as possible when swinging boom.
3. Keep distance between boom nose and load as short as possible to prevent excessive load swing.
4. Never lift load with lift cylinders fully retracted (bottomed).
5. When lowering or extending boom, let out cable simultaneously to prevent two-blocking boom nose and hook block.
6. Always operate crane control levers with slow even pressure. Never jerk any control lever.
7. Never suddenly release a control lever to stop a function. Always return lever to neutral in smooth, even manner.

INSTALLING CABLE ON HOIST.

CAUTION: IF CABLE IS WOUND FROM STORAGE REEL ONTO DRUM, REEL SHOULD BE ROTATED IN SAME DIRECTION AS HOIST.



CRANE OPERATION

INSTALLING CABLE ON HOIST. (CONT)

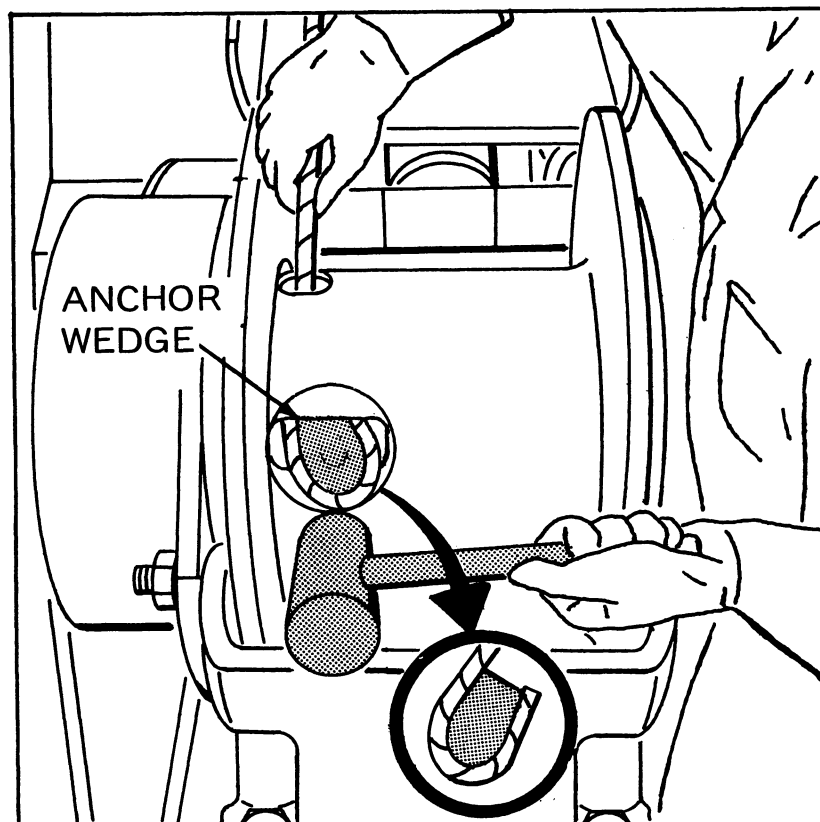
NOTE: CABLE SHOULD BE STRAIGHTENED PRIOR TO INSTALLATION ON HOIST.

Install cable on hoist drum in accordance with the following procedure.

1. Position cable over boom nose sheave and route to hoist drum.
2. Position hoist drum with cable anchor slot on top.
3. Insert cable through slot and position around anchor wedge.

NOTE: END OF CABLE SHOULD BE EVEN WITH BOTTOM OF ANCHOR WEDGE.

4. Position anchor wedge in drum slot; pull firmly on free end of cable to secure wedge.



Installing Cable on Hoist.



NOTE: IF WEDGE DOES NOT SEAT SECURELY IN SLOT, CAREFULLY TAP TOP OF WEDGE WITH MALLET.

5. Slowly rotate drum, assuring that first layer of cable is evenly wound onto drum.
6. Install remainder of cable, as applicable.

CABLE REEVING INSTRUCTIONS.

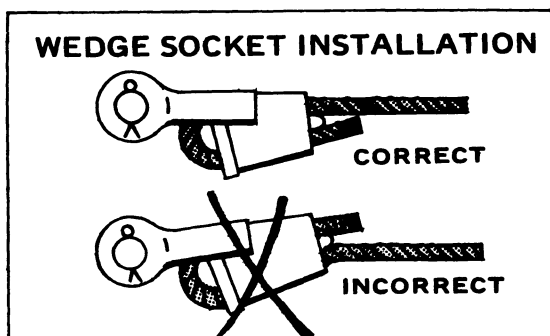
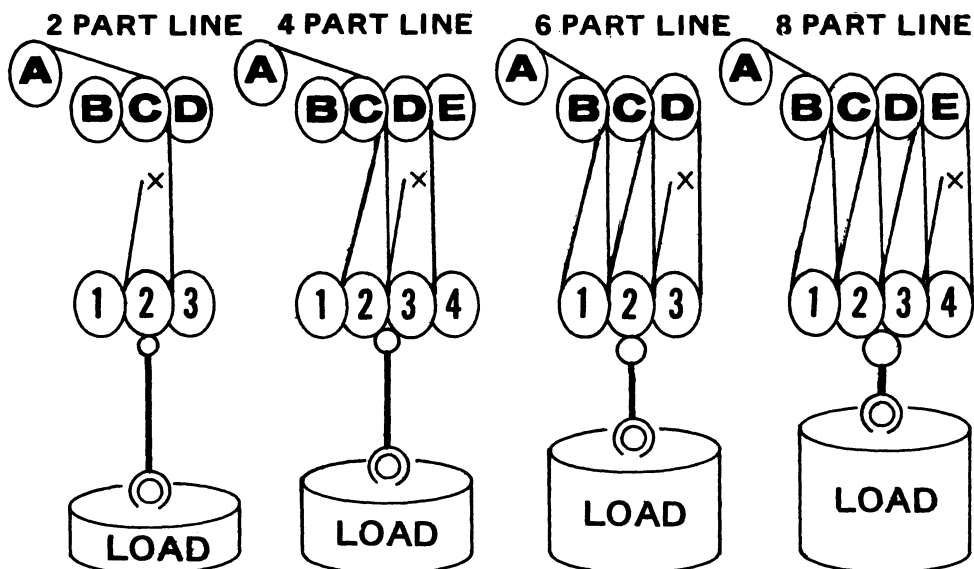
Multi-part reeving permits lifting a greater load than provided with the use of single-part line. Accomplish desired cable reeving as follows:

1. **Two Part Line.** (3-Sheave Hook Block.)
 - a. From idler sheave "A", route cable over sheave "C".
 - b. From sheave "C", route cable down under sheave "2"; secure wedge socket to anchor fitting on boom nose.
2. **Four Part Line.** (4-Sheave Hook Block.)
 - a. From idler sheave "A", route cable over sheave "C".
 - b. From sheave "C", route cable down under sheave "2".
 - c. From sheave "2", cross over and route cable up over sheave "D".
 - d. From sheave "D", route cable down under sheave "3"; secure wedge socket to anchor fitting on boom nose.
3. **Six Part Line.** (3-Sheave Hook Block.)
 - a. From idler sheave "A", route cable over sheave "B".
 - b. From sheave "B", route cable down under sheave "1".
 - c. From sheave "1", cross over and route cable up over sheave "C".
 - d. From sheave "C", route cable down under sheave "2".
 - e. From sheave "2", cross over and route cable up over sheave "D".
 - f. From sheave "D", route cable down under sheave "3"; secure wedge socket to anchor fitting on boom nose.

INSTALLING CABLE ON HOIST. (CONT)

4. Eight Part Line. (4-Sheave Hook Block.)

- a. From idler sheave "A", route cable over sheave "B".
- b. From sheave "B", route cable down under sheave "1".
- c. From sheave "1", cross over and route cable up over sheave "C".
- d. From sheave "C", route cable down under sheave "2".
- e. From sheave "2", cross over and route cable up over sheave "D".
- f. From sheave "D", route cable down under sheave "3".
- g. From sheave "3", cross over and route cable up over sheave "E".
- h. From sheave "E", route cable down under sheave "4"; secure wedge socket to anchor fitting on boom nose.



CAUTION: WHEN REEVING WITH LESS THAN THE TOTAL NUMBER OF SHEAVES IN BOOM NOSE AND/OR HOOK BLOCK, REEVE CABLE OVER AND/OR UNDER CENTERMOST SHEAVES OF BOOM NOSE AND/OR HOOK BLOCK ASSEMBLIES TO EQUALLY DISTRIBUTE CABLE LOAD.

Cable Reeving Diagram.

TRAVELING WITH A LOAD.

CAUTION: WHEN TRAVELING WITH A LOAD, DO NOT EXCEED 2.5 MPH (4KM/H).

All capacity ratings are based on machine being in a stationary position, even though RT models are used in pick and carry operations. Traveling with suspended loads entails many variables, i.e., the type of terrain, boom length, momentum in starting and stopping, etc. Therefore it is impossible to formulate a single standard rating procedure with any assurance of safety. Thus, when traveling with a load, the operator must evaluate the prevailing conditions and determine the applicable safety precautions. The following precautions would fall into a general category.

1. Position boom parallel with direction of travel.
2. Engage swing (house) lock, if applicable.
3. Maintain travel speed suitable to terrain.
4. Maintain correct tire pressures.
5. Avoid sudden starting and stopping.
6. Provide tag or restraint lines to snub load swing.
7. Do not start any travel until outriggers are fully stowed.

