

Manitowoc 2250

Operator Manual Luffing Jib Attachment



605513



OPERATOR MANUAL

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

2250 with #133 or 133A Luffing Jib

Luffing Jib Model Number

2255Ref

Luffing Jib Serial Number

This Manual is divided into the following sections:


SECTION 1	INTRODUCTION
SECTION 2	SAFETY INFORMATION
SECTION 3	OPERATING CONTROLS AND PROCEDURES
SECTION 4	SET-UP AND INSTALLATION
SECTION 5	LUBRICATION
SECTION 6	MAINTENANCE CHECKLIST

NOTICE

The serial number of the crane and applicable attachments (i.e. luffing jib, MAX-ER[®]) is the only method your Manitowoc dealer or Manitowoc Crane Care has of providing you with correct parts and service information.

The serial number is located on a crane identification plate attached to the operator's cab and each attachment. Refer to the Nameplate and Decal Assembly Drawing in Section 2 of this manual for the exact location of the crane identification plate.

Always furnish serial number of crane and its attachments when ordering parts or discussing service problems with your Manitowoc dealer or Manitowoc Crane Care.

	⚠ WARNING
	<p>To prevent death or serious injury:</p> <ul style="list-style-type: none">• Avoid unsafe operation and maintenance. Crane and attachments must be operated and maintained by trained and experienced personnel. Manitowoc is not responsible for qualifying these personnel.• Do not operate or work on crane or attachments without first reading and understanding instructions contained in Operator Information Manual and Service Manual supplied with crane and applicable attachments.• Store Operator Information Manual and Service Manual in operator's cab. If Operator Information Manual or Service Manual is missing from cab, contact your Manitowoc dealer for a new one.

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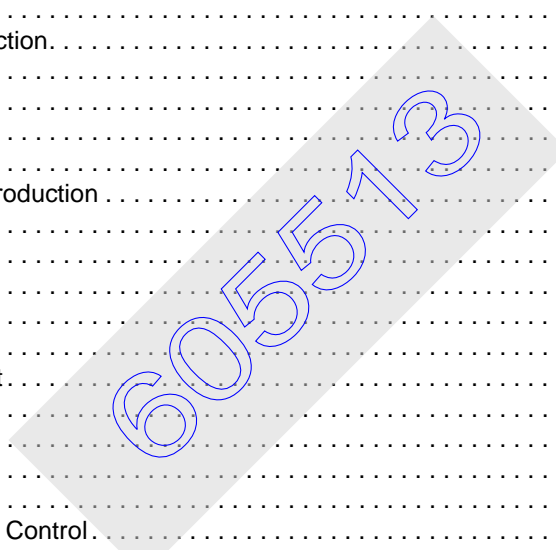
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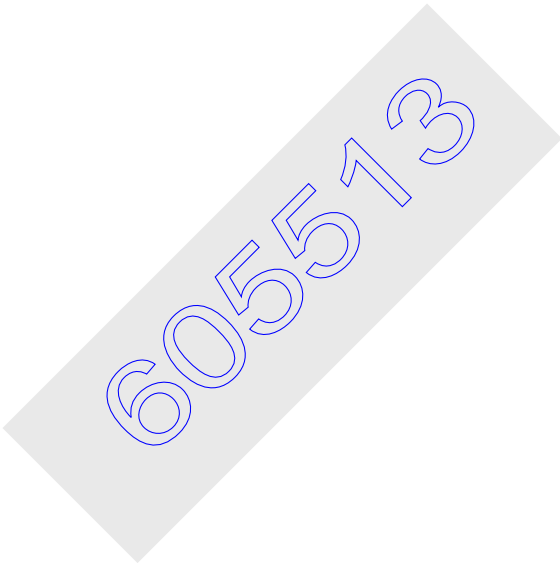
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SECTION 1 INTRODUCTION

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 jib, MAX-ER, and RINGER) 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.

CHANGE OF OWNERSHIP REGISTRATION

If you are the new owner of a Manitowoc crane, please register it with Manitowoc Crane Care so we can contact you if the need arises.

1. Go to www.manitowoccranes.com
2. Go to Service > Manitowoc Crane Care > Service Information > Change of Ownership Form.
3. Complete the form.

MANITOWOC DEALER

For questions about this manual or the 16000 crane, contact your Manitowoc dealer. If you do not know the contact information for your dealer, locate the Manitowoc dealer nearest you, as follows:

1. Go to www.manitowoccranes.com
2. Go to Dealer Locator.
3. Follow the on-screen prompts to locate your Manitowoc dealer.

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 LUFFING JIB COMPONENTS

See Figure 1-2 for identification of the #133 or 133A luffing components.

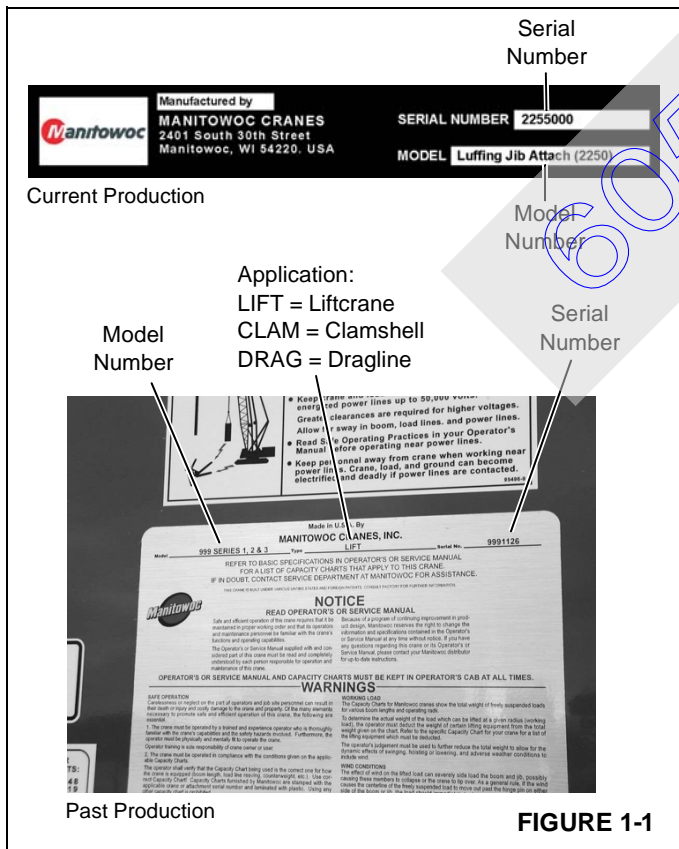


FIGURE 1-1

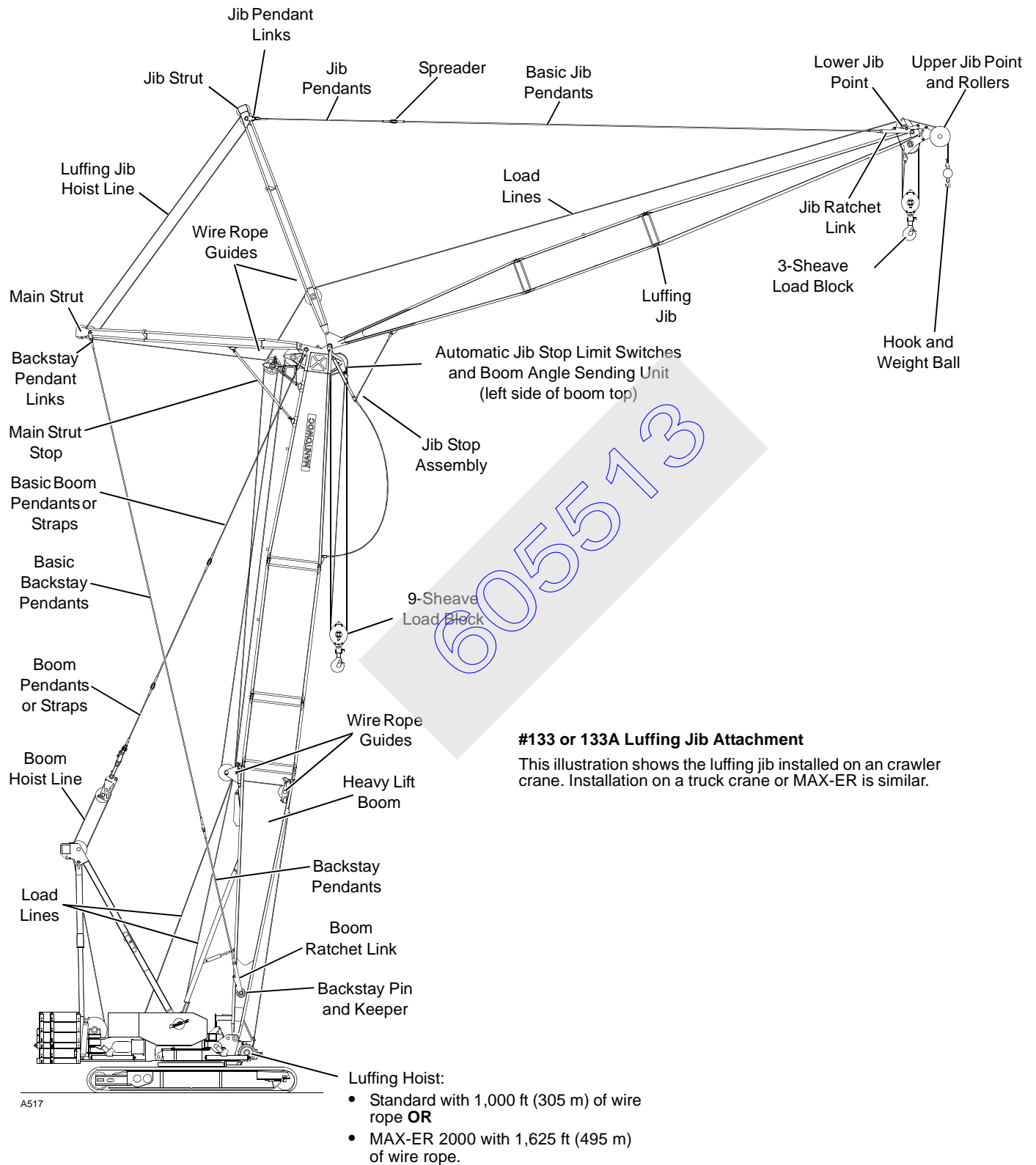


FIGURE 1-2

CRANE WEIGHTS

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

Description	Weight	
	Pounds	Kilograms
LIFTCRANE:		
Upperworks and lowerworks complete, counterweight, gantry, backhitch, fully rigged 70 ft (21,3 m) boom No. 44 with one piece butt and heavy lift top (including upper boom point, 300 USt (272t) block, and 15 USt (14t) hook and weight ball), boom stops and load lines	449,615	203 941
2250 SERIES 1		
2250 SERIES 2	549,740	249 357
2250 SERIES 3	649,740	294 717
2250 SERIES 1 with RINGER prep	461,340	209 260
2250 SERIES 2 with RINGER prep	561,465	254 676
2250 SERIES 3 with RINGER prep	661,465	300 035
UPPERWORKS MACHINERY MODULE:		
Rotating bed rear section, split rear drums with load lines, rotating bed pin pullers, boom hoist, gantry, gantry lifting cylinders, equalizer, boom hoist line, operator's cab, Cummins N14-C450 III power plant, hydraulic reservoir (full), and fuel tank (1/2 full)	77,695	35 241
With RINGER prep - - - - -	83,930	38 070
ROTATING MODULE WITH CARBODY:		
Rotating bed front section with bearing turntable, swing drive, carbody with pin pullers, rotating union, piping and installation, 40 ft (12,2 m) boom butt and boom stops	69,465	31 508
With RINGER prep - - - - -	74,955	33 999
Replace 40 ft (12,2 m) butt and boom stops with 12 ft (3,7m) lower 2 piece butt	63,475	28 791
CRAWLERS:		
30 ft 9 in (9 373 mm) crawler assembly with 48 in (1 219 mm) treads (each)	53,820	24 412
COUNTERWEIGHT - UPPER:		
Tray - - - - -	38,775	17 588
Lifting frame (each) 2 required - - - - -	170	77
Center counterweight - - - - -	37,000	16 782
Lower side counterweight (6 on all SERIES) (each)	15,500	7 030
Upper side counterweight (2 on SERIES 2; 4 on SERIES 3) (each)	20,000	9 071
Upper power pin with cylinder (each) - -	30	13
Lower power pin with cylinder (each) - -	20	9
Center counterweight lifting pendant (each)	20	9
Total upperworks counterweight - 2250 SERIES 1	169,200	76 747
2250 SERIES 2	209,200	94 891
2250 SERIES 3	249,200	113 035
COUNTERWEIGHT - LOWER:		
Carbody center counterweight (2 on SERIES 2 and SERIES 3) (each)	30,000	13 607
Carbody side counterweight (4 only on SERIES 3) (each)	15,000	6 803
GANTRY:		
28 ft 0 in (8 534 mm) gantry with polyamide sheaves	11,330	5 139
Backhitch (each leg) - - - - -	1,585	718
Counterweight handling link (each) - - -	90	40

Description	Weight	
	Pounds	Kilograms
BOOM NO. 44:		
40 ft 0 in (12,2 m) butt	8,605	3 903
30 ft 0 in (9,1 m) top (with lower point, wire rope guide)	11,625	5 273
10 ft 0 in (3,0 m) insert - - - - -	1,890	857
20 ft 0 in (6,1 m) insert - - - - -	3,215	1 458
40 ft 0 in (12,2m) light insert - - - - -	4,250	1 927
40 ft 0 in (12,2 m) insert - - - - -	5,420	2 458
31 ft 1-3/16 in (9,5 m) basic strap (each) -	425	192
10 ft 0 in (3,0 m) strap (with connector links) (each)	175	79
20 ft 0 in (6,1 m) strap (with connector links) (each)	295	133
40 ft 0 in (12,2 m) strap (with connector links) (each)	540	244
3 ft 4-3/8 in (1,0 m) strap (with connector links) (each)	80	36
Intermediate suspension link (each) - - -	65	29
47 ft 6 in (14,5 m) intermediate suspension pendant (each)	240	108
29 ft 5 in (9,0 m) intermediate suspension pendant (each)	175	79
9 ft 9 in (3,0 m) intermediate suspension pendant (each)	105	47
Lower intermediate suspension link with pin (each)	60	27
Upper boom point (single sheave) - - -	930	421
Wire rope guide (on butt) - - - - -	2,090	948
Equalizer - - - - -	1,810	821
Strap link (attached to equalizer) (each) 4 required	25	11
Boom stop (each tube) - - - - -	825	374
NO. 133/133A LUFFING JIB:		
30 ft 0 in (9,1 m) butt - - - - -	3,160	1 433
40 ft 0 in (12,2 m) top (with lower point, upper point roller and wire rope guide)	7,255	3 290
10 ft 0 in (3,0 m) insert - - - - -	965	437
20 ft 0 in (6,1 m) insert - - - - -	1,770	802
40 ft 0 in (12,2 m) insert - - - - -	3,260	1 478
Pendant ratchet link (each) - - - - -	130	58
71 ft 3 in (21,7 m) basic pendant (each)	385	174
10 ft 1 in (3,1 m) pendant (each) - - -	135	61
20 ft 1-1/2 in (6,1 m) pendant (each) - -	175	79
40 ft 3 in (12,3 m) pendant (each) - - -	260	117
Pendant spreader - - - - -	130	58
33 ft 6 in (10,2 m) jib strut with guide sheave, luffing sheaves and links	4,550	2 063
31 ft 0 in (9,4 m) main strut with luffing sheaves and links	4,450	2 018
Luffing wire rope guide - - - - -	1,070	485
73 ft 6 in (22,4 m) basic backstay pendant (each)	395	179
Backstay ratchet link (each) - - - - -	185	83
Backstay pin in boom butt (each) - - -	285	129
Strut stop tube with pins (each) - - - -	130	58
25 ft 9 in (7,8 m) strut handling pendant (each)	30	13
Strut handling link with pin (on main strut) (each)	5	2
Strut handling link, wedge socket and pins	45	20
Jib stop tube assembly - - - - -	445	201
30 ft 0 in (9,1 m) jib stop pendant (each)	110	49
11 ft 2 in (3,4 m) jib stop pendant (each)	75	34

Description	Weight	
	Pounds	Kilograms
NO. 140 JIB:		
20 ft 0 in (6,1 m) butt - - - - -	1,020	462
20 ft 0 in (6,1 m) top (with jib point sheaves)	2,375	1 077
20 ft 0 in (6,1 m) insert - - - - -	800	362
40 ft 0 in (12,2 m) basic pendant (each) -	175	79
19 ft 2 in (5,8 m) pendant (each) - - - -	115	52
Jib stop pendant and link (each) - - - -	95	43
20 ft 0 in (6,1 m) strut with sheave and links	1,360	616
83 ft 8-1/8 in (25,5 m) backstay pendant (each)	300	136
Backstay support - - - - -	515	233
Jib stop strut with pins - - - - -	60	27
6 ft 0 in (1,8 m) jib stop pendant (each) -	20	9
7 ft 7 in (2,3 m) jib stop pendant (each) -	20	9
Jib stop adjustable link (each) - - - - -	5	2
BOOM NO. 44 OPTIONS:		
300 USt (272t) load block with swivel hook	8,000	3 628
100 USt (91t) load block with weight plates	4,800	2 177
60 USt (55t) load block with weight plates	2,825	1 281
60 USt (55t) load block with weight plates	4,425	2 007
15 USt (14t) hook and weight ball (swivel)	1,250	566
WIRE ROPE:		
Boom hoist - 975 ft (297 m) of 1 in (26 mm) wire rope - 1.85 lb per ft (2,75 kg/m)	1,805	818
Luffing jib hoist - 1,200 ft (366 m) of 7/8 in (22mm) wire rope - 1.42 lb per ft (2,11 kg/m)	1,705	773
Load lines		
1-1/8 in (28,6 mm) wire rope - 2.70 lb per ft (4,02 kg/m)	5,535	2 510
Hoist line - 2,050 ft (625 m)		
Hoist line - 1,775 ft (541 m) luffing jib load hoist	4,795	2 174
Whip line - 1,270 ft (387 m) with heavy lift top	3,430	1 555
29 mm wire rope - 2.85 lb per ft (4,25 kg/m)	5,845	2 651
Hoist line - 2,050 ft (625 m)		
Hoist line - 1,775 ft (541 m) luffing jib load hoist	5,060	2 295
Whip line - 1,270 ft (387 m) with heavy lift top	3,620	1 642

ENGLISH AND METRIC CONVERSIONS

Inverse Conversion

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:

$$12 \text{ ft} \times 0.3048 = 3,6576 \text{ m}$$

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

$$3,6576 \text{ m} \div 0.3048 = 12$$

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 Newton	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

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)	US t	Load Ratings	Metric Ton	t	0.9072
US Ton (2000 lb)	US t		Kilogram	kg	907.1847

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SECTION 2

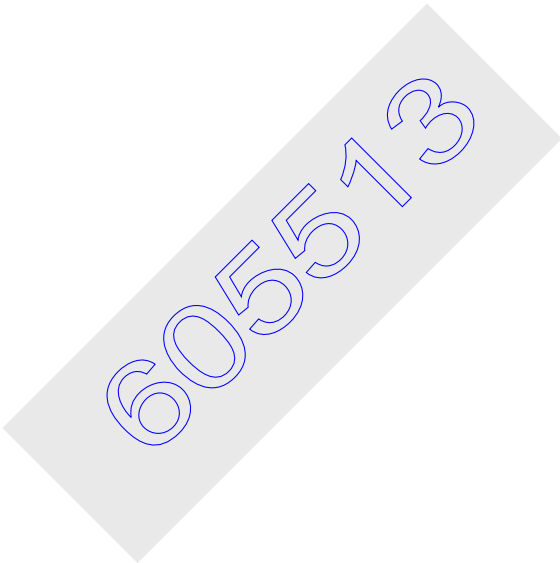
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SECTION 2

SAFETY INFORMATION



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 cancer, 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.

CONTINUOUS INNOVATION

Due to continuing product innovation, the information in this manual is subject to change without notice. If you are in doubt about any procedure, contact your Manitowoc dealer or Crane Care in Manitowoc.

NAMEPLATES AND DECALS

See drawing 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.

Symbol Identification

Many of the symbols used in the safety and information signs and nameplates on this crane are identified in Table 2-1 and Table 2-2.

Table 2-1 Common Safety Symbols





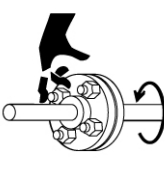










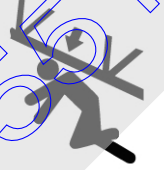




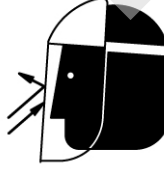




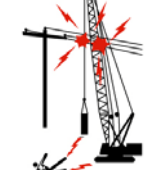


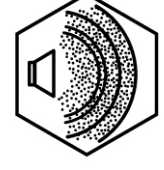







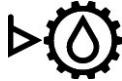

Cut or Crush Hazards					Cut Hazard
 M100090	 M100091	 M100066	 M100065	 M100069	 M100067
Crush Hazards					Fire Extinguisher
 M100070	 M100071	 M100072	 M100073	 M100074	 M100082
Fall Hazards			Falling Boom (Crush) Hazards		Explosion Hazard
 M100083	 M100084	 M100085	 M100068	 M100075	 M100080
Falling Load Hazards		Flying Objects Hazards			Overhead Obstruction Hazard
 M100076	 M100077	 M100088	 M100088	 M100089	 M100081
Electrocution Hazards		Personal Fall Protection	Pressure Cleaning	Sound Power Level	Read Manual
 M100078	 M100079	 M100095	 M100087	 M100096	 M100093

Table 2-2 Miscellaneous Symbols

Diesel Fuel	Engine Coolant	Engine Coolant Vent	Engine Oil Level	Hydraulic Filter	Hydraulic Oil
 M100271	 M100267	 M100268	 M100269	 M100272	 M100273
Pump Drive Oil Level	Tire Pressure (if equipped)				
 M100270	 M100266				

SAFETY AND INFORMATION SIGNS

Maintaining Signs

The crane owner/user shall make sure that all safety and information 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 the Nameplate and Decal Drawing at the end of this section for the installation locations of signs.

Ordering Signs

Order replacement safety and information signs from your Manitowoc dealer.

When ordering a sign, give the crane model number, the crane serial number, and the name and part number of the sign.

CRANE ACCESS POINTS



WARNING

Crush Hazard!

Upperworks 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 onto or off crane while upperworks is being swung or crane is being traveled.
- Signal operator for permission to climb onto/off crane.
- Operator: do not swing or travel while personnel are climbing onto or off crane. Stop swing and travel motions. Apply swing brake and turn on travel park.
- Operator: Always sound horn to alert personnel before you swing or travel.
- 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.

General

Take necessary precaution to prevent slipping and/or falling off the crane 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 2-1.

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. Store 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 risk of slipping, non-skid material (sand in paint) has been applied to painted walkways and platforms.

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 cab. 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 catwalks.

NOTE: Catwalks are available from Manitowoc for boom and jib sections.

Two optional ladders, stored in 40 ft (12 m) insert next to 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 crane shall do so only at steps or ladders 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.**

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

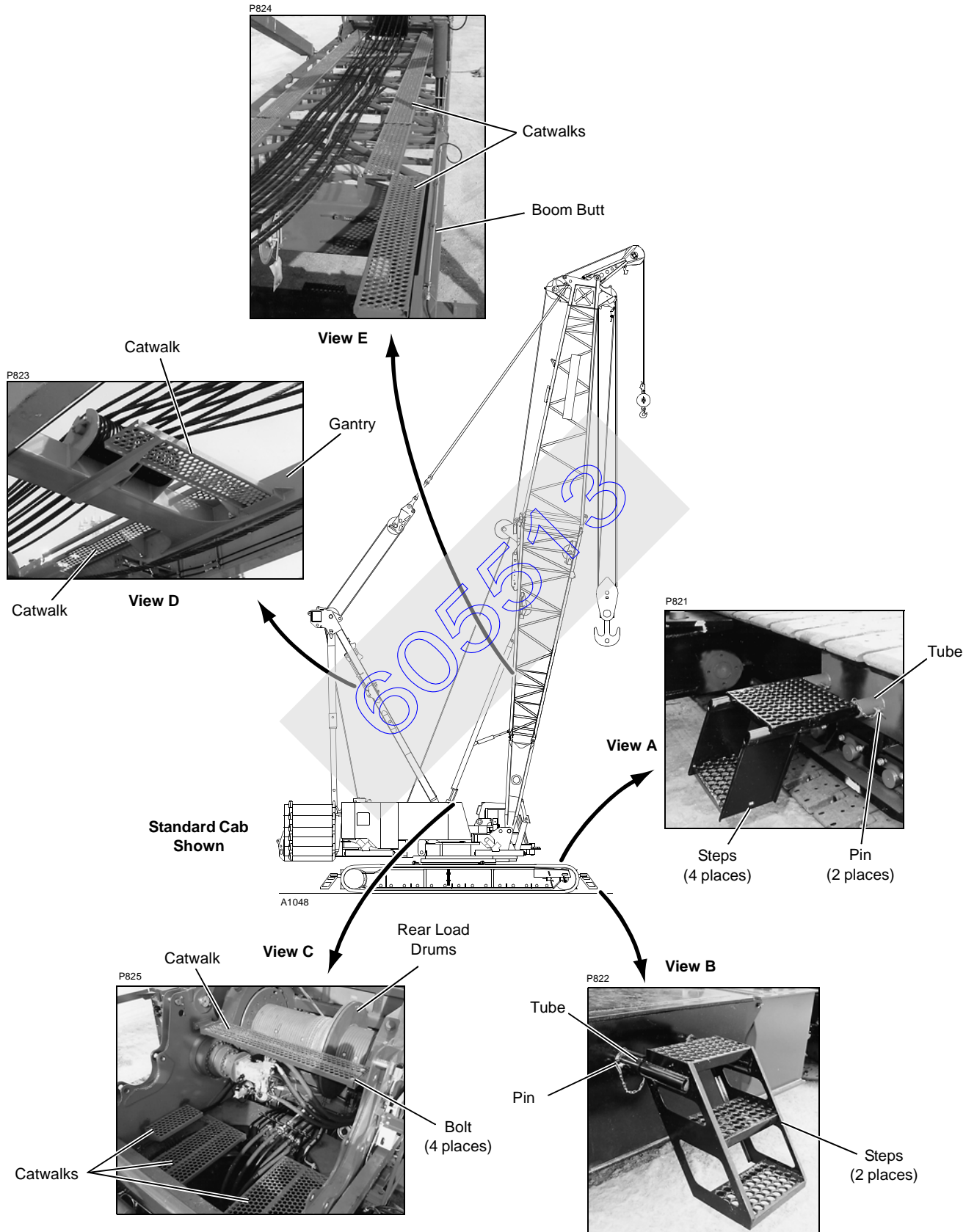
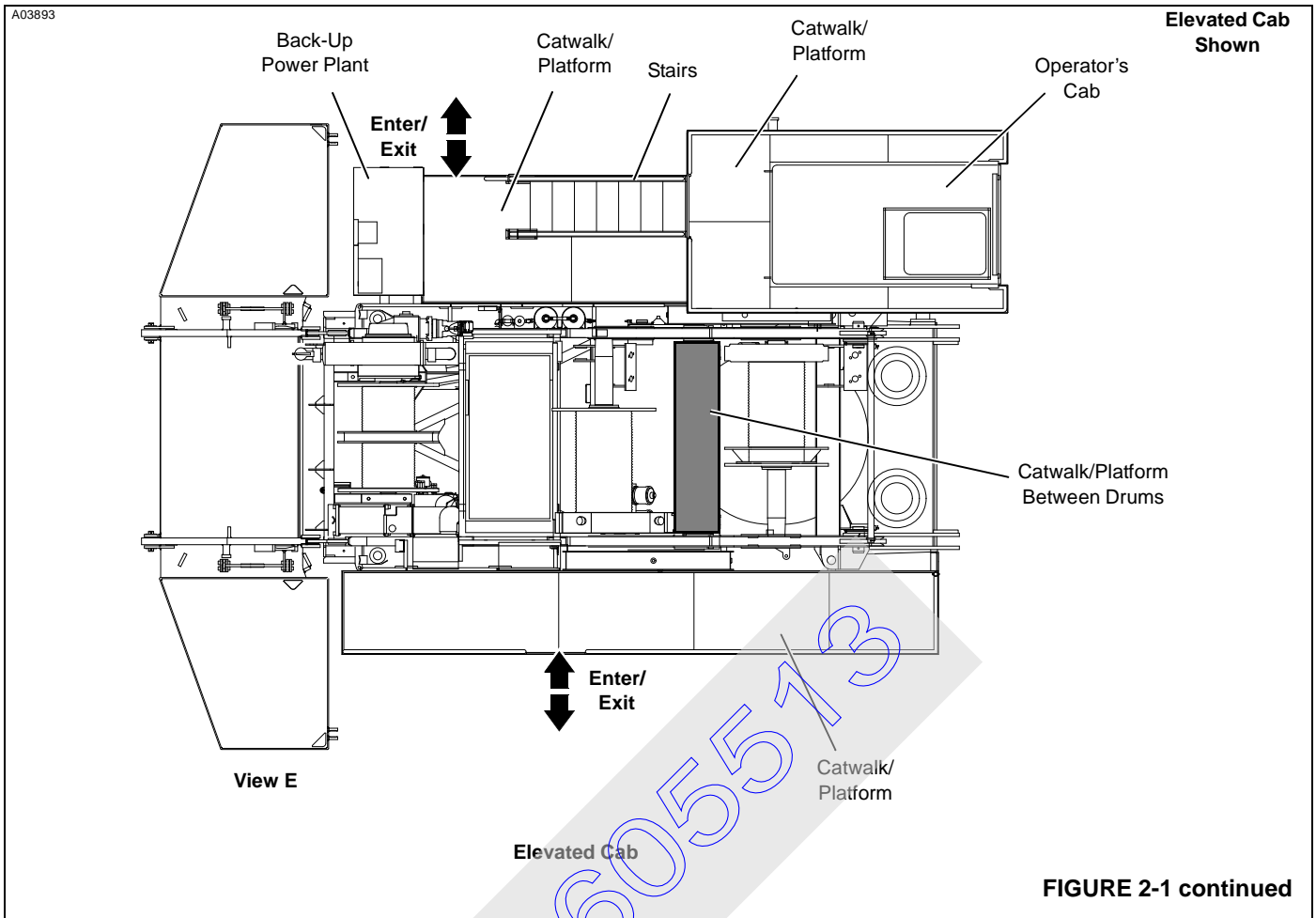


FIGURE 2-1



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 dealer for the proper manuals or Capacity Charts.

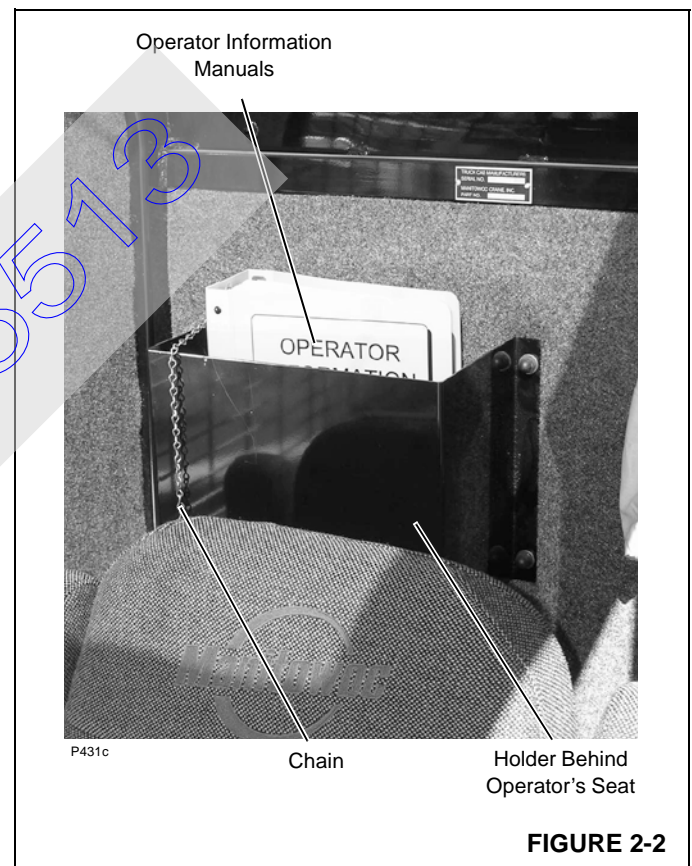
Do not operate crane or attachment if proper Capacity Chart is not in cab.

Storing Manuals

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

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.



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 into which the manual is translated.

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 dealer.

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 crane or enter crane cab unless performance of their duties requires them to do so, and then only with knowledge of 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 National 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 can 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 the crane.
2. The operator shall not operate the crane when he/she is 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.
4. The operator shall be thoroughly familiar with operation of 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 off the position and all brakes and locking devices are applied or engaged.
 - c. All personnel are clear of the crane. Deploy a swing radius barrier.



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 in Capacity Chart for crane.

- See Size of Load 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.

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.
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 the 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 the cranes configuration (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 in 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.

- c. The operator shall perform the following operations before leaving the operator's cab for any reason:
 - a. Park crane and position upperworks so 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 the master clutch, if equipped.
- h. Stop the engine.

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

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

13. 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.

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

Do not operate the crane with a snow or ice covered boom. 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 c 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.

15. Wind can cause the 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 in 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, land all loads and apply the 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.

16. 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 the boom, jib, or mast sections from dropping.

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

17. 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 the total weight of freely suspended loads for various boom and jib 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 the 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 total the load 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 load is within the static or dynamic rating for radius at which 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 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 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.
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 all crawlers. Unless otherwise specified in the Capacity Chart, the foundation shall be *level to within 1% — 1ft (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 rope 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 the 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 the 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 the 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:

- 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 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 the load or the boom to a point where less than three full wraps of wire rope are remaining 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 the 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 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 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.

Multiple Load Line Operation



WARNING

Avoid Over Load and Side Load Damage to Crane

Manitowoc highly recommends that you contact your Manitowoc dealer 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 the 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 the 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 the load on each load line.

Operator is still responsible for 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 close to 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 the boom and jib point shafts unless special lift approval is granted by Manitowoc.
 - The load lines should be located over the 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, the operator shall take the following precautions:

1. Not leave his/her position at the controls.
2. Not allow personnel to stand or pass under the 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 signal which is 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.
5. When it is necessary to give instructions to the operator (other than those established by the signal system), all crane motions shall be stopped.
6. The 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 the 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 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 in 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 indicator 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 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 in the Capacity Chart).

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 boxes, 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 as conductors, including the wire rope, pendants or straps, and taglines.

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 to the 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, taglines, 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 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 movement of the overhead lines when determining a 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. Taglines should always be made of non-conductive materials. Any tagline 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 ensure 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 point (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.
 - 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.

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

If the dealer is not 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 dealer.

REFUELING

- When using a portable container to refuel the crane, the container shall be a safety-type can equipped with an automatic closing cap and a flame arrester.
- The engine shall be **stopped** before refueling crane.
- Smoking and open flames shall be prohibited in refueling area.

FIRE EXTINGUISHERS

- A portable fire extinguisher with a minimum rating of 10 BC shall be installed in operator's or machinery cab of crane.
- 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 your Manitowoc dealer or the Product Safety and Reliability Department at the following address:

Manitowoc Cranes
2401 So. 30th St.
Manitowoc, WI 54220
Phone: 920-684-6621

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

The crane must not be returned to service until it is thoroughly inspected for any evidence of damage. All damaged parts must be repaired or replaced as authorized by Manitowoc.

SAFE MAINTENANCE



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 publication 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 in 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 dealer for assistance.

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

- Perform the following steps (as applicable) before starting a maintenance procedure:
 - Park the crane where it will not interfere with other equipment or operations.
 - Lower all loads to the ground or otherwise secure them against movement.
 - Lower the boom onto blocking at ground level, if possible, or otherwise secure the boom against dropping.
 - Move all controls to off and secure all functions against movement by applying or engaging all brakes, pawls, or other locking devices.
 - Stop the engine and render the starting means inoperative.

- f. Place a warning sign at the start controls alerting other personnel that 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 the crane.
Lift tools and other equipment which cannot be carried in pockets or tool belts onto and off the crane with hand lines or hoists.
 6. The boom and gantry are not intended as ladders. Do not attempt to climb lattice work of the 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 the 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, coolant or 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 coolant and 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.
 24. Use care while welding or burning on the 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 the 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 the 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 the 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 the 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.

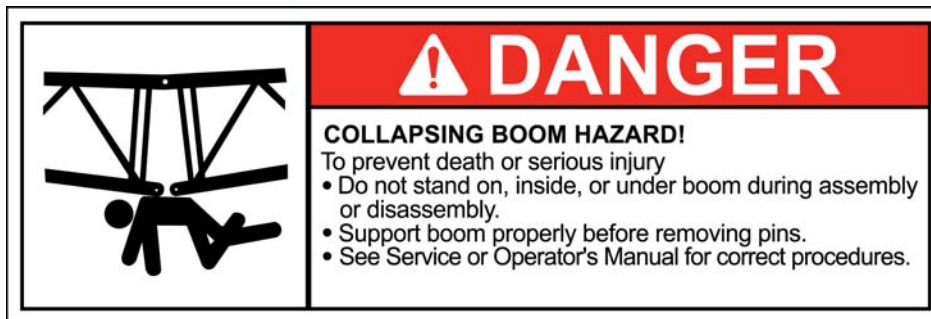


FIGURE 2-3

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 2-3) 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.

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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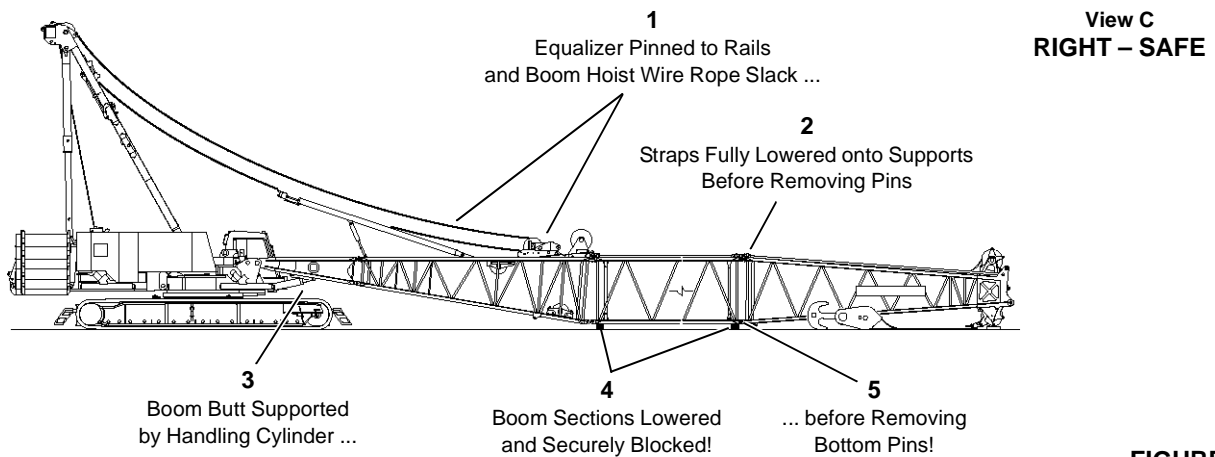
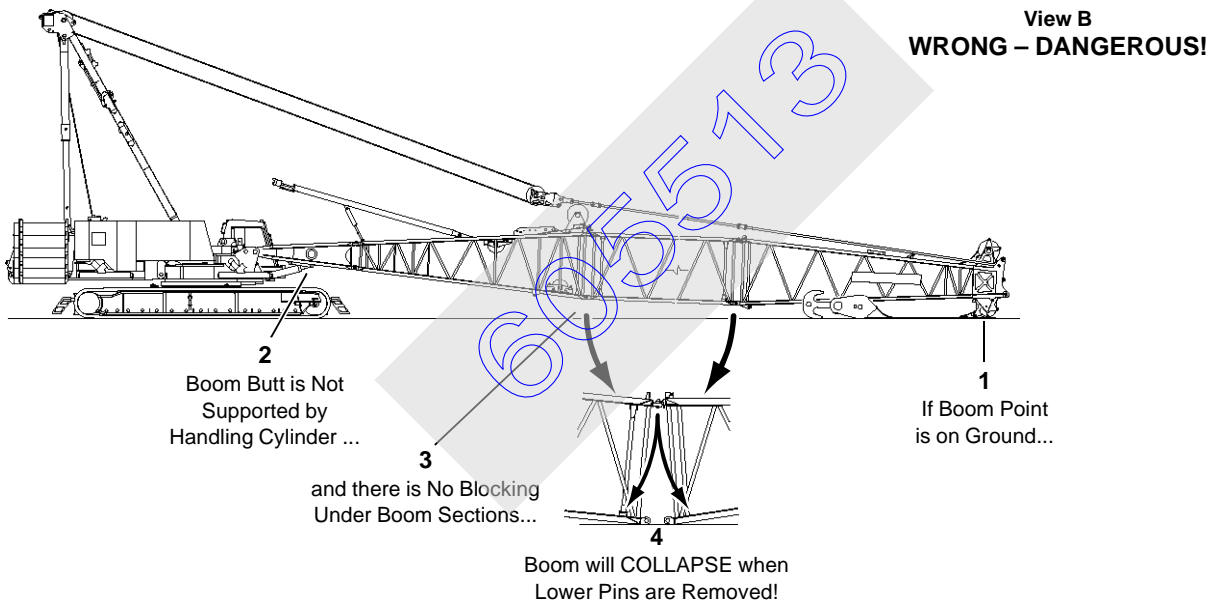
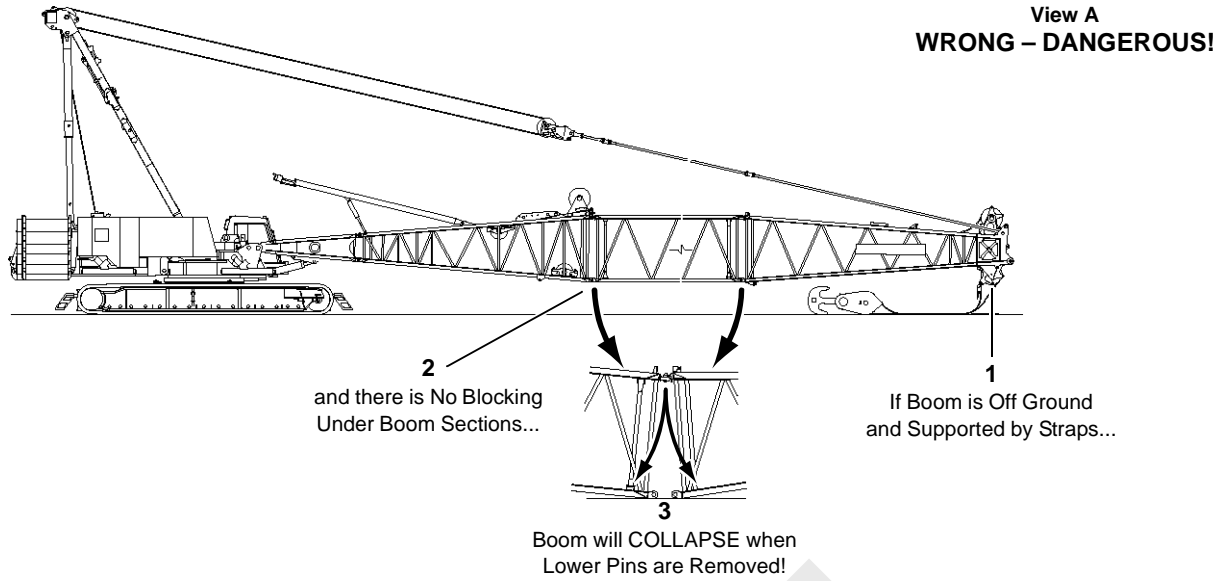


FIGURE 2-4

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 2-4, View A.
 - Do not remove strap connecting pins until straps are fully lowered into supports as shown in Figure 2-4, 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 2-4, View B.
 - Never work or stand inside boom unless it is lowered and securely blocked as shown in Figure 2-4, 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.***

605513

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 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 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 personal protection equipment is provided (i.e., personal fall-protection system, etc.)

- 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 PROHIBITED, 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 recommends that cranes be properly maintained, regularly inspected, and repaired as necessary. All safety signs 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.

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

Manitowoc Cranes

2401 So. 30th St.
Manitowoc, WI 54220

Phone: 920-684-6621

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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, hook rollers 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 in Capacity Charts. If specified crane list and/or dynamic conditions are exceeded, crane's capacity may be exceeded; hook rollers 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 the foundation (Figure 2-5).

