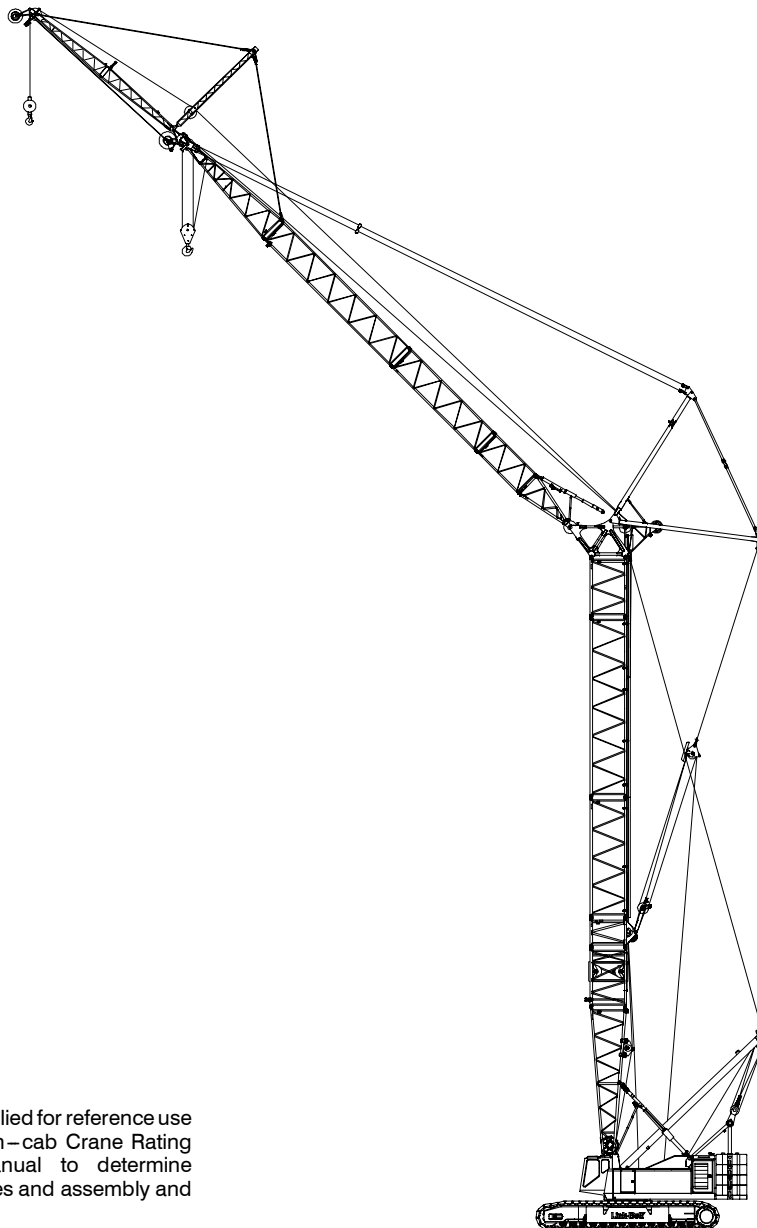


Technical Data

Specifications & Luffing Attachment
Capacities

LS-278H

Crawler Crane
250 Ton (227 metric ton)



CAUTION: This material is supplied for reference use only. Operator must refer to in-cab Crane Rating Manual and Operator's Manual to determine allowable crane lifting capacities and assembly and operating procedures.

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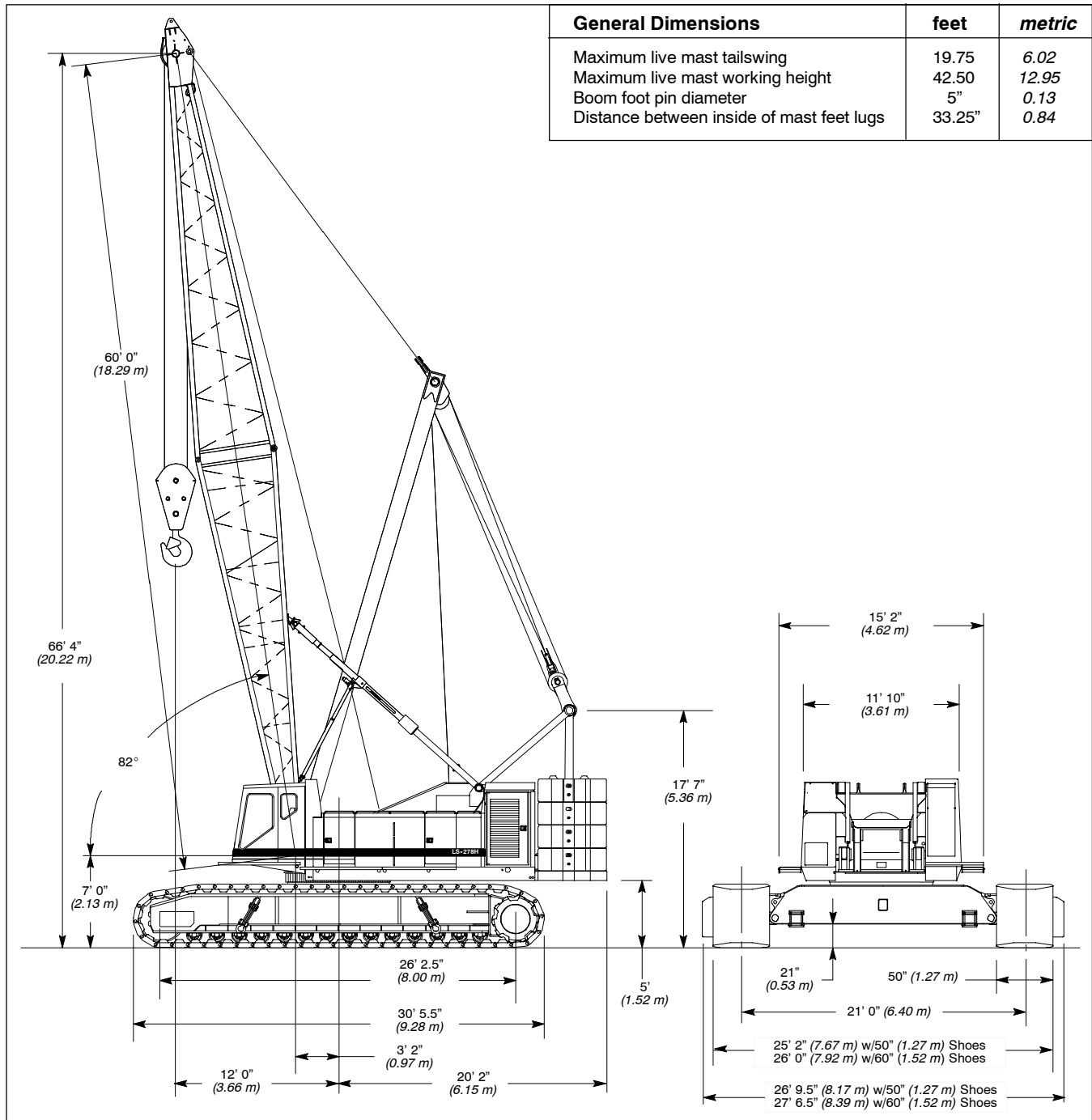
Specifications

Hydraulic Lattice Boom Crawler Crane

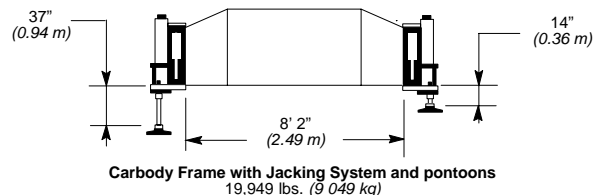
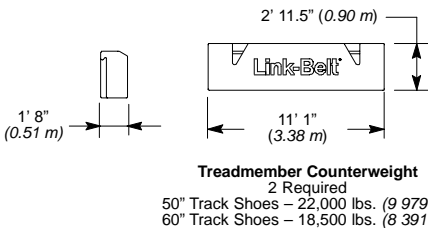
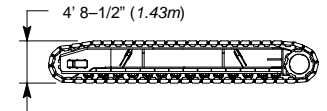
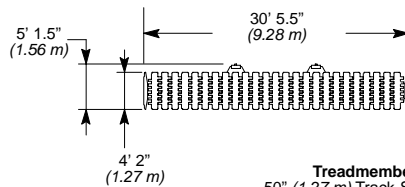
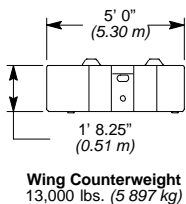
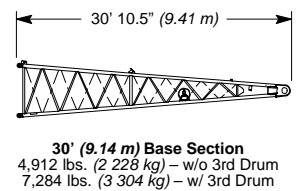
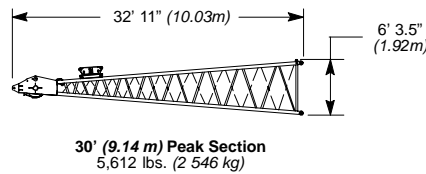
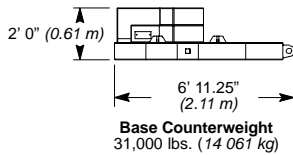
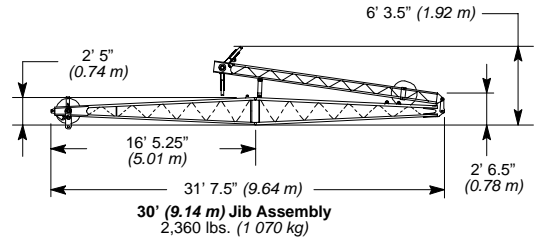
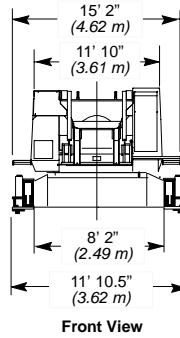
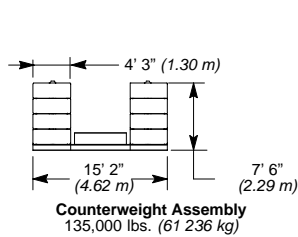
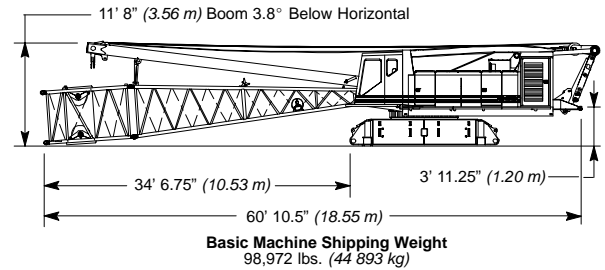
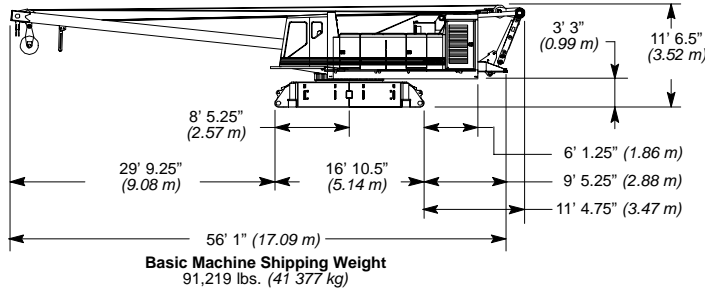
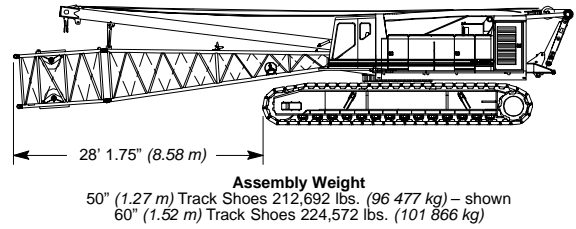
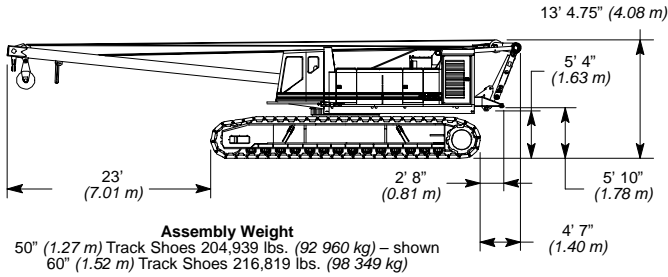
LS-278H

250-Ton (227 metric ton)

HYLAB Series



LS-278H Machine Transport Weights



Base Counterweight	31,000 lbs. (14 062 kg)
Base Counterweight + 4 Wing Counterweights	83,000 lbs. (37 649 kg)
Base Counterweight + 8 Wing Counterweights	135,000 lbs. (61 236 kg)

LS-278H Transportation Weights – approximate

Base Machine: Jacking system with four floats, 18-part bail assembly, 50 gallons (189 L) of fuel, 30' (9.14 m) live mast, 18-part boom hoist reeving, boom backstops, auxiliary lifting bail, 1,025' (312.4 m) front hoist rope and 850' (259.1 m) rear hoist rope.