JIBS—ERECTION/INSTALLATION AND REMOVAL.

ERECTING AND STOWING SINGLE-SECTION JIB — TYPICAL.

Erecting Single-Section Jib. Erect single-section jib in accordance with the following procedure:

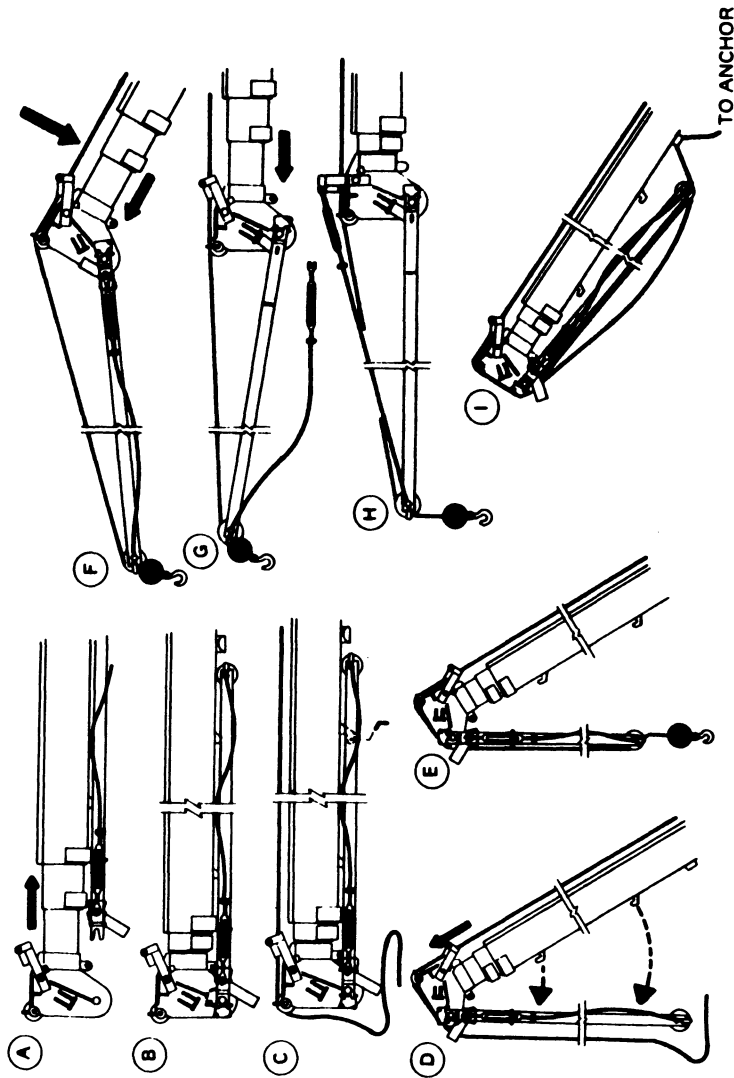
WARNING: DO NOT SET OUTRIGGERS NEAR HOLES, OR ON ROCKY OR EXTREMELY SOFT SURFACES. THIS MAY CAUSE MACHINE TO OVERTURN, RESULTING IN INJURY TO PERSONNEL.

1. Extend and set outriggers.
2. Swing boom to side of carrier.
3. Retract boom, if extended; rig for single-part line (A).
4. Secure jib to boom nose with attach pins; install safety pins in attach pins (B).



CRANE OPERATION

WARNING: REFER TO APPLICABLE LOAD CHART FOR JIB OFFSET AND LOAD LIMITATIONS.



Erecting and Stowing Single-Section Jib — Typical.

NOTE: OFFSET IS ACCOMPLISHED BY LENGTHENING PENDANT TURNBUCKLES. ADJUST FOR EQUAL SUPPORT.



CRANE OPERATION

Erecting Single-Section Jib. (Cont)

5. Remove lock pin from aft stowing bracket (C).
6. Elevate and extend boom, allowing jib to swing free of stowing brackets (D).
7. Reeve cable over jib sheave and attach headache ball (E).
8. Extend and lower boom until jib sheave touches ground.
9. Retract and lower boom until jib is positioned well ahead of boom nose.
10. Take in cable until headache ball contacts jib sheave (F).

CAUTION: DO NOT RAISE JIB AGAINST JIB STOPS, AS DAMAGE TO JIB WILL RESULT.

11. Extend boom, raising jib slightly above horizontal (in reference to boom); disconnect pendant cables from stowing brackets on jib base (G).
12. If applicable, remove lock pins, place gantries in upright position, and reinsert lock pins.
13. Secure pendant cables to boom nose or gantries with attaching hardware.
14. Let out cable until pendant cables support jib (H). The jib is now erected and ready for operation.

Stowing Single-Section Jib. Stow single-section jib in accordance with the following procedure:

1. Retract and swing boom over side of carrier.
2. Take in cable, until headache ball contacts jib tip, relieving weight from pendant cables; disconnect pendant cables from boom nose or gantries as applicable (G). Stow gantries, if applicable.
3. Let out cable and elevate boom (F) until jib is vertical.
4. Remove headache ball from hoist cable; reinstall wedge socket.
5. Route cable under boom and attach to anchor (I).
6. Slightly extend boom and take in cable until jib is parallel to boom.
7. Fully retract boom, engaging jib in stowing brackets; secure jib with lock pin (B).
8. Remove safety and attach pins securing jib to boom nose;



Stowing Single-Section Jib. (Cont)

stow pendant cables and secure with attach pins. Jib is now stowed.

ERECTING AND STOWING TELESCOPING JIB — TYPICAL.

Erecting Telescoping Jib. Erect telescoping jib in accordance with the following procedure:

WARNING: DO NOT SET OUTRIGGERS NEAR HOLES, OR ON ROCKY, OR EXTREMELY SOFT SURFACES. THIS MAY CAUSE MACHINE TO OVERTURN, RESULTING IN INJURY TO PERSONNEL.

1. Extend and set outriggers.
2. Swing boom to side of carrier.
3. Retract boom, if extended; rig for single-part line (A).
4. Secure jib to boom nose with attach pins; install safety pins in attach pins (B).
5. Remove lock pin from aft stowing bracket (C).
6. Elevate and extend boom, allowing jib to swing free of stowing brackets (D).
7. Reeve cable over jib sheave and attach headache ball (E).
8. Extend and lower boom until jib sheave touches ground.
9. Retract and lower boom until jib is positioned well ahead of boom nose.
10. Take in cable until headache ball contacts jib sheave (F).

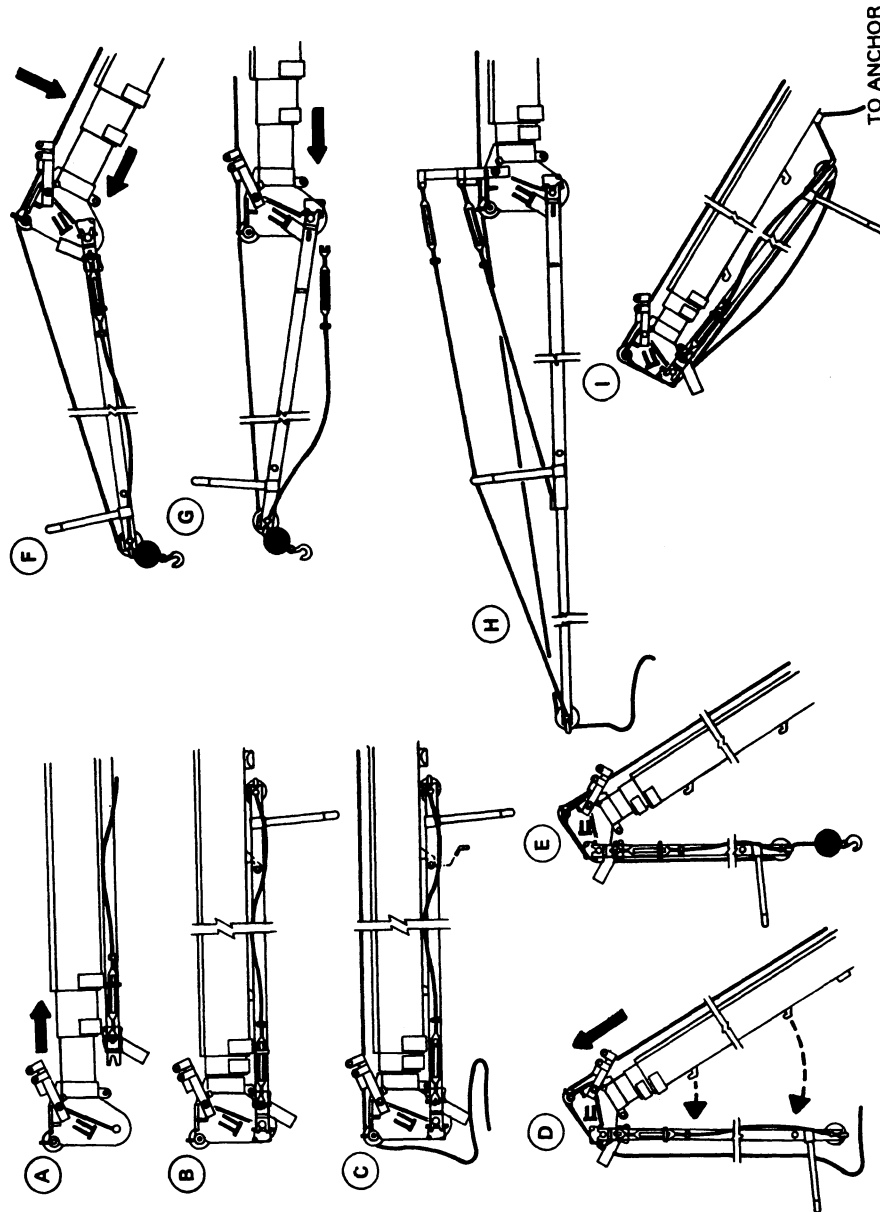
CAUTION: DO NOT RAISE JIB AGAINST STOPS, AS DAMAGE TO JIB WILL RESULT.