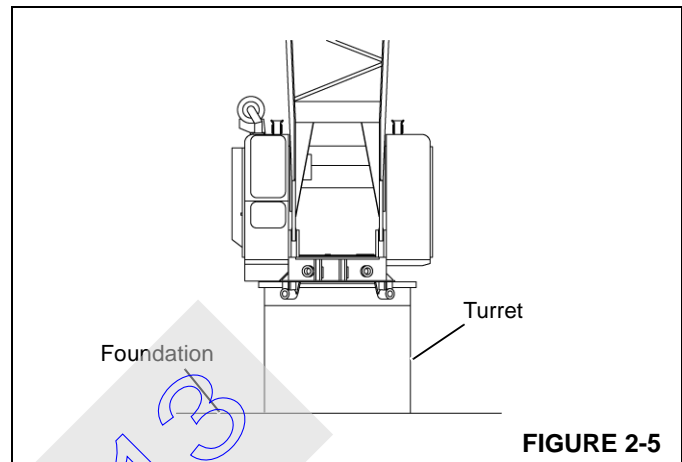


FIGURE 2-5

2. Crane rotating bed mounted on a carbody (crawlers removed) which is securely fastened to the foundation (Figure 2-6).

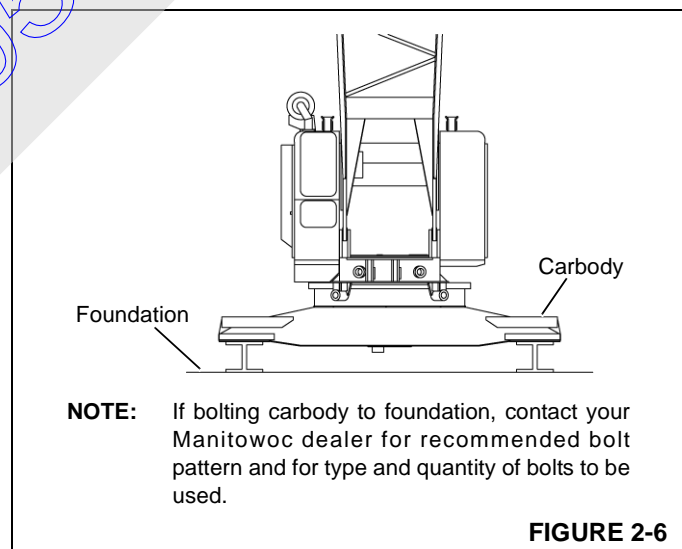


FIGURE 2-6

Barge Mounted Crane

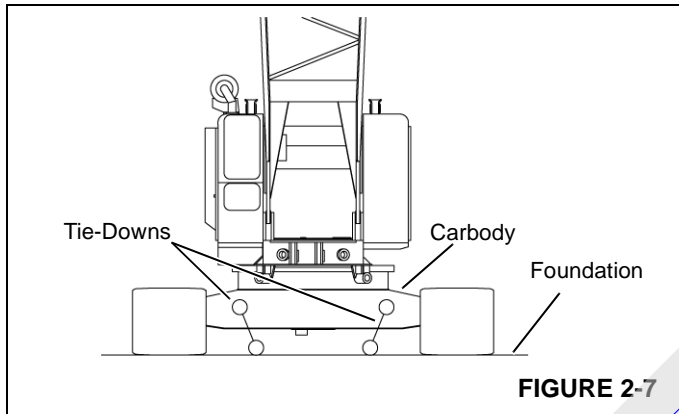
Definition

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.

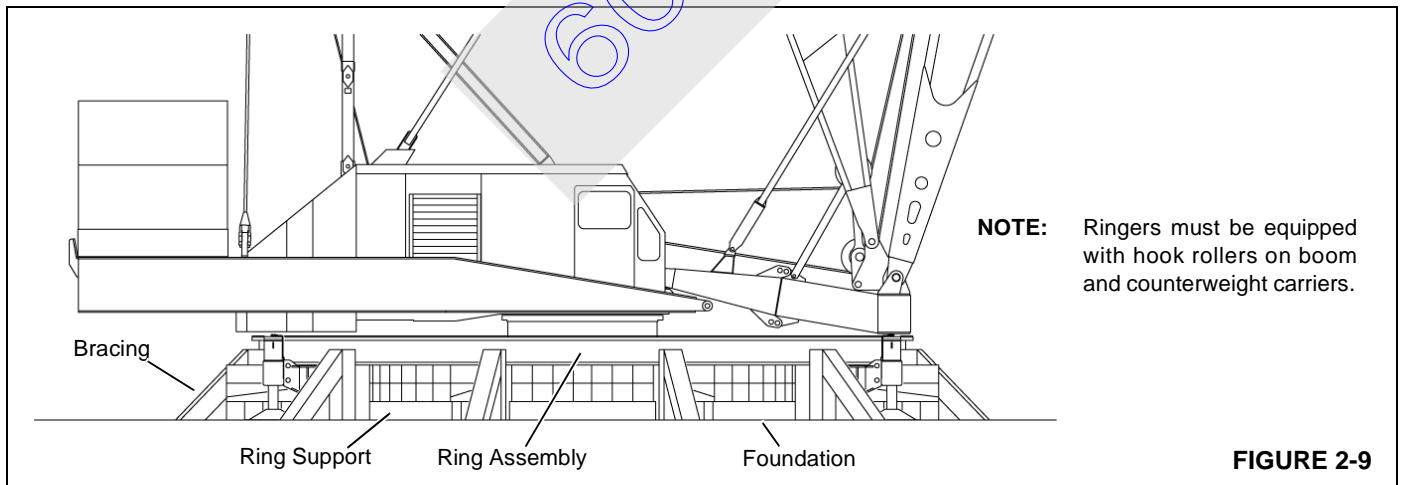
Examples

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

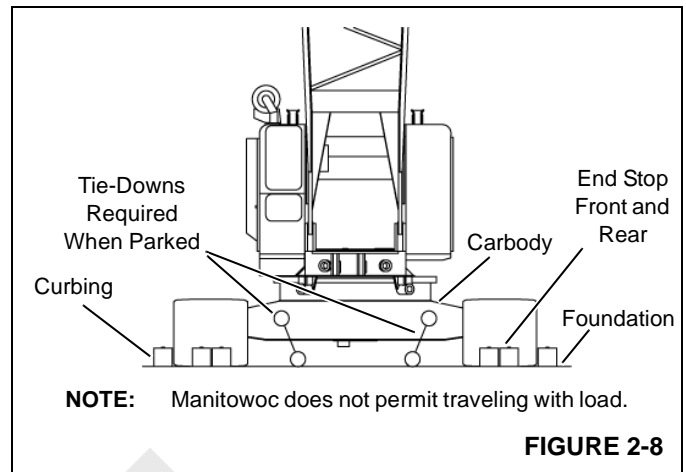
1. Crawler-mounted crane with carbody anchored with tie-downs to the foundation (Figure 2-7).



2. Crawler-mounted crane working on a timbered area of the barge, ship, or floating platform with the crawlers



restrained by curbing and end stops (Figure 2-8). When not working, the crane carbody is anchored with tie-downs to the foundation. **Traveling with load is not permitted.**



3. RINGER® (crawler mounted, carbody mounted) supported on blocking, screw jacks, or steel pedestals which are braced and fastened to the foundation in such a manner as to prevent movement (Figure 2-9).
4. RINGER (platform mounted) which has the ring braced and fastened directly to the foundation in such a manner as to prevent movement.

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

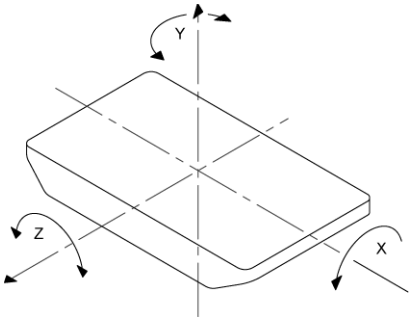


FIGURE 2-10

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 the 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 2-10 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 recommend 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.

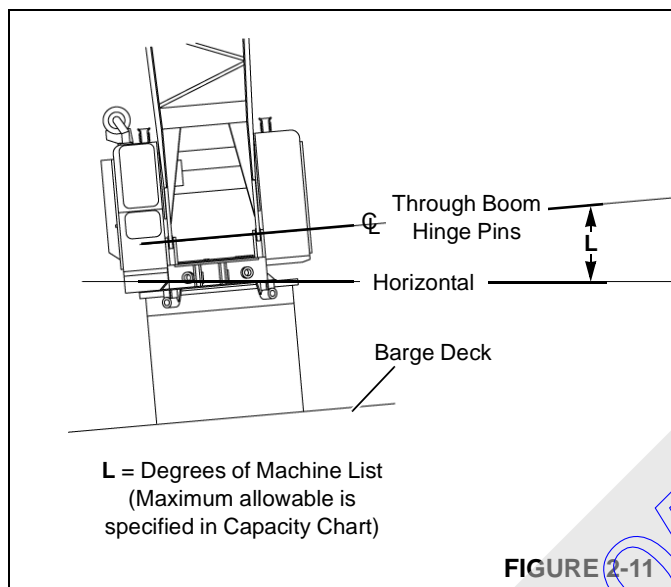
Definitions

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 2-11). 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 the maximum allowable lifting capacity for the crane when experiencing an out-of-level condition (side-to-side) of 2 degrees as measured by

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

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

3. *Barge List and Machine List are not same.* As the crane rotates on a 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.



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
- Backhitch
- Rotating Bed
- Wire Rope
- Pendants and Straps
- Hook and House Rollers

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.

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SECTION 3

OPERATING CONTROLS AND PROCEDURES

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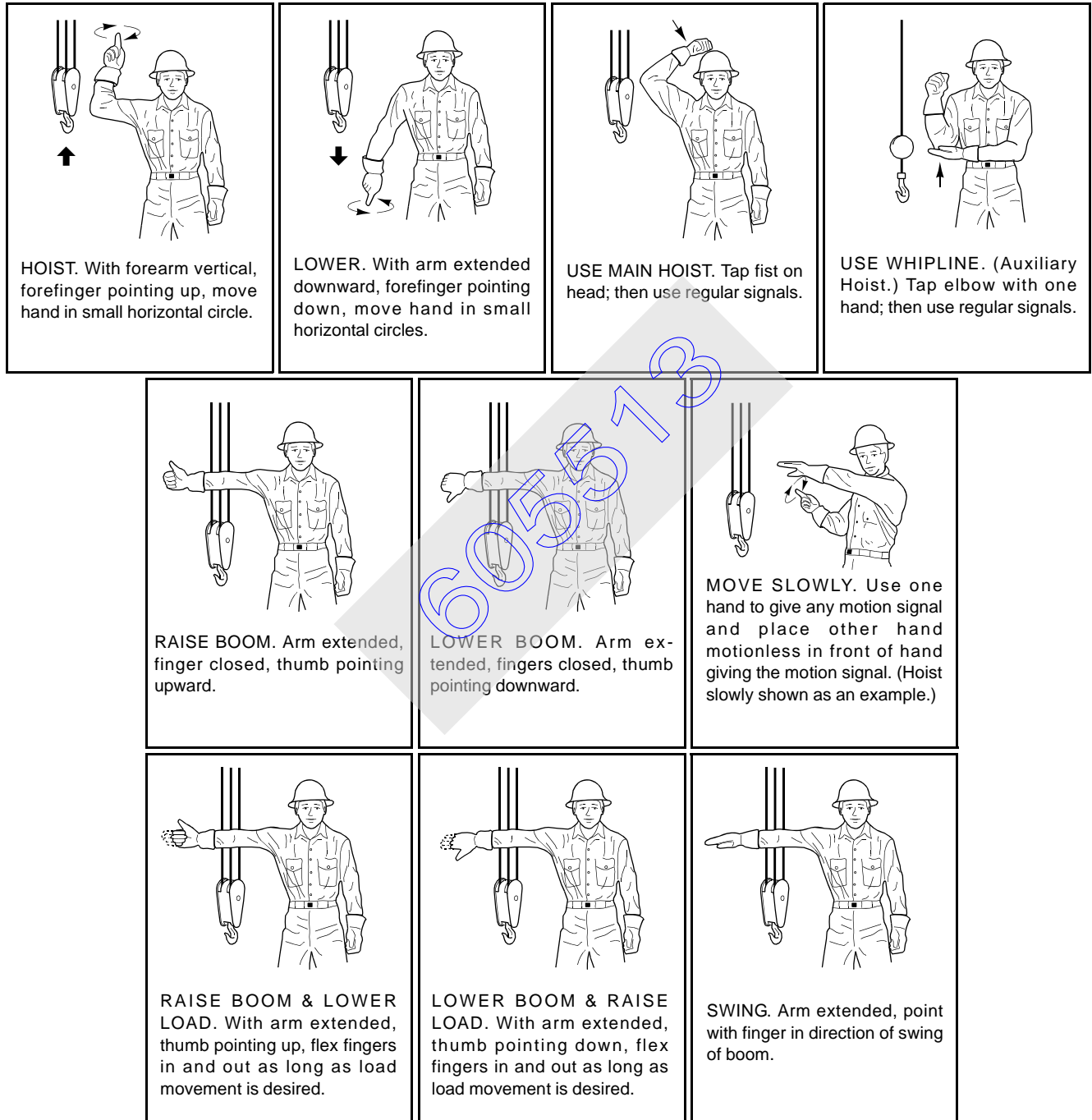
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SECTION 3 OPERATION

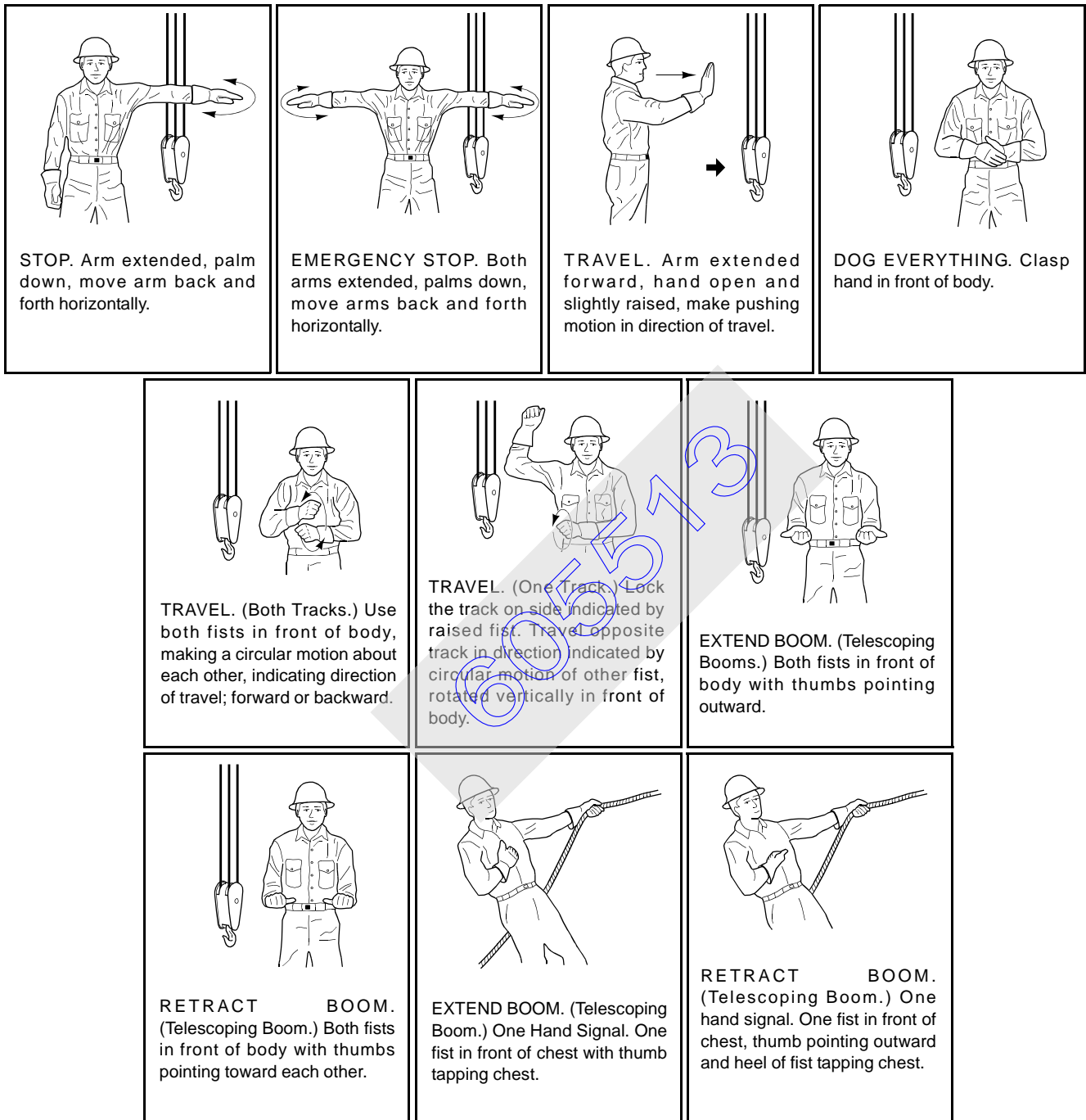
STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS

The following standard hand signals comply with ASME B30.5



da0108

FIGURE 3-1



da0109

FIGURE 3-1 continued

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

Crane Mode Selector

Selects hoist to be operated — STANDARD mode for boom hoist or LUFFING JIB mode for luffing hoist. Both hoists cannot be operated at the same time.

If luffing jib is operated on a MAX-ER attachment, MAX-ER mode must be selected and confirmed in addition to desired main mode (standard or luffing jib).

Once selected and confirmed, modes appear on digital display as shown in Figure 3-2. The *M on right side of the screen indicates that MAX-ER mode is on.

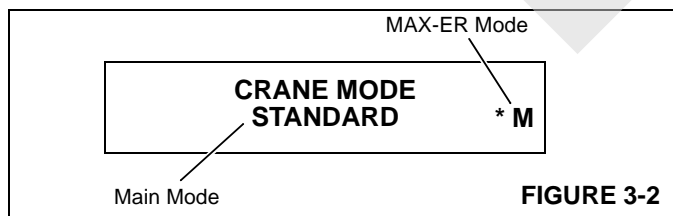


FIGURE 3-2

Digital Display

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

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

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 Crane Operator's Manual for a complete list of operating conditions, system faults, and operating limits.

Limit Bypass Switches

Refer to Section 3 of the Crane Operator Manual for identification, location, and operation of the limit bypass switches on your crane. One or two switches are provided.

Section 3 of the Crane Operator Manual also contains tables identifying which limits can be bypassed with the corresponding limit bypass switch.

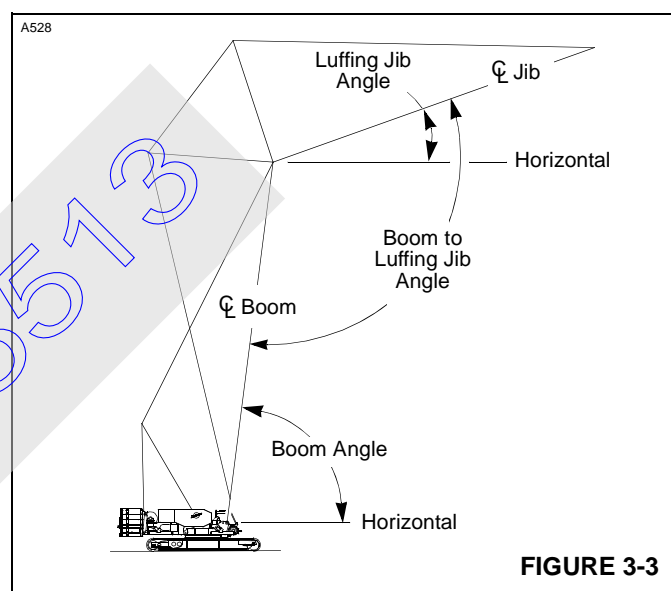


FIGURE 3-3

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 (yellow light and buzzer) comes on and the digital display indicates which limit has been reached.

Past Production Jib Stops

Past production units are equipped with two jib stops:

- **LUFFING JIB MAX UP** limit which automatically stops the luffing hoist when the boom to luffing jib angle is 168°.
 - Do not use limit bypass switch to raise jib above MAX UP limit. Jib could be pulled over backwards.
- **LUFFING JIB MAX DOWN** limit which automatically stops the luffing hoist when the boom to luffing jib angle is 60°.

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.

Current Production Jib Stops

- Current production units are equipped with three jib stops:
- **LUFFING JIB MAX UP 1** limit which automatically stops the luffing hoist when the boom to luffing jib angle is 168°. The limit bypass switch can be activated to allow the jib to be raised and additional 2° to the LUFFING JIB MAX UP 2 limit.

LUFFING JIB MAX UP 2 limit which automatically stops the luffing hoist when the boom to luffing jib angle is 170°.

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

- **LUFFING JIB MAX DOWN** limit which automatically stops the luffing hoist when the boom to luffing jib angle is 60°.

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.

NOTE: The boom cannot be lowered until the boom hoist pawl is disengaged. The operating fault alarm (in operator's cab) will come on if the pawl is engaged.

Luffing Hoist

To select luffing hoist operation, proceed as follows:

1. Release boom-luffing hoist control handle to off to stop boom hoist.
2. Engage boom hoist pawl.
3. Select and confirm LUFFING JIB mode

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

4. Disengage luffing hoist pawl (it may be necessary to luff up slightly). 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.

NOTE: The luffing jib cannot be lowered until the luffing hoist pawl is disengaged. The operating fault alarm (in operator's cab) will come on if the pawl is engaged.

Boom/Luffing Hoist Control

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

Refer to Section 3 of the Crane Operator Manual for identification, location, and operation of the boom and luffing hoist controls.

SELECTING DESIRED HOIST

Boom Hoist

To select boom hoist operation, proceed as follows:

1. Release boom-luffing hoist control handle to off to stop luffing jib.
2. Engage luffing hoist pawl.
3. Select and confirm STANDARD MODE.

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

4. Disengage boom hoist pawl (it may be necessary to boom up slightly). 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.

OPERATING PRECAUTIONS



WARNING

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

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.
2. Read and comply with instructions in this manual and in Crane Operator's Manual.
3. Read and comply with Maximum Allowable Travel Specifications in Luffing Jib Capacity Chart Manual.
4. If luffing jib is operated on a MAX-ER attachment, read and comply with swing and travel instructions contained in appropriate MAX-ER Operator's Manual.
5. Make sure luffing jib attachment is installed properly. Read and comply with instructions in Section 4 of this manual.
6. 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.

Make sure proper luffing jib capacity chart is selected to turn on luffing jib mode.

7. Make sure crawlers are blocked, if required per capacity chart, prior to raising and lowering attachment. Read and comply with instructions in Capacity Charts.
8. Raise and lower attachment as instructed in Section 4 of this manual.
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.
12. Observe minimum block weight requirement given on capacity charts.

Beware when operating in those areas of capacity chart marked (b) — weight of backstay pendants 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.

WIND CONDITIONS

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.

For wind conditions specific to the luffing jib on this crane, see Wind Conditions in Luffing Jib Capacity Charts provided with attachment.

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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 RIGGING INFORMATION

This section contains installation and removal instructions for layout luffing jib attachment on the following units:

- Crawler Crane with #44 Boom
- Truck Crane with #44A Boom
- MAX-ER 225 with #49-44 Boom
- MAX-ER 2000 with #79-44 Boom

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 dealer 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, selected boom and jib length, and movement of an assist crane.



WARNING

Read Capacity Charts

Crane must be rigged and operated according to instructions in Capacity Charts and Luffing Jib Raising Procedure charts contained in this section.

Read Capacity Charts, raising procedure charts, and instructions in this manual before installing, operating, or removing attachment. Failing to comply with instructions can result in tipping or structural failure of boom and jib.

CRANE ORIENTATION

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.

ACCESSING PARTS

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

The owner/user must provide workers with approved ladders or aerial work platforms to access those areas of the crane and attachment 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.

Optional boom ladders (stored in boom butt) are available from Manitowoc. If your crane has ladders, see Section 4 in Operator's Manual provided with crane.

Do not use top of boom or jib as walkways.

ASSIST CRANE REQUIREMENTS

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

The jib butt, jib strut, main strut, and main strut stop tubes are normally shipped from Manitowoc as an assembled unit. This assembly weighs approximately 13,000 lb (5 897 kg) and is the heaviest load to be lifted. Size the assist crane accordingly.

See the Raising Procedure with Outside Assist charts for assist crane requirements when equipped with a boom and jib combination requiring outside assist for raising and lowering.

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 Section 3 of this manual and in Section 3 of the Crane Operator's Manual.

COUNTERWEIGHT REQUIREMENT

See the applicable Luffing Jib Capacity Charts and Raising Procedure Charts for counterweight requirements when operating with jib.



WARNING

Tipping Hazard!

Prevent crane from tipping. Do not operate crane until proper counterweight is installed.

BLOCKED CRAWLERS/EXTENDED OUTRIGGERS

To prevent crane from tipping, all boom and jib combinations must be raised and lowered as follows:

- Over blocked crawlers for a crawler-mounted crane. See Capacity Charts and raising procedure charts for blocked crawler requirements and to Crawler Blocking Diagram in Luffing Jib Capacity Chart Manual.
- Over rear of carrier leveled on extended outriggers for a truck-mounted crane (see outrigger operating instructions in Crane Operator's Manual).

LUFFING JIB RIGGING DRAWING



DANGER

Tipping Hazard!

Prevent crane from tipping or structural damage to attachment. Do not attempt to raise or lower boom and jib from or to ground until crawlers are blocked.

The boom and jib components (top, inserts, butt, pendants) must be assembled in proper sequence according to the Luffing Jib Rigging Assembly drawing.

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

See the tables on the rigging drawing to determine the quantity and length of inserts and pendants required for various boom and jib lengths. One table is provided for the boom and one table for the jib. **Make sure proper table is referred to.**

The table for the boom lists the pendants required for both the boom and the jib backstay. See Figure 4-2 for a sample of this table.

Read and comply with Insert and Pendant Notes on the rigging drawing.

NOTE: The pendant information given on the rigging drawing will vary when the crane has a load indicator. If equipped with a load indicator, see the Load Indicator Assembly drawing for pendant length and pinning variations.

The basic pendants must be attached to the following locations:

- **Basic Jib Pendants** to jib top.
- **Basic Jib Backstay Pendants** to main strut.
- **Basic Boom Pendants** to boom top.

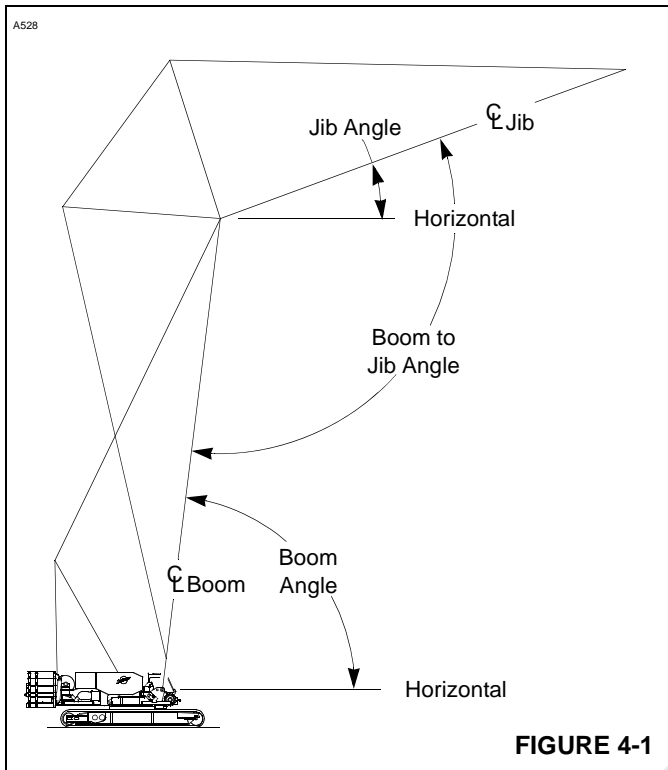
LUFFING JIB RAISING PROCEDURE

See the end of this section for 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 the component.



Boom Length	10 ft (3,0 m) Insert	20 ft (6,1 m) Insert	40 ft (12,2 m) Insert	10 ft 1 in (3,07 m) Pendant	20 ft 1-1/2 in (6,13 m) Pendant	40 ft 3 in (12,27 m) Pendant	Wire Rope Timbers 1 each 10 ft (3,0 m) Insert 1 each 20 ft (6,1 m) Insert 2 each 40 ft (12,2 m) Insert
170 ft	0	1	2	2 (0/2)	4 (4/0)	12 (8/4)	5 27.00 16
180 ft	1	1	2	4 (4/0)	6 (4/2)	12 (8/4)	6 27.00 20

Typical Each Pendant Length	Total Number of Pendants Required	Backstay Link Adjustment	
	Number of Boom Pendants Required		Pendant Tie-Down Straps
	Number of Jib Backstay Pendants Required		

FIGURE 4-2

BOOM AND JIB CONNECTORS

The boom sections have FACT™ connectors — two fixed vertical top pins and two removable horizontal bottom pins at end of each boom section.

The #133 and 133A jibs are identical except for the type of connectors:

- The #133 jib has Fact™ connectors — two fixed vertical top pins and two removable horizontal bottom pins at end of each jib section.
- The #133A jib has standard connectors — four removable horizontal pins at end of each jib section.

IDENTIFYING BOOM/JIB COMPONENTS

Boom and jib sections are marked for proper identification as shown in Views A and B, Figure 4-3.

Boom and jib pendants are marked for proper identification as shown in View C, Figure 4-3.

NOTE: The markings shown in Figure 4-3 can vary depending on when your crane was produced and the original equipment manufacturer.

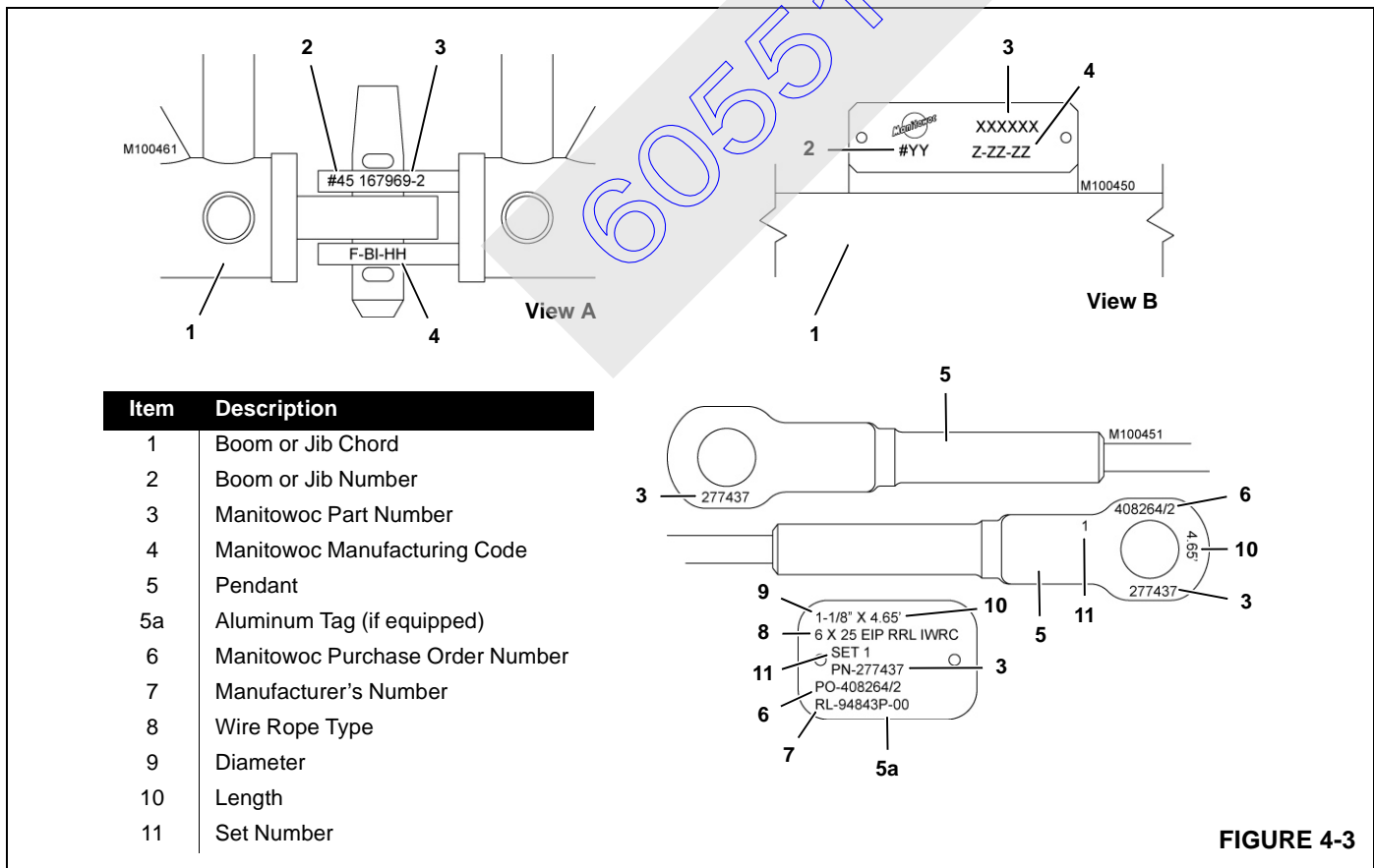
DRUM SPACER

The crane can be equipped with a 73 in (1,9 m) wide rear drum for Ringer operation. When the 73 in (1,9 m) wide rear drum is used for crane operation, a spacer must be installed on left end of drum (see Drum Spacer/Lagging Installation in Section 4 of the Crane Operator's Manual).

For remainder of this section, reference to the left rear drum applies both to the left rear drum on a split drum and to the drum spacer on the left end of a 73 in (1,9 m) wide rear drum.

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.**



SHIPPING CRANE COMPONENTS

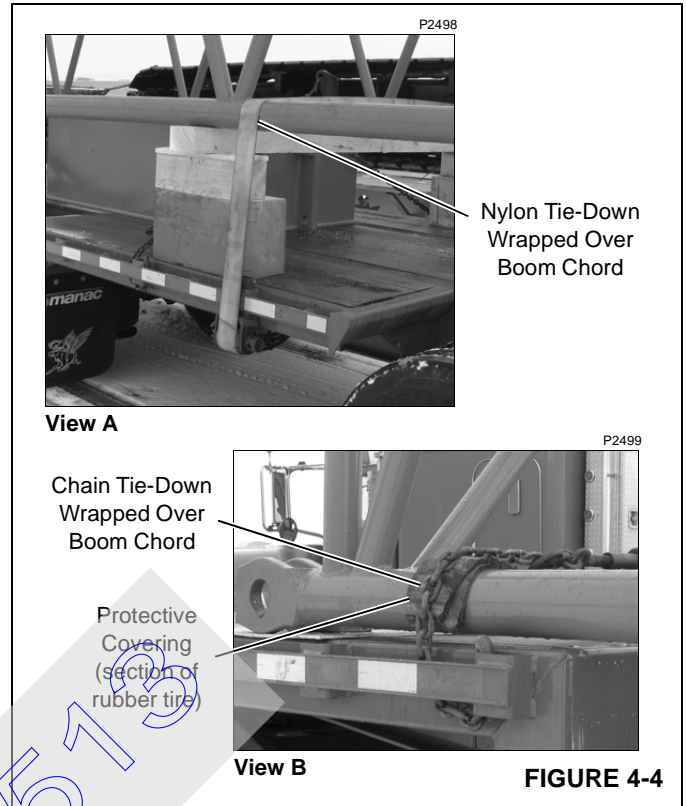
It is the owner/user's responsibility to ensure the following:

- That all trailer loads comply with local, state, and federal transportation requirements.
- **That all crane components are properly blocked and secured so they cannot fall off the trailers.**
- To avoid damage to components:

Use nylon tie-downs to secure components as shown in Figure 4-4, View A.

If chain tie-downs are used, install protective covering (such as sections of rubber tire) between the chain and component being secured as shown in Figure 4-4, View B.

When securing boom sections, wrap tie-downs over chords — never over lacings. Keep tie-downs as close to blocking as possible (View A) to prevent bending the chords.



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JIB STORAGE

To reduce shipping space and the number of vehicles needed to ship boom and jib, the fixed jib sections can be stored inside the 20 and 40 ft boom or luffing jib inserts as indicated in the table. See Figure 4-6 for shipping arrangements.

The luffing jib sections can be stored inside the 20 and 40 ft boom inserts as indicated in Table 4-1.

To store jib sections, proceed as follows (see Figure 4-5):

1. Fasten shipping timbers to brackets on bottom chords with 5/8-11UNC - 2A x 5-1/2 inch long carriage bolts.

Be sure to remove shipping timbers prior to erecting boom or jib.

NOTE: The following quantities of shipping timbers are required:

- 8 each 40 ft (12,19 m) boom insert,
- 4 each 20 ft (6,10 m) boom insert,
- 6 each 40 ft (12,19 m) luffing jib insert,
- 3 each 20 ft (6,10 m) luffing jib insert.

2. Remove diagonal lacings from each boom insert.
3. Slide jib sections into boom inserts. **Take care not to damage lacings or chords.**
4. Adjust position of inserts as necessary and reinstall diagonal lacings so they are not lost during shipment.
5. Block inserts on transport vehicle.
6. Tie down inserts to prevent movement during transport.

NOTE: Use protective covering such as tire sections between tie-downs and chords of inserts. Fasten tie-downs to chords only, not to lacings.

WARNING **Falling Boom!**

Reinstall diagonal lacings prior to erecting boom or jib. Torque connecting nuts to value given in Figure 4-5.

Boom or jib can collapse if diagonal lacings are not installed.

Death or serious injury can result.

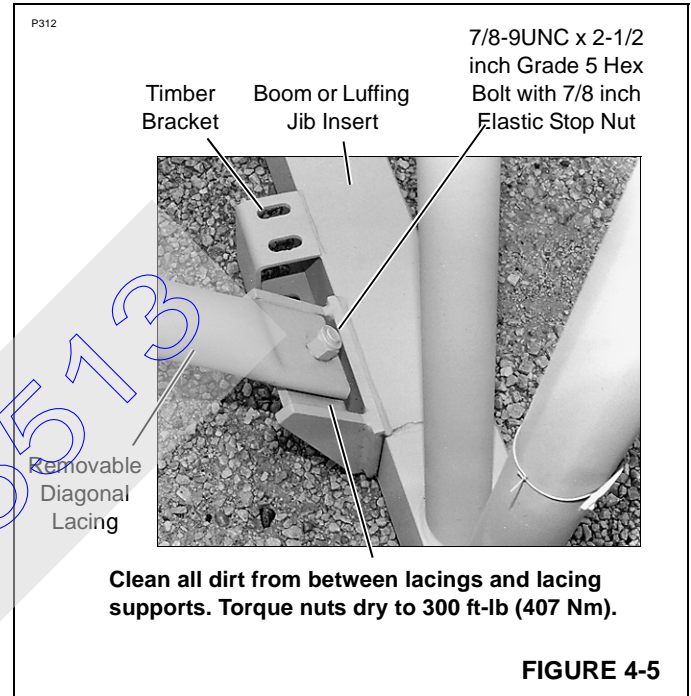
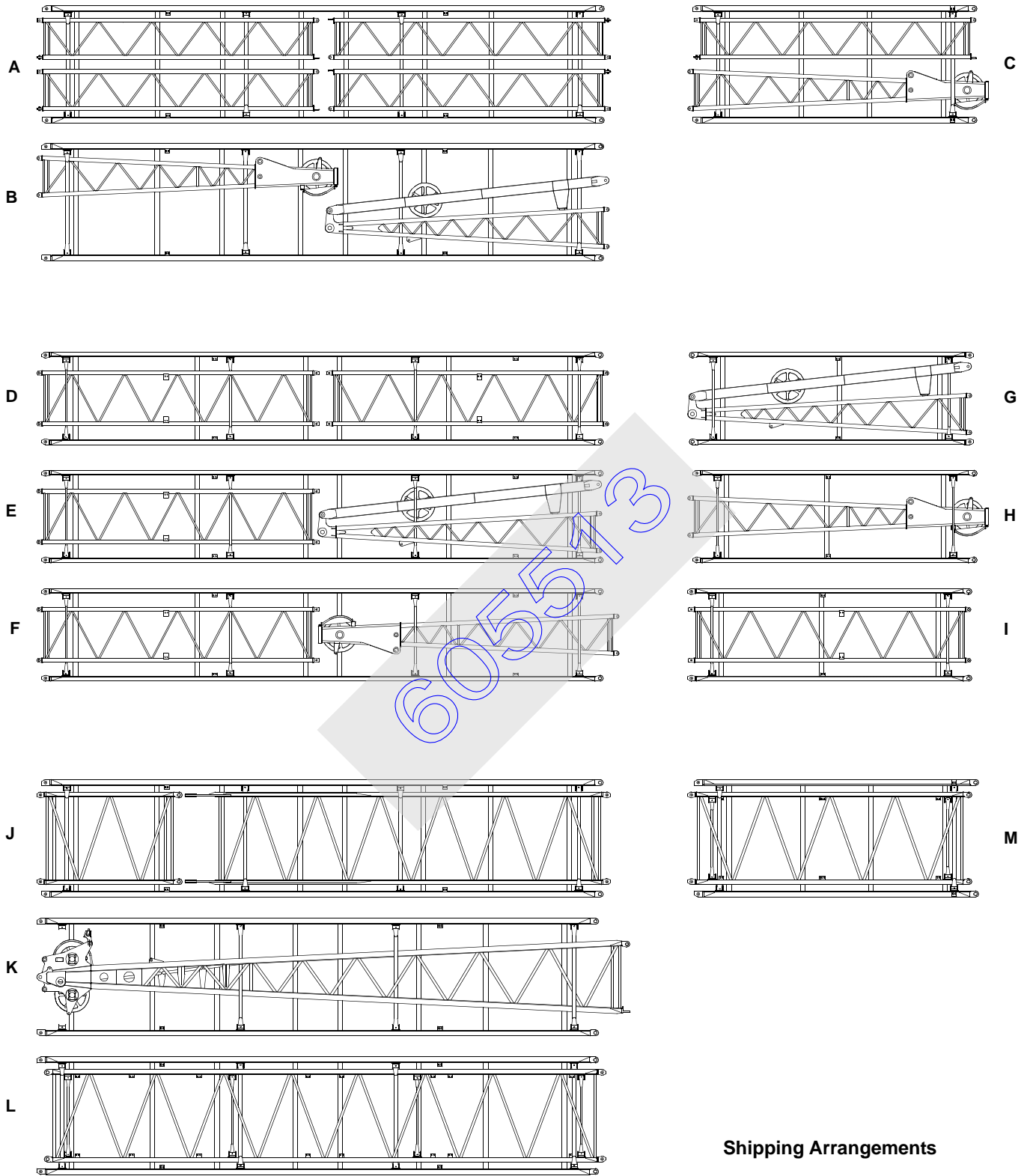


Table 4-1

#140 Jib Sections	Stored in 133 or 133A Boom Insert	Figure 4-6 Illustration
2, 20 ft (6,10 m) Inserts	40 ft (12,19 m)	D
Butt and 20 ft (6,10 m) Insert	40 ft (12,19 m)	E
Top and 20 ft (6,10 m) Insert	40 ft (12,19 m)	F
Butt	20 ft (6,10 m)	G
Top	20 ft (6,10 m)	H
20 ft (6,10 m) Insert	20 ft (6,10 m)	I
#133/133A Jib Sections	Stored in 44 or 44A Boom Insert	Figure 4-6 Illustration
Butt and 10 ft (3,05 m) Insert	40 ft (12,19 m)	J
Top	40 ft (12,19 m)	K
40 ft (12,19 m) or 2, 20 ft (6,10 m) Inserts	40 ft (12,19 m)	L
20 ft (6,10 m) Insert	20 ft (6,10 m)	M

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Shipping Arrangements

FIGURE 4-6

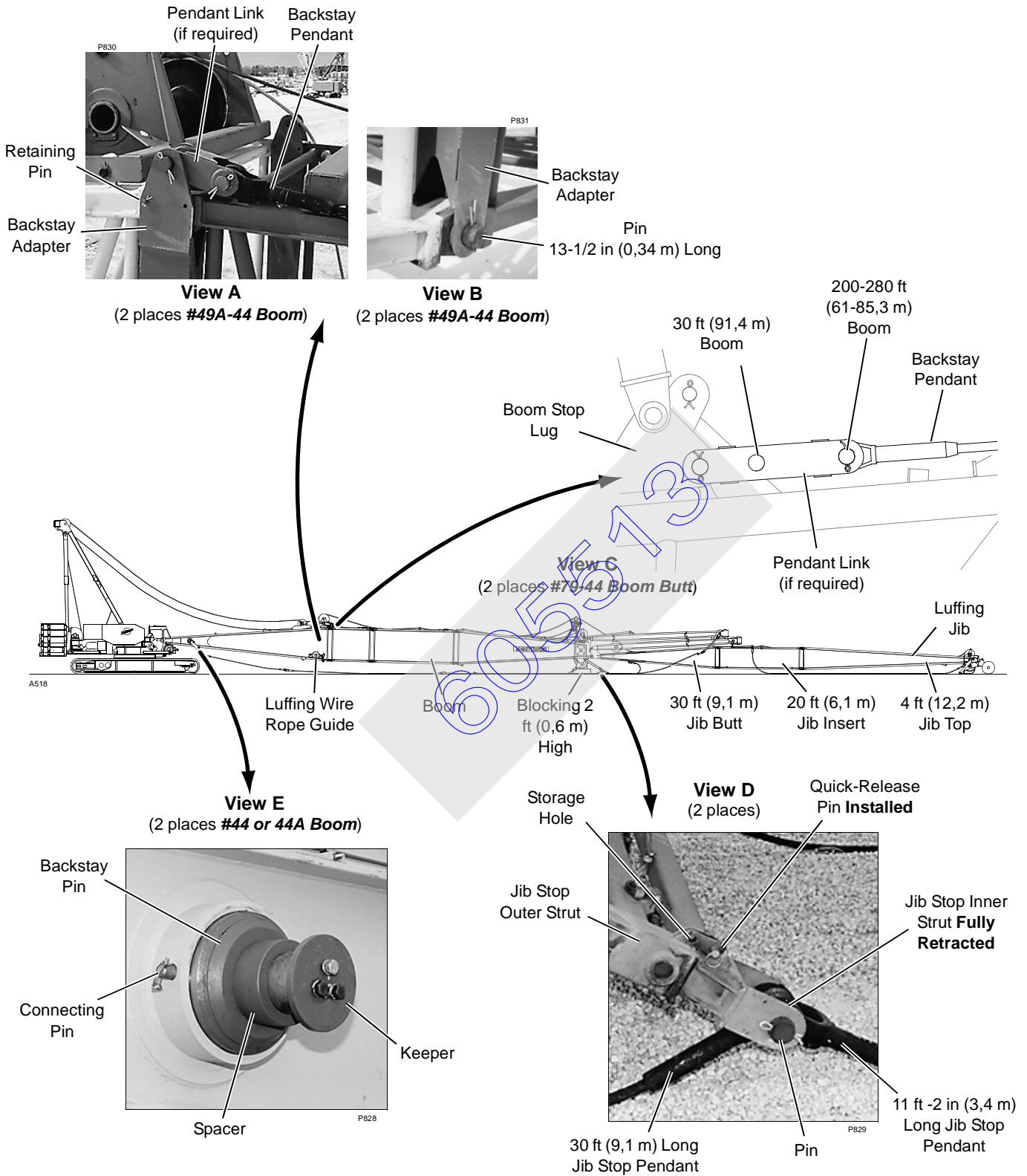


FIGURE 4-7

INSTALLING JIB

Lower Boom

1. Travel front crawler rollers onto blocking or level truck carrier on extended outriggers.
2. Swing upper slightly to either side and lower load block and weight ball onto ground.
3. Swing boom in-line with crawlers or carrier and lower boom onto blocking approximately 2 ft (0,6 m) high (Figure 4-7).

