

# Manitowoc MLC80A-1/MLC90A-1/ MLC100A-1/MLC100-1

## Operator Manual





# WARNING

## California Proposition 65

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

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

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

Do not modify or tamper with the exhaust system.

Do not idle the engine except as necessary.

For more information, go to [www.P65warnings.ca.gov/diesel](http://www.P65warnings.ca.gov/diesel)

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



## California Spark Arrestor

Operation of this equipment may create sparks that can start fires around dry vegetation. A spark arrestor may be required. The owner/ operator should contact local fire agencies for laws or regulations relating to fire prevention requirements.





# OPERATOR MANUAL

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

## MLC80A-1/MLC90A-1/MLC100A-1/MLC100-1

Crane Model Number

**91001xxx**

Crane Serial Number

This Manual is divided into the following sections:


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

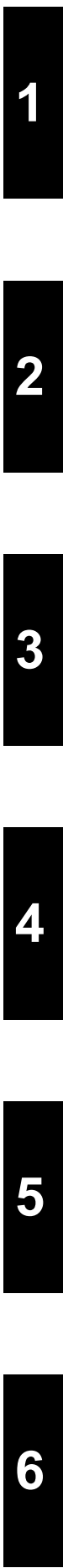
### NOTICE

The serial number of this crane and applicable attachments 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's cab and each attachment. Refer to the Nameplate and Decal Assembly Drawing in Section 2 of this manual for the exact location of the crane identification plate.

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

	<b>⚠ WARNING</b>
	<p><b>To prevent death or serious injury:</b></p> <ul style="list-style-type: none"><li>• Avoid unsafe operation and maintenance. Crane and attachments must be operated and maintained by trained and experienced personnel. Manitowoc is not responsible for qualifying these personnel.</li><li>• 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.</li><li>• Store Operator Information Manual and Service Manual in operator's cab.</li></ul> <p>If Operator Information Manual or Service Manual is missing from cab, contact your Manitowoc dealer for a new one.</p>



***THE ORIGINAL LANGUAGE OF THIS PUBLICATION IS ENGLISH***

See end of this manual for Alphabetical Index

<b>SECTION 1</b> .....	<b>Introduction</b>
Crane Data .....	1-1
Crane Weights .....	1-1
Outline Dimensions .....	1-1
Change of Ownership Registration .....	1-1
Manitowoc Dealer .....	1-1
Crane Identification .....	1-1
Crane Orientation .....	1-1
Identification and Location of Components .....	1-2
English and Metric Conversions .....	1-4
Direct Conversion .....	1-4
Inverse Conversion .....	1-4
<b>SECTION 2</b> .....	<b>Safety Information</b>
Continuous Innovation .....	2-1
Nameplates and Decals .....	2-1
Safety Messages .....	2-1
General .....	2-1
Safety Alert Symbol .....	2-1
Signal Words .....	2-1
Symbol Identification .....	2-1
Safety and Information Signs .....	2-3
Maintaining Signs .....	2-3
Ordering Signs .....	2-3
Crane Access Points .....	2-5
General .....	2-5
Getting On or Off Crane .....	2-5
Personal Fall-Protection .....	2-5
Operator Manual/Capacity Chart Storage .....	2-6
General .....	2-6
Storing Manuals .....	2-6
Safe Operating Practices .....	2-7
General .....	2-7
Read Operator Manual .....	2-7
Operator Qualifications .....	2-7
Operator Conduct .....	2-7
Handling Load .....	2-9
Signals .....	2-12
Safety Devices .....	2-13
Operational Aids .....	2-13
Category 1 Operational Aids .....	2-13
Category 2 Operational Aids .....	2-14
Assembling, Disassembling, or Operating Crane Near Electric Power and Transmission Lines .....	2-15
Electrocution Hazard .....	2-15
Set-Up and Operation .....	2-15
Electrocution Hazard Devices .....	2-16
Electrical Contact .....	2-16
Refueling .....	2-17
Fire Extinguishers .....	2-17
Accidents .....	2-17
Safe Maintenance .....	2-17
Maintenance Instructions .....	2-17
Safe Maintenance Practices .....	2-17
Environmental Protection .....	2-19
Boom Disassembly Safety .....	2-21

General . . . . .	2-21
Location . . . . .	2-21
Pin Removal . . . . .	2-21
Disassembly Precaution . . . . .	2-21
Personnel Handling Policy . . . . .	2-22
Pedestal/Barge Mounted Cranes . . . . .	2-23
Pedestal Mounted Crane . . . . .	2-24
Barge Mounted Crane . . . . .	2-24
Capacity Charts for Barge Mounted Crane . . . . .	2-25
Shock Loading Caused by Barge Dynamics . . . . .	2-25
Operation on Barge . . . . .	2-25
Barge Mount Definitions . . . . .	2-26
Inspection of Barge-Mounted Crane . . . . .	2-26
Transporting Crane on Barge . . . . .	2-26

**SECTION 3 . . . . . Operating Controls And Procedures**

Standard Hand Signals for Controlling Crane Operations . . . . .	3-2
Symbols Used on Control Consoles . . . . .	3-4
Left Console . . . . .	3-12
Right Console . . . . .	3-14
Overhead Console . . . . .	3-22
Foot Pedals . . . . .	3-25
Seat Controls . . . . .	3-26
Other Operation Aids . . . . .	3-27
Remote Control . . . . .	3-32
Operating Limits Identification . . . . .	3-34
Cab Window Operation . . . . .	3-37
Opening Windows for Ventilation . . . . .	3-37
Exiting Cab in Emergency . . . . .	3-37
Operating in Wind . . . . .	3-37
Crawler Blocking . . . . .	3-37
Preparing Crane for Operation . . . . .	3-38
Startup Procedures . . . . .	3-38
Operating Procedures . . . . .	3-40
Boom Hoist Operation . . . . .	3-41
Swing Operation . . . . .	3-42
Load Drum Operation—Liftcrane Full Power . . . . .	3-43
Load Drum Operation—Liftcrane Free Fall . . . . .	3-44
Free Fall Drum Slip and Pedal Response . . . . .	3-45
Load Drum Operation—Clamshell . . . . .	3-46
Travel Operation . . . . .	3-47
Shutdown Procedure or Leaving the Crane Unattended . . . . .	3-49
Low Clearance Travel Option . . . . .	3-49
Low Clearance Travel Boom Configurations . . . . .	3-49
Low Clearance Travel Limitations . . . . .	3-49
Preparing Fully Rigged Boom for Low Clearance Travel . . . . .	3-51
Returning Gantry to Normal Operating Position . . . . .	3-51
Preparing Cantilevered Boom Inserts for Low Clearance Travel . . . . .	3-53
Returning Gantry to Normal Operating Position . . . . .	3-53
Cold Weather Operation . . . . .	3-55
Crane Limitations . . . . .	3-55
Wire Rope . . . . .	3-55
Cold Weather Starting Aid . . . . .	3-55
Cooling System . . . . .	3-55
Batteries . . . . .	3-55
Engine Oil, Gear Oil, and Hydraulic Oil . . . . .	3-55

AC Power Supply . . . . .	3-57
Generator Installation/Removal . . . . .	3-57
Turning AC Power ON . . . . .	3-57
Turning AC Power OFF . . . . .	3-57
Work Lights . . . . .	3-57
Cold Weather Heaters . . . . .	3-59
Fuses and Circuit Breakers . . . . .	3-61

## **SECTION 4. . . . . Setup and Installation**

Boom and Jib Assembly Drawings . . . . .	4-1
Liftcrane Boom Butt Capacities . . . . .	4-1
Crane Orientation . . . . .	4-1
Accessing Parts . . . . .	4-1
Assembly and Disassembly Notes . . . . .	4-1
Assembly and Disassembly Area . . . . .	4-2
Handling Components . . . . .	4-2
Retaining Connecting Pins . . . . .	4-2
Crane Weights and Shipping Data . . . . .	4-2
Parts Storage . . . . .	4-2
Parts Box . . . . .	4-2
Position Light and Anemometer Option . . . . .	4-2
Lifting Sling . . . . .	4-3
Shipping Configuration . . . . .	4-5
Self-Erect Components . . . . .	4-5
Self-Erect Controls . . . . .	4-6
Pin and Connecting Hole Cleanliness . . . . .	4-7
Electric Cable Cleanliness . . . . .	4-7
Connecting/Disconnecting Hydraulic Hoses and Electric Cables . . . . .	4-7
Pre-Start Checks . . . . .	4-7
Deploy the crane platforms as necessary to gain access to components. . . . .	4-7
Engine . . . . .	4-7
Gear Boxes . . . . .	4-7
Hydraulic System . . . . .	4-7
Crane Assembly . . . . .	4-9
Prepare Trailer for Unloading . . . . .	4-9
Deploy Crawler Steps . . . . .	4-9
Deploy Crane Platforms . . . . .	4-9
Prepare Cab . . . . .	4-11
Raise Handrails . . . . .	4-13
Start Engine . . . . .	4-15
Configure RCL/RCI for Crane Setup . . . . .	4-15
Raise Gantry . . . . .	4-15
Travel Crane off Trailer . . . . .	4-15
Extend Crawlers . . . . .	4-17
Install Hook-and-Weight Ball . . . . .	4-19
Unload Trailers . . . . .	4-19
Assemble Boom and Jib . . . . .	4-23
Install Carbody Counterweight . . . . .	4-23
Assemble Crane Counterweight . . . . .	4-25
Activate Remote Control . . . . .	4-27
Install Crane Counterweight . . . . .	4-27
Install Crane Counterweight (continued) . . . . .	4-29
Install Crane Counterweight (continued) . . . . .	4-31
Remove Hook-and-Weight Ball . . . . .	4-33
Connect Boom Butt to Boom . . . . .	4-33
Connect Boom Pendants to Equalizer . . . . .	4-35
Disconnect Equalizer from Boom Butt . . . . .	4-35

Configure RCL/RCI for Crane Operation . . . . .	4-35
Connect Boom Butt to Boom Top Electric Cables . . . . .	4-37
Install Boom Top Position Light and Wind Speed Indicator (option) . . . . .	4-39
Install Boom Top Camera (option) . . . . .	4-39
Install Boom Block-Up Limit Components . . . . .	4-39
Install Jib Top Position Light and Wind Speed Indicator (option) . . . . .	4-41
Install Jib Top Camera (option) . . . . .	4-41
Connect Jib Extension Cable . . . . .	4-41
Install Jib Block-Up Limit Components . . . . .	4-41
Deactivating/Activating a Block-up Limit Switch . . . . .	4-43
Install Load Lines . . . . .	4-45
Boom and Jib Rigging — General . . . . .	4-46
Blocked Crawlers . . . . .	4-46
Boom Handling . . . . .	4-46
Rigging Drawings . . . . .	4-46
Identifying Boom and Jib Components . . . . .	4-46
Handling Boom and Jib Sections . . . . .	4-47
Boom #290 Assembly . . . . .	4-49
Assemble Boom Inserts . . . . .	4-49
Connect Boom Top to Inserts . . . . .	4-49
Install Boom Pendants . . . . .	4-50
Install Intermediate Suspension Pendants . . . . .	4-51
Install Upper Boom Point . . . . .	4-51
Install Optional Rope Guard . . . . .	4-53
Install Tagline . . . . .	4-53
Complete Boom/Crane Assembly . . . . .	4-53
Jib #117 Assembly . . . . .	4-55
Prepare Boom . . . . .	4-55
Install Jib Bottom . . . . .	4-55
Install Jib Inserts . . . . .	4-55
Install Jib Top . . . . .	4-55
Install Jib/Backstay Pendants . . . . .	4-57
Prepare to Raise Jib Strut . . . . .	4-57
Deploy Strut Raising Arm . . . . .	4-57
Raise Jib Strut . . . . .	4-59
Deploy Strut Stops . . . . .	4-59
Complete Jib Rigging . . . . .	4-59
Raise Boom . . . . .	4-60
Pre-Raising Checks . . . . .	4-60
Boom Raising Procedure . . . . .	4-60
Shipping Crane Components . . . . .	4-61
Crane Disassembly . . . . .	4-63
Prepare Crane . . . . .	4-63
Lower Boom . . . . .	4-63
Store Load Lines . . . . .	4-63
Remove Boom/Jib Point Electronics . . . . .	4-63
Store Strut Stops . . . . .	4-65
Deploy Strut Raising Arm . . . . .	4-65
Lower Jib Strut . . . . .	4-65
Connect Equalizer to Boom Butt . . . . .	4-67
Open Boom . . . . .	4-69
Disconnect Boom Pendants from Equalizer . . . . .	4-71
Disconnect Boom Butt from Boom . . . . .	4-71
Install Hook-and-Weight Ball . . . . .	4-71
Configure RCL/RCI for Crane Setup . . . . .	4-71
Remove Crane Counterweight . . . . .	4-73
Remove Crane Counterweight (continued) . . . . .	4-75



Disassemble Crane Counterweight . . . . .	4-75
Remove Carbody Counterweight. . . . .	4-77
Disassemble Jib and Boom . . . . .	4-77
Load Trailers . . . . .	4-79
Remove Hook-and-Weight Ball . . . . .	4-79
Retract Crawlers . . . . .	4-81
Prepare Trailer for Loading . . . . .	4-83
Travel Crane onto Trailer. . . . .	4-83
Lower Gantry . . . . .	4-83
Secure Operator Cab. . . . .	4-84
Lower Handrails . . . . .	4-84
Store Crane Platforms . . . . .	4-84
Store Crawler Steps. . . . .	4-84
Prepare Trailer for Travel. . . . .	4-84
Boom #290 Disassembly . . . . .	4-84
Jib #117 Disassembly. . . . .	4-85
Wire Rope Installation . . . . .	4-86
Wire Rope Specifications. . . . .	4-86
Wire Rope Storage . . . . .	4-86
Seizing and Cutting Wire Rope . . . . .	4-86
Anchoring Wire Rope to Drum . . . . .	4-86
Winding Wire Rope onto Drum . . . . .	4-88
Anchoring Wire Rope to Wedge Socket . . . . .	4-91
Anchoring Wire Rope to Button Socket . . . . .	4-93
Pad Eye Usage for Wire Rope Reeving . . . . .	4-93
Breaking in Wire Rope. . . . .	4-93
Load Line Reeving . . . . .	4-95
Guide Sheaves and Drums . . . . .	4-95
Dead End Location . . . . .	4-95
Load Block Identification . . . . .	4-95
Wire Rope Specifications. . . . .	4-95
Load Block Reeving. . . . .	4-95
Load Block Tieback . . . . .	4-96
General . . . . .	4-96
Specifications. . . . .	4-96

**SECTION 5. . . . . Lubrication**

Lubrication . . . . .	5-1
Lube and Coolant Product Guide . . . . .	5-1

**SECTION 6. . . . . Maintenance Checklist**

Inspection and Maintenance Checklist . . . . .	6-1
Fiberglass Maintenance . . . . .	6-1
Field Paint Repair Guide . . . . .	6-1

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# SECTION 1 INTRODUCTION

## TABLE OF CONTENTS

Crane Data .....	1-1
Crane Weights .....	1-1
Outline Dimensions .....	1-1
Change of Ownership Registration .....	1-1
Manitowoc Dealer .....	1-1
Crane Identification .....	1-1
Crane Orientation .....	1-1
Identification and Location of Components .....	1-2
English and Metric Conversions .....	1-4
Direct Conversion .....	1-4
Inverse Conversion .....	1-4

FOR REFERENCE ONLY

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# SECTION 1 INTRODUCTION

## CRANE DATA

See the end of this section for crane data specific to your crane:

- Basic Specifications
- EC Declaration (if applicable)

## CRANE WEIGHTS

See the end of this section for crane weights.

## OUTLINE DIMENSIONS

See the end of this section for outline dimensions.

## 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](http://www.manitowoccranes.com).
2. Go to Parts & Service > Service Support > Change of Ownership Form.
3. Complete the form.

## MANITOWOC DEALER

For questions about this manual or your 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](http://www.manitowoccranes.com)
2. Go to Dealer Locator.
3. Follow the on-screen prompts to locate your Manitowoc dealer.

## CRANE IDENTIFICATION

An identification plate (3, [Figure 1-2](#)) is attached to the outside of the operator cab.

The crane model and serial number are provided on the plate ([Figure 1-1](#)).

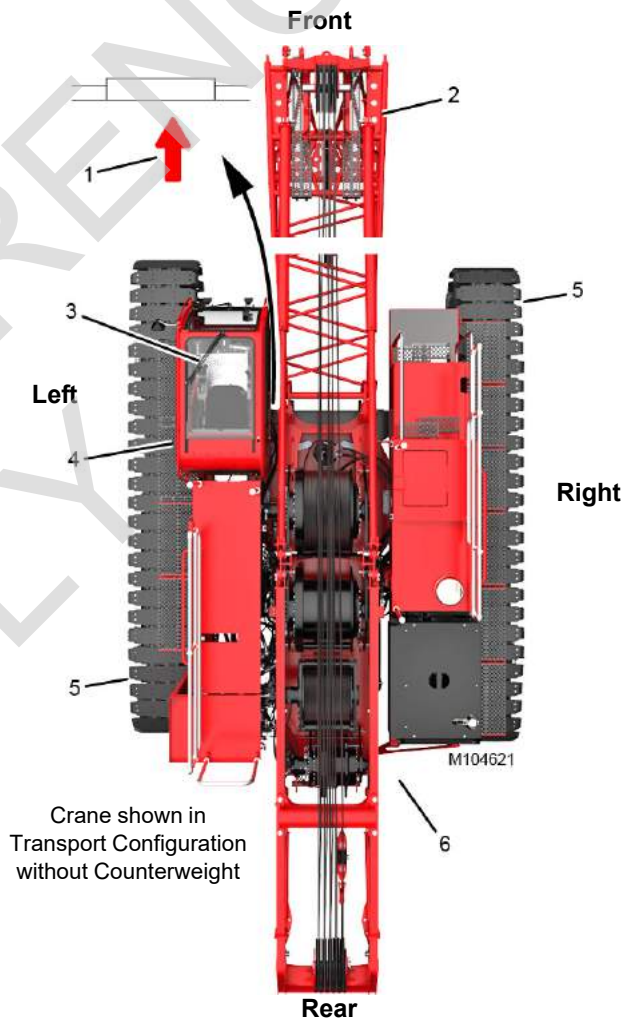


Figure 1-1. Identification Plate

## CRANE ORIENTATION

See [Figure 1-2](#).

The terms right, left, front, and rear used in this manual refer to the operator's right, left, front, and rear sides when seated in the operator cab. The red arrow on the carbody indicates the front of the lowerworks. The boom is on the front the of upperworks.

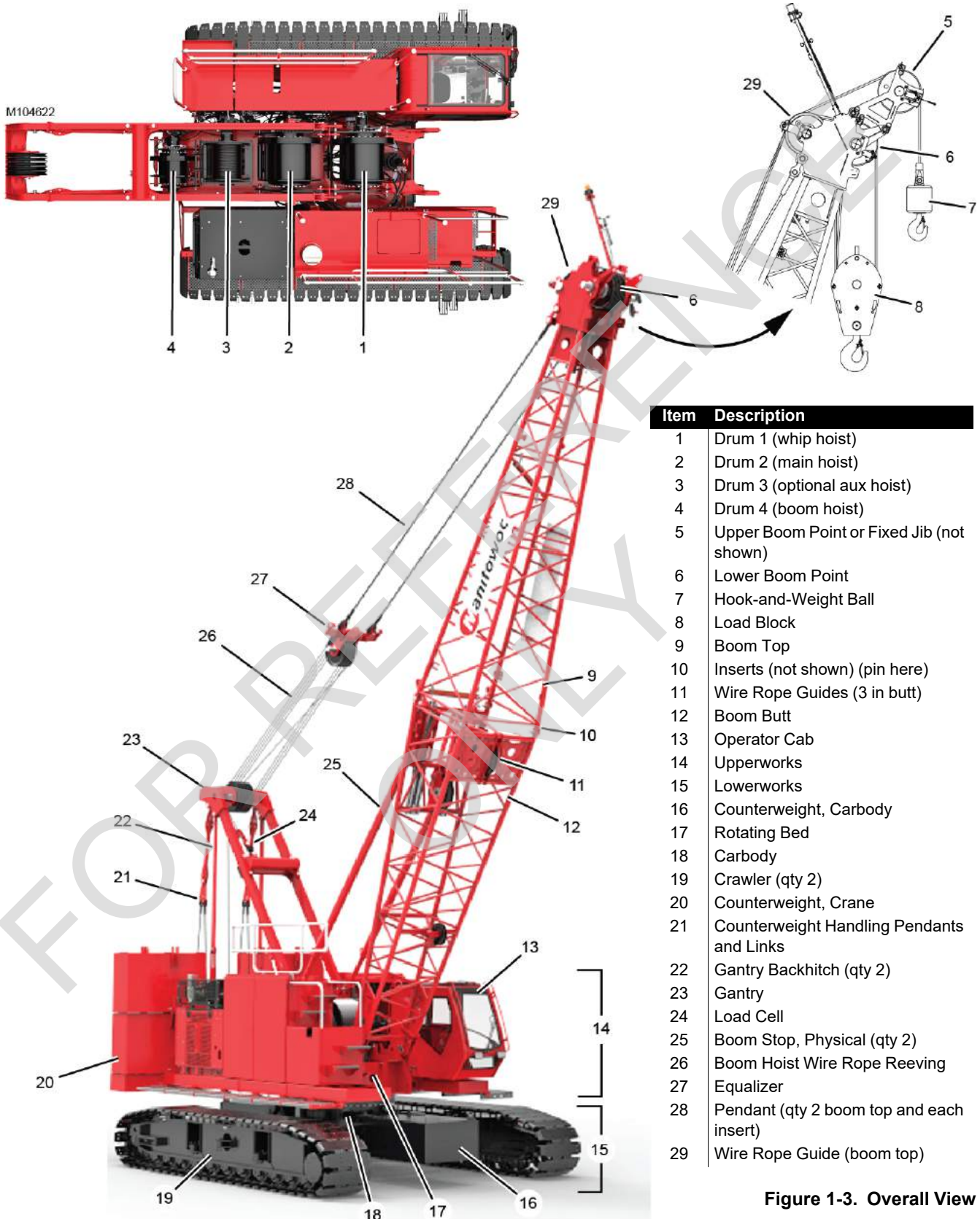


Crane shown in Transport Configuration without Counterweight

Item	Description
1	Red Arrow
2	Boom Butt
3	Operator Cab
4	Identification Plate
5	Crawler Drive
6	Crane Counterweight (not shown)

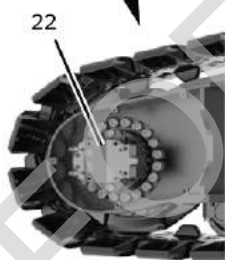
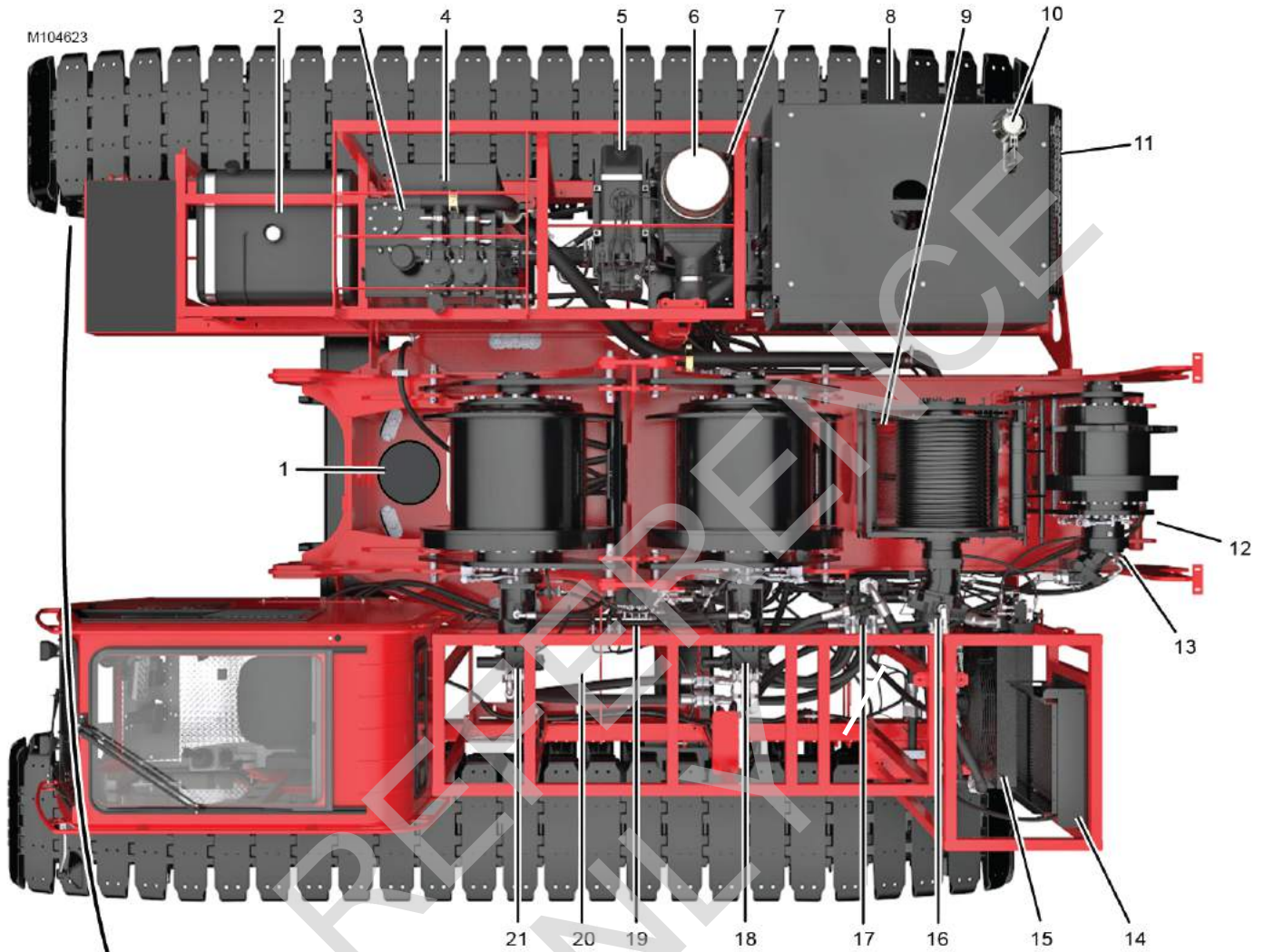
Figure 1-2. Crane Orientation

IDENTIFICATION AND LOCATION OF COMPONENTS



Item	Description
1	Drum 1 (whip hoist)
2	Drum 2 (main hoist)
3	Drum 3 (optional aux hoist)
4	Drum 4 (boom hoist)
5	Upper Boom Point or Fixed Jib (not shown)
6	Lower Boom Point
7	Hook-and-Weight Ball
8	Load Block
9	Boom Top
10	Inserts (not shown) (pin here)
11	Wire Rope Guides (3 in butt)
12	Boom Butt
13	Operator Cab
14	Upperworks
15	Lowerworks
16	Counterweight, Carbody
17	Rotating Bed
18	Carbody
19	Crawler (qty 2)
20	Counterweight, Crane
21	Counterweight Handling Pendants and Links
22	Gantry Backhitch (qty 2)
23	Gantry
24	Load Cell
25	Boom Stop, Physical (qty 2)
26	Boom Hoist Wire Rope Reeving
27	Equalizer
28	Pendant (qty 2 boom top and each insert)
29	Wire Rope Guide (boom top)

Figure 1-3. Overall View



Item	Description	Item	Description
1	Swing Drive <sup>1</sup>	12	Counterweight Pins
2	Fuel Tank	13	Drum 4 Drive <sup>3</sup>
3	Hydraulic Tank	14	A/C Condenser
4	Battery Box	15	Hydraulic Oil Cooler
5	Tier 4 DEF Tank	16	Drum 3 Drive <sup>3</sup>
6	Engine Air Cleaner	17	Main Control Valve
7	Pump Drive and Pump	18	Drum 2 Drive <sup>3</sup>
8	Engine	19	Low Pressure Accessory Valve
9	High Pressure Accessory Valve <sup>2</sup>	20	Crawler Extend/Retract Cylinder
10	Engine Exhaust System	21	Drum 1 Drive <sup>3</sup>
11	Radiator	22	Crawler Drive (inboard side both crawlers) <sup>4</sup>

<sup>1</sup> Swing drive includes a planetary gearbox with swing pinion, a spring-applied brake, and a motor.

<sup>2</sup> Inside rotating bed. Accessible from under rotating bed.

<sup>3</sup> Each drum drive includes a drum, a planetary gearbox, a spring applied brake, and a motor.

<sup>4</sup> Each crawler drive includes a planetary gearbox, a drive tumbler, a spring applied brake, and a motor.

Figure 1-4. Top View

## ENGLISH AND METRIC CONVERSIONS

## Inverse Conversion

## Direct Conversion

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

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

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

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

To Convert	Symbol	Application	To	Symbol	Multiply By
<b>AREA</b>					
Square Inch	in <sup>2</sup>	Filter Area Clutch Contact	Square Centimeter	cm <sup>2</sup>	6.4516
Square Foot	ft <sup>2</sup>	Ground Contact	Square Meter	m <sup>2</sup>	0.0929
<b>FORCE</b>					
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
<b>LENGTH</b>					
Inch	in.	Adjustments	Millimeter	mm	25.4000
Foot	ft	Outline Dimensions	Meter	m	0.3048
Mile	miles	Travel Distance	Kilometer	km	1.6093
<b>POWER</b>					
Horsepower	hp	Engine	Kilowatt	kW	0.7457
<b>PRESSURE</b>					
Pound/Sq. In.	psi	Hydraulic & Air	Bar		0.0689
<b>TEMPERATURE</b>					
Degrees Fahrenheit	°F	Oil, Air, Etc.	Degrees Centigrade	°C	°F - 32 ÷ 1.8
Degrees Centigrade	°C		Degrees Fahrenheit	°F	°C x 1.8 + 32
<b>TORQUE</b>					
Inch Pound	in lb	Bolt Torque	Newton Meter	Nm	0.1129
Foot Pound	ft lb		Newton Meter	Nm	1.3558
<b>VELOCITY</b>					
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
<b>VOLUME</b>					
Cubic Yard	yd <sup>3</sup>	Bucket Capacity	Cubic Meter	m <sup>3</sup>	0.7646
Cubic Foot	ft <sup>3</sup>		Cubic Meter	m <sup>3</sup>	0.0283
Cubic Inch	in <sup>3</sup>	Pump Displacement	Cubic Centimeter	cm <sup>3</sup>	16.3871
<b>VOLUME (LIQUID)</b>					



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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## SECTION 2

### SAFETY INFORMATION

#### TABLE OF CONTENTS

Continuous Innovation .....	2-1
Nameplates and Decals .....	2-1
Safety Messages .....	2-1
General .....	2-1
Safety Alert Symbol .....	2-1
Signal Words .....	2-1
Symbol Identification .....	2-1
Safety and Information Signs .....	2-3
Maintaining Signs .....	2-3
Ordering Signs .....	2-3
Crane Access Points .....	2-5
General .....	2-5
Getting On or Off Crane .....	2-5
Personal Fall-Protection .....	2-5
Operator Manual/Capacity Chart Storage .....	2-6
General .....	2-6
Storing Manuals .....	2-6
Safe Operating Practices .....	2-7
General .....	2-7
Read Operator Manual .....	2-7
Operator Qualifications .....	2-7
Operator Conduct .....	2-7
Handling Load .....	2-9
Size of Load .....	2-9
Attaching Load .....	2-9
Lifting/Moving Load .....	2-10
Multiple Load Line Operation .....	2-11
Holding Load .....	2-12
Signals .....	2-12
Safety Devices .....	2-13
Operational Aids .....	2-13
Category 1 Operational Aids .....	2-13
Category 2 Operational Aids .....	2-14
Assembling, Disassembling, or Operating Crane Near Electric Power and Transmission Lines .....	2-15
Electrocution Hazard .....	2-15
Set-Up and Operation .....	2-15
Electrocution Hazard Devices .....	2-16
Electrical Contact .....	2-16
Refueling .....	2-17
Fire Extinguishers .....	2-17
Accidents .....	2-17
Safe Maintenance .....	2-17
Maintenance Instructions .....	2-17
Safe Maintenance Practices .....	2-17
Environmental Protection .....	2-19
Boom Disassembly Safety .....	2-21
General .....	2-21
Location .....	2-21
Pin Removal .....	2-21
Disassembly Precaution .....	2-21
Personnel Handling Policy .....	2-22

Pedestal/Barge Mounted Cranes .....	2-23
Pedestal Mounted Crane .....	2-24
Definition .....	2-24
Examples .....	2-24
Barge Mounted Crane .....	2-24
Definition .....	2-24
Examples .....	2-24
Capacity Charts for Barge Mounted Crane .....	2-25
Shock Loading Caused by Barge Dynamics .....	2-25
Operation on Barge .....	2-25
Barge Mount Definitions .....	2-26
Inspection of Barge-Mounted Crane .....	2-26
Transporting Crane on Barge .....	2-26

FOR REFERENCE ONLY

## SECTION 2

### SAFETY INFORMATION



#### WARNING

##### California Proposition 65

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

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

For more information go to [www.P65warnings.ca.gov/diesel](http://www.P65warnings.ca.gov/diesel).

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

##### California Spark Arrestor

Operation of this equipment may create sparks that can start fires around dry vegetation. A spark arrestor may be required. The owner/operator should contact local fire agencies for laws or regulations relating to fire prevention requirements.

#### CONTINUOUS INNOVATION

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

#### NAMEPLATES AND DECALS

See drawing at the end of this section.

#### SAFETY MESSAGES

##### General

The importance of safe operation and maintenance cannot be over emphasized. Carelessness or neglect on the part of operators, job supervisors and planners, rigging personnel,

and job site workers can result in their death or injury and costly damage to the crane and property.

To alert personnel to hazardous operating practices and maintenance procedures, safety messages are used throughout the manual. Each safety message contains a safety alert symbol and a signal word to identify the hazard's degree of seriousness.

#### Safety Alert Symbol



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. **Obey all safety messages that follow this symbol to avoid possible death or injury.**

#### Signal Words



#### DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



#### WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



#### CAUTION

Used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

#### CAUTION

Without the safety alert symbol, identifies potential hazards that could result in property damage.

**NOTE** Highlights operation or maintenance procedures.

#### Symbol Identification

Many of the symbols used in the safety and information signs and nameplates on this crane are identified in [Table 2-1 on page 2-2](#) and [Table 2-2 on page 2-3](#).

Table 2-1 Common Safety Symbols





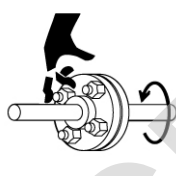

























<b>Cut or Crush Hazards</b>					<b>Cut Hazard</b>
 M100090	 M100091	 M100066	 M100065	 M100069	 M100067
<b>Crush Hazards</b>					<b>Fire Extinguisher</b>
 M100070	 M100071	 M100072	 M100073	 M100074	 M100082
<b>Fall Hazards</b>			<b>Falling Boom (Crush) Hazards</b>		<b>Explosion Hazard</b>
 M100083	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

Table 2-1 Common Safety Symbols










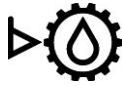

Emergency Cab Exit	Lift	Do Not Lift	Prohibited
 <p>M102486</p>	 <p>M104626</p>	 <p>M104627</p>	 <p>M104628</p>

Table 2-2 Miscellaneous Symbols

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

**SAFETY AND INFORMATION SIGNS**

**Maintaining Signs**

The crane owner/user shall make sure that all safety and information signs are legible and installed at the proper locations on the crane. If a sign has been defaced or removed, it must be replaced immediately. See the Nameplate and Decal Drawing at the end of this section for the installation locations of signs.

**Ordering Signs**

Order replacement safety and information signs from your Manitowoc dealer.

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

Item	Description	Material
1	Steps (both crawlers)	Non-skid grating
1A	Steps (stowed)	Non-skid grating
1B	Steps (working)	Non-skid grating
2	Platform (both sides)	Non-skid grating
3	Carbody Counterweight	Non-skid paint
4	Steps	Non-skid grating
5	Handrails	
6	Enclosure Platforms	Non-skid strips
7	Crane Counterweight (not shown)	Non-skid paint
8	Ladder	Grated rungs
9	Platform	Non-skid strips

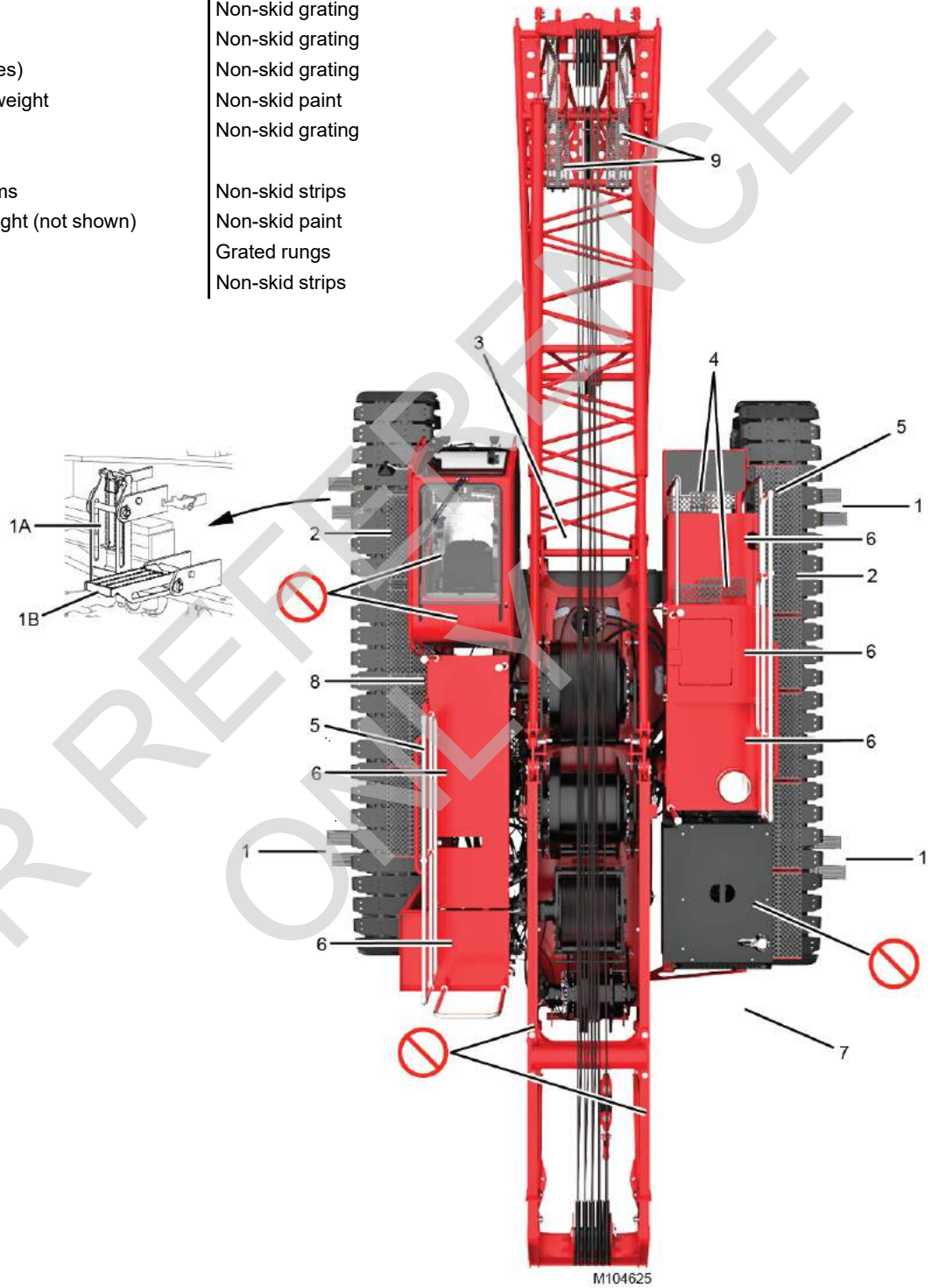


Figure 2-1. Crane Access Points



## CRANE ACCESS POINTS



### WARNING

#### Crush Hazard!

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

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

To prevent death or serious injury:

- Barricade all accessible areas to the crane so personnel cannot be struck or crushed when the upperworks is swung.
- Do not climb onto or off the crane while the upperworks is being swung or the crane is being traveled.
- Signal the operator for permission to climb onto/off the crane.
- Operator: do not swing or travel while personnel are climbing onto or off the crane. Stop the swing and travel motions. Apply the swing brake and turn on travel park.
- Operator: Always sound the horn to alert personnel before you swing or travel.
- Automatic alarms will sound to alert personnel when the crane is swung or traveled.

**NOTE** If the swing and travel alarms are not operating properly, they must be repaired as soon as possible. Until they are repaired, the operator shall alert personnel to crane movement using the horn on the control console.

### General

Take necessary precaution to prevent slipping and/or falling off the crane during assembly, disassembly, maintenance, or other work. **Falling from any height could result in serious injury or death.**

Manitowoc has provided ladders and platforms at the locations shown in [Figure 2-1](#).

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

Adhere to local, state, and federal regulations for handling personnel and for personnel fall protection.

- Access points must be kept clear to prevent personal injury and unsafe operation of the crane. Store clothing and other personal belongings so they do not interfere with controls in operator cab or with operation of the crane.

- Do not allow ground personnel to store their personal belongings (clothing, lunch boxes, water coolers, and the like) on the crane.

This practice will prevent ground personnel from being crushed or electrocuted when they attempt to access personal belongings stored on the crane.

- Tools, oil cans, spare parts, and other necessary equipment must be stored in tool boxes or other appropriate locations. Do not allow these items to lie around loose in operator cab or on steps, ladders, catwalks, and platforms.
- To reduce risk of slipping, non-skid material (sand in paint) has been applied to painted walkways and platforms.
- Walkways and platforms can be slippery when wet and when oil or is grease is spilled on them. **Keep walkways and platforms clean and dry to prevent slipping on them.** When non-skid material wears out, reapply it.
- Wear shoes with a highly slip-resistant sole material. Clean any mud or debris from shoes before entering the crane cab or climbing onto the cab. A shoe that is not clean might slip off a control pedal during operation.
- Do not make modifications or additions to the crane's access system that have not been evaluated and approved by Manitowoc.

### GETTING ON OR OFF CRANE

Personnel getting on and off the crane shall do so only at the ladders provided and only **while the crane is parked**.

Never climb onto or off a moving crane. **Climb onto and off the crane only when it is parked and only with the operator's permission.**

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

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

### PERSONAL FALL-PROTECTION

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

**! WARNING**  
**Fall Hazard!**

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

## OPERATOR MANUAL/CAPACITY CHART STORAGE

### General

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

- Operator Manual (Serial Numbered)  
Contains safety information, crane specifications, assembly/erection procedures, operating instructions, lubrication and maintenance checks.
- Parts Manual (Serial Numbered)  
Contains illustrations and part numbers of replaceable parts.
- Capacity Chart Manual (Serial Numbered)  
Contains lifting capacities and related information (wire rope specifications, drum and lagging information, etc.)
- Maintenance Checks and Lube Guide  
Contains lists of maintenance checks and lube services and their prescribed intervals.
- RCI/RCL Operation  
Contains rated capacity indicator and/or rated capacity limiter operation, limits, and calibration procedures.
- Service Manual (Serial Numbered)  
Contains theory of operation, maintenance procedures, crane and wire rope inspection procedures, troubleshooting information, and shop procedures.

The manuals which must be retained in the operator cab (Operator Manual, Capacity Charts, Maintenance Checks and Lube Guide, and RCL Operation) are supplied in an OPERATOR INFORMATION binder.

The Operator Manuals and Capacity Charts are stamped with the serial number of the crane or attachment. The serial number on the manuals and capacity charts must match the serial number of the crane. **Using any other manual or capacity chart is prohibited.**

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

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

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

### Storing Manuals

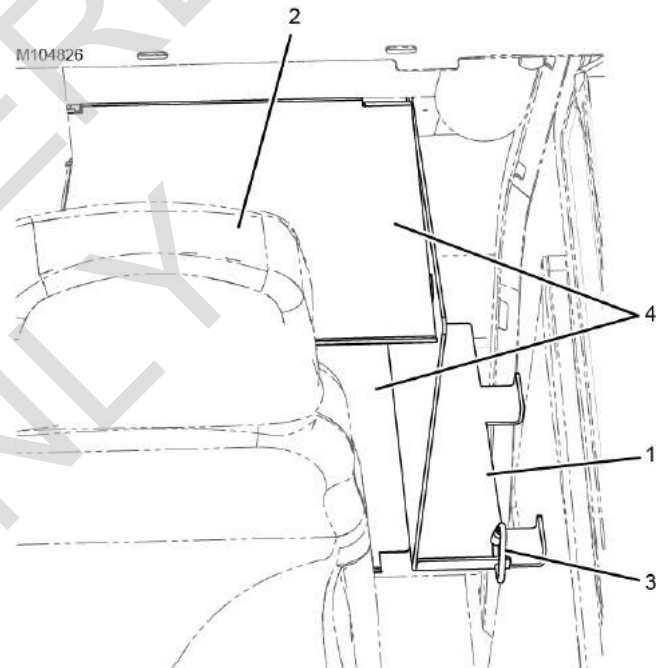
See [Figure 2-2](#).

Store the Operator Information binder in the holder (1) located behind the seat (2) in the left rear corner of the operator cab.

Attach the chain from the manual to the link (3) on the holder.

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

Additional storage is provided on the storage shelves (4).



Item	Description
1	Holder
2	Seat
3	Link
4	Storage Shelves

**Figure 2-2. Manual Holder in Cab**

## SAFE OPERATING PRACTICES

### General

The importance of safe operation cannot be over emphasized. Carelessness and neglect on the part of operators, supervisors and planners, rigging personnel and job site personnel can result in their death or injury and costly damage to the crane or property.

The safety information in this publication is intended only as a guide to assist qualified operators, supervisors and planners, rigging personnel, and job site personnel in safe operation. Manitowoc cannot foresee all hazards that will arise in the field; therefore, **safety remains responsibility of crane operators and owner.**

Local, state, and other governmental agencies may require stricter operating practices. When a conflict in practices exists, follow the strictest practice.

### Read Operator Manual

Safe and efficient assembly, disassembly, and operation of this crane requires that it be maintained in proper working order and that its operators and maintenance personnel be familiar with the crane's functions and capabilities.

The Operator Manual supplied with and considered part of your crane must be read and completely understood by each person responsible for assembly, disassembly, operation, and maintenance of the crane.

The Operator Manual must be read to personnel who cannot read or understand English or other language into which the manual is translated.

Because of a program of continuing improvement in product design, Manitowoc reserves the right to change the information and specifications contained in the Operator Manual at any time without notice. If you have any questions regarding the crane or its Operator Manual, please contact your Manitowoc dealer.

### Operator Qualifications

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

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

inspection or to verify the crane's performance after maintenance procedures.

***No personnel shall be allowed to climb onto the crane or enter cab unless performance of their duties requires them to do so, and then only with knowledge of operator or other qualified person.***

**Qualified person** is defined as one who by reason of training and experience is thoroughly familiar with crane operations and the hazards involved. Such a person shall meet the operator qualifications specified in Occupational Safety and Health Administration (OSHA) Regulations (United States Federal Law), in ASME B30.5 American National Standard, or in any other applicable federal, state, or local laws.

**Operator training and qualification is crane owner's responsibility.**

**NOTE** The regulations and standards mentioned above and later in this section can be obtained from:

**US DOL/OSHA** Rules and Regulations are available by mail from the Superintendent of Documents, PO Box 371954, Pittsburgh, PA, 15250-7954 or by:

- Phone 202-512-1899
- Fax 202-512-2250
- Online at [www.osha.gov](http://www.osha.gov)

**ASME** (formerly ANSI) B30 Series American National Standards are available by mail from the ASME, 22 Law Drive, Fairfield, New Jersey, 07004-2900 or by:

- Phone US & Canada 800-843-2763
- Phone Mexico 95-800-843-2763
- Phone Universal 973-882-1167
- Fax 973-882-1717 or 973-882-5155
- E-mail [infocentral@asme.org](mailto:infocentral@asme.org)

### Operator Conduct

1. The operator shall not engage in any practice which diverts his/her attention while operating the crane.
2. The operator shall not operate the crane when he/she is physically or mentally unfit.
3. The operator shall be responsible for all operations under his/her direct control. When safety of an operation is in doubt, the operator shall stop the crane's functions in a controlled manner. Lift operations can resume only after safety concerns have been addressed or the continuation of crane operations is directed by the lift supervisor.

4. The operator shall be thoroughly familiar with operation of the crane and its proper care. If adjustments or repairs are necessary or if there are known defects that impair safe operation, the crane must not be operated until unsafe conditions have been corrected.
5. If there is a warning sign at the start controls, the operator shall not start the engine until the warning sign has been removed by the person who installed it.
6. Before starting the engine, the operator shall make sure that:
  - a. All daily inspection and maintenance services have been performed.
  - b. All controls are in the off position and all brakes and locking devices are applied or engaged.
  - c. All personnel are clear of the crane. Deploy a swing radius barrier.

**WARNING**

Safety devices and operational aids such as rated capacity indicator or limiter, boom and jib angle indicator or limiter, anti-two-block device, level indicator, swing limiter, proximity device, etc., may be installed on your crane. Such devices are to be used only as **AIDS TO ASSIST OPERATOR**; their presence on the crane in no way substitutes for or lessens requirement that operator knowledge, experience, and judgment are required to ensure safe operation of the crane.

**Crane must not be loaded beyond applicable static or dynamic ratings given in Capacity Chart for crane.**

- See Size of Load later in this section.
  - For a description of each safety device and operational aid, see Section 3 of the Operator Manual.
7. The operator shall test all controls, limits, and communication systems at the start of each shift. Any defects found must be corrected before operation is begun.
  8. The operator shall not start crane movement if the load or designated signal person is not within his/her range of vision or communication.
  9. The operator shall understand and respond to signals from the person directing the lift or from the designated signal person. When a signal person or crane follower is not required, the operator is responsible for the lift. **Operator shall obey a stop signal at all times, no matter who gives it.**

10. The operator shall verify that the Capacity Chart being used is the correct one for the cranes configuration (boom length, load line reeving, counterweight, etc.).
11. The operator shall verify that:
  - a. All attachments are properly assembled and attached to the crane according to the rigging drawings called for in the Capacity Chart.
  - b. The counterweight — to include applicable auxiliary counterweight — is in place and of proper weight. **Maximum required counterweight must not be exceeded.**

**WARNING****Moving Load/Tipping Crane Hazard!**

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

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

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

- NOTE** The designated person shall be familiar with the job site limitations, the crane configuration, and the expected weather conditions.
- e. Move all controls to off.
  - f. Apply all drum brakes and pawls.
  - g. Disengage the master clutch, if equipped.
  - h. Stop the engine.

**NOTE** Also read Unattended Crane instructions in Section 3 of the Crane Operator Manual.

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

- a. Land all suspended loads, if possible, under brake or power control.
  - b. Apply all brakes and locking devices.
  - c. Move all controls to off.
14. If the crane will be operated at night, the operator shall make sure that there is sufficient lighting for safe operation. The load and landing area must be illuminated.
15. The operator shall not operate the crane during periods of bad weather if his/her ability to see the load or the signal person is impaired by darkness, fog, rain, snow, and the like.

Do not operate the crane with a snow or ice covered boom. The extra weight may cause overload, tipping, or structural damage.

Never operate the crane during an electrical thunderstorm.

When a local weather storm warning exists (including electrical thunderstorm), stop operation and secure the crane. See step 12 on page 2-8.

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

16. Wind can cause the crane to tip or the boom and other attachments to collapse. The operator or qualified person directing the lift shall compensate for the effect of wind on the load and boom by reducing ratings, reducing operating speeds, or a combination of both.

Unless otherwise specified in the Capacity Chart, or Operator Manual, stop operation under the following wind conditions:

- a. If the wind causes the load to swing forward past the allowable operating radius or sideways past either boom hinge pin, land the load and apply the drum brakes.
- b. If the wind exceeds 16 m/s (35 mph), land all loads and apply the drum brakes, lower the boom onto blocking at ground level or otherwise restrain it, and apply the swing and travel brakes and/or locks.

**NOTE** “*Land load*” means to set it down on a firm uniformly supporting surface.

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

boom rigging) must be securely blocked to prevent the boom, jib, or mast sections from dropping.

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

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

## Handling Load

### Size of Load

1. The crane must not be loaded beyond the applicable static or dynamic ratings given in the Capacity Chart for the crane configuration.

**NOTE** Capacity charts for Manitowoc cranes show the total weight of freely suspended loads for various boom and jib lengths and operating radii.

“*Freely suspended load*” is a load that is hanging free with no direct external force applied except by the crane’s load-line reeving.

To determine the actual weight of the load which can be lifted at a given radius (working load), the operator shall deduct the weight of certain lifting equipment from the total weight given in the chart. See the specific Capacity Chart for your crane for a list of lifting equipment which must be deducted.

The operator’s judgment shall be used to further reduce total load to allow for the dynamic effects of swinging, hoisting, or lowering, and adverse weather conditions to include wind.

2. The operator or other designated person directing the lift shall verify that the weight of load is within the static or dynamic rating for radius at which load will be lifted.

**Verified weights and measured radii must take priority over RCI/RCL readings.**

### Attaching Load

1. Attach the hook to the load with slings, or other suitable rigging. Each hook must have a latch that is in proper working order. **Hook latches must not be wired open.**
  - a. Inspect each hook and latch before using.
  - b. Never use a hook or latch that is distorted or bent.
  - c. Make sure spring will force the latch against the tip of the hook.
  - d. Make sure the hook supports the load. The latch must never support the load. Latches are only intended to retain loose slings under slack conditions.

2. Only use slings and other rigging that are in safe operating condition and have a rating equal to or greater than the load to be lifted.
3. Do not wrap the load line around the load.
4. Use suitable protection between slings and any sharp edges on the load. When synthetic slings are used, the synthetic sling manufacturer's instructions, limitations, specifications, and recommendations must be followed.
5. Secure unused legs of a multi-leg sling before handling a load with one leg of sling.

### Lifting/Moving Load

1. Before lifting or moving a load, the operator or qualified person directing the lift shall make the following checks:
  - a. Crane has a firm, uniformly supporting foundation under all crawlers. Unless otherwise specified in the Capacity Chart, the foundation must be level to within 1% — 0,3 m (1ft) rise or fall in 30,5 m (100 ft) distance.  
  
When such a surface is not available, it must be provided with timbers, cribbing, or other structural members to distribute the load such that the allowable bearing capacity of the underlying member is not exceeded.
  - b. The load is secured and properly balanced in the slings or the lifting device before lifting the load more than 76 to 152 mm (3 to 6 in).
  - c. The lift and swing paths are clear of personnel and obstructions.
  - d. The load is free to be lifted.
  - e. The load line is not kinked or otherwise damaged.
  - f. Multiple part load lines are not twisted around each other in such a manner that the lines will not separate when the load is lifted.
  - g. The hook is brought over the load in a manner that will minimize twisting or swinging.
  - h. The load line and the boom hoist rope are properly spooled on the drums and seated in the sheaves.
  - i. The load drum brakes are in proper working order.  
  
The operator shall test the load drum brakes each time a load approaching the rated load is handled. Lift the load 76 to 152 mm (3 to 6 in) and fully apply the brakes — load must not lower through applied brakes.
  - j. Unused load drums are parked (working and parking brakes applied; if equipped, drum pawls engaged).
2. While lifting or moving the load, the operator shall take the following precautions:
  - a. Accelerate and decelerate the load smoothly to avoid excessive stress on the boom and machinery.
  - b. Avoid sudden starts and stops while swinging. Keep the swing speed under control to prevent the load from swinging out beyond the radius at which the load can be handled and to minimize the pendulum action of the load.
  - c. Sound the signal horn before swinging and intermittently while swinging, especially when approaching personnel.  
  
If equipped, the automatic swing alarm will sound when the crane is swung.
  - d. Use taglines or other restraints to control the load when necessary.
  - e. Do not exceed any swing limitations (areas of operation) given in the Capacity Chart.
  - f. Do not allow the load, boom, or any other part of the crane to contact obstructions.
  - g. Do not use the crane to drag a load.
  - h. Do not hoist, lower, or swing the load while personnel are on the load or the hook. See Personnel Handling in this section.
  - i. Avoid carrying the load over personnel. Loads which are suspended must be blocked or cribbed before personnel are allowed to work under or between them.
  - j. Before lifting a load which requires the use of outriggers (or anytime outriggers are used), fully extend the outrigger beams and jacks so the truck tires do not bear any load.  
  
Securely fasten the outrigger jack pads or floats to jacks and set them on a flat, firm surface that will support the load placed on the pads or floats. Do not set the jack pads or floats in holes, on rocky ground, or on extremely soft ground.  
  
When dictated by ground conditions, install wood blocking or steel plates under the jack pads or floats to properly distribute the loading on the supporting surface.  
  
Wood blocking or steel plates used under the jack pads or floats must be:
    - Free of defects
    - Strong enough to prevent crushing, bending, or shear failure
- k. All personnel are clear of the swing radius of the crane's counterweight.

- Of sufficient thickness, width, and length to completely support the jack pad or float, transmit the load to the supporting surface, and prevent shifting, toppling, or excessive settlement under load.

- k. Fully retract and lock the jacks and the outrigger beams so they cannot extend when not in use.
- l. Operate with extreme caution when using two or more cranes to lift the same load.

One designated person shall be responsible for operation when two or more cranes are used to lift the same load. The designated person shall analyze the lift and instruct all personnel involved in proper rigging and positioning of the load and all movements to be made. Decisions such as the necessity to reduce crane ratings, load position, boom position, ground support, and speed of movements must be in accordance with the designated person's decision.

- m. Do not lower the load or the boom to a point where less than three full wraps of wire rope remain on the respective drum (or as otherwise indicated in local, state, or federal regulations).
  - n. Engage the boom hoist pawl when operating with the boom at a fixed radius.
  - o. Engage the luffing hoist pawl when operating with the luffing jib at a fixed radius.
3. While traveling, the operator shall take the following precautions:
- a. Sound the signal horn before traveling and intermittently while traveling, especially when approaching personnel.  
If equipped, the automatic travel alarm will sound when the crane is traveled.
  - b. Carry the boom in-line with the lowerworks and facing the direction of travel.
  - c. Do not position the boom so high that it could bounce over backwards whether traveling with or without load.
  - d. Secure the rotating bed against rotation except when it is necessary to negotiate a turn, and then only when the operator is seated at controls or the boom is supported on a dolly.
  - e. Lash or otherwise restrain unused hooks so they cannot swing freely.
4. Before traveling with a load, the operator shall take the following additional precautions:

- a. A designated person shall be responsible for operation. Decisions such as the necessity to reduce crane ratings, load position, boom position, ground support, and speed of movements must be in accordance with the designated person's decision.
- b. Maintain specified tire pressures (truck cranes).
- c. Avoid sudden starts and stops. Use taglines or other restraints to control the position of the load.

### Multiple Load Line Operation



### WARNING

#### Avoid Over Load and Side Load Damage to Crane

Manitowoc highly recommends that you contact your Manitowoc dealer for lift planning assistance and approval.

Multiple load line operation is becoming common practice for applications like panel tilt-up, pile tilt-up, pile driving, rolling fabricated sections, etc. The multiple lines may be on a common shaft (each with different parts of line) or on multiple shafts (lower boom point and upper point, boom point and fixed jib point, etc).

Manitowoc authorizes multiple load line operation for those applications requiring it, provided the following steps are performed:

1. The qualified lift planner and crane operator shall read and become thoroughly familiar with the appropriate Capacity Charts and Wire Rope Specification Charts.
2. The lift planner and the crane operator shall make sure the total load does not exceed the rated capacity given in the Capacity Chart and Wire Rope Specification Chart for given boom point or jib point, whichever is less.  
EXAMPLE: If one load line is lifting from the jib point, the proper jib chart applies.
3. The crane must be thoroughly inspected by a qualified person prior to setup.
4. The crane must be thoroughly inspected for load line interference caused by routing and reeving of multiple load lines. If interference is found, it must be eliminated.
5. For cranes produced before 2003, Rated Capacity Indicators/Limiters were not required by ASME B30.5 for non-personnel lifting.

To aid the operator in staying within the crane's Capacity Chart with the total applied load, Manitowoc recommends that its cranes be equipped with Rated

Capacity Indicators/Limiters to monitor the load on each load line.

***Operator is still responsible for knowing load and radius whether or not the crane is equipped with load indicator(s).***

6. Manitowoc recommends that each load line be equipped with an anti two-block device.
7. Manitowoc's Capacity Charts are based on freely suspended loads. To prevent side load damage to the boom, jib, and sheaves:
  - The load lines must hang as close to vertical as possible to minimize side and forward loads.
  - The distance between the load points and the hook points must be a minimum of three times the horizontal distance between the hook point on the load being lifted.
  - The load must remain centered on the boom and jib point shafts unless special lift approval is granted by Manitowoc.
  - The load lines should be located over the load's center of gravity as it is supported on a trailer, a barge, or the ground.
8. The crane operator shall be familiar with the operational characteristic of the crane as it relates to multiple drum operation (simultaneous operation, same or opposite direction, or individual operation).
9. When using tandem drums, the maximum operating layers may be limited depending on whether the crane was initially designed for tandem drum operation or not.
10. Load shift when lifting with two hooks may be more unpredictable than typical one hook lifting.

### ***Holding Load***

When a load is suspended, the operator shall take the following precautions:

1. Not leave his/her position at the controls
2. Not allow personnel to stand or pass under the load
3. Move all controls to off, apply all drum brakes, engage the boom hoist pawl, and apply the swing and travel brakes or locks.

## **SIGNALS**

1. Continuous communication must be maintained between the operator and the signal person during all crane movements. If communication is disrupted, ***operator shall stop all crane movements.***
2. Signals to the operator must be in accordance with the standard signals shown in Section 3, unless communications equipment (telephone, radio, etc.) is used.
3. All signals must be easily understood by the operator at all times. The operator shall not respond to any signal which is not clearly understood.
4. For operations not covered in the standard signals, or for special situations or emergencies, additional signals may be required. In those cases, the signals used must be agreed upon in advance by the operator and the signal person. The signals used must not conflict with or have potential to be confused with the standard signals.
5. When it is necessary to give instructions to the operator (other than those established by the signal system), all crane motions must be stopped.
6. The signal person shall:
  - a. Be tested by a designated person and show that he or she has a basic understanding of crane operations and limitations, to include boom deflection.
  - b. Be thoroughly familiar with the standard hand signals and voice signals if used.
  - c. Be positioned in clear view of the operator. The signal person's position should give him or her a clear view of the load, the crane, and the operating area.
  - d. Direct the load so it does not pass over personnel.
  - e. Keep unnecessary personnel out of the crane's operating area.
7. When moving the crane, the following audible signals must be used:
  - a. STOP - one short audible signal
  - b. GO AHEAD - two short audible signals
  - c. BACK UP - three short audible signals



## SAFETY DEVICES



### WARNING

Do not operate the crane unless all safety devices listed in this section are in proper working order.

- If a safety device stops working properly during operation, the operator shall safely stop operation.
- If any safety device listed in this section is not in proper working order, the safety device must be taken out of service and crane operation must not resume until the safety device is again working properly.
- Alternative measures are not permitted to be used for a faulty safety device.
- Always tag-out any faulty safety device and place a warning tag in the cab stating that the crane is out of service and must not be used.

Manitowoc provides the following safety devices on its cranes.

1. Horn activated by a switch on the control console in the operator cab  
If the horn is not working properly, it must be tagged-out or removed if possible.
2. Crane level indicator: either electronic (viewable in crane's electronic display) or mechanical (viewable from operator cab seat). If the crane level indicator is not working properly, it must be tagged-out or removed, if possible.
3. Cranes operating on a barge require: a trim indicator, a swing brake, and a wind direction indicator if the wind is a factor (supplied by crane owner or user).
4. Boom stops, both physical and automatic  
If a boom stop is damaged or not working properly, it must be tagged-out or removed if possible.
5. Jib stops, both physical and automatic (for fixed jib and luffing jib)  
If a jib stop is damaged or not working properly, it must be tagged-out or removed if possible.
6. Pedal locks for all foot-operated brakes (if applicable)  
If a pedal lock is damaged or not working properly, it must be tagged-out or removed if possible.
7. An integral holding device or check valve on each jacking cylinder.

## OPERATIONAL AIDS



### WARNING

Do not operate the crane unless all applicable operational aids listed in this section are in proper working order, except:

- Where an operational aid is being repaired
- The crane user implements a specified temporary alternative measure.

If an operational aid stops working properly during operation, the operator shall safely stop operation until the temporary alternative measures are implemented or the device is again working properly.

Manitowoc provides the following operational aids on its cranes, either as standard equipment or optional equipment. The operational aids are designated as Category 1 or Category 2:

### Category 1 Operational Aids

If a Category 1 operational aid is not working properly, it must be repaired no later than 7 calendar days after the deficiency occurs.

Exception: If the crane user documents that he/she has ordered the necessary parts within 7 calendar days of the occurrence of the deficiency, the repair must be completed within 7 calendar days of receiving the parts.

#### 1. Boom or Luffing Jib Angle Limiter (automatic boom or jib stop)

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift shall make sure the maximum boom or jib angle/radius specified in the Capacity Chart for the load being handled is not exceeded. One or more of the following methods must be used:

- a. Measure radius using a tape measure.
- b. Measure the boom angle with a protractor-level on the centerline of boom.
- c. Clearly mark the boom or luffing hoist cable (so it can easily be seen by the operator) at a point that gives the operator sufficient time to stop the boom or jib within the minimum allowable radius.

In addition, install mirrors or remote video cameras and displays if necessary for the operator to see the mark.

- d. Clearly mark the boom or luffing hoist cable (so it can easily be seen by a designated signal person)

at a point that gives the signal person sufficient time to signal the operator and have the operator stop the boom or jib within the minimum allowable radius.

## 2. Anti-Two-Block Device

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift shall establish procedures to furnish equivalent protection. One or more of the following methods must be used:

- a. Assign a signal person to signal the operator to stop hoisting when the load is a safe distance from the boom or jib point.
- b. Clearly mark the hoist cable (so it can easily be seen by the operator) at a point that will give the operator sufficient time to stop the load a safe distance from the boom or jib point.

The temporary alternative measures for the anti-two-block device do not apply when lifting personnel in load line supported baskets. ***Personnel shall not be lifted in load line supported baskets when anti-two-block devices are not functioning properly.***

## Category 2 Operational Aids

If a Category 2 operational aid is not working properly, it must be repaired no later than 30 calendar days after the deficiency occurs.

Exception: If the employer documents that he/she has ordered the necessary parts within 7 calendar days of the occurrence of the deficiency, and the part is not received in time to complete the repair in 30 calendar days, the repair must be completed within 7 calendar days of receiving the parts.

### 1. Rated Capacity Indicator/Limiter

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift shall establish procedures for determining load weights and shall make sure that the weight of the load does not exceed the crane's rating at the radius where the load is handled.

The weight of the load must be provided to the operator before the lift is made.

### 2. Boom Angle or Radius Indicator

Temporary alternative measures if inoperative or malfunctioning:

- a. Refer to the pendulum boom angle indicator on the boom butt (visible from operator cab).
- b. Measure the boom angle with a protractor-level on the centerline of boom.
- c. Measure radius using a tape measure.

### 3. Jib Angle or Radius Indicator

Temporary alternative measures if inoperative or malfunctioning. Use either or both:

- a. First, make sure you know the boom angle (see item 2 above).
- b. Then, measure radius using a tape measure.

### 4. Drum Rotation Indicator

Temporary alternative measures if inoperative or malfunctioning:

Mark the drum to indicate its rotation.

If the operator cannot see the drum, add mirrors or remote video cameras and displays so the operator can see the mark.

### 5. OPTIONAL Swing Limiter or Proximity Device

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift shall establish procedures to furnish equivalent protection (for example, assign an additional signal person to observe the distance between the boom or load and job site obstructions to include power lines or to limit the swing sector specified in the Capacity Chart).

### 6. OPTIONAL Drum Spooling Limiter (maximum or minimum bail limit)

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift, the operator, or a designated signal person shall watch the drum and signal the operator to stop it before it is over spooled (rope does not jump off drum) or before there are less than 3 full wraps of wire rope on the load drum or boom hoist.

### 7. OPTIONAL Closed-Circuit Television (CCTV)

Temporary alternative measures if inoperative or malfunctioning:

A designated signal person shall watch the load, the drums, and the counterweight and provide necessary hand or voice signals to the crane operator.

## ASSEMBLING, DISASSEMBLING, OR OPERATING CRANE NEAR ELECTRIC POWER AND TRANSMISSION LINES

### Electrocution Hazard

Thoroughly read, understand, and abide by all applicable federal, state, and local regulations regarding operation of cranes near electric power lines or equipment.

***United States federal law prohibits the use of cranes closer than 6 m (20 ft) to power sources up to 350 kV and greater distances for higher voltages unless the line's voltage is known [29CFR1910.180 and 29CFR1926.1400].***

***To avoid death or serious injury, Manitowoc recommends that all parts of the crane, boom, and load be kept at least 6 m (20 ft) away from all electrical power lines and equipment less than 350 kV.***

**NOTE** For detailed guidelines on operating near power lines, refer to the current edition of OSHA 29CFR1926.1400 and ASME B30.5 American National Standard.



### WARNING

#### Electrocution Hazard!

Manitowoc cranes are not equipped with all features required to operate within OSHA 29CFR1926.1408, Table A clearances when the power lines are energized.

1. Keep all personnel and their personal belongings (clothing, water coolers, lunch boxes, etc.) away from the crane if it is being operated near electrical power lines or equipment.
2. Before operating the crane in the vicinity of electrical power lines or equipment, notify the power utility company. Obtain positive and absolute assurance that the power has been turned off.

The crane is NOT INSULATED. Always consider all parts of the load and the crane as conductors, including the wire rope, pendants or straps, and taglines.

Most overhead power lines ARE NOT insulated. Treat all overhead power lines as being energized unless you have reliable information to the contrary from the utility company or owner.

The rules in this section must be followed at all times, even if the electrical power lines or equipment have been de-energized.

3. Crane operation is dangerous when close to an energized electrical power source. Exercise extreme caution and prudent judgment. Operate slowly and cautiously when in the vicinity of power lines.

4. If the load, wire rope, boom, or any portion of the crane contacts or comes too close to an electrical power source, everyone in, on, and around the crane can be seriously injured or killed.

The safest way to avoid electrocution is to stay away from electrical power lines and electrical power sources.

5. The operator is responsible for alerting all personnel to the dangers associated with electrical power lines and equipment. The crane is not insulated. Do not allow unnecessary personnel in the vicinity of the crane while operating. Permit no one to lean against or touch the crane. Permit no one, including riggers and load handlers, to hold the load, load lines, taglines, or rigging gear.

6. Even if the crane operator is not affected by an electrical contact, others in the area may become seriously injured or killed.

7. It is not always necessary to contact a power line or power source to become electrocuted. Electricity, depending on magnitude, can arc or jump to any part of the load, load line, or crane boom if it comes too close to an electrical power source. Low voltages can also be dangerous.

### Set-Up and Operation

1. During crane use, assume that every line is energized ("hot" or "live") and take necessary precautions.
2. Position the crane such that the load, boom, or any part of the crane and its attachments cannot be moved to within 6 m (20 ft) of electrical power lines or equipment. This includes the crane boom and all attachments. Overhead lines tend to blow in the wind, so allow for movement of the overhead lines when determining a safe operating distance.
3. Erect a suitable barricade to physically restrain the crane, all attachments, and the load from entering into an unsafe distance from electrical power lines or equipment.
4. Plan ahead and always plan a safe route before traveling under power lines. A wooden clearance frame should be constructed to ensure sufficient clearance is maintained between crane and power lines.
5. Appoint a reliable and qualified signal person, equipped with a loud signal whistle or horn and voice communication equipment, to warn the operator when any part of the crane or load moves near a power

source. This person should have no other duties while the crane is working.

6. Taglines should always be made of non-conductive materials. Any tagline that is wet or dirty can conduct electricity.
7. DO NOT store materials under power lines or close to electrical power sources.
8. When operating near transmitter/communication towers where an electrical charge can be induced into the crane or load:
  - The transmitter must be deenergized OR,
  - Tests must be made to determine if an electrical charge will be induced into the crane or load.
  - The crane must be provided an electrical ground.
  - If taglines are used, they must be non-conductive.
  - Every precaution must be taken to dissipate induced voltages. Consult with a qualified RF (radio frequency) Consultant. Also refer to local, state, and federal codes and regulations.

### Electrocution Hazard Devices

1. The use of insulated links, insulated boom cages/guards, proximity warning devices, or mechanical limit stops does not ensure that electrical contact will not occur. Even if codes or regulations require the use of such devices, failure to follow the rules in this section may result in serious injury or death.
2. Be aware that such devices have limitations and you should follow the rules and precautions outlined in this section at all times even if the crane is equipped with these devices.
3. Insulating links installed into the load line afford limited protection from electrocution hazards. Links are limited in their lifting abilities, insulating properties, and other properties that affect their performance. Moisture, dust, dirt, oils, and other contaminants can cause a link to conduct electricity. Due to their capacity ratings, some links are not effective for large cranes and/or high voltages/currents.
4. The only protection that may be afforded by an insulated link is below the link (electrically downstream), provided the link has been kept clean, free of contamination, has not been scratched or damaged, and is periodically tested (just before use) for its dielectric integrity.
5. Boom cages and boom guards afford limited protection from electrocution hazards. They are designed to cover only the boom nose and a small portion of the boom. Performance of boom cages and boom guards is limited by their physical size, insulating characteristics, and operating environment (for example, dust, dirt, moisture, etc.). The insulating characteristics of these devices can be compromised if not kept clean, free of contamination, and undamaged.

6. Proximity sensing and warning devices are available in different types. Some use boom point (localized) sensors and others use full boom length sensors. No warning may be given for components, cables, loads, and other attachments located outside of the sensing area. Reliance is placed upon the operator in selecting and properly setting the sensitivity of these devices.
7. Never rely solely on a device to protect you and your fellow workers from danger.

