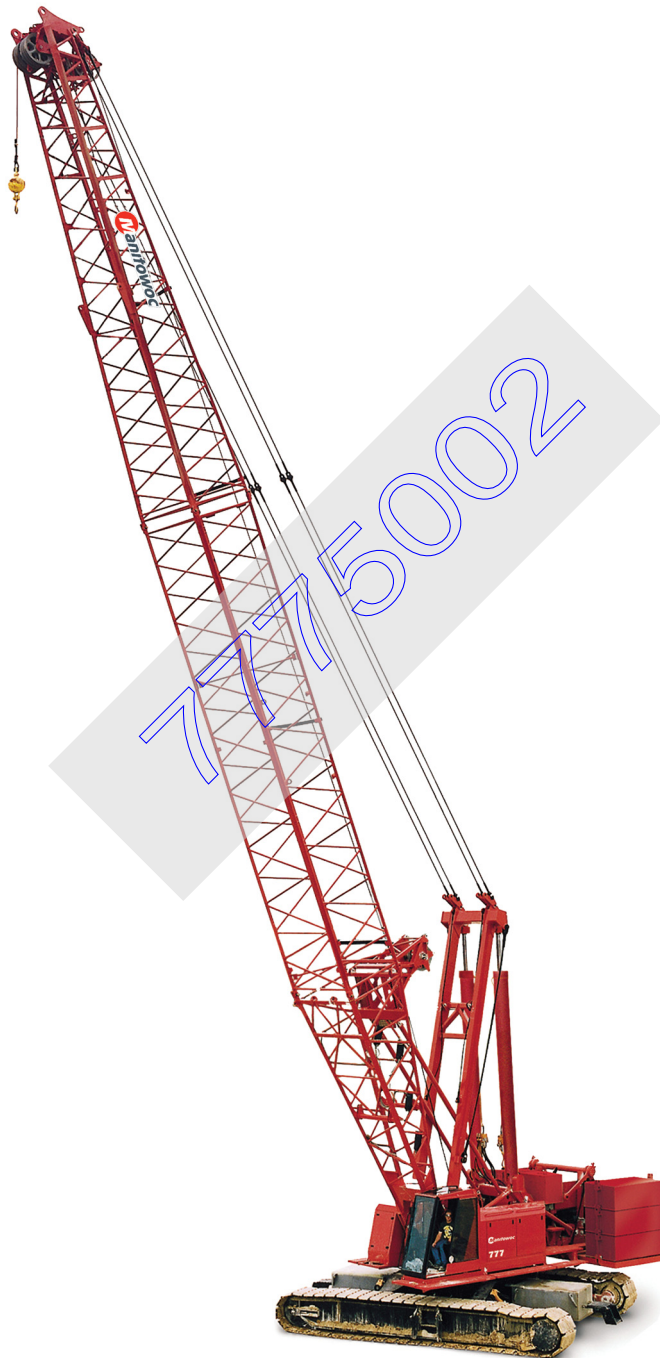


Manitowoc 777

Operator Manual Luffing Jib Attachment





WARNING



California Proposition 65

Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Always start and operate the engine in a well-ventilated area.

If in an enclosed area, vent the exhaust to the outside.

Do not modify or tamper with the exhaust system.

Do not idle the engine except as necessary.

For more information, go to www.P65warnings.ca.gov/diesel

Batteries, battery posts, terminals, and related accessories can expose you to chemicals, including lead and lead compounds, which are known to the State of California to cause cancer and birth defects or other reproductive harm. Wash hands after handling. For more information, go to www.P65warnings.ca.gov



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.



OPERATOR MANUAL

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

777

Luffing Jib Model Number

7775Ref

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	SETUP AND INSTALLATION
SECTION 5	LUBRICATION
SECTION 6	MAINTENANCE

NOTICE

The serial number of the crane and luffing jib is the only method your Manitowoc dealer or Manitowoc Product Support 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 luffing jib. Refer to the Nameplate and Decal Assembly Drawing in Section 2 of this manual for the exact location of the crane identification plates.

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



⚠ WARNING

To prevent death or serious injury:

- 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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See end of this manual for Alphabetical Index

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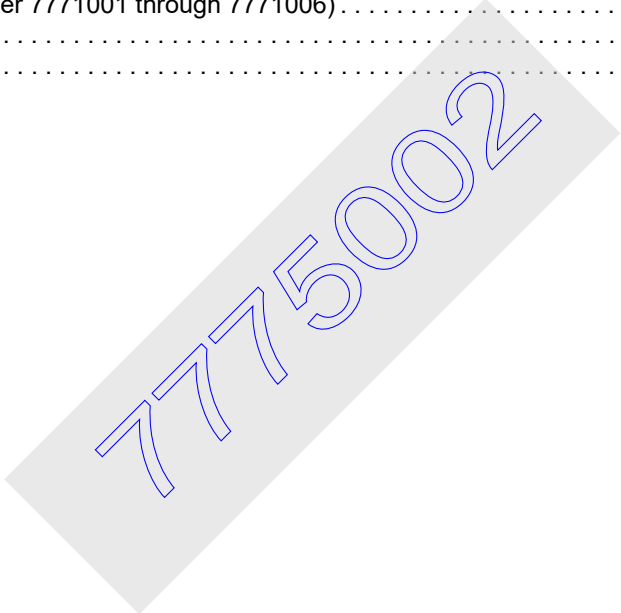
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SECTION 1

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 plate (see Figure 1-1) is attached to the outside of the operator's cab and to attachments available for this crane (for example, luffing jib).

The crane or attachment model and serial number are provided on the plates.

For the exact location of the identification plates on your crane, 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 Product Support so we can contact you if the need arises.

1. Go to www.manitowoc.com
2. Go to SUPPORT>SERVICES>CHANGE OF OWNERSHIP.

3. Complete the form.

CRANE ORIENTATION

The terms RIGHT, LEFT, FRONT, REAR used in this manual refer to 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 rotating bed.
- The carbody and crawler controls are on the front of the carbody.
- The drive shafts and gear boxes are on the rear of the crawlers.

MANITOWOC DEALER

For questions about this manual or the 777 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.manitowoc.com
2. Click on the red FIND A DEALER button.
3. Follow the on-screen prompts to locate your Manitowoc dealer.

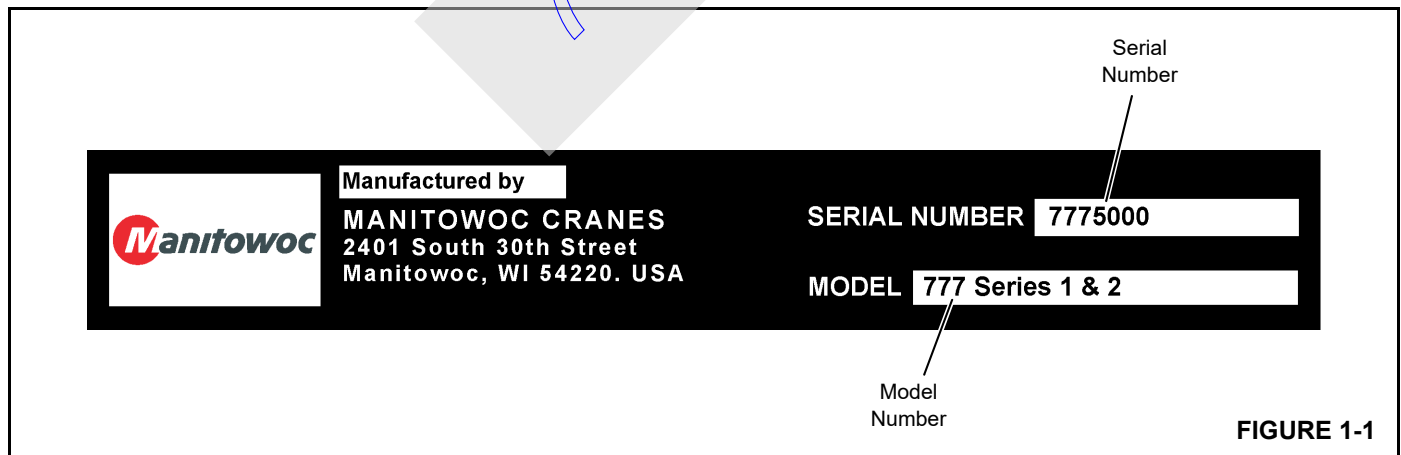


FIGURE 1-1

IDENTIFICATION OF LUFFING JIB COMPONENTS

See Figure 1-2 for identification of the luffing jib components.
 See Section 1 of the Crane Operator Manual for identification of crane components.

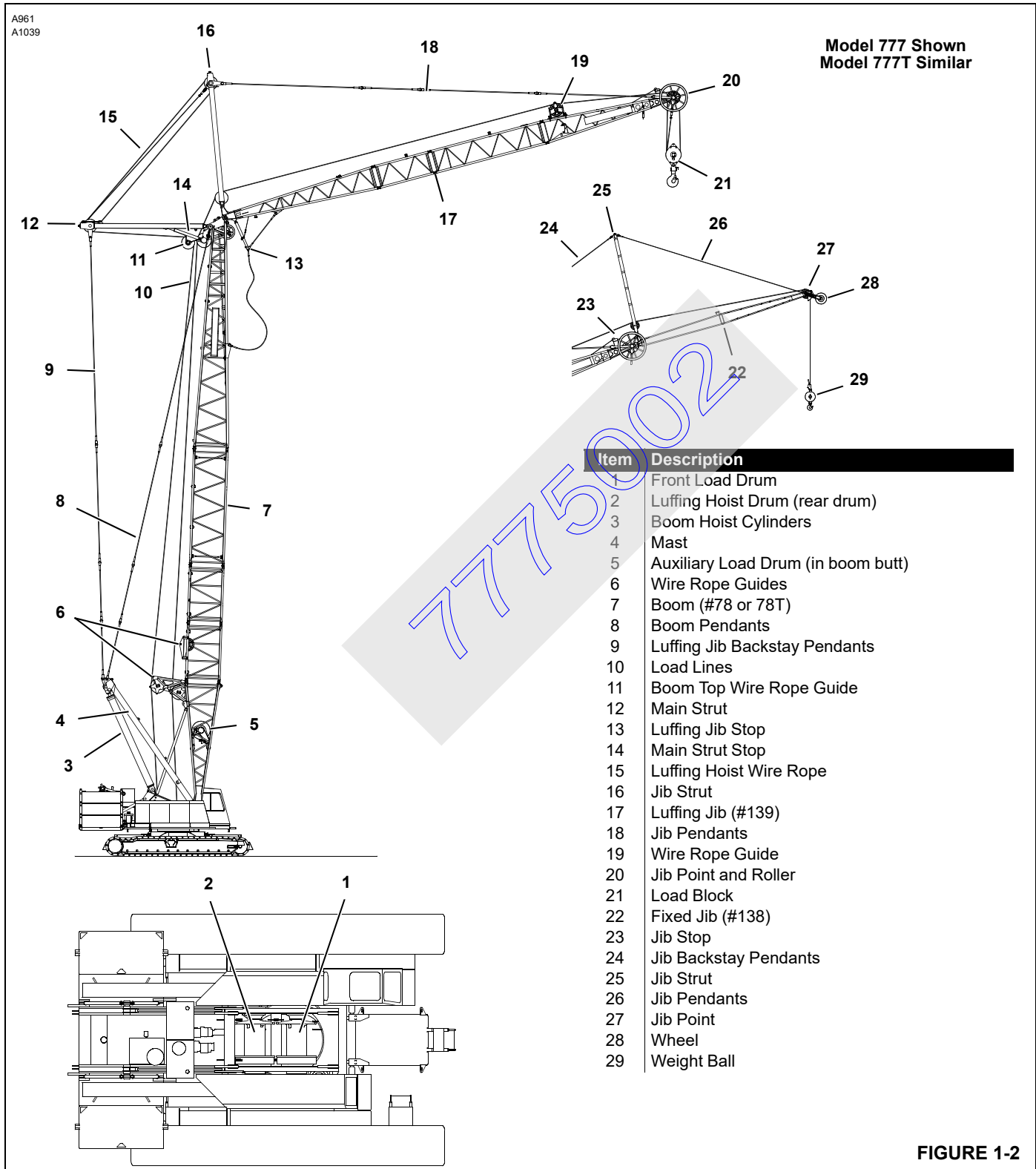


FIGURE 1-2

CRANE AND LUFFING JIB WEIGHTS — CRAWLER

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

	Weight	
	Pounds	Kilograms
LIFTCRANE - BOOM NO. 78:		
Upperworks and lowerworks complete, 38 in. (965 mm) crawler treads, counterweight, boom hoist cylinders, mast, fully rigged 60 ft (18.3 m) boom No. 78 (including upper boom point, 175 USt (160 t) block, and 15 USt (14 t) hook and weight ball), boom stops and maximum length hoist and whip lines		
777 SERIES 1	261,590	118 655
777 SERIES 2	342,710	155 450
UPPERWORKS MACHINERY MODULE WITH CARBODY:		
Carbody, upperworks with two full power drums, operator's cab, boom hoist cylinders, mast, boom butt with integral wire rope guide, carbody jacking arrangement (optional), and maximum length hoist and whip lines		
	86,125	39 065
CRAWLERS:		
24 ft, 9 in. (7 544 mm) crawler assembly with 38 in. (965 mm) treads (each)		
	28,210	12 795
24 ft, 9 in. (7 544 mm) crawler assembly with 48 in. (1 219 mm) treads (each)		
	33,775	15 320
COUNTERWEIGHT - UPPER:		
Box - side (4 on 777 SERIES 1, 6 on SERIES 2) (each)		
	18,500	8 391
Tray - lower counterweight		
	31,035	14 077
Counterweight pins (each)		
	5	2
Total upperworks counterweight - 777 SERIES 1		
	105,000	47 627
Total upperworks counterweight - 777 SERIES 2		
	142,000	64 410
COUNTERWEIGHT HANDLING:		
Counterweight lifting link (each)		
	130	58
Pivot frame with latch, pins and end plates		
	1,080	489
Pendant pivot link		
	335	151
Strut (each) with pins		
	390	176
1-1/4 in. (32 mm) pendant x 6 ft 1-1/2 in. (1.9 m) long (each)		
	85	38
1-1/2 in. (38 mm) pendant x 6 ft 1-1/2 in. (1.9 m) long (each)		
	135	61
Counterweight hanger pins (each) with end plates		
	40	18
Counterweight rear support pins (each)		
	10	4
Hinge pins (each) on engine base		
	20	9
COUNTERWEIGHT - CARBODY:		
Carbody counterweight (2 on SERIES 2) (each)		
	22,000	9 979
Carbody counterweight steps (each)		
	55	24
BOOM STOP:		
Lower tube (each)		
	145	65
Upper tube (each)		
	300	136
Spring (each)		
	75	34

	Weight	
	Pounds	Kilograms
MAST:		
26 ft (7 925 mm) mast -----	5,000	2 267
20 ft (6.1 m) pendant (each) -----	195	88
16 ft, 7-1/2 in. (5.1 m) pendant (each) -----	35	15
Hydraulic boom hoist cylinders - wet (each) with pins -----	4,940	2 240
BOOM NO. 78:		
22 ft 6 in. (6.9 m) butt with integral wire rope guide -----	5,755	2 610
37 ft, 6 in. (11.4 m) top (with lower point, wire rope guide and pendant links) -----	7,865	3 567
10 ft (3.0 m) insert -----	1,275	578
20 ft (6.1 m) insert -----	1,950	884
20 ft (6.1 m) insert (with jib backstay lugs) -----	2,015	913
40 ft (12.2 m) insert -----	3,525	1 598
40 ft (12.2 m) insert (with jib backstay lugs) -----	3,590	1 628
37 ft (11.3 m) basic pendant (each) -----	175	79
10 ft 1 in. (3.1 m) pendant (each) -----	80	36
20 ft, 1-1/2 in (6.1 m) pendant (each) -----	120	54
40 ft, 3 in (12.3 m) pendant (each) -----	175	79
Intermediate strut -----	605	274
Link - on mast (each) -----	160	72
Wire rope guide (top - 2 sheave) -----	970	439
Timber wire rope guard (each) -----	25	11
Wire rope guide (butt) -----	900	408
Wire rope guide (components of integral rope guide frame on butt) -----	205	92
JIB NO. 134:		
15 ft (4.6 m) butt -----	580	263
15 ft (4.6 m) top (with jib point) -----	990	449
10 ft (3.0 m) insert -----	350	158
20 ft (6.1 m) insert -----	580	263
30 ft, 9 in (9.4 m) basic pendant (each) -----	115	52
9 ft, 6 in (2.9 m) pendant (each) -----	65	29
19 ft (5.8 m) pendant (each) -----	85	38
12 ft, 6 in (3.8 m) strut with sheave -----	665	301
Backstay link (each) attached to strut -----	25	11
Backstay tie link -----	10	4
Backstay link (each) -----	65	29
Backstay spreader -----	50	22
44 ft, 7 in (13.6 m) backstay pendant (each) -----	150	68
4 ft, 8 in (1.4 m) backstay pendant (each) -----	50	22
Backstay link (each) attached to boom insert -----	20	9
Jib stop assembly -----	155	70
Wire rope anchor -----	70	31
Winch -----	35	15
Load sensor -----	110	49

	Weight	
	Pounds	Kilograms
LUFFING JIB NO. 139:		
27 ft (8.2 m) butt -----	2,000	907
23 ft (7.0 m) top (with jib point, wire rope guide, limit control, load sensor and pendant links) -----	3,675	1 666
10 ft (3.0 m) insert -----	580	263
20 ft (6.1 m) insert -----	980	444
40 ft (12.2 m) insert -----	1,795	814
20 ft, 1-1/2 in (6.1 m) basic pendant (each) -----	185	83
24 ft (7.3 m) basic pendant (each) -----	190	86
10 ft, 1 in (3.1 m) pendant (each) -----	130	58
40 ft, 3 in (12.3 m) pendant (each) -----	260	117
21 ft, 6 in (6.6 m) jib strut with guide sheaves, luffing sheaves and links -----	3,190	1 446
20 ft (6.1 m) main strut with luffing sheaves and links -----	2,670	1 211
35 ft, 5-1/2 in (10.8 m) basic backstay pendant (each) -----	215	97
40 ft, 3 in (12.3 m) backstay pendant (each) -----	210	95
20 ft, 1-1/2 in (6.1 m) backstay pendant (each) -----	145	65
10 ft (3.0 m) backstay pendant (each) -----	110	49
1 ft, 6 in (457 mm) backstay link (each) attached to mast -----	160	72
Jib stop assembly -----	700	317
Main strut stop assembly -----	720	326
Wire rope guide on jib top (2 sheave) -----	645	292
Wire rope anchor -----	225	102
JIB NO. 138:		
15 ft (4.6 m) butt -----	335	151
15 ft (4.6 m) top (with jib point and wheel) -----	685	310
10 ft (3.0 m) insert -----	175	79
70 ft, 6 in (21.5 m) basic pendant -----	90	40
9 ft (2.7 m) pendant (each) -----	20	9
Pendant link (each) -----	5	2
17 ft, 9-7/16 in (5.4 m) strut with sheave -----	440	199
Backstay link (each) -----	5	2
56 ft, 6-1/2 in (17.2 m) backstay pendant (each) -----	75	34
Jib stop assembly -----	95	43
MACHINE OPTIONS:		
Cummins M11-C330 power plant (increase over standard) -----	660	299
Free fall for front drum (increase over standard) -----	95	43
Free fall for rear drum (increase over standard) -----	95	43
High line speed arrangement for front drum (increase over standard) -----	1,140	517
High line speed arrangement for rear drum (increase over standard) -----	1,140	517
High line pull arrangement for front drum (increase over standard) -----	1,455	660
High line pull arrangement with free fall for front drum (increase over standard) -----	1,695	769
Lifting arrangement for upperworks and carbody -----	500	226
Crawler handling arrangement -----	570	258
Carbody jacking arrangement with beams, cylinders and pads -----	2,840	1 288
21-1/4 in (540 mm) Diameter lagging for 30-1/8 in. (765 mm) wide drum -----	535	242
25-1/4 in (641 mm) Diameter lagging (high line pull) for 30-1/8 in (765 mm) wide drum -----	1,055	479
140 ft (42.7 m) of 1 in. (26 mm) self-assembly wire rope -----	260	117

	Weight	
	Pounds	Kilograms
BOOM AND JIB OPTIONS:		
Upper boom point (single sheave) -----	920	417
Lower boom point for 1-1/4 in (32 mm) wire rope (increase over standard) -----	20	9
Auxiliary drum assembly in boom butt -----	3,670	1 664
21-1/4 in (540 mm) Diameter lagging for auxiliary drum -----	670	303
Wire rope guide (10 ft [3.0 m] insert - required with auxiliary drum) -----	650	294
15 USt (14 t) hook and weight ball -----	1,250	566
30 USt (27 t) load block -----	1,500	680
60 USt (54 t) load block -----	2,825	1 281
175 USt (160 t) load block -----	5,470	2 481
WIRE ROPE:		
Load lines - 1 in. rotation resistant wire rope 2.03 lb/ft (3.02 kg/m)		
Hoist line - 1200 ft (366 m) -----	2,435	1 104
Hoist line - 1400 ft (427 m) -----	2,840	1 288
Whip line - 890 ft (271 m) -----	1,805	818
Auxiliary line - 890 ft (271 m) -----	1,805	818
26 mm rotation resistant wire rope 2.13 Lb/Ft (3.17 kg/m)		
Hoist line - 1200 ft (366 m) -----	2,555	1 158
Hoist line - 1400 ft (427 m) -----	2,980	1 350
Whip line - 890 ft (271 m) -----	1,895	859
Auxiliary line - 890 ft (271 m) -----	1,895	859
32 mm rotation resistant wire rope 3.23 Lb/Ft (4.81 kg/m)		
Hoist line - 1000 ft (305 m) -----	3,230	1 465
Whip line - 860 ft (262 m) -----	2,780	1 261
1 in. conventional wire rope 1.85 Lb/Ft (2.75 kg/m)		
Hoist line - 1200 ft (366 m) -----	2,220	1 007
Hoist line - 1400 ft (427 m) -----	2,590	1 175
Whip line - 890 ft (271 m) -----	1,645	746
Auxiliary line - 890 ft (271 m) -----	1,645	746
26 mm conventional wire rope 1.94 Lb/Ft (2.89 kg/m)		
Hoist line - 1200 ft (366 m) -----	2,330	1 057
Hoist line - 1400 ft (427 m) -----	2,715	1 232
Whip line - 890 ft (271 m) -----	1,725	782
Auxiliary line - 890 ft (271 m) -----	1,725	782
1-1/4 in. conventional wire rope 2.89 Lb/Ft (4.30 kg/m)		
Hoist line - 1000 ft (305 m) -----	2,890	1 311
Whip line - 860 ft (262 m) -----	2,485	1 127

CRANE AND LUFFING JIB WEIGHTS — TRUCK

NOTE: Weights may fluctuate $\pm 3\%$ due to manufacturing tolerances.

	Weight	
	Pounds	Kilograms
LIFTCRANE - BOOM NO. 78T:		
Upperworks and carrier complete, 95,400 Lb. crane counterweight, 25,000 Lb. front bumper counterweight, boom hoist cylinders, mast, fully rigged 42.5 ft (13.0 m) boom No. 78T (including upper boom point, 175 USt (160 t) block, and 15 USt (14 t) hook and weight ball), boom stops and maximum length hoist and whip lines -----	275,800	125 100
UPPERWORKS WITH MAST AND LOWER BOOM BUTT:		
Upperworks with two full power drums, operator's cab, boom hoist cylinders, mast, lower boom butt, and maximum length hoist and whip lines -----	54,560	24 748
CARRIER:		
Carrier with counterweight handling cylinders -----	57,480	26 072
Rear outriggers with jacks and pads -----	13,970	6 336
Front outrigger (each) with jack and pad -----	4,035	1 830
Total carrier with outriggers, jacks, pads, and counterweight handling cylinders -----	79,520	36 069
COUNTERWEIGHT - UPPER:		
Box (each) 5 required -----	16,975	7 699
Tray -----	10,400	4 717
Tray pins - upper (each) -----	20	9
Tray pins - lower (each) -----	15	6
Counterweight pins (each) -----	5	2
Total upperworks counterweight -----	95,400	43 272
COUNTERWEIGHT - FRONT BUMPER:		
Adaptor -----	8,045	3 649
Front bumper counterweight -----	16,975	7 699
Adaptor pins (each) -----	5	2
Counterweight pins (each) -----	5	2
BOOM STOP:		
Lower tube (each) -----	145	65
Upper tube (each) -----	300	136
Spring (each) -----	75	34
MAST:		
26 ft (7 925 mm) mast -----	4,880	2 213
21 ft (6.4 m) assembly pendant (each) -----	155	70
Hydraulic boom hoist cylinders - wet (each) with pins -----	4,540	2 059

	Weight	
	Pounds	Kilograms
BOOM NO. 78T:		
9 ft, 6 in (2.9 m) lower butt -----	2,465	1 118
13 ft (4.0 m) upper butt with wire rope guide -----	4,285	1 943
20 ft (6.1 m) top (with lower point, wire rope guide and pendant links) -----	6,730	3 052
17 ft, 6 in (5.3 m) insert with wire rope guides -----	4,080	1 850
10 ft (3.0 m) insert -----	1,140	517
20 ft (6.1 m) insert -----	1,990	902
20 ft (6.1 m) insert (with jib backstay lugs) -----	2,120	961
50 ft (15.2 m) insert -----	4,265	1 934
50 ft (15.2 m) insert (with jib backstay lugs) -----	4,395	1 993
14 ft, 1-13/32 in (4.3 m) basic strap (each) -----	175	79
9 ft, 5 in (2.9 m) strap (each) -----	120	54
19 ft, 5 in (5.9 m) strap (each) -----	235	106
49 ft, 5 in (15.1 m) strap (each) -----	570	258
7 in (0.2 m) connector links with pins (1 set of 2 links) -----	35	15
Intermediate suspension beam -----	160	72
Intermediate suspension link (each) with pin -----	30	13
4 ft, 7-1/8 in (1.4 m) Intermediate suspension pendant (each) -----	20	9
Intermediate suspension adaptor (each) -----	45	20
Link - on mast (each) -----	85	38
Wire rope guide (top - 2 sheave) -----	985	446
Timber wire rope guard (each) -----	15	6
Upper wire rope guide (upper butt) -----	770	349
Wire rope guide (components of integral wire rope guide frame on upper butt) -----	225	102
JIB NO. 134:		
15 ft (4.6 m) butt -----	580	263
15 ft (4.6 m) top (with jib point) -----	990	449
10 ft 0 (3.0 m) insert -----	350	158
20 ft (6.1 m) insert -----	580	263
30 ft, 9 in (9.4 m) basic pendant (each) -----	115	52
9 ft, 6 in (2.9 m) pendant (each) -----	65	29
19 ft, (5.8 m) pendant (each) -----	85	38
12 ft, 6 in (3.8 m) strut with sheave -----	665	301
Backstay link (each) attached to strut -----	25	11
Backstay tie link -----	10	4
Backstay link (each) -----	65	29
Backstay spreader -----	50	22
44 ft, 7 in (13.6 m) backstay pendant (each) -----	150	68
4 ft, 8 in (1.4 m) backstay pendant (each) -----	50	22
Backstay link (each) attached to boom insert -----	20	9
Jib stop assembly -----	155	70
Wire rope anchor -----	70	31
Winch -----	35	15
Load sensor -----	110	49

	Weight	
	Pounds	Kilograms
LUFFING JIB NO. 139:		
27 ft (8.2 m) butt -----	2,000	907
23 ft (7.0 m) top (with jib point, wire rope guide, limit control, load sensor and pendant links) -----	3,675	1 666
10 ft (3.0 m) insert -----	580	263
20 ft (6.1 m) insert -----	980	444
40 ft (12.2 m) insert -----	1,795	814
20 ft, 1-1/2 in (6.1 m) basic pendant (each) -----	185	83
24 ft, 0 in (7.3 m) basic pendant (each) -----	190	86
10 ft, 1 in (3.1 m) pendant (each) -----	130	58
40 ft, 3 in (12.3 m) pendant (each) -----	260	117
21 ft, 6 in (6.6 m) jib strut with guide sheaves, luffing sheaves and links -----	3,190	1 446
20 ft, 0 in (6.1 m) main strut with luffing sheaves and links -----	2,670	1 211
35 ft, 5-1/2 in (10.8 m) basic backstay pendant (each) -----	215	97
40 ft, 3 in (12.3 m) backstay pendant (each) -----	210	95
20 ft, 1-1/2 in (6.1 m) backstay pendant (each) -----	145	65
10 ft (3.0 m) backstay pendant (each) -----	110	49
1 ft, 6 in (457 mm) backstay link (each) attached to mast -----	160	72
Jib stop assembly -----	700	317
Main strut stop assembly -----	720	326
Wire rope guide on jib top (2 sheave) -----	645	292
Wire rope anchor -----	225	102
Luffing jib hinge pin (each) -----	25	11
MACHINE OPTIONS:		
Cummins M11-C330 power plant (increase over standard) -----	660	299
High line speed arrangement for front or rear drum (increase over standard) -----	190	86
BOOM AND JIB OPTIONS:		
Upper boom point (single sheave) -----	920	417
Auxiliary drum assembly in upper boom butt -----	3,670	1 664
21-1/4 in (540 mm) Diameter lagging for auxiliary drum -----	670	303
15 USt (14 t) hook and weight ball -----	1,250	566
30 USt (27 t) load block -----	1,500	680
60 USt (54 t) load block -----	2,825	1 281
175 USt (160 t) load block -----	5,800	2 630
WIRE ROPE:		
Load lines - 1 in. rotation resistant wire rope 2.03 Lb./ft (3.02 kg/m)		
Hoist line - 1200 ft (389 m) -----	2,435	1 104
Whip line - 900 ft (274 m) -----	1,825	827
Auxiliary line - 900 ft (274 m) -----	1,825	827
26 mm rotation resistant wire rope 2.13 Lb./ft (3.17 kg/m)		
Auxiliary line - 900 ft (274 m) -----	1,915	868
1 in. conventional wire rope 1.85 Lb./ft (2.75 kg/m)		
Hoist line - 1200 ft (389 m) -----	2,220	1 006
Whip line - 900 ft (271 m) -----	1,665	755
Auxiliary line - 900 ft (271 m) -----	1,665	755
26 mm conventional wire rope 1.94 Lb./ft (2.89 kg/m)		
Auxiliary line - 900 ft (271 m) -----	1,745	791

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
Feet Per Second	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
VOLUME (LIQUID)					

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

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SECTION 2

SAFETY INFORMATION

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SECTION 2

SAFETY INFORMATION



WARNING

California Proposition 65

Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to www.P65warnings.ca.gov/diesel.

Batteries, battery posts, terminals, and related accessories can expose you to chemicals, including lead and lead compounds, which are known to the State of California to cause cancer and birth defects or other reproductive harm. Wash hands after handling. For more information go to www.P65warnings.ca.gov.

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 Manitowoc Product Support.

NAMEPLATES AND DECALS

See the 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 on page 2-2](#) and [Table 2-2 on page 2-3](#).

Table 2-1 Common Safety Symbols





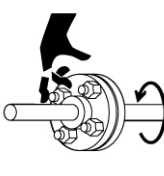


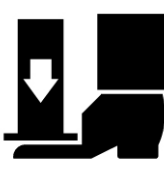












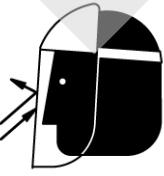







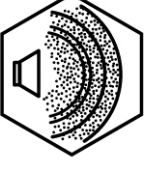

Cut or Crush Hazards					Cut Hazard
 M100090	 M100091	 M100066	 M100065	 M100069	 M100067
Crush Hazards					Fire Extinguisher
 M100070	 M100071	 M100072	 M100073	 M100074	 M100082
Fall Hazards			Falling Boom (Crush) Hazards		Explosion Hazard
 M100083	 M100084	 M100085	 M100068	 M100075	 M100080
Falling 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 2-1 Common Safety Symbols











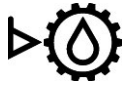




Emergency Cab Exit	Lift	Do Not Lift	Prohibited
 M102486	 M104626	 M104627	 M104628

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	 M101972	 M101973	 M101974	

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!

The upperworks can swing into and crush personnel climbing on or off the crane.

Moving crawlers can crush personnel climbing on or off the crane.

To prevent death or serious injury:

- Barricade all accessible areas to the crane so personnel cannot be struck or crushed when the upperworks is swung.
- Do not climb onto or off the crane while the upperworks is being swung or the crane is being traveled.
- Signal the operator for permission to climb onto/off the crane.
- Operator: do not swing or travel while personnel are climbing onto or off the crane. Stop the swing and travel motions. Apply the swing brake and turn on travel park.
- Operator: Always sound the 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 shall 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 a ladder, steps, platforms, and catwalks at the locations shown in

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

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 the crane. Store clothing and other personal belongings so they do not interfere with controls in operator cab or with operation of the 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 operator 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 Maniowoc.

GETTING ON OR OFF CRANE

Personnel getting on and off the crane shall do so only:

- a. at the steps or ladders provided,
- b. while crane is parked and not moving,
- c. with the operator's or qualified person's permission,
- d. if the performance of their duties requires them to do so.

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

Always maintain a three-point contact with the ladder: two feet and one hand or two hands and one foot.

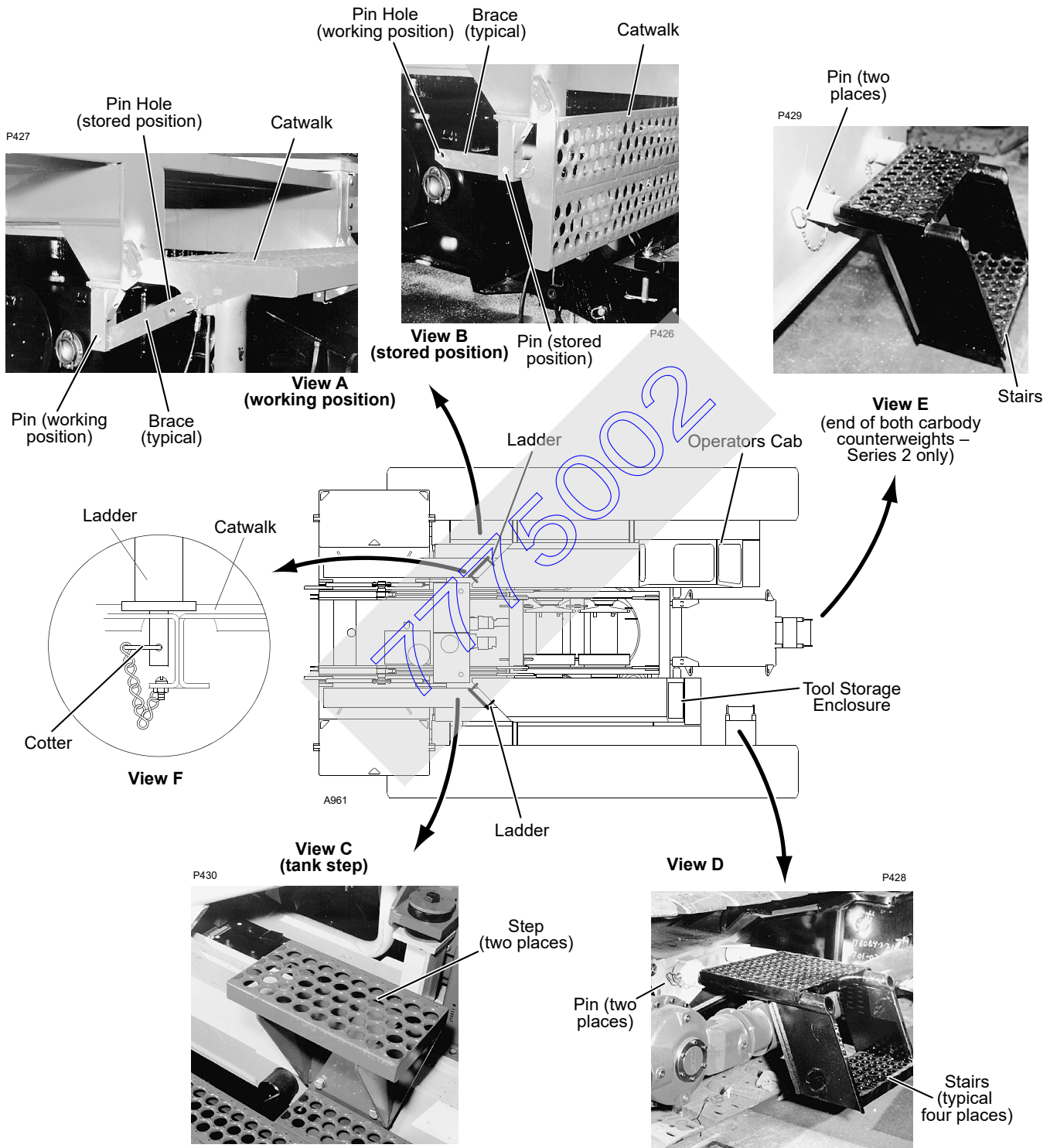


Figure 2-1. Crane Access Points

PERSONAL FALL-PROTECTION

It is the crane owner/user's responsibility to provide assembly/maintenance personnel with appropriate fall-protection equipment.

WARNING Fall Hazard!

To prevent falling from any height during crane assembly and disassembly, personnel shall appropriately wear fall-protection equipment.

OPERATOR MANUAL/CAPACITY CHART STORAGE

General

Manitowoc provides the following manuals and other important literature with your crane:

- Operator 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.
- RCI/RCL 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 cab (Operator Manual, Capacity Charts, Maintenance Checks and Lube Guide, and RCL Operation) are supplied in an OPERATOR INFORMATION binder.

The Operator 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. **Using any other manual or capacity chart is prohibited.**

The crane model and serial number are located on the Crane Identification Plate on the crane cab.

If the serial numbers of your manuals and capacity charts do not match the serial numbers of the crane, contact your Manitowoc dealer for the proper manual or capacity charts.

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

Storing Manuals

See [Figure 2-2](#).

Store the Operator Information Manuals for the crane and each applicable attachment on the bookshelf in the Operator's cab.

Attach the chain from the manual in use to the link behind the operator's seat.

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



Figure 2-2.

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.

Work Area Control

Personnel within the swing radius of the crane and fall zone of the crane's boom and/or load are subject to hazards if the crane is not operated per the requirements of the manufacturer and industry recognized safe operating practices.

To minimize the risk of harm, training of personnel on jobsite hazard recognition and prevention is required. Additionally, restricting access to the swing radius and fall zone during specific work conditions is required. The U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) regulations for Construction provides requirements in 29CFR1926.1417 Operation, 29CFR1926.1424 Work area control, 29CFR1926.1425 Keeping clear of the load and 29CFR1926.1426 Free fall and controlled load lowering.

Read Operator 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 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 Manual must be read to personnel who cannot 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

Manual at any time without notice. If you have any questions regarding the crane or its Operator Manual, please contact your Manitowoc dealer or Manitowoc Product Support.

Operator Qualifications

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

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

No personnel shall be allowed to climb onto the crane or enter 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, 07004-2900 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 can 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 the crane and its proper care. If adjustments or repairs are necessary or if there are known defects that impair safe operation, the crane must not be operated until unsafe conditions have been corrected.
5. If there is a warning sign at the start controls, the operator shall not start the engine until the warning sign has been removed by the person who installed it.
6. Before starting the engine, the operator shall make sure that:
 - a. All daily inspection and maintenance services have been performed.
 - b. All controls are in the off position and all brakes and locking devices are applied or engaged.
 - c. All personnel are clear of the crane. 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 the crane in no way substitutes for or lessens requirement that operator knowledge, experience, and judgment are required to ensure safe operation of the crane.

Crane must 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 Section 3 of the MLC100-1 Operator Manual.

7. The operator shall test all controls, limits, and communication systems at the start of each shift. Any defects found must 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 must not be exceeded.**



WARNING

Moving Load/Tipping Crane Hazard!

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

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

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

NOTE The designated person shall 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 Manual.

13. 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.
14. If the crane will be operated at night, the operator shall make sure that there is sufficient lighting for safe operation. The load and landing area must be illuminated.
15. 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 12 on page 2-8.

NOTE DO NOT depend on grounding. Grounding of a crane affords little or no protection from electrical hazards. The effectiveness of grounding is limited by the size of the conductor (wire) used, condition of the ground, the magnitude of voltage and current present, and numerous other factors.

16. Wind can cause 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 Operator 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 16 m/s (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.

17. Booms, jibs, or masts which are being assembled or disassembled on the ground (with or without support of boom rigging) must 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.

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

Handling Load

Size of Load

1. The crane must not be loaded beyond the applicable static or dynamic ratings given in the Capacity Chart for the crane configuration.
2. The ratings given in the Capacity Chart are developed based on “Freely suspended loads” and specified operating conditions. When cranes are used for service other than lifting service and/or special lifting operations, Manitowoc or a qualified person shall establish the ratings, operating limitations, maintenance, testing, and inspection requirements. Please reference Special Application/Service later in this section.

NOTE “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 shall 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 shall be used to further reduce total load to allow for the dynamic effects of swinging, hoisting, or lowering, and adverse weather conditions to include wind.

3. 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 must take priority over RCI/RCL readings.

Attaching Load

1. Attach the hook to the load with slings, or other suitable rigging. Each hook must have a latch that is in proper working order. **Hook latches must 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 must be level to within 1% — 0,3 m (1ft) rise or fall in 30,5 m (100 ft) distance.

When such a surface is not available, it must 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.manitowoc.com
 - b. The load is secured and properly balanced in the slings or the lifting device before lifting the load more than 76 to 152 mm (3 to 6 in).
 - 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 76 to 152 mm (3 to 6 in) 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 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. When lifting, any non-vertical loads applied to the crane from dynamics, multi-crane lifts or environmental factors must be minimized or eliminated. The load must remain under the lifting point at all times.
 - d. 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.
 - e. Use taglines or other restraints to control the load when necessary.
 - f. Do not exceed any swing limitations (areas of operation) given in the Capacity Chart.
 - g. Do not allow the load, boom, or any other part of the crane to contact obstructions.
 - h. Do not use the crane to drag a load.
 - i. Do not hoist, lower, or swing the load while personnel are on the load or the hook. See Personnel Handling in this section.
 - j. Avoid carrying the load over personnel. Loads which are suspended must be blocked or cribbed before personnel are allowed to work under or between them.

- k. 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 must 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.

- l. Fully retract and lock the jacks and the outrigger beams so they cannot extend when not in use.
- m. Do not lower the load or the boom to a point where less than three full wraps of wire rope remain on the respective drum (or as otherwise indicated in local, state, or federal regulations).
- n. Engage the boom hoist pawl when operating with the boom at a fixed radius.
- o. Engage the luffing hoist pawl when operating with the luffing jib at a fixed radius.

- 3. While traveling, the operator shall take 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 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 must 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.

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 must 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 must be in accordance with the standard signals shown in Section 3, unless communications equipment (telephone, radio, etc.) is used.
3. All signals must 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 must be agreed upon in advance by the operator and the signal person. The signals used must 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 must 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 must 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 the 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 shall 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 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 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. An integral holding device or check valve on each jacking cylinder.

OPERATIONAL AIDS



WARNING

Do not operate the 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 shall 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.

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 he/she 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 (visible from operator 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 6 m (20 ft) 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 the crane, boom, and load be kept at least 6 m (20 ft) 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 judgment. 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 6 m (20 ft) 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 must be deenergized OR,
 - Tests must 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.