Prepare Boom for Jib

1. If installed, disconnect load line from hook and weight ball. **Load line from left rear drum is required for raising main strut.**

The load block can remain reeved if it is required for operation. See Install Boom Load Line topic in this section.

2. Remove upper boom point if equipped.
3. Remove #132 fixed jib if equipped.
4. If equipped with a long reach boom, convert it to a heavy lift boom as shown on Luffing Jib Rigging Assembly drawing.
5. Change boom length as necessary to meet job requirements.
6. **For #49A-44 boom only**, install backstay pendant adapters at proper location between #49A boom sections (see Figure 4-7, View A and B, and rigging drawing at end of this section).
7. **For #79-44 boom only**, pin backstay pendant links to boom stop lugs on boom butt (see Figure 4-7, View C and rigging drawing at end of this section).
8. Check that all inserts and pendants or straps are assembled in proper sequence according to rigging drawing.
9. If necessary remove left and right sheave clusters from lower boom point and replace them with spacers (see Lower Boom Point Sheaves in Section 4 of the Crane Operator's Manual). See raising procedure chart for boom length limitations with all nine lower boom point sheaves installed.



WARNING

Tipping Crane Hazard!

Do not attempt to raise more boom than specified when all nine lower boom point sheaves are installed. Rear of crane will tip forward.

10. Fasten luffing hoist wire rope guides to proper boom sections (see rigging drawing):
 - Bottom chords of boom butt (#44, 44A, and 49A-44 boom).
 - Bottom chords of insert next to boom butt (#79-44 boom).
 - Top chords of insert next to boom butt (#49A-44 and #79-44 booms).
11. If required, install luffing hoist to include connecting hydraulic lines, air lines, and electric cord. See appropriate assembly drawings at the end of this section.

NOTE: On current production units, the MAX-ER 2000 luffing hoist can be used for all applications, provided:

- Luffing hoist sheaves are grooved for 1 in (26 mm) wire rope. Past production sheaves were grooved for 7/8 in (22 mm) wire rope. **Be sure to check your sheaves before using MAX-ER 2000 luffing hoist.**
 - Hydraulic lines are properly connected as instructed on Hydraulic Piping Assembly drawing in Crane Parts Manual.
12. For #44 or 44A boom only, install backstay pin on both sides of boom butt (Figure 4-7, View E).
 13. Add or remove crane counterweight to comply with applicable capacity chart.

Install Jib Stop Assembly

See Figure 4-7, View D for following procedure.

1. If not already done, pin jib stop inner strut in retracted position.
2. Pin jib stop outer strut to lugs on bottom of boom top — **strut must point away from boom.**
3. Support strut on blocking approximately 12 in (0,3 m) high (will provide clearance for attaching pendants).
4. Fasten hand winch to lugs on boom butt and install control cable. See Jib Stop Assembly drawing at the end of this section.
 - a. Make sure control cable is routed through all guide sheaves in boom top and in strut (it may be necessary to weld guide sheaves to boom top as shown on assembly drawing).
 - b. Make sure cable slips are properly positioned to allow minimum cable movement given on assembly drawing.
 - c. Make sure all cable clips are tight.

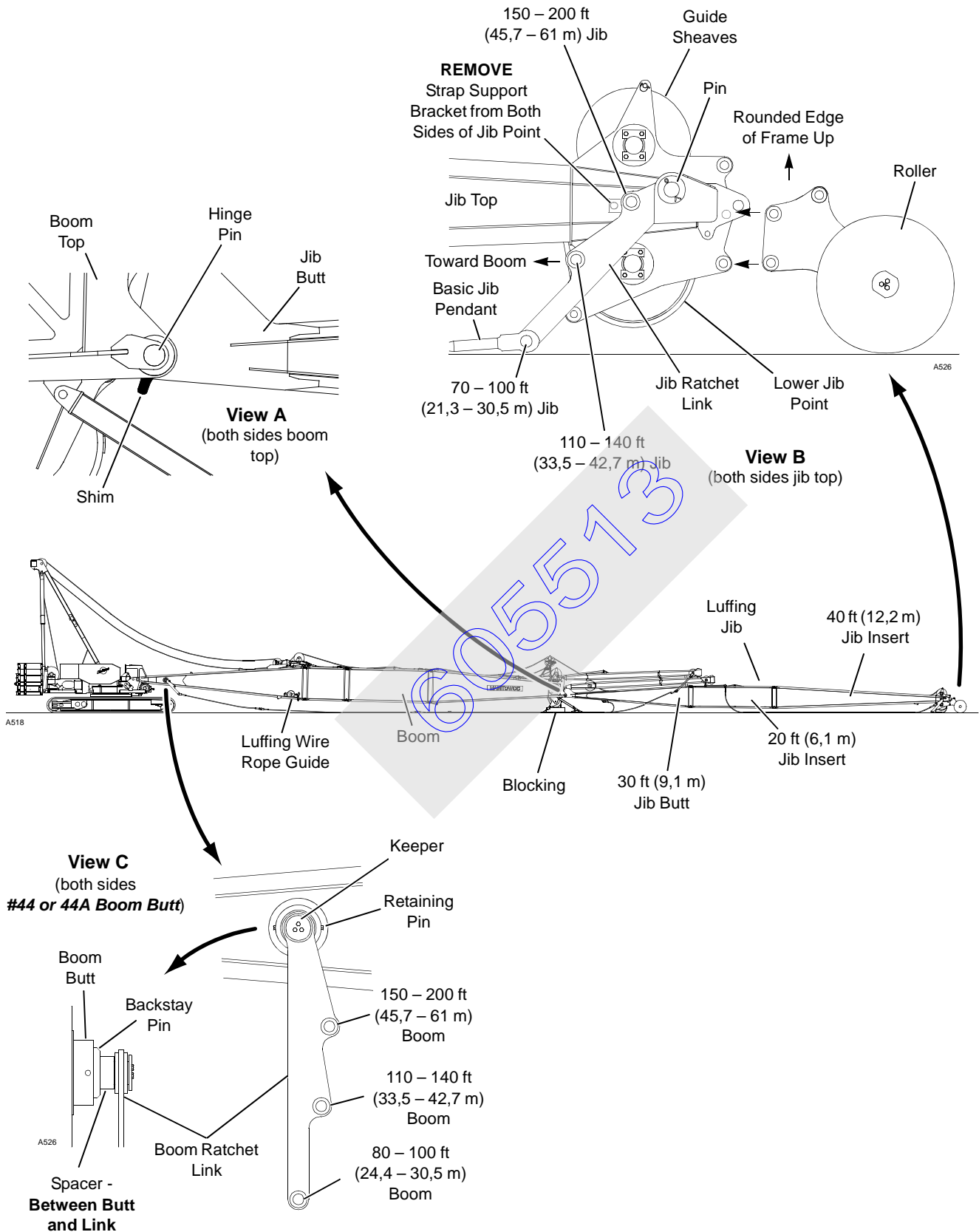


FIGURE 4-8

Install Jib Butt

See Figure 4-8 for following procedure.

1. Pin jib butt to lugs on boom top with hinge pins (View A).

Hinge pins have a keeper on one end. Keepers are slotted to engage gusset on sides of boom top. This design prevents pins from turning during operation.

Make sure hinge pins are installed on proper side of butt. Both pins have a grease fitting. Left side pin also has a tapped hole in center of pin for mounting jib stop.

Both hinge pins are retained with a cotter pin.

NOTE: As pins are installed, install shims (View A) on outboard side of both jib butt lugs **so jib butt is centered on boom top.**

The shims have handles to make installation easier.

2. Lower jib butt onto blocking.
3. Apply several shots of grease to both hinge pins.

Install Jib Inserts and Top

1. Determine jib length required for lift to be made.
2. Check that removable **diagonal lacings are securely fastened to each jib insert** (Figure 4-5).
3. Remove timbers from storage brackets (Figure 4-5) on bottom chords of jib inserts.



WARNING Collapsing Jib Hazard!

Install diagonal lacings prior to raising jib. Jib can collapse if this step is not taken.



WARNING Tipping Crane Hazard!

Do not attempt to raise jib with storage timbers installed. Added weight will cause rear of crane to tip forward.

4. Pin inserts and jib top to butt **in proper sequence with shortest inserts nearest butt** (see rigging drawing).

The top connectors are joined in one of two manners:

- By fixed vertical pins that hook into holes in adjacent connectors (#133 jib).
- By removable horizontal pins (#133A jib).

The bottom connectors are joined by removable horizontal pins.

5. Block inserts as assembly progresses.

Install Upper Point Roller Assembly

1. Pin upper point roller assembly to jib top at holes indicated in Figure 4-8, View B.
2. Apply several shots of grease to fitting on both ends of shaft.

Install Jib Ratchet Links

1. Remove strap support (Figure 4-8, View B) from both sides of jib point. **Supports will be damaged if this step is not performed.**

Strap supports are required only for long reach boom operation without luffing jib.

2. Pin a ratchet link to lugs on both sides of jib top (Figure 4-8, View B).

The attachment has either two or four ratchet links:

- Two for all jib tops.
- Two for boom butt (#44 or 44A boom only).

Ratchet links for jib top are approximately 20 in (0,5 m) shorter than links for boom butt.

3. Make sure pendant connecting holes in jib links are toward boom.

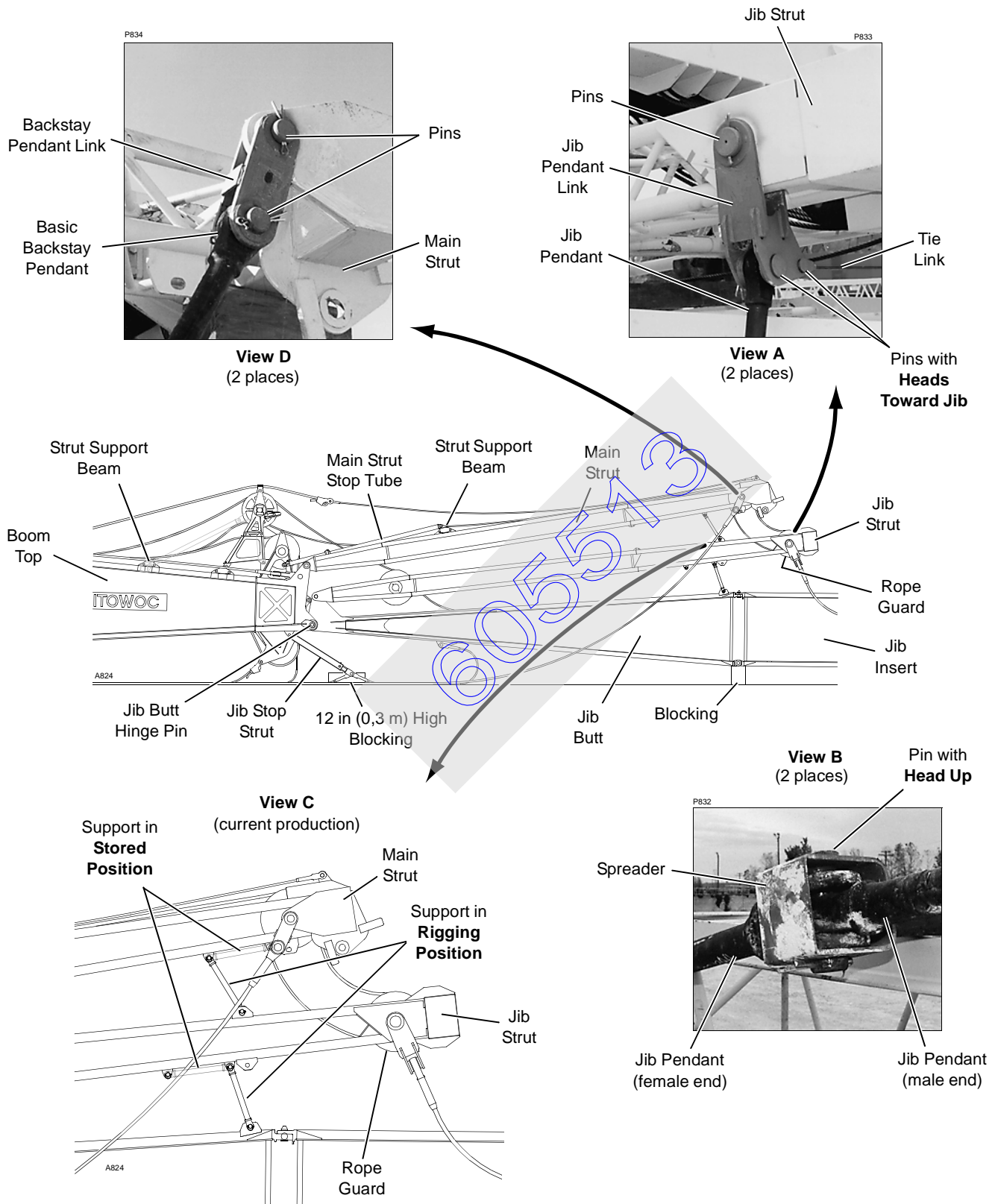


FIGURE 4-9

Install Jib Strut

See Figure 4-9 for following procedure.

1. Pin jib pendant links to jib strut (Figure 4-9, View A).
2. Pin tie link between pendant links (Figure 4-9, View A).
3. Position jib strut so rope guard over upper sheaves faces down.
4. Pin strut to lugs on jib butt.
5. On current production jibs, a strut support is provided on both sides of the jib strut as shown in Figure 4-9, View C. Pin the supports in the rigging position to support the jib strut.

On past production jibs without strut supports, lower strut onto blocking at least 12 in (0,3 m) high placed across jib butt.

Install Main Strut

See Figure 4-9 for following procedure.

1. Pin backstay pendant links to main strut (Figure 4-9, View D).
2. Position main strut so strut support beam lugs face up.
3. On current production jibs, a strut support is provided on both sides of the main strut as shown in Figure 4-9, View C. Pin the supports in the rigging position to support the main strut.

On past production jibs without strut supports, pin strut to lugs on boom top and lower strut onto blocking at least 6 in (152 mm) high placed across jib strut.

Blocking across jib strut must be directly above blocking across jib butt.

Install Jib Pendants and Spreaders

1. Pin basic jib pendants to proper hole in ratchet links on jib top (Figure 4-8, View B).
2. Pin remaining pendants between basic jib pendants and pendant links on jib strut.

Make sure pendants are installed in proper sequence with shortest pendants nearest jib strut (see rigging drawing).

3. Install spreaders at proper locations as pendants are pinned together. **Install connecting pins with heads up** (Figure 4-9, View B).
4. See table on rigging drawing for quantity of spreaders required for each jib length:

Install Jib Stop Pendants

1. Pin jib stop pendants to lugs on jib stop inner strut (Figure 4-7, View D).
2. Connect other end of 11 ft 2 in (3,4 m) long pendants to lugs on bottom of jib butt.
3. Stretch 30 ft (9,1 m) long pendants along ground toward crane. These pendants will be connected when jib is raised.

Install Main Strut Stops

See Figure 4-9 for following procedure.

NOTE: Strut support beam which goes on jib butt is approximately 76 in (1,9 m) wide. Lugs on ends of this beam are straight.

Strut support beam which goes on boom top is approximately 80 in (2,0 m) wide. Lugs on ends of this beam are tapered to match taper of boom top.

1. Pin strut support beam to jib butt. **Lugs on top of beam must angle toward boom.**
2. Pin strut support beam to boom top (past production only). Support can be installed only one way.
3. If not done, pin main strut stop tubes in fully retracted position (Figure 4-12, View D).
4. Position strut stop tubes so quick-release pin lugs face up and pin strut stop tubes to support beam on main strut.
5. Lower strut stop tubes onto main strut.

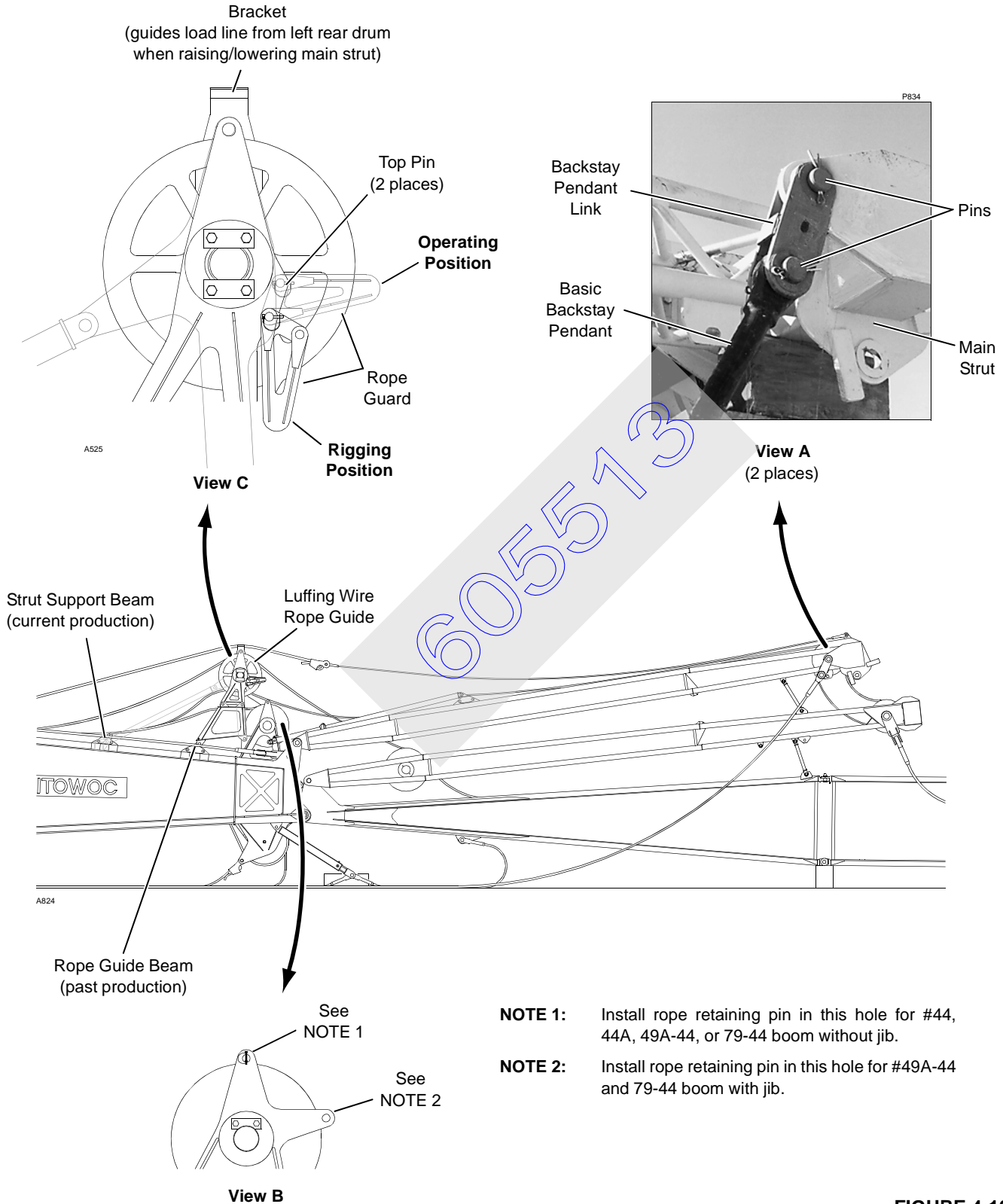


FIGURE 4-10

Install Luffing Rope Guide Assembly

See Figure 4-10 for following procedure.

1. Pin rope guide beam to boom top (past production models only). Rope guide beam is approximately 76 in (1,9 m) wide. Lugs on ends of this beam are tapered to match taper of boom top.
2. Pin luffing wire rope guide to lugs on boom top and rope guide beam.
3. Remove top pin from both ends of rope guard and rotate rope guard to rigging position (Figure 4-10, View C).

Install Boom Ratchet Links

Perform following steps for **#44 or 44A Boom only**.

1. Remove keeper from backstay pins (Figure 4-7, View E).
2. Install a ratchet link on each backstay pin (Figure 4-8, View C).
 - Make sure spacer is installed between boom butt and both ratchet links.
 - Make sure pendant connecting holes in ratchet links face jib.
3. Securely install keepers to retain links.

Install Backstay Pendants

1. Pin basic backstay pendants to pendant links on main strut (Figure 4-10, View A).
2. Pin remaining backstay pendants in proper sequence to basic backstay pendants.

Make sure pendants are installed in proper sequence with shortest pendants nearest boom butt (see rigging drawing).

3. Lay backstay pendants on ground alongside boom. Pendants are connected to ratchet links on boom butt or to backstay adapters after main strut is raised.

Install Luffing Hoist Wire Rope

1. Place reel of luffing hoist wire rope on ground along left side of jib near sheave end of struts.
2. Reeve luffing hoist wire rope through strut sheaves and guide sheaves as shown in reeving diagram on rigging drawing. Also see Figure 4-41.
3. Securely anchor wire rope to right side of luffing hoist drum with straight wedge provided (see Wire Rope Installation in this section).

Wire rope must spool off front of luffing hoist drum.

4. Tightly wind excess wire rope onto luffing hoist drum.
5. Anchor free end of luffing hoist wire rope to left side of main strut with socket and wedge provided (see Wire Rope Installation in this section).

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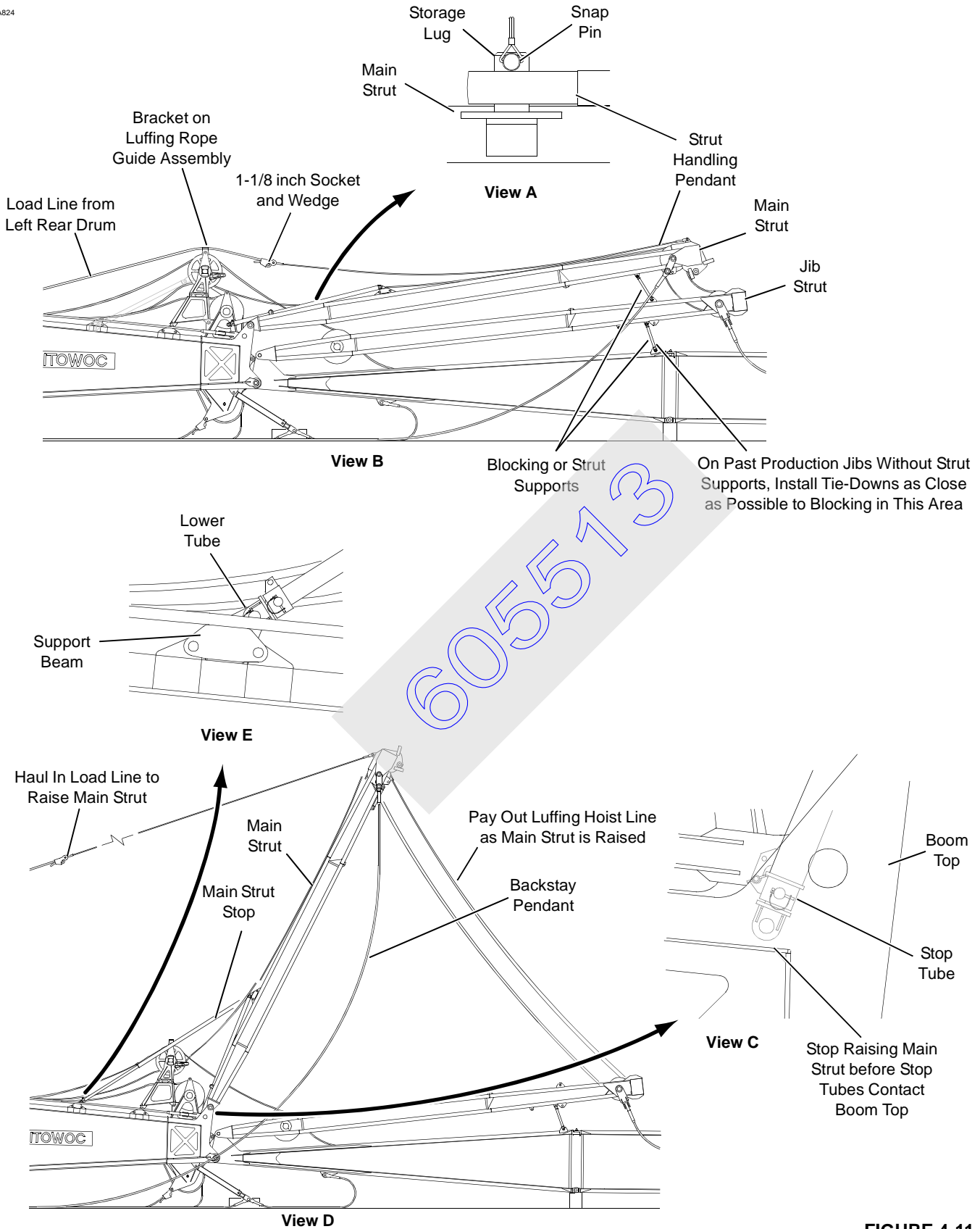


FIGURE 4-11

Raise Main Strut and Connect Backstay Pendants



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 load line or luffing hoist line before climbing onto boom top or jib butt when connecting and disconnecting strut stop tubes.

1. Tie-downs are not required on current production jibs. The strut supports (Figure 4-11, View B) will prevent the jib strut from rising when the main strut is raised.

On past production jibs without strut supports, tie down both sides of jib strut to jib butt so strut cannot rise when main strut is raised.

Install tie-downs as close to blocking on jib butt as possible (Figure 4-11, View B). **Tie-downs must withstand a 5,000 lb (2 268 kg) pull on both sides of jib strut.**
 2. Unpin strut handling pendant from storage lug on left side of main strut (Figure 4-11, View A). Store snap pin in lug.
 3. Guide load line from **left rear drum** through proper sheave in rope guide on boom butt (Figure 4-41).
 4. Connect socket and wedge for 1-1/8 inch rope to load line from left rear drum.
 5. Guide load line over bracket on luffing rope guide assembly and pin socket on load line to strut handling pendant (Figure 4-11, View B).
- NOTE:** Pin for connecting socket to strut handling pendants is 1-3/8 inch diameter.
6. On current production jibs, haul in load line just enough to support main strut. Then, **unpin strut supports from rigging position and pin in storage position** (Figure 4-9, View C).
 7. Haul in load line to raise main strut. At same time pay out luffing hoist line (Figure 4-11, View D).
 8. Stop raising main strut (release control handles to off) when main strut stop tubes are a few inches (mm) from contacting boom top (Figure 4-11, View C).
 9. Perform following steps for both main strut stop tubes:
 - a. Remove and store quick-release pin (Figure 4-12, View D). **Do not remove stop pin.**
 - b. Extend middle tube by hand until connecting hole in lower tube lines up with connecting hole in support beam on boom top.
 - c. Pin lower tube to support beam (Figure 4-11, View E).

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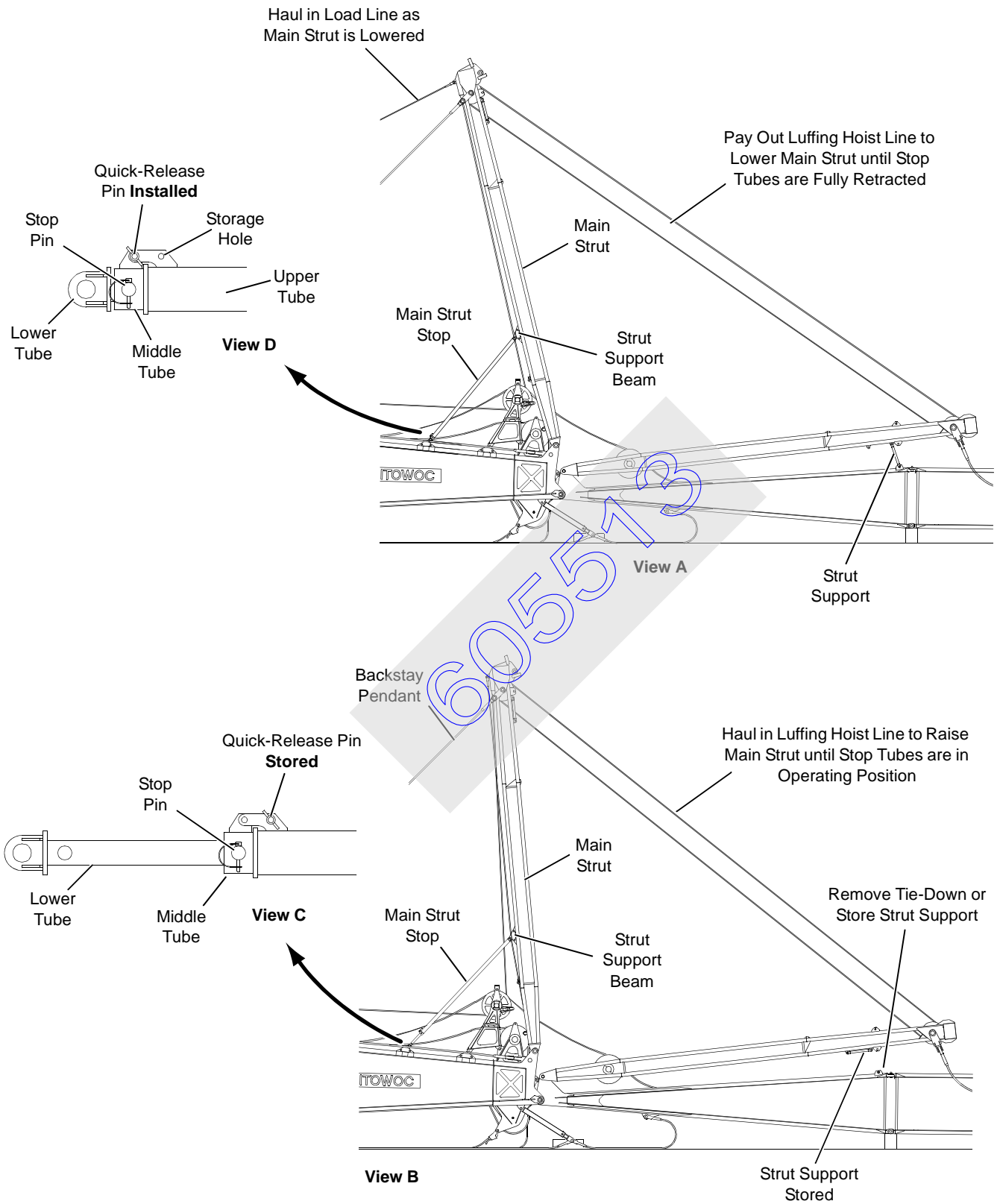


FIGURE 4-12

10. Haul in load line and pay out luffing hoist line until main strut stop tubes are fully retracted (Figure 4-12, View A).
 11. Remove quick-release pins from storage holes and install pins (Figure 4-12, View D).
 12. Disconnect strut handling pendant from socket and pin pendant to storage lug on left side of main strut with quick-release pin (Figure 4-11, View A).
Remove socket and wedge from left rear drum load line and store.
- NOTE:** Pin used to attach socket and wedge to strut handling pendant is not standard pin. If socket and wedge are used for load handling make sure standard pin is used (1-1/2 inch diameter).
13. Connect backstay pendants:
 - **For #44 or 44A boom**, pin backstay pendants to proper hole in each ratchet link on boom butt (Figure 4-8, View D). Install with pin heads toward boom — this will make it easier to remove pins.
 - **For #49A-44 boom**, pin backstay pendants to backstay adapters or pendant links (Figure 4-7, View A) depending on boom length (see rigging drawing for specifications).
 - **For #79-44 boom**, pin backstay pendants to proper hole in each link on boom butt (Figure 4-7, View C).
 14. Remove stop pin (Figure 4-12, View D) from both main strut stop tubes.
 15. Raise main strut (haul in luffing hoist line) until hole in both middle tubes lines up with upper hole in both lower tubes (Figure 4-12, View C).
 16. Install both stop pins (Figure 4-12, View C).
 17. Relax luffing hoist line.
 18. Remove quick-release pin from both main strut stop tubes and store pins (Figure 4-12, View C).
 19. Luff up slightly to support jib strut (Figure 4-12, View B):
 - On current production jibs, unpin strut supports from rigging position and pin in storage position (Figure 4-9, View C).
 - On past production jibs, remove tie-downs.
 20. If required, remove blocking from top of jib strut.
 21. Rotate rope guard on luffing wire rope guide UP to operating position (Figure 4-10, View C). Install top pins to retain guard in this position.

Install Load Line to Boom

It is permissible to handle loads from the lower boom point when equipped with a jib.

Keep in mind, however, that **weight of load block, load line, slings, etc. hanging from lower boom point must be deducted from jib capacities** (see Capacity Charts for limitations).

1. Determine parts of line required for job and size load block accordingly (see Wire Rope Specifications).
2. Route load line from desired drum through proper guide sheaves on boom.
3. Reeve load line through lower boom point and load block sheaves and anchor load line to dead end (see Load Block Reeving in Crane Operator's Manual).
4. For #49A-44 and 79-44 booms only, move rope retaining pin (Figure 4-10, View B) to front holes in wire rope guide.
5. Install block-up limit for lower boom point (see Block-Up Limit Control in Section 6 of this manual).

Install Load Line to Jib

The jib can be operated with a single-part load line over upper point and up to a six-part load line over lower point.

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

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 prior to raising jib point rollers off ground.

CAUTION

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. This could cause personnel injuries and damage to equipment. 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 in this section).
2. Route load lines from desired drums through proper guide sheaves on boom, on jib strut, and on jib point (see Figure 4-41).
3. Reeve load line through lower and upper jib point and load block sheaves and anchor load line at dead end (see Wire Rope Installation and Load Block Reeving in this section).
4. Install block-up limit for upper and lower jib points (see Block-Up Limit Control in Section 6 of this manual).

Connect Electric Cords and Adjust Indicators and Limits

See respective topics in Section 6 of this manual for installation and adjustment instructions.

Connect electric cords from junction box on left side of boom top to following parts:

- Angle indicator on jib butt.
- Jib stop limit switches (maximum and minimum on boom top).
- Block-up limit reel in jib butt.

Perform following adjustments before raising boom and jib:

- Adjust automatic luffing jib stop limit switches.
- Adjust boom and jib angle indicators.
- Adjust automatic boom stop maximum limit switch to specified angle **after boom and jib have been raised**.

PRE-RAISING CHECKS

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

- Crawlers blocked (required for all boom and jib lengths). See Crawler Blocking Diagram in Luffing Jib Capacity Chart Manual for blocking procedure.
- All installation steps given in this section performed.
- Boom and jib inserts (luffing and fixed) installed in proper sequence according to rigging drawings.
- Boom, jib, backstay, and jib stop pendants (or straps) installed in proper sequence according to rigging drawings.
- All connecting pins installed and properly secured.
- Main strut raised and mast strut stop tubes pinned in operating position.
- Jib strut unpinned from storage position.
- Boom and luffing hoist wire rope anchored properly to drums, spooled tightly onto drums, and engaged with proper sheaves. Make sure rope guard pins, bars, or rollers are installed to retain wire rope in sheaves.
- Lower boom point sheaves, boom point wire rope guide, and jib strut lower guide sheave and shaft removed (if

required for boom and jib length in use). See Luffing Jib Raising Procedure Chart for sheave removal requirements.

- Load lines anchored properly to drums, spooled tightly onto drums, and engaged with proper sheaves. Make sure rope guard pins, bars, or rollers are 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.
- Pendants not hooked alongside boom and jib.

Guide pendant connectors clear of wire rope guides and boom and jib chords as boom and jib are raised.

- All safety devices installed, electric cords connected, and limits adjusted.
 - 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.
- All lube points greased (see Section 5 of this manual).
- LUFFING JIB mode selected and confirmed.
- Wind within allowable limits for raising boom and jib (see charts in Luffing Jib Capacity Chart Manual).

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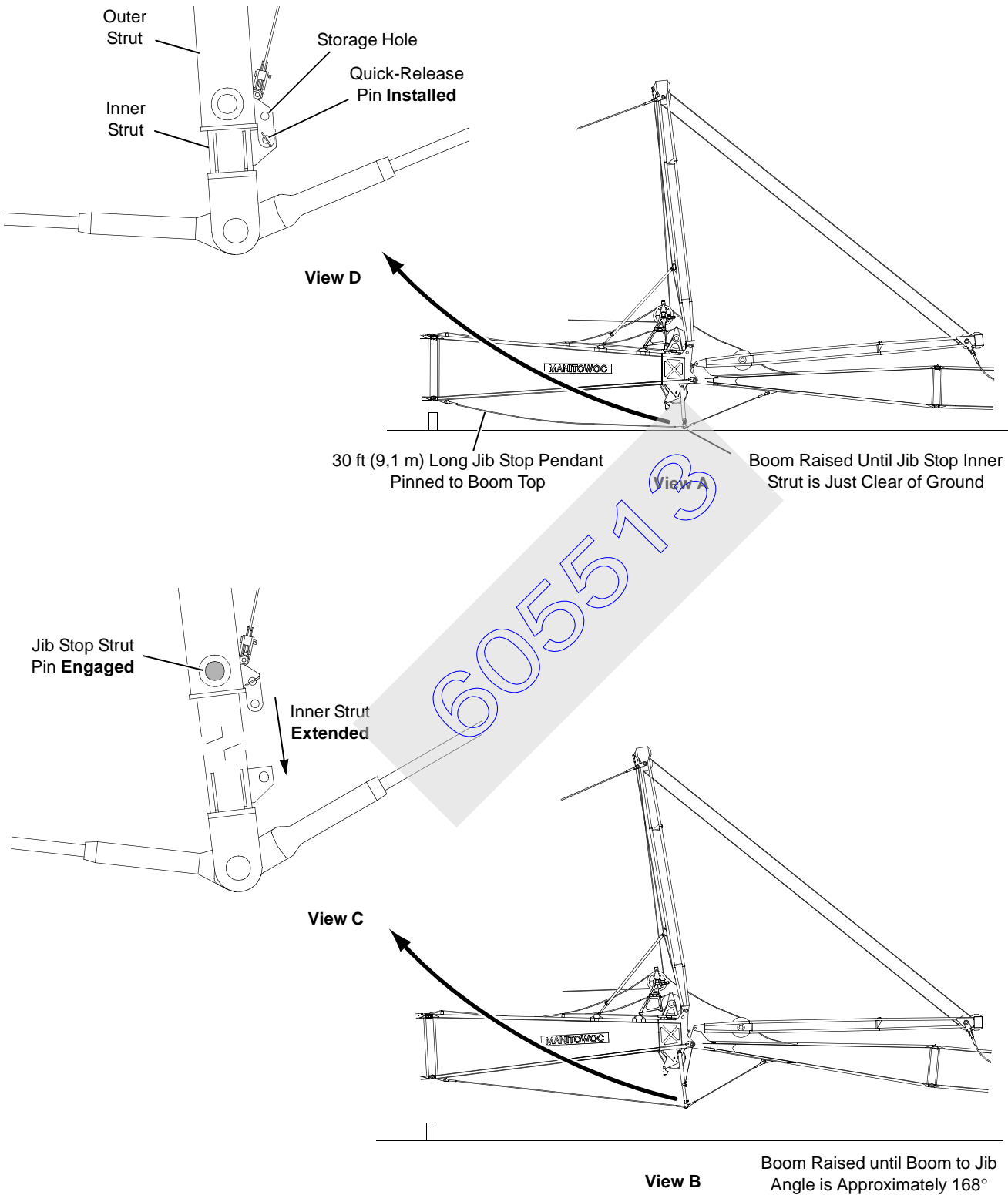


FIGURE 4-13

RAISING BOOM AND JIB — STANDARD ARRANGEMENT

If a fixed jib will be installed on the luffing jib, prepare the boom and luffing jib as required. See Jib Rigging — #140 Jib for instructions. The fixed jib can be installed before the luffing jib is raised or after the luffing jib is raised to the jack-knife position.

The following raising procedure does not apply to boom and jib combinations which must be raised with OUTSIDE ASSIST. If the boom and jib combination in use requires outside assist, see Raising and Lowering Procedure for Outside Assist in this section.



WARNING

Falling Boom And Jib Hazard!

Select and confirm LUFFING JIB mode. 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.



DANGER

Moving Part Hazard!

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

Death or severe crushing injuries will occur if personnel come into contact with rollers.

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 raising procedure chart to determine which method can be used.

Unless other wise specified, see Figure 4-13 for following procedure.

1. Raise jib strut about 1 ft (0,3 m) (luff up) and remove any blocking from between jib strut and jib.
2. Extend jib stop struts and connect jib stop pendants, as follows:
 - a. Slacken jib stop control cable with hand winch on boom butt (Figure 4-14). Slacken cable until it rests

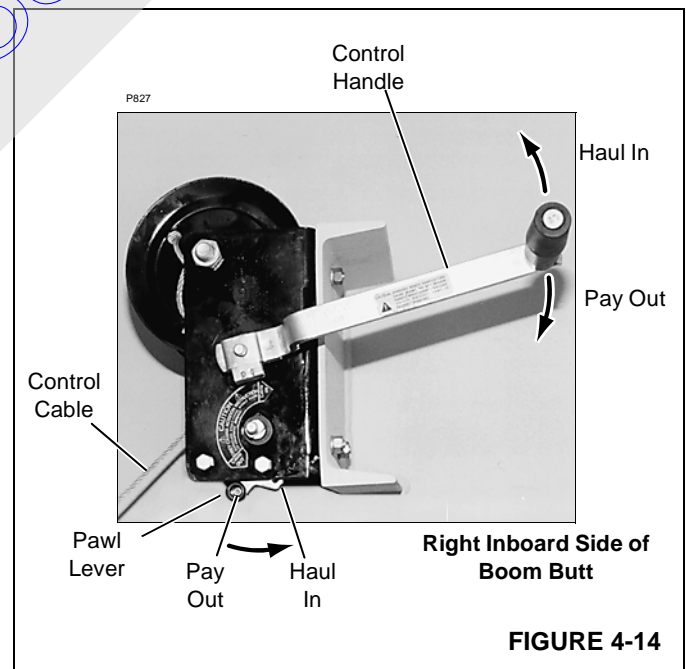
on bottom lacings in boom. Then pay out 4 ft (1,2 m) more cable. **Jib stop inner strut will not extend properly if control cable is not slack.**

- b. Slowly raise boom (boom up) until jib stop strut is just clear of ground and stop (View A).
- c. Pin 30 ft (9,1 m) long jib stop pendants to lugs on underside of boom top.
- d. Remove and store quick-release pin from both ends of inner strut (View D). Inner strut will extend slightly.
- e. Slowly raise boom until jib stop inner strut is fully extended (View B) (boom to luffing jib angle will be approximately 168°).

Jib stop strut pins should engage automatically when inner strut is fully extended (View C). **Do not raise boom any higher until both pins are engaged.**

Outer end of jib stop strut pins are painted white (or other contrasting color) to make pins more visible from ground.

