Manitowoc 31000

Operator Manual
Luffing Jib Attachment

Grove Manitowoc National Crane Potain

Manitowoc

OPERATOR MANUAL

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

31000

Luffing Jib Model Number

31005Ref

Luffing Jib Serial Number

This Manual is divided into the following sections:

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

NOTICE

The serial number of the crane and applicable attachments (i.e. luffing jib) is the only method your Manitowoc dealer or the Manitowoc Crane Care Lattice Team has of providing you with correct parts and service information.

The serial number is located on a crane identification plate attached to the operator cab and each attachment. Refer to the Nameplate and Decal Assembly Drawing in Section 2 of the 31000 Operator Manual for the exact location of the crane identification plate.

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

WARNING

To prevent death or serious injury:

- Avoid unsafe operation and maintenance.

  Crane and attachments shall 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 cab.

  If Operator Information Manual or Service Manual is missing from cab, contact your Manitowoc dealer for a new one.

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THE ORIGINAL LANGUAGE OF THIS PUBLICATION IS ENGLISH

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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)

CHANGE OF OWNERSHIP REGISTRATION

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

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

MANITOWOC DEALER

For questions about this manual or the MLC165 crane, contact your Manitowoc dealer. If you do not know the contact information for your dealer, locate the Manitowoc dealer nearest you, as follows:

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

CRANE/ATTACHMENT/STRAP IDENTIFICATION

An identification plate is on the outside of the operator cab (Figure 1-1), on attachments (for example, luffing jibs), and on straps available for this crane:

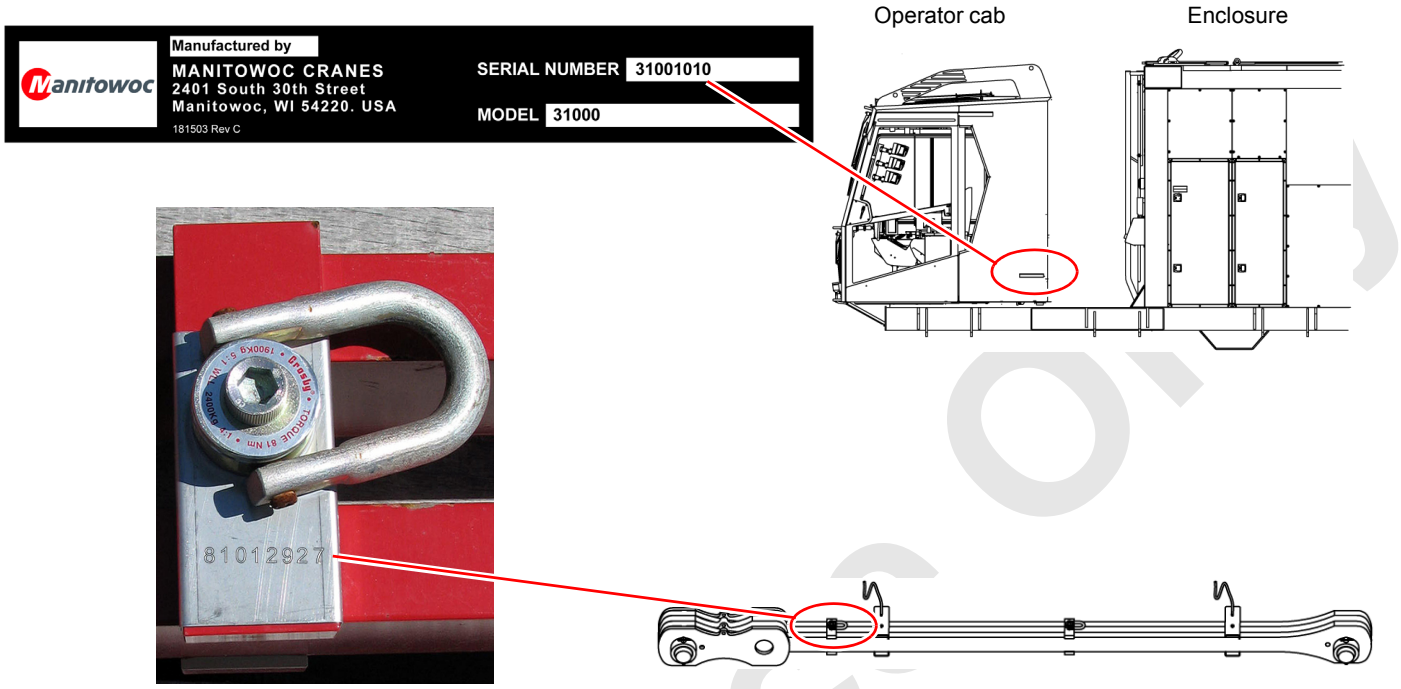
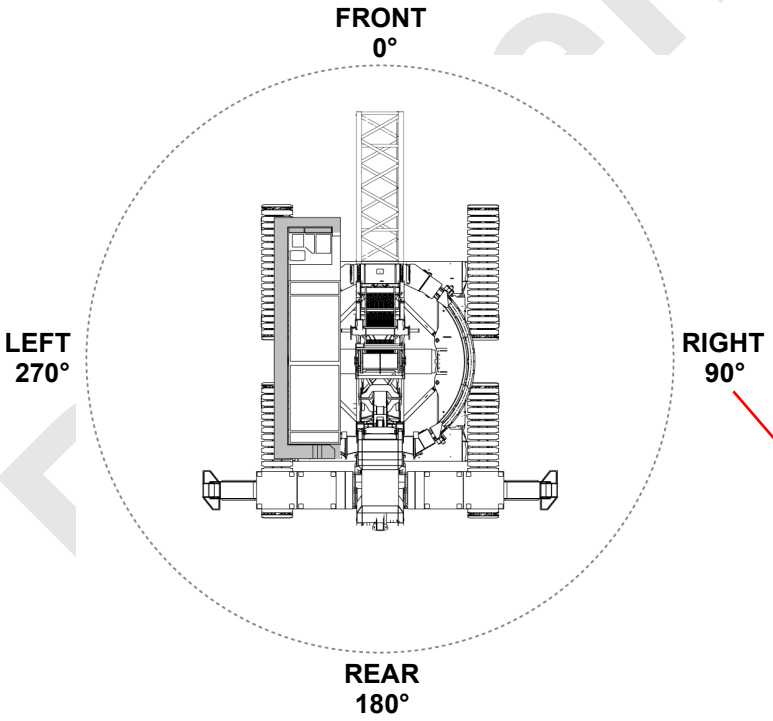


FIGURE 1-1

CRANE ORIENTATION



These numbers (0°, 90°, 180°, and 270°) represent the swing angle.

The current swing angle is shown on the RCL/RCI system Working screen (see Folio **Model 31000 2204 RCL/RCI Manual**).

FIGURE 1-2

IDENTIFICATION AND LOCATION OF COMPONENTS

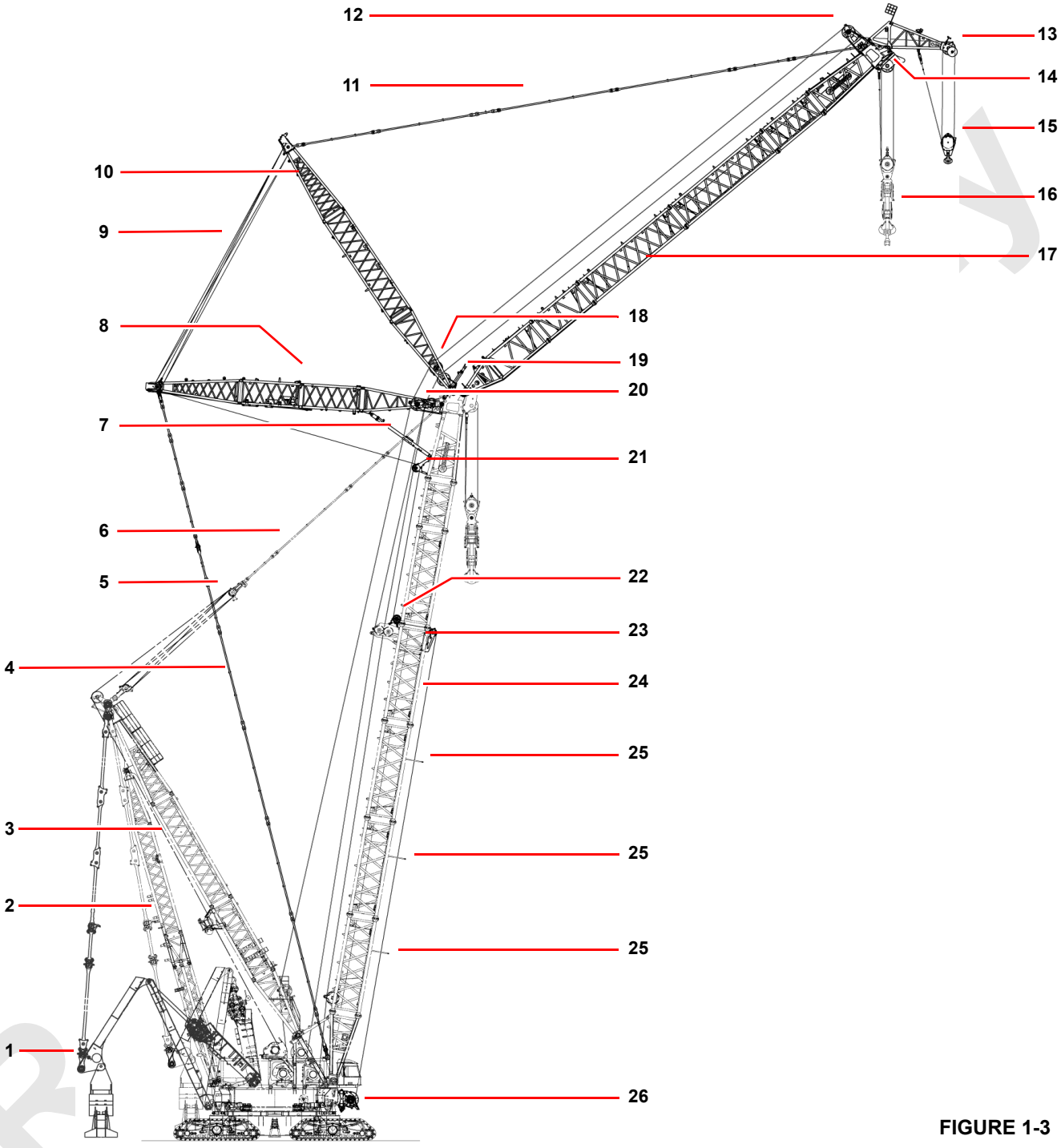


FIGURE 1-3

Item	Description
1	VPC (Variable Position Counterweight) shown partially extended and retracted.
2	Backhitch.
3	Mast.

4	Jib backstay straps.
5	Equalizer.
6	Boom straps.
7	Main strut stop.
8	Main strut.
9	Luffing hoist wire rope.
10	Jib strut.
11	Luffing jib straps.
12	Wire rope guide.
13	Upper jib point.
14	Lower jib point.
15	Load block.
16	Load block.
17	#91 luffing jib.
18	Wire rope guides.
19	Luffing jib stop.
20	Wire rope guide.
21	Luffing jib wire rope guide (top).
22	Luffing jib wire rope guide (upper).
23	Luffing jib wire rope guide (lower).
24	#90 boom.
25	Luffing jib wire rope guide (on insert).
26	Luffing jib hoist (drum 5).

ENGLISH AND METRIC CONVERSIONS

Direct Conversion

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

12 ft x 0.3048 = 3.6576 m

Inverse Conversion

DIVIDE (÷) known value by conversion factor to obtain equivalent value in desired units. For example, 3.6576 m is converted to feet, as follows:

3.6576 m ÷ 0.3048 = 12

To Convert	Symbol	Application	To	Symbol	Multiply By
AREA					
Square Inch	in^2	Filter Area Clutch Contact	Square Centimeter	cm^2	6.4516
Square Foot	ft^2	Ground Contact	Square Meter	m^2	0.0929
FORCE					
Pound Force	lb	Pedal Effort	KiloNewton 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 and Air	Bar		0.0689
TEMPERATURE					
Degrees Fahrenheit	°F	Oil, Air, And So On	Degrees Centigrade	°C	°F - 32 ÷ 1.8
Degrees Centigrade	°C		Degrees Fahrenheit	°F	°C x 1.8 + 32
TORQUE					
Inch Pound	in lb	Bolt Torque	Newton Meter	Nm	0.1129
Foot Pound	ft lb		Newton Meter	Nm	1.3558
VELOCITY					
Miles Per Hour	mph	Vehicle Speed	Kilometers Per Hour	km/h	1.6093
Miles Per Hour	mph	Wind Speed	Meters Per Second	m/s	0.4470
Feet Per Minute	fpm	Line Speed	Meters Per Minute	m/min	0.3048
VOLUME					
Cubic Yard	yd^3	Bucket Capacity	Cubic Meter	m^3	0.7646
Cubic Foot	ft^3		Cubic Meter	m^3	0.0283
Cubic Inch	in^3	Pump Displacement	Cubic Centimeter	cm^3	16.3871
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
Ton (2,000 lb.)	USt	Load Ratings	Metric Ton	t	0.9072
Ton (2,000 lb.)	USt		Kilogram	kg	907.1847

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SAFETY INFORMATION

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SAFETY INFORMATION

SAFETY

See Section 2 of the 31000 Operator Manual

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OPERATING CONTROLS AND PROCEDURES

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OPERATING CONTROLS

See Section 3 of the 31000 Operator Manual.

OPERATING PROCEDURES

See Section 3 of the 31000 Operator Manual.

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SECTION 4
SET-UP AND INSTALLATION

OVERVIEW

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.

This section contains installation and removal instructions for the #91 luffing jib attachment on a Model 31000.

The instructions in this section assume that the crane and required length of boom are already installed and ready for luffing jib installation.

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

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

The installation/removal area shall be firm, level, and free of ground and overhead obstructions.

Unless otherwise specified in the capacity chart, the foundation shall be level to within 0.5% — 0.5 ft (0,15 m) rise or fall in 100 ft (30,5 m) distance.

The area selected shall be large enough to accommodate the crane, selected boom and luffing jib length, and movement of an assist crane.

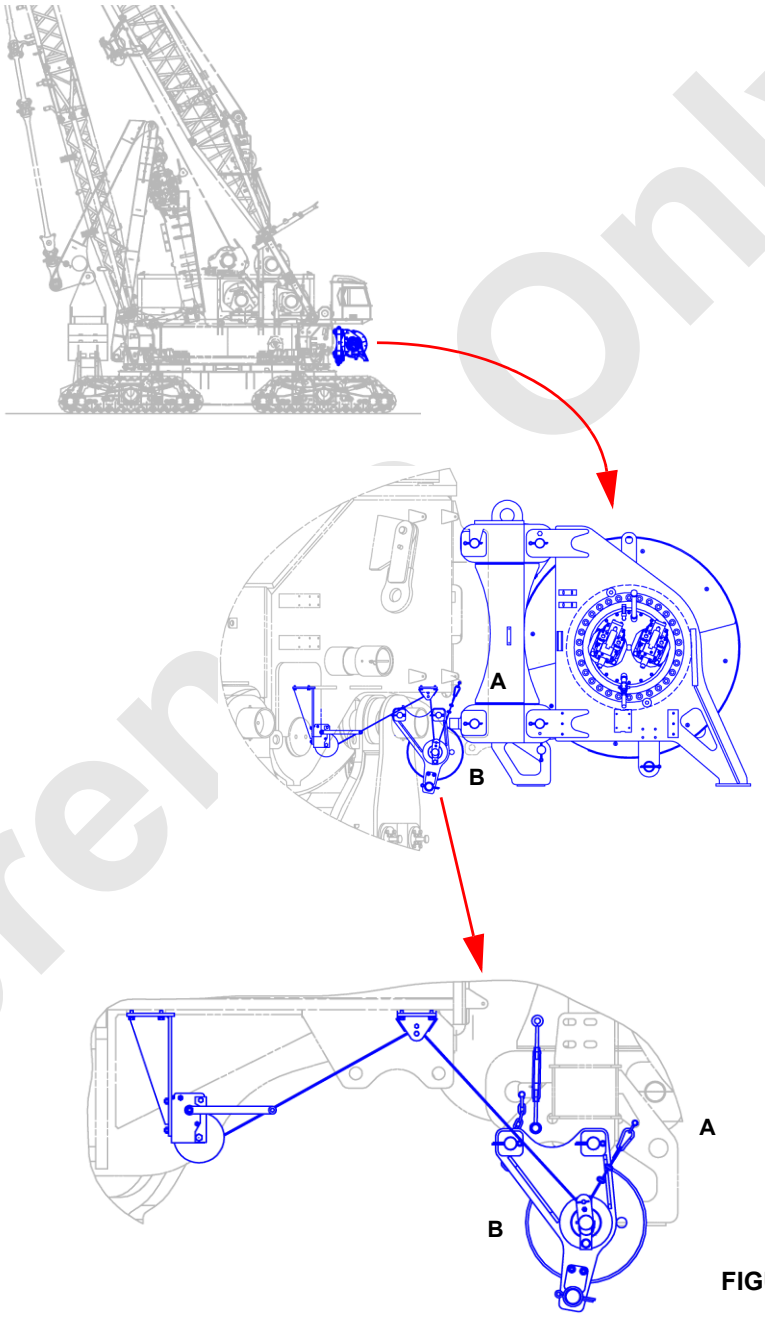
See the Jib Assembly Drawings at the end of this section for:

- Maximum combined boom and luffing jib length.
- Minimum boom length for use with the luffing jib.

4

PRE-INSTALLATION CHECKLIST

Step	Done?	Checklist item
1	☐	Read GENERAL SAFETY in Section 4 of the **31000 Operator Manual**.
2	☐	Read CRANE ORIENTATION in Section 4 of the **31000 Operator Manual**.
3	☐	Read RIGGING DRAWINGS in Section 4 of the **31000 Operator Manual**.
4	☐	Read ASSEMBLY AND DISASSEMBLY NOTES in Section 4 of the **31000 Operator Manual**.
5	☐	Read ASSEMBLY AND DISASSEMBLY AREA in Section 4 of the **31000 Operator Manual**.
6	☐	Read ACCESSING PARTS in Section 4 of the **31000 Operator Manual**.
7	☐	Read PERSONNEL FALL PROTECTION in Section 4 of the **31000 Operator Manual**.
8	☐	Read HANDLING COMPONENTS in Section 4 of the **31000 Operator Manual**.
9	☐	Read RETAINING CONNECTING PINS in Section 4 of the **31000 Operator Manual**.
10	☐	Read ASSEMBLY/DISASSEMBLY TOOLS in Section 4 of the **31000 Operator Manual**.
11	☐	Read ASSIST CRANE REQUIREMENTS in Section 4 of the **31000 Operator Manual**.
12	☐	Read AERIAL WORK PLATFORM in Section 4 of the **31000 Operator Manual**.
13	☐	Read CRANE WEIGHTS in Section 4 of the **31000 Operator Manual**.
14	☐	Read HOSE AND CABLE CLEANLINESS in Section 4 of the **31000 Operator Manual**.
15	☐	Read PIN AND CONNECTING HOLE CLEANLINESS in Section 4 of the **31000 Operator Manual**.
16	☐	Read TIGHTENING HYDRAULIC COUPLERS in Section 4 of the **31000 Operator Manual**.
17	☐	Read SYMBOLS in Section 4 of the **31000 Operator Manual**.
18	☐	Read TOOLS in Section 4 of the **31000 Operator Manual**.
19	☐	Read SHIPPING DATA in Section 4 of the **31000 Operator Manual**.
20	☐	Read SHIPPING CRANE COMPONENTS in Section 4 of the **31000 Operator Manual**.
21	☐	Read PRE-START CHECKS — PORTABLE HYDRAULIC POWER UNIT in Section 4 of the **31000 Operator Manual**.

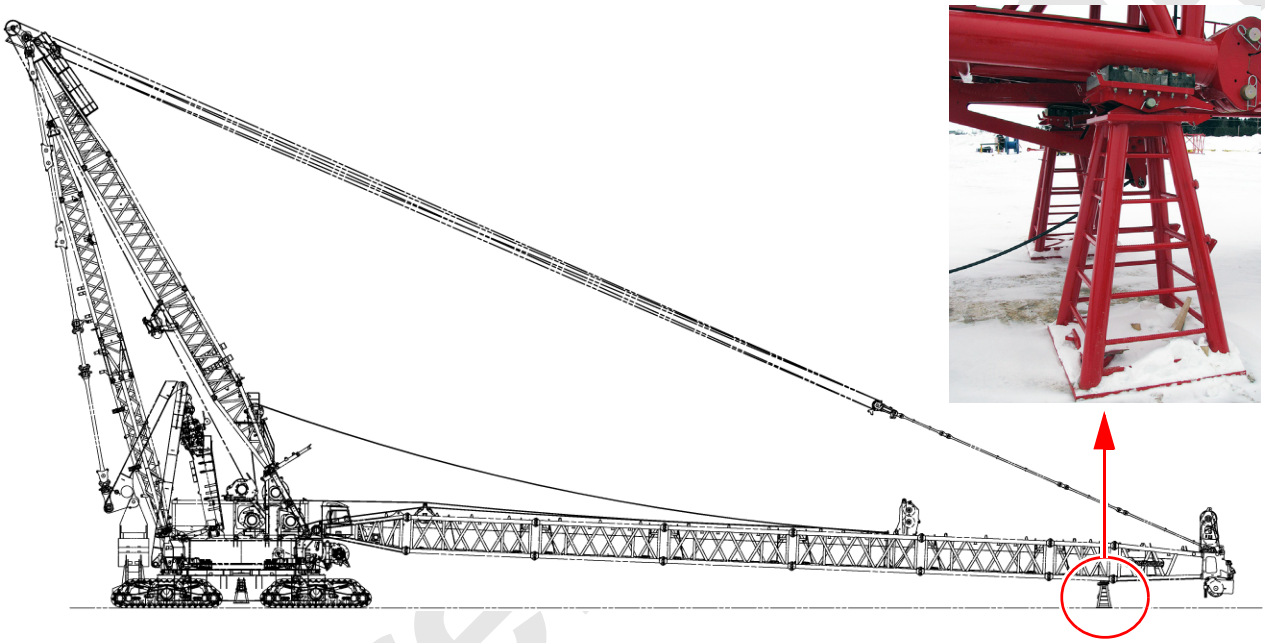
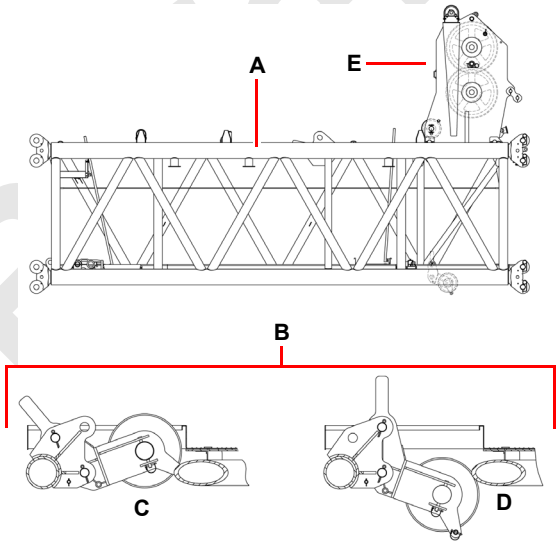
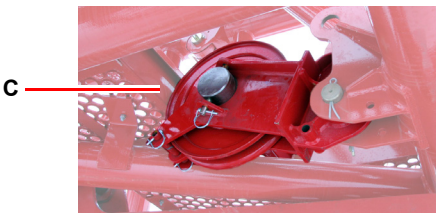
22	☐	*Information below from drawing A19443, Sheet 7:* Drum 5 (**A**) attached to the crane. Drum 6 (rigging winch) (**B**) relocated to the Drum 5 frame. If either of the above has not been done, then see Section 4 of the **31000 Operator Manual** for instructions.  **FIGURE 4-1**
23	☐	Remove block from the lower point. See Section 4 of the **31000 Operator Manual** for instructions.
24	☐	Remove upper boom point. See Section 4 of the **31000 Operator Manual** for instructions.

#91 LUFFING JIB INSTALLATION

In the following steps, except where noted, a 54 m (177.2 ft) #91 luffing jib will be attached to a 70 m (229.7 ft) #90 boom.

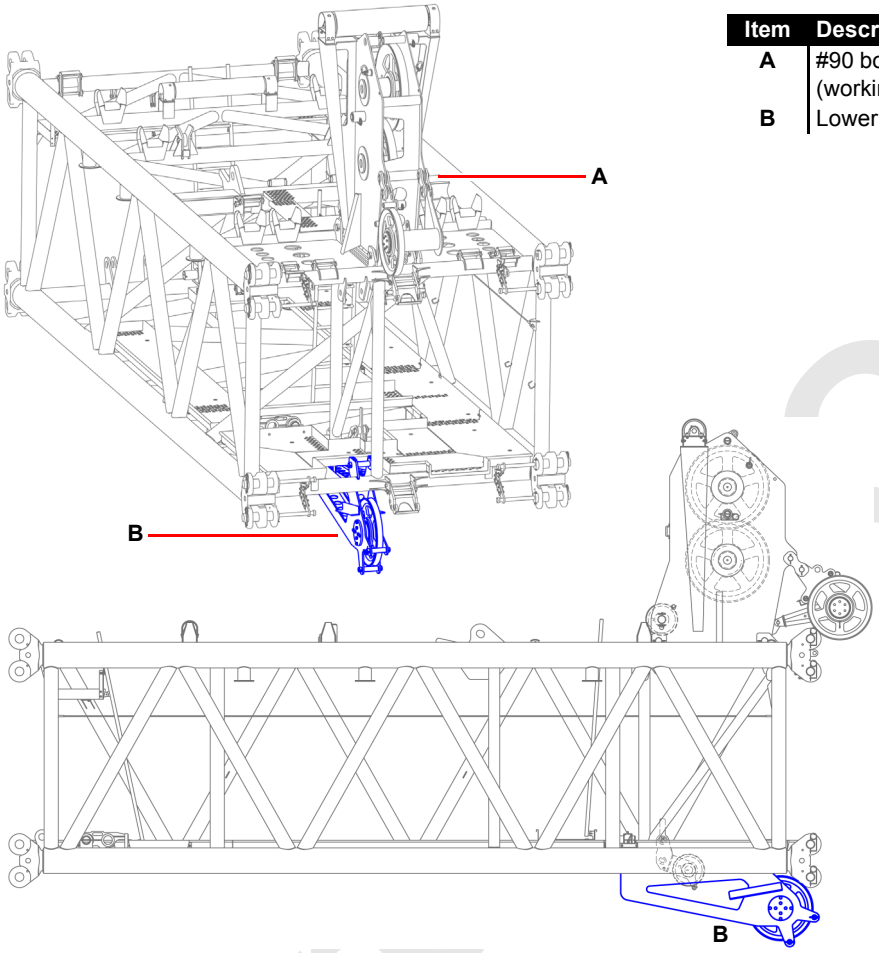
NOTE: For node and sensor wiring for the #91 luffing jib, see the Remove the Luffing Jib Drum 5 Assembly and Relocate the Wire Rope Guide (page 4-80).

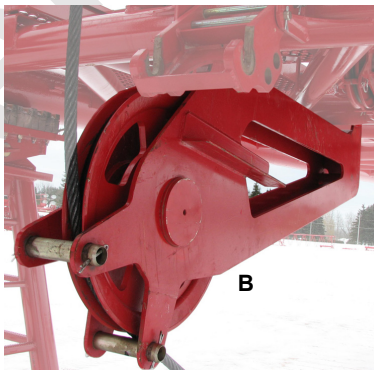
Set Up the Equalizer Insert

Step	Action
1	*Information below from drawing A19443, Sheet 8:* Assembly the #90 boom per luffing jib assembly drawings for the #91 luffing jib on #90 boom. Then lower the boom on two boom stands that are placed under the end of the last insert before the boom top insert:  FIGURE 4-2
2	*Information below from drawing A19443, Sheet 8:* On the #90 boom 10 m (32.8 ft) equalizer insert, set the winch equalizer assembly to the *working* position:  **Item** / **Description** **A** #90 boom 10 m (32.8 ft) equalizer insert. **B** Winch equalizer assembly. **C** Winch equalizer assembly (stowed position). **D** Winch equalizer assembly (working position). **E** Wire rope guide.  FIGURE 4-3

Step	Action
3	*Information below from drawing A19443, Sheet 4 and 8:* On the #90 boom 10 m (32.8 ft) equalizer insert (**A**), attach the *lower* wire rope guide (**B**):

Item	Description
A	#90 boom 10 m (32.8 ft) equalizer insert (working configuration)
B	Lower wire rope guide (working position).





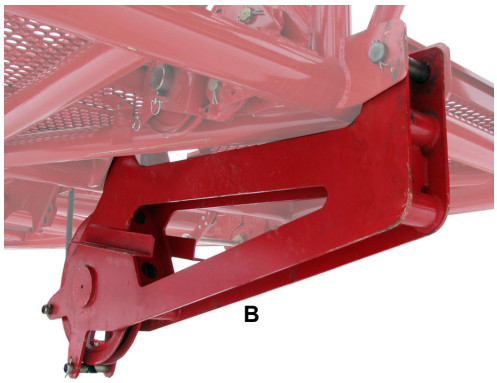
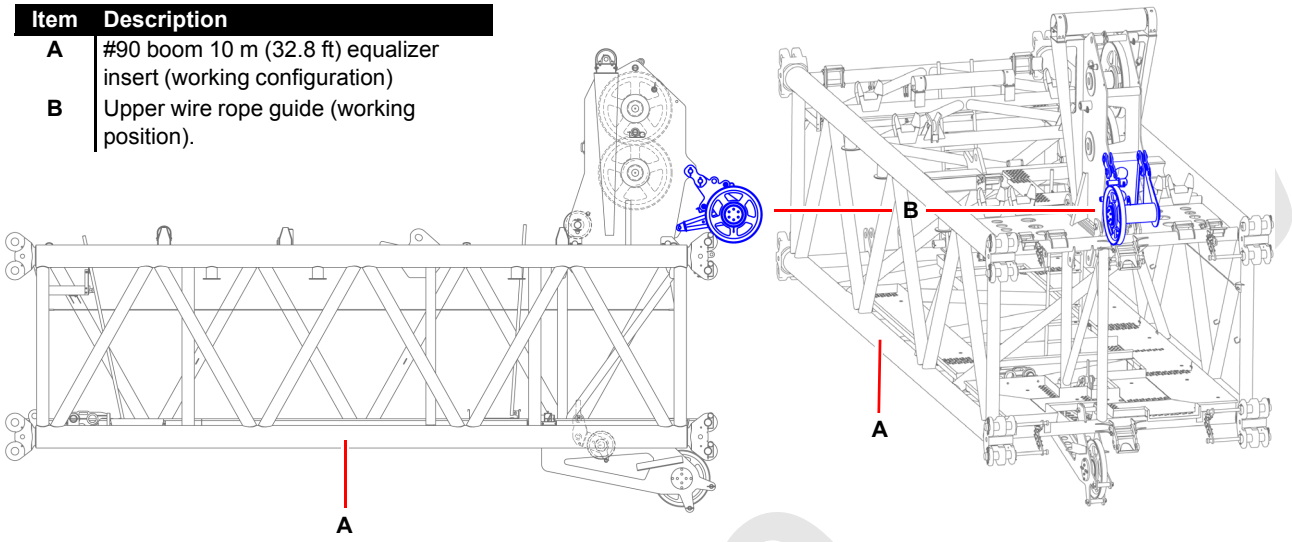
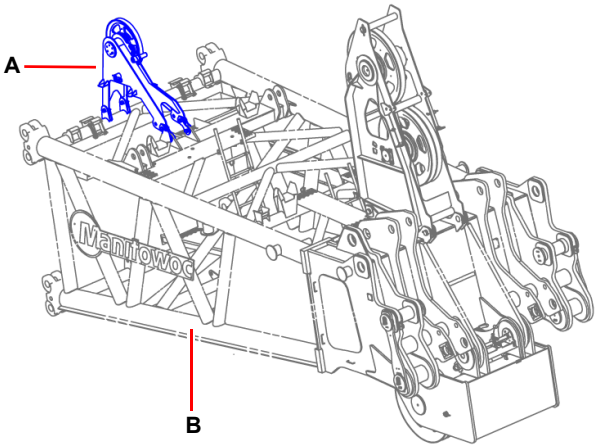
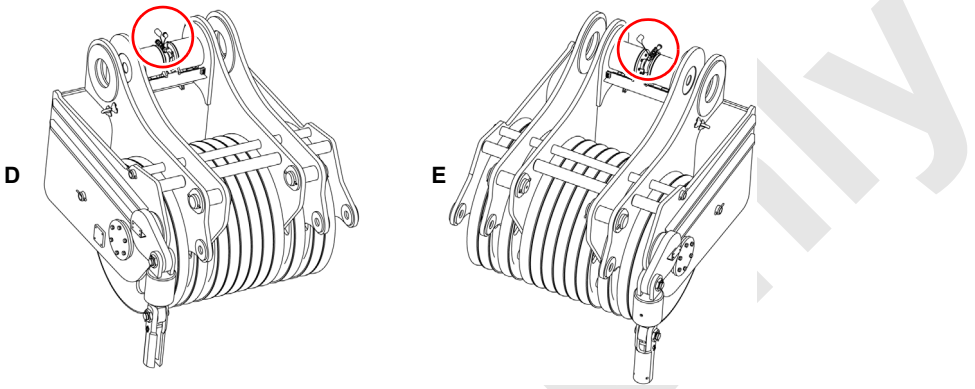
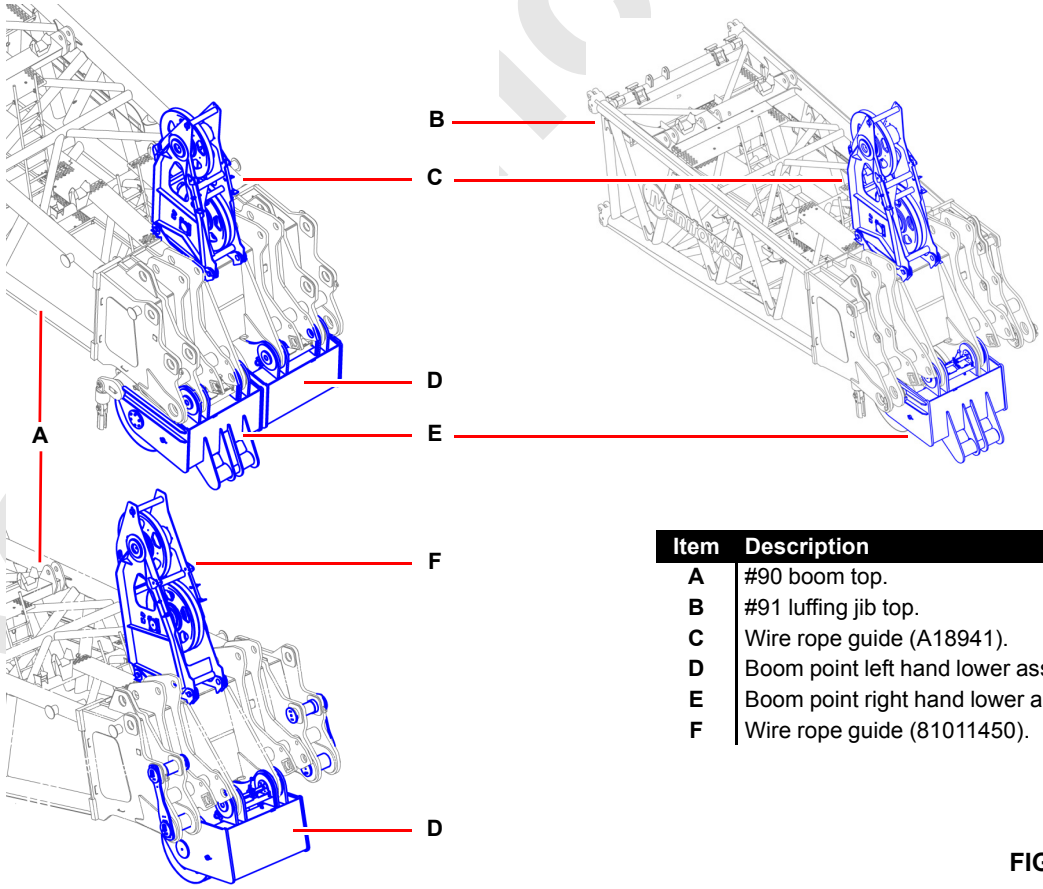


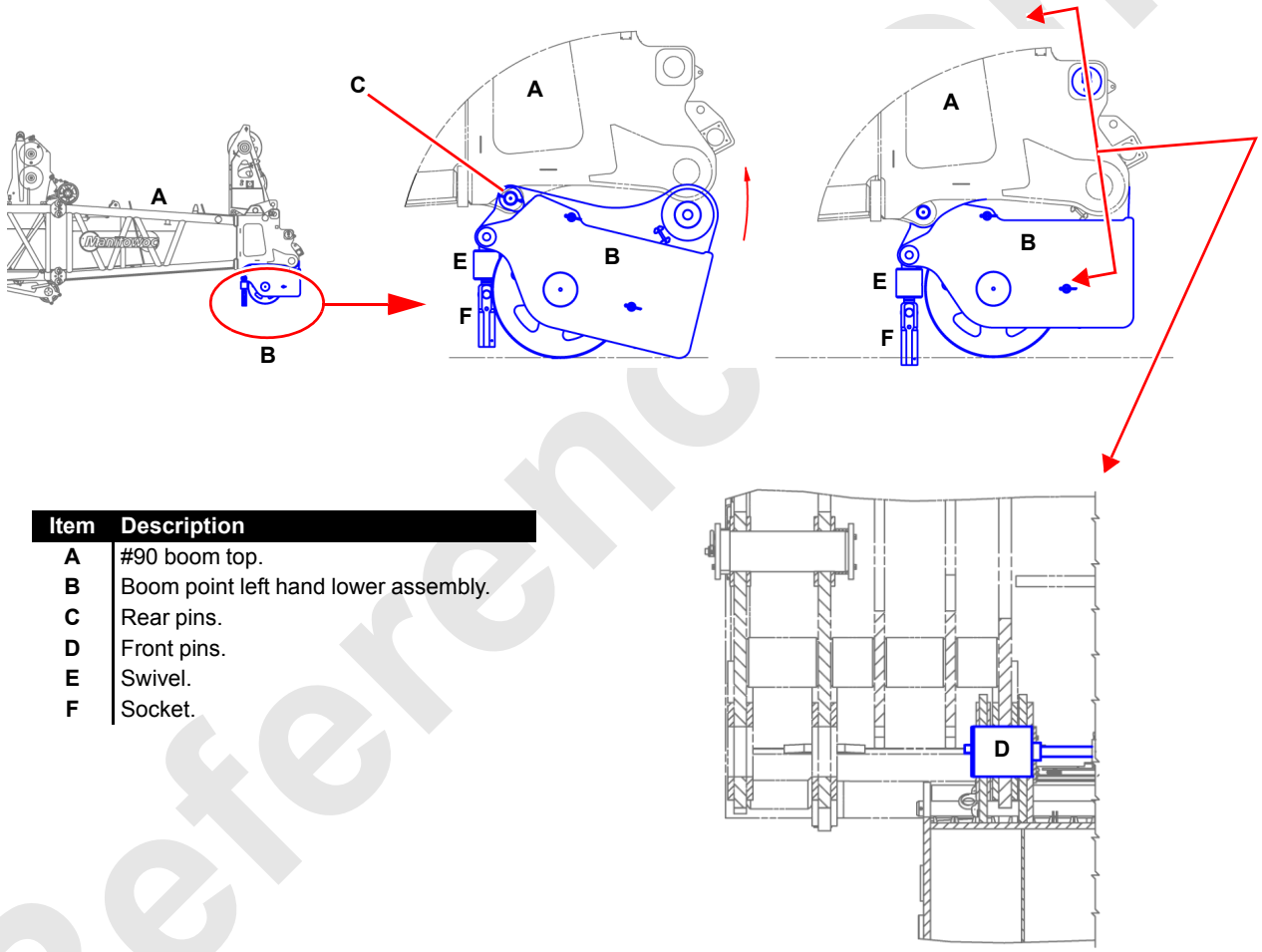
FIGURE 4-4

Step	Action
4	*Information below from drawing A19443, Sheet 4 and 8:* On the #90 boom 10 m (32.8 ft) equalizer insert (**A**), attach the *upper* wire rope guide (**B**): **Item** / **Description** **A** — #90 boom 10 m (32.8 ft) equalizer insert (working configuration) **B** — Upper wire rope guide (working position).  **FIGURE 4-5**

Configure the #90 Boom and #91 Luffing Jib Tops

Step	Action
5	*Information below from drawing A19443, Sheet 8:* On the #90 boom top (**B**), attach the *top* wire rope guide (**A**): **Item** / **Description** **A** — Top wire rope guide (working position). NOTE: This guide is **only** required on booms that are 70 m (229.7 ft) and longer. **B** — #90 boom top.  **FIGURE 4-6**

Step	Action
6	*Information below from drawing A19443, Sheet 3:* Relocate the wire rope guide (**C**) and left (**D**) and right (**E**) boom point lower assemblies: **NOTE:** In order to remove or attach the left (**D**) and right (**E**) boom point lower assemblies to the #90 boom top (**A**), connect the ISO 46 hydraulic circuit of the Portable Power Unit to the hydraulic couplers (circled below) of the lower assemblies:  • Relocate the #90 boom top (**A**) wire rope guide (**C**) to the #91 luffing jib top (**B**) as shown below. • Attach wire rope guide (**F**) to the #90 boom top (**A**). • Relocate the boom point *right hand* lower assembly (**E**) to the #91 luffing jib top (**B**) as shown in Figure 4-54 on page 4-52. • Move the boom point *left hand* lower assembly (**D**) to the center of the #90 boom top (**A**) as shown below:  **Item** / **Description** **A** #90 boom top. **B** #91 luffing jib top. **C** Wire rope guide (A18941). **D** Boom point left hand lower assembly. **E** Boom point right hand lower assembly. **F** Wire rope guide (81011450). **FIGURE 4-7**

Step	Action
7	*Information below from drawing A19443, Sheet 3:* Boom point *left hand* lower assembly installation on the #90 boom top: • Position the boom point left hand lower assembly (**B**) on the grade shown below. • Use an assist crane to position the #90 boom top (**A**) over the boom point left hand lower assembly (**B**). • Fasten the rear pins (**C**). • Lower the #90 boom top (**A**) until it is possible to engage the front pins (**D**) with the pull puller. • For two drum/lead operation at the luffing jib top, relocate swivel (**E**) and socket (**F**) from the #90 boom top (**A**) to the #91 luffing jib top (see Figure 4-54 on page 4-52). **NOTE:** The socket (**F**) will be used on the Drum 2 wire rope to position the main strut (see Figure 4-26 on page 4-26).  **FIGURE 4-8**

Item	Description
A	#90 boom top.
B	Boom point left hand lower assembly.
C	Rear pins.
D	Front pins.
E	Swivel.
F	Socket.