Item Description	Gross Weight		Transport Loads										Notes and Load Summary	
	lb.	kg.	1	2	3	4	5	6	7	8	9	10		
Base Machine	91,219	41 376	1											Numbers in the load columns to the left represent quantities. Estimated transport assumes the load out consist of 230' (70.1m) of tube boom + 75' (22.86m) of jib with full counterweight. Support loads were targeted at 45,000 lb (20 412kg), 8'-6" (2.6m) wide, 48' (14.6m) long, and 13'-6" (4.1m) high using a drop deck trailer. This may vary depending on state laws, empty truck/trailer weights, and style of trailer. Estimated weights vary by +/- 2%. Estimated Total Load of #1 91,219 lbs. (41 376 kg) Estimated Total Load of #2 56,860 lbs. (25 791 kg) Estimated Total Load of #3 56,860 lbs. (25 791 kg) Estimated Total Load of #4 44,482 lbs. (20 358 kg) Estimated Total Load of #5 42,413 lbs. (19 238 kg) Estimated Total Load of #6 32,449 lbs. (14 719 kg) Estimated Total Load of #7 31,576 lbs. (14 319 kg) Estimated Total Load of #8 40,567 lbs. (18 401 kg) Estimated Total Load of #9 39,567 lbs. (17 947 kg) Estimated Total Load of #10 8,328 lbs. (3 778 kg)
Add treadmember with 50" (1.27 m) pads – 2 required	56,860	25 791		1	1									
Add 60" (1.52 m) shoes in place of standard – 2 required	5,940	2 694												
Add 31,000 lbs. (14 061 kg) base counterweight	31,000	14 061				1								
Add 13,000 lbs. (5 897 kg) wing counterweight – 8 required	13,000	5 897					2	2	2	1	1			
Add treadmember ctwt. for 50" track shoes – 2 required	22,000	9 979								1	1			
Add treadmember ctwt. for 60" track shoes – 2 required	18,500	8 391												
Add third drum ready base section	4,912	2 228				1								
Add 30' (9.14 m) top section with six head sheaves	5,612	2 546					1							
Add 10' (3.10 m) "JE" wall ext. with pins and pendants	1,727	783												
Add 10' (3.05 m) "JE" wall ext. with sheaves, pins and pendants	3,251	1 474				1								
Add 20' (6.10 m) "JE" wall ext. with pins and pendants	2,514	1 140					1					1		
Add 30' (9.14 m) "JE" wall ext. with pins and pendants	3,454	1 567										1		
Add 40' (12.19 m) "JE" wall ext. with pins and pendants	4,567	2 072											1	
Add 50' (15.24m) "JE" wall ext. with pins and pendants	5,567	2 525						1	1	1				
Add auxiliary tip extension	980	445												
Add hydraulic third drum plumbing	500	227												
Add hydraulic third drum without rope	2,372	1 076												
Add 30' (9.14 m) tubular jib	2,360	1 070										1		
Add 10' (3.10 m) jib extension	259	117						1						
Add 20' (6.14 m) jib extension	441	200						1	2					
Add hammerhead top section with 10' transition section	5,514	2 501												
Add auxiliary hammerhead tip extension	976	443										1		
Add jib wire rope 1.12" x 850' type "RB"	2,338	1 060										3		
Add jib wire rope 1" x 1,210' type "RB"	2,626	1 191												
Add jib wire rope 1" x 1,210' type "DB"	2,130	966												
Add drum wire rope 1" x 1,050' type "RB"	2,279	1 034												
Add 15-ton (13.6 mt) Hook Ball – Non Swivel	1,400	635						1						
Add 15-ton (13.6 mt) Hook Ball – Swivel	1,400	635												
Add 60-ton (54 mt) 2 Sheave Hook Block	5,720	2 595				1								
Add 150-ton (136 mt) 6 Sheave Hook Block	1,400	635												
Add 200-ton (181 mt) 6 Sheave Hook Block	3,860	1 751												
Add 250-ton (227 mt) 6 Sheave Hook Block	5,650	2 563						1						
Add 100 gallons of fuel	724	328												
Add left and right side catwalks	537	244										1		
Remove 4 floats for jacking system	-235	-107												
Remove jacking system without floats	-1,739	-789												
Remove front hoist rope	-2,398	-1 088												
Remove rear hoist rope	-1,700	-771												
Remove auxiliary lifting bail	-410	-186												

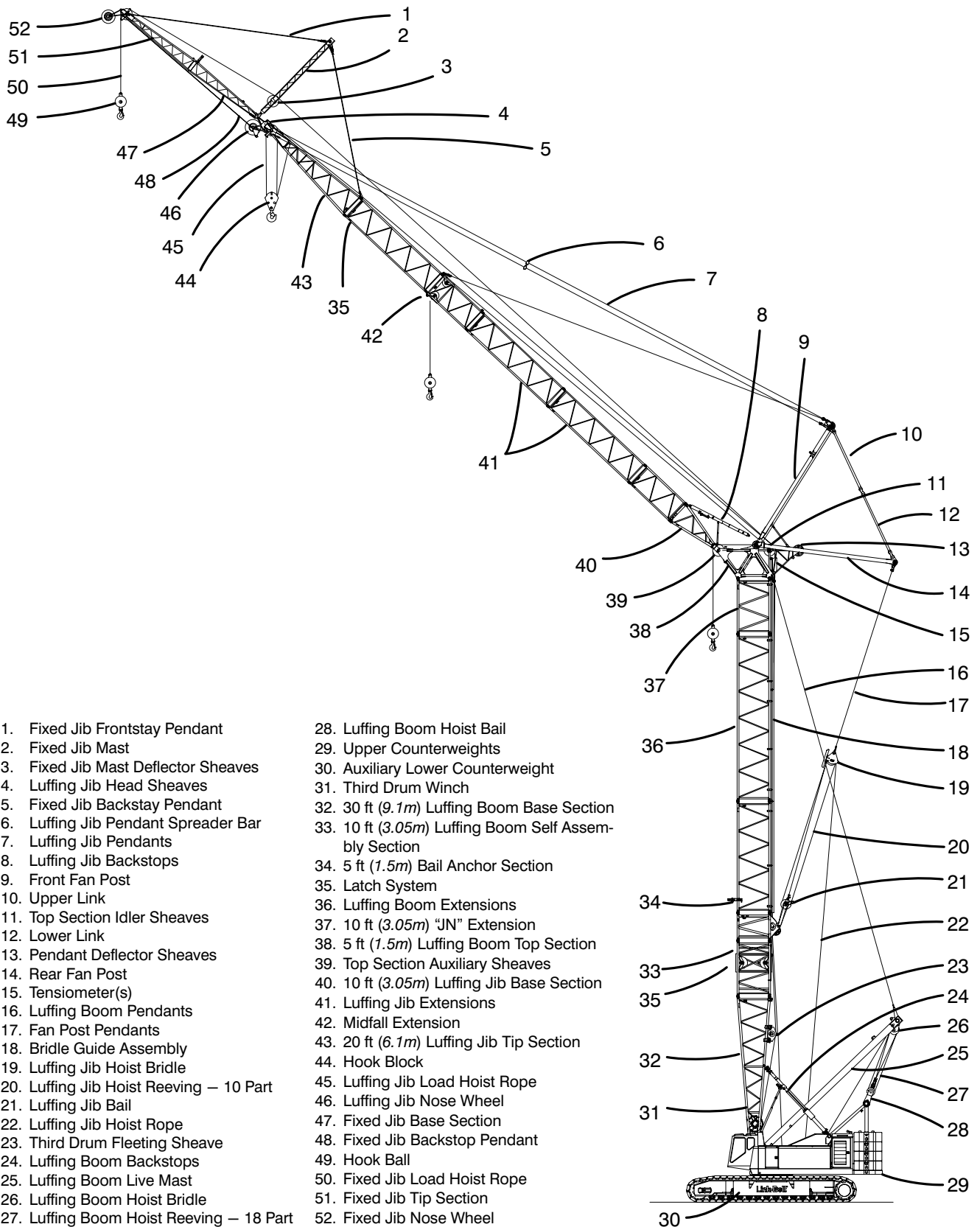
Notes:

- Estimated transport loads assume the load out consist of 330' (100.58 m) of main boom plus 100' (30.48 m) of jib with full counterweight.
- Support loads were targeted at 45,000 lbs. (20 412 kg), 8' 6" (2.59 m) wide, 48' (14.63 m) long and 13' 6" (4.11 m) high using a single drop trailer. This may vary depending on state laws, empty truck/trailer weights and style of trailer.
- Estimated loads may vary by +/- 2%.

LS-278H Machine Working Weight		50" (1.27 m) Track Shoes		60" (1.52 m) Track Shoes	
		Gross Weight lbs. (kg)	Ground Bearing Pressure psi (kg/cm ²)	Gross Weight lbs. (kg)	Ground Bearing Pressure psi (kg/cm ²)
1	Base Machine equipped with 60' (18.29 m) of open throat tubular boom, live mast, 135,000 lbs of upper counterweight, lower counterweights, 1,025' (312.42 m) front hoist rope, 850' (259.08 m) rear hoist rope, 250-ton (226.8 mt) hook block, 148 gallons (560.2 L) of fuel, and 200 lbs. (90.7 kg) operator.	401,560 (182 144)	12.11 (0.85)	406,440 (184 358)	10.22 (0.72)
2	Option #1 plus midpoint pendants, and 270' (82.3 m) of boom extensions to obtain 330' (100.58 L) of main boom.	434,561 (197 114)	13.11 (0.92)	439,441 (199 327)	11.04 (0.78)
3	Option #2 plus 100' (30.48 m) of jib and 15-ton (13.6 mt) hook ball – subtract 30' (9.14 m) of boom extension and midpoint pendants to obtain maximum 300' + 100' (91.44 + 30.48 m) of main boom + jib.	436,449 (197 970)	13.16 (0.93)	441,329 (200 184)	11.09 (0.78)
4	Base Machine equipped with 45' (13.72 m) of Hammer head tube boom, live mast, 135,000 lbs. of upper counterweight, lower counterweights, 1,025' (312.42 m) front hoist rope, 850' (259.08 m) rear hoist rope, 250-ton (226.8 mt) hook block, 148 gallons (560.2 L) of fuel, and 200 lbs. (90.7 kg) operator.	401,461 (182 100)	12.11 (0.85)	406,341 (184 313)	10.21 (0.72)
5	Option #4 plus "B" counterweight and 200' (60.96 m) of boom extensions to obtain 245' (74.68 m) of main boom.	427,381 (193 857)	12.89 (0.91)	432,261 (196 070)	10.86 (0.76)

Notes:
 1. Ground bearing pressure is based on the total weight distributed evenly over the track contact area.
 2. Total contact area for 50" (1.27 m) track shoes is 33,158 in² (213 922 cm²) and 60" (1.52 m) track shoes is 39,788 in² (256 696 cm²)