Some variables you shall know and understand are:

- Proximity devices are advertised to detect the existence of electricity and not its distance, quantity, or magnitude.
- Some proximity devices may detect only alternating current (AC) and not direct current (DC).
- Some proximity devices detect radio frequency (RF) energy and others do not.
- Most proximity devices simply provide a signal (audible, visual, or both) for the operator and this signal must not be ignored.
- Sometimes the sensing portion of the proximity devices becomes confused by complex or differing arrays of power lines and power sources.

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

### Electrical Contact

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

1. Stay in the crane cab. DON'T PANIC.
2. Immediately warn PERSONNEL in the vicinity to STAY AWAY.
3. Attempt to move the crane away from the contacted power source using the crane's controls which are likely to remain functional.
4. Stay in the crane until the power company has been contacted and the power source has been de-energized. NO ONE shall attempt to come close to the crane or load until the power has been turned off.

Only as a last resort should an operator attempt to leave the crane upon contacting a power source. If it is absolutely necessary to leave the cab, JUMP

COMPLETELY CLEAR OF CRANE. DO NOT STEP OFF. Hop away with both feet together. DO NOT walk or run.

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

If the dealer is not immediately available, contact Manitowoc Crane Care Lattice Team. The crane must not be returned to service until it is thoroughly inspected for any evidence of damage and all damaged parts are repaired or replaced as authorized by Manitowoc or your Manitowoc dealer.

## REFUELING

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

## FIRE EXTINGUISHERS

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

## ACCIDENTS

If this crane becomes involved in a property damage and/or personal injury accident, immediately contact your Manitowoc dealer or the Product Safety and Reliability Department at the following address:

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

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

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

## SAFE MAINTENANCE



### WARNING

Importance of safe maintenance cannot be over emphasized. Carelessness and neglect on part of maintenance personnel can result in their death or injury and costly damage to the crane or property.

Safety information in this publication is intended only as a guide to assist qualified maintenance personnel in safe maintenance. Manitowoc cannot foresee all hazards that will arise in field; therefore, **safety remains responsibility of maintenance personnel and crane owner.**

## Maintenance Instructions

To ensure safe and proper operation of Manitowoc cranes, they must be maintained according to the instructions contained in this manual and in the Service Manual provided with the crane.

Crane maintenance and repair must be performed by qualified personnel. These personnel shall **read Operator Manual and Service Manual before attempting any maintenance procedure.** If there is any question regarding maintenance procedures or specifications, contact your Manitowoc dealer for assistance.

**Qualified person** is defined as one who by reason of training and experience is thoroughly familiar with the crane's operation and required maintenance as well as the hazards involved in performing these tasks.

**Training and qualification of maintenance and repair personnel are crane owner's responsibility.**

## Safe Maintenance Practices

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

- f. Place a warning sign at the start controls alerting other personnel that the crane is being serviced and the engine must not be started. **Do not remove sign until it is safe to return the crane to service.**
2. Do not attempt to maintain or repair any part of the crane while the engine is running, unless absolutely necessary.
 

If the engine must be run, keep your clothing and all parts of your body away from moving parts. **Maintain constant verbal communication between person at controls and person performing maintenance or repair procedure.**
  3. Wear clothing that is relatively tight and belted.
  4. Wear appropriate eye protection and approved hard hat.
  5. Never climb onto or off a moving crane. **Climb onto and off the crane only when it is parked and only with operator's permission.**

Use both hands and handrails, steps and ladders provided to climb onto and off the crane.

Lift tools and other equipment which cannot be carried in pockets or tool belts onto and off the crane with hand lines or hoists.
  6. The boom and gantry are not intended as ladders. Do not attempt to climb lattice work of the boom or gantry to get to maintenance points. If the boom or gantry is not equipped with an approved ladder, lower them before performing maintenance or repair procedures.
  7. Do not remove cylinders until the working unit has been securely restrained against movement.
  8. Pinch points are impossible to eliminate; watch for them closely.
  9. Pressurized air, coolant, and hydraulic oil can cause serious injury. Make sure all air, coolant, and hydraulic lines, fittings, and components are tight and serviceable.
 

**Do not use your hands to check for air, coolant or hydraulic oil leaks:**

    - Use a soap and water solution to check for air leaks (apply to fittings and lines and watch for bubbles).
    - Use a piece of cardboard or wood to check for coolant and hydraulic oil leaks.
  10. Relieve pressure before disconnecting air, coolant, and hydraulic lines and fittings.
  11. Do not remove the radiator cap while the coolant is hot or under pressure. Stop the engine, wait until the pressure drops and the coolant cools, then slowly remove the cap.
  12. Avoid battery explosion: do not smoke while performing battery maintenance or short across battery terminals to check its charge.
  13. Read the safety information in the battery manufacturer's instructions before attempting to charge a battery.
  14. Avoid battery acid contact with skin and eyes. If contact occurs, flush the area with water and immediately consult a doctor.
  15. Stop the engine before refueling the crane.
  16. Do not smoke or allow open flames in refueling area.
  17. Use a safety-type can with an automatic closing cap and flame arrestor for refueling.
  18. Hydraulic oil can also be flammable. Do not smoke or allow open flames in the area when filling hydraulic tanks.
  19. Never handle wire rope with bare hands. Always wear heavy-duty gloves to prevent being cut by broken wires.
  20. Use extreme care when handling coiled pendants. Stored energy can cause the coiled pendants to uncoil quickly with considerable force.
  21. When inflating tires, use a tire cage, a clip-on inflater, and an extension hose which permits standing well away from the tire.
  22. Only use cleaning solvents which are non-volatile and non-flammable.
  23. Do not attempt to lift heavy components by hand. Use a hoist, jacks, or blocking to lift components.
  24. Use care while welding or burning on the crane. Cover all hoses and components with non-flammable shields or blankets to prevent a fire or other damage.
  25. To prevent damage to crane parts (bearings, cylinders, swivels, slewing ring, computers, etc.), perform the following steps **before welding on the crane:**
    - Disconnect all cables from batteries.
    - Disconnect output cables at engine junction box.
    - Attach the ground cable from the welder directly to the part being welded and as close to the weld as possible.

Do not weld on the engine or engine mounted parts (per engine manufacturer).
  26. Disconnect and lock the power supply switch before attempting to service high voltage electrical components and before entering tight areas (such as carbody openings) containing high voltage components.
  27. When assembling and disassembling booms, jibs, or masts on the ground (with or without support of boom

rigging pendants or straps), securely block each section to provide adequate support and alignment.

**Do not go under boom, jib, or mast sections while connecting bolts or pins are being removed.**

28. Unless authorized in writing by Manitowoc, do not alter the crane in any way that affects the crane's performance (including welding, cutting, or burning of structural members or changing pressures and flows of air/hydraulic components). Doing so will invalidate all warranties and Capacity Charts and make the crane owner/user liable for any resultant accidents.
29. **Keep crane clean.** Accumulations of dirt, grease, oil, rags, paper, and other waste will not only interfere with safe operation and maintenance but also create a fire hazard.
30. Store tools, oil cans, spare parts, and other necessary equipment in tool boxes. Do not allow these items to lie around loose in the operator cab or on walkways and stairs.
31. Do not store flammable materials on the crane.
32. Do not return the crane to service at completion of maintenance or repair procedures until all guards and covers have been reinstalled, trapped air has been bled from hydraulic systems, safety devices have been

reactivated, and all maintenance equipment has been removed.

33. Perform a function check to ensure proper operation at the completion of maintenance or repair.

## ENVIRONMENTAL PROTECTION

**Dispose of waste properly!** Improperly disposing of waste can threaten the environment.

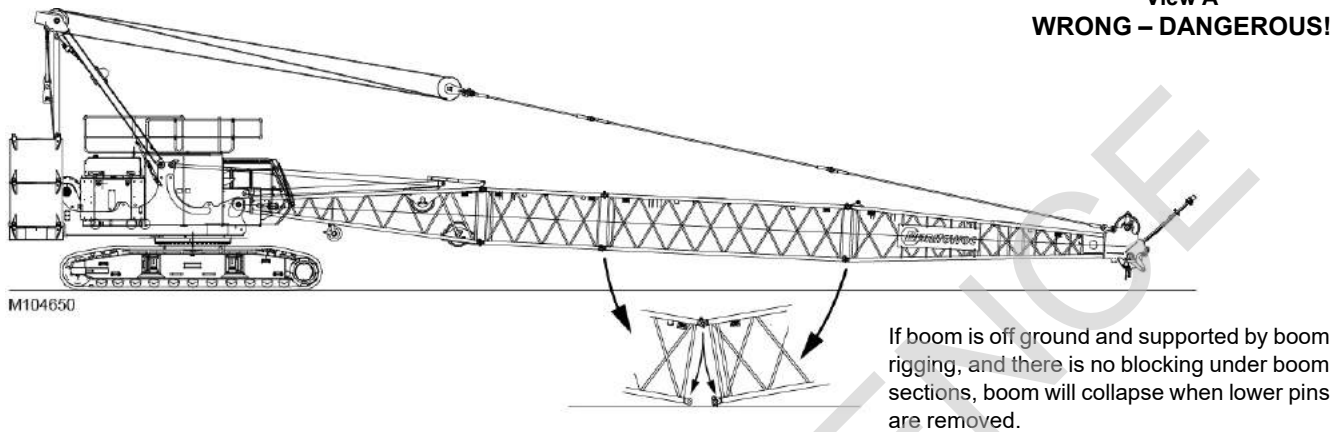
Potentially harmful waste used in Manitowoc cranes includes — but is not limited to — oil, fuel, grease, coolant, air conditioning refrigerant, filters, batteries, and cloths which have come into contact with these environmentally harmful substances.

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

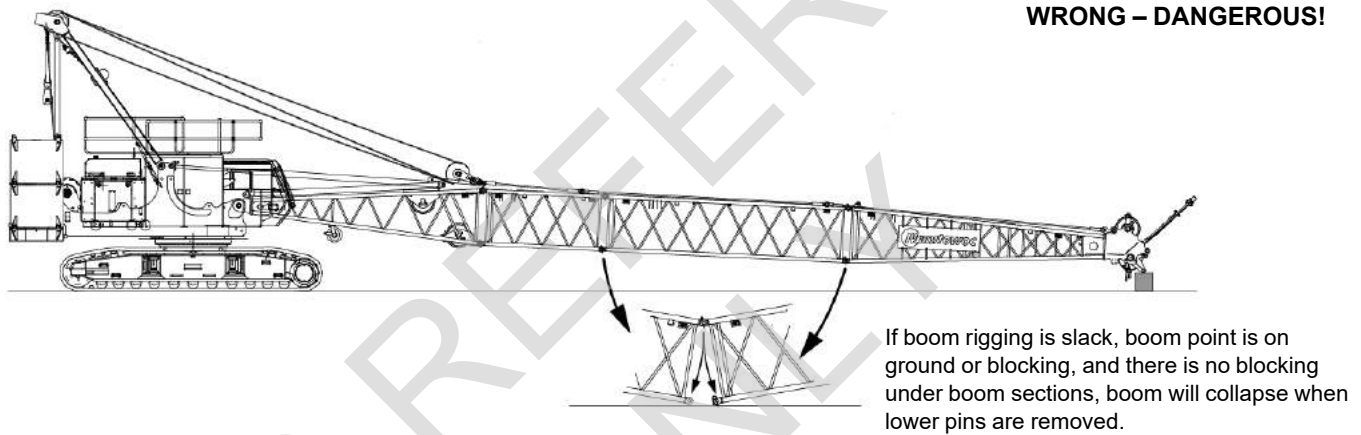
When filling and draining crane components: do not pour waste fluids onto the ground, down any drain, or into any source of water.

- Always drain waste fluids into leak proof containers that are clearly marked with what they contain.
- Always fill or add fluids with a funnel or a filling pump.
- Immediately wipe up any spills.

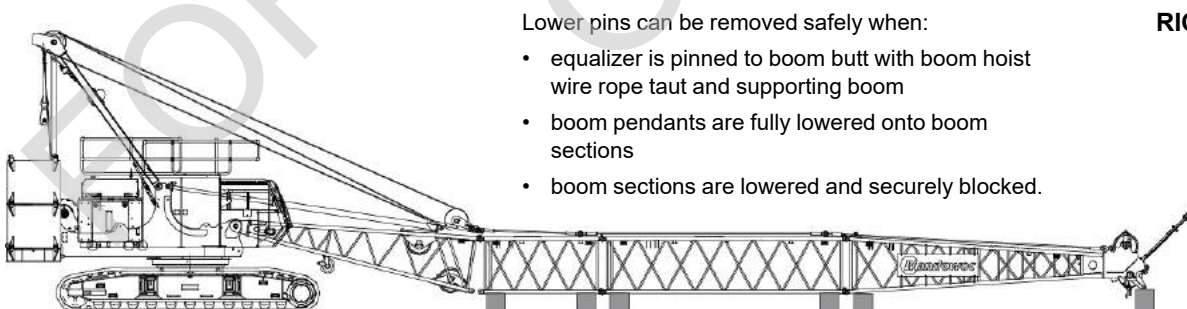
**View A**  
**WRONG – DANGEROUS!**



**View B**  
**WRONG – DANGEROUS!**



**View C**  
**RIGHT – SAFE**



**Figure 2-3. Boom Disassembly**



## BOOM DISASSEMBLY SAFETY

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



### DANGER!

#### Collapsing Boom Hazard!

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

Safe handling of lattice booms during disassembly is a primary concern for preventing serious or fatal injuries. A boom can collapse during disassembly if workers fail to observe safe working practices.

Accidents during boom disassembly usually result from one of three primary causes:

- Workers are not familiar with equipment or are not properly trained.
- Disassembly area is not suitable.
- Safe procedures are overlooked because not enough time is allocated for the task.

### General

Safety decals ([Figure 2-4](#)) are placed near the connectors on the boom sections as shown on the Boom Disassembly Decal Drawing at the end of this section.

Workers involved with boom disassembly shall be trained and experienced in the operation and disassembly of construction cranes. Everyone shall read and understand these instructions, the information in the Boom Assembly Drawing, and the instructions in Section 4 before beginning disassembly. **Anyone who has a question should ask for an explanation. *One worker who does not fully understand or fails to follow correct procedures can endanger other workers.***

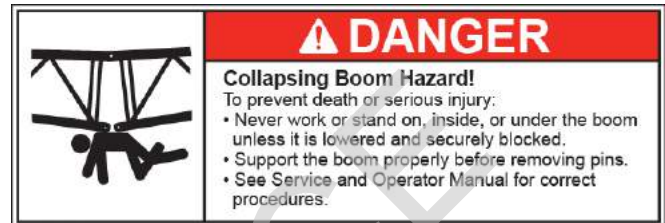
### Location

Select a suitable location for boom disassembly. It must be firm, level, and free of obstructions. It should have enough open space to accommodate the crane, the length of boom, and – if required – movement of an assist crane or other equipment. If possible, secure the area to keep unauthorized personnel and vehicles away.

### Pin Removal

When removing pins from boom sections, stand clear of pins being removed. Even though the boom is resting on

blocking, individual pin connections may still be under load. Pins can be ejected forcefully if the boom has any pressure on it or if the boom is not supported properly.



M101904

Figure 2-4. Safety Decal

## Disassembly Precaution

Always block boom sections so they are securely supported and cannot shift or move suddenly when pins are removed. If there is any doubt about a boom disassembly procedure, **block tightly under boom sections before removing any pin.**



### DANGER

#### Collapsing Boom Hazard!

Boom can collapse or jerk when pins are removed. To avoid death or serious injury:

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



### DANGER

#### Falling Boom Hazard!

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

## PERSONNEL HANDLING POLICY

In 1998, the American Society of Mechanical Engineers issued a new American National Standard entitled, Personnel Lifting Systems, ASME B30.23-1998. This standard provides, ***“lifting and lowering of personnel using ASME B30 Standard hoisting equipment shall be undertaken only in circumstances when it is not possible to accomplish the task by less hazardous means. Unless all of the applicable requirements of this volume are met, the lifting or lowering of personnel using ASME B30 Standard equipment is prohibited.”***

The ASME Standards recognize that mobile and locomotive cranes are primarily designed and intended for handling materials and not personnel. The ASME Standards have a retrofit statement that applies to existing cranes after the standards go into effect. It is not the intent of the standards to require retrofitting of existing equipment. If an item is being modified, the performance requirement must be reviewed relative to the current standard.

This new standard is consistent with the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) regulations for Construction that state, in 29CFR1926.1431(a): ***The use of a crane or derrick to hoist employees on a personnel platform is prohibited, except when the erection, use, and dismantling of conventional means of reaching the work site, such as a personnel hoist, ladder, aerial lift, elevating work platform or scaffold, would be more hazardous or is not possible because of structural design or work site conditions.***

Use of a Manitowoc crane to handle personnel is acceptable provided:

- The crane user shall comply with the manufacturer's specifications and limitations for lifting accessories (hooks, slings, personnel platforms, etc.).
- The requirements of the applicable national, state and local regulations and safety codes are met.
- A determination has been made that use of a crane to handle personnel is the least hazardous means to perform the work.
- The crane operator shall be qualified to operate the specific type of hoisting equipment used in the personnel lift.
- The crane operator shall remain in the crane cab at all times when personnel are off the ground.
- The crane operator and occupants have been instructed in the recognized hazards of personnel platform lifts.
- The crane is in proper working order.
- Load and boom hoist drum brakes, swing brakes, and locking devices such as pawls and dogs must be

engaged when the occupied personnel platform is in a stationary position.

- The crane must be equipped with a boom angle indicator that is visible to the crane operator.
- The crane must be equipped with boom hoist limiting device.
- If the luffing jib is used for hoisting personnel, the crane must be equipped with a luffing jib angle indicator that is visible to the crane operator.
- If the luffing jib is used for hoisting personnel, the crane must be equipped with a luffing hoist limiting device.
- The crane is equipped with a positive acting device which prevents contact between the load block or overhaul ball and the boom tip (anti-two-block device).

For friction cranes, this implies the addition of spring applied brakes activated by the anti-two-block device. The load line hoist drum must have a system or device on the power train, other than the load hoist brake, which regulates the lowering rate of speed of the hoist mechanism (controlled load lowering).

### ***Free fall of the hoist line is prohibited.***

- The Operator Manual is in the cab, readily accessible to the operator.
  - The crane's load Capacity Chart is affixed inside the crane cab, readily accessible to the operator. The total weight of the loaded personnel platform and related rigging must not exceed 50 percent of the rated capacity for the radius and configuration of the crane.
  - The crane is uniformly level within one percent of level grade and located on a firm footing. Some Capacity Charts require more stringent levelness criteria.
- Cranes with outriggers or stabilizers must have them all extended and locked. All outriggers or stabilizers must be extended equally in accordance with the Capacity Charts and operating procedures.
- Handling personnel from a platform suspended by wire rope from a luffing jib is acceptable, but only when it is not possible to accomplish the task using a less hazardous means. The crane user and operator shall take into account hazards that may be present when using a luffing jib.
  - Direct attachment of a personnel platform to a luffing jib is prohibited.
  - The platform meets the requirements as prescribed by applicable standards and regulations.
  - Applicable personal protection equipment is provided (for example, personal fall-protection system).

- For wire rope suspended platforms, the crane is equipped with a hook latch that can be closed and locked, eliminating the throat opening.
- The platform is properly attached and secure.
- Personnel platforms must not be used in winds exceeding 20 mph (9 m/s) at the hoisted platform height or in electric storms, snow, ice, sleet, or other adverse weather conditions which could affect the safety of personnel.
- Hoisting personnel within 6 m (20 ft) of a power line that is up to 350 kV or within 15 m (50 ft) of a power line that is over 350 kV is PROHIBITED, except for work covered in OSHA 29CFR1926 subpart V.

For operation outside the United States, the requirements of the applicable national, state and local regulations and safety codes must be met. This may include, in addition to the above:

- Automatic brakes such that when the equipment operating controls are released, the motions are brought to rest.
- A holding device (such as a load hold check valve) must be provided in the hydraulic or pneumatic systems to prevent uncontrolled movement of the hoisting equipment in the case of a system failure.

Manitowoc offers upgrade packages for friction controlled models to install anti-two-block, dead man control, and automatic hoist system control requirements to satisfy other codes and standards.

Manitowoc recommends that cranes be properly maintained, regularly inspected, and repaired as necessary. All safety signs must be in place and legible. We also urge Manitowoc crane owners to upgrade their cranes with rated capacity indicator/limiter systems for all lifting operations.

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

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

## PEDESTAL/BARGE MOUNTED CRANES

### **WARNING** **Overload Hazard!**

A pedestal mounted crane will not tip to indicate to the operator that the crane's capacity has been exceeded. When the capacity of a pedestal mounted crane is exceeded, the hook rollers or other structural components may break, before the load lines fail, causing the crane to separate from the pedestal.

For this reason, great care must be taken to operate a pedestal mounted crane within its rated capacity.

Careful planning is required before a crane can be operated on a barge. The crane user shall verify that the barge is capable of limiting crane list and/or dynamics to the maximum allowable specified in the Capacity Charts. If the specified crane list and/or dynamic conditions are exceeded, the crane's capacity may be exceeded; the hook rollers or other structural components may break, causing the crane to separate from the pedestal.

### **WARNING**

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

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

### Pedestal Mounted Crane

Also see ASME publication B30.8-2004, Floating Cranes and Derricks.

#### Definition

A pedestal mounted crane is a crane which is securely fastened to a foundation, barge, ship, or floating platform so the crane is restrained from tipping.

#### Examples

1. Crane rotating bed mounted on a turret (pedestal) which is securely fastened to the foundation (Figure 2-5).

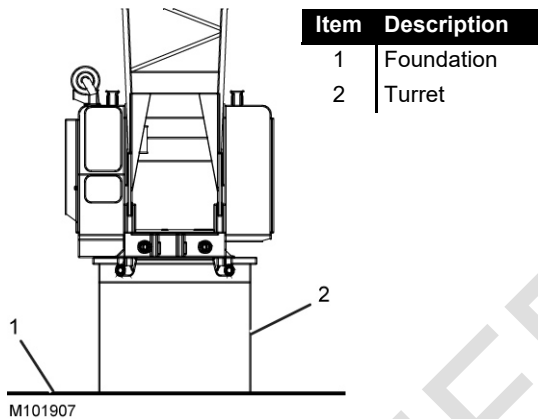


Figure 2-5. Turret-Mounted Crane

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

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

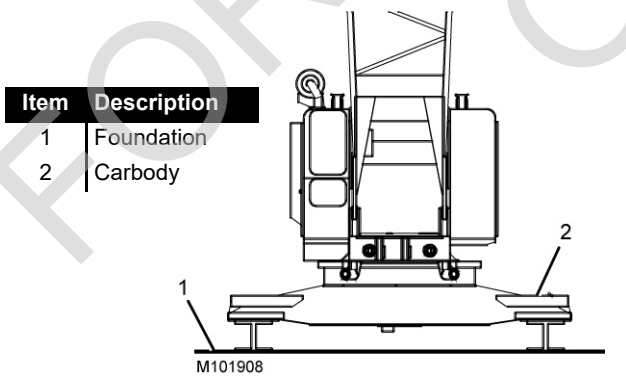


Figure 2-6. Carbody-Mounted Crane

### Barge Mounted Crane

#### Definition

A barge mounted crane is a crane that is anchored or restrained in a work area of the barge, ship, or floating platform and is subjected to tipping forces.

#### Examples

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

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

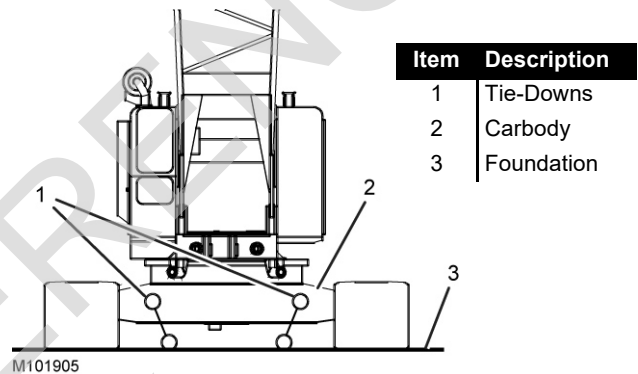


Figure 2-7. Crawler-Mounted Crane

2. Crawler-mounted crane working on a timbered area of the barge, ship, or floating platform with the crawlers restrained by curbing and end stops (Figure 2-8). When not working, the crane carbody is anchored with tie-downs to the foundation. **Traveling with load is not permitted.**

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

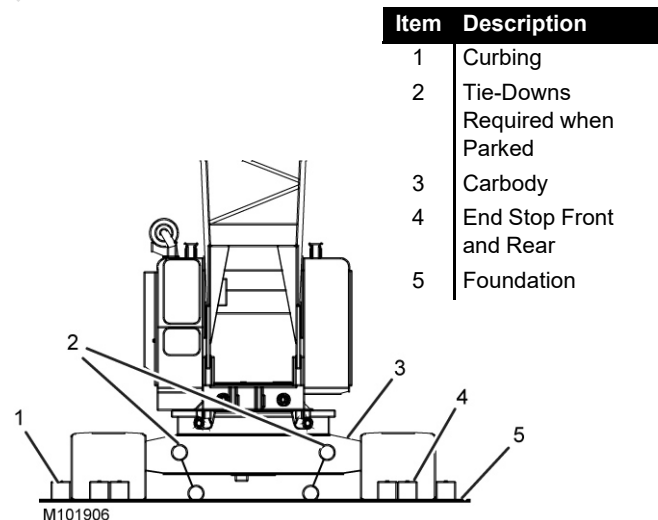


Figure 2-8. Crawler-Mounted Crane

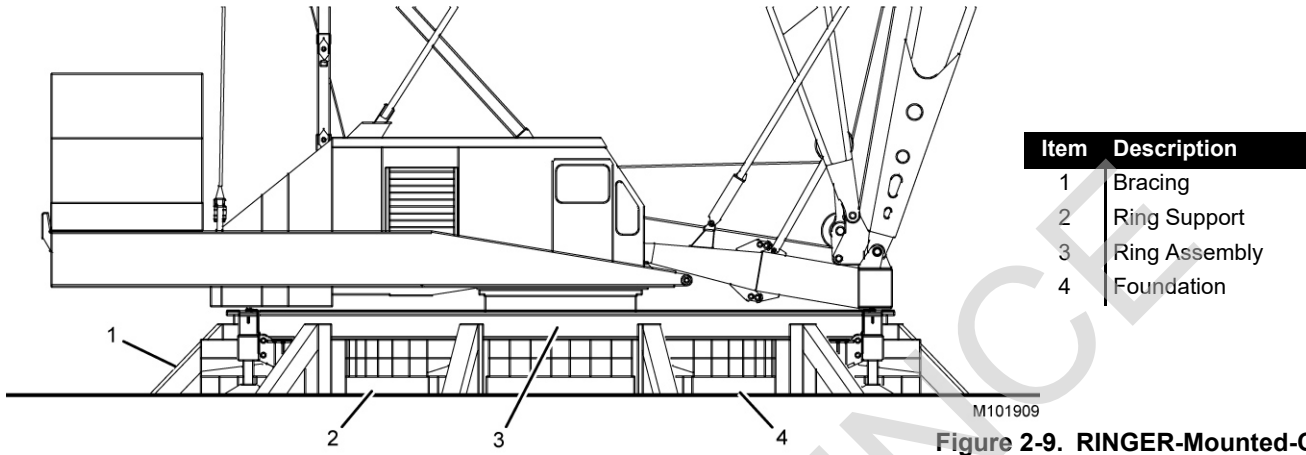
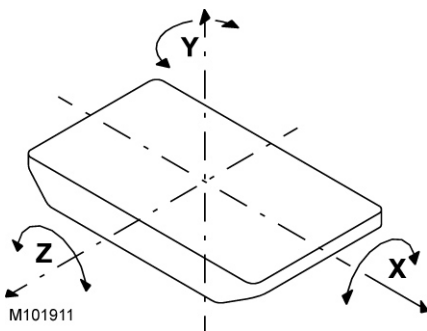


Figure 2-9. RINGER-Mounted-Crane



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

Figure 2-10. Barge Dynamics

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

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

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

### Capacity Charts for Barge Mounted Crane

Manitowoc provides two types of Capacity Charts for a crane mounted on a barge or other supporting structure under static conditions.

1. A Capacity Chart based on tipping when the crane is anchored only to prevent shifting.
2. A Capacity Chart based on structural competence when the crane is securely fastened for use as a pedestal mounted crane.

**NOTE** Unless otherwise specified in a machine list Capacity Chart, a 0 degree machine list Capacity Chart rating applies to machine list **not to exceed 1/2 degree**. All other machine list ratings – 1°, 2°, and 3° – must NOT be exceeded.

### Shock Loading Caused by Barge Dynamics

Shock loads to the crane can be experienced when the barge is subjected to up and down movement of wave action (referred to as DYNAMICS). Figure 2-10 illustrates the dynamic conditions of the barge which influence crane capacity.

### CAUTION

#### Structural Damage Hazard!

If the crane's boom or structure is shock loaded during operation, or there is any indication of shock loading, all structural components of the crane must be inspected to detect cracks and other damage. Nondestructive test equipment, such as magnetic particle or ultrasonic procedures, is recommended for this inspection.

**NOTE** Manitowoc does not recommend crane operation under dynamic conditions.

### Operation on Barge

Machine list and/or dynamics will be experienced when a crane is operated on a barge, ship, or floating platform. Both of these conditions reduce the crane's capacity and each must be taken into account for safe operation on a barge, ship, or floating platform.

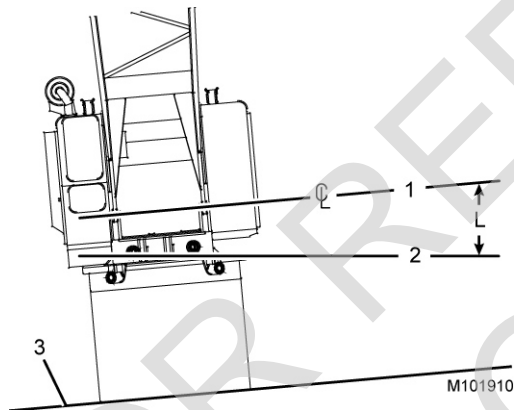
**WARNING****Tipping Crane Hazard!**

Tie-downs which only prevent the crane from shifting as in barge, ship or floating platform mounting, may not provide adequate support when using a Capacity Chart for pedestal mounting. Before operating a crane on a barge, a ship or a floating platform, the crane user shall verify that correct the Capacity Chart is being used — pedestal mounted, barge mounted, 0°, 1°, 2° or 3° list or dynamic Capacity Chart.

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

**Barge Mount Definitions**

1. Machine List, as defined by Manitowoc, is the crane's out-of-level condition — from side-to-side — as measured by the angle between horizontal and a line drawn through the centerline of the crane's boom hinge pins (Figure 2-11). This out-of-level condition creates side load and affects the crane's lifting capacity.



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

**Figure 2-11. Machine List**

2. Barge List (also referred to as heel or trim) causes swing out of the load and may produce side load. When Manitowoc provides a Capacity Chart showing capacities for a 2 degree machine list for example, we

are referring to the maximum allowable lifting capacity for the crane when experiencing an out-of-level condition (side-to-side) of 2 degrees as measured by angle between horizontal and a line drawn through centerline of the crane's boom hinge pins.

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

3. Barge List and Machine List are not the same. As the crane rotates on a barge, barge list (as defined above) will change. The worst machine list condition generally occurs when the crane swings over the corner of the barge, producing maximum side load.

**Inspection of Barge-Mounted Crane**

To aid in preventing harmful and damaging failure as previously indicated, regular inspection for signs of overloading in the following load bearing components is required. Correct each defect found before placing the crane into service.

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

When equipped with hook rollers, it is recommended that each hook roller assembly be inspected daily for any sign of overloading, to include:

- Deformation of roller path
- Proper hook roller adjustment
- Deformation or cracks in hook roller hanger
- Bent hook roller shaft
- Damaged bearings

**Transporting Crane on Barge**

If it is necessary to transport the crane on a barge, ship, or floating platform when dynamic conditions will be experienced, the boom must be lowered onto a cradle (or other support) and the crane's boom, rotating bed, and lowerworks must be secured against movement. If the crane is equipped with a mast, the mast must be securely tied down with guylines. Failing to take these steps can result in shock load or side load damage to the boom and mast.

# SECTION 3

## OPERATING CONTROLS AND PROCEDURES

### TABLE OF CONTENTS

Standard Hand Signals for Controlling Crane Operations .....	3-2
Symbols Used on Control Consoles .....	3-4
Left Console .....	3-12
Right Console .....	3-14
Overhead Console .....	3-22
Foot Pedals .....	3-25
Seat Controls .....	3-26
Other Operation Aids .....	3-27
Boom Angle Indicator .....	3-27
Crane Capacity Beacon (Optional) .....	3-27
Crane Level .....	3-27
Swing and Travel Alarm .....	3-27
Battery Disconnect Switch .....	3-28
Crane Cameras .....	3-30
Crane Camera Monitor .....	3-31
Remote Control .....	3-32
Operating Limits Identification .....	3-34
Cab Window Operation .....	3-37
Opening Windows for Ventilation .....	3-37
Exiting Cab in Emergency .....	3-37
Operating in Wind .....	3-37
Crawler Blocking .....	3-37
Preparing Crane for Operation .....	3-38
Startup Procedures .....	3-38
Operating Procedures .....	3-40
Boom Hoist Operation .....	3-41
Swing Operation .....	3-42
Load Drum Operation—Liftcrane Full Power .....	3-43
Load Drum Operation—Liftcrane Free Fall .....	3-44
Free Fall Drum Slip and Pedal Response .....	3-45
Load Drum Operation—Clamshell .....	3-46
Preparing For Clamshell Operation: .....	3-46
Clamshell Operation In Full-Power .....	3-46
Travel Operation .....	3-47
Shutdown Procedure or Leaving the Crane Unattended .....	3-49
Low Clearance Travel Option .....	3-49
Low Clearance Travel Boom Configurations .....	3-49
Fully Rigged Boom .....	3-49
Cantilevered Boom Inserts .....	3-49
Low Clearance Travel Limitations .....	3-49
Preparing Fully Rigged Boom for Low Clearance Travel .....	3-51
Returning Gantry to Normal Operating Position .....	3-51
Preparing Cantilevered Boom Inserts for Low Clearance Travel .....	3-53
Returning Gantry to Normal Operating Position .....	3-53
Cold Weather Operation .....	3-55
Crane Limitations .....	3-55
Wire Rope .....	3-55
Cold Weather Starting Aid .....	3-55
Cooling System .....	3-55
Batteries .....	3-55
Engine Oil, Gear Oil, and Hydraulic Oil .....	3-55

AC Power Supply .....	3-57
Generator Installation/Removal .....	3-57
Turning AC Power ON .....	3-57
Turning AC Power OFF .....	3-57
Work Lights .....	3-57
Cold Weather Heaters .....	3-59
Fuses and Circuit Breakers .....	3-61

FOR REFERENCE ONLY



## SECTION 3

### OPERATING CONTROLS AND PROCEDURES



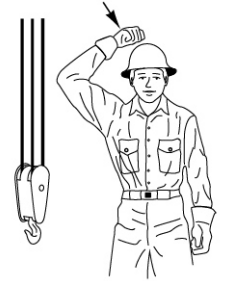
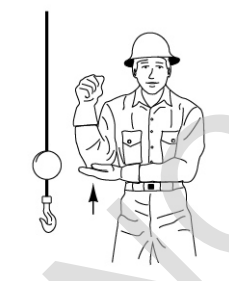
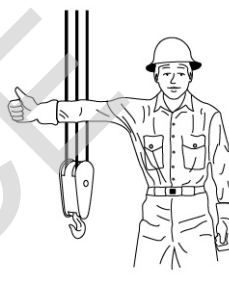

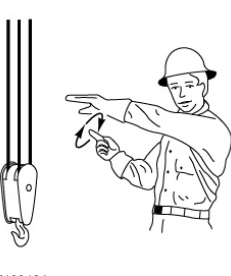
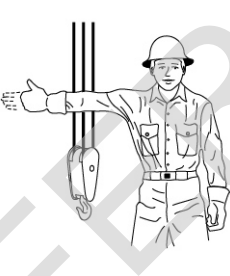
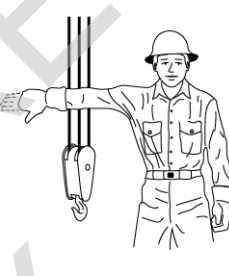

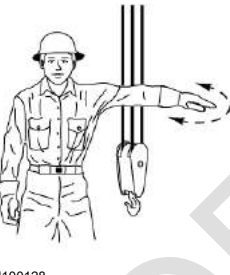
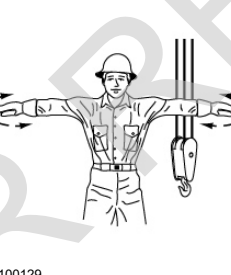
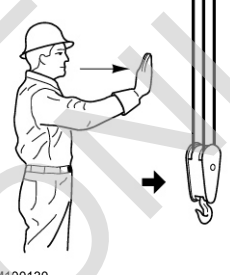
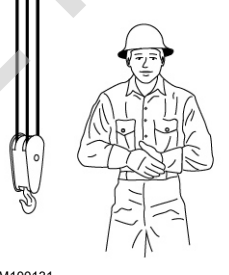
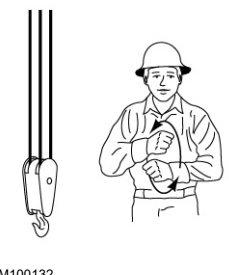
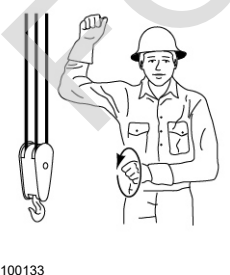
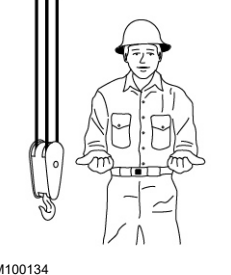
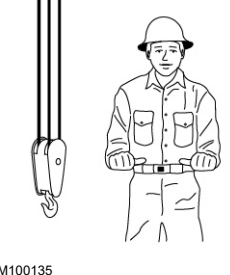
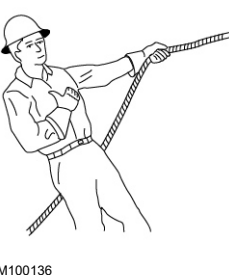

This section identifies all standard and optional operating controls and indicators available for the MLC80A-1, 90A-1, 100A-1 and 100-1. Therefore, some of the controls and indicators identified in this section may not be provided on your crane.

The instructions in this section apply only to the MLC80A-1, 90A-1, 100A-1 and 100-1 equipped with **Operator Cab Assembly 80123265**.

### STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS

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

**Table 3-1. Standard Hand Signals for Controlling Crane Operations**

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

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Table 3-1. Standard Hand Signals for Controlling Crane Operations

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

### SYMBOLS USED ON CONTROL CONSOLES

The following symbols are used on the control consoles to identify the operating controls and their operation.

**Table 3-2. Symbol Identification — Control Consoles**








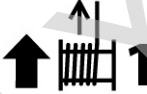





 M100138	Air Conditioner	 M100144	Cylinders, Extend and Retract
 M100154	Battery, 12 Volt Supply	 M100151	Drum with or without Number (number and its location varies)
 M100168	Bypass, Crane Limits	 M100149	Drum, Free Fall with Drum Number
 M102790a	Cab	 M100150	Drum, Lower
 M101960	Camera	 M100152	Drum, Raise
 M100191a	Crawlers	 M100155	Engine or Auxiliary Engine
 M100196	Crawler Speed		

Table 3-2. Symbol Identification — Control Consoles




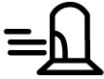












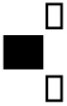
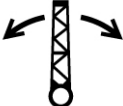

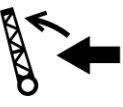

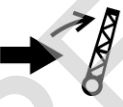










 M100154	Energize	 M100165	Lights, Console
 M100160	Engine Run	 M100291	Light, Position
 M100160	Engine Start	 M100166	Light, Work and Camera
 M100161	Engine Stop	 M100167	Lighter
 M100142a	Fan	 M100170	Off
 M102435	Gantry	 M100171	On
 M102084	Heater	 M101959	Park Off
 M100164	Horn	 M100172	Park On

Table 3-2. Symbol Identification — Control Consoles

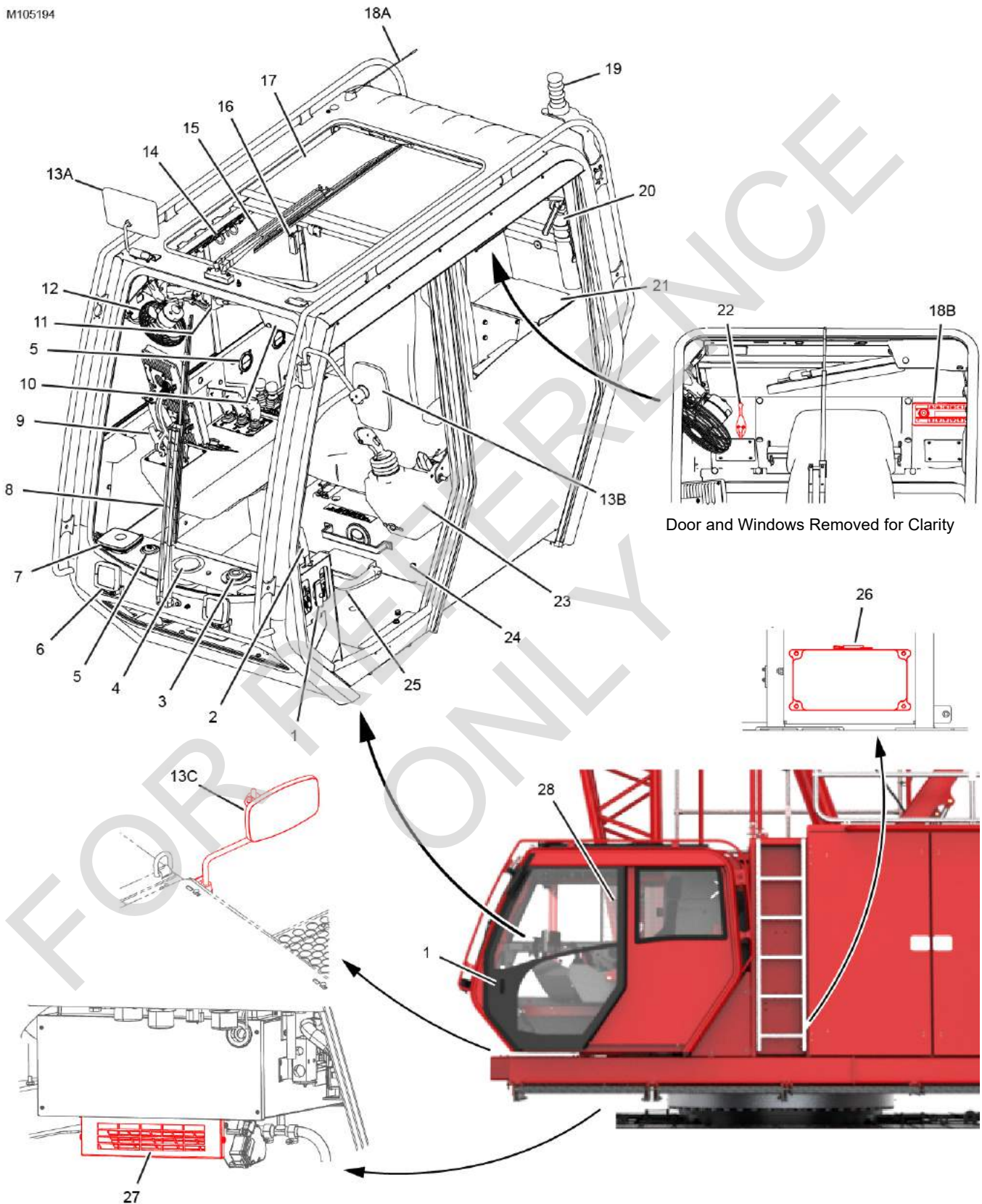
 <p>M100177</p>	<p>Pin, Disengage</p>	 <p>M100186</p>	<p>Swing</p>
 <p>M100178</p>	<p>Pin, Engage</p>	 <p>M100189</p>	<p>Swing Left</p>
 <p>M100285</p>	<p>Regen (Tier 4), Inhibit</p>	 <p>M100190</p>	<p>Swing Right</p>
 <p>M100284</p>	<p>Regen (Tier 4), Initiate</p>	 <p>M100192a</p>	<p>Travel Forward and Reverse—Left Crawler</p>
 <p>M100182</p>	<p>Setup</p>	 <p>M100193a</p>	<p>Travel Forward and Reverse—Right Crawler</p>
 <p>M100183</p>	<p>Speed, Fast</p>	 <p>M104620</p>	<p>USB</p>
 <p>M100184</p>	<p>Speed, Slow</p>	 <p>M101957a</p>	<p>Windshield Washer, Front</p>
 <p>M100185</p>	<p>Stop, Emergency</p>	 <p>M101958a</p>	<p>Windshield Washer, Overhead</p>

FOR REFERENCE ONLY

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OPERATING CONTROLS

M105194

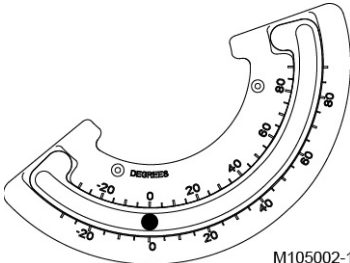


Door and Windows Removed for Clarity



Table 3-3. Cab Controls and Indicators

Item	Name	Description
1	Outside Door Handle	<ul style="list-style-type: none"> <li>• Unlock the door with the key provide with the crane.</li> <li>• Press the button in the handle and the handle will pop out.</li> <li>• Rotate the handle to open the door.</li> <li>• Slide the door rearward to access the cab.</li> </ul> Reverse the steps to close and lock the door.
2	Inside Door Latch	The door will latch when slid fully rearward and forward. <ul style="list-style-type: none"> <li>• To close the door from inside the cab — push the door latch forward to unlatch the door. Use the grab handle above the door latch to slide the door forward until it latches.</li> <li>• To open the door from inside the cab — pull the door latch rearward to unlatch the door. Use the grab handle above the door latch to slide the door rearward.</li> </ul>
3	Crane Level	See <a href="#">page 3-27</a> for more information.
4	Cup Holder	Provided for operator convenience.
5	Air Vents (Qty 6)	Adjust as desired to circulate air in the operator cab.
6	Crane Work Lights	See <a href="#">page 3-22</a> for more information.
7	GPS Antenna	Contact your Manitowoc dealer for CraneSTAR information.
8	Front Windshield Wiper	See <a href="#">page 3-22</a>
9	Right Console	See <a href="#">page 3-14</a> for more information.
10	Sun Visor (front window)	Position the visor as desired to shade the sunlight.
11	Crane Camera Monitor	See <a href="#">page 3-31</a> for more information.
12	Fan	The fan as its own on-off switch. The fan's position is adjustable for directing air flow in the cab.
13A	Drum Mirror	Adjustable to provide a view of the drums.
13B	Rear View Mirror (optional left side)	Adjustable to provide a view to the rear of the crane.
13C	Rear View Mirror (optional right side)	Adjustable to provide a view to the rear of the crane.
14	Overhead Console	See <a href="#">page 3-22</a> for more information.
15	Upper Windshield Wiper	See <a href="#">page 3-22</a> for more information.
16	Window Latch	See <a href="#">page 3-37</a> for more information.
17	Sun Shade	A shade is provided for the roof window. Position the shade as desired to shade the sunlight.
18A	Radio Antenna	See the manufacturer's manual at the end of this section.
18B	Radio (left rear upper corner)	

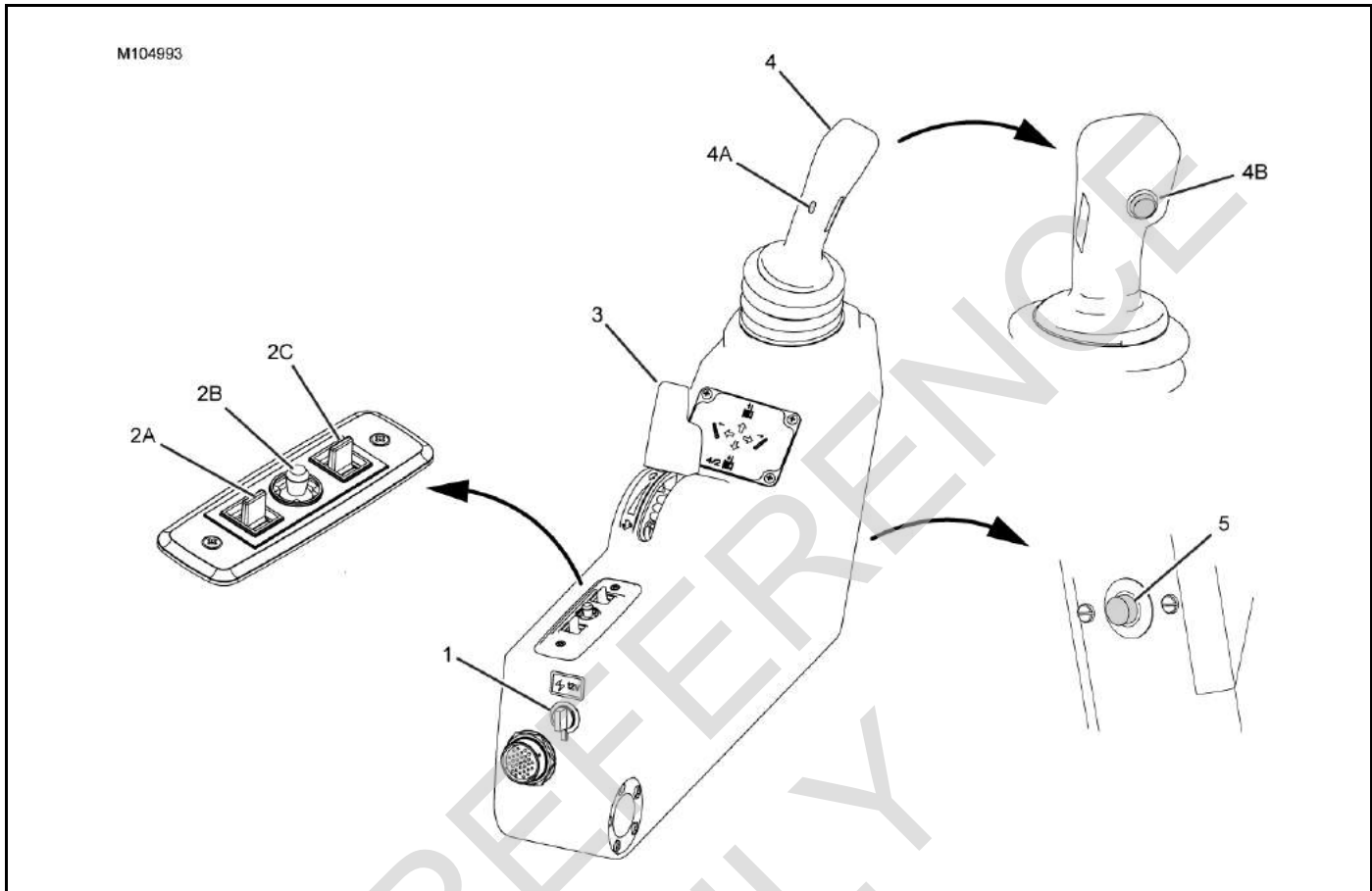
19	Rated Capacity Limiter (RCL) Light	The beacon rotates and the alarm sounds whenever the crane's capacity is near an overload condition (when RCL system is ON). See <a href="#">page 3-27</a> .
20	Fire Extinguisher	In Cab (standard): 2.5# Dry Chemical 1A:10-B:C On Right Enclosure (optional): 15# Carbone Dioxide 10B:C
22	Storage Shelves and Operator Information Manual Holder	Store manuals and capacity charts here.
22	Coat Hook	Provided for operator convenience.
23	Left Console	See <a href="#">page 3-12</a> for more information.
24	HVAC Unit	The main components for heating and cooling the operator cab are located here.
25	Engine Foot Throttle and Optional Free Fall Brake Pedals	See <a href="#">page 3-25</a> for more information
26	Windshield Washer Fluid Tank	Inside the left enclosure. Fill with a quality brand of non-freezing windshield washer fluid.
27	HVAC Filter Element	Remove the cover and replace the filter element every six months, or sooner in extremely dusty climates. Reinstall the cover.
28	Boom Angle Indicator	See <a href="#">page 3-27</a> for more information. 

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Left Console

Table 3-4. Left Console



Item	Name	Description								
1	12VDC Power Source	Maximum current draw is 15A. For fuse locations, see <a href="#">Fuses and Circuit Breakers on page 3-61</a> .								
2	Seat Riser Control	<table border="1"> <thead> <tr> <th>Item</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>Engage this switch to raise or lower the front riser.</td> </tr> <tr> <td>B</td> <td>Engage this switch to raise and lower the seat and to move the seat forward or backward.</td> </tr> <tr> <td>C</td> <td>Engage this switch to raise or lower the rear riser.</td> </tr> </tbody> </table>	Item	Description	A	Engage this switch to raise or lower the front riser.	B	Engage this switch to raise and lower the seat and to move the seat forward or backward.	C	Engage this switch to raise or lower the rear riser.
Item	Description									
A	Engage this switch to raise or lower the front riser.									
B	Engage this switch to raise and lower the seat and to move the seat forward or backward.									
C	Engage this switch to raise or lower the rear riser.									
3	Hand Throttle	<ul style="list-style-type: none"> <li>Move the handle FORWARD to DECREASE the engine speed.</li> <li>Move the handle BACK to INCREASE the engine speed.</li> </ul> <p>Engine speed must be fast enough to provide sufficient power for the work being done. <b>The engine can stall under the load if the engine speed is too slow.</b></p>								

Table 3-4. Left Console

<p>4</p>	<p>Boom and Swing Control Handle</p>	<p><b>Boom Hoist Control Handle:</b></p> <p>The location of the control handles can vary depending on crane configuration. For drum and control handle identification, see <a href="#">Figure 3-1 on page 17</a>.</p> <p>See <a href="#">Boom Hoist Operation on page 3-41</a>.</p> <ul style="list-style-type: none"> <li>• Move the control handle BACK to RAISE the boom. The hoist brake releases and speed changes in relation to control handle movement.</li> <li>• Release the control handle to CENTER to STOP the boom. Speed decreases to off and the hoist brake applies to hold the boom or jib in position.</li> <li>• Move the control handle FORWARD to LOWER the boom. The hoist brake releases and speed changes in relation to the control handle movement.</li> </ul> <p><b>Swing Control Handle:</b></p> <p>See <a href="#">Swing Operation on page 3-42</a>.</p> <ul style="list-style-type: none"> <li>• Move the control handle to the LEFT to SWING LEFT.</li> <li>• Release the control handle to CENTER to STOP swinging. Swing speed decreases and the rotating bed slows to a stop. Move the control handle in the opposite direction to stop the swing motion faster.</li> <li>• Move the control handle to the RIGHT to SWING RIGHT.</li> </ul> <p>The swing and travel alarm beeps to warn personnel when the crane is swung.</p> <table border="1" data-bbox="634 940 1511 1266"> <thead> <tr> <th data-bbox="634 940 732 982">Item</th> <th data-bbox="732 940 1511 982">Description</th> </tr> </thead> <tbody> <tr> <td data-bbox="634 982 732 1083">A</td> <td data-bbox="732 982 1511 1083">Drum rotation indicator—a pin-type actuator in the control handle moves up and down to signal the operator by feel that the drum is turning.</td> </tr> <tr> <td data-bbox="634 1083 732 1266">B</td> <td data-bbox="732 1083 1511 1266">Swing holding brake switch—holds the rotating bed in position for short periods of time. The swing control handle is not operable while the swing holding brake switch is pressed.                             <ul style="list-style-type: none"> <li>• PRESS the switch to APPLY the swing holding brake.</li> <li>• RELEASE the switch to RELEASE the swing holding brake.</li> </ul> </td> </tr> </tbody> </table>	Item	Description	A	Drum rotation indicator—a pin-type actuator in the control handle moves up and down to signal the operator by feel that the drum is turning.	B	Swing holding brake switch—holds the rotating bed in position for short periods of time. The swing control handle is not operable while the swing holding brake switch is pressed. <ul style="list-style-type: none"> <li>• PRESS the switch to APPLY the swing holding brake.</li> <li>• RELEASE the switch to RELEASE the swing holding brake.</li> </ul>
Item	Description							
A	Drum rotation indicator—a pin-type actuator in the control handle moves up and down to signal the operator by feel that the drum is turning.							
B	Swing holding brake switch—holds the rotating bed in position for short periods of time. The swing control handle is not operable while the swing holding brake switch is pressed. <ul style="list-style-type: none"> <li>• PRESS the switch to APPLY the swing holding brake.</li> <li>• RELEASE the switch to RELEASE the swing holding brake.</li> </ul>							
<p>5</p>	<p>Left Console Tilt Button</p>	<ul style="list-style-type: none"> <li>• To RAISE the left console, press and hold the button on the front of the console. A gas cylinder will raise the console to make more room for entering or exiting the cab.</li> <li>• To LOWER the left console, press and hold the button, and push the console down to the desired position.</li> </ul>						

### Right Console

Table 3-5. Right Console

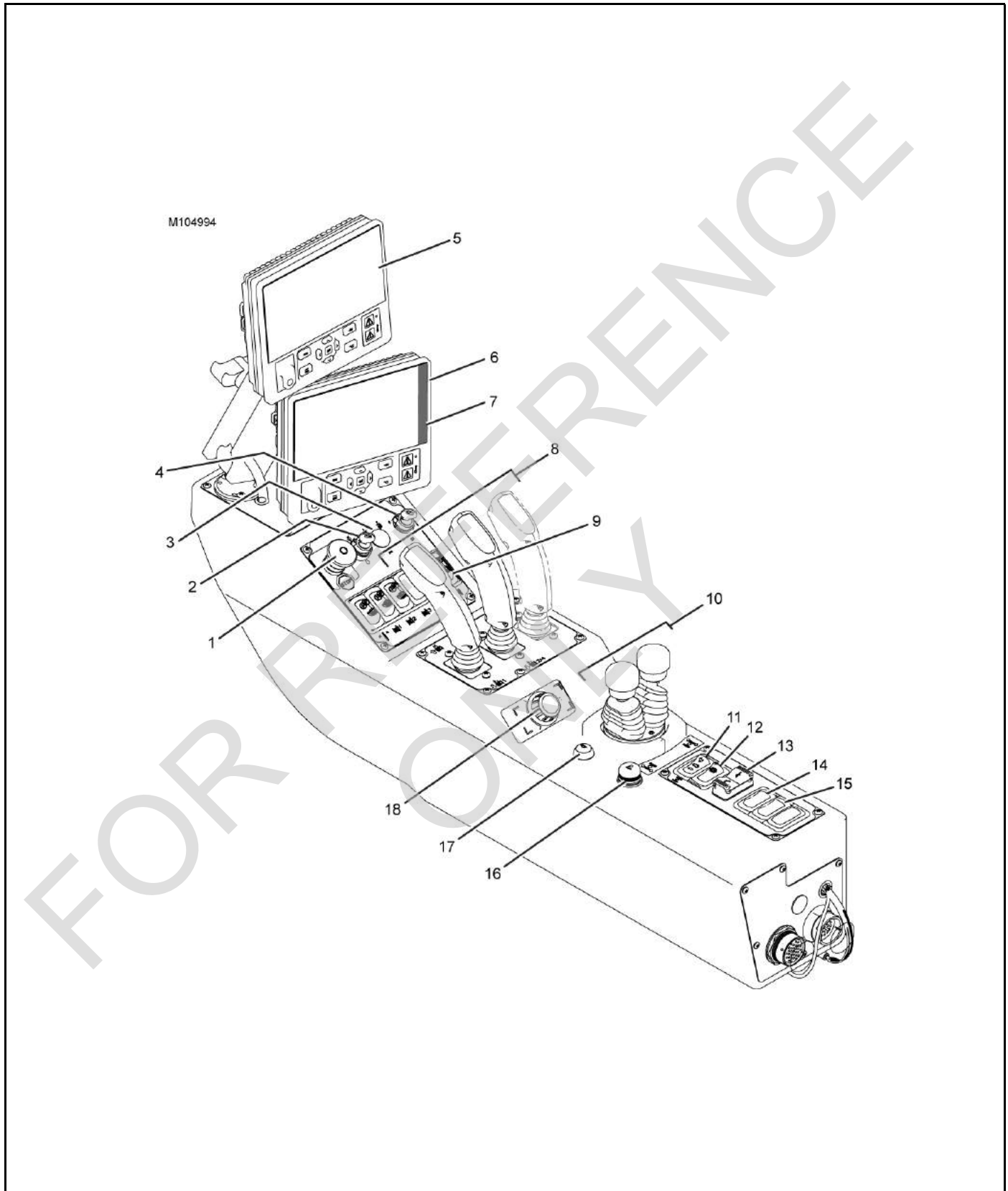


Table 3-5. Right Console

Item	Name	Description
1	Emergency Stop Button	<p>When this button is depressed, the crane engine shuts off, the brakes apply, and the currently operated crane functions come to a complete stop.</p> <p>For normal engine shut down, use the engine ignition switch.</p> <p><b>NOTE</b> The button must be pulled up before the engine can be restarted.</p> <p>If the emergency stop switch has been activated while functions were being operated, test the corresponding disk brakes for proper operation before putting the crane back into service.</p>
2	Engine Ignition Switch	<p>The engine ignition switch has the following positions:</p> <ul style="list-style-type: none"> <li>• Stop (A)</li> <li>• Run (B)</li> <li>• Start (C)</li> </ul>
3	Free Fall Enable Switch	<p>See <a href="#">Load Drum Operation—Liftcrane Free Fall on page 3-44</a> for detailed instructions on turning free fall on and off.</p> <p>This key switch spring returns to center when released.</p> <ul style="list-style-type: none"> <li>• Turn COUNTERCLOCKWISE and release to ENABLE Drum 1 free fall.</li> <li>• Turn COUNTERCLOCKWISE again and release to DISABLE Drum 1 free fall.</li> <li>• Turn CLOCKWISE and release to ENABLE Drum 2 free fall.</li> <li>• Turn CLOCKWISE again and release to DISABLE Drum 2 free fall.</li> </ul> <p>Remove the key to prevent unauthorized operation.</p>
4	Limit Bypass Key Switch	<p>This key bypasses the limits described in <a href="#">Operating Limits Identification on page 3-34</a>:</p> <ul style="list-style-type: none"> <li>• Turn the key to I and hold to BYPASS an operating limit.</li> <li>• RELEASE the key to O to ENABLE operating limits. This position allows the limits to stop the crane functions in the normal matter. <b>The key must be in this position for all normal operation. Otherwise, structural damage can occur.</b></li> </ul> <p>Remove the key to prevent unauthorized operation.</p>
5	Rated Capacity Limiter (RCL) and Rated Capacity Indicator (RCI) Display	Displays load lifting information and alerts the operator to overload conditions. See the RCL/RCI Operation Manual for detailed information.
6	Main Display	Displays operating conditions, faults, and diagnostic information. See the Main Display Operation Manual for detailed information.

Table 3-5. Right Console


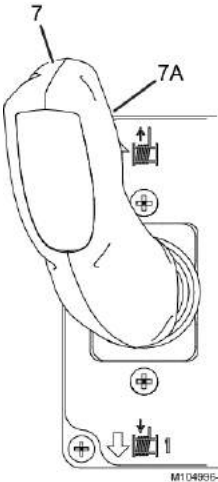
<p>7</p>	<p>Drum Indicator</p>	<p>The status bar on the right side of the Main Display Working Screen indicates which drums are parked and which drum is being controlled by the corresponding handle.</p> <ul style="list-style-type: none"> <li>• Gray colored drum icon = Drum is PARKED</li> <li>• White colored drum icon = Drum is UNPARKED</li> </ul> <p>In the example, Drums 3 and 4 are parked and Drums 1 and 2 are unparked.</p> <p>The orange dot below each drum icon indicates which handle controls the corresponding drum. In the example, Drum 4 is controlled by the left handle, Drum 1 by the first right handle, and so on.</p> <p>When the setup remote is controlling Drum 4, none of the dots will be highlighted in orange.</p>	 <p>M105018</p>
<p>8</p>	<p>Load Drum Control Handles</p>	<p>For drum and control handle identification, see <a href="#">Figure 3-1</a>.</p> <p>For non-free fall load drums, see <a href="#">Load Drum Operation—Liftcrane Full Power on page 3-43</a>.</p> <p>For free fall load drums, see <a href="#">Load Drum Operation—Liftcrane Free Fall on page 3-44</a>.</p> <p><b>NOTE</b> The free fall option is available only for Drums 1 and 2.</p> <ul style="list-style-type: none"> <li>• Pull the handle BACK to RAISE the load. The drum brake releases and speed increases in relation to handle movement.</li> <li>• Release the handle to OFF (center) to STOP the load. Speed decreases to off and the drum brake applies to stop and hold the drum in position. <b>If equipped with free fall, make sure the brake pedal is depressed or the load will continue to lower under its own weight.</b></li> <li>• Push the handle FORWARD to LOWER the load. The drum brake releases and speed increases in relation to handle movement.</li> </ul>	 <p>M104995-1</p>
<p>8A</p>	<p>Drum Rotation Indicator</p>	<p>A pin-type actuator in the control handle for each drum moves up and down to signal the operator by feel that the drum is turning.</p>	



Table 3-5. Right Console

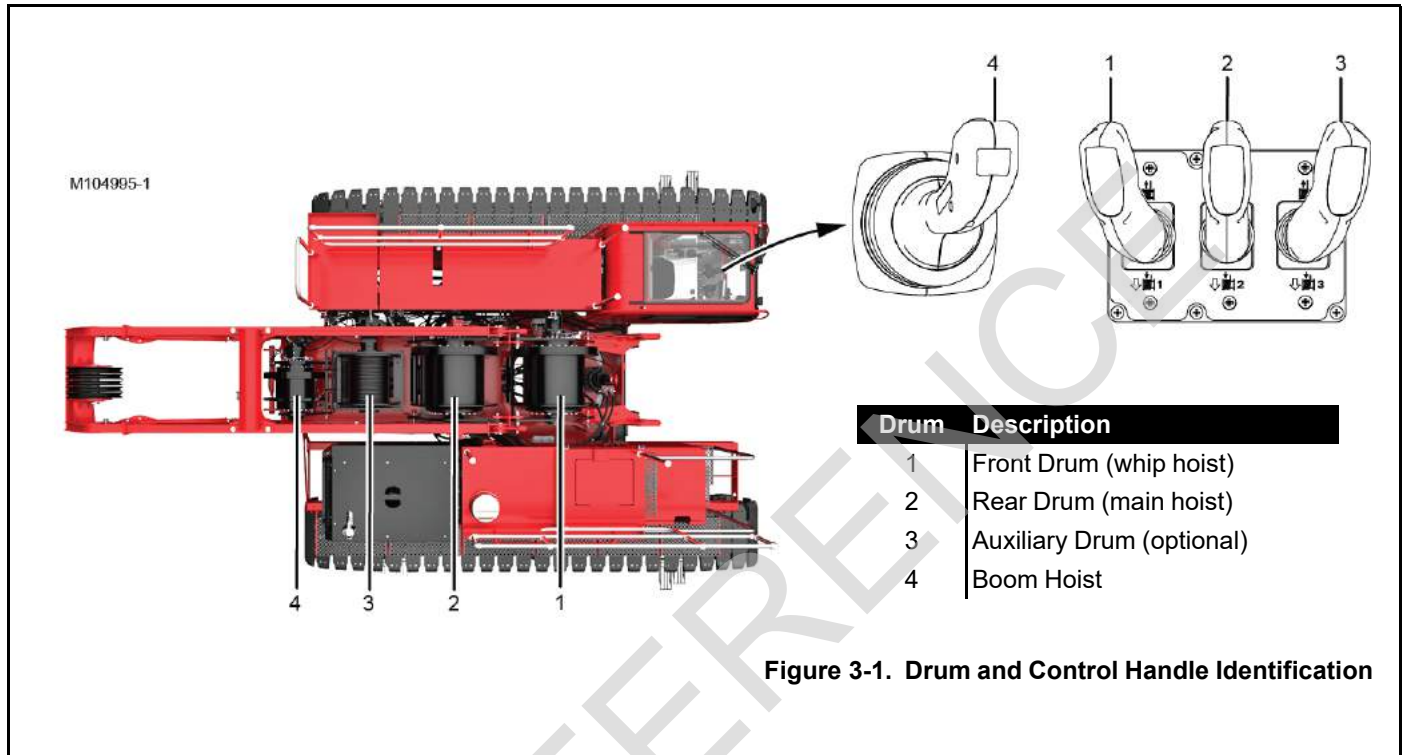


Table 3-5. Right Console

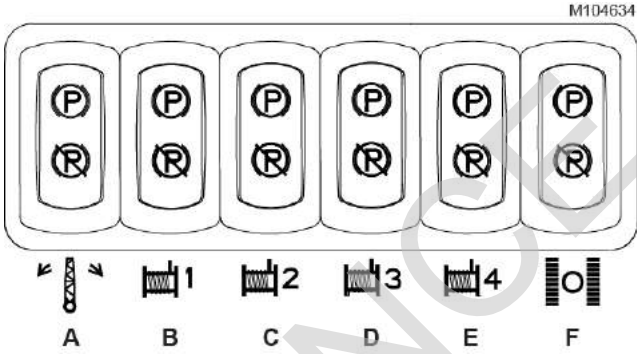


<p>9</p>	<p>Park Switches</p>	<p>A separate switch is provided for each crane function: Swing (A), Drum 1 (B), Drum 2 (C), Drum 3 (D), Drum 4 (E), and Travel (F).</p>  <ul style="list-style-type: none"> <li>• Press the TOP of the rocker to PARK the corresponding crane function. With drum park on, the corresponding control handle is inoperable, the brake is applied, and (if equipped) the pawl is engaged.</li> <li>• Press the bottom of the rocker to UN-PARK the corresponding crane function. With park off, the corresponding control handle is operable, the brake is applied and released in conjunction with control handle movement, and (if equipped) the pawl is disengaged.</li> </ul> <p><b>NOTE</b> At startup:</p> <ul style="list-style-type: none"> <li>• All functions are automatically parked.</li> <li>• All drum pawls remain in the state they were at shutdown and will not engage or disengage until the corresponding park/unpark switch is pressed.</li> </ul> <p>The status bar on the right side of the Main Display Working Screen indicates which functions are parked and unparked.</p> <p>Alternatively, each crane function can be parked in the Main Display Speed and Torque Settings Screen. See the Main Display Operation Manual for instructions.</p> <p>If the operator moves a control handle for a function that is parked, the corresponding fault icon will appear in the Alerts Bar of the Main Display Working Screen and the function will be inoperable until unparked.</p> <ul style="list-style-type: none"> <li>  if the function was parked with a park switch OR         </li> <li>  if the function was parked in the speed and torque settings screen.         </li> </ul>
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Table 3-5. Right Console

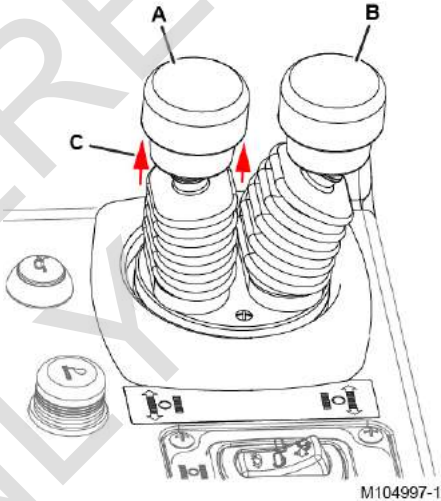

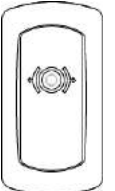
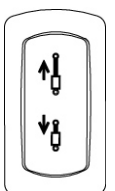

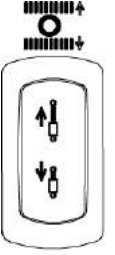

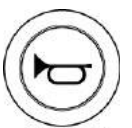
<p>10</p>	<p>Crawler Handles</p>	<p>See <a href="#">Travel Operation on page 3-47</a>.</p> <p>The following directions of travel are with the <b>front of the rotating bed and the front of carbody facing the same direction</b>.</p> <p>The swing and travel alarm beeps to warn personnel when the crane is traveled.</p> <p><b>A</b> = left crawler handle, <b>B</b> = right crawler handle, and <b>C</b> = cruise control.</p> <ul style="list-style-type: none"> <li>• Pull the control handle BACK to travel the corresponding crawler in REVERSE. The travel brake releases and speed increases in relation to control handle movement.</li> <li>• Release the control handle to OFF (center) to STOP the crawler. Speed decreases to off and the travel brake applies to stop and hold the crawler in position.</li> <li>• Push the control handle FORWARD to travel the corresponding crawler FORWARD. The travel brake releases and speed increases in relation to control handle movement.</li> </ul>  <p>M104997-1</p> <ul style="list-style-type: none"> <li>• To turn travel CRUISE ON, pull up and release the bottom portion of handle (C) while traveling in the desired direction and speed. The crane will continue to travel in the selected direction and speed when the operator releases the crawler handles.</li> <li>• To turn travel CRUISE OFF, push either crawler control handle in the opposite direction or pull up and release the button bottom portion of handle (C) again. Travel cruise will also turn off if an operating limit that prevents operation is reached (for example, seat switch or park switch).</li> </ul>
<p>11</p>	<p>Travel Speed Switch</p>	<ul style="list-style-type: none"> <li>• Press the TOP of the rocker to operate the travel motors in HIGH speed. High speed operation provides maximum available travel speed for traveling long distances.</li> <li>• Press the BOTTOM of the rocker to operate the travel motors in LOW speed. Low speed operation provides smooth starts and stops and allows more precise control of the travel motors than high speed.</li> </ul>  <p>M104638</p>

Table 3-5. Right Console

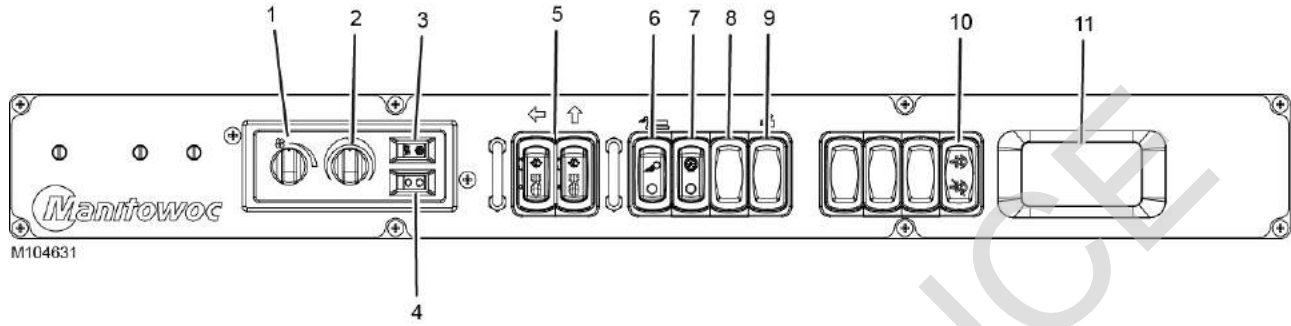
<p>12</p>	<p>Free Spool Activation Switch</p>	<p>This is a 2-position momentary switch that is spring returned to the center position.</p> <p>After enabling free spool in the Main Display:</p> <ul style="list-style-type: none"> <li>• Press and release the top of the rocker to activate free spool.</li> <li>• Press and release the bottom of the rocker to deactivate free spool.</li> </ul> <p>If free spool is disabled in the Main Display, it will also be automatically deactivated, and have to be re-activated after it is re-enabled.</p> <p>Refer to F2334 for detailed free spool operating instructions.</p>	 <p>M105195</p>
<p>13</p>	<p>USB Receptacles</p>	<p>Use to power/charge a personal electronic device (like a cell phone) while the ENGINE is RUNNING.</p>	
<p>14</p>	<p>Gantry Cylinders Switch</p>	<p>To activate this switch, the Boom Butt Configuration must be selected in the RCL/RCI Display. See Section 4 of the MLC80A-1, 90A-1, 100A-1, and 100-1 Operator Manual for gantry raising and lowering instructions.</p> <ul style="list-style-type: none"> <li>• Press and hold the TOP of the rocker to EXTEND the gantry cylinders (raise gantry).</li> <li>• Release the rocker to CENTER to STOP the cylinders. The valves on the cylinders will lock them in position.</li> <li>• Press and hold the BOTTOM of the rocker to RETRACT the gantry cylinders (lower gantry).</li> </ul>	 <p>M101933</p> 
<p>15</p>	<p>Crawler Positioning Cylinders Switch</p>	<ul style="list-style-type: none"> <li>• Press and hold the TOP of the rocker to EXTEND the crawler positioning cylinders (extend crawlers).</li> <li>• Release the rocker to CENTER to STOP the cylinders. The valves on the cylinders will lock them in position.</li> <li>• Press and hold the BOTTOM of the rocker to RETRACT the crawler positioning cylinders (retract crawlers).</li> </ul>	 <p>M101933</p>
<p>16</p>	<p>Cigarette Lighter</p>	<ul style="list-style-type: none"> <li>• Push IN to TURN ON the lighter.</li> <li>• The lighter will pop out when the coil is hot.</li> </ul> <p>This receptacle can be used to power other 12VDC devices. The maximum current draw is 15A.</p>	 <p>M101923</p>
<p>17</p>	<p>Horn Switch</p>	<ul style="list-style-type: none"> <li>• Press and hold the TOP of the rocker to TURN ON the horn.</li> <li>• RELEASE the rocker to TURN OFF the horn.</li> </ul> <p>Before swinging or traveling, sound the horn to alert nearby personnel.</p>	 <p>M100164-1</p>
<p>18</p>	<p>Jog Dial</p>	<p>Used in conjunction with the Crane Control System (CCS). See the MLC80A-1, 90A-1, 100A-1, and 100-1 Main Display Operation Manual and the RCL/RCI Operation Manual for more information.</p>	

FOR REFERENCE ONLY

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Overhead Console

Table 3-6. Overhead Console




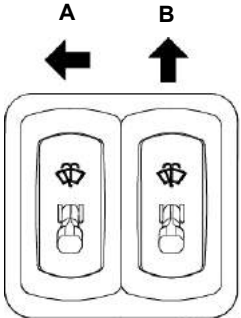
Item	Name	Description
1	Blower Fan Speed Switch	<ul style="list-style-type: none"> <li>• CLOCKWISE faster.</li> <li>• COUNTERCLOCKWISE slower.</li> </ul>
2	Temperature Switch	<ul style="list-style-type: none"> <li>• CLOCKWISE hotter.</li> <li>• COUNTERCLOCKWISE cooler.</li> </ul>
3	HVAC Selector Switch	<ul style="list-style-type: none"> <li>• LEFT end, heater.</li> <li>• RIGHT end, air conditioner.</li> </ul> <p><b>NOTE</b> The shut-off valves in the heater hoses at the engine must be open for heater operation. The shut-off valves can be closed to block hot water flow through the heater core during warm weather.</p>  <p>Cab heater shut-off valve at engine (Qty 2). Shown closed. Turn counterclockwise to open.</p>
4	Outside Air Switch	<ul style="list-style-type: none"> <li>• LEFT end, off.</li> <li>• RIGHT end, on. Draws in and circulates outside air.</li> </ul>
5	Windshield Wiper Switches	<p><b>A</b> = front windshield and <b>B</b> = upper windshield wiper.</p> <ul style="list-style-type: none"> <li>• Toggle fully down = OFF.</li> <li>• Toggle up = INTERMITTENT depending on how far up the toggle is moved.</li> <li>• Toggle fully up = HIGH speed.</li> <li>• Press the TOP END of the switch to SPRAY WASHER FLUID onto the windows.</li> </ul> <p>During cold weather, fill the windshield washer tank with a non-freezing cleaning fluid.</p> 

Table 3-6. Overhead Console



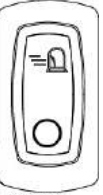

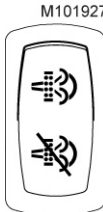
6	Cab Work Lights Switch	<ul style="list-style-type: none"> <li>Press the TOP of the rocker to TURN ON the cab work lights.</li> <li>Press the BOTTOM of the rocker to TURN OFF the cab work lights.</li> </ul> <p>For optional gantry and boom work lights see <a href="#">Work Lights on page 3-57</a>.</p>	 <p>M100166-1</p>
7	Console Switch Back Lights	<ul style="list-style-type: none"> <li>Press the TOP of rocker to TURN ON the console switch back lights.</li> <li>Press the BOTTOM of rocker to TURN OFF the console switch back lights.</li> </ul>	 <p>M100165</p>
8	Boom Position Light	<ul style="list-style-type: none"> <li>Press the TOP of the rocker to TURN ON the boom position light.</li> <li>Press the BOTTOM of the rocker to TURN OFF the boom position light.</li> </ul>	 <p>M105196</p>
9	Camera Lights	<ul style="list-style-type: none"> <li>Press the TOP of the rocker to TURN ON the camera lights.</li> <li>Press the BOTTOM of the rocker to TURN OFF the camera lights.</li> </ul>	 <p>M100166-2</p>
10	Diesel Particulate Filter Regeneration/Inhibit Switch	<p>The regeneration/inhibit switch is a three-position rocker switch. The top position is momentary. The center and bottom positions are maintained. For more information on this switch, see Section 7 of the MLC80A-1, 90A-1, 100A-1, and 100-1 Service Manual.</p> <p><b>Active Position</b></p> <p>The active center position is for normal engine operation. The position does not require operator assistance under normal conditions. This position allows the exhaust system to actively (automatically) regenerate.</p> <p>Continued on next page.</p>	 <p>M101927</p>

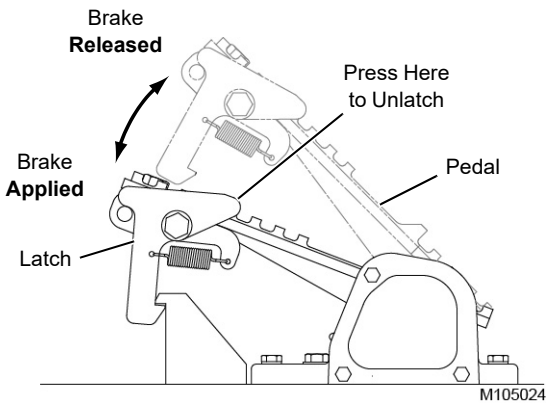
Table 3-6. Overhead Console

10	Diesel Particulate Filter Regeneration/Inhibit Switch (continued)	<p><b>Manual Regeneration</b></p> <p>If the Engine Information Screen in the Main Display indicates the exhaust system requires a manual regeneration, press and release the top of the rocker. The engine ECM will control a regeneration cycle.</p> <p>The top of the rocker switch is momentary and the switch will return to the active position after the top of the switch is pressed.</p> <p>A manual regeneration will begin only if the engine is at low idle.</p> <p><b>NOTE</b> The top end of the switch has a guard that prevents accidental manual regeneration.</p> <p>The High Exhaust System Temperature (HEST) lamp may come on during regeneration and remain on for a short time after regeneration.</p> <p><b>Regeneration Inhibit</b></p> <p>To prevent the exhaust system active (automatic) regeneration, press the bottom of the rocker. The switch will remain depressed. The amber LED in the rocker will glow. To re-enable active regeneration, manually return the switch to the active position.</p> <p>Do not use the Inhibit switch unless specifically instructed by Manitowoc Crane Care or a Cummins' technical advisor.</p> <p>The exhaust system regen inhibited icon indicates the after-treatment system active (automatic) regeneration is prevented because the inhibit switch is in the inhibit position.</p> <p>For information on exhaust system-related faults, see the MLC80A-1, 90A-1, 100A-1, and 100-1 Main Display Operation Manual.</p> <p>See engine manufacturer's operation and maintenance manual for information on the after-treatment system and engine faults.</p>
11	Dome Light	PRESS the lens to turn the light ON and OFF.