Set Up #90 Boom

Step	Action
8	*Information below from drawing A19443, Sheet 8:* On the #90 boom, lower the wire rope roller assemblies (**A**) to their working position (**C**):

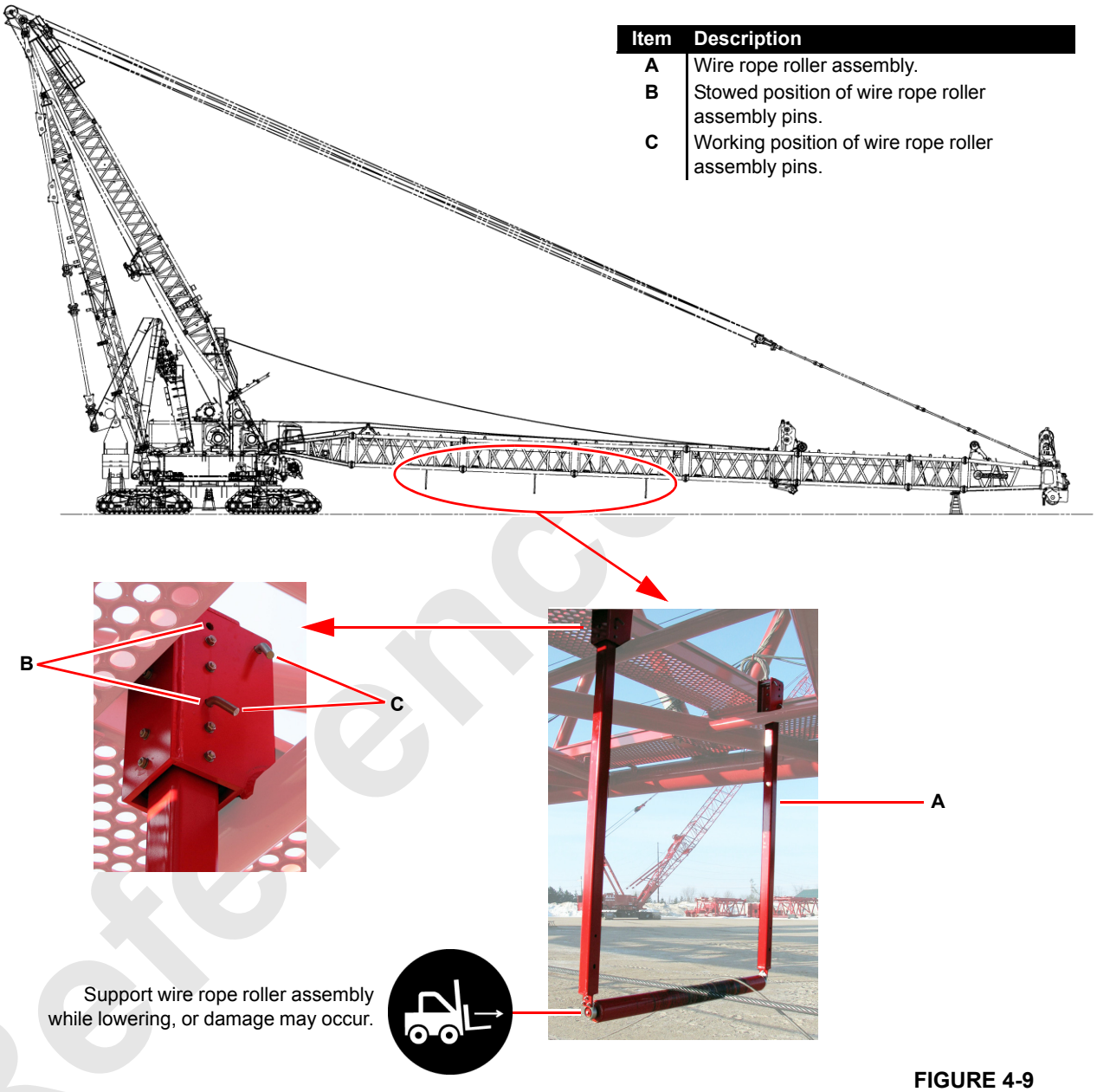


FIGURE 4-9

Step	Action
9	*Information below from drawing A19443, Sheet 8:* Use the Drum 6 rigging winch (**C**) to reeve the following: • 50 mm load hoist wire ropes up to the wire rope guide on the wire rope guide (see Figure 4-7). • From Drum 5 to the #90 boom top as shown below:

Item	Description
A	Drum 5 wire rope.
B	Drum 6 winch wire rope.
C	Drum 6 winch.
D	Luffing jib wire rope guide (upper).
E	Luffing jib wire rope guide (lower).

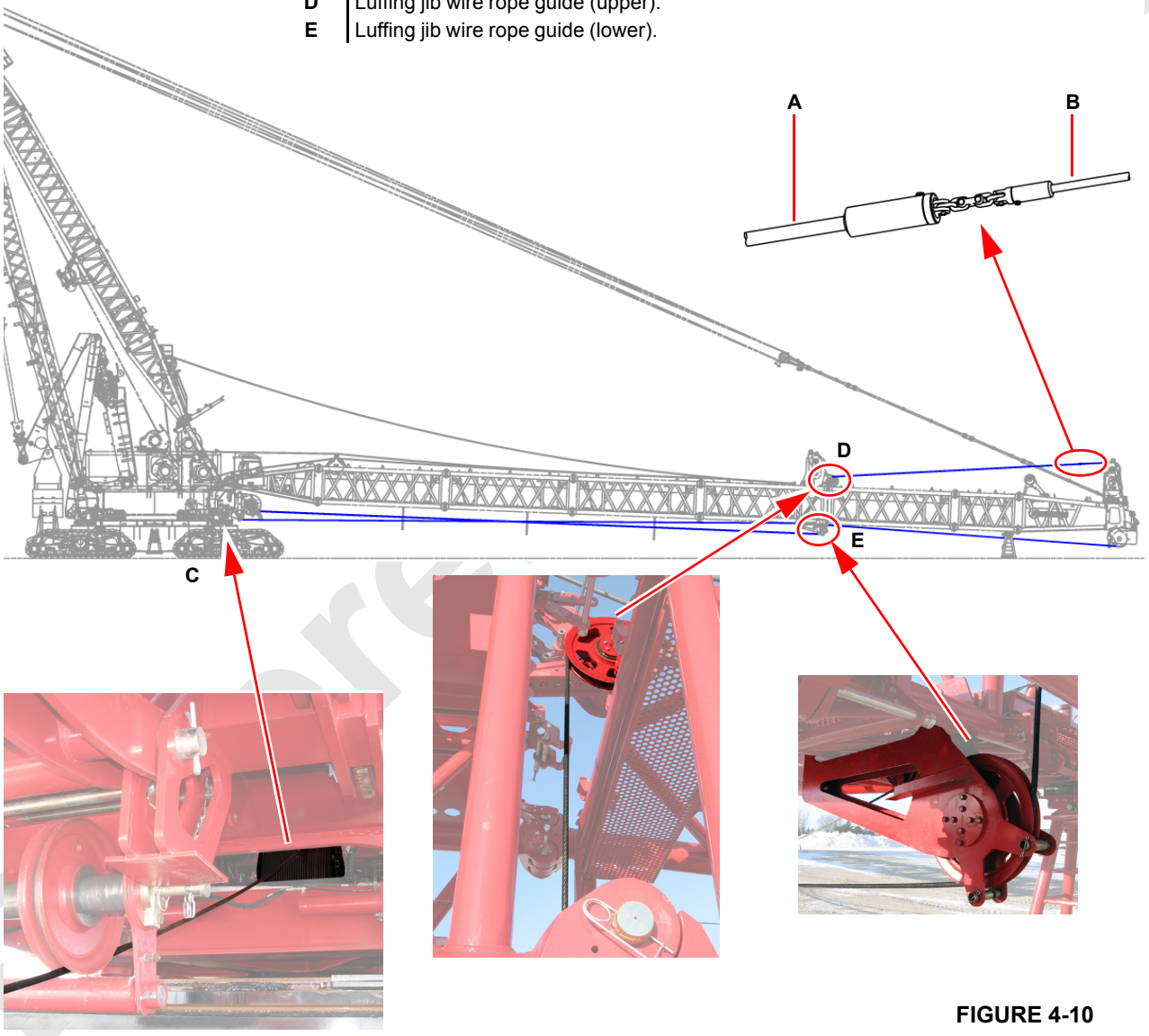


FIGURE 4-10

Assemble and Attach the Jib Strut

Step	Action
10	*Information below from drawing A19443, Sheet 8:* Assemble the jib strut: • Block (**D**) the jib strut butt (**C**) as shown below. • Using an assist crane (**A**), attach the jib strut insert (**E**) to the jib strut butt (**C**) with connector and safety pins (**I**). **NOTE:** If straps (**H**) are stored on the jib strut insert (**E**), then the jib strut butt (**C**) can be attached to the jib strut insert (**E**) and no blocking (**D**) is necessary. • Using an assist crane (**A**), attach the jib strut top (**F**) to the jib strut insert (**E**) with connector and safety pins (**I**).

Item	Description
A	Assist crane.
B	Approximately 157.5 cm (62.0 in).
C	Jib strut butt.
D	Blocking.
E	Jib strut insert.
F	Jib strut top.
G	Strut cap.
H	Strap.
I	Insert joint with safety pin:

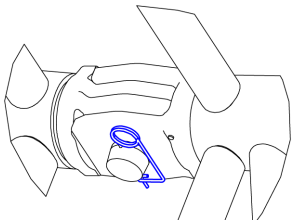


FIGURE 4-11

4

Step	Action
11	*Information below from drawing A19443, Sheet 9:* Attach the jib strut to the #90 boom: • Use an assist crane (see Figure 4-13) to align the jib strut butt (**A**) with the #90 boom top (**B**). • Install the jib strut hinge pin (**C**), luffing jib hinge pin (**D**), and link (**E**). *The arrow (**H**) on the jib strut hinge pin (**C**) shall point **towards** the crane.* • Attach an end plate (**F**) and swivel hook (**G**) to the end of the jib strut hinge pin (**C**).

Item	Description
A	Jib strut butt.
B	#90 boom top.
C	Jib strut hinge pin.
D	Luffing jib hinge pin.
E	Link.
F	End plate.
G	Swivel hook.
H	Arrow.

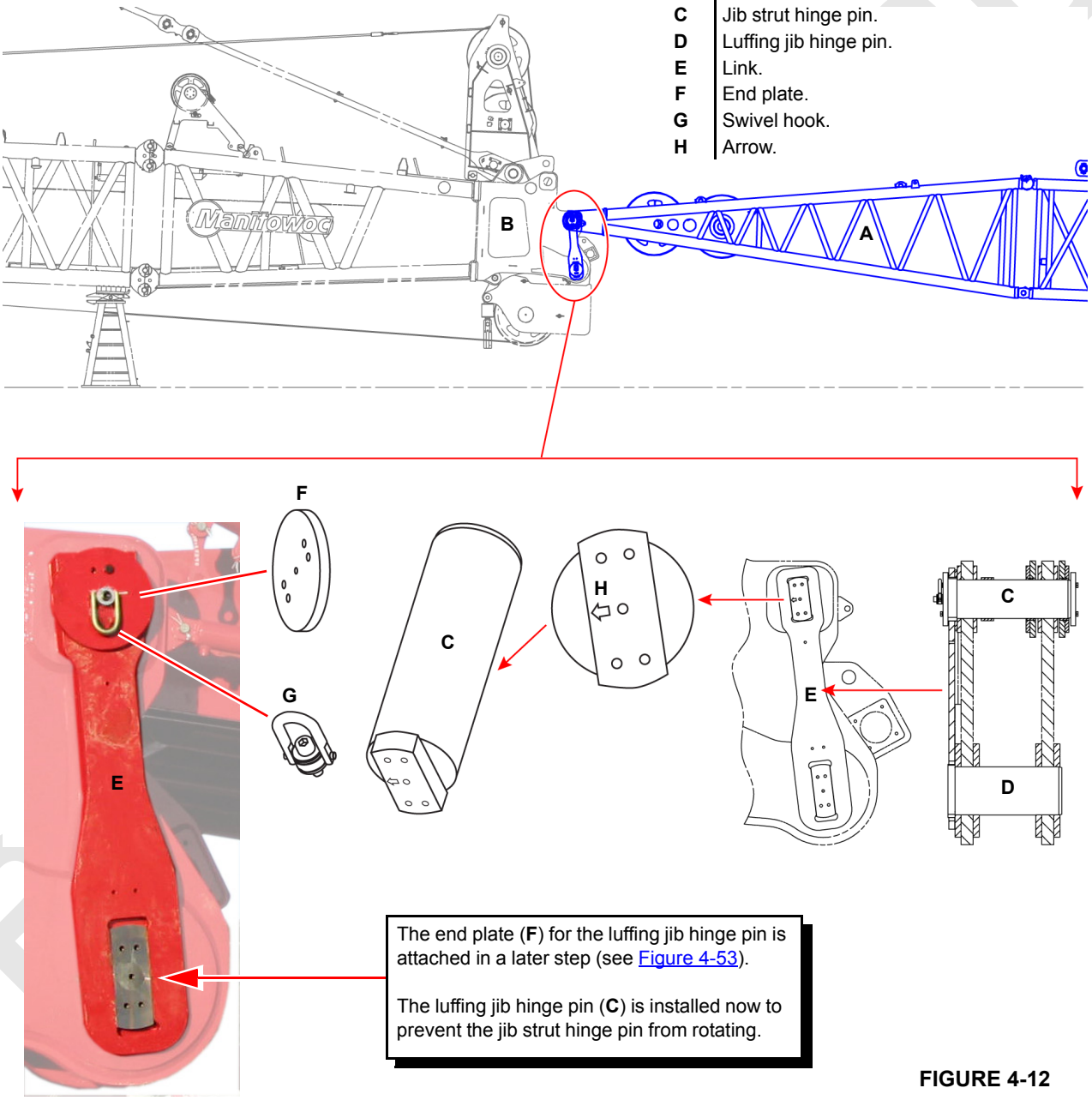


FIGURE 4-12

Step	Action
12	*Information below from drawing A19443, Sheet 9:* Use an assist crane (**A**) to place counterweight boxes (**C** or **D**) at the end of the jib strut (**B**) as shown below: • For cast counterweights (**C**), attach the lifting sling (**E**) to rollers (**F**). • For fabricated counterweights (**D**), first place blocking (**H**) under the strut top (**I**). Then attach the lifting sling (**E**) to shackles (**G**).

Item	Description
A	Assist crane.
B	31.2 m (102 ft 5 in)
C	Cast counterweights (10 metric tons each).
D	Fabricated counterweights (20 metric tons each).
E	Lifting sling.
F	Roller.
G	Shackle.
H	Blocking.
I	Strut top.

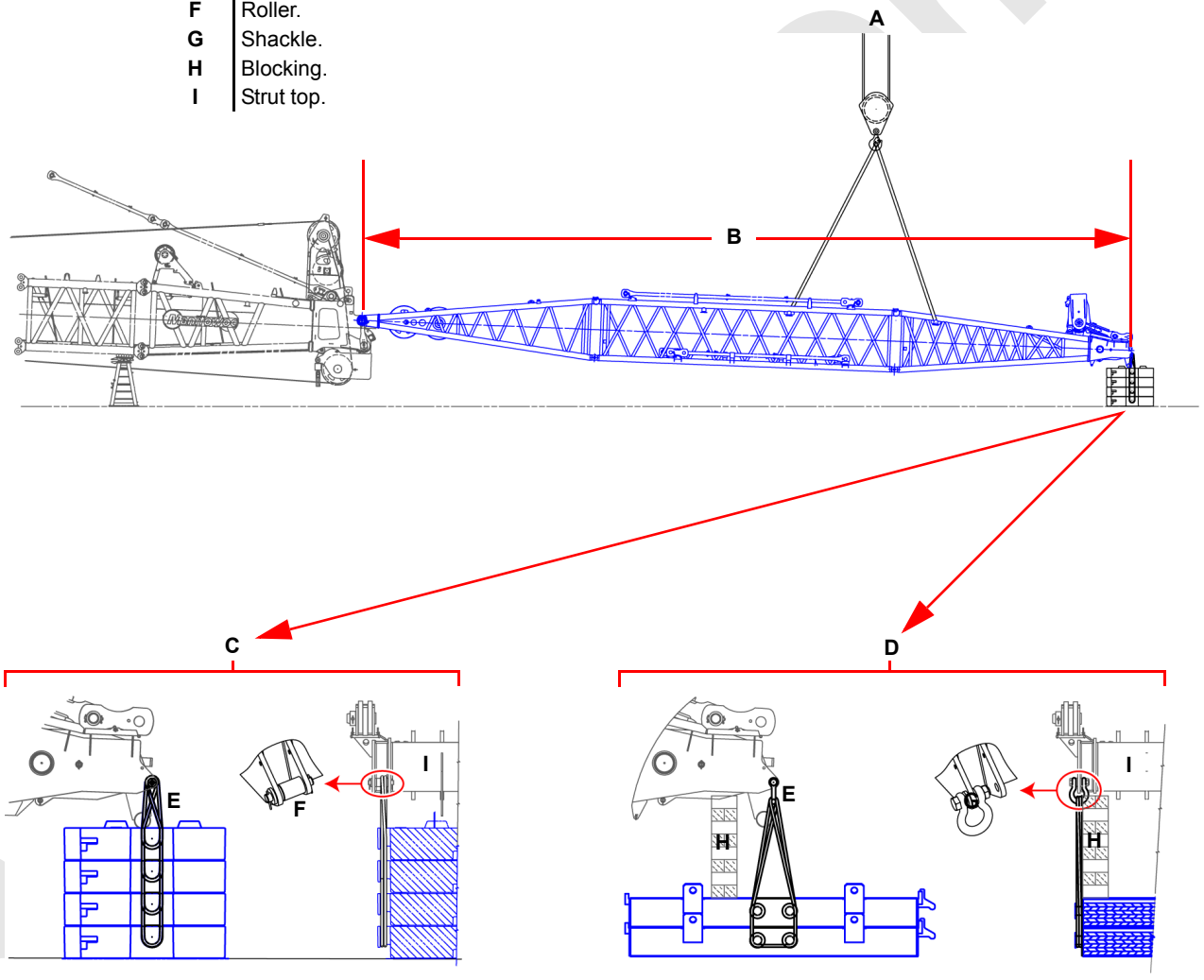


FIGURE 4-13

Step	Action
13	*Information below from drawing A19443, Sheet 10:* The strut cap (**D**) that ships with the luffing jib is reeved with a sucker line (**C**). Attach the Drum 5 wire rope (**B**) to this sucker line (**C**). While paying out Drum 5, use an assist crane (**A**) to pull the Drum 5 wire rope (**B**) through the strut cap (**D**) and jib strut top (**E**) as indicated by the arrows below:

Item	Description
A	Assist crane.
B	Drum 5 wire rope.
C	Sucker line.
D	Strut cap.
E	Jib strut top.

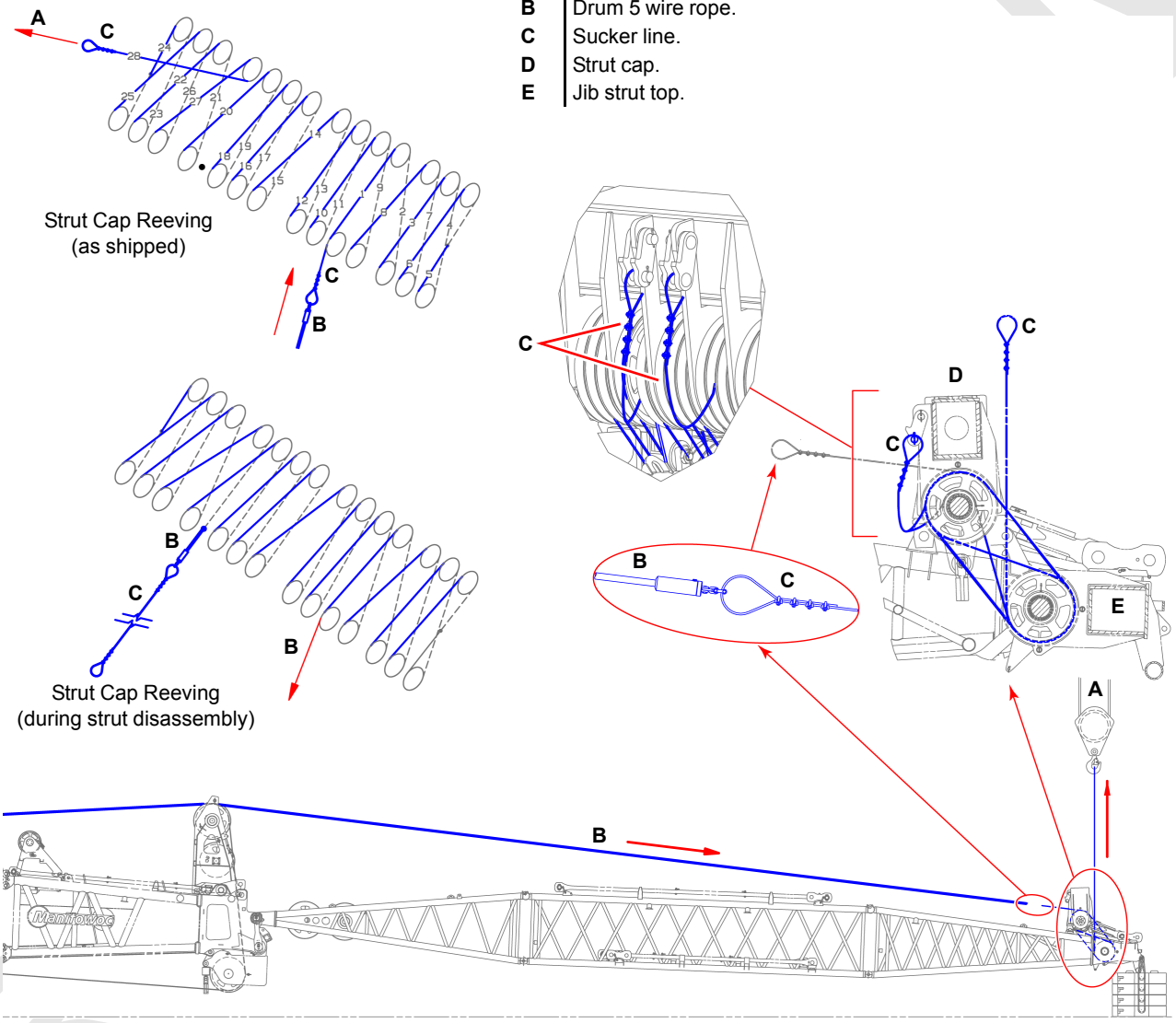


FIGURE 4-14

Step	Action
14	*Information below from drawing A19443, Sheet 10:* After reeving the Drum 5 wire rope (**A**) through the strut cap (**C**), attach the Drum 5 wire rope dead end (**B**) as shown below. **NOTE:** *For cranes with boom lengths 70 m (229.7 ft) and greater,* reeve the Drum 5 wire rope (**A**) through the wire rope top assembly (**D**). Position the rope guard (**G**) so that it is not over the sheave. Use an assist crane to position the Drum 5 wire rope (**A**) to the side of the jib strut to allow for clearance for assembling the main strut. Remove the jib backstay straps (**E**) from the jib strut.

Item	Description
A1	Drum 5 wire rope from crane.
A2	Drum 5 wire rope to strut cab C.
B	Drum 5 wire rope dead end.
C	Strut cap.
D	Wire rope top assembly. Use with #90 boom lengths 70 m (229.7 ft) and greater.
E	Jib backstay strap.
F	Safety pin.
G	Rope guard.

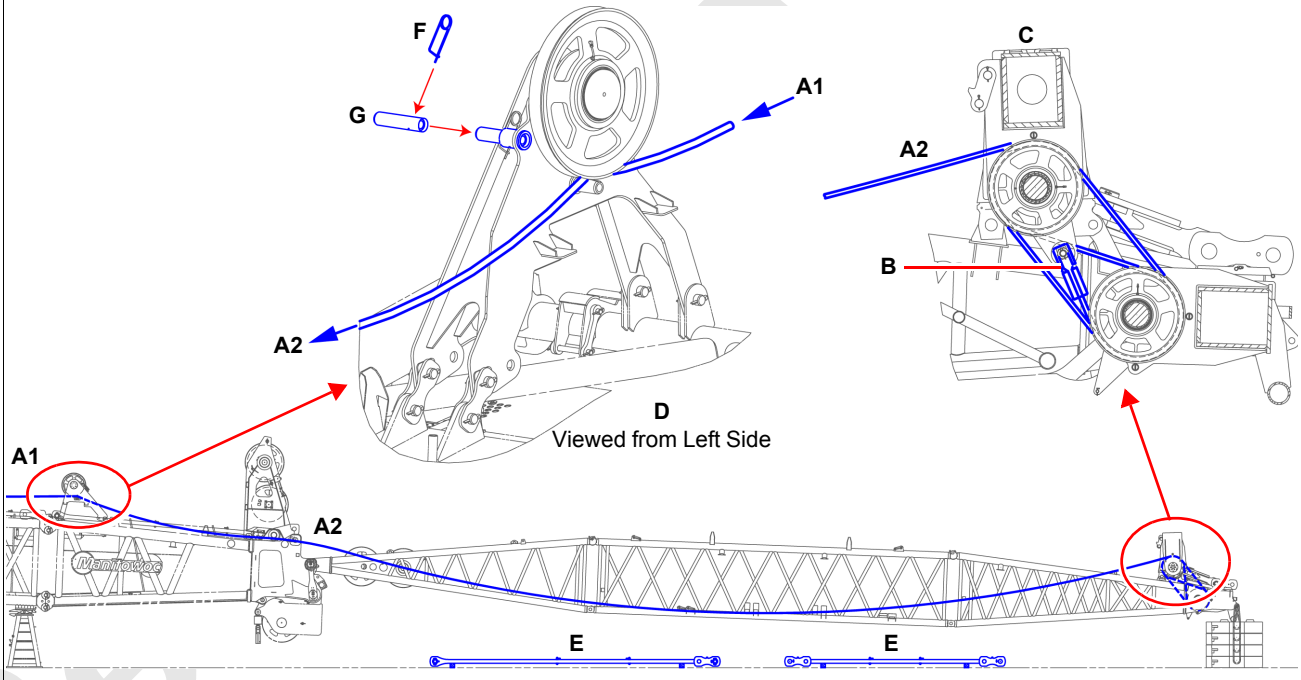


FIGURE 4-15

Assemble and Attach the Lower Half of the Main Strut

Step	Action
15	*Information below from drawing A19443, Sheet 11:* Use an assist crane (**A**) to assemble the *lower* half of the main strut: • Block the main strut butt (**C**) to have a horizontal center line (**B**). • Remove the jib backstay straps (**E**, **F**) from the main strut insert (**D**). • Attach the main strut insert (**D**) to the main strut butt (**C**) using safety pins (**G**).

Item	Description
A	Assist crane.
B	Approximately 157.5 cm (62.0 in).
C	Main strut butt.
D	Main strut insert.
E	Jib backstay strap, 5 m.
F	Jib backstay strap, 3.559 m.
G	Insert joint with safety pin:

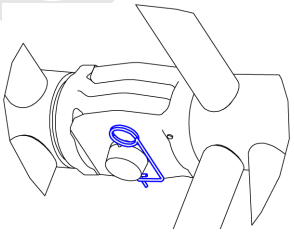


FIGURE 4-16

Step	Action
16	*Information below from drawing A19443, Sheet 11:* Using an assist crane (**A**) attached to the main strut insert (**G**) as shown below, attach the *lower* half of the main strut to the #90 boom top (**F**): • Align the main strut butt (**E**) with the #90 boom top (**F**) and install the hinge pins (**C**). • Connect the two support struts (**D**) on the main strut insert (**G**) to the support strut lugs (**B**) on the jib strut butt (**H**). **NOTE:** Align each support strut (**D**) so that it forms an angle with the jib strut butt (**H**) that is as close as possible to 90°. Use the three holes in each support strut lug (**B**) to adjust this angle.

Item	Description
A	Assist crane.
B	Support strut lug.
C	Main strut butt hinge pin.
D	Support strut.
E	Main strut butt.
F	#90 boom top.
G	Main strut insert.
H	Jib strut butt.
I	Main strut stop support lower pin.

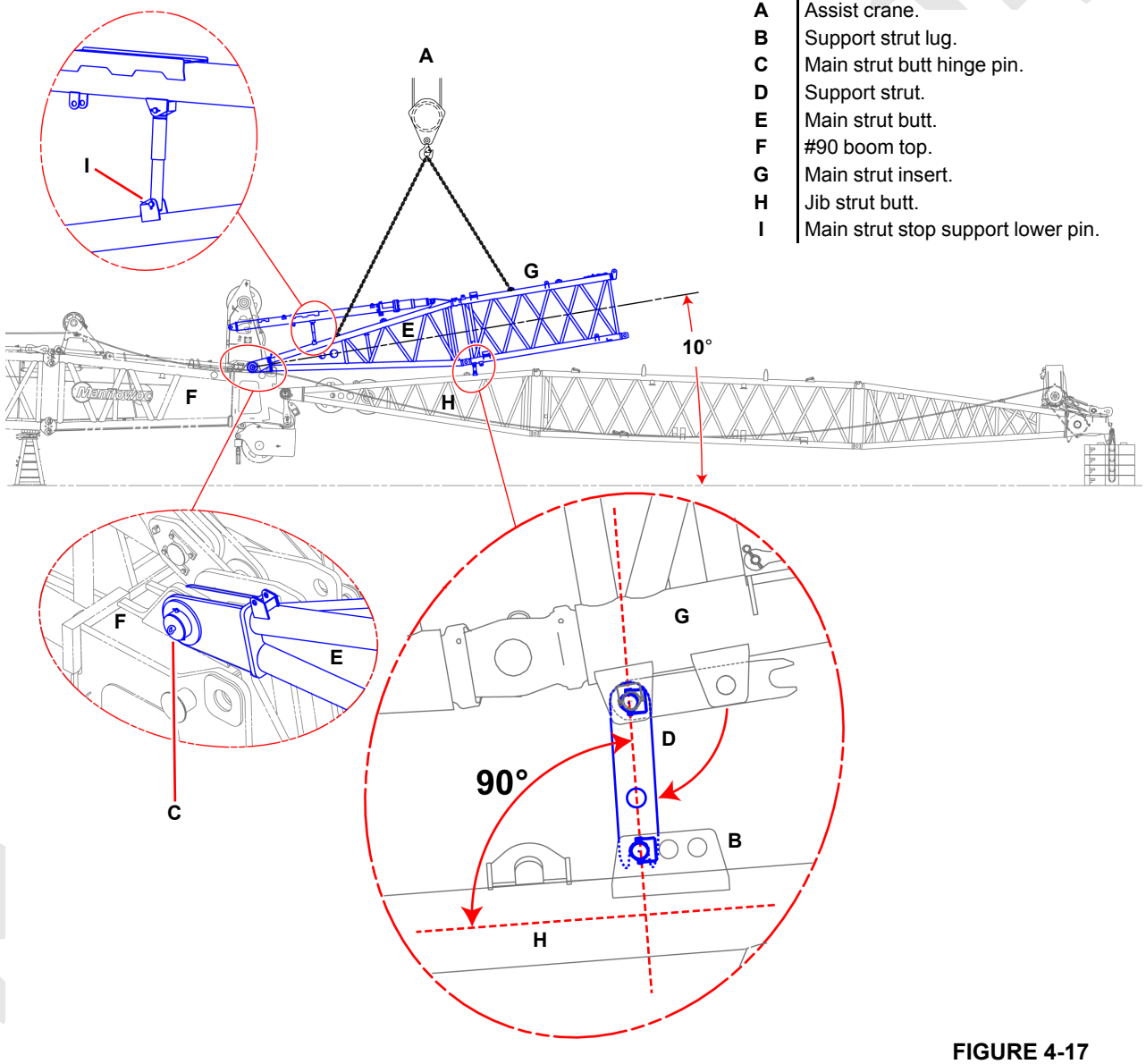
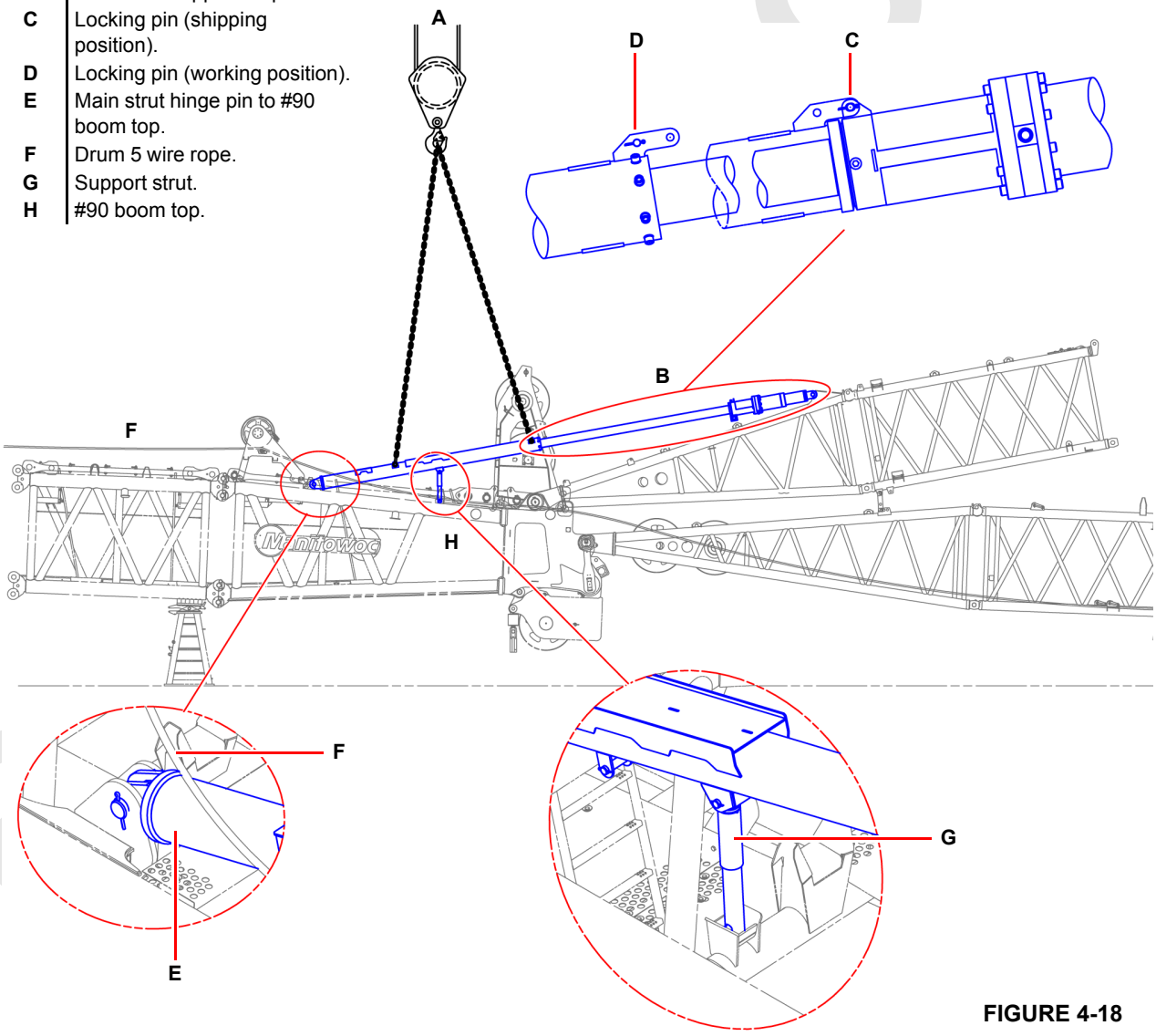
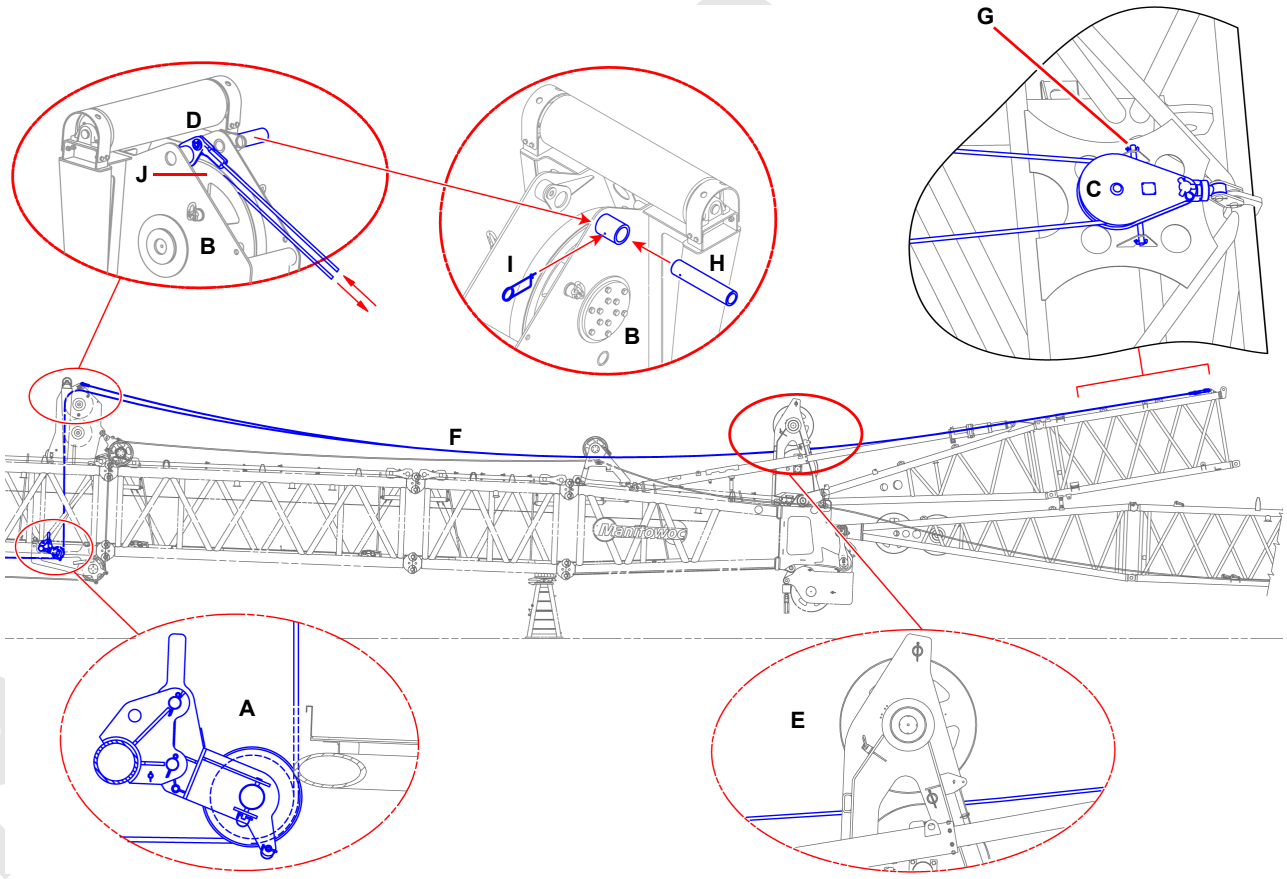


FIGURE 4-17

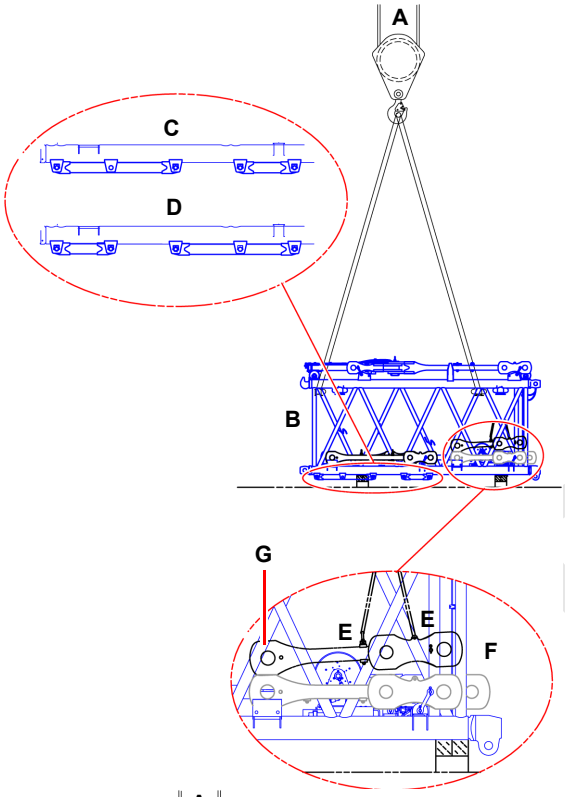
4

Step	Action
17	*Information below from drawing A19443, Sheet 11:* Use an assist crane (**A**) to attach the main strut stops to the #90 boom top (**H**): • Attach an assist crane (**A**) to one of the main strut stops (**B**). • Remove the main strut stop support lower pin (see **I** in Figure 4-17). Then move the main strut stop support to its working position. • Move the main strut stop locking pin from the shipping position (**C**) to the working position (**D**). • Extend the main strut support stop (**B**). • Place Drum 5 wire rope (**F**) **above** the main strut support stop (**B**). • Attach the main strut support stop (**B**) to the #90 boom top (**E**). • Adjust the length of the support strut (**G**) to be in the cradle position on the #90 boom top (**H**). **Item** **Description** **A** Assist crane. **B** Main strut support stop. **C** Locking pin (shipping position). **D** Locking pin (working position). **E** Main strut hinge pin to #90 boom top. **F** Drum 5 wire rope. **G** Support strut. **H** #90 boom top.  **FIGURE 4-18**

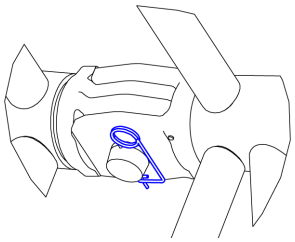
Step	Action
18	*Information below from drawing A19443, Sheet 12:* Connect the Drum 6 winch wire rope (**F**) to the main strut: • Run the Drum 6 winch wire rope (**F**) through the winch equalizer assembly (**A**), the wire rope guide (**B**), and the snatch block (**C**) on the main strut insert. • Attach the Drum 6 winch wire rope (**F**) to the dead end (**D**) on the wire rope guide (**B**). • Remove the safety pin (**I**) on the wire rope guide (**B**) rope guard (**H**). Position the rope guard (**H**) so that it does NOT cover the top of the sheave (**J**). • Remove the retaining pin (**G**) so that it no longer holds down the snatch block (**C**). Then reinsert the retaining pin (**G**). • Leave enough slack in the Drum 6 winch wire rope (**F**) to move it to the left side of the wire rope guide (**E**). **Item** / **Description** **A** Winch equalizer assembly. **B** Wire rope guide. **C** Snatch block. **D** Dead end. **E** Wire rope guide. **Item** / **Description** **F** Drum 6 winch wire rope. **G** Retaining pin. **H** Rope guard. **I** Safety pin. **J** Sheave.  70 m (229.7 ft) boom length configuration shown. **FIGURE 4-19**

Assemble the Upper Half of the Main Strut

Step	Action
19	*Information below from drawing A19443, Sheet 12:* Use an assist crane (**A**) to assemble the *upper* half of the main strut: • Block the main strut insert (**B**). • Configure the support struts (**C** and **D**) based on the #90 boom length. • For upcoming steps, note the short strap lifting points (**E**), removal (**F**), and shipment location (**F** and **G**). • Remove the stowed jib backstay straps (**I** and **J**) and the jib backstay spreader (**K**) from the main strut insert (**B**). • Attach the main strut transition insert (**H**) to the main strut insert (**B**) using safety pins (**L**).