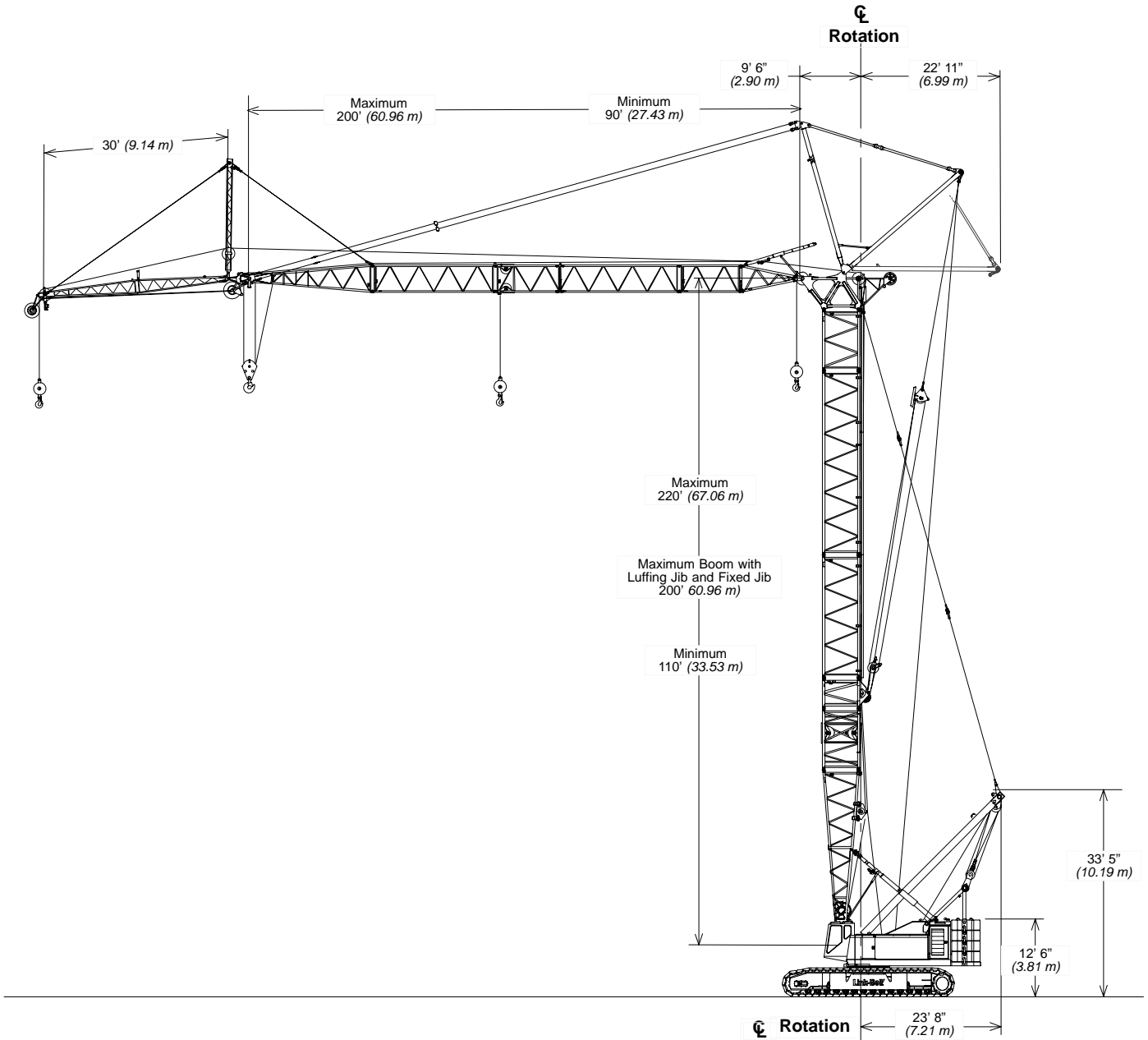
LS-278H Luffing Attachment Nomenclature



- 1. Fixed Jib Frontstay Pendant
- 2. Fixed Jib Mast
- 3. Fixed Jib Mast Deflector Sheaves
- 4. Luffing Jib Head Sheaves
- 5. Fixed Jib Backstay Pendant
- 6. Luffing Jib Pendant Spreader Bar
- 7. Luffing Jib Pendants
- 8. Luffing Jib Backstops
- 9. Front Fan Post
- 10. Upper Link
- 11. Top Section Idler Sheaves
- 12. Lower Link
- 13. Pendant Deflector Sheaves
- 14. Rear Fan Post
- 15. Tensiometer(s)
- 16. Luffing Boom Pendants
- 17. Fan Post Pendants
- 18. Bridle Guide Assembly
- 19. Luffing Jib Hoist Bridle
- 20. Luffing Jib Hoist Reeving – 10 Part
- 21. Luffing Jib Bail
- 22. Luffing Jib Hoist Rope
- 23. Third Drum Fleeting Sheave
- 24. Luffing Boom Backstops
- 25. Luffing Boom Live Mast
- 26. Luffing Boom Hoist Bridle
- 27. Luffing Boom Hoist Reeving – 18 Part

- 28. Luffing Boom Hoist Bail
- 29. Upper Counterweights
- 30. Auxiliary Lower Counterweight
- 31. Third Drum Winch
- 32. 30 ft (9.1m) Luffing Boom Base Section
- 33. 10 ft (3.05m) Luffing Boom Self Assembly Section
- 34. 5 ft (1.5m) Bail Anchor Section
- 35. Latch System
- 36. Luffing Boom Extensions
- 37. 10 ft (3.05m) "JN" Extension
- 38. 5 ft (1.5m) Luffing Boom Top Section
- 39. Top Section Auxiliary Sheaves
- 40. 10 ft (3.05m) Luffing Jib Base Section
- 41. Luffing Jib Extensions
- 42. Midfall Extension
- 43. 20 ft (6.1m) Luffing Jib Tip Section
- 44. Hook Block
- 45. Luffing Jib Load Hoist Rope
- 46. Luffing Jib Nose Wheel
- 47. Fixed Jib Base Section
- 48. Fixed Jib Backstop Pendant
- 49. Hook Ball
- 50. Fixed Jib Load Hoist Rope
- 51. Fixed Jib Tip Section
- 52. Fixed Jib Nose Wheel

LS-278H Luffing Attachment Dimensions



Attachment Options

■ 60' – 330' (18.29 – 100.58 m) Tubular Boom

Basic Boom – 60' (18.29 m) two-piece design that utilizes a 30' (9.14 m) base section and a 30' (9.14 m) open throat top section with in-line connecting pins on 80" (2.03 m) wide and 68" (1.73 m) deep centers.

- 250-ton (226.8 mt) maximum capacity
- Max boom tip height of 333' (101.5 m)
- Boom feet on 66" (1.67 m) centers
- 4.25" (10.79 cm) diameter chords

- Lugs on base section to attach carrying links
- Skywalk platform
- Deflector roller on top section
- Rigid sheave guards
- Six, 21" (0.53 m) root diameter steel sheaves mounted on sealed anti-friction bearings
- Oil filled mechanical boom angle indicator

Boom Extensions – The following table provides the lengths available and the suggested quantity to obtain maximum boom in 10' (3.05m) increments. Midpoint pendant connections are required at 140' (42.67 m) for boom lengths 250' (72.6 m) and longer.

Tube Boom Extensions	Suggested Quantity for Maximum Boom
10' (3.05 m)	1
20' (6.10 m)	2
30' (9.14 m)	2
40' (12.19 m)	2

- Deflector roller on top of each section
- Two rollers on 40' (12.19 m) and 50' (15.24 m) extensions.
- Appropriate length pendants
- The optional 10' (3.05 m) extension with lifting sheaves is used for self assembly/disassembly instead of using live mast and auxiliary lifting bail.

■ 45' – 245' (13.72 – 74.68 m) Hammer Head Boom

Basic Boom – 45' (13.72 m) three-piece design that utilizes a 30' (9.14 m) base section, a 10' (3.05 m) taper section, and a 5' (1.52 m) hammer head top section. Taper section pins to standard base section with in-line connecting pins on 80" (2.03 m) wide and 68" (1.73 m) deep centers.

- 200-ton (178.6 mt) maximum capacity
- Maximum boom tip height is 243' (74.07 m)
- 4.25 (10.80 m) tubular "JE" wall chords
- Lugs on base section to attach carrying links.
- Skywalk platform
- Deflector roller on top section
- Rigid sheave guards
- Six, 21" (0.53 m) root diameter steel sheaves mounted on sealed anti-friction bearings.
- Oil-filled mechanical boom angle indicator.

Hammer Head Boom Extensions – The following table provides the lengths available and the suggested quantity to obtain maximum boom in 10' (3.05 m) increments. Extensions are common with open throat extensions.

Hammer Head Boom Extensions "JE"	Suggested Quantity for Maximum Boom
10' (3.05 m) with or without lifting sheaves	1
20' (6.10 m)	1
30' (9.14 m)	1
40' (12.19 m)	0
50' (15.24 m)	3

- Deflector roller on top of each section. Two rollers 40' (12.19 m) and 50' (15.24 m) extensions.
- Appropriate length pendants
- 10' (3.05 m) extension with lifting sheaves is available for self-assembly and disassembly.

■ 30' – 100' (9.14 – 30.48 m) Tubular Jib

Basic Tube Jib – 30' (9.14 m) two-piece design that utilizes a 15' (4.57 m) base section and a 15' (4.57 m) top section with in-line connecting pins on 32" (0.81 m) wide and 24" (0.61 m) deep centers. Designed to be used on the open throat top section only.

- 30-ton (27.2 mt) maximum capacity
- Maximum tip height of tube boom + jib is 403.8' (123.1 m).
- Jib offset angles at 5, 15 and 25 degrees
- 2.25" (57 mm) tubular chords
- One 18.5" (0.47 m) root diameter steel sheave mounted on sealed anti-friction bearings.

Jib Extensions – The following table provides the lengths available and the suggested quantity to obtain maximum jib in 10' (3.05 m) increments.

Jib Extensions	Suggested Quantity for Maximum Boom
10' (3.05 m)	1
20' (6.10 m)	3

- Wood wear block on top of each section.
- Appropriate length pendants.

■ 90' – 200' (27.43 – 50.29 m) Luffing Jib

Basic Luffing Jib – 90' (24.38 m) five-piece design utilizes a 5' (1.52 m) luffing boom top section, 10' (3.05 m) base section, 10' (3.05 m) extension, 20' (6.01 m) extension, 30' (9.14 m) extension, and 20' (6.10 m) top section with in-line connecting pins. Boom extensions are 50" (1.12 m) wide and 60" (1.37 m) deep at the centers.

- 54-ton (24.5 mt) maximum capacity
- Working lengths of 90' (24.38 m) to 200' (48.77 m)
- Top section includes mounting lugs for all attachment options.
- Lugs on base section to attach fan-post transport links.
- Two polyamide 24" (0.46 m) diameter luffing jib head sheaves
- Two polyamide 25" (0.54 m) diameter luffing boom auxiliary head sheaves
- Pin on nose wheel
- Ten-part luffing jib hoist.
- 1.25" (31.75 mm) diameter type "BC" pendants

Luffing Jib Extensions – The following table provides the lengths available and the suggested quantity to obtain the maximum luffing jib in 10' (3.05 m) increments. Midpoint pendants are not required.

Luffing Jib Extensions	Suggested Quantity for Maximum Boom
10' (3.05 m)	1
20' (6.10 m)	1
30' (9.14 m)	2
40' (12.19 m)	2

Midfall Extension – The midfall (if equipped) consists of a 10' (3.05 m) luffing jib extension equipped with load hoisting machinery and provides an auxiliary load hoist location for short radius light duty lifting.

- Midfall capacities and suspension adjustments are available for luffing jib lengths of 110 – 200' (33.5 – 61.0 m).
- Midfall capacities range from 18,800 lbs. (8 528 kg) to 9,400 lbs. (4 264 kg).

■ Luffing Boom

- Common base and extensions as open throat boom
- 10' (3.05 m) Self-Assembly section required for bail anchor
- Working angles of 90, 85, 80, 75, 70, and 65 degrees.
- Working lengths of 110' (25.91 m) to 220' (50.29 m)
- 1.25" (34.92 mm) diameter type "BC" pendants; same as open throat boom.

Luffing Boom Extensions – The following table provides the lengths available and the suggested quantity to obtain the maximum

luffing boom in 10' (3.05 m) increments. Midpoint pendants are not required.

Luffing Boom Extensions	Suggested Quantity for Maximum Boom
10' (3.05 m) *	2
20' (6.10 m)	1
30' (9.14 m)	1
40' (12.19 m)	1
50' (15.24 m)	3

* : 10' (3.05 m) Must be the Self-assembly and "JN" section.

- Rear hoist drum becomes luffing jib hoist
- Optional third drum provides second working hoist line, if required.
- Designed for self-assembly
- Luffing jib hoist bridle and bail can remain reeved for machine transport
- Job site mobility with attachment
- Rolled out or rolled under erection methods
- Compact transport module.

■ Auxiliary 5' (1.5 m) Tip Extension

Designed to use in place of jib to provide clearance between working hoist lines. The horsehead style extension is equipped with a single 28.3" (0.72 m) root diameter steel sheaves mounted on sealed anti-friction bearing. Maximum capacity is 25-tons (22.32 mt).

■ Auxiliary Hammer Head Tip Extension

Designed to use in place of jib to provide clearance between working hoist lines. The extension is equipped with a single 20" (0.51 m) root diameter steel sheaves mounted on sealed anti-friction bearing. Maximum capacity is 17.5-tons (15.9 mt).

■ Boom Hoist System

Designed to lift off maximum boom or maximum boom plus jib unassisted. Operates up to a maximum boom angle of 82 degrees. Boom hoist limit system limits maximum boom angle operation.

- Hydraulic controlled retractable gantry frame.
- 18-part reeving with 1" (2.54 cm) type "W" wire rope
- Bridle assembly and 35' (10.67 m) live mast
- Four 1.25" x 26' 4" (3.18 cm x 8.03 m) pendants
- Two 1" x 112' 10" (25.4 cm x 34.39 m) mid-point pendants
- Tubular spring-buffered boom backstops (rigid type)
- Sheaves contain sealed anti-friction bearings
- Boom speed from minimum to maximum operating radius for 150' (45.72 m) of open throat boom is 84 seconds.

Revolving Upper Structure

■ Frame

All welded steel frame with precision machined surfaces for mating parts.

■ Engine

Detroit Diesel Series 60 – 12.7 Liter with oil filter, oil cooler, air cleaner, fuel filter, water separator, tachometer and electrical shutdown.	
Number of cylinders	6
Bore and stroke – in. (mm)	5.12" x 6.00" (130 x 152)
Piston displacement – cu. in. (cm ³)	778 (12 751)
Max brake hp (kw)	450 (336) @ 1,800 r.p.m.
Peak torque – ft./lb. (joules)	1,550 (2 102) @ 1,350 r.p.m.
Electrical System	12V
Batteries	4, Group 31 rated @ 725 cc amps at 0 deg. (F)
Alternator	130 amps
Approximate fuel consumption	Gal./hr. (L/hr)
100% HP	20.09 (76.05)
75% HP	15.06 (57.01)
50% HP	10.04 (38.01)
25% HP	5.02 (19.00)

■ Hydraulic System Specifications

Hydraulic Pumps – The pump arrangement is designed to provide hydraulically powered functions allowing positive, precise control with independent or simultaneous operation of all crane functions.

