

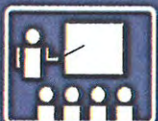
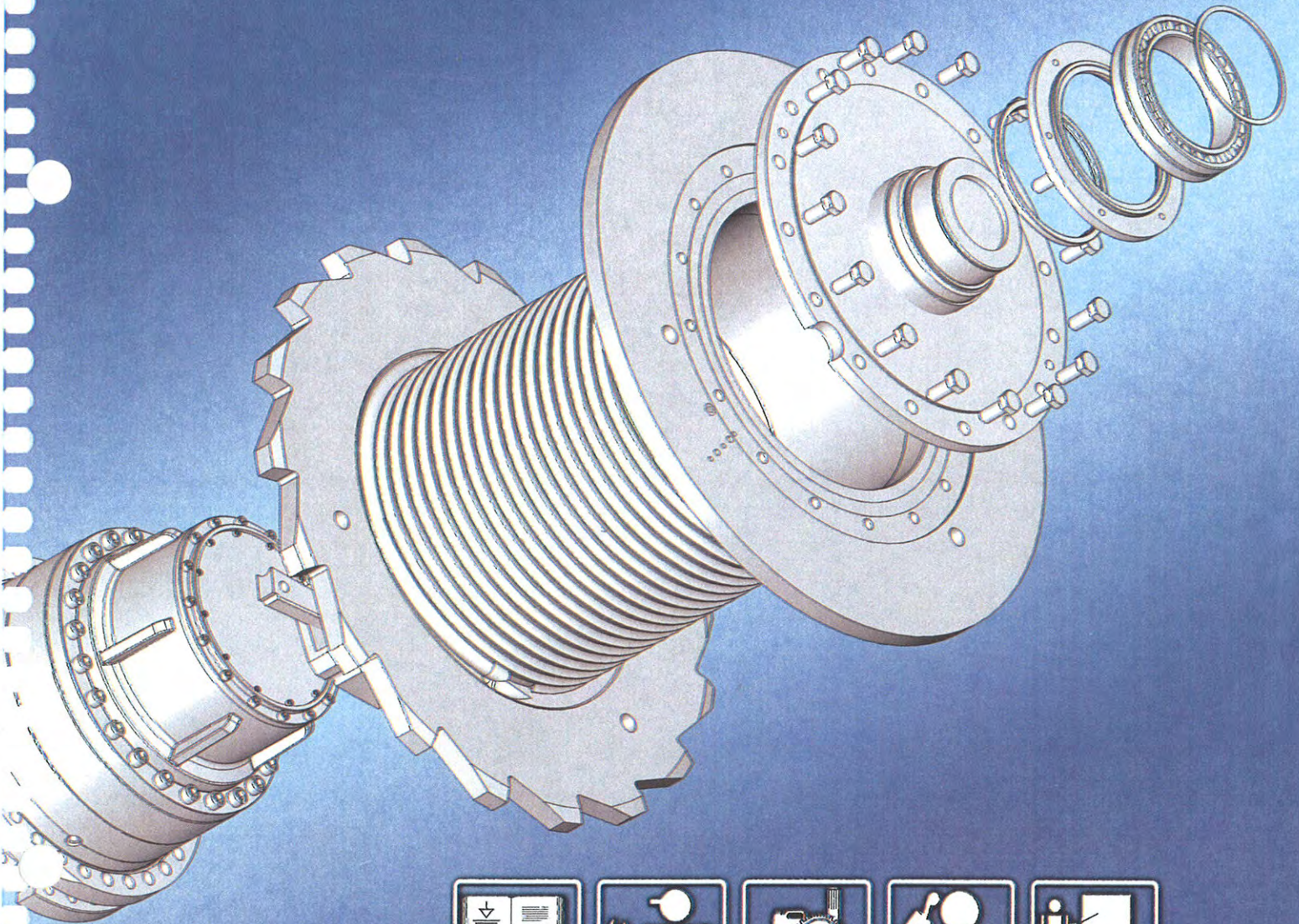
Manitowoc

TM890
SUPER
STRUCTURE

Crane Care

GROVE

TM890 - 72977
Operator's Manual



OPERATOR'S AND SAFETY HANDBOOK

**TM 890
SUPERSTRUCTURE**

S/N 72977

PUBLISHED: JULY, 1980
CHANGE 1 - SEPTEMBER, 1981

LIST OF EFFECTIVE PAGES

Numbers	Change In Effect
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iii thru x	Original
xi	Change 1
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WARNING

ELECTROCUTION HAZARD TO PREVENT DEATH OR SERIOUS BODILY INJURY

NEVER OPERATE THIS CRANE WITHIN ANY DISTANCE OF A POWER SOURCE OR POWER LINE WITHOUT FIRST NOTIFYING THE POWER OR UTILITY COMPANY

NEVER OPERATE CRANE ANY PART THEREOF OR LOAD WITHIN 20 FEET OF ANY ELECTRICAL POWER LINE OR POWER SOURCE OR SUCH DISTANCE AS IS SPECIFIED OR REQUIRED BY LOCAL OR OTHER APPLICABLE SAFETY CODES OR REGULATIONS

NEVER OPERATE CRANE WITHOUT CONSULTING LOCAL OR OTHER APPLICABLE SAFETY CODES OR REGULATIONS

NEVER OPERATE SERVICE OR MAINTAIN THIS CRANE WITHOUT PROPER INSTRUCTIONS. REMEMBER IT IS THE EMPLOYER'S RESPONSIBILITY TO IMPLEMENT THE ABOVE AND TO PROVIDE ALL SAFETY DEVICES OR MEANS THAT MAY BE NECESSARY OR REQUIRED FOR ANY USE OPERATION, SET UP OR SERVICE

MAKE SAFETY FIRST---NOT LAST!!! READ YOUR OPERATOR'S HANDBOOK!

NOTE DO NOT REMOVE THIS SIGN OR OPERATOR'S MANUAL FROM THIS CRANE.

CHANGE RECORD

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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 the Grove Manufacturing Company. If the distributor is unknown and/or cannot be reached, please contact the Grove Manufacturing Company, (717) 263-5100. (Address: 1086 Wayne Avenue, P.O. Box 695, Chambersburg, Pennsylvania, 17201).

DO NOT OVERLOAD

Weight of load should always be known before any attempt is made to lift it.

FOREWORD

This manual has been compiled to assist you in properly operating and maintaining your Grove Crane.

Before placing the crane in service, take time to thoroughly familiarize yourself with the contents of this manual. After all sections have been read and understood, retain the manual for future reference in a readily accessible location.

The Grove Crane has been designed for maximum performance with minimum maintenance. With proper care, years of trouble-free service can be expected.

Constant improvement and engineering progress makes it necessary that we reserve the right to make specification and equipment changes without notice.

Engine operating procedures and routine maintenance procedures are supplied in a separate manual with each crane, and should be referred to for detailed information.

Information in this manual does not replace federal, state, or local regulations, safety codes, or insurance requirements.

Any reference to PAT in this manual is to be used for general information only. For detailed operating instructions of the PAT System, refer to the PAT Operator's Handbook.

Changes from the first printing of this manual that have been made in the text are marked by a vertical bar (|) on the margin of the page opposite the change.

In the event some text is removed, and is not replaced with new or changed material, a deletion arrow is used where the text was deleted.

In the event there is a change in an illustration, a hand with a pointing finger will be used to point out where the change occurred.

A CHANGE RECORD page is included as page iv herein. It is intended that the recipient of the CHANGE RECORD update as each change is received by him.

The definitions of WARNING, CAUTION, and NOTE as used in this manual apply as follows.

WARNING

A WARNING IS USED TO EMPHASIZE THAT IF AN OPERATION, PROCEDURE, OR PRACTICE IS NOT FOLLOWED EXACTLY, DEATH OR INJURY TO PERSONNEL MAY RESULT.

CAUTION

A CAUTION IS USED TO EMPHASIZE THAT IF AN OPERATION, PROCEDURE, OR PRACTICE IS NOT FOLLOWED EXACTLY, EQUIPMENT DAMAGE MAY RESULT.

NOTE

A note is used to emphasize an important procedure or condition.

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SECTION I

GENERAL

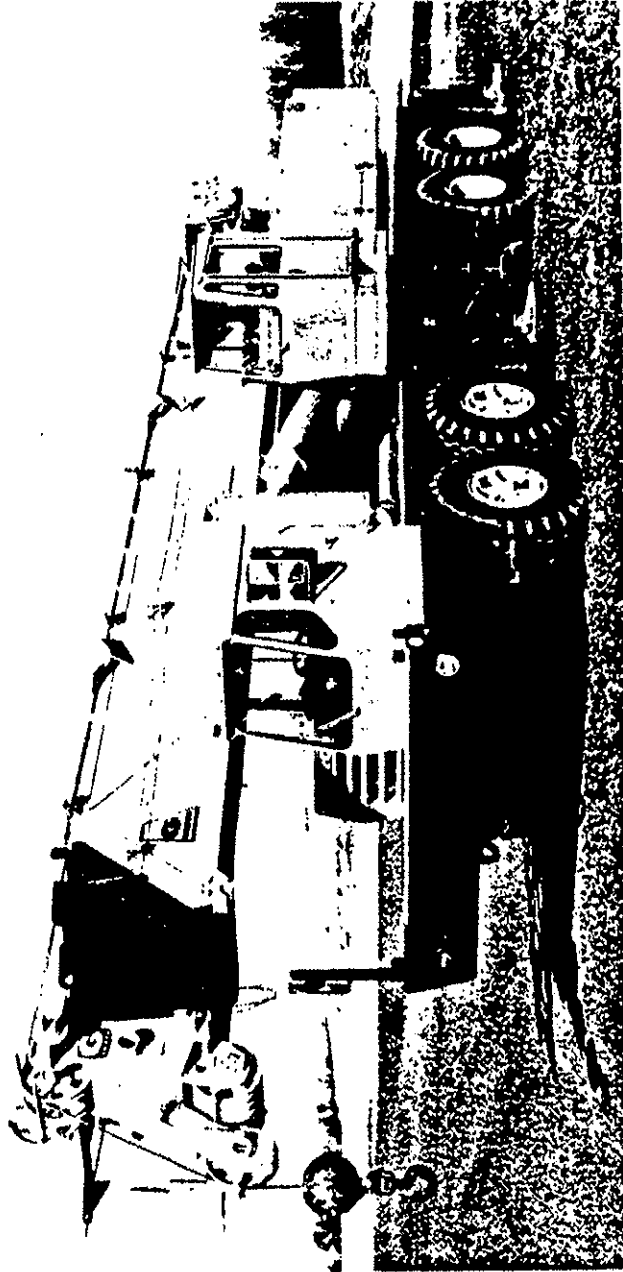
INTRODUCTION.

The superstructure is mounted on a 8 x 4 or optional 12 x 6 carrier. It is capable of 360 degree rotation in either direction and contains a separate power plant for producing the hydraulic and electrical power required to perform all crane functions. All crane functions, with the exception of counterweight removal, are controlled from the fully-enclosed cab. The crane is equipped with a four section trapezoidal boom with power-pinned fly (full powered boom is optional). Additional reach is obtained by utilizing the swingaway boom extension and an optional multi-section lattice jib. Lifting is provided by a main hoist and an optional auxiliary hoist.

Hydraulic, double box, sliding beam outriggers are integral with the carrier frame. An auxiliary outrigger control panel is mounted on either side of the carrier.

NOTE

Throughout this handbook, reference is made to left, right, front, and rear when describing locations. These reference locations are to be considered as those viewed from the operator's seat with the superstructure facing forward over the front of the carrier frame.



0026

LIST OF SPECIFICATIONS.

CAPACITIES.

Fuel Tank	78 gallons (295.2 liters)
Hydraulic Tank	305 gallons (1155 liters)
Coolant System	(See Engine Specifications)
Engine Lubrication System	(See Engine Specifications)
Constant Speed Pump Drive	4.4 quarts (4.26 liters)
Hoists	(Main) Grove Model HO-30-26 12 quarts (11.3 liters)
	(Aux.) Grove Model HO-30-16 12 quarts (11.3 liters)
	(Aux.) Grove Model HO-15 9 quarts (8.7 liters)
Swing Gearbox	15 quarts (14.2 liters)
Swing Brake Pedal Master Cylinder (Later Models)	5 to 6 ounces (151 to 181 cm ³)

FIRE EXTINGUISHER.

Manufacturer	Kidde
Type	Dry
Rating	10 BC
Weight	2.75 pounds (1.2 kg)

AIR INTAKE FILTER.

Manufacturer	Donaldson
Type	Dry
Model	FWG14-0077

SWING MOTOR.

Manufacturer	Char-Lynn
Model	H Series
Type	Orbit
Displacement	17.9 inch ³ (293 cm ³) per rev.

SWING GEARBOX.

Manufacturer	Grove
Model	GB-200A
Type	Gear Reduction
Reduction Ratio	20.2:1

BOOM.

Length 36 - 114 feet (11 - 44.5 m)
Power Power pinned fly (standard)
Full power (optional)
Elevation -4 to +80 degrees
Extensions 32 foot (9.7 m) swingaway
46, 60, 74, 88, (14, 18.3, 22.6, 26.8 m) lattice jibs (optional)

MAIN HOIST.

Grove Model HO-30B-26.

Drum Dimensions Diameter 16 inch (40.64 cm)
Length 26 inch (66 cm)
Cable Capacity 0.75 inch (19 mm) cable. 855 feet (261 m)
Permissible Line Pull Refer to the Line Pulls and Reeving Info
Chart located in the superstructure cab

AUXILIARY HOIST (OPTIONAL).

Grove Model HO-30B-16.

Drum Dimensions Diameter 16 inch (40.64 cm)
Length 16 inch (40.64 cm)
Cable Capacity 0.75 inch (19 mm) cable. 525 feet (160 m)
Permissible Line Pull Refer to the Line Pulls and Reeving Info
Chart located in the superstructure cab

Grove Model HO-15B.

Drum Dimensions Diameter 12 inch (30.48 cm)
Length 16 inch (40.64 cm)
Cable Capacity 0.5 inch (13 mm) cable 585 feet (178 m)
0.625 inch (16 mm) cable 365 feet (111 m)
Permissible Line Pull Refer to the Line Pulls and Reeving Info
Chart located in the superstructure cab

Gearmatic Model 25 With Free-Fall.

Drum Dimensions Diameter 9 inch (22.9 cm)
Length 13 inch (33 cm)
Cable Capacity 0.5 inch (13 mm) cable 550 feet (168 m)

Permissible Line Pull Refer to the Line Pulls and Reeving Info
Chart located in the superstructure cab

COUNTERWEIGHT.

Type Removable
Weight (See Axle Weight Distribution Chart)

OUTRIGGERS.

Type Double box beam and jack
Extended Length 25.4 feet (7.75 m)
Retracted Length 9.8 feet (3.0 m)

HYDRAULIC SWIVEL.

Manufacturer Grove
Hydraulic Ports 2

ELECTRICAL SWIVEL.

Manufacturer United Equipment
Slip Rings 15

Electrical System.

Type Single wire ground return (chassis)
System Voltage 12
Starting Voltage 24
Batteries.
 Number 4
 Manufacturer Delco-Remy
 Model Delco 1200
Alternator.
 Manufacturer Delco-Remy

CAB HEATER.

Manufacturer Hunter
Model HW125
Type Hot water
Voltage 12 volts
Manufacturer Hupp

Model 781-12V-D
Type Hot water heater
Voltage 12 volts

AIR CONDITIONER (OPTIONAL).

Manufacturer Frigiking
Model Industrial FK-4 Series

ENGINE SPECIFICATIONS

Make and Model	Cummins 68TA5.9	GMGV-53N	Caterpillar 3208
Type	6 cylinder O.H.V.	6 cylinder O.H.V.	8 cylinder O.H.V.
Bore and Stroke	4.02 in. x 4.72 in. 102MM x 120MM	3.875 x 4.5 in. (98 mm x 114 mm)	4.5 in. x 5.0 in. (114 mm x 127 mm)
Displacement	358 cu. in. (5866 cm ³)	318 cu. in. (5212 cm ³)	636 cu. in. (10424 cm ³)
Horsepower (Net)	192 @ 2800 RPM	196 @ 2800 RPM	199 @ 2800 RPM
Governed RPM	3000	2800	2800
Torque (Net)	458 lb. ft. (63 kgm) @ 1700 RPM	427 lbs. ft. (59 kgm) @ 1500 RPM	450 lbs. ft. (62 kgm) @ 1400 RPM
Combustion System	4 cycle Turbocharged Aftercooled	2 cycle, with blower	4 cycle, naturally aspirated
Cooling System (Cap.)	9.5 gal. (35.9 liters)	9.25 gal. (35.0 L)	11.5 gal (43.5)
Lubrication System (Cap.)	3.75 gal. (14.2 liters)	5.0 gal. (18.9 L)	3.3 gal. (12.5 L)

AXLE WEIGHT DISTRIBUTION CHART

ITEM	POUNDS			KILOGRAMS		
	GROSS	FRONT	REAR	GROSS	FRONT	REAR
	Basic standard machine to include: 36 - 114 ft. (10.97 - 34.75 m) trapezoidal boom plus a 32 ft. (9.75 m) swingaway extension, Grove model 308-26 main hoist with 750 ft. (228.60 m) of 3/4 in. (19 mm) rope, 12,975 lb. (5,885 kg.) counterweight, Grove model 8x4 - 80 carrier, Cummins NTC 335 (Carrier Engine), Cummins 68TA5.9L (Superstructure Engine)	117,450	39,605	77,845	53,275	17,965
* Remove standard 12,975 lb. (5,885 kg.) counterweight	-12,975	+5,288	-18,263	-5,885	+2,399	-8,284
80 ton (72.56 mt), 6 sheave hook block (stowed)	+1,600	+2,571	-971	+726	+1,166	-440
Auxiliary boom head	+230	+455	-225	+104	+208	-102
** Model 15B Auxiliary hoist with 550 ft. (167.64 m) of 5/8 in. (16 mm) dia. rope	+1,140	-468	+1,608	+517	-212	+729
** Model 25 free fall Auxiliary hoist with 550 ft. (167.64 M) of 1/2 in. (13 mm) dia. rope	+1,100	-452	+1,552	+499	-205	+704
** Model 308-16 Auxiliary hoist with 550 ft. (167.64 m) of 3/4 in. (19 mm) dia. rope end idler	+2,469	-1,014	+3,483	+1,120	-460	+1,580
** Substitute 12,300 lb. (5,579 kg.) counterweight	-675	+275	-950	-306	+125	-431
** Substitute 11,300 lb. (5,126 kg.) counterweight	-1,675	+683	-2,358	-760	+310	-1,070

Substitute GM8V-71N engine (carrier)	-365	-409	+44	-166	-186	+20
Substitute Caterpillar 3406T engine (carrier)	+90	+101	-11	+41	+46	.5
Substitute GM6V-53N engine (superstructure)	-170	9	-161	.77	-4	.73
Substitute Caterpillar 3208 engine (superstructure)	-410	-22	-388	-186	-10	.176
Remove standard 32 ft. (9.75 m) swingaway extension	-1,550	-1,557	+7	.703	-706	+3
Remove standard main hoist with rope	-2,980	+818	-3,798	-1,352	+371	-1,723
Remove (2) front outrigger beams & jacks	-5,000	-3,259	-1,741	-2,268	-1,478	.790
Remove (2) rear outrigger beams & jacks	-5,000	+1,830	-6,830	-2,268	+830	-3,098

* Use 12,975 lb. (5,885 kg.) counterweight without auxiliary hoist.

** Use 12,300 lb. (5,579 kg.) counterweight with Grove 15B or Gearmatic model 25 free fall auxiliary hoist.

*** Use 11,300 lb. (5,126 kg.) counterweight with Grove 308-16 auxiliary hoist.

AXLE WEIGHT DISTRIBUTION CHART

ITEM	POUNDS		KILOGRAMS	
	GROSS	FRONT REAR	GROSS	FRONT REAR
Basic standard machine to include 36-114 ft. (10.9 - 34.8 m) trapezoidal boom (power pinned fly) plus a 32 ft. (9.7 m) "Swingaway" extension, Grove Model 308-26 main hoist with 750 ft. (228.6 m) of 3/4 in. (19 mm) rope, 12,975 lb. (5885 kg) counterweight, Grove Model 8 x 4-80 carrier, Cummins NTA855C(carrier engine), Cummins 68TA5.9L (superstructure engine)	119,089	40,612 78,477	54,019	18,421 35,597
REMOVE:				
*Standard 12,975 lb. (5885 kg) counterweight	-12,975	+5,288	-5,885	+2,399
Standard 32 ft. (9.7 m) "Swingaway" extension	-1,654	-1,685	-750	-764
Standard main hoist with rope	-2,825	+776	-1,281	+352
(2) front outrigger beams & jacks	-5,000	-3,259	-2,268	-1,478
(2) rear outrigger beams & jacks	-5,000	+2,098	-2,268	+952
ADD:				
80-ton (72.5 mt), 6-sheave hookblock (towed)	+1,600	+2,571	+726	+1,166
Auxiliary boom head	+230	+455	+104	+206
Fifth front outrigger jack	+600	+805	+272	+365
**Model 158-16 auxiliary hoist with 550 ft. (167.6 m) of 5/8 in. (16 mm) dia. rope	+1,118	-460	+508	-209
** Model 11 SGEGR free-fall auxiliary hoist with 550 ft. (167.6 m) of 1/2 in. (13 mm) dia. rope	+1,078	-443	+489	-201
**Model 308-16 auxiliary hoist with 550 ft. (167.6 m) of 3/4 in. (19 mm) dia. rope and idler	+2,385	-980	+1,082	-445
		+3,365	+1,521	+690
				+1,526

SUBSTITUTE:									
36-114 Ft. (10.9-34.7 m) full power boom	+1,184	+506	+678	+537	+230	+307			
..12,300 lb. (5579 kg) counterweight	-675	+275	-950	-306	+125	-431			
...11,300 lb. (5126 kg) counterweight	-1,675	+683	-2,358	-760	+310	-1,070			
GM8V - 71N engine (carrier)	-550	-617	+67	-249	-280	+30			
Caterpillar 3406T engine (carrier)	-165	-185	+20	+75	+84	-9			
GM6V - 53N engine (superstructure)	-170	-9	-161	-77	-4	-73			
Caterpillar 3208 engine (superstructure)	-410	-22	-388	-186	-10	-176			

*Use 12,975 lb. (5885 kg) counterweight without auxiliary hoist.
 **Use 12,300 lb. (5579 kg) counterweight with Grove[®] 15B-16 or Gearmatic Model 11 SGECR free-fall auxiliary hoist.
 ***Use 11,300 lb. (5126 kg) counterweight with Grove 30B-16 auxiliary hoist.

AXLE WEIGHT DISTRIBUTION CHART

ITEM	POUNDS			KILOGRAMS		
	GROSS	FRONT	REAR	GROSS	FRONT	REAR
Basic standard machine to include 36-114 ft. (10.9 - 34.8 m) trapezoidal boom (power pinned fly) plus a 32 ft. (9.7 m) "Swingaway" extension, Grove Model 308-26 main hoist with 750 ft. (228.6 m) of 3/4 in. (19 mm) rope, 12,975 lb. (5885 kg) counterweight, Grove Model 12 x 6 - 100 carrier, Cummins NT855C carrier engine), Cummins 6BTA5.9L (superstructure engine) REMOVE: *Standard 12,975 lb. (5885 kg) counterweight Standard 32 ft. (9.7 m) "Swingaway" extension Standard main hoist with rope (2) front outrigger beams & jacks (2) rear outrigger beams & jacks ADD: 80-ton (72.5 mt), 6-sheave hookblock (stowed) Auxiliary boom head Fifth front outrigger jack **Model 158-16 auxiliary hoist with 550 ft. (167.6 m) of 5/8 in. (16 mm) dia. rope ** Model 11 SGEGR free-fall auxiliary hoist with 550 ft. (167.6 m) of 1/2 in. (13 mm) dia. rope ** Model 308-16 auxiliary hoist with 550 ft. (167.6 m) of 3/4 in. (19 mm) dia. rope and idler	131,940	38,027	93,913	59,848	17,249	42,599
	-12,975	+5,702	-18,677	-5,886	+2,586	-8,472
	-1,654	-1,385	-269	-750	-628	-122
	-2,845	+912	-3,757	-1,290	+414	-1,704
	-5,600	-3,302	-2,298	-2,540	-1,498	-1,042
	-5,600	+2,253	-7,853	-2,540	+1,022	-3,562
	+1,600	+2,756	-1,156	+726	+1,280	-524
	+230	+389	-159	+104	+176	-72
	+600	+809	-209	+272	+367	-95
	+1,119	-495	+1,614	+508	-225	+732
	+1,078	-477	+1,555	+489	-216	+705
	+2,385	-1,055	+3,440	+1,082	-479	+1,560

SUBSTITUTE:									
36-114 Ft. (10.9-34.7 m) full power boom	+1,184	+351	+833	+537	+159	+378			
**12,300 lb. (5579 kg) counterweight	-675	+297	-972	-306	+135	-441			
***11,300 lb. (5126 kg) counterweight	-1,675	+736	-2,411	-760	+334	-1,094			
GM8V - 71T engine (carrier)	-400	-447	+47	-181	-203	+21			
Caterpillar 3406T engine (carrier)	-95	-106	+11	-43	.48	+5			
GM6V - 53N engine (superstructure)	-170	+5	-175	-77	+2	-79			
Caterpillar 3208 engine (superstructure)	-410	+12	-422	-186	+5	-191			

*Use 12,975 lb. (5885 kg) counterweight without auxiliary hoist.

**Use 12,300 lb. (5579 kg) counterweight with Grove 15B-16 or Gearmatic Model 11 SGECR free-fall auxiliary hoist.

***Use 11,300 lb. (5126 kg) counterweight with Grove 30B-16 auxiliary hoist.

SECTION II

SAFETY PRECAUTIONS

GENERAL.

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

With this thought in mind, this information has been provided to assist you, the crane operator, in promoting a safe working atmosphere for yourself and those around you. It is meant to cover every conceivable circumstance which could arise. It is intended to present basic safety precautions that should be followed in daily crane operation.

Because you, the crane operator, are the only part of the crane that can think and reason, your responsibility is not lessened by the addition of warning devices. Indeed, you must guard against acquiring a false sense of security when using them. They are there to assist, **NOT** direct the operation. Warning devices can be mechanical, electrical, electronic, or a combination thereof. They are subject to failure or misuse.

You, the operator, are the only one who can be relied upon to assure the safety of yourself and those around you. Be a **PROFESSIONAL** and follow the **RULES** of safety.

REMEMBER, failure to follow just one safety precaution can cause that accident to people or equipment.

You are responsible for the safety of yourself and those around you.

Ensure you and those working with you are aware of any special dangers where you are operating the crane. Be especially careful of dangerous ground and objects, including buildings, near the crane.

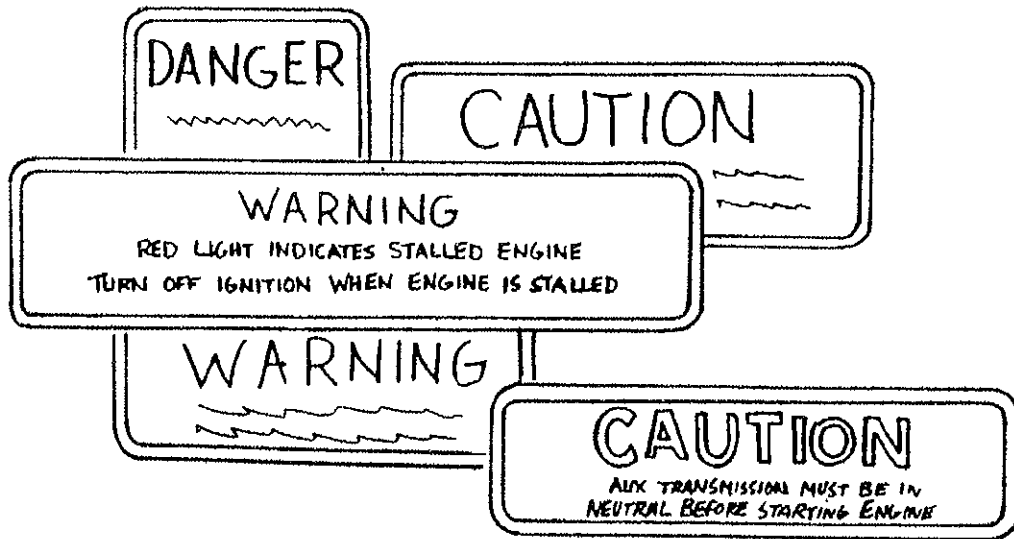
Be aware at all times that you are responsible for the safety of yourself, your co-workers, the crane and everything around it. Make certain the crane is level, properly maintained, and then pay attention to winds, boom deflection, rope sway, and any unusual things, which you, as a crane operator, may notice which would not be important to others.

Know and abide by the basic safety rules.

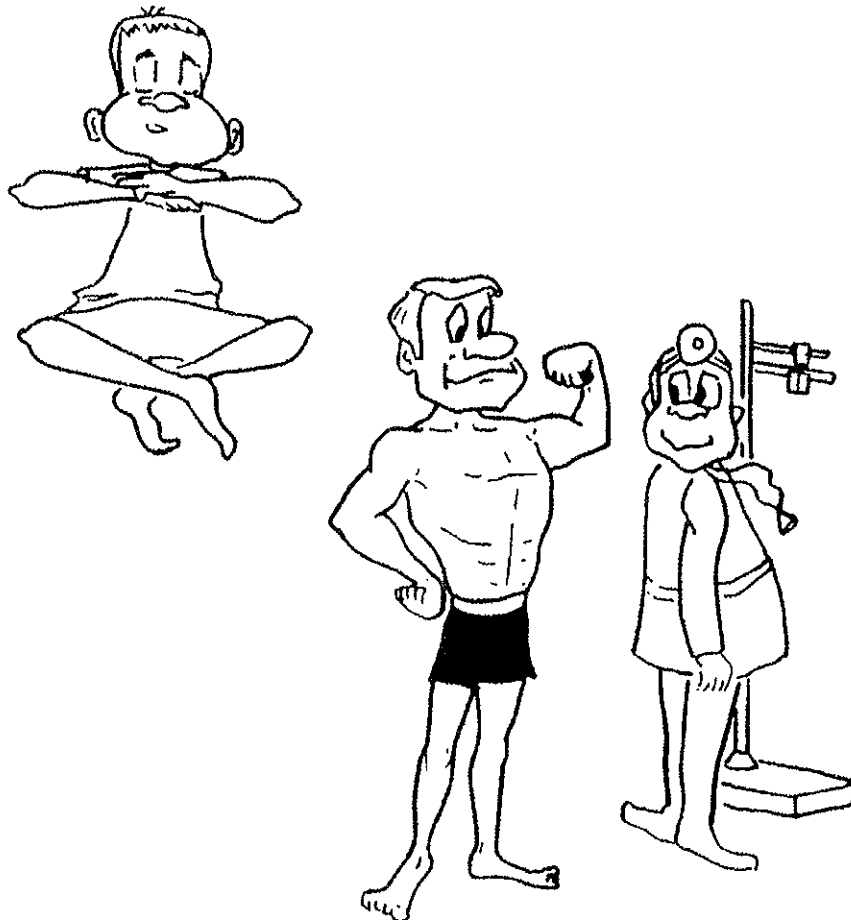
Read and understand the operator's handbook before entering the cab.



Follow directions on all placards. Know what they mean and follow their instructions.



Be prepared for the work day.



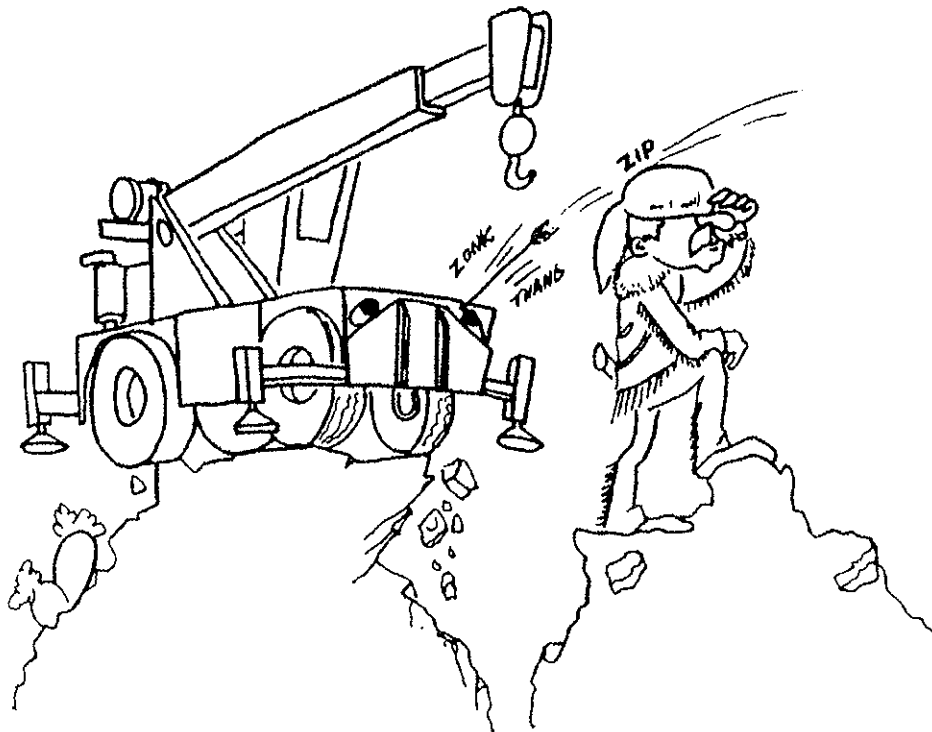
Crane operators must be thoroughly familiar with safe crane operating practices and have a complete understanding of all operation and maintenance instructions provided. Operators should be physically fit and thoroughly trained, with related experience, not be easily excitable, not be subject to epileptic seizures, and not be using any drug that could impair physical, visual, or mental reactions or capabilities.

Wear the proper clothing for the job. Wear personnel protective equipment as required by local or job regulations.

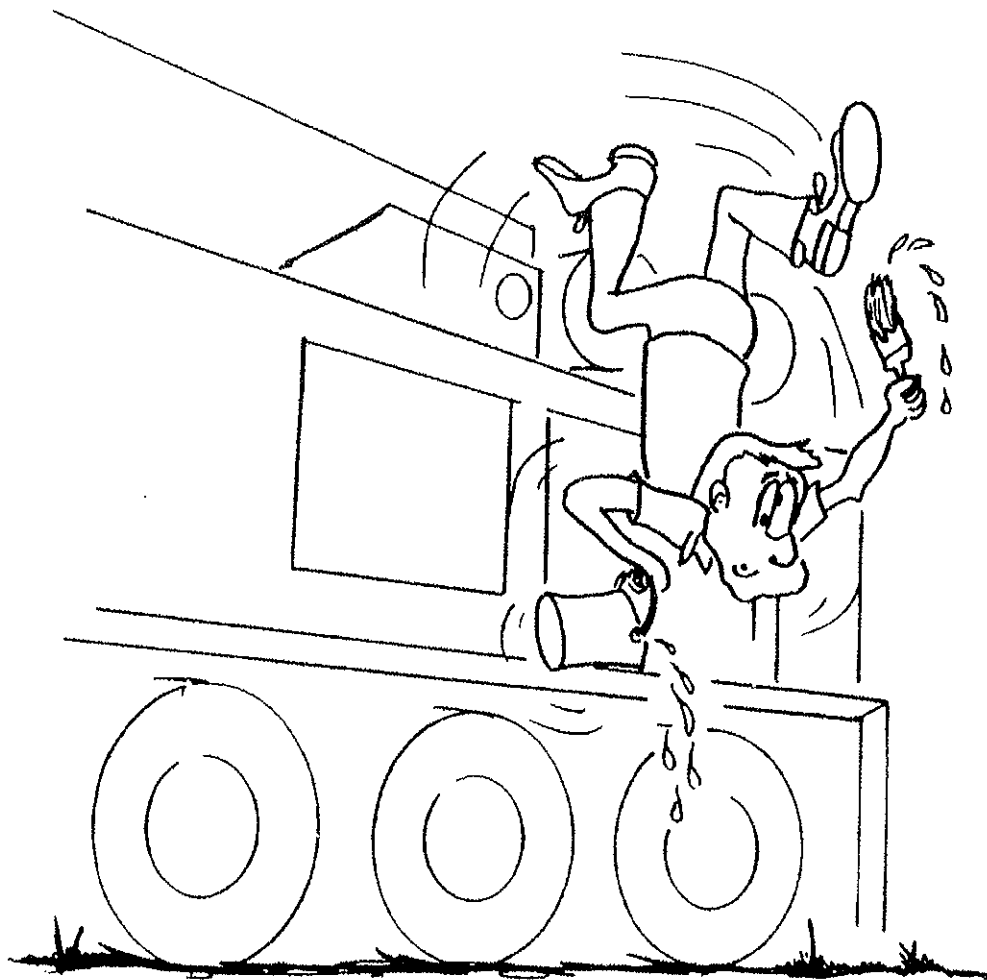
Inspect the crane every day. Ensure that routine maintenance and lubrication are being dutifully performed. Don't operate a damaged or poorly maintained crane. You risk lives when operating faulty machinery, including your own.

Know the area in which you are working. Familiarize yourself with work site obstructions and other potential hazards in the area.

Use caution when in the vicinity of overhanging banks or edges.



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



Since certain shoe sole materials are more slip resistant than others, all operating and service personnel should wear footwear with high slip resistant sole material.

Avoid a dirty or greasy crane. Keep the cab, deck, and foot and hand holds free of mud and grease for operator safety. Dirty equipment fails rapidly and makes good maintenance difficult.

Observe and heed possible pinch points while performing maintenance or other work.

Check for WARNING tags placed on the crane. If found, refuse to operate the crane until repairs are made and WARNING tags are removed by authorized personnel.

Before performing maintenance, disconnect the battery, remove the ignition key, and place WARNING SIGNS in the cab.

Proper lubrication is a requirement in any heavy equipment operation. Follow the factory recommendations regarding the lubrication time intervals and types of lubricants used. Adjust time intervals accordingly, when working under severe conditions.

When adding oil to the hydraulic system, follow the manufacturer's recommendations. Mixing the wrong fluids could destroy seals, causing machine failure.

When performing maintenance, refer to the appropriate manual for instructions. Consult the factory if there is any question regarding procedures or specifications.

Do not attempt repairs you do not understand!

BEFORE performing maintenance on the crane, remove all weight from outrigger jack cylinders, and lower attachments to the ground or place them on suitable blocking.

Pressurized hydraulic oil can cause serious injury. Be certain all lines, components, and fittings are tight and serviceable. Use a piece of cardboard or wood to search for suspected leaks.

Never exceed the manufacturer's recommended relief valve pressure settings.

Always replace the guards or other safety devices which may have been removed during crane repair or adjustment.

Have an approved fire extinguisher available and know how to use it. Inspect as required to ensure it is fully charged and operable.

Maintain battery electrolyte at the proper level and check it with a flashlight.

A spark or flame could cause a battery explosion. Don't short across the posts to check the charge.

Check battery condition only with proper test equipment.

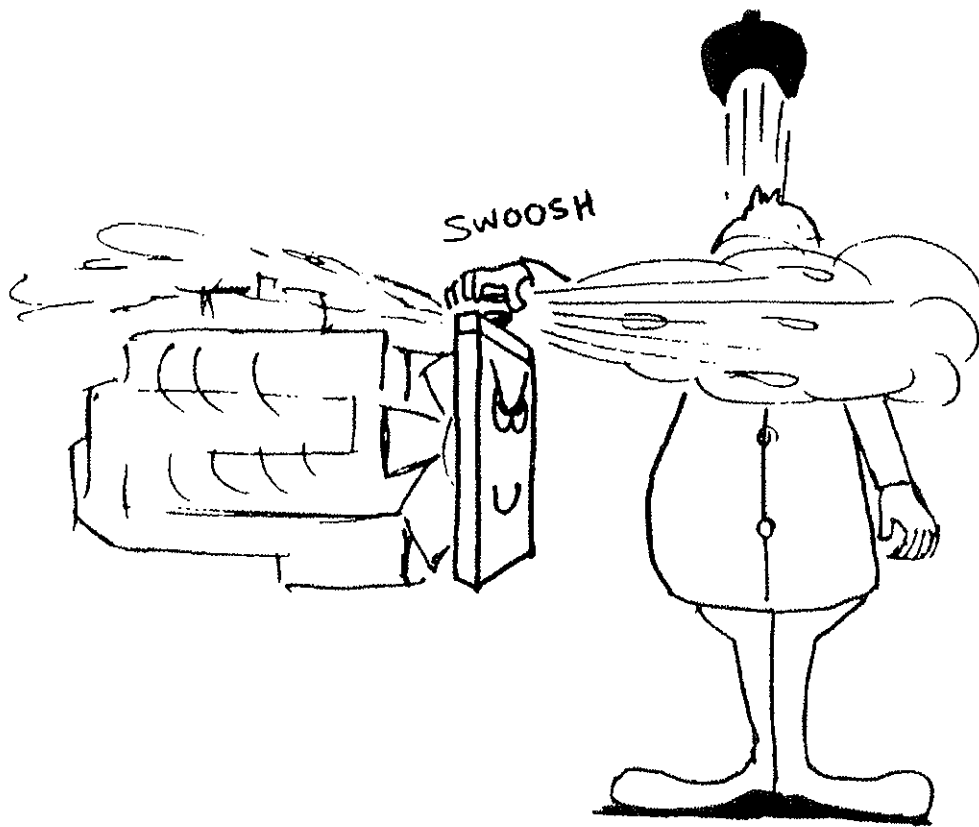
Wear your safety glasses when servicing batteries.

Don't smoke while performing battery maintenance.

Disconnect the grounded battery clamp first when removing a battery and connect it last when installing battery.

Before charging a battery, remove the battery caps to allow gases to escape.

Avoid battery acid contact with the skin and eyes. If accidentally contacted, flush the area with water and consult a doctor immediately.



Be careful when checking the coolant level. Shutdown the engine and allow the radiator time to cool before removing the radiator cap.

Follow standard safety precautions when refueling. **FUEL IT SAFELY.**

Unless authorized and approved by Grove Manufacturing Company, do not make any modifications, alterations, or changes to a crane which could in any way affect its original design. Such action invalidates all warranties and capacity charts, and makes the owner/user liable for any resultant accidents.

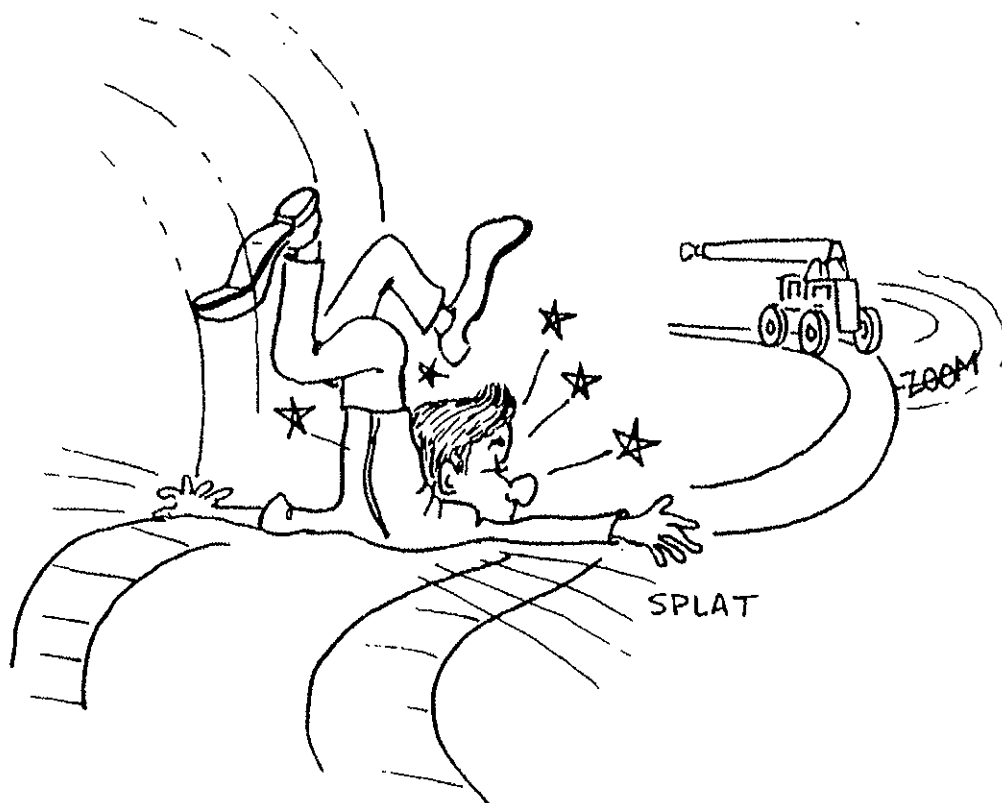
Keep the crane properly maintained and adjusted at all times. Shutdown the crane while making repairs or adjustments.

Keep your fingers away from potentially hazardous areas.

Use cleaning solutions that are non-flammable and approved for the work being performed.

Always perform a function check after repairs have been made to ensure proper operation. Load tests should be performed when structural or lifting members are involved.

Do not store flammable materials on the crane at any time.



Never get off or on a moving crane.

Allow No One other than the operator to be on the crane while the crane is functioning or moving, unless they are seated in a two-man cab.

When getting on or off a stationary crane, use both hands and use the handrails and steps provided.

When shutting down the crane:

Engage the parking brakes.

Put controls in neutral.

Chock the wheels.

Remove the ignition key.

Lock the machine and install vandal guards, if used.

Don't touch metal surfaces that could freeze you to them.

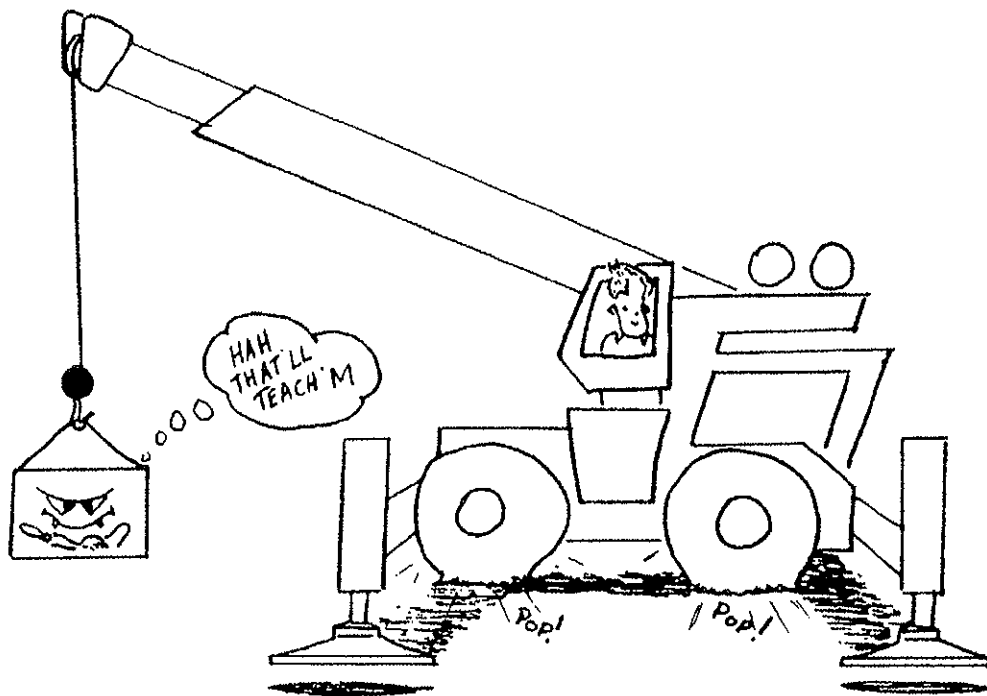
CRANING OPERATION.

