Manitowoc Cranes, Inc.
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Luffing Jib Assemble-In-Air Raising Procedure

999 SERIES 3

Luffing Jib No. 149 On Boom No. 82
Fixed Jib No. 134 On Luffing Jib 149 On Boom No. 82

Recommended boom and luffing jib assemble-in-air raising and lowering procedure using jack-knife method

999 SERIES 3 equipped with 219,600 Lb. (99 610 kg) crane counterweight, 80,000 Lb. (36 290 kg) carbody counterweight and 5 Ft. (1 524 mm) raising outrigger requires assemble-in-air when raising and lowering boom, luffing jib and fixed jib combinations shown in tables.

Warning: User must exercise extreme caution when raising and lowering these boom and luffing jib combinations because their length requires assemble/disassemble-in-air of luffing jib with assembly crane. During raising and lowering boom and luffing jib combinations, it is very important to follow instructions carefully. A successful operation depends entirely on personnel and equipment performing the task. Danger tag **No. A01531** shall be mounted in crane cab in clear view of operator, warning that boom and luffing jib combinations may not be raised or lowered without assembly crane.

Boom and luffing jib are assembled in layout, end to end, position. Boom and luffing jib must be over side of 5 Ft. (1 524 mm) raising outrigger fully set prior to raising boom and luffing jib.

***Caution*:** Anytime luffing jib point rollers are in contact with ground during raising or lowering procedure, disengage swing lock and release swing brake.

Preparation:

Refer to fixed jib assembly **No. 196404**, luffing jib rigging assembly **No. A01426** and **No. A01031** for proper make-up of inserts, straps, pendants and miscellaneous parts, etc.

1. Desired length of boom assembled to crane and resting on blocking at ground level.
2. Lower boom point must be removed.
3. Partial jib length assembled to boom top.
4. Position jib strut to rest on jib butt.
5. Slide round bar through right end upper pin connectors of jib insert and strap links.
6. Connect rollers to end of insert.
7. Tie hoist line off at end of insert maintaining slack (keep hoist line on top of insert).
8. Jib stop strut must be retracted with boom on blocking.
9. Attach assembly crane lifting slings at location shown in TABLE 1.
10. Assembly crane should operate at approximately 70 - 80 degree boom angle. Recommended assembly crane boom lengths may vary depending on type and placement of crane and skill of operator.
11. To raise or lower boom and luffing jib, assembly crane should be in a level position on a firm uniformly supporting surface with crawlers parallel to boom and luffing jib.
12. Assembly crane upperworks should face in direction of 999 SERIES 3 boom.
13. Assembly crane should hoist and crawl simultaneously in order to keep hoist line vertical.
14. Check to insure jib straps/links are in brackets.
15. Attach fixed jib backstay pendants to luffing jib insert and place on top of insert (if fixed jib is used).

TABLE 1

Attachment Location of Assembly Crane from Right End of Jib Insert - Feet (Meters)							
Boom Length Feet (Meters)	Partial Luffing Jib Length (Less 25 Ft. [7.6m] Jib Top) - Feet (Meters)						
	85 (25.9)	95 (29.0)	105 (32.0)	115 (35.1)	125 (38.1)	135 (41.1)	145 (44.2)
200 (61.0)	—	—	—	**N/A**	**N/A**	**N/A**	**N/A**
210 (64.0)	**N/A**	**N/A**	40 (12.2)	40 (12.2)	40 (12.2)	40 (12.2)	40 (12.2)
220 (67.1)	40 (12.2)	40 (12.2)	40 (12.2)	40 (12.2)	40 (12.2)	60 (18.3)	60 (18.3)
230 (70.1)	**Not Allowed**	**Not Allowed**	**Not Allowed**	**Not Allowed**	60 (18.3)	80 (24.4)	80 (24.4)

N/A = Not Applicable (assembly crane not required for this combination).