Item	Description
A	Assist crane.
B	Main strut insert.
C	Support strut configuration for 55 m (180.5 ft), 60 m (196.9 ft), and 65 m (213.3 ft) #90 boom lengths.
D	Support strut configuration for 70 m (229.7 ft), 75 m (246.1 ft), 80 m (262.5 ft), 85 m (278.9 ft), 90 m (295.3 ft), 95 m (311.7 ft), 100 m (328.1 ft), and 105 m (344.5 ft) #90 boom lengths.
E	Short strap lifting points.
F	Short strap removal and storage.
G	Attach this end to insert first.
H	Main strut transition insert.
I	Jib backstay strap, 3.14 m (10.3 ft).
J	Jib backstay strap, 2.19 m (7.2 ft).
K	Jib backstay spreader.
L	Insert joint with safety pin:
M	Blocking — under the main strut transition insert to necessary to maintain stability.



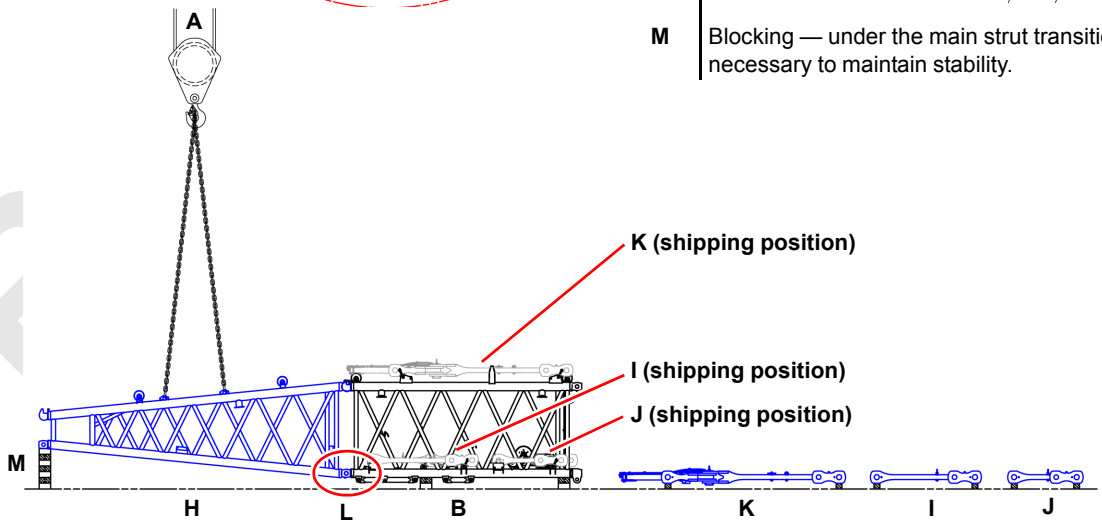


FIGURE 4-20

Step	Action
20	*Information below from drawing A19443, Sheet 13:* Use an assist crane (**A**) to attach the upper half of the main strut to the lower half of the main strut: • Use the connector pins and the cotter pins provided (**B**). • Attach the support strut (**C** or **D**) on the *upper* half insert to the *lower* half insert.

Item	Description
A	Assist crane.
B	Connector pin and cotter pin.
C	Short support strut used for 70 m (229.7 ft), 75 m (246.1 ft), 80 m (262.5 ft), 85 m (278.9 ft), 90 m (295.3 ft), 95 m (311.7 ft), 100 m (328.1 ft), and 105 m (344.5 ft) #90 boom lengths.
D	Long support strut used for 55 m (180.5 ft), 60 m (196.9 ft), and 65 m (213.3 ft) #90 boom lengths.

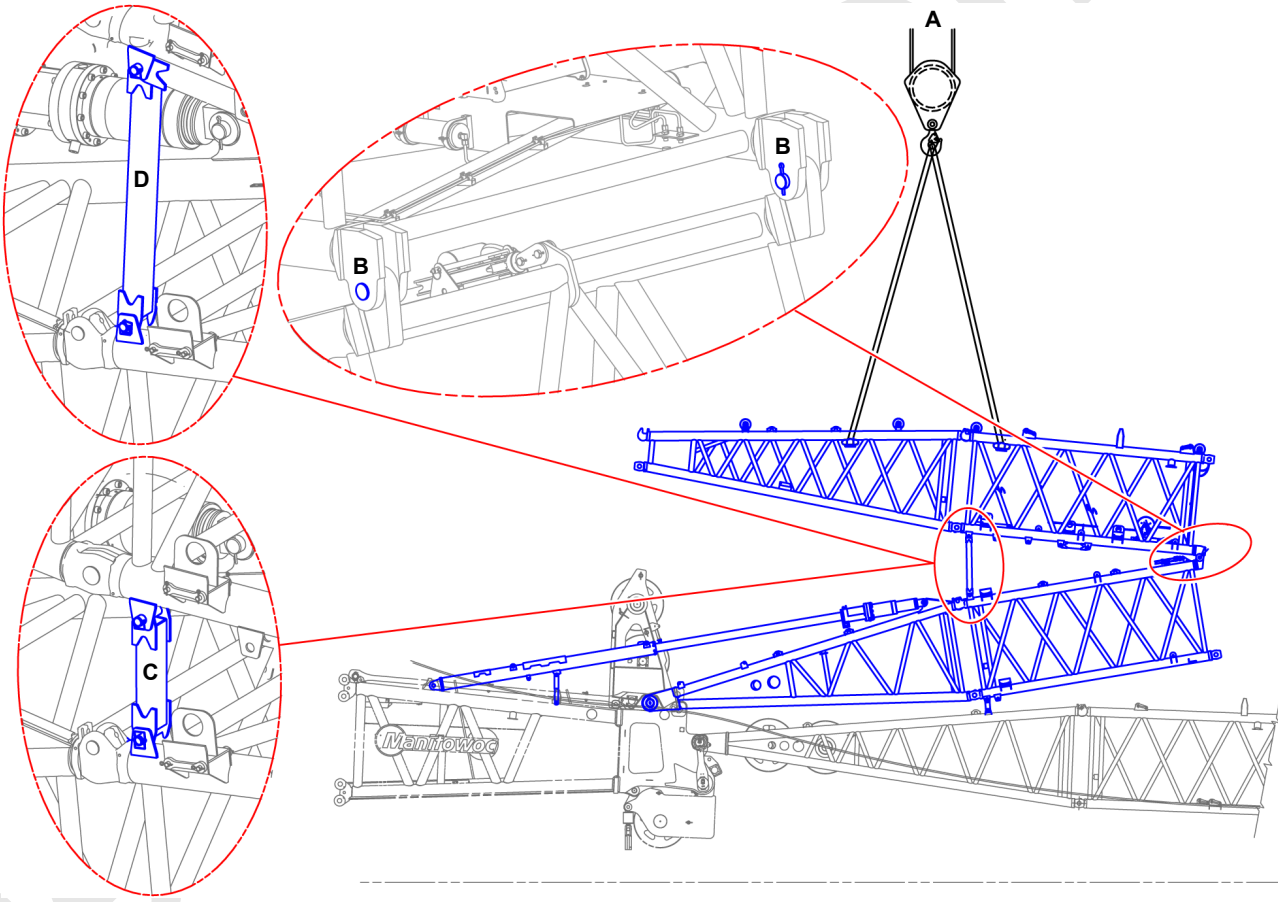
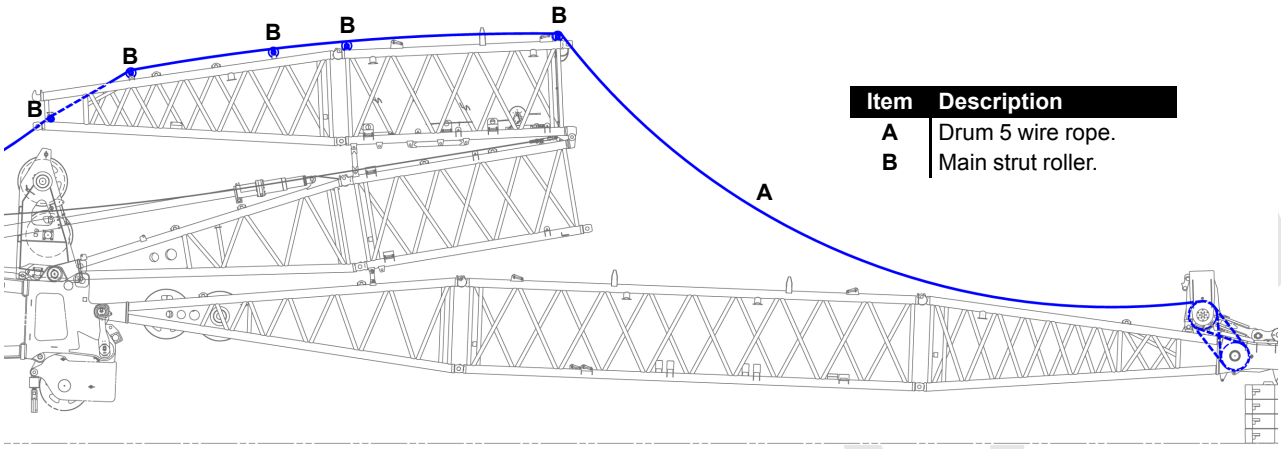


FIGURE 4-21

4

Step	Action
21	*Information below from drawing A19443, Sheet 13:* Move the Drum 5 wire rope (**A**) on top of the main strut rollers (**B**):  70 m (229.7 ft) boom length configuration shown. **FIGURE 4-22**

Item	Description
A	Drum 5 wire rope.
B	Main strut roller.

Step	Action
22	*Information below from drawing A19443, Sheets 3, 4, and 13:* Assemble the jib support straps (**J**) to the main strut: • Move the pin holding the link support set (**B**) to the storage trough (**C**) from the storage position (**D**) to the working position (**E**). *Failure to move this pin will damage the crane.* • Prepare to assemble the jib backstay straps (**J**) necessary for the current #90 boom length. Refer to drawing A19443 (examples **H** and **I** provided below). • Flip jib backstay strap links (**F**) to their working position.

Item	Description
A	Assist crane.
B	Link support set.
C	Storage trough.
D	Pin (storage position).
E	Pin (working position).
F	Link (working position).
G	Strut cap.
H	55 m (180.5 ft) #90 boom example.
I	60 m (196.9 ft) #90 boom example.
J	Jib backstay strap.
K	Jib backstay spreader.

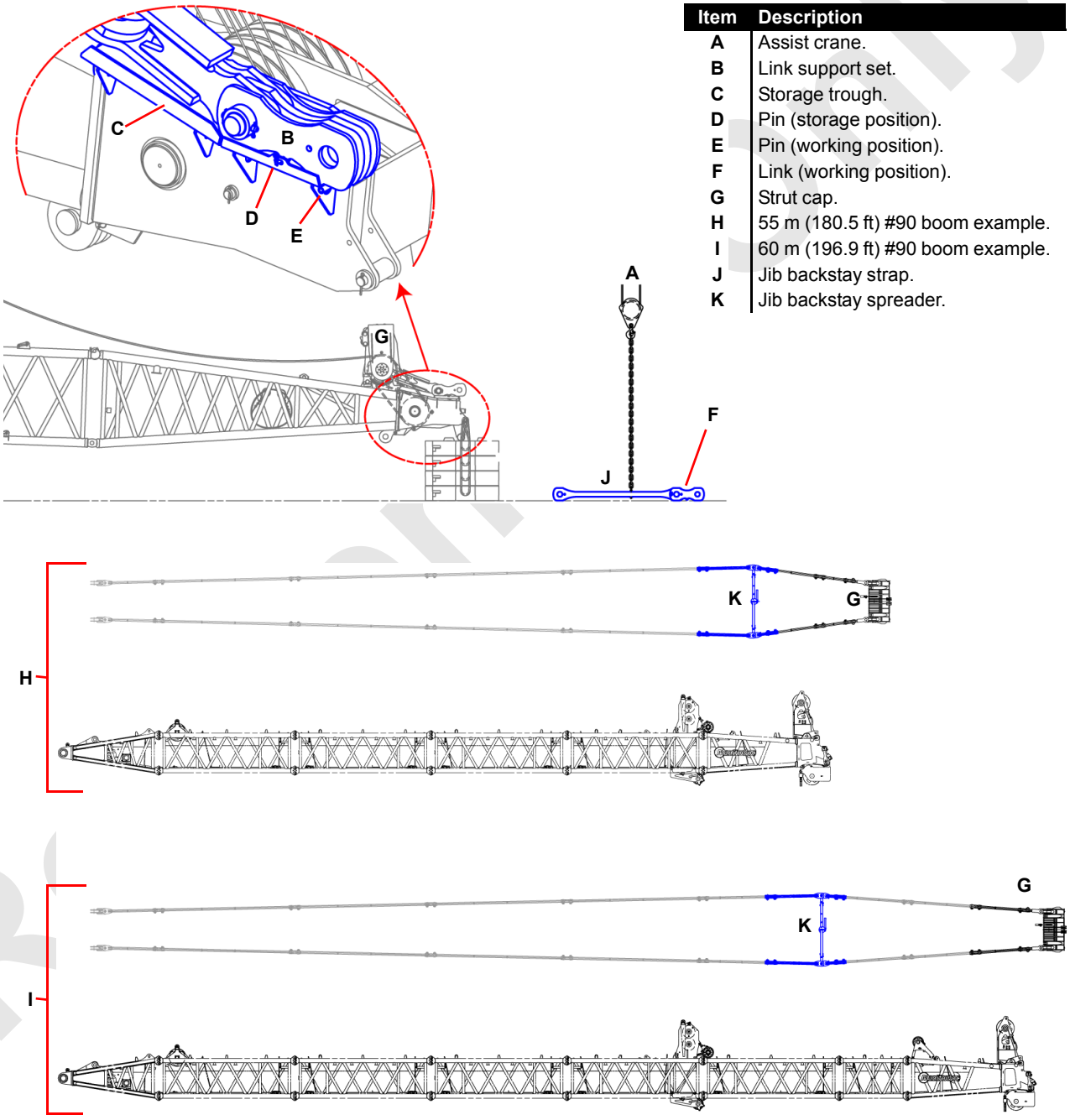


FIGURE 4-23

Step	Action
23	Using drawing A19443 as a guide, connect the jib backstay straps (**A**): • Move the strap links from the tie-down position (**C**) to the stowage position (**D**). • Remove the pin, collar, and pin assembly (**G**) from the strap as shown below. • Attach the strap rigging winch (**F**) to the strap as shown below. Then attach the lifting pin (**H**) from the winch to the boom link support set (**B**). • Use the strap rigging winch (**F**) to flip over the boom link support set (**B**). • Reattach the pin, collar, and pin assembly (**G**).
24	Connect the jib backstay spreader: • See Figure 4-25 if the crane boom length is *less than 70 m (229.7 ft)*. • See Figure 4-26 if the crane boom length is *70 m (229.7 ft) or greater.*

Item	Description
A	Jib backstay strap.
B	Boom link support set.
C	Strap link (tie-down position).
D	Strap link (stowage position).
E	Boom insert.
F	Strap rigging winch.
G	Pin, collar, pin assembly.
H	Lifting pin.

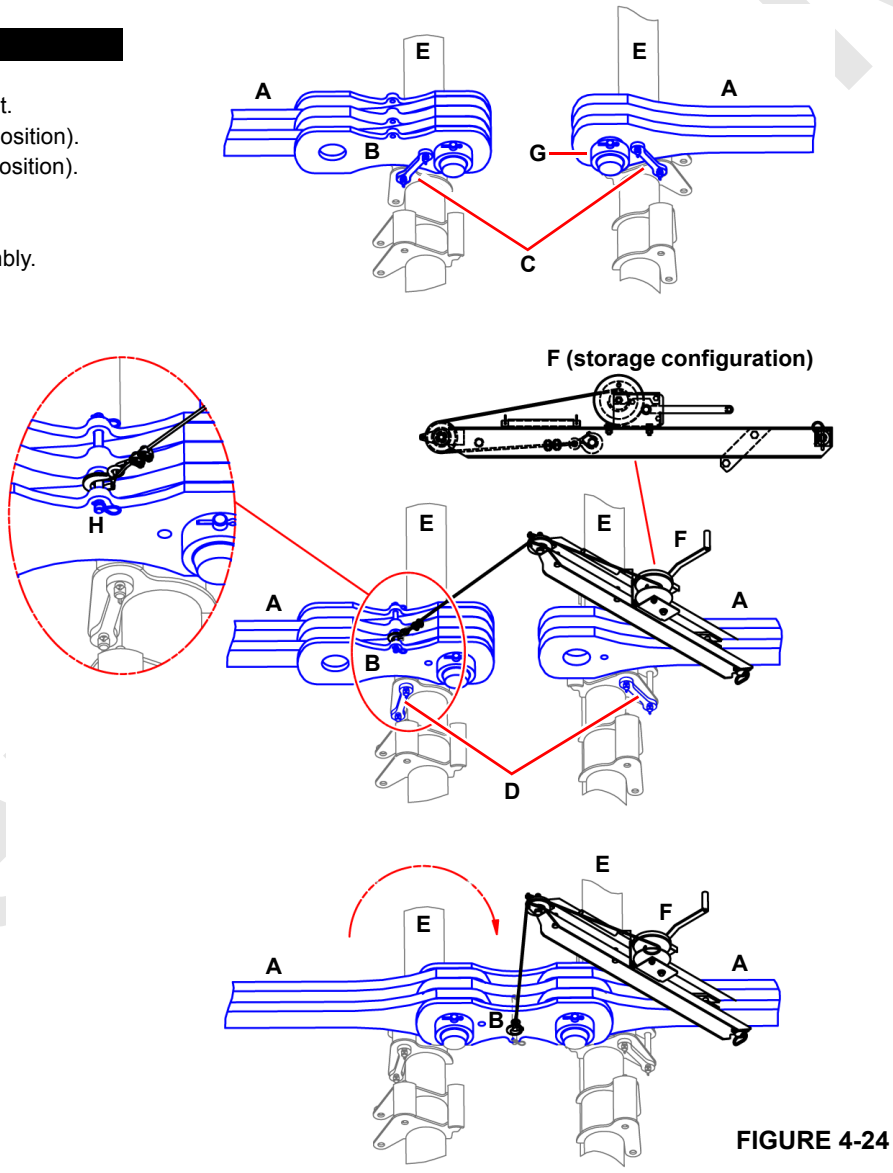
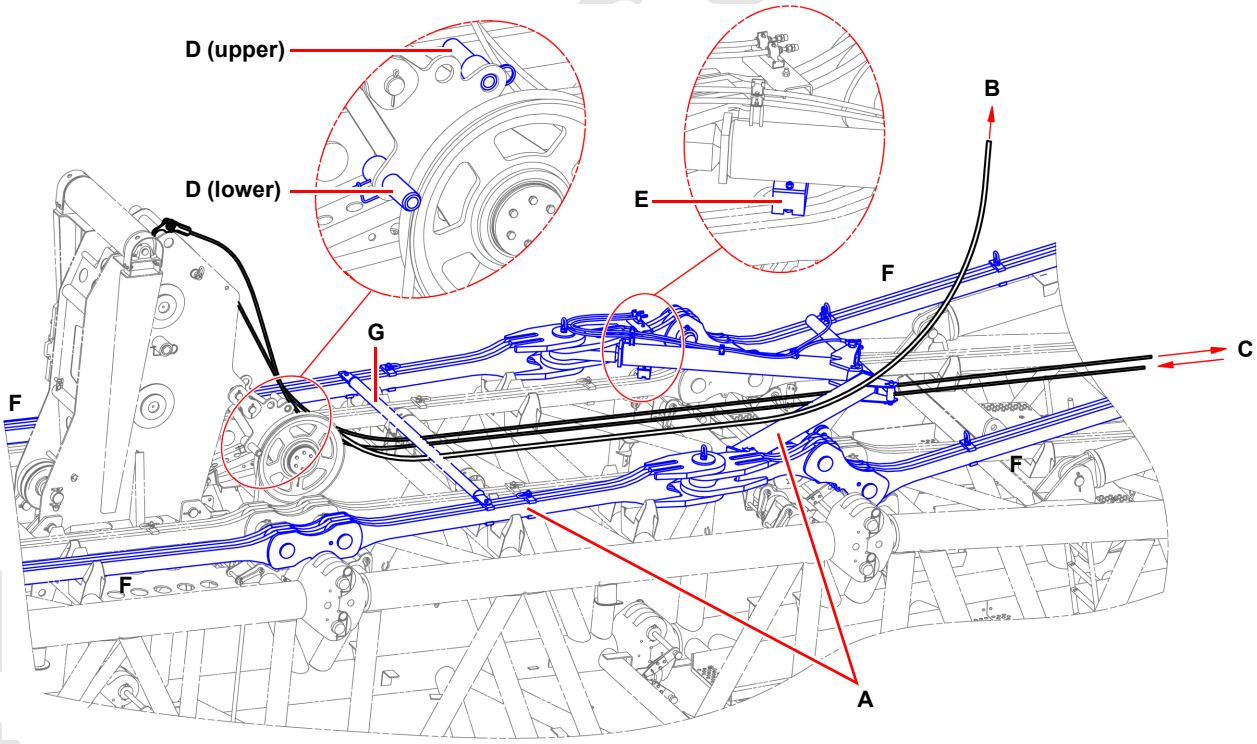


FIGURE 4-24

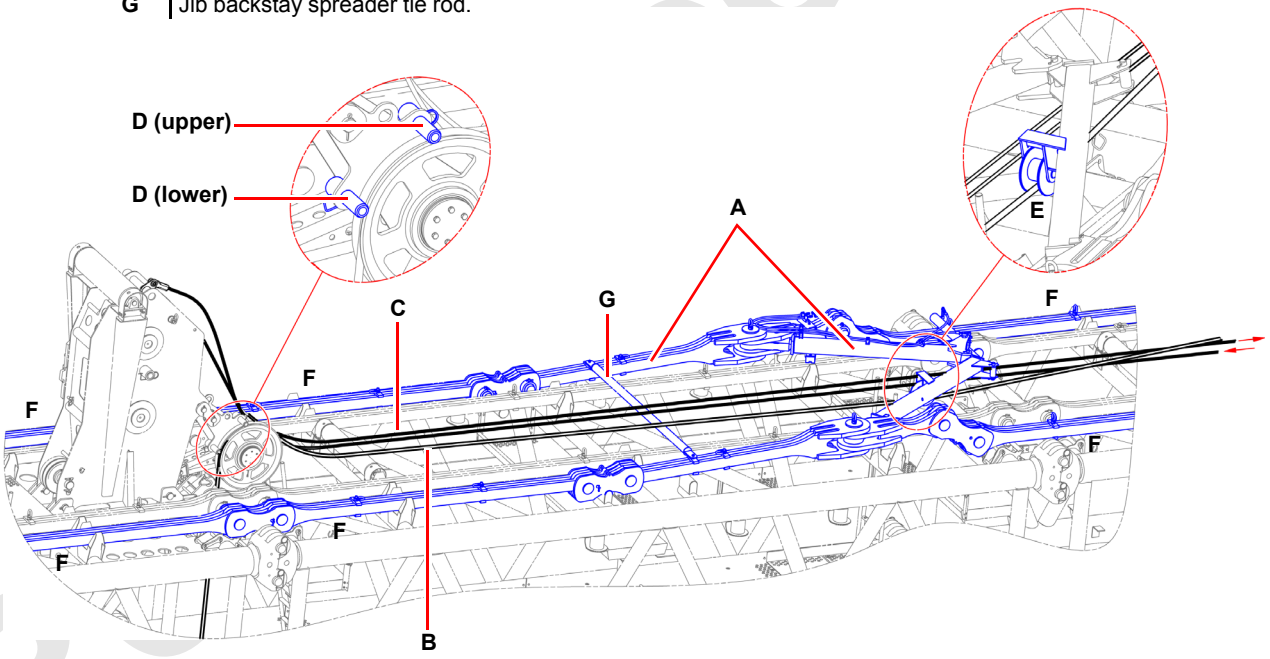
Step	Action
25	*Information below from drawing A19443, Sheet 14:* Jib backstay spreader connection for boom lengths *less than 70 m (229.7 ft)*: • Jib backstay straps shall be connected (see Figure 4-24). • Place the jib backstay spreader (**A**) on the boom insert closest to the last connected jib backstay strap. • *Except for a boom length of 55 m (180.5 ft)*, the jib backstay spreader pad (**E**) should rest on a jib backstay strap. • Remove the jib backstay spreader tie rod (**G**). • Position the Drum 5 wire rope (**B**) ***above*** the jib backstay spreader (**A**). • Position the Drum 6 winch wire rope (**C**) under the jib backstay spreader (**A**). • Place the *upper* wire rope guard (**D**) in the stowed position as shown below. *After the main strut is erected, place the upper wire rope guard (**D**) back to its working position*. • Attach the jib backstay spreader (**A**) to the jib backstay straps (**F**) (see Figure 4-24).

Item	Description
A	Jib backstay spreader.
B	Drum 5 wire rope.
C	Drum 6 winch wire rope.
D	Wire rope guard.
E	Jib backstay spreader pad.
F	Jib backstay strap.
G	Jib backstay spreader tie rod.

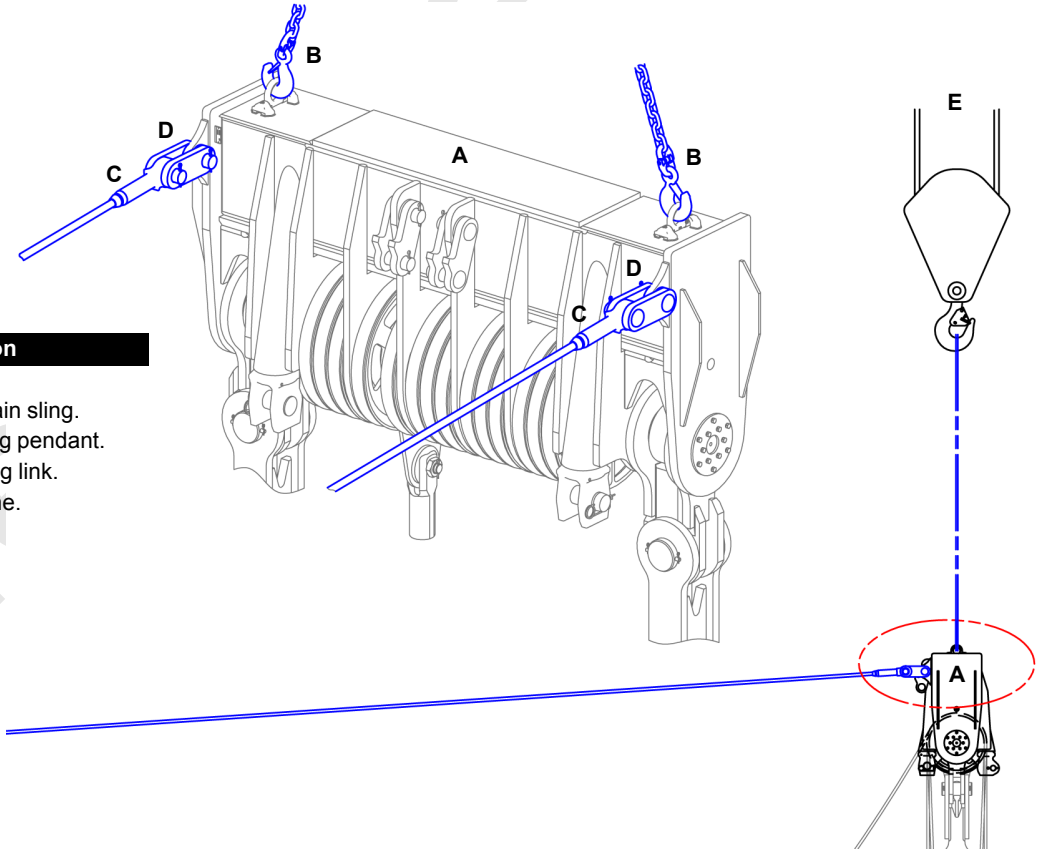


Spreader assembly connection for cranes with boom lengths *less than 70 m (229.7 ft)*
60 m (196.9 ft) boom length configuration shown above.

FIGURE 4-25

Step	Action
26	*Information below from drawing A19443, Sheet 14:* Jib backstay spreader connection for boom lengths *70 m (229.7 ft) and greater*: • Jib backstay straps shall be connected (see Figure 4-24). • Place the jib backstay spreader (**A**) on the boom insert closest to the last connected jib backstay strap. • Position the Drum 5 wire rope (**B**) *and* Drum 6 winch wire rope (**C**) *under* the jib backstay spreader (**A**). • The Drum 6 winch wire rope (**C**) shall also be located on the *left side* of the top wire rope guide (see **A** in Figure 4-6). • The jib backstay spreader roller (**E**) should rest on top of the Drum 5 wire rope (**C**). • Remove the jib backstay spreader tie rod (**G**). • *Both* wire rope guards (**D**) should be in the *working* position as shown below. • Attach the jib backstay spreader (**A**) to the jib backstay straps (**F**) (see Figure 4-24). **Item** / **Description** **A** Jib backstay spreader. **B** Drum 5 wire rope. **C** Drum 6 winch wire rope. **D** Wire rope guard. **E** Jib backstay spreader roller. **F** Jib backstay strap. **G** Jib backstay spreader tie rod.  **Spreader assembly connection for cranes with boom lengths *70 m (229.7 ft) and greater*** *70 m (229.7 ft) boom length configuration shown above.* **FIGURE 4-26**

Relocate the Strut Cap from the Jib Strut to the Main Strut

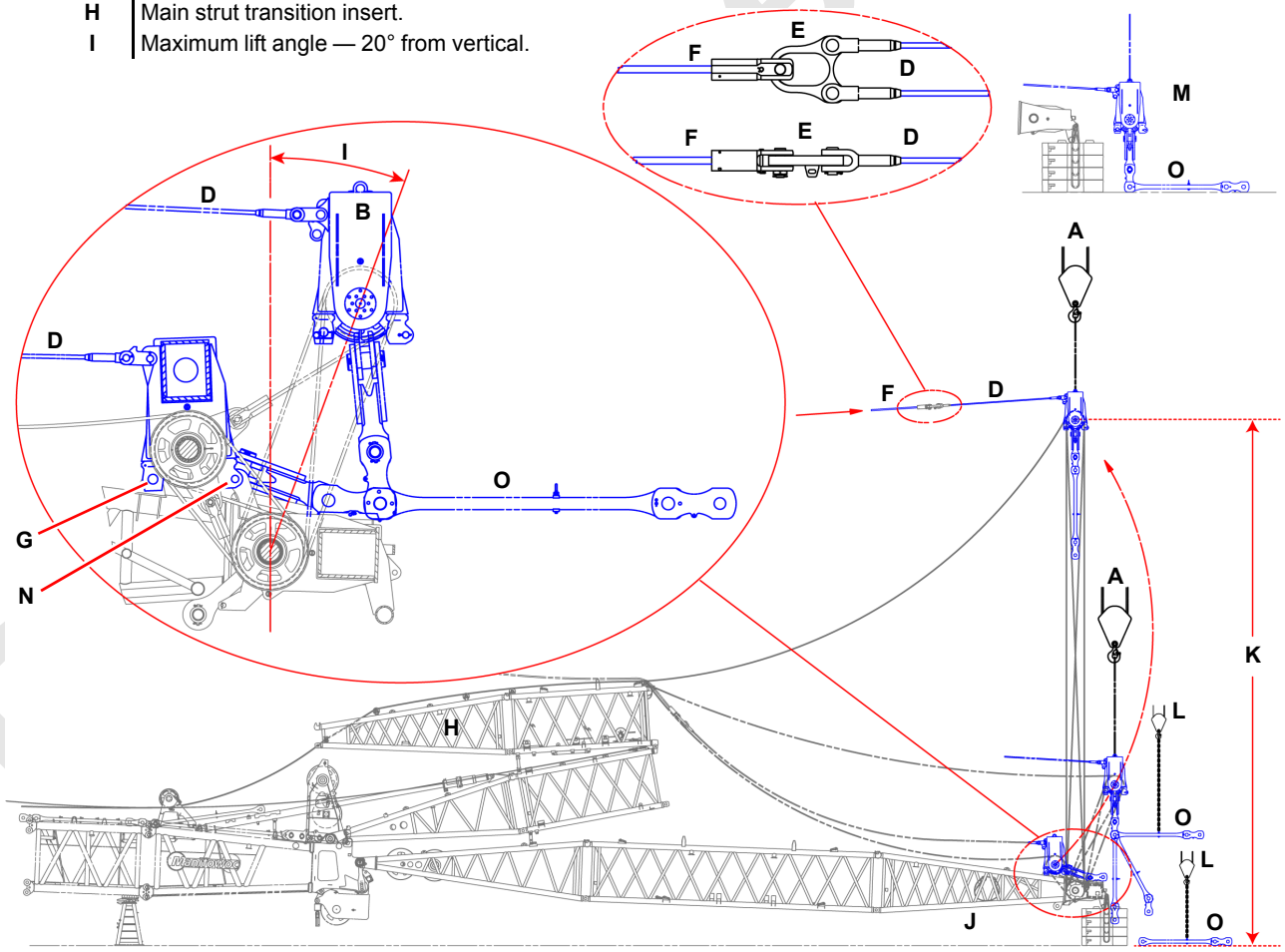
Step	Action
27	*Information below from drawing A19443, Sheet 15:* • Attach an assist crane to the top of the strut cap (**A**) using a 2-point chain sling (**B**):  **FIGURE 4-27** • Connect the lifting links on the strut raising pendant (**C**) to the strut raising links (**D**) on the strut cap (**A**):  **FIGURE 4-28**

Item	Description
A	Strut cap.
B	2-point chain sling.
C	Strut raising pendant.
D	Strut raining link.
E	Assist crane.

Step	Action
28	*Information below from drawing A19443, Sheet 15:* • Attach the lifting lug (**E**) on the strut raising pendant (**D**) to the Drum 1 or Drum 2 wire rope (**F**). • Remove the rear strut cap pins (**G**). *These pins will be used in a later step to fasten the strut cap (**B**) to the top of the main strut transition insert (**H**). Leave the front strut cap pins (**N**) in place.* • Using an assist crane (**A**), lift the strut cap (**B**) so that the front strut cap pins (**N**) disengage from the slotted holes on the strut cap (**B**) — see Figure 4-30 for details. *Keep the Drum or Drum 2 wire rope slack during this step.* • Using a second assist crane (**L**), attach the appropriate backstay straps (**O**) to the strut cap (**B**). *If a second assist crane is not available, then lower the strut cap (**B**) to the backstay straps (**O**) positioned on the ground.* • While moving toward the top end of the strut cap, lift the strut cap (**B**) to a height of 41 m (135 ft). *Keep the maximum lift angle (**I**) less than 20 degrees from vertical. The goal is to be near 20 degrees when the strut cap (**B**) is lifted to eliminate the straps and links from contacting the struts.*

Item	Description
A	Assist crane #1.
B	Strut cap.
C	2-point chain sling.
D	Strut raising pendant.
E	Lifting lug.
F	Drum 1 or Drum 2 wire rope.
G	Rear strut cap pin.
H	Main strut transition insert.
I	Maximum lift angle — 20° from vertical.

Item	Description
J	#491 strut assembly top.
K	41 m (135 feet).
L	Assist crane #2.
M	Backstay strap attachment with one assist crane.
N	Front strut cap pin.
O	Backstay strap.

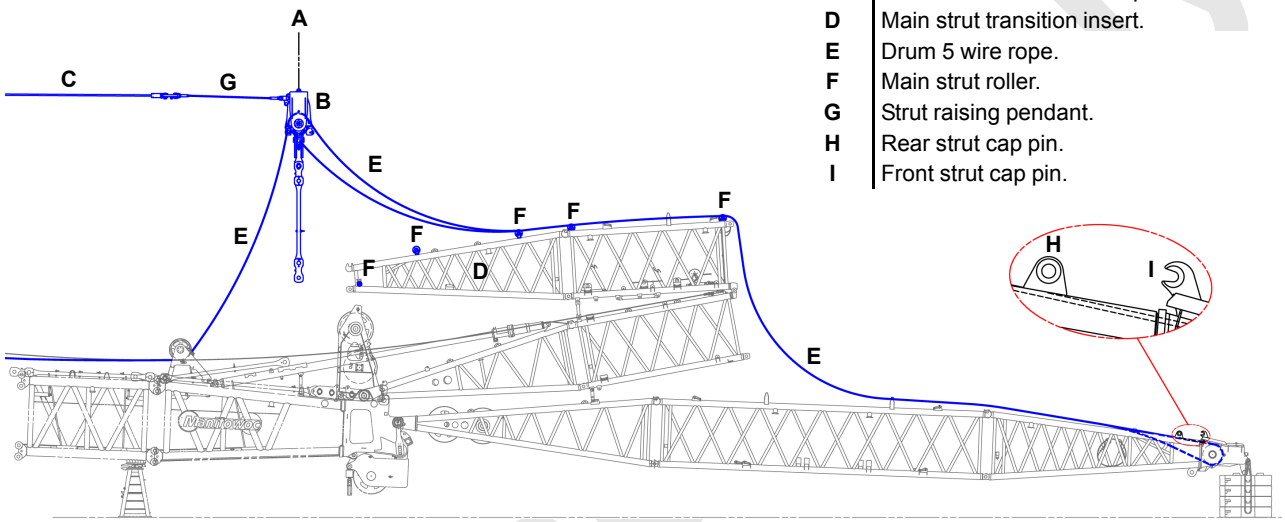


70 m (229.7 ft) boom length configuration shown.

FIGURE 4-29

Step	Action
29	*Information below from drawing A19443, Sheet 15:* Using an assist crane (**A**) and the Drum 1 or Drum 2 wire rope (**C**), • Move the strut cap (**B**) over the main strut transition insert (**D**). • Position the Drum 5 wire rope (**E**) on top of the main strut rollers (**F**).

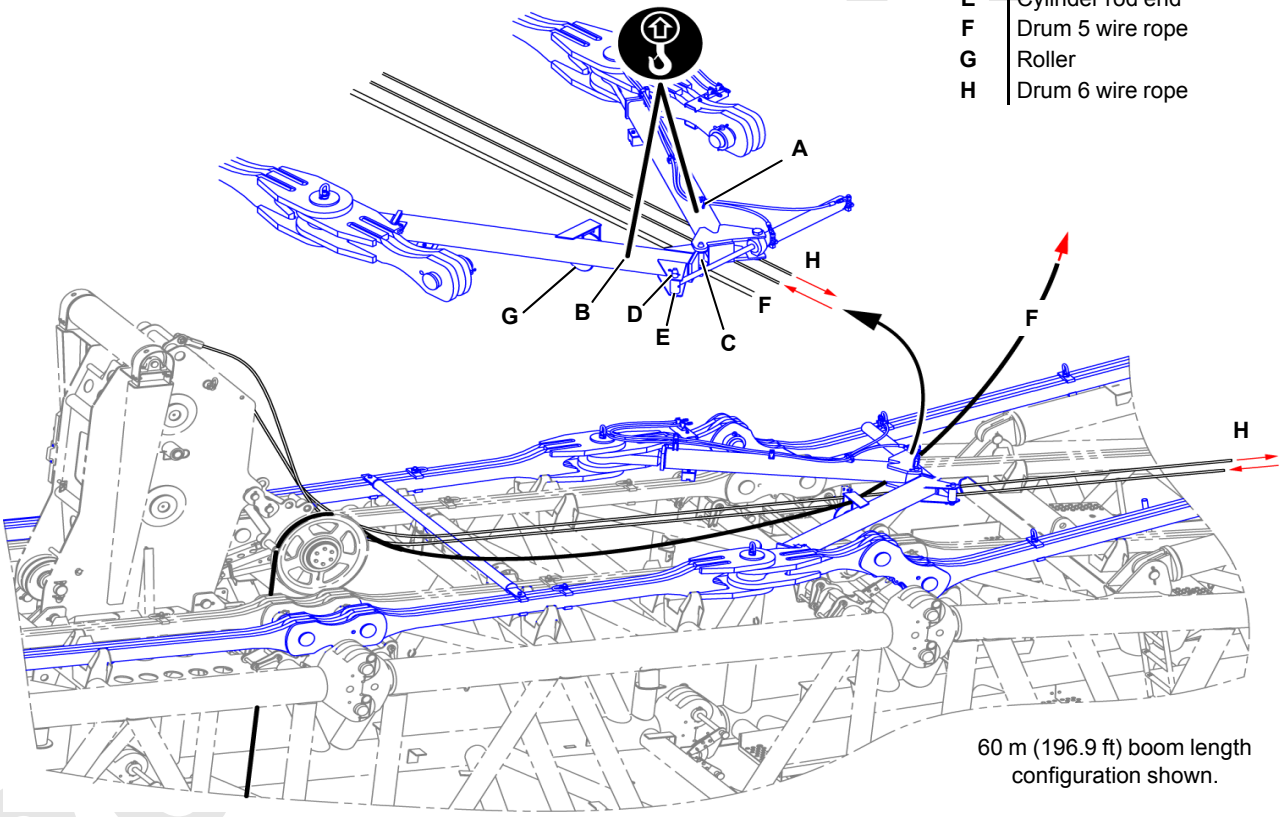
Item	Description
A	Assist crane.
B	Strut cap.
C	Drum 1 or Drum 2 wire rope.
D	Main strut transition insert.
E	Drum 5 wire rope.
F	Main strut roller.
G	Strut raising pendant.
H	Rear strut cap pin.
I	Front strut cap pin.



70 m (229.7 ft) boom length configuration shown.