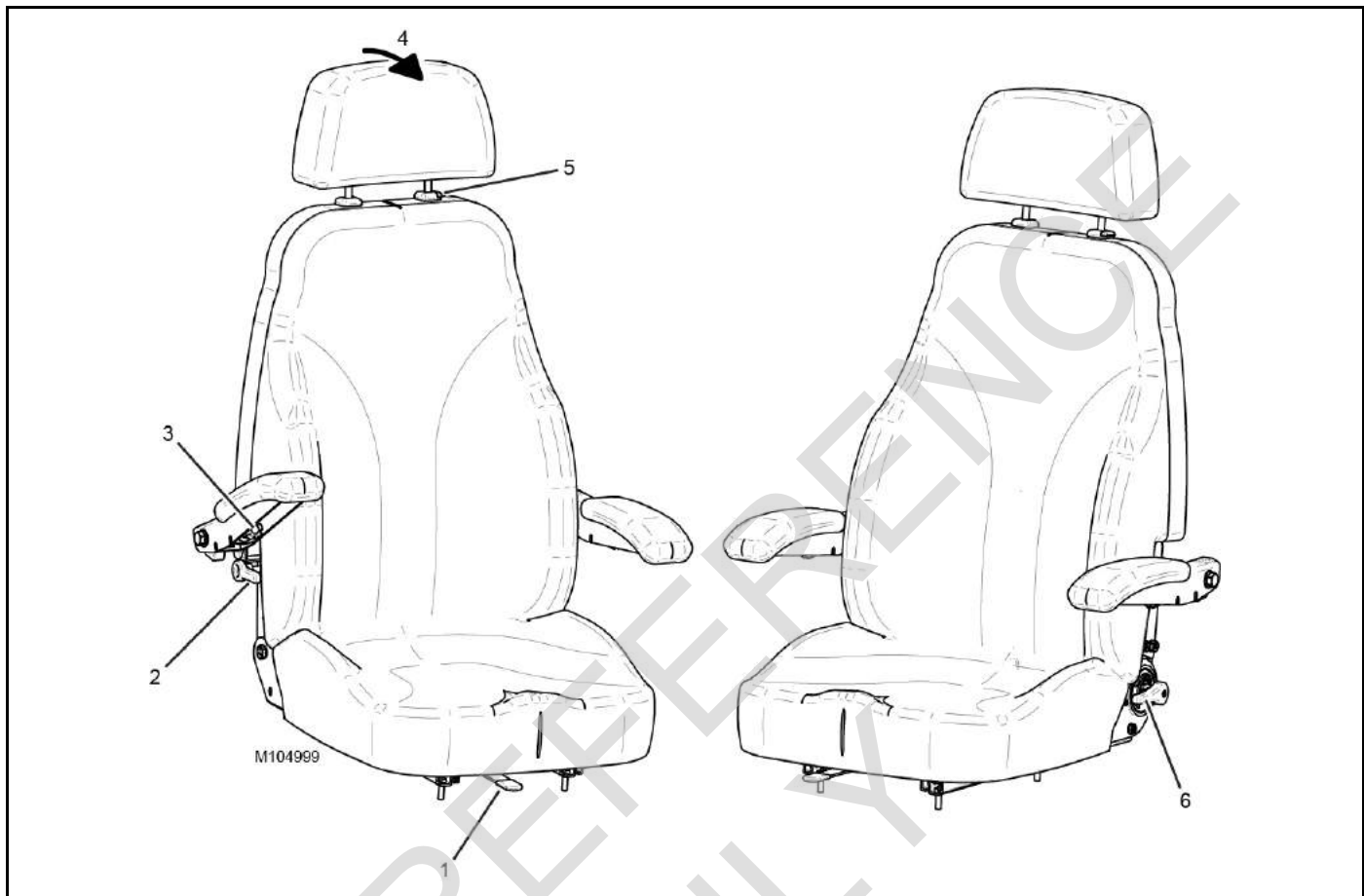
### Foot Pedals

Table 3-7. Foot Pedals

Item	Name	Description
1	Engine Foot Throttle	<ul style="list-style-type: none"> <li>• Press <b>DOWN</b> on the foot throttle to <b>INCREASE</b> engine speed above the hand throttle setting.</li> <li>• <b>RELEASE</b> the foot throttle to <b>DECREASE</b> engine speed to idle or to the hand throttle setting.</li> </ul>
2 3	Drum 1 Free Fall Brake Pedal Drum 2 Free Fall Brake Pedal	<p>Each free fall equipped drum has a spring-applied, hydraulically-released free fall brake controlled by a brake pedal. When free falling a load, the free fall brake can be applied at any time to slow down and stop the load.</p> <p>The brake pedals have no function and are inoperable when operating with free off.</p> <ul style="list-style-type: none"> <li>• Depress to apply the free fall brake in relation to pedal movement. Fully depress and latch the pedal to fully apply the brake.</li> <li>• Depress the heel of the latch to unlatch the pedal and then release the pedal (ease up) to release the free fall brake gradually as the pedal rises.</li> </ul>  <p style="text-align: right; font-size: small;">M105024</p>

## Seat Controls

Table 3-8. Seat Controls



Item	Name	Description
1	Fore-Aft Control Lever	<ul style="list-style-type: none"> <li>• Push to the LEFT to UNLOCK the seat.</li> <li>• Use your body weight to slide the seat to the desired position.</li> <li>• RELEASE the lever and ensure that it is latched to LOCK the seat in position.</li> </ul>
2	Lumbar Adjustment Lever	Rotate up or down to adjust the lumbar support in or out.
3	Armrest Adjustment Knob	<ul style="list-style-type: none"> <li>• Rotate CLOCKWISE to RAISE the armrest.</li> <li>• Rotate COUNTERCLOCKWISE to LOWER the armrest.</li> </ul>
4	Headrest Position	Pull or push to position the headrest at 1 of 3 detents between 0 to 30°.
5	Headrest Adjustment Button	<ul style="list-style-type: none"> <li>• Depress and move the headrest up or down.</li> <li>• Make sure the button is latched to lock the headrest in the desired position.</li> </ul>
6	Backrest Adjustment Handle	<ul style="list-style-type: none"> <li>• Rotate up to adjust the backrest.</li> <li>• Release to lock the backrest in the desired position.</li> </ul>
7	Seat Switch (not shown)	<p>Prevents the crane from being operated until the operator is seated.</p> <p>When the operator is out of the seat, all control handles are inoperable, all brakes are applied, and travel cruise is turned off.</p> <p><b>When the Lifterane Boom Butt Capacities Chart selected in the RCL/RCI Display, the boom hoist function is operable.</b></p>

## Other Operation Aids

### Boom Angle Indicator

The boom angle indicator (Figure 3-2) is located on the boom butt and is visible through the right side cab window. The indicator shows the angle of the boom in degrees above horizontal.

**NOTE** The boom angle can also be viewed in the RCL/RCI Display or in the Main Display.

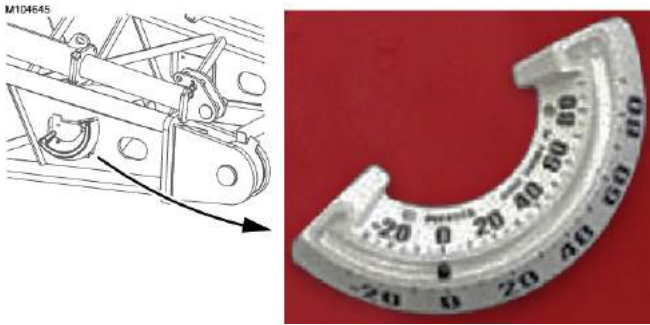


Figure 3-2. Boom Angle Indicator

### **!** WARNING Overload Hazard

Use the boom angle indicator only as a guide to position the boom near the angle corresponding to the radius for a given load.

In all cases, radius shall govern the capacity. Exceeding the radius given in the capacity chart can result in tipping or structural damage.

### Crane Capacity Beacon (Optional)

The purpose of the crane capacity beacon is to alert personnel in the vicinity of the crane to the degree at which the crane is operating within its rated capacity:

- Green Beacon ON = Crane's rated capacity is at a safe level.
- Amber Beacon ON = Crane's rated capacity is approaching the maximum level.
- Red Beacon ON = Crane's rated capacity has been exceeded.

The beacon colors correspond to the colors shown in the rated capacity bar or triangle in the RCL/RCI Display.

### Crane Level

The level indicates crane levelness from front to rear and from side to side.

Level is indicated when the bubble is centered in the circle. One degree out of level is indicated when the bubble is touching the outside edge of the circle.

### **!** WARNING

#### Crane Tipping Hazard

Unless otherwise specified on the capacity chart, perform all crane operations with the crane level to within one percent of grade in all directions — 0,3 m in 30 m (1 ft in 100 ft); otherwise, the crane could tip.

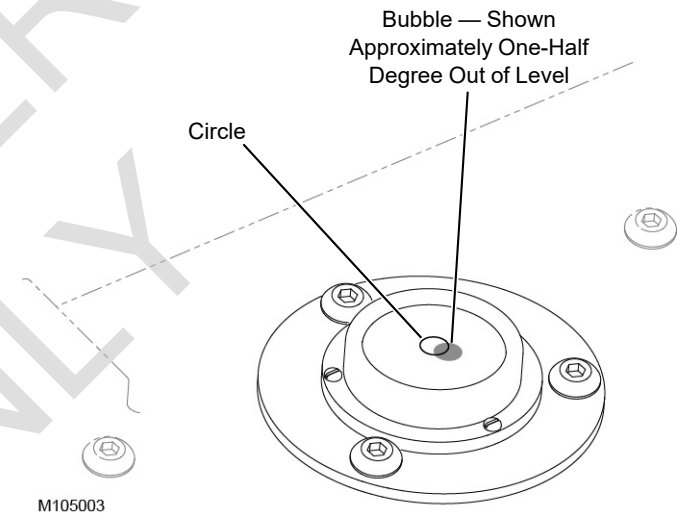


Figure 3-3. Level

**NOTE** Optionally, crane pitch, roll, and levelness can be monitored in the Crane Position Bar of the Main Display Working Screen. See Main Display Operation Manual for instructions.

### Swing and Travel Alarm

The swing and travel alarm is mounted on the front of the rotating bed. It is a dual-tone, interrupted alarm that sounds when the swing or either travel control handle is moved in either direction from off. The alarm turns off when the control handles are moved to off.

**Battery Disconnect Switch****CAUTION****Engine Damage!**

To avoid possible engine fault codes and undesirable operation, make sure the engine ignition switch has been off five minutes before disconnecting the batteries.

Do not rely on this switch to protect the crane's electronic systems when welding. Disconnect the cables at the batteries before welding.

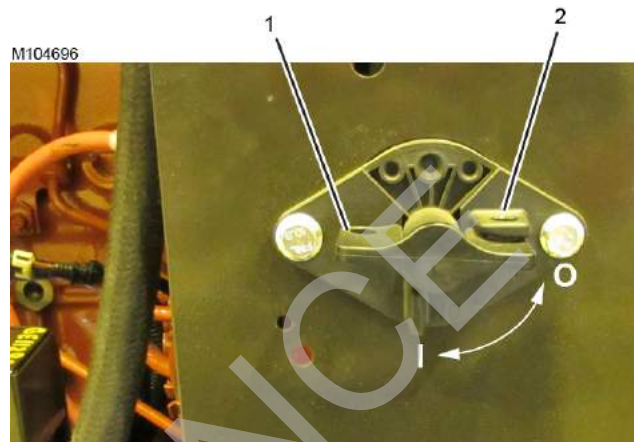
See [Figure 3-4](#).

Turn the knob **CLOCKWISE** to **CONNECT (I)** the battery circuit.

Turn the knob **COUNTERCLOCKWISE** to **DISCONNECT (O)** the battery circuit for the following reasons:

- When servicing the crane's electrical control system.
- If desired, to prevent the batteries from discharging when the crane is stored for extended periods of time.
- If desired, to prevent the crane from being started by unauthorized personnel.

The disconnect switch can be padlocked to prevent unauthorized use.



Right Side Enclosure

Item	Description
1	Battery Disconnect Switch
2	Padlock Holes
I	Connect Batteries.
O	Disconnect Batteries

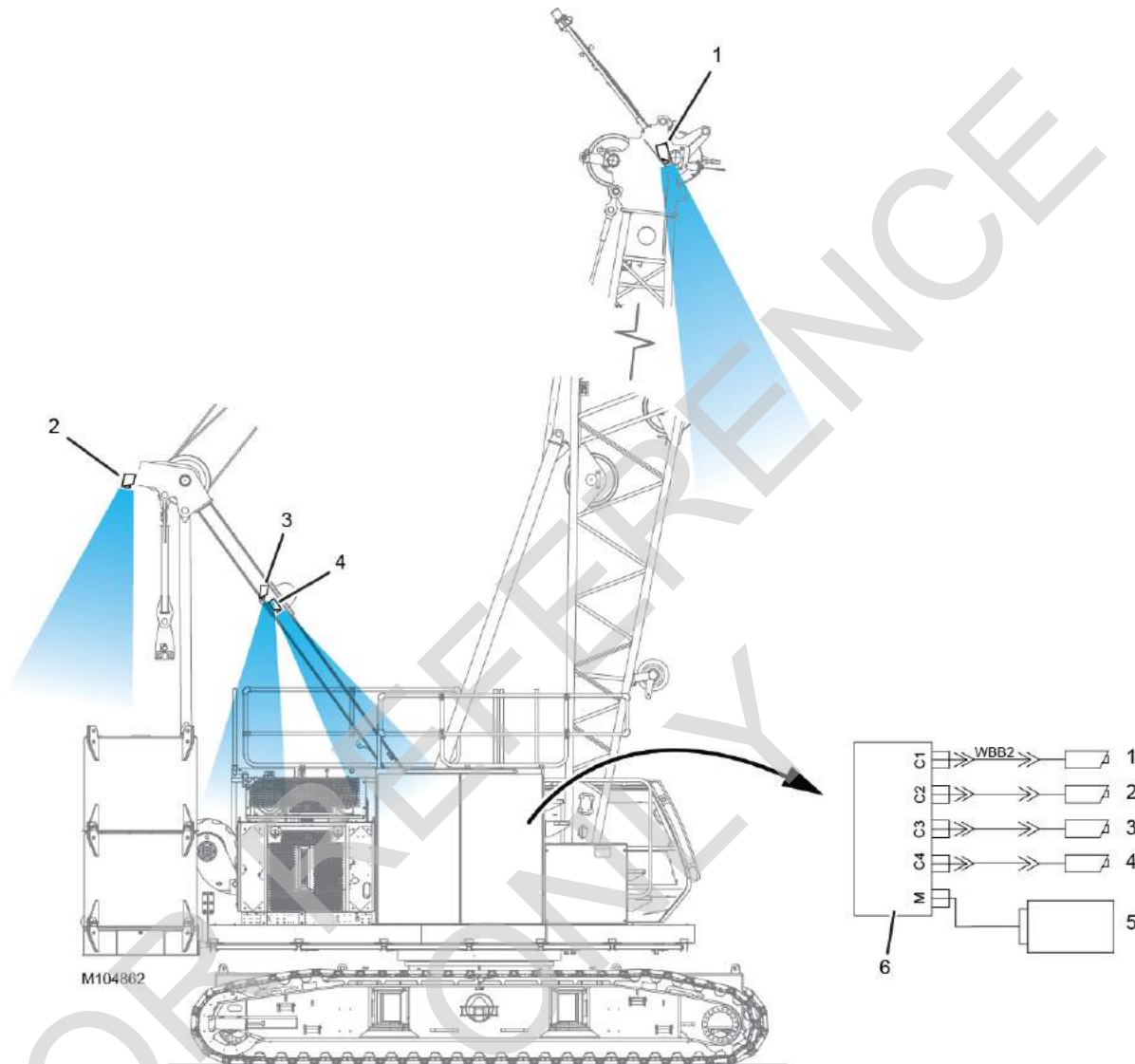
**Figure 3-4. Battery Disconnect Switch**

FOR REFERENCE ONLY

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Crane Cameras

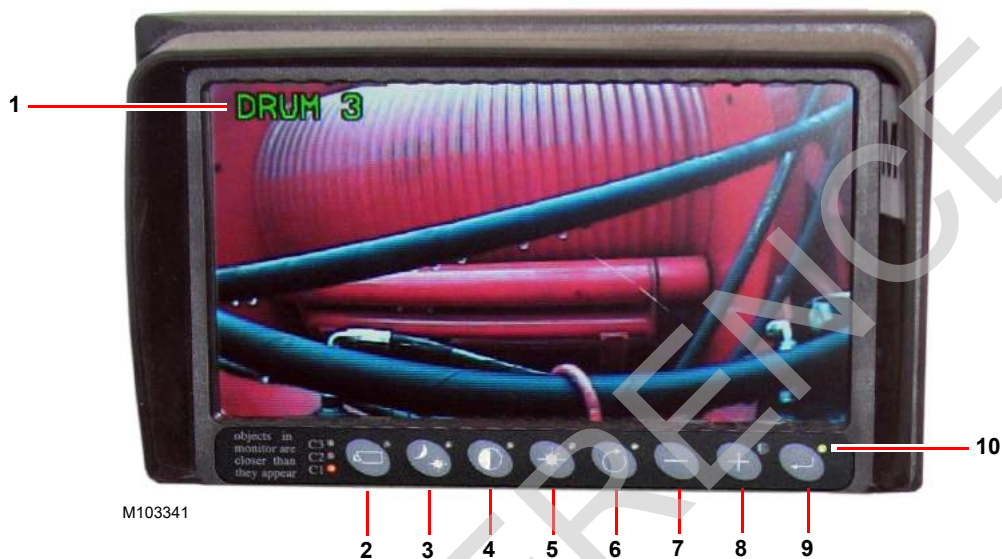
Table 3-9. Crane Camera Locations



Item	Name
1	Camera Points at LOAD from boom point or from jib point
2	Camera Points to REAR (tail swing)
3	Camera Points at DRUM 3/4
4	Camera Points at DRUM 1/2
5	Monitor in Cab (see <a href="#">Table 3-10 on page 3-31</a> )
6	Camera Switcher (in left front enclosure)

## Crane Camera Monitor

Table 3-10. Camera Monitor Operating Controls

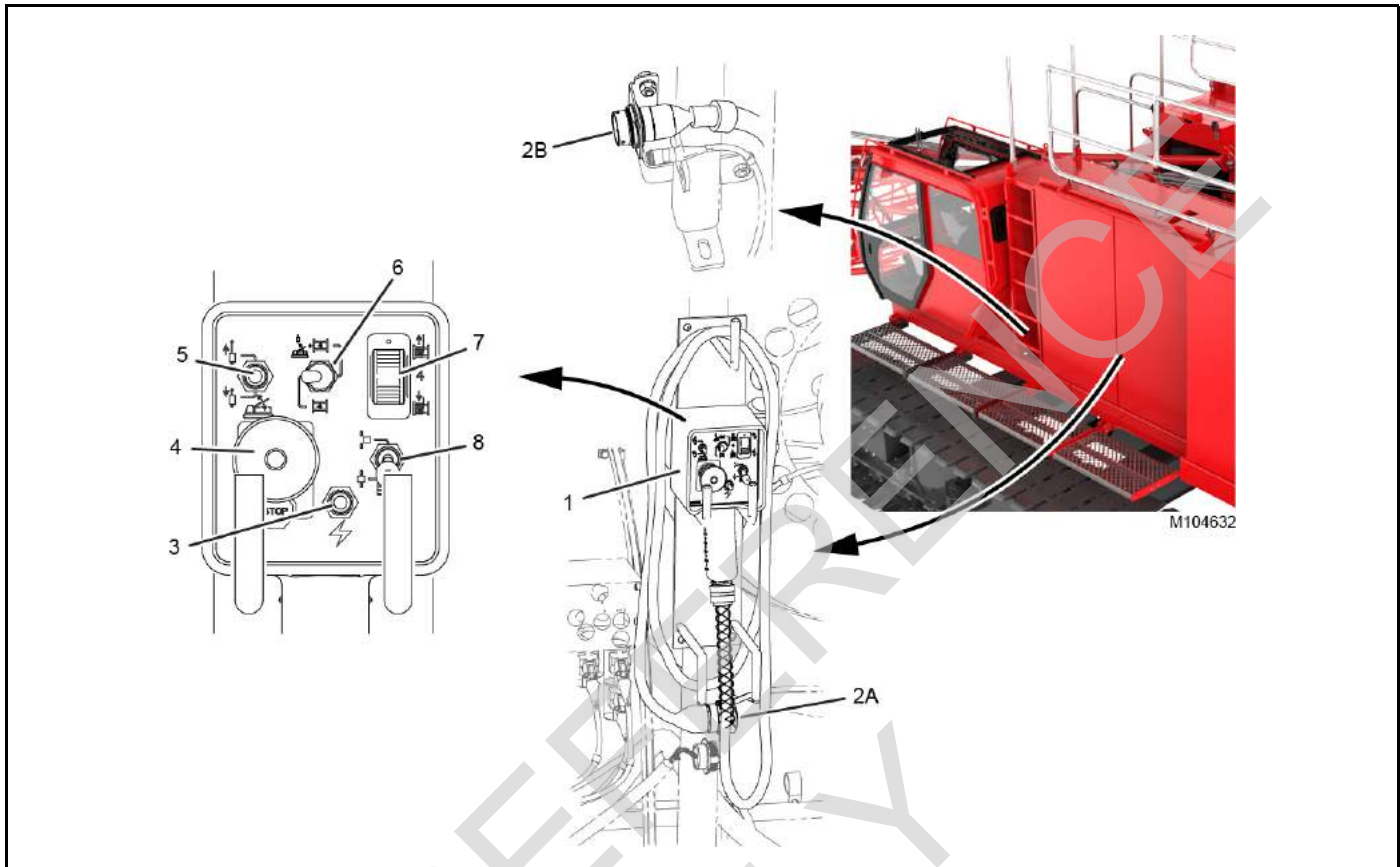


**NOTE** For detailed information about the camera monitors, refer to the camera manual that is supplied with the crane.

Item	Name	Description
1	Camera label	To change the label ("DRUM 3" in this case), refer to the vendor manual.
2	CAMERA button	After pressing CAMERA, use PLUS or MINUS to select the desired camera.
3	AUTOMATIC BRIGHTNESS button	Press AUTOMATIC BRIGHTNESS. The monitor brightness will adjust automatically to changing light conditions.
4	CONTRAST button	After pressing CONTRAST, use PLUS and MINUS to adjust the monitor contrast.
5	BRIGHTNESS button	After pressing BRIGHTNESS, use PLUS and MINUS to adjust the monitor brightness.
6	OPTION button	Used to go to a previous menu item. Press button for 3 seconds to exit menu screens.
7	MINUS button	After pressing BRIGHTNESS, <i>decreases</i> the monitor brightness. After pressing CONTRAST, <i>decreases</i> the monitor contrast. In the Operator Menu, go to the <i>previous</i> menu option.
8	PLUS button	After pressing BRIGHTNESS, <i>increases</i> the monitor brightness. After pressing CONTRAST, <i>increases</i> the monitor contrast. In the Operator Menu, go to the <i>next</i> menu option.
9	ENTER button	Press once to enter the monitor Operator Menu.
10	Power LED	Glows green when the monitor is powered.

## REMOTE CONTROL

Table 3-11. Remote Control Identification and Operation



To operate the remote control (1):

- The electric cable (2A) must be connected to the receptacle (2B) in the left enclosure.
- The Boom Butt Configuration must be selected in the RCL/RCI Display.
- The remote control must be turned on in the Main Display.

See Section 4 of this manual for Assembly and Disassembly procedures using the remote control (1).

Item	Name	Description
3	Power Toggle	<ul style="list-style-type: none"> <li>• Push UP and hold to turn ON power to the hand-held remote control.</li> <li>• RELEASE to turn OFF power to the hand-held remote control.</li> </ul>
4	Emergency Stop Button	<ul style="list-style-type: none"> <li>• Press to stop the engine and all remote control functions.</li> <li>• Pull up to restart the engine.</li> </ul> <p><b>Only use this button in an emergency because the engine will stop and any function being used will come to an abrupt stop.</b></p> <p>In normal situations, use the ignition switch to stop the engine.</p>
5	Gantry Cylinders Switch	<ul style="list-style-type: none"> <li>• Push UP and hold to EXTEND the gantry cylinders (raise gantry).</li> <li>• RELEASE to STOP the cylinders. The valves on the cylinders will lock them in position.</li> <li>• Push DOWN and hold to RETRACT the gantry cylinders (lower gantry).</li> </ul>






Table 3-11. Remote Control Identification and Operation









6	Sync Switch	<p>This switch allows the gantry raising cylinders to extend and retract automatically in conjunction with the boom hoist when using the Drum 4 (boom hoist) thumb-wheel control (item 5 on remote control).</p> <ul style="list-style-type: none"> <li>• Push RIGHT to SYNC (synchronize) operation of the gantry cylinders and the boom hoist.</li> </ul> <p>Use this position for counterweight installation and removal. This will allow the gantry cylinders to follow along with the gantry as the boom hoist controls gantry raising and lowering.</p> <ul style="list-style-type: none"> <li>• Push LEFT to turn OFF SYNC. The gantry raising cylinders and the boom hoist are controlled independently of each other.</li> </ul> <p>Use this position for all other operations.</p> <p>Refer to Section 4 of the MLC80A-1, 90A-1, 100A-1, or 100-1 Operator Manual for detailed instructions on:</p> <ul style="list-style-type: none"> <li>• Gantry raising and lowering</li> <li>• Counterweight Installation and removal</li> </ul>
7	Drum 4 (boom hoist) Thumb-Wheel Control	<ul style="list-style-type: none"> <li>• Rotate UP to PAY OUT Drum 4 wire rope. Speed is in relation to control movement.</li> <li>• RELEASE to center to STOP Drum 4. The drum brake applies to stop and hold the drum in position.</li> <li>• Rotate DOWN to HAUL IN Drum 4 wire rope. Speed is in relation to control movement.</li> </ul>
8	Counterweight Pins Switch	<ul style="list-style-type: none"> <li>• Pull OUT to UNLOCK the switch.</li> <li>• Push UP and hold to DISENGAGE the counterweight pins.</li> <li>• RELEASE (spring returns down) to ENGAGE the counterweight pins and lock the switch.</li> </ul>



## OPERATING LIMITS IDENTIFICATION

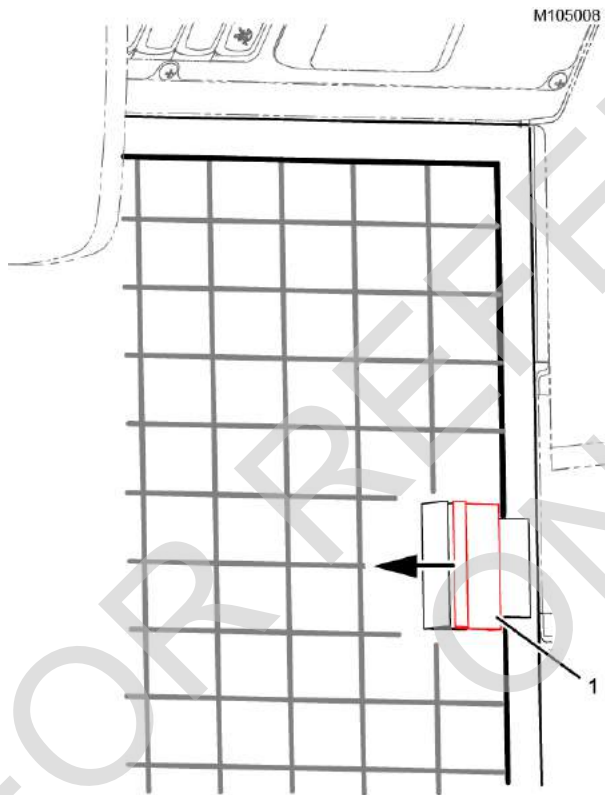
The following table lists the operating limits this crane is equipped with and identifies which of those limits are bypassable. When a limit is reached, the operating limit fault is activated and the corresponding fault icon appears in the fault bar of the Main Display Working Screen.

**Table 3-12. Operating Limits Description**

Operating Limit	Icon
<p><b>Bail, Minimum</b></p> <p>This limit stops the corresponding drum from lowering when there are three to four wraps of wire rope remaining on the drum.</p> <ul style="list-style-type: none"> <li>The load can be raised after the limit is contacted.</li> <li>This limit can only be bypassed by disconnecting the electric cable from the limit switch and connecting the shorting plug to the cable end.</li> </ul> <p style="text-align: center;"><b>! WARNING</b> <b>Falling Load Hazard!</b></p> <p>When lowering a load below the minimum bail limit, do so slowly with extreme caution. Do not lower the load to the point where less than three full wraps of wire rope are on the drum. The wire rope could be pulled out of the drum allowing the load to fall.</p>	 <p>M102775</p>
<p><b>Block Up</b></p> <p>This limit stops the boom from lowering and the load drum from hoisting when the load contacts a block-up limit switch.</p> <ul style="list-style-type: none"> <li>The load on the corresponding drum can be lowered and the boom can be raised after a block-up limit switch is contacted.</li> <li>This limit can be bypassed using the limit bypass switch on the right console.</li> </ul> <p style="text-align: center;"><b>! WARNING</b> <b>Two-Blocking Hazard!</b></p> <p>If it is necessary to hoist a load above the block-up limit, do so slowly with extreme caution to prevent two-blocking.</p> <p>Do not hoist the load above the minimum block clearance given in the Reeving Diagrams in Section 4 of this manual (MLC80A-1, 90A-1, 100A-1, 100-1 Operator Manual).</p> <p>Do not use the limit bypass switch to lower the boom after the block-up limit is contacted, or two-blocking could occur. The load could fall.</p> <p style="text-align: center;"><b>CAUTION</b> <b>Avoid Boom Damage!</b></p> <p>When operating at high boom angles and high load block heights, maintain adequate clearance between the load block and the boom top. If this precaution is not observed, the load block can contact the boom top resulting in damage to the boom top.</p>	 <p>M102773</p>
<p><b>Boom Max Up</b></p> <p>This limit stops the boom when it is raised to 82°.</p> <p>This limit is not bypassable. The boom can be lowered after this limit is reached.</p>	 <p>M102777</p>

Operating Limit	Icon
<p><b>Counterweight Too High</b></p> <p>This limit stops Drum 4 if the crane counterweight is raised to high during crane setup. See Section 4 in this manual (MLC80A-1, 90A-1, 100A-1, and 100-1 Operator Manual) for counterweight installation instructions. This limit cannot be bypassed.</p>	 <p>M104647</p>
<p><b>Free Fall Lowering Over Speed</b></p> <p>This limit does not stop operation. It alerts the operator if the load on either Drum 1 or 2 is being lowered faster than 300 rpm, which can result in accelerated wear and shortened service life of the free fall brake.</p>	 <p>M104600</p>
<p><b>Function Parked</b></p> <p>This limit prevents the selected crane function from being operated until the park switch is turned off (un-parked). This limit cannot be bypassed.</p>	<p>M102772</p>  <p>M104949</p> 
<p><b>Operator Out of Seat</b></p> <p>This limit prevents the crane functions from being operated when the operator is out of the seat. Sit down in the seat to operate the crane functions. This limit cannot be bypassed.</p>	 <p>M102790</p>
<p><b>Pawl Engaged</b></p> <p>This limit prevents the corresponding drum from lowering until the pawl is disengaged from the ratchet. It may be necessary to hoist slightly to fully disengage the pawl. This limit cannot be bypassed.</p>	 <p>M102794</p>
<p><b>Rated Capacity Limiter</b></p> <p>This fault is activated for the following conditions. Take immediate corrective action.</p> <ul style="list-style-type: none"> <li>• Overload</li> <li>• Sensor fault</li> <li>• Out of the capacity chart (a condition that is not covered by the current capacity chart)</li> <li>• Unconfirmed or invalid RCL/RCI configuration.</li> </ul> <p>This limit cannot be bypassed.</p>	 <p>M102787</p>
<p><b>Speed Sensor Fault</b></p> <p>Does not stop operation. Alerts the operator if a drum speed sensor is not detecting drum rotation. Diagnose the speed sensor failure and replace the sensor or the harness as needed.</p>	 <p>M104967</p>

Operating Limit	Icon
<p><b>WRL (working range limit) Boom/Luffing Jib Angle</b></p> <ul style="list-style-type: none"> <li>• Operate boom/jib in opposite direction.</li> <li>• Change angle (see the Main Display Operation Manual).</li> <li>• Turn limit off, if desired.</li> </ul>	 <p>M104538</p>
<p><b>WRL Swing Angle</b></p> <ul style="list-style-type: none"> <li>• Operate swing in opposite direction.</li> <li>• Change angle (see the Main Display Operation Manual).</li> <li>• Turn limit off, if desired.</li> </ul>	 <p>M104539</p>



Item	Description
1	Latch (right-side and roof window)

Figure 3-5. Cab Windows

## CAB WINDOW OPERATION

See [Figure 3-5](#).

### Opening Windows for Ventilation

The right-side and roof windows can be opened for ventilation as shown.

For non-European cabs only, the roof window can be opened for ventilation in the same manner as the right-side window.

For European cabs, the roof window that cannot be opened.

### Exiting Cab in Emergency

If you cannot exit the cab through the sliding door, proceed as follows:

While seated in the cab seat, kick out the front window and exit the cab through the opening. The front window is attached to the cab frame with offset rubber molding that allows the window to be kicked out.

## OPERATING IN WIND

Wind adversely affects lifting capacity and stability. The result could be loss of control over the load and crane, even if the load is within the crane's capacity.

Do not raise the boom for the purpose of measuring the wind speed with the crane's anemometer.

---

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

The judgment and experience of qualified operators, job planners, and supervisors shall be used to compensate for the affect of wind on the lifted load and the boom by reducing ratings or operating speeds, or a combination of both.

Failing to observe this precaution can cause the crane to tip or the boom and/or jib to collapse. Death or serious injury to personnel can result.

---

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

The wind speed at the boom or jib point can be greater than the wind speed at ground level. Also be aware that the larger the sail area of the load, the greater the wind's affect on the load.

As a general rule, ratings and operating speeds must be reduced when the **wind causes load to swing forward past allowable operating radius or sideways past either boom hinge pin.**

For wind conditions specific to this crane, see the Wind Conditions chart at the end of this section or, if applicable, see the wind conditions in the capacity charts provided with the crane and attachment.

## CRAWLER BLOCKING

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

Do not attempt to raise or lower the boom or the boom and jib from or to ground level until the crawlers are blocked, if required. Otherwise, the crane will tip.

---

To prevent the crane from tipping, some boom and jib lengths require blocked crawlers. See the appropriate Liftcrane Boom or Jib Capacities chart for blocked crawler requirements.

For crawler blocking dimensions and instructions, see the Crawler Blocking topic in the Capacity Chart Information folio located in the Capacity Chart Manual supplied with the crane.

## PREPARING CRANE FOR OPERATION



### WARNING

#### Read Capacity Charts

Do not attempt to operate the crane without first reading and understanding the capacity charts located in the Capacity Chart Manual provided with the crane.

The crane must be rigged and operated according to the instructions given in the capacity charts and in Section 4 of the MLC80A-1, 90A-1, 100A-1, and 100-1 Operator Manual.

Unless otherwise specified in the capacity charts, all crane operations must be performed with the crane level to within one 1% of grade in all directions — 0,3 m in 30 m (1 ft in 100 ft); otherwise, crane could tip.

Do not operate the crane—including raising the boom from ground level—if the wind speed exceeds the limits given in the capacity charts. Contact your local weather station for the wind velocity in your area.

Failing to comply with the requirements of the capacity charts can result in tipping or structural failure of the boom or jib.

#### Equipment Failure Hazard

At low ambient temperatures, dynamic loads (impact and shock) can affect the steels used in Manitowoc cranes when operating in cold weather. Read and comply with [Cold Weather Operation on page 3-55](#) before operating the crane.



### WARNING

#### Moving Load Hazard

The operator shall select the proper crane capacity chart in the RCL/RCI Display before operating.

Unexpected drum motion or improper limit responses can result if the wrong capacity chart is selected.

The limit bypass switch shall be in the enable position (on) and all the limits with which the crane is equipped shall be operational before operating the crane.

#### Avoid Injuring Personnel in Operating Area

Sound the horn to alert personnel that operation is about to begin.



### WARNING

#### Moving Machinery Hazard

To avoid injuring personnel or damaging the crane and property:

- Do not start the engine if an out-of-order sign or do not operate tag is present at the start controls.
- Check that all controls are off and parked so the crane and load do not move when the engine is started.
- Check that all personnel are clear of the crane before starting the engine. **Sound horn to alert personnel.**

#### Engine Explosion Hazard

Do not use starting fluids with this crane's engine. The engine is equipped with an air intake heater. Use of starting fluid can cause an explosion, fire, personal injury, severe damage to the engine and damage to property.

### CAUTION

#### Machinery Damage Hazard

Before operating the crane at the start of each shift:

- Perform the preventative maintenance checks and lubrication requirements listed in Sections 5 and 6 of the this manual (MLC80A-1, 90A-1, 100A-1, and 100-1 Operator Manual).
- Adjust the operator's seat. See [Seat Controls on page 3-26](#).

## STARTUP PROCEDURES

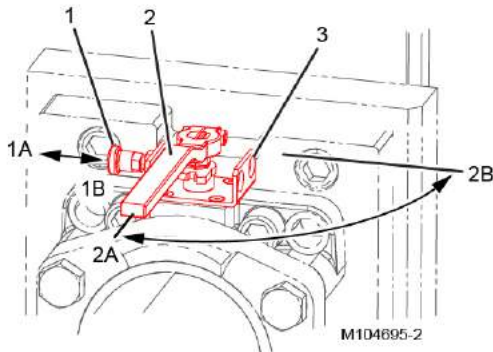
Read and understand the starting instructions in the engine manufacturer's operation and maintenance manual provided with this crane.

1. If used, unplug or turn off the engine block heater, engine oil pan heater, hydraulic tank heaters, and any other crane heaters.

**NOTE** Manitowoc recommends the use of the Cold Weather Package to aid startup when the ambient temperature will be 0°C (32°F) and below. See [Cold Weather Heaters on page 3-59](#).

2. Make sure the battery disconnect switch is in the I (on) position. The engine will not start if the batteries are disconnected. See [Battery Disconnect Switch on page 3-28](#).

Right Side Enclosure at Rear of Hydraulic Tank



Item	Description
1	Locking Knob
1A	Unlock
1B	Lock
2	Shut-Off Valve
2A	Open
2B	Close
3	Padlock Holes (for owner furnished padlock)

Figure 3-6. Hydraulic Tank Shut-Off Valve

### CAUTION Engine Damage!

To avoid possible engine fault codes and undesirable operation, make sure the engine ignition switch has been off five minutes before disconnecting the batteries.

Do not rely on this switch to protect the crane's electronic systems when welding. Disconnect the cables at the batteries before welding

3. Make sure the emergency stop button on the right console and on the setup remote control is UP. The engine will not start if either button is depressed (see [Emergency Stop Button on page 3-15](#)).
4. Make sure the hydraulic tank shutoff valve is open as shown in [Figure 3-6](#).

### CAUTION Pump Damage

Do not start the engine until the hydraulic tank shutoff valve is open. Otherwise, the pumps could cavitate and be damaged.

5. Make sure all crane functions are parked.  
The crane is equipped with a hydraulic oil warm-up circuit. The warm-up circuit is activated only if all crane functions are parked. The warm-up circuit stays on until the hydraulic oil temperature reaches 18.3°C (65°F).  
If a function is unparked, the warm-up circuit will deactivate and remain deactivated until all functions are again parked and the hydraulic oil temperature drops below 15.6°C (60°F).

6. Turn the ignition switch to the RUN position.

- The indicator lights on the RCL/RCL and Main Displays, the operating limit buzzer, and the system fault beeper should come on for 2 to 3 seconds when the ignition switch is in the RUN position; if not, correct the fault as soon as possible.
- The *WAIT TO START* icon will appear in the Crane Operation Status Bar of the Main Display indicating that the pre-heater is warming the engine's air intake.



The length of time the wait to start icon remains on depends on ambient temperature. The lower the ambient temperature, the longer the icon will stay on.

7. When the *WAIT TO START* icon turns off, turn the ignition switch to the START position.

### CAUTION Avoid Starter Damage

If the engine does not start after 30 seconds of cranking, wait a few minutes before starting again so the starter motor cools.

8. Once the engine starts, increase engine speed as necessary to keep the engine running.

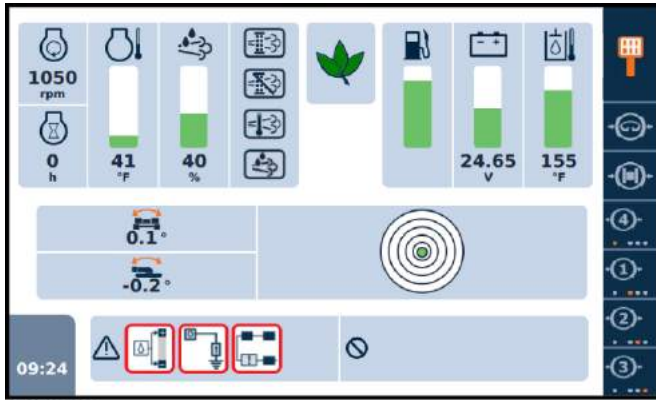
**NOTE** You will not be able to increase engine speed until the hydraulic oil temperature is warmed to at least 17°C (63°F).

The hydraulic oil temperature fault will remain on until the hydraulic oil temperature is 17°C (63°F). **There will be no throttle response until this fault is cleared.**



9. Once the engine starts, the following will occur:
- The Working Screen shown in [Figure 3-7](#) will appear in the Main Display.

See the Main Display Operation Manual for detailed instructions on what is displayed in the Working Screen.

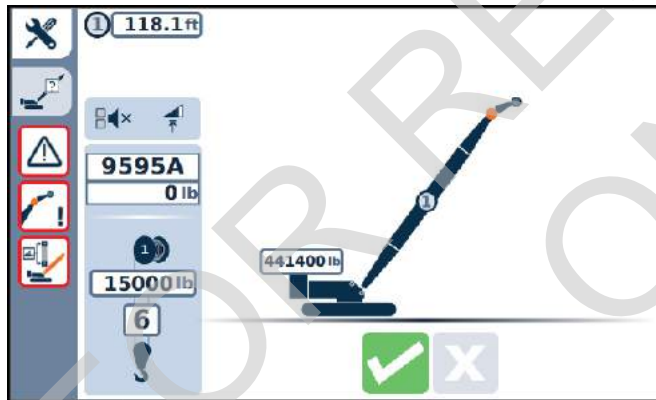


M105064-1B

**Figure 3-7. Main Display Working Screen**

- The Confirmation Screen will appear in the RCL/RCI Display. You must either confirm the current configuration or select a new configuration.

See the RCL/RCI Operation Manual for detailed instructions.



M104859

**Figure 3-8. RCL/RCI Confirmation Screen**

10. Once the engine starts, it is normal for faults to appear in the Alerts Bar of the Main Display Working Screen. The

faults should go away as soon as the engine oil pressure and the hydraulic oil temperature rise to normal.

See the MLC80A-1, 90A-1, 100A-1, and 100-1 Main Display Operation Manual for fault identification,

**CAUTION**

**Machinery Damage**

Do not operate the crane while faults exist. If the faults do not go away soon after the engine is started, or if any faults come on during operation, immediately proceed as follows:

- Determine fault in the Main Display Working Screen
- Land loads, if possible, and park all functions
- Move all control handles to off
- Stop engine
- Correct cause of fault



**WARNING**

**Falling Load Hazard!**

Faulty drum operation and possible uncontrolled lowering of the loads can occur if the following step is not performed.

11. **Warm up the drum circuits during cold weather.** To ensure proper operation of the drums after cold weather startup, slowly operate them in both directions (up and down) several times to flush the control circuits with warm oil.

12. If equipped/required, turn on the work lights. See [AC Power Supply on page 3-57](#).

**OPERATING PROCEDURES**

**NOTE** The following operating procedures assume the following:

- Engine is already running.
- The correct capacity chart and crane configuration have been selected in the RCL/RCI Display. For detailed instructions, see the MLC80A-1, 90A-1, 100A-1, and 100-1 RCL/RCI Operation Manual.



## Boom Hoist Operation

### CAUTION

#### Avoid Rigging Damage

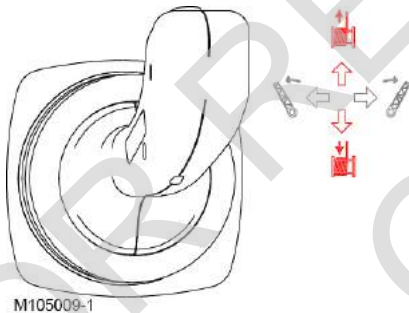
Check that the boom hoist wire rope is reeved through all sheaves and spooled properly onto Drum 4 before raising the boom from the ground.

- For wire rope and reeving specifications, see the Boom Assembly Drawing in Section 4 of the MLC80A-1, 90A-1, 100A-1, and 100-1 Operator Manual.
- For instructions on attaching the wire rope to boom hoist drum, see the Wire Rope Installation topic in Section 4 of the MLC80A-1, 90A-1, 100A-1, and 100-1 Operator Manual.

#### Avoid Boom Damage

When operating at high boom angles and high load block heights, maintain adequate clearance between the load block and the boom top. If this precaution is not observed, the load block can contact the boom top resulting in damage to the boom top.

**NOTE** The location of the boom hoist control handle can vary depending on whether or not the crane is equipped with a luffing jib. For Drum and Control Handle Identification, see [Figure 3-1 on page 17](#).



**Figure 3-9. Boom Control Handle**

1. Adjust boom hoist speed to meet operator needs.  
Speed can be adjusted between 25% and 100%. See the Speed and Torque Setting Screen topic in the Main Display Operation Manual for detailed instructions.
2. Make sure the automatic boom stop is set at the proper angle (82°). For detailed instructions, see the Automatic Boom Stop Adjustment topic in Section 4 of the Service Manual.

3. Turn off the boom hoist park switch. It may be necessary to raise the boom slightly to disengage the boom hoist pawl.

The Pawl Engaged fault will come on if the pawl is engaged when you attempt to lower the boom.

### CAUTION

#### Avoid Boom Damage

Do not turn on the drum park switch while raising or lowering the boom. The brake will bring the boom to an abrupt stop. This action could cause shock load damage to the boom and load line. Bring the boom to a smooth stop with the control handle and then turn on the drum park switch.

4. Increase the engine speed to the desired RPM with the hand throttle. Press the foot throttle to momentarily increase the engine speed when more power is required.
5. Pull the boom control handle BACK from off to RAISE the boom or push the boom control handle FORWARD from off to LOWER the boom.

The boom hoist brake will release and speed will increase/decrease in relation to control handle movement.



### WARNING

#### Avoid Two-Blocking Hazard

Pay out the load lines while lowering the boom. The load may contact the boom point or jib point sheaves if this step is not taken. The wire rope or other parts could break, allowing the load to fall.

6. As the boom nears the desired angle, slowly move the boom control handle toward off to decrease speed.  
Then, move the control handle to off to stop the boom when it reaches the desired angle. The boom hoist brake will apply to hold the boom in position.
7. To hold the boom in position for long periods, turn park the boom hoist. The boom hoist pawl will engage.
8. Besides the boom maximum up limit of 82°, a physical boom stop is provided. The physical boom stop cushions boom raising between approximately 59° and the maximum boom angle. The boom stop also provides a physical stop at 84°.

## Swing Operation

### WARNING

#### Tipping Hazard

To prevent the crane from tipping, adhere to any swing limitations given in the capacity chart.

### DANGER

#### Moving Crane Hazard

The counterweights can strike personnel in the area of the swing path! Warn personnel to stay clear of the swing path. Sound the horn prior to swinging.

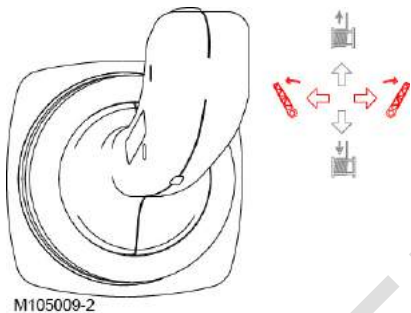


Figure 3-10. Swing Control Handle

1. Adjust swing speed to meet operator needs.

Speed and torque can be adjusted between 25% and 100%. See the Speed and Torque Setting Screen topic in the Main Display Operation Manual for detailed instructions.

2. Turn off the swing park switch.

## CAUTION

### Avoid Boom/Swing Drive Damage

Do not apply the swing holding brake or turn on the swing park switch while swinging. The brake will bring the rotating bed to an abrupt stop. This action could cause damage to the boom and jib from side loading or damage to the swing drive from shock loading.

Bring the rotating bed to a smooth stop with the swing control handle and then apply the swing holding brake or turn on the swing park switch.

3. Increase the engine speed to the desired RPM with the hand throttle. Press the foot throttle to momentarily increase the engine speed when more power is required.

4. Move the swing control handle to the LEFT from off to SWING LEFT or move the swing control handle to the RIGHT from off to SWING RIGHT.

Speed will increase/decrease in relation to control handle movement.

5. Start the swing motion with a smooth acceleration. Continue control handle motion to swing at the desired speed.

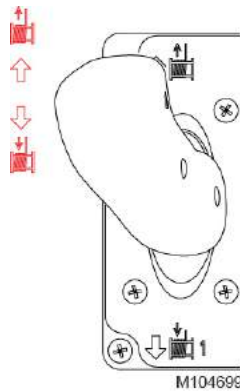
6. Stop swinging by releasing the swing control handle to OFF. Swing speed will decrease to off and the rotating bed will coast to a stop.

If a faster stop is desired, move the swing control handle past OFF to the opposite swing direction.

7. Once the rotating bed stops, depress the button on the control handle to apply the swing holding brake to hold the rotating bed in position for short periods during the operating cycle.

8. To hold the rotating bed in position for long periods, turn on the swing park switch.

## Load Drum Operation—Liftcrane Full Power



**Figure 3-11. Load Drum Control Handle**

1. Adjust load drum speed to meet operator needs.



### WARNING

#### Falling Load Hazard

Prevent the load on unused drums from falling. Turn on the drum park switch for drums not in use.

Speed can be adjusted between 25% and 100%. See the Speed and Torque Setting Screen topic in the Main Display Operation Manual for detailed instructions.

**NOTE** Drum 1 and 2 High Speed Operation with CCM software Rev 0.073 and ODM software Rev 1.010 or prior:

- If EITHER Drum 1 or 2 is un-parked, high speed operation is enabled for that drum.
- If BOTH drums are un-parked, high speed operation is disabled for both drums.

Drum 1 and 2 High Speed Operation with CCM software Rev 0.074 and ODM software Rev 1.011 or later:

- Drum 1 and 2 High Speed Operation is enabled by adjusting the programmable speed limiter on the Speed and Torque Settings Screen over 100% (see F2315 for Speed and torque Settings Screen operation).
- If both drums are in use, high-speed operation is temporarily disabled for both.

### CAUTION

#### Avoid Boom Damage

Do not turn on the drum park switch while raising or lowering the load; the brake will bring load to an abrupt stop. This action could cause shock load damage to the boom and load line.

Bring the load to a smooth stop with the drum control handle and then turn on the drum park switch.

2. Turn off the drum park switch for the drum to be operated.
3. Increase the engine speed to the desired RPM with the hand throttle. Press the foot throttle to momentarily increase the engine speed when more power is required.

### CAUTION

#### Avoid Boom Damage

When operating at high boom angles and high load block heights, maintain adequate clearance between the load block and the boom top. If this precaution is not observed, the load block can contact the boom top resulting in damage to the boom top.

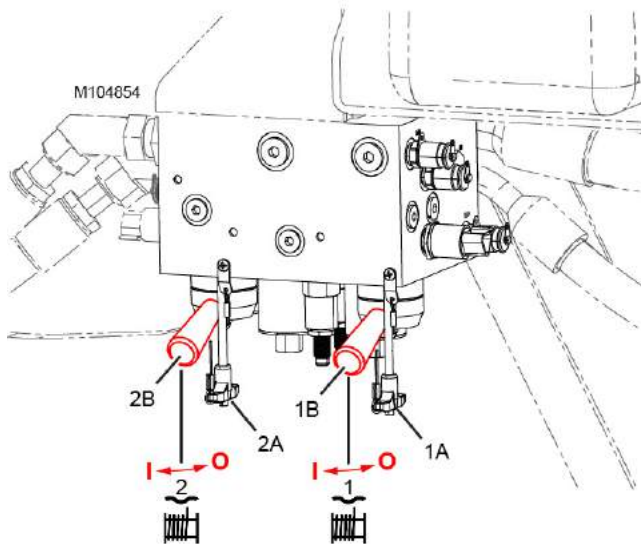
4. Pull the drum control handle BACK from OFF to RAISE the load or push the drum control handle FORWARD from OFF to LOWER the load.

The drum brake will release and speed will increase/decrease in relation to control handle movement.

5. As the load nears the desired position, slowly move the drum control handle toward OFF to slow down the load.
6. Then release the control handle to OFF to stop the load when it reaches the desired position. The drum brake will apply to hold the load in position.
7. To hold the load in position for long periods, turn on the corresponding drum park switch.

### Load Drum Operation—Liftcrane Free Fall

Right Side Enclosure Above Pumps



Item	Description
1A	Drum 1 Locking Pin
1A	Drum 1 Free Fall Selector Valve Handle
2A	Drum 2 Locking Pin
2B	Drum 2 Free Fall Selector Valve Handle
O	Off
I	On

Figure 3-12. Free Fall Selector Valves

1. If required, remove the pressure roller from the front and rear drums. For instructions, see Section 5 of the MLC80A-1, 90A-1, 100A-1, and 100-1 Service Manual.
2. To turn on free fall for the desired load drum:
  - a. Park the load drum.
  - b. Latch down the free fall brake pedal. This will close a safety switch to allow free fall to be enabled.

See [page 3-25](#) for operation of the brake pedals.

Free fall cannot be turned on until the free fall brake pedal is latched down. If the pedal is not latched down, the free fall “pedal not latched” icon will appear in the Free Fall Enable Screen of the main display.



Depress the button on the locking pin, and pull out the locking pin (1A or 2A, [Figure 3-12 on page 44](#)) for the drum to be operated.

- c. Rotate the corresponding free fall selector valve handle (1B or 2B, [Figure 3-12 on page 44](#)) to the ON (I) position.
- d. Reinstall the locking pin (1A or 2A, [Figure 3-12 on page 44](#)).
- e. Unpark the load drum.
 

Free fall cannot be turned on until the drum is unparked. If the drum is not unparked, the “function parked” icon will appear in the Free Fall Enable Screen of the main display.
- f. Turn on free fall for the corresponding drum using the free fall enable switch on the right console (see [page 3-15](#)).



The free fall icon for Drum 1, Drum 2, or both drums will appear in the Crane Operation Status Bar of the main display.



#### CAUTION

##### Avoid Boom Damage

Do not park a load drum while raising or lowering a load; the brake will bring the load to an abrupt stop. This action could cause shock load damage to the boom and load line. Bring the load to a smooth stop with the drum control handle and then park the drum.

3. Increase the engine speed to the desired RPM with the hand throttle. Press the foot throttle to momentarily increase the engine speed when more power is required.

#### CAUTION

##### Avoid Boom Damage

When operating at high boom angles and high load block heights, maintain adequate clearance between the load block and the boom top. If this precaution is not observed, the load block can contact the boom top resulting in damage to the boom top.

4. To raise the load, leave the free fall brake pedal latched down and pull the corresponding drum control handle back from off. The drum brake will release and the load will rise under hydraulic power at a speed in relation to handle movement.

As the load nears the desired position, slowly move the drum control handle toward off to slow down the load. Then release the drum control handle to off to stop the load. The drum brake will apply to hold the load in position.

**WARNING****Falling Load Hazard**

When operating in free fall, the load will lower uncontrolled if the free fall brake pedal is not applied when the drum handle is released to off (center).

When operating either drum in free fall, do not exceed 150 rpm free fall lowering speed.

Exceeding this limit is not recommended and can result in accelerated wear and reduced free fall brake life. The brake could slip allowing the load to lower uncontrolled.

5. The load can be lowered in one of two ways — with the free brake pedal or with hydraulic power.

- a. **To lower a load with the free fall brake pedal** — leave the drum control handle in off (center) and slowly release the free fall brake pedal to lower the load at the desired speed.

When free falling a load, the corresponding free fall icon will appear in the Crane Operation Status Bar of the main display.



As the load nears the desired position, increase foot pressure on the free fall brake pedal to slow down the load. Then fully apply the brake to stop the load and hold it in position.

Alternatively, pull the corresponding drum control handle back from off to slow down the load. When the load stops moving, the hoist will automatically transition to power raising.

**Be aware that if the free fall brake pedal is fully released when the drum control handle is moved to off, the load will begin to lower uncontrollably. Be sure to latch down the free fall brake pedal before moving the drum control handle to off.**

Drum slip and brake pedal response can be adjusted to meet operator need. See [Free Fall Drum Slip and Pedal Response](#).

- b. **To lower a load with hydraulic power** — with the desired free fall brake pedal latched down, push the corresponding drum control handle forward from off. The drum brake will release and the load will lower under hydraulic power at a speed in relation to handle movement.

As the load nears the desired position, slowly move the drum control handle toward off to slow down the load. Then release the drum control handle to off to stop the load. The drum brake will apply to hold the load in position.

6. If the load will be suspended for any length of time, latch down the free fall brake pedal and park the drum.

**NOTE** The drum brakes will apply and free fall for both drums will turn off automatically (and have to be turned back on) if:

- The engine is stopped (or power is lost for any reason)
- When applicable operating limits are reached
- When applicable system faults occur
- When the drum park switches are moved to the park position
- The operator gets out of the seat

7. To turn off free fall for the desired drum:

- a. Latch down the desired brake pedal.
- b. Turn off free fall for the corresponding drum using the free fall enable switch on the right console (see [page 3-15](#)).

The corresponding free fall drum icon will disappear from the Crane Operation Status Bar of the main display.

- c. Park the drum.
- d. Depress the locking pin button, and pull out the desired locking pin (1A or 2A, [Figure 3-12 on page 44](#)).
- e. Rotate the corresponding free fall selector valve handle (1B or 2B, [Figure 3-12 on page 44](#)) to the OFF (O) position.
- f. Reinstall the locking pin (1A or 2A, [Figure 3-12 on page 44](#)).

### Free Fall Drum Slip and Pedal Response

Two free fall adjustments can be made for each drum: drum slip and pedal response.

To adjust drum slip and pedal response, see the MLC80A-1, 90A-1, 100A-1, and 100-1 Main Display Manual.

**Drum slip** can be adjusted to meet the type of operation being performed:

- For most operations (such as liftcrane), 100% slip should be selected so that the load line pays out freely when a load is lowered with the brake pedal.
- For applications like pile driving, adjust slip so the hammer follows the pile at the desired rate of speed (load line pays out automatically without having to use brake pedal).

The corresponding free fall brake pedal can be applied to stop the drum regardless of the slip adjustment. Likewise, the corresponding drum control handle can be pulled back or

pushed forward to hoist or lower the load with hydraulic power.

**Pedal response** can be adjusted to suit operator feel. A high setting increases the free fall brake pedal movement required to control a small load and decreases the free fall brake pedal movement required to control a heavy load.

### Load Drum Operation—Clamshell

For clamshell operation, the crane must be equipped with Drums 1 and 2:

- Drum 1 is the closing line
- Drums 2 is the holding line

**NOTE** The parking brakes for Drums 1 and 2 are released at all times when operating in the Clamshell Mode. Some creeping down of the holding and closing lines is normal when the drums are not being used (handles in off). Turn on the drum park switches for Drums 1 and 2 when not actively operating in the Clamshell Mode to prevent the bucket from creeping down.

#### Preparing For Clamshell Operation:

1. Select the desired Clamshell/Duty Cycle Capacity Chart in RCL/RCI display.
2. Enable the clamshell mode in the Main Display. This step can only be performed after the capacity chart is selected in [step 1](#).
3. Turn off drum park for both drums.
4. Set engine speed at high Idle to provide smooth operation and maximum production.
5. The clam closing pressure is set automatically.

#### Clamshell Operation In Full-Power

Perform Preparing for Clam Operation steps. Then proceed as follows:

##### CLOSING BUCKET (Digging)

1. Lower the bucket into the digging area.
2. Pull back the closing line handle to close the bucket. The holding line will pay out automatically allowing the bucket to dig in as it closes.
3. Release the closing line handle to off when the bucket is closed fully.

**NOTE** Use care when digging in a blind area. The bucket is closed when the holding line starts to slacken.

##### RAISING BUCKET

1. Pull the holding line handle back to raise the bucket at the desired speed.
2. Swing to the dumping area as the bucket rises.
3. Release the holding line handle to off when the bucket is at the desired height.

##### DUMPING BUCKET

1. Push the closing line handle forward to dump bucket at the desired speed.
2. Release the closing line handle to off as soon as bucket is empty and fully open.

Use care not to slacken the closing line while dumping. Any slack in the closing line will have to be taken out while digging. This action will slow down the clam cycle.

##### LOWERING BUCKET

1. Push the holding line handle forward to lower the bucket at the desired speed.
2. Control the lowering speed by slowly moving the holding line handle toward off.

**NOTE** Lowering speed is controlled by handle movement. It is not necessary to apply the working brakes to slow down the bucket during full-power clamshell operation.

3. Swing back to the digging area as the bucket lowers.
4. Stop swinging when the bucket lands in the digging area.
5. The bucket will stop lowering automatically when it contacts ground.
6. Release the holding line handle to off.
7. Repeat the clam cycle.

**NOTE** Clamshell operation can also be performed with free fall enabled for both drums.

With clamshell enabled, the free fall brakes will release only when the closing line handle is pushed forward. The free fall brakes for both drums are released at this time. Full power dumping of the bucket is not possible with free fall enabled.

If the holding line is operated in free fall, the closing line must also be operated in free fall; otherwise, the closing line will not keep up with the holding line and the bucket will close while lowering.

## Travel Operation

### **WARNING** Tipping Hazard

The travel surface must be firm and uniformly supporting. Refer to the Maximum Allowable Travel Specifications chart in the Capacity Chart Manual for:

- Travel specifications with load
- Travel specifications without load

Failure to comply with the Maximum Allowable Travel Specifications can result in tipping.

### **Moving Crane Hazard**

Know the position of the rotating bed with relation to the front of the carbody before traveling. An accident can result if the crane travels opposite of the intended direction.

- The boom is at the FRONT of the rotating bed.
- A red painted arrow (Figure 3-14) on the front of the carbody indicates the FRONT of the carbody.

### **Flying Object Hazard**

Excessive dirt build-up at the tumbler and the roller ends of crawlers can result in excessive tension in tread connectors. The tread connectors can break if over tensioned, causing the treads to fly apart unexpectedly with dangerous force.

### **CAUTION** Boom Damage

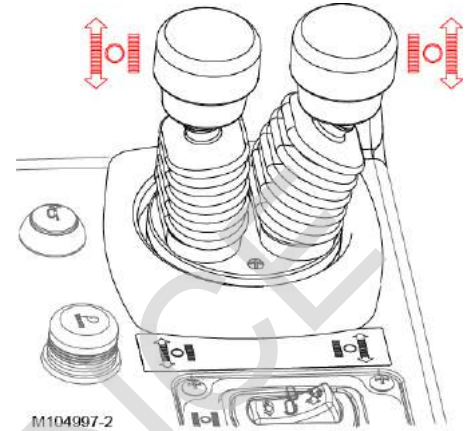
Abrupt travel operation could result in shock loading to the boom and rigging. To avoid this, perform all travel functions—starting, turning, stopping—slowly and smoothly.

### **Accelerated Crawler Wear**

To reduce the wear and tear of the crawler components (treads, rollers, frames), try not to allow dirt to pile up at the tumbler and the roller ends of the crawlers.

Dirt can pile up when turning on soft surfaces. To avoid this:

- Bring the crawlers to a complete stop before changing the direction of travel.
- Turn a few degrees. Then slowly travel forward or reverse so dirt falls away from the crawlers. Continue this procedure until the desired turn has been made.
- Avoid sharp turns if possible.
- Make gradual turns or counter-rotate whenever possible so both crawlers are always powered.
- Clean the crawlers often.
- Keep the crawler treads properly adjusted.