Electrical Contact

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

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 shall attempt to come close to the crane or load until the power has been turned off.

Only as a last resort should an operator attempt to leave the crane upon contacting a power source. If it is absolutely necessary to leave the cab, JUMP COMPLETELY CLEAR OF CRANE. DO NOT STEP OFF. Hop away with both feet together. DO NOT walk or run.

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

If the dealer is not immediately available, contact Manitowoc Product Support. 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

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

FIRE EXTINGUISHERS

1. A portable fire extinguisher with a minimum rating of 10 BC must be installed in operator's or machinery cab of the crane.
2. The operator and all maintenance personnel shall be thoroughly familiar with the location, use, and care of the fire extinguisher(s) provided.

ACCIDENTS

If this crane becomes involved in a property damage and/or personal injury accident, immediately contact 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. Accident reporting forms can be found at www.manitowoc.com.

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 shall **read Operator 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

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

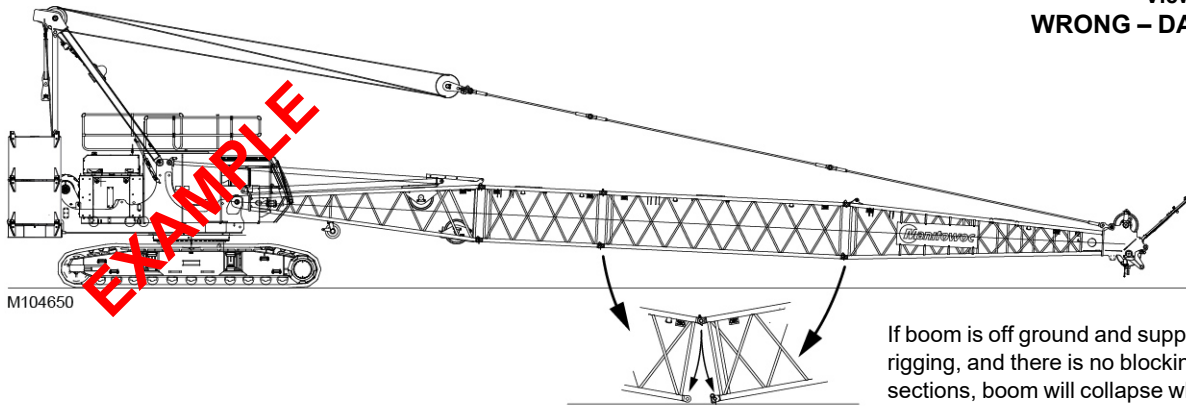
Potentially harmful waste used in Manitowoc cranes includes — but is not limited to — oil, fuel, grease, coolant, air conditioning refrigerant, filters, batteries, and cloths which have come into contact with these environmentally harmful substances.

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

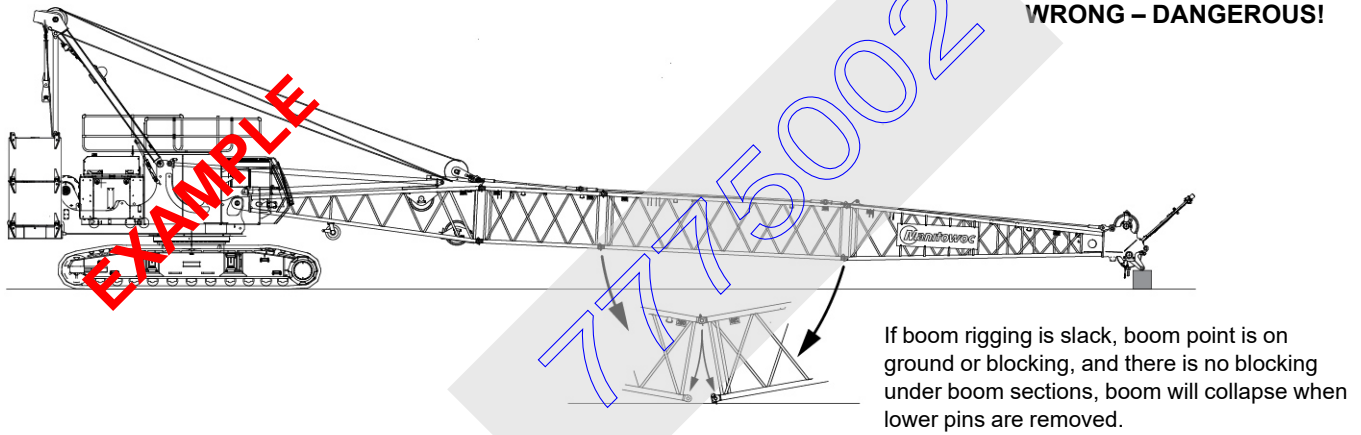
When filling and draining crane components: do not pour waste fluids onto the ground, down any drain, or into any source of water.

- 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.

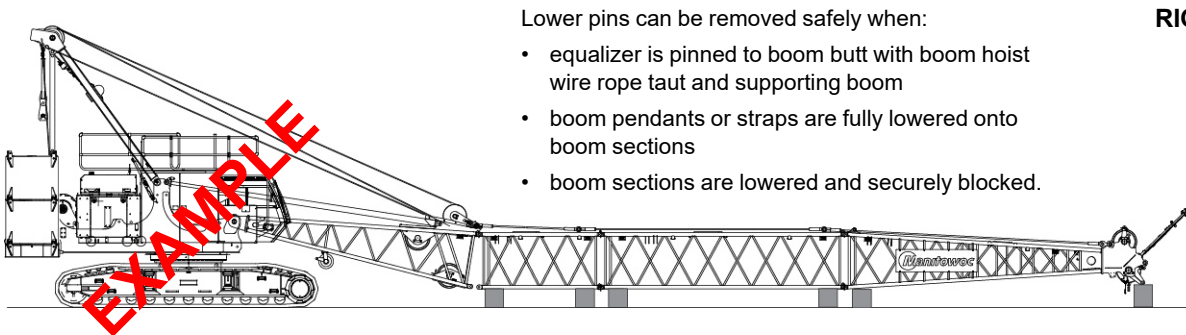
**View A
WRONG – DANGEROUS!**



**View B
WRONG – DANGEROUS!**



**View C
RIGHT – SAFE**



Lower pins can be removed safely when:

- equalizer is pinned to boom butt with boom hoist wire rope taut and supporting boom
- boom pendants or straps are fully lowered onto boom sections
- boom sections are lowered and securely blocked.

Figure 2-3. Boom Disassembly

BOOM DISASSEMBLY SAFETY

NOTE The term “boom” used in the following instructions applies to all lattice attachments (fixed jib, luffing jib, mast, etc.).



DANGER!

Collapsing Boom Hazard!

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

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 2-4](#)) 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 shall be trained and experienced in the operation and disassembly of construction cranes. Everyone shall read and understand these instructions, the information in the Boom Assembly Drawing, and the instructions in Section 4 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 endanger other workers.**

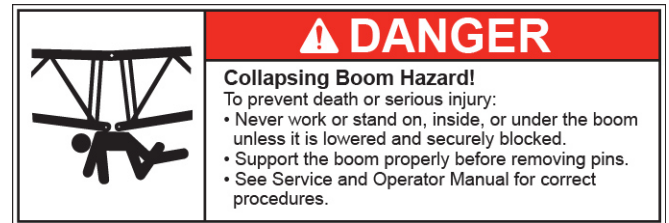
Location

Select a suitable location for boom disassembly. It must be firm, level, and 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.

Pin Removal

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.



M101904

Figure 2-4. Safety Decal

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.**



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 pendants as shown in [Figure 2-3](#), View A.
- Do not remove pendant connecting pins until pendants are fully lowered onto boom sections as shown in [Figure 2-3](#), View C.
- Do not remove bottom connecting pins from any boom section when boom point is resting on ground or blocking and boom rigging is slack as shown in [Figure 2-3](#), View B.
- Never work or stand inside boom unless it is lowered and securely blocked as shown in [Figure 2-3](#), View C.
- Do not stand or walk on top of the boom.



DANGER

Falling Boom Hazard!

Crane can tip or the boom can collapse if excess boom is cantilevered. Never cantilever more boom than allowed in rigging drawing or capacity chart.

SPECIAL APPLICATION/SERVICE

Special Application/Service is defined as anything other than normal lifting activities or normal lifting operation.

As identified in ASME B30.5, cranes are sometimes used for service other than lifting service and/or special lifting operations. In such cases Manitowoc or a qualified person shall review the service to be performed and jobsite conditions prior to operation. If appropriate, Manitowoc or a qualified person shall determine and establish a reduction in rated capacity, operating limitations, maintenance, testing and inspection requirements based on the job site conditions/limitations.

Because Manitowoc is not aware of all job site conditions/limitations we cannot provide further guidance until the intended service is understood, and a review of the conditions/limitations is complete.

Manitowoc cannot foresee all hazards that will arise in the field related to the special applications/services below; therefore, safety remains the responsibility of the qualified lifting personnel involved in the crane operations and owners.

Additional resources, training and experience may exist in the crane industry to provide guidance of risk assessments and hazard avoidance regarding special applications/service.

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 must 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, 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 shall 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 must 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 must 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 Operator Manual is in the 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 must 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 must 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 (for example, personal fall-protection system).
- 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 6 m (20 ft) of a power line that is up to 350 kV or within 15 m (50 ft) 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) must 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.

In 2016, **The International Crane Stakeholder Assembly** published a guidance document titled *Lifting of Persons with Mobile Cranes*. This document may assist crane owners and lifting personnel in the risk assessment of personnel handling.

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

PEDESTAL/BARGE MOUNTED CRANES

WARNING **Overload Hazard!**

A pedestal mounted crane will not tip to indicate to the operator that the crane's capacity has been exceeded. When the capacity of a pedestal mounted crane is exceeded, the hook rollers or other structural components may break, before the load lines fail, causing the crane to separate from the 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. The crane user shall verify that the barge is capable of limiting crane list and/or dynamics to the maximum allowable specified in the Capacity Charts. If the specified crane list and/or dynamic conditions are exceeded, the crane's capacity may be exceeded; the hook rollers or other structural components may break, causing the crane to separate from the pedestal.

! WARNING

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

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

Pedestal Mounted Crane

Also see ASME publication B30.8-2015, 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](#)).

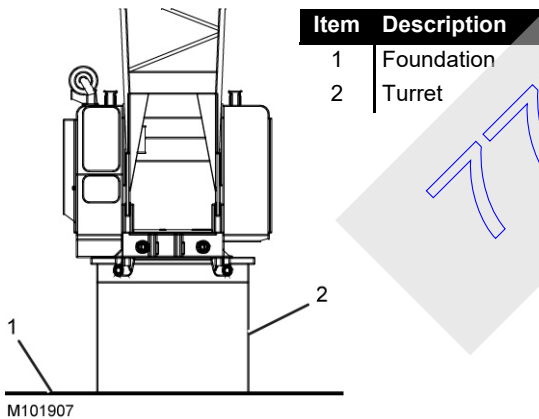


Figure 2-5. Turret-Mounted Crane

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

NOTE If the carbody will be bolted to the foundation, contact your Manitowoc dealer for the recommended bolt pattern and for the type and quantity of bolts to be used.

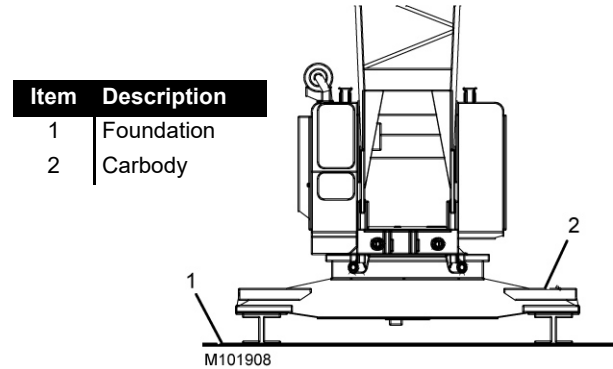


Figure 2-6. Carbody-Mounted Crane

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 the carbody anchored with tie-downs to the foundation ([Figure 2-7](#)).

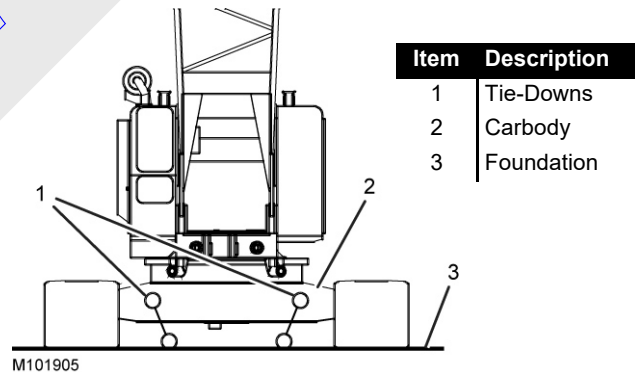


Figure 2-7. Crawler-Mounted Crane

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.**

NOTE Manitowoc does not permit traveling on a barge deck with load.

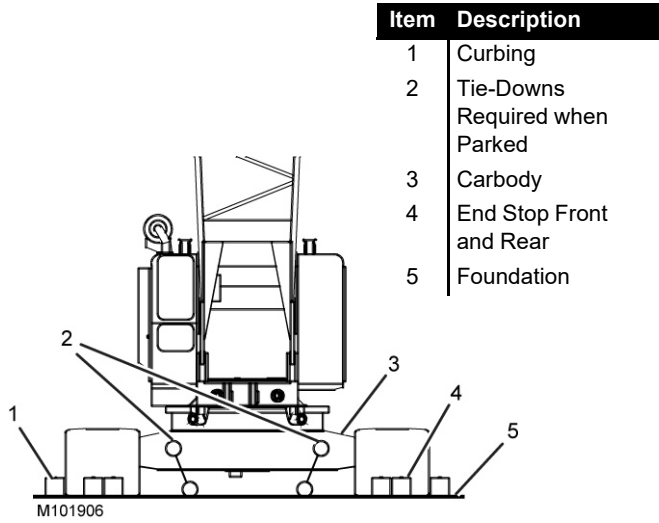


Figure 2-8. Crawler-Mounted Crane

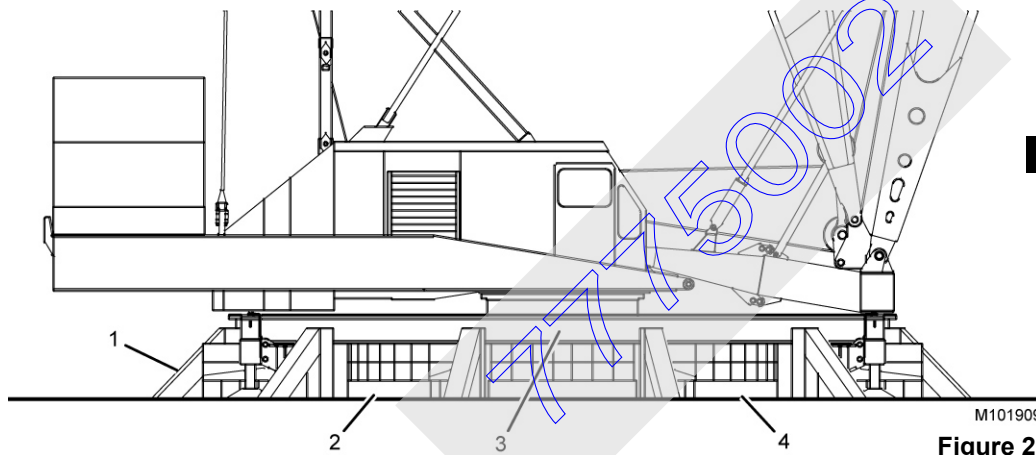
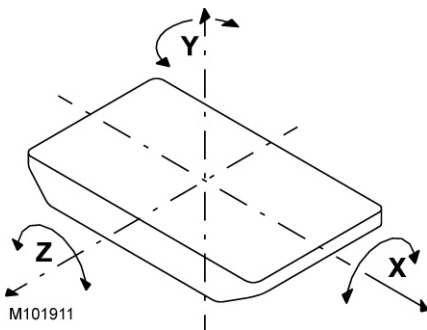


Figure 2-9. RINGER-Mounted-Crane



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. Barge Dynamics

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).

NOTE RINGERS must be equipped with hook rollers on the boom carrier and the counterweight carrier.

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

Capacity Charts for Barge Mounted Crane

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 the 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 Caused by Barge Dynamics

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 the crane's boom or structure is shock loaded during operation, or there is any indication of shock loading, all structural components of the crane must 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

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

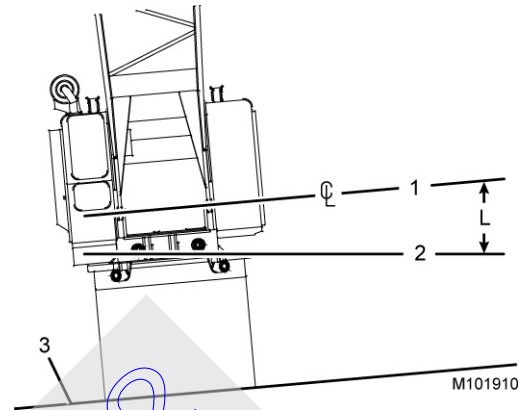
Tipping Crane Hazard!

Tie-downs which only prevent the 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, a ship or a floating platform, the crane user shall verify that correct the Capacity Chart is being used — pedestal mounted, barge mounted, 0°, 1°, 2° or 3° list or dynamic Capacity Chart.

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

Barge Mount 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.



Item	Description
1	Centerline through Boom Hinge Pins
2	Horizontal
3	Barge Deck
	Degrees of Machine List (Maximum allowable is specified in Capacity Chart)

Figure 2-11. Machine List

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 the 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.

Inspection of Barge-Mounted Crane

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 must be lowered onto a cradle (or other support) and the crane's boom, rotating bed, and lowerworks must be secured against movement. If the crane is equipped with a mast, the mast must 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.

PILE DRIVING AND EXTRACTING

Introduction

By operating within the following guidelines, pile driving is an approved application for Manitowoc brand mobile crawler cranes. Because pile driving and extracting presents many variables and unknowns, Manitowoc crane owners shall exercise discretion when considering the use of a crane for this application.

It is not our intention to recommend specific types or makes of pile driving and extracting equipment but rather to advise crane owners of our operational requirements to help avoid pile driving and extracting from having any detrimental effect on the crane and invalidating the new machine warranty. The following are the operating requirements that must be used during pile driving and extracting with a Manitowoc crawler crane. These notes are in addition to any guidelines published on the crane's capacity charts.

Operation of Pile Driving and Extracting Equipment

1. The combined weight of the drive or extractor, piling, leads, attachments, etc., must not exceed the published load chart values. A qualified person shall determine if additional capacity reductions are necessary.
2. The pile driver or pile extractor must be kept clear of the boom top at all times.
3. The crane operator shall ensure that the crane is not subject to impact loading or vibration being induced into the boom and crane structure by meeting the rate of descent of the driver and piling.
4. Pile driving or extracting must be restricted to the boom. A qualified person shall determine an appropriate configuration.
5. Pile Extraction is only permitted when using extraction devices that do not transmit vibration or shock loading into the crane. All possible precautionary measures must be taken to prevent shock loads or vibration from being imposed on crane components, either directly through the hoist cable or indirectly from ground borne vibration. Do not exceed load capacity.
6. The crane operator and other personnel associated with the pile driving and pile extraction operation shall have read and understood all safety standards applicable to crane operations as well as being thoroughly trained in the safe operation of pile driving and extracting equipment.
7. The load lines must be kept vertical at all times during pile driving and pile extraction operations.

Crane Equipment

1. Manitowoc recommends that hoist cable length be reduced to operate on the first layer for optimal spooling.
2. Crane must be assembled per applicable rigging drawing and operator manual.
3. All hoist hooks must be equipped with a positive locking latch.
4. Refer to the specific hook block or headache ball manufacturer website for additional guidelines on usage in pile driving applications.

Crane Inspection

1. In addition to the crane's frequent and periodic inspections, dated daily records must be maintained showing inspections were performed on the crane during the time it was used for pile driving or extraction.
2. The "40 Hours of Operation or Weekly" boom related inspection intervals published in the crane's *Inspection*

and *Maintenance Checklist* must be increased to 8 hour or daily intervals for the duration of pile driving operations.

3. The hoist cable must be inspected daily to ensure no abrasion or wear is occurring.

In 2014, **FEM**, a member of **The International Crane Stakeholder Assembly** published a guidance document titled *Using Mobile Cranes for Pile Driving/Extraction*. Additionally, ASSE A 10.19 Safety Requirements for Pile Installation and Extraction Operations may assist crane owners and lifting personnel in the risk assessment related to pile driving/extraction.

ELECTROCUTION HAZARD DEVICES

The use of insulated links, insulated boom cages/guards, or proximity warning devices does not assure that electrical contact will not occur. Therefore, Manitowoc does not endorse their use. When insulated links, insulated boom cages/guards, or proximity warning devices are installed on the crane as required by Regulations, Industry Codes, or company policies, the crane owner is responsible for ensuring that:

- a. The device manufacturer is contacted and provides instructions for storage, inspection, maintenance, and use of the devices.
- b. The device manufacturer provides all limitations and restrictions of the device.
- c. The documentation provided by the device manufacturer is maintained on the crane and available to the crane operator at all times.

Further, when insulated links, insulated boom cages/guards, or proximity warning devices are installed on the crane, a pre-operational meeting is to be held and a review of the instructions, limitations and restrictions related to the device(s) will be communicated to all personnel that are to work on or around the crane.

Even if the crane is equipped with these devices, failure to follow the rules, limitations and precautions outlined in this manual and provided by the device manufacturer at all times may result in serious injury or death.

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, the condition of the ground, the magnitude of the voltage/current present, and numerous other factors.

MULTIPLE LOAD LINE OPERATION

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 load 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 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 must be thoroughly inspected by a qualified person prior to setup.
4. The crane must be thoroughly inspected for load line interference caused by routing and reeving of multiple load lines. If interference is found, it must 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 the 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, jib, and sheaves:
 - The load lines must hang as close to vertical as possible to minimize side and forward loads.
 - 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. To minimize the angle of the load transmitted into the boom and/or jib, 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.

9. The crane operator shall 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).
10. 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.
11. Load shift when lifting with two hooks may be more unpredictable than typical one hook lifting.

MULTIPLE CRANE LIFTS

Operate with extreme caution when using more than one crane to lift the same load. Any lift that requires more than one crane to lift the same load must be precisely planned and coordinated by a qualified person due to new and different hazards.

The following additional precautions must be taken if it is necessary for more than one crane to lift the load:

- a. Secure the services of a qualified person to analyze and plan the lift.
- b. Verify proper controls are in place to prevent overload such as the necessity to reduce crane ratings, load position, boom position, ground support, and speed of movements. These controls must be in accordance with the qualified person's

decision and all other requirements identified in the operator manual.

- c. Ensure the lift director coordinates and instructs all personnel involved in the lift plan, to include but limited to, proper rigging and positioning of the load and all movements to be made prior to beginning the lift.
- d. Make sure all signals are coordinated through the lift director.
- e. A qualified person must direct the lift.
- f. Maintain communication between all parties throughout the entire lift. If possible, provide approved radio equipment for voice communication between all parties engaged in the lift.
- g. Ensure the load lines are directly over the attach points to avoid side loading, forward loading, and transfer of loading from one crane to the other.

In 2016, **The International Crane Stakeholder Assembly** published a guidance document titled *Lifting A Load With Several Mobile Cranes (Multiple Crane or Tandem Lifting)*. This document may assist crane owners and lifting personnel in the risk assessment of multiple crane lifts.

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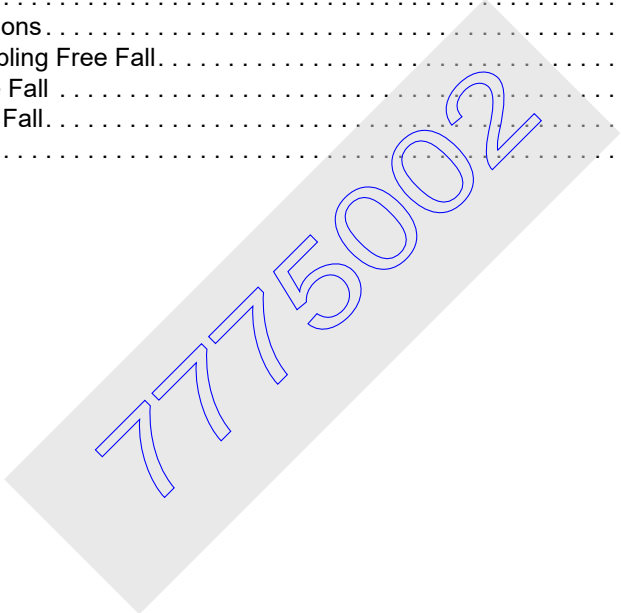
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SECTION 3

OPERATING CONTROLS AND PROCEDURES

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SECTION 3 OPERATING CONTROLS AND PROCEDURES


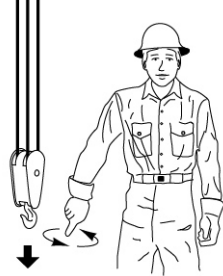
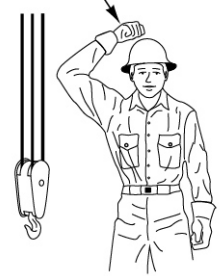
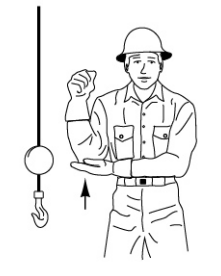


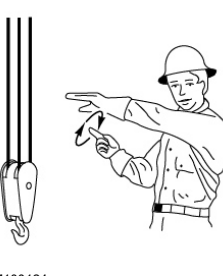
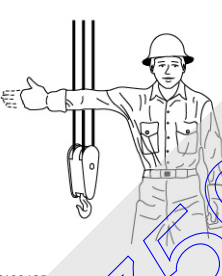
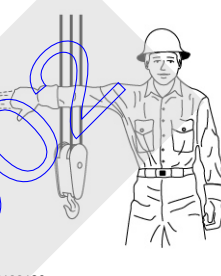
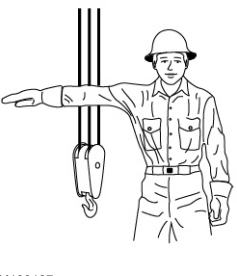
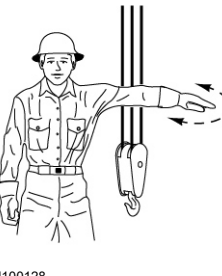
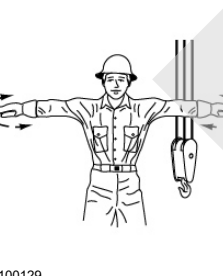
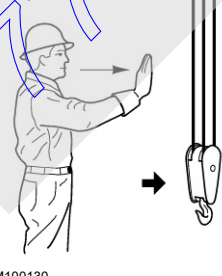
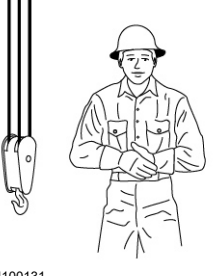

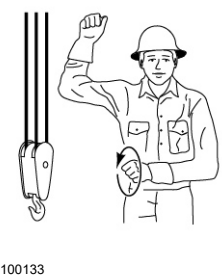
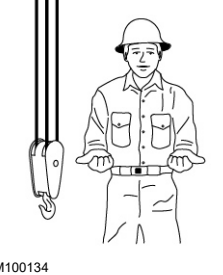
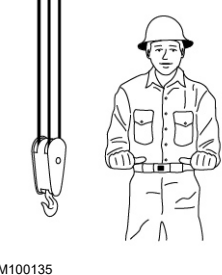
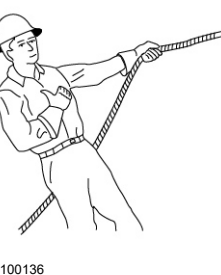

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STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS

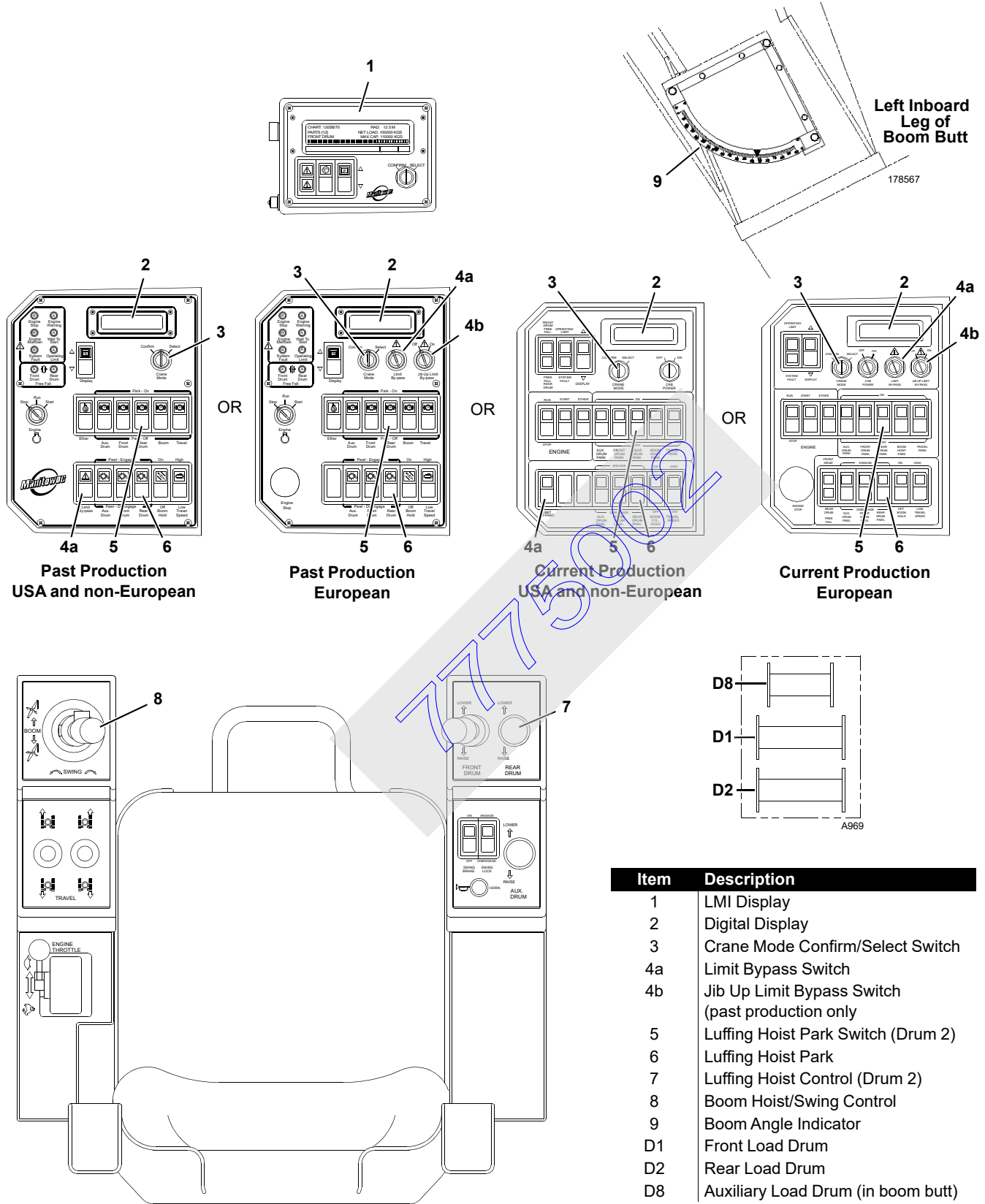
The following standard hand signals comply with ASME B30.5-2014.

Table 3-1 Standard Hand Signals for Controlling Crane Operations

<p style="text-align: center;">1</p>  <p style="text-align: center;">M100118</p>	<p style="text-align: center;">2</p>  <p style="text-align: center;">M100119</p>	<p style="text-align: center;">3</p>  <p style="text-align: center;">M100120</p>	<p style="text-align: center;">4</p>  <p style="text-align: center;">M100121</p>	<p style="text-align: center;">5</p>  <p style="text-align: center;">M100122</p>
<p style="text-align: center;">6</p>  <p style="text-align: center;">M100123</p>	<p style="text-align: center;">7</p>  <p style="text-align: center;">M100124</p>	<p style="text-align: center;">8</p>  <p style="text-align: center;">M100125</p>	<p style="text-align: center;">9</p>  <p style="text-align: center;">M100126</p>	<p style="text-align: center;">10</p>  <p style="text-align: center;">M100127</p>
<p style="text-align: center;">11</p>  <p style="text-align: center;">M100128</p>	<p style="text-align: center;">12</p>  <p style="text-align: center;">M100129</p>	<p style="text-align: center;">13</p>  <p style="text-align: center;">M100130</p>	<p style="text-align: center;">14</p>  <p style="text-align: center;">M100131</p>	<p style="text-align: center;">15</p>  <p style="text-align: center;">M100132</p>
<p style="text-align: center;">16</p>  <p style="text-align: center;">M100133</p>	<p style="text-align: center;">17</p>  <p style="text-align: center;">M100134</p>	<p style="text-align: center;">18</p>  <p style="text-align: center;">M100135</p>	<p style="text-align: center;">19</p>  <p style="text-align: center;">M100136</p>	<p style="text-align: center;">20</p>  <p style="text-align: center;">M100137</p>

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Item	Description
1	HOIST —With forearm vertical, forefinger pointing up, move hand in small horizontal circles.
2	LOWER —With arm extended downward, forefinger pointing down, move hand in small horizontal circles.
3	USE MAIN HOIST —Tap fist on head. Then use regular signals.
4	USE WHIPLINE (Auxiliary Hoist) —Tap elbow with one hand. Then use regular signals.
5	RAISE BOOM —Arm extended, fingers closed, thumb pointing upward.
6	LOWER BOOM —Arm extended, fingers closed, thumb pointing downward.
7	MOVE SLOWLY —Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal (hoist slowly shown as an example).
8	RAISE BOOM & LOWER LOAD —With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.
9	LOWER BOOM & RAISE LOAD —With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.
10	SWING —Arm extended, point with finger in direction of swing of boom.
11	STOP —Arm extended, palm down, move arm back and forth horizontally.
12	EMERGENCY STOP —Both arms extended, palms down, move arms back and forth horizontally.
13	TRAVEL —Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.
14	DOG EVERYTHING —Clasp hands in front of body.
15	TRAVEL (Both Tracks) —Use both fists in front of body, making a circular motion about each other, indicating direction of travel forward or backward. (For Land Cranes Only).
16	TRAVEL (One Track) —Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body. (For Land Cranes Only).
17	EXTEND BOOM (Telescoping Booms) —Both fists in front of body with thumbs pointing outward.
18	RETRACT BOOM (Telescoping Boom) —Both fists in front of body with thumbs pointing toward each other.
19	EXTEND BOOM (Telescoping Boom) — One Hand Signal. One fist in front of chest with thumb tapping chest.
20	RETRACT BOOM (Telescoping Boom) — One hand signal. One fist in front of chest, thumb pointing outward and heel of fist tapping chest.



Item	Description
1	LMI Display
2	Digital Display
3	Crane Mode Confirm/Select Switch
4a	Limit Bypass Switch
4b	Jib Up Limit Bypass Switch (past production only)
5	Luffing Hoist Park Switch (Drum 2)
6	Luffing Hoist Park
7	Luffing Hoist Control (Drum 2)
8	Boom Hoist/Swing Control
9	Boom Angle Indicator
D1	Front Load Drum
D2	Rear Load Drum
D8	Auxiliary Load Drum (in boom butt)

FIGURE 3-1

LUFFING JIB OPERATING CONTROLS

See Figure 3-1 for Location of Controls.

The instructions in this section supplement the operating control instructions in the Crane Operator 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 Manual, and in Luffing Jib Rigging drawings and Capacity Charts.

1 – Rated Capacity Indicator/Limiter (RCL)

Displays load lifting information and alerts the operator to overload conditions.

See separate LMI Manual for operating instructions.

2 – Crane Mode Selector

Use this control to select and confirm the LUFFING JIB mode.

Once selected and confirmed, the mode appears on the digital display as shown in Figure 3-2.

See the Crane Operator Manual for detailed instructions on selecting and confirming the crane mode.

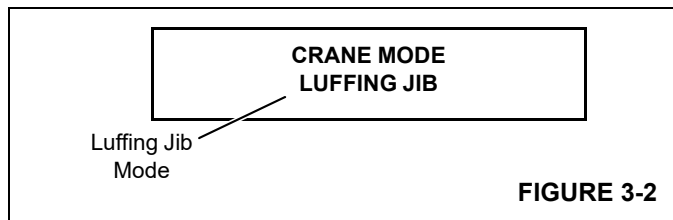


FIGURE 3-2

On crane S/N 7771165 and newer, use the crane mode selector to also turn on the LUFFING JIB SETUP MODE. This mode allows the limits listed in Table 3-3 to be bypassed with Limit Bypass Switch (4a).

To bypass the limits listed in Table 3-3 for luffing jib setup, proceed as follows:

- Select and confirm luffing jib setup mode.

- Rotate limit bypass switch (F1) clockwise and release. The limits will remain bypassed for 10 seconds.
- Move the desired control handle (luffing hoist, boom hoist, load drum) — one control handle at a time — in the required direction. The limits will remain bypassed for as long as the handle is moved in either direction.
- The limits will remain bypassed for 10 seconds after the control handle(s) is returned to off.

3 – 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 — angle between centerline of boom and horizontal. Monitor this angle when raising boom to operating angle.

Adjust automatic boom stop for 88° when operating with luffing jib. See Boom Stop Adjustment instructions in Section 6 of this manual.

- LUFFING JIB ANGLE — angle between centerline of jib and horizontal. Monitor this angle when raising and lowering jib during operation.
- BOOM TO LUFFING JIB ANGLE — 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 the Crane Operator Manual for a complete list of operating conditions, system faults, and operating limits.

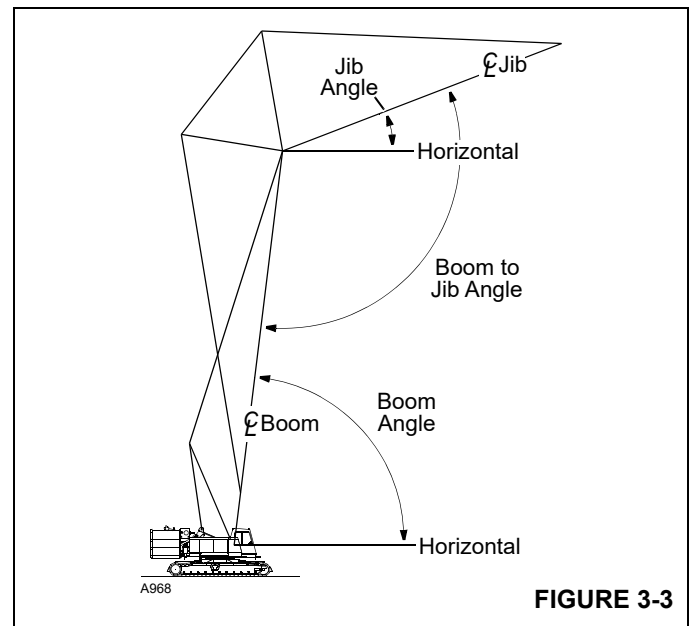


FIGURE 3-3

4a – Limit Bypass Switch and 4b – Jib Up Limit Bypass Switch

Switch (4a) bypasses the limits identified in Table 3-2 and Table 3-3.

Switch (4b) bypasses the limits identified in Table 3-3 on past production cranes. This switch is not provided on current production cranes.

See the Crane Operator Manual for:

- Detailed instructions on operating the limit bypass switches.
- A complete list of operating limits and precautions.

5 – Rear Drum Park Switch

Parks the rear drum (luffing hoist) when not in use.

See the Crane Operator Manual for detailed instructions on operating the drum park switch.

6 – Rear Drum Pawl Switch

Provides a positive means of locking the rear drum in position when not in use.

See the Crane Operator Manual for detailed instructions on operating the rear drum pawl switch.

7 – Boom Hoist Control

8 – Luffing Hoist Control

When the LUFFING MODE is selected and confirmed:

- The luffing hoist limits are activated.
- The rear drum operates as the luffing hoist and must be rigged accordingly. See Section 4 of this manual for raising and lowering instructions when equipped with a luffing jib attachment.

See the Crane Operator Manual for drum identification and for detailed instructions on drum operation.

For luffing jib operation, **free fall must be disabled for rear drum.**

9 – Boom Angle Indicator

Shows the angle of the boom in degrees above horizontal. The boom and luffing jib angles can also be viewed under OPERATING CONDITIONS on the digital display.

See Figure 3-3 for identification of the various boom and luffing jib angles.

10 – Level

Indicates crane levelness from front to rear and from side to side as shown in Figure 3-4. The level is mounted on cab

support and is visible through right side window in operators's cab.



WARNING

Tipping Hazard!

Unless otherwise specified on capacity chart, all crane operations must be performed with crane *level* to within one percent of grade in all directions – 1 ft in 100 ft (0.3 m in 30 m); otherwise, crane could tip.

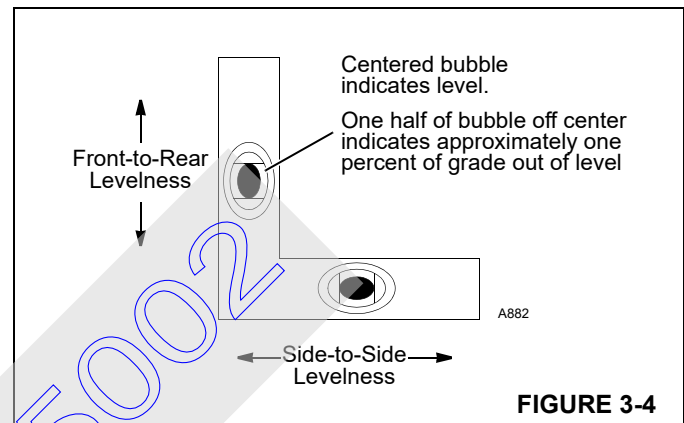


FIGURE 3-4

OPERATING PRECAUTIONS

1. Read and comply with instructions in Liftcrane Luffing Jib Capacity Charts provided with luffing jib attachment. Do not operate beyond limits given in capacity charts.
Make sure proper counterweight is installed.
2. Read and comply with instructions in this manual and in Crane Operator Manual.
3. Read and comply with Maximum Allowable Travel Specifications in Luffing Jib Capacity Chart Manual.
4. Make sure luffing jib attachment is installed properly. Read and comply with instructions in Section 4 of this manual.
5. Make sure all safety devices — block-up limits, boom and jib angle indicators, boom and jib stops, rated capacity indicator/limiter — are installed and operating properly. See Section 6 of this manual and the separate rated capacity indicator/limiter manual.
LUFFING JIB mode must be selected and confirmed to turn on luffing hoist limits.
6. Raise and lower attachment as instructed in Section 4 of this manual.
7. 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).

8. Operate all crane functions slowly and smoothly. Avoid sudden starts and stops which could side load or shock load attachment.
9. Do not operate crane, to include raising boom from ground level, if wind exceeds limits given in Capacity Charts. Contact your local weather station for wind velocity.
10. Disable free fall for rear drum. See instructions in this section.