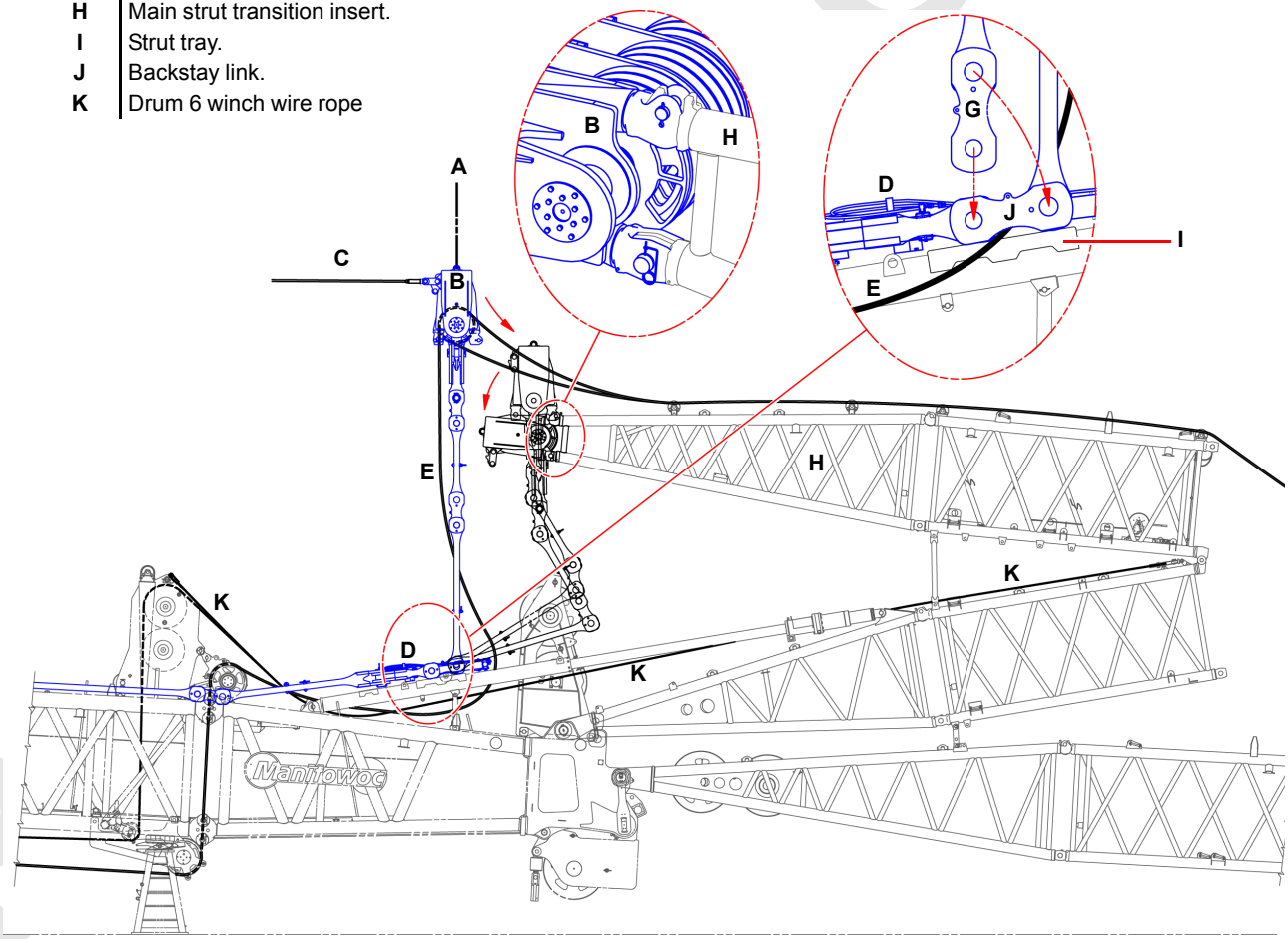
FIGURE 4-30

4

Step	Action
30	*Information below from drawing A19443, Sheet 16 and 17:* • Reposition the Drum 5 wire rope as follows: - Support the spreader halves (**A** and **B**) with lifting slings from the assist crane. - Remove the pins (**C** and **D**) to create and opening between the spreader halves. - Pass the Drum 5 wire rope (**F**) through the opening and lay the wire rope on top of the boom sections. - Close the spreader halves (**A** and **B**) and reinstall pins (**C** and **D**) - Disconnect the lifting slings - IMPORTANT: Be sure to position the Drum 5 wire rope under the roller (**G**) when the strut is raised. Failure to position the Drum 5 wire rope (**F**) **under** the spreader halves (**A** and **B**) will result in structural damage when the main strut is raised. **Item** / **Description** **A** Left spreader half **B** Right spreader half **C** Pin with cotter pins (2) **D** Pin with cotter pins (2) **E** Cylinder rod end **F** Drum 5 wire rope **G** Roller **H** Drum 6 wire rope  60 m (196.9 ft) boom length configuration shown. **FIGURE 4-31**
31	Connect the strut cap to the jib backstay spreader: • Go to Figure 4-32 if the crane boom length is 55 m (180.5 ft). • Go to Figure 4-33 if the crane boom length is 60 m (196.9 ft). • Go to Figure 4-34 if the crane boom length is 65 m (213.3 ft). • Go to Figure 4-35 if the crane boom length is 70 m (229.7 ft), 75 m (246.1 ft), 80 m (262.5 ft), or 85 m (278.9 ft). • Go to Figure 4-36 if the crane boom length is 90 m (295.3 ft), 95 m (311.7 ft), 100 m (328.1 ft), or 105 m (344.5 ft).

Step	Action
32	*Information below from drawing A19443, Sheet 16:* *For a crane with a boom length of 55 m (180.5 ft),* connect the strut cap (**B**) to the jib backstay spreader (**D**) as shown below: • Using an assist crane (**A**) and the Drum 1 or Drum 2 wire rope (**C**), position the strut cap (**B**) over the end of the jib backstay spreader (**D**) as shown. • Connect the lowest strut cap strap (**G**) to the jib backstay spreader (**D**) using pin, collar, pin assembly. Before trying to connect, align the holes first by setting the backstay link (**J**) on the strut tray (**I**). • Attach the strut cap (**B**) to the main strut transition insert (**H**) as shown in Figure 4-37.

Item	Description
A	Assist crane.
B	Strut cap.
C	Drum 1 or Drum 2 wire rope.
D	Jib backstay spreader.
E	Drum 5 wire rope.
F	Not used.
G	Strut cap strap.
H	Main strut transition insert.
I	Strut tray.
J	Backstay link.
K	Drum 6 winch wire rope

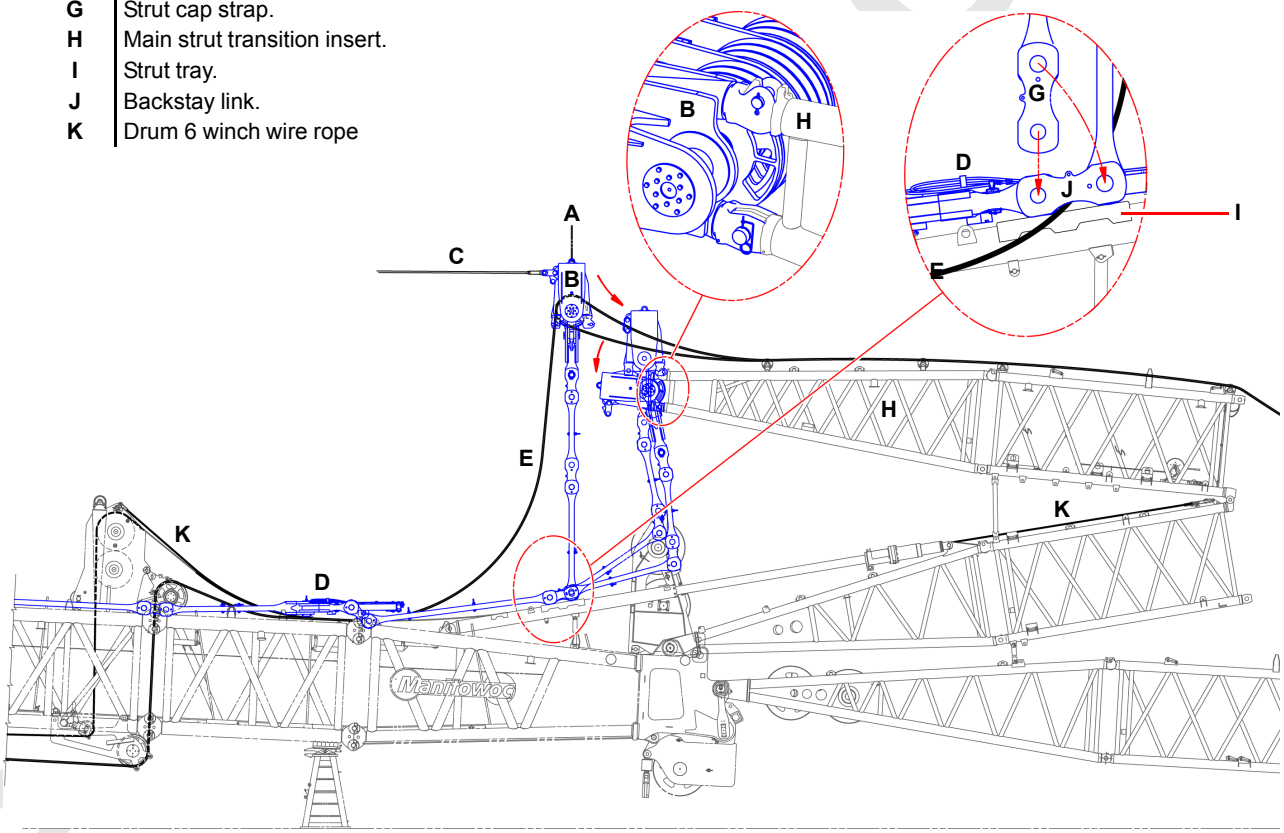


55 m (180.5 ft) boom length configuration shown.

FIGURE 4-32

Step	Action
33	*Information below from drawing A19443, Sheet 17:* *For a crane with a boom length of 60 m (196.9 ft)*, connect the strut cap (**B**) to the jib backstay spreader (**D**) as shown below: • Using an assist crane (**A**) and the Drum 1 or Drum 2 wire rope (**C**), position the strut cap (**B**) over the end of the jib backstay spreader (**D**) as shown. • Connect the lowest strut cap strap (**G**) to the jib backstay spreader (**D**) using pin, collar, pin assembly. Before trying to connect, align the holes first by setting the backstay link (**J**) on the strut tray (**I**). • Attach the strut cap (**B**) to the main strut transition insert (**H**) as shown in Figure 4-37.

Item	Description
A	Assist crane.
B	Strut cap.
C	Drum 1 or Drum 2 wire rope.
D	Jib backstay spreader.
E	Drum 5 wire rope.
F	Not used.
G	Strut cap strap.
H	Main strut transition insert.
I	Strut tray.
J	Backstay link.
K	Drum 6 winch wire rope

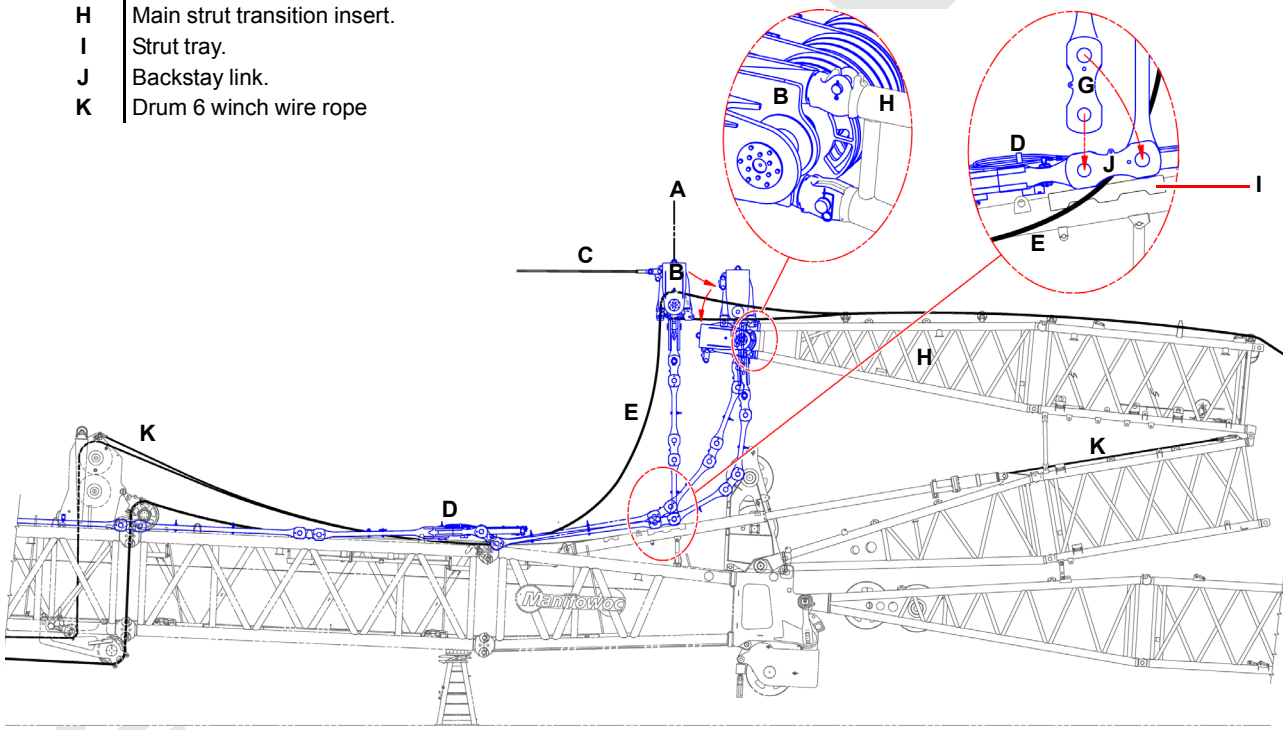


60 m (196.9 ft) boom length configuration shown.

FIGURE 4-33

Step	Action
34	*Information below from drawing A19443, Sheet 17:* *For a crane with a boom length of 65 m (213.3 ft)*, connect the strut cap (**B**) to the jib backstay spreader (**D**) as shown below: • Using an assist crane (**A**) and the Drum 1 or Drum 2 wire rope (**C**), position the strut cap (**B**) over the end of the jib backstay spreader (**D**) as shown. • Connect the lowest strut cap strap (**G**) to the jib backstay spreader (**D**) using pin, collar, pin assembly. Before trying to connect, align the holes first by setting the backstay link (**J**) on the strut tray (**I**). • Attach the strut cap (**B**) to the main strut transition insert (**H**) as shown in Figure 4-37.

Item	Description
A	Assist crane.
B	Strut cap.
C	Drum 1 or Drum 2 wire rope.
D	Jib backstay spreader.
E	Drum 5 wire rope.
F	Not used.
G	Strut cap strap.
H	Main strut transition insert.
I	Strut tray.
J	Backstay link.
K	Drum 6 winch wire rope

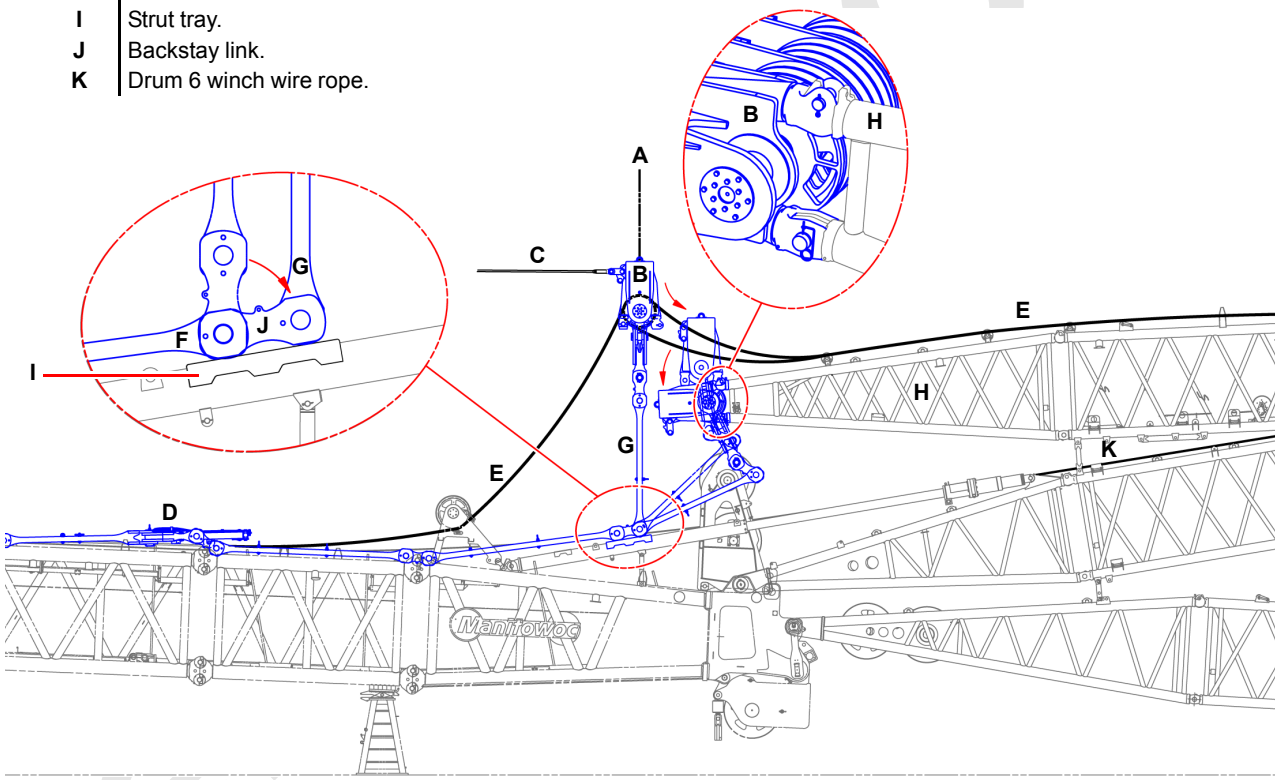


65 m (213.3 ft) boom length configuration shown.

FIGURE 4-34

Step	Action
35	*Information below from drawing A19443, Sheet 18:* *For a crane with a boom length of 70 m (229.7 ft), 75 m (246.1 ft), 80 m (262.5 ft), or 85 m (278.9 ft)*, connect the strut cap (**B**) to the last jib backstay strap (**F**) on the jib backstay spreader (**D**) as shown below: • Connect the lowest strut cap strap (**G**) to the jib backstay spreader (**D**) using pin, collar, pin assembly. *Before trying to connect, align the holes first by setting the backstay link (**J**) on the strut tray (**I**).* • Attach the strut cap (**B**) to the main strut transition insert (**H**) as shown in Figure 4-37.

Item	Description
A	Assist crane.
B	Strut cap.
C	Drum 1 or Drum 2 wire rope.
D	Jib backstay spreader.
E	Drum 5 wire rope.
F	Last jib backstay strap.
G	Strut cap strap.
H	Main strut transition insert.
I	Strut tray.
J	Backstay link.
K	Drum 6 winch wire rope.

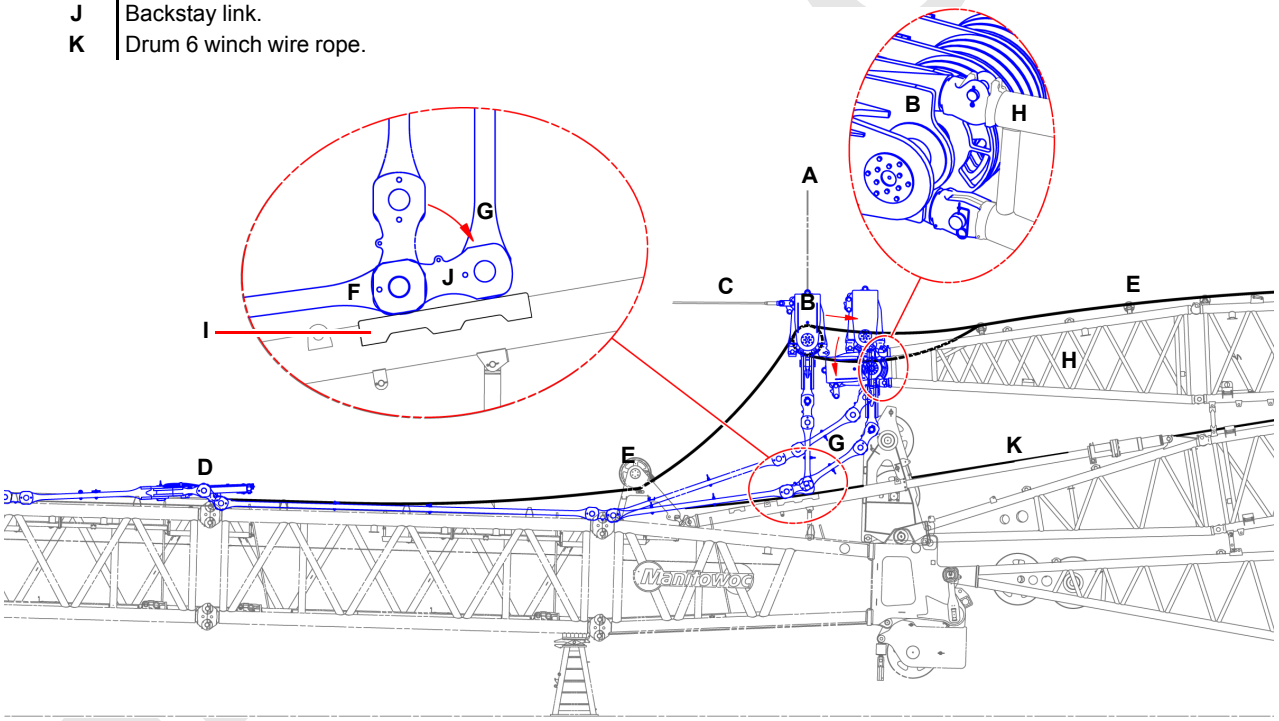


70 m (229.7 ft), 75 m (246.1 ft), 80 m (262.5 ft), or 85 m (278.9 ft) boom length configuration shown.

FIGURE 4-35

Step	Action
36	*Information below from drawing A19443, Sheet 18:* *For a crane with a boom length of 90 m (295.3 ft), 95 m (311.7 ft), 100 m (328.1 ft), or 105 m (344.5 ft)*, connect the strut cap (**B**) to the last jib backstay strap (**F**) on the jib backstay spreader (**D**) as shown below: • Connect the lowest strut cap strap (**G**) to the jib backstay spreader (**D**) using pin, collar, pin assembly. *Before trying to connect, align the holes first by setting the backstay link (**J**) on the strut tray (**I**).* • Attach the strut cap (**B**) to the main strut transition insert (**H**) as shown in Figure 4-37:

Item	Description
A	Assist crane.
B	Strut cap.
C	Drum 1 or Drum 2 wire rope.
D	Jib backstay spreader.
E	Drum 5 wire rope.
F	Last jib backstay strap.
G	Strut cap strap.
H	Main strut transition insert.
I	Strut tray.
J	Backstay link.
K	Drum 6 winch wire rope.



90 m (295.3 ft), 95 m (311.7 ft), 100 m (328.1 ft), or 105 m (344.5 ft) boom length configuration shown.

FIGURE 4-36

Step	Action
37	Using an assist crane (**E**) and Drum 1 or Drum 2 wire rope (**F**), attach the strut cap (**D**) to the main strut transition insert (**C**): • Position the strut cap (**D**) so that the *top* two strut cap pins (**A**) engage the main strut transition insert (**J**) hook connector (**B**). • Slowly swing the strut cap (**D**) down until it is possible to fasten the *bottom* two strut cap pins (**A**).

Item	Description
A	Strut cap pin.
B	Hook connector.
C	Main strut transition insert.
D	Strut cap.
E	Assist crane.
F	Drum 1 or Drum 2 wire rope.

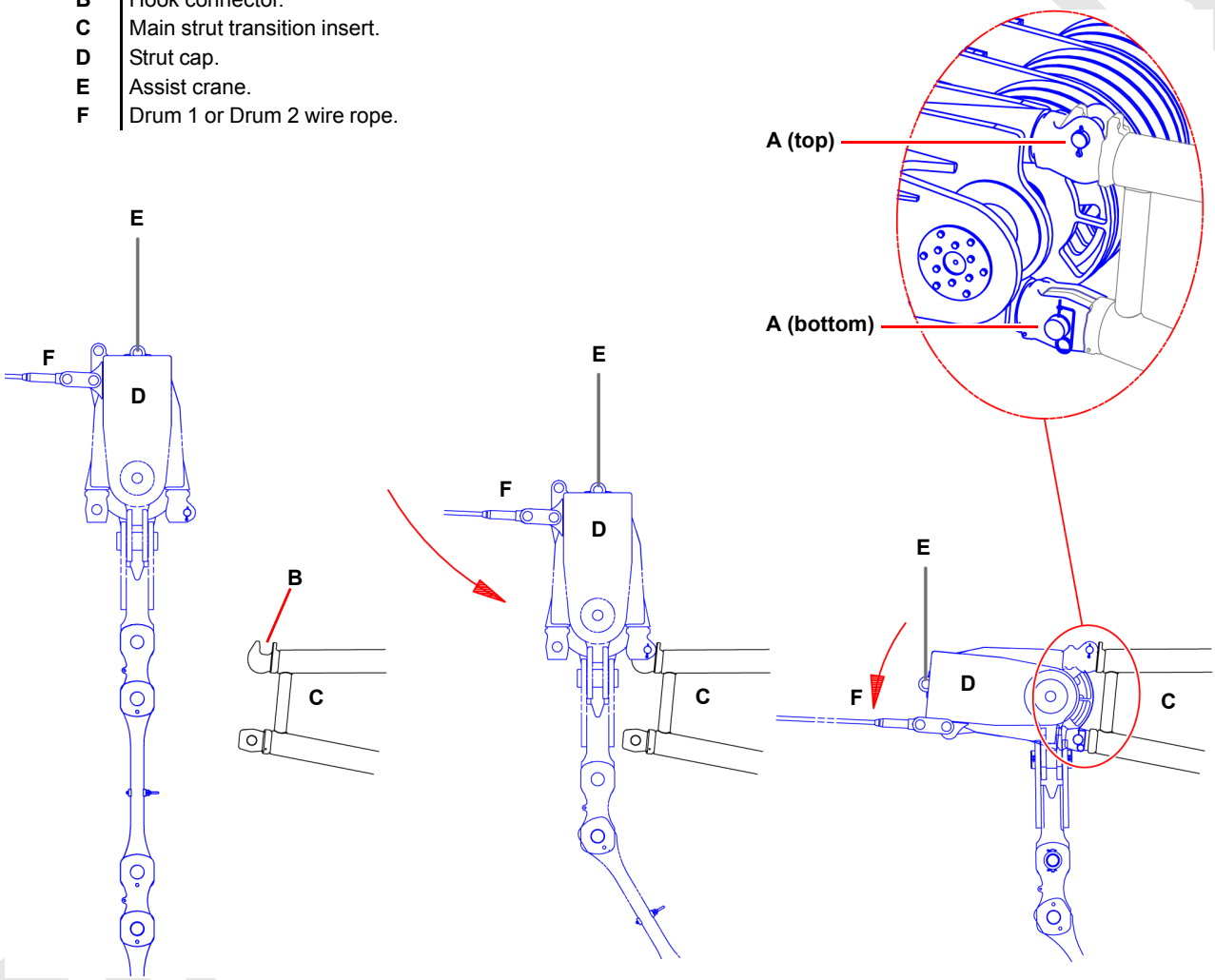
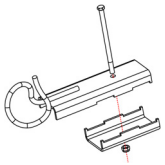
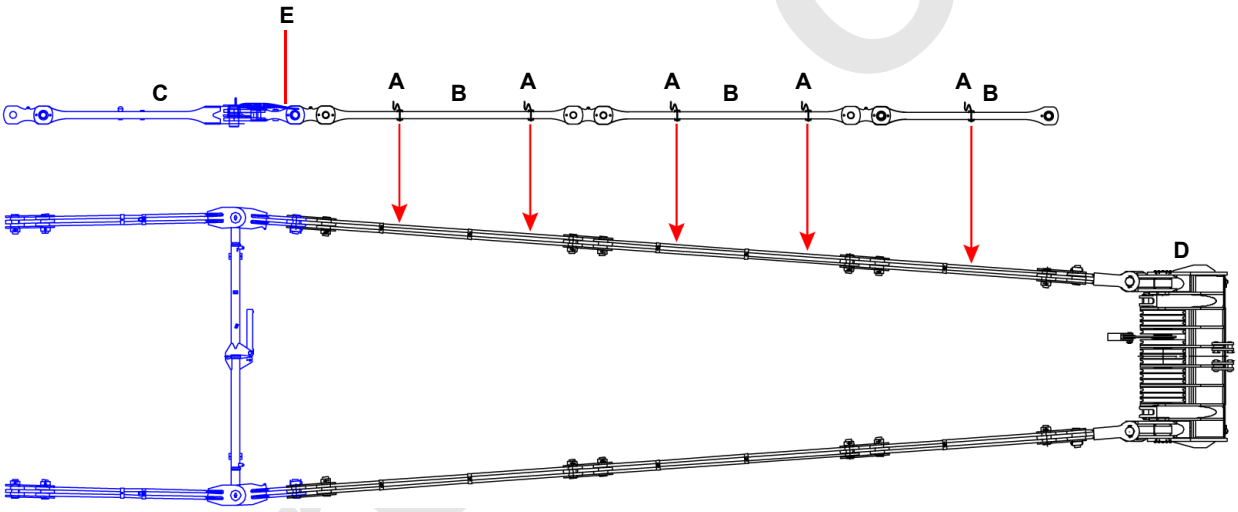
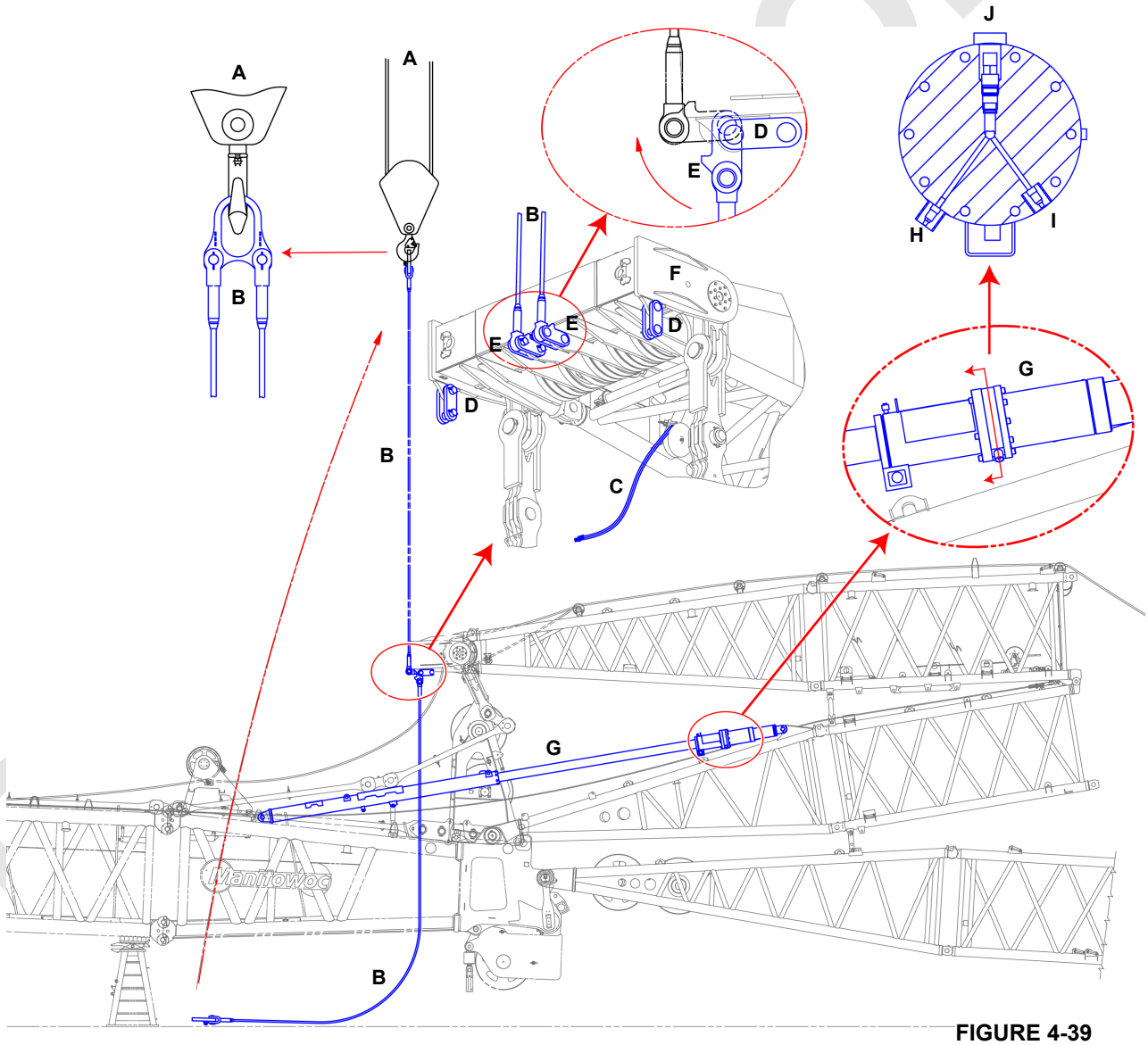
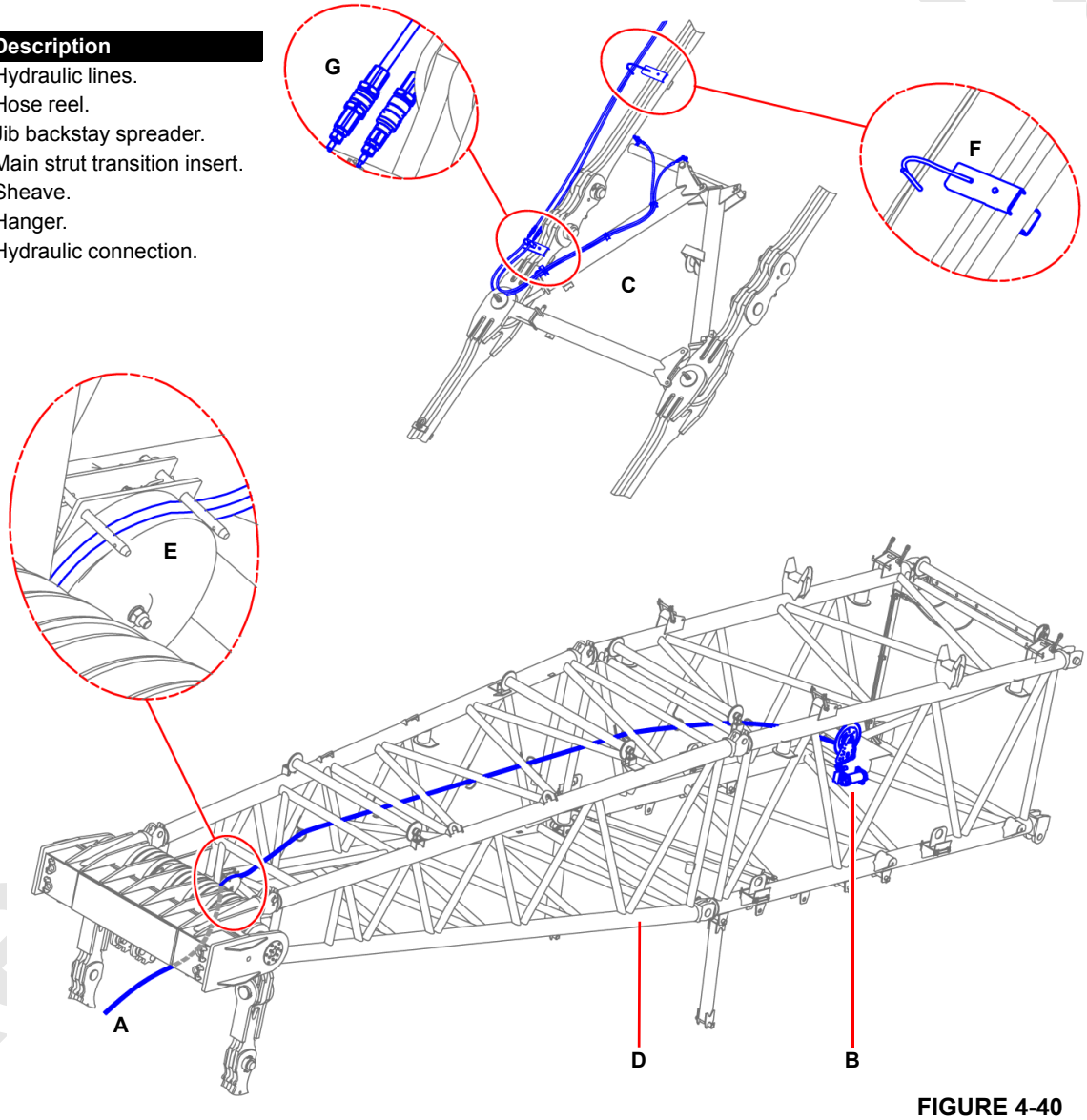


FIGURE 4-37

Step	Action
38	*Information below from drawing A19443, Sheet 20:* Attach hydraulic line stays (**A**) to the *left hand* jib backstay straps (**B**) that connect the jib backstay spreader (**C**) to the strut cap (**D**): **Item** / **Description** **A** Hydraulic line stays.  **B** Jib backstay strap. **C** Jib backstay spreader. **D** Strut cap. **E** Jib backstay spreader hydraulic connection.  70 m (229.7 ft) boom length configuration shown. **FIGURE 4-38**

Step	Action
39	*Information below from drawing A19443, Sheet 19:* • Disconnect the strut raising pendant (**B**) from the Drum 2 wire rope. *If Drum 2 will not be rigged, then return the Drum 2 wire rope to Drum 2.* • Open the bypass valve (**I**) on both of the main strut support stops (**G**). SCREW OUT the bypass valve (I) to OPEN it. SCREW IN the bypass valve (**I**) to CLOSE it. *Failure to open the bypass valve (**I**) will **not** allow the main strut to close. This will cause structural damage.* • Connect the strut raising pendant (**B**) to the inner links (**E**) of the strut cap (**F**) and to the assist crane (**A**). **Item** / **Description** **A** Assist crane. **B** Strut raising pendant. **C** Hydraulic lines (see Figure 4-40). **D** Outer link. **E** Inner link. **Item** / **Description** **F** Strut cap. **G** Main strut support stop. **H** Filling valve. **I** Bypass valve. **J** Sequence valve.  **FIGURE 4-39**

Step	Action
40	*Information below from drawing A19443, Sheet 20:* Connect the hydraulic lines (**A**) from the hose reel (**B**) to the jib backstay spreader (**C**): • Uncoil the hydraulic lines (**A**) from the hose reel (**B**). • Run the hydraulic lines (**A**) over the top of the sheave (**E**) on the main transition insert (**D**). • Continue running the hydraulic lines (**A**) to the jib backstay spreader (**C**) as shown in Figure 4-38. • Support the hydraulic lines (**A**) with hangers (**F**). • Connect the hydraulic lines (**A**) to the hydraulic connection (**G**) on the jib backstay spreader (**C**). **Item** **Description** **A** Hydraulic lines. **B** Hose reel. **C** Jib backstay spreader. **D** Main strut transition insert. **E** Sheave. **F** Hanger. **G** Hydraulic connection.  **FIGURE 4-40**

Raise the Main Strut

Step	Action
41	*Information below from drawing A19443, Sheet 21:* Use the assist crane (**A**) to raise the main strut (**B**) while paying out Drum 5 wire rope (**C**): • When clearance permits, stop raising the main strut (**B**) and stow the support struts (**E, F, G, H**). • Continue to pay out Drum 5 wire rope (**C**) while using the assist crane (**A**) to slowly raise the main strut (**B**) until the strut stop telescoping tube approaches the contact position (**D**).

Item	Description
A	Assist crane.
B	Main strut.
C	Drum 5 wire rope.
D	Strut stop contact position.
E	Main strut support — upper stowage (for boom lengths less than 70m).
F	Main strut support — upper stowage (for boom lengths 70m and greater).
G	Main strut support — lower stowage.
H	Main strut support stop support stowage,

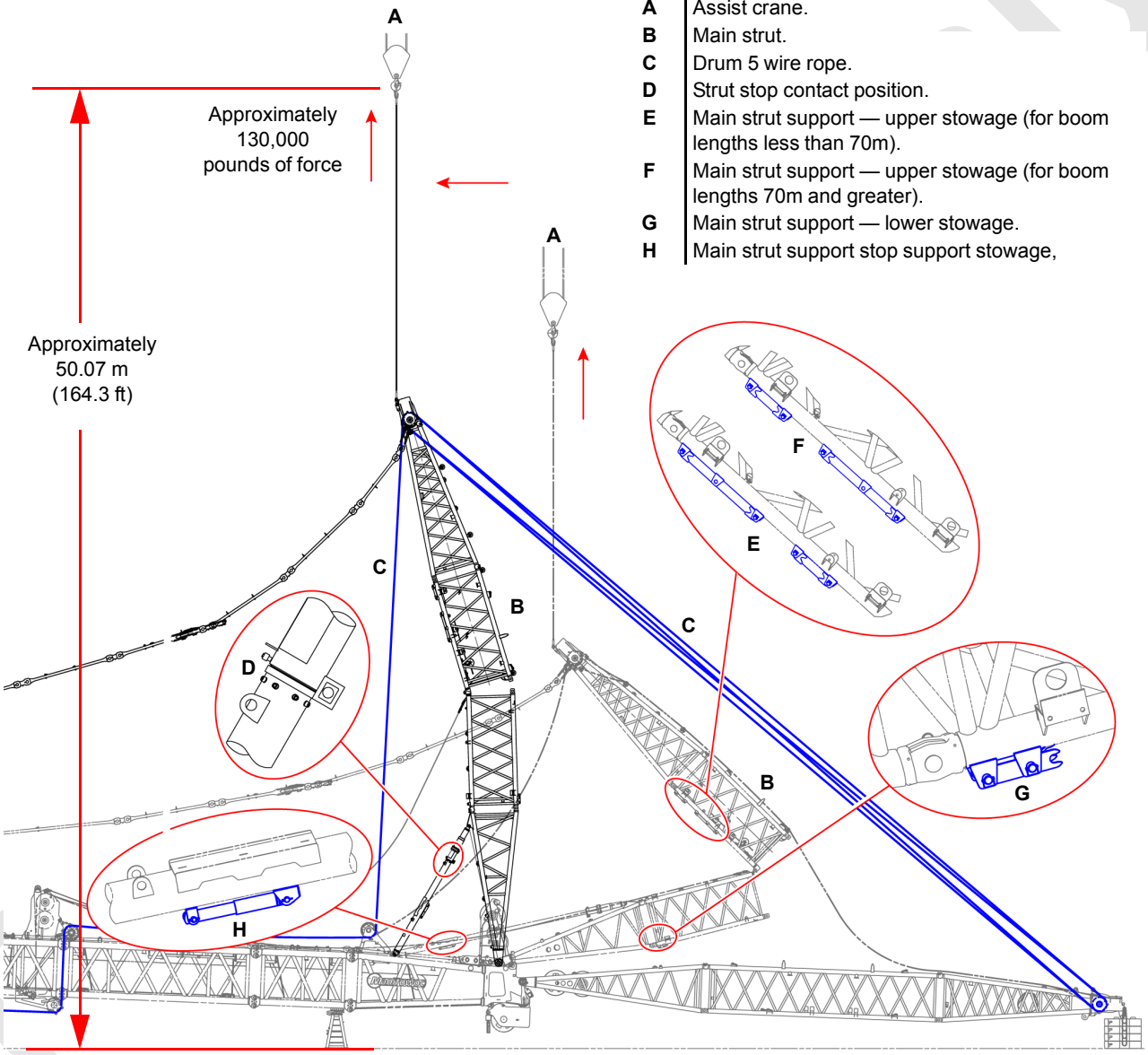
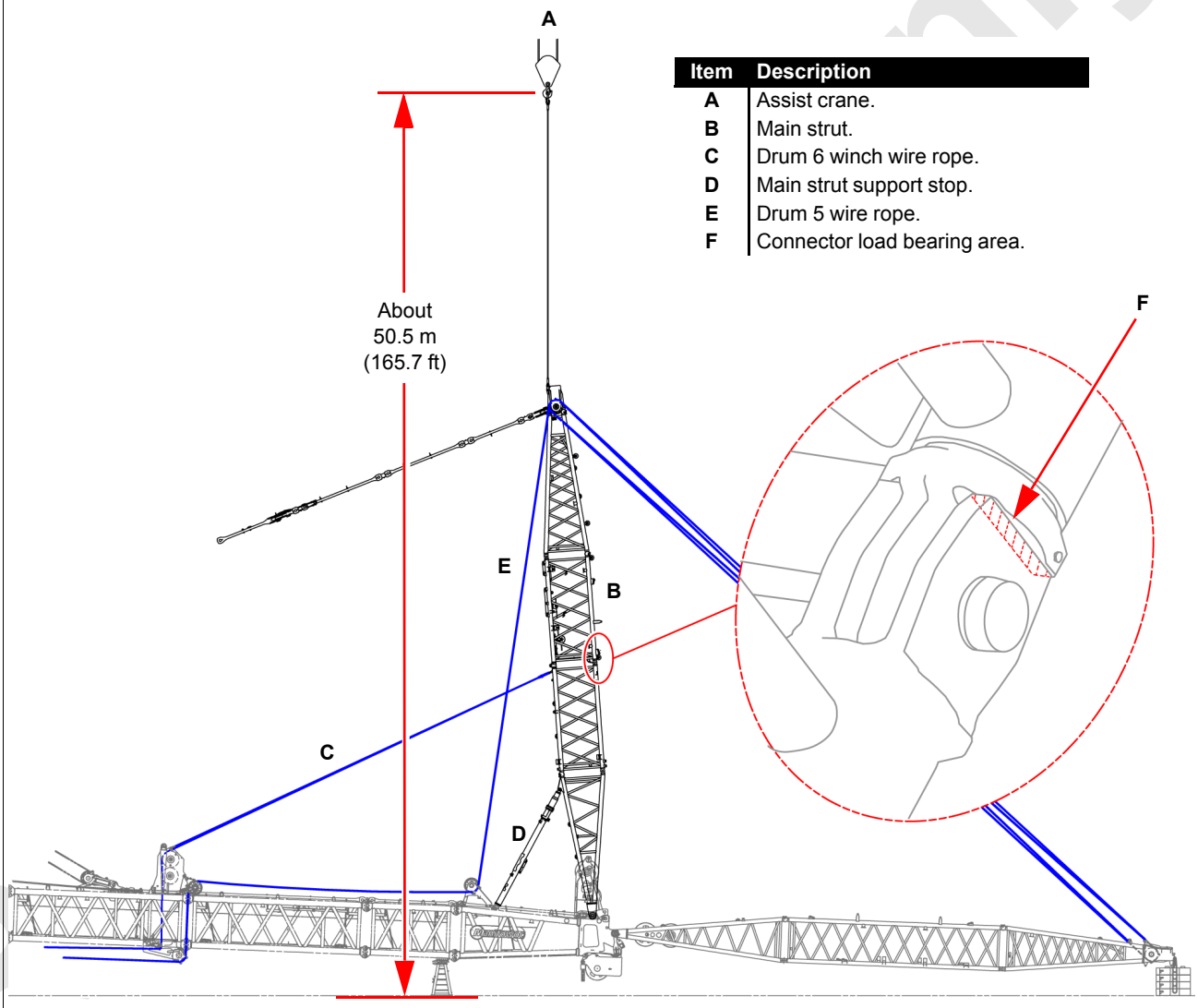


FIGURE 4-41

Step	Action
42	*Information below from drawing A19443, Sheet 22:* Complete raising the main strut (**B**): • Continue to hoist with the assist crane (**A**) while taking out slack with the Drum 6 winch wire rope (**C**). • When the upper and lower sections of the main strut (**B**) are almost closed, verify that the connector pins are fully retracted (see Figure 4-45). • Then hoist in with Drum 6 winch wire rope (**C**) to cause the main strut support stop (**D**) to retract. Let off with the assist crane (**A**) to 10,000 to 15,000 pounds while simultaneously luffing up with Drum 5 wire rope (**E**) to complete the closure. • Use a man basket to ensure that the connector load bearing areas (**F**) are in contact before continuing.  **FIGURE 4-42**

Item	Description
A	Assist crane.
B	Main strut.
C	Drum 6 winch wire rope.
D	Main strut support stop.
E	Drum 5 wire rope.
F	Connector load bearing area.