- f. Check that jib stop control cable is slack; pay out cable until it rests on bottom lacings in boom. Then pay out 3 ft (0,9 m) more cable. **Jib stop control cable must be slack at all times during luffing jib operation; otherwise, cable may break.**



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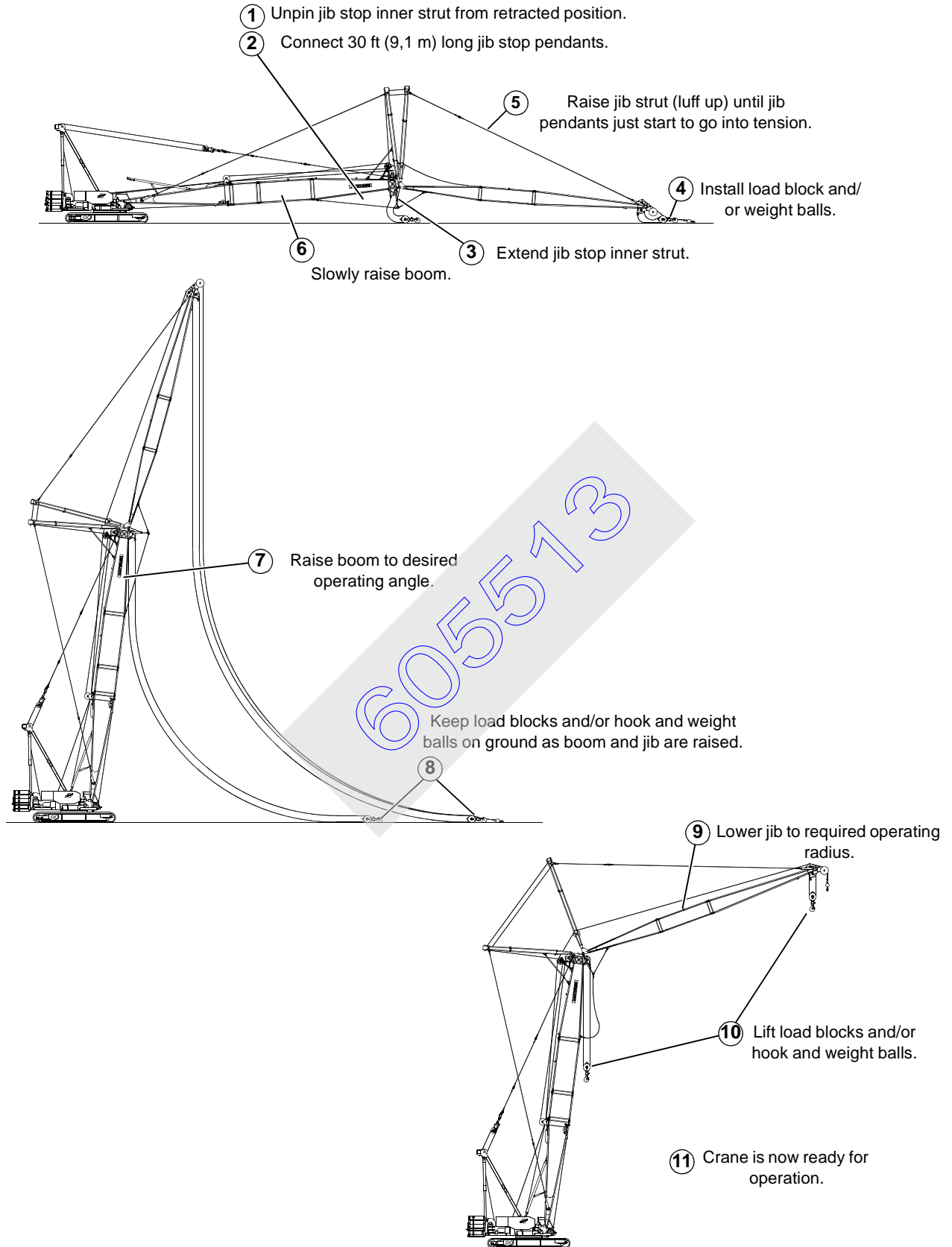


FIGURE 4-15

3. If boom and jib will be raised using **In-Line Method**, proceed as follows (Figure 4-15):

**WARNING****Tipping Crane Hazard!**

For in-line method, do not raise boom and jib combinations longer than specified on raising procedure chart. Crane could tip.

NOTE: It is normal for the BLOCK UP fault to come on during the raising procedure. The fault will go off once the boom and luffing jib are raised and the load lines/block-up limit chains are hanging freely.

- a. Install load block and/or hook and weight ball if not already done (see Install Jib Load Line in this section).

**WARNING****Tipping Crane Hazard!**

Do not lift load blocks and/or hook and weight balls from ground until boom has been raised to desired operating angle and jib has been positioned at required operating radius. Crane could tip.

- b. Slowly raise jib strut (luff up) until jib pendants start to go into tension and stop. It will be necessary to use limit bypass switch if MAX UP 1 limit is on.

CAUTION**Jib Stop Damage!**

Do not raise jib off ground with luffing hoist during step 3b. Jib stop pendants will be over tensioned, possibly resulting in damage.

- c. Slowly raise boom and jib to desired boom angle. Luffing jib can be operated with boom at one of seven angles (see capacity chart for boom angles).
- d. Pay out load lines as boom and jib are raised.
- e. Position jib at required operating radius and lift load blocks and/or hook and weight balls to desired positions. It will be necessary to use limit bypass switch if BLOCK UP limit is on.

When load block from lower boom point is not in use, tie it off to front of upperworks adapter frame.

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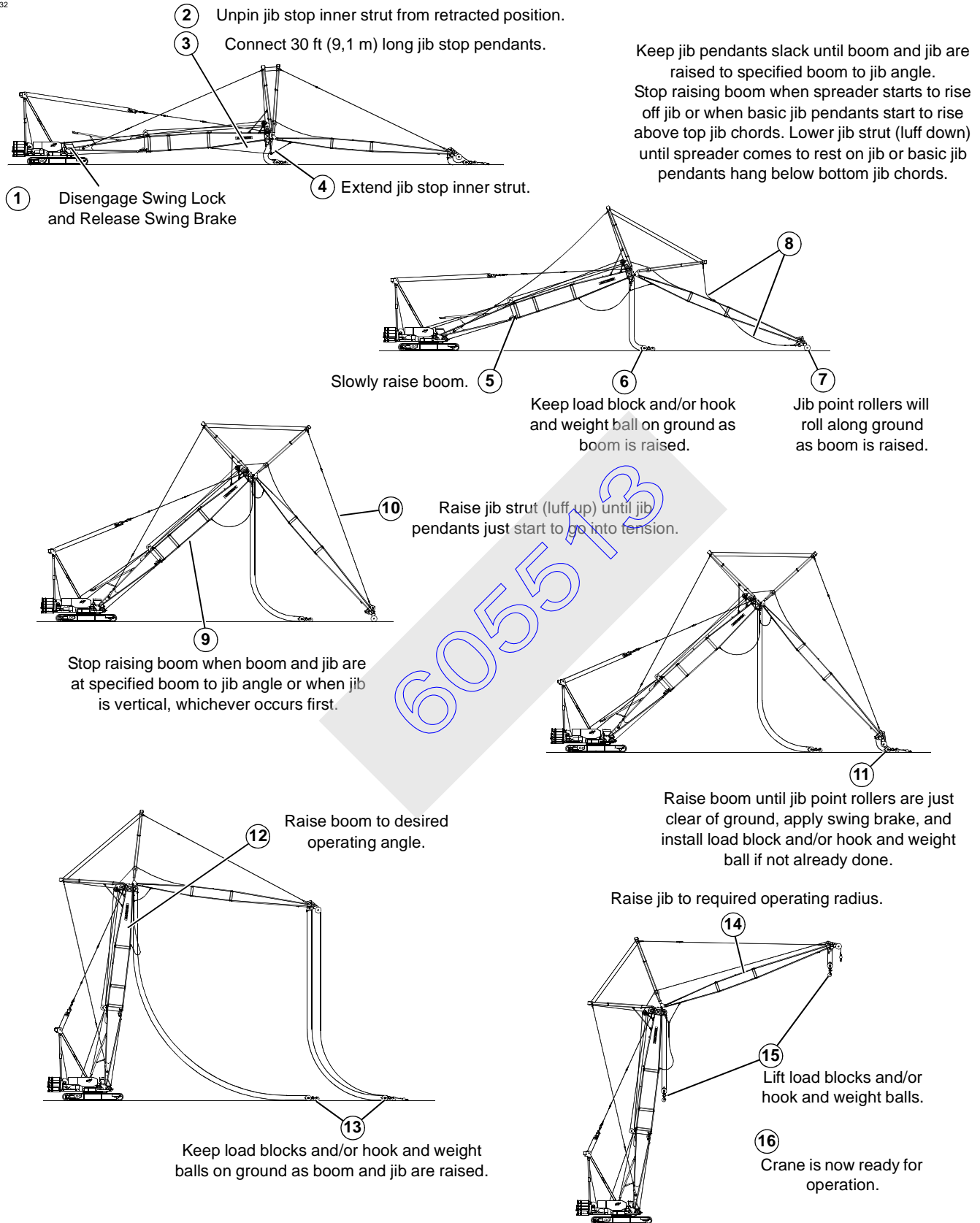


FIGURE 4-16

4. If boom and jib will be raised using **Jack-Knife Method**, proceed as follows (Figure 4-16):

**WARNING****Tipping Hazard!**

Determine BOOM TO LUFFING JIB ANGLE that boom and jib must be jack-knifed to before jib can be raised (see Raising Procedure Chart). Crane will tip or structural damage will result if specified angle is not adhered to.

Monitor angle on digital display as boom and jib are raised.

CAUTION

Avoid possible structural damage to boom and jib from 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 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°

- a. Determine boom to luffing jib angle. Boom and jib must be raised before jib can be raised (see raising procedure chart).
- b. Disengage swing lock and release swing brake.
- c. Slowly raise boom (boom up).
Jib point rollers will roll along ground as boom and jib are jack-knifed into position.
- d. Pay out load lines as boom is raised and jib point rolls along ground.

**WARNING****Tipping Crane Hazard!**

Do not lift load blocks and/or hook and weight balls from ground until boom has been raised to desired operating angle and jib has been positioned at required operating radius. Crane could tip.

- e. Jib pendants will tighten as boom is raised.
Have a signal person watch spreader bar at end of basic jib pendants as boom rises. Signal operator to stop raising boom when spreader bar rises off jib.
If not equipped with a spreader bar, watch basic jib pendants. **Signal operator to stop raising boom**

when basic jib pendants rise above top chords of jib.

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

- f. Pay out luffing hoist line (luff down) until spreader rests on jib or until basic jib pendants are below bottom chords of jib. **Do not allow jib strut to contact jib while paying out luffing hoist line.**

**WARNING****Tipping Crane Hazard!**

Keep jib pendants slack until boom and jib have been raised to specified boom to luffing jib angle given on raising procedure chart.

Crane may tip if jib pendants are tensioned too soon.

- g. Continue with Raising Boom and Jib steps 4c through 4f until 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.**
- h. Stop raising boom when required boom to luffing jib angle is reached or jib is vertical.

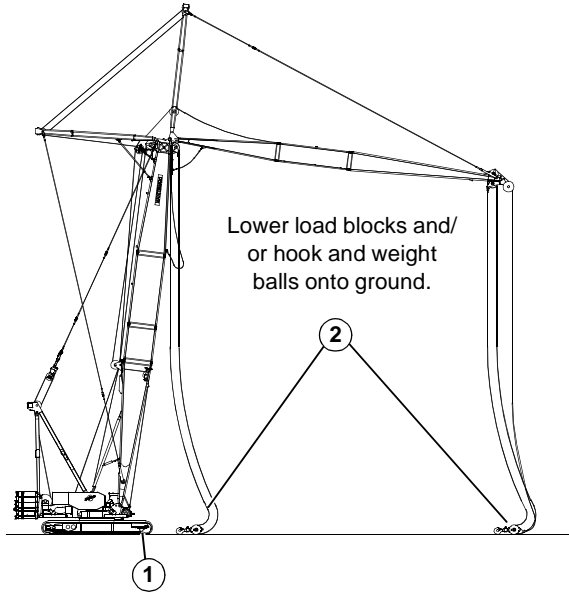
**WARNING****Falling Jib Hazard!**

Do not raise boom and jib to any boom to luffing jib angle less than minimum stop (60°). Structural damage to jib butt will occur, possibly causing jib to collapse.

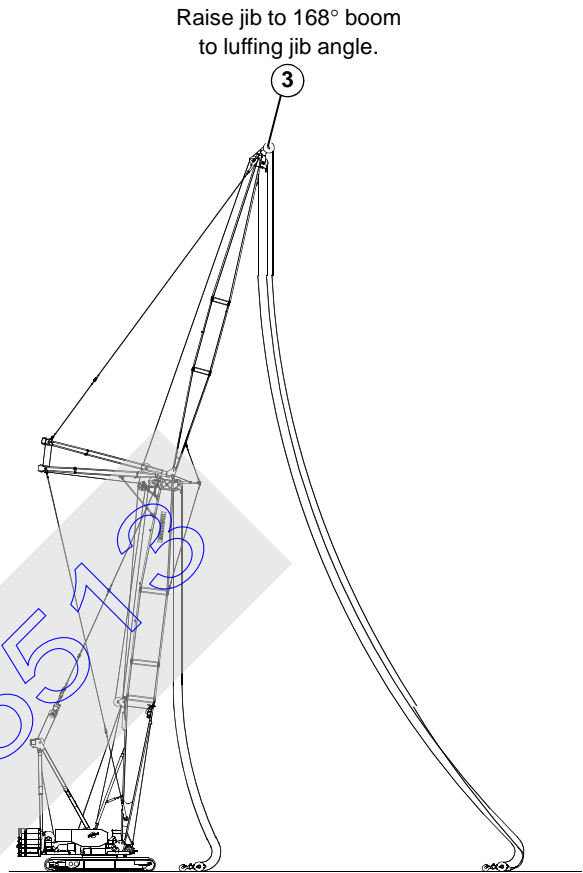
- i. Slowly raise jib strut (luff up) until jib pendants start to go into tension and stop.
- j. Raise boom until jib point rollers are just clear of ground, apply swing brake, and install load block and/or hook and weight balls (see Install Jib Load Line in this section).
Load blocks and/or weight balls and all wire rope below boom and jib point are considered load. **Keep load blocks and/or hook and weight balls on ground until boom has been raised to desired operating angle and jib has been lowered to required operating radius.**
- k. Slowly raise boom and jib to desired boom angle. Luffing jib can be operated with boom at one of seven angles (see capacity chart for boom angles).

- l. Position jib at required operating radius and lift load blocks and/or hook and weight balls to desired positions.
When load block from lower boom point is not in use, tie it off to front of upperworks adapter frame.

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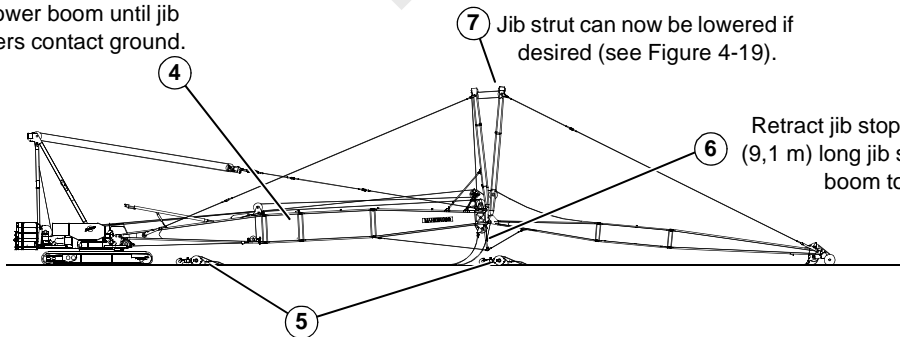


Swing upper in-line over front of crawlers.
Travel front crawler rollers onto blocking.



Raise jib to 168° boom to luffing jib angle.

Slowly lower boom until jib point rollers contact ground.



Haul in load lines as boom and jib are lowered.

Retract jib stop struts, disconnect 30 in (9,1 m) long jib stop pendants, and lower boom top onto blocking.

Jib strut can now be lowered if desired (see Figure 4-19).

FIGURE 4-17

LOWERING BOOM AND JIB — STANDARD ARRANGEMENT

The following lowering procedure does not apply to boom and jib combinations which must be lowered with OUTSIDE ASSIST. If the boom and jib combination in use requires outside assist, see Raising and Lowering Procedure for Outside Assist in this section.



WARNING

Falling Boom And Jib Hazard!

Select and confirm LUFFING JIB mode. 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.



DANGER

Moving Part Hazard!

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

Death or severe crushing injuries will occur if personnel come into contact with rollers.

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

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 raising procedure chart to determine which method can be used.

1. Swing upperworks in-line with lowerworks so boom is over **front of crawlers or rear of carrier**.
2. Travel crawler rollers onto blocking or level truck carrier on extended outriggers.



DANGER

Tipping Crane Hazard!

Lower all boom and jib combinations over blocked crawlers or rear of carrier leveled on extended outriggers; otherwise, crane will tip.

3. Swing boom and jib slightly to either side of center and lower load blocks and/or hook and weight balls onto

ground. Then swing boom and jib in-line with crawlers or carrier.



WARNING

Tipping Crane Hazard!

Lower all load blocks and/or hook and weight balls onto ground before lowering boom and jib. Crane could tip if this step is not performed.

4. If boom and jib will be lowered using **In-Line Method**, proceed as follows (Figure 4-17):



DANGER

Tipping Crane Hazard!

For in-line method, do not lower boom and jib combinations longer than specified on raising procedure chart. Crane will tip.

- a. Raise jib to 168° boom to luffing jib angle.
- b. Slowly lower boom and jib (boom down) until jib point rollers contact ground. It will be necessary to use limit bypass switch if BLOCK UP limit is on.
- c. Haul in load lines as boom and jib are lowered, but **do not lift load blocks and/or hook and weight balls off ground**.

CAUTION

Jib Stop Damage!

Do not lower boom any farther once jib point rollers contact ground. Damage to jib stop struts and/or pendants will result if struts are over tensioned.

- d. Disengage jib stop strut pins by rotating hand winch control handle (Figure 4-14) COUNTER-CLOCKWISE until both pins are disengaged and hold handle in position.

Outer end of jib stop strut pins are painted white (or other contrasting color) to make pins more visible from ground.

- e. Slowly lower boom to retract jib stop inner strut.
Release hand winch handle once jib stop inner strut retracts a few inches (mm).
It will be necessary to use limit bypass switch to boom down if BLOCK UP or MAX UP limits are on.
- f. Stop lowering boom when jib stop inner strut is fully retracted (Figure 4-13, View D).

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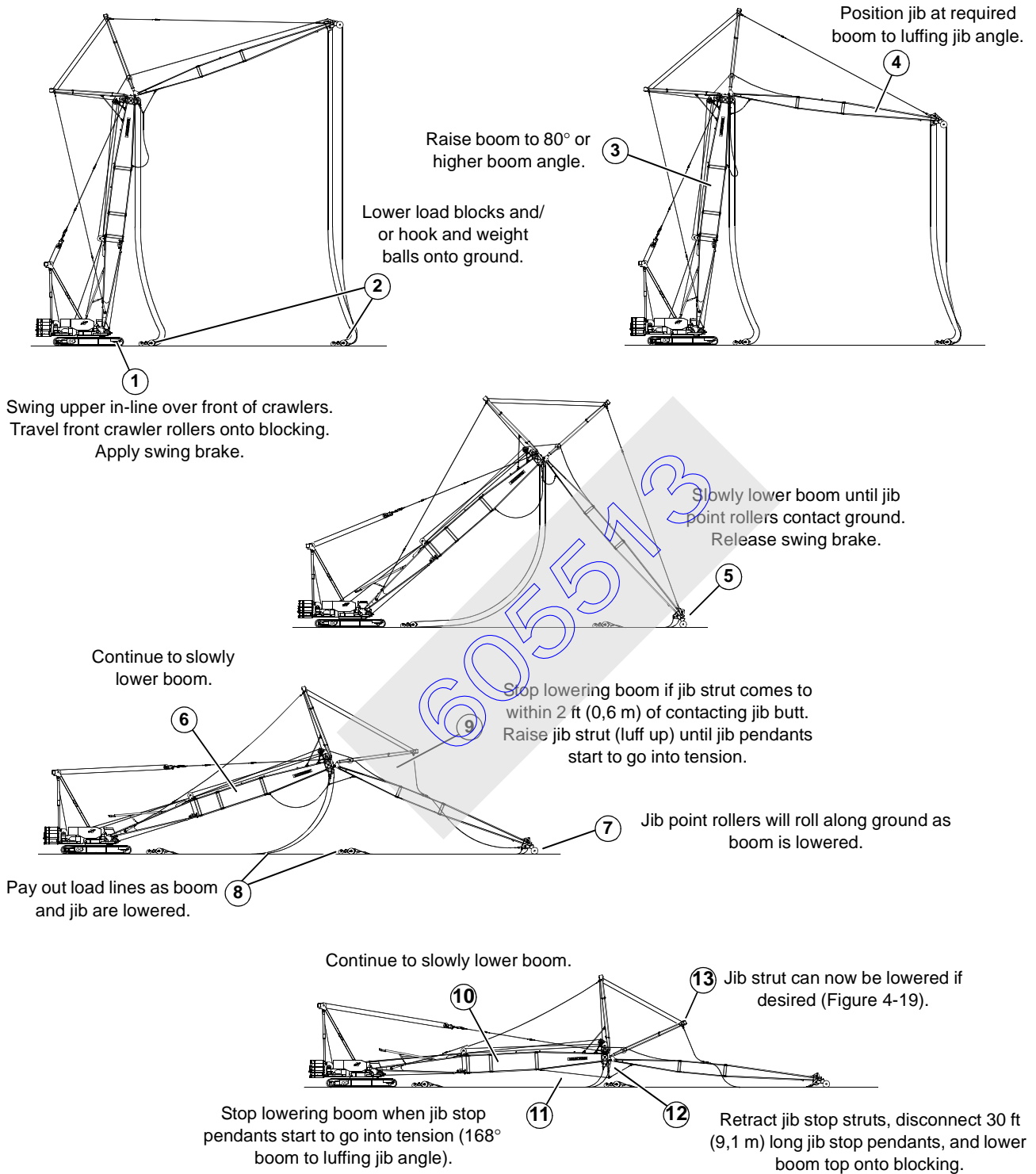


FIGURE 4-18

- g. Remove both quick-release pins from storage holes and install pins to connect jib stop inner strut to outer strut in retracted position (Figure 4-13, View D).
 - h. Unpin both 30 ft (9,1 m) long jib stop pendants from underside of boom top and lay pendants on ground.
 - i. Rotate jib stop struts forward as shown in Figure 4-19 (use assist crane or lever operated hand hoist).
 - j. Lower boom top onto blocking approximately 2 ft (0,6 m) high.
 - k. Lower jib strut and main strut if required. See Removing Luffing Jib in this section.
5. If boom and jib will be lowered using **Jack-Knife Method**, proceed as follows (Figure 4-18):
- NOTE:** It is normal for BLOCK UP, MAX UP 1, and MAX UP 2 limits to come on during the lowering procedure.
- a. Raise boom to a minimum angle of 80°.
 - b. Position jib at required boom to luffing jib angle (see raising procedure chart for angle). **Monitor this angle on digital display.**
It will be necessary to use limit bypass switch to luff down if BLOCK UP limit is on.
- c. Slowly lower boom until jib point rollers contact ground.
It will be necessary to use limit bypass switch to boom down if BLOCK UP limit is on.
 - d. 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.
 - e. Continue to lower boom slowly.
Jib point rollers will roll along ground as boom and jib are jack-knifed into position.
 - f. Pay out load lines as boom and jib are lowered.
 - g. Jib pendants will slacken as boom is lowered.
Have a signal person watch jib strut as boom lowers. Signal operator to stop lowering boom if jib strut comes to within 2 ft (0,6 m) of contacting jib butt.
Haul in luffing hoist line (luff up) to raise jib strut until jib pendants just start to go into tension.
 - h. Continue with Lowering Boom And Jib — Standard Arrangement steps 5e through 5g until jib stop pendants start to go into tension.
 - i. Perform Lowering Boom And Jib — Standard Arrangement steps 4d through 4k.



DANGER

Tipping Crane Hazard!

For jack-knife method, do not lower boom and jib to ground until boom has been positioned at minimum angle of 80° and jib has been positioned at specified boom to luffing jib angle. Crane will tip.

Falling Jib Hazard!

Do not lower jib to any boom to luffing jib angle less than minimum stop (60°). Structural damage to jib butt will occur, possibly causing jib to collapse.

CAUTION

Avoid possible structural damage to boom and jib from side loading as boom and jib are lowered — disengage swing lock and release swing brake when jib point rollers contact ground.

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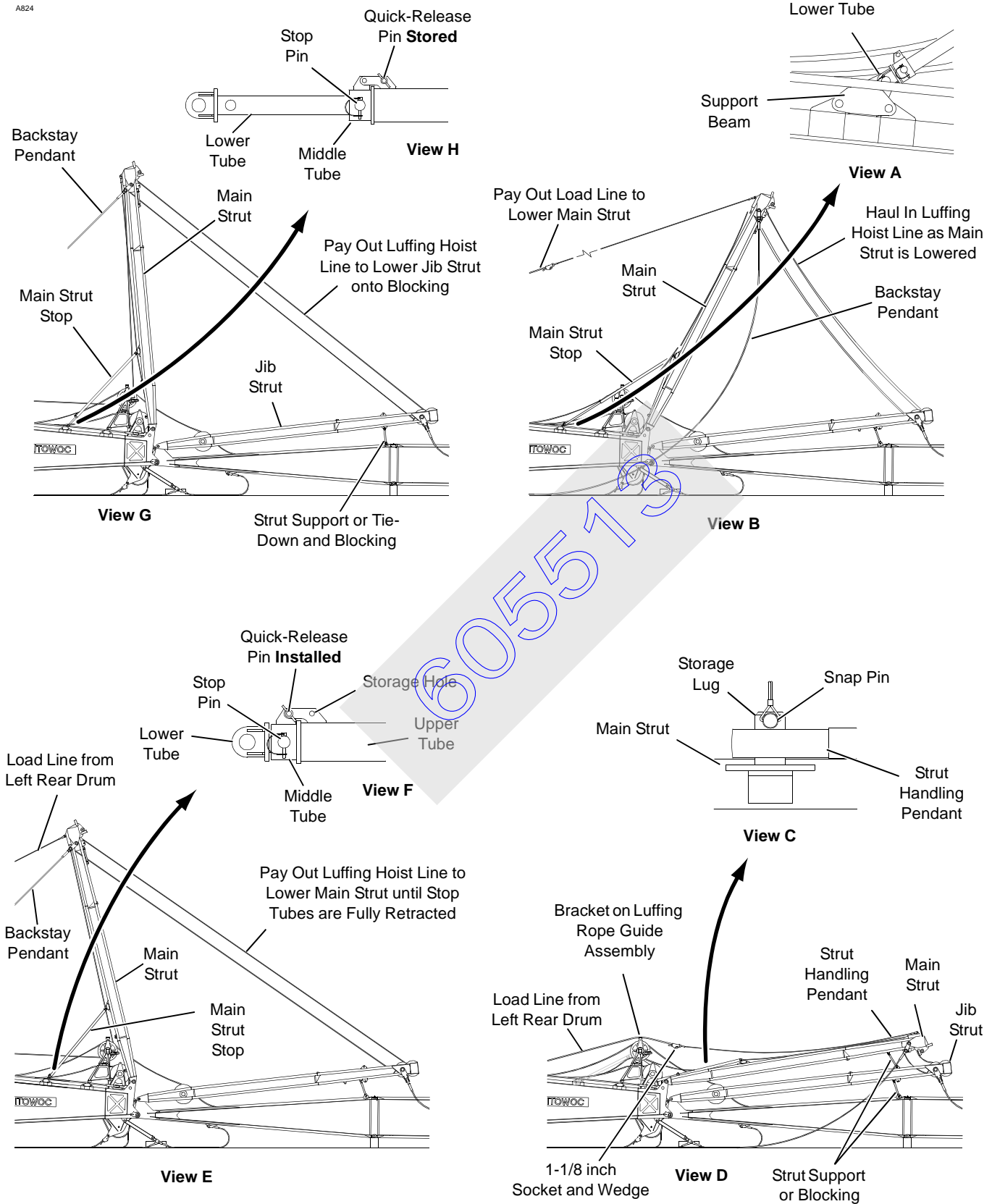


FIGURE 4-19

LOWERING JIB STRUT AND MAIN 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 when connecting and disconnecting strut stop tubes.

1. On past production jibs without strut supports, install block 12 in (0,3 m) high across jib butt near connectors at end of jib butt.

CAUTION

Jib Strut Damage!

Failing to install blocking or pin supports in rigging position will result in damage to jib strut tie link when jib strut is lowered.

2. On current production jibs, slowly lower jib strut (luff down) until it is approximately 2 ft (0,6 m) from jib. Unpin strut supports from stored position on jib strut and pin support to jib (Figure 4-19, View G).

On past production jibs, slowly lower jib strut (luff down) until it comes to rest on blocking. Avoid damage to guide pendant ends and links clear of jib butt as jib strut is lowered.

3. On past production jibs without strut supports, tie down both sides of jib strut to jib butt so strut cannot rise when main strut is lowered.

Install tie-downs as close to blocking between jib strut and jib butt as possible. **Tie-downs must withstand a 5,000 lb (2 268 kg) pull on both sides of jib strut.**

4. On past production jibs without strut supports, install blocking 6 in (152 mm) high across jib strut directly above blocking between jib butt and jib strut.
5. Remove quick-release pins from storage holes in main strut stop tubes (Figure 4-19, View H) and install both quick-release pins (Figure 4-19, View F). It may be necessary to raise or lower main strut slightly (luff up or down) to align holes.
6. Remove both stop pins (Figure 4-19, View H). It may be necessary to raise or lower main strut slightly (luff up or down) to align holes.

7. Pay out luffing hoist line to lower main strut until hole in both middle tubes lines up with bottom hole in both lower tubes (Figure 4-19, View E).

8. Install stop pins to connect middle tubes to lower tubes (Figure 4-19, View F).

9. For #44 or 44A boom, unpin backstay pendants from ratchet links on boom butt (Figure 4-8, View D).

For #49-44 or 79-44 boom, unpin backstay pendants from backstay adapters or pendant links on boom (Figure 4-7, View A or C).

10. Unpin strut handling pendant from storage lug on left side of main strut (Figure 4-19, View C). Store snap pin in lug.

11. Guide load line from **left rear drum** through proper sheave in rope guide on boom butt (Figure 4-41).

12. Connect socket and wedge for 1-1/8 inch rope to load line from left rear drum.

13. Guide load line over bracket on luffing rope guide assembly and pin socket on load line to strut handling pendant (Figure 4-19, View D).

NOTE: Pin for connecting socket to strut handling pendant is 1-3/8 inch diameter.

14. Haul in load line until all slack is removed.

15. Remove and store both quick-release pins (Figure 4-19, View F). **Do not remove stop pins.**

16. Haul in luffing hoist line to pull main strut forward (Figure 4-19, View B). Tension load line as main strut nears vertical so strut moves forward smoothly past vertical.

17. Continue to pay out load line and haul in luffing hoist line until main strut is approximately 25° forward of vertical (Figure 4-19, View B).

18. Perform following steps for both main strut stop tubes:

- a. Unpin lower tube from support beam (Figure 4-19, View A).
- b. Fully retract middle tube by hand.
- c. Remove quick-release pin from storage hole and install pin to hold tubes in retracted position (Figure 4-19, View F).

19. On current production jibs, slowly pay out load line and haul in luffing hoist line until main strut is approximately 2 ft (0,6 m) from jib strut. Unpin strut supports from stored position on main strut and pin supports to jib strut (Figure 4-19, View D).

On past production jibs, slowly pay out load line and haul in luffing hoist line until main strut comes to rest on blocking.

CAUTION**Strut Damage!**

Lower main strut as slowly as possible; otherwise, main strut will fall violently when it nears horizontal.

20. Disconnect strut handling pendant from socket and pin pendant to storage lug on left side of main strut with quick-release pin (Figure 4-19, View C).

21. Remove socket and wedge from left rear drum load line and store.

NOTE: Pin used to attach socket and wedge to strut handling pendant is not standard pin. If socket and wedge are used for load handling, make sure standard pin is used (1-1/2 inch diameter).

22. Spool load line onto left rear drum.

REMOVING JIB

1. Removing jib is opposite of installing jib.

NOTE: Jib butt, jib strut, and main strut can be removed and shipped as an assembled unit.

2. Following parts must be removed from boom before attempting to raise boom without jib attached:

a. Luffing wire rope guide on boom top (Figure 4-10).

b. Rope guide beam and strut support beam (Figure 4-10). **Past production models only.**

c. Boom ratchet links and backstay pins (Figure 4-8, View C) or backstay links (Figure 4-7, View A and C).

3. Automatic boom stop must be reset to specified angle (see Automatic Boom Stop in Section 6 of this manual).

**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.

RAISING AND LOWERING PROCEDURE — OUTSIDE ASSIST

General

The following raising and lowering instructions apply to boom and jib combinations requiring OUTSIDE ASSIST. **These instructions replace raising and lowering instructions previously discussed.**

Extreme care must be used when raising and lowering boom-luffing jib combinations requiring outside assist.



DANGER

Read Capacity Charts!

Crane must be rigged and operated according to instructions in Luffing Jib Capacity Chart and Luffing Jib Raising Procedure Chart for Outside Assist.

Read Capacity Charts and instructions in this section before attempting to raise or lower luffing jib attachment.

Failing to comply with instructions in Capacity Charts and this section will result in tipping or structural failure of boom and luffing jib.

Death or serious injury to personnel can result.

Danger Tag

Danger tag, Manitowoc No. 147841 shown in Figure 4-20, shall be attached in the 2250 operator's cab in clear view of the operator as a reminder that boom-luffing jib combination in use requires outside assist for raising and lowering.



Signal Person

Two operators are required to raise and lower the luffing jib with outside assist: one to operate the 2250 and one to operate the assist crane. A qualified signal person shall be provided to coordinate the raising and lowering procedure and to provide necessary signals to both crane operators.

Counterweight Requirement

For operation with boom-luffing jib combinations requiring outside assist, the **2250 must be equipped with S-2 counterweight as specified in Capacity Chart.**



DANGER

Tipping Hazard!

Do not operate crane until S-2 counterweight is installed. Crane will tip if not equipped with proper counterweight.

Blocking Crawlers

To prevent tipping, all boom-luffing jib combinations requiring outside assist must be raised and lowered over **front of block crawlers** (see Crawler Blocking Diagram in Luffing Jib Capacity Chart Manual for blocking instructions). The crawler drive motors must be to the rear.



WARNING

Tipping Hazard!

Do not raise or lower boom and luffing jib from or to ground until front of 2250 crawlers are blocked. Crane could tip.

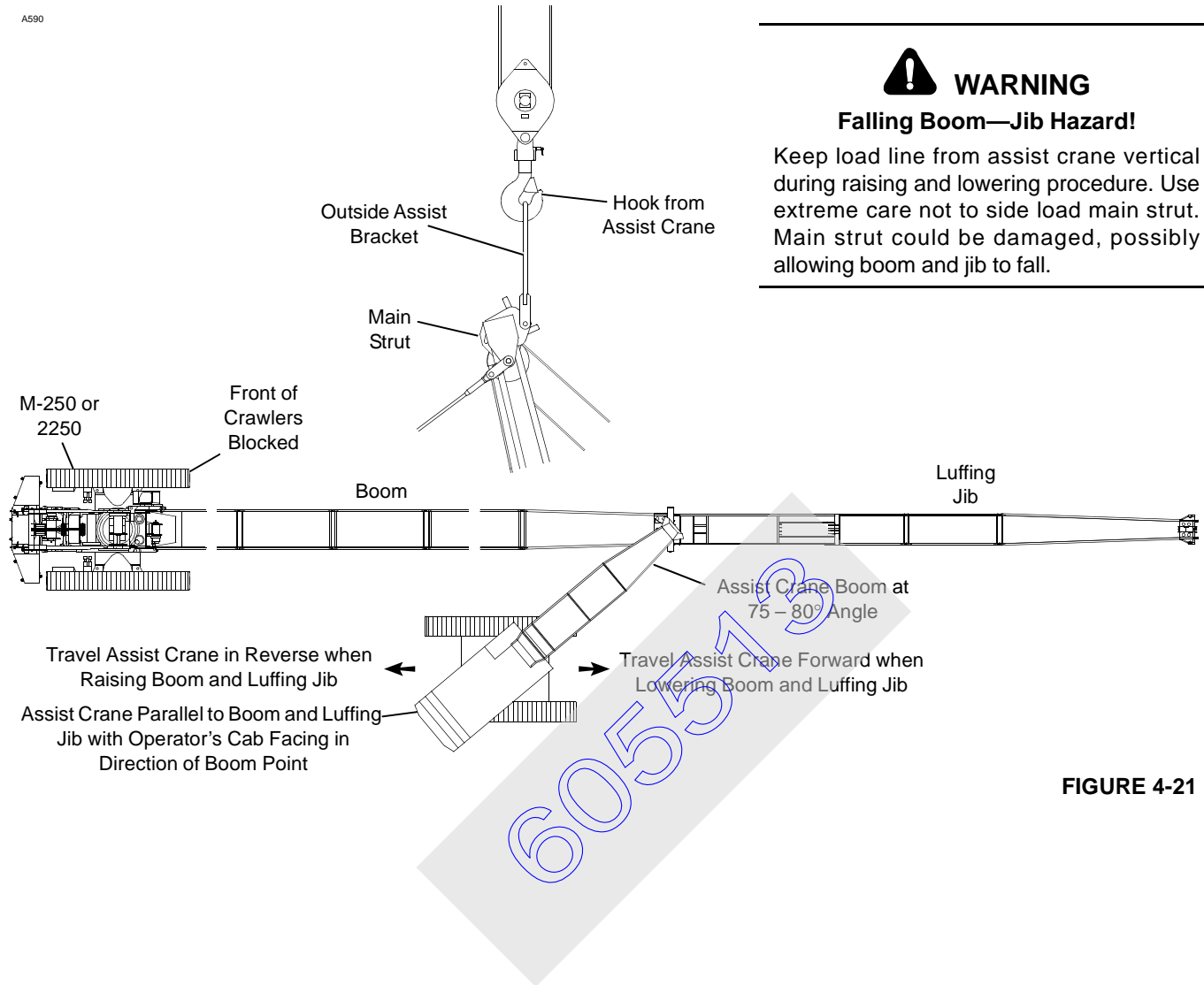
Boom-Luffing Jib Rigging

The boom, luffing jib, jib struts, jib stop, and all pendants must be assembled according to the installation instructions previously discussed.

Be sure to use the proper boom ratchet link. See View A in the Luffing Jib Rigging Drawing for Outside Assist. Two different links are provided depending on boom length.

The left and right sheave clusters in the lower boom point must be removed and replaced with spacers. Boom-luffing jib combinations requiring outside assist can be operated only with three middle sheaves installed in the lower boom point.

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WARNING

Falling Boom—Jib Hazard!

Keep load line from assist crane vertical during raising and lowering procedure. Use extreme care not to side load main strut. Main strut could be damaged, possibly allowing boom and jib to fall.

FIGURE 4-21

There are no Capacity Charts for handling loads from the lower boom point when equipped with boom-luffing jib combinations requiring outside assist. Do not install a load line and load block at the lower boom point.



WARNING
Tipping Crane Hazard!

Do not attempt to raise or lower boom and luffing jib with more than three sheaves installed in lower boom point or with a load block installed at lower boom point. Crane could tip.

Lifting Bracket

Attach the outside assist lifting bracket to the main strut as shown in Figure 4-21.

For cranes not originally equipped for outside assist, the main strut must be field modified to allow installation of the lifting bracket. See Manitowoc drawing 174954 for the modification.

Assist Crane

The assist crane must carry the entire load of the boom and luffing jib during the raising and lowering procedure — **2250 boom hoist must not carry any part of load.**

The assist crane must have a boom length and capacity of at least that shown in the outside assist table in the Luffing Jib Raising Procedure Chart for Outside Assist.

Position the assist crane along either side of the boom and luffing jib, as follows (Figure 4-21):

1. Position assist crane boom at 75 – 80° boom angle.
2. Position assist crane on a firm, level, uniformly supporting surface with its crawlers parallel to boom and luffing jib.
3. Position assist crane upperworks facing in direction of 2250 boom point. This position will provide the assist crane operator with a clear view of the boom and luffing jib during raising and lowering.
4. Operate assist crane in such a manner that load line remains vertical. **Assist crane must not put any side load into main strut of luffing jib.**

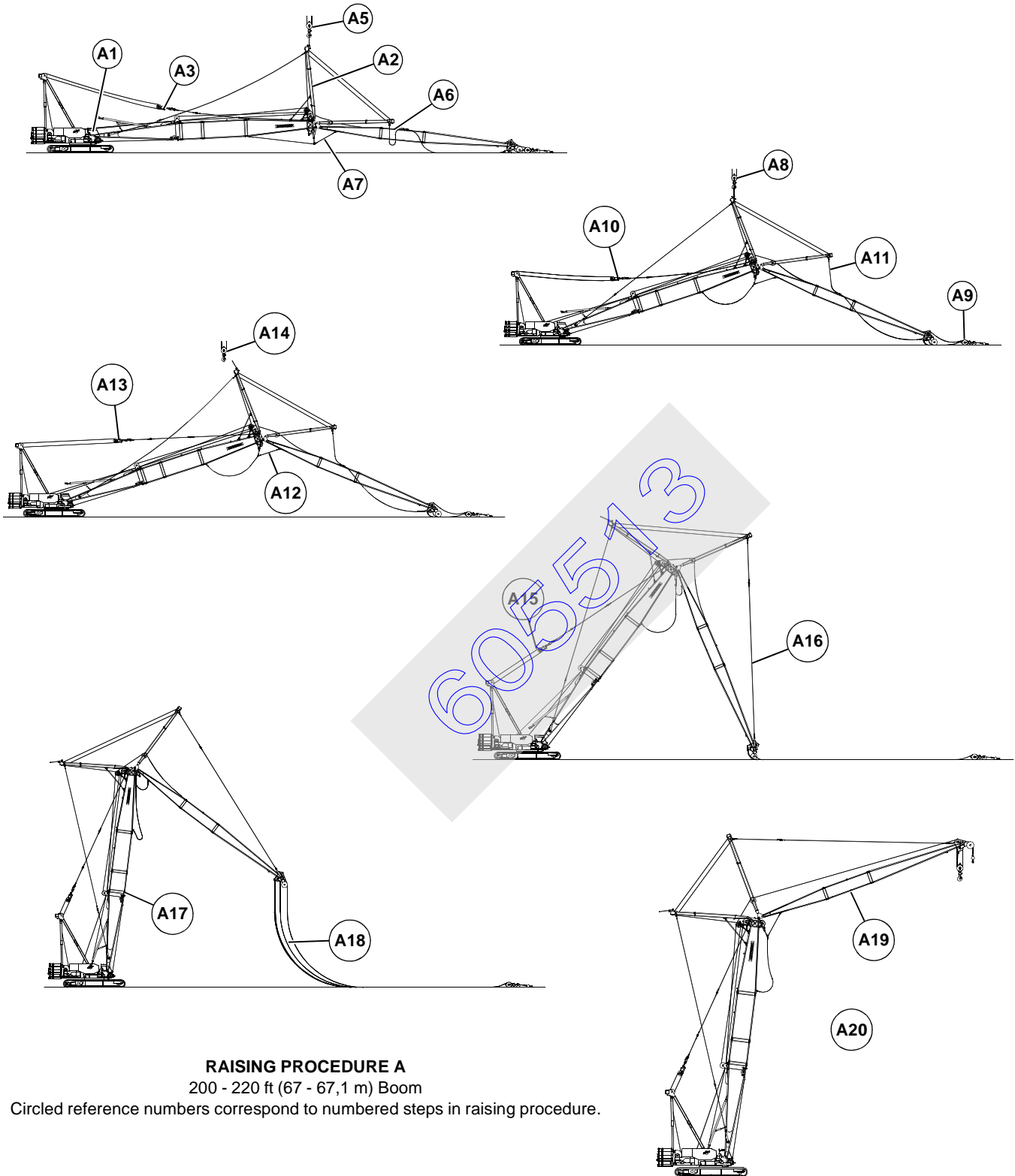


DANGER
Tipping Crane Hazard!

Assist crane must meet requirements given in Luffing Jib Raising Procedure Chart for Outside Assist. Using too small an assist crane or positioning and operating assist crane improperly will result in tipping. Boom and luffing jib could collapse.

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RAISING PROCEDURE A
 200 - 220 ft (67 - 67,1 m) Boom

Circled reference numbers correspond to numbered steps in raising procedure.

FIGURE 4-22

Raising Procedure A – 200 - 220 ft (61- 67,1 m) Boom



DANGER

Moving Part Hazard!

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

Death or severe crushing injuries will occur if personnel come into contact with rollers.

See Figure 4-22 for following procedure.

1. Apply 2250 swing brake and engage swing lock. **Swinging 2250 is not permitted while raising boom and luffing jib.**
2. Raise main strut to operating position and connect backstay pendants. See procedure discussed earlier in this section
3. Pay out 2250 boom hoist wire rope so there is a slight sag in boom rigging.
4. Determine angle to which 2250 must be assisted. See table in Luffing Jib Raising Procedure Chart for Outside Assist.