- One variable displacement pump operating at 5,225 psi (36 025 kPa) and 94 gal/min (355 L/min) powers front hoist drum.
- One variable displacement pump operating at 5,100 psi (35 163 kPa) and 94 gal/min (355.8 L/min) powers the rear hoist drum.
- One variable displacement pump operating at 4,600 psi (31 717 kPa) and 73 gal/min (278 L/min) powers the boom hoist drum.
- Two variable displacement pumps operating at 5,000 psi (34 474 kPa) and 52 gal/min (197 L/min) powers the travel system.
- One variable displacement pump operating at 4,350 psi (29 993 kPa) and 73 gal/min (276 L/min) powers the swing system.
- One fixed displacement gear type pump operating at 1,250 psi (88 kg/cm²) and 8 gal/min (32 L/min) powers the pilot control system.

Pump Control (“Fine Inching”) mode – Special pump setting, selectable from operator’s cab, that allows very slow movements of front and rear hoist for precision work.

Hydraulic Reservoir – 144 gal (545 L), equipped with sight level gauge. Diffusers built in for deaeration.

Filtration – One 10 micron, full flow, line filter in the return line of the hydraulic reservoir.

Counterbalance Valves – All hoist motors are equipped with counterbalance valves to provide positive load lowering and prevent accidental load drop if the hydraulic pressure is suddenly lost.

■ Front Hoist Drums

Drum contains a pilot controlled, bi-directional, axial piston motor and a planetary gear reduction unit to provide positive control under all load conditions.

- Power up/down operation mode
- Spring applied, hydraulically released, disc-type brake controlled automatically
- 1.12" (28.4 mm) grooved “Lebus” lagging
- Drum pawl controlled automatically
- Electronic drum rotation indicator
- Mounted on anti-friction bearings
- 20.88" (0.53 m) root diameter
- 36" (0.91 m) flange diameter
- 31.94" (0.81 m) width

■ Rear Hoist Drums

Drum contains a pilot controlled, bi-directional, axial piston motor and a planetary gear reduction unit to provide positive control under all load conditions.

- Power up/down operation mode
- Spring applied, hydraulically released, disc-type brake controlled automatically
- 1" (25.4 mm) grooved “Lebus” lagging
- Drum pawl controlled automatically
- Electronic drum rotation indicator
- Mounted on anti-friction bearings
- 30.88" (0.78 m) root diameter
- 40.5" (1.03 m) flange diameter
- 31.94" (0.81 m) width

■ Optional Third Hoist Drum

The hydraulic winch is mounted in the boom base section and is used in conjunction with a fleeting sheave and three sheave assembly to run the wire rope over the boom top section.

- Power up/down operation mode
- Automatic brake mode (spring applied, hydraulically released)
- Smooth drum
- Electronic drum rotation indicator
- Mounted on anti-friction bearings
- 12.75" (0.32m) root diameter
- 22.75" (0.58m) flange diameter
- 17" (0.43m) width

■ Boom Hoist Drum

Contains a pilot controlled, bi-directional, axial piston motor and a planetary gear reduction unit to provide positive control under all load conditions.

- Spring applied, hydraulically released, disc type brake controlled automatically
- 1" (2.54 cm) grooved lagging
- Drum pawl controlled automatically
- Mounted on anti-friction bearings
- Electronic drum rotation indicator
- 20.88" (0.53 m) root diameter
- 31" (0.79 m) flange diameter
- 30.75" (0.78 m) width

■ Swing System

Contains a pilot controlled bi-directional axial piston motors and the planetary gear reduction unit to provide positive control under all load conditions.

- Spring applied, hydraulically released, 360 degree multi-plate brake
- Free swing mode when lever is in neutral position
- 360 degree positive house lock
- Audio/visual swing alarm
- Maximum swing speed is 2.4 rpm

■ Upper Counterweight

Consist of a nine-piece design. Easily lowered to the ground using a remote control box to hydraulically retract the gantry. The design allows division of 135, 000 lbs. (61 235 kgs) of counterweight into light-weight modules for transportation. This design allows for operating with less than maximum counterweight.

- 31,000 lbs. (14 061 kg) base counterweight
- Eight, 13,000 lbs. (5 897 kg) wing counterweights
- Capacity charts exist for 135,000 lbs. (61 235 kg), 83,000 lbs. (37 648 kg) or 31,000, (14 061 kg).

■ Operator’s Cab and Controls

Fully enclosed modular steel compartment is independently mounted and insulated to protect against vibration and noise.

- All tinted/tempered safety glass
- Sliding entry door
- Swing up roof window with wiper
- Door and window locks
- Heater with circulating fan
- Engine instrumentation panel (tachometer, fuel gauge, voltmeter, engine oil pressure, engine water temperature, hydraulic oil temperature, hour meter and service monitor system)
- Electronic drum rotation indicators

(continued on page 9)

LS-278H Load Hoisting Performance

Available line speed and line pull – based on Cummins N14-C440 engine at 1,800 rpm. Line pulls are not based on wire rope strength. See Wire Rope Capacity Chart for maximum permissible single part-of-line working loads.

Rope Layer	Front Drum – 1.12" (28.45 mm) Wire Rope											
	Maximum Line Pull		No Load Line Speed		Full Load Line Speed		Pitch Diameter		Layer		Total	
	lb.	kg	ft./min.	m/min.	ft./min.	m/min.	in.	mm	ft.	m	ft.	m
1	44,390	22 403	287	87.5	142	43.3	22	558.8	148	45.1	148	45.1
2	44,808	20 325	316	96.3	157	47.9	24.25	616.1	164	50.0	312	95.1
3	41,003	18 599	346	105.5	171	52.1	26.5	673.1	179	54.6	491	149.7
4	37,794	17 143	375	114.3	186	56.7	28.75	730.3	194	59.1	684	208.5
5	35,051	15 899	404	123.1	200	61.0	31	787.4	209	63.7	893	272.2
6	32,679	14 823	434	132.3	215	65.5	33.25	844.6	224	68.3	1118	340.8
7	30,608	13 884	463	141.1	229	69.8	35.5	901.7	239	72.8	1357	413.6

NOTE: The seventh layer is for storage only

Rope Layer	Rear Drum – 1" (25.4 mm) Wire Rope											
	Maximum Line Pull		No Load Line Speed		Full Load Line Speed		Pitch Diameter		Layer		Total	
	lb.	kg	ft./min.	m/min.	ft./min.	m/min.	in.	mm	ft.	m	ft.	m
1	33,206	15 062	416	126.8	206	62.8	31.88	809.8	242	73.8	242	73.8
2	31,245	14 173	442	134.7	219	66.8	33.88	860.5	257	78.3	499	152.1
3	29,503	13 383	468	142.6	232	70.7	35.88	911.4	272	82.9	771	235
4	27,945	12 676	494	150.6	245	74.7	37.88	962.1	287	87.5	1058	322.5

NOTE: The fourth layer is for storage only

Rope Layer	Boom Hoist Drum – 1" (25.4 mm) Wire Rope											
	Maximum Line Pull		No Load Line Speed		Full Load Line Speed		Pitch Diameter		Layer		Total	
	lb.	kg	ft./min.	m/min.	ft./min.	m/min.	in.	mm	ft.	m	ft.	m
1	42,966	19 489	239	72.8	120	36.6	21.88	555.8	160	48.8	160	48.8
2	39,367	17 857	261	79.6	131	39.9	23.88	606.6	174	53.0	334	101.8
3	36,324	16 477	283	86.3	142	43.3	25.88	657.4	189	57.6	523	159.4
4	33,718	15 294	305	93.0	153	46.6	27.88	708.2	204	62.2	727	221.6
5	31,461	14 270	327	99.7	164	50.0	29.88	759.0	218	66.4	945	288.0

Rope Layer	Third Hoist Drum – 1" (25.4 mm) Wire Rope											
	Maximum Line Pull		No Load Line Speed		Full Load Line Speed		Pitch Diameter		Layer		Total	
	lb.	kg	ft./min.	m/min.	ft./min.	m/min.	in.	mm	ft.	m	ft.	m
1	29,090	13 195	271	82.6	230	70.1	21	533.4	131	39.9	131	39.9
2	26,560	12 048	297	90.5	251	76.5	23	584.2	143	43.6	274	83.5
3	24,440	11 086	322	98.1	273	83.2	25	635.0	156	47.5	430	131.1
4	22,630	10 265	348	106.1	295	89.9	27	685.8	168	51.2	598	182.3
5	21,070	9 557	374	114.0	317	96.6	29	736.6	181	55.2	779	237.4
6	NOTE: Storage layer only								193	58.8	972	296.3

Wire Rope Application	Diameter		Length		Type	Maximum Permissible Load	
	in	mm	ft	m		lbs	kg
Boom Hoist	1	25.4	870	265.2	W	11,770	5 339
Front Hoist	1.125	28.4	1025	312.4	LB	40,850	18 529
Rear Hoist (Optional)	1	25.4	850	259.1	RB	22,760	10 324
Rear Hoist (Optional)	1	25.4	1210	368.8	RB	22,760	10 324
Rear Hoist (Optional)	1	25.4	1210	368.8	DB	29,540	13 399
Third Drum (Optional)	1	25.4	1050	320.0	RB	22,760	10 324

Rope Type	Description
W	6 x 26 (6 X 19 Class) – Extra Improved Plow Steel – Preformed – Independent Wire Rope Core – Right Lay – Alternate Lay
LB	6 x 26 (6 X 19 Class) – Filler Wire – Preformed – Independent Wire Rope Core – Right Lay – Regular Lay
RB *	19 x 19 Rotation Resistant – Extra-Extra Improved Plow Steel – Preformed – Right Lay – Regular Lay
DB	6 x 26 (6 X 19 Class) – Warrington Seale – Extra Improved Plow Steel – Preformed – Right Lay – Regular Lay

* – Use of swivel ball is not recommended.

Revolving Upper Structure (continued from page 7)

■ Operator's Cab and Controls (continued)

- Six way adjustable seat with seat belt
- Dry chemical fire extinguisher
- Twist lock hand and foot throttle
- Hand and foot operated boom hoist control
- Pilot operated arm chair single axis control levers
- Swing lever with swing brake and horn located on handle
- 12-volt power outlet

■ Load Indicator / Rated Capacity Limiter

Standard Equipment – PAT DS-350/1334 modular system that includes two lineriders, angle sensor, computer, graphic

display, and anti-two block equipment to provide the following information.

- Graphic representation of machine configuration.
- Step-by-step machine set-up
- Boom length & angle
- Jib length & angle
- Load on hook
- Rated load
- Load radius
- Tip height
- Anti-two block warning & function limiters
- Operation mode
- Provides audio/visual warning when the load on hook is within 90% of the crane's rated load.
- Provides audio/visual warning and limits functions when the load on hook is at 100% of the crane's rated load.
- Operator settable alarms include minimum

and maximum boom angle, maximum tip height, left and right swing, and range control (obstacle avoidance). These alarms provide an audio/visual warning only.

Note: Function limiters are activated for anti-two block and overload conditions. These limiters are designed to prevent hoist-up on front and rear drums and boom down.

■ Additional Equipment – Standard

- 93" (2.36 m) outside diameter turntable bearing
- Front, right and left side removable catwalks
- 143 (usable) U.S. gallons (541.3 L) fuel tank
- Machine lifting links

Lower Structure

■ Carbody

All welded box construction frame with precision-machined surfaces for turntable bearing and rotating joint.

- 10' (3.05 m) overall width
- 16' 10" (5.13 m) overall length
- Hydraulic tubing and hoses for travel system
- Four ground controlled hydraulic jacks with 24" (610 mm) aluminum floats

■ Treadmembers

All welded, precision-machined assemblies that are attached to the carbody with hydraulic assist pin pullers..

- 21' (6.40 m) extended gauge
- 30' 5" (9.27 m) overall length
- 50" (1.27 m) wide track shoes – standard
- 60" (1.52 m) wide track shoes – optional

- 14 sealed (oil filled) track rollers per treadmember
- Sealed (oil filled) idler and drive planetaries
- Compact travel drives
- Hydraulic adjusting tracks
- Ladder assembly
- Lifting links

Travel and Steering – Each treadmember contains a pilot controlled, bi-directional, axial piston motor and a planetary gear reduction unit to provide positive control under all load conditions.

- Individual control provides smooth, precise maneuverability including full counter-rotation.
- Spring applied, hydraulically released disc type brake controlled automatically.
- Maximum travel speed is 0.7 mph. (1.6 km/h).
- Designed to 30% gradeability.

■ Lower Counterweight

The design consist of a counterweight that quickly hangs on each treadmember for increased 360 degree capacities.

- Two, 22,000 lbs. (9 979 kg) counterweight are for 50" (1.27 m) track shoes.
- Two, 18,500 lbs. (8 391 kg) counterweights are for 60" (1.52 m) track shoes.
- Capacity charts exist for 135,000 lbs (61 235 kg) of upper counterweight plus lower counterweights..