11. Extend boom, raising jib slightly above horizontal (in reference to boom); disconnect pendant cables from stowing brackets on jib base (G).
12. Secure base section pendant cables to holes in boom nose with attaching hardware.
13. Let out cable until jib is supported by pendants (H).
14. Remove lock pins, place gantries in upright position; reinsert lock pins.
15. Let out cable, remove lock pin from telescoping section of jib and pull section out to working position; reinsert lock pin.



CRANE OPERATION

WARNING: REFER TO APPLICABLE LOAD CHART FOR JIB OFFSET AND LOAD LIMITATIONS.



Erecting and Stowing Telescoping Jib – Typical.

NOTE: OFFSET IS ACCOMPLISHED BY LENGTHENING PENDANT TURNBUCKLES. ADJUST FOR EQUAL JIB SUPPORT.



Erecting Telescoping Jib. (Cont)

CAUTION: DO NOT RAISE JIB AGAINST STOPS, AS DAMAGE TO JIB WILL RESULT.

16. Extend boom until headache ball contacts jib tip, raising jib slightly above horizontal; secure pendant cables (routed over jib base mast) to jib tip and gantries with attaching hardware.
17. Let out cable until jib is supported by pendants. The jib is now ready for operation (I).

Stowing Telescoping Jib. Stow telescoping jib in accordance with the following procedures:

1. Retract and swing boom over side of carrier.
2. Take in cable until headache ball contacts jib tip, relieving weight from pendant cables; disconnect pendant cables from gantries and jib tip; place gantries in stowed position (H).
3. Remove lock pin and slide telescoping section into base section; reinsert lock pin.
4. Take in cable until headache ball contacts jib tip, relieving jib weight from remaining set of pendant cables; disconnect cables from boom nose (G).
5. Let out cable and elevate boom until jib is vertical (E).
6. Remove headache ball from hoist cable; reinstall wedge socket.
7. Route cable under boom and attach to anchor (I).
8. Slightly extend boom and take in cable until jib is parallel to boom (C).
9. Fully retract boom, engaging jib in stowing brackets; secure jib with lock pin (B).
10. Remove safety and attach pins securing jib to boom nose; stow pendant cables and secure with attach pins. The jib is now stowed (A).



STOWING AND PARKING

WARNING: NEVER PARK MACHINE NEAR HOLES, OR ON ROCKY, OR EXTREMELY SOFT SURFACES. THIS MAY CAUSE MACHINE TO OVERTURN, RESULTING IN INJURY TO PERSONNEL.

After crane is parked, complete the following:

1. If machine has been working on job site, retract and lower boom over front (travel position).

CAUTION: IN SEVERE COLD WEATHER AREAS, ALLOW BOOM LIFT CYLINDER RODS TO EXTEND APPROXIMATELY 3/4-INCH (18 MM) FROM BARREL. THIS WILL PREVENT CYLINDER FROM FREEZING TIGHT AND DAMAGING SEALS ON INITIAL EXTENSION.

2. Engage parking brake.
3. Lower one outrigger until firm contact with standing surface is made.

WARNING: BEFORE LEAVING MACHINE, ASSURE THAT SWING (HOUSE) LOCK IS ENGAGED, IF EQUIPPED.

ENGINE OILS.

There are hundreds of commercial crankcase oils marketed today. Lubricants marketed for heavy duty service consist of refined crude oil containing additives compounded to meet the desired engine performance levels. Oil additive selection is based on evaluations conducted by the oil supplier; therefore, satisfactory OIL QUALITY is the responsibility of the oil supplier. (The term oil supplier is applicable to refiners, blenders and rebranders of petroleum products, and does not include distributors of such products.) Experience has shown that oil performance in commercial heavy duty service applications varies from brand to brand.

Obviously engine manufacturers or users cannot completely evaluate the hundreds of commercial oils; therefore the selection of a suitable lubricant in consultation with a reliable oil supplier, strict observance of his oil change recommendations (used oil sample analysis can be of value), and proper filter maintenance will provide your best assurance of satisfactory oil performance.

Engine lubricant recommendations⁽¹⁾ are based on general experience with current lubricants of various types and their availability.

MIL-L-2104C LUBRICANTS.

Diesel and gasoline engines have given optimum performance and experienced the longest service life with the MIL-L-2104C, SAE 30 oils. MIL-L-2104C oils have superseded MIL-L-2104B and Supplement 1 oils. MIL-L-2104C, SAE30 oils should be used during run-in prior to initial oil drain and are recommended for continued use thereafter. Contact a reliable oil supplier and obtain his assurance that his product has been tested and given good performance. An SAE30 oil of MIL-L-2104C performance level is recommended for year-round use. Lower viscosity oils or multigrade products will usually result in less than nominal engine life.

⁽¹⁾ Military and engine manufacturers lubricant specifications are subject to change and equipment users should keep informed of the latest developments.



LUBRICATION AND FUEL RECOMMENDATIONS

MULTIGRADE LUBRICATING OILS.

Multigrade oils are NOT recommended. An SAE30 grade is desirable for year-round use when cold starting can be accomplished. Multigrade oils should be considered only as the "last resort" to facilitate starting when prolonged exposure to temperatures below freezing is unavoidable and adequate starting aids are unavailable.

Experience clearly indicates that multigrade oils are NOT comparable to SAE30 lubricants for heavy duty diesel service. Cylinder liner scuffing, liner port and ring groove deposit levels are all greater when using multigrade lubricants. This results in shortened engine life.

COLD WEATHER OPERATION.

Cold weather starting is easier when immersion type electrical coolant heaters can be used. Batteries, cables and connectors of adequate size, generators or alternators of ample capacity, proper setting of voltage regulators, ether starting aids, oil and coolant heater systems, and proper fuel selection will accomplish starting with the use of SAE30 oil. For complete cold weather starting information, consult an authorized diesel service outlet.

OIL CHANGES.

It is recommended that new engines be run with 100 hour oil change periods. The drain interval may be then gradually increased, or decreased after experience with a specific lubricant. The recommendations of the oil supplier (analysis of the drained oil can be helpful here) should also be considered in determining the most practical oil change for the particular service.

Solvents should not be used as flushing oils in running engines. Dilution of the fresh refill oil supply can occur which may be detrimental.



LUBRICATION AND FUEL RECOMMENDATIONS

OIL FILTRATION.

Heavy sludge deposits on the oil filter elements at oil change time are an indication that the detergency of the oil has been exhausted. When this occurs the oil drain interval should be shortened. Since abrasive dust, metal particles and carbon material accumulate in the lubricating oil during engine operation, the oil filter elements must be replaced each time the oil is changed.

NOTE: THE MANUFACTURER'S WARRANTY APPLICABLE TO ENGINES PROVIDES IN PART THAT THE PROVISIONS OF SUCH WARRANTY SHALL NOT APPLY TO ANY ENGINE UNIT WHICH HAS BEEN SUBJECTED TO MISUSE, NEGLIGENCE OR ACCIDENT. ACCORDINGLY, MALFUNCTIONS ATTRIBUTABLE TO NEGLIGENCE OR FAILURE TO FOLLOW THE MANUFACTURER'S LUBRICATING RECOMMENDATIONS MAY NOT BE WITHIN THE COVERAGE OF THE WARRANTY.

LUBRICANTS.

Specific recommendations of brand and grade of lubricants is not made due to regional availability, operating conditions, and the continual development of improved products. Where questions arise, refer to the component manufacturer's manual and a reliable supplier.

EXTREME PRESSURE.

A multi-purpose grease having a minimum dripping point of 350° F (176.6°C), with excellent water resistance and extreme pressure characteristics.

DRIVE GEAR.

"Standard" SAE140 viscosity lubricants are to be used in units that operate under average conditions. Where extreme low temperatures prevail, "optional" SAE90 viscosity lubricants may be required. This multi-purpose extreme pressure gear oil must meet military specifications MIL-L-2105B and provide necessary and suitable load-carrying characteristics to prevent scoring and wear, have



LUBRICATION AND FUEL RECOMMENDATIONS

good stability in storage and service and give good resistance to corrosion. Fillers or any other substances which produce an artificial viscosity are not permitted. An API-GL-4 or API-GL-5 lubricant best meet these requirements.

WHEEL BEARING GREASE.

This grease shall be a homogenous combination of refined petroleum oil and stable soaps or thickeners which will produce a smooth textured product in an NLGI Grade No. 2 consistency. It shall not contain corrosive or abrasive materials and it shall inhibit corrosion in the presence of moisture.

CHASSIS GREASE.