DANGER

Tipping Crane Hazard!

Boom and luffing jib must be raised with assist crane to angle given in table in Luffing Jib Raising Procedure Chart for Outside Assist.

Do not attempt to raise boom and luffing jib with 2250 boom hoist. Crane will tip.

5. Position assist crane alongside boom and hook assist crane to outside assist bracket on main strut.
6. Luff up to raise jib strut about 1 ft (0,3 m) and remove blocking from between jib strut and luffing jib.
7. Extend jib stop struts and connect jib stop pendants, as follows:
 - a. Slacken jib stop control cable with hand winch in boom butt (Figure 4-14). Slacken cable until it rests on bottom lacings in boom. Then pay out four more feet of cable.

Jib stop inner strut will not extend properly if control cable is not slack.
 - b. Slowly raise boom with assist crane until jib stop strut is just clear of ground and stop (Figure 4-13, View A).

- c. Pin 30 ft (9,1 m) long jib stop pendants to lugs on underside of boom top.
- d. Remove and store quick-release pin from both ends of inner strut (Figure 4-13, View D). Inner strut will extend slightly.
- e. Slowly raise boom with assist crane until jib stop inner strut is fully extended (Figure 4-13, View B) (boom to luffing jib angle will be approximately 168°).

Jib stop strut pins should engage automatically when inner strut is fully extended (Figure 4-13, View C). **Do not raise boom any higher until both pins are engaged.**

Outer end of jib stop strut pins are painted white (or other contrasting color) to make pins more visible from ground.

- f. Check that jib stop control cable is slack; pay out cable until it rests on bottom lacings in boom. Then pay out three more feet of cable.

Jib stop control cable must be slack at all times during luffing jib operation; otherwise, cable may break.

8. Slowly raise boom and luffing jib with assist crane while traveling assist crane in reverse.

The jib point rollers will roll along the ground as the boom and luffing jib are raised.

9. Depending on location of load block and/or hook and weight ball:
 - a. Pay out load lines from 2250 so load block and/or hook and weight ball is not dragged along ground.
 - b. Haul in load lines so jib point roller does not roll over load lines.
10. Haul in 2250 boom hoist wire rope only enough to maintain a slight sag in boom rigging as boom and luffing jib are raised with assist crane. **2250 boom hoist must not be used to raise boom and luffing jib — tipping will occur.**
11. Jib pendants will tighten as boom and luffing jib are raised:
 - a. Watch spreader bar at end of basic jib pendants as boom and luffing jib rise. **Signal assist crane operator to stop hoisting and traveling when spreader bar rises off luffing jib.**
 - b. Pay out luffing hoist line (luff down) until spreader bar rests on luffing jib. **Do not allow jib strut to contact luffing jib while paying out luffing hoist line.**

See Figure 4-22 for following procedure.



WARNING
Tipping Crane Hazard!

Keep jib pendants slack until boom and luffing jib have been raised to specified boom angle given on Luffing Jib Raising Procedure Chart for Outside Assist.

Crane may tip if jib pendants are tensioned too soon.

12. Continue to slowly raise boom and luffing jib with assist crane until boom is at or slightly above required outside assist angle.
13. Tighten 2250 boom rigging until boom and luffing jib are supported by rigging, **but do not lift jib pint rollers off ground.**
14. Unhook assist crane from outside assist lifting bracket.
15. Raise boom and luffing jib with 2250 boom hoist until boom to luffing jib angle is 60° or luffing jib is vertical, whichever occurs first.
16. Slowly raise jib strut (luff up) until jib pendants start to go into tension and stop.
17. Slowly raise boom and luffing jib to desired boom angle. The luffing jib can be operated with the boom at one of two angles (see capacity chart for boom angles).

18. Pay out load lines from 2250 as boom and luffing jib are raised.



WARNING
Tipping Crane Hazard!

Do not lift load block and/or hook and weight ball from ground until boom has been raised to desired operating angle and luffing jib has been positioned at required operating radius. Crane could tip.

19. Position luffing jib at required operating radius (see Luffing Jib Capacity Chart Manual) and lift load block and/or hook and weight ball to desired position.



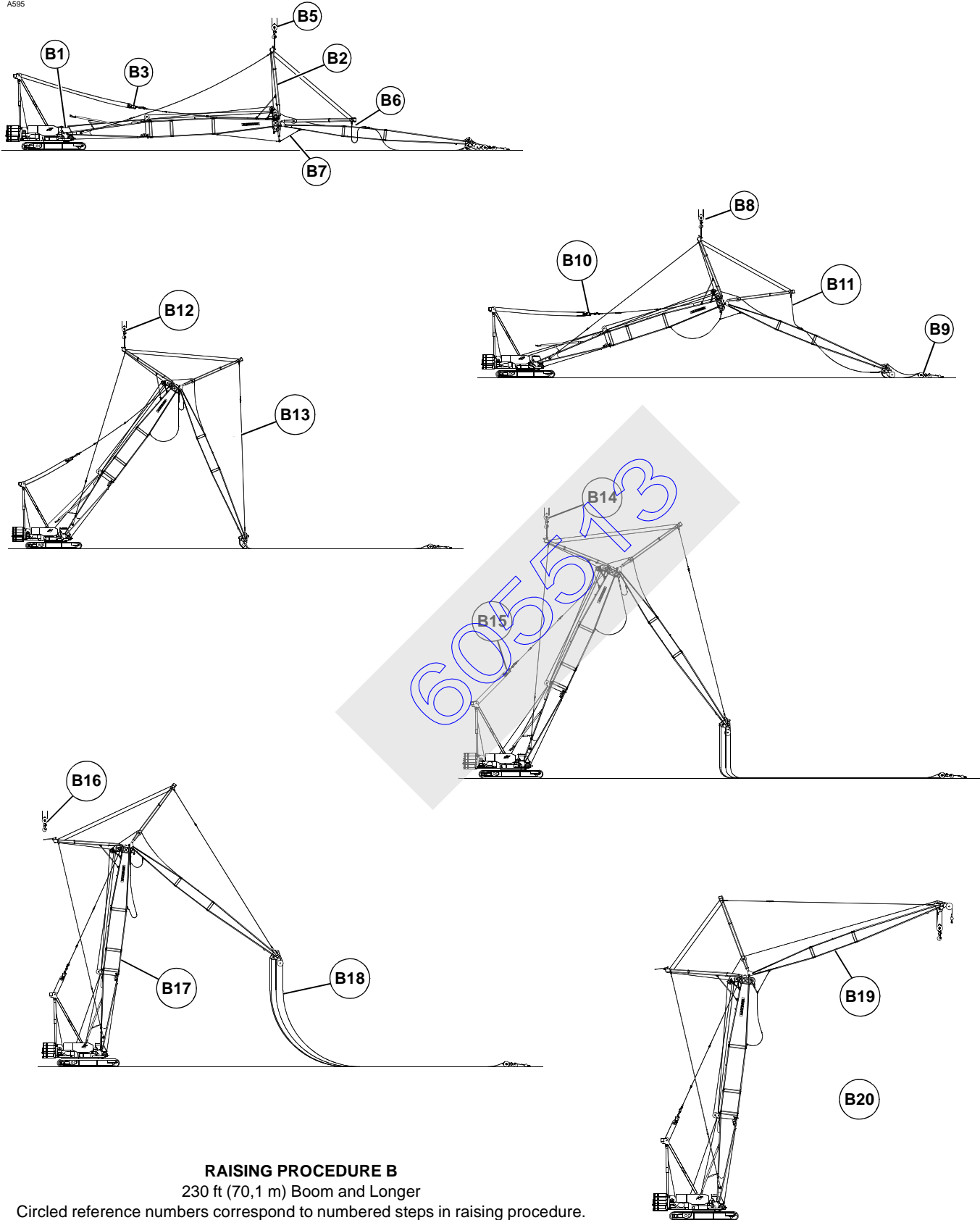
WARNING
Tipping Crane Hazard!

Do not swing 2250 until boom is at 83° or higher angle and luffing jib is at required operating radius. Tipping can occur.

20. Luffing jib is now ready for operation.



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RAISING PROCEDURE B

230 ft (70,1 m) Boom and Longer

Circled reference numbers correspond to numbered steps in raising procedure.

FIGURE 4-23

Raising Procedure B – 230 ft (70,1 m) Boom and Longer

See Figure 4-23 for following procedure.



DANGER

Moving Part Hazard!

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

Death or severe crushing injuries will occur if personnel come into contact with rollers.

1. Apply 2250 swing brake and engage swing lock. **Swinging 2250 is not permitted while raising boom and luffing jib.**
2. Raise main strut to operating position and connect backstay pendants. See procedure discussed previously in this section.
3. Pay out 2250 boom hoist wire rope so there is a slight sag in boom rigging.
4. Determine angle to which 2250 must be assisted. See table in Luffing Jib Raising Procedure Chart for Outside Assist.



DANGER

Tipping Crane Hazard!

Boom and luffing jib must be raised with assist crane to angle given in table in Luffing Jib Raising Procedure Chart for Outside Assist.

Do not attempt to raise boom and luffing jib with 2250 boom hoist. Crane will tip.

5. Position assist crane alongside boom and hook assist crane to outside assist bracket on main strut.
6. Luff up to raise jib strut about 1 ft (0,3 m) and remove blocking from between jib strut and luffing jib.
7. Extend jib stop struts and connect jib stop pendants, as follows:
 - a. Slacken jib stop control cable with hand winch in boom butt (see procedure discussed earlier in this section). Slacken cable until it rests on bottom lacings in boom. Then pay out four more feet of cable.

Jib stop inner strut will not extend properly if control cable is not slack.
 - b. Slowly raise boom with assist crane until jib stop strut is just clear of ground and stop (Figure 4-13, View A).
- c. Pin 30 ft (9,1 m) long jib stop pendants to lugs on underside of boom top.
- d. Remove and store quick-release pin from both ends of inner strut (Figure 4-13, View D). Inner strut will extend slightly.
- e. Slowly raise boom with assist crane until jib stop inner strut is fully extended (Figure 4-13, View B) (boom to luffing jib angle will be approximately 168°).

Jib stop strut pins should engage automatically when inner strut is fully extended (Figure 4-13, View C). **Do not raise boom any higher until both pins are engaged.**

Outer end of jib stop strut pins are painted white (or other contrasting color) to make pins more visible from ground.
- f. Check that jib stop control cable is slack; pay out cable until it rests on bottom lacings in boom. Then pay out three more feet of cable.

Jib stop control cable must be slack at all times during luffing jib operation; otherwise, cable may break.
8. Slowly raise boom and luffing jib with assist crane while traveling assist crane in reverse.

The jib point rollers will roll along the ground as the boom and luffing jib are raised.
9. Depending on location of load block and/or hook and weight ball:
 - a. Pay out load lines from 2250 so load block and/or hook and weight ball is not dragged along ground.
 - b. Haul in load lines so jib point roller does not roll over load lines.
10. Haul 2250 boom hoist wire rope only enough to maintain a slight sag in boom rigging as boom and luffing jib are raised with assist crane. **2250 boom hoist must not be used to raise boom and luffing jib — tipping will occur.**
11. Jib pendants will tighten as boom and luffing jib are raised with assist crane.
 - a. Watch spreader bar at end of basic jib pendants as boom and luffing jib rise. **Signal assist crane operator to stop hoisting and traveling when spreader bar rises off luffing jib.**
 - b. Pay out luffing hoist line (luff down) until spreader bar rests on luffing jib. **Do not allow jib strut to contact luffing jib while paying out luffing hoist line.**

See Figure 4-23 for following procedure.

WARNING**Tipping Crane Hazard!**

Keep jib pendants slack until boom and luffing jib have been raised to specified boom angle given on Luffing Jib Raising Procedure Chart for Outside Assist.

Crane may tip if jib pendants are tensioned too soon.

-
12. Continue raising boom and luffing jib with assist crane until boom to luffing jib angle is 60° or luffing jib is vertical, whichever occurs first.
 13. Slowly raise jib strut (luff up) until jib pendants start to go into tension and stop.
 14. Continue to slowly raise boom and luffing jib with assist crane until boom is at or above angle given in table in Luffing Jib Raising Procedure Chart for Outside Assist.
 15. Tighten 2250 boom rigging until boom and luffing jib are supported by rigging.
 16. Unhook assist crane from outside assist lifting bracket.
 17. Slowly raise boom and luffing jib to desired boom angle. The luffing jib can be operated with the boom at one of two angles (see capacity chart for boom angles).

18. Pay out load lines from 2250 as boom and luffing jib are raised.

**WARNING****Tipping Crane Hazard!**

Do not lift load block and/or hook and weight ball from ground until boom has been raised to desired operating angle and luffing jib has been positioned at required operating radius. Crane could tip.

-
19. Position luffing jib at required operating radius (see Luffing Jib Capacity Chart Manual) and lift load block and/or hook and weight ball to desired position.

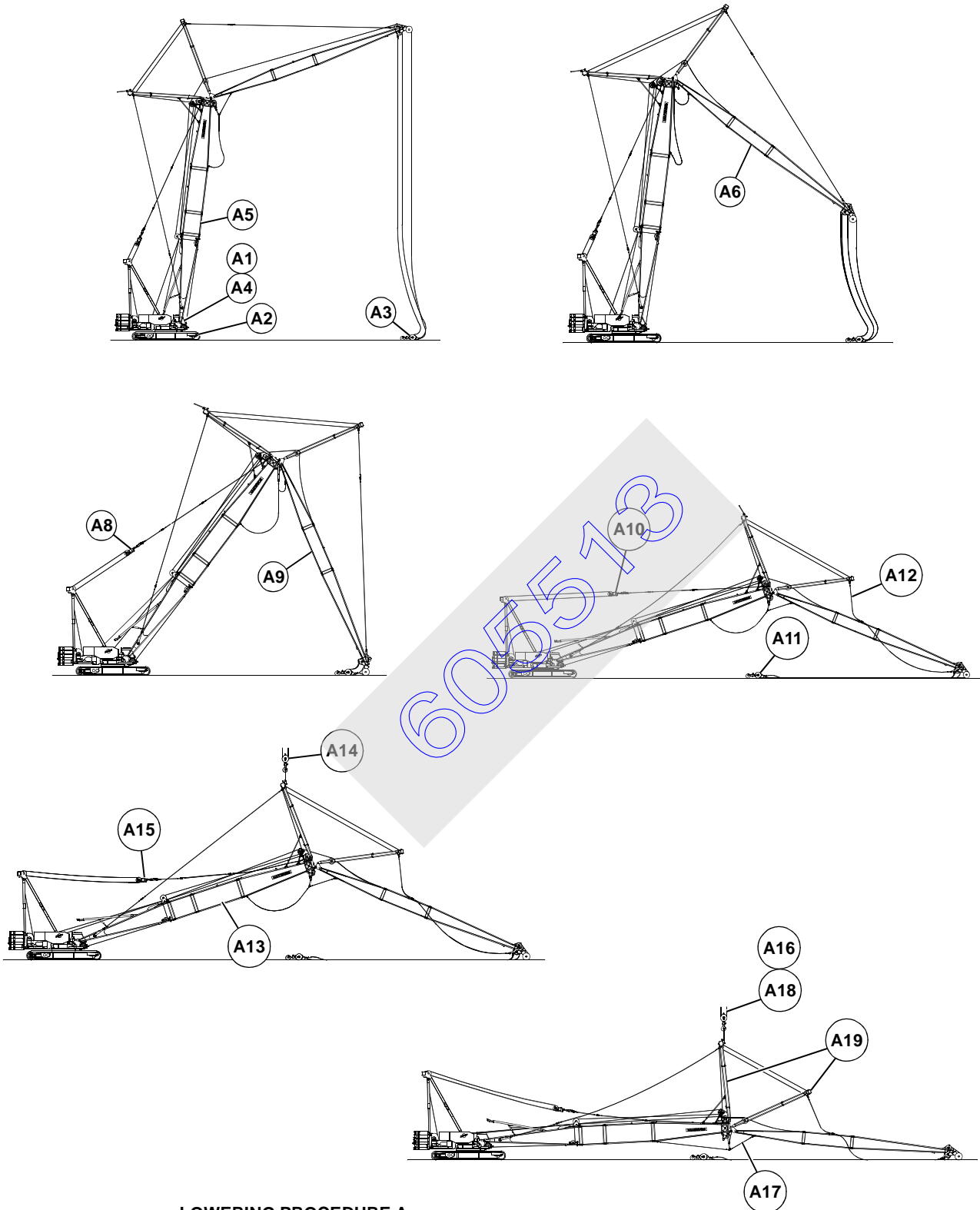
**WARNING****Tipping Crane Hazard!**

Do not swing 2250 until boom is at 83° or higher angle and luffing jib is at required operating radius. Tipping can occur.

-
20. Luffing jib is now ready for operation.



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LOWERING PROCEDURE A

200 - 220 ft (67 - 67,1 m) Boom

Circled reference numbers correspond to numbered steps in raising procedure.

FIGURE 4-24

Lowering Procedure A – 200 - 220 ft (61- 67,1 m) Boom



DANGER Moving Part Hazard!

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

Death or severe crushing injuries will occur if personnel come into contact with rollers.

See Figure 4-24 for following procedure.

1. Swing upperworks in line with lowerworks so boom is over **front of crawlers**.
2. Travel front crawler rollers onto blocking.
3. Swing boom and luffing jib slightly to either side of center and lower load block and/or hook and weight ball onto ground. Then swing boom and luffing jib in line with crawlers.



WARNING Tipping Crane Hazard!

Lower load block and/or hook and weight ball onto ground before lowering boom and luffing jib.

Crane could tip if this step is not performed.

4. Apply swing parking brake and engage swing lock.
5. Raise boom to 83° or higher.
6. Position luffing jib so boom to luffing jib angle is 60°.



WARNING Falling Jib/Boom Hazard!

Do not lower luffing jib to a boom to luffing jib angle of less than 60°.

Structural damage can result, possibly allowing luffing jib and boom to collapse.

7. Determine angle to which 2250 must be assisted. See table in Luffing Jib Raising Procedure Chart for Outside Assist.
8. Slowly lower boom and luffing jib with 2250 boom hoist until jib point rollers contact ground.

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

10. Continue to slowly lower boom and luffing jib.

Jib point rollers will roll along ground as boom and luffing jib are lowered.

11. Pay out load lines so load block and/or hook and weight ball is not dragged along ground.

12. Jib pendants will slacken as boom and luffing jib are lowered:
 - a. Watch jib strut as boom and luffing jib lower. Stop lowering boom and luffing jib if jib strut comes to within two feet of contacting luffing jib.
 - b. Haul in luffing hoist line (luff up) to raise jib strut until jib pendants just start to go into tension.

13. Stop lowering boom and luffing jib when boom is at or slightly above outside assist angle.

14. Position assist crane alongside boom and hook assist crane to outside assist bracket on main strut.



DANGER Tipping Crane Hazard!

Boom and luffing jib must be lowered with assist crane below angle given in table in Luffing Jib Raising Procedure Chart for Outside Assist.

Do not attempt to lower boom and luffing jib with 2250 boom hoist. Crane will tip.

15. Pay out 2250 boom hoist wire rope to maintain a slight sag in boom rigging as boom and luffing jib are lowered with assist crane. **2250 boom hoist must not be used to lower boom and luffing jib — tipping will occur.**

16. Continue to lower boom and luffing jib slowly with assist crane until jib stop pendants start to go into tension and stop.

17. Retract jib strut stops and disconnect jib stop pendants, as follows (Figure 4-13):
 - a. Disengage jib stop strut pins — rotate winch control handle in boom butt (Figure 4-14) COUNTER-CLOCKWISE until both pins are disengaged and hold handle in position.

Outer end of jib stop strut pins are painted white (or other contrasting color) to make pins more visible from ground.

See Figure 4-24 for following procedure.

- b. Slowly lower boom and luffing jib with assist crane to retract jib stop inner strut.

Release winch control handle once jib stop inner strut retracts 2-4 in (51-102 mm).

- c. Stop lowering boom and luffing jib when jib stop inner strut is fully retracted (Figure 4-13, View D).
- d. Remove both quick-release pins from storage holes and install pins to connect jib stop inner strut to outer strut in retracted position (Figure 4-13, View D).

- e. Unpin both 30 ft (9,1 m) long jib stop pendants from underside of boom top and lay pendants on ground.
- f. Rotate jib stop struts forward as shown in Figure 4-19, View D (use assist crane or lever operated hand hoist).
- g. Lower boom top onto blocking approximately two feet high (Figure 4-19).

18. Unhook assist crane from outside assist bracket.

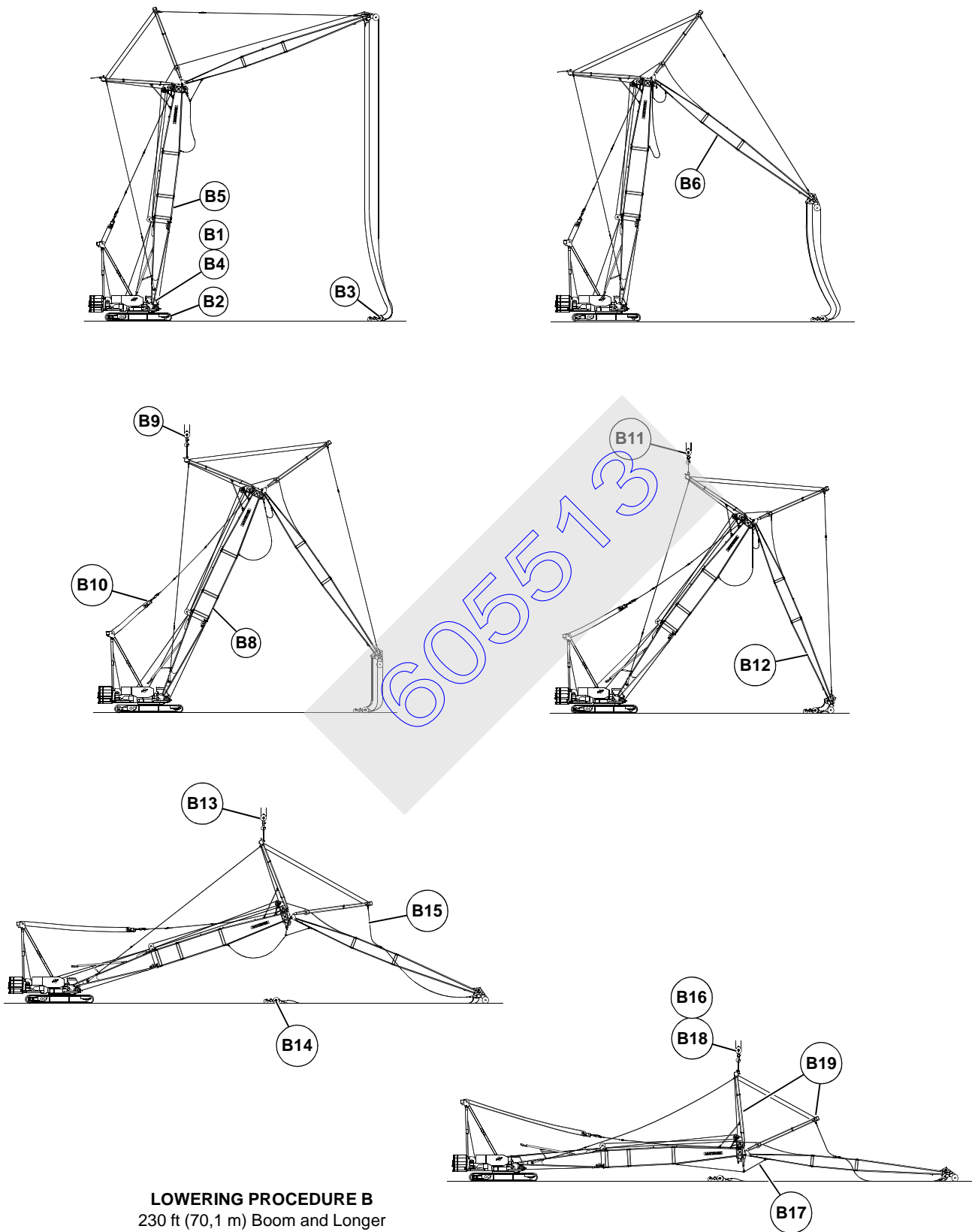
19. Lower jib strut and main strut if required. See Lowering Jib Strut and Main Strut topic in this section.

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LOWERING PROCEDURE B
230 ft (70,1 m) Boom and Longer

Circled reference numbers correspond to numbered steps in lowering procedure.

FIGURE 4-25

Lowering Procedure B – 230 ft (70,1 m) Boom or Longer



DANGER

Moving Part Hazard!

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

Death or severe crushing injuries will occur if personnel come into contact with rollers.

See Figure 4-25 for following procedure.

1. Swing upperworks in line with lowerworks so boom is over **front of crawlers**.
2. Travel front crawler rollers onto blocking.
3. Swing boom and luffing jib slightly to either side of center and lower load block and/or hook and weight ball onto ground. Then swing boom and luffing jib in line with crawlers.



WARNING

Tipping Crane Hazard!

Lower load block and/or hook and weight ball onto ground before lowering boom and luffing jib.

Crane could tip if this step is not performed.

4. Apply swing parking brake and engage swing lock.
5. Raise boom to 83° or higher.
6. Position luffing jib so boom to luffing jib angle is 60°.



WARNING

Falling Jib/Boom Hazard!

Do not lower luffing jib to a boom to luffing jib angle of less than 60°.

Structural damage can result, possibly allowing luffing jib and boom to collapse.

7. Determine angle to which 2250 must be assisted. See table in Luffing Jib Raising Procedure Chart for Outside Assist.
8. Lower boom with 2250 boom hoist until boom is at or slightly above outside assist angle.
9. Position assist crane alongside boom and hook assist crane to outside assist bracket on main strut.

10. Pay out 2250 boom hoist wire rope to maintain a slight sag in boom rigging as boom and luffing jib are lowered with assist crane. **2250 boom hoist must not be used to lower boom and luffing jib — tipping will occur.**



DANGER

Tipping Crane Hazard!

Boom and luffing jib must be lowered with assist crane below angle given in table in Luffing Jib Raising Procedure Chart for Outside Assist.

Do not attempt to lower boom and luffing jib with 2250 boom hoist. Crane will tip.

11. Slowly lower boom and luffing jib with assist crane until jib point rollers contact ground.
12. Depending on boom-jib combination, luffing jib may be hanging vertically when rollers contact ground. If this is the case, raise luffing jib (luff up) until jib is a few degrees forward of vertical.
13. Continue to lower boom and luffing jib slowly with assist crane.
14. Jib point rollers will roll along ground as boom and luffing jib are lowered.
15. Pay out load lines so load block and/or hook and weight ball are not dragged along ground.
16. Jib pendants will slacken as boom and luffing jib are lowered:
 - a. Watch jib strut as boom lowers. Signal assist crane operator to stop lowering and traveling if jib strut comes to within two feet of contacting luffing jib butt.
 - b. Haul in luffing hoist line (luff up) to raise jib strut until jib pendants just start to go into tension.
17. Continue to lower boom and luffing jib with assist crane until jib stop pendants start to go into tension and stop.
18. Retract jib strut stops and disconnect jib stop pendants, as follows (Figure 4-13):
 - a. Disengage jib stop strut pins — rotate winch control handle in boom butt (Figure 4-14) COUNTER-CLOCKWISE until both pins are disengaged and hold handle in position.

Outer end of jib stop strut pins are painted white (or other contrasting color) to make pins more visible from ground.
 - b. Slowly lower boom and luffing jib with assist crane to retract jib stop inner strut.

Release winch control handle once jib stop inner strut retracts a 2-4 in (51-102 mm).

See Figure 4-25 for following procedure.

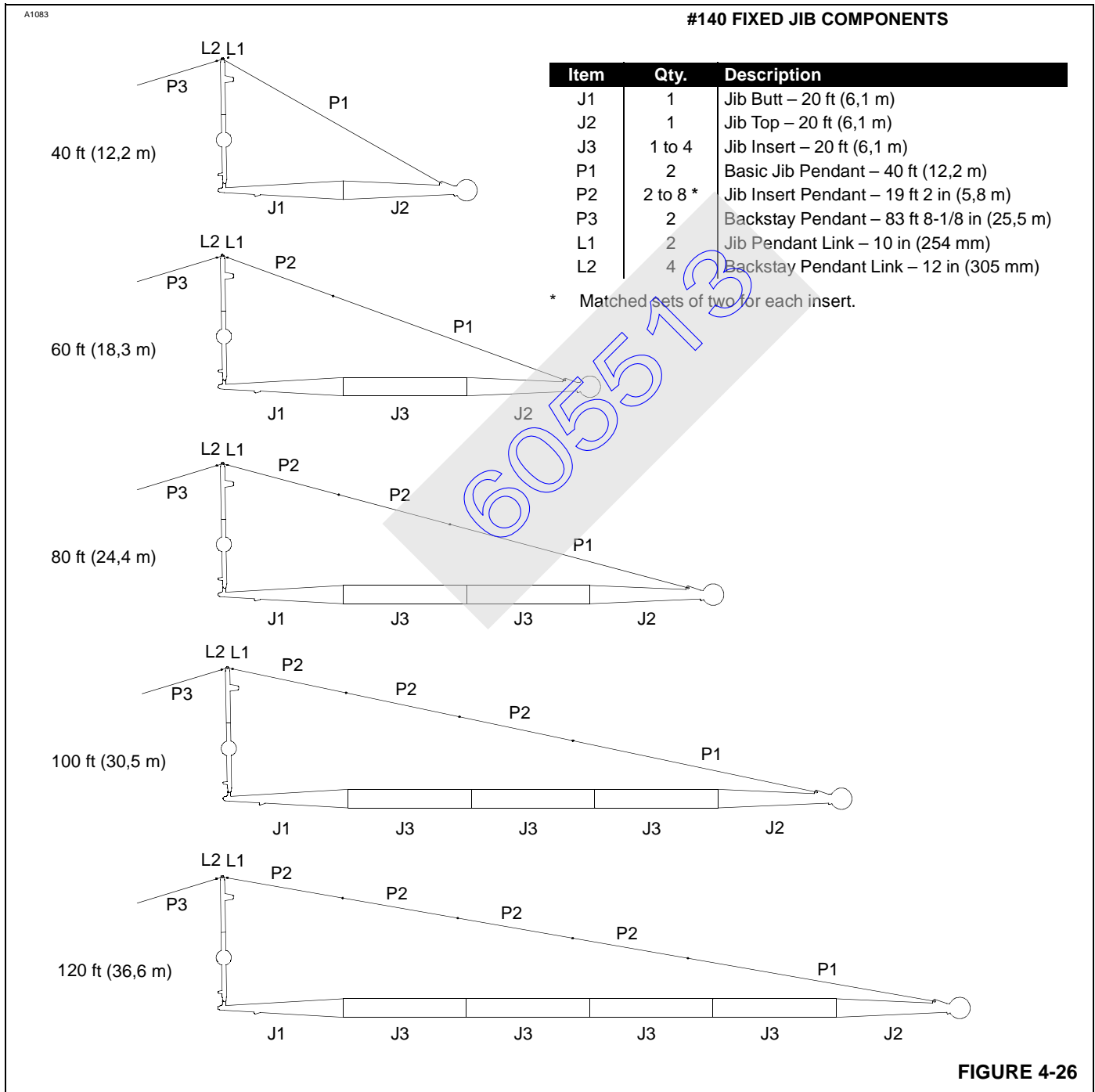
- c. Stop lowering boom and luffing jib when jib stop inner strut is fully retracted (Figure 4-13, View D).
- d. Remove both quick-release pins from storage holes and install pins to connect jib stop inner strut to outer strut in retracted position (Figure 4-13, View D).
- e. Unpin both 30 ft (9,1 m) long jib stop pendants from underside of boom top and lay pendants on ground.

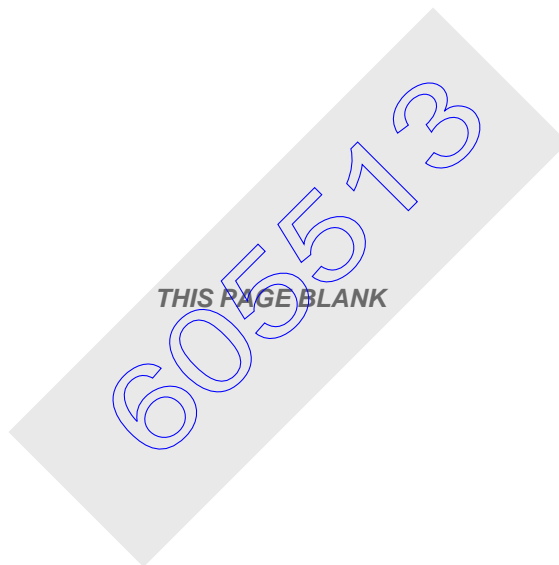
- f. Rotate jib stop struts forward as shown in Figure 4-19, View D (use assist crane or lever operated hand hoist).

- g. Lower boom top onto blocking approximately two feet high (Figure 4-19).

19. Unhook assist crane from outside assist bracket.

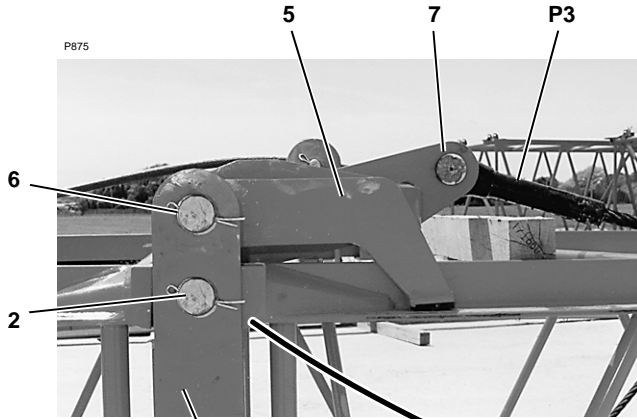
20. Lower jib strut and main strut if required. See Lowering Jib Strut and Main Strut topic in this section.



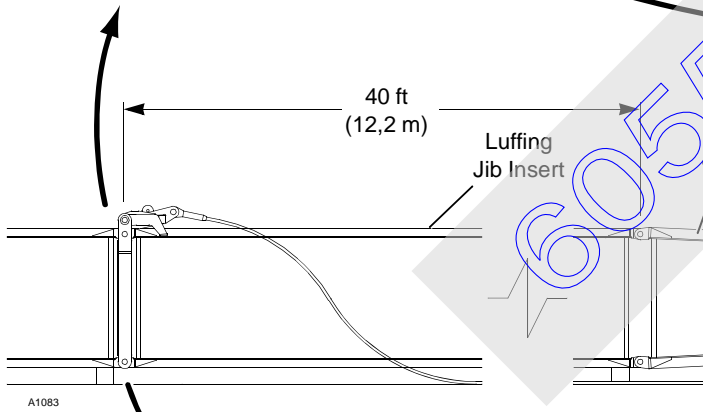


Item	Qty.	Description
1	2	Backstay Link
2*	2 or 4	Pin with Cotter Pins
3	1	Washer
4	1	Retaining Pin with Cotter Pins
5	1	Backstay Support
6	2	Pin with Cotter Pins
7	2	Pin with Cotter Pin
P3	2	Backstay Pendant

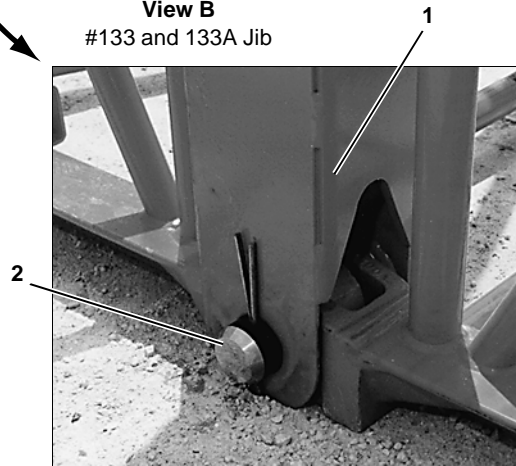
* These pins are 12 in (305 mm) long and replace standard pins supplied with luffing jib inserts.



View A
#133A
or #133



View B
#133 and 133A Jib



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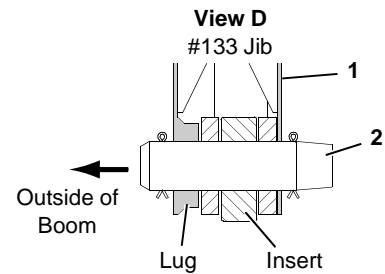
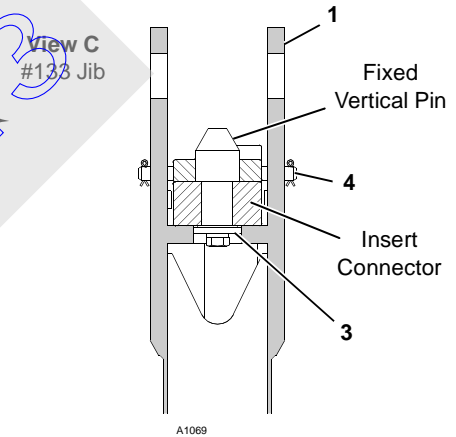


FIGURE 4-27

JIB RIGGING – #140 FIXED JIB

General

This section contains installation and removal instructions for the #140 fixed jib on the #133 or #133A luffing jib.

The fixed jib consists of a 20 ft (6,1 m) butt and a 20 ft (6,1 m) top, providing a basic length of 40 ft (12,2 m). Inserts are available to assemble additional jib lengths of 60 – 120 ft (18,3 – 36,6 m) as shown in Figure 4-26.

See the applicable Jib Lifting Capacities Chart to determine boom and luffing jib length limitations with the fixed jib attached.

Preparing Boom and Luffing Jib

This section assumes that the boom and luffing jib are completely assembled and ready to be raised. See Jib Rigging Guide in this section for detailed assembly instructions.

The luffing jib must be prepared as follows for fixed jib installation and use:

1. Front crawler rollers blocked. Per Luffing Jib Raising Procedure, **all boom and jib combinations must be raised and lowered over front of blocked crawlers.**
2. Lower boom point sheaves removed if specified in Luffing Jib Raising Procedure Chart. See Lower Boom Point in Section 4 of the Crane Operator's Manual for procedure.
3. Fixed jib backstay links installed at proper location between luffing jib inserts as shown in Figure 4-27. See installation procedure in this section.

Luffing Jib Configuration

The luffing jib can be in one of the following configurations when installing fixed jib.

1. Boom and luffing jib fully assembled and laid out on ground as shown in Figure 4-28.
2. Boom and luffing jib fully assembled and raised to jack-knife angle called for in Luffing Jib Raising Procedure Chart at the end of this section with luffing jib rollers resting on ground (Figure 4-30, View A).

Installing Fixed Jib

Install Backstay Links

See Figure 4-27 for following procedure.

1. For #133A Luffing Jib proceed as follows:
 - a. Lift backstay link (1) into position at end of appropriate luffing jib insert. Links are symmetrical, so their position does not matter.
 - b. Align connecting holes in backstay link with connecting holes in insert (Views A and B) and support backstay link so it cannot fall during step 2d.
 - c. Repeat steps 1a and 1b for other backstay link.
 - d. Lift next insert into position and align connecting holes.
 - e. Pin backstay links and inserts together as shown in Views A and B. **Long tapered end of pins (2) must point inward.**
2. For #133 Luffing Jib proceed as follows:
 - a. Lift backstay link (1) into position at end of appropriate luffing jib insert. Links are symmetrical, so their position does not matter, **except that lug at bottom connecting hole must be toward outside of boom (View D).**
 - b. Engage hole in backstay link with washer (3, View C) on underside of insert connector.
 - c. Install retaining pin (4, View C) through holes on butt side of backstay link to prevent link from falling off insert.
 - d. Repeat steps 2a – 2c for backstay link on other side of insert.
 - e. Proceed to install next boom insert.
 - f. Pin backstay links and inserts together as shown in View D. **Long tapered end of pins (2) must point inward.**

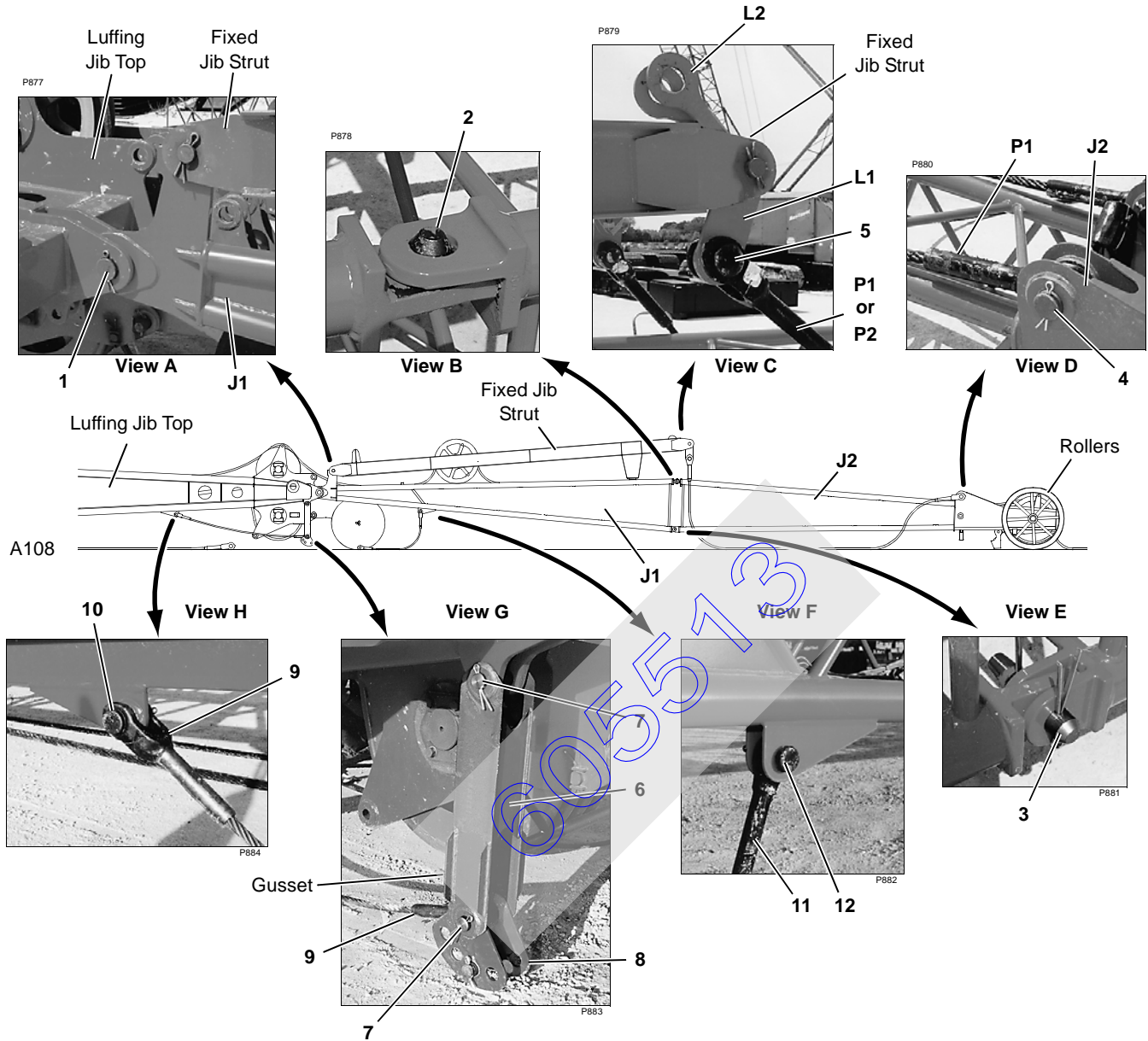
Install Backstay Pendants

See Figure 4-27, View A for following procedure.

NOTE: If boom and luffing jib will be jack-knifed into position before fixed jib is installed, perform this procedure before boom and luffing jib are raised.

1. Lift backstay support (5) into position between ears of links (1).
2. Align connecting holes in support with those in links.
3. Pin supports to links.
4. Pin backstay pendants (P3) to lugs on support (5).

Lay backstay pendants on ground along side luffing jib. **Fixed jib strut will be raised and backstay pendants pinned to strut after boom and luffing jib are raised.**



Item	Qty.	Description	Item	Qty.	Description
1	2	Pin with Cotter Pins	10	2	Pin with Cotter Pin
2	2	Fixed Vertical Pin	11	2	Jib Stop Pendant – 6 ft (1,8 m)
3	2	Removable Horizontal Pin with Cotter pins	12	2	Pin with Cotter Pin
4	2	Pin with Cotter Pins	J1	1	Jib Butt
5	2	Pin with Cotter Pin	J2	1	Jib Top
6	1	Jib Stop Strut	L1	2	Jib Pendant Link
7	4	Pin with Cotter Pins	L2	4	Backstay Pendant Link
8	4	Adjusting Links	P1	2	Basic Jib Pendant
9	2	Jib Stop Pendant – 7 ft 7 in (2,3 m)	P2	2 to 8	Jib Insert Pendant

FIGURE 4-28

Install Jib Sections



DANGER Collapsing Jib Hazard!

To prevent death or serious injury, do not stand on, inside, or under jib sections during assembly. Always stand outside of jib sections when installing connecting pins.

