Manitowoc 2000

Operator Manual

Grove Manitowoc National Crane Potain

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OPERATOR'S MANUAL

This manual has been prepared for and is considered part of -

2250 MAX-ER™ 2000 #44 Luffing Jib

Model Number

2255REF

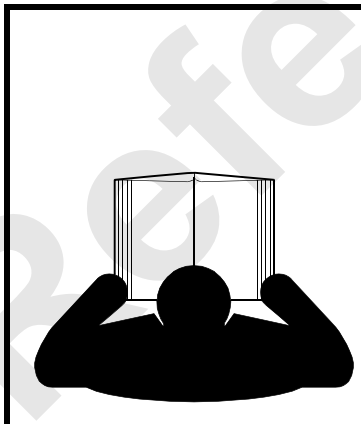
Serial Number

This Manual is divided into the following sections:

NOTICE

The luffing jib serial number is the only method your distributor or the factory has of providing you with correct parts and service information.

The luffing jib serial number is located on the crane identification decal attached to the luffing jib strut. ***Always furnish luffing jib serial number*** when ordering parts or communicating service problems with your distributor or the factory.



⚠ WARNING

To prevent death or serious injury:

- Avoid unsafe operation and maintenance.
- This crane and attachment must be operated and maintained by trained and experienced personnel. Manitowoc is not responsible for qualifying these personnel.
- Do not operate or work on this crane or attachment without first reading and understanding Operator's Manuals and Capacity Charts supplied with crane and attachment.
- Store Operator's Manuals in holder provided on crane.
- Attach laminated Capacity Charts supplied with crane to chain in operator's cab.
- If Operator's Manuals or Capacity Charts are missing from cab, contact your distributor for new ones.

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Published 4-19-2011, Control # 072-04

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SECTION 1
INTRODUCTION

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SECTION 1
INTRODUCTION

GENERAL DESCRIPTION

The instructions in this manual apply only to the Model 2250 MAX-ER™ 2000 with a #44 Luffing Jib on a #79 Boom.

CRANE DATA

See the end of this section for crane data specific to your crane:

- Basic Specifications.
- EC Declaration (if applicable).

CRANE/ATTACHMENT IDENTIFICATION

An identification label is attached to the outside of the operator's cab (see Figure 1-1) and to the attachments (i.e. luffing jibs, MAX-ER's, and Ringers) available for this crane.

The crane or attachment model, application, and serial number are provided on the label.

For the exact location of the identification labels on your crane and attachments, see the Nameplates and Decals Drawing in Section 2 of this manual.

CRANE ORIENTATION

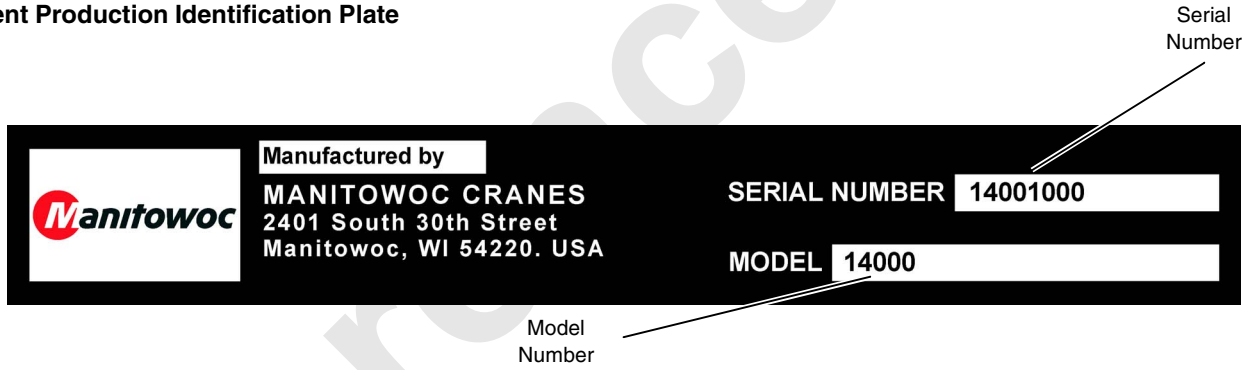
The terms RIGHT, LEFT, FRONT, REAR used in this manual see operator's right, left, front, and rear sides when seated in the operator's cab looking forward.

- The boom is on the front of the upperworks.
- The crawler drive shafts are at the rear of the crawlers and carbody.

IDENTIFICATION OF MAX-ER COMPONENTS

See Figure 1-2 for identification of the MAX-ER components. See Section 1 of the Crane Operator's Manual for identification of the crane components.

Current Production Identification Plate



Past Production Identification Plate

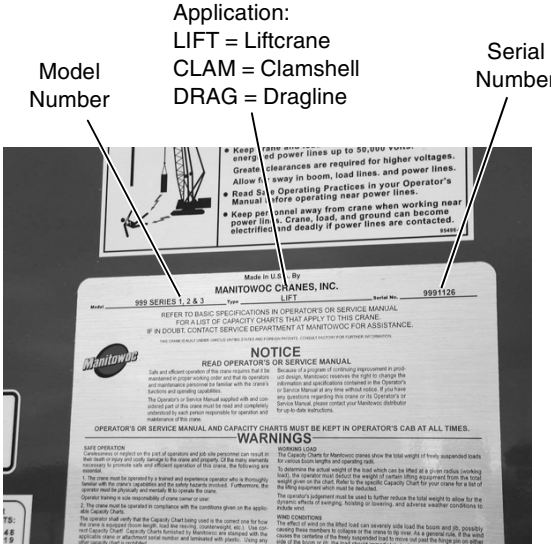


FIGURE 1-1

Reference Only

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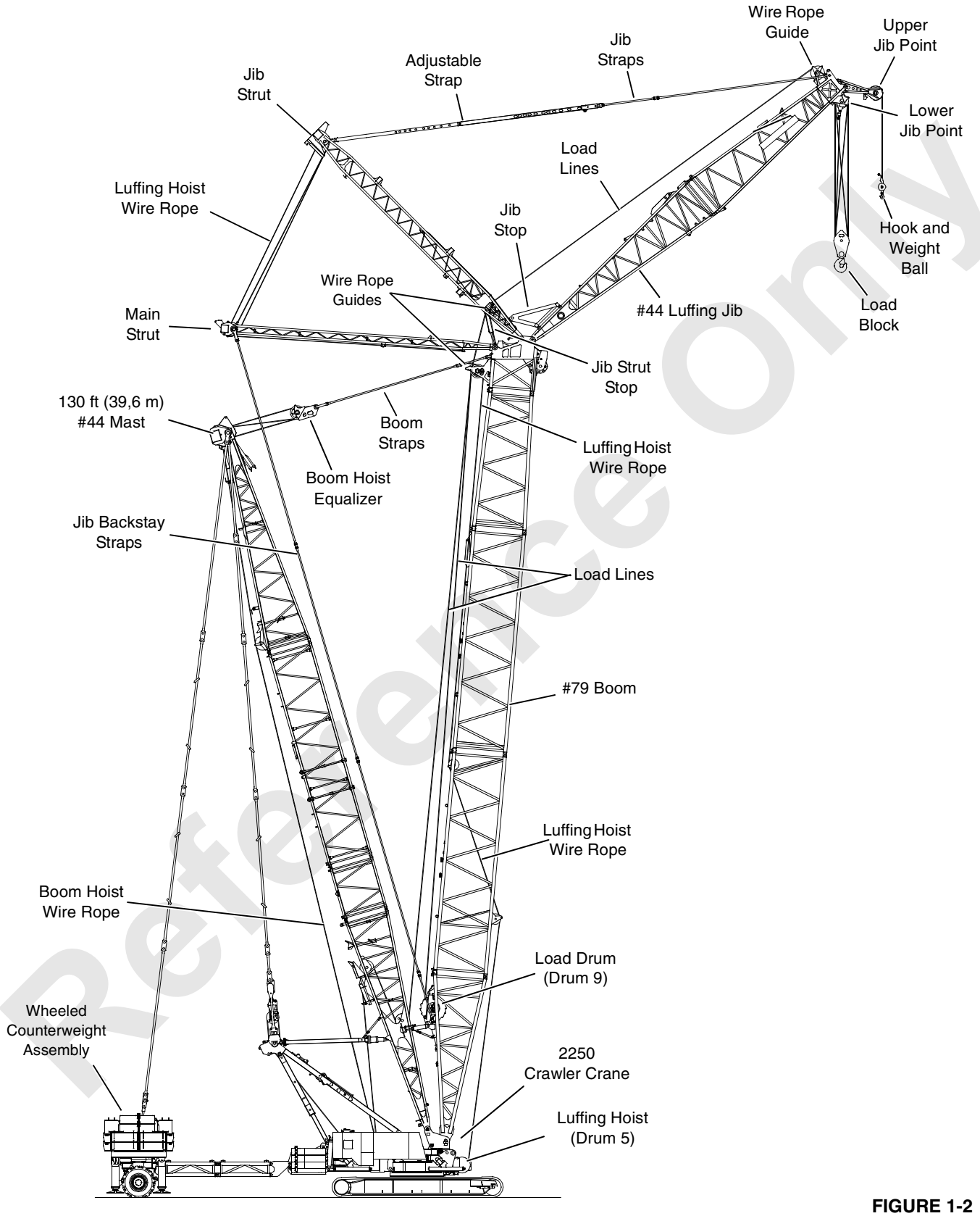

FIGURE 1-2

Reference Only

WEIGHTS OF COMPONENTS

NOTE: Weights may fluctuate ±3% due to manufacturing tolerances

Description	Weight Pounds	Weight Kilograms
LIFTCRANE:		
Upperworks and lowerworks complete, 2 swing drives, counterweight, gantry, backhitch, MAX-ER equipped with 462,000 lb (209 560 kg) wheeled counterweight, 130 ft (39,6 m) No. 44 Mast, fully rigged 120 ft (42,7m) Boom No. 79 [including upper boom point, 500 USt (453 t) block and 15 USt (14 t) hook], boom stops, and load lines	1,103,575	500 573
COUNTERWEIGHT - CRANE:		
Tray	38,775	17 588
Lifting frame (each) 2 required	140	63
Center counterweight	37,000	16 782
Lower side counterweight (6 required) (each)	15,500	7 030
Upper power pin with cylinder (each)	30	13
Lower power pin with cylinder (each)	20	9
Total crane counterweight	169,200	76 747
COUNTERWEIGHT - WHEELED:		
Side counterweight box (each) 4 required	20,000	9 071
Side counterweight box (each) 8 required	19,500	8 845
Center top counterweight box (each) 4 required	15,000	6 803
Center middle counterweight box (each) 2 required	21,250	9 638
Center bottom counterweight box (each) 2 required	21,250	9 638
Wheeled counterweight trailer assembly with strap cylinders	77,420	35 117
Front trailer insert	2,565	1 163
Rear trailer insert	2,565	1 163
Adapter arm	2,800	1 270
Total wheeled counterweight	462,000	209 559
COUNTERWEIGHT - CARBODY:		
Carbody center counterweight (each) 2 required	30,000	13 607
MAST ASSEMBLY - 130 ft (39,6m):		
40 ft (12,2 m) butt	10,215	4 633
40 ft (12,2 m) top with sheaves in point, links and straps	15,810	7 171
10 ft (3,0 m) insert	1,890	857
40 ft (12,2 m) insert	6,115	2 773
16 ft 10-1/4 in (5,1 m) backhitch strap (each)	355	161
17 ft 0-1/8 in (5,1 m) backhitch strap (each)	355	161
26 ft 10-5/8 in (8,2 m) backhitch strap (each)	575	260
3 ft 9-1/8 in (1,1 m) backhitch strap (each)	115	52
1 ft 1 in (0,3 m) backhitch link set (each) with pins and collars	100	45
Backhitch spreader bar	1,625	737
Backhitch link (each) attached to equalizer	55	24
Equalizer with pins	1,925	873
Mast and boom adaptor	4,305	1 952
Mast stop	2,230	1 011

Reference Only

Description	Weight Pounds	Weight Kilograms
34 ft 5-3/4 in (10,5 m) counterweight strap (each)	740	335
26 ft 10-5/8 in (8,2 m) counterweight strap (each)	575	260
26 ft 6 in (8,1 m) counterweight strap (each)	525	238
1 ft 1 in (0,3 m) counterweight link set (each) with pins and collars	100	45
2 ft (0,6 m) counterweight link set (each) with pins and collars	195	88
NO. 79 BOOM:		
30 ft (9,1 m) butt	12,165	5 517
5 ft (1,5 m) top with lower point and wire rope guide	15,595	7 073
25 ft (7,6 m) transition insert	7,340	3 329
20 ft (6,1 m) insert	6,725	3 050
40 ft (12,2 m) insert	11,145	5 055
40 ft (12,2 m) insert with equalizer platform	11,365	5 155
1 ft 0 in (0,3 m) link (each) boom top	65	29
4 ft 10-1/2 in (1,5 m) basic strap (with connector links) (each)	115	52
25 ft (7,6 m) basic strap (with connector links) (each)	350	158
20 ft (6,1 m) strap (with connector links) (each)	290	131
40 ft (12,2 m) strap (with connector links) (each)	525	238
Links (attached to equalizer) 2 with pins	75	34
Equalizer	2,160	979
Equalizer fork with pins	635	288
Equalizer weight box with jaw and hook	3,015	1 367
Upper boom point (single sheave)	725	328
Lower wire rope guide [on 40 ft (12,2 m) insert]	410	185
Upper wire rope guide [on 40 ft (12,2 m) insert]	410	185
Drum No. 9 (bare)	8,750	3 968
Boom stop (each tube)	305	138
Boom stop strut (each) with pins	30	13
NO. 44 LUFFING JIB:		
40 ft (12,2 m) butt	8,605	3 903
30 ft (9,1 m) top with lower point and wire rope guide	12,040	5 461
10 ft (3,0 m) insert - No. 44	1,890	857
20 ft (6,1 m) insert - No. 44	3,215	1 458
40 ft (12,2 m) insert - No. 44	5,420	2 458
31 ft 1-3/16 in (9,5 m) basic strap (each)	400	181
20 ft 0 in (6,1m) strap (with connector links) (each)	295	133
40 ft 0 in (12,2 m) strap (with connector links) (each)	540	244
Adjustable strap (each) with pins	1,565	709
50 ft 0 in (15,2 m) jib strut with guide sheave, luffing sheaves and links	13,285	6 025
47 ft 0 in (14,3 m) main strut with luffing sheaves and links	9,425	4 275
Luffing wire rope guide	1,070	485
38 ft 2 in (11,6 m) backstay basic strap (with connector links) (each)	410	185
20 ft 0 in (6,1 m) backstay strap (with connector links) (each)	295	133
40 ft 0 in (12,2 m) backstay strap (with connector links) (each)	540	244
8 ft 1-51/64 in (2,5 m) backstay strap (attached to boom butt) (each)	150	68
Luffing jib stop assembly	1,850	839
Upper point (single sheave) with rollers	1,220	553

Reference Only

Description	Weight Pounds	Weight Kilograms
BLOCK OPTIONS:		
300 USt (272 t) load block with swivel hook	16,500	7 484
100 USt (91 t) load block with weight plates	9,800	4 445
60 USt (55 t) load block with weight plates	4,425	2 007
30 USt (27 t) load block with weight plates	3,500	1 587
15 USt (14 t) swivel hook with weight plates	1,900	861
WIRE ROPE:		
Boom Hoist - 2,600 ft (792 m) of 1-1/8 in (28,6 mm) wire rope - 2.58 lb per ft (3,84 kg/m)	6,710	3 043
Luffing Jib Hoist		
1 in (25,4 mm) wire rope - 2.03 lb per ft (3,02 kg/m)		
1,625 ft (495 m) No. 44 Luffing Jib	2,335	1 059
Load Lines		
1-1/8 in (28,6 mm) wire rope - 2.58 lb per ft (3,84 kg/m)		
4,400 ft (1 341 m) No. 79 Boom	11,350	5 148
3,800 ft (1 158 m) No. 44 Luffing Jib	9,805	4 447
Alternate Load Lines		
1-1/8 in (28,6 mm) wire rope - 2.70 lb per ft (4,02 kg/m)		
4,400 ft (1 341 m) No. 79 Boom	11,880	5 388
3,800 ft (1 158 m) No. 44 Luffing Jib	10,260	4 653
Whip Lines		
1 in (25,4 mm) wire rope - 2.03 lb per ft (3,02 kg/m)		
1,150 ft (351 m) No. 79 Boom	2,335	1 059
1-1/8 in (28,6 mm) wire rope - 2.70 lb per ft (4,02 kg/m)		
1,375 ft (419 m) No. 44 Luffing Jib	3,715	1 685

Reference Only

ENGLISH AND METRIC CONVERSIONS

Direct Conversion

MULTIPLY (x) known value by conversion factor to obtain equivalent value in desired units. For example, 12 ft is converted to meters (m), as follows:

12 ft x 0.3048 = 3,6576 m

Inverse Conversion

DIVIDE (÷) known value by conversion factor to obtain equivalent value in desired units. For example, 3,6576 m is converted to feet, as follows:

3,6576 m ÷ 0.3048 = 12

To Convert	Symbol	Application	To	Symbol	Multiply By
AREA					
Square Inch	in^2	Filter Area Clutch Contact	Square Centimeter	cm^2	6.4516
Square Foot	ft^2	Ground Contact	Square Meter	m^2	0.0929
FORCE					
Pound Force	lb	Pedal Effort	KiloNewton	kN N	0.00445 4.4482
Pound Force	lb	Line Pull	KiloNewton	kN	0.00445
Pound Force Per Inch	lb/in.	Spring Force	Newton per millimeter	Nmm	0.1751
Pound Force Per Foot	lb/ft		Newton per meter	Nm	14.5939
LENGTH					
Inch	in.	Adjustments	Millimeter	mm	25.4000
Foot	ft	Outline Dimensions	Meter	m	0.3048
Mile	miles	Travel Distance	Kilometer	km	1.6093
POWER					
Horsepower	hp	Engine	Kilowatt	kW	0.7457
PRESSURE					
Pound/Sq. In.	psi	Hydraulic & Air	Bar		0.0689
TEMPERATURE					
Degrees Fahrenheit	°F	Oil, Air, Etc.	Degrees Centigrade	°C	°F - 32 ÷ 1.8
Degrees Centigrade	°C		Degrees Fahrenheit	°F	°C x 1.8 + 32
TORQUE					
Inch Pound	in lb	Bolt Torque	Newton Meter	Nm	0.1129
Foot Pound	ft lb		Newton Meter	Nm	1.3558
VELOCITY					
Miles Per Hour	mph	Vehicle Speed	Kilometers Per Hour	km/h	1.6093
Miles Per Hour	mph	Wind Speed	Meters Per Second	m/s	0.4470
Feet Per Minute	fpm	Line Speed	Meters Per Minute	m/min	0.3048
VOLUME					
Cubic Yard	yd^3	Bucket Capacity	Cubic Meter	m^3	0.7646
Cubic Foot	ft^3		Cubic Meter	m^3	0.0283
Cubic Inch	in^3	Pump Displacement	Cubic Centimeter	cm^3	16.3871

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To Convert	Symbol	Application	To	Symbol	Multiply By
VOLUME (LIQUID)					
Ounce	oz	Fluid Capacities	Milliliter	mL	29.5735
Pint	pt		Liter	L	0.4732
Quart	qt		Liter	L	0.9464
Gallon	gal		Liter	L	3.7854
Gallon Per Minute	gpm	Pump Flow	Liters Per Minute	L/min	3.7854
WEIGHT					
Pound	lb	Unit/Component	Kilogram	kg	0.4536
US Ton (2000 lb)	USt	Load Ratings	Metric USt	t	0.9072
US Ton (2000 lb)	USt		Kilogram	kg	907.1847

MANITOWOC DISTRIBUTORS

To locate the Manitowoc Approved Distributor nearest you:

1. Go to **www.manitowoc.com.**
2. Click on Manitowoc logo.
3. Click on ***Dealers.***
4. Follow on-screen instructions to locate distributor.

When calling a distributor with parts or service questions, you need to know the model and serial number of your crane or attachment. This information is located on the Crane Identification Label on the crane cab or on the attachment.

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SECTION 2
SAFETY INFORMATION

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SECTION 2
SAFETY INFORMATION

DIESEL ENGINE EXHAUST

WARNING

California Proposition 65

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

Battery posts, terminals, and related accessories contain chemical lead and lead compounds, chemicals known to the State of California to cause cander, birth defects, and other reproductive harm. Wash hands after handling.

California Spark Arrestor

Operation of this equipment may create sparks that can start fires around dry vegetation. A spark arrestor may be required. The owner/operator should contact local fire agencies for laws or regulations relating to fire prevention requirements.

NAMEPLATES AND DECALS

See drawings at the end of this section.

SAFETY MESSAGES

General

The importance of safe operation and maintenance cannot be over emphasized. Carelessness or neglect on the part of operators, job supervisors and planners, rigging personnel, and job site workers can result in their death or injury and costly damage to the crane and property.

To alert personnel to hazardous operating practices and maintenance procedures, safety messages are used throughout the manual. Each safety message contains a safety alert symbol and a signal word to identify the hazard's degree of seriousness.

Safety Alert Symbol

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. ***Obey all safety messages that follow this symbol to avoid possible death or injury***.

Signal Words

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION

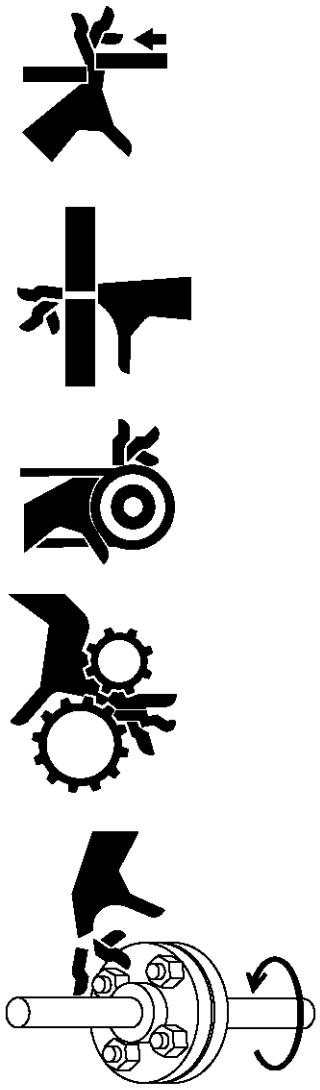
Without the safety alert symbol, identifies potential hazards that could result in property damage.

NOTE: Highlights operation or maintenance procedures.

Safety Symbols

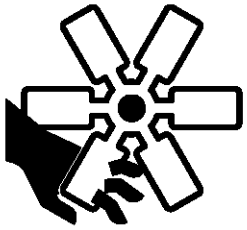
Safety symbols used in the decals on this crane are identified in Figure 2-1.

Reference Only

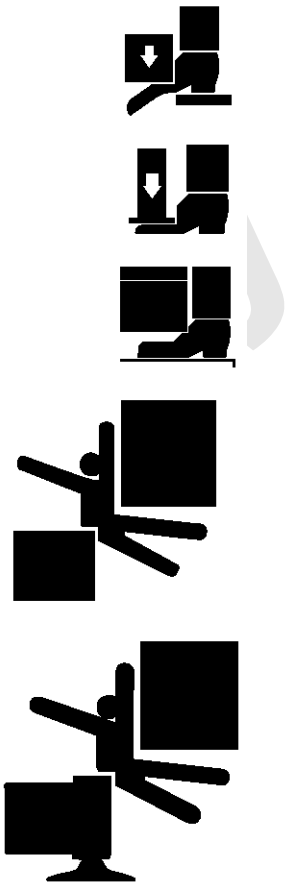


Cut or Crush Hazards

Cut Hazard



Crush Hazards



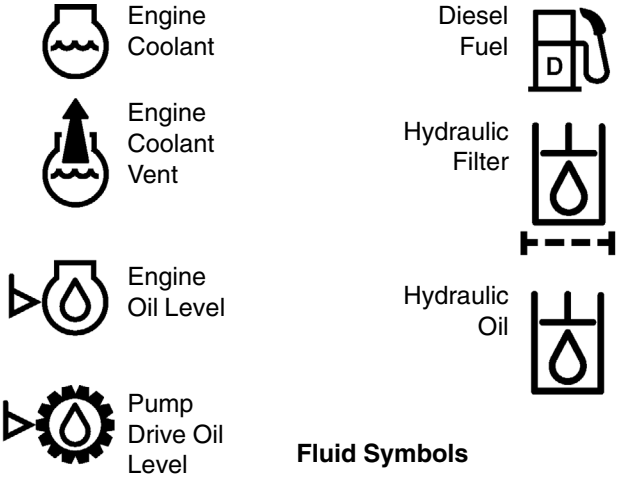
Electrocution Hazard

Explosion Hazard

Fall Hazard

FIGURE 2-1

Fall Hazards

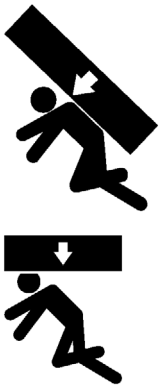


Fluid Symbols

Falling Boom Hazards (Crush Hazard)

Flying Object Hazards

Overhead Obstruction Hazard



Falling Load Hazards (Crush Hazard)

Fire Extinguisher

Power Line Hazard (Electrocution)

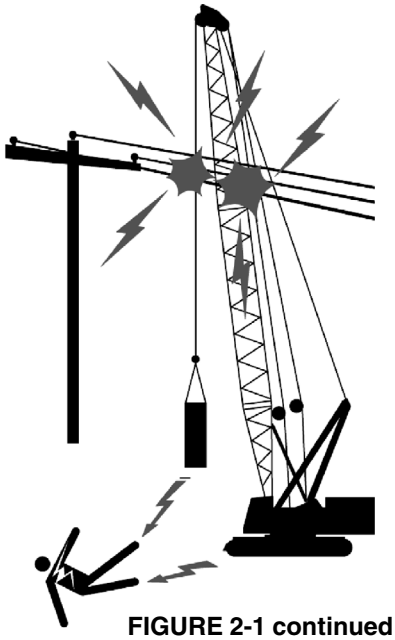
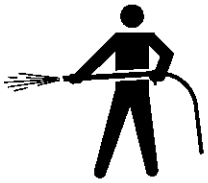


FIGURE 2-1 continued

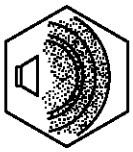
Personal Fall Protection



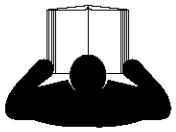
Pressure Cleaning

Pressure Release Hazard

Sound Power Level



Read Manual



Tire Pressure (if applicable)

FIGURE 2-1 continued

Reference Only

SAFETY AND INFORMATION SIGNS

Maintaining Signs

The crane owner/user shall make sure that all signs are legible and installed at the proper locations on the crane. If a sign has been defaced or removed, it must be replaced immediately. See Nameplates and Decals Drawing at the end of this section for the installation locations of signs.

Ordering Signs

Order replacement signs from your local Manitowoc Dealer or Crane Care Customer Service at Manitowoc at following address:

Manitowoc Crane Care
2401 So. 30th St.
Manitowoc, WI 54220

Phone: 1-888-499-7278
Fax: 1-920-683-6278
Email: latticeteam@manitowoc.com

When ordering a sign, give the crane model number, the crane serial number, and the name and part number of the sign (Figure 2-2). If the sign has a figure number, it can be used if the drawing number is missing.

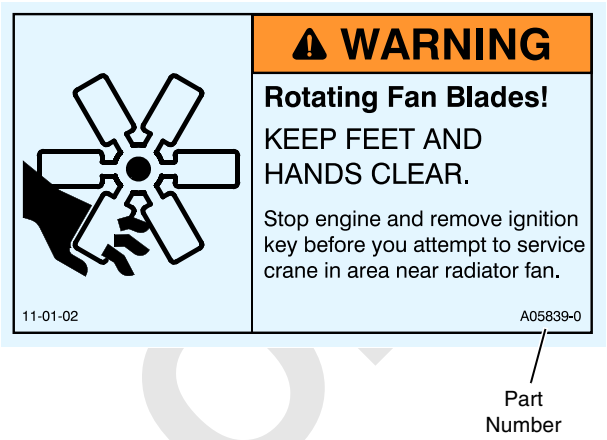


FIGURE 2-2

Reference Only

CRANE ACCESS POINTS

WARNING

Crushing Injury Hazard!

Rotating bed can swing into and crush personnel climbing on or off crane.

Moving crawlers can crush personnel climbing on or off crane.

To prevent death or serious injury:

- Barricade all accessible areas to crane so personnel cannot be struck or crushed when upperworks is swung. See Swing Radius Barrier topic in this section.
- Do not climb on or off crane while upperworks is being swung or crane is being traveled.
- Signal operator for permission to climb on or off crane.
- Operator: do not swing or travel while personnel are climbing on or off crane. Stop swing and travel motions. Apply swing brake and turn on travel park.
- If equipped, automatic alarms will sound to alert personnel when the crane is swung or traveled.

NOTE: If the swing and travel alarms are not operating properly, they must be repaired as soon as possible. Until they are repaired, the operator must alert personnel to crane movement using the horn on the control console.

Take necessary precautions to prevent slipping and /or falling off the crane or attachment during assembly, disassembly, maintenance, or other work. ***Falling from any height could result in serious injury or death.***

Manitowoc has provided stairways, ladders, and platforms at the locations shown in Figure 2-3.

The owner/user must provide workers with approved ladders or aerial work platforms to access those areas of the crane, mast and boom that cannot be reached from the ground or from steps, ladders, catwalks, and platforms provided by Manitowoc.

Adhere to local, state, and federal regulations for handling personnel and for personnel fall protection.

- Access points must be kept clear to prevent personal injury and unsafe operation of crane. The operator must store his/her clothing and other personal belongings so they do not interfere with controls in operator's cab or with operation of crane.
- Do not allow ground personnel to store their personal belongings (clothing, lunch boxes, water coolers, and the like) on the crane.

  This practice will prevent ground personnel from being crushed or electrocuted when they attempt to access personal belongings stored on the crane.
- Tools, oil cans, spare parts, and other necessary equipment must be stored in tool boxes or other appropriate locations. Do not allow these items to lie around loose in operators cab or on steps, ladders, catwalks, and platforms.
- To reduce the risk of slipping, non-skid material (sand in paint) has been applied to painted walkways and platforms. However, walkways and platforms can be slippery when wet and when oil or grease is spilled on them. ***Keep walkways and platforms clean and dry to prevent slipping on them.*** When non-skid material wears out, reapply it.
- Wear shoes with a highly slip-resistant sole material. Clean any mud or debris from shoes before entering the crane cab or climbing onto the crane. A shoe that is not clean might slip off a control pedal during operation.
- Do not make modifications or additions to the crane's access system that have not been evaluated and approved by Manitowoc.
- Do not use top of mast, boom or jib as walkways (unless they have optional catwalks).

NOTE: Optional walkways (catwalks) are available for the boom and luffing jib sections, but only for those countries that authorize their use.

Two ladders, stored in the boom butt, are available for boom assembly and disassembly. See Boom Ladder Assembly in Section 4 of this manual for instructions.

GETTING ON OR OFF CRANE

Personnel getting on and off the crane shall do so only at the steps provided and only ***while crane is parked***.

Never climb onto or off a moving crane. ***Climb onto and off crane only when it is parked and only with operator's permission***.

When personnel use ladders to get on or off the crane or attachment, their hands shall be free of any objects. Objects which cannot be carried in pockets or tool belts shall be lifted into place with a hand line or hoist.

Always maintain three points of contact when climbing ladders: two feet and one hand or two hands and one foot.

Retention Only

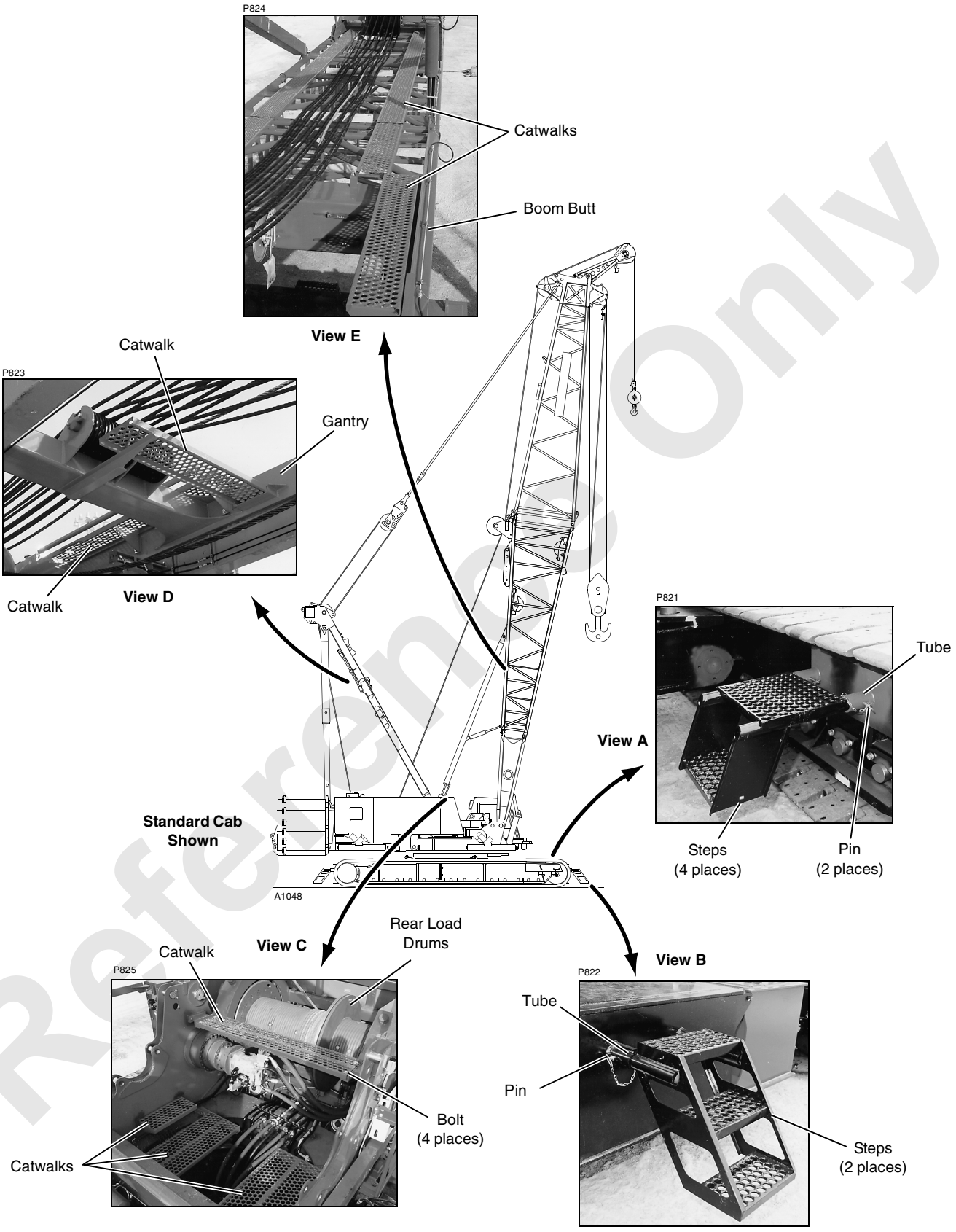


FIGURE 2-3

Reference Only

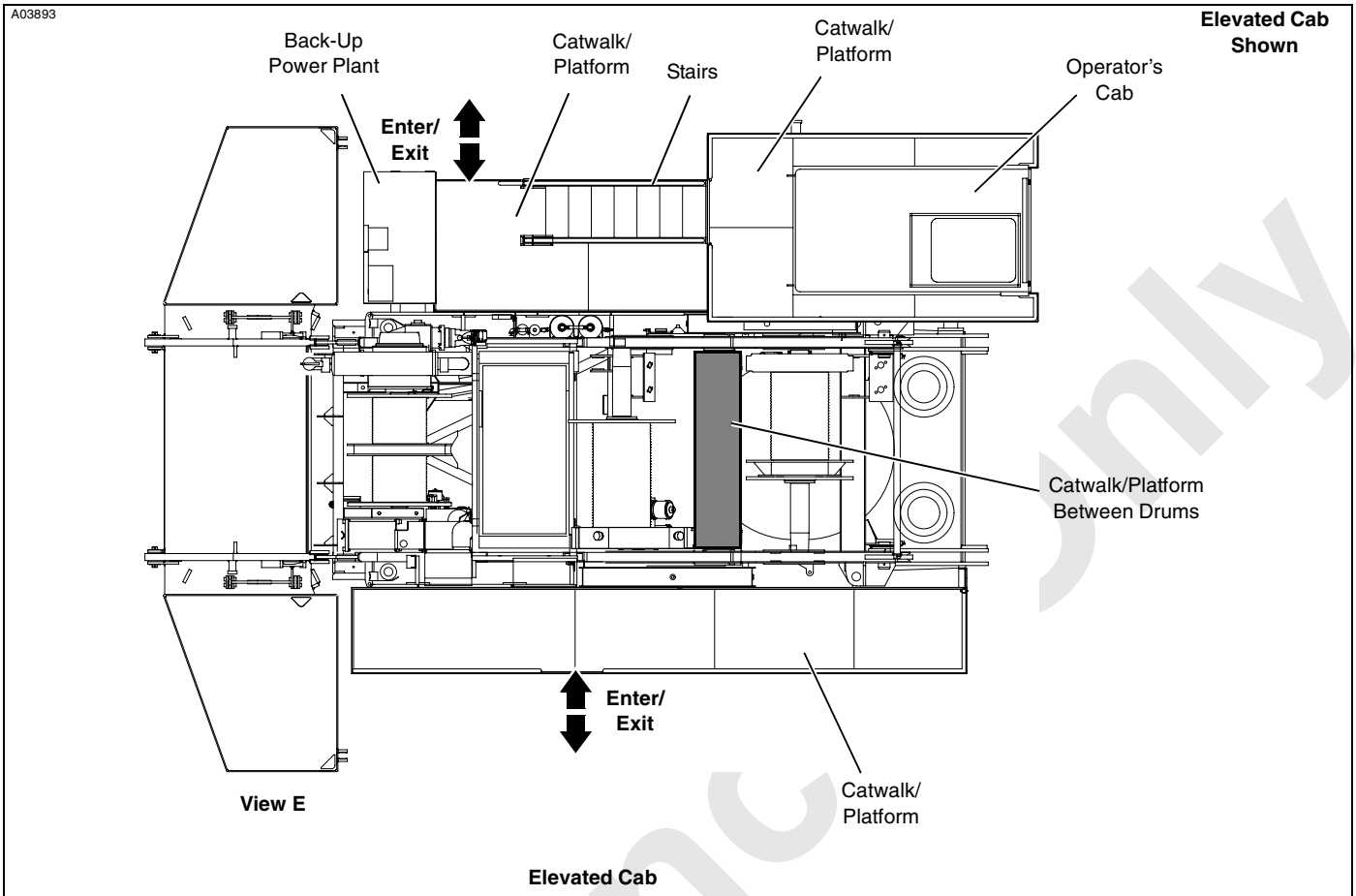


FIGURE 2-3 continued

Reference Only

OPERATOR'S MANUAL/CAPACITY CHART STORAGE

Manitowoc provides the following manuals and other important literature with your crane and attachment (Luffing Jib, etc.):

- Operator's Manual (Serial Numbered)
  Contains safety information, crane specifications, assembly/erection procedures, operating instructions, lubrication and maintenance checks.
- Parts Manual (Serial Numbered)
  Contains illustrations and part numbers of replaceable parts.
- Capacity Chart Manual (Serial Numbered)
  Contains lifting capacities and related information (wire rope specifications, drum and lagging information, etc.)
- Maintenance Checks and Lube Guide
  Contains lists of maintenance checks and lube services and their prescribed intervals.
- Rated Capacity Indicator/ Limiter Operation
  Contains rated capacity indicator and/or rated capacity limiter operation, limits, and calibration procedures.
- Service Manual (Serial Numbered)
  Contains theory of operation, maintenance procedures, crane and wire rope inspection procedures, troubleshooting information, and shop procedures.

The manuals which must be retained in the operator's cab (Operator's Manual, Capacity Charts, Maintenance Checks and Lube Guide, and RCL Operation) are supplied in an OPERATOR INFORMATION binder. A separate binder is provided for the crane and each applicable attachment.

The Operator's Manuals and Capacity Charts are stamped with the serial number of the crane or attachment. The serial number on the manuals and capacity charts must match the serial number of the crane and attachment in use. ***Using any other manual or Capacity Chart is prohibited.***

- The crane model and serial number is located on the Crane Identification Plate on the crane cab.
- The model and serial number of the attachment (other than standard boom) is located on the Crane Identification Plate on the attachment.

If the serial numbers of your manuals and Capacity Charts do not match the serial numbers of the crane or attachment, contact your Manitowoc distributor for the proper manuals or Capacity Charts.

Do not operate crane or attachment if proper Capacity Chart is not in cab.

Storing Manuals

Store the Operator Information Manuals for the crane and each applicable attachment in the holder in the Operator's cab (Figure 2-4).

Chain the manual to the link provided.

Keep all other manuals provided with the crane in the crane owner's/user's office so they are readily available when needed.

FIGURE 2-4

Reference Only

SAFE OPERATING PRACTICES

General

The importance of safe operation cannot be over emphasized. Carelessness and neglect on the part of operators, supervisors and planners, rigging personnel and job site personnel can result in their death or injury and costly damage to the crane or property.

The safety information in this publication is intended only as a guide to assist qualified operators, supervisors and planners, rigging personnel, and job site personnel in safe operation. Manitowoc cannot foresee all hazards that will arise in the field; therefore, ***safety remains responsibility of crane operators and owner.***

Local, state, and other governmental agencies may require stricter operating practices. When a conflict in practices exists, follow the strictest practice.

Read Operator's Manual

Safe and efficient assembly, disassembly, and operation of this crane requires that it be maintained in proper working order and that its operators and maintenance personnel be familiar with the crane's functions and capabilities.

The Operator's Manual supplied with and considered part of your crane must be read and completely understood by each person responsible for assembly, disassembly, operation and maintenance of the crane.

The Operator's Manual must be read to personnel who can not read or understand English or other language the manual is translated into.

Because of a program of continuing improvement in product design, Manitowoc reserves the right to change the information and specifications contained in the Operator's Manual at any time without notice. If you have any questions regarding the crane or its Operator's Manual, please contact your Manitowoc distributor.

Operator Qualifications

The crane shall be operated only by the following ***qualified*** personnel:

1. Designated operators.
2. Trainees under direct supervision of a designated operator.
3. Supervisors, inspectors and maintenance or test personnel when necessary in performance of their duties. Operation of the crane by these personnel shall be limited to the crane functions needed to perform the inspection or to verify the crane's performance after maintenance procedures.

   No personnel shall be allowed to climb onto the crane or enter the crane cab unless performance of their duties require them to do so, and then only with knowledge of the operator or other qualified person.

Qualified person is defined as one who by reason of training and experience is thoroughly familiar with crane operations and the hazards involved. Such a person shall meet the operator qualifications specified in Occupational Safety and Health Administration (OSHA) Regulations (United States Federal Law), in ASME B30.5 American Nation Standard, or in any other applicable federal, state, or local laws.

Operator training and qualification is crane owner's responsibility.

NOTE: The regulations and standards mentioned above and later in this section cab be obtained from:

US DOL/OSHA Rules and Regulations are available by mail from the Superintendent of Documents, PO Box 371954, Pittsburgh, PA, 15250-7954 or by:

- Phone 202-512-1899
- Fax 202-512-2250
- Online at www.osha.gov.

ASME (formerly ANSI) B30 Series American National Standards are available by mail from the ASME, 22 Law Drive, Fairfield, New Jersey, 0700-2900 or by:

- Phone US & Canada 800-843-2763
- Phone Mexico 95-800-843-2763
- Phone Universal 973-882-1167
- Fax 973-882-1717 or 973-882-5155
- E-mail infocentral@asme.org.