Check crane stability before lifting loads. Ensure the outriggers (or tires if lifting on rubber) are firmly positioned on solid surfaces. Ensure the crane is level, brakes are set, and the load is properly rigged and attached to the hook. Lift the load slightly off the ground and recheck the stability before proceeding with the lift. Determine the weight of the load before you attempt the lift. Check the load chart against the weight of the load.

Most accidents involving mobile hydraulic cranes are caused by the following:

- crane out of level,
- bad surface conditions,
- outriggers used improperly or not used at all,
- inadequate blocking under outrigger floats,
- improper crane operation.

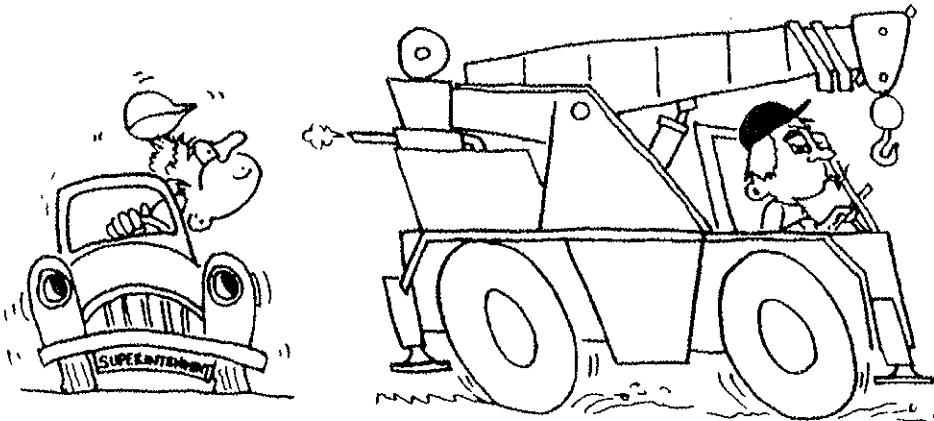
After the crane has been properly set-up, make a dry run before making the first lift. Become familiar with all factors peculiar to the job site. Know what moves to make BEFORE attaching the first load. Plan ahead.



Unless lifting within On Rubber capacities, outrigger beams must be fully extended, jack cylinders extended and safety locks set, to provide maximum leveling of the crane. Remove all weight from tires before lifting on outriggers.

Use adequate cribbing under outrigger floats to distribute weight over a greater area. Check frequently for settling.

When moving in tight quarters, post a look-out to help guard against collisions or bumping structures.



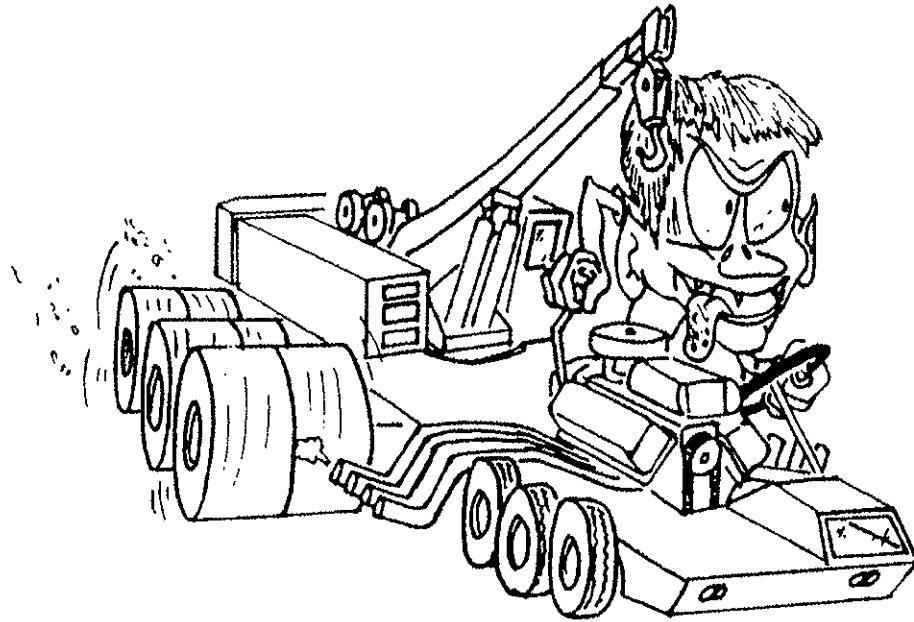
Never back up without the aid of a signalman to verify the area behind the crane is clear of obstructions and/or personnel.

When traveling, the boom should be completely retracted, lowered, and stowed in its travel position.

Do not attempt to move the crane until brake system air pressure is at operating level.

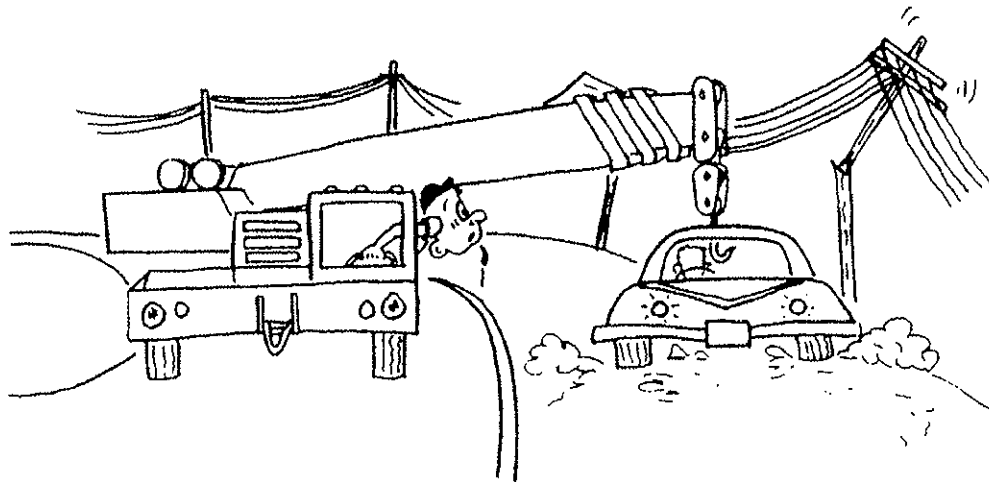
Secure the hook block and other items before moving the crane.

When traveling, keep the lights on, use traffic warning flags and signs, and use front and rear flag vehicles. Check state and local restrictions and regulations.

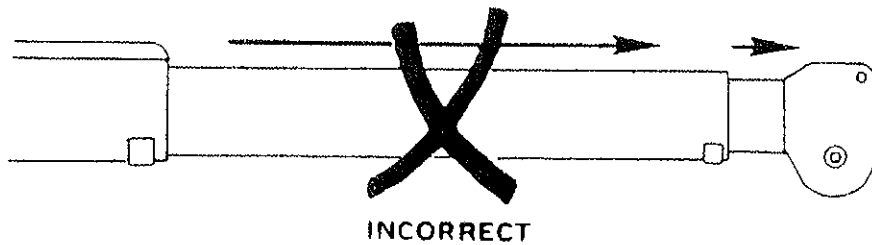
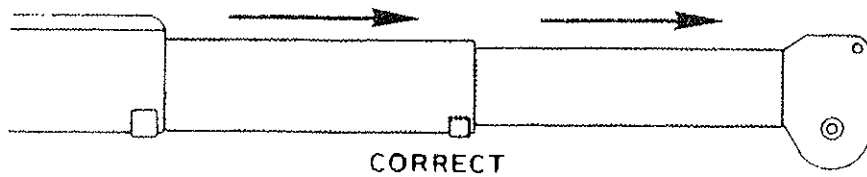


Drive carefully and avoid speeding.

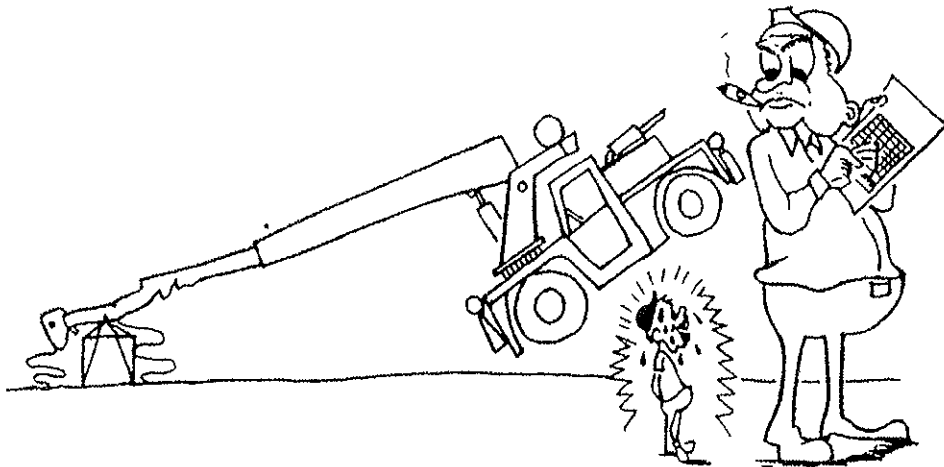
Before traveling a crane, check suitability of proposed route with regard to crane height, width, and length.



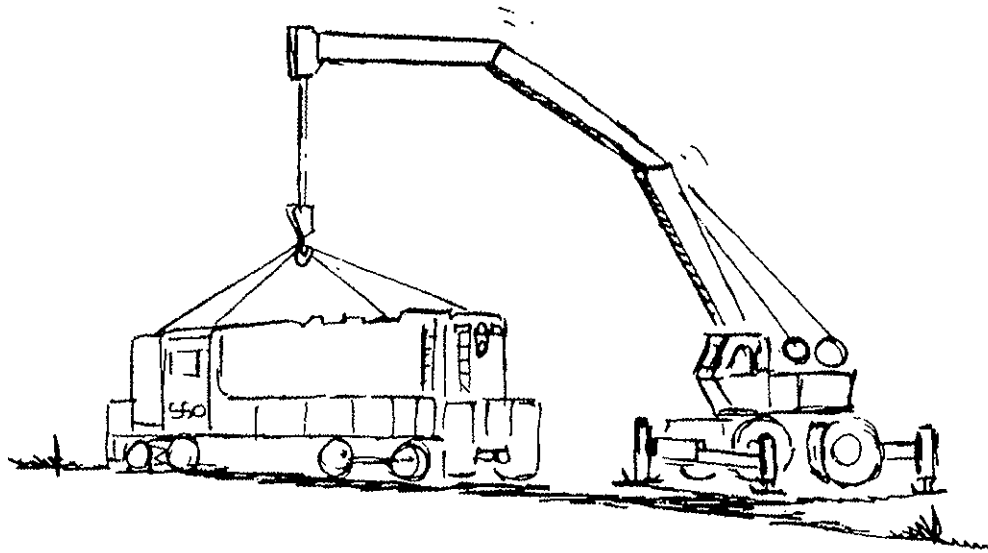
Secure the turntable before moving crane, use the swing lock.



Extend boom sections equally. Keep the lifting lines and the boom as short as the load and conditions will permit. Remember, the load chart capacities are based on equally extended boom sections.



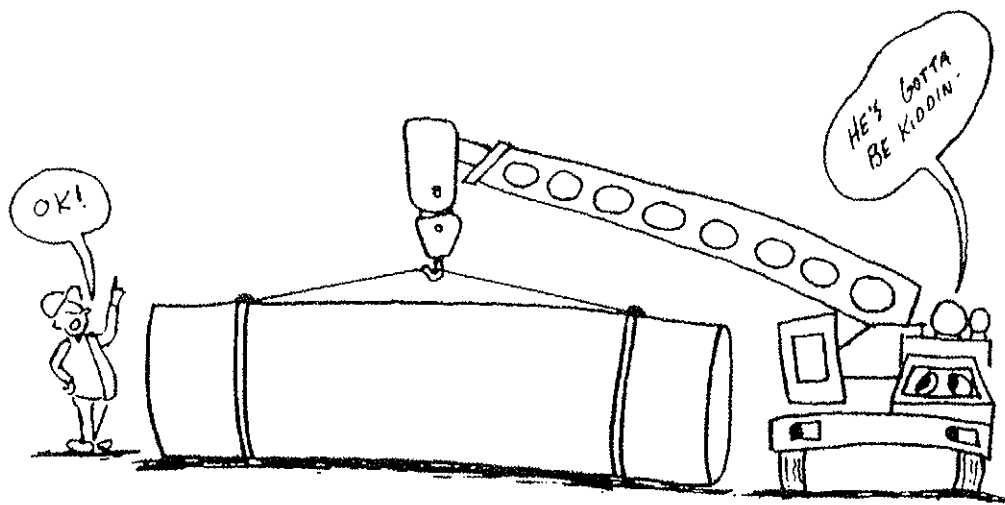
Do not exceed crane rating. Do not rely on the crane tipping stability to determine the maximum lifting capacity. Do not exceed the capacities shown on the load chart in the cab. REMEMBER: ALL LIFTING DEVICES (HEADACHE BALL, BLOCK, JIB, ETC.) - ARE PART OF THE LOAD.



Always check the capacity of the crane as shown on the load chart before making any lifts.

Know the weight of all loads before you attempt a lift. Ensure the load to be lifted is within the rated lifting capacity of the crane.

Always keep the load as near to the crane and as close to the ground as possible.



NEVER exceed the rated lift capacity shown on the load chart. Always check the load chart to ensure the load to be lifted at the desired radius is within the rated capacity of the crane.

NEVER use the crane stability to determine capacity. It may be too late when you find out.

Multiple crane lifts are not recommended. The use of more than one crane to make a lift requires the ultimate in equipment, engineering, operating skill, and lift coordination.

BUT, if it is necessary to perform a multi-crane lift, the operator shall be responsible for assuring that the following minimum safety precautions are taken.

1. Secure the services of a qualified engineer to direct the operation.
2. Use one signal person and be sure he is qualified.
3. Coordinate lifting plans with the operator, engineer and signal person prior to beginning the lift.
4. Use cranes and rigging of equal capabilities and use the same boom length. Be certain cranes are of adequate lifting capacity.
5. Use outriggers on cranes so equipped.

6. Calculate the amount of weight to be lifted by each crane and attach slings at the correct points for proper weight distribution.
7. Lift only from a stationary position - DO NOT TRAVEL.
8. If possible, provide approved radio equipment for voice communication between all parties engaged in the lift.
9. Ensure the load lines are directly over the attach points to avoid side loading the cranes.

Always use enough parts-of-line to accommodate heavy lifts. Provide a safety allowance and reeve more parts of line, rather than fewer parts, than you need. Refer to the values on the load capacity chart for the line weight ratios.

Watch the tail-swing of the revolving superstructure, especially if there are people or obstacles in the area.

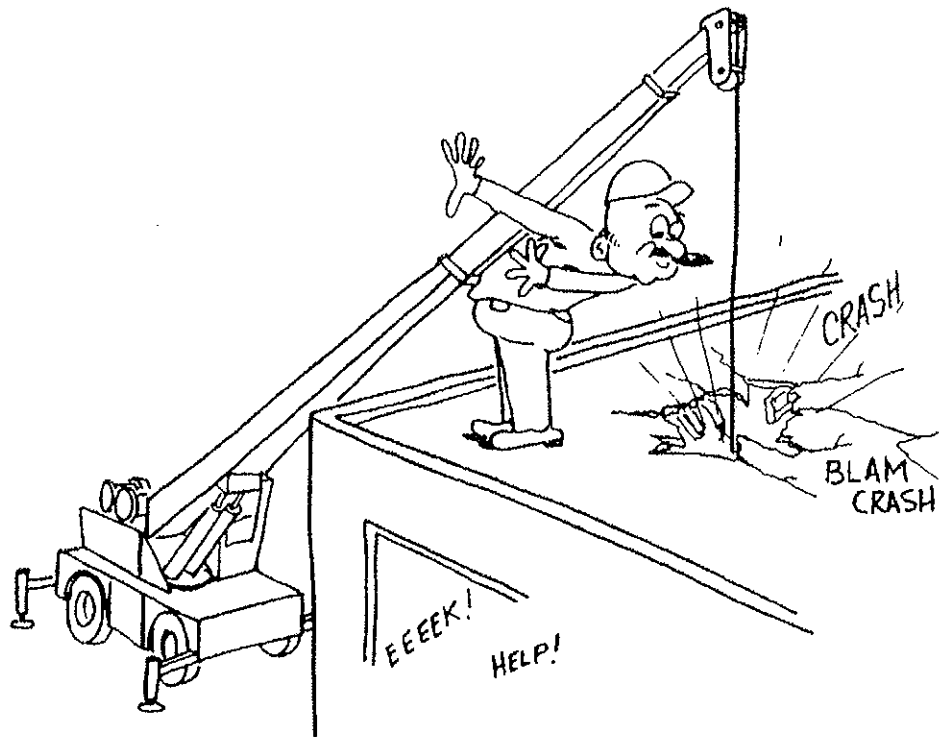
Always make daily inspections of the wire-rope and replace worn, rusty, or frayed ropes.

Always place the load on the ground when lubricating or adjusting.

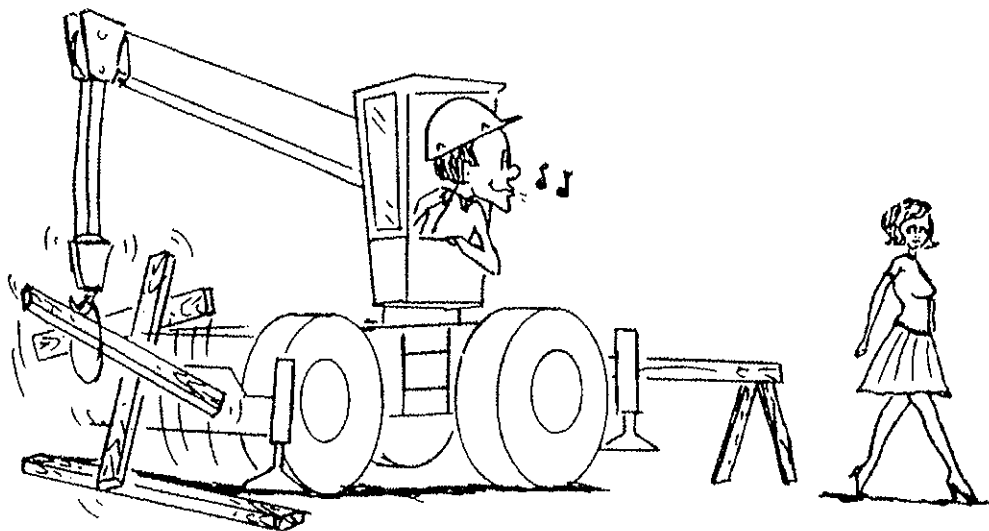
A qualified signalman should be available at all times and especially when;

- working in vicinity of power lines,
- the crane operator cannot clearly see the load at all times,
- moving the crane in an area or direction in which the operator cannot clearly see the path of travel.

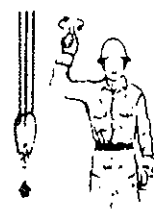
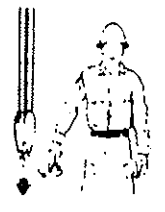
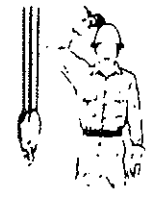

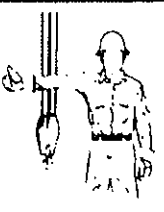
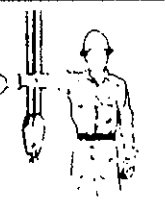
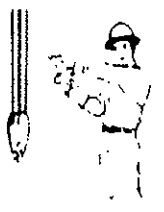
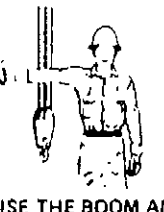
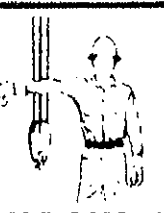
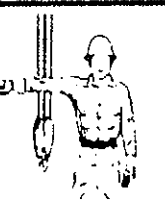
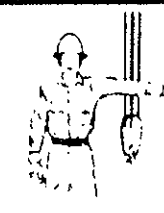
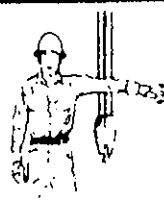
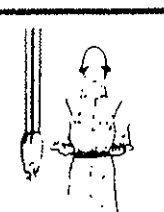


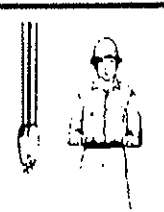



At all times use standardized hand signals previously agreed on and completely understood by the operator.



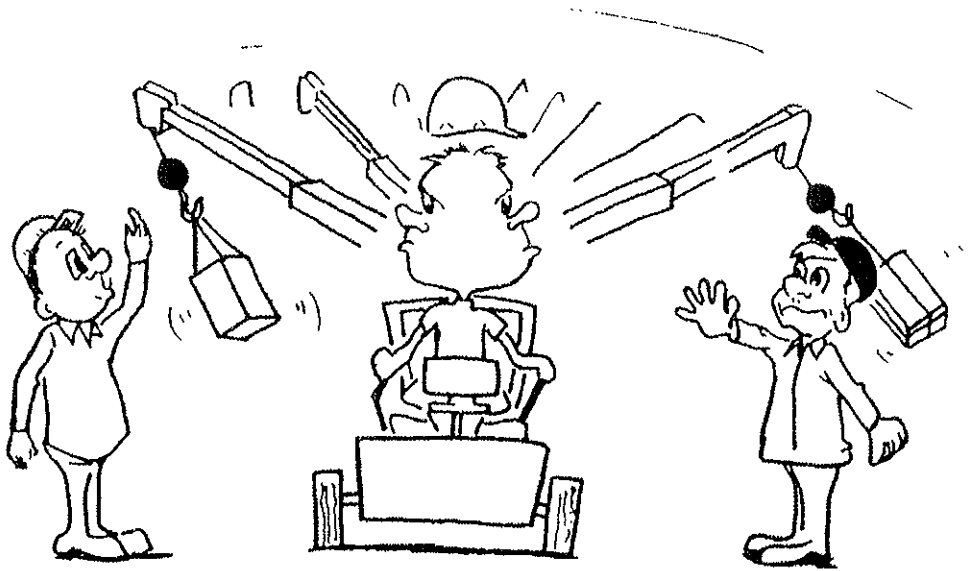
If communication with the signalman is lost, crane movement must be stopped until contact is regained.



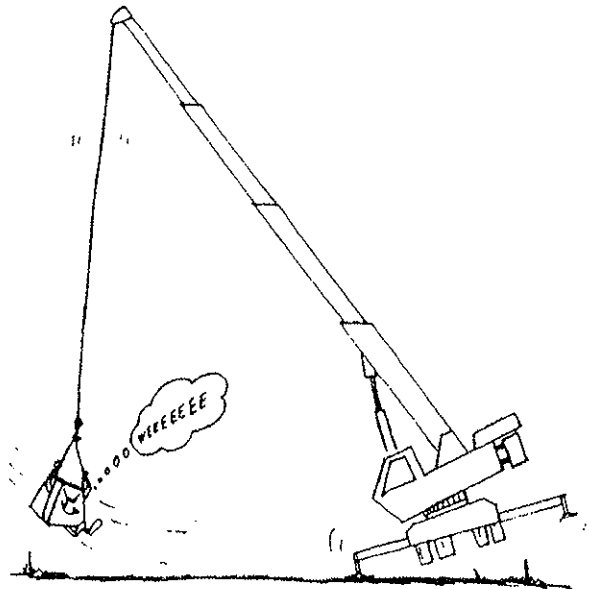
Watch the load at all times. Watch the signalman and/or load while it is moving. In case you must look in another direction, stop the operation immediately.

			
HOIST	LOWER	USE MAIN HOIST	USE WHIP LINE (Auxiliary Hoist)
			
RAISE BOOM	LOWER BOOM	MOVE SLOWLY	RAISE THE BOOM AND LOWER THE LOAD
			
LOWER THE BOOM AND RAISE THE LOAD	SWING	STOP	EMERGENCY STOP
			
EXTEND BOOM	REEL EVERYTHING	TRAVEL	RETRACT BOOM
	 HAND SIGNALS GROVE MANUFACTURING COMPANY <small>11000 11000 GROVE ROAD, S.W. GRAND RAPIDS, MICHIGAN 49508 PHONE (616) 941-1000</small>		
EXTEND BOOM (ONE HAND)			RETRACT BOOM (ONE HAND)

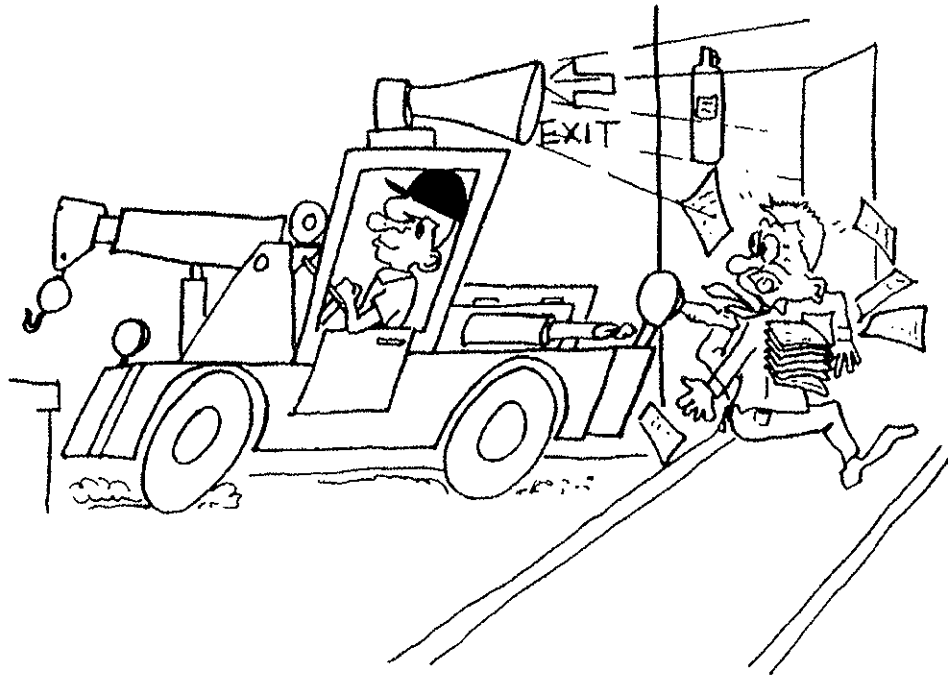
Use only one qualified signalman whenever vision is obscured and follow only his directions. But



. . . . Obey a signal to stop from anyone.



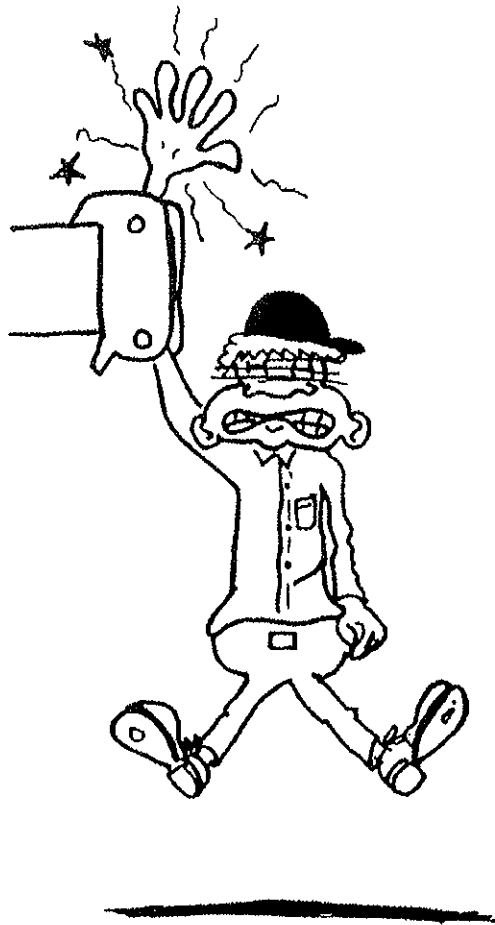
KEEP THE BOOM SHORT. Swinging loads with a long line can create an unstable condition and possible structural failure of the boom.



Sound a warning before moving the crane or when approaching personnel.

Always move toward the load and move slowly. Use a tagline to control the load.

Stay clear of the sheave wheels, holes, and lattice work in telescoping booms and other potentially dangerous areas whenever the crane is in operation.



Pinch points are impossible to eliminate. Keep all portions of your body away from cable drums, sheaves, pulleys, and other moving parts of the crane. Be extremely careful when performing maintenance on the crane.

Cranes equipped with an extendable counterweight must have the counterweight in extended position prior to lifting.

Use extreme caution when lifting with more than one hoist.

Do not strike any obstruction with the boom. If the boom should accidentally contact an object; stop immediately. Inspect the boom. Remove the crane from service if the boom is damaged.

Never push or pull with a crane boom.

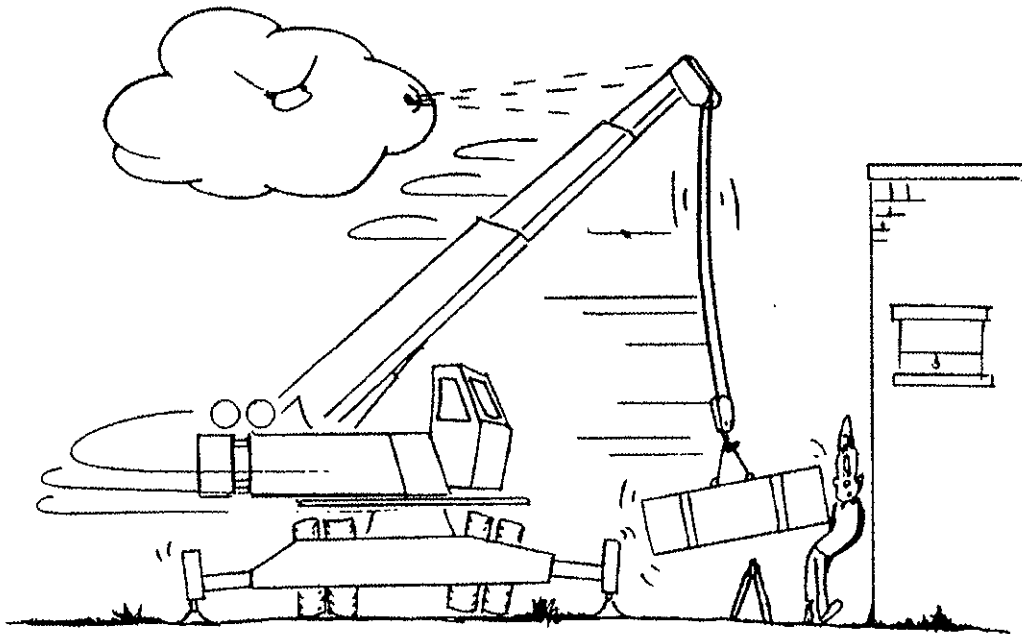
Do not add to the counterweight to increase capacity.

When lifting loads, lift slowly and proceed with caution.

Maintaining a steady tension may free the load without shock loading the crane.

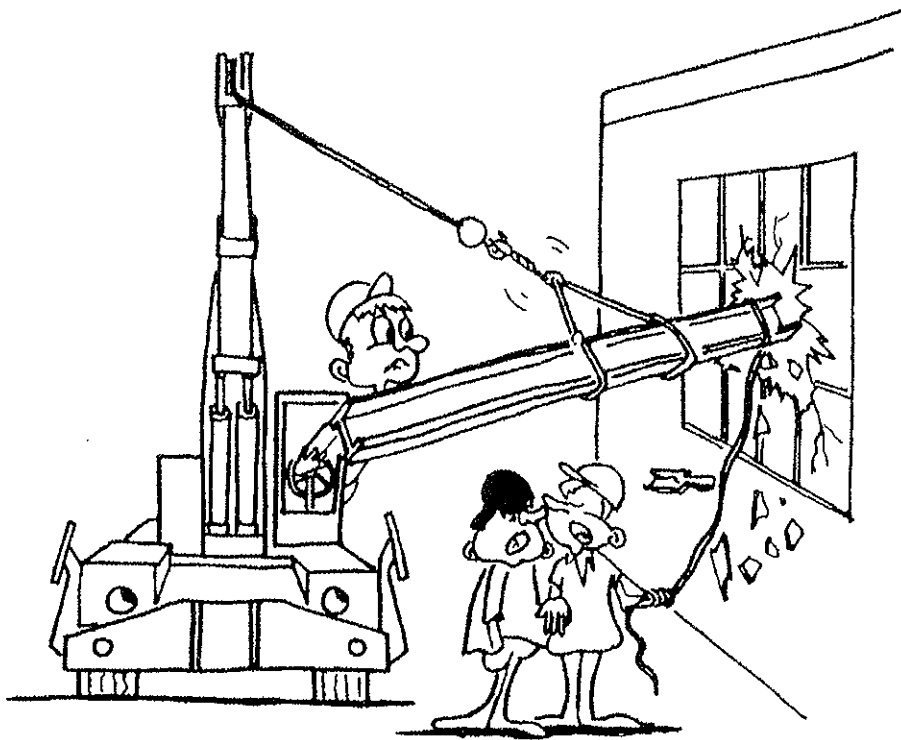
Cranes are designed and rated to handle freely suspended loads. Do not pull post, piling, or submerged articles that may have a heavy accumulation of mud, silt, or sand.

When lifting loads, the crane will lean toward the boom and the load will swing out, increasing load radius. Ensure the load capacity chart is not exceeded when this happens.



Check the swing brake. Make certain the swing brake operates correctly. Unexpected free swinging of a boom can be dangerous.

Wind and other factors such as boom length, boom angle, size and weight of load being lifted, etc. can affect crane stability and crane structures. Practical working loads for each particular job and lift shall be established by the user depending upon conditions that exist at the time a lift is being made. Appropriate capacity reductions shall be made whenever conditions indicate the possibility that a loss of crane stability or structural damage could occur. Be extremely cautious if wind velocity approaches 20 miles per hour.



Exercise caution when swinging loads.

Never swing or lower the boom into the carrier cab.

Stop the hook block from swinging when unhooking a load.

Swinging rapidly can cause the load to swing out and increase the load radius. Swing the load slowly. Swing with caution and keep the load lines vertical.

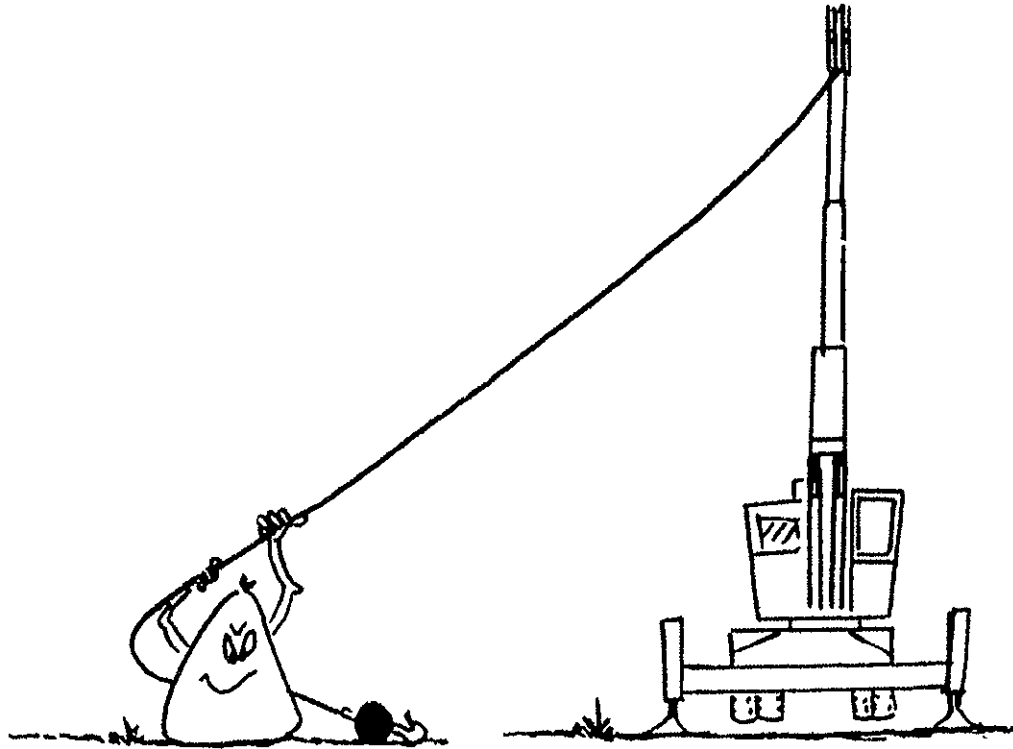
Operate the crane only from the crane operator's seat. Operating from any other position, such as reaching in a window, constitutes a safety hazard.

Never operate the crane with less than two wraps of rope on the hoist drum.

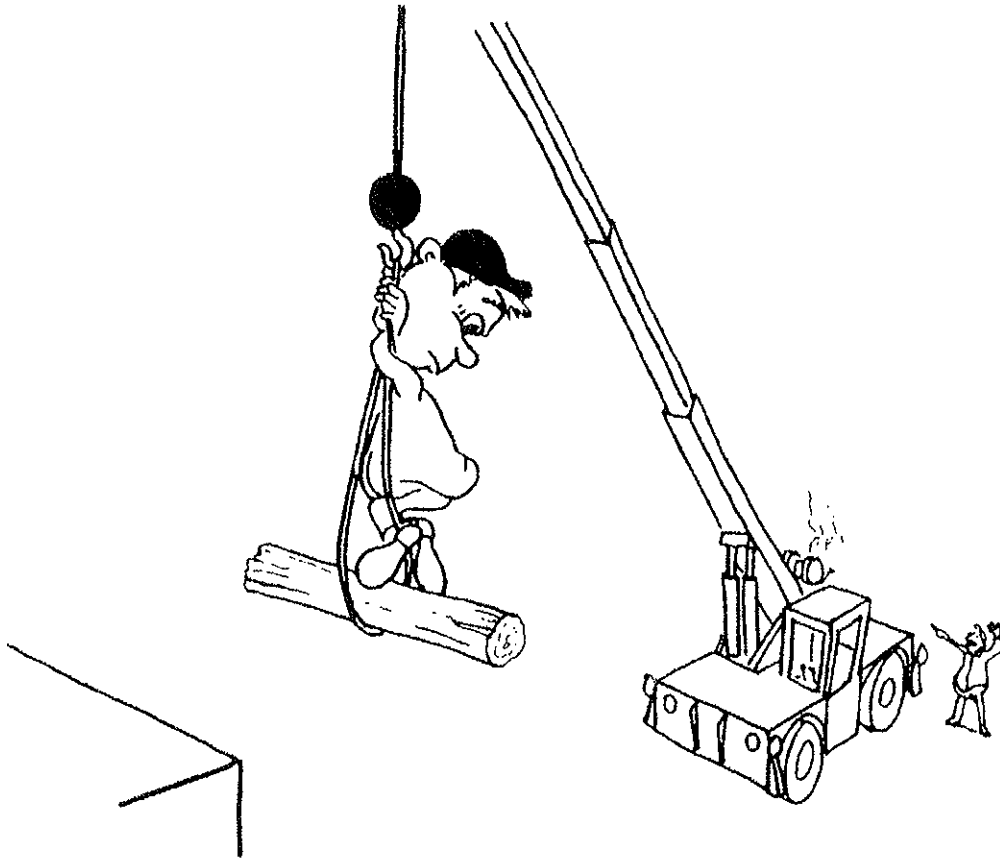
Check the hoist brake by raising the load a few inches and holding it there. Be sure the hoist brake is working correctly before continuing the lift.

When using a controlled free-fall hoist, slowly return the hoist to normal lowering speed before stopping the descent of a load. Quick stops could cause the machine to fail. Also refer to CONTROLLED FREE-FALL HOIST information in this Section.

Do not attempt to change/shift speeds, on multiple speed hoists, with hoist in motion.



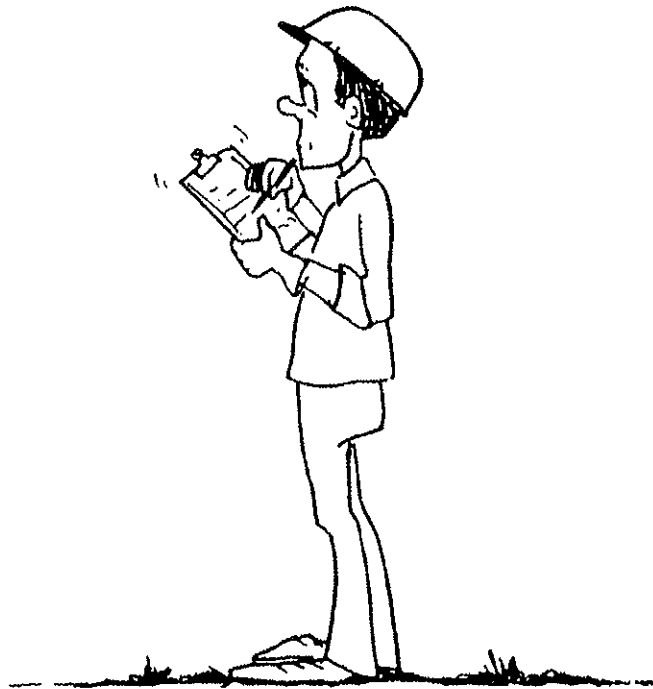
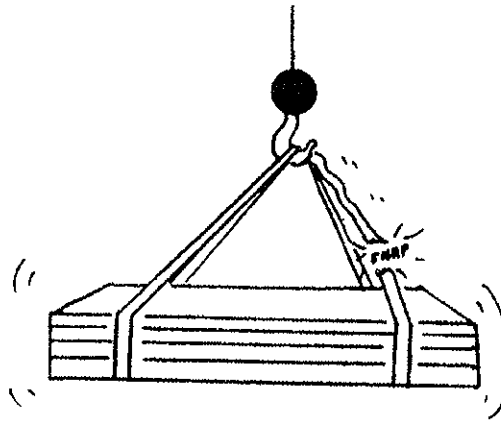
Never pull sideways with the boom. Booms and swing systems are not designed to side pull and may be damaged if subjected to excessive side loading. Booms are designed for lifting only freely suspended loads.



Do not permit anyone to ride loads, slings, hooks, etc., for any reason.

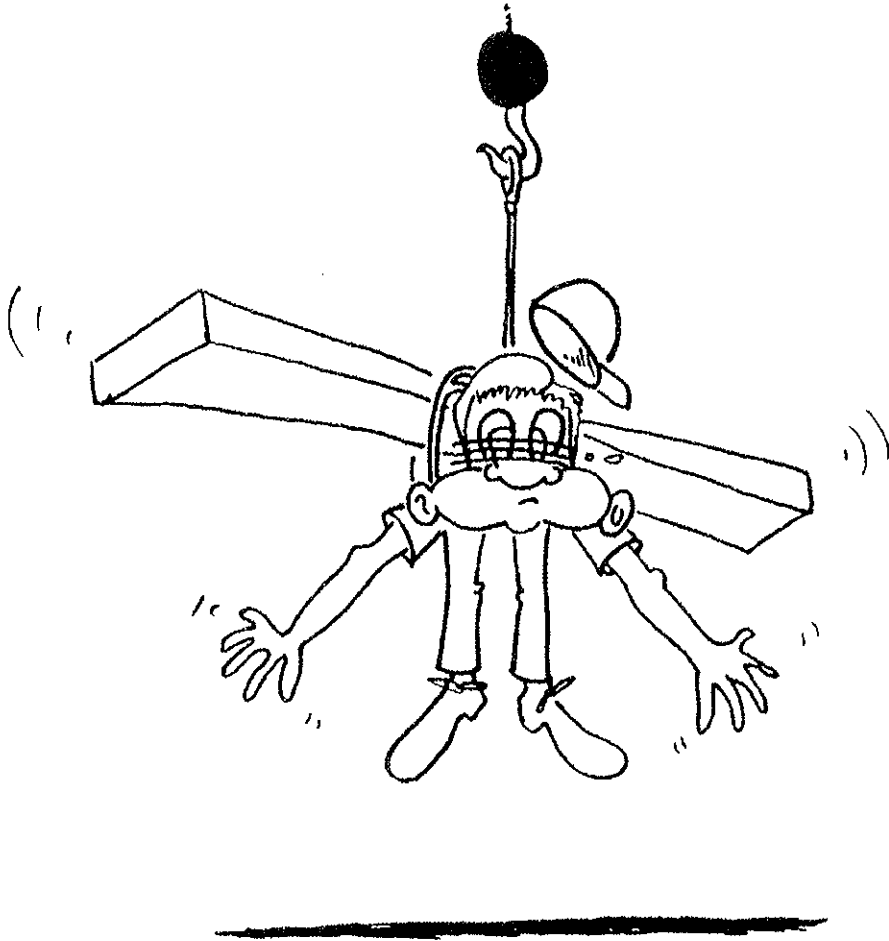
Look before swinging your crane. Even though the original set-up may have been checked, situations do change.

Never stand or work on or near the superstructure while the crane is moving or swinging.