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Table 3-2 Bypassable Limit Identification — PRIOR TO CRANE S/N 7771165

Limit	USA and non-EUROPEAN	EUROPEAN	
	Limit Bypass Switch (F1) (momentary)	Limit Bypass Switch (F1) (momentary)	Jib Up Limit Bypass Switch (F6) (maintained) ¹
Boom Maximum Up	Yes or No ²	No	No
Boom Maximum Down	Yes	Yes	No
Block Up (each load drum)	Yes	Yes	No
Bail – Max and Min (each load drum)	Yes	Yes	No
Load Moment	Yes	Yes	No
Luffing Jib Max Up	Yes	No	Yes
Luffing Jib Max Down	Yes	Yes	No

¹ Use only for rigging.

² 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 below.



WARNING

Falling Boom/Jib Hazard!

If you bypass boom up limit for any reason, DO NOT allow physical boom stops to bottom out. Boom butt could be damaged, causing boom and jib to fall over backwards.

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 the boom stop limit switch plunger down to trip the boom up limit switch open (see Section 4 of Crane Service Manual).
3. Rotate limit bypass key (F1) 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.
5. The test is complete: release the limit bypass key and the limit switch plunger to the normal operating positions.

LIMIT BYPASS TEST: Perform the following test to determine if the boom up limit on your crane can be bypassed or not:

Table 3-3 Bypassable Limit Identification — CRANE S/N 7771165 AND NEWER

Operating Limit	non-CE ¹	non-CE Luffing Jib Setup Mode On ²	CE	CE Luffing Jib Setup Mode On ²	CE External Override Switch
Boom Maximum Up	No	No	No	No	No
Block Up (Drum 1, 2, and 8)	Yes	Alarm ⁴	Yes ⁵	Alarm	Alarm
Block Up (Boom Hoist)	Yes	Alarm	Yes ⁵	Alarm	Alarm
Maximum Bail (Drum 1, 2, and 8)	Yes	No	No	No	No
Minimum Bail (Drum 1, 2, and 8)	Yes	No	No	No	No
Load Moment (Drum 1, 2, and 8))	Yes	Alarm	Yes ^{6,7}	Alarm ⁸	Alarm
Load Moment (Boom Hoist)	Yes	Alarm	Yes ^{6,7}	Alarm ⁸	Alarm
Pawl In (Drum 1, 2, and 8)	Yes	No	Yes	No	No
Luffing Jib Max Up 1	Yes	Alarm	No	Alarm	Alarm
Luffing Jib Max Up 2	Yes ^{9,10}	Alarm ¹¹	No	Alarm ¹¹	Alarm
Luffing Jib Max Down 1	Yes	Alarm	No	Alarm	Alarm
Luffing Jib Max Down 2	Yes ¹⁰	Alarm	No	No	No
Counterweight Max Up	Yes	No	Yes	No	No

¹ CE = Cranes that comply with 2010 European Requirements.

² Use only for rigging. See page 3-5 for instructions.

³ See Rated Capacity Indicator/Limiter Operation Manual.

⁴ Alarm = Operating limit alarm comes on and fault appears in system fault screen of Digital Display. Operation (motion) of the corresponding function is not stopped. The alarm is not bypassable.

⁵ Bypassable if below chart angle, otherwise cutout and alarms active.

⁶ Bypassed from 100-110% rated capacity with reduced speeds (bypass switch not required).

⁷ Bypassable when boom or luffing jib is below chart angle for rigging purposes.

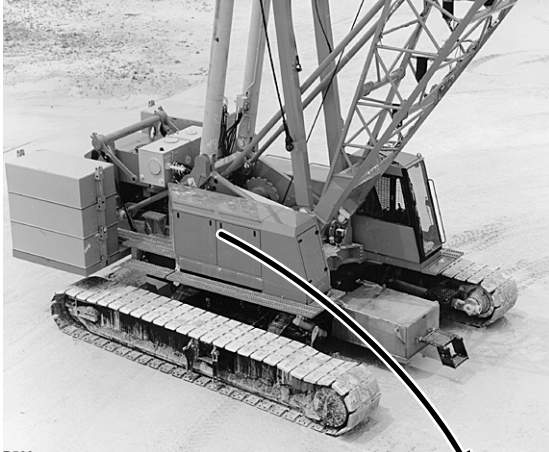
⁸ Only if below chart angle. Otherwise cutout and alarm is active.

⁹ Bypassable only if boom is below 50 degrees. Otherwise cutout and alarm is active.

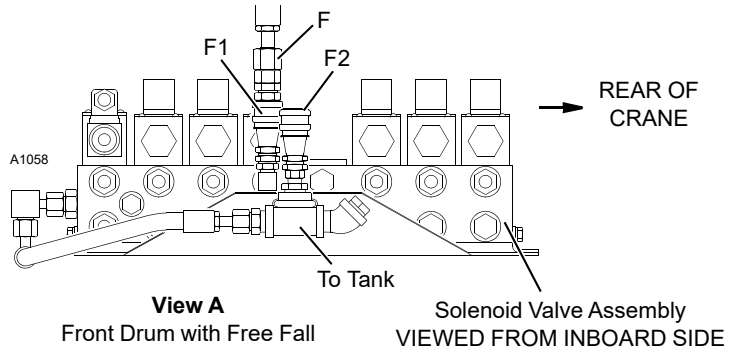
¹⁰ Bypassable only if handle is returned to neutral while holding bypass switch. Otherwise cutout and alarm is active.

¹¹ Only if boom is below 50 degrees. Otherwise cutout and alarm is active.

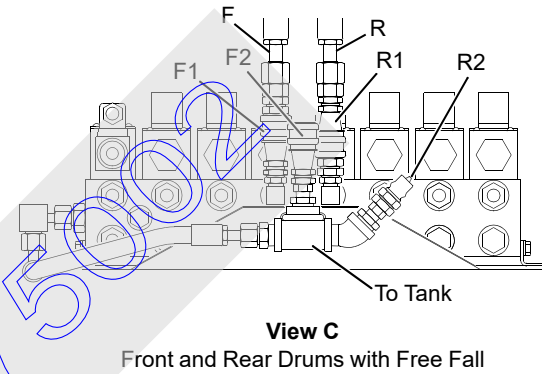
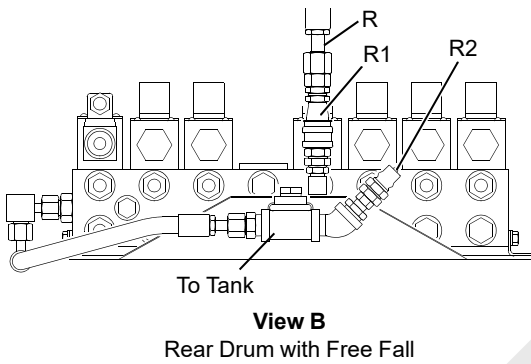
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PAST PRODUCTION



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CURRENT PRODUCTION

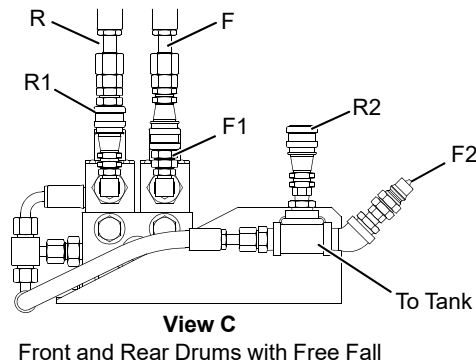
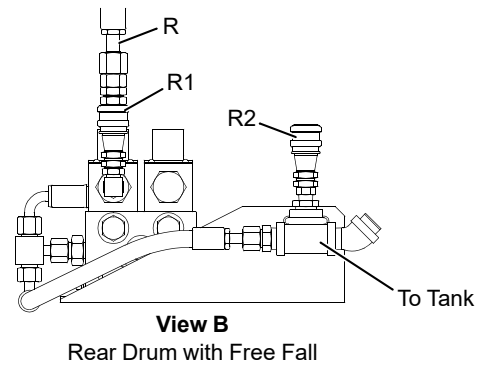
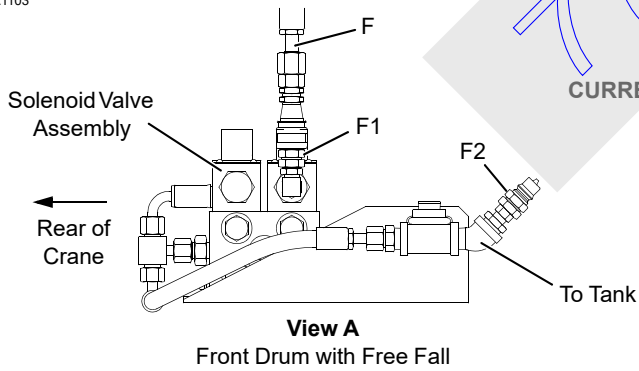


FIGURE 3-5

DISABLING AND ENABLING FREE FALL

The quick-disconnect couplers in the hydraulic hoses to the drum clutch solenoid valves allow FREE FALL operation to be disabled at either or both drum clutches.

When equipped with a luffing jib and free fall on the rear drum, **free fall must be disabled so the luffing jib cannot lower uncontrolled.**



DANGER

Falling Jib Hazard!

When equipped with a luffing jib, do not operate rear drum in FREE FALL mode. Luffing jib can lower uncontrolled if this precaution is not taken. To prevent free fall from being selected, disable free fall as instructed in this topic.

Disabling Free Fall

See Figure 3-5 for following procedure.

Perform the following steps to disable free fall operation for either or both load drums:

1. **Stop engine.**
2. For FRONT DRUM:
 - a. Disconnect clutch hose (F, View A or C) from coupler (F1) at clutch solenoid valve.
 - b. Connect clutch hose (F, View A or C) to coupler (F2) in tank return line.
3. For REAR DRUM:
 - a. Disconnect clutch hose (R, View B or C) from coupler (R1) at clutch solenoid valve.
 - b. Connect clutch hose (R, View B or C) to coupler (R2) in tank return line.

- c. **Install dust caps to keep unused couplers clean.**



WARNING

Falling Load or Jib Hazard!

To prevent load or luffing jib from falling:

- Always stop engine before disconnecting and connecting drum clutch hydraulic hoses.
- Do not operate crane unless drum clutch hydraulic hoses are connected either to couplers at solenoid valve or to couplers in tank return line.

Faulty clutch operation can occur if these precautions are ignored. Load or luffing jib could fall.

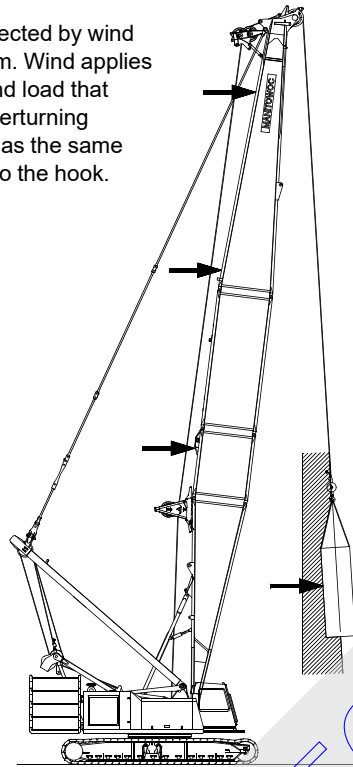
Enabling Free Fall

See Figure 3-5 for following procedure.

Perform the following steps to enable free fall operation for either or both load drums:

1. **Stop engine.**
2. For FRONT DRUM:
 - a. Disconnect clutch hose (F, View A or C) from coupler (F2) in tank return line.
 - b. Connect clutch hose (F, View A or C) to coupler (F1) at clutch solenoid valve.
3. For REAR DRUM:
 - a. Disconnect clutch hose (R, View B or C) from coupler (R2) in tank return line
 - b. Connect clutch hose (R, View B or C) to coupler (R1) at clutch solenoid valve.
 - c. **Install dust caps to keep unused couplers clean.**

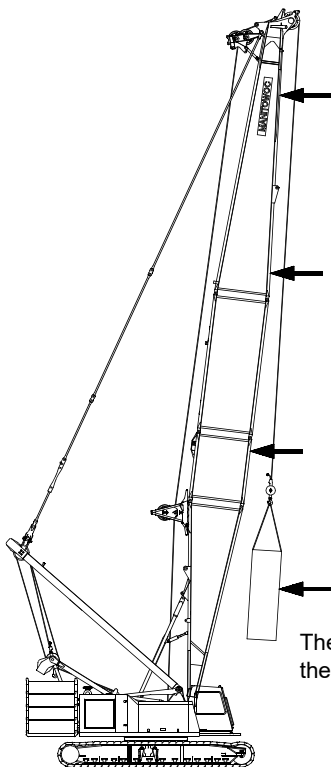
Forward stability is affected by wind on the rear of the boom. Wind applies a force to the boom and load that adds to the crane's overturning moment. This action has the same effect as adding load to the hook.



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The wind's effect on the rear of the load increases load radius. This condition can result in an overload hazard, possibly causing the crane to tip or the boom to collapse.

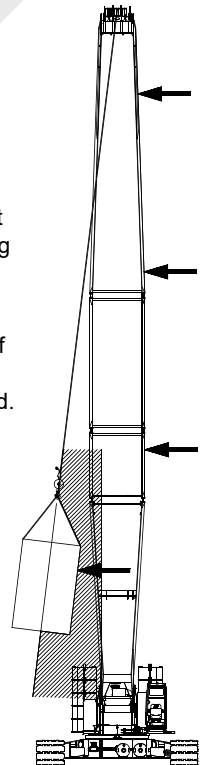
To avoid this hazard, reduce operating speeds and load (see appropriate table for recommended capacity reductions).



Backward stability is affected by wind on the front of the boom. This condition is especially dangerous when the boom is at or near the maximum angle when operating without load.

Wind forces on the front of the boom reduce the normal forward tipping effect of the boom. The crane can tip or the boom can collapse if this condition is not avoided.

The boom can buckle and collapse if the load contacts the boom.



Boom strength is affected the most when the wind acts on the side of the boom.

The wind's affect on the side of the load can cause the load to swing out past the boom hinge pin. This condition can result in excessive side load forces on the boom, possibly causing the crane to tip or the boom to collapse.

To avoid this hazard, reduce operating speeds and load (see appropriate table for recommended capacity reductions).

FIGURE 3-6

WIND CONDITIONS

Wind adversely affects lifting capacity and stability as shown in Figure 3-6. 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, reducing 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.

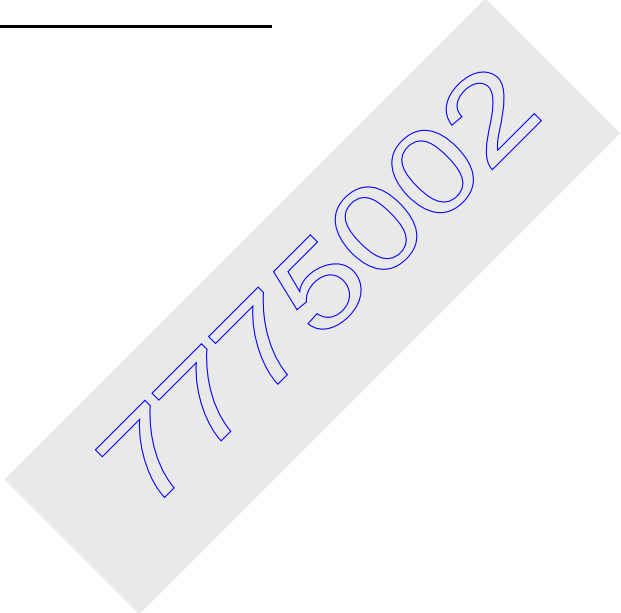
For wind conditions specific to this crane, see Wind Conditions Chart at end of this section or, if applicable, see wind conditions in Capacity Charts provided with crane and attachments.

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

Beware that wind speed at boom or jib point can be greater than wind speed at ground level. Also beware 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.



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SECTION 4

SET-UP AND INSTALLATION

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SECTION 4

SETUP AND INSTALLATION

LUFFING JIB ATTACHMENT

This section contains installation and removal instructions for the luffing jib attachment.

The parts identified below from the Model 888 #135 luffing jib can be used for the #139 luffing jib:

- Jib top to include jib point roller assembly, wire rope guide, hand winch, and universal anchor joint.
- Jib inserts (all lengths).
- Insert pendants (all lengths).
- Jib stop pendants.

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



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.

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

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

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

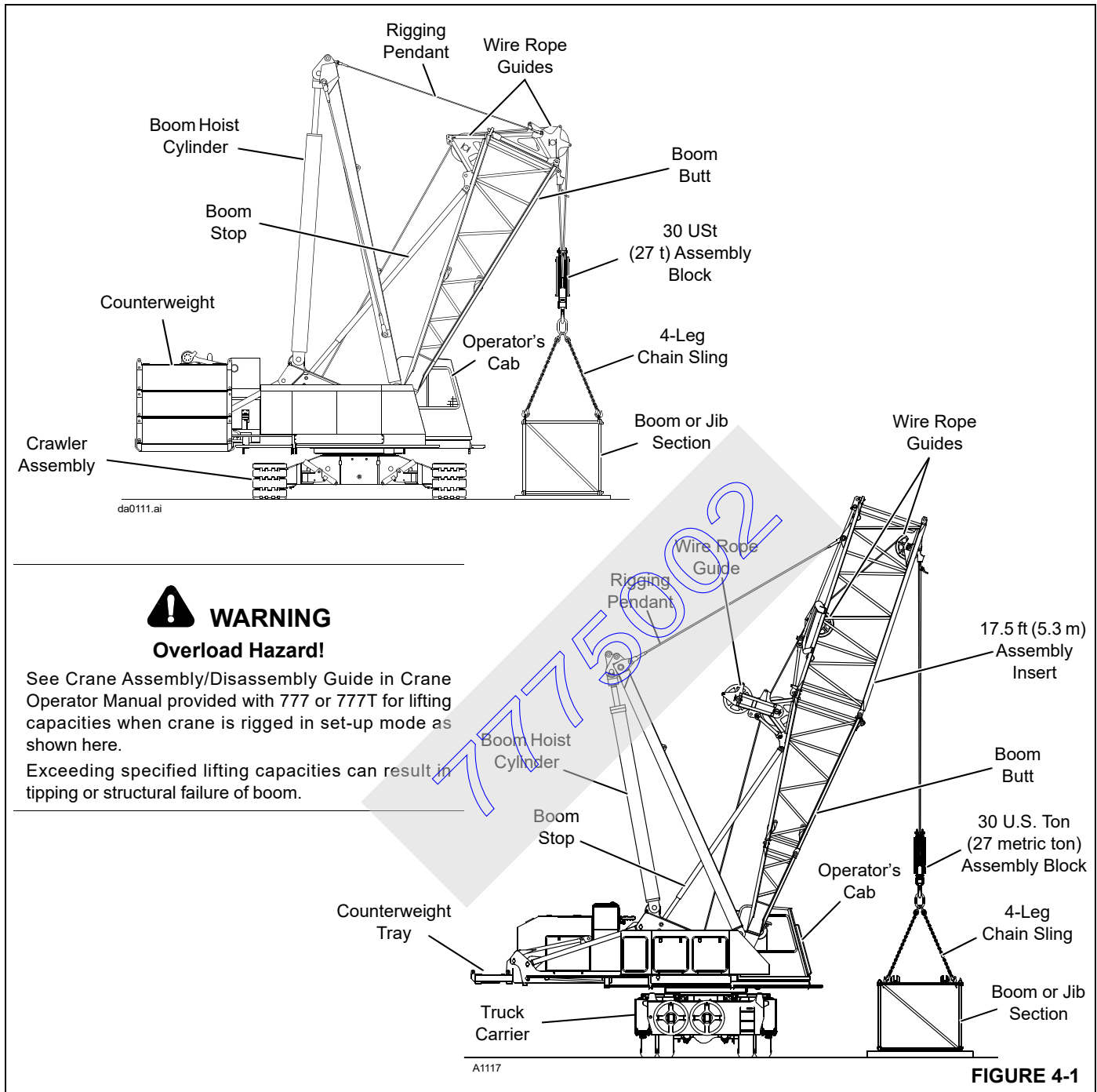
The terms RIGHT, LEFT, FRONT, REAR used in this section refer to the operator's right, left, front, and rear sides when seated in the operator's cab looking forward.

ACCESSING PARTS

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

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

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



WARNING
Overload Hazard!

See Crane Assembly/Disassembly Guide in Crane Operator Manual provided with 777 or 777T for lifting capacities when crane is rigged in set-up mode as shown here. Exceeding specified lifting capacities can result in tipping or structural failure of boom.

FIGURE 4-1

ASSIST CRANE REQUIREMENTS

An assist crane is not required for jib installation and removal. The 777 or 777T can be used to self-assemble the boom and jib components when rigged in the set-up mode shown in Figure 4-1. See the Crane Assembly and Disassembly Guide in the Crane Operator Manual provided with the 777 or 777T for detailed assembly instructions and for lifting capacities.

The jib butt, jib strut, and jib stop are shipped from Manitowoc as an assembled unit. This assembly weighs approximately 6,000 lb (1 829 kg) and is the heaviest jib load to be lifted.

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 attachment. Read and understand the instructions in Section 3 of this manual.

- If equipped, disable free-fall for rear drum.
- Select and Confirm Luffing Jib mode to operate luffing hoist.

COUNTERWEIGHT REQUIREMENT

See 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

NOTE: This requirement applies only to the 777 crawler crane.

To prevent crane from tipping or structural damage to attachment, **all boom and jib combinations must be raised and lowered over blocked crawlers**. See Luffing Jib Capacity Charts and Raising Procedure Charts for blocked

crawler requirements. Also see Crawler Blocking Diagram in Luffing Jib Capacity Chart Manual for instructions.



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.

EXTENDED OUTRIGGERS

NOTE: This requirement applies only to the 777T truck crane.

To prevent crane from tipping, all boom and jib combinations must be raised and lowered over rear of truck with outriggers and jacks fully extended. See Capacity Charts and Raising Procedure Charts for outrigger requirements and to Outrigger Controls and Operation in Section 3 of the 777T Crane Operator Manual for instructions.



DANGER

Tipping Hazard!

Prevent crane from tipping. Do not attempt to raise or lower boom and jib from or to ground until outriggers are extended.

RIGGING DRAWINGS

See the end of this section for applicable jib rigging drawings.

The boom and jib components (butts, inserts, tops, pendants, straps) must be assembled in proper sequence according to the rigging drawings.

Two tables are provided on the luffing jib rigging drawings: one table lists the boom sections and backstay pendants required for various boom lengths; the other table lists the jib sections required for various jib lengths. *Make sure proper table is referred to.* Read and comply with insert and pendant notes on the rigging drawing.

For additional help, refer to Figure 4-14, 4-15, and 4-16.

LUFFING JIB RAISING PROCEDURE

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

IDENTIFYING BOOM/JIB COMPONENTS

The boom and jib sections are marked for proper identification, as follows:

- **Past Production** (Figure 4-2, View A) — boom or jib number, part number, and manufacturing code stamped into two connectors (diagonally opposite) on both ends of each insert and on end of top and butt.
- **Current Production** (Figure 4-2, View B) — boom or jib number, part number, and manufacturing code stamped into a plate mounted on all four chords of each section.

IDENTIFYING PENDANTS

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

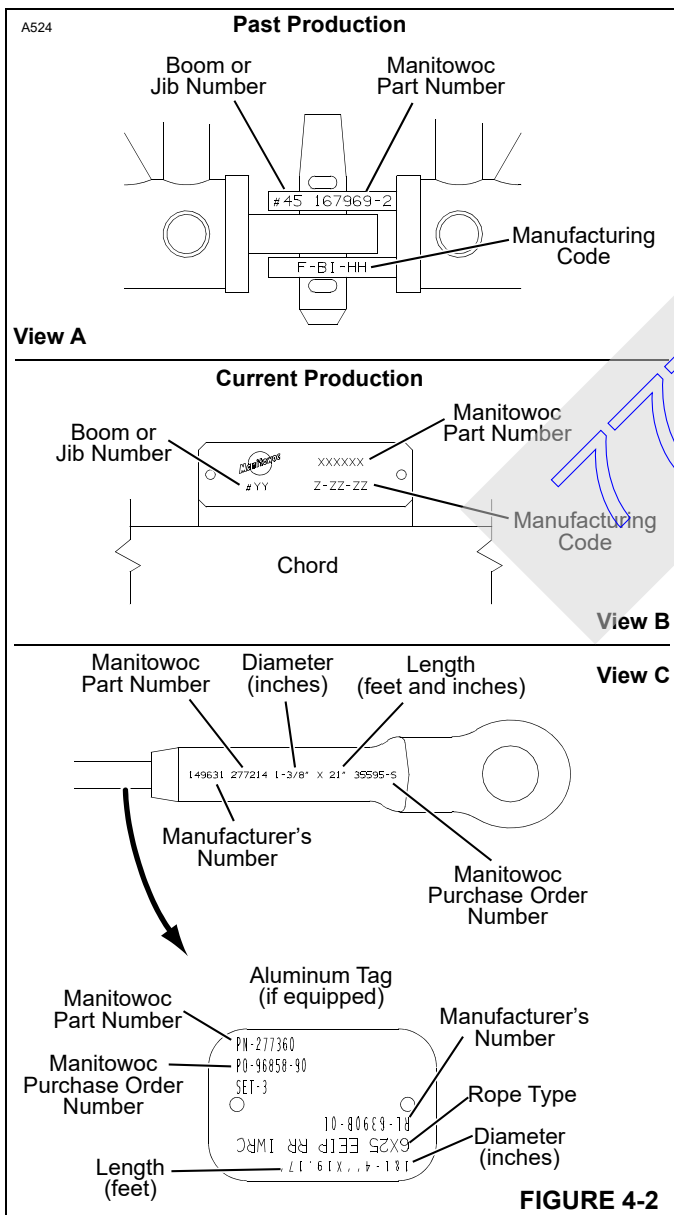


FIGURE 4-2

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.

RETAINING CONNECTING PINS

Connecting pins are retained in various ways:

- Snap pins.
- Quick-release pins.
- Cotter pins.
- Keeper plates with cap screws and lock washers.

Do not operate crane until all connecting pins are installed and properly retained.

MAST LINKS

NOTE: The following applies only to 777T truck crane.

The 777T boom rigging must be equipped with the appropriate mast links as shown in Figure 4-3. See Luffing Jib Assembly Drawing for additional information.

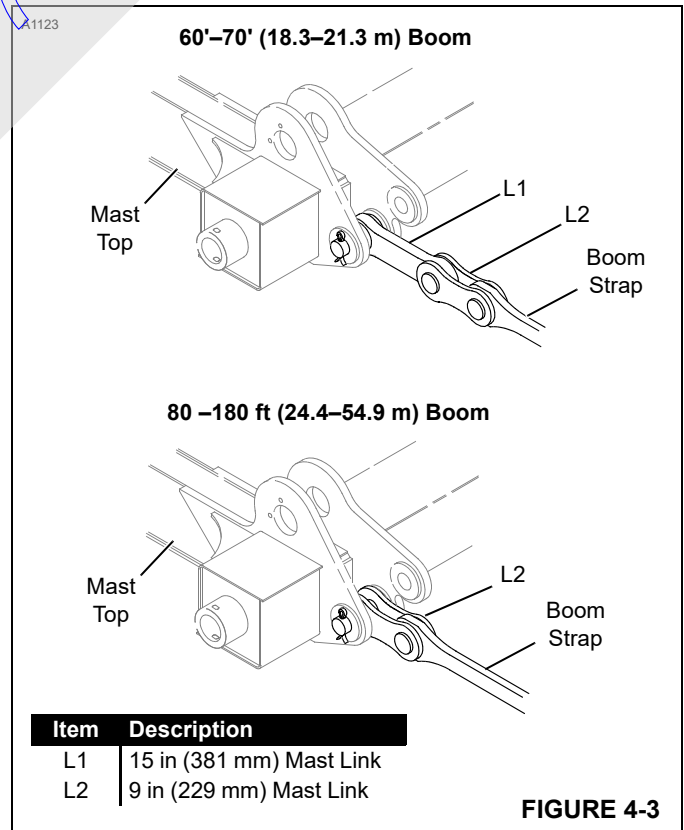


FIGURE 4-3

SHIPPING LUFFING JIB COMPONENTS

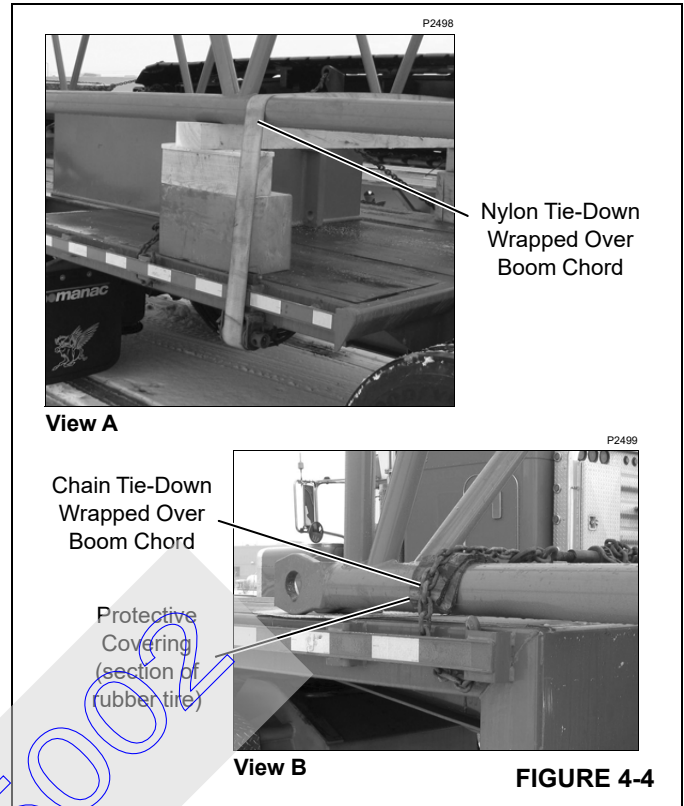
It is the owner/user's responsibility to ensure the following:

- That all trailer loads comply with local, state, and federal transportation requirements.
- ***That all components are properly blocked and secured so they cannot shift or fall off trailers.***
- To avoid damage to components (see Figure 4-4):

Use nylon tie-downs to secure components as shown in 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 View B.

When securing boom and jib 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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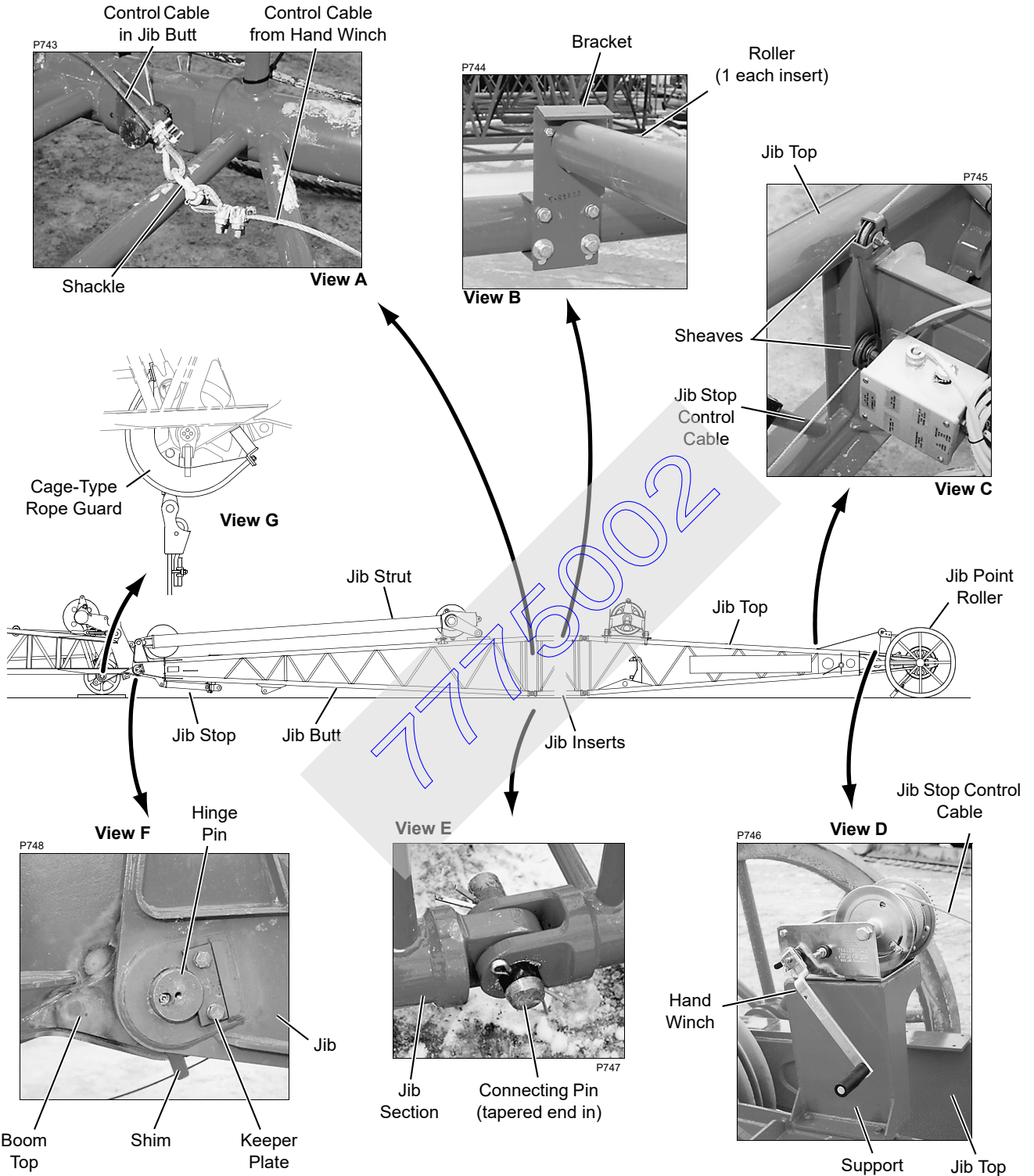


FIGURE 4-5

LUFFING JIB RIGGING GUIDE (#139 LUFFING JIB) – CRAWLER AND TRUCK

Installing Jib

See Figure 4-5 for following procedure, unless otherwise noted.

Lower Boom

1. For 777, travel front crawler rollers onto blocking.
2. For 777T, fully extend and level crane on outriggers.
3. Swing upper slightly to either side and lower load block and weight ball onto ground.
4. Swing boom in-line with crawlers and lower boom point sheaves onto blocking 6 – 12 in. (152 – 305 mm) high.

Prepare Crane for Jib

See Boom Rigging Guide and Jib Rigging Guide in Crane Operator Manual for boom and fixed jib assembly and disassembly instructions.

1. Remove load block or weight ball from rear drum load line (rear drum is used for luffing hoist).
2. Remove load line from rear drum and install proper lagging and wire rope for luffing hoist operation. See Luffing Jib Assembly Drawing for wire rope specifications and to Drum and Lagging chart for lagging requirements.
3. Remove load block from lower boom point if not required. Remember that block and other rigging hanging below lower boom point is considered part of load from jib point.
4. If crane will be used to self-assemble luffing jib, disconnect boom from boom butt (777) or 17-1/2 ft (5.3 m) insert (777T) and install assembly block. See Figure 4-5 and procedure in Crane Assembly and Disassembly Guide in Crane Operator Manual.
5. Remove fixed jib or upper boom point, if equipped.
6. Remove cage-type rope guard from lower boom point (View G).
7. Change boom length as necessary to meet job requirements.
8. Check that all boom inserts and pendants are assembled in proper sequence according to Boom Rigging drawing.
9. Remove following components from 180 ft (54.86 m) boom (777 and 777T) or 170 ft (51.8 m) boom (777T only) (operation with only one load line is permitted):
 - a. Auxiliary drum from boom butt.
 - b. Auxiliary drum wire rope guide from 10 ft (3.05 m) insert (777 only).

- c. Wire rope guides from 17-1/2 ft (5.3 m) insert (777T only)
- d. Lower boom point sheaves.
- e. One wire rope guide sheave from jib strut (if equipped with two sheaves).

NOTE: Perform step 9b or 9c after boom and jib are assembled if 777 or 777T is used for self-assembly.

WARNING Tipping Hazard!

Crane can tip when boom and jib are raised and lowered if step 9 is not performed.

10. If equipped, check that removable lacings are installed in boom butt and each boom insert.

WARNING Collapsing Boom Hazard!

Install removable lacings prior to raising boom. Boom can collapse if this step is not taken.

11. Add or remove crane counterweight to comply with applicable capacity chart.

Install Jib Butt

The jib butt, jib strut, and jib stop are shipped from the factory as an assembled unit.

1. Lift jib butt into position at boom top and align connecting holes.
2. Pin jib butt to boom top with pins and keeper plates (View F).

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

3. Lower jib butt onto blocking.
4. 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. Pin inserts and jib top to butt *in proper sequence — shortest inserts nearest butt* (see rigging drawing and Figure 4-16).

Tapered end of connecting pins must face in (View E).

3. Wire rope rollers on inserts (View B) may be shipped upside down. If necessary, unscrew and reattach brackets and rollers rightside up.

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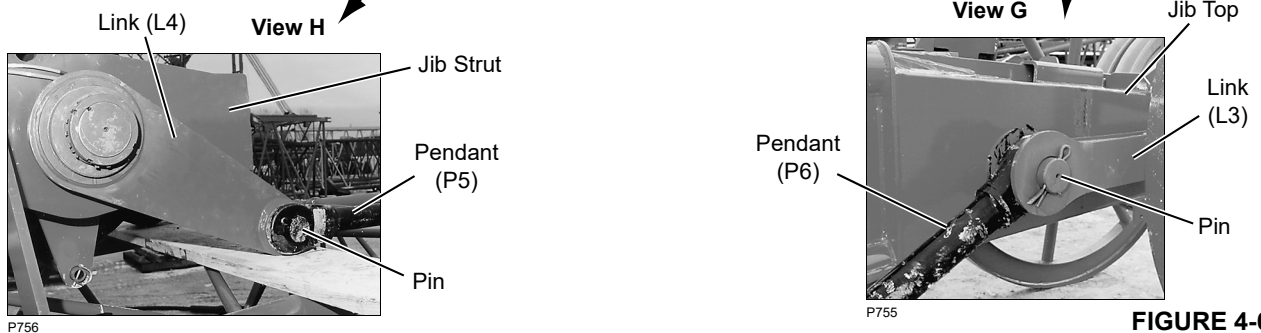
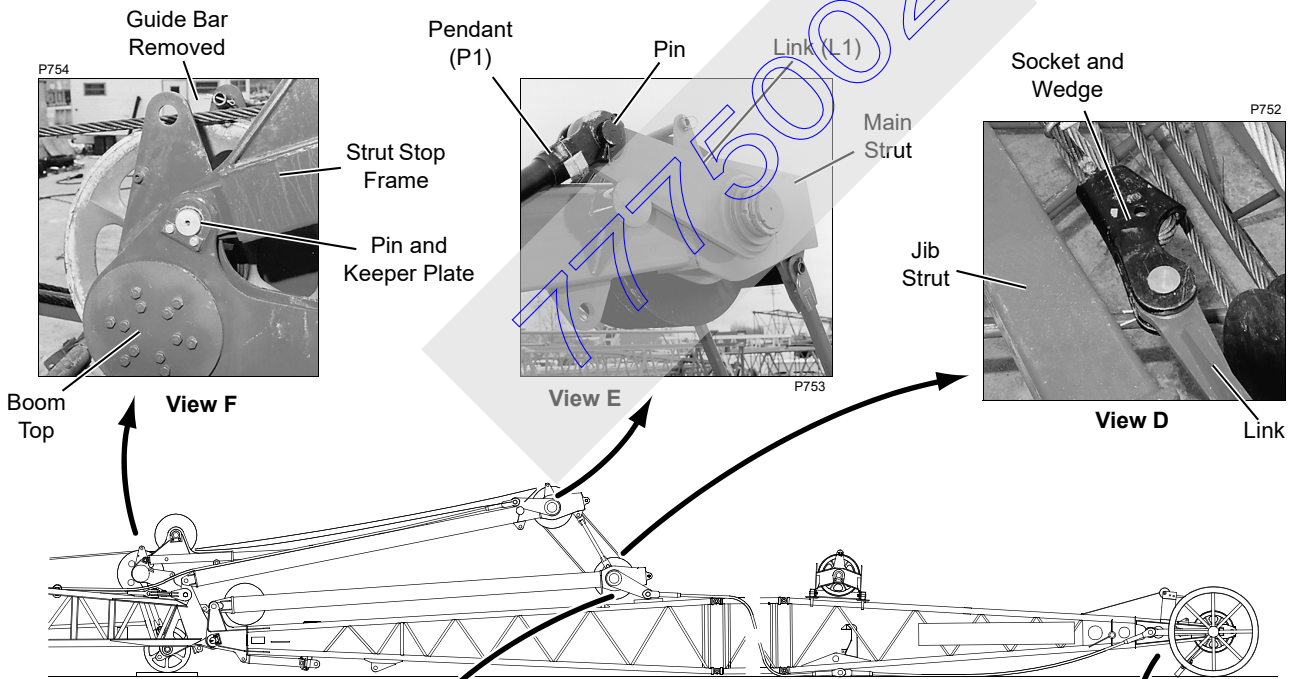
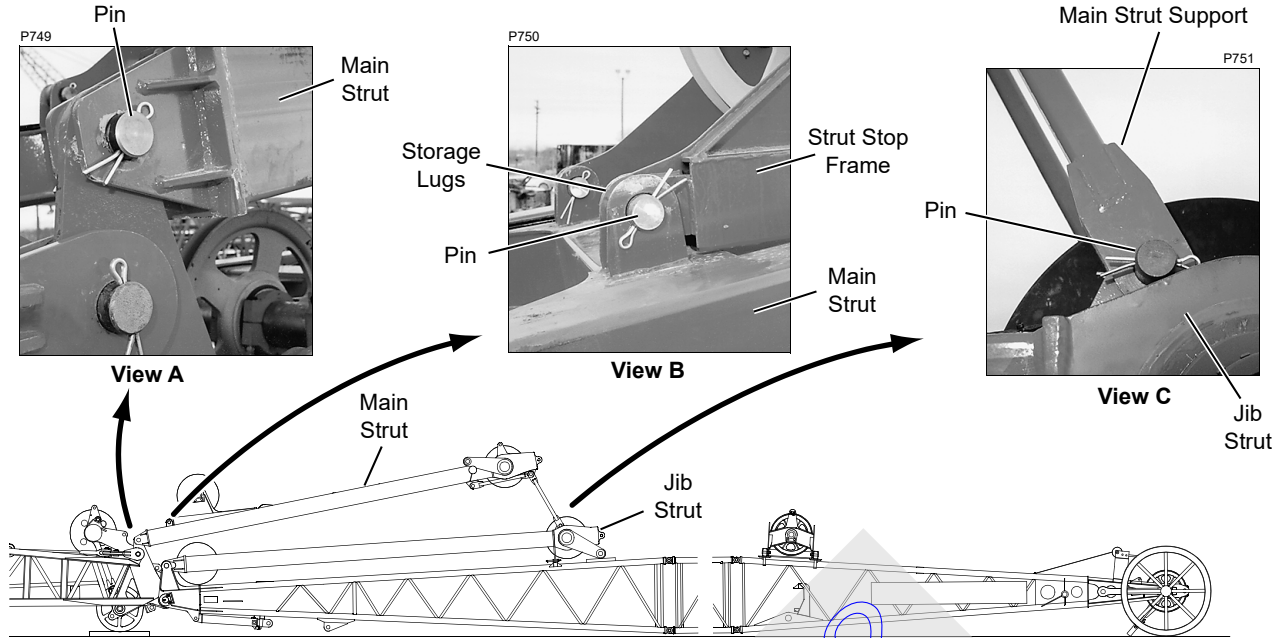


FIGURE 4-6

Install Jib Stop Control Cable

See Figure 4-5 for following procedure.