Step	Action
43	*Information below from drawing A19443, Sheet 19 and Sheet 21:* Close the *bypass* valve (**B**) on both main strut support stops (**A**): **NOTE:** Screw out the bypass valve to open it. Screw in the bypass valve to close it.

Item	Description
A	Main strut support stop.
B	Bypass valve.
C	Filling valve.
D	Sequence valve.

Failure to close the bypass valve will make the main strut support stop **unable** to support the main strut and the jib backstay straps.

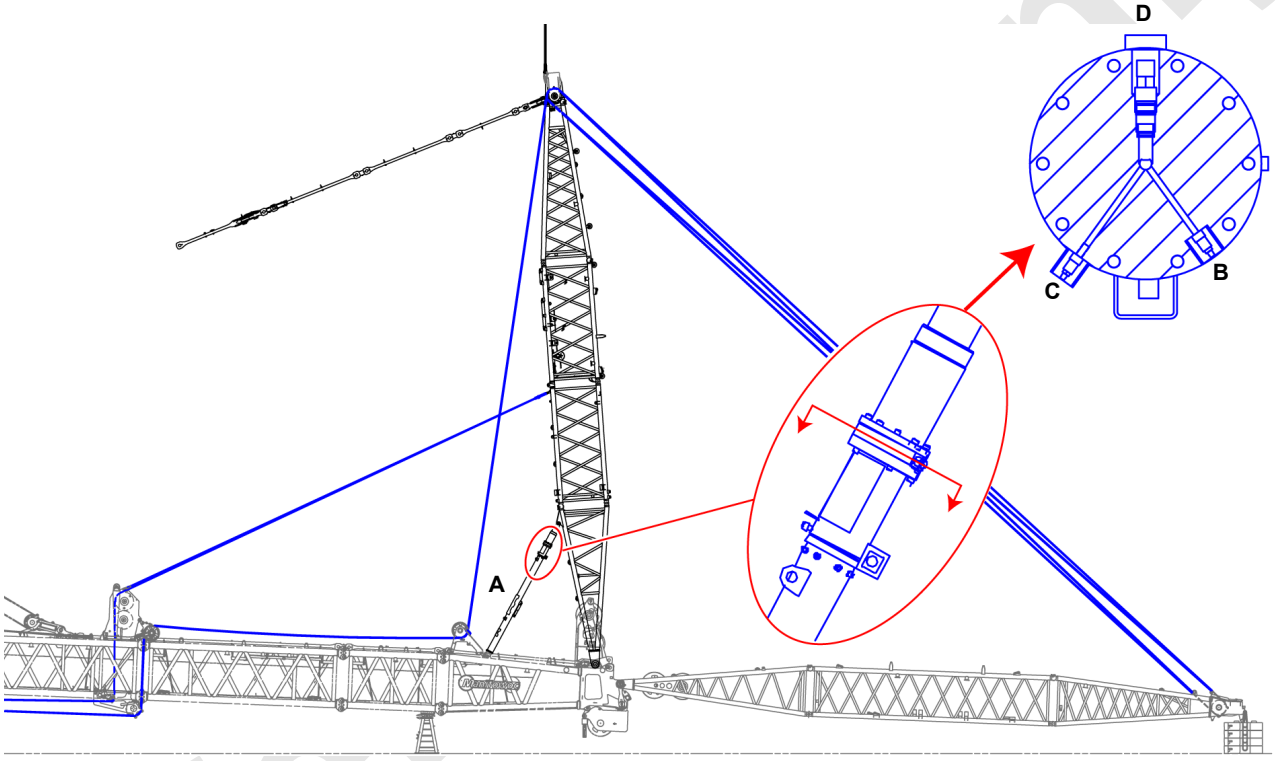
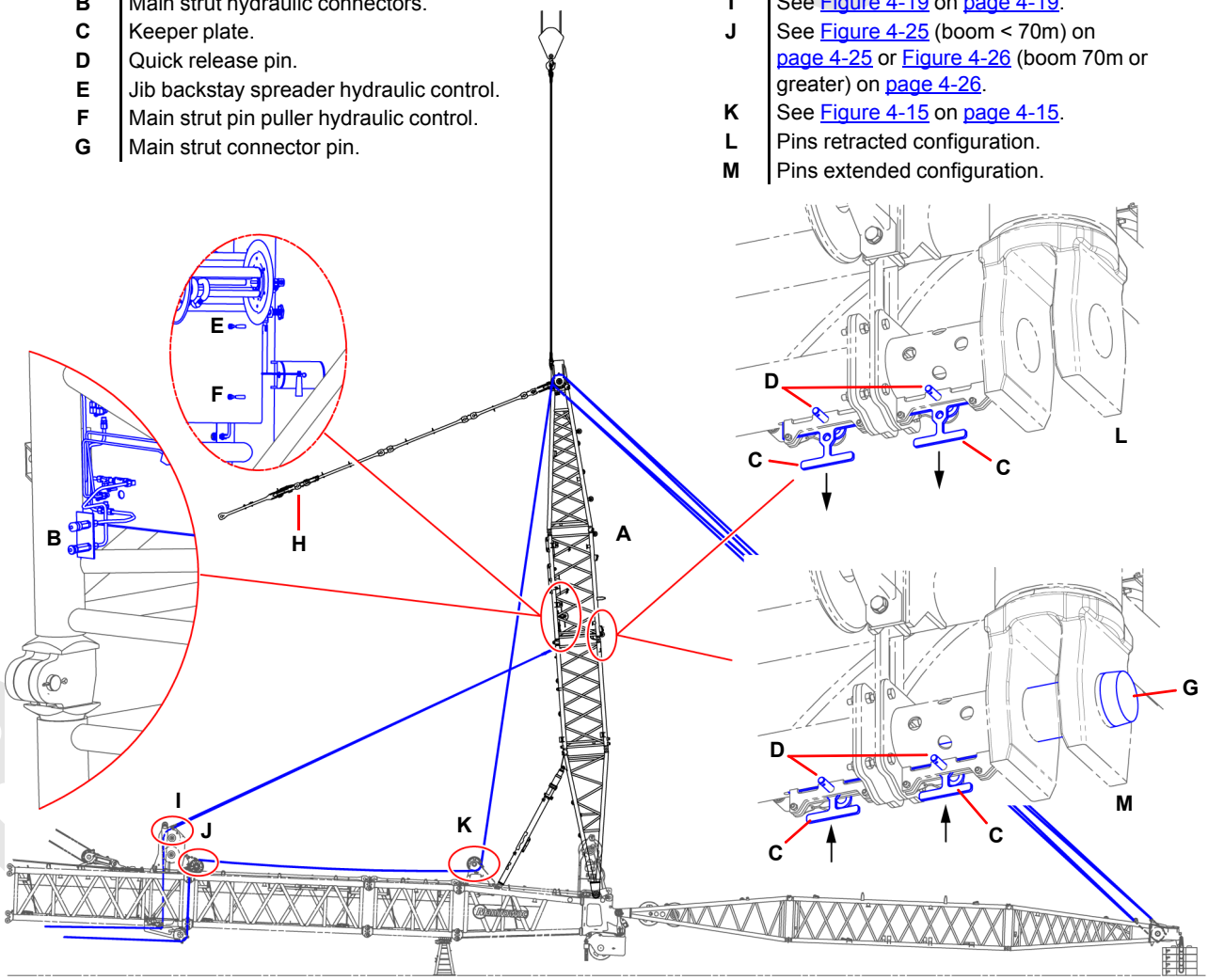
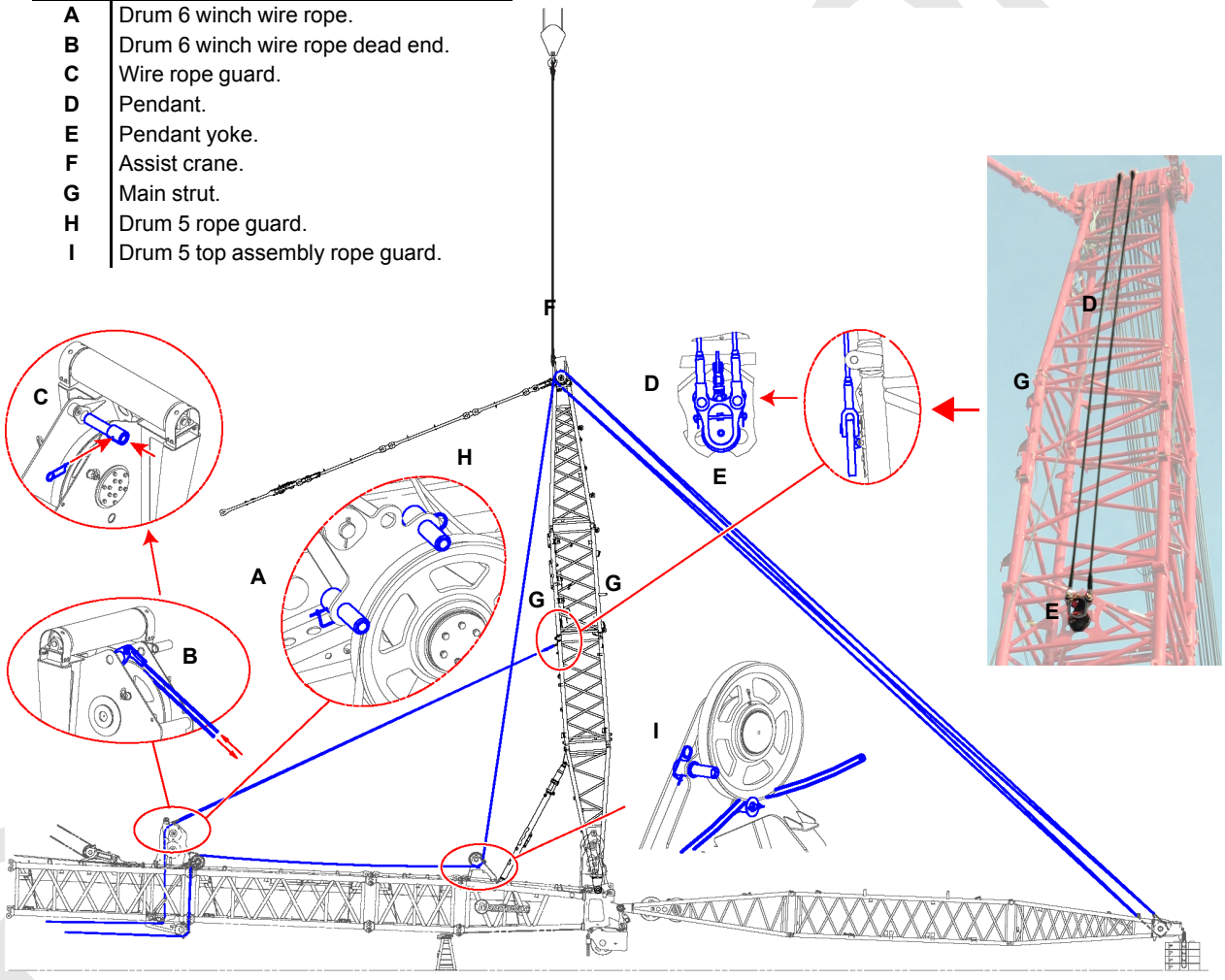
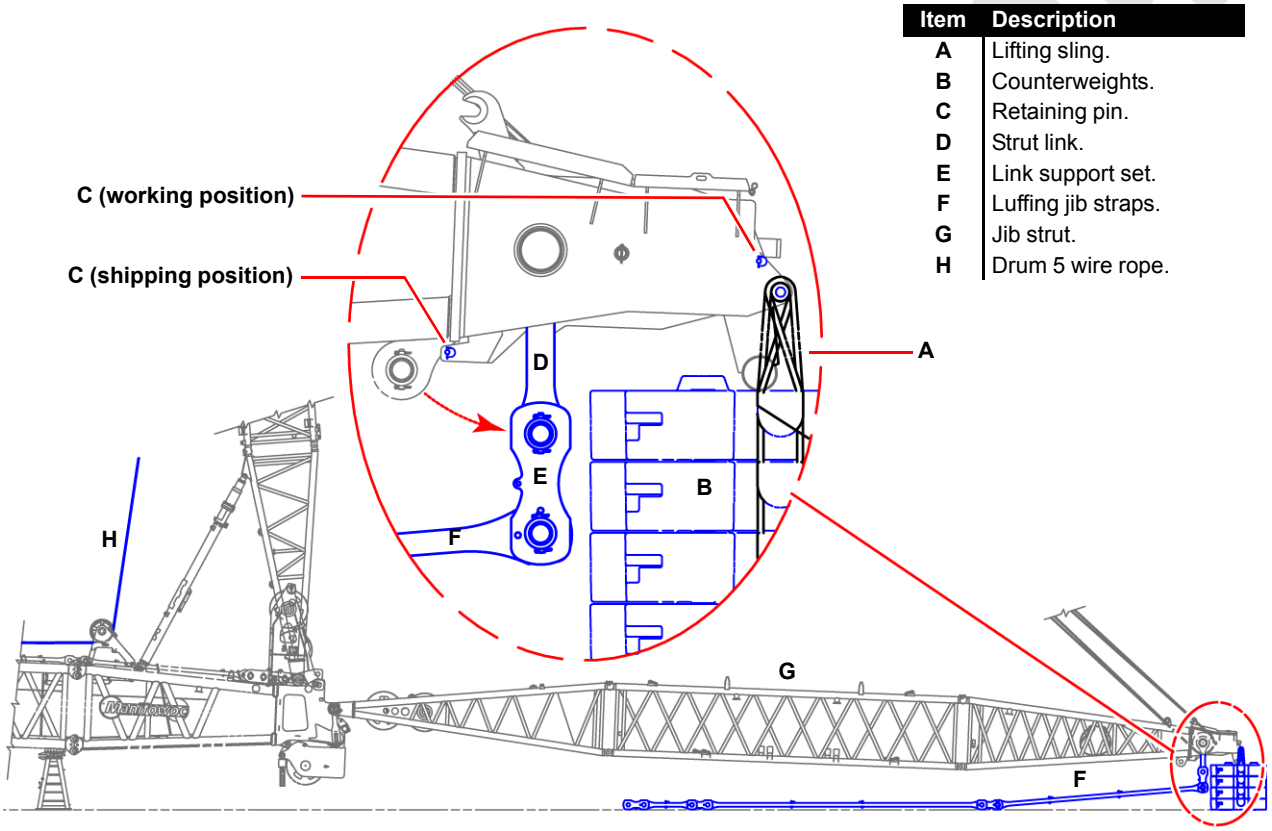


FIGURE 4-43

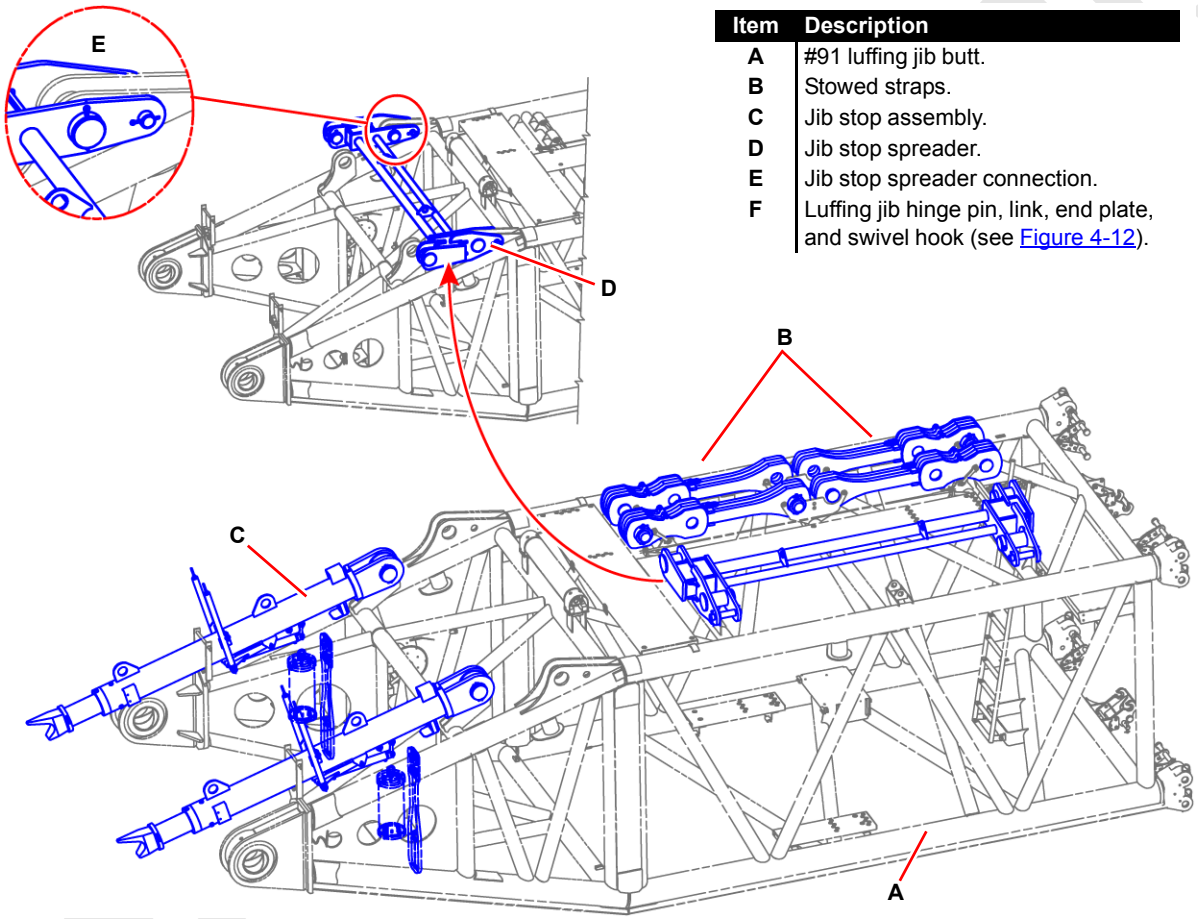
Step	Action
44	*Information below from drawing A19443, Sheet 22:* Fasten the upper and lower sections of the main strut (**A**) and extend the jib backstay spreader (**H**): • Ensure that the main strut connector pins (**G**) are both retracted. • On both sides of the main strut (**A**), remove the quick release pins (**D**) and position the keeper plates (**C**) to the pins retracted configuration (**L**). Put the quick release pins (**D**) back in. • Connect the Arctic 15 hydraulic circuit of the Portable Power Unit (see Folio 2220) to the main strut hydraulic connectors (**B**). • Use the main strut pin puller hydraulic control (**F**) to extend the main strut connector pins (**G**) and lock the upper and lower sections of the main strut together. • Use the jib backstay spreader hydraulic control (**E**) to extend the jib backstay spreader (**H**). • After the jib backstay spreader (**H**) has been extended, remove the quick release pins (**D**) on both sides of the main strut and position the keeper plates (**C**) to the pins extended configuration (**M**). • Disconnect the Portable Power Unit hydraulic lines from the main strut hydraulic connectors (**B**). **Item** / **Description** **A** Main strut. **B** Main strut hydraulic connectors. **C** Keeper plate. **D** Quick release pin. **E** Jib backstay spreader hydraulic control. **F** Main strut pin puller hydraulic control. **G** Main strut connector pin. **Item** / **Description** **H** Jib backstay spreader. **I** See Figure 4-19 on page 4-19. **J** See Figure 4-25 (boom < 70m) on page 4-25 or Figure 4-26 (boom 70m or greater) on page 4-26. **K** See Figure 4-15 on page 4-15. **L** Pins retracted configuration. **M** Pins extended configuration.  **FIGURE 4-44**

Step	Action
45	*Information below from drawing A19443, Sheet 22:* Remove the Drum 6 winch wire rope: • Disconnect the Drum 6 winch wire rope (**A**) dead end (**B**). • Reel in the Drum 6 winch wire rope (**A**). • Return the wire rope guide rope guard (**C**) to the working position covering the top of the sheave. • Lower the assist crane (**F**) and stow the pendants (**D**) and pendant yoke (**E**) on the main strut (**G**). • *For boom lengths of 55 m (180.5 ft), 60 m (196.9 ft), or 65 m (213.3 ft)*, return the Drum 5 wire rope guard (**H**) to its working position covering the top of the sheave as shown below. • *For boom lengths 70 m (229.7 ft) or greater,* return the Drum 5 top assembly rope guard (**I**) to its working position covering the sheave as shown below. **Item** / **Description** **A** Drum 6 winch wire rope. **B** Drum 6 winch wire rope dead end. **C** Wire rope guard. **D** Pendant. **E** Pendant yoke. **F** Assist crane. **G** Main strut. **H** Drum 5 rope guard. **I** Drum 5 top assembly rope guard.  **FIGURE 4-45**

Prepare the Jib Strut

Step	Action
46	*Information below from drawing A19443, Sheet 23:* Prepare to raise the jib strut: • With the jib strut (**G**) supported by the Drum 5 wire rope (**H**), remove lifting slings (**A**). See Figure 4-13. • Relocate counterweights (**B**) away from the jib assembly area. • While supporting the strut link (**D**), remove the retaining pin (**C**) from its shipping location to its working position. • Let the strut link (**D**) slowly swing to its working position as shown below. • Attach the luffing jib support straps (**F**) and link support sets (**E**) to the strut links (**D**).  **FIGURE 4-46**

Item	Description
A	Lifting sling.
B	Counterweights.
C	Retaining pin.
D	Strut link.
E	Link support set.
F	Luffing jib straps.
G	Jib strut.
H	Drum 5 wire rope.

Step	Action
47	*Information below from drawing A19443, Sheet 23:* Prepare the #91 luffing jib butt (**A**) for assembly: • Remove the stowed straps (**B**) for use per luffing jib table on A19443 sheet 1 and strap configuration per jib makeup on A19443 sheets 5 and 6. • Remove the jib stop assembly (**C**). • Remove the jib stop spreader (**D**) and reattach to the front of the #91 luffing jib butt (**A**) as shown below (**E**). **NOTE:** The luffing jib hinge pins, links, end plates, and swivel hooks (**F**) were removed and installed earlier (see Figure 4-12).  **FIGURE 4-47**

Item	Description
A	#91 luffing jib butt.
B	Stowed straps.
C	Jib stop assembly.
D	Jib stop spreader.
E	Jib stop spreader connection.
F	Luffing jib hinge pin, link, end plate, and swivel hook (see Figure 4-12).

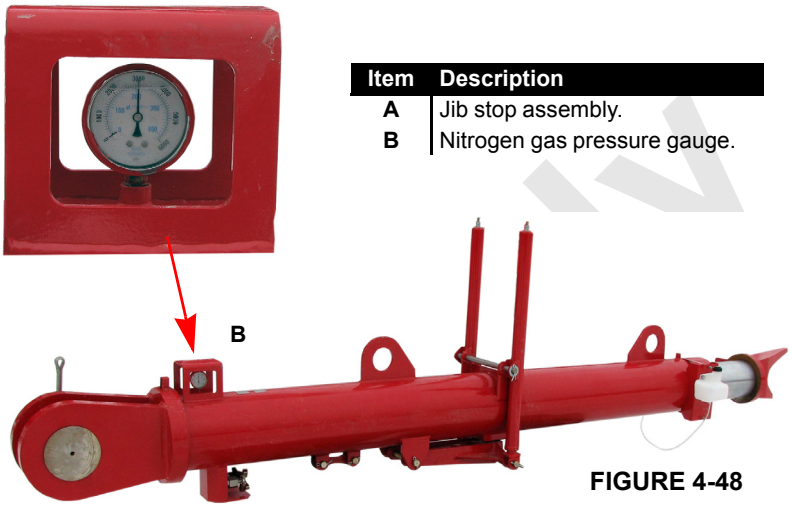
Step	Action

48

The nitrogen gas pressure gauge (**B**) on the jib stop assembly (**A**) should read the pressure shown in the table below. To increase gas pressure, see Luffing Jib Physical Stop (page 6-9).

TABLE 1. Jib Stop Pressures

°F	°C	PSI	BAR
80	27	3155	218
70	21	3100	214
60	15.5	3040	210



Item	Description
A	Jib stop assembly.
B	Nitrogen gas pressure gauge.

FIGURE 4-48

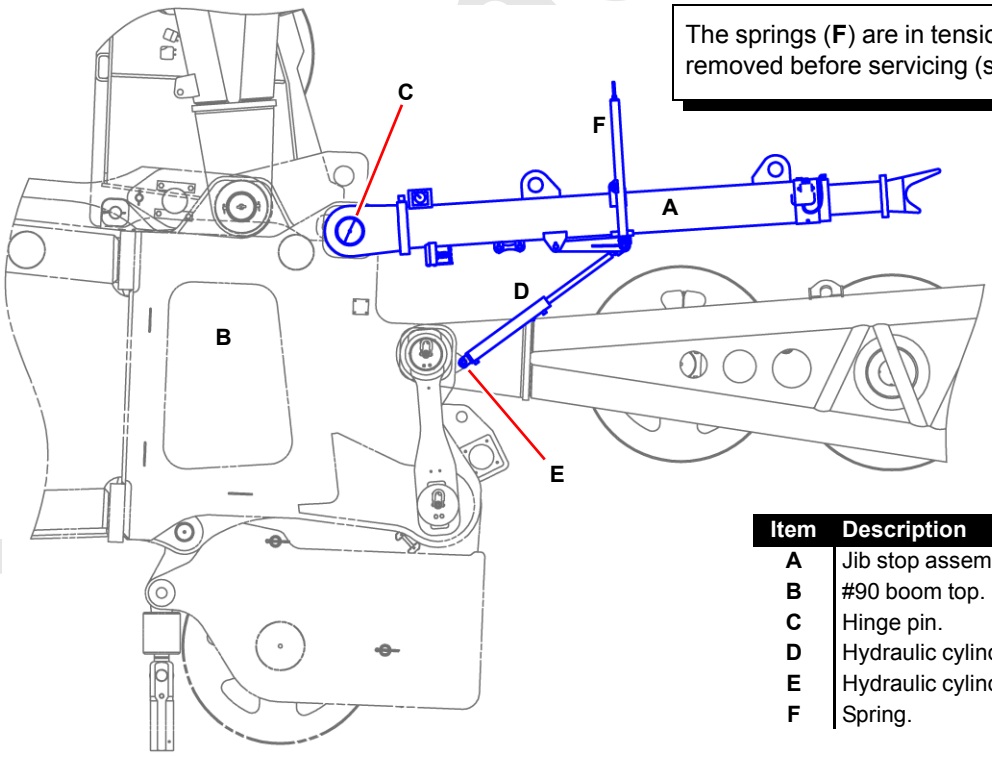
49

Information below from drawing A19443, Sheet 23:

Attach a jib stop assembly (**A**) to both sides of the #90 boom top (**B**). *The jib stop assembly with the Max UP limit switch must be installed on the left side of the boom top*:

- Connect the jib stop assembly (**A**) to the #90 boom top (**B**) with the hinge pins (**C**) provided.
- Connect the hydraulic cylinders (**D**) to the #90 boom top (**B**) with the hydraulic cylinder pins (**E**) provided.

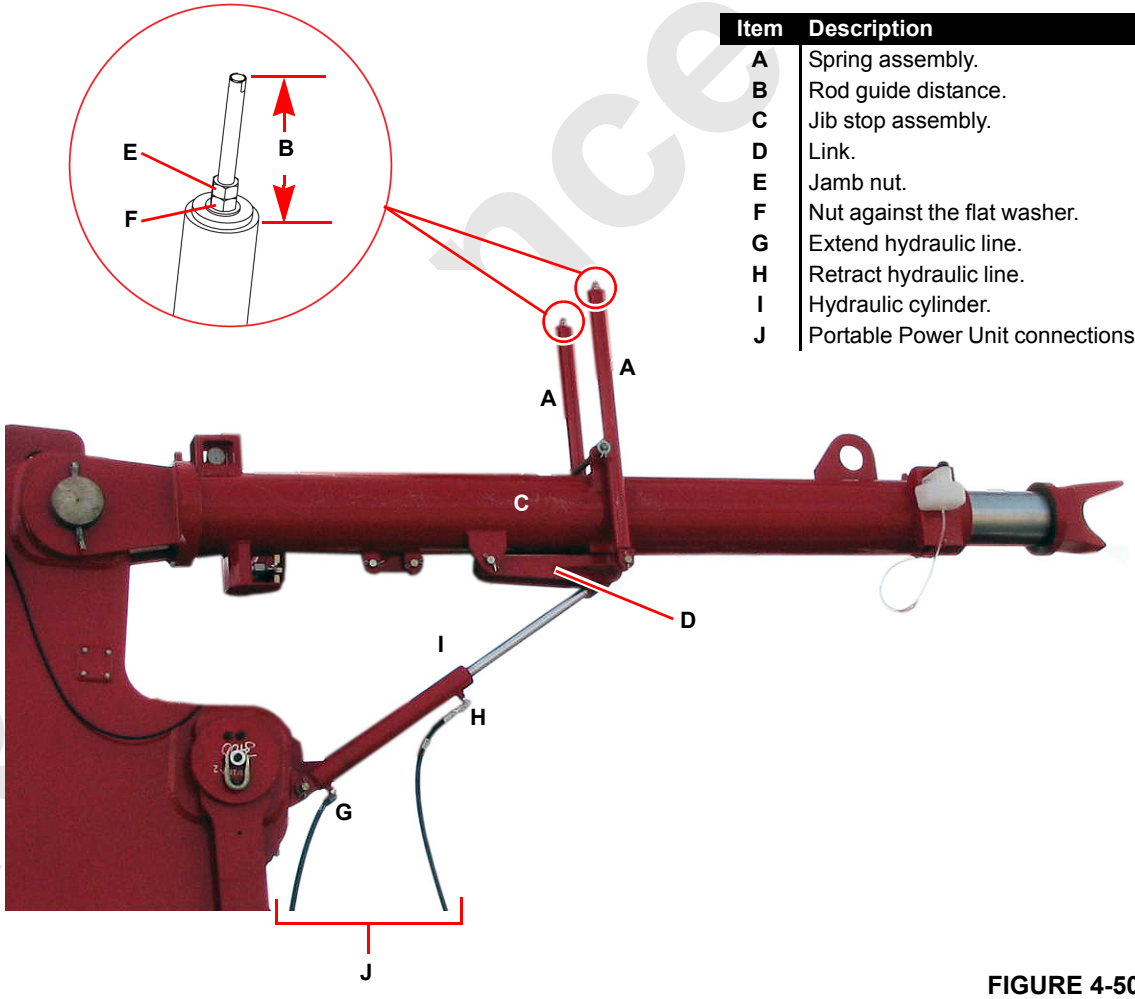
The springs (**F**) are in tension. Tension shall be removed before servicing (see Figure 4-50).



Item	Description
A	Jib stop assembly.
B	#90 boom top.
C	Hinge pin.
D	Hydraulic cylinder.
E	Hydraulic cylinder pin.
F	Spring.

FIGURE 4-49

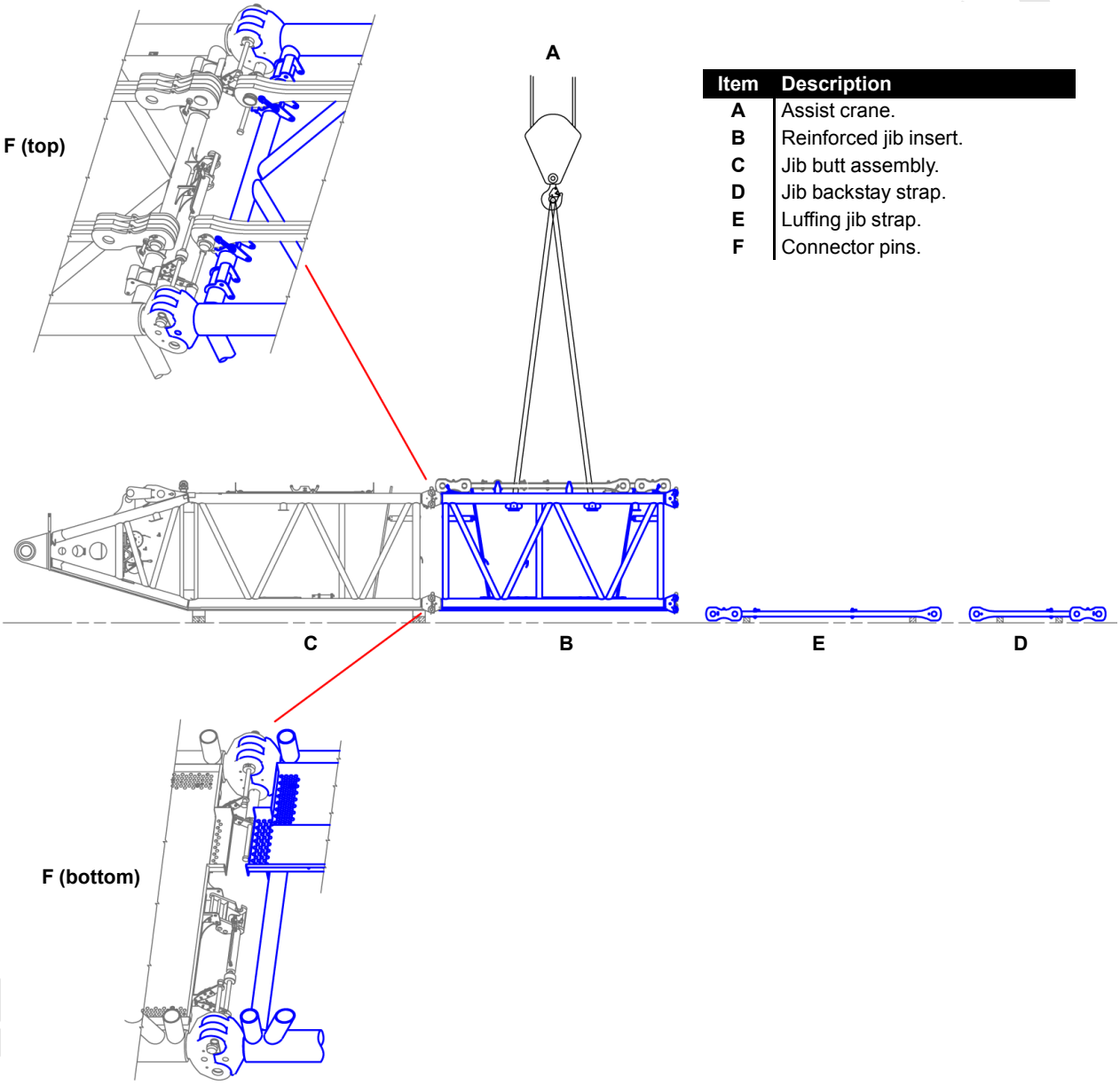
4

Step	Action
50	*Information below from drawing 81012709:* Set the spring assembly (**A**) rod guide distance (**B**) on each jib stop assembly (**C**) to approximately 117.0 mm (4.61 in): • The link (**D**) shall contact the jib stop assembly (**C**). Use the extend (**G**) and retract (**H**) hydraulic lines to move the link (**D**) into position. • Loosen the jamb nut (**E**) on the spring assembly (**A**). • Adjust the nut against the flat washer (**F**) until the rod guide distance (**B**) is approximately 117.0 mm (4.61 in) from the top of the spring assembly (**A**). • Tighten the jamb nut (**E**). **NOTE:** After setting the rod guide distance (**B**), the spring assemblies (**A**) are now in tension. *Before removing the spring assemblies (**A**), tension shall be relieved from the rod guides by decreasing the rod guide distance (**B**).* • Connect the Arctic 15 hydraulic circuit on the Portable Power Unit (**J**) to the extend (**G**) and retract (**H**) hydraulic lines. Then fully extend each hydraulic cylinder (**I**) as shown below. • After fully extending the hydraulic cylinders (**I**), disconnect the Portable Power Unit (**J**) from each hydraulic cylinder (**I**). Then position both hydraulic lines (**G**, **H**) out of the way for the upcoming jib butt assembly.  **FIGURE 4-50**

Item	Description
A	Spring assembly.
B	Rod guide distance.
C	Jib stop assembly.
D	Link.
E	Jamb nut.
F	Nut against the flat washer.
G	Extend hydraulic line.
H	Retract hydraulic line.
I	Hydraulic cylinder.
J	Portable Power Unit connections.

Assemble the Luffing Jib and Attach to #90 Boom

Step	Action
51	*Information below from drawing A19443, Sheet 24:* Remove jib backstay straps (**D**) and luffing jib straps (**E**) from the reinforced jib insert (**B**). Use an assist crane (**A**) to attach the 6 m (19.7 ft) reinforced jib insert (**B**) to the jib butt assembly (**C**). Install connector pins (**F**) per drawing A18701, sheet 7.



Item	Description
A	Assist crane.
B	Reinforced jib insert.
C	Jib butt assembly.
D	Jib backstay strap.
E	Luffing jib strap.
F	Connector pins.

FIGURE 4-51

4

Step	Action
52	*Information below from drawing A19443, Sheet 24:* Use an assist crane (**A**) to attach a 12 m (39 ft) insert (**B**) to the reinforced jib insert (**C**). Install connector pins (**F**) per drawing A18701, sheet 7.

Item	Description
A	Assist crane.
B	12m (39 ft) insert.
C	Reinforced jib insert.
D	Connector pin.

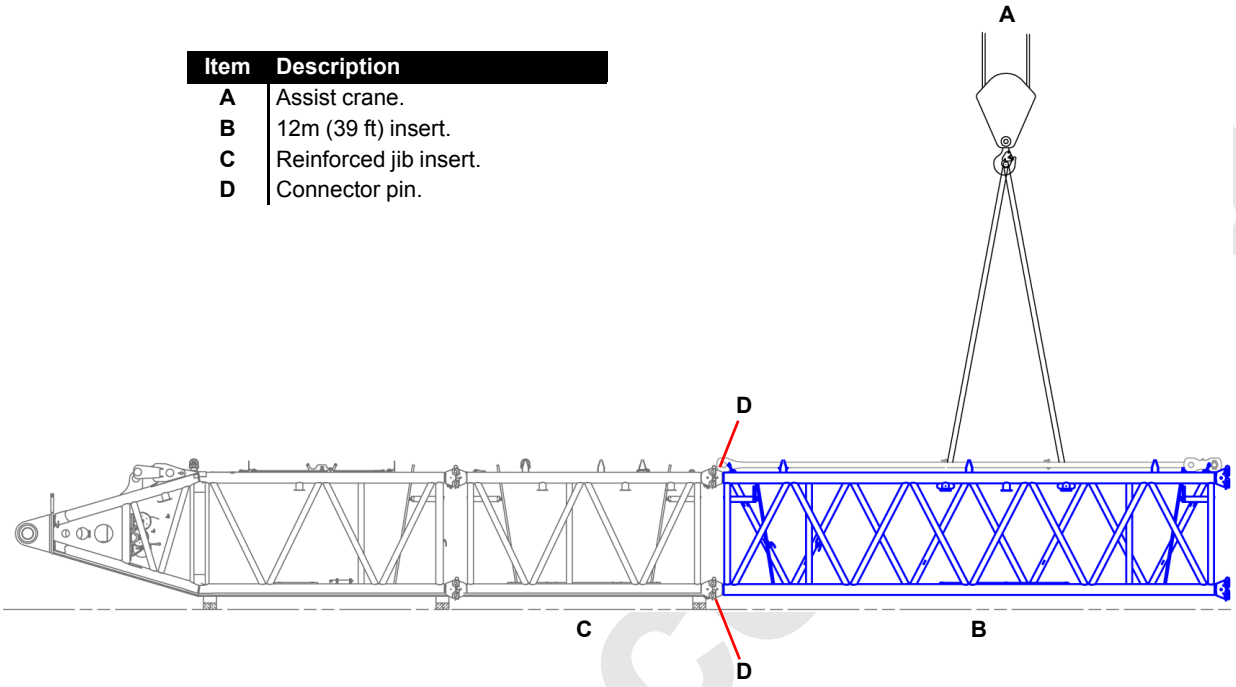


FIGURE 4-52

Step	Action
53	*Information below from drawing A19443, Sheet 24:* Attach the #91 luffing jib (**B**) to the #90 boom top (**D**): • Ensure that the cylinders on the jib stop assembly (**E**) are fully extended (see Figure 4-50). • Use an assist crane (**A**) to raise the jib strut a *maximum of 67°* above horizontal so that the assist crane (**A**) wire ropes clear the jib strut (**C**) in order to attach the #91 luffing jib (**B**). *The angle shall not exceed 67° or a loss of jib strut stability may occur.* • Finish the installation of the luffing jib hinge pins (**F**) started in Figure 4-12 by adding end plates (**G**) and a swivel hook (**M**). • Use the boom stand (**H**) to support the #91 luffing jib (**B**) for the addition of more inserts. *Information below from drawing A19443, Sheet 25:* • Connect the extend (**I**) and retract (**J**) hydraulic lines to the hard piping fittings (**L**) on the jib butt assembly (**K**).