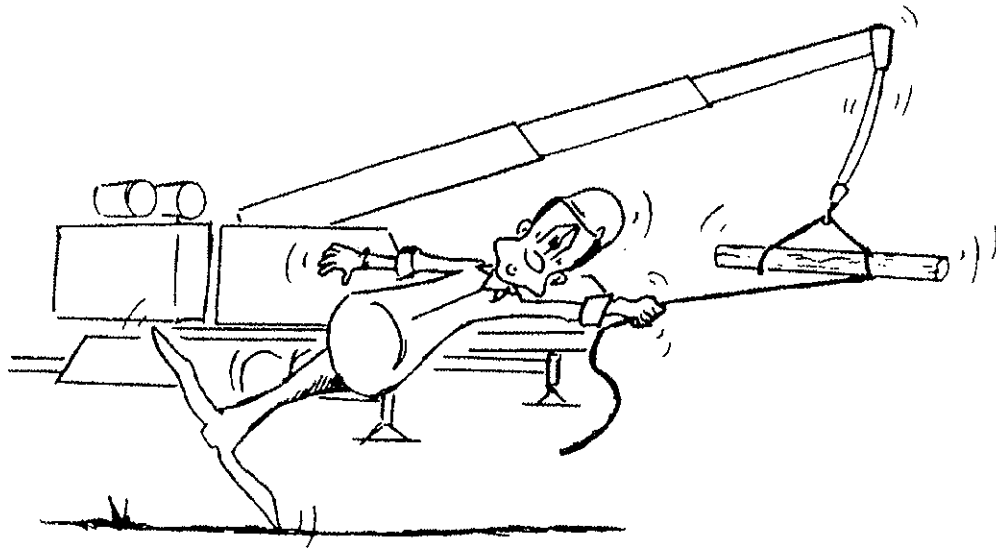


Keep everyone away from suspended loads. Allow no one to walk under a load. Ensure that all slings, ties, and hooks are correctly placed and secured before raising or lowering the load.

Use tag lines, as appropriate, for positioning and restraining loads. Check the load slings before lifting.



Be sure everyone is clear of the crane and work area before making any lifts.

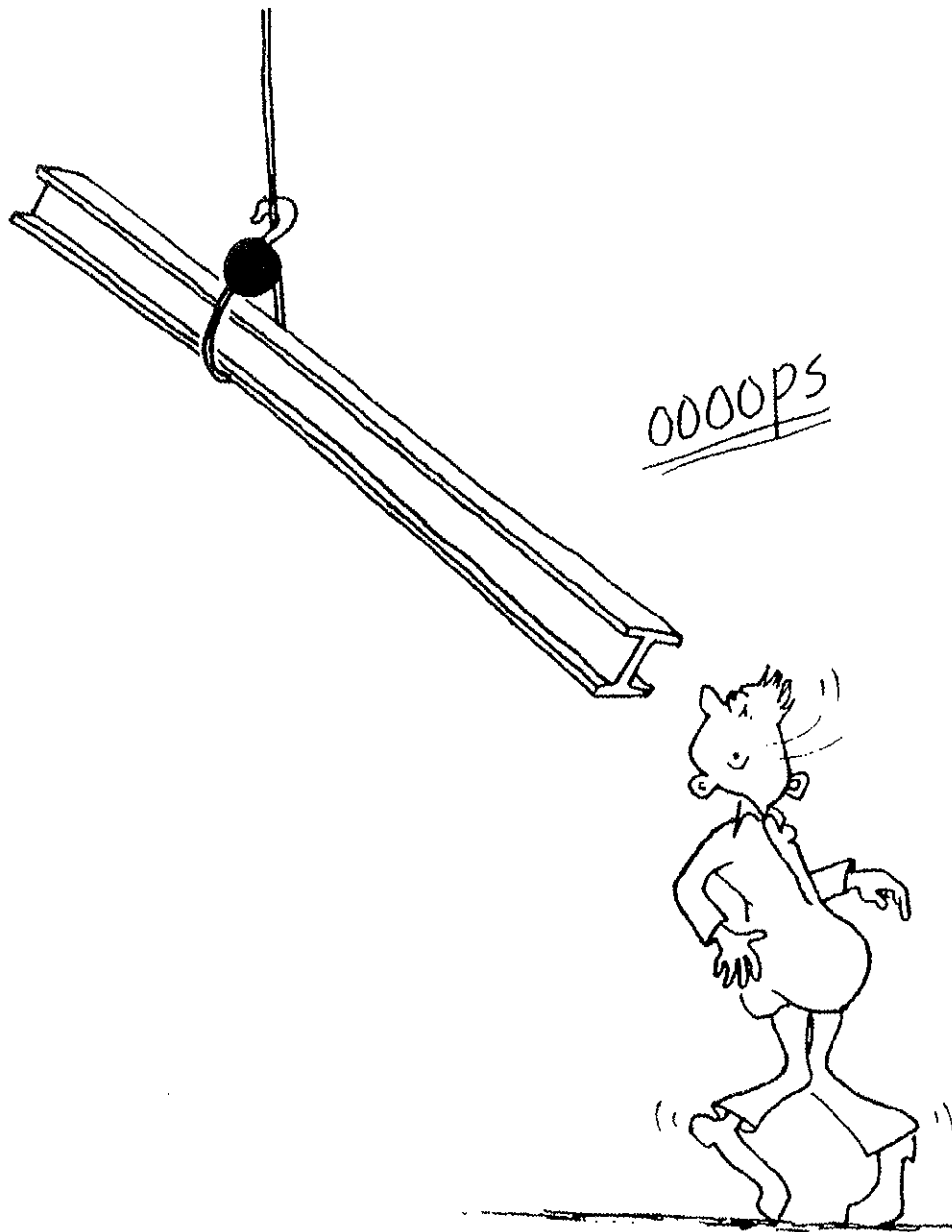


Check all braking and holding devices before operation. Perform an operational check of all braking (wheel and swing) and safety holding devices before starting any crane or traveling operations.

Be sure the load is well secured and attached to the hook with rigging of proper size and in good condition.

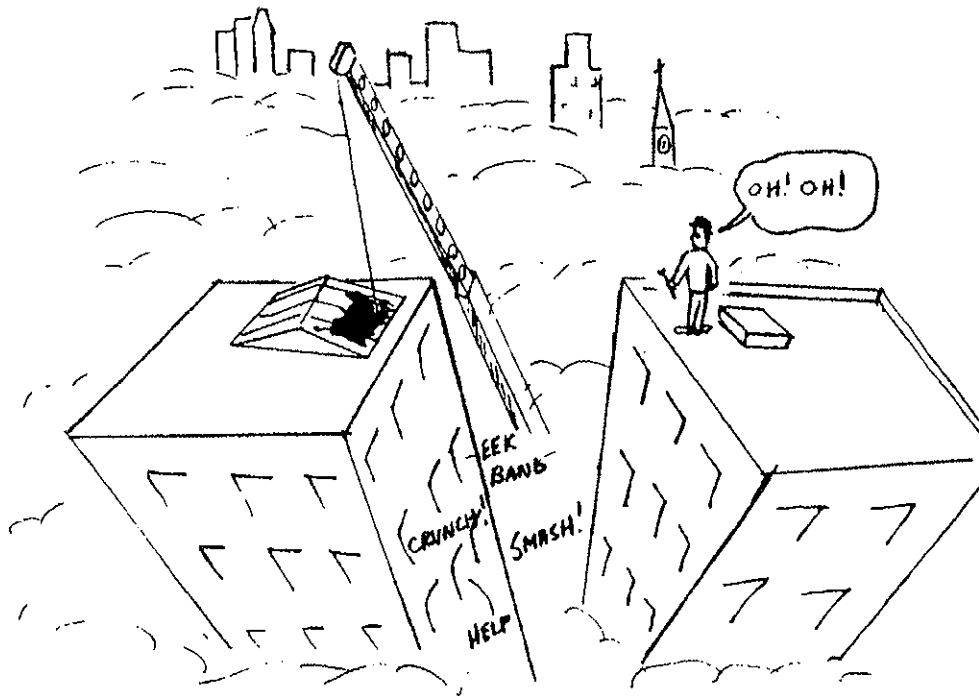
Allow no one to ride on the crane, carrier deck, engine compartment, etc.

Tag line personnel must guide the load from the ground.



Use only slings or other rigging devices rated for the job and use them properly. Never wrap the hoist cable around a load.

Check all tackle, hardware, and slings before use. Refuse to use faulty equipment.



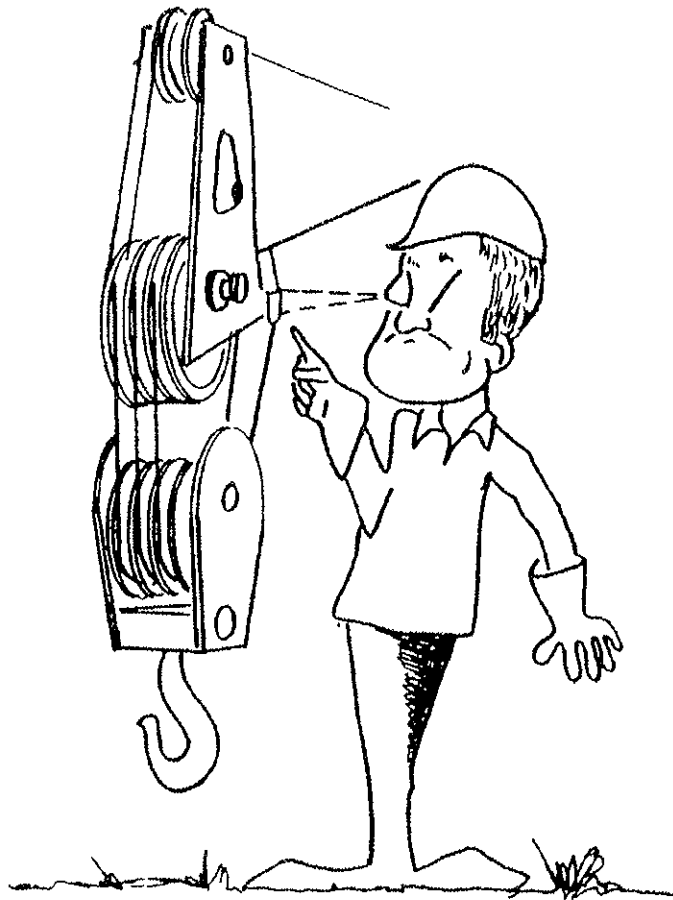
Never work the crane when darkness, fog, or other visibility restrictions make such operations unsafe.

Exercise extreme caution when picking and carrying a load. Never pick and carry a load with a crane that is not authorized for such operation.

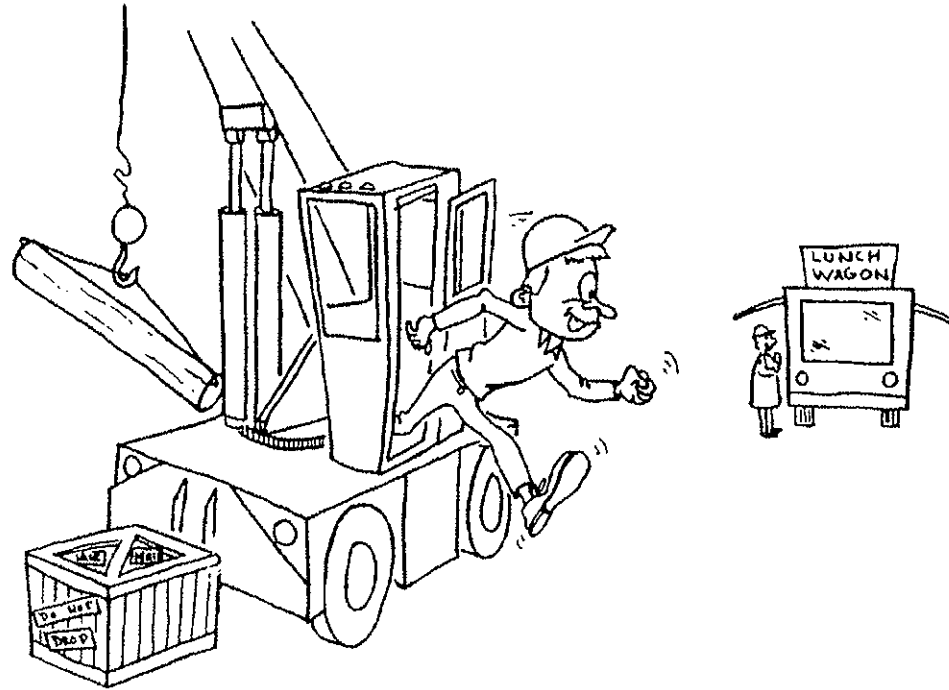
When performing pick and carry operations or operating on sloping ground, carry loads much less than capacity. Keep the load low, carry the load uphill from the crane, swing only to keep load uphill, and always place the loads on the high side.

When traveling with a load, the boom should be carried in line with the direction of motion.

Report any crane damage immediately.



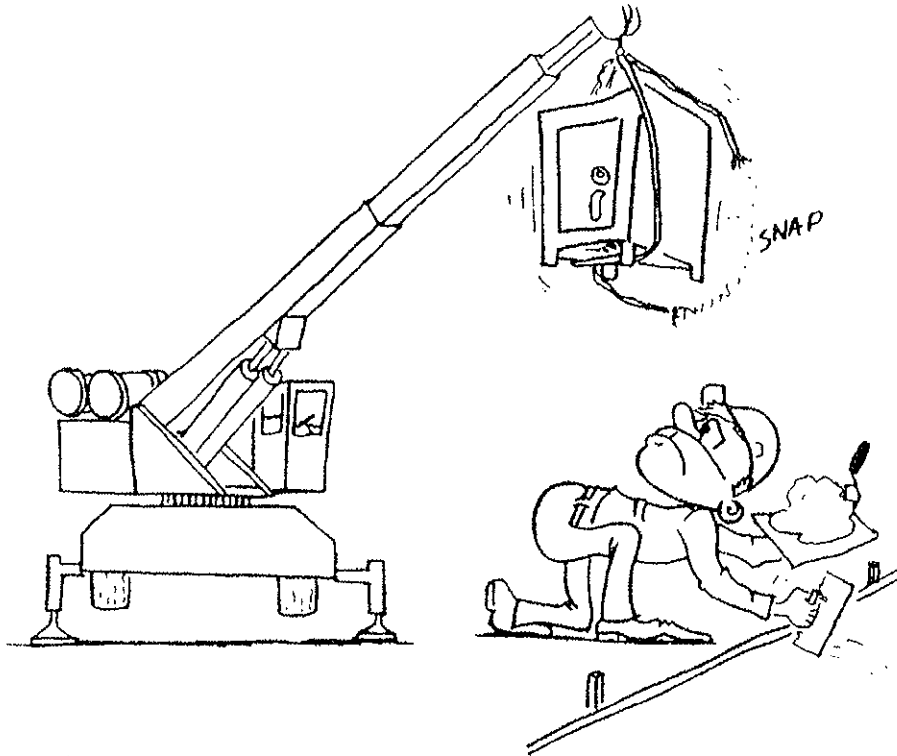
Check all pin connections, bolts, latches, locks, braking and restraining devices before operation. Perform a visual inspection and replace/tighten any damaged or loose devices prior to initiating any crane or traveling operations.



Never leave the crane with a load suspended. Should it become necessary to leave the crane, lower the load to the ground and stop the engine before leaving the cab.

Be alert- stay alert.

Long cantilever booms can create a tipping condition when in an extended and lowered position. Retract the boom proportionally with reference to the capacity of the applicable load chart.

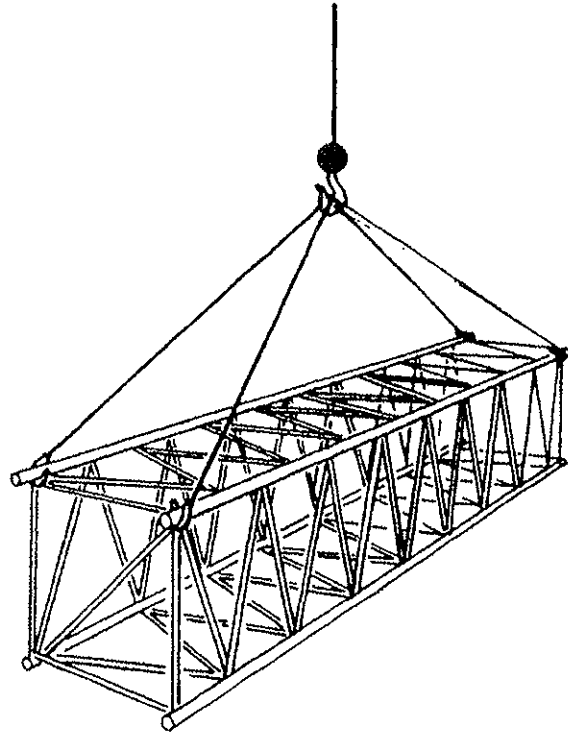


Never swing over personnel, regardless of whether load is suspended from or attached to the boom.

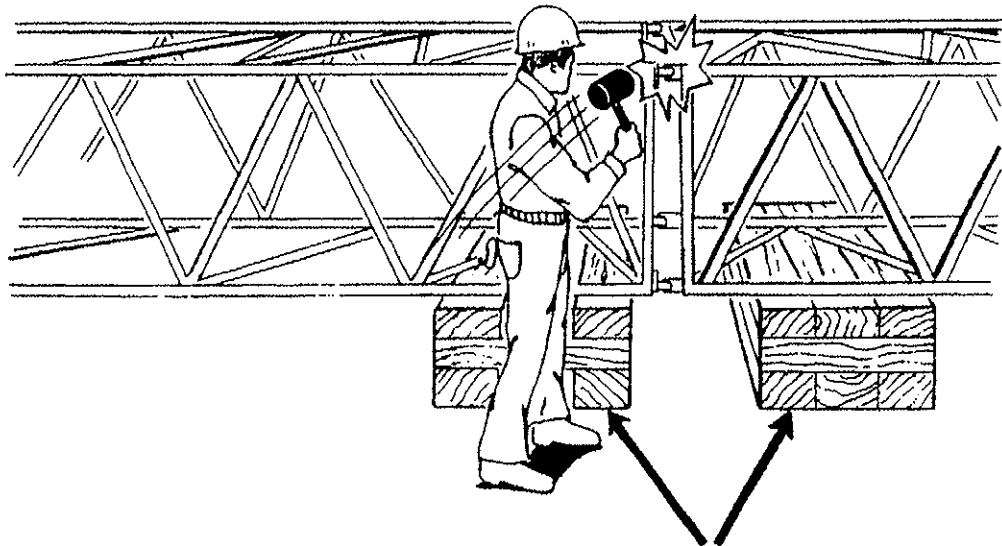
When shutting down the crane adhere to the following.

- Engage the brakes.
- Lower the boom and the load.
- Place the controls in neutral.
- Ensure the swing lock is engaged.
- Remove the ignition key.
- Lock up the crane and install vandal guards, if used.

JIBS.



Sling jib sections from the main chords or the end fittings.



When assembling and disassembling jib sections, use blocking to adequately support each section and to provide proper alignment.

WIRE ROPE AND SHEAVES.

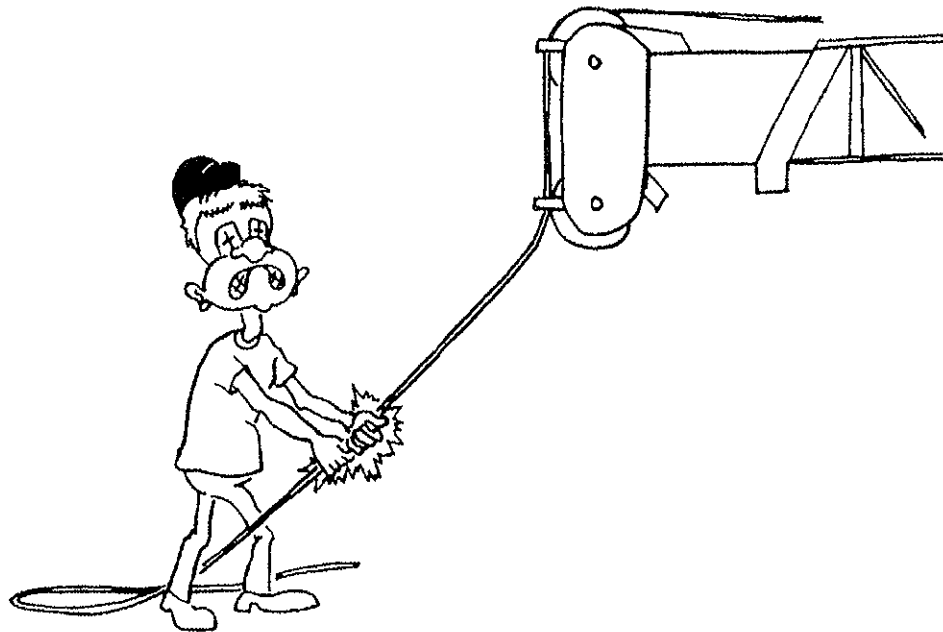
The following information is taken from a National Consensus Standard as referenced by Federal Government Agencies.

All wire rope will eventually deteriorate to a point where it is no longer useable. Wire rope shall be taken out of service when any of the following conditions exist:

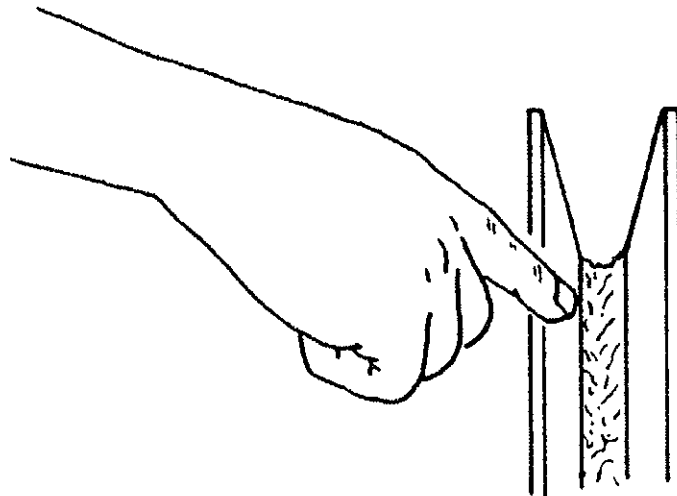
1. In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay.
2. Wear of one-third the original diameter of outside individual wires. Kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure.
3. Evidence of any heat damage from any cause.
4. Reductions from nominal diameter of more than:
 - 1/64 inch for diameters up to and including 5/16 inch.
 - 1/32 inch for diameters 3/8 and 1/2 inch inclusive.
 - 3/64 inch for diameters 9/16 to 3/4 inch inclusive.
 - 1/16 inch for diameters 7/8 to 1 1/8 inches inclusive.
 - 3/32 inch for diameters 1 1/4 to 1 1/2 inches inclusive.
5. In standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.

Refuse to work with worn or damaged wire rope.

Demand to see the rope inspection record required by law and inspect the wire rope yourself. Don't take another person's word.

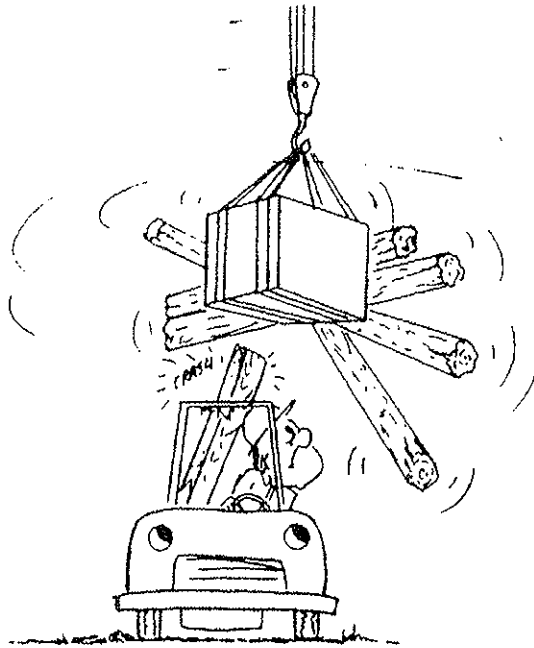


Never handle wire rope with bare hands.

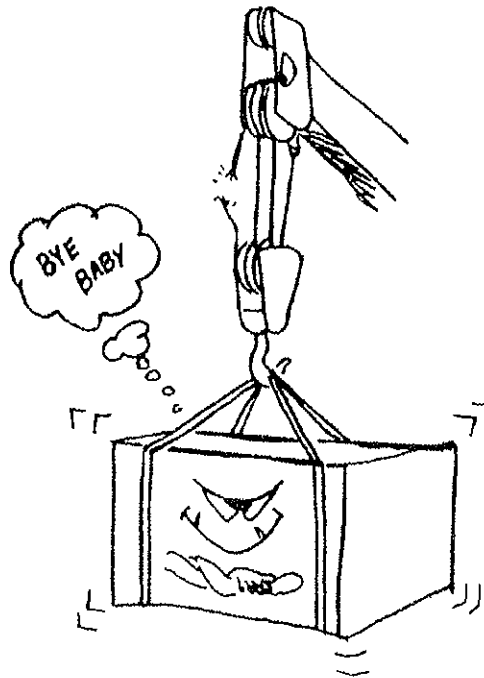


Inspect the boom nose and hook block sheaves for wear. Damaged sheaves cause rapid deterioration of wire rope.

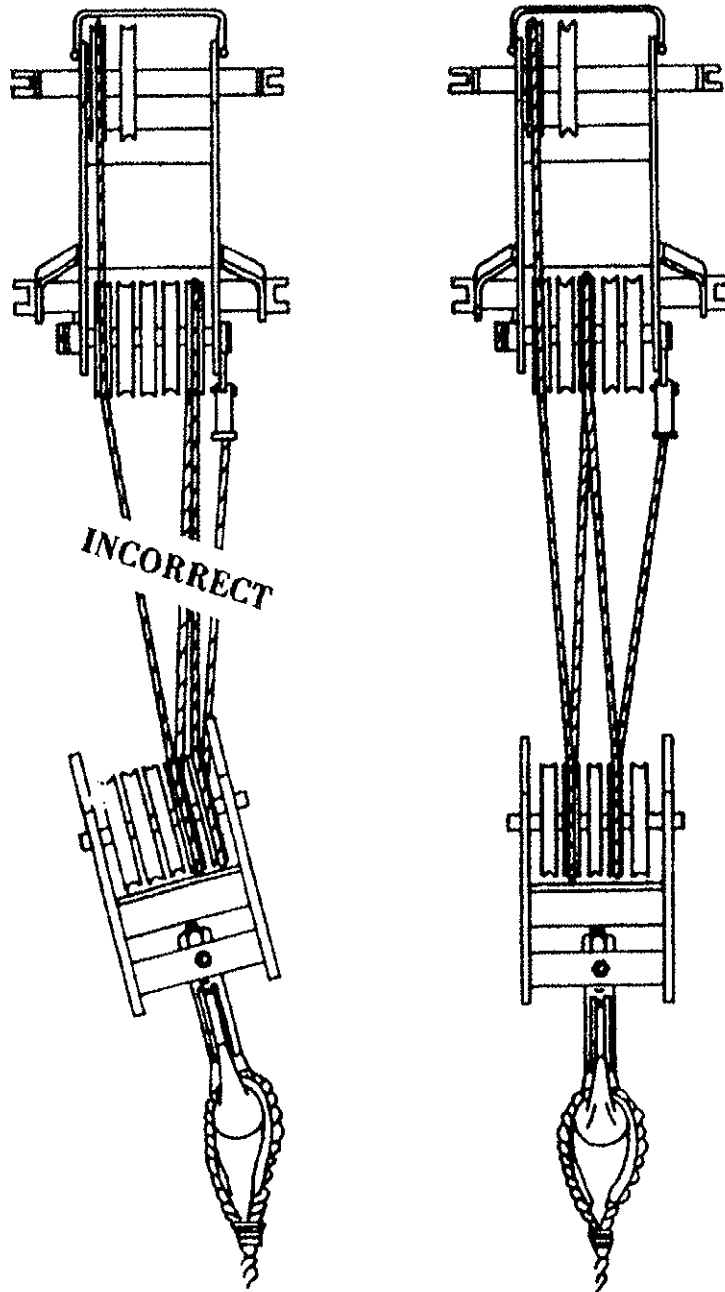
Use the wire rope that is specified by the manufacturer.



LIFT ONE LOAD AT A TIME. Do not lift two or more separately rigged loads at one time, even if the loads are within the rated crane capacity.

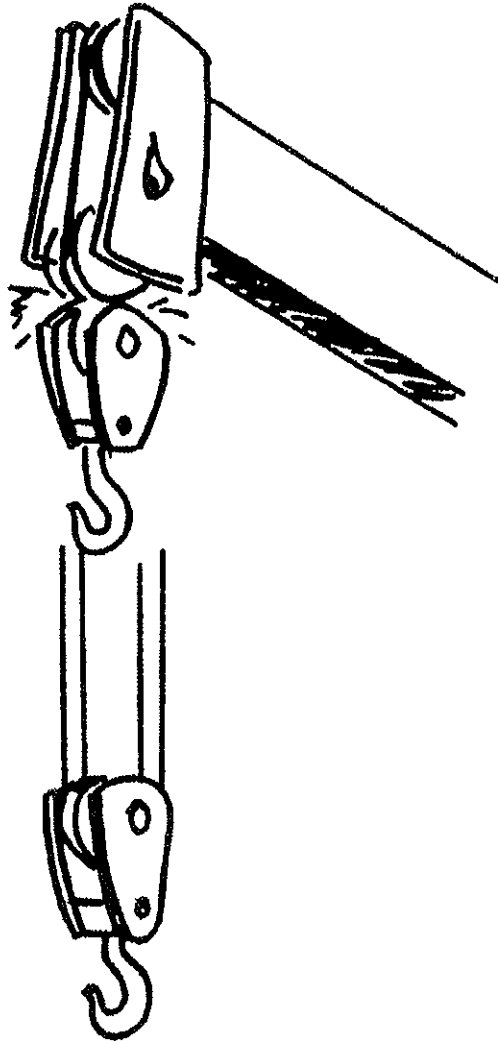


USE ENOUGH PARTS OF LINE FOR HEAVY LIFTS AND CHECK ALL LINES, SLINGS, AND CHAINS FOR CORRECT ATTACHMENT. To obtain maximum lifting capacities the hook block must be set up with enough parts of line. **NO LESS THAN TWO WRAPS** of wire rope should remain on the hoist drum. When slings, ties, hooks, etc., are used, make certain they are correctly positioned and secured before raising or lowering the loads.

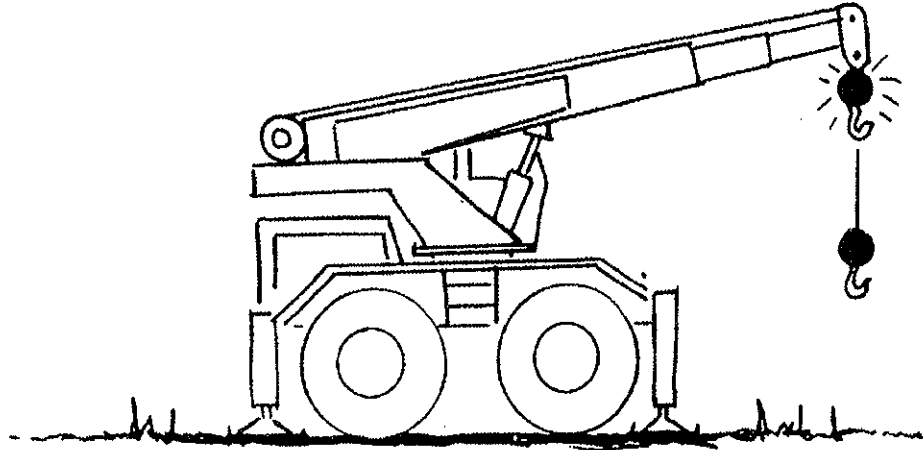


Ensure hoist cable (wire rope) is properly routed.

Two-Blocking **MUST BE AVOIDED**, to prevent damage to your crane and to avoid creating a safety hazard. Two-Blocking exists whenever the load block, headache ball, rigging, etc. come into physical contact with the boom, boom nose, sheave, jib etc. Two-Blocking can cause hoist lines (wire rope) rigging, reeving, and other components to become highly stressed and overloaded in which case the wire rope may fail allowing the load, block, etc. to free fall.



Antitwo-block devices are available with audio-visual alarms and/or control lever lockouts to assist the operator in preventing two-blocking. Consult your Grove Distributor.



Caution must be used when lowering or extending the boom - let out cable simultaneously to prevent two-blocking the 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 the boom is lowered. Keep the hookblock, etc. at least 12 inches (30.48 cm) away from the boom nose at all times.

CONTROLLED FREE-FALL HOIST.

When using your crane during controlled free-fall hoisting operations, the following recommendations are offered:

Exercise caution when using (optional) controlled free-fall hoists - Smooth and gradual snubbing of load is necessary to avoid high shock loads.

Use single-part (line) reeving only.

Fully extend and set the outriggers.

Ensure the crane is level and on a firm supporting surface.

Use main boom whenever practicable.

Reduce load values to 30% of the cranes rated load values or 50% of the permissible line pull values as indicated on the crane load capacity chart or the hoist manufacturers maximum allowable rating, whichever is less.

ELECTRICAL HAZARDS.

Read and abide by this WARNING placard posted on the crane.

WARNING

ELECTROCUTION HAZARD
TO PREVENT DEATH OR SERIOUS BODILY INJURY

NEVER OPERATE THIS CRANE WITHIN ANY DISTANCE OF A POWER SOURCE OR POWER LINE WITHOUT FIRST NOTIFYING THE POWER OR UTILITY COMPANY

NEVER OPERATE CRANE ANY PART THEREOF OR LOAD WITHIN 20 FEET OF ANY ELECTRICAL POWER LINE OR POWER SOURCE OR SUCH DISTANCE AS IS SPECIFIED OR REQUIRED BY LOCAL OR OTHER APPLICABLE SAFETY CODES OR REGULATIONS

NEVER OPERATE CRANE WITHOUT CONSULTING LOCAL OR OTHER APPLICABLE SAFETY CODES OR REGULATIONS

NEVER OPERATE SERVICE OR MAINTAIN THIS CRANE WITHOUT PROPER INSTRUCTIONS. REMEMBER IT IS THE EMPLOYER'S RESPONSIBILITY TO IMPLEMENT THE ABOVE AND TO PROVIDE ALL SAFETY DEVICES OR MEANS THAT MAY BE NECESSARY OR REQUIRED FOR ANY USE OPERATION, SET-UP OR SERVICE

MAKE SAFETY FIRST---NOT LAST!!! **READ YOUR OPERATOR'S HANDBOOK!**

NOTE DO NOT REMOVE THIS SIGN OR OPERATOR'S MANUAL FROM THIS CRANE.

Crane operation is extremely dangerous when close to an electrical power source. A mobile hydraulic crane is more vulnerable due to the natural maneuverability and versatility of the crane.



Assume all power sources are electrically energized ("hot" or "live") until you have absolutely reliable information to the contrary.

When operating in the vicinity of power lines, have the power company cut off the power and ground the lines. Obey the following rules, at all times, whether the power is cut off or not.

- Position the crane far enough away from power sources to ensure that no part of the crane or load can reach to within an unsafe zone. This includes the crane boom (fully extended to maximum height, radius, and length) and all attachments (jibs, boom extensions, rigging, tag lines, etc.).
- Erect a suitable barricade to physically restrain the crane and all attachments (including the load) from entering into an unsafe distance from the power source.
- Obtain positive and absolute assurance that power has been turned OFF.

IMPORTANT - Always consider the wire rope, hoist cable, pendant cables, tag lines, etc. as conductors.

EXERCISE EXTREME CAUTION AND PRUDENT JUDGEMENT WHENEVER ELECTROCUTION HAZARDS EXIST - OPERATE SLOWLY AND CAUTIOUSLY.

Federal law prohibits use of cranes closer than 10 feet (3.048 m) to power sources - to be safe, double that (i.e. 20 ft. [6.096 m]).

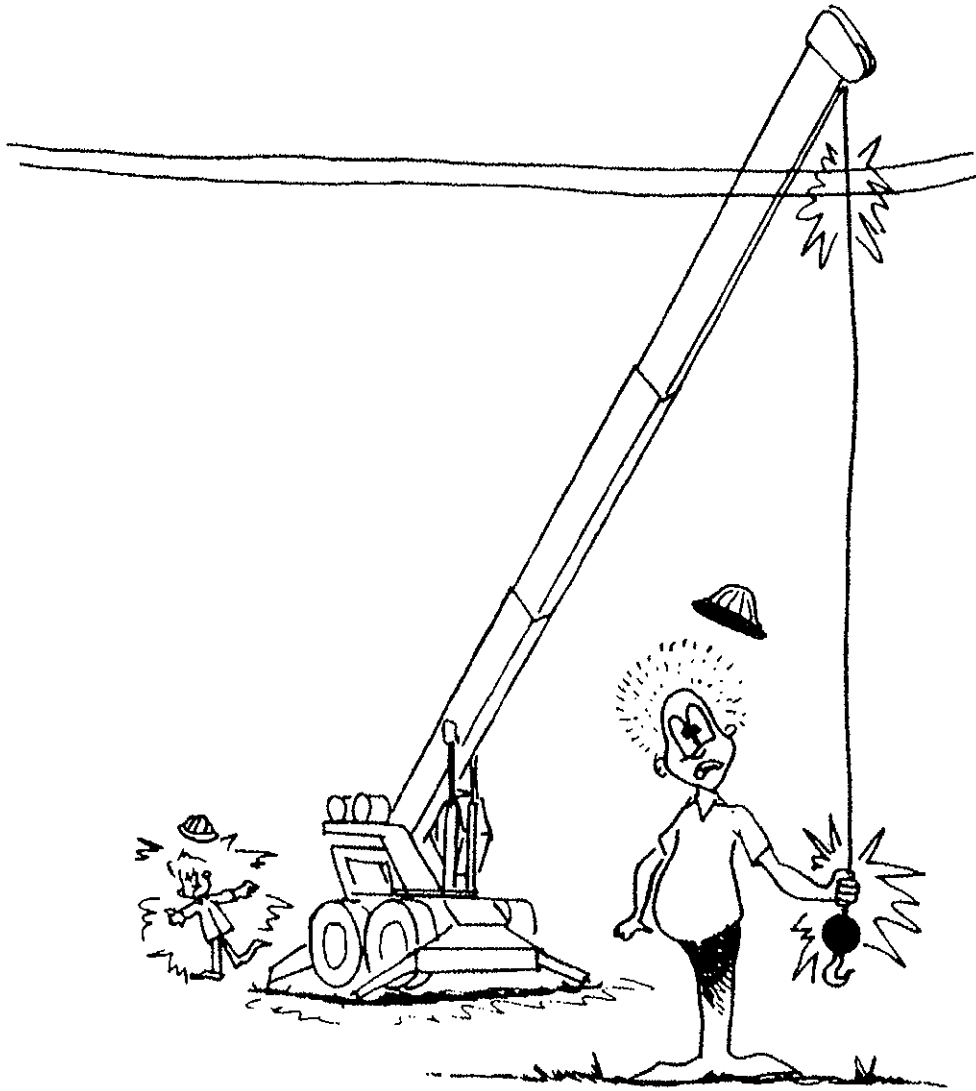
Comply with all federal, state, and local laws and regulations.

It is not necessary to touch a power line or power source to become electrocuted. Electricity, depending on magnitude, can jump or become induced into a crane. "Low" voltages can also be dangerous.

Be alert.

Keep all parts of the crane (ropes, lines, load block, and load) at least 20 feet (6.096 m) from the line.

Slow down crane operations.



Whenever a load, wire rope, crane boom or any portion of a crane contacts or approaches too closely to an electrical power source, everyone in, on, and around the crane can be seriously injured or killed!

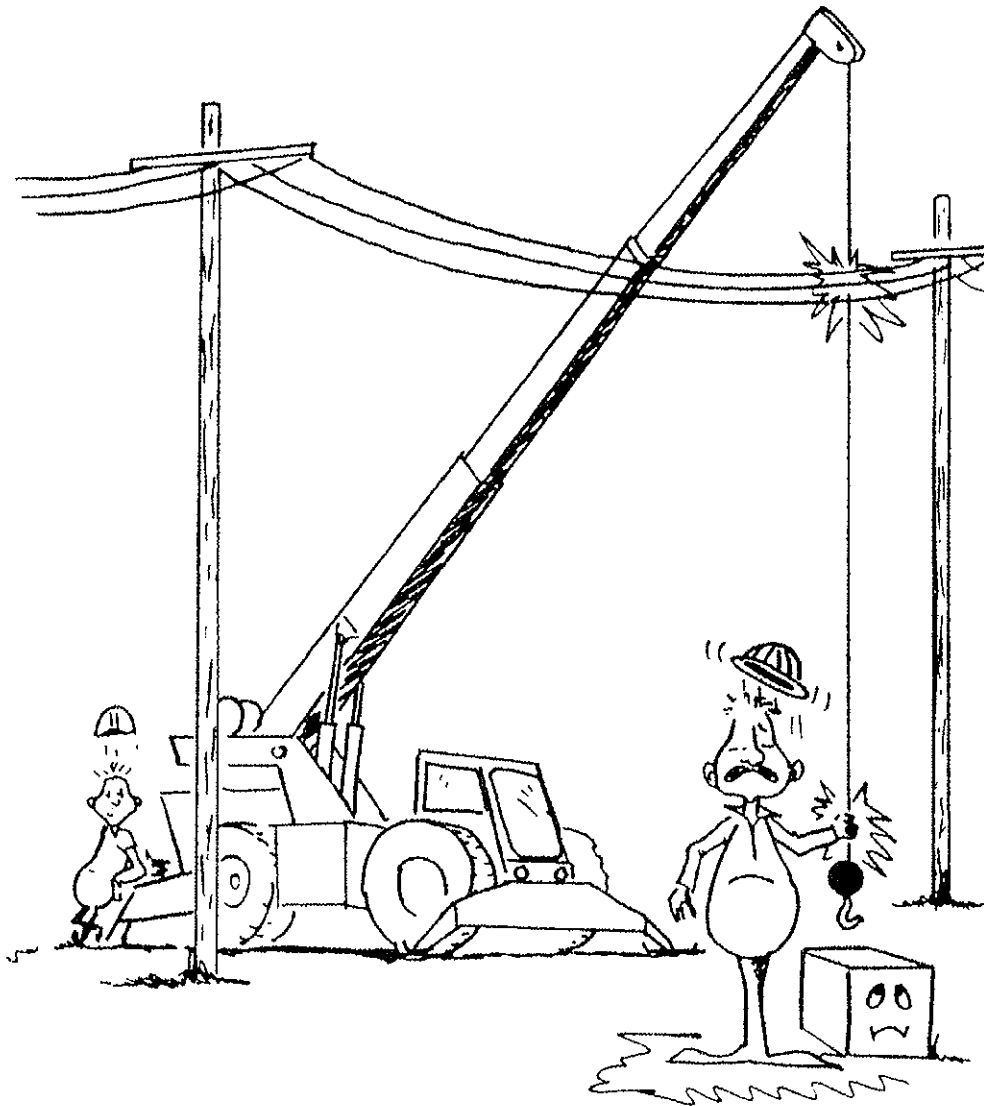
THE ONLY SAFE WAY TO OPERATE A CRANE IS TO STAY AWAY FROM ELECTRICAL SOURCES!

Assume that every line is "hot".

Appoint a reliable and qualified signal person, equipped with a loud signal whistle or horn and voice communication equipment, to warn the operator when any part of the crane or load moves near a power source. This person should have no other duties while the crane is working.

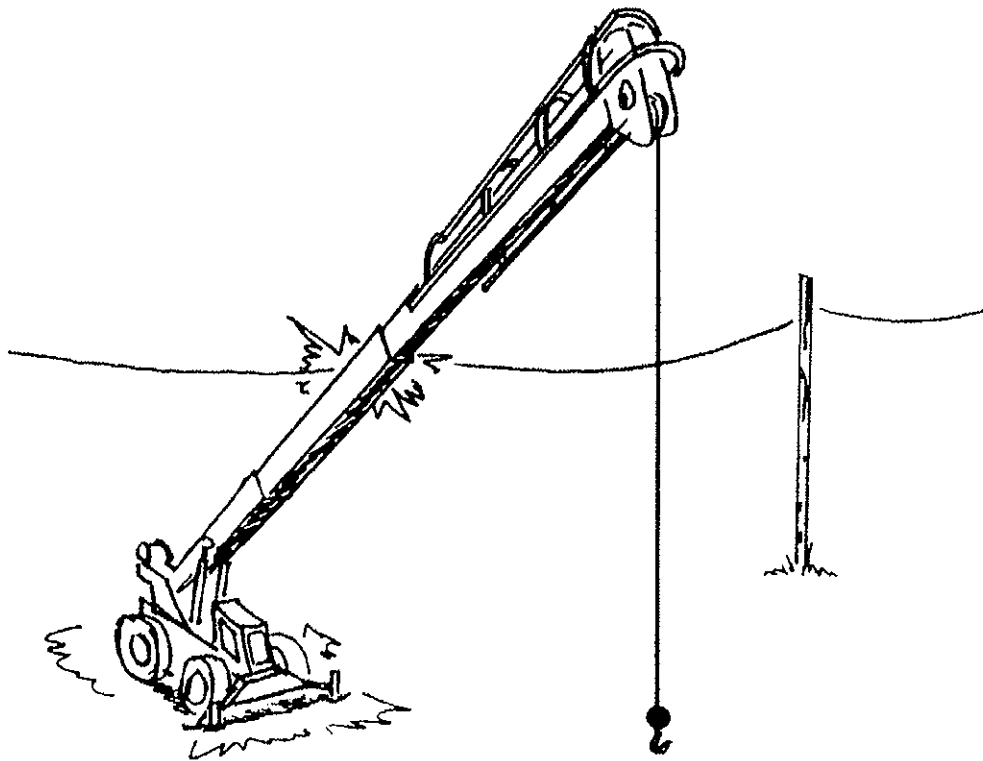
Warn all personnel of danger. Allow no unnecessary personnel in the area. Permit no one to lean against or touch the crane. Permit no one including sling men or load handlers to hold load, lines, or rigging gear.

Even if the crane operator is not affected by an electrical contact, others in the area may become seriously injured or killed.