This NLGI Grade No. 0 grease shall be a homogenous combination of refined mineral oil and metallic soap or a mixture of metallic soaps. The grease shall not contain any fillers which adversely affect the lubricating qualities of the product. It may have additives that give a high degree of protection against corrosion of metal parts and oxidation of grease. This product shall be a non-corrosive, and may be water-resistant but not waterproof; smooth fiber grease of excellent mechanical and storage stability.

POWER STEERING FLUID.

MIL-L-2104C oils, viscosity SAE10W is normally recommended. Automatic transmission fluid may be used in this system but DO NOT USE hydraulic brake fluid, shock absorber fluid or similar oils.

AUTOMATIC TRANSMISSION FLUID.

Lubricants used in the automatic transmissions of RT machines should be qualified Type A (Suffix A) Automatic Transmission Fluid, or equivalent, as recommended by the component manufacturer. Lubricants shall be well refined, free from water, sediment, acid, or any other substance detrimental to proper performance.



LUBRICATION AND FUEL RECOMMENDATIONS

GASOLINE.

A good grade of gasoline with a minimum octane rating (by Research method) of 90 will be suitable for all carburetor type engines. The cleanliness and quality of gasoline will generally be no better than the source of supply, and the purchase of standard branded products marketed by reputable oil companies is usually the soundest practice.

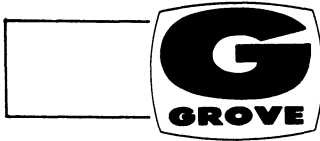
To further assist in identifying suitable grades of gasoline, the product should conform to Federal Specification VV-M-561 — Regular grade, Class A, for summer use, and Class B for winter. Gasoline which has been in a fuel tank on machine or in storage for over three months may be “stale”, and because of known tendency to form deposits in fuel lines, intake manifold, carburetor, etc., should preferably be discarded or employed for some other purpose not requiring a high level of quality.

DIESEL FUEL.

The quality of the fuel oil used for high-speed diesel engine operation is a major factor in satisfactory engine performance and life. The fuel oils selected must be clean, completely distilled, stable and noncorrosive. Enlist the aid of your supplier in obtaining proper fuel oil. The responsibility for clean fuel lies with the fuel supplier as well as with the operator.

DISTILLATION RANGE, CETANE NUMBER, and SULFUR CONTENT are three of the most important properties in the selection of diesel fuels for optimum combustion and minimum wear. Engine speed, load, and atmospheric temperature influence the selection of the fuel with respect to distillation range and cetane number. The SULFUR CONTENT of the fuel must be as low as possible, to avoid excessive deposit formation and premature wear.

Diesel fuels are generally marketed according to ASTM DESIGNATION D975 and only distillate fuels No. 1D and 2D are considered satisfactory for diesel engines. These fuels should not be



LUBRICATION AND FUEL RECOMMENDATIONS

confused with the domestic type furnace oils ASTM D396 which have similar properties but are not always satisfactory for engine use due to their varying composition, cetane number, and distillation range.

As a guide to the selection of the proper fuel oil for various applications refer to the Fuel Oil Selection Chart and the ASTM Classification.

FUEL OIL SELECTION CHART

Type Engine Service	General Fuel Classification	Final Boiling Pt. (Max.)	Cetane Number (Min.)	Sulfur Content (Max.)
Light load and speed with considerable idling.	No. 1-D	555 ° F	45	0.30%
Light load and speed.	Winter No. 1-D Summer No. 1-D	600 ° F 600 ° F	40 45	0.50% 0.50%
Medium load and speed.	Winter No. 1-D Summer No. 2-D	600 ° F 675 ° F	45 45	0.50% 0.50%
Heavy load and speed and idling.	Winter No. 2-D Summer No. 2-D	675 ° F 675 ° F	45 40	0.50% 0.50%
Heavy load and high speed.	No. 2-D	675 ° F	45	0.50%

NOTE: FOR MOST SATISFACTORY ENGINE LIFE, USE ONLY THOSE NO. 2D DIESEL FUEL OILS CONTAINING 0.50% OR LESS SULFUR. WHERE MINIMUM EXHAUST SMOKE IS REQUIRED OR WHERE LONG PERIODS OF IDLING OR COLD WEATHER CONDITIONS BELOW 32°F ARE ENCOUNTERED, THE MORE VOLATILE OR LIGHT DISTILLATE FUELS ARE RECOMMENDED.

Engine operation at altitudes above 5,000 feet requires use of next lighter class of fuel oil than would normally be used.

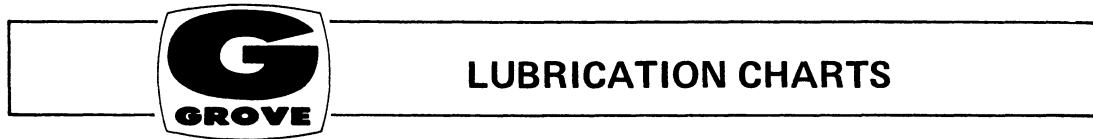


LUBRICATION AND FUEL RECOMMENDATIONS

ASTM CLASSIFICATION OF DIESEL FUEL OILS

CHARACTERISTICS	No. 1-D	No. 2-D
Flash Pt.; ° F Min.	100	125
Carbon Residue; %	0.15	0.35
Water and Sediment; (% by Volume) Max.	Trace	0.10
Ash; %-by Wt.; Max.	0.01	0.02
Distillation, ° F 90% Pt.; Max. Min.	550 -----	640 540
Viscosity at 100° F; centistokes Min. Max.	1.4 2.5	2.0 4.3
Sulfur; % Max.	0.5	0.7
Cetane No.; Min.	40	40

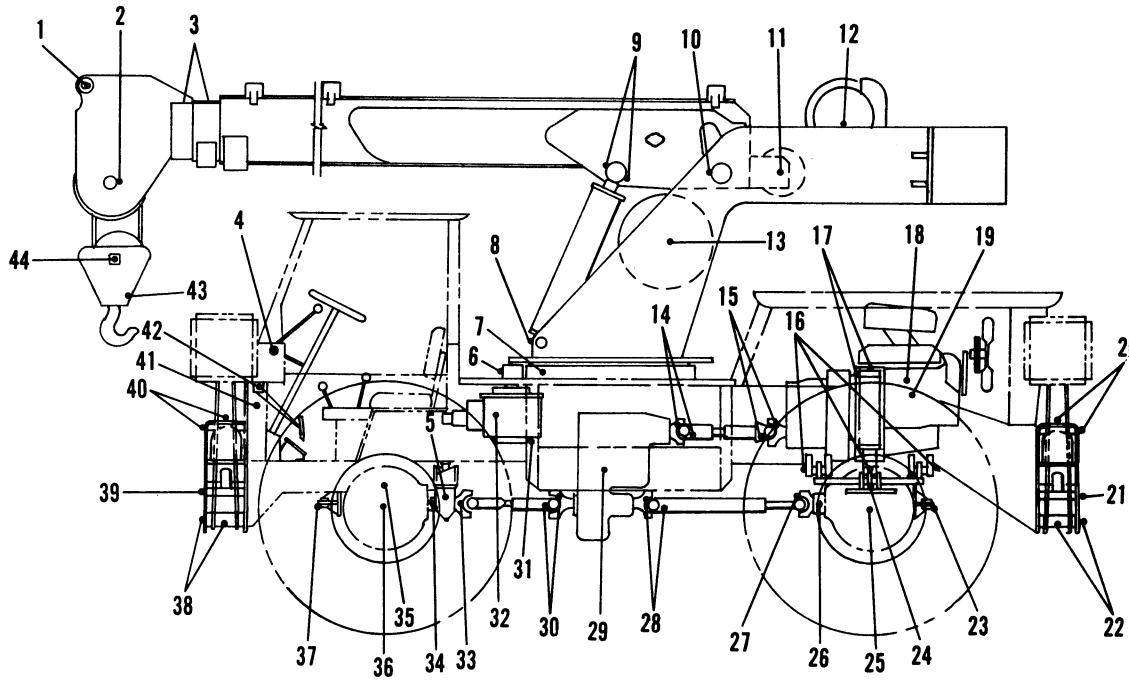
During cold weather engine operation, the “cloud point” (the temperature at which wax crystals begin to form in the fuel oil) should be 10°F below the lowest expected fuel temperature to prevent clogging of the fuel filters by wax crystals.



The lubrication charts in this section reflect typical machine configurations. Lube point locations are general, as changes in manufacturer and vendor component design may result in relocation and/or number of lube fittings, fill plugs, drain plugs, etc.

Specific “brand name” lubricants are not referenced since most all nationally known oil suppliers’ products are suitable for use, providing they meet the requirements of the Mil Specs and standards appearing in the LUBRICATION AND FUEL RECOMMENDATIONS section of this handbook.

Should any conflict of information arise between lubricant recommendations for vendor components and those recommended in the applicable vendor’s publication, contact the nearest vendor representative, as changes in their recommendations may occur after issuance of this publication.