1. Fasten hand winch to bracket on jib top (View D).
2. Route control cable from hand winch through guide sheaves in jib top (View C).
3. Connect control cable from hand winch to control cable in jib butt with shackle (View A).

Install Main Strut

See Figure 4-6 for following procedure.

The strut stop is shipped in the stored position on the main strut.

1. Lift main strut into position at boom top so strut stop is toward boom top.

NOTE: Two lifting lugs are provided in end of strut so strut can be lifted vertically. Three lifting lugs are provided in middle of strut so strut can be lifted horizontally.

2. Pin main strut to boom top (View A).
3. Lower main strut until it is approximately 3 ft (0.91 m) above jib strut.
4. Unpin strut supports from storage lugs on main strut and lower strut supports to vertical.
5. Lower main strut and pin strut supports to lugs on jib strut (View C).
6. Move strut stop to operating position as follows:
 - a. Using a sling from crane, hoist slightly against sheave in strut stop frame.
 - b. Remove pins connecting strut stop frame to storage lugs on main strut (View B).
 - c. Hoist strut stop frame clear of storage lugs and reinstall pins in storage lugs.
 - d. Pull strut stop frame toward boom top, align connecting holes, and pin frame to boom top (View F).

Install Jib Pendants

See Figure 4-6 for following procedure, unless otherwise noted.

NOTE: Either non-stowable pendants or stowable pendants can be used to assemble the jib.

The stowable pendants are slightly longer than the non-stowable pendants. When disassembling the jib, the stowable pendants can be disconnected and left on top of the sections for shipping. This arrangement allows the jib to be reassembled faster.

It is owner/user's responsibility to securely attach stowable pendants to jib sections so that pendants cannot fall off jib sections during shipment.


 **WARNING**
Falling Jib Hazard!

Pendants must be installed in same sequence as inserts (shortest inserts and pendants nearest butt). Pendants are furnished in matched sets of two and must be installed in matched sets — pendant on one side of jib insert must match pendant on opposite side of insert. Do not mix stowable pendants with non-stowable pendants. *Failing to observe this precaution will cause jib to twist excessively when boom is raised. Structural damage to jib will occur.*

1. Pin basic jib pendants (P6, View G) to links (L3) on jib top.
2. Assemble and pin required jib insert pendants together and to basic jib pendants (P6) on ground alongside jib. *Be sure to assemble pendants in proper sequence* (see Figure 4-16 for pendant and link identification).
3. Pin basic jib pendants (P5, View H) between links (L4) on jib strut and last set of jib insert pendants.

Install Backstay Pendants

See Figure 4-6 for following procedure, unless otherwise noted.

 **WARNING**
Falling Boom Hazard!

Starting at top end of boom, backstay pendants must be installed in same sequence as boom inserts (shortest inserts and pendants nearest butt). Backstay pendants are furnished in matched sets of two and must be installed in matched sets — pendant on one side of boom insert must match pendant on opposite side of boom insert. *Failing to observe this precaution will cause jib struts to twist excessively when boom is raised. Structural damage to jib or boom will occur.*

1. Pin basic backstay pendants (P1, View E) to links (L1) on main strut.
2. Assemble and pin remaining backstay pendants together and to basic backstay pendants (P1). *Be sure to assemble pendants in proper sequence* (see Figures 4-14 or 4-15 for pendant and link identification).
3. Stretch pendants along top of boom while working toward boom butt.

Connect Crane to Boom

If 777 or 777T was used to self-assemble the boom and jib, connect the boom butt (777) or boom butt and 17-1/2 ft (5.3 m) insert (777T) to the boom. **Be sure to block under front crawler rollers if required for 777 or to extend outriggers and jacks for 777T.**

Install Luffing Hoist Wire Rope

1. Place reel of luffing hoist wire rope on ground along right side of jib near sheave end of struts.
2. Reeve luffing hoist wire rope through main strut sheaves, jib strut sheaves, and guide sheaves on boom as shown in reeving diagram on Jib Assembly Drawing.
 - Remove wire rope guide bar from wire rope guide on boom top (Figure 4-6, View F) until after main strut is raised.
3. Securely anchor wire rope to rear drum with wedge provided (see Wire Rope Installation and Maintenance).
Wire rope must spool off top of rear drum.
4. Tightly wind excess wire rope onto rear drum.
5. Anchor free end of luffing hoist wire rope to right side of jib strut with socket and wedge provided (Figure 4-6, View D) (see Wire Rope Installation and Maintenance in this section).

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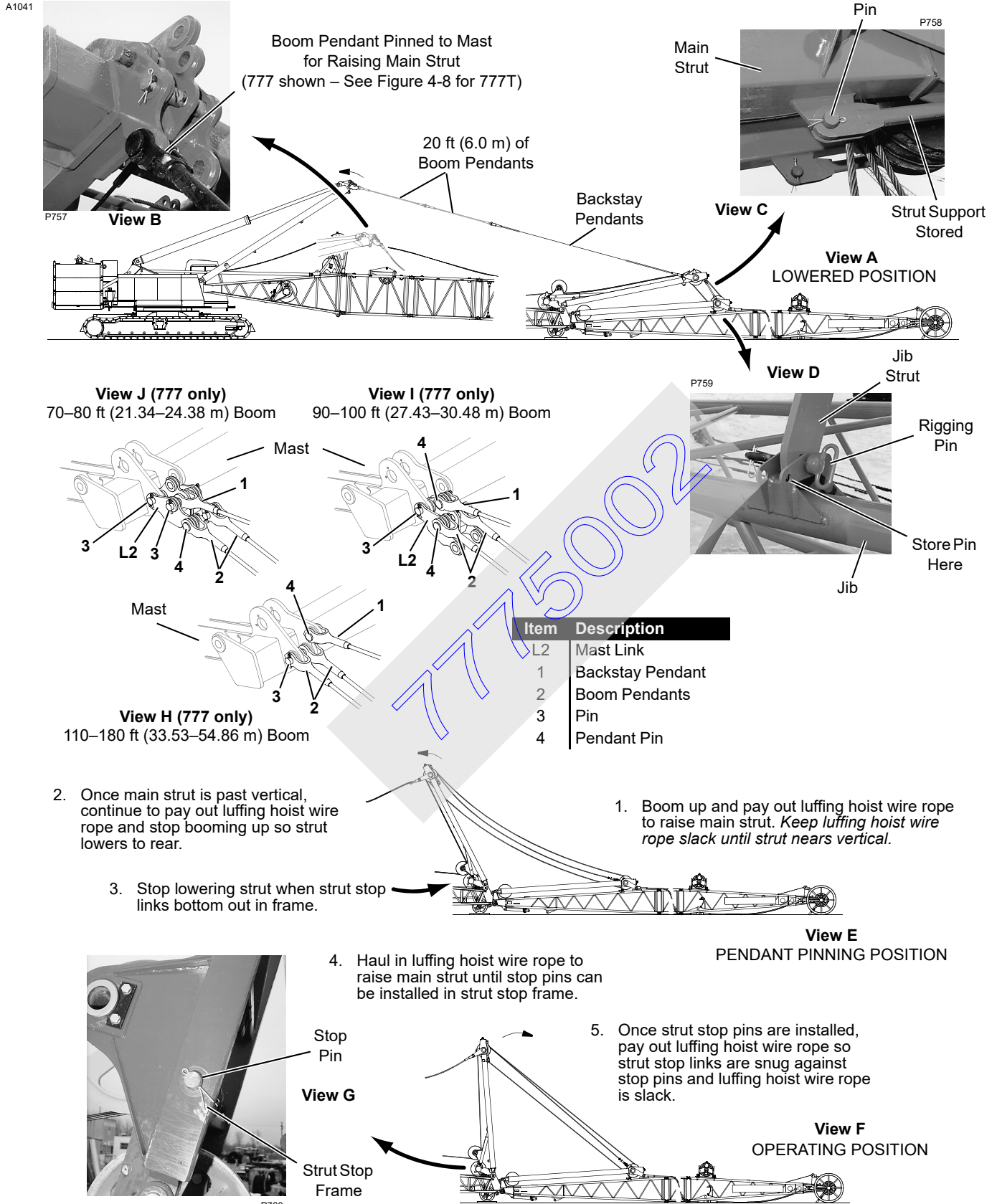


FIGURE 4-7

Raise Main Strut and Connect Backstay Pendants

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

! 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 pendants or luffing hoist wire rope before climbing onto boom top or jib butt when connecting and disconnecting strut stop tubes.

1. Lower mast until pendant holes are accessible in end of mast (View A).
2. Pin 20 ft (6.10 m) of boom pendant to end of both backstay pendants and to pendant holes in mast (View B).

Any hole in end of mast can be used, as long as same hole is used on both sides of mast.
3. Make sure jib strut is pinned to jib (View D).
4. Slowly boom up to support main strut so strut support pins are loose.
5. Unpin strut supports from jib strut (Figure 4-6, View C).
6. Raise main strut as required and pin strut supports to underside of main strut (Figure 4-6, View C).
7. Slowly pay out luffing hoist wire rope and boom up to raise main strut. *Keep luffing hoist wire rope slack until main strut nears vertical.*

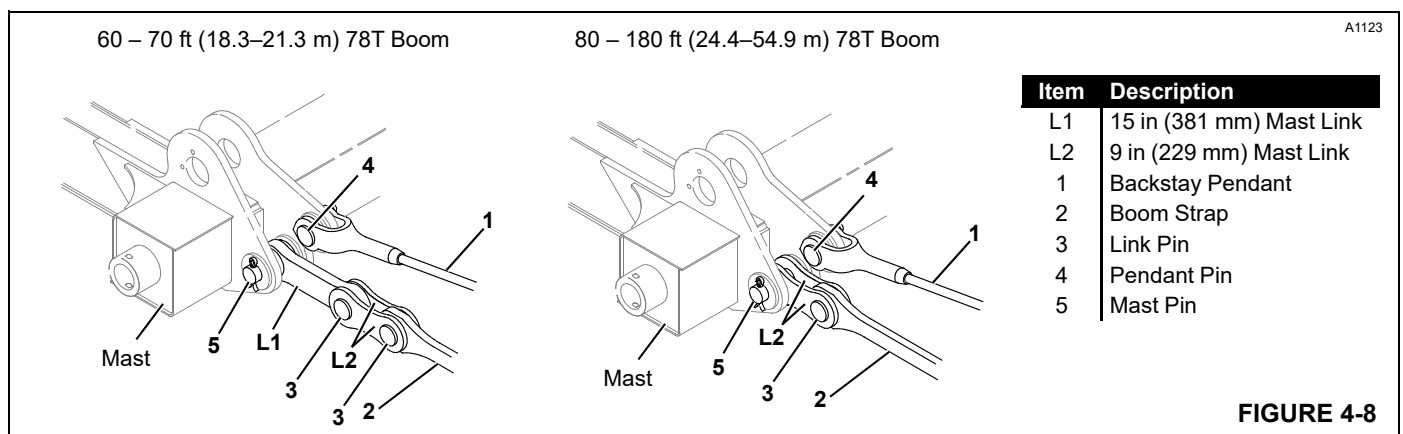
CAUTION

Jib Strut Damage!

Do not allow luffing hoist wire rope to go into tension until main strut is near vertical. Jib strut could be damaged.

8. Tighten luffing hoist wire rope as main strut nears vertical so strut moves smoothly past vertical.
9. Once main strut is past vertical, continue to pay out luffing hoist wire rope and stop booming up to lower strut to rear.
10. Stop paying out luffing hoist wire rope when strut stop links bottom out in strut stop frame (View E).
11. Lower mast until pendant holes are accessible in end of mast (View B).
12. Unpin boom pendants used to raise main strut from mast and from backstay pendants.
13. 777: Pin boom pendants and backstay pendants to proper holes in mast or link (L2, View H, I, or J).

777T: Pin boom straps and backstay pendants to proper holes in mast or link (L2, Figure 4-8)
14. Raise mast until braces in mast are clear of luffing hoist wire rope.
15. Slowly haul in luffing hoist wire rope to raise main strut until both strut stop links are above pin holes in frame (View F).
16. Install stop pins in frame (View G). Same pins are used to store strut stop on main strut.
17. Pay out luffing hoist wire rope until strut stop links are snug against stop pins and luffing hoist wire rope is slack.
18. Remove rigging pins connecting jib strut to jib and store pins in holes provided (View D).
19. Haul in luffing hoist wire rope to raise jib strut until jib pendants are just clear of top chords in jib sections. *Guide pendants as jib strut is raise so pendants do not get caught on side of jib sections.*



Install Fixed Jib

If required, install fixed jib at this time or after boom and luffing jib have been raised to jack-knife raising angle.

Install Jib Load Line

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

If the jib will be raised using the Jack-Knife Method, reeve load line through guide sheave on jib point. Pull load line approximately 40 ft (6.1 m) past end of jib and lay line on ground. Securely fasten load line to jib. Install load block or weight ball after boom and jib have been jack-knifed into position just prior to raising jib point rollers off ground.

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

For long boom and short jib combinations, wire rope on boom side of attachment can overhaul unsecured wire rope on jib side of attachment. Wire rope could fall off boom. Securely fasten load line to jib before raising attachment.

1. Determine parts of load line required for job and size load block accordingly (see Wire Rope Specifications in Capacity Chart Manual).
2. Route load line from desired drum through proper guide sheaves on boom, jib strut, and jib (see Load Line Reeving in this section).
3. Reeve load line through required jib point sheaves and anchor load line at dead-end socket and wedge (see Load Line Reeving in this section).
4. Install block-up limit for jib point (see Block-Up Limit Control in Section 6 of this manual).

Connect Electric Cords and Adjust Electronic Devices

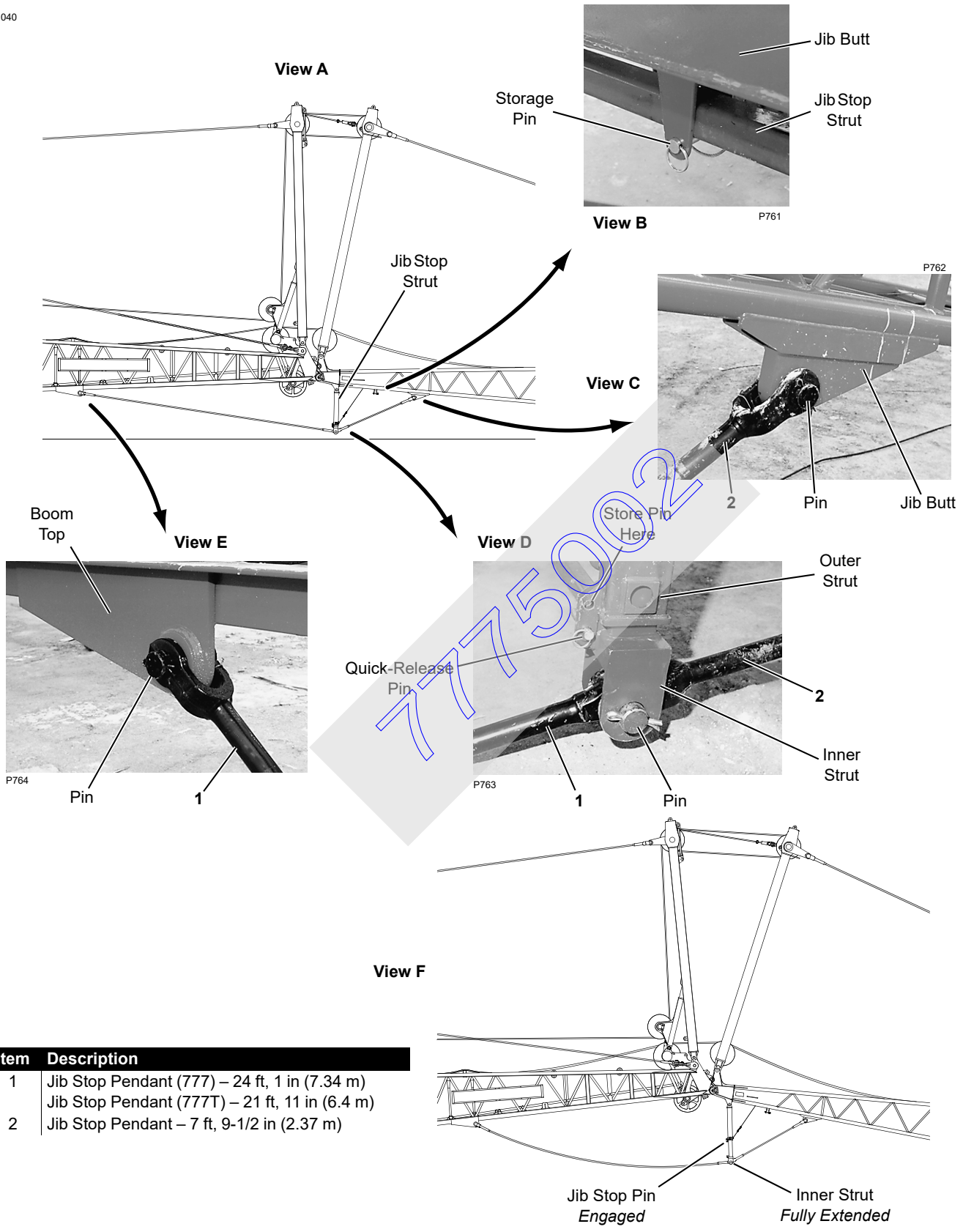
1. Connect electric cords to respective junction boxes and switches (see Boom Wiring Drawing at the end of this section):
 - Angle indicator on jib butt.
 - Maximum jib stop limit switch on boom top.
 - Minimum jib stop limit switch on boom top.
 - Block-up limit reel in jib butt.
 - Block-up limit switches.
 - Load indicator pins (see Load Indicator Assembly Drawing at end of this section).
 - Connect all unused electric cords to proper shorting plugs on junction boxes. *Boom will not lower and drums will not hoist if electric cords are not shorted out.*
2. Adjust electronic devices according to appropriate instructions in Section 6 of this manual:
 - Jib stop limit switches.
 - Jib angle indicator.
 - Block-up limit switches.
 - Boom stop (after boom and jib are raised).

Pre-Raising Checks

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

- ❑ Boom, luffing jib, and fixed jib properly assembled according to instructions in this section and rigging drawings.
 - ❑ Boom butt properly connected to boom according to Crane Assembly/Disassembly Guide.
 - ❑ 777: Crawlers blocked (required for all boom and jib lengths). See Crawler Blocking Diagram for blocking procedure.
 - ❑ 777T: Outriggers and jacks fully extended if required by capacity charts.
 - ❑ All installation steps given in this section performed.
 - ❑ Boom and jib inserts installed in proper sequence according to rigging drawings.
 - ❑ 777: Boom, jib, backstay, and jib stop pendants installed in proper sequence according to rigging drawings.
 - ❑ 777T: Boom straps and jib, backstay, and jib stop pendants installed in proper sequence according to rigging drawings.
 - ❑ All connecting pins installed and properly secured.
 - ❑ Main strut raised and pinned in operating position.
 - ❑ Jib strut unpinned from storage position.
 - ❑ Luffing hoist wire rope anchored properly to drum, spooled tightly onto drum, and engaged with proper sheaves (see Rigging Drawings and Wire Rope Installation and Maintenance). Make sure rope guard pins, bars, or rollers are installed to retain wire rope in sheaves.
 - ❑ 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 and from jib point roller path area.
 - ❑ All safety devices installed, electric cords connected, and limits adjusted (see appropriate adjustments topics in Crane Operator Manual).
 - ❑ 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.
 - ❑ LUFFING JIB mode selected and confirmed.
 - ❑ Wind within allowable limits for raising boom and jib.

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Item	Description
1	Jib Stop Pendant (777) – 24 ft, 1 in (7.34 m) Jib Stop Pendant (777T) – 21 ft, 11 in (6.4 m)
2	Jib Stop Pendant – 7 ft, 9-1/2 in (2.37 m)

FIGURE 4-9

Raising Boom and Luffing Jib



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 Luffing Jib 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.

Preliminary Raising Procedure

See Figure 4-9 for following procedure.

1. Raise boom until distance between lower boom point sheaves and ground is approximately 3-1/2 ft (1.07 m).
2. Using hand winch on jib top, tighten jib stop control enough to support jib stop strut.
3. Remove jib stop strut storage pin (View B). Install pin in lugs on jib butt after jib stop strut is lowered.

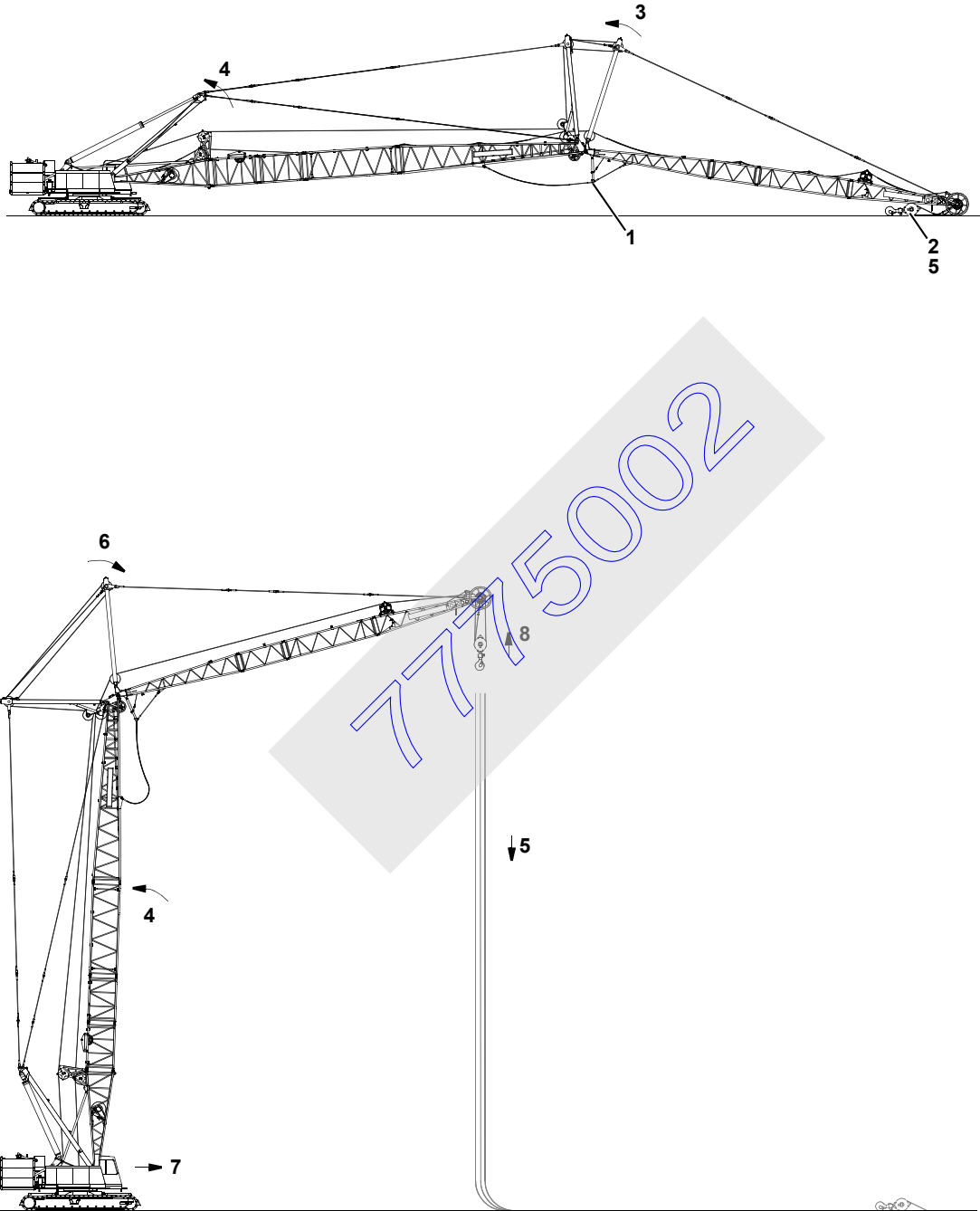
4. Using hand winch on jib top, lower jib stop strut to vertical as shown in View A.
5. Pin jib stop pendants (1) to lugs on boom top (View E).
6. Pin jib stop pendants (1 and 2) to jib stop inner strut (View D).
7. Pin jib stop pendants (2) to lugs on jib butt (View C). If necessary, haul in jib stop control cable with hand winch to get enough pendant slack for pinning.
8. *Stand to side of jib stop strut* and remove quick-release pin from both sides of inner strut (View D).
9. Inner strut will extend slightly when this step is performed.
10. Store quick-release pins in storage holes on outer strut (View D).
11. Using hand winch on jib top, slacken jib stop control cable until it rests on bottom lacings in jib.
Jib stop inner strut will not extend properly and pins will not engage if control cable is tight.
12. Slowly boom up until jib stop inner strut is fully extended (View F). Boom to luffing jib angle will be approximately 168°.

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

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

Check that jib stop control cable is slack: pay out cable until it rests on bottom lacings in boom. Jib stop control cable must be slack at all times during luffing jib operation; otherwise, pins may disengage or cable may break.

A1040



ITEM NUMBERS CORRESPOND TO IN-LINE
RAISING PROCEDURE STEPS
777 Crawler Crane Shown
777T Truck Crane Similar

FIGURE 4-10

In-Line Raising Procedure

See Figure 4-10 for following procedure.

NOTE: Item numbers in Figure 4-10 correspond to numbered steps in following procedure.

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

For in-line procedure, do not raise boom and jib combinations longer than specified on Luffing Jib Raising Procedure Chart. Crane will 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.

1. Perform Preliminary Raising Procedure.
2. Install load block and/or weight ball if not already done.

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

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

3. Slowly luff up until jib and backstay 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 3. Jib stop pendants will be over tensioned, possibly resulting in damage.

4. 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).
5. Pay out load line as boom and jib are raised.
6. Luff down to position jib at required operating radius for load to be handled. It will be necessary to use limit bypass switch if BLOCK UP limit is on.
7. Travel forward until load block or weight ball is below jib point and lift load block or weight ball to desired position.

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ITEM NUMBERS CORRESPOND TO JACK-KNIFE
RAISING PROCEDURE STEPS
777 Crawler Crane Shown
777T Truck Crane Similar

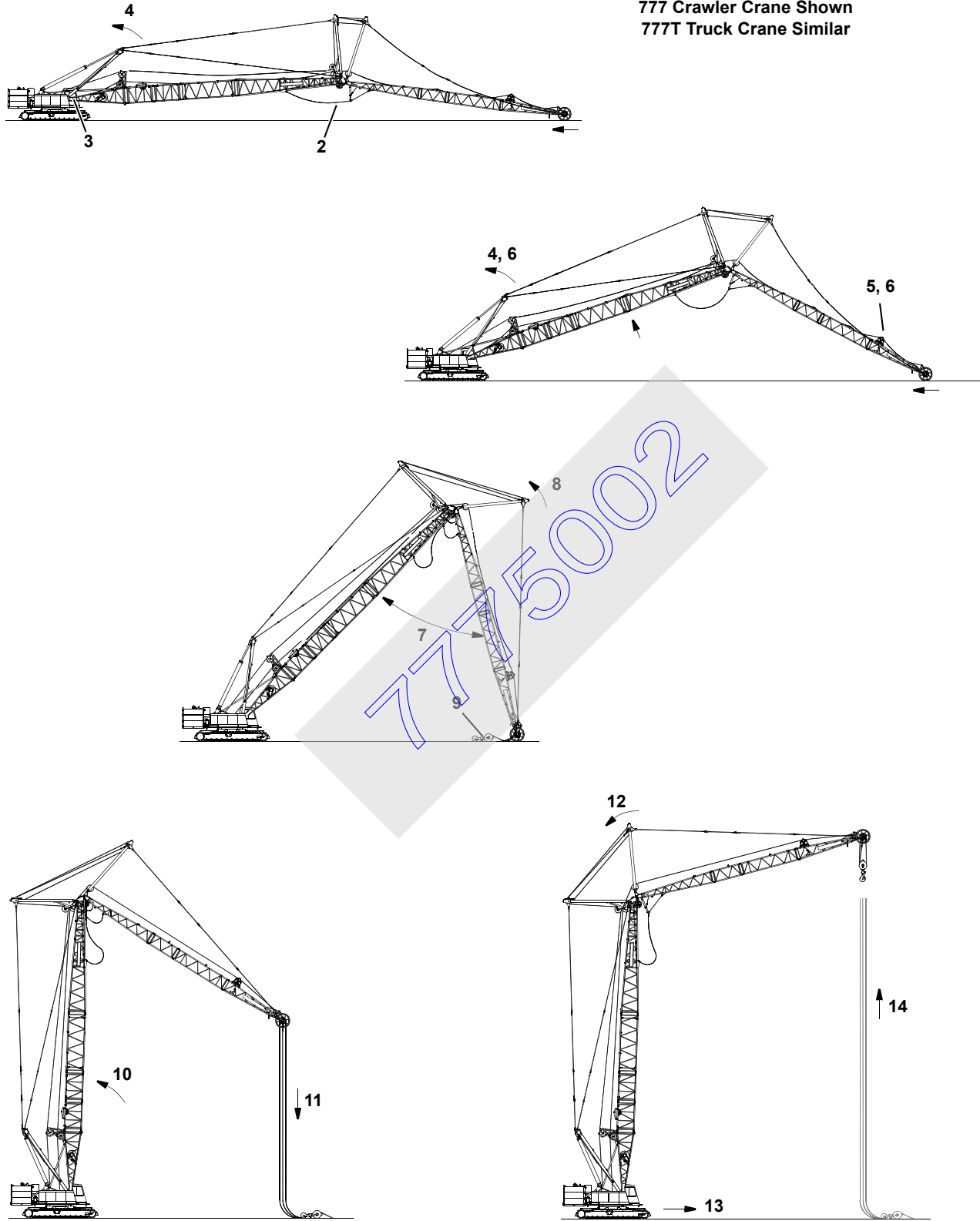


FIGURE 4-11

Jack-Knife Raising Procedure

See Figure 4-11 for following procedure.

NOTE: Item numbers in Figure 4-11 correspond to numbered steps in following procedure.

WARNING Tipping Hazard!

Determine BOOM TO LUFFING JIB ANGLE that boom and jib must be jack-knifed to before jib can be raised (see Luffing Jib 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 the following limits to come on during the raising procedure:

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

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

1. Determine boom to luffing jib angle boom and jib must be raised to before jib can be raised (see Luffing Jib Raising Procedure Chart).
2. Perform Preliminary Raising Procedure.
3. Disengage swing lock and release swing brake.
4. Slowly boom up.
Jib point rollers will roll along ground as boom and jib are jack-knifed into position.
5. Jib pendants will tighten as boom and jib rise.

Signal person, watch jib pendants along left side of jib as boom and jib are raised. **Do not allow jib pendants to go into tension.**

Signal operator to pay out luffing hoist wire rope as boom is raised so jib pendants remain slack. Do not allow pendants to become too slack or they will bounce against jib inserts or fall off side of jib. Keep pendant connectors at end jib top approximately 6 in. (152 mm) above jib top.

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

WARNING Tipping Hazard!

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

6. Slowly continue with Jack-Knife Raising Procedure steps 4 and 5.
7. Stop raising boom when boom and jib have been position at required boom to luffing jib angle or jib is vertical, whichever occurs first. **Monitor this angle on digital display.**

DANGER Falling Jib Hazard!

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

8. Slowly luff up until jib pendants start to go into tension and stop.
9. Boom up to raise jib point rollers clear of ground, apply swing brake, and install load blocks or weight balls at jib points (see Install Load Lines earlier in this topic).

WARNING Falling Load Hazard!

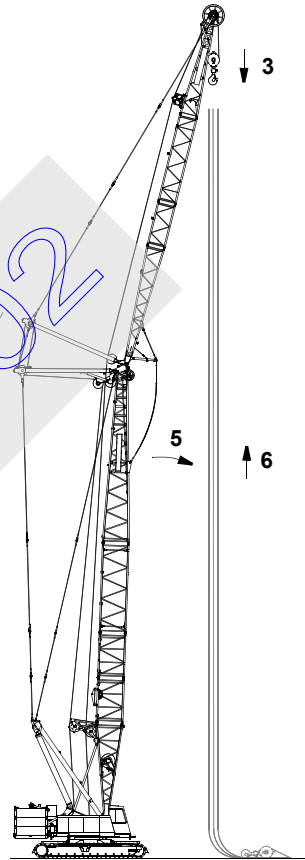
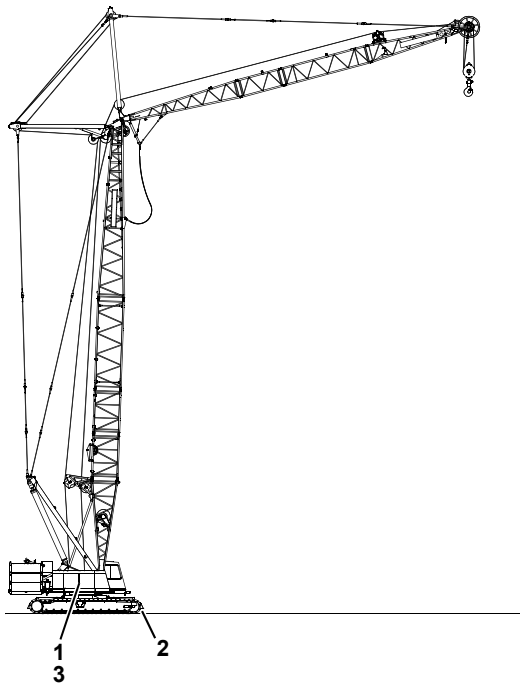
Load line going up boom can overhaul load line going down jib. Do not untie load line from jib until load block or weight ball have been installed. Load line can fall off boom if this precaution is not followed.

WARNING Tipping Crane Hazard!

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

10. 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).
11. Pay out load lines as boom and jib are raised.
12. Position jib at required operating radius.
13. Travel forward until load block or weight ball is below jib point.
14. Lift load block or weight ball to desired position.

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ITEM NUMBERS CORRESPOND TO IN-LINE
LOWERING PROCEDURE STEPS
777 Crawler Crane Shown
777T Truck Crane Similar

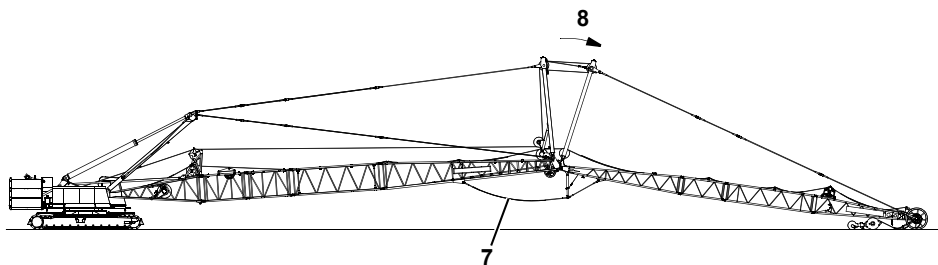


FIGURE 4-12

Lowering Boom and Luffing Jib



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 lowering boom and jib.

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

As defined in the Luffing Jib 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.

In-Line Lowering Procedure

See Figure 4-12 for following procedure.

NOTE: Item numbers in Figure 4-12 correspond to numbered steps in following procedure.

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

1. 777: Swing upperworks in-line with lowerworks so boom is over *front of crawlers*.

777T: Swing upperworks in-line with lowerworks so boom is over *rear of truck*.

2. 777: Travel crawler rollers onto blocking.

777T: Fully extend outriggers and outrigger jacks.



DANGER

Tipping Crane Hazard!

Lower all boom and jib combinations over blocked crawlers or extended outriggers and jacks; otherwise, crane will tip.

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



WARNING

Tipping Crane Hazard!

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



DANGER

Tipping Crane Hazard!

For in-line method, do not lower boom and jib combinations longer than specified in Luffing Jib Raising Procedure Chart. Crane will tip.

4. Raise jib to 168° boom to luffing jib angle.
5. Slowly lower boom and jib until jib point rollers contact ground. It will be necessary to use limit bypass switch if BLOCK UP limit is on.
6. Haul in load line as boom and jib are lowered, but do not lift load block or weight ball off ground.

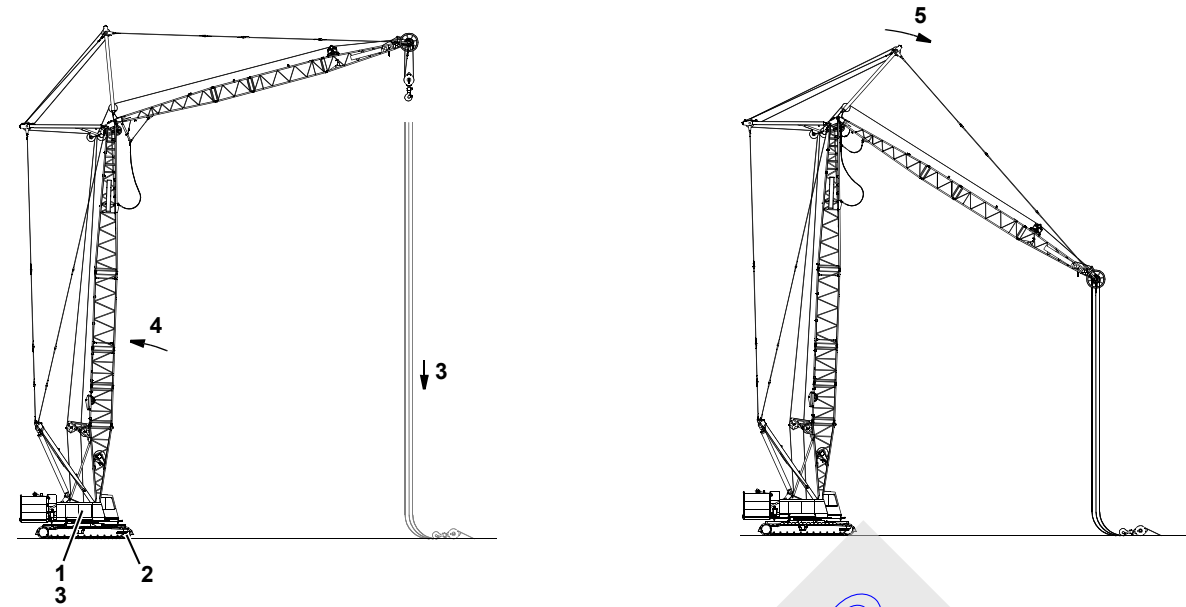
CAUTION

Jib Stop Damage!

Do not lower boom any farther until step 7 is performed. Once jib point rollers contact ground, damage to jib stop struts or pendants will result if struts are over tensioned.

7. Retract and store jib stop struts. Perform Final Lowering Procedure.
8. Jib struts and main struts can now be lowered, if required. See Lowering Jib Strut and Main Strut in this section for procedure.

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ITEM NUMBERS CORRESPOND TO JACK-KNIFE
LOWERING PROCEDURE STEPS
777 Crawler Crane Shown
777T Truck Crane Similar

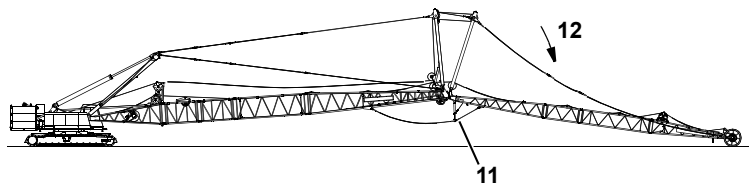
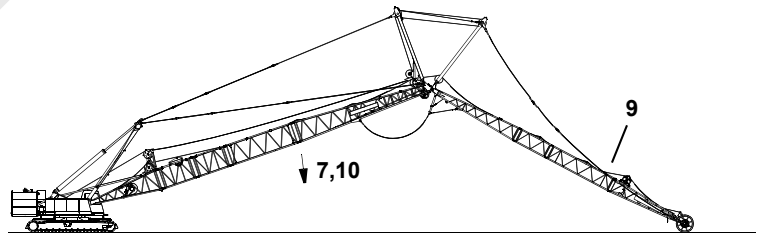
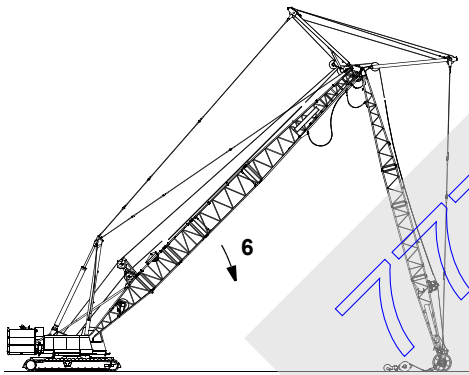


FIGURE 4-13

Jack-Knife Lowering Procedure

See Figure 4-13 for following procedure.

NOTE: Item numbers in Figure 4-13 correspond to numbered steps in following procedure.

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

1. 777: Swing upperworks in-line with lowerworks so boom is over *front of crawlers*.
777T: Swing upperworks in-line with lowerworks so boom is over *rear of truck*.
2. 777: Travel crawler rollers onto blocking.
777T: Fully extend outriggers and outrigger jacks.

**DANGER****Tipping Crane Hazard!**

Lower all boom and jib combinations over blocked crawlers or extended outriggers and jacks; otherwise, crane will tip.

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

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

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

4. Raise boom to a minimum angle of 75°.
5. Position jib at required boom to luffing jib angle (see Luffing Jib Raising Procedure Chart for angle).

**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 75° 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.

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

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

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

7. Release swing brake (disengage swing lock) and continue to lower boom slowly.

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

8. Pay out load line as boom and jib are lowered.

9. Jib and backstay pendants will slacken as boom and jib lower.

Signal person, watch jib pendants along left side of jib as boom and jib are lowered. Signal operator to haul in luffing hoist wire rope so jib pendants do not get too slack. If pendants get too slack, they will bounce against jib inserts or fall off side of jib. Keep pendant connectors at end of jib top approximately 6 in. (152 mm) above jib top.

Do not allow jib pendants to go into tension.

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

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

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

10. Continue with Jack-Knife Lowering Procedure steps 7 – 9 until jib stop pendants start to go into tension (approximately 168° boom to jib angle). **Monitor this angle on digital display.**

CAUTION**Jib Stop Damage!**

Once jib stop pendants start to go into tension, do not lower boom any farther until step 11 is performed. Damage to jib stop struts or pendants will result if struts are over tensioned.

11. Retract and store jib stop struts. Perform Final Lowering Procedure.
12. Jib struts and main struts can now be lowered, if required. See Lowering Jib Strut and Main Strut in this section for procedure.

Final Lowering Procedure

Perform the following steps once the boom and jib have been lowered to either of the following positions (Figure 4-9, View F):

IN-LINE PROCEDURE — jib point rollers just contact ground.

JACK-KNIFE PROCEDURE — jib stop pendants just start to go into tension (approximately 168° boom to jib angle).

1. Disengage jib stop strut pins with hand winch on left side of jib top (Figure 4-5, View D).

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

See Figure 4-9 for remaining steps.