Fixed jib sections have FACT™ connectors:

- Top connectors are joined by fixed vertical pins that hook into holes in the adjacent section as shown in Figure 4-28, View B.
- Bottom connectors are joined by removable horizontal pins as shown in Figure 4-28, View E.

Install Jib Butt

See Figure 4-28 for following procedure.

NOTE: Fixed jib strut is shipped in stored position on the jib butt.

1. Lift fixed jib butt (J1) into position at end of luffing jib top.
2. Align holes in fixed jib butt with holes in luffing jib top and install connecting pins (1, View A).
3. Lower jib butt to ground.

Install Jib inserts

See Figure 4-28 for following procedure.

1. Lift first insert into position and engage top connector holes with fixed vertical pins (2, View B) in jib butt.
2. Lower insert to ground.
3. Attach nylon lifting slings to chords at top end of jib butt and hook assist crane to slings.
4. Lift butt until bottom connector holes between butt and insert are aligned.
5. Install removable horizontal pins (3, View E) to connect insert to butt. **Long tapered end of pins must point in.**
6. Lift next insert into position and engage top connector holes with fixed vertical pins (2, View B) in adjacent insert.
7. Attach nylon lifting slings to chords at top end of adjacent insert and hook assist crane to slings.
8. Lift adjacent insert until bottom connector holes between inserts are aligned.
9. Install removable horizontal pins (3, View E) to connect inserts. **Long tapered end of pins must point in.**

10. Repeat steps 6 – 9 until all inserts are installed.

Install Jib Top

See Figure 4-28 for following procedure.

1. Lift jib top (J2) into position and engage top connector holes with fixed vertical pins (2, View B) in jib butt or insert.
2. Lower jib top to ground.
3. Attach nylon lifting slings to chords at top end of jib butt or last insert and hook assist crane to slings.
4. Lift jib butt or insert until bottom connector holes between butt or insert and jib top are aligned.
5. Install removable horizontal pins (3, View E) to connect jib top to butt or insert. **Long tapered end of pins must point in.**

Install Jib Pendants

See Figure 4-28 for following procedure.

NOTE: Jib pendants are furnished in matched sets of two and must be installed in matched sets — pendant on one side of insert must match pendant on other side of insert.

1. Pin basic jib pendants (P1, View D) to jib top (J2).
2. Lay pendants on ground along side jib.
3. If required, pin jib insert pendants (P2) to basic pendants (P1).
4. Pin basic jib pendants (P1) or insert pendants (P2) to links (L1) at jib strut (View C).

Install Jib Stop

See Figure 4-28 for following procedure.

1. Slide jib stop frame (6) into position under luffing jib top.
2. Raise jib stop frame into position, align connecting holes, and pin strut to luffing jib top (View G). **Gussets on frame must be toward ground.**
3. Pin jib stop adjusting links (8, View G) and pendants (9) to strut.
4. Pin other end of pendants (9, View H) to lugs on luffing jib top.
5. Pin pendants (11, View F) to lugs on fixed jib butt. **Do not attempt to pin pendants (11) to adjusting links (8) until after jib point is raised clear of ground (see Raising Boom and Jib procedure later in this section).**

Install Load Line

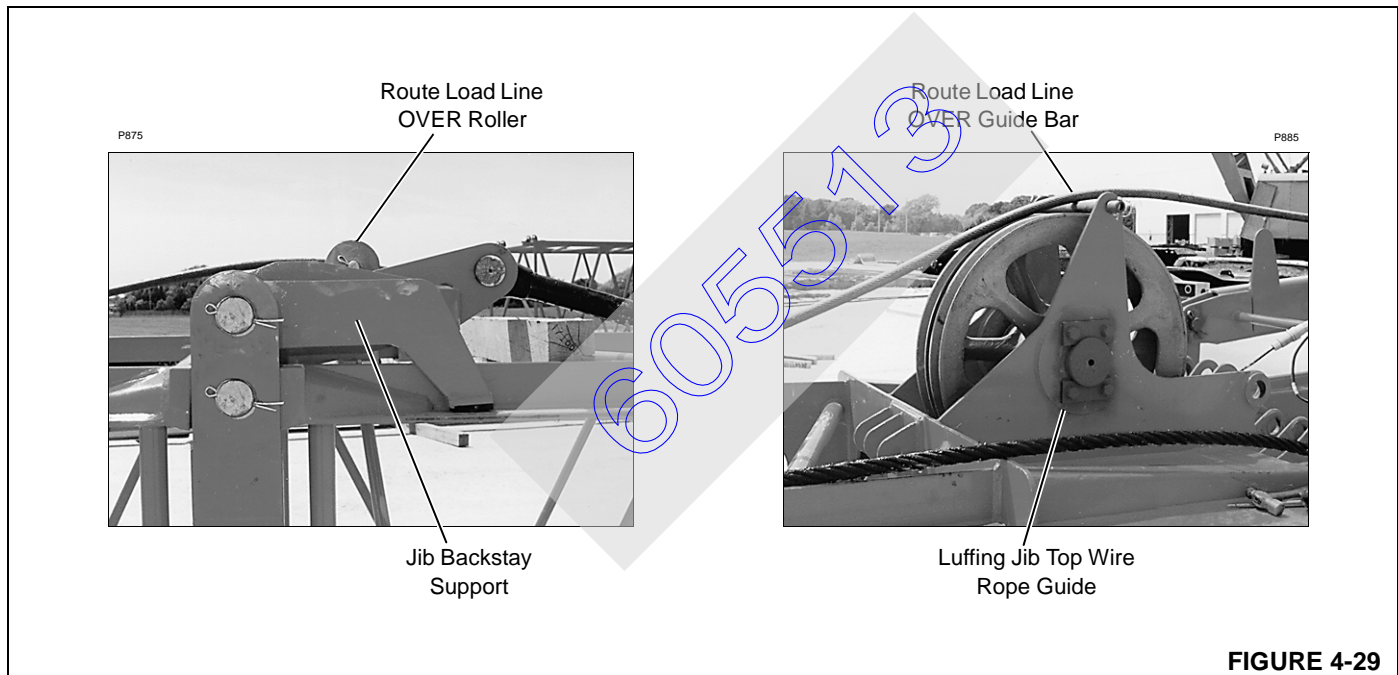
NOTE: If boom and luffing jib will be jack-knifed into position before the fixed jib is installed, then perform steps 1 and 2 before raising boom and luffing jib and securely fasten the load line to luffing jib point.

1. Route load line from desired drum through proper guide sheaves on boom and luffing jib strut (see Figure 4-41).
2. Be sure to route load line **over** roller on jib backstay support and **over** rope guide bar on luffing jib top as shown in Figure 4-29.
3. If equipped with a load indicator, route load line around load sensing sheave as shown in Figure 4-43.

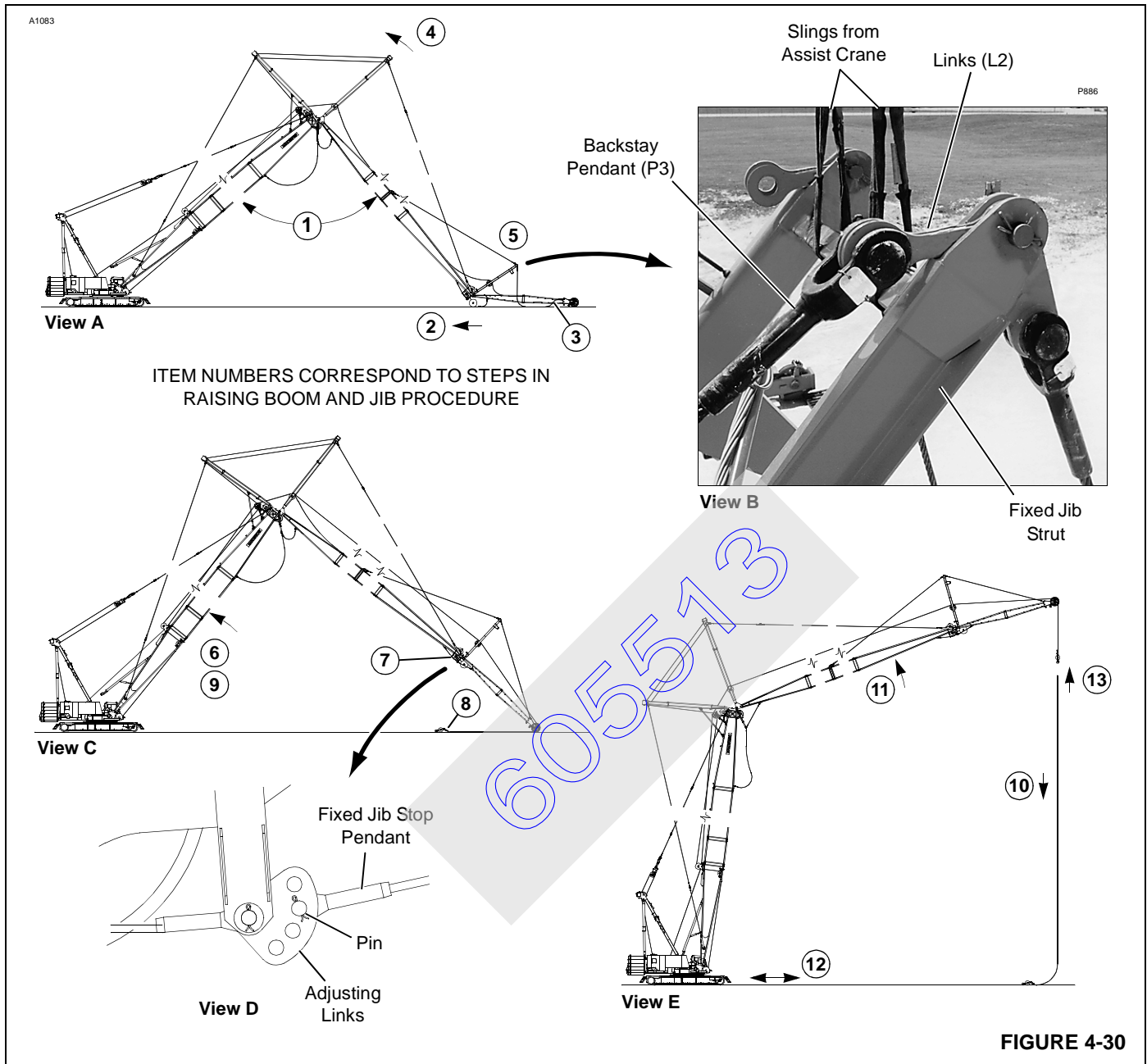
4. Install block-up limit for fixed jib point (see Block-Up Limit Control in Section 6 of this manual).
5. Pull approximately 50 ft (15,2 m) of load line past end of jib point and securely fasten load line to end of fixed jib. Weight ball or load block will be installed just prior to lifting fixed jib from ground.

**WARNING****Falling Wire Rope Hazard!**

For long boom and short luffing jib combinations, load line on boom side of attachment can overhaul load line on luffing jib side of attachment. Load line could fall off boom as attachment is raised. Securely fasten load line to jib point (fixed or luffing) before raising attachment.

**FIGURE 4-29**





Raising Boom and Jibs (Luffing and Fixed)

See Figure 4-30 for following procedure. Item numbers in Figure 4-30 correspond to numbered steps in following procedure.

NOTE: Monitor angles on digital display in operator's cab while raising boom and luffing jib.

The following procedure assumes the operator is thoroughly familiar with the Model 2250 Luffing Jib and is experienced with its raising procedure. See Raising Boom and Jib — Standard Arrangement

earlier in this section and see Luffing Jib Raising Procedure Chart at end of this section.

! WARNING
Moving Part Hazard!

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

Death or severe crushing injuries can occur if personnel come into contact with rollers.

Perform pre-raising checks given earlier in this section.

1. Raise boom and luffing jib (jack knife) to BOOM TO LUFFING JIB ANGLE specified in Luffing Jib Raising Procedure Chart.

CAUTION

Avoid Boom and Jib Damage!

Never raise boom and luffing jib to point that boom to luffing jib angle is less than 60°. Structural damage can result.



WARNING

Tipping Hazard!

Crane can tip if boom and luffing jib are not at specified angle when boom is raised with fixed jib attached.

2. If fixed jib is already installed, it will roll along ground as boom and luffing jib are raised.
3. If fixed jib is not installed, install it after boom and luffing jib have been positioned at specified boom to luffing jib angle.
4. Once boom and luffing jib have been raised to specified boom to luffing jib angle, slowly haul in luffing hoist wire rope until luffing jib pendants start to go into tension and **stop**.



WARNING

Tipping Crane Hazard or Structural Damage!

Crane can tip or structural failure of attachment can occur if following precautions are not observed:

- Do not attempt to raise luffing jib until boom is positioned at 83°.
 - Do not exceed 83° boom angle while raising luffing jib – 83° boom angle must be maintained until luffing jib is positioned at required operating radius given in capacity chart.
5. Connect fixed jib backstay pendants (View B):
 - a. Using an assist crane, raise fixed jib strut and pin backstay pendants (P3) to links (L2). **A personnel hoist is required for this procedure.**
 - b. Lower strut until it is supported by backstay pendants and disconnect assist crane.

CAUTION

Avoid Jib Damage!

Take care not to allow jib pendants to get caught on side of fixed jib sections while boom is raised during step 6. Damage to pendants or jib sections can occur.

6. Slowly raise boom – **do not raise luffing jib (luff up)** – until fixed jib is hanging from backstay pendants with rollers just clear of ground (View C). **Do not raise boom higher than 83°.**
 - In some cases, fixed jib rollers will lift off ground before boom is raised to 83°. If this occurs, stop raising boom and go to step 7.
 - If fixed jib rollers have not lifted off ground when boom is raised to 83°, slowly raise luffing jib until fixed jib is hanging from backstay pendants with rollers just clear of ground (View C). Then go to step 7.
7. Connect fixed jib stop pendants to holes in adjusting links (View D) which give least pendant slack or some preload. **A personnel hoist is required for this procedure.**
8. Install weight ball or load block.



WARNING

Falling Load Hazard!

Load line going up boom can overhaul load line going down luffing jib. Do not untie load line from luffing jib or fixed jib until weight ball or load block has been installed. Load line can fall off boom if this precaution is not followed.



WARNING

Tipping Crane Hazard!

Do not lift weight ball or load block from ground until boom has been raised to desired operating angle and luffing jib has been positioned at proper operating radius to lift weight ball or load block. Crane could tip.

9. If not already done, raise boom to 83° **while maintaining specified boom to luffing jib angle.**
10. Pay out load line as boom and jibs are raised.
11. Position luffing jib at required operating radius.
12. Travel as required to position weight ball or load block below fixed jib point.
13. Lift weight ball or load block to desired position.

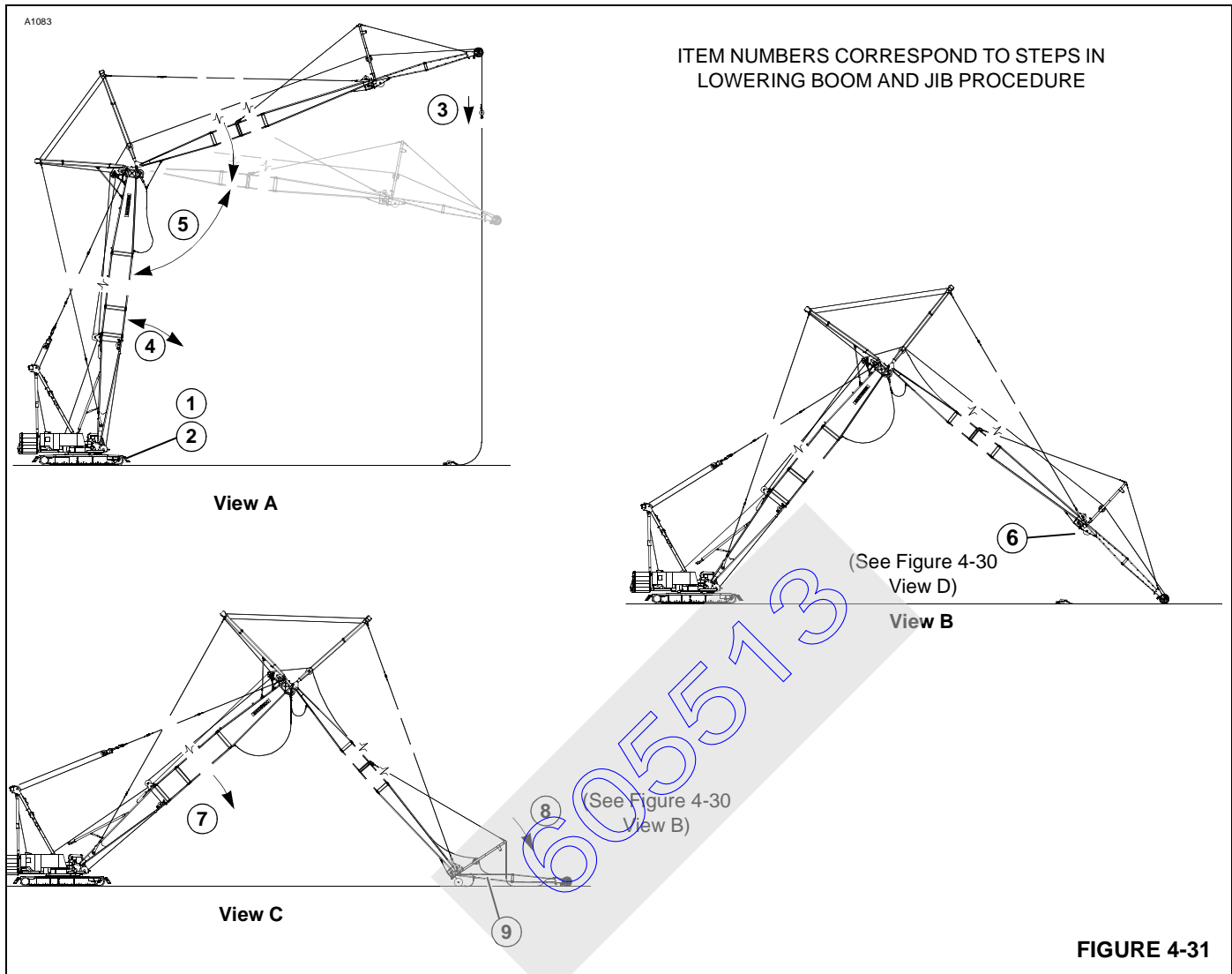


FIGURE 4-31

Lowering Boom and Jibs

See Figure 4-31 for following procedure. Item numbers in Figure 4-31 correspond to numbered steps in following procedure.

NOTE: Monitor angles on digital display in operator's cab while raising boom and luffing jib.

The following procedure assumes the operator is thoroughly familiar with the Model 2250 Luffing Jib and is experienced with its lowering procedure. See Lowering Boom and Jib — Standard Arrangement earlier in this section and see Luffing Luffing Jib Raising Procedure Chart at end of this section.

1. Swing upperworks in-line with lowerworks so boom is over **front of crawlers**.
2. Travel crawler rollers onto blocking.



WARNING

Moving Part Hazard!

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

Death or severe crushing injuries can occur if personnel come into contact with rollers.

**WARNING****Tipping Crane Hazard!**

Lower all boom and jib combinations over blocked crawlers; otherwise, crane can tip.

**WARNING****Tipping Crane Hazard!**

Lower all weight balls or load blocks onto ground before lowering boom and jibs. Crane can tip if this step is not performed.

3. Swing boom and jibs slightly to either side of center and lower weight ball or load block onto ground. Then swing boom and jibs in-line with crawler

**WARNING****Tipping Crane Hazard or Structural Damage!**

Do not lower boom and jibs to ground until boom has been positioned at 83° and luffing jib has been positioned at specified boom to luffing jib angle. 83° boom angle must not be exceeded during lowering procedure. Crane can tip or structural failure of attachment can occur if this precaution is not observed.

4. Position boom at 83° as shown in View A.
5. Lower luffing jib to BOOM TO LUFFING JIB ANGLE specified in Luffing Jib Raising Procedure Chart.
 - a. If fixed jib point rollers contact ground before luffing jib reaches specified boom to luffing jib angle, proceed to step 6 and disconnect jib stop pendants. Then continue to lower luffing jib to specified angle.
 - b. If fixed jib point rollers do not contact ground before luffing jib reaches specified boom to luffing jib angle, slowly lower boom until rollers just contact ground. Then proceed to step 6 and disconnect fixed jib stop pendants.
6. Disconnect fixed jib stop pendants from adjusting links (Figure 4-30, View D). **A personnel hoist is required for this procedure.**

CAUTION**Avoid Jib Stop Damage!**

Do not continue to lower boom or luffing jib once fixed jib rollers contact ground. Damage to fixed jib stop pendants and/or fixed jib butt will occur.

7. Continue to lower boom slowly — **do not lower luffing jib** — until luffing jib rollers contact ground as shown in View C.

Fixed jib point rollers will roll along ground as boom is lowered.
8. Disconnect fixed jib backstay pendants (Figure 4-30, View B):
 - a. Using an assist crane, support fixed jib strut.
 - b. Unpin backstay pendants (P3) from links (L2).
 - c. Lower strut onto fixed jib butt and disconnect assist crane.
9. Remove fixed jib at this time or after boom and luffing jib have been lowered to ground level. See Luffing Jib Rigging Guide section and Luffing Jib Raising Procedure Chart in this manual for detailed lowering instructions.

Removing Fixed Jib

Removing the fixed jib is opposite of installing the jib.

The jib butt and jib strut can be shipped as an assembled unit.

**WARNING****Collapsing Jib Hazard!**

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

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

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

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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.

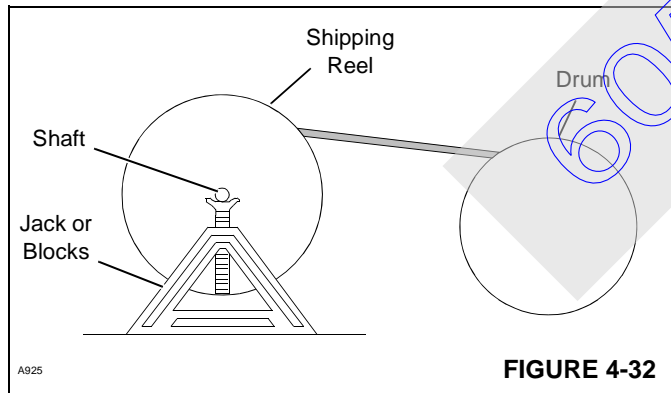
Removing Wire Rope from Shipping Reel

CAUTION!

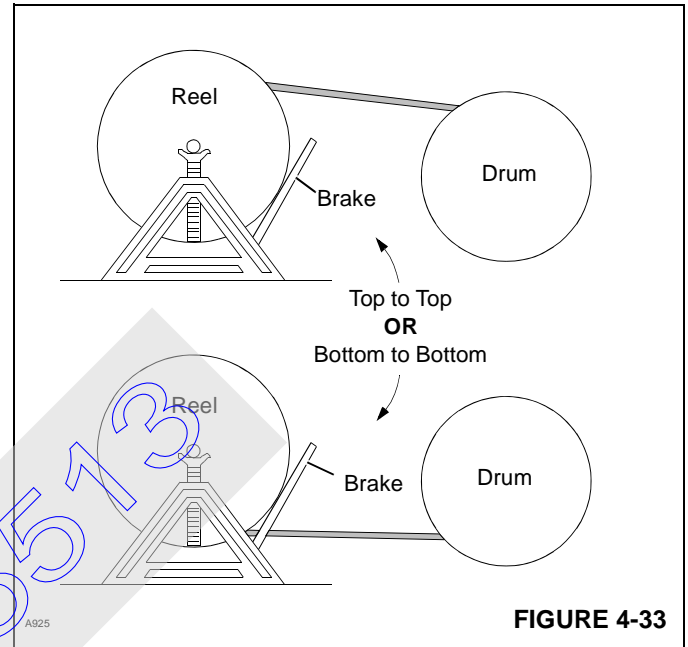
Wire Rope Damage!

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 4-32.



2. Provide a brake at shipping reel (see Figure 4-33) so wire rope can be wound tightly onto drum.
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 4-33.
4. Avoid dragging wire rope in dirt or around objects that can scrape, nick, cut, or crush wire rope.



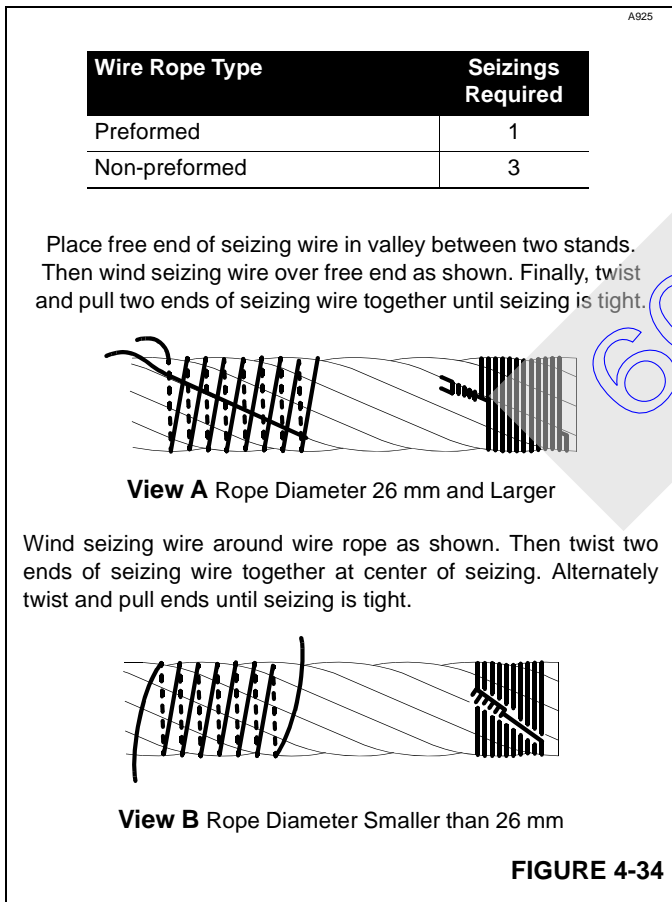
Seizing and Cutting Wire Rope

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 4-34 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.



Anchoring Wire Rope to Drum

See Figure 4-35 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.

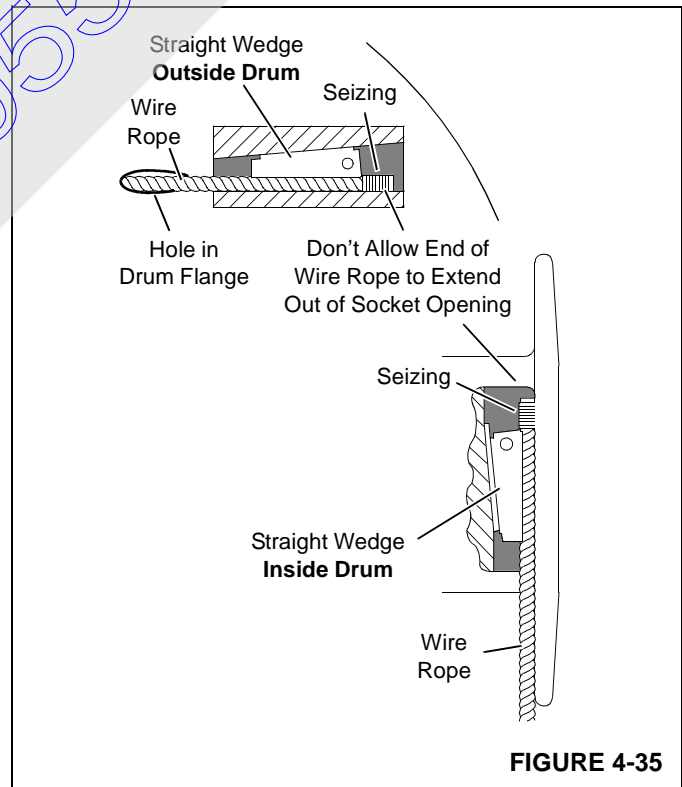
1. Assemble wire rope and wedge to drum socket.
2. Tighten wedge, rapping back of wedge with a brass drift pin and hammer.



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.



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.

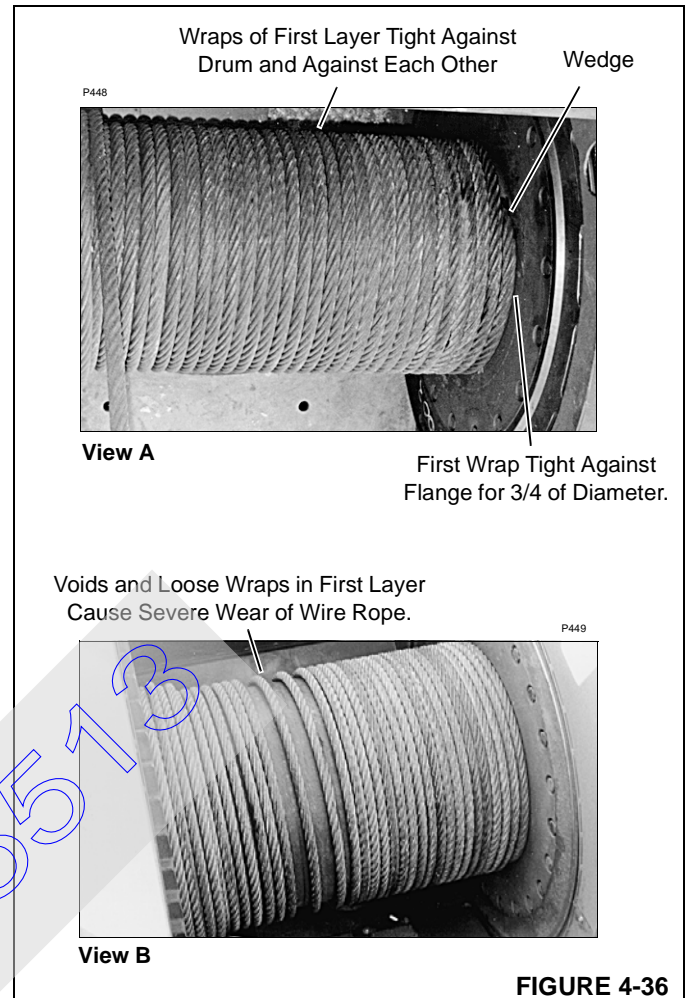
See Boom Rigging Drawing at end of this section for correct type, size, and amount of wire rope to be installed on boom hoist drums.

1. Carefully inspect drums and all rope guides, rollers, and sheaves for wear or damage that can cause wire rope to wear or be cut. If defects cannot be fixed, replace faulty parts.
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 4-36).

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.



CAUTION!

Wire Rope Damage!

Voids or spaced wraps in first layer (Figure 4-36, 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 4-37 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.**

 **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.

TL (Tail Length)

Standard 6 to 8 Strand Wire Rope

Minimum of 6 rope diameters, but not less than 6 in (152 mm).

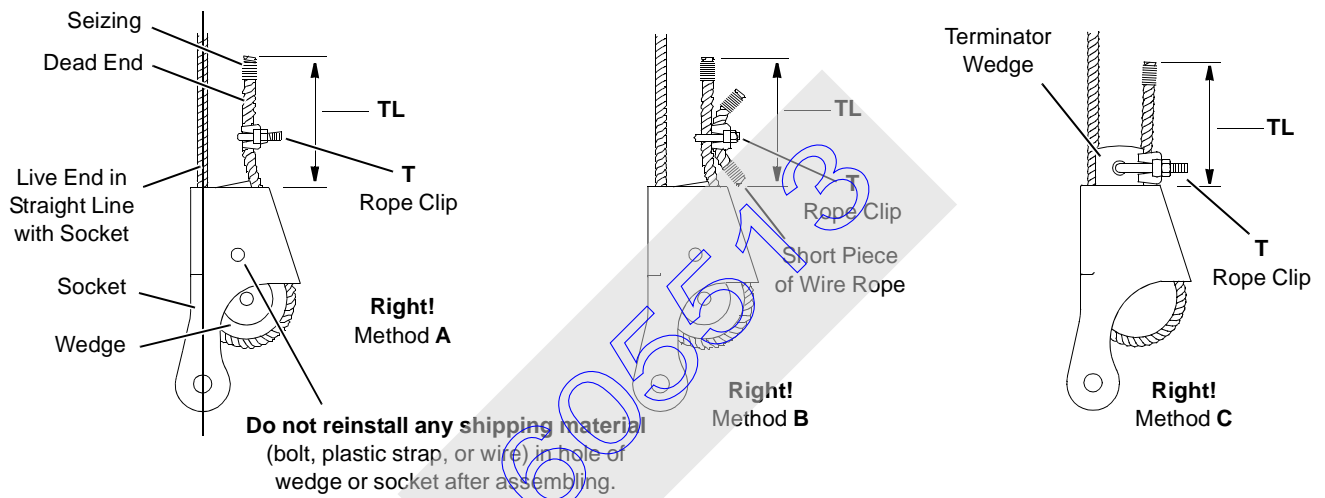
Rotation Resistant Wire Rope

Minimum of 20 rope diameters, but not less than 6 in (152 mm).

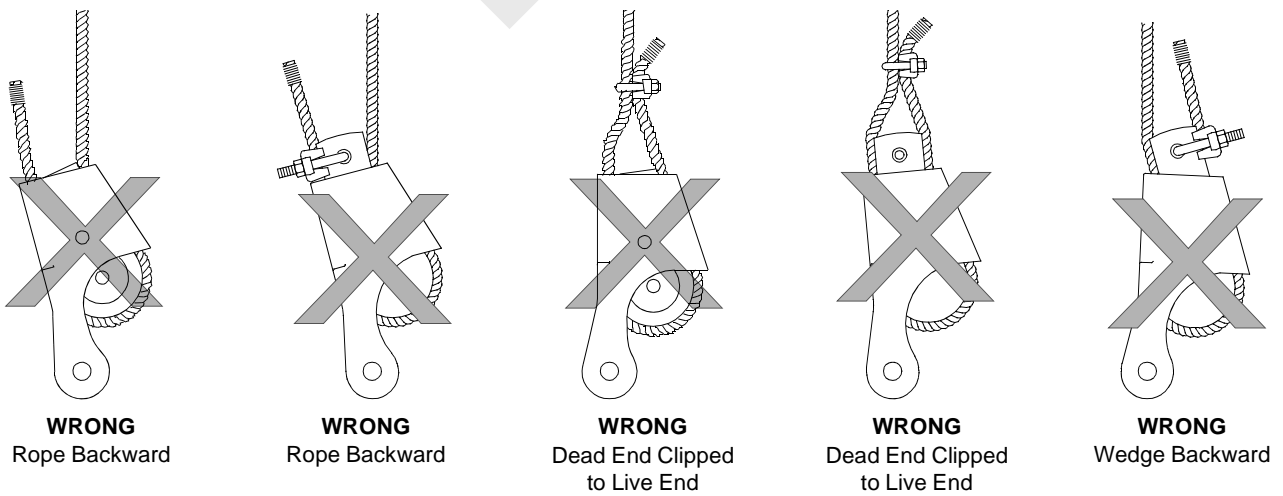
T (Rope Clip Nut Torque)

inch (mm)	Wire Rope/Clip Size			
	7/8 (22,23)	1 (25,4)	1-1/8 (28,58)	1-1/4 (31,75)
Torque				
* ft/lbs (kN/m)	225 (0,30)	225 (0,30)	225 (0,30)	360 (0,49)

* Tightening torque values shown are based on threads being clean, dry and free of lubrication.



ALL ARE DANGEROUS AND PROHIBITED!



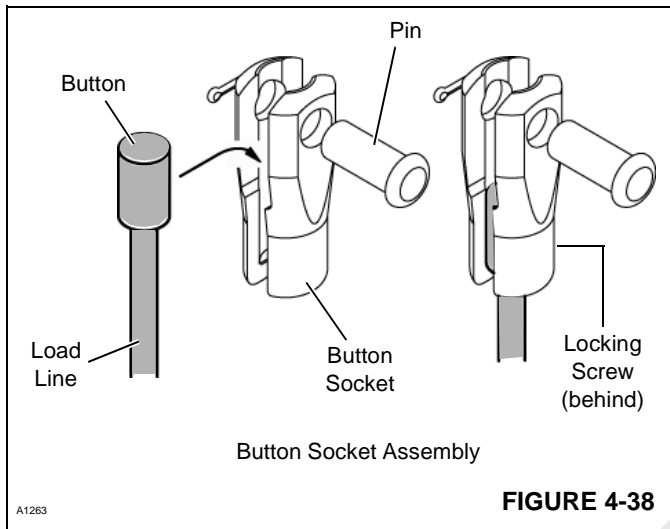
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FIGURE 4-37

Anchoring Wire Rope to Button Socket

See Figure 4-38 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.



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 4-39 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.



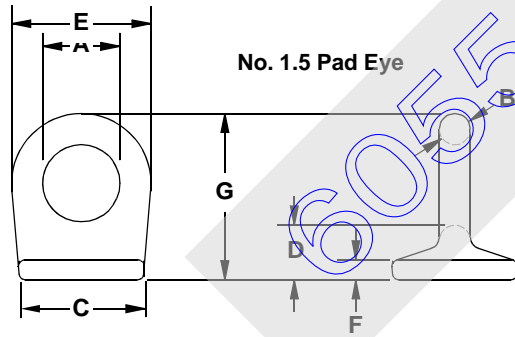
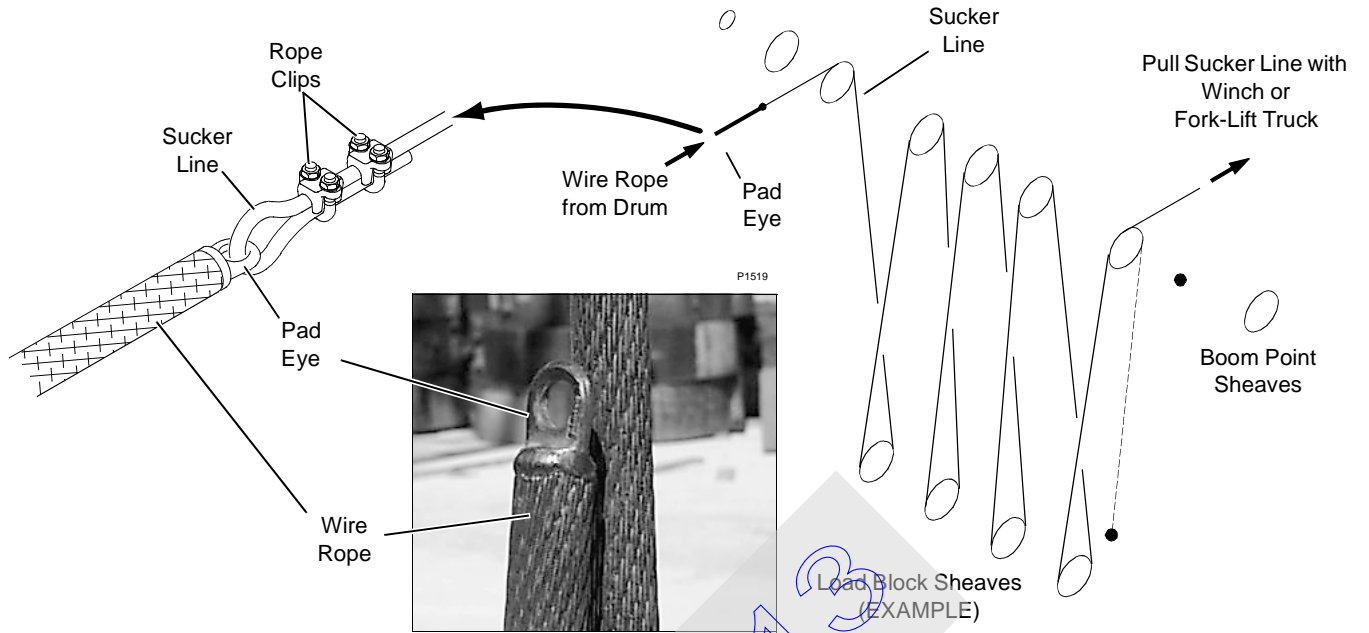
WARNING

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.

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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 4-39

LOAD BLOCK REEVING

Reeving Diagrams

This topic provides load block reeving information for the 2250 equipped as follows:

- #133 or 133A Luffing Jib on #44 Boom. See Figure 4-42 for recommended reeving.
- #140 Fixed Jib on #133 or 133A Luffing Jib. See Figure 4-43 for recommended reeving.

Load Block

The following load blocks are available from Manitowoc:

- 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)

NOTE: Manitowoc recommends laced reeving as shown in this section. Using this type reeving will result in the least amount of block spin and load rotation. It is normal with this type reeving for the block to tip slightly when it is raised and lowered empty.

When reeving rotation resistant wire rope with odd parts of line, **dead end rope as close to center of block as possible to avoid rope damage.**

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.

Universal Anchor Joint

The universal anchor joint on the #140 jib point (Figure 4-43) provides an alternate dead end location for 2-part reeving. The anchor joint swivels in both directions to prevent bending loads. Its location in the jib point minimizes twisting of the load line.

The universal anchor joint must be removed from the jib point when a 2 or 4-part line is dead ended at the upper dead end lug and when a 3-part line is used. **If universal anchor joint is not removed, load line will rub against anchor joint support when operating at high boom angles.**

Duplex Hook

The duplex hook capacities are based on the lifting sling angles given in Figure 4-40. Attach the load so it is balanced equally on each ear of the hook.

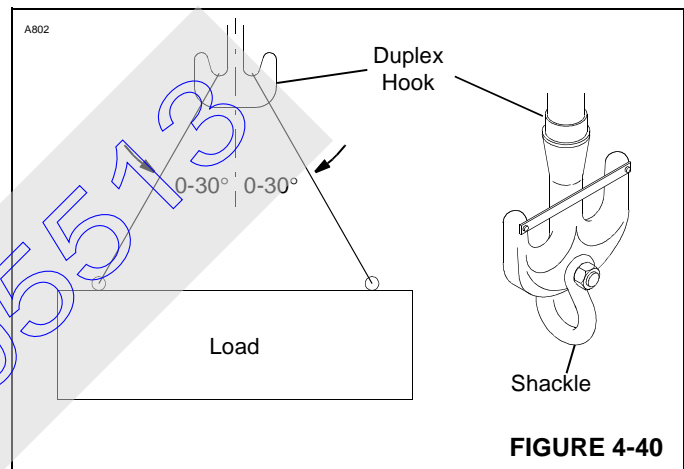
The duplex hook has a hole to which a shackle can be attached as shown in Figure 4-40.

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.



Guide Sheaves

See Figure 4-41 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.