LUBE SYMBOL KEY

- EP - Heavy duty Extreme Pressure Mill Type
- HBF - Hydraulic Brake Fluid 70-R1
- HO - Hydraulic Oil — SAE 10W — (MIL-L-2104C)
- EPGL - Extreme Pressure Gear Lube SAE90
- ATF - Automatic Transmission Fluid, Type "A"
- N/A - Not Applicable

RESERVOIR CAPACITY

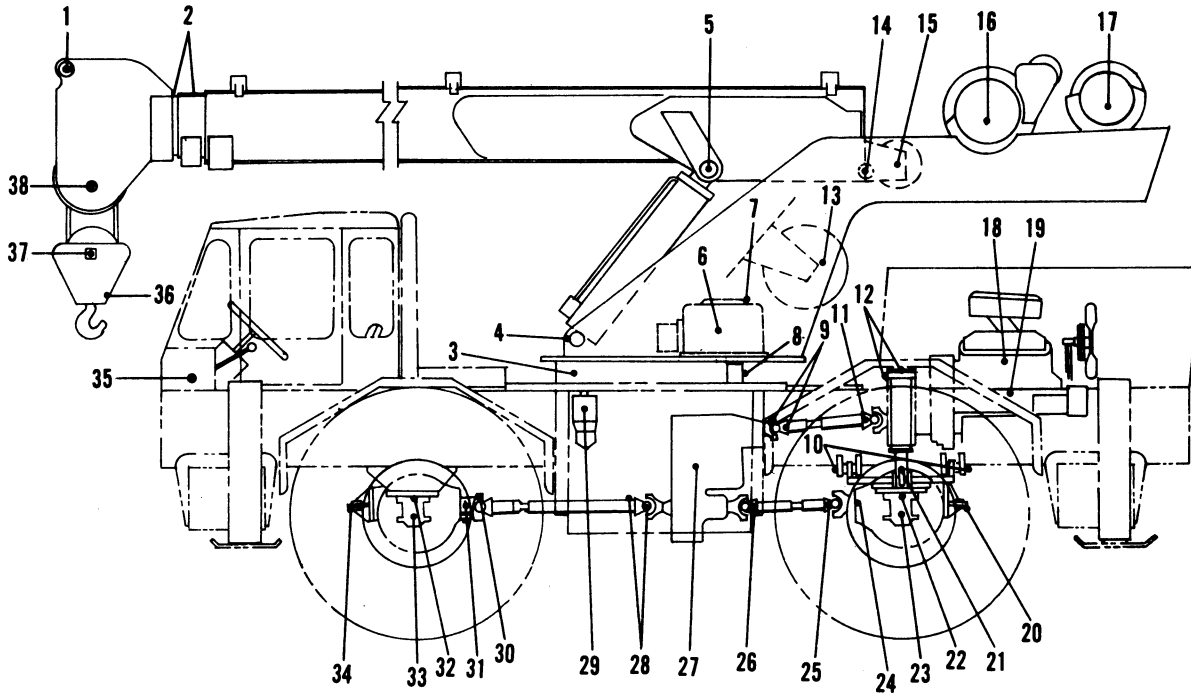
- RT48/49 - 62 U.S. Gal. (234.7 liters)
- RT56 & 58 - 90 U.S. Gal. (340.7 liters)

RT48, 49, 56, and 58 Models—Typical.

INDEX NO.	ITEM	TYPE OF LUBE OR FILL POINTS	LUBE SYMBOL	FREQUENCY OF LUBRICATION (HOURS)	CAPACITIES AND INSTRUCTIONS
1	Boom Nose Idler Sheave	SAE Std. Grease Fitting	EP	50	Brush sides & bottom
2	Boom Nose Sheaves	SAE Std. Grease Fitting	EP	50	
3	Boom Sections	None	EP	25	
4	Control Lever Attach Shaft	SAE Std. Grease Fitting	EP	50	
5	Hydraulic Oil Filter	Replaceable Cartridge	N/A	200	
6	Pinion Gear	SAE Std. Grease Fitting	EP	100	
7	Ring Gear	SAE Std. Grease Fitting	EP	100	
8	Lift Cylinder (base shaft)	SAE Std. Grease Fitting	EP	10	
9	Lift Cylinder (rod shaft)	SAE Std. Grease Fitting	EP	10	
10	Boom Pivot/Anchor Shaft	SAE Std. Grease Fitting	EP	10	
11	Hose Guide Sheave	SAE Std. Grease Fitting	EP	50	
12	Hoist Final Drive	Fill Plug	EPGL	500	
13	Hose Reel	SAE Std. Grease Fitting	EP	50	
14	Drive Shaft Universal (trans.)	SAE Std. Grease Fitting	EP	50	
15	Drive Shaft Universal (trans.)	SAE Std. Grease Fitting	EP	50	
16	Oscillation Lockout Cradle	SAE Std. Grease Fitting	EP	25	
17	Oscillation Cradle Cylinder (base)	SAE Std. Grease Fitting	EP	25	
18	Engine Crankcase	Fill Cap	HO	100	
19	Engine Oil Filter	Replaceable Cartridge	N/A	100	
20	Outrigger Cylinder (base shaft)	SAE Std. Grease Fitting	EP	50	
21	Outrigger Cylinder (rod shaft)	SAE Std. Grease Fitting	EP	50	
22	Outrigger Pivot Shaft	SAE Std. Grease Fitting	EP	50	
23	Rear Steer Cylinder (rod shaft)	SAE Std. Grease Fitting	EP	50	
24	Trunnion Bearing (rear axle)	SAE Std. Grease Fitting	EP	50	
25	Planetary Hub (rear)	Fill Plug	EPGL	100	Fill to OIL LEVEL plug opening
26	Tie Rod (rear)	SAE Std. Grease Fitting	EP	50	
27	Drive Shaft Universal (rear dr.)	SAE Std. Grease Fitting	EP	50	
28	Drive Shaft Universal (rear dr.)	SAE Std. Grease Fitting	EP	50	
29	Transmission Gear Case	Fill Pipe	ATF	1000	
30	Drive Shaft Universal (front dr.)	SAE Std. Grease Fitting	EP	50	
31	Speed Reducer Bearing	SAE Std. Grease Fitting	EP	100	
32	Speed Reducer Gear Case	Fill Plug	EPGL	2500	
33	Drive Shaft Universal (front dr.)	SAE Std. Grease Fitting	EP	50	
34	Tie Rod (front)	SAE Std. Grease Fitting	EP	50	
35	Planetary Hub (front)	Fill Plug	EPGL	100	
36	Trunnion Bearing (front axle)	SAE Std. Grease Fitting	EP	100	
37	Front Steer Cylinder (rod shaft)	SAE Std. Grease Fitting	EP	50	
38	Outrigger Pivot Shaft	SAE Std. Grease Fitting	EP	50	
39	Outrigger Cylinder (rod shaft)	SAE Std. Grease Fitting	EP	50	
40	Outrigger Cylinder (base shaft)	SAE Std. Grease Fitting	EP	50	
41	Brake Master Cylinder	Fill Cap	HBF	50	Replenish as required
42	Brake Pedal	SAE Std. Grease Fitting	EP	50	
43	Hook Block Swivel Bearing	SAE Std. Grease Fitting	EP	10	
44	Hook Block Sheaves	SAE Std. Grease Fitting	EP	50	

NOTES:

1. Be sure to lubricate like items on both sides of machine.
2. For detailed information regarding lubricants, refer to Lubrication and Fuel Recommendations, this Section.
3. Frequency of lubrication is recommended by the Manufacturer under normal machine applications. Where severe operating conditions exist, the user must adjust the lubricating schedule accordingly.
4. Change lubricant in hoist after first 240 hours.
5. Engine crankcase requires one (1) additional U.S. quart (.946 liters) with oil filter change. (Capacity given is for engine supplied with standard machine.)
6. (RT48, 49, and 56 models with Grove Model 15 hoist.) Fill plug located on drum barrel.
7. Check with engine running.



LUBE SYMBOL KEY

- EP - Heavy duty Extreme Pressure Mill Type
- HO - Hydraulic oil — SAE 10W — (MIL-L-2104C)
- EPGL - Extreme Pressure Gear Lube SAE90
- ATF - Automatic Transmission Fluid, Type "A"
- N/A - Not Applicable