2. Slowly lower boom to retract jib stop inner strut.
It will be necessary to use limit bypass switch to boom down if BLOCK UP or MAX UP limits are on.
3. Stop lowering boom when jib stop inner strut is fully retracted (View A).
4. Remove both quick-release pins from storage holes and install pins to connect jib stop inner strut to outer strut (View D).
5. Unpin jib stop pendants (1) from boom top (View E).
6. If jib attachment is being removed, remove and store jib stop pendants (1 and 2, Views C and D).
7. Using hand winch on jib top, rotate jib stop strut to storage position under jib butt.
8. Install storage pin (View B) to fasten jib stop strut to jib butt.
9. Lower boom top onto blocking approximately 6 – 12 in. (152 – 305 mm) high.
10. Lower jib strut and main strut if required.

Lowering Jib Strut and Main Strut**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 pendants or luffing hoist wire rope before climbing onto boom top or jib butt when connecting and disconnecting strut stop frame.

1. Pay out luffing hoist wire rope to lower jib strut until strut comes to rest on jib.

Guide jib pendants to ground along side jib as jib strut is lowered.

2. Install rigging pins (Figure 4-7, View D) to fasten jib strut to jib butt.
3. Boom down so backstay pendants are slack.
4. Haul in luffing hoist wire rope just enough to loosen stop pins in strut stop frame (Figure 4-7, View G).
5. Remove stop pins from strut stop frame and store pins in lugs on main strut (Figure 4-6, View B).
6. Pay out luffing hoist wire rope to lower main strut until strut stop links bottom out in strut stop frame (Figure 4-7, View E).
7. Lower mast until pendant holes are accessible in end of mast.
8. Unpin boom pendants and backstay pendants from holes in mast (Figure 4-7, View H, I, or J).
9. Pin 20 ft (6.10 m) of boom pendant to end of both backstay pendants and to pendant holes in mast as shown in Figure 4-7, View B.

Any hole in end of mast can be used, as long as same hole is used on both sides of mast.
10. Slowly haul in luffing hoist wire rope and boom down to raise main strut. *Keep backstay pendants slack until main strut nears vertical.*
11. Once main strut is past vertical, continue to boom down and haul in luffing hoist wire rope to lower main strut forward. *Keep luffing hoist wire rope slack as strut lowers.*

CAUTION**Jib Strut Damage!**

Do not allow backstay pendants to go into tension until main strut is near vertical. Jib strut could be damaged.

12. Stop when end of main strut is approximately 3-1/2 ft (1.07 m) above jib strut.
13. Unpin strut supports from underside of main strut (Figure 4-7, View C) and lower supports to vertical.
14. Lower main strut as required, and pin strut supports to lugs on jib strut (Figure 4-6, View C).
15. Lower mast until pendant holes are accessible in end of mast.
16. Unpin pendants used to raise main strut from mast and from backstay pendants.
17. Move strut stop frame to storage position as follows:
 - a. Using a sling from crane, hoist slightly against sheave in strut stop.
 - b. Remove pins and keeper plates to disconnect strut stop frame from boom top (Figure 4-6, View F).
Store pins, keeper plates, and screws for future use with main strut.
 - c. Hoist strut stop as necessary, slide frame on to main strut, and pin strut stop frame to storage lugs (Figure 4-6, View B).

Removing Jib



WARNING

Collapsing Boom/Jib Hazard!

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

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

- Support boom and jib points on blocking or ground.
- Slacken rigging — do not attempt to remove connecting pins while boom or jib is supported by rigging.
- Block below both ends of each boom or jib section before removing connecting pins.
- Stand 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 laces and chords as pins are knocked out.

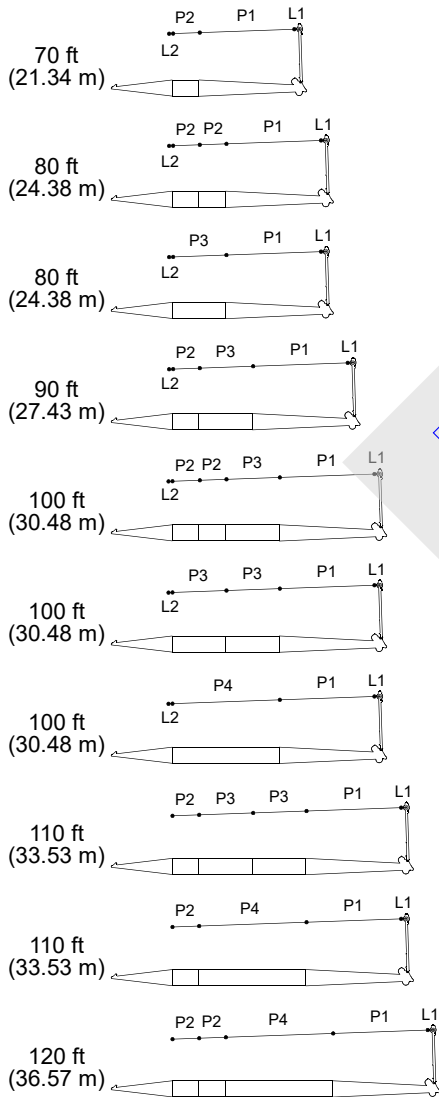
Removing jib is opposite of installing jib.

Jib butt, jib strut, and jib stop can be removed and shipped as an assembled unit.

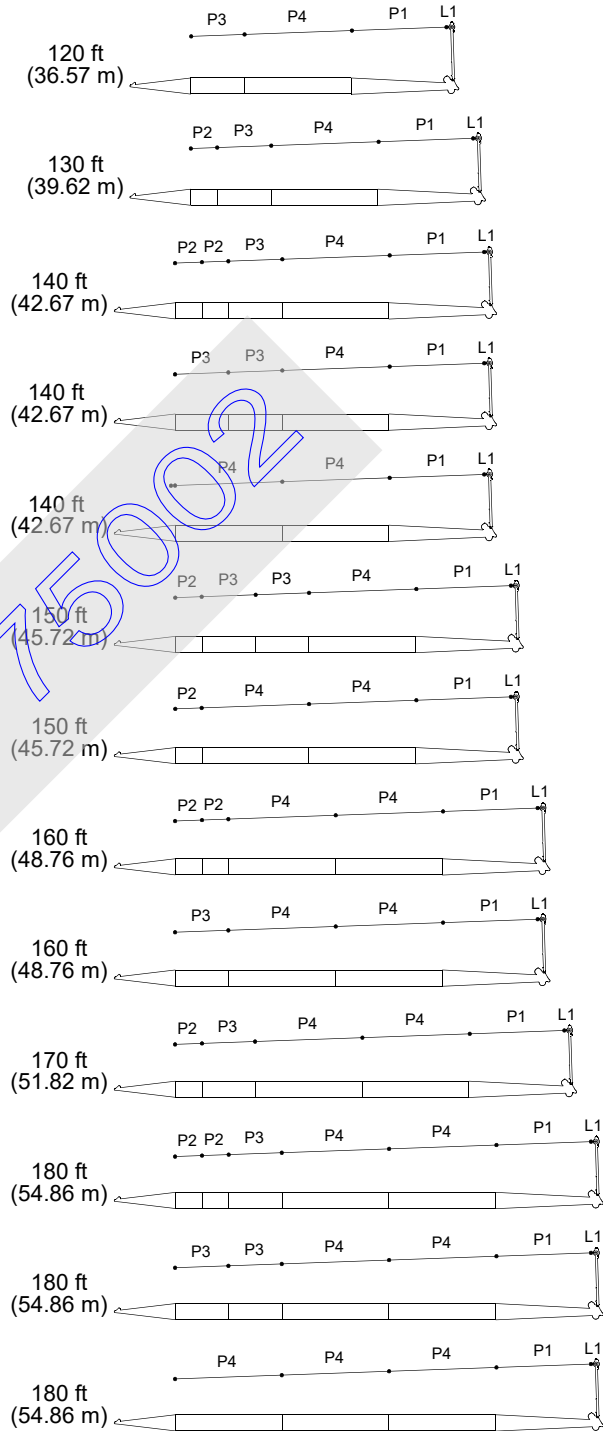
NOTE: Automatic boom stop must be reset to 83° for operation without the luffing jib (see Automatic Boom Stop Adjustment in Section 6 of this manual).

Item	Description
L1	Main Strut Link
L2	Mast Link
P1	Basic Backstay Pendant – 35 ft, 5-1/2 in (10.81 m)
P2	Backstay Pendant – 10 ft (3.05 m)
P3	Backstay Pendant – 20 ft (6.10 m)
P4	Backstay Pendant – 40 ft (12.19 m)

- Backstay pendants must be installed in same sequence as boom inserts, with shortest pendants toward boom butt.
- Do not mix pendants of different lengths. Pendants are supplied in matched sets and must be installed in matched sets. Pendants on one side of boom must be same length as pendants on other side of boom.



Backstay Rigging for 777 Crawler Crane



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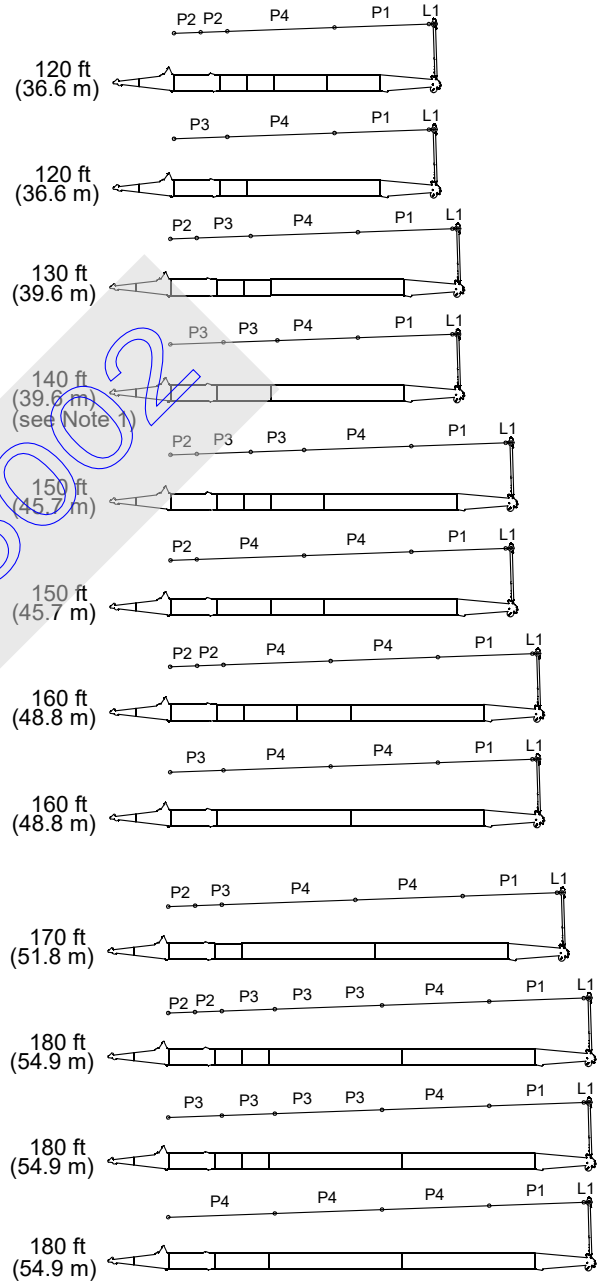
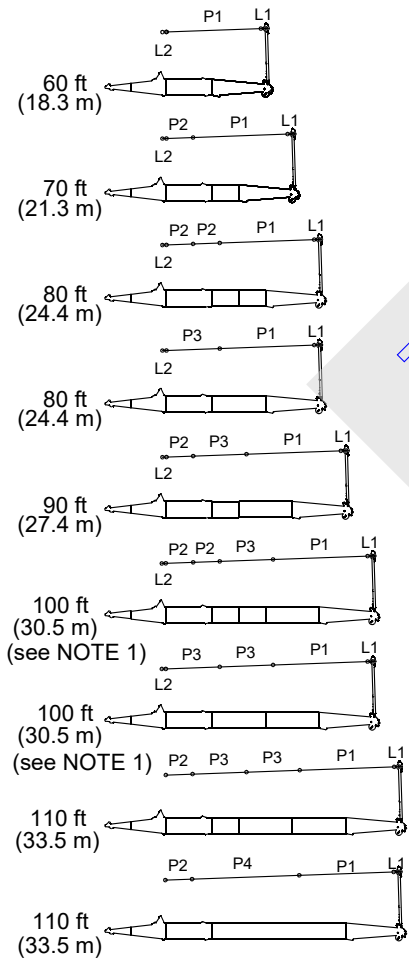
FIGURE 4-14

Item	Description
L1	Main Strut Link
L2	Mast Link
P1	Basic Backstay Pendant – 35 ft, 5-1/2 in (10.81 m)
P2	Backstay Pendant – 10 ft (3.05 m)
P3	Backstay Pendant – 20 ft (6.10 m)
P4	Backstay Pendant – 40 ft (12.19 m)

- Backstay pendants must be installed in same sequence as boom inserts, with shortest pendants toward boom butt.
- Do not mix pendants of different lengths. Pendants are supplied in matched sets and must be installed in matched sets. Pendants on one side of boom must be same length as pendants on other side of boom.

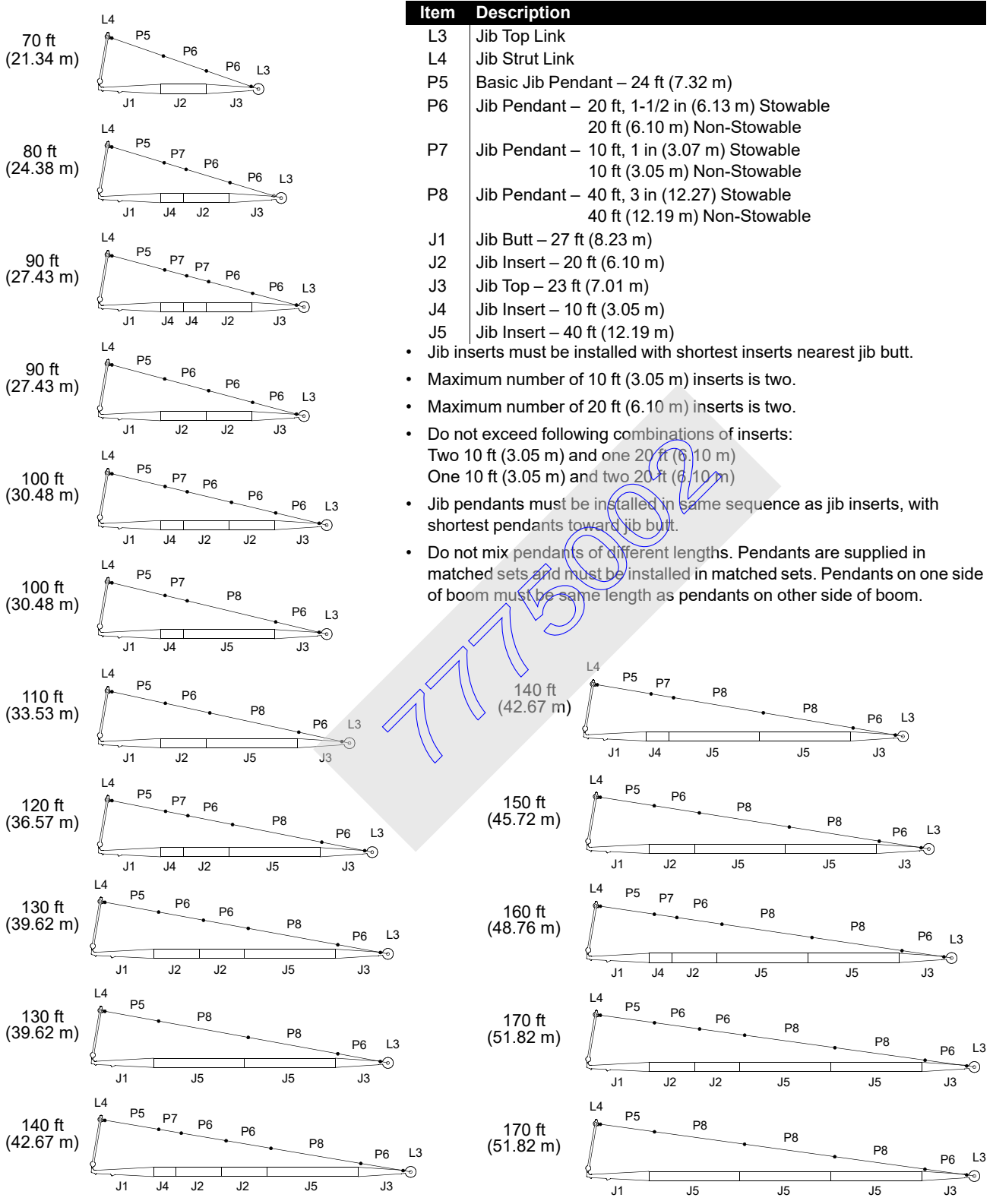
NOTE: One 40 ft (12.19 m) pendant (P4) can be substituted for two 20 ft (6.10 m) pendants (P3) or for one 20 ft (6.10 m) pendant (P3) and two 10 ft (3.05 m) pendants (P2).

Backstay Rigging for 777T Truck Crane



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FIGURE 4-15



Item Description

L3	Jib Top Link
L4	Jib Strut Link
P5	Basic Jib Pendant – 24 ft (7.32 m)
P6	Jib Pendant – 20 ft, 1-1/2 in (6.13 m) Stowable 20 ft (6.10 m) Non-Stowable
P7	Jib Pendant – 10 ft, 1 in (3.07 m) Stowable 10 ft (3.05 m) Non-Stowable
P8	Jib Pendant – 40 ft, 3 in (12.27) Stowable 40 ft (12.19 m) Non-Stowable
J1	Jib Butt – 27 ft (8.23 m)
J2	Jib Insert – 20 ft (6.10 m)
J3	Jib Top – 23 ft (7.01 m)
J4	Jib Insert – 10 ft (3.05 m)
J5	Jib Insert – 40 ft (12.19 m)

- Jib inserts must be installed with shortest inserts nearest jib butt.
- Maximum number of 10 ft (3.05 m) inserts is two.
- Maximum number of 20 ft (6.10 m) inserts is two.
- Do not exceed following combinations of inserts:
Two 10 ft (3.05 m) and one 20 ft (6.10 m)
One 10 ft (3.05 m) and two 20 ft (6.10 m)
- Jib pendants must be installed in same sequence as jib inserts, with shortest pendants toward jib butt.
- Do not mix pendants of different lengths. Pendants are supplied in matched sets and must be installed in matched sets. Pendants on one side of boom must be same length as pendants on other side of boom.

Jib Rigging

FIGURE 4-16

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FIXED JIB RIGGING GUIDE (#138 FIXED JIB) – CRAWLER AND TRUCK

This topic contains installation and removal instructions for the #138 fixed jib on the #139 luffing jib.

The jib consists of a 15 ft (4.57 m) butt and a 15 ft (4.57 m) top, providing a basic length of 30 ft (9.14 m). Inserts are available to assemble additional jib lengths of 40 – 60 ft (12.19 – 18.29 m) as shown in Figure 4-17.

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

Assist Crane Requirements

An assist crane is required to assemble and disassemble the jib. See the Crane Weights in Section 1 of this manual for weights of jib components.

Jib Assembly Drawing

Jib components (top, inserts, butt, pendants) must be assembled in proper sequence according to this topic and the Jib Assembly Drawing. See Figure 4-17 to determine quantity and length of inserts and pendants required for various jib lengths.

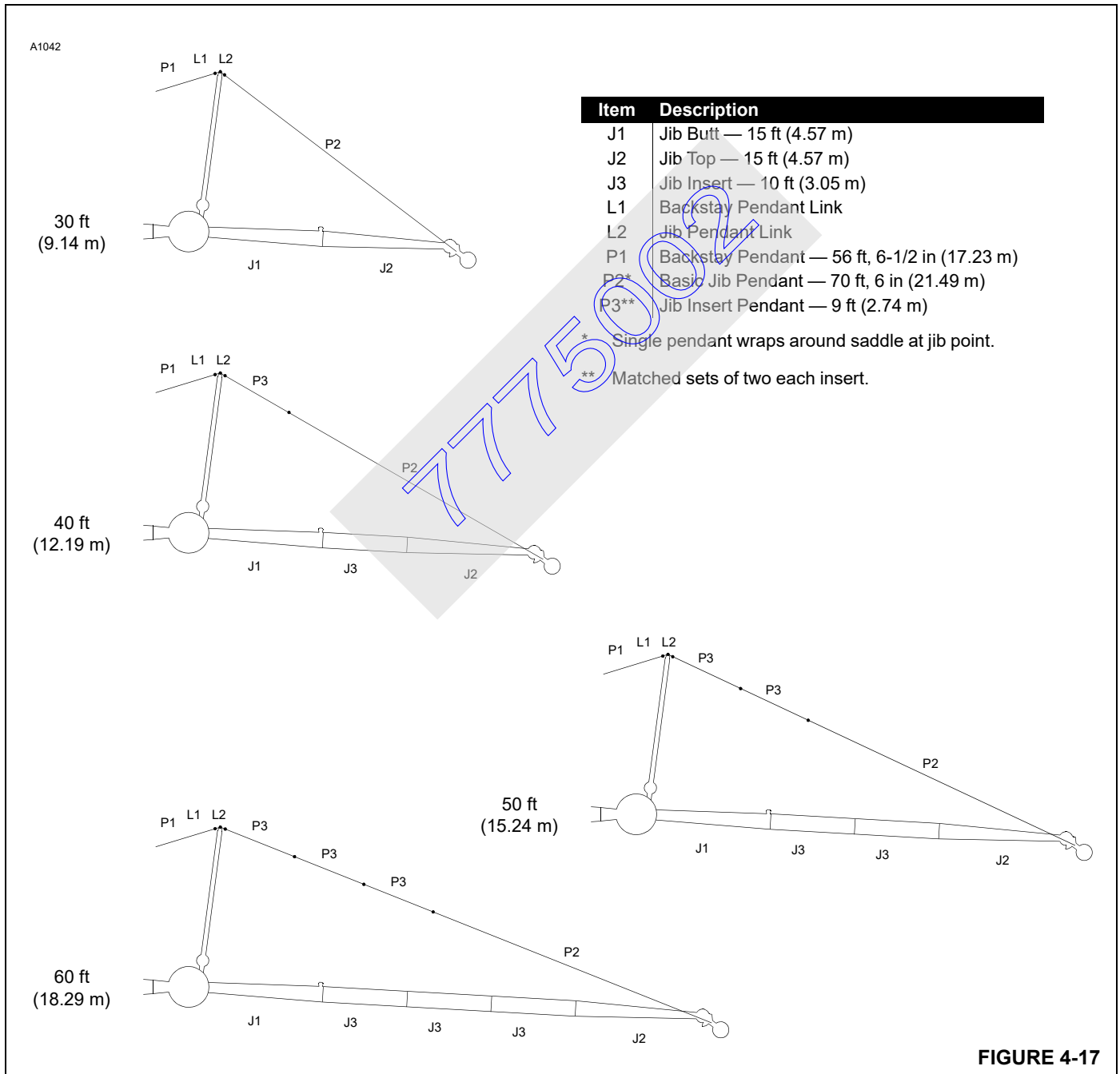


FIGURE 4-17

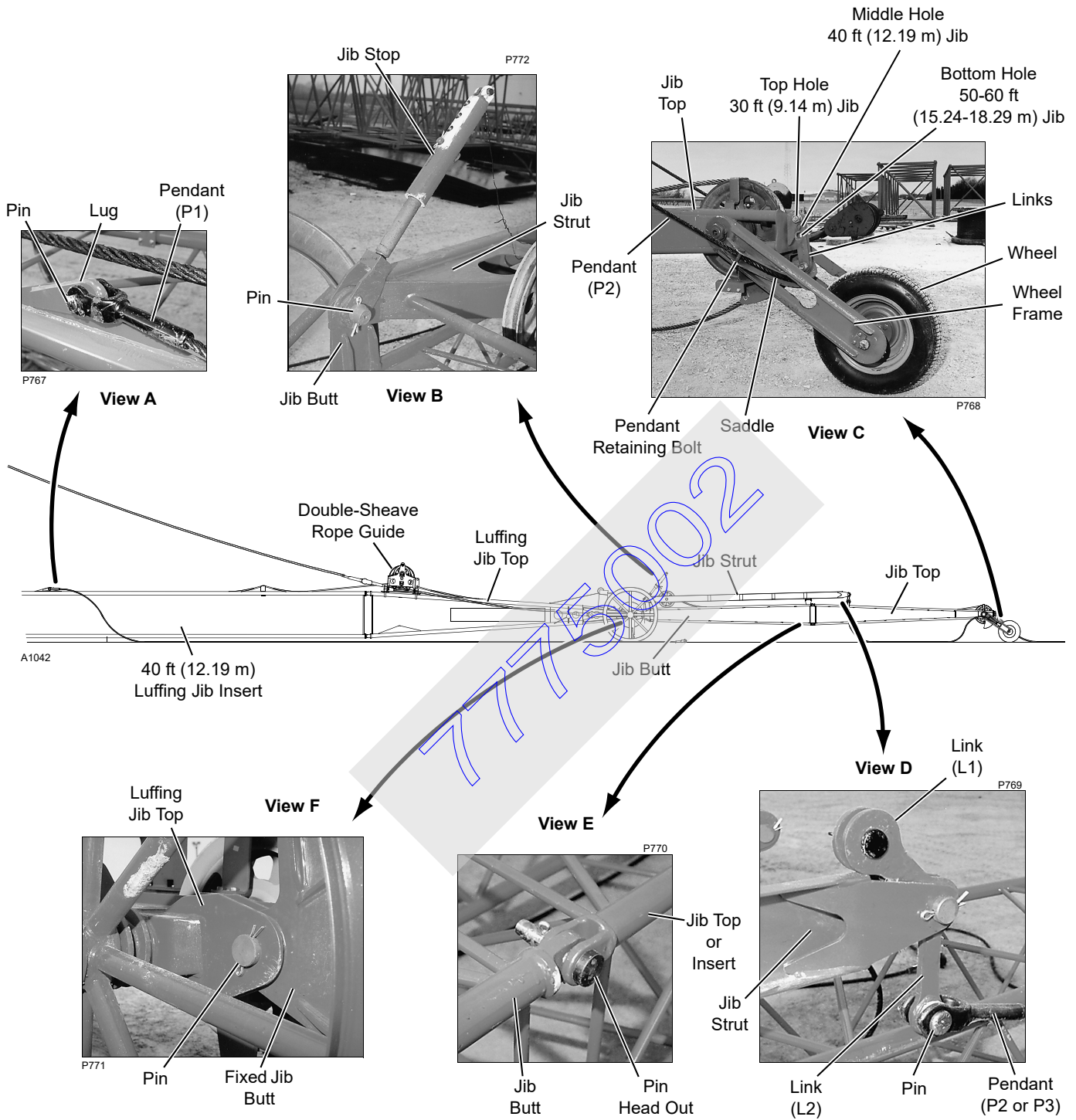


FIGURE 4-18

Preparing Boom and Luffing Jib

This topic assumes that the boom and luffing are completely assembled and ready to be raised. See Luffing 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. 40 ft (12.19 m) insert with jib backstay lugs installed next to luffing jib top as shown in Figure 4-18.
2. Following components removed from 180 ft (54.86 m) boom (777 and 777T) or 170 ft (51.8 m) boom (777T only) (operation with only one load line is permitted):
 - a. Auxiliary drum from boom butt.
 - b. Auxiliary drum wire rope guide from 10 ft (3.05 m) insert (777 only).
 - c. Wire rope guides from 17-1/2 ft (5.3 m) insert (777T only)
 - d. Lower boom point sheaves.
 - e. One wire rope guide sheave from jib strut (if equipped with two sheaves).
3. Double-sheave wire rope guide installed on luffing jib top. Small sheave is required for load line to fixed jib.

Luffing Jib Configuration

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

1. Boom and luffing jib fully assembled on ground as shown in Figure 4-18.
2. Boom and luffing jib fully assembled and raised to jack-knife angle called for in Luffing Jib Raising Procedure Chart with jib point rollers resting on ground.

Installing Fixed Jib

See Figure 4-18 for following procedures.

Install Jib Butt

NOTE: The jib strut and jib stop tubes are shipped in the stored position on the jib butt as shown in View B. Securely fasten the jib stop tubes to the strut so the tubes cannot fall.

1. Lift jib butt into position at end of luffing jib top.
2. Align holes in jib butt with holes in luffing jib top and install connecting pins (View F).

Install Jib Inserts

1. Pin desired length of jib inserts to butt. Pin heads must be toward outside of jib (View E).
2. Block inserts as assembly progresses.

Install Jib Top

1. Securely attach proper holes in wheel frame links to end of jib top as shown in View C:
 - Top hole for 30 ft (9.14 m) jib.
 - Middle hole for 40 ft (12.19 m) jib.
 - Bottom hole for 50 and 60 ft (15.24 and 18.29 m) jib.
2. Pin jib top to last insert or butt, depending on jib length. Pin heads must be toward outside of jib (View E).

Install Jib Pendants

The 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. Install basic jib pendant (P2, View C) through holes in wheel frame and engage saddle.
2. Install bolts (View C) to retain pendant in saddle.
3. Lay basic pendant on ground along side jib.
4. If required, pin jib insert pendants (P3, Figure 4-17) to basic pendant (P2).
5. Pin insert pendants (P3) or backstay pendants (P2) to links (L2) at jib strut (View D).

Install Backstay Pendants

NOTE: If the boom and luffing jib will be jack-knifed into position before the fixed jib is installed, perform step 1 before raising the boom and luffing jib.

1. Pin backstay pendants (P1) to lugs on 40 ft (12.19 m) luffing jib insert (View A).
2. Lay backstay pendants on ground along side luffing jib.

NOTE: The jib strut will be raised and the backstay pendants pinned to the strut after the boom and luffing jib are raised.

Install Jib Load Line

If the boom and luffing will be jack-knifed into position before the fixed jib is installed, perform steps 1 and 2 before raising the boom and luffing jib. Pull load line approximately 50 ft (15.2 m) past end of luffing jib point and lay line on ground. Securely fasten load line to luffing jib point. Install load block or weight ball and block-up limit after boom and luffing jib have been jack-knifed into position just prior to raising fixed jib wheel off the ground.



WARNING

Falling Wire Rope Hazard!

For long boom and short jib combinations, wire rope on boom side of attachment can overhaul unsecured wire rope on jib side of attachment. Wire rope could fall off boom. Securely fasten load line to jib before raising attachment.

1. Determine parts of load line required for job and size load block accordingly (see Wire Rope Specifications in Capacity Chart Manual).
2. Route load line from desired drum through proper guide sheaves on boom, jib strut, and jib (see Load Line Reeving in this section).

3. Reeve load line through required jib point sheaves and anchor load line at dead-end socket and wedge (see Load Line Reeving in this section).
4. Install block-up limit for jib point (see Block-Up Limit Control in Section 6 of this manual).

Install Electronic Devices

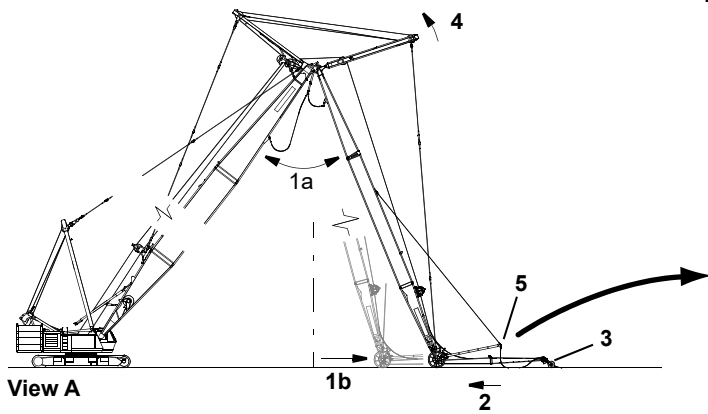
1. Install block-up limit components and connect electric cords to junction box on luffing jib point and to limit switch on fixed jib point (see Block-Up Limit Adjustment in Section 6 of this manual).
2. Install load indicator components (if required) and connect electric cords as shown in Load Indicator Assembly Drawing at end of this section.
3. Connect all unused electric cords to proper shorting plugs on junction boxes. *Boom will not lower and drums will not hoist if electric cords are not shorted out.*
4. Adjust block-up limit switch at fixed jib point according to Block-Up Limit Adjustment in Section 6 of this manual.

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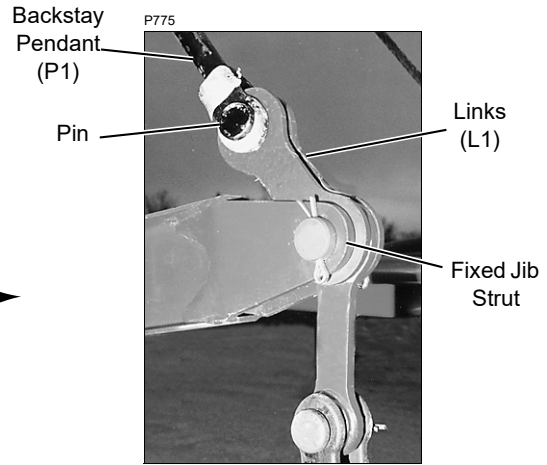
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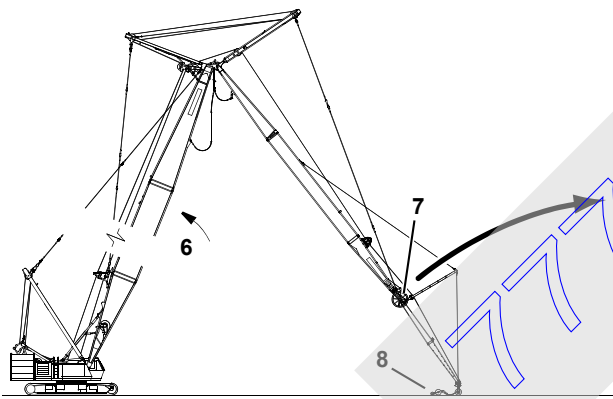
View A



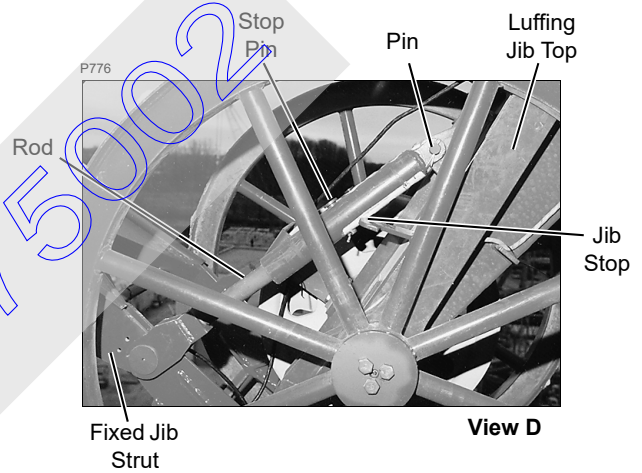
View B

Crawler crane shown
777T similar.

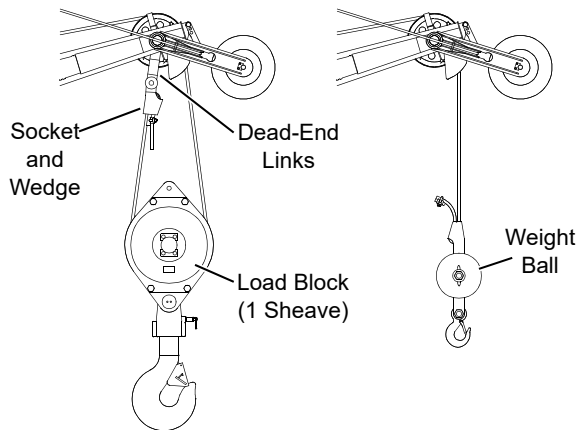
ITEM NUMBERS CORRESPOND TO STEPS
IN LOWERING BOOM AND JIB PROCEDURE.



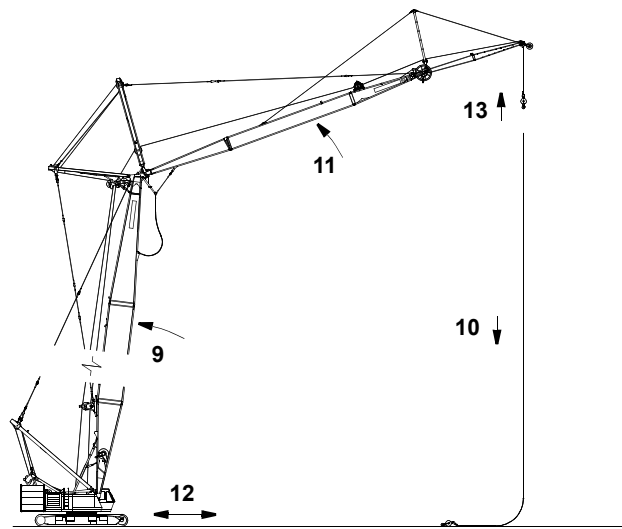
View C



View D



View E



View F

FIGURE 4-19

Raising Boom and Jibs

NOTE: Item numbers in Figure 4-19 correspond to numbered steps in following procedure.

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

Perform pre-raising checks in this section.

1. Raise boom and luffing jib to proper jack-knife angle called for in Luffing Jib Raising Procedure Chart with jib point rollers resting on ground (Figure 4-19, View A):

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 angle.
4. Once boom and luffing jib have been raised to specified angle, slowly haul in luffing hoist wire rope until luffing jib pendants start to go into tension and stop. **Do not attempt to lift luffing jib at this time or crane will tip.**
5. Connect fixed jib backstay pendants (Figure 4-19, View B):
 - a. Using an assist crane, raise fixed jib strut and pin backstay pendants (P1) to links (L1).
 - b. Lower strut until it is supported by backstay pendants and disconnect assist crane.
6. Slowly raise boom — **do not raise luffing jib** — until fixed jib is hanging from backstay pendants with wheel just lightly touching ground (Figure 4-19, View C).

Take care not to allow jib pendants to get caught on side of fixed jib. Guide jib pendants clear of jib sections as fixed jib rises.

7. Connect jib stops (Figure 4-19, View D):
 - a. Unfasten both jib stops from fixed jib strut.
 - b. Make sure stop pin is installed in **hole nearest rod end of both tubes**.
 - c. Pin both jib stop tubes to lugs on luffing jib top. Adjust rods if required to align connecting holes.
8. Install weight ball or load block as shown in Figure 4-19, View E.

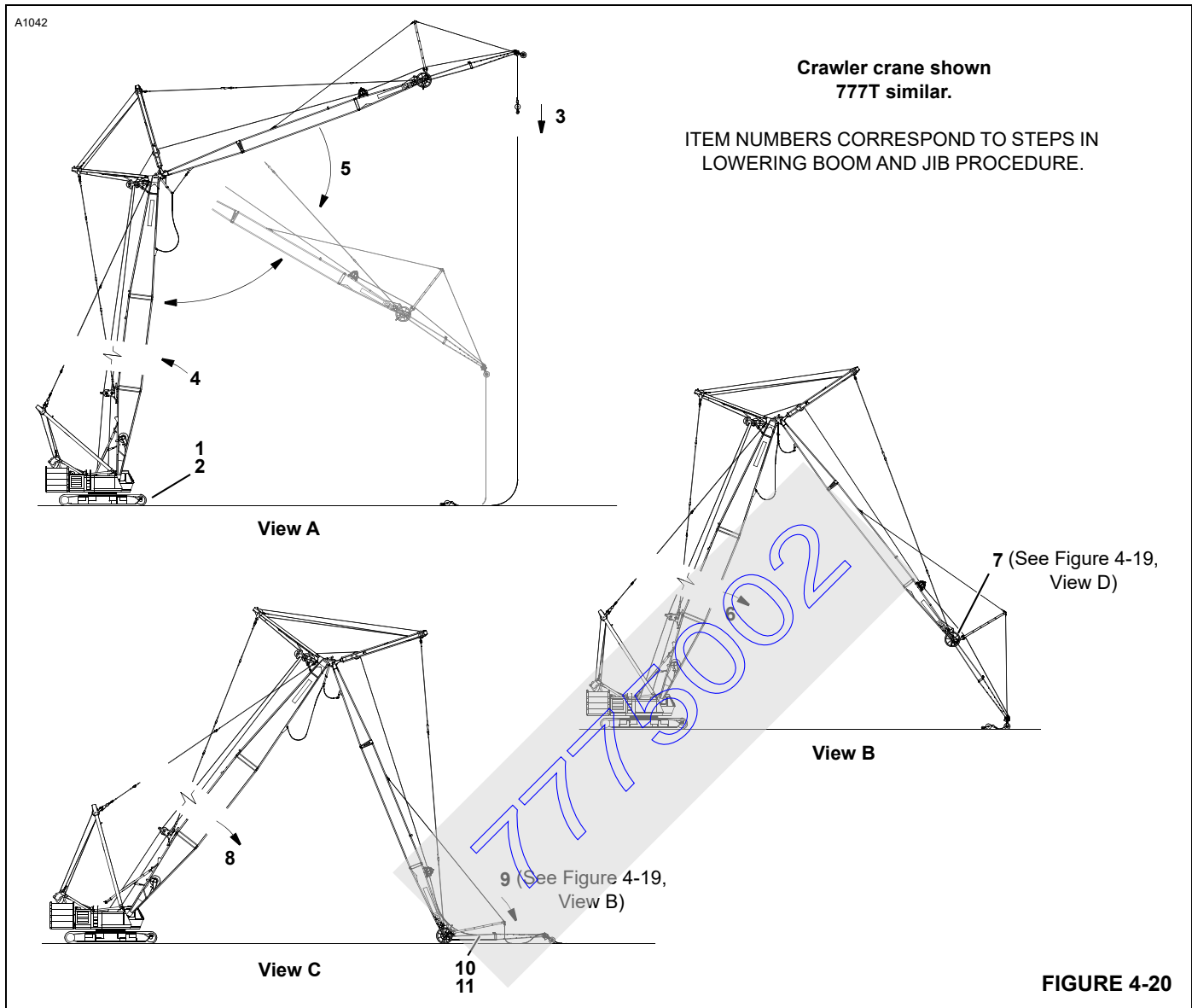
WARNING Falling Load Hazard!

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.

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. Raise boom to desired operating angle (see Capacity Chart).
10. Pay out load line as boom and jib are raised.
11. Position luffing jib at required operating radius.
12. Travel crawler rollers off blocking (777) or retract outriggers (777T).
See Maximum Allowable Travel Specifications chart for travel instructions.
13. Travel as required to position weight ball or load block below jib point.
14. Lift weight ball or load block to desired position.



Lowering Boom and Jibs

NOTE: Item numbers in Figure 4-20 correspond to numbered steps in following procedure.

Monitor angles on digital display in operator’s cab while lowering boom and jibs.

! WARNING
Moving Part Hazard!

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

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

1. For crawler crane, swing *upperworks in-line with lowerworks so boom is over front of crawlers.*

For truck crane, swing upperworks in-line with lowerworks so boom is over rear of truck.

! WARNING

Tipping Crane Hazard!

Lower all boom and jib combinations over blocked crawlers or extended outriggers; otherwise, crane will tip.

2. Travel *front crawler rollers onto blocking or extend and set outriggers.*

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

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

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

4. Raise boom to a minimum angle of 75°.
5. Position jib at required boom to luffing jib angle as shown in Figure 4-20, View A (see Luffing Jib Raising Procedure Chart for angle).

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

Do not lower boom and jibs to ground until boom has been positioned at minimum angle of 75° and luffing jib has been positioned at specified boom to luffing jib angle. Crane will tip.