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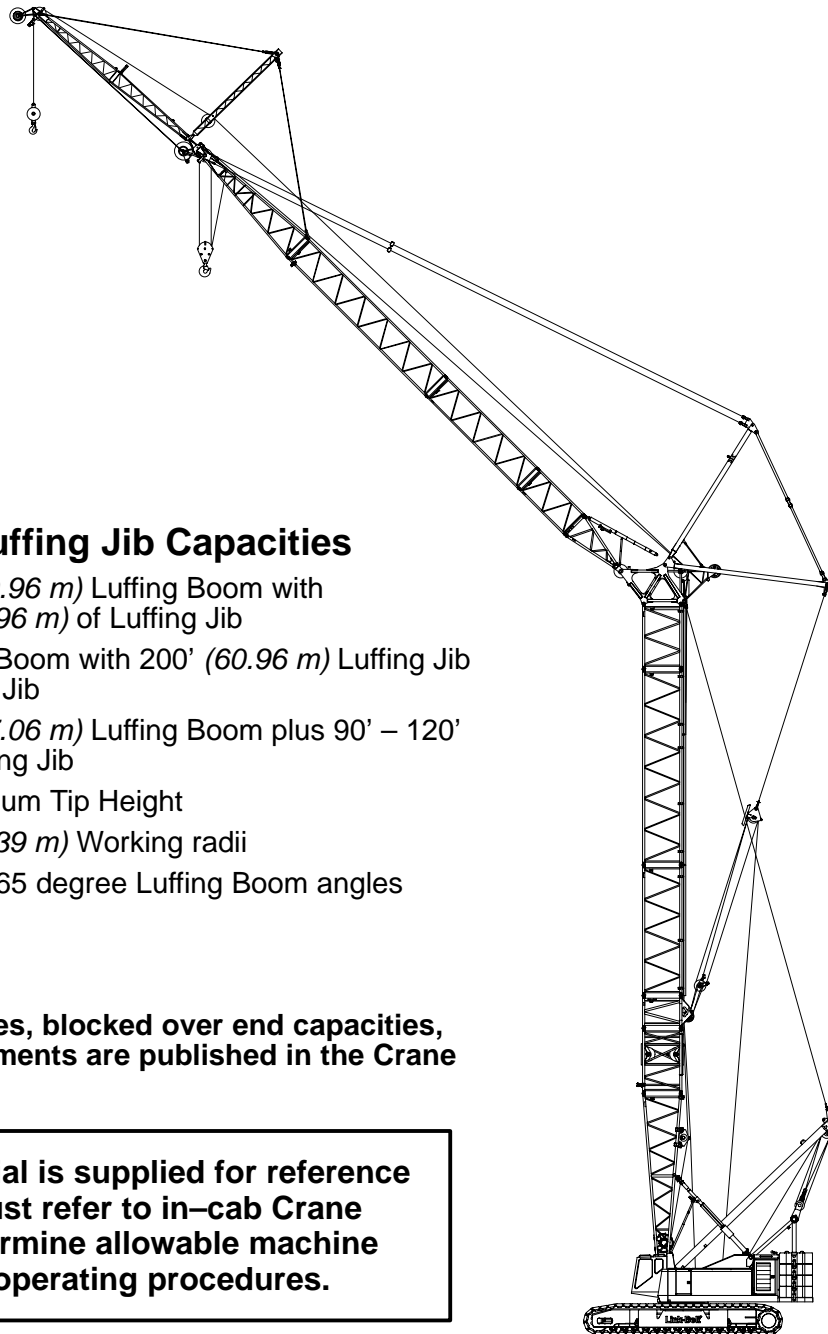
Lifting Capacities

Lattice Boom Crawler Crane with Luffing Attachment

LS-278H

52-ton (47.17 metric ton)

HYLAB Series



Luffing Boom and Luffing Jib Capacities

- 110' – 200' (33.53 – 60.96 m) Luffing Boom with 90' – 200' (27.43 – 60.96 m) of Luffing Jib
- 200' (60.96 m) Luffing Boom with 200' (60.96 m) Luffing Jib and 30' (9.14 m) Fixed Jib
- 110' – 220' (33.53 – 67.06 m) Luffing Boom plus 90' – 120' (27.43 – 36.58 m) Luffing Jib
- 432' (131.67 m) Maximum Tip Height
- 33' – 290' (10.06 – 88.39 m) Working radii
- 90, 85, 80, 75, 70 and 65 degree Luffing Boom angles
- 360 Degree Capacities
- Full Counterweight

Note: Over end capacities, blocked over end capacities, and lengths in 10' increments are published in the Crane Rating Manual.

CAUTION: This material is supplied for reference use only. Operator must refer to in-cab Crane Rating Manual to determine allowable machine lifting capacities and operating procedures.



WARNING

READ AND UNDERSTAND THE OPERATOR'S AND SAFETY MANUAL AND THE FOLLOWING INSTRUCTIONS AND CHART VALUES BEFORE OPERATING THE CRANE. OPERATION WHICH DOES NOT FOLLOW THESE INSTRUCTIONS MAY RESULT IN AN ACCIDENT.

OPERATING INSTRUCTIONS

GENERAL:

1. Rated lifting capacities in kips (1,000 pounds) as shown on lift charts pertain to this crane as originally manufactured and normally equipped. Modifications to the crane or use of optional equipment other than that specified can result in a reduction of capacity.
2. Construction equipment can be dangerous if improperly operated or maintained. Operation and maintenance of this crane must be in compliance with the information in the Operator's, Parts, and Safety Manuals supplied with this crane. If these manuals are missing, order replacements through the distributor.
3. The operator and other personnel associated with this crane shall read and fully understand the latest applicable American National Standards Institute (ANSI) safety standards for cranes.
4. All capacities listed in this book are in compliance with ASME/ANSI B30.5, SAE J987, and SAE J765 at date of manufacture.
4. The crane capacities marked with an asterisk (*) are based on structural strength. The crane capacities in the non-asterisked area are based on stability ratings.
5. For recommended reeving, parts of line, wire rope type, and wire rope inspection, see Wire Rope Capacity chart, Operator's Manual, and Parts Manual. Rated lifting capacities are based on correct reeving. Deduction must be made for excessive reeving. Any reeving over minimum required is considered excessive and must be accounted for when making lifts. Use Working Range Diagram to estimate the extra feet of wire rope included in reeving. Then consult Wire Rope Capacity chart to determine the weight per foot of wire rope type. Deduct this amount for each extra foot of wire rope before attempting to lift a load.
6. Load ratings in this Crane Rating Manual are based on freely suspended loads and make no allowances for such factors as the effect of the wind on load, ground conditions, and operating speeds. The operator shall therefore reduce load ratings in order to take these conditions into account. Refer to the Wind Speed Restrictions and Job Site Travel Restrictions for safe operation, travel, and storage of the attachment.

SET UP:

1. For all operating conditions, the crane must be leveled on a firm supporting surface that will adequately support the loadings without settling or collapsing.
7. Rated lifting capacities do not account for the effects of wind on a suspended load or boom. Lifting capacities should be considered acceptable for wind speeds less than 25 mph and appropriately reduced for wind speeds greater than 25 mph. Extreme caution should be used when lifting heavy loads or loads with large wind sail area under high wind conditions (over 25 mph). See Wind Restriction charts in this manual for appropriate capacity reductions.
8. The 35 ft luffing boom live mast must be used for all capacities shown in this Crane Rating Manual.
9. Retractable high gantry must be fixed in raised position for all capacities in this manual.
10. The 10' "JN" luffing boom extension must be pinned to the luffing boom cap for all luffing boom combinations.
11. The 10' Self Assembly Section must be pinned between the luffing boom base section and the 5' Bail Anchor Section for all luffing boom combinations.
12. The least stable rated condition is over the side with **unblocked** sprockets and idlers.
13. Refer to the enclosed charts for allowable attachment liftoff lengths and allowable working lengths at the various luffing boom angles.
14. Do not operate at radii or boom lengths where this Crane Rating Manual lists no capacity. Do not use longer booms or jibs than those listed in this Crane Rating Manual. Any of the above can cause a tipping condition or boom and jib failure.
15. When traveling with a load, refer to Job Site Travel With Load information and be sure to follow all of the guidelines listed in the Operator's Manual.



WARNING

For over end capacities and lift off of combinations with luffing boom lengths longer than 180', the idlers/sprockets must be blocked with a minimum of 1/2" steel plate.

2. Counterweights: All luffing attachment combinations require the Maximum Counterweight Combination (135K + LWR).
3. Refer to the Operator's Manual for instructions pertaining to assembly and raising and lowering of the attachment.
4. The fixed jib has only one length (30 ft) and only one offset with respect to the luffing jib (5 degrees).

LUFFING ATTACHMENT OPERATION:

1. Capacities shown in this publication are in kips (1,000 pounds) and are not more than 75% of the tipping loads with the crane standing level on a firm supporting surface. A deduction must be made from these capacities for weight of hook block, hook ball, sling, grapple, load weighing device, etc.
2. When lifting from the luffing jib with the fixed jib installed, or when lifting from the auxiliary sheaves with the luffing jib or fixed jib installed, reduce capacities by the values shown on the Capacity Deductions For Auxiliary Load Handling Equipment. See Operator's Manual for all limitations when raising or lowering the attachment.
3. Do not suspend more than one load at a time.

CAPACITY DEDUCTIONS FOR AUXILIARY LOAD HANDLING EQUIPMENT

Lifting From Luffing Jib With:	Weight (lb)
30 ft Fixed Jib Installed	2,700
15-ton hook ball on fixed jib (see hook ball for actual weight)	1,325
15-ton hook ball on auxiliary sheave (see hook ball for actual weight)	1,325
60-ton hook block on auxiliary sheave	1,700
Lifting From Fixed Jib With:	Weight (lb)
15-ton hook ball on fixed jib (see hook ball for actual weight)	1,325
15-ton hook ball on auxiliary sheave (see hook ball for actual weight)	1,325
60-ton hook block on auxiliary sheave	1,700

Lifting From Auxiliary Sheave With:	Weight (lb)
15-Ton Hook Ball on Fixed Jib	1,325
15-Ton Hook Ball on Luffing Jib	1,325
60-Ton Hook Block on Luffing Jib	1,700
Pendant Deflector (w/o Luffing Jib)	800
90' Luffing Jib	20,300
100' Luffing Jib	21,400
110' Luffing Jib	22,600
120' Luffing Jib	23,900
130' Luffing Jib	25,100
140' Luffing Jib	26,400
150' Luffing Jib	27,800
160' Luffing Jib	29,200
170' Luffing Jib	30,600
180' Luffing Jib	32,000
190' Luffing Jib	33,500
200' Luffing Jib	35,000
90' Luffing Jib + 30' Fixed Jib	22,900
100' Luffing Jib + 30' Fixed Jib	24,200
110' Luffing Jib + 30' Fixed Jib	25,500
120' Luffing Jib + 30' Fixed Jib	26,800
130' Luffing Jib + 30' Fixed Jib	28,200
140' Luffing Jib + 30' Fixed Jib	29,600
150' Luffing Jib + 30' Fixed Jib	31,100
160' Luffing Jib + 30' Fixed Jib	32,600
170' Luffing Jib + 30' Fixed Jib	34,100
180' Luffing Jib + 30' Fixed Jib	35,700
190' Luffing Jib + 30' Fixed Jib	37,300
200' Luffing Jib + 30' Fixed Jib	38,900

JOB SITE TRAVEL RESTRICTIONS WITH A LOAD

Guidelines:

- The travel surface must be firm and uniformly compacted. The travel surface must be capable of supporting the crane's ground bearing pressure under the exact crane configuration (including suspended load) being used.
- Maximum machine gradeability (fore and aft) = 5%
- Maximum machine list (side to side) = 1%
- Travel with the crane upper inline with the crawlers (straight over the end). Do not swing and travel at the same time. Do not hoist and travel at the same time. Operate all crane functions independently.
- Travel with the travel drive motors towards the rear.
- The machine's house lock must be engaged.
- Travel with load must not be done under adverse weather conditions, or conditions of poor visibility.
- The wind speed must be less than 10 MPH. The suspended load's wind sail area can greatly increase the wind loading. Therefore, the operator shall reduce the load ratings to account for this condition.
- Block and steer with the load suspended to turn the machine.

CAUTION

Avoid severe movements of the crane. Severe movements can side load or shock load the luffing attachment. Perform all crane functions smoothly and slowly.

- When traveling on a grade, position the counterweight up the grade and raise the luffing boom the corresponding angle (degrees) of the grade to be traveled.

Allowable Loads

- The luffing boom must be positioned at 80°, 75° or 70° only, with the machine sitting on a level surface.
- The luffing jib must be positioned between a 30° and 60° angle.
- The machine may be traveled with a load with any luffing boom attachment up to the maximum lengths listed below. There must be a rating listed on the 360 Degree capacity chart (Section 4) for the angles listed above. The luffing boom and luffing jib must be positioned at the proper angles listed in the capacity chart.

Luffing Boom Lengths	Luffing Jib Lengths
110' – 150'	90' – 150'

- Travel with up to 75% of the rated capacity is permitted.
- The load must be suspended from either the auxiliary sheaves or the luffing jib sheaves. Do not travel with a load suspended from the fixed jib.
- Refer to the Operator's Manual for more information.