RESERVOIR CAPACITY

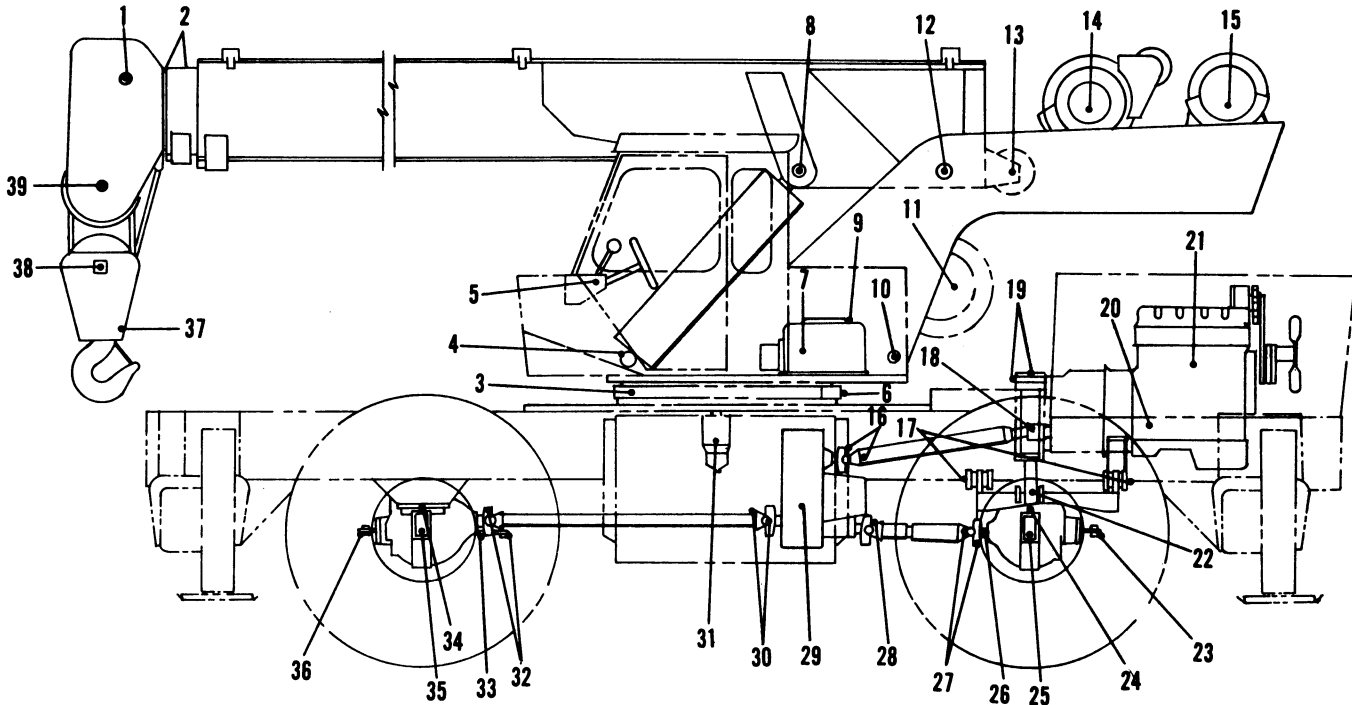
90 U.S. Gal. (340.7 liters)

RT59/60 Models — Typical.

INDEX NO.	ITEM	TYPE OF LUBE OR FILL POINTS	LUBE SYMBOL	FREQUENCY OF LUBRICATION (HOURS)	CAPACITIES AND INSTRUCTIONS
1	Boom Nose Idler Sheave	SAE Std. Grease Fitting	EP	50	Brush sides & bottom
2	Boom Sections	None	EP	25	
3	Ring Gear	SAE Std. Grease Fitting	EP	100	
4	Lift Cylinder (base shaft)	SAE Std. Grease Fitting	EP	10	5½ U.S. Qts. (5.2 liters)
5	Lift Cylinder (rod shaft)	SAE Std. Grease Fitting	EP	10	
6	Speed Reducer Gear Case	Fill Plug	EPGL	2500	
7	Speed Reducer Bearing	SAE Std. Grease Fitting	EP	100	
8	Pinion Gear	SAE Std. Grease Fitting	EP	100	
9	Drive Shaft Universal (trans.)	SAE Std. Grease Fitting	EP	50	
10	Oscillation Lockout Cradle	SAE Std. Grease Fitting	EP	50	
11	Drive Shaft Universal (trans.)	SAE Std. Grease Fitting	EP	50	
12	Oscillation Cradle Cylinder (base)	SAE Std. Grease Fitting	EP	50	
13	Hose Reel	SAE Std. Grease Fitting	EP	50	
14	Boom Pivot/Anchor Shaft	SAE Std. Grease Fitting	EP	10	Fill to Fill Plug opening (4) (6) Fill to Fill Plug opening (4) (6) 9 U.S. Qts. (8.5 liters) dry (5) Replace with oil change
15	Hose Guide Sheave	SAE Std. Grease Fitting	EP	50	
16	Main Hoist Final Drive	Fill Plug	EPGL	500	
17	Auxiliary Hoist Final Drive	Fill Plug	EPGL	500	
18	Engine Crankcase	Fill Cap	HO	100	Fill to OIL LEVEL plug opening
19	Engine Oil Filter	Replaceable Cartridge	N/A	100	
20	Rear Steer Cylinder (rod shaft)	SAE Std. Grease Fitting	EP	50	
21	Oscillation Lockout Cradle	SAE Std. Grease Fitting	EP	25	
22	Trunnion Bearing (rear axle)	SAE Std. Grease Fitting	EP	50	
23	Planetary Hub (rear)	Fill Plug	EPGL	100	
24	Tie Rod (rear)	SAE Std. Grease Fitting	EP	50	
25	Drive Shaft Universal (rear dr.)	SAE Std. Grease Fitting	EP	50	
26	Drive Shaft Universal (rear dr.)	SAE Std. Grease Fitting	EP	50	
27	Transmission Gear Case	Fill Pipe	ATF	1000	
28	Drive Shaft Universal (front dr.)	SAE Std. Grease Fitting	EP	50	Fill to FULL mark on dipstick (7)
29	Hydraulic Oil Filter	Replaceable Cartridge	N/A	200	
30	Drive Shaft Universal (front dr.)	SAE Std. Grease Fitting	EP	50	
31	Tie Rod (front)	SAE Std. Grease Fitting	EP	50	
32	Trunnion Bearing (front axle)	SAE Std. Grease Fitting	EP	50	
33	Planetary Hub (front)	Fill Plug	EPGL	100	
34	Front Steer Cylinder (rod shaft)	SAE Std. Grease Fitting	EP	50	
35	Control Lever Attach Shaft	SAE Std. Grease Fitting	EP	50	
36	Hook Block Swivel Bearing	SAE Std. Grease Fitting	EP	10	
37	Hook Block Sheaves	SAE Std. Grease Fitting	EP	50	
38	Boom Nose Sheaves	SAE Std. Grease Fitting	EP	50	

NOTES:

1. Be sure to lubricate like items on both sides of machine.
2. For detailed information regarding lubricants, refer to Lubrication and Fuel Recommendations, this Section.
3. Frequency of lubrication is recommended by the Manufacturer under normal machine applications. Where severe operating conditions exist, the user must adjust the lubricating schedule accordingly.
4. Change lubricant in hoist after first 240 hours.
5. Engine crankcase requires one (1) additional U.S. quart (.946 liters) with oil filter change. (Capacity given is for engine supplied with standard machine.)
6. Fill plug located on drum barrel of Grove Model 15 hoist.
7. Check with engine running.



LUBE SYMBOL KEY

- EP - Heavy duty Extreme Pressure Mill Type
- HO - Hydraulic Oil — SAE 10W — (MIL-L-2104C)
- EPGL - Extreme Pressure Gear Lub SAE90
- ATF - Automatic Transmission Fluid, Type "A"
- N/A - Not Applicable

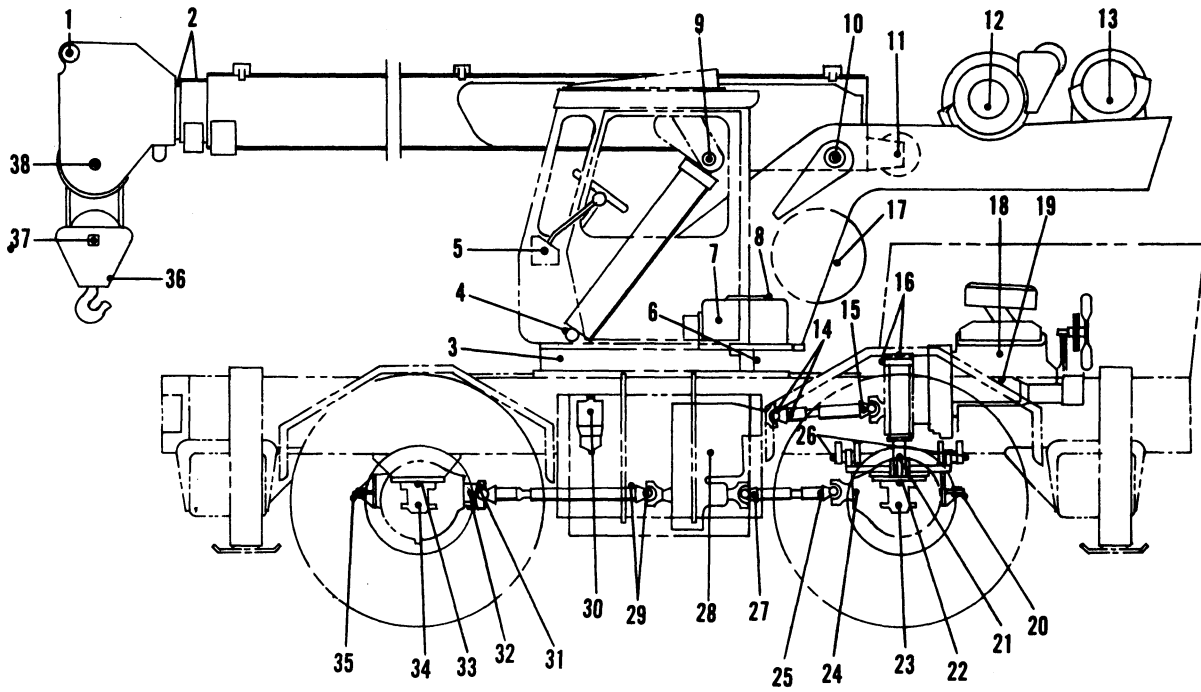
RESERVOIR CAPACITY
180 U.S. Gal. (681.3 liters)

RT63S Models — Typical.