6. Slowly lower boom until fixed jib point wheel just lightly contacts ground as shown in Figure 4-20, View B.
7. Disconnect jib stops (Figure 4-19, View D):
 - a. Unpin both jib stop tubes from lugs on luffing jib top. Store pins with jib stops.
 - b. Rotate jib stops forward against jib strut and securely fasten both jib stops to strut.
8. Continue to lower boom slowly — **do not lower luffing jib** — until luffing jib rollers contact ground as shown in Figure 4-20, View C.

Fixed jib point wheel will roll along ground as boom is lowered.

9. Disconnect fixed jib backstay pendants (Figure 4-19, View B):
 - a. Using an assist crane, support fixed jib strut.
 - b. Unpin backstay pendants (P1) from links (L1).
 - c. Lower strut onto fixed jib butt and disconnect assist crane.
10. Remove fixed jib at this time or after boom and luffing jib have been lowered to ground level.

Removing Fixed Jib**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 lacings and chords as pins are knocked out.

Removing the fixed jib is opposite of installing the jib.

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

WIRE ROPE INSTALLATION AND MAINTENANCE

NOTE: Wire rope installation instructions from various OEM's are provided at the end of this section. If a conflict exists between the following instructions and the OEM instructions, the OEM instructions apply.

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.

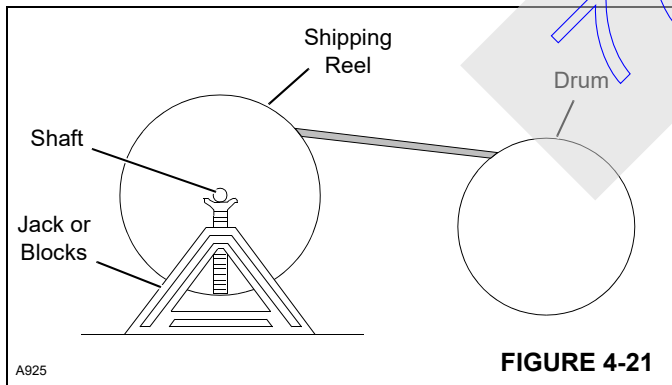
Removing Wire Rope from Shipping Reel

CAUTION!

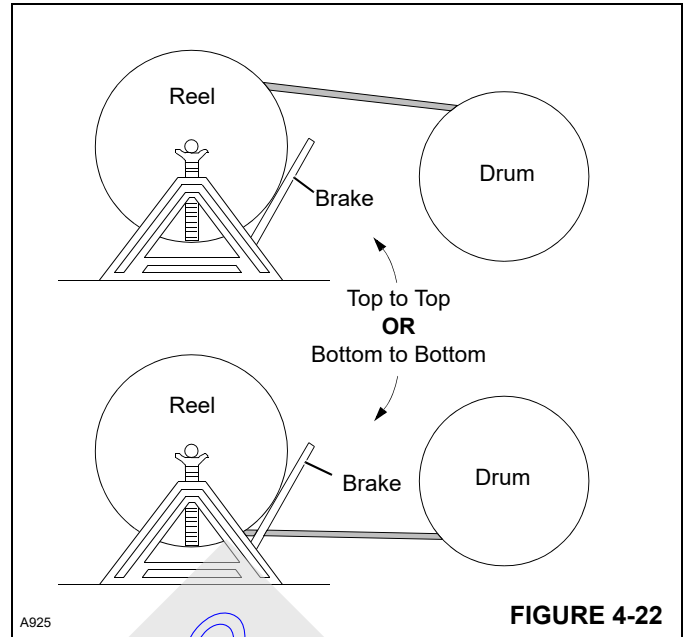
Wire Rope Damage!

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 4-21.



2. Provide a brake at shipping reel (see Figure 4-22) 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 4-22.

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

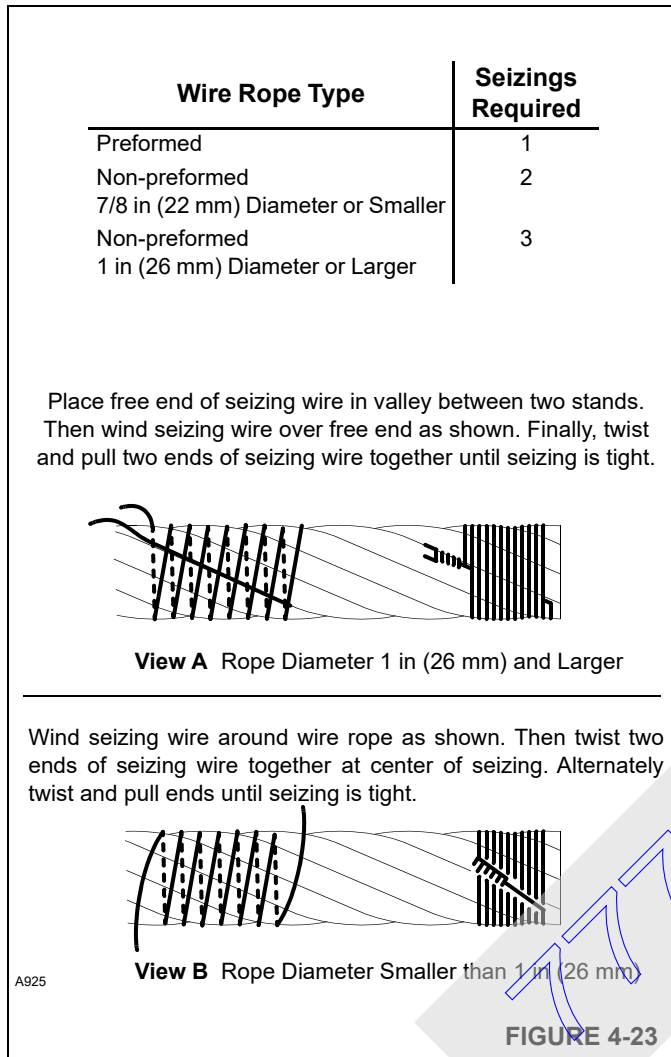
Seizing and Cutting Wire Rope

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 4-23 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 4-24 for following procedure.

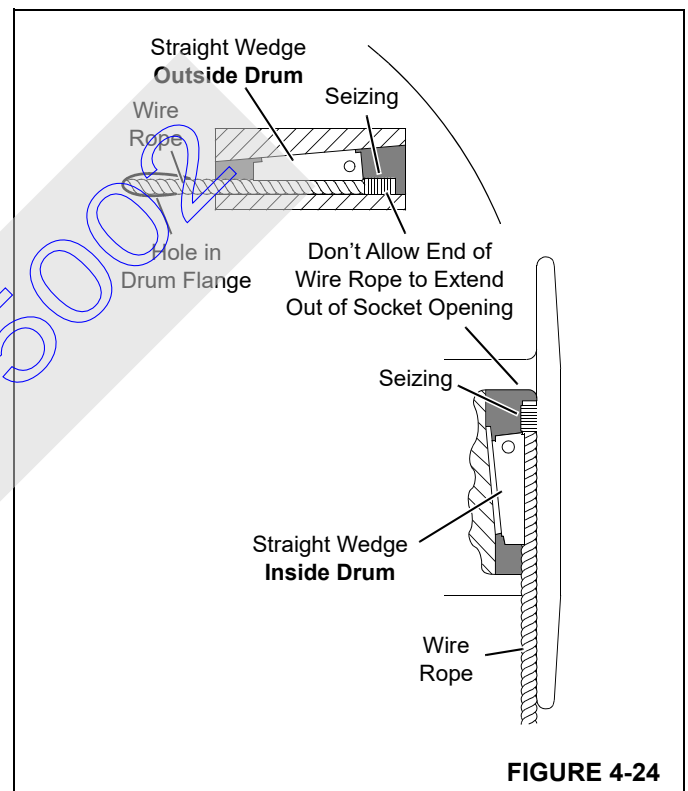
Use the correct wedge part number for the size of wire rope being used; see parts drawing for the boom hoist drums or for the load drum shaft to obtain the correct part number.

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.

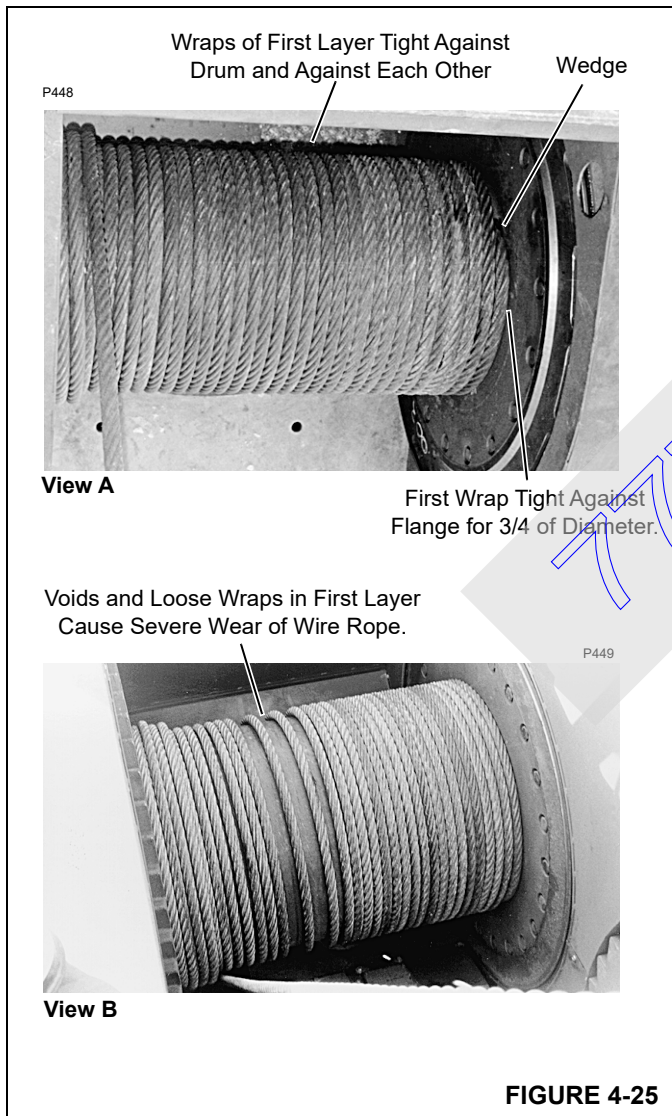
1. Carefully inspect drums and all rope guides, rollers, and sheaves for defects that can cause wire rope to wear or be cut. If defects cannot be fixed, replace faulty parts.

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 4-25).

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 4-25, 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.

See Figure 4-26 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.

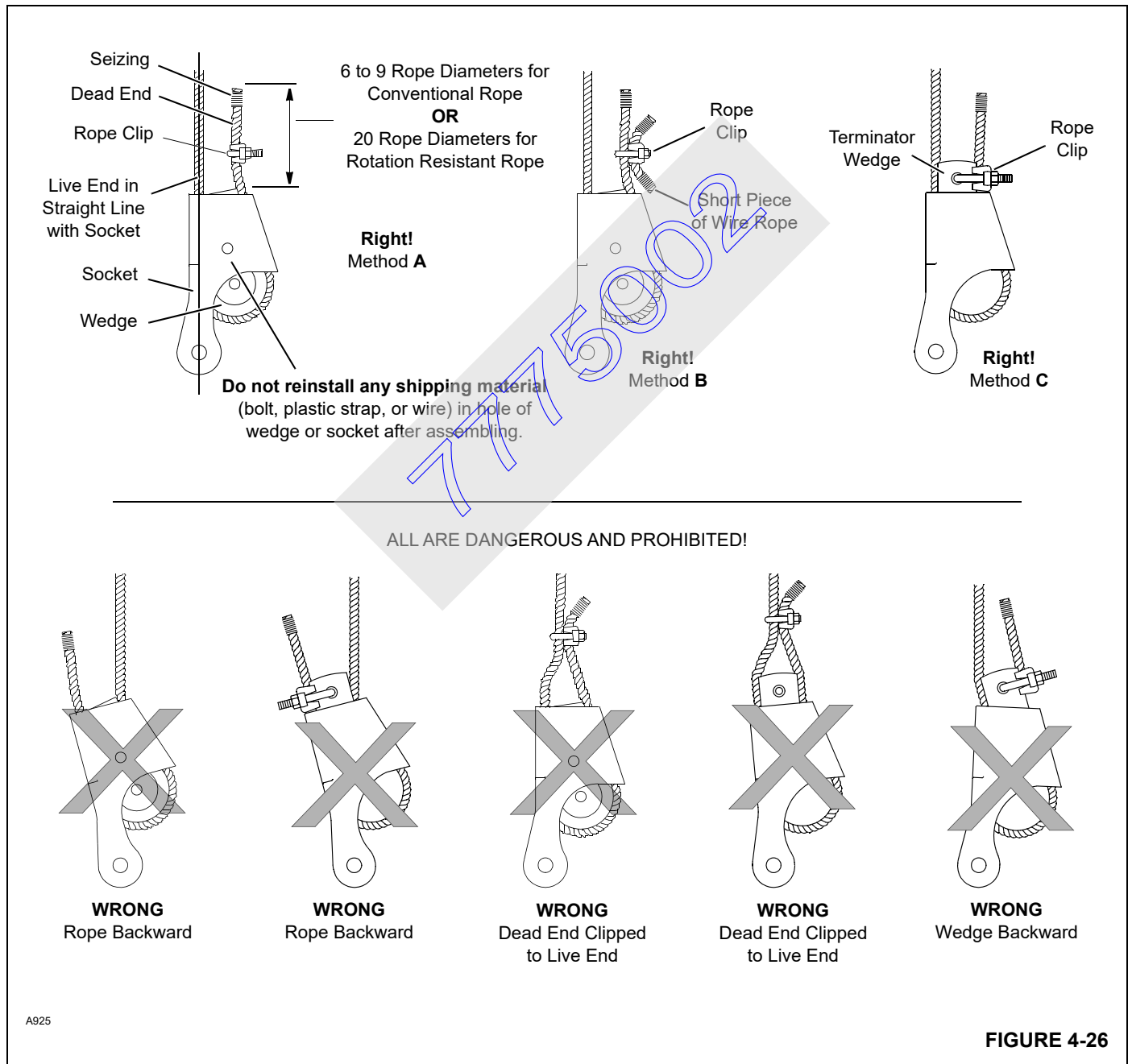
NOTE: Use Right Method A only if wire rope clip is small enough to be securely tightened to dead end. Right Method C is only for a Terminator wedge socket.

- 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.



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 4-27 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 (Figure 4-27).
 - Cracks or breaks exist in metal or weld.

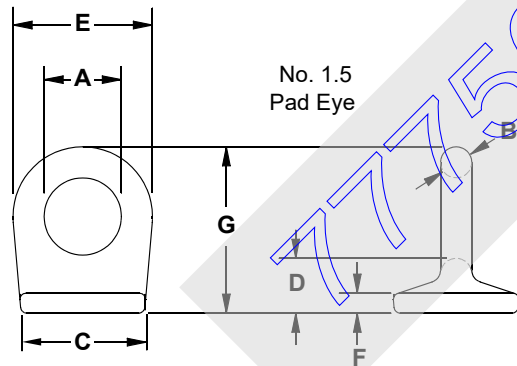
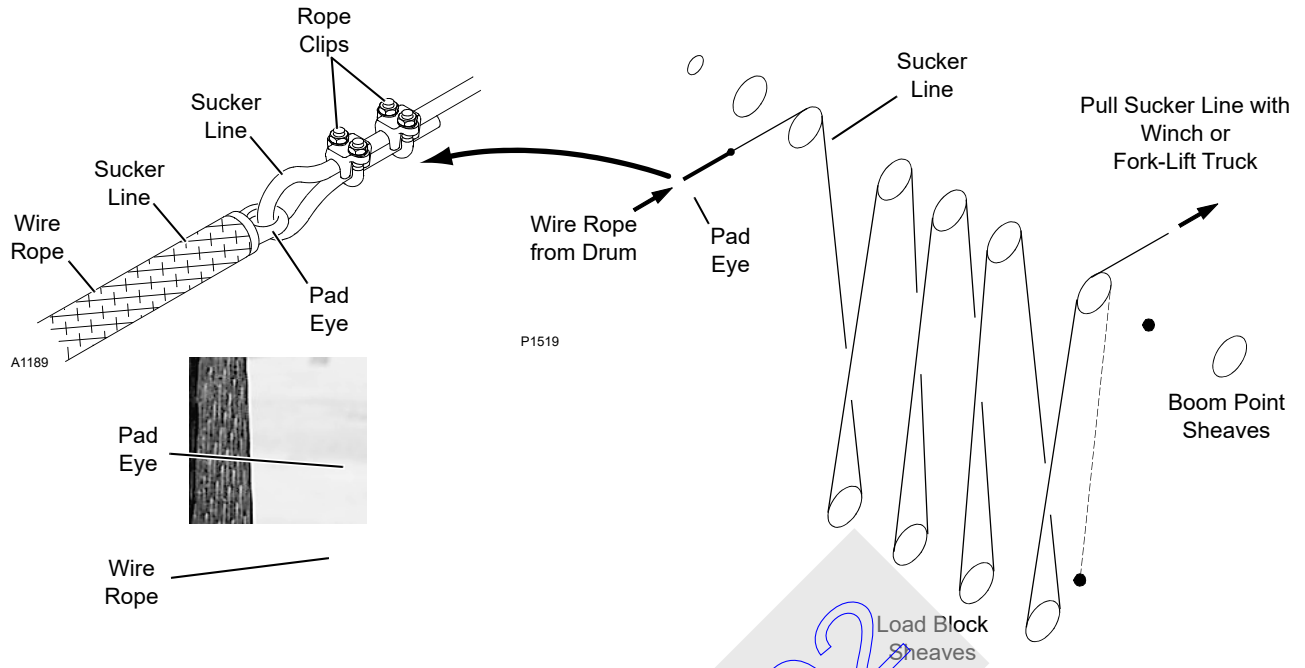


WARNING

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.



No. 1.5 Pad Eye

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 4-27

LOAD LINE REEVING — CRAWLER AND TRUCK

Wire Rope Specifications

See the Wire Rope Specifications chart in the Capacity Chart Manual for the following information:

- Parts of line required for various loads.
- Wire rope lengths and notes about hoisting distance for various parts of line.
- Maximum spooling capacity of load drums.

CAUTION

Wire Rope Damage!

Avoid wire rope damage from improper fleet angle or contact with adjacent parts. Do not hoist load block or hook and weight ball any closer to jib points than specified on Range Diagram (see Capacity Chart Manual).

When equipped with a luffing jib, the rear drum is used for the luffing hoist. Therefore, only two drums are available for handling loads: front drum and auxiliary drum in boom butt. The user must determine which drum is used for which load handling application, based on required spooling capacity, line pull, and line speed.

The auxiliary drum is limited to 20,000 lb (9 070 kg) line pull, but is approximately 20% faster than the front drum.

Wire Rope Installation

See the Wire Rope Installation and Maintenance for the following instructions:

- Anchoring wire rope to drums.
- Installing wire rope on drums.
- Anchoring wire rope to wedge sockets.

Sheaves must be positioned at indicated dimensions to ensure proper fleet angles.

Guide Sheave Identification

See Figure 4-28 for identification of wire rope guide sheaves on boom and jib.

If rotation resistant wire rope is used, also see the manufacturer's instructions for important installation procedures.



WARNING

Falling Load Hazard!

Avoid damage to wire rope or wire rope guide. Position sheaves and route wire rope as shown in Figure 4-28. Failing to position sheaves and route wire rope properly can cause wire rope to break and load to fall.



WARNING

Falling Load Hazard!

Avoid damage to wire rope or wire rope guide. Position sheaves and route wire rope as shown in Figure 4-28. Failing to position sheaves and route wire rope properly can cause wire rope to break and load to fall.

Reeving Diagrams

See Figure 4-29 for suggested reeving diagrams, for component identification, and dead-end locations.

Load Blocks

Two different size load blocks are available from Manitowoc:

- 15 USt (14 t) hook and weight ball.
- 30 USt (27 t) load block with one sheave.
- 60 USt (54 t) load block with two sheaves.



WARNING!

Falling Load Hazard!

Load block capacity must be equal to or greater than weight of load to be handled. Load block can fail if overloaded, allowing load to fall.

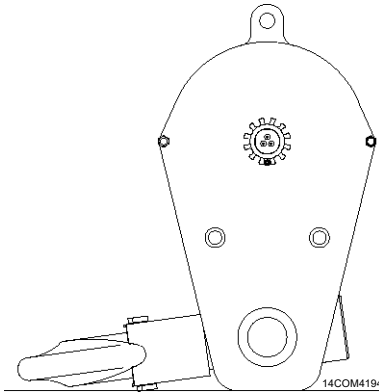


WARNING

Falling Load Hazard!

Exercise care when block is standing in vertical position, as the potential for tipping exists. Potential causes of tipping are unstable work area, boom movement and the reeving process.

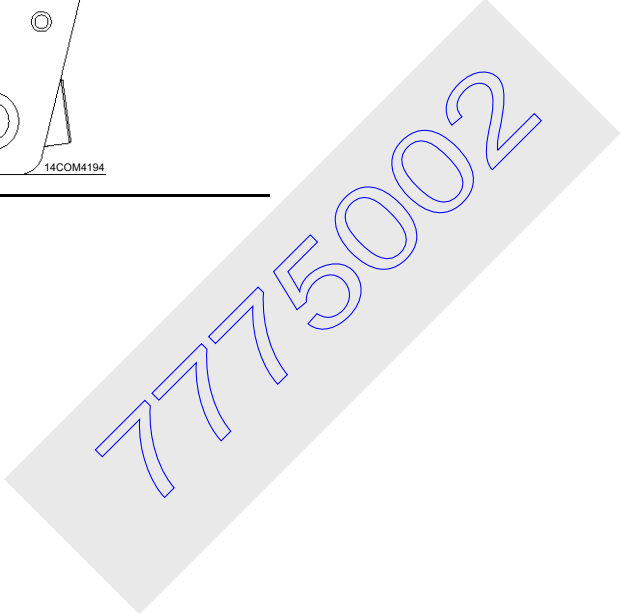
If work area is unstable, lay block flat on side plate.



Universal Anchor Joint

A universal anchor joint (Figure 4-29) is available to provide an alternate dead-end location for 2-part reeving.

See Universal Anchor Joint in this section for safety information and a complete description of the universal anchor joint.



Legend for Figure 4-28

Item		Note	
F	From Front Drum	1	All sheaves are viewed from boom butt.
A	From Auxiliary Drum	2	Gap between clamps must be equal on both sides. Torque bolts lubricated with SAE 20 oil to 120 ft-lb (1 751 Nm).
•	Wire Rope (Route as Shown)	3	Either park left side sheave to side or position it properly for reeving to lower boom point (see Load Line Reeving in Section 4 of Crane Operator Manual).
		4	When two load lines are routed to luffing jib, ropes must not cross until after they pass through wire rope guide on jib top.



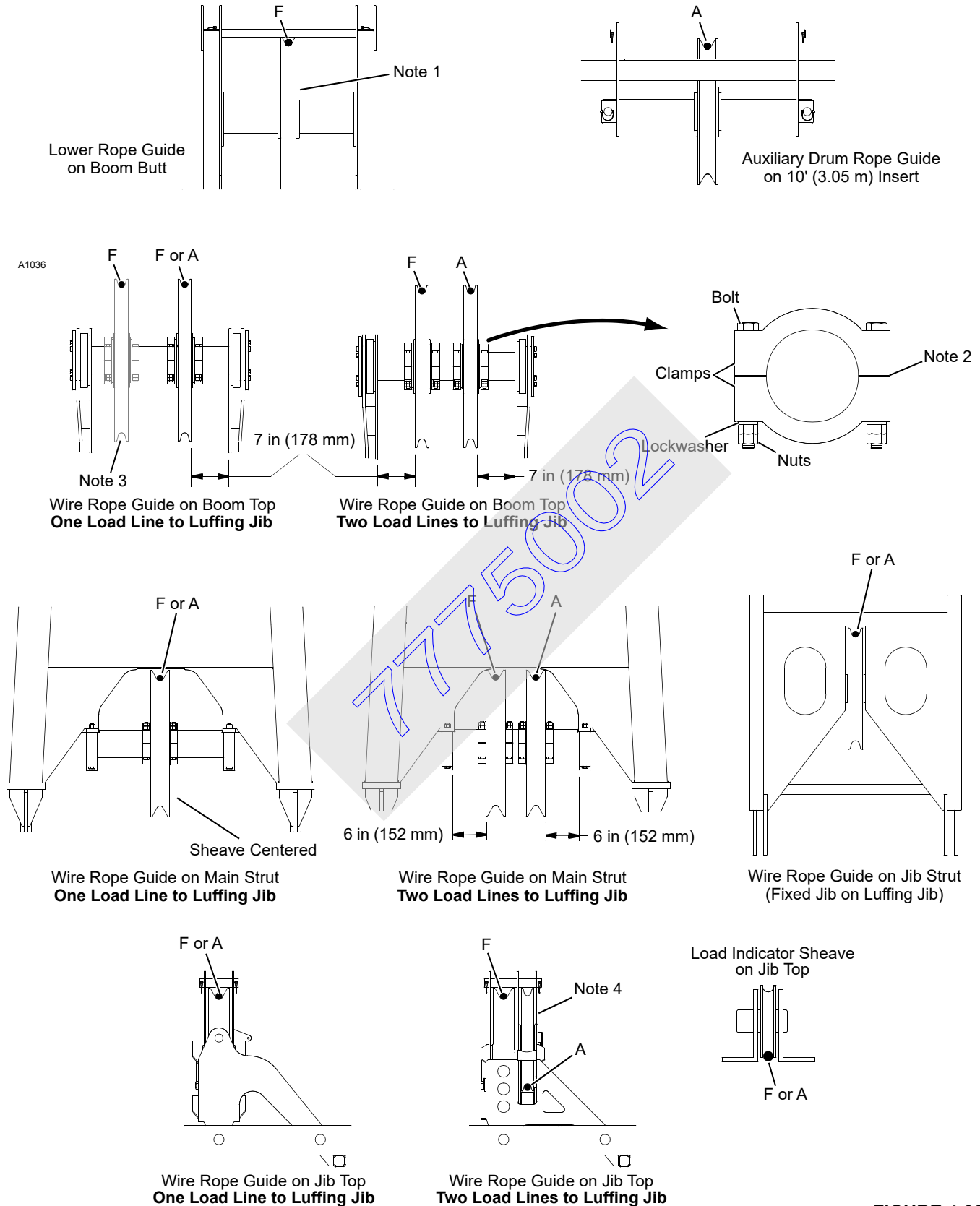
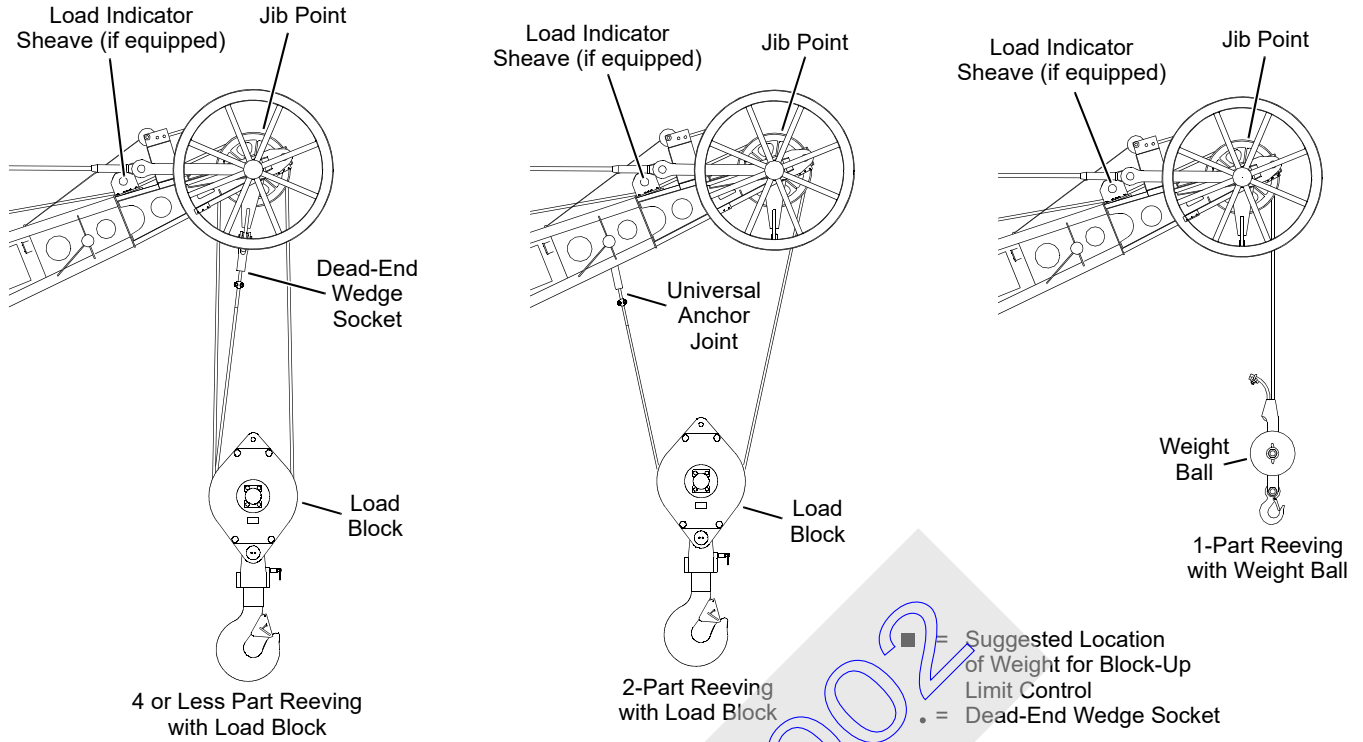
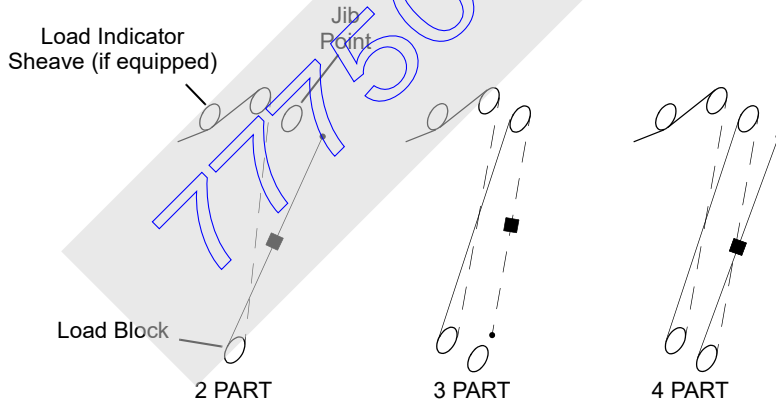


FIGURE 4-28



#139 Luffing Jib



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#138 Fixed Jib

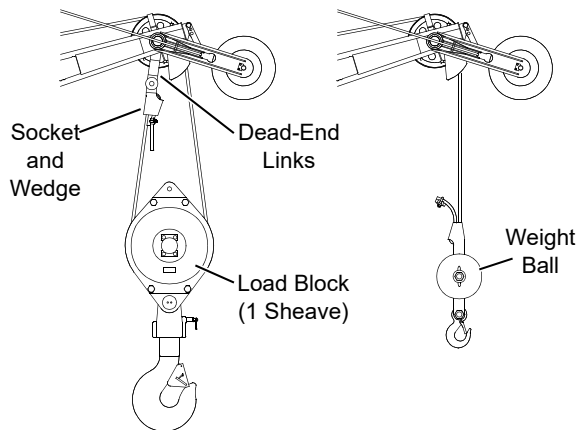


FIGURE 4-29

UNIVERSAL ANCHOR JOINT

The dead-end socket and wedge can be anchored to any of the following locations in the boom and jib point, depending on the type of operation (see Figure 4-30):

1. Link (if equipped) in boom or jib point for liftcrane operation.
2. Lug welded inside boom or jib point directly behind boom or jib point shaft for liftcrane operation.
3. Universal anchor joint located 30 in. (0.8 m) to 72 in. (1.8 m) behind boom or jib point. This location provides greater separation between the load lines which reduces twisting of the load. The universal anchor joint is used for magnet, clamshell, grapple and liftcrane operation requiring a 2-part load line. For container handling or rock tray operation, a double hanger universal anchor joint is used.

NOTE: Movement of the dead-end socket on the link or lug (1 and 2 above) is in two directions only – forward and back (see Figure 4-30). Movement of the dead-end socket on the universal anchor joint (3 above) is in four directions – forward, back and sideways (see Figure 4-30).

If the anchor link or lug in the boom or jib point has been used for any duty-cycle work with a 2-part load line, check for cracks due to side bending loads. Consult with factory for repair procedure.

If the boom or jib point is not prepared for the universal anchor joint, the boom or jib top is neither designed for nor intended for duty-cycle work.

For liftcrane operation requiring 3-parts of load line or greater, it is necessary to remove the universal anchor joint. This step will prevent interference of the universal anchor joint with the wire rope at high boom angles.

! WARNING
Falling Load Hazard!

Do not operate as liftcrane at high boom angle with universal anchor joint in place. Interference of wire rope with universal anchor joint can damage wire rope causing rope to break and load to fall.

For wire rope size and maximum load of universal anchor joint, see appropriate wire rope chart, capacity chart, or rigging drawing.

! WARNING
Falling Load Hazard!

Do not dead-end a 2-part load line to anchor link or lug in boom or jib point for magnet, clamshell, grapple or other operations requiring rapid swing cycles. Sideways motion may break link or lug causing load to fall.

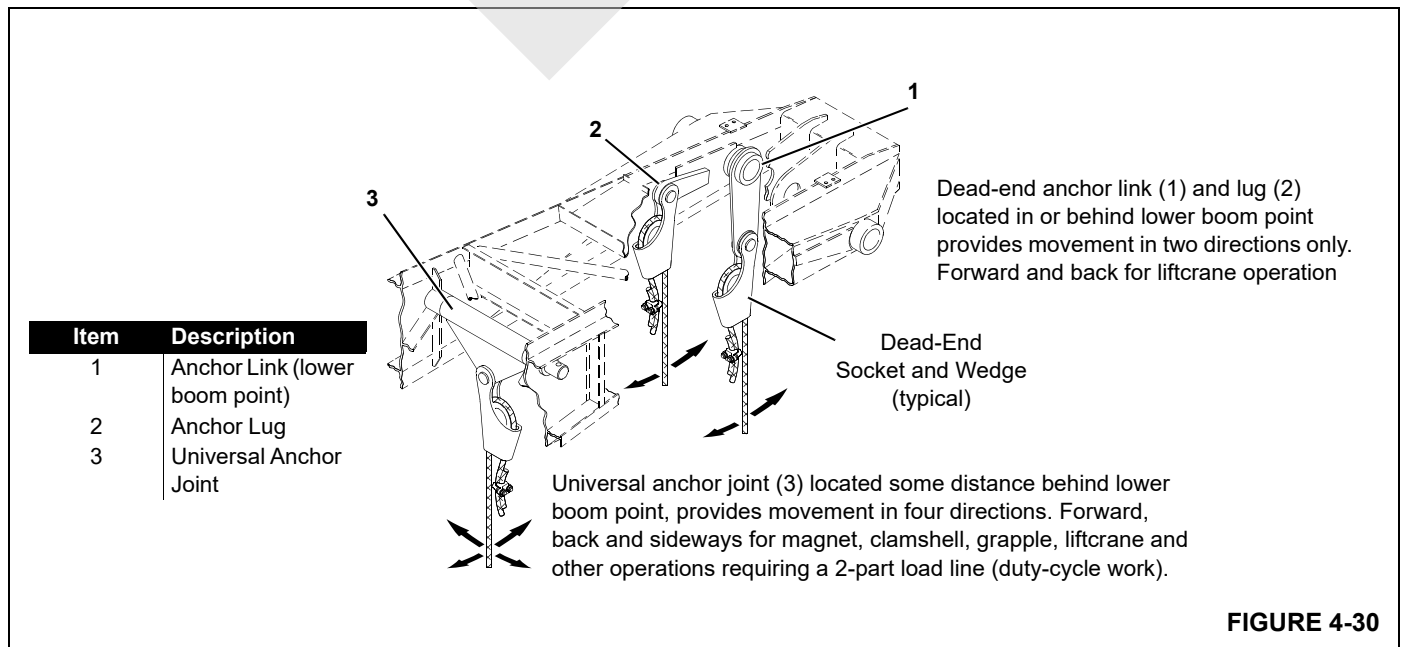


FIGURE 4-30

LOAD BLOCK TIEBACK

For Models 777 and 777T, Manitowoc provides a lug on the front of the rotating bed (Figure 4-31, View A) for tying back the load block when not in use.

Specifications

Shackle

See Figure 4-31 for identification of tieback hole diameter and shackle size.

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.

Sling Capacity

The slings 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 slings, take into account the dynamic affects of traveling and swinging the crane. ***It is the crane user's responsibility to calculate this load.***

CAUTION

Avoid damage to boom:

- Haul in load line only until tieback sling(s) 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 rubs 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.

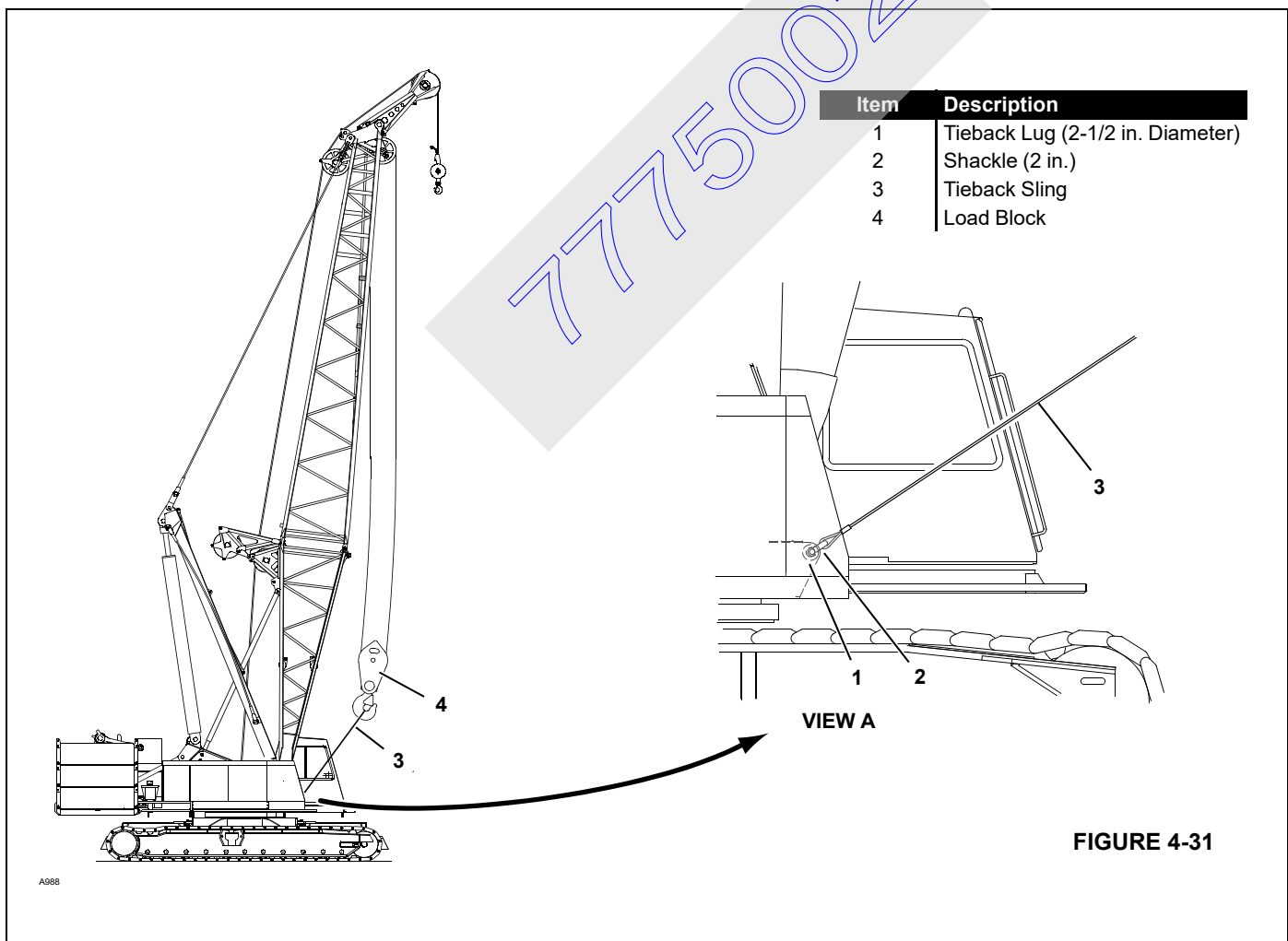


FIGURE 4-31

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SECTION 5 LUBRICATION

LUBRICATION

See F2107 at the end of this section.



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SECTION 6 MAINTENANCE

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SECTION 6 MAINTENANCE

MAINTENANCE AND ADJUSTMENT

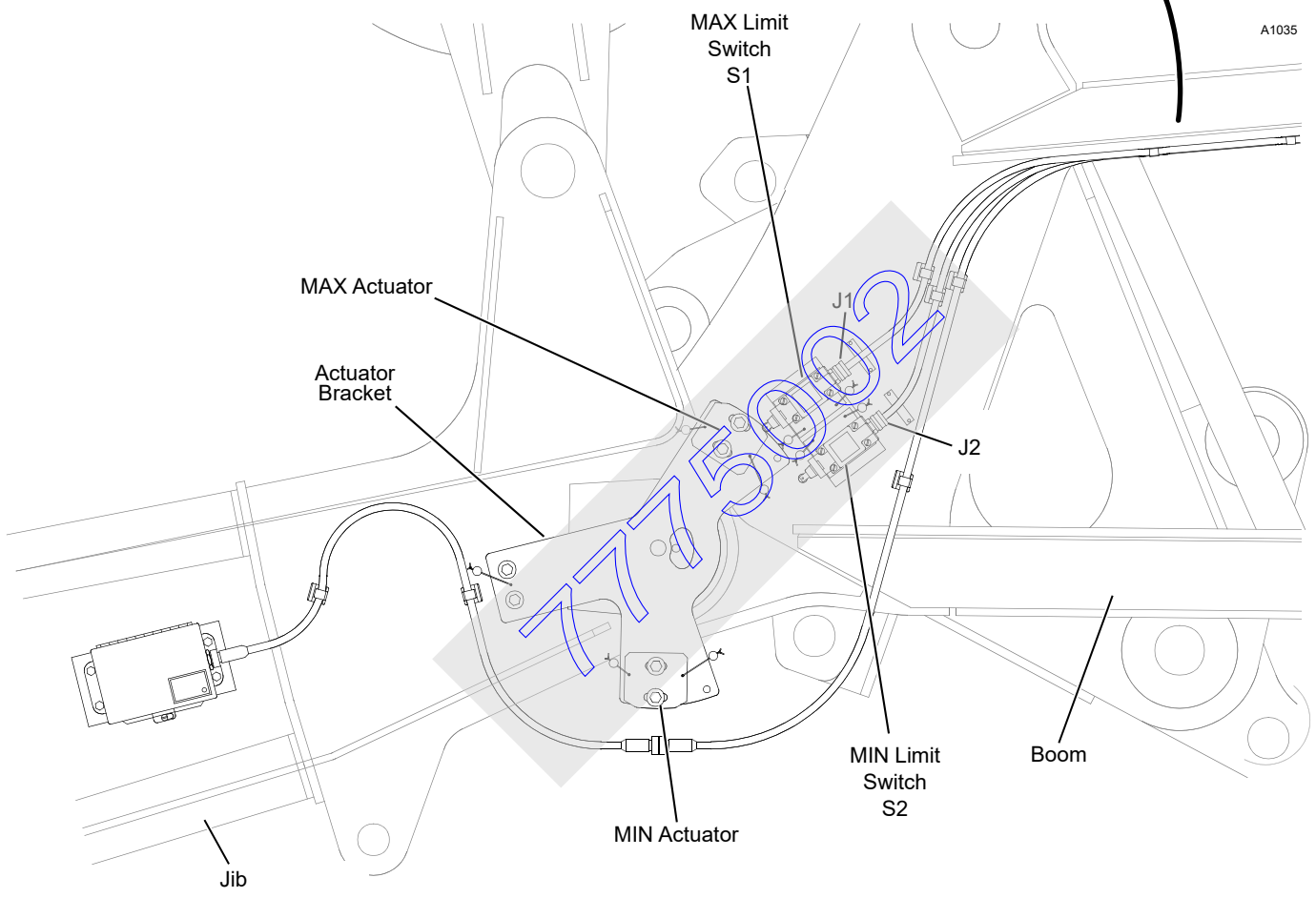
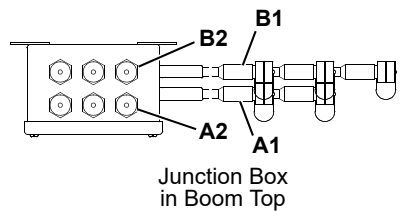
This section contains maintenance and adjustment instructions for the limit devices used with the #139 luffing jib attachment on both a crawler crane and a truck crane.