Operator Conduct

1. The operator shall not engage in any practice which diverts his/her attention while operating crane.
2. The operator shall not operate crane when physically or mentally unfit.
3. The operator shall be responsible for all operations under his/her direct control. When safety of an operation is in doubt, the operator shall stop the crane's functions in a controlled manner. Lift operations shall resume only after safety concerns have been addressed or the continuation of crane operations is directed by the lift supervisor.

Reference Only

4. The operator shall be thoroughly familiar with the operation of the crane and its proper care. If adjustments or repairs are necessary or if there are known defects that impair safe operation, the crane shall not be operated until unsafe conditions have been corrected.
5. If there is a warning sign at the start controls, the operator shall not start the engine until the warning sign has been removed by the person who installed it.
6. Before starting the engine, the operator shall make sure that:
   a. All daily inspection and maintenance services have been performed.
   b. All controls are in the off position and all brakes and locking devices are applied or engaged.
   c. All personnel are clear of the crane. If equipped, deploy a swing radius barrier available from Manitowoc (see instructions in this section).
7. The operator shall test all controls, limits, and communication systems at the start of each shift. Any defects found shall be corrected before operation is begun.

WARNING

Safety devices and operational aids such as rated capacity indicator or limiter, boom and jib angle indicator or limiter, anti-two-block device, level indicator, swing limiter, proximity device, etc., may be installed on your crane. Such devices are to be used only as ***AIDS TO ASSIST OPERATOR***; their presence on crane in no way substitutes for or lessens requirement that operator knowledge, experience, and judgment are required to ensure safe operation of crane.

Crane shall not be loaded beyond applicable static or dynamic ratings given on Capacity Chart for crane.

- See Size of Load topic later in this section.
- For a description of each safety device and operational aid, see Safety Devices and Operational Aids in this section and Section 3 of this manual.

8. The operator shall not start crane movement if the load or designated signal person is not within his/her range of vision or communication.
9. The operator shall understand and respond to signals from the person directing the lift or from the designated signal person. When a signal person or crane follower is not required, the operator is responsible for lift. ***Operator shall obey a stop signal at all times, no matter who gives it.***
10. The operator shall verify that the Capacity Chart being used is the correct one for how the crane is equipped (boom length, load line reeving, counterweight, etc.).
11. The operator shall verify that:
    a. All attachments are properly assembled and attached to the crane according to the rigging drawings called for on the Capacity Chart.
    b. The counterweight — to include applicable auxiliary counterweight — is in place and of proper weight. ***Maximum required counterweight shall not be exceeded.***

WARNING

Moving Load/Tipping Crane Hazard!

Changing weather conditions including but not limited to: wind, ice or snow accumulation, precipitation, flooding, lightning, etc. should be considered when determining the location and configuration of a crane when it will be left unattended.

12. The operator shall perform the following operations before leaving the operator's cab for any reason:
    a. Park crane (if mobile) and position upperworks so the crane does not interfere with operation of other equipment.
    b. Apply travel and swing brakes or locking devices.
    c. Land any attached load.
    d. Lower the boom onto blocking at ground level or onto a boom rest if possible.

       If the boom cannot be lowered, as determined by a qualified designated person, it must be securely fastened from movement by wind or other outside forces (see Wind Conditions in Capacity Chart Manual).

NOTE: The designated person must be familiar with the job site limitations, the crane configuration, and the expected weather conditions.

    e. Move all controls to off.
    f. Apply all drum brakes and pawls.
    g. Disengage master clutch, if equipped.
    h. Stop the engine.

NOTE: Also read Unattended Crane Instructions in Section 3 of the Crane Operator's Manual.

13. The operator shall perform the following operations if power or a control function fails during operation:

Reference Only

a. Land all suspended loads, if possible, under brake or power control.

b. Apply all brakes and locking devices.

c. Move all controls to off.

14. If the crane will be operated at night, the operator shall make sure that there is sufficient lighting for safe operation. The load and landing area shall be illuminated.

15. The operator shall not operate the crane during periods of bad weather if his or her ability to see the load or the signal person is impaired by darkness, fog, rain, and the like.

Do not operate the crane with a snow or ice-covered boom or jib. The extra weight may cause overload, tipping or structural damage.

Never operate the crane during an electrical thunderstorm.

When a local weather storm warning exists (including electrical thunderstorm), stop operation and secure the crane. See step 12 under Operator Conduct topic.

NOTE: 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 conductor (wire) used, condition of the ground, the magnitude of voltage and current present, and numerous other factors.

16. Wind can cause crane to tip or the boom and other attachments to collapse. The operator or qualified person directing the lift shall compensate for the effect of wind on the load and boom by reducing ratings, reducing operating speeds, or a combination of both.

Unless otherwise specified on the Capacity Chart, or in Operator's Manual, stop operation under the following wind conditions:

a. If the wind causes the load to swing forward past the allowable operating radius or sideways past either boom hinge pin, land the load and apply the drum brakes.

b. If the wind exceeds 35 mph (56 km/h), land all loads and apply drum brakes, lower the boom onto blocking at ground level or otherwise restrain it, and apply the swing and travel brakes and/or locks.

NOTE: ***"Land load"*** means to set it down on a firm uniformly supporting surface.

17. Booms, jibs, or masts which are being assembled or disassembled on the ground (with or without support of boom rigging) shall be securely blocked to prevent dropping of boom, jib, or mast sections.

Workers shall not go under boom, jib, or mast sections when removing connecting pins or bolts.

18. Each outrigger shall be visible to the operator or the signal person during extension and retraction.

Handling Load

Size of Load

1. The crane shall not be loaded beyond the applicable static or dynamic ratings given in the Capacity Chart for the crane configuration.

NOTE: Capacity charts for Manitowoc cranes show total weight of freely suspended loads for various boom lengths and operating radii.

"Freely suspended load" is a load that is hanging free with no direct external force applied except by the crane's load-line reeving.

To determine the actual weight of the load which can be lifted at a given radius (working load), the operator must deduct weight of certain lifting equipment from the total weight given in the chart. See the specific Capacity Chart for your crane for a list of lifting equipment which must be deducted.

The operator's judgment must be used to further reduce the total weight to allow for the dynamic effects of swinging, hoisting, or lowering, and adverse weather conditions to include wind.

2. The operator or other designated person directing the lift shall verify that the weight of the load is within the static or dynamic rating for the radius at which the load will be lifted.

Verified weights and measured radii shall take priority over RCI/RCL readings.

Attaching Load

1. Attach the hook to the load with slings, or other suitable rigging. Each hook shall have a latch that is in the proper working order. ***Hook latches shall not be wired open.***

a. Inspect each hook and latch before using.

b. Never use a hook or latch that is distorted or bent.

c. Make sure the spring will force the latch against the tip of the hook.

d. Make sure the hook supports the load. The latch must never support the load. Latches are only intended to retain loose slings under slack conditions.

Reference Only

2. Only use slings and other rigging that are in safe operating condition and have a rating equal to or greater than the load to be lifted.
3. Do not wrap the load line around the load.
4. Use suitable protection between slings and any sharp edges on the load. When synthetic slings are used, the synthetic sling manufacturer's instructions, limitations, specifications, and recommendations must be followed.
5. Secure unused legs of a multi-leg sling before handling a load with one leg of sling.

Lifting/Moving Load

1. Before lifting or moving a load, the operator or qualified person directing the lift shall make the following checks:
   - **a.** Crane has a firm uniformly supporting foundation under both crawlers, all tires, or each outrigger jack pad or float. Unless otherwise specified in Capacity Chart, the foundation shall be ***level to within 1%*** — 1 ft (0,3 m) rise or fall in 100 ft (30,5 m) distance.

     When such a surface is not available, it shall be provided with timbers, cribbing, or other structural members to distribute the load such that the allowable bearing capacity of the underlying member is not exceeded.

     For ground bearing data go to: www.manitowoccranes.com/site/EN/groundbearingpressure.aspx.
   - **b.** The load is secured and properly balanced in the slings or the lifting device before lifting the load more than 3 to 6 in (76 to 152 mm).
   - **c.** The lift and swing paths are clear of personnel and obstructions.
   - **d.** The load is free to be lifted.
   - **e.** The load line is not kinked or otherwise damaged.
   - **f.** Multiple part load lines are not twisted around each other in such a manner that the lines will not separate when the load is lifted.
   - **g.** The hook is brought over the load in a manner that will minimize twisting or swinging.
   - **h.** The load line and the boom hoist ropes are properly spooled on the drums and seated in the sheaves.
   - **i.** The load drum brakes are in proper working order.

     The operator shall test the load drum brakes each time a load approaching the rated load is handled. Lift the load 3 to 6 in (76 to 152 mm) and fully apply brakes — ***load must not lower through applied brakes.***
   - **j.** Unused load drums are parked (working and parking brakes applied; if equipped, drum pawls engaged).
   - **k.** All personnel are clear of the swing radius of the crane's counterweight.
2. While lifting or moving the load, the operator shall take the following precautions:
   - **a.** Accelerate and decelerate the load smoothly to avoid excessive stress on the crane boom and machinery.
   - **b.** Avoid sudden starts and stops while swinging. Keep the swing speed under control to prevent the load from swinging out beyond radius at which the load can be handled and to minimize the pendulum action of the load.
   - **c.** Sound the signal horn before swinging and intermittently while swinging, especially when approaching personnel.

     If equipped, the automatic swing alarm will sound when the crane is swung.
   - **d.** Use taglines or other restraints to control the load when necessary.
   - **e.** Do not exceed any swing limitations (areas of operation) given in the Capacity Chart.
   - **f.** Do not allow the load, the boom, or any other part of crane to contact obstructions.
   - **g.** Do not use the crane to drag a load.
   - **h.** Do not hoist, lower, or swing the load while personnel are on the load or the hook. See Personnel Handling in this section.
   - **i.** Avoid carrying the load over personnel. Loads which are suspended shall be blocked or cribbed before personnel are allowed to work under or between them.
   - **j.** Before lifting a load which requires the use of outriggers (or anytime outriggers are used), fully extend the outrigger beams and jacks so the truck tires do not bear any load.

     Securely fasten the outrigger jack pads or floats to jacks and set them on a flat, firm surface that will support the load placed on the pads or floats. Do not set the jack pads or floats in holes, on rocky ground, or on extremely soft ground.

     When dictated by ground conditions, install wood blocking or steel plates under the jack pads or floats to properly distribute the loading on the supporting surface.

     Wood blocking or steel plates used under the jack pads or floats shall be:

Reference Only

- Free of defects.
- Strong enough to prevent crushing, bending, or shear failure.
- Of sufficient thickness, width, and length to completely support the jack pad or float, transmit the load to the supporting surface, and prevent shifting, toppling, or excessive settlement under load.

k. Fully retract and lock the jacks and the outrigger beams so they cannot extend when not in use.

l. Operate with extreme caution when using two or more cranes to lift the same load.

One designated person shall be responsible for operation when two or more cranes are used to lift the same load. The designated person shall analyze the lift and instruct all personnel involved in proper rigging and positioning of the load and all movements to be made. Decisions such as the necessity to reduce crane ratings, load position, boom position, ground support, and speed of movements shall be in accordance with the designated person's decision.

m. Do not lower load or the boom to a point where less than three full wraps of wire rope remain on the respective drum (or as otherwise indicated in local, state, or federal regulations).

n. Engage the boom hoist pawl when operating with the boom at a fixed radius.

o. Engage the luffing hoist pawl when operating with the luffing jib at a fixed radius.

3. While traveling, the operator shall take following precautions:

a. Sound the signal horn before traveling and intermittently while traveling, especially when approaching personnel.

If equipped, the automatic travel alarm will sound when the crane is traveled.

b. Carry the boom in-line with the lowerworks and facing the direction of travel.

c. Do not position the boom so high that it could bounce over backwards whether traveling with or without load.

d. Secure the rotating bed against rotation except:

- When operating with a MAX-ER attachment.
- When it is necessary to negotiate a turn, and then only when the operator is seated at the controls or the boom is supported on a dolly.

e. Lash or otherwise restrain unused hooks so they cannot swing freely.

4. Before traveling with a load, the operator shall take the following additional precautions:

a. A designated person shall be responsible for operation. Decisions such as the necessity to reduce crane ratings, load position, boom position, ground support, and speed of movements shall be in accordance with designated the designated person's decision.

b. Maintain specified tire pressures (truck cranes).

c. Avoid sudden starts and stops. Use taglines or other restraints to control the position of the load.

Reference Only

Multiple Load Line Operation

WARNING

Avoid Over Load and Side Load Damage to Crane

Manitowoc highly recommends that you contact your Manitowoc distributor for lift planning assistance and approval.

Multiple load line operation is becoming common practice for applications like panel tilt-up, pile tilt-up, pile driving, rolling fabricated sections, etc. The multiple lines may be on a common shaft (each with different parts of line) or on multiple shafts (lower boom point and upper point, boom point and fixed jib point, etc.).

Manitowoc authorizes multiple load line operation for those applications requiring it, provided following steps are performed:

1. The qualified lift planner and the crane operator shall read and become thoroughly familiar with the appropriate Capacity Charts and Wire Rope Specification Charts.
2. The lift planner and the crane operator shall make sure the total load does not exceed the rated capacity given in the Capacity Chart and Wire Rope Specification Chart for given boom point or jib point, whichever is less.

   EXAMPLE: If one load line is lifting from the jib point, the proper jib chart applies.
3. The crane shall be thoroughly inspected by a qualified person prior to setup.
4. The crane shall be thoroughly inspected for load line interference caused by routing and reeving of multiple load lines. If interference is found, it shall be eliminated.
5. For cranes produced before 2003, Rated Capacity Indicators/Limiters were not required by ASME B30.5 for non-personnel lifting.

   To aid operator in staying within the crane's Capacity Chart with the total applied load, Manitowoc recommends that its cranes be equipped with Rated Capacity Indicators/Limiters to monitor load on each load line.

   Operator is still responsible knowing load and radius whether or not crane is equipped with load indicator(s).
6. Manitowoc recommends that each load line be equipped with an anti two-block device.
7. Manitowoc's Capacity Charts are based on freely suspended loads. To prevent side load damage to the boom, the jib, and the sheaves:
   - The load lines must hang as near vertical as possible to minimize side and forward loads.

     The distance between the load points and the hook points must be a minimum of three times the horizontal distance between the hook point on the load being lifted.
   - The load must remain centered on boom and jib point shafts unless special lift approval is granted by Manitowoc.
   - The load lines should be located over load's center of gravity as it is supported on a trailer, a barge, or the ground.
8. The crane operator must be familiar with the operational characteristic of the crane as it relates to multiple drum operation (simultaneous operation, same or opposite direction, or individual operation).
9. When using tandem drums, the maximum operating layers may be limited depending on whether the crane was initially designed for tandem drum operation or not.
10. Load shift when lifting with two hooks may be more unpredictable than typical one hook lifting.

Holding Load

When a load is suspended, operator shall take the following precautions:

1. Not leave his/her position at controls.
2. Not allow personnel to stand or pass under load.
3. Move all controls to off, apply all drum brakes, engage the boom hoist pawl, and apply the swing and travel brakes or locks.

SIGNALS

1. Continuous communication shall be maintained between the operator and the signal person during all crane movements. If communication is disrupted, ***operator shall stop all crane movements***.
2. Signals to the operator shall be in accordance with the standard signals shown in Section 3, unless communications equipment (telephone, radio, etc.) is used.
3. All signals shall be easily understood by the operator at all times. The operator shall not respond to any signals which are not clearly understood.
4. For operations not covered in the standard signals, or for special situations or emergencies, additional signals may be required. In those cases, the signals used shall be agreed upon in advance by the operator and the signal person. The signals used shall not conflict with or have potential to be confused with the standard signals.

Reference Only

5. When it is necessary to give instructions to the operator (other than those established by signal system), all crane motions shall be stopped.
6. Signal person shall:
   a. Be tested by a designated person and show that he or she has a basic understanding of crane operations and limitations, to include boom deflection.
   b. Be thoroughly familiar with standard hand signals and voice signals if used.
   c. Be positioned in clear view of the operator. The signal person's position should give him or her a clear view of the load, the crane, and the operating area.
   d. Direct the load so it does not pass over personnel.
   e. Keep unnecessary personnel out of the crane's operating area.
7. When moving the crane, the following audible signals shall be used:
   a. STOP - one short audible signal.
   b. GO AHEAD - two short audible signals.
   c. BACK UP - three short audible signals.

SAFETY DEVICES

WARNING

Do not operate crane unless all safety devices listed in this section are in proper working order.

- If a safety device stops working properly during operation, the operator must safely stop operation.
- If any safety device listed in this section is not in proper working order, the safety device must be taken out of service and crane operation must not resume until the safety device is again working properly.
- Alternative measures are not permitted to be used for a faulty safety device.
- Always tag-out any faulty safety device and place a warning tag in the cab stating that the crane is out of service and must not be used.

Manitowoc provides the following safety devices on its cranes.

1. Horn activated by a switch on the control console in the operator's cab.

   If the horn is not working properly, it must be tagged-out or removed if possible.
2. Crane level indicator: either electronic (viewable in crane's electronic display) or mechanical (viewable from operator's cab seat). If the crane level indicator is not working properly, it must be tagged-out or removed if possible.
3. Cranes operating on a barge require: a trim indicator, a swing brake, and a wind direction indicator if the wind is a factor (supplied by crane owner or user).
4. Boom stops, both physical and automatic.

   If a boom stop is damaged or not working properly, it must be tagged-out or removed if possible.
5. Jib stops, both physical and automatic (for fixed jib and luffing jib).

   If a jib stop is damaged or not working properly, it must be tagged-out or removed if possible.
6. Pedal locks for all foot-operated brakes (if applicable).

   If a pedal lock is damaged or not working properly, it must be tagged-out or removed if possible.
7. A integral holding device or check valve on each jacking cylinder.

OPERATIONAL AIDS

WARNING

Do not operate crane unless all applicable operational aids listed in this section are in proper working order, except:

- Where an operational aid is being repaired.
- The crane user implements a specified temporary alternative measure.

If an operational aid stops working properly during operation, the operator must safely stop operation until the temporary alternative measures are implemented or the device is again working properly.

Manitowoc provides the following operational aids on its cranes, either as standard equipment or optional equipment. The operational aids are designated as Category 1 or Category 2:

Category 1 Operational Aids

If a Category 1 operational aid is not working properly, it must be repaired no later than 7 calendar days after the deficiency occurs.

Exception: If the crane user documents that he/she has ordered the necessary parts within 7 calendar days of the

Reference Only

occurrence of the deficiency, the repair must be completed within 7 calendar days of receiving the parts.

1. **Boom or Luffing Jib Angle Limiter**
(automatic boom or jib stop)

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift shall make sure the maximum boom or jib angle/radius specified on the Capacity Chart for the load being handled is not exceeded. One or more of the following methods must be used:

a. Measure radius using a tape measure.

b. Measure the boom angle with a protractor-level on the centerline of boom.

c. Clearly mark the boom or luffing hoist cable (so it can easily be seen by the operator) at a point that gives the operator sufficient time to stop the boom or jib within the minimum allowable radius.

In addition, install mirrors or remote video cameras and displays if necessary for the operator to see the mark.

d. Clearly mark the boom or luffing hoist cable (so it can easily be seen by a designated signal person) at a point that gives the signal person sufficient time to signal the operator and have the operator stop the boom or jib within the minimum allowable radius.

2. **Anti-Two-Block Device**

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift shall establish procedures to furnish equivalent protection. One or more of the following methods must be used:

a. Assign a signal person to signal the operator to stop hoisting when the load is a safe distance from the boom or jib point.

b. Clearly mark the hoist cable (so it can easily be seen by the operator) at a point that will give the operator sufficient time to stop the load a safe distance from the boom or jib point.

NOTE: The temporary alternative measures for the anti-two-block device do not apply when lifting personnel in load line supported baskets. ***Personnel shall not be lifted in load line supported baskets when anti-two-block devices are not functioning properly***.

Category 2 Operational Aids

If a Category 2 operational aid is not working properly, it must be repaired no later than 30 calendar days after the deficiency occurs. Exception: If the employer documents that it has ordered the necessary parts within 7 calendar days of the occurrence of the deficiency, and the part is not received in time to complete the repair in 30 calendar days, the repair must be completed within 7 calendar days of receiving the parts.

1. **Rated Capacity Indicator/Limiter**

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift shall establish procedures for determining load weights and shall make sure that the weight of the load does not exceed the crane's rating at the radius where the load is handled.

The weight of the load must be provided to the operator before the lift is made.

2. **Boom Angle** or **Radius Indicator**

Temporary alternative measures if inoperative or malfunctioning:

a. Refer to the pendulum boom angle indictor on the boom butt (viewable from operator's cab).

b. Measure the boom angle with a protractor-level on the centerline of boom.

c. Measure radius using a tape measure.

3. **Jib Angle** or **Radius Indicator**

Temporary alternative measures if inoperative or malfunctioning. Use either or both:

a. First, make sure you know the boom angle (see item 2 above).

b. Then, measure the radius using a tape measure.

4. **Drum Rotation Indicator**

Temporary alternative measures if inoperative or malfunctioning:

Mark the drum to indicate its rotation.

If the operator cannot see the drum, add mirrors or remote video cameras and displays so the operator can see the mark.

5. OPTIONAL **Swing Limiter** or **Proximity Device**

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift shall establish procedures to furnish equivalent protection (for example, assign an additional signal person to observe the distance between the boom or load and job site obstructions to include power lines or to limit the swing sector specified on the Capacity Chart).

Reference Only

6. OPTIONAL **Drum Spooling Limiter** (maximum or minimum bail limit)

   Temporary alternative measures if inoperative or malfunctioning:

   The qualified person directing the lift, the operator, or a designated signal person shall watch the drum and signal the operator to stop it before it is over spooled (rope does not jump off drum) or before there are less than 3 full wraps of wire rope on the load drum or boom hoist.

7. OPTIONAL **Closed-Circuit Television** (CCTV)

   Temporary alternative measures if inoperative or malfunctioning:

   A designated signal person shall watch the load, the drums, and the counterweight and provide necessary hand or voice signals to the crane operator.

ASSEMBLING, DISASSEMBLING, OR OPERATING CRANE NEAR ELECTRIC POWER AND TRANSMISSION LINES

Electrocution Hazard

Thoroughly read, understand, and abide by all applicable federal, state, and local regulations regarding operation of cranes near electric power lines or equipment.

United States federal law prohibits the use of cranes closer than 20 ft (6 m) to power sources up to 350 kV and greater distances for higher voltages unless the line's voltage is known [29CFR1910.180 and 29CFR1926.1400].

To avoid death or serious injury, Manitowoc recommends that all parts of crane, boom, and load be kept at least 20 ft (6 m) away from all electrical power lines and equipment less than 350 kV.

NOTE: For detailed guidelines on operating near power lines, refer to the current edition of OSHA 29CFR1926.1400 AND ASME B30.5 American National Standard.

WARNING

Electrocution Hazard!

Manitowoc cranes are not equipped with all features required to operate within OSHA 29CFR1926.1408, Table A clearances when the power lines are energized.

1. Keep all personnel and their personal belongings (clothing, water coolers, lunch buckets, etc.) away from the crane if it is being operated near electrical power lines or equipment.
2. Before operating the crane in the vicinity of electrical power lines or equipment, notify the power utility company. Obtain positive and absolute assurance that the power has been turned off.

   The crane is NOT INSULATED. Always consider all parts of the load and the crane, including the wire rope, pendants or straps, and tag lines as conductors.

   Most overhead power lines ARE NOT insulated. Treat all overhead power lines as being energized unless you have reliable information to the contrary from the utility company or owner.

   The rules in this section must be followed at all times, even if the electrical power lines or equipment have been de-energized.
3. Crane operation is dangerous when close to an energized electrical power source. Exercise extreme caution and prudent judgement. Operate slowly and cautiously when in the vicinity of power lines.
4. If the load, wire rope, boom, or any portion of the crane contacts or comes too close to an electrical power source, everyone in, on, and around the crane can be seriously injured or killed.

   The safest way to avoid electrocution is to stay away from electrical power lines and electrical power sources.
5. The operator is responsible for alerting all personnel of dangers associated with electrical power lines and equipment. The crane is not insulated. Do not allow unnecessary personnel in the vicinity of the crane while operating. Permit no one to lean against or touch the crane. Permit no one, including riggers and load handlers, to hold the load, load lines, tag lines, or rigging gear.
6. Even if the crane operator is not affected by an electrical contact, others in the area may become seriously injured or killed.
7. It is not always necessary to contact a power line or power source to become electrocuted. Electricity, depending on magnitude, can arc or jump to any part of

Reference Only

the load, load line, or crane boom if it comes too close to an electrical power source. Low voltages can also be dangerous.

Set-Up and Operation

1. During crane use, assume that every line is energized ("hot" or "live") and take necessary precautions.
2. Position the crane such that the load, boom, or any part of the crane and its attachments cannot be moved to within 20 ft (6 m) of electrical power lines or equipment. This includes the crane boom and all attachments. Overhead lines tend to blow in the wind so allow for lines' movement when determining safe operating distance.
3. Erect a suitable barricade to physically restrain the crane, all attachments, and the load from entering into an unsafe distance from electrical power lines or equipment.
4. Plan ahead and always plan a safe route before traveling under power lines. A wooden clearance frame should be constructed to ensure sufficient clearance is maintained between crane and power lines.
5. 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.
6. Tag lines should always be made of non-conductive materials. Any tag line that is wet or dirty can conduct electricity.
7. DO NOT store materials under power lines or close to electrical power sources.
8. When operating near transmitter/communication towers where an electrical charge can be induced into the crane or load:
   - The transmitter shall be deenergized OR,
   - Tests shall be made to determine if an electrical charge will be induced into the crane or load.
   - The crane must be provided an electrical ground.
   - If taglines are used, they must be non-conductive.
   - Every precaution must be taken to dissipate induced voltages. Consult with a qualified RF (radio frequency) Consultant. Also refer to local, state, and federal codes and regulations.

Electrocution Hazard Devices

1. The use of insulated links, insulated boom cages/ guards, proximity warning devices, or mechanical limit stops does not assure that electrical contact will not occur. Even if codes or regulations require the use of such devices, failure to follow the rules in this section may result in serious injury or death.
2. Be aware that such devices have limitations and you should follow the rules and precautions outlined in this section at all times even if the crane is equipped with these devices.
3. Insulating links installed into the load line afford limited protection from electrocution hazards. Links are limited in their lifting abilities, insulating properties, and other properties that affect their performance. Moisture, dust, dirt, oils, and other contaminants 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.
4. The only protection that may be afforded by an insulated link is below the link (electrically downstream), provided the link has been kept clean, free of contamination, has not been scratched or damaged, and is periodically tested (just before use) for its dielectric integrity.
5. Boom cages and boom guards afford limited protection from electrocution hazards. They are designed to cover only the boom nose and a small portion of the boom. Performance of boom cages and boom guards is limited by their physical size, insulating characteristics, and operating environment (e.g. dust, dirt, moisture, etc.). The insulating characteristics of these devices can be compromised if not kept clean, free of contamination, and undamaged.
6. Proximity sensing and warning 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, and other attachments located outside of the sensing area. Reliance is placed upon the operator in selecting and properly setting the sensitivity of these devices.
7. Never rely solely on a device to protect you and your fellow workers from danger.

   Some variables you must know and understand are:
   - Proximity devices are advertised to detect the existence of electricity and not its distance, quantity, or magnitude.
   - Some proximity devices may detect only alternating current (AC) and not direct current (DC).
   - Some proximity devices detect radio frequency (RF) energy and others do not.
   - Most proximity devices simply provide a signal (audible, visual, or both) for the operator and this signal must not be ignored.

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- Sometimes the sensing portion of the proximity devices becomes confused by complex or differing arrays of power lines and power sources.

8. 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 magnitude of the voltage and current present, and numerous other factors.

Electrical Contact

If the crane comes in contact with an energized power source, the operator must:

1. Stay in the crane cab. DON'T PANIC.

2. Immediately warn PERSONNEL in the vicinity to STAY AWAY.

3. Attempt to move the crane away from the contacted power source using the crane's controls which are likely to remain functional.

4. Stay in the crane until the power company has been contacted and the power source has been de-energized. NO ONE must attempt to come close to the crane or load until the power has been turned off.

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 cab, JUMP COMPLETELY CLEAR OF CRANE. DO NOT STEP OFF. Hop away with both feet together. DO NOT walk or run.

5. Following any contact with an energized electrical source, your Manitowoc distributor must be immediately advised of the incident and consulted on necessary inspections and repairs.

If the distributor not be immediately available, contact Manitowoc Crane Care at the factory. The crane must not be returned to service until it is thoroughly inspected for any evidence of damage and all damaged parts are repaired or replaced as authorized by Manitowoc or your Manitowoc distributor.

REFUELING

1. When using a portable container to refuel the crane, container shall be a safety-type can equipped with an automatic closing cap and a flame arrester.

2. Engine shall be ***stopped*** before refueling crane.

3. Smoking and open flames shall be prohibited in refueling area.

FIRE EXTINGUISHERS

1. A portable fire extinguisher with a minimum rating of 10 BC shall be installed in the operator's or the machinery cab of the crane.

2. The operator and all maintenance personnel shall be thoroughly familiar with the location, use, and care of the fire extinguisher(s) provided.

ACCIDENTS

If this crane becomes involved in a property damage and/or personal injury accident, immediately contact Manitowoc Crane Care or the Product Safety and Reliability Manager at:

Manitowoc Cranes
2401 So. 30th St.
Manitowoc, WI 54220

Phone: 1-888-499-7278 **or**
Fax: 920-683-6390

Provide a complete description of the accident, including the crane model and serial number.

SAFE MAINTENANCE PRACTICES

WARNING

Importance of safe maintenance cannot be over emphasized. Carelessness and neglect on part of maintenance personnel can result in their death or injury and costly damage to the crane or property.

Safety information in this section is intended only as a guide to assist qualified maintenance personnel in safe maintenance. Manitowoc cannot foresee all hazards that will arise in field; therefore, ***safety remains responsibility of maintenance personnel and crane owner***.

Maintenance Instructions

To ensure safe and proper operation of Manitowoc cranes, they must be maintained according to the instructions contained in this manual and the Service Manual provided with the crane.

Crane maintenance and repair must be performed by qualified personnel. These personnel must ***read Operator's Manual and Service Manual before attempting any maintenance procedure***. If there is any question regarding maintenance procedures or specifications, contact your Manitowoc distributor for assistance.

Qualified person is defined as one who by reason of training and experience is thoroughly familiar with the

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crane's operation and required maintenance as well as the hazards involved in performing these tasks.

Training and qualification of maintenance and repair personnel are crane owner's responsibility.

Safe Maintenance Practices

1. Perform the following steps (as applicable) before starting a maintenance procedure:
   - **a.** Park crane where it will not interfere with other equipment or operations.
   - **b.** Lower all loads to the ground or otherwise secure them against movement.
   - **c.** Lower the boom onto blocking at ground level, if possible, or otherwise secure boom against dropping.
   - **d.** Move all controls to off and secure all functions against movement by applying or engaging all brakes, pawls, or other locking devices.
   - **e.** Stop the engine and render the starting means inoperative.
   - **f.** Place a warning sign at the start controls alerting other personnel that the crane is being serviced and the engine must not be started. ***Do not remove sign until it is safe to return crane to service.***
2. Do not attempt to maintain or repair any part of the crane while the engine is running, unless absolutely necessary.

   If the engine must be run, keep your clothing and all parts of your body away from moving parts. ***Maintain constant verbal communication between person at controls and person performing maintenance or repair procedure.***
3. Wear clothing that is relatively tight and belted.
4. Wear appropriate eye protection and approved hard hat.
5. Never climb onto or off a moving crane. ***Climb onto and off crane only when it is parked and only with operator's permission.***

   Use ***both hands*** and handrails, steps and ladders provided to climb onto and off crane.

   Lift tools and other equipment which cannot be carried in pockets or tool belts onto and off crane with hand lines or hoists.
6. Boom and gantry are not intended as ladders. Do not attempt to climb lattice work of boom or gantry to get to maintenance points. If the boom or gantry is not equipped with an approved ladder, lower them before performing maintenance or repair procedures.
7. Do not remove cylinders until working unit has been securely restrained against movement.
8. Pinch points are impossible to eliminate; watch for them closely.
9. Pressurized air, coolant, and hydraulic oil can cause serious injury. Make sure all air, coolant, and hydraulic lines, fittings, and components are tight and serviceable.

   Do not use your hands to check for air and hydraulic oil leaks:
   - Use a soap and water solution to check for air leaks (apply to fittings and lines and watch for bubbles).
   - Use a piece of cardboard or wood to check for hydraulic oil leaks.
10. Relieve pressure before disconnecting air, coolant, and hydraulic lines and fittings.
11. Do not remove the radiator cap while the coolant is hot or under pressure. Stop the engine, wait until the pressure drops and the coolant cools, then slowly remove the cap.
12. Avoid battery explosion: do not smoke while performing battery maintenance or short across battery terminals to check its charge.
13. Read the safety information in the battery manufacturer's instructions before attempting to charge a battery.
14. Avoid battery acid contact with skin and eyes. If contact occurs, flush the area with water and immediately consult a doctor.
15. Stop the engine before refueling crane.
16. Do not smoke or allow open flames in refueling area.
17. Use a safety-type can with an automatic closing cap and flame arrestor for refueling.
18. Hydraulic oil can also be flammable. Do not smoke or allow open flames in the area when filling hydraulic tanks.
19. Never handle wire rope with bare hands. Always wear heavy-duty gloves to prevent being cut by broken wires.
20. Use extreme care when handling coiled pendants. Stored energy can cause the coiled pendants to uncoil quickly with considerable force.
21. When inflating tires, use a tire cage, a clip-on inflator, and an extension hose which permits standing well away from the tire.
22. Only use cleaning solvents which are non-volatile and non-flammable.
23. Do not attempt to lift heavy components by hand. Use a hoist, jacks, or blocking to lift components.

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24. Use care while welding or burning on crane. Cover all hoses and components with non-flammable shields or blankets to prevent a fire or other damage.

25. To prevent damage to crane parts (bearings, cylinders, swivels, slewing ring, computers, etc.), perform the following steps ***before welding on crane***:

- Disconnect all cables from batteries.
- Disconnect output cables at engine junction box.
- Attach ground cable from the welder directly to the part being welded and as close to the weld as possible.

Do not weld on the engine or engine mounted parts (per engine manufacturer).

26. Disconnect and lock the power supply switch before attempting to service high voltage electrical components and before entering tight areas (such as carbody openings) containing high voltage components.

27. When assembling and disassembling booms, jibs, or masts on ground (with or without support of boom rigging, pendants or straps), securely block each section to provide adequate support and alignment.

Do not go under boom, jib, or mast sections while connecting bolts or pins are being removed.

28. Unless authorized in writing by Manitowoc, do not alter the crane in any way that affects the crane's performance (to include welding, cutting, or burning of structural members or changing pressures and flows of air/hydraulic components). Doing so will invalidate all warranties and Capacity Charts and make the crane owner/user liable for any resultant accidents.

29. ***Keep crane clean.*** Accumulations of dirt, grease, oil, rags, paper, and other waste will not only interfere with safe operation and maintenance but also create a fire hazard.

30. Store tools, oil cans, spare parts, and other necessary equipment in tool boxes. Do not allow these items to lie around loose in operator's cab or on walkways and stairs.

31. Do not store flammable materials on the crane.

32. Do not return the crane to service at completion of maintenance or repair procedures until all guards and covers have been reinstalled, trapped air has been bled from hydraulic systems, safety devices have been reactivated, and all maintenance equipment has been removed.

33. Perform a function check to ensure proper operation at completion of maintenance or repair.

ENVIRONMENTAL PROTECTION

Dispose of waste properly! Improperly disposing of waste can threaten the environment.

Potentially harmful waste used in Manitowoc cranes includes — but is not limited to — oil, fuel, grease, coolant, air conditioning refrigerant, filters, batteries, and cloths which have come into contact with these environmentally harmful substances.

Handle and dispose of waste according to local, state, and federal environmental regulations.

When filling and draining crane components: do not pour waste fluids onto the ground, down any drain, or into any source of water.

- Always drain waste fluids into leak proof containers that are clearly marked with what they contain.
- Always fill or add fluids with a funnel or a filling pump.
- Immediately wipe up any spills.

Reference Only

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Reference Only

BOOM DISASSEMBLY SAFETY

DANGER!

Collapsing Boom Hazard!

Prevent death or serious injury when disassembling boom sections — read and adhere to following instructions.

NOTE: The term "***Boom"*** used in the following instructions applies to all lattice attachments (boom, fixed jib, luffing jib, mast, etc.).

Safe handling of lattice booms during disassembly is a primary concern for preventing serious or fatal injuries. A boom can collapse during disassembly if workers fail to observe safe working practices.

Accidents during boom disassembly usually result from one of three primary causes:

- Workers are not familiar with equipment or are not properly trained.
- Disassembly area is not suitable.
- Safe procedures are overlooked because not enough time is allocated for the task.

General

Safety decals (Figure 2-5) are placed near the connectors on the boom sections as shown on the Boom Disassembly Decal Drawing at the end of this section.

Workers involved with boom disassembly must be trained and experienced in the operation and disassembly of construction cranes. The workers must read and thoroughly understand the assembly and disassembly instructions in the Boom Assembly Drawing, and in the assembly and disassembly instructions in Section 4 of this manual before beginning disassembly. Anyone who has a question should ask for an explanation. ***One worker who does not fully understand or fails to follow correct procedures can be killed or seriously injured or endanger other workers.***

WARNING

Falling Boom Hazard!

Crane can tip or boom can collapse if excess boom is cantilevered. Never cantilever more boom than specified in Boom Assembly Drawing.

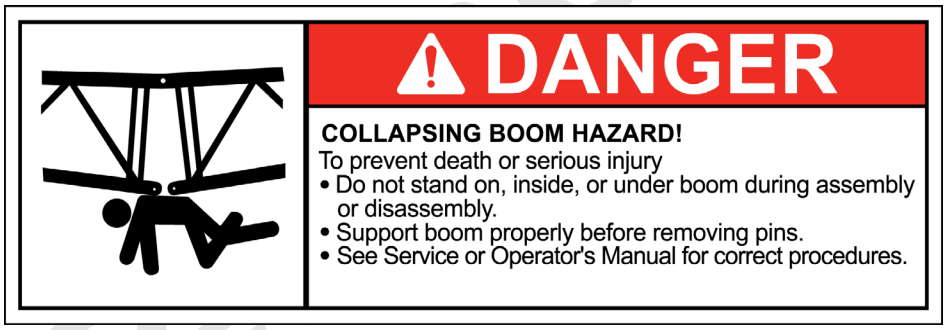

FIGURE 2-5

Location

Select a suitable location for boom disassembly. It must be firm, level, and be free of obstructions. It should have enough open space to accommodate the crane, the length of boom, and – if required – movement of an assist crane or other equipment. If possible, secure the area to keep unauthorized personnel and vehicles away.

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Pin Removal

DANGER

Collapsing Boom Hazard!

Boom can collapse or jerk when pins are removed. To avoid death or serious injury:

- Do not remove bottom connecting pins from any boom section when boom is supported by straps as shown in Figure 2-6, View A.
- Do not remove strap connecting pins until straps are fully lowered into supports as shown in Figure 2-6, View C.
- Do not remove bottom connecting pins from any boom section when boom point is resting on ground and boom butt is not supported by handling cylinder as shown in Figure 2-6, View B.
- Never work or stand inside boom unless it is lowered and securely blocked as shown in Figure 2-6, View C.
- Do not stand or walk on top of boom unless it has walkways.

When removing pins from boom sections, stand clear of pins being removed. Even though the boom is resting on blocking, individual pin connections may still be under load. Pins can be ejected forcefully if the boom has any pressure on it or if the boom is not supported properly.

Disassembly Precaution

Always block boom sections so they are securely supported and cannot shift or move suddenly when pins are removed. If there is any doubt about a boom disassembly procedure, ***block tightly under boom sections before removing any pin***.

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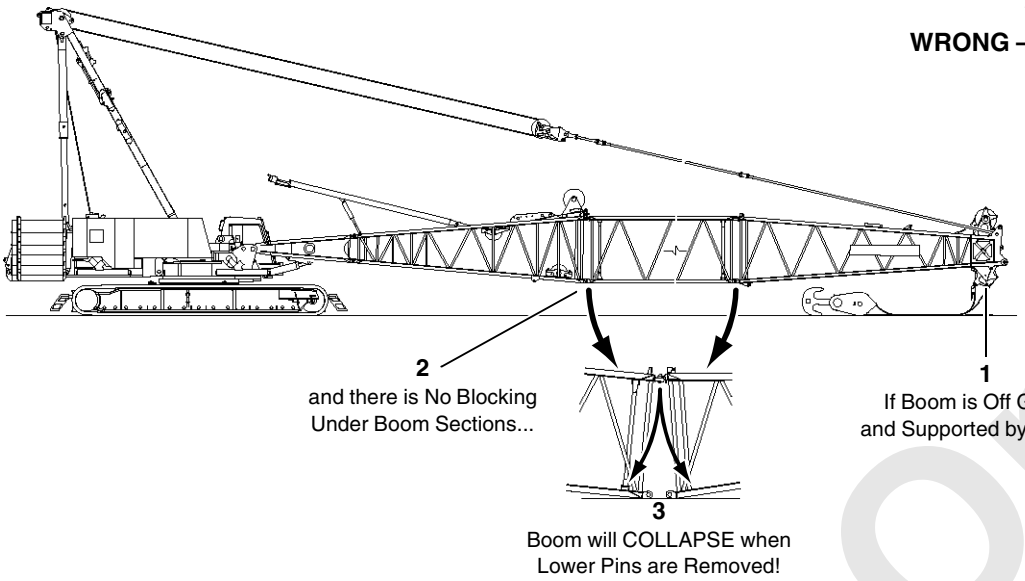

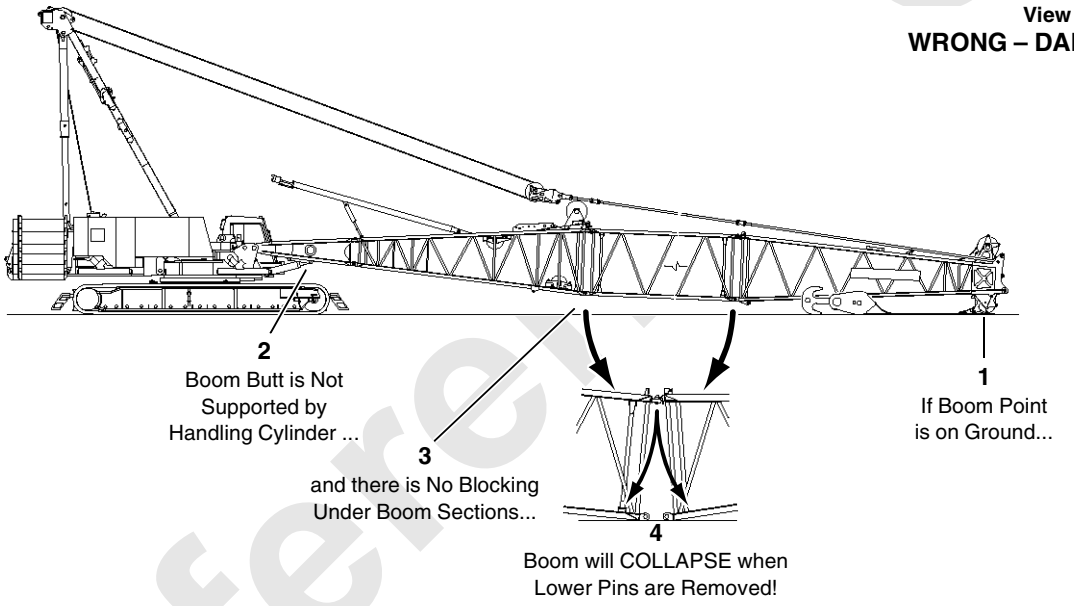

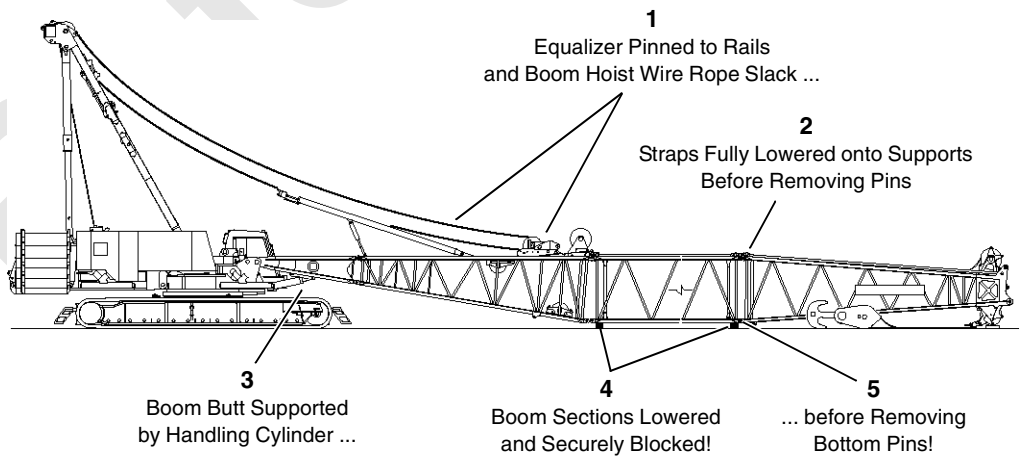

FIGURE 2-6

Reference Only

PERSONNEL HANDLING POLICY

In 1998, the American Society of Mechanical Engineers issued a new American National Standard entitled, Personnel Lifting Systems, ASME B30.23-1998. This standard provides, ***"lifting and lowering of personnel using ASME B30 Standard hoisting equipment shall be undertaken only in circumstances when it is not possible to accomplish the task by less hazardous means. Unless all of the applicable requirements of this volume are met, the lifting or lowering of personnel using ASME B30 Standard equipment is prohibited."***

The ASME Standards recognize that mobile and locomotive cranes are primarily designed and intended for handling materials and not personnel. The ASME Standards have a retrofit statement that applies to existing cranes after the standards go into effect. It is not the intent of the standards to require retrofitting of existing equipment. If an item is being modified, the performance requirement shall be reviewed relative to the current standard.