**Figure 3-13. Crawler Handles**

#### 1. Before traveling:

- Check for travel restrictions. See the Maximum Allowable Travel Specifications chart in the Capacity Chart Manual.
- Plan the travel route. It must be firm, level, and free of obstructions. Do not exceed the grades specified in the Maximum Allowable Travel Specifications chart.
- Check the crawlers for proper adjustment.
- Warn personnel to stand clear of the travel area. **Do not travel without a signal person.** Turn off the travel park switch.

#### 2. When **traveling with load**, position the boom at or above the boom angle given in the Maximum Allowable Travel Specifications chart.

When **traveling with load**, carry the load as close to the ground as possible. Stabilize the load with taglines.

For **traveling without load**, carry the load block and weight ball low enough that they cannot swing into the boom or jib. If desired, tie off the load block at front of rotating bed. Position the boom as specified in the Maximum Allowable Travel Specifications chart.

3. Increase the engine speed to the desired RPM with the hand throttle. When more power is needed, depress the foot throttle to momentarily increase the engine speed.
4. Travel speed can be adjusted between 25% and 100% to meet operator needs. See the Speed and Torque Setting Screen topic in the Main Display Operation Manual for detailed instructions.
5. Select the desired travel speed—low or high.

**NOTE** The following directions of travel are with the front of the rotating bed and the front of carbody facing the same direction.

If the front of the rotating bed and the front of the carbody face in opposite directions, the crane will travel in the direction opposite of control handle movement.

Travel cruise can be turned on once the crane is being traveled in the desired direction (see [Crawler Handles on page 3-19](#)).

When either crawler control handle is moved in either direction from off, the corresponding travel brake releases and speed increases/decreases in relation to control handle movement.

- To TRAVEL STRAIGHT ([Figure 3-14](#)), move both of the crawler handles the same amount in the desired direction from the neutral position.

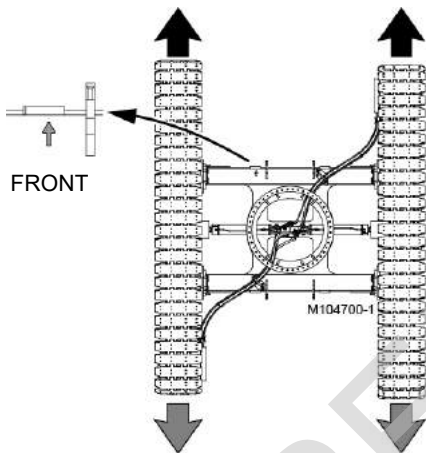


Figure 3-14. Travel Straight

- To make a SHARP LEFT TURN ([Figure 3-15](#)), move the right crawler control handle forward from the neutral position and leave the left crawler control handle in the neutral position. The crane will pivot about the left crawler.

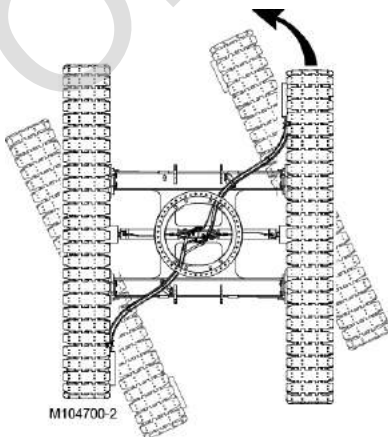


Figure 3-15. Travel Left (sharp turn)

- To make a GRADUAL RIGHT TURN ([Figure 3-16](#)), move both crawler handles forward from the neutral position. Move the left crawler control handle farther forward than the right crawler handle. The left crawler will turn faster than right crawler.

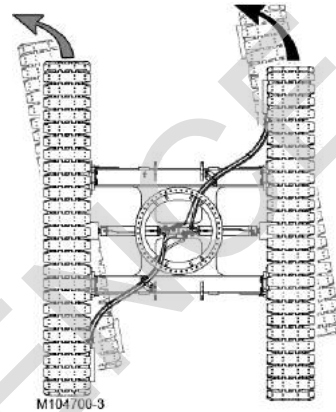


Figure 3-16. Travel Left (gradual turn)

- To COUNTER-ROTATE LEFT ([Figure 3-17](#)), move the right crawler control handle forward from the neutral position and move left crawler control handle reward from the neutral position.

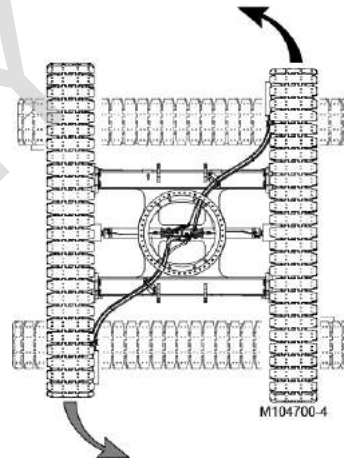


Figure 3-17. Counter-Rotate Left

- To COUNTER-ROTATE RIGHT, move the left crawler control handle forward from the neutral position and move right crawler control handle reward from the neutral position.
- Slowly move both crawler handles to the neutral position to stop traveling. The travel brakes will apply to hold the crane in position.
- When finished traveling, park the travel function.



## SHUTDOWN PROCEDURE OR LEAVING THE CRANE UNATTENDED



### WARNING

#### Moving Load/Tipping Crane Hazard

The operator shall not leave the operator cab until the crane, loads, and boom have been secured against movement.

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

1. Travel the crane onto a level surface. **Do not leave the crane unattended on a grade.**
2. Turn on the travel park switch.
3. Swing the rotating bed to the desired position. Then turn on the swing park switch.
4. Lower all loads to the ground.
5. Turn on the drum park switch for each load drum.
6. If possible, lower the boom and jib (if equipped) onto blocking at ground level.

If the boom cannot be lowered, as determined by a qualified designated person, it must be securely fastened from movement by the wind or other outside forces.

Refer to the wind conditions in the Wind Conditions chart for operating restrictions under various wind conditions.

**NOTE** The qualified designated person must be familiar with the job site limitations, the crane configuration, and the expected weather conditions.

7. Check that all the control handles are in the off position.
8. Decrease engine speed to idle. Allow the engine to idle for three to five minutes so it cools evenly.
9. Stop the engine.
10. Remove all keys from the cab to prevent unauthorized operation.
11. Lock the operator cab windows and door to prevent unauthorized entry.

## LOW CLEARANCE TRAVEL OPTION

To provide low clearance, the this can be traveled with the gantry down when equipped with the optional tie-down links and hardware identified in [Figure 3-19 on page 3-46](#) and [Figure 3-20 on page 3-48](#).

## Low Clearance Travel Boom Configurations

Low clearance travel is allowed for the following boom configurations:

### Fully Rigged Boom

See [Figure 3-19 on page 3-46](#).

- Series 1 or 2 counterweight (1) installed.
- A maximum boom length (2) of 19 m (62.3 ft) fully assembled in proper sequence according to the Boom Rigging Drawing. See Section 4 of the Operator Manual for detailed assembly instructions.
- Appropriate length of boom pendants (3) installed and connected to the boom top and equalizer (4). See Section 4 of the Operator Manual for detailed assembly instructions.
- Equalizer UNPINNED from the boom butt.
- Gantry (5) lowered and pinned to the crane counterweight.

### Cantilevered Boom Inserts

See [Figure 3-20 on page 3-48](#).

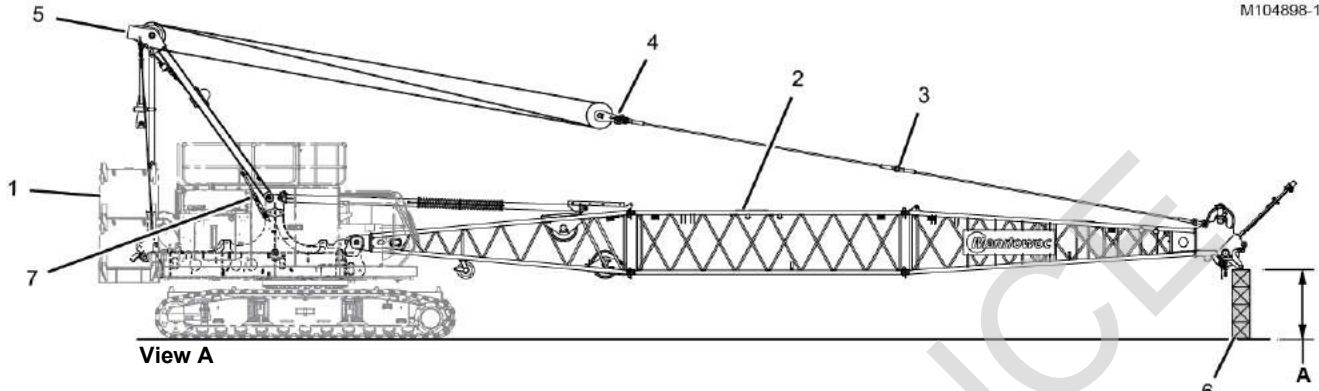
- Series 1 or 2 counterweight (1) installed.
- A maximum boom length (2) of 27 m (88.6 ft), to include boom butt, fully assembled in proper sequence according to the Boom Rigging Drawing. See Section 4 of the Operator Manual for detailed assembly instructions. See [Table 3-13 on page 3-53](#) for insert limitations.
- Boom pendants removed.
- Equalizer (4) PINNED to the boom butt.
- Gantry (5) lowered and pinned to the crane counterweight.

## Low Clearance Travel Limitations

For low clearance travel:

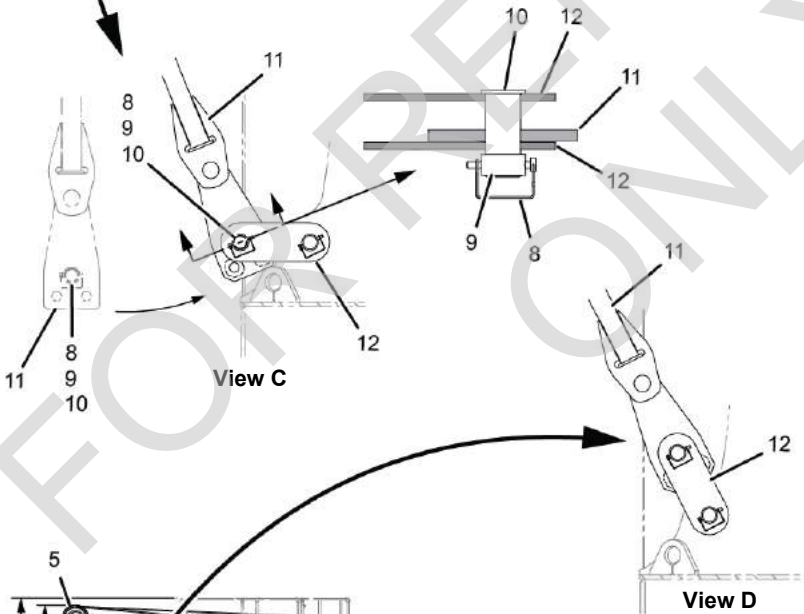
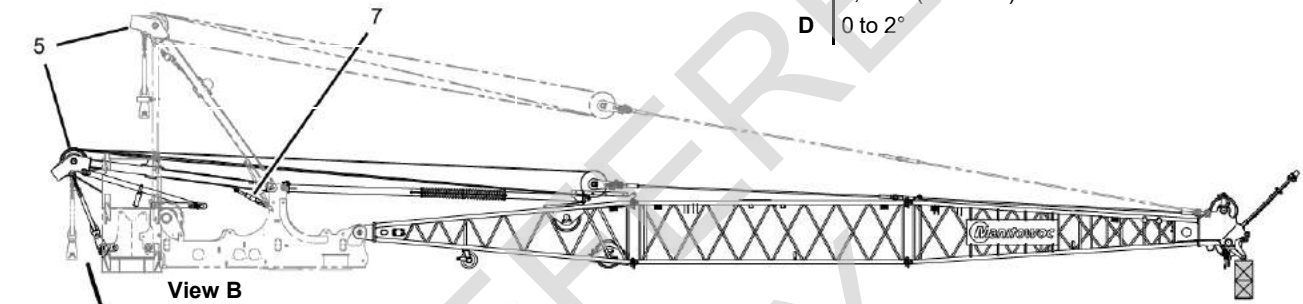
- The crane must be operated on a firm uniformly supporting surface.
- The upperworks must be in line with the lowerworks and grade when grade exceeds 1% (0.5°). Swing is prohibited.
- The boom angle must be limited to horizontal (0°) and not more than 2° above horizontal.
- The grade in the direction of travel must not exceed 5% (2.9°).
- The grade from side to side must not exceed 2% (1.1°) measured at the boom hinge pins.
- The crane must be traveled slowly and smoothly to avoid shock loading the boom and rigging.

M104898-1



**Dimension**

- A 1,52 m (5 ft)
- B 4,30 m (14 ft 1 in)
- C 4,14 m (13 ft 7 in)
- D 0 to 2°



**Item Description**

- 1 Counterweight (Series 1 or 2)
- 2 Fully Rigged Boom – 19 m (62.3 ft)
- 3 Boom Pendants
- 4 Equalizer
- 5 Gantry
- 6 Blocking
- 7 Gantry Cylinder (Qty 2)
- 8 Safety Pin (Qty 2)
- 9 Collar (Qty 2)
- 10 Pin (Qty 2)
- 11 Counterweight Handling Link (Qty 2)
- 12 Tie-Down Links (Qty 4)

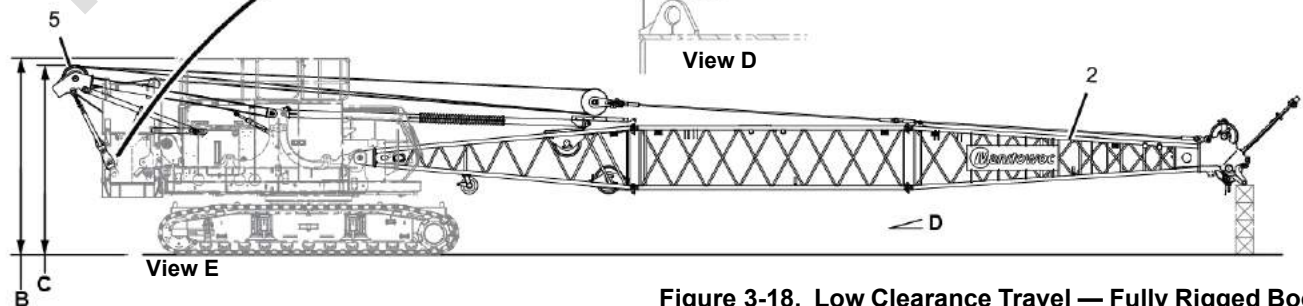


Figure 3-18. Low Clearance Travel — Fully Rigged Boom

**WARNING****Structural Damage Hazard**

To avoid damage and possible collapse of boom, do not attempt low clearance travel with a fully rigged boom longer than 19 m (62.3 ft).

## Preparing Fully Rigged Boom for Low Clearance Travel

See [Figure 3-18](#).

1. Lower the boom onto blocking (6, View A) at least 1,52 m (5 ft) high.
2. Either remove the load block or connect it to the lug on the front of the rotating bed.
3. Using the gantry cylinders switch on the right console, fully retract the gantry cylinders (7, View A) to lower the gantry (5, View B).  
To activate the gantry cylinders switch, the Boom Butt Configuration must be selected in the RCL/RCI Display.
4. Slowly pay out the boom hoist wire rope as required while the gantry lowers.
5. Remove the safety pin (8, View C), the collar (9), and the pin (10) from both counterweight handling links (11).
6. Rotate the counterweight handling links (11, View C) toward the counterweight and align the holes in the counterweight handling links with those in the tie-down links (12).
7. Install the pins (10, View C), the collars (9), and the safety pins (8) to attach the counterweight handling links (11) to the tie-down links (12).

***The pin heads must face inward.***

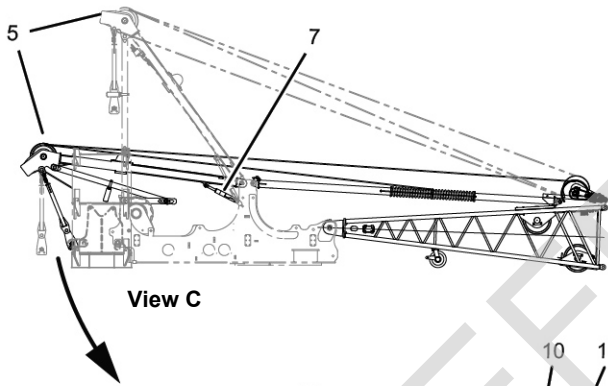
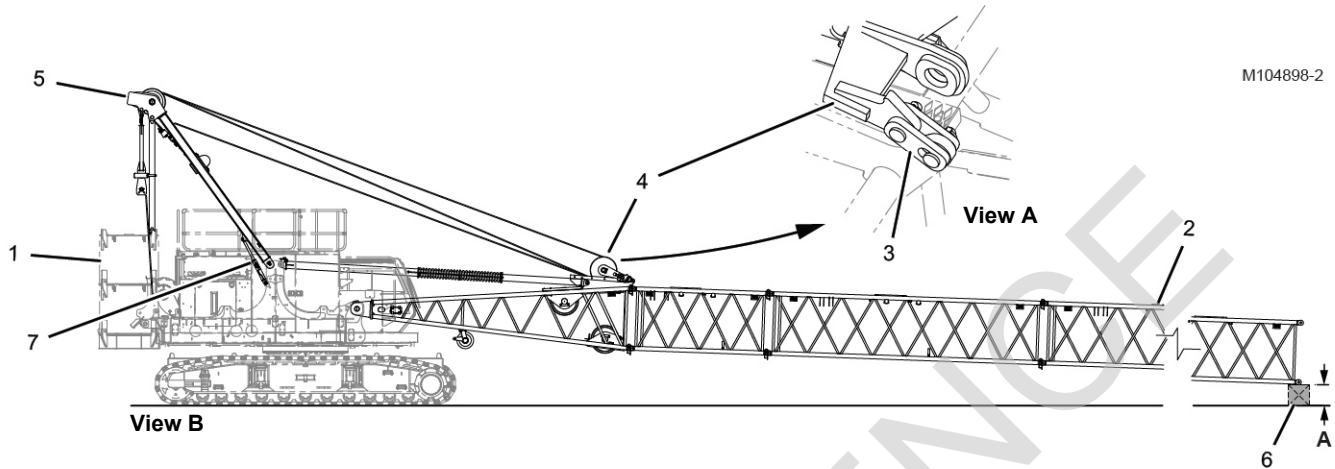
8. Using the gantry cylinders switch on the right console, extend the gantry cylinders until the counterweight handling links (11, View D and E) and the tie-down links (12) are taut.
9. Make sure the boom hoist wire rope is spooled properly on the boom hoist drum.
10. Raise the boom to no higher than 2° above horizontal.
11. The crane is now ready for travel. See [Low Clearance Travel Limitations on page 3-49](#).

## Returning Gantry to Normal Operating Position

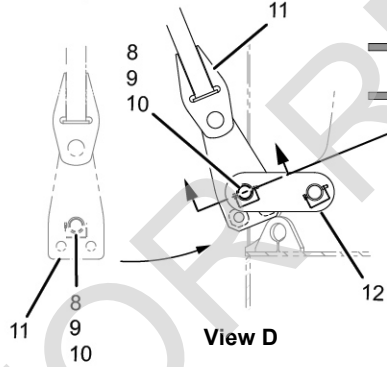
See [Figure 3-18](#).

1. Lower the boom onto blocking (6, View A) at least 1,52 m (5 ft) high.
2. Using the gantry cylinders switch on the right console, fully retract the gantry cylinders (7, View B and C) to lower the gantry (5).
3. Slowly pay out the boom hoist wire rope as required.
4. Support the counterweight handling links (11, View C) and remove the safety pins (8), the collars (9), and the pins (10).
5. Rotate the counterweight handling links (11, View C) to vertical and reconnect the pins (10), the collars (9), and the safety pins (8) to the counterweight handling links.
6. Make sure the boom hoist wire rope is spooled properly on the boom hoist drum.
7. Using the gantry cylinders switch on the right console, fully extend the gantry cylinders (7, View A) to raise the gantry (5) to the normal operating position.
8. Select the desired Boom Configuration in the RCL/RCI Display.
9. Raise the boom to the desired operating angle.

M104898-2



Item	Description
1	Counterweight (Series 1 or 2)
2	Cantilevered Boom Inserts (see Table)
3	Tie-Back Links
4	Equalizer
5	Gantry
6	Blocking
7	Gantry Cylinder (Qty 2)
8	Safety Pin (Qty 2)
9	Collar (Qty 2)
10	Pin (Qty 2)
11	Counterweight Handling Link (Qty 2)
12	Tie-Down Links (Qty 4)



Dimension	
A	457 mm (18 in)
B	4,30 m (14 ft 1 in)
C	4,14 m (13 ft 7 in)
D	0 to 2°

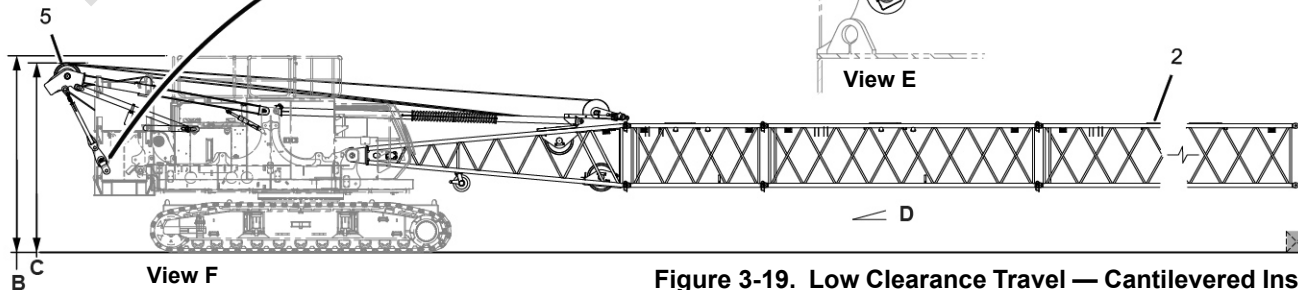
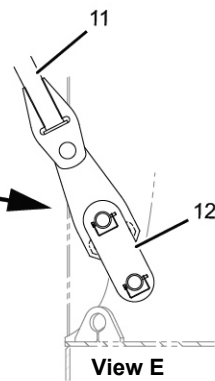


Figure 3-19. Low Clearance Travel — Cantilevered Inserts

**Table 3-13. Maximum Cantilevered Boom Inserts**

Length	3 m (9.8 ft) Insert	6 m (19.7 ft) Insert	12 m (39.4 ft) Insert
3 m (9.8 ft)	1	0	0
6 m (19.7 ft)	0	1	0
	2	0	
9 m (29.5 ft)	1	1	0
12 m (39.4 ft)	0	0	1
	2	1	0
15 m (49.2 ft)	1	0	1
18 m (59.1 ft)	0	1	1
	2	0	
21 m (69.9 ft)	1	1	1

**WARNING****Structural Damage Hazard**

To avoid damage and possible collapse of boom, do not attempt low clearance travel with cantilevered boom inserts longer than specified in [Table 3-13](#).

### Preparing Cantilevered Boom Inserts for Low Clearance Travel

See [Figure 3-18](#).

1. The following instructions assume:
  - a. The equalizer (4, View A) is anchored to the boom butt with tie-back links (3).
  - b. The required length of inserts (2, View B) is properly assembled, pinned to the boom butt, and resting on blocking at least 457 mm (18 in) high.
 

See Section 4 of the Operator Manual for detailed assembly instructions.
  - c. The boom pendants are removed.
2. Using the gantry cylinders switch on the right console, fully retract the gantry cylinders (7, View B) to lower the gantry (5, View C).
 

To activate the gantry cylinders switch, the Boom Butt Configuration must be selected in the RCL/RCI Display.
3. Slowly pay out the boom hoist wire rope as required while the gantry lowers.
4. Remove the safety pin (8, View D), the collar (9), and the pin (10) from both counterweight handling links (11).

5. Rotate the counterweight handling links (11, View D) toward the counterweight and align the holes in the counterweight handling links with those in the tie-down links (12).
6. Install the pins (10, View D), the collars (9), and the safety pins (8) to attach the counterweight handling links (11) to the tie-down links (12).
 

**The pin heads must face inward.**
7. Using the gantry cylinders switch on the right console, extend the gantry cylinders until the counterweight handling links (11, View E and F) and the tie-down links (12) are taut.
8. Make sure the boom hoist wire rope is spooled properly on the boom hoist drum.
9. Raise the boom inserts to no higher than 2° above horizontal.
10. The crane is now ready for travel. See [Low Clearance Travel Limitations on page 3-49](#).

### Returning Gantry to Normal Operating Position

See [Figure 3-18](#).

1. Lower the boom inserts onto blocking (6, View B) at least 457 mm (18 in) high.
2. Using the gantry cylinders switch on the right console, fully retract the gantry cylinders (7, View C and D) to lower the gantry (5).
3. Slowly pay out the boom hoist wire rope as required while the gantry lowers.
4. Support the counterweight handling links (11, View D) and remove the safety pins (8), the collars (9), and the pins (10).
5. Rotate the counterweight handling links (11, View D) to vertical and reconnect the pins (10), the collars (9), and the safety pins (8) to the counterweight handling links.
6. Make sure the boom hoist wire rope is spooled properly on the boom hoist drum.
7. Using the gantry cylinders switch on the right console, fully extend the gantry cylinders (7, View B) to raise the gantry (5) to the normal operating position.
8. Complete boom assembly as instructed in Section 4 of the Operator Manual.
9. Select the desired Boom Configuration in the RCL/RCI Display.
10. Raise the boom to the desired operating angle.

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## COLD WEATHER OPERATION

Also see [AC Power Supply on page 3-57](#).

### Crane Limitations

The static load-carrying limitations of the steels used in Manitowoc cranes are not affected by cold weather. Manitowoc's capacity charts are acceptable for use in cold weather.

However, dynamic loads (impact and shock) can affect the steels used in Manitowoc cranes when operating in cold weather. Dynamic loads are created by traveling, sudden application and release of load, and duty-cycle operations.



### DANGER

#### Injury and Equipment Failure Hazard

At low ambient temperatures, dynamic loads (impact and shock) can result in structural failure leading to serious injury or death.

#### When operating in ambient temperatures of:

##### -20 to -30°C (-5 to -22°F):

- Avoid impact or shock-loading of the crane and any attachment.
- Conduct operations with regard to potential failure of hydraulic components.

##### -31 to -40°C (-23 to -40°F):

- De-rate crane by 40% for all lift operations. Halting all lifts should be considered.
- Duty-cycle operation is prohibited.

##### below -40°C (-40°F):

- All operation (lift and duty-cycle) is prohibited except in extreme emergencies, and then only with approval from a competent engineer who has de-rated crane accordingly.

### Wire Rope

Wire rope manufacturers state that wire rope will not become brittle in temperatures down to -34°C (-30°F). However, lubrication may be a problem during extremely cold weather because normal wire rope lubricants may harden and chip off, leaving rope without lubrication.

Consult your wire rope supplier for recommended cold-weather lubricants.

### Cold Weather Starting Aid

The engine has a heater ("grid heater") in the air intake that comes on during crane startup.



### WARNING

#### Engine Explosion Hazard

An explosion and serious burns may result if ether is sprayed into the engine air intake.

Do not spray any combustible starting aid (ether) into the air intake. The grid heater will ignite the ether.

**To prevent overheating, the oil pan and coolant heaters must be unplugged when the engine is running or when the ambient temperature is above -1°C (30°F).**

### Cooling System

The cooling system must be kept full and be protected from freezing at the lowest expected ambient temperature. See engine manual for antifreeze recommendations.

A mixture of 40% antifreeze and 60% water provides freeze protection to -37°C (-35°F). A mixture of 60% antifreeze and 40% water provides freeze protection to approximately -51°C (-60°F). 100% antifreeze will freeze at -23°C (-10°F).

### Batteries

To provide maximum cranking power and to prevent the batteries from freezing, they must be kept fully charged (resting voltage 12.4V-13.2V) and warm when crane is idle during cold weather.

It is recommended that batteries be stored indoors or heated with a battery heater when crane is idle. Be aware that:

- A battery with a 50% charge freezes at -27°C (-16°F). A battery with a 100% charge freezes at -57°C (-70°F).
- A battery with a 100% charge retains only 40% of its cranking power at -18°C (-0°F). At -29°C (-20°F), the same battery retains only 18% of its cranking power.

### Engine Oil, Gear Oil, and Hydraulic Oil

For extreme cold, refer to Approved Lubricants for Operation in Arctic Climate in the Lubrication Guide.

### CAUTION

#### Avoid Hydraulic Component Damage

Before operating any hydraulic components, always allow the hydraulic system to warm up to 7°C (45°F).

To activate the crane's hydraulic oil warm-up circuit during cold weather startup, all crane functions must be parked. The warm-up circuit will remain on until the hydraulic oil temperature reaches 10°C (50°F). If a function is unparked, the warm-up circuit will deactivate and remain deactivated until all functions are parked and the hydraulic oil temperature drops below 8°C (46°F).

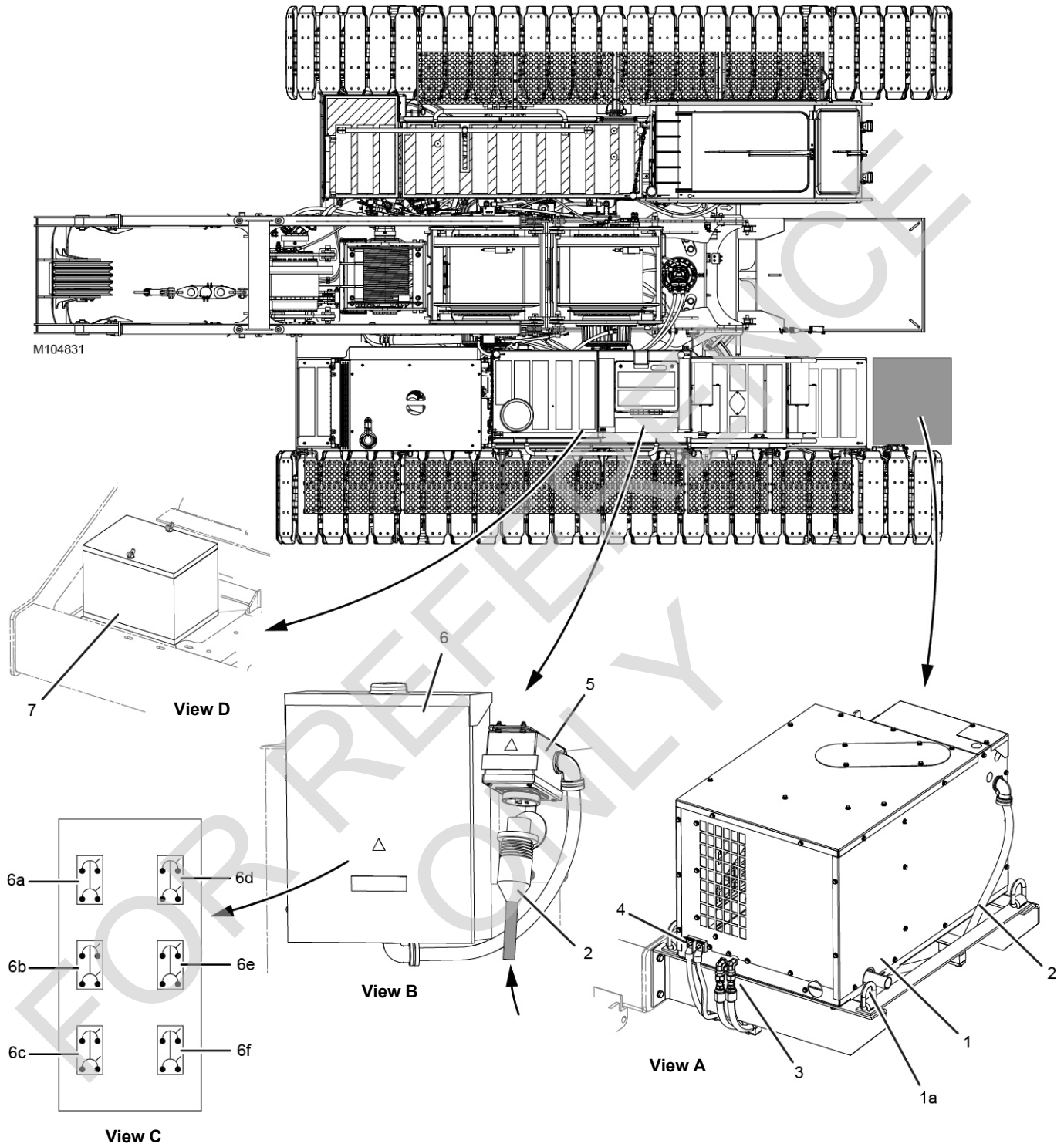


Figure 3-20. AC Generator



Legend for [Figure 3-20](#)

Item	Description
1	Generator (diesel driven 5 kW, 120/240VAC)
1a	Lifting Ring (Qty 4)
2	Power Supply Cable with Plug (120/240VAC, 50A)
3	Fuel Lines
4	Battery Cables
5	Receptacle (120/240VAC, 50A)
6	Load Center (120/240VAC)
6a	Circuit Breaker — 50A Main
6b	Circuit Breaker — 15A, 300W Rotating Bed Lights
6c	Circuit Breaker — 15A, 900W Boom Lights
6d	Circuit Breaker — 15A, 150W Battery Pads and 300W Engine Oil heater
6e	Circuit Breaker — 15A, 2000W Hydraulic Tank Heater
6f	Circuit Breaker — 15A, 1500W Engine Coolant Heater
7	Battery (12V, 660 CCA)

## AC POWER SUPPLY

See [Figure 3-20](#).

The optional work lights and cold weather heaters can be powered either by an owner supplied generator (shore power) or by an optional on-board generator (1).



### DANGER

#### Generator Voltage is Deadly!

Lights and heaters are powered by 240V electricity —

- Do not attempt to service the AC electric system until power is turned off.
- Do not attempt to service the AC electric system unless you are a qualified electrician.
- Do attempt to operate or service the generator until you have thoroughly read the Generator Operator Manual at end of this section.

## Generator Installation/Removal

- To install the generator (1):
  - Remove the mounting hardware from the generator frame.
  - Lift the generator (1) into position at the end of the right side enclosure.
    - Four lifting rings (1a) are provided
    - The generator weighs 181 kg (400 lb)

- Install and securely tighten the mounting hardware.
  - Connect the power supply cable (2) to the receptacle (5).
  - Connect the fuel lines (3) to the shut-off valves under the fuel tank.
  - Open the fuel shut-off valves.
  - Connect the battery cables (4) to the battery (7) terminals.
- To remove the generator (1), reverse the installation steps.

## CAUTION

### Avoid Machinery Damage

Do not turn on the heaters when the ambient temperature is above  $-1^{\circ}\text{C}$  ( $30^{\circ}\text{F}$ ) or when the engine is running. Doing so may result in overheating.

## Turning AC Power ON

- Stop the generator (1) engine.
- Turn OFF the circuit breakers in the load center (6).
- Connect the power supply cable (2) to the receptacle (5) on the crane and to the receptacle on the generator.
- Start the generator engine.
- Turn ON the desired circuit breakers in the load center (6).

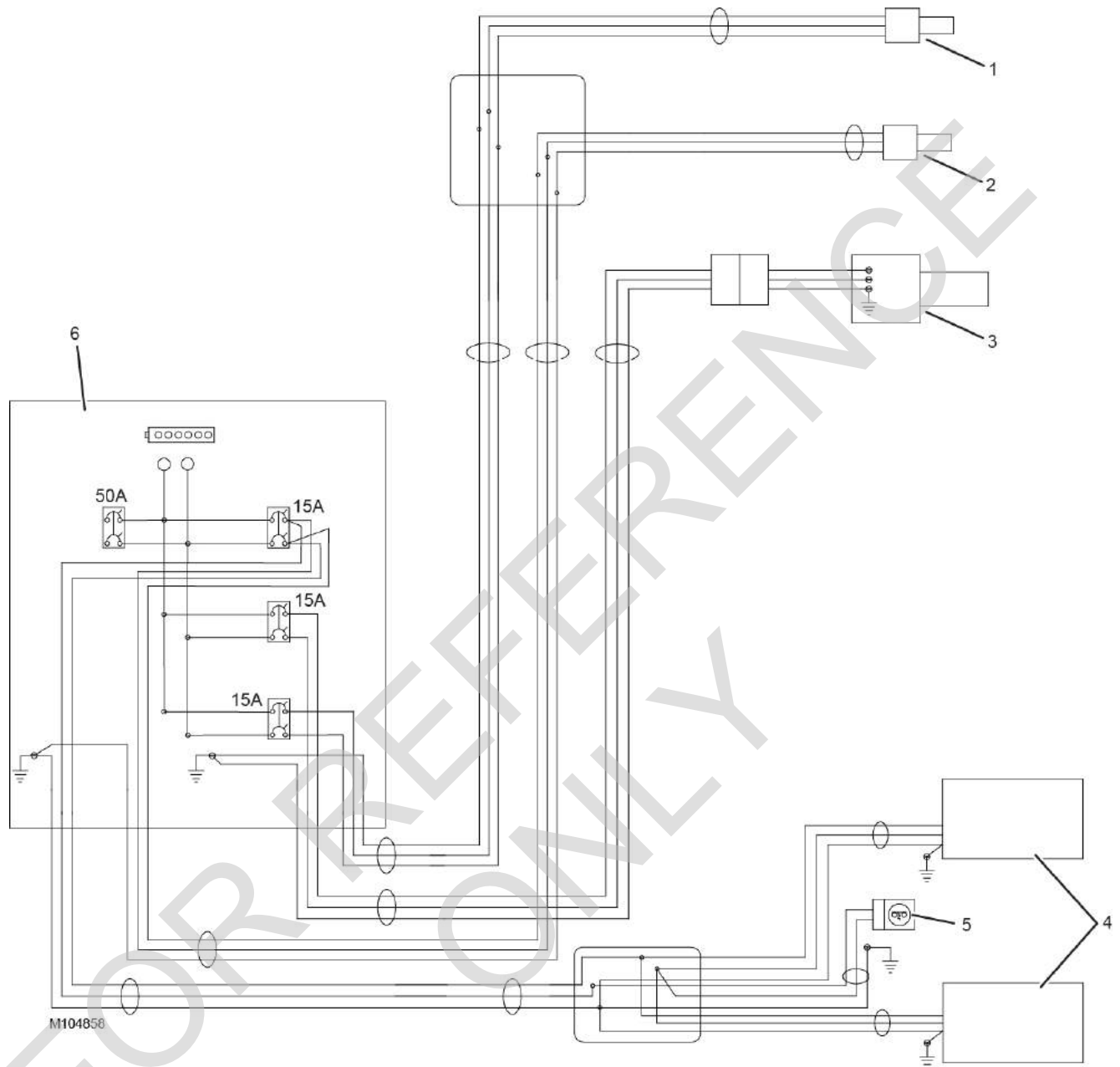
## Turning AC Power OFF

- Turn OFF the circuit breakers in the load center (6).
- Stop the generator engine.
- If necessary, disconnect the power supply cable (2) from the receptacle (5) on the crane. Store the cable on the generator.

## WORK LIGHTS

The work lights package consist of the following:

- Cab (standard) — two 24V, 65W floodlights — controlled by a switch in the operator cab
- Gantry (optional) — two 240V, 150W floodlights — controlled by a circuit breaker in the load center ([Figure 3-20](#))
- Boom (optional) — three to five 240V, 150W to 300W floodlights or spot lights — controlled by a circuit breaker in the load center ([Figure 3-20](#))



Item	Description
1	Engine Coolant Heater
2	Engine Oil Heater
3	Hydraulic Tank Heater
4	Battery Pad Heater (2)
5	Battery Pad Heater Thermostat
6	Load Center (see <a href="#">Figure 3-21 on page 3-51</a> )

Figure 3-21. Cold Weather Heaters

## COLD WEATHER HEATERS

To preheat critical components and lubricant sumps during a cold weather shutdown, an optional Cold Weather Heater Kit is available. The kit contains the following heaters:

See [Figure 3-21](#)

- Engine coolant heater (item 1) 750W.
- Engine oil heater (item 2) — 300W.

---

### CAUTION

#### Avoid Machinery Damage

When the ambient temperature is above 30°F (–1°C) or when the engine is running, do not turn on the engine oil pan or coolant heaters. Doing so may result in overheating because they are not supplied with a thermostat.

- 
- Hydraulic tank heater (item 3) — 2,000 watt.  
The hydraulic tank heater is designed to keep the hydraulic oil temperature 30°F (17°C) warmer than the ambient air temperature.

A thermostat (located under heater cover) is factory-set to turn the heater on at 31°C (87°F) and off at 100°F (38°C).

- Battery pad heaters (item 4) — two, 75W each with thermostat (item 5) set at: ON 5°C (41°F) and OFF 15°C (59°F).

The heaters are powered by the 240V AC Power Supply described on [page 3-57](#).

Refer to [Figure 3-20](#) for identification of the heater circuit breakers.

**NOTE** When operating below –30°F (–34°C), the heater package may not provide adequate protection. Contact your Manitowoc dealer for recommendations.

To turn the heaters ON, see [Turning AC Power ON on page 3-57](#).

To turn the heaters OFF, see [Turning AC Power OFF on page 3-57](#).

Electrical Control Panel Behind Operator Seat in Cab

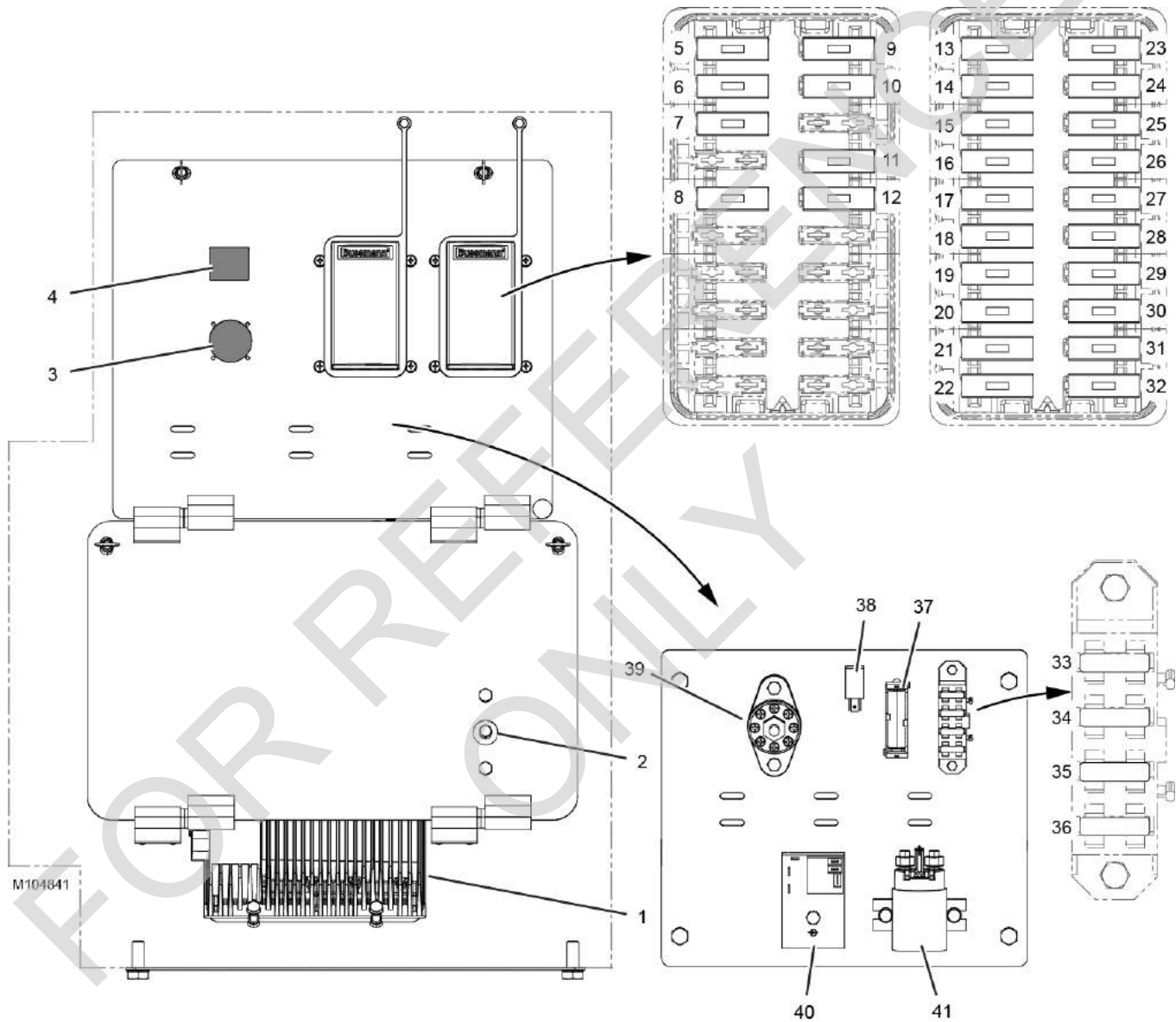


Figure 3-22.

## FUSES AND CIRCUIT BREAKERS

See [Figure 3-22](#),

Item	Description
1	Power Supply Converter — 24/12VDC, 30A
2	Main Circuit Breaker — 120A
3	Diagnostic Receptacle
4	Program Receptacle
5	Crane Bus — 15A Circuit Breaker
6	Key — 15A Circuit Breaker
7	Radio — 15A Circuit Breaker
8	Cab Main and RCL Displays — 15A Circuit Breaker
9	Boom Position Light — 10A Circuit Breaker
10	ECM Key — 15A Circuit Breaker
11	Cab Accessories — 15A Circuit Breaker
12	DC/DC Converter — 25A Circuit Breaker
13	IOLC30 UB— 15A Circuit Breaker
14	IOLC31 UB— 15A Circuit Breaker
15	CCM10 UB— 15A Circuit Breaker
16	CCM10 UB— 15A Circuit Breaker
17	CCMC11 UB — 15A Circuit Breaker
18	SCM00 UB — 15A Circuit Breaker
19	Cab A/C Heat— 25A Circuit Breaker
20	Switch Back Lights — 15A Circuit Breaker
21	J1939 Diagnostics— 15A Circuit Breaker
22	Radio Illumination — 15A Circuit Breaker
23	IOLC30 UB— 15A Circuit Breaker
24	IOLC31 UB— 15A Circuit Breaker
25	CCM10 UB— 15A Circuit Breaker
26	CCM10 UB— 15A Circuit Breaker
27	CCMC11 UB — 15A Circuit Breaker
28	IOSA22 UB — 15A Circuit Breaker
29	Wipers — 15A Circuit Breaker
30	Cab Work Lights — 15A Circuit Breaker
31	Camera Monitor Power — 15A Circuit Breaker
32	Joysticks — 15A Circuit Breaker
33	12VDC Accessory Socket (right console) — 15A Fuse
34	Seat Riser — 20A Fuse
35	12VDC Accessory Socket (left console) — 15A Fuse
36	Spare — 15A Fuse
37	Battery, SCM Controller Real-Time Clock — 3.6V Lithium AA, 2400 mAh
38	Relay — 24V, 10A
39	Ground Distribution Post
40	Time Delay Relay, SCM and CCM Controller Backup — 24V
41	Relay Contactor — 28V, 120A

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## SECTION 4

### SET-UP AND INSTALLATION

#### TABLE OF CONTENTS

Boom and Jib Assembly Drawings . . . . .	4-1
Liftcrane Boom Butt Capacities . . . . .	4-1
Crane Orientation . . . . .	4-1
Accessing Parts . . . . .	4-1
Assembly and Disassembly Notes . . . . .	4-1
Assembly and Disassembly Area . . . . .	4-2
Handling Components . . . . .	4-2
Retaining Connecting Pins . . . . .	4-2
Crane Weights and Shipping Data . . . . .	4-2
Parts Storage . . . . .	4-2
Parts Box . . . . .	4-2
Position Light and Anemometer Option . . . . .	4-2
Lifting Sling . . . . .	4-3
Shipping Configuration . . . . .	4-5
Self-Erect Components . . . . .	4-5
Self-Erect Controls . . . . .	4-6
Pin and Connecting Hole Cleanliness . . . . .	4-7
Electric Cable Cleanliness . . . . .	4-7
Connecting/Disconnecting Hydraulic Hoses and Electric Cables . . . . .	4-7
Pre-Start Checks . . . . .	4-7
Deploy the crane platforms as necessary to gain access to components . . . . .	4-7
Engine . . . . .	4-7
Gear Boxes . . . . .	4-7
Hydraulic System . . . . .	4-7
Crane Assembly . . . . .	4-9
Prepare Trailer for Unloading . . . . .	4-9
Deploy Crawler Steps . . . . .	4-9
Deploy Crane Platforms . . . . .	4-9
Prepare Cab . . . . .	4-11
Raise Handrails . . . . .	4-13
Start Engine . . . . .	4-15
Configure RCL/RCI for Crane Setup . . . . .	4-15
Raise Gantry . . . . .	4-15
Travel Crane off Trailer . . . . .	4-15
Extend Crawlers . . . . .	4-17
Install Hook-and-Weight Ball . . . . .	4-19
Unload Trailers . . . . .	4-19
Assemble Boom and Jib . . . . .	4-23
Install Carbody Counterweight . . . . .	4-23
Assemble Crane Counterweight . . . . .	4-25
Activate Remote Control . . . . .	4-27
Install Crane Counterweight . . . . .	4-27
Install Crane Counterweight (continued) . . . . .	4-29
Install Crane Counterweight (continued) . . . . .	4-31
Remove Hook-and-Weight Ball . . . . .	4-33
Connect Boom Butt to Boom . . . . .	4-33
Connect Boom Pendants to Equalizer . . . . .	4-35
Disconnect Equalizer from Boom Butt . . . . .	4-35
Configure RCL/RCI for Crane Operation . . . . .	4-35
Connect Boom Butt to Boom Top Electric Cables . . . . .	4-37
Install Boom Top Position Light and Wind Speed Indicator (option) . . . . .	4-39

Install Boom Top Camera (option) . . . . .	4-39
Install Boom Block-Up Limit Components . . . . .	4-39
Install Jib Top Position Light and Wind Speed Indicator (option) . . . . .	4-41
Install Jib Top Camera (option) . . . . .	4-41
Connect Jib Extension Cable . . . . .	4-41
Install Jib Block-Up Limit Components . . . . .	4-41
Deactivating/Activating a Block-up Limit Switch . . . . .	4-43
Install Load Lines . . . . .	4-45
Boom and Jib Rigging — General . . . . .	4-46
Blocked Crawlers . . . . .	4-46
Boom Handling . . . . .	4-46
Rigging Drawings . . . . .	4-46
Identifying Boom and Jib Components . . . . .	4-46
Handling Boom and Jib Sections . . . . .	4-47
Boom #290 Assembly . . . . .	4-49
Assemble Boom Inserts . . . . .	4-49
Connect Boom Top to Inserts . . . . .	4-49
Install Boom Pendants . . . . .	4-50
Install Intermediate Suspension Pendants . . . . .	4-51
Install Upper Boom Point . . . . .	4-51
Install Optional Rope Guard . . . . .	4-53
Install Tagline . . . . .	4-53
Complete Boom/Crane Assembly . . . . .	4-53
Jib #117 Assembly . . . . .	4-55
Prepare Boom . . . . .	4-55
Install Jib Bottom . . . . .	4-55
Install Jib Inserts . . . . .	4-55
Install Jib Top . . . . .	4-55
Install Jib/Backstay Pendants . . . . .	4-57
Prepare to Raise Jib Strut . . . . .	4-57
Deploy Strut Raising Arm . . . . .	4-57
Raise Jib Strut . . . . .	4-59
Deploy Strut Stops . . . . .	4-59
Complete Jib Rigging . . . . .	4-59
Raise Boom . . . . .	4-60
Pre-Raising Checks . . . . .	4-60
Boom Raising Procedure . . . . .	4-60
Shipping Crane Components . . . . .	4-61
Crane Disassembly . . . . .	4-63
Prepare Crane . . . . .	4-63
Lower Boom . . . . .	4-63
Store Load Lines . . . . .	4-63
Remove Boom/Jib Point Electronics . . . . .	4-63
Store Strut Stops . . . . .	4-65
Deploy Strut Raising Arm . . . . .	4-65
Lower Jib Strut . . . . .	4-65
Connect Equalizer to Boom Butt . . . . .	4-67
Open Boom . . . . .	4-69
Disconnect Boom Pendants from Equalizer . . . . .	4-71
Disconnect Boom Butt from Boom . . . . .	4-71
Install Hook-and-Weight Ball . . . . .	4-71
Configure RCL/RCI for Crane Setup . . . . .	4-71
Remove Crane Counterweight . . . . .	4-73
Remove Crane Counterweight (continued) . . . . .	4-75
Disassemble Crane Counterweight . . . . .	4-75
Remove Carbody Counterweight . . . . .	4-77
Disassemble Jib and Boom . . . . .	4-77



Load Trailers . . . . .	4-79
Remove Hook-and-Weight Ball . . . . .	4-79
Retract Crawlers . . . . .	4-81
Prepare Trailer for Loading . . . . .	4-83
Travel Crane onto Trailer . . . . .	4-83
Lower Gantry . . . . .	4-83
Secure Operator Cab. . . . .	4-84
Lower Handrails . . . . .	4-84
Store Crane Platforms . . . . .	4-84
Store Crawler Steps. . . . .	4-84
Prepare Trailer for Travel. . . . .	4-84
Boom #290 Disassembly . . . . .	4-84
Jib #117 Disassembly. . . . .	4-85
Wire Rope Installation . . . . .	4-86
Wire Rope Specifications. . . . .	4-86
Wire Rope Storage . . . . .	4-86
Seizing and Cutting Wire Rope . . . . .	4-86
Anchoring Wire Rope to Drum. . . . .	4-86
Winding Wire Rope onto Drum . . . . .	4-88
Anchoring Wire Rope to Wedge Socket . . . . .	4-91
Anchoring Wire Rope to Button Socket . . . . .	4-93
Pad Eye Usage for Wire Rope Reeving . . . . .	4-93
Breaking in Wire Rope. . . . .	4-93
Load Line Reeving . . . . .	4-95
Guide Sheaves and Drums . . . . .	4-95
Dead End Location . . . . .	4-95
Load Block Identification . . . . .	4-95
Wire Rope Specifications. . . . .	4-95
Load Block Reeving. . . . .	4-95
Load Block Tieback . . . . .	4-96
General . . . . .	4-96
Specifications. . . . .	4-96

FOR REFERENCE ONLY

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## SECTION 4

### SETUP AND INSTALLATION



#### WARNING

##### Death or Serious Injury Hazard!

Read and understand the setup and installation instructions in this section before attempting to assemble or disassemble the crane. Comply with all safety information in this section to prevent accidents that can result in death or injury during crane assembly and disassembly.

##### Tippling/Overload Hazard!

Avoid tipping the crane over or collapsing the gantry:

- Assemble and disassemble the crane on a firm, level, uniformly supporting surface.

**Level** = 1% of grade or

0,3 m (1 ft) in 30,5 m (100 ft)

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

##### Avoid Falling Off Crane and Boom!

It is necessary to climb onto the crane and boom during assembly and disassembly steps.

Use sturdy owner furnished ladders or an approved personnel hoist to gain access to areas that cannot be reached from the ladders, steps, or platforms provided with the crane.

##### 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.
- Do not raise or lower the gantry until all personnel are off the crane.
- Keep unauthorized personnel well clear of the crane.

##### Falling Load Hazard!

To prevent lifting equipment from failing and the load from dropping, the crane owner/user shall verify the 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.

#### BOOM AND JIB ASSEMBLY DRAWINGS

The Boom and Jib Rigging drawings that apply to your crane are located at the end of this section.

#### LIFTCRANE BOOM BUTT CAPACITIES

Lifting capacities for the boom butt are located at the end of this section and in the Capacity Chart Manual for this crane.

#### CRANE ORIENTATION

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

- The operator cab is at the front of the upperworks.
- A colored arrow on the carbody indicates the FRONT of the carbody.

#### ACCESSING PARTS



#### WARNING

##### Fall Hazard!

To avoid serious injury, the owner/user shall provide workers with approved ladders or aerial work platforms to access those areas of the crane and boom that cannot be reached from the ground or from Manitowoc-provided steps, ladders, and platforms.

Adhere to local, state, and federal regulations for handling personnel and personnel fall protection.

Some parts of the crane, boom, and jib cannot be reached from the ground. Take the necessary precautions to prevent slipping and/or falling off the crane, boom, or jib during assembly, disassembly, maintenance, or other work. **Falling from any height could result in serious injury or death.**

#### ASSEMBLY AND DISASSEMBLY NOTES

The crane, boom, and jib must be assembled and disassembled by experienced personnel trained in erection and operation of construction cranes.

Before attempting to assemble, operate, or disassemble the crane, the experienced personnel shall read and become thoroughly familiar with the following:

- The instructions in the applicable capacity charts located in the Capacity Chart Manual or at the end of this section.

- The safety, assembly, and disassembly instructions in this section.
- The instructions in the Boom and Jib Rigging Drawings located at the end of this section.

Contact your Manitowoc dealer for assistance if any procedure is not fully understood.

### ASSEMBLY AND DISASSEMBLY AREA

Select an assembly/disassembly area that has a firm, level, uniformly supporting surface. Make sure the area is large enough to accommodate the crane and the selected boom length, movement of trucks with trailers, and movement of an assist crane if used.

Contact your Manitowoc dealer for ground bearing information.

### HANDLING COMPONENTS

The major components are equipped with lifting lugs. The lifting lugs are identified by the following symbol in the assembly and disassembly illustrations.



Figure 4-1

When lifting lugs are not provided, use nylon lifting slings to lift the components. If wire rope or chain slings are used, install protective covering (such as sections of rubber tire) between the slings and the component being lifted.

It is the crane owner's/user's responsibility to ensure that all lifting slings, hooks, and shackles are in safe working order and capable of handling the load applied to them.

### RETAINING CONNECTING PINS

Connecting pins are retained in various ways:

- Wire-lock pins
- Quick-release pins

- Cotter pins
- Hitch Pins
- Safety pins
- Keeper plates with cap screws and lock washers

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

### CRANE WEIGHTS AND SHIPPING DATA

See the Crane Weights topic in Section 1 of the Operator Manual for the weights of individual crane components.

See the Product Guide in Section 1 of the Operator Manual for the outline and shipping dimensions of individual crane components.

### PARTS STORAGE

#### Parts Box

Manitowoc provides a parts box that can be lifted with a forklift.

The following parts are stored in the parts box:

- Anti-two block chains and weights
- Chain lifting sling (Figure 4-2, for counterweight boxes)
- Quick-drain drainer assembly (for oil changes)
- Button sockets, links, swivels, and pins
- Boom top pendant links
- Crawler adjustment hand pump, cylinder, and shims
- Touch-up paint
- Spray lubricant (for cylinder rods)
- Camera (optional boom and jib top)

#### Position Light and Anemometer Option

If equipped with the optional position light and anemometer assembly, they can be stored in the left enclosure. It is the crane users responsibility to protect the assembly by wrapping it with foam or bubble wrap and securely attaching it to the enclosure frame so the assembly cannot be damaged during transport.

LIFTING SLING

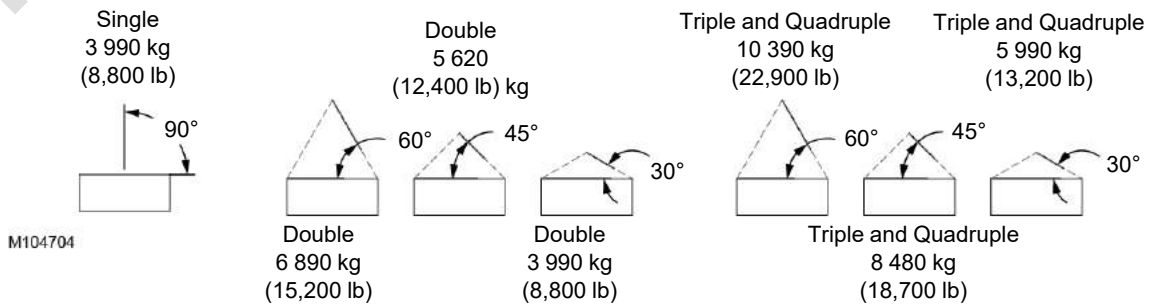
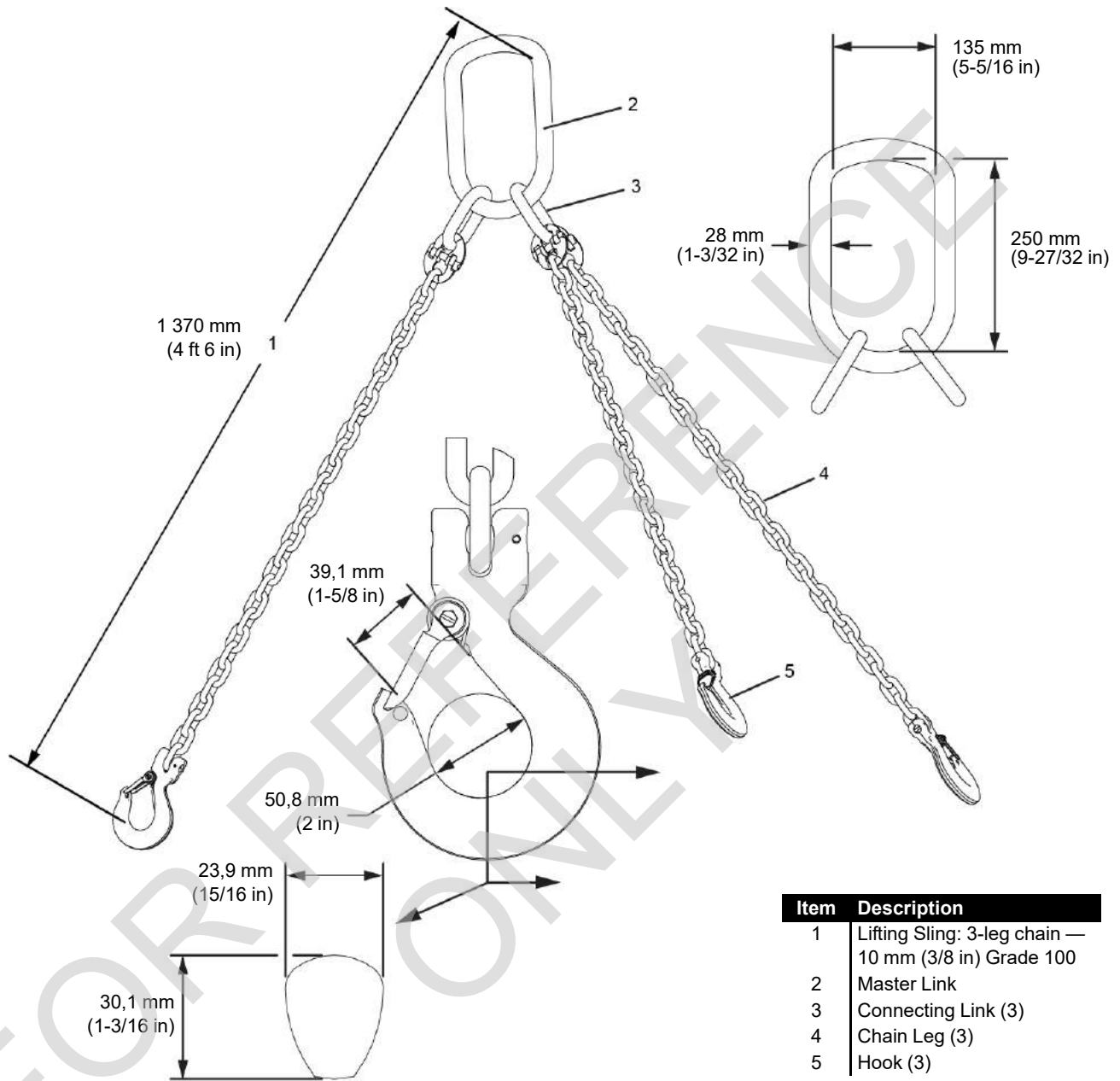
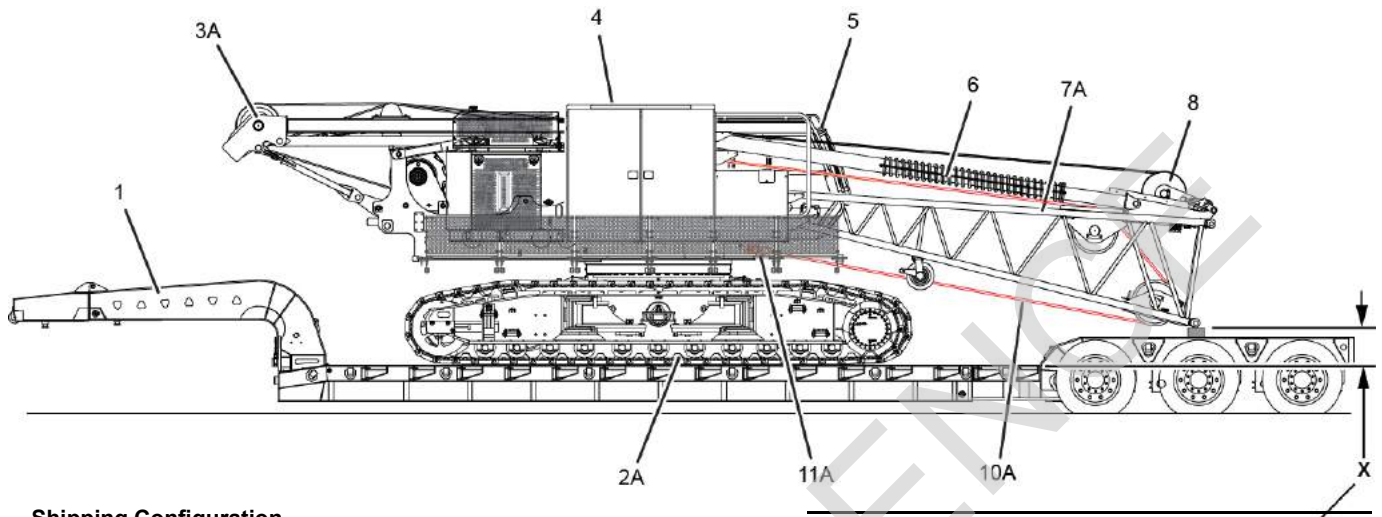


Figure 4-2



**Shipping Configuration**

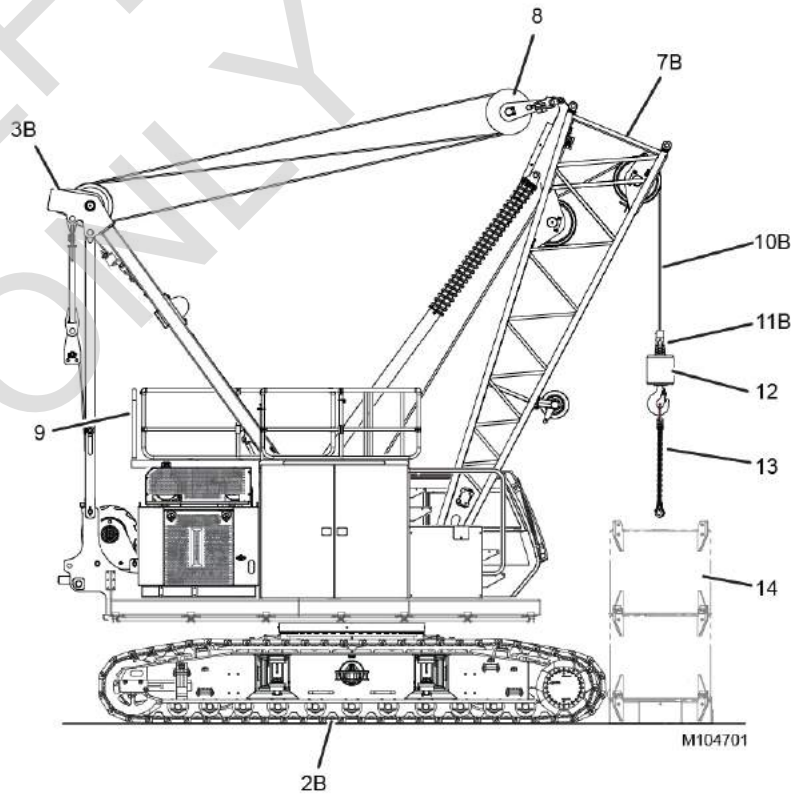
- Max shipping width = 3.7 m (12 ft)
- Max shipping height = 4.1 m (13 ft 6 in)
- Shipping weight with Drum 3 and Wire Rope = 42 563 kg (93,835 lb)
- Shipping weight without Drum 3 = 41 300 (91,050 lb)

**CAUTION**

**Avoid Wire Rope Damage!**

To avoid wire rope damage, the boom butt must be blocked at dimension X prior to raising the gantry. Dimension X is measured from trailer deck to underside of bottom boom butt connectors.

Item	Description
1	Double Drop Deck, 3-Axle Trailer (minimum) with Removable Goose Neck
2A	Crawlers Retracted (without carbody counterweight)
2B	Crawlers Extended
3A	Gantry Lowered
3B	Gantry Raised
4	Upperworks (without crane counterweight)
5	Operator Cab
6	Boom Stops
7A	Boom Butt Lowered
7B	Boom Butt Raised
8	Equalizer
9	Handrails Raised
10A	Load Line from Front Drum (stored for shipping)
10B	Load Line from Front Drum (working)
11A	Button Socket (stored for shipping)
11B	Button Socket (working)
12	Hook-and-Weight Ball
13	3-Leg Chain Sling
14	Crane Counterweight (assembled on ground)
X	457 mm (18 in) Minimum for Gantry Raising or <b>Damage can Occur</b>



**Self-Erect Configuration**

**Figure 4-3**

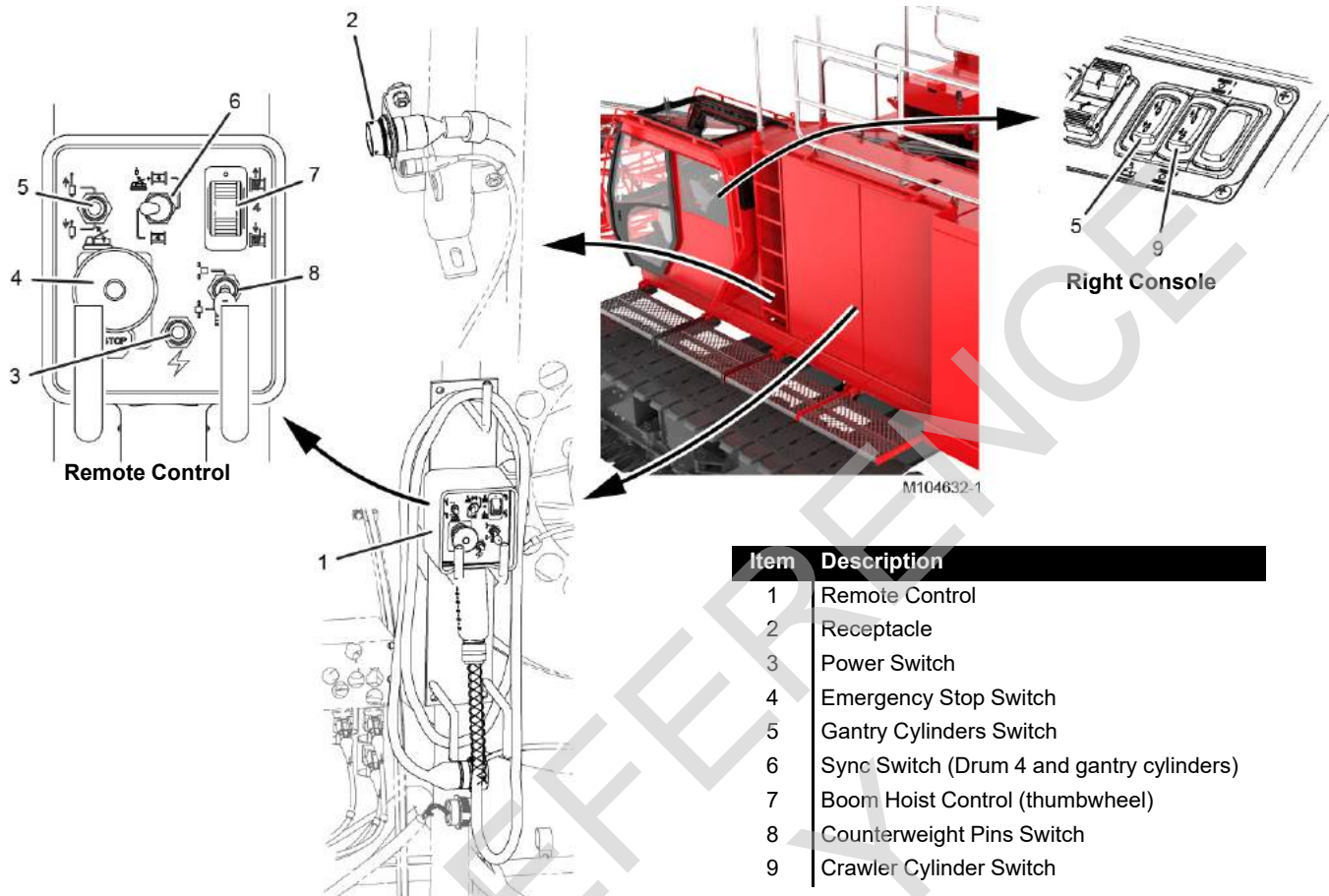
## SHIPPING CONFIGURATION

The crane ships in the configuration shown in [Figure 4-3](#).