INDEX NO.	ITEM	TYPE OF LUBE OR FILL POINTS	LUBE SYMBOL	FREQUENCY OF LUBRICATION (HOURS)	CAPACITIES AND INSTRUCTIONS
1	Boom Nose Idler Sheave	SAE Std. Grease Fitting	EP	50	Brush sides & bottom 4 U.S. Gal. (15.14 liters) Fill to Fill Plug opening (4)(6) Fill to Fill Plug opening (4)(6) Replace with oil change 27.9 U.S. Qts. (26.4 liters) dry (5) Fill to OIL LEVEL plug opening Fill to FULL mark on dipstick (7) Fill to OIL LEVEL plug opening
2	Boom Sections	None		25	
3	Ring Gear	SAE Std. Grease Fitting	EP	100	
4	Lift Cylinder (base shaft)	SAE Std. Grease Fitting	EP	10	
5	Control Lever Attach Shaft	SAE Std. Grease Fitting	EP	50	
6	Pinion Gear	SAE Std. Grease Fitting	EP	50	
7	Speed Reducer Gear Case	Fill Plug	PGL	2500	
8	Lift Cylinder (rod shaft)	SAE Std. Grease Fitting	EP	10	
9	Speed Reducer Bearing	SAE Std. Grease Fitting	EP	100	
10	Swing (House) Lock Mechanism	SAE Std. Grease Fitting	EP	50	
11	Hose Reel	SAE Std. Grease Fitting	EP	50	
12	Boom Pivot/Anchor Shaft	SAE Std. Grease Fitting	EP	10	
13	Hose Guide Sheave	SAE Std. Grease Fitting	EP	50	
14	Main Hoist Final Drive	Fill Plug	PGL	500	
15	Auxiliary Hoist Final Drive	Fill Plug	PGL	500	
16	Drive Shaft Universal (trans.)	SAE Std. Grease Fitting	EP	50	
17	Oscillation Lockout Cradle	SAE Std. Grease Fitting	EP	25	
18	Drive Shaft Universal (trans.)	SAE Std. Grease Fitting	EP	50	
19	Oscillation Lockout Cylinder (base)	SAE Std. Grease Fitting	EP	25	
20	Engine Oil Filter	Replaceable Cartridge	N/A	100	
21	Engine Crankcase	Fill Cap	HO	100	
22	Oscillation Lockout Cylinder (rod end)	SAE Std. Grease Fitting	EP	25	
23	Rear Steer Cylinder (rod shaft)	SAE Std. Grease Fitting	EP	50	
24	Trunnion Bearing (rear axle)	SAE Std. Grease Fitting	EP	50	
25	Planetary Hub (rear)	Fill Plug	PGL	100	
26	Tie Rod (rear)	SAE Std. Grease Fitting	EP	50	
27	Drive Shaft Universal (rear dr.)	SAE Std. Grease Fitting	EP	50	
28	Drive Shaft Universal (rear dr.)	SAE Std. Grease Fitting	EP	50	
29	Transmission Gear Case	Fill Pipe	ATF	1000	
30	Drive Shaft Universal (front dr.)	SAE Std. Grease Fitting	EP	50	
31	Hydraulic Oil Filter	Replaceable Cartridge	N/A	200	
32	Drive Shaft Universal (front dr.)	SAE Std. Grease Fitting	EP	50	
33	Tie Rod (front)	SAE Std. Grease Fitting	EP	50	
34	Trunnion Bearing (front axle)	SAE Std. Grease Fitting	EP	50	
35	Planetary Hub (front)	Fill Plug	PGL	100	
36	Front Steer Cylinder (rod shaft)	SAE Std. Grease Fitting	EP	50	
37	Hook Block Swivel Bearing	SAE Std. Grease Fitting	EP	10	
38	Hook Block Sheaves	SAE Std. Grease Fitting	EP	50	
39	Boom Nose Sheaves	SAE Std. Grease Fitting	EP	50	

NOTES:

1. Be sure to lubricate like items on both sides of machine.
2. For detailed information regarding lubricants, refer to Lubrication and Fuel Recommendations, this Section.
3. Frequency of lubrication is recommended by the Manufacturer under normal machine applications. Where severe operating conditions exist, the user must adjust the lubricating schedule accordingly.
4. Change lubricant in hoist after 240 hours.
5. Engine crankcase requires one (1) additional U. S. quart (.946 liters) with oil filter change. (Capacity given is for engine supplied with standard machine.)
6. Fill plug located on drum barrel of Grove Model 15 hoist.
7. Check with engine running.



LUBE SYMBOL KEY

- EP - Heavy Duty Extreme Pressure Mill Type
- HO - Hydraulic Oil — SAE 10W — (MIL-L-2104C)
- EPGL - Extreme Pressure Gear Lub SAE90
- ATF - Automatic Transmission Fluid, Type "A"
- N/A - Not Applicable

RESERVOIR CAPACITY

90 U.S. Gal. (340.7 liters)

RT59S/60S Models—Typical.

INDEX NO.	ITEM	TYPE OF LUBE OR FILL POINTS	LUBE SYMBOL	FREQUENCY OF LUBRICATION (HOURS)	CAPACITIES AND INSTRUCTIONS	
1	Boom Nose Idler Sheave	SAE Std. Grease Fitting	EP	50	Brush sides & bottom	
2	Boom Sections	None	EP	25		
3	Ring Gear	SAE Std. Grease Fitting	mmp	100		
4	Lift Cylinder (base shaft)	SAE Std. Grease Fitting	mmp	10	5½ U.S. Qts. (5.2 liters)	
5	Control Lever Attach Shaft	SAE Std. Grease Fitting	mmp	50		
6	Pinion Gear	SAE Std. Grease Fitting	mmp	100		
7	Speed Reducer Gear Case	Fill Plug	mmpPGL	2500		
8	Speed Reducer Bearing	SAE Std. Grease Fitting	mmp	100		
9	Lift Cylinder (rod shaft)	SAE Std. Grease Fitting	mmp	10		
10	Boom Pivot/Anchor Shaft	SAE Std. Grease Fitting	mmp	10		
11	Hose Guide Sheave	SAE Std. Grease Fitting	mmp	50		
12	Main Hoist Final Drive	Fill Plug	mmpPGL	500		Fill to Fill Plug opening (4) Fill to Fill Plug opening (4)
13	Auxiliary Hoist Final Drive	Fill Plug	mmpPGL	500		
14	Drive Shaft Universal (trans.)	SAE Std. Grease Fitting	mmp	50	9 U.S. Qts. (8.5 liters) dry (5) Replace with oil change	
15	Drive Shaft Universal (trans.)	SAE Std. Grease Fitting	mmp	50		
16	Oscillation Lockout Cylinder (base)	SAE Std. Grease Fitting	mmp	25		
17	Hose Reel	SAE Std. Grease Fitting	EP	50		
18	Engine Crankcase	Fill Cap	HO	100		
19	Engine Oil Filter	Replaceable Cartridge	N/A	100		
20	Rear Steer Cylinder (rod shaft)	SAE Std. Grease Fitting	mmp	50	Fill to OIL LEVEL plug opening	
21	Oscillation Lockout Cylinder (rod shaft)	SAE Std. Grease Fitting	mmp	25		
22	Trunnion Bearing (rear axle)	SAE Std. Grease Fitting	mmp	50		
23	Planetary Hub (rear)	Fill Plug	mmpPGL	100		
24	Tie Rod (rear)	SAE Std. Grease Fitting	mmp	50		
25	Drive Shaft Universal (rear dr.)	SAE Std. Grease Fitting	mmp	50		
26	Oscillation Lockout Cradle	SAE Std. Grease Fitting	EP	25	Fill to FULL mark on dipstick(6)	
27	Drive Shaft Universal (rear dr.)	SAE Std. Grease Fitting	EP	50		
28	Transmission Gear Case	Fill Pipe	ATF	1000		
29	Drive Shaft Universal (front dr.)	SAE Std. Grease Fitting	EP	50		
30	Hydraulic Oil Filter	Replaceable Cartridge	N/A	200		
31	Drive Shaft Universal (front dr.)	SAE Std. Grease Fitting	EP	50		
32	Tie Rod (front)	SAE Std. Grease Fitting	mmp	50	Fill to OIL LEVEL plug opening	
33	Trunnion Bearing (front axle)	SAE Std. Grease Fitting	mmp	50		
34	Planetary Hub (front)	Fill Plug	mmpPGL	100		
35	Front Steer Cylinder (rod shaft)	SAE Std. Grease Fitting	mmp	50		
36	Hook Block Swivel Bearing	SAE Std. Grease Fitting	mmp	10		
37	Hook Block Sheaves	SAE Std. Grease Fitting	mmp	50		
38	Boom Nose Sheaves	SAE Std. Grease Fitting	EP	50		

NOTES:

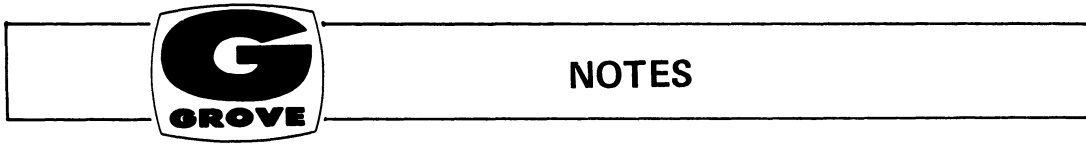
1. Be sure to lubricate like items on both sides of machine.
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3. Frequency of lubrication is recommended by the Manufacturer under normal machine applications. Where severe operating conditions exist, the user must adjust the lubricating schedule accordingly.
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6. Check with engine running.