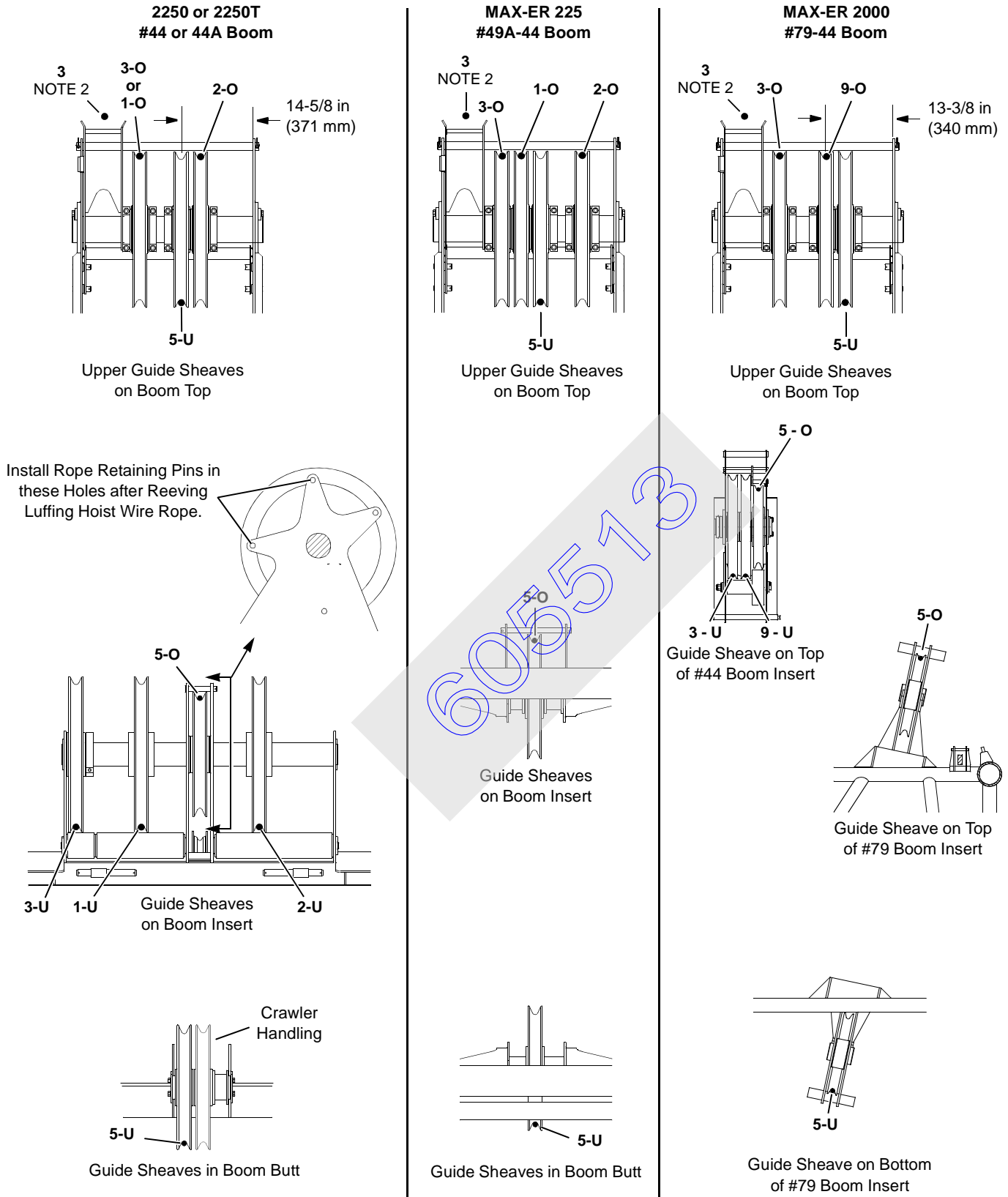
Wire Rope Installation

See Wire Rope Installation in this section for following instructions:

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

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FIGURE 4-41

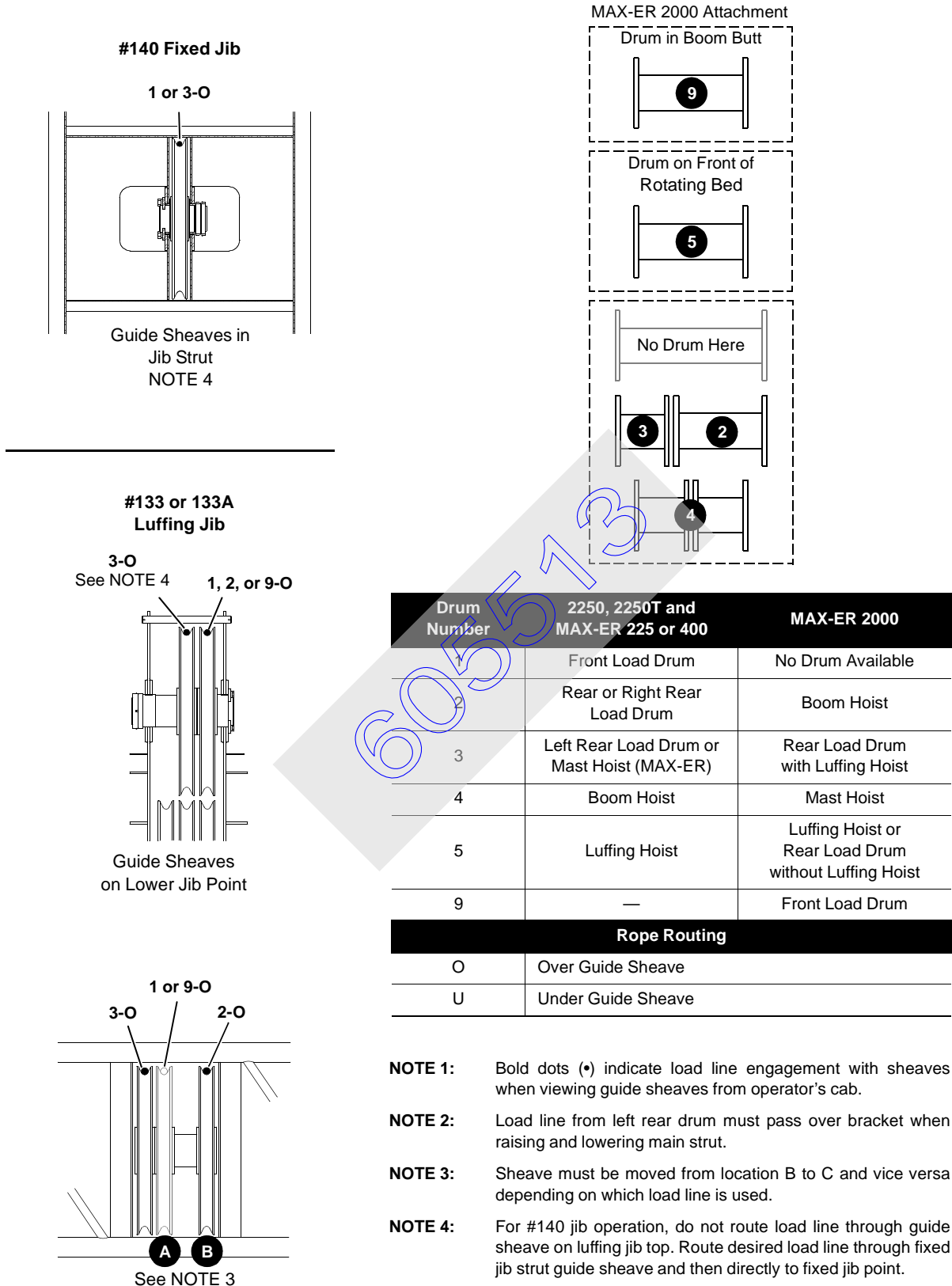
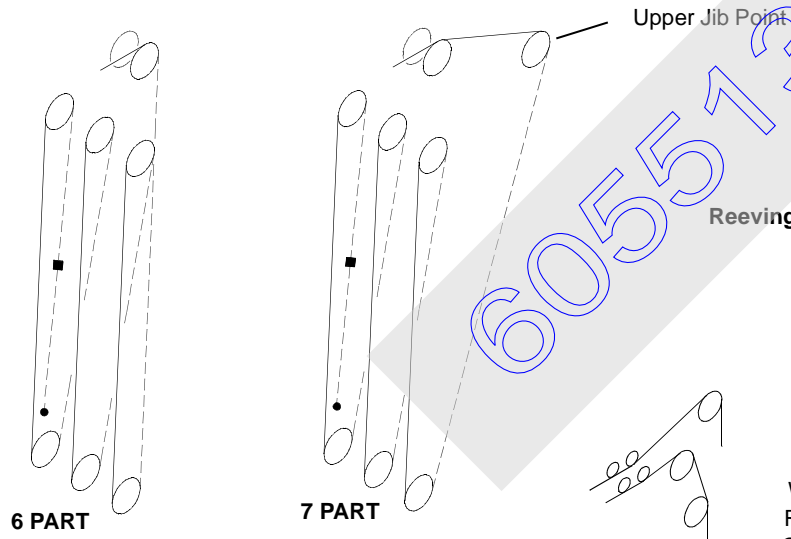
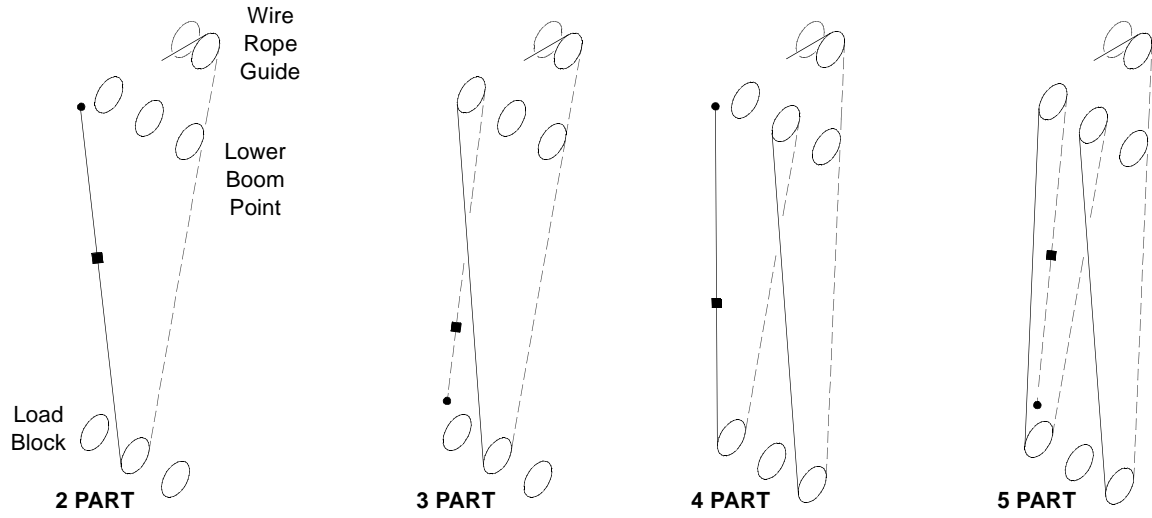


FIGURE 4-41 continued

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Reeving Diagrams #133 or 133A Luffing Jib

■ = Suggested Location of Weight for Block-Up Limit Control

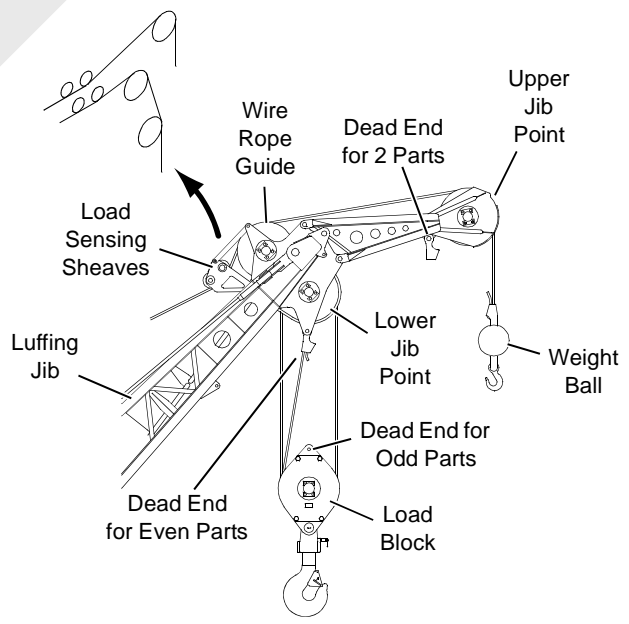
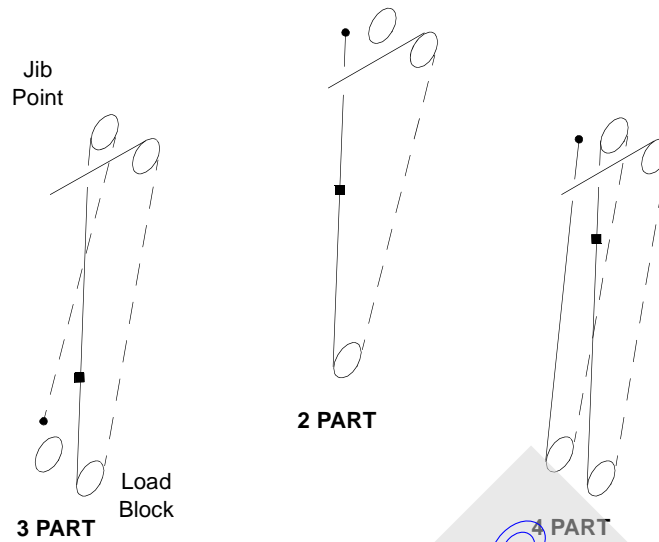


FIGURE 4-42

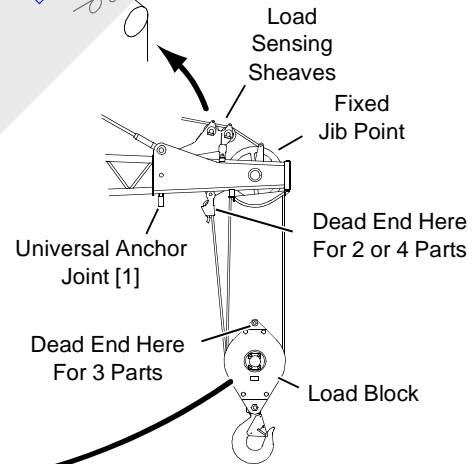


! WARNING

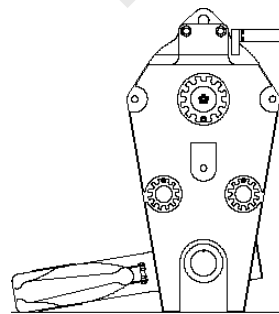
Avoid Death or Serious Injury!

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.



[1] Must be removed when 2 or 4 part line is dead ended at upper dead end lug or when 3 part line is used.



Reeving Diagrams #140 Fixed Jib

FIGURE 4-43

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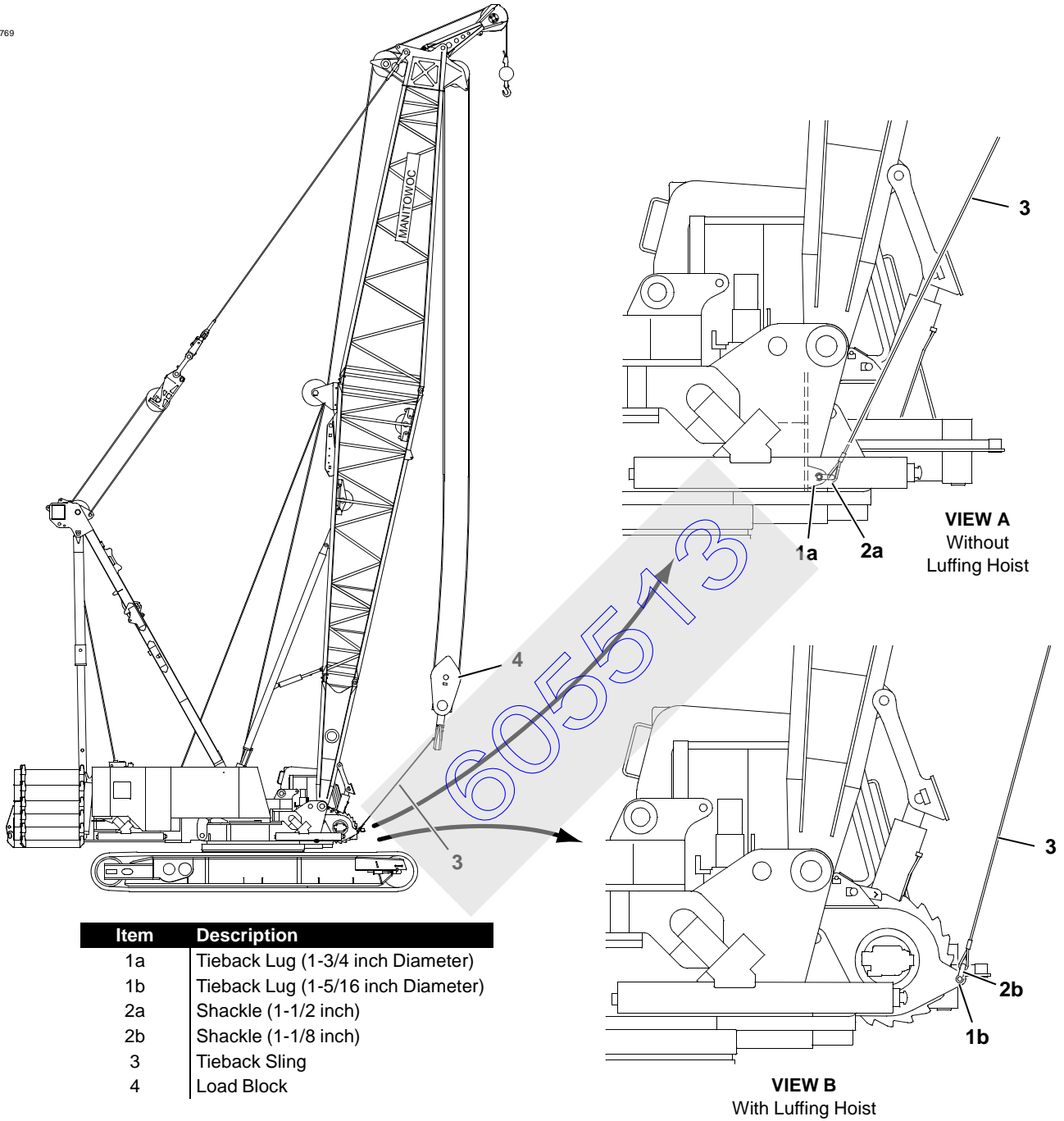


FIGURE 4-44

LOAD BLOCK TIEBACK

See Figure 4-44 for this topic.

General

Manitowoc provides a lug on the front of the rotating bed (View A) and on the luffing hoist frame (View B) for tying 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 4-44 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.
-

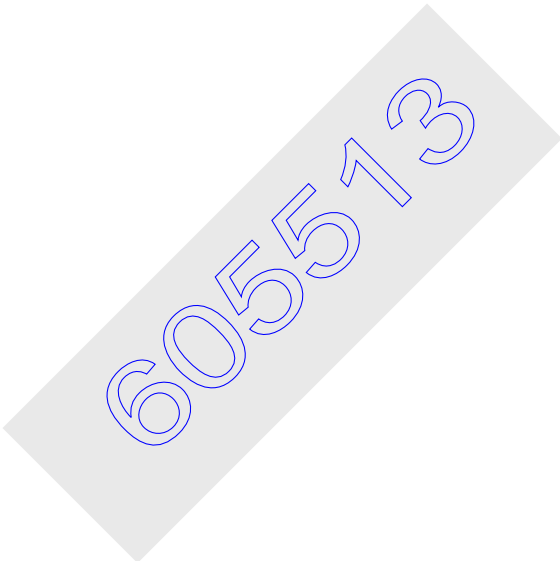
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SECTION 5 LUBRICATION

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Lube and Coolant Product Guide 5-1



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SECTION 5 LUBRICATION

LUBRICATION GUIDE

See F2105 at the end of this section.

LUBE AND COOLANT PRODUCT GUIDE

See the publication at the end of this section.

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SECTION 6 MAINTENANCE

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SECTION 6 MAINTENANCE

GENERAL MAINTENANCE

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 on the luffing jib butt (see Figure 6-1).

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 6-2) 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.**

Disconnecting Luffing Jib Angle Indicator

Perform the following steps when removing the luffing jib (see Figure 6-1):

1. Unplug electric cord from receptacle on sending unit.
2. Connect protective cap to receptacle on sending unit.
3. Connect electric cord to shorting plug on boom point junction box (see Block-Up Limit Control Assembly drawing at end of Section 4 in this manual).

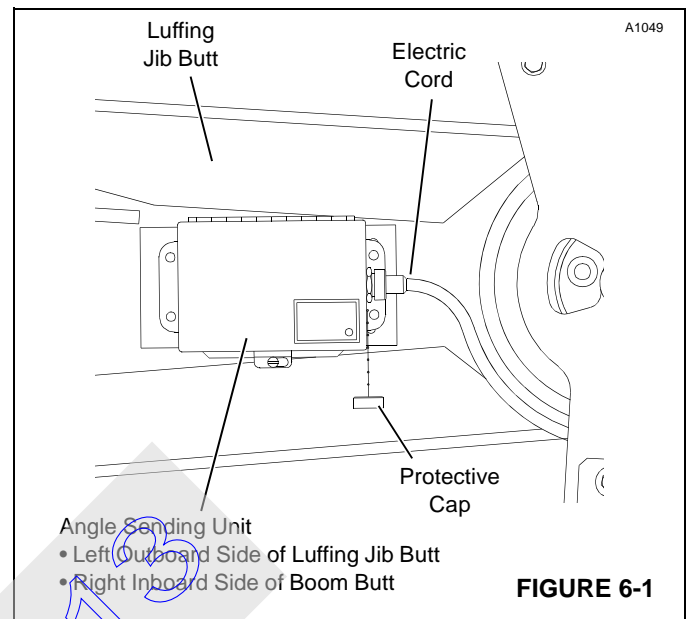


FIGURE 6-1

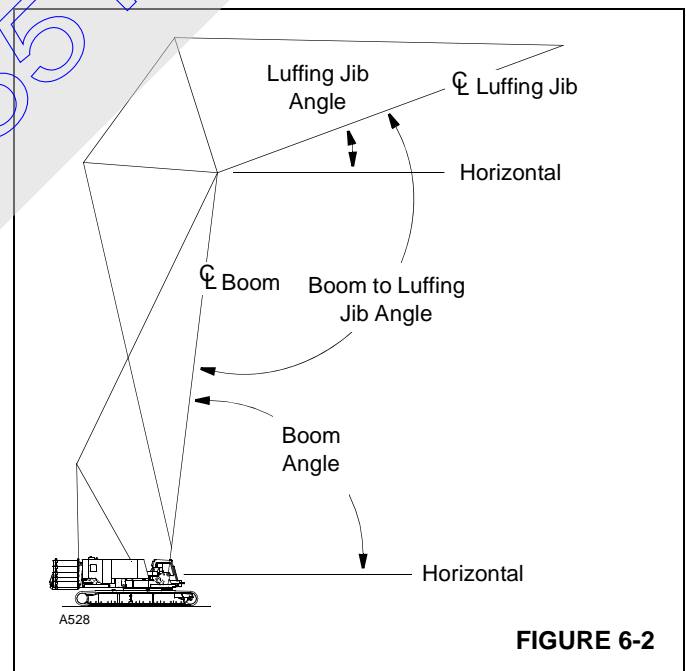


FIGURE 6-2

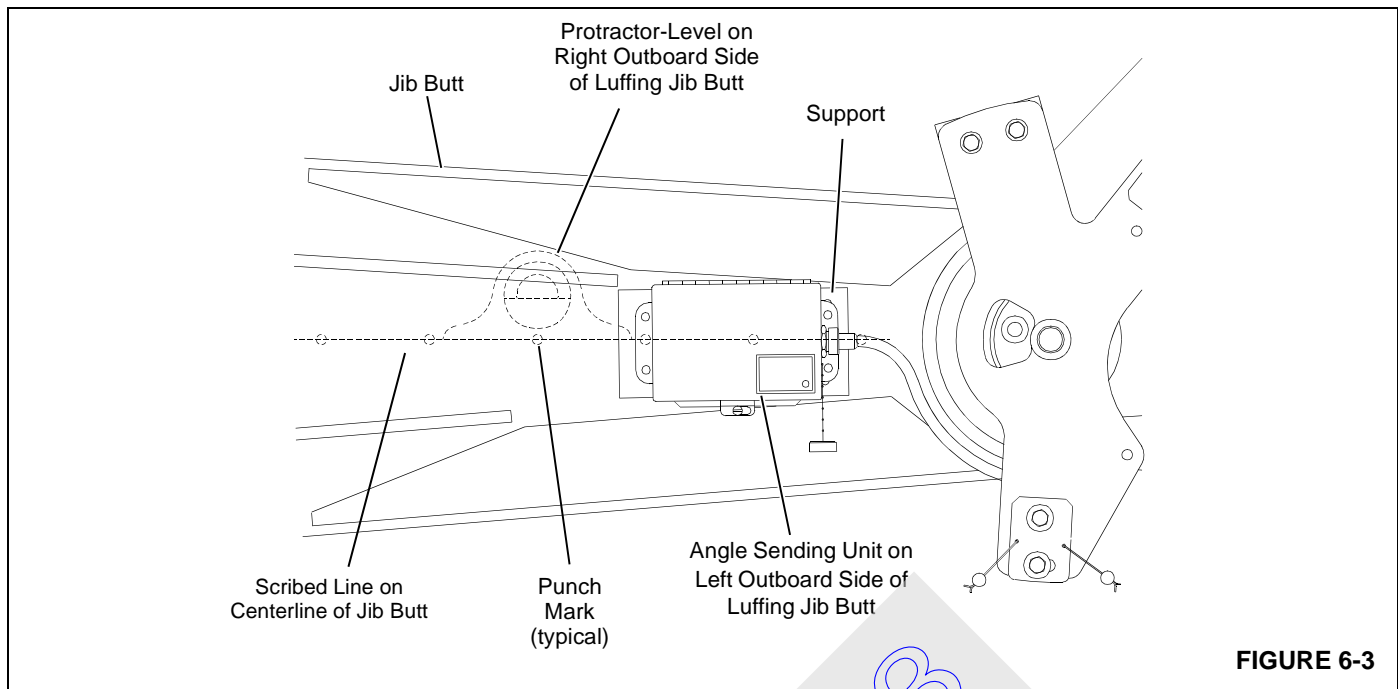


FIGURE 6-3

Adjusting Angle Indicators

See Figure 6-3 for following procedure.

To adjust the angle indicator at the boom butt see instructions in the 2250 Service Manual or the MAX-ER Operator's Manual.

Adjust the luffing jib angle indicator 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 centerline of jib butt as shown in Figure 6-3.
3. Hold a protractor-level along scribed line.
4. Record angle indicated on protractor-level.
5. Scroll to corresponding luffing jib angle on digital display in operator's cab.
6. Angle shown on digital display must match angle recorded in step 4 plus or minus one degree.
7. If necessary, loosen mounting screws and rotate sending unit in mounting slots until reading on digital display matches angle on protractor-level.
8. Securely tighten mounting screws to lock adjustment.

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

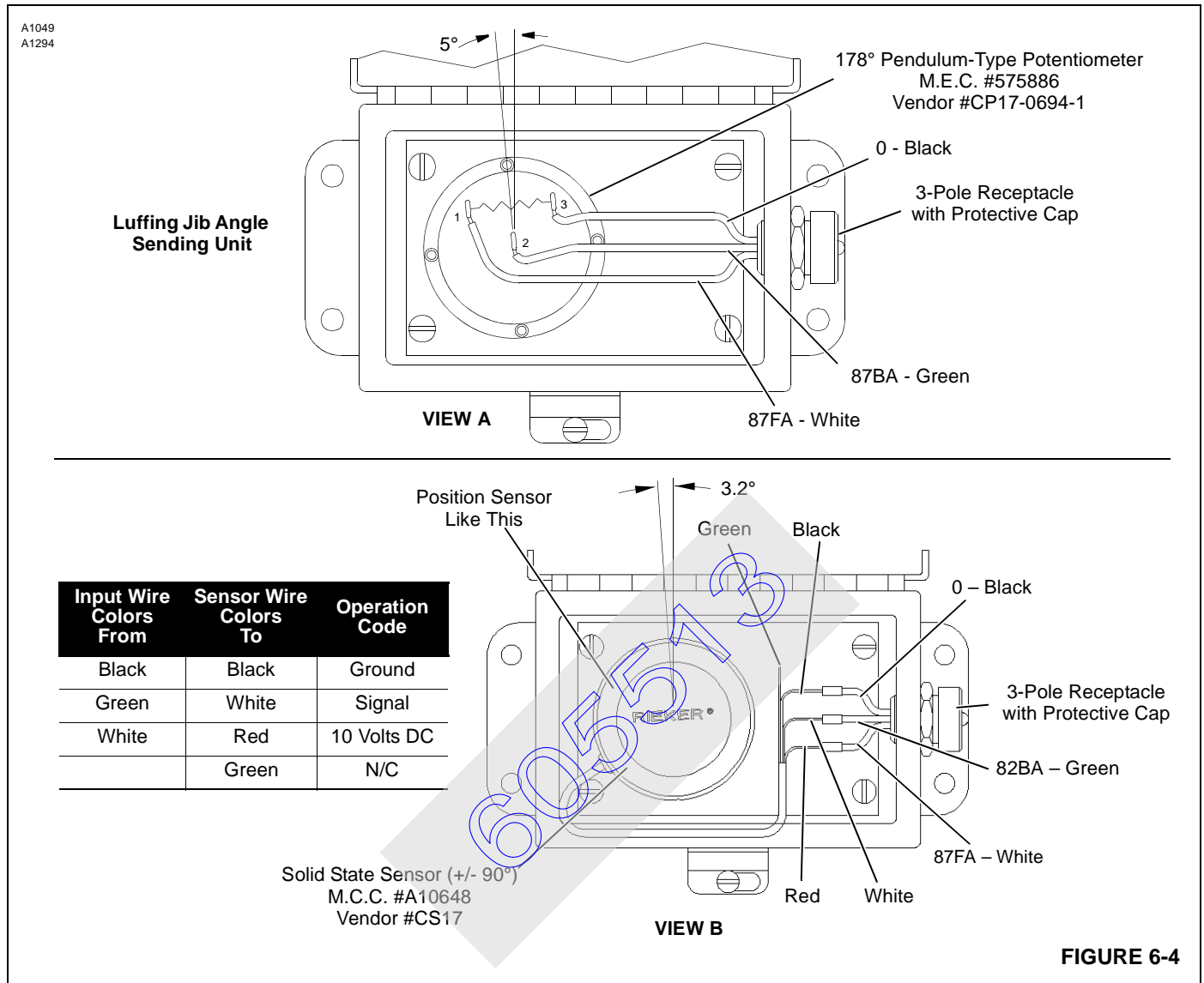
When replacing parts in the pendulum-type potentiometer sending unit, take the following precautions (see Figure 6-4, View A):

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 Figure 6-4, 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.



AUTOMATIC BOOM STOP ADJUSTMENT

General

This crane has limit switches which automatically stop the boom hoist and apply its brake when the boom is raised or lowered to a preset angle (see Tables in Figure 6-5 or Figure 6-6).

NOTE: For MAX-ER 2000 boom angles, refer to the Operator's Manual supplied with the MAX-ER.



WARNING

Falling Attachment Hazard!

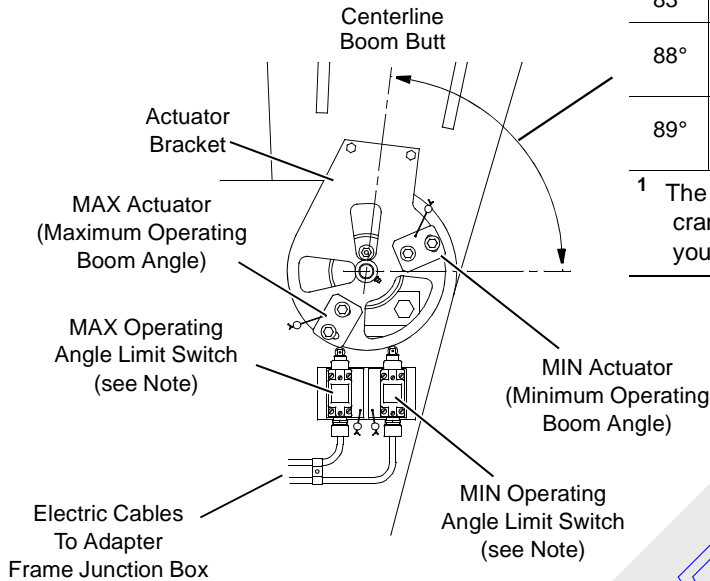
Do not operate crane unless automatic boom stop is properly adjusted and operational. Do not adjust MAX operating angle higher than specified.

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).

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View at Right Side Boom Hinge Pin
#44 Heavy Lift Boom

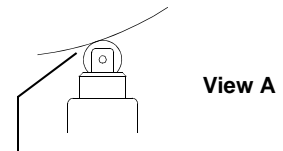


Boom Angle	
0°	Minimum (MIN) angle. The optional minimum boom stop can be adjusted to any angle between 4° above or below horizontal.
83°	All #44 Boom Lengths with Luffing Jib Removed.
88°	#44 Boom Lengths with 133 or 133A Luffing Jib Installed when boom up limit can be bypassed ¹ .
89°	#44 Boom Lengths with 133 or 133A Luffing Jib Installed when boom up limit cannot be bypassed ¹ .

¹ The boom up limit cannot be bypassed on current production cranes. To determine if the boom up limit can be bypassed on your crane, perform the test given on page 6-6 in this section.

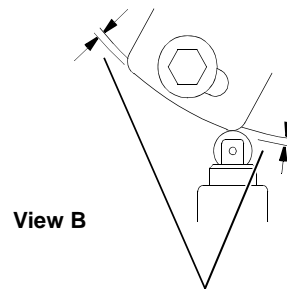
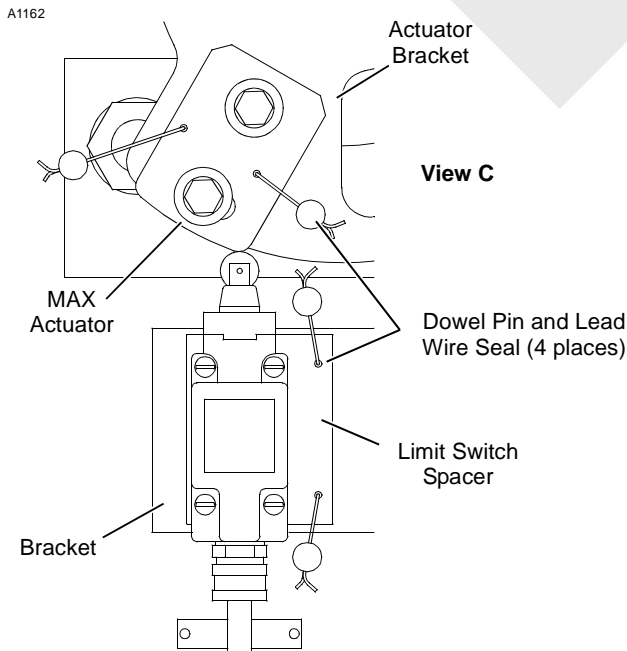
NOTE: Connect electric wires to normally closed contacts (2 and 5) inside both limit switches.

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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.



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.

FIGURE 6-5

Operation

See for Figure 6-5 following description.

When the boom is below the maximum angle, limit switch (View A) is closed. The boom hoist can be operated.

When the boom is raised to the maximum angle, Max actuator (View C) opens limit switch. Boom hoist operation stops automatically because the open limit switch turns off power to the boom hoist electric circuit. The boom hoist pump shifts to neutral and the boom hoist brake applies to stop boom movement.



WARNING Falling Attachment Hazard!

If boom fails to stop for any reason, stop engine immediately. Troubleshoot system to determine problem.

Do not resume operation until problem has been corrected.

An optional minimum boom stop is available. It operates the same as the maximum boom stop, but in the down direction.

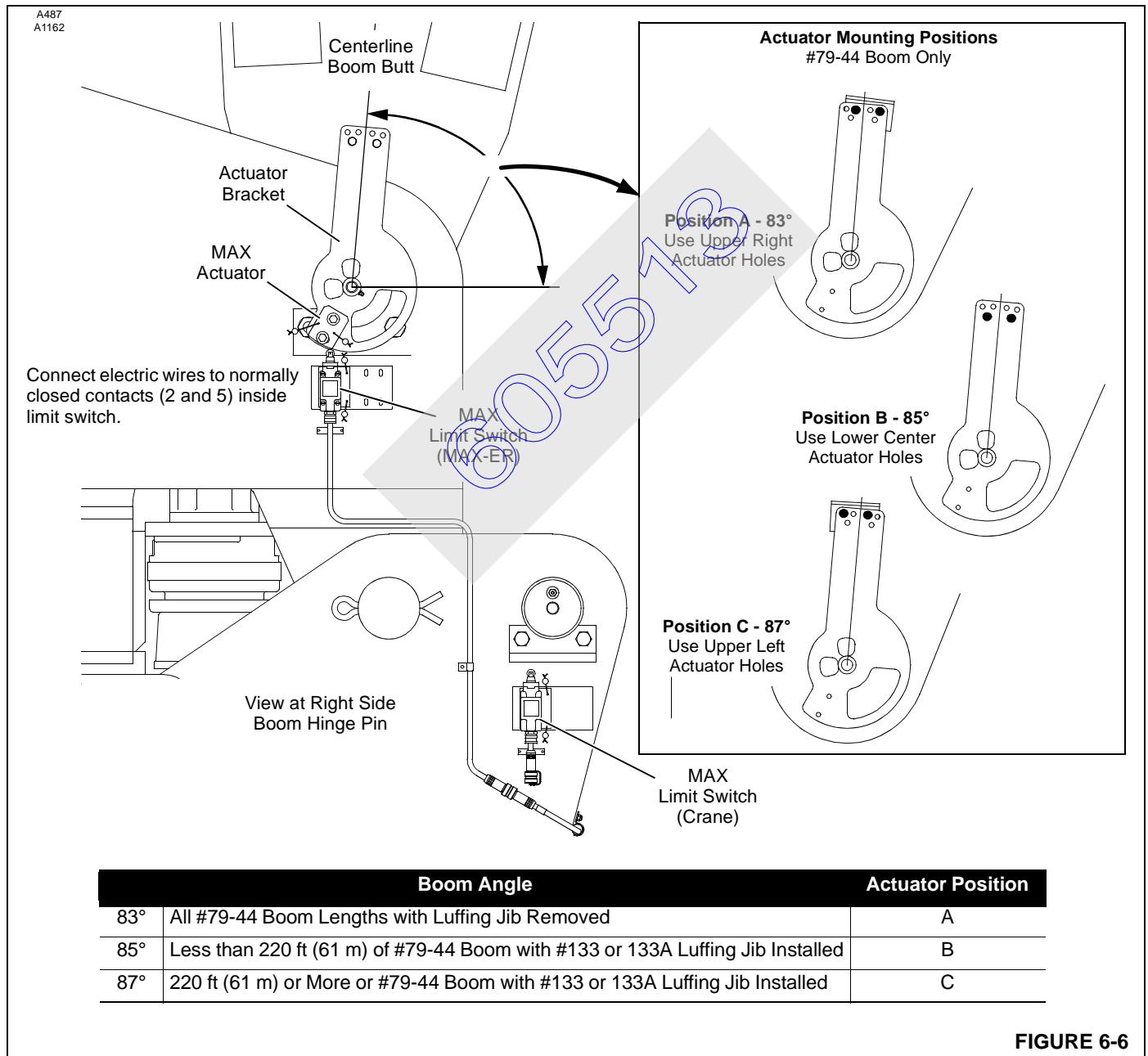


FIGURE 6-6

Bypass Limit Test

Perform the following test to determine if the boom up limit on your crane can be bypassed or not.

 **WARNING**
Crush Hazard!

Maintain constant communication between operator and assistant during following steps.

Stay clear of moving parts.

1. Lower the boom onto blocking at ground level.
2. Have an assistant push boom up limit switch plunger in to trip the limit switch open.
3. Rotate limit bypass key to the bypass position and hold.
4. Try to boom up SLOWLY — do not raise the boom any higher than necessary to perform the test:
 - a. If the boom rises, your boom up limit can be bypassed.
 - b. If the boom does not rise, your boom up limit cannot be bypassed.

The test is complete: release the limit bypass key and the boom stop rod to the normal operating positions.

Maintenance

At least once weekly, check that the automatic boom stop stops the boom at the specified maximum angle. If not, replace any worn or damaged parts and/or adjust the boom stop.

Once the automatic boom stop is properly adjusted, it should not require periodic adjustment. Adjustment is required, however, when:

- The luffing jib is installed or removed.
- Parts are replaced.

Monthly, grease the fitting on the actuator bracket.



WARNING

Falling Attachment Hazard!

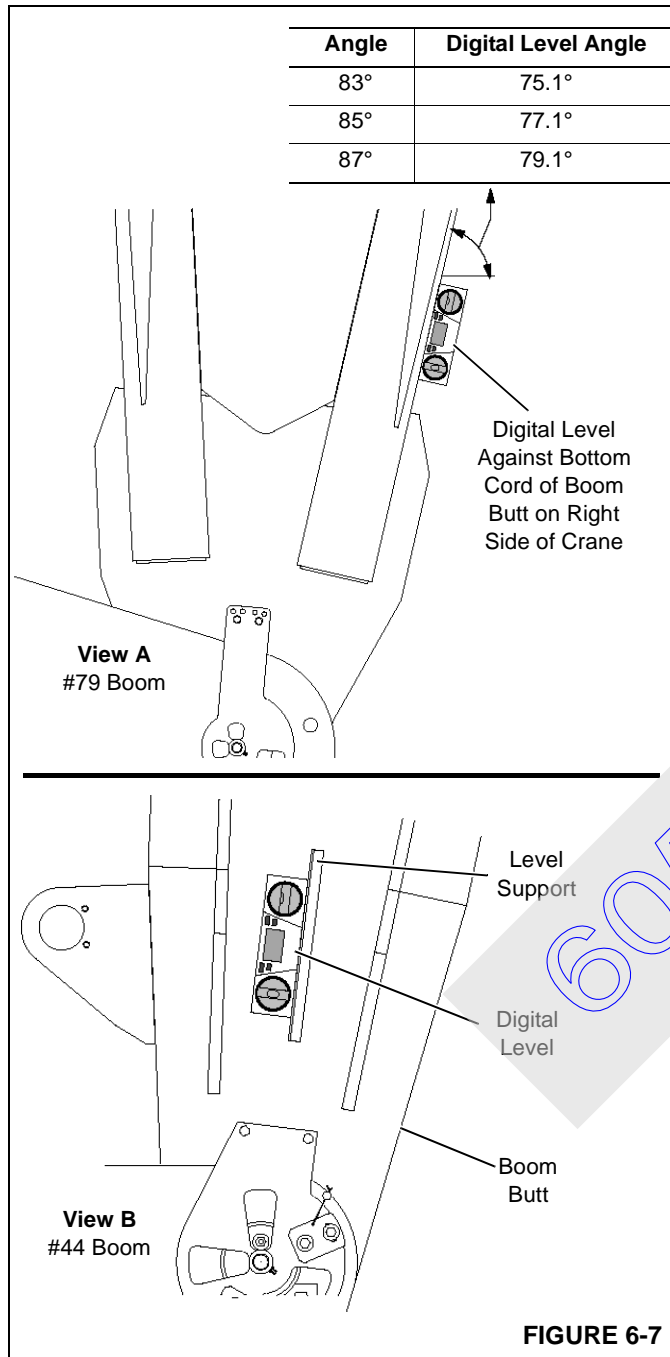
Do not operate crane unless automatic boom stop is properly adjusted and operational. Do not adjust maximum operating angle higher than specified. Boom could be pulled over backwards or collapse, causing death or serious injury.

Adjustment

Maximum (MAX) Boom Stop

See Figure 6-5 for following procedure.

1. For a crawler crane, travel the crane onto a firm level surface or level the crane by blocking under the crawlers.
For a truck crane, level the crane with the outriggers.
2. For #79-44 boom only, make sure actuator bracket is securely fastened in proper position on boom butt (Figure 6-6, Position A, B, or C).
3. Check position of MAX limit switch with relation to actuator bracket (Figure 6-5, View A).
4. Loosen capscrews retaining MAX actuator to actuator bracket.
5. Rotate MAX actuator CLOCKWISE in its slots so it does not contact limit switch roller when step 6 is performed.
6. Raise the boom to specified boom angle shown in Figure 6-5 table while monitoring the angle on the mechanical indicator or on the operating conditions screen of the front-console display.
7. Verify that the boom is at the proper maximum angle:
 - a. Check boom angle using an accurate digital level placed on boom butt (Figure 6-7).
 - b. Boom up or down as required to position boom at specified angle as indicated by digital level.



8. Rotate MAX actuator against limit switch roller until limit switch just “clicks” open and hold.
9. Check position of MAX actuator with relation to actuator bracket (Figure 6-5, View B).
10. Securely tighten capscrews for MAX actuator.
11. Test the adjustment as follows:
 - a. Lower the boom several degrees below the specified maximum angle.

- b. Slowly raise the boom.
- c. **Boom must stop at specified Maximum Angle.** If the boom does not stop at the specified angle:
 - Stop raising the boom (move control handle to off).
 - Lower the boom several degrees below the specified angle.
 - Repeat adjustment steps 6 through 11.

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 6-5, View C.

Minimum (MIN) Boom Stop

See Figure 6-5 for following procedure.

NOTE The slots in MIN actuator allow the minimum boom angle to be adjusted to any angle between 4° above or below horizontal.

1. If necessary, adjust the position of limit switch with relation to actuator bracket as instructed in View B.
2. Loosen cap screws (View C) retaining MIN actuator to actuator bracket.
3. Rotate MIN actuator COUNTERCLOCKWISE in its slots so it does not contact the limit switch roller when step 4 is performed.
4. Lower the boom to the desired minimum angle.
5. Rotate MIN actuator against the roller of limit switch until the limit switch just “clicks” open and hold.
6. Check the position of MIN actuator with relation to actuator bracket as instructed in View C.
7. Securely tighten cap screws to secure actuator.

Test the adjustment as follows:

- a. Raise the boom several degrees above the desired minimum angle.
- b. Slowly lower the boom.
- c. The boom should stop at the desired minimum angle. If the boom does not stop at the desired angle:
 - Stop lowering the boom (move control handle to off).
 - Raise the boom several degrees above the desired minimum angle.
 - Repeat adjustment steps 4 through .
8. Seal the adjustment as shown in View C.

JIB STOP ADJUSTMENT - PAST PRODUCTION

General

Past production #133 or 133a luffing jib attachments are equipped with two 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:

- Maximum (MAX) boom to luffing jib angle of 168°.
- Minimum (MIN) boom to luffing jib angle of 60°.

The fault alarm (in operator's cab) comes on when the jib reaches either 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 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 6-5.

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 by-pass the automatic luffing jib stops when the luffing jib is removed. See Figure 6-8.

1. Unplug electric cord (A₁) from MAX limit switch and connect cord to receptacle (A₂) on boom top junction box.
2. Unplug electric cord (B₁) from MIN limit switch and connect cord to receptacle (B₂) on boom top junction box.