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Fixed Jib No. 134 On Luffing Jib 149 On Boom No. 82

Assemble-In-Air — Raising

Step 1: Raise Jib

Caution: Assembly crane must not induce any side load on luffing jib.

1. Luff up jib strut to approximately 30 degrees (jib straps just off of rearward brackets).
2. Raise partial jib section (85 - 145 Ft. [25.9 - 44.2m]) with assembly crane approximately 1-2 Ft. (305 - 610 mm) off ground (maintain slack in jib stop pendants).

Step 2: Raise Boom

***Danger*:** Rollers must not touch ground during this operation (maintain at least 1-2 Ft. [305 - 610 mm] of ground clearance).

1. Slowly raise boom until jib stop strut is just clear of ground.
2. Attach luffing jib stop pendants and unpin luffing jib stop inner strut from retracted position.
3. Slowly raise boom until luffing jib stop is fully extended and pins engaged (approximately 168 degree boom to luffing jib angle).
4. Boom up to angle shown in TABLE 2 while maintaining 1-2 Ft. (305 - 610 mm) clearance between jib insert rollers and ground.
5. Tension should be applied to luffing jib hoist to keep luffing jib strut off luffing jib during boom raising.
6. After reaching boom angle shown in TABLE 2, lower jib inserts with assembly crane until rollers contact ground.

Step 3: Attach Jib Top

1. Remove assembly crane lifting slings from insert and attach four way hook-up to jib top.
2. Remove round bar from straps (***Warning:*** Do not stand in front of straps). Flip links back (do not contact lacing).
3. Attach jib top and insert retaining pins to FACT connectors.
4. Connect strap links to jib top straps. (May need to luff up and/or use pry bar to position straps to connect links.)
5. Slide hoist line on top of jib top and anchor at end.
6. Attach assembly crane lifting slings under FACT connectors at end of insert adjacent to jib top (make sure slings do not interfere with connectors).
7. Remove rollers from jib insert. (Hoist with assembly crane to remove rollers.)
8. Attach electric luffing jib cable to jib top junction box.
9. Attach jib stop cable from winch to cable in jib butt.
10. Raise luffing jib with assembly crane approximately 1 Ft. (305 mm) off ground and insert lower connector pins.
11. Luff up to center strap links between brackets.
12. Lower jib until rollers contact ground.
13. Remove assembly crane slings from insert.

Step 4A: Raise Boom and Luffing Jib Without Fixed Jib

1. Machine is now ready to raise boom and luffing jib to operating position.
2. Boom up until boom to luffing jib angle reaches value specified in TABLE 3 or luffing jib hangs vertical, whichever occurs first.
3. Tighten luffing jib suspension with luffing jib hoist.
4. Boom and luffing jib are then raised together using boom hoist until boom reaches 85 degrees.
5. Luffing jib radius must be within capacity chart before raising outriggers or swinging over end of machine.
6. Boom may then be adjusted to desired operating angle.

Step 4B: Raise Boom, Luffing Jib With Fixed Jib Attached Before Luffing Jib Lift-Off

1. Machine is now ready to raise boom and luffing jib to operating position.
2. Boom up until boom to luffing jib angle reaches value specified in TABLE 4.
3. Tighten luffing jib suspension with luffing jib hoist.
4. Attach fully assembled fixed jib to luffing jib.

Caution: Do not under any condition allow fixed jib butt to luffing jib top angle become less than 95 degrees.

5. Attach fixed jib backstays to fixed jib strut.
6. Attach fixed jib stop to luffing jib top in fold back position (raising).
7. Boom and luffing jib are raised together using boom hoist while fixed jib point roller rolls on ground.
8. Continue raising until fixed jib suspension tightens.
9. Insert pin through jib stop link and luffing jib top.
10. Boom, luffing jib and fixed jib are then raised together using boom hoist until boom reaches 85 degrees.
11. Fixed jib radius must be within capacity chart before raising outriggers or swinging over end of machine.
12. Boom may then be adjusted to desired operating angle.