This new standard is consistent with the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) regulations for Construction that state, in 29CFR1926.1431(a): ***The use of a crane or derrick to hoist employees on a personnel platform is prohibited, except when the erection, use, and dismantling of conventional means of reaching the work site, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform or scaffold, would be more hazardous or is not possible because of structural design or work site conditions.***

Use of a Manitowoc crane to handle personnel is acceptable provided:

- The crane user shall comply with the manufacturer's specifications and limitations for lifting accessories (hooks, slings, personnel platforms, etc.).
- The requirements of the applicable national, state and local regulations and safety codes are met.
- A determination has been made that use of a crane to handle personnel is the least hazardous means to perform the work.
- The crane operator shall be qualified to operate the specific type of hoisting equipment used in the personnel lift.
- The crane operator must remain in the crane cab at all times when personnel are off the ground.
- The crane operator and occupants have been instructed in the recognized hazards of personnel platform lifts.
- The crane is in proper working order.
- Load and boom hoist drum brakes, swing brakes, and locking devices such as pawls and dogs shall be engaged when the occupied personnel platform is in a stationary position.
- The crane must be equipped with a boom angle indicator that is visible to the crane operator.
- The crane must be equipped with a boom hoist limiting device.
- If the luffing jib is used for hoisting personnel, the crane must be equipped with a luffing jib angle indicator that is visible to the crane operator.
- If the luffing jib is used for hoisting personnel, the crane must be equipped with a luffing hoist limiting device.
- The crane is equipped with a positive acting device which prevents contact between the load block or overhaul ball and the boom tip (anti-two block device).

  For friction cranes, this implies the addition of spring applied brakes activated by the anti-two block device. The load line hoist drum shall have a system or device on the power train, other than the load hoist brake, which regulates the lowering rate of speed of the hoist mechanism (controlled load lowering).

  Free fall of the hoist line is prohibited.
- The crane's Operator's Manual is in the crane's cab, readily accessible to the Operator.
- The crane's load Capacity Chart is affixed inside the crane's cab, readily accessible to the operator. The total weight of the loaded personnel platform and related rigging shall not exceed 50 percent of the rated capacity for the radius and configuration of the crane.
- The crane is uniformly level within one percent of level grade and located on a firm footing. Some capacity charts require more stringent levelness criteria.

  Cranes with outriggers or stabilizers shall have them all extended and locked. All outriggers or stabilizers must be extended equally in accordance with the Capacity Charts and operating procedures.
- Handling personnel from a platform suspended by wire rope from a luffing jib is acceptable, but only when it is not possible to accomplish the task using a less hazardous means. The crane user and operator shall take into account hazards that may be present when using a luffing jib.
- Direct attachment of a personnel platform to a luffing jib is prohibited.
- The platform meets the requirements as prescribed by applicable standards and regulations.
- Applicable personnel protection equipment is provided (i.e., personnel fall-protection system, etc.)

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- For wire rope suspended platforms, the crane is equipped with a hook latch that can be closed and locked, eliminating the throat opening.
- The platform is properly attached and secure.
- Personnel platforms must not be used in winds exceeding 20 mph (9 m/s) at the hoisted platform height or in electric storms, snow, ice, sleet, or other adverse weather conditions which could affect the safety of personnel.
- Hoisting personnel within 20 ft (6 m) of a power line that is up to 350 kV or within 50 ft (15 m) of a power line that is over 350 kV is PROHIBITTED, except for work covered in OSHA 29CFR1926 subpart V.

For operation outside the United States, the requirements of the applicable national, state and local regulations and safety codes must be met. This may include, in addition to the above:

- Automatic brakes such that when the equipment operating controls are released, the motions are brought to rest.
- A holding device (such as a load hold check valve) shall be provided in the hydraulic or pneumatic systems to prevent uncontrolled movement of the hoisting equipment in the case of a system failure.

Manitowoc offers upgrade packages for friction controlled models to install anti-two block, dead man control, and automatic hoist system control requirements to satisfy other codes and standards.

Manitowoc recommend that cranes be properly maintained, regularly inspected and repaired as necessary. All safety decals must be in place and legible. We also urge Manitowoc crane owners to upgrade their cranes with rated capacity indicator/limiter systems for all lifting operations.

Should you have any questions about this subject or other product safety matters relating to the operation and use of a Manitowoc crane, please contact Manitowoc Crane Care or the Product Safety and Reliability Manager at the following address:

Manitowoc Cranes
2401 So. 30th St.
Manitowoc, WI 54220

Phone: 1-888-499-7278 **or**
920-683-6390

Reference Only

PEDESTAL/BARGE MOUNTED CRANES

WARNING

Overload Hazard!

A pedestal mounted crane will not tip to indicate to operator that crane's capacity has been exceeded. When capacity of a pedestal mounted crane is exceeded, turntable bearing, hook rollers (if equipped), or other structural components may break, before load lines fail, causing crane to separate from pedestal.

For this reason, great care must be taken to operate a pedestal mounted crane within its rated capacity.

Careful planning is required before a crane can be operated on a barge. Crane user shall verify that barge is capable of limiting crane list and/or dynamics to maximum allowable specified on Capacity Charts. If specified crane list and/or dynamic conditions are exceeded, crane's capacity may be exceeded, turntable bearing, hook rollers (if equipped), or other structural components may break, causing crane to separate from pedestal.

WARNING

Crane owner/user must verify that method used to fasten or restrain crane to foundation, barge, ship or floating platform is strong enough, under all operating conditions, to prevent crane from breaking off foundation or moving on barge.

Manitowoc does not permit use of a truck crane on a barge, ship or floating platform.

Pedestal Mounted Crane

Also see ASME publication B30.8-2004, Floating Cranes and Derricks.

Definition

A pedestal mounted crane is a crane which is securely fastened to a foundation, barge, ship or floating platform so the crane is restrained from tipping.

Examples

1. Crane rotating bed mounted on a turret (pedestal) which is securely fastened to foundation (Figure 2-7).

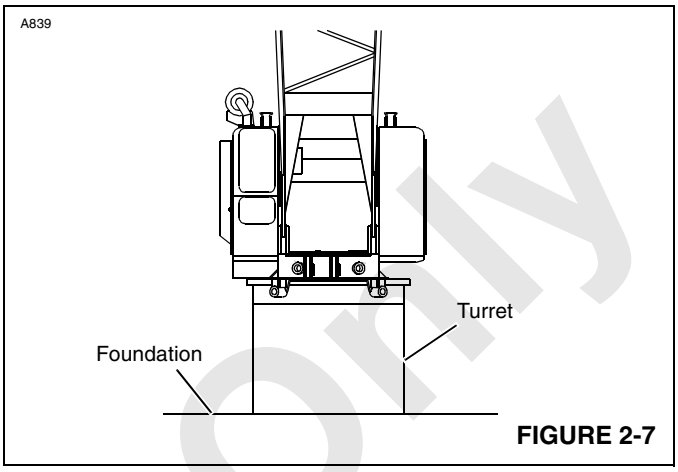
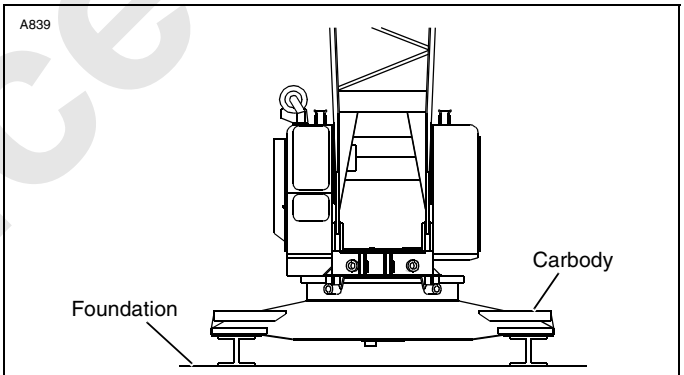


FIGURE 2-7

2. Crane rotating bed mounted on carbody (crawlers removed) which is securely fastened to the foundation (Figure 2-8).



NOTE: If bolting carbody to foundation, contact your Manitowoc distributor for recommended bolt pattern and for type and quantity of bolts to be used.

FIGURE 2-8

Reference Only

Barge Mounted Crane

Definition

A barge mounted crane is a crane that is anchored or restrained in a work area of the barge, ship or floating platform and is subjected to tipping forces.

Examples

NOTE: The foundation is the deck of the barge, ship or floating platform.

1. Crawler-mounted crane with carbody anchored with tie-downs to foundation (Figure 2-9).

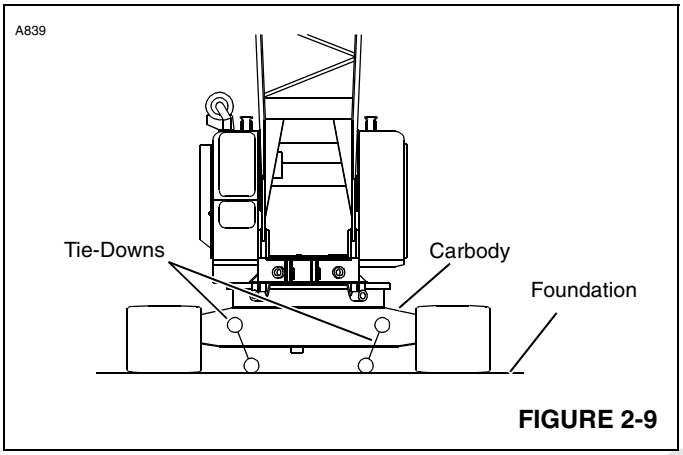


FIGURE 2-9

2. Crawler-mounted crane working on timbered area of barge, ship or floating platform with the crawlers restrained by curbing and end stops (Figure 2-10). When not working, the crane carbody is anchored with tie-downs to the foundation. ***Traveling with load is not permitted.***

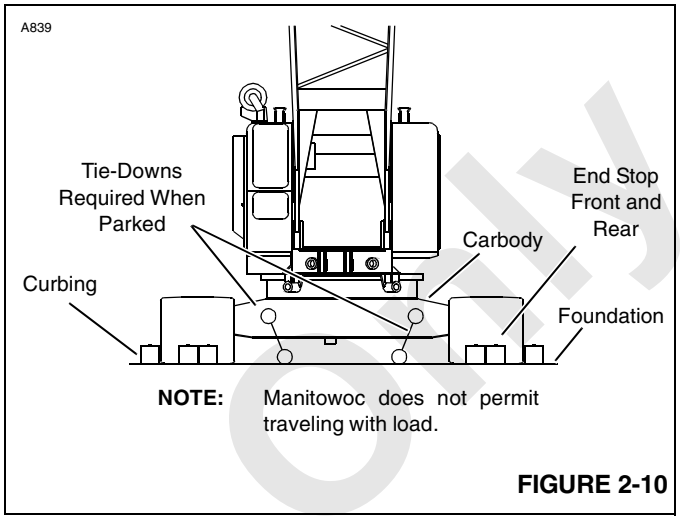


FIGURE 2-10

3. RINGER® (crawler mounted, carbody mounted) supported on blocking, screw jacks or steel pedestals which are braced and fastened to foundation in such a manner as to prevent movement (Figure 2-11).

4. RINGER (platform mounted) which has ring braced and fastened directly to foundation in such a manner as to prevent movement.

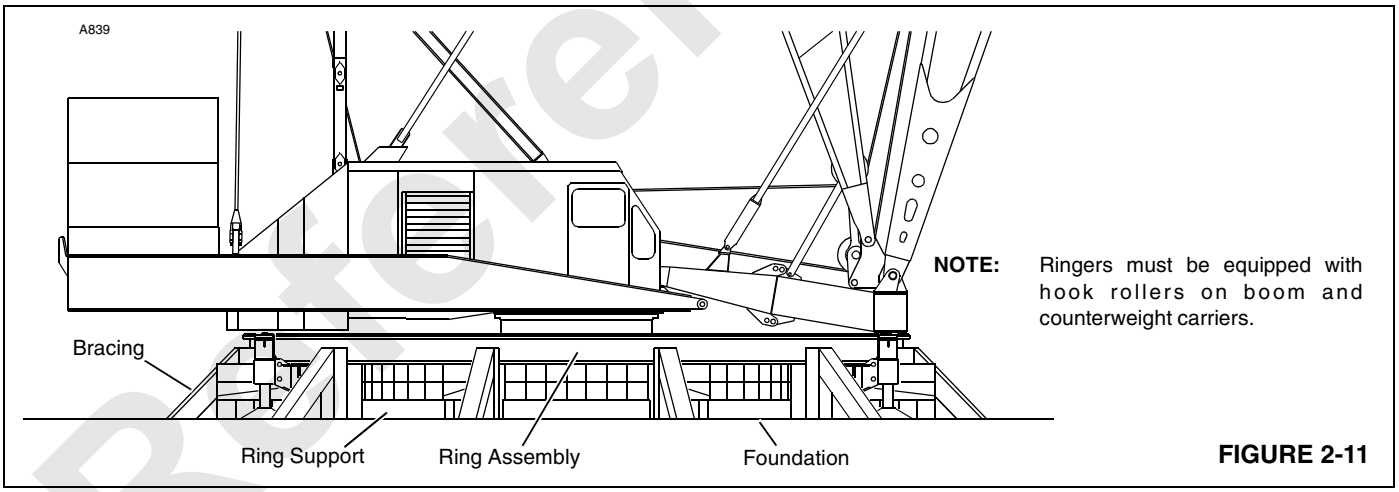


FIGURE 2-11

Reference Only

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AXIS		TRANSITIONAL		ROTATIONAL	
SYMBOL	NAME	STATIC	DYNAMIC	STATIC	DYNAMIC
X	Longitudinal		Surge	Heel List	Roll
Y	Vertical		Heave		Yaw
Z	Lateral		Sway	Trim	Pitch

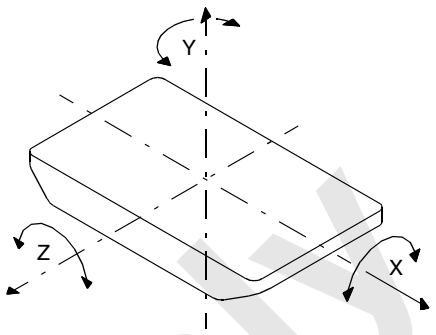

FIGURE 2-12

Capacity Charts

Manitowoc provides two types of Capacity Charts for a crane mounted on a barge or other supporting structure under static conditions.

1. A Capacity Chart based on tipping when crane is anchored only to prevent shifting.
2. A Capacity Chart based on structural competence when crane is securely fastened for use as a pedestal mounted crane.

NOTE: Unless otherwise specified in a machine list Capacity Chart, a 0 degree machine list Capacity Chart rating applies to machine list ***not to exceed 1/2 degree.*** All other machine list ratings – 1°, 2°, and 3° – must NOT be exceeded.

Shock Loading

Definition

Shock loads to the crane can be experienced when the barge is subjected to up and down movement of wave action (referred to as DYNAMICS). Figure 2-12 illustrates the dynamic conditions of the barge which influence crane capacity.

CAUTION

Structural Damage Hazard!

If crane boom or structure is shock loaded during operation, or there is any indication of shock loading, all structural components of crane shall be inspected to detect cracks and other damage. Nondestructive test equipment, such as magnetic particle or ultrasonic procedures, is recommended for this inspection.

NOTE: Manitowoc does not allow crane operation under dynamic conditions.

Operation On Barge

General

Machine list and/or dynamics will be experienced when a crane is operated on a barge, ship or floating platform. Both of these conditions reduce the crane's capacity, and each must be taken into account for safe operation on a barge, ship or floating platform.

WARNING

Tipping Crane Hazard!

Tie-downs which only prevent crane from shifting as in barge, ship or floating platform mounting, may not provide adequate support when using a Capacity Chart for pedestal mounting. Before operating a crane on a barge, ship or floating platform, crane user shall verify that correct Capacity Chart is being used — pedestal mounted, barge mounted, 0°, 1°, 2° or 3° list or dynamic Capacity Chart.

Failing to use correct Capacity Chart can result in an accident.

Definitions

1. ***Machine List***, as defined by Manitowoc, is the crane's out-of-level condition — from side-to-side — as measured by the angle between horizontal and a line drawn through the centerline of the crane's boom hinge pins (Figure 2-13). This out-of-level condition creates side load and affects the crane's lifting capacity.
2. ***Barge List*** (also referred to as heel or trim) causes swing out of the load and may produce side load. When Manitowoc provides a Capacity Chart showing capacities for a 2 degree machine list for example, we are referring to maximum allowable lifting capacity for the crane when experiencing an out-of-level condition (side-to-side) of 2 degrees as measured by angle

Reference Only

between horizontal and a line drawn through the centerline of the crane's boom hinge pins.

Unless otherwise specified on the Capacity Chart, barge list (heel or trim) must not exceed machine list degrees given on the Capacity Chart.

3. ***Barge List and Machine List are not same.*** As the crane rotates on barge, barge list (as defined above) will change. The worst machine list condition generally occurs when the crane swings over the corner of the barge, producing maximum side load.

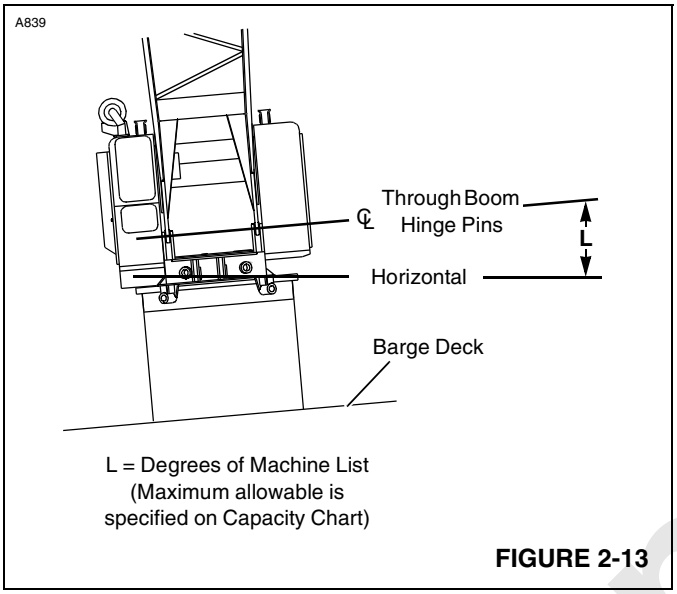

FIGURE 2-13

Crane Inspection

To aid in preventing harmful and damaging failure as previously indicated, regular inspection for signs of overloading in the following load bearing components is required. Correct each defect found before placing the crane into service.

- Boom
- Counterweight
- Gantry
- Backhitch
- Rotating Bed
- Wire Rope
- Pendants and Straps
- Turntable Bearing

When equipped with hook rollers, it is recommended that each hook roller assembly be inspected daily for any sign of overloading, to include:

- Deformation of roller path.
- Proper hook roller adjustment.
- Deformation or cracks in hook roller hanger.
- Bent hook roller shaft.
- Damaged bearings.

Transporting Crane on Barge

If it is necessary to transport the crane on a barge, ship or floating platform when dynamic conditions will be experienced, the boom shall be lowered onto a cradle (or other support) and the crane's boom, rotating bed and lowerworks shall be secured against movement. If the crane is equipped with a mast, the mast shall be securely tied down with guylines. Failing to take these steps can result in shock load or side load damage to the boom and mast.

Reference Only

SECTION 3
OPERATING CONTROLS AND PROCEDURES

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SECTION 3
OPERATING CONTROLS AND PROCEDURES

STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS

The following standard hand signals comply with ASME B30.5a - 2004

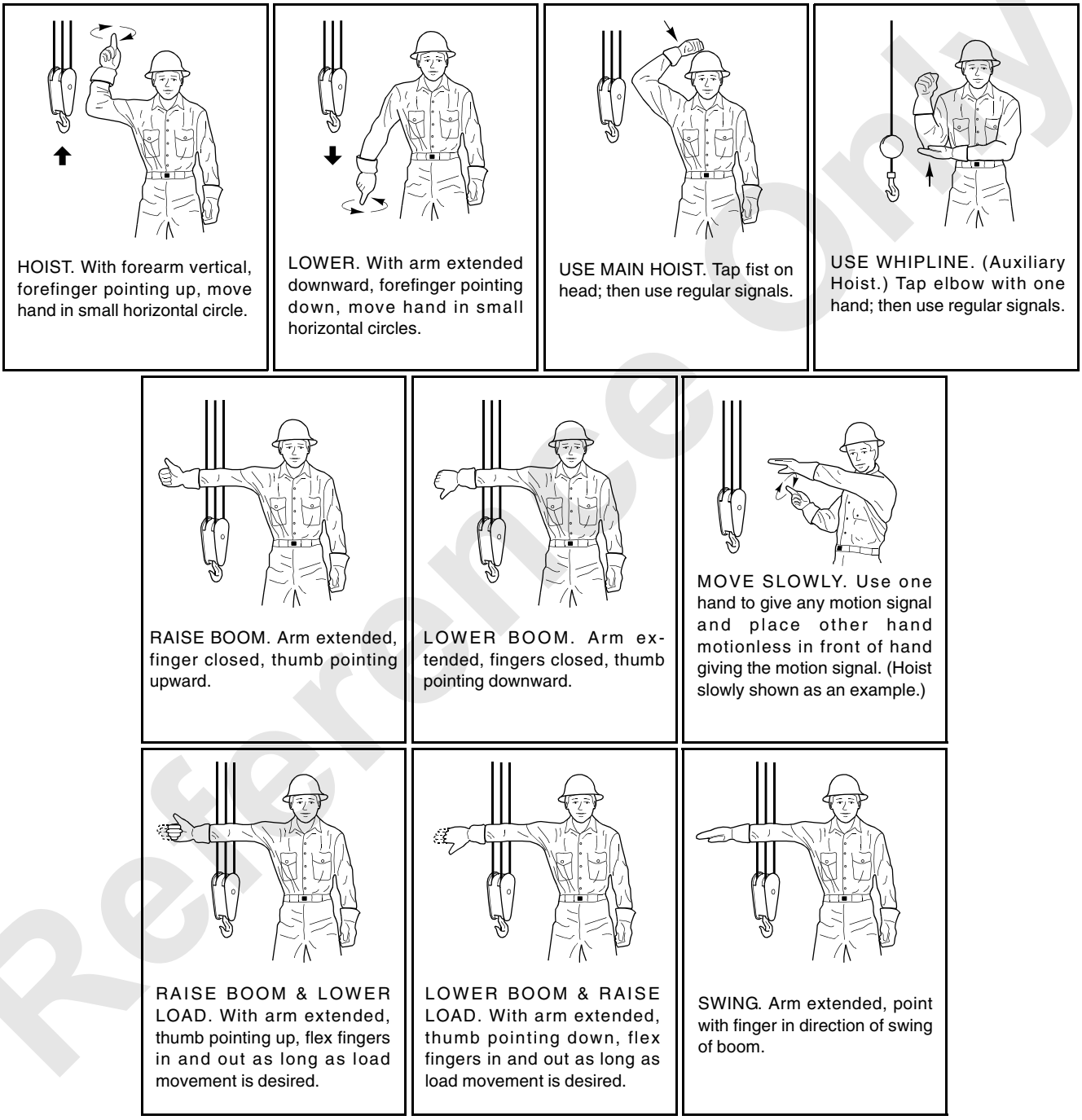

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FIGURE 3-1

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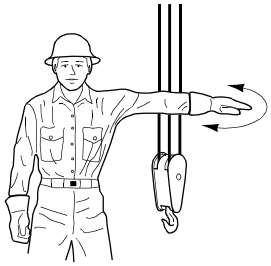
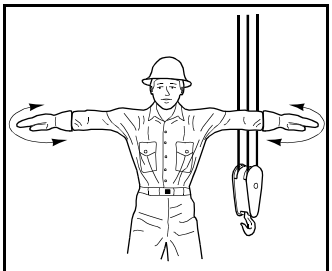
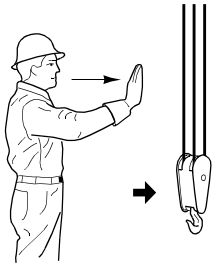


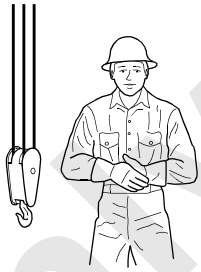
STOP. Arm extended, palm down, move arm back and forth horizontally.



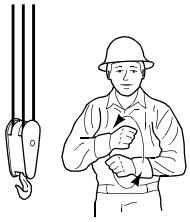
EMERGENCY STOP. Both arms extended, palms down, move arms back and forth horizontally.



TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.

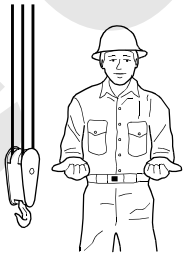


DOG EVERYTHING. Clasp hand in front of body.

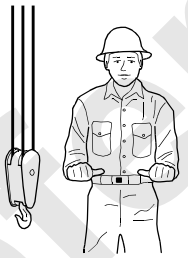


TRAVEL. (Both Tracks.) Use both fists in front of body, making a circular motion about each other, indicating direction of travel; forward or backward.

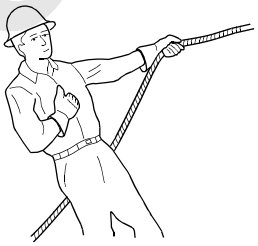
TRAVEL. (One Track.) Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body.



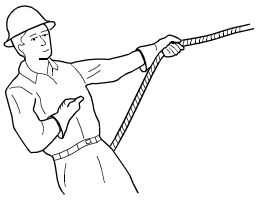
EXTEND BOOM. (Telescoping Booms.) Both fists in front of body with thumbs pointing outward.



RETRACT BOOM. (Telescoping Boom.) Both fists in front of body with thumbs pointing toward each other.



EXTEND BOOM. (Telescoping Boom.) One Hand Signal. One fist in front of chest with thumb tapping chest.



RETRACT BOOM. (Telescoping Boom.) One hand signal. One fist in front of chest, thumb pointing outward and heel of fist tapping chest.

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FIGURE 3-1 continued

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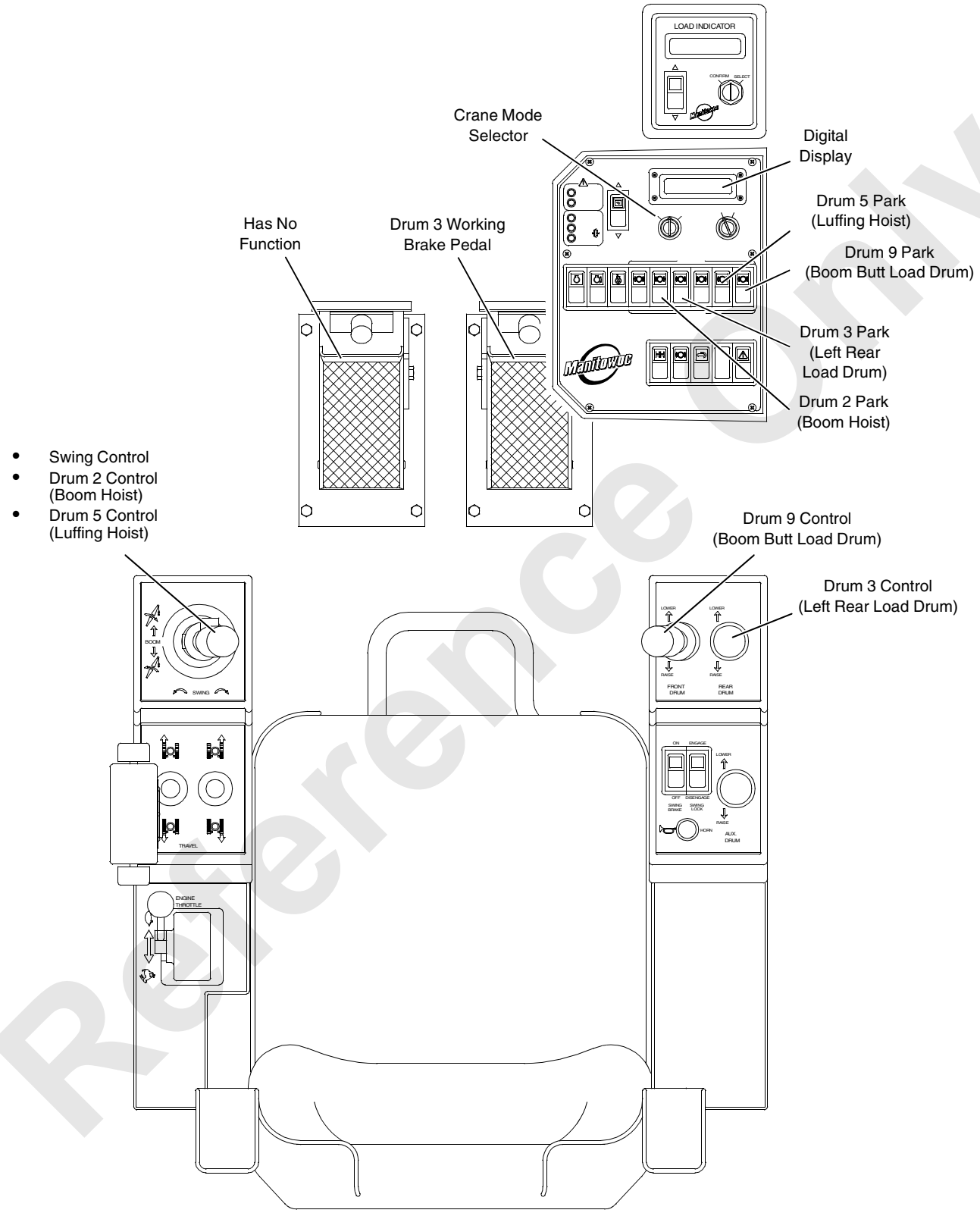

FIGURE 3-2

Reference Only

GENERAL OPERATION

The instructions in this section supplement the operating control instructions in the Crane Operator's Manual. This section has two purposes:

- To familiarize *qualified operators* with the location of the controls used for luffing jib operation.
- To alert operators to important safety information.

WARNING

Prevent death or serious injury to personnel!

Luffing jib attachment must be installed and operated by experienced personnel trained in erection and operation of construction cranes. These personnel shall read, understand, and comply with instructions in this manual, in Crane Operator's Manual, and in Luffing Jib Rigging drawings and Capacity Charts.

LUFFING JIB OPERATING CONTROLS

See Figure 3-2 for Location of Controls.

Crane Mode Selector

Use this control to select and confirm the MAX-ER mode and to select and confirm the hoist to be operated — STANDARD mode for boom hoist (DRUM 2) or LUFFING JIB mode for luffing hoist (DRUM 5). **Only one hoist can be operated at a time.**

The MAX-ER mode must be selected and confirmed in addition to the desired main mode (standard or luffing jib).

Once selected and confirmed, the modes appear on the digital display as shown in Figure 3-3. The ***M** on the right side of the screen indicates that the MAX-ER mode is on.

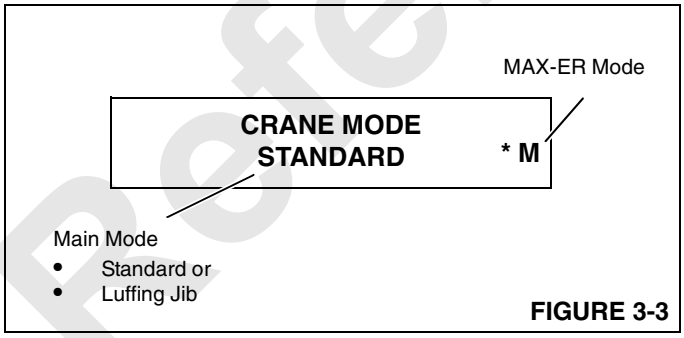

FIGURE 3-3

Boom/Luffing Hoist Control

Controls direction and speed of desired hoist's operation - boom or luffing - depending on which mode is selected.

Only one hoist can be operated at time: boom (standard mode) or luffing (luffing jib mode).

Boom/Luffing Hoist Park Switches

Enables and disables drum operation for the corresponding hoist:

When park is ON, the corresponding hoist handle is inoperable, the parking brake is spring applied, and the drum pawls engaged.

When park is OFF, the corresponding hoist handle is operable and the drum pawl is disengaged. The parking brake applies and releases automatically when the control handle is operated.

Digital Display

Displays boom angle, luffing jib angle, and boom to luffing jib angle. See Figure 3-4 for identification of each angle:

- BOOM ANGLE is angle between centerline of boom and horizontal. Monitor this angle when raising boom to operating angle.

  When operating with luffing jib, adjust automatic boom stop for 85 or 87° depending on boom length. See Automatic Boom Stop Adjustment in Section 6 of this manual for adjustment procedure.
- LUFFING JIB ANGLE is angle between centerline of jib and horizontal. Monitor this angle when raising and lowering jib during operation.
- BOOM TO LUFFING JIB ANGLE is angle between centerline of boom and centerline of jib. Monitor this angle when raising boom and jib from ground and lowering boom and jib to ground.

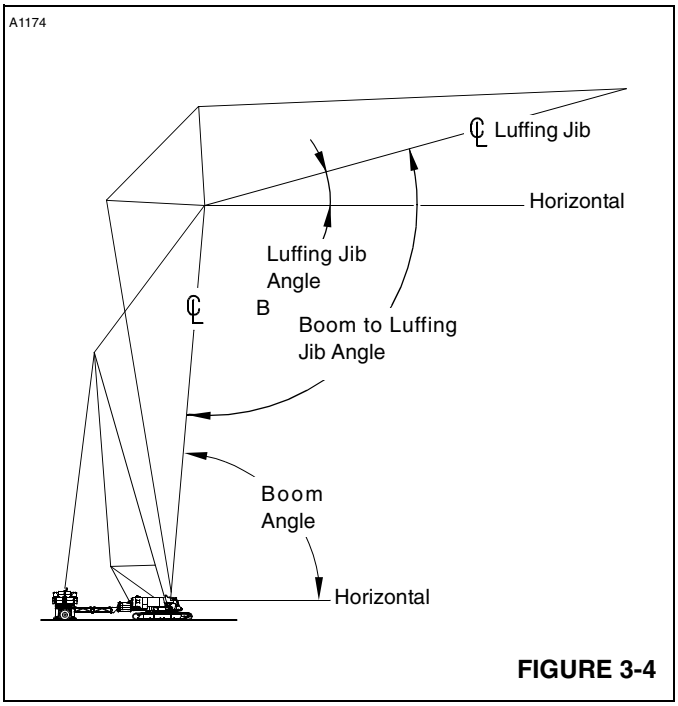

FIGURE 3-4

Reference Only

The digital display also displays system faults and operating limits for the luffing hoist and all other crane functions. See Digital Display Readings in Section 3 of the Crane Operator's Manual for a complete list of operating conditions, system faults, and operating limits.

Automatic Jib Stop

When an automatic jib stop is reached, the luffing hoist stops automatically (brake spring applies) and is inoperable. The operating limit alert comes on and the digital display indicates which limit has been reached.

Three jib stop limits are provided:

- MAX UP 1 (maximum working angle) automatically stops the luffing hoist when the boom to luffing jib angle is 168°. The jib up limit bypass switch can be depressed to allow the jib to be raised to the MAX UP 2 limit at 169.2°.
- MAX UP 2 (maximum jib angle) automatically stops the luffing hoist when the boom to luffing jib angle is 169.2°.

  This limit can be bypassed only when the attachment is lowered to the ground (boom below 50°).

WARNING

Falling Boom/Jib Hazard!

Do not raise luffing jib above MAX UP 2 limit. Structural damage will occur, possibly causing boom and luffing jib to be pulled over backwards.

- MAX DOWN (minimum jib angle) automatically stops the luffing hoist when the boom to luffing jib angle is 70°.

  Do not use limit bypass switch to lower jib below MAX DOWN limit. Jib butt will contact boom top, resulting in structural damage and possible collapse of jib.

WARNING

Falling Boom/Jib Hazard!

Do not lower luffing jib below down limit. Structural damage will result, possibly causing boom and luffing jib to collapse.

Selecting Desired Hoist

To select boom hoist operation, proceed as follows:

Boom Hoist (Drum 2)

1. Release boom-luffing hoist control handle to off to stop luffing jib.
2. Turn on DRUM 5 PARK.
3. Select and confirm STANDARD MODE.

NOTE: The operating fault alarm (in operator's cab) will come on if the luffing hoist is not parked.

4. Turn off DRUM 2 park (it may be necessary to boom up slightly to disengage boom hoist pawl). The boom hoist can now be operated in either direction to boom up and down.

   With the boom hoist selected, all other crane functions — swing, travel, load drums — are also operable. The luffing hoist is inoperable.

NOTE: Drum 3 (left rear load drum) can be operated only when boom hoist (Drum 2) is parked.

WARNING

Falling Boom Hazard!

Do not switch Drum 2 (boom hoist) to free-fall mode. Boom could fall uncontrolled.

Luffing Hoist (Drum 5)

To select luffing hoist operation, proceed as follows:

1. Release boom-luffing hoist control handle to off to stop boom hoist.
2. Turn on DRUM 2 PARK.
3. Select and confirm LUFFING JIB MODE.

NOTE: The operating fault alarm (in operator's cab) will come on if the boom hoist is not parked.

4. Turn off DRUM 5 park (it may be necessary to luff up slightly to disengage luffing hoist pawl). The luffing hoist can now be operated in either direction to luff up and down.

   With the luffing hoist selected, all other crane functions — swing, travel, load drums — are also operable. The boom hoist is inoperable.

Operating Precautions

WARNING

Falling Boom Hazard!

Observe following precautions to prevent death or serious injury to personnel from tipping crane or structural failure of attachment.

Reference Only

1. Read and comply with instructions in Liftcrane Luffing Jib Capacity Charts provided with luffing jib attachment. Do not operate beyond limits given in capacity charts.

   Make sure proper counterweight – crane and MAX-ER – is installed.

2. Read and comply with operating instructions in Crane Operator's Manual.

3. Read and comply with Maximum Allowable Travel Specifications in Luffing Jib Capacity Chart Manual.

4. Make sure luffing jib attachment is installed properly. Read and comply with instructions contained in Section 4 of this manual.

5. Make sure all operating limits — block-up, boom and jib stops, boom and jib angle indicators, and Rated Capacity Indicator/Limiter (RCL) — are installed and operating properly. See Section 6 of this manual for adjustment procedures. See separate Rated Capacity Indicator/Limiter Manual for operation and calibration of the RCL.

6. Make sure crawlers are blocked prior to raising and lowering attachment. Read and comply with instructions in Crawler Blocking Diagram in Luffing Jib Capacity Chart Manual.

7. Raise and lower attachment as instructed in Section 4 of this manual.

8. Observe minimum block weight requirement, if applicable, given on Liftcrane Luffing Jib Capacity Chart.

   Beware when operating in those areas of capacity chart marked **(b)** — weight of backstay straps can pull luffing jib against physical stops if load block or hook and weight ball is not heavy enough. This action will result in sudden unexpected movement of the load.

9. Perform all operations with crane on a firm, level, uniformly supporting surface. Crane must be level to within 1 ft (0,3 m) in 100 ft (30,1 m).

10. Operate all crane functions slowly and smoothly. Avoid sudden starts and stops which could side load or shock load attachment.

11. Do not operate, to include raising boom and luffing jib from ground level, if wind exceeds allowable limits given in Capacity Charts provided with crane and luffing jib. Contact your local weather station for wind velocity..

WIND CONDITIONS — #44 LUFFING JIB ON #79 BOOM

Wind adversely affects lifting capacity and stability. The result could be loss of control over the load and crane, even if the load is within the crane's capacity.

WARNING

Tipping Crane Hazard!

Judgment and experience of qualified operators, job planners, and supervisors must be used to compensate for affect of wind on lifted load and boom by reducing ratings or operating speeds, or a combination of both.

Failing to observe this precaution can cause crane to tip or boom and/or jib to collapse. Death or serious injury to personnel can result.

Wind speed (to include wind gusts) must be monitored by job planners and supervisors.

Wind speed at the boom or jib point can be greater than wind speed at ground level. Also be aware that the larger the sail area of the load, the greater the wind's affect on the load.

As a general rule, ratings and operating speeds must be reduced when:

Wind causes load to swing forward past allowable operating radius or sideways past either boom hinge pin.

Reference Only

Operation Permitted

Operation is permitted in steady winds or wind gusts up to 35 mph (16 m/s). However, ratings must be reduced the amount given in the following tables for the corresponding attachment.

For special conditions not covered in this section, contact Crane Care Customer Service at Manitowoc.

Operation Not Permitted

- **Up to 50 mph (22 m/s)** — Park crane (upper in line with crawlers) with load block on ground or secured and position boom at 75° and luffing jib at 50°.
- **Above 50 mph (22 m/s)** — Lower boom and jib onto blocking at ground level.

Table 3-1
Rating Reductions for Various Wind Speeds and Wind Gusts

Luffing Jib Length ft (m)		**70–120 (21,3–36,6)**			**130–170 (39,6–51,8)**			**180–240 (54,9–73,2)**		
Boom Length ft (m)		**140–180 (42,7–54,9)**	**200–260 (61,0–79,2)**	**280–300 (85,3–91,4)**	**140–180 (42,7–54,9)**	**200–260 (61,0–79,2)**	**280–300 (85,3–91,4)**	**140–180 (42,7–54,9)**	**200–260 (61,0–79,2)**	**280–300 (85,3–91,4)**
Maximum Wind Speed		**Percent Rating Reduction**								
mph	**m/s**									
15	7	0	0	0	0	0	0	0	0	0
20	9	0	0	0	0	0	0	0	40	60
25	11	0	0	10	0	20	40	0		
30	13	0	10	30	0	**50**				
35	16	0	20	50	0					
Above 35 mph (16 m/s)		**OPERATION NOT PERMITTED**								

For luffing jib operation in winds above 15 mph (7 m/s) with luffing jib positioned above 50°, load block from luffing jib point must weigh at least 10,000 lb (4 540 kg). ***Luffing jib could be blown over backwards if this precaution is not observed.***

For fixed jib operation in winds above 15 mph (7 m/s) with boom positioned above 70°, load block from fixed jib point must weigh at least 10,000 lb (4 540 kg). ***Fixed jib could be blown over backwards if this precaution is not observed.***

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SECTION 4
SET-UP AND INSTALLATION

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SECTION 4
SET-UP AND INSTALLATION

WARNING

Avoid Death or Serious injury!

Read and understand instructions in this section before attempting to install or remove attachment.

Moving Parts/Pinch Points!

Avoid death or crushing injury during crane assembly and disassembly:

- Assembly personnel – take every precaution to prevent injury when working near moving parts.
- Maintain communication between operator and assemblers to avoid accidents.

KEEP UNAUTHORIZED PERSONNEL WELL CLEAR OF CRANE.

Falling Load Hazard!

To prevent lifting equipment from failing and load from dropping, crane owner/user shall verify following prior to each lift:

- All lifting equipment (shackles, hooks, slings, blocks) has been properly maintained and is safe for use.
- All lifting equipment has a capacity equal to or greater than load to be lifted.

GENERAL INSTALLATION AND REMOVAL

This section contains installation and removal instructions for the #44 luffing jib attachment used on the 2250 MAX-ER™ 2000 with #79 Boom.

NOTE: For installation and removal of the #133 or 133A luffing jib, see the 2250 #133 or 133A Luffing Jib Operator's Manual

For the remainder of this section, luffing jib attachment is referred to as *jib or attachment*.

The attachment shall be installed, operated, and removed by experienced personnel trained in the operation and erection of construction cranes. These personnel shall read, understand, and comply with the instructions in this section, in the Luffing Jib Rigging Drawing, and in the Liftcrane Luffing Jib Capacity Charts provided with the attachment.

Contact your Manitowoc Distributor for a detailed explanation of any procedure not fully understood.

The installation/removal area must be firm, level, and free of ground and overhead obstructions. The area selected must be large enough to accommodate the crane with MAX-ER attachment, selected boom and jib length, and movement of an assist crane.

ACCESSING PARTS

Some parts of the crane, boom, and jib cannot be reached from the ground. Take necessary precautions to prevent falling off the crane, boom, or jib during installation and removal.

Owner/user shall provide approved ladders or personnel hoists so workers can safely access those areas of crane, boom, and jib that cannot be reached from ground. Adhere to local, state, and federal regulations for handling personnel.

Optional boom ladders (stored in boom butt) are available from Manitowoc. If your crane has ladders, see Section 3 in Operator's Manual provided with crane.

ASSIST CRANE REQUIREMENTS

An assist crane is required to install and remove boom and jib components.

The jib strut, main strut, strap link, and associated components are normally shipped from Manitowoc as an assembled unit. This assembly weighs approximately 23,250 lb (10 550 kg) and is one of the heaviest loads to be lifted. The assist crane is also required to lift the weight of the assembled jib.

CRANE WEIGHTS

See Crane Weights in Section 1 of this manual for the weights of the individual boom and jib components.

OPERATING CONTROLS

Become thoroughly familiar with the location and function of all operating controls provided for the crane and attachments. Read and understand the instructions in the following manuals before attempting to operate the crane:

- Section 3 of this manual.
- Section 3 of the Operator's Manual fro the 2250 Crane.
- Section 3 of the Operator's Manual for the MAX-ER 2000.

Reference Only

COUNTERWEIGHT REQUIREMENT

See applicable capacity charts and raising procedure charts for counterweight requirements when operating with the jib.

WARNING

Tipping Hazard!

Install proper counterweight before operating crane. See capacity charts, raising procedure charts, and travel specifications chart in Luffing Jib Capacity Chart Manual for counterweight requirements.

BLOCKED CRAWLERS

To prevent crane from tipping, all boom and jib combinations must be raised and lowered over blocked crawlers. See capacity charts and raising procedure charts for blocked crawler requirements and to Crawler Blocking Diagram folio for instructions.

WARNING

Tipping Hazard!

Block crawlers before raising or lowering boom and jib from ground.

LUFFING JIB RIGGING DRAWING

See the end of this section for applicable Luffing Jib Rigging Assembly drawings.

LUFFING JIB RAISING PROCEDURE

See the end of this section applicable luffing jib raising (and lowering) procedures.

HANDLING COMPONENTS

Handle boom and jib components with care to avoid damaging lacings and chords. *Lift against chords only, never against lacings.*

Nylon slings should be used to handle components. If wire rope or chain slings are used, protective covering (such as sections of rubber tire) must be used between the slings and component.

The terms RIGHT, LEFT, FRONT, REAR used in this section see the operator's right, left, front, and rear sides when seated in the operator's cab looking forward with the crawler motors to the rear.

REMOVABLE LACINGS

The 20 ft (6,1 m) and standard 40 ft (12,2 m) #44 inserts are equipped with removable diagonal lacings. These lacings may be removed to allow the storage of other components during shipping.

If removed, the removable diagonal lacings must be reinstalled before operating the crane.

See Figure 4-1 for following procedure.

1. Thoroughly clean all dirt from mating surfaces between lacings and supports on inserts.
2. Reinstall proper number of removable lacings in each insert with bolts and stop nuts.
3. Securely tighten nuts.

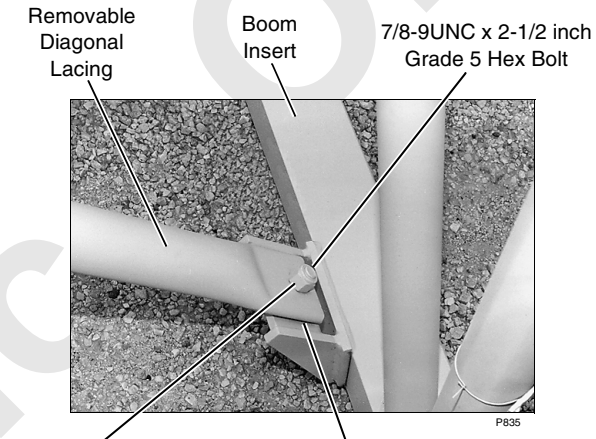

FIGURE 4-1

IDENTIFYING BOOM/JIB SECTIONS

The boom and jib sections are marked for proper identification, as follows (Figure 4-2, View A):

- **Past Production —** boom or jib number, part number, and manufacturing code stamped into two connectors (diagonally opposite) on both ends of each insert and on end of top and butt.
- **Current Production —** boom or jib number, part number, and manufacturing code stamped into a plate mounted on all four chords of each section.

IDENTIFYING PENDANTS

To aid in identification, the pendant part number and length are stamped into the pendant ends (Figure 4-2, View B).

NOTE: Pendants attached to the main strut are used during strut erection and then stowed. No other pendants are used with this attachment.

Reference Only

IDENTIFYING STRAPS

The backstay and jib straps are marked for identification as shown in (Figure 4-2, View C).

DRUMS

The crane must be equipped with a standard width split rear drum (Drum 4). Front drum (Drum 1) cannot be installed when equipped with MAX-ER 2000 attachment.

RETAINING CONNECTING PINS

All connecting pins are retained with snap pins or cotter pins. ***Do not operate crane until all snap pins and cotter pins are installed and spread.***

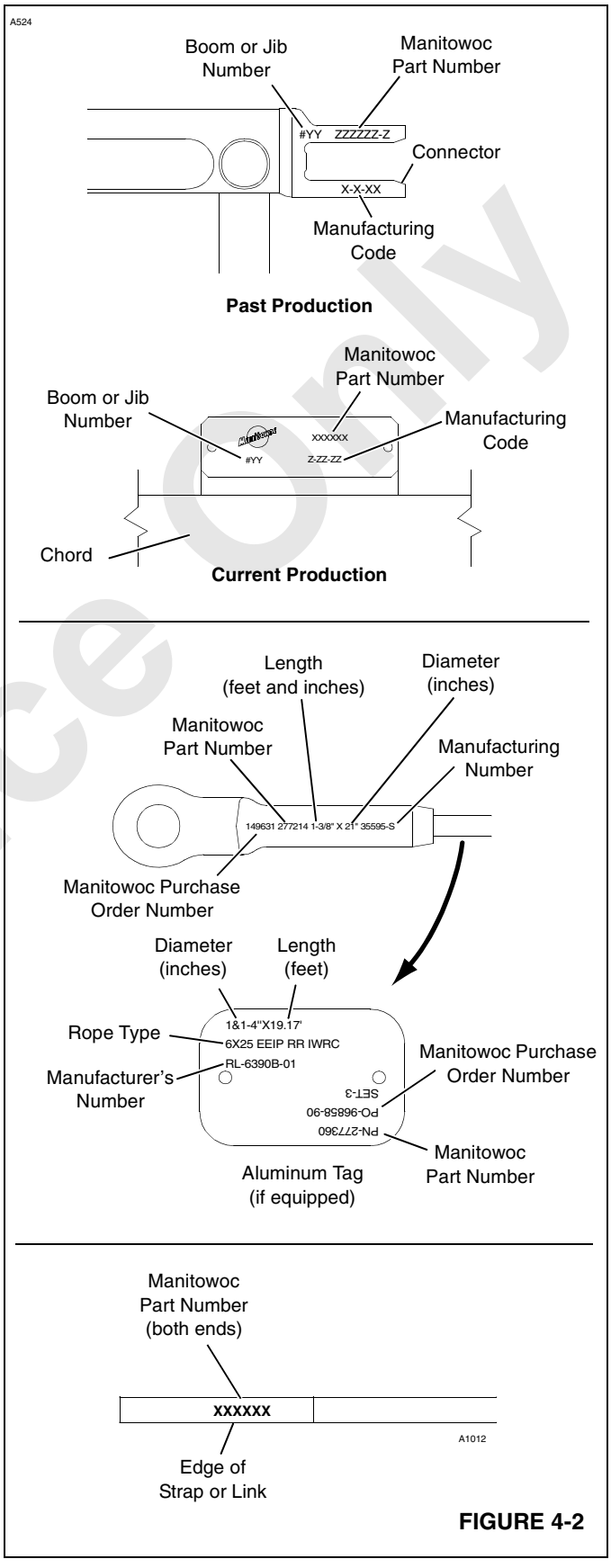

FIGURE 4-2

Reference Only

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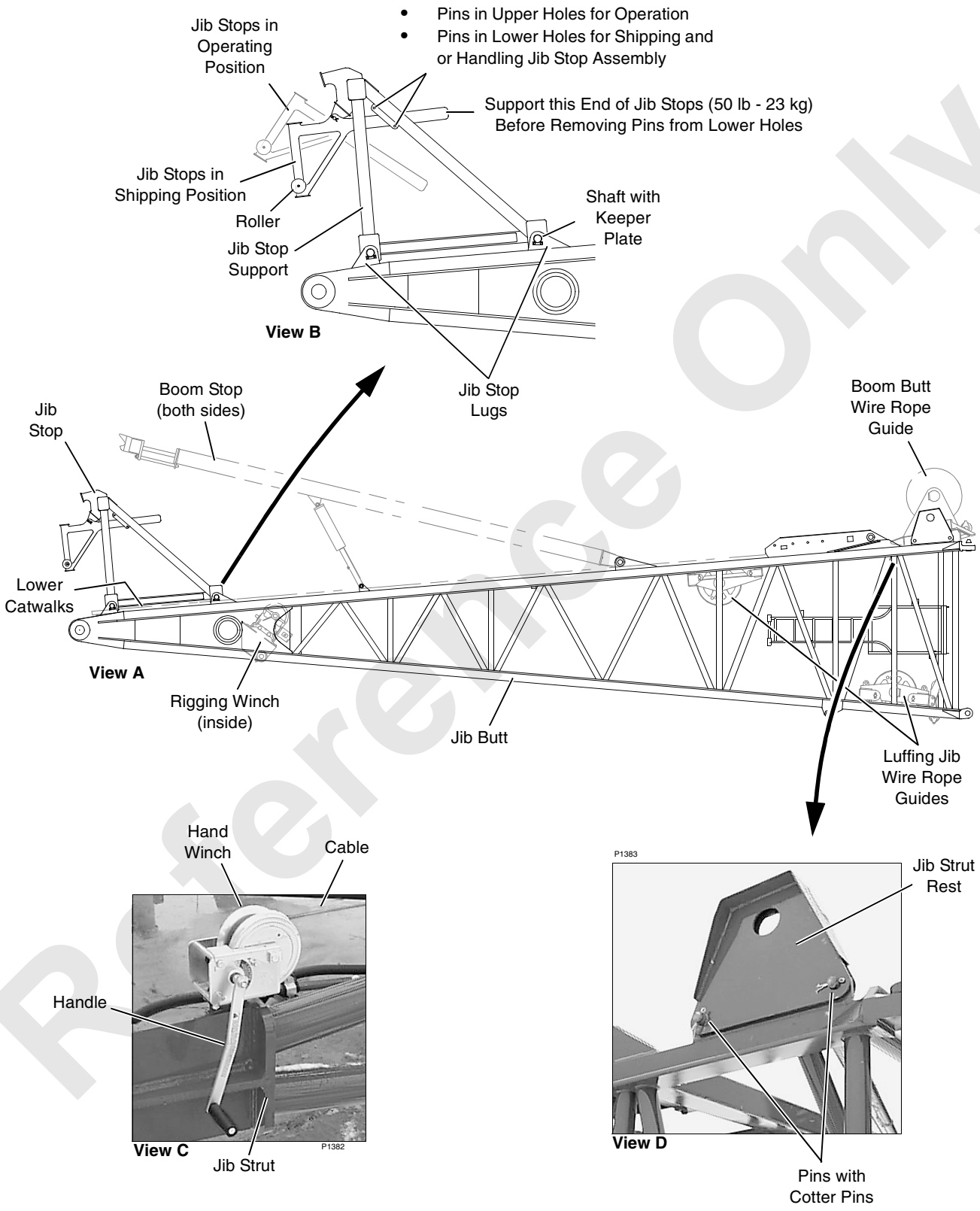


FIGURE 4-3

Reference Only

JIB RIGGING — #44 LUFFING JIB ON #79 BOOM

Installing Jib

Lower Boom

1. Travel front crawler rollers onto blocking.
2. Swing upper slightly to either side and lower load block and weight ball onto ground.
3. Swing boom in-line with crawlers and lower boom onto blocking approximately 4 ft (1,2 m) high (Figure 4-4).

Prepare Boom and Jib

1. If installed, disconnect load line from hook and weight ball. *Load line from drum in boom butt (Drum 9) is required for raising main strut.*

   The load block can remain reeved if it is required for operation.
2. Remove upper boom point, if equipped.
3. If equipped with a long reach boom, convert it to a heavy lift boom as shown on Luffing Jib Rigging Assembly drawing.
4. Change boom length as necessary to meet job requirements.
5. Check that all boom inserts and straps are assembled in proper sequence according to rigging drawing.

CAUTION

Tipping Crane Hazard!

Crane can tip if step 6 is not performed when required.

6. If specified by raising procedure chart, remove following items:
   - Lower boom point from #79 boom top.
   - Rigging winch and luffing jib wire rope guides from #44 jib butt.
7. Add or remove crane counterweight to comply with applicable capacity chart.
8. Remove boom stops, lower catwalk, and wire rope guide from #44 boom butt.
9. Modify #44 boom butt for use as jib butt as shown on modification drawings.
10. Pin jib stop assembly to lugs on jib butt (Figure 4-3, Views B and C).
    a. Insert shafts through lugs on jib butt and legs of jib stop support.
    b. Install keeper plates.
11. Attach hand winches to jib strut if necessary (Figure 4-3, View C).

    If necessary, install cables and attach to adjustable straps.

    Install handles if removed for shipping.
12. Pin jib strut rest to lugs on jib butt (Figure 4-3, View D).

Reference Only

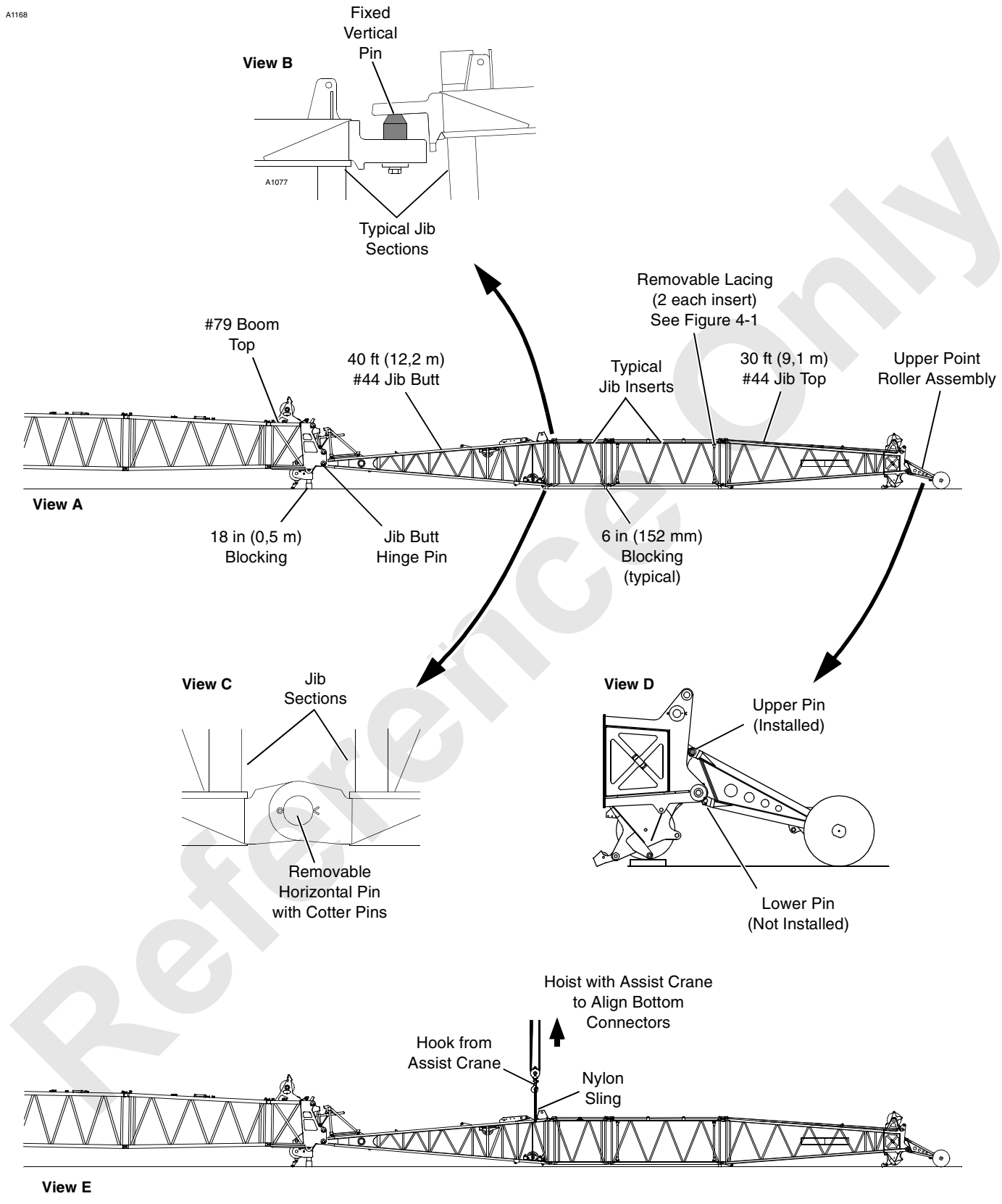


FIGURE 4-4

Reference Only

Install Jib Butt

See Figure 4-4, View A for following procedure.

1. Raise boom and block approximately 18 in (0,5 m) off ground.
2. Lift jib butt into position at end of boom top.

   Pin jib butt to lugs on boom top with hinge pins.
3. Lower jib butt onto blocking approximately 6 in (152 mm) high.

See Figure 4-3, View B for remaining steps.

4. Support jib stops at point shown (50 lb - 23 kg).
5. Remove pins from lower holes and install them in upper holes (operating position).
6. Lower jib stops to operating position.

Install Jib Inserts and Top

See Figure 4-4 for following procedure.

1. Determine jib length required for lift to be made.

WARNING

Collapsing Jib Hazard!

Install removable lacings, if removed, before raising jib.

2. Check that removable diagonal lacings are securely fastened to each jib insert (see Figure 4-1).
3. Assemble jib inserts *in proper sequence — shortest inserts nearest butt* (see Luffing Jib Assembly Rigging drawing):
   a. Lift first insert into position and engage top connector holes in insert with fixed vertical pins in butt as shown in View B.
   b. Lower insert onto blocking approximately 6 in (152 mm) high at top end of insert.

      Insert will be pinned to butt later (see Connect Jib Inserts to Jib Butt topic).
   c. Lift next insert into position and engage top connector holes with fixed vertical pins (View B).
   d. Lower insert until bottom connector holes are aligned and install removable horizontal pins as shown in View C.
   e. Block inserts as assembly progresses.
   f. Repeat steps 3c – 3e until all inserts and jib top have been installed.

Connect Jib Inserts to Jib Butt

See Figure 4-4, View E for following procedure.

1. Attach nylon lifting slings to chords at top end of butt.
2. Hook assist crane to slings. *Crane must have capacity to lift 1/2 the weight of assembled jib.*
3. Lift insert until bottom connecting holes line up.
4. Insert both horizontal pins and cotter pins (View C).

Reference Only

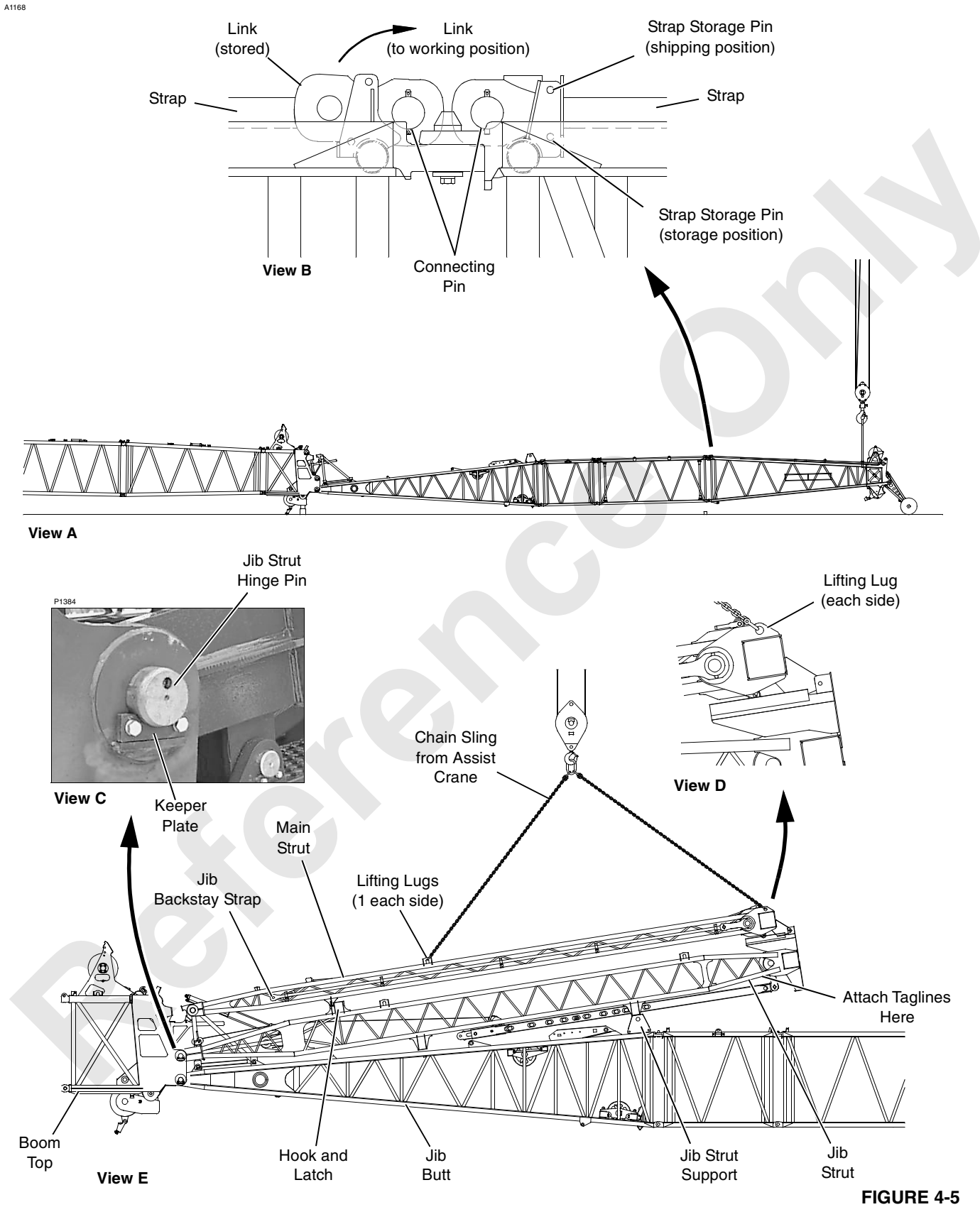


FIGURE 4-5

Reference Only

Complete Upper Jib Point Roller Installation

See Figure 4-5, View A for following procedure.

1. Attach chain slings from assist crane to lugs at end of jib top.

NOTE: Assist crane must have sufficient capacity to lift weight of assembled jib.

2. Slowly lift jib top until bottom holes in upper jib point roller are aligned with holes in jib top.
3. Insert lower pins to complete pinning upper jib point roller to jib top.
4. Lower jib top until rollers are on ground.
5. Disconnect chain slings from jib top.

Connect Jib Straps

See Figure 4-5, View B for following procedure.

Jib straps and links are stored on the inserts and jib top for shipping.

1. Remove strap storage pins from shipping position and store in storage position.
2. Remove retaining pins, collars, and connecting pins from end of each strap.
3. Rotate stored links from storage position to working position.
4. Install connecting pins, collars, and retaining pins to pin links to adjacent strap.

Install Jib Strut Assembly

See Figure 4-5 for following procedure.

The main strut and the jib strut are shipped from the factory completely assembled and ready for installation.

1. Remove pins from jib backstay strap storage brackets along each side of strut. Store pins in storage lugs on brackets.

   Allow straps to rest in storage brackets.
2. Attach taglines approximately 15 ft (5 m) long to top of jib strut.
3. Attach shackles and chain slings to lifting lugs on top of main strut (4 places) (Views D and E).

NOTE: Rear chain slings should be approximately 3 ft (1,0 m) longer than front slings so strut assembly is at an angle to jib stop as shown in View E.

4. Lift strut assembly into position over jib butt.

   Use taglines to guide assembly.
5. Align connecting holes in jib strut with holes in boom top.
6. Pin jib strut to boom top. *Install washers as pins are inserted to limit jib butt side play to 1/8 in (3 mm).*
7. Install keeper plates (View C).
8. Lower strut assembly so top end of jib strut rests on jib strut support (View E).
9. Remove taglines.

Reference Only

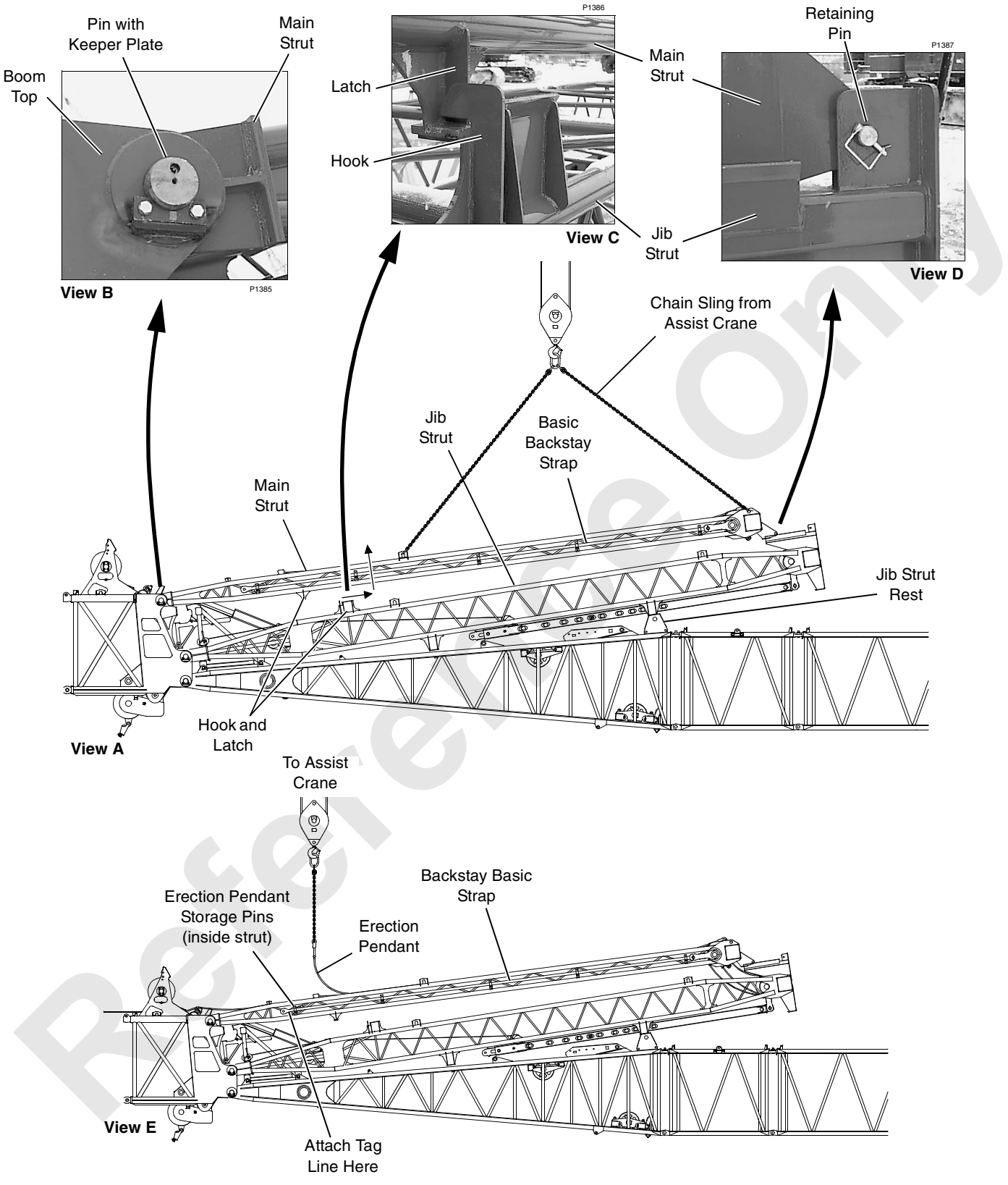


FIGURE 4-6

Reference Only

Install Main Strut

See Figure 4-6 for following procedure.

DANGER

Moving Parts Hazard!

Main strut will shift suddenly if handled with 2-point connection. Use a 4-point connection (View A) to handle main strut.

1. Connect chain sling from assist crane to four lifting lugs on main strut (View A).
2. Remove retaining pins connecting main strut to jib strut (View D). Store pins in jib strut holes once main strut is moved.

NOTE: It may be necessary to lift main strut slightly to free pin for removal.

3. Separate main strut from jib strut:
   a. Lift main strut slightly so that it just lifts off jib strut at hook and latch (View C).
   b. Swing and hoist as required to unhook main strut from latch on jib strut (View A).
   c. Slowly swing to move main strut butt toward boom butt.

NOTE: Sucker line reeving between jib and main struts, if installed, must have sufficient slack to allow moving main strut to boom top.

4. Align connecting holes and pin main strut to boom top. Install keeper plates (View B).
5. Disconnect assist crane from strut.

Install Wire Rope

Luffing Hoist (Drum 5)

1. Select and confirm LUFFING JIB mode.
2. Place reel of luffing hoist wire rope on ground along left side of jib near sheave end of struts.
3. Attach wire rope to sucker line, if installed.

   If sucker line is not installed, reeve luffing hoist wire rope through strut sheaves and guide sheaves as shown in reeving diagram on rigging drawing.
4. Securely anchor wire rope to right side of luffing hoist drum with straight wedge provided (see Wire Rope Installation and Maintenance in Section 5 of the Crane Service Manual).

   Wire rope must spool off front of luffing hoist drum.
5. Tightly wind excess wire rope onto luffing hoist drum.
6. Anchor free end of luffing hoist wire rope to left side of main strut with socket and wedge provided (see Wire Rope Installation and Maintenance in Section 5 of the Crane Service Manual).

Load Line (Drum 9)

1. Select and confirm MAXER mode.
2. Install Drum 9 load line if not installed. (Drum 9 is load drum in boom butt.)

   See Load Block Reeving in Section 4 of Crane Operator's Manual for proper routing and reeving of load lines.
3. Spool load line from Drum 9 until end of load line can be attached to erection pendant.

Connect Erection Pendants

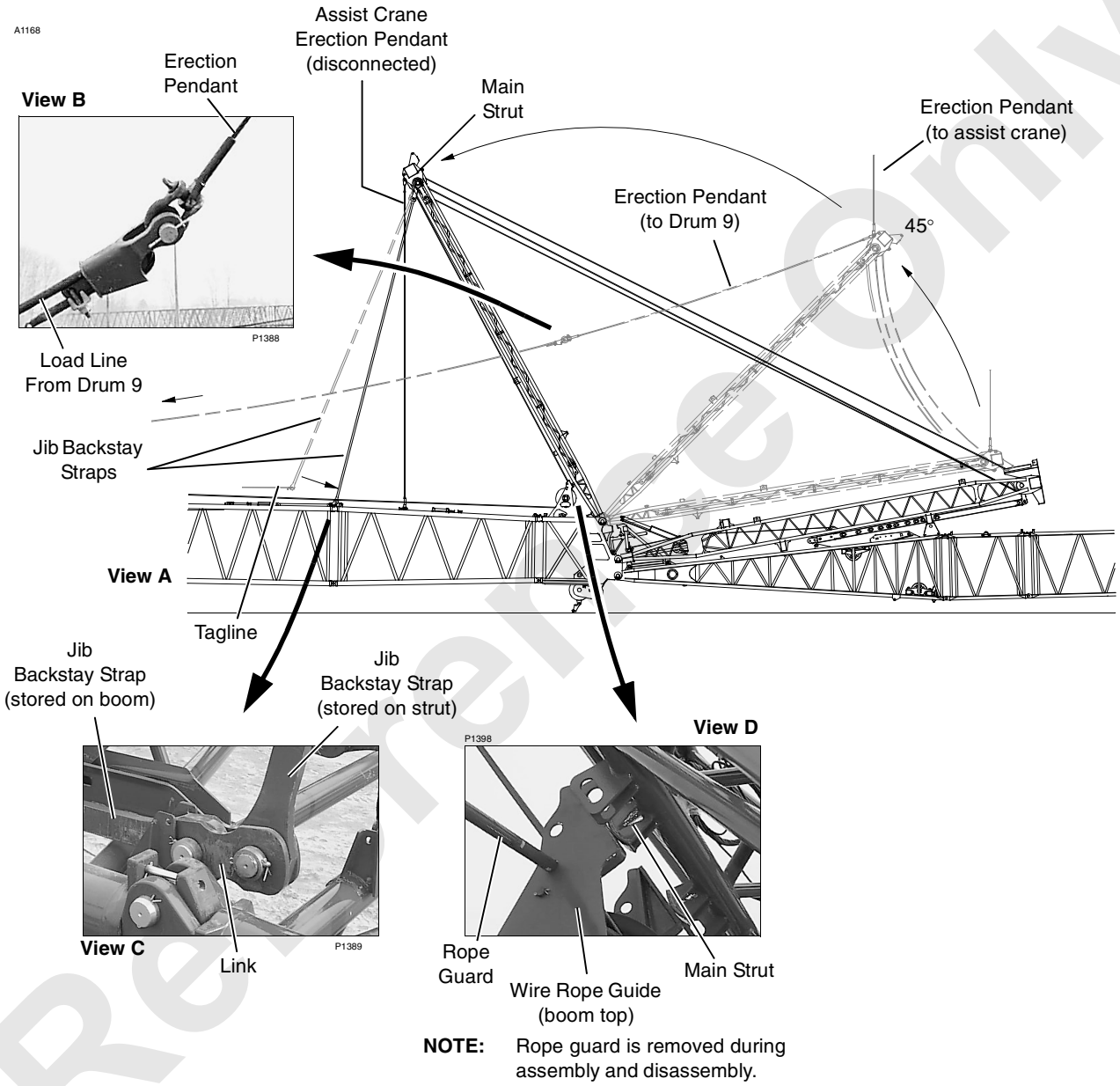
See Figure 4-6, View E for following procedure.

1. Attach taglines to backstay basic straps. taglines should be at least 20 ft (6 m) long.
2. Unpin strut erection pendants from storage lug at bottom of main strut.

   Stow pins in storage lugs.
3. Connect assist crane to one pendant.
4. Hoist and swing so erection pendant is extended vertically above top of main strut.
5. Connect other pendant to load line from Drum 9 (Figure 4-7, View B).

   Main strut can now be raised. See Raise Main Strut topic for procedures.

Reference Only



NOTE: Rope guard is removed during assembly and disassembly.

FIGURE 4-7

Reference Only

Raise Main Strut

See Figure 4-7 for following procedure.

WARNING

Moving Part Hazard!

Do not stand on boom top or jib butt while main strut is being raised or lowered.

Wait until main strut is stopped and supported by assist crane or luffing hoist line before climbing onto boom top or jib butt.

1. With one erection pendant connected to assist crane, slowly haul in assist crane load line to raise main strut. At same time pay out luffing hoist line (Drum 5) (View A).

CAUTION

Strut Damage!

Keep load line from assist crane centered over main strut while raising strut. Avoid side loading.

Operators must carefully match rate of speed at which luffing jib hoist line (Drum 5) is payed out with rate of speed at which assist crane load line is hauled in.

Luffing hoist wire rope should remain slack until strut is raised to vertical.

CAUTION

Strut Damage!

Too much tension in luffing hoist wire rope can damage strut or boom top and possibly cause strut to buckle. Keep luffing hoist wire rope slack as strut is raised.

2. Raise strut to approximately 45° and stop.
3. Slowly haul in crane load line (Drum 9) until load line is supporting strut (View A).
4. Lower assist crane load block until erection pendant hangs free from top of main strut.
5. Disconnect erection pendant from assist crane.
6. Slowly haul in crane load line to raise jib strut. Continue to pay out luffing jib hoist line (View A).
7. As strut nears vertical, haul in luffing jib hoist line until it is tight. *Verify that jib strut is resting on jib butt*.
8. Slowly pay out luffing jib hoist line to move main strut past vertical to rear. Stop hauling in crane load line.
9. Have ground personnel use taglines to guide jib backstay straps so they do not hit boom lacings.
10. Continue to pay out luffing jib hoist line to lower main strut until it rests against stop on boom top (View D).

Connect Backstay Straps

See Figure 4-7, View C for following procedure, unless otherwise noted.

1. Remove strap storage pins from shipping position and store (Figure 4-5, View B).
2. Remove retaining pins, collars, and connecting pins from end of each strap.
3. Rotate links from storage position to working position.
4. Align hole in basic straps on main strut with holes in links Insert connecting pins.
5. Install collars and retaining pins.
6. Lower assist crane load block so erection pendant hangs suspended from top of main strut (Figure 4-7, View A).
7. Pay out crane load line (Drum 9) so erection pendant hangs suspended from top of main strut (Figure 4-7, View A).
8. Disconnect erection pendants.

   Allow pendants to hang suspended.

Reference Only

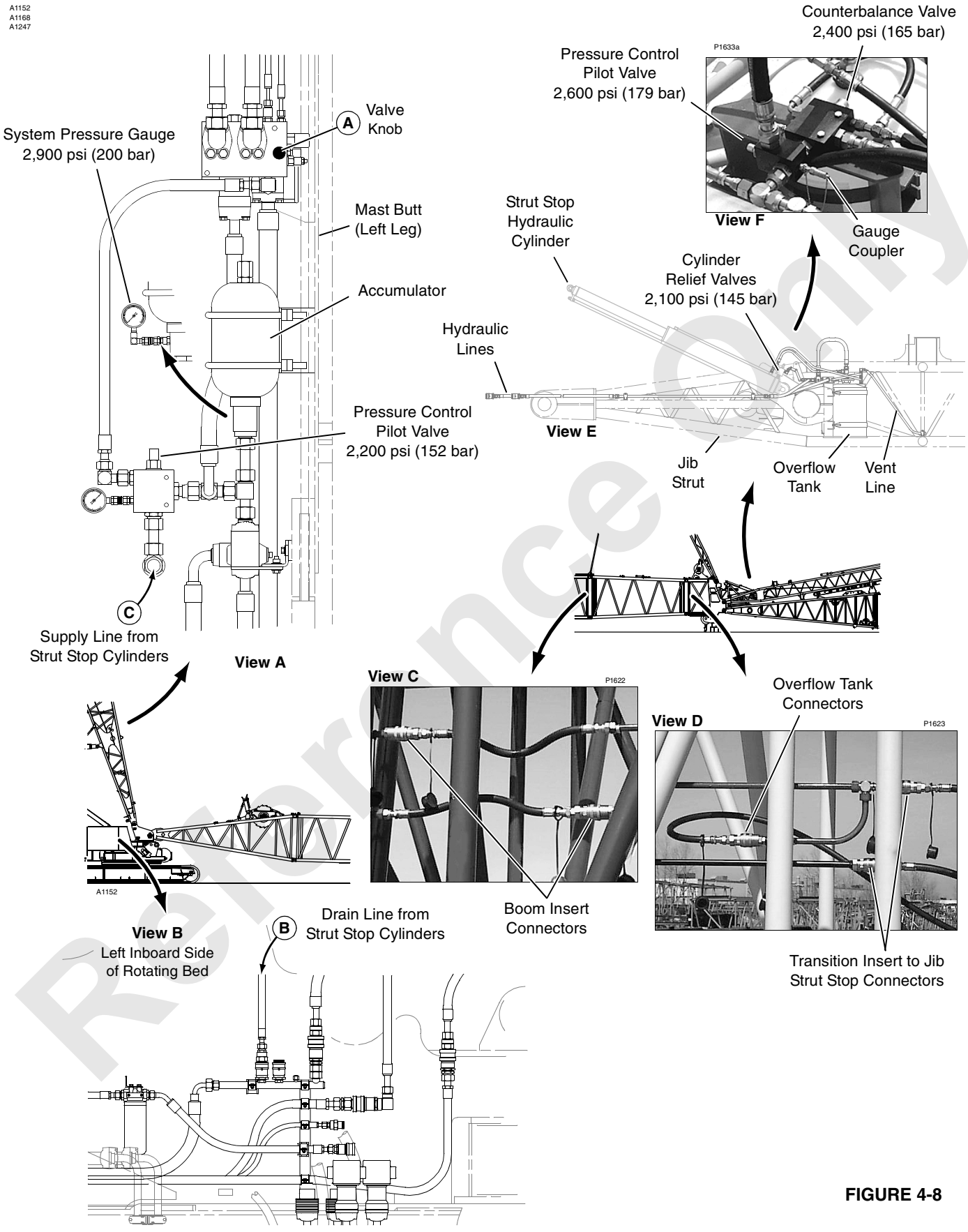


FIGURE 4-8

Reference Only

Connect Hydraulic Hoses

See Figure 4-8 for following procedure.

CAUTION

Strut Damage

If luffing jib will be operated when air temperature is below 32°F (0°C), drain and refill hydraulic systems (crane and boom) with Petro Canada Premium Plus hydraulic oil (MCC #549318). Be sure strut stop cylinders and supply lines are completely drained before refilling.

For operation below 10°F (-12°C) use a thinner fluid such as Petro Canada Premium Arctic 15 (MCC #A03745).

The strut stop hydraulic hoses have quick couplers with dust caps. The dust caps must be removed before making the connections.

1. ***Stop engine***.
2. Loosen locking knob behind valve knob (A, View A).
3. Fully open valve knob (A) by turning counterclockwise. Hoses cannot be connected in following steps until this step is performed.
4. Connect drain hose (B, View B) (top hose from boom butt) to coupler on rotating bed.
5. Connect supply hose (C, View A) (bottom hose from boom butt) to coupler on mast butt.
6. Connect hoses between ends of boom inserts along entire length of boom (View C).
7. Connect hydraulic hoses from jib strut to couplers on transition insert (View D).
8. Fully close valve knob (A, View A) by turning clockwise and lock adjustment with locking knob.

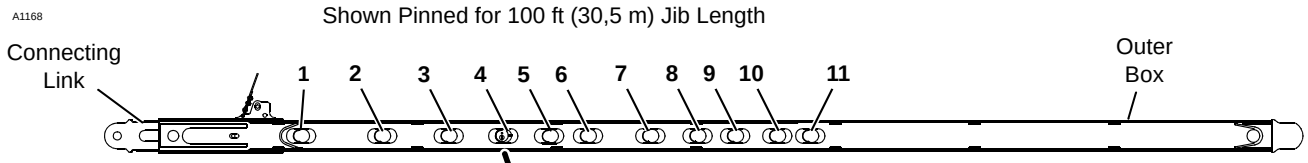
   Valve must be closed to ensure proper operation of system.
9. Start engine.
10. Strut stop cylinders should fully extend, if not already done.
11. Check fluid level in overflow tank. Tank should be empty.

    If tank is not empty, possible causes include:

    - Wrong oil viscosity for cold weather operation (see CAUTION above).
    - Drain line hydraulic connections not made.
    - Bent or kinked drain line blocking oil flow.
    - Drain line check valve on transition insert incorrectly installed.
12. Confirm that system pressure gauge at accumulator on mast butt (View A) reads 2,900 psi (200 bar) – see Assembly Guide in MAX-ER 2000 Operator's Manual for adjustment procedure.

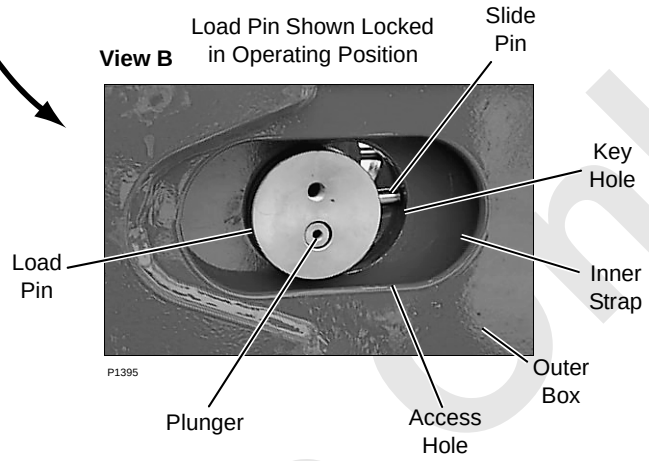
    All other valves are preset to pressure settings given in Views A, E, and F.

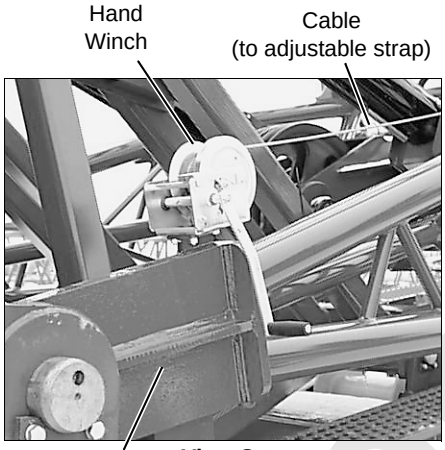
Reference Only

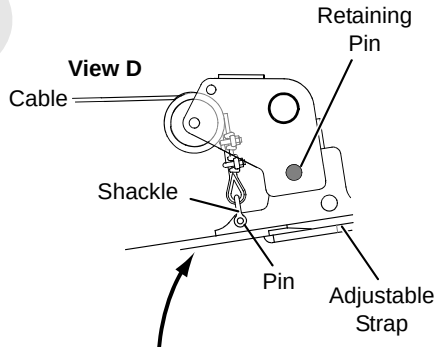


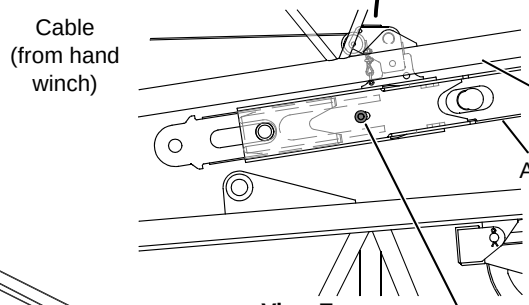
View A

Hole No.	Jib Length	Hole No.	Jib Length
1	70 ft (21,3 m)	8	150 ft (48,8 m) 160 ft (48,8 m)
2	80 ft (24,4 m)		
3	90 ft (27,4 m)	9	170 ft (51,8 m) 180 ft (54,9 m)
4	100 ft (30,5 m)		
5	110 ft (33,5 m)	10	190 ft (57,9 m) 200 ft (61,0 m) 210 ft (64,0 m)
6	120 ft (36,6 m)		
7	130 ft (39,6 m) 140 ft (42,7 m)	11	220 ft (67,1 m) 230 ft (70,1 m) 240 ft (73,2 m)









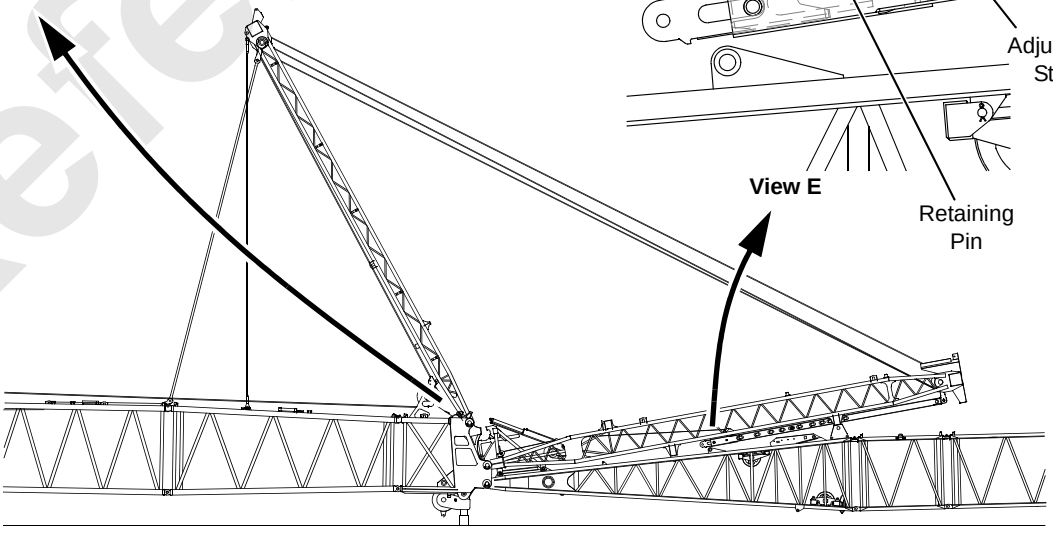


FIGURE 4-9

Reference Only

Set Up Adjustable Straps

See Figure 4-9 for following procedure.

The adjustable strap (View A) consists of four major parts: a connecting link, an inner strap, an outer box, and a load pin. The connecting link is pinned to the backstay strap on the strut. The inner strap is inside the outer box. The outer box slides up or down over the inner strap. The load pin must be inserted in one of a number of key holes in the inner strap before the jib strut is raised. The length of the jib dictates which key hole must be used for the load pin. The load pin is designed to slide through the outer box when the strap is extended.

The outer rims of the load pin have flanges that hold the pin in place in the key hole in the inner strap (View B). A slide pin mounted inside the load pin holds the load pin in place. Depressing a spring-loaded plunger in the load pin allows the slide pin to move through the load pin as long as the plunger is depressed. When released, the plunger engages one of two grooves in the slide pin to lock the slide pin in place. Extending the slide pin holds the load pin in place in the key hole.

DANGER

Crane Collapse!

Pin adjustable strap in proper hole for jib length (Figure 4-9, View A)

WARNING

Adjustable Strap Separation!

Make sure adjustable strap locking pin is installed (Figure 4-9, View E).

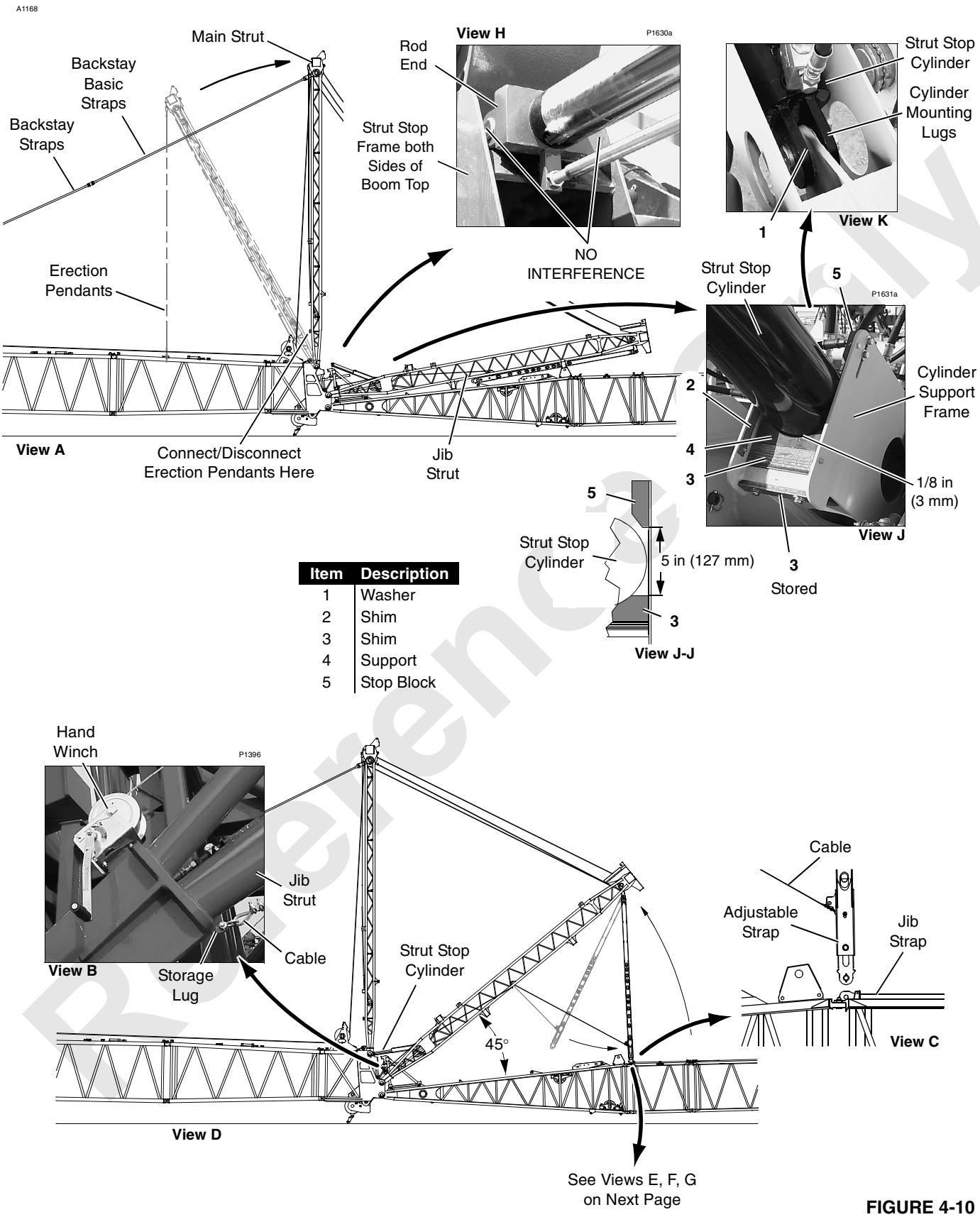
1. Determine correct pinning location for adjustable strap based on desired jib length. (See View A and table in Figure 4-9).
2. Remove load pin from its stored position in adjustable strap (Previous Production) or from the Parts Box (Current Production) by depressing plunger and sliding pin toward wider end of key hole (View B).

   Remove pin through outer box access hole.
3. Insert pin through access hole in outer box at required pinning location.
4. Depress plunger and slide load pin into narrow end of key hole. Release plunger.
5. Check that load pin is tightly locked against narrow end of key hole (View B).

NOTE: If load pin is not tightly locked in operating position, remove load pin, rotate 180°, and reinstall. Distance from edge of groove to end of slide pin is not the same at each end.

6. Make sure locking pins are installed as shown in View E.
7. Check that cables from hand winches are attached to adjustable straps (View D).
8. Check that cables between hand winches and adjustable straps are snug.
9. Check that ratchets on hand winches are set to prevent winches from paying out line.
10. Remove retaining pins holding adjustable straps to jib strut. *There should be no load on these pins before removing them.*

Reference Only



Item	Description
1	Washer
2	Shim
3	Shim
4	Support
5	Stop Block

FIGURE 4-10

Raise Jib Strut

See Figure 4-10 for following procedure, unless otherwise noted.

WARNING

Moving Part Hazard!

Do not stand on boom top or jib butt while either strut is being raised or lowered.

Wait until struts are stopped and supported by an assist crane or luffing hoist wire rope before climbing onto boom top or jib butt.

NOTE: While raising strut, use mechanical angle indicator mounted on jib strut to monitor strut angle.

1. Haul in luffing jib hoist line to pull main strut forward until the backstay straps are taut enough to raise jib strut (View A).
2. Attach erection pendants to storage lugs on main strut (View A).
3. Continue hauling in luffing jib hoist line to slowly raise jib strut to approximately 45° angle and stop.
4. While raising jib strut, observe strut stop cylinder rod ends:
   a. Make sure rod ends don't interfere with any part of strut stop frames as shown in View H.

      If interference occurs, stop raising jib strut and readjust washers (1, View K) and shims (2, View K) until there is NO INTERFERENCE (cylinders centered in frames).

   b. Install shims (3, View J) under supports (4) so that when rollers bottom out in strut stop pockets on boom top (View B, Figure 4-11) there is a 1/8 in (3 mm) gap between supports (4) and underside of cylinders.

      Then reposition stop blocks (5, View J) so distance between stop blocks and supports (4) is 5 in (127 mm) as shown in View J-J.
5. Continue raising strut as needed to connect adjustable straps to jib straps on jib insert (angle varies depending on jib length).

   Stop before strut stop cylinders are fully retracted or strut angle is 70°. At 70° cylinder rod will have approximately 5 in (127 mm) travel remaining (Figure 4-11, View B).
6. Connect adjustable straps to jib straps on jib insert:
   a. Release ratchet on hand winch (View B).
   b. Using hand winch, lower adjustable strap (View D).
   c. Raise or lower strut as needed to align adjustable strap with jib strap on jib insert (View E).
   d. Pin adjustable strap to jib strap (View E).
   e. Repeat preceding steps for other adjustable strap.
7. Lower jib strut until adjustable straps are fully retracted (View D).
8. Check that there is no load on retaining pin in each adjustable strap.
9. Remove retaining pins and store in storage lug (View F). *Pins should have no load when they are removed.*

CAUTION

Structural Damage!

Length of adjustable strap will not change with retaining pin in erection position. Remove pin and store before raising jib strut.

10. Disconnect cable from hand winch and attach to storage lug (View B).

    Use hand winch to tighten cable as needed.

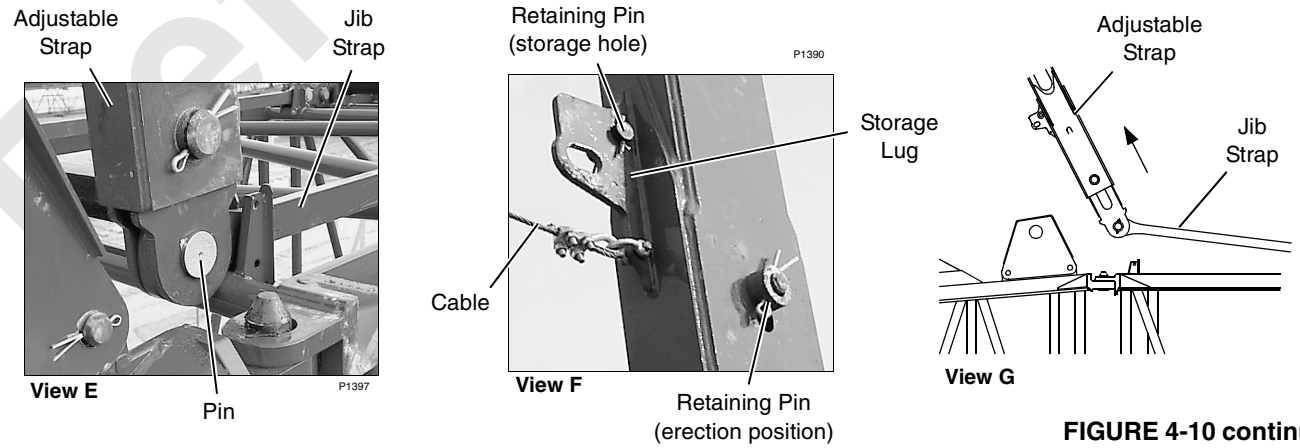


FIGURE 4-10 continued

Reference Only

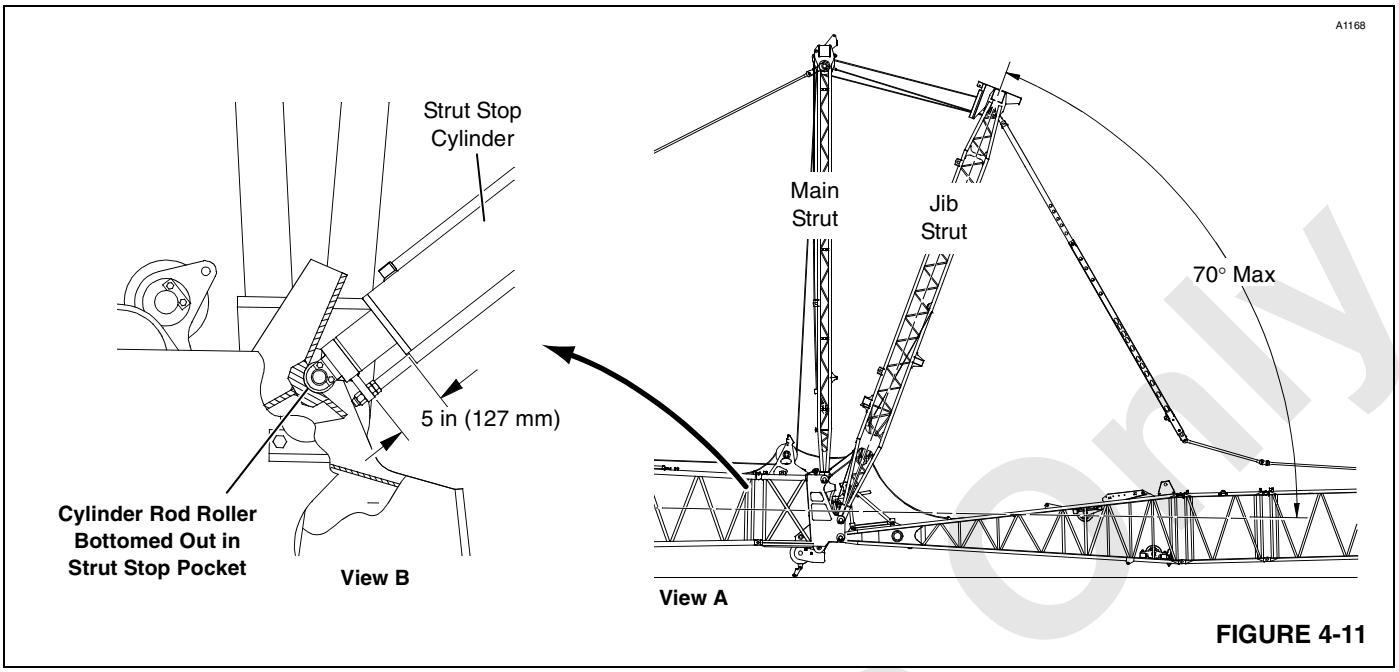


FIGURE 4-11

Install Jib Load Line

See Load Block Reeving in this section for instructions.

In-Line Method: If jib will be raised using In-Line Method, install load block and weight ball before boom and jib are raised.

Jack-Knife Method: If jib will be raised using Jack-Knife Method, reeve load lines through guide sheaves on jib point. Pull both load lines approximately 20 ft (6,1 m) past end of jib and lay lines on ground. Securely tie off load lines to jib. Install load block and/or weight ball after boom and jib have been jack-knifed into position just before jib point rollers lift off ground.

WARNING

Run-Away Wire Rope!

For long boom and short jib combinations, wire rope on boom side of attachment can overhaul unsecured wire rope on jib side. Securely tie off load lines to jib before raising attachment.

1. Determine parts of load line required for job and size load block accordingly (see Wire Rope Specifications).
2. Route load lines from desired drums through proper guide sheaves on boom, on jib strut, and on jib point.
3. Reeve load line through lower jib point and load block sheaves and anchor load line at dead end (see Load Block Reeving later in this section and Wire Rope Installation and Maintenance in Section 5 of the Crane Service Manual).
4. Reeve load line through upper jib point sheaves and anchor load line at dead end on hook and weight ball (see Load Block Reeving in Section 4 of the Crane Operator's Manual and Wire Rope Installation and Maintenance in the Crane Service Manual).
5. Install block-up limit for upper and lower jib points (see Block-Up Limit Control in Section 6 of this manual).

Connect Electric Cords

Connect electric cords to respective junction boxes and switches:

- Load moment indicator (see Load Indicator Assembly drawing at end of this section).
- Angle indicators on boom and jib butt (see Angle Indicator in Section 6 of this manual).
- Block-up limit reel in jib butt (see Block-up Limit Control Assembly drawing at end of this section).

Adjust Electronic Devices

Perform following adjustments before raising boom and jib:

- Adjust boom and jib angle indicators (see Section 6 in this manual).
- Adjust automatic boom stop (see Section 6 in this manual).
- Adjust automatic luffing jib stop limit switches (see Section 6 in this manual).
- Block-up limit switches ((see Section 6 in this manual).
- Calibrate load moment indicator (see Load Moment Indicator Operation Manual).

Reference Only

- Adjust automatic boom stop maximum limit switch to 85° or 87°, depending on boom length, after boom and jib are raised (see Automatic Boom Stop in Section 6 of this manual).

Pre-Raising Checks

Make the following checks and correct any defects before raising the attachment.

- ❑ Lower boom point removed from boom top if required by raising procedure chart.
- ❑ Rigging winch and wire rope guides removed from jib butt if required by raising procedure chart.
- ❑ Crawlers blocked (required for all boom and jib lengths). See Crawler Blocking Diagram for blocking procedure.
- ❑ All installation steps given in this topic performed.
- ❑ Boom and jib inserts installed in proper sequence according to rigging drawings.
- ❑ Boom, jib, and backstay straps installed in proper sequence according to rigging drawings.
- ❑ All connecting pins installed and properly secured.
- ❑ Main and jib struts in operating position.
- ❑ All hydraulic connections made.
- ❑ Jib stop in operating position.
- ❑ Jib strut stop cylinders extended and adjusted.
- ❑ Boom and luffing hoist wire rope anchored properly to drums, spooled tightly onto drums, and engaged with proper sheaves (see Rigging Drawings and Wire Rope Installation and Maintenance in Luffing Jib Operator's Manual).
- ❑ Load lines anchored properly to drums, spooled tightly onto drums, and engaged with proper sheaves (see Reeving Diagrams and Wire Rope Installation and Maintenance in Luffing Jib Operator's Manual).
- ❑ Wire rope guard pins, bars, or rollers installed to retain wire rope in sheaves.
- ❑ **If load line will be installed after boom and jib are jack-knifed into position, make sure load line going to jib point is securely attached to end of jib point so load line cannot fall off jib and boom.**
- ❑ All blocking, tools, and other items removed from boom and jib.
- ❑ All blocking, tools, and other items removed from jib point roller path area.
- ❑ All safety devices installed, electric cords connected, and limits adjusted (see appropriate adjustments in Luffing Jib Operator's Manual):
  - Load moment indicator, if equipped.
  - Boom and jib angle indicators.
  - Automatic boom stop (must be reset for luffing jib operation after boom and jib are raised).
  - Automatic jib stops.
  - Jib and boom block-up limits.
- ❑ Luffing Jib Raising Procedure Chart reviewed, and following operations determined:
  - Raising method — in-line or jack-knife.
  - Required boom to jib angle for jack-knife raising method.
- ❑ Raising procedure in this section read and thoroughly understood.
- ❑ Proper amount of crane and MAX-ER counterweight installed.
- ❑ All lube points greased (see Lubrication in Luffing Jib Operator's Manual).
- ❑ MAXER and LUFFING JIB modes selected and confirmed.
- ❑ Wind within allowable limits for raising boom and jib (see Section 3 in this manual).

Reference Only

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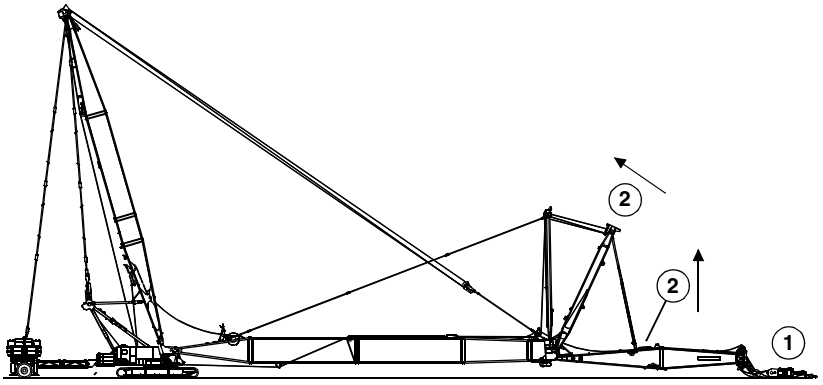
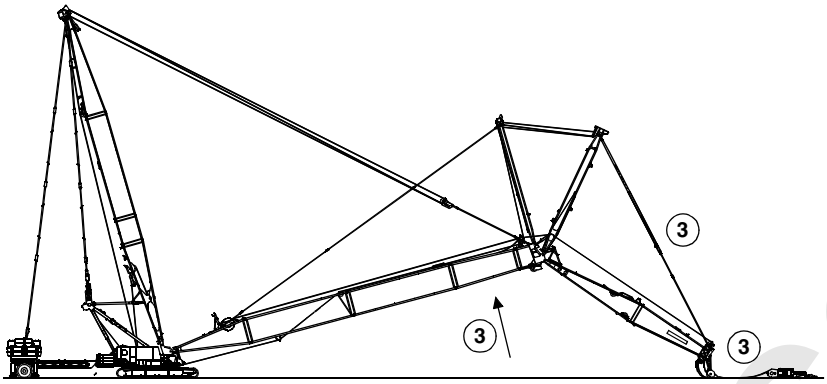
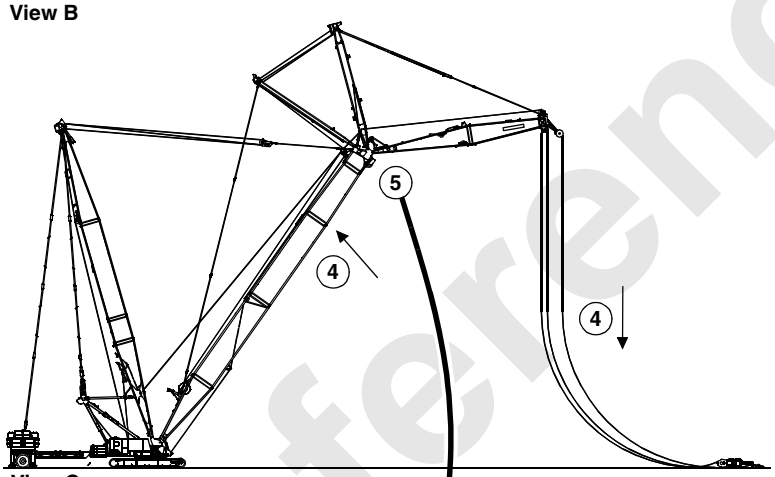
Numbered items correspond to step numbers for in-line raising procedure



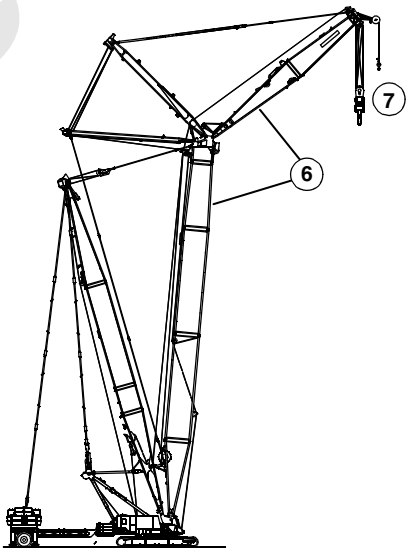
View A



View B



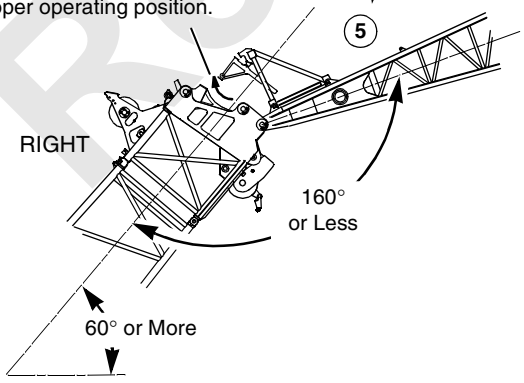
View C



View D

When steps 4 and 5 are performed, jib stop will swing past boom top into proper operating position.

View E



If steps 4 and 5 are not performed, jib stop will not swing past boom top into proper operating position.

Damage could occur. Jib stop will not operate properly.

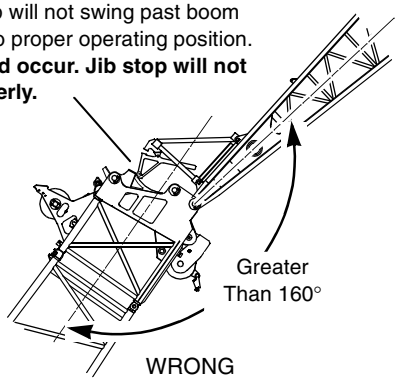


FIGURE 4-12

Reference Only

Raising Boom and Jib

As defined in the raising procedure chart, one of two methods can be used to raise the boom and jib depending on the boom and jib combination: In-Line Method or Jack-Knife Method. See the chart to determine which method can be used. ***Be sure crane is properly configured for selected raising method***.

WARNING

Falling Boom And Jib Hazard!

Select and confirm MAXER and LUFFING JIB modes. Operating in any other mode with luffing jib attached is prohibited.

Luffing jib limits are disabled when LUFFING JIB mode is off. Boom and jib could be pulled over backwards.

WARNING

Moving Part Hazard!

Warn all personnel to stand clear of jib point rollers while raising boom and jib.

Use digital display in cab to monitor boom angle and boom to luffing jib angle while raising boom and jib.

In-Line Method

Use following procedure to raise boom and jib with ***in-line method*** (Figure 4-12).

NOTE: It is normal for the following limits to come on during the raising procedure:

BLOCK UP – this fault will go off once the boom and luffing jib are raised and the load lines/block-up limit chains are hanging freely.

MAX UP 1 and MAX UP 2 – these faults will go off once the boom to luffing jib angle is less than 168°.

WARNING

Tipping Crane Hazard!

When using in-line method:

- Do not raise boom and jib combinations longer than specified on raising procedure chart.
- Raise boom to desired operating angle and position jib at required operating radius before lifting load blocks or weight balls from ground.

1. Install load blocks and/or weight balls (if not already done).
2. Slowly luff up to raise jib strut until jib straps clear strap storage brackets on jib and stop.

   It will be necessary to use limit bypass switch to luff up if MAX UP 1 limit is on.

CAUTION

Structural Damage!

Do not exceed 70° jib strut angle while boom is on ground. Use mechanical angle indicator on jib strut to monitor strut angle.

3. Slowly boom up to raise boom until jib straps are taut and stop. Jib point rollers will roll along ground as boom and jib rise.

CAUTION

Jib Stop Damage!

Jib stop will not swing past boom top to operating position if steps 4 and 5 are not performed. Damage could occur. Jib stop will not operate properly.

4. Continue to slowly boom up to raise boom and jib until boom angle is 60° or higher and stop.

   Pay out load lines as boom is raised.

5. Check boom to luffing jib angle. If angle is more than 160°, luff down until angle is 160° or less.

   Jib stop will swing past boom top into operating position.

   It will be necessary to use limit bypass switch to luff down if BLOCK UP limit is on.

6. Raise boom and jib to desired operating angle and radius.

   Pay out load lines as boom and jib are raised.

7. Travel crane forward until jib point is over load blocks and/or weight balls and lift load blocks and/or weight balls to desired operating position.

Reference Only

A1174

Numbered items correspond to step numbers for jack-knife raising procedure

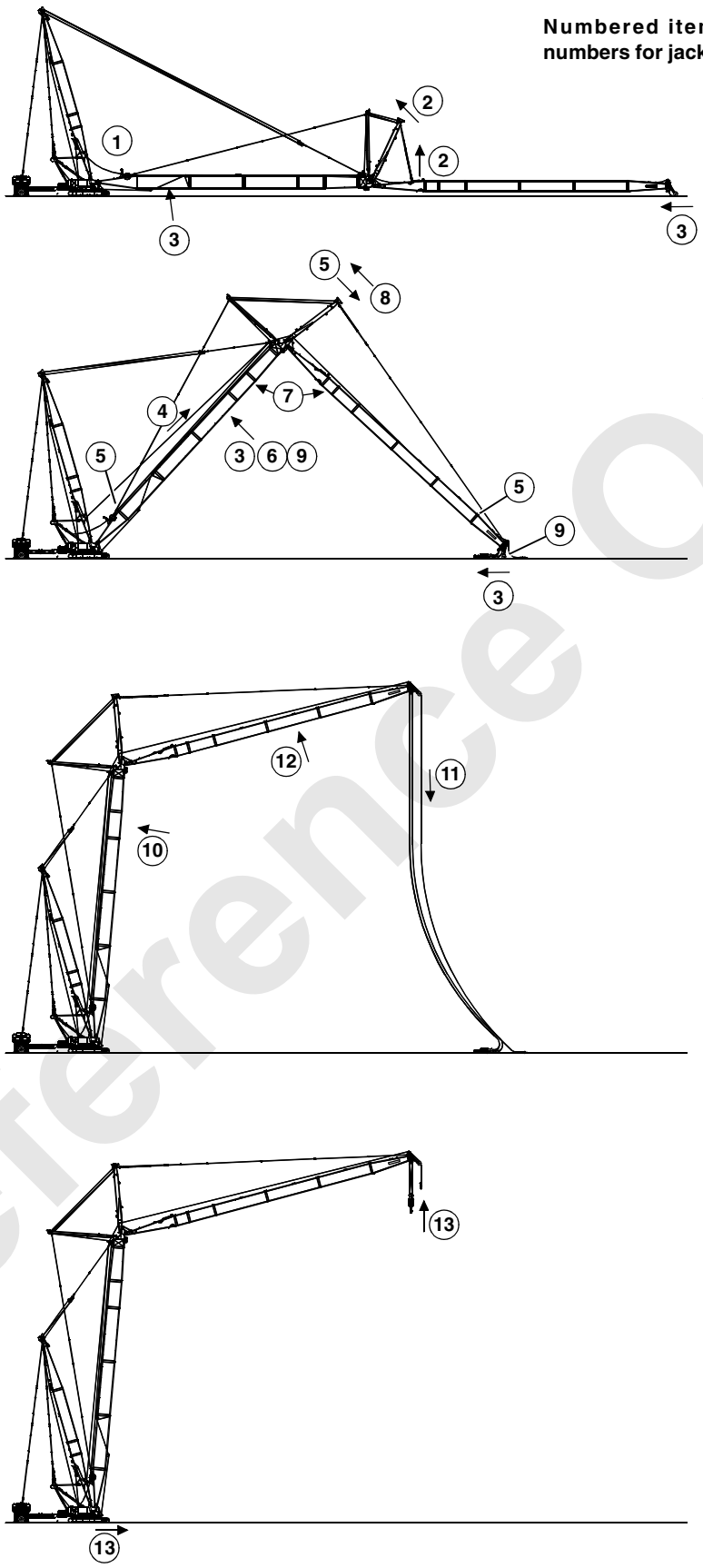


FIGURE 4-13

Reference Only

Jack-Knife Method

Use following procedure to raise boom and jib with ***jack-knife method*** (Figure 4-13).

WARNING

Tipping Hazard/Structural Damage!

- See Raising Procedure Chart to determine BOOM TO LUFFING JIB ANGLE that boom and jib must be jack-knifed to before jib can be raised.
- Do not raise boom and jib combinations longer than specified on raising procedure chart.
- Monitor angle on digital display as boom and jib are raised.

CAUTION

Structural Damage!

- Do not exceed 70° jib strut angle while boom is on ground. Use mechanical angle indicator on jib strut to monitor strut angle.
- **Avoid side loading as boom and jib are raised.**
- Disengage swing lock and release swing brake until boom and jib have been raised to required boom to luffing jib angle.

NOTE: It is normal for the following limits to come on during the raising procedure:

BLOCK UP – this fault will go off once the boom and luffing jib are raised and the load lines/block-up limit chains are hanging freely.

MAX UP 1 and MAX UP 2 – these faults will go off once the boom to jib angle is less than 168°.

1. Disengage swing lock and release swing brake.
2. Slowly luff up until jib straps lift out of strap brackets on jib and stop.
3. Slowly boom up.

   Jib point rollers will roll along ground as boom and jib are jack-knifed into position.

WARNING

Tipping Hazard/Structural Damage!

Do not allow jib or backstay straps to become too tight during raising steps. Crane will tip or structural damage will result.

Do not allow jib and backstay straps to become too slack during raising steps. Jib strut could fall onto jib butt.

4. Pay out load lines as boom and jib are raised.
5. Jib straps and backstay straps will tighten as boom and jib rise.

   OPERATOR AND SIGNAL PERSON — watch backstay straps and jib straps along left side of boom and jib as boom and jib rise.

   Pay out luffing hoist wire rope (luff down) so jib straps remain slack.

- Allow backstay straps to float up and down 3-6 in (76-162 mm) above strap brackets at top end of boom butt.
- Allow jib straps to float up and down 3-6 in (76-162 mm) above strap brackets at end of jib top.

  It will be necessary to use limit bypass switch to luff down if BLOCK UP limit is on.

6. Slowly continue with Jack-Knife Raising Procedure steps 3 – 5.

WARNING

Falling Jib Hazard/Structural Damage!

Do not lower jib to any boom or jib angle less than minimum stop (70°).

7. Stop raising boom when boom and jib have been positioned at required boom to luffing jib angle or jib is vertical, whichever occurs first. ***Monitor this angle on digital display***.
8. Slowly luff up until jib straps start to go into tension and stop.
9. Boom up to raise jib point rollers clear of ground, apply swing brake, and install load blocks and/or weight balls at jib points (see Install Load Lines topic earlier in this section).

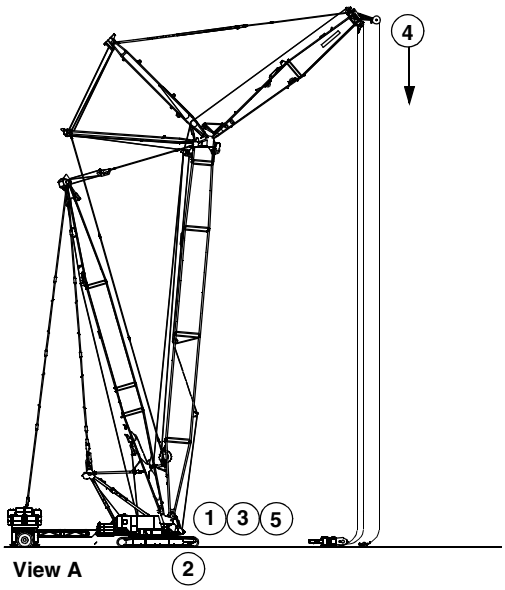
WARNING

Falling Load Hazard!

- Raise boom to desired operating angle and position jib at required operating radius before lifting load blocks or weight balls from ground.
- Untie load lines from jib after installing load blocks or weight balls. Load lines going up boom can overhaul load lines going down jib. Load lines can fall off boom.

10. Slowly raise boom to desired operating angle. See Capacity Chart for allowable boom angles.
11. Pay out load lines as boom and jib are raised.
12. Luff up to position jib at required operating radius for load to be handled.
13. Travel forward as required to position load blocks and/or weight balls below jib points and lift load blocks and/or weight balls to desired operating position.

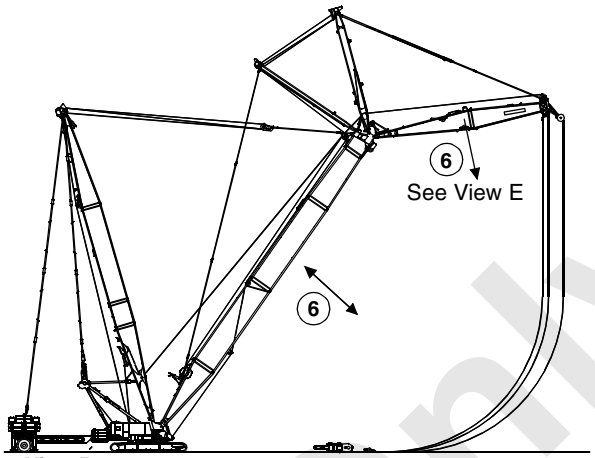
Reference Only



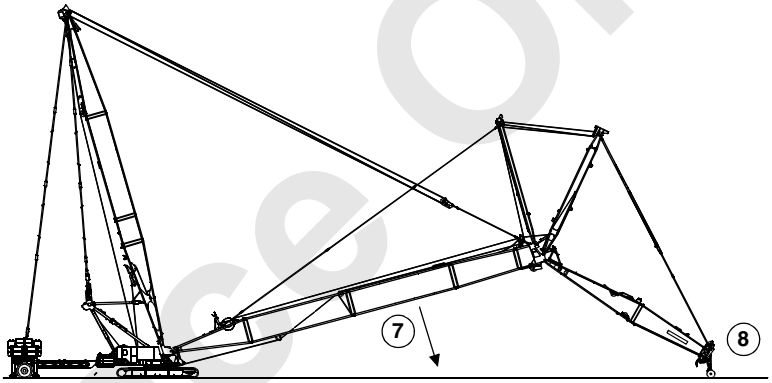
View A

Numbered items correspond to step numbers for in-line lowering procedure

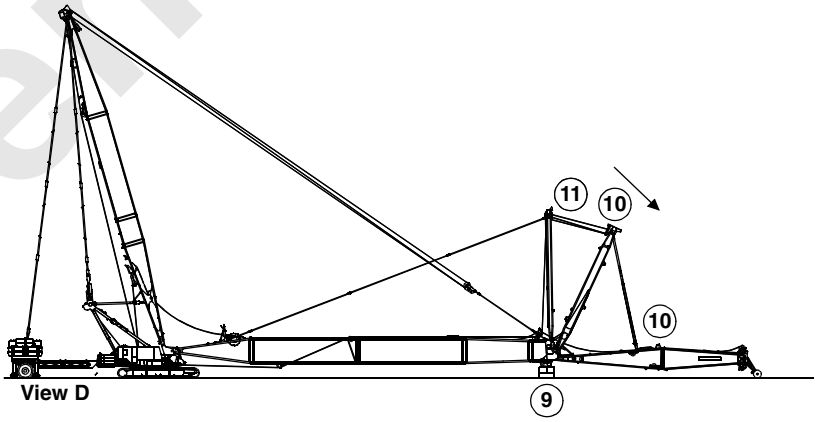
A1174



View B

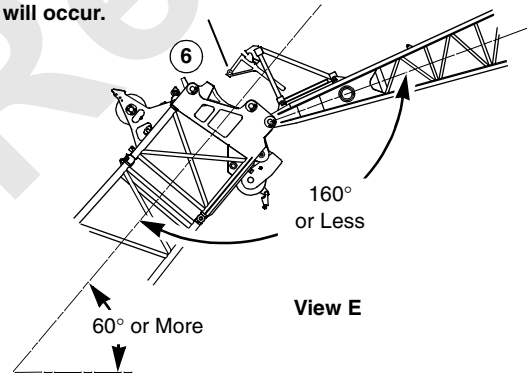


View C



View D

If step 6 is not performed, jib stop will not swing past boom top into storage position. **Damage will occur.**



View E

FIGURE 4-14

Reference Only

Lowering Boom and Jib

As defined in the raising procedure chart, one of two methods can be used to lower the boom and jib depending on the boom and jib combination: In-Line Method or Jack-Knife Method. See the chart to determine which method can be used. **Be sure crane is properly configured for selected method**.

WARNING

Falling Boom And Jib Hazard!

Select and confirm MAXER and LUFFING JIB modes. Operating in any other mode with luffing jib attached is prohibited.

Luffing jib limits are disabled when LUFFING JIB mode is off. Boom and jib could be pulled over backwards.

WARNING

Moving Part Hazard!

Warn all personnel to stand clear of jib point rollers while raising boom and jib.

NOTE: Use digital display in cab to monitor boom and boom to luffing jib angles while lowering boom and jib.

In-Line Method

Use following procedure to lower boom and jib with in-line method (Figure 4-14).

WARNING

Tipping Crane Hazard!

- Observe boom to luffing jib angles specified on raising procedure chart.
- Lower all boom and jib combinations over blocked crawlers.
- Lower all load blocks and/or weight balls to ground before lowering boom and jib.

NOTE: It is normal for BLOCK UP, MAX UP 1, and MAX UP 2 limits to come on during the lowering procedure.

1. Swing upperworks in line with lowerworks so boom is over *front of crawlers*.
2. Travel crawler rollers onto blocking.
3. Swing boom and jib slightly to either side of center.
4. Lower load blocks and/or hook and weight balls to ground.
5. Swing boom and jib in line with crawlers.

CAUTION

Jib Stop Damage!

Jib stop will not rotate to proper storage position if step 6 is not performed.

6. Position boom at 60° or higher boom angle and lower luffing jib to 160° or less boom to luffing jib angle.
7. Slowly boom down until jib point rollers are just above ground.

   It will be necessary to use limit bypass switch to boom down if BLOCK UP limit is on.

   Haul in load lines as boom and jib are lowered but *do not lift load blocks and/or weight balls off ground*.
8. Remove load blocks and /or weight balls.

CAUTION

Structural Damage!

Do not exceed 70° jib strut angle while boom is on ground. Use mechanical angle indicator on jib strut to monitor strut angle.

9. Slowly boom down until boom top rests on blocking.

   Jib point rollers will roll along ground as boom lowers.
10. Slowly luff down to lower jib strut until jib straps rest in strap storage brackets on jib.
11. Lower struts as described later in this topic.

Reference Only

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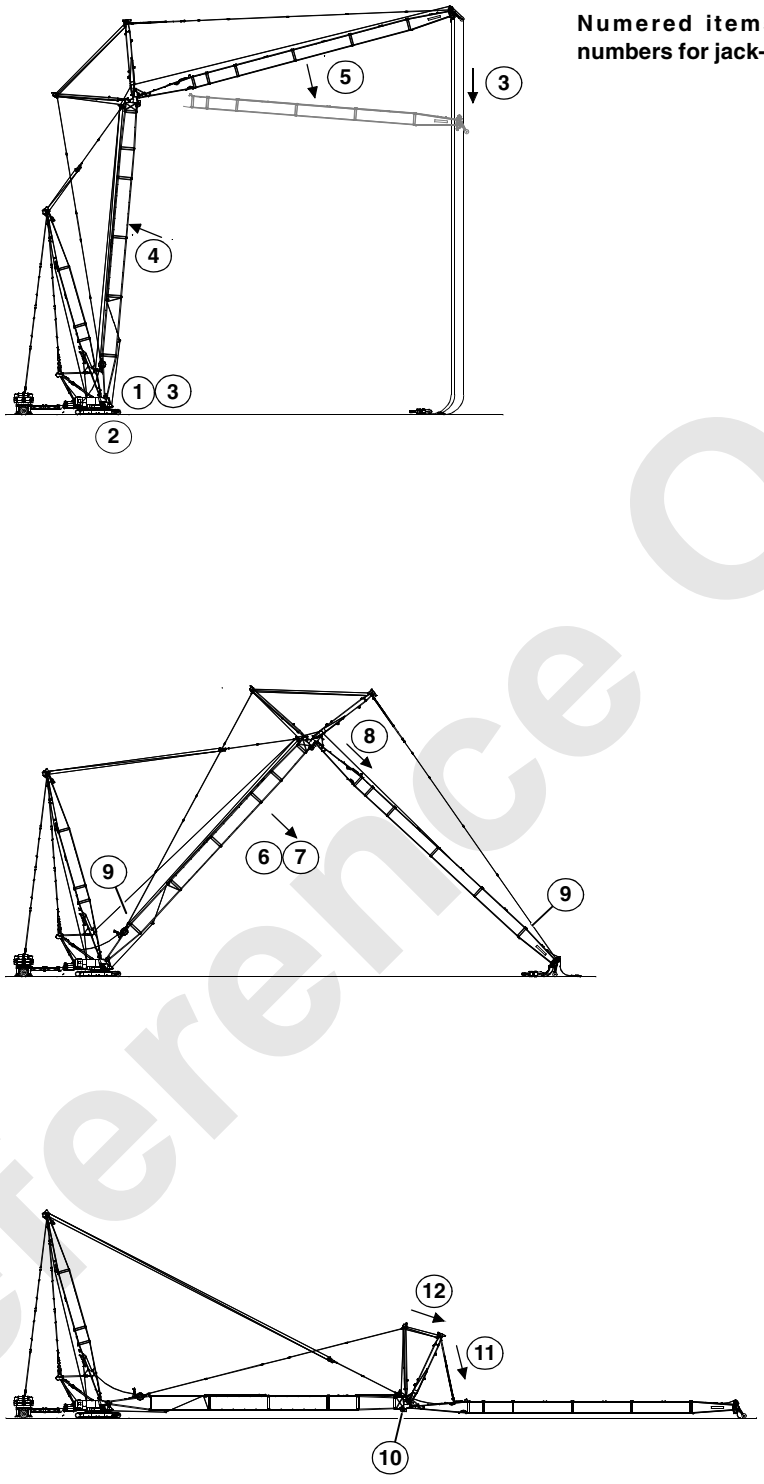


Numered items correspond to step numbers for jack-knife lowering procedure

FIGURE 4-15

Reference Only

Jack-Knife Method

Use this procedure to lower the boom and jib with the jack-knife method (Figure 4-15).

WARNING

Tipping Crane Hazard!

- Observe boom to luffing jib angles specified on raising procedure chart. Use digital display in cab to monitor boom and boom to luffing jib angles.
- Lower all boom and jib combinations over blocked crawlers.
- Lower all load blocks and/or weight balls to ground before lowering boom and jib.

NOTE: It is normal for the BLOCK UP, MAX UP 1, and MAX UP 2 limits to come on during the lowering procedure.

1. Swing upperworks in line with lowerworks so boom is centered over *front of crawlers.*
2. Travel crawler rollers onto blocking.
3. Swing boom and jib slightly to either side of center and lower load blocks and/or weight balls onto ground. Then swing boom and jib in line with crawlers and apply swing brake.
4. Raise boom to 70° or higher boom angle.

WARNING

Tipping Crane Hazard!

Do not lower boom and jib to ground until boom has been positioned at minimum boom angle of 70° and jib has been positioned at specified boom to luffing jib angle. Use digital display in cab to monitor boom and boom to luffing jib angles.

WARNING

Falling Jib Hazard!

Do not lower jib to any boom to luffing jib angle less than minimum stop (70°). Structural damage to jib butt will occur, possibly causing jib to collapse.

5. Slowly luff down to position jib at required boom to luffing jib angle (see Raising Procedure Chart for angle). ***Monitor angle on digital display***.

   It will be necessary to use limit bypass switch to luff down if BLOCK UP limit is on.

CAUTION

Structural Damage!

- **Avoid side loading as boom and jib are lowered.**
- Disengage swing lock and release swing brake when jib point rollers contact ground.

6. Slowly boom down until jib point rollers contact ground.

   Depending on boom and jib combination, jib may be hanging vertical when rollers contact ground. If this happens, raise jib (luff up) until jib is a few degrees forward of vertical.

   It will be necessary to use limit bypass switch to boom down if BLOCK UP limit is on.
7. Release swing brake (disengage swing lock) and continue to lower boom slowly.

   Jib point rollers will roll along ground as boom and jib unfold.
8. Pay out load lines as boom and jib lower.
9. Jib straps and backstay straps will slacken as boom and jib lower.

   OPERATOR AND SIGNAL PERSON — watch backstay straps and jib straps along left side of boom jib as boom and jib lower.

   Do not allow straps to become to slack.

- Allow backstay straps to float up and down 3-6 in (76-162 mm) above strap brackets at top end of boom butt.
- Allow jib straps to float up and down 3-6 in (76-162 mm) above strap brackets at end of jib top.

  It will be necessary to use limit bypass switch to luff down if BLOCK UP limit is on.

WARNING

Tipping Hazard/Structural Damage!

Do not allow jib or backstay straps to become too tight during lowering steps. Crane will tip or structural damage will result.

Do not allow jib and backstay straps to become too slack during lowering steps. Jib strut could fall onto jib butt.

10. Continue with Jack-Knife Lowering Procedure steps 7 – 9 until boom top is resting on blocking at ground level.
11. Slowly luff down to lower jib strut until jib straps rest in strap storage brackets on jib.
12. Lower struts as described later in this topic.

Reference Only

Removing Jib

Lower Jib Strut

WARNING

Moving Part Hazard!

Do not stand on boom top or jib butt while either strut is being lowered.

Wait until struts have been stopped and are supported by load line or luffing hoist line before climbing onto boom top or jib butt during disassembly.

1. Pay out luffing jib hoist line (Drum 5) to lower jib strut. Continue lowering strut until adjustable strap is fully retracted (Figure 4-10, View D). Strut should be at approximately 45° angle.
2. Remove retaining pin from storage lug and install in adjustable strap (Figure 4-10, View F). Raising or lowering jib strut slightly may be necessary to align holes in strap.
3. Disconnect adjustable strap from jib strap. (Figure 4-10, View E).
4. Connect adjustable strap to jib strut:
   a. Release ratchet on hand winch (Figure 4-10, View B).
   b. Disconnect cable from storage lug on jib strut (Figure 4-10, View B).
   c. Attach cable to lug on adjustable strap (Figure 4-10, View F).
   d. Unpin adjustable strap from backstay strap (Figure 4-10, View E).
   e. Using hand winch, raise adjustable strap (Figure 4-10, View D).
   f. Attach adjustable strap to jib strut (Figure 4-9, View E).
   g. Repeat preceding steps 4a – 4f for other adjustable strap.
5. Lower jib strut so that strut top rests on jib strut support (Figure 4-10, View A).
6. Disconnect hydraulic hoses from jib strut at boom transition insert (Figure 4-8, View D). ***Install dust caps.***

   Coil hoses and tie them to jib strut for storage.
7. If boom will be removed, disconnect hydraulic hoses between boom inserts (Figure 4-8, View C) and at couplers in mast butt and on rotating bed (Figure 4-8, Views A and B). ***Install dust caps.***

Lower Main Strut

1. Disconnect erection pendants from storage lugs on main strut (Figure 4-10, View A).
2. Connect one erection pendant to crane load line (Drum 9) (Figure 4-7, View B).
3. Connect other erection pendant to assist crane load line.

   Haul in assist crane load line, but keep erection pendant slack.
4. Haul in Drum 9 load line to pull strut to rear until it rests against stops on boom top (Figure 4-7, View D).

   Pay out luffing jib hoist line to prevent lifting jib strut.
5. Disconnect jib backstay straps from backstay straps on boom (Figure 4-7, View C).
6. Rotate links to storage position and insert storage pins.
7. Attach taglines to end of backstay basic straps. taglines should be about 20 ft (6,1 m) long.
8. Haul in luffing jib hoist line to pull main strut forward.

   As strut passes vertical, use Drum 9 to lower main strut. Slowly pay out luffing jib hoist line as main strut is lowered.
9. Lower main strut to approximately 45° and stop (Figure 4-7, View A).
10. Haul in assist crane load line until assist crane is supporting strut.
11. Pay out assist crane load line to lower strut. Pay out Drum 9 as strut is lowered to keep its erection pendant slack.
12. Lower main strut and allow to rest on jib strut.

    Guide backstay basic straps into storage brackets with taglines while lowering strut.
13. Remove taglines.
14. Disconnect erection pendants from assist crane load line and Drum 9 load line.

    Store pendants to storage lugs on main strut (Figure 4-6, View E).
15. Insert strap storage pins in straps on side of strut to store basic straps.

Assemble Struts for Shipping

1. Connect assist crane to main strut (Figure 4-6, View A).
2. Remove hinge pin connecting main strut to boom top (Figure 4-6, View B).
3. Lift lower end of strut to disengage strut from boom top.
4. Swing to slide top of main strut away toward top of jib strut.
5. Lower strut so it rests on jib strut.
6. Slide main strut to rear to engage hook and latch (Figure 4-6, View C).

Reference Only

7. Pin main strut top to jib strut top with latch pin (Figure 4-6, View D). Use assist crane to align holes if necessary.
8. Rehook chain sling to connect sling to four lifting lugs on main strut (Figure 4-5, View D).
9. Remove pin connecting main strut to boom top (Figure 4-5, View D).
10. Lift strut assembly from jib butt and set to side.

Remove Jib

WARNING

Collapsing Boom/Jib Hazard!

Improper disassembly of boom and jib sections can cause boom or jib to collapse onto personnel removing connecting pins.

Death or serious injury can result if precautions listed below are not taken:

1. Lower boom/jib so boom and jib points are supported on blocking or ground.
2. Slacken rigging — do not attempt to remove connecting pins while boom or jib is supported by rigging.
3. Block below both ends of each boom or jib section before removing connecting pins.
4. Stand on outside of boom or jib sections when removing connecting pins. Never work under or inside boom or jib sections. Use care not to damage lacings and chords as pins are knocked out.

WARNING

Collapsing Boom/Jib Hazard!

Improper disassembly of boom and jib sections can cause boom or jib to collapse onto personnel removing connecting pins.

- Lower boom/jib so boom and jib points are supported on blocking or ground.
- Slacken rigging — do not attempt to remove connecting pins while boom or jib is supported by rigging.
- Block below both ends of each boom or jib section before removing connecting pins.
- Stand outside of boom or jib sections when removing connecting pins. Never work under or inside boom or jib sections. Use care not to damage lacings and chords as pins are knocked out.

Remove jib in opposite sequence of installing jib.

Automatic boom stop must be reset to 85° for MAX-ER operation without jib.

Reference Only

WIRE ROPE INSTALLATION

NOTE Wire rope manufacturer's recommendations take precedence over information in this section.

Wire Rope Storage

Store wire rope in coils or on reels off the ground or floor in a clean and dry indoor location. If outdoor storage is necessary, the wire rope must be covered with a protective wrapper. Keep the wire rope away from acids, fumes, and other corrosives. Keep the wire rope away from heat that can dry out the lubricant. If the storage period will be long, lubricate the wire rope and perform periodic inspection given in this section at least monthly.

Removing Wire Rope from Shipping Reel

CAUTION!

Wire Rope Damage!

Shipping reel must rotate when wire rope is unwound. Attempting to remove wire rope from a stationary reel can result in a "kinked" wire rope, and wire rope will be ruined.

1. Mount wire rope shipping reel on a shaft supported at both ends by jacks or blocks as shown in Figure 4-16.

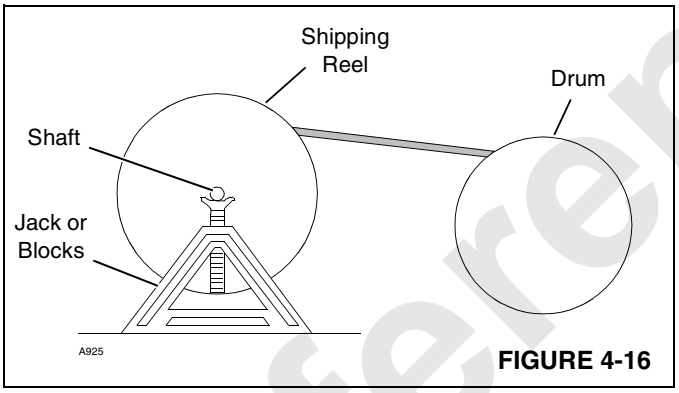


FIGURE 4-16

2. Provide a brake at shipping reel (see Figure 4-17) so wire rope can be wound tightly onto drum.

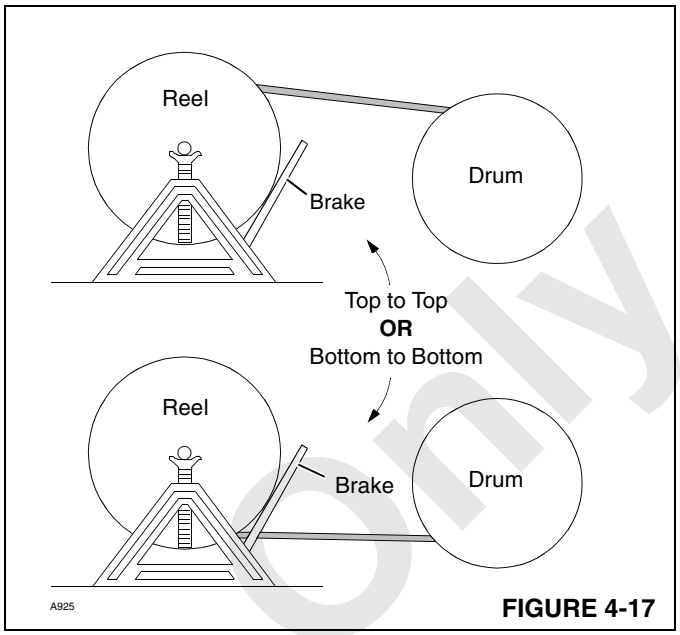


FIGURE 4-17

3. *Avoid a reverse bend when winding wire rope onto drum:* wind from top of reel to top of drum or from bottom of reel to bottom of drum as shown in Figure 4-17.

4. Avoid dragging wire rope in dirt or around objects that can scrape, nick, cut, or crush wire rope.

Seizing and Cutting Wire Rope

Apply tight seizings of annealed wire to the ends of all wire rope. If not done, the rope wires and strands may slacken. This action will result in overloading of some strands and underloading of others. Bird caging and breakage of the wire rope can occur.

Before cutting wire rope, apply seizings on both sides of the point where the cut will be made. Then cut the wire rope with a torch, rope cutter, or abrasive cut-off wheel.

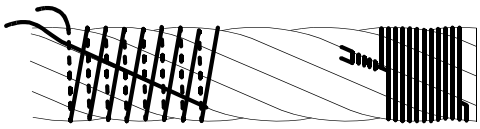
See Figure 4-18 for:

- Number of seizings to be applied to the ends of wire rope and to both sides of the point where a cut will be made.
- Proper application method. Each seizing should be one rope diameter long.

Reference Only

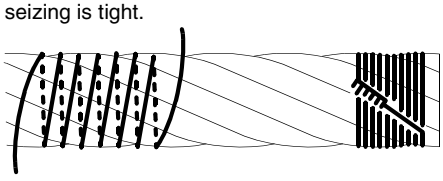
Wire Rope Type	Seizings Required
Preformed	1
Non-preformed 7/8 (22 mm) Diameter or Smaller	2
Non-preformed 1 in (26 mm) Diameter or Larger	3

Place free end of seizing wire in valley between two stands. Then wind seizing wire over free end as shown. Finally, twist and pull two ends of seizing wire together until seizing is tight.



View A Rope Diameter 1 in (26 mm) and Larger

Wind seizing wire around wire rope as shown. Then twist two ends of seizing wire together at center of seizing. Alternately twist and pull ends until seizing is tight.



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View B Rope Diameter Smaller than 1 in (26 mm)

FIGURE 4-18

Anchoring Wire Rope to Drum

See Figure 4-19 for following procedure.

Use the correct wedge part number for the size of wire rope being used; see parts drawing for the boom hoist drums or for the load drum shaft to obtain the correct part number.

1. Assemble wire rope and wedge to drum socket.
2. Tighten wedge, rapping back of wedge with a brass drift pin and hammer.

WARNING!

Falling Load Hazard!

Wire rope can be pulled out of drum if following steps are not taken.

- Install straight wedge so corrugated side is against wire rope.
- Install wedge so end of wire rope extends past end of wedge, but not out of drum socket.
- Make sure seizing is not under wedge. Remove seizing if it interferes with assembly.

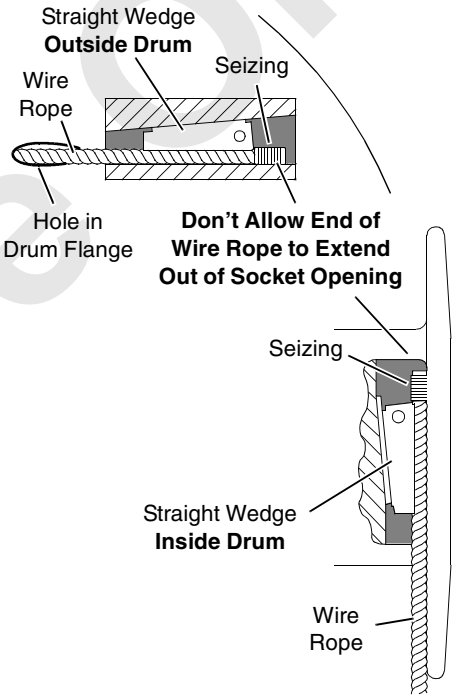


FIGURE 4-19

Winding Wire Rope onto Drum

See Drum and Lagging Chart in Capacity Chart Manual for correct size of drum laggings, if used.

See Wire Rope Specifications Chart in Capacity Chart Manual for correct type, size, and amount of wire rope to be installed on load drums.

See Boom Rigging Drawing at end of this section for correct type, size, and amount of wire rope to be installed on boom hoist drums.

1. Carefully inspect drums and all rope guides, rollers, and sheaves for defects that can cause wire rope to wear or be cut. If defects cannot be fixed, replace faulty parts.

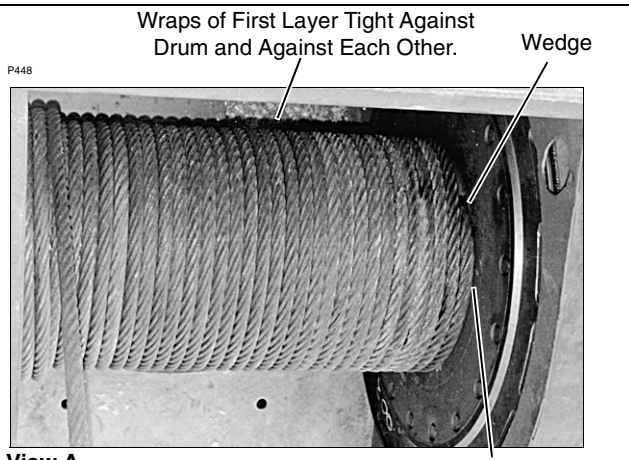
Reference Only

2. Apply tension to wire rope as it is wound slowly onto drum.

   First wrap must be tight against drum flange for approximately three-fourths of drum diameter (see Figure 4-20).

3. Tap adjacent wraps against each other with a soft metal or wooden mallet.

   Use extreme care not to put twists or turns in wire rope; allow rope to assume its natural lay.



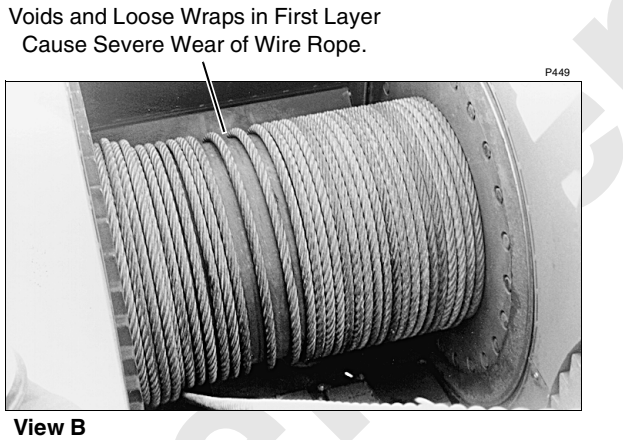


FIGURE 4-20

CAUTION!

Wire Rope Damage!

Voids or spaced wraps in first layer (see Figure 4-20, View B) will permit movement and a wedging action with subsequent layers. Wedging action will cause crushing and abrasion of wire rope.

Never allow wire rope to "cross wind" on drums.

Anchoring Wire Rope to Wedge Socket

WARNING

Falling Load Hazard!

- Inspect all parts prior to use. Do not use parts that are cracked or otherwise defective.
- Remove minor nicks, burrs, or rough edges from socket, wedge, or pin by lightly grinding. Do not reduce original dimensions by more than 10%.
- Do not reinstall shipping material (bolt, plastic strap or wire) in hole of wedge or socket after assembling. Discard these materials because they can prevent wedge from tightening in socket.
- Only use a wedge and socket which are correct size for wire rope being used. Do not mix and match parts from one assembly with parts from another assembly.

  Terminator™ socket and wedge has "go" and "no go" holes to check for proper rope size.
- Attach wire rope clip to dead end of wire rope after assembling wire rope to wedge and socket.
- If dead end of wire rope is welded, seize end of wire rope and cut off weld before assembling to wedge and socket. Weld will not allow strands of wire rope to adjust around bend of wedge, resulting in high strands and wavy rope. This condition can seriously weaken attachment.

See Figure 4-21 for following procedure.

1. Assemble wire rope and wedge to socket so live end of wire rope is in a straight line with socket pin hole. *Do not assemble WRONG as shown.*
2. Allow dead end of wire rope to extend past end of socket amount shown.
3. Allow wire rope to assume its natural lay.
4. Pull against wedge and live end of wire rope enough to tighten wedge in socket.

   Use a brass hammer to seat wedge and wire rope as deep into socket as possible.
5. Attach a wire rope clip to dead end of wire rope using one of the RIGHT methods shown. Rope clip will aid in preventing wire rope from being pulled out of socket.

NOTE Use Right Method A only if wire rope clip is small enough to be securely tightened to dead end. Right Method C is only for a Terminator™ wedge socket.

6. After socket is pinned in place, hoist load slowly so wedge seats tight. *Do not shock load socket and wedge*.

Reference Only

WARNING

Falling Load Hazard!

Wire rope can break if following precaution is not observed:

- Do not attach dead end of wire rope to live end of wire rope with wire rope clip. Wire rope clip will transfer load from live side of wire rope to dead end, seriously weakening attachment.

Breaking in Wire Rope

After installing a new wire rope, break it in by operating it several times under light load and at reduced speed. This practice allows the wire rope to form its natural lay and the strands to seat properly.

NOTE Wire rope will stretch during the break-in period, reducing the wire rope's diameter as the strands compact around the core.

The dead wraps of wire rope on the drum can become slack during operation, even if the utmost care is used during installation of the wire rope. This slackening is caused by the normal stretch that occurs in a new wire rope under tension and periodically throughout the wire rope's life from release of the load.

When slackness is noted, tightly wind the dead wraps of wire rope onto the drum. If left uncorrected, a wedging action with subsequent layers will occur, and the resultant abrasion may cause broken wires in the dead wraps.

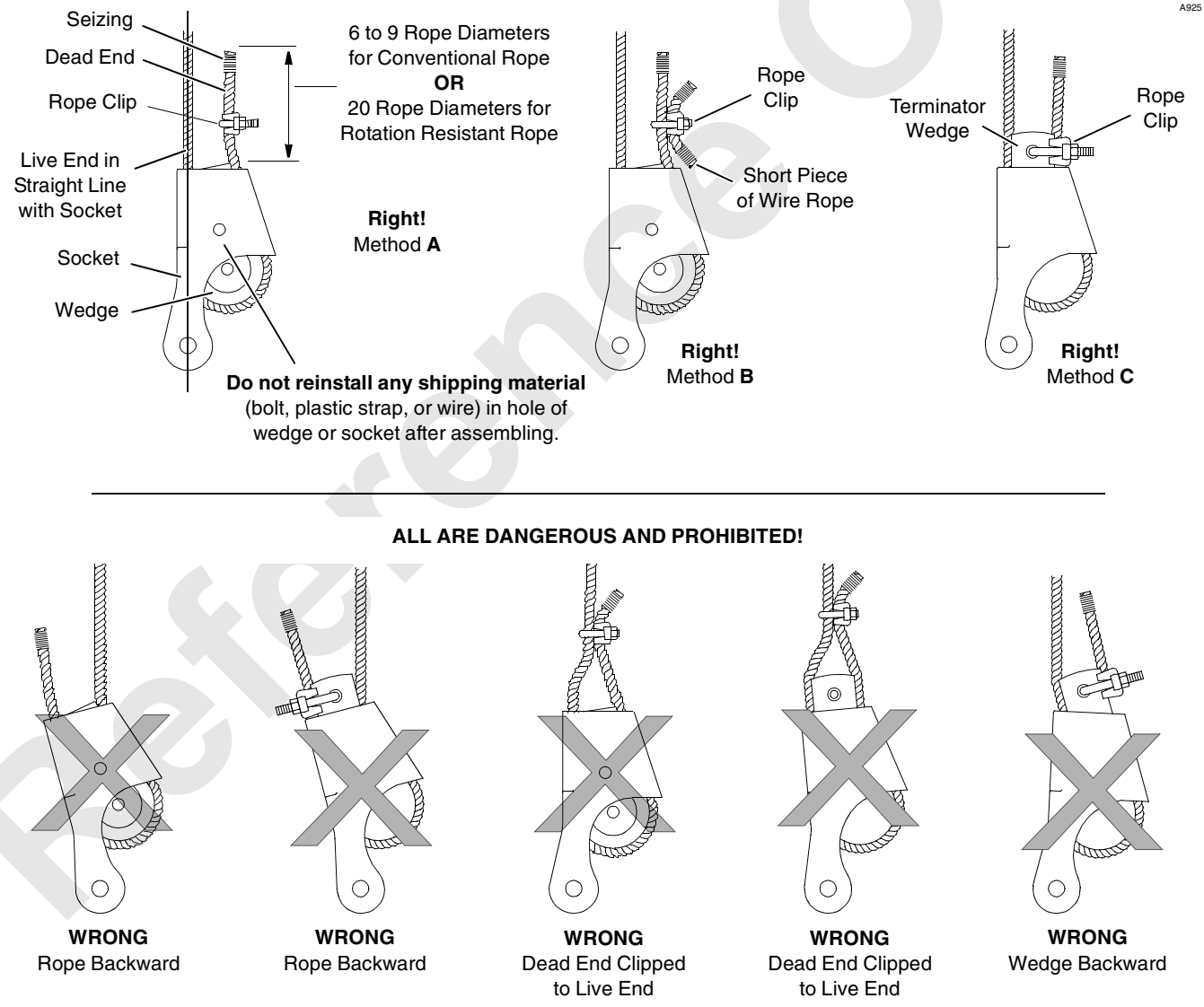


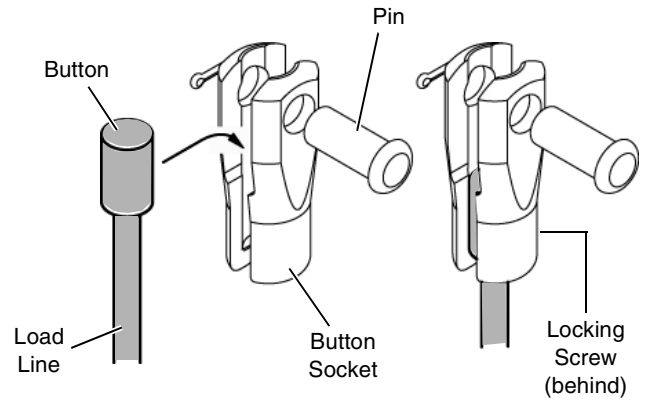
FIGURE 4-21

Reference Only

Anchoring Wire Rope to Button Socket

See Figure 4-22 for following procedure.

1. Remove pin from socket.
2. Install button end of load line in socket.
3. Pin socket to anchor point.
4. Securely tighten locking screw.



Button Socket Assembly

A1263

FIGURE 4-22

Breaking in Wire Rope

After installing a new wire rope, break it in by operating it several times under light load and at reduced speed. This practice allows the wire rope to form its natural lay and the strands to seat properly.

NOTE: Wire rope will stretch during the break-in period, reducing the wire rope's diameter as the strands compact around the core.

The dead wraps of wire rope on the drum can become slack during operation, even if the utmost care is used during installation of the wire rope. This slackening is caused by the normal stretch that occurs in a new wire rope under tension and periodically throughout the wire rope's life from release of the load.

When slackness is noted, tightly wind the dead wraps of wire rope onto the drum. If left uncorrected, a wedging action with subsequent layers will occur, and the resultant abrasion may cause broken wires in the dead wraps.

PAD EYE USAGE FOR WIRE ROPE REEVING

See Figure 4-23 for following procedure.

General

Some rotation-resistant wire rope supplied by Manitowoc is equipped with a No. 1.5 pad eye welded to the leading end of the wire rope.

A sucker-line can be attached to the pad eye to make it easier to reeve the load block.

Safety

1. For No. 1.5 pad eye, do not exceed 1,000 lb (4,45 kN) single line pull.
2. Make sure sucker line and rope clips are rated for at least 1,000 lb (4,45 kN) line pull.
3. Inspect pad eye prior to each use. ***Replace it if:***
   - Any original dimensions have changed .
   - Cracks or breaks exist in metal or weld.

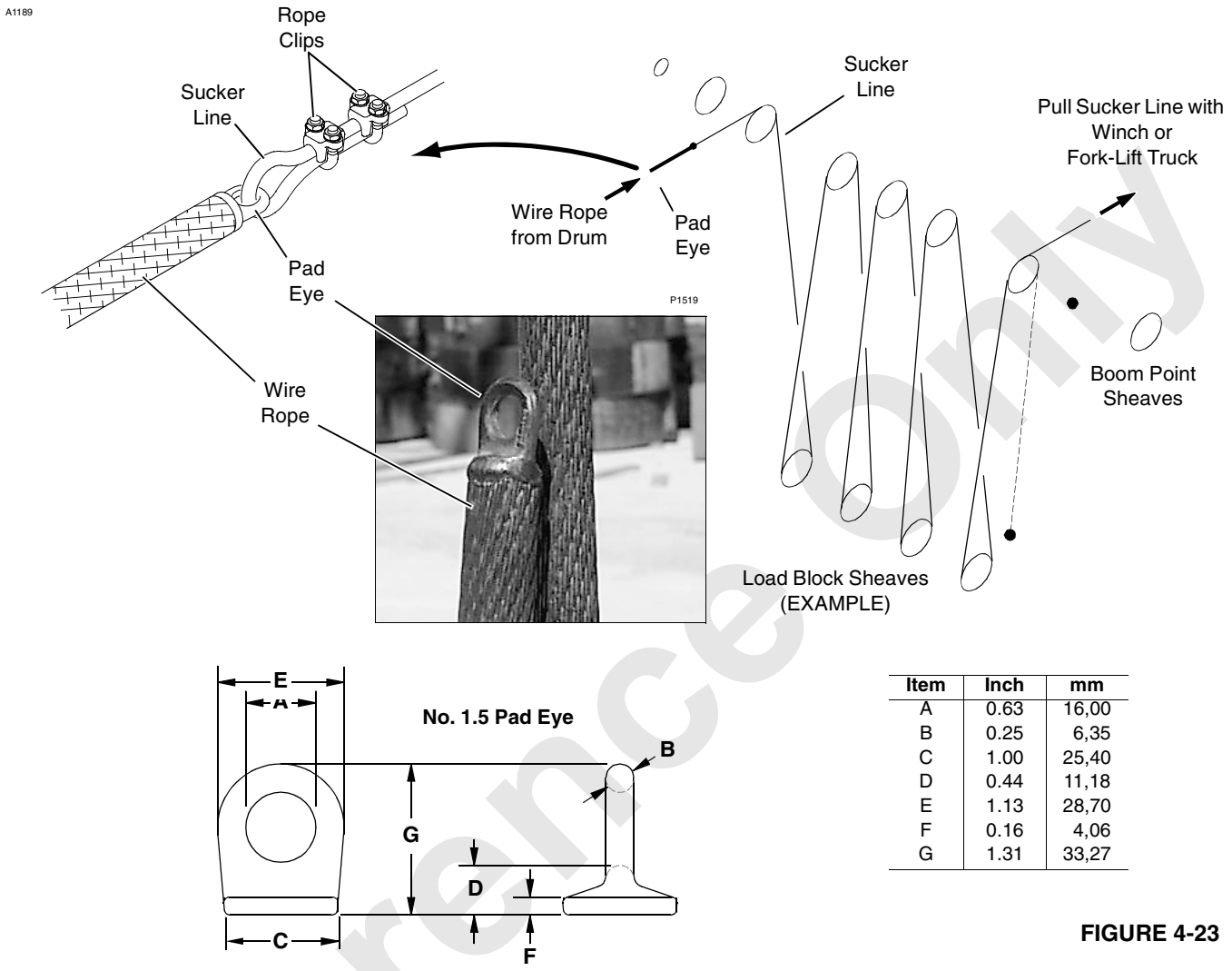
WARNING

Flying Part Hazard!

Pad eye on end of wire rope has been provided ***for reeving purposes only***. Any other use is neither intended nor approved.

Pad eye can break and fly apart with considerable force if it is overloaded, not used properly, or not maintained properly.

Reference Only



Item	Inch	mm
A	0.63	16,00
B	0.25	6,35
C	1.00	25,40
D	0.44	11,18
E	1.13	28,70
F	0.16	4,06
G	1.31	33,27

FIGURE 4-23

4

LOAD BLOCK REEVING

Reeving Diagrams

This topic provides load block reeving information for the 2250 MAX-ER 2000 equipped as follows:

- #44 Luffing Jib on #79 Boom — see Figure 4-28 for recommended reeving.

Load Block

The following load blocks are available from Manitowoc:

- 300 USt (272 t) with weight plates – 15,400 lb (7 484 kg)
- 100 USt (91 t) with weight plates – 9,800 lb (6 985kg)
- 60 USt (55 t) with weight plates – 4,425 lb (2 007kg)
- 30 USt (27 t) with weight plates – 3,500 lb (1 587 kg)
- 15 USt (14 t) swivel hook with weight plates – 1,900 lb (861 kg)

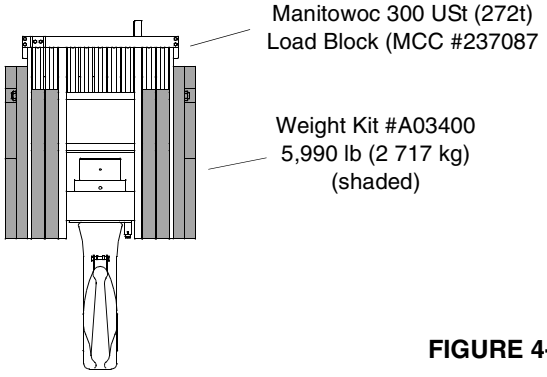


FIGURE 4-24

Reference Only

WARNING

Falling Load Hazard!

Use only a load block with a capacity equal to or greater than load to be handled.

Avoid overloading bearings of load block sheaves. Attach load to duplex hook so load hangs straight.

Load block can fail if overloaded, allowing load to fall.

Duplex Hook

The duplex hook capacities are based on the lifting sling angles given in Figure 4-25. Attach the load so it is balanced equally on each ear of the hook.

The duplex hook has a hole to which a shackle can be attached as shown in Figure 4-25.

WARNING

Falling Load Hazard!

Limit load to be handled with shackle to capacity of load block or shackle, whichever is less.

Load block or shackle can fail if overloaded, allowing load to fall.

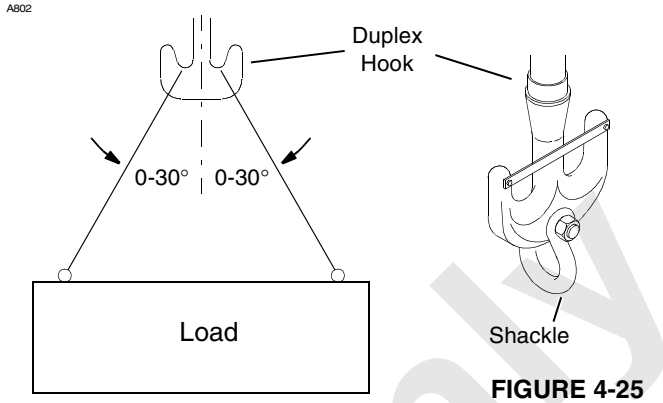


FIGURE 4-25

Guide Sheaves

See Figures 4-26 and 4-27 for guide sheave identification.

Once wire rope is routed through guide sheaves, be sure to install rope guard pins, bars, and rollers to retain rope on guide sheaves. ***Wire rope and sheaves can be damaged if rope is not properly retained on sheaves***.

Wire Rope Specifications

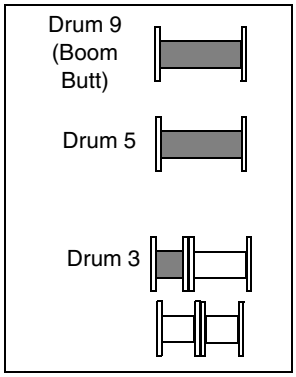
See Wire Rope Specifications chart in Capacity Chart Manual for parts of line required to handle desired load.

Wire Rope Installation

See Wire Rope Installation in this section for the following instructions:

- Anchoring wire rope to drum.
- Installing wire rope on drum.
- Anchoring wire rope to wedge socket.

Reference Only



Wire Rope Routing
O = Route OVER Sheave
U = Route UNDER Sheave
3 = Drum 3
5 = Drum
9 = Drum 9

NOTE 1: Sheave used only for luffing hoist wire rope.

NOTE 2: See Figure 4-27 for guide sheave positioning.

NOTE 3: Install rope retaining pin in this hole for #44 jib.

#79 Boom with #44 Luffing Jib

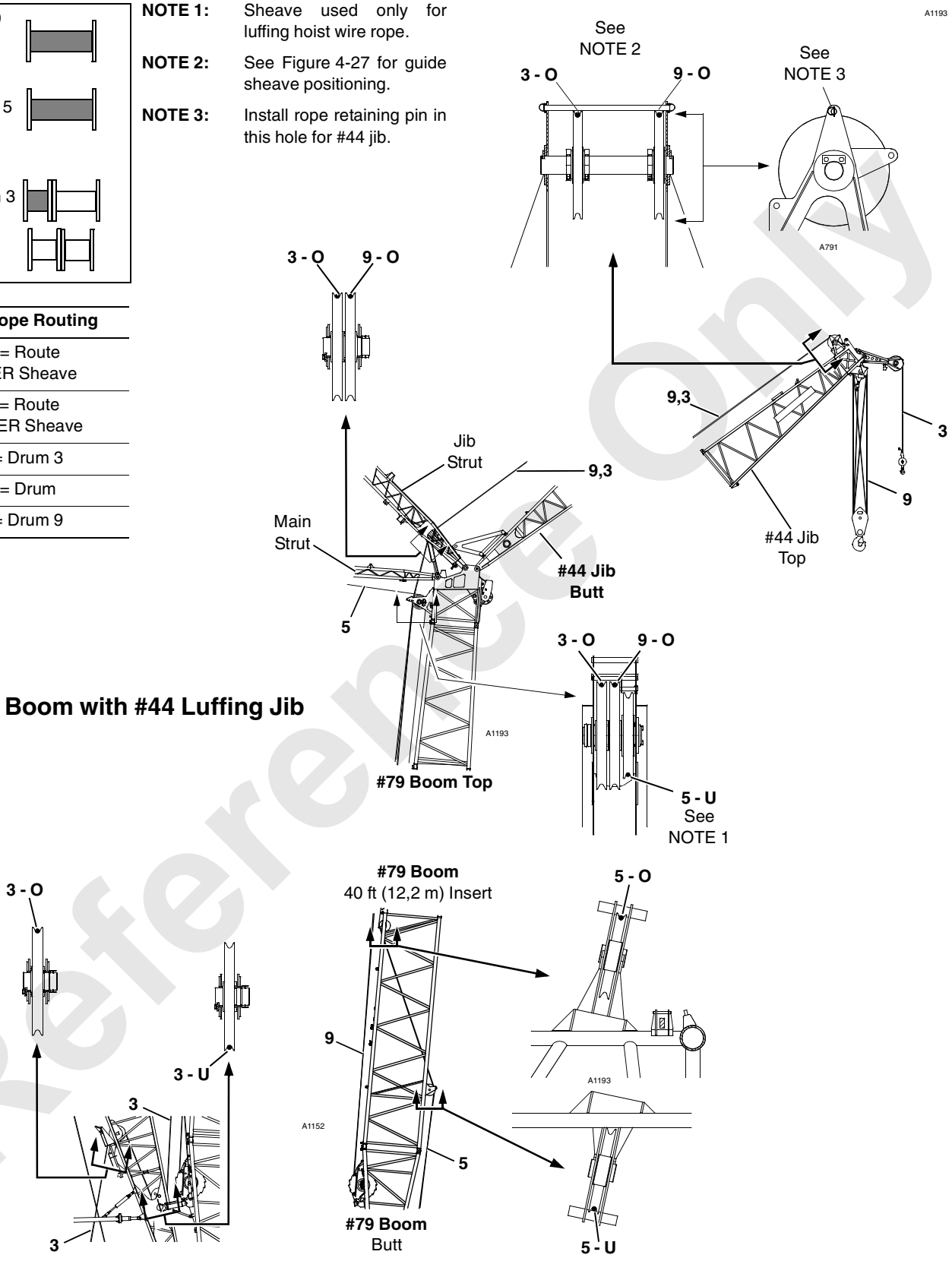
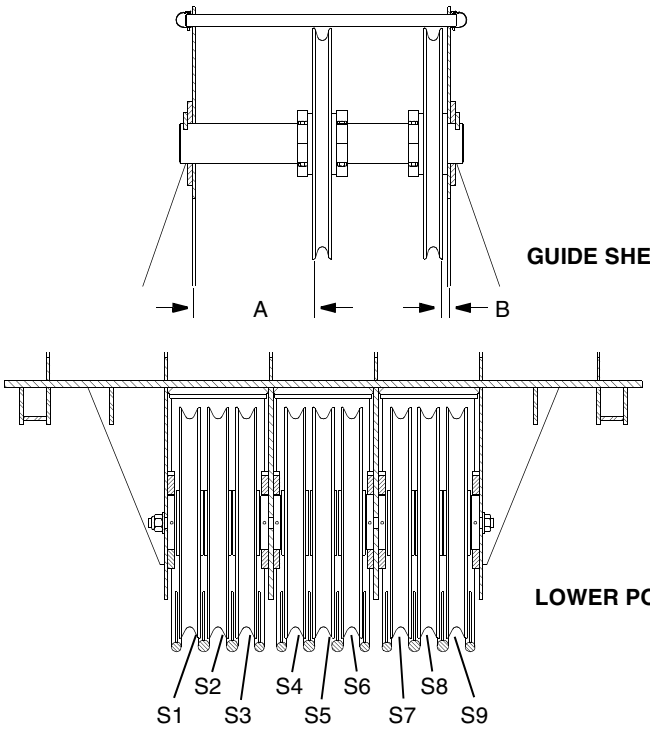


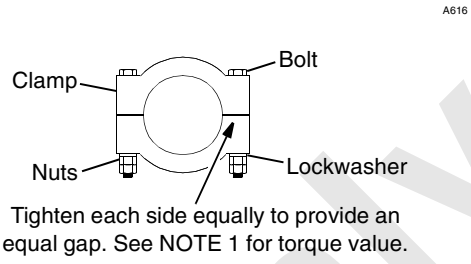
FIGURE 4-26

Reference Only



GUIDE SHEAVES

LOWER POINT SHEAVES



Location of Guide Sheaves with Lead Line Going to Lower Point Sheave Indicated

Lead Line to Sheave	Dimension A
S1	5/8 in (16 mm) NOTE 2
S2	2-1/16 in (52 mm) NOTE 3
S3	4-15/16 in (127 mm) NOTE 3
S4	10-11/16 in (272 mm) NOTES 3 & 4
	Dimension B
S6	10-7/16 in (265 mm) NOTE 3
S7	4-15/16 in (127 mm) NOTE 3
S8	2-1/16 in (52 mm) NOTE 3
S9	5/8 in (16 mm) NOTE 2

NOTE 1: Hand position clamps tight against bearing. Before torquing bolts, check that sheave turns freely. Torque bolts lubricated with S.A.E. 20 oil to 120 ft-lb (163 Nm).

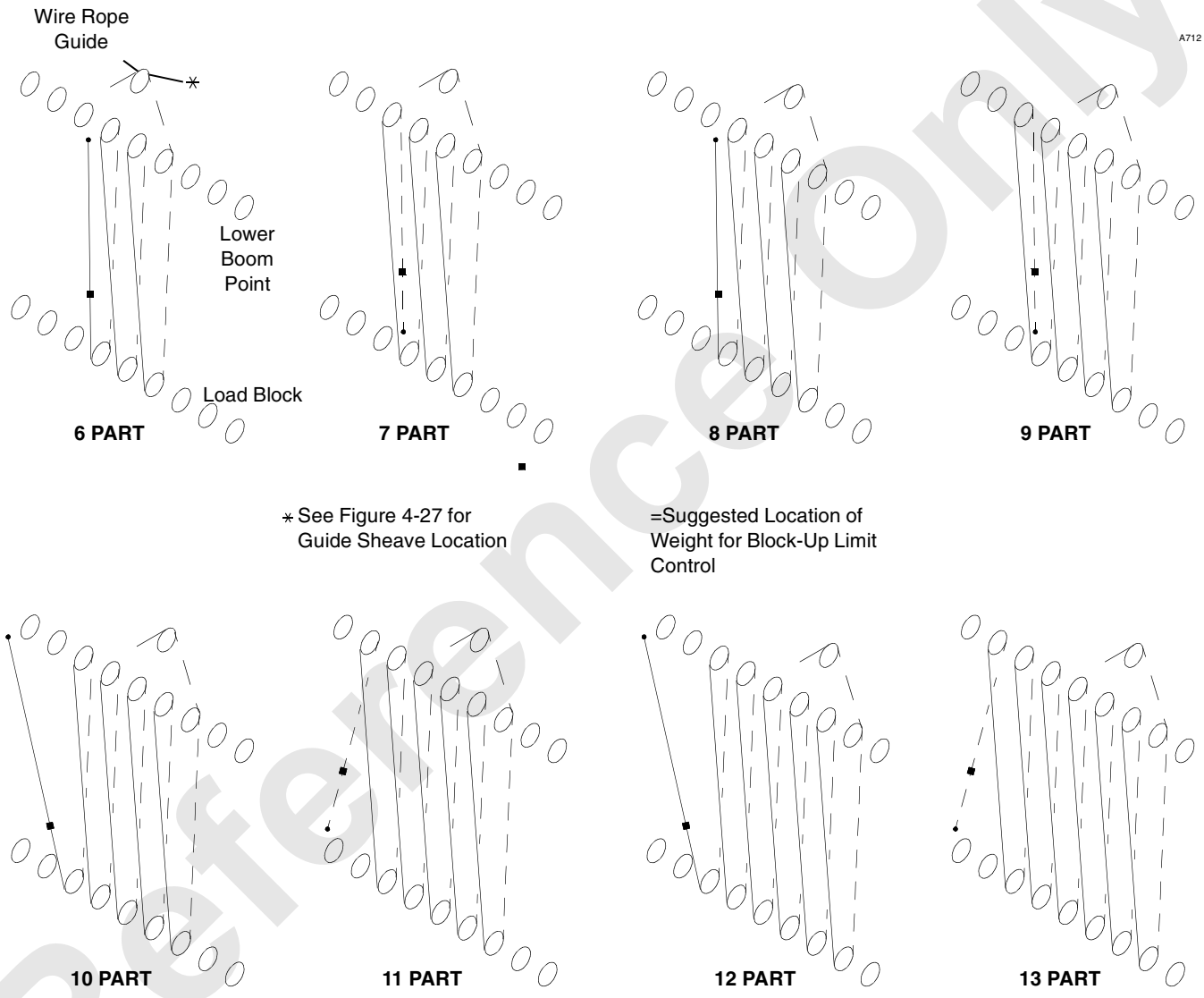
NOTE 2: This location requires sheave bearing to bear up against boom top plate as shown at Dimension B.

NOTE 3: This location requires four clamps as shown at Dimension A.

NOTE 4: Also position guide sheave at this location for whipline operation over upper point. Use two clamps.

FIGURE 4-27

Reference Only



Reference Only

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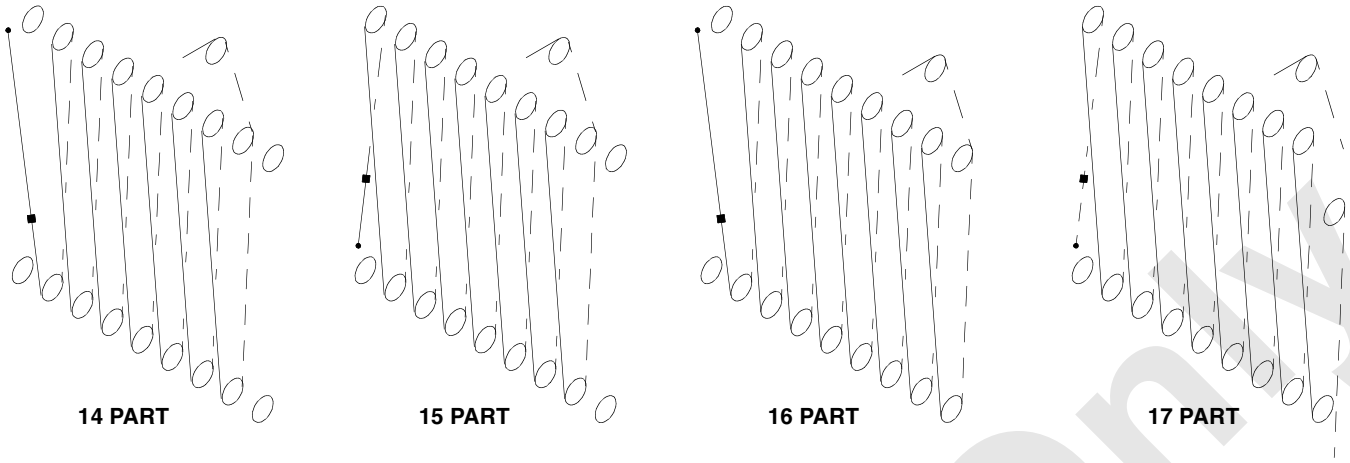
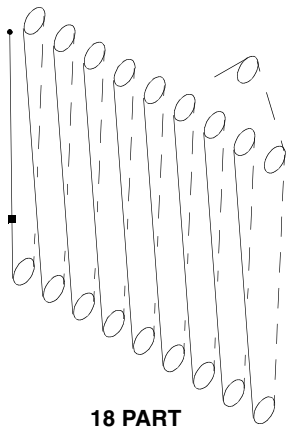
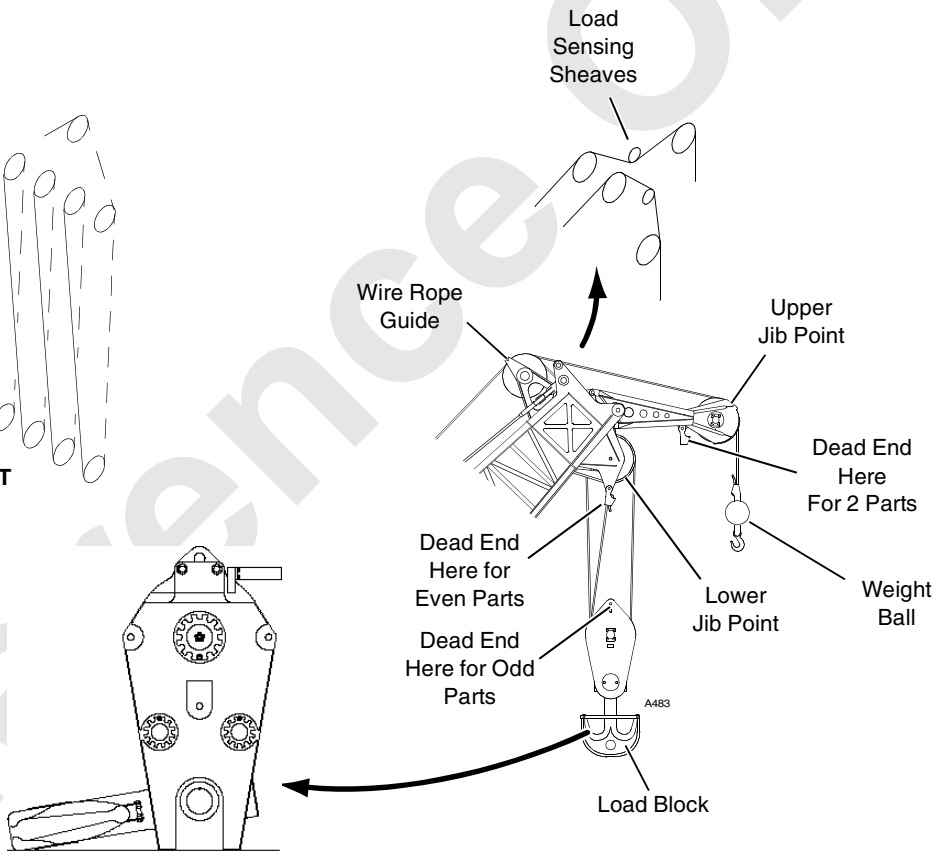
FIGURE 4-28







WARNING

Avoid Death or Serious Injury!

If you are using a load block that can be stood up vertically for reeving, exercise care, as the potential for tipping exists. Potential causes of tipping are unstable work area, boom or jib movement, and the reeving process.

If work area is unstable, lay load block flat on side plate.

FIGURE 4-28 continued

Reference Only

LOAD BLOCK TIEBACK

General

Manitowoc provides a lug on the front of the rotating bed (Figure 4-29, View A) and on the luffing hoist frame (Figure 4-29, View B) for tieing back the load block when not in use.

Specifications

Sling

Length

The sling should be long enough to connect it to a shackle in the tieback hole and to the hook of the freely suspended load block. This will prevent personnel from having to swing the block in, toward crane, to make the connection.

Capacity

The sling must be capable of supporting the weight of the load block and 1/2 the weight of the wire rope suspended from the boom point. When sizing the sling, take into account the dynamic affects of traveling and swinging the crane. ***It is the crane users responsibility to calculate this load.***

Shackle

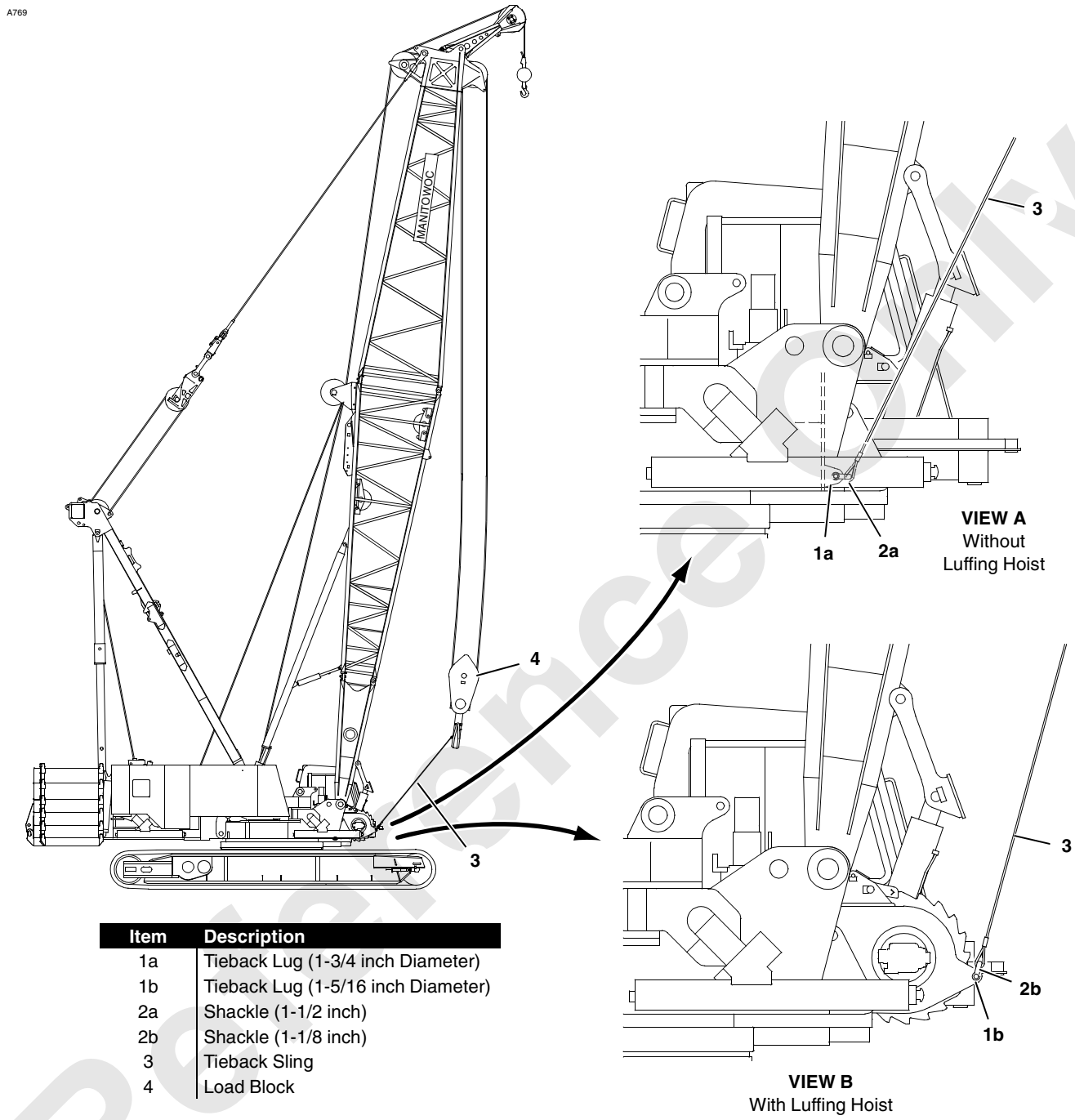
See Figure 4-29 for identification of tieback hole diameter and shackle size.

CAUTION

Avoid damage to boom:

- Haul in load line only until tieback sling is taut. Purpose of tieback is only to prevent load block from swinging when not in use.
- Do not tighten load line to point that load line can rub against lacings in boom sections or load block can bounce into lacings.
- Operator, be aware that as you boom down load lines and tieback sling will tighten even more. Pay out load line while booming down so that you don't pull load block into boom. Damage to lacings or chords could result.
- Make sure that tieback sling, load block, and load lines do not interfere with operation of luffing hoist wire rope.

Reference Only



Item	Description
1a	Tieback Lug (1-3/4 inch Diameter)
1b	Tieback Lug (1-5/16 inch Diameter)
2a	Shackle (1-1/2 inch)
2b	Shackle (1-1/8 inch)
3	Tieback Sling
4	Load Block

FIGURE 4-29

Reference Only

SECTION 5
LUBRICATION

TABLE OF CONTENTS

Reference Only

Reference Only

SECTION 5
LUBRICATION

GENERAL LUBRICATION

Depending on options the crane or attachment is equipped with, some lubrication points given in this section may not apply.

LUBRICATION INTERVALS

The intervals listed in this section are for "average operating conditions" based on experience gained by testing lubricants at the factory and on recommendations given by the lubricant suppliers. Severe operating conditions (excessively dusty or corrosive atmosphere, unusually high or low outside temperature, extreme loadings, uncommonly frequent or long operating cycles) may require shortening the lubrication intervals. Follow the intervals given in this section until adequate experience is obtained to establish intervals which meet your operating conditions.

Bearings and bushings that are too warm, excessive play in moving parts, binding in moving parts, excessive or abnormal wear, and rust accumulation indicate a lack of lubrication. If these conditions are found during regular inspection, the lubrication interval for the faulty parts should be shortened.

CAUTION

Machinery Damage!

Before lengthening lubrication intervals, check that all parts are receiving an adequate supply of clean lubricant; otherwise, parts will be damaged from a lack of lubrication. Contact your local Manitowoc Distributor or Crane Care Customer Service at factory for recommendations on lengthening lubrication intervals.

OVER-LUBRICATION

Over-lubrication is not only wasteful but also harmful:

- Oil or grease which drips onto walkways can cause personnel to slip and be hurt.
- An extra shot of grease, if too stiff or under too much pressure, can pop out a bearing seal.

LUBRICATION TIPS

- Keep oil and grease dispensers and containers tightly closed and stored in a dirt and moisture-free locations.
- Clean grease fittings before and after applying grease.
- Apply grease until the bushing or bearing is purged so dirt and water cannot enter. Wipe up excess grease.

OIL CAN POINTS

Oil *all pins* not equipped with grease fittings with engine oil every 40 hours of operation (even if attachment is not being operated).

APPROVED GREASE

Use an extreme pressure, heavy duty, water repellent grease meeting the most up-to-date MIL-G-10924 specification. Grease must be fluid enough to be applied by a grease gun and to flow through grease lines at expected ambient temperature.

Factory Fill:

Mobilux E.P. #2 (MCC #471197) for all grease points.

Reference Only

WIRE ROPE LUBRICATION

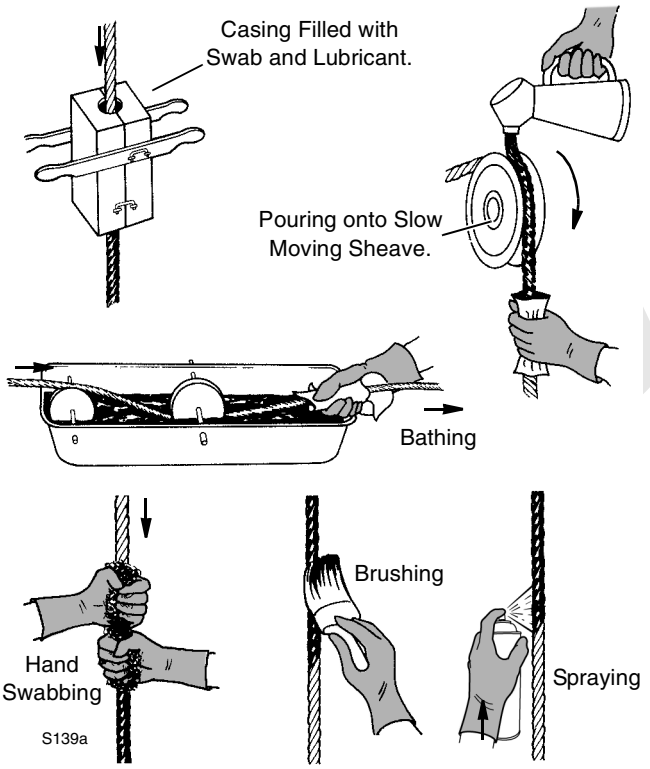
New wire rope is lubricated during manufacturing, but this lubricant is only adequate for initial storage and the early stages of operation. To prevent the damaging effects of corrosion and to reduce wear, the wire rope must be lubricated at regular intervals.

Contact your wire rope manufacturer/dealer for lubrication recommendations. The lubrication interval and the type of lubricant used depends on the type of wire rope, the severity of duty, and the type of corrosive elements the wire ropes is subjected to.

The wire rope must be properly protected at all times. The lubricant must be fluid enough to fully penetrate the strands and rope core. Use one of the methods shown in Figure 5-1 to lubricate the wire rope. For maximum penetration, apply lubricant where the wire rope "opens up" as it travels around a sheave or winds onto a drum.

The wire rope must be clean and dry before applying lubricant; an air jet, or wire brush are some cleaning methods.

Do not use grease to lubricate wire rope. Grease will not penetrate rope properly and will buildup in valleys between wires and strands. This buildup will inhibit rope inspection and could trap moisture in rope's interior.



WARNING

Moving Rope Hazard!

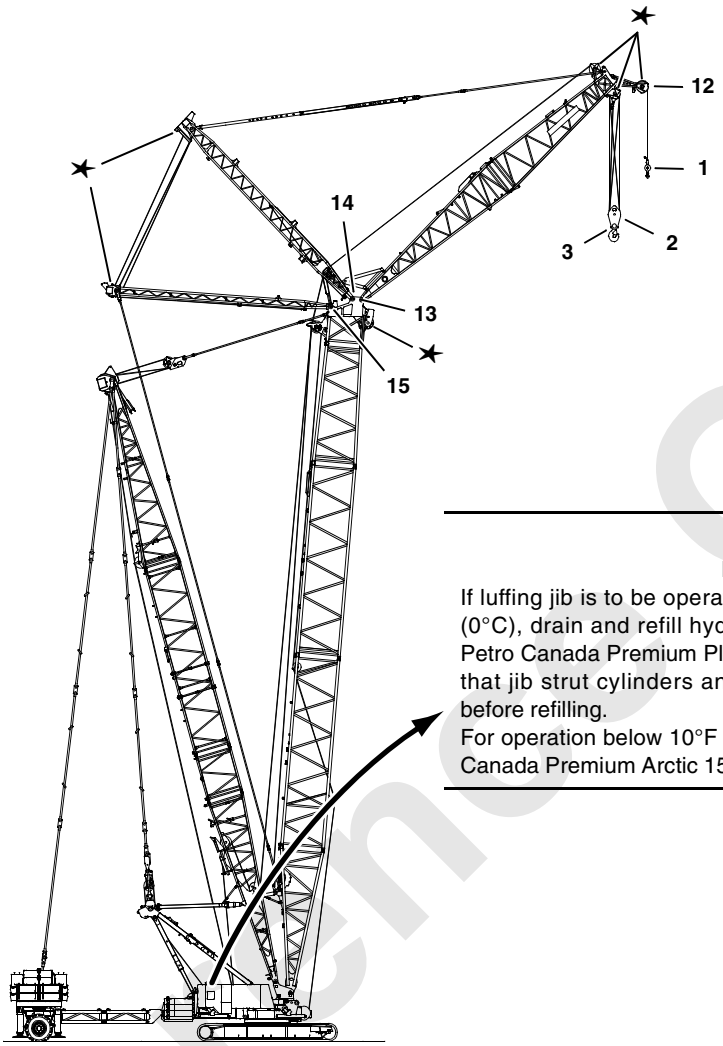
Take every precaution to protect hands from injury when rope is moving. Wear heavy gloves and move rope as slowly as possible.

FIGURE 5-1

Reference

LUBRICATION POINTS

A1152

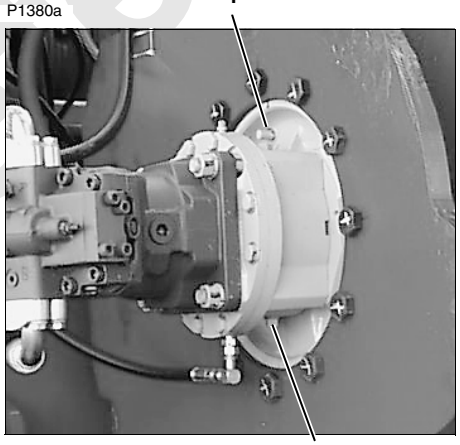


CAUTION
Parts Damage

If luffing jib is to be operated when air temperature is below 32°F (0°C), drain and refill hydraulic systems (crane and boom) with Petro Canada Premium Plus hydraulic oil (MCC #549318). Be sure that jib strut cylinders and supply lines are completely drained before refilling.

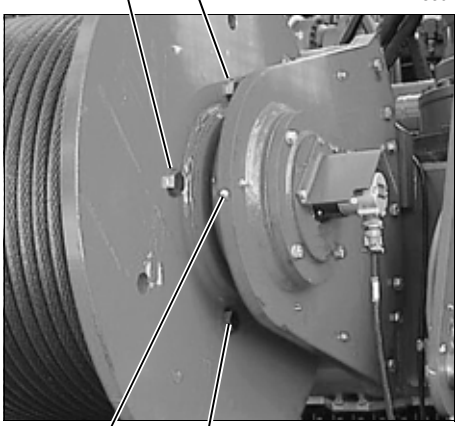
For operation below 10°F (-12°C) usa a thinner fluid such as Petro Canada Premium Arctic 15 (MCC #A03745).

P1380a



Right Side of Hoist

P1380



Left Side of Hoist

5

Reference Only

LUBRICATION INTERVALS

Item	Description	Required Service (see Note 1)
Every 40 Hours or Weekly (whichever comes first)		
1	Weight Ball Swivel	Grease.
2	Load Block Sheaves	Grease if equipped with fittings.
3	Load Block Trunnion/Swivel	Grease if equipped with fittings.
4	Gear Box Breather	Clean (see Note 2).
After First 100 Hours of Operation (see Note 3)		
5	Gear Box Drain Plug	Drain and refill with gear oil (see Note 4, 5, and 6).
6	Brake Drain Plug	Drain with gear box (refilled by gear box).
Every 200 Hours or Monthly (whichever comes first)		
7	Drum Shaft Bearing	Grease
8	Gear Box Level Plug	Check level. Fill to plug opening (see Note 6).
9	Gear Box Fill Plug	Fill to proper level with gear oil.
Every 1,000 Hours or Semiannually (whichever comes first)		
10	Gear Box Drain Plug	Drain and refill with gear oil (see Note 4, 5, and 6).
11	Brake Drain Plug	Drain with planetary (refilled by gear box).
Each Time Boom and Luffing are Lowered to Ground		
12	Luffing Jib Roller (2 places)	Grease each.
13	Luffing Jib Hinge Pin (2 places)	Grease each.
14	Jib Strut Hinge Pin (2 places)	Grease each.
15	Main Strut Hinge Pin (2 places)	Grease each.

NOTE 1: See Crane Operator's Manual for lubrication instructions for the crane.

See MAX-ER 2000 Operator's Manual for lubrication instructions for the MAX-ER attachment and boom.

NOTE 2: Soak in non-flammable solvent; blow dry with compressed air.

NOTE 3: Required to remove metal particles and other impurities after initial run-in of planetary. *Brass particles in drained oil are normal.*

NOTE 4: Use same gear oil used in load drum gear boxes. See Lubrication in section 5 of Crane Operator's Manual for lubrication types and usage data.

NOTE 5: Gear box oil capacity is approximately 12-1/2 gal (47 L).

NOTE 6: Remove guard and rotate drum so all three plugs are accessible at front of hoist. Plug (5) must be on centerline of drum frame. ***Reinstall guard after servicing.***

Reference Only

SECTION 6
MAINTENANCE CHECKLIST

TABLE OF CONTENTS

Reference Only

Reference Only

SECTION 6
MAINTENANCE

LIMIT DEVICES

This section contains maintenance and adjustment instructions for the limit devices used with the luffing jib attachment.

For maintenance and inspection of the following components, see the Service Manual supplied with your crane:

- Straps
- Wire Rope
- Load Block and Weight Ball
- Boom and Jib

ANGLE INDICATOR ADJUSTMENT

General

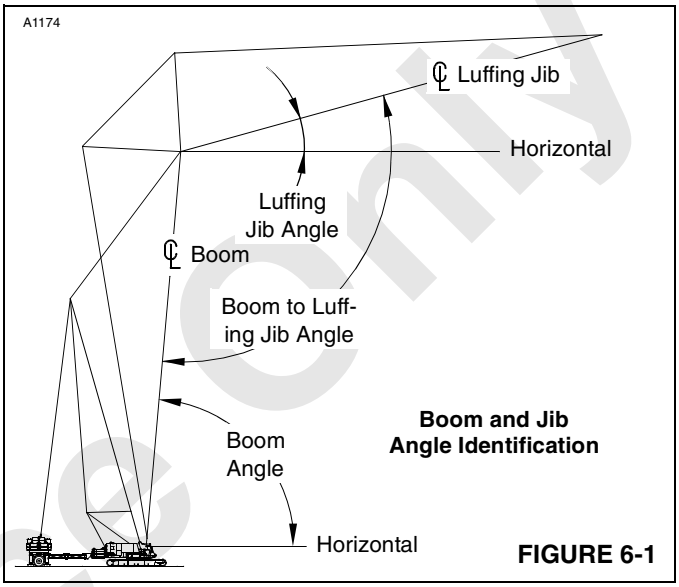
An angle sending unit is mounted on the boom butt and, if equipped, on the luffing jib butt (see Figure 6-2).

Each sending unit houses either a pendulum-type potentiometer or a sensor which sends an electric signal to the crane's programmable controller. The programmable controller converts the electric signal into an angle which can be monitored on the digital display in the operator's cab.

Three angles (see Figure 6-1) can be monitored:

1. Boom angle.
2. Luffing jib angle.
3. Boom to luffing jib angle.

The sending unit for the boom and for the luffing jib are identical in appearance. ***The two units are different, however, and must not be interchanged.***



Boom and Jib Angle Identification

FIGURE 6-1

Disconnecting Luffing Jib Angle Indicator

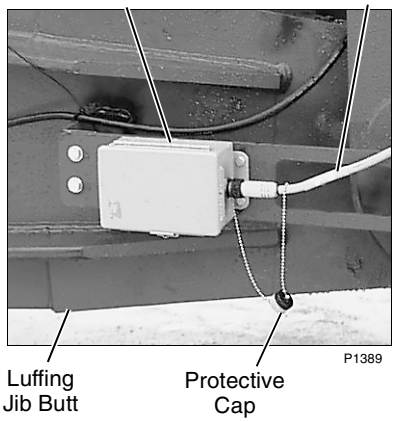
Perform the following steps when removing the luffing jib (see Figure 6-2):

1. Unplug electric cord (B) from receptacle on sending unit.
2. Connect protective cap to receptacle on sending unit.
3. Connect electric cord to receptacle (A) on boom point junction box.

Reference Only

A1168

Angle Sending Unit
- Left Outboard Side of Luffing Jib Butt
- Right Inboard Side of Boom Butt



	Description
A	Shorting Plug for Luffing Jib Angle
B	Electric Cord to Luffing Angle Sending Unit

Junction Box on Left Outboard Side of Boom Top

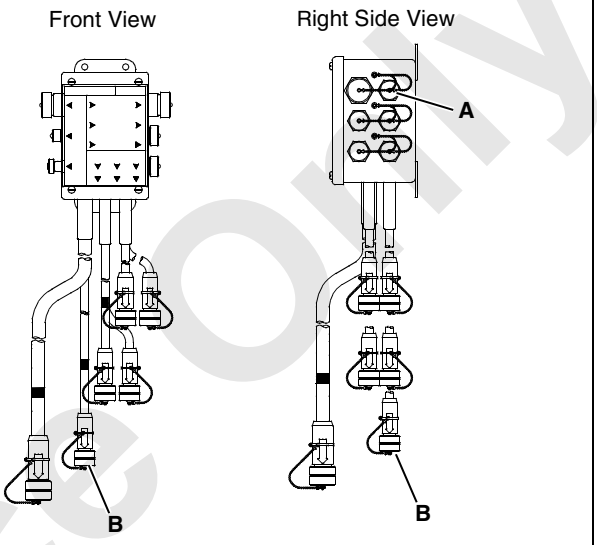


FIGURE 6-2

Adjusting Angle Indicators

See Figure 6-3 for following procedure.

Perform following adjustment steps at initial installation, after installing a new sending unit or potentiometer, and at least monthly when boom/jib is lowered to ground.

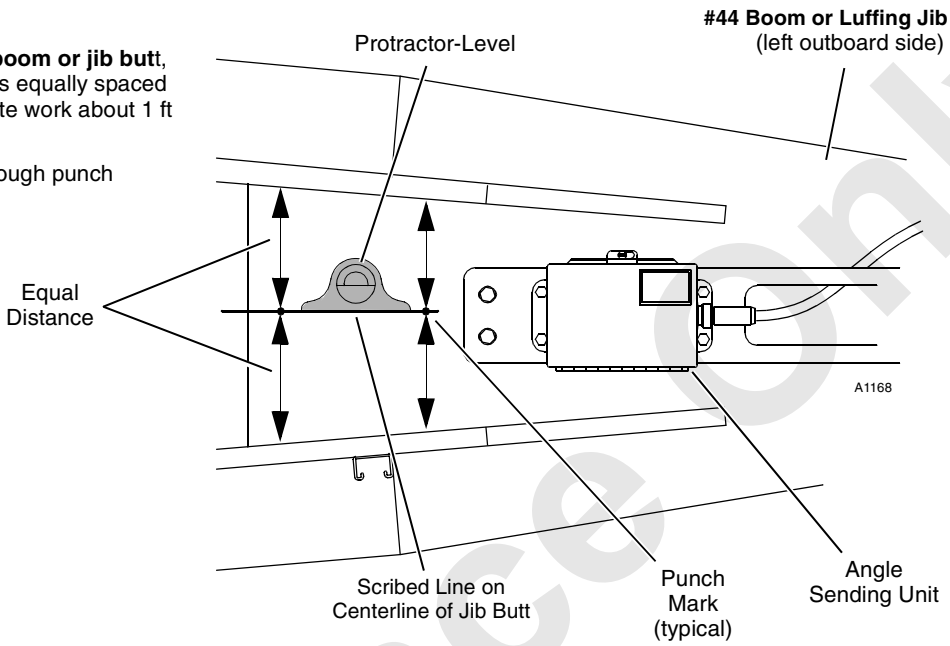
1. Lower boom and luffing jib onto blocking at ground level.
2. Scribe a line through punch marks on center line of boom/jib butt as shown in Figure 6-3.
3. If center line of boom or jib butt is not punch marked, perform procedure given in Views A and B.
4. Hold a protractor-level along scribed line.
5. Record angle indicated on protractor-level.
6. Scroll to corresponding angle – boom or luffing jib – on digital display in operator's cab.
7. Angle shown on digital display must match angle recorded in step 4 plus or minus one degree.
8. If necessary, loosen mounting screws and rotate sending unit in mounting slots until reading on digital display matches angle on protractor-level.
9. Securely tighten mounting screws to lock adjustment.

Reference Only

View A

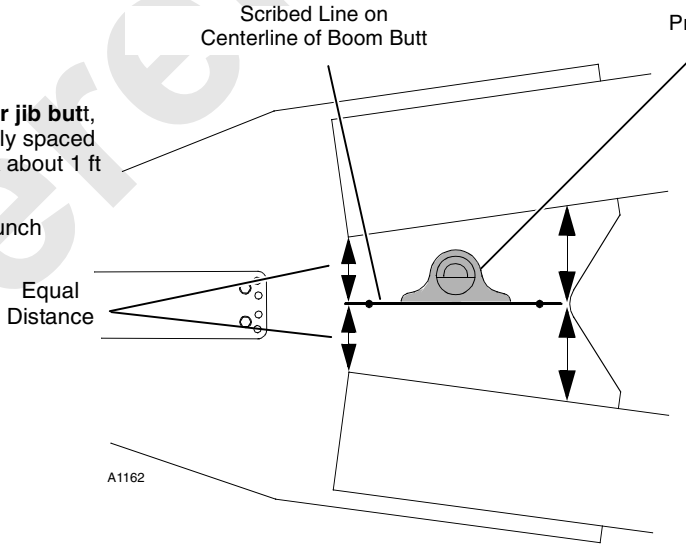
To locate center of boom or jib butt, punch mark two points equally spaced between edges of plate work about 1 ft (0,3 m) apart.

Then scribe a line through punch marks.



To locate center of boom or jib butt, punch mark two points equally spaced between edges of plate work about 1 ft (0,3 m) apart.

Then scribe a line through punch marks.



View B

#79 Boom Butt
(right outboard side)

FIGURE 6-3

Reference Only

Replacing Sending Unit Assembly

Replacement sending units can be either the pendulum-type potentiometer (past production) or the solid state sensor (current production).

Pendulum-Type Potentiometer

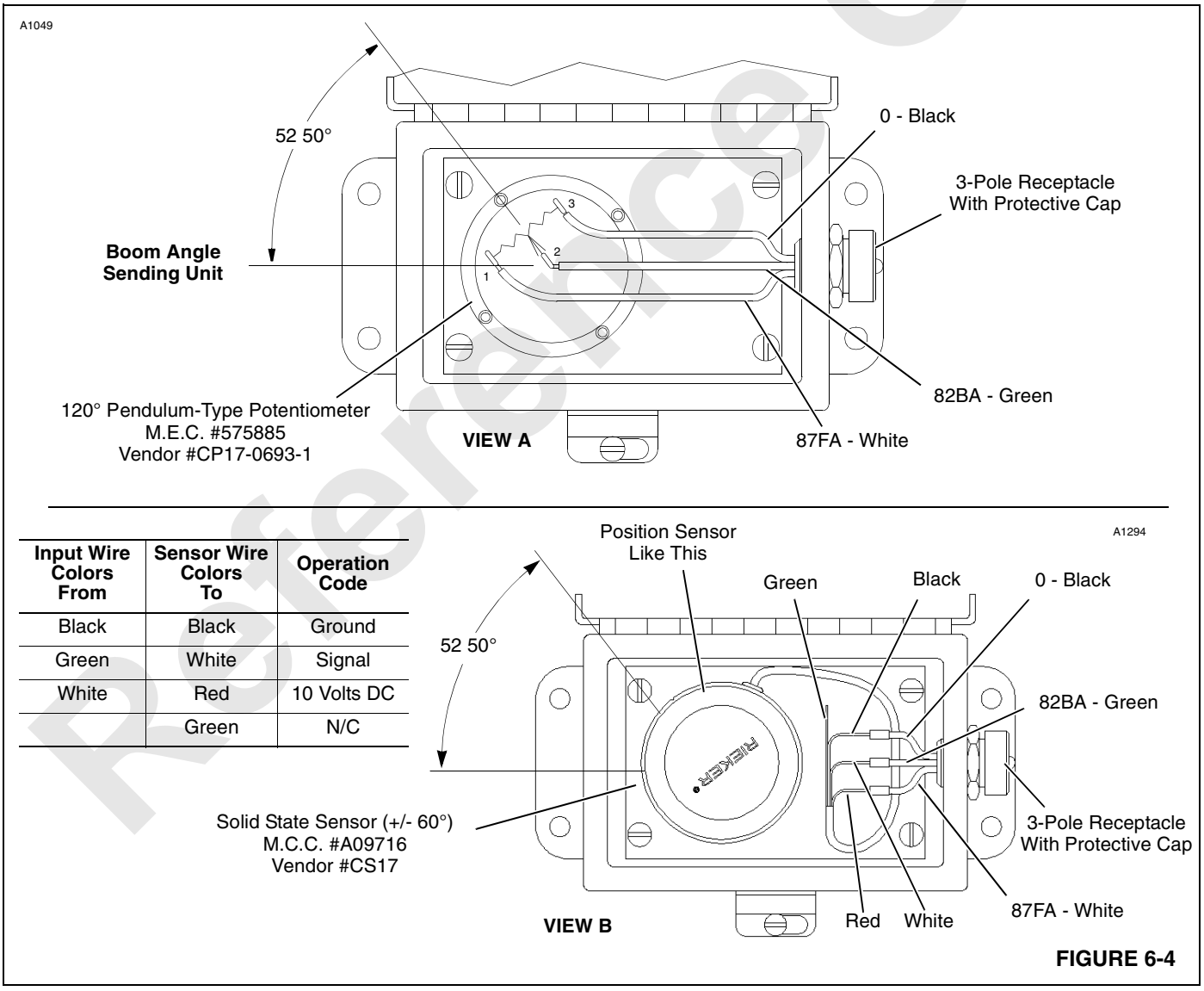
When replacing parts in the pendulum-type potentiometer sending unit, take the following precautions (see Figures 6-4 and 6-5, View A):

1. Mount potentiometer at angle shown.
2. Connect black, green, and white wires from receptacle to proper terminals on terminal strip.
3. Connect wires from potentiometer to proper terminals on terminal strip.
4. Make sure all parts are securely fastened to their mounting position.

Solid State Sensor

When replacing an existing pendulum-type potentiometer with a current production solid state sensor, take the following precautions (see Figures 6-4 and 6-5, View B):

1. Identify all input wires to existing potentiometer.
2. Cut existing input wires near terminal strip (if used) to allow for splicing.
3. Remove existing potentiometer and terminal strip (if used).
4. Mount new sensor in existing holes as shown in View B.
5. See wiring chart in View B and parallel splice sensor wires to existing input wires with crimp, solder, and heat shrink tubing.
6. Seal green wire on sensor with heat shrink tubing and coil up.

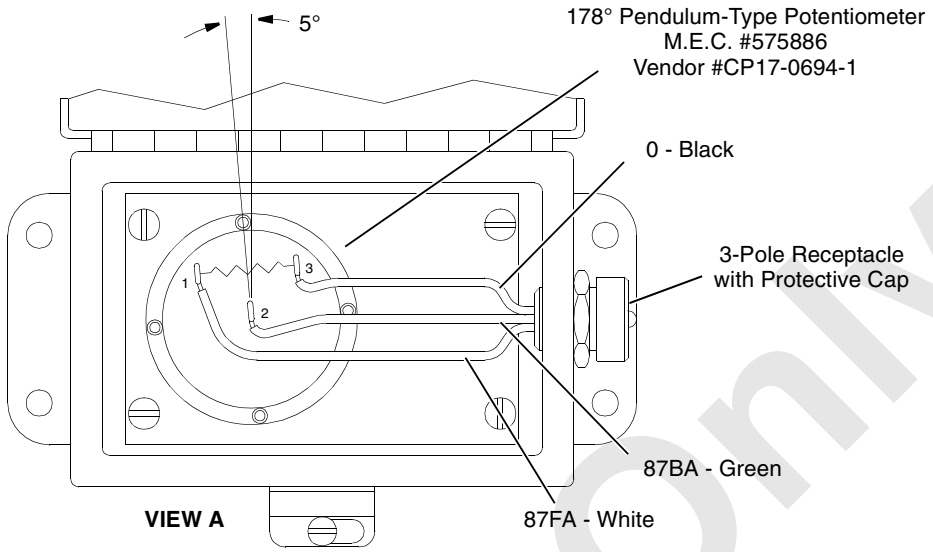


Input Wire Colors From	Sensor Wire Colors To	Operation Code
Black	Black	Ground
Green	White	Signal
White	Red	10 Volts DC
	Green	N/C

FIGURE 6-4

Reference Only

A1049

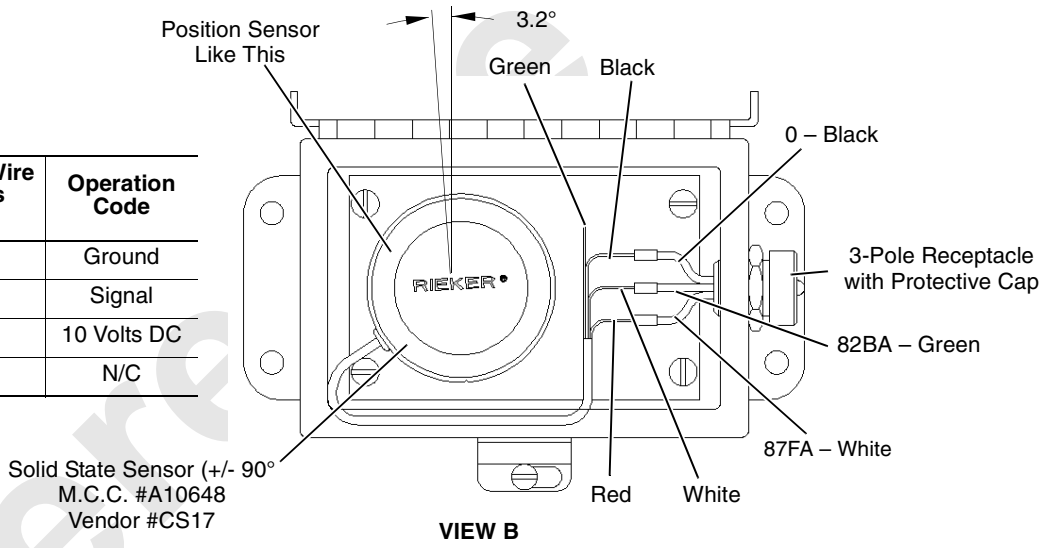


Luffing Jib Angle Sending Unit

VIEW A

A1294

Input Wire Colors From	Sensor Wire Colors To	Operation Code
Black	Black	Ground
Green	White	Signal
White	Red	10 Volts DC
	Green	N/C



VIEW B

FIGURE 6-5

Reference Only

6

AUTOMATIC BOOM STOP ADJUSTMENT

Unless otherwise specified, see Figure 6-7 for following procedure.

General

This crane is equipped with a maximum (MAX) boom angle limit switch which automatically stops the boom hoist and applies its brake when the boom is raised to a preset angle.

The limit switch must be set at one of the following angles, depending on boom and luffing jib use:

- 83° for all #79 Boom Lengths with Luffing Jib Removed.
- 85° for Less than 200 ft (61 m) of #79 Boom with #44 Luffing Jib Installed.
- 87° for 200 ft (61 m) or More of #79 Boom with #44 Luffing Jib Installed.

WARNING

Falling Attachment Hazard!

Do not operate crane unless automatic boom stop is properly adjusted and operational. Do not adjust MAX operating angle higher than specified.

Boom can be pulled over backwards or collapse causing death or serious injury.

Adjust boom angle indicator before adjusting automatic boom stop (see procedure in this section).

Maintenance

At least once weekly, check that the automatic boom stop stops the boom at the specified MAX angle; if not, replace defective parts and/or adjust the boom stop.

Monthly, grease the fitting on the actuator bracket.

Adjustment

The automatic boom stop was adjusted and sealed at the factory. Readjustment is required only when parts are replaced and when ***installing or removing luffing jib***. The seals must be removed to allow readjustment.

1. Make sure actuator bracket is securely fastened in proper position on boom butt (Position A, B, or C).
2. Check position of MAX limit switch with relation to actuator bracket (View A).
3. Loosen capscrews retaining MAX actuator to actuator bracket.
4. Rotate MAX actuator CLOCKWISE in its slots so it does not contact limit switch roller when step 5 is performed.
5. Raise boom:
   a. Slowly raise boom to specified angle – 85° or 87° – while monitoring angle on digital display.
   b. Check boom angle using an accurate protractor-level placed on centerline of boom butt (Figure 6-3, View B).
   c. Boom up or down as required to position boom at specified angle as indicated by protractor-level.

   Angle on protractor-level should match angle on digital display to within 1°.
6. Rotate MAX actuator against limit switch roller until limit switch just "clicks" open and hold.
7. Check position of MAX actuator with relation to actuator bracket (View B).
8. Securely tighten capscrews for MAX actuator.
9. Lower boom several degrees.
10. Slowly raise boom.
11. ***Boom must stop at specified angle***; if not, repeat adjustment steps.
12. Once adjustments are complete, drill and seal limit switch spacer to mounting bracket and MAX actuator to actuator bracket with dowel pins and lead wire seals as shown in Figure 6-6.

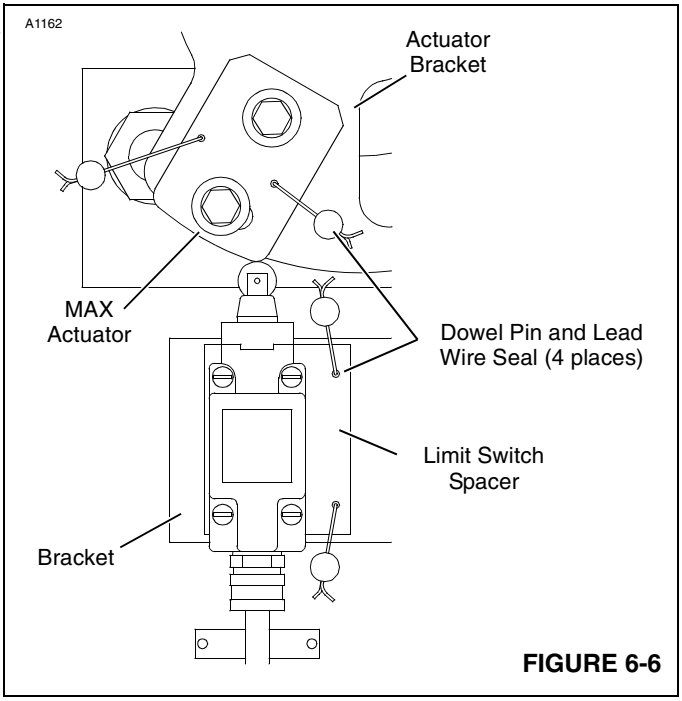


FIGURE 6-6

Reference Only

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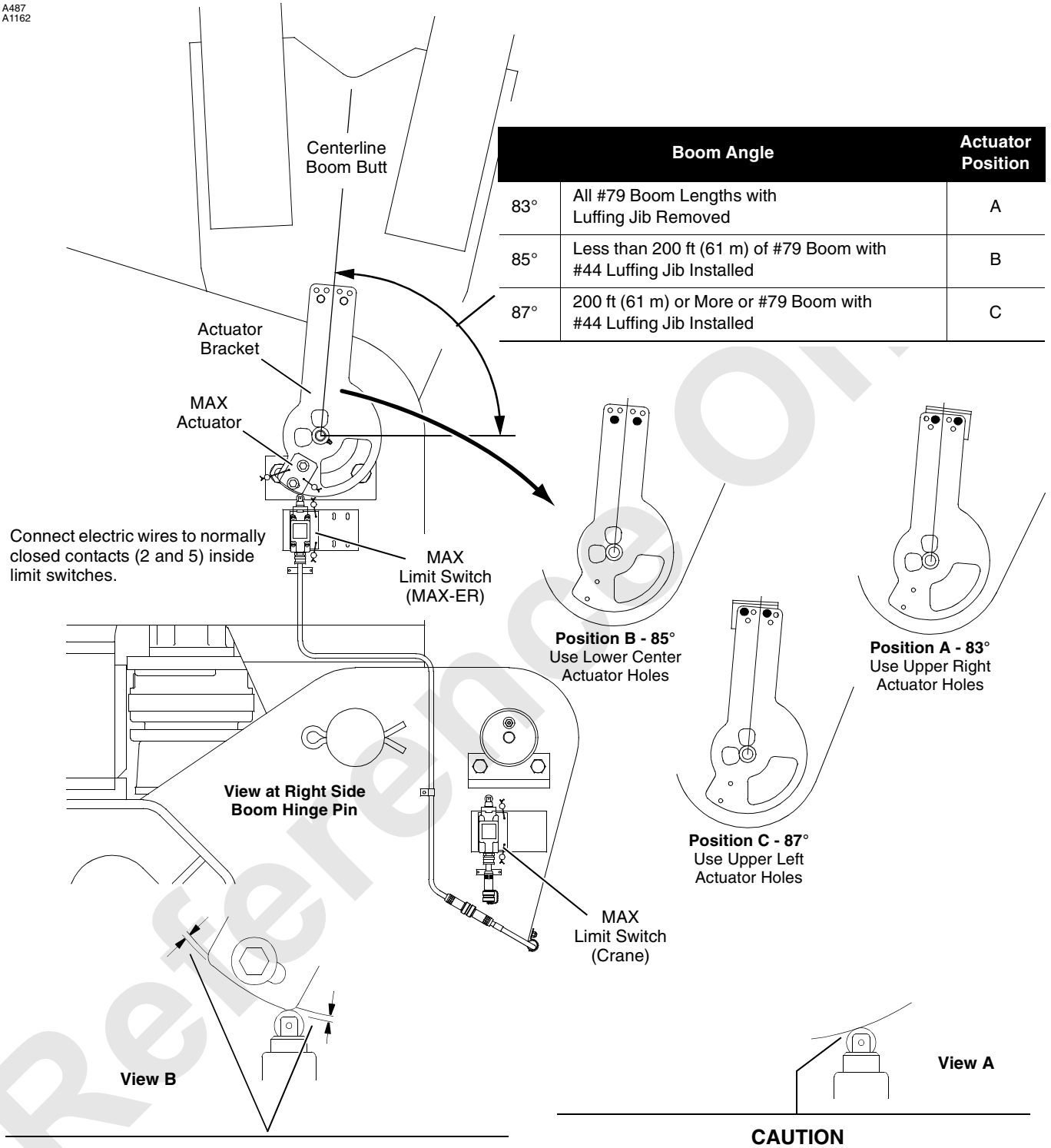
A1162



Boom Angle		Actuator Position
83°	All #79 Boom Lengths with Luffing Jib Removed	A
85°	Less than 200 ft (61 m) of #79 Boom with #44 Luffing Jib Installed	B
87°	200 ft (61 m) or More or #79 Boom with #44 Luffing Jib Installed	C

CAUTION

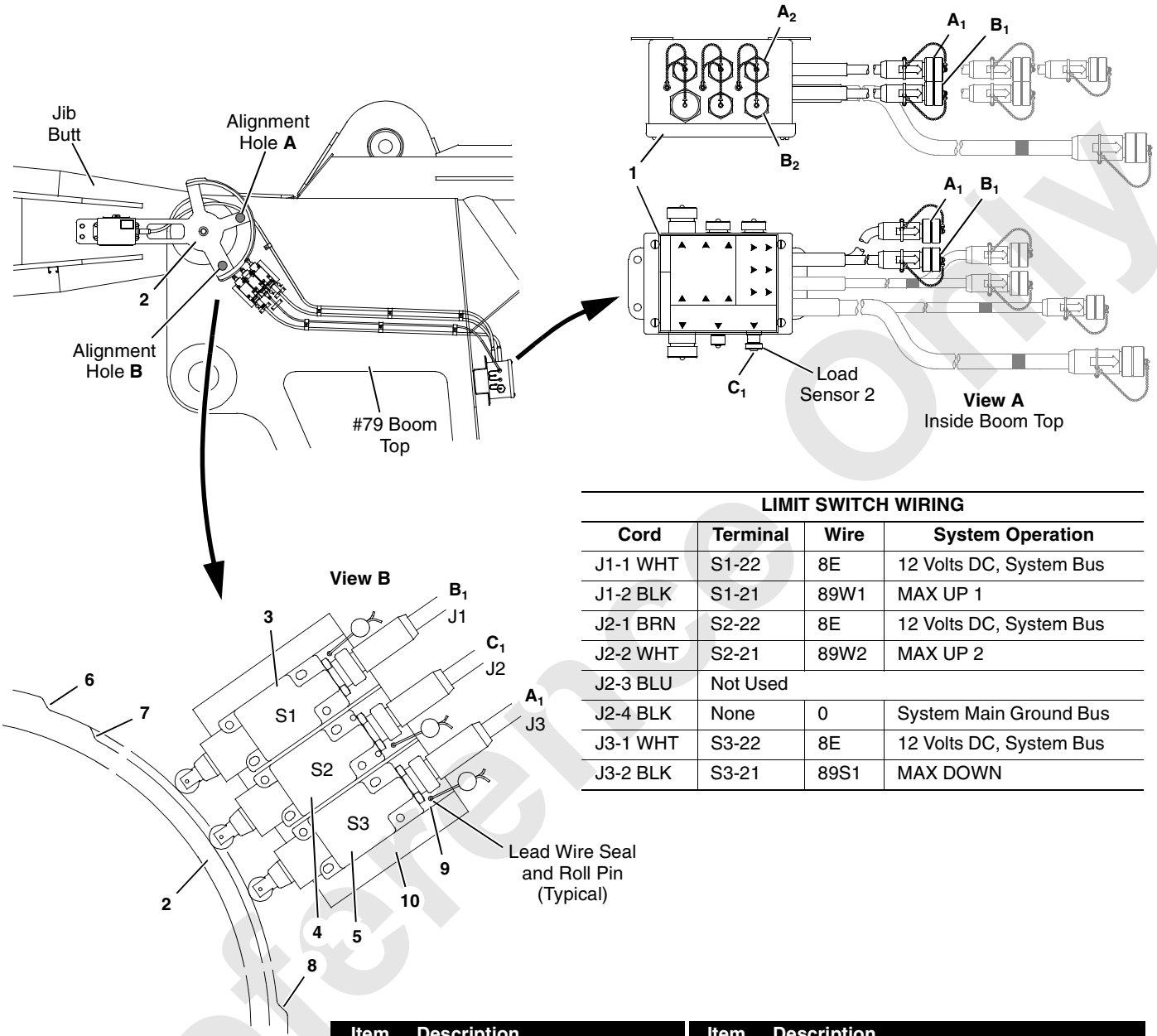
Check this distance after adjusting limit switch. Distance from both ends of MAX actuator to outside edge of actuator bracket must be equal. Limit switch could be damaged from over-travel if either end of actuator is cocked.

CAUTION

Before adjusting limit switch, move limit switch up or down in slots so edge of roller is even with edge of actuator bracket. Limit switch will not trip open if positioned too low in slots. Limit switch could be damaged from over-travel if positioned too high in slots.

FIGURE 6-7

Reference Only



LIMIT SWITCH WIRING

Cord	Terminal	Wire	System Operation
J1-1 WHT	S1-22	8E	12 Volts DC, System Bus
J1-2 BLK	S1-21	89W1	MAX UP 1
J2-1 BRN	S2-22	8E	12 Volts DC, System Bus
J2-2 WHT	S2-21	89W2	MAX UP 2
J2-3 BLU	Not Used		
J2-4 BLK	None	0	System Main Ground Bus
J3-1 WHT	S3-22	8E	12 Volts DC, System Bus
J3-2 BLK	S3-21	89S1	MAX DOWN

Item	Description	Item	Description
1	Junction Box	9	Spacer (each limit switch)
2	Actuator	10	Mounting Bracket
3	Limit Switch - MAX UP 1 (S1)	A_1	Cord to MAX DOWN Limit Switch (J3)
4	Limit Switch - MAX UP 2 (S2)	A_2	Shorting Plug for MAX DOWN Limit Switch
5	Limit Switch - MAX DOWN (S3)	B_1	Cord to MAX UP 1 Limit Switch (J1)
6	Cam - MAX UP 1	B_2	Shorting Plug for MAX UP 1 Limit Switch
7	Cam - MAX UP 2	C_1	Cord to MAX UP 2 Limit Switch (J2)
8	Cam - MAX DOWN		

A1133
A1168

FIGURE 6-8

Reference Only

JIB STOP ADJUSTMENT — #44 LUFFING JIB ON #79 BOOM

General

The luffing jib attachment is equipped with three limit switches (Figure 6-8) which automatically stop the luffing hoist and apply its brake when the luffing jib is raised or lowered to the following angles:

- MAX UP 1 (maximum working angle) — 168° boom to luffing jib angle. This limit can be bypassed, allowing the luffing jib to be raised an additional 1.2° to MAX UP limit.
- MAX UP 2 (maximum jib angle) — 169.2° boom to luffing jib angle. This limit can be bypassed only when the attachment is lowered to the ground with the boom below 50°.
- MAX DOWN (minimum jib angle) — 70° boom to luffing jib angle. ***Do not bypass this limit. Structural damage will occur***.

The fault alarm (in operator's cab) comes on when the jib reaches any limit. The fault alarm also comes if the luffing jib is lowered below horizontal.

WARNING

Falling Attachment Hazard!

Do not operate crane unless luffing jib stops are properly adjusted and operational.

Operating luffing jib above MAX UP limit or below MIN limit is neither intended nor approved. Jib can be pulled over backwards or collapse.

NOTE: For operation with luffing jib, the boom stop must be set at the angle specified in Figure 6-7.

Maintenance

At least once weekly, check that the limit switches stop the luffing jib at the specified angles; if not, replace any defective parts and/or adjust the limit switches.

Removing Luffing Jib

Perform the following steps to bypass the luffing jib stops when the luffing jib is removed.

See Figure 6-8 for following procedure.

1. Unplug cords (A_1), (B_1), and (C_1) from jib stop limit switches (View B).
2. Connect cords A_1 and B_1 to shorting plug receptacles A_2 and B_2 at boom top junction box (1, View A).

NOTE: Cord C_1 does not have a shorting plug.

Adjustment

See Figure 6-8 for following procedures.

The jib stop limit switches must be installed, adjusted, and sealed at initial assembly of the attachment. Limit switch adjustments must be checked and readjusted if required each time the attachment is reassembled and when parts are replaced. *Seals must be removed to allow readjustment.*

Preliminary Adjustment

All adjustments must be made with the boom and luffing jib resting on blocking at ground level.

1. Lower attachment to ground.
2. Remove screws connecting actuator (2) to jib butt.
3. Rotate actuator (2) counterclockwise so all three limit switch rollers are in middle of rotation between cams (View B).
4. Loosen limit switch mounting screws.
5. Position limit switches so rollers just contact actuator surfaces. DO NOT ACTUATE ANY LIMIT SWITCH.
6. Securely tighten limit switch mounting screws.

NOTE: For remaining steps, make sure LUFFING JIB mode is selected and confirmed and D2 diagnostic screen is visible on digital display (Figure 6-9).

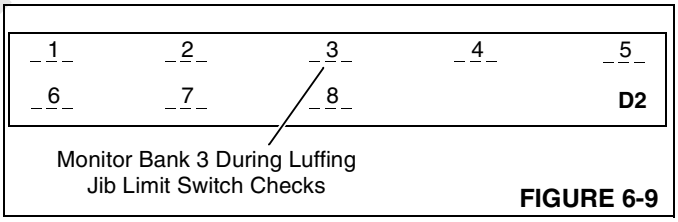


FIGURE 6-9

MAX UP 1 Limit Adjustment

1. Note number in bank 3 of D2 diagnostic screen (Figure 6-9).
2. Rotate actuator (2) clockwise so MAX UP 1 limit switch roller (3) contacts cam (6) and limit switch clicks open. On current production unit, install alignment pin in holes A of actuator and boom top.
3. Pull luffing jib handle back. Luffing hoist must not turn and LUFFING JIB MAX UP 1 operating limit should come on. Number in bank 3 of D2 screen should decrease by 4, indicating that limit switch is open.
4. Readjust limit switch if necessary to ensure proper operation.
5. Remove alignment pin (current production unit only).

Reference Only

MAX UP 2 Limit Adjustment

1. Turn limit bypass key clockwise to bypass MAX UP 1 limit.
2. Rotate actuator (2) clockwise so MAX UP 2 limit switch roller (3) contacts cam (6) and limit switch clicks open. On current production unit, install alignment pin in holes B of actuator and boom top.
3. Pull luffing jib handle back. Luffing hoist must not turn and LUFFING JIB MAX UP 2 operating limit should come on.
4. Readjust limit switch if necessary to ensure proper operation.
5. Remove alignment pin (current production unit only).

MAX DOWN Limit Adjustment

1. Note number in bank 3 of D2 diagnostic screen (Figure 6-9).
2. Rotate actuator (2) counterclockwise so MIN limit switch roller (5) contacts cam (8) and limit switch clicks open.
3. Push luffing jib handle forward. Luffing hoist must not turn and LUFFING JIB MAX DOWN operating limit should come on. Number in bank 3 of D2 screen should decrease by 2, indicating that limit switch is open.
4. Readjust limit switch if necessary to ensure proper operation.

Final Adjustments

5. Once limit switches are properly adjusted, drill and seal limit switch spacers (9) to mounting bracket (10) with dowel pins and lead wire seals.
6. Securely attach actuator (2) to jib butt with screws, lockwashers, and nuts provided.

Operational Checks

Make the following operational checks after the boom and jib are raised.

Make sure boom and luffing jib angle indicators are properly adjusted prior to raising boom and luffing jib. See instructions under operational checks.

1. Raise boom and luffing jib until boom is at 80°.
2. Monitor BOOM TO LUFFING JIB ANGLE on display screen in operator's cab while performing remaining steps.
3. SLOWLY raise luffing jib.
4. Luffing hoist must stop and be inoperable when boom to luffing jib angle is 168°.

   Fault alarm should come on indicating MAX UP 1 limit has been reached.

   Stop raising luffing jib immediately if limit switch fails to stop luffing hoist. Lower boom and jib to ground and readjust MAX UP 1 limit switch.
5. Turn limit bypass key clockwise to bypass MAX UP 1 limit.
6. SLOWLY raise luffing jib past MAX UP 1 limit.
7. Luffing hoist must stop and be inoperable when boom to luffing jib angle is 169.2°.

   Fault alarm should come on indicating MAX UP limit has been reached.

   Stop raising luffing jib immediately if limit switch fails to stop luffing hoist. Lower boom and jib to ground and readjust MAX UP limit switch.
8. SLOWLY lower luffing jib.

   Luffing hoist must stop and be inoperable when boom to luffing jib angle is 70°.

   Stop lowering luffing jib immediately if limit switch fails to stop luffing hoist. Lower boom and jib to ground and readjust MIN limit switch.

Reference Only

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Reference Only

BLOCK-UP LIMIT CONTROL

General

The block-up limit control (also called anti two-block device) is a ***two-blocking prevention device*** which automatically stops the load drum from hoisting and the boom from lowering when a load is hoisted a predetermined distance.

DEFINITION: Two-blocking is the unsafe condition in which the load block or the weight ball contacts the sheave assembly from which either is suspended.

Two-blocking can result in failure of sheaves and wire rope, possibly causing load to fall.

WARNING

Two-Blocking Hazard!

Block-up limit control is a protective device designed only to assist operator in preventing a two-blocking condition; any other use is neither intended nor approved.

Block-up limit control may not prevent two-blocking when load is hoisted at maximum single line speed. Operator must determine fastest line speed that will allow block-up limit control to function properly and, thereafter, not exceed that line speed.

The block-up limit control consists of the following components (see Figure 6-10):

1. Normally closed limit switch assembly fastened at any or all of the following locations (multiple limit switches are wired in series):
   a. Lower jib point.
   b. Upper jib point.
2. Weight freely suspended by chain from each limit switch actuating lever (weight encircles load line).
3. Lift block clamped to single-part load line or lift plates fastened to multiple-part load block.

Operation

See Figure 6-10 and Figure 6-13 for following procedures. See Section 3 of your Crane Service Manual for an electric schematic of the block-up limit control system.

Block-Up Limit Control Deactivated

During normal operation, the weight overcomes the spring force and rotates the actuating lever away from the limit switch lever. This action allows the limit switch to close the load drum UP and boom/luffing jib DOWN electric circuits. Therefore, the load can be hoisted and the boom/luffing jib can be lowered.

Block-Up Limit Control Activated

When the weight is lifted by the lift block or the lift plates, spring force rotates the actuating lever against the limit switch lever. This action causes the corresponding limit switch to open the load drum UP and boom/luffing jib DOWN electric circuits.

The load drum and boom/luffing hoist pumps stroke to off. At the same time, the load drum and boom/luffing jib parking brakes apply to stop the load drum from hoisting and the boom/luffing jib from lowering.

The BLOCK UP fault alarm (in operator's cab) will come on to alert the operator.

Installation

The system must be installed according to the Block-Up Limit Control Assembly Drawing at the end of Section 4 in this manual. ***Make sure weights are suspended from proper lengths of chain or system will not operate properly.***

Securely fasten the electric cords to the boom and jib with the nylon straps and cord clips provided.

Connect the electric wires to the normal-closed contacts inside each limit switch.

See Figure 6-12 for installation of the weights.

Storing Electric Cord

The electric cords for the boom and luffing jib are long enough to accommodate the maximum length of each attachment.

Store excess cord for the boom or jib on the reel mounted in either butt (see Figure 6-11).

Each reel is equipped with a locking pin. Disengage the locking pin to allow the reel to be wound. Engage the locking pin to lock the reel in position. The power supply cord to the reel must be disconnected before the reel can be wound.

Reference Only

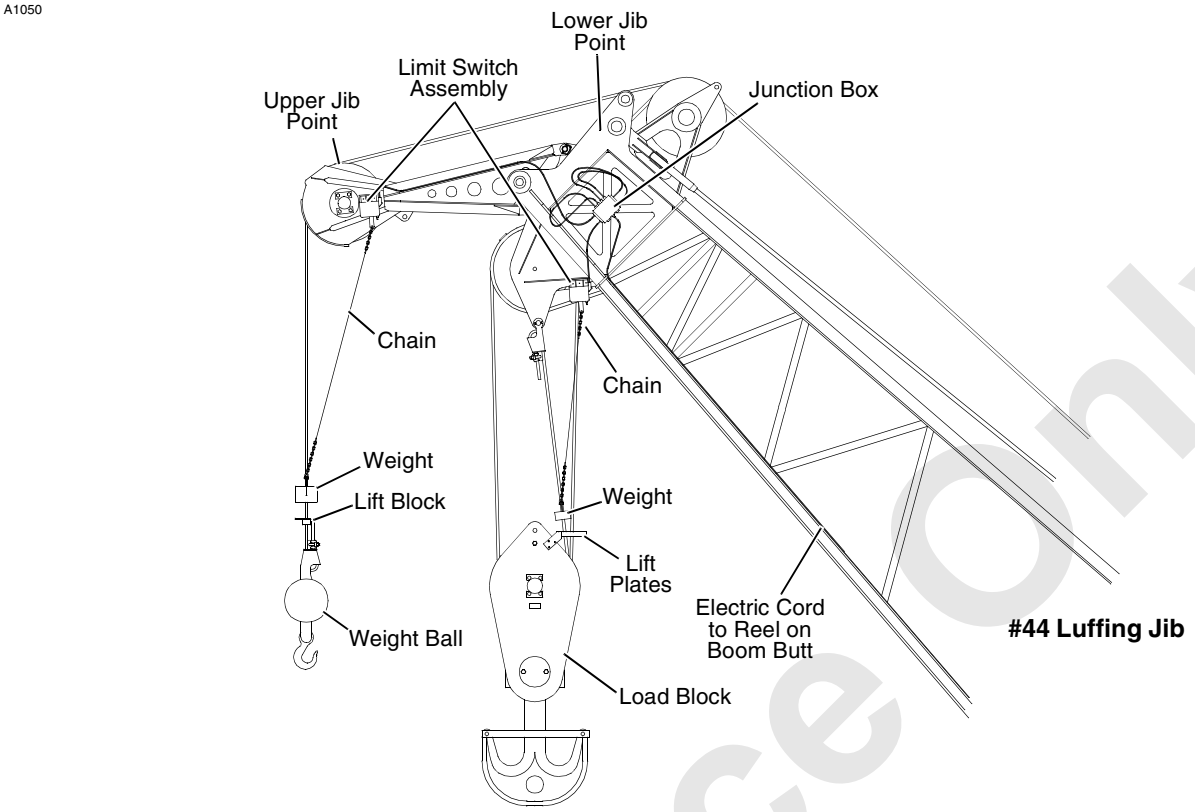

FIGURE 6-10

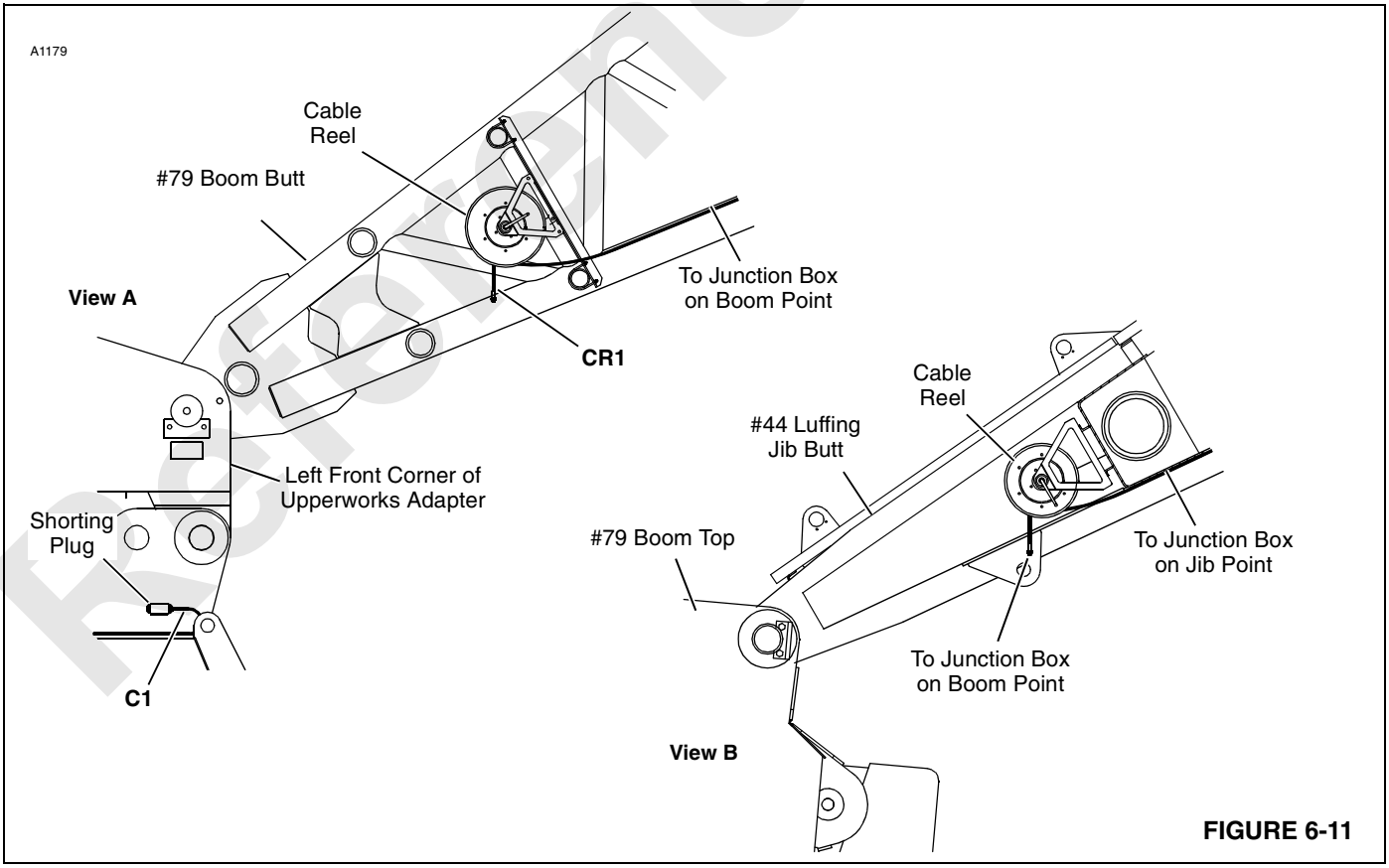

FIGURE 6-11

Reference Only

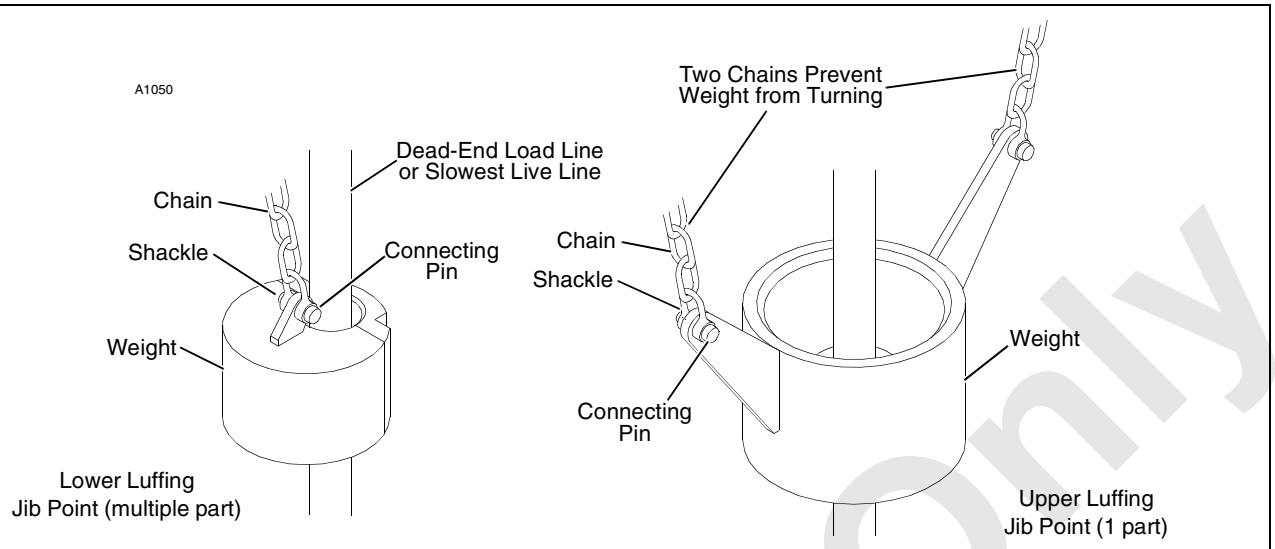

FIGURE 6-12

Disconnecting Block-Up Limit Control

A shorting plug (Figure 6-11) is provided on the left front corner of the upperworks adapter so the block-up limit system can be disconnected for the following reasons:

- Crane setup and rigging.
- Maintenance.
- Operations not requiring use of a block-up limit control (clamshell and dragline).

To disconnect the block-up limit system, proceed as follows (see Figure 6-11):

1. Disconnect electric cord (C1) from cable reel (CRI).
2. Remove closure cap from shorting plug.
3. Connect electric cord (C1) to shorting plug.
4. Reverse steps to reconnect block-up limit control.

Removing Jib or Boom Point

The junction boxes on the boom and jib points are equipped with shorting plugs.

If an electric cord is disconnected from a block-up limit switch, the cord must be connected to the corresponding shorting plug. Failing to perform this step will prevent the load drum from hoisting and the boom/jib from lowering. Also the operating limit alert will come on.

See Block-Up Limit Control Assembly Drawing in Section 4 of this manual for identification and location of the shorting plugs.

Be sure to reconnect electric cord to proper block-up limit switch when corresponding attachment is reinstalled.

Maintenance

Inspect and test the block-up limit control *weekly or every 40 hours of operation*, as follows:

NOTE: *Do not operate crane until cause for improper operation and all hazardous conditions have been found and corrected.*

1. Lower the boom and jib (if equipped) onto blocking at ground level and carefully inspect the following items:
   - **a.** Inspect each limit switch lever and actuating lever for freedom of movement. Apply one-half shot of grease to the fitting on the actuating lever; wipe away any excess grease.
   - **b.** Inspect each weight for freedom of movement on the load line.
   - **c.** Inspect each weight, each chain, each shackle and each connecting pin for excessive or abnormal wear. Make sure cotter pins for shackles are installed and spread.
   - **d.** Inspect the entire length of electric cords for damage.
   - **e.** Check that electric cords are clear of all moving parts on the boom and jib and that the cords are securely fastened to the boom and jib with straps (metal straps for 2250 Crane or nylon straps for MAX-ER 2000).
   - **f.** Check that all plugs are securely fastened.
2. Test the block-up limit control for proper operation using either of the following methods:

Reference Only

a. BOOM LOWERED: Manually lift each weight — *one at a time* — while the engine is running. The load drum should not operate in the HOIST direction and the boom hoist should not operate in the LOWER direction.

b. BOOM RAISED: *Slowly* hoist each load block and weight ball — *one at a time* — against weight. When chain goes slack, corresponding load drum should stop HOISTING and boom/luffing hoist should not operate in LOWER direction.

CAUTION

Use extreme care when testing block-up limit control when boom is raised. If block-up limit control fails to stop load, immediately stop load by moving drum control handle to off or by applying drum working brake; otherwise, two-blocking may occur.

Adjustment

See Figure 6-13 for following procedure.

Lower boom onto blocking at ground level and adjust each limit switch as follows:

1. Adjust spring tension so there is enough force to lift weight of chain and rotate actuating lever when weight is lifted. Note that limit switch at #79 lower boom point has two springs.
2. Loosen setscrew in limit switch lever so lever is free to rotate.
3. Manually lift weight so actuating lever rotates upward.
4. Hold lever at Dimension A.
5. Hold roller on limit switch lever against actuating lever while performing step 6.
6. Turn limit switch shaft CLOCKWISE *only enough to "click" limit switch open and hold.* Then securely tighten setscrew in limit switch lever.
7. Test limit switch for proper operation (see Maintenance); repeat adjustment steps until limit switch operates properly.

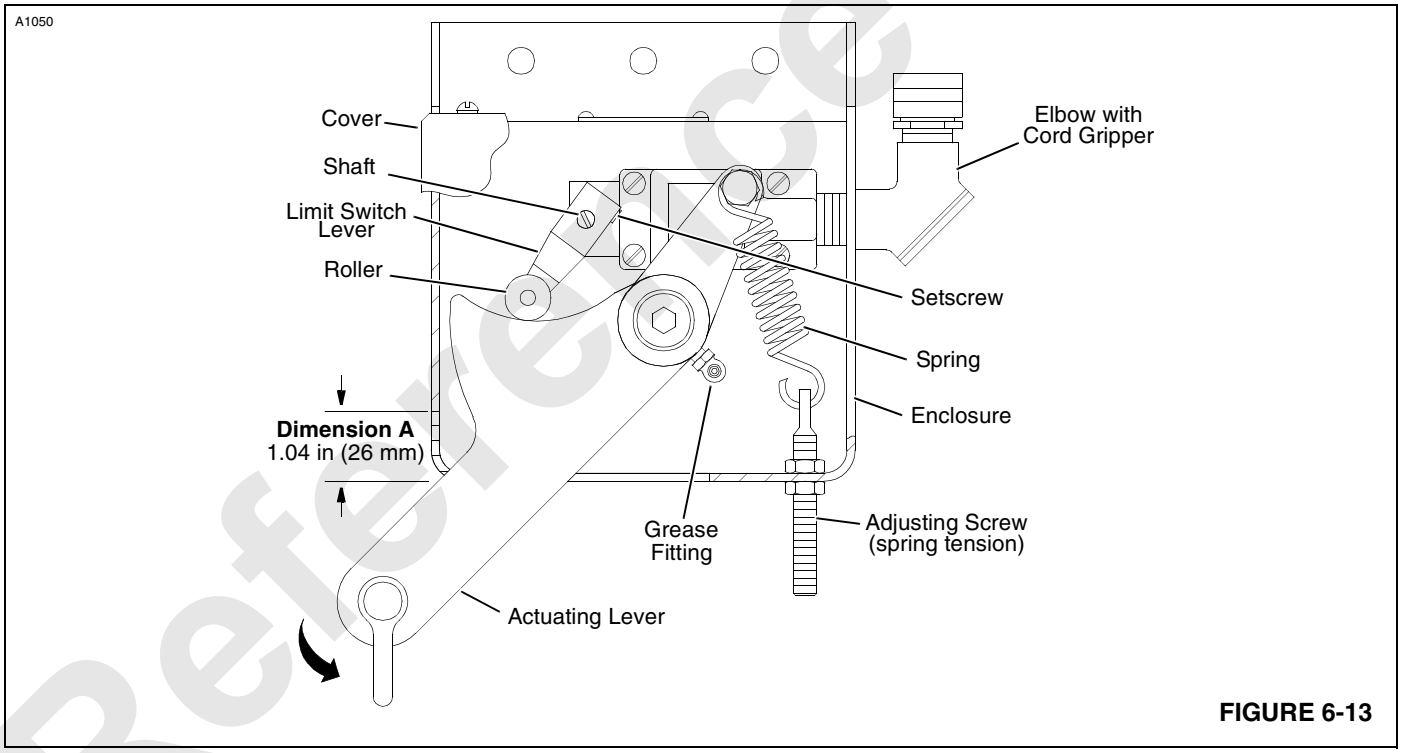

FIGURE 6-13

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