Manitowoc MLC165-1

Operator Manual

Grove Manitowoc National Crane Potain

Manitowoc®

WARNING

California Proposition 65

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

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

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

Do not modify or tamper with the exhaust system.

Do not idle the engine except as necessary.

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

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

California Spark Arrestor

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

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OPERATOR MANUAL

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

MLC165-1

Crane Model Number

XXXXXRef

Crane Serial Number

This Manual is divided into the following sections:

NOTICE

The serial number of the crane and applicable attachments (for example, a luffing jib) is the only method a Manitowoc dealer or the Manitowoc Crane Care Lattice Team has of providing the correct parts and service information.

The serial number is located on a crane identification plate attached to the operator cab and each attachment. Refer to the Nameplate and Decal Assembly drawing in Section 2 of 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 a Manitowoc dealer or the Manitowoc Crane Care Lattice Team.

WARNING

To prevent death or serious injury:

- Avoid unsafe operation and maintenance.

  Crane and attachments shall be operated and maintained by trained and experienced personnel. Manitowoc is not responsible for qualifying these personnel.

- Do not operate or work on crane or attachments without first reading and understanding instructions contained in the manuals supplied with crane and applicable attachments.

- Store crane manuals in the operator cab.

  If crane manuals are missing from the cab, contact a Manitowoc dealer for new ones.

Published 08-06-19, Control # 237-09_v3

THE ORIGINAL LANGUAGE OF THIS PUBLICATION IS ENGLISH

See end of this manual for Alphabetical Index

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SECTION 1
INTRODUCTION

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Published 08-06-19, Control # 237-09

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SECTION 1
INTRODUCTION

CRANE/ATTACHMENT IDENTIFICATION

An identification plate is attached to the outside of the operator cab (see Figure 1-1) and to the attachments (i.e. luffing jibs) available for this crane.

The crane or attachment model and serial number are etched into the plate.

For the exact location of the identification plates on your crane and attachments, refer to the Nameplate and Decal Assembly drawing at the end of this section.

Figure 1-1. Identification Plate

MANITOWOC DEALER

For questions about this manual or the MLC165-1 crane, contact your Manitowoc dealer. If you do not know the contact information for your dealer, locate the Manitowoc dealer nearest you, as follows:

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

CHANGE OF OWNERSHIP REGISTRATION

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

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

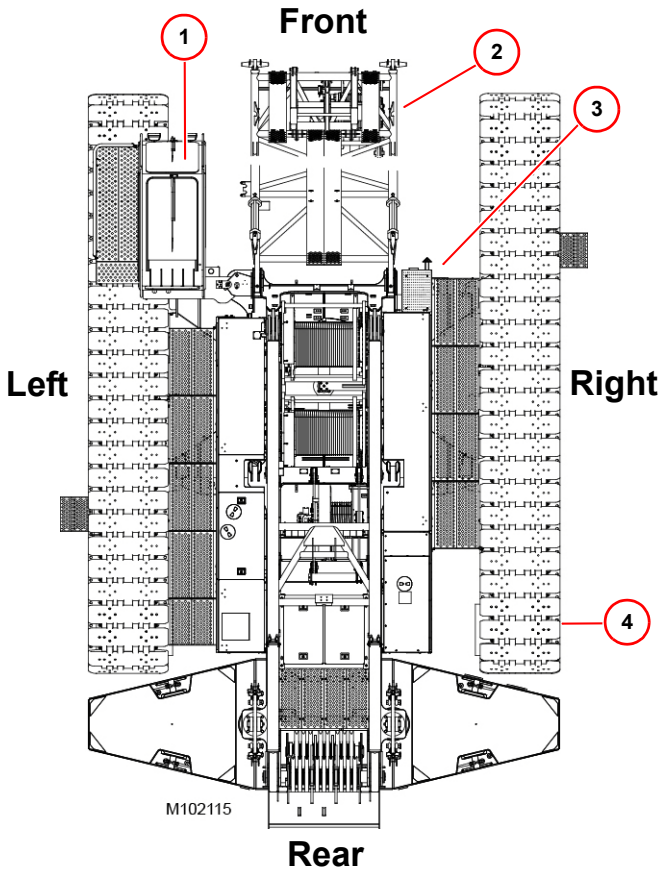
IN CASE OF TECHNICAL OR OPERATION ISSUES

For questions about this manual or the MLC165-1 crane, contact a Manitowoc dealer. Before calling, find the model and serial number of the crane or attachment. This information is located on the identification plate on the crane cab or attachment.

CRANE ORIENTATION

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. See Figure 1-2.

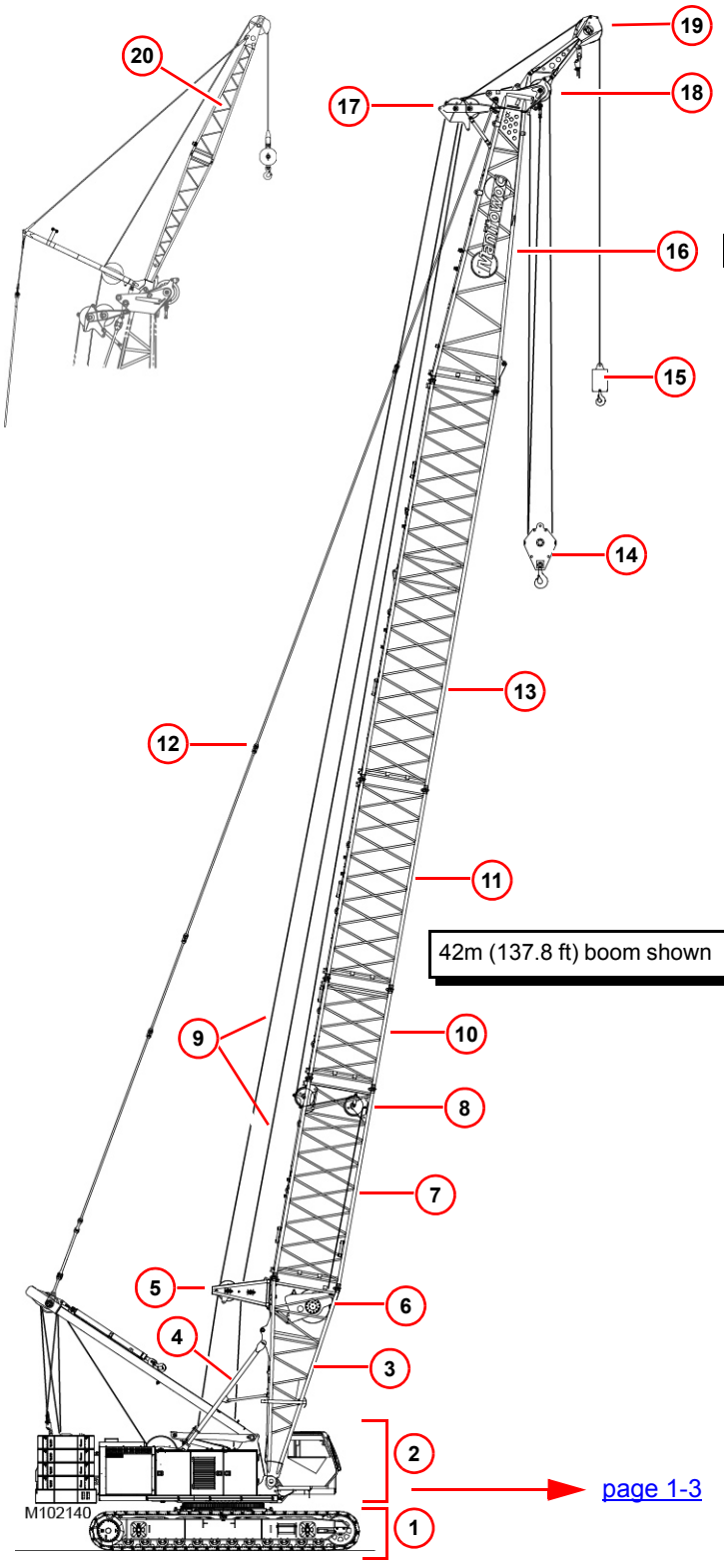
- The operator cab (1) and the boom are at the front of the upperworks.
- The carbody controls (3) are at the front of the carbody.
- The Crawler gearboxes are at the rear of the crawlers.



Item	Description
1	Operator Cab
2	Boom Butt
3	Carbody Controls
4	Crawler Gearbox (both crawlers)

Figure 1-2. Crane Orientation

IDENTIFICATION AND LOCATION OF COMPONENTS



Item	Description
1	Lowerworks
2	Upperworks
3	Boom Butt
4	Boom Stop (physical)
5	Boom Butt Wire Rope Guide
6	Drum 3 (luffing hoist or auxiliary)
7	Insert: 6 m (19.7 ft) with Sheaves
8	Guide Sheaves (in insert)
9	Load Lines
10	Insert: 3 m (9.8 ft)
11	Insert: 6 m (19.7 ft)
12	Boom Straps
13	Insert: 12 m (39.4 ft)
14	Load Block
15	Weight Ball
16	Boom Top
17	Boom Top Wire Rope Guide
18	Lower Boom Point
19	Upper Boom Point
20	Fixed Jib

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Figure 1-3. Identification and Location of Components

Item	Description
21	Mast
22	Self-Assembly Cylinder
23	Engine Enclosure
24	Left Enclosure with Platform
25	Handrail (optional both sides)
26	Drum 2 (rear load drum)
27	Drum 1 (front load drum)
28	Operator Cab Platform and Railings
29	Left Crawler
30	Carbody Jack (4)
31	Carbody Counterweight (Series 2 option)
32	Rotating Bed
33	Carbody
34	Ladder (optional)
35	Right Crawler
36	Right Enclosure with Platform
37	Mast-Assist Cylinder (both sides)
38	Mast-Assist Arm (both sides)
39	Drum 4 (boom hoist)
40	Generator (optional)
41	Crane Counterweights
42	Counterweight Handling Cylinder
43	Boom Hoist Wire Rope

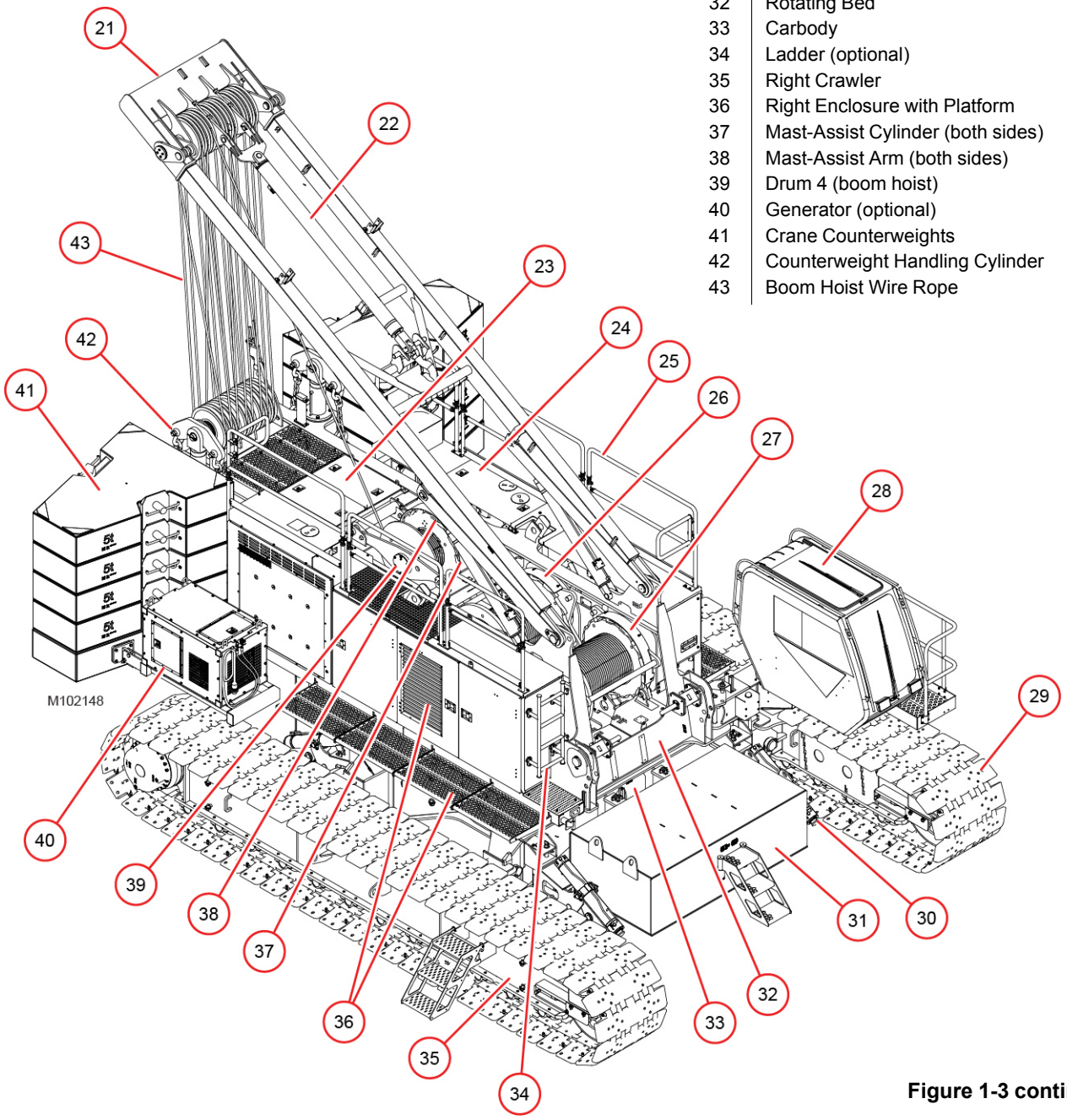

Figure 1-3 continued

CRANE WEIGHTS

See the Crane Weights publication at the end of this section.

OUTLINE DIMENSIONS

See the Outline Dimension drawing at the end of this section.

ENGLISH AND METRIC CONVERSIONS

Direct Conversion

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

12 ft x 0.3048 = 3.6576 m

Inverse Conversion

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

3.6576 m ÷ 0.3048 = 12

Table 1-1. English and Metric Conversions

To Convert	Symbol	Application	To	Symbol	Multiply By
AREA					
Square Inch	in^2	Filter Area Clutch Contact	Square Centimeter	cm^2	6.4516
Square Foot	ft^2	Ground Contact	Square Meter	m^2	0.0929
FORCE					
Pound Force	lb	Pedal Effort	KiloNewton Newton	kN N	0.00445 4.4482
Pound Force	lb	Line Pull	KiloNewton	kN	0.00445
Pound Force Per Inch	lb/in.	Spring Force	Newton per millimeter	Nmm	0.1751
Pound Force Per Foot	lb/ft		Newton per meter	Nm	14.5939
LENGTH					
Inch	in.	Adjustments	Millimeter	mm	25.4000
Foot	ft	Outline Dimensions	Meter	m	0.3048
Mile	miles	Travel Distance	Kilometer	km	1.6093
POWER					
Horsepower	hp	Engine	Kilowatt	kW	0.7457
PRESSURE					
Pound/Sq. In.	psi	Hydraulic & Air	Bar		0.0689
TEMPERATURE					
Degrees Fahrenheit	°F	Oil, Air, and so on	Degrees Centigrade	°C	°F - 32 ÷ 1.8
Degrees Centigrade	°C		Degrees Fahrenheit	°F	°C x 1.8 + 32
TORQUE					
Inch Pound	in lb	Bolt Torque	Newton Meter	Nm	0.1129
Foot Pound	ft lb		Newton Meter	Nm	1.3558
VELOCITY					
Miles Per Hour	mph	Vehicle Speed	Kilometers Per Hour	km/h	1.6093
Miles Per Hour	mph	Wind Speed	Meters Per Second	m/s	0.4470
Feet Per Minute	fpm	Line Speed	Meters Per Minute	m/min	0.3048

Table 1-1. English and Metric Conversions

To Convert	Symbol	Application	To	Symbol	Multiply By
VOLUME					
Cubic Yard	yd^3	Bucket Capacity	Cubic Meter	m^3	0.7646
Cubic Foot	ft^3		Cubic Meter	m^3	0.0283
Cubic Inch	in^3	Pump Displacement	Cubic Centimeter	cm^3	16.3871
VOLUME (LIQUID)					
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
Gallons 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

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SECTION 2
SAFETY INFORMATION

CALIFORNIA PRECAUTIONS

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.

Battery posts, terminals, and related accessories contain chemical lead and lead compounds, chemicals known to the State of California to cause cancer, birth defects, and other reproductive harm. Wash hands after handling.

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 the 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. and Table 2-2..

Table 2-1. Common Safety Symbols

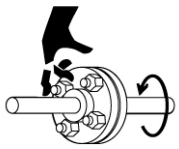
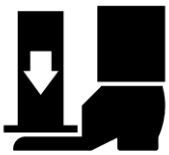
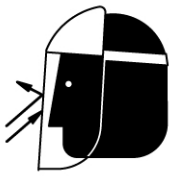
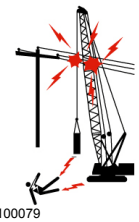
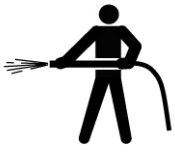
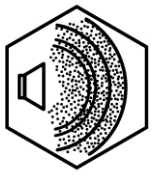
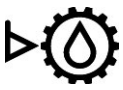
Cut or Crush Hazards					Cut Hazard
 M100090	 M100091	 M100066	 M100065	 M100069	 M100067
Crush Hazards					Fire Extinguisher
 M100070	 M100071	 M100072	 M100073	 M100074	 M100082
Fall Hazards			Falling Boom (Crush) Hazards		Explosion Hazard
 M100083	 M100084	 M100085	 M100068	 M100075	 M100080
Falling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

Table 2-2. Miscellaneous Symbols

Diesel Fuel	Engine Coolant	Engine Coolant Vent	Engine Oil Level	Hydraulic Filter	Hydraulic Oil
 M100271	 M100267	 M100268	 M100269	 M100272	 M100273
Pump Drive Oil Level	**Tire Pressure (if equipped)**	**DEF** Diesel Exhaust Fluid	**NO Fuel**	**NO Water**	
 M100270	 M100266	 M101972	 M101973	 M101974	

SAFETY AND INFORMATION SIGNS

Maintaining Signs

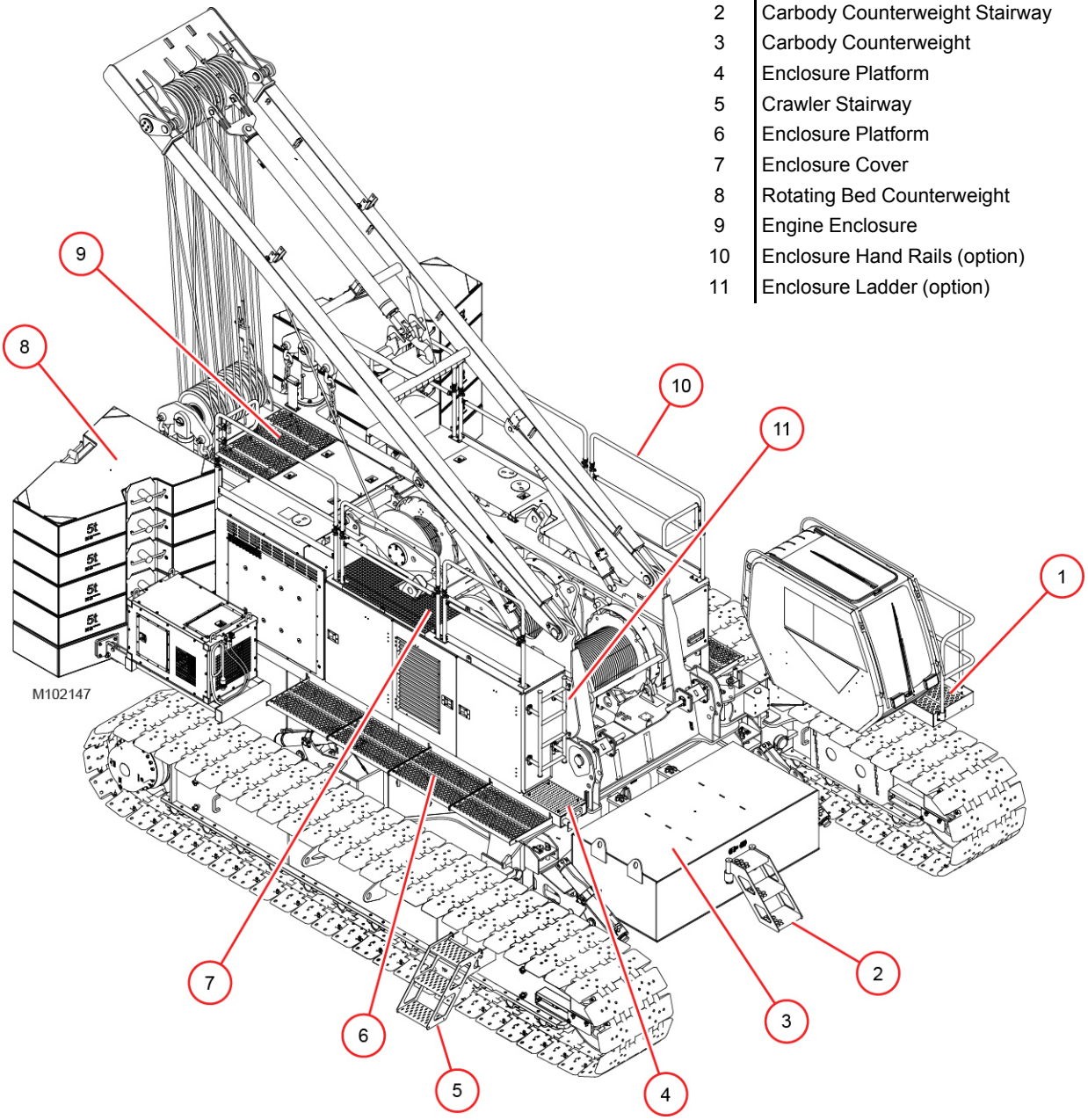
The crane owner/user shall make sure that all safety and information signs are legible and installed at the proper locations on the crane. If a sign has been defaced or removed, it shall be replaced immediately. See the Nameplate and Decal Drawing at the end of this section for the installation locations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

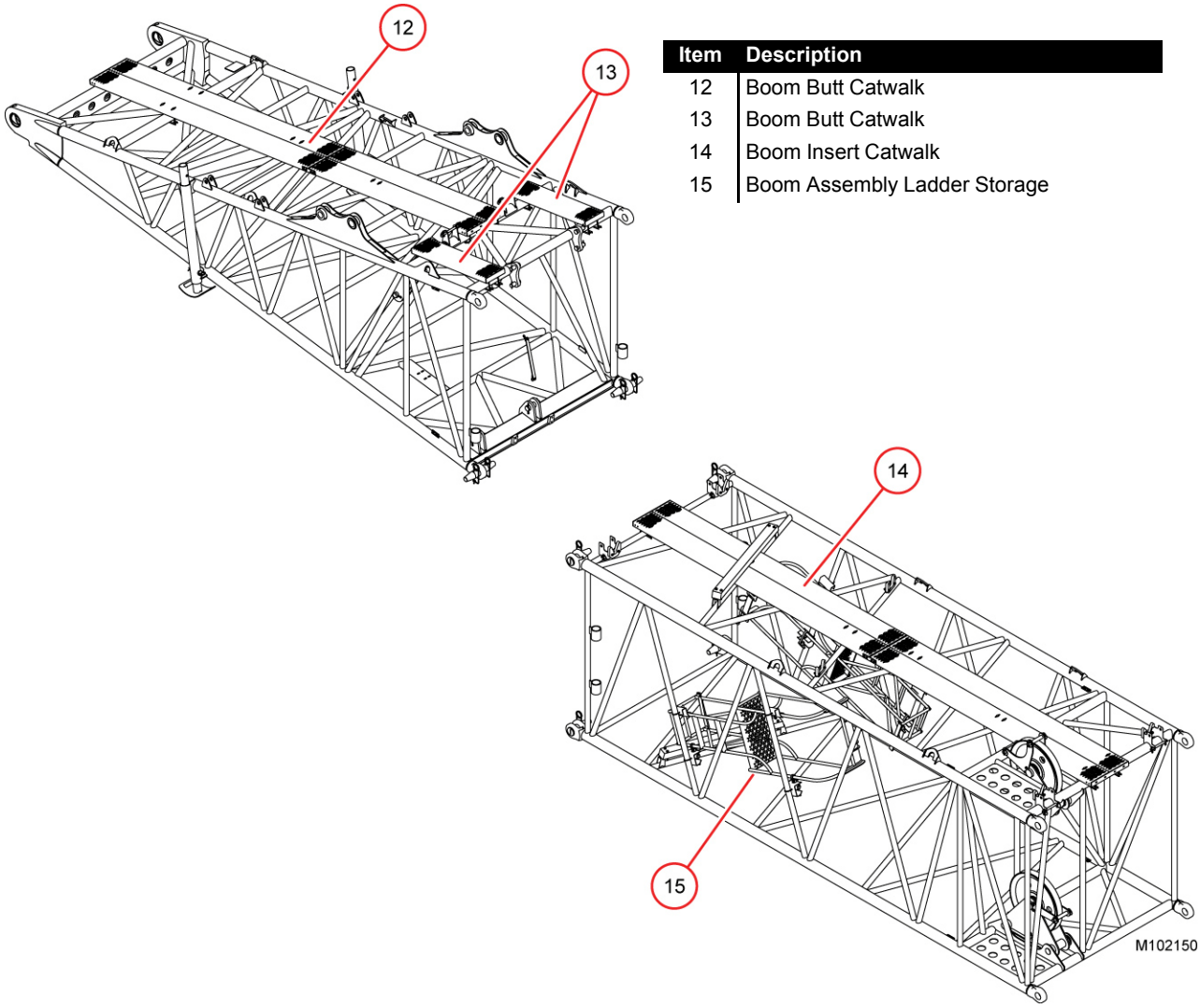
Item	Description
1	Operator Cab Platform
2	Carbody Counterweight Stairway
3	Carbody Counterweight
4	Enclosure Platform
5	Crawler Stairway
6	Enclosure Platform
7	Enclosure Cover
8	Rotating Bed Counterweight
9	Engine Enclosure
10	Enclosure Hand Rails (option)
11	Enclosure Ladder (option)



Smooth walking surfaces have a non-skid coating applied.

Platforms, catwalks, and stairways are constructed with non-skid grating.

Figure 2-1. Access Points



Item	Description
12	Boom Butt Catwalk
13	Boom Butt Catwalk
14	Boom Insert Catwalk
15	Boom Assembly Ladder Storage

Figure 2-1. Continued

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 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 horn to alert personnel before you swing or travel.
- If equipped, 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 shall 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 steps, 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 Manitowoc.

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 the controls in the 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 shall be stored in tool boxes or other appropriate locations. Do not allow these items to lie around loose in operator cab or on steps, ladders, catwalks, and platforms.
- To reduce risk of slipping, non-skid material (sand in paint) has been applied to painted walkways and platforms.

  Walkways and platforms can be slippery when wet and when oil or grease is spilled on them. ***Keep walkways and platforms clean and dry to prevent slipping on them.*** When non-skid material wears out, reapply it.
- Wear shoes with a highly slip-resistant sole material. Clean any mud or debris from shoes before entering the crane cab or climbing onto the cab. A shoe that is not clean might slip off a control pedal during operation.
- Do not make modifications or additions to the crane's access system that have not been evaluated and approved by Manitowoc.
- Do not use top of mast, boom, or jib as walkways unless they have catwalks.

NOTE Catwalks are available from Manitowoc for boom and jib sections.

Two optional ladders, stored in the boom butt, are available for boom assembly and disassembly. See Boom Ladder Assembly in Section 4 for instructions.

GETTING ON OR OFF CRANE

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

Never climb onto or off a moving crane. ***Climb onto and off crane only when it is parked and only with 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 must be lifted into place with a hand line or hoist.

OPERATOR MANUAL/CAPACITY CHART STORAGE

General

Manitowoc provides the following manuals and other important literature with your crane and attachment (Luffing Jib, etc.):

- 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.
- Rated Capacity Indicator/ Limiter 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 shall 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. A separate binder is provided for the crane and each applicable attachment.

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 shall match the serial number of the crane and attachment in use. ***Using any other manual or capacity chart is prohibited.***

- The crane model and serial number is located on the Crane Identification Plate on the crane cab.
- The model and serial number of the attachment (other than standard boom) is located on the Crane Identification Plate on the attachment.

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

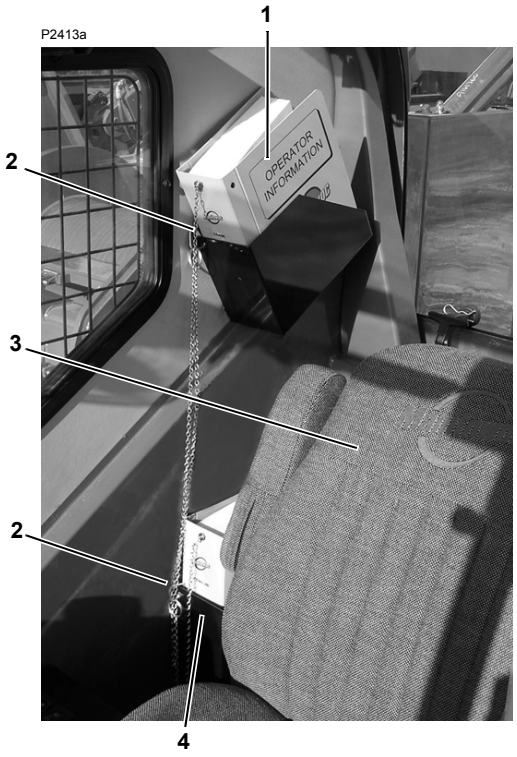
Do not operate the crane or attachment if proper Capacity Chart is not in cab.

Storing Manuals

Store a copy of the Operator Manual for the crane and each applicable attachment in the holder provided in the operator cab (Figure 2-2).

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

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



Item	Description
1	Operator Information Manual
2	Link and Chain Ring
3	Spare Holder Behind Seat
4	Holder on Right Wall for Manual in Use

Figure 2-2. Operator Manual Storage

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 shall be read and completely understood by each person responsible for assembly, disassembly, operation, and maintenance of the crane.

The Operator Manual shall 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 shall 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 crane 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 the crane owner's responsibility.

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

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

- Phone 202-512-1899
- Fax 202-512-2250
- Online at www.osha.gov

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

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

Operator Conduct

1. The operator shall not engage in any practice which diverts his/her attention while operating the crane.
2. The operator shall not operate the crane when he/she is physically or mentally unfit.
3. The operator shall be responsible for all operations under his/her direct control. When safety of an operation is in doubt, the operator shall stop the crane's functions in a controlled manner. Lift operations shall 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 shall 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 off the 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 shall not be loaded beyond applicable static or dynamic ratings given in Capacity Chart for the crane.

- See Size of Load later in this section.
- For a description of each safety device and operational aid, see Safety Devices and Operational Aids in this section and Section 3.

7. The operator shall test all controls, limits, and communication systems at the start of each shift. Any defects found shall 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 shall 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 shall 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 shall 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 under Operator Conduct topic.

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 in 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 35 mph (16 m/s), 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) shall 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 shall be visible to the operator or the signal person during extension and retraction.

Handling Load

Size of Load

1. The crane shall 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 shall be deducted.

The operator's judgment shall be used to further reduce total the 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 shall take priority over RCI/RCL readings.

Attaching Load

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

      When such a surface is not available, it shall be provided with timbers, cribbing, or other structural members to distribute the load such that the allowable bearing capacity of the underlying member is not exceeded.

      For ground bearing data go to:
      www.manitowoccranes.com

   b. The load is secured and properly balanced in the slings or the lifting device before lifting the load more than 3 to 6 in (76 to 152 mm).
   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 3 to 6 in (76 to 152 mm) and fully apply the brakes — load shall not lower through applied brakes.
   j. Unused load drums are parked (working and parking brakes applied; if equipped, drum pawls engaged).
   k. All personnel are clear of the swing radius of the crane's counterweight.
2. While lifting or moving the load, the operator shall take the following precautions:
   a. Accelerate and decelerate the load smoothly to avoid excessive stress on the crane 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, the 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 shall 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 shall be:

- Free of defects
- Strong enough to prevent crushing, bending, or shear failure
- Of sufficient thickness, width, and length to completely support the jack pad or float, transmit the load to the supporting surface, and prevent shifting, toppling, or excessive settlement under load

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 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 shall 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 are remaining 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 operating with a MAX-ER attachment.
- 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 shall 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 the 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 shall be thoroughly inspected by a qualified person prior to setup.

4. The crane shall be thoroughly inspected for load line interference caused by routing and reeving of multiple load lines. If interference is found, it shall 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, the jib, and the sheaves:
   - The load lines shall hang as close to vertical as possible to minimize side and forward loads.
   - The distance between the load points and the hook points shall be a minimum of three times the horizontal distance between the hook point on the load being lifted.
   - The load shall 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 shall 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 shall be in accordance with the standard signals shown in Section 3, unless communications equipment (telephone, radio, etc.) is used.
3. All signals shall 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 shall be agreed upon in advance by the operator and the signal person. The signals used shall 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 shall 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 shall 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 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 shall be taken out of service and crane operation shall 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall be tagged-out or removed if possible.

7. A 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 shall 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 shall 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 shall 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 shall 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.

NOTE 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 shall be repaired no later than 30 calendar days after the deficiency occurs. Exception: If the employer documents that it 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 shall 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 shall 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 20 ft (6 m) 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 20 ft (6 m) 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 shall 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 the 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 20 ft (6 m) 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 the 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 shall be deenergized OR,
   - Tests shall be made to determine if an electrical charge will be induced into the crane or load.
   - The crane shall be provided an electrical ground.
   - If taglines are used, they shall be non-conductive.
   - Every precaution shall 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.

   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 (dust, dirt, moisture, etc.). The insulating characteristics of these devices can be compromised if not kept clean, free of contamination, and undamaged.
5. 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.
6. 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 shall not be ignored.
   - Sometimes the sensing portion of the proximity devices becomes confused by complex or differing arrays of power lines and power sources.
7. 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.

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

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

REFUELING

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

FIRE EXTINGUISHERS

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

ACCIDENTS

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

Manitowoc Cranes
2401 So. 30th St.
Manitowoc, WI 54220

Phone:920-684-6621

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

The crane shall not be returned to service until it is thoroughly inspected for any evidence of damage. All damaged parts shall 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 shall be maintained according to the instructions contained in this manual and in the Service Manual provided with the crane.

Crane maintenance and repair shall 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 the crane owner's responsibility.

Safe Maintenance Practices

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

f. Place a warning sign at the start controls alerting other personnel that the crane is being serviced and the engine shall 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 shall 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 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 inflator, 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 (to include 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.

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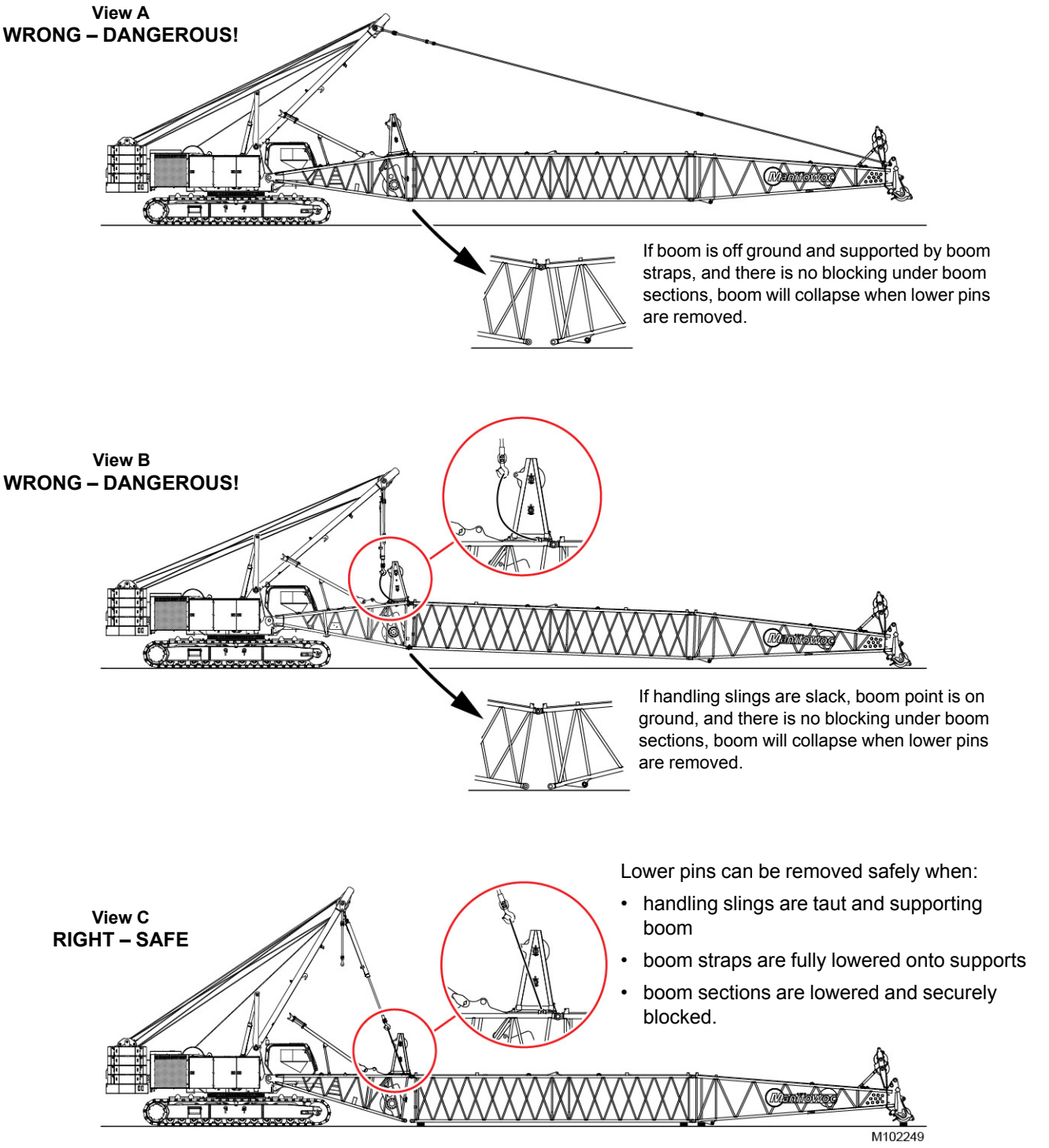

Figure 2-3. Boom Disassembly

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 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 shall 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.

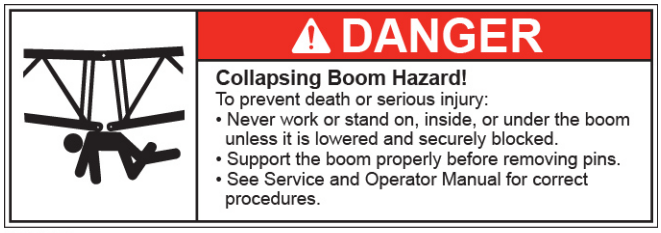

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Figure 2-4. Boom Section Decal

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 straps as shown in Figure 2-3, View A.
- Do not remove strap connecting pins until straps are fully lowered into supports 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 and handling pendants are 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 boom unless it has walkways.

DANGER

Falling Boom Hazard!

Crane can tip or boom can collapse if excess boom is cantilevered. Never cantilever more boom than allowed in rigging drawings or capacity charts.

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 shall 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, stairway, 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 shall be engaged when the occupied personnel platform is in a stationary position.
- The crane shall be equipped with a boom angle indicator that is visible to the crane operator.
- The crane shall be equipped with boom hoist limiting device.
- If the luffing jib is used for hoisting personnel, the crane shall 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 shall 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 shall 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 shall 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 shall have them all extended and locked. All outriggers or stabilizers shall 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 (i.e., personal fall-protection system, etc.)

- 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 shall 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 20 ft (6 m) of a power line that is up to 350 kV or within 50 ft (15 m) of a power line that is over 350 kV is PROHIBITTED, 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 shall 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) shall 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 shall 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 operator that the crane's capacity has been exceeded. When capacity of a pedestal mounted crane is exceeded, hook rollers or other structural components may break, before load lines fail, causing the crane to separate from pedestal.

For this reason, great care shall 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 maximum allowable specified in Capacity Charts. If specified crane list and/or dynamic conditions are exceeded, the crane's capacity may be exceeded; 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, barge, ship or 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 the use of a truck crane on a barge, ship or floating platform.

Pedestal Mounted Crane

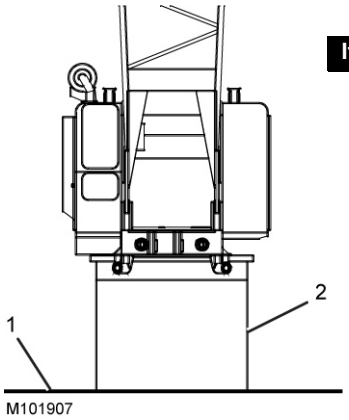
Also see ASME publication B30.8-2004, Floating Cranes and Derricks.

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).

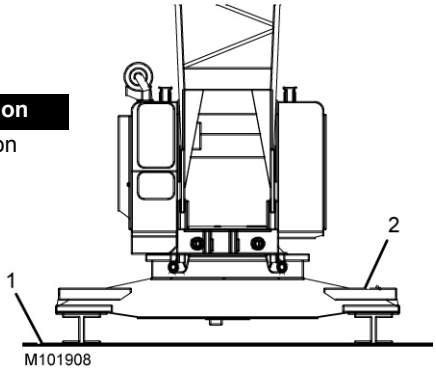


Item	Description
1	Foundation
2	Turret

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.



Item	Description
1	Foundation
2	Carbody

Figure 2-6. Carbody-Mounted Crane

Barge Mounted Crane

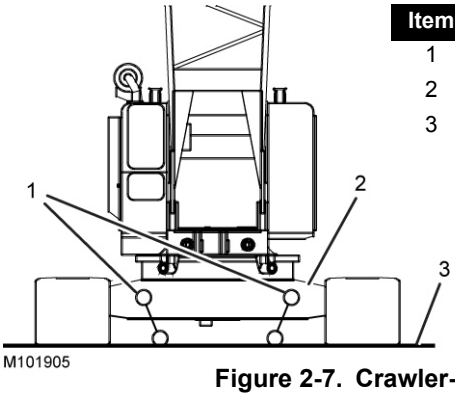
Definition

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).

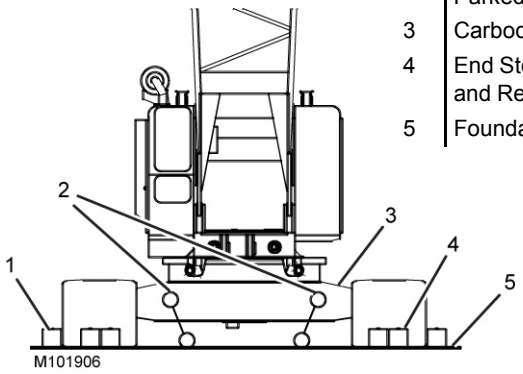


Item	Description
1	Tie-Downs
2	Carbody
3	Foundation

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.



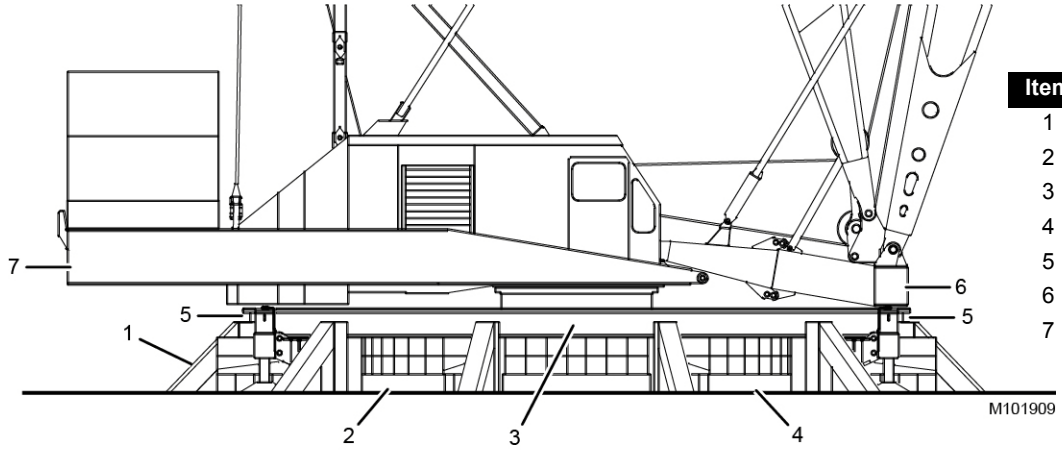
Item	Description
1	Curbing
2	Tie-Downs Required when Parked
3	Carbody
4	End Stop Front and Rear
5	Foundation

Figure 2-8. Crawler-Mounted Crane

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).

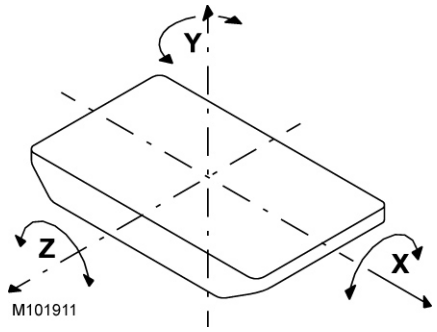
NOTE RINGERS shall be equipped with hook rollers on the boom carrier and the counterweight carrier.

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



Item	Description
1	Bracing
2	Ring Support
3	Ring Assembly
4	Foundation
5	Hook Roller
6	Boom Carrier
7	Counterweight Carrier

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

Capacity Charts for Barge Mounted Cranes

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° – shall 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 boom or structure is shock loaded during operation, or there is any indication of shock loading, all structural components of the crane shall 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 shall be taken into account for safe operation on a barge, ship, or floating platform.

WARNING

Tipping Crane Hazard!

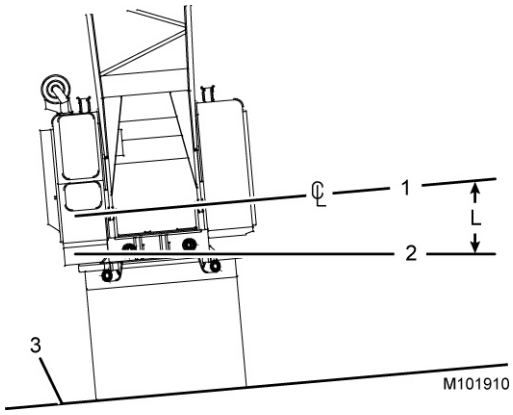
Tie-downs which only prevent the crane from shifting on the barge, the ship, or the floating platform, may not provide adequate support when using a Capacity Chart for pedestal mounting.

Before operating a crane on a barge, ship or floating platform, the crane user shall verify that the correct Capacity Chart is being used — pedestal mounted, barge mounted, 0°, 1°, 2° or 3° list, or dynamic.

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

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SECTION 3
OPERATING CONTROLS AND PROCEDURES

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CAB CONTROLS AND INDICATORS

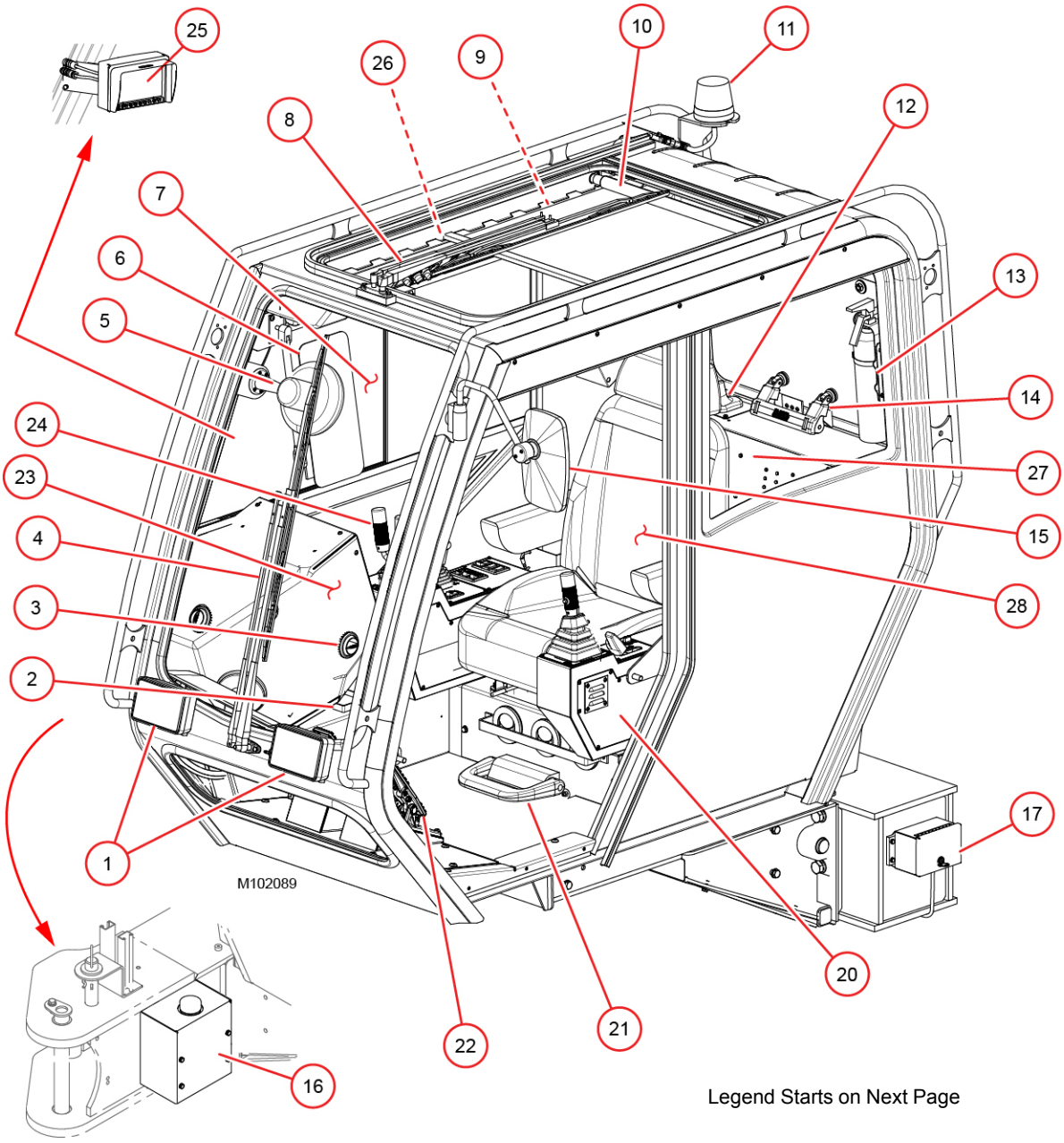

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Table 3-1. Cab Controls and Indicators

Item	Name	Description
1	Cab Exterior Lights	See Light Switches on page 3-19.
2	Cup Holder	—
3	Louvre	Several are located in the cab. Open, close, and rotate to direct air flow from heater and air conditioner.
4	Front Windshield Wiper	See Windshield Wipers on page 3-18.
5	Cab Fan	Fan direction is adjustable. The switch has off, low, and high positions.

Table 3-1. Cab Controls and Indicators

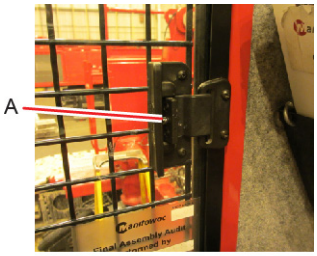
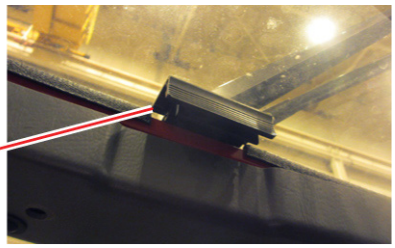
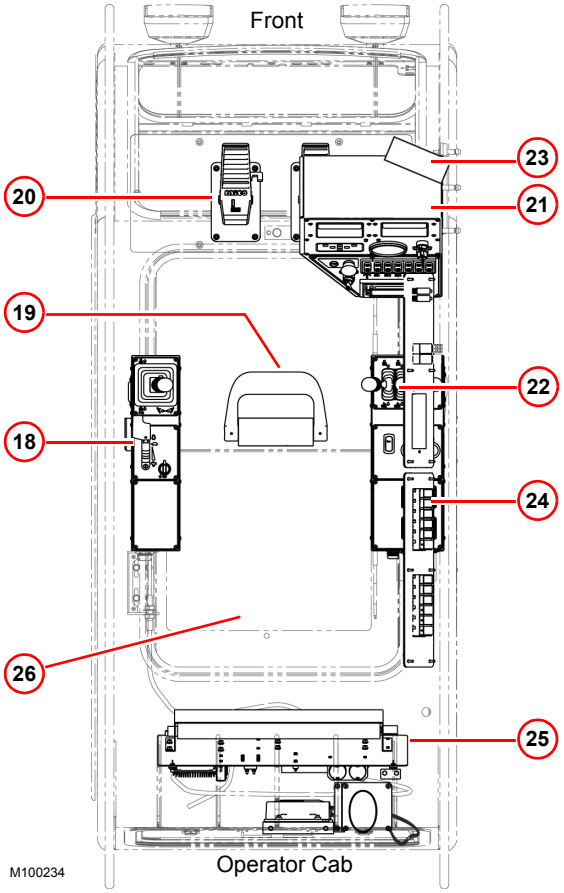
6	Sun Visor	Optional. Can be positioned to reduce sun glare through windows.
7	Front Window	Emergency exit. Can be kicked out if the sliding door cannot be used.
8	Overhead Windshield Wiper	See Windshield Wipers on page 3-18.
9	Dome Light	Light has an on-off push button switch.
10	Overhead Shade	Optional. Can be positioned to block sun glare through overhead window.
11	RCL/RCI Warning Light	Optional. See RCL/RCI Warning Light on page 3-26.
12	GPS Antenna (if equipped)	For CraneSTAR use.
13	Fire Extinguisher	Used to extinguish Class A, B, or C fires. One fire extinguisher is located in the cab. A second, optional fire extinguisher is located in the right side enclosure.
14	Window Latches	Right window latch (**A**): squeeze handle to unlatch and slide window forward for ventilation. Pull handle fully back to latch window closed. Rear window latch (**B**): raise handle to unlatch and open window for ventilation. Push handle down to close and latch window. Overhead window latch (**C**): squeeze handle to unlatch and slide window back for ventilation. Push handle fully forward to latch window closed.  M102086  M102085  M102087
15	Rear-View Mirrors	Optional. Adjustable rear-view mirrors mounted on the operator cab and at the right-front corner of the rotating bed allow the operator to view the rear of the crane.
16	Windshield Washer Tank	Fill the windshield washer tank with a non-freezing cleaning fluid.
17	External Limit Bypass Switch	Cranes that comply with CE requirements are equipped with this switch. See the MLC165-1 RCL/RCI Manual.

Table 3-1. Cab Controls and Indicators

18	Left Console (see page 3-6)
19	Foot Throttle (see page 3-9)
20	Free Fall Brake Pedals (optional) (see page 3-9)
21	Front Console (see page 3-11)
22	Right Console (see page 3-14)
23	Camera Monitor (optional) (see page 3-22)
24	Overhead Console (see page 3-18)
25	Rear Console (see Section 3 of MLC165-1 Service Manual)
26	Seat Controls (see page 3-21)



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Left Console

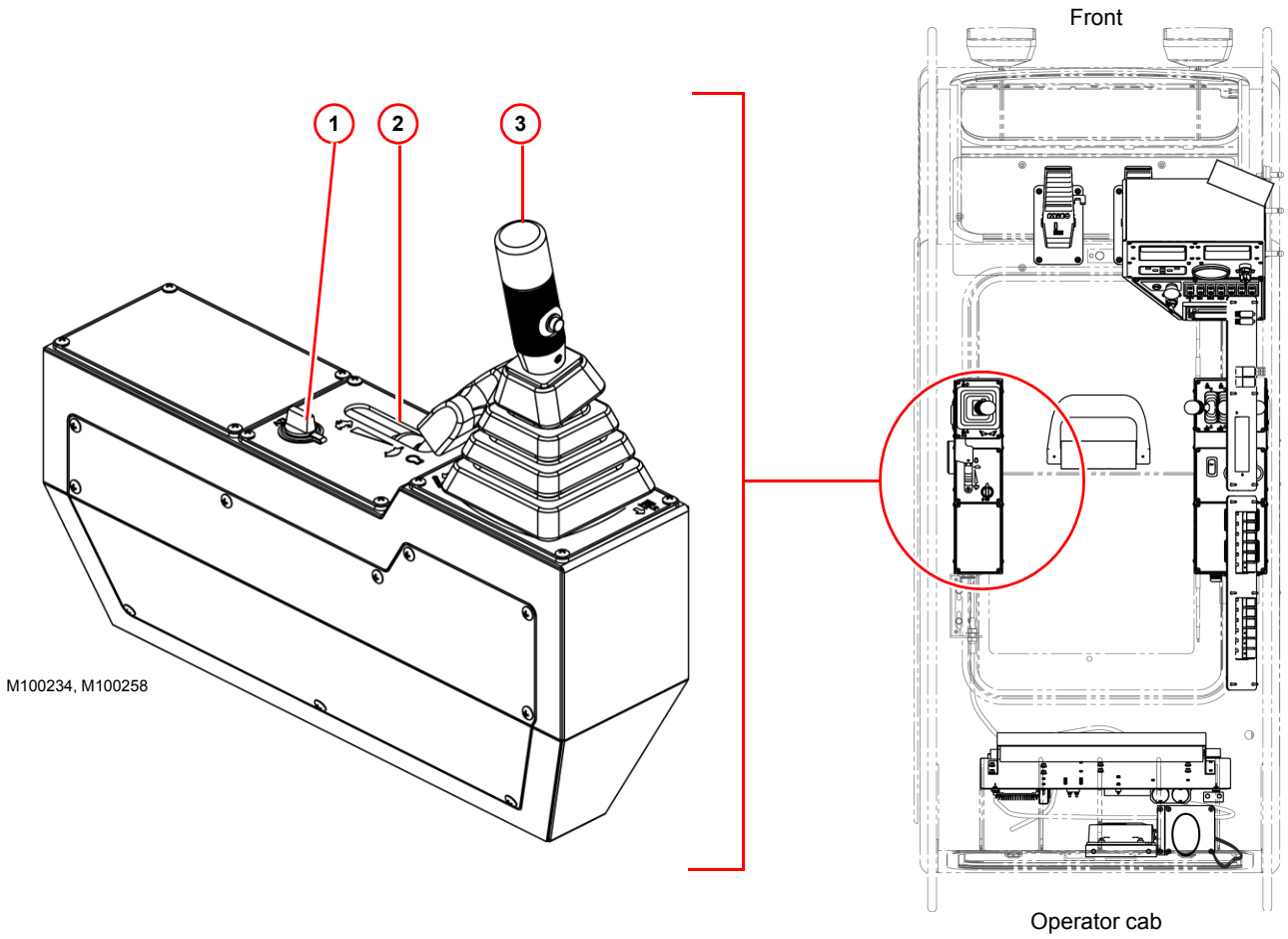
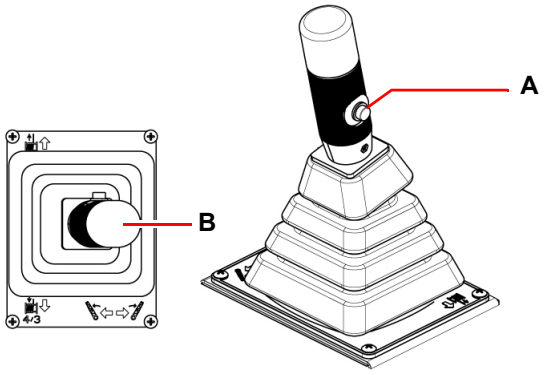


Table 3-2. Left Console

Item	Name	Description
1	12VDC Power Source	Maximum current draw is 10A. For fuse location, see Section 3 of MLC165-1 Service Manual.
2	Hand Throttle	Move the handle toward  to decrease engine speed. Move the handle toward  to increase engine speed. **NOTE** Engine speed must be fast enough to provide sufficient power for the work being done. ***The engine can stall under load if the engine speed is too slow.***

Table 3-2. Left Console

<table>
<tr>
<td>3</td>
<td>Boom Hoist and Swing Control Handle</td>
<td>


M100265

Boom Hoist Control Handle:

See Boom Hoist (Drum 4) Operation on page 3-39.

The location of the boom hoist control handle can vary depending on crane configuration. See Handle-to-Drum Identification on page 3-25.

Move the handle BACK to RAISE the boom. The boom hoist brake releases and speed changes in relation to handle movement.
Release the handle to CENTER to STOP the boom. Speed decreases to off and the boom hoist brake applies to hold the boom in position.
Move the handle FORWARD to LOWER the boom. The boom hoist brake releases and speed changes in relation to handle movement.

NOTE In the setup mode, the boom hoist control handle will simultaneously raise and lower the mast and pay out or haul in the boom hoist wire rope.

Swing Control Handle:

See Swing Operation on page 3-40.

Move the handle to the LEFT to SWING LEFT.
Release the handle to CENTER to STOP swinging. Swing speed decreases and the rotating bed slows to a stop. Move the handle in the opposite direction to stop the swing motion faster.
Move the handle to the RIGHT to SWING RIGHT.

The swing and travel alarm beeps to warn personnel when the crane is swung.

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>A</td><td>Swing holding brake switch: holds the rotating bed in position for short periods of time. The swing handle is not operable while the swing holding brake switch is pressed.
PRESS the switch to APPLY the swing holding brake.
RELEASE the switch to RELEASE the swing holding brake.</td></tr>
<tr><td>B</td><td>Drum rotation indicator: an actuator in the top of the handle moves up and down to signal the operator by feel that the boom hoist is turning and how fast.</td></tr>
</table>
</td>
</tr>
</table>

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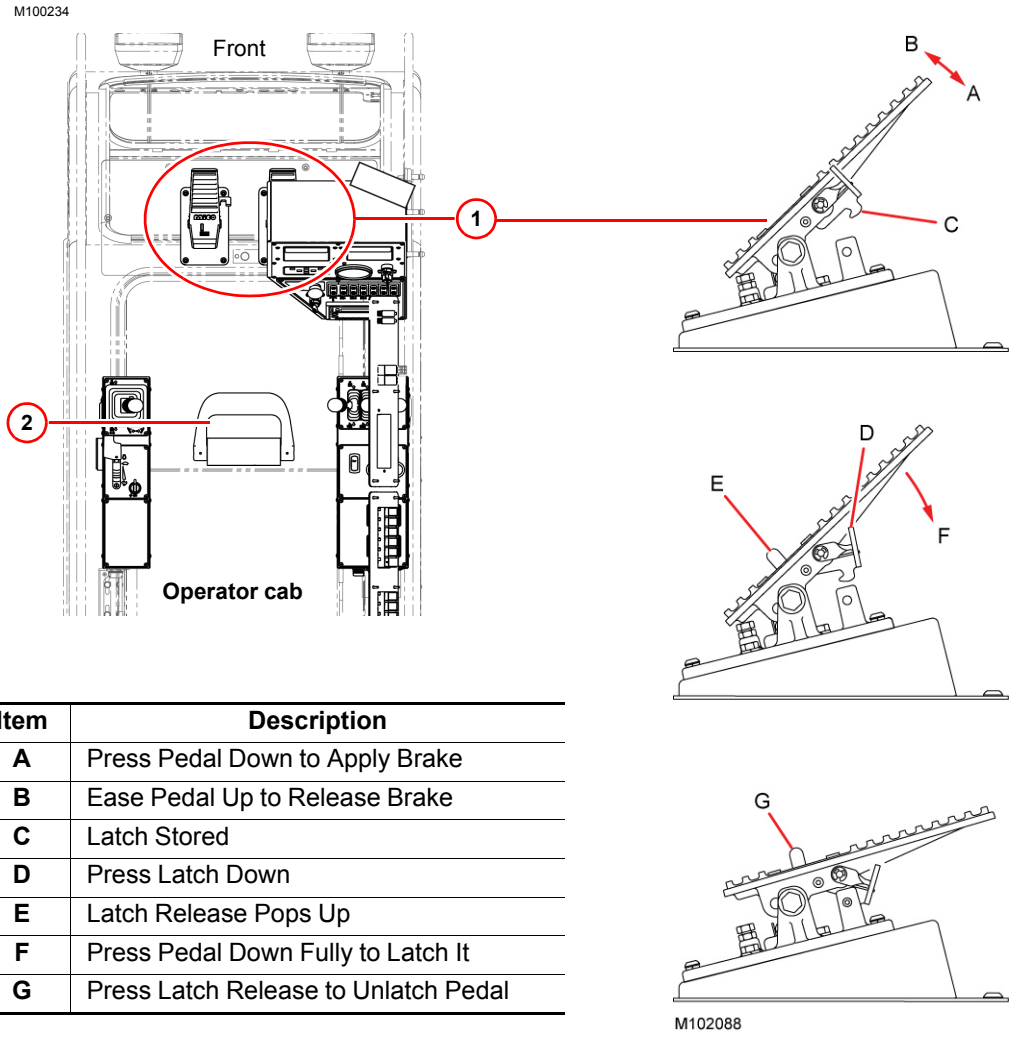
Foot Pedals

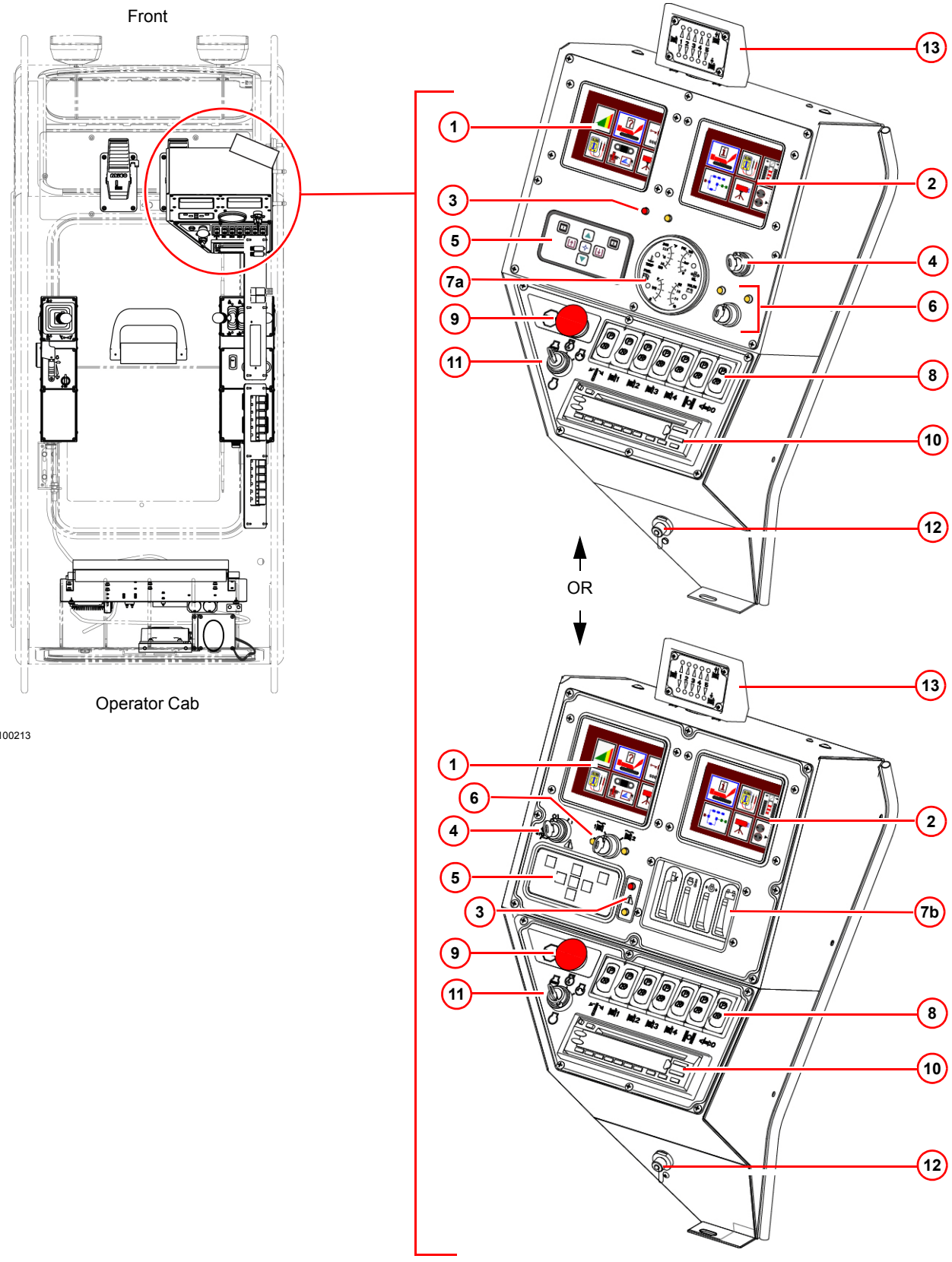


Item	Description
A	Press Pedal Down to Apply Brake
B	Ease Pedal Up to Release Brake
C	Latch Stored
D	Press Latch Down
E	Latch Release Pops Up
F	Press Pedal Down Fully to Latch It
G	Press Latch Release to Unlatch Pedal

Table 3-3. Foot Pedals

Item	Name	Description
1	Free Fall Brake Pedals	The crane can be equipped with 1 or 2 optional free fall brake pedals. The left pedal is for Drum 1 and the right pedal is for Drum 2. Each free fall equipped drum has a spring-applied, hydraulically-released clutch/brake that is controlled by the brake pedals shown above. When free falling a load, the brake pedal must be used to slow down and stop the load. To use free fall, see Drum 1 or Drum 2 Free Fall Operation on page 3-42.
2	Foot Throttle	• Press down on the foot throttle to INCREASE engine speed above the hand throttle setting (see Hand Throttle on page 3-6). • Release the foot throttle to DECREASE engine speed to idle or to the hand throttle setting (see Hand Throttle on page 3-6).

Front Console



M100234, M100213

Right Console

Table 3-4. Front Console

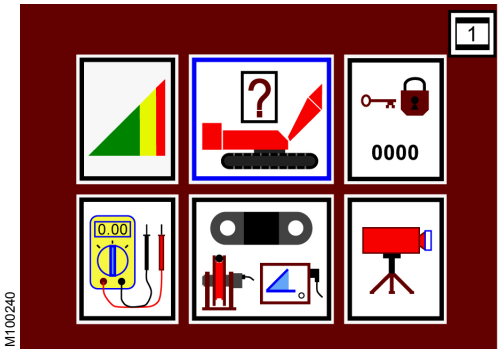
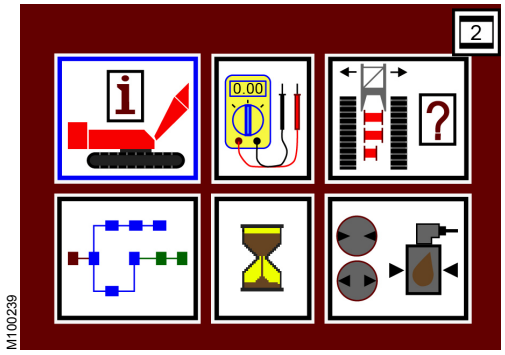
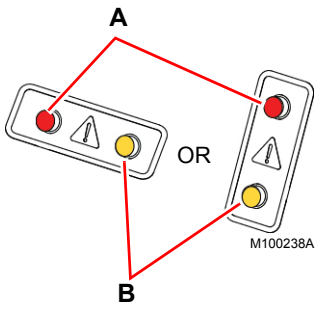
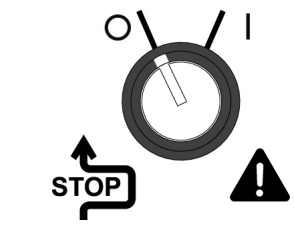
Item	Name	Description
1	Rated Capacity Limiter / Rated Capacity Indicator (RCL/RCI) Display	Displays load lifting information and alerts the operator to overload conditions. See the MLC165-1 RCL/RCI Manual for instructions. 
2	Main Display	Displays operating conditions, faults, and diagnostic information. See the MLC165-1 Main Display Operation Manual for instructions. 
3	RCL/RCI Indicators	Alerts the operator to overload conditions: • Red light (**A**) = maximum load • Amber light (**B**) = near maximum load 
4	Limit Bypass Key Switch	This key can bypass the limits described in Bypassable Limits Identification on page 3-24: • To BYPASS an operating limit, turn the key to **I** and hold the key in this position. • To ENABLE operating limits, release the key to **O**. This position allows a limit to stop a crane function in the normal matter. ***The key must be in this position for all normal operation. Otherwise, structural damage can occur.*** Remove the key to prevent unauthorized operation. 

Table 3-4. Front Console

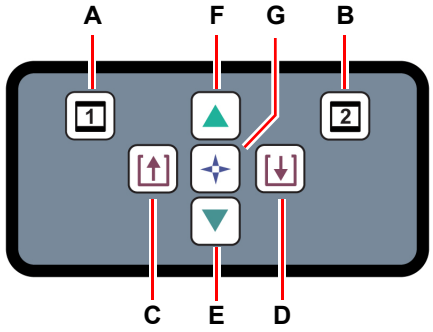
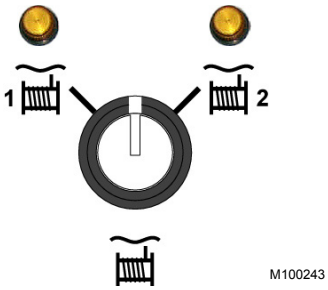
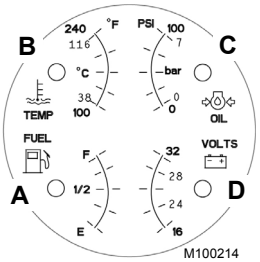
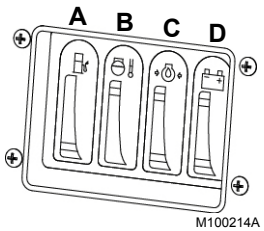
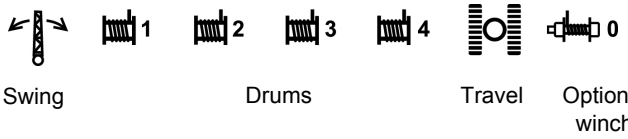
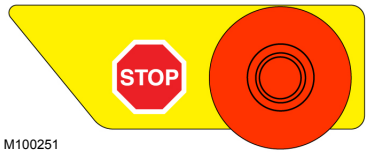
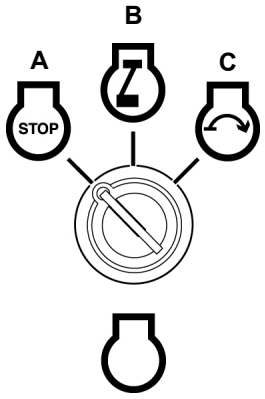
5	Touch Pad	Touch keys are used to access the RCL/RCI and main display screens: • **A** = Access the RCL/RCI display • **B** = Access the Main display • **C** = Exit • **D** = Enter • **E** = Scroll down • **F** = Scroll up • **G** = Confirm  M100224
6	Free Fall Enable/Disable Key Switch	If the crane is equipped with this option, this switch is used to select and de-select a drum for free fall operation. The switch is a return-to-center type. It will toggle the free fall mode on and off. The amber light ON indicates that free fall is enabled for the selected drum. For more information, see Drum 1 or Drum 2 Free Fall Operation on page 3-42.  M100243
7a	Engine Gauge Cluster	The gauge cluster displays the following engine values: **A** – Fuel Level **B** – Coolant Temperature **C** – Oil Pressure **D** – Battery Voltage **NOTE** If equipped with optional cold weather heaters, it is normal for the gauge readings to drop momentarily (1-2 seconds) when the heaters turn on.  M100214
7b	Engine Bar Graph	The bar graph displays the following engine conditions: **A** – Fuel Level **B** – Coolant Temperature **C** – Oil Pressure **D** – Battery Voltage The bars are color code to indicate the following: • Green = okay • Yellow = approaching an unsafe level • Red = take immediate corrective action  M100214A

Table 3-4. Front Console

8	Park Switches	 Press Park ON to PARK the corresponding crane function. With park on, the corresponding handle is inoperable, the brake is applied, and (if equipped) the drum pawl is engaged. Press Park OFF to UNPARK the corresponding crane function. With park off, the corresponding handle is operable, the brake is applied and released in conjunction with handle movement, and (if equipped) the drum pawl is disengaged.
9	Emergency Stop Button	When this button is pressed, the crane engine stops, all brakes apply, and the currently operated functions come to a complete stop. For normal engine stopping, use the engine ignition switch.  M100251 **NOTE** The button must be pulled up before the engine can be restarted. If the emergency stop switch has been activated, test all disk brakes for proper operation before putting the crane back in service.
10	Radio	Optional. See the manufacturer's instructions.
11	Engine Ignition Switch	The engine ignition switch has the following positions: • Stop (**A**) • Run (**B**) • Start (**C**)  M100257
12	Programming Connector	Used to connect a computer to the crane operating system in order to update the crane firmware.
13	Drum Direction Indicator Lights	Glow green to indicate the direction in which a drum is being operated.

3

Right Console

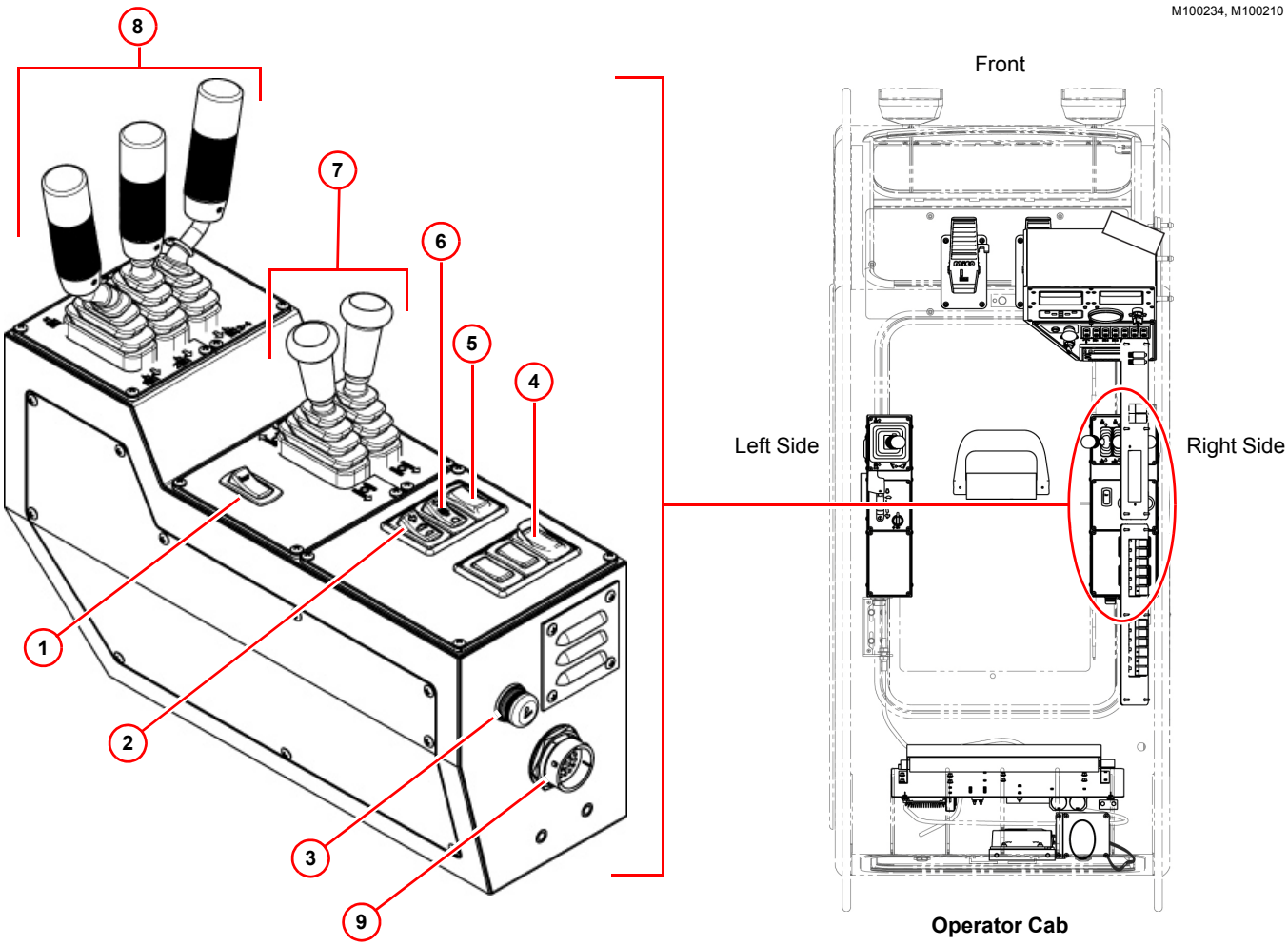


Table 3-5. Right Console

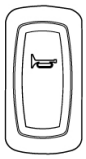
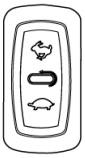
Item	Name	Description
1	Horn Switch	 M100277 Press and hold the front of this switch to sound the horn. Release the switch to silence the horn. Before starting the engine, swinging, or traveling, sound the horn to alert nearby personnel.
2	Travel Speed Selector	 Press  to operate the travel motors in high speed. High speed operation provides maximum available travel speed for traveling long distances. Press  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.

Table 3-5. Right Console

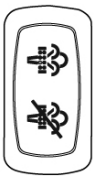
3	Cigarette Lighter	 M100281 Push in to turn on the lighter. The lighter will pop out when the coil is hot. This receptacle can be used to power 12 VDC devices. Maximum current draw is 10A.
4	SCR Regeneration Switch	 M100282 This 3-position switch is provided only on cranes with a Tier 4 Final engine. SCR = Selective Catalytic Reduction A guard over the front end of the rocker prevents accidental manual regeneration. **Center Position** Press the CENTER of the switch (maintained) to allow AUTOMATIC REGENERATION of the exhaust system. This position does not require operator assistance under normal engine operating conditions. **TOP Position** Press and release the TOP of the switch (momentary) to start MANUAL REGENERATION when needed. Manual regeneration is required if the SCR regeneration light comes on in the Engine Information Screen of the main display. The engine ECM will control the regeneration cycle. The switch will return to the center position when the rocker is released. Manual regeneration will begin only if the following conditions are met: • The engine is at low idle • The accelerator pedal is not pressed The High Exhaust System Temperature (HEST) fault in the main display may come on during regeneration and remain on for a short time after regeneration. **Regeneration Inhibit** Press the BOTTOM of the switch (maintained) to INHIBIT (prevent) exhaust system automatic regeneration. The SCR regeneration inhibited light comes on in the Engine Information Screen of the main display. To re-enable automatic regeneration, manually return the rocker to the center position. Do not use the inhibit switch unless specifically instructed to do so by a Manitowoc or Cummins technical advisor. For information on exhaust system-related faults, see Tier 4 Engine Faults on page 3-33. Also see the engine manufacturer's operation and maintenance manual for information on the after-treatment system and engine faults.

Table 3-5. Right Console

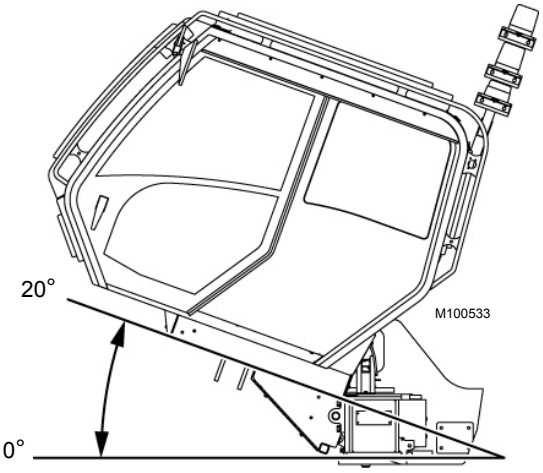
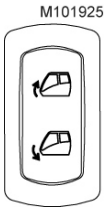
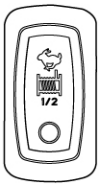
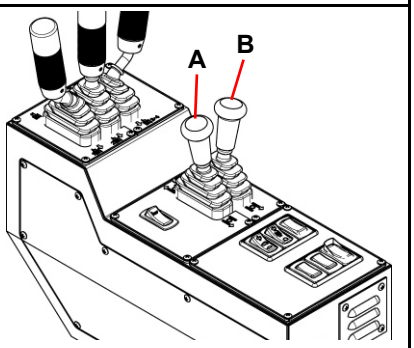
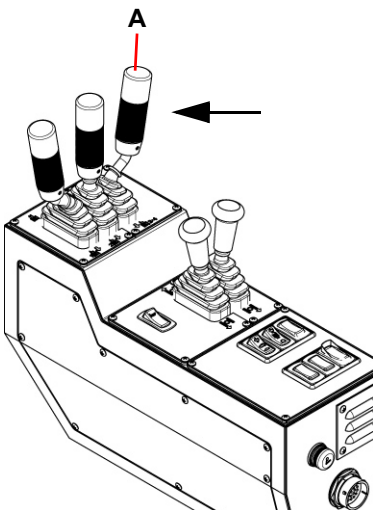
5	Cab Tilt Switch	 Optional.  Press to RAISE front of the cab up to 20° above horizontal. Release the rocker to CENTER to LOCK the cab in the desired position. Press to LOWER front of the cab to horizontal.
6	Drum 1/2 High Speed Switch	 Press to operate both Drum 1 and Drum 2 at high speed. Drum torque is reduced in high speed. Press to return both Drum 1 and Drum 2 to normal speed.
7	Crawler Control Handles	See Travel Operation on page 3-46. The following directions of travel are with the ***front of the upperworks (boom end) over the front of the lowerworks (front roller ends of crawlers).*** The swing and travel alarm beeps to warn personnel when the crane is traveled. **A** = left crawler handle and **B** = right crawler handle  • Pull the handle BACK to travel the corresponding crawler in REVERSE. The travel brake releases and speed increases in relation to handle movement. • Release the handle to CENTER to STOP the crawler. Speed decreases to off and the travel brake applies to stop and hold the crawler in position. • Push the handle FORWARD to travel the corresponding crawler FORWARD. The travel brake releases and speed increases in relation to handle movement.

Table 3-5. Right Console

8	Drum Control Handles	See Drum 1 and Drum 2 Full Power Operation on page 3-41. See Drum 1 or Drum 2 Free Fall Operation on page 3-42. • Pull the handle BACK to RAISE the load. The drum brake releases and speed increases in relation to handle movement. • Release the handle to CENTER to STOP the load. Speed decreases to off and the drum brake applies to stop and hold the drum in position. • Push the handle FORWARD to LOWER the load. The drum brake releases and speed increases in relation to handle movement. The position of the drum control handles can vary depending on crane configuration. See Handle-to-Drum Identification on page 3-25.  **A** = Drum rotation indicator (top of each handle): moves up and down to signal the operator by feel that the drum is turning and how fast. **NOTE** The drum 3/4 control handle operates the self-assembly cylinder in the setup mode with drum 3/4 parked. The swing/travel alarm will sound when the handle is operated. To turn on the setup mode, see the instructions in Section 4 of the MLC165-1 Operator Manual. • Push the handle forward to extend the self-assembly cylinder. • Pull the handle back to retract the self-assembly cylinder.
9	Receptacle for Test Harness	For use by qualified Manitowoc technicians.

Overhead Console

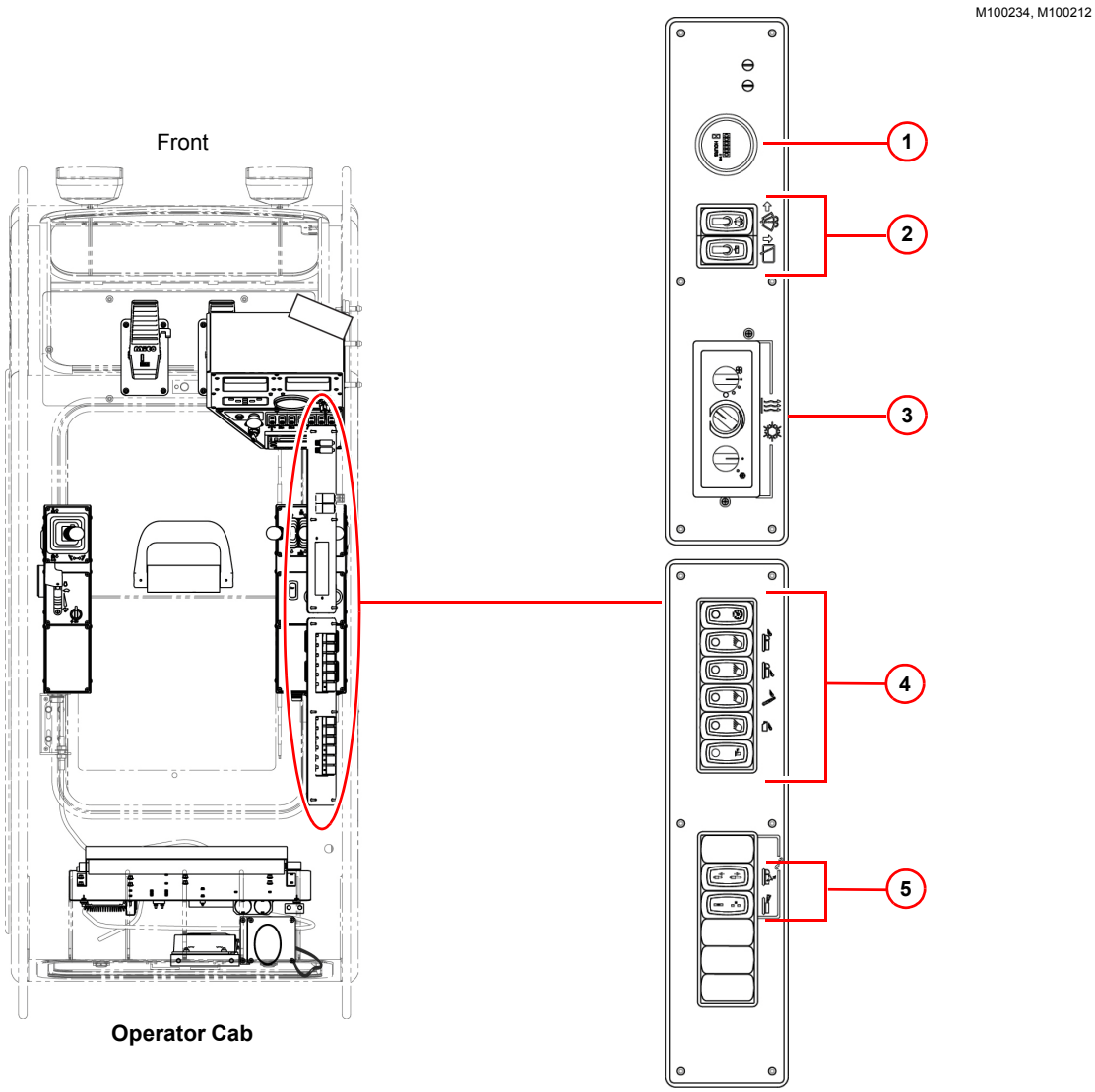


Table 3-6. Overhead Console

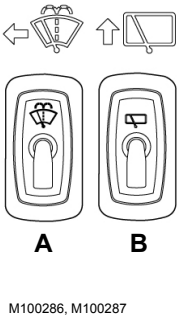
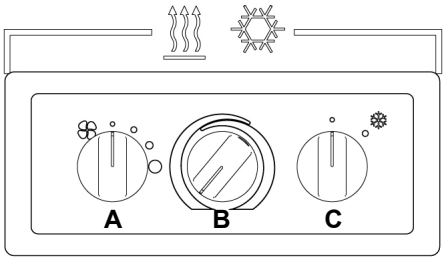
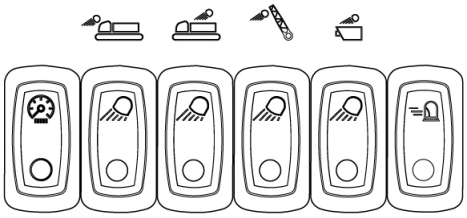
Item	Name	Description
1	Engine Hours Meter	Optional. Displays hours of engine operation.
2	Windshield Wipers	 Front (**A**) and overhead (**B**) windshield wiper toggle switches: Toggle fully down = OFF. Toggle up = Intermittent depending on how far up the toggle is moved. Toggle fully up = HIGH speed. For the front window only, press the top end of the switch to spray washer fluid onto the window. During cold weather, fill the windshield wiper fluid tank with non-freezing cleaning fluid.

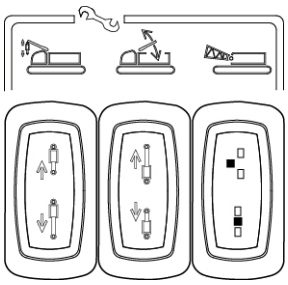
Table 3-6. Overhead Console

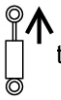
<table>
<tr>
<td>3</td>
<td>Climate Controls</td>
<td>


M100288
<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>A</td><td>Fan Speed: clockwise faster, counterclockwise slower.</td></tr>
<tr><td>B</td><td>Temperature Control: clockwise hotter, counterclockwise cooler.</td></tr>
<tr><td>C</td><td>Air Conditioner: clockwise ON, counterclockwise OFF.</td></tr>
</table>
</td>
</tr>
<tr>
<td>4</td>
<td>Light Switches</td>
<td>


M100289
<table>
<tr><td>A = Panel Lights</td></tr>
<tr><td>B = Cab Work Lights,
C = Rotating Bed Work Lights (optional),
D = Boom Work Lights (optional),
E = Drum Camera Lights (optional):
Press to turn on a light.
Press ◯ to turn off a light.
NOTE The rotating bed and boom work lights are 240 VAC. The generator and load center circuit breakers must be on before the lights can be turned on. See AC Electric System on page 3-51 for instructions.</td></tr>
<tr><td>F = Boom Position Light:
Press to turn on the position light.
Press ◯ to turn off the position light.
NOTE The boom position light is powered by the crane’s batteries. If the light is left on when the crane’s engine is off, the batteries could die. An optional battery charger is available. See AC Electric System on page 3-51 for instructions.</td></tr>
</table>
</td>
</tr>
</table>

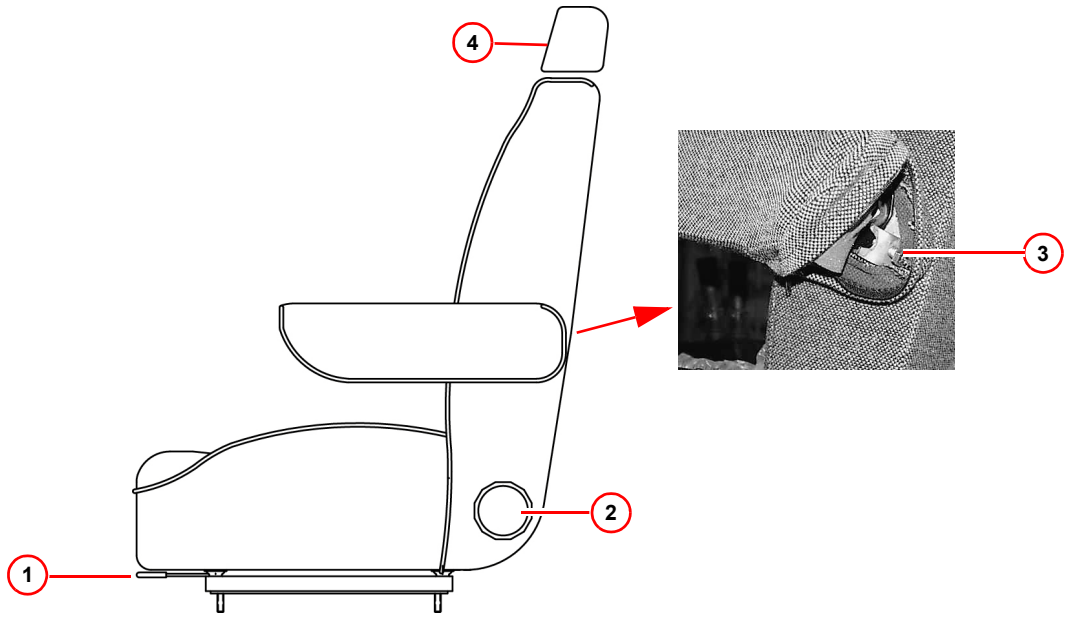
Table 3-6. Overhead Console

5	Self-Assembly Controls (operable only in setup mode) To turn on setup mode, see instructions in Section 4 of MLC165-1 Operator Manual. The swing/travel alarm will sound when these switches are operated.	M100290A 

Item	Description
A	Self-assembly cylinder switch: used to retract and extend the self-assembly cylinder. The cylinder can also be operated using the Drum 3/4 control handle as instructed on page 3-17. • Press  to RETRACT the self-assembly cylinder. • Press  to EXTEND the self-assembly cylinder.
B	Mast-assist arms switch: used to raise and lower the mast assist arms. Refer to Section 4 of the MLC165-1 Operator Manual for detailed mast raising and lowering instructions. • Press  to RAISE the mast assist arms (extend cylinder). • Press  to LOWER the mast assist arms (retract cylinders).
C	Boom hinge pins switch: used to engage and disengage the boom hinge pins. Refer to Section 4 of the MLC165-1 Operator Manual for detailed mast raising and lowering instructions. • Press  to DISENGAGE the boom hinge pins. • Press  to ENGAGE the boom hinge pins.

Seat Controls

Table 3-7. Seat Controls

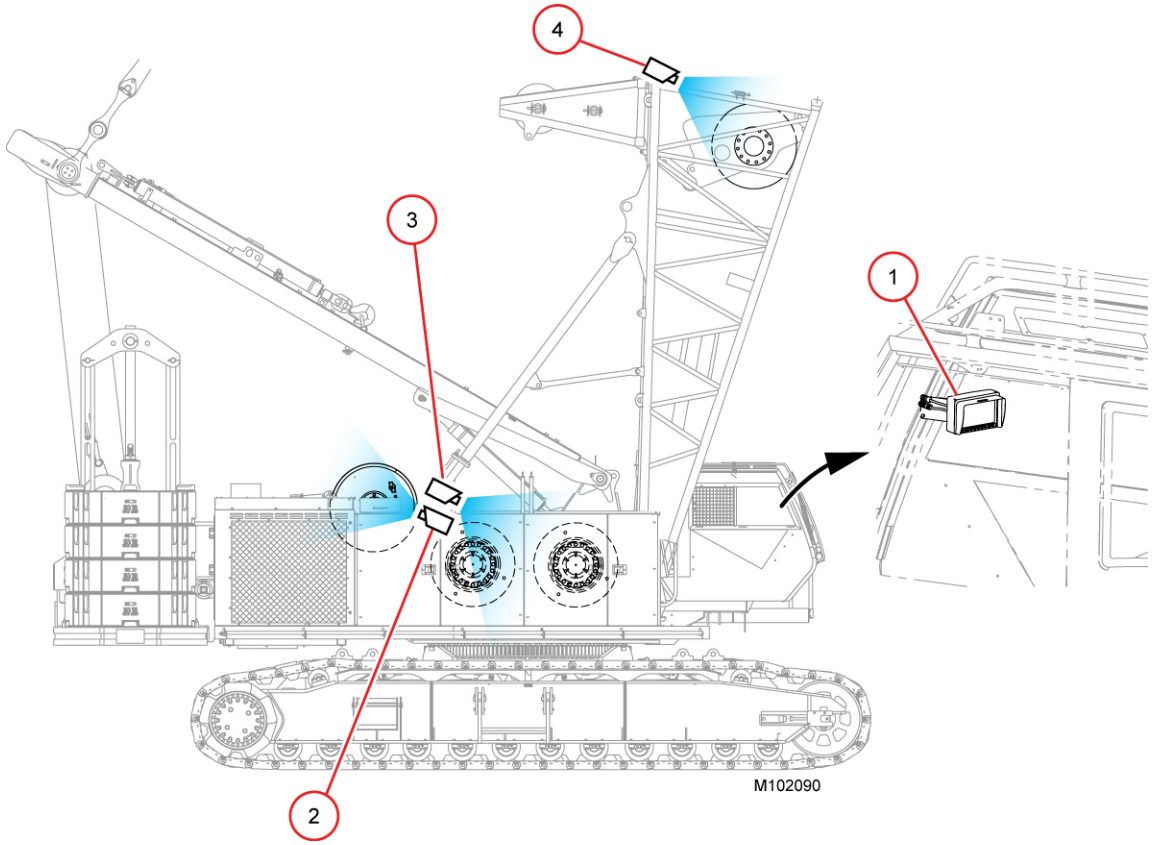


M100812, M100822

Item	Name	Description
1	Seat Only Fore-Aft Control	• Push the lever to the left to unlock. • Use body weight to slide the seat to the desired position. • Release the lever and make sure it is latched to lock the seat in position.
2	Backrest Adjust	• Turn the knob to raise and lower the backrest to the desired position.
3	Armrest Adjust	• Open the zipper at the end of the armrest. • Turn the bolt clockwise to raise the armrest or counterclockwise to lower the armrest. • Tighten the jam nut and close the zipper.
4	Headrest (optional)	• Adjustable up and down.

Camera Controls

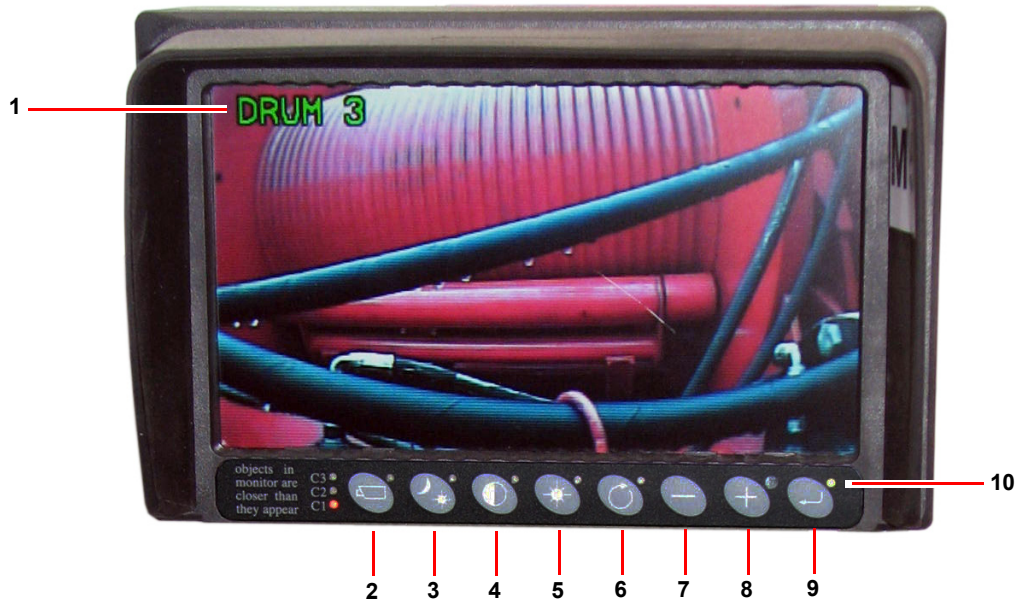
Table 3-8. Camera Controls



Item	Name	Description
1	Camera Monitor	The camera monitor displays the selected drum and contains switches for selecting and operating the cameras. See Camera Monitor Operating Controls on page 3-23.
2	Drum 1 and Drum 2 Camera	Views the front and rear load drums.
3	Drum 4 Camera	Views the boom hoist drum.
4	Drum 3 Camera	Views the drum in the boom butt (auxiliary or luffing).

NOTE Each camera has a light. To turn the camera lights on and off, see Light Switches on page 3-19.

Table 3-9. 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 one of the three cameras.
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, *decreases* the monitor brightness. After pressing Contrast, *decreases* the monitor contrast. In the Operator Menu, go to the *previous* menu option.
8	Plus Button	After pressing Brightness, *increases* the monitor brightness. After pressing Contrast, *increases* the monitor contrast. In the Operator Menu, go to the *next* menu option.
9	Enter Button	Press once to enter the monitor Operator Menu.
10	Power LED	Glows green when the monitor is powered.

BYPASSABLE LIMITS IDENTIFICATION

Limit	Limit Bypass Switch		External Bypass Switch[1]
	Non-CE	CE [2]	CE [2]
Boom Max Up	No	No	No
Block Up (each load line)	Yes	Yes [3]	No
Minimum Bail (each drum)	Yes	No	No
Mast too Far Forward (see Section 4)	No	No	No
Control Handle Faults	Yes [5, 6]	Yes [5, 6]	Yes [5, 6]
Swing Limiter	No	No	No
Rated Capacity Indicator/Limiter	Yes	Yes [3, 4]	Yes

[1] Cranes meeting CE requirements are equipped with this switch located outside the operator cab. See the MLC165-1 RCL/RCI Manual.

[2] CE = Cranes that comply with European requirements. Cranes meeting European requirements are equipped with an RCL/RCI External Override Switch located outside the operator cab (see the MLC165-1 RCL/RCI Manual).

[3] Only if the boom is below an allowable angle given in the capacity chart (while raising or lowering the boom from or to the ground level).

[4] Rated capacity bypassed up to 110%. The speed of the crane functions is limited to 25% of their maximum speed for movements that increase load.

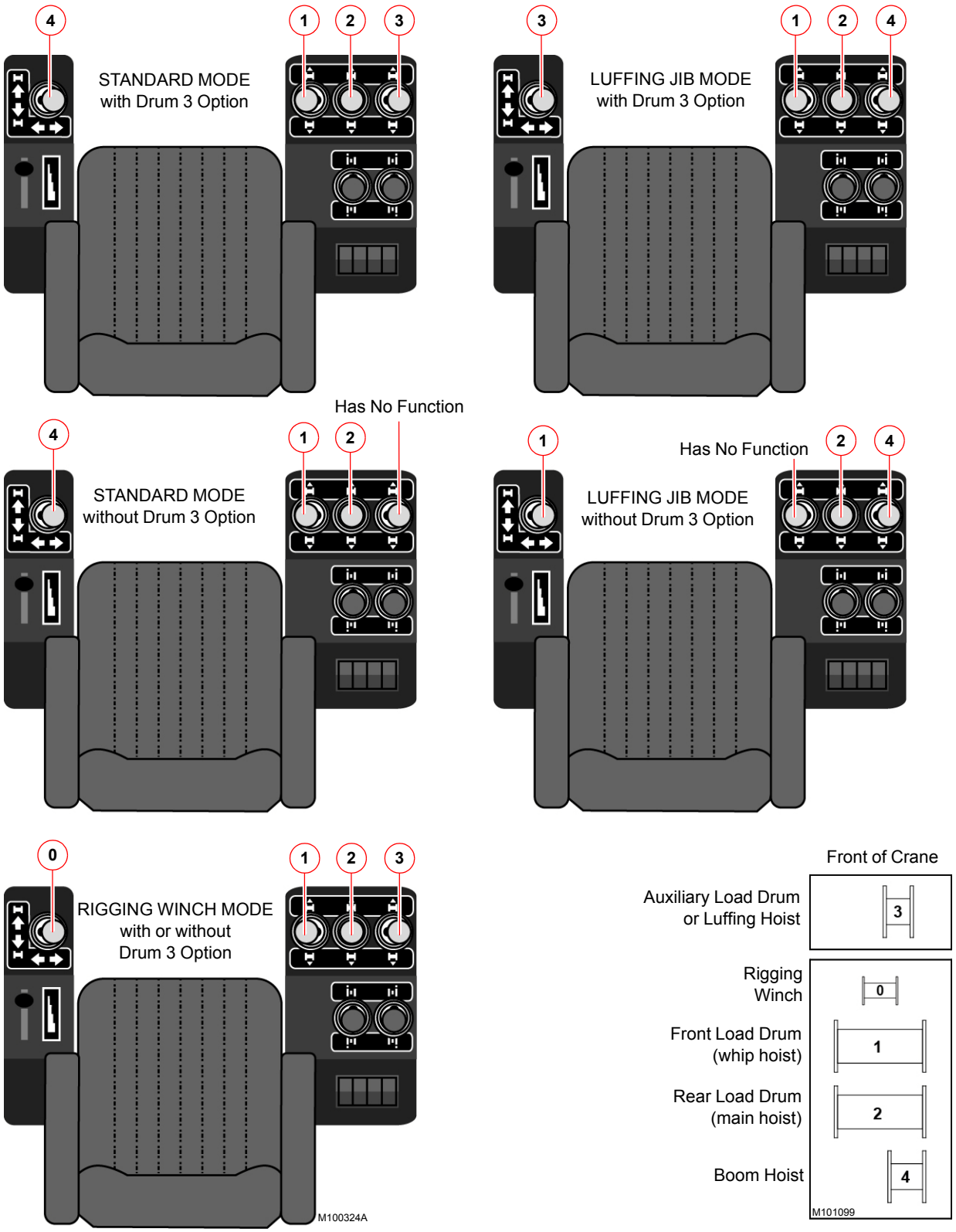
[5] The alarm will sound.

[6] Not bypassable when crane is in setup mode and boom hoist is being operated.

For luffing jib limits and faults, see the MLC165 Luffing Jib Operator Manual.

HANDLE-TO-DRUM IDENTIFICATION

CIRCLED NUMBERS CORRESPOND TO DRUM NUMBERS



BOOM ANGLE INDICATOR

The boom angle indicator (Figure 3-1) is located on the boom butt and is visible outside the right cab window. The indicator shows the angle of the boom in degrees above horizontal.

NOTE The boom, luffing jib, and mast angles can be viewed on RCL/RCI display or the Main display.

M102145

Figure 3-1. 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, the radius shall govern the capacity. Exceeding the radius given in the capacity chart can result in tipping or structural damage.

RCL/RCI WARNING LIGHT

The purpose of the RCL/RCI warning light (11, page 3-2) is to alert personnel in the vicinity of the crane of the degree to which the crane is operating within its rated capacity:

- Green On = Crane's rated capacity is at a safe level.
- Amber Flashing On-Off = Crane's rated capacity is approaching the maximum level.
- Red Flashing On-Off = Crane's rated capacity has been exceed.

The warning light colors correspond to the color shown in the rated capacity bar or triangle in the RCL/RCI display.

UPPERWORKS BUBBLE LEVEL

The bubble level (Figure 3-2) is mounted on the left side of the rotating bed and is visible from the right cab window.

The level indicates crane levelness, as follows:

- The crane is level when the bubble is centered in the circle.
- The crane is one degree out of level when the bubble is touching the outside edge of the circle.

WARNING

Crane Tipping Hazard

Unless otherwise specified in the capacity chart, perform all crane operations with the crane level to within one percent of grade (0.5°) in all directions—1 ft in 100 ft (0.3 m in 30 m); otherwise, the crane could tip.

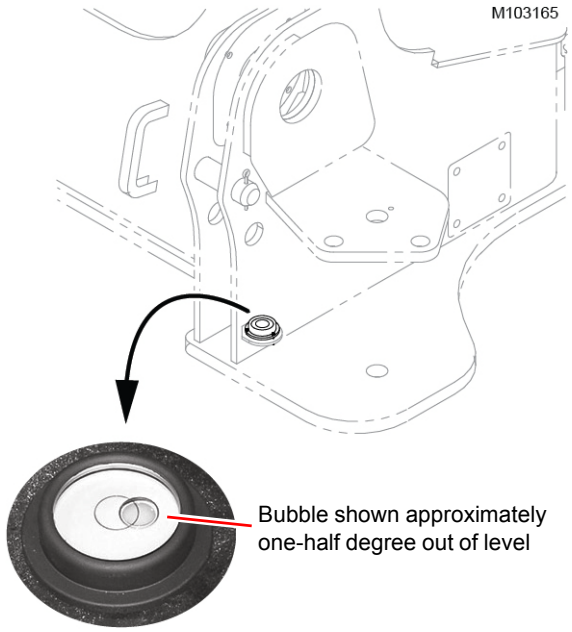


Figure 3-2. Bubble Level

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SETUP CONTROLS

The following setup controls are provided to operate the crane during assembly and disassembly:

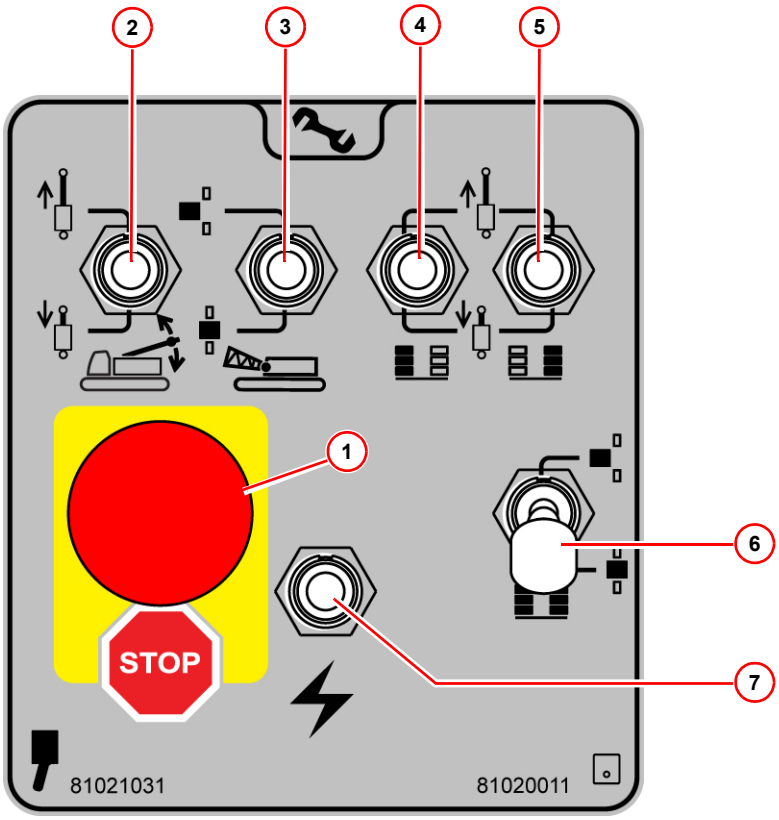
- Remote control (hand-held)
- Carbody controls (see page 3-30)

To use these controls, the crane must be in the setup mode and the desired control icon must be enabled in the setup function mode screen of the main display. See Section 4 of the MLC165-1 Operator Manual for instructions.

- When the remote control is enabled in the setup mode, the swing/travel alarm will sound when a setup function is operated from the remote control.
- When the carbody controls are enabled in the setup mode, the swing/travel alarm will sound continuously.
- For cranes meeting CE requirements, the controls in the operator cab and on the setup remote control cannot be operated when the carbody controls are enabled and vice versa.

Remote Control

Table 3-10. Remote Control Switches



M100596, M100298

Behind Front Door of Right Side Enclosure

M102146

Item	Name	Description
1	Emergency Stop Button	• Press button to stop the engine and all remote control functions. • Pull up button in order to restart the engine. ***Only use this button in an emergency because the engine will stop and any function being used will come to an abrupt stop.*** In normal situations, use the ignition switch to stop the engine.

Table 3-10. Remote Control Switches

2	Mast Cylinders	• Press  to RAISE the mast-assist arms. • Press  to LOWER the mast-assist arms.
3	Boom Hinge Pins	• Press  to DISENGAGE the boom hinge pins. • Press  to ENGAGE the boom hinge pins.
4	Left Counterweight Cylinder	• Press  to RAISE the corresponding side of the counterweight assembly. • Press  to LOWER the corresponding side of the counterweight assembly. Operate both switches at the same time to raise and lower the counterweight assembly. If either side gets out of level, stop and operate only the corresponding switch to re-level the assembly.
5	Right Counterweight Cylinder	
6	Counterweight Pins (must pull up to unlock)	• Press  to DISENGAGE the counterweight pins. • Press  to ENGAGE the counterweight pins.
7	Power Toggle	• Press and hold to turn on power to the hand-held remote control. • Release to turn off power to the hand-held remote control.

3

Carbody Controls

The carbody controls are mounted on the right-front side of the carbody.

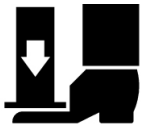
The speed at which jacks and pins operate depends on the amount of control handle movement and engine speed.

CAUTION

Avoid Damaging the Jacks

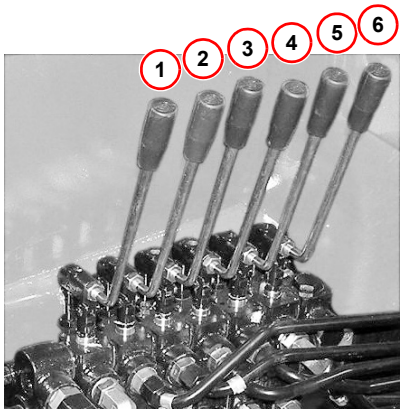
Fully retract the jacks before traveling.

WARNING



To avoid serious injury:

- Keep feet clear of moving jacks.
- Warn all personnel to stay clear of the jacks while they are being extended.
- If the jacks or crawler pins are not visible from the control handles, use a signal person or spotter who can ensure that personnel are clear.



M100280

Table 3-11. Carbody Control Handles

1	Right Front Carbody Jack	Push the handle toward the carbody to raise the carbody (extend jack). Release the handle to center to stop the jack. Valves on the jack lock it in position. Pull the handle away from the carbody to lower the carbody (retract jack).
2	Right Rear Carbody Jack	
5	Left Front Carbody Jack	
6	Left Rear Carbody Jack	
3	Right Crawler Pin	Push the handle toward the carbody to engage the crawler connecting pins. The crawler locking pins must be installed to lock the connecting pins in the engaged position Release the handle to center to stop the pins.
4	Left Crawler Pin	

OPERATING LIMITS AND FAULTS

The following limits and faults can be activated during crane operation.

For luffing jib limits and faults, see the MLC165 Luffing Jib Operator Manual.

WARNING

Falling Boom/Jib Hazard

Do not raise boom above specified maximum angle. Boom and jib could be pulled over backward.

Boom Max Up Limit

Fault 55

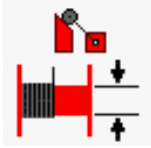
A limit switch stops the boom hoist when the boom is raised to the maximum angle.

- 82.7° for boom without luffing jib
- 88.0° for boom with luffing jib

To correct the fault once it is activated, lower the boom. This fault cannot be bypassed.

The boom max up limit angle must be adjusted each time the luffing jib is installed or removed. See the Service Manual for the adjustment procedure.

Minimum Bail Limit



Fault 57

A limit switch stops the drum in the pay-out direction if three wraps of wire rope remain on the drum.

To correct the fault once it is activated, haul-in rope onto the drum.

To remove wire rope from the drum, the limit bypass switch can be used to pay out the wire rope beyond the limit.

Block-Up Limit

WARNING

Two-Blocking Hazards

If it is necessary to hoist a load above the block-up limit, do so slowly with extreme caution to prevent two-blocking.

Do not use the limit bypass switch to lower the boom after the block-up limit is contacted, otherwise two-blocking could occur, causing the load to fall.

Fault 60

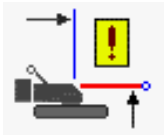
A limit switch stops the boom hoist in the down direction and the load hoists in the up direction if a load is hoisted too close to the point.

To correct the fault once it is activated, operate the boom hoist in the up direction and operate the load hoist in the down direction.

The limit bypass switch must be turned to the bypass position before a load can be hoisted above the limit.

Mast Too Far Forward

Fault 66



This limit stops the mast if it is lowered to 160°. To correct the fault once it is activated, operate the boom hoist in the up direction.

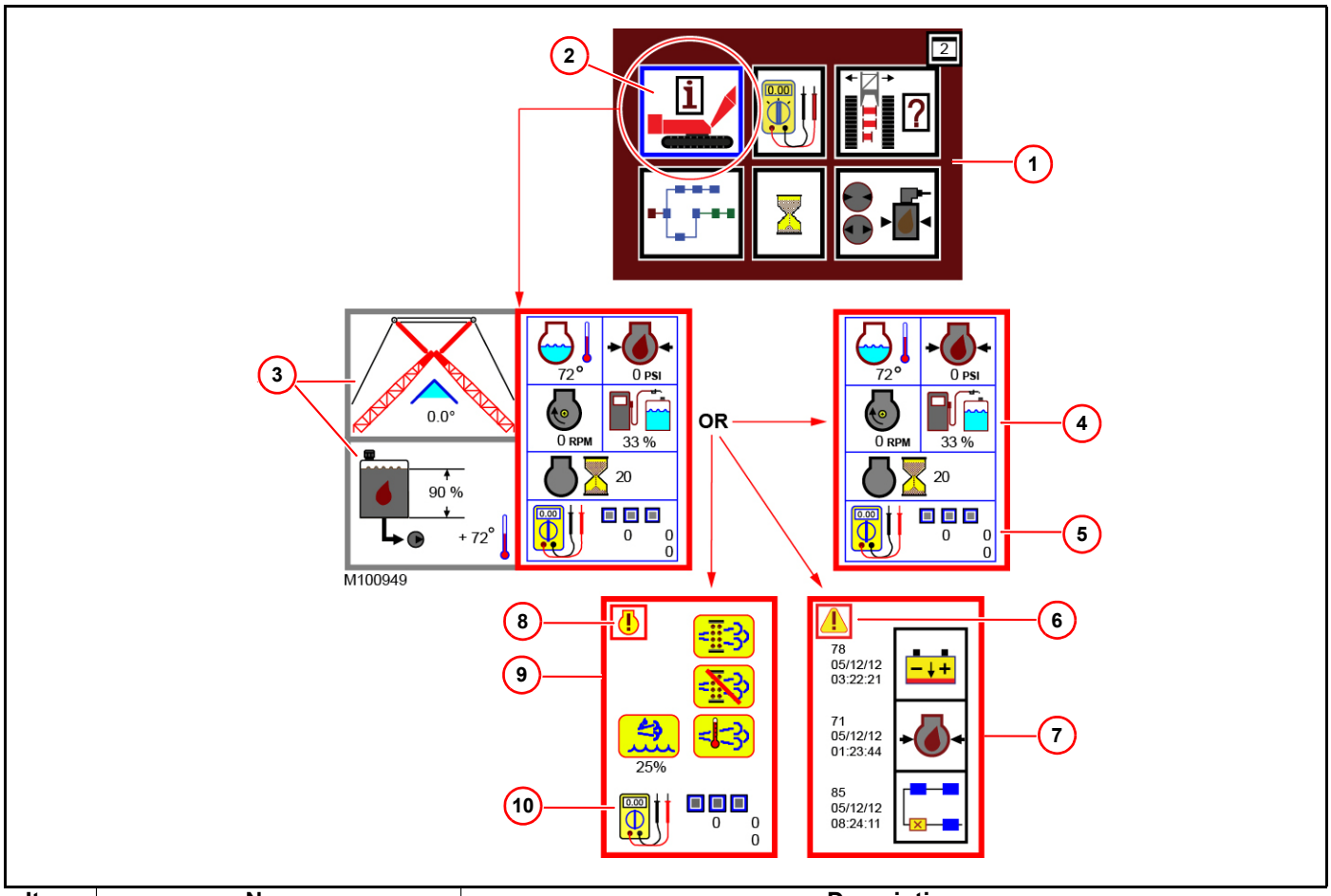
Rated Capacity Limit

Fault 54

This software limit stops the hoist in the raise direction if the crane's rated capacity is exceeded. See the MLC165-1 RCL/RCI Manual for instructions.

MAIN DISPLAY INFORMATION SCREEN

Table 3-12. Main Display Information Screen

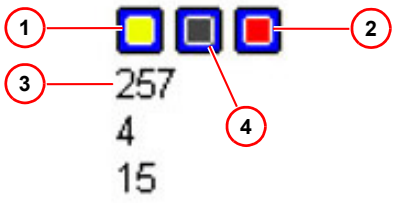


Item	Name	Description
1	Main Display	The Main Display is mounted in the front control console. It displays operating conditions, faults, and diagnostic information. See the MLC165-1 Main Display Operation Manual for instructions.
2	Information Screen	The Information Screen shows all of the general crane information that can be viewed during operation. The information screen contains three data boxes that may be individually tailored by the operator to show the desired information. See the MLC165-1 Main Display Operation Manual for instructions on selecting and scrolling through the screens.
3	Crane Information Data Boxes	Displays crane operating conditions. See the MLC165-1 Main Display Operation Manual for a complete list of operating conditions and for instructions on scrolling through the screens.
4	Engine Operating Conditions	Displays temperature, pressure, and other operating conditions for both the Tier 3 and Tier 4 engine. See the MLC165-1 Main Display Operation Manual for a complete list of operating conditions and specifications.
5	Tier 3 Engine Warning Lights and Fault Codes	See Engine Warning Lights and Fault Codes on page 3-33.
6	System Fault Alert Symbol	Appears in the upper right corner of the information screen, in the upper left corner of the system faults data box (7), and an alarm turns on to alert the operator. See the MLC165-1 Main Display Operation Manual for a complete list of system faults and operating limits. Take corrective action when this alert is activated.

Table 3-12. Main Display Information Screen

7	System Faults Data Box	Displays activated operating limits and faults. See the MLC165-1 Main Display Operation Manual for a complete list of fault symbols and for instructions on scrolling through the faults.
8	Tier 4 Engine Fault Alert Symbol	Appears in the upper right corner of the information screen, in the upper left corner of the Tier 4 engine data box, and an alarm turns on to alert the operator. See the MLC165-1 Main Display Operation Manual for a complete list of Tier 4 engine faults. Take corrective action when this alert is activated. 
9	Tier 4 Engine Data Box	See Tier 4 Engine Faults.
10	Tier 4 Engine Warning Lights and Fault Codes	See Engine Warning Lights and Fault Codes.

ENGINE WARNING LIGHTS AND FAULT CODES



Item	Description
1	Amber Warning Light
2	Red Stop Light
3	Fault Code
4	Has No Function

Figure 3-3. Engine Warning Lights and Fault Codes

The warning lights shown in Figure 3-3 will come on when an engine fault exists. This applies to both Tier 3 and Tier 4 engines. Service the engine as follows:

- Amber warning light (1) ON. Service the engine at the first available opportunity.
- Red stop light (2) ON. Service the engine as soon as it can be safely done.

NOTE: The center indicator (4) has no function.

The engine manufacturer's fault code (3) appears under the lights. See the Engine Wiring Diagram supplied with the crane for a description of these fault codes.

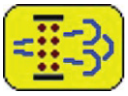
CAUTION

Avoid Engine Damage!

Immediately correct the underlying cause of any engine fault.

TIER 4 ENGINE FAULTS

SCR Regeneration



Displays one of three conditions:

- When on, indicates that the after-treatment system requires an SCR regeneration within the next few hours. Use the SCR switch to manually start an SCR regeneration cycle (see SCR Regeneration Switch on page 3-15).
- When flashing, indicates that the SCR is in regeneration mode. The operator may sense a reduction in power. No immediate action is required.
- When flashing and the red stop light is on, indicates that regeneration is required but is inhibited. The operator will notice a significant reduction in engine power. Turn off the regeneration inhibit switch and perform a manual regeneration immediately (see SCR Regeneration Switch on page 3-15)

SCR Regeneration Inhibited

When on, indicates that SCR regeneration has been inhibited by the SCR switch (see SCR Regeneration Switch on page 3-15).

CAUTION

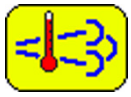
Aftertreatment System Damage

Do not place the SCR regeneration switch in the inhibit mode unless directed to do so by a Manitowoc or Cummins technical advisor.

If SCR regeneration is inhibited for an extended period, the SCR will become damaged and require replacement.

Using the regeneration inhibit mode may result in loss of engine power or shutdown by the ECM and the need to service or replace the SCR.

High Exhaust System Temperature (HEST)



When on, indicates that higher than normal exhaust temperatures exist, normally due to SCR regeneration. It is normal for this indicator to come on during normal operations.

WARNING

High Exhaust Temperatures

Active SCR regeneration can occur at low engine idle as well as during crane operation. This may result in high exhaust temperature.

Always keep personnel well away from the exhaust to prevent injury.

DEF Tank Level

25%

When on, indicates that the level of diesel exhaust fluid (DEF) in the tank is low.

The number below the icon is the percentage of usable DEF remaining in the DEF tank.

- At a 10% level of DEF left in the tank, the alert will come on.
- At a 5% level of DEF left in the tank, the alert will flash on and off.

At engine startup, the DEF tank indicator will flash on and off as the system does a functional test and fills the DEF lines. Within 2 minutes, the indicator should go off unless the DEF level is low.

At engine shutdown, the DEF dosing unit purges the DEF lines and returns the unused DEF to the tank.

NOTE: DEF will freeze at 12° F (–11° C). When frozen, it will expand by 7%. There are no approved additives to improve the freezing point.

WARNING

Chemical Hazard

DEF contains urea. Do not get DEF in your eyes. In case of contact, immediately flush eyes with large amounts of water for a minimum of 15 minutes. Do not swallow. In the event DEF is ingested, contact a physician immediately.

NOTE: Do not store DEF for long periods of time. DEF will deteriorate relative to time and temperature. Low-quality DEF may require the tank to be drained and the system purged.

If the following fault codes are activated, the operator has a limited time to operate the engine with full power:

NOTE: The following time limits are approximate.

- **Low DEF Level (Amber):** This warning comes on when the level of DEF in the tank is 2.5%. Engine power and speed will be reduced.

  If the level falls to 0%, the operator has 30 minutes before engine power will be reduced further.

- **Low DEF Level (Red):** This warning comes on when the level of DEF in the tank has been 0% for 30 minutes.

  The engine will continue to operate at reduced power and speed for another 30 minutes, then the engine will shut down.

- **Low DEF Quality (Amber):** This warning comes on when the DEF in the tank is of poor quality. If not corrected:

  After 150 minutes, engine power and speed will be reduced.

  After another 75 minutes, engine power will be further reduced. The engine will run in this condition for 15 minutes, then the red indicator will come on.

- **Low DEF Quality (Red):** This is the final warning. If the problem is not corrected, the engine will operate at reduced power and speed for 30 minutes, then the engine will shut down.

- **SCR Malfunction or Tampering (Amber):** This warning comes on when a problem with the SCR has been detected. If not corrected:

  After 150 minutes, engine power and speed will be reduced.

  After another 75 minutes, engine power will be further reduced. The engine will run in this condition for 15 minutes, then the red indicator will come on.

- **SCR Malfunction or Tampering (Red):** This is the final warning. If the problem is not corrected, the engine will operate at reduced power and speed for 30 minutes, then the engine will shut down.

NOTE: The above is only a partial list of faults that may be set by the engine ECM.

EMERGENCY CAB EXIT

If a situation arises that prevents the sliding door from opening, the front window may be kicked out. It is designed to give way if firmly kicked from the inside of the cab.

CAB VENTILATION

The right window, rear window, and the overhead window (non-CE crane) can be opened for ventilation.

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) shall 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:

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 Capacity Charts provided with the crane and attachment.

CRAWLER BLOCKING

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 Capacity 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.

OPERATING PROCEDURES

Preparing the Crane for Operation

WARNING

Read and Use the Capacity Charts

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

The crane must be rigged and operated according to the instructions given in the capacity charts and rigging guides.

Unless otherwise specified in the capacity charts, all crane operations shall be performed with the crane level to within 1% of grade in all directions—1 ft in 100 ft (0,3 m in 30 m), otherwise the 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 Wind Conditions chart located at the end of this section and in the Capacity Chart Manual.

Failing to comply with the requirements of the capacity charts can result in tipping or structural failure of the boom or luffing 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 3-49 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 must be in the enable position (on) and all the limits with which the crane is equipped must be operational before operating the crane.

Avoid injuring personnel in operating area

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

Moving Machinery Hazard

To avoid injuring personnel or damaging the crane and property:

- Do not start the engine if an out-of-order or a Do Not Operate tag is present at the start controls.
- Check that all controls are off 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 the 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

Avoid Machinery Damage

Before operating the crane at start of each shift:

- Perform the preventive maintenance checks and lubrication requirements. See Sections 5 and 6 of the MLC165-1 Operator Manual.
- Adjust the operator seat (see Seat Controls on page 3-21).

Startup Procedure

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

1. If used, unplug or turn off the engine block heater, engine oil pan heater, hydraulic tank heaters, and any other crane heaters. See Cold Weather Heater Package on page 3-53.

NOTE The hydraulic oil must be heated to at least 32°F (0°C) prior to start-up. Tank heaters are available from Manitowoc.

Manitowoc recommends using the Cold Weather Package to aid start-up when the ambient temperature will be 32°F (0°C) and below.

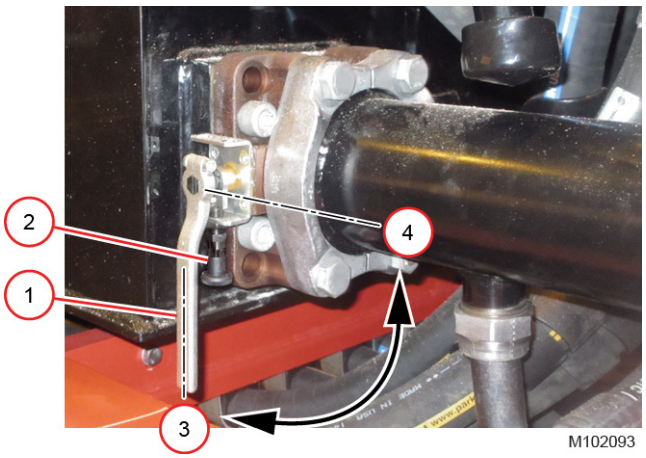
CAUTION

Avoid Pump Damage

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

2. Make sure the hydraulic tank shutoff valve (Figure 3-4) located at the rear of the hydraulic tank is open.

Left Side of Crane



Item	Description
1	Valve Handle
2	Locking Pin (pull out to turn handle)
3	Close
4	Open

Figure 3-4. Hydraulic Tank Shutoff Valve

3. Make sure the battery disconnect switch (Figure 3-5) located in the right side enclosure is connected.

   When the switch is in the connected position, the handle (1) can be removed to prevent unauthorized operation.

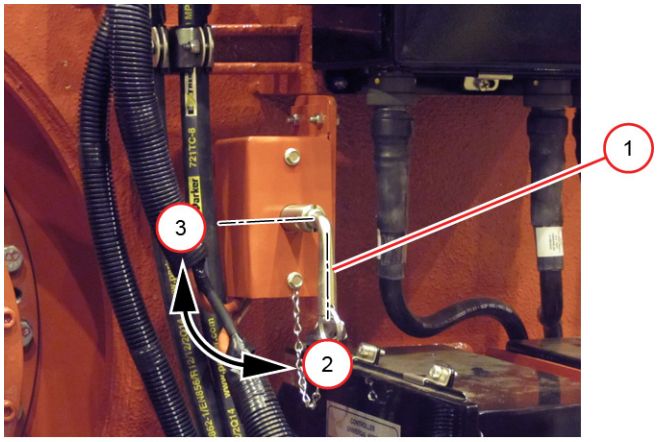
CAUTION

Avoid Engine Damage

To avoid possible engine fault codes and undesirable operation, make sure the 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 battery cables at the batteries before welding.

Right Side of Crane



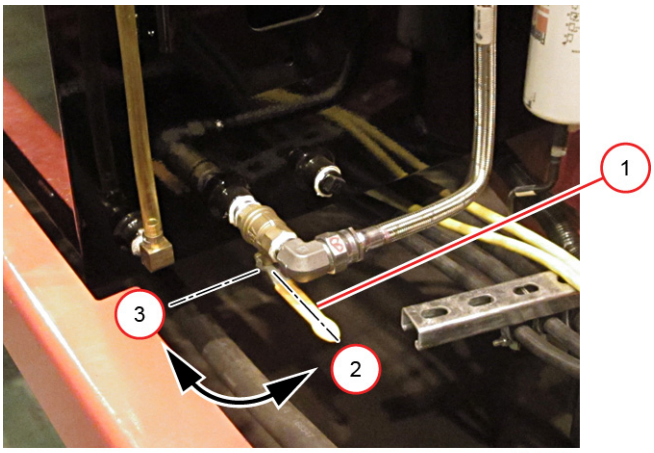
M102092

Item	Description
1	Handle
2	Connected
3	Disconnected

Figure 3-5. Battery Disconnect Switch

4. Make sure the fuel system shut-off valve at both ends of the fuel tank (1, Figure 3-6) is open.

Right Side of Crane at Both Ends of Fuel Tank



M102091

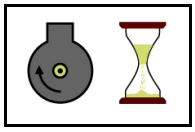
Item	Description
1	Valve Handle
2	Open
3	Close

Figure 3-6. Fuel System Shut-Off Valves

5. Make sure the emergency stop button is UP in the cab an on the remote control. The engine will not start if either button is down (see Emergency Stop Button on page 3-13).

6. Turn the ignition switch to the RUN position.

   - All indicator lights, operating limit buzzer, and the system fault beeper should come on for 2 to 3 seconds when ignition switch is in the RUN position. If any do not, troubleshoot as soon as possible.
   - The WAIT-TO-START icon will appear on the main display indicating that the pre-heater is warming the engine's air intake.



7. When the WAIT-TO-START icon disappears (4–5 seconds), 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 that the starter motor cools.

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

NOTE It is normal for faults to appear when the engine is started. The faults should go away as soon as the engine oil pressure and hydraulic oil temperature rise to normal.

Fault 65 will remain on until the hydraulic oil temperature is 60° F (15° C). ***There will be no throttle response until this fault is cleared.***

To allow the hydraulic oil to warm up during cold weather startup, the crane can be in standard or setup mode. Do not activate any lower accessory functions until the hydraulic oil has warmed up to a minimum operating temperature of 60° F (15° C).

For fault identification, see the MLC165-1 Main Display Operation Manual.

CAUTION

Avoid Machinery Damage

Do not operate the crane if faults do not go away soon after the engine is started, or if any come on during operation. In case of a fault, immediately:

- Determine the fault on the main display information screen.
- Land the loads, if possible, and park all functions.
- Move all control handles to off.
- Stop the engine.
- Correct the cause of the fault.

9. After the engine is started, the icon shown in Figure 3-7 will appear on the main display showing the current drum designations for the four control handles.

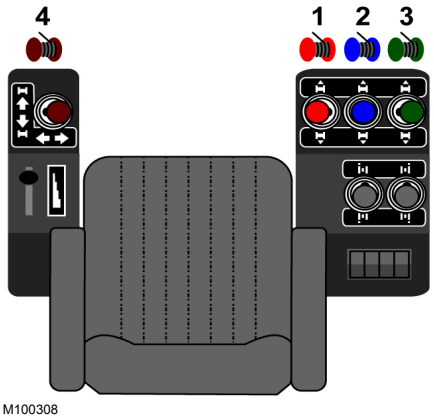


Figure 3-7. Handle Designations

10. Press  on the touch pad.

NOTE To change the control handle settings, use the RCL/RCI display. See the MLC165-1 RCL/RCI Manual.

11. After pressing  , the Information screen will appear on the Main display, similar to the figure below:

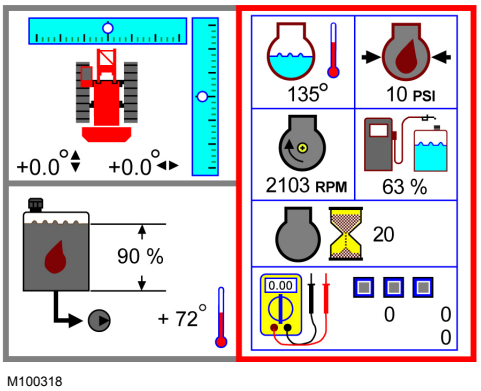


Figure 3-8. Information Screen

12. Use the RCL/RCI display to configure the crane and select the correct capacity chart. See the MLC165-1 RCL/RCI Manual.

NOTE The last chart used will be the current chart.

Boom Hoist (Drum 4) Operation

NOTE The following is only a very basic description of boom hoist operation. All operators must be fully qualified and experienced before operating the crane.

When the crane is equipped with a luffing jib, the boom hoist may be operated with drum handle 3/4 on the right console. See Handle-to-Drum Identification on page 3-25.

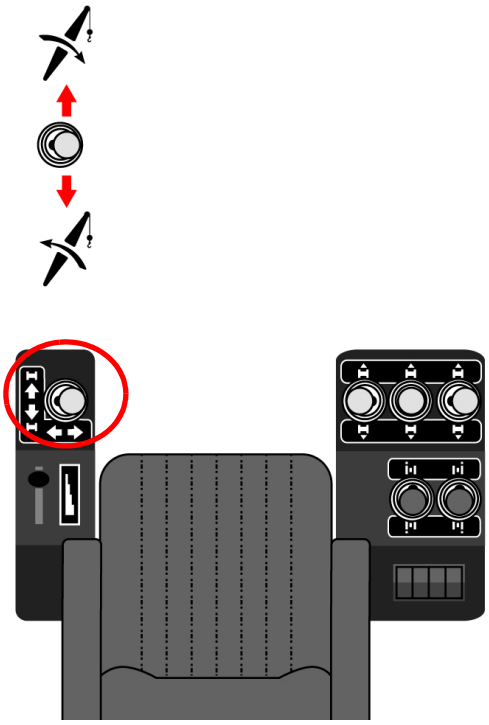


Figure 3-9. Boom Hoist Control Handle

1. If not already done, select the proper crane configuration and capacity chart in the RCL/RCI display. For more information, see the MLC165-1 RCL/RCI Manual.

CAUTION

Avoid Rigging Damage

Check that the boom hoist wire rope is reeved through all required sheaves and spooled properly onto the boom hoist drum before raising the boom from the ground. For related information, see Section 4 of the MLC165-1 Operator Manual for:

- For the Boom Assembly Drawing
- For Wire Rope Installation

2. Turn off the Drum 4 park switch. The Drum 4 pawl will disengage from the drum when the park switch is moved to off.
3. Increase engine speed to the desired rpm with the hand throttle. Press the foot throttle to momentarily increase engine speed when more power is required.
4. Push the boom hoist handle forward to lower the boom or pull the handle back to raise the boom (see Figure 3-9.

WARNING

Two-Blocking Hazard

While lowering the boom, pay out the load lines. Otherwise, the load might contact the boom point or jib point sheaves. This could result in the wire rope parting or other parts breaking, allowing the load to fall.

5. As the boom nears the desired angle, slowly move the handle toward the center position to decrease speed. Then move the handle to the center position to stop the boom. The boom hoist brake will apply.

NOTE Reminder: the crane has an automatic boom stop that stops the boom when it is raised to a preset angle (see Boom Max Up Limit on page 3-31).

The crane also has a physical boom stop. When the boom is raised to 80°, the boom stop springs begin to compress.

As the boom is raised higher, spring compression increases to exert greater force against the boom.

If for any reason the boom is raised to 89.5°, the boom stop springs fully compress to provide a physical stop.

6. To hold the boom in a set position, turn on the Drum 4 park switch. The boom hoist brake will apply and the pawl will engage.

CAUTION

Avoid Boom or Jib Damage

Do not turn on the boom hoist park switch while raising or lowering the boom. This will bring the boom to an abrupt stop which could cause shock load damage to the boom and jib. First bring the boom to a smooth stop with the handle, then turn on the boom hoist park switch.

Avoid Rigging Damage

If equipped with an upper boom point:

When lowering the boom to ground, remove the upper boom point before the upper point contacts the ground.

Swing Operation

NOTE The following is only a very basic description of swing operation. All operators must be fully qualified and experienced before operating the crane.

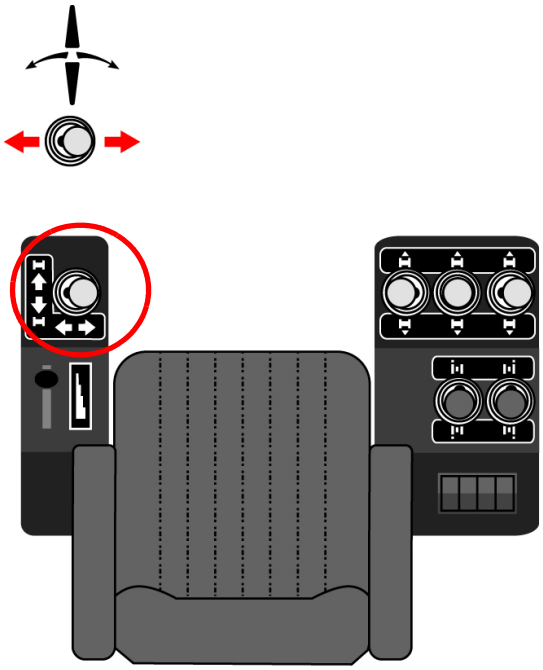


Figure 3-10. Swing Control Handle

WARNING

Crane Tipping Hazard

Prevent the crane from tipping. Adhere to any swing limitations given in the capacity charts.

WARNING

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.

1. Turn off the swing park switch.
2. Increase engine speed to the desired rpm with the hand throttle. Press the foot throttle to momentarily increase engine speed when more power is required.
3. Push the swing handle to the left to swing left or pull the handle to the right to swing right (see Figure 3-10).
4. Start the swing motion with a smooth acceleration. Continue the handle motion to swing at the desired speed.

NOTE Adjust the swing speed and torque, as required, in the main display Function Modes screen. See the MLC165-1 Main Display Operation Manual.

If equipped with the optional swing limit assembly, program the desired automatic swing stops in the swing function modes screen.

5. To stop swinging, release the swing handle. The swing speed will decrease and the rotating bed will coast to a stop.

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

DANGER

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 could cause extensive damage to the boom from side-loading or damage to the swing drive from shock-loading. This equipment failure could result in serious injury or death.

Before applying the swing holding brake or turning on the swing park switch, bring the rotating bed to a smooth stop with the swing handle.

6. Once the rotating bed stops, apply the swing holding brake to hold the rotating bed in position for short periods during the operating cycle.

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

Drum 1 and Drum 2 Full Power Operation

NOTE The following instruction is for non-free fall operation.

The following is only a very basic description of load drum operation. All operators must be fully qualified and experienced before operating the crane.

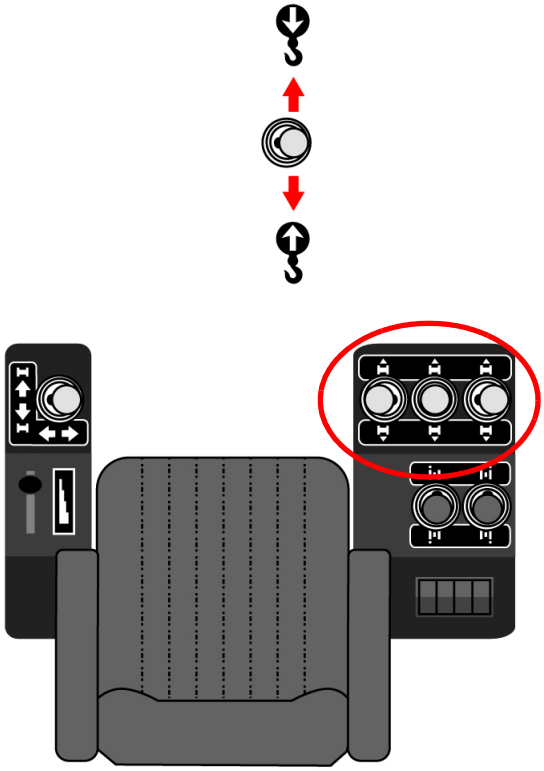


Figure 3-11. Load Drum Control Handles

1. Select the desired crane configuration and capacity chart using the RCL/RCI display. See the MLC165-1 RCL/RCI Manual.
2. Turn off the drum park switch for the drum to be operated.
3. Increase engine speed to the desired rpm with the hand throttle. Press the foot throttle to momentarily increase engine speed when more power is required.
4. Pull the corresponding drum handle back to raise the load or push the handle forward to lower the load.
5. As the load nears the desired position, slowly move the drum handle toward the center position to slow down the load. To stop the load, move the handle to center. The drum brake will apply to stop the hoist and hold the load in position.
6. When a load drum is not being used, turn on its drum park switch.

WARNING

Falling Load Hazard

To prevent the load on the unused drums from falling, turn on the drum park switch for the drums not in use.

CAUTION

Avoid Boom or Luffing Jib Damage

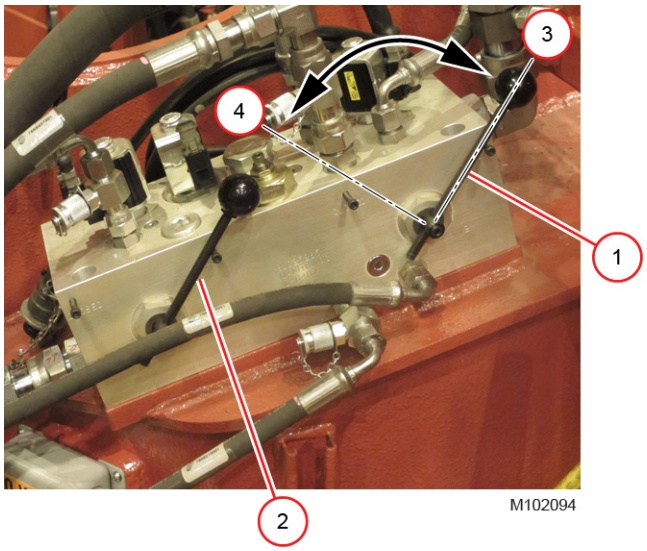
Do not turn on the drum park switch while raising or lowering the load. The brake will bring the load to an abrupt stop. This could cause shock load damage to the boom, luffing jib, and load line.

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

Drum 1 or Drum 2 Free Fall Operation

1. In the RCL/RCI display, select the correct crane configuration and capacity chart, if not already done.
2. To turn on free fall for the desired load drum:
   a. Park the load drums.
   b. Move the desired free fall selector valve handle (1 or 2, Figure 3-12) to the ON position.

Right Side Enclosure



Item	Description
1	Drum 1 (Front) Free Fall Selector Valve
2	Drum 2 (Rear) Free Fall Selector Valve
3	Free Fall OFF (typical both handles)
4	Free Fall ON (typical both handles)

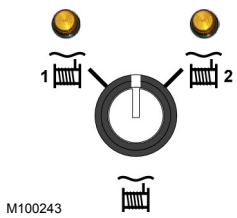
Figure 3-12. Free Fall Valves

   c. Latch down the corresponding free fall brake pedal. This will close a safety switch to allow free fall to be enabled.

      See Free Fall Brake Pedals on page 3-9 for operation of the brake pedals.

   d. Turn off the drum park switch for the desired drum to be operated.

   e. Use the free fall enable/disable key switch to turn on free fall drum for the desired drum. The corresponding amber light will come on to indicate that free fall is enabled for the selected drum.



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

CAUTION

Avoid Gearbox Damage

While a load is being lowered using the free fall brake, leave the drum handle at center. Before using the control handle, use the free fall brake to bring the drum to a complete stop.

Moving the control handle off-center while a load is free falling will immediately engage the motor shaft to the planetary gears, which can result in extensive equipment damage.

4. To raise the load, unlatch the brake pedal and pull the Drum 1 (or Drum 2) handle back.

   As the load nears the desired position, begin to apply the brake and slowly move the drum handle toward center to slow down the load. ***Then fully apply the brake to stop and hold the load.***

WARNING

Falling Load Hazard

In free fall mode, the load will fall uncontrolled when the drum handle is centered unless the brake pedal is applied.

Always be ready to apply the brake pedal so lowering speed can be controlled.

If this is not done, the load can fall, possibly resulting in injury or death.

To prevent the load from falling when free fall is selected, latch down the free fall brake pedal.

5. The load can be lowered in one of two ways: with the brake pedal only or with normal hydraulic power plus the brake pedal.

   To lower a load with the brake pedal only: leave the drum handle at center and slowly release the brake pedal to lower the load at the desired speed.

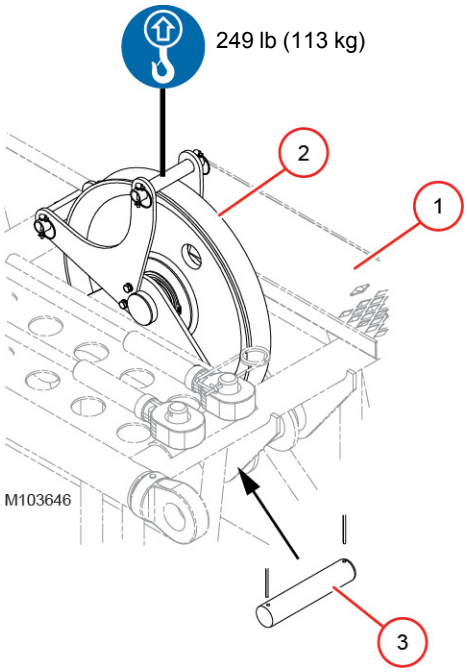
   As the load nears the desired position, increase foot pressure on the brake pedal to slow down the load. Then fully apply the brake to stop the load and hold it in position.

   ***To lower the load with hydraulic power*:** while the brake pedal is held down, push the drum handle forward from center and slowly release the brake. Lowering speed is now controlled by drum handle movement and any desired pressure on the brake pedal.

   As the load nears the desired position, slowly move the

drum handle toward center to slow down the load. ***Then fully apply the brake to stop the load.*** Release the drum handle to center. ***Maintain foot pedal pressure to hold the load in place.***

6. If a load will be suspended for any length of time, latch down the brake pedal and turn on the drum park switch.
7. To turn off free fall for the desired drum:
   a. Latch down the desired brake pedal.
   b. Use the free fall enable/disable key switch to select the free fall drum to be turn off. The amber indicator light will turn off.
   c. Move the corresponding free fall selector valve handle to the off position (Figure 3-12 on page 3-42).



Item	Description
1	Insert with Sheaves: 19.7 ft (6 m)
2	Upper Wire Rope Guide
3	Pin with Cotter Pins (2)

Figure 3-13. Wire Rope Guide

Clamshell Operation

NOTE The clamshell mode should normally be operated with the drum high speed switches on, which (in clamshell mode only) will shift the motors to minimum displacement. Heavier loads may activate the motor pressure compensators, making it difficult to synchronize the drums. If this happens, turn the drum high speed switch off to lock the motors in their maximum displacement position.

In the clamshell mode, the drum maximum speed adjustment screen will adjust motor displacement instead of handle pilot pressure. Start with both drums at 100%. If the drum speed isn't well synchronized, decrease the adjustment of the faster drum so that it slows down and synchronizes with the slower drum.

When operating the boom hoist and clamshell (Drums 1 and 2) simultaneously, some flow from the closing drum will be diverted to the boom hoist. Adjust the holding line handle position to compensate.

Preparing for Clamshell Operation

1. Use the RCL/RCI display to select the appropriate clamshell capacity chart.
2. Turn off the drum park for both drums.
3. Set the engine speed at the desired rpm.

CAUTION

Wire Rope Guide Damage

To avoid damage to the upper wire rope guide in the 19.7 ft (6 m) insert (1, Figure 3-13), remove the upper wire rope guide for clamshell operation.

4. Remove the upper wire rope guide (2, Figure 3-13):
   a. Attach an owner furnished synthetic lifting sling from an assist crane to the top pin in the upper wire rope guide (2).
   b. Hoist until the lifting sling is taut.

c. Remove the pins (3) and lift the upper wire rope guide (2) out of the insert.

d. Store the upper wire rope guide and pins for future use.

Closing the Bucket (Digging)

1. Lower the bucket into the digging area using both control handles.
2. Pull back the closing line handle to close the bucket.
3. Release the closing line handle to off when the bucket is closed fully.

Raising the Bucket

1. Pull both control handles back to raise the bucket at the desired speed.
2. Swing to the dumping area as the bucket rises.
3. Release both control handles to off when the bucket is at the desired height.

Dumping the Bucket

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

NOTE 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 slows down the clamshell cycle.

Lowering the Bucket

1. Push both control handles forward to lower the bucket at the desired speed.
2. Control the lowering speed by slowly moving both control handles toward the off position.

NOTE The lowering speed is controlled by handle movement. It is not necessary to apply the free fall brakes to slow down the bucket in 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. Release the holding line handle to off.
6. Repeat the clamshell cycle.

NOTE Clamshell operation can also be performed with the load drums in the free fall mode. Free fall operation is limited to the following:

- Placing Drum 1 in free fall allows the bucket to dump via free fall when the closing line handle is pushed forward. Use the working brake as needed to control bucket opening.
- Placing Drum 2 in free fall allows the holding line to go slack when the closing line handle is pulled back to dig into material. This allows the weight of the bucket to assist with digging into material. Use the working brake as needed to control bucket lowering.
- To allow Drum 2 free fall to engage, the last direction of the holding line must be in the down direction. This will allow the operator to increase closing line tension while raising the bucket.
- Both modes can be on at the same time, however, you will not be able to free fall both lines at once.

The operator can adjust free fall drum slip to assist in preventing the drums from overspooling.The slip command adjusts the accessory pressure available to both free fall pedals: therefore, a slip adjustment to either Drum 1 or 2 affects both drums.

Travel Operation

CAUTION

Avoid Accelerated Crawler Wear

To reduce wear and tear of the crawler components (treads, rollers, frames), try not to allow dirt to pile up at the tumbler and front 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 direction of travel.
- Turn a few degrees. Then slowly travel forward or reverse so the 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.

Avoid Boom Damage

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

WARNING

Crane Tipping Hazard

For all travel, refer to the Maximum Allowable Travel Specifications chart located in the Capacity Chart Manual.

The travel surface must be firm and uniformly supporting.

When traveling with load:

- The grade must not exceed 1% (0.5°) in any direction.

For traveling without load:

- The allowable grade in the direction of travel depends upon boom angle (refer to the Maximum Allowable Travel Specifications chart).
- The grade from side-to-side must not exceed 2% (1.0°), measured at the boom hinge pins.

Failure to comply with the above instructions can result in tipping.

WARNING

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.

Flying Object and Tread Damage Hazard

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

7. Before traveling:
   - Check the Maximum Allowable Travel Specifications chart located in the Capacity Chart Manual.
   - Plan the travel route. It must be free of obstructions.
   - Check the crawlers for proper adjustment.
   - Warn personnel to stand clear of the travel area. ***Do not travel without a signal person***.
8. Turn off the travel park switch.
9. When ***traveling with a load,*** position the boom at or above the boom angle given in the capacity chart.
   - When ***traveling with a load***, carry the load as close to the ground as possible. Stabilize the load with taglines.
   - When ***traveling without a load***, carry the load block and the weight ball low enough so that they cannot swing into the boom or jib. If desired, tie off the load block at the front of the rotating bed.
10. Align the boom with the crawlers except when swinging is necessary while traveling. Travel with the boom facing in the direction of travel.
11. Increase the engine speed to the desired rpm with the hand throttle. When more power is required, press the foot throttle to momentarily increase the engine speed.
12. Select the desired travel speed—low or high.

NOTE Travel speed may be changed while traveling. The travel motors will shift immediately from high to low when low speed is selected.

In low speed, the travel motors operate at approximately 1/3 of high speed.

The travel motors will not shift from low to high when high speed is selected until:

- Engine speed is at high idle.
- Hydraulic pressure is low enough to allow the motors to shift from low to high speed.

NOTE The following directions of travel are with the ***front of the upperworks (boom end) over the front of the lowerworks (front roller ends of crawlers).***

If the front of the upperworks and the front of the lowerworks face in opposite directions, the crane will travel in the direction opposite of handle movement.

13. To TRAVEL STRAIGHT (Figure 3-14), move both crawler handles the same amount in the desired direction from the center position.

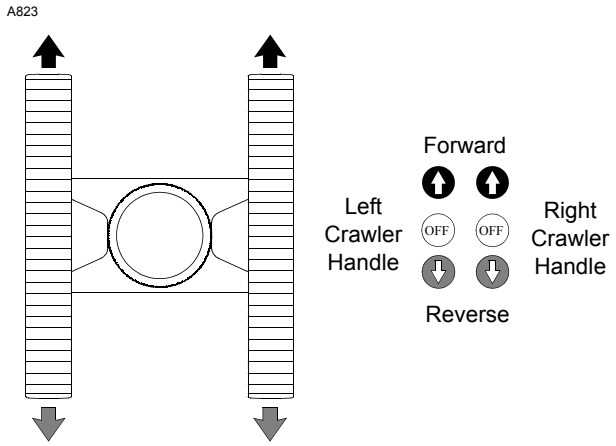


Figure 3-14. Travel Straight

14. To make a SHARP LEFT TURN (Figure 3-15), move the right crawler handle to the front from the center position and leave the left crawler handle in the center position. The crane will pivot about the left crawler.

15. To make a SHARP RIGHT TURN, reverse the previous step.

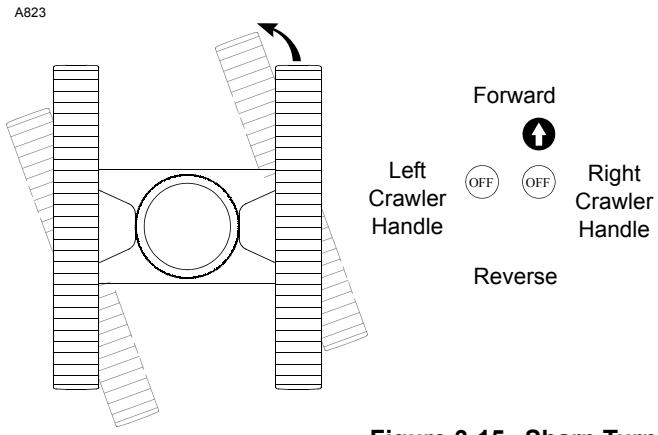


Figure 3-15. Sharp Turn

16. To make a GRADUAL LEFT TURN (Figure 3-16), move both crawler handles to the front from the center position. Move the right crawler control handle farther than the left crawler control handle. The right crawler will turn faster than the left crawler.

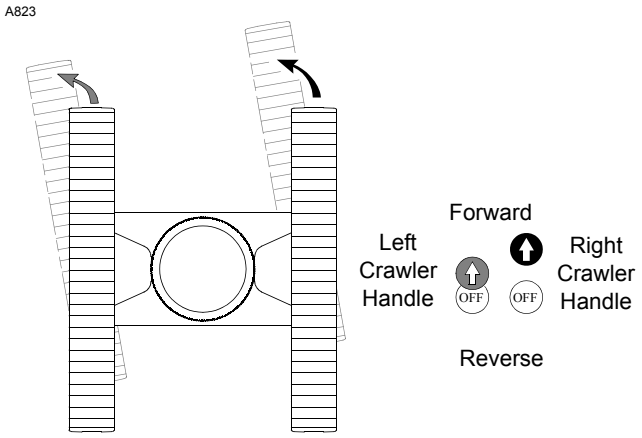


Figure 3-16. Gradual Turn

17. To make a GRADUAL RIGHT TURN, reverse the previous step.

18. To COUNTER ROTATE LEFT (Figure 3-17), move the right crawler handle to the front from the center position. Move the left crawler handle to the rear from the center position.

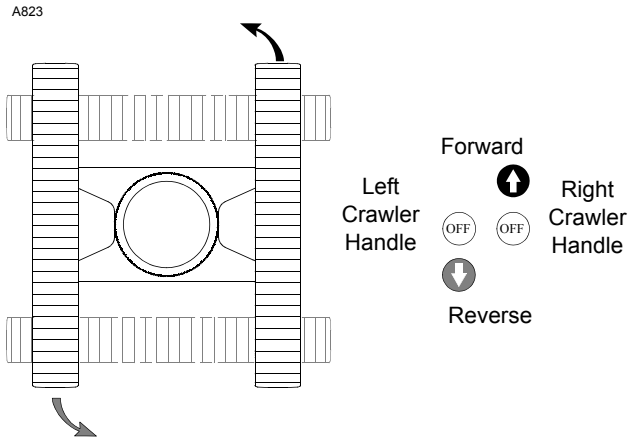


Figure 3-17. Counter Rotate

19. To COUNTER ROTATE RIGHT, reverse the previous step.

20. Slowly move both crawler handles to the center position to stop traveling and to hold the crane in position.

21. When finished traveling, turn on the travel park switch.

Crane Shutdown 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 a 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 luffing jib, if equipped) onto blocking at ground level.

   In event of winds up to 50 mph (22 m/s), place load blocks and weight balls on the ground and position the boom at 68°.

   If wind speeds of 50 mph (22 m/s) or greater are expected, lower the boom 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.

NOTE The qualified designated person shall 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 center 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.

COLD WEATHER OPERATION

Also see Cold Weather Heater Package on page 3-53.

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:

–5 to –22°F (–20 to –30°C):

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

–23 to –40°F (–31 to –40°C):

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

Below –40°F (–40°C):

- 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 the crane accordingly.

CAUTION

Avoid Hydraulic Component Damage

Heat the hydraulic oil to at least 32°F (0°C) prior to start-up. Tank heaters are available from Manitowoc.

Before operating any hydraulic components, always allow the hydraulic system to warm up to 60°F (16°C). Crane can be in standard or setup mode during warm up.

Do not activate any lower accessory functions until the hydraulic system has obtained the minimum operating temperature of 60°F (16°C).

Wire Rope

Wire rope manufacturers state that wire rope will not become brittle in temperatures down to -30°F (-34°C). However, lubrication may be a problem during extreme 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 start-up.

WARNING

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.

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

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

Batteries

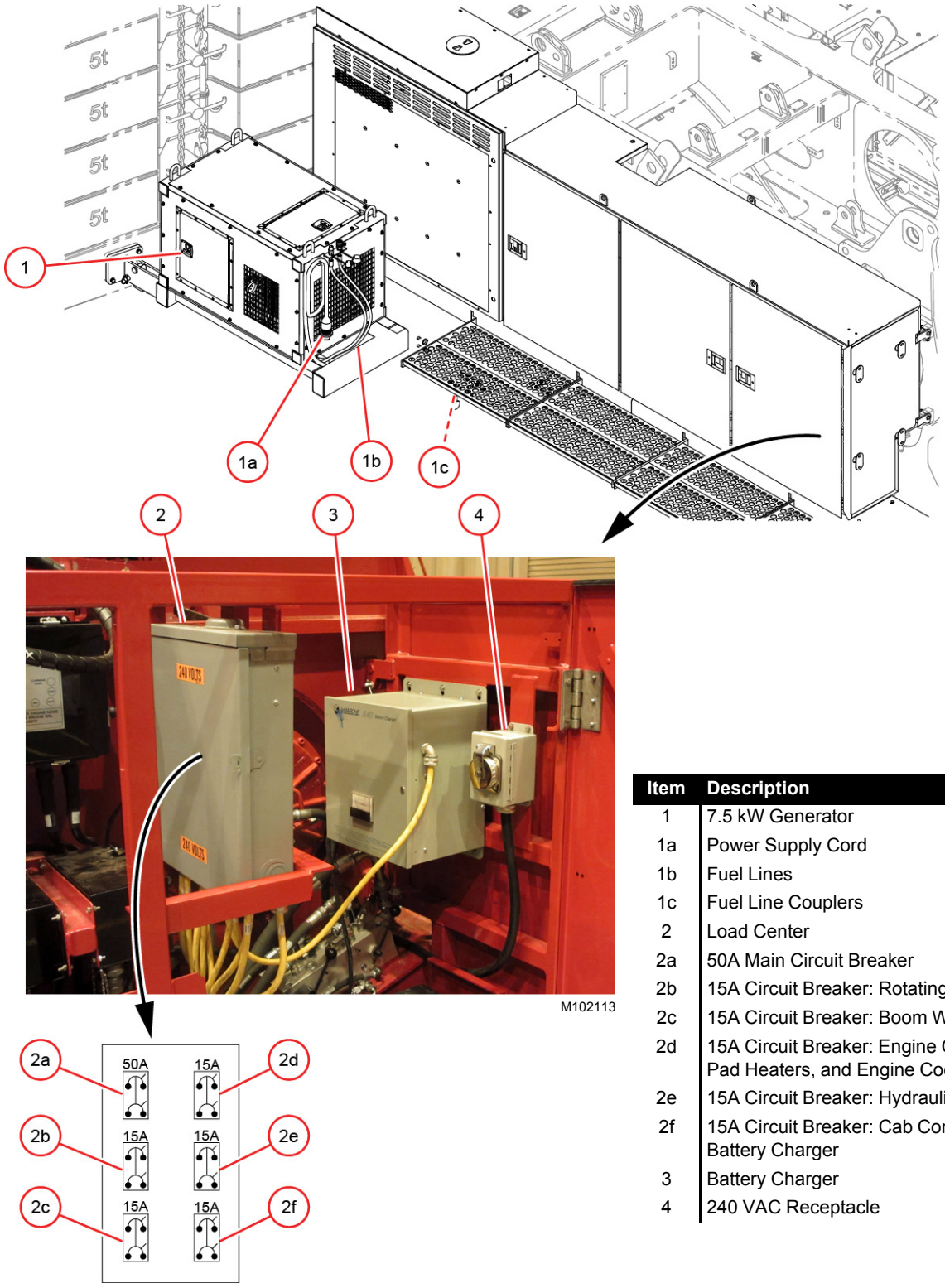
To provide maximum cranking power and to prevent the batteries from freezing, they must be kept fully charged (resting voltage 12.4V–12.6V) and warm when the crane is idle during cold weather.

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

- A battery with a 50% charge freezes at -16°F (-27°C). A battery with a 100% charge freezes at -70°F (-57°C).
- A battery with a 100% charge retains only 40% of its cranking power at -0°F (-18°C). At -20°F (-29°C), 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 MLC165-1 Lubrication Guide.



Item	Description
1	7.5 kW Generator
1a	Power Supply Cord
1b	Fuel Lines
1c	Fuel Line Couplers
2	Load Center
2a	50A Main Circuit Breaker
2b	15A Circuit Breaker: Rotating Bed Work Lights
2c	15A Circuit Breaker: Boom Work Lights
2d	15A Circuit Breaker: Engine Oil Heater, Battery Pad Heaters, and Engine Coolant Heater
2e	15A Circuit Breaker: Hydraulic Tank Heater
2f	15A Circuit Breaker: Cab Console Heater and Battery Charger
3	Battery Charger
4	240 VAC Receptacle

Figure 3-18. 240VAC Electric System

AC ELECTRIC SYSTEM

The generator engine can be operated with either Tier 3 or Tier 4 fuel.

See Figure 3-18 for the following instructions.

The 240 VAC electric system controls the following optional components:

- Rotating bed work lights: four 240V, 200W lights mounted at the four corners of the crane.
- Boom work lights: five 240V, 200W lights mounted in the underside of the boom sections.
- Battery charger.
- Cold weather heater package (see Cold Weather Heater Package on page 3-53).

240 VAC single-phase electric power can be supplied by one of two sources:

- Owner furnished generator
- Optional 7.5 kW crane-mounted generator (1)

  Refer to the generator manufacturer's manual for operating and maintenance instructions.

  The crane-mounted generator receives fuel from the crane's fuel system. Connect the fuel lines (1b) from the generator to the fuel line couplers (1c) under the right platform. Make sure the shut-off valve in the fuel supply line is open.

WARNING

Electrocution Hazard

Severe electric shock can cause death or serious injury.

The crane owner/user shall make provisions for turning off the electrical power supply before connecting or disconnecting the power supply cord to or from the crane.

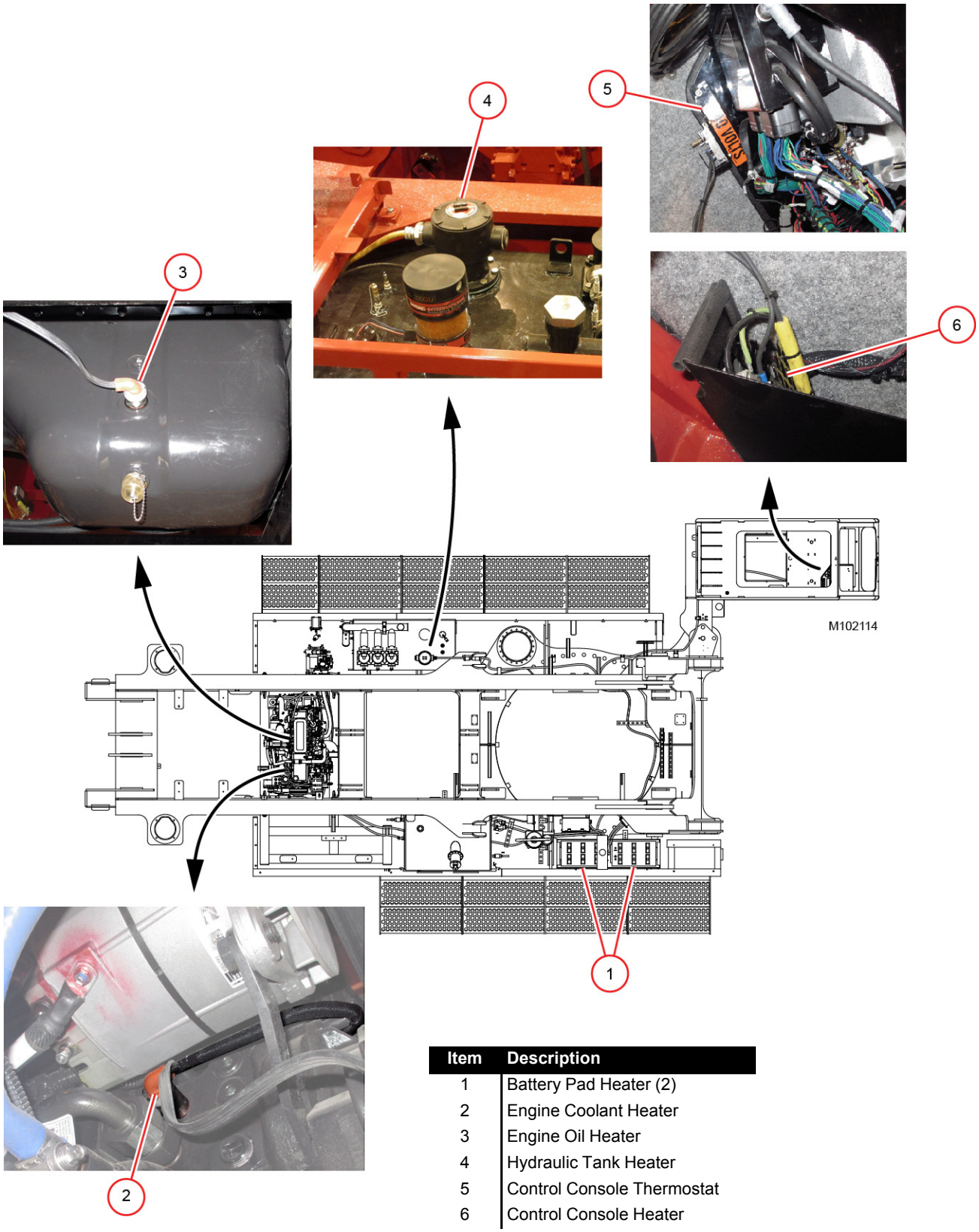
Turning On AC Components

1. Turn off the generator (1).
2. In the load center (2), check that the main circuit breaker and each individual circuit breaker is off.
3. In the operator cab, make sure the beacon and work light switches are off.
4. Connect the power supply cord from the generator to the receptacle (4).

   The power supply cord (1a) from the crane-mounted generator can remain connected at all times.
5. Turn on the generator.
6. In the load center (2), first turn on the main circuit breaker and then turn on the desired individual circuit breakers: work lights, heaters, battery charger.
7. In the operator cab, turn on the beacon and work light switches.

Turning Off AC Components

1. In the operator cab, turn off the beacon and work light switches.
2. In the load center (2), turn off the individual circuit breakers and then the main circuit breaker.
3. Turn off the generator (1).
4. For the owner supplied generator, unplug the power supply cord from the receptacle (4).



Item	Description
1	Battery Pad Heater (2)
2	Engine Coolant Heater
3	Engine Oil Heater
4	Hydraulic Tank Heater
5	Control Console Thermostat
6	Control Console Heater

Figure 3-19. Heaters

CAUTION

Avoid Machinery Damage

Operating in an arctic climate without heaters can damage machinery during cold weather start-up due to lack of lubrication.

When the MLC165-1 is operated in an arctic climate, defined as an outside temperature continuously below 0°F (–18°C) and –30°F (–34°C), the crane should be equipped with heaters identified in this section and lubricated with the lubricants listed in the Lubrication Guide.

COLD WEATHER HEATER PACKAGE

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

See Figure 3-19

- Battery pad heaters (1): two, 75 watts each.
- Engine coolant heater (2) 1,000 watt.
- Engine oil heater (3): 300 watts.

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 (4): 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 60°F and off at 80°F (16°C and 21°C).

- Control console air heater (6): 125 watt.

  The thermostat (5) turns on the control console air heater at 50°F and off at 60°F (10°C and 16°C).

The heater package is powered by the AC Electric System described on page 3-51.

Refer to Figure 3-18 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 On AC Components on page 3-51.

To turn the heaters OFF, see Turning Off AC Components on page 3-51.

3

STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS

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

Table 3-13. Standard Hand Signals for Controlling Crane Operations

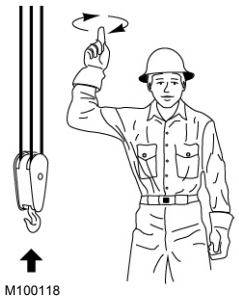
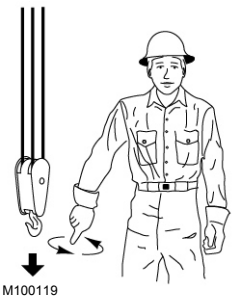
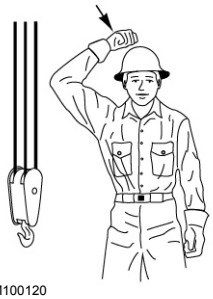
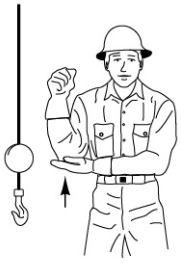
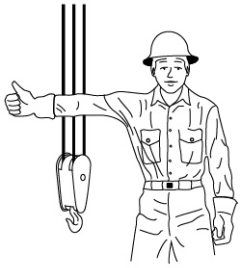
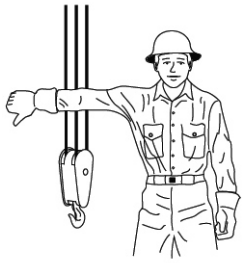
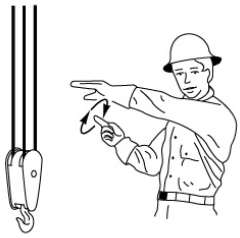
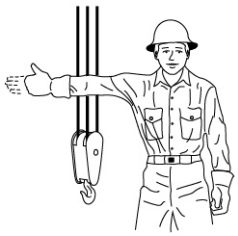
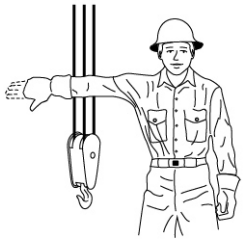
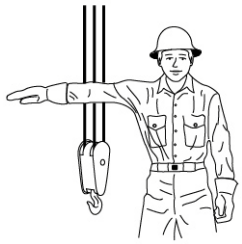
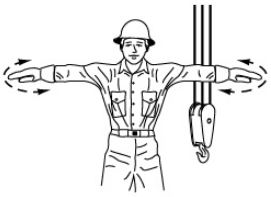
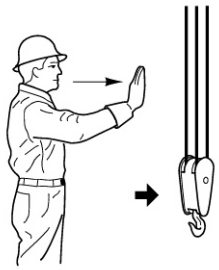
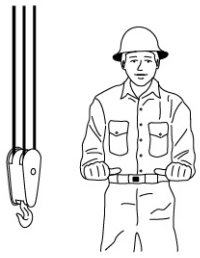
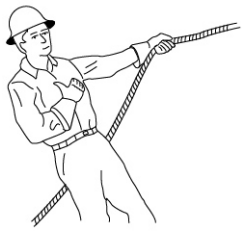
1	2	3	4	5
 M100118	 M100119	 M100120	 M100121	 M100122
6	**7**	**8**	**9**	**10**
 M100123	 M100124	 M100125	 M100126	 M100127
11	**12**	**13**	**14**	**15**
 M100128	 M100129	 M100130	 M100131	 M100132
16	**17**	**18**	**19**	**20**
 M100133	 M100134	 M100135	 M100136	 M100137

Table 3-13. Standard Hand Signals for Controlling Crane Operations

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

SYMBOLS USED ON CONTROL CONSOLES

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

Table 3-14. Symbol Identification

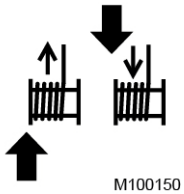
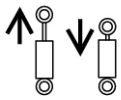
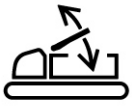
 M100138	Air Conditioning	 M102079	Cylinder, Self-Assembly
 M100141	Alert Symbol, Safety	 M100147	Decrease/Increase
 M102074	Counterweight, All	 M100148	Drum
 M102072	Counterweight, Left	 M100149	Drum, Free Fall
 M102073	Counterweight, Right	 M100150	Drum, Lower or Raise
 M100144	Cylinder, Extend and Retract	 M100151	Drum Number (position varies)
 M102080	Cylinders, Mast Arms	 M102071a	Drum 3/4 High Speed

Table 3-14. Symbol Identification

 M100154	Energize or 12v Power	 M100284	Engine SCR Regeneration
 M100155	Engine	 M100161	Engine Stop
 M100156	Engine Battery	 M100142	Fan
 M100157	Engine Fuel	 M102070	Heater
 M100158	Engine Pressure	 M100164	Horn
 M100159	Engine Run	 M102077	Light, Boom
 M100160	Engine Start	 M102075	Light, Cab
 M100285	Engine SCR Inhibit	 M102078	Light, Camera

3

Table 3-14. Symbol Identification

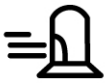
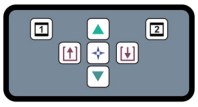
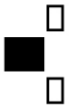
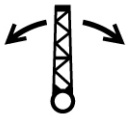
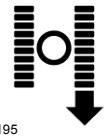
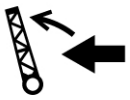
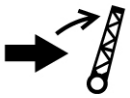
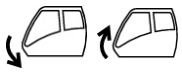
 M100165	Light, Panel	 M101959	Park Off
 M100291	Light, Position	 M100170	Park On
 M102076	Light, Rotating Bed	 M100224	Pad, Touch (see page 3-12)
 M100166	Light, Work	 M100166 M102081	Pins, Boom Hinge
 M100167	Lighter	 M100177	Pins, Disengage
 M100168	Limit Bypass	 M100178	Pins, Engage
 M100170	Off	 M100180	Remote Control
M100170	On		

Table 3-14. Symbol Identification

 M100182	Setup	 M100191a	Travel
 M100183	Speed, Fast	 M100192	Travel Direction Forward—Left Crawler
 M100184	Speed, Slow	 M100193	Travel Direction Forward—Right Crawler
 M100185	Stop, Emergency	 M100194	Travel Direction Reverse—Left Crawler
 M100186	Swing	 M100195	Travel Direction Reverse—Right Crawler
 M100189	Swing Left	 M100196	Travel High Speed
 M100190	Swing Right	 M102082	Windshield Washer, Front (with washer)
 M101689,90	Tilt, Cab Down or Up	 M102083	Windshield Washer, Overhead

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SECTION 4
SET-UP AND INSTALLATION

TABLE OF CONTENTS

4

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SECTION 4
SETUP AND INSTALLATION

LIFTING ASSEMBLY DRAWING

The instructions in this section are for an MLC165-1 not equipped with the self-erect package. An assist crane is required for crane assemble and disassembly.

The largest item to be handled with the assist crane is:

- Upperworks with mast and cab stored
- Carbody

Refer to the Lifting Assembly Drawing 81023872 at the end of this section for lifting weights and pick points.

BOOM AND JIB ASSEMBLY DRAWINGS

Boom and jib assembly drawings that apply to your crane are located at the end of this section.

GENERAL SAFETY

To prevent accidents that can result in death or injury during crane assembly and disassembly, comply with the following general safety information and with specific safety information contained in the assembly and disassembly steps.

WARNING

Avoid Death or Serious injury!

Read and understand the setup and installation instructions in this section before attempting to assemble or disassemble the crane.

WARNING

Tipping/Overload Hazard!

Prevent the crane from tipping over and the live mast from collapsing:

- Assemble and disassemble the crane on a firm uniformly supporting surface that is level to within 1% grade — 1 ft (0,3 m) in 100 ft (30,5 m).

WARNING

Avoid Falling Off Crane and Boom!

It is necessary to climb onto the crane and the 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 or the steps provided with the crane.

WARNING

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 the operator and assemblers to avoid accidents.
- Do not raise or lower the mast until all personnel are off the crane.
- Keep unauthorized personnel well clear of the crane.

WARNING

Falling Load Hazard!

To prevent the 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 the load to be lifted.

CRANE ORIENTATION

The terms RIGHT, LEFT, FRONT, and 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 rotating bed.
- The crawler remote controls are on the FRONT of the carbody.

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, read and become thoroughly familiar with the instructions in this section and in the boom and jib assembly drawings 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, the movement of trucks with trailers, and movement of the assist crane.

Contact your Manitowoc dealer for ground bearing information.

ACCESSING PARTS

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 or boom during assembly disassembly, maintenance, or other work.

WARNING

Fall Hazard!

To avoid serious injury:

Falling from any height could result in serious injury or death. The crane owner/user shall provide workers with approved ladders or aerial work platforms to access those areas of the crane, the mast, and the boom that cannot be reached from the ground or from Manitowoc-provided steps, ladders, catwalks, and platforms.

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

CRANE WEIGHTS AND SHIPPING DATA

See Crane Weights topic in Section 1 of this manual for the weights of individual crane components.

See the MLC165-1 Product Guide in Section 1 of this manual for the outline dimensions of individual components and for transport data. Size the transport trailers accordingly.

RETAINING CONNECTING PINS

Connecting pins are retained in various ways:

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

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

PARTS BOXES

Manitowoc provides two parts boxes: one for the crane and one for the luffing jib. The parts boxes can be lifted with a forklift.

The following types of parts are shipped in the parts box for the crane:

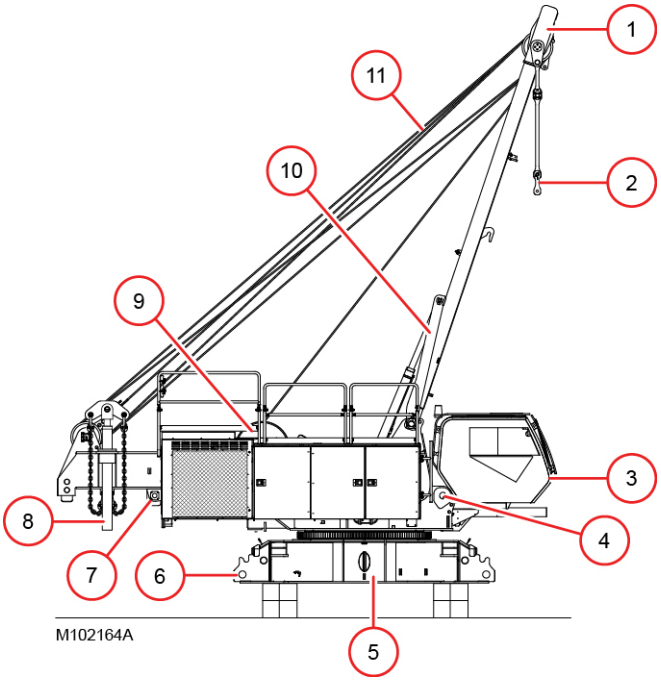
- Boom butt shims
- Intermediate suspension parts
- Lower boom point 3-sheave center bolt
- Crawler adjusting parts
- Block-up limit parts
- Wind speed transmitter parts
- Wrench for -24 hydraulic coupler
- Quick-drain drainer valve (for changing oil)
- Position indicator light parts
- Wedge sockets, links, and pins
- Fixed jib links and pins
- Shore power plug and receptacle
- Mast-to-boom link pins (can be used to replace the load sensing pins for duty-cycle operation) (see RCL/RCI Operation Manual for details)

Carefully inventory the parts boxes according to the packing diagrams under each parts box cover.

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.



Item	Description (Qty)
1	Mast
2	Mast-to-Boom Links
3	Operator Cab
4	Boom Hinge Pin (2)
5	Carbody
6	Crawler Pin (4)
7	Inner Counterweight Pin (2)
8	Counterweight Cylinder (2)
9	Boom Hoist
10	Mast Assist Arm
11	Boom Hoist Wire Rope
12	Load Sensing Pin (2)

Figure 4-1

HOSE AND CABLE CLEANLINESS

To prevent dirt from entering the hydraulic systems or from damaging the electric connectors:

- Thoroughly clean the hydraulic fittings and the electric connectors before connecting them.
- Thoroughly clean the dust caps before attaching them to hoses, tubes, or cables.
- Do not drag the hydraulic hose fittings, the hydraulic hoses, the electric cable connectors, or the electric cables on the ground.
- Apply a light coat of silicone lubricant to the threads of all dust caps, couplers, and connectors to help in preventing the threads from seizing.

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.

SELF-ASSEMBLY COMPONENTS

The crane is equipped with the following hydraulically actuated assembly/disassembly components (see Figure 4-1):

- Boom hinge pins (4) for connecting the boom butt to the rotating bed.
- Crawler pins (6) for connecting and disconnecting the crawlers to and from the carbody.
- Inner counterweight pins (7) for connecting and disconnecting the counterweight to and from the rotating bed.
- Counterweight cylinders (8) for installing and removing the crane counterweight.
- Mast-assist arms (10) for raising the mast to the operating position and lowering it to the transport position.
- Controls for operating the above components (see Figure 4-2 on page 4-4).

LOAD SENSING PINS

At the crane owner's discretion for duty-cycle operation only, the load sensing pins (12, Figure 4-1) can be replaced with the mast-to-boom link pins located in the parts box. See the RCL/RCI Operation Manual for details.

WARNING

Tipping/Structural Damage Hazard!

To prevent tipping or structural damage:

- The load sensing pins must be installed for all liftcrane operations AND
- the proper liftcrane capacity chart must be selected in the RCL/RCI display.

4

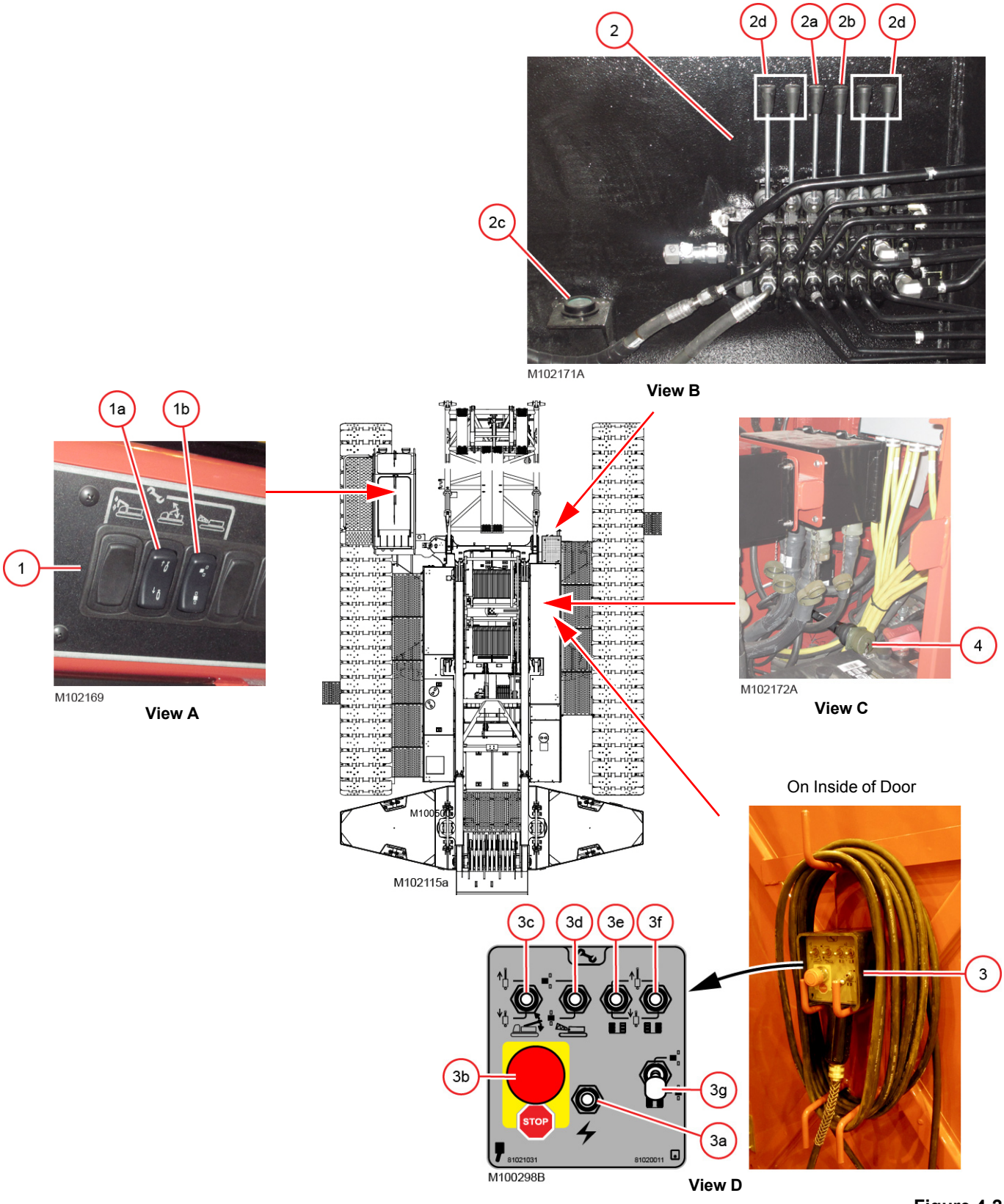

2
2d
2a
2b
2d
2c
M102171A
View B
1a
1b
1
M102169
View A
M100500
M102115a
4
M102172A
View C
On Inside of Door
3
3c
3d
3e
3f
3b
3g
3a
STOP
81021031
81020011
M100298B
View D

Figure 4-2

Legend for Figure 4-2

Item	Description
1	Overhead Console Switches
1a	Mast-Assist Arms
1b	Boom Hinge Pins
2	Carbody Controls
2a	Right Front Carbody Jack
2b	Right Rear Carbody Jack
2c	Level
2d	Have No Function (inoperable)
3	Remote Control (hand-held)
3a	Power
3b	Emergency Stop
3c	Mast Assist Arms
3d	Boom Hinge Pins
3e	Left Counterweight Cylinder
3f	Right Counterweight Cylinder
3g	Inner Counterweight Pins
4	W56J1 Receptacle

SELF-ASSEMBLY CONTROLS

See Figure 4-2

For identification and operation of the self-assembly controls, see Section 3 of this manual.

Do not operate the self-assembly controls without first reading Section 3 of this manual and the applicable assembly and disassembly procedures in this section.

To operate the self-assembly controls, the crane must be in the setup mode. See Setup Mode on page 4-6.

NOTE The speed of all self-assembly functions depends on engine speed: the faster the engine speed, the faster the self-assembly functions (and vice versa).

In the setup mode, the boom control handle will simultaneously raise and lower the mast and haul in and pay out boom hoist wire rope. The mast-assist arms are also functional and controlled automatically by the boom control handle.

1 – Overhead console switches (View A). The swing/travel alarm will sound when these switches are operated.

2 – Carbody control handles (View C).

3 – Remote control switches (View E). Connect the hand-held remote control to the W56J1 receptacle (4, View D) above the batteries in the right enclosure.

NOTE When the carbody controls are enabled in the setup mode, the swing/travel alarm will sound continuously.

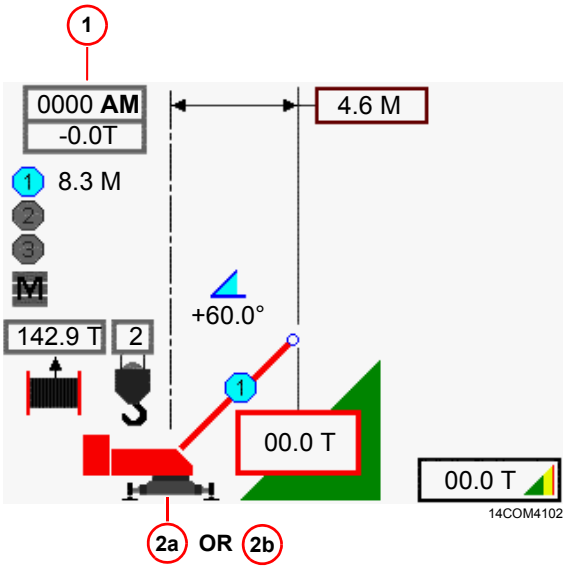
When the remote control is enabled in the setup mode, the swing/travel alarm will sound when a setup function is operated from the remote control.

For cranes meeting CE requirements, the controls in the operator cab and on the setup remote control cannot be operated when the carbody controls are enabled and vice versa.

SETUP MODE

To operate in the setup mode, two steps must be performed:

- The desired setup icon (2a or 2b, Figure 4-3) and the proper Liftcrane Mast Handling Capacities Chart (1) must be selected in the RCL/RCI configuration screen. See the RCL/RCI Manual supplied with the crane for detailed instructions.
- The appropriate control icon (1 or 2, Figure 4-5) must be turned on in the setup function screen of the main display.



NOTE The setup functions operate the same, regardless of which icon is selected

Item	Description
1	Capacity Chart Box
2a	Setup Icon on Jacks
2b	Setup Icon on Crawlers

Figure 4-3

To navigate to the Setup Function screen (Figure 4-5):

1. At the Main Display screen, press the Scroll Up key ▲ or Scroll Down key ▼ to cycle through the screen icons until the Function icon becomes highlighted with a blue border.
2. Press the Enter key [↓]. The Function Selection screen appears.
3. At the Function Selection screen, press the Scroll Up key ▲ or Scroll Down key ▼ to cycle through the highlighted crane functions until the Wrench Icon appears at the bottom of the screen.
4. Press the Enter key [↓]. The Setup Function screen appears.

To change a field (Figure 4-5):

1. Press the Scroll Up key ▲ or Scroll Down key ▼ to cycle through the screen fields until the desired field becomes highlighted with a blue border.
2. Press the Enter key [↓]. The field becomes highlighted with a red border.
3. Press the Scroll Up key ▲ or Scroll Down key ▼ to toggle a function on (**I**) or off (**O**).

Once the setup mode is on, the icon in Figure 4-4 will appear in the fault area of the information screen and the fault alarm will sound with an intermittent tone.

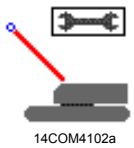
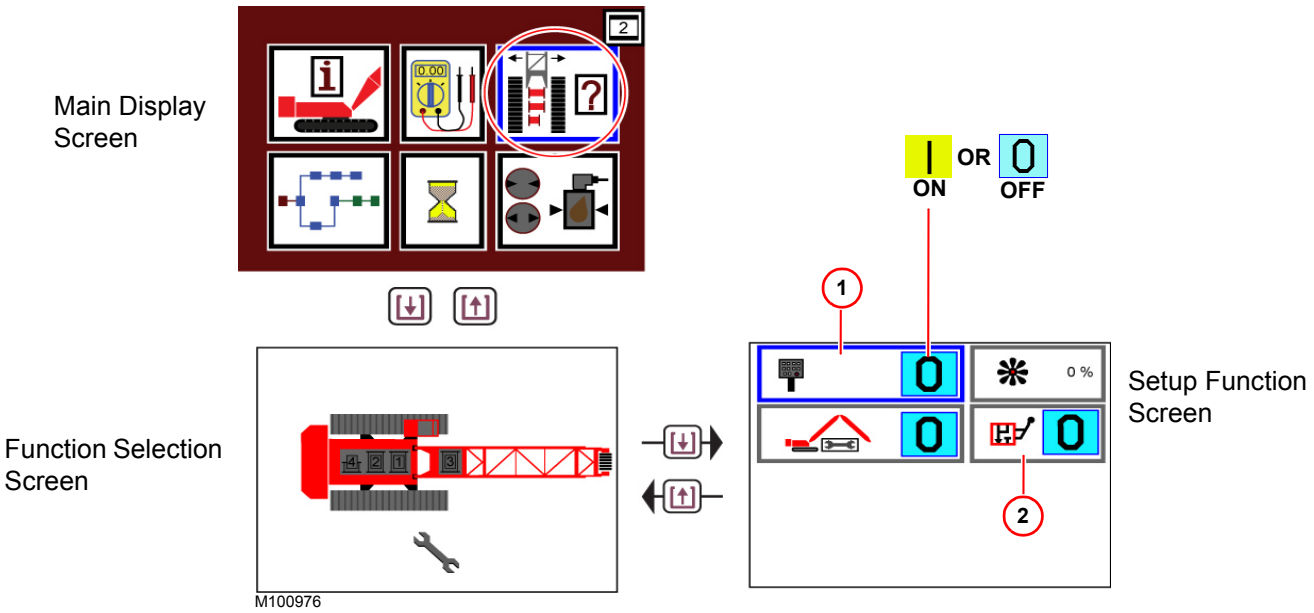


Figure 4-4

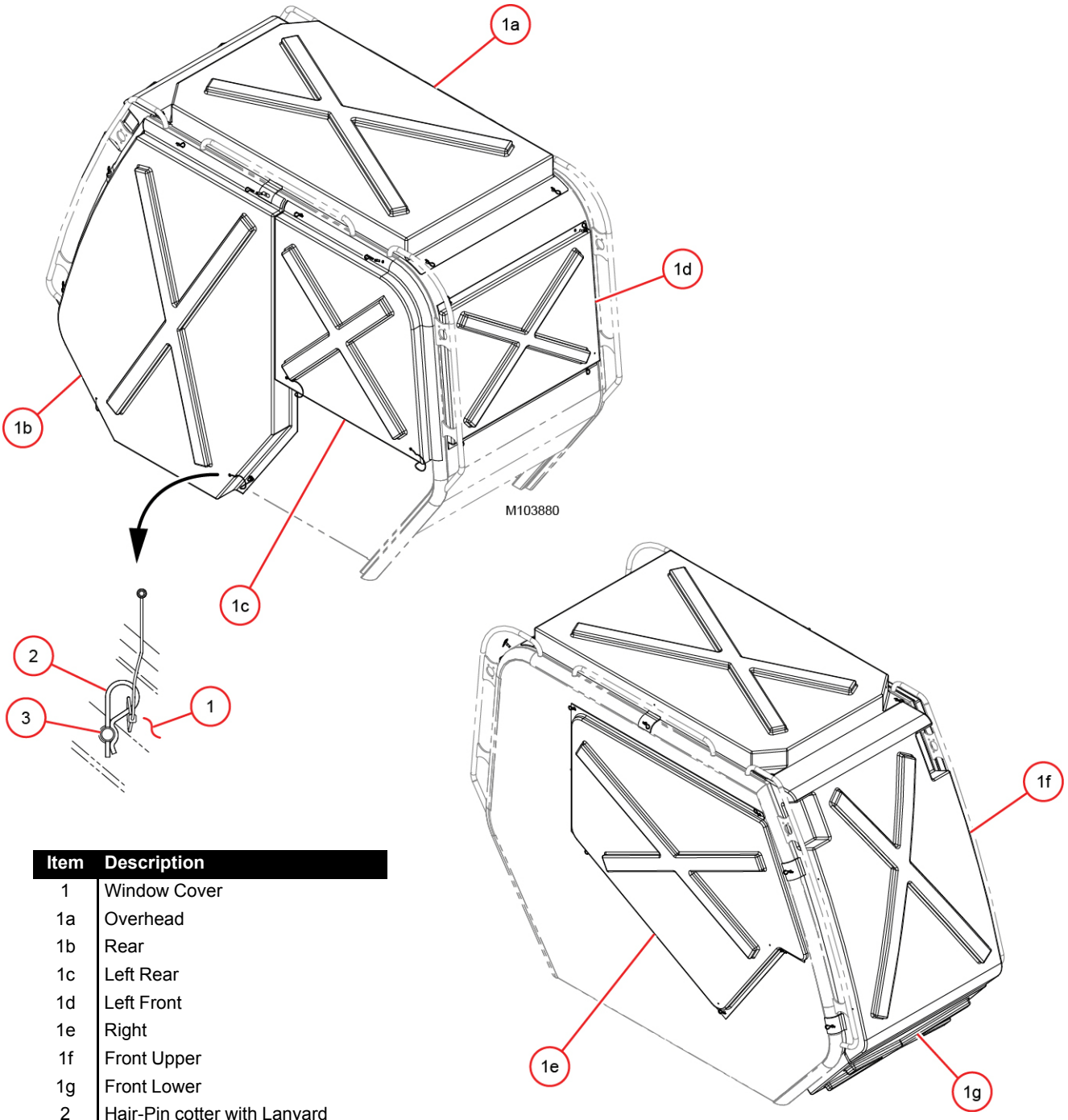


Item	Description
1	Enables (I) or Disables (O) Remote Control
2	Enables (I) or Disables (O) Carbody Control

Figure 4-5

4

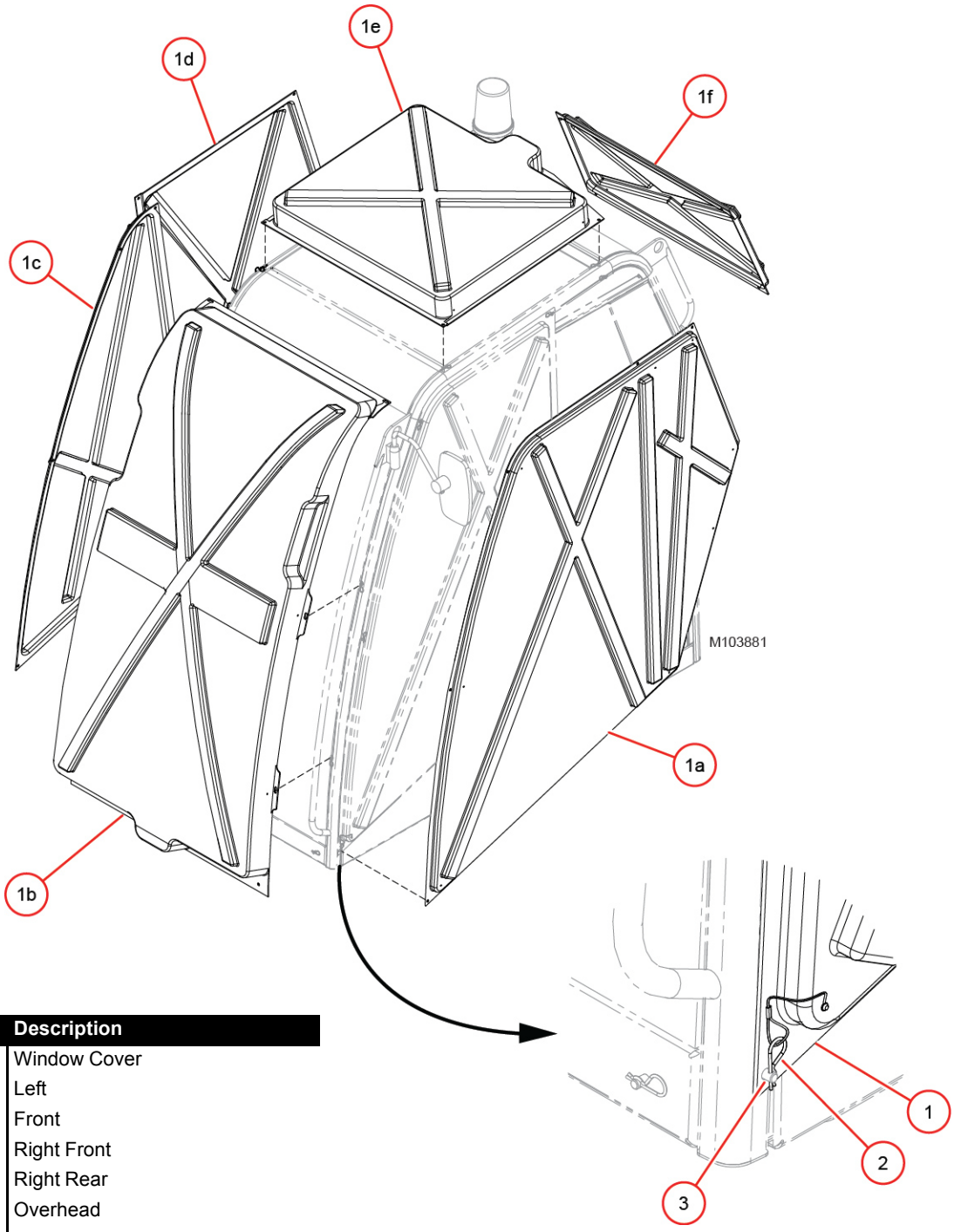
STANDARD CAB



Item	Description
1	Window Cover
1a	Overhead
1b	Rear
1c	Left Rear
1d	Left Front
1e	Right
1f	Front Upper
1g	Front Lower
2	Hair-Pin cotter with Lanyard
3	Stud

Figure 4-6

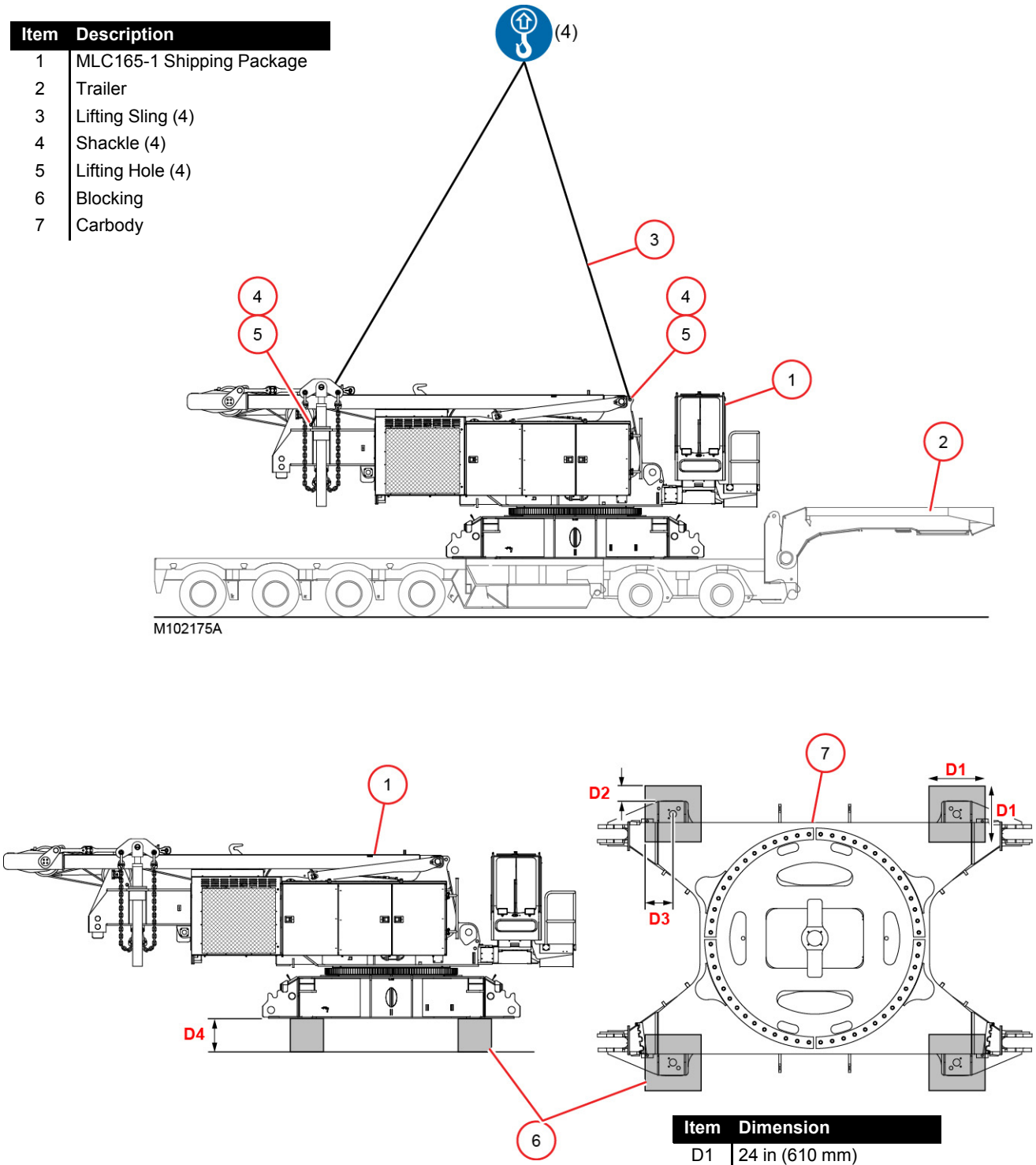
VISION CAB



Item	Description
1	Window Cover
1a	Left
1b	Front
1c	Right Front
1d	Right Rear
1e	Overhead
1f	Rear
2	Hair-Pin cotter with Lanyard
3	Stud

Figure 4-7

Item	Description
1	MLC165-1 Shipping Package
2	Trailer
3	Lifting Sling (4)
4	Shackle (4)
5	Lifting Hole (4)
6	Blocking
7	Carbody



Item	Dimension
D1	24 in (610 mm)
D2	6 in (152 mm)
D3	12 in (305 mm)
D4	25-28 in (635-711 mm)

Figure 4-8

CRANE ASSEMBLY

DANGER

Tipping Hazard!

Swing is prohibited while the crane is on blocking.

Do not swing the MLC165-1 upperworks until after the first crawler is installed and resting on the ground.

Remove Crane from Trailer

See Figure 4-8.

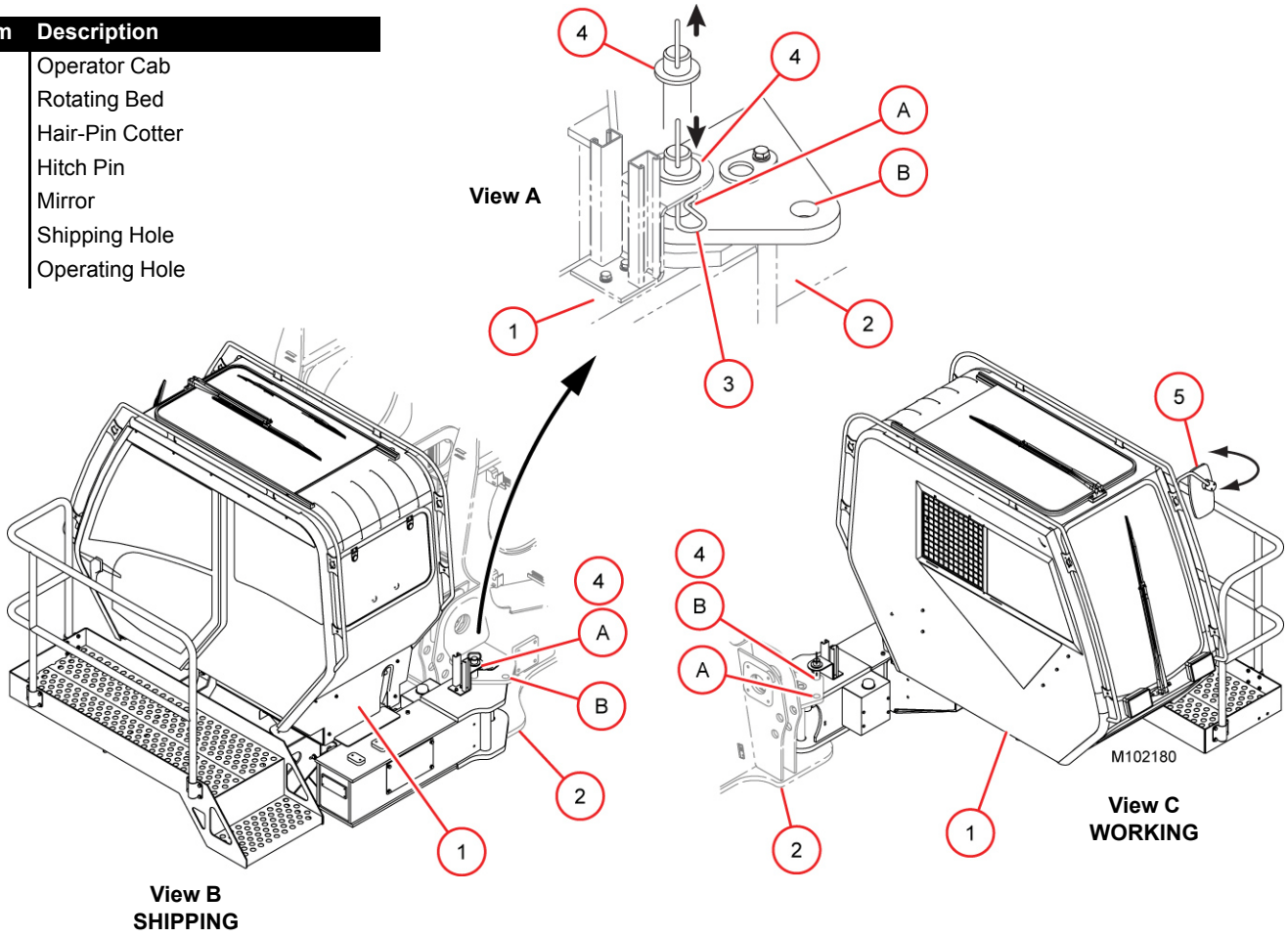
1. Attach owner furnished lifting slings (3) from the assist crane to shackles (4) at the lifting holes (5) in the rotating bed of the MLC165-1.

   Refer to the Lifting Assembly 81023872 at the end of this section for sling and pick point specifications and for the total weight to be lifted.

   It is crane owner's responsibility to properly size the assist crane, the lifting slings, and the shackles for the weight to be lifted.

2. Remove all chains and straps used to secure the carbody (7) to the trailer (2).
3. Lift the MLC165-1 off the trailer and place it on hard-wood blocking (6) under the four corners of the carbody (7).
   - The blocking must be sized and positioned as shown so the carbody is 25-28 in (635-711 mm) above the ground.
   - The blocking at ***each corner*** must be capable of supporting at least 52,000 lb (23 587 kg).
4. Disconnect the lifting slings and shackles.

Item	Description
1	Operator Cab
2	Rotating Bed
3	Hair-Pin Cotter
4	Hitch Pin
5	Mirror
A	Shipping Hole
B	Operating Hole



STANDARD CAB SHOWN
VISION CAB SIMILAR

Figure 4-9

Remove Cab Window Covers

If equipped, remove and store the cab window covers:

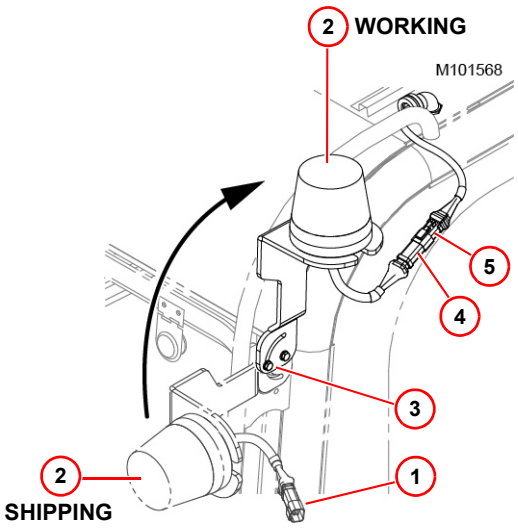
- Standard Cab, see Figure 4-6 on page 4-8.
- Vision Cab, see Figure 4-7 on page 4-9.

Deploy Operator Cab

See Figure 4-9 for the following procedure.

Rotate the operator cab (1) to the operating position as follows:

1. Remove the hair-pin cotter (3, View A) from the top retaining hole in the hitch pin (4).
2. Raise the hitch pin (4, View A) to the disengaged position (bottom retaining hole visible) and reinstall the hair-pin cotter (3).
3. Rotate the cab (1) 90° from the shipping position (View B) to the working position (View C).
4. Remove the hair-pin cotter (3, View A) and lower the hitch pin (4) to the engaged position.
5. Reinstall the hair-pin cotter (3, View A).
6. Rotate the mirror (5, View C) to the operating position.



Item	Description
1	Dust Cap
2	Light Assembly
3	Cap Screw, Washers, and Nut (2)
4	Electric Cable (from light)
5	Electric Cable (from cab)

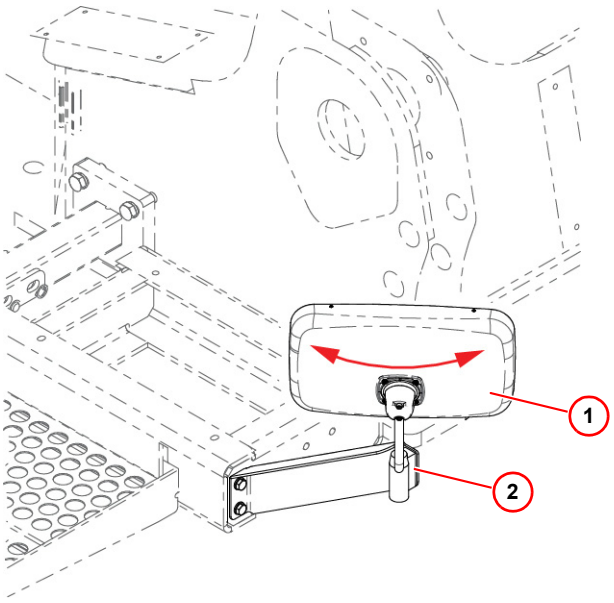
Figure 4-10

Install RCL/RCI Indicator Light

If equipped, the RCL/RCI indicator light is shipped on the cab as shown in Figure 4-10.

Connect the light as follows:

1. Loosen the nuts (3) and rotate the light (2) from the shipping position to the working position.
2. Tighten the nuts (3).
3. Disconnect the dust caps (1) from the ends of the electric cables.
4. Connect the electric cable (4) from the light to the electric cable (5) from the cab.

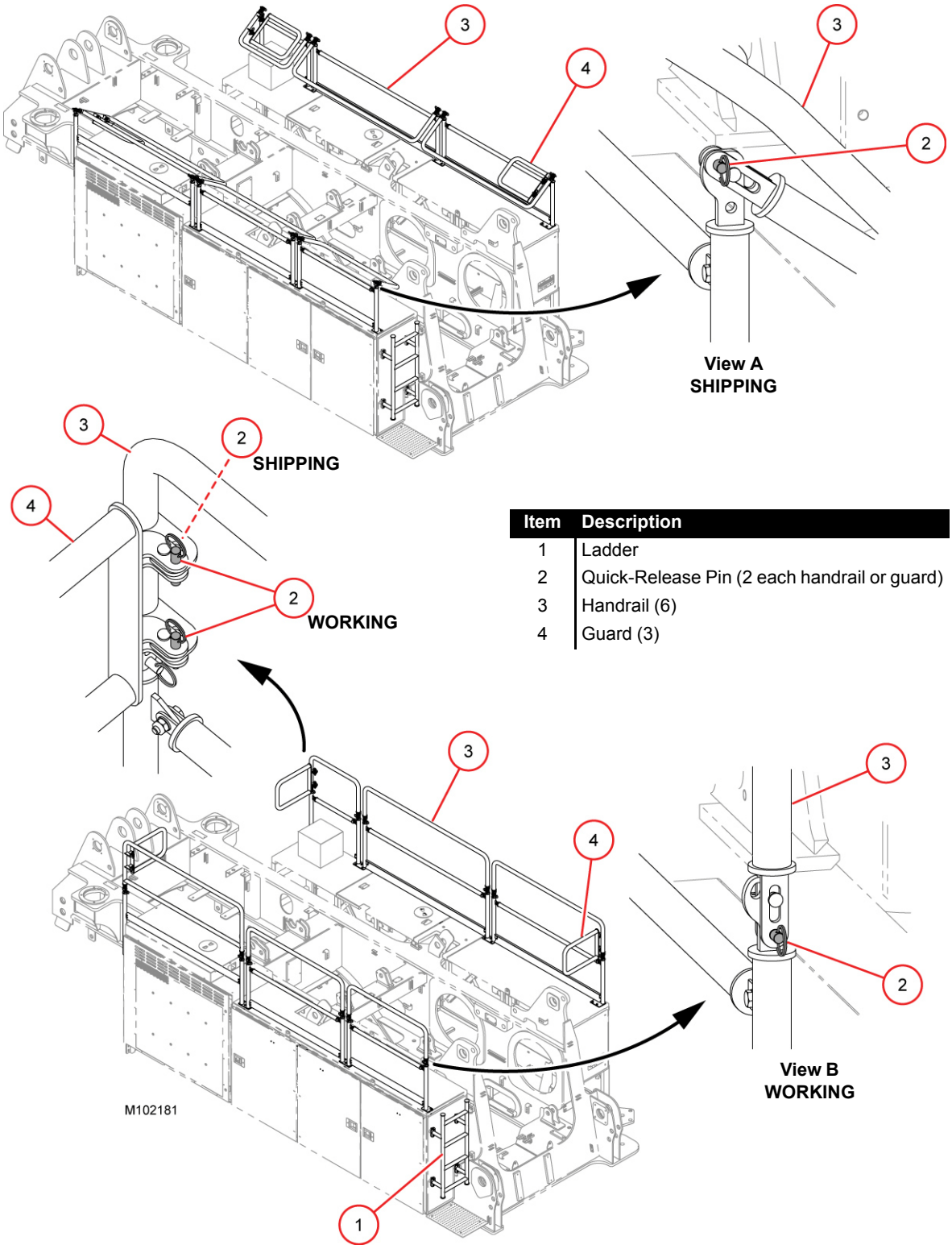


Item	Description
1	Mirror
2	Bracket with Mounting Hardware

Figure 4-11

Install Rotating Bed Mirror

If equipped, install the mirror (1) on the right-front corner of the rotating bed as shown in Figure 4-11. Rotate the mirror to the desired operating position.



Item	Description
1	Ladder
2	Quick-Release Pin (2 each handrail or guard)
3	Handrail (6)
4	Guard (3)

Figure 4-12

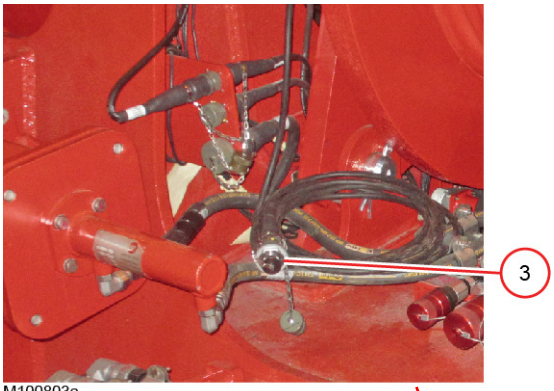
Raise Handrails

This procedure only pertains to cranes equipped with optional handrails (Figure 4-12).

It is necessary to climb onto the top of the rotating bed for this procedure. ***Take every precaution to prevent falling off the crane.***

1. Climb onto the top of the rotating bed at the ladder (1).
2. Remove the quick-release pins (2) from the shipping position (View A) and rotate the handrails (3) or the guards (4) to the working position (View B).
3. Reinstall the quick-release pins.

Item	Description
1	Battery Disconnect Switch Lever
1a	Disconnected
1b	Connected
2	Hydraulic Tank Shut-Off Valve Lever
2a	Locking Pin (pull down to operate lever)
2b	Closed
2c	Opened
3	WBC Electric Cable with RIN Terminator
4	CAN Terminating Plug
4a	WN IN Receptacle on Node 5



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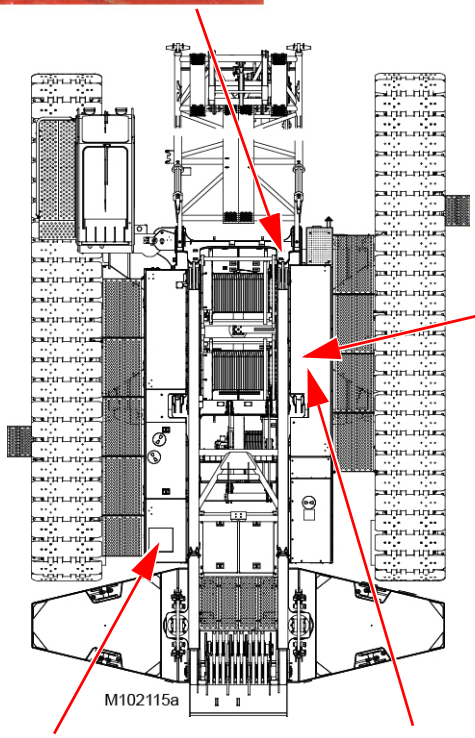
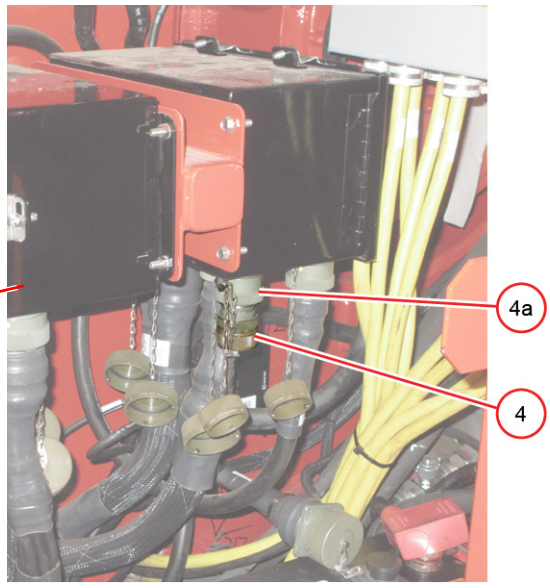
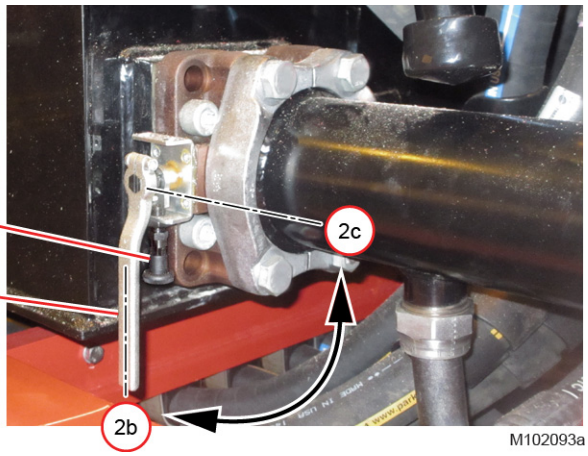

M102115a



M102174



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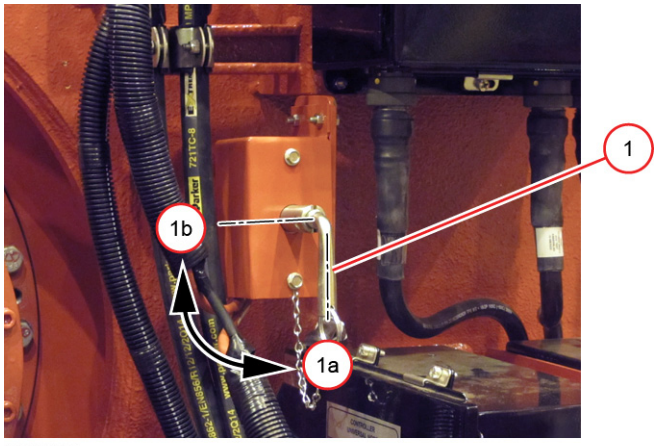


M102092a

Figure 4-13

Perform Pre-Start Checks

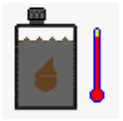
Make the following checks before proceeding to assemble or disassemble the crane.

1. Perform required lubrication services and maintenance checks. See the MLC165-1 Lubrication Guide and the Maintenance Checklist supplied with the crane.
2. Check for leaks and then correct.
3. Check that the battery disconnect switch (1) is connected (Figure 4-13).
4. Make sure that the hydraulic tank shut-off valve (2) is open (Figure 4-13).
5. Check that RIN terminator (3) is connected to the WBC cable on the front of the rotating bed (Figure 4-13). Otherwise, the crane controls may not operate properly and faulty readings may appear on the displays.
6. Check that the CAN terminator plug (4) is connected to the WN IN receptacle (4a) on Node 5. Otherwise, the crane controls may not operate properly and faulty readings may appear on the displays.

Start Engine

1. Start the engine and allow the crane components to warm up to their normal operating temperatures.

NOTE Fault 65 will remain on until the hydraulic oil temperature is above 60°F (15° C). **There will be no throttle response until this fault is cleared.**

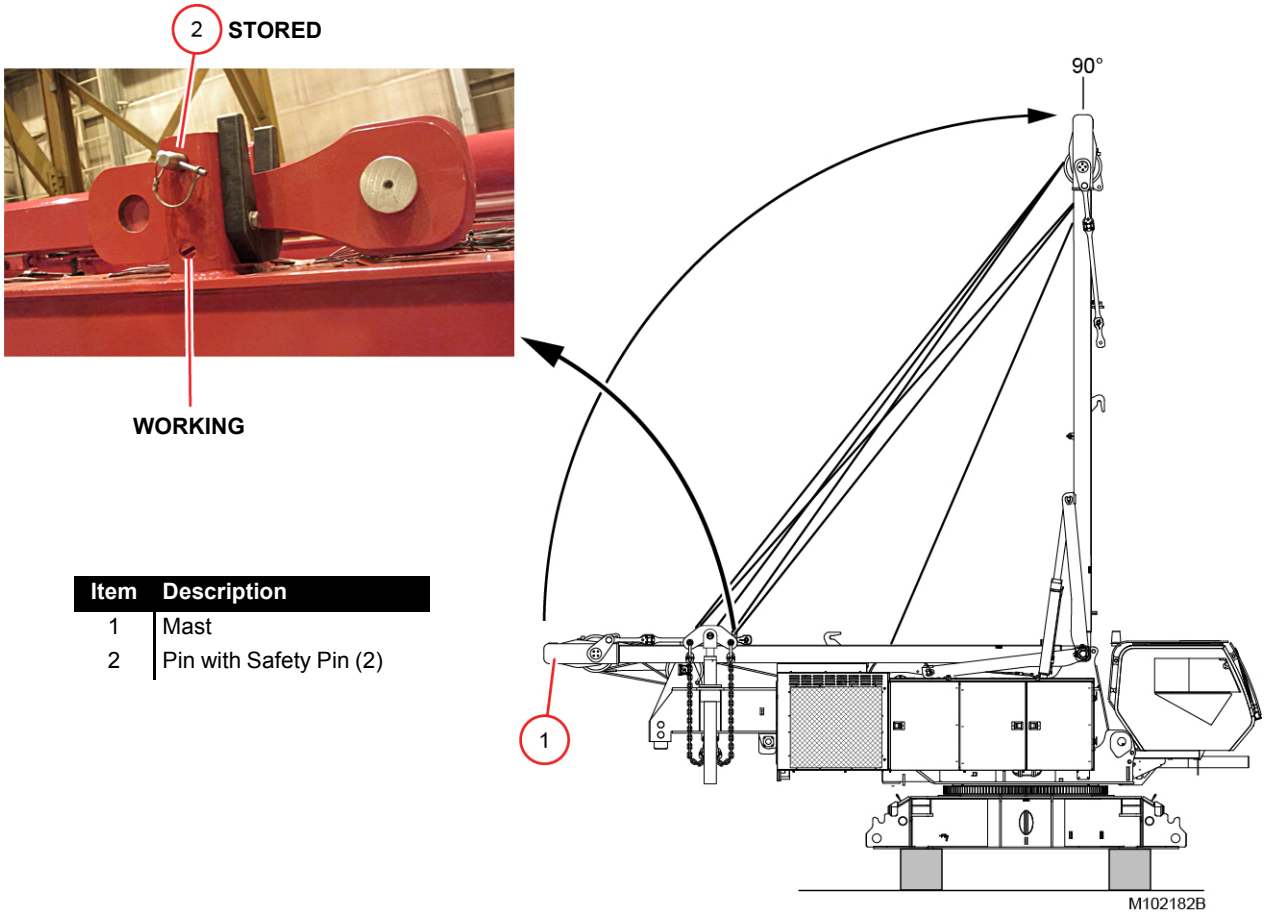


The main display hydraulic oil temperature will read 55° until the oil temperature rises above 55°. Monitor the hydraulic oil temperature on the gauge at the hydraulic tank until the oil temperature rises above 55°.

The hydraulic oil can be warmed up during cold weather startup with the crane either in the standard mode or the setup mode. The oil will not warm up, however, if the carbody control is enabled in the setup function screen (item 2 in Figure 4-5).

2. Turn on the setup mode in the RCL/RCI and in the main display. See Setup Mode on page 4-6 for instructions.

   The SETUP MODE MUST BE ON to operate the self-assembly controls during the remainder of the assembly procedure



Item	Description
1	Mast
2	Pin with Safety Pin (2)

Figure 4-14

DANGER

Tipping Hazard!

Swing is prohibited while the crane is on blocking.

Do not swing the MLC165-1 upperworks until after the first crawler is installed and resting on the ground.

Prepare Mast for Raising

It is necessary to climb onto the top of the rotating bed for this procedure. ***Take every precaution to prevent falling off the crane.***

See Figure 4-14.

1. Climb onto the top of the rotating bed at the ladder provided.
2. Move the pins (2) from the stored position to the working position.

DANGER

Moving Part and Crush Hazard!

Avoid being crushed by moving parts:

- Do not stand on the crane while the mast is raised or lowered.

Raise Mast to Vertical

NOTE To raise the mast, the engine must be running and the setup mode must be on (see Setup Mode on page 4-6).

The mast angles can be monitored in the information screen of the main display or in the working screen of the RCL/RCI display (in setup mode).

See Figure 4-14.

1. BOOM DOWN using the boom control handle in the operator cab.
2. The mast-assist arms will rise automatically to raise the mast.
3. Stop raising the mast when it is at 90°.

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Mast Working Angles

Item	Description
1	Mast
2	Mast-Assist Arm and Cylinder
A	Transport Position (fully lowered)
B	Mast at 90° for Installing Crawlers and Carbody Counterweight with Assist Crane
C	Maximum angle for attaching mast links to boom straps
D	Fault 66 Icon: Mast too far forward. This fault is activated when the mast is at 162°. Raise the mast. Do not lower the mast any further with the boom hoist.
E	Fault 13 Icon: Mast at 2°. Mast stops and must be lowered the remainder of the way with the mast-assist arms switch on the overhead console or on the remote control.

NOTE Mast must be raised to approximately 90° when installing crawlers and carbody counterweight. Mast-assist arm cylinders will retract automatically as the mast is raised and then extend when the mast is lowered.

DANGER

Falling Mast Hazard!

Do not the lower the mast-assist arms until the mast is connected to the boom rigging. The mast will fall over backwards if raised to vertical when the mast-assist arms are down.

WARNING

Falling Mast Hazard!

Do not lower the mast below 162° with the boom hoist. The boom hoist wire rope will rub on the drum rope guard. Damage to the wire rope will occur, possibly causing the rope to break and the mast to fall.

If it is necessary to lower the mast below 162° for any reason, use an assist crane.

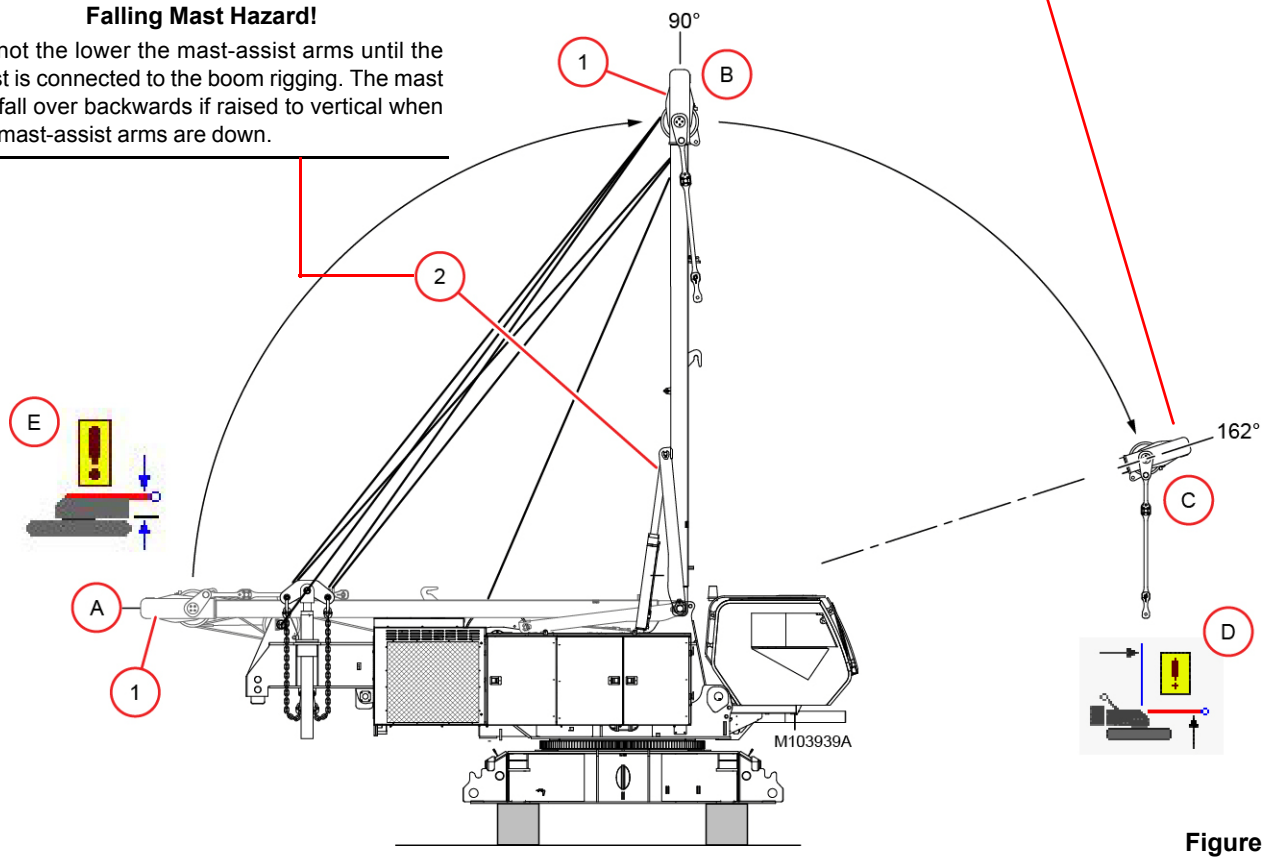
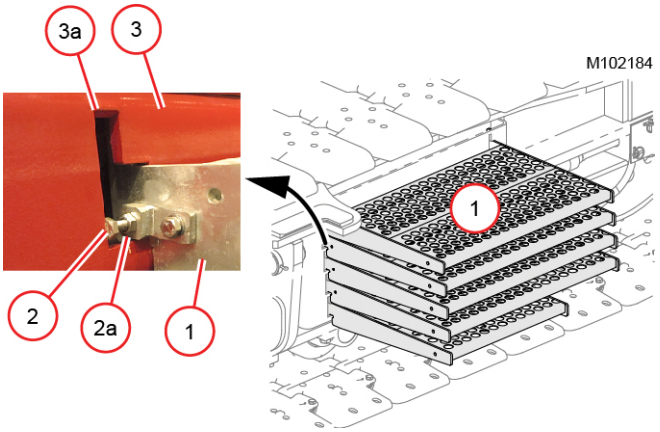


Figure 4-15

Install Crawlers – Preliminary Steps

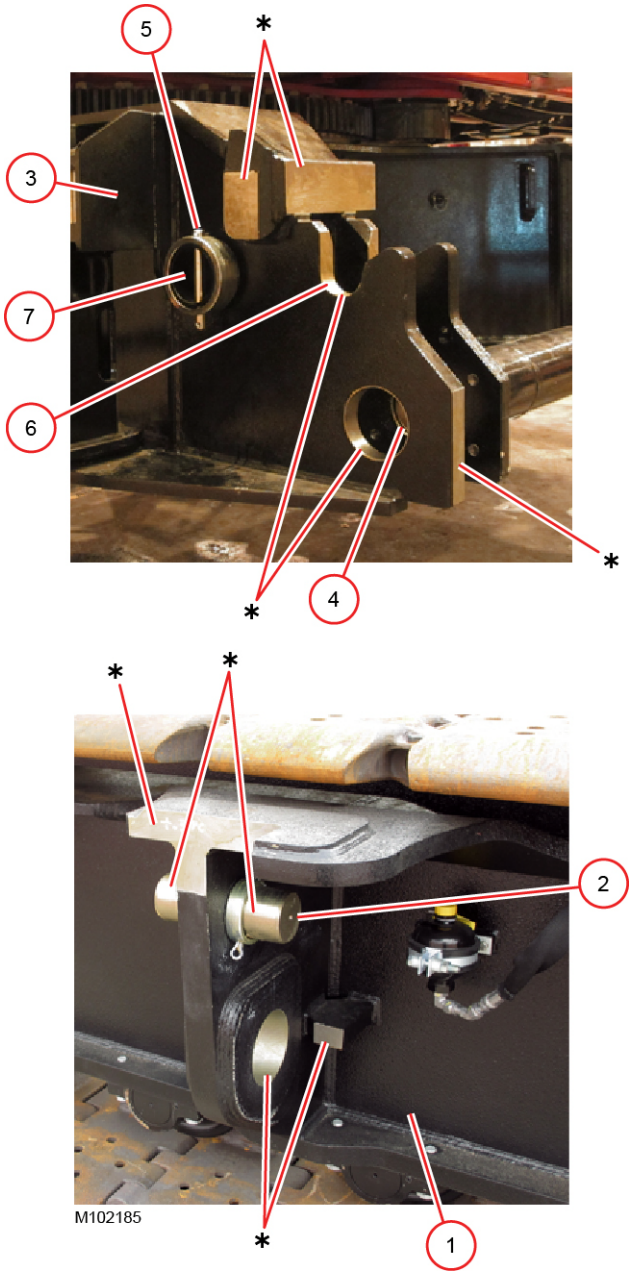
1. Remove the platform sections (1, Figure 4-16) from their storage position on each crawler and put the sections in a safe place until the crawlers have been installed:
   a. Loosen the lock nut (2a) and the retaining screw (2).
   b. Slide and lift the top section (1) out of the slots (3a) in the frame (3).
      Each section weighs approximately 17 lb (8 kg).
   c. Repeat the steps for the remaining sections.
      The left crawler holds the five left side platforms.
      The right crawler holds the four right side platforms.



Item	Description
1	Platform Sections
2	Retaining Screw
2a	Lock Nut
3	Frame
3a	Slot
*	Machined Surfaces

Figure 4-16

2. Thoroughly clean and apply Never-Seez® or equivalent anti-seizing compound to all machined surfaces on the carbody and the crawlers — surfaces marked ∗ in Figure 4-17.
   If this step is not performed, excessive friction will occur in the closely machined mating surfaces between the crawlers and the carbody. The result will be loud noises coming from the lowerworks when turning (cutting) the crawlers or swinging the upperworks over the corner of the crawlers.
3. Remove the collar (5, Figure 4-17) from all four crawler pins (4).
4. Temporarily store the collars (5) on the storage lugs (7).
5. Start the engine.
6. Using the carbody controls, disengage all four crawler pins (4).



Item	Description
1	Crawler
2	Alignment Pin
3	Carbody
4	Crawler Pin
5	Collar with Pin and Safety Pins
6	Alignment Saddles
7	Storage Lug

Figure 4-17

Install First Crawler

1. Do not raise the mast past vertical (90°), Figure 4-18, or it will interfere with crawler installation.

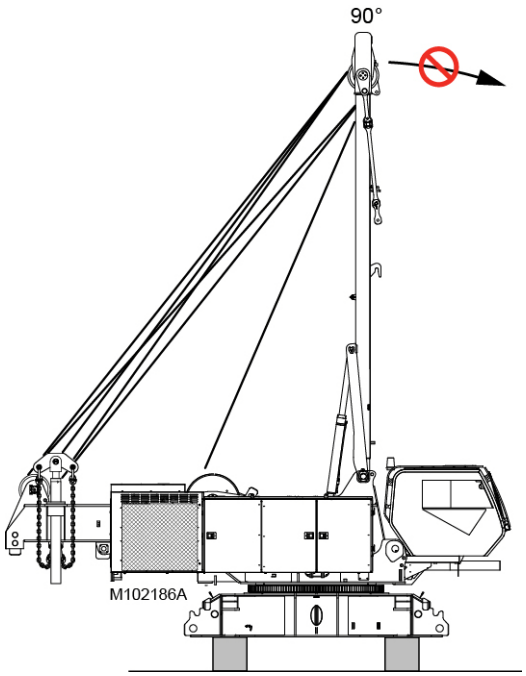


Figure 4-18

NOTE Two crawler assemblies are provided: right side and left side.

The hydraulic hoses on the drive end of the crawlers must be positioned adjacent to the hydraulic hoses on the rear of the carbody.

2. Attach a 3-leg chain sling (Figure 4-19) — or shackles and synthetic slings — from the assist crane to the three lifting lugs on the crawler. The crawler weighs approximately 33,000 lb (14 969 kg).

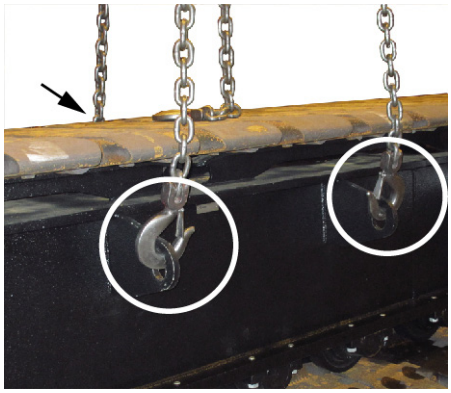
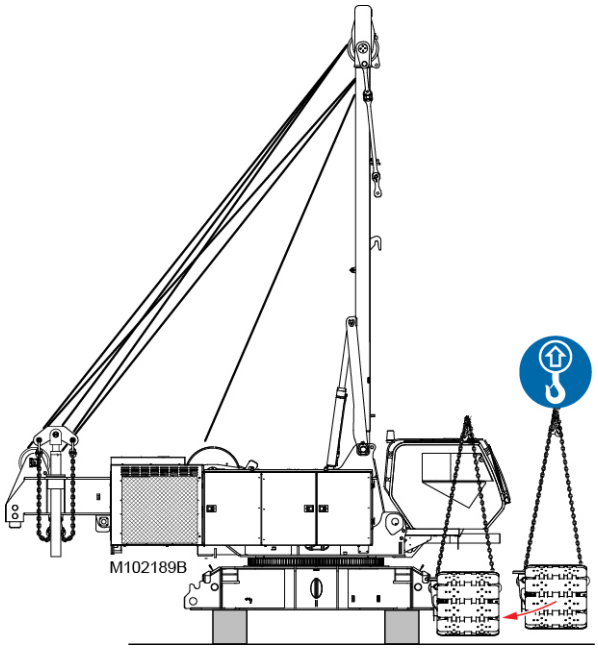
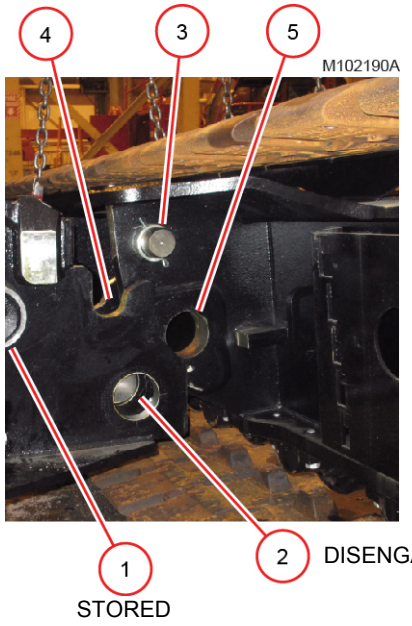


Figure 4-19

3. Lift the crawler clear of the trailer using the assist crane. The crawler will hang slightly out of level toward the crane.
4. Remove the trailer.
5. Lift the crawler into position at the carbody (Figure 4-20)

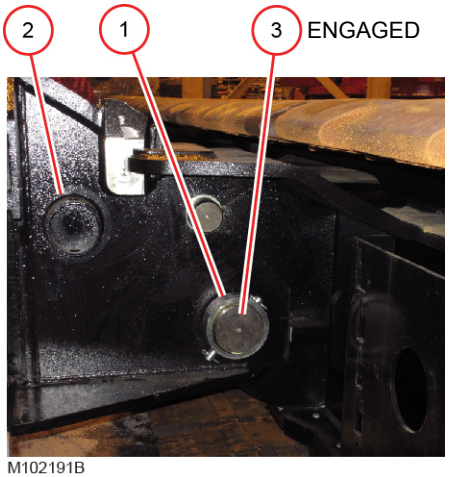




Item	Description
1	Collar Stored
2	Crawler Pin (2)
3	Alignment Pin (2)
4	Alignment Saddle (2)
5	Connecting Hole (2)

Figure 4-20

6. Lower the crawler so the alignment pins (3, Figure 4-20) engage the alignment saddles (4). Continue to lower the crawler until the lifting slings go slack.
7. Using the carbody control, engage the crawler pins (3, Figure 4-21).



Item	Description
1	Collar with Pin and Safety Pins (2)
2	Storage Lug (2)
3	Crawler Pin (2)

Figure 4-21

8. Remove the collars (1, Figure 4-21) from the storage lugs (2) and assemble the collars to the end of the crawler pins (3).
9. Disconnect the lifting slings from the crawler.
10. Attach owner furnished synthetic lifting slings (1, Figure 4-22) to the boom hinge pins (2).
    - Boom hinge pins should be engaged
    - Slings can be either basketed or chocked
    - Sling length should be at least 15 ft (5 m) long
    - Sling capacity is at least 54,000 lb (24 494 kg)

    Use caution to prevent the slings from being damaged by the edges of the boom hinge plates on the rotating bed.

Item	Description
1	Owner Furnish Synthetic Slings
2	Boom Hinge Pin (2)
3	Blocking

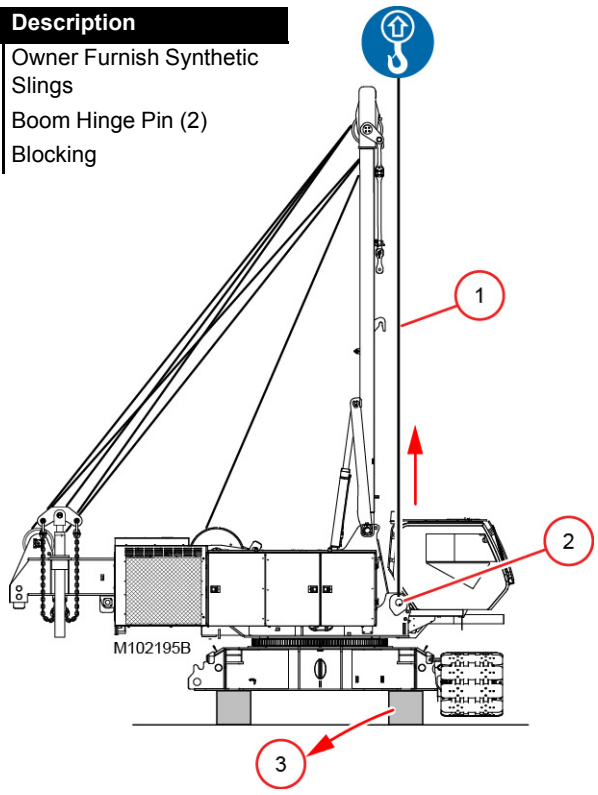


Figure 4-22

11. Lift the crane only enough to loosen the load on the blocking (3, Figure 4-22) and remove the blocking.

DANGER

Tipping Hazard!

Swing is prohibited while the crane is on blocking.

Do not swing the MLC165-1 upperworks until after the first crawler is installed and resting on the ground.

12. Lower the crane until the crawler is on the ground (Figure 4-23) and the lifting slings slacken.
13. Disconnect the lifting slings from the boom hinge pins.

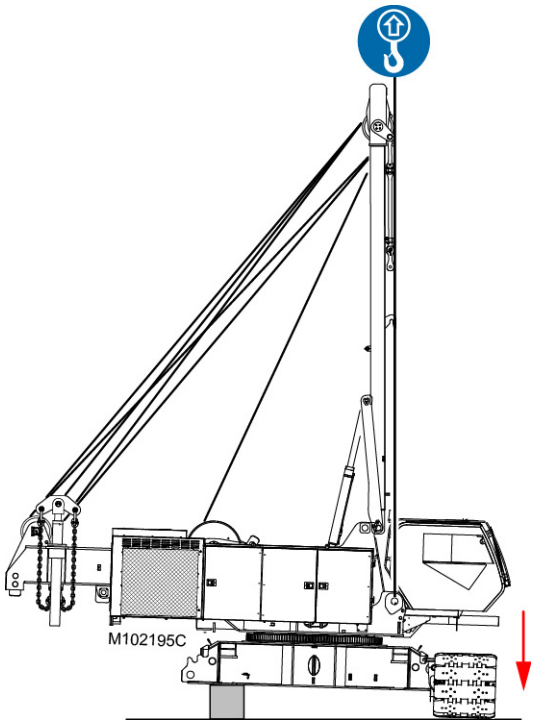


Figure 4-23

14. Swing the upperworks 180° (Figure 4-24).

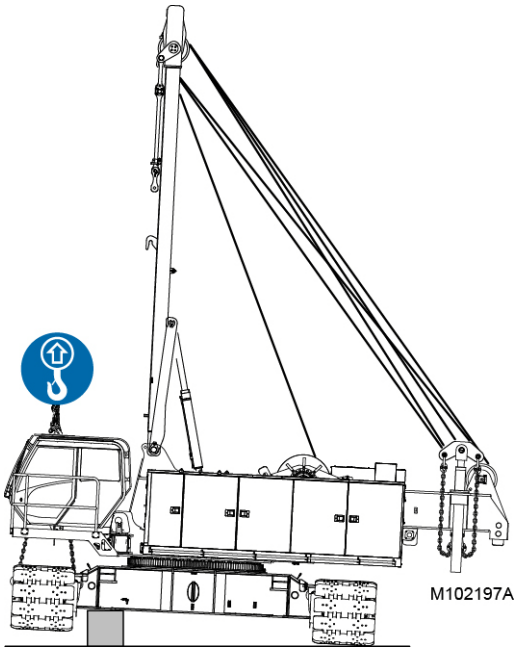


Figure 4-24

15. Install the second crawler in the same manner the first crawler was installed.

Repeat Install First Crawler step 1 through step 13 until the second crawler is on the ground.

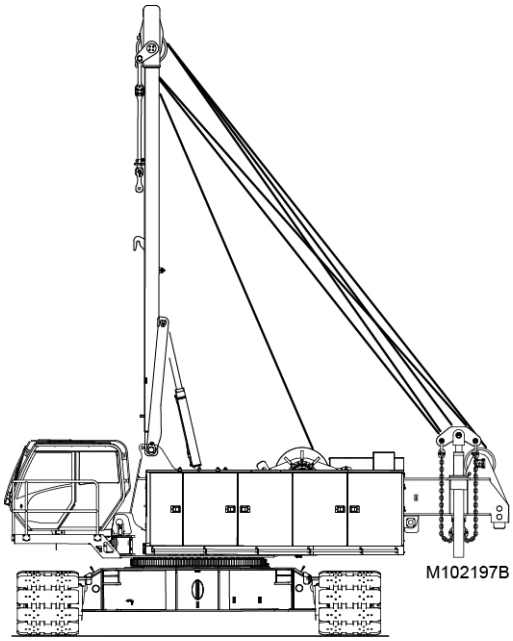
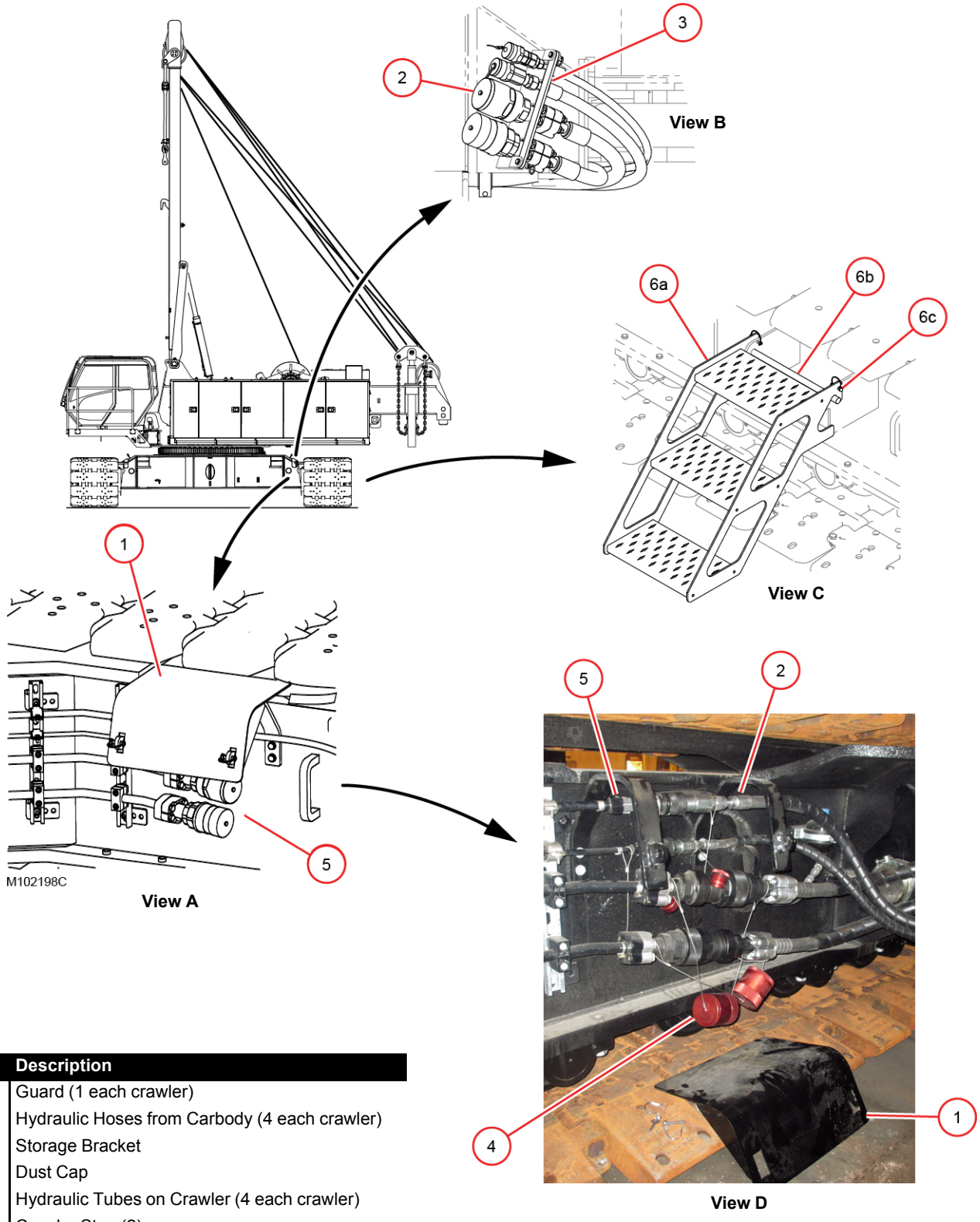


Figure 4-25

16. Go to Finish Installing Crawlers on page 4-27.

4



Item	Description
1	Guard (1 each crawler)
2	Hydraulic Hoses from Carbody (4 each crawler)
3	Storage Bracket
4	Dust Cap
5	Hydraulic Tubes on Crawler (4 each crawler)
6a	Crawler Step (2)
6b	Bar (2)
6c	Wire-Lock Pin (4)

Figure 4-26

Finish Installing Crawlers

See Figure 4-26.

1. Connect the hydraulic lines:
   a. Stop the engine.
   b. Remove the guard (1, View A) from the crawler.
   c. Disconnect the hydraulic hoses (2, View B) from under the storage bracket (3).
   d. Pin the storage bracket in the closed position.
   e. Disconnect the dust caps (4, View D) from the hydraulic hoses (2) and the hydraulic tubes (5).
   f. Thoroughly clean all fittings.
   g. Apply a light coat of silicone lubricant to the threads of all dust caps, couplers, and connectors to help in preventing the threads from seizing.
   h. Connect the four hydraulic hoses (2, View D) from the carbody to the hydraulic tubes (5) on the crawler. The hoses can be connected one way only.
   i. Connect the large dust caps together for storage.
   j. Install the guard (1, View A).
2. At both crawlers, hook the crawler step (6a, View C) onto the bar (6b) and install the wire-lock pins (6c).

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Install Upperworks Platform Sections

See Figure 4-27 for the following procedure.

The right side platform sections are stored on the right crawler. The left side platform sections are stored on the left crawler.

Starting at the FRONT on the RIGHT SIDE of the crane, install the right side platform sections, as follows:

1. Lift the section (1) into position.
2. Hook the section lugs through the slots (4) in the frame (5).
3. Rotate the section down so the notches in the section engage the frame (5).
4. Slide the section forward as far as it will go.
5. Install the remaining sections in the same manner.

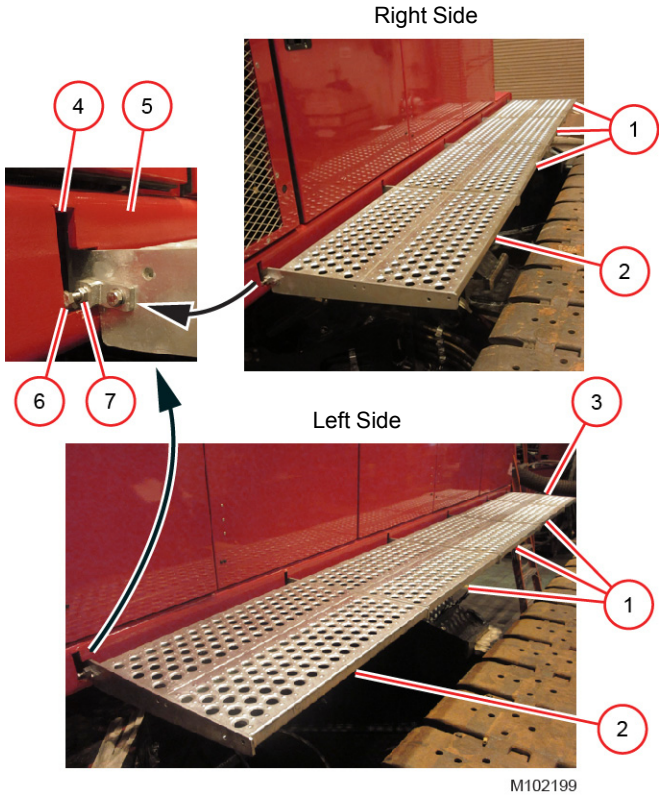
   Platform section (2) must be closest to the rear of the crane.
6. Once all of the right side sections are installed, hand tighten the retaining screw (6) in the slot (4) and securely tighten the lock nut (7) to lock the sections in position.

Starting at the REAR on the LEFT SIDE of the crane, install the left side platform sections, as follows:

Note that the left rear section (3) is shorter than the rest.

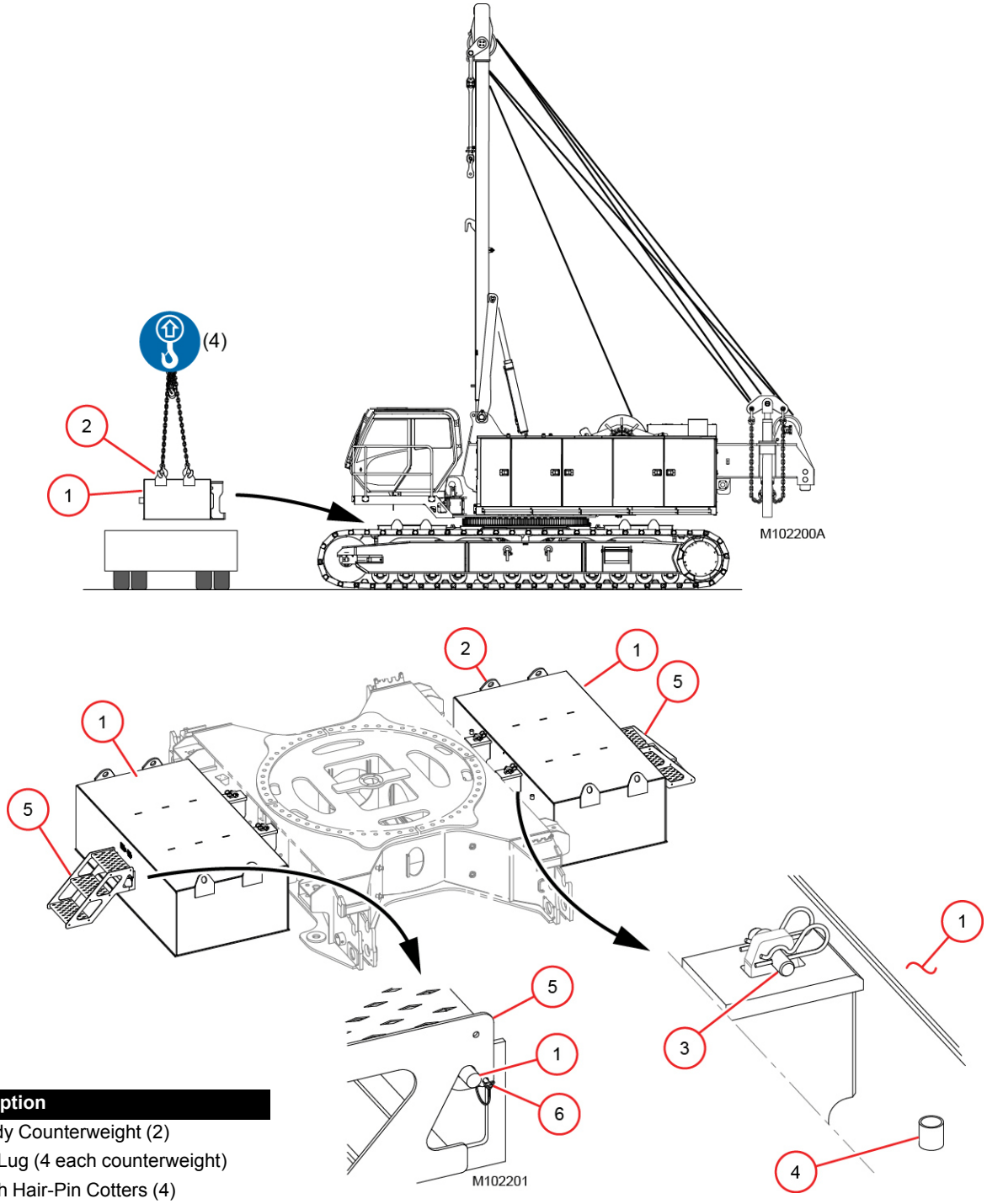
1. Lift the section (3) into position.
2. Hook the section lugs through the slots (4) in the frame (5).
3. Rotate the section down so the notches in the section engage the frame (5).
4. Slide the section rearward as far as it will go.
5. Install the remaining sections (1 and 2) in the same manner.

   Platform section (2) must be closest to the front of the crane.
6. Once all of the left side sections are installed, hand tighten the retaining screw (6) in the slot (4) and securely tighten the lock nut (7) to lock the sections in position.



Item	Description
1	Platform Section (3 each side)
2	Platform Section with Screw (1 each side)
3	Platform Section (short) (1 left side)
4	Slot
5	Frame
6	Retaining Screw (1 each side)
7	Lock Nut

Figure 4-27



Item	Description
1	Carbody Counterweight (2)
2	Lifting Lug (4 each counterweight)
3	Pin with Hair-Pin Cotters (4)
4	Storage Lug
5	Step (2)
6	Wire-Lock Pin (4)

Figure 4-28

Install Carbody Counterweight (Series 2)

If your crane has the Series 2 counterweight package, install the carbody counterweights as follows, before installing the crane counterweights.

DANGER

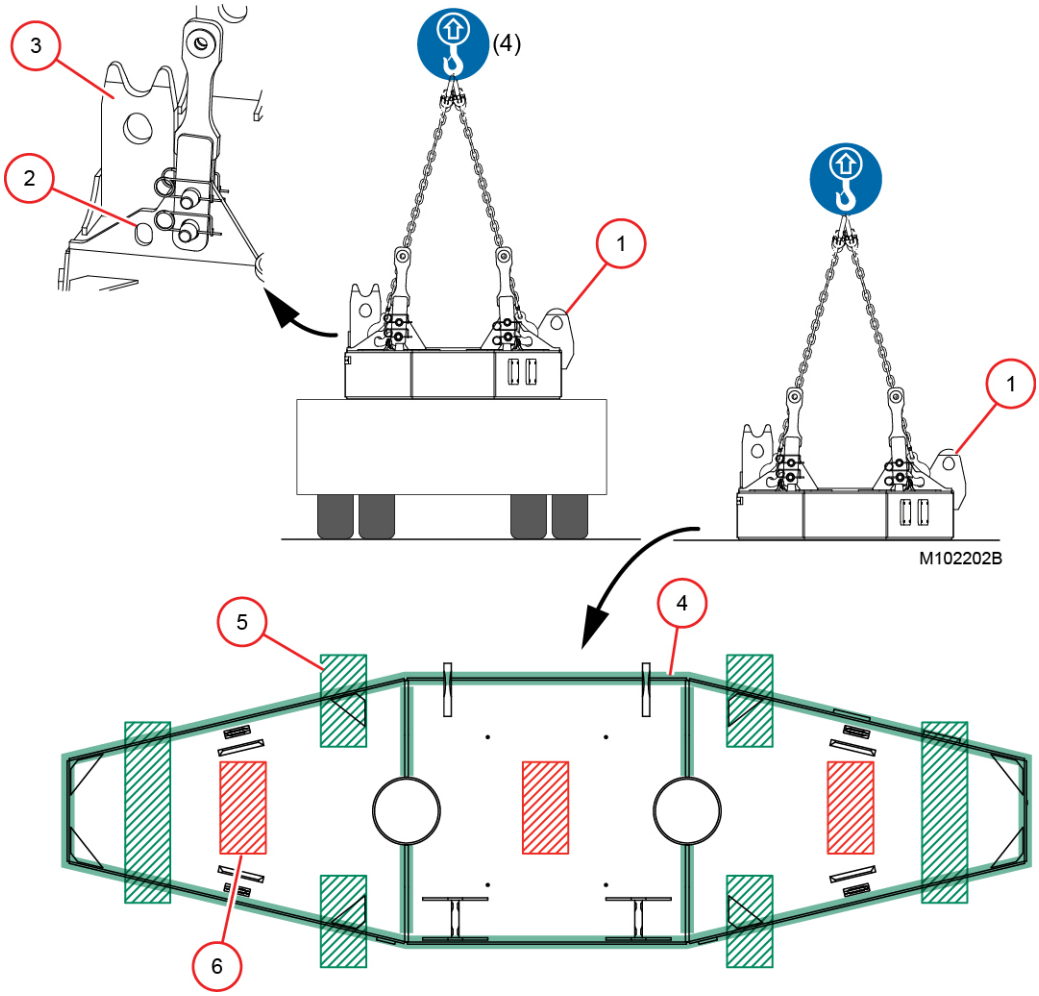
Tipping Hazard!

To prevent tipping or structural failure of components:

- Install the carbody counterweight before installing the crane counterweight.

See Figure 4-28 for the following procedure.

1. Position the trailer carrying the carbody counterweight (1) on the desired side of the crane.
2. Attach a 4-leg chain sling — or shackles and synthetic slings — from the assist crane to the four lifting lugs on the carbody counterweight. Each carbody counterweight weighs approximately 22,488 lb (10 200 kg).
3. Lift the carbody counterweight clear of the trailer and remove the trailer.
4. Rotate the carbody counterweight as required so the slotted lugs on the counterweight face the carbody.
5. Position the carbody counterweight between the crawlers at the cab end of the crane.
6. Lower the carbody counterweight so the slotted lugs on the counterweight engage the hooked lugs on the carbody.
7. Continue to lower the counterweight until the lifting slings go slack.
8. Remove the two pins (3) from the storage lugs (4) on the carbody counterweight.
9. Install the two pins (3) in the hooked lugs to secure the carbody counterweight to the carbody.
10. Disconnect the lifting slings.
11. If necessary, hook the crawler step (2) onto the counterweight bar, and install the wire-lock pins (6).
12. Swing 180° and repeat the process for the other carbody counterweight.



Item	Description
1	Counterweight Tray
2	Lifting Hole (4)
3	Hooked Alignment Lug (2)
4	Locate Blocking Under Plates Highlighted in Green
5	**Acceptable** Blocking Locations – **Green**
6	**Unacceptable** Blocking Locations – **Red**

Figure 4-29

Assemble Crane Counterweight

See Figure 4-29.

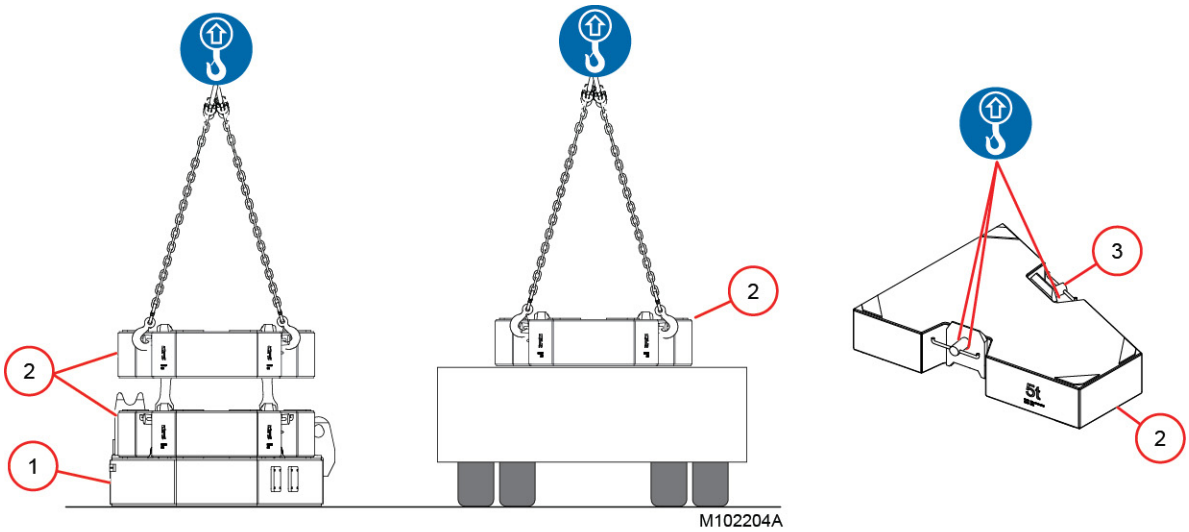
1. Attach a 4-leg chain sling — or shackles and synthetic slings — from the assist crane to the four lifting holes (2) on the counterweight tray. The tray weighs approximately 35,274 lb (16 000 kg).
2. Lift the counterweight tray clear of the trailer and remove the trailer.
3. Set the counterweight tray on blocking at ground level in the desired installation location. Level the tray as needed.

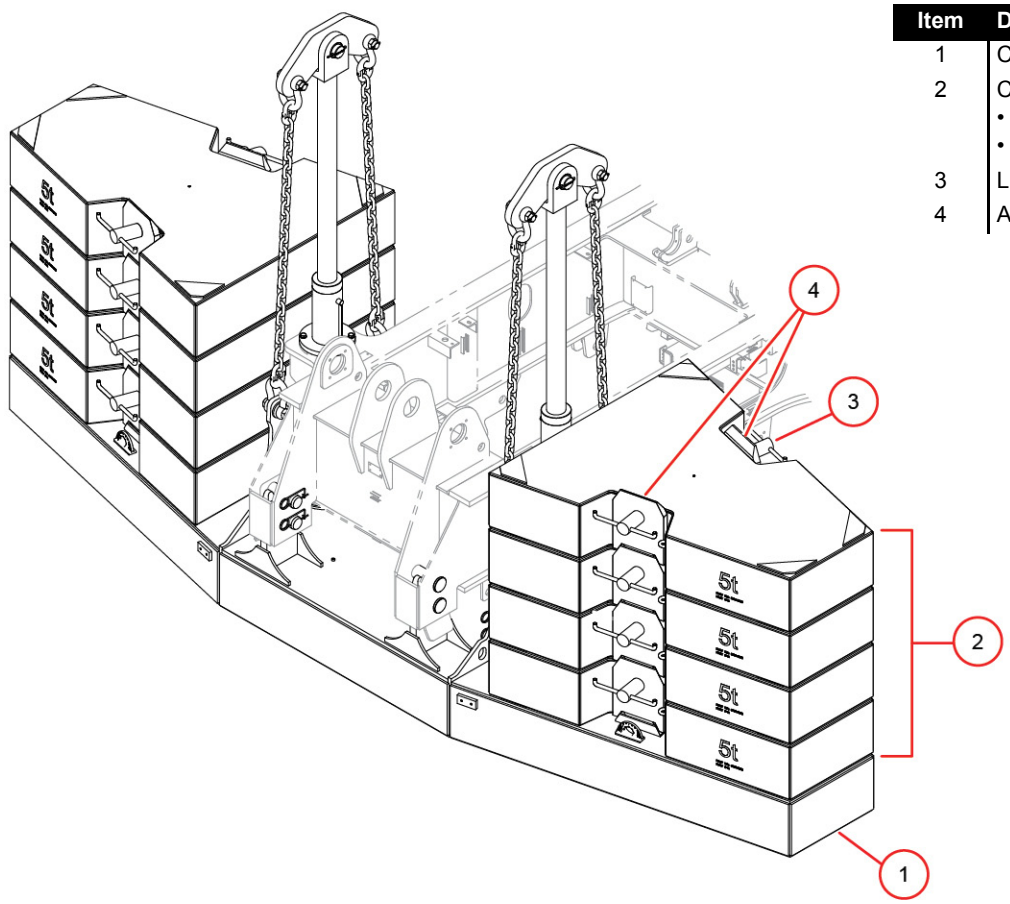
   Block only as shown or damage to the tray will occur.

NOTE The counterweight tray can only be installed between the crawler drives of the MLC165-1, not between the front rollers. This is because the crawlers may be longer over the front than the rear due to tread adjustment.

The hooked alignment lugs (3) must be farthest from the crawler drives when installing the upper counterweight.

Continued on the next page.





Item	Description
1	Counterweight Tray
2	Counterweight Box: • 3 each side for Series 1 • 4 each side for Series 2
3	Lifting Lug (2 each box)
4	Alignment Lug

Figure 4-30

See Figure 4-30 for the remaining steps.

4. Attach lifting slings to the two lifting lugs (3) on the counterweight box (2) as shown. Each box weighs 11,023 lb (5 000 kg).

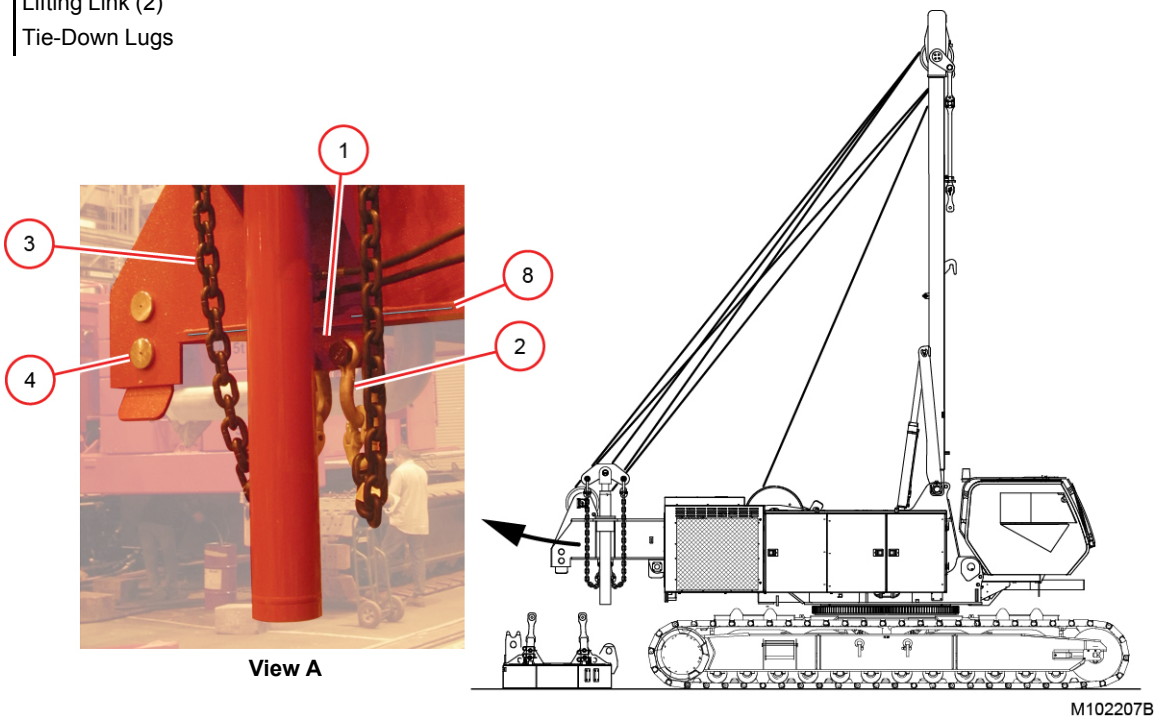
   Use either:

   - Two legs of a chain lifting sling looped around the lifting lugs and hooked to the master link.
   - Two synthetic lifting slings vertically connected to the lifting lugs and to the assist crane hook.

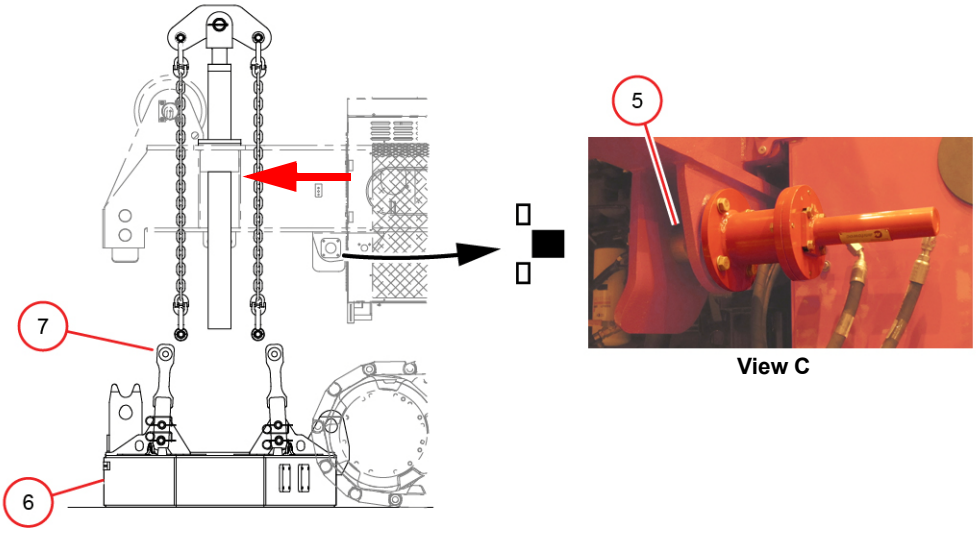
5. Lift the counterweight box (2) off the trailer and remove the trailer.
6. Use the alignment lugs (4) on the tray to align the box.
7. Disconnect the lifting sling and repeat the process for each box.
8. Use the alignment lugs (4) on each box to align the adjacent box.
9. Stack the boxes as shown for either Series 1 or Series 2.

Item	Description
1	Storage Lug (2)
2	Shackle (4)
3	Handling Chain (4)
4	Outer Connecting Pin with Safety Pin (4)
5	Inner Connecting Pin (2)
6	Counterweight Tray
7	Lifting Link (2)
8	Tie-Down Lugs

NOTE: For clarity, the counterweight boxes are not shown.



View A



View B

View C

Figure 4-31

Install Crane Counterweight

DANGER

Tipping Hazard!

To prevent tipping or structural failure of components:

- Install the carbody counterweight before installing the crane counterweight.

Crush Hazard!

To prevent serious crushing injury:

- Do not stand on, under, or in front of the crane counterweight while it is lifted.

See Figure 4-31.

1. If not already done, install the carbody counterweight.
2. Disconnect the handling chains (3, View A) from the tie-down lugs (8).
3. Disconnect the shackles (2, View A) from the storage lugs (1) and allow the handling chains (3) to hang freely.
4. Remove the outer connecting pins (4, View A) from both sides of the rotating bed. Put the pins on the counterweight tray (6) for access later.
5. Start the engine.
6. Turn on the remote control icon (**I**) in the setup function screen of the main display (see Setup Mode on page 4-6).
7. Using the switch on the remote control, disengage the inner connecting pins (5, View C) from both sides of the rotating bed.
8. Position the crane (View B) in line with the counterweight tray (6). A signal person is required to direct the operator.
9. The handling chains (3, View B) must hang vertically from side-to-side and front-to-rear in-line with the lifting links (7), View B).

WARNING

Moving Equipment Hazard!

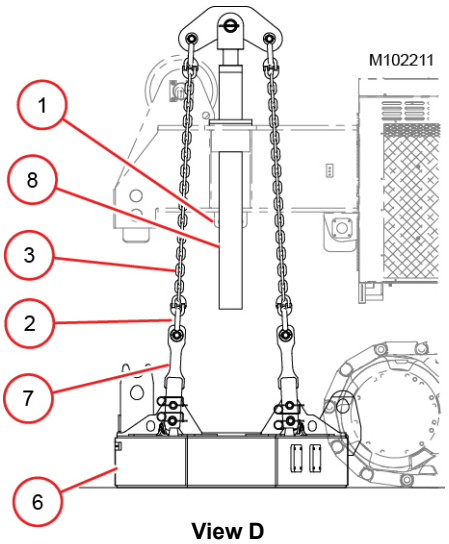
Before raising the counterweight tray, make sure the handling chains are hanging vertical from side-to-side and front-to-back.

Failure to do so may result in injury caused by the counterweight swinging as it is lifted off the ground.

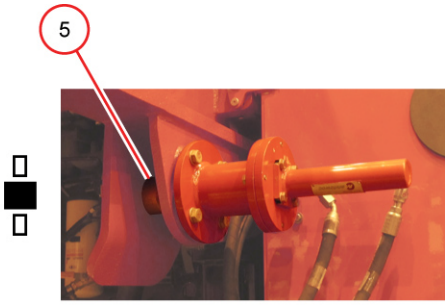
Continued on the next page.

NOTE: For clarity, the counterweight boxes are not shown.

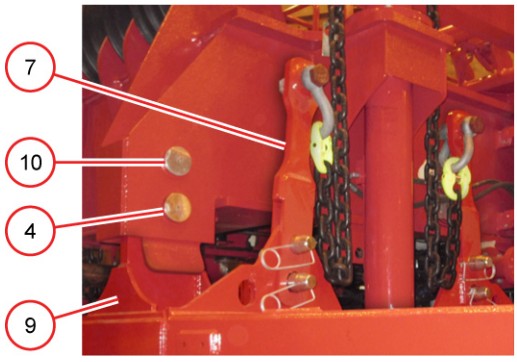
Item	Description
1	Storage Lug with Safety Pin (4)
2	Shackle (4)
3	Handling Chain (4)
4	Outer Connecting Pin with Safety Pin (2)
5	Inner Connecting Pin (2)
6	Counterweight Tray
7	Lifting Link (4)
8	Counterweight-Handling Cylinder (2)
9	Alignment Lug (2)
10	Stop Pin (2)



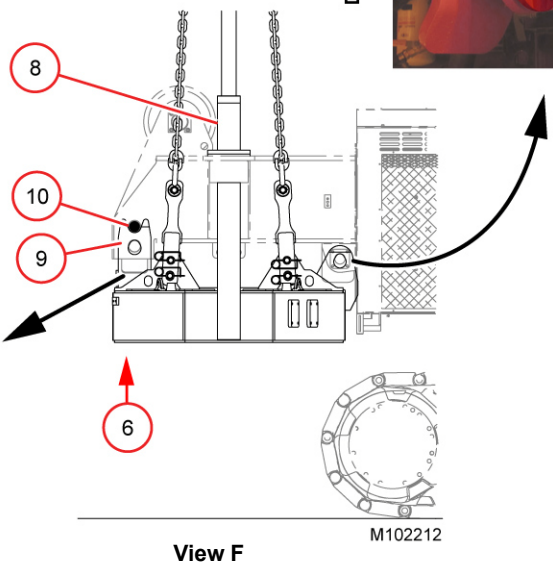
View D



View E



View G



View F

Figure 4-32

See Figure 4-32 for the remaining steps.

10. Pin the shackles (2, View D) to the lifting links (7).

Using the switches on the remote control, extend and retract the counterweight-handling cylinders (8) as needed to align the shackles with the lifting links.

11. Make sure the inner connecting pins (5) are fully disengaged.

12. Using the switches on the remote control, extend the counterweight-handling cylinders (8, View F) to lift the crane counterweight to its working position. ***Keep the counterweight tray (6) as level as possible from side-to-side as it rises***.

13. Stop when the alignment lugs (9, Views F and G) bottom out against the stop pins (10) and the inner connecting holes are aligned.

14. Using the switch on the remote control, engage the inner counterweight pins (5, View E).

WARNING

Burn Hazard!

Do not climb onto the counterweight tray for any reason while the counterweight is in the working position.

The exhaust pipe can burn and cause serious injury.

15. Install the outer counterweight pins (4, View G).

16. Using the switch on the remote control, fully retract the counterweight-handling cylinders.

17. The chains and shackles can remain connected to the lifting links (View G) for crane operation.

Install Counterweight Work Lights

See Figure 4-33 for the following procedure.

If equipped with optional work lights, install them on the crane counterweight as follows:

1. Stop the engine.

2. Remove the work lights (1) from storage.

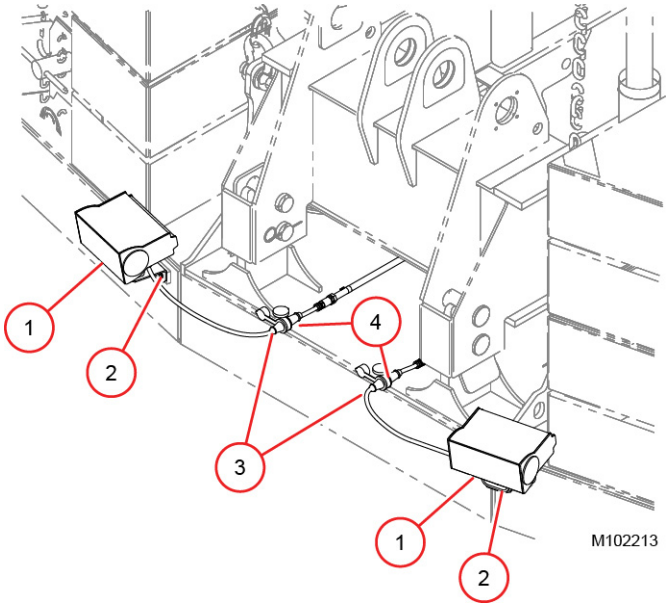
3. Securely fasten the work lights (1) to the counterweight tray with the cap screws and lock washers (2).

4. Connect the electric cables (3) to the receptacles (4) on the rear of the counterweight tray.

5. Connect the electric cables from the rotating bed to the receptacles (4) on the front of the counterweight tray.

6. Loosen the cap screws and nuts and adjust the position of the lights left-to-right and up-and-down as needed.

7. Securely tighten the cap screws and nuts.



Item	Description
1	Work Light (2)
2	Cap Screw and Lock Washer (4)
3	Electric Cable (2)
4	Receptacle (4)

Figure 4-33

Item	Description
1	Boom Butt
A	Front Lifting Lug (2)
B	Middle Lifting Lug (2)
C	Rear Lifting Lug: NOT USED

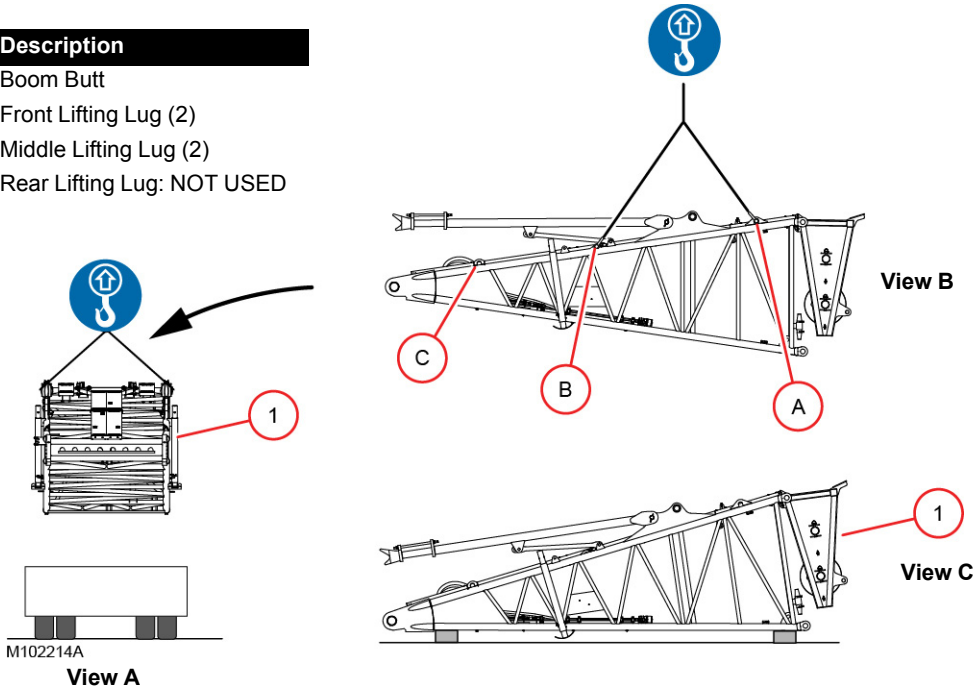


Figure 4-34

Remove Boom Butt from Trailer

See Figure 4-34.

1. Attach a 4-leg chain sling — or shackles and synthetic slings — from the assist crane to the four lifting lugs on the boom butt (1, View B). The boom butt weighs 5,869 lb (2 662 kg). Add 5,037 lb (2 285 kg) if equipped with a drum in the butt.
2. Lift the boom butt off the trailer and remove the trailer.
3. Place the boom butt on blocking at ground level (View C)
4. Disconnect the lifting slings from the boom butt.

Raise Boom Butt Wire Rope Guide

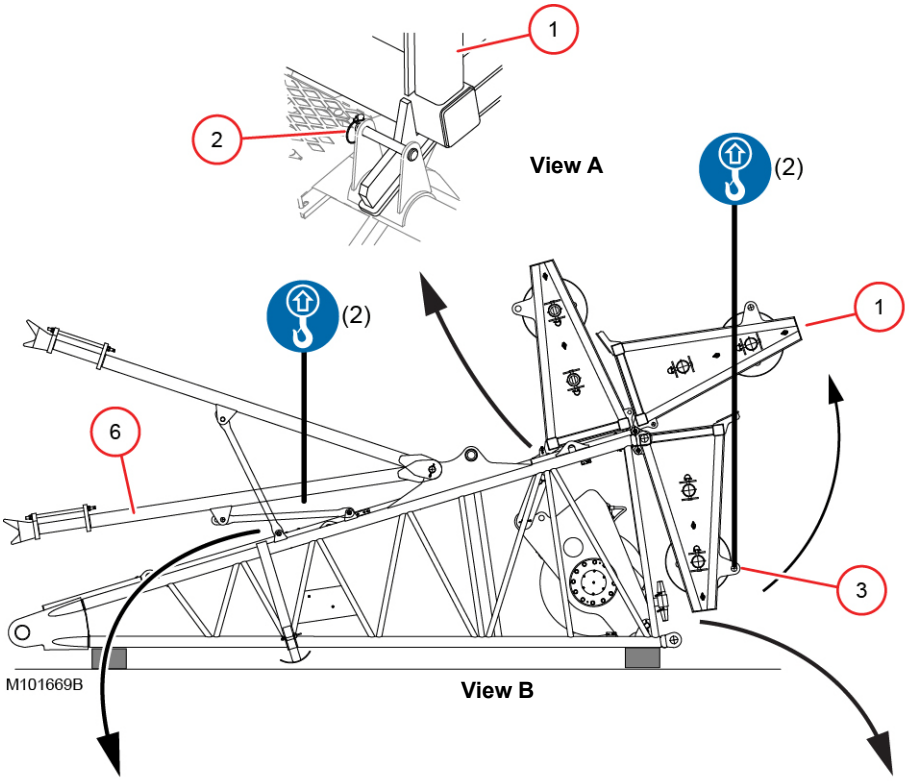
See Figure 4-35.

1. Remove the pins (2, View A) from the lugs on the boom butt.
2. Attach a lifting sling from the hook of the assist crane to the lugs (2, View B) on the wire rope guide (1).
3. Hoist just enough to support the wire rope guide (1).
4. Remove the pin (4, View C), rotate the link (5) to the working position, and reinstall the pin (4).
5. Raise the wire rope guide (1, View B) to the operating position.
6. Install the pins (2, View A).
7. Disconnect the lifting sling from the wire rope guide.

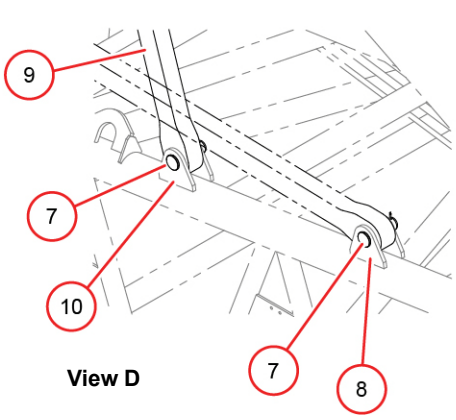
Raise Boom Stops

(Figure 4-35):

1. Using a basket hitch, attach a synthetic lifting sling from the hook of the assist crane to either boom stop (6, View B) at the approximate location shown.
2. Hoist just enough to loosen the pin (7) in the storage lugs (8).
3. Remove the pin (7) from the storage lug.
4. Raise the boom stop until the strut (9) can be pinned in the working position.
5. Install the pin (7) in the working lugs (10).
6. Disconnect the lifting sling.
7. Repeat the steps for the other boom stop.



Item	Description
1	Wire Rope Guide
2	Pin with Wire-Lock Pin (2)
3	Lifting Lug (2)
4	Pin with Cotter Pins
5	Link
6	Boom Stop (2)
7	Pin with Cotter Pin (2)
8	Storage Lugs
9	Strut (2)
10	Working Lugs



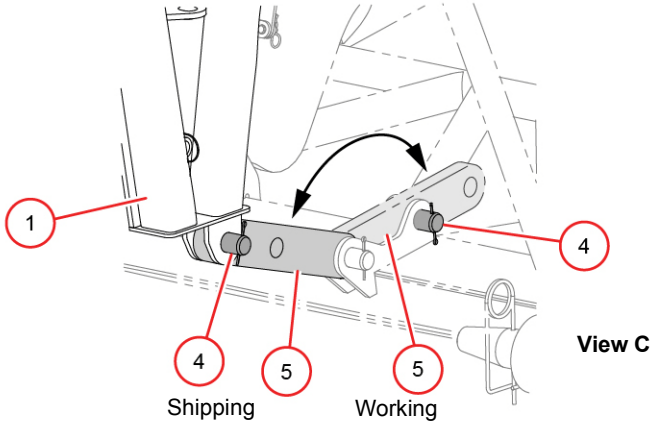
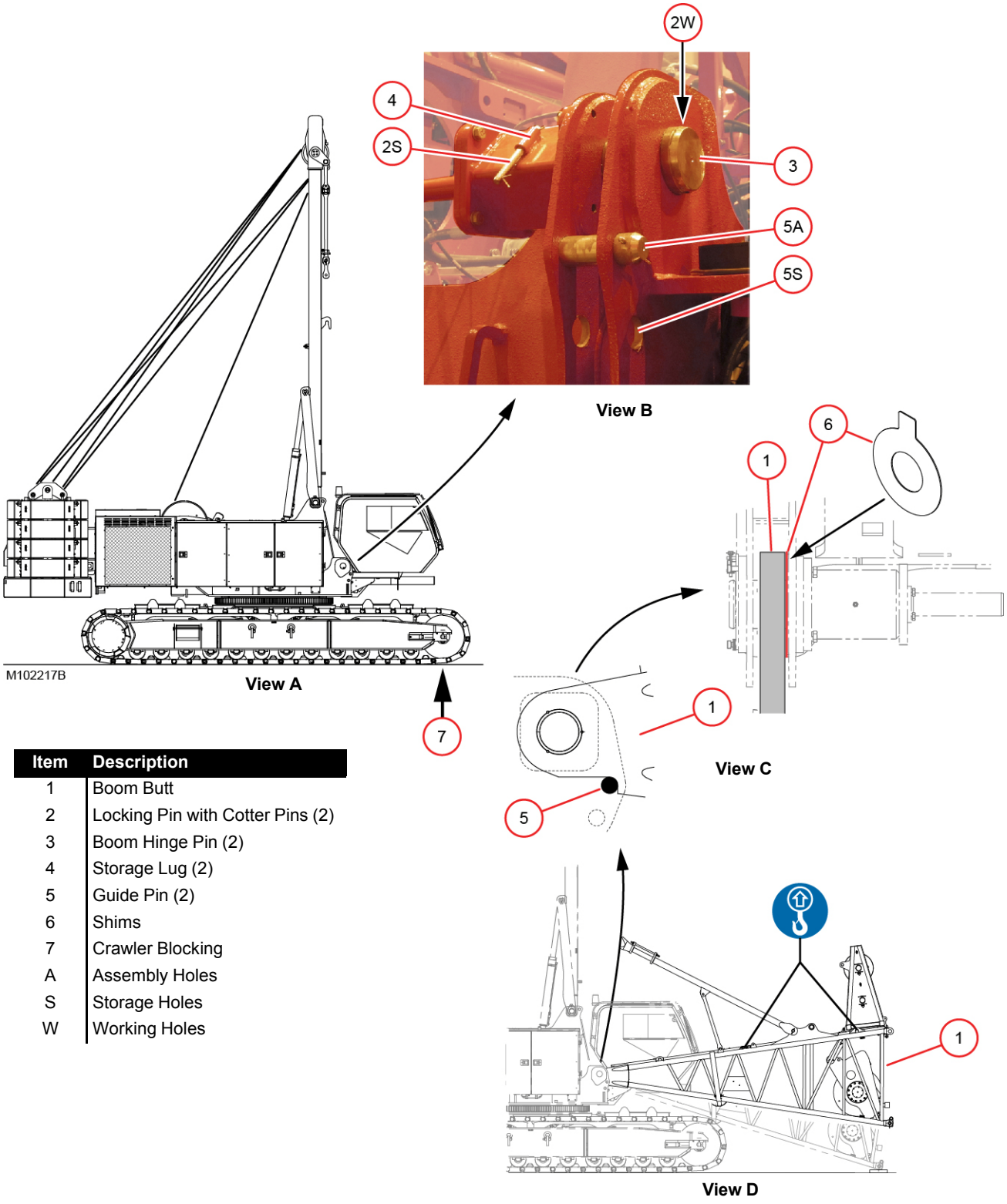


Figure 4-35



Item	Description
1	Boom Butt
2	Locking Pin with Cotter Pins (2)
3	Boom Hinge Pin (2)
4	Storage Lug (2)
5	Guide Pin (2)
6	Shims
7	Crawler Blocking
A	Assembly Holes
S	Storage Holes
W	Working Holes

Figure 4-36

Attached Boom Butt to Crane

See Figure 4-36.

NOTE 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.

1. Start the engine.
2. If required, travel the front crawler rollers onto blocking (7, View A) as instructed in the Crawler Blocking Diagram in the Capacity Chart Manual.
3. Remove the locking pins (2W, View B) from the boom hinge pins (3) and store them in the storage lugs (4).
4. Using the switch on the overhead control console or on the remote control, fully disengage the boom hinge pins (3, View B).
5. Move the guide pins (5, View B) from the storage holes (5S) and install them in the assembly holes (5A).

   The guide pins aid in aligning the boom butt connecting holes.
6. Apply a light coat of grease to the flat on the underside of both boom hinge lugs.
7. Attach a 4-leg chain sling — or shackles and synthetic slings — from the assist crane to the four lifting lugs on the boom butt (1, View D).
8. Lift the boom butt into position until the stops on the underside of the boom hinge lugs are snug against the guide pins (5, View C).
9. Raise the boom butt until the holes in the boom butt are aligned with the holes in the rotating bed.
10. Install the shims (8, View C) on the inboard side of both boom hinge legs. ***Shims must be installed to prevent the butt from contacting outboard rotating bed lugs.***

WARNING

Crush Hazard!

Avoid injury when engaging the boom hinge pins:

Keep your fingers out of the space between the boom butt lugs and rotating bed lugs. The boom butt may move from side-to-side when the pins are engaged.

Keep your fingers away from the underside of the hinge pin cylinder housings. Alignment lugs move when the pins are engaged.

11. Using the switch on the overhead control console or on the remote control, fully engage the boom hinge pins (3, View A).
12. Raise the boom butt slightly and move the guide pins (5, View C) from the assembly holes (5A, View B) to the storage holes (5S). ***Do not lower the boom butt to the ground until the guide pins are stored***.
13. Install the locking pins (2, View B) in the boom hinge pins (3).

WARNING

Falling Boom Hazard!

Prevent the boom butt (or boom) from falling off the crane:

- Do not operate the crane until the locking pins are installed in the boom hinge pins.

14. Lower the boom butt onto blocking at least 9 in (229 mm) high at ground level.

Item	Description
1	Boom Butt
2	Insert
3	Top Connector Pin with Safety Pin (2)
4	Storage Bracket

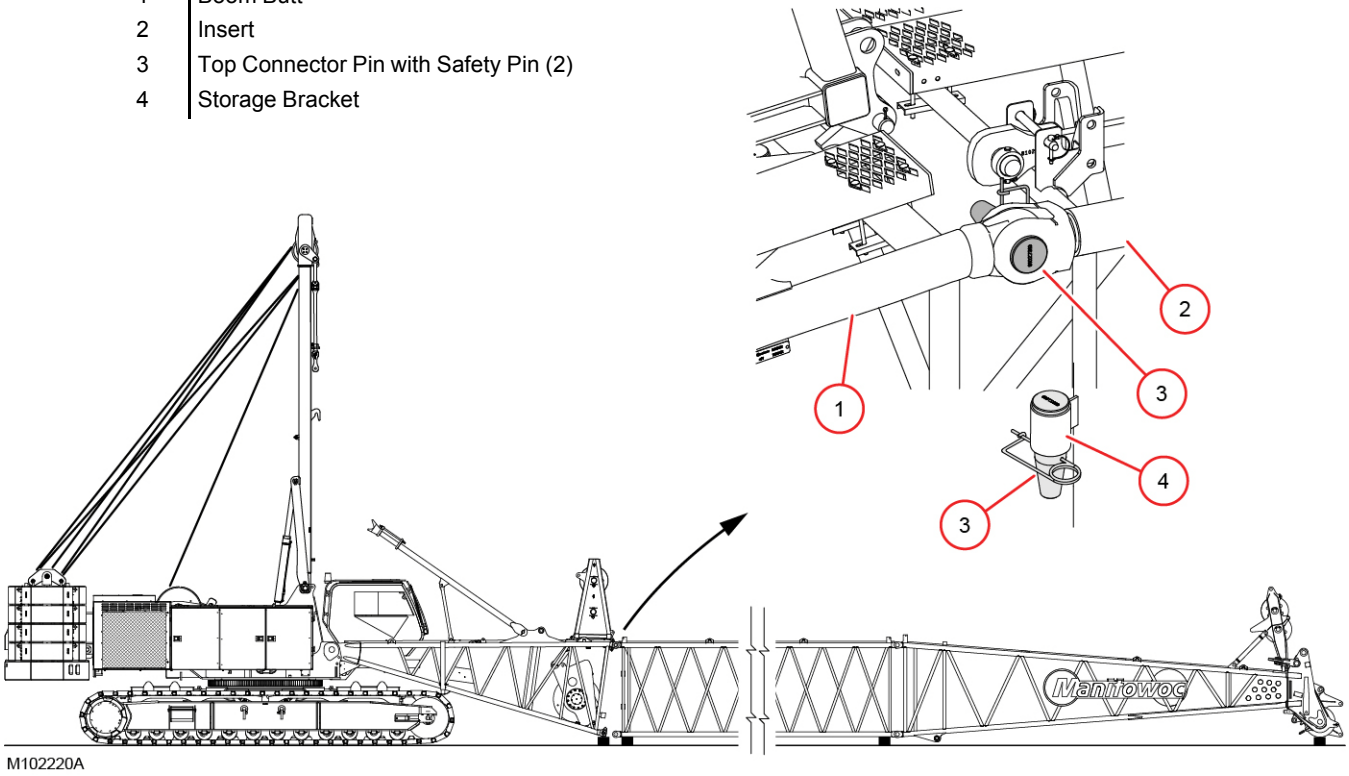


Figure 4-37

WARNING

Crushing Injury Hazard!

Prevent serious crushing injury:

- Do not stand inside the boom sections while installing the connector pins — STAND OUTSIDE BOOM.

Assemble Boom to Boom Butt

Read the following topics before proceeding:

- Boom Ladders on page 4-85
- Boom and Jib Rigging on page 4-86

See Figure 4-37.

1. Lift the first insert (2) into position at the end of the boom butt (1). See Handling Components on page 4-88.
2. Align the top connector holes.
3. Remove the top connector pins (3) from the storage brackets (4).
4. Install the top connector pins (3). The pin heads must face the outside.
5. Secure the connector pins with safety pins.
6. Block under the insert so it is level.
7. Disconnect the lifting slings.
8. Attach the remaining boom sections. Perform all of the steps under the topic Boom #74A Assembly on page 4-91.

Item	Description
1	Boom Butt
2	Insert
3	Lifting Lug (2)
4	Bottom Connector Pin with Safety Pin (2)
5	Storage Bracket

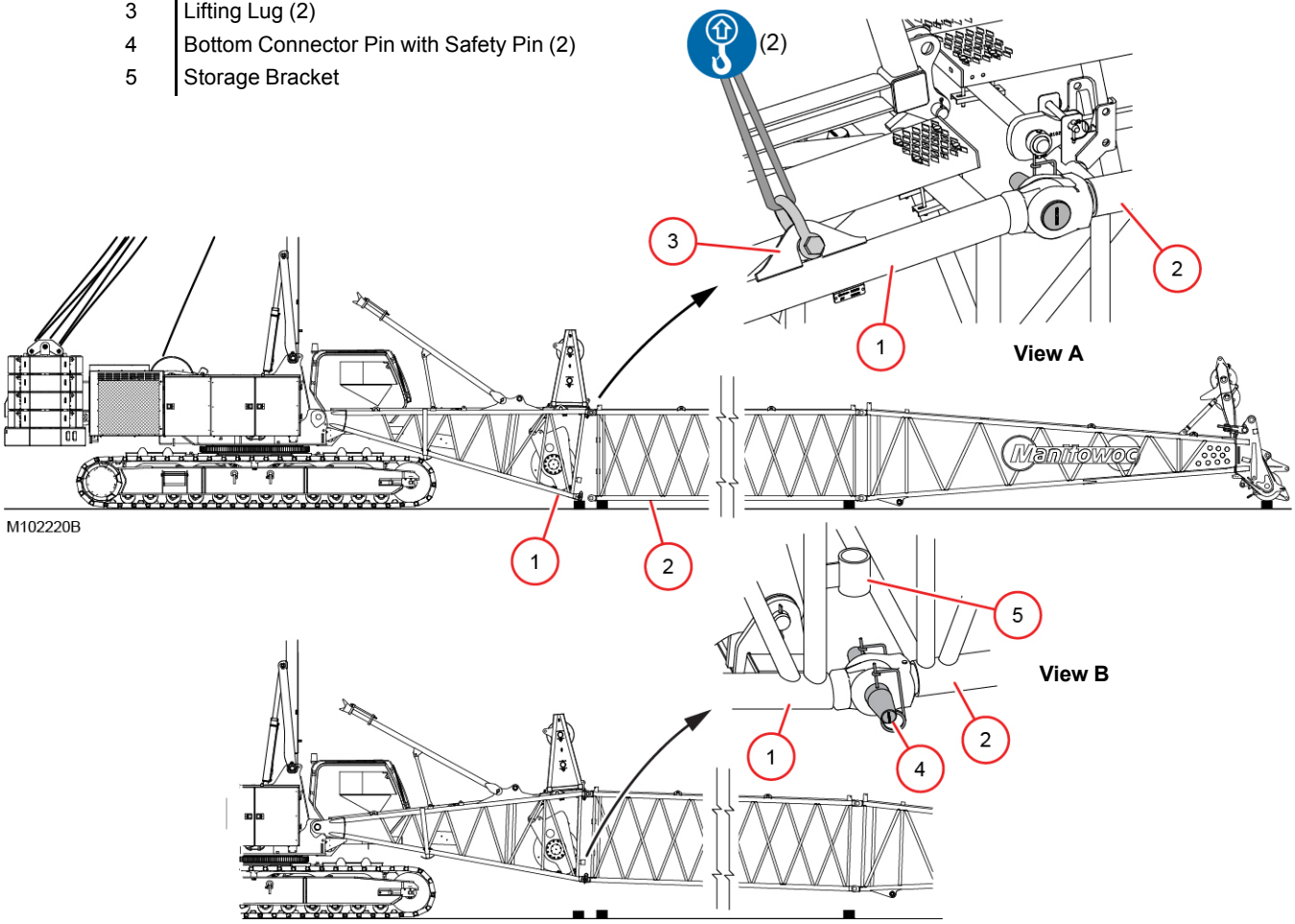


Figure 4-38

See Figure 4-38 for the remaining steps.

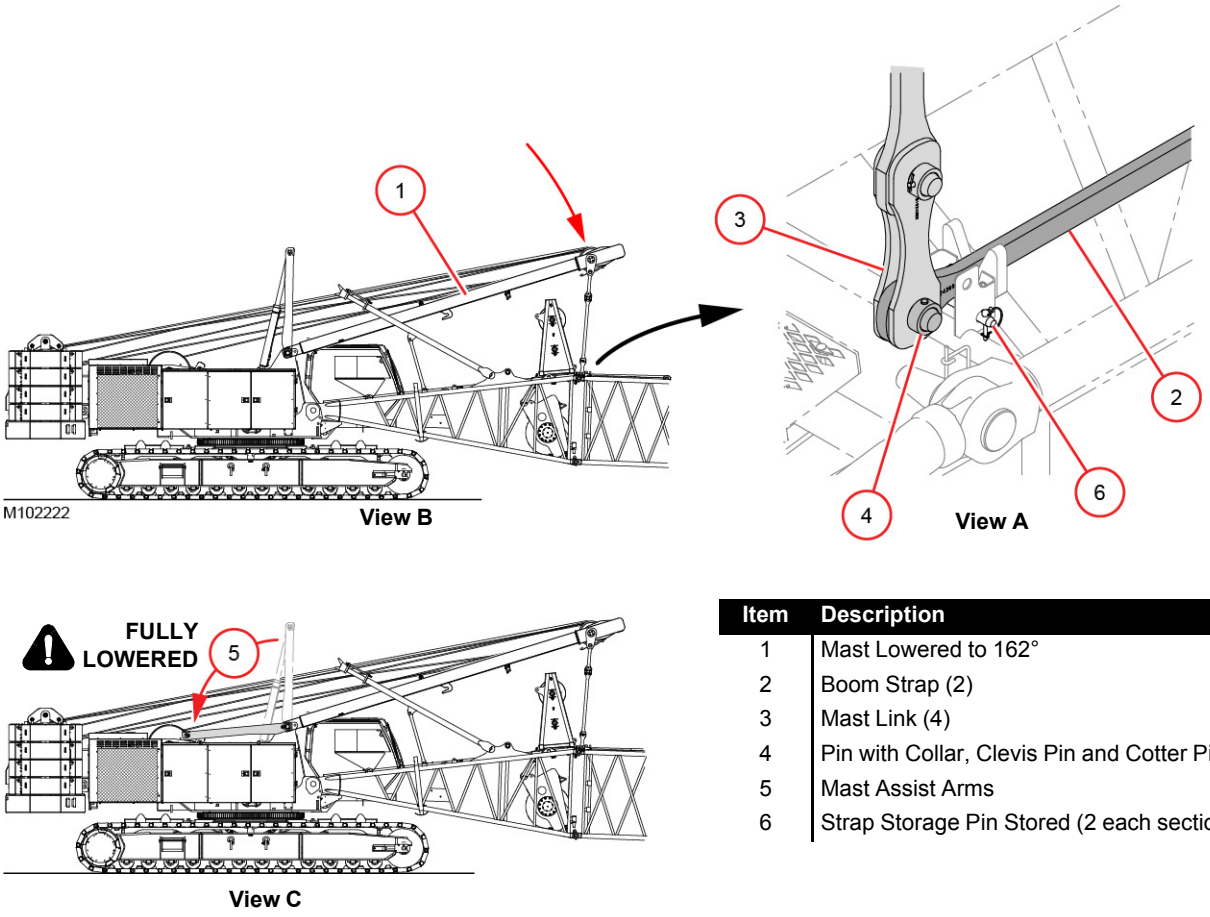
9. Connect lifting slings from the assist crane to the top two lifting lugs (3, View A) on the boom butt (1).

Use a 2-leg chain sling or shackles and synthetic slings. The assist crane and lifting slings must be sized to lift half the weight of the assembled boom.

10. Slowly lift the boom butt to align the bottom connector holes and install bottom connector pins (4, View B). The pins are stored in the brackets (5) on the boom butt (1).

11. Lower the boom butt until the lifting slings are slack

12. Disconnect the lifting slings from the boom butt.



Item	Description
1	Mast Lowered to 162°
2	Boom Strap (2)
3	Mast Link (4)
4	Pin with Collar, Clevis Pin and Cotter Pin (2)
5	Mast Assist Arms
6	Strap Storage Pin Stored (2 each section)

Figure 4-39

Connect Mast Straps to Boom Straps

See Figure 4-39.

1. Remove pin (4, View A) from the end of each boom strap (2).
2. Lower the mast (1, View B) until the holes in the mast links (3, View A) are aligned with the holes in the boom straps (2). The mast will be at approximately 162°.

WARNING

Falling Load Hazard!

Do not exceed a maximum mast angle of 162°. The mast could fall suddenly.

3. Connect the mast links (3) to the boom straps (2) with the pins and collars (4, View A).
4. Using the switch on the overhead control console or on the remote control, fully LOWER the mast-assist arms (5, View C).

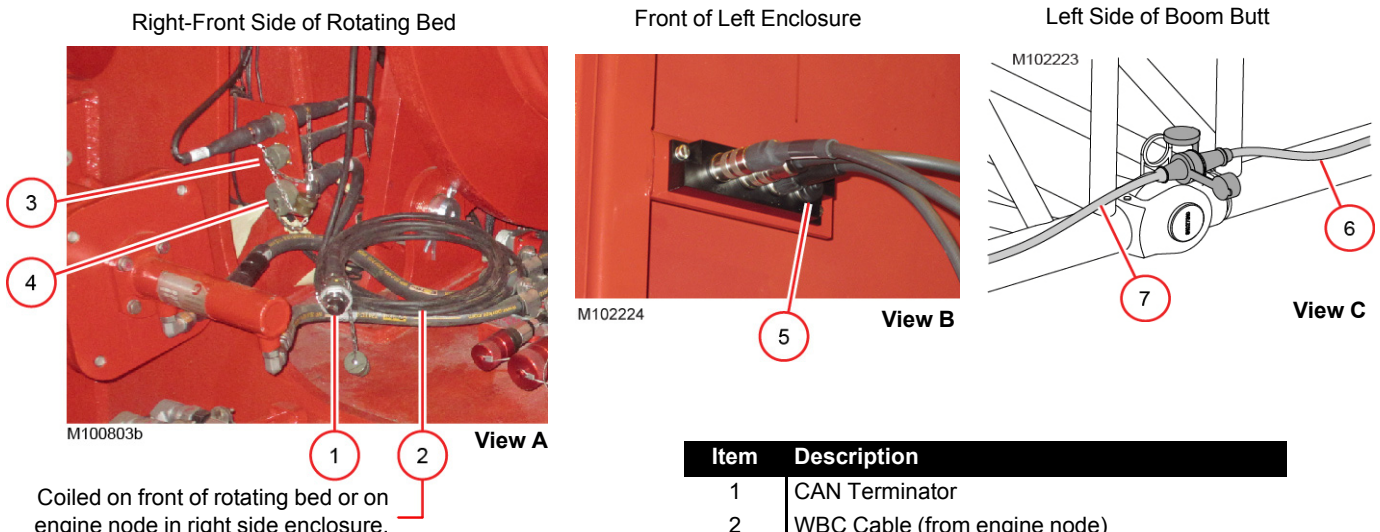
DANGER

Falling Mast/Boom Hazard!

Prevent the mast and the boom from falling:

- Fully lower the mast-assist arms before raising the boom. The mast can buckle and collapse if it contacts the mast-assist arms with a fully rigged boom.

5. Turn off the setup mode. See Setup Mode on page 4-6.
6. Select the proper Liftcrane Boom or Jib Capacities Chart on the configuration screen of the RCL/RCI display. See the MLC165-1 RCL/RCI Manual for instructions.
7. Store the remote control (see View E, Figure 4-2 on page 4-4).
8. Make sure the strap storage pin (6, View A) at the end of each boom strap (2) is stored, or DAMAGE WILL OCCUR when the boom is raised.



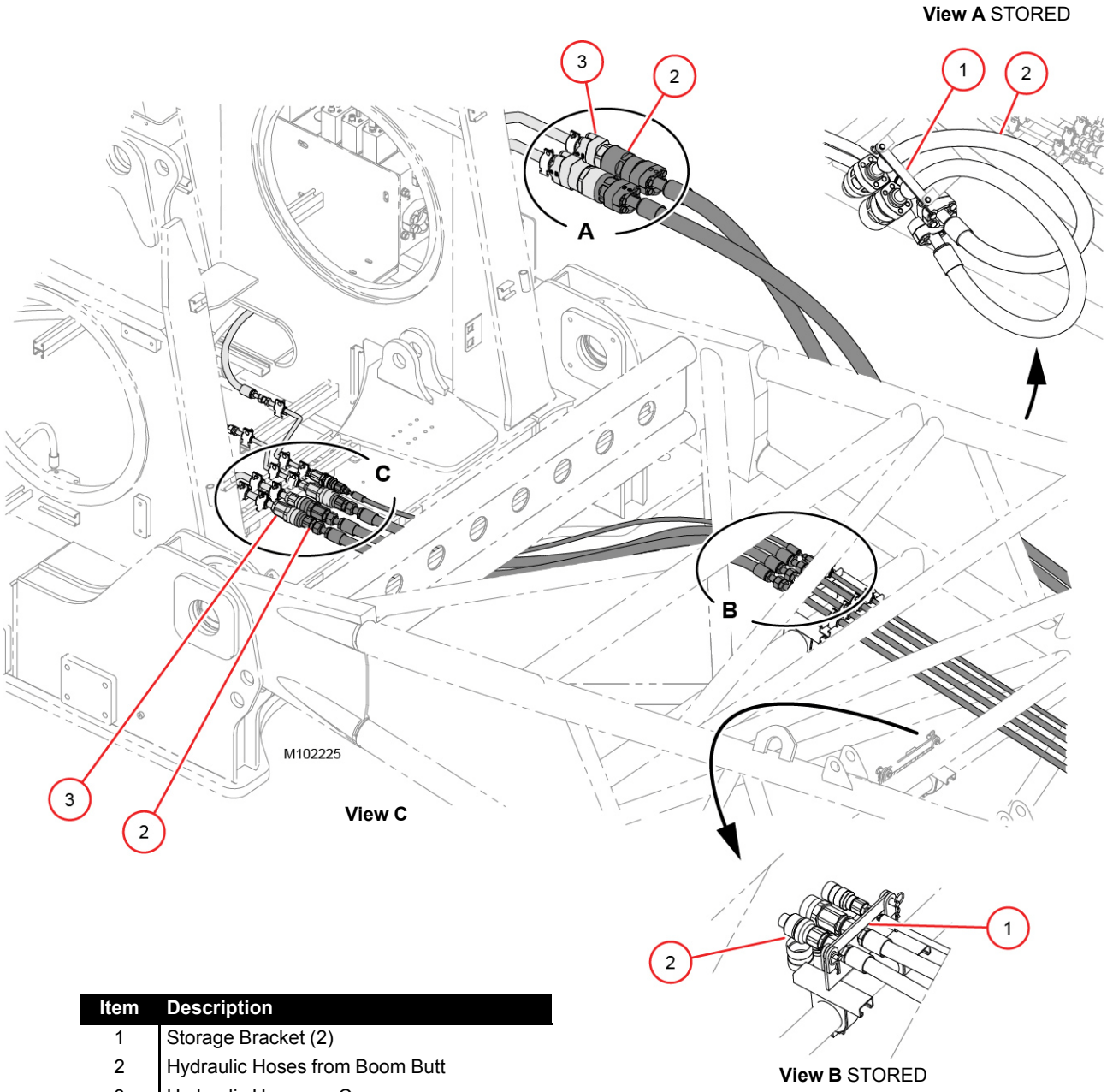
Item	Description
1	CAN Terminator
2	WBC Cable (from engine node)
3	Receptacle for Optional Position Light
4	Receptacle for Optional Drum in Boom Butt
5	Receptacle for Boom Butt Camera
6	Boom Work Lights Electric Cable from Crane
7	Receptacle

Figure 4-40

Connect Electric Cables from Crane to Boom Butt

See Figure 4-40.

1. Stop the engine.
2. Disconnect the dust caps from the receptacles and electric cable connectors.
3. Thoroughly clean all electric connectors.
4. Disconnect CAN terminator (1, View A) from the WBC cable (2) on the right side of the rotating bed.
5. Connect the WBC cable (2) from the crane to the WBC cable on the cable reel in the boom butt.
6. If equipped with the position light option, connect the WWLA cable from the cable reel in the boom butt to the receptacle (3, View A) on the right side of the rotating bed.
7. If equipped with the optional drum in the boom butt, connect the W44 cable from the drum to the receptacle (4) on the right side of the rotating bed.
8. If equipped with the drum camera in the boom butt, connect the electric cable from the camera to the receptacle (5, View B) in the left front enclosure.
9. If equipped with boom work lights, connect the electric cable (6, View C) coiled on the front of the rotating bed to the receptacle on the electric cable (7) at the end of the adjacent boom section.



Item	Description
1	Storage Bracket (2)
2	Hydraulic Hoses from Boom Butt
3	Hydraulic Hoses on Crane

Figure 4-41

Connect Boom Butt Hydraulic Hoses

Proceed as follows, if equipped with a drum in the boom butt.

See Figure 4-41.

1. Stop the engine.
2. Disconnect the hydraulic hoses (2) from the storage brackets (1, Views A and B).
3. Disconnect the dust caps from the ends of the hydraulic hoses.
4. Thoroughly clean all hydraulic couplers.
5. Connect the hydraulic hoses (2) from the boom butt to the hydraulic hoses (3) on the crane.

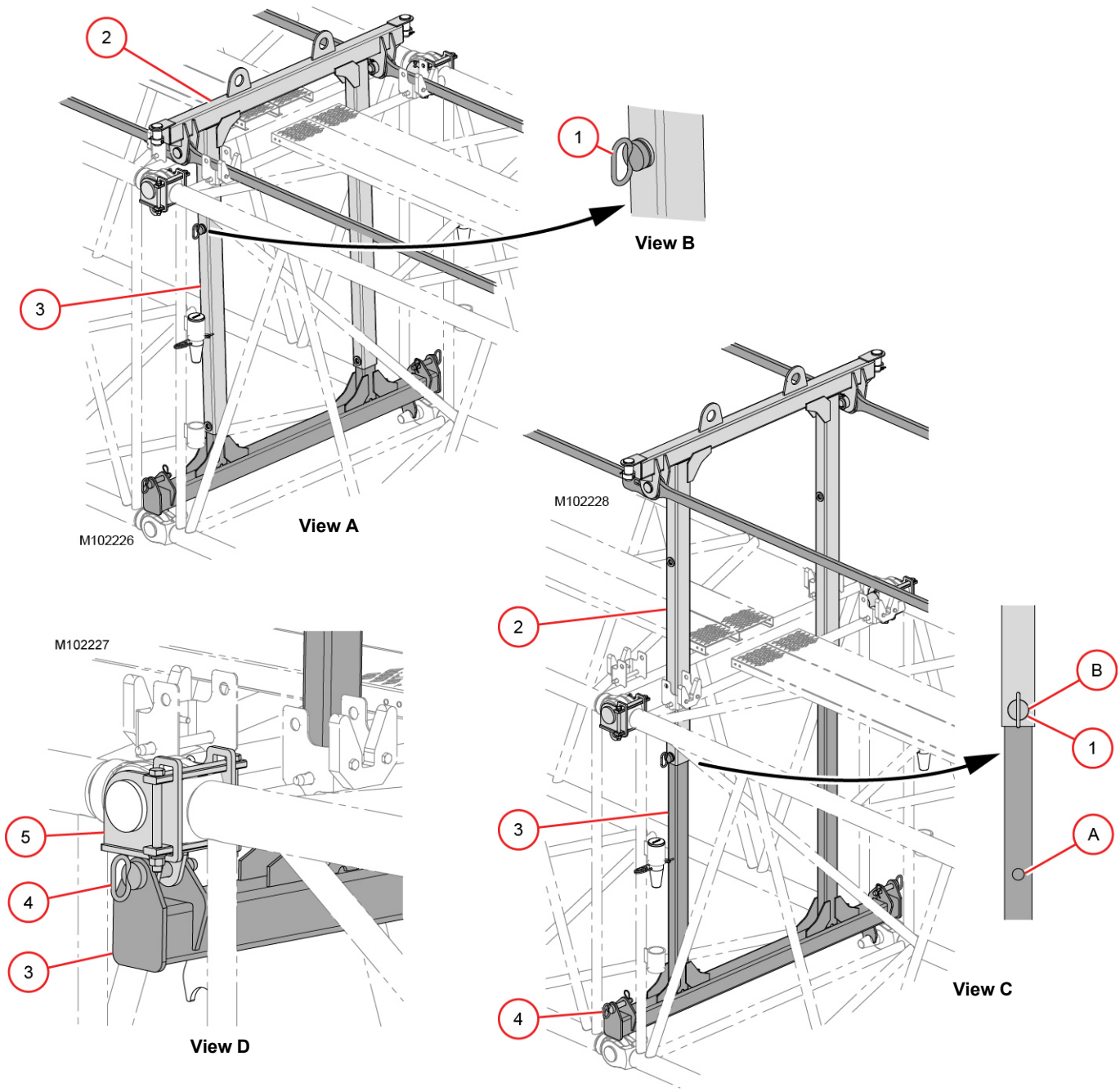
   The hoses at location (**A**, View C) can be connected only one way.

   The hoses between locations (**B** and **C**, View C) must not cross. They must be connected in the same order at point **C** as they are at point **B**.

Complete Boom and Jib Assembly

Finish assembling the boom and jib as needed. See:

- Boom #74A Assembly on page 4-91
- Jib #134 Assembly on page 4-107



Item	Description
1	Hitch Pin with Hair-Pin Cotter (2)
2	Outer Strut Frame
3	Inner Strut Frame
4	Hitch Pin with Hair-Pin Cotter (2)
5	Bracket (2)
A	Pin here for 236.2 ft (72 m), 246.1 ft (75 m), and 255.9 ft (78 m) Boom
B	Pin here for 265.7 ft (81 m) and 275.6 ft (84 m) Boom

Figure 4-42

RAISE BOOM

NOTE Refer to the MLC165 Luffing Jib Operator Manual for the pre-raising checks and raising procedure when equipped with a luffing jib.

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.
- ☐ Boom hinge pins are fully engaged and secured.
- ☐ Crawler connecting pins are engaged and locking pins installed.
- ☐ Carbody jack pads are removed and secured in storage position.
- ☐ Carbody jacks are fully retracted and pinned in crane working position.
- ☐ Boom and jib inserts are installed in proper sequence per boom and jib assembly drawings.
- ☐ Intermediate suspension strut is installed, if required.
- ☐ All straps are unpinned from storage lugs.
- ☐ All straps are properly pinned together. Cotter pins are installed and spread.
- ☐ Mast links are properly connected to boom straps.
- ☐ Mast assist arms are fully lowered.
- ☐ 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 to socket and wedge at boom and jib points or at load block and weight ball.
- ☐ Boom ladders are secured in their storage locations.
- ☐ All tools and other items are removed from boom and jib.
- ☐ Electrical boom stop is properly installed, operational, and adjusted to proper angle.
- ☐ Electric cables from crane control system are connected to cable reel in boom butt.
- ☐ Electric cables in boom and jib are connected to proper receptacles on junction boxes.
- ☐ Block-up limit control is properly installed, operational, and adjusted.
- ☐ RCL/RCI is properly configured and operational.
- ☐ Proper capacity chart is selected 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.

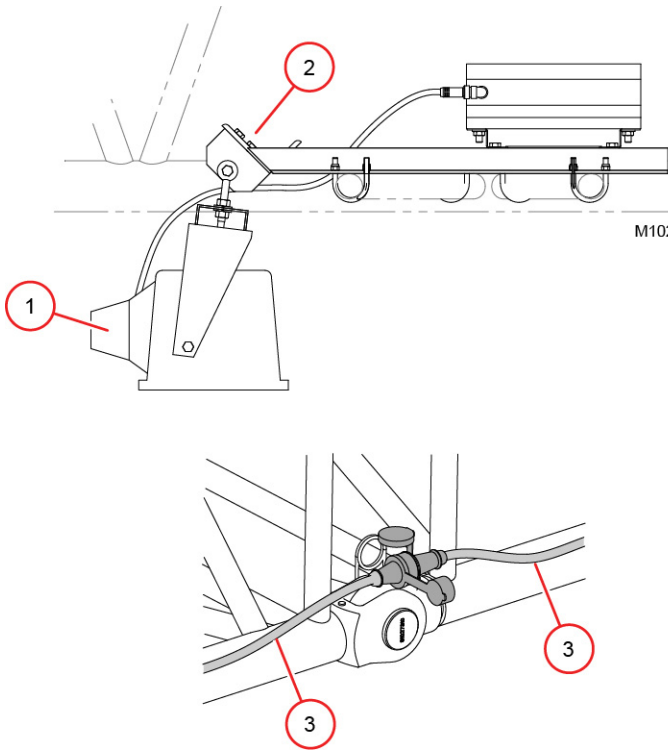
Boom Raising Procedure

1. Verify that the pre-raising checks have been performed.
2. SLOWLY start to boom up:
   - **a.** Have an assistant watch the boom straps as the boom rises.

     Signal the operator to STOP raising the boom if the straps get caught on the brackets, pins, or timber guards. ***Correct the problem before continuing***.
   - **b.** If equipped with intermediate suspension (see Figure 4-42):
     - Boom up just enough to loosen the hitch pins (1, View B) and remove the hitch pins.
     - Have an assistant watch the straps and the intermediate suspension strut as the boom rises.
     - Signal the operator to STOP raising the boom if the straps get caught on the brackets, pins, or timber guards. ***Correct the problem before continuing.***
     - Signal the operator to STOP raising the boom if the outer strut frame (2) stops rising. ***Correct the problem before continuing.***
     - Continue to boom up slowly. The outer strut frame (2) will rise.
     - Stop when the outer strut frame is positioned over the correct holes (A or B, View C) in the inner strut frame (3).
     - Install the hitch pins (1, View C) in the holes (A or B) depending on the boom length in use.
     - Remove the hitch pins (4, View C) and continue to boom up. The outer and inner strut frames will rise.
     - Signal the operator to STOP raising the boom if struts stop rising. ***Correct the problem before continuing.***
     - Stop when the holes in the inner strut frame (3, View D) line up with the holes in the brackets (5) and the install hitch pins (4).

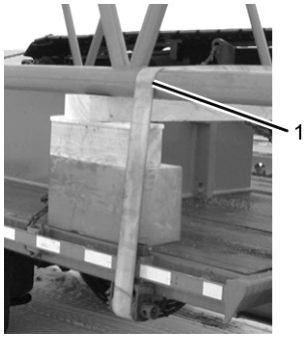
Continued on the next page.

3. SLOWLY continue to boom up.
4. If equipped with an upper boom point, stop when the bottom holes in the upper boom point are aligned with the holes in the boom top. Install the connecting pins. See Install the Upper Boom Point on page 4-100.
5. 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.
6. Install the load block(s) and hook-or-weight ball at the lower and upper boom points. See Install the Boom Load Lines on page 4-102.
7. Install the block-up limit components at the boom points. See Install the Boom Block-Up Limit Components on page 4-102.
8. If equipped with optional work lights (Figure 4-43):
   a. Install the light fixtures (1) under the boom sections once the boom can be raised to horizontal. See the Boom Light Fixture Drawing at the end of this section.
   b. Connect the electric cables (3) between the boom sections.
9. 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-or-weight ball.
   a. Signal the operator to STOP raising the boom if the jib pendants get caught on the brackets, pins, or timber guards. ***Correct the problem before continuing***.
   b. Make sure the jib stop pins (5, Figure 4-87 on page 4-113) fully engage the holes in the jib stop frame.
10. Install the load block or hook-or-weight ball at the jib point. See Install the Jib Load Lines on page 4-115.
11. Install the block-up limit components at the jib point. See Install the Jib Block-Up Limit Components on page 4-115.
12. Continue to boom up until the boom is at an angle that safely allows the load block(s) and hook-and-weight ball to be lifted.
13. 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 MLC165-1 Operator Manual).
   c. Check that the boom stop is adjusted for the proper maximum boom angle.
   d. Check that the RCL/RCI is properly calibrated.



Item	Description
1	Light Fixture
2	Cap Screws with Lock Nuts
3	Electric Cables

Figure 4-43



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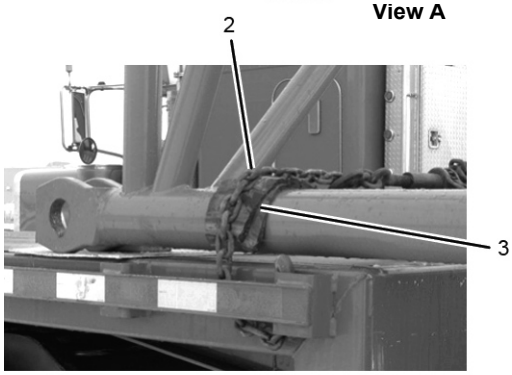
View A



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View B

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 4-44

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.

To avoid damage to components:

- Use synthetic tie-downs to secure components as shown in Figure 4-44, 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 4-44, 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.

CRANE DISASSEMBLY

Before proceeding, read and understand all of the topics on page 4-1 through page 4-6.

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

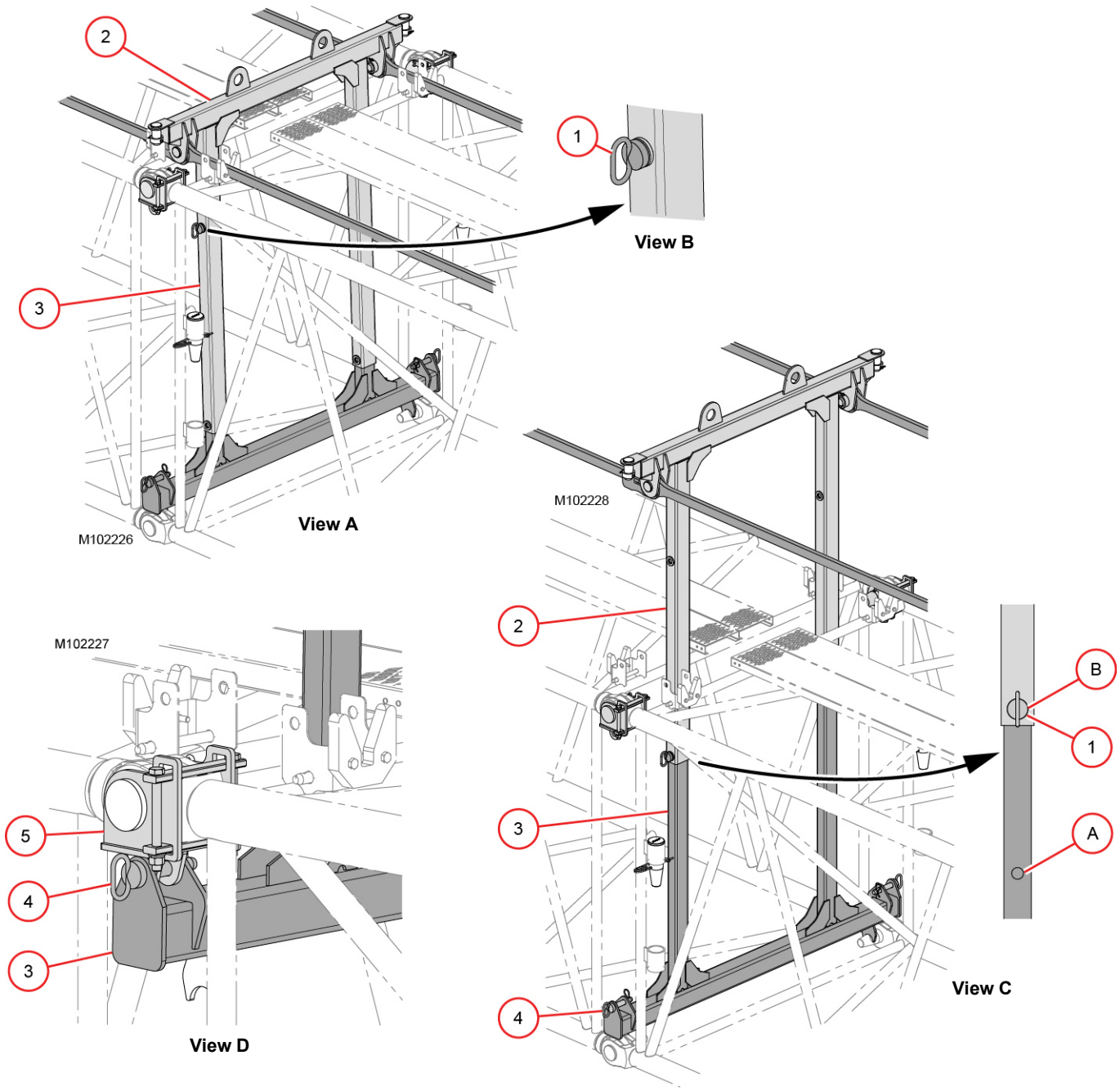
Tipping Hazard!

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.
   a. If equipped with a **luffing jib,** refer to the Luffing Jib Operator Manual for lowering instructions.
   b. If equipped with a **fixed jib,** disengage the jib stops before the jib point contacts the ground. See Lower Boom and Jib on page 4-116.
   c. If equipped with an **upper boom point,** remove the bottom connecting pins when the upper boom point just contacts the ground. See Figure 4-73 on page 4-100.
3. Continue to lower the boom until the boom is resting on blocking at least 9 in (229 mm) high placed under the bottom connectors between the last insert and the boom top.

Continued on next page.



Item	Description
1	Hitch Pin with Hair-Pin Cotter (2)
2	Outer Strut Frame
3	Inner Strut Frame
4	Hitch Pin with Hair-Pin Cotter (2)
5	Bracket (2)
A	Pin here for 236.2 ft (72 m), 246.1 ft (75 m), and 255.9 ft (78 m) Boom
B	Pin here for 265.7 ft (81 m) and 275.6 ft (84 m) Boom

Figure 4-45

4. If equipped with **intermediate suspension**, proceed as follows:
   - Boom up or down as needed to loosen the hitch pins (4, View D).
   - Remove the hitch pins (4, View D).
   - Have an assistant watch the straps and the intermediate suspension strut as they lower.
   - Slowly boom down. The outer and inner strut frames will lower.
   - Signal the operator to STOP booming down if the struts stop lowering. ***Correct the problem before continuing.***
   - Stop booming down when the inner strut frame (3, View C) contacts the bottom connector pins in the inserts.
   - Install the hitch pins (4, View C) in the inner strut frame (3).
   - Boom up just enough to loosen the hitch pins (1, View C) and remove the hitch pins.
   - Continue to boom down slowly. The outer strut frame (2, View C) will lower.
   - Signal the operator to STOP booming down if the outer strut frame (2) stops lowering. ***Correct the problem before continuing.***
   - Signal the operator to STOP booming down if the straps get caught on the brackets, pins, or timber guards. ***Correct the problem before continuing.***
   - Stop booming down when the straps are resting in the storage brackets (View A) and the uppermost holes are aligned between the strut frames.
   - Install the hitch pins (1, View B).
5. Continue to lower the boom until:
   - The boom straps are resting in the storage brackets on the top of the boom sections (see View B, Figure 4-70 on page 4-96).
   - The mast is at approximately 162° (see View B, Figure 4-46 on page 4-56).
6. Stop the engine.

Remove Block-Up Limit Components

Remove the block-up limit weights and chains (see Figure 4-75 on page 4-102) and store them in the parts box.

Store the Load Lines

1. Disconnect the button sockets, wedge sockets, and adapters from the boom and jib tops (see Figure 4-100 on page 4-128).
2. Disconnect the load lines from the button sockets and/or wedge sockets.
3. Wind the load lines onto the load drums and secure them for shipping.
4. Store the button sockets, wedge sockets, adapters, and connecting pins in the parts box.

Remove Boom Work Lights

If equipped, stop the engine and remove the boom work lights (see Figure 4-43 on page 4-52) or secure them to the boom sections for storage.

Disconnect Boom Wiring

Refer to the ESI Boom Wiring drawing at the end of this section.

1. Stop the engine.
2. Disconnect the electric cables in the boom and jib from the corresponding receptacles.
3. Connect the CAN terminators to any unused CAN plugs. Failing to perform this step will cause a fault alert and the corresponding function will not operate properly.
4. To prevent dirt and moisture from entering electric components, connect dust caps to all plugs, CAN terminators, and receptacles.
5. Coil the electric cable onto the cable reel in the boom butt.

Disconnect Boom Butt Electric Cables

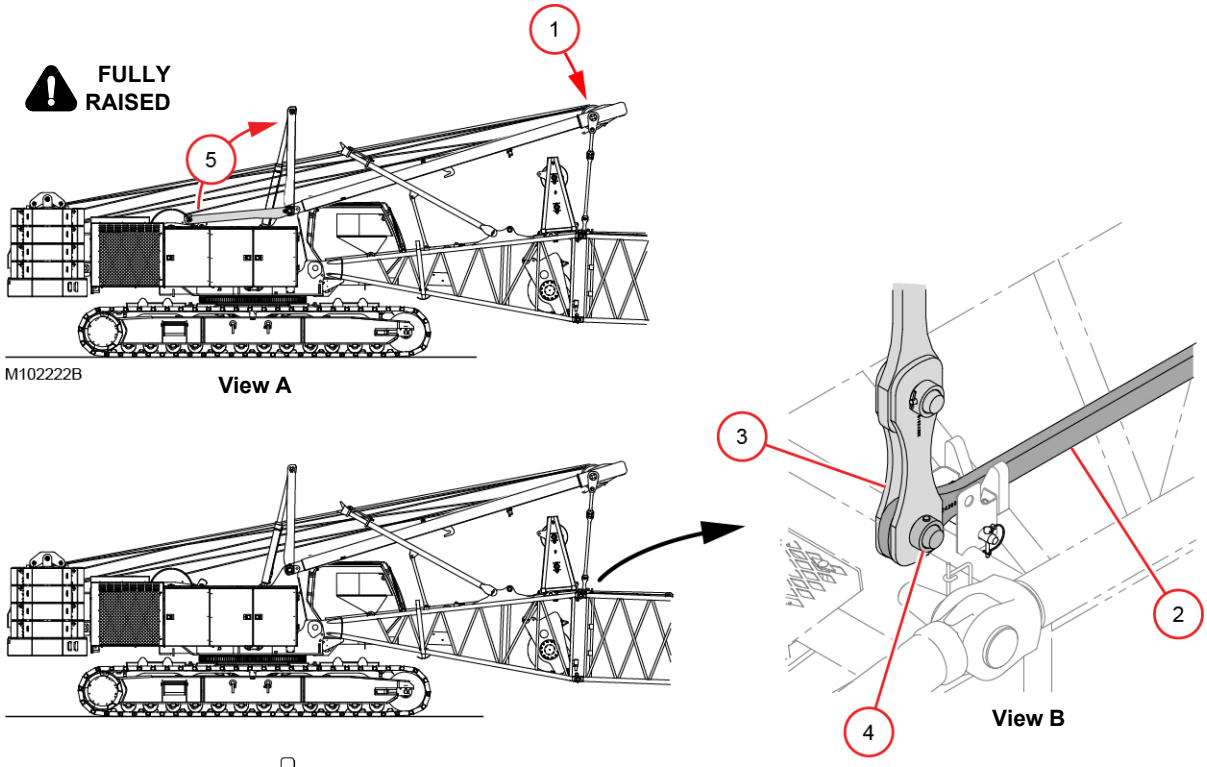
Stop the engine and reverse the installation steps under Connect Electric Cables from Crane to Boom Butt on page 4-47.

- Clean all cable connectors and dust caps.
- Securely fasten dust caps to all cable ends and receptacles.
- Be sure to install the CAN terminator on the end of the electric cable (2, View A, Figure 4-40 on page 4-47) or you will encounter faults when the engine is started.
- Coil the electric cables on the boom butt and the front of the rotating bed and secure them with plastic wire ties.

Disconnect Boom Butt Hydraulic Hoses

Stop the engine and reverse the installation steps under Connect Boom Butt Hydraulic Hoses on page 4-49.

- Clean all hose couplers and dust caps.
- Securely fasten dust caps to all hose couplers.
- Store the hydraulic hoses as shown in Views A and B, Figure 4-41 on page 4-48.



Item	Description
1	Mast Lowered to 162°
2	Boom Strap (2)
3	Mast Link (4)
4	Pin with Collar, Clevis Pin and Cotter Pin (2)
5	Mast Assist Arms (fully raised)

Figure 4-46

Disconnect Mast Straps from Boom Straps

See Figure 4-46.

1. Start the engine.
2. Remove the remote control from storage (see View E, Figure 4-2 on page 4-4).
3. Select the proper Liftcrane Mast Handling Capacities Chart in the configuration screen of the RCL/RCI display. See the MLC165-1 RCL/RCI Manual for instructions.
4. Turn on the setup mode. See Setup Mode on page 4-6.

WARNING

Falling Load Hazard!

Do not exceed a maximum mast angle of 162°. The mast could fall suddenly.

5. Lower the mast (1, View A) so the boom straps (2, View B) are resting in the storage brackets on the boom insert. The mast will be at approximately 162°.

DANGER

Falling Mast/Boom Hazard!

Prevent the mast from falling:

- Fully raise the mast-assist arms before disconnecting the mast links from the boom straps.

  The mast can fall over backwards if the mast-assist arms are not raised.

6. Using the switch on the overhead control console or on the remote control, fully RAISE the mast-assist arms (5, View A).
7. Remove the pin (4, View B) and collar from the end of each boom strap (2).
8. Raise the mast so the mast links (3, View A) are clear of the boom straps (2).
9. Reinstall the pin (4, View B) and collar in the end of each boom strap (2).
10. Confirm that the mast-assist arms (5, View A) are fully raised.
11. Raise the mast to vertical (90°, View C).

Item	Description
1	Boom Butt
2	Insert
3	Lifting Lug
4	Bottom Connector Pin with Safety Pin (2)
5	Storage Bracket
6	Top Connector Pin with Safety Pin (2)
7	Storage Bracket

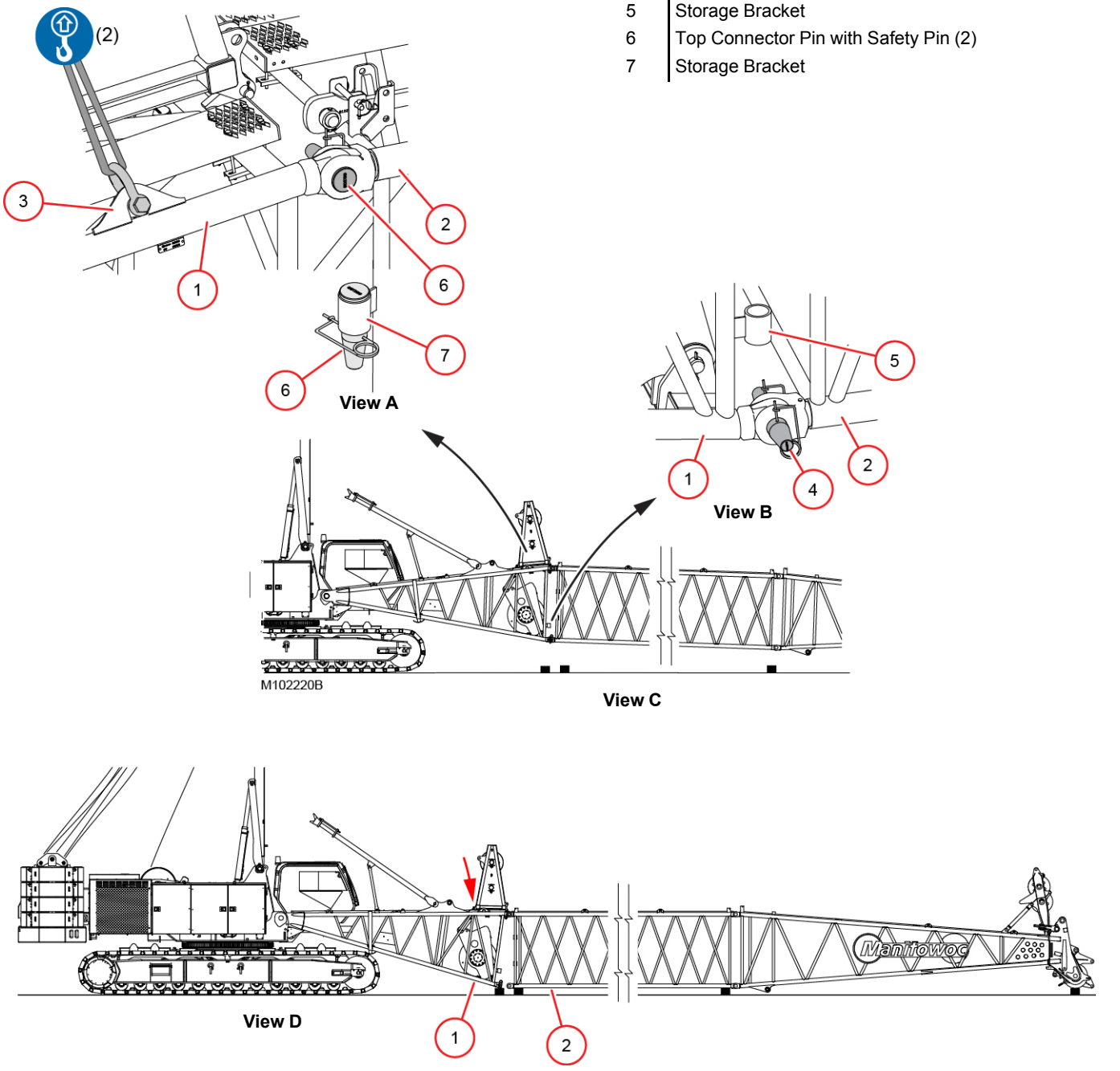


Figure 4-47

Disconnect Boom Butt from Boom

See Figure 4-47.

WARNING

Crushing Injury Hazard!

Prevent serious crushing injury:

- Do not stand inside the boom sections while installing the connector pins — STAND OUTSIDE BOOM.

1. Connect lifting slings from the assist crane to the top two lifting lugs (3, View A) on the boom butt (1):

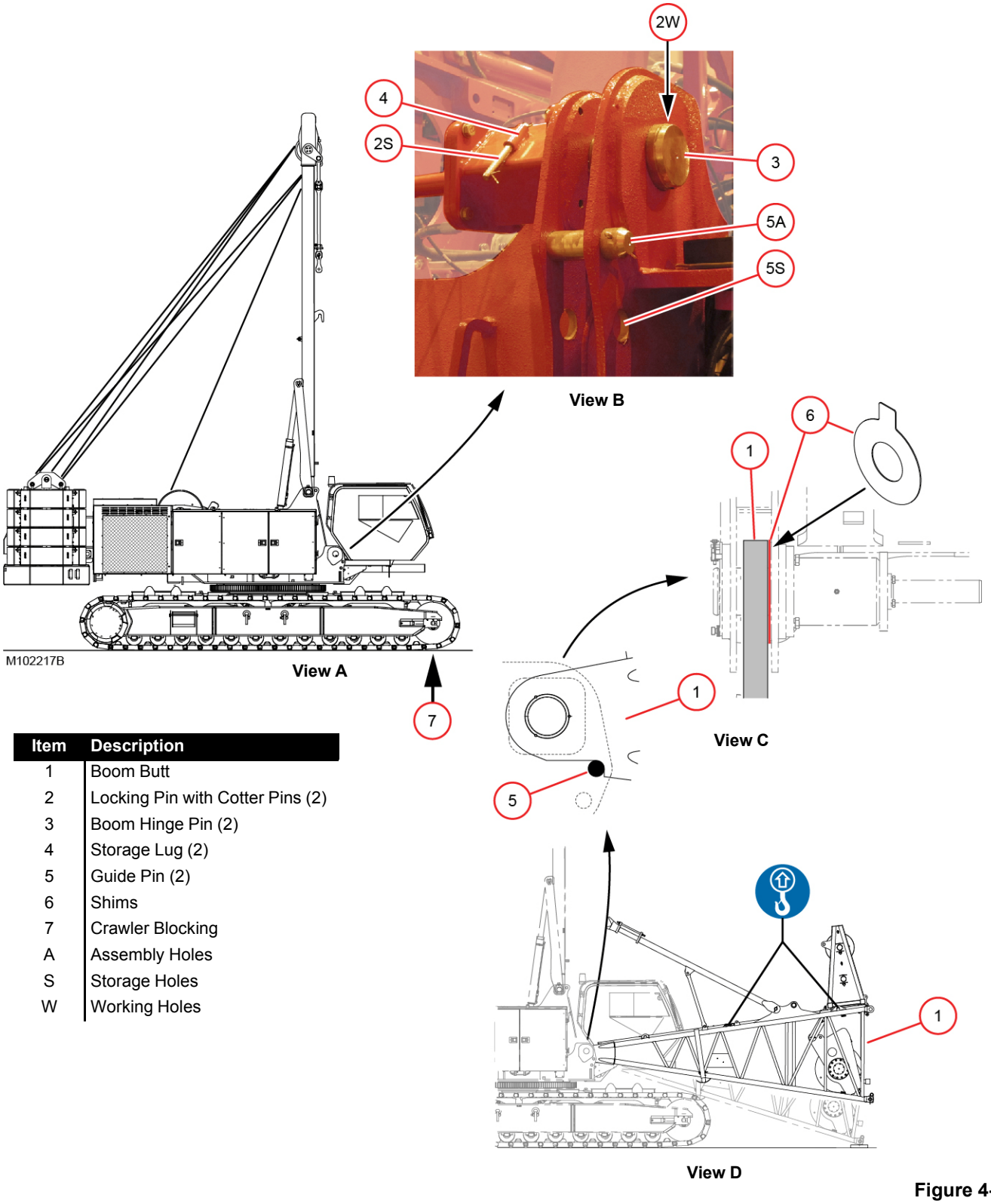
   Use a 2-leg chain sling or shackles and synthetic slings. The assist crane and lifting slings must be sized to lift half the weight of the assembled boom.

2. Hoist just enough to support the boom butt.
3. Remove the bottom connector pins (4, View B) and install them in the brackets (5) on the boom butt (1).
4. Slowly lower the boom butt and boom sections onto blocking at least 9 in (229 mm) high.
5. Slacken the lifting slings and disconnect them from the boom butt.
6. Remove the top connector pins (6, View B) and store them in the brackets (7) on the insert (2).

Disassemble Boom from Boom Butt

Read the following topics before proceeding:

- Boom Ladders on page 4-85
- Boom and Jib Rigging on page 4-86



View A

View B

View C

View D

Item	Description
1	Boom Butt
2	Locking Pin with Cotter Pins (2)
3	Boom Hinge Pin (2)
4	Storage Lug (2)
5	Guide Pin (2)
6	Shims
7	Crawler Blocking
A	Assembly Holes
S	Storage Holes
W	Working Holes

Figure 4-48

Remove Boom Butt

See Figure 4-48 for the remianing steps.

1. Attach a 4-leg chain sling — or shackles and synthetic slings — from the assist crane to the four lifting lugs on the boom butt (1, View D).
2. Raise the boom butt (1, View C) until the assembly holes (A) in the rotating bed are accessible.
3. Move the guide pins (5, View B) from the storage holes (5S) to the assembly holes (5A).
4. Slowly boom down until the boom butt is contacting the guide pins (5, View C).
5. Remove the locking pins (5, View B) from the boom hinge pins (3) and store them in the storage lugs (4).
6. Using the switch on the overhead control console or on the remote control, fully disengage the boom hinge pins (3, View B).
7. Remove the shims (6, View C) on the inboard side of both boom hinge legs as the pins are disengaged. Store the shims in the parts box.
8. Slowly lift the boom butt away from the crane and place it on blocking.
9. Disconnect the lifting slings from the boom butt.
10. Using the switch on the overhead control console or on the remote control, fully engage the boom hinge pins (3, View B).
11. Reinstall the locking pins (2W, View B) in the boom hinge pins (3).
12. The guide pins (5, View B) can be left in the assembly holes (A).

Item	Description
1	Wire Rope Guide
2	Pin with Wire-Lock Pin (2)
3	Lifting Lug (2)
4	Pin with Cotter Pins
5	Link
6	Boom Stop (2)
7	Pin with Cotter Pin (2)
8	Storage Lugs
9	Strut (2)
10	Working Lugs

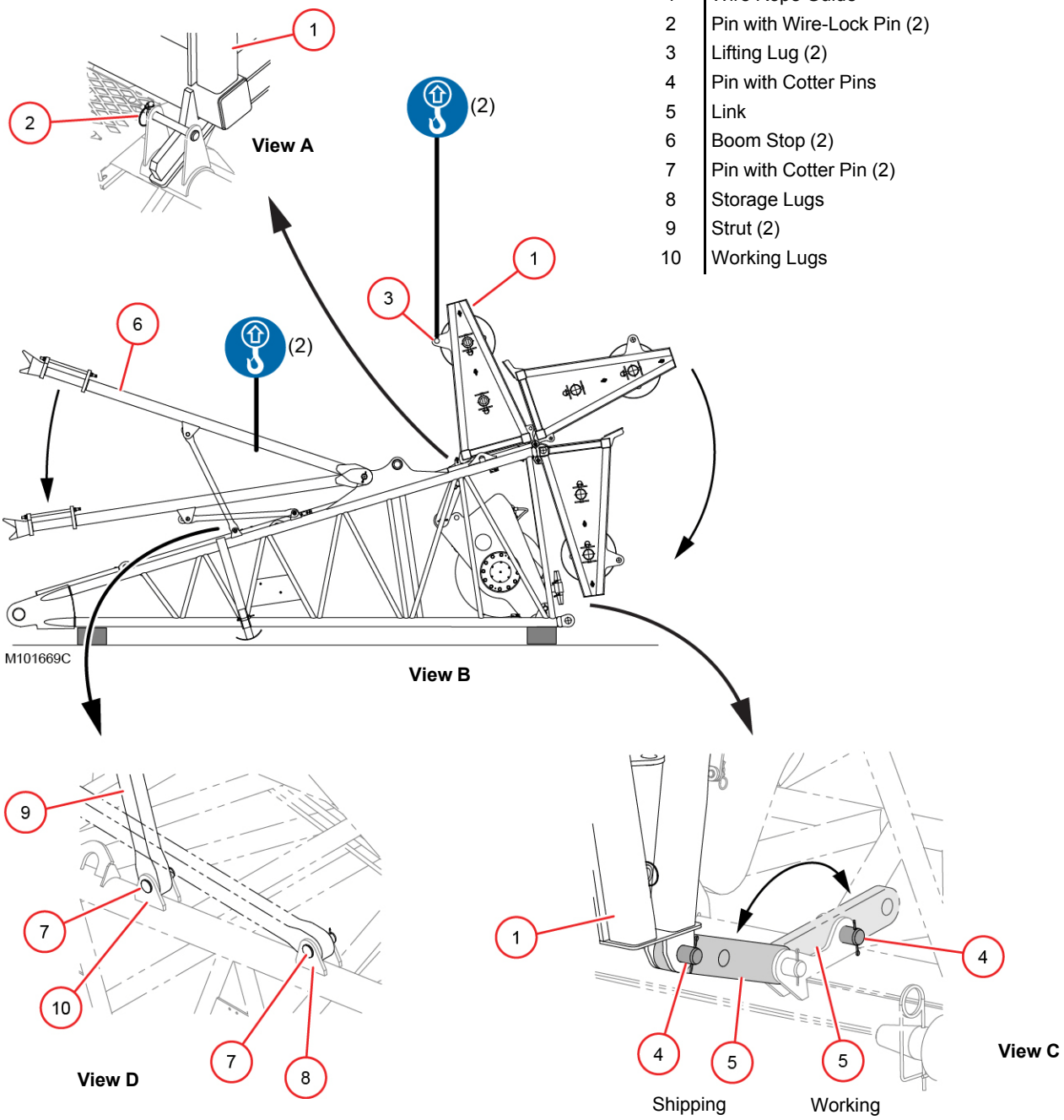


Figure 4-49

Lower Boom Stops

See Figure 4-49.

1. Using a basket hitch, attach a synthetic lifting sling from the assist crane to either boom stop (6, View B) at the approximate location shown.
2. Hoist just enough to support the boom stop.
3. Remove the pins (7, View D) from the working lugs (10).
4. Lower the boom stop until the strut (9) can be pinned in the shipping position.
5. Using pin (7, View D), pin the strut (9) to the storage lugs (8).
6. Disconnect the lifting sling.
7. Repeat the steps for the other boom stop.

Lower Boom Butt Wire Rope Guide

See Figure 4-49.

1. Attach a lifting sling from the hook of the assist crane to the lifting lugs (3, View B) on the wire rope guide (1).
2. Hoist just enough to support the wire rope guide (1).
3. Remove the pins (2, View A) from the lugs on the boom butt.
4. Rotate the wire rope guide to the shipping position (View C).
5. Store the pins (2, View A) in the lugs on the boom butt.
6. Remove the pin (4, View C), rotate the link (5) to the shipping position, and pin the link (5) to the wire rope guide (1) with pin (4).
7. Disconnect the lifting sling from the wire rope guide.

Lift Boom Butt onto Trailer

Reverse the step under the topic Remove Boom Butt from Trailer on page 4-40.

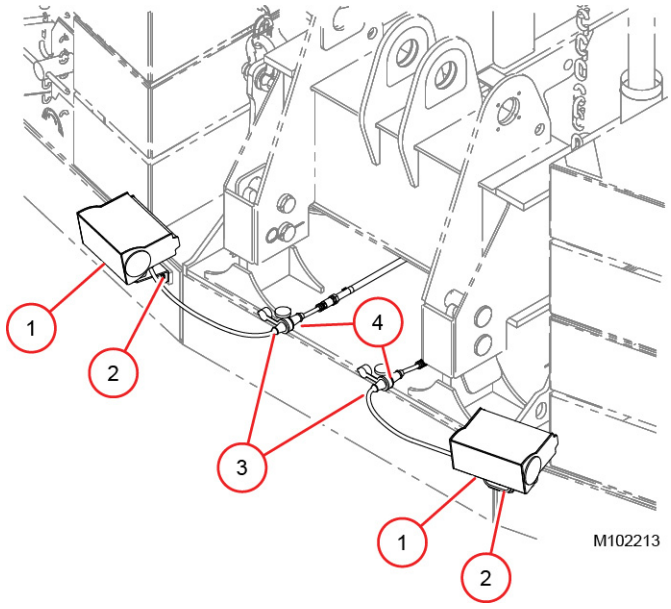
See Shipping Crane Components on page 4-53.

Store Counterweight Work Lights

See Figure 4-50 for the following procedure.

If equipped with optional work lights, store them as follows:

1. Stop the engine.
2. Disconnect the electric cables from the rotating bed at the receptacles (4) on the front of the counterweight tray.
3. Disconnect the electric cables (3) from the lights at the receptacles (4) on the rear of the counterweight tray.
4. Remove the cap screws and lock washers (2) securing the lights to the tray.
5. Remove the work lights (1) and store them.
6. Reinstall the cap screws and lock washers (2) in the camera mounting holes.



Item	Description
1	Work Light (2)
2	Cap Screw and Lock Washer (4)
3	Electric Cable (2)
4	Receptacle (4)

Figure 4-50

4

NOTE: For clarity, the counterweight boxes are not shown.

Item	Description
1	Shackle (4)
2	Handling Chain (4)
3	Lifting Link (4)
4	Counterweight-Handling Cylinder (2)
5	Inner Connecting Pin (2)
6	Outer Connecting Pin with Safety Pin (2)
7	Counterweight Tray

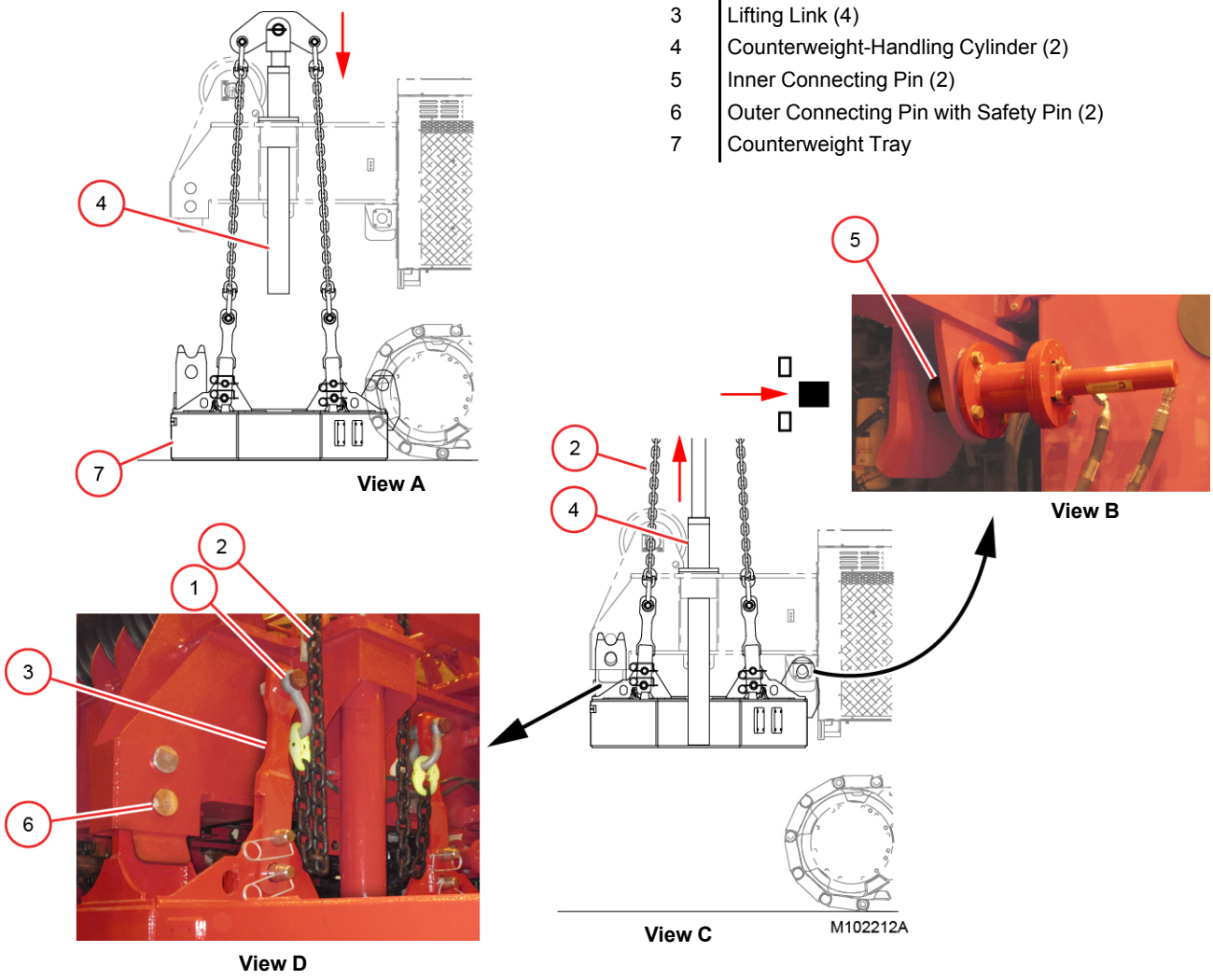


Figure 4-51

Remove Crane Counterweight

DANGER

Falling Load Hazard!

Prevent structural failure of components or tipping:

- Remove the crane counterweight before removing the carbody counterweight.

Crush Hazard!

To prevent serious crushing injury:

- Do not stand on, under, or in front of the crane counterweight while it is lifted.

WARNING

Burn Hazard!

Do not climb onto the counterweight tray for any reason while the counterweight is in working position.

The exhaust pipe can burn and cause serious injury.

See Figure 4-51.

NOTE The counterweight must be removed over the drive end of the crawlers, not over the front roller end. This is because the crawlers may be longer over the front than the rear due to tread adjustment.

1. If not already done, pin the shackles (1, View D) and handling chains (2) to the lifting links (3).

   Make sure the handling chains are not tangled up or hooked on adjacent parts.

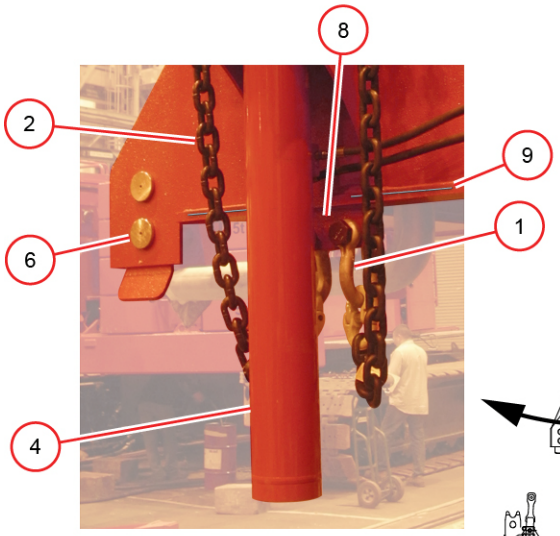
2. Start the engine.
3. Using the switch on the remote control, extend the counterweight-handling cylinders (4, View C) until the handling chains (2) are taut.
4. Using the switch on the remote control, disengage the inner counterweight pins (5, View B).
5. Make sure the inner connecting pins (5) are fully disengaged.
6. Remove the outer counterweight pins (6, View D).
7. Using the switch on the remote control, fully retract the counterweight-handling cylinders (4, View A) to lower the counterweight tray (7) onto blocking at ground level.

   Block only as shown in Figure 4-29 on page 4-32 ***or damage to the tray will occur.***

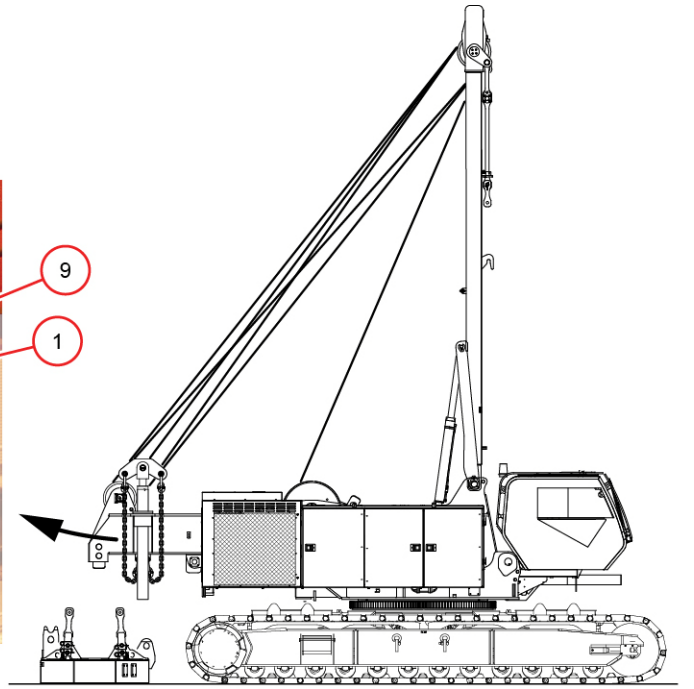
Continued on the next page.

Item	Description
1	Shackle (4)
2	Handling Chain (4)
3	Lifting Link (2)
4	Counterweight-Handling Cylinder (2)
5	Inner Connecting Pin (2)
6	Outer Connecting Pin with Safety Pin (4)
7	Counterweight Tray
8	Storage Lug (2)
9	Tie-Down Lugs

NOTE: For clarity, the counterweight boxes are not shown.



View E



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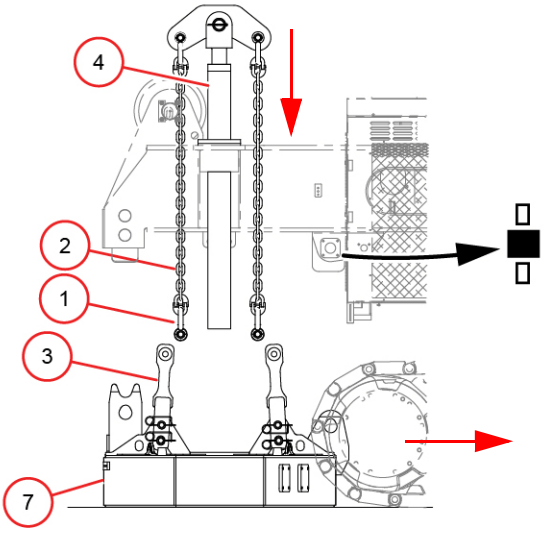
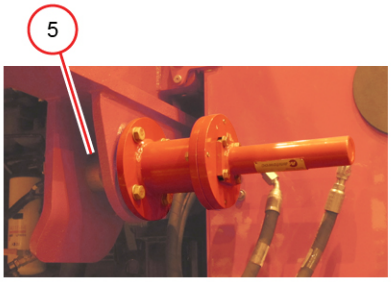


View G

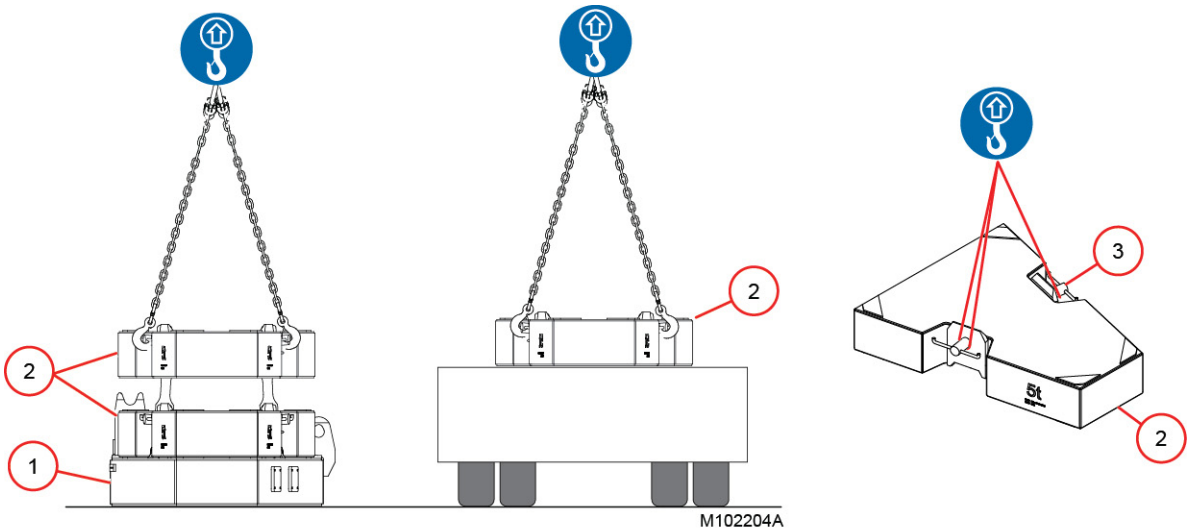


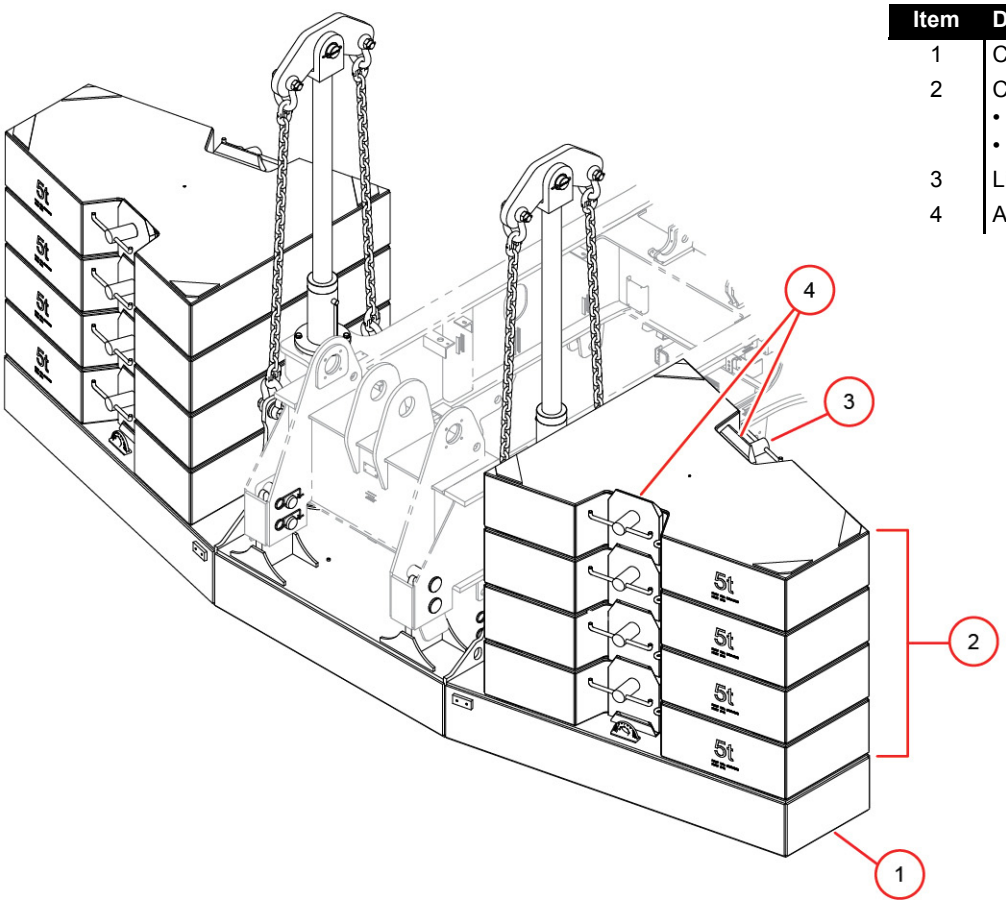
View F

Figure 4-51 continued

See Figure 4-51 continued.

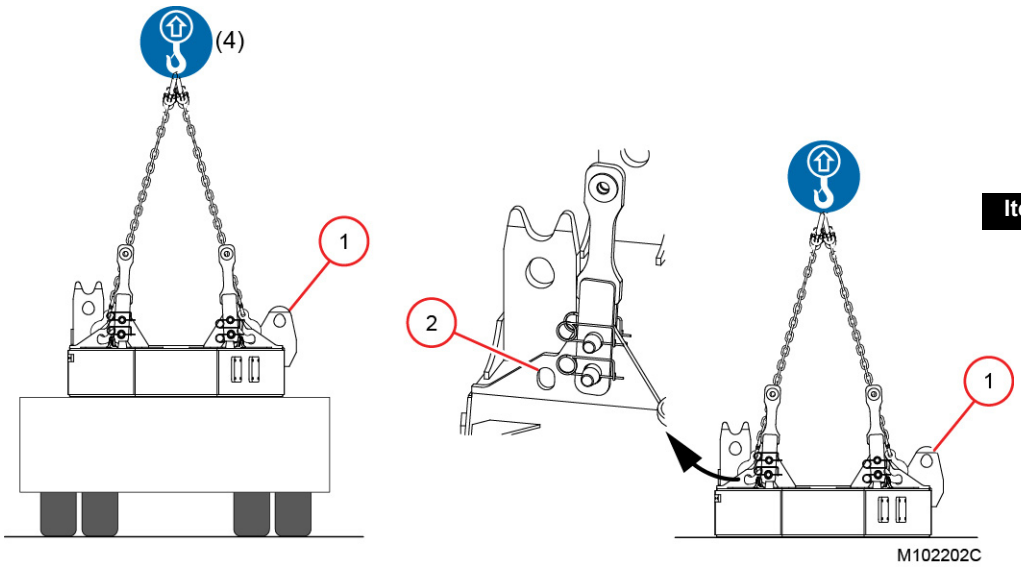
8. Using the switch on the remote control, engage the inner connecting pin (5, View F) on both sides of the rotating bed.
9. Install the outer connecting pin (6, View A) on both sides of the rotating bed.
10. Disconnect the shackles (1, View G) and the handling chains (2) from the lifting links (3).
11. Using the switch on the remote control, fully retract the counterweight-handling cylinders (4, View G).
12. Pin the shackles (1, View E) to the storage lugs (8).
13. Remove excess slack in the chains by wire tying them to the tie-down lugs (9).
14. Travel the crane away from the counterweight tray (7).





Item	Description
1	Counterweight Tray
2	Counterweight Box: • 3 each side for Series 1 • 4 each side for Series 2
3	Lifting Lug (2 each box)
4	Alignment Lug

Figure 4-52



Item	Description
1	Counterweight Tray
2	Lifting Hole (4)

Figure 4-53

Disassemble Crane Counterweight

See Figure 4-30.

1. Attach lifting slings to the two lifting lugs (3) on the counterweight box (2) as shown. Each box weighs 11,023 lb (5 000 kg).

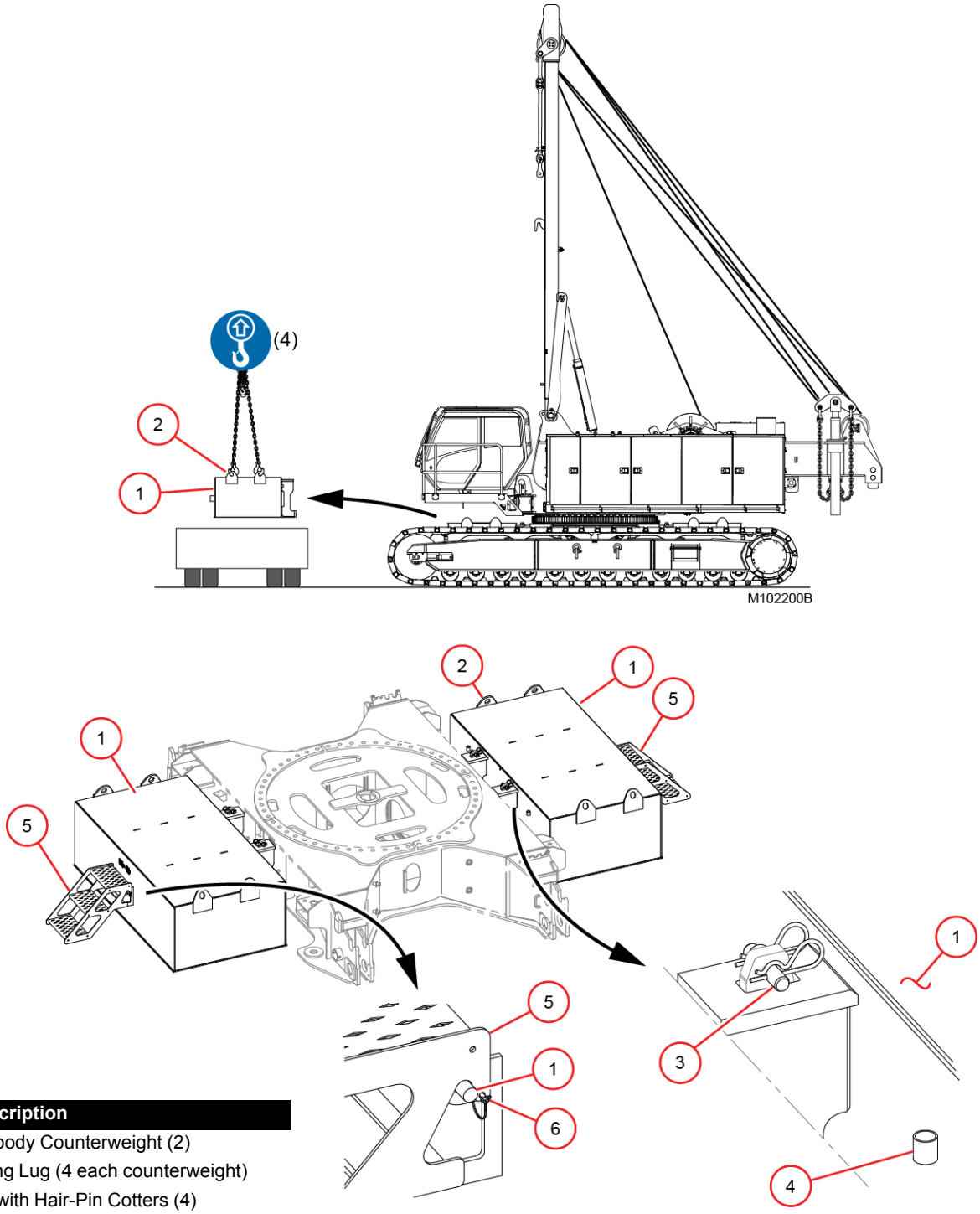
   Use either:

   - Two legs of the chain lifting sling looped around the lifting lugs and hooked to the master link.
   - Two synthetic lifting slings vertically connected to the lifting lugs and to the assist crane hook.

2. Lift the counterweight (2) box off the counterweight stack and place it on a trailer.
3. Disconnect the lifting slings.
4. Secure the counterweight box to the trailer. See Shipping Crane Components on page 4-53.
5. Repeat the steps for each box.

See Figure 4-53 for the remaining steps.

1. Attach a 4-leg chain sling — or shackles and synthetic slings — from the assist crane to the four lifting holes (2) on the counterweight tray (1). The tray weighs approximately 35,274 lb (16 000 kg).
2. Lift the counterweight tray (2) onto a trailer.
3. Disconnect the lifting slings.
4. Secure the counterweight tray to the trailer. See Shipping Crane Components on page 4-53.



Item	Description
1	Carbody Counterweight (2)
2	Lifting Lug (4 each counterweight)
3	Pin with Hair-Pin Cotters (4)
4	Storage Lug
5	Step (2)
6	Wire-Lock Pin (4)

Figure 4-54

Remove Carbody Counterweight (Series 2)

If your crane has the Series 2 counterweight package, remove the carbody counterweights as follows, ***after removing the crane counterweights***.

DANGER

Crane Tipping Hazard!

To avoid serious crushing injury:

- Remove the carbody counterweight after removing the crane counterweight.

See Figure 4-54.

1. If necessary, remove the crawler step (5) from the carbody counterweight (1) and secure the step on a trailer.
2. Attach a 4-leg chain sling — or shackles and synthetic slings — from the assist crane to the four lifting lugs on the carbody counterweight. Each carbody counterweight weighs approximately 22,488 lb (10 200 kg).
3. Remove the two pins (3) from the carbody lugs.
4. Store the two pins (3) in the storage lugs (4) on the carbody counterweight.
5. Lift the carbody counterweight clear of the carbody lugs.
6. Lower the carbody counterweight onto the trailer.
7. Disconnect the lifting sling.
8. Secure the carbody counterweight to the trailer. See Shipping Crane Components on page 4-53.
9. Repeat the steps for the other carbody counterweight.

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Remove Upperworks Platforms

See Figure 4-27 for the following procedure.

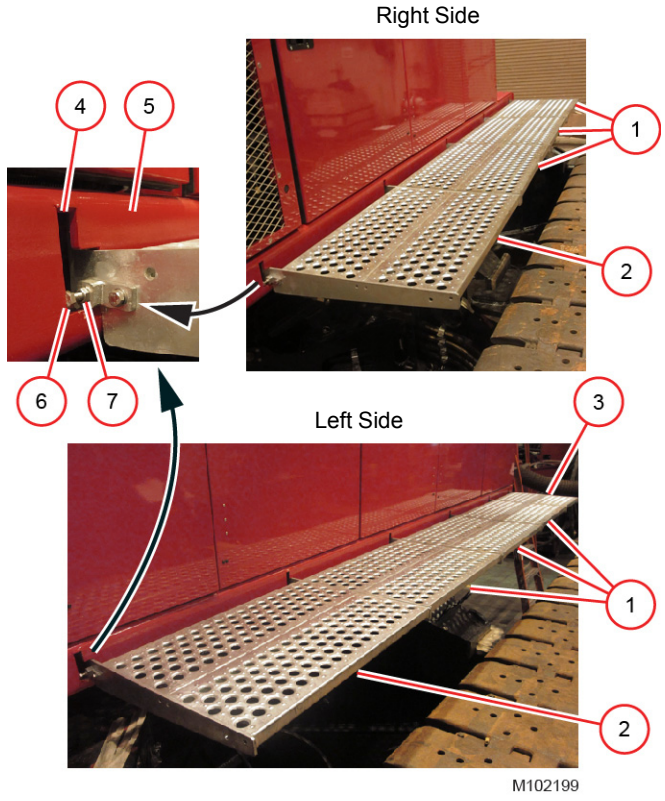
Starting at the REAR on the RIGHT SIDE of the crane, remove the right side platform sections, as follows:

1. Loosen the lock nut (7), turn the retaining screw (6) in, and rotate the locking bracket out of the slot (4) to unlock the platform sections.
2. Slide the platform section (2) rearward as far as it will go.
3. Lift the platform section (2) out of the slots (4) in the frame (5).
4. Remove the remaining platform sections in the same manner.
5. Place the platform sections to side for installation later on the right crawler.

Starting at the FRONT on the LEFT SIDE of the crane, remove the left side platform sections, as follows:

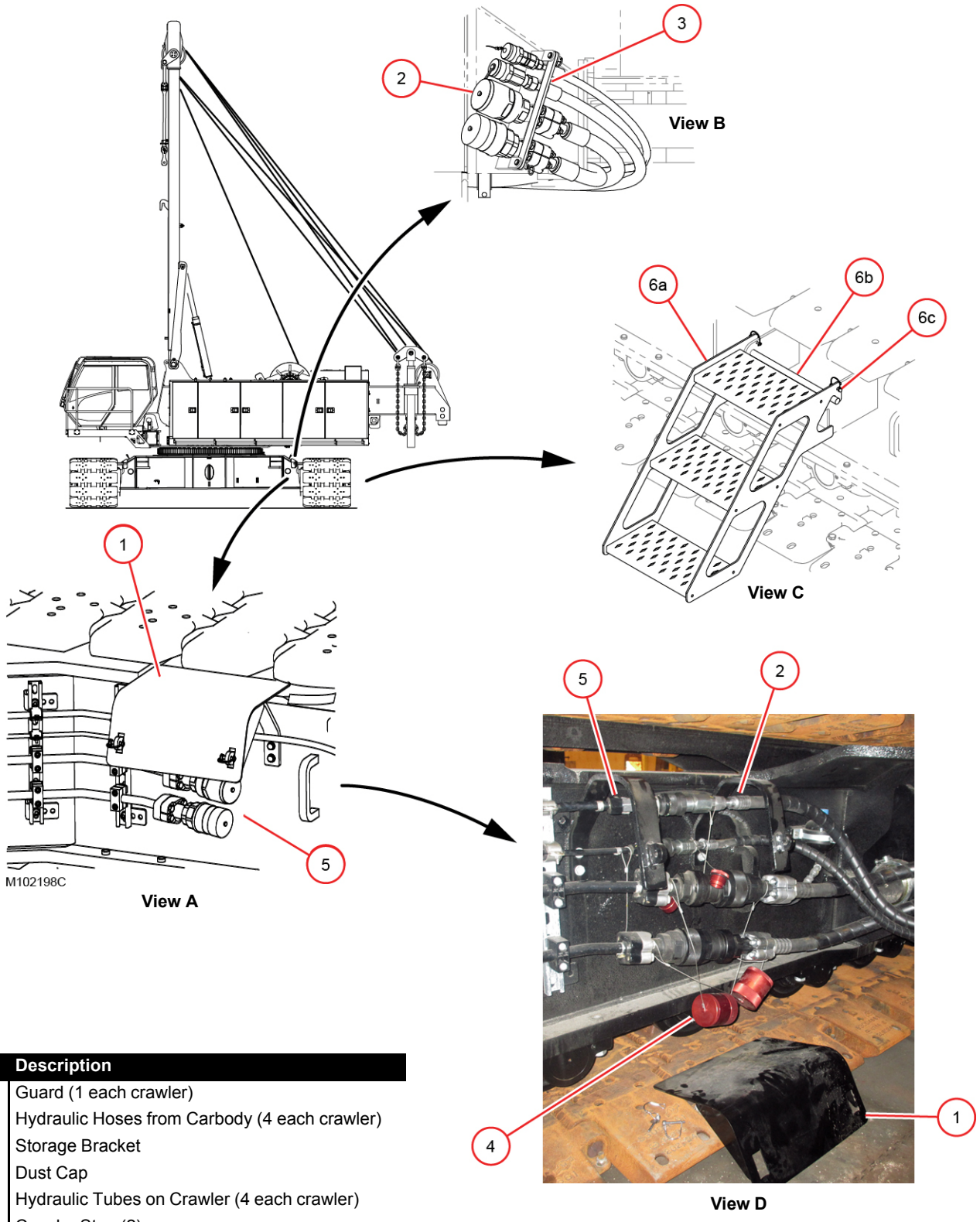
Note that the left rear section (3) is shorter than the rest.

1. Loosen the lock nut (7), turn the retaining screw (6) in, and rotate the locking bracket out of the slot (4) to unlock the platform sections.
2. Slide the platform section (2) forward as far as it will go.
3. Lift the platform section (2) out of the slots (4) in the frame (5).
4. Remove the remaining platform sections in the same manner.
5. Place the platform sections to side for installation later on the left crawler.



Item	Description
1	Platform Section (3 each side)
2	Platform Section with Screw (1 each side)
3	Platform Section (short) (1 left side)
4	Slot
5	Frame
6	Retaining Screw (1 each side)
7	Lock Nut

Figure 4-55



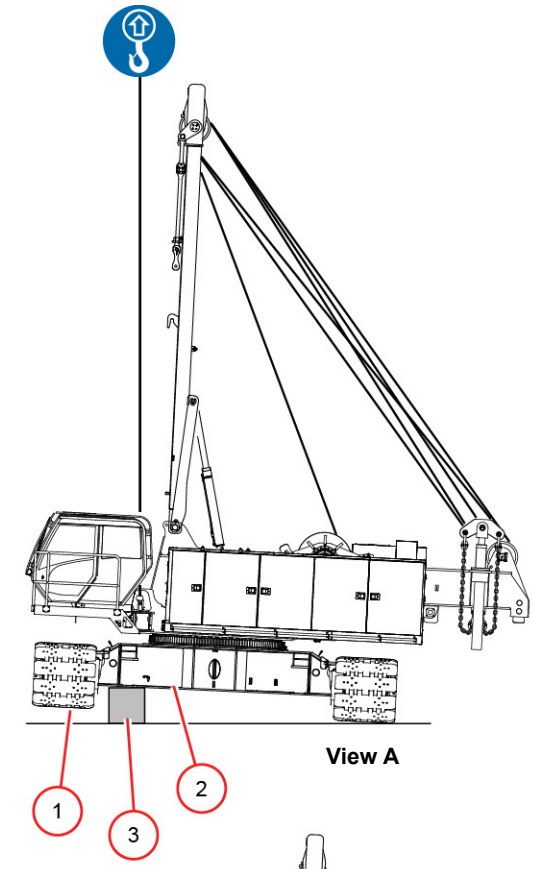
Item	Description
1	Guard (1 each crawler)
2	Hydraulic Hoses from Carbody (4 each crawler)
3	Storage Bracket
4	Dust Cap
5	Hydraulic Tubes on Crawler (4 each crawler)
6a	Crawler Step (2)
6b	Bar (2)
6c	Wire-Lock Pin (4)

Figure 4-56

Remove Crawlers – Preliminary Steps

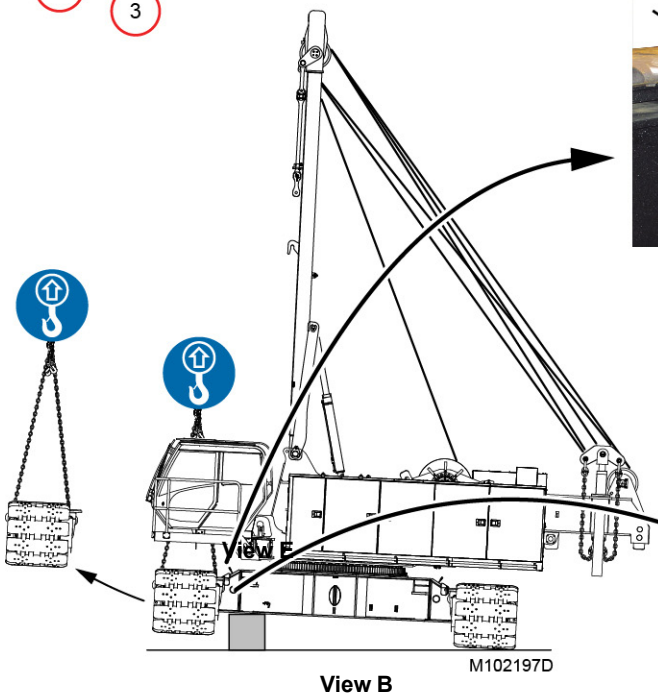
See Figure 4-56 for the following procedure.

1. At both crawlers, remove the wire-lock pins (6C, View C) and unhook the crawler step (6a) from the bar (6b).
2. Reinstall the wire-lock pins (6c) in the crawler steps and secure the steps to a trailer.
3. At the drive end of both crawlers:
   a. Remove the guard (1, View A) from the crawler.
   b. Uncouple the dust caps (4, View D) and thoroughly clean them.
   c. Stop the engine.
   d. Disconnect the hydraulic hoses (2, View D) from the carbody at the hydraulic tubes (5) on the crawler.
   e. Thoroughly clean all fittings.
   f. Apply a light coat of silicone lubricant to the threads of all dust caps, couplers, and connectors to help in preventing the threads from seizing.
   g. Connect the dust caps to the couplers on the crawler and to the hoses on the carbody.
   h. Store the hoses (2, View B) under the brackets (3) on the carbody.
   i. Reinstall the guard (1, View A).

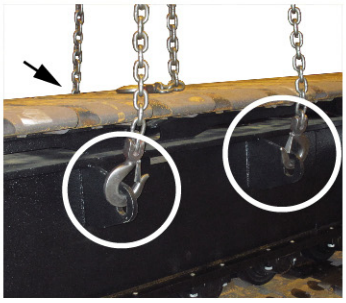


View A

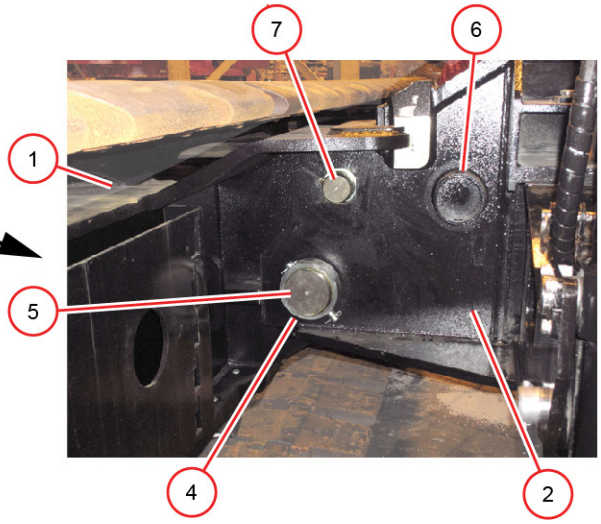
Item	Description
1	Crawler
2	Carbody
3	Blocking
4	Collar with Pin and Safety Pins (2)
5	Crawler Pin (2)
6	Storage Lug (2)
7	Alignment Pin (2)



View B



View C



View D

Figure 4-57

Remove First Crawlers

See Figure 4-57.

1. Swing the upperworks over the side of the crawler (1, View A) to be removed.
2. Do not lower the mast below vertical (90°) or it will interfere with crawler installation
3. Attach owner furnished synthetic lifting slings to the boom hinge pins.
   - Boom hinge pins should be engaged
   - Slings can be either basketed or chocked
   - Sling length should be at least 15 ft (5 m) long
   - Sling capacity is at least 54,000 lb (6 804 kg)

   Use caution to prevent slings from being damaged by edges of boom hinge plates on rotating bed.
4. Lift the MLC165-1 with the assist crane and place hardwood blocking (3, View A) under the two corners of the carbody (2) next to the crawler (1) being removed.
5. To allow crawler removal:
   - The blocking must be sized and positioned as shown in Figure 4-8 on page 4-10 so the carbody is 25-28 in (635-711 mm) above the ground.
   - The blocking at ***each corner*** must be cable of supporting at least 52,000 lb (23 587 kg).
6. Lower the MLC165-1 onto the blocking and slacken the lifting slings.
7. Disconnect the lifting slings from the boom hinge pins.
8. Attach a 3-leg chain sling (View C) — or shackles and synthetic slings — from the assist crane to the three lifting lugs on the crawler. The crawler weighs approximately 33,000 lb (14 969 kg).
9. Remove the collars (4, View D) from both crawler pins (5).
10. Temporarily store the collars on the storage lugs (6, View D).
11. Hoist with the assist crane until the lifting slings are taut.
12. Start the engine.
13. Using the carbody control, disengage the corresponding crawler pins (5, View D).
14. Hoist with the assist crane until the alignment pins (7, View D) in the crawler (1) disengage the alignment saddles in the carbody (2).
15. Hoist with the assist crane until the crawler is clear of the carbody.

    The crawler will hang slightly out of level.
16. Lower the crawler onto the trailer until the lifting slings are slack.
17. Disconnect the lifting slings from the crawler.
18. Secure the crawler to the trailer. See Shipping Crane Components on page 4-53.
19. Remove the trailer and crawler from the area.
20. Using the carbody control, engage the crawler pins (5, View D).
21. Remove the collars (4, View D) from the storage lugs (6) and install them on the crawlers pins (5).
22. Proceed to remove the second crawler.

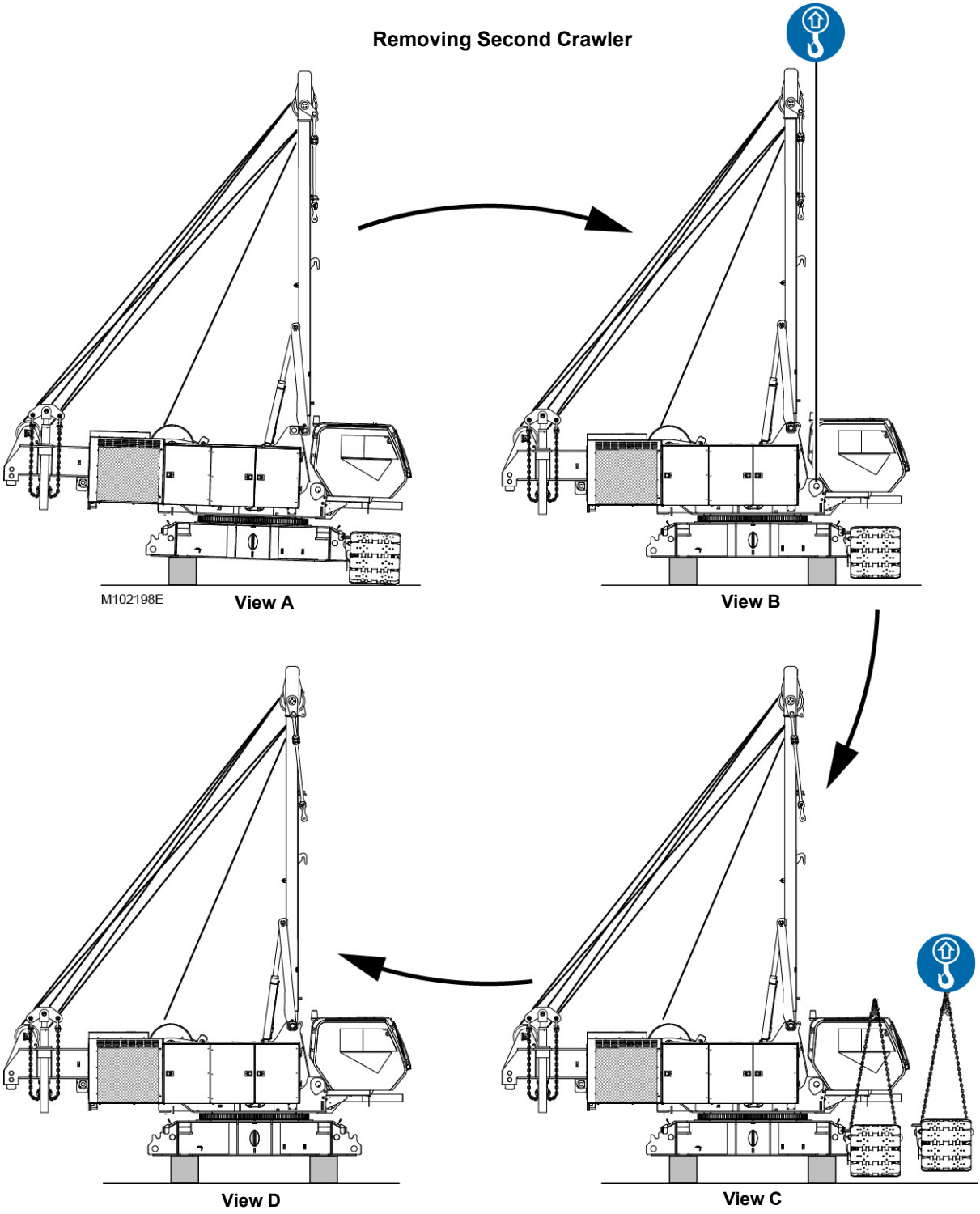


Figure 4-58

Remove Second Crawler

DANGER

Falling Load Hazard!

Prevent structural failure of components or tipping:

- Do not exceed the radius given in the Liftcrane Mast Handling Capacities chart at the end of this section.
- Do not swing over the second crawler until it is lowered to the ground.

See Figure 4-58 for the following procedure.

1. ***S***wing the upperworks so the mast is over the second crawler (View A).
2. Repeat Remove First Crawler step 3 through step 21, page 4-77.

DANGER

Tipping Hazard!

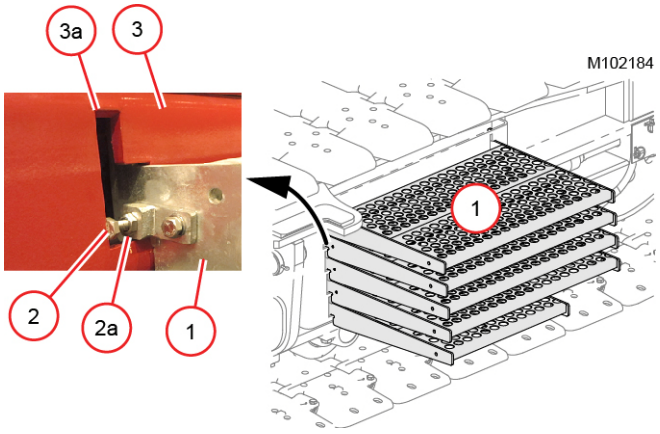
Swing is prohibited while crane is on blocking.

Store Upperworks Platform Sections

Store the platform sections (1, Figure 4-59) on each crawler, as follows:

- The left crawler holds the five left side platforms.
- The right crawler holds the four right side platforms.

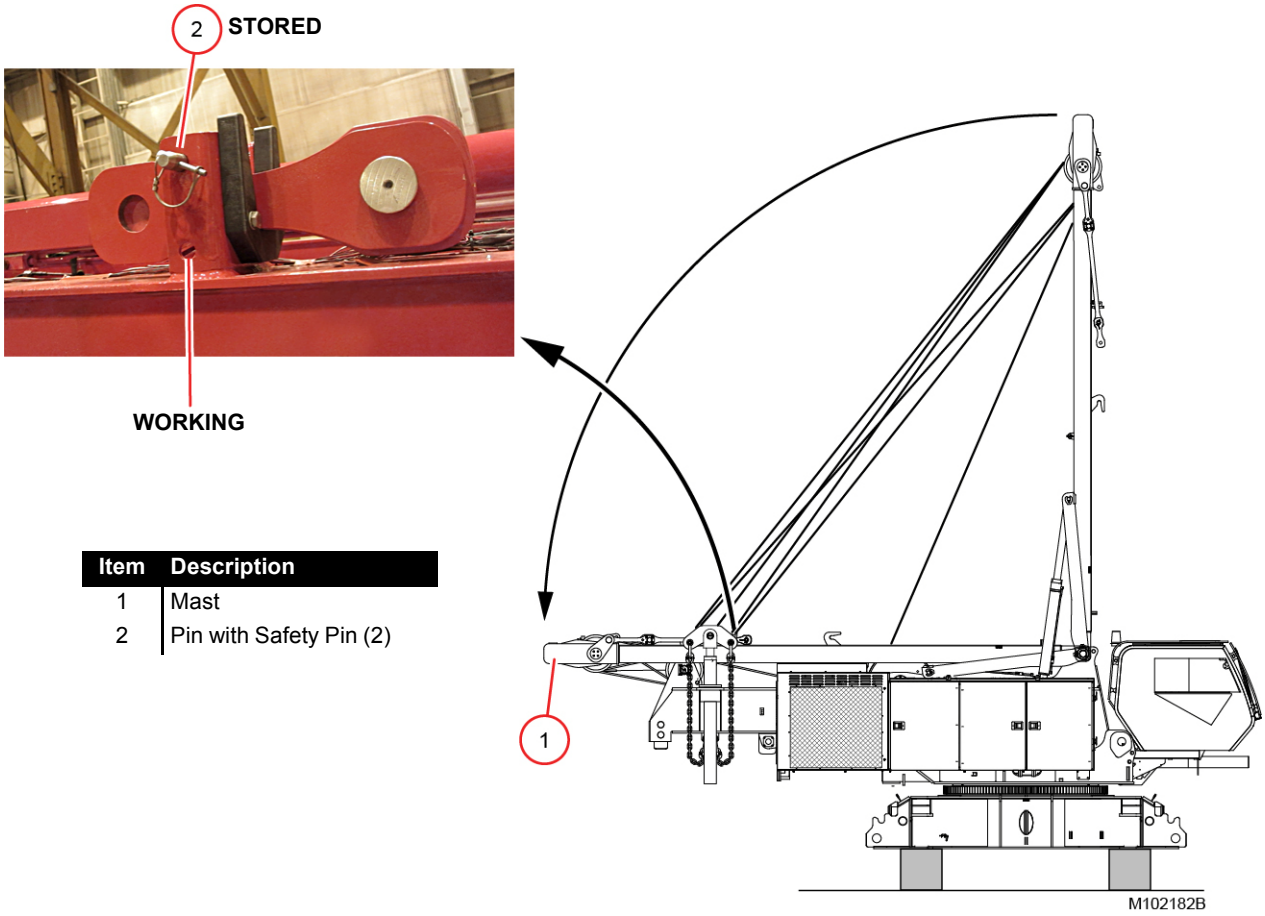
1. Lift the section (1) into position:
   - The short platform section from the left side of the upperworks must be installed first on the left crawler.
   - The platform sections with the retaining screw (2) and the lock nut (2a) must be installed last on both crawlers.
2. Hook the section lugs through the slots (3a) in the frame (3).
3. Rotate the section down so the notches in the section engage the frame (3).
4. Slide the section forward as far as it will go.
5. Install the remaining sections in the same manner.
6. Once all of the sections are installed, hand-tighten the retaining screw (2) in the slot (3a) and securely tighten the lock nut (2a) to lock the sections in position.



Item	Description
1	Platform Sections
2	Retaining Screw
2a	Lock Nut
3	Frame
3a	Slot

Figure 4-59

4



Item	Description
1	Mast
2	Pin with Safety Pin (2)

Figure 4-60

DANGER

Moving Part and Crush Hazard!

Avoid being crushed by moving parts:

- Do not stand on the crane while the mast is raised or lowered.

Lower Mast to Transport Position

NOTE To lower the mast, the setup mode must be on (see Setup Mode on page 4-6).

The mast angles can be monitored in the information screen of the main display or in the working screen of the RCL/RCI display (in setup mode).

.

WARNING

Falling Mast Hazard!

Prevent the mast from falling over backwards:

- Make sure the mast-assist arms are fully raised.

1. Start the engine.
2. BOOM DOWN using the boom control handle in the operator cab.

   Once contacted by the mast, the mast-assist arms will retract automatically.
3. Continue to BOOM UP to lower the mast to the transport position.
4. The mast will stop automatically and the MAST AT 2° fault will come on (D, Figure 4-15 on page 4-21).
5. Using the mast-assist arms switch on the overhead control console or on the remote control, lower the mast the remainder of the way.
6. The MAST AT 2° fault will be turned off.
7. Climb onto the top of the rotating bed at the ladder provided. ***Take every precaution to prevent falling off the crane.***
8. Move the pins (2) from the working position to the stored position.

Lower Handrails

Lower the optional handrails on the top of the crane. Reverse the steps under Raise Handrails on page 4-15.

Remove or Store Rotating Bed Mirror

If equipped, remove or rotate the mirror on the right-front corner of the rotating bed to the shipping position. See Figure 4-11 on page 4-13.

Store RCL/RCI Indicator Light

Lower the optional RCL/RCI indicator light to the shipping position. Reverse the steps under Install RCL/RCI Indicator Light on page 4-13.

Stop Engine

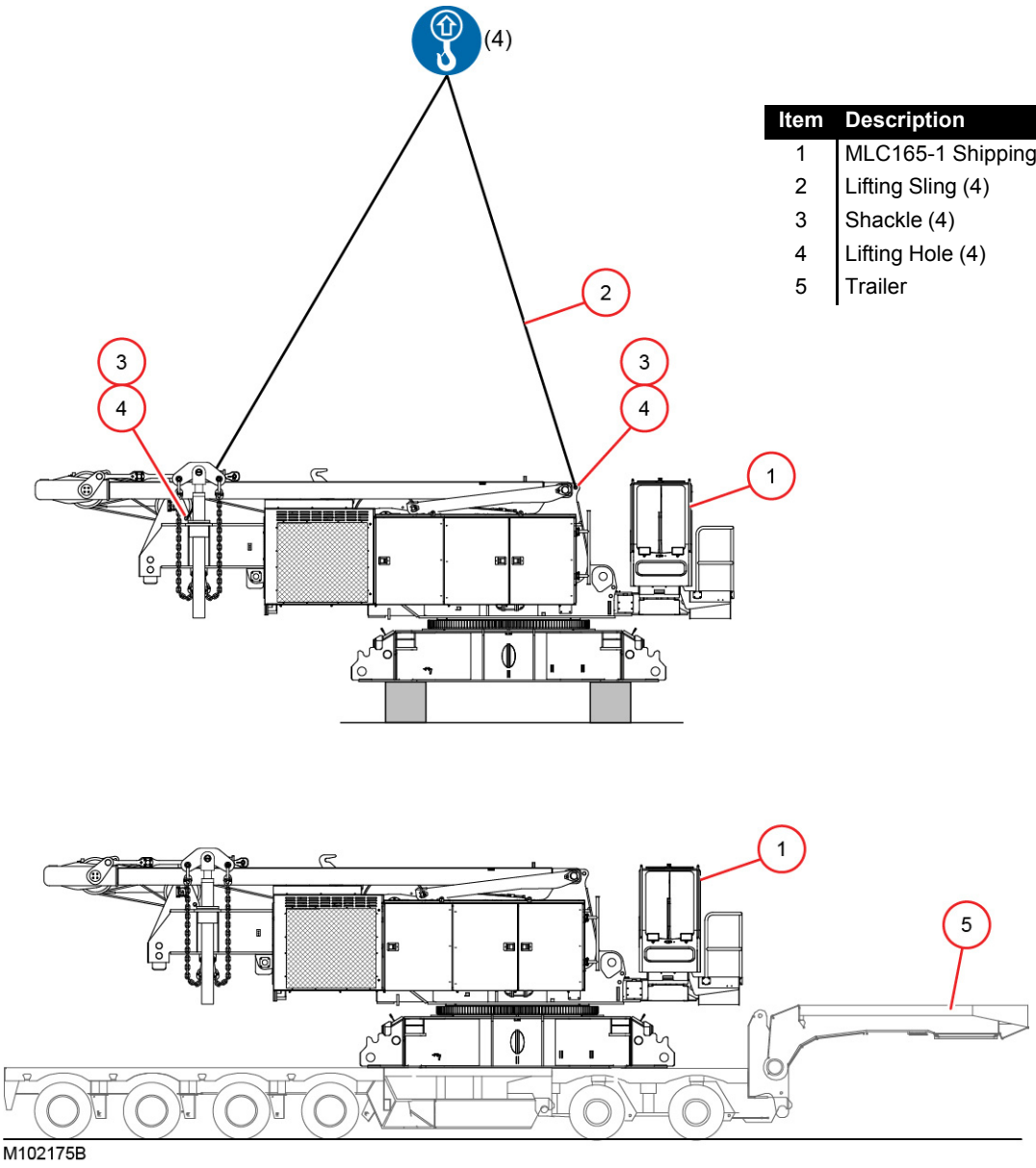
1. Store the remote control if not already done. See View E, Figure 4-2 on page 4-4.
2. Lock all enclosures and remove the keys.
3. Park all crane functions in the cab.
4. Turn off all accessories in the cab.
5. Stop the engine.
6. Remove all keys from the control console in the cab.
7. Close and latch all cab windows.
8. Close and lock the cab door and remove the key.

Install Window Covers

If equipped, install the window covers as shown in Figure 4-7 on page 4-9.

Store Operator Cab

Store the operator cab for shipping. Reverse the steps under Deploy Operator Cab on page 4-12.



Item	Description
1	MLC165-1 Shipping Package
2	Lifting Sling (4)
3	Shackle (4)
4	Lifting Hole (4)
5	Trailer

Figure 4-61

DANGER

Tipping Hazard!

Swing is prohibited while crane is on blocking.

Install Crane from Trailer

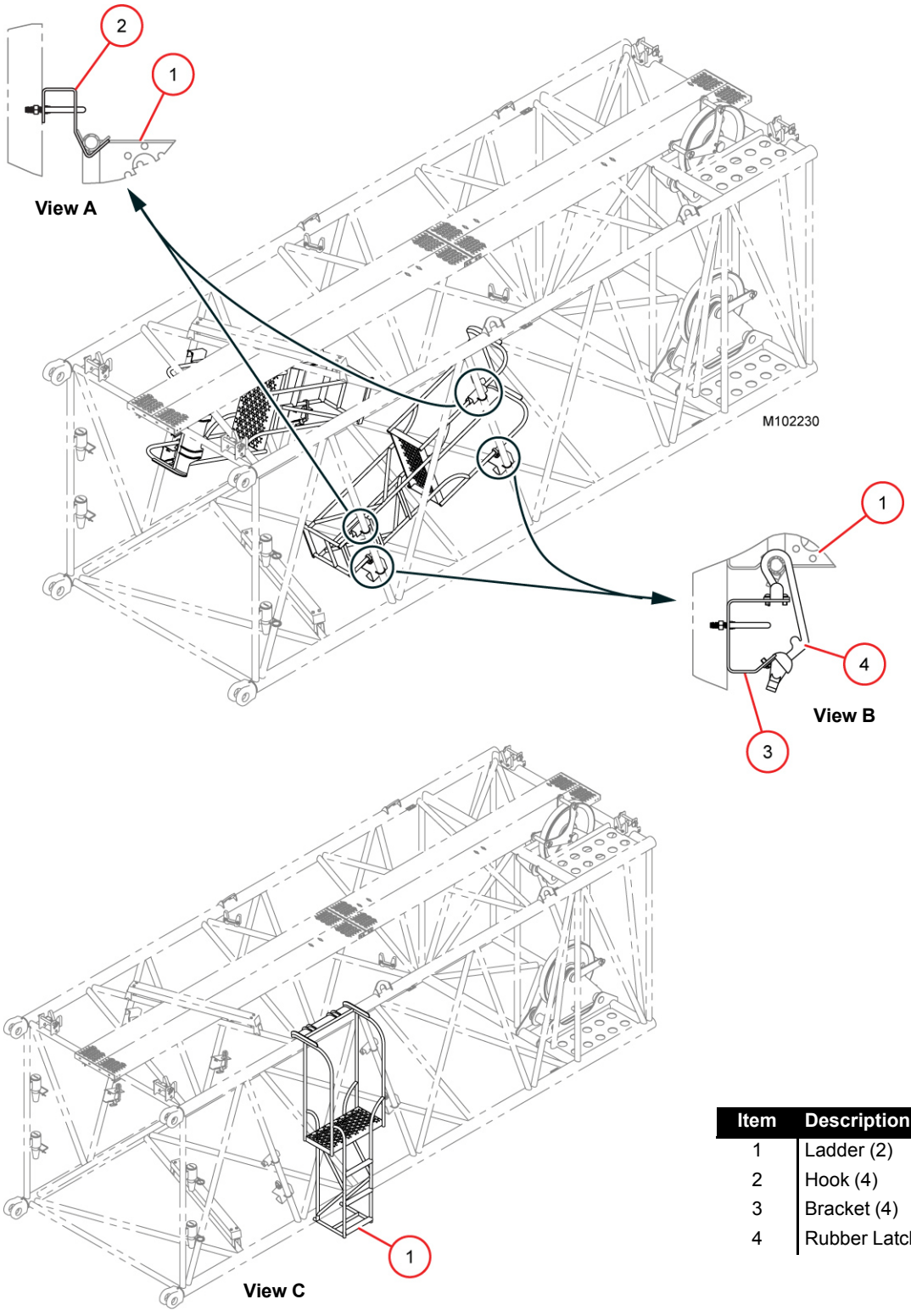
See Figure 4-61.

1. Attach owner furnished lifting slings (2) from the assist crane to shackles (3) at the lifting holes (4) in the rotating bed of the MLC165-1.

   Refer to the Lifting Assembly 81023872 at the end of this section for sling and pick point specifications and for the total weight to be lifted.

   It is crane owner's responsibility to properly size the assist crane, the lifting slings, and the shackles for the weight to be lifted.

2. Lift the MLC165-1 onto the trailer.
3. Secure the MLC165-1 to the trailer. See Shipping Crane Components on page 4-53.
4. Disconnect the lifting slings and shackles.
5. The crane is ready for transport.



Item	Description
1	Ladder (2)
2	Hook (4)
3	Bracket (4)
4	Rubber Latch (4)

Figure 4-62

BOOM LADDERS

See Figure 4-62

If equipped, optional boom ladders are stored inside the 19.7 ft (6 m) boom insert with sheaves.

The ladders are designed for use in assembly, disassembly, and maintenance of the #74A boom sections and components.

Each ladder weighs approximately 27 lb (12 kg).

WARNING

Fall Hazard!

Prevent serious injury or death:

- Limit load on the ladders to 300 lb (136 kg).
- Avoid improper use. The boom ladders are intended for use only on Manitowoc #74A boom inserts. Any other use is prohibited.
- Use the boom ladders for boom assembly, disassembly, and maintenance only when the boom is horizontal.
- Make sure the boom ladders are properly secured to the boom inserts.
- When climbing a ladder, your hands must be free of any objects. Objects which cannot be carried in pockets or tool belts must be lifted into place onto the ladder platform prior to climbing the ladder.
- Stand only on the ladder platforms. Do not stand on the cross braces.

Installing the Ladders

Use two people to remove the ladders from the insert: one person inside the insert to unlatch and lift the ladders and another person outside of the insert to help guide the ladders out of the insert.

Perform the following steps for both ladders:

1. The boom sections must be blocked in the horizontal position.
2. Unhook the rubber latches (4, View B).
3. Lift the ladder (1) up and out of the hooks (2, View A).
4. Guide the ladder through the lacings to the outside of the insert.
5. Place the ladder in the desired outside location on the insert (View C).
   - The ladder must be securely hooked over the inboard side of the upper chord and must rest firmly against the lower chord.
   - The ladder must hang vertically against the insert when in use.

WARNING

Falling Object Hazard!

The ladders shall be properly stored to prevent them from falling out of the boom when it is raised.

Storing the Ladders

Use two people to store the ladders in the insert: one person outside of the insert to help guide the ladders into the insert, and another person inside the insert to lift the ladders and latch them in position.

Perform the following steps for both ladders:

1. Lift the ladder (1) through the lacings to the inside of the insert.
2. Hang the ladder rails over the hooks (2, View A) inside the insert.
3. Route the rubber latches (4, View B) tightly over the lower rail and connect them to bracket (3).
4. Make sure the ladder cannot move once it is latched in place.

BOOM AND JIB RIGGING

Assist Crane Requirements

An assist crane is used to assemble and disassemble the boom and jib components during the following procedures.

See the Crane Weights topic in Section 1 the MLC165-1 Operator Manual for the weights of boom and jib components.

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 with Mast

Boom handling with the mast must be limited to the boom length given in the Boom Assembly Drawing at the end of this section.

WARNING

Falling Boom Hazard!

Do not attempt to handle more boom with the mast than specified in the Boom Assembly Drawing. Structural failure of components can occur, allowing the boom to fall.

Assembly Drawings

Boom and jib components (top, inserts, butt, straps) must be assembled in the proper sequence according to the applicable Boom and Jib Assembly Drawings at the end of this section.

Identifying Boom and Jib Components

The boom and jib sections are marked for proper identification as shown in View A, Figure 4-63.

The jib pendants are marked for proper identification as shown in View B, Figure 4-63.

The boom straps and links are marked for proper identification as shown in View C, Figure 4-63.

Item	Description
1	Boom or Jib Chord
2	Boom or Jib Number
3	Manitowoc Manufacturing Code
4	Manitowoc Part Number
5	Pendant
5a	Aluminum Tag (if equipped)
6	Manitowoc Purchase Order Number
7	Manufacturer's Number
8	Wire Rope Type
9	Diameter
10	Length
11	Boom Strap
12	Link
13	Part Number and Serial Number

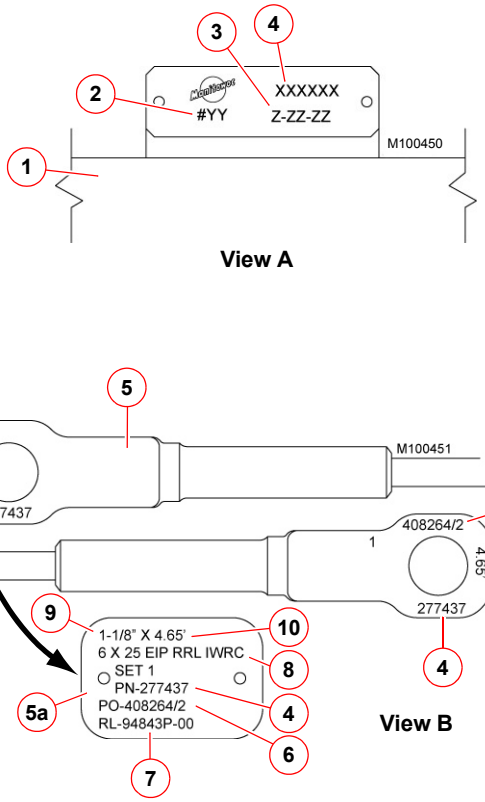


Figure 4-63

Handling Components

Handle the boom and jib sections with care to avoid damaging the lacings and chords.

All boom sections have lifting lugs as shown in Figure 4-64.

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.

When the lifting lugs are not used:

- Lift against chords only, never against lacings.
- Use synthetic lifting slings. If wire rope or chain slings are used, install protective covering (such as sections of rubber tire) between the slings and the chords.

Refer to Figure 4-65 for the approximate centers of gravity for the boom sections.

CAUTION

Lacing Damage!

Ensure the boom straps and links (Figure 4-64) are secured in the shipping position on the boom inserts and top during handling and transportation unloading.

WARNING

Personal Injury or Property Damage!

Ensure the boom straps and links remain properly secured in the shipping position on the boom inserts and top during transportation loading or unloading and assembly or disassembly of the boom. The straps and links could shift or fall resulting in personal injury or property damage if not properly secured.

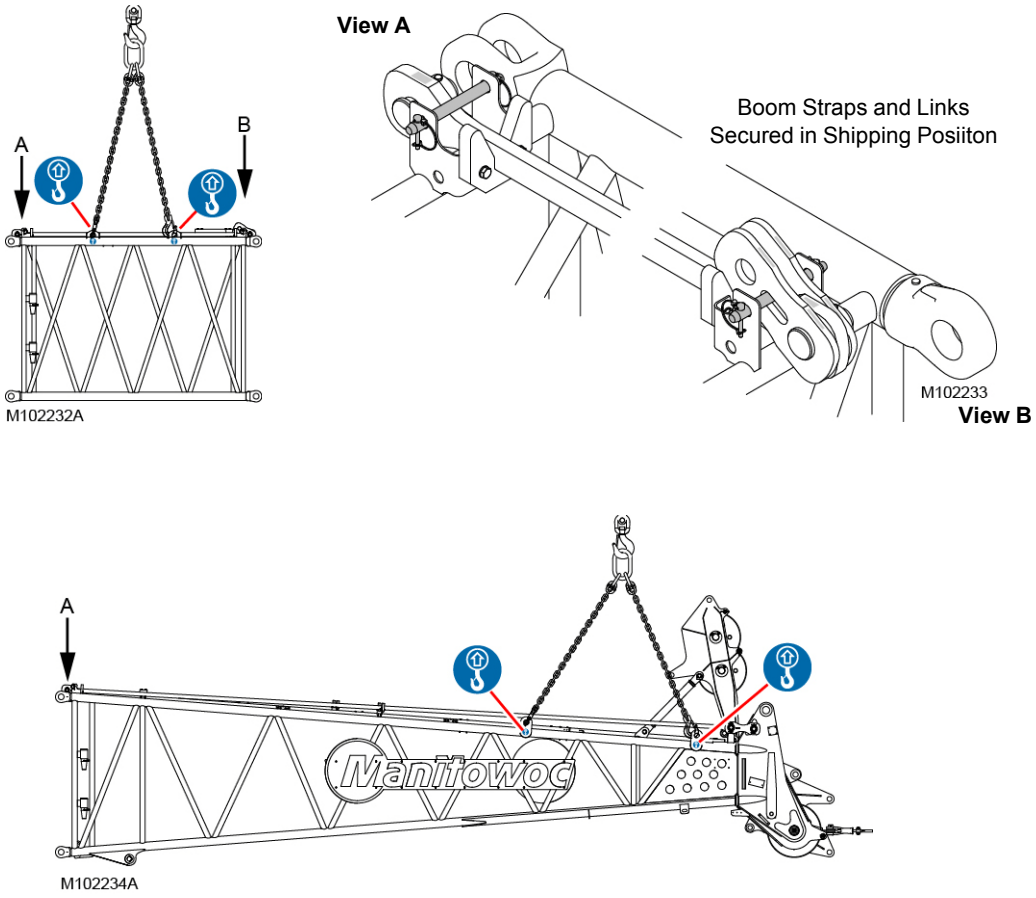


Figure 4-64

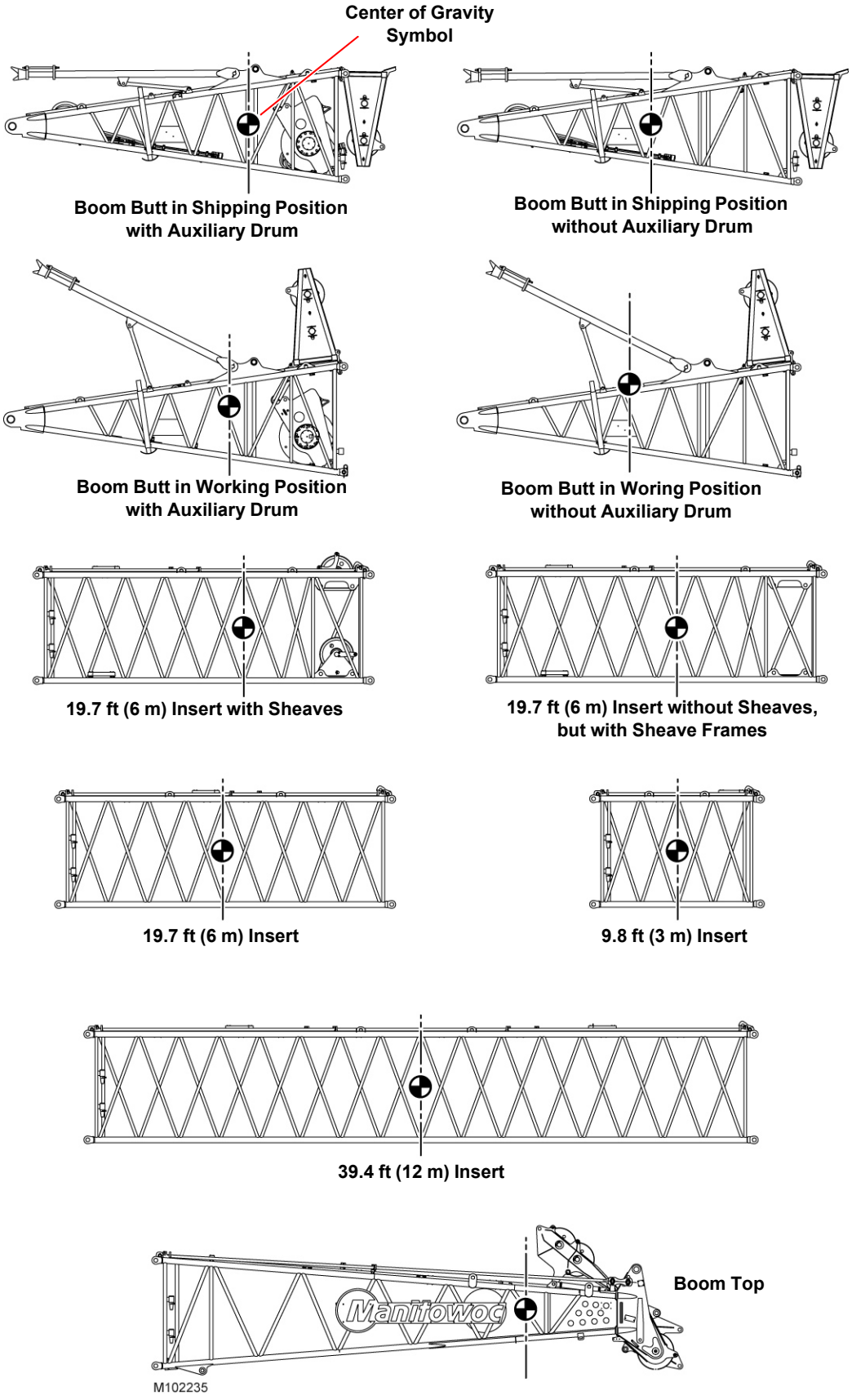