Luffing Jib Assemble-In-Air Raising Procedure

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Fixed Jib No. 134 On Luffing Jib 149 On Boom No. 82

TABLE 2

Maximum Boom and PARTIAL Luffing Jib Lengths Lifted With Assembly Crane Over Side of 5 Ft. (1 524 mm) Raising Outrigger								
Boom Length Feet (Meters)	Partial Luffing Jib Length (Less 25 Ft. [7.6m] Jib Top) - Feet (Meters)							Recommended Assemble Crane Boom Length Feet (Meters)
	85 (25.9)	95 (29.0)	105 (32.0)	115 (35.1)	125 (38.1)	135 (41.1)	145 (44.2)	
	Minimum Boom Angle Boom Must Be Raised To While Partial Jib is Suspended Off Ground With Assembly Crane - Degrees							
200 (61.0)	—	—	—	2	2	2	4	—
210 (64.0)	4	4	6	8	8	8	12	80 (24.4)
220 (67.1)	10	12	12	14	14	14	16	90 (27.4)
230 (70.1)	**Not Allowed**	**Not Allowed**	**Not Allowed**	**Not Allowed**	18	20	20	100 (30.1)
Recommended capacity of assembly crane is 25,000 Lbs.								

TABLE 3

Maximum Boom and FULL Luffing Jib Lengths Lifted Unassisted Over Side of 5 Ft. (1 524 mm) Raising Outrigger from Minimum Boom Angle to 85 Degrees								
Boom Length Feet (Meters)	Luffing Jib Length (includes 25 Ft. [7.6m] Jib Top) - Feet (Meters)							Boom To Luffing Jib Angle Degrees
	110 (33.5)	120 (33.6)	130 (39.6)	140 (42.7)	150 (45.7)	160 (48.8)	170 (51.8)	
	Minimum Boom Angle Boom Must Not Go Below - Degrees							
*200 (61.0)	—	—	—	2	2	2	4	60
210 (64.0)	4	4	6	8	8	8	12	60
220 (67.1)	10	12	12	14	14	14	16	60
230 (70.1)	**Not Allowed**	**Not Allowed**	**Not Allowed**	**Not Allowed**	18	20	20	60
Load blocks, hook and weight ball on ground until boom and luffing jib are erected. * 200 Ft. (61.0m) boom length with 140 - 170 Ft. (42.7 - 51.8m) luffing jib with intermediate fall may be raised and lowered over end of blocked crawlers (5 Ft. [1 524 mm] raising outrigger not required).								

TABLE 4

Maximum Boom, FULL Luffing Jib and Fixed Jib Lengths Lifted Unassisted Over Side of 5 Ft. (1 524 mm) Raising Outrigger from TABLE 3 Angle to 85 Degrees			
Boom Length Feet (Meters)	Luffing Jib No. 149 Feet (Meters)	Fixed Jib No. 134 Feet (Meters)	Boom To Luffing Jib Angle Degrees
*200 (61.0)	170 (48.8)	30 - 80 (9.1 - 24.4)	60
210 (64.0)	170 (48.8)	30 - 80 (9.1 - 24.4)	60
220 (67.1)	170 (48.8)	30 - 80 (9.1 - 24.4)	60
230 (70.1)	170 (48.8)	30 - 80 (9.1 - 24.4)	55
Load blocks, hook and weight ball on ground until boom, luffing jib and fixed jib are erected. * 200 Ft. (61.0m) boom length with 170 Ft. (51.8m) luffing jib with intermediate fall and 30 - 80 Ft. (9.1 - 24.4m) fixed jib may be raised and lowered over end of blocked crawlers (5 Ft. [1 524 mm] raising outrigger not required).			

Luffing Jib Assemble-In-Air Raising Procedure

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Luffing Jib No. 149 On Boom No. 82
Fixed Jib No. 134 On Luffing Jib 149 On Boom No. 82

Disassemble-In-Air — Lowering

Step 5A: Lower Boom and Luffing Jib Without Fixed Jib

Danger: To prevent structural damage to machine, it is of utmost importance that the boom and luffing jib not be lowered beyond angle shown in TABLE 3 until assembly crane is attached to luffing jib.