Damage will occur if the cylinders on the jib stop assembly (**E**) are not fully extended prior to attaching the #91 luffing jib.

Item	Description
A	Assist crane.
B	#91 luffing jib.
C	Jib strut.
D	#90 boom top.
E	Jib stop assembly.
F	Luffing jib hinge pin.
G	End plate.
H	Boom stand.
I	Extend hydraulic line.
J	Retract hydraulic line.
K	Jib butt assembly.
L	Hard pipe fittings.
M	Swivel hook.

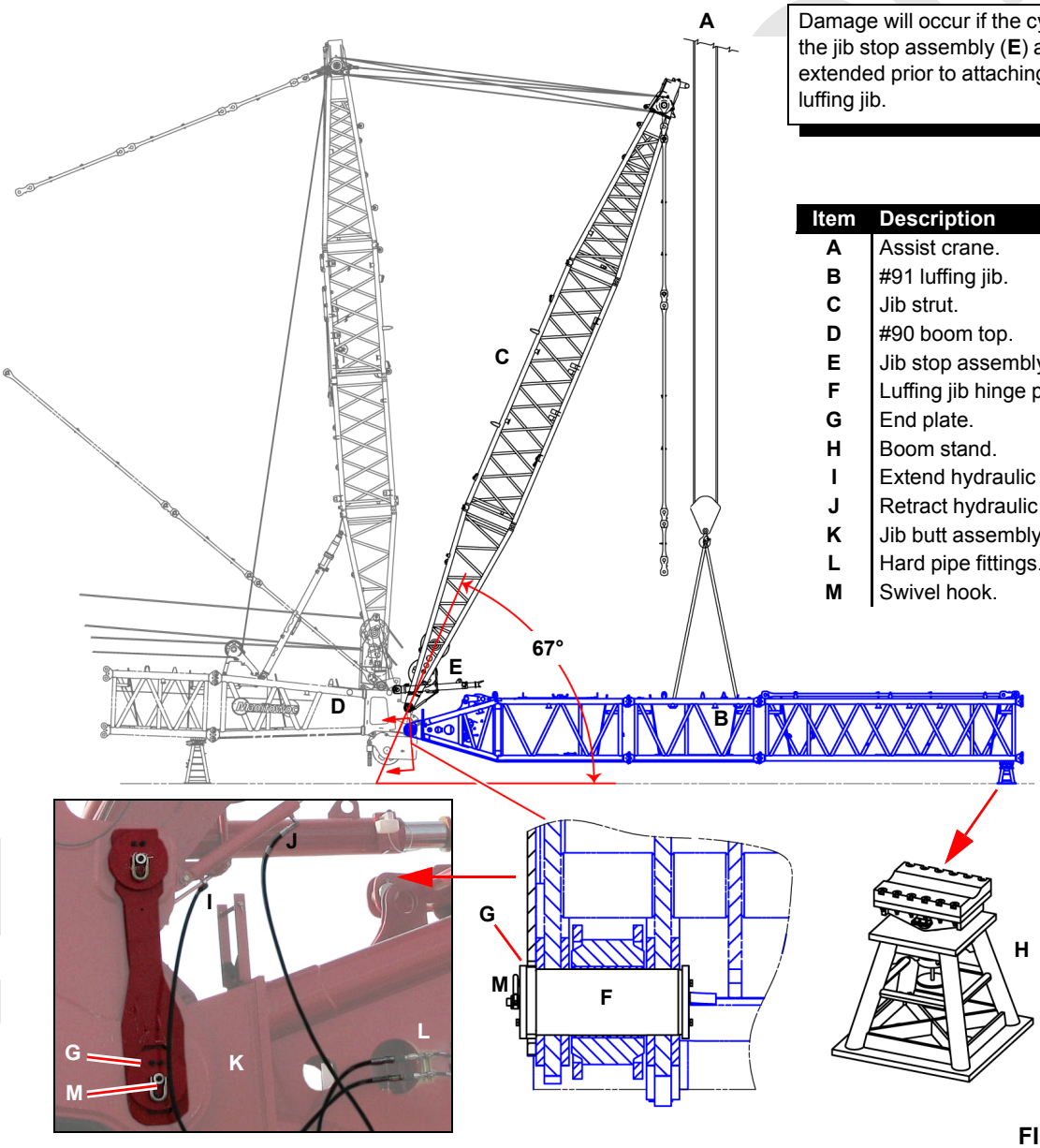
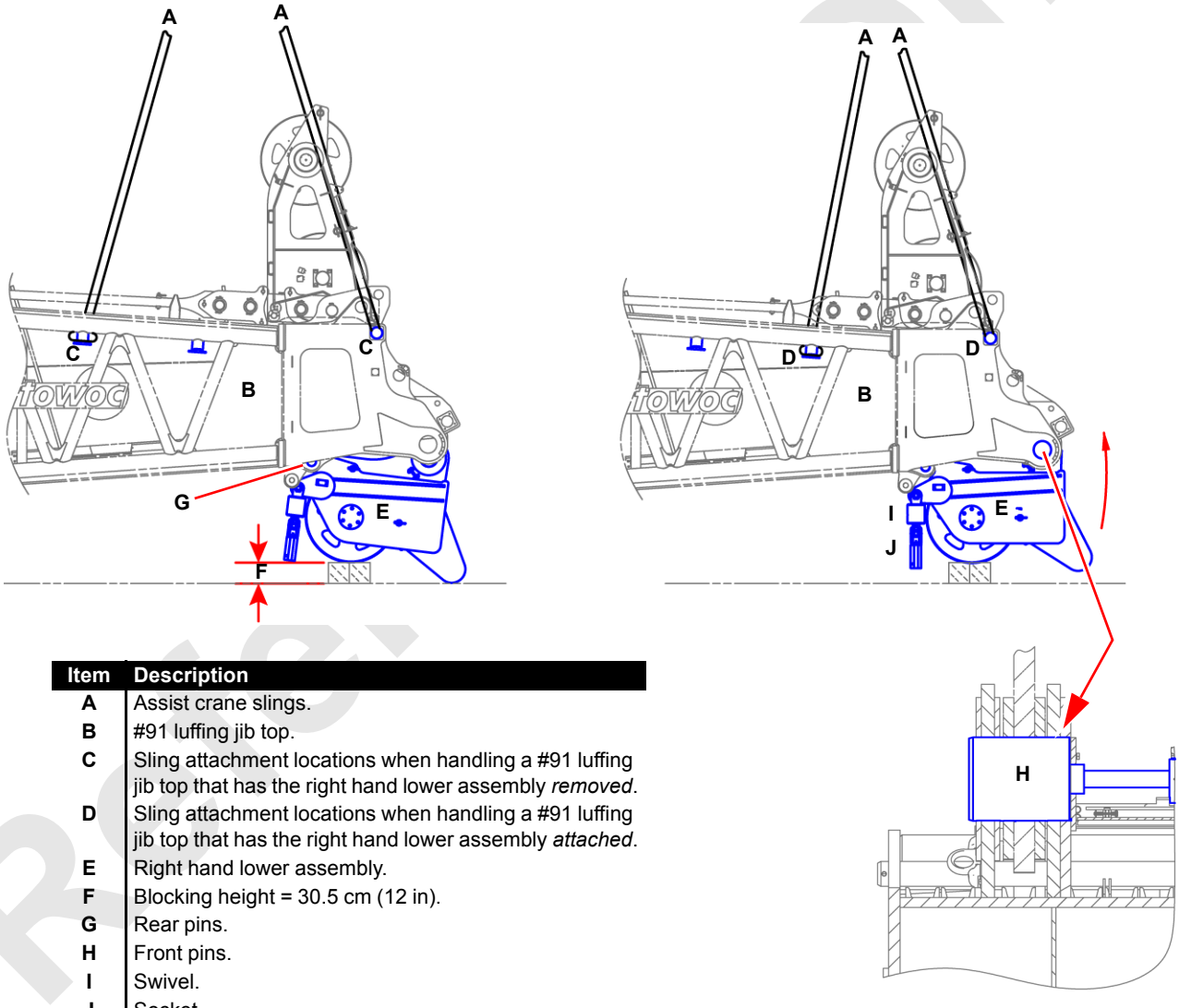


FIGURE 4-53

Step	Action
54	*Information below from drawing A19443, Sheet 24:* Boom point *right hand* lower assembly installation on the #91 luffing jib top: • Position the right hand lower assembly (**E**) on the ground with block as shown below. • Using an assist crane with slings (**A**) attached at the correct locations (**C-C** or **D-D**), position the #91 luffing jib top (**B**) onto the right hand lower assembly (**E**). • Fasten the rear pins (**G**). • Lower the #91 luffing jib top (**B**) until it is possible to engage the front pins (**H**) with the pin puller. • Attach the ISO 46 hydraulic circuit of the Portable Power Unit to the right hand lower assembly (**E**) and engage the pins. • For two drum/lead operation, relocate swivel (**I**) and socket (**J**) from the #90 boom top (see Figure 4-8 on page 4-8) to the #91 luffing jib top.

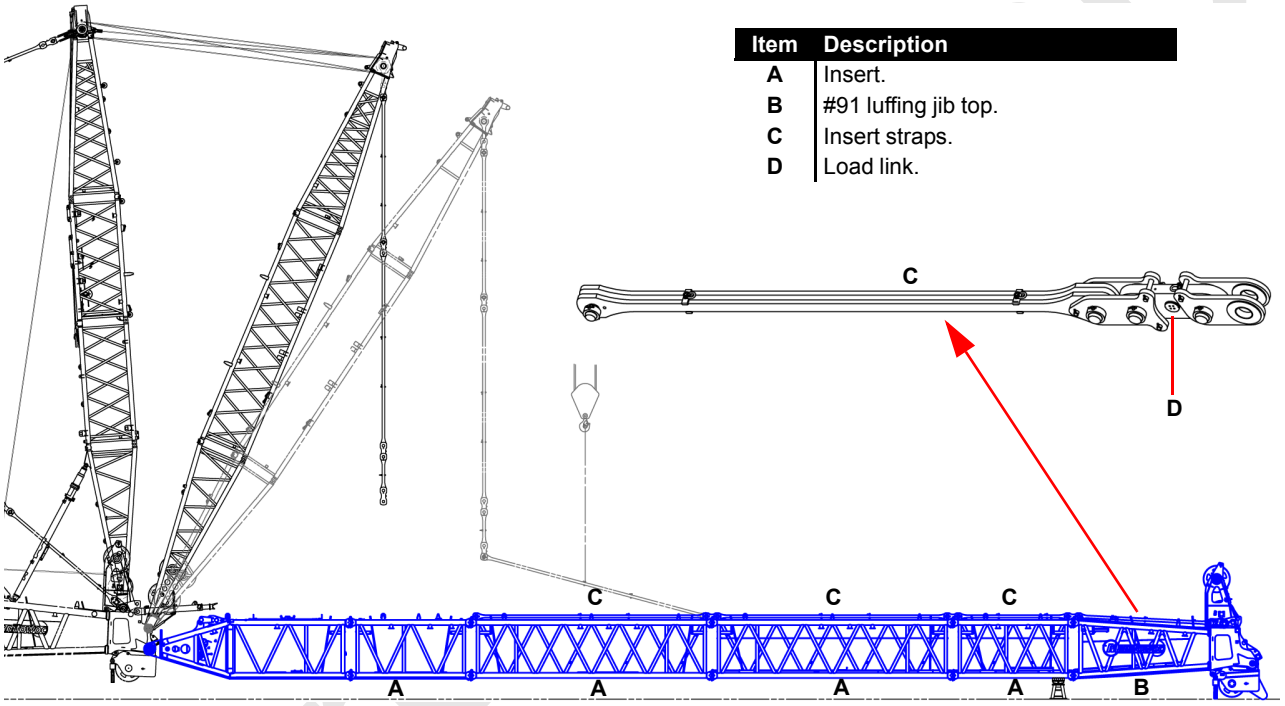


Item	Description
A	Assist crane slings.
B	#91 luffing jib top.
C	Sling attachment locations when handling a #91 luffing jib top that has the right hand lower assembly *removed*.
D	Sling attachment locations when handling a #91 luffing jib top that has the right hand lower assembly *attached*.
E	Right hand lower assembly.
F	Blocking height = 30.5 cm (12 in).
G	Rear pins.
H	Front pins.
I	Swivel.
J	Socket.

FIGURE 4-54

Step	Action
55	*Information below from drawing A19443, Sheet 25:* Complete the jib assembly: • Use an assist crane to attach each insert (**A**) and the #91 luffing jib top (**B**) per drawing A19443. **NOTE:** *If intermediate suspension shall be installed*, then the intermediate suspension yokes (see Figure 4-72) shall be installed on the bottom connectors of the appropriate insert. See Intermediate Suspension Installation on page 4-65. • See drawing A18701 to connect inserts (**A**) and #91 luffing jib top (**B**). • Connect insert straps (**C**) per drawing A18701. Note that the strap that connects directly to the #91 luffing jib top (**B**) has a load link (**D**). Refer to the jib backstay table on drawing A19443.

Item	Description
A	Insert.
B	#91 luffing jib top.
C	Insert straps.
D	Load link.



54 m (177 feet) luffing jib length configuration shown

FIGURE 4-55

Step	Action
56	• Uncoil the hydraulic lines (**A**) from the jib butt assembly reel (**B**) and extend the lines to the #91 luffing jib top (**C**).

Item	Description
A	Hydraulic lines.
B	Jib butt assembly reel.
C	Jib top.
D	Jib stop assembly hydraulic cylinder.

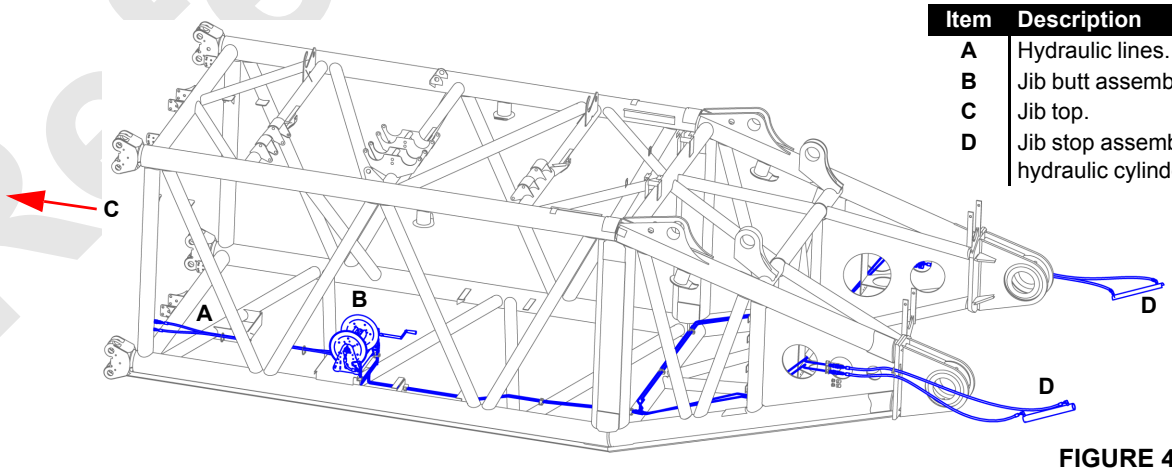


FIGURE 4-56

Step	Action
57	*Information below from drawing A19443, Sheet 25:* • Reeve the Drum 2 main load hoist line (**A**) over the main strut (**B**) upper sheave and the jib strut (**C**) upper sheave. • Reeve the Drum 1 main load hoist line (**D**) or the Drum 3 whip/auxiliary load line (**E**) over the *top* of the main strut (**B**) lower sheave and under the *bottom* of the jib strut (**C**) lower sheave. • Then reeve the Drum 1 (or Drum 3) line to the jib top — over the top of the lower sheave on the wire rope guide

Item	Description
A	Drum 2 main load hoist line.
B	Main strut.
C	Jib strut.

Item	Description
D	Drum 1 main load hoist line.
E	Drum 3 whip/auxiliary load line.

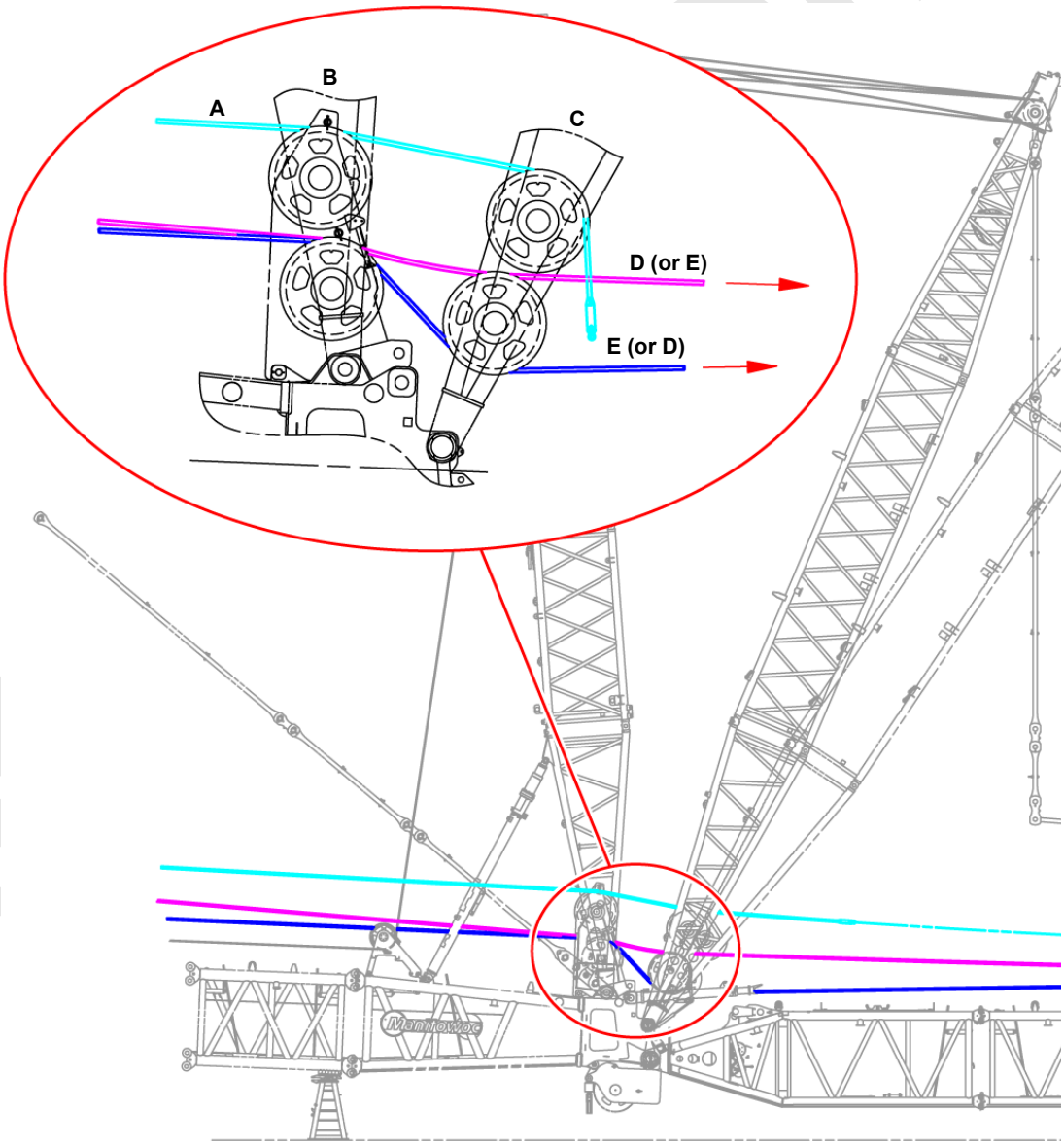


FIGURE 4-57

Step	Action
58	*Information below from drawing A19443, Sheet 25:* • With Drum 1 (**A**) or Drum 3 (**B**) reeved to the jib top wire rope guide, reeve the other line — Drum 3 (**B**) or Drum 1 (**A**) — from the *bottom to the top* on the wire rope guide upper sheave (**C**) and towards the suspended strap (**D**) links. • Relocate the pin/collar/pin connection from the end of the 12M insert straps to the suspended straps (**D**). • Attach a sling to the Drum 3 (**B**) or Drum 1 (**A**) load hoist rope socket.

Item	Description
A	Drum 1 main load hoist line.
B	Drum 3 whip/auxiliary load line.
C	Wire rope guide top sheave.
D	Suspended straps.
E	Sling.
F	Socket.

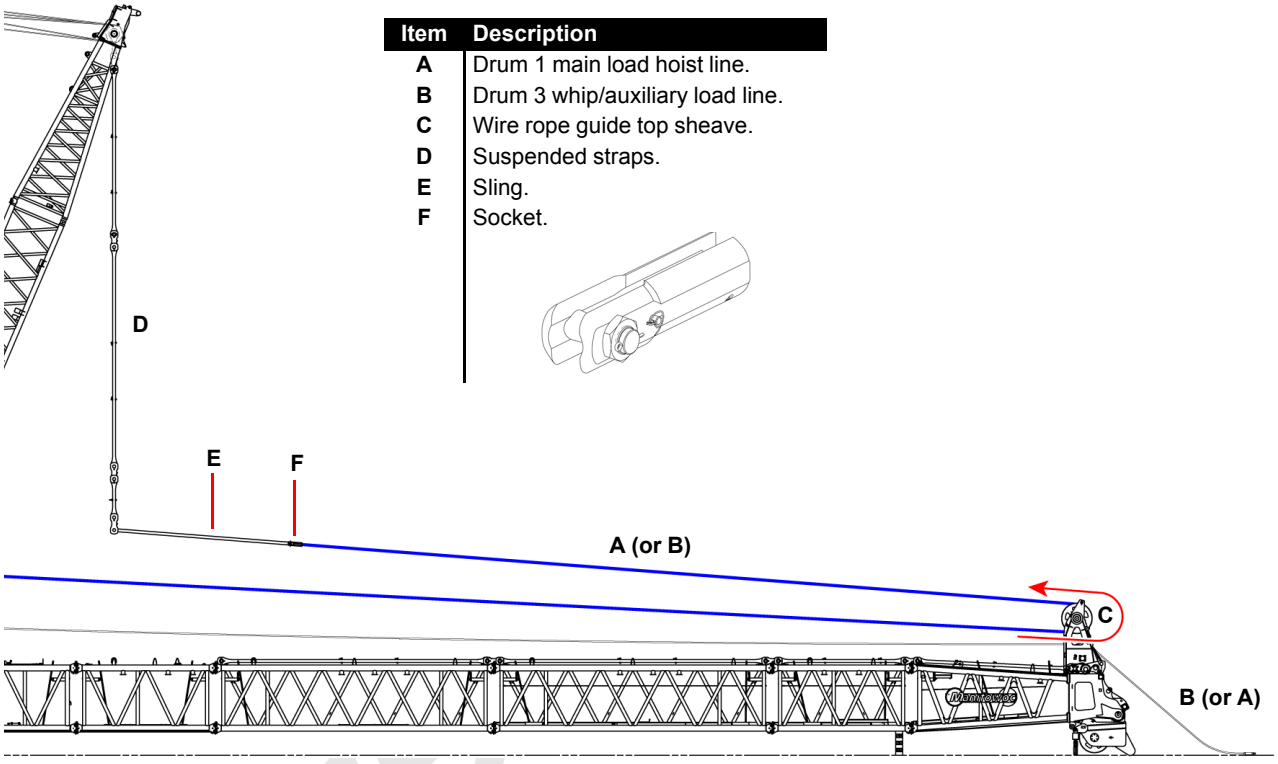
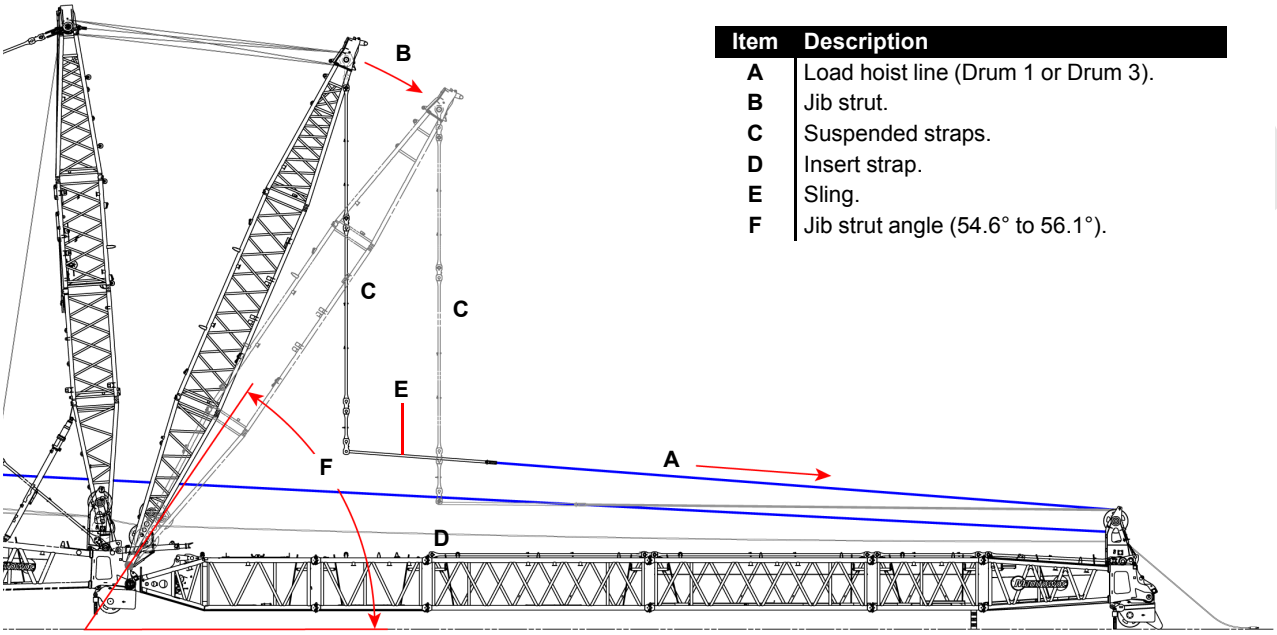


FIGURE 4-58

Step	Action
59	*Information below from drawing A19443, Sheet 25:* • Pay in the load hoist line (**A**) and lower the jib strut (**B**) until the suspended straps (**C**) are positioned vertically over the last insert strap (**D**). • Disconnect the sling (**E**) and the load hoist line (**A**).  **FIGURE 4-59**

Item	Description
A	Load hoist line (Drum 1 or Drum 3).
B	Jib strut.
C	Suspended straps.
D	Insert strap.
E	Sling.
F	Jib strut angle (54.6° to 56.1°).

Step	Action
60	*Information below from drawing A19443, Sheet 25:* • Reroute the main load hoist line (**A**) from the *top to the bottom* of the wire rope guide (**B**). • Tie off the main load hoist line (**A**) and the whip line (**E**) to the #91 luffing jib top (**C**). • Use an assist crane (**D**) to lift the last insert strap (**F**) and attach it to the bottom suspended strap (**G**) with the pin/collar/pin from Figure 4-57.
61	• Connect the electric wiring between the boom and the luffing jib and at the luffing jib points. See Electric Control Assembly, Boom Wiring and Limits drawing at the end of this section. *If the upper point will not be installed, DO NOT CONNECT the upper point electric cable (WUBP) at the universal node in the jib point. Faulty operation and system faults will occur.* • Install the wind speed indicator and connect the electric wiring. See Wind Speed Assembly drawing at the end of this section. • Install the aircraft warning system. See Electrical Accessory Assembly, Aircraft Warning drawing at the end of this section.
62	• *If the #91 luffing jib length is 90 m (295.3 ft) or greater*, then intermediate suspension shall be installed. Go to Intermediate Suspension Installation on page 4-65. • *If the #91 luffing jib is less than 90 m (295.3 ft)*, then go to Figure 4-61.

Item	Description
A	Main load hoist line.
B	Wire rope guide.
C	#91 luffing jib top.
D	Assist crane.
E	Whip line.
F	Last insert strap.
G	Bottom suspended strap.

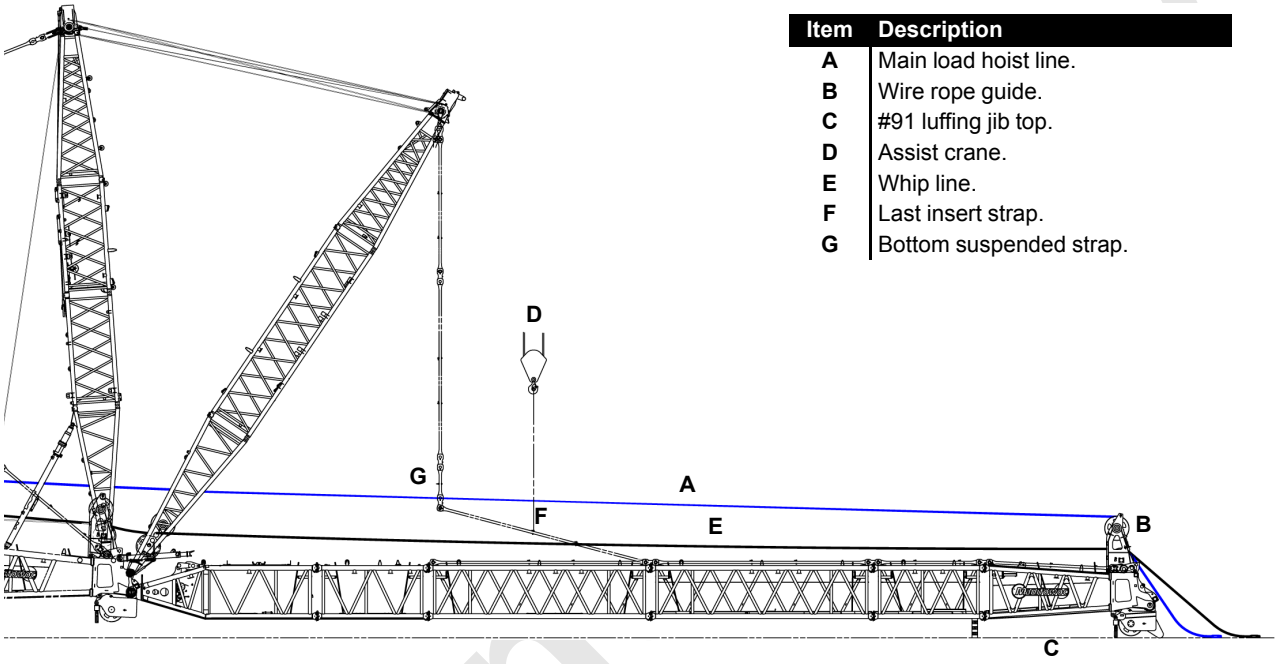
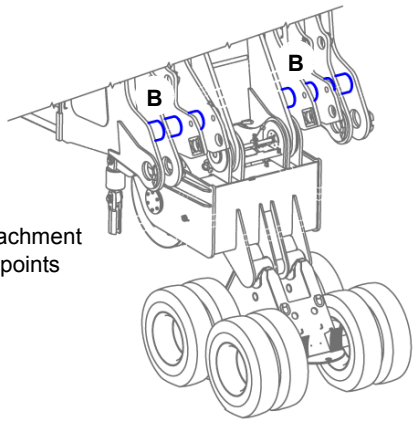


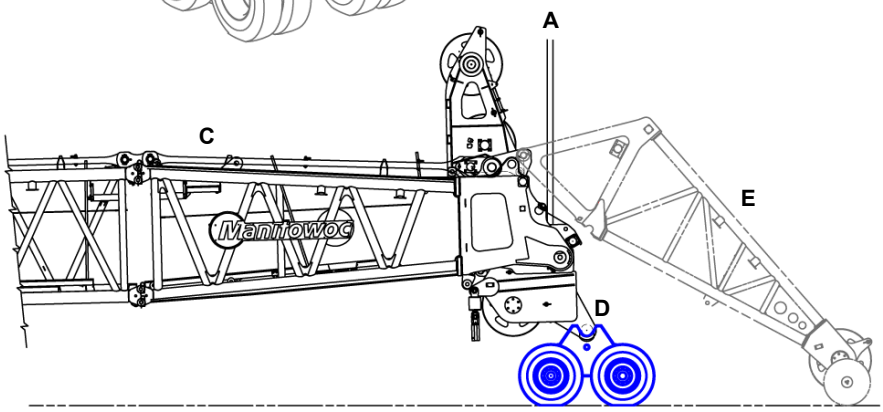
FIGURE 4-60

Raise the Luffing Jib

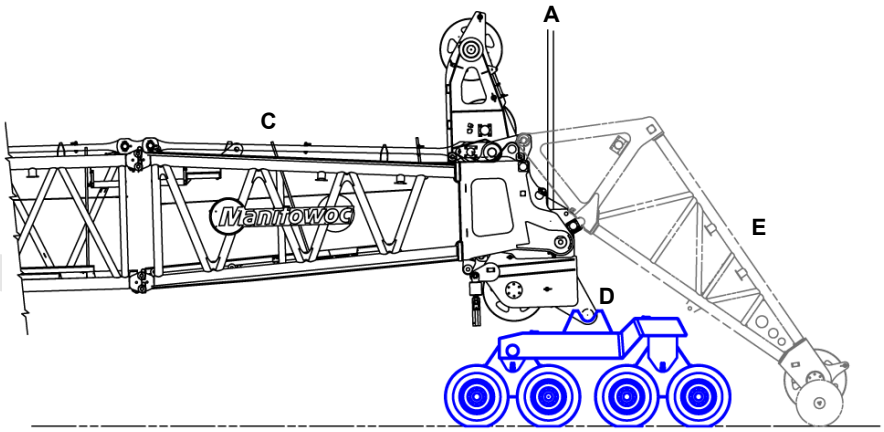
Step	Action
63	*Information below from drawing A19443, Sheet 25:* Position the dolly: • Use straps to attach an assist crane (**A**) to the jib top tubes (**B**). • Raise the #91 luffing jib (**C**) high enough to place the jib top in the dolly cradle (**D**). **NOTE:** Before using the dolly, prepare it as described in Section 4 of the 31000 Operator Manual.



Item	Description
A	Assist crane.
B	Jib top tube.
C	#91 luffing jib.
D	Dolly cradle.
E	Upper boom point.

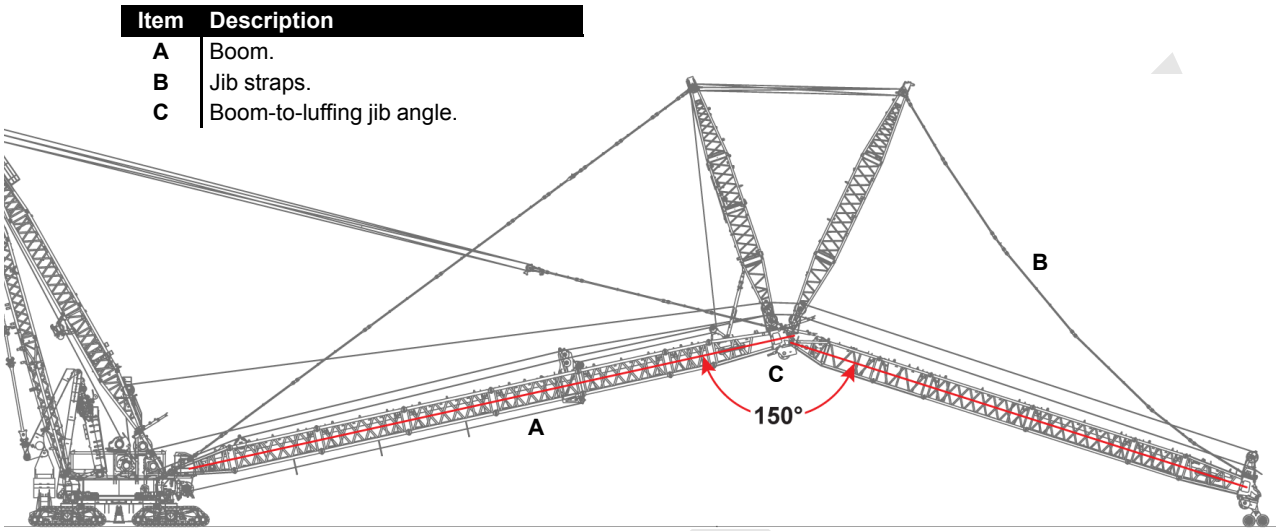


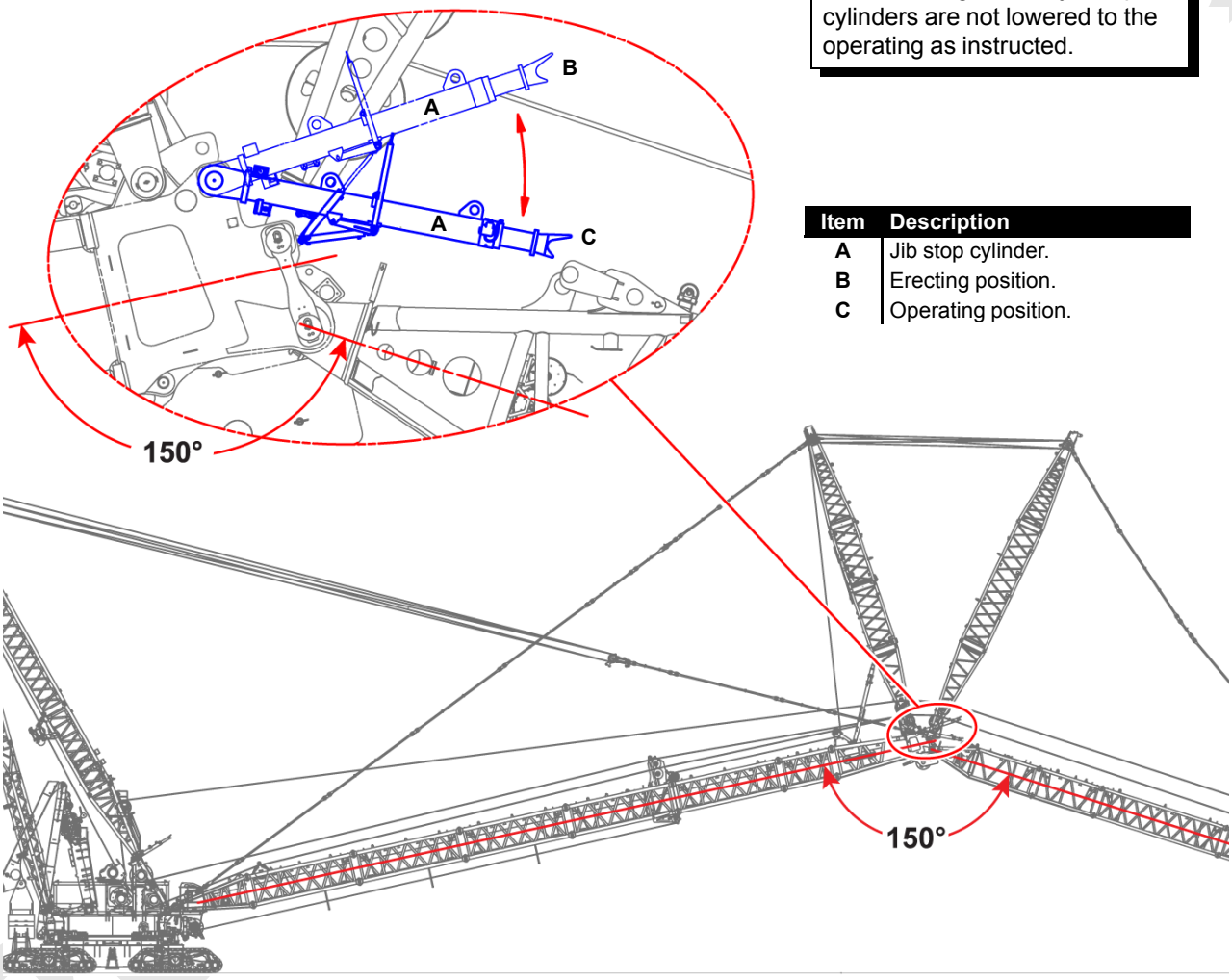
Dolly Configuration for #91 Luffing Jib Lengths *less than 72 m (236.2 ft)*



Dolly Configuration for #91 Luffing Jib Lengths *equal to greater than 72m (236.2 ft)*

FIGURE 4-61

Step	Action
64	*Information below from drawing A19443, Sheet 26:* Raise the boom (**A**) — with minimum tension on the jib straps (**B**) — until the boom-to-luffing jib angle (**C**) equals 150°:  **FIGURE 4-62**
65	• If an upper boom point will be attached now, then go to Upper Boom Point Installation — Method 1 on page 4-71. • Otherwise, go to Figure 4-63.

Step	Action
66	*Information below from drawing A19443, Sheet 26:* Once the boom-to-luffing jib angle is 150°, retract each jib stop support cylinder, one at a time: • Connect the Arctic 15 hydraulic hoses from the Portable Power Unit to either jib stop cylinder (**A**) as shown in Figure 4-50. • Then retract the jib stop cylinder to lower it from the erecting position (**B**) to the operating position (**C**). • Repeat the steps for the other jib stop cylinder. The boom, luffing jib, and jib stop will be damaged if the jib stop cylinders are not lowered to the operating as instructed.  **FIGURE 4-63**

Item	Description
A	Jib stop cylinder.
B	Erecting position.
C	Operating position.

Step	Action
67	*Information below from drawing A19443, Sheet 26 and 27:* • Raise the boom to the proper boom-to-luffing jib included angle (**A**) — 70°, 90°, or 150° — specified in the luffing jib raising/lowering procedure charts. • In order to reeve the hook block (**B**), locate the hook block the distance (**C**) within the luffing jib capacity chart at lift off.

Item	Description
A	Boom-to-luffing jib angle.
B	Hook block.
C	Hook block distance.