Job site travel restrictions without a load:

- Travel with the luffing jib folded under and latched to the luffing boom is permitted only when the luffing boom is at a 75 degree luffing boom angle.
- Travel is prohibited at luffing boom angles greater than 85 degrees.
- If a luffing attachment combination has a capacity listed for a given radius and the luffing boom angle is less than 85 degrees, travel without load is permitted in that configuration.
- With the luffing boom set at 75°, travel without load is permitted at the negative value of any luffing jib angle that has a rated capacity on the 360° chart for a 75° luffing boom angle

WIND SPEED RESTRICTIONS

- Failure to follow these wind speed restrictions may result in structural failure of the luffing jib and/or luffing boom, which would cause property damage and/or bodily injury.
- The effects of the wind force on the hook load are the responsibility of the user and are not taken into account. When hoisting any load in windy conditions, the load wind area and load controllability must be considered for safe crane operation.
- Wind speed is to be determined at the luffing boom cap.

WIND SPEED CHART	
Luffing Boom Lengths: 110' – 160' Luffing Jib Only Lengths: 90' – 140' Luffing Jib + Fixed Jib Lengths: 90' + 30' – 110' + 30'	
DESCRIPTION	ALLOWABLE WIND SPEEDS IN M.P.H.
1. Normal Lifting Operation. (See Capacity Charts)	0–25
2. Reduced Operation. Capacities must be reduced by 50%.	26–40
3. No Operation. Store Attachment On Ground.	Over 40
4. Job Site Travel Without A Load.	0–15
5. Job Site Travel With A Load.	0–10

WIND SPEED RESTRICTIONS (continued)

Luffing Boom Lengths: 170' to 220' Luffing Jib Only Lengths: 150' to 200' Luffing Jib + Fixed Jib Lengths: 120' + 30' to 200' + 30'	
DESCRIPTION	ALLOWABLE WIND SPEEDS IN M.P.H.
1. Normal Lifting Operation. (See Capacity Charts)	0-25
2. No Operation. Store Attachment.*	26-40
3. No Operation. Store Attachment On Ground.	Over 40
4. Job Site Travel Charts Without A Load.	0-15
5. Job Site Travel With A Load.	0-10

*The attachment must be stored in one of the following positions:

1. Lay the luffing boom and luffing jib on the ground.
2. Tie off luffing boom tip to an immovable object. For details and information on the tie-off procedure, see the Operator's Manual.

ROLLED OUT LIFTOFF CAPABILITIES

Luffing Boom Length		Luffing Jib Length	
ft	meters	ft	meters
110	33.5	90-200	27.4-64.0
120	36.6	90-200	27.4-64.0
130	39.6	90-200	27.4-64.0
140	42.7	90-200	27.4-64.0
150	45.7	90-200	27.4-64.0
160	48.8	90-200	27.4-64.0
170	51.8	90-200	27.4-64.0
180	54.9	90-200	27.4-64.0
*190	57.9	90-200	27.4-64.0
*200	61.0	90-200	27.4-64.0
*210	64.0	90-180	27.4-54.9
*220	67.1	90-120	27.4-36.6

Luffing Jib + Fixed Jib Length	
ft	meters
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 200+30	27.4+9.1-64.0+9.1
90+30 - 150+30	27.4+9.1-45.7+9.1
90+30 - 110+30	27.4+9.1-33.5+9.1

ROLLED UNDER LIFTOFF CAPABILITIES

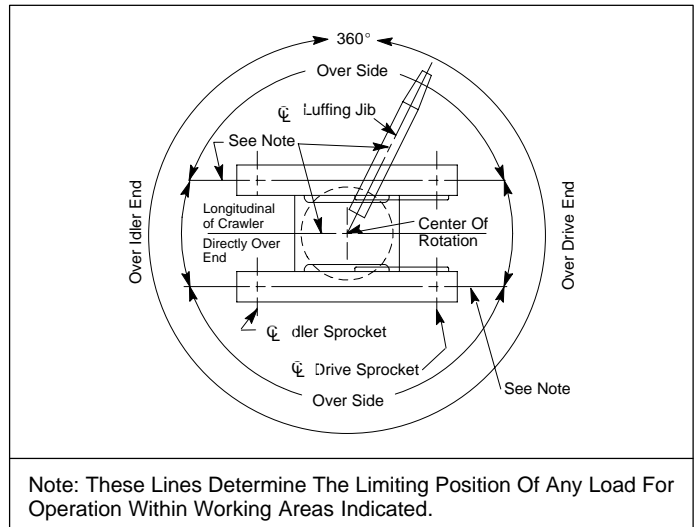
Luffing Boom Length		Luffing Jib Length	
ft	meters	ft	meters
110	33.5	90-100	27.4-30.5
120	36.6	90-110	27.4-33.5
130	39.6	90-120	27.4-36.6
140	42.7	90-130	27.4-39.6
150	45.7	90-140	27.4-42.7
160	48.8	90-150	27.4-45.7
170	51.8	90-160	27.4-48.8
180	54.9	90-170	27.4-51.8
*190	57.9	90-180	27.4-54.9
*200	61.0	90-190	27.4-57.9
*210	64.0	90-180	27.4-54.9
*220	67.1	90-120	27.4-36.6

WARNING

The luffing boom angle must be 75° when erecting or lowering the luffing jib. Crane damage can occur. See Operator's Manual for more information.

* Erection must be done over the end of the lower, with the idlers/sprockets blocked with a minimum of 1/2" steel plate. Counterweights "135K" (135,000) lbs. upper + "LWR" must be installed.

WORKING AREAS



WIRE ROPE CAPACITY

Parts of Line	1"			
	Type DB	Type CC	Type LB	Type RB
1	29,500	30,700	32,500	22,700
2	59,000	61,400	65,000	45,400
3	88,500	92,100	97,500	68,100
4	118,000	122,800	130,000	90,800
5	147,500	153,500	162,500	113,500
6	177,000	184,200	195,000	136,200
7	206,500	214,900	227,500	158,900
8	236,000	245,600	260,000	181,600
9	265,500	276,300	292,500	204,300
10	295,000	307,000	325,000	227,000
11	324,500	337,700	357,500	249,700
12	354,000	368,400	390,000	272,400
Weight (lb/ft)	1.85	2.03	1.85	2.00

Parts of Line	1-1/8"				
	Type DB	Type CC	Type LB	Type RB	Type DC
1	37,100	39,000	40,800	28,600	43,900
2	74,200	78,000	81,600	57,200	87,800
3	111,300	117,000	122,400	85,800	131,700
4	148,400	156,000	163,200	114,400	175,600
5	185,500	195,000	204,000	143,000	219,500
6	222,600	234,000	244,800	171,600	263,400
7	259,700	273,000	285,600	200,200	307,300
8	296,800	312,000	326,400	228,800	351,200
9	333,900	351,000	367,200	257,400	395,100
10	371,000	390,000	408,000	286,000	439,000
11	408,100	429,000	448,800	314,600	482,900
12	445,200	468,000	489,600	343,200	526,800
Weight (lb/ft)	2.34	2.58	2.34	2.50	2.36

LBCE Type	Description
CC	36 x 7 Classification Non-rotating – Extra Extra Improved Plow Steel Right LAY – Regular Lay – Compacted Strand
DB	6 x 26 (6 x 19 Class) – Warrington Seale – Extra Improved Plow Steel – Preformed – Right Lay – Regular Lay – I.W.R.C.
LB	6 x 25 (6 x 19 Class) Filler Wire – Preformed – I.W.R.C. – Right Lay – Regular Lay – Compact Strands
RB	19 x 19 Rotation Resistant– Extra Extra Improved Plow Steel – Preformed – Right Lay – Regular Lay. Swaged
DC	8 Strand Rope – Compacted Strand – Right Lay Regular Lay

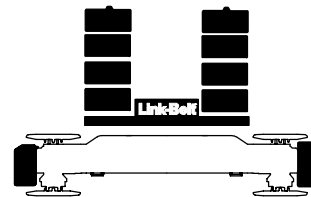
Notes:
 1. Capacities shown are in pounds and working loads must not exceed the ratings on the capacity charts in this Crane Rating Manual.
 2. Study Operator's Manual for wire rope inspection procedures.

AUXILIARY SHEAVES NOTES

- Capacities are for a LS-278H Crawler Crane with "135K" upper counterweight and "LWR" lower counterweight.
- Capacities are for working areas as described on the Working Areas Chart found in the General Information section of this Crane Rating Manual and are based on the crane sitting level on a firm supporting surface.
- Capacities are limited to an LBCE 68" x 80" tubular boom with a luffing boom top.
- Capacities are for luffing boom lengths between 110 feet and 210 feet.
- The least stable condition is over the side with **unblocked** idlers and sprockets.
- All capacities are in pounds and are not more than 75% of the tipping loads. Those capacities followed by an asterisk are governed by factors other than those which would cause a tipping condition.
- The appropriate deduction must be taken if any luffing jib or fixed jib components are installed. See the Capacity Deductions for Auxiliary Load Handling Equipment for more information.
- If the luffing jib is installed, the minimum luffing boom angle is 65 degrees. The maximum boom angle is 80 degrees when using the auxiliary sheaves.
- The luffing jib should be set to a 15 degree offset when using the auxiliary sheaves.
- See Operator's Manual for more information.

ALLOWABLE COUNTERWEIGHT COMBINATIONS

Counterweight combinations are in kips (1 kip = 1,000 lbs.)



135K+LWR
 135,000 lbs. Upper Counterweight
 Full Lower Counterweight

AUXILIARY LOWER COUNTERWEIGHT COMBINATION

Counterweight combinations are in kips (1 kip = 1,000 lbs.)



(front view)

Auxiliary Lower Counterweight components for Full LWR



(top view)

22 K (each)

**22,000 lbs. Auxiliary Lower Counterweight Assembly
 Required with 50" Open End Track Shoes**



(top view)

18.5 K (each)

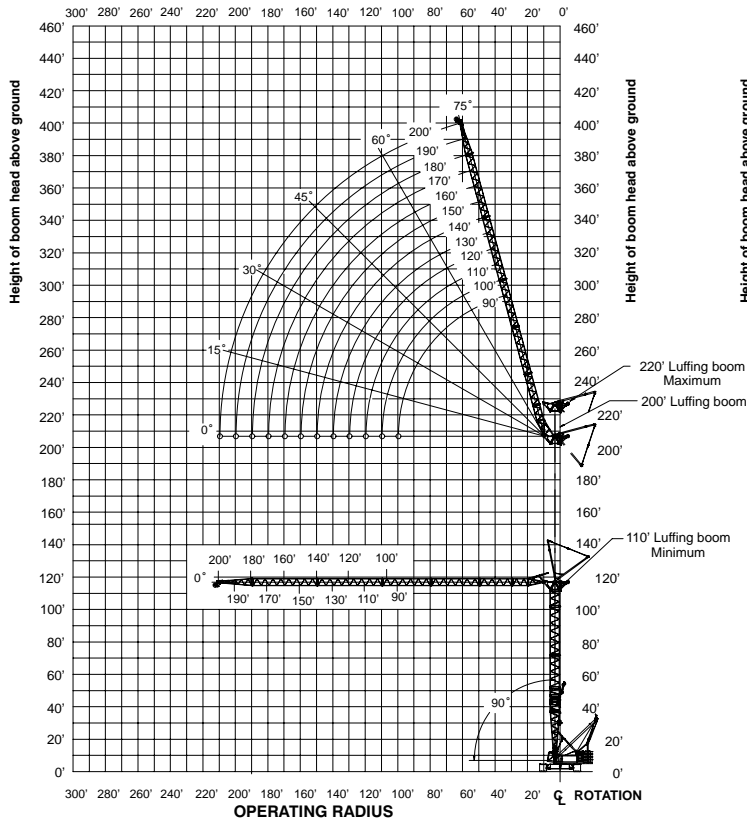
**18,500 lbs. Auxiliary Lower Counterweight Assembly
 Required with 60" Open End Track Shoes**