1. Position boom at 85 degrees with boom and luffing jib over side of 5 Ft. (1 524 mm) raising outrigger fully set prior to lowering luffing jib.
2. Set load blocks, hook and weight ball on ground before lowering boom and luffing jib to ground.
3. Lower luffing jib until boom to luffing angle reaches value specified in TABLE 3.
4. Lower boom until luffing jib point rollers contact ground.
5. If luffing jib is hanging at or near vertical, raise luffing jib a few degrees forward of vertical to allow luffing jib to roll out.
   Caution: Be careful not to damage upper jib point after contacting ground by booming down and rollers not wanting to roll out.
6. Continue to lower boom while luffing jib point rollers roll on ground.
7. Keep enough tension on luffing jib hoist to keep luffing jib strut off luffing jib.
8. Stop lowering boom when boom angle is at or slightly above angle shown in TABLE 3.

Step 5B: Lower Boom, Luffing Jib With Fixed Jib

1. Position boom at 85 degrees with boom, luffing jib and fixed jib over side of 5 Ft. (1 524 mm) raising outrigger fully set prior to lowering luffing jib.
2. Set load blocks, hook and weight ball on ground before lowering boom, luffing jib and fixed jib to ground.
3. Lower luffing jib until boom to luffing jib angle reaches value specified in TABLE 4.
4. Lower boom until fixed jib point roller is just above ground.
5. Remove fixed jib stop pin from luffing jib top.
6. Lower boom as fixed jib point roller rolls on ground.
7. Lower boom until luffing jib point rollers contact ground.
   Caution: Do not under any condition allow fixed jib butt to luffing jib top angle become less than 95 degrees.
8. Remove fixed jib from luffing jib.
9. If luffing jib is hanging at or near vertical, raise luffing jib a few degrees forward of vertical to allow luffing jib to roll out.
   Caution: Be careful not to damage upper jib point after contacting ground by booming down and rollers not wanting to roll out.
10. Continue to lower boom while luffing jib point rollers roll on ground.
11. Keep enough tension on luffing jib hoist to keep luffing jib strut off luffing jib.
12. Stop lowering boom when boom angle is at or slightly above angle shown in TABLE 3.

Step 6: Remove Jib Top

Caution: Assembly crane must not induce any side load on luffing jib.

1. Check to insure jib straps/links are in brackets and intermediate suspension is clear of jib straps (may need to luff up jib strut).
2. Attach assembly crane lifting slings under FACT connectors at end of insert adjacent to jib top.
3. Raise luffing jib with assembly crane approximately 1 Ft. (305 mm) off ground and remove lower connector pins.
4. Lower jib top to ground (luff up to keep jib straps from sliding down jib).
5. Remove retaining pins from FACT connectors.
6. Remove strap pins from links (may need timber for strap leverage). Flip links back (do not contact lacing).
7. Attach rollers to jib insert and lower jib sections until rollers contact ground.
8. Remove assembly crane lifting slings from insert and attach four way hook-up to jib top.
9. Remove fixed jib backstay pendants if on jib top.
10. Remove electric luffing jib cable from jib top junction box.
11. Remove jib stop cable from winch to cable in jib butt.
12. Remove hoist line from jib top and anchor at end of jib insert.
13. Remove jib top.
14. Slide round bar through right end upper pin connectors of jib insert and strap links (may need pry bar to align links).

Step 7: Lower Boom and Partial Luffing Jib

Danger: Rollers must not touch ground during this operation (maintain at least 1-2 Ft. [305 - 610 mm] of ground clearance).