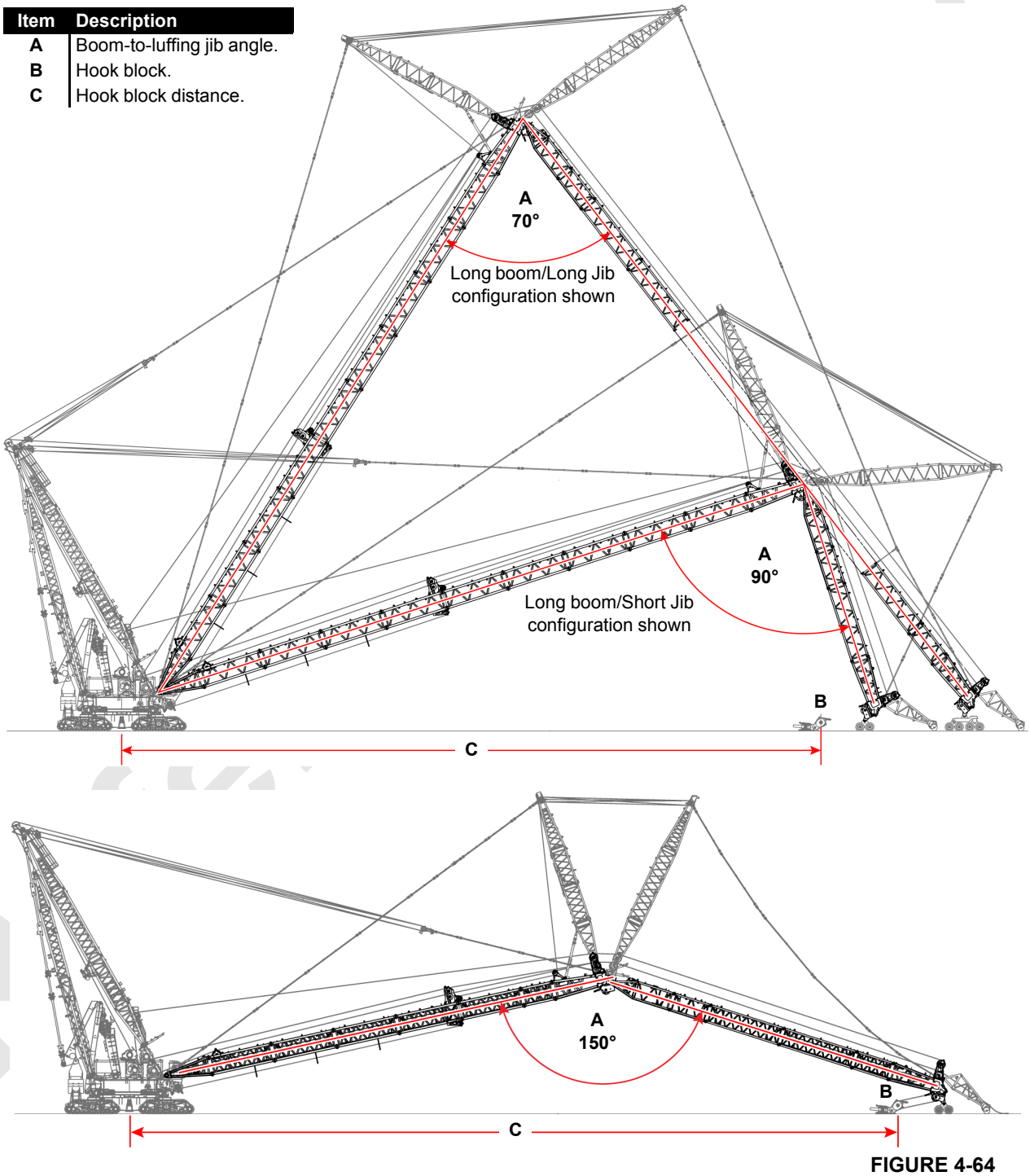
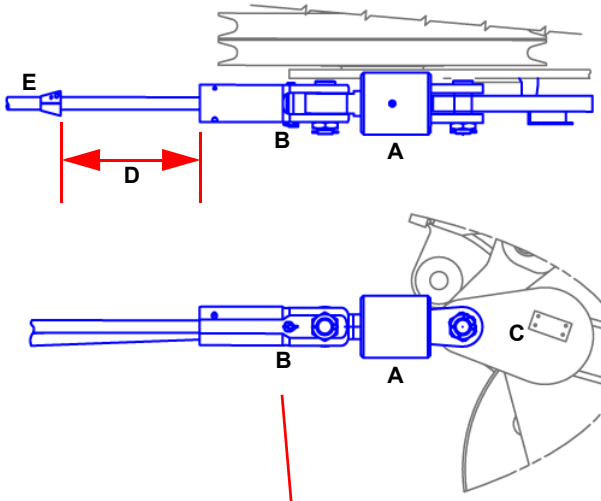


FIGURE 4-64

Step	Action

Information below from drawing A19443, Sheet 26:

Temporarily remove the link swivel (**A**) and button socket (**B**) from the lower boom point dead end lug (**C**).



Item	Description
A	Link swivel.
B	Button socket.
C	Lower boom point dead end lug.
D	800 mm (23.6 inches).
E	50 mm wire rope (Drum 1 and/or Drum 2, and Drum 3).

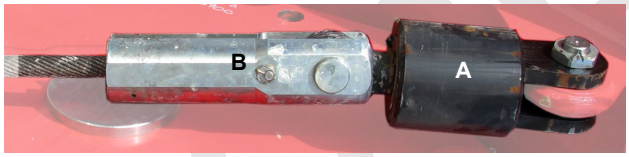
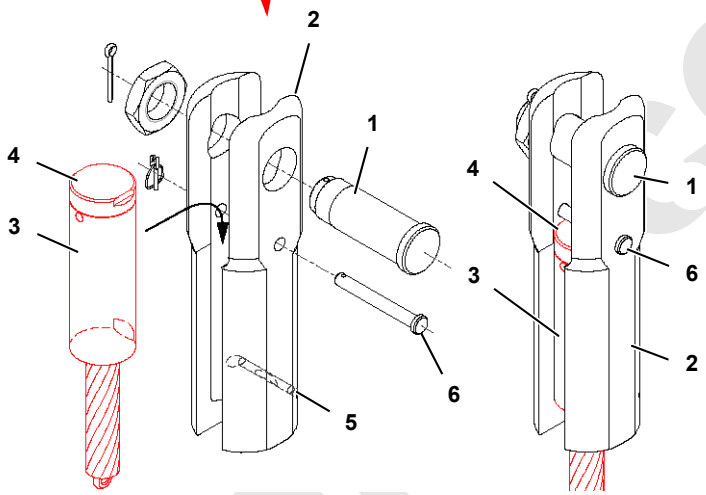


FIGURE 4-65

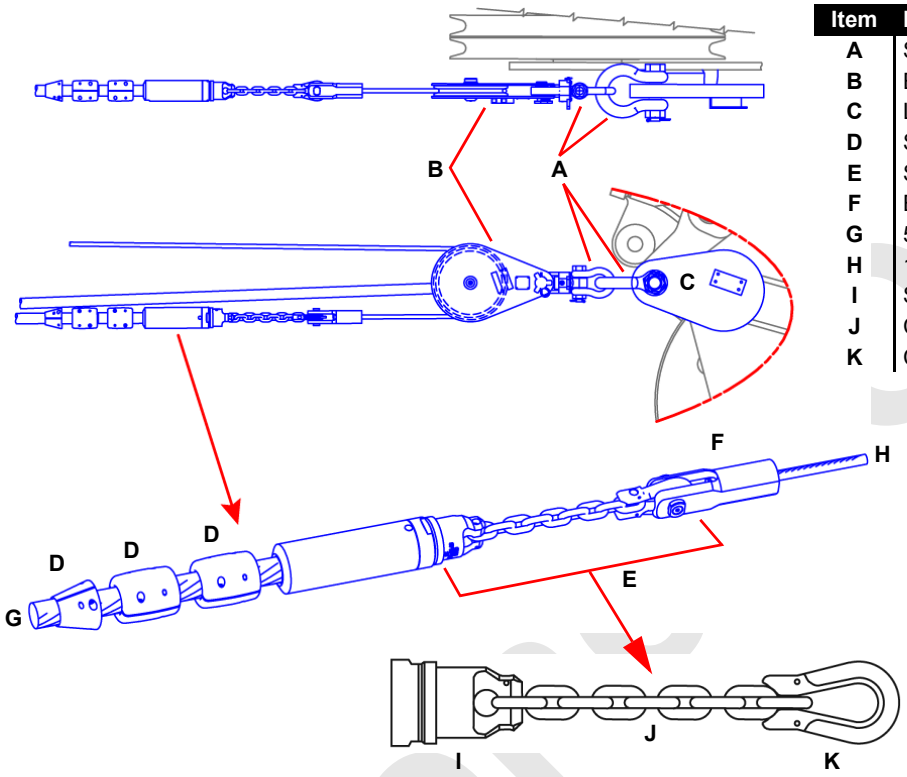
68



Item	Description
1	Bolt, Nut, and Cotter Pin
2	Button Socket
3	Button (on load line)
4	Button Cover
5	Roll Pin
6	Locking Pin with Quick-Release Pin

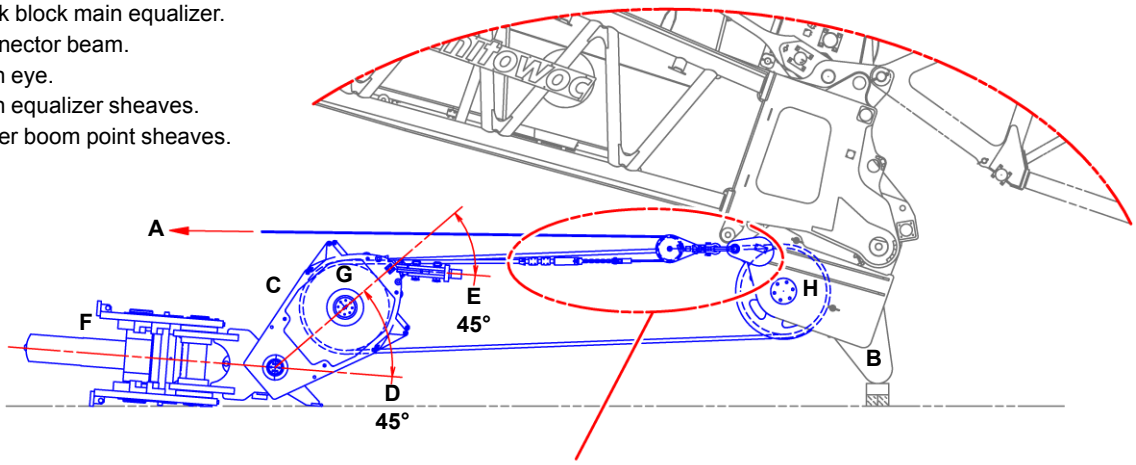
- Button cover (4) must be attached to button (3).
- Flat on button (3) must be against roll pin (5).
- Be sure to install locking pin (6) after button is inserted in socket.

Step	Action
69	*Information below from drawing A19443, Sheet 26:* • Install shackles (**A**) and block snatch (**B**) to the lower boom point dead end lug (**C**). • Reeve the hook block with a sucker line per drawing A18701. • Connect the 50 mm rope (**G**) to the 19 mm rope (**H**) as shown below:



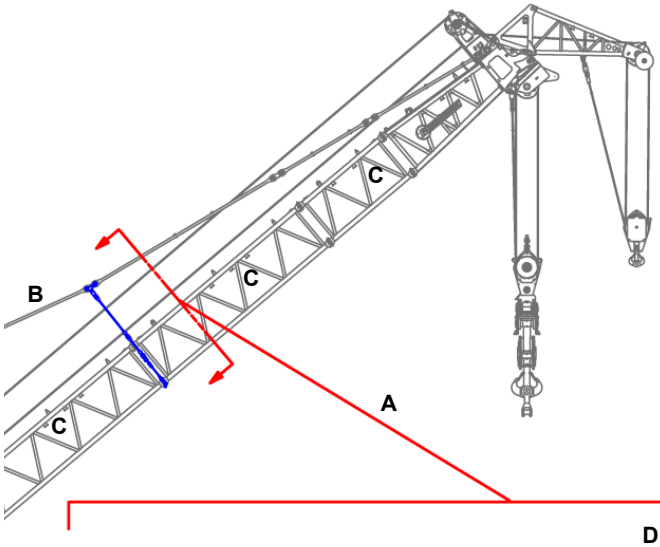
Item	Description
A	Shackles.
B	Block snatch.
C	Lower boom point dead end lug.
D	Split collars for 50 mm rope.
E	Swivel head button.
F	Button socket for 19 mm rope.
G	50 mm rope.
H	19 mm rope (Drum 6 rigging winch).
I	Swivel head button.
J	Chain.
K	Chain coupler.

FIGURE 4-66

Step	Action
70	*Information below from drawing A19443, Sheet 26:* Reeve the 19 mm Drum 6 winch wire rope (**A**) through the lower boom point assembly (**B**) and the hook block (**C**) per the reeving diagrams as indicated on the selected hook block: • Place the hook block main equalizer (**D**) in a 45° position with the connector beam (**E**) parallel to the main eye (**F**) *which shall be tied up to the bolt just above the eye with a strap to prevent the eye from swinging around during laying down and standing up after reeving.* • Position the hook block main equalizer sheaves (**G**) in line with the lower boom point sheaves (**H**). • Position the luffing jib (with or without a dolly) to allow for adequate rigging of 50 mm wire rope with clearance at the connector beam. **NOTE:** When reeving the hook block and the luffing jib is positioned in a dolly, chock the dolly wheels for stability. **NOTE:** The optional upper boom point shall not be preinstalled per Figure 4-77 if the boom-to-luffing jib angle configuration is either 70° or 90° **and** the luffing jib top is positioned on the ground or blocking instead of on a dolly. **Item** **Description** **A** Drum 6 winch wire rope. **B** Lower boom point assembly. **C** Hook block. **D** Hook block main equalizer. **E** Connector beam. **F** Main eye. **G** Main equalizer sheaves. **H** Lower boom point sheaves.  See Figure 4-66 for details. **FIGURE 4-67**
71	*Information below from drawing A19443, Sheet 26:* Connect the dead end to the 50 mm wire rope: • When the reeving of the hook block is complete, remove the shackles and snatch block from the lower boom point dead end lug (see Figure 4-66). • Reattach the link swivel and button socket from the lower boom point dead end lug that were removed in Figure 4-65. • Assemble the 50 mm wire rope end into the button socket shown in Figure 4-65. Then place loose components into a stowage box. **FIGURE 4-68**
72	• If an upper boom point will be attached after hook block reeving, then go to Upper Boom Point Installation — Method 2 on page 4-74. • Otherwise, this complete the #91 luffing jib installation.

Intermediate Suspension Installation

Step	Action
1	*Information below from drawing A19443, Sheet 29:* Intermediate suspension shall be installed on a crane when the luffing jib is 90 m (295.3 ft) or greater. Intermediate suspension (**A**) is a connection between the luffing jib straps (**B**) and the #91 luffing jib inserts (**C**) as shown below. To install intermediate suspension, first consult the Recommended Jib Makeup section of drawing A19443 to see where the intermediate suspension should be installed for the specific luffing jib length.



Item	Description
A	Intermediate suspension.
B	Luffing jib straps.
C	#91 luffing jib inserts.
D	Intermediate suspension top link.
E	Intermediate suspension top pendant link.
F	Intermediate suspension pendant.
G	Intermediate suspension cross member.
H	Intermediate suspension short lower link.
I	Intermediate suspension long lower link.
J	Intermediate suspension yoke.

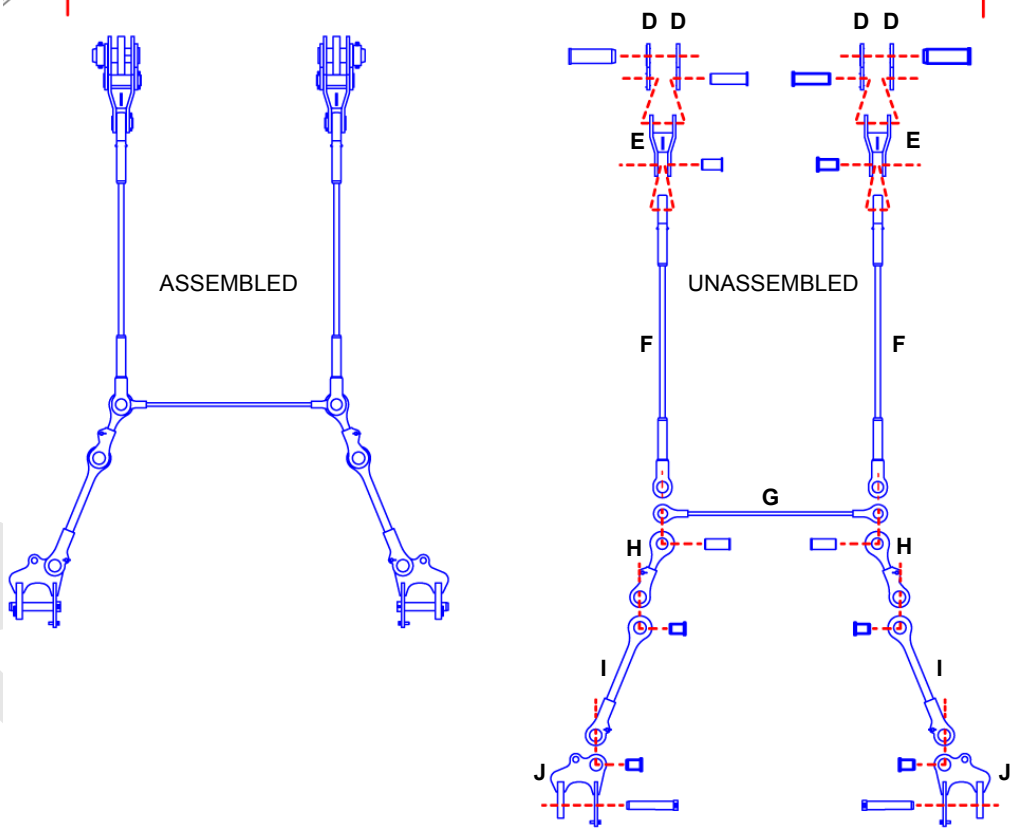
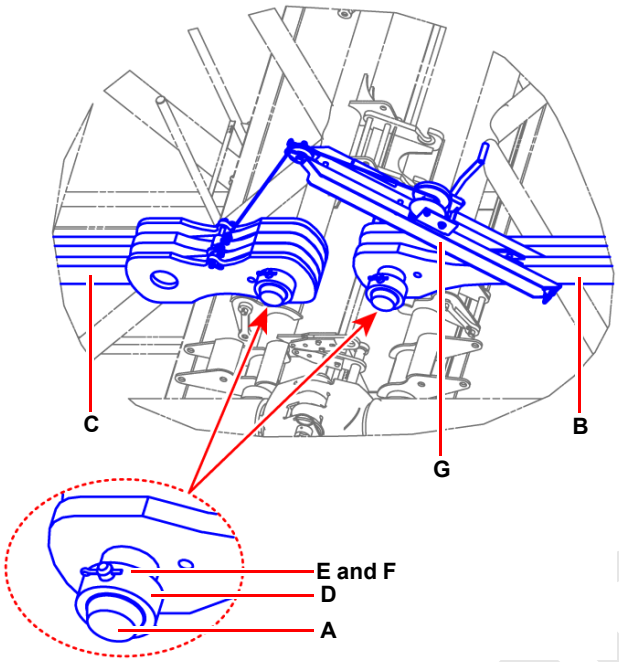


FIGURE 4-69

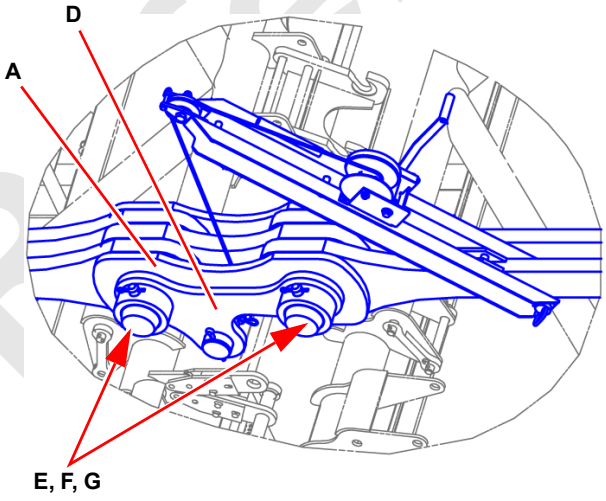
Step	Action
2	*Information below from drawing A19443, Sheet 29:* • Attach the strap rigging winch (**G**) as shown in Figure 4-24. • Remove the short strap pin (**A**) from the boom strap without the link assembly (**B**). • Store the short strap pin (**A**). Keep the collar (**D**), pin (**E**), and cotter pin (**F**).



Item	Description
A	Short strap pin.
B	Strap without link assembly.
C	Strap with link assembly.
D	Collar.
E	Pin.
F	Cotter pin.
G	Strap rigging winch.

FIGURE 4-70

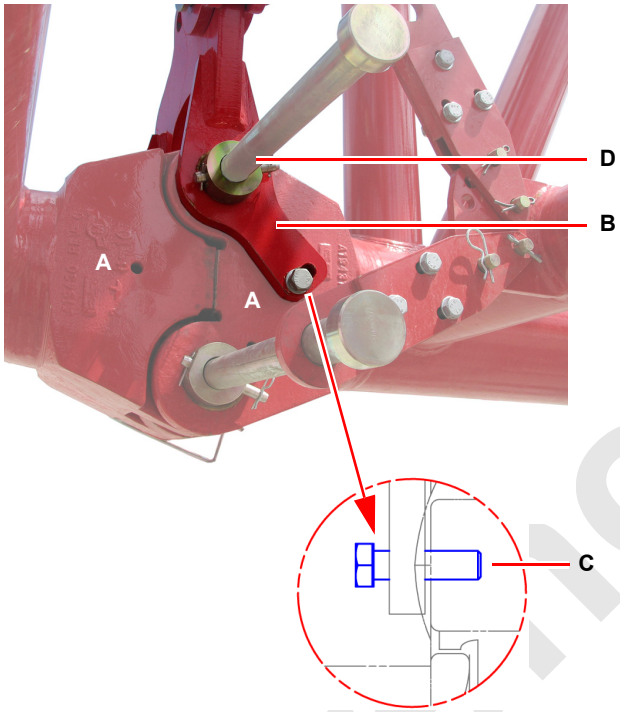
Step	Action
3	*Information below from drawing A19443, Sheet 29:* • Rotate the link assembly (**A**) into its normal position as shown below. • Connect the link assembly (**A**) to the boom strap (**H**) using the long boom strap pin (**B**). • Replace the remaining short boom strap pin (**C**) with a long boom strap pin (**B**). • Place the intermediate suspension link (**D**) over both long boom strap pins (**B**). • Add collar (**E**), pin (**F**), and cotter pin (**G**) from the previous step (Figure 4-70). • Repeat for the other link assembly.



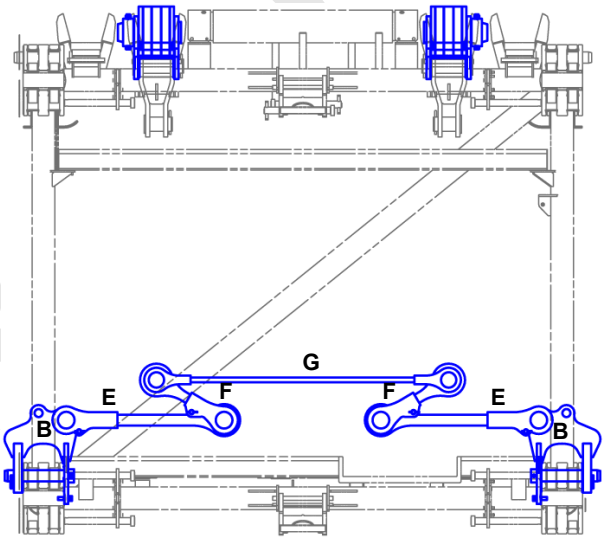
Item	Description
A	Link assembly.
B	Long boom strap pin.
C	Short boom strap pin.
D	Intermediate suspension top link.
E	Collar.
F	Pin.
G	Cotter pin.

FIGURE 4-71

Step	Action
4	*Information below from drawing A19443, Sheet 29:* Connect the lower portion of the intermediate suspension: • Apply Loctite 242 to retaining screw (**C**) threads. Then attach the intermediate suspension yoke (**B**) to the appropriate insert (**A**) using the retaining screw (**C**) and insert pin (**D**). *The intermediate suspension yoke (**B**) should be attached during the luffing jib assembly (see Figure 4-55).* • Connect the intermediate suspension long lower link (**E**) and short lower link (**F**) to the suspension yoke (**B**). • Intermediate suspension cross member (**G**) and intermediate suspension top pendant link (**I**) are shown for reference only. They will be attached in a later step.



Item	Description
A	Insert.
B	Intermediate suspension yoke.
C	Retaining screw — install to provide clearance of movement for intermediate suspension yoke.
D	Insert pin.
E	Intermediate suspension long lower link.
F	Intermediate suspension short lower link.
G	Intermediate suspension cross member.
H	Intermediate suspension top link.
I	Intermediate suspension top pendant link.



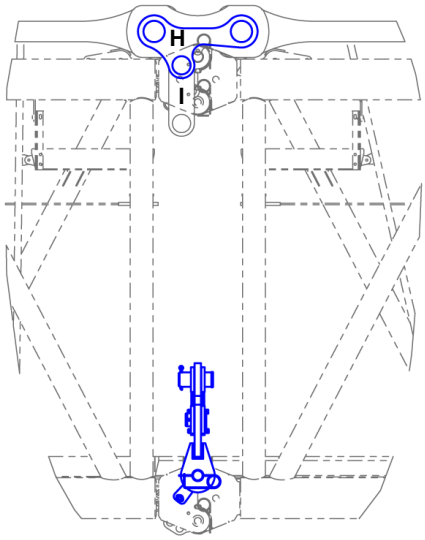
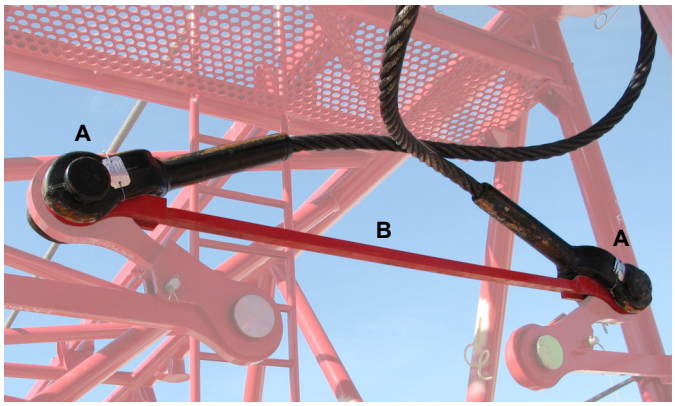
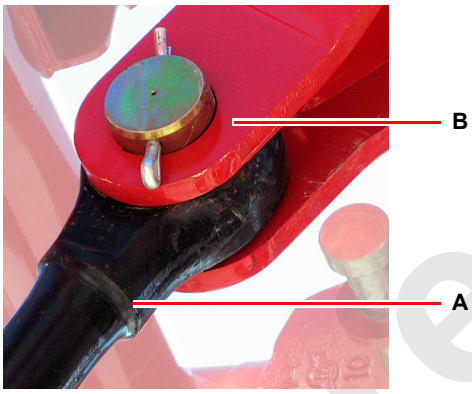
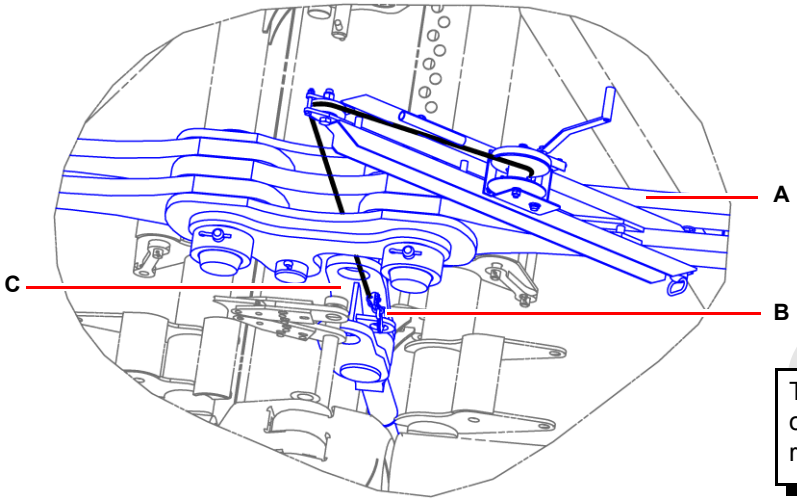


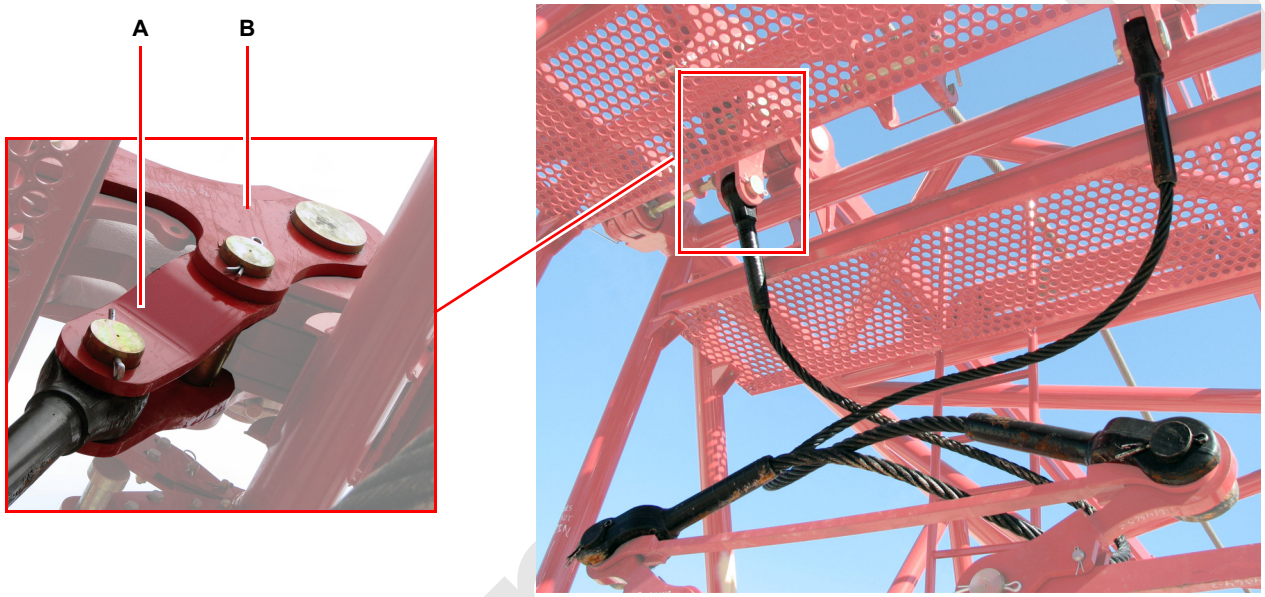
FIGURE 4-72

Step	Action
5	*Information below from drawing A19443, Sheet 29:* Connect the *open end* of the intermediate suspension pendant (**A**), along with the intermediate suspension cross member (**B**) to the lower portion of the intermediate suspension:  **Item** / **Description** **A** — Intermediate suspension pendant (open end). **B** — Intermediate suspension cross member. **FIGURE 4-73**
6	*Information below from drawing A19443, Sheet 29:* Connect the *closed end* of the intermediate suspension pendant (**A**) to the intermediate suspension top pendant link (**B**). Then set the pendant on the ground.  **Item** / **Description** **A** — Intermediate suspension pendant (closed end). **B** — Intermediate suspension pendant. **FIGURE 4-74**

Step	Action
7	*Information below from drawing A19443, Sheet 29:* Lower the strap rigging winch hook (**B**) between the strap links as shown below. Then connect the hook to the lifting lug on the intermediate suspension top pendant link (**C**):  **FIGURE 4-75**

Item	Description
A	Strap rigging winch.
B	Strap rigging winch hook.
C	Intermediate suspension top pendant link.

Three wraps of wire rope shall be left on the strap rigging winch so that the rope does not come off.

Step	Action
8	*Information below from drawing A19443, Sheet 29:* Use the strap rigging winch to raise the intermediate suspension top pendant link (**A**) until the link can be pinned to the intermediate suspension top link (**B**). **Item** **Description** **A** Intermediate suspension top pendant link. **B** Intermediate suspension top link.  **FIGURE 4-76**
9	Move the strap rigging winch over the other insert strap links. Repeat the procedure from Figure 4-73.
10	This completes the intermediate suspension installation procedure.

Upper Boom Point Installation

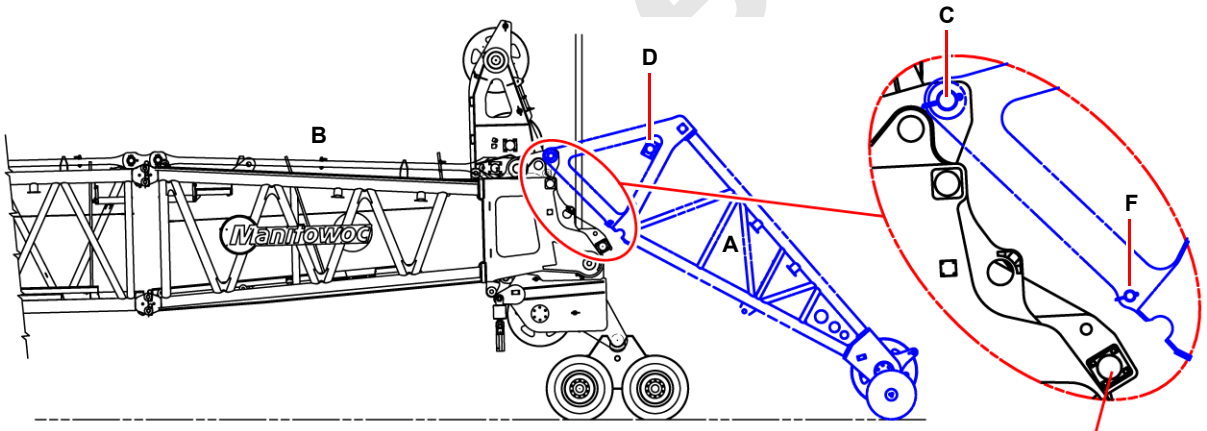
- If reeving the lower boom point while the luffing jib is on a dolly OR if the boom-to-luffing jib included angle is 150°, then go to Upper Boom Point Installation — Method 1 on page 4-71.
- If reeving the lower boom point while the luffing jib is on the ground or on blocking OR if the boom-to-luffing jib included angle is either 70° or 90°, then go to Upper Boom Point Installation — Method 2 on page 4-74.

Upper Boom Point Installation — Method 1

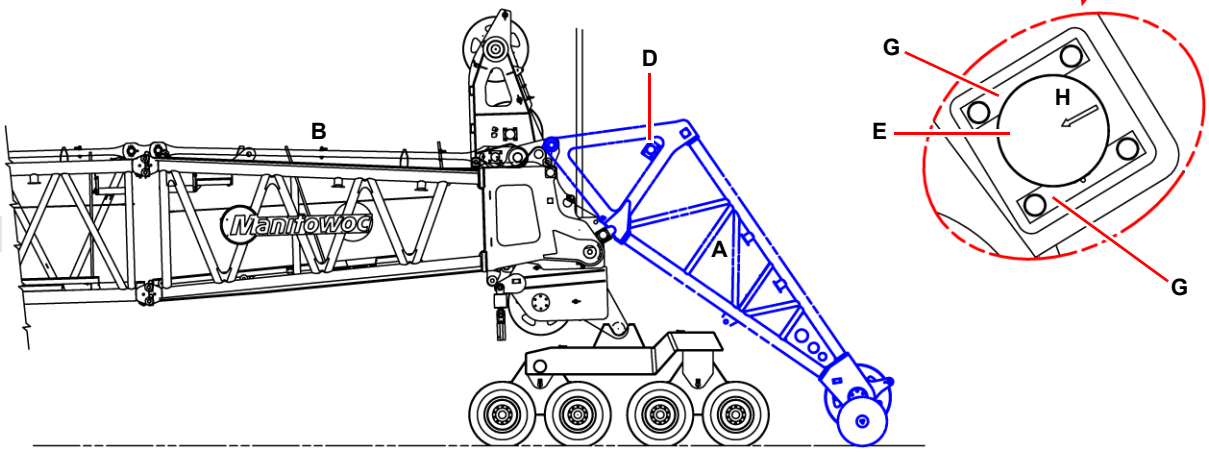
Step	Action
1	*Information below from drawing A19443, Sheet 28:* • Secure the upper boom point (**A**) to the #91 luffing jib top (**B**) at the upper hinge pin (**C**). • Remove the retaining pin (**F**) from the #91 luffing jib top (**B**). • Remove the load pin (**E**) from the load pin storage (**D**) on the upper boom point (**A**). Also remove the fastener hardware from the #91 luffing jib top (**B**). • Attach the load pin (**E**) using keeper plates (**G**). The load pin (**E**) shall be positioned so that the arrow inscribed on the pin (**H**) points toward the lower point sheave bank as shown.

Item	Description
A	Upper boom point.
B	#91 luffing jib top.
C	Upper hinge pin.
D	Load pin storage.

Item	Description
E	Load pin.
F	Retaining pin.
G	Keeper plate.
H	Load pin arrow.

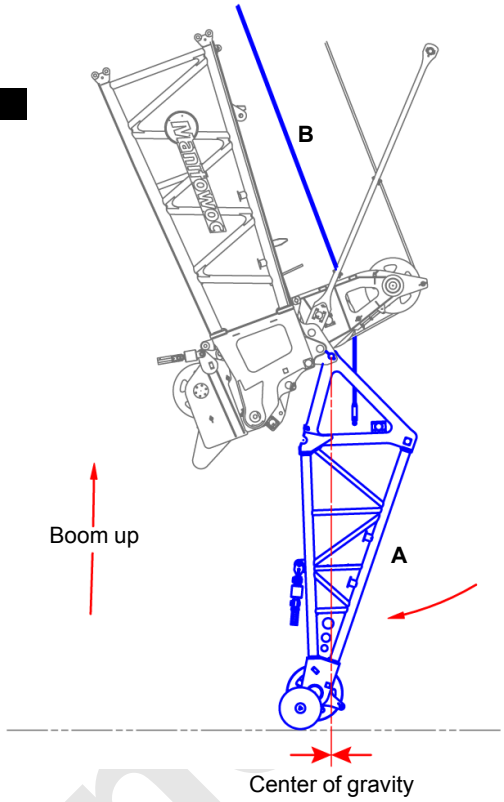


Configuration for #91 Luffing Jib Lengths *less than 72 m (236.2 ft)*

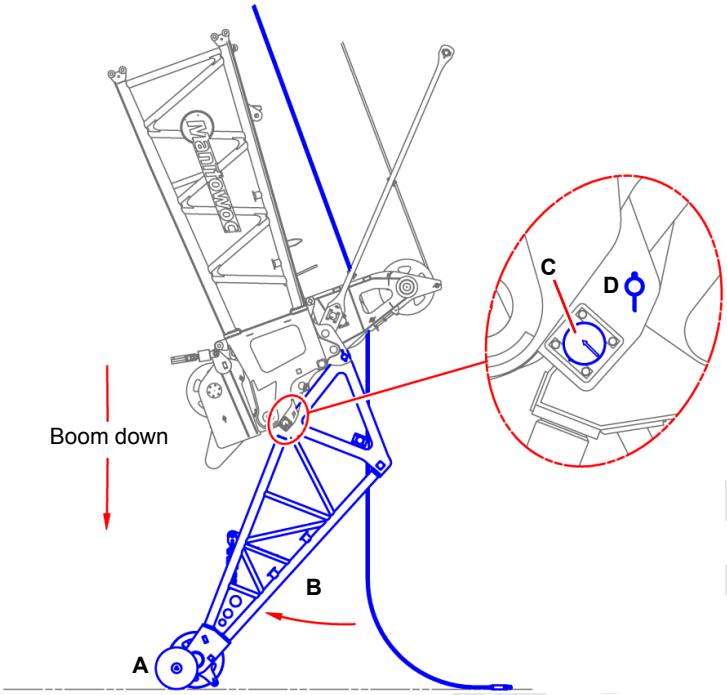


Configuration for #91 Luffing Jib Lengths *equal to greater than 72m (236.2 ft)*

FIGURE 4-77

Step	Action
2	*Information below from drawing A19443, Sheet 28:* Boom up to allow the upper boom point (**A**) to hang vertically: **Item** / **Description** **A** Upper boom point. **B** Drum 3 wire rope.  **FIGURE 4-78**

Step	Action
3	*Information below from drawing A19443, Sheet 28:* • Slowly boom down as the upper boom point wheel (**A**) contacts the ground and rolls towards the crane. • When the upper boom point (**B**) rotates into position against the load pins (**C**), reinstall the locking pins (**D**). • As required, install aircraft warning flag (**E**), warning light (**F**), and wind speed indicator (**G**).
4	This completes the Method 1 upper boom point installation procedure.



Item	Description
A	Upper boom point wheel.
B	Upper boom point.
C	Load pin.
D	Locking pin.
E	Aircraft warning flag.
F	Warning light.
G	Wind speed indicator.