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

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Item	Description
A ₁	Power Cord (J1) to MAX Angle Limit Switch
A ₂	Shorting Plug for MAX Angle Limit
B ₁	Power Cord (J2) to MIN Angle Limit Switch
B ₂	Shorting Plug for MIN Angle Limit



LIMIT SWITCH WIRING

Cord	Terminal	Wire	System Operation
J1-1 WHT	S1-22	87FA	10 Volts DC, System Regulated Bus
J1-2 BLK	S1-21	89W1	MAX UP
J2-1 WHT	S2-22	97FA	10 Volts DC, System Regulated Bus
J2-2 BLK	S2-21	89S1	MAX DOWN

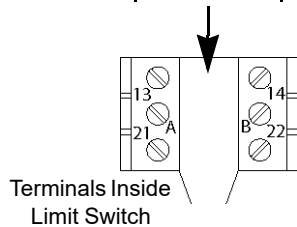


FIGURE 6-1

JIB STOP ADJUSTMENT — PAST PRODUCTION

The luffing jib attachment is equipped with two limit switches (see Figure 6-1) 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 operating limits alert (yellow light and buzzer in operator's cab) comes on when either angle is reached. The operating limits alert also comes on anytime the luffing jib is lowered below horizontal.

The following procedures apply to both crawler cranes and truck cranes.

Maintenance

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

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.



WARNING

Falling Attachment Hazard!

Do not operate crane unless automatic luffing jib stop is properly adjusted and operational.

Operation of luffing jib above MAX boom to luffing jib angle or below MIN boom to luffing jib angle is neither intended nor approved.

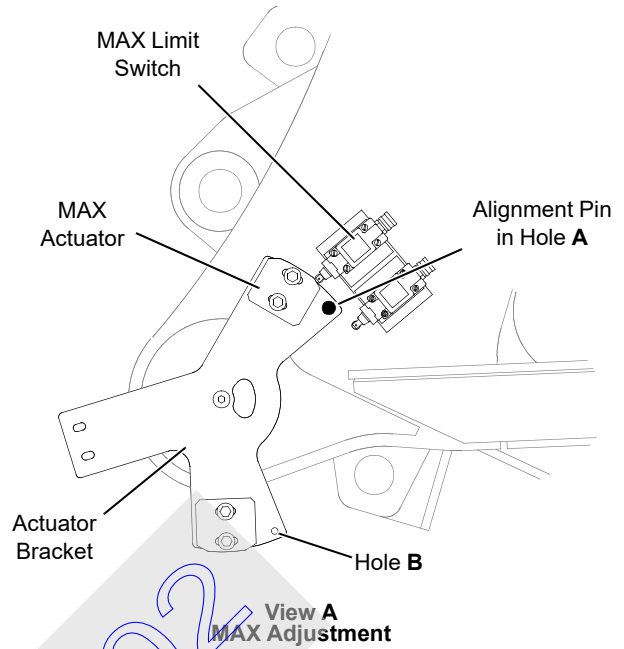
Jib and boom can be pulled over backwards or collapse if operated at angles other than specified. Death or serious injury to personnel can result.

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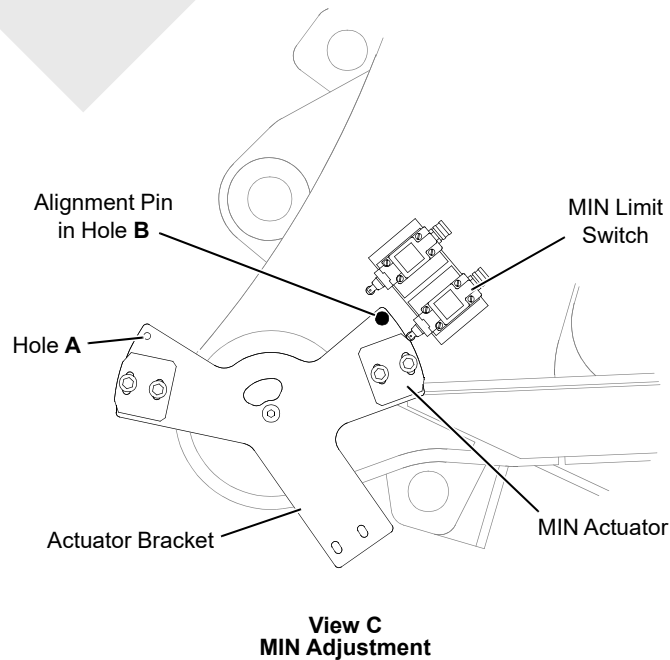
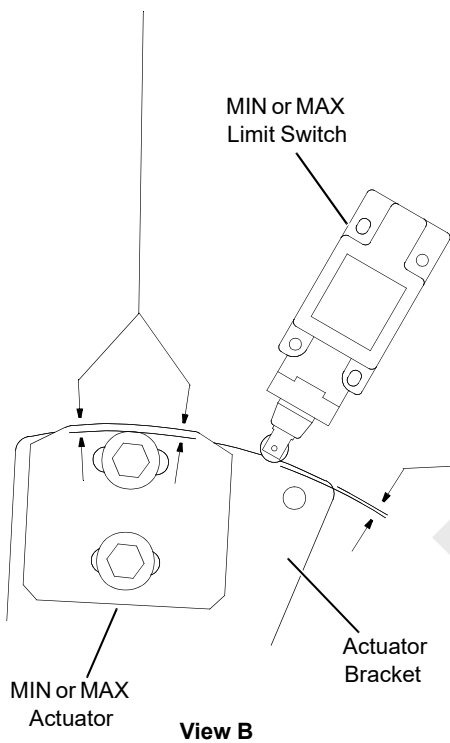
CAUTION

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 1/16 in (1.6 mm) past edge of actuator bracket. Limit switch will not trip open if positioned too high in slots. Limit switch could be damaged from over-travel if positioned too low in slots.



? Drill for 1/8 in (3.2 mm) dowel. Install wire and lead seal after adjustments are made.

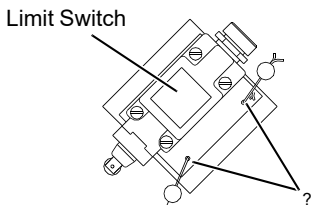


FIGURE 6-2

Maximum Boom to Luffing Jib Angle

See Figure 6-2, View A for following procedure, unless otherwise specified.

1. Remove screws fastening actuator bracket to jib butt.
2. Loosen screws 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 6-2, 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 6-2, 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 (170°).
 - 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.

14. Once limit switch is properly adjusted, drill and seal limit switch spacers to mounting bracket with dowel pins and lead wire spacers.

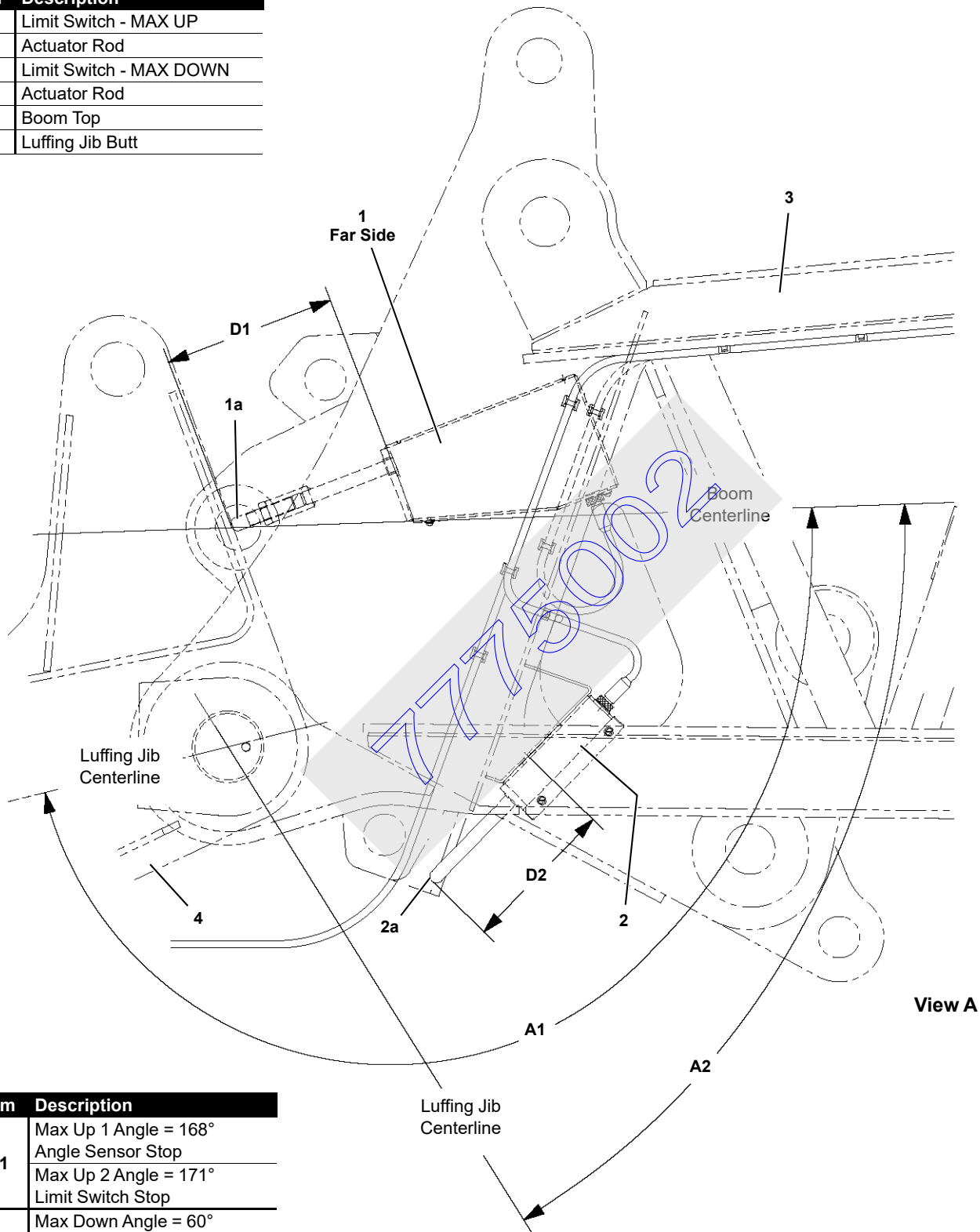
Minimum Boom to Luffing Jib Angle

See Figure 6-2, View C for following procedure, unless otherwise specified.

1. Remove screws fastening actuator bracket to jib butt.
2. Loosen screws 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 6-2, 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 6-2, 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.
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.
13. Once limit switch is properly adjusted, drill and seal limit switch spacers to mounting bracket with dowel pins and lead wire spacers.

A20242-1

Item	Description
1	Limit Switch - MAX UP
1a	Actuator Rod
2	Limit Switch - MAX DOWN
2a	Actuator Rod
3	Boom Top
4	Luffing Jib Butt



View A

Item	Description
A1	Max Up 1 Angle = 168°
	Angle Sensor Stop
	Limit Switch Stop
A2	Max Down Angle = 60°
	Angle Sensor Stop
	Limit Switch Stop

FIGURE 6-3

A20242-2
A20242-3

Item	Description	Deactivated	Activated
D1	Edge of Actuator Rod (1a) to Edge of Limit Switch Mounting Pad	9-11/16 in (246,1 mm)	9-7/16 in (239,7 mm)
D2	Edge of Actuator Rod (2a) to Center of Notch in Jib Stop Mounting Bracket	8-25/32 in (223,0 mm)	8-9/32 in (210,3 mm)

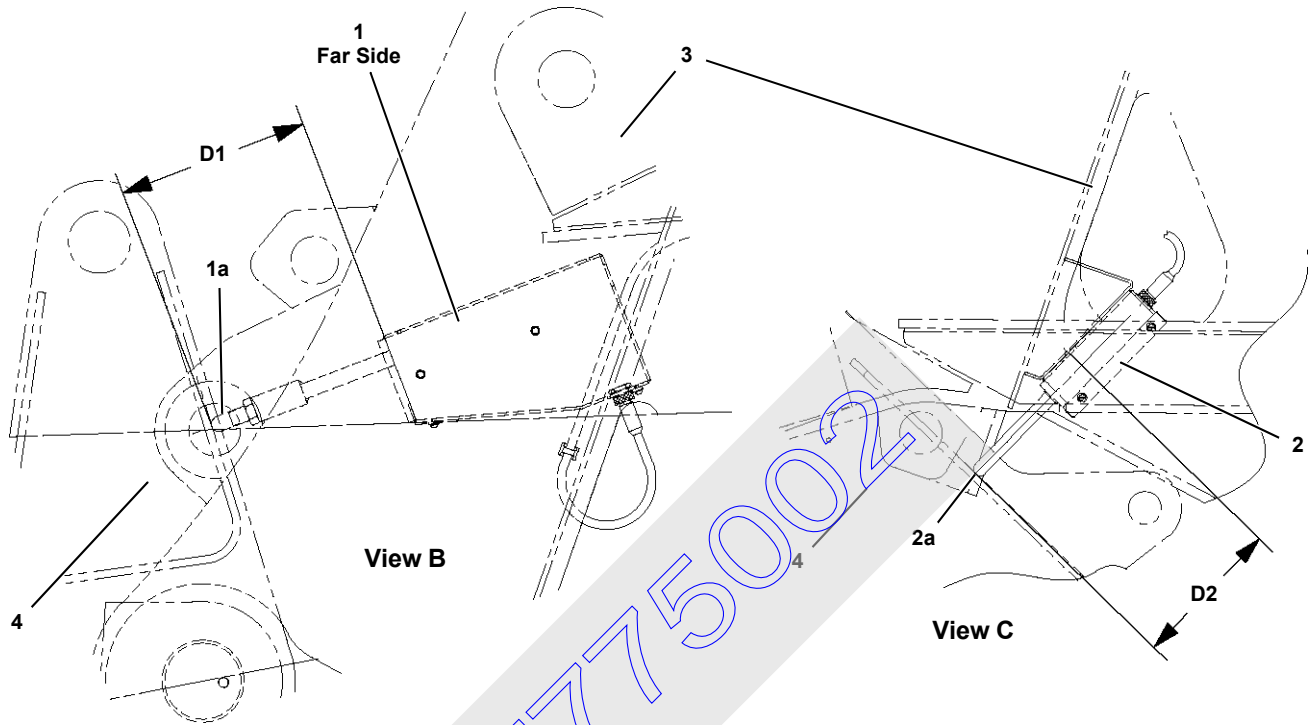


FIGURE 6-3 continued

JIB STOP ADJUSTMENT — CURRENT PRODUCTION



WARNING

Falling Attachment Hazard!

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

Operating luffing jib above JIB MAX UP 2 limit or below JIB MAX DOWN limit is neither intended nor approved. Jib can be pulled over backwards or collapse.

General

The luffing jib attachment is equipped with two limits which automatically stop the luffing hoist and apply its brake when the luffing jib is raised or lowered to the following angles.

NOTE: Luffing jib angles given in this section can vary plus or minus 1°.

- JIB MAX UP 1 (maximum working angle) – 168° boom to luffing jib angle. This is a programmed limit controlled by the crane's programmable controller in conjunction with signals from the boom and jib angle sensors.

This limit can be bypassed, allowing the luffing jib to be raised an additional 3° to JIB MAX UP 2 limit.

- JIB MAX UP 2 (maximum angle limit) – 171° boom to luffing jib angle. This limit is controlled by limit switch (1, Figure 6-3).
- JIB MAX DOWN (minimum angle) – 60° boom to luffing jib angle. This is a programmed limit controlled by the crane's programmable controller in conjunction with signals from the boom and jib angle sensor.
- JIB MAX DOWN (minimum limit) – 57° minimum limit switch (2, Figure 6-3) is provided as a backup to stop the jib if the programmed minimum limit fails.

Maintenance

At least once weekly and each time the attachment is erected, check that the luffing jib stops at the specified angles.

Pre-Erection Checks

To insure proper operation of the luffing jib stops:

- The jib stop limit switches must be mounted properly.
- The luffing jib angles must be properly calibrated. See Rated Capacity Indicator/Limiter Operation Guide for instructions.

Jib Max Up 2 Limit Check

See Figure 6-3 for following procedure.

Perform the following steps with the boom and luffing jib on the ground:

1. Check Dimension (D1, View A) and if necessary, adjust actuator rod to obtain deactivated dimension.

Perform remaining steps with engine running and appropriate Luffing Jib Capacity Chart selected.

2. Depress limit switch (1a) actuator rod to activated Dimension D1 (View B) and hold. Listen for limit switch to "click" open (LED OFF if equipped).

3. Pull luffing jib handle back.

Luffing hoist must not turn in up direction and JIB MAX UP 2 fault should come on.

Jib Max Down Limit Check

See Figure 6-3 for following procedure.

Perform the following steps with the boom and luffing jib on the ground:

1. Check Dimension (D2, View A) and if necessary, adjust position of limit switch housing to obtain deactivated dimension.

Perform remaining steps with engine running and appropriate Luffing Jib Capacity Chart selected.

2. Depress limit switch (2a) actuator rod to activated Dimension D2 (View C) and hold. Listen for limit switch to "click" open (LED OFF if equipped).

3. Push luffing jib handle forward.

Luffing hoist must not turn in down direction and JIB MAX DOWN fault should come on.

Operational Checks

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

1. Travel crane onto a firm level surface or level crane by blocking under crawlers.
2. Raise boom and luffing jib until boom is at 80°.
3. Monitor BOOM TO LUFFING JIB ANGLE on main display information screen while performing remaining steps.
4. SLOWLY raise luffing jib.
5. Luffing hoist must stop and be inoperable in up direction when boom to luffing jib angle is 168°.
6. Operating limit alarm should come on indicating JIB MAX UP 1 angle has been reached.

7. Turn appropriate limit bypass key switch to bypass position.

**WARNING****Falling Attachment Hazard!**

Watch that physical jib stop pendants do not become tight before MAX UP 2 limit switch is activated.

Jib can be pulled over backwards or collapse.

8. SLOWLY raise luffing jib past JIB MAX UP 1 limit.
9. Luffing hoist must stop and be inoperable in up direction when boom to luffing jib angle is 171°.

10. Operating limit alarm should come on indicating JIB MAX UP 2 limit has been reached.

If maximum stops do not operate properly, troubleshoot system.

11. SLOWLY lower luffing jib.
12. Luffing hoist must stop and be inoperable when boom to luffing jib angle is 60°.

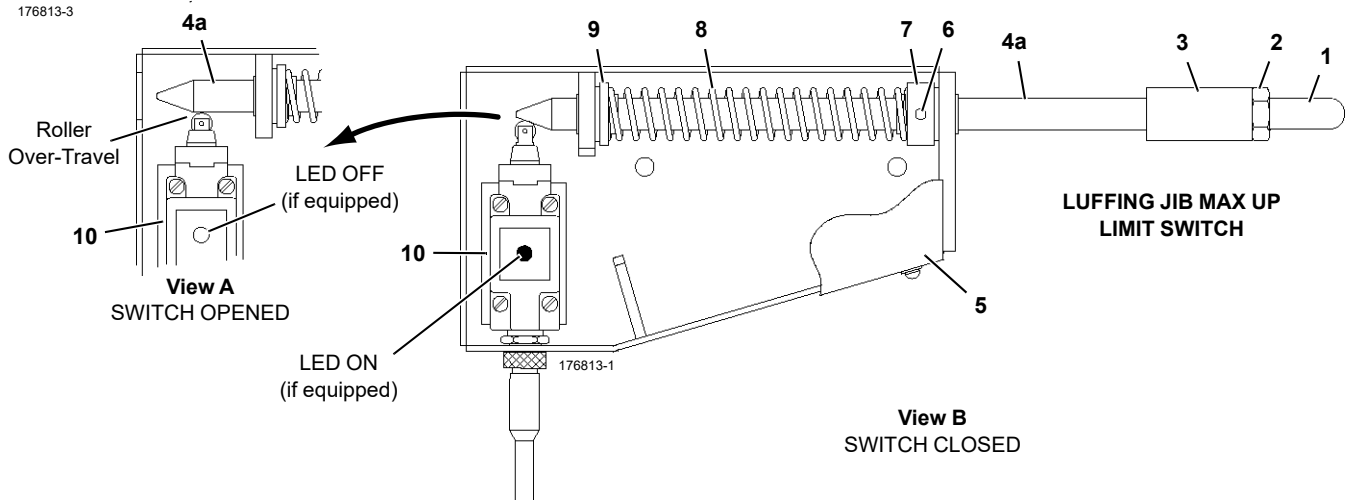
Operating limit alarm should come on indicating JIB MAX DOWN angle has been reached.

13. Turn appropriate limit bypass key switch to bypass position and lower jib.

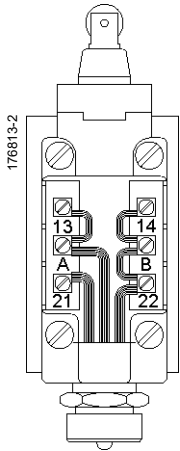
Luffing hoist must stop and be inoperable in down direction when boom to luffing jib angle is 57°.

If minimum stops do not operate properly, troubleshoot system.

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Past Production

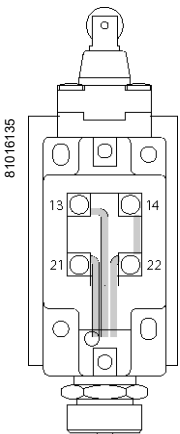


Item	Description	Item	Description
1	Adjusting Rod	6	Dowel Pin 1/4 in (6,35 mm) Diameter
2	Jam Nut	7	Spring Washer
3	Coupling	8	Spring
4a	Actuator Rod (Max Up Limit)	9	Spring Washer
4b	Actuator Rod (Max Down Limit)	10	Limit Switch
5	Cover		

Limit Switch Wiring

Receptacle	Switch Terminals	Function
1 (green)	22	B 14 Max Angle (Up or Down)
2 (black)	A 13	LED
3 (white)	21	12 VDC Supply

Current Production



View C SWITCH WIRING

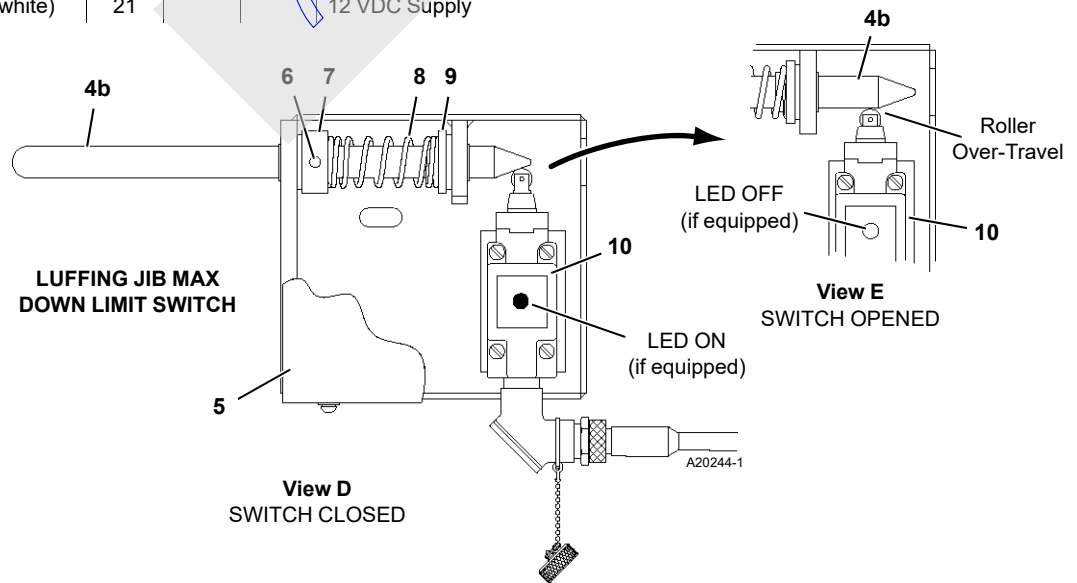


FIGURE 6-4

Actuator Rod Replacement

Max Up Limit Actuator Rod

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

1. Remove damaged actuator rod (4a).
2. Slide spring washers (9 and 7) and spring (8) over new actuator rod while sliding new actuator rod into bracket assembly.
3. Position actuator rod (4a) so tapered end just touches limit switch (10) roller (View B). Actuator rod must not depress limit switch roller.
4. Drill 1/4 in (6,35 mm) hole through spring washer (7) and actuator rod (4a).
5. Install dowel pin (6).
6. Check limit switch roller to insure there is over-travel as shown in View A.

7. Install proper adjusting rod (1) and adjust as needed for correct maximum angle.

Max Down Actuator Rod

See Figure 6-4 View D for following procedure.

1. Remove damaged actuator rod (4b).
2. Slide spring washers (9 and 7) and spring (8) over new actuator rod (4b) while sliding actuator rod into bracket assembly.
3. Position actuator rod (4b) so tapered end just touches limit switch (10) roller. Actuator rod must not depress limit switch roller.
4. Drill 1/4 in (6,35 mm) hole through spring washer (7) and actuator rod (1).
5. Install dowel pin (6).
6. Check limit switch roller to insure there is over-travel as shown in View E.

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AUTOMATIC BOOM STOP ADJUSTMENT

Maximum Boom Angle

Boom stop limit switch (2, Figure 6-5) automatically stops the boom and applies the boom hoist brake when the boom is raised to **Angle A**.

Operation

See Figure 6-5 for following description.

When the boom is below the maximum angle, limit switch (2) is closed and its LED (light-emitting diode) (if equipped) is ON. The boom hoist can be operated.

When the boom is raised to the maximum angle, actuator (3) opens limit switch (2) and the LED (if equipped) goes off. 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 holding valves close 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.

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.



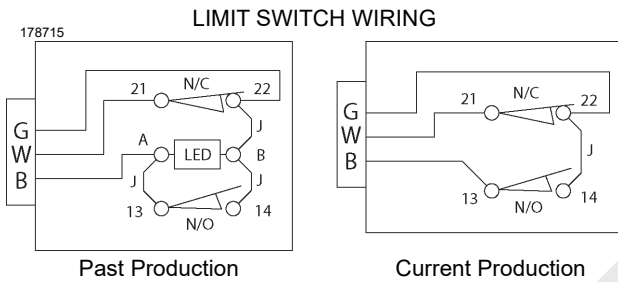
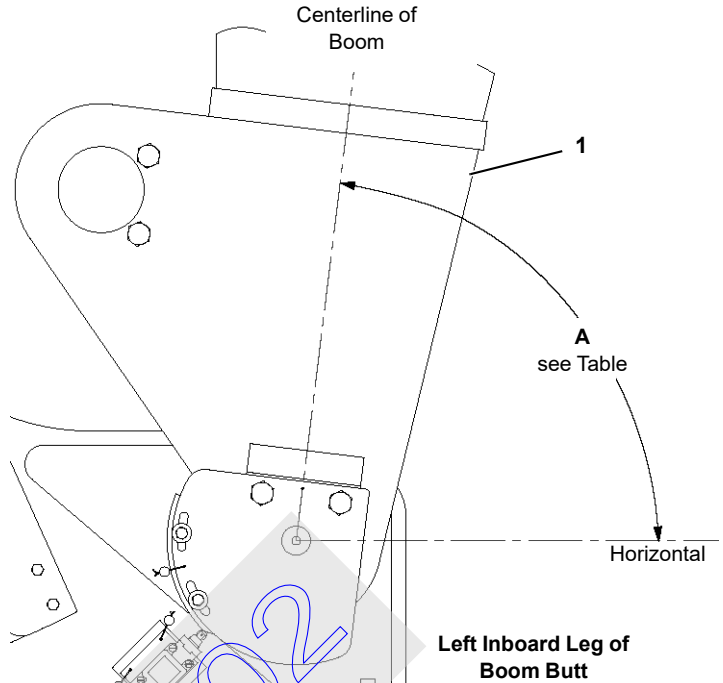
WARNING

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.

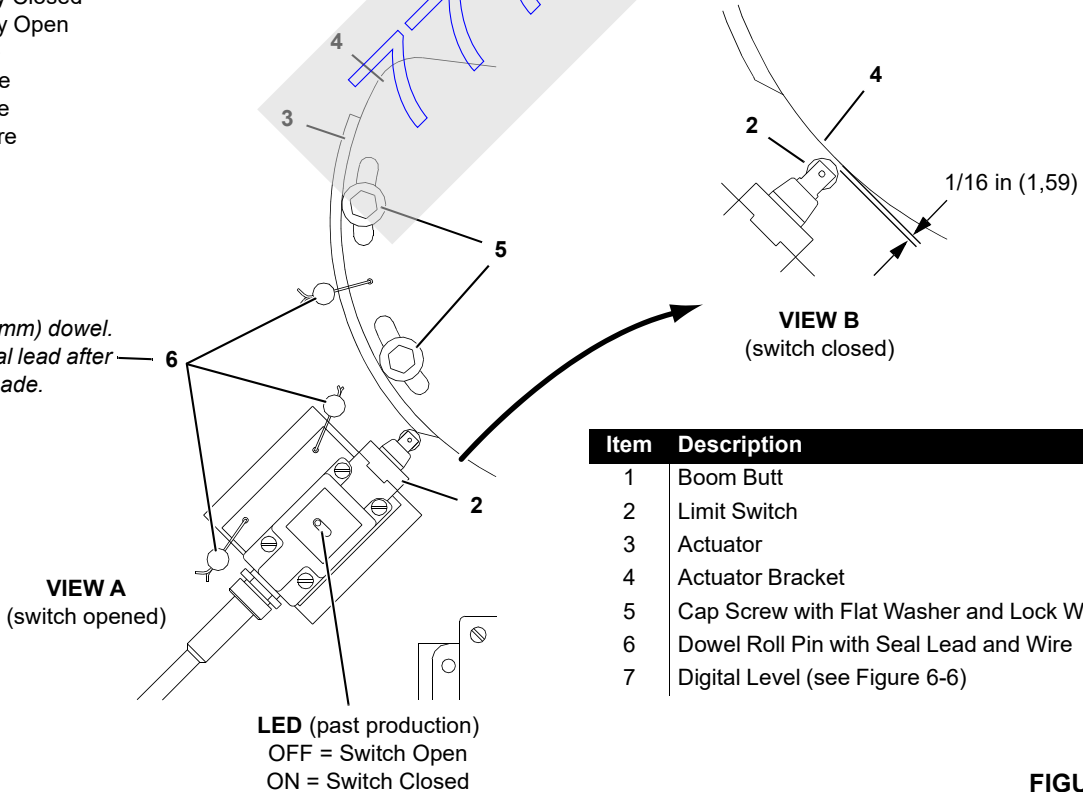
Angle A	
83°	#78 Boom.
88°	#78 Boom with #139 Luffing Jib when the boom up limit can be bypassed.*
89°	#78 Boom with #139 Luffing Jib when the boom up limit cannot be bypassed.*

* To determine if the boom up limit on your crane can be bypassed or not, perform Limit Bypass Test on page 6-15.



N/C = Normally Closed
 N/O = Normally Open
 B = Black Wire
 G = Green Wire
 W = White Wire
 J = Jumper Wire

Drill for 1/8 in (3,2 mm) dowel.
 Install wire and seal lead after
 adjustments are made.



Item	Description
1	Boom Butt
2	Limit Switch
3	Actuator
4	Actuator Bracket
5	Cap Screw with Flat Washer and Lock Washer
6	Dowel Roll Pin with Seal Lead and Wire
7	Digital Level (see Figure 6-6)

FIGURE 6-5

Limit Bypass Test

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



WARNING

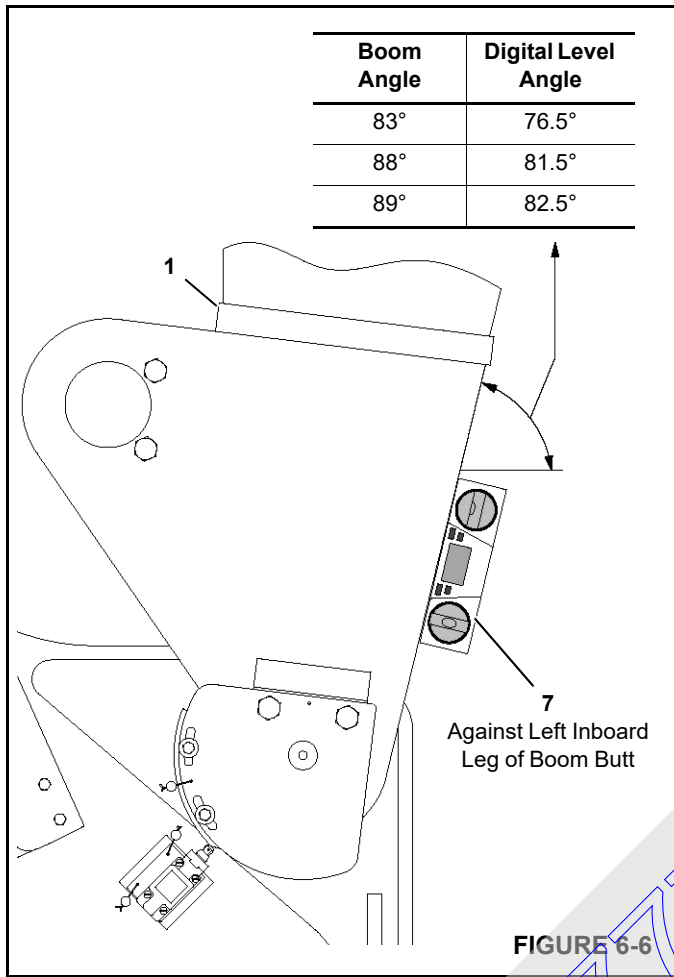
Crush Hazard!

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 the limit switch plunger down to trip the boom stop limit switch open.
 3. Rotate the limit bypass key (in crane cab) to the bypass position and hold.
 4. Try to boom up — 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**.
 5. The test is complete. Release the limit bypass key and the limit switch plunger to the normal operating positions.
- Adjustment**
- See Figure 6-5 for following procedure.
1. Park the crane on a firm level surface or level the crane by blocking under the crawlers.
 2. Loosen cap screws (5, View A).
 3. Rotate actuator (3) out of the way so it does not contact the roller on limit switch (2) when step 4 is performed.
 4. Raise the boom to specified **Angle A** while monitoring the angle on the mechanical indicator or on the operating conditions screen of the front-console display.
 5. Verify that the boom is at the proper Angle A:
 - a. Place an accurate digital level (7) on the boom butt as shown in Figure 6-6. The corresponding **Digital Level Angle** should appear on the digital level.
 - b. Raise or lower the boom as necessary.
 6. Check the position of the limit switch roller with relation to actuator bracket (4, View B). If necessary, loosen the limit switch mounting screws and adjust the limit switch up or down in the mounting slots to obtain the dimension in View B. Securely tighten the mounting screws.

Limit switch will not trip open if it is too far from actuator bracket. Limit switch could be damaged from over-travel if it is too close to actuator bracket.
 7. Rotate actuator (3, View A) against the roller of limit switch (2) until the limit switch just “clicks” open and hold. The LED (if equipped) should go off when the switch opens.
 8. Securely tighten cap screws (5) to secure actuator (4).
 9. Test the adjustment as follows:
 - a. Lower the boom several degrees below the specified Angle A (LED comes on, if equipped).
 - b. Slowly raise the boom.
 - c. **Boom must stop at specified Angle A** (LED goes off, if equipped); 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 2 through 9.
 10. Seal the adjustment as shown in Figure 6-5.



- Assist in preventing the boom rigging from pulling the boom back when traveling or setting loads with the boom at any angle above 81°.
- Assist in moving the boom forward when lowering the boom from any angle above 81°.
- Provide a physical stop at 90°.

! WARNING

Physical boom stop must be installed for all crane operations.

Physical boom stop does not automatically stop boom at maximum operating angle. Automatic boom stop must be installed and properly adjusted.

Operation

See Figure 6-7 for following procedure.

1. When the boom is raised to 81°, the springs in the boom stop tube begin to compress.
2. As the boom is raised higher, spring compression increases to exert greater force against the boom.
3. If for any reason the boom is raised to 90°, the boom stop springs will fully compress to provide a physical stop.

Removal

Normally, the boom stop tubes are not removed unless they need repair or replacement.

PHYSICAL BOOM STOP

The physical boom stop assembly (Figure 6-7) serves the following functions:

- Assist in stopping the boom smoothly at any angle above 81°.

! WARNING

Falling Load Hazard!

Use care if boom stop tubes are removed for any reason. Lower tube is not retained by upper tube and tubes may separate when detached.

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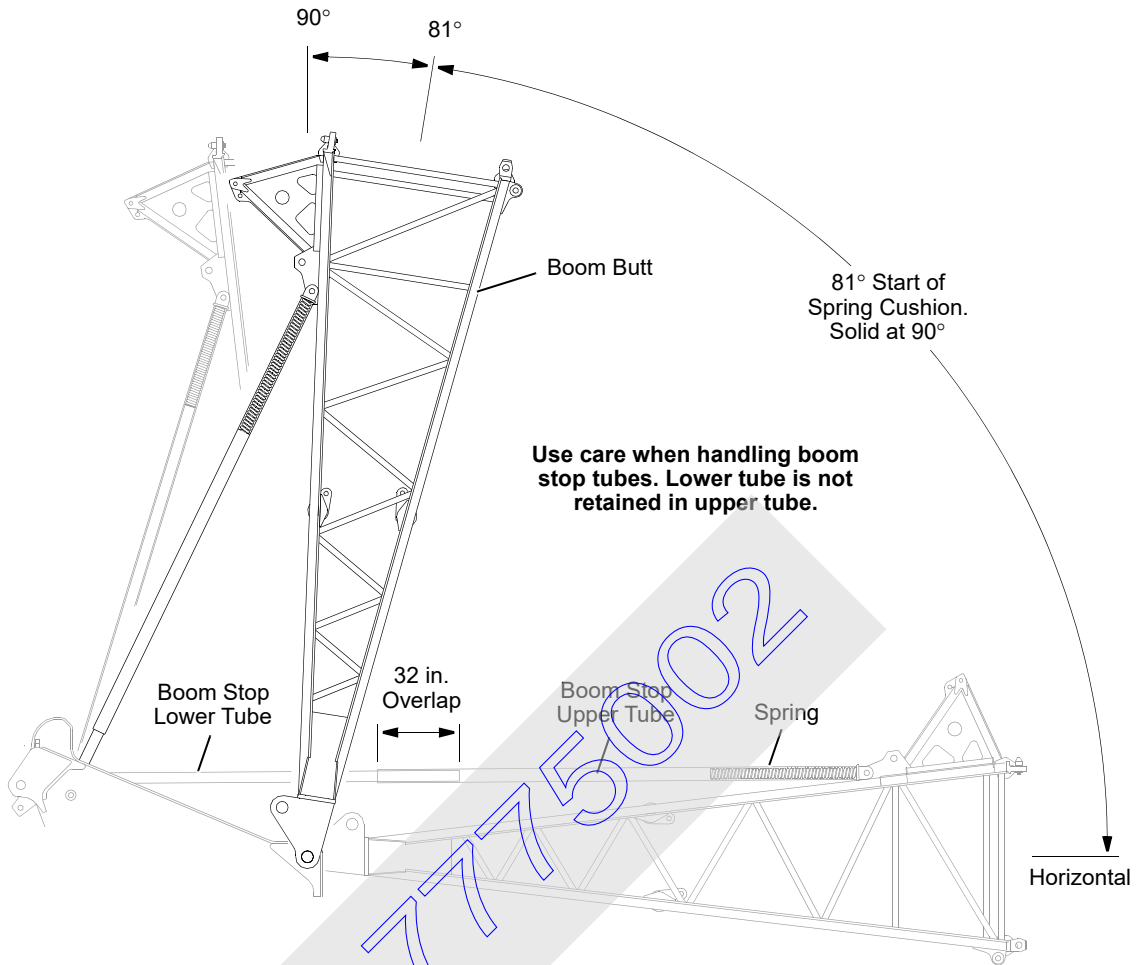
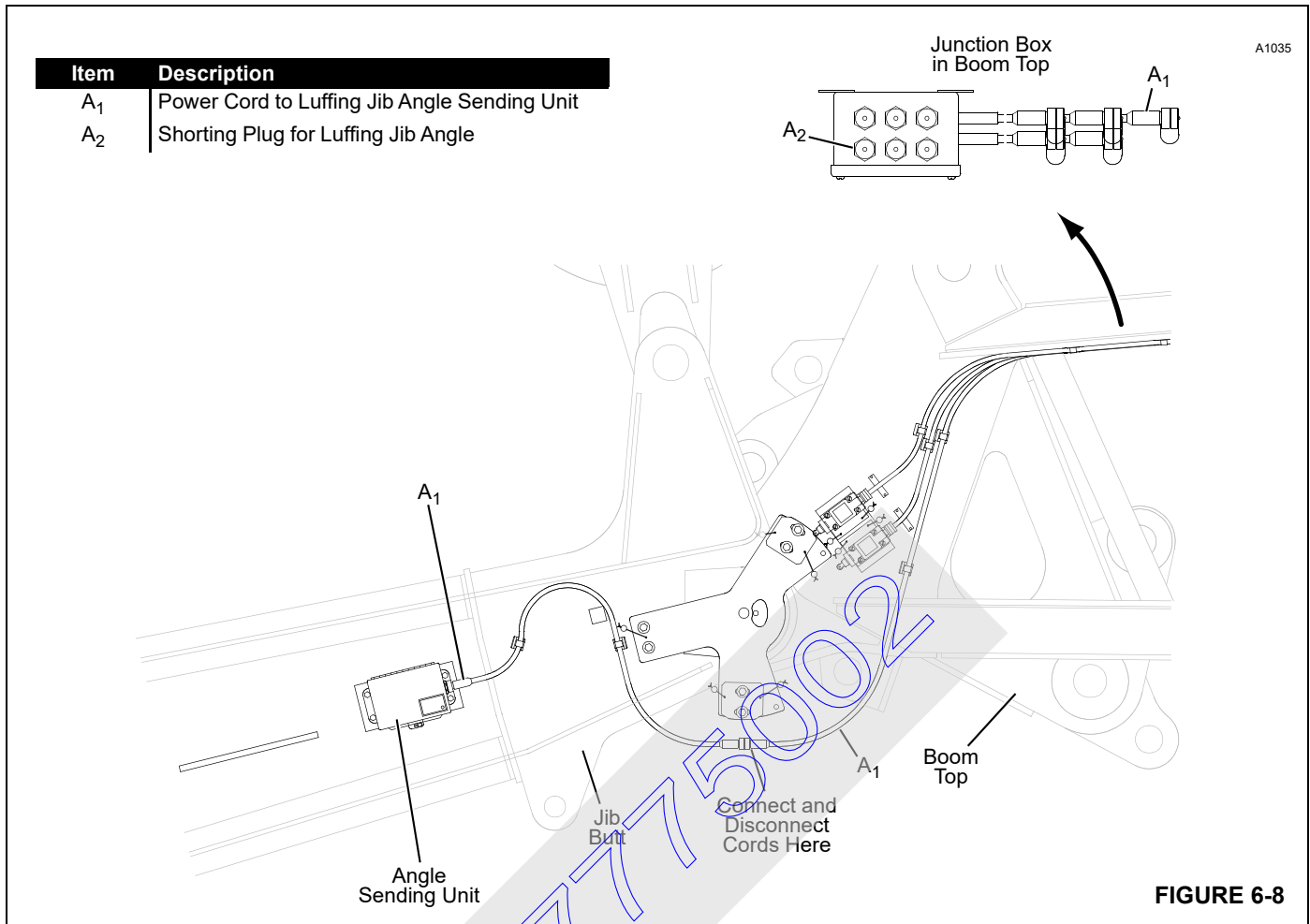


FIGURE 6-7



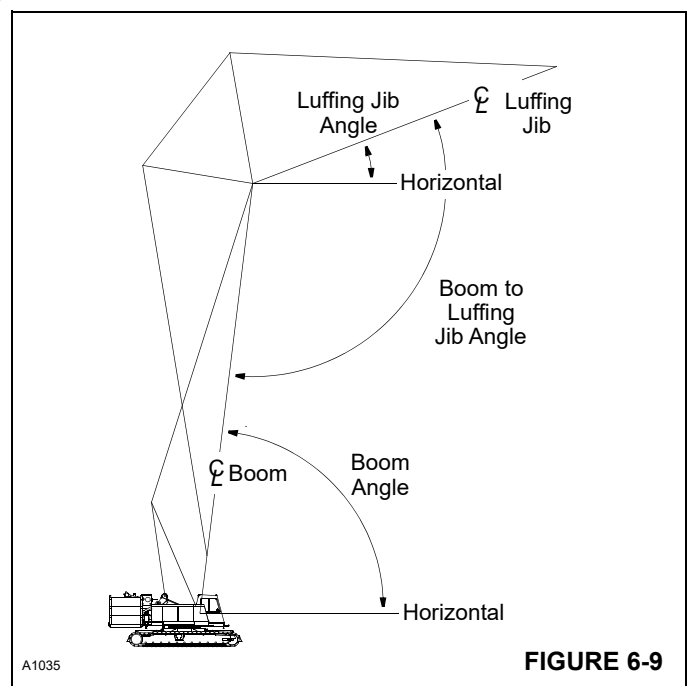
JIB ANGLE INDICATOR ADJUSTMENT—CRAWLER AND TRUCK

An angle sending unit is mounted on the left side of the luffing jib butt (see Figure 6-8).

The angle sending unit houses a pendulum-type 178° potentiometer which sends an electric signal to the crane's programmable controller. The programmable controller converts the signal into an angle which can be monitored on the digital display in the operator's cab.

Two angles (see Figure 6-9) can be monitored:

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



Sending Unit Assembly

Replacement sending units (Figure 6-10) can be either the pendulum-type 178° potentiometer (past production) or the solid state sensor (current production).

Pendulum-type 178° Potentiometer

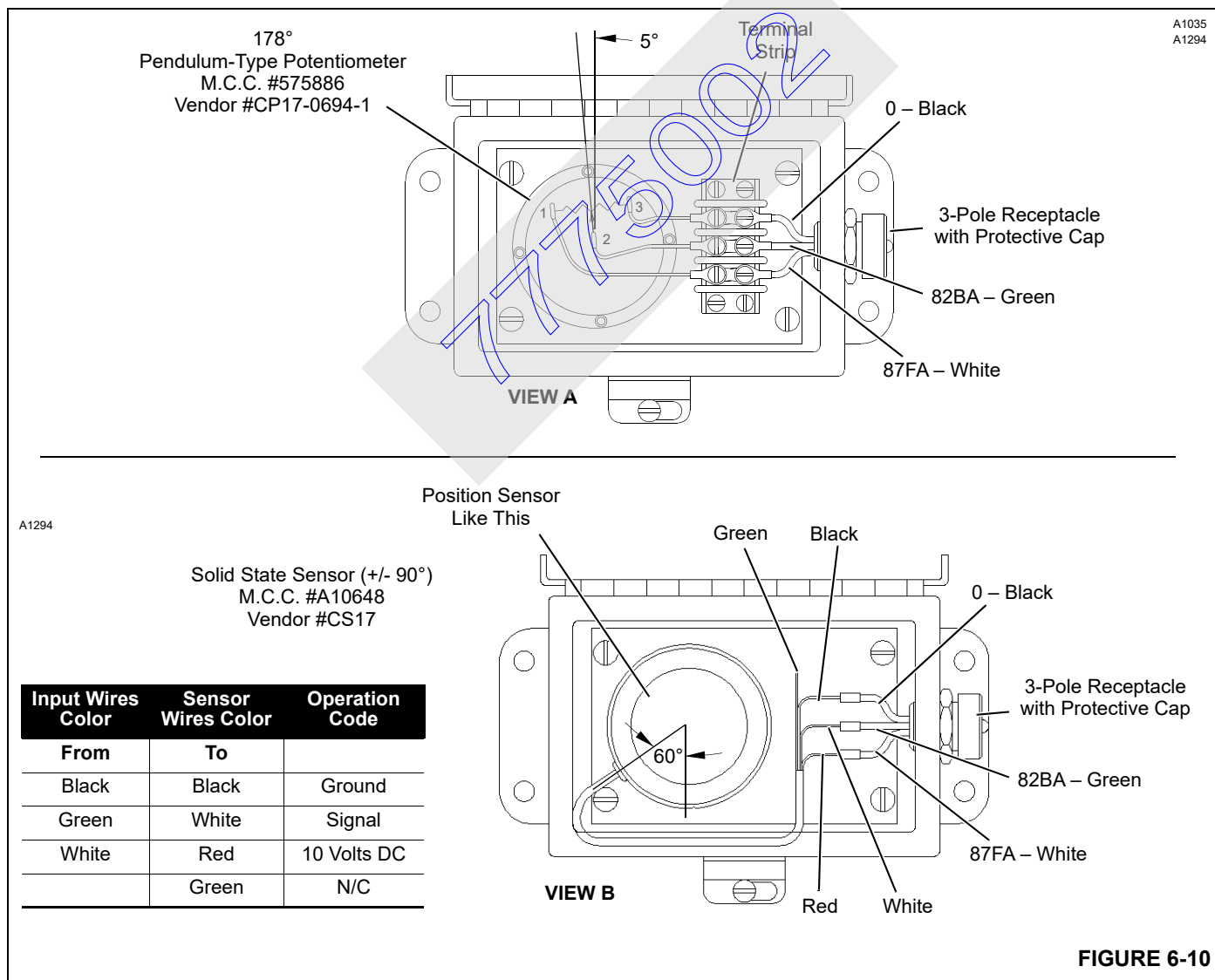
When replacing parts in the pendulum-type potentiometer sending unit, take the following precautions (see Figure 6-10, View A):

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 6-10, 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 at 3.2° as shown in View B.
5. Refer to 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.



Disconnecting Luffing Jib Angle Indicator

Perform the following steps when removing the luffing jib (see Figure 6-8):

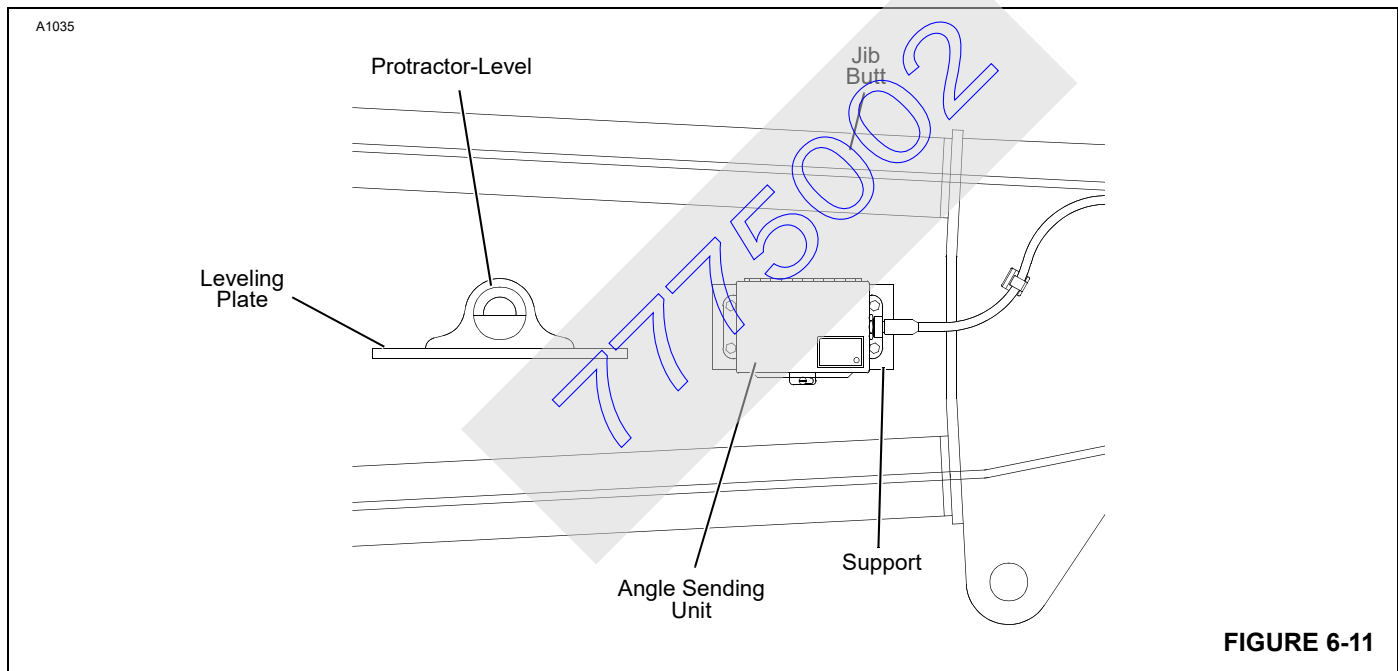
1. Disconnect electric cord A₁ from sending unit at electric cord A₁ from junction box.
2. Connect protective cap to cord A₁ from sending unit.
3. Connect electric cord to receptacle A₂ on junction box in boom top.

NOTE: The system fault alert will come on if the electric cord is not connected to the shorting plug or to the sending unit.

Adjusting Angle Indicator

Perform following adjustment steps at initial installation, after installing a new sending unit or potentiometer, and at least monthly when jib is lowered to ground. See Figure 6-11.

1. Lower boom and luffing jib onto blocking at ground level.
2. Place a protractor-level on leveling plate.
3. Record angle indicated on protractor-level.
4. Scroll to desired angle on digital display in operator's cab.
5. Angle shown on digital display must match angle recorded in step 3 plus or minus one degree.
6. If necessary, loosen mounting screws and rotate sending unit in mounting slots until reading on digital display matches angle on protractor-level.
7. Securely tighten mounting screws to lock adjustment.



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BLOCK-UP LIMIT ADJUSTMENT

A 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.

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. Upper boom point.
 - c. Fixed jib point.
 - d. Luffing jib point.
 - e. Universal anchor joint.
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 6-18 for component identification.

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 the assembly drawing following this section.

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

When equipped with more than one block-up limit switch, *wire limit switches in series*.

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

See Figure 6-17 for installation of the weights.

Storing Electric Cord

The electric cords for the boom, fixed jib, and luffing 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 it around the brackets on the jib butt (Figure 6-13).

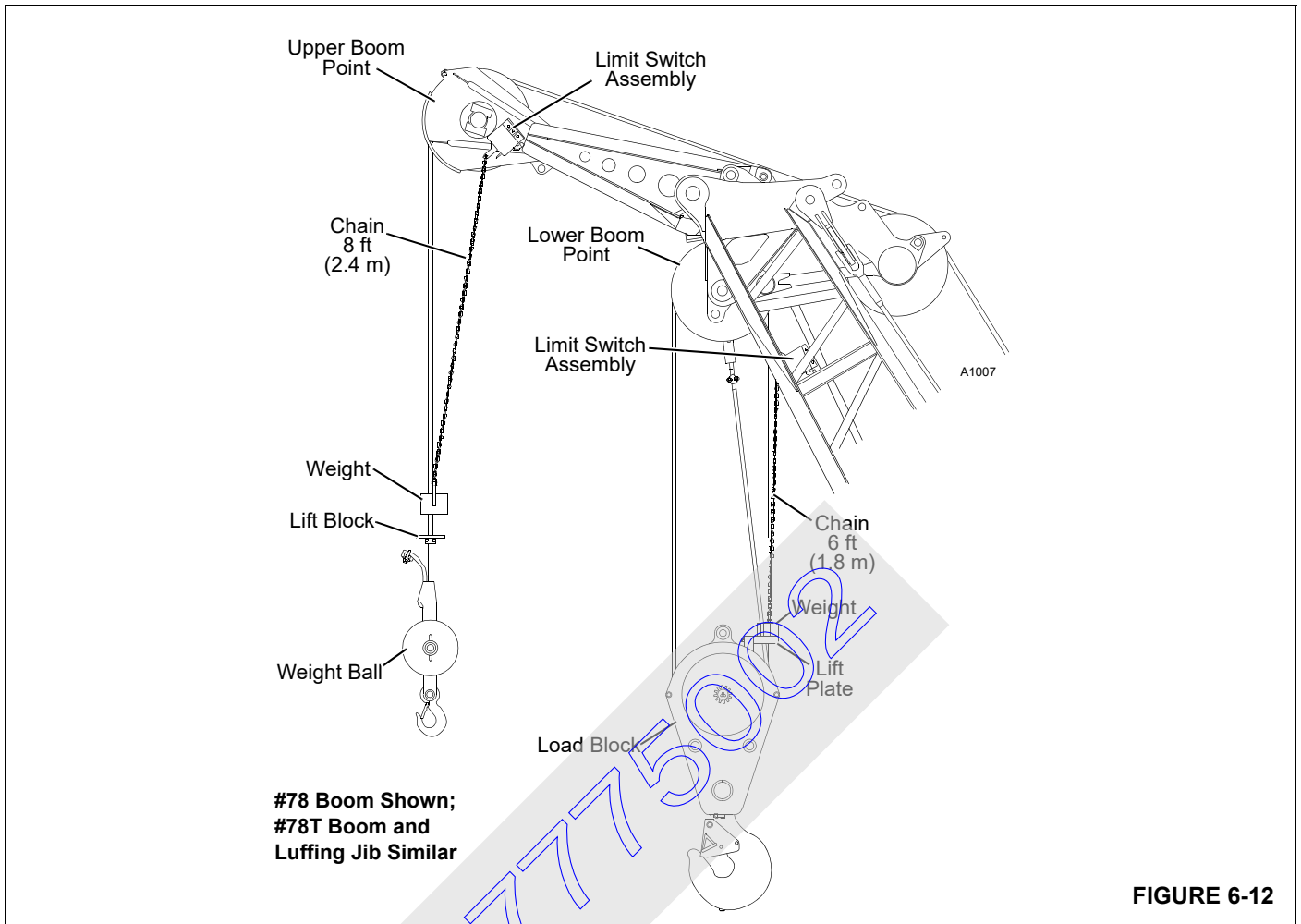


FIGURE 6-12

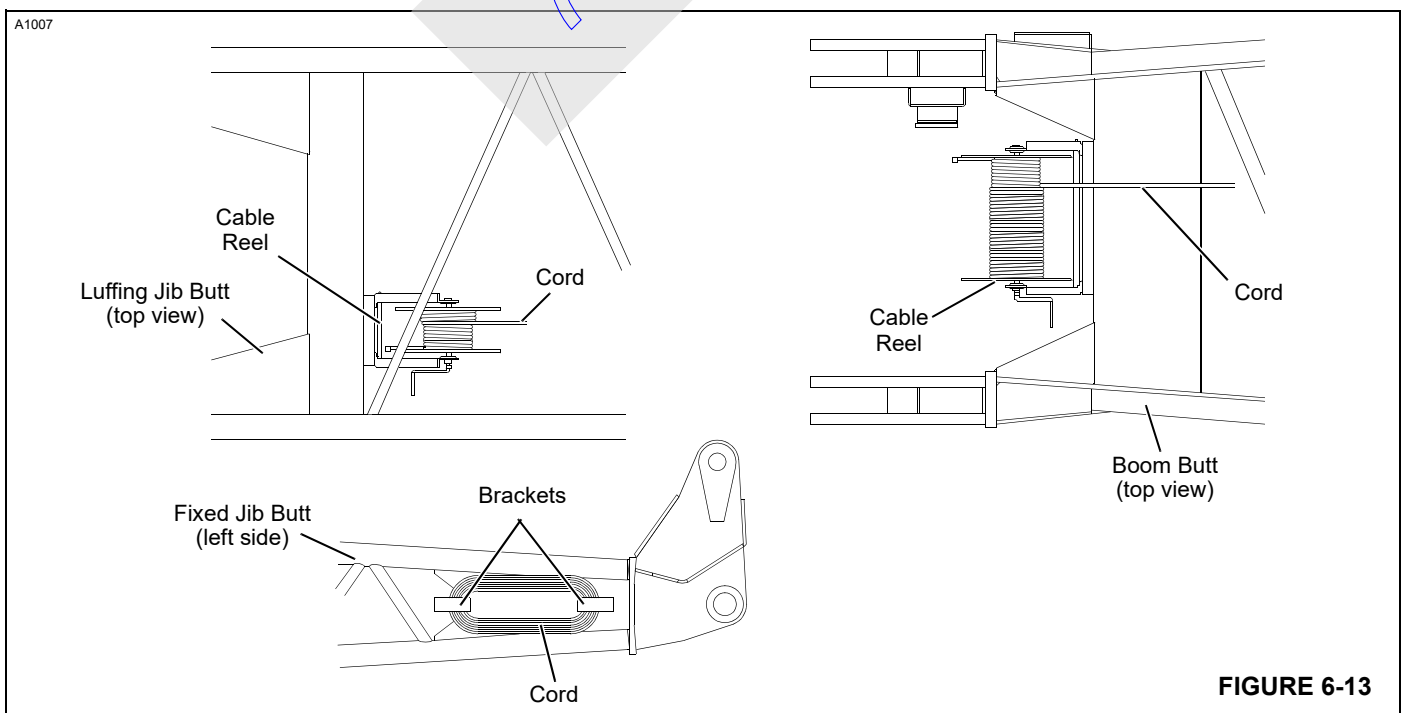


FIGURE 6-13

Disconnecting Block-Up Limit Control

Shorting plug (SP1, Figure 6-14, 6-15, and 6-16) is provided on the left front corner of the rotating bed 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:

1. Disconnect electric cord (C2) from cable reel (CR1).
2. Remove the closure cap from shorting plug (SP1).
3. Connect electric cord (C2) to shorting plug (SP1).
4. Reverse the steps to reconnect the block-up limit control.

Removing Jib or Boom Point

See Figure 6-15 and 6-16 for identification of the electric cords and shorting plugs.

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

If the fixed jib point, upper boom point, or luffing 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 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.

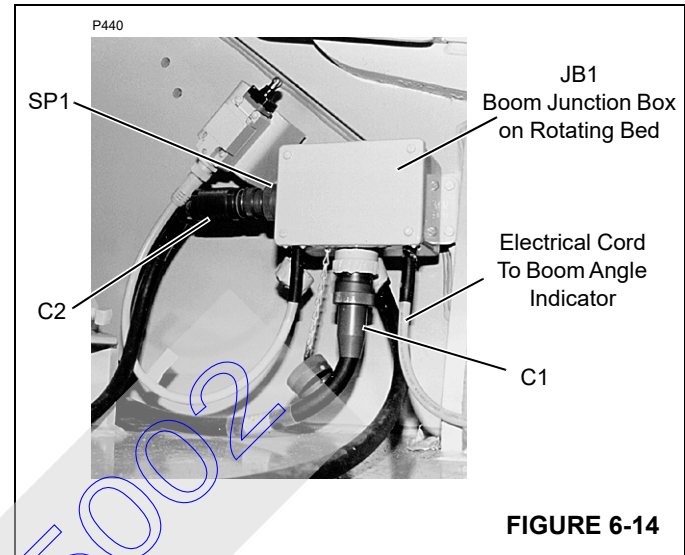


FIGURE 6-14

PAST PRODUCTION (CRAWLER 7771001 THROUGH 7771006)

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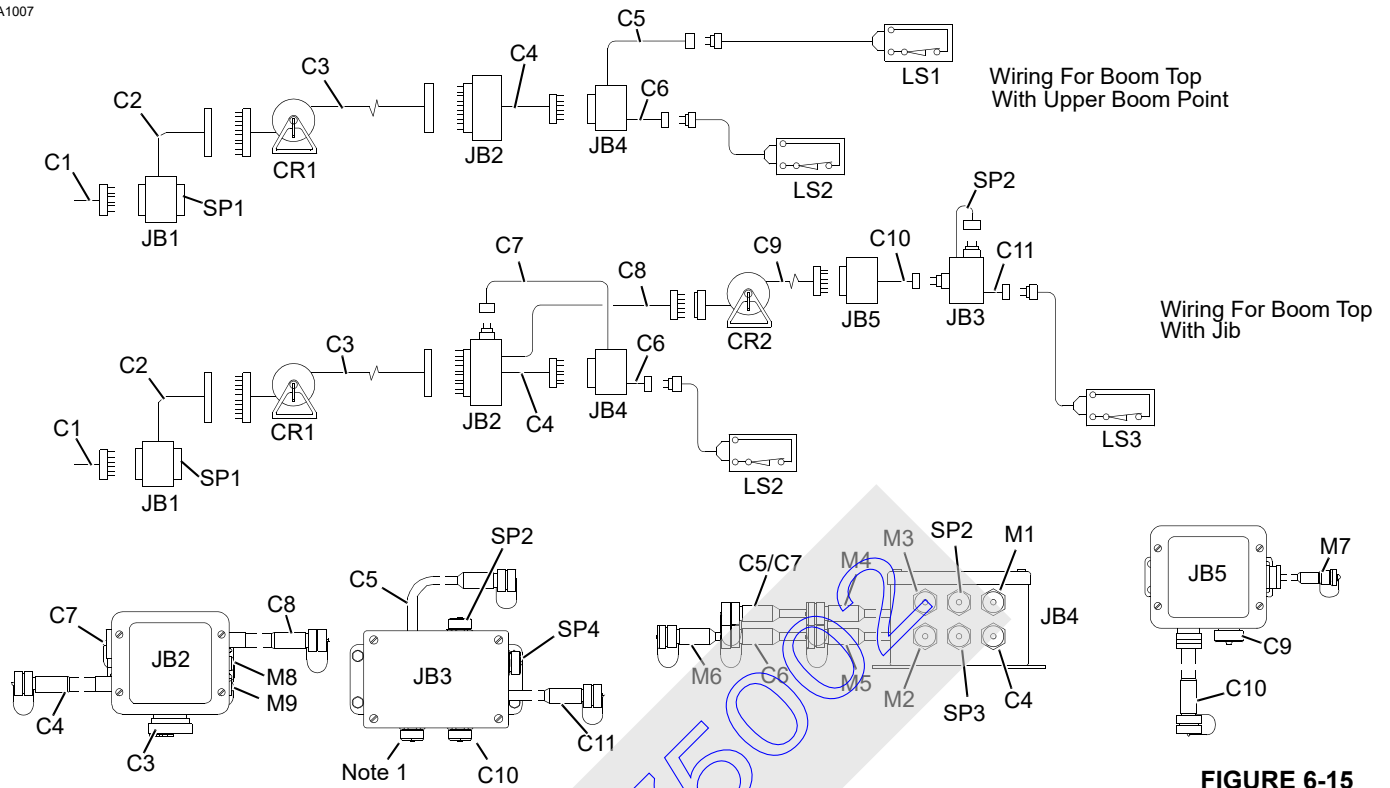


FIGURE 6-15

Item	Description	Item	Description
Cable Reels		Limit Switches	
CR1	Cable Reel on Boom Butt	LS1	Upper Boom Point Limit Switch
CR2	Cable Reel on Luffing Jib Butt	LS2	Lower Boom Point Limit Switch
Electric Cords		LS3	Jib Point Limit Switch
C1	Cord from Main Junction Box Behind Operator's Cab	Shorting Plugs	
C2	Cord to Cable Reel on Boom Butt	SP1	Block-Up Limit System
C3	Cord from Cable Reel on Boom Butt	SP2	Upper Boom Point or Upper Jib Point Shorting Plug
C4	Cord to Boom Top Junction Box	SP3	Lower Boom Point Shorting Plug
C5	Cord to Upper Boom Point Limit Switch	SP4	Jib Point Shorting Plug
C6	Cord to Lower Boom Point Limit Switch	Miscellaneous	
C7	Cord from Boom Top Junction Box	M1	Luffing Jib Angle Sensor Shorting Plug
C8	Cord to Luffing Jib Cable Reel or Fixed Jib Cable	M2	Luffing Jib Minimum Angle Shorting Plug
C9	Cord from Luffing Jib Cable Reel or Fixed Jib Cable	M3	Luffing Jib Maximum Angle Shorting Plug
C10	Cord to Jib Top Junction Box	M4	Cord from Luffing Jib Maximum Angle Limit
C11	Cord to Jib Point Limit Switch	M5	Cord from Luffing Jib Minimum Angle Limit
Junction Boxes		M6	Cord to Luffing Jib Angle Sensor
JB1	Boom Junction Box (on Rotating Bed)	M7	Cord to Jib or Luffing Jib Load Indicator Sheave
JB2	Boom Top Adaptor Junction Box	M8	Cord from Lower Boom Point Load Indicator Sheave
JB3	Jib Top Junction Box	M9	Cord from Upper Boom Point Load Indicator Sheave
JB4	Boom Top Junction Box		
JB5	Jib Top Adaptor Junction Box		

NOTE 1: Capped and not used.

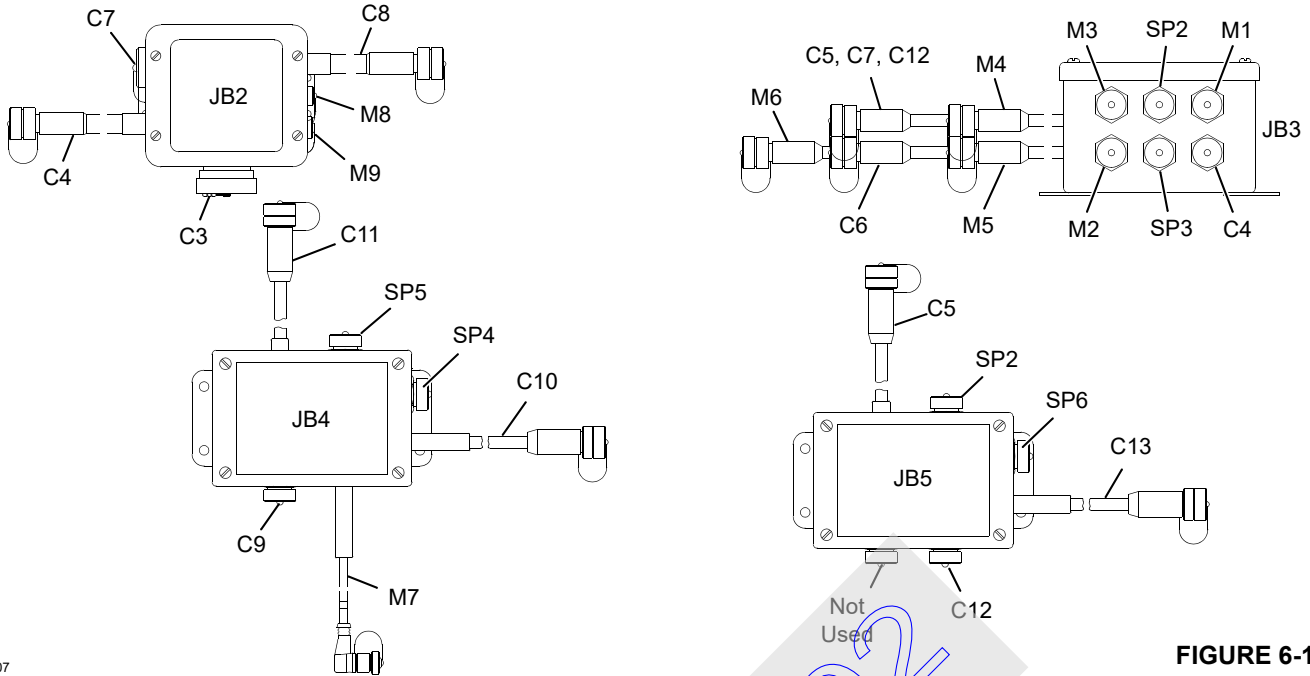
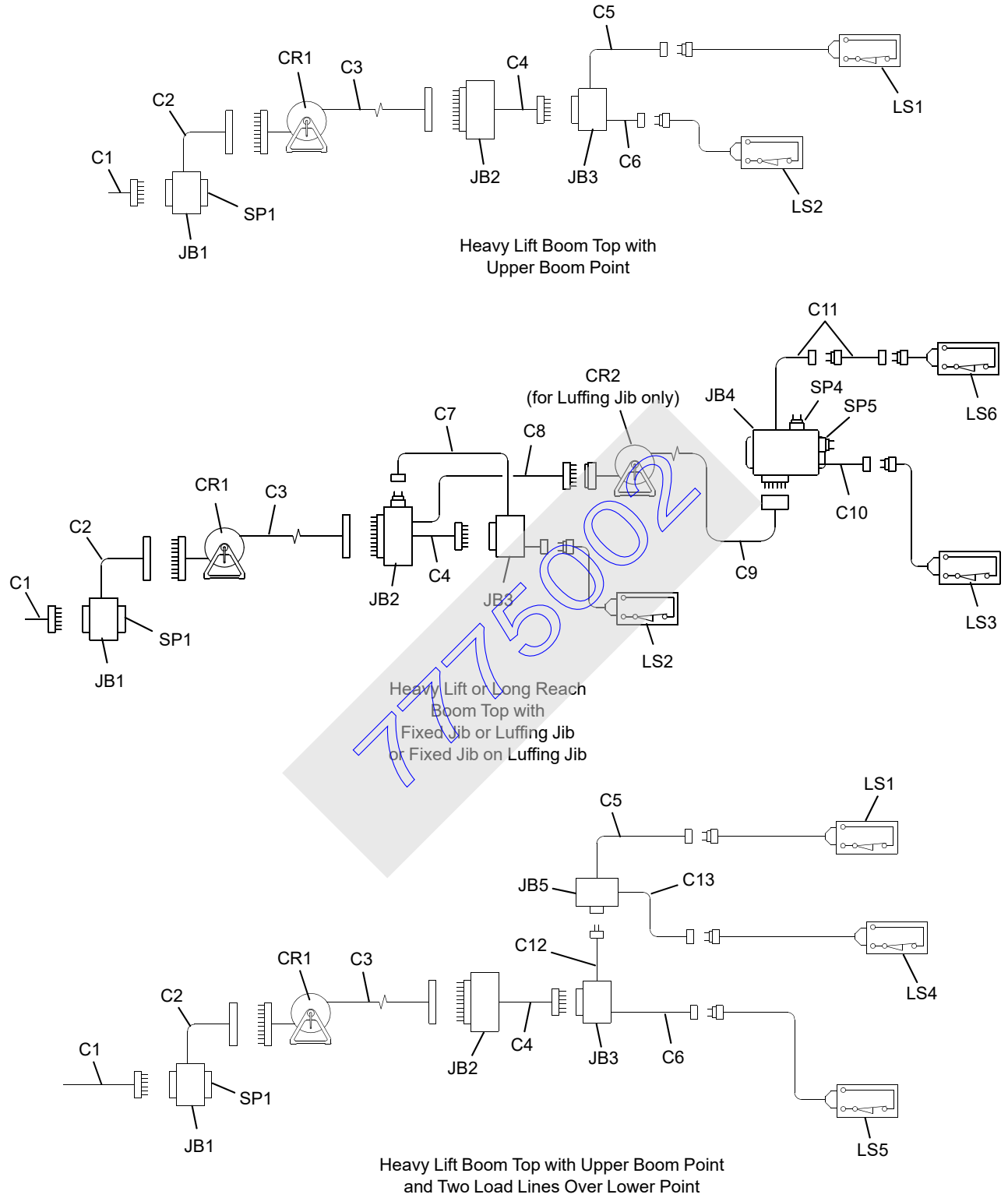


FIGURE 6-16

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Item	Description
Cable Reels	
CR1	Cable Reel on Boom Butt
CR2	Cable Reel on Luffing Jib Butt
Electric Cords	
C1	Cord from Main Junction Box Behind Operator's Cab
C2	Cord to Cable Reel on Boom Butt
C3	Cord from Cable Reel on Boom Butt
C4	Cord to Boom Top Junction Box (JB3)
C5	Cord to Upper Boom Point Limit Switch
C6	Cord to Lower (or Lower Right) Boom Point Limit Switch
C7	Cord from Boom Top Adapter Junction Box
C8	Cord to Luffing Jib Cable Reel or Fixed Jib Cable
C9	Cord from Luffing Jib Cable Reel or Fixed Jib Cable
C10	Cord to Lower Jib Point Limit Switch
C11	Cord to Upper Jib Point Limit Switch
C12	Cord to Boom Top Junction Box (JB5)
C13	Cord to Lower Left Boom Point Limit Switch
Junction Boxes	
JB1	Boom Junction Box (on Rotating Bed)
JB2	Boom Top Adaptor Junction Box
JB3	Boom Top Junction Box (Heavy Lift Top)
JB4	Jib Top Junction Box
JB5	Boom Top Junction Box (Heavy Lift Top)
JB6	Boom Top Junction Box (Long Reach Top)

Item	Description
Limit Switches	
LS1	Upper Boom Point Limit Switch
LS2	Lower Boom Point Limit Switch
LS3	Lower Jib Point Limit Switch
LS4	Lower Boom Point Left Limit Switch
LS5	Lower Boom Point Right Limit Switch
LS6	Upper Jib Point Limit Switch
Shorting Plugs	
SP1	Block-Up Limit System
SP2	Upper Boom Point Shorting Plug
SP3	Lower (or Lower Right) Boom Point Shorting Plug
SP4	Lower Jib Point Shorting Plug
SP5	Upper Jib Point Shorting Plug
SP6	Lower Left Boom Point Shorting Plug
Miscellaneous	
M1	Luffing Jib Angle Sensor Shorting Plug
M2	Luffing Jib Minimum Angle Shorting Plug
M3	Luffing Jib Maximum Angle Shorting Plug
M4	Cord from Luffing Jib Maximum Angle Limit
M5	Cord from Luffing Jib Minimum Angle Limit
M6	Cord to Luffing Jib Angle Sensor
M7	Cord to Jib or Luffing Jib Load Indicator Sheave
M8	Cord from Lower Boom Point Load Indicator Sheave
M9	Cord from Upper Boom Point Load Indicator Sheave



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FIGURE 6-16 continued

Maintenance

Inspect and test the block-up limit control *weekly or every 40 hours of operation*, as follows:

CAUTION

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 the entire length of electric cords for damage.

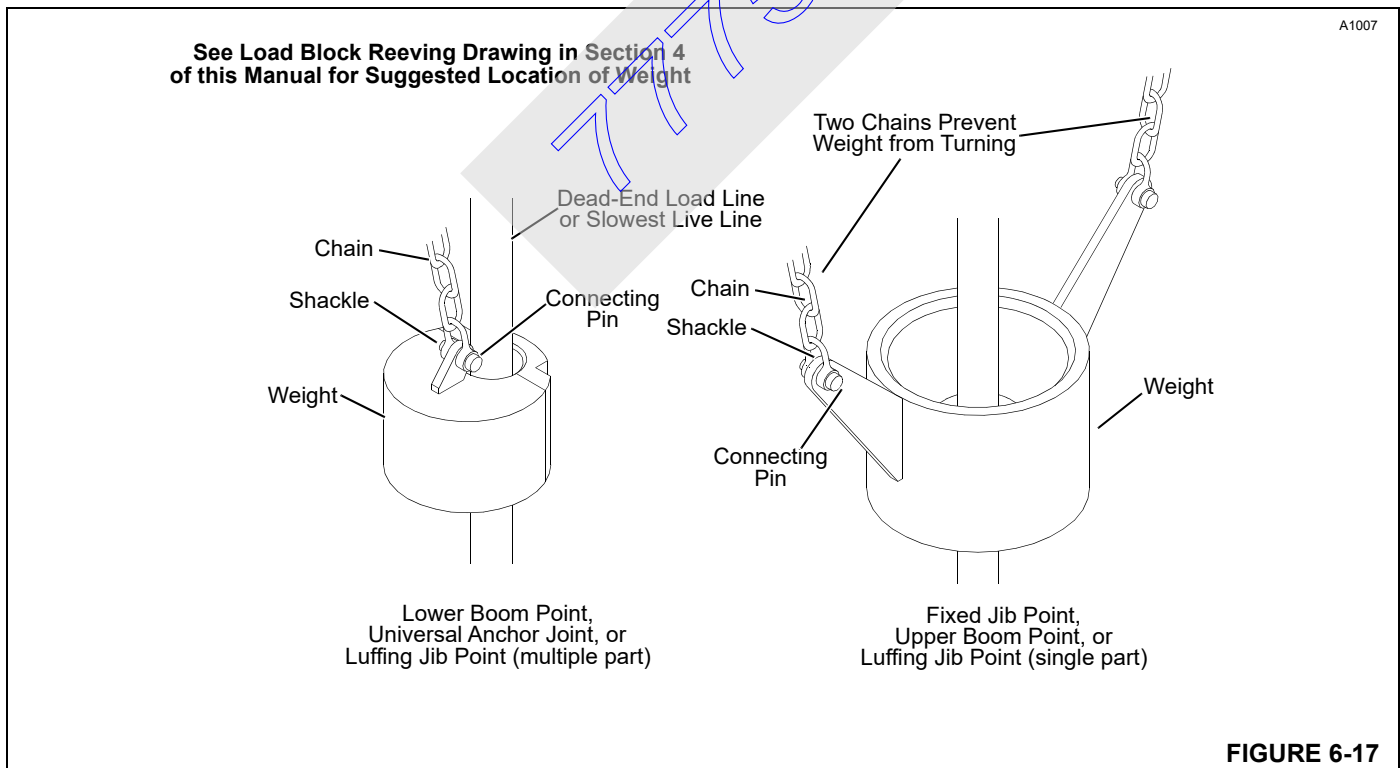
- e. Check that the electric cords are clear of all moving parts on the boom and jib and that the cords are securely fastened to the boom and jib with metal straps.
- f. Check that all plugs are securely fastened.

2. Test the 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/luffing 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.

- 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/luffing hoist should not operate in the LOWER direction.



Adjustment

See Figure 6-18 for 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 the next step.
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); repeat the adjustment steps until the limit switch operates properly.

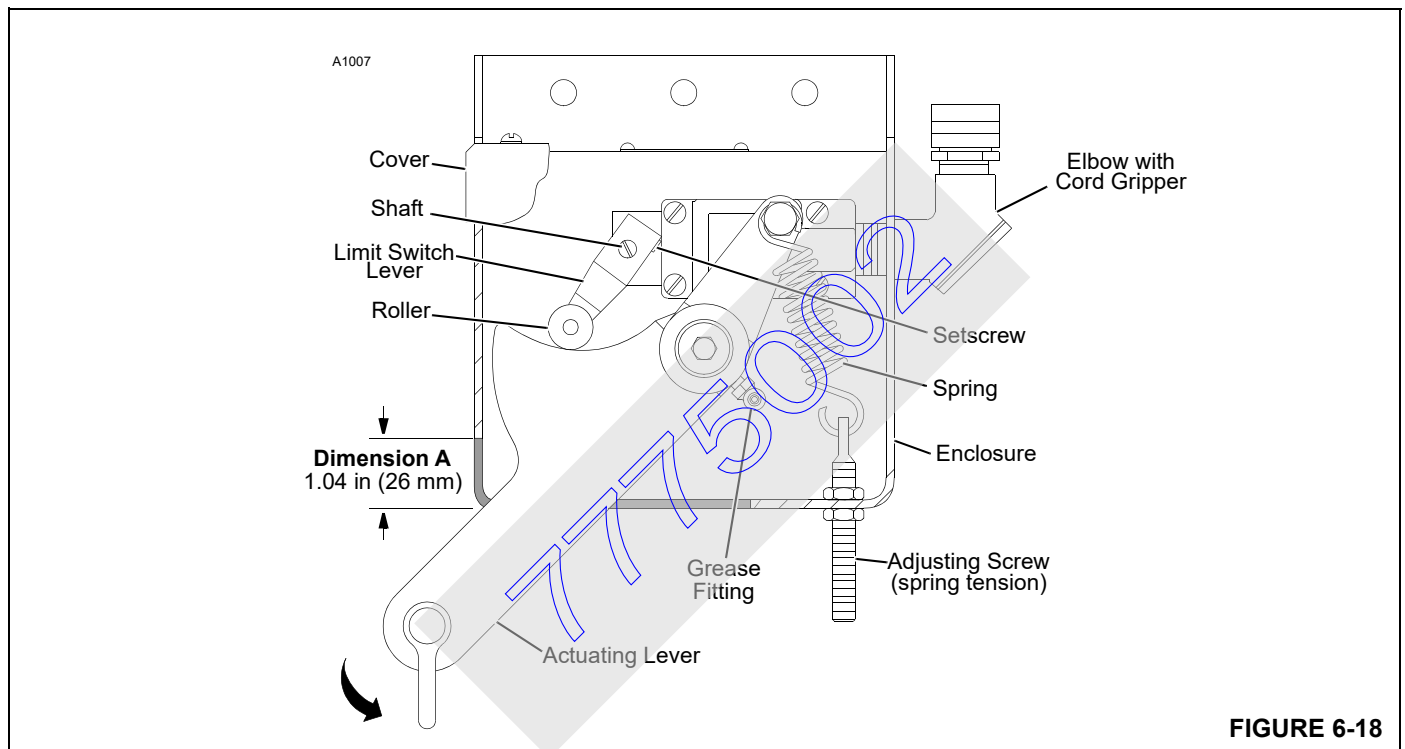


FIGURE 6-18

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