1. Attach assembly crane lifting slings under FACT connector at location shown in TABLE 1.
2. Raise partial jib section (85 - 145 Ft. [25.9 - 44.2m]) approximately 1-2 Ft. (305 - 610 mm) off ground with assembly crane.
3. Slowly lower boom keeping jib rollers off ground until luffing jib stop pendants start to go into tension (approximately 168 degree boom to luffing jib angle).
4. Disengage luffing jib stop strut pins and lower boom to retract luffing jib stop inner strut.
5. Pin strut in retracted position and unpin luffing jib stop pendants.
6. Rotate luffing jib stop struts to rear and lower boom onto blocking first and then lower partial jib sections until rollers contact ground.

Luffing Jib Assemble-In-Air Raising Procedure

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Luffing Jib No. 149 On Boom No. 82
Fixed Jib No. 134 On Luffing Jib 149 On Boom No. 82

Alternate procedure for 200 Ft. boom only with
140 - 170 Ft. (42.7 - 51.8m) luffing jib with intermediate fall

200 Ft. (61.0m) boom length with 140 - 170 Ft. (42.7 - 51.8m) luffing jib with intermediate fall may be raised and lowered over end of blocked crawlers (5 Ft. [1 524 mm] raising outrigger not required).

Assemble-In-Air — Raising

Preparation:

Refer to fixed jib assembly **No. 196404**, luffing jib rigging assembly **No. A01426** and **No. A01031** for proper make-up of inserts, straps, pendants and miscellaneous parts, etc.

1. 200 Ft. boom length assembled to crane and resting on blocking at ground level.
2. Lower boom point must be removed.
3. Full jib length assembled to boom top.
4. Position jib strut to rest on jib butt.
5. Jib stop strut must be retracted with boom on blocking.
6. Attach assembly crane lifting slings at location shown in TABLE 5.
7. Assembly crane should operate at approximately 70 - 80 degree boom angle. Recommended assembly crane boom lengths may vary depending on type and placement of crane and skill of operator.
8. To raise or lower boom and luffing jib, assembly crane should be in a level position on a firm uniformly supporting surface with crawlers parallel to boom and luffing jib.
9. Assembly crane upperworks should face in direction of 999 SERIES 3 boom.
10. Assembly crane should hoist and crawl simultaneously in order to keep hoist line vertical.
11. Check to insure jib straps/links are in brackets.
12. Attach fixed jib backstay pendants to luffing jib insert and place on top of insert and jib top (if fixed jib is used).

TABLE 5

Attachment Location of Assembly Crane from Right End of Jib Top - Feet (Meters)					
Boom Length Feet (Meters)	Luffing Jib Length (includes 25 Ft. [7.6m] Jib Top) - Feet (Meters)				
	70 - 130 (21.3 - 39.6)	140 (42.7)	150 (45.7)	160 (48.8)	170 (51.8)
200 (61.0)	—	25 (7.6)	25 (7.6)	25 (7.6)	25 (7.6)

Step 1: Raise Jib

Caution: Assembly crane must not induce any side load on luffing jib.

1. Luff up jib strut to approximately 30 degrees (jib straps just off of rearward brackets).
2. Raise luffing jib (140 - 170 Ft. [42.7 - 51.8m]) with assembly crane approximately 1-2 Ft. (305 - 610 mm) off ground (maintain slack in jib stop pendants).

Step 2: Raise Boom

***Danger*:** Rollers must not touch ground during this operation (maintain at least 1-2 Ft. [305 - 610 mm] of ground clearance).

1. Slowly raise boom until jib stop strut is just clear of ground.
2. Attach luffing jib stop pendants and unpin luffing jib stop inner strut from retracted position.
3. Boom up to angle shown in TABLE 3 while maintaining 1-2 Ft. (305 - 610 mm) clearance between jib insert rollers and ground.
4. Tension should be applied to luffing jib hoist to keep luffing jib strut off luffing jib during boom raising.
5. After reaching boom angle shown in TABLE 3, lower luffing jib with assembly crane until rollers contact ground.
6. Remove assembly crane slings from insert.
7. Slowly raise boom until luffing jib stop is fully extended and pins engaged (approximately 168 degree boom to luffing jib angle).
8. Go to recommended raising procedure Step 4A (without fixed jib) or 4B (with fixed jib) to raise boom and luffing jib to operating position.