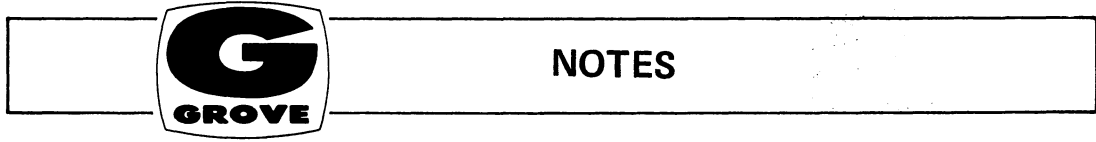


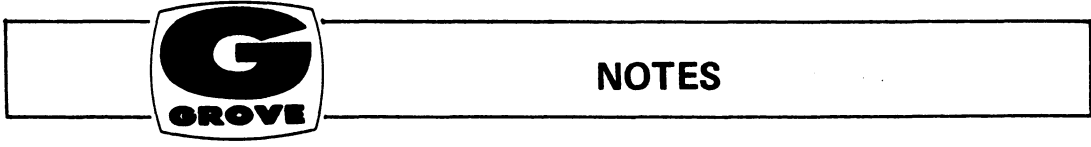
SERVICING RECORD

SERVICE RECORD CHART

COMPONENT	DATE CHECKED	MACHINE HOURS	SERVICE REQUIRED	REMARKS
ENGINE CRANKCASE				
ENGINE COOLANT				
TRANSMISSION				
HYDRAULIC RESERVOIR				
MAIN HOIST				
AUXILIARY HOIST				
SPEED REDUCER				
TIRE PRESSURES				
AIR BRAKE RESERVOIR				







GLOSSARY

The following is a glossary of technical terms and definitions peculiar to this manual and associated Grove publications.

ACCESSORY. A secondary part or assembly of parts which contributes to the overall function and usefulness of a machine.

ANGLE INDICATOR (BOOM). An accessory which measures the angle of the boom above horizontal.

ATTACHMENT (BOOM). A designation for equipment installed on, or attached to, the boom.

AXIS OF ROTATION. The vertical line through the axis around which the crane superstructure rotates.

AXLE. The shaft or spindle about which a wheel revolves. On wheel mounted cranes it refers to an automotive type of axle assembly including housings, gearing, differential, bearings and mounting hardware.

BASE. See **SUPERSTRUCTURE.**

BECKET. See **WEDGE SOCKET.**

BOOM. A telescoping arm pivot-mounted on the revolving superstructure and adjustable as to angle by means of hydraulic lift cylinders (boom lift cylinders).

BOOM ANGLE. The angle above horizontal of the longitudinal axis of the boom.

BOOM HEAD. See **BOOM NOSE.**

BOOM LENGTH. The straight line through the centerline of boom pivot pin to the centerline of the boom nose sheave pin, measured along the longitudinal axis of the boom.

BOOM NOSE. Outermost portion (tip) of boom, comprised of sheaves and attaching hardware for reeving cable.

GLOSSARY (CONT)

BOOM SECTIONS. Hydraulic or mechanically operated segments, which, when assembled, form the boom.

BRAKE. A device for retarding or stopping motion by means of friction or power.

BRAKE SHOE. That part of a shoe-type brake or clutch which makes contact with brake drum or clutch drum.

BUCKET. See **CONCRETE AND CLAMSHELL BUCKET.** A material container attached to machine by flexible means, such as wire rope.

CAB. A housing which covers the operator and/or machinery.

CABLE. See **WIRE ROPE.**

CARRIER. The traveling base upon which the superstructure is mounted.

CLAMSHELL. Two or more similar scoops hinged together, used for digging or holding material.

CLAMSHELL BUCKET. A bucket used with the clamshell attachment.

CLOSING LINE. The rope reeved from hoist drum to control closing of rope operated clamshell bucket.

CLUTCH. A friction, electromagnetic, hydraulic, pneumatic or mechanical locking device for engagement or disengagement of power.

CONCRETE BUCKET. Bucket for handling wet concrete, fitted with bail or bridle, usually handled on lifting crane and hoisted to dumping location.

COUNTERWEIGHT. Weight used to supplement the weight of the machine in providing stability for lifting working loads; attached to rear of revolving superstructure.

GLOSSARY (CONT)

DRUM (HOIST). A rotating cylinder with side flanges on which cable used in lifting operation is wrapped.

FREE FALL. Lowering of the hook (with or without load) without being coupled to the power train, with the lowering speed being controlled by a retarding device, such as a brake.

GANTRY (A-FRAME). See **MAST**.

GOVERNED SPEED. Engine revolutions per minute controlled by the power plant governor.

GRADEABILITY. The slope which a machine can climb expressed as a percentage.

HEADACHE BALL. A heavy (overhaul) ball used with single line lifting to provide weight required to unwind cable from hoist drum.

HOIST. A hydraulically operated drum used for lifting, lowering, and holding loads.

HOOK BLOCK. Block with hook attached used in lifting service. It may have a single sheave for two-part line, or multiple sheaves for more parts of line.

JIB. An extension attached to the boom nose to provide added boom length for handling specified loads. The jib may be in line with the boom or offset.

LINE PULL (AVAILABLE). The line pull in pounds (lbs.) developed by hoisting mechanism with specified pitch diameter drum, for the first layer of rope, not exceeding that developed by the driving mechanism torque.

LINE PULL (PERMISSIBLE). A line pull, less than the available pull, restricted by rope strength, clutch or brake ability, or other limitation in machinery or equipment.

GLOSSARY (CONT)

LINE SPEED (AVAILABLE). The line speed in feet per minute (fpm) developed by hoisting mechanism with specified pitch diameter drum, for the first layer of rope, developed by power plant output speed.

MAST. Frame (posts) hinged at or near boom nose or jib tip, extending above boom or jib, for use in attaching or supporting jib pendant cables.

OPERATING PRESSURE. The pressure that the pump delivers, determined by main and circuit relief valves.

OUTRIGGERS. Extendible or fixed arms attached to the mounting base, which rest on supports at the outer ends to increase stability.

PENDANT. Support cable for jib.

POWER TAKE-OFF. A direct drive, friction clutch, fluid coupling, or hydrostatic auxiliary power (driving) source provided by the prime mover.

PRIME MOVER. Internal combustion engine or electric motor used as main power supply for crane.

RADIUS (OF LOAD). Operating radius is the horizontal distance from the axis of rotation to the centerline of the hoist line or tackle with loads applied.

RATED LOAD. Rated loads at specified radii with the subject equipment are the lesser of a specified percentage of tipping loads or the machine's hydraulic or structural competence as established by the manufacturer, and are the maximum loads at those radii covered by the manufacturer's warranty.

REAR END RADIUS (TAIL SWING). Clearance distance from center of rotation to maximum rear extension of revolving superstructure.

REEVING. A rope system where the rope travels around drums and sheaves.

GLOSSARY (CONT)

ROPE. Refers to wire rope unless otherwise specified. See **WIRE ROPE.**

SIDE LOADING. A load applied at an angle to the vertical plane of the boom.

STABILITY. The ability of a mobile machine to resist tipping. Does not normally apply to a stationary mounting.

STRUCTURAL STRENGTH. The ability of the machine and its components to withstand the stresses imposed by applied loads.

SUPERSTRUCTURE. The rotating frame and components installed thereon for operating the machine.

SWING. The function of revolving the superstructure.

SWING BEARING. A combination of rings with balls or rollers capable of sustaining radial, axial, or overturning loads of the revolving superstructure.

SWING CIRCLE. See **SWING BEARING.**

SWING GEAR. Splined, gear (integral with swing bearing) with which swing pinion meshes to provide swing motion.

SWING (HOUSE) LOCK. A manual or lever controlled, pin-type locking assembly used to secure the superstructure to the carrier, thereby preventing accidental swinging of the superstructure.

SWING MECHANISM. The machinery involved in providing directional rotation of the revolving superstructure.

SWING PINION. Splined, external gear (driven by speed reducer) which meshes with swing gear and provides swing motion.

SWING SPEED. The speed, in revolutions per minute, at which the superstructure rotates.

GLOSSARY (CONT)

TAIL SWING. See **REAR END RADIUS.**

TELESCOPING BOOM. A boom from which one or more boom extensions are telescoped to vary the length.

TIPPING CONDITION. A machine is considered to be at the point of tipping when a balance is reached between the overturning moment of the load and the stabilizing moment of the machine when on a firm, level supporting surface, or on outriggers.

TIRE SIZES. These are specified by diameter of casing, diameter of wheel and ply rating, i.e., 14.00x24 - 10 ply is a 14-inch diameter casing on a 24-inch diameter wheel or rim, and is of 10 ply construction.

TRAVEL. The function of the machine moving from one location to another.

TURNTABLE. See **SUPERSTRUCTURE.**

TURNTABLE LOCK. See **SWING LOCK.**

TWO-BLOCK. (TWO-BLOCKING.) Condition encountered when hook block or headache ball contacts boom nose or jib tip.

WEDGE SOCKET. Hardware attached to working end of hoist cable, which provides means of securing cable to boom nose or jib tip anchor.

WHEELBASE. Distance between centerline of front and rear axles.

WIRE ROPE. A flexible, multi-wired member usually consisting of core member around which a number of multi-wired strands are "laid" or helically bent.

WORKING WEIGHT. Weight of machine in working order with complete front end equipment.