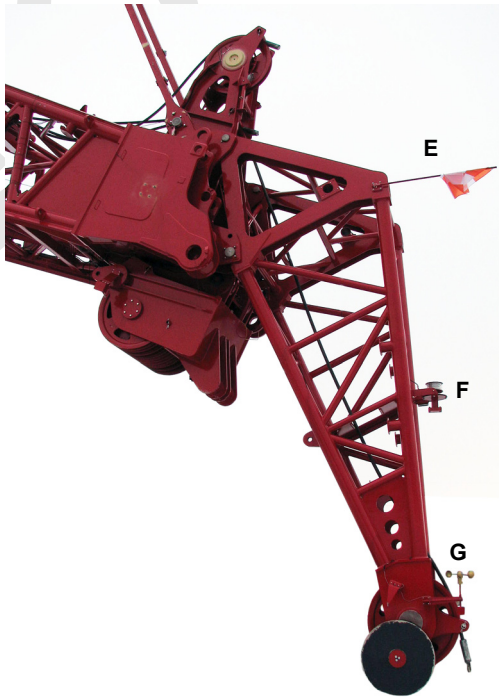
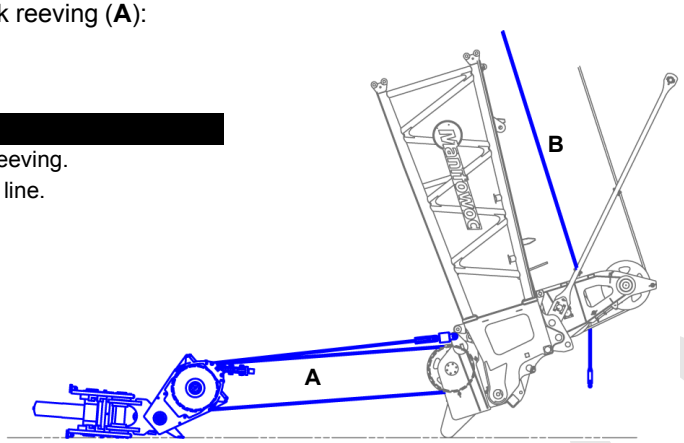
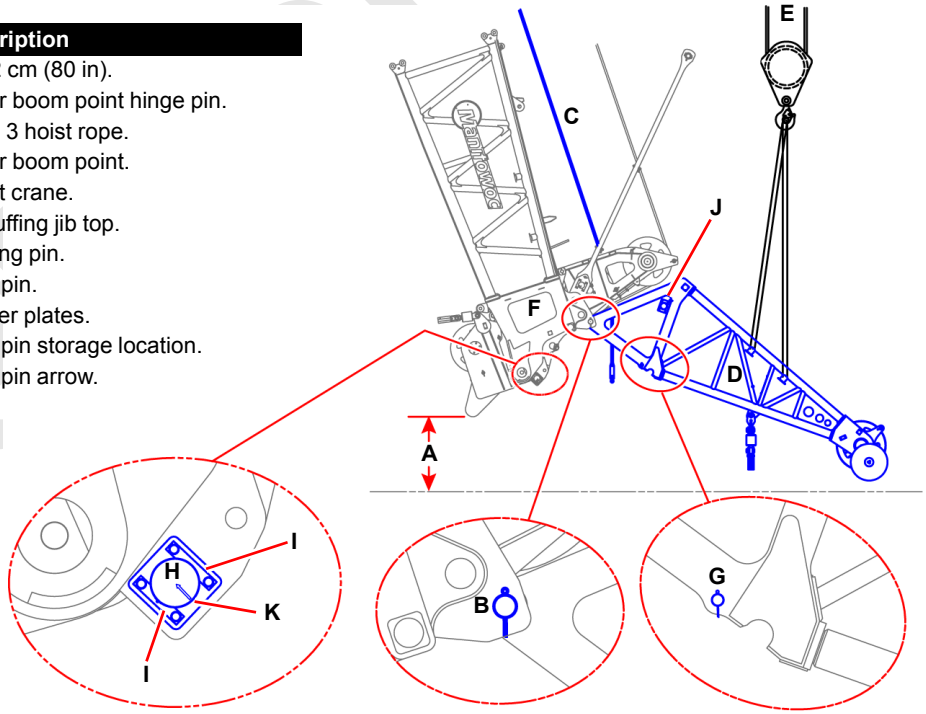
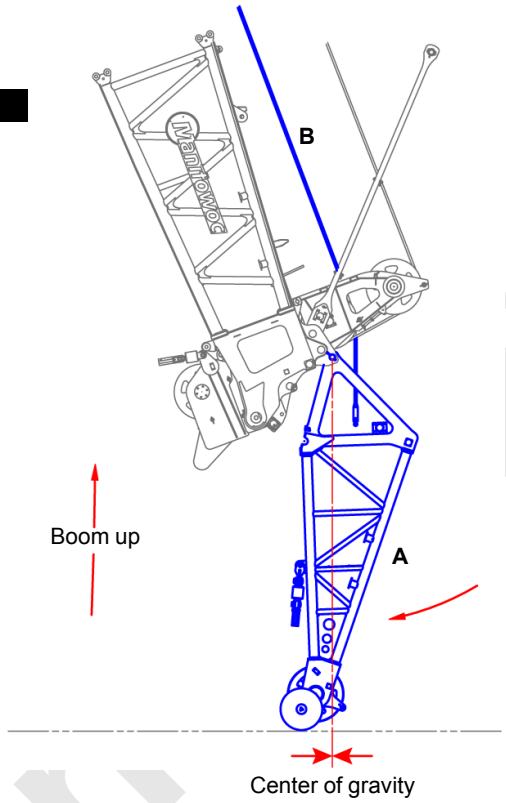


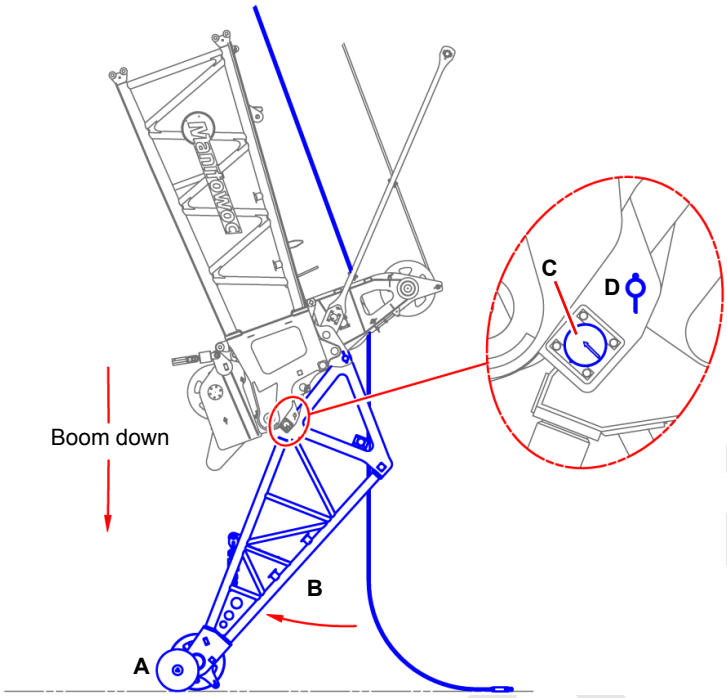
FIGURE 4-79

Upper Boom Point Installation — Method 2

Step	Action
1	*Information below from drawing A19443, Sheet 28:* Complete the hook block reeving (**A**): **Item** / **Description** **A** Hook block reeving. **B** Drum 3 hoist line.  **FIGURE 4-80**
2	*Information below from drawing A19443, Sheet 28:* • Boom up distance (**A**) to provide access to the upper boom point hinge pin (**B**) hole. • Position the Drum 3 hoist rope (**C**) so that it does not interfere with the upper boom point installation (**D**). • Use an assist crane (**E**) attached as shown below to secure the upper boom point (**D**) to the #91 luffing jib top (**F**) with the upper boom point hinge pin (**B**). • Remove locking pins (**G**) from the upper boom point (**D**). *Keep these locking pins (**G**) as they will be needed to lock the upper boom point (**D**) in place.* • Remove the load pins (**H**) and keeper plates (**I**) from the load pin storage location (**J**). • Use the keeper plates (**I**) to secure the load pins (**H**) to the #91 luffing jib top (**F**). Note that the load pin arrow (**K**) shall point *towards the crane*. **Item** / **Description** **A** 203.2 cm (80 in). **B** Upper boom point hinge pin. **C** Drum 3 hoist rope. **D** Upper boom point. **E** Assist crane. **F** #91 luffing jib top. **G** Locking pin. **H** Load pin. **I** Keeper plates. **J** Load pin storage location. **K** Load pin arrow.  **FIGURE 4-81**

Step	Action
3	*Information below from drawing A19443, Sheet 28:* Boom up to allow the upper boom point (**A**) to hang vertically: **Item** / **Description** **A** Upper boom point. **B** Drum 3 wire rope.  **FIGURE 4-82**

Step	Action
4	*Information below from drawing A19443, Sheet 28:* • Slowly boom down as the upper boom point wheel (**A**) contacts the ground and rolls towards the crane. • When the upper boom point (**B**) rotates into position against the load pins (**C**), reinstall the locking pins (**D**). • As required, install aircraft warning flag (**E**), warning light (**F**), and wind speed indicator (**G**).
5	This completes the Method 2 upper boom point installation procedure.



Item	Description
A	Upper boom point wheel.
B	Upper boom point.
C	Load pin.
D	Locking pin.
E	Aircraft warning flag.
F	Warning light.
G	Wind speed indicator.

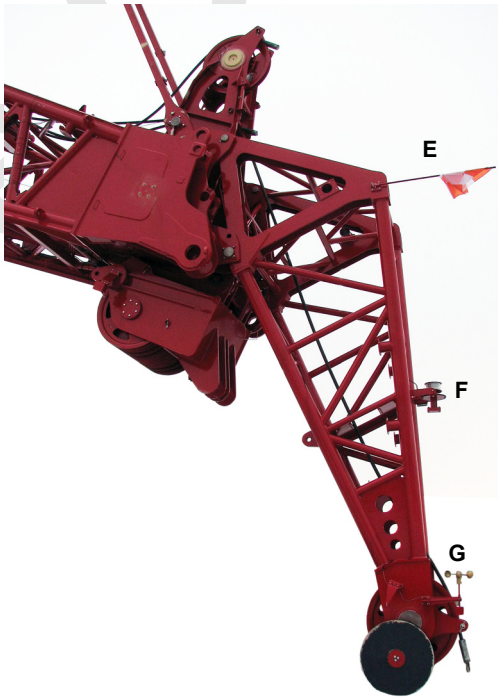


FIGURE 4-83

#91 LUFFING JIB DISASSEMBLY

Lower the Luffing Jib and Boom

Step	Action
1	Lower the hook block and/or weight ball per the load chart for the luffing jib/boom length configuration.
2	Lower the luffing jib per the luffing jib raising/lowering procedure chart to a 70°, 90°, or 150° boom-to-luffing jib included angle as specified by the chart.
3	With the luffing jib at the chart specified included angle, lower the boom towards the ground as the main hoist and whip/auxiliary wire rope is payed out so as to not drag the blocks. **NOTE:** If the luffing jib is equipped with an upper boom point, remove the locking pins (Figure 4-79) and use mechanical means to pivot the upper boom point away from the crane, the reversal of Figure 4-82. The upper boom point should end up positioned as shown in Figure 4-81.
4	Lower the boom while positioning the jib top onto the dolly as shown in Figure 4-61.
5	Disconnect the main load hoist wire rope from the lower boom point and the whip line from the upper boom point.
6	If the optional upper boom point is installed, remove it (Figure 4-78).
7	With the jib top in the dolly, lower the boom until the boom-to-luffing jib included angle equals 150°.
8	Raise the jib stop to the erecting position (Figure 4-63).
9	Boom down as the dolly moves away from the crane. As soon as the jib backstay spreader hydraulic control (Figure 4-44) is reachable, use the Portable Power Unit to retract the jib backstay spreader (Figure 4-38) and to pull the jib backstay straps towards the center line.
10	Open the bypass valves on both main strut support stops (Figure 4-39).
11	Continue to boom down as the dolly moves away from the crane. Support the boom on stands (Figure 4-2). Position the jib strut to allow the jib straps to be disconnected and folded onto the appropriate inserts (Figure 4-57 and Figure 4-59).

Adjust or Remove the Luffing Jib

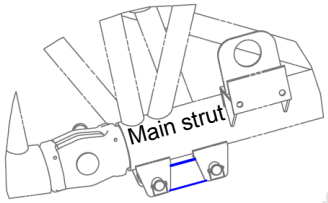
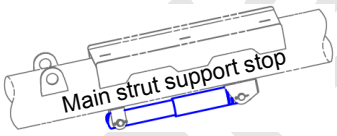
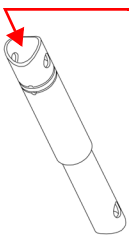
Step	Action
12	With the luffing jib in the down position (Figure 4-55), the luffing jib length can be adjusted or the luffing jib can be disassembled. • *If adjusting the luffing jib length*, use proper care with the jib stop hydraulic lines that from the #91 luffing jib butt reel. • *If disassembling the luffing jib*, before unpinning the #91 luffing jib butt from the #90 boom top, return the hydraulic lines to the #91 boom jib butt (Figure 4-56) and disconnect the jib stop hydraulic lines from the #91 luffing jib butt hard piping (Figure 4-53).
13	*For luffing jib disassembly*, pay in the main load hoist and whip wire ropes so that the rope ends in the #90 boom top wire rope guide (Figure 4-7). Move the Drum 2 wire rope behind the equalizer insert (Figure 4-3).

Lower the Jib Strut

Step	Action
14	With the luffing jib removed, pay out the luffing jib hoist line (Drum 5) and lower the jib strut onto the counterweight box configuration shown in Figure 4-13.

Step	Action
15	Disconnect the jib straps from the link support set. Return the link support set to its shipping position (Figure 4-46).

Lower the Main Strut

Step	Action
16	Disconnect pendants, yoke, and snatch block from the main strut (Figure 4-45 and Figure 4-19).
17	Attach the yoke and pendants to an assist crane (Figure 4-39) Hoist up with the assist crane to take the slack out of the pendants (10,000 to 15,000 pounds maximum).
18	Attach the Drum 6 winch wire rope to the main strut snatch block (Figure 4-19).
19	Hoist in the luffing jib until the load bearing areas of the connectors make contact (Figure 4-42). Use the Portable Power Unit to retract the main strut connector pins (Figure 4-44). **NOTE:** There should be *no slack* in the Drum 6 winch wire rope (Figure 4-42) in order to prevent the upper half of the main strut from opening suddenly.
20	Slowly pay out the 34mm luffing hoist rope (Drum 5) while hoisting up the main strut top with an assist crane. As the main strut sections open (Figure 4-41), relieve tension on the 19mm Drum 6 winch wire rope and the 34mm luffing hoist rope (Drum 5). Disconnect the 19mm Drum 6 winch wire rope from the dead end on the wire rope guide (Figure 4-19) and pay in the 19mm wire rope to the Drum 6 winch (Figure 4-10). Store the 19mm wire rope fittings in a storage box.
21	Continue to support the main strut top with an assist crane as the main strut folds down towards the jib strut. Adjust the 34mm luffing hoist rope (Drum 5) as necessary during the lowering of the main strut to avoid tangling wire rope in the strut inserts.
22	 **FIGURE 4-84** Pivot the *main strut* support strut (Figure 4-84) from its stowed position (Figure 4-17). Allow the support strut to hang vertically.  **FIGURE 4-85** Pivot the *main strut* support stop strut (Figure 4-85) from its stowed position (Figure 4-18). Adjust this support strut to its minimum length (Figure 4-86). ***Failure to adjust the main strut support stop strut to its minimum length may cause structural damage to the crane.*** Allow the support strut to hang vertically.  **FIGURE 4-86** Lower the main strut with the assist crane until the main strut support strut (Figure 4-84) nests onto the jib strut butt (Figure 4-17). Adjust the length of the main strut support stop strut (Figure 4-86) until contact is made with the #90 boom top (Figure 4-18). Pivot the long (or short) support strut (Figure 4-21) from their stowed positions and attach to the main strut insert below.
23	Disconnect the hydraulic lines from the jib backstay spreader (Figure 4-40) and rewind the lines on the reel.

Main Strut in Folded Position

Step	Action
24	Disconnect the strut raising pendant (Figure 4-39) from the assist crane and the strut cap (Figure 4-28).

Relocate the Strut Cap from the Main Strut to the Jib Strut

Step	Action
25	Disconnect the pin, collar, pin assembly from the jib backstay straps setting on the main strut stop (Figure 4-32 through Figure 4-36).
26	Attach an assist crane at four places to the strut cap (Figure 4-27). Attach Drum 2 wire rope to the strut cap (Figure 4-28).
27	Remove the bottom strut cap pin that attaches the strut cap to the main strut transition insert (Figure 4-37).
28	Use an assist crane and Drum 2 to raise the strut cap into a vertical position while pivoting around the hook connector (Figure 4-37).
29	Use an assist crane to raise the strut cap with attached straps high enough to clear the main strut transition insert, and move the strut cap towards the jib strut top (Figure 4-30). **NOTE:** The strut raising pendant and Drum 2 wire rope does NOT have to be used during this step.
30	Remove the jib support straps (Figure 4-23) from the strut cap. Then attach the strut cap to the jib strut cap using the two strut cap pins (Figure 4-29).
31	Using a pin stored during assembly, secure the link support set to the storage trough on the jib strut top (Figure 4-23).
32	With strut configuration similar to Figure 4-22, reeve a sucker line through the strut cap and jib strut top (Figure 4-14).
33	Pay in the unattached luffing hoist rope to the boom top.

Remove the Upper Half of the Main Strut

Step	Action
34	Using an assist crane attached as shown in Figure 4-21, pivot the support struts into their storage position.
35	Remove the connector pins and lift off the *upper* half of the main strut (Figure 4-21). Store the connector pins in the holes they were removed from on the main strut insert.
36	Disconnect the main strut transition insert from the main strut insert (Figure 4-20).

Remove the Lower Half of the Main Strut

Step	Action
37	Attach an assist crane to the main strut stop. Then remove the hinge pin holding the main strut stop to the #90 boom top (Figure 4-18).
38	Retract the main strut support stop and move the locking pin to its shipping position (Figure 4-18).
39	Adjust the length of the main strut support stop (Figure 4-86) and fold it into the storage position on the main strut (Figure 4-17).
40	Attach an assist crane to the lower half of the main strut and move the support strut to its storage position on the main strut insert (Figure 4-17).
41	Remove the main strut butt hinge pins (Figure 4-17). Then lift off the lower half of the main strut. Stow the main strut butt hinge pins in the main strut butt.
42	Disassemble the lower half of the main strut (Figure 4-16).

Remove the Jib Strut

Step	Action
43	Remove the sling connecting the strut top to the counterweight boxes (Figure 4-13).
44	Using an assist crane attached to the jib strut as shown in Figure 4-13, remove the hinge pins and links (Figure 4-12).
45	Place jib strut on blocking and disassemble (Figure 4-11).

Disassemble the Luffing Jib and Remove it from the Boom

Step	Action
	The boom shall be removed from the crane in order to access Drum 5. See drawing A18701 for disassembly.
46	See Section 4 of the **31000 Operator Manual**.

Remove the Luffing Jib Drum 5 Assembly and Relocate the Wire Rope Guide

Step	Action
	The boom shall be removed from the crane in order to access Drum 5. See drawing A18701 for disassembly.
47	See Section 4 of the **31000 Operator Manual**.

SECTION 4 INSERTS

- Drawing A19443 — Luffing Jib Assembly, #91 on #90 Boom
- Drawing 81000640 — Wind Speed Assembly
- Drawing 81009008 — Electrical Accessory Assembly, Aircraft Warning
- Drawing 81012924 — Electrical Control Assembly, Boom Wiring and Limits
- Drawing 81014362 — Intermediate Suspension, Luffing Jib Assembly #91

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SECTION 5
LUBRICATION

Lubrication Guide 5-1

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SECTION 5
LUBRICATION

LUBRICATION GUIDE

See F2201 at the end of this section.

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SECTION 6
MAINTENANCE CHECKLIST

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Luffing Jib-to-Boom Maximum Angle Switch Adjustment 6-7
Physical Stop and Indicator Maintenance 6-9
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Block-Up 6-9
Aircraft Warning Lights 6-9

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SECTION 6
MAINTENANCE

OVERVIEW

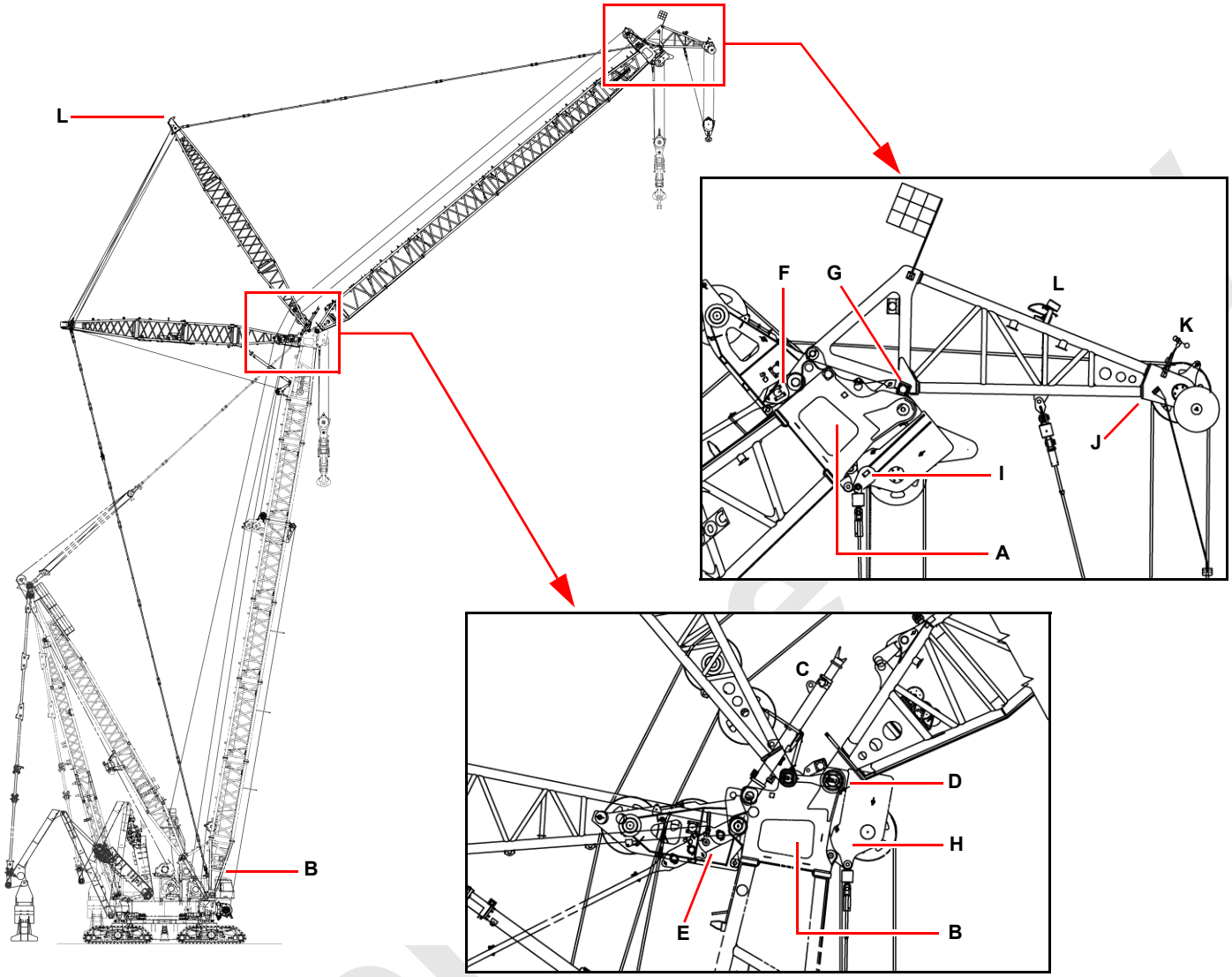
This section contains maintenance and adjustment instructions for the following devices used with the luffing jib attachment:

- Sensors — angle, load, limit, and wind speed
- Physical stops — boom and luffing jib
- Aircraft warning lights

For maintenance and inspection of the following components, see the 31000 Service Manual supplied with the crane:

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

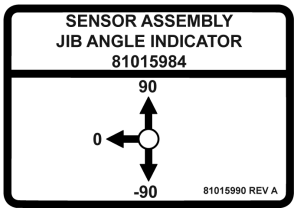
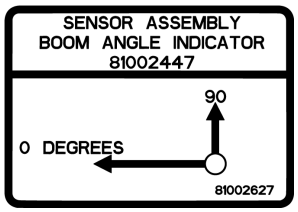
SENSOR, PHYSICAL STOP, AND INDICATOR LOCATIONS



Item	Description
A	Jib angle indicator (inside the luffing jib top).
B	Boom angle indicator (on the boom butt and the boom top).
C	Luffing jib maximum angle limit switch (on the left luffing jib stop).
D	Luffing jib minimum angle limit switch (near the left luffing jib butt connection).
E	Boom strap load links.
F	Luffing jib strap load links.
G	Luffing jib upper boom point load pins.
H	Boom block-up limit switch (on the left side).
I	Luffing jib top block-up limit switch.
J	Luffing jib upper boom point block-up limit switch (on left side of the upper point).
K	Wind speed indicator.
L	Aircraft warning light.

FIGURE 6-1

SENSOR MAINTENANCE

Sensor (see Figure 6-1 for locations)	Maintenance	
	Possible Fault[1]	Remedy
Jib angle indicator 	 Fault 64: Jib angle sensor out of range.	• Check sensor wiring. Perform an RCL/RCI calibration.[2] • Replace the sensor. See the 31000 Service Manual.
	 Fault 49: Jib maximum up angle.	• These fault icons indicate operational limits which are not necessarily sensor malfunctions. • However, if a sensor malfunction is suspected, first perform an RCL/RCI calibration[2]. • If sensor calibration fails to correct the fault, replace the sensor. See the 31000 Service Manual.
	 Fault 50: Jib maximum down angle.	
Boom angle indicator 	 Fault 63: Boom angle sensor out of range.	• Check sensor wiring. Perform an RCL/RCI calibration.[2] • Replace the sensor. See the 31000 Service Manual.
	 Fault 55: Boom maximum up.	• This fault icon indicates an operational limit which is not necessarily a sensor malfunction. • However, if a sensor malfunction is suspected, first perform an RCL/RCI calibration[2]. • If sensor calibration fails to correct the fault, replace the sensor. See the 31000 Service Manual.
Luffing jib maximum angle limit switch	 Fault 73: Jib maximum up switch.	• This fault icon indicates an operational limit which is not necessarily a sensor malfunction. • However, if a sensor malfunction is suspected, try adjusting the sensor as described on page 7.
Luffing jib minimum angle switch	 Fault 67: Jib maximum down switch.	• This fault icon indicates an operational limit which is not necessarily a sensor malfunction. • However, if a sensor malfunction is suspected, try adjusting the sensor as described on page 4.
Load links and load pins	 Fault 42: RCL/ RCI sensor out of range.	• Check sensor wiring. Perform an RCL/RCI calibration.[2] • If load sensor calibration fails to correct the fault, use the RCL/RCI Diagnostics screen[2] to try to isolate the faulty sensor. Then replace the sensor.
Block-up limit switch	 Fault 60: Block-up limit.	• This fault icon indicates an operational limit which is not necessarily a sensor malfunction. • However, if a sensor malfunction is suspected, see the 31000 Service Manual.
Wind speed indicator	 Main Display wind speed icon.	• There is no fault icon for the wind speed indicator. • If a fault is suspected with the wind speed indicator, replace the indicator. See the 31000 Service Manual.

NOTES:

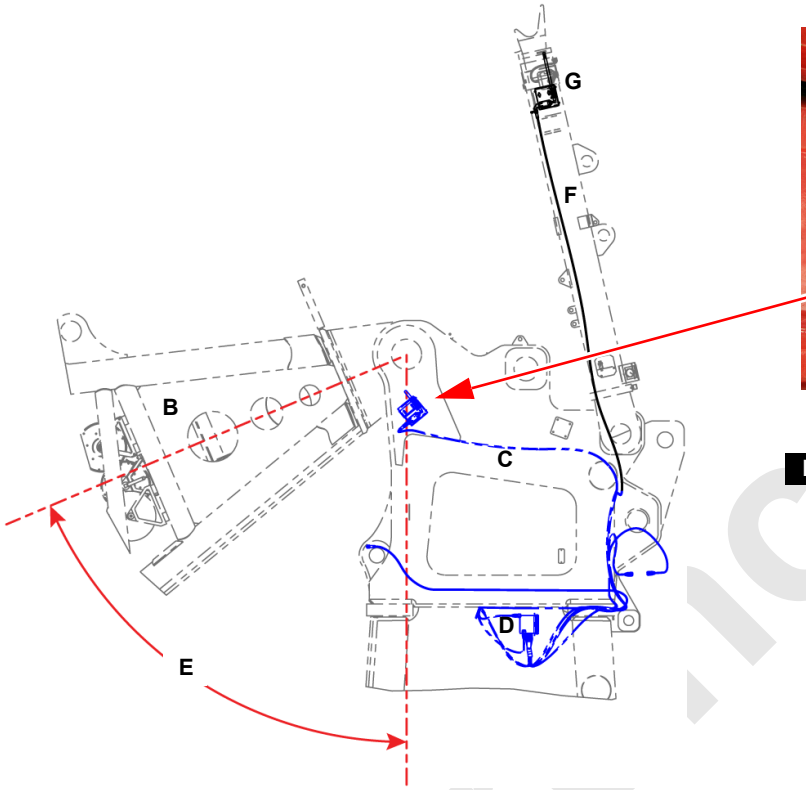
[1] Fault icons appear on the Main Display screen. See Folio 2207 for more information.

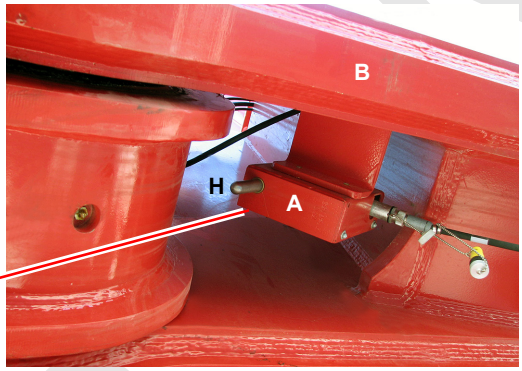
[2] See Folio 2204 for more information.

Luffing Jib-to-Boom Minimum Angle Switch Adjustment

The luffing jib-to-boom minimum angle switch (**A**) is activated when the following sequence of events occurs:

- The luffing jib is lowered to a point where the luffing jib butt (**B**) contacts and depresses the actuator rod (**H**).
- When the actuator rod (**H**) is depressed far enough, the luffing jib-to-boom minimum angle switch (**A**) is activated.
- After the luffing jib-to-boom minimum angle switch (**A**) is activated, a Fault 67: Jib Maximum Down Switch icon should appear on the Main Display screen.



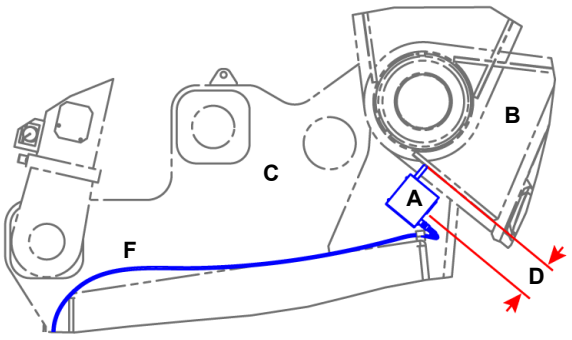


Item	Description
A	Luffing jib-to-boom minimum angle switch.
B	#91 luffing jib butt.
C	#90 boom top.
D	Boom top universal node #20.
E	67° 0’ = minimum luffing jib-to-boom angle.
F	Physical luffing jib stop.
G	Luffing jib-to-boom maximum angle switch.
H	Actuator rod.

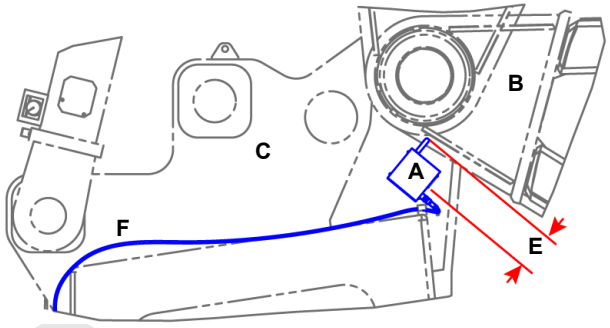
FIGURE 6-2

1. The luffing jib-to-boom *minimum* angle switch (**A**) should be mounted as shown in Figure 6-2. Activated and non-activated positions of the actuator rod are shown in Figure 6-3:

Item	Description
A	Luffing jib-to-boom minimum angle switch.
B	#91 luffing jib butt.
C	#90 boom top.
D	174.2mm = actuated position of actuator rod.
E	180.0mm = non-actuated position of actuator rod.
F	W203 cable (see Remove the Luffing Jib Drum 5 Assembly and Relocate the Wire Rope Guide on page 4-80).



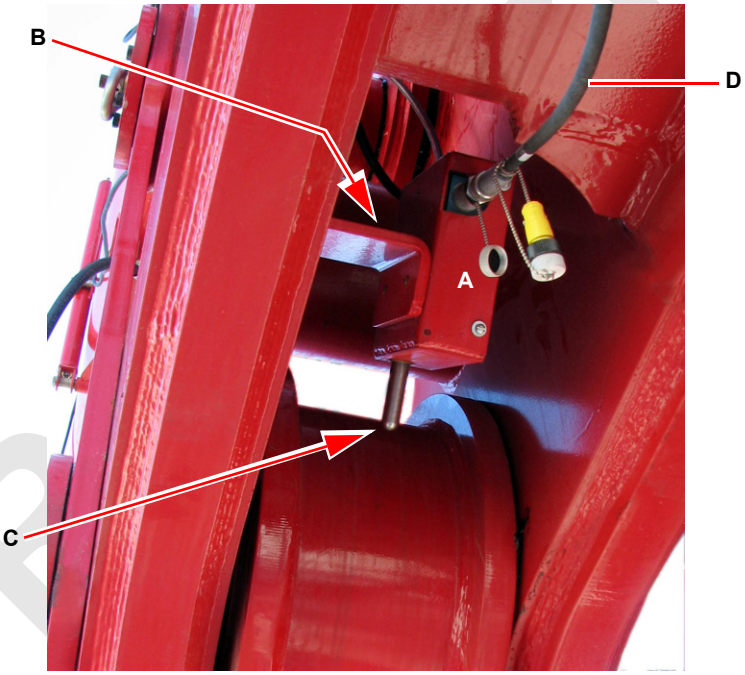
Luffing jib-to-boom minimum angle switch (actuated position)



Luffing jib-to-boom minimum angle switch (non-actuated position)

FIGURE 6-3

2. To determine the position of the actuator rod on the luffing jib-to-boom *minimum* angle switch (**A**), measure the distance between the angle switch mount back (**B**) and the actuator rod tip (**C**) as shown in Figure 6-4:



Item	Description
A	Luffing jib-to-boom minimum angle switch.
B	Angle switch mount back.
C	Actuator rod tip.
D	W203 cable (see Remove the Luffing Jib Drum 5 Assembly and Relocate the Wire Rope Guide on page 4-80).

FIGURE 6-4

3. To adjust the actuator rod (**A**) position, loosen the lid screws (**B**) and remove the lid (**C**). Loosen the mounting bolts (**D**) and move the switch box as needed:

Item	Description
A	Actuator rod.
B	Lid screws.
C	Lid.
D	Mounting bolts.

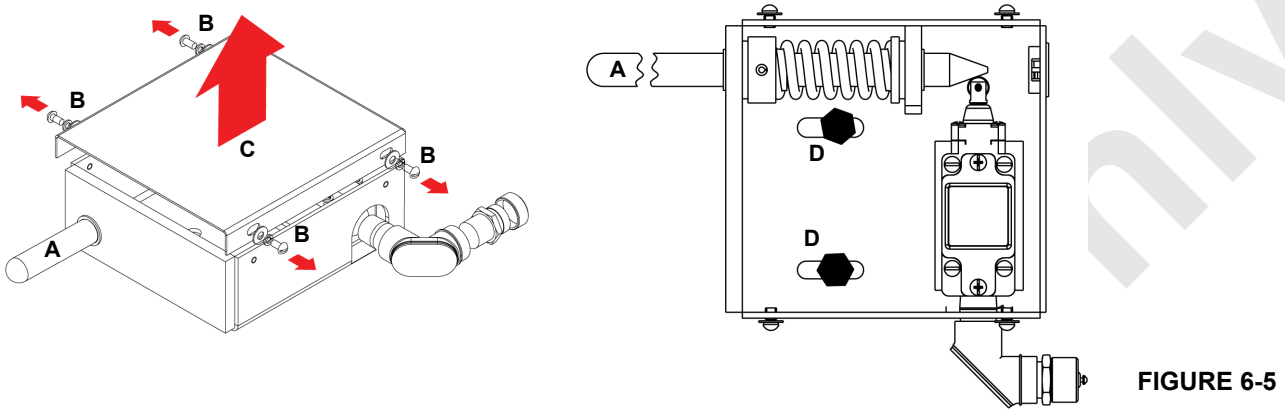
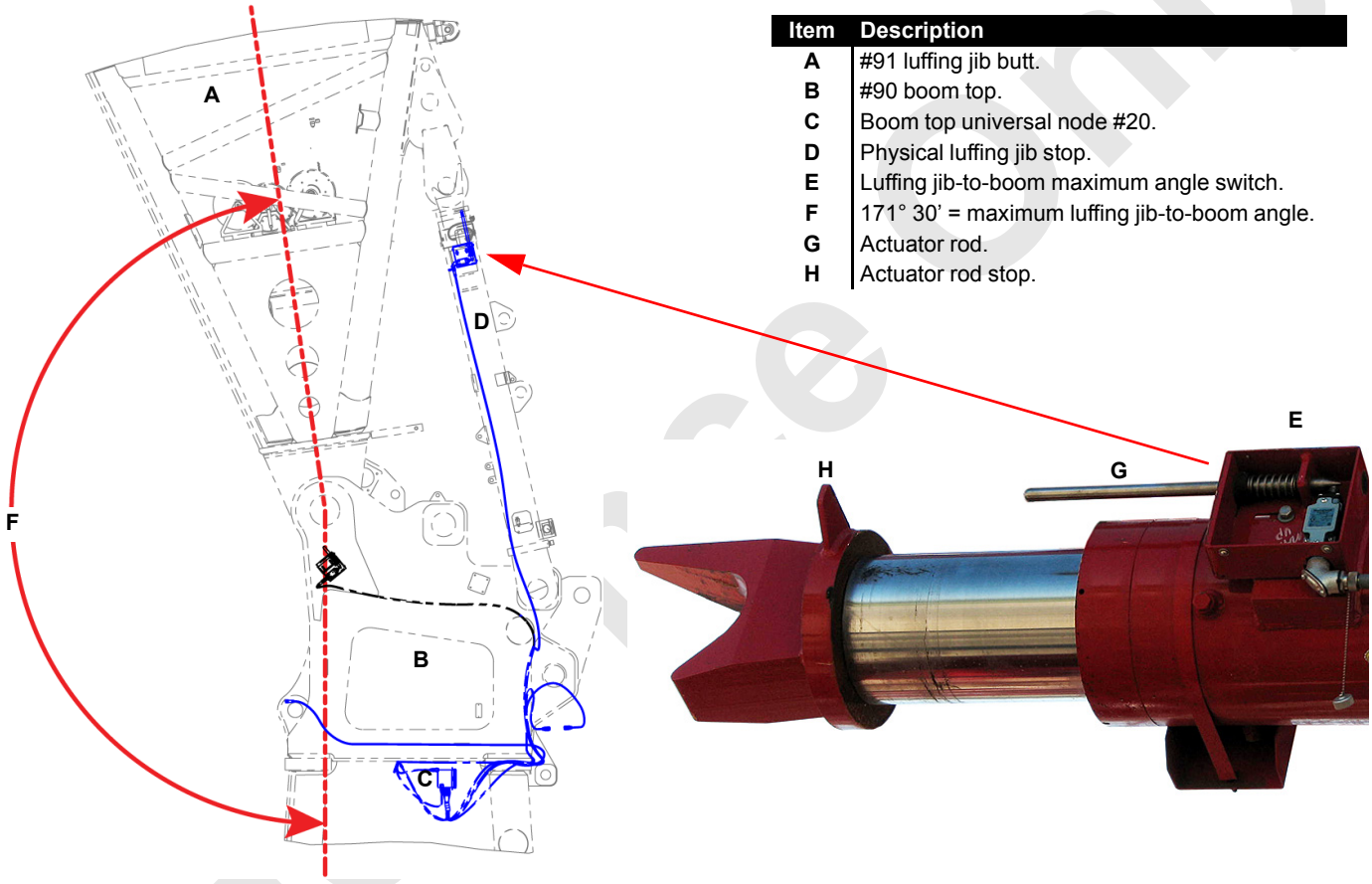


FIGURE 6-5

Luffing Jib-to-Boom Maximum Angle Switch Adjustment

The luffing jib-to-boom maximum angle switch (**E**) is activated when the following sequence of events occurs:

- The luffing jib is raised to a point where the luffing jib butt (**A**) contacts the physical luffing jib stop (**D**).
- As the physical luffing jib stop (**D**) is compressed, the actuator rod stop (**H**) contacts and depresses the actuator rod (**G**)
- When the actuator rod (**G**) is depressed far enough, the luffing jib-to-boom maximum angle switch (**E**) is activated.
- After the luffing jib-to-boom maximum angle switch (**E**) is activated, a Fault 73: Jib Maximum Up Switch icon should appear on the Main Display screen.



Item	Description
A	#91 luffing jib butt.
B	#90 boom top.
C	Boom top universal node #20.
D	Physical luffing jib stop.
E	Luffing jib-to-boom maximum angle switch.
F	171° 30’ = maximum luffing jib-to-boom angle.
G	Actuator rod.
H	Actuator rod stop.

FIGURE 6-6

1. The luffing jib-to-boom *maximum* angle switch should be mounted as shown in Figure 6-6.

2. To determine the position of the actuator rod on the luffing jib-to-boom *maximum* angle switch (**A**), measure the distance between the angle switch mounting block (**B**) and the actuator rod tip (**C**) as shown in Figure 6-7:

Item	Description
A	Luffing jib-to-boom maximum angle switch.
B	Mounting block.
C	Actuator rod.
D	Actuator rod position: 323.0mm = non-activated distance. 317.2mm = activated distance.
E	W203 cable (see Remove the Luffing Jib Drum 5 Assembly and Relocate the Wire Rope Guide on page 4-80).
F	Physical jib stop.

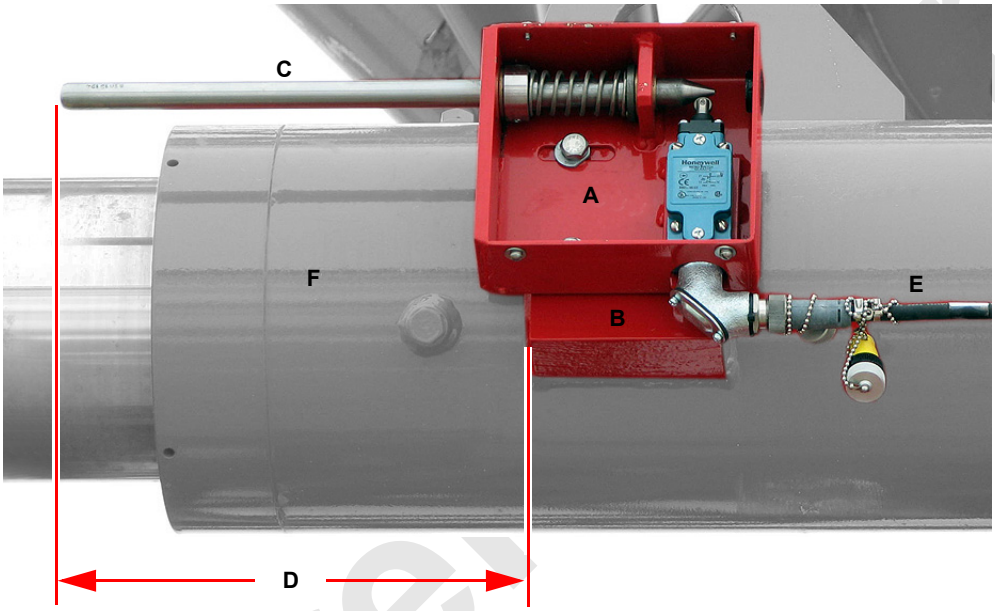


FIGURE 6-7

3. To adjust the actuator rod position (**D**), see Figure 6-5.

PHYSICAL STOP AND INDICATOR MAINTENANCE

Boom Physical Stop

See Section 4 of the 31000 Service Manual.

Luffing Jib Physical Stop

See Section 4 of the 31000 Service Manual.

Block-Up

See Section 4 of the 31000 Service Manual.

Aircraft Warning Lights

See Section 4 of the 31000 Service Manual.

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