Luffing Jib Assemble-In-Air Raising Procedure

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Luffing Jib No. 149 On Boom No. 82
Fixed Jib No. 134 On Luffing Jib 149 On Boom No. 82

Disassemble-In-Air — Lowering

Step 3A: Lower Boom and Luffing Jib Without Fixed Jib

Danger: To prevent structural damage to machine, it is of utmost importance that the boom and luffing jib not be lowered beyond angle shown in TABLE 3 until assembly crane is attached to luffing jib.

1. Position boom at 85 degrees with boom and luffing jib over side of 5 Ft. (1 524 mm) raising outrigger fully set prior to lowering luffing jib.
2. Set load blocks, hook and weight ball on ground before lowering boom and luffing jib to ground.
3. Lower luffing jib until boom to luffing angle reaches value specified in TABLE 3.
4. Lower boom until luffing jib point rollers contact ground.
5. If luffing jib is hanging at or near vertical, raise luffing jib a few degrees forward of vertical to allow luffing jib to roll out.
   Caution: Be careful not to damage upper jib point after contacting ground by booming down and rollers not wanting to roll out.
6. Continue to lower boom while luffing jib point rollers roll on ground.
7. Keep enough tension on luffing jib hoist to keep luffing jib strut off luffing jib.
8. Slowly lower boom until luffing jib stop pendants start to go into tension (approximately 168 degree boom to luffing jib angle).
9. Disengage luffing jib stop strut pins and lower boom to retract luffing jib stop inner strut.
10. Pin strut in retracted position and unpin luffing jib stop pendants.
11. Stop lowering boom when boom angle is at or slightly above angle shown in TABLE 3.

Step 3B: Lower Boom, Luffing Jib With Fixed Jib

1. Position boom at 85 degrees with boom, luffing jib and fixed jib over side of 5 Ft. (1 524 mm) raising outrigger fully set prior to lowering luffing jib.
2. Set load blocks, hook and weight ball on ground before lowering boom, luffing jib and fixed jib to ground.
3. Lower luffing jib until boom to luffing jib angle reaches value specified in TABLE 4.
4. Lower boom until fixed jib point roller is just above ground.
5. Remove fixed jib stop pin from luffing jib top.
6. Lower boom as fixed jib point roller rolls on ground.
7. Lower boom until luffing jib point rollers contact ground.
   Caution: Do not under any condition allow fixed jib butt to luffing jib top angle become less than 95 degrees.
8. Remove fixed jib from luffing jib.
9. If luffing jib is hanging at or near vertical, raise luffing jib a few degrees forward of vertical to allow luffing jib to roll out.
   Caution: Be careful not to damage upper jib point after contacting ground by booming down and rollers not wanting to roll out.
10. Continue to lower boom while luffing jib point rollers roll on ground.
11. Keep enough tension on luffing jib hoist to keep luffing jib strut off luffing jib.
12. Slowly lower boom until luffing jib stop pendants start to go into tension (approximately 168 degree boom to luffing jib angle).
13. Disengage luffing jib stop strut pins and lower boom to retract luffing jib stop inner strut.
14. Pin strut in retracted position and unpin luffing jib stop pendants.
15. Stop lowering boom when boom angle is at or slightly above angle shown in TABLE 3.

Step 4: Lower Boom and Luffing Jib

Danger: Rollers must not touch ground during this operation (maintain at least 1-2 Ft. [305 - 610 mm] of ground clearance).

1. Attach assembly crane lifting slings under FACT connector at location shown in TABLE 5.
2. Raise luffing jib (140 - 170 Ft. [42.7 - 51.8m]) approximately 1-2 Ft. (305 - 610 mm) off ground with assembly crane.
3. Rotate luffing jib stop struts to rear and lower boom onto blocking first and then lower luffing jib until rollers contact ground.