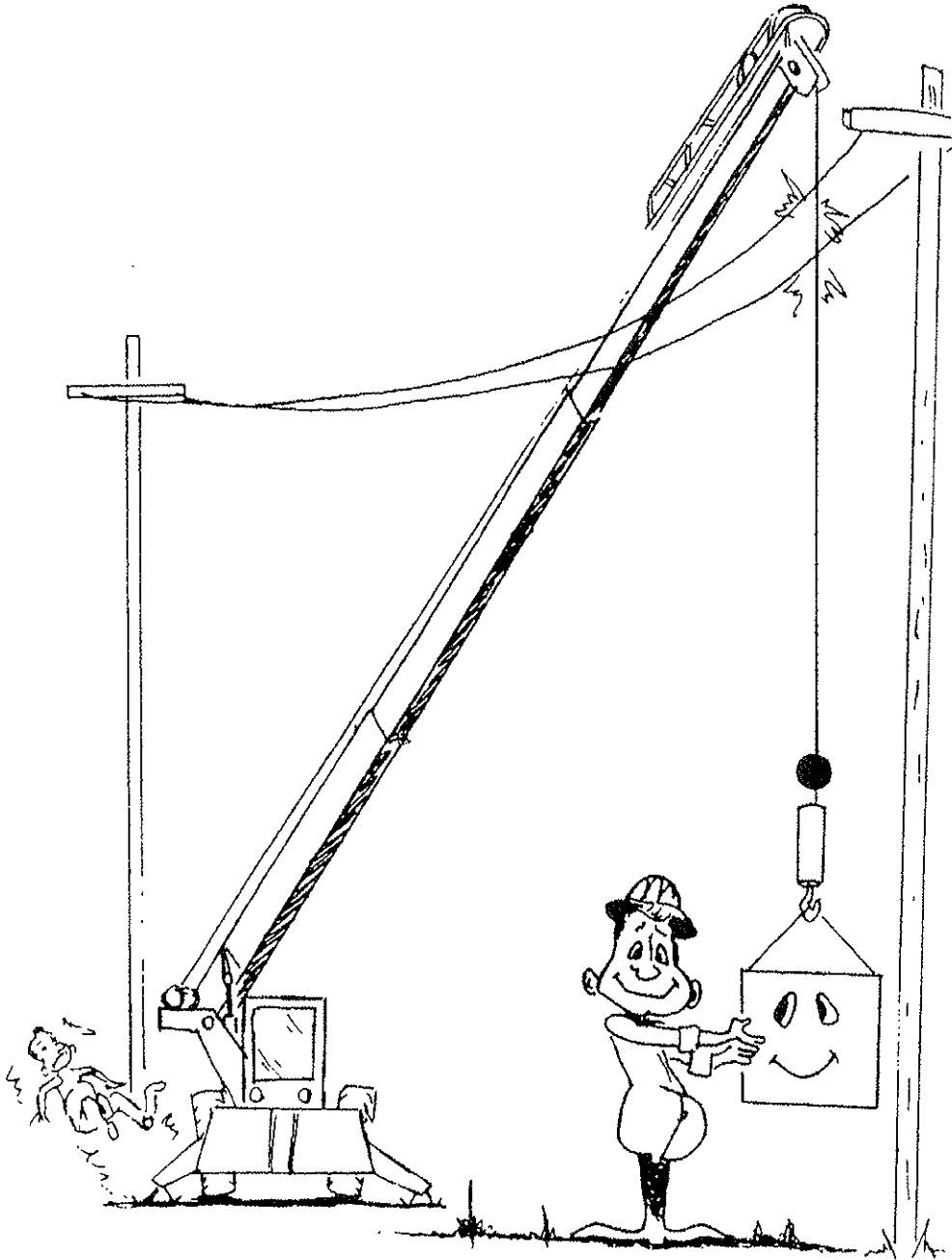


The use of boom guards, proximity devices, insulated hooks, links, or mechanical limit stops does not assure safety. Even if codes or regulations require the use of such devices, failure to follow rules listed here may result in serious injury or death. You should be aware of some of the limitations of the devices.

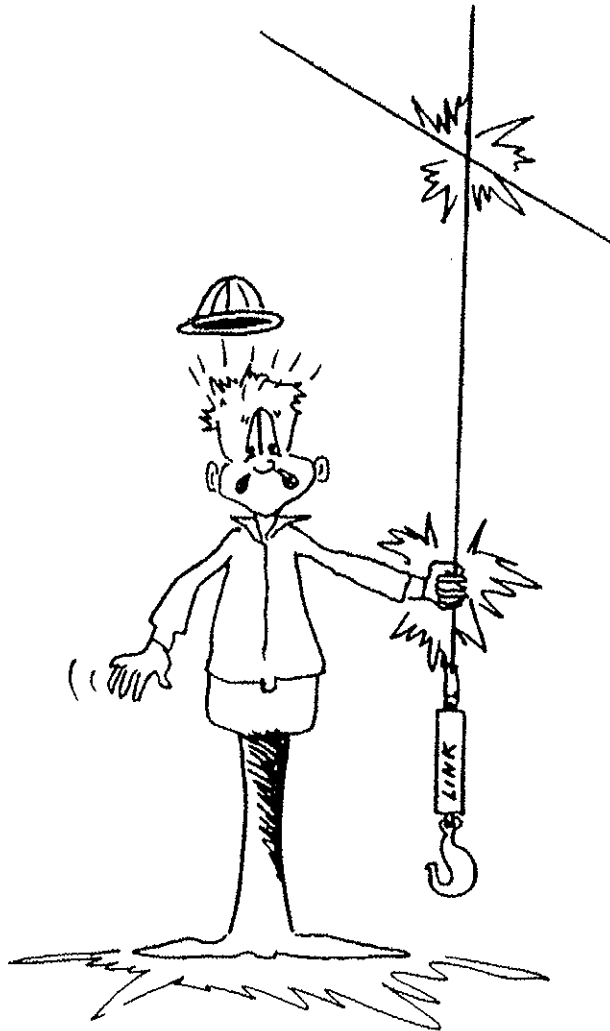
Boom Cage/Guards afford limited protection from electrocution hazards. They are designed to cover only the boom-nose/point, and a portion of the boom. Performance of boom cages/guards is limited by their physical lengths, insulating characteristics, and the operating environment (e.g. dust, dirt, moisture, etc.).



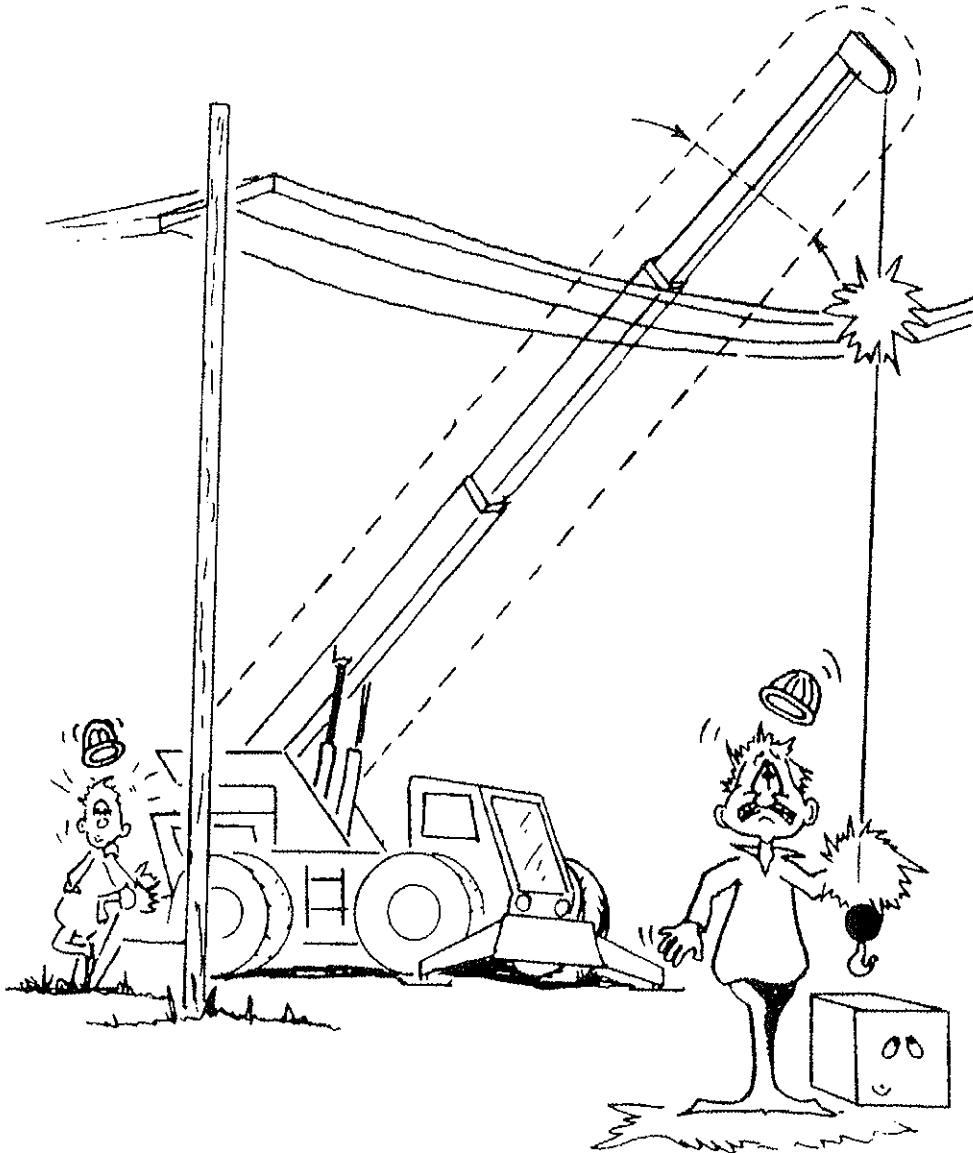
Insulating links installed into the load-line afford limited protection for those handling the load. Links have limited lifting, insulating, and other properties that affect their performance. Moisture, dust, dirt, oils, etc. can cause a link to conduct electricity. Due to their capacity ratings, some links are not effective for large cranes and/or high voltages/currents.

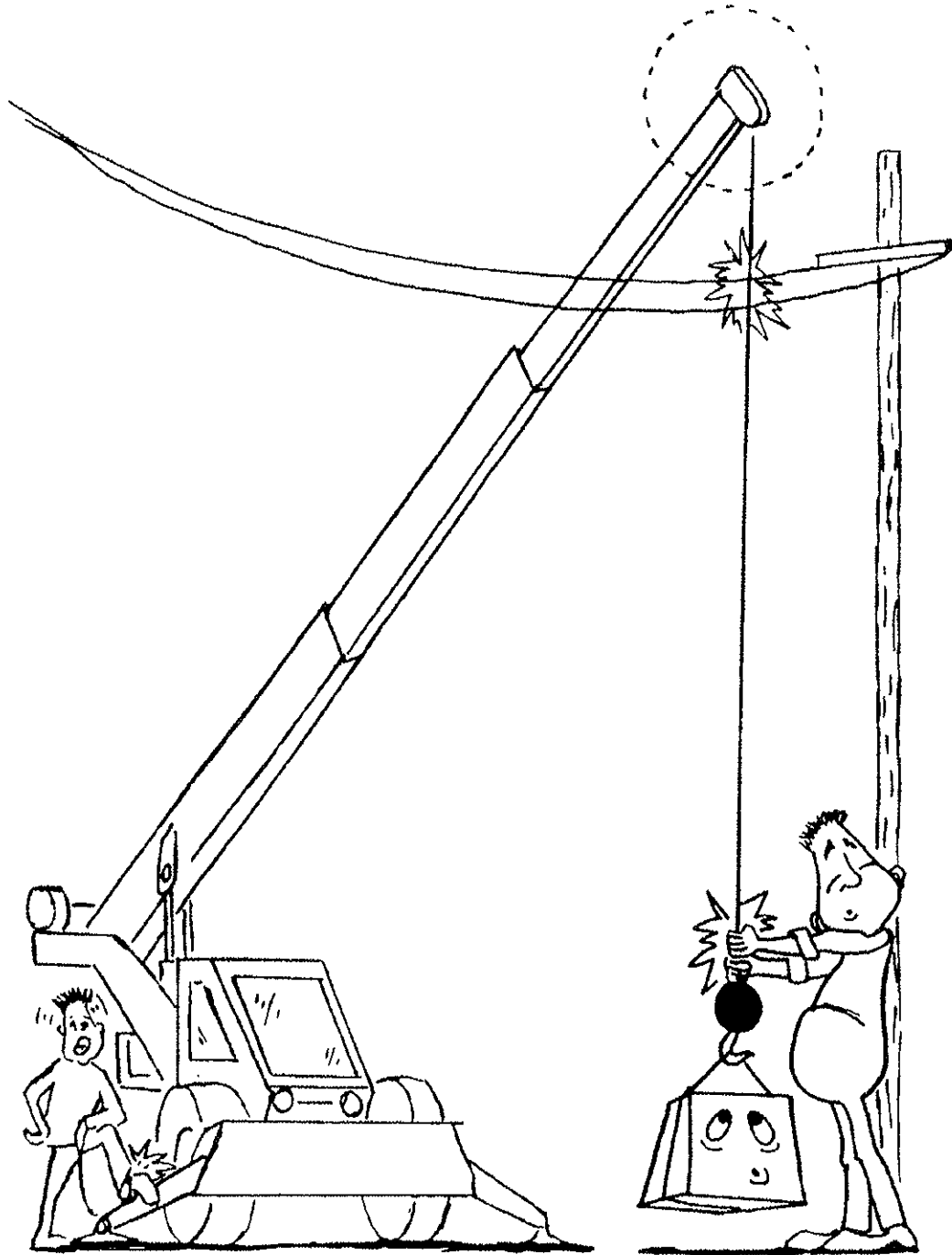


The only protection afforded by a link is that which is obtained below the link - electrically downstream, provided the link has been kept clean and free of contamination and is periodically (right before use) tested for its dielectric integrity.



Proximity sensing devices are available in different types. Some use boom nose (localized) sensors and others use full boom length sensors. No warning may be given for components, cables, loads, etc. located outside of the sensing area. Much reliance is placed upon you, the operator, in selecting and properly setting the sensitivity of these devices.



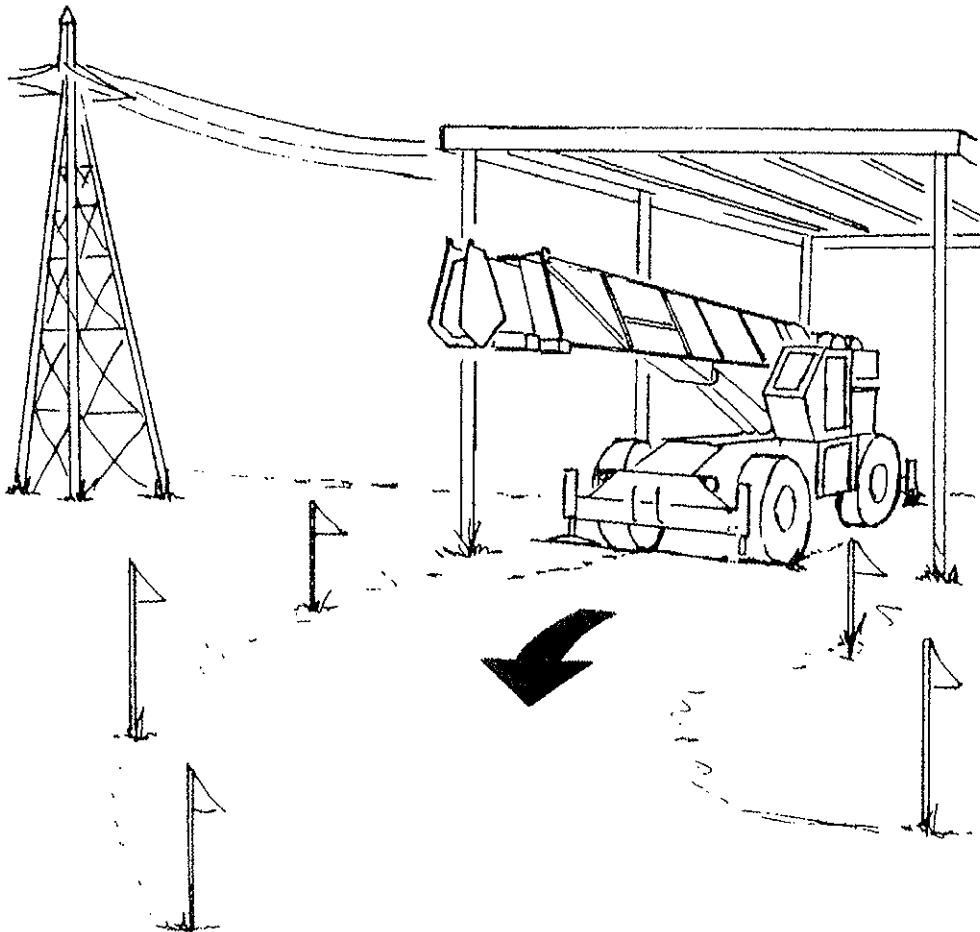


Never rely solely on a device to protect you and your fellow workers from danger!

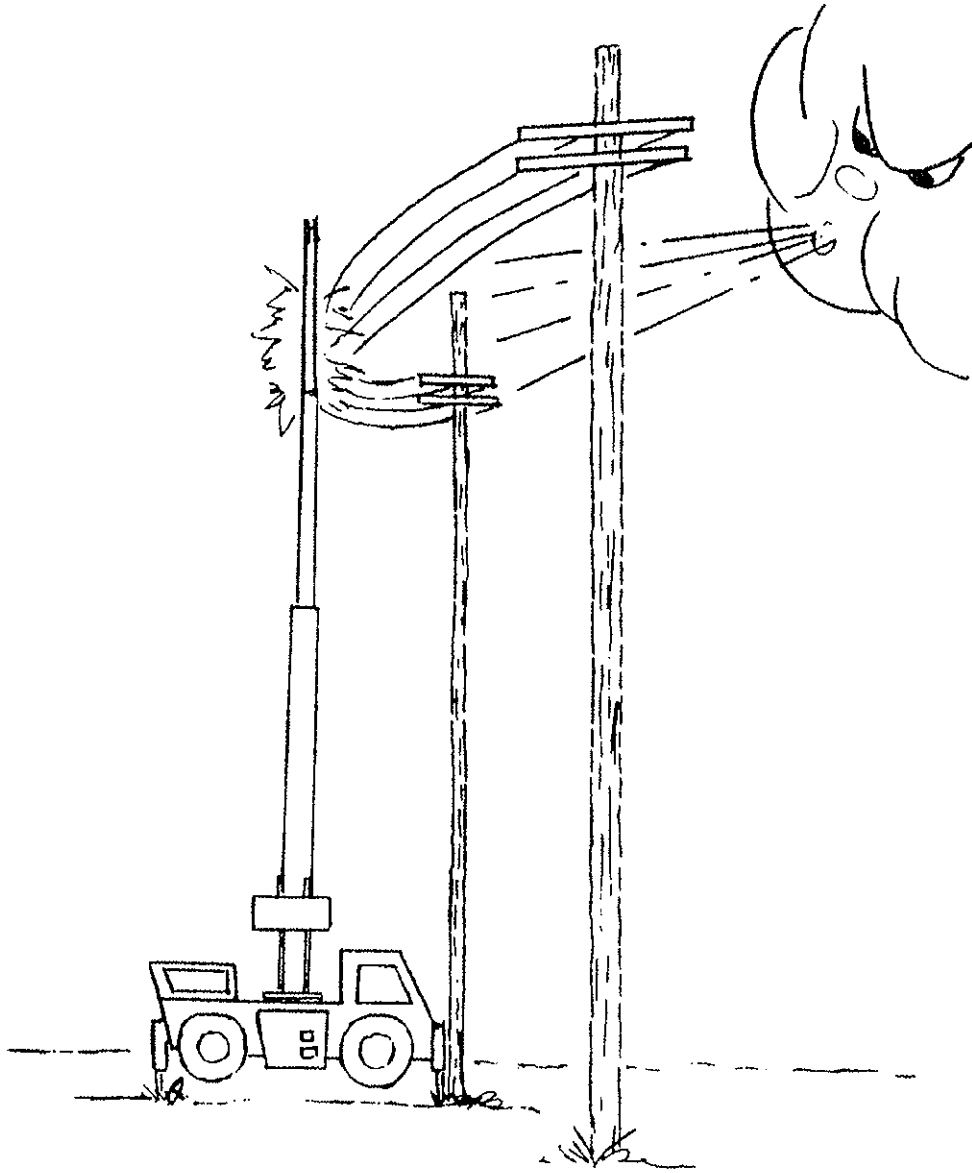
Some variables with which you must be aware are:

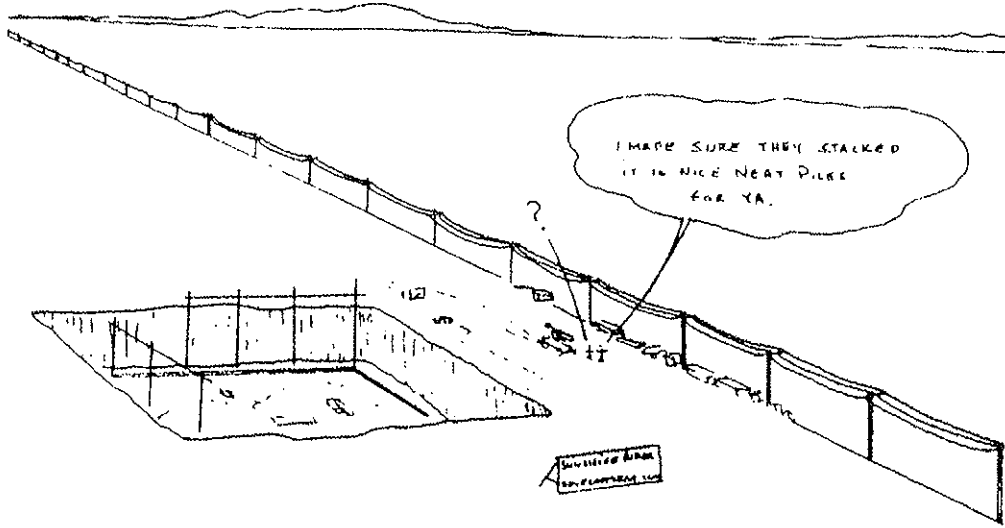
1. Proximity devices are supposed to detect the existence of electricity - not it's quantity or magnitude.
2. Some proximity devices will detect only alternating current (AC) - not direct current (DC).
3. Some devices detect radio frequency (RF) energy - others do not.
4. Most proximity devices simply provide a signal (audible, visual, or both) for the operator - the signal must not be ignored.
5. Sometimes the sensing portion of the proximity devices becomes confused by complex or differing arrays of power lines/sources.

Plan ahead and plainly mark a safe route before traveling under power lines. Erect rider poles on each side of the crossing to assure sufficient clearance is maintained.



Overhead lines tend to blow with the wind. Allow for this when determining safe operating distances.



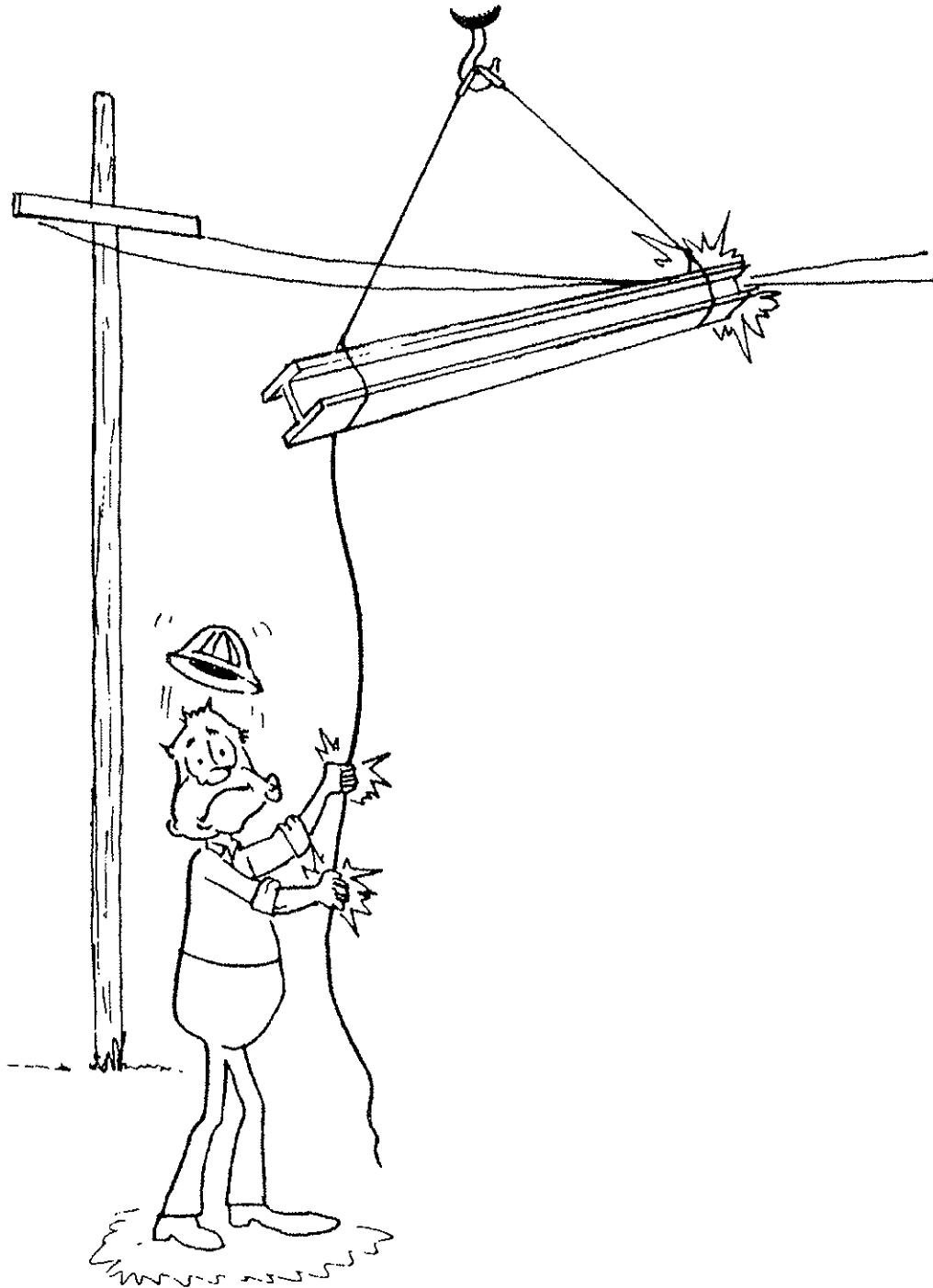


DO NOT store material under power lines or close to electrical power sources.



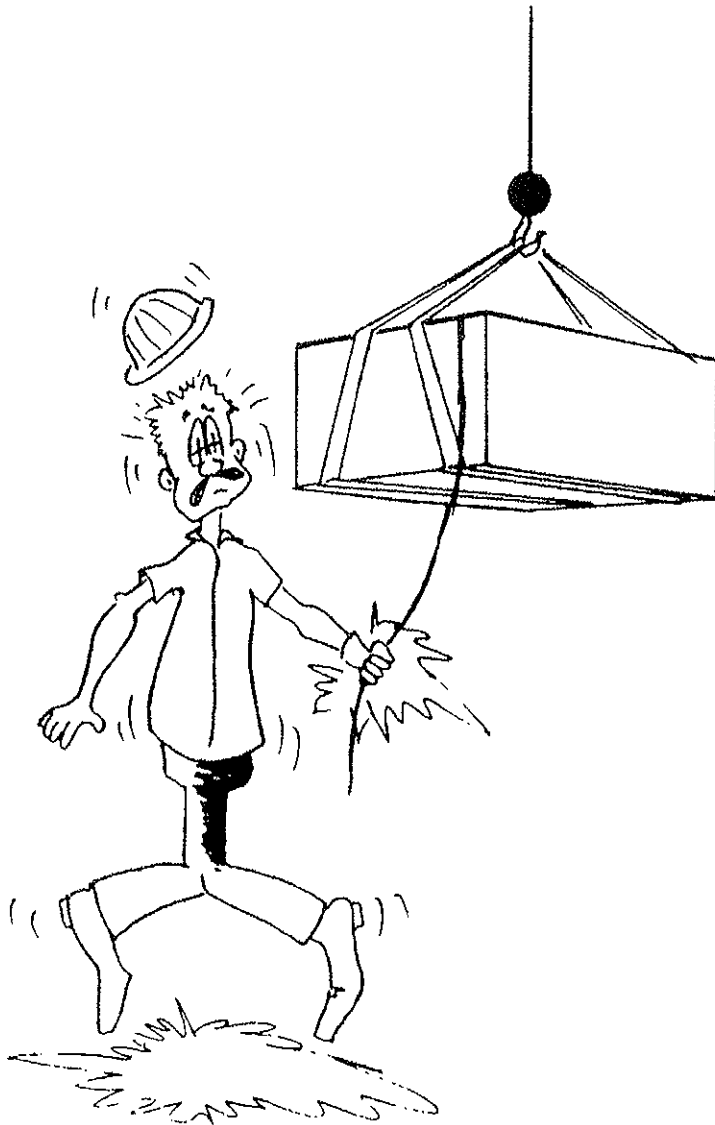
DO NOT depend on grounding!

Grounding of a crane affords little or no protection from electrical hazards. The effectiveness of grounding is limited by the size of the (wire) conductor used, the condition of the ground, the amount of the voltage and current present, etc. Power source contacts have been known to cause serious arcing due to grounding.



Tag lines should always be made for non-conductive materials.

Any tag line that is wet or dirty enough can conduct electricity.



Working in the vicinity of radio frequency transmission towers/sources may cause a crane to become electrically "charged". Survey the work site and develop specific safety precautions and operating procedures, prior to commencing operations.

If contact is made with a power source - THINK - DON'T PANIC.

1. Warn everyone to stay away from the crane.
2. Attempt to free the crane by operating the crane functions.

3. Stay in the crane until the power source has been deenergized.

Only as a Last Resort should an operator attempt to leave the crane upon contacting a power source.

If it is absolutely necessary to leave the operator station, JUMP COMPLETELY CLEAR OF THE CRANE - DO NOT STEP OFF. Hop away with both feet together. DO NOT walk or run.

When operating cranes equipped with electromagnets you must take additional precautions:

- Permit no one to touch the magnet or load.
- Alert personnel by sounding a warning signal when moving a load.
- Do not allow the cover of the electromagnet power supply to be open during operation or at any time the electrical system is activated.
- Shut down the crane completely and open magnet control switch prior to connecting or disconnecting magnet leads.
- Use only a nonconductive device when positioning a load.
- Lower magnet to stowing area and shut off power BEFORE leaving the operator's cab.

Following any contact with an energized electrical source, thoroughly inspect the wire rope and all points of contact with the crane.

Advise your distributor of the incident and consult the factory for advice and crane inspection instructions prior to resuming operations.

PERSONNEL PLATFORMS.

Handling of personnel from the boom is not authorized except with equipment furnished and installed by Grove Manufacturing Company. Upon approval by Grove of any personnel handling device, the following minimum safety requirements shall be strictly observed:

NOTE

Platform as used herein is defined as any attachment made to a crane boom which is intended to elevate or position people and includes work baskets, cages, or other devices for handling personnel.

- Whoever mounts a platform upon a crane shall perform stability tests before the unit is placed in operation. Thereafter, the installer shall perform a thorough visual inspection of the crane and platform for evidence of defects, deformation of any component, hydraulic leaks, and other items. All defects noted shall be corrected prior to handling personnel.
- The installation of platform(s) to the main boom or any boom extension (appurtenance) firmly secured by mechanical means (i.e., pins, bolts, etc.) to the main boom shall require the crane to be checked for stability. If such an arrangement cannot meet stability requirements of ANSI A92.2 with the platform positioned at its furthest operating radius and positioned in the least stable direction (i.e., over the side, end, etc.), then a means to warn the operator when he has reached the maximum operating radius must be supplied. Attachment of platform(s) to jibs supported by wire rope (e.g., pendants, backstays, etc.) is strictly prohibited.
- Materials shall not be handled or lifts performed when personnel are occupying the platform.
- Locks and brakes provided on the platform shall be set when the platform is in working position and personnel are at their work location.
- Prior to handling personnel, the crane and platform shall be thoroughly inspected and simulated lifts shall be made for each work situation to ensure all systems and controls are functioning properly, and all safety features provided are operating satisfactorily.
- A voice communication system shall be provided between crane operator and personnel occupying the platform.
- Audible and visual alert systems shall be provided to the personnel in the platform so they can signal for assistance in the event of an emergency.

- Special precautions shall be taken to protect personnel from electrical hazards. Maintain specified distances from power sources. Proximity devices may be used, but not in lieu of meeting the minimum distance requirements as specified by Grove.
- Handling of personnel is prohibited when wind velocity exceeds 10 MPH.
- The crane shall be level during operation. When provided, outriggers shall be fully extended and jacks firmly set on level terrain at all times when handling personnel.
- Handling of personnel shall be discontinued upon any impending danger, including the presence of thunderstorms.
- Crane operators responsible for operating cranes used to handle personnel shall be thoroughly familiar with safe craning practices and have a complete understanding of all Operation and Maintenance instructions provided. They shall be thoroughly trained operators with related experience.
- Prior to handling personnel, the owner shall agree, in writing, to comply with all safety rules as specified by Grove.
- A means shall be provided to indicate to the operator the crane boom's extended length - in feet or meters.
- The weight of the platform, personnel, attachments, and all other items contributing to the total weight of the boom shall be taken into consideration and appropriate reductions to lifting capacity values shall be made prior to lifting personnel.
- The handling of personnel via wire rope or rigging suspended platforms installed upon boom extensions, shall be strictly prohibited.
- Cranes should not be rigged for performing lifting service when personnel are being handled.

- All precautions and instructions on the decals attached to the crane, supporting frame, and each platform shall be strictly observed.
- Clear, unobstructed visibility between personnel on the platform(s) and the crane operator shall be maintained at all times except where a special signal person shall have been assigned and positioned such that he is visible to both. The signal person shall have no other duties when personnel are on the platform.
- If the crane is to be used for materials handling or other lifting service with the platform(s) attached, appropriate reductions in load rating chart values shall be made.
- Prior to traveling (i.e., moving the crane) the boom shall be lowered, retracted, and secured in the travel position; personnel handling is prohibited when crane is traveling.
- Belting off or otherwise attaching a platform to an adjacent pole, structure, or equipment shall not be permitted.
- Personnel platforms shall be easily identifiable by high visibility color or marking.
- Personnel shall always stand firmly on the floor of the platform and shall not sit or climb on the edge of the platform or use planks, ladders, or other devices for a work position.
- Personnel shall wear a body belt with lanyard attached to the boom or platform when occupying a platform.
- Climbers shall not be worn while performing work from a platform.
- Users shall ensure that all duties set forth in this handbook are adhered to including compliance with ALL safety requirements.
- All manuals, operating instructions, etc. provided shall be read and understood by operating personnel prior to commencing operations.
- Operating personnel shall have constant access to instruction manuals.
- Approval from Grove Manufacturing Company shall be requested and obtained in writing prior to handling personnel.

- Platforms shall be installed and used ONLY upon the specific crane for which they were tested and intended for use.
- Authorization from Grove shall be obtained PRIOR to any alterations or modifications to the basic crane or the platform.
- Grove parts should be used for replacement purposes in order to ensure that components are compatible with their original counterparts.
- Crane load rating capacities shall be reduced by 50% of published load chart values when handling personnel.

COLD WEATHER OPERATION.

Cold weather operation requires additional caution on the part of the operator.

Check operating procedures for cold weather starting.

Don't touch metal surfaces that could freeze you to them.

Clean the crane, especially the boom, of all ice and snow.

Allow ample time for hydraulic oil to warm up.

During freezing weather, frequently check all air tanks for water.

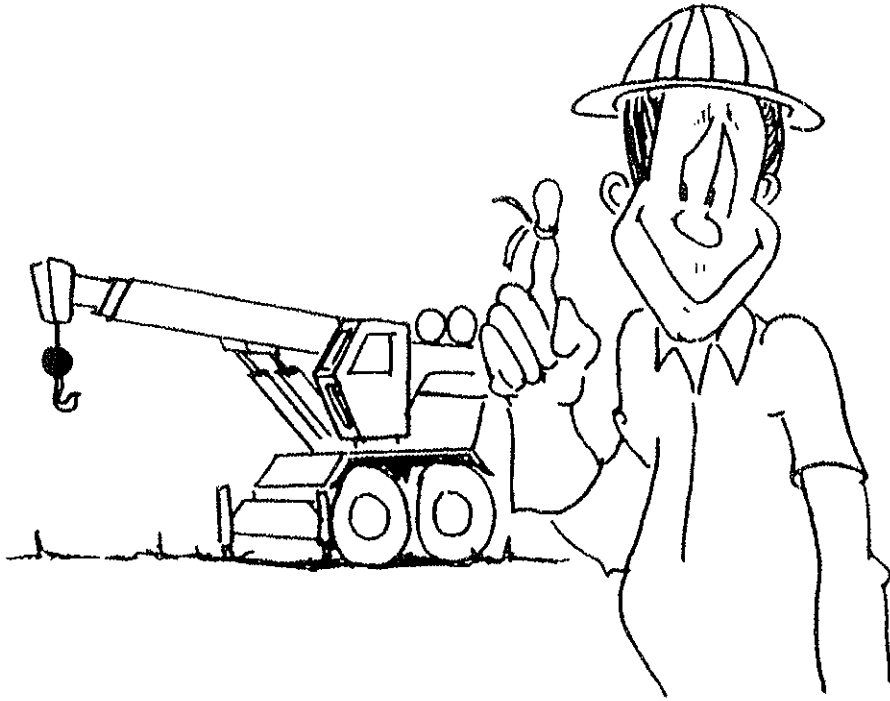
Always handle propane tanks according to the supplier's instructions.

Never store flammable materials on the crane.

Before lifting, ensure the load is not frozen to the ground or other surface.

If cold weather starting aids are provided on your crane, use them. The use of aerosol spray or other types of starting fluids containing ether/volatiles can cause explosions or fire.

DON'T FORGET.



LOAD CHARTS REPRESENT THE ABSOLUTE MAXIMUM ALLOWABLE LOADS, WHICH ARE BASED ON EITHER TIPPING OR STRUCTURAL LIMITATIONS UNDER SPECIFIC CONDITIONS. KNOWING THE PRECISE RADIUS OF OPERATION, BOOM LENGTH, AND ANGLE SHOULD BE A PART OF YOUR ROUTINE PLANNING AND OPERATION. ACTUAL LOADS, INCLUDING NECESSARY ALLOWANCES, SHOULD BE KEPT BELOW THESE CAPACITY FIGURES.

WORKING AREAS MUST BE ADHERED TO WHEN DETERMINING ALLOWABLE LOAD FROM LOAD CHART(S).

ENSURE THE COUNTERWEIGHT IS FULLY EXTENDED BEFORE OPERATION.

IF THE CRANE IS NOT LEVEL, LOAD CAPACITIES ARE REDUCED WHEN LIFTING ON THE LOW SIDE. DON'T BE MISLEAD BY OPTICAL ILLUSIONS. USE YOUR BUBBLE LEVEL.

IF YOU SHOULD ENCOUNTER A TIPPING CONDITION, START LOWERING THE LOAD WITH THE HOIST LINE AND RETRACT OR ELEVATE THE BOOM TO BRING THE LOAD IN. NEVER LOWER OR EXTEND THE BOOM, THIS WILL AGGRAVATE THE CONDITION.

WHEN USING THE HOIST AVOID SUDDEN STOPS. INCREASED LOADING WILL RESULT AND COULD CAUSE TIPPING OR A STRUCTURAL FAILURE TO OCCUR.

EVEN IF A HYDRAULIC LINE MAY BE SHEARED OR BROKEN ON THE LIFT OR EXTENSION CYLINDERS, THE CRANE WILL STILL FUNCTION SUFFICIENTLY TO GET THE LOAD DOWN.

MAXIMUM LIFTING CAPABILITY IS AVAILABLE AT THE SHORTEST RADIUS, MINIMUM BOOM LENGTH AND HIGHEST BOOM ANGLE.

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SECTION III

DESCRIPTION

GENERAL.

The crane is fully self-contained. All crane functions are either electrically or hydraulically controlled and hydraulically operated. The main functions are: raising and lowering the boom, extending or retracting the boom, raising and lowering loads with the hoists, swinging the boom, and extending and retracting the outrigger beams and stabilizers. Hydraulic cylinders activate the elevation, telescope and outrigger systems. The hoist and swing systems are driven by hydraulic motors.

A diesel engine provides drive power for the hydraulic pumps and also drives an alternator which supplies electrical power for control, accessory, and lighting systems.

MAJOR COMPONENTS AND SYSTEMS.

CAB ASSEMBLY.

The cab is all-steel, acoustically-treated, fully-enclosed with tinted safety glass windows throughout. The cab contains all engine and crane controls, and indicators for complete operation of the crane including outrigger controls and a sight leveling bubble indicator. The cab also contains the Krueger LMI, engine hot water heater, defroster fan, electric windshield wiper, swing horn button, domelight, dash light, and a 2-3/4 lb. (1.2 kg) dry type fire extinguisher. The operator's seat is fully adjustable and has a headrest.

HYDRAULIC SYSTEM AND COMPONENTS.

The hydraulic system is designed to provide adequate pressure and gpm output for simultaneous operation of various crane functions.

Reservoir.

The hydraulic reservoir is a 305 gallon (1155 liters) steel tank located on the right rear side of the superstructure. A full flow return type 25 micron filter is installed in the reservoir.

Hydraulic Oil Cooler.

The hydraulic oil cooler is located forward of the diesel engine radiator. As hydraulic oil flows from the bottom of the cooler to the top, the oil is cooled by air from the engine fan. Return oil from the counterweight extension/counterweight removal, lift, and main hoist circuits is routed through the oil cooler.

Pumps.

The crane utilizes two two-section pumps and one one-section pump. A pump drive and clutch assembly transmits power from the superstructure engine to the hydraulic pumps. The pumps may be disengaged from the engine for cold weather starting. This is accomplished by a PUMP DISCONNECT lever located under the right side of the superstructure which actuates the clutch assembly. Pump disengagement or engagement must be performed with the engine shutdown.

Directional Control Valves.

The directional control valves are four-way three-position valves with either an "open" or "closed" spool. The valves are grouped into valve banks permitting simultaneous independent control of crane functions. The "closed" spool type valve contains an integral load check valve to prevent "back sliding" of components which support heavy loads. Each valve bank contains a main relief valve and additionally, certain crane functions are protected by a circuit relief valve.

Hydraulic Boost Circuit.

Hydraulic boost is provided for the auxiliary hoist operation. This feature is accomplished by using a second control valve from another valve bank and pump. The auxiliary hoist control lever is connected to an off center rod connected between the control valve and boost control valve. The off center rod allows for full opening of the control valve with only half travel of the control lever. Further movement of the control lever opens the boost control valve proportional to lever movement to provide increased speed in the circuit.

TURNTABLE ASSEMBLY AND SWING MECHANISM.

An antifriction roller bearing supports the superstructure to the carrier and allows 360 degrees of continuous rotation (swing) in either direction.

Swing is accomplished by a hydraulically-driven motor driving a gearbox which in turn drives the roller bearing. A free-swing, spring actuated and hydraulically released brake is provided to stop swing and hold the superstructure in the desired position. To further secure the superstructure in a desired position, a positive swing lock is also provided.

Swing Motor.

The hydraulic swing motor is a low speed, high torque motor. The motor provides indirect drive power for turntable swing through the swing gearbox.

Swing Gearbox.

The swing gearbox is a sun and planetary gear type, driven mechanically by the swing motor. The swing gearbox rotates the turntable at a reduced operational speed of approximately 1.9 rpm.

Swing Brake.

The swing brake assembly consists of a brake assembly mounted on the swing gearbox. It is hydraulically controlled. The swing brake is controlled from the superstructure cab using the swing brake foot pedal and the swing brake switch.

BOOM ASSEMBLY.

The boom is a four-section, trapezoidal boom with a power pinned fly that extends from 36 to 114 feet (10.97 to 34.75 meters). An optional four section boom with full power is available. Boom elevation is accomplished by dual, double acting hydraulic cylinders with integral holding valves. An equalizer line is connected between the two cylinders to maintain equal pressure on both cylinders thereby ensuring that the cylinders are synchronized. A remote mounted third holding valve installed in the hydraulic circuit is common to both cylinders. Boom elevation from -4 to +80 degrees is provided. A 32-foot (9.75 m) swingaway lattice boom extension is stowed on the right side of the main boom. When attached to the boom nose it provides a maximum hook height of 146 foot (44.5 m). As an option, a maximum of four 14-foot (4.27 m) lattice sections and the 32-foot (9.75 m) swingaway extension may be added to the boom nose, providing a maximum hook height of 202 feet (61.6 m) with cable offsets from 5 to 30 degrees.

MAIN HOIST.

The main hoist incorporates two-speed capability. It provides power or speed

for all load raising and lowering operations. A vane type hydraulic motor drives the hoist drum by means of a planetary gear reduction system. A metallic disc brake is an integral part of the hoist assembly. Indication of hoist drum rotation is provided by an electronic transmitter attached to the hoist and an electronic driven indicator on the main hoist control lever in the cab.

OUTRIGGER SYSTEM.

The outriggers and optional front stabilizer are mounted on the carrier but are controlled and operated by the superstructure electrical and hydraulic systems. The outriggers are full hydraulic, double-box type, and are installed on the crane carrier. The outriggers are positioned to provide a rigid four point platform (outriggers fully extended and set) capable of supporting the machine and its maximum load capacity. The optional front stabilizer is provided for stabilization during over the front lifting and is not designed to lift the machine. A pressure switch in the extend side of the cylinder actuates at 2400 psi to illuminate a warning light on the Krueger panel in the superstructure cab if the over the front lift is too great. Control of the outriggers and optional front stabilizer is provided on either side of the carrier or the control console in the superstructure cab. Integral holding valves, spin-type locks, and floats are standard equipment. A sight level bubble indicator is located in the vicinity of each outrigger control panel.

SWIVELS.

The electrical and hydraulic swivels are used to route the electrical and hydraulic circuits from the superstructure to the carrier for outrigger and front stabilizer operation.

ELECTRICAL SYSTEM.

The superstructure electrical system is 12 vdc operation with 24 vdc starting, consisting of an alternator and four 12-volt lead-acid batteries series-parallel connected. Two batteries are connected in parallel to make two parallel sets of batteries for a higher amperage rate. Only one parallel set of batteries is used to supply the normal 12-volt electrical system. When starting the engine, both parallel sets are connected in series to provide 24-volt starting voltage to the engine starter motor. The batteries are maintenance free and have a state of charge indicator located on top of the battery. The system is the single wire-ground return type, utilizing the machine's structure as ground.

ENGINE.

A diesel engine is housed in the engine compartment on the right side of the superstructure. The primary purpose of the engine is to drive the hydraulic pumps and supply electrical power used to charge the batteries and provide power for crane control circuits, accessories, and lighting. In addition, the engine cooling system supplies hot water for operation of the cab heater. Recommended engine operating speed is 2300 to 2400 rpm for optimum performance of the hydraulic pumps. All controls for the engine are located in the operator's cab.

COUNTERWEIGHT ASSEMBLY.

A hydraulically controlled two-position counterweight is installed on the rear of the turntable assembly. For crane travel, the counterweight is fully retracted to the stowed position and secured with a travel lock. For crane operation, the counterweight is fully extended. The controls for counterweight operation are located in the left rear compartment of the superstructure.

Provisions for removing and installing the counterweight are provided to reduce the total weight of the machine for highway travel. Normally the counterweight is removed in conjunction with the boom and lift cylinders, and both are transported on a specially built trailer, or the counterweight is removed and transported on the dolly for trailing boom transport.