## SELF-ERECT COMPONENTS

The crane can assemble and disassemble itself using the following self-erect components (see [Figure 4-3](#)):

- Hydraulic cylinder for extending and retracting crawlers
  - Hydraulic cylinders for raising and lowering gantry
  - Hydraulic pin pullers for disengaging and engaging counterweight pins
  - Boom butt sheaves for single part rigging line from front drum
- The boom butt can be used to handle, assemble, and disassemble the following components:
- Carbody counterweight boxes
  - Crane counterweight tray and boxes
  - Boom sections
  - Jib sections
- 3-leg chain lifting sling
  - Switches on right side console and remote control for operating the above components



Item	Description
1	Remote Control
2	Receptacle
3	Power Switch
4	Emergency Stop Switch
5	Gantry Cylinders Switch
6	Sync Switch (Drum 4 and gantry cylinders)
7	Boom Hoist Control (thumbwheel)
8	Counterweight Pins Switch
9	Crawler Cylinder Switch

Figure 4-4

### SELF-ERECT CONTROLS

See [Figure 4-4](#).

The controls required for crane assembly and disassembly are located on the remote control and on the right console in the operator cab.

The remote control is stored in the left enclosure. It has an electric cable that is long enough to allow the operator to stand at the rear of the crane while using the remote control during counterweight installation and removal.

To operate the remote control:

- The electric cable from the remote control must be connected to the receptacle (2) in the left front enclosure.
- The Boom Butt Configuration must be selected in the RCL/RCI Display.

- The remote control must be turned on in the Main Display. See the Main Display Operation Manual.
- Drum 4 must be unparked to operate Drum 4 from the remote control.

Refer to Section 3 of the Operator Manual for instructions on operating the self-erect controls.

### WARNING

#### Moving Load Hazard

When the Boom Butt Configuration is selected in the RCL/RCI Display, the boom hoist function is not disabled when the operator gets out of the seat.

Use extreme care not to activate the boom hoist function by inadvertently operating the boom hoist control handle when exiting and entering the operator cab.



## PIN AND CONNECTING HOLE CLEANLINESS

To prevent dirt from damaging closely machined surfaces of pins and connecting holes:

- Thoroughly clean all pins and connecting holes.
- Apply a light coat of grease to all pins and connecting holes.

## ELECTRIC CABLE CLEANLINESS

To prevent dirt from damaging the electric connectors:

- Thoroughly clean the electric connectors before connecting them.
- Thoroughly clean the dust caps before attaching them to electric cables.
- Do not drag the electric cable connectors or cables on the ground.
- Apply a light coat of dielectric grease to all cable connector pins and connecting holes.
- Apply a light coat of silicone lubricant to the threads of the cable connectors and dust caps.

## CONNECTING/DISCONNECTING HYDRAULIC HOSES AND ELECTRIC CABLES

Always **STOP ENGINE** before performing the following steps during crane assembly and disassembly:

- Connecting and disconnecting hydraulic lines. It will be easier to connect and disconnect the couplers when there is no pressure in the system.

- Connecting and disconnecting electric cables. The potential for operating faults or damage to the electric components exists if the engine is not stopped.

## PRE-START CHECKS

Make the following checks before starting the engine upon arrival at the job site.

- See Section 5 of the Operator Manual for lubrication requirements.
- See Section 3 of the Operator Manual for starting instructions.

Deploy the crane platforms as necessary to gain access to components.

### Engine

1. Check for leaks.
2. Check fuel, oil, and coolant levels.
3. Repair or refill as required.

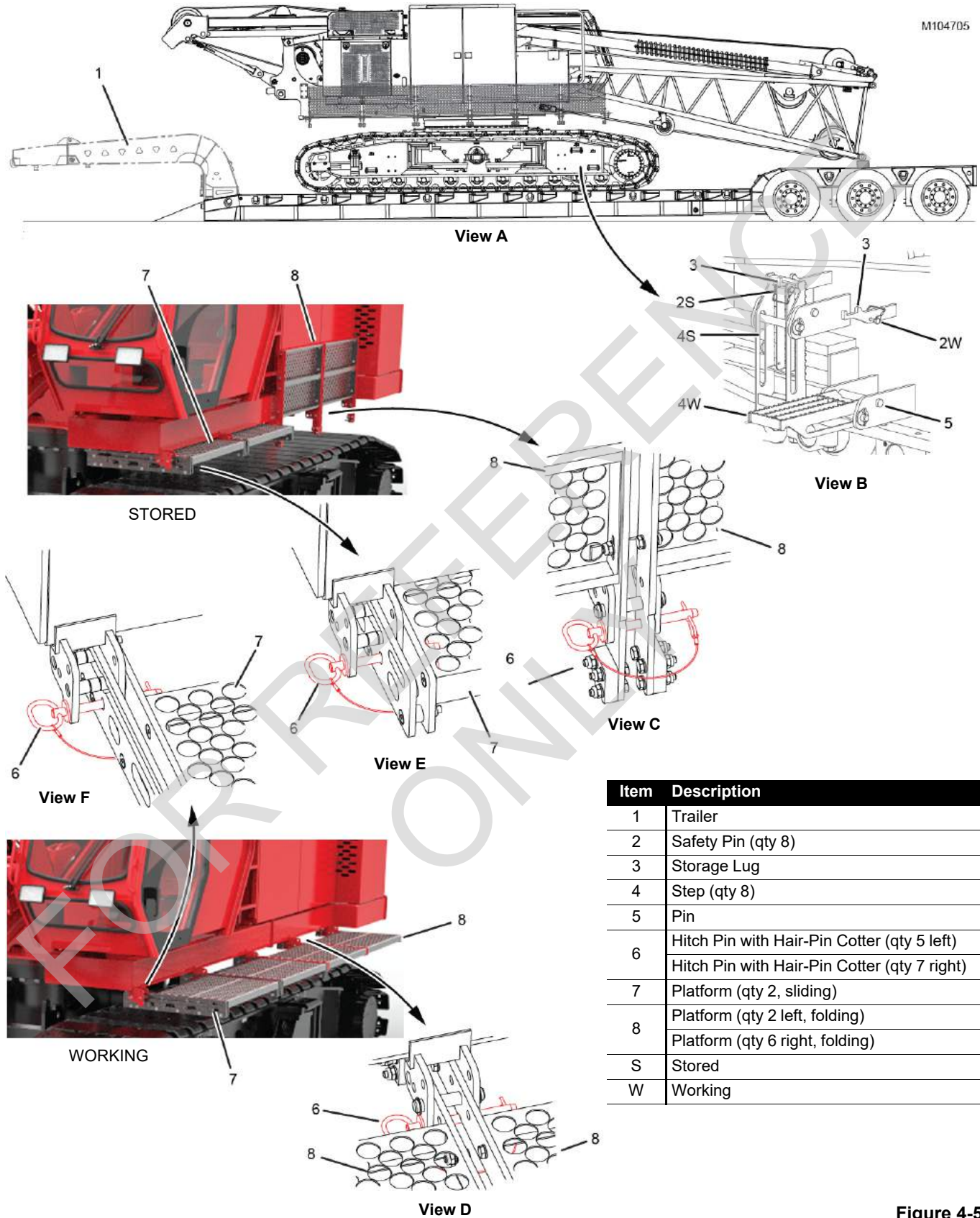
### Gear Boxes

1. Check for leaks.
2. Check levels.
3. Repair or refill as required.

### Hydraulic System

1. Check for leaks.
2. Check level.
3. Repair or refill as required.
4. Make sure hydraulic tank shut-off valve is open.

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Item	Description
1	Trailer
2	Safety Pin (qty 8)
3	Storage Lug
4	Step (qty 8)
5	Pin
6	Hitch Pin with Hair-Pin Cotter (qty 5 left) Hitch Pin with Hair-Pin Cotter (qty 7 right)
7	Platform (qty 2, sliding)
8	Platform (qty 2 left, folding) Platform (qty 6 right, folding)
S	Stored
W	Working

Figure 4-5

## CRANE ASSEMBLY

### Prepare Trailer for Unloading

See [Figure 4-5](#).

1. Position the trailer (1, View A) on a firm level surface.
2. Lower the trailer deck to the ground.
3. Remove the goose neck and the truck.

### Deploy Crawler Steps

See [Figure 4-5](#), View B.

1. Remove the safety pin (2) from the storage lug (3).
2. Unhook the step (4) from the storage lug (3).
3. Lower the step (4) to the working position and hook it under pin (5).
4. Store the safety pin (2) in the storage lug (3).

### Deploy Crane Platforms

**NOTE** The crane platforms can be deployed either before or after the crane is traveled off the trailer, at the crane user's discretion.

It will be easier to access the operator cab if you leave the sliding platform stored under the front of the cab until after the crane is traveled off the trailer.

See [Figure 4-5](#).

1. From under the cab:
  - a. Remove the hitch pins (6, View E).
  - b. Slide the platforms (7, View E) out to the working position (View F).
  - c. Install the hitch pins (6, View F).
2. At the left side enclosures:
  - a. Remove the hitch pins (6, View C).  
In some cases, one hitch pin secures two platforms. Remove the hitch pin only enough to lower one platform at a time.
  - b. Lower the platforms (8, View C) to the working position (View D).
  - c. Install the hitch pins (6, View D).
3. At the right side enclosures, repeat [step 2](#) above.

Item	Description
1	Cab Cover (optional)
2	Rear View Mirror (optional on cab)
3	Rear View Mirror (optional right side)

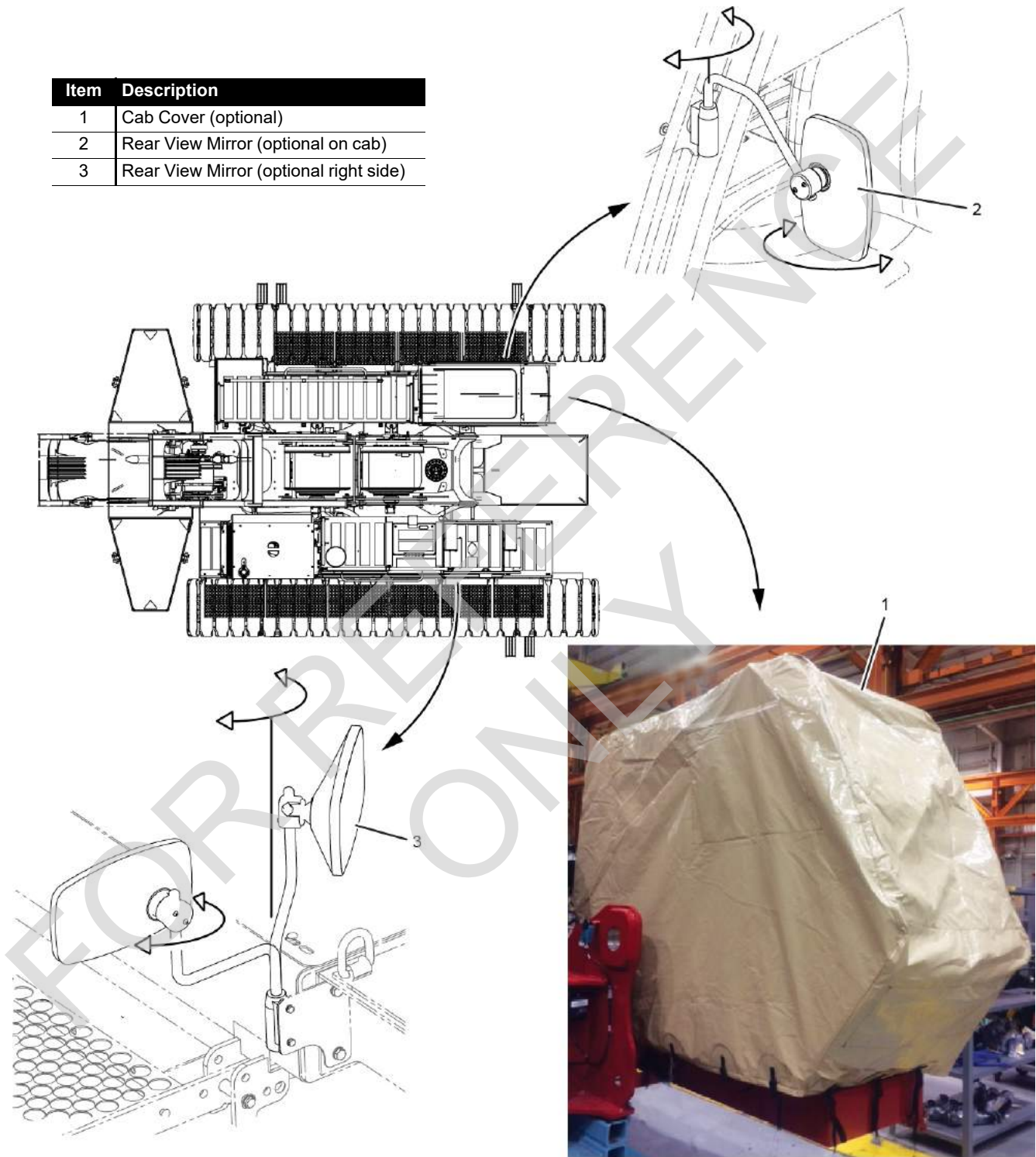


Figure 4-6

## Prepare Cab

See [Figure 4-6](#) for the following steps.

1. Remove and store the cab cover.
2. Rotate the rear view mirror (2) to the operating position and adjust it as required.
3. Rotate the rear view mirror (3) to the operating position and adjust it as required.

FOR REFERENCE ONLY

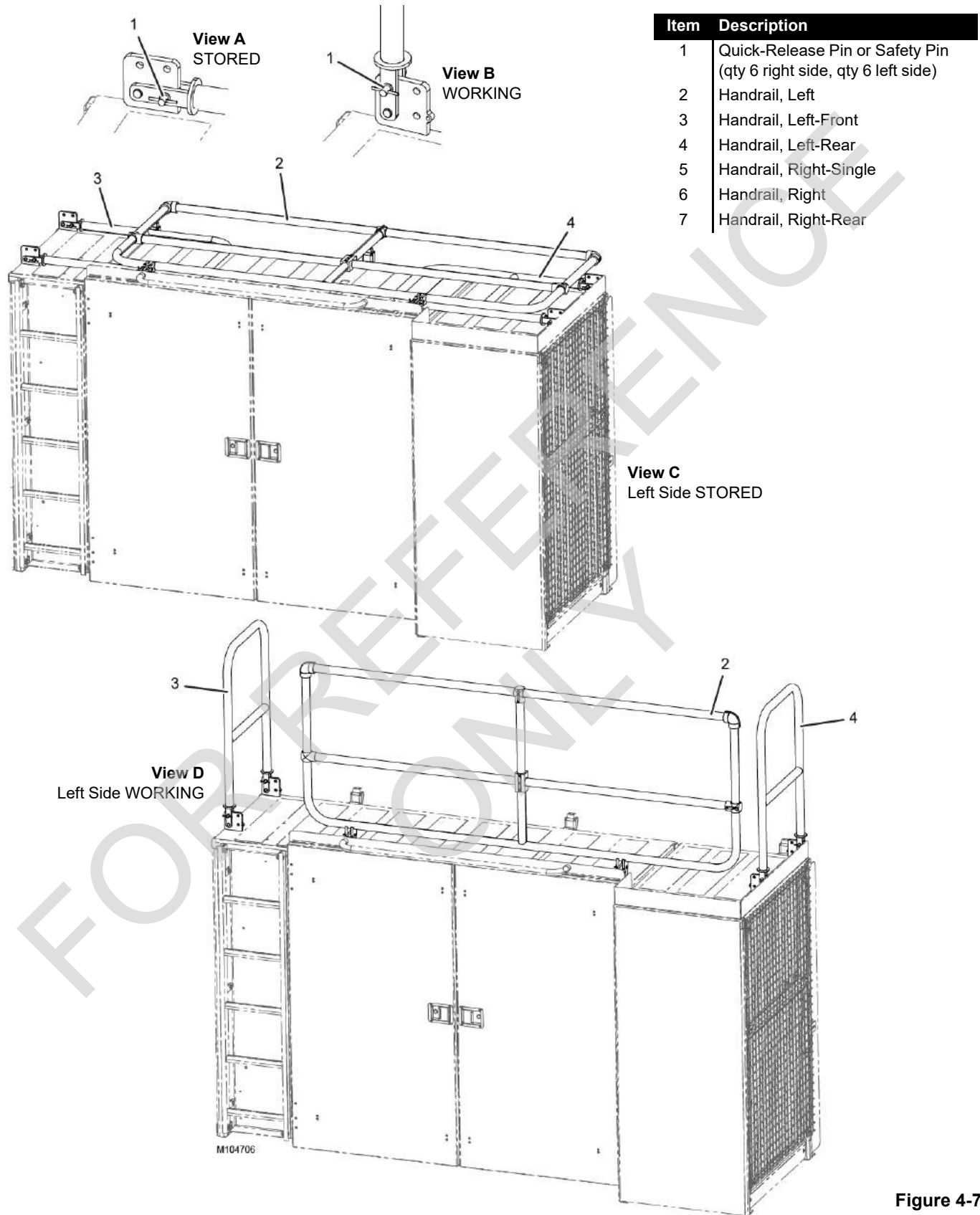


Figure 4-7

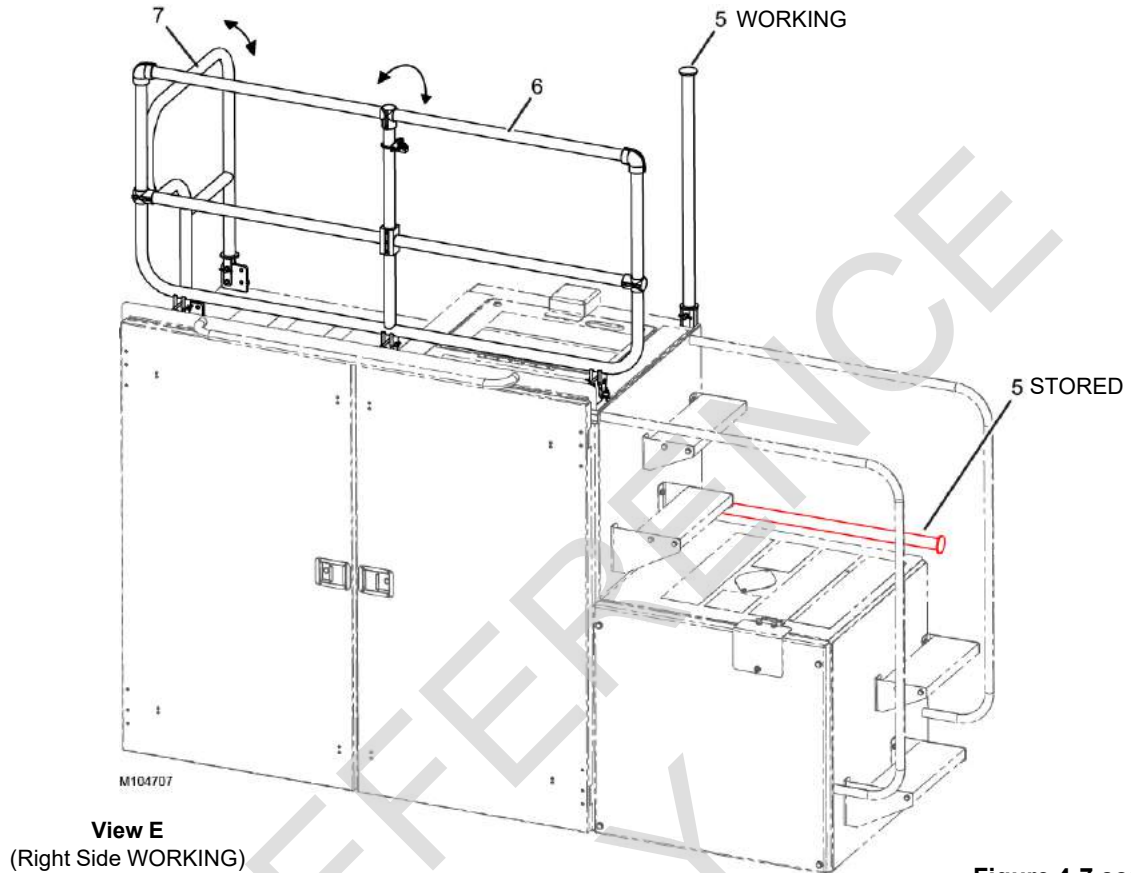


Figure 4-7 continued

## Raise Handrails

### CAUTION

#### Avoid Handrail Damage!

Raise the left side handrails before raising the gantry, or damage will occur.

When stored, the left side handrails lie over the top of the gantry.

See [Figure 4-7](#).

#### 1. On the left side of the crane:

- a. Remove the quick-release or safety pins (1, View A) securing the left handrail (2) in the stored position (View C).
- b. Raise the left handrail (2) to the working position (View D) and install the quick-release or safety pins (1, View B) to secure the handrail (2) in the working position.
- c. Remove the quick-release or safety pins (1, View A) securing the left-front handrail (3) in the stored position (View C).

- d. Raise the left-front handrail (3) to the working position (View D) and install the quick-release or safety pins (1, View B) to secure the handrail (3) in the working position.

- e. Repeat [step c](#) and [step d](#) for the left-rear handrail (4).

#### 2. On the right side of the crane:

- a. Remove the quick-release or safety pin securing the right-single handrail (5, View E) in the stored position.
- b. Pin the right-single handrail (5) in the working position and install the quick-release or safety pin.
- c. Remove the quick-release or safety pins securing the right handrail (6, View E) in the stored position, raise the handrail to the working position, and install the quick-release or safety pins.
- d. Remove the quick-release or safety pins securing the right-rear handrail (7, View E) in the stored position, raise the handrail to the working position, and install the quick-release or safety pins.

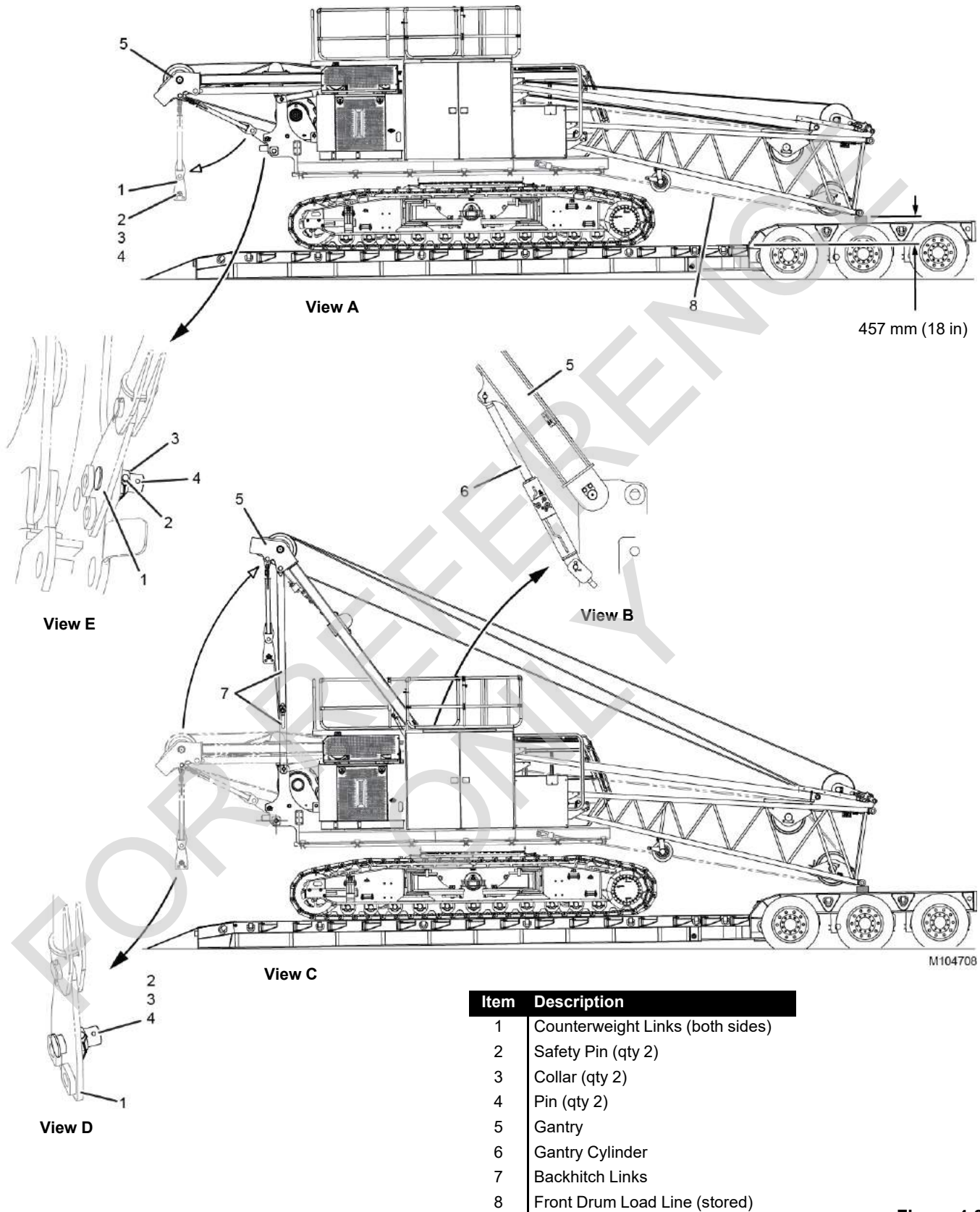


Figure 4-8



## Start Engine

Perform the pre-start checks given on [page 4-7](#) and start the engine.

## Configure RCL/RCI for Crane Setup

Select the Boom Butt Configuration in the RCL/RCI display. The block-up faults will come on at start-up and remain on until this step is performed.

## Raise Gantry

See [Figure 4-8](#).

Manitowoc recommends that the gantry be raised while the crane is on the trailer.

### CAUTION

#### Avoid Wire Rope Damage!

If you chose to travel the crane off the trailer with the gantry down, the boom hoist wire rope will rub against the cross brace on the gantry and possibly against the wire rope on the rear drum when the boom butt is raised. Premature rope wear will occur, resulting in shorter rope life.

To raise the gantry, the boom butt must be at least 457 mm (18 in) above the trailer deck (View A). Otherwise, wire rope damage can occur.

1. Hold the counterweight links (1, View A) so they cannot fall when the pins are removed.
2. Remove the safety pins (2, View E), the collars (3), and the pins (4).
3. Lower the counterweight links to vertical.
4. Reinstall the safety pins (2, View D), the collars (3), and the pins (4) in the holes in the counterweight links (1).

The pin heads should be on the inboard side of the links.

5. Using the gantry cylinders switch on the right console in the cab, extend the gantry cylinders (6, View B) to raise the gantry.
6. The boom hoist wire rope will slacken as the gantry rises. Haul in the wire rope with the boom hoist control in the cab only enough to remove the slack.
7. Continue to raise the gantry until the cylinders are fully extended and the backhitch links (7, View C) are tight.

## Travel Crane off Trailer



### WARNING

#### Tipping Crane Hazard!

To prevent tipping, do not swing (keep upperworks inline with lowerworks) until the crane is traveled off the trailer.

See [Figure 4-9](#).

1. Verify that the boom hoist wire rope is spooled properly on the boom hoist drum.

2. Raise the boom butt to no higher than horizontal.

If the front load line (8, View A, [Figure 4-8](#)) is stored on the boom butt, keep it slack as the butt rises.

3. Slowly travel the crane off the trailer.

4. Remove the trailer from the assembly area.

360° swing is permitted once the crane is off the trailer.

### CAUTION

#### Avoid Sheave Damage!

Use extreme care while swinging so the rope guide under the boom butt does not hit the crawlers (or carbody counterweight once installed).

4

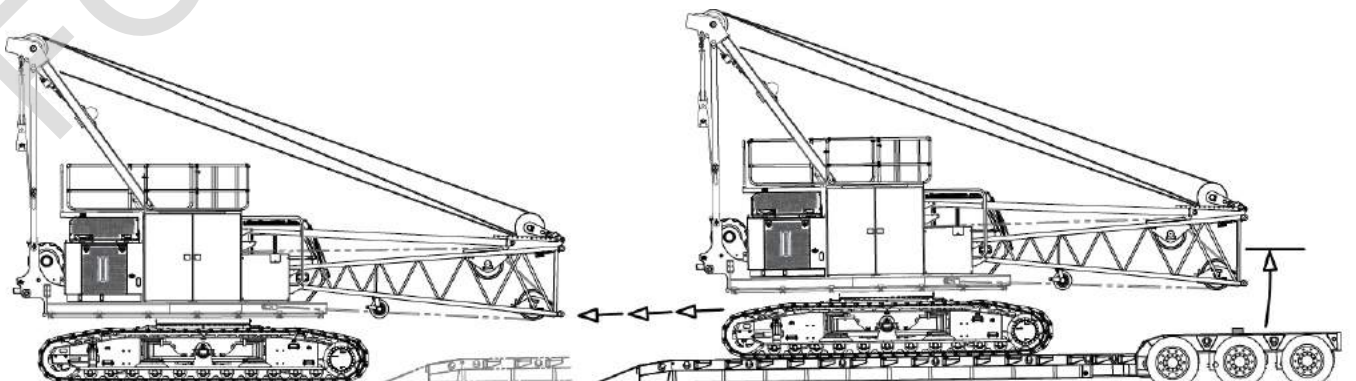


Figure 4-9

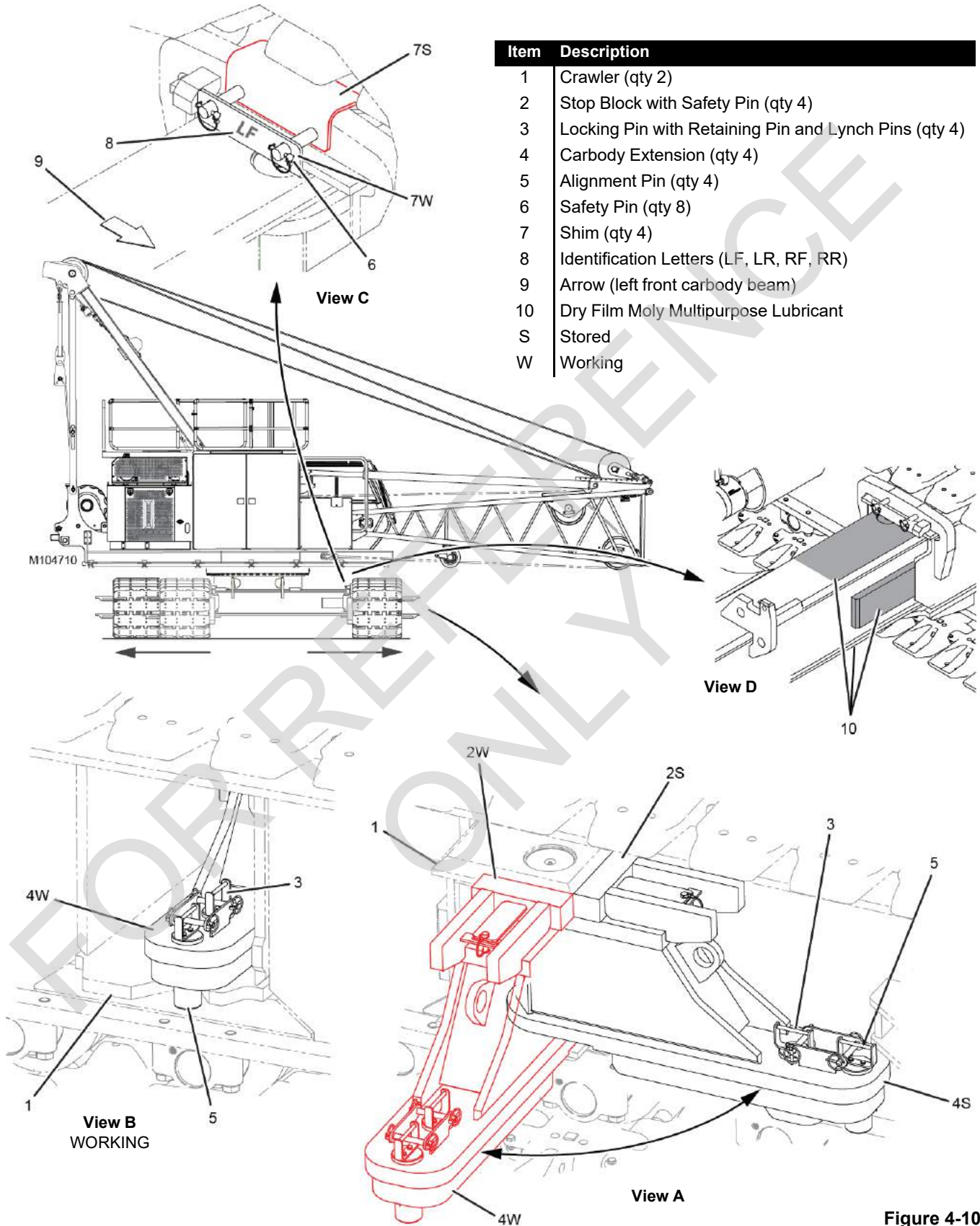


Figure 4-10

**WARNING****Crush Hazard!**

To avoid crushing personnel while extending the crawlers, maintain constant communication (signals) between the operator and ground personnel.

Do not extend/retract crawlers or swing while personnel are standing between the crawlers.

**Extend Crawlers**

See [Figure 4-10](#).

**NOTE** The crawlers must be extended one at a time.

1. Perform the following steps at each carbody extension for one of the crawlers (4, View A):
  - a. Thoroughly clean and spray the sliding surfaces of the carbody extension and the crawler with a quality brand of dry film moly multipurpose lubricant.
  - b. Remove the stop block (2S).
  - c. Remove the locking pin (3).
  - d. Swing the carbody extension (4) outward 90°.
  - e. Reinstall the stop block (2W) in the working position.

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

Do not attempt to extend (or retract) the crawlers with the crane counterweight installed. Tipping will occur if the crane is swung in either direction.

- f. If there is sufficient space on the jobsite, swing the upperworks so that the boom butt is over the crawler that has been prepared for extension.
2. Using the crawler positioning switch on the right console in the cab, extend one crawler (with the other crawler pinned in a fixed position).

Depending on ground conditions:

- It may be necessary to swing
- It may be necessary to travel slowly in either direction

3. Stop extending the crawler when the alignment pins (5, View B) are engaged in the guide pockets of the crawler (1) frames.
4. Install the locking pins (3, View B) in the working position.
5. Remove the shims (7S, View C, four places) from the stored position.

**CAUTION****Avoid Carbody/Crawler Damage!**

Failing to install the shims as instructed in the following steps can result in structural damage to the carbody and/or crawlers.

6. Lubricate the shims with a quality brand of dry film moly multipurpose lubricant to prevent seizing.
7. Install the shims (7W, View C) in the working position.
  - It may be necessary to swing the upperworks to increase the clearance between the crawler and carbody so the shims can be installed.
  - Alternatively, holding the crawler positioning switch in the extend position will cause the crawlers to tip slightly, thereby providing more clearance.

The shims must be installed at the proper carbody beam as indicated by the identification letters:

- LF = Left front
- LR = Left Rear
- RF = Right front
- RR = Right rear

The arrow (9, View C) on the left front carbody beam indicates the FRONT of the carbody.

Do not interchange the shims. They must be installed at the proper carbody beam.

8. Inspect the shims each time they are installed:
  - If a shim is damaged or difficult to install, replace it.
  - Measure the gap between the shims and crawler. The gap must be 1 to 3 mm (0.04 to 0.12 in).
9. Repeat steps 1-8 for the other crawler.
10. Once the crawlers are extended and pinned, thoroughly clean all four sides of the carbody beams at the locations indicated in View D and spray them with a quality brand of dry film moly multipurpose lubricant.

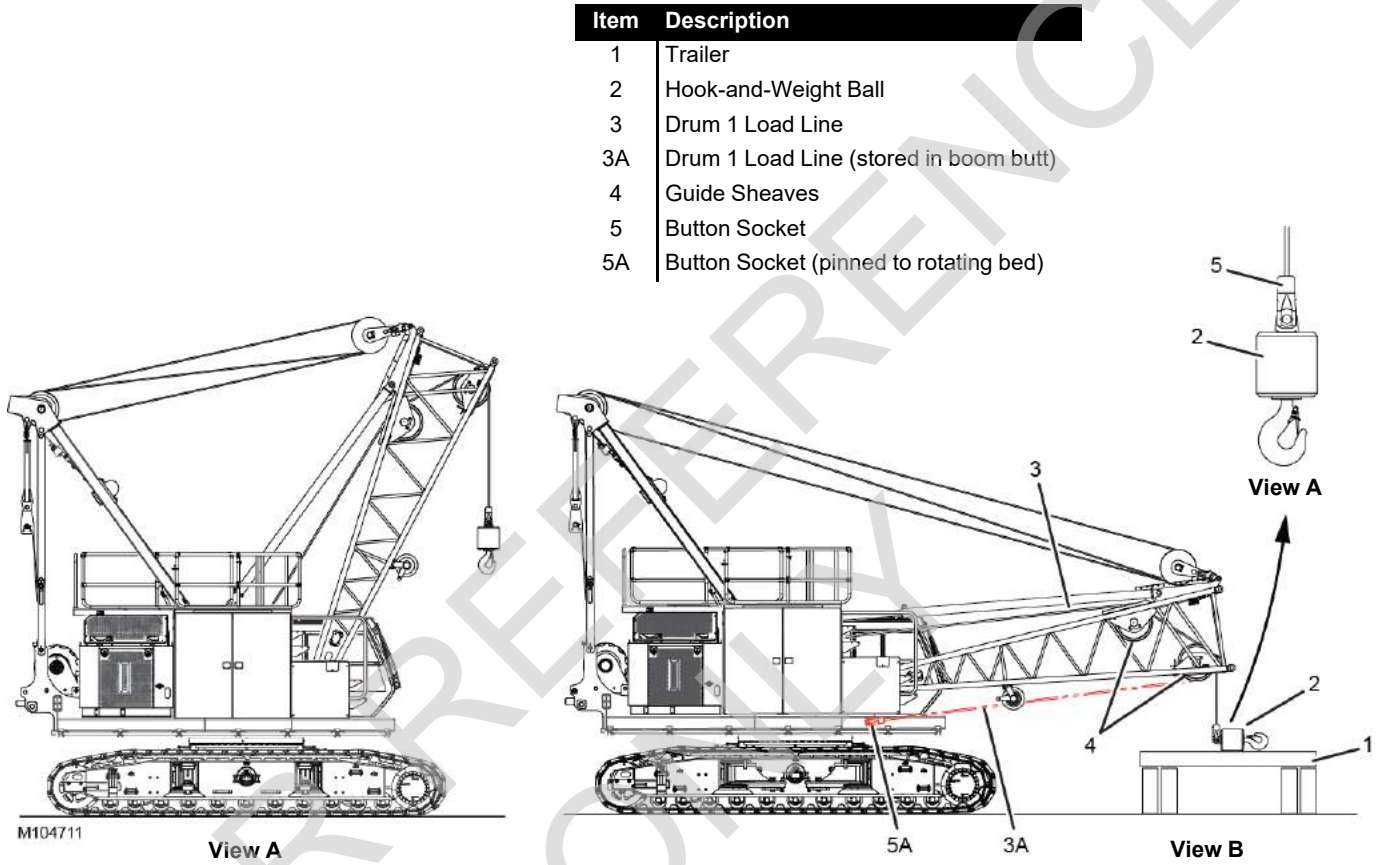


Figure 4-11

## Install Hook-and-Weight Ball

See [Figure 4-11](#).

1. Position the trailer (1, View B) carrying the hook-and-weight ball (2) under the boom butt.
2. If necessary, route the load line (3, View B) from **Drum 1 (front drum only)** over the guide sheaves (4) in the boom butt.

OR — if the load line (3A, View B) is already stored in the boom butt — unpin the button socket (5A, View B) from the hole in the front of the rotating bed.

3. Connect the button socket (5, View A) to the button on the end of the load line. See [Anchoring Wire Rope to Button Socket on page 4-93](#).

The button socket is stored in the parts box supplied with the crane.

4. Connect the button socket (5, View A) to the lug on the hook-and-weight ball (2).
5. Verify that the wire rope is spooled properly on the boom hoist drum.
6. Raise the boom butt and remove the trailer.

### CAUTION

#### Wire Rope Damage!

Observe the load line spooling on Drum 1 often during crane assembly.

To avoid wire rope damage, adjust the load line spooling as necessary.

## Unload Trailers

The crane can now be used to unload the trailers as shown in [Figure 4-12](#), View A.

Refer to the Liftcrane Boom Butt Capacities at the end of this section for lifting capacities.



### WARNING Falling Load Hazard!

The lifting lugs on each boom section are designed only for lifting that section. Do not attempt to lift two or more boom sections with the lifting lugs on one section. The lifting lugs may break allowing the boom sections to fall.

#### Boom Sections

All boom sections have lifting lugs as shown in [Figure 4-12](#).

- Handle the boom sections with care to avoid damaging the lacings and chords.
- Use synthetic lifting slings (7) (crane owner furnished) to lift the boom sections. If wire rope or chain slings are used to handle the boom sections, install protective covering (such as sections of rubber tire) between the slings and the section being lifted.

#### Jib Sections

The jib sections do not have lifting lugs.

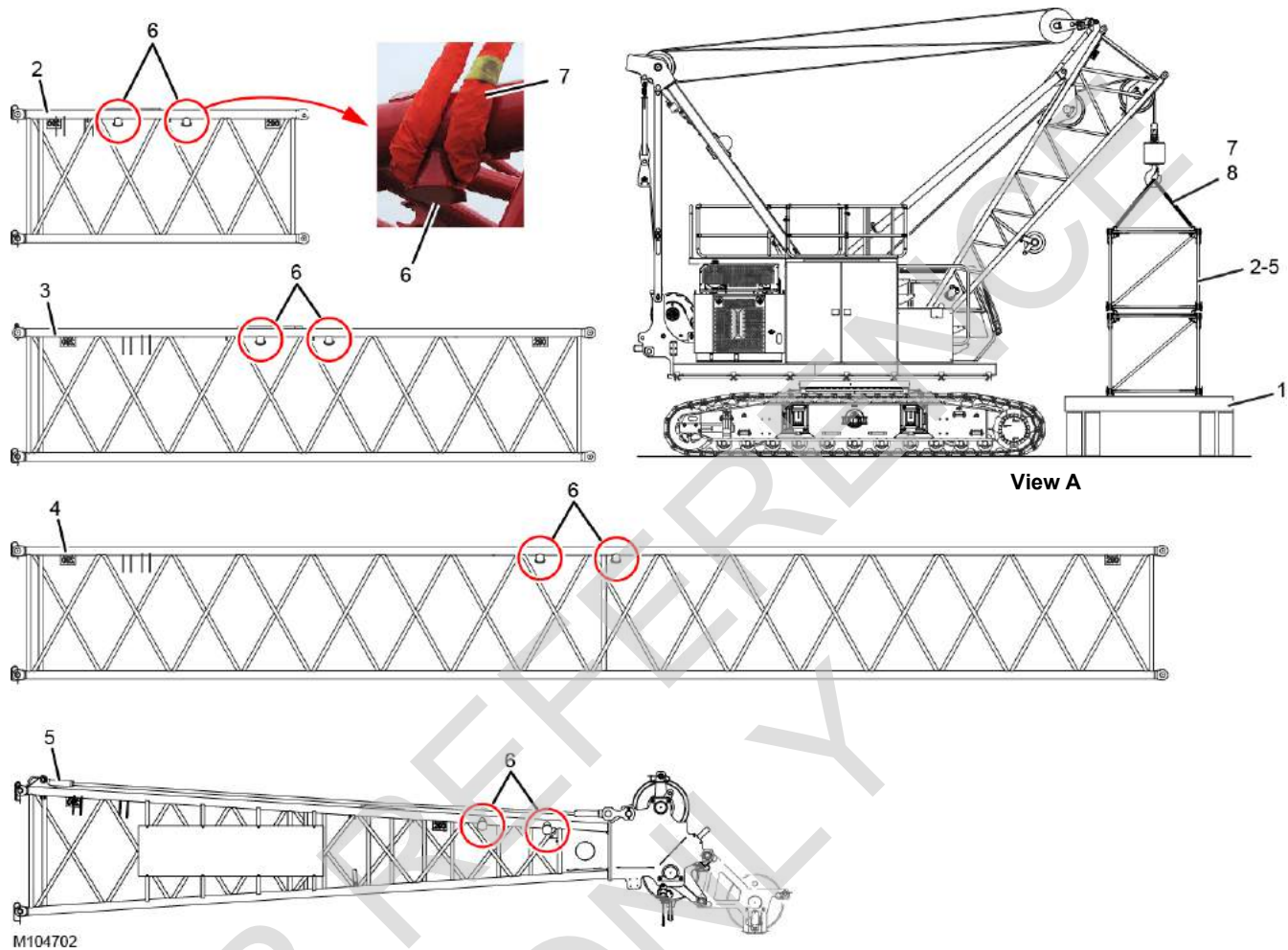
- Handle the jib sections with care to avoid damaging the lacings and chords.
- Use synthetic lifting slings (crane owner furnished) to handle the jib sections. Lift at the chords only. Never lift at the lacings. If wire rope or chain slings are used to handle the jib sections, install protective covering (such as sections of rubber tire) between the slings and the section being lifted.

- See [Figure 4-13](#) for the center of gravity of the jib sections.

#### Counterweight

- Each crane counterweight box has two lifting points.
- The crane counterweight tray and each carbody counterweight has three lifting lugs.

Use the Manitowoc supplied chain lifting sling ([Figure 4-2 on page 4-3](#)) to handle the crane and carbody counterweight boxes and tray.



Item	Description
1	Trailer
2	3 m Boom Insert
3	6 m Boom Insert
4	12 m Boom Insert
5	Boom Top with Pendants Installed and Upper Boom Point either Installed or Removed
6	Lifting Lug (4 each boom section)
7	Synthetic Lifting Slings *
8	Chain Lifting Sling (3-leg) **

\* Supplied by crane owner

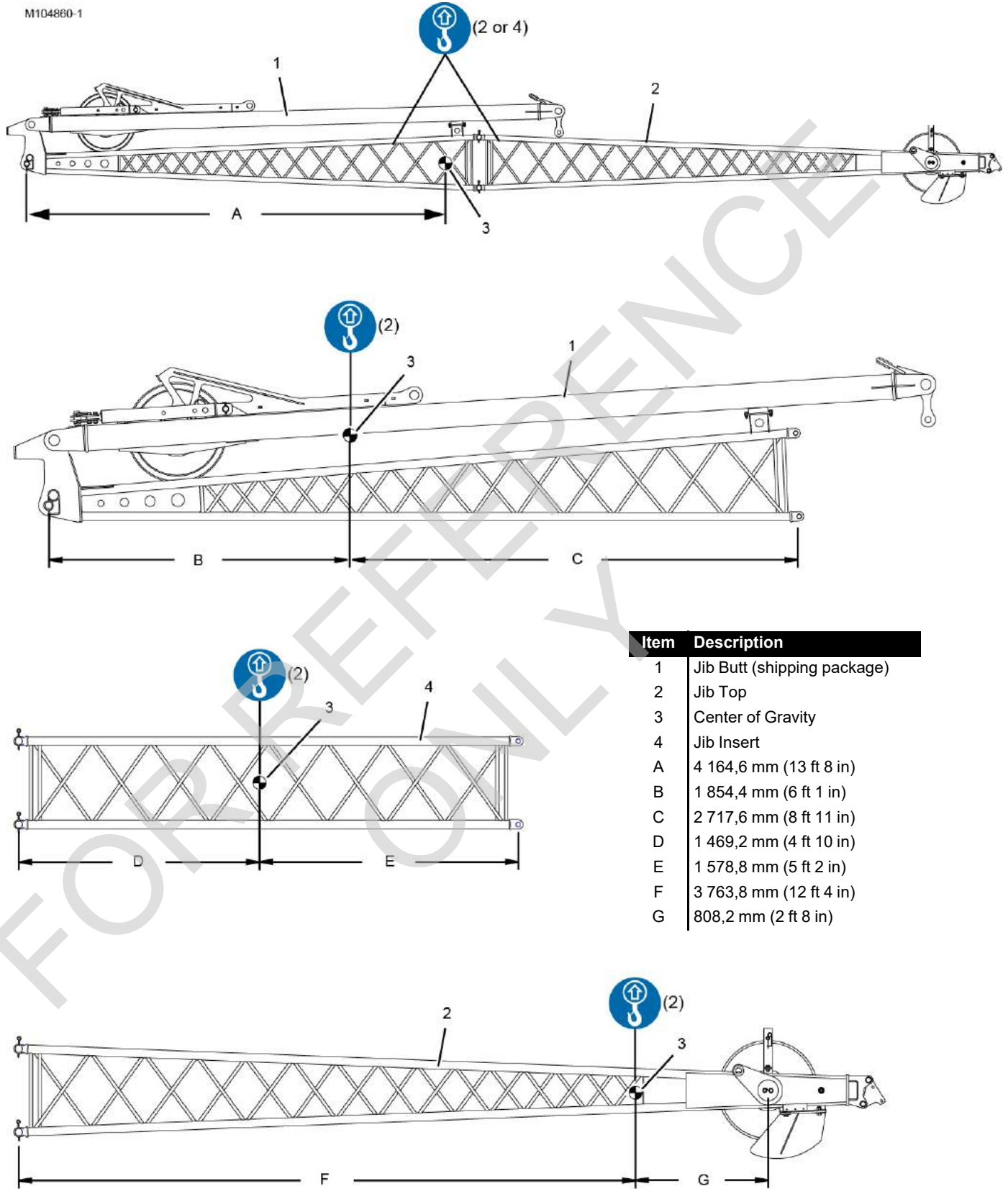
\*\* Supplied by Manitowoc

**! WARNING**  
**Falling Load Hazard!**

To prevent the pendants from falling off the boom top during transport, the boom top pendants must be securely attached to the boom top with owner furnished cargo tie-down straps.

Figure 4-12

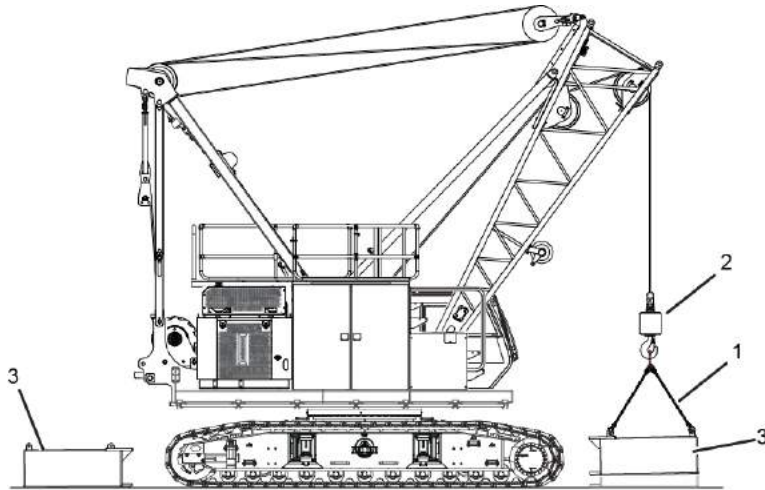
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Item	Description
1	Jib Butt (shipping package)
2	Jib Top
3	Center of Gravity
4	Jib Insert
A	4 164,6 mm (13 ft 8 in)
B	1 854,4 mm (6 ft 1 in)
C	2 717,6 mm (8 ft 11 in)
D	1 469,2 mm (4 ft 10 in)
E	1 578,8 mm (5 ft 2 in)
F	3 763,8 mm (12 ft 4 in)
G	808,2 mm (2 ft 8 in)

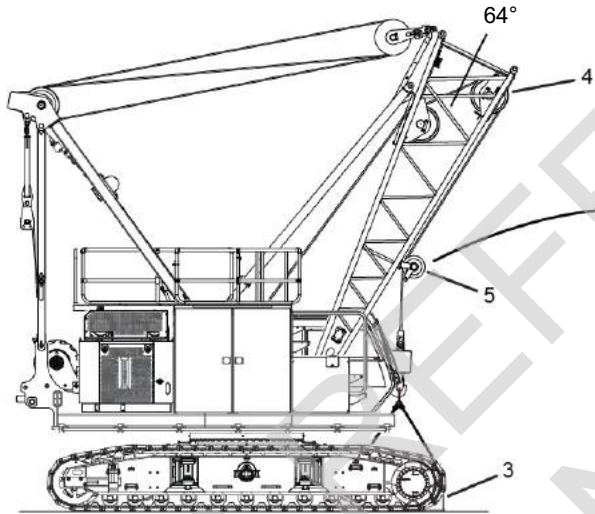
4

Figure 4-13

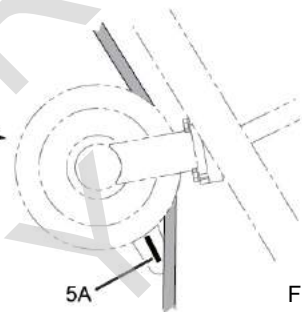


View A

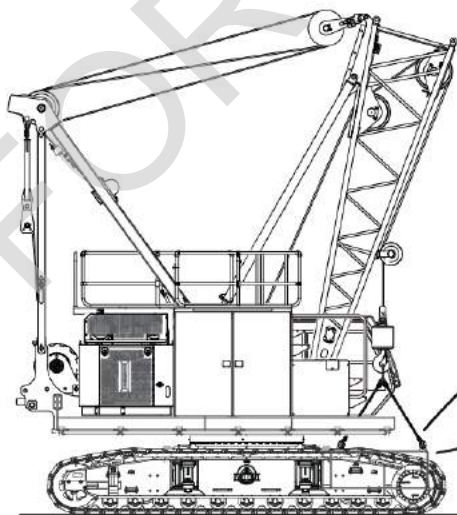
Item	Description
1	Chain Lifting Sling
2	Hook-and-Weight Ball
3	Carbody Counterweight (2)
4	Boom Butt at Min Angle of 64°
5	Counterweight Handling Sheave
5A	Sheave Indicator
6	Pin with Hair-Pin Cotter (4)
7	Hooked Lug (4)



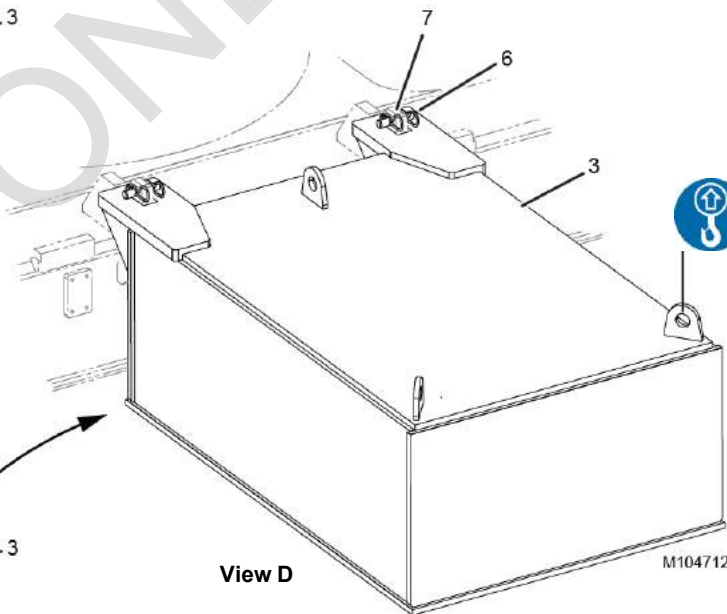
View B



View E  
From Cab Side  
of Boom Butt



View C



View D

M104712

Figure 4-14



## Assemble Boom and Jib

The boom and jib can be assembled with this crane's boom butt or with an assist crane.

The boom and jib can be assembled with this crane either before or after the crane counterweight is installed, at the crane users discretion. The crane will be much easier to maneuver without the crane counterweight installed.

For instructions, see the following topics:

- ["Boom #290 Assembly" on page 4-49](#)
- [Jib #117 Assembly on page 4-55](#)

## Install Carbody Counterweight

For Series 1, disregard this procedure and go to [page 4-25](#).

**NOTE** The following procedure uses the crane's boom butt.

To provide sufficient clearance if you use an assist crane:

- Swing the upperworks perpendicular to the crawlers so the operator cab is on the same side of the carbody that counterweight is being installed.

See [Figure 4-14](#).

If equipped with Series 2 counterweight, install the carbody counterweight (3) at both ends of the carbody, as follows, **BEFORE installing crane counterweight**.

1. Attach the chain lifting sling (1, View A) to the hook-and-weight ball (2).
2. Hook onto the carbody counterweight (3) with the chain lifting sling (1) and lift the counterweight into position at the desired end of the carbody.
3. Set the counterweight on the ground.
4. Repeat [step 1](#) through [step 3](#) for the carbody counterweight at the other end of the crane.

5. Raise the boom butt to approximately 80°.
6. Pay out the load line from Drum 1 and reposition the load line behind the counterweight handling sheave (5, View B). You can stand on the right side platform to perform this step.

---

### CAUTION

#### Avoid Boom Butt Damage!

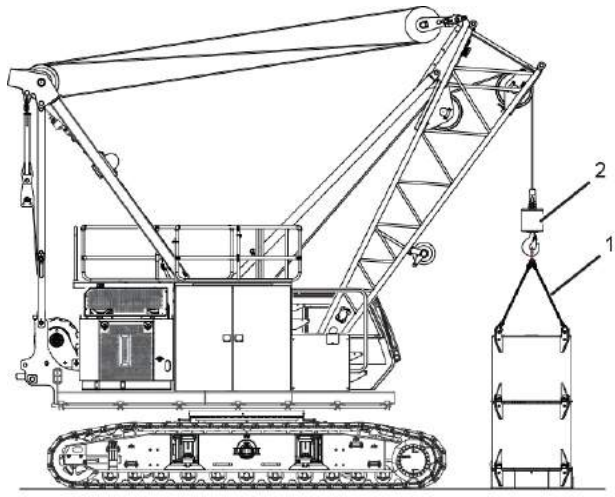
Do not lower the boom butt below 64° while handling the counterweight from the handling sheave. Do not allow the load line to contact the sheave indicator (5A, View E).

Overload damage to the sheave and boom butt can occur.

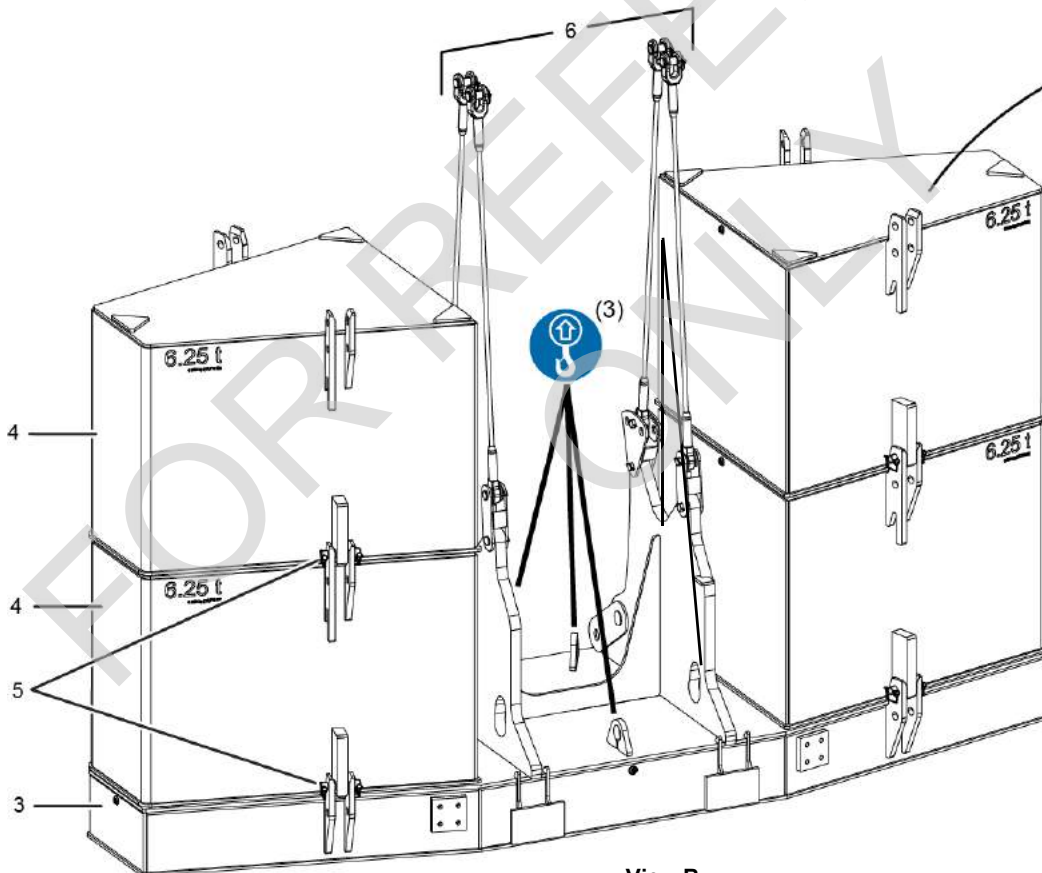
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7. Travel forward so the load line is hanging vertically from the sheave. **DO NOT DRAG the carbody counterweight.**
8. Lift the carbody counterweight off the ground.
9. Remove the pins (6, View D) from the hooked lugs (7) on the carbody.
10. Boom, swing, and hoist as required to engage the cutouts in the carbody counterweight (3, View D) with the hooked lugs (7) on the carbody.
11. Lower the carbody counterweight until the lifting slings go slack.
12. Install the pins (6, View D) to secure the carbody counterweight to the carbody.
13. Disconnect the chain lifting sling from the carbody counterweight.
14. Swing 180° and connect the chain lifting sling to the second carbody counterweight.
15. Repeat the above steps for the other carbody counterweight.

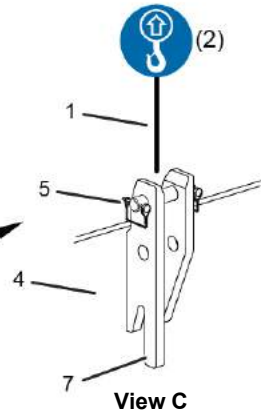
Item	Description
1	Chain Lifting Sling (Manitowoc furnished)
2	Hook-and-Weight Ball
3	Counterweight Tray
4	Counterweight Box <ul style="list-style-type: none"> <li>• Qty 2 for Series 1</li> <li>• Qty 4 for Series 2</li> </ul>
5	Connecting Pin with Safety Pins (Qty 4 or 8)
6	Handling Pendants and Links (stored on tray)
7	Grab Handle (Qty 2 each box)



View A



View B



View C

Figure 4-15

## Assemble Crane Counterweight

See [Figure 4-15](#).

The crane can be used to assemble the crane counterweight using the chain lifting sling (1, View A) attached to the hook-and-weight ball (2).

1. Lift the counterweight tray (1, View B) onto the ground. Lift at the three lifting lugs provided.



### WARNING

#### Falling Load Hazard!

The three lifting lugs on the counterweight tray are designed only for lifting the tray. Do not attempt to lift the counterweight tray from the lifting lugs with the counterweight boxes installed. The lifting lugs may break allowing the tray and boxes to fall.

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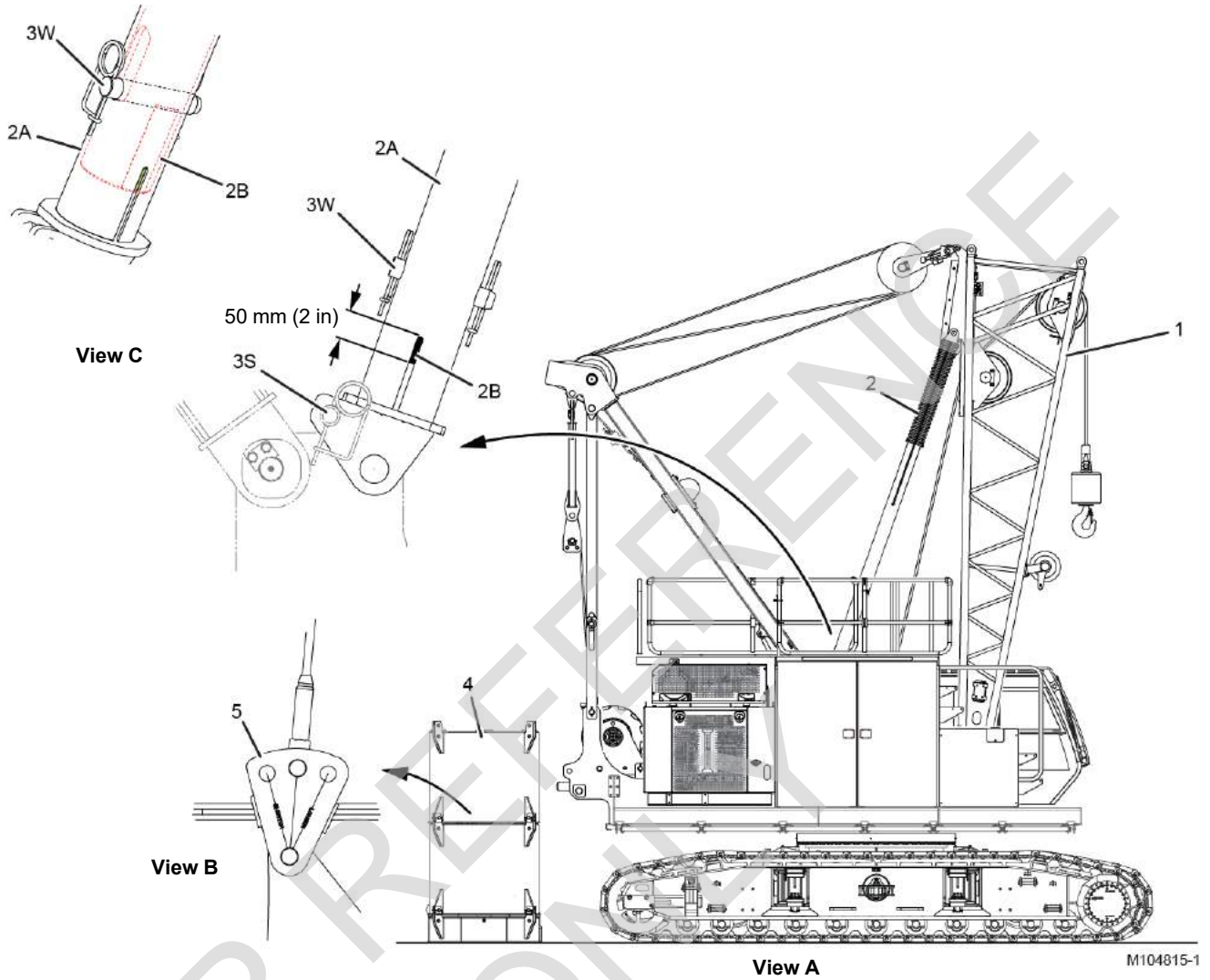
#### 1. For **Series 1**:

- a. Install the two connecting pins (5, View C) in the top holes of either counterweight box (4).

- b. Using two legs of the chain lifting sling (1, View C), lift the counterweight box (4) at the two connecting pins (5).
- c. Lift the counterweight box into position on the counterweight tray (3, View B).
- d. Disconnect the lifting slings and remove the connecting pins (5, View B) from the top holes of the counterweight box (4).
- e. Pin the counterweight box (4, View B) to the counterweight tray (3) with the two connecting pins (5).
- f. Repeat the above steps for the other counterweight box (4).

2. For **Series 2**, repeat the above steps for the top two counterweight boxes (4).

3. Make sure all of the counterweight boxes are pinned to the tray and to each other with connecting pins (5). Make sure the safety pins are installed.



M104815-1

Item	Description
1	Boom Butt at 81°
2	Boom Stop Spring Compressed (qty 2)
2A	Boom Stop Outer Tube (Qty 2)
2B	Boom Stop Inner Tube (Qty 2)
3	Hold-Back Pin with Hair-Pin Cotter (Qty 2)
4	Crane Counterweight
5	Adjustable Handling Link (Qty 2)
S	Storage Holes
W	Working Holes

Figure 4-16

**DANGER****Crush Hazard!**

Avoid being crushed by moving parts:

- Do not stand between the crane counterweight and the crane while the crane counterweight is being installed.
- Do not stand on the crane counterweight while it is being raised or lowered.
- Do not climb onto the crane counterweight until the counterweight pins are engaged.
- Never go under the crane counterweight until the counterweight pins are engaged.

**Activate Remote Control**

Activate the remote control in the main display. Read the topic "[Self-Erect Controls](#)" on page 4-6.

**Install Crane Counterweight**

See [Figure 4-16](#).

**NOTE** Using the remote control will allow the operator to see the hold-back holes during the following steps.

**WARNING****Crush Hazard!**

Moving parts can cut or crush.

Do not stick your fingers into the slots in the boom stop outer tubes (2A, View C, [Figure 4-16](#)).

1. Prepare the boom stops.

**CAUTION****Structural Damage to Crane!**

Use extreme care when compressing the boom stops during the following steps. Do not compress the boom stops until they are solid. Damage to the boom butt or boom stops can occur.

Stop compressing the boom stops when the hold-back holes are aligned.

- a. Slowly raise the boom butt (1, View A) to approximately 81°. This step will compress the boom stop springs (2).
- b. Stop raising the boom butt when the boom stop inner tubes (2B, View C) are visible approximately 50 mm (2 in) into the slots in the boom stop outer tubes (2A).  
The hold-back holes in the inner and outer tubes should now be aligned.
- c. Remove the hold-back pins (3, View C) from the storage holes (S) and install them in the working holes (W) between the boom stop tubes.

2. The boom butt will now remain in position while the gantry is raised and lowered during the remaining steps.
3. Travel the crane into position so it is in line and centered in front of the crane counterweight (4, View A).
4. The adjustable handling links (5, View B) must be toward the rear.

*Continued on next page.*

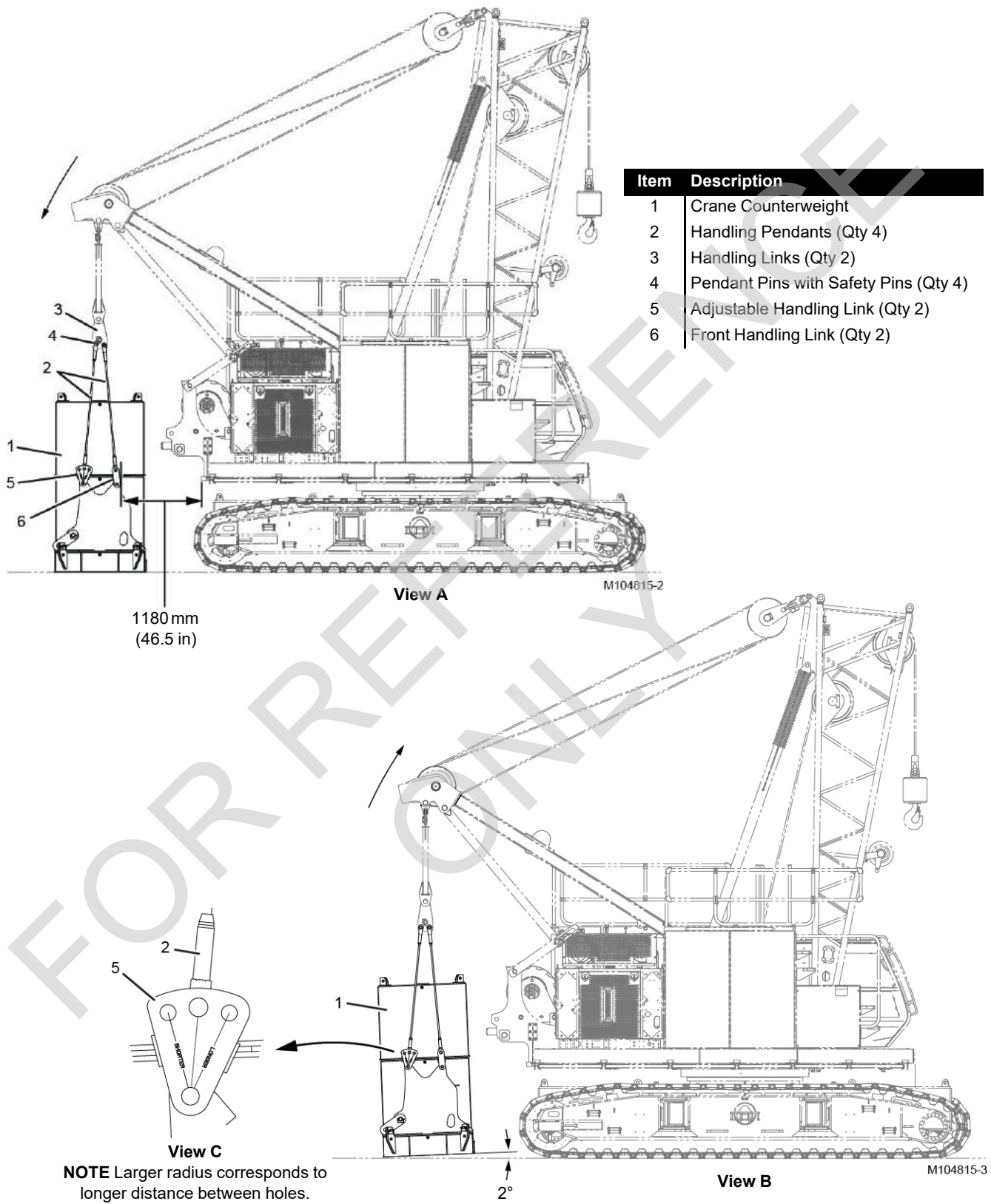


Figure 4-17

## Install Crane Counterweight (continued)

Use the remote control for the remaining steps. This will allow the installer to stand at the rear of the crane and view the installation procedure.

- Use the Drum 4 (boom hoist) thumbwheel on the remote control to raise and lower the gantry.
- **Turn ON the SYNC switch** on the remote control so the gantry raising cylinders follow the gantry as it is raised and lowered during the following steps. See Section 3 of the Operator Manual for detailed instructions.

See [Figure 4-17](#).

5. Remove the pins from the handling pendants (2, View A).
6. Lower the gantry (boom down using the Drum 4 thumbwheel on the remote control) until the handling pendants (2, View A) can be pinned to the handling links (3).

At this point:

- The gantry will be at approximately 31°.