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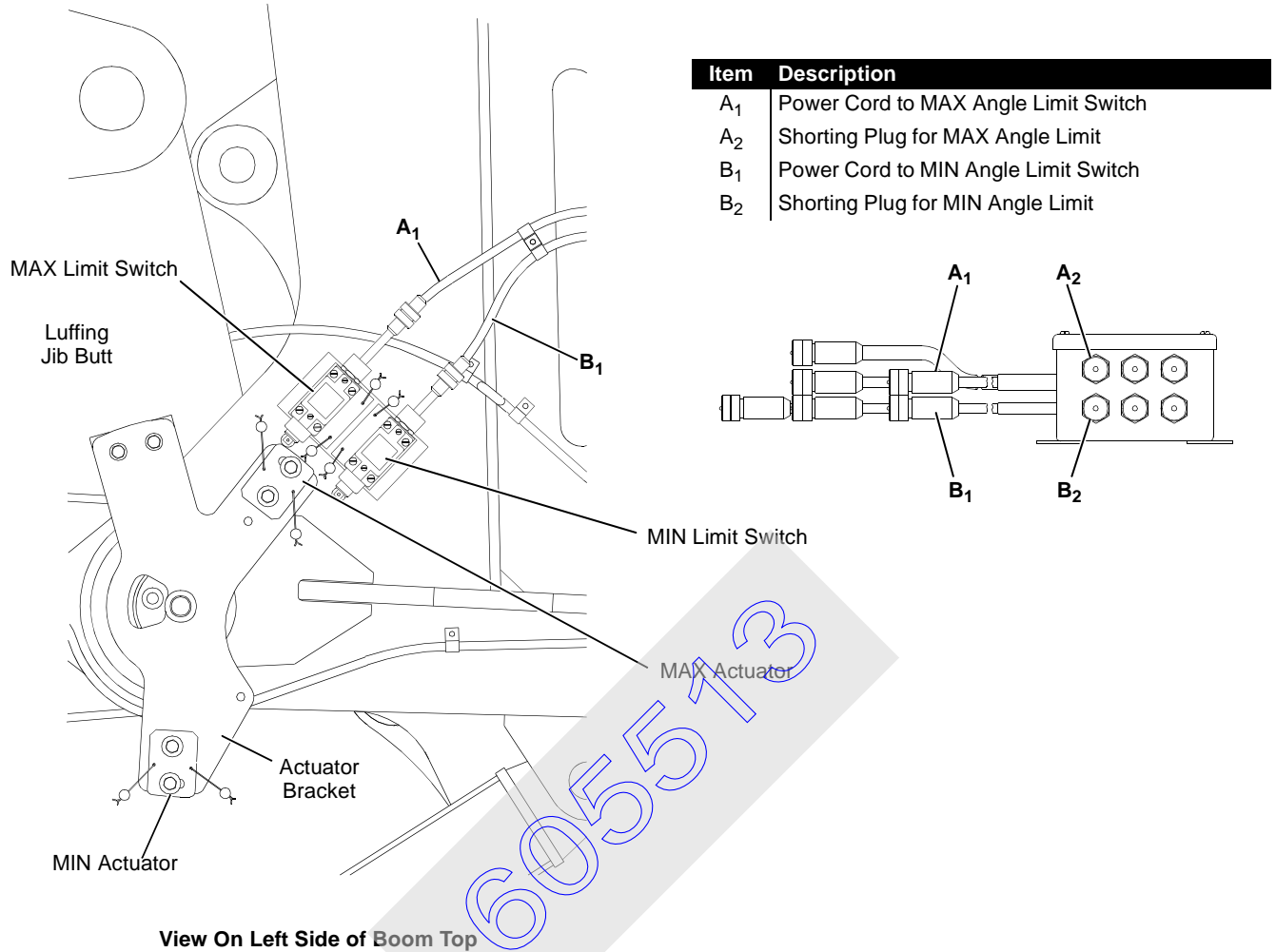
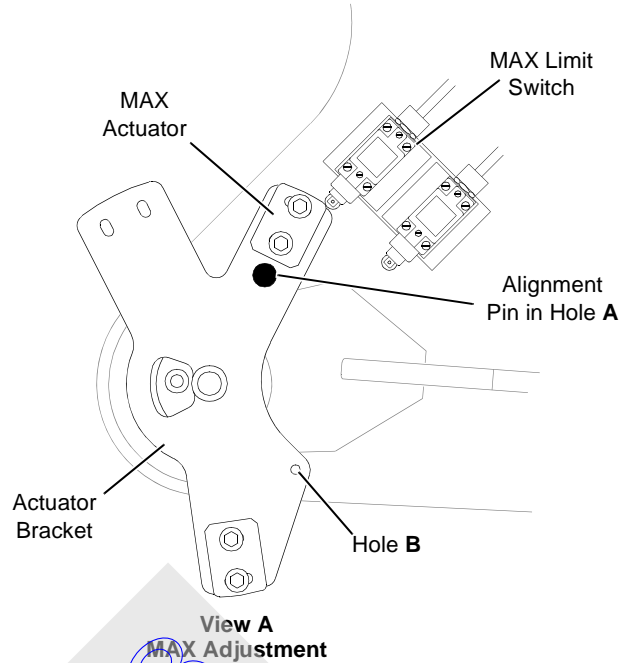
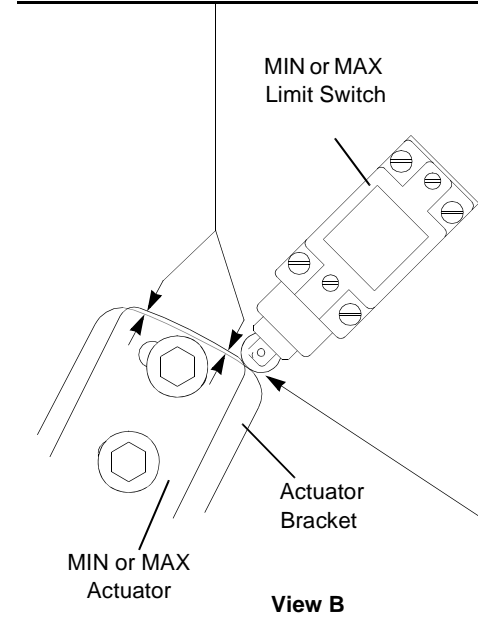


FIGURE 6-8

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CAUTION

Check this distance after adjusting either limit switch. Distance from both ends of actuator (MIN or MAX) 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 either 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.

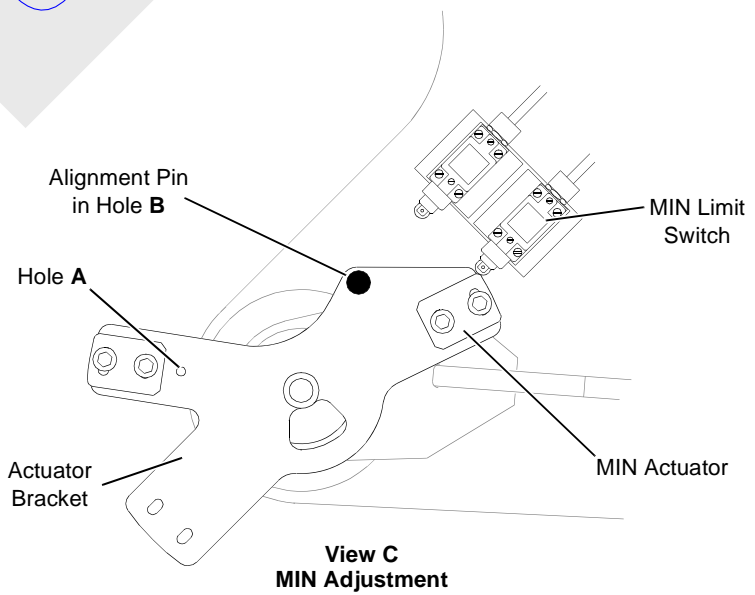
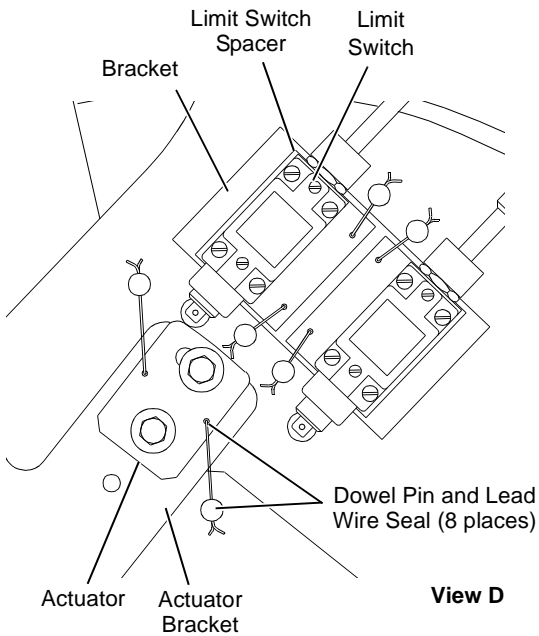


FIGURE 6-9

Adjustment

The automatic luffing jib stops must be installed, adjusted, and sealed at initial assembly of the attachment.

Readjustment is required each time the attachment is reassembled and when parts are replaced (seals must be removed to allow readjustment).

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

Maximum Boom to Luffing Jib Angle

See Figure 6-9, View A for following procedure.

1. Remove screws fastening actuator bracket to jib butt.
2. Loosen capscrews retaining MAX actuator to actuator bracket.
3. Rotate actuator bracket to MAX angle position so hole (A) in actuator bracket lines up with hole in boom top.
4. Insert alignment pin through hole (A) in actuator bracket and into hole in boom top. **Make sure shoulder of alignment pin rests squarely against actuator bracket to ensure proper alignment for adjustment.**
5. Check position of MAX limit switch with relation to actuator bracket (Figure 6-9, View B).
6. Rotate MAX actuator against MAX limit switch roller until limit switch just "clicks" open and hold.
7. Check position of MAX actuator with relation to actuator bracket (Figure 6-9, View B).
8. Securely tighten screws for MAX actuator.
9. Remove alignment pin.
10. Slowly rotate actuator bracket. There must not be any binding between MAX actuator and MAX limit switch.
If binding occurs, readjust position of MAX actuator.
11. Make final check of MAX angle setting as follows:
 - a. Rotate actuator bracket so MAX actuator contacts MAX limit switch roller.
 - b. Stop rotating actuator bracket when MAX limit switch clicks open.
 - c. Hole (A) in actuator bracket must line up with hole in boom top.
 - d. With LUFFING JIB mode selected, luffing hoist drum must not turn and LUFFING JIB MAX UP operating limit should come on when luffing hoist handle is pulled back.
 - e. Readjust MAX actuator as necessary to provide proper adjustment.
12. Fasten actuator bracket to jib butt.
13. Make following operational check for MAX limit switch after boom and jib are raised:
 - a. Raise boom to 80° above horizontal.
 - b. Slowly raise jib (luff up) to maximum boom to jib angle (168°).
 - c. MAX limit switch must stop luffing jib before jib stop pendants get tight.
 - d. If jib stop pendants get tight before luffing jib has stopped, **stop raising luffing jib immediately. Failing to do so will result in damage.**
 - e. Lower boom and luffing jib to ground and readjust MAX actuator and limit switch.

Minimum Boom to Luffing Jib Angle

See Figure 6-9, View C for following procedure.

1. Remove screws fastening actuator bracket to jib butt.
2. Loosen capscrews retaining MIN actuator to actuator bracket.
3. Rotate actuator bracket to MIN angle position so hole (B) in actuator bracket lines up with hole in boom top.
4. Insert alignment pin through hole (B) in actuator bracket and into hole in boom top. **Make sure shoulder of alignment pin rests squarely against actuator bracket to ensure proper alignment for adjustment.**
5. Check position of MIN limit switch with relation to actuator bracket (Figure 6-9, View B).
6. Rotate MIN actuator against MIN limit switch roller until limit switch just "clicks" open and hold.
7. Check position of MIN actuator with relation to actuator bracket (Figure 6-9, View B).
8. Securely tighten screws for MIN actuator.
9. Remove alignment pin.
10. Slowly rotate actuator bracket. There must not be any binding between MIN actuator and MIN limit switch.
If binding occurs, readjust position of MIN actuator.
11. Make final check of MIN angle setting as follows:
 - a. Rotate actuator bracket so MIN actuator contacts MIN limit switch roller.
 - b. Stop rotating actuator bracket when MIN limit switch clicks open.
 - c. Hole (B) in actuator bracket must line up with hole in boom top.
 - d. With LUFFING JIB mode selected, luffing hoist drum must not turn and LUFFING JIB MAX DOWN operating limit should come on when luffing hoist handle is pushed forward.
 - e. Readjust MIN actuator as necessary to provide proper adjustment.
12. Fasten actuator bracket to jib butt.

Final Adjustment

Once adjustments are complete, drill and seal the limit switch spacers to the mounting bracket and the actuators to actuator bracket with dowel pins and lead wire seals as shown in Figure 6-9, View D.

JIB STOP ADJUSTMENT — CURRENT PRODUCTION

General

The luffing jib attachment is equipped with three limit switches (Figure 6-10) which automatically stop the luffing hoist and apply its brake when the luffing jib is raised or lowered to the following angles:

- LUFFING JIB MAX UP 1 — 168° boom to luffing jib angle. This limit can be bypassed, allowing the luffing jib to be raised an additional 2° to MAX UP 2 limit.
- LUFFING JIB MAX UP 2 — 170° boom to luffing jib angle. This limit can be bypassed only when the attachment is lowered to the ground with the boom below 15°.
- LUFFING JIB MAX DOWN — 60° boom to luffing jib angle.

The fault alarm (in operator's cab) comes on when the jib reaches any of the limits. The operating limit alert also comes on any time 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 2 limit or below MAX DOWN 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 6-5.

Maintenance

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

Removing Luffing Jib

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

See Figure 6-10 for following procedure.

1. Unplug electric cord (A₁) from limit switch (1, View B) and connect cord to receptacle (A₂) at boom top junction box (8, View A).
2. Unplug electric cord (B₁) from limit switch (3, View A) and connect cord to receptacle (B₂) at boom top junction box (8, View A).

NOTE: Electric cord to limit switch (3) does not require a shorting plug.

Adjustment

The automatic luffing jib stops must be installed, adjusted, and sealed at initial assembly of the attachment.

Readjustment is required each time the attachment is reassembled and when parts are replaced (seals must be removed to allow readjustment).

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

Preliminary Adjustment

1. Lower attachment to ground.
2. Remove screws fastening actuator (4) to jib butt.

Max Up 1 Limit Adjustment

See Figure 6-10 for following procedure.

1. Rotate actuator (4) clockwise until Hole A in actuator lines up with hole in boom top.
2. Insert alignment pin (9) through Hole A in actuator and into hole in boom top. **Make sure shoulder of pin rests squarely against actuator to ensure proper alignment for adjustment.**
3. Slide limit switch (1) against cam (5) until limit switch just "clicks" open and hold.
4. Securely tighten screws in limit switch.
5. Remove alignment pin.
6. Check MAX UP 1 limit setting as follows:
 - a. Rotate actuator (4) counterclockwise and then clockwise so MAX UP 1 limit switch roller contacts cam (5).
 - b. Limit switch must click open when Hole A in actuator lines up with hole in boom top (step 2).
 - c. With LUFFING JIB mode selected, pull luffing jib handle back. Luffing hoist must not turn and LUFFING JIB MAX UP 1 operating limit should come on.
 - d. Readjust limit switch if necessary to ensure proper operation.
7. After boom and jib are raised, check operation of MAX UP 1 limit following instructions under Operational Checks.

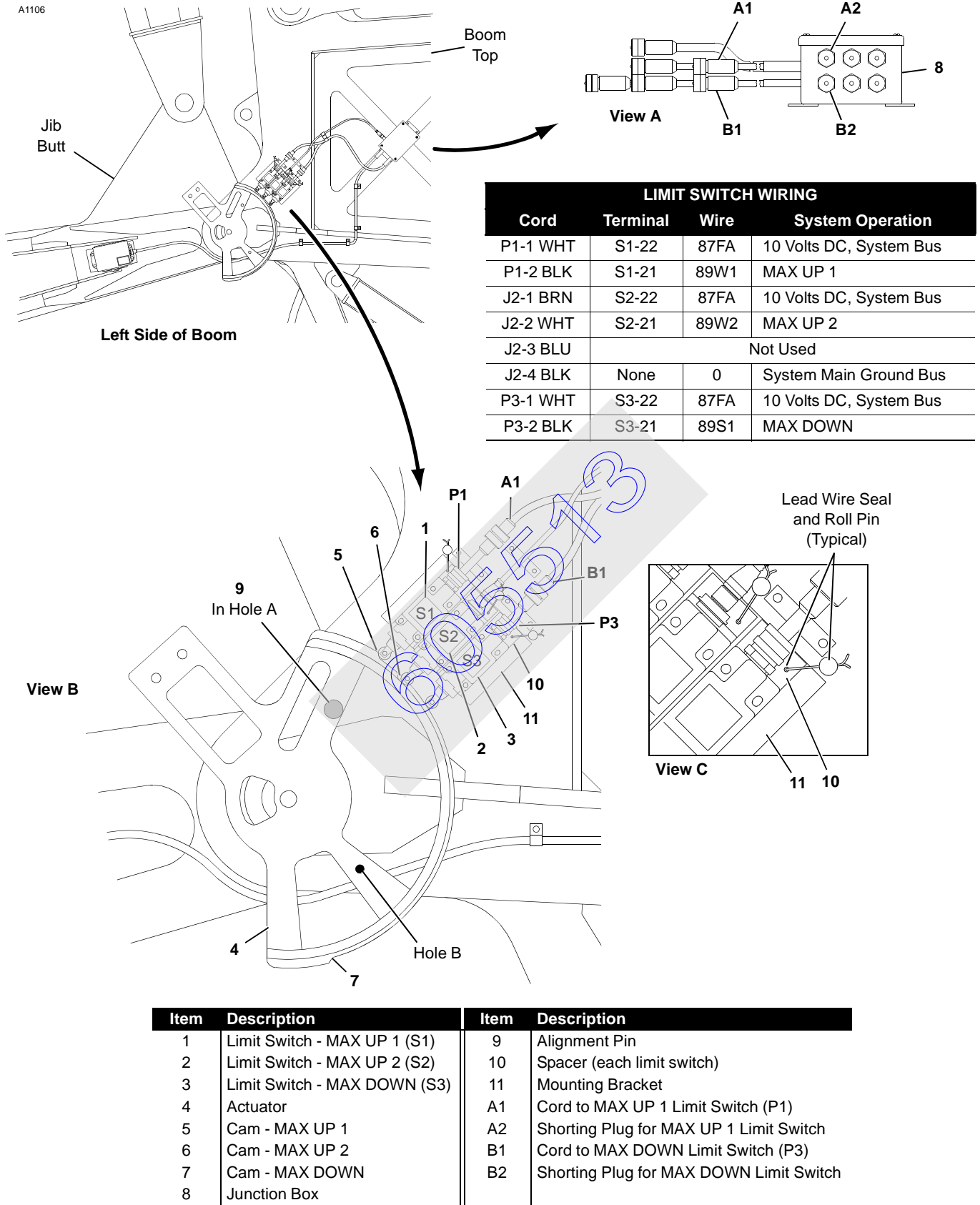


FIGURE 6-10

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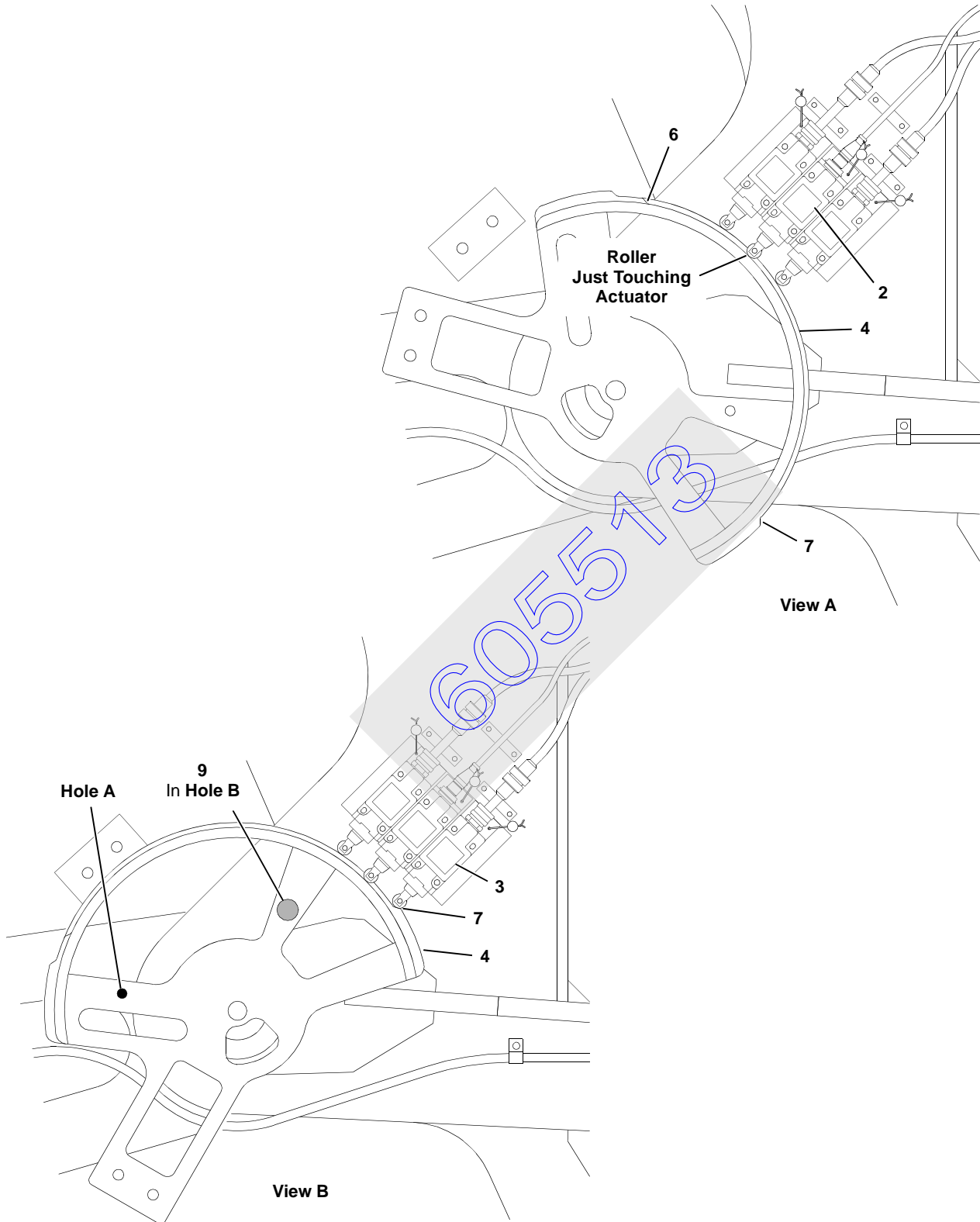


FIGURE 6-11

Max Up 2 Limit Adjustment

See Figure 6-11, View A for following procedure.

1. Loosen screws in limit switch (2).
2. Rotate actuator (4) so roller on limit switch (2) is between cams (6 and 7).
3. Slide limit switch (2) toward actuator (4) until roller just touches actuator and hold. **Switch must not click open.**
4. Securely tighten screws in limit switch.
5. After boom and jib are raised, check operation of MAX UP 2 limit following instructions under Operational Checks.

Max Down Limit Adjustment

See Figure 6-11, View B for following procedure.

1. Rotate actuator (4) counterclockwise until Hole B in actuator lines up with hole in boom top.
2. Insert alignment pin (9) through Hole B in actuator and into hole in boom top. **Make sure shoulder of pin rests squarely against actuator to ensure proper alignment for adjustment.**
3. Slide limit switch (3) against cam (7) until limit switch just "clicks" open and hold.
4. Securely tighten screws in limit switch.
5. Remove alignment pin.
6. Check MAX DOWN limit setting as follows:
 - a. Rotate actuator (4) clockwise away from limit switch and then counterclockwise so MAX DOWN limit switch roller contacts cam (7).
 - b. Limit switch must click open when Hole B in actuator lines up with hole in boom top (step 2).
 - c. With LUFFING JIB mode selected, push luffing jib handle forward. Luffing hoist must not turn and LUFFING JIB MAX DOWN operating limit should come on.
 - d. Readjust limit switch if necessary to ensure proper operation.

Final Adjustment Steps

1. Securely fasten actuator (4) to jib butt with screws and lock washers provided.
2. Once limit switches are properly adjusted, drill and seal limit switch spacers (10, Figure 6-10, View C) to mounting bracket (11) with dowel pins and lead wire seals.

Operational Checks

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

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°.
5. Fault alarm should come on indicating MAX WORKING limit has been reached.

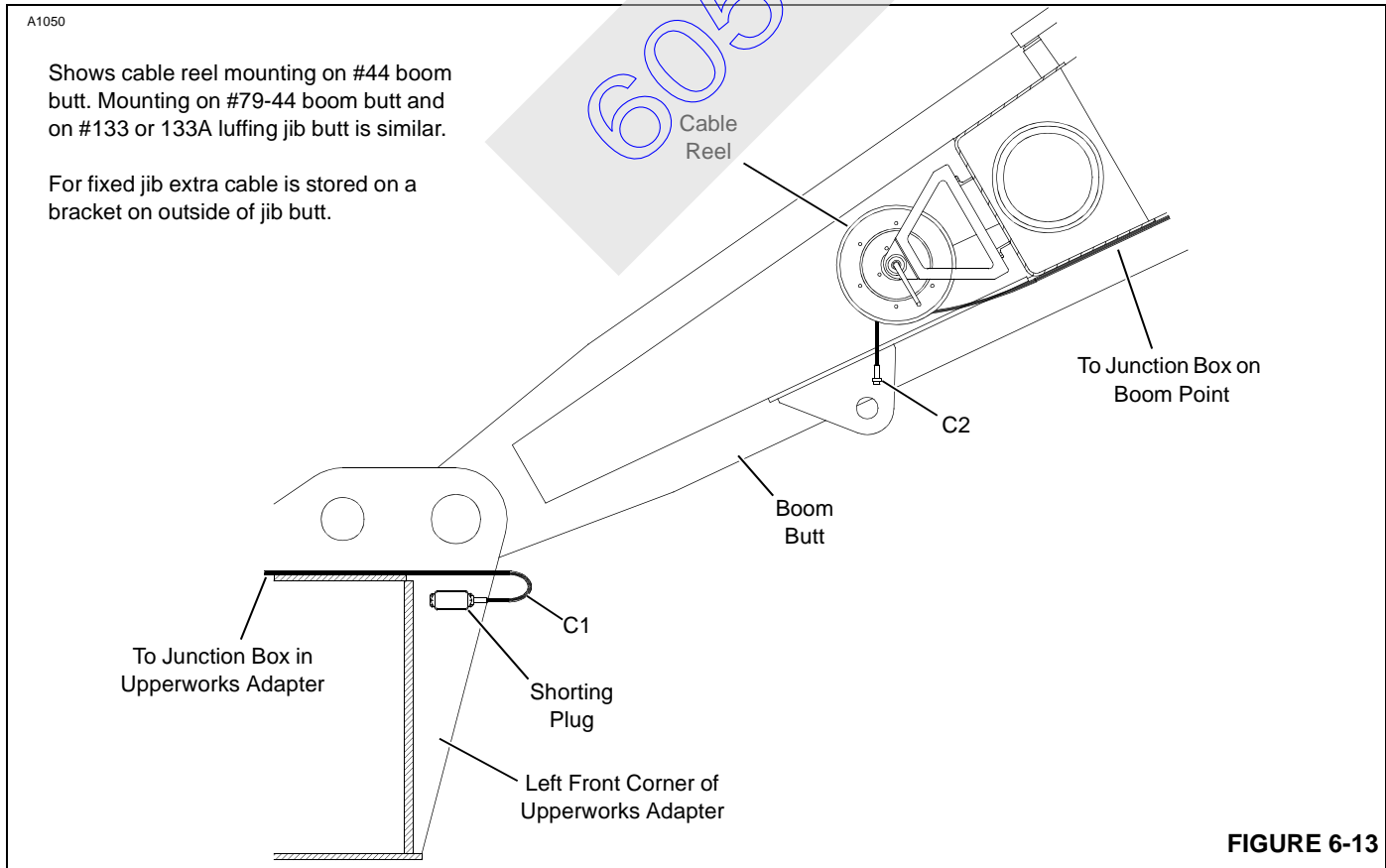
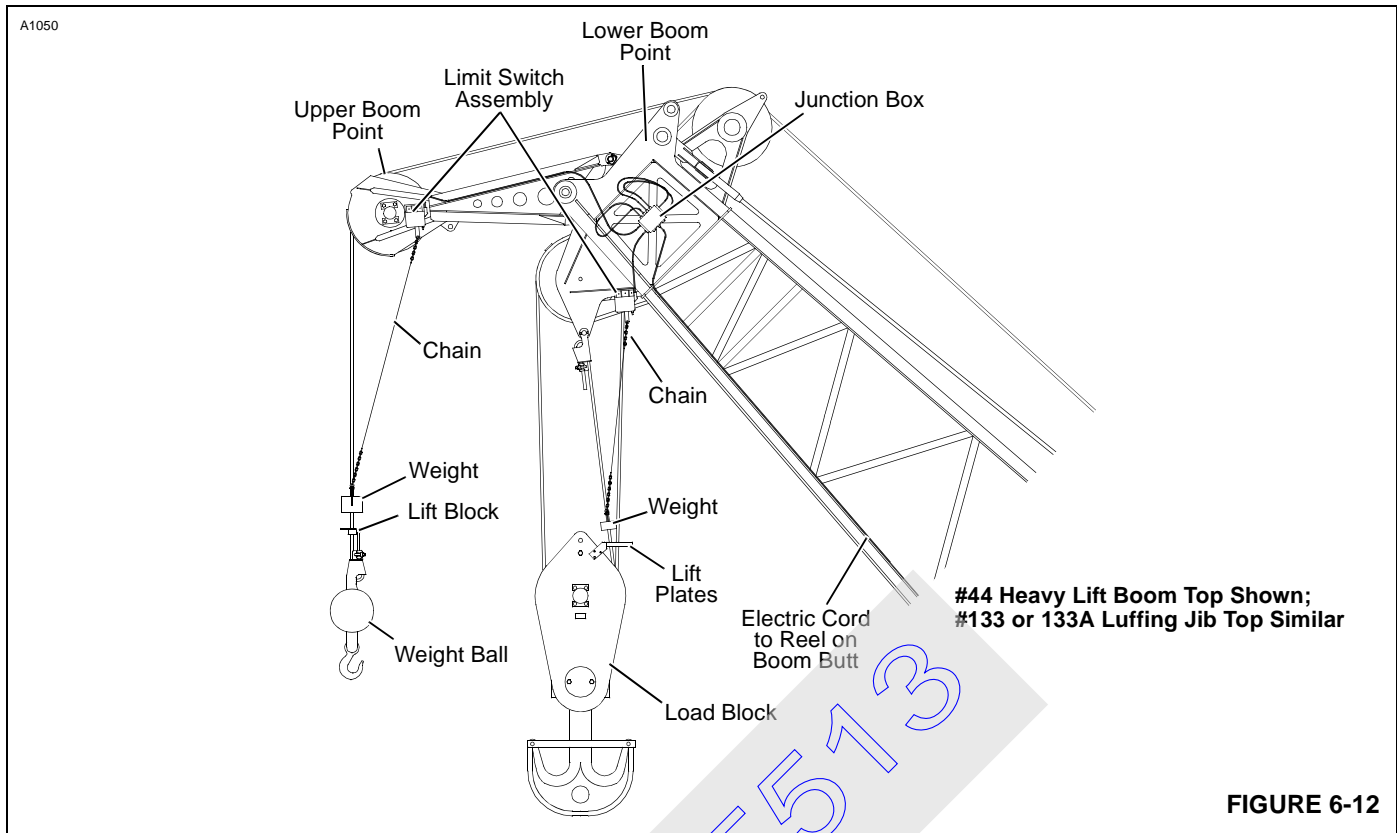
Stop raising luffing jib immediately if limit switch fails to stop luffing hoist. Lower boom and jib to ground and readjust MAX WORKING limit switch.

6. Turn limit bypass key clockwise to bypass MAX WORKING limit.
7. SLOWLY raise luffing jib past MAX WORKING limit.
8. Luffing hoist must stop and be inoperable when boom to luffing jib angle is 170°.
9. 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.

10. SLOWLY lower luffing jib.
11. Luffing hoist must stop and be inoperable when boom to luffing jib angle is 55°.

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



BLOCK-UP LIMIT CONTROL ADJUSTMENT

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 6-12):

1. Normally closed limit switch assembly fastened at any or all of the following locations (multiple limit switches are wired in series):
 - a. Lower boom point.
 - b. Lower luffing jib point.
 - c. Upper luffing jib point.
 - d. Fixed 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 6-12 and Figure 6-15 for the following procedures. See Block-Up Limit Control Assembly Drawing at the end of Section 4 in this manual for electric wiring diagrams 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 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.

Installation

The block-up limit control must be installed according to Block-Up Limit Control Assembly Drawing at the end of Section 4 in this manual.

Securely fasten the electric cords to the boom and jib with the metal straps and nuts provided.

Connect the electric wires to the normal-closed contacts inside each limit switch.

See Figure 6-14 for installation of the weights.

Storing Electric Cord

The electric cords for the boom, luffing jib, and fixed jib are long enough to accommodate the maximum length of each attachment.

Store the excess cord for the boom and luffing jib on the reel mounted on either butt (Figure 6-13).

The 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.

Store the excess electric cord for the fixed jib by winding the cable around the brackets on the jib butt.

Disconnecting Block-Up Limit Control

A shorting plug (Figure 6-13) 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 6-13):

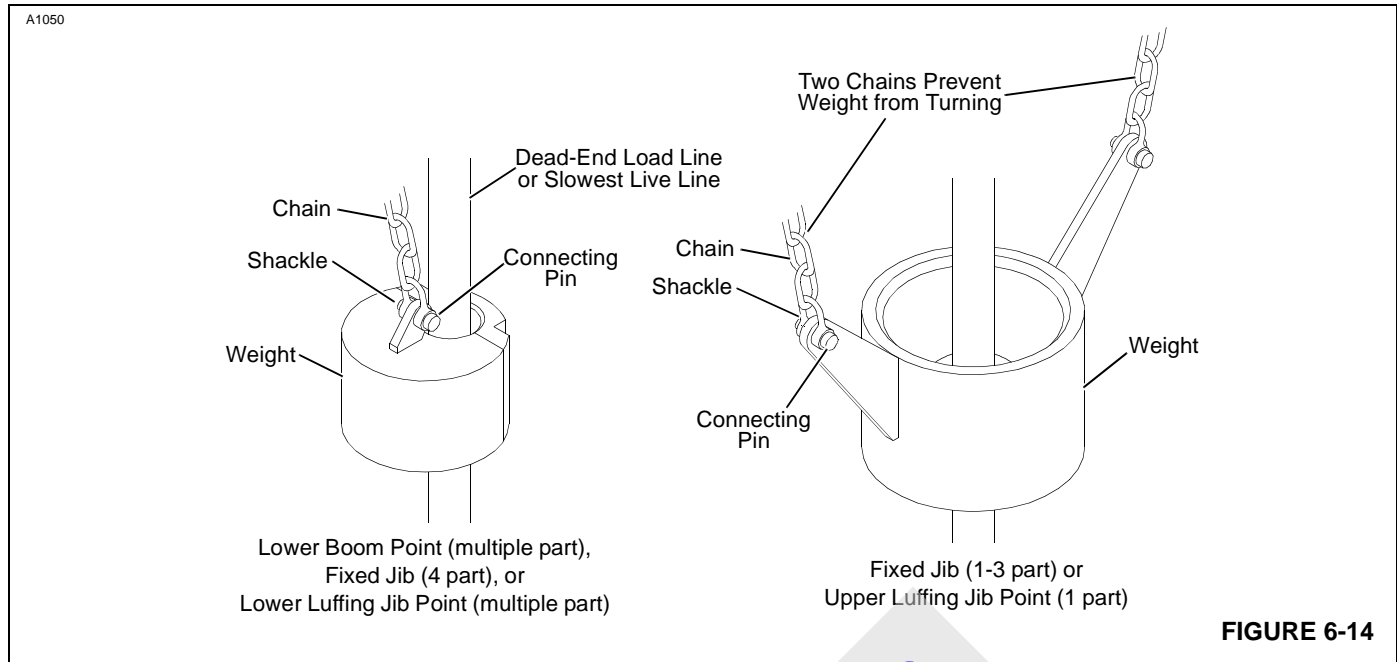


FIGURE 6-14

1. Disconnect electric cord (C1) from cable reel cable (C2).
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 Point

For identification of junction boxes, electric cords, and shorting plugs in boom and jib points, see the Block-Up Limit Control Assembly drawing at the end of Section 4 in this manual.

The junction boxes on the boom and jib points are equipped with shorting plugs.

If the luffing jib point or fixed jib point is equipped with a block-up limit switch, the electric cord from the limit switch must be connected to the proper shorting plug when the corresponding attachment is removed.

Failing to perform this step will prevent the load drum from hoisting and the boom/ luffing hoist from lowering. Also the operating limit alert will come on.

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 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 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 cords are securely fastened to the boom and jib with metal straps.
 - f. Check that all plugs are securely fastened.
2. Test block-up limit control for proper operation using either of the following methods:
 - 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 the weight. When the chain goes slack, the corresponding load drum should stop HOISTING and the boom hoist should not operate in the LOWER direction.

CAUTION

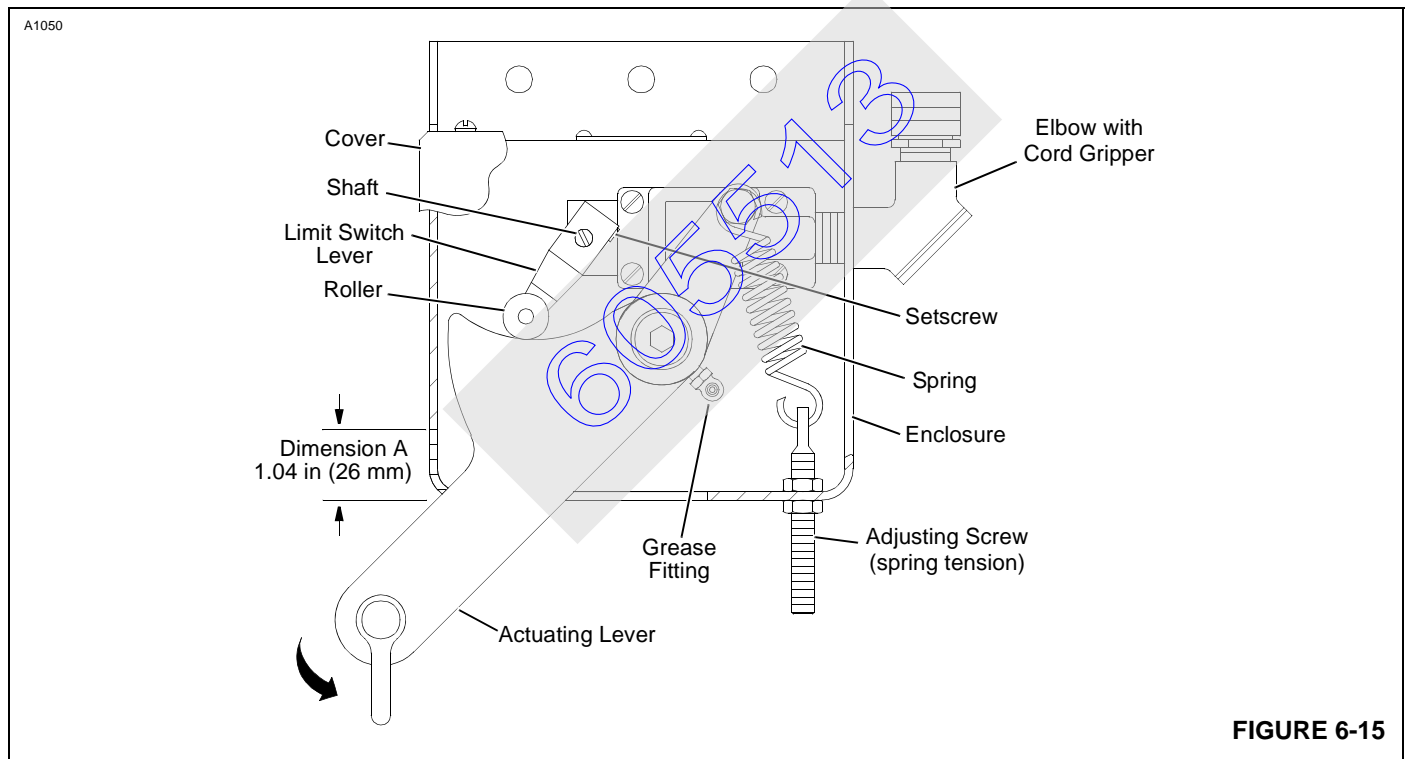
Use extreme care when testing block-up limit control when boom is raised. If block-up limit control fails to stop load, immediately stop load by moving drum control handle to off or by applying drum working brake; otherwise, two-blocking may occur.

Adjustment

See Figure 6-15 for the following procedure.

Lower the boom onto blocking at ground level and adjust each limit switch as follows:

1. Adjust spring tension so there is enough force to lift the weight of the chain and rotate the actuating lever when the weight is lifted.
2. Loosen the setscrew in the limit switch lever so the lever is free to rotate.
3. Manually lift the weight to allow the actuating lever to rotate upward.
4. Hold lever at Dimension A.
5. Hold the roller on the limit switch lever against the actuating lever while performing step 6
6. Turn the limit switch shaft **CLOCKWISE** *only enough to "click" limit switch open and hold*. Then securely tighten the setscrew in the limit switch lever.
7. Test the limit switch for proper operation (see Maintenance earlier in this section); repeat the adjustment steps until the limit switch operates properly.



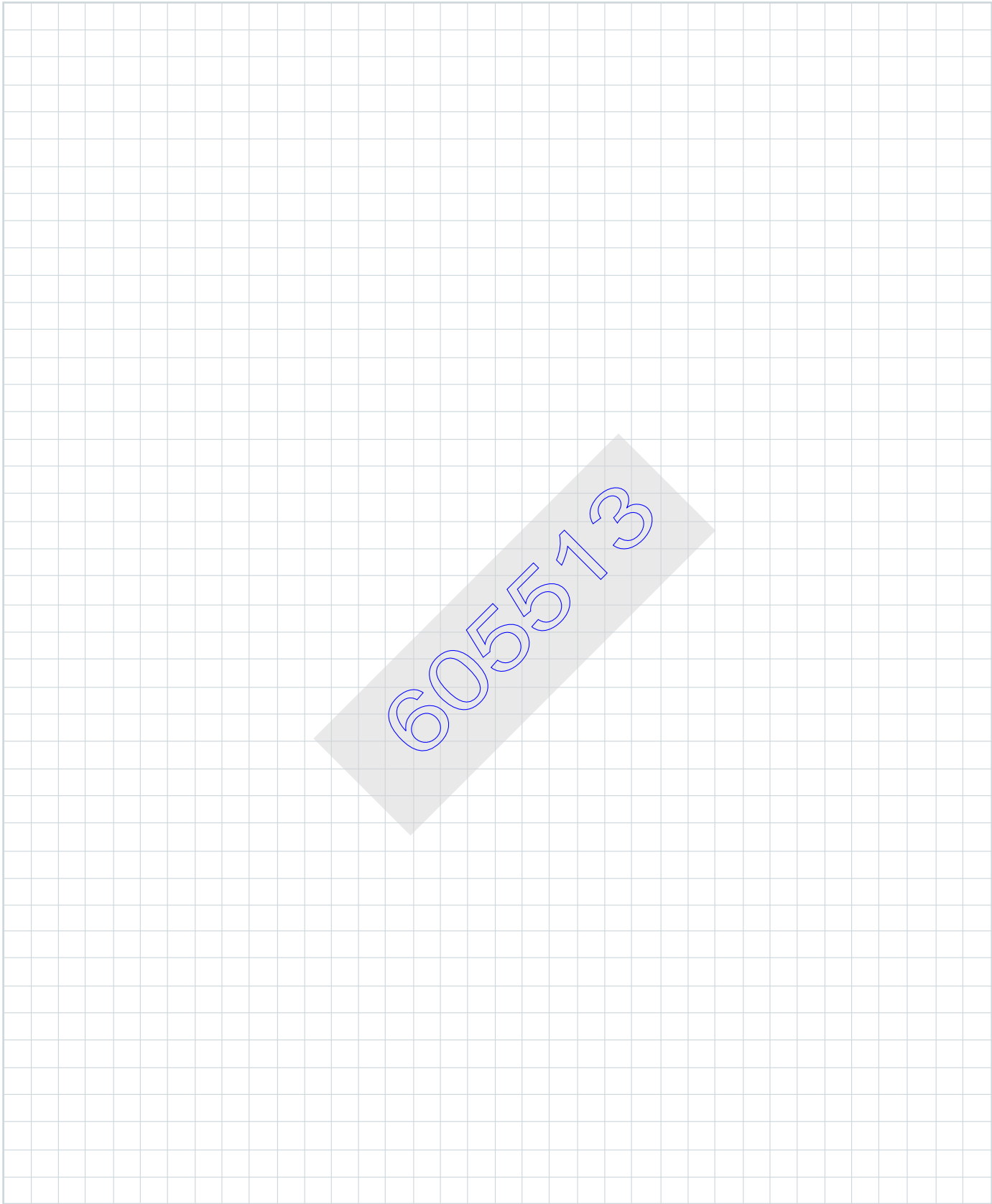
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