ROLLED UNDER LIFTOFF CAPABILITIES

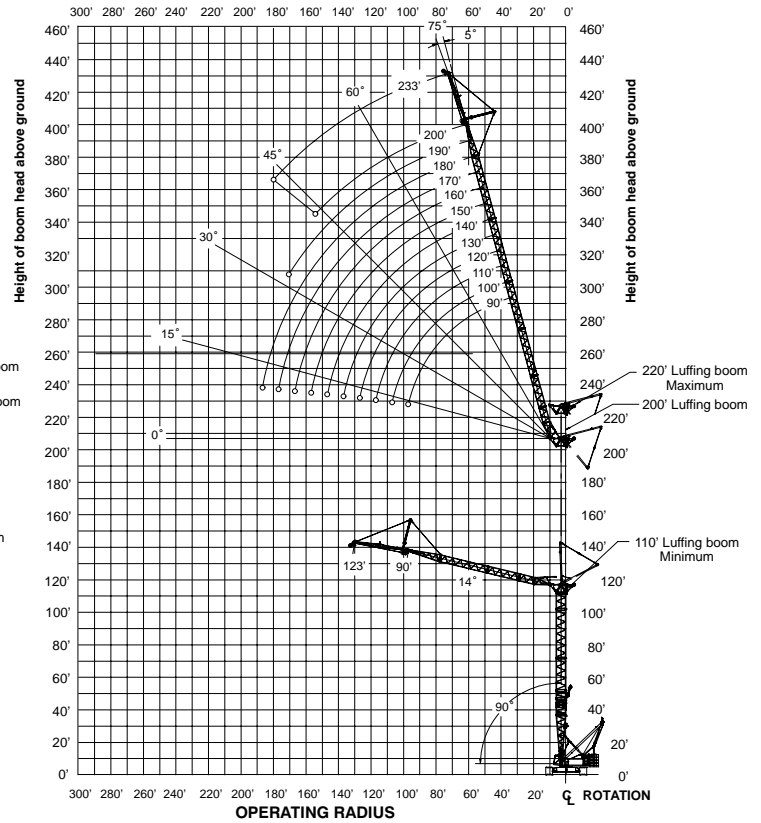
Component	Weight	
	lb	kg
1. 30' Luffing Boom Base Section (w/o 3rd Drum Assembly)	4,912	2 228
• 3rd Drum Assembly (w/o Rope)	2,857	1 296
• 3rd Fleeting Sheave Assembly	850	386
• 3rd Drum Rope (970' of 1" type "RB")	1,940	880
2. Luffing Boom Extensions (w/o Guide Rails and Pendants)		
• 10' Luffing Boom Extension Assembly	1,243	564
• 10' Luffing Boom Extension With Lifting Sheaves Assembly	3,251	1 475
• 10' Luffing Boom Extension With Heavy Side Lattice	1,273	577
• 20' Luffing Boom Extension Assembly	2,067	938
• 30' Luffing Boom Extension Assembly	2,892	1 312
• 40' Luffing Boom Extension Assembly	3,923	1 779
• 50' Luffing Boom Extension Assembly	4,807	2 180
3. Pendants		
• 1-1/4" Diameter X 10' Long, Type "N" (Each)	82	37
• 1-1/4" Diameter X 20' Long, Type "N" (Each)	109	49
• 1-1/4" Diameter X 30' Long, Type "N" (Each)	137	62
• 1-1/4" Diameter X 40' Long, Type "N" (Each)	164	74
• 1-1/4" Diameter X 50' Long, Type "N" (Each)	192	87
4. 5' Bail Anchor Extension	1,992	904
5. Luffing Jib Bail Assembly	1,122	509
6. Luffing Jib Bridle Assembly	788	357
7. Luffing Jib Bridle Guide Rails		
• 20' Rail (Each)	158	72
• Crossmember Support Assembly (Each)	68	31
• 20' Guide Rail Completely Assembled (Each)	520	236
8. 5' Luffing Boom Cap Assembly (w/o Pendant Deflector)	3,674	1 667
9. Pendant Deflector Assembly	782	355
10. Fan Post Assembly	5,553	2 519
11. 10' Luffing Jib Base Assembly (w/ Luffing Jib Backstops)	1,823	827
12. Luffing Jib Extensions		
• 10' Luffing Jib Extension Assembly	602	273
• 20' Luffing Jib Extension Assembly	1,022	464
• 30' Luffing Jib Extension Assembly	1,444	655
• 40' Luffing Jib Extension Assembly	1,864	846
13. 20' Luffing Jib Peak Assembly (w/ Nose Wheel)	3,786	1 717
14. 30' Fixed Jib Assembly (w/ Nose Wheel)	2,147	974
15. Upper Counterweights		
• Fabricated Base Upper Counterweight	31,000	14 062
• Cast Upper Counterweight (Each)	13,000	5 897
16. Auxiliary Lower Counterweights		
• 22K Assembly for 50" Open End Track Shoes (Each)	22,000	9 979
• 18.5K Assembly for 60" Open End Track Shoes (Each)	18,500	8 392
17. Side Frames		
• Side Frame with 60" Open End Track Shoes (Each)	56,860	25 792
• Side Frame with 50" Open End Track Shoes (Each)	62,800	28 486

WORKING RANGE DIAGRAMS

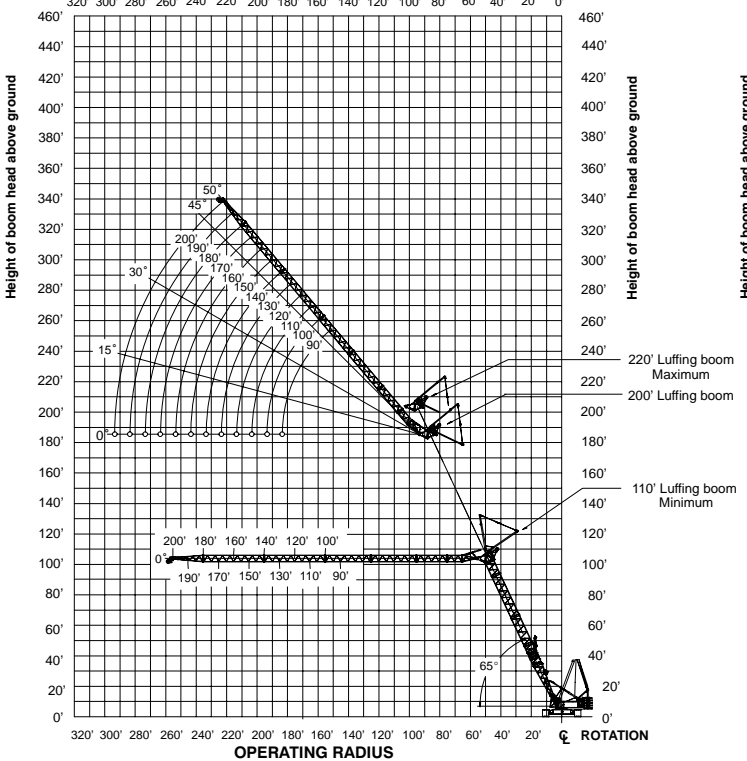
90° LUFFING BOOM ANGLE – 360° LUFFING JIB



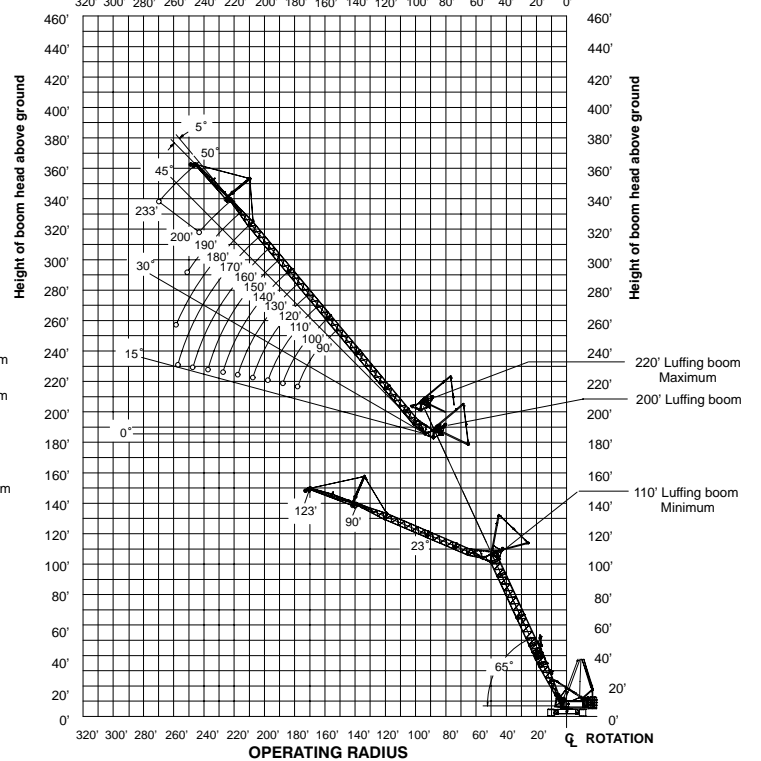
90° LUFFING BOOM ANGLE – 360° LUFFING JIB + FIXED JIB



65° LUFFING BOOM ANGLE – 360° LUFFING JIB



65° LUFFING BOOM ANGLE – 360° LUFFING JIB + FIXED JIB



Notes:

1. Boom and jib geometry shown are for unloaded condition and crane standing level on firm supporting surface. Boom deflection, subsequent radius, and boom angle change must be accounted for when applying load to hook.
2. Maximum and minimum luffing jib angles are equal to the values listed in the Capacity Chart for each boom length.
3. Refer to the Capacity Charts for allowable luffing boom, luffing jib, and fixed jib combinations.

LS-278H 360 Degree Capacities - Luffing Boom + Luffing Jib
68" x 80" Luffing Boom, 50" x 60" Luffing Jib, 135K + LWR Counterweight

Luffing Boom Length (ft)	Luffing Jib Length (ft)	Load Radius (ft)	Luffing Boom Angle																	
			90 Degrees			85 Degrees			80 Degrees			75 Degrees			70 Degrees			65 Degrees		
			Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)
110	90	33	75.0	203.9	104.0	*														
110	90	35	73.5	203.3	100.6	*														
110	90	40	70.2	201.7	93.7	*														
110	90	50	63.3	197.4	80.4	*	70.0	200.6	92.8	*										
110	90	60	55.9	191.5	69.0	*	62.9	196.2	79.3	*										
110	90	66									65.0	195.8	81.0							
110	90	70	47.8	183.6	61.0	*	55.5	190.2	71.4	*	62.5	194.1	76.0							
110	90	80	38.4	172.9	55.8	*	47.4	182.3	63.2	*	55.1	188.0	64.3							
110	90	83									60.0	189.6	59.2							
110	90	90	26.6	157.2	54.2	*	38.0	171.4	56.8	*	46.9	179.9	55.6	54.5	184.9	53.3				
110	90	98												55.0	181.9	45.8				
110	90	100	0.0	117.0	31.0	*	25.9	155.4	50.7		37.4	168.9	48.8	46.2	176.6	46.8				
110	90	109					0.0	116.0	35.2	*										
110	90	110									25.1	152.4	43.3	36.6	165.3	41.6	45.3	172.2	40.1	
110	90	113															50.0	173.0	37.1	
110	90	118									0.0	114.2	39.3	*						
110	90	120									24.0	148.2	37.5	35.5	160.5	36.0	44.1	166.7	34.5	
110	90	128									0.0	111.6	34.5							
110	90	130												22.3	142.4	32.5	34.0	154.4	31.2	
110	90	137												0.0	108.2	30.3				
110	90	140															19.9	134.7	28.3	
110	90	145															0.0	104.0	26.8	
110	110	38	75.0	223.3	89.2	*														
110	110	40	73.9	222.7	86.8	*														
110	110	50	68.4	219.3	74.5	*														
110	110	57					70.0	219.4	77.0	*										
110	110	60	62.7	214.7	63.9	*	68.2	218.1	73.9	*										
110	110	70	56.6	208.9	55.0	*	62.4	213.5	65.7	*										
110	110	75									65.0	213.9	68.9	*						
110	110	80	50.1	201.4	48.3	*	56.4	207.6	58.7	*	62.1	211.4	63.7							
110	110	90	43.0	192.0	43.5	*	49.8	200.1	50.9	*	56.0	205.4	55.0							
110	110	93									60.0	206.9	50.7							
110	110	100	34.6	179.5	40.1	*	42.6	190.5	45.1	*	49.5	197.8	48.2	55.5	202.3	46.2				
110	110	110	24.0	161.7	39.5	*	34.2	177.9	40.7	*	42.2	188.1	42.8	48.9	194.6	41.0	55.0	198.3	39.6	
110	110	120	0.0	117.0	24.8	*	23.4	159.8	39.0	*	33.7	175.3	38.7	41.6	184.7	37.0	48.2	190.3	35.4	
110	110	126															50.0	188.3	31.8	
110	110	129					0.0	116.1	28.1	*										
110	110	130									22.7	156.6	34.9	33.0	171.5	33.5	40.8	180.1	32.0	
110	110	138									0.0	114.2	31.5	*						
110	110	140												21.6	152.2	30.4	32.0	166.5	29.1	
110	110	148									0.0	111.6	28.3							
110	110	150												20.2	146.1	26.6	30.7	160.1	25.4	
110	110	157												0.0	108.2	25.0				
110	110	160															18.0	138.0	23.3	
110	110	165															0.0	104.0	22.2	
110	130	43	75.0	242.6	74.9	*														
110	130	50	71.8	240.5	68.8	*														
110	130	60	67.1	236.8	60.8	*														
110	130	64					70.0	238.2	65.6	*										
110	130	70	62.3	232.1	51.2	*	66.9	235.6	61.0	*										
110	130	80	57.2	226.2	44.1	*	62.0	230.9	54.9	*										
110	130	83									65.0	232.0	58.4	*						
110	130	90	51.7	219.1	38.1	*	56.9	225.0	47.9	*	61.8	228.8	54.4							
110	130	100	45.9	210.3	34.2	*	51.5	217.8	41.4	*	56.6	222.8	47.6							
110	130	103									60.0	224.2	44.0							
110	130	110	39.4	199.5	31.3	*	45.6	208.9	36.0	*	51.2	215.5	42.2	56.2	219.7	40.7				
110	130	120	31.8	185.5	29.5	*	39.1	198.0	32.5	*	45.3	206.6	37.9	50.8	212.3	36.5				
110	130	121												55.0	214.7	34.3				
110	130	130	22.0	165.8	29.1	*	31.4	183.8	30.0	*	38.7	195.5	33.5	44.8	203.2	32.9	50.2	208.0	31.4	
110	130	139															50.0	203.6	27.4	
110	130	140	0.0	117.0	19.9	*	21.5	163.7	28.6	*	30.9	181.1	29.9	38.1	191.9	29.9	44.2	198.8	28.5	
110	130	149					0.0	116.1	22.7	*							49.4	202.7	27.1	
110	130	150									20.8	160.5	27.1	30.3	177.2	27.3	37.4	187.2	26.0	
110	130	158									0.0	114.2	25.6	*			43.3	193.2	24.8	
110	130	160												19.9	155.8	25.1	29.4	172.0	23.9	
110	130	168									0.0	111.6	23.5				36.4	181.2	22.7	
110	130	170															18.5	149.5	22.0	
110	130	177												0.0	108.2	20.8	28.2	165.4	20.9	
110	130	180															16.6	141.1	19.3	
110	130	185															0.0	104.1	18.5	
110	150	48	75.0	261.9	61.7	*														
110	150	50	74.3	261.4	60.9	*														
110	150	60	70.3	258.2	56.2	*														
110	150	70	66.2	254.3	48.4	*	70.0	257.0	55.7	*										
110	150	80	62.0	249.4	40.1	*	66.0	253.1	50.6	*										
110	150	90	57.5	243.6	34.9	*	61.8	248.2	46.0	*										
110	150	92			34.1	*					65.0	250.2	49.5	*						
110	150	100	52.9	236.6	30.7	*	57.3	242.3	38.2	*	61.5	246.1	45.9	*						
110	150	110	47.9	228.4	27.4	*	52.7	235.3	33.3	*	57.1	240.2	41.6							
110	150	113									60.0	241.5	38.9							
110	150	120	42.6	218.4	24.8	*	47.7	227.0	29.4	*	52.4	233.1	36.4	*	56.7	237.1	35.9			