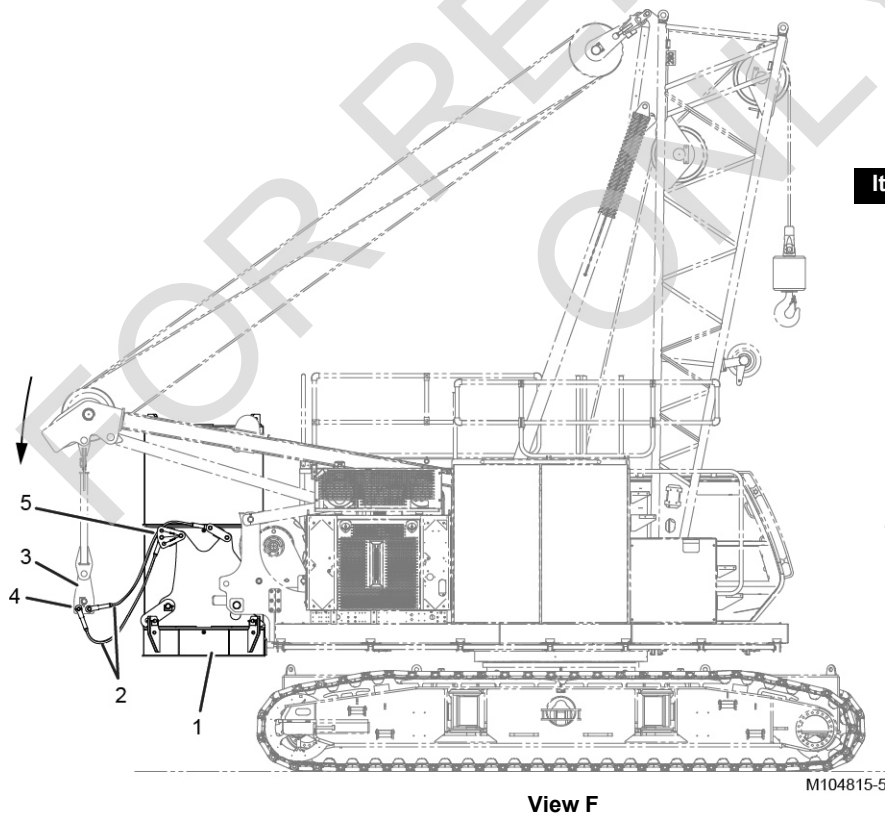
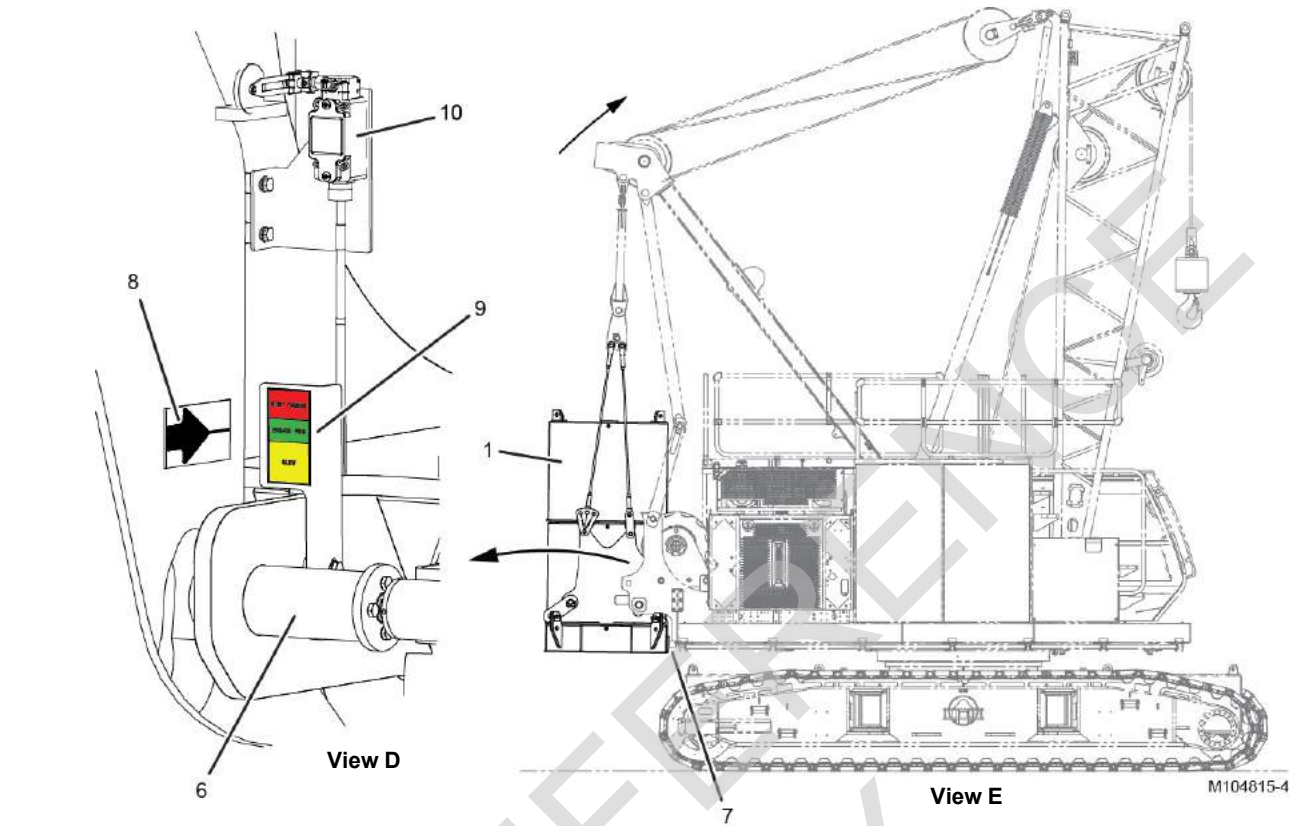
- The handling links (3) will be centered over the crane counterweight (1).
- The crane will be at the approximate dimension given in View A.

7. Install the handling pins (4, View A).
8. Slowly raise the gantry (boom up using the Drum 4 thumbwheel on the remote control) until the crane counterweight is about to leave the ground. The tray should hang approximately 2° out of level (View B) — front of tray higher than rear of tray.
9. If needed, the angle can be adjusted slightly by changing which holes the handling pendants are pinned to in the adjustable handling links (5, View C).

The rear handling pendants (2, View C) can be made longer (increase lifting angle) or shorter (decrease lifting angle) by pinning the pendants to the corresponding holes in the links. Be sure to pin both pendants to the same holes, or the crane counterweight will lift out of level from side to side.

10. It is normal for the counterweight to lift slightly out of level to the right.

*Continued on next page.*



Item	Description
1	Crane Counterweight
2	Handling Pendants (Qty 4)
3	Handling Links (Qty 2)
4	Pendant Pins with Cotter Pins (Qty 4)
5	Not Used
6	Counterweight Pin (Qty 2)
7	Pad (Qty 2)
8	Arrow
9	Alignment Decal
10	Limit Switch

View F

M104815-5

Figure 4-17 continued



## Install Crane Counterweight (continued)

See [Figure 4-17](#).

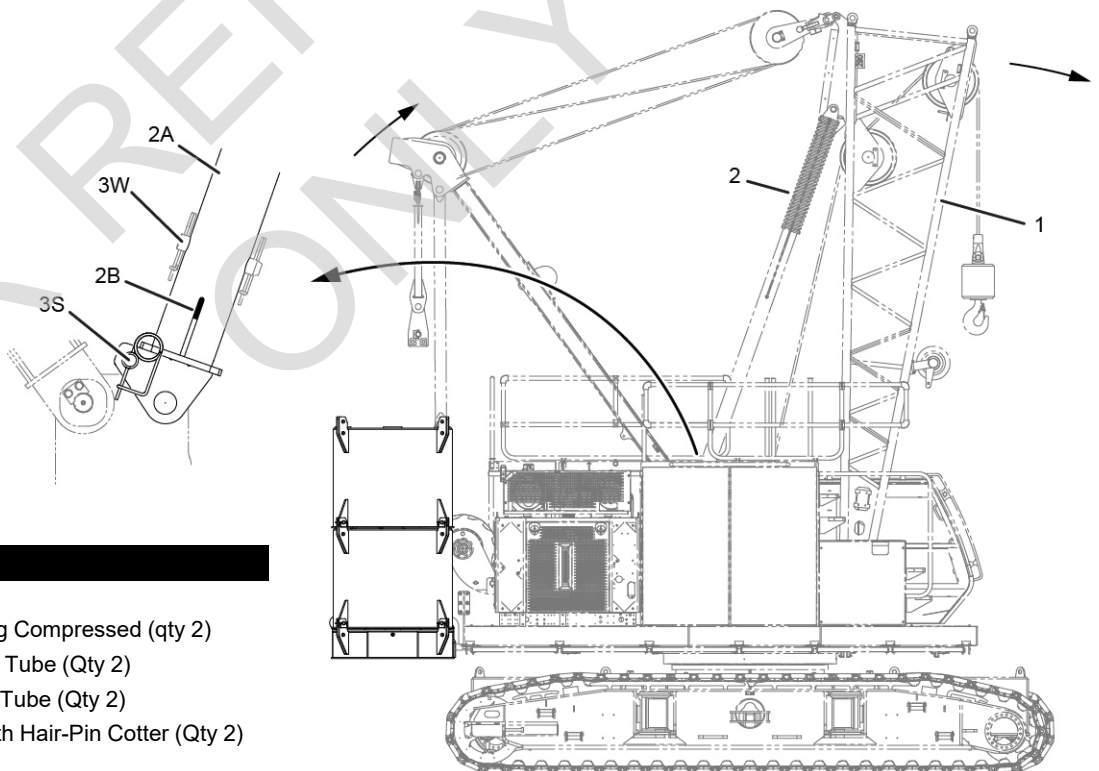
11. Disengage the counterweight pins (6, View D) using the switch on the remote control.
12. Slowly raise the gantry (boom up using the Drum 4 thumbwheel on the remote control) to lift the crane counterweight (1, View E) into position.  
The boom butt will rise slightly and the boom stops will fully compress during this step.
13. The pads (7, View E) on the front of the tray should contact the rear of the crane first.
14. Use the arrow (8, View D) on the tray and the alignment decal (9) to judge when the crane counterweight is high enough to engage the counterweight pins.
15. Once the arrow (8, View D) points to the green area of the alignment decal (9), release the counterweight pins switch on the remote control to engage the counterweight pins (6, View D).

**NOTE** If the crane counterweight is raised too high, the limit switch (10, View D) will trip open to stop the gantry and prevent the backhitch from fully extending. The COUNTERWEIGHT TOO HIGH fault will come on in the main display.

16. Verify that the counterweight pins are fully engaged.
17. Slowly lower the gantry (boom down using the Drum 4 thumbwheel on the remote control) to lower the crane counterweight onto the pins.
18. Continue to lower the gantry until the handling pendants (2, View F) can be unpinned from the handling links (3).
19. Unpin the pendants and store them on the counterweight tray

See [Figure 4-18](#).

20. Fully raise the gantry (boom up using the Drum 4 thumbwheel on the remote control) until the cylinders are fully extended and the backhitch links are tight.
21. Boom up slightly using the Drum 4 thumbwheel on the remote control so the hold-back pins (3) are loose.
22. Remove the hold-back pins (3) from the working holes (W) in the boom stop tubes and install the pins in the storage holes (S).
23. **Turn OFF the SYNC switch** on the remote control.
24. Lower the boom butt into the working range.
25. The remote control can now be disabled and stored.

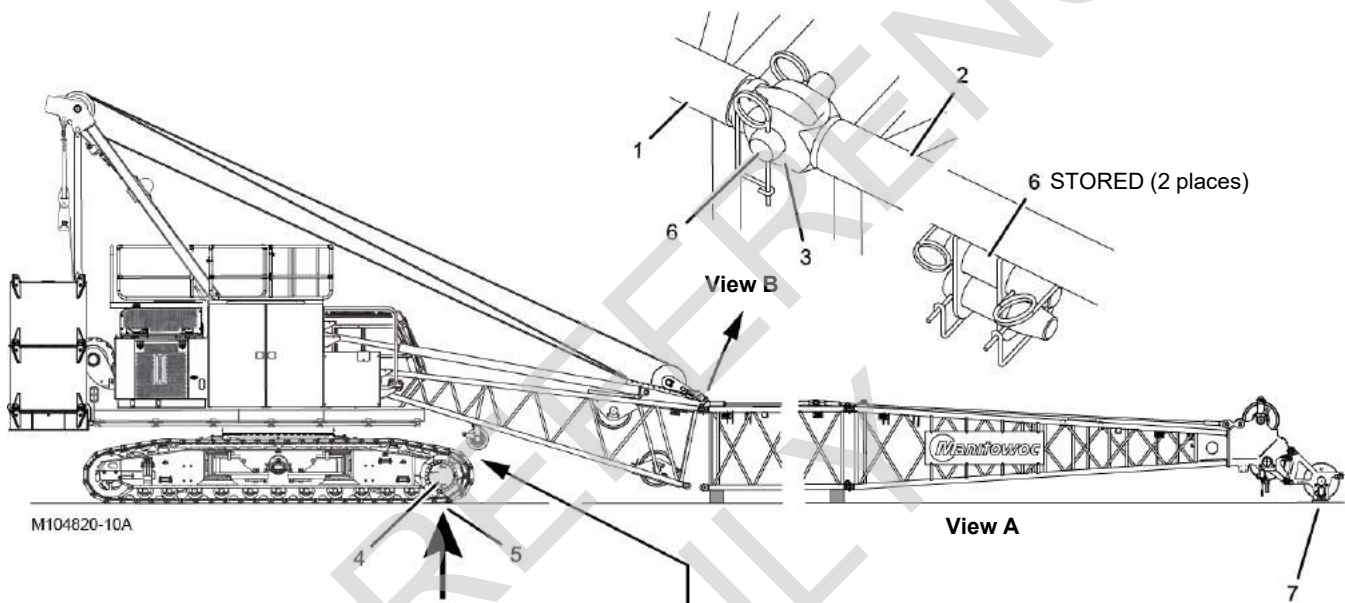


Item	Description
1	Boom Butt at 84°
2	Boom Stop Spring Compressed (qty 2)
2A	Boom Stop Outer Tube (Qty 2)
2B	Boom Stop Inner Tube (Qty 2)
3	Hold-Back Pin with Hair-Pin Cotter (Qty 2)
S	Storage Holes
W	Working Holes

M104815-6

Figure 4-18

Item	Description
1	Boom Butt
2	Boom Insert
3	Top Connectors
4	Tumbler or Roller
5	Blocking
6	Top Connector Pins with Safety Pins
7	Upper Boom Point Stands



**CAUTION**

**Avoid Sheave Damage!**

Use extreme care while swinging so the rope guide under the boom butt does not hit the crawlers (or carbody counterweight if installed).

Figure 4-19

## Remove Hook-and-Weight Ball

After you are done using the for self-assembly, remove the hook-and-weight ball from the boom butt. Reverse the steps for [Install Hook-and-Weight Ball on page 4-19](#).

## Connect Boom Butt to Boom

See [Figure 4-19](#).

1. If not already done, remove the hook-and-weight ball. See [Remove Hook-and-Weight Ball](#).
2. Boom up to lift the boom butt (1, View A) clear of the ground.
3. Position the crane so the boom butt (1, View A) is in line with the boom insert (2).
4. Travel forward slowly, swing, and boom up and down as needed to align the top connectors (3, View B) on the boom butt (1) with the top connectors (3) on the insert (2).



### WARNING

#### Tipping Hazard!

Prevent the crane from tipping:

- Block the crawlers — if required per the capacity chart — before attempting to raise the boom.

5. Check the appropriate capacity chart to see if the crawlers need to be blocked to raise the boom. If so, proceed as follows:
  - a. Mark the ground at the center of the front tumbler or roller (4, View A).
 

See the Crawler Blocking Diagram in the Capacity Chart Manual for blocking requirements.
  - b. Slowly travel in reverse several feet.
  - c. Place the required blocking (5, View A) on the ground at the points marked in [step a](#).
  - d. Repeat [step 4](#) while traveling onto the blocking.



### WARNING

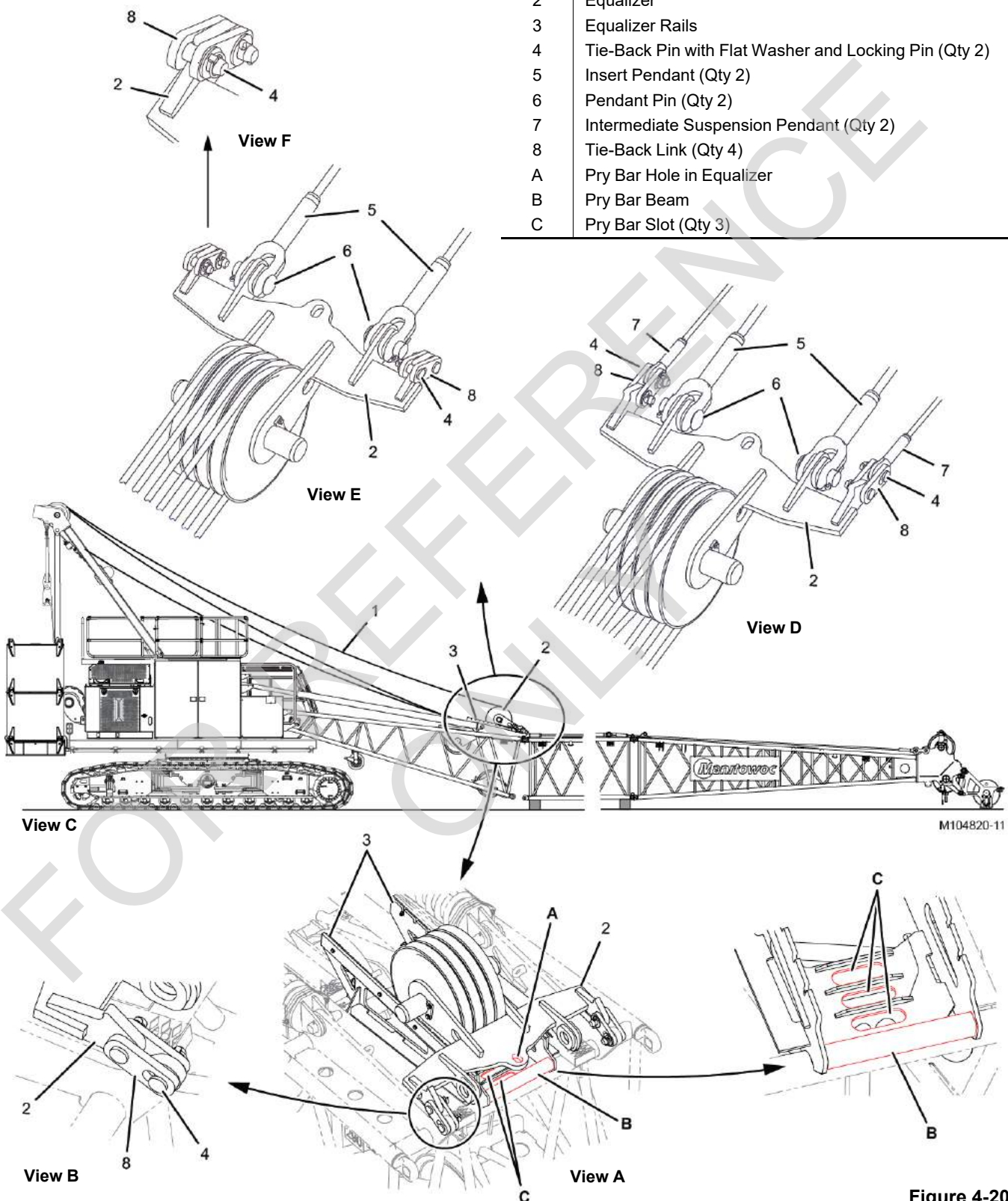
#### Crushing Injury Hazard!

Prevent serious crushing injury:

- Do not stand inside the boom sections while installing the connector pins — STAND OUTSIDE BOOM.
6. Align the top connector holes and install the top connector pins (6, View B) — long tapered end pointing in.
 

The pins are stored in holders on the boom insert.
  7. **Connect the boom pendants to the equalizer now, BEFORE CLOSING THE BOOM.** See [Connect Boom Pendants to Equalizer on page 4-35](#).

Item	Description
1	Boom Hoist Wire Rope
2	Equalizer
3	Equalizer Rails
4	Tie-Back Pin with Flat Washer and Locking Pin (Qty 2)
5	Insert Pendant (Qty 2)
6	Pendant Pin (Qty 2)
7	Intermediate Suspension Pendant (Qty 2)
8	Tie-Back Link (Qty 4)
A	Pry Bar Hole in Equalizer
B	Pry Bar Beam
C	Pry Bar Slot (Qty 3)



M104820-11

Figure 4-20

## Connect Boom Pendants to Equalizer

See [Figure 4-20](#).

1. Boom down to slacken the boom hoist wire rope (1, View C) until the equalizer (2, View B) is resting firmly on the boom butt equalizer rails (3) and the tie-back pins (4, View A) are loose.
2. Pin the insert pendants (5, View D or E) to the equalizer (2) with the pendant pins (6) — **pin heads toward inboard side of pendants**.

## Close Boom

### CAUTION

#### Avoid Gantry and/or Boom Butt Damage!

Do not boom up past the bottom insert connector holes.

1. During the following step, the boom will pivot about the upper boom point stands if the upper boom point is installed.

If the upper boom point is not installed, block under the lower boom point, as required, so it does not dig into the ground as the boom is raised.

2. Slowly boom up to align the bottom connector holes and install the bottom connector pins (3, [Figure 4-21](#)). — long tapered end pointing in.

The pins are stored in holders on the boom insert.

3. Boom down to slacken the boom hoist reeving.

## Disconnect Equalizer from Boom Butt



### WARNING

#### Moving Object Hazard!

Prevent serious crushing injury:

Make sure the pins (4, View A) are loose before removing them. Otherwise, the equalizer can be pulled rearward by the boom hoist wire rope.

See [Figure 4-20](#).

1. **Make sure the tie-back pins (4, View B) are loose before removing them.**

2. Slacken the boom hoist wire rope.

3. If necessary, use a pry bar to move the equalizer forward enough to loosen the tie-back pins (4, View B).

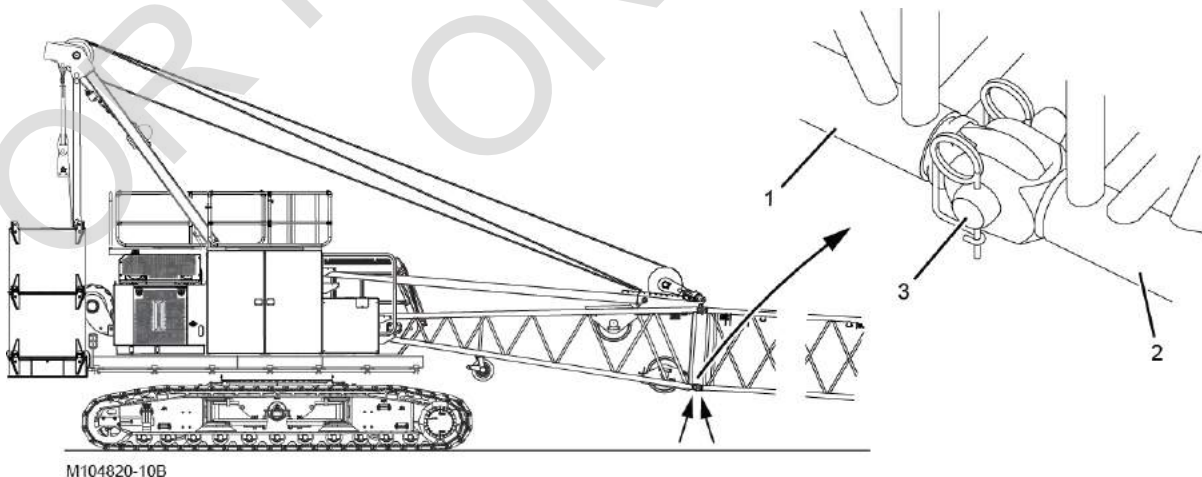
A pry bar hole (A, View A) is provided in the equalizer. A pry bar beam (B) and slots (C) are provided in the boom butt.

4. If equipped with intermediate suspension, pin the intermediate suspension pendants (7, View D) to the tie-back links (8) with the tie-back pins (4).

5. If not equipped with intermediate suspension, pin the tie-back links (8, View F) in the storage position with the tie-back pins (4).

## Configure RCL/RCI for Crane Operation

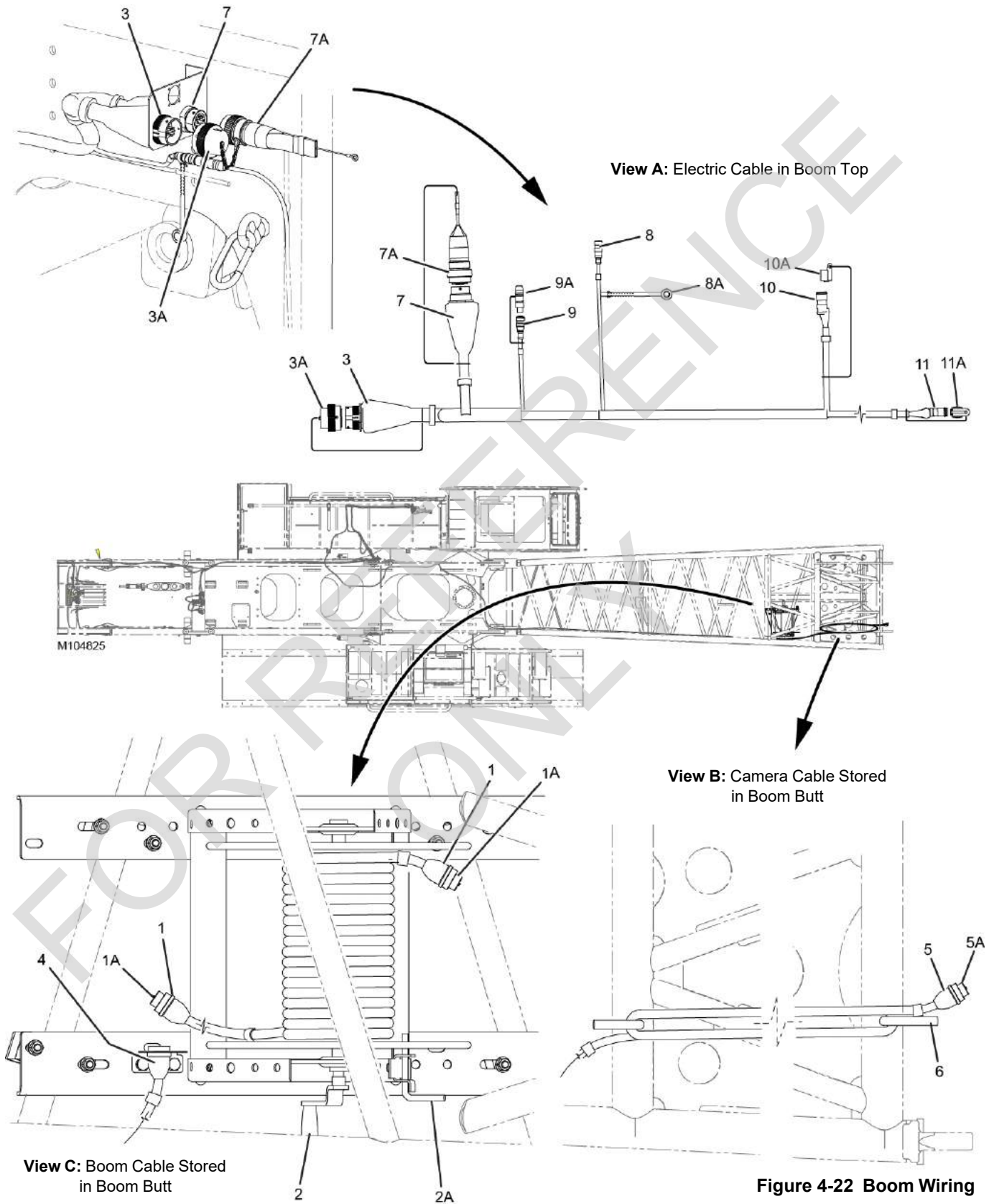
Select and confirm the required Crane Configuration and capacity chart in the RCL/RCI display.



M104820-10B

Item	Description
1	Boom Butt
2	Boom Insert
8	Bottom Connector Pins with Safety Pins

Figure 4-21



Legend for [Figure 4-22](#).

Item	Description
1	Boom Extension Cable (WBBI-P2)
1A	Dust Cap
2	Cable Reel
2A *	Handle
2B *	Locking Lever
3	Boom Top Connector (WBT1-J1)
3A	Dust Cap
4	Boom Connector (WRL1-J9)
5	Camera Extension Cable (WBB2 CCTV)
5A	Dust Cap
6	Storage Bracket
7	Attachment Connector (WBT1-J2)
7A	Shorting Plug
8	Lower Point Block-Up Limit Cable (WBT1-P4)
8A	Dust Cap
9	Second Lower Point Block-Up Limit Cable (WBT1-P3)
A	Shorting Plug
10	Anemometer Cable (WBT1-P6)
10A	Dust Cap
11	Position Light Cable (WBT1-P5)
11A	Dust Cap

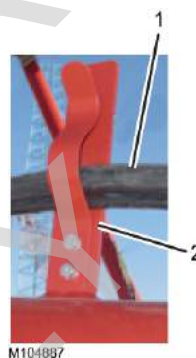
\* Handle (2A) and locking lever (2B) may be on inboard side of cable reel.

### Connect Boom Butt to Boom Top Electric Cables

See [Figure 4-22](#).

1. STOP the engine.

2. Prior to connecting the electric cables, remove the dust caps or shorting plugs, and thoroughly clean the cable connectors.
3. Apply dielectric grease to the cable connectors.
4. Unlock the cable reel (2, View C) and pay out the required length of boom extension cable (1).
5. Route the boom extension cable (1) up the boom, remove the dust cap (1A), and connect the boom extension cable to the boom top connector (3, View A).
6. Connect the strain relief on the boom extension cable (1) to the carabiner in the boom top (see View C, [Figure 4-24 on page 4-38](#)).
7. Connect the other end of the boom extension cable (1, View C) to the boom connector (4) and lock the cable reel in position with the locking lever (2A).
8. Secure the boom extension cable to the storage brackets in the boom sections as shown in [Figure 4-23](#).



Item	Description
1	Electric Cable
2	Cable Storage Bracket

Figure 4-23



View G — RIGHT



View F — WRONG

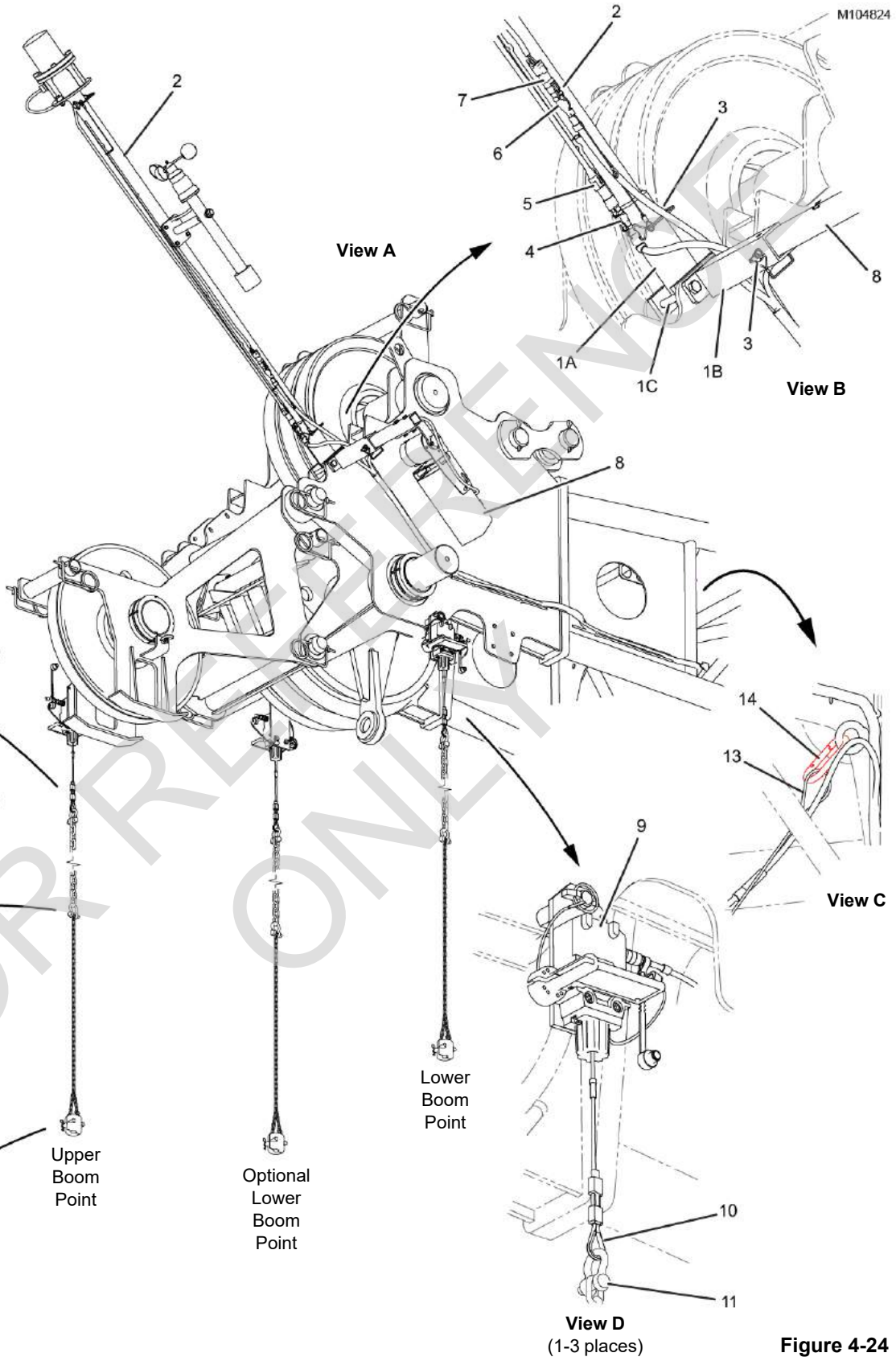


Figure 4-24



Legend for [Figure 4-24](#)

Item	Description
1A	Position Light and Anemometer Bracket
1B	Camera Bracket
1C	Mounting Screws, Lock Washers, and Nuts (Qty 2)
2	Position Light and Anemometer Assembly
3	Safety Pin (Qty 2)
4	Electric Cable (WBT1-P5)
5	Electric Cable (from position light)
6	Electric Cable (WBT1-P6)
7	Electric Cable (from position light)
8	Boom Top Camera
9	Limit Switch (Qty 1-3)
10	Actuator Cable (Qty 1-3)
11	Chain with Shackles and Pins (Qty 1-3)
12	Weight with Chain and Link (Qty 1-3)
13	Strain Relief
14	Carabiner

### Install Boom Top Position Light and Wind Speed Indicator (option)

See [Figure 4-24](#).

1. If not already done, fasten the position light and anemometer bracket (1A, View B) and, if required, the camera bracket (1B) to the left side of the boom top with the mounting hardware (1C).
2. Remove the position light and anemometer assembly (2, View A) from storage.
3. Assemble the position light and anemometer assembly (2, View B) to the bracket (1A) and install the safety pin (3).

**Make sure the anemometer is hanging correctly as shown in View G.**

4. STOP the engine.
5. Remove the dust caps and thoroughly clean the cable connectors.
6. Apply dielectric grease to the cable connectors.
7. Connect the electric cable (4, View B) from the boom top to the electric cable (5) from the position light.

8. Connect the electric cable (6, View B) from the boom top to the electric cable (7) from the anemometer.

**Make sure the electric cable from the anemometer is not wrapped around the support bracket as shown in View F.**

### Install Boom Top Camera (option)

1. Remove the boom top camera (8, View A, [Figure 4-24](#)) from storage in the parts box.
2. Assemble the camera (8, View B, [Figure 4-24](#)) to the bracket (1B) and install the safety pin (3).
3. Uncoil the required length of camera extension cable (5, View B, [Figure 4-22 on page 4-36](#)) from the storage bracket (6) in the boom butt.
4. Route the camera extension cable up the boom, remove the dust cap, and thoroughly clean the cable connectors.
5. Secure the camera extension cable to the storage brackets in the boom sections as shown [Figure 4-23 on page 4-37](#).
6. STOP the engine.
7. Apply dielectric grease to the cable connectors.
8. Connect the camera extension cable to the camera.
9. Connect the strain relief (13, View C, [Figure 4-24](#)) on the camera extension cable to the carabiner (14) in the boom top.

### Install Boom Block-Up Limit Components

See [Figure 4-24](#).

Perform the following steps at each of the required boom points:

- Upper boom point
  - Optional second block-up limit at lower boom point
  - Lower boom point
1. Remove the block-up limit chains (11) and weights (12) from storage in the parts box.
  2. Connect the chain (11, View D) to the actuator cable (10) from the limit switch (9) at the corresponding boom point.
  3. Connect the chain from the weight (12, View E) to the chain (11).
  4. Make sure the locking flag is stored in each limit switch as shown in View E, [Figure 4-26 on page 4-42](#).

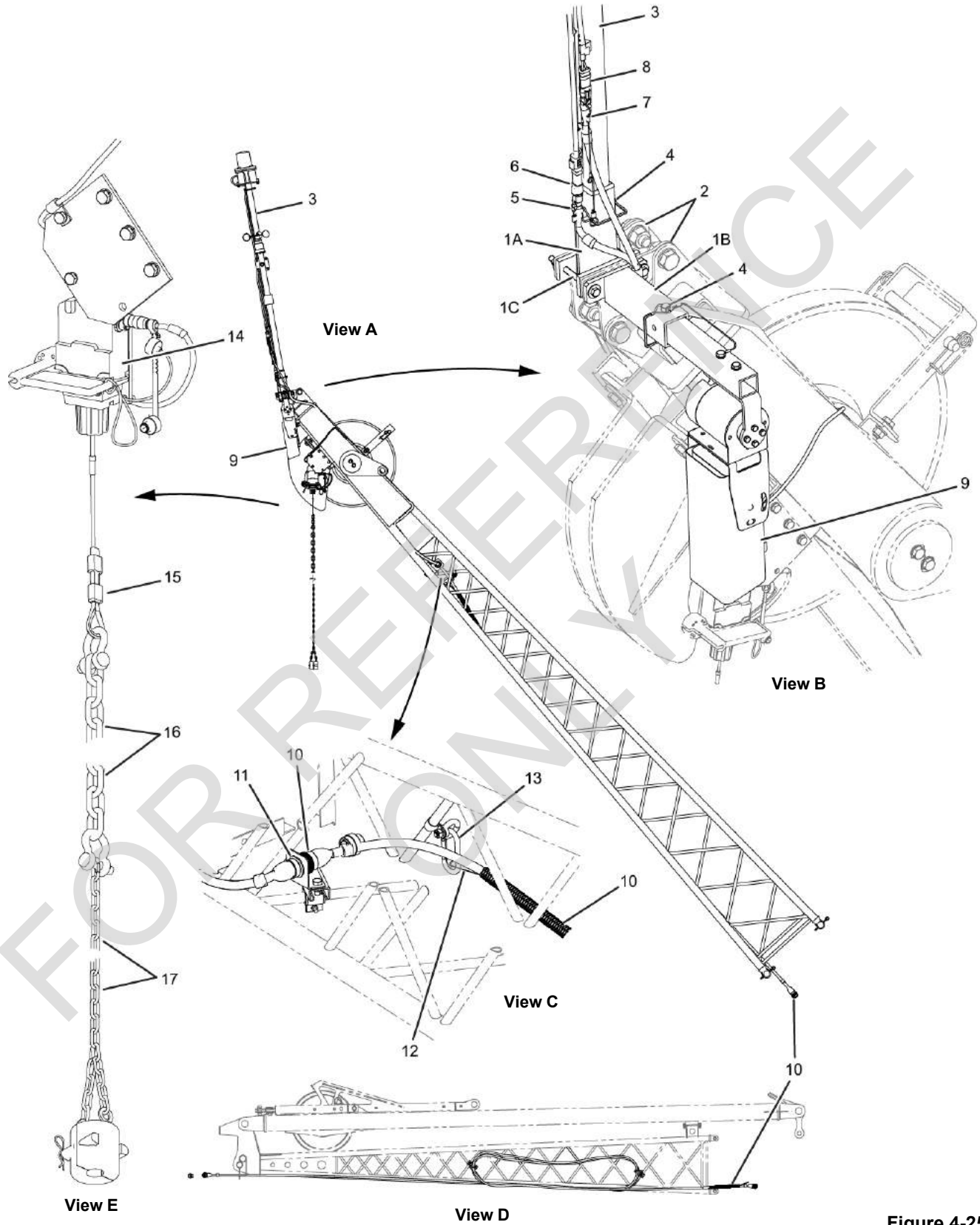


Figure 4-25

Legend for [Figure 4-25](#)

Item	Description
1A	Position Light and Anemometer Bracket
1B	Camera Bracket
1C	Mounting Screws, Lock Washers, and Nuts (Qty 2)
2	Jib Top Bracket (Qty 2)
3	Position Light and Anemometer Assembly
4	Safety Pin (Qty 2)
5	Electric Cable (WBT1-P5)
6	Electric Cable (from position light)
7	Electric Cable (WBT1-P6)
8	Electric Cable (from position light)
9	Camera
10	Jib Extension Cable
11	Jib Top Receptacle (WZT1-J1)
12	Strain Relief
13	Carabiner
14	Limit Switch
15	Actuator Cable
16	Chain with Shackles and Pins
17	Weight with Chain and Link

## Install Jib Top Position Light and Wind Speed Indicator (option)

See [Figure 4-25](#).

1. If required, remove the position light and anemometer bracket (1A, View B) and, if required, the camera bracket (1B) from the boom top.
  2. Fasten the position light and anemometer bracket (1A, View B) and, if required, the camera bracket (1B) to the jib top brackets (2) with the mounting hardware (1C).
  3. Remove the position light and anemometer assembly (3, View A) from storage.
  4. Assemble the position light and anemometer assembly (3, View B) to the bracket (1A) and install the safety pin (4).
- Make sure the anemometer is hanging correctly** (see View G, [Figure 4-24 on page 4-38](#)).
5. STOP the engine.
  6. Remove the dust caps and thoroughly clean the cable connectors.
  7. Apply dielectric grease to the cable connectors.
  8. Connect the electric cable (5, View B) from the jib top to the electric cable (6) from the position light.
  9. Connect the electric cable (7, View B) from the jib top to the electric cable (8) from the anemometer.

**Make sure the electric cable from the anemometer is not wrapped around the support bracket** (see View F, [Figure 4-24 on page 4-38](#)).

## Install Jib Top Camera (option)

1. Remove the camera (9, View A, [Figure 4-25](#)) from storage in the parts box.
2. Assemble the camera (9, View B, [Figure 4-25](#)) to the bracket (1B) and install the safety pin (4).
3. Uncoil the required length of camera extension cable (5, View B, [Figure 4-22 on page 4-36](#)) from the storage bracket (6) in the boom butt.
4. Route the camera extension cable up the boom, remove the dust cap, and thoroughly clean the cable connectors.
5. Secure the camera extension cable to the storage brackets in the boom sections as shown [Figure 4-23 on page 4-37](#).
6. Apply dielectric grease to the cable connectors.
7. STOP the engine.
8. Connect the camera extension cable to the camera.
9. Connect the strain relief on the camera extension cable to the carabiner in the jib top.
10. Secure the camera extension cable to the boom and jib sections with plastic wire ties.

## Connect Jib Extension Cable

See [Figure 4-25](#) for the following procedure.

1. STOP the engine.
2. Uncoil the required length of jib extension cable (10, View D) from the storage brackets on the jib bottom.
3. Route the jib extension cable to the boom top, remove the dust cap, and thoroughly clean the cable connectors.
4. Apply dielectric grease to the cable connectors.
5. Connect the butt of the jib extension cable to the attachment connector (7, View A, [Figure 4-22 on page 4-36](#)).
6. Connect the top end of the jib extension cable (10, View C) to the jib top receptacle (11).
7. Connect the strain relief (12, View C) on the jib extension cable to the carabiner (13) in the jib top.
8. Secure the jib extension cable to the jib sections with plastic wire ties.

## Install Jib Block-Up Limit Components

See [Figure 4-25](#).

1. Remove the block-up limit chains (16) and weights (17) from storage in the parts box.

*Continued on next page.*

2. Connect the chain (16, View E) to the actuator cable (15) from the limit switch (14) at the jib point.
3. Connect the chain from the weight (17, View E) to the chain (16).
4. Make sure the locking flag is stored in the limit switch as shown in View E, [Figure 4-26 on page 4-42](#).

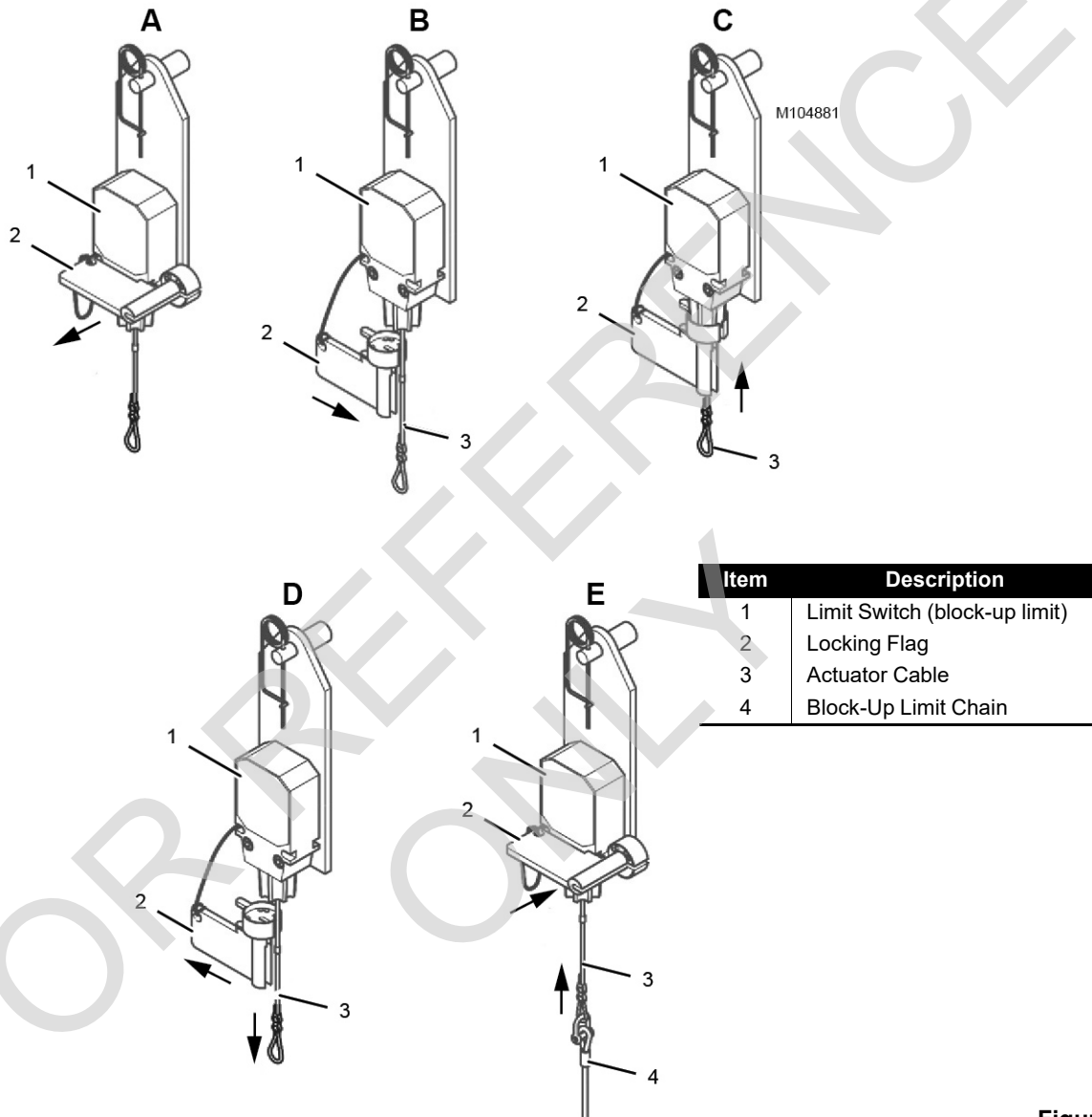


Figure 4-26

**WARNING****Two-Blocking Hazard**

Two-blocking is the condition in which the load block or the hook-and-weight ball runs into the boom or jib point sheaves.

**Two-blocking can result in failure of the sheaves and wire rope, possibly causing the load to fall.**

If a block-up limit switch is deactivated, it is the operator's responsibility to stop load the block or the hook-and-weight ball before it contacts the boom or jib point sheaves.

### Deactivating/Activating a Block-up Limit Switch

If the block-up limit switch is not used at the following locations, the corresponding limit switch must be deactivated to prevent the block-up limit fault from coming on during operation.

- Lower Boom Point
- Upper Boom Point
- Jib Point

See [Figure 4-26](#).

To DEACTIVATE a limit switch, proceed as follows:

1. Remove the locking flag (2, View A) from the storage slots in the limit switch (1).
2. Slip the locking flag (2, View B) over the actuator cable (3).
3. Engage the locking flag (2, View C) with the limit switch (1).
4. Release the actuator cable (3).
5. Disconnect the block-up limit chain (4) and weight from the actuator cable.

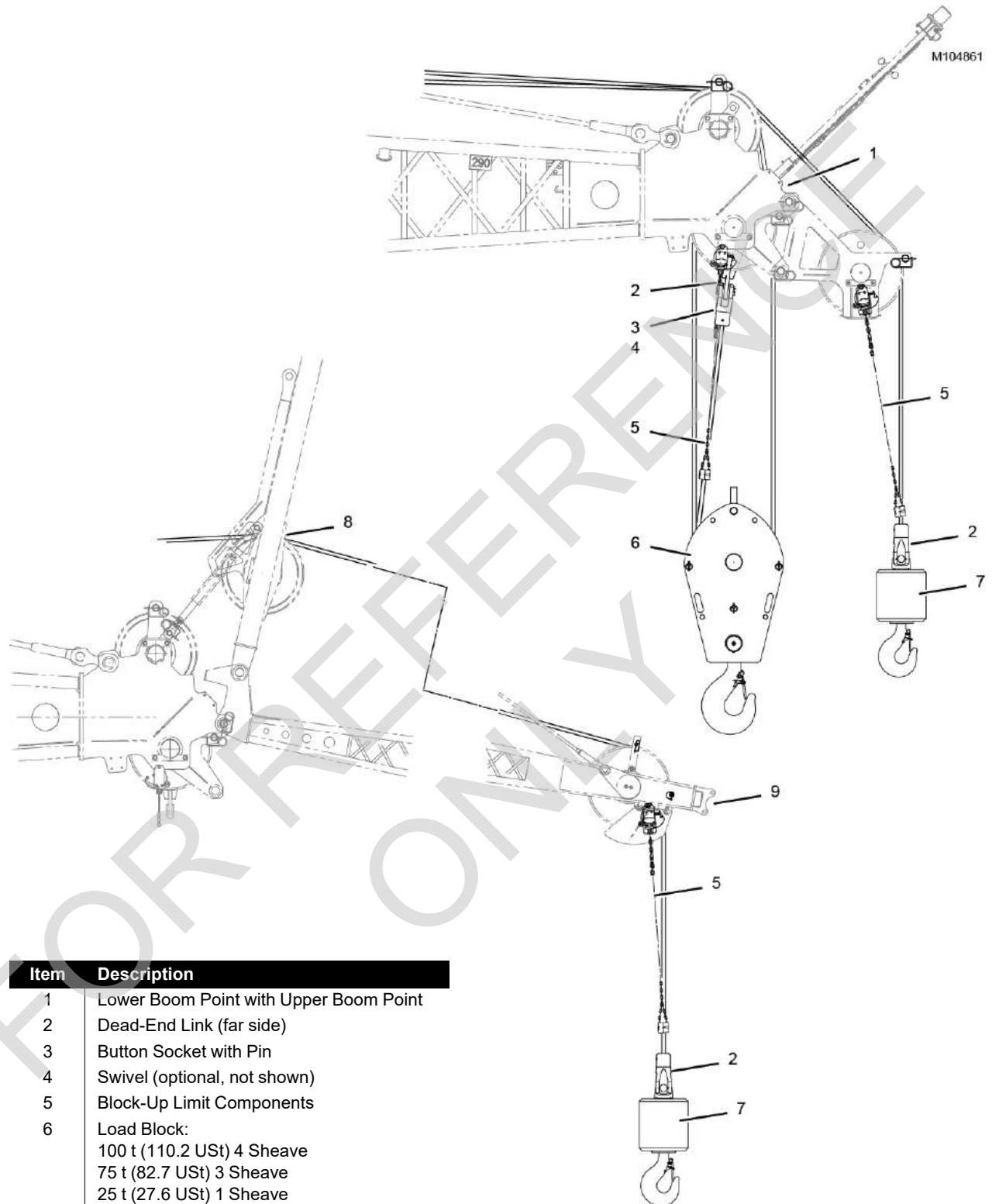
To ACTIVATE a limit switch, proceed as follows:

1. Pull down the actuator cable (3, View D) and remove the locking flag (2).
2. Install the locking flag (2, View E) in the storage slots in the limit switch (1).
3. Connect the block-up limit chain (4, View E) and weight to the actuator cable (3).

**NOTE** The optional second block-up limit switch at the lower boom point is equipped with a shorting plug as shown in [Figure 4-22 on page 4-36](#).

If the optional second block-up limit switch is not used, it can be deactivated either by:

- Performing the above procedure.
- Attaching the shorting plug to the electric cable. This will allow the limit switch to be removed and stored in the tool box.



Item	Description
1	Lower Boom Point with Upper Boom Point
2	Dead-End Link (far side)
3	Button Socket with Pin
4	Swivel (optional, not shown)
5	Block-Up Limit Components
6	Load Block: 100 t (110.2 USt) 4 Sheave 75 t (82.7 USt) 3 Sheave 25 t (27.6 USt) 1 Sheave
7	Hook-and-Weight Ball: 12,5 t (13.8 USt)
8	Jib Strut
9	Jib Point

Figure 4-27

## Install Load Lines

1. Route the load lines up the boom (and jib, if equipped) and over the desired guide sheaves in the boom top (and jib top, if equipped). See [Figure 4-27](#) and the Load Line Reeving Diagrams at the end of this section.
2. Install the load block(s) and the hook-and-weight ball(s) ([Figure 4-27](#)) after the boom (and jib, if equipped) is raised to a convenient height. See "[Boom Raising Procedure](#)" on page 4-60.
3. Be sure to route the load lines through the block-up limit weights. See [Install Boom Block-Up Limit Components](#) on page 4-39.
4. Read the following topics:
  - "[Wire Rope Installation](#)" on page 4-86
  - "[Load Line Reeving](#)" on page 4-95.
  - The Wire Rope Specifications chart located in the Capacity Chart Manual supplied with the crane for:
    - Parts of the line required for various loads
    - Wire rope lengths and notes about the hoisting distance for various parts of the line
    - Maximum spooling capacity of the load drums
  - Load Line Reeving diagrams at the end of this section.

### **WARNING** Falling Load Hazard!

For some parts of line, it is necessary to reeve the load line over the upper boom point to the load block hanging from the lower boom point (see [Figure 4-28](#)).

For these cases, REMOVE the front rope guard bar from the load block (location X in [Figure 4-28](#)) to prevent the load line from rubbing against the bar.

Failing to perform this step can result in wire rope damage and possible failure.

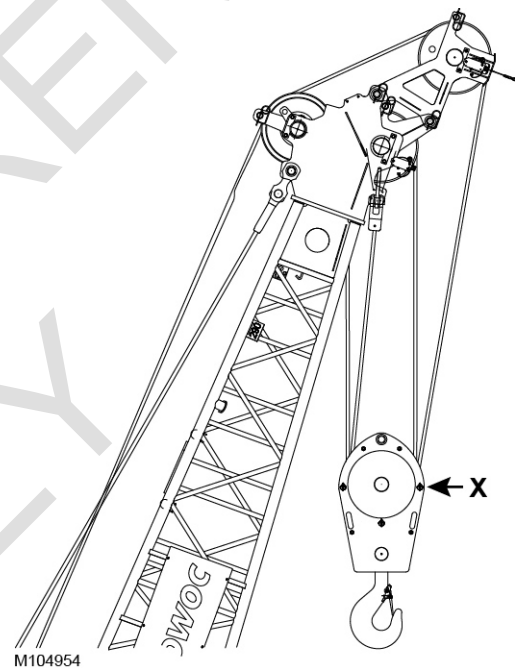


Figure 4-28

Item	Description
1	Boom or Jib Chord
2	Boom or Jib Number
3	Manitowoc Part Number
4	Manitowoc Manufacturing Code
5	Chord Identification
6	Pendant
7	Diameter
8	Length
9	Manitowoc Purchase Order Number
10	Wire Rope Type
11	Set Number
12	Manufacturer's Number
13	Aluminum Tag (if equipped)

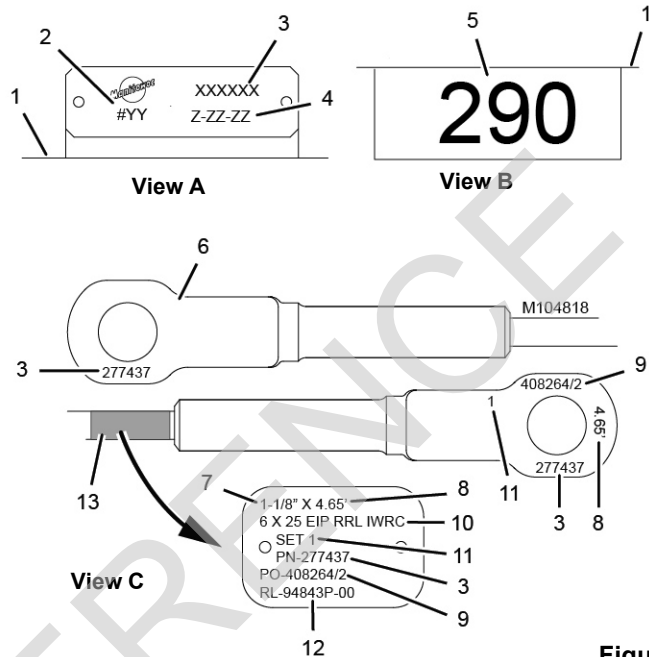


Figure 4-29

## BOOM AND JIB RIGGING — GENERAL

### Blocked Crawlers

To prevent the crane from tipping, some boom and jib lengths must be raised and lowered over blocked crawlers. See the appropriate boom or jib capacity chart for blocked crawler requirements and the Crawler Blocking Diagram in the Capacity Chart Manual for instructions.

**! DANGER**  
Tipping Hazard!

Do not attempt to raise or lower the boom or the boom and jib from or to the ground until the crawlers are blocked, if required. Otherwise, the crane will tip.

### Boom Handling

Boom handling with the equalizer pinned to the boom butt (Figure 4-30) is limited to the boom length given in the Boom Rigging Drawing at the end of this section.



### WARNING

#### Falling Boom Hazard!

Do not attempt to handle more boom with the equalizer pinned to the boom butt than specified in the Boom Rigging Drawing. Structural failure of components can occur, allowing the boom to fall.

### Rigging Drawings

Boom and jib components (top, inserts, butt, pendants) must be assembled in the proper sequence according to the applicable Boom and Jib Rigging Drawings at the end of this section.

### Identifying Boom and Jib Components

See [Figure 4-29](#).

The boom and jib sections are marked for proper identification as shown in View A. An identification plate is mounted on all four chords.

The boom inserts also have a chord identification plate mounted on both top chords as shown in View B.

The boom and jib pendants are marked for proper identification as shown in View C.



## Handling Boom and Jib Sections



### WARNING

#### Falling Load Hazard!

The lifting lugs on each boom section are designed only for lifting that section. Do not attempt to lift two or more boom sections with the lifting lugs on one section. The lifting lugs may break allowing the boom sections to fall.

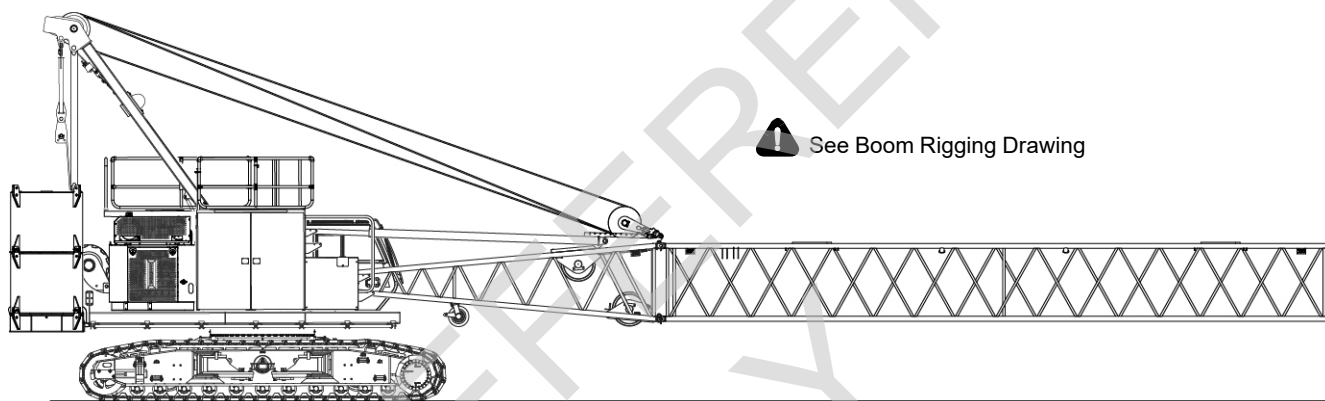
All boom sections have lifting lugs as shown in [Figure 4-12 on page 4-20](#).

- Handle the boom sections with care to avoid damaging the lacings and chords.
- Use synthetic lifting slings (crane owner furnished) to lift the boom sections.

The jib sections do not have lifting lugs.

- Handle the jib sections with care to avoid damaging the lacings and chords.
- Use synthetic lifting slings (crane owner furnished) to handle the jib sections. Lift at the chords only. Never lift at the lacings.

If wire rope or chain slings are used to handle the boom or jib sections, install protective covering (such as sections of rubber tire) between the slings and component being lifted.



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Boom Handling with Equalizer Pinned to Boom Butt

Figure 4-30

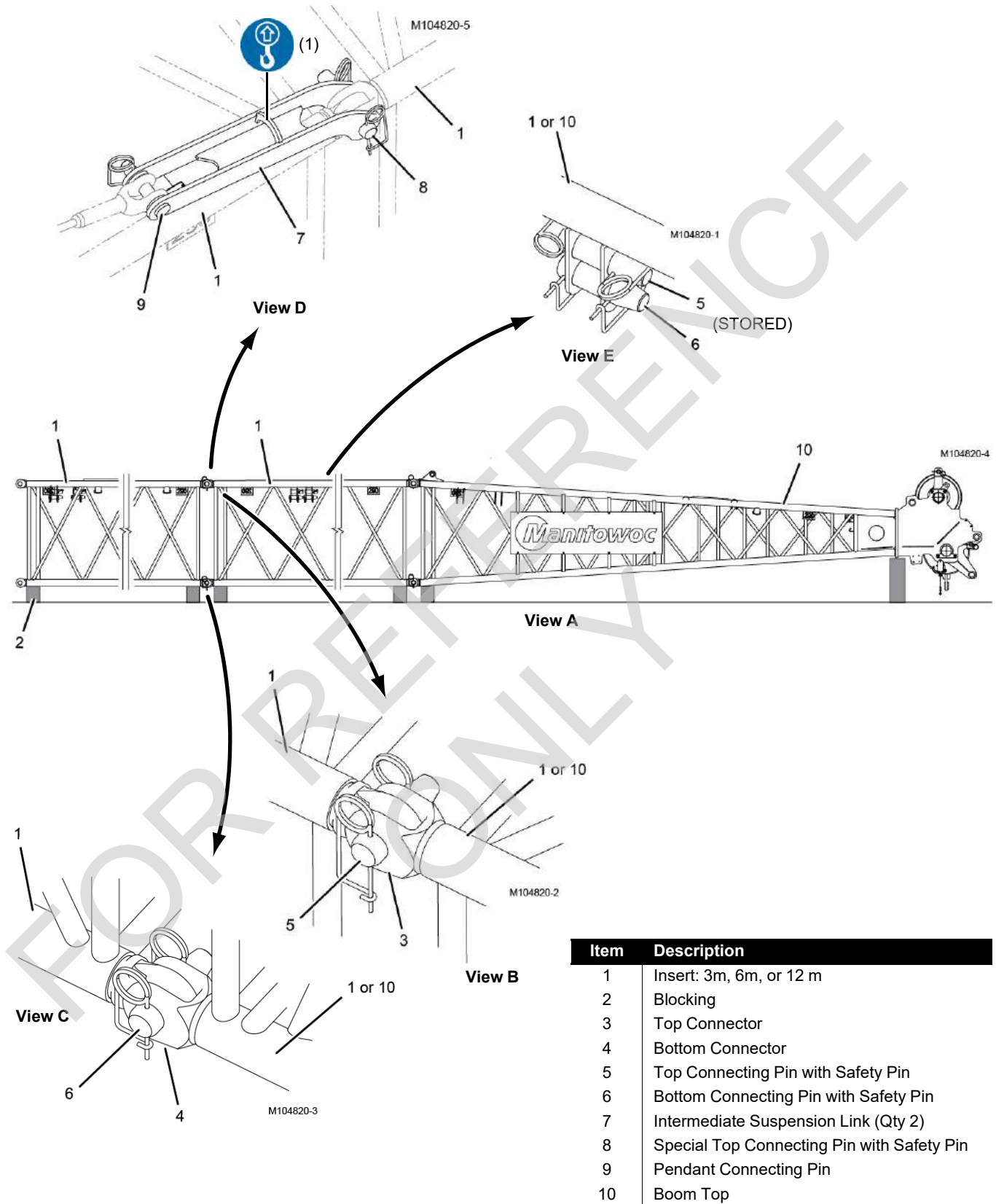


Figure 4-31

## BOOM #290 ASSEMBLY



### WARNING

#### Crush Hazard!

Never work under or inside boom sections that are not securely blocked.

Assemble the boom in the exact sequence shown in the Boom Rigging Drawing at the end of this section.

See the Boom Rigging Drawing at the end of this section to determine if intermediate suspension is required for the boom length being assembled.

**NOTE** See [Figure 4-12 on page 4-20](#) for boom section lifting locations.

### Assemble Boom Inserts

See [Figure 4-31](#).

1. Lift the first insert (1, View A) into position in the assembly area and place it on blocking (2) 203 mm (8 in) high.
2. Adjust the blocking as needed so the insert is level.
3. Disconnect the lifting slings.
4. Lift the next insert into position, engage the top and bottom connectors (3, View B and 4, View C), and align the connecting holes.
5. Remove the connecting pins (5 and 6, View E) from the storage brackets on the adjacent insert.
6. Install the top connecting pins (5, View B) — long tapered end pointing in.
7. If intermediate suspension is required, disregard [step 6](#) and proceed as follows:

- a. Determine the location of the intermediate suspension links (7, View D) as specified in the Boom Rigging Drawing.
  - b. Leave the top connecting pins (5, View B) stored.
  - c. Remove the special top connecting pin (8, View D) from each intermediate suspension link (7).
  - d. Lift each intermediate suspension link into position (View D) and align the connecting holes.
  - e. Install the special top connecting pin (8, View D).
8. Install the bottom connecting pins (6, View C) — long tapered end pointing in.
  9. Block the top end of the adjacent insert.
  10. Disconnect the lifting slings.
  11. Repeat the above steps until all inserts are installed in PROPER SEQUENCE.

### Connect Boom Top to Inserts

See [Figure 4-31](#).

1. Lift the boom top (10, View A) into position, engage the top and bottom connectors (3, View B and 4, View C), and align the connecting holes.
2. Remove the connecting pins (5 and 6, View E) from the storage brackets on the boom top.
3. Install the top connecting pins (5, View B).
4. Install the bottom connecting pins (6, View C).
5. Block the top end of the boom top if the upper boom point is not installed.  
If the upper point is installed, block under the upper point, as required (see [Figure 4-34](#)).
6. Disconnect the lifting slings.

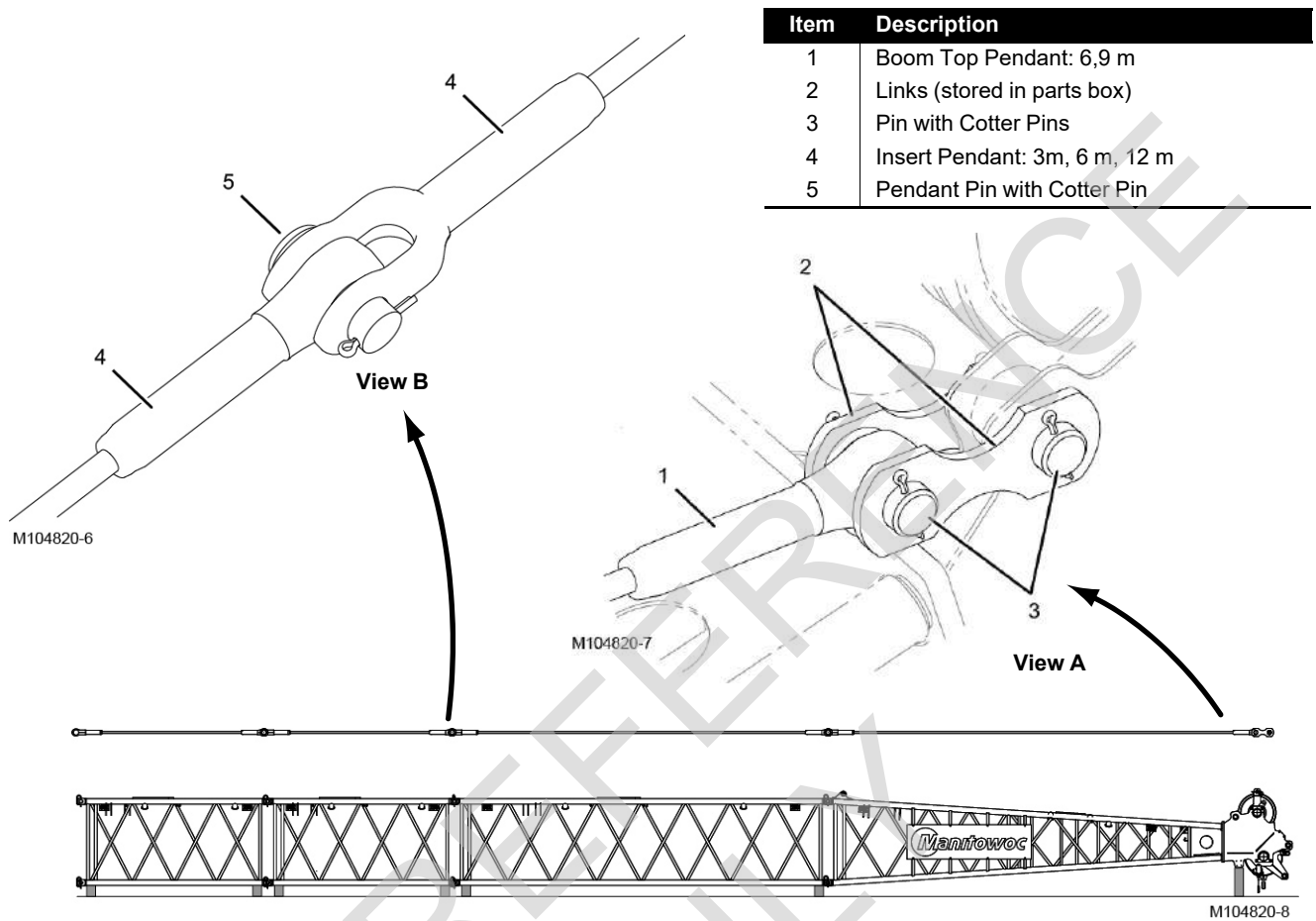


Figure 4-32

### Install Boom Pendants

See [Figure 4-32](#).



#### WARNING

##### Flying Object Hazard!

Use extreme care when handling coiled pendants. Stored energy can cause the coiled pendants to uncoil quickly with considerable force.

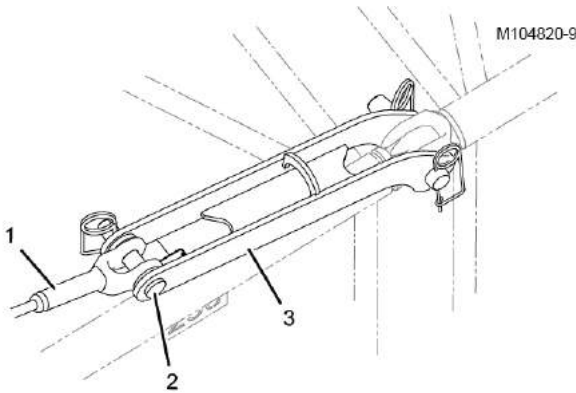
1. Carefully uncoil the pendants alongside the boom. Use care not to kink them.
2. Thoroughly clean and lubricate the pendants.
3. Starting at the boom top:
  - a. If not already done, pin the links (2, View A) to the boom top pendants (1) with the pins (3).

- b. Lift the boom top pendant (1 View A) into position on the boom top.
- c. Pin the links (2, View A) to the boom top with pins (3).

**NOTE:** The pendants must be installed in the same sequence as the inserts.

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

4. Lift the adjacent insert pendants (4) into position on the insert.
5. Pin the pendants together with the pins (5, View B) — **pin heads toward inboard side of pendants.**
6. Repeat the steps until all of the pendants are installed and pinned.



Item	Description
1	Intermediate Suspension Pendant (21.3 m)
2	Pendant Connecting Pin
3	Intermediate Suspension Link (Qty 2)

Figure 4-33

### Install Intermediate Suspension Pendants

See [Figure 4-33](#).

If equipped with intermediate suspension, perform the following steps on both sides of the boom.

**! WARNING**  
**Flying Object Hazard!**

Use extreme care when handling coiled pendants. Stored energy can cause the coiled pendants to uncoil quickly with considerable force.

- Carefully uncoil the intermediate suspension pendant alongside the boom. Use care not to kink them.
- Thoroughly clean and lubricate the pendant.
- Remove the pendant connecting pin (2) from the intermediate suspension link (3).
- Lift the intermediate suspension pendant (1) into position on the boom inserts.
- Pin the intermediate suspension pendant (1) to the intermediate suspension link (3) with pendant connecting pin (2).

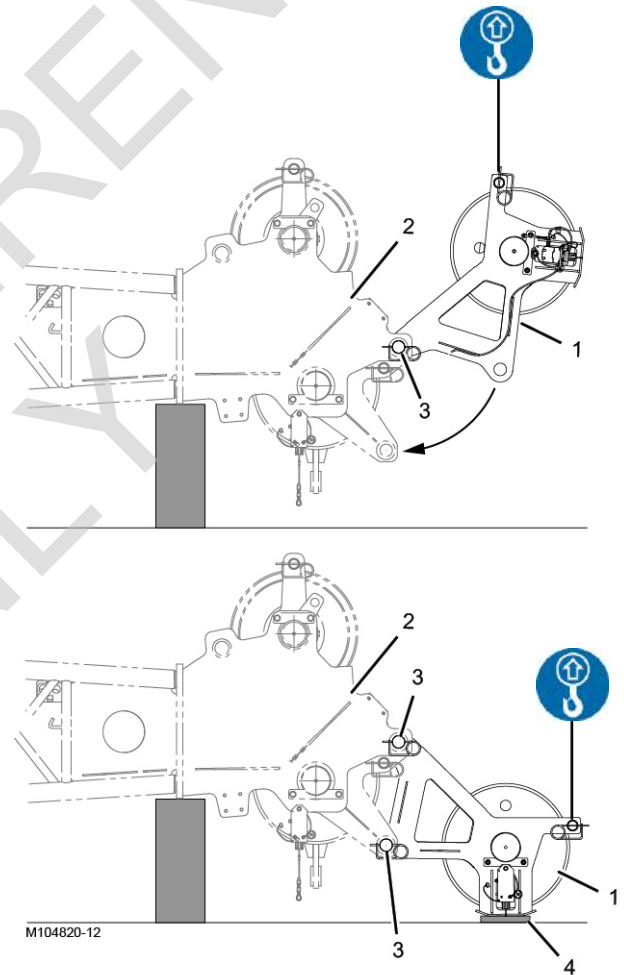
### Install Upper Boom Point

Disregard this procedure if a jib will be installed.

See [Figure 4-34](#).

- Lift the upper boom point with synthetic lifting slings attached to the rope guard as shown.

- Lift the upper boom point (1) into position at the end of the boom top (2).
- Remove the connecting pins (3) from the upper boom point.
- Align the top connecting holes in the upper boom point with those in the boom top and install the top connecting pins (3).
- Lower the upper boom point (1) to align the bottom connecting holes and install the bottom connecting pins (3)
- Install blocking (4) under the upper boom point.
- Disconnect the lifting slings.



Item	Description
1	Upper Boom Point
2	Boom Top
3	Connecting Pin with Safety Pin (Qty 2)
4	Blocking

Figure 4-34

Item	Description
1	Shaft with Safety Pin
2	Cap Screw, Flat Washer, and Lock Nut (Qty 2)
3	Rope Guard
4	Adjusting Screw, Flat Washers, and Nuts (Qty 2)

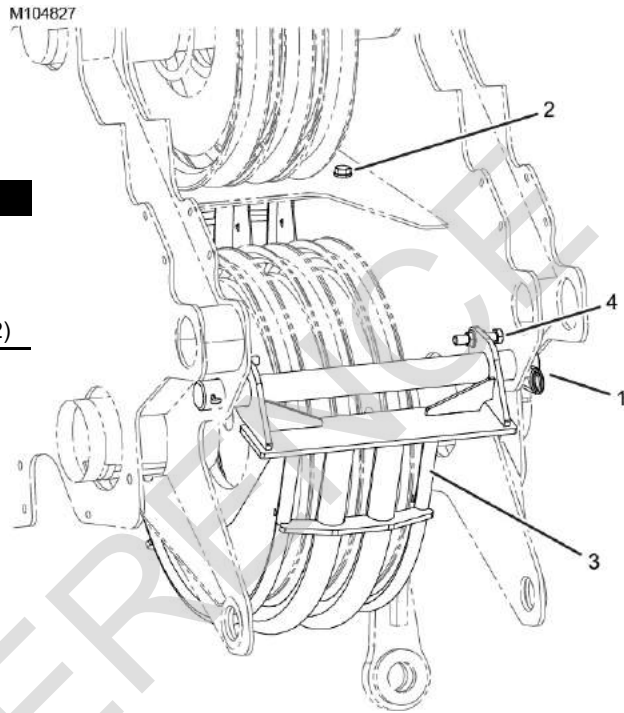
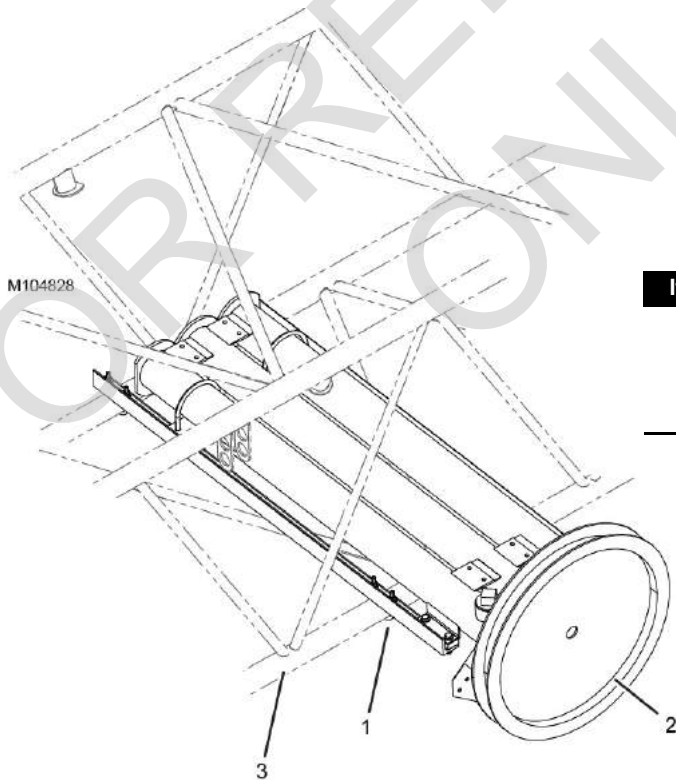


Figure 4-35



Item	Description
1	U-Bolt with Flat Washers, Lock Washers, and Nuts (Qty 4)
2	Tagline Assembly
3	Boom Insert

Figure 4-36

## Install Optional Rope Guard

See [Figure 4-31](#).

If equipped with the optional rope guard, install it as follows:

1. Remove the shaft (1) and the cap screws (2) from the lower boom point.
2. Lift the rope guard (3) into position at the lower boom point. The rope guard weighs approximately 53 kg (117 lb).
3. Align the mounting holes and install the shaft (1).
4. Loosely install the cap screws (2) with flat washers and lock nuts.
5. Adjust the screws (4) so the inner two rope guards are centered over the sheave gaps at the top end of the rope guard.
6. Adjust the rope guard in the bottom mounting slots so the inner two rope guards are centered over the sheave gaps at the bottom end of the rope guard.
7. Securely tighten the lock nuts on the cap screws (2).

## Install Tagline

See [Figure 4-31](#).

If equipped with the optional tagline assembly, install it as follows:

1. Remove the u-bolts (1) from the tagline assembly (2).
2. Lift the tagline assembly (2) into position at the desired location in the boom. The tagline assembly weighs approximately 1 086 kg (2,394 lb).
  - The tagline should be mounted approximately one-third the way up the boom from the boom hinge pin
  - The cable reel must be on the right side of the boom
3. Install the u-bolts (1) with the flat washers, lock washers, and nuts.
4. Securely tighten the nuts.
5. Refer to the manufacturer's manual at the end of this section for tagline safety, operation, installation, and maintenance instructions.

## Complete Boom/Crane Assembly

- Complete boom and crane assembly/rigging starting with [Connect Boom Butt to Boom on page 4-33](#)
- Then,
  - Connect the boom pendants.
  - Install and connect the boom electronics.
  - Install the boom and jib load lines.

Item	Description
1	Jib Bottom
1A	Jib Stop Plate (Qty 2)
2	Boom Top
3	Blocking
4	Pin with Safety Pins (Qty 2)
5	Pin with Safety Pins (Qty 4 each jib section)
6	Jib Insert (Qty 1 or 2 if installed)
7	Jib Top

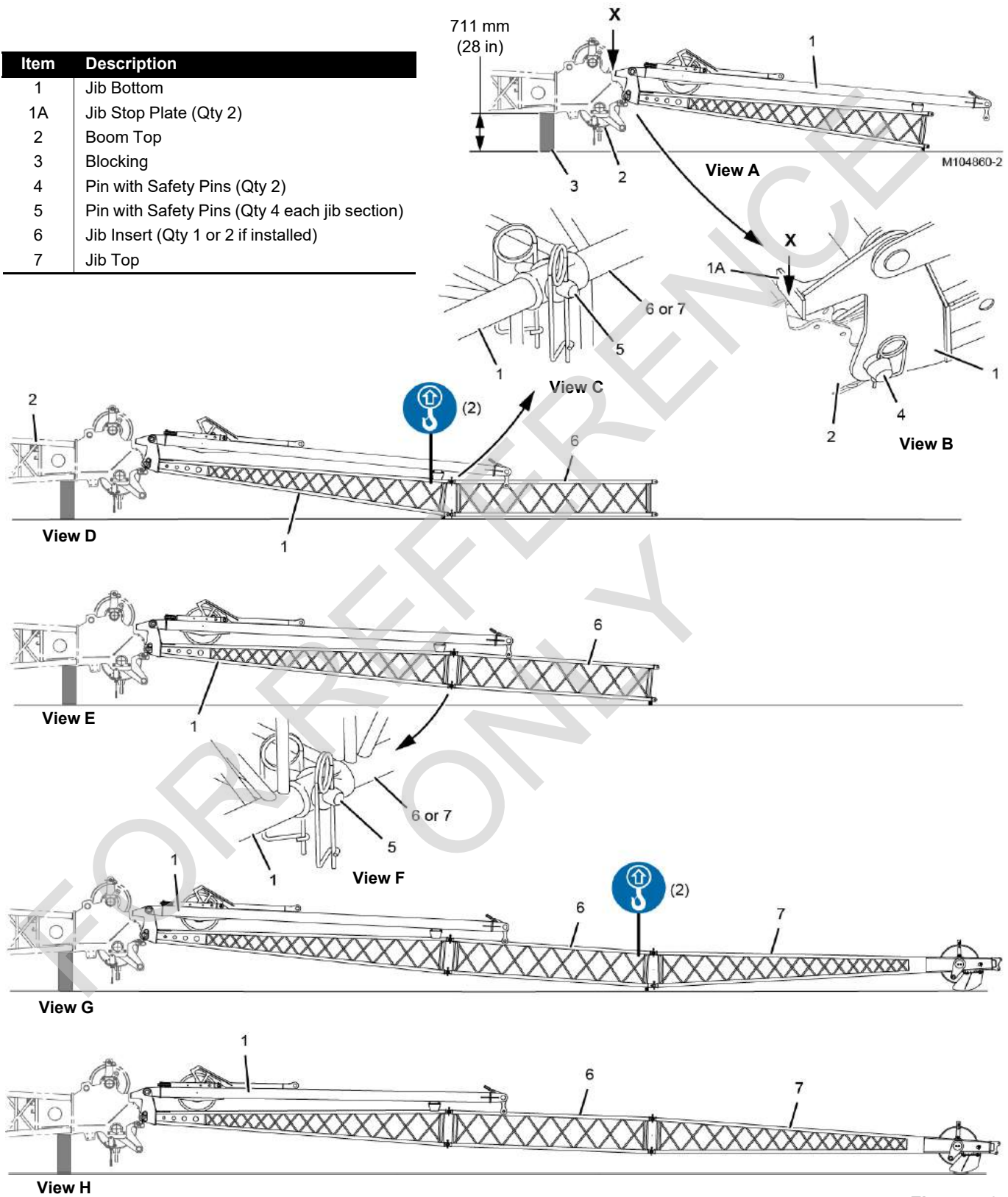


Figure 4-37



## JIB #117 ASSEMBLY

See the #117 Jib Rigging Drawing at end of this section for jib makeup.

The jib bottom (1, [Figure 4-37](#)) is shipped as an assembled unit consisting of the following:

- Jib butt
- Jib strut
- Strut raising arm
- Strut stops

The jib bottom and the jib top can be shipped as an assembled unit.

The jib can be assembled with an assist crane or with this crane.

**NOTE** See [Figure 4-13 on page 4-21](#) for jib section lifting locations.

## Prepare Boom

See [Figure 4-37](#).

### CAUTION!

#### Avoid Structural Damage!

Block the boom top (2, View A) at least 711 mm (28 in) high at the location shown in View A. This distance is required to prevent the boom stop plates (1A, View B) from contacting the boom top at locations X in Views A and B.

If the boom is already assembled and attached to the crane, proceed as follows.

1. Lower the boom (2, View A) onto the blocking (3) specified in View A.
2. Remove the load line from the upper boom point, if equipped.
3. Remove and store the upper boom point.

## Install Jib Bottom

1. Lift the jib bottom (1, View A), and the jib top if shipped pinned to the jib butt, into position at the boom top (2) and remove the pins (3, View B) from the jib bottom.
2. Align the connecting holes and pin the jib bottom to the boom top with the pins (3, View B) and the safety pins.
3. Lower the jib bottom onto blocking and disconnect the lifting slings.

## Install Jib Inserts



### WARNING!

#### Collapsing Jib Hazard!

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

1. Disconnect the jib top from the jib butt. If the jib top was shipped pinned to the jib butt.
2. If desired, lift the jib insert (5, View B) into position at the jib bottom (1) and remove the four pins (4, View C) from the jib insert.
3. Align the top connecting holes and pin the jib insert to the jib bottom with the pins (4, View C) and the safety pins.
4. Lower the jib insert onto blocking and disconnect the lifting slings.
5. Connect the lifting slings to the top end of the chords on the jib bottom (1, View D).
6. Raise the jib bottom until the bottom connecting holes are aligned between the jib bottom and the jib insert.
7. Pin the jib insert to the jib bottom with the pins (4, View F) and the safety pins.
8. Disconnect the lifting slings.
9. Repeat the above steps for any remaining jib inserts.

## Install Jib Top

**NOTE** Disregard this step if the jib top was shipped pinned to the jib butt and no inserts were added.

1. Lift the jib top (6, View G) into position at the jib bottom (1) or the jib insert (5) and remove the four pins (4, View C) from the jib top.
2. Align the top connecting holes and pin the jib top to the jib bottom or the jib insert with the pins (4, View C) and the safety pins.
3. Lower the jib top onto the ground and disconnect the lifting slings.
4. Connect the lifting slings to the top end of the chords on the jib bottom (1) or the jib insert (5, View G).
5. Raise the jib bottom or the insert until the bottom connecting holes are aligned between the jib bottom or the insert and the jib top.
6. Pin the jib top to the jib bottom or the insert with the pins (4, View F) and the safety pins.
7. Disconnect the lifting slings.

Item	Description
1	Jib Bottom
2	Boom Top
3	Jib Insert (if equipped)
4	Jib Strut
5	Jib Top Pendant (Qty 2)
6	Link (Qty 2)
7	Pin with Cotter Pin (Qty 1 or 2 each pendant)
8	Jib Insert Pendant (Qty 2 or 4 if installed)
9	Link (Qty 2)
10	Backstay Pendant (Qty 2)
11	Link (Qty 2)
12	Whip Line (Drum 1)
13	Strut Raising Arm
14	Button Socket
15	Pin with Cotter Pin
16	Rope Guide Pin with Safety Pin

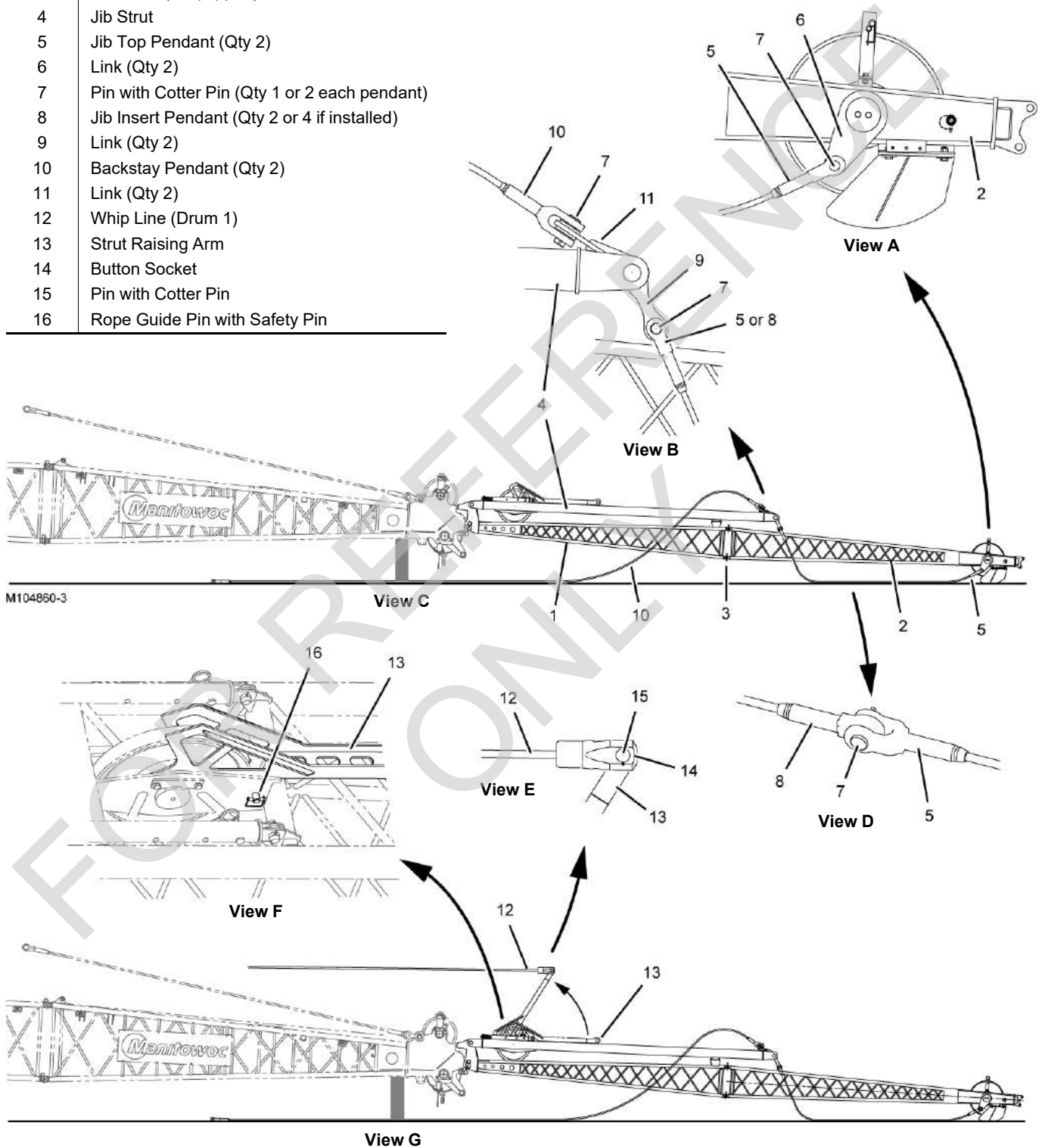


Figure 4-38

## Install Jib/Backstay Pendants

See [Figure 4-38](#).



### WARNING

#### Flying Object Hazard!

Use extreme care when handling coiled pendants. Stored energy can cause the coiled pendants to uncoil quickly with considerable force.

**NOTE:** The jib pendants must be installed in the same sequence as the jib sections.

The jib pendants are furnished in matched sets of two and must be installed in matched sets — the pendant on one side of the jib section must match the pendant on other side of the jib section.

1. Carefully uncoil the pendants alongside the jib. Use care not to kink them.
2. Thoroughly clean and lubricate the pendants.
3. Remove the pins from the pendant ends.
4. Starting at the jib top (2):
  - a. Pin the jib top pendants (5, View A) to the jib top links (6) with the pendant pins (7) and cotter pins.
  - b. If required, pin the jib insert pendants (8, View D) to the jib top pendants (5) and to each other with the pendant pins (7) and cotter pins.
  - c. Pin the jib top pendants (5, View B) or the jib insert pendants (8) to the strut links (9) with the pendant pins (7) and cotter pins.
5. At the jib strut (4, View B):
  - a. Pin the backstay pendants (10) to the strut links (11) with the pendant pins (7) and cotter pins.
  - b. Lay the backstay pendants on the ground alongside the boom top.

## Prepare to Raise Jib Strut

The jib strut can be raised either using an assist crane or with the whip line (Drum 1) from this crane.

***The strut can be raised with the whip line only for boom lengths longer than 22 m (72.2 ft). For lesser boom lengths, the equalizer will interfere with rope routing.***

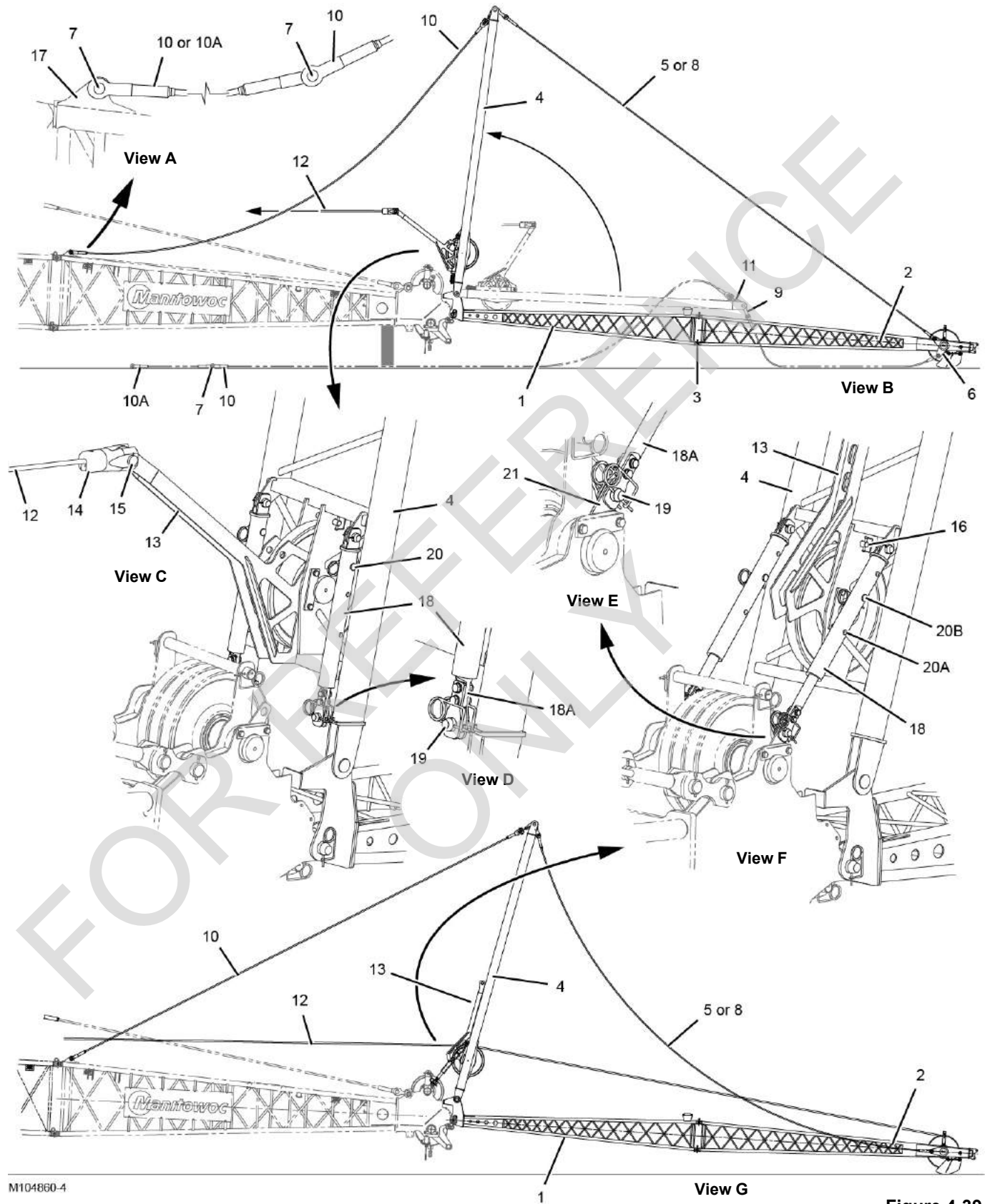
If the strut will be raised with the whip line, the following steps must first be performed for this crane:

- Boom fully rigged and connected to the boom butt.
- Boom pendants installed/connected and connected to the equalizer.
- Equalizer unpinned from the rails and raised so the whip line can be routed under the equalizer to the boom top.

## Deploy Strut Raising Arm

See [Figure 4-38](#), View E and G.

1. Route the whip line (12) from Drum 1 to the end of the strut raising arm (13).
2. If not already done, assemble the button socket (14) to the end of the whip line (12) and remove the pin (15).
3. Remove the rope guard pin (16, View F)
4. Raise the strut raising arm (13) by hand. It weighs 11 kg (25 lb).
5. Pin the button socket (14) to the strut raising arm (13) with the pin (15) and cotter pin.
6. Haul in the whip line just enough to support the strut raising arm.



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Figure 4-39

Legend for [Figure 4-39](#).

Item	Description
1	Jib Bottom
2	Boom Top
3	Jib Insert (if equipped)
4	Jib Strut
5	Jib Top Pendant (Qty 2)
6	Link (Qty 2)
7	Pin with Cotter Pin (Qty 1 or 2 each pendant)
8	Jib Insert Pendant (Qty 2 or 4 if installed)
9	Link (Qty 2)
10	Backstay Pendant (Qty 2)
10A	30° Offset Pendant (Qty 2)
11	Link (Qty 2)
12	Whip Line (Drum 1)
13	Strut Raising Arm
14	Button Socket
15	Pin with Cotter Pin
16	Rope Guide Pin with Safety Pin
17	Backstay Lug (Qty 2)
18	Strut Stop (Qty 2)
18A	Inner Stop Tube (Qty 2)
19	Pin with Safety Pins (Qty 2)
20	Stop Pin with Safety Pin (Qty 2)
21	Strut Stop Lug (Qty 2)
A	30° Offset Holes
B	10° Offset Holes

## Raise Jib Strut

See [Figure 4-39](#).

1. If the 30° jib offset will be used, pin the 30° offset pendants (10A, Views A and B) to the backstay pendants (10) with the pendant pins (7) and cotter pins.

### CAUTION

#### Avoid Structural Damage!

DO NOT LIFT JIB POINT OFF GROUND during [step 2](#). Structural damage may occur.

2. Slowly haul in the whip line (12, Views B and C) from Drum 1 to raise the jib strut (4) until the jib pendants (5 and 8) are tight.

Guide the pendants clear of the jib sections as the strut rises. Do not allow the pendants to catch on the jib section connecting pins or to rub against the jib sections.

3. Pin the backstay pendants as follows:
  - For the 10° offset, pin the backstay pendants (10, View A) to the backstay lugs (17) on the boom top with the pendant pins (7) and cotter pins.
  - For the 30° offset, pin the 30° offset pendants (10A, View A) to the backstay lugs (17) on the boom top with the pendant pins (7) and cotter pins.

4. Slowly pay out the whip line (12, View C and G) until the backstay pendants are supporting the jib strut (4) and the whip line starts to go slack.
5. Disconnect the button socket (14, View C) on the whip line (12) from the strut raising arm (13).
6. Remove the button socket from the whip line and place it to the side for later use.
7. Rotate the strut raising arm (13, View F), by hand, to the stored position against the jib strut (4).
8. Route the whip line through the strut raising arm (13, View F) and over the sheave in the jib strut (4).
9. Install the rope guide pin (16, View F) to retain the strut raising arm in the stored position.
10. Pay out the whip line to the end of the jib top.

## Deploy Strut Stops

See [Figure 4-39](#).

Perform the following steps [1-3](#) at each strut stop (18), one side at a time.

1. Remove the pins (19, View D) from the end of the inner stop tube (18A).
2. Support the inner stop tube and remove the stop pin (20, View C).
3. Extend the inner stop tube (18A, View E) and pin it to the strut stop lug (21) on the boom top.
4. Install the stop pins (20, View F) in the desired offset holes (A or B).

Boom up (extend strut stops) if necessary to provide adequate clearance for installing the stop pins in the desired holes.

## Complete Jib Rigging

- Install the load line at the jib point.
- Install and connect the jib electronics.

## RAISE BOOM

### Pre-Raising Checks

Perform the following checks before raising the boom and jib:

- Maintenance and lubrication checks have been performed according to Maintenance Checklist and Lubrication Guide.
- Crane is on a firm, level surface.
- Crawlers are blocked if required per capacity chart in use.
- Crawlers pinned in extended position.
- Boom and jib inserts are installed in proper sequence per boom and jib rigging drawings.
- Safety pins are installed in all boom connecting pins.
- Intermediate suspension (if required) is installed.
- All pendants are installed in proper sequence and properly pinned together. Cotter pins are installed and spread.
- Boom hoist wire rope is spooled tightly onto boom hoist and engaged with the proper sheaves.
- Load lines are spooled tightly onto drums and engaged with proper sheaves.
- Load lines are securely anchored at boom and jib points or at load block and hook-and-weight ball.
- All tools and other items are removed from boom and jib.
- Boom max up limit switch properly installed, operational, and adjusted to proper angle.
- Electric cables from crane control system are connected between boom butt and boom top.
- Electric cables are properly connected in boom and jib.
- Block-up limit control is properly installed, operational, and adjusted.
- Anemometer is hanging correctly and electric cable is not wrapped around support bracket.
- RCL/RCI is properly configured and operational.
- Proper capacity chart is selected and necessary deducts applied on configuration screen of RCL/RCI Display.
- Operator has read and is thoroughly familiar with selected capacity chart. **Consult the selected capacity chart for applicable deducts and boom length raising limitations.**
- Wind is within allowable limits for operation as shown in Wind Conditions document located at end of Section 3.

### Boom Raising Procedure

1. Verify that the pre-raising checks have been performed.
2. SLOWLY start to boom up:
  - a. Have an assistant watch the boom pendants as the boom rises.
  - b. Signal the operator to STOP raising the boom if the pendants get caught on the boom sections. **Correct the problem before continuing.**
3. SLOWLY continue to boom up.
4. Continue to raise the boom until the lower and upper boom points are at a convenient height for installing the load block(s) and hook-or-weight ball.
5. Install the load block(s) and the hook-or-weight ball at the lower and upper boom points (see [Figure 4-27](#)).
6. If equipped with a jib, continue to raise the boom until the jib point is at a convenient height to install the load block or the hook-and-weight ball.
  - a. Signal the operator to STOP raising the boom if the jib pendants get caught on the jib sections. **Correct the problem before continuing.**
  - b. Make sure the jib stop pins are properly installed. See [Deploy Strut Stops on page 4-59](#).
7. Install the load block or the hook-and-weight ball at the jib point (see [Figure 4-27](#)).

---

### CAUTION

#### Avoid Wire Rope Damage

Have an assistant watch the load lines as the boom is raised.

Make sure the wire rope is engaged with the sheaves in the boom points, the jib point, and the load block.

Severe damage can occur if the wire rope has “jumped” off a sheave.

---

8. Continue to boom up until the boom is at an angle that safely allows the load block(s) and/or hook-and-weight balls to be lifted.
9. Once the boom is raised:
  - a. Check all crane functions for proper operation.
  - b. Check all safety devices for proper operation (see Section 3 of the Operator Manual).
  - c. Check that the boom max up limit switch is adjusted to the proper maximum boom angle.
  - d. Check that the RCL/RCI is properly calibrated.

### SHIPPING CRANE COMPONENTS

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

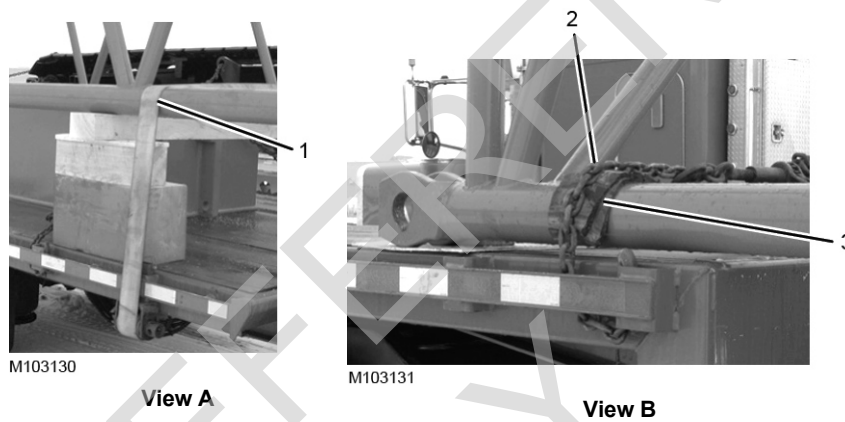
- All trailer loads comply with local, state, and federal transportation requirements.
- All crane components are properly blocked and secured so they cannot shift or fall off the trailers.
- All pendants, if shipped on boom sections, are securely attached with owner furnished cargo tie-down straps so the pendants cannot shift or fall off the boom sections.

- To avoid damage to components:

Use synthetic tie-downs to secure components as shown in [Figure 4-40](#), View A.

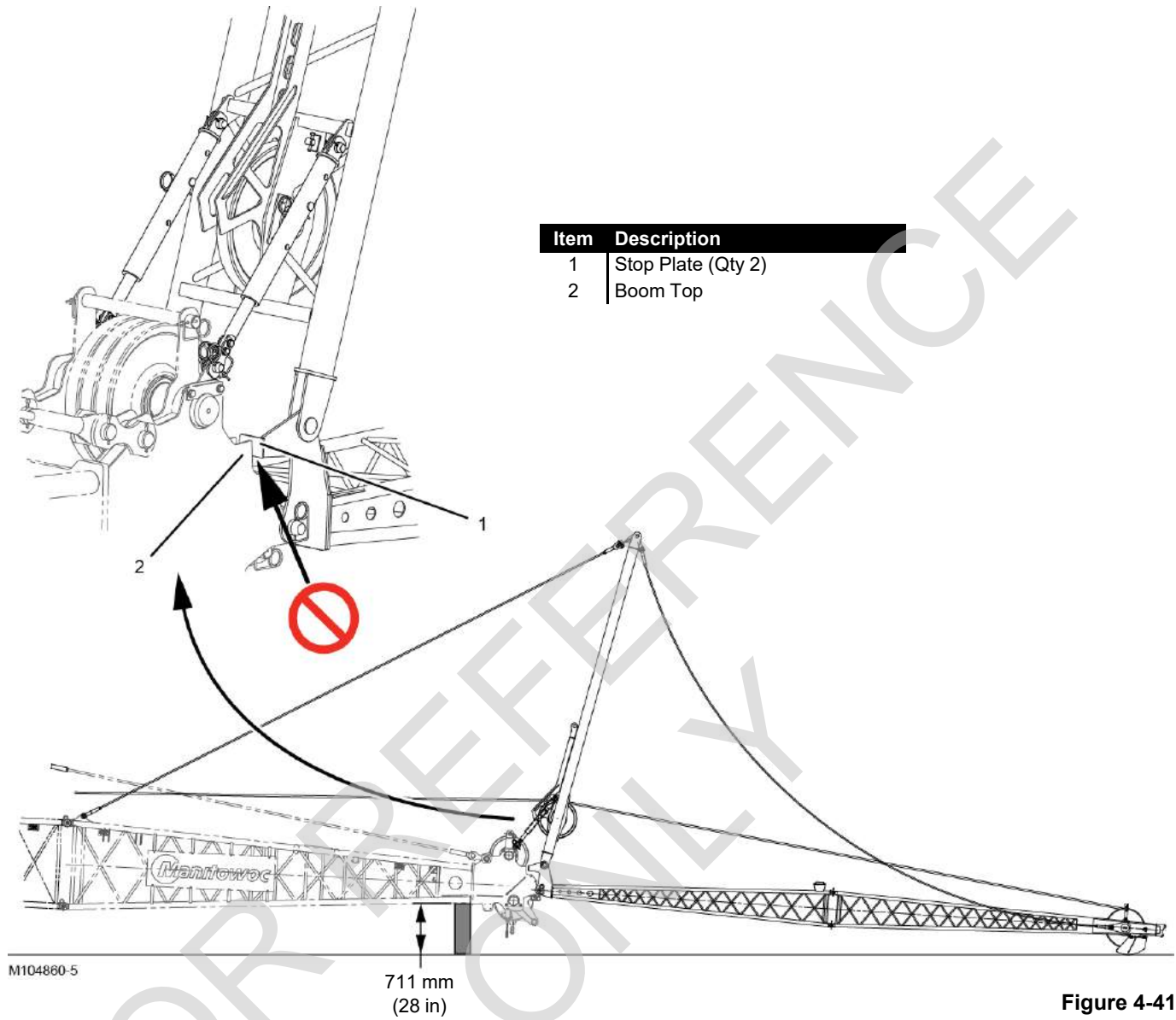
If chain tie-downs are used, install protective covering (such as sections of rubber tire) between the chain and the component being secured as shown in [Figure 4-40](#), View B.

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



Item	Description
1	Synthetic Tie-Down Wrapped Over Boom Chord
2	Chain Tie-Down Wrapped Over Boom Chord
3	Protective Covering (section of rubber tire)

Figure 4-40





## CRANE DISASSEMBLY

Before proceeding, read and understand all of the topics on [page 4-1](#) through [page 4-7](#).

### Prepare Crane

1. Position the crane in the desired disassembly area.
2. If required, **block under the boom end of the crawlers**. See the following:
  - Appropriate Liftcrane Boom or Jib Capacity Chart for blocked crawler requirements.
  - Crawler Blocking Diagram in the Capacity Chart Manual for blocking dimensions.



### DANGER

#### Tipping Hazard!

Do not attempt to lower the boom or the boom and jib to the ground until the crawlers are blocked, if required. Otherwise, the crane will tip.

### Lower Boom

1. Swing the boom to either side of center and lower the load blocks and/or the hook-and-weight balls to the ground. Take every precaution to prevent damage to the load lines.
2. Swing the boom in line with the crawlers and slowly lower the boom.
3. If equipped with a **fixed jib** ([Figure 4-41](#)), do not allow the jib stop plates (1) to contact the boom top (2). **Structural damage will occur**. Block under the boom top at least at least 711 mm (28 in) high at the location shown.
4. If equipped with an **upper boom point**, lower the boom until the upper boom point stands are contacting the ground as shown in [Figure 4-34 on page 4-51](#). Block under the stands if required/desired.
5. Continue to lower the boom onto blocking (as required) until the boom pendants are resting on the top of the

boom sections and the equalizer is resting on the boom butt rails as shown in [Figure 4-20 on page 4-34](#).

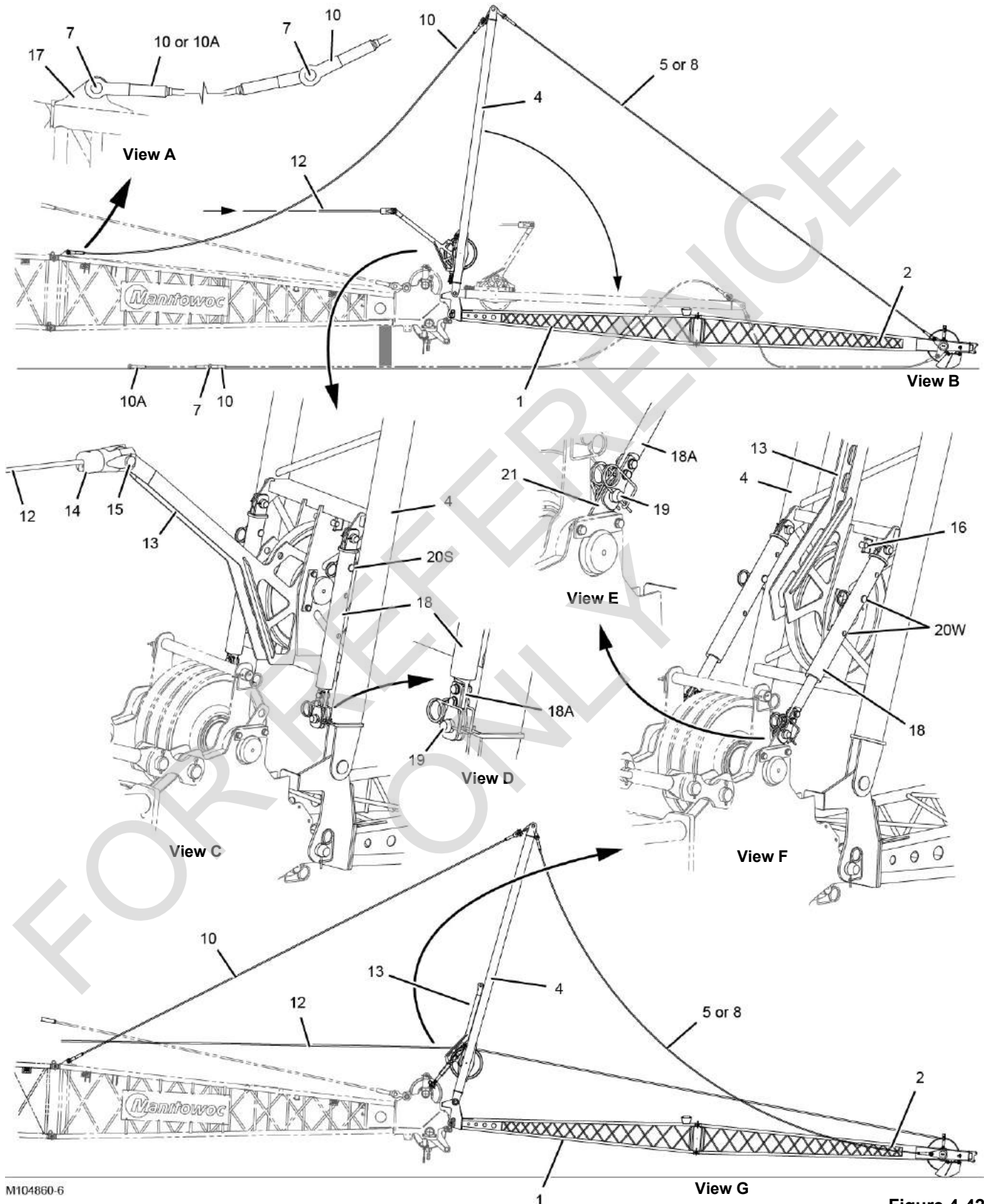
### Store Load Lines

1. Disconnect the button sockets, swivels, and links from the boom and jib tops (see [Figure 4-27 on page 4-44](#)).
2. Disconnect the load lines from the button sockets.
3. Wind the load lines onto the load drums and secure them for shipping.
 

If the whip line (Drum 1) will be used to lower the jib strut, don't store it until after the jib strut is lowered.
4. Store the button sockets, swivels, and connecting pins in the parts box.

### Remove Boom/Jib Point Electronics

1. Stop the engine.
2. Reverse the [Install Boom Top Position Light and Wind Speed Indicator \(option\)](#) steps on [page 4-39](#) and store it.
3. Reverse the [Install Boom Top Camera \(option\)](#) steps on [page 4-39](#) and store the camera.
4. Reverse the [Install Boom Block-Up Limit Components](#) steps on [page 4-39](#) and store them in the parts box.
5. Reverse the [Install Jib Top Position Light and Wind Speed Indicator \(option\)](#) steps on [page 4-41](#) and store it.
6. Reverse the [Install Jib Top Camera \(option\)](#) steps on [page 4-41](#) and store the camera.
7. Reverse the [Install Jib Block-Up Limit Components](#) steps on [page 4-41](#) and store them in the parts box.
8. Disconnect the electric cables between the boom top and the upper boom point or the jib.
  - Clean all cable connectors and dust caps.
  - Securely fasten dust caps to all cable ends and receptacles.
  - Store the jib extension cable on the jib butt as shown in [Figure 4-25 on page 4-40](#) and secure it with plastic wire ties.
  - Store the electric cables on the boom butt as shown in [Figure 4-22 on page 4-36](#).



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Figure 4-42

Legend for [Figure 4-42](#).

Item	Description
1	Jib Bottom
2	Boom Top
3	Not Used
4	Jib Strut
5	Jib Top Pendant (Qty 2)
6	Not Used
7	Pin with Cotter Pin (Qty 1 or 2 each pendant)
8	Jib Insert Pendant (Qty 2 or 4 if installed)
10	Backstay Pendant (Qty 2)
10A	30° Offset Pendant (Qty 2)
11	Not Used
12	Whip Line (Drum 1)
13	Strut Raising Arm
14	Button Socket
15	Pin with Cotter Pin
16	Rope Guide Pin with Safety Pin
17	Backstay Lug (Qty 2)
18	Strut Stop (Qty 2)
18A	Inner Stop Tube (Qty 2)
19	Pin with Safety Pins (Qty 2)
20	Stop Pin with Safety Pin (Qty 2)
21	Strut Stop Lug (Qty 2)
S	Storage Hole
W	Working Holes

**NOTE** The jib strut can be lowered either using an assist crane or with the whip line (Drum 1) from this crane.

***The strut can be lowered with the whip line only for boom lengths longer than 22 m (72.2 ft). For lesser boom lengths, the equalizer will interfere with rope routing.***

If the strut will be lowered with the whip line, store the strut stops and lower the strut BEFORE disconnecting the boom butt from the boom.

## Store Strut Stops

See [Figure 4-42](#).

Perform the following steps at both strut stops (18), one side at a time.

1. Remove the stop pin (20W, View F).
2. Support the inner stop tube (18A, View E) and remove the pin (19).
3. Rotate the inner stop tube (18A, View D) 90°, fully retract the inner stop tube, and install the stop pin (20S, View C).

4. Install the pin (19, View D) in the inner stop tube (18A).
5. Lower the strut stop onto the jib strut (4, View C).

## Deploy Strut Raising Arm

See [Figure 4-42](#).

1. Remove the rope guard pin (16, View F).
2. Route the whip line (12, View C) from Drum 1 to the end of the strut raising arm (13).
3. If not already done, assemble the button socket (14, View C) to the end of the whip line (12).
4. Pin the button socket (14, View C) to the strut raising arm (13) with the pin (15) and cotter pin.

## Lower Jib Strut

See [Figure 4-42](#).

### CAUTION

#### Avoid Structural Damage!

DO NOT LIFT JIB POINT OFF GROUND during [step 1](#). Structural damage may occur.

1. Slowly haul in the whip line (12, Views B and C) from Drum 1 so the jib pendants (5 and 8) are tight and the backstay pendants (10 or 10A, View A) are loose.
2. Unpin the backstay pendants (10 or 10A, View A) from backstay lugs (17) on the boom top and lower the pendants to the ground.
3. Slowly pay out the whip line (12, View B) — lower jib strut (4) — until the jib strut is resting on the bumpers on the jib bottom (1).

Guide the pendants clear of the boom top and the jib sections as the strut lowers. Do not allow the pendants to catch on the jib section connecting pins or to rub against the boom top or the jib sections.

4. Support the strut raising arm by hand and disconnect the button socket (14, View C) from the strut raising arm (13).
5. Lower the strut raising arm (13, View F), by hand, to the stored position against the jib strut (4) and install the rope guide pin (16) and safety pin.
6. Haul in the whip line onto Drum 1 and store it for shipping.

Item	Description
1	Boom Hoist Wire Rope
2	Equalizer
3	Equalizer Rails
4	Intermediate Suspension Pendant (Qty 2)
5	Tie-Back Link (Qty 4)
6	Tie-Back Pin with Flat Washer and Locking Pin (Qty 2)
7	Boom Butt Lug (Qty 2)
8	Insert Pendant (Qty 2)
A	Pry Bar Hole in Equalizer
B	Pry Bar Beam
C	Pry Bar Slot (Qty 3)

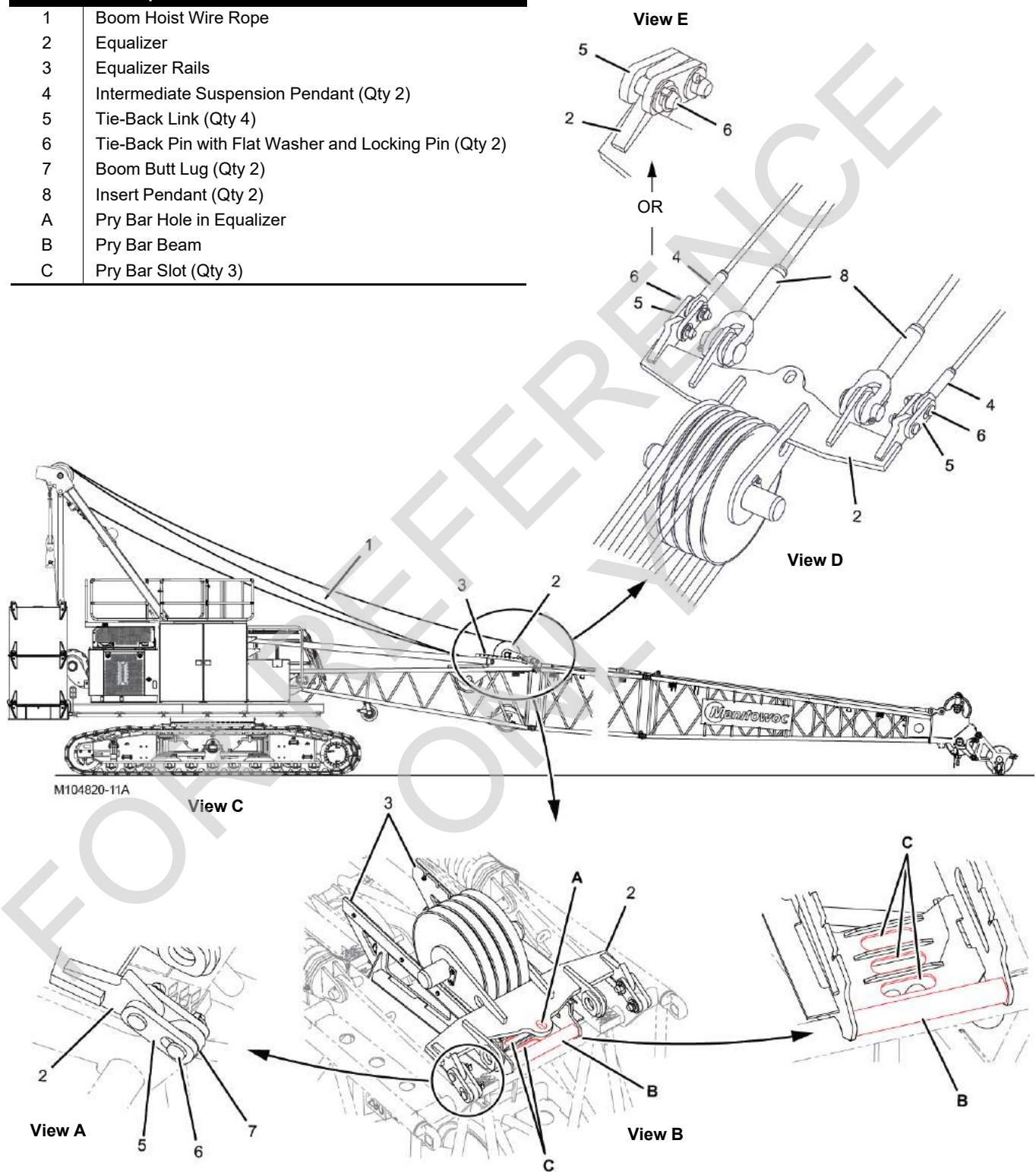


Figure 4-43

**NOTE** If the jib strut will be lowered with the whip line, store the strut stops ([page 4-65](#)) and lower the strut BEFORE disconnecting the boom butt from the boom.

## Connect Equalizer to Boom Butt



### WARNING

#### Moving Object Hazard!

Prevent serious crushing injury:

Do not disconnect the insert pedants (8, View D, [Figure 4-43](#)) from the equalizer (2) until the equalizer is pinned to the boom butt. Otherwise, the equalizer can be pulled rearward by the boom hoist wire rope.

See [Figure 4-43](#).

1. Boom down to slacken the boom hoist wire rope (1, View C) until the equalizer (2, View B) is resting firmly on the boom butt equalizer rails (3).
2. If equipped with intermediate suspension, unpin the intermediate suspension pendants (4, View D) from the tie-back links (5).
3. If stored, remove the tie-back pins (6, View E).
4. Pin the tie-back links (5, View A) to the boom butt lugs (7) with the tie-back pins (6).
5. If necessary, use a pry bar to move the equalizer forward enough to allow connection of the tie-back links (5, View A).

A pry bar hole (**A**, View B) is provided in the equalizer. A pry bar beam (**B**) and slots (**C**) are provided in the boom butt.

Item	Description
1	Boom Butt
2	Boom Insert
3	Bottom Connector Pin (Qty 2)

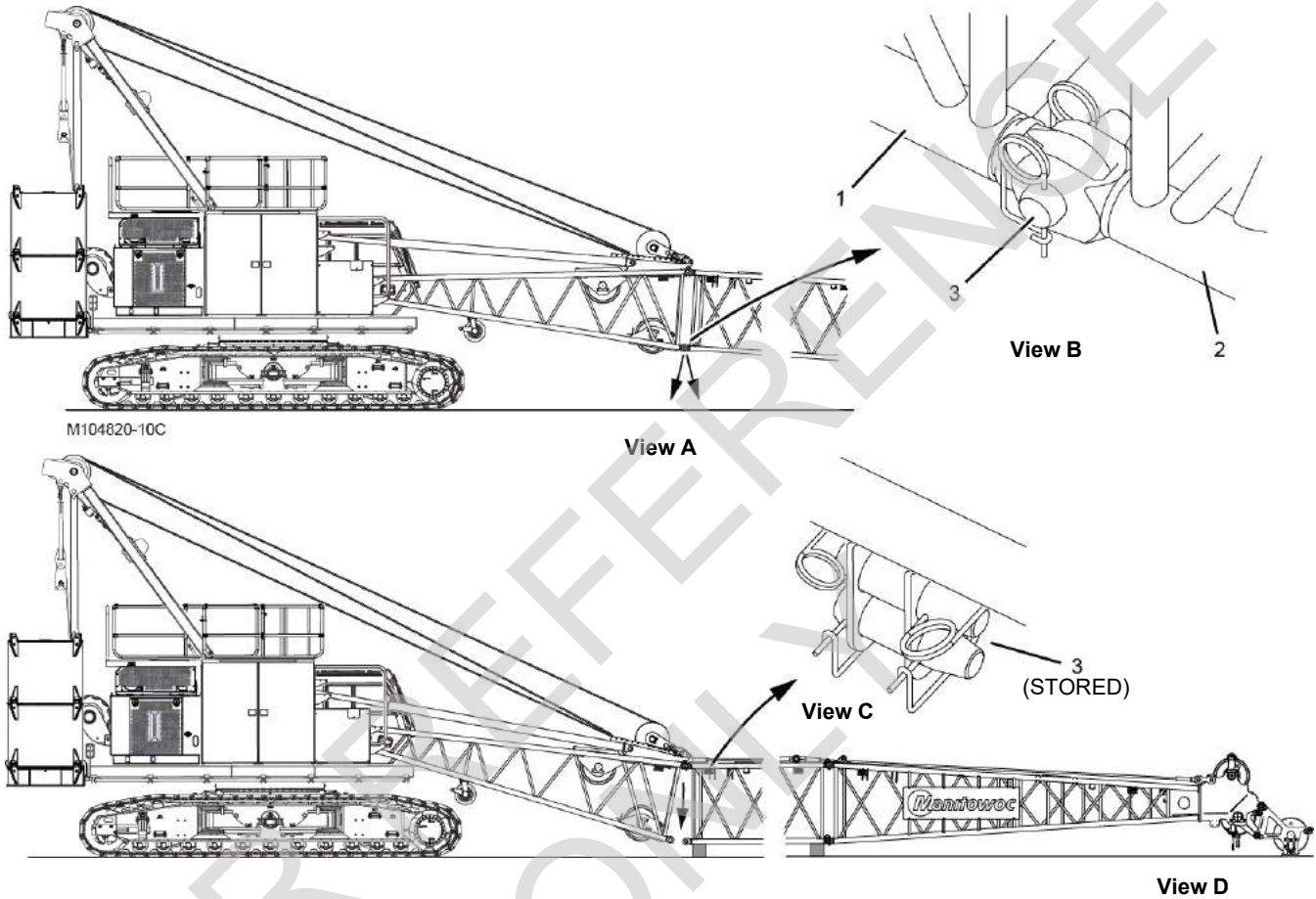


Figure 4-44

## Open Boom

See [Figure 4-44](#).

1. During the following step, the boom will pivot about the upper boom point stands if the upper boom point is installed.

If the upper boom point is not installed, block under the lower boom point, as required, so it does not dig into the ground as the boom is lowered.

---

### CAUTION

#### Avoid Gantry and/or Boom Butt Damage!

Do not attempt to lift the boom during the following step. Damage can occur.

---

2. Boom up only enough to support the boom when the bottom connector pins (3, View B) are removed.



### WARNING

#### Crushing Injury Hazard!

Prevent serious crushing injury:

- Do not stand inside the boom sections while removing the connector pins — STAND OUTSIDE BOOM.
- 
3. Remove the bottom connector pins.
  4. Store the pins in the holders on the boom insert (View C).
  5. Slowly boom down and lower the boom sections onto blocking (View D).

Item	Description
1	Equalizer
3	Insert Pendant (Qty 2)
2	Pendant Pin (Qty 2)
4	Boom Butt
5	Boom Insert
6	Top Connector Pin with Safety Pin (Qty 2)
7	Rope Guide

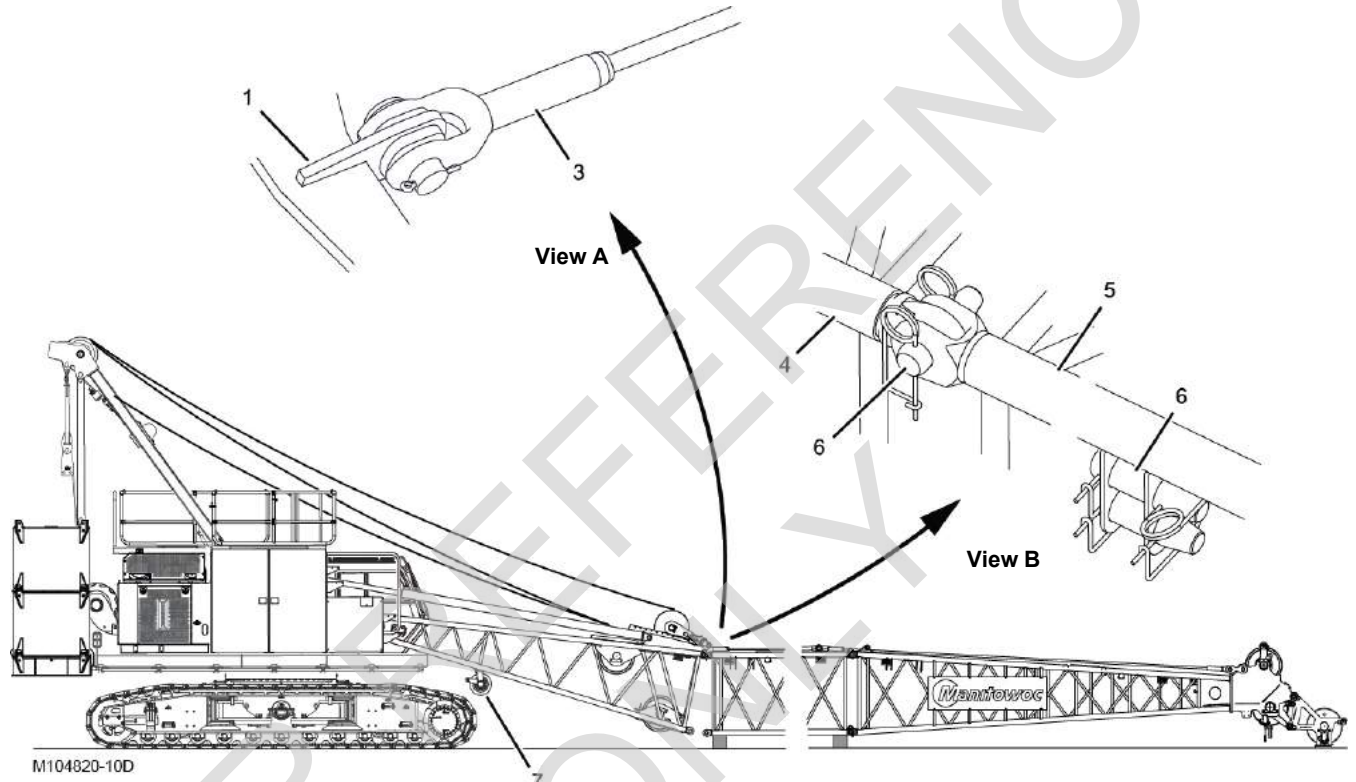


Figure 4-45



## Disconnect Boom Pendants from Equalizer



### WARNING

#### Moving Object Hazard!

Prevent serious crushing injury:

Do not disconnect the insert pedants (3, View A, [Figure 4-45](#)) from the equalizer (2) until the equalizer is pinned to the boom butt. Otherwise, the equalizer can be pulled rearward by the boom hoist wire rope.

1. Make sure the equalizer is pinned to the boom butt with the tie-back links as shown in View, [Figure 4-43 on page 4-66](#).
2. Unpin the insert pendants (3, View A, [Figure 4-45](#)) from the equalizer (2).
3. Store the pendant pins in the pendant holes.

## Disconnect Boom Butt from Boom

See [Figure 4-45](#).

1. Boom up only enough to support the boom butt when the top connector pins are removed.
2. Remove the top connector pins (6, View B).
3. Store the pins in the holders on the boom insert.

4. Travel the crane in reverse, away from the boom sections.

### CAUTION

#### Avoid Sheave Damage!

Once the boom butt is disconnected from the boom, use extreme care while swinging so the rope guide (7) under the boom butt does not hit the crawlers (or carbody counterweight if installed).

## Install Hook-and-Weight Ball

If you are going to use the crane for self-disassembly, install the hook-and-weight ball on the boom butt. See [Install Hook-and-Weight Ball on page 4-19](#).

Only use the load line from **Drum 1 (front drum only)**.

### CAUTION

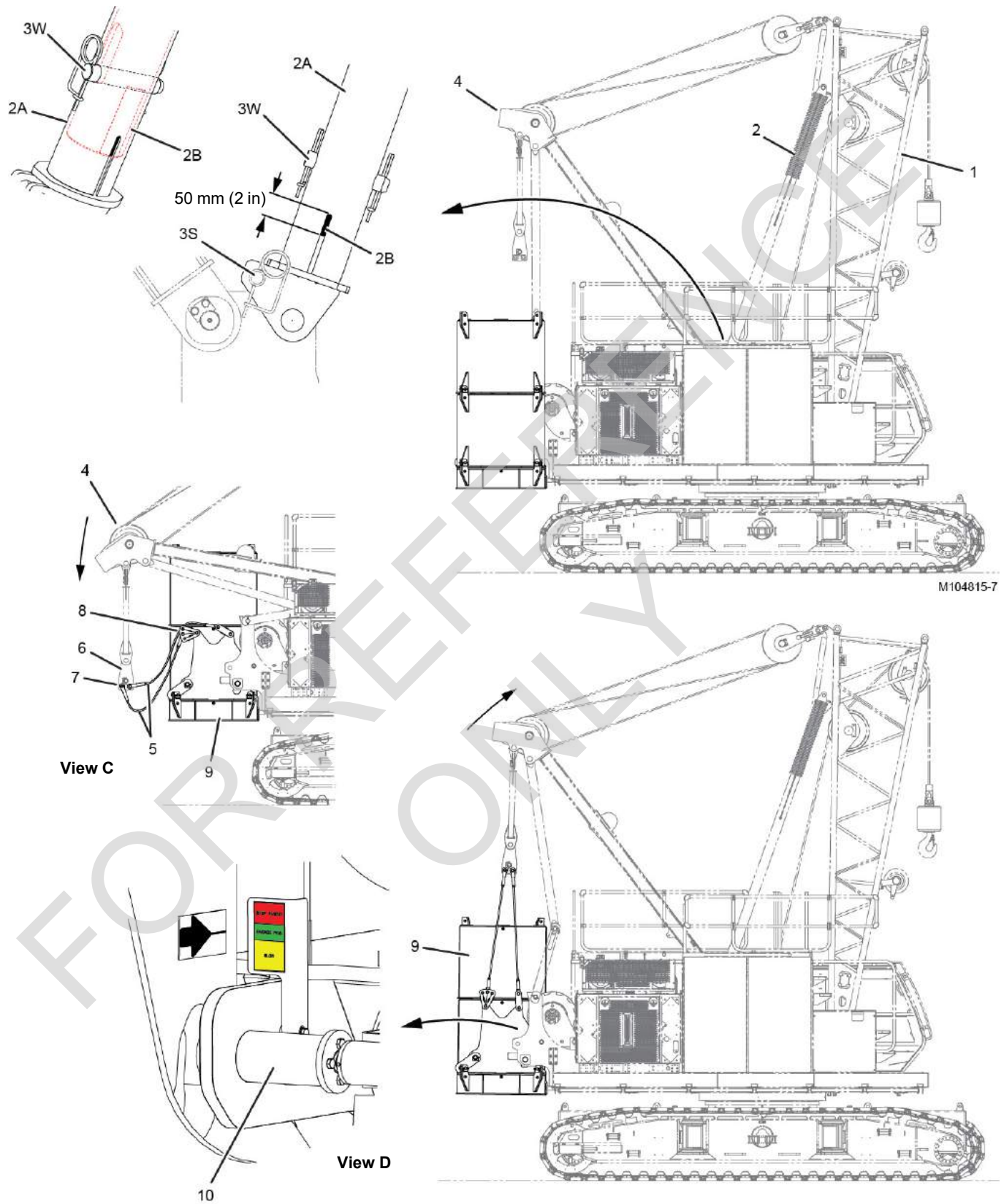
#### Wire Rope Damage!

Observe the load line spooling on Drum 1 often during crane disassembly.

To avoid wire rope damage, adjust the load line spooling as necessary.

## Configure RCL/RCI for Crane Setup

Select the Boom Butt Configuration in the RCL/RCI display.



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Figure 4-46

Legend for [Figure 4-46](#).

Item	Description
1	Boom Butt at 81°
2	Boom Stop Spring Compressed (qty 2)
2A	Boom Stop Outer Tube (Qty 2)
2B	Boom Stop Inner Tube (Qty 2)
3	Hold-Back Pin with Hair-Pin Cotter (qty 2)
4	Gantry
5	Handling Pendant (Qty 4)
6	Handling Link (Qty 2)
7	Pendant Pin with Cotter Pin (Qty 4)
8	Adjustable Handling Link (Qty 2)
9	Crane Counterweight
10	Counterweight Pin (Qty 2)
S	Storage Hole
W	Working Holes



### DANGER

#### Crush Hazard!

Avoid being crushed by moving parts:

- Do not stand on the crane counterweight while it is being raised or lowered.
- Do not climb onto the crane counterweight once the counterweight pins are disengaged.
- Never go under the crane counterweight when it is unpinned from the crane and hanging from the gantry.

## Remove Crane Counterweight

If equipped with Series 2 counterweight, remove the crane counterweight **BEFORE removing carbody counterweight**.

See [Figure 4-46](#).

1. Activate the remote control in the main display. Read the topic "[Self-Erect Controls](#)" on page 4-6.
2. Prepare the boom stops:

### CAUTION

#### Avoid Structural Damage to Crane!

Use extreme care when compressing the boom stops during the following steps. Do not compress the boom stops until they are solid. Damage to the boom butt or boom stops can occur.

Stop compressing the boom stops when the hold-back holes are aligned.



### WARNING

#### Crush Hazard!

Moving parts can cut or crush.

Do not stick your fingers into the slots in the boom stop outer tubes (2A, View B, [Figure 4-46](#)).

- a. Slowly raise the boom butt (1, View A) to approximately 81°. This step will compress the boom stop springs (2).
- b. Stop raising the boom butt when the boom stop inner tubes (2B, View B) are visible approximately 50 mm (2 in) into the slots in the boom stop outer tubes (2A).

The hold-back holes in the inner and outer tubes should now be aligned.

- c. Remove the hold-back pins (3, View C) from the storage holes (S) and install them in the working holes (W) between the boom stop tubes.

3. The boom butt will now remain in position while the gantry is raised and lowered during the remaining steps.

4. Use the remote control for the remaining steps. This will allow the operator to stand at the rear of the crane and view the removal procedure.

- **Turn ON the SYNC switch** on the remote control so the gantry raising cylinders follow the gantry as it is raised and lowered during the following steps. See Section 3 of the Operator Manual for detailed instructions.

- Use the Drum 4 (boom hoist) thumbwheel on the remote control to raise and lower the gantry.

5. Lower the gantry (4, View C) (boom down using the Drum 4 thumbwheel on the remote control) until the handling pendants (5) can be pinned to the handling links (6).

The pendants are stored on the counterweight tray.

6. Pin the handling pendants (5, View C) to the handling links (6) with the pendant pins (7).

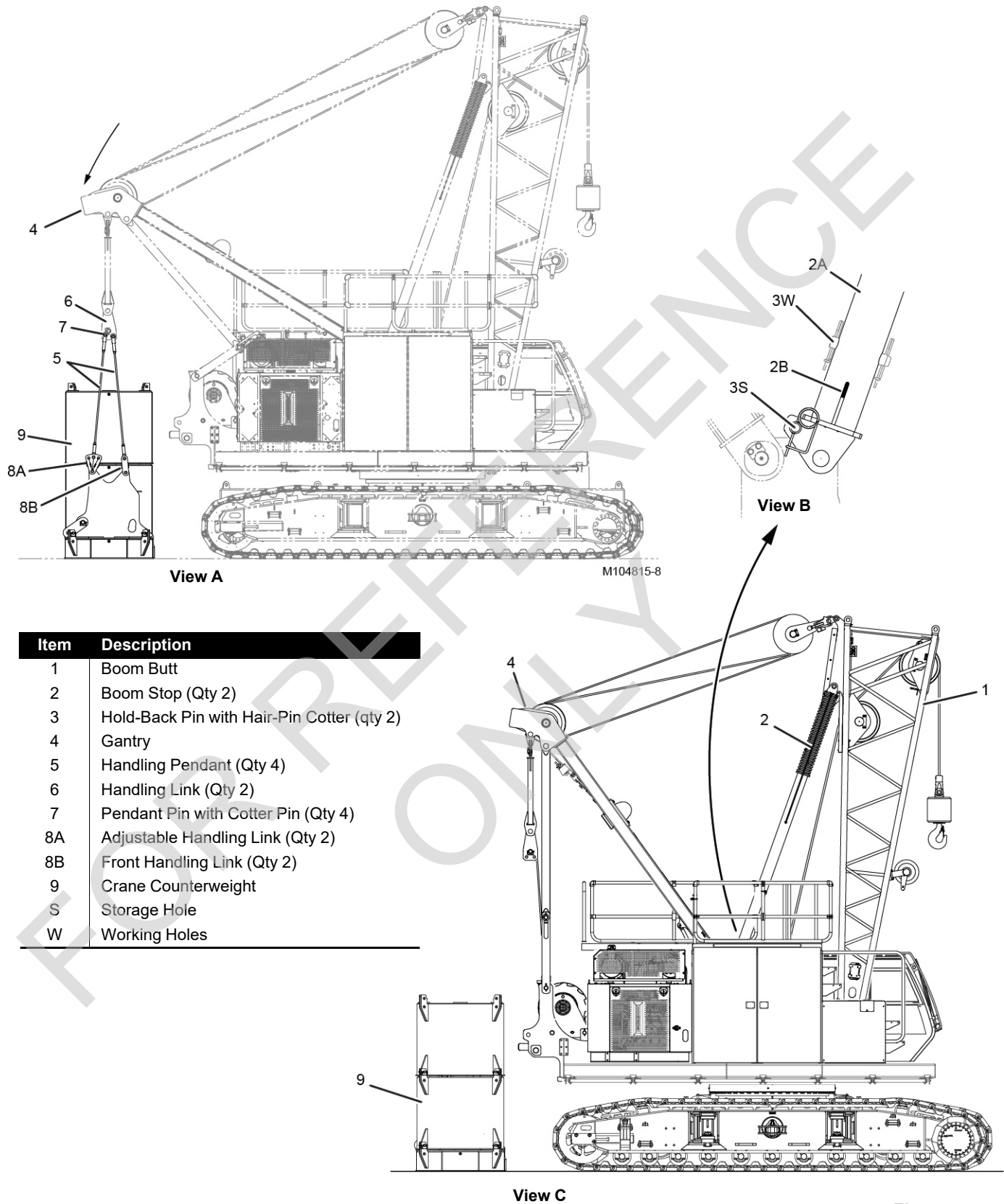
### CAUTION

#### Avoid Damage to Pendants!

Use extreme care when raising gantry during following step. Make sure the handling pendants don't get caught on the pins and links.

7. Slowly raise the gantry (boom up using the Drum 4 thumbwheel on the remote control) until the handling pendants are tight.

*Continued on next page.*



Item	Description
1	Boom Butt
2	Boom Stop (Qty 2)
3	Hold-Back Pin with Hair-Pin Cotter (qty 2)
4	Gantry
5	Handling Pendant (Qty 4)
6	Handling Link (Qty 2)
7	Pendant Pin with Cotter Pin (Qty 4)
8A	Adjustable Handling Link (Qty 2)
8B	Front Handling Link (Qty 2)
9	Crane Counterweight
S	Storage Hole
W	Working Holes

Figure 4-47

## Remove Crane Counterweight (continued)

8. Slowly continue to raise the gantry until the weight of the crane counterweight (9, View D, [Figure 4-46 on page 4-72](#)) is off the counterweight pins (10). The arrow (View D) should be pointing at the green area of the alignment decal.

The boom butt will rise slightly and the boom stops will fully compress during this step.

9. Disengage the counterweight pins using the switch on the remote control. Raise the gantry (counterweight) as required to disengage the pins.

**NOTE** If the crane counterweight is raised too high, a limit switch will trip open to stop the gantry and prevent the backhitch from fully extending. The COUNTERWEIGHT TOO HIGH fault will come on in the main display.

10. Verify that the counterweight pins are fully disengaged.

See [Figure 4-47](#).

11. Slowly lower the gantry (4, View A) (boom down using the Drum 4 thumbwheel on the remote control) to lower the crane counterweight (9) to the ground. If necessary, **block under the counterweight tray so it is stable**.
12. Once the counterweight has been lowered far enough, engage the counterweight pins using the switch on the remote control.
13. Continue to lower the gantry until the handling pendants (5, View A) are slack.
14. Unpin the handling pendants (5, View A) from the handling links (6).
15. Store the pendant pins (7, View A) in the pendant holes.

16. Store the handling pendants (5, View A) and the links (8A and 8B) on the counterweight tray.
17. Leave the Handling links (6, View A) pinned to the gantry links.
18. Fully raise the gantry (4, View C) (boom up using the Drum 4 thumbwheel on the remote control) until the cylinders are fully extended and the backhitch links are tight.

---

### CAUTION

#### Structural Damage to Crane!

Use extreme care when compressing the boom stops during the following steps. Do not compress the boom stops until they are solid. Damage to the boom butt or boom stops can occur.

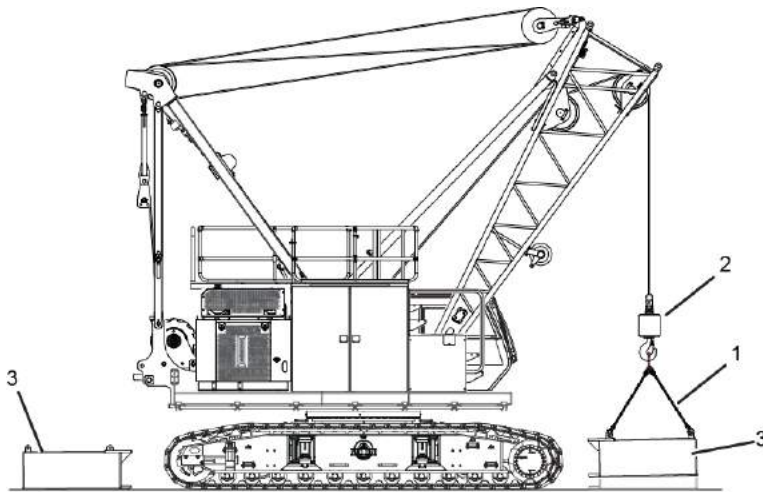
Stop compressing the boom stops when the hold-back holes are aligned.

---

19. Boom up slightly using the Drum 4 thumbwheel on the remote control to compress the boom stops (2, View C) and remove the boom hold-back pins (3, View B) from the working holes (W).
20. Install the hold-back pins (3, View B) in the storage holes (S).
21. **Turn OFF the SYNC switch** on the remote control.
22. Lower the boom butt into the working range.

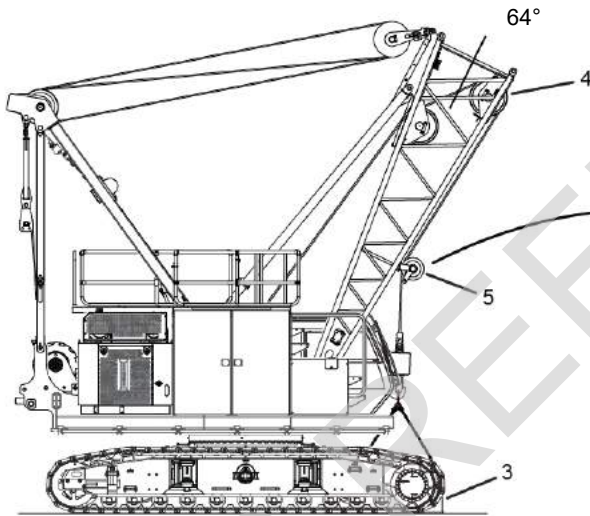
### Disassemble Crane Counterweight

To disassemble the crane counterweight, reverse the assembly steps on [page 4-25](#).

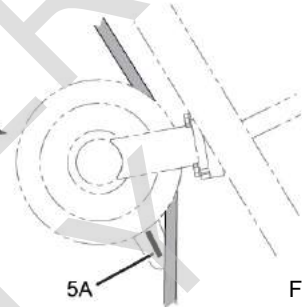


View A

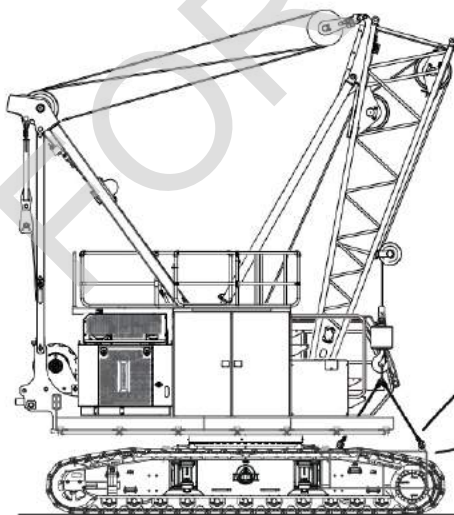
Item	Description
1	Chain Lifting Sling
2	Hook-and-Weight Ball
3	Carbody Counterweight (2)
4	Boom Butt at Min Angle of 64°
5	Counterweight Handling Sheave
5A	Sheave Indicator
6	Pin with Hair-Pin Cotters (4)
7	Hooked Lug (4)



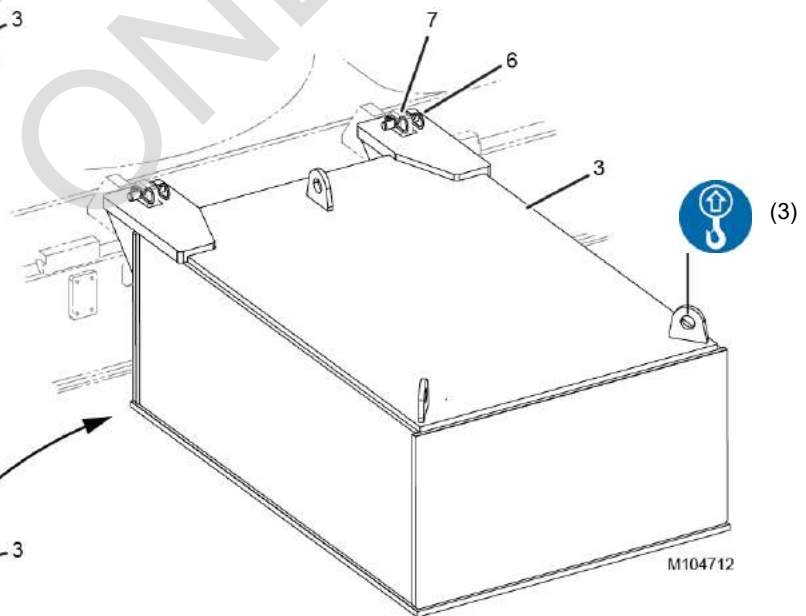
View B



View E  
From Cab Side  
of Boom Butt



View C



View D

M104712

Figure 4-48

## Remove Carbody Counterweight

For Series 1, disregard this procedure.

**NOTE** The following procedure uses the boom butt.

To provide sufficient clearance if you use an assist crane:

- Swing the upperworks perpendicular to the crawlers so the operator cab is on the same side of the carbody that the counterweight is being removed from.

If equipped with Series 2 counterweight, remove the crane counterweight ([page 4-73](#)), **BEFORE removing the carbody counterweight.**

For Series 2, proceed as follows:

1. Attach the chain lifting sling (1, View A) to the hook-and-weight ball (2).
2. Raise the boom butt to approximately 80°.
3. Pay out the load line from Drum 1 and reposition the load line behind the counterweight handling sheave (5, View B). You can stand on the right side platform to perform this step.
4. Hook onto the carbody counterweight (3, View D) with the chain lifting sling (1).
5. Swing and raise the boom butt so the hook and weight-ball is centered over the counterweight (View C).
6. Remove the pins (6, View D).
7. Hoist as required to disengage the cutouts in the carbody counterweight (3, View D) from the hooked lugs (7) on the carbody.
8. Lower the boom butt to no lower than 64°.

## CAUTION

### Avoid Boom Butt Damage!

Do not lower the boom butt below 64° while handling the counterweight from the handling sheave. Do not allow the load line to contact the sheave indicator (5A, View E).

Overload damage to the sheave and boom butt can occur.

9. Pay out the load line to lower the counterweight onto the ground.
10. Store the pins (6, View D) in the hooked lugs (7) on the carbody.
11. Slacken the chain lifting slings and disconnect them from the carbody counterweight.
12. Repeat the steps for the other carbody counterweight.
13. Disengage the load line from behind the counterweight handling sheave (5, View B) and allow the load line to hang vertically from the boom butt (View A).
14. You can now use the to move the carbody counterweights to the desired storage/shipping location.

## Disassemble Jib and Boom

The jib and boom can be disassembled with this crane's boom butt or with an assist crane.

The boom and jib can be disassembled with this crane either before or after the crane counterweight is removed, at the crane users discretion. The will be much easier to maneuver without crane counterweight.

- See [Boom #290 Disassembly on page 4-84](#).
- See [Jib #117 Disassembly on page 4-85](#).

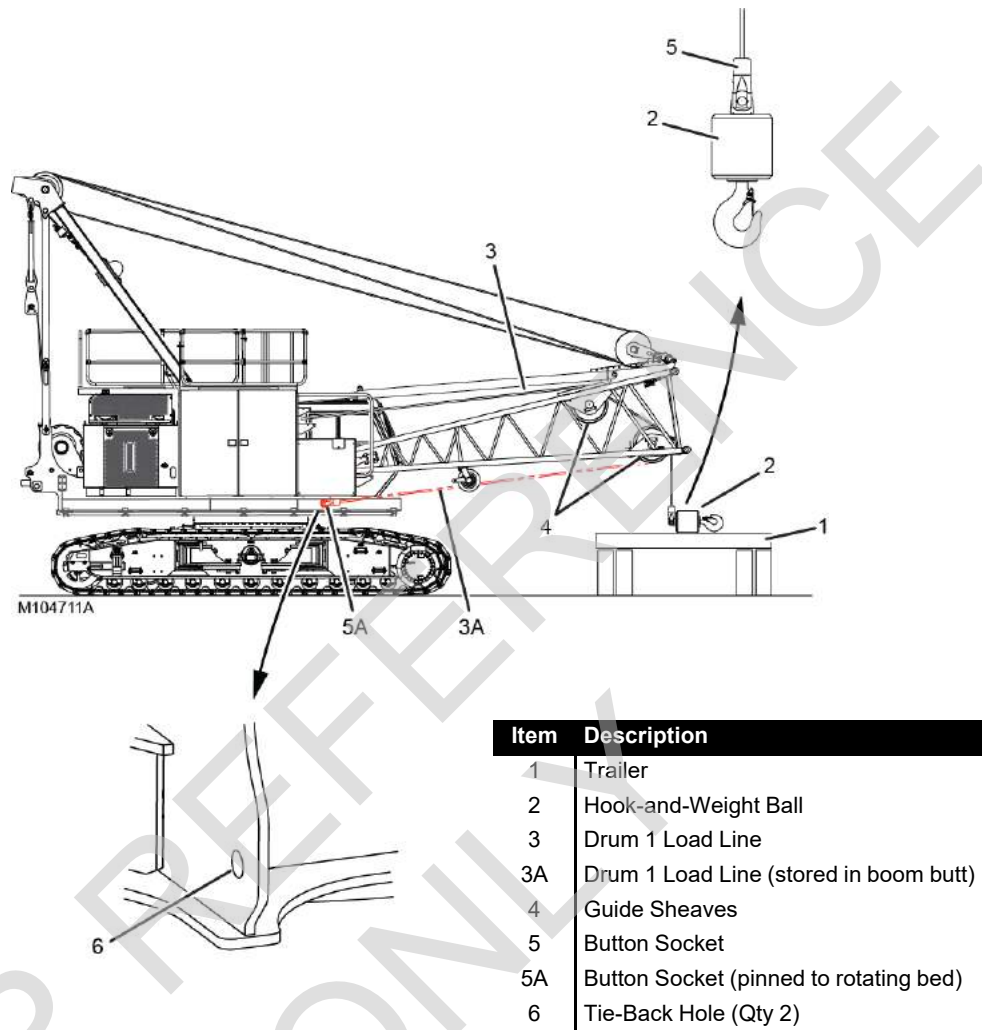


Figure 4-49



## Load Trailers

The crane can load the trailers as shown in View A, [Figure 4-12 on page 4-20](#).

Refer to the Liftcrane Boom Butt Capacities at the end of this section for lifting capacities.



### WARNING

#### Falling Load Hazard!

The lifting lugs on each boom section are designed only for lifting that section. Do not attempt to lift two or more boom sections with the lifting lugs on one section. The lifting lugs may break allowing the boom sections to fall.

### Boom Sections

All boom sections have lifting lugs as shown in [Figure 4-12 on page 4-20](#).

- Handle the boom sections with care to avoid damaging the lacings and chords.
- Use synthetic lifting slings (crane owner furnished) to lift the boom sections. If wire rope or chain slings are used to handle the boom sections, install protective covering (such as sections of rubber tire) between the slings and the section being lifted.

### Jib Sections

The jib sections do not have lifting lugs.

- Handle the jib sections with care to avoid damaging the lacings and chords.
- Use synthetic lifting slings (crane owner furnished) to handle the jib sections. Lift at the chords only. Never lift at the lacings. If wire rope or chain slings are used to handle the jib sections, install protective covering (such as sections of rubber tire) between the slings and the section being lifted.
- See [Figure 4-13 on page 4-21](#) for the center of gravity of the jib sections.

## Counterweight

- Each crane counterweight box has two lifting points.
- The crane counterweight tray and each carbody counterweight has three lifting lugs.

Use the Manitowoc supplied chain lifting sling ([Figure 4-2 on page 4-3](#)) to handle the crane and carbody counterweight boxes and tray.

## Remove Hook-and-Weight Ball

See [Figure 4-49](#).

1. Position a trailer (1) under the boom butt.
2. Lower the hook-and-weight ball (2) onto the trailer.
3. Disconnect the button socket (5) from the lug on the hook-and-weight ball (2).
4. Remove the trailer.

**NOTE** At the crane owner's/user's discretion, the load line (3) can be stored either on the load drum or on the boom butt.

5. If the load line (3) will be stored on the load drum, proceed as follows:
  - a. Disconnect the button socket (5) from the button on the end of the load line.
  - b. Store the button socket in the parts box supplied with the crane.
  - c. Haul in the load line (3) onto the load drum and secure the load line.
6. If the load line will be stored on the boom butt, proceed as follows:
  - a. Pay out the load line (3A).
  - b. Pin the button socket (5A) to either tie-back hole (6) on the front of the rotating bed.
  - c. Keep the load line slack while raising and lowering the boom butt during the remaining procedures.

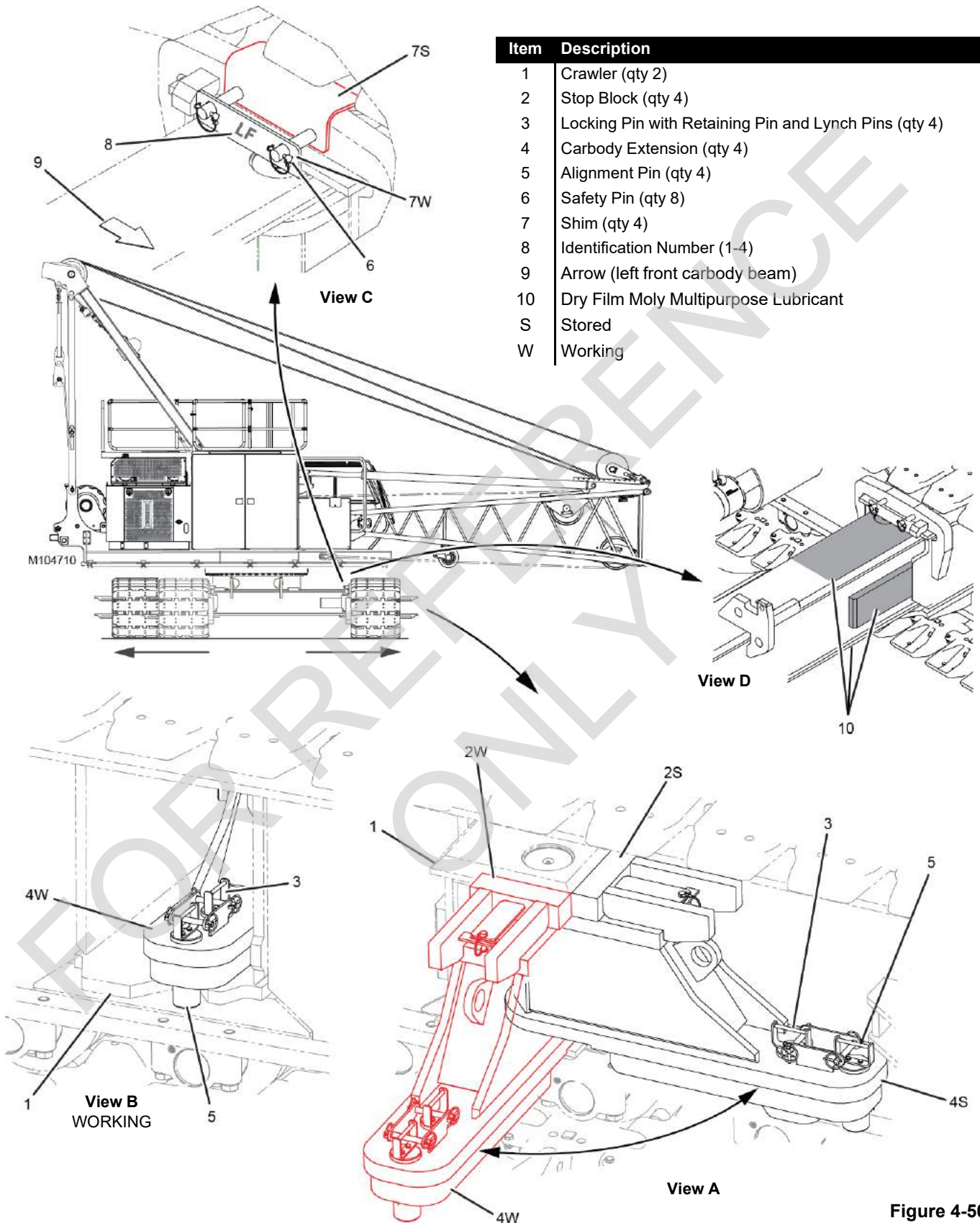


Figure 4-50

## Retract Crawlers

See [Figure 4-50](#).



### WARNING

#### Tipping Hazard!

Do not attempt to retract (or extend) the crawlers with the crane counterweight installed. Tipping will occur if the crane is swung in either direction.

#### Crush Hazard!

To avoid crushing personnel while retracting the crawlers, maintain constant communication (signals) between the operator and ground personnel.

Do not extend/retract crawlers or swing while personnel are standing between the crawlers.

**NOTE** The crawlers must be retracted one at a time.

1. Perform the following steps at each carbody extension for one of the crawlers (4W, View B).
2. Thoroughly clean and spray the sliding surfaces of the carbody extension and the crawler with a quality brand of dry film moly multipurpose lubricant.
3. Inspect the shims each time they are removed:
  - If a shim is damaged or difficult to remove, replace it.
  - Measure the gap between the shims and crawler. The gap must be 1 to 3 mm (0.04 to 0.12 in).
4. Remove the shims (7W, View C, four places) from the working position and install them in the stored position (7S).

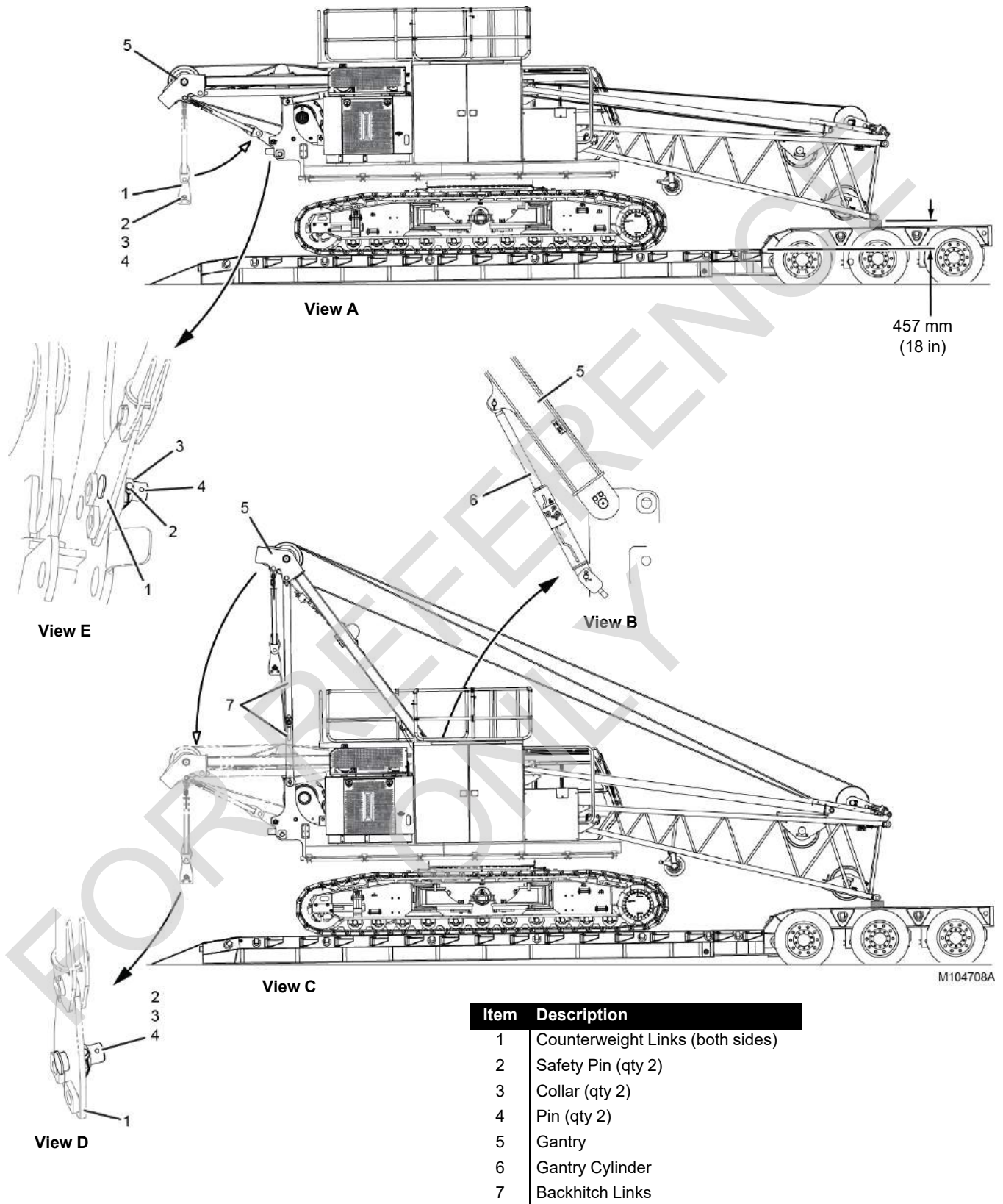
- It may be necessary to swing the upperworks to increase the clearance between the crawler and carbody so the shims can be removed.
- Alternatively, holding the crawler positioning switch in the extend position will cause the crawlers to tip slightly, thereby providing more clearance.

**NOTE** The shims and the carbody legs are stamped with matching identification numbers (8, View C). Do not interchange the shims. The number on each shim must match the number on the corresponding carbody leg.

5. Remove the locking pins (3, View B) from the working position.
6. Using the crawler positioning switch on the right console in the cab, retract one crawler (with the other crawler pinned in a fixed position).

Depending on ground conditions:

- It may be necessary to swing
  - It may be necessary to travel slowly in either direction
7. Store each carbody extension (4, View A):
    - a. Remove the stop block (2W).
    - b. Swing the carbody extension (4) inward 90°.
    - c. Reinstall the stop block (2S).
    - d. Secure the carbody extension to the crawler with the locking pin (3).
  8. Repeat steps 1-7 for the other crawler.



Item	Description
1	Counterweight Links (both sides)
2	Safety Pin (qty 2)
3	Collar (qty 2)
4	Pin (qty 2)
5	Gantry
6	Gantry Cylinder
7	Backhitch Links

Figure 4-51

## Prepare Trailer for Loading

See [Figure 4-52](#).

1. Position the trailer (1, View A) on a firm level surface.
2. Remove the goose neck and the truck.
3. Lower the trailer deck to the ground.

Manitowoc recommends that the gantry be lowered after the crane is traveled onto the trailer.

### CAUTION

#### Avoid Wire Rope Damage!

If you chose to lower the gantry before traveling the crane onto the trailer, the boom hoist wire rope will rub against the cross brace on the gantry and possibly against the wire rope on the rear drum when the boom butt is lowered. Premature rope wear will occur, resulting in shorter rope life.

## Travel Crane onto Trailer



### WARNING

#### Tipping Crane Hazard!

To prevent tipping, do not swing (keep upperworks inline with lowerworks).

See [Figure 4-52](#).

1. Swing the upperworks in line with the lowerworks and PARK the swing function.

2. Lower the boom butt to horizontal.
3. Slowly travel the crane into the desired position on the trailer and PARK the travel function.
4. Secure the crane to the trailer.
5. Lower the boom butt onto blocking (View A) so the boom butt is at least 457 mm (18 in) above the trailer deck.

### CAUTION

#### Avoid Wire Rope Damage!

To lower the gantry, the boom butt must be at least 457 mm (18 in) above the trailer deck (View A). Otherwise, wire rope damage can occur.

## Lower Gantry

See [Figure 4-51](#).

Use the gantry cylinder switches either on the right console in the cab for this procedure.

1. Pay out the boom hoist wire rope as required to keep slack in the boom hoist reeving.
2. Retract the gantry cylinders (6, View B) to fully lower the gantry (5, View C).
3. Remove the safety pins (2, View D), the collars (3), and the pins (4) from the holes in the counterweight links (1).
4. Rotate the counterweight links (1, View A) to the shipping position and align the connecting holes.
5. Install the pins (4, View E), the collars (3), and the safety pins (2).

The pin heads should be on the inboard side of the links.

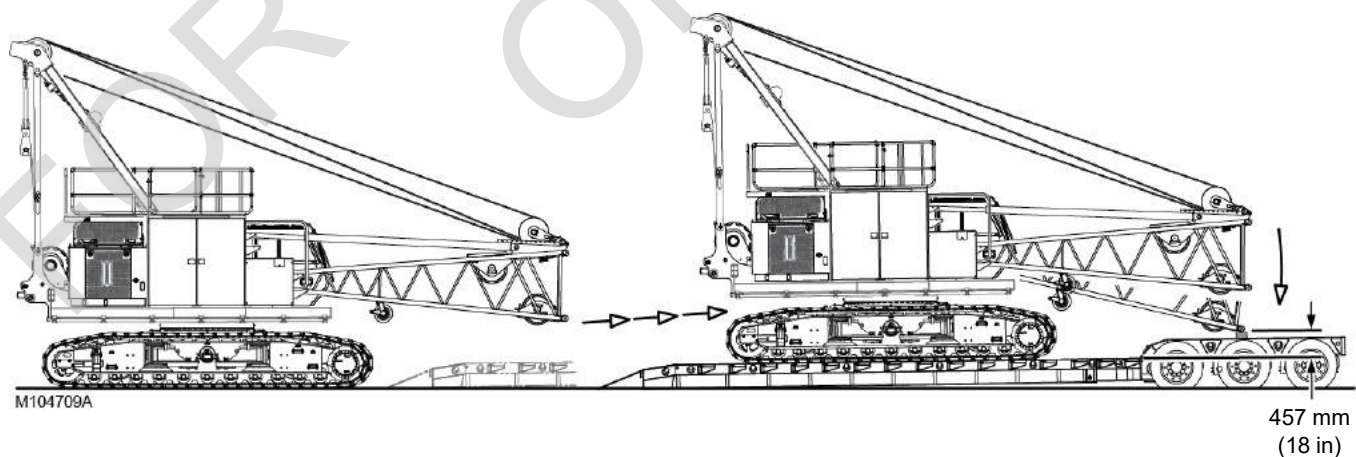


Figure 4-52

## Secure Operator Cab

1. If not already done, disable and store the remote control in the left-front enclosure as shown in [Figure 4-4 on page 4-6](#).
2. In the cab:
  - Stop the engine.
  - Park all crane functions.
  - Turn off all accessories.
  - Remove all keys from the control console.
  - Close and latch all windows.
3. Close and lock the cab door.
4. Rotate the cab mirror (1, [Figure 4-6](#)) to the stored position.

## Lower Handrails

To lower the handrails, reverse the steps for [Raise Handrails on page 4-13](#).

## Store Crane Platforms

To store the crane platforms, reverse the steps for [Deploy Crane Platforms on page 4-9](#).

## Store Crawler Steps

To store the crawler steps, reverse the steps for [Deploy Crawler Steps on page 4-9](#).

## Prepare Trailer for Travel

1. Store the trailer deck.
2. Attach the goose neck and the truck.
3. Verify that the crane is securely attached to the trailer. Read [Shipping Crane Components on page 4-61](#).

## BOOM #290 DISASSEMBLY

The following instructions assume that the boom and jib have already been lowered to the ground and the load lines have been stored.

The following instructions also assume that the boom butt has been disconnected from the boom and the crane is being used to disassemble the boom sections.

1. If not already done, remove and store the block-up limit chains and weights.
2. Disconnect and store the electric cables between the boom and jib or between the boom and upper boom point.
3. If equipped remove the following:
  - #117 jib (see [Jib #117 Disassembly on page 4-85](#))
  - Upper boom point (reverse the installation steps on [page 4-51](#)).
  - If equipped, disconnect and store the wind speed and position light components so they are not damaged during shipping.
  - If equipped, disconnect and store the boom top camera so it is not damaged during shipping.
4. Disconnect and remove the boom pendants. Reverse the steps for [Install Boom Pendants on page 4-50](#).



### DANGER

#### Collapsing Boom Hazard!

To prevent death or serious injury, do not stand on, inside, or under the boom sections during boom disassembly. Always stand outside the boom sections when removing connecting pins.

5. Disassemble the boom sections and place them on trailers for shipping:
  - Reverse the steps for [Install Boom Pendants on page 4-50](#) and for [Install Intermediate Suspension Pendants on page 4-51](#).
  - Reverse the steps for ["Connect Boom Top to Inserts" on page 4-49](#).
  - Reverse the steps for ["Assemble Boom Inserts" on page 4-49](#).
  - See [Figure 4-12 on page 4-20](#) for handling the boom sections.

## JIB #117 DISASSEMBLY

The following instructions assume:

- Boom and jib have already been lowered to the ground.
  - Strut stops have been stored.
  - Strut has been lowered.
  - Load lines have been stored.
  - The boom butt has been disconnected from the boom and the crane is being used to disassemble the jib.
1. If not already done, remove and store the block-up limit chains and weights.
  2. Disconnect and store the electric cables between the boom and jib.
  3. If equipped disconnect and store the following:
    - Wind speed and position light components so they are not damaged during shipping.
    - Jib top camera so it is not damaged during shipping.
  4. Disconnect and remove the jib pendants. Reverse the steps for [Install Jib/Backstay Pendants on page 4-57](#).



### DANGER

#### Collapsing Boom Hazard!

To prevent death or serious injury, do not stand on, inside, or under the jib sections during jib disassembly. Always stand outside the jib sections when removing connecting pins.

5. Disassemble the jib sections and place them on trailers for shipping:

**NOTE** If desired, the jib top can be shipped pinned to the jib butt.

- See [Figure 4-13 on page 4-21](#) for handling the jib sections.
- Reverse the steps for [Install Jib Top on page 4-55](#).
- Reverse the steps for [Install Jib Inserts on page 4-55](#).
- Reverse the steps for [Install Jib Bottom on page 4-55](#).

## WIRE ROPE INSTALLATION

**NOTE** The wire rope manufacturer's recommendations take precedence over the following information.

### Wire Rope Specifications

See the Wire Rope Specifications Chart in the Capacity Chart Manual for the correct type, size, and amount of wire rope to be installed on the crane.

The Wire Rope Specifications Chart contains the following information:

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

### Wire Rope Storage

Store the wire rope in coils or on reels off the ground or floor in a clean, dry, indoor location. If outdoor storage is necessary, the wire rope must be covered with a protective wrapper.

Keep the wire rope away from acids, fumes, and other corrosives. Keep the wire rope away from heat that can dry out the lubricant.

If the storage period will be long, lubricate the wire rope and perform the periodic inspection given in the Service Manual at least monthly.

### Seizing and Cutting Wire Rope

Apply tight seizings of annealed wire to the ends of all wire rope. If not done, the rope wires and strands may slacken. This will result in overloading of some strands and underloading of others. Bird-caging and breakage of the wire rope can occur.

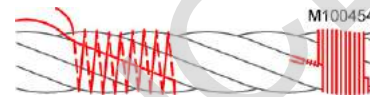
Before cutting the wire rope, apply seizings on both sides of the point where the cut will be made. Then cut the wire rope with a torch, rope cutter, or abrasive cut-off wheel.

See [Figure 4-53](#) for:

- The number of seizings to be applied to the ends of the wire rope and to both sides of the point where a cut will be made.
- The proper application method. Each seizing should be one rope diameter long.

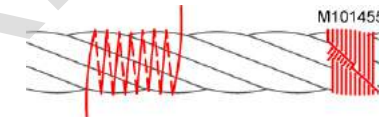
Wire Rope Type	Seizings Required
Preformed	1
Non-preformed	3

Place the free end of the seizing wire in the valley between two strands. Then wind the seizing wire over the free end as shown. Finally, twist and pull the two ends of seizing wire together until the seizing is tight.



**View A**—Rope Diameter 1 in (26 mm) and Larger

Wind the seizing wire around the wire rope as shown. Then twist the two ends of seizing wire together at the center of the seizing. Alternately twist and pull the ends until the seizing is tight.



**View B**—Rope Diameter Smaller than 1 in (26 mm)

**Figure 4-53**

### Anchoring Wire Rope to Drum

Anchor the wire rope to the drums on this crane in the numbered sequence shown in [Figure 4-54](#) or [Figure 4-55](#)



#### WARNING

##### Moving Machinery Hazard!

The drum guards must be secured to the drums during crane operation.

When a guard is removed for wire rope installation, use extreme care to prevent injury from a moving rope socket.

##### Falling Load Hazard!

The wire rope can be pulled out of the drum if the following steps are not taken:

- Make sure the clamp bar is installed.
- Make sure there is no rope seizing under the clamp bar. Pull the rope past the end of the rope socket if necessary.
- Make sure Tuflok® is applied to the clamp screws.
- Make sure the screws are tightened to the proper torque.



Drums 1, 2, and 4



- 1 Remove half of the guard from the drum.
- 6 Reinstall the guard.



2 Route the wire rope from the inside of the drum, through the hole in the drum flange, and into the rope socket on the outside of the drum flange.

- 4 Install the clamp bar above the wire rope. **Make sure there is no rope seizing under the clamp bar.**
- 3 Position the end of the rope at or slightly beyond the end of the rope socket.



5 Tighten the clamp screws (see Torque Note).

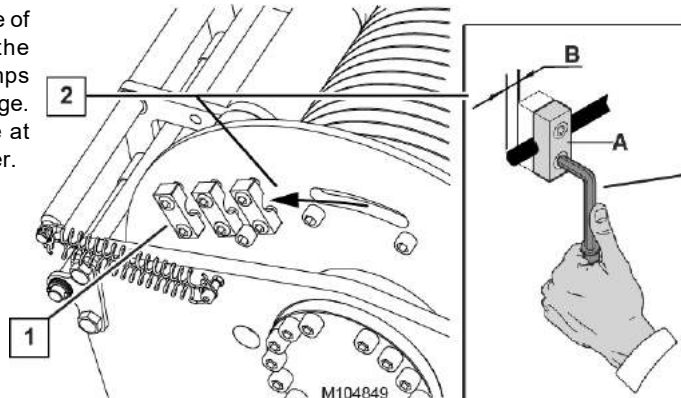
**Torque Note**

- Torque clamp screws to 206 Nm (150 ft-lb)
- Do not use Loctite
- Tuflok® thread-locking compound has been applied to the screws. The screws can be removed/installed several times before reapplying the compound.

M104830

Figure 4-54

Route the wire rope from the inside of the drum, through the hole in the drum flange, and under the clamps "A" on the outside of the drum flange. The rope protrusion "B" must be at least twice the wire rope's diameter.



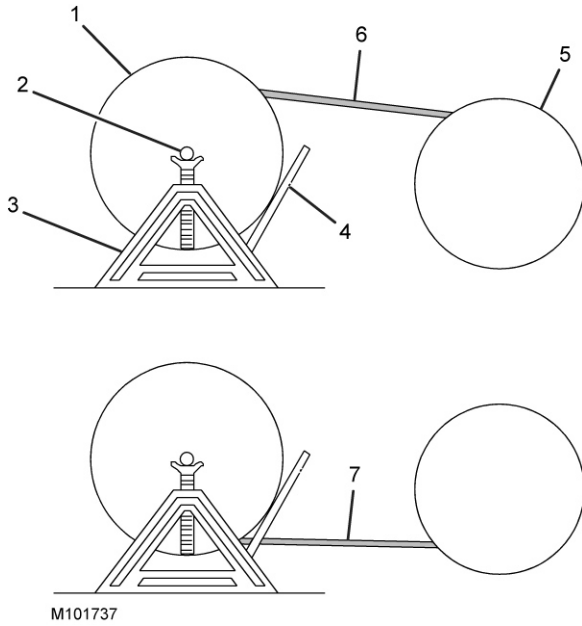
Loosen the clamp screws.

- 3 Securely tighten the clamp screws to 207 Nm (150 ft-lb).

Drum3

M104849

Figure 4-55



M101737

Item	Description	Item	Description
1	Shipping Reel	5	Drum
2	Shaft	6	Top to Top Winding
3	Jack Stand	7	Bottom to Bottom Winding
4	Brake		

Figure 4-56

1. Remove the wire rope from the shipping reel:
  - a. Mount the wire rope shipping reel (1, [Figure 4-56](#)) on a shaft (2) supported at both ends by jacks (3) or blocks.
  - b. Provide a brake at the shipping reel so that the wire rope can be wound tightly on the drum.
  - c. Avoid a reverse bend when winding the wire rope onto the drum: wind from the top of the reel to the top of drum (upper view) or from the bottom of the reel to the bottom of the drum (lower view).
  - d. Avoid dragging the wire rope in the dirt or around objects that can scrape, nick, cut, or crush the wire rope.
2. Carefully inspect the drums and all rope guides, rollers, and sheaves for defects that can cause the wire rope to wear or be cut. If defects cannot be fixed, replace the faulty parts.
3. Apply tension to the wire rope as it is wound slowly onto the drum.
  - a. The first wrap of wire rope must be tight against the drum flange for the approximately three-fourths of the drum diameter (View A, [Figure 4-57](#)).
  - b. Tap the adjacent wraps against each other with a soft metal or wooden mallet as the wire rope is spooled onto the drum.
  - c. Use extreme care not to put twists or turns in the wire rope. Allow the rope to assume its natural lay.

### Winding Wire Rope onto Drum

#### CAUTION

##### Avoid Wire Rope Damage

The shipping reel must rotate when the wire rope is unwound.

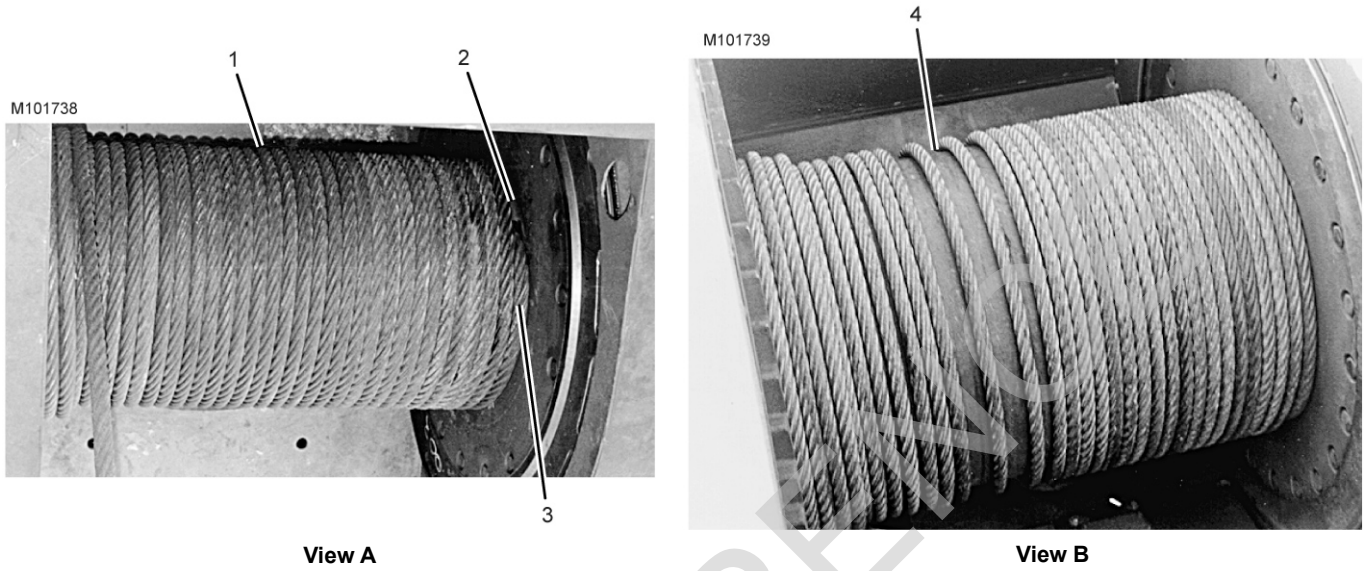
Attempting to remove the wire rope from a stationary reel can result in a kinked wire rope, and the wire rope will be ruined.

#### CAUTION

##### Avoid Wire Rope Damage

Voids or spaced wraps (View B, [Figure 4-57](#)) in the first layer will permit movement and a wedging action with the subsequent layers. Crushing and abrasion of the wire rope will occur.

Never allow the wire rope to “cross-wind” on the drum.



Item	Description
1	Wraps of first layer tight against drum flanges and each other
2	Wedge
3	Tight against drum flange for 3/4 of diameter
4	VOIDS and loose wraps in first layer will cause sever wear of wire rope

Figure 4-57

Item	Description
1	Seizing
2	Dead End
3	Live End in Straight Line with Socket
4	Socket
5	Wedge
6	Rope Clip
7	Short Piece of Wire Rope
8	Terminator Wedge
9	Shipping holes: <b>Do not reinstall any shipping material</b> (bolt, plastic strap, or wire) in shipping holes of wedge or socket after assembling.

T (Rope Clip Nut Torque)

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

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

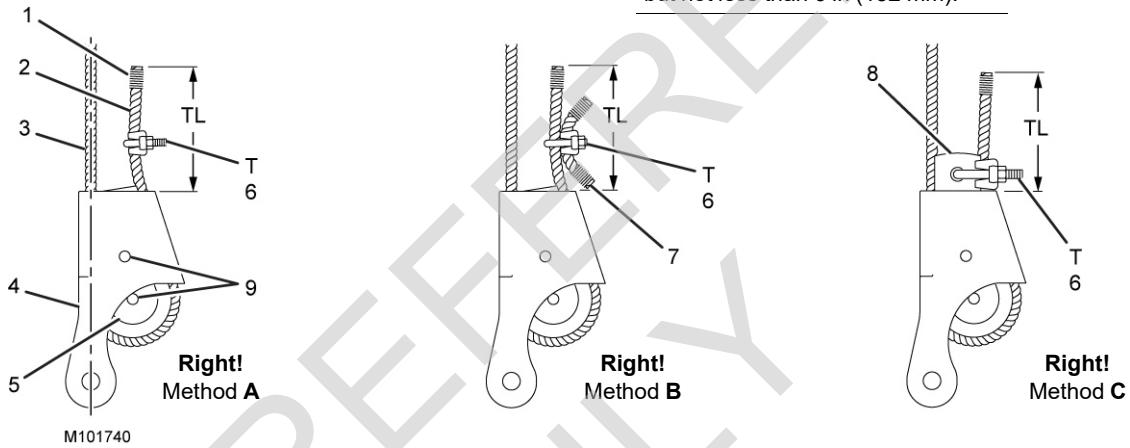
TL (Tail Length)

**Standard 6 to 8 Strand Wire Rope**

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

**Rotation Resistant Wire Rope**

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



ALL ARE DANGEROUS AND PROHIBITED!

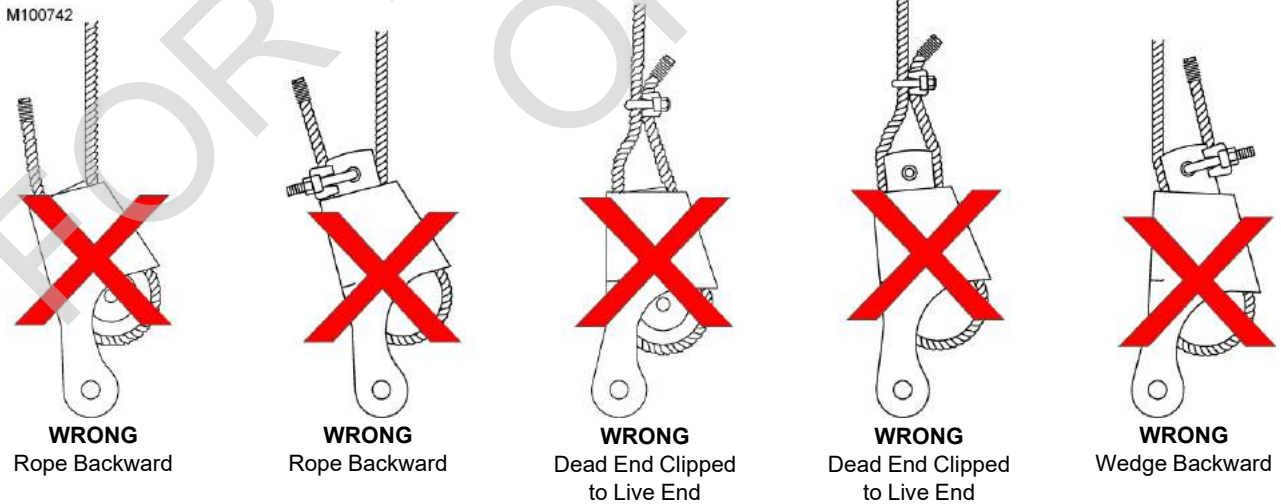


Figure 4-58

## Anchoring Wire Rope to Wedge Socket

See [Figure 4-58](#)



### WARNING

#### Falling Load Hazard!

- Inspect all parts prior to use. Do not use parts that are cracked or otherwise defective.
- Remove minor nicks, burrs, or rough edges from socket, wedge, or pin by lightly grinding. Do not reduce original dimensions by more than 10%.
- Do not reinstall shipping material (bolt, plastic strap or wire) in the shipping holes (9) of the wedge or the socket after assembling them. Discard these materials because they can prevent the wedge from tightening in the socket.
- Only use a wedge and socket which are the correct size for the wire rope being used. Do not mix and match parts from one assembly with parts from another assembly.
- The Terminator™ socket and wedge has “go” and “no go” holes to check for proper rope size.
- Attach the wire rope clip to the dead end of the wire rope after assembling the wire rope to the wedge and socket.

1. Assemble the wire rope and the wedge to the socket so the live end of the wire rope is in a straight line with the socket pin hole. Do not assemble WRONG as shown.

2. Allow the dead end of the wire rope to extend past the end of the socket the amount shown.
3. Allow the wire rope to assume its natural lay.
4. Pull against the wedge and the live end of the wire rope enough to tighten the wedge in the socket.
5. Use a brass hammer to seat the wedge and wire rope as deep into the socket as possible.
6. Attach a wire rope clip to the dead end of the wire rope using one of the RIGHT methods shown. The rope clip will aid in preventing the wire rope from being pulled out of the socket.

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

7. After the socket is pinned in place, hoist the load slowly so the wedge seats tightly. Do not shock load the socket and wedge.

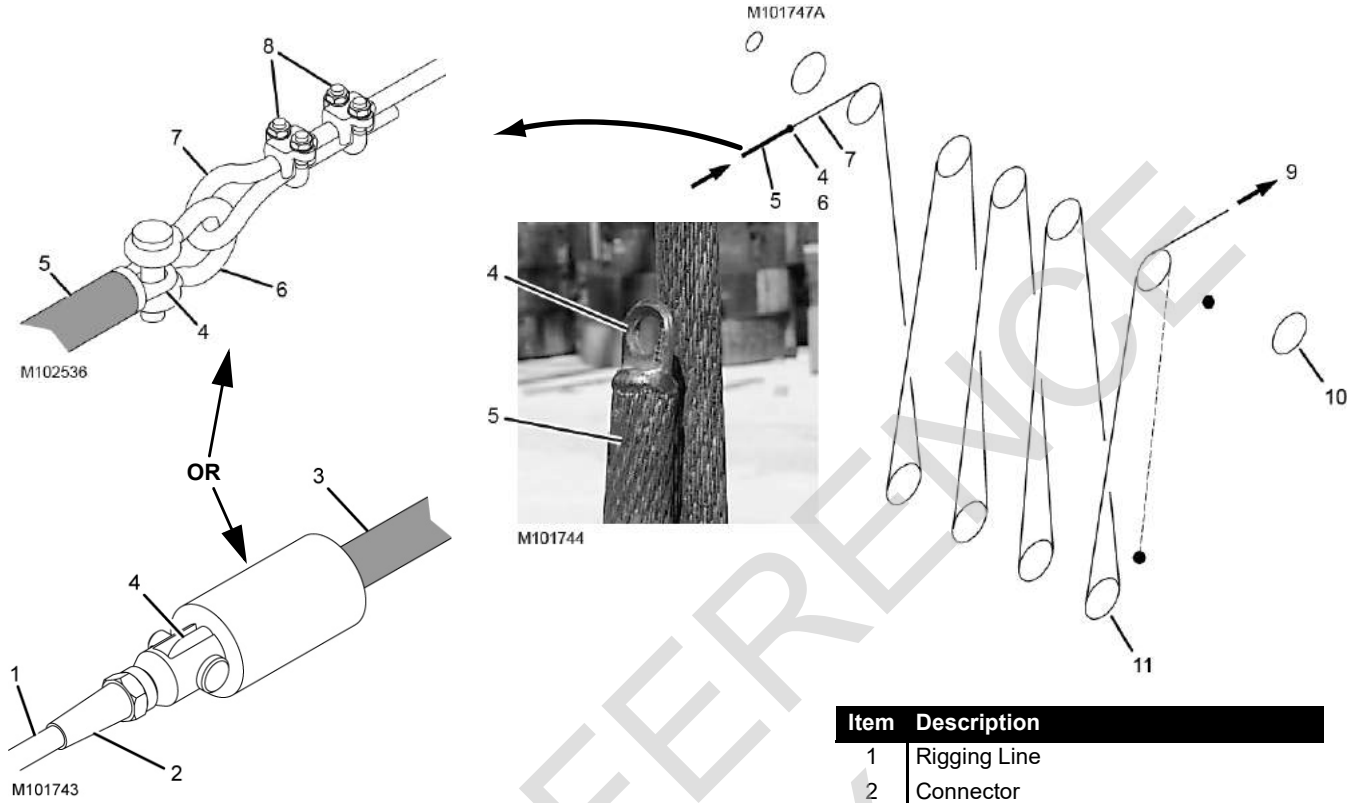


### WARNING

#### Falling Load Hazard!

The wire rope can break if the following precaution is not observed:

- Do not attach the dead end of wire rope to the live end of wire rope with a wire rope clip. The wire rope clip will transfer the load from the live side of the wire rope to the dead end, seriously weakening the attachment.



Item	Description
1	Rigging Line
2	Connector
3	Wire Rope with Button
4	Pad Eye
5	Wire Rope without Button
6	Shackle
7	Rigging Line
8	Rope Clips
9	Pull Rigging Line with Winch or Forklift
10	Boom Point Sheaves
11	Load Block Sheaves <b>EXAMPLE</b>

No. 1 Pad Eye			
Item	mm	Inch	
<b>Approximate Capacity 553 kg (1220 lb)</b>			
A	9,65	3/8	
B	6,35	1/4	
C	22,40	7/8	
D	10,40	13/32	
E	22,40	7/8	
F	3,30	1/8	
G	25,40	1-1/32	

No. 1.5 Pad Eye			
Item	mm	Inch	
<b>Approximate Capacity 553 kg (1220 lb)</b>			
A	16,00	5/8	
B	6,35	1/4	
C	25,40	1	
D	11,18	7/16	
E	28,70	1-1/8	
F	4,06	1/16	
G	33,27	1-5/16	

No. 2 Pad Eye			
Item	mm	Inch	
<b>Approximate Capacity 1 179 kg (2600 lb)</b>			
A	19,05	3/4	
B	9,65	3/8	
C	26,92	1-1/16	
D	12,70	1/2	
E	38,10	1-1/2	
F	4,83	3/16	
G	41,26	1-5/8	

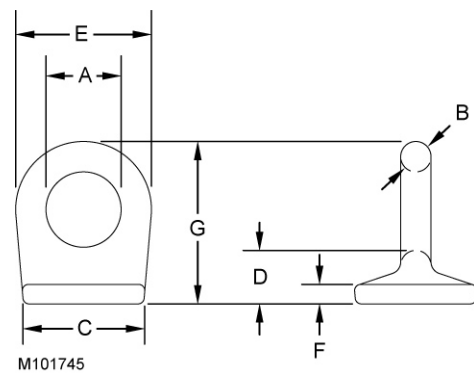
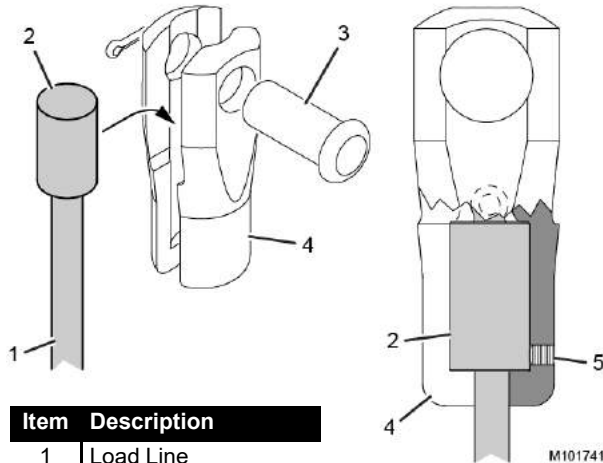


Figure 4-59



Item	Description
1	Load Line
2	Button
3	Pin
4	Button Socket
5	Locking Screw

Figure 4-60

### **! WARNING**

#### **Falling Load Hazard!**

The wire rope must be installed in the button socket as instructed below. Failing to follow these instructions can result in wire rope damage or failure.

### **Anchoring Wire Rope to Button Socket**

See [Figure 4-60](#)

1. Remove the pin (3) from the button socket (4).
2. Loosen the locking screw (5) so it is not protruding past the inner surface of the button socket.
3. Install the button (2) end of the load line (1) into the button socket (4). **Make sure the button socket is fully seated in the button.**
4. Securely tighten the locking screw (5). There is no hole or flat spot on the button for the locking screw.
5. Pin the socket to the anchor point.

### **Pad Eye Usage for Wire Rope Reeving**

See [Figure 4-59](#)

### **General**

Some rotation-resistant wire rope supplied by Manitowoc is equipped with a pad eye welded to the leading end of the wire rope or to the button on the end of the wire rope.

A rigging line can be attached to the pad eye to make it easier to reeve the load block.

### **! WARNING** **Flying Part Hazard!**

Pad eye on end of wire rope has been provided **for reeving purposes only**. Any other use is neither intended nor approved.

The pad eye can break and fly apart with considerable force if it is overloaded, not used properly, or not maintained properly.

### **Safety**

1. Do not exceed the approximate capacities listed in [Figure 4-59](#).
2. Make sure the rigging line and the attaching hardware (clips and rope connectors) are rated for the approximate capacities shown in [Figure 4-59](#).
3. Inspect the pad eye prior to each use. **Replace it if:**
  - Any original dimensions have changed
  - Cracks or breaks exist in the metal or the weld

### **Breaking in Wire Rope**

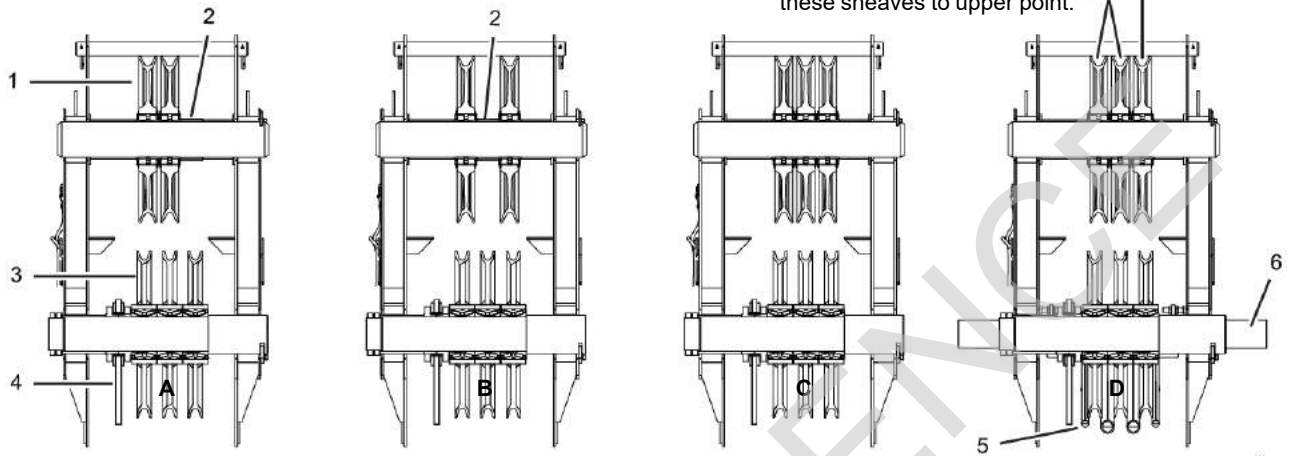
After installing a new wire rope, break it in by operating it several times under light load at reduced speed. This practice allows the wire rope to form its natural lay and the strands to seat properly.

**NOTE** The wire rope will stretch during the break-in period, reducing the wire rope's diameter as the strands compact around the core.

The dead wraps of wire rope on the drum can become slack during operation, even if the utmost care is used during installation of the wire rope. This slackening is caused by the normal stretch that occurs in a new wire rope under tension and periodically throughout the wire rope's life from release of the load.

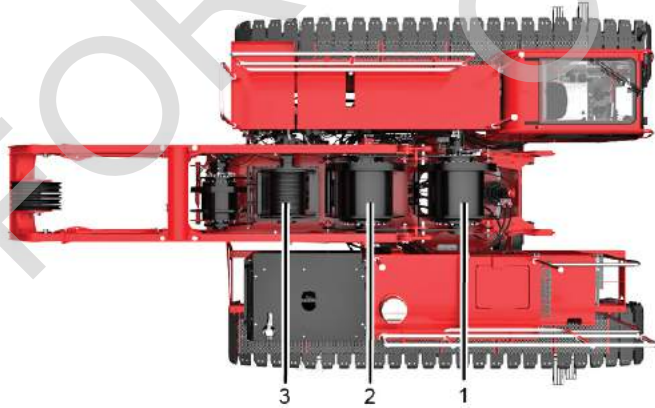
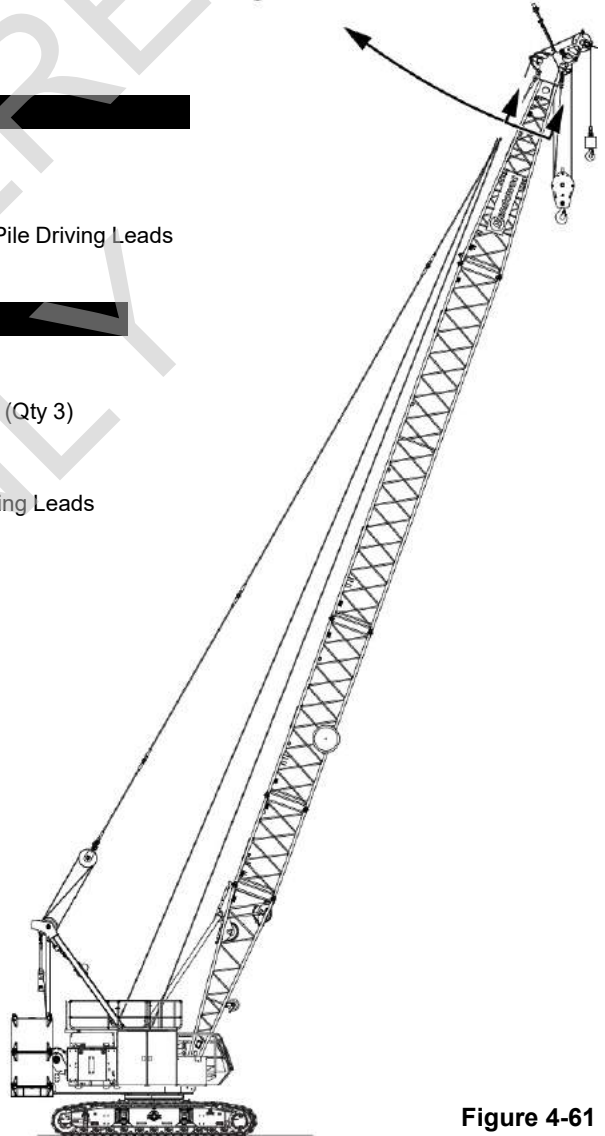
When slackness is noted, tightly wind the dead wraps of wire rope onto the drum. If left uncorrected, a wedging action with subsequent layers will occur, and the resultant abrasion may cause broken wires in the dead wraps.

M104829



Configuration	Description
A	Two Load Lines
B	Two Load Lines
C	Three Load Lines
D	Three Load Lines with Pile Driving Leads

Item	Description
1	Guide Sheave (Qty 2 or 3)
2	Spacer
3	Lower Boom Point Sheaves (Qty 3)
4	Dead-End Link (left side)
5	Duty-Cycle Rope Guard
6	Extended Shaft for Pile Driving Leads



Drum	Description
1	Whip Hoist
2	Main Hoist
3	Auxiliary Hoist

Figure 4-61



## LOAD LINE REEVING



### WARNING

#### Falling Load Hazard!

Use only a load block or hook-and-weight ball with a capacity equal to or greater than load to be handled.

The load block can fail if overloaded, allowing the load to fall.

### Guide Sheaves and Drums

See [Figure 4-61](#) for identification of the load drums and the guide sheaves.

Refer to the Reeving Diagrams at the end of this section for rope routing over the boom top wire rope guide.

Once the wire rope is routed through the guide sheaves, install all the rope guard pins, bars, and rollers to retain the wire rope on the sheaves. **Wire rope and sheaves can be damaged if the rope is not properly retained on sheaves.**

### Dead End Location

See [Figure 4-61](#) and for the dead end locations and required hardware. All hardware is stored in the job boxes provided with the crane.

### Load Block Identification

See the Boom Rigging Drawing at the end of this section for a complete list of load blocks and hook-and-weight balls available for use with this crane.

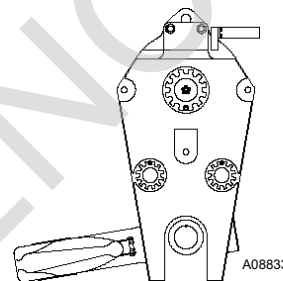


### WARNING

#### Avoid Death or Serious Injury!

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

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



### Wire Rope Specifications

Refer to the Wire Rope Specifications chart in the Capacity Chart Manual for:

- Parts of the line required to handle desired load
- Wire rope length required for various boom lengths and parts of line
- Maximum spooling capacity of load drums

### Load Block Reeving

For reeving of the lower boom point, see the Reeving Diagrams at the end of this section.

Also refer to [Install Load Lines on page 4-45](#).

Reeving in any manner other than shown can result in excessive block twist.

### CAUTION

#### Wire Rope Damage!

Do not hoist the load block closer to the boom point than shown in the reeving diagrams. Improper fleet angle or contact with other parts can damage the wire rope.

## LOAD BLOCK TIEBACK

### General

Holes (1, [Figure 4-62](#)) on the front of the rotating bed can be used to tieback the load block (3) when not in use.

### Specifications

#### Sling Length

The owner furnish sling (2) must be long enough to connect it to owner furnished shackles in the tieback holes (1) and to the hook of the freely suspended load block (3). This will prevent personnel from having to swing the block in, toward the crane, to make the connection.

#### Sling and Shackle Capacity

The sling and shackles must be capable of supporting the weight of the load block and 1/2 the weight of the wire rope suspended from the boom point. When sizing the sling and shackles, take into account the dynamic affects of traveling and swinging the crane. ***It is the crane user's responsibility to calculate this load.***

---

### CAUTION

Avoid damage:

- Haul in the load line only until the tieback sling is taut. The purpose of the tieback is only to prevent the load block from swinging when not in use.
  - Do not tighten the load line to the point that the load line rubs against the lacings in the boom sections or to the point that the load block can bounce into the lacings.
  - Operator, be aware that as you boom down, the load lines and tieback sling will tighten even more. Pay out the load line while booming down so that you don't pull the load block into the boom. Damage to lacings or chords could result.
  - Only use the hole for tying back the load block. Using the hole for any other purpose is neither intended of authorized. Damage could result.
- 

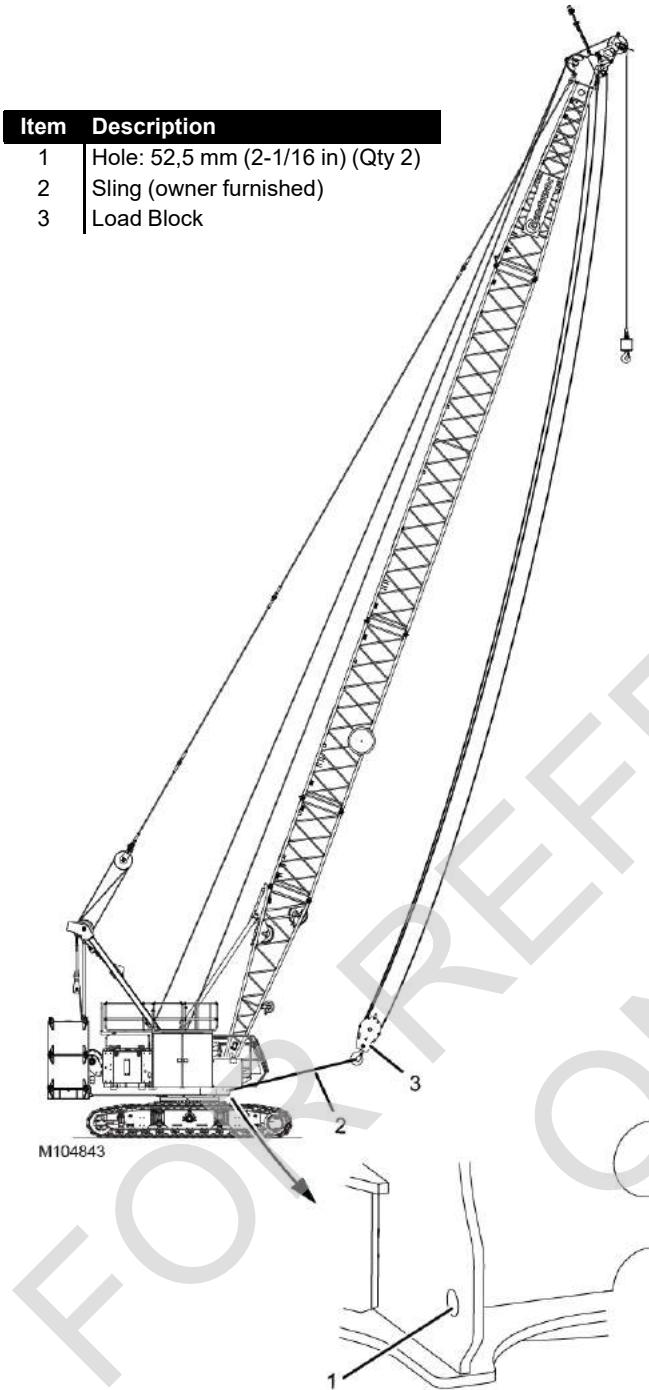


Figure 4-62

# SECTION 5 LUBRICATION

## TABLE OF CONTENTS

Lubrication .....	5-1
Lube and Coolant Product Guide .....	5-1

FOR REFERENCE ONLY

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## SECTION 5 LUBRICATION

### LUBRICATION

See F2314 at the end of this section.

### LUBE AND COOLANT PRODUCT GUIDE

See the publication at the end of this section.

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# SECTION 6 MAINTENANCE CHECKLIST

## TABLE OF CONTENTS

Inspection and Maintenance Checklist .....	6-1
Fiberglass Maintenance .....	6-1
Field Paint Repair Guide .....	6-1

FOR REFERENCE ONLY

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## SECTION 6 MAINTENANCE CHECKLIST

### INSPECTION AND MAINTENANCE CHECKLIST

See F2317 at the end of this section.

### FIBERGLASS MAINTENANCE

See Bulletin W04-009 at the end of this section.

### FIELD PAINT REPAIR GUIDE

See F2333 at the end of this section.

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# ALPHABETICAL INDEX

Assembling, Disassembling, or Operating Crane Near Electric Power and Transmission Lines . . . . .	2-15
AC Power Supply . . . . .	3-57
Accessing Parts . . . . .	4-1
Accidents . . . . .	2-17
Assembly and Disassembly Area . . . . .	4-2
Assembly and Disassembly Notes . . . . .	4-1
Boom #290 Assembly . . . . .	4-49
Boom #290 Disassembly . . . . .	4-84
Boom and Jib Assembly Drawings . . . . .	4-1
Boom and Jib Rigging — General . . . . .	4-46
Boom Disassembly Safety . . . . .	2-21
Cab Window Operation . . . . .	3-37
Change of Ownership Registration . . . . .	1-1
Cold Weather Heaters . . . . .	3-59
Cold Weather Operation . . . . .	3-55
Connecting/Disconnecting Hydraulic Hoses and Electric Cables . . . . .	4-7
Continuous Innovation . . . . .	2-1
Crane Access Points . . . . .	2-5
Crane Assembly . . . . .	4-9
Crane Data . . . . .	1-1
Crane Disassembly . . . . .	4-63
Crane Identification . . . . .	1-1
Crane Orientation . . . . .	1-1
Crane Orientation . . . . .	4-1
Crane Weights and Shipping Data . . . . .	4-2
Crane Weights . . . . .	1-1
Crawler Blocking . . . . .	3-37
Electric Cable Cleanliness . . . . .	4-7
English and Metric Conversions . . . . .	1-4
Environmental Protection . . . . .	2-19
Fiberglass Maintenance . . . . .	6-1
Field Paint Repair Guide . . . . .	6-1
Fire Extinguishers . . . . .	2-17
Fuses and Circuit Breakers . . . . .	3-61
Getting On or Off Crane . . . . .	2-5
Handling Components . . . . .	4-2
Identification and Location of Components . . . . .	1-2
Inspection and Maintenance Checklist . . . . .	6-1
Introduction . . . . .	1-1
Jib #117 Assembly . . . . .	4-55
Jib #117 Disassembly . . . . .	4-85
Liftcrane Boom Butt Capacities . . . . .	4-1
Lifting Sling . . . . .	4-3
Load Block Tieback . . . . .	4-96
Load Line Reeving . . . . .	4-95
Low Clearance Travel Option . . . . .	3-49
Lube and Coolant Product Guide . . . . .	5-1
Lubrication . . . . .	5-1
Lubrication . . . . .	5-1
Maintenance Checklist . . . . .	6-1
Manitowoc Dealer . . . . .	1-1
Nameplates and Decals . . . . .	2-1
Operating Controls And Procedures . . . . .	3-1

Operating in Wind . . . . .	3-37
Operating Limits Identification . . . . .	3-34
Operating Procedures . . . . .	3-40
Operational Aids . . . . .	2-13
Operator Manual/Capacity Chart Storage . . . . .	2-6
Outline Dimensions . . . . .	1-1
Parts Storage . . . . .	4-2
Pedestal/Barge Mounted Cranes . . . . .	2-23
Personal Fall-Protection . . . . .	2-5
Personnel Handling Policy . . . . .	2-22
Pin and Connecting Hole Cleanliness . . . . .	4-7
Preparing Crane for Operation . . . . .	3-38
Pre-Start Checks . . . . .	4-7
Raise Boom . . . . .	4-60
Refueling . . . . .	2-17
Remote Control . . . . .	3-32
Retaining Connecting Pins . . . . .	4-2
Safe Maintenance . . . . .	2-17
Safe Operating Practices . . . . .	2-7
Safety and Information Signs . . . . .	2-3
Safety Devices . . . . .	2-13
Safety Information . . . . .	2-1
Safety Messages . . . . .	2-1
Self-Erect Components . . . . .	4-5
Self-Erect Controls . . . . .	4-6
Setup and Installation . . . . .	4-1
Shipping Configuration . . . . .	4-5
Shipping Crane Components . . . . .	4-61
Shutdown Procedure or Leaving the Crane Unattended . . . . .	3-49
Signals . . . . .	2-12
Standard Hand Signals for Controlling Crane Operations . . . . .	3-2
Startup Procedures . . . . .	3-38
Symbols Used on Control Consoles . . . . .	3-4
Wire Rope Installation . . . . .	4-86
Work Lights . . . . .	3-57

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