OPTIONAL EQUIPMENT.

The following paragraphs describe optional equipment available on the crane.

SPOTLIGHT.

The spotlight is installed on the right side of the hinged skylight. Sufficient slack is provided in the wire to allow 180 degree rotation and to allow opening of the skylight. The spotlight is controlled by a switch mounted on the spotlight.

AIR CONDITIONER.

The air conditioner is installed in the cab. All controls for the air conditioner are provided on the unit. The compressor is driven by a hydraulic motor.

AUXILIARY HOIST CONTROLLED FREE-FALL.

The controlled free-fall hoist contains a final drive planetary reduction with

a planet hub attached to the cable drum by a spline and having the internal gear mounted on ball bearings. The internal gear is held from rotating by a multi-disc brake. The brake is applied by springs that force a piston against segments which in turn act as levers to magnify the spring load and hold the brake engaged.

When hydraulic oil is introduced into the area between the piston and the cylinder shaft, the effective spring load is reduced as the hydraulic pressure increases. When a load is suspended on the hoist cable and hydraulic pressure is applied to move the piston to the end of its travel (full release position), the internal gear will turn and allow the load to lower freely to the ground.

In order to provide control when lowering a load with the free-fall hoist, it is necessary to regulate the brake release pressure. The actual pressure required at the piston varies depending upon the hoist line load. This pressure also changes in proportion to the static and dynamic friction values of the brake. Since it is difficult for an operator to alter the pressure in proportion to changing friction values, a metering pump is installed to control pressure automatically, thereby providing control for lowering light loads at increased line speeds.

The free-fall control valve is a type of manually operated metering valve which is normally open. Oil enters the control valve and as the control valve is moved, the flow of oil is restricted, creating pressure at the brake release port in the hoist. Once the brake is released sufficiently to allow the internal gear to rotate, the metering pump, driven by the internal gear, meters a portion of the oil supply out of the circuit allowing the brake release pressure to drop, thus compensating for the change from static to dynamic friction at the brake and regulating the speed of the hoist.

The speed at which the load is lowered is proportional to the amount of travel of the control valve. As the travel of the control is increased, the flow of oil through the control valve is restricted to a greater extent and a slight increase in pressure releases the brake further, causing an increase in speed and a larger flow of oil through the metering pump. When the control valve is moved to its full extent, all the control oil (1-1/2 gpm [0.09 lps]) is directed to the brake release piston and metering pump. A maximum uniform speed is obtained when the metering pump achieves a balance with the brake release pressure.

CAUTION

WHEN A LOAD IS BEING LOWERED WITH THE FREE-FALL BRAKE, THE CONTROL VALVE MUST BE MOVED GRADUALLY. SUDDEN MOVEMENT OF THE CONTROL VALVE WILL CREATE A PRESSURE SURGE AND CAUSE THE LOAD TO LOWER AT AN UNEVEN SPEED. THE CONTROL VALVE MUST ALSO BE MOVED SLOWLY TO STOP THE LOAD SMOOTHLY.

The controlled free-fall hoist may be used in power up and power down operations or in the controlled free-fall mode as desired.

CAUTION

USE OF THE CONTROLLED FREE-FALL FEATURE IS RECOMMENDED ONLY FOR APPLICATIONS SUCH AS LOWERING EMPTY CONCRETE BUCKETS AND FOR LOWERING OF EMPTY HOOK DURING STEEL SETTING OR MATERIAL HANDLING JOBS.

Each controlled free-fall hoist model has a rated maximum load for lowering under controlled free-fall conditions. Do not exceed the maximum rated load of 2345 pounds (1290 kg).

Operating Control.

A free-fall control valve actuator is located on or near the applicable primary hoist control lever to operate the free-fall system within the hoist.

Hoist Brakes.

The hoist has two spring applied, hydraulically released brake assemblies.

1. The hoist main brake is located in the primary drive assembly.
2. The hoist free-fall brake is located in the final drive assembly.

Both brakes are entirely enclosed and cooled by circulating hydraulic oil from the crane's main hydraulic oil system.

AUXILIARY HOIST.

Three models are available for the auxiliary hoist; a two-speed Grove Model HO-30B-16, a single speed Grove Model HO-15B-16, or the single speed Gearmatic Model 25 with controlled free-fall. The auxiliary hoist provides power and/or speed for all load raising and lowering operations. Vane type hydraulic motors drive the hoist drum by means of a planetary gear reduction system. A disc brake is also an integral part of the hoist assembly. Optional indication of hoist drum rotation is provided by an electronic transmitter attached to the hoist, with an electronically driven indicator on the auxiliary hoist control lever in the cab.

LATTICE JIB.

Lattice jib inserts, 14 foot (4.3 m) in length, are available to be used with the swingaway boom extension. By combining lattice inserts with the swingaway boom extension, jibs of 46 foot (14 m), 60 foot (18.3 m), 74 foot (22.6 m), and 88 foot (26.8 m) lengths can be assembled and mounted to the main boom nose. The lattice jib combinations can be offset 5, 17 and 30 degrees.

CAB CONTROLS AND INDICATORS.

NOTE

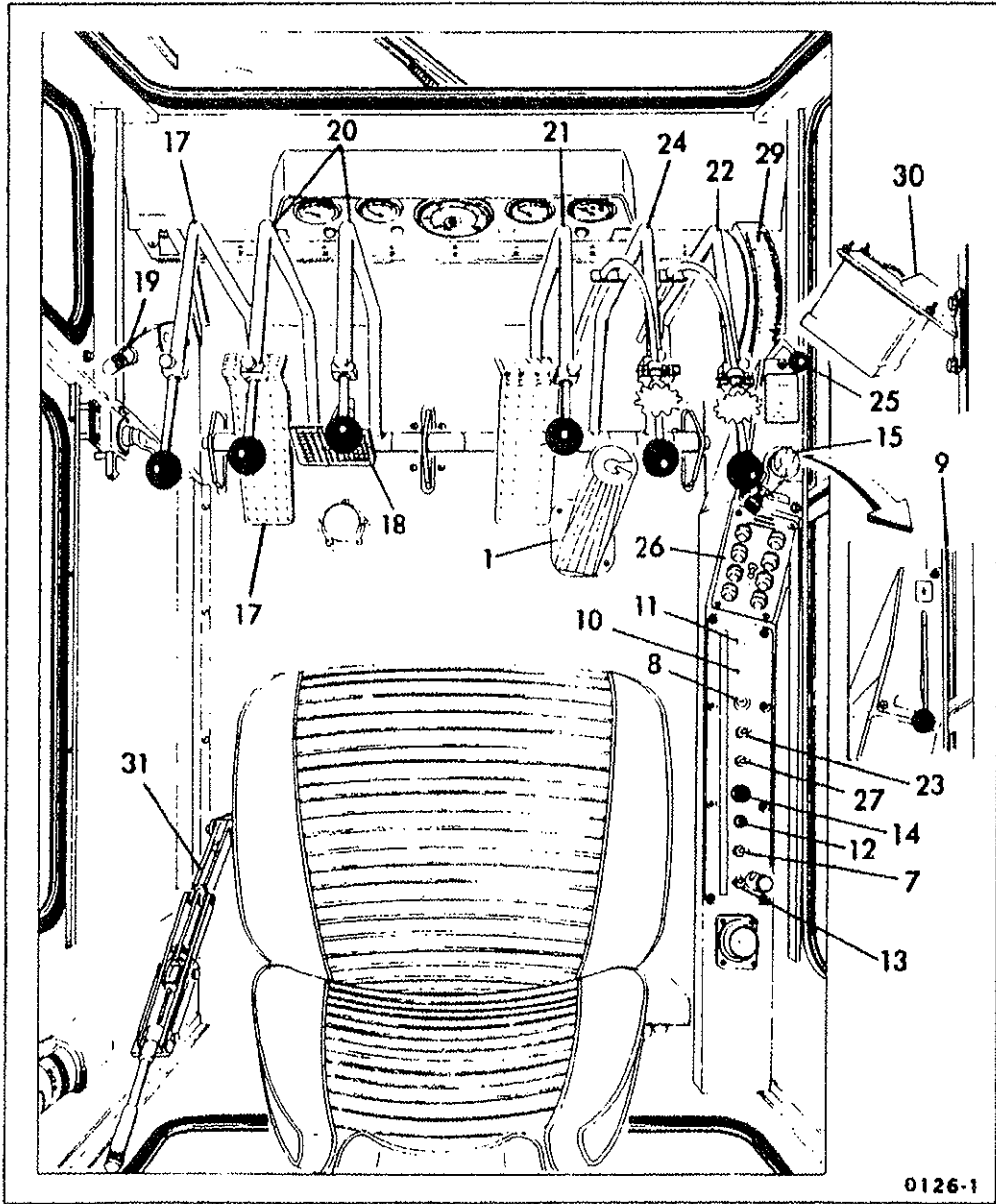
The following paragraphs describe the controls and indicators located in the cab. The numbers in () represent the index number from the figure titled Cab Controls and Indicators.

FOOT THROTTLE PEDAL.

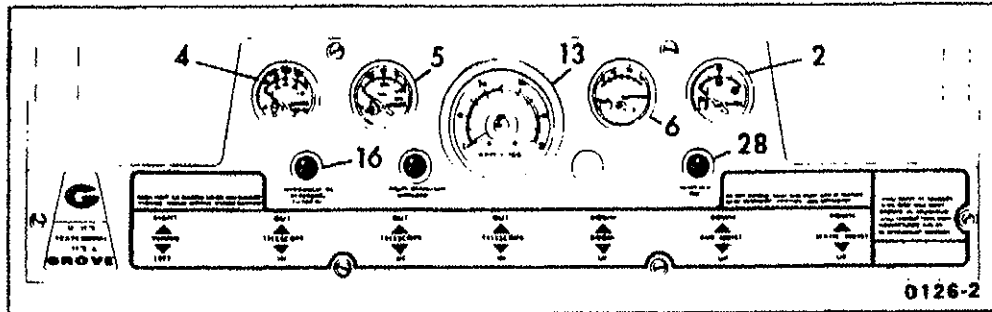
The foot throttle pedal (1) is located on the right side of the cab floor and is used to set engine rpm for proper hydraulic pump output.

THROTTLE LOCK CONTROL.

The throttle lock control (9) is located on the front end of the control console. The throttle lock is mechanically connected to the foot throttle and provides the operator with a means of maintaining specified engine rpm for crane operation. To use the throttle lock, depress the foot throttle to obtain the desired engine rpm, push the button on the throttle lock control knob and pull out on the knob. When pressure is felt, release the button and turn the control knob in a clockwise direction to lock the throttle at the desired rpm.



Cab Controls and Indicators (Sheet 1 of 2)



- | | |
|--|---|
| 1. Foot Throttle Pedal | 16. Hydraulic Oil Bypassing Light |
| 2. Fuel Quantity Gauge | 17. Swing Control Lever |
| 3. Tachometer | 18. Swing Brake Pedal |
| 4. Water Temperature Gauge | 19. Positive Swing Lock Control Handle |
| 5. Oil Pressure Gauge | 20. Boom Telescope Control |
| 6. Voltmeter | 21. Boom Elevation Control |
| 7. Lights Switch | 22. Main Hoist Control |
| 8. Ignition Switch | 23. Main and Auxiliary Hoists Speed Selector Switches |
| 9. Throttle Lock Control (Later Models) | 24. Auxiliary Hoist Control |
| 10. Engine Stop Control | 25. Free-Fall Control Lever (Optional) |
| 11. Engine Emergency Stop Control (GMC only) | 26. Outrigger Control Panel |
| 12. Heater Control Switch | 27. Swing Brake Switch |
| 13. Control Console Light | 28. Ignition On Light |
| 14. Windshield Wiper Switch | 29. Boom Angle Indicator (Earlier Models) |
| 15. Throttle Lock Control (Earlier Models) | 30. Boom Angle Indicator (Later Models) |
| | 31. Swing Brake Control (Earlier Models) |

To release the throttle, rotate the control knob counterclockwise, depress the button and push in on the cable.

IGNITION SWITCH.

The key operated ignition switch (8) is located on the control console and has four placarded positions; ACC., OFF, ON, and START. The switch is spring return from START to ON. With the switch in the OFF position, all electrical power to the superstructure is off. Positioning the switch to ACC. energizes all superstructure electrical components except the engine fuel solenoid valve (not used with Detroit Diesel). Positioning the switch to ON is the same as ACC. except the engine fuel solenoid valve becomes energized. Positioning the switch to START energizes the starter relay which in turn energizes the cranking motor solenoid and cranks the engine for starting. Releasing the switch will spring return it to ON. To shutdown the engine, except the Detroit Diesel, position the ignition switch to OFF, which will close the fuel solenoid valve.

ENGINE STOP CONTROL (DETROIT DIESEL ONLY).

The ENGINE STOP control (10) is used to shutdown the Detroit Diesel engine and is located on the control console. Pulling out on the control actuates a cable, which closes the governor and thereby shuts down the engine.

HEATER CONTROL SWITCH.

The forced air hot water heater is installed in the cab behind the operators seat. Hot water from the superstructure engine cooling system provides the heat. Operation of the heater fan is provided by a rotary switch (12) located on the control console.

FUEL TANK.

The fuel tank for the superstructure diesel engine is located in the left rear compartment of the superstructure. The tank has a capacity of 78 gallons (295.2 liters). The filler cap is located on top of the tank and is accessible by opening a door on top of the compartment.

DEFROSTER FAN.

The fan is installed on the right side of the cab windshield to provide defrosting of the windshield. The fan motor is controlled by a switch mounted on the fan housing.

ENGINE EMERGENCY STOP CONTROL (DETROIT DIESEL ONLY).

The ENGINE EMERGENCY STOP control (11) is used to shutdown the Detroit Diesel engine if the ENGINE STOP control does not function properly. Pulling out on the control actuates a cable which closes the air supply to the engine thereby causing the engine to shutdown. The control is located on the control console adjacent to the ENGINE STOP control.

ENGINE QUICK START SYSTEM (OPTIONAL).

The engine quick start system is provided as an aid for starting the superstructure engine during cold weather. The system consists of a push-button switch, a solenoid valve, a starting fluid container, and the necessary tubing. The QUICK START PUSH-BUTTON switch is located on the control console in the cab. The solenoid valve and starting fluid container are mounted inside the rear engine access door on the right side of the superstructure. The quick start is energized only when the ignition switch is in the start position and the QUICK START button is pushed.

FUEL GAUGE.

A standard fuel quantity gauge (2) is installed on the right side of the instrument panel and provides a visual display of the superstructure fuel tank quantity. It is in operation whenever the ignition switch is in the ACC. or ON position.

VOLTMETER.

A voltmeter (6) located adjacent to the fuel gauge provides an indication of battery condition when the engine is not running. With superstructure engine operating, the voltmeter indicates the voltage being supplied from the alternator. The voltmeter is in operation whenever the ignition switch is in the ACC. or ON position.

TACHOMETER.

The tachometer (3) is located in the center of the instrument panel. The tachometer sender on the engine provides a signal to the indicator to indicate engine rpm. The tachometer requires no power from the superstructure electrical system.

OIL PRESSURE GAUGE.

The oil pressure gauge (5) is located to the left of the tachometer and provides an indication of the lubricating oil pressure in the engine. It is in operation whenever the ignition switch is in the ACC. or ON position.

WATER TEMPERATURE GAUGE.

The water temperature gauge (4) is located adjacent to the oil pressure gauge and provides an indication of the coolant temperature in the coolant system. The gauge is in operation whenever the ignition switch is in the ACC. or ON position.

IGNITION ON LIGHT.

The IGNITION ON light (28) is a green light located on the instrument panel beneath the fuel gauge and voltmeter. It is illuminated whenever the ignition switch is in the ACC. or ON position.

HYDRAULIC PUMP DRIVE CONTROL.

A PUMP DISCONNECT lever extending below the right side of the superstructure frame controls operation of the pump drive assembly. The lever is used to disengage the hydraulic pumps from the engine for cold weather starting, operating the superstructure engine (under no load) for maintenance checks, and for immediate shutdown of the hydraulic system should an emergency condition arise. The pump drive should never be engaged unless the engine is shutdown.

CAB DOMELIGHT.

The cab domelight is mounted on the rear of the cab above the operator's seat. It is illuminated by positioning the LIGHTS switch on the control console to CAB.

CONTROL CONSOLE LIGHT.

The control console light (13) on the rear of the console provides for illumination of the console. It is illuminated by positioning the LIGHTS switch to INST and PANEL.

LIGHTS SWITCH.

The LIGHTS switch (7) is located on the rear of the control console and is a

three position switch placarded INST and PANEL, and CAB with the center position being off. Positioning the switch to INST and PANEL illuminates the control console light and the internal lights of the five instruments on the instrument panel. Positioning the switch to CAB illuminates the cab dome-light.

WINDSHIELD WIPER.

The windshield WIPER switch is located on the control console. The switch has three positions; off, low, and high. In addition, pushing the switch energizes the motor on the windshield washer pump assembly. Rotating the switch to the first detent energizes the wiper motor at low speed and rotating it to the second detent energizes the motor at high speed. Rotating the switch counter-clockwise to off, stops the motor and causes the automatic park function of the wiper motor to return the wiper blade to the parked position.

HYDRAULIC OIL BYPASSING FILTER(S) LIGHT.

The HYDRAULIC OIL BYPASSING FILTER(S) light (16) is a red light located on the instrument panel. It illuminates when the hydraulic oil filter becomes restricted and oil is bypassing the filter.

SWING HORN BUTTON.

The swing horn control button is located on the swing control lever. The swing horn is used by the operator to provide a warning that the superstructure is rotating.

SWING CONTROL.

The SWING control lever (17) is installed at the far left of the control lever bank. The lever, when positioned to LEFT or RIGHT, actuates a control valve through linkage rods to provide 360 degree continuous rotation in the desired direction. A foot pedal attached to the base of the control lever provides the operator with foot control, if desired.

SWING BRAKE PEDAL.

The foot-operated swing brake pedal (18) is installed to the right of the swing lever control foot pedal. The swing brake is used to slow or stop swing motion. Braking is proportional to pedal depression. With the pedal not depressed and the SWING BRAKE switch in DISENGAGE, hydraulic pressure is applied to the brake thereby, overcoming spring pressure and releasing the brake. De-

pressing the pedal actuates a valve to reduce hydraulic pressure to the brake and allow spring pressure to apply the brake. The brake is a multi-disc type brake installed on the top of the swing box.

SWING BRAKE SWITCH.

The SWING BRAKE switch (27) is located on the control console and is a two position switch placarded ENGAGE and DISENGAGE. The switch operates a hydraulic solenoid valve which in turn controls the swing brake in the same manner as the foot pedal. In the ENGAGE position, the solenoid bleeds all hydraulic pressure from the brake and allows spring pressure to fully set the brake to act as a parking brake. This holds the boom in the desired position allowing the operator to remove his foot from the pedal.

POSITIVE SWING LOCK CONTROL HANDLE.

The positive swing lock control handle (19) is located to the left of the swing control lever. The purpose of the swing lock is to secure the superstructure in any position. When the control handle is pushed forward, the swing lock is disengaged from the turntable bearing and swing can be accomplished. Pulling back on the control handle engages the lock in the turntable bearing. The control lever is adjusted to require approximately 45 pounds (20.4 kg) force to move the handle into the engage position.

BOOM TELESCOPE CONTROLS.

Two boom TELESCOPE control levers (three if a full power boom) are located to the right of the SWING control lever. The levers, when positioned to IN or OUT, actuate appropriate control valves through linkage rods to extend or retract the appropriate boom section. The first lever to the right of the SWING control lever controls the outer-mid. The second lever to the right of the SWING control lever controls the inner-mid. If the crane is equipped with a full power boom, the third lever to the right of the SWING control lever controls the fly section.

BOOM ELEVATION CONTROL.

The BOOM elevation control lever (21) is located to the right of the TELESCOPE control levers. Positioning the BOOM elevation control lever to UP or DOWN actuates a control valve through linkage rods to position the boom from 80 degrees above to 4 degrees below horizontal. A foot pedal attached to the base of the control lever provides the operator with foot control, if desired.

AUXILIARY HOIST CONTROL (OPTIONAL).

The optional AUX. HOIST control lever (24) is located to the right of the BOOM elevation control lever. Positioning the AUX. HOIST control lever to UP or DOWN actuates, through linkage rods, a control valve to drive the auxiliary hoist to raise or lower the auxiliary hoist cable.

MAIN HOIST CONTROL.

The MAIN HOIST control lever (22) is located on the far right of the control lever bank. Positioning the MAIN HOIST control lever to UP or DOWN actuates, through linkage rods, a control valve to drive the main hoist to raise or lower the main hoist cable.

HOIST ROTATION INDICATOR.

A hoist rotation indicator is located on the respective hoist control lever. The indicators are electronically driven by a signal from an electronic transmitter attached to the respective hoist and driven by the drum.

FREE-FALL CONTROL LEVER (OPTIONAL).

The controlled free-fall control handle (25) is located on the auxiliary hoist control lever, and operates a manually operated, normally open metering valve. When activated, the valve controls the flow of oil to the free-fall brake release port on the Gearmatic hoist.

MAIN AND AUXILIARY HOISTS SPEED SELECTOR SWITCHES.

The MAIN HOIST SPEED and optional AUX. HOIST SPEED selector switches (23) are located on the control console. Positioning the switches to either HIGH or LOW controls a solenoid valve on the respective hoist, which in the auxiliary hoist, determines the flow of hydraulic oil to the hoist motors and in the main hoist, shifts the drive gears within the hoist.

OUTRIGGER CONTROL PANELS.

Three outrigger control panels are provided for control of the outriggers and optional center front stabilizer. There is a panel located on each side of the carrier and one in the cab on the front end of the control console. Each control panel provides operation of all outriggers and the optional center front stabilizer. The panels on the carrier are installed in a box with a protective

cover. There are nine push-button switches and one two position, spring return to center OFF toggle switch on each panel. Depressing any one of the push-button switches energizes a solenoid valve for the appropriate component to be operated. Positioning the toggle switch to EXTEND or RETRACT energizes the control solenoid to allow hydraulic fluid to flow through the control solenoid valve and the individual solenoid valve and move the selected component in the desired direction. Releasing the toggle switch will cause it to spring return to OFF.

CAUTION

ALWAYS DEPRESS A PUSH BUTTON BEFORE POSITIONING THE TOGGLE SWITCH TO EXTEND OR RETRACT. FAILURE TO DO THIS MAY CAUSE A HYDRAULIC LOCK AGAINST THE INDIVIDUAL SOLENOID VALVES, PREVENTING THEM FROM OPENING.

BUBBLE LEVEL INDICATOR.

There are three bubble level indicators, one on the rear of the control console in the cab and one at each outrigger control panel on the carrier. The indicators on the carrier are contained in a protective box.

COUNTERWEIGHT POSITIONING CONTROL.

The COUNTERWEIGHT positioning control lever is installed in the left rear compartment of the superstructure. The lever is pushed in to extend the counterweight and pulled out to retract the counterweight.

COUNTERWEIGHT REMOVAL CONTROLS.

WARNING

ENSURE ALL PERSONNEL ARE CLEAR OF THE AREA AROUND THE COUNTERWEIGHT BEFORE ATTEMPTING COUNTERWEIGHT REMOVAL.

The BOOM control lever provides for removal and installation of the counterweight. With the counterweight extended, a cable is connected between the counterweight and the base of the inner-mid section of the boom. Pushing in

on the BOOM control lever causes the inner-mid section of the boom to extend and raise the counterweight. To prevent raising the counterweight too far, a rotating trip mechanism actuates a safety valve to stop flow of hydraulic oil to the extend side of the inner-mid telescope cylinder.

SECTION IV

OPERATING PROCEDURES

PRE-STARTING CHECKS.

A complete walk-around visual inspection of the crane should always be made with special attention to structural damage, loose equipment, leaks, or other conditions that would require immediate correction for safety of operation. The following checklist items are suggested specifically for the operator's benefit to ensure his crane is prepared for starting the day's work.

FUEL SUPPLY.

Ensure the fuel tank is full and the cap is properly secured.

ENGINE OIL.

CAUTION

DO NOT OVERFILL.

Check the oil level in the engine crankcase. If required, add the proper oil to the full mark on the dipstick.

ENGINE COOLANT.

Check the coolant level in the engine radiator. Fill to proper level. Ensure that cap is properly secured.

BATTERIES.

Check the state of charge indicator on the batteries. Check that cables and clamps are tight and not corroded.

HYDRAULIC OIL RESERVOIR AND FILTER.

Check hydraulic fluid quantity level indicator and check filter condition indicator. Check breather for cleanliness and security.

DAILY LUBRICATION.

Ensure that all components requiring daily lubrication have been serviced.

(Refer to Section VI, Lubrication.)

WIRE ROPE.

Inspect wire rope in accordance with applicable Federal Regulations. Sheaves, guards, guides, drums, flanges, etc., and any other surfaces that come in contact with the rope should be inspected for any condition that could cause possible damage to the rope.

HOOK BLOCK.

Visually inspect 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). Ensure the safety latch is free and aligned.

SWINGAWAY EXTENSION.

WARNING

FAILURE TO MAINTAIN THE CLEARANCE BETWEEN THE SWINGAWAY ANCHOR LUGS AND BOOM NOSE ANCHOR FITTINGS COULD CAUSE THESE FITTINGS AND LUGS TO COME INTO CONTACT WITH EACH OTHER DURING FULL RETRACTION OF THE BOOM. THIS ACTION COULD RESULT IN DAMAGE TO THE CRANE AND POSSIBLE SERIOUS INJURY OR DEATH TO PERSONNEL.

Ensure there is sufficient clearance between the boom nose anchor fittings and swingaway extension anchor lugs when the boom is fully retracted and the swingaway is properly stowed.

AIR CLEANER.

Check the filter condition indicator. Check filter and tubing for security.

ENGINE OPERATION.

Starting and shutdown procedures for most diesel engines generally follow the same pattern. Therefore, the following procedures can be applied except

where specific differences are noted. (Refer to the applicable engine manufacturer's manual for detailed procedures.)

STARTING PROCEDURE.

WARNING

BEFORE STARTING THE ENGINE, ENSURE THE POSITIVE SWING LOCK IS ENGAGED.

CAUTION

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

CAUTION

IF THE ENGINE FAILS TO START AFTER FOUR ATTEMPTS, CORRECT THE PROBLEM BEFORE ATTEMPTING ANOTHER START.

1. Position the ignition switch to START. After the engine starts, release the switch and it will return to ON.

CAUTION

IF OIL PRESSURE AND/OR WATER TEMPERATURE INDICATOR(S) DO NOT INDICATE PROPER READINGS, SHUTDOWN THE ENGINE AND CORRECT THE MALFUNCTION BEFORE RESUMING OPERATION.

2. With the engine operating at idle rpm, check the engine instruments for proper indications.
3. Allow the engine and hydraulic oil to warm up for at least five minutes before applying a load to the engine.

NOTE

If the hydraulic pumps were disengaged before starting the engine, shutdown the engine after warm-up and engage the pumps. Restart the engine and allow the hydraulic oil to warm-up at a low engine rpm.

Normal Engine Gauge Readings

GAUGE	CUMMINS		CAT	GMC
Eng. Water Temp. ° F (° C)	175-185 (79-85)	175-185 (79-85)	175-185 (79-85)	175-185 (79-85)
Eng. Oil Press psi (kPa)				
Idle	15 (103)	10 (69)	11 (76)	7 (48)
Rated	50-70 (345-483)	45-70 (310-483)	55-75 (379-517)	30-44 (207-303)

COLD WEATHER STARTING.

The correct grade of oil for the existing temperature should be used in the crankcase to prevent hard cranking. In an emergency, white kerosene may be added to the fuel to bring the pour point down, as required by temperature, in order to prevent clogging of filters and small passages by wax crystals. The addition of white kerosene is not recommended for general use. If low temperatures are expected only at starting, it is advisable to use starting aids such as preheating or starting fluids.

1. Using the PUMP DISCONNECT lever under the right side of the superstructure, disengage the hydraulic pumps by positioning the lever to DIS-ENGAGE. This will reduce the engine starter load and avoid possible pump cavitation after start.

CAUTION

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

CAUTION

AVOID OVERLOADING THE AIR BOX WITH HIGH VOLATILE FLUID WHICH COULD RESULT IN A MINOR EXPLOSION.

2. Position the ignition switch to START and at the same time depress the QUICK START (optional) button for one or two seconds and then release. If the engine does not start within 30 seconds, allow the starter to cool at least two minutes and repeat the procedure.

Diesel fuel should have a pour point of 10 degrees F (-12 degrees C) less than the lowest expected temperature.

SHUTDOWN PROCEDURE.

1. Allow the engine to operate at fast idle speed for approximately five minutes to avoid high internal heat rise and allow for heat dissipation.

NOTE

Step 2 is applicable to the Detroit Diesel only.

2. Pull out on the ENGINE STOP control knob.
3. Position the ignition switch to OFF.

EMERGENCY ENGINE SHUTDOWN.

NOTE

Steps 1, 2 and 4 are applicable to the Detroit Diesel only.

1. Pull out on the ENGINE STOP control knob.

CAUTION

THE ENGINE EMERGENCY STOP SHOULD ONLY BE USED IF THE ENGINE STOP DOES NOT SHUTDOWN THE ENGINE. DAMAGE TO THE ENGINE COULD RESULT WHEN THE ENGINE EMERGENCY STOP IS USED.

2. Pull out on the ENGINE EMERGENCY STOP control knob.
3. Position the ignition switch to OFF.

WARNING

IF AN OVERHEATING CONDITION NECESSITATES AN EMERGENCY SHUTDOWN, USE CAUTION WHEN CHECKING THE RADIATOR. WHEN LOOSENING THE RADIATOR CAP TO RELIEVE PRESSURE, USE A HEAVY CLOTH OR GLOVES. ALLOW THE ENGINE TO COOL BEFORE REMOVING THE CAP FROM THE RADIATOR.

CAUTION

CORRECT THE PROBLEM THAT RESULTED IN THE EMERGENCY SHUTDOWN BEFORE ATTEMPTING A RESTART OF THE ENGINE.

4. If the ENGINE EMERGENCY STOP was used, 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.

GENERAL CRANE OPERATION.

HANDLING THE LOAD.

Safety is the operator's responsibility. Refer to Safety Information in Section II of this manual. The following additional guidelines should be observed.

WARNING

THE OUTRIGGERS MUST BE POSITIONED IN PLACE AND LOCKED BEFORE THE BOOM IS RAISED FROM THE BOOM REST.

WARNING

LONG CANTILEVER BOOMS CAN CREATE A TIPPING CONDITION WHEN IN AN EXTENDED AND LOWERED POSITION EVEN WHEN UNLOADED.

1. Lift only if the machine is level and firmly positioned on fully extended outriggers.

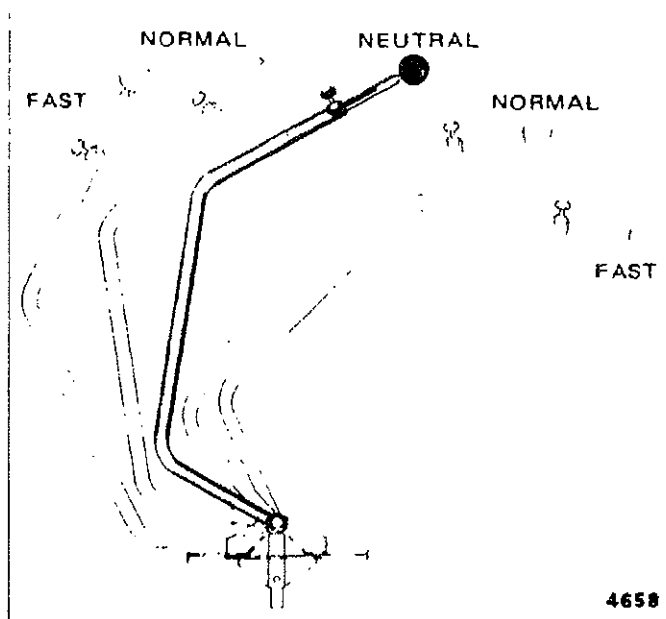
2. Ensure the area around and beneath the load is kept clear of all obstructions and personnel.
3. Always use the correct chains and slings as applied to the type of load.
4. Ensure that all personnel on the ground are wearing approved head coverings.
5. Refer to the capacity and load chart before attempting to lift any load.
6. The hoist must never be operated with less than two wraps of cable on the hoist drum.

The operator should also be aware of the following important safeguards to avoid subjecting the machine to undue stresses and loads.

1. Do not perform any crane operations with the engine at idle speed. Operate the engine at governed rpm during the performance of all operations.
2. Always keep the load as close to the crane and/or the ground as possible when swinging.
3. Never lift a load with the boom lift cylinders fully retracted (bottomed).
4. When lowering and extending the boom, let out the hoist cables at the same time to prevent two-blocking the boom nose and hook block.
5. Always operate the crane control levers with a smooth, even pressure; never jerk a lever.
6. Never release a lever suddenly to stop a movement. Always return the lever to neutral with a smooth even motion.

CONTROL LEVER OPERATION.

The control lever operation for crane function is standard, i.e., the closer the lever is to neutral (center), the slower the system responds. This applies to both forward and rear movement of the applicable lever. Always operate the control levers with slow, even pressure.



Control Lever Operation

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 THE ENGINE AT OR NEAR THE GOVERNED RPM DURING PERFORMANCE OF ALL CRANE FUNCTIONS.

NOTE

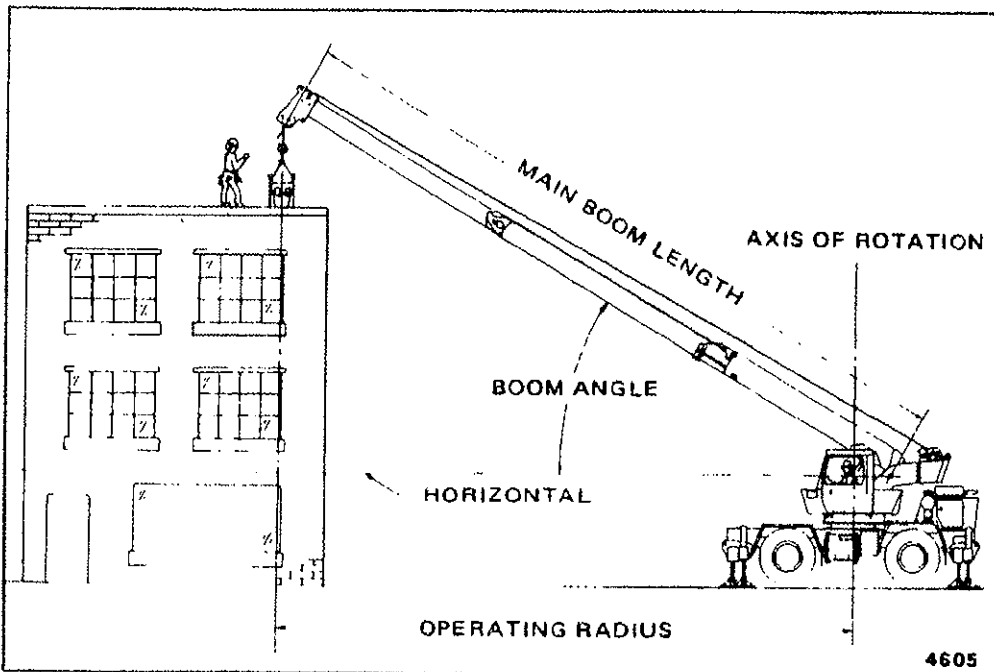
Carefully read and become familiar with all crane operating instructions before attempting a preload check and operating the crane under load.

1. Extend and set the outriggers.
2. Raise, lower, and swing the boom right and left a minimum of 45 degrees.

3. Telescope the boom in and out, extending and retracting the boom sections equally at all times.

4. Raise and lower the cable a few times at various boom lengths. Ensure there is no kinking.

USING YOUR LOAD CHART.



Terms to Know

NOTE

One of the most important tools of every Grove crane is the load chart found in the crane operator's cab.

The load chart contains a large amount of information, which must be thoroughly understood by the operator.

The load chart is divided into capacities limited by structural strength, and capacities limited by stability. This is shown by the bold line across the chart. Capacities above the line are limited by structural strength, and capacities below the line are limited by machine stability.

The chart shows the radius of the load in a column at the left. The radius is the distance between the centerline of rotation of the crane and the center of gravity of the load. Various boom lengths are listed across the top, ranging from fully retracted to fully extended, and with the power pinned fly or the swingaway extension in use. The boom angle (in degrees) required for the given lift is shown in parenthesis, below the maximum total weight which can be lifted. Notice that the boom lengths in between the increments shown should always be treated as if the boom was extended to the next longer length. For example, if the load chart has capacities for 55 ft. and 65 ft. boom lengths and the actual length of the boom in use is 58 ft., then the maximum capacity will be listed under the the 65 ft. boom length, because the boom is beyond 55 ft. in length. Another important section of the load chart is the range diagram. The range diagram illustrates the tip height which can be achieved at each boom length, angle, and radius. If the operator knows the radius required for a specific lift, and the tip height necessary, he can calculate the required boom length and angle needed for the lift. He then checks the capacity chart for the specific boom length and radius to find out if the crane is capable of performing the lift safely. Or, on the other hand, if the boom length and angle are known, the radius can be determined from the range diagram.

A lifting area diagram is included as part of the load chart to describe over side, over rear, and over front lifting area. An examination of the lifting area diagram shows that the locations of the outrigger stabilizer cylinders in the fully extended position are used to mark the boundaries of the lifting areas.

The last major portion of the load chart is the section concerning notes to lifting capacities. Be sure to read all notes carefully so you understand what each one means. The load chart also gives weight reductions for Grove load handling devices such as hookblocks, headache balls, boom extension sections, etc., which must be taken into consideration as part of the load. Remember, any other load handling devices such as chains, slings, or spreader bars must also be considered, and the weight of these devices must be subtracted from the weight of the load.

NOTE

The information in the following paragraph is an example of how to compute a lift but the numbers used in the example may not coincide with the load chart in the crane cab.

To understand the uses of the load chart, here is a typical example of a lifting problem. Determine whether or not the lift can be made safely. The problem is to lift a concrete beam weighing 7.5 tons (15,000 lbs.) to a height of 60 ft. at a radius of 90 ft. (maximum). Using the TMB75 with the four section boom, the range diagram indicates the power pinned section of the boom must be extended in order to reach to a height of 90 ft. and a 60 ft. radius. This gives a total boom length of 114 ft. A quick check of the load chart at a 60 ft. radius with 114 ft. of boom (power pinned fly extended, on outriggers) shows a capacity of 17,230 lbs. It appears to be obvious that this capacity allows the lifting of 7.5 tons (15,000 lbs.) easily. But wait! The listed capacity must be reduced by the weight of all load handling devices. Now, check to see how the crane is equipped. First, assume this crane has the swingaway boom extension in the stowed position alongside the base boom section. The chart says 365 lbs. must be subtracted for the stowed swingaway. This unit also has a rooster sheave requiring a reduction of 230 lbs. The ten ton headache ball is sufficient for use and weighs 500 lbs. If the lift being attempted requires slings, chains, spreader bars, or other rigging, the weight of these items must also be subtracted. For our purposes, assume these items weigh 350 lbs. A quick addition of the weight reduction necessary for the load handling devices reveals 1445 lbs. must be subtracted from the capacity of the load chart. Or, $17,230 \text{ lbs} - 1445 \text{ lbs.} = 15,785 \text{ lbs.}$ can be safely attached to the hook. Recheck the load chart and see that the machine is capable of making the lift. Also note the laden boom angle (found in parenthesis under the weight capacity of the load chart) will be 58 degrees.

CRANE FUNCTIONS.

WARNING

THE OUTRIGGERS AND THE OPTIONAL CENTER FRONT STABILIZER MUST BE EXTENDED AND SET BEFORE ANY OTHER OPERATION OF THE CRANE IS ATTEMPTED.

SETTING THE OUTRIGGERS.

1. Position the outrigger floats approximately 7.5 feet (2.3 m) directly out from each outrigger.

CAUTION

ALWAYS DEPRESS A PUSH BUTTON BEFORE POSITIONING THE TOGGLE SWITCH TO EXTEND OR RETRACT. FAILURE TO DO THIS MAY CAUSE A HYDRAULIC LOCK AGAINST THE INDIVIDUAL SOLENOID VALVES, PREVENTING THEM FROM OPENING.

NOTE

It is recommended that the right outriggers be operated from the control panel on the right side of the carrier and the left ones from the left side of the carrier.

2. Depress the appropriate EXTENSION push-button switch and position the toggle switch to EXTEND. The appropriate outrigger should begin to extend.

NOTE

More than one outrigger may be extended at one time. However, to ensure that each outrigger is fully extended, each EXTENSION button should be depressed individually and the toggle switch momentarily positioned to EXTEND after multi-outrigger extension.

3. After all four outrigger beams have been fully extended, depress the appropriate STABILIZER push-button switch and position the toggle switch to EXTEND.
4. Extend each stabilizer, positioning the float as necessary, until the locking levers of the float engage the stabilizer cylinder rod.

NOTE

More than one stabilizer may be extended at one time.

5. With each stabilizer float firmly touching the ground, depress the F (front) STABILIZER switches and position the toggle switch to EXTEND to extend the front stabilizers approximately 3 to 4 inches (7.6 to 10.2 cm).
6. Depress the R (rear) STABILIZER switches and position the toggle switch to EXTEND to extend the rear stabilizers approximately 3 to 4 inches (7.6 to 10.2 cm).
7. Repeat the procedures in steps 5 and 6 until all 8 wheels are clear of the ground and the machine is level, as indicated by the sight level bubble located at each control panel.
8. On each stabilizer, lift the spin-type lock handle and rotate the handle in a clockwise direction until the handle will no longer turn. This mechanically locks the stabilizer in the extended position. Fold the handle over to the stowed position.

STOWING THE OUTRIGGERS.

CAUTION

BEFORE STOWING THE OUTRIGGERS, ENSURE THE CENTER FRONT STABILIZER HAS BEEN FULLY RETRACTED AND THE SPIN-TYPE LOCKS HAVE BEEN UNLOCKED.

1. Depress each STABILIZER push-button switch and momentarily position the toggle switch to EXTEND.
2. Lift the spin-type lock handle on each stabilizer and turn the handle counterclockwise until the handle can no longer be turned. Fold down the handle.
3. Depress the R (rear) STABILIZER push-button switches and position the toggle switch to RETRACT until the rear stabilizers have retracted sev-

eral inches.

4. Depress the F (front) STABILIZER push-button switches and position the toggle switch to RETRACT until the front stabilizers have retracted several inches.

5. Repeat steps 3 and 4 until the machine is resting on all 8 wheels and the stabilizer floats are several inches off the ground.

WARNING

**KEEP FEET AND HANDS CLEAR OF THE
FLOATS WHEN UNLOCKING THEM FROM
THE STABILIZERS.**

6. Release the locking levers and allow the floats to drop to the ground.

7. Continue to retract the stabilizers until they are fully retracted.

8. Depress the appropriate EXTENSION push-button switch and position the toggle switch to RETRACT TO retract each outrigger.

NOTE

**More than one outrigger may be retracted at a
time.**

9. Stow the floats in their holding brackets.

WARNING

**BEFORE INITIATING ANY SWING OPERA-
TIONS, ENSURE THE AREA IN THE SWING
PATH OF THE HOOK AND/OR LOAD, AS
WELL AS THE TAIL SWING AREA, IS CLEAR
OF ALL OBSTRUCTIONS AND PERSONNEL.
SOUND THE SWING HORN BEFORE SWING-
ING.**

SWINGING THE BOOM.

WARNING

THE OUTRIGGERS AND STABILIZERS MUST BE FULLY EXTENDED AND SET AND THE COUNTERWEIGHT FULLY EXTENDED PRIOR TO STARTING ANY LIFTING OPERATIONS.

CAUTION

THE BOOM MUST ALWAYS BE ELEVATED FROM THE BOOM REST BEFORE SWING IS ATTEMPTED.

CAUTION

NEVER PUSH OR PULL THE SWING CONTROL LEVER THROUGH NEUTRAL TO THE OPPOSITE DIRECTION TO STOP SWING MOTION. TO SLOW SWING, FEATHER THE SWING CONTROL LEVER TOWARD NEUTRAL AND USE THE SWING BRAKE FOOT PEDAL. TO STOP SWING, POSITION THE LEVER TO NEUTRAL AND USE THE SWING BRAKE FOOT PEDAL.

CAUTION

ENSURE THE POSITIVE SWING LOCK IS DISENGAGED BY PUSHING FORWARD ON THE HANDLE. ENSURE THE SWING BRAKE SWITCH IS IN THE DISENGAGED POSITION.

To swing to the right, push forward (RIGHT) on the SWING control lever or use the toe of the foot pedal and hold until near desired position. Return the lever to neutral and use the swing foot brake to stop swing. To swing to the left, pull (LEFT) on the SWING control lever or use the heel of the foot pedal. After reaching the desired position and the swing is stopped, turn the SWING BRAKE switch to ENGAGED and set the positive swing brake.

NOTE

The positive swing brake is adjusted to require approximately a 45 pound (20.4 kg) force to pull the handle.

ELEVATING AND LOWERING THE BOOM.

Elevating the Boom.

WARNING

BEFORE ELEVATING THE BOOM, ENSURE THE AREA ABOVE AND BELOW THE BOOM IS CLEAR OF ALL OBSTRUCTIONS AND PERSONNEL.

To elevate the boom, pull back (UP) on the BOOM control lever or use the heel of the foot pedal. Hold the control lever or the foot pedal until the boom reaches the desired elevation angle.

Lowering the Boom.

WARNING

BEFORE LOWERING THE BOOM, ENSURE THE AREA BENEATH THE BOOM IS CLEAR OF ALL OBSTRUCTIONS AND PERSONNEL.

WARNING

LONG UNLOADED CANTILEVER BOOMS CAN CREATE A TIPPING CONDITION WHEN IN AN EXTENDED AND LOWERED POSITION.

CAUTION

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

CAUTION

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

To lower the boom, push forward (DOWN) on the BOOM control lever or use the toe of the foot pedal. Hold the control lever or the foot pedal until the boom reaches the desired angle.

Foot Control.

The boom may also be raised or lowered using the foot control. Push the pedal forward away from the operator to lower, and push back towards the operator to elevate.

EMERGENCY BOOM OPERATING PROCEDURES.

Although highly improbable if proper maintenance and frequent inspections are made, there remains the possibility that the boom lift cylinders hydraulic equalizer line could fail. If this occurs, there are restricting devices provided that allow continued operation of the crane. All crane functions remain operable until the hydraulic oil in the reservoir is depleted. The most important thing is to get the boom in a safe position so that repairs can be made. The following procedures are recommended for getting the boom to a safe position should the equalizer line fail.

NOTE

Remain at the operator's station since all functions can be accomplished from this position.

1. Accelerate the engine to normal operating rpm.
2. Maintain the desired boom angle by pulling back (UP) on the BOOM control lever, as necessary.
3. While maintaining the boom at this angle, activate swing, telescope in the boom sections, and operate the hoist(s) as necessary until the load is safely lowered to the ground.
4. If over-the-side, telescope in as much boom as possible and then lower the boom. If over-the-rear, it will not be necessary to telescope in.

TELESCOPING THE BOOM

Extending the Boom.

WARNING

POWER TELESCOPING SECTIONS MUST BE EXTENDED EQUALLY AT ALL TIMES TO COMPLY WITH THE LOAD CHART MAXIMUM LIFTING CAPACITIES.

WARNING

WHEN EXTENDING THE BOOM, LOWER THE CABLE SIMULTANEOUSLY TO PREVENT TWO-BLOCKING.

WARNING

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

To extend the boom, push forward (OUT) on all TELESCOPE control levers and hold in this position until the boom sections extend to the desired length.

Retracting the Boom.

To retract the boom, pull back (IN) on all TELESCOPE control levers and hold in this position until the boom sections retract to the desired length.

WARNING

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

WARNING

FAILURE TO MAINTAIN THE CLEARANCE BETWEEN THE SWINGAWAY ANCHOR LUGS AND BOOM NOSE ANCHOR FITTINGS COULD CAUSE THESE FITTINGS AND LUGS TO COME INTO CONTACT WITH EACH OTHER DURING FULL RETRACTION OF THE BOOM. THIS ACTION COULD RESULT IN DAMAGE TO THE CRANE AND POSSIBLE SERIOUS INJURY OR DEATH TO PERSONNEL.

POWER-PINNED FLY SECTION.

CAUTION

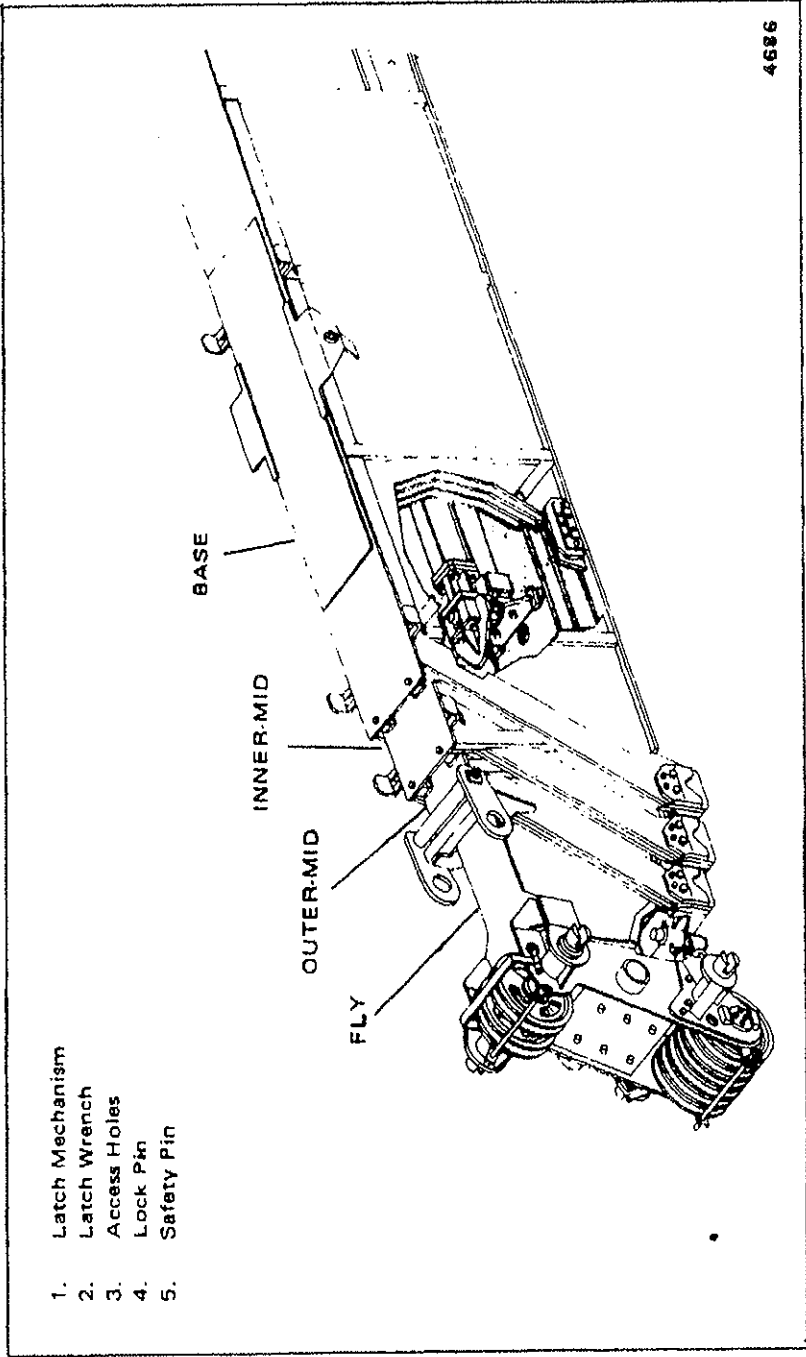
THE BOOM MUST BE AT ZERO DEGREES ELEVATION DURING ALL SET-UP AND STOWAGE OPERATIONS FOR THE POWER-PINNED FLY SECTION

CAUTION

WHEN THE POWER-PINNED FLY SECTION IS EXTENDED, REFER TO THE LOAD CHART IN YOUR CAB FOR THE LOAD LIMIT USING THE POWER-PINNED FLY SECTION.

Extend.

1. Locate the crane on a firm, level surface.
2. Fully extend and set the outriggers. Engage the spin locks.
3. Position the boom over the side or rear. Lower to horizontal.



Extending and Retracting Power-Pinned Fly Section

4. Extend the inner-mid section until the access holes to the latch mechanism are exposed. Line up the latch mechanism with the slot in the lock block.
5. Using the boom latch wrench, activate the latch mechanism by turning the wrench in a counterclockwise direction (viewed by looking up).
6. Extend the outer-mid section fully, engaging the latch in the slot on the back end of the fly section.

CAUTION

**FAILURE TO REMOVE THE LOCK PIN CAN
RESULT IN DAMAGE TO THE BOOM.**

7. Remove the safety pin from the lock pin and remove the lock pin from the bottom of the outer-mid section.
8. Fully retract the outer-mid section. The fly section will remain extended because it is locked to the inner-mid section by the latching mechanism.

NOTE

It may be necessary to extend or retract the outer-mid section to align the hole in the front end of the outer-mid section with the hole in the back end of the fly section.

9. Insert the lock pin through the hole in the outer-mid section into the hole in the fly. Insert the safety pin in the lock pin. This maintains the fly section in the fully extended position.
10. Using the boom latch wrench (2), disengage the latch mechanism by turning the wrench clockwise until the stop is reached.

NOTE

- **A slight jog of the outer-mid may be required to allow the latch to disengage.**

Retract.

1. Locate the crane on a firm, level surface.

2. Fully extend and set the outriggers. Engage the spin locks.
3. Fully retract all sections of the boom except the outer-mid section, which should be approximately 30 inches (76.2 cm) extended.
4. Extend or retract the inner-mid section as necessary to align the latch mechanism access holes.
5. Using the boom latch wrench, activate the latch mechanism by turning the wrench in a counterclockwise direction (viewed by looking up).
6. Retract the outer-mid section until the lock mechanism engages the slot on the back end of the fly section.

CAUTION

**FAILURE TO REMOVE THE LOCK PIN CAN
RESULT IN DAMAGE TO THE BOOM.**

7. Remove the safety pin from the lock pin and remove the lock pin from the outer-mid section.
8. Fully extend the outer-mid section.
9. Install the lock pin through the outer-mid section into the forward hole of the fly section. Install the safety pin in the lock pin. This locks the fly section in the retracted position.
10. Using the boom latch wrench, disengage the latch by turning the wrench clockwise until the stop is reached.

NOTE

**A slight jog of the outer-mid may be required
to allow the latch to disengage.**

11. Using the appropriate TELESCOPE control levers, fully retract all boom sections.

LOWERING AND RAISING THE CABLE.

The following procedures are applicable to the operation of either the main or auxiliary hoist.

WARNING

BEFORE RAISING OR LOWERING THE CABLE (LOAD), ENSURE THE AREA BENEATH THE LOAD IS CLEAR OF ALL OBSTRUCTIONS AND PERSONNEL.

CAUTION

WHEN STARTING OR STOPPING THE HOIST, DO NOT JERK THE CONTROL LEVER. JERKING THE CONTROL LEVER CAUSES THE LOAD TO BOUNCE WHICH COULD RESULT IN AN OVERLOAD CONDITION AND POSSIBLE DAMAGE TO THE MACHINE.

NOTE

When the load is stopped at the desired height, the automatic brake will engage and hold the load as long as the control lever remains in neutral.

Lowering the Cable.

To lower the cable, push forward (DOWN) on the applicable HOIST control lever. Hold the lever in this position until the hook or load is at the desired level. The hoist rotation indicator should be rotating, indicating that the hoist drum is rotating.

Raising the Cable.

To raise the cable, pull back (UP) on the applicable HOIST control lever. Hold the lever in this position until the hook or load is at the desired level. The hoist rotation indicator should be rotating, indicating that the hoist drum is rotating.

Hoist Speed Range Selection.

WARNING

DO NOT CHANGE THE HOIST SPEED RANGE WITH THE HOIST ROTATING.

To change the speed range of the hoist, position the applicable switch (MAIN HOIST SPEED or OPTIONAL AUX. HOIST SPEED) to HIGH or LOW as applicable.

COUNTERWEIGHT OPERATION.

WARNING

THE COUNTERWEIGHT MUST BE FULLY EXTENDED PRIOR TO STARTING ANY LIFTING OPERATIONS.

CAUTION

THE OUTRIGGERS AND STABILIZERS MUST BE FULLY EXTENDED AND SET WITH THE MACHINE IN A WORKING POSITION BEFORE EXTENDING THE COUNTERWEIGHT. THE COUNTERWEIGHT MUST BE RETRACTED BEFORE RETRACTING THE OUTRIGGERS.

CAUTION

ENSURE THAT THE TRAVEL LOCK PIN IS REMOVED AND STOWED.

Extending the Counterweight.

To extend the counterweight, push the COUNTERWEIGHT control lever and hold until the counterweight is fully extended.

Retracting the Counterweight.

To retract the counterweight, pull the COUNTERWEIGHT control lever and hold until the counterweight is fully retracted.

OPTIONAL EQUIPMENT OPERATION.

SETTING THE CENTER FRONT STABILIZER.

CAUTION

NEVER OPERATE THE CENTER FRONT STABILIZER UNLESS THE BOOM IS RETRACTED AND IN THE BOOM REST POSITION. NEVER EXTEND THE CENTER FRONT STABILIZER UNLESS THE MAIN OUTRIGGERS AND STABILIZERS ARE EXTENDED AND LOCKED. ALWAYS RETRACT THE CENTER FRONT STABILIZER BEFORE RETRACTING THE MAIN STABILIZERS AND OUTRIGGERS.

1. Position the float under the center front stabilizer.
2. Depress the CENTER FRONT STABILIZER push-button switch and position the toggle switch to EXTEND.
3. Extend the stabilizer, positioning the float as necessary, until the locking levers of the float engage the stabilizer cylinder rod.

CAUTION

DO NOT TRY TO LIFT OR LEVEL THE CRANE WITH THE CENTER FRONT STABILIZER.

4. Continue to extend the stabilizer until the float is firmly set on the ground.

STOWING THE CENTER FRONT STABILIZER.

CAUTION

NEVER OPERATE THE CENTER FRONT STABILIZER UNLESS THE BOOM IS RETRACTED AND IN THE BOOM REST POSITION. NEVER EXTEND THE CENTER FRONT STABILIZER UNLESS THE MAIN OUTRIGGERS AND STABILIZERS ARE EXTENDED AND LOCKED. ALWAYS RETRACT THE CENTER FRONT STABILIZER BEFORE RETRACTING THE MAIN STABILIZERS AND OUTRIGGERS.

CAUTION

IN LATER MODELS THE CENTER FRONT STABILIZER WILL RETRACT WHEN THE MAIN OUTRIGGER CONTROL IS SHIFTED TO THE RETRACT POSITION. AFTER OPERATING THE MAIN OUTRIGGER CONTROL, THE CENTER FRONT STABILIZER MUST BE RESET BEFORE OPERATING THE CRANE.

1. Depress the CENTER FRONT STABILIZER push-button switch and position the toggle switch to RETRACT.

WARNING

KEEP FEET AND HANDS CLEAR OF THE FLOAT WHEN UNLOCKING IT FROM THE STABILIZER.

2. Retract the stabilizer until the float is several inches off the ground and release the locking levers, allowing the float to fall to the ground.
3. Continue to retract the center front stabilizer until the stabilizer is fully retracted.
4. Stow the float in its holding rack.

CONTROLLED FREE-FALL.

Operating the Hoist in the Controlled Free-Fall Mode.

Normally, a load is powered by actuating the hoist control lever. The free-fall feature of the hoist operates only in lowering.

NOTE

When not being used, the free-fall control valve is held in the direct (powered) hoisting position by spring loading. The control valve is remote mounted and operated by a tee handle cable.

1. The free-fall control tee handle is located on the hoist control lever. Pull the tee handle slowly until the free fall brake begins to release. The load is then started into a controlled free-fall condition, at which point the hoist main brake has no influence on the descending load.
2. Using caution, slowly relax the pull on the control valve actuator as the load begins to descend, in order to control the lowering speed. Pull the tee handle to increase speed and release the tee handle to decrease speed.
3. To stop the load, when operating under controlled free-fall conditions, at a desired height above the ground, the tee handle is slowly released to allow spring force to move the valve to the neutral position. As the tee handle is allowed to move to neutral, the load is gradually brought under control by the free-fall brake. When the control valve reaches neutral, full braking effort is applied and the load is stopped. The suspended load is held by the hoists' entire braking system.

CAUTION

SLOWLY ALLOW THE TEE HANDLE TO RETURN TOWARD NEUTRAL BEFORE THE LOAD REACHES THE HEIGHT AT WHICH YOU WANT TO STOP IT.

CAUTION

THE LOWERING OPERATION WITH A CONTROLLED FREE-FALL HOIST TAKES ONLY A FEW SECONDS.

Suggested Procedures for Operators.

In order for an operator to get the feel of lowering loads with a controlled free-fall hoist and acquire greater skill in this crane operation, the following procedure is required.

1. Begin by using a light load (1000 lbs. [453.6 kg] or less) and operate only with a relatively short (moderately telescoped) boom and at a conservative boom elevation angle. Refer to the crane capacity chart.
2. Gradually increase such factors as the load and the boom telescoped length and operate at different boom elevation. Establish a feel for each different configuration as you raise the loads to varying heights and lower them, using controlled free-fall.
3. A certain rhythm is required for this particular craning operation that an operator can only establish by practice and experimentation. Good operators can acquire the skills necessary to become proficient without overloading or damaging the crane.

CAUTION

**ALL BOOM SECTIONS MUST BE EXTENDED
EQUALLY AT ALL TIMES.**

CAUTION

**SMOOTH AND GRADUAL SNUBBING OF
THE LOAD IS NECESSARY TO AVOID HIGH
SHOCK LOADS.**

When a load is being lowered under controlled free-fall conditions, the tee handle must be moved slowly and smoothly.

Sudden movement or jerking the tee handle will cause a pressure surge within the hoist and the load will lower at an uneven speed.

Sudden movement of the tee handle toward neutral will bounce the load, making it difficult to bring the load to a smooth stop at the desired height from the ground.

The importance of smooth operation in putting a load into free-fall and in bringing a load to rest from a controlled free-fall condition, cannot be over-

emphasized, and depends upon the skill of the operator. Timing and smooth operation of the tee handle in putting the load into free-fall and in bringing the load to a smooth and even stop, is essential. The less abruptly the load is put into free-fall and the less abruptly it is stopped, the better the craning operation and the less strain on the equipment.

Back Pressure.

CAUTION

EXCESSIVE BACK PRESSURE IN THE FREE-FALL BRAKE HYDRAULIC CIRCUIT WILL MAKE THE FREE-FALL HOIST UNSAFE TO USE.

Some causes of excessive back pressure:

1. Cold Oil. In cold weather, hydraulic oil becomes thick and can cause excessive back pressure in the brake circuit. Always allow hydraulic oil to warm up before attempting to operate the free-fall hoist.
2. If free-fall mechanism does not operate smoothly when lowering loads, a malfunction of the metering pump may have developed. Stop operation immediately upon detecting any malfunction and check the metering pump before resuming operation.

ENGINE QUICK START SYSTEM.

The engine quick start system is provided as an aid for starting the engine during cold weather. The system consists of a push-button switch, a solenoid valve, a starting fluid container, and the necessary tubing. The QUICK START push-button switch is located on the side console in the cab. The solenoid valve and starting fluid container are mounted inside the engine compartment on the right side of the hood. The quick start is energized only when the ignition switch is in the START position and the QUICK START button is pushed. (See COLD WEATHER STARTING.)

AIR CONDITIONER.

There are two control switches mounted on the top of the evaporator assembly in the cab.

NOTE

This switch can be rotated only 90 degrees clockwise; if the low fan speed has been selected, the switch must be turned counterclockwise back through the medium and high selections to turn the unit OFF.

The unit fan control, a rotary switch, has four positions: OFF and 3, 2, and 1 for high, medium, and low respective fan speeds.

The temperature control, a rotary type thermostat control switch, is adjustable over a wide range to provide maximum comfort for various changes of temperature and humidity conditions. This switch can be turned clockwise from OFF to its coldest setting and counterclockwise back to OFF.

NOTE

To prevent evaporator frost or icing, do not operate the temperature control at its coldest setting with the unit control at the low fan speed selection, especially in humid weather. If frost or icing does occur, turn temperature control OFF and fan speed to high for a few minutes. Then, resume cooling at a warmer temperature setting.

To rapidly cool a hot cab, use the following procedure.

1. Close the outside air vents.
2. Start the engine.
3. Turn the temperature control to its coldest setting and unit control to highest fan speed.
4. Open a window. Hot air will be blown out the window within a few minutes. Then, close the window and adjust the controls to desired fan speed and temperature.

To remove excessive cigarette smoke, open a window or air vent slightly to admit fresh air.

SECTION V

OPERATIONAL AIDS

GENERAL.

This section describes the operational aids available on the crane.

PAT LOAD MOMENT INDICATING (LMI) SYSTEM.

The LMI system is an electro-mechanical sensing system designed to alert the operator of impending capacity lifts when the system is properly preset by the crane operator. The control panel is mounted on the instrument panel in the cab. When a maximum load condition is sensed, the LMI system provides the operator with a visual and audible warning, and locks out the control levers to prevent lowering the boom, extending the boom, or raising the main or auxiliary hoist cables. Antitwo-block devices are also incorporated into the system to prevent the hook block from coming into contact with the boom nose or jib. Activation of the antitwo-block feature will also cause a lockout of the above mentioned control functions. Boom angle indication is provided on the control panel.

CONTROL LEVER LOCKOUT CIRCUIT.

The control lever lockout feature is designed to deactivate various control directions or functions which would tend to hasten an impending overload condition of the crane or two-block direction or condition. The system consists of a solenoid controlled hydraulic cylinder and the associated linkage and rods to lockout the control levers. The linkage is connected in such a manner as to lockout functions that may worsen the condition, i.e. boom down, telescope out, or hoist up. Therefore, when control lever lockout occurs, the control levers can only be moved in a direction that will alleviate the condition.

SECTION VI

LUBRICATION

GENERAL.

Following the designated lubrication procedures is important in ensuring maximum crane lifetime and utilization. The procedures and lubrication charts in this section include information on the types of lubricants used, the location of the lubrication points, the frequency of lubrication, and other information.

The service intervals specified are for normal operation where moderate temperature, humidity, and atmospheric conditions prevail. In areas of extreme conditions, the service periods and lubrication specifications should be altered to meet existing conditions. For information on extreme condition lubrication, contact your local service representative or Grove Customer Services, Chambersburg, Pennsylvania.

LUBRICANTS.

CAUTION

CHASSIS GREASE LUBRICANTS MUST NOT BE APPLIED WITH AIR PRESSURE DEVICES AS THIS LUBRICANT IS USED ON SEALED FITTINGS.

CAUTION

THE MULTIPURPOSE GREASE INSTALLED DURING MANUFACTURE IS OF A LITHIUM BASE. USE OF A NON-COMPATIBLE GREASE COULD RESULT IN DAMAGE TO EQUIPMENT.

Specific recommendations of brand and grade of lubricants are not made here 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.

SYMBOL DESCRIPTION

CG Chassis Grease. Lubricating grease of proper consistency is to be applied periodically at relatively frequent intervals with grease guns through grease fittings. Minimum apparent viscosity of 300 SUS (Saybolt Universal Seconds) at 100° F (38° C) is recommended.

Higher quality EP-MPG multipurpose grease may also be used. See EP-MPG for recommended consistency grades.

EP-MPG Extreme Pressure Multipurpose Grease. This is a lithium soap base grease with a high load carrying capacity. The following properties are recommended.

Timken OK Load	40 lb. Minimum
Dropping Point	350° F (177° C) min.
Oil Viscosity	75 SUS Minimum at 210° F (99° C)
Water Resistance	Excellent

Under normal operation conditions, the following consistency grades are recommended.

- NLGI No. 0 for sub-zero Fahrenheit temperatures.
- NLGI No. 1 or No. 2 for normal ambient temperatures.
- NLGI No. 2 or No. 3 for temperatures over 100° F (38° C).

WBG Wheel Bearing Grease. This grease is of such composition, structure, and consistency that it is suitable for long time use in anti-friction wheel bearings. It must have high resistance to the deteriorating effects of temperature and the separating effects of centrifugal action. It shall not contain corrosive or abrasive materials and shall inhibit corrosion in the presence of moisture. NLGI grade No. 2 is recommended where not otherwise specified.

RGL Regular Gear Lubricant. This is a straight-mineral gear oil of relatively high viscosity for the lubrication of spiral-bevel and worm gear rear axles and most manual transmissions operating under low unit pressures and sliding velocities. API-GL-1 service classification. Unless otherwise specified, the following viscosity characteristics are recommended.

Viscosity Index 85 minimum
 Summer Operation SAE 90
 Winter Operation SAE 80

EPGL Extreme Pressure Multipurpose Gear Lubricant. This gear lubricant is compounded to achieve high load carrying capacity and meet the requirements of either API-GL-5 or MIL-L-2105C. Unless otherwise specified, SAE 80W-90 viscosity may be used for year-round service. Low temperature usage is restricted as follows.

SAE Viscosity Number	Minimum Ambient Temperature - °F (°C)
75W	- 40 (- 40)
80W	- 15 (- 26)
85W	+10 (- 12)
90	+20 (- 7)
140	+40 (+ 5)
250	+50 (+10)

EPGL (SCL) Extreme Pressure Gear Lubricant, Sulpho-Chloro-Lead. This is a special gear lube formulated with EP additives of the sulfur-chlorine-lead types. Usage is restricted to those component parts for which the manufacturer specifies a lubricant of this composition. (Reference Clark MS-B-Specification).

OGL Open Gear Lubricant. This is a special adhesive lubricant of heavy consistency for protection of wire rope and exposed gears where provision is not made for continuous lubricant replenishment. Select the viscosity that gives best protection and lubrication without peeling, scaling, or excessive throw off.

EO Engine Oil. Internal combustion engine lubricating oils are classified primarily by viscosity characteristics and on performance as determined by a series of tests called MS test sequences. Lubricants marketed for heavy duty service consist of refined crude oil containing additives compounded to meet the desired engine performance levels. Use only good quality oil provided by a reputable supplier in accordance with the service classification and viscosity requirements specified by the engine service manual.

ATF	Automatic Transmission Fluid. ATF shall meet the latest requirements for General Motors Dexron II specifications.
HTF	Hydraulic Transmission Fluid. A fluid qualified to Detroit Diesel Allison (Div. of GMC) specifications for Type C-3 transmission fluid, SAE 10W.
BF	Brake Fluid. A glycol ether fluid for use in hydraulic brake systems. Must meet or exceed SAE specification J1703.
HYDO	Hydraulic Oil. Oil in a hydraulic system serves as the power transmission medium, system lubricant, and coolant. Selection of the proper oil is essential to ensure satisfactory system performance and life. (See HYDRAULIC OIL RECOMMENDATIONS.)

HYDRAULIC OIL RECOMMENDATIONS.

New machines come from the factory with Sun 2105 (5W20) hydraulic oil. This oil facilitates start up at temperatures down to -10°F (-23°C) and is satisfactory up through normal operating temperatures. When replenishment of hydraulic oil becomes necessary, the following types of oil are suitable under most operating conditions.

1. Good quality antiwear hydraulic oils.
2. Engine oil meeting the requirements of MIL-L-2104B or API Service Classification CB or CC, and having a minimum of 0.6% zinc by weight as zinc dithiophosphate.

The most important factors in selecting an oil for hydraulic service are:

1. Viscosity.
2. Anti-wear additives.

Viscosity.

The oil must have proper viscosity to provide a lubricating film at system operating temperature.

Oil viscosity is important because it has a direct bearing on efficient transmission of power. An oil must flow readily through the system with a minimum

of pressure and flow loss. Positive lubrication depends on viscosity. The oil must be sufficiently light to get between the components machined surfaces, and maintain a lubricating film at system operating temperatures. Oil too light may cause the following conditions in the system.

1. Excessive leakage.
2. Lower volumetric efficiency of the pump.
3. Increased component wear.
4. Loss of system pressure.
5. Lack of positive hydraulic control.
6. Lower overall efficiency.

Oil too heavy may cause the following conditions in the system.

1. System pressure drop.
2. Increases system temperature.
3. Sluggish system operation.
4. Low mechanical efficiency.
5. Higher power consumption.

The following oil viscosity characteristics are recommended.

80 to 180 SUS optimum at system operating temperature
60 SUS minimum at system operating temperature
7500 SUS maximum at starting temperature
90 Viscosity Index (VI), minimum

When an engine crankcase oil is selected, the following grades will usually meet the above viscosity requirements.

SAE VISCOSITY DESIGNATION	TEMPERATURE - °F (°C)
5W-20	- 10 to 180 (- 23 to 82)
10W	+10 to 180 (- 12 to 82)
10W-30	+10 to 210 (- 12 to 99)

Arctic Conditions. (Below 0° F [-18° C]).

In general, petroleum based fluids developed especially for low temperature service may be used with satisfactory results. However, certain fluids, such as hydrogenated hydrocarbons, nitro hydrocarbons, and phosphate ester hydraulic fluids, might not be compatible with hydraulic system seals and wear bands. If you are in doubt about the suitability of a specific fluid, check with your authorized Grove distributor or Grove Customer Services.

Regardless of temperature and oil viscosity, always use suitable start-up procedures to ensure adequate lubrication during system warm-up.

Antiwear Additives.

Excessive wear in the system may cause a loss in volumetric efficiency, and may cause shutdowns for maintenance. An efficient antiwear oil protects the components against rusting; resists oxidation, and helps prevent wear.

LUBRICATION POINTS.

A regular frequency of lubrication must be established for all lubrication points. This frequency should be established on a time basis, i.e. daily, weekly, etc., as well as use the engine hourmeter and the odometer to ensure coverage of all lube points.

All oil levels are to be checked with the crane parked on a level surface in transport position, and while the oil is cold, unless otherwise specified.

On plug type check points, the oil levels are to be at the bottom edge of the check port.

On all hoists with a check plug in the drum, the fill plug shall be directly on top of the hoist, and the check plug level.

All grease fittings are SAE STANDARD unless otherwise indicated. Grease non-sealed fittings until grease is seen extruding from the fitting. One ounce

(28 grams) of EP-MPG equals one pump on a standard one pound (0.45 kg) grease gun.

Overlubrication of non-sealed fittings will not harm the fittings or components, but underlubrication will definitely lead to a shorter lifetime.

On sealed U-Joints, care must be exercised to prevent rupturing seals. Fill only until expansion of the seals first becomes visible.

Unless otherwise indicated, items not equipped with grease fittings, such as linkage, pin, levers, etc., should be lubricated with oil once a week. Motor oil, applied sparingly, will provide the necessary lubrication and help prevent the formation of rust. An Anti-Seeze compound may be used if rust has not formed. Otherwise the component must be cleaned first.

Grease fittings that are worn and will not hold the grease gun, or those that have a stuck check ball, must be replaced.

Where wear pads are used, cycle the components and relubricate to ensure complete lubrication of the entire wear area.

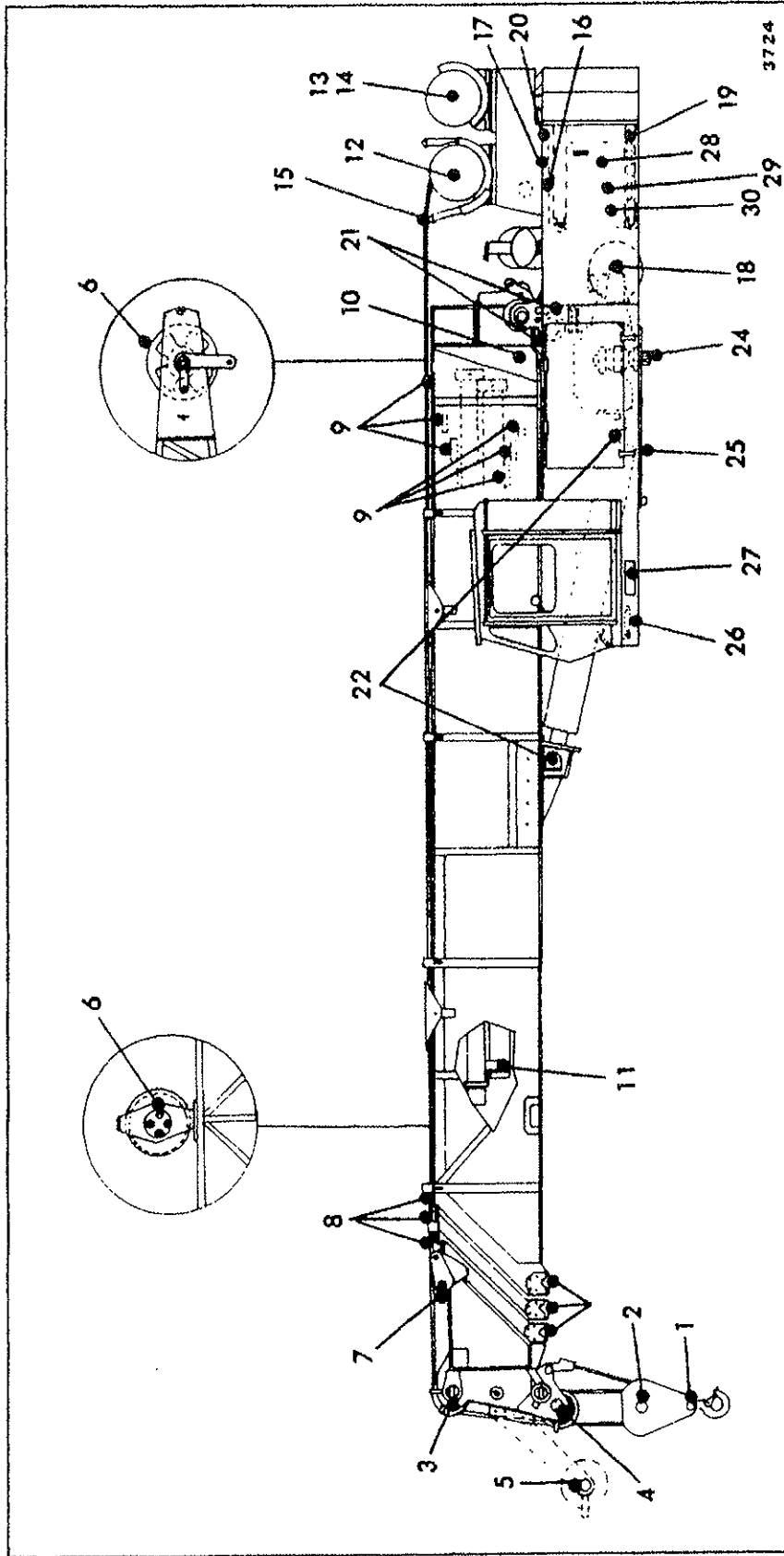
The following describe the lubrication points and gives the lube type, lube interval, lube amount, and application for each. Each lubrication point is numbered, and this number corresponds to the index number shown on the Lubrication Diagram.

1. Hook Block Swivel Bearing.

Lube Type - EP-MPG
Lube Interval - Weekly
Lube Amount - Until grease extrudes
Application - 1 grease fitting

2. Hook Block Sheaves.

Lube Type - EP-MPG
Lube Interval - Weekly
Lube Amount - Until grease extrudes
Application - 1 grease fitting per sheave



Lubrication Chart

3. Lower Boom Nose Sheaves.

Lube Type - EP-MPG
Lube Interval - Weekly
Lube Amount - Until grease extrudes
Application - 1 grease fitting per sheave

4. Upper Boom Nose Sheaves.

Lube Type - EP-MPG
Lube Interval - Weekly
Lube Amount - Until grease extrudes
Application - 1 grease fitting per sheave

5. Rooster Sheave (Optional).

Lube Type - EP-MPG
Lube Interval - Weekly
Lube Amount - Until grease extrudes
Application - 1 grease fitting

6. Boom Extension Sheave.

Lube Type - EP-MPG
Lube Interval - Weekly
Lube Amount - Until grease extrudes
Application - 1 grease fitting per sheave

7. Outer Mid Cable Roller.

Lube Type - EP-MPG
Lube Interval - Weekly
Lube Amount - Until grease extrudes
Application - 1 grease fitting

8. Front Adjustable Wear Pads.

Lube Type - EP-MPG
Lube Interval - 25 hours
Lube Amount - Thoroughly coat the area the wear pads move on
Application - By brush

The base, outer-mid and inner-mid sections have one pad on each

side of the bottom front of each section. They also have one pad on each side of the bottom front approximately 5.5 feet (1.67 m) to the rear of the front pad.

9. Non Adjustable Wear Pads.

Lube Type - EP-MPG

Lube Interval - Weekly

Lube Amount - Thoroughly coat the area the wear pad moves on

Application - By brush

The fly, outer-mid and inner-mid sections have one pad on each side of the top rear and the bottom rear of each section.

10. Hose Rollers.

Lube Type - EO

Lube Interval - Weekly

Lube Amount - Until grease extrudes

Application - Apply to shaft

11. Telescope Cylinder Wear Pads.

Lube Type - EP-MPG

Lube Interval - Weekly

Lube Amount - Thoroughly coat the area the wear pad moves on

Application - By brush

All cylinders have wear pads on the cylinder ends. The telescope cylinder support foot has wear pads.

12. Grove Model HO-30B-26 Hoist.

A. Final Drive.

Lube Type - EPGL-90 (The hoist is filled at the factory with SAE 90 Trojan Gear Oil)

Lube Interval - Check every 250 hours

Lube Amount - Capacity - 12 quarts (11.3 L)

Application - The oil should be level with the bottom of the check-fill plug when the crane is level

- B. 2-Speed Shift Lever, (Mounted on Hoist).

Lube Type - EP-MPG
Lube Interval - Weekly
Lube Amount - Until grease extrudes
Application - 1 grease fitting

13. Grove Model HO-30B-16 Hoist.

- A. Final Drive.

Lube Type - EPGL-90 (The hoist is filled at the factory with SAE 90 Trojan Gear Oil)
Lube Interval - Check every 250 hours
Lube Amount - Capacity - 12 quarts (11.3 L)
Application - The oil should be level with the bottom of the check-fill plug when the crane is level

- B. 2-Speed Shift Lever (Mounted on Hoist)

Lube Type - EP-MPG
Lube Interval - Weekly
Lube Amount - Until grease extrudes
Application - 1 grease fitting

14. Grove Model HO-15B Auxiliary Hoist.

Lube Type EPGL-90 (The hoist is filled at the factory with SAE 90 Trojan Gear Oil)
Lube Interval - Check every 250 hours
Lube Amount - Capacity 9 quarts (8.5 L)
Application - Check the oil level at the plug in the drum 90 degrees from the top of the drum. The oil level should be at the edge of the port opening.

15. Cable Follower and Idler Assembly (Optional).

- A. Grove Model HO-30B Main and Auxiliary Hoist.

Lube Type - EP-MPG
Lube Interval - Weekly
Lube Amount - Until grease extrudes

Application -

Main Hoist Idler - 1 fitting (mounted on end of boom base)

Aux. Hoist Idler - 1 fitting

Cable Follower - 1 fitting on roller
2 on lever arms

B. Grove Model HO-15 Auxiliary Hoist. (Idler Mounted on Main Hoist.)

Lube Type - EP-MPG

Lube Interval - Weekly

Lube Amount - Until grease extrudes

Application - Cable follower - 1 fitting on roller
2 on lever arms

C. Gearmatic Model 25 Auxiliary Hoist. (Idler Mounted on Main Hoist.)

Lube Type - EP-MPG

Lube Interval - Weekly

Lube Amount - Until the roller is full

Application - Through the pipe plug in the roller

16. Hydraulic Reservoir.

Lube Type - HYDO

Lube Interval - Check daily. Drain as necessary.

Lube Amount - Capacity 305 gallons (1155 L)

Application - Fill through the cap on top of the tank. When tank is drained, clean the magnetic pipe plug

17. Hydraulic Reservoir Filter.

Lube Type - HYDO

Lube Interval - Change the filter when the flag is red

Lube Amount - N/A

Application - N/A

18. Hose Reel.

Lube Type - EP-MPG

Lube Interval - 50 hours

Lube Amount - Until grease extrudes

Application - 2 grease fittings per hose reel

19. Counterweight Extension Cylinder.

Lube Type - EP-MPG
Lube Interval - 100 hours
Lube Amount - Until grease extrudes
Application - 2 grease fittings

20. Counterweight Removal Sheave.

Lube Type - EP-MPG
Lube Interval - Every 6 months
Lube Amount - Until grease extrudes
Application - 2 grease fittings

21. Boom Pivot Shafts.

NOTE

When greasing the boom pivot shafts, better distribution of grease within the shafts is obtained if the weight of the boom is removed from the shafts.

Lube Type - EP-MPG
Lube Interval - Daily
Lube Amount - Until grease extrudes
Application - 2 grease fittings, one on each side

22. Lift Cylinders.

NOTE

When greasing the lift cylinders and boom pivot shafts, better distribution of grease within the shafts is obtained if the weight of the boom is removed from the shafts.

A. Grove Cylinders.

Lube Type - EP-MPG
Lube Interval - Daily
Lube Amount - Until grease extrudes
Application - 1 fitting on the top and 2 fittings on the bottom of each cylinder bushing

B. Iowa Cylinders.

Lube Type - EP-MPG

Lube Interval - Daily

Lube Amount - Until grease extrudes

Application - 1 fitting in the center of each cylinder bushing

23. Swing Gearbox.

Lube Type - EPGL-5

Lube Interval - 1. Check every 50 hours
2. Drain 1st time after 250 hours and every 500 hours or 12 months thereafter

Lube Amount - Capacity 7.5 quarts (7.1 L)

Application - Fill to bottom of check/fill plug

24. Swing Gear and Pinion.

Lube Type - OGL - Rotek

EP-MPG - All others

Lube Interval - Daily

Lube Amount - Coat all teeth

Application - Brush on

25. Swing Bearing.

Lube Type - EP-MPG

Lube Interval - Weekly

Lube Amount - Until grease extrudes the whole circumference of the bearing

Application - Rotate the turntable 10 degrees and apply grease to the fittings. Continue rotating 10 degrees and greasing the fittings until the whole bearing is greased

26. Swing Brake Pedal.

Lube Type - CG

Lube Interval - Weekly

Lube Amount - Until grease extrudes

Application - 1 grease fitting on pedal pivot shaft

27. Swing Brake Pedal Master Cylinder.

Lube Type - BF

Lube Interval - Check weekly

Lube Amount - Capacity 5 to 6 oz. (151.0 to 181.0 cm³)

Application - Plug on top of cylinder - gain access through spring loaded cover on front left side of cab

28. Engine.

Lube Type - EO

Lube Interval - 1. Check daily

2. Drain per engine Service Manual

Application - See Engine Service Manual

29. Engine Oil Filter.

Application - See Engine Service Manual

30. Constant Speed Pump Drive.

Lube Type - EPGL-90W. (The pump drive is filled at the factory with SAE 90 Trojan Gear Oil).

Lube Interval - 50 hours

Lube Amount - To the edge of the port opening

Application - Remove the plug marked check plug. The oil level should be at the edge of the port opening.

WIRE ROPE LUBRICATION.

Wire rope is lubricated during manufacturing so the strands, and individual wires in strands, may move and adjust as the rope moves and bends. A wire rope cannot be lubricated sufficiently during manufacture to last its entire life. Therefore, new lubricant must be added periodically throughout the life of a rope to replace factory lubricant which is used or lost.

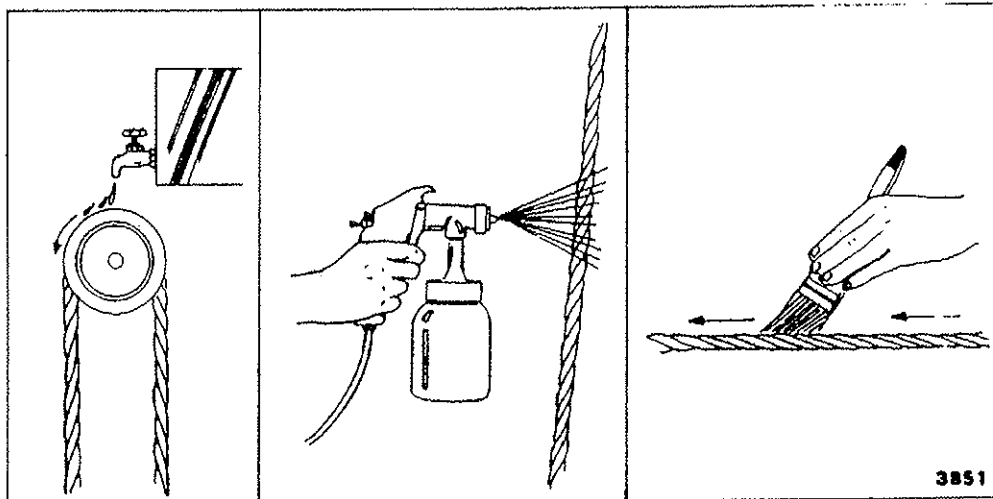
The surface of some ropes may become covered with dirt, rock dust, or other material during their operation. This covering can prevent field applied lubricant from properly penetrating into the rope. Therefore, these ropes should be cleaned before being lubricated.

The lubricant applied should be light bodied enough to penetrate to the core of the rope. Lubricant may be applied effectively by various methods. It may

be dripped on, sprayed on, or put on by brushing, but in any case it should be applied at a place where the rope is being bent, such as at a sheave. It should be applied at the top of the bend, because at that point the strands are spread by bending and are more easily penetrated. The service life of rope will be directly proportional to the effectiveness of the method used and amount of lubricant reaching the working parts of the rope.

A proper lubricant must reduce friction, protect against corrosion, adhere to every wire and be pliable and not crack or separate when cold, and yet not drip when warm.

Special lubricants can be applied at the factory to meet unusual conditions.



Wire Rope Maintenance

SECTION VII

SET-UP AND INSTALLATION PROCEDURES

GENERAL.

This section provides procedures for installing the hoist cable on the hoist drum, cable reeving, erecting and stowing the 32-foot (9.75 m) swingaway extension, erecting and stowing the multi-section lattice jib with the swingaway extension, removing and installing the counterweight, and trailing boom set-up.

INSTALLING CABLE ON THE HOIST DRUM.

CAUTION

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

NOTE

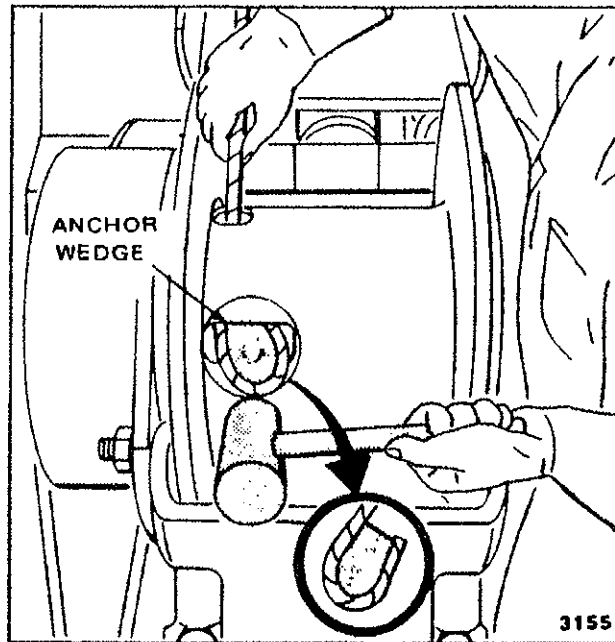
Preferably the cable should be straightened before installation on the hoist drum.

Install the cable on the hoist drum in accordance with the following procedures. These procedures are applicable to both the main and auxiliary hoists.

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

NOTE

The end of the cable should be even with the bottom of the anchor wedge.



Installing Cable Anchor Wedge

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

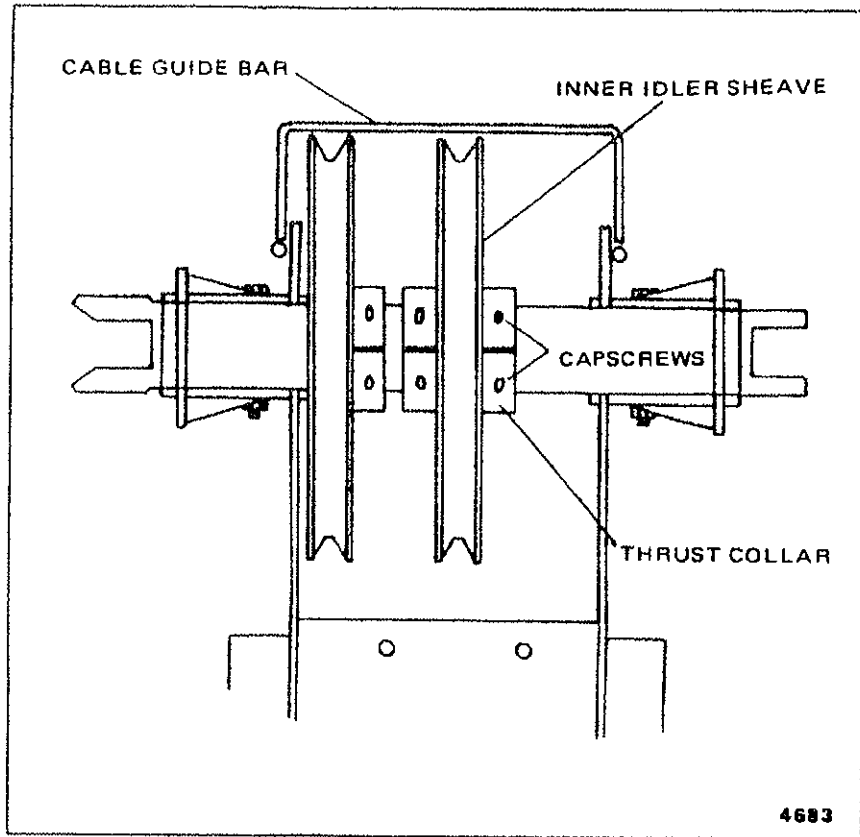
NOTE

If the wedge does not seat securely in the slot, carefully tap the top of the wedge with a mallet.

5. Slowly rotate the drum, ensuring the first layer of cable is evenly on to the drum.
6. Install the remainder of the crane as applicable.

CABLE REEVING.

Within the limits of the load and range charts and permissible line pull, multi-part lines allow the operator to raise a greater load than can be raised with a single part line. Cable reeving should be accomplished by qualified riggers, using approved rigging procedures. To maintain alignment of the cable between the idler sheaves and lower sheaves on the main boom nose, it is imperative that the idler sheaves be repositioned before reeving cable.



Repositioning Inner Idler Sheave

CAUTION

FAILURE TO PROPERLY ALIGN THE IDLER SHEAVES WITH THE LOWER BOOM NOSE SHEAVES CAN IMPOSE EXCESSIVE SIDE LOADING ON THE BEARINGS OF THE IDLER SHEAVE WHICH MAY CAUSE PREMATURE SHEAVE/BEARING FAILURE AND/OR CABLE DAMAGE.

REPOSITIONING THE INNER IDLER SHEAVE.

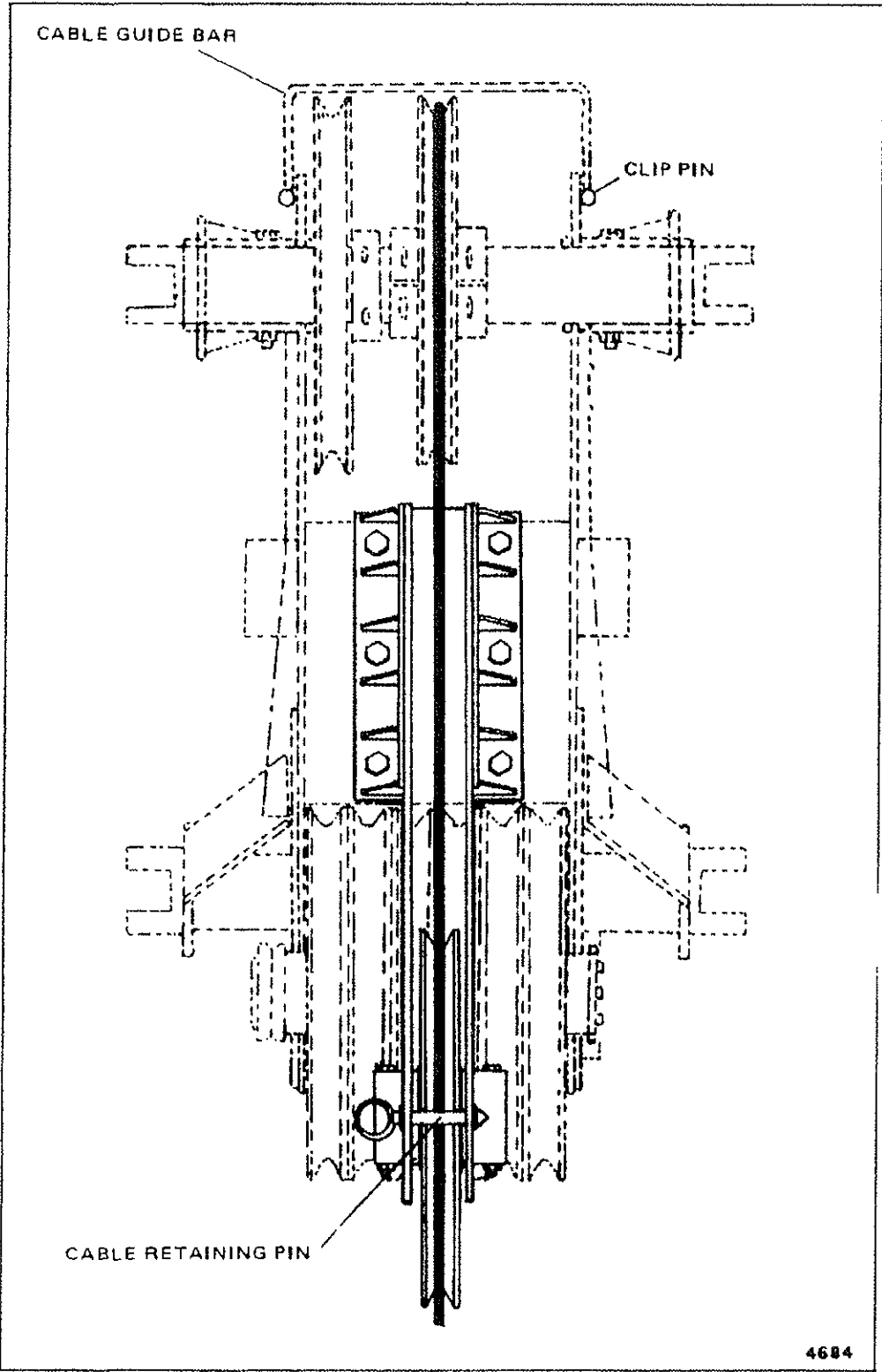
The following procedures are used to reposition the inner idler sheave for single part line reeving.

1. Remove the two capscrews on both two-piece thrust collars on each side of the inner-idler sheave.
2. Slide the inner idler sheave to its desired position.
3. Reinstall both two-piece thrust collars on each side of the inner-idler sheave and secure with the two capscrews.

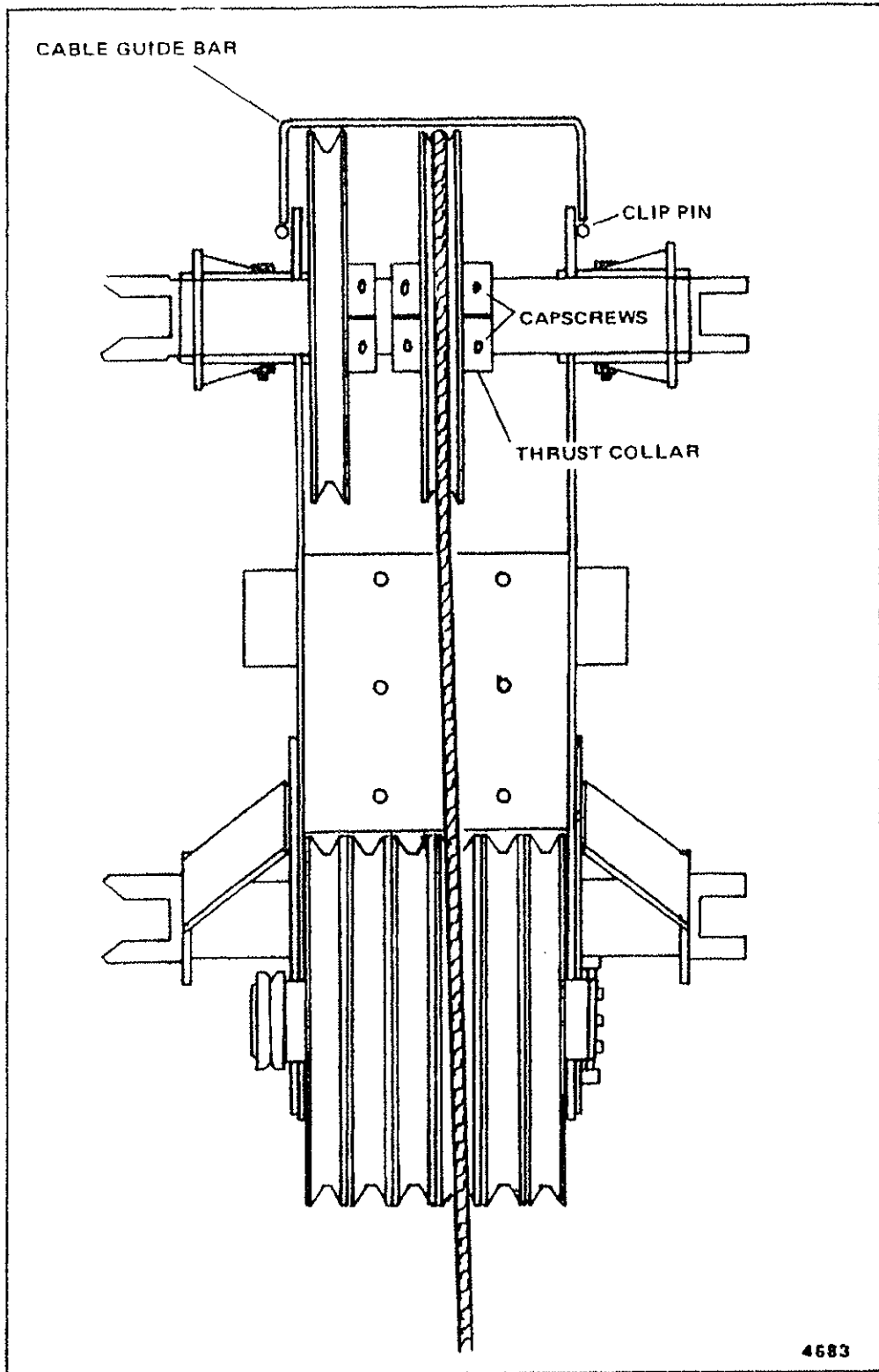
SINGLE PART REEVING.

Over the Main Boom Nose With the Auxiliary Boom Nose (Rooster Sheave).

1. Remove one clip pin securing the cable guide bar and lift the bar up.
2. Remove the safety pin from the cable retaining pin at the idler sheaves and remove the cable retaining pin.
3. Remove the safety pin from the cable retaining pin on the auxiliary boom nose and remove the cable retaining pin.
4. Route the hoist cable over the top of the center idler sheave and the single sheave provided on the auxiliary boom nose (rooster sheave).
5. Insert the idler sheaves cable retaining pin and install the safety pin.



Single Part Reeving Over Main Boom With Rooster Sheave

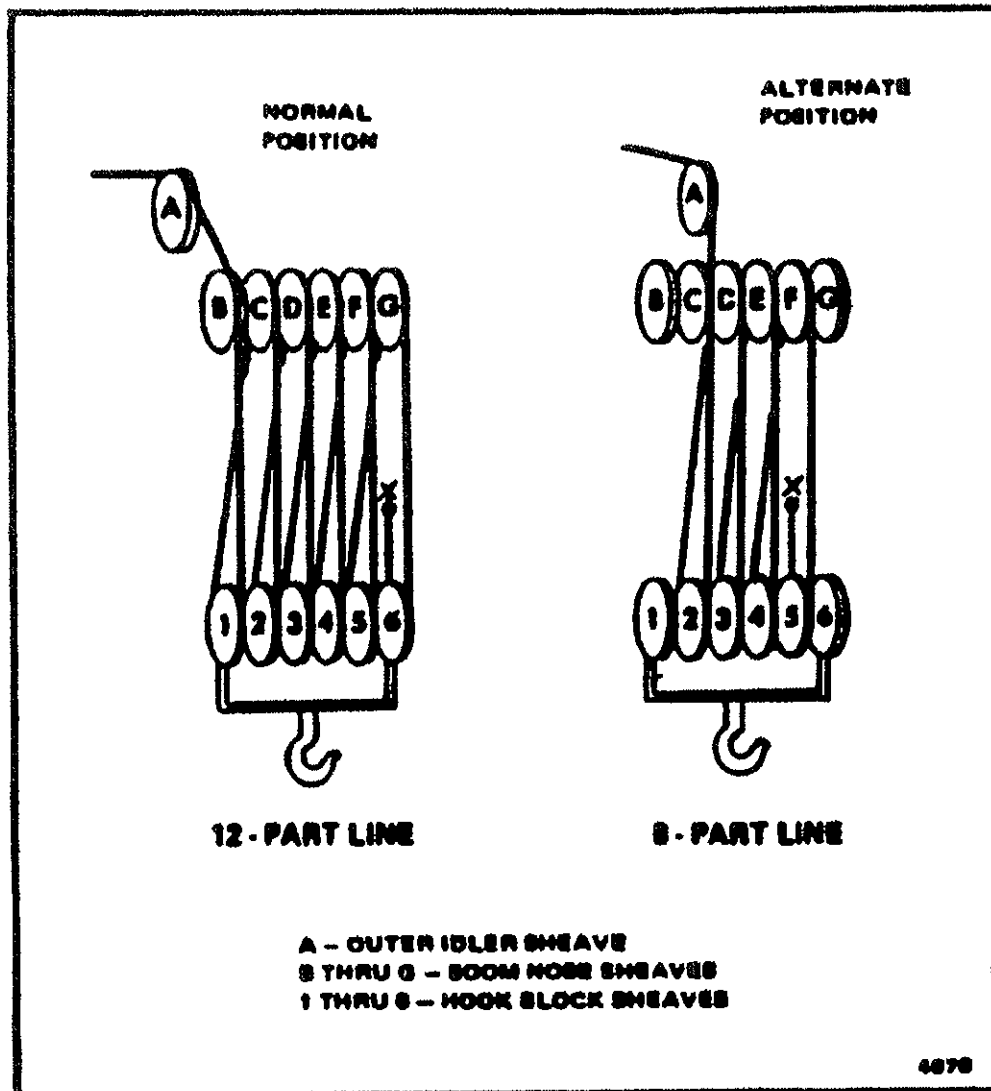


Single Part Reeving Over Main Boom Without Rooster Sheave

6. Insert the auxiliary boom nose cable retaining pin and install the safety pin.
7. Fold down the cable guide bar and secure it with the pin.
8. Pass the cable down through the antitwo-block weight and attach the headache ball and hook assembly.
9. Remove the jumper plug from the PAT receptacle on the main boom nose and connect the PAT extension cord from this receptacle to the receptacle on the auxiliary boom nose.

Over the Main Boom Nose Without Auxiliary Boom Nose (Rooster Sheave).

1. Remove one pin securing the cable guide bar and lift the bar up.
2. Remove the safety pin from the cable retaining pin at the idler sheaves and remove the cable retaining pin.
3. The idler sheaves may be positioned to use either the outer or inner idler sheave. If the outer sheave is used, no repositioning of the idler sheave is necessary. If the inner idler sheave is used, reposition the inner idler sheave with the corresponding lower sheave as described in Repositioning the Inner Idler Sheave ensuring it is in direct alignment with the lower sheave.
4. Remove the safety pin from cable retaining pin at the boom nose lower sheaves and remove the cable retaining pin.
5. Route the hoist cable over the top of the appropriate idler sheave and its corresponding sheave on the lower boom nose sheaves.
6. Insert both the cable retaining pins and install the safety pins.
7. Fold down the cable guide bar and secure it with the pin.
8. Pass the cable down through the antitwo-block weight and attach the headache ball and hook assembly.



Example of 12-Part and 8-Part Line Reeving

MULTI-PART REEVING.

Various cable reeving (part line) is available with the six sheave boom nose and hook block. This reeving should be accomplished by a qualified rigger using standard rigging procedures. It may be necessary, for certain reeving, to reposition the outer idler sheave. Before anchoring the cable, ensure the cable is passed through the anti-two-block weight.

ERECTING AND STOWING THE SWINGAWAY BOOM EXTENSION

WARNING

BEFORE ERECTING OR STOWING THE SWINGAWAY, READ AND ADHERE TO THE WARNING DECALS INSTALLED ON THE SWINGAWAY AND / OR SUPPORT BRACKETS.

NOTE

Before attempting to erect the crane select firm and level ground. Uneven ground will hamper the leveling of the crane and cause increased difficulty when erecting the swingaway and related equipment.

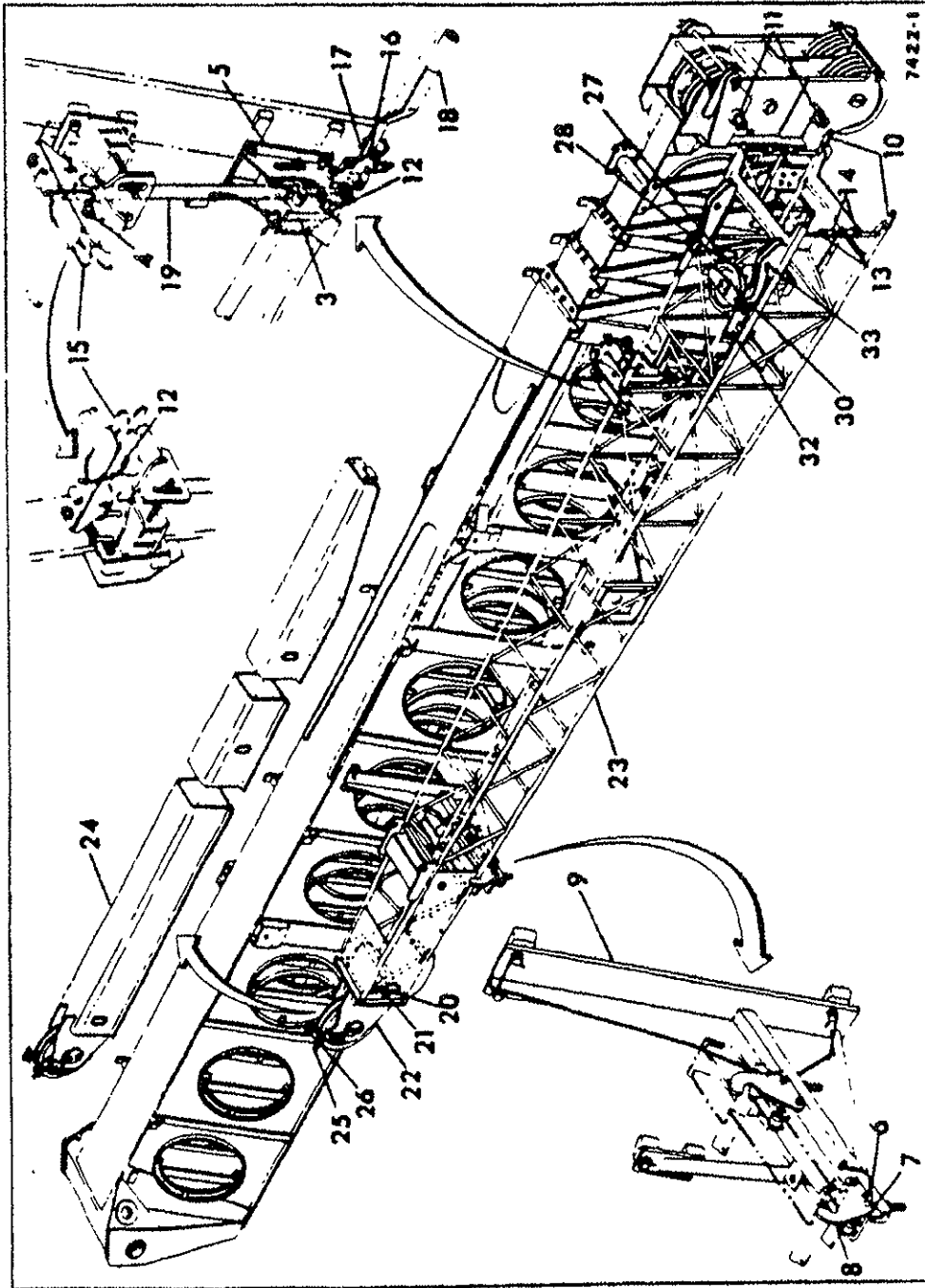
Erecting

1. Fully extend and set the outriggers and level the crane.
2. Position the boom over the rear and rig the cable for single or two part line.
3. Position the boom at 5 degrees above horizontal
4. Extend the boom while reeling out the hoist cable until the boom is extended 5-10 feet greater than the length of the swingaway. Reel out on the hoist cable until the hookblock or headache ball is 6 inches from the ground.
5. Lower the boom to minimum elevation to permit ease of installation of pins and access to the boom nose. Be sure the headache ball or hookblock is on the ground and the hoist cable is slack. Tilt the crane as needed by using the outriggers to raise the front and lower the rear of the crane to increase accessability to the boom nose.

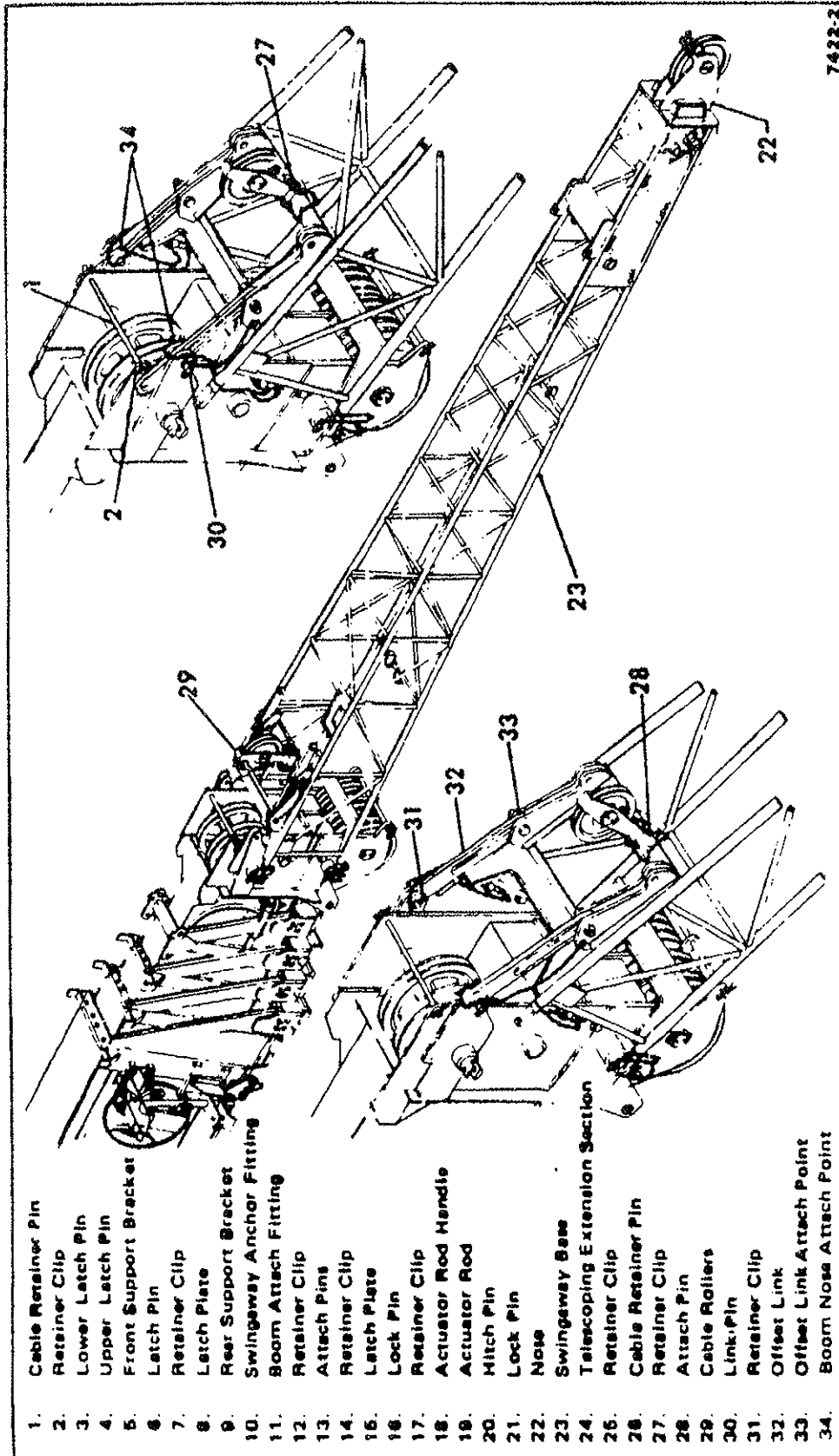
NOTE

The auxiliary boom nose (rooster sheave) does not have to be removed.

6. Remove the retainer clips (2) and the cable retainer pins (1) from the upper and lower sheaves on the boom nose. Disconnect the anti-two-block cable and the anti-two-block weight.



Erecting or Stowing the Swingaway Boom Extension (Sheet 1 of 2)



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Erecting or Stowing the Swingaway Boom Extension (Sheet 2 of 2)

7. Rig the main or auxiliary hoist cable for single or two part line.

CAUTION

DO NOT ALLOW THE HOIST CABLE TO COME IN CONTACT WITH THE PAT SYSTEM CABLE OR DAMAGE MAY RESULT TO THE PAT SYSTEM CABLE.

8. Remove the cable from the boom nose sheaves and the rooster sheave and lay the cable over the left side of the boom nose.
9. Replace all cable retainer pins (1) and retainer clips (2).

WARNING

THE BOOM MUST BE COMPLETELY RETRACTED BEFORE ENGAGING THE SWINGAWAY BOOM EXTENSION WITH THE BOOM NOSE.

10. Fully retract all the boom sections and raise the boom to horizontal.

WARNING

DO NOT REMOVE THE ATTACH PINS SECURING THE SWINGAWAY TO THE FRONT SUPPORT BRACKET AT THIS TIME.

11. Remove the retainer clip (7) and latch pin (6) securing the latch plate (8) on the rear support bracket (9) and swing the latch plate (8) down to release the swingaway (23). Stow the latch pin (6) and retainer clip (7) on the rear support bracket.
12. With the front support bracket (5) acting as a pivot, pull outward on the swingaway tip to position the swingaway anchor fittings (10) into the boom attach fittings (11) on the boom nose.
13. Remove the retainer clip (14) and the attach pins (13) stowed in the base of the swingaway and insert the attach pins (13) through the boom attach and swingaway anchor fittings (10 & 11) on the right side of the boom nose. Install the retainer clips (14) in the attach pins (13).

14. Attach a length of rope to the swingaway tip to aid in pulling the swingaway around to engage the swingaway anchor fittings (10) with the boom attach fittings (11) on the left side of the boom nose.

WARNING

THE BOOM MUST BE RAISED TO HORIZONTAL TO PREVENT THE SWINGAWAY FROM SWINGING AROUND AFTER REMOVING THE ATTACH PINS FROM THE FRONT SUPPORT BRACKET.

15. Elevate the boom 2 to 3 degrees above horizontal.

16. Remove the retainer clip (12) and lower latch pin (3) securing the bottom of the swingaway to the front support bracket (5). Stow the pin (3) and retainer clip (12) on the front support bracket (5).

17. Remove the retainer clip (12) and upper latch pin (4) securing the latch plate (15) in position. Stow the pin (4) and the retainer clip (12) on the front support bracket (5).

18. Remove the retainer clip (17) and lock pin (16) securing the actuator rod handle (18) in the locked position and pull the handle downward so that the actuator rod lifts the latch plate (15) releasing the swingaway (23). Stow the pin (16) and retainer clip back in the handle and bracket weldment (18).

WARNING

WHEN ERECTING THE SWINGAWAY ENSURE ALL PERSONNEL AND EQUIPMENT ARE KEPT CLEAR OF THE SWING PATH.

CAUTION

DO NOT ALLOW THE SWINGAWAY TO SLAM INTO THE FITTINGS ON THE BOOM NOSE.

19. Using the rope attached to the tip of the swingaway (23), pull the swingaway around while slowly lowering the boom a little at a time (1 to 2 degrees) until the swingaway anchor fittings (10) engage the boom attach fittings (11) on the left side of the boom nose.

20. If the attach pins do not fit easily into the attach fittings readjust the adjustable lug on the swingaway. Refer to ADJUSTABLE LUG ADJUSTMENT in this section.

NOTE

Step 20 applies only if there is difficulty in aligning the upper swingaway extension attach point to the boom nose.

WARNING

DO NOT MODIFY THE SWINGAWAY ANCHOR OR BOOM ATTACH FITTINGS (10 & 11) TO PERMIT INSTALLATION OF THE ATTACH PINS.

CAUTION

DO NOT PLACE BLOCKING UNDER THE SWINGAWAY NOSE SHEAVE.

CAUTION

DO NOT OVERLOAD THE SWINGAWAY ANCHOR FITTINGS (10) OR THE SWINGAWAY BASE SECTION (23) WHEN LOWERING THE BOOM.

21. Place blocking under the swingaway nose and relieve the weight of the swingaway by a very careful and slight lowering of the boom until the holes of the anchor and attach fittings (10 & 11) are aligned.

22. Install the attach pins (13) and retainer clips (14) into the swingaway anchor and boom attach fittings (10 & 11) on the left side of the boom nose.

23. Remove the rope from the tip of the swingaway (23).

NOTE

Refer to SETTING THE OFFSET in this section to obtain a 15 or 30 degree offset with the swingaway.

NOTE

Refer to SETTING THE TELESCOPING EXTENSION LENGTH in this section for extending or retracting the telescoping extension section.

24. Lower the boom to minimum elevation and remove the cable retainer pins (26 & 1) from the swingaway nose sheave and center idler sheave on the boom nose.

NOTE

If the cable has come in contact with the ground be sure cable is free from any dirt or foreign matter that could damage the cable.

25. Route the cable over the center idler sheave on the main boom and over the nose sheave on the swingaway tip. Install the cable retainer pins (26 & 1) and retainer clips (25 & 2).
26. Remove the cable roller retainer pin (28) from its stowed position on the swingaway and raise the cable roller (29) to an upright position so that the hoist cable is under the sheave. Reinstall the attach pin (28) and retainer clip (27).
27. Connect the anti-two-block weight and anti-two-block cable.

WARNING

BE CERTAIN THE "PAT" SYSTEM IS IN THE PROPER PROGRAM MODE BEFORE LIFTING OVER THE SWINGAWAY EXTENSION.

28. Operate the crane following correct operating procedures.

Stowing

NOTE

The swingaway boom extension must be set at minimum offset, and if used the telescoping section must be fully retracted in order to stow the swingaway. Refer to **SETTING THE OFFSET** and / or **SETTING THE TELESCOPING EXTENSION** in this section.

1. Fully extend and set the outriggers and level the crane.
2. Fully retract the boom and position the boom over the rear.

WARNING

ENSURE THE BOOM IS BELOW HORIZONTAL (ZERO) ELEVATION OR BOOM MAY SWING AROUND AND SLAM INTO THE SIDE OF THE BOOM WHEN THE ATTACH PINS ARE REMOVED.

3. Lower the boom below horizontal elevation.
4. Remove the retainer clip (27) and cable roller attach pin (28) securing the cable roller (29) in the upright position. Lay the cable roller over into the stowed position and install the cable roller attach pin (28) and retainer clip (27).
5. Disconnect the anti-two-block weight from the swingaway nose and the anti-two-block cable at the swingaway base.

CAUTION

DO NOT ALLOW HOIST CABLE TO COME IN CONTACT WITH THE "PAT" SYSTEM CABLE OR DAMAGE MAY RESULT TO THE "PAT" SYSTEM CABLE.

6. Remove the cable retainer pins (26 & 1) and clip pins (25 & 2) from the swingaway nose sheave (22) and boom nose idler sheave. Remove the hoist cable from the sheaves and lay the cable over the left side of the boom nose. Install the cable retainer pins (26 & 1) and retainer clips (25 & 2).

7. Attach a length of rope to the swingaway tip.

8. Ensure the retainer clips (12) and latch pins (3 & 4) are removed from the front support bracket (5) and the retainer clip (7) and latch pin (6) are removed from the rear support bracket (9).

WARNING

WHEN STOWING THE SWINGAWAY ENSURE ALL PERSONNEL AND EQUIPMENT ARE KEPT CLEAR OF THE SWING PATH.

9. Remove the retainer clips (14) and attach pins (13) from the swingaway anchor and boom attach fittings (10 & 11) on the left side of the boom nose and stow them in the holding brackets on the base of the swingaway.

CAUTION

DO NOT ALLOW THE SWINGAWAY TO SLAM INTO THE REAR SUPPORT BRACKET WHEN STOWING THE SWINGAWAY.

NOTE

If the swingaway does not engage with the latch plate on the front support bracket pull the actuator rod handle downward to lift the latch plate and swing the swingaway into the stowed position.

10. Using the rope attached to the tip of the swingaway pull the swingaway around while slowly raising the boom 1 to 2 degrees at a time so as to control the motion of the swingaway.

11. Secure the swingaway to the front support bracket (5) with the attach pins (3 & 4) and retainer clips (12).

12. Secure the actuator rod handle (18) in position with the lock pin (16) and retainer clip (17). Remove the rope.

13. Remove the attach pins (13) from the swingaway anchor fittings (10) and boom attach fittings (11) on the right side of the boom nose and stow them in the swingaway base.

14. Disengage the swingaway anchor fittings (10) from the boom attach fittings (11) by pushing the tip of the swingaway (23) into position onto the rear support bracket.

NOTE

If the swingaway does not easily engage the rear support bracket slowly elevate the boom and using extreme caution push against the tip of the swingaway until the swingaway engages the rear support bracket.

15. Position the rear latch plate (8) to secure the swingaway (23) in the rear support bracket (9) and install the latch pin (6) and retainer clip (7).

WARNING

FAILURE TO MAINTAIN THE PROPER CLEARANCE BETWEEN THE SWINGAWAY ANCHOR FITTINGS AND THE BOOM NOSE ATTACH FITTINGS COULD CAUSE THESE FITTINGS TO CONTACT EACH OTHER DURING OPERATION OF THE BOOM AND RESULT IN DAMAGE TO THE FITTINGS AND / OR BRACKETS.

16. Check to ensure there is sufficient clearance between the boom nose fittings and swingaway anchor fittings when the boom is fully retracted and the swingaway is properly stowed.

17. Lower the boom to minimum elevation.

NOTE

If the cable has come in contact with the ground, be sure the cable is free from dirt or foreign matter that could damage the cable.

18. Remove the cable retainer pin (1) from the upper sheaves on the boom nose route the cable over the proper sheave and replace the retaining pin (1) and retainer clip (2).
19. Extend the boom until the boom nose is over the headache ball.
20. Remove the cable retainer pin (1) from the lower sheaves on the boom nose and route the cable over the proper sheave. Replace the retaining pin (1) and retainer clip (2).
21. Rig the hoist cable as desired according to proper procedures. Connect the anti-two-block weight and connect the anti-two-block cable.

WARNING

BE CERTAIN THE "PAT" SYSTEM IS IN THE PROPER PROGRAM MODE BEFORE LIFTING OVER THE SWINGAWAY BOOM EXTENSION.

22. Operate the crane following correct operating procedures.

SETTING THE OFFSET

WARNING

ENSURE ANY BLOCKING MATERIAL USED IS ADEQUATE TO SUPPORT THE WEIGHT OF THE SWINGAWAY WITHOUT TIPPING OR FALLING.

1. Extend and set the outriggers, level the crane and swing the boom to over-the-rear. Position the boom 2 to 3 degrees above horizontal.

WARNING

DO NOT PLACE BLOCKING UNDER THE SWINGAWAY NOSE SHEAVE.

2. Block up under the tip of the swingaway base section.
3. To set the offset from zero (0) degrees to 15 or 30 degrees perform the following procedures.

CAUTION

DO NOT OVERLOAD THE SWINGAWAY ANCHOR FITTINGS (10) OR THE SWINGAWAY BASE SECTION (23) WHEN LOWERING THE BOOM.

- a. Slowly lower the boom until the pressure is relieved on the upper two anchor and attach fittings (10 & 11) and the two attach pins (13).

WARNING

DO NOT REMOVE THE UPPER ATTACH PINS SECURING THE SWINGAWAY TO THE BOOM NOSE UNTIL THE OFFSET LINKS ARE PINNED IN THE DESIRED POSITION.

- b. Remove the link pins (30) securing the offset links (32) in the stowed position and pivot the links 180 degrees toward the boom nose. Pin the offset links (32) to the attach points (33) on the boom nose. If a 15 degree offset is desired place the link pin in the offset link slot. If a 30 degree offset is desired place the link pin in the hole in the offset link. Secure the offset links to the boom nose with the link pins (30), washers and retainer clips (31).

WARNING

ENSURE THE SWINGAWAY IS FULLY SUPPORTED BEFORE REMOVING THE UPPER ATTACH (13) AND RETAINER CLIPS (14).

- c. Remove the attach pins (13) and retainer clips (14) from the upper anchor and attach fittings (10 & 11) and stow them in the holding brackets on the base of the swingaway (23).
- d. For all boom extension settings reeve the hoist cable under the cable roller.
- e. Slowly elevate and extend the boom at the same time so that the swingaway (23) does not move off of the blocking until the offset links (32) take the full weight of the swingaway.

4. To set the offset from 15 to 30 or from 30 to 15 degrees, perform the following procedures.

CAUTION

DO NOT OVERLOAD THE SWINGAWAY ANCHOR FITTINGS (10) OR THE SWINGAWAY BASE SECTION (23) WHEN LOWERING THE BOOM.

a. slowly lower and retract the boom at the same time so that the swingaway does not move off of the blocking while the pressure is being relieved from the offset links and the upper swingaway anchor fittings are aligned with the upper attach fittings.

WARNING

DO NOT REMOVE THE LINK PINS (30) FROM THE OFFSET LINKS UNTIL THE UPPER ATTACH PINS (13) SECURING THE SWINGAWAY TO THE BOOM NOSE HAVE BEEN INSTALLED.

b. Remove the attach pins (13) and retainer clips (14) from the holding brackets on the base of the swingaway and install them in the upper anchor and attach fittings (10 & 11) on the boom nose and swingaway base section.

c. Remove the link pins (30) and retainer clips (31) securing the offset links (32) in their present offset position.

d. Position the offset links (32) to the desired offset position and secure with the link pins (30), washers and retainer clips (31).

WARNING

ENSURE THE SWINGAWAY IS FULLY SUPPORTED BEFORE REMOVING THE RETAINER CLIPS (14) AND ATTACH PINS (13).

e. Remove the attach pins (13) and retainer clips (14) from the upper anchor and attach fittings (10 & 11) and stow them in the holding brackets on the base of the swingaway.

f. Slowly elevate and extend the boom at the same time so that the swingaway does not move off of the blocking until the offset links take the full weight of the swingaway

g. Reeve the hoist cable as outlined in step 3 d..

5. To set the offset from 15 or 30 degrees to zero (0) degrees perform the following procedures.

CAUTION

DO NOT OVERLOAD THE SWINGAWAY ANCHOR FITTINGS (10) OR THE SWINGAWAY BASE SECTION (23) WHEN LOWERING THE BOOM.

- a. Slowly lower the boom until the pressure is relieved from the offset links (32) and the upper swingaway anchor fittings (10) are aligned with the upper boom attach fittings.

WARNING

DO NOT REMOVE THE LINK PINS FROM THE OFFSET LINKS UNTIL THE UPPER ATTACH PINS SECURING THE SWINGAWAY TO THE BOOM NOSE HAVE BEEN INSTALLED.

- b. Remove the retainer clips (14) and attach pins (13) from the holding brackets on the base of the swingaway and install them in the upper anchor and attach fittings (10 & 11) on the boom nose and swingaway base section.
- c. Remove the link pins (30) securing the offset links (32) to the boom nose.
- d. Pivot the offset links (32) into stowed position on the swingaway and secure with the link pins (30), washers and retainer clips (31).
- e. Reeve the hoist cable as outlined in step 3 d.

SETTING THE TELESCOPING EXTENSION LENGTH.

Extending without offset (0 degree offset)

1. Fully extend and set the outriggers and level the crane.
2. Position the boom over the rear.
3. Set the swingaway to minimum offset according to the procedures in SETTING THE OFFSET in this section.
4. Rig the cable for single part line.

NOTE

If the telescoping extension rollers are properly lubricated and rotate freely it should be possible to pull the telescoping extension out manually.

5. Position the boom at 5 degrees above horizontal.
6. Extend the boom while reeling out the hoist cable until the boom is extended 5 to 10 feet greater than the length of the telescoping extension to be extended. Reel out the hoist cable until the hookblock or headache ball is 6 inches from the ground.
7. Lower the boom to minimum elevation to permit ease of installation of pins and access to the boom nose. Be sure the headache ball or hookblock is on the ground and the hoist cable is slack.
8. Remove the ant-two-block weight.
9. Remove the cable retainer pin (26) from the nose sheave (22) on the swingaway (23) and lay the cable off to the side.
10. Fully retract the boom.

WARNING

BEFORE REMOVING THE HITCH PIN SECURING THE TELESCOPING EXTENSION INSIDE THE BASE SECTION ENSURE THE TELESCOPING EXTENSION CANNOT SLIDE COMPLETELY OUT OF THE BASE SECTION.

11. Remove the lock pin (21) from the telescoping extension hitch pin (20) and remove the hitch pin.
12. Loosen the side wear pads on the swingaway (23) until the telescoping extension is free.
13. Pull the telescoping extension (24) out to the desired length.
14. Install the telescoping extension hitch pin (20) and secure with the lock pin.
15. If the wear pads were loosened, retighten the wear pads as necessary to ensure the telescoping extension is straight with the base section.

NOTE

If a 15 or 30 degree offset is to be used with the telescoping extension perform the following procedures. If the offset is not to be used continue with step 16 below.

CAUTION

DO NOT PLACE BLOCKING UNDER THE SWINGAWAY NOSE SHEAVE.

- a. Place blocking under the tip of the swingaway base section.
- b. Set the offset as required in SETTING THE OFFSET in this section.
- c. Slowly raise the boom while telescoping out so as not to drag the telescoping extension nose sheave (22) across the ground until the offset links (32) take the full weight of the swingaway (23).

CAUTION

IF THE HOIST CABLE HAS COME IN CONTACT WITH THE GROUND BE SURE THE CABLE IS FREE FROM ANY DIRT OR FOREIGN MATTER.

16. Replace the hoist cable over the nose sheave (22) and reinstall the cable retainer pins (26) and retainer clips (25).
17. Connect the anti-two-block weight to the telescoping extension nose and the anti-two-block cable to the base of the telescoping extension.

WARNING

BE CERTAIN THE "PAT" SYSTEM IS IN PROPER PROGRAM MODE BEFORE LIFTING OVER THE SWINGAWAY TELESCOPING EXTENSION.

18. Operate the crane using correct operating procedures.

STOWING THE TELESCOPING EXTENSION

NOTE

If a 15 or 30 degree offset is being used with the telescoping extension perform the following procedures. If the offset is not being used begin with step one (1) below.

CAUTION

BE SURE ADEQUATE BLOCKING IS PLACED UNDER THE SWINGAWAY NOSE WHEN STOWING THE TELESCOPING EXTENSION.

CAUTION

USE EXTREME CAUTION WHEN LOWERING THE BOOM WHEN USING THE TELESCOPING EXTENSION WITH THE OFFSET. DO NOT JAM THE TELESCOPING EXTENSION INTO THE GROUND.

- a. Slowly lower the boom until the telescoping extension nose (22) touches the ground.
- b. Slowly retract and lower the boom at the same time so that the telescoping extension nose (24) does not drag across or dig into the ground. Continue to lower and retract the boom until the swingaway tip rests on the blocking.

CAUTION

DO NOT OVERLOAD THE SWINGAWAY ANCHOR FITTINGS (10) OR THE SWINGAWAY BASE SECTION (23) WHEN LOWERING THE BOOM.

- c. Continue to lower and retract the boom until the swingaway is at zero offset and the telescoping extension nose is off of the ground.
- d. Install the swingaway offset link pins (30) in the zero offset position and secure with the link pins (30), washers and retainer clips (31).

e. Continue with step 2 below.

1. Lower the boom until the nose of the telescoping extension (24) is 4 to 5 feet off of the ground.

NOTE

Refer to RETRACTING THE TELESCOPING EXTENSION WITH CABLE in this section to retract the telescoping extension with the hoist cable.

2. Remove the anti-two-block weight from the telescoping extension nose and the anti-two-block cable from the base of the telescoping extension.
3. Remove the cable retaining pins (26) from the telescoping extension nose sheave (22) and lay the cable off to the left side.

WARNING

BEFORE REMOVING THE HITCH PIN SECURING THE TELESCOPING EXTENSION INSIDE THE BASE SECTION, ENSURE THAT THE TELESCOPING EXTENSION CANNOT SLIDE COMPLETELY OUT OF THE BASE SECTION.

4. Remove the lock pin (21) from the telescoping extension hitch pin (20) and remove the hitch pin.
5. Loosen the side wear pads on the tip of the swingaway until the telescoping extension is free.
6. Push the telescoping extension into the swingaway base until the telescoping extension is in the fully stowed position.
7. Replace the telescoping extension hitch pin (20) and secure with the lock pin (21).
8. If the wear pads were loosened, retighten the wear pads as necessary to ensure that the telescoping extension is straight with the base section.

NOTE

If the hoist cable has come in contact with the ground be sure the cable is free from any dirt or foreign matter.

9. Route the cable over the swingaway nose sheave (22) and replace the cable retainer pins (26) and retainer clips (25).
10. Connect the anti-two-block weight to the swingaway nose.

WARNING

BE CERTAIN THE "PAT" SYSTEM IS IN THE PROPER PROGRAM MODE BEFORE LIFTING OVER THE SWINGAWAY BOOM EXTENSION.

11. Operate the crane using correct operating procedures.

RETRACTING THE TELESCOPING EXTENSION WITH CABLE.

1. Position the boom at 5 degrees above horizontal.
2. Extend the boom while reeling out the hoist cable until the boom is extended 5 to 10 feet greater than the length of the telescoping extension that is extended. Reel out on the hoist cable until the headache ball is 6 inches from the ground.
3. Lower the boom to minimum elevation. Be sure the headache ball is on the ground and the hoist cable is slack.
4. Remove the anti-two-block weight from the telescoping extension nose.
5. Remove the anti-two-block cable from the base of the telescoping extension.

CAUTION

DO NOT REEL OUT ON THE HOIST CABLE.

6. Fully retract the boom.
7. Disconnect the becket from the headache ball and connect the becket to the lug underneath the tip of the swingaway with the becket pin.

WARNING

BEFORE REMOVING THE HITCH PIN SECURING THE TELESCOPING EXTENSION INSIDE THE BASE SECTION, ENSURE THE TELESCOPING EXTENSION CANNOT SLIDE COMPLETELY OUT OF THE BASE SECTION.

8. Remove the lock pin (21) from the telescoping extension hitch pin (20) and remove the hitch pin.

NOTE

If it was necessary to loosen the wear pads to extend the telescoping extension it may be necessary to loosen them to retract the telescoping extension.

9. Loosen the side wear pads on the tip of the swingaway until the telescoping extension is free.

WARNING

WHEN USING THE HOIST CABLE TO PULL THE TELESCOPING EXTENSION INTO THE SWINGAWAY BASE, DO NOT DAMAGE THE HOIST CABLE OR THE SWINGAWAY BY PULLING THE EXTENSION PAST ITS FULLY STOWED POSITION.

CAUTION

IF A BINDING CONDITION OCCURS DURING RETRACTION, STOP IMMEDIATELY. RESOLVE THE PROBLEM BEFORE CONTINUING THE RETRACTION OF THE TELESCOPING EXTENSION.

10. Slowly extend the boom until the nose sheave (22) on the telescoping extension is 3 feet from the swingaway nose.

Slowly reel in the hoist cable pulling the telescoping extension (24) into the swingaway base (23) until the telescoping extension hitch pin (20) can be installed.

12. Install the hitch pin (20) and lock pins (21).
13. If the wear pads were loosened, retighten the wear pads as necessary to ensure the telescoping extension (24) is straight with the base section (23).
14. Remove the bucket from the lug underneath the tip of the swingaway (23) and reconnect the bucket to the headache ball with the bucket pin and retainer clip.

WARNING

DO NOT TWO-BLOCK THE HEADACHE BALL AGAINST THE SWINGAWAY NONE SHEAVE.

15. Extend the boom until the swingaway nose (22) is over the headache ball. Raise the boom until the ball is off the ground, then reel in the hoist cable and lower the boom for easy access to the swingaway nose.
16. Reconnect the anti-two-block weight to the swingaway nose.

WARNING

BE CERTAIN THE "PAT" SYSTEM IS IN THE PROPER PROGRAM MODE BEFORE LIFTING OVER THE SWINGAWAY EXTENSION.

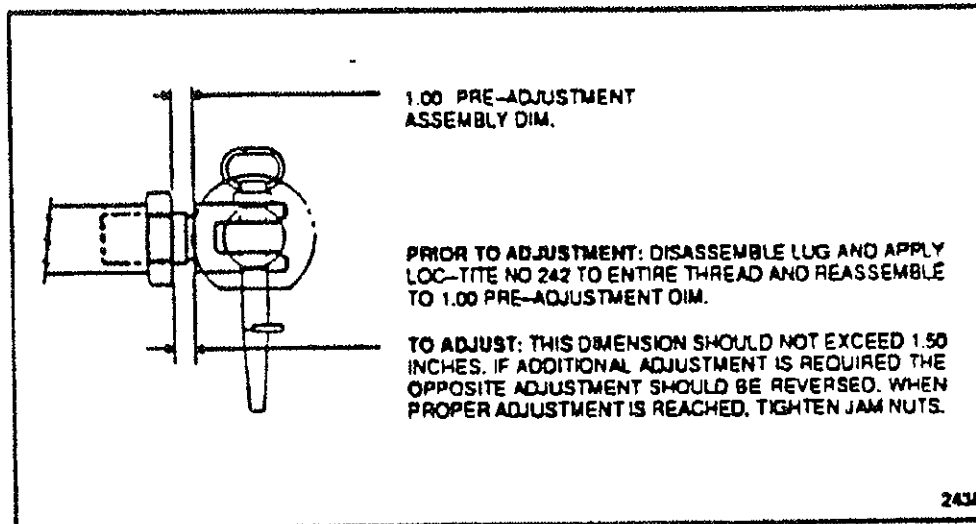
17. Operate the crane using correct operating procedures.

ADJUSTABLE LUG ADJUSTMENT .

NOTE

This procedure should only be used if the attach pins do not fit easily into the attach fittings on the boom nose.

1. Stow the swingaway on the side of the boom.
2. Dissassemble the lugs and clean all Loctite from the threads.
3. Assemble the lug and adjust to a dimension of 1.0 inch (2.54 cm) as shown in the figure titled Adjustable Lug Adjustment.



Adjustable Lug Adjustment

4. Erect the swingaway as outlined under ERECTING in this section.
5. Adjust the lug as necessary to allow the attach pins to fit easily into the attach fittings on the boom nose. Do not exceed a dimension of 1.5 inches (3.8 cm). If additional adjustment is necessary, reverse the adjustment on the opposite lug.
6. Stow the swingaway. Adjust the front and rear swingaway stowage brackets on the side of the boom if necessary. Refer to STOWING in this section.
7. Carefully measure the dimension of the final adjustment. Disassemble the lug and apply Loctite 242 to the entire length of thread and reassemble to the dimension of the final adjustment. Tighten the jam nuts.

ERECTING AND STOWING THE MULTI-SECTION LATTICE JIB AND MAST.

Multi-section lattice jibs are designed to provide a selection of jib lengths required to fit the job. This is accomplished by providing 14-foot (4.27 m) long insert sections (one of which must be the base section) that can be pinned together and used with the 32-foot (9.75 m) swingaway.

WARNING

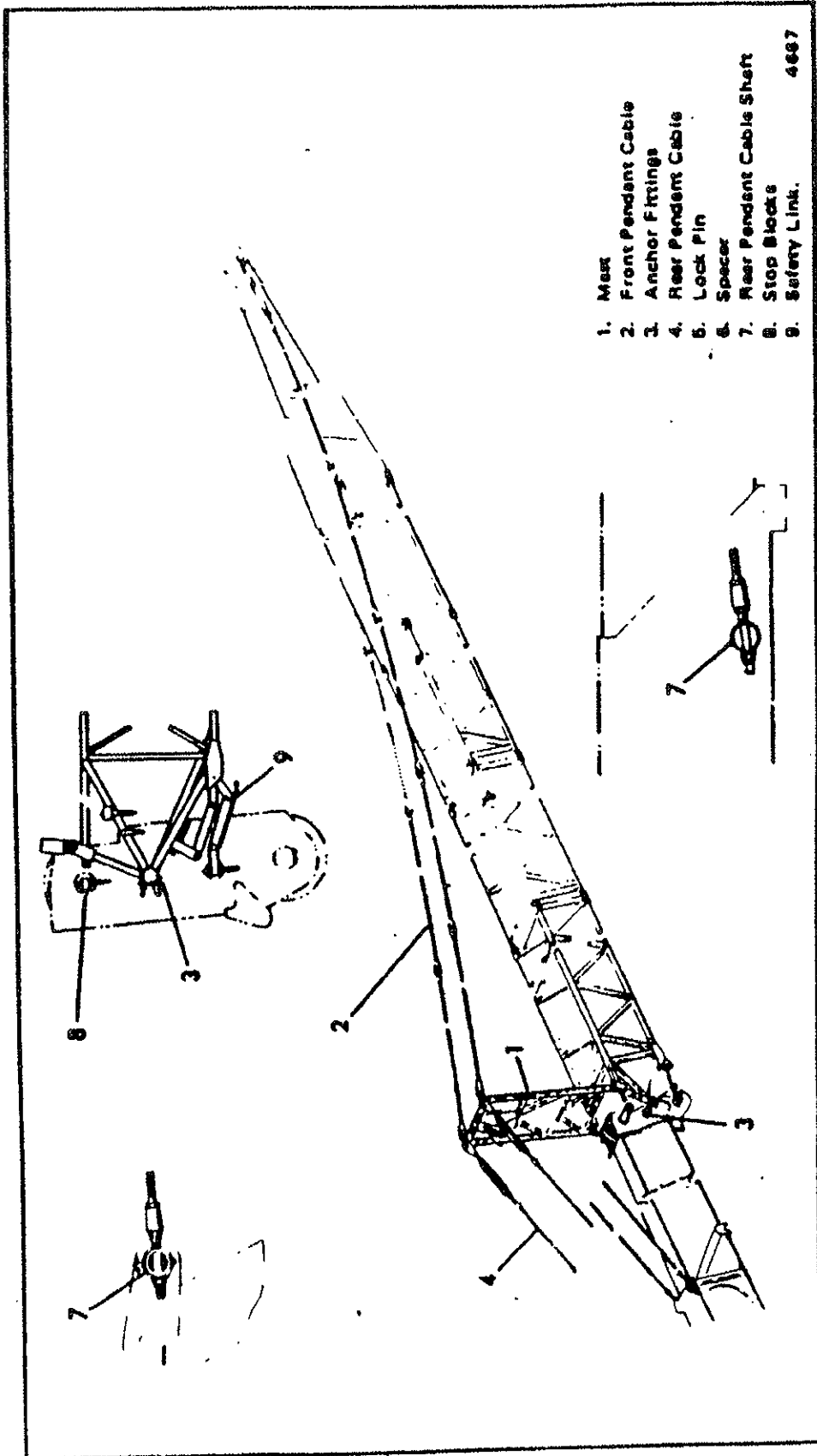
BEFORE ERECTING OR STOWING, READ AND ADHERE TO THE WARNING DECALS INSTALLED ON THE SWINGAWAY.

ERECTING THE 46-FOOT (14.0 M) JIB.

1. Extend and set the outriggers.
2. Elevate the boom from the boom rest and swing to over-the-rear.

WARNING

THE BOOM MUST BE COMPLETELY RE-TRACTED BEFORE ENGAGING THE SWINGAWAY BOOM EXTENSION WITH THE BOOM NOSE.



Erecting and Stowing Multi-Section Jib

3. Fully retract all boom sections and lower the boom to minimum elevation.
4. If installed, remove the block from the main hoist cable.
5. Attach the 32-foot (9.75 m) swingaway to the boom nose using steps 5 thru 19 of ERECTING THE 32-FOOT (9.75 M) SWINGAWAY BOOM EXTENSION.
6. If the crane is equipped with a power-pinned fly section, it must be extended at this time. Refer to Section 4 for extension procedures.
7. Extend the boom as necessary to permit sufficient clearance for installation of the appropriate number of jib sections; then lower it until the tip of the swingaway is lying on the ground. Block up under the swingaway, approximately 8 to 10 feet (2.4 to 3.0 m) ahead of the boom nose.
8. Remove the safety clips and attaching pins that secure the swingaway to the boom nose.
9. Retract the boom (except the power-pinned fly section), leaving the swingaway on the ground.
10. Ensure the mast (1) is pinned to and lying on top of the jib base section.
11. Remove the front pendant cable (2) from the jib base section.
12. Using the main or auxiliary hoist cable, lift the jib base section and position it at the base end of the swingaway.
13. Mate the jib base section to the swingaway and install the four attaching pins and safety clips removed in step 8.
14. With the hoist cable still attached to the jib base section, lift the assembled unit and move the blocking, erected in step 7, to approximately 8 to 10 feet (2.4 to 3.0 m) ahead of the boom nose attach end of the jib base section.
15. Lower the assembled unit onto the blocks and detach the hoist cable.
16. Retract the boom (except the power-pinned fly section) and lower to minimum elevation.
17. Remove the hook from the hoist cable and leave the becket on the cable.

Remove the cable from the boom nose center idler sheave.

18. If the boom is full powered, extend the fly section approximately 4 to 5 feet (1.22 to 1.52 m). If the boom has a power-pinned fly, proceed as follows.

a. Position the outer-mid section and the inner-mid section to within approximately 30 inches (76.2 cm) of the fully retracted position.

b. Align the latch mechanism access holes by alternately activating the inner and outer-mid boom section telescoping controls.

c. Using the boom latch wrench, engage the latch mechanism by turning counterclockwise until the stop is reached.

NOTE

A slight jog of the outer-mid may be required to allow the latch to engage.

d. Remove the retaining pin and lock pin from the outer-mid section before extending.

CAUTION

FAILURE TO REMOVE THE LOCK PIN CAN RESULT IN DAMAGE TO THE BOOM.

e. Extend the outer-mid section to within approximately 4 to 5 feet (1.22 to 1.52 m) of the boom nose.

19. Extend the boom (inner-mid on power-pinned fly boom; inner and outer-mid on full power boom) and mate the attach lugs on the jib base section with the anchor fittings (3) on the boom nose. It may be necessary to raise or lower the boom slightly to mate the attach lugs. Remove the attach lug locking pins from their stowed position on the jib base section and install the pin to secure the jib base section to the attach lugs.

20. Stow the cable roller assembly by removing the retaining pin and laying it on its side.

WARNING

**BEFORE USING THE PENDANT CABLES,
ENSURE THE CABLE END FITTINGS ARE
TIGHT.**

21. Attach the turnbuckle end of each front pendant cable (2) to the cable links (8) on the swingaway tip.
22. Attach the front pendant cables (2) to the lugs on the mast (1).
23. Attach the clevis end of the rear pendant cables (4) to the links on the other side of the mast (1).
24. Remove the lock pin (5) securing the spacer (6) to one end of the rear pendant cable shaft (7) and remove the spacer.
25. On older models insert the rear pendant cable shaft through the hole in the outer mid and fly sections. In newer models insert the rear pendant cable shaft (7) through the fitting on the top front end of the outer mid. Install the spacer (6) and secure with the lock pin (5).
26. Remove the nut, jam nut, and washer from the ends of the rear pendant cables (4). Insert the cable ends through the holes in the shaft and install the washer, jam nut, and nut on each cable end. Allow approximately 1/2 inch (1.3 cm) of the thread exposed on the threaded end of the cable assembly.
28. Route the hoist cable over the mast sheave and the swingaway sheave. Install the sheave cable retainer pins. Attach a hook to cable becket.
29. Remove the clip pins, attach pins, and stop blocks (8) from the stowed position on the jib base section and install these items in the upper swingaway attach fittings on each side of the boom nose.
30. Remove the clip pins, attach pins, and one end of the safety link assembly (9) from the stowed position on the jib base section and install these items in the lower swingaway attach fittings on each side of the boom nose.

CAUTION

WHILE TELESCOPING THE BOOM, ENSURE THE FRONT AND REAR PENDANT CABLES DO NOT CATCH ON ANYTHING. STATION AN OBSERVER ON EACH SIDE OF THE BOOM.

NOTE

If the boom is full powered, perform steps 32 and 33. If the boom has a power-pinned fly, perform step 34.

31. If the boom is full powered, extend the fly section and retract the inner-mid and outer-mid sections until the fly section is completely extended without moving the jib.

32. Remove the clip pin and pin securing the fly section lock pin in it's stowed position. Install the lock pin through the outer-mid into the rear of the fly section. Install the pin and clip pin.

33. If the boom has a power-pinned fly, proceed as follows:

a. Retract the outer-mid section and extend the inner-mid section until the outer-mid section is fully retracted without moving the jib.

NOTE

The pinning hole in the rear of the fly section should be aligned with the hole in the forward end of the outer-mid section.

b. Install the lock pin through the outer-mid section and the rear of the fly. This secures the fly section in the extended position. Secure the lock pin with the safety pin.

c. Using the boom latch wrench, turn the latch mechanism locking bolt clockwise until the stop is reached.

NOTE

A slight jog of the outer-mid may be required to allow the latch to disengage.

NOTE

Performing either step 32 or step 34 will take the slack out of the rear pendant cables and raise the mast off the jib base section. Raising the mast will take the slack out of the front pendant cables.

CAUTION

BEFORE PROCEEDING, ENSURE THE LOCK PIN IS PROPERLY INSERTED THROUGH THE OUTER-MID AND FLY SECTION AND PROPERLY SECURED.

CAUTION

WHEN ELEVATING THE BOOM, ENSURE BOTH REAR PENDANT CABLES AND BOTH FRONT PENDANT CABLES ARE OF EQUAL LENGTH. ADJUST TURNBUCKLES AS NECESSARY.

34. Slowly elevate and retract (except fly section) the boom until all the slack is removed from the pendant cables.

35. Refer to the load chart in the cab for 46-foot (14.0 m) lattice jib and operate the crane using normal operating procedures.

STOWING THE 46-FOOT (14.0 M) JIB.

1. Swing the boom to over-the-rear and fully retract the boom (except the fly section). Lower the boom until the swingaway sheave is on the ground and the front pendant cables are slack.

NOTE

If the boom is full powered, perform steps 2 and 3. If the boom has a power-pinned fly, perform step 4.

NOTE

Performing either step 3 or step 4 will slack the pendant cables and lower the mast.

CAUTION

LOWER THE MAST SLOWLY. DO NOT ALLOW THE MAST TO FALL AND HIT THE TOP OF THE JIB BASE AS DAMAGE MAY RESULT TO THE MAST AND/OR JIB BASE SECTION.

2. If the boom is full powered, remove the clip pin and pin securing the lock pin through the outer-mid and fly sections. Remove the lock pin and position it in its stowed position. Secure the lock pin with the pin and clip pin.
3. If the boom is full powered, extend the outer-mid section and retract the fly section until the outer-mid is within 4 to 5 feet (1.22 to 1.52 m) of the boom nose and the mast (1) is laying on the jib base section.
4. If the boom has a power-pinned fly, proceed as follows.
 - a. Position the outer-mid section and the inner-mid section to within approximately 30 inches (76.2 cm) of the fully retracted position.
 - b. Align the latch mechanism access holes by alternately activating the inner and outer-mid boom section telescoping controls.
 - c. Using the boom latch wrench, engage the latch mechanism by turning counterclockwise until the stop is reached.

NOTE

A slight jog of the outer-mid may be required to allow the latch to engage.

d. Remove the retaining pin and lock pin from the outer-mid section before extending.

CAUTION

**FAILURE TO REMOVE THE LOCK PIN CAN
RESULT IN DAMAGE TO THE BOOM.**

e. Extend the outer-mid section until it is within 4 to 5 feet (1.22 to 1.52 m) of the boom nose and the mast (1) is laying on the jib base section.

5. Remove the clip pins, attach pins, and stop blocks (8) from the upper swingaway attach fitting on each side of the boom nose. Stow these items in the stowage brackets in the jib base section.

6. Remove the clip pins, attach pins, plates, and one end of the safety link assembly (9) from the lower swingaway attach fittings on each side of the boom nose. Stow these items in the stowage brackets in the jib base section.

7. Remove the hook from the hoist cable, leaving the becket on the cable. Remove the hoist cable from the swingaway sheave and the mast sheave. Install the cable retainer pins. Reel in the hoist cable and lay the cable over the side of the boom.

8. Disconnect the rear pendant cables from the outer-mid.

9. Remove the lock pin (5) securing the spacer (6) to one end of the shaft (7). Remove the spacer and remove the shaft from the outer-mid fitting. Install the spacer on the shaft and secure with the lock pin.

10. Disconnect the rear pendant cables (4) from the mast.

11. Disconnect the front pendant cables (2) from the mast.

12. Disconnect the front pendant cables (2) from links (8) on the swingaway tip.

13. Install the swingaway cable roller assembly in the stowed position.

14. Block up under the jib base section, approximately 8 to 10 feet (2.4 to 3 m) forward of the boom nose:

15. On the jib base section attaching lugs (3), remove the clip pins.
16. Retract the boom and disengage the anchor fittings (7) on the boom nose from the attaching lugs (3) on the jib base section.
17. Remove the idler sheave cable guide bar and retaining pin on the boom nose. Position the hoist cable over idler sheave and install the cable guide bar and the retainer pin.
18. Attach a hook to the hoist cable.
19. If the boom has a power-pinned fly, proceed as follows.
 - a. Retract the outer-mid section, leaving the fly section extended.

NOTE

The pinning hole in the rear of the fly section should be aligned with the hole in the forward end of the outer-mid section.

- b. Install the lock pin through the outer-mid section and the rear of the fly. This secures the fly section in the extended position. Secure the lock pin with the safety pin.
 - c. Using the boom latch wrench, turn the latch mechanism locking bolt clockwise until the stop is reached.

NOTE

A slight jog of the outer-mid may be required to allow the latch to disengage.

20. Position the boom as necessary and attach the hoist hook to the jib base section.
21. Lift the jib base and move the support blocks to approximately 8 to 10 feet (2.4 to 3 m) forward of the jib base to swingaway extension attach points.
22. Lower the hoist cable until the swingaway is resting on the blocks.
23. With the hoist hook still attached to the jib base section, remove the safety clips from the four attaching pins and remove the pins connecting the jib base section to the swingaway.

WARNING

BEFORE INITIATING ANY SWING OPERATIONS, ENSURE THE AREA IN THE SWING PATH OF THE HOOK AND/OR LOAD, AS WELL AS THE TAIL SWING AREA, IS CLEAR OF ALL OBSTRUCTIONS AND PERSONNEL. SOUND THE SWING HORN BEFORE SWINGING.

SWINGING THE BOOM.

WARNING

THE OUTRIGGERS AND STABILIZERS MUST BE FULLY EXTENDED AND SET AND THE COUNTERWEIGHT FULLY EXTENDED PRIOR TO STARTING ANY LIFTING OPERATIONS.

CAUTION

THE BOOM MUST ALWAYS BE ELEVATED FROM THE BOOM REST BEFORE SWING IS ATTEMPTED.

CAUTION

NEVER PUSH OR PULL THE SWING CONTROL LEVER THROUGH NEUTRAL TO THE OPPOSITE DIRECTION TO STOP SWING MOTION. TO SLOW SWING, FEATHER THE SWING CONTROL LEVER TOWARD NEUTRAL AND USE THE SWING BRAKE FOOT PEDAL. TO STOP SWING, POSITION THE LEVER TO NEUTRAL AND USE THE SWING BRAKE FOOT PEDAL.

CAUTION

ENSURE THE POSITIVE SWING LOCK IS DISENGAGED BY PUSHING FORWARD ON THE HANDLE. ENSURE THE SWING BRAKE SWITCH IS IN THE DISENGAGED POSITION.

To swing to the right, push forward (RIGHT) on the SWING control lever or use the toe of the foot pedal and hold until near desired position. Return the lever to neutral and use the swing foot brake to stop swing. To swing to the left, pull (LEFT) on the SWING control lever or use the heel of the foot pedal. After reaching the desired position and the swing is stopped, turn the SWING BRAKE switch to ENGAGED and set the positive swing brake.

NOTE

The positive swing brake is adjusted to require approximately a 45 pound (20.4 kg) force to pull the handle.

ELEVATING AND LOWERING THE BOOM.

Elevating the Boom.

WARNING

BEFORE ELEVATING THE BOOM, ENSURE THE AREA ABOVE AND BELOW THE BOOM IS CLEAR OF ALL OBSTRUCTIONS AND PERSONNEL.

To elevate the boom, pull back (UP) on the BOOM control lever or use the heel of the foot pedal. Hold the control lever or the foot pedal until the boom reaches the desired elevation angle.

Lowering the Boom.

WARNING

BEFORE LOWERING THE BOOM, ENSURE THE AREA BENEATH THE BOOM IS CLEAR OF ALL OBSTRUCTIONS AND PERSONNEL.

24. Using the hoist, remove the jib base section and position it to one side of the crane.
25. Stow the front pendant cables (2) on the jib base section.
26. Position the boom and extend it to line up and engage the boom nose with the swingaway. Install the four attaching pins and safety clips removed in step 23.
27. If the crane is equipped with a power-pinned fly, retract it at this time. Refer to Section 4 for retraction procedures.
28. Fully retract the boom.
29. Stow the 32-foot (9.75 m) swingaway on the main boom using steps 6 thru 15 of **STOWING THE 32-FOOT (9.75 M) SWINGAWAY BOOM EXTENSION**.
30. Rig the main boom as desired and operate the crane using normal procedures.

ERECTING THE 60, 74, AND/OR 88-FOOT (18.3, 22.6, AND/OR 26.8 M) JIBS.

Erect these jibs using the same procedures as outlined in **ERECTING THE 46-FOOT (14 M) JIB** with the following additions.

1. Remove the additional pendant cables from each 14-foot (4.27 m) jib mid-section to be used.
2. Attach the 14-foot (4.27 m) jib mid-section(s) to the swingaway, moving the blocks each time a section is added; then attach the jib base section to the last mid section.

WARNING

INSPECT THE PENDANT CABLES TO ENSURE THE CABLE END FITTINGS ARE TIGHT. THE NUT AND BOLT IN THESE END FITTINGS, USED TO ATTACH THE CABLES TOGETHER, ARE OF A SPECIAL GRADE MATERIAL AND SHOULD NOT BE SUBSTITUTED WITH NUTS OR BOLTS OF OTHER MATERIAL.

3. Add one set of pendant cables, for each mid-section used, between the pendant cable connected to the swingaway and the mast.

STOWING THE 60, 74, AND/OR 88-FOOT (18.3, 22.8, AND/OR 26.8 M) JIBS.

Stow these jibs using the same procedures as outlined in STOWING THE 46-FOOT (14 M) JIB with the following additions.

1. One, two, or three additional sets of pendant cables will have to be removed and stowed on each jib mid-section.
2. One, two, or three jib mid-sections will have to be removed after removing the jib base section.

REMOVING AND INSTALLING THE COUNTERWEIGHT.

Provisions for removing and installing the counterweight are provided to reduce the total weight of the machine for highway travel. Normally the counterweight is removed in conjunction with the boom and lift cylinders, and both are transported on a specially built trailer or the counterweight is removed and transported on the dolly for trailing boom transport.

REMOVAL.

1. Fully extend and lock the outriggers.
2. In early models remove the two clip pins (10) and swing the travel lock up. In later models remove the travel lock pin (10) and stow in the holding bracket. Extend the counterweight by pushing on the COUNTERWEIGHT control lever located in the left rear compartment. Position the counterweight sheave directly under the cable anchor point on the rear of the hoist mounting structure.
3. Fully retract the boom, swing to over-the-rear, and lower the boom to horizontal.
4. Route the lug end of the counterweight cable (6) under the sheave (7) on the counterweight and up to the anchor point (3) on the rear of the hoist mounting structure. Secure the cable end to the anchor point with the pin (4) and clip pin (5).

5. Remove the clip pin and pin from the rear sheave (2). Route the cable over the sheave and install the pin and clip pin.
6. Remove the clip pin and pin from the front sheave (1). Route the cable under the sheave and install the pin and clip pin.
7. Route the cable forward to the anchor point (13) on the inner-mid section and secure with the pin (12) and clip pin (11).

NOTE

It may be necessary to extend or retract the counterweight at this time so the cable is straight between the anchor point and counterweight sheave.

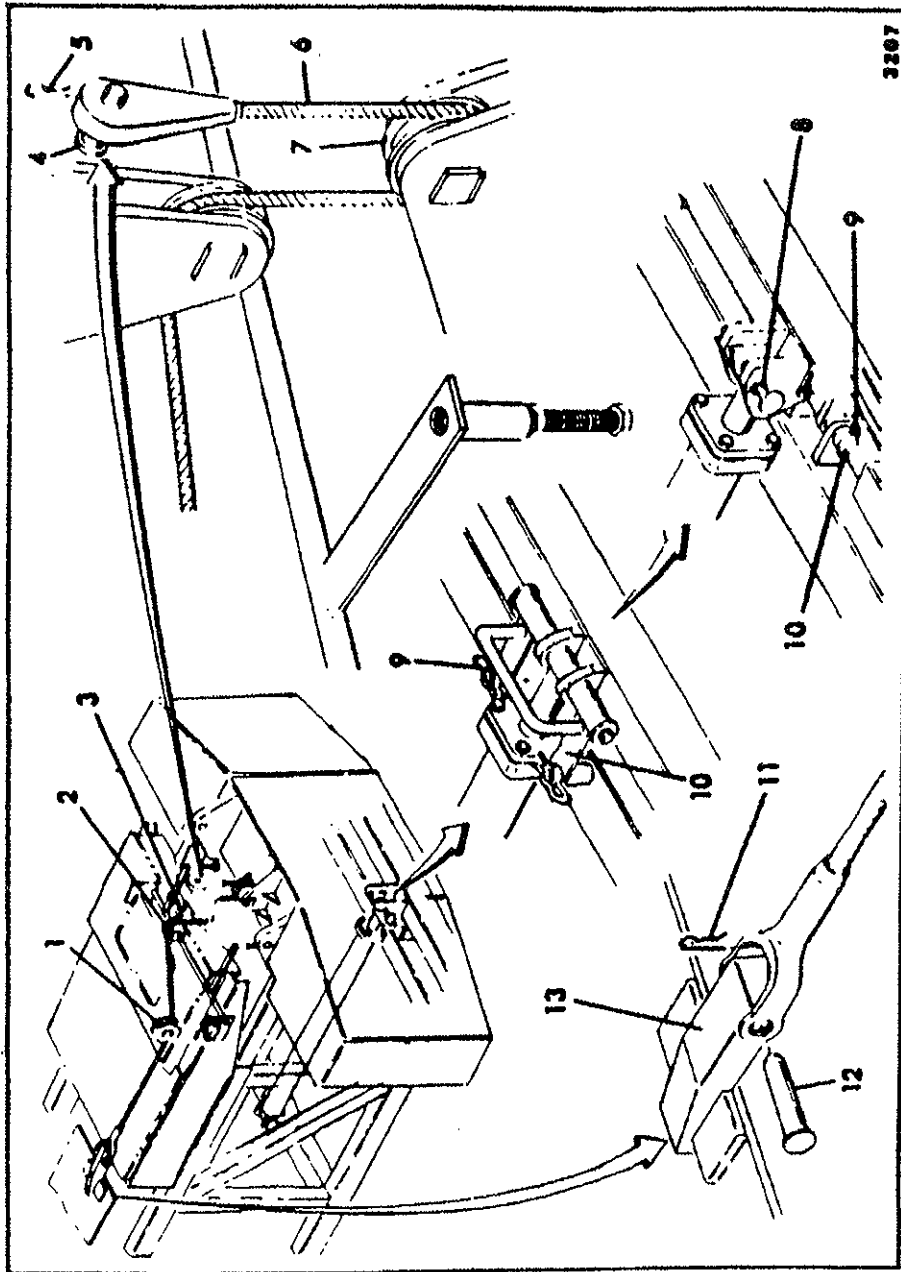
8. Remove the snap lock hitch pin (8) attaching the counterweight to the hydraulic cylinder rod anchor fitting. After removing the counterweight, install the pin in the anchor fitting.

WARNING

ENSURE ALL PERSONNEL ARE CLEAR OF THE AREA AROUND THE COUNTERWEIGHT BEFORE ATTEMPTING COUNTERWEIGHT REMOVAL.

WARNING

NEVER USE THE INNER-MID TELESCOPE CONTROL LEVER IN THE CAB TO REMOVE OR INSTALL THE COUNTERWEIGHT BECAUSE THE TWO-WAY CAM OPERATED HYDRAULIC VALVE WILL NOT FUNCTION IN THIS CIRCUIT.



Removing and Installing Counterweight (Sheet 1 of 2)

1. Forward Sheave
2. Aft Sheave
3. Hoist Structure Anchor Point
4. Pin
5. Clip Pin
6. Cable
7. Counterweight Sheave
8. Snap Lock Hitch Pin
9. Clip Pin
10. Travel Lock Pin (Later Models)
Travel Lock Pin (Earlier Models)
11. Clip Pin
12. Pin
13. Inner-Mid Section Anchor Point

Removing and Installing Counterweight (Sheet 2 of 2)

CAUTION

COUNTERWEIGHT REMOVAL IS ACCOMPLISHED BY EXTENDING AND RETRACTING THE INNER-MID SECTION OF THE BOOM USING THE BOOM CONTROL LEVER IN THE LEFT REAR COMPARTMENT. THEREFORE, AS THE BOOM IS BEING TELESCOPED, IT WILL BE NECESSARY TO REEL OUT THE HOIST CABLES TO PREVENT TWO-BLOCKING THE BOOM NOSE AND HOOK BLOCKS.

NOTE

A safety device, consisting of two adjustable bolts (set at 3-1/2 inches (8.89 cm)) on a push bar connected to a two-way cam operated hydraulic valve, will automatically stop the flow of hydraulic oil to the extend side of the inner-mid telescope cylinder to prevent damage to the structure from raising the counterweight too far.

9. Push on the BOOM control lever in the left rear compartment, extending the inner-mid section to take up the slack in the cable.
10. Continue to extend the inner-mid, lifting the counterweight (approximately 3-1/2 inches (8.89 cm)) from the mounting structure.
11. Swing the superstructure to position the counterweight over-the-side.
12. Pull out on the COUNTERWEIGHT control lever to retract the counterweight supporting structure. In early models secure the travel lock (10) by swinging it down onto the two lock pins and inserting the clip pin. In later models, install the travel lock pin.
13. Pull out on the BOOM control lever to retract the inner-mid section and lower the counterweight to the ground or a solid surface capable of supporting the counterweight.
14. Remove the clip pin (11) and pin (12) securing the cable to the anchor fitting (13) on the inner-mid section and reinstall the pin and clip pin.

15. Remove the clip pin (5) and pin (4) securing the cable to the anchor fitting (3) on the rear of the hoist mounting structure and reinstall the pin and clip pin in the cable end.
16. Remove the cable from under the sheave (7) on the counterweight.
17. Remove the cable retaining pins and remove the cable from the other two sheaves (1 and 2). Install the cable retaining pins.
18. Using the main hoist, lift the counterweight and position it as desired.

INSTALLATION.

1. Fully extend and lock the outriggers.
2. Using the main hoist, lift and position the counterweight 5 feet (1.52 m) from one side of the carrier and centered on the axis of rotation of the superstructure.
3. Fully retract the boom, lower it to the horizontal, and swing to position the rear of the superstructure over the side on which the counterweight was positioned.
4. Route the lug end of the counterweight cable (6) under the sheave (7) on the counterweight and up to the anchor point (3) on the rear of the hoist mounting structure. Secure the cable end to the anchor point with the pin (4) and clip pin (5).
5. Remove the clip pin and pin from the rear sheave (2). Route the cable over the sheave and install the pin and clip pin.
6. Remove the clip pin and pin from the front sheave (1). Route the cable under the sheave and install the pin and the clip pin.
7. Route the cable forward to the anchor point (13) on the inner-mid section and secure with the pin (12) and clip pin (11).
8. In early models, remove the two clip pins and swing the travel lock up. In later models remove the travel lock pin (10) and stow in the holder.
9. Remove the snap lock hitch pin (8) from the counterweight hydraulic cylinder rod anchor fitting.

CAUTION

COUNTERWEIGHT INSTALLATION IS ACCOMPLISHED BY EXTENDING AND RETRACTING THE INNER-MID SECTION OF THE BOOM USING THE BOOM CONTROL LEVER IN THE LEFT REAR COMPARTMENT. THEREFORE, AS THE BOOM IS TELESCOPED, IT WILL BE NECESSARY TO REEL OUT THE HOIST CABLES TO PREVENT TWO-BLOCKING THE BOOM NOSE AND HOOK BLOCK.

10. Push on the BOOM control lever in the left rear compartment, extending the inner-mid section to take up slack in the cable.
11. Continue to extend the inner-mid, lifting the counterweight up under the structure. Release BOOM control lever just before safety stop device is contacted.
12. Swing the superstructure to position the boom over-the-rear.
13. Extend the counterweight supporting structure by pushing on the COUNTERWEIGHT control lever in the left rear compartment.
14. Pull on the BOOM control lever to retract the inner-mid section, lowering the counterweight onto the supporting structure.

NOTE

It may be necessary to actuate the BOOM and COUNTERWEIGHT control levers simultaneously to accomplish step 14.

15. After the counterweight is fully seated on the supporting structure, fully retract the inner-mid section using the BOOM control lever.
16. Install the snap lock hitch pin (8) through the counterweight lug and hydraulic cylinder rod anchor fitting.
17. Remove the clip pin (11) and pin (12) securing the cable to the anchor fitting (13) on the inner-mid and install the pin and clip pin.

TRAILING BOOM.

In order to distribute crane weight over a greater number of axles to comply with roading axle weight requirements, a trailing boom option is available. Lift cylinder shutoff valves allow the boom to float vertically when roading. Also on later models, disengaging the swing brake allows the boom to move horizontally.

The trailer and crane carrier are equipped with quick disconnect electrical and air couplings to provide electrical power to the trailer lights and air to the trailer brakes.

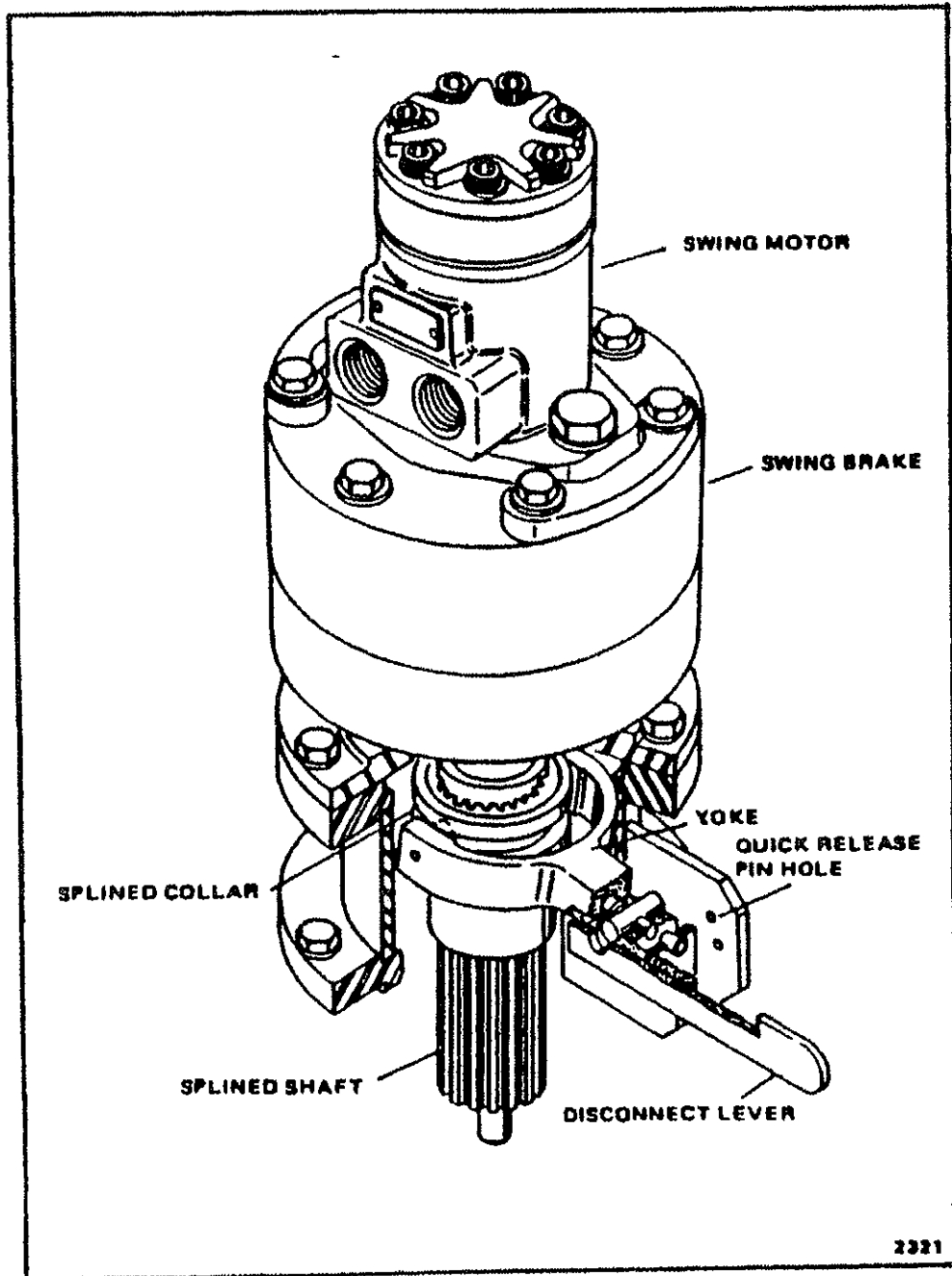
OPERATING MODE TO THE TRAILING MODE.

1. Extend and set the outriggers.
2. Swing the boom to over-the-rear.
3. Position the boom on the trailer.
4. Open the three hand valves at the lift cylinder port blocks.

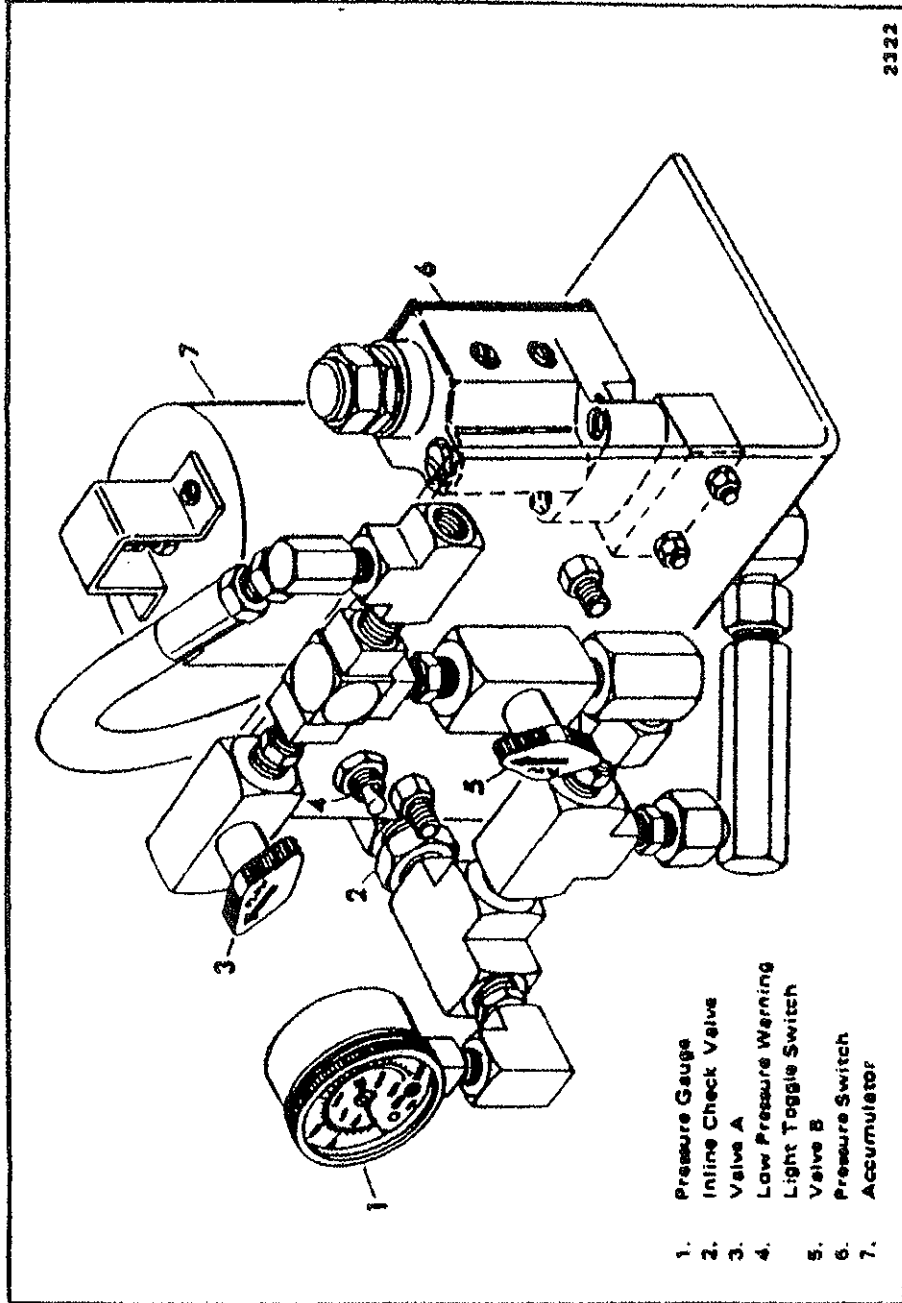
NOTE

Crane models manufactured up to and including April, 1978, are equipped with a puck-type swing brake and require no operation on the swing brake system for the trailing boom. Crane models manufactured between and including May, 1978, through March, 1980, are equipped with a disc and stator type swing brake with a mechanical lever disconnect for trailing boom. To disconnect the brake for these models follow step 5 and then proceed to step 10. Cranes manufactured from and including June, 1980, are equipped with a hydraulic swing brake disconnect assembly located in the rear of the valve compartment. Follow steps 6 through 10 for these models.

5. Remove the quick release pin from the handle and push down on the handle until the coupling disengages the swing drive. Insert the quick release pin through the lower hole on the housing and the handle to secure the handle in the disengaged position.



Mechanical Lever Disconnect Assembly



2322

Hydraulic Swing Brake Disconnect Assembly

6. Engage the swing brake and set the positive swing lock.

CAUTION

DO NOT ATTEMPT TO SWING THE BOOM WITH THE SWING BRAKE ENGAGED AND VALVE B (REFER TO FIGURE TITLED HYDRAULIC SWING BRAKE RELEASE ASSEMBLY, OPEN SINCE THE SWING BRAKE COULD DISENGAGE CAUSING DAMAGE TO THE BOOM AND/OR TRAILER.

NOTE

The accumulator will not stay charged unless valve A is closed before valve B is opened.

7. Close valve A. Activate the swing control left to swing left. Note the pressure reading on the swing brake release gauge. The pressure should rise to 1500 psi (10,340 kPa/103.4 bar) and level off.

NOTE

With valve A closed and the accumulator charged to 1500 psi (10,340 kPa/103.4 bar) opening valve B will release the swing brake.

8. Open valve B.

NOTE

Positioning the LOW PRESSURE WARNING LIGHT switch to the ON position activates the low accumulator pressure electrical circuit. If pressure drops to 250 psi (1720 kPa/17.2 bar) a red light in the carrier cab illuminates to alert the operator.

CAUTION

IF THE LOW PRESSURE WARNING LIGHT SHOULD ILLUMINATE IN THE CARRIER CAB INDICATING A LOSS OF PRESSURE IN THE SWING BRAKE RELEASE SYSTEM, REPEAT STEPS 8 THROUGH 10 TO RE-ACTIVATE THE SYSTEM.

9. Position the LOW, PRESSURE WARNING LIGHT toggle switch to the ON position.
10. Release the positive swing lock.

TRAILING MODE TO THE OPERATING MODE.

WARNING

THE THREE HAND VALVES ON THE LIFT CYLINDER PORT BLOCKS MUST BE COMPLETELY CLOSED BEFORE OPERATING THE CRANE.

1. Close the three hand valves on the lift cylinder port blocks.
2. Extend and set the outriggers. Shutdown the engine.

NOTE

Crane models manufactured up to and including April, 1978, are equipped with a puck-type swing brake and require no operation on the swing brake system for the trailing boom. Crane models manufactured between and including May, 1978, through March, 1980, are equipped with a disc and stator type swing brake with a mechanical lever disconnect for trailing boom. To engage the brake for these models refer to step 3 and then proceed to step 6. Cranes manufactured from and including June, 1980, are equipped with a hydraulic swing brake disconnect assembly located in the rear of the valve compartment. Refer to step 4.

1. Remove the quick release pin from handle and housing and pull up on the handle until the coupling engages the swing drive. Insert the quick release pin through the upper hole on the housing and the handle to secure the handle in the engage position.
4. Completely open valve A and close valve B.
5. Position the LOW PRESSURE WARNING LIGHT toggle switch to the OFF position.
6. Start the engine. Release the swing brake.
7. Lift the boom from the trailer.