**LS-278H 360 Degree Capacities - Luffing Boom + Luffing Jib
68" x 80" Luffing Boom, 50" x 60" Luffing Jib, 135K + LWR Counterweight**

Luffing Boom Length (ft)	Luffing Jib Length (ft)	Load Radius (ft)	Luffing Boom Angle																	
			90 Degrees			85 Degrees			80 Degrees			75 Degrees			70 Degrees			65 Degrees		
			Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)
150	190	169																		
150	190	170	32.4	258.7	9.7	*	39.1	275.7	13.9	*	44.9	287.8	18.2	*	50.1	296.0	20.1			
150	190	180	26.2	240.8	8.6	*	34.0	262.2	12.3	*	40.5	276.9	15.3	*	46.0	287.0	18.5			
150	190	190	18.2	216.3	7.7	*	28.2	245.7	10.7	*	35.6	264.1	12.8	*	41.7	276.6	16.8			
150	190	194																		
150	190	200	0.0	157.0	7.7	*	20.9	223.8	9.3	*	30.0	248.6	10.9	*	36.9	264.4	13.7		50.0 285.8 13.4	
150	190	210					9.4	186.9	8.2	*	23.3	228.7	9.4	*	31.6	249.7	11.3		47.8 281.0 12.8	
150	190	212					0.0	155.9	7.6	*									43.6 271.2 11.8	
150	190	220									13.8	198.8	8.2	*	25.2	231.2	9.4		39.0 259.8 10.9	
150	190	226									0.0	153.7	7.1	*						
150	190	230												16.8	205.2	7.9	*	26.8	231.5 9.8	
150	190	238												0.0	150.3	6.7	*		33.9 246.2 10.1	
150	190	240																19.1	207.8 7.9	
150	190	250																3.8	158.4 6.3	
150	190	260																	20.7 207.5 8.2	
150	190	262																	8.9 169.7 6.2	
																			0.0 140.3 5.6	
150	200	61	75.0	350.2	27.8	*														
150	200	70	72.4	347.6	26.3	*														
150	200	80	69.4	344.2	24.3	*														
150	200	90	66.3	340.1	22.3	*														
150	200	91					70.0	343.8	28.8	*										
150	200	100	63.1	335.4	20.3	*	67.2	340.3	27.1	*										
150	200	110	59.8	329.9	18.3	*	64.1	335.7	25.2	*										
150	200	120	56.5	323.7	16.4	*	60.8	330.5	23.2	*	65.0	334.9	26.3	*						
150	200	130	53.0	316.6	14.6	*	57.5	324.6	21.1	*	61.8	329.9	24.7	*						
150	200	140	49.3	308.6	12.9	*	54.0	317.8	19.0	*	58.5	324.1	23.3	*						
150	200	148												60.0	323.5	23.9	*			
150	200	150	45.4	299.3	11.4	*	50.4	310.0	17.0	*	55.1	317.6	21.9	*	59.4	322.3	23.6	*		
150	200	160	41.2	288.7	10.0	*	46.6	301.2	15.0	*	51.5	310.1	20.6	*	56.0	316.0	21.6	*		
150	200	170	36.6	276.3	8.8	*	42.5	291.0	13.0	*	47.7	301.6	17.8	*	52.4	308.8	19.8	*		
150	200	175																55.0	309.6 17.2	
150	200	180	31.5	261.5	7.7	*	38.1	279.2	11.4	*	43.7	291.8	14.9	*	48.7	300.6	18.2		53.3 306.1 16.5	
150	200	190	25.5	243.1	6.9	*	33.1	265.2	10.0	*	39.4	280.6	12.4	*	44.8	291.2	16.7		49.6 298.1 15.2	
150	200	200	17.7	217.9	6.2	*	27.5	248.1	8.8	*	34.6	267.3	10.4	*	40.6	280.4	13.7	*	45.7 289.0 14.0	
150	200	201																	50.0 293.5 12.4	
150	200	210	0.0	157.0	5.7	*	20.4	225.6	7.6	*	29.2	251.3	8.8	*	36.0	267.7	11.2	*	41.6 278.6 12.9	
150	200	220					9.2	187.7	6.7	*	22.7	230.7	7.5	*	30.7	252.5	9.2	*	37.1 266.3 11.9	
150	200	222					0.0	155.9	6.0	*										
150	200	230									13.4	200.0	6.6	*	24.6	233.4	7.6	*	32.0 251.8 9.9	
150	200	236									0.0	153.7	5.7	*					38.0 263.3 9.8	
150	200	240												16.4	206.6	6.3	*	26.1	233.8 7.9	
150	200	248												0.0	150.3	5.4	*		33.0 249.2 9.0	
150	200	250																18.6	209.5 6.3	
150	200	260																3.7	158.8 5.0	
150	200	270																	20.2 209.3 6.6	
150	200	272																	8.7 170.5 4.9	
																			0.0 140.3 4.4	
170	90	33	75.0	263.9	89.2	*														
170	90	35	73.5	263.3	87.4	*														
170	90	40	70.2	261.7	83.3	*														
170	90	50	63.3	257.4	73.7	*														
170	90	55					70.0	260.4	80.4	*										
170	90	60	55.9	251.5	65.9	*	66.6	258.4	76.1	*										
170	90	70	47.8	243.6	56.1	*	59.5	253.3	68.3	*										
170	90	77									65.0	254.9	64.6							
170	90	80	38.4	232.9	47.9	*	51.8	246.5	61.7	*	62.8	253.4	61.5							
170	90	90	26.6	217.2	41.2	*	43.1	237.3	56.0	*	55.4	247.4	53.1							
170	90	98																		
170	90	100	0.0	177.0	34.3	*	32.7	224.5	48.1	*	47.3	239.4	46.6		60.0	247.5	44.2			
170	90	110					17.8	203.3	40.8	*	37.8	228.5	41.3		58.7	246.5	43.2			
170	90	114					0.0	175.8	37.2	*					50.9	239.4	38.8			
170	90	119																		
170	90	120									25.7	212.4	37.4		55.0	238.3	32.5			
170	90	129									0.0	173.3	34.0		54.1	237.5	32.1			
170	90	130																		
170	90	139																		
170	90	140																		
170	90	143																		
170	90	150																		
170	90	157																		
170	90	160																		
170	90	170																		
170	90	171																		
170	110	38	75.0	283.3	76.6	*														
170	110	40	73.9	282.7	74.9	*														
170	110	50	68.4	279.3	66.8	*														
170	110	60	62.7	274.7	58.5	*														
170	110	62					70.0	279.2	68.7	*										
170	110	70	56.6	268.9	50.7	*	65.4	275.9	63.3	*										
170	110	80	50.1	261.4	43.7	*	59.6	270.7	57.1	*										
170	110	85																		
170	110	90	43.0	252.0	38.1	*	53.3	264.0	52.2	*	65.0	273.0	56.0							
											62.3	270.7	52.4							

LS-278H 360 Degree Capacities - Luffing Boom + Luffing Jib
68" x 80" Luffing Boom, 50" x 60" Luffing Jib, 135K + LWR Counterweight

Luffing Boom Length (ft)	Luffing Jib Length (ft)	Load Radius (ft)	Luffing Boom Angle																	
			90 Degrees			85 Degrees			80 Degrees			75 Degrees			70 Degrees			65 Degrees		
			Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)
220	120	140				21.9	270.3	19.7 *	39.7	299.1	28.4	52.1	312.5	25.1						
220	120	149				0.0	225.6	17.8 *												
220	120	150							31.4	285.1	25.0 *	45.7	303.8	22.8						
220	120	153													55.0	309.9	19.2			
220	120	160							20.5	264.6	21.3 *	38.6	292.7	20.9	50.9	304.7	18.1			
220	120	168							0.0	222.6	16.3 *									
220	120	170										30.1	278.1	19.2	44.5	295.6	16.6			
220	120	179																50.0	295.6	12.9
220	120	180										18.5	256.0	17.7	37.2	284.0	15.3	49.4	294.8	12.8
220	120	186										0.0	217.9	13.7 *						
220	120	190													28.3	268.5	14.1	42.8	285.2	11.8
220	120	200													15.5	243.6	13.0	35.2	272.8	10.9
220	120	204													0.0	211.6	11.3 *			
220	120	210																25.7	255.8	10.0
220	120	220																10.2	224.9	9.2
220	120	222																0.0	203.7	9.0

LS-278H 360 Degree Capacities - Luffing Boom (200 ft.) + Luffing Jib (200 ft.) + Fixed Jib (30 ft.)
68" x 80" Luffing Boom, 50" x 60" Luffing Jib, 24" x 32" Fixed Jib, 135K + LWR Counterweight

Luffing Boom Length (ft)	Luffing & Fixed Jib Lengths (ft)	Load Radius (ft)	Luffing Boom Angle																	
			90 Degrees			85 Degrees			80 Degrees			75 Degrees			70 Degrees			65 Degrees		
			Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)	Jib Angle (deg)	Tip Height (ft)	Capacity (kips)
200	200+30	72	75.0	431.7	12.8 *															
200	200+30	80	73.1	429.4	12.2 *															
200	200+30	90	70.5	426.0	11.1 *															
200	200+30	100	67.8	422.0	10.1 *															
200	200+30	109				70.0	424.0	14.8 *												
200	200+30	110	65.1	417.5	9.0 *	69.8	423.7	14.8 *												
200	200+30	120	62.4	412.5	7.9 *	67.1	419.6	13.7 *												
200	200+30	130	59.5	406.8	6.8 *	64.4	415.0	12.6 *												
200	200+30	140	56.6	400.4	5.8 *	61.6	409.7	11.4 *												
200	200+30	145							65.0	413.2	16.2 *									
200	200+30	150	53.6	393.2	4.9 *	58.8	403.9	10.2 *	63.7	410.8	15.7 *									
200	200+30	160	50.5	385.3	4.0 *	55.9	397.3	8.9 *	60.9	405.4	14.5 *									
200	200+30	170	47.2	376.3	3.2 *	52.8	389.9	7.8 *	58.0	399.3	13.2 *									
200	200+30	180	43.7	366.2	2.5 *	49.6	381.7	6.7 *	55.0	392.5	11.9 *	60.0	399.3	14.7 *						
200	200+30	190				46.3	372.5	5.6 *	51.9	384.9	10.6 *	57.1	393.0	13.1						
200	200+30	200				42.7	362.1	4.7 *	48.7	376.4	9.3 *	54.1	385.9	12.0						
200	200+30	210				38.9	350.3	3.8 *	45.3	366.9	8.1 *	51.0	378.1	10.9						
200	200+30	214													55.0	382.4	8.4			
200	200+30	220				34.8	336.6	3.1 *	41.7	356.2	6.9 *	47.7	369.3	10.0	53.0	377.5	7.9			
200	200+30	230							37.8	343.9	4.9 *	44.2	359.4	8.6 *	49.8	369.3	7.1			
200	200+30	240							33.5	329.6	3.1 *	40.6	348.2	6.5 *	46.5	360.2	6.4			
200	200+30	245																50.0	362.6	3.6 *
200	200+30	250										36.6	335.4	4.6 *	43.0	349.9	5.6 *	48.5	358.5	3.3 *
200	200+30	260										32.1	320.4	2.8 *	39.2	338.1	4.9 *	45.1	348.9	2.7 *
200	200+30	270													35.0	324.6	4.2 *	41.5	338.1	2.1 *
200	200+30	280													30.4	308.7	2.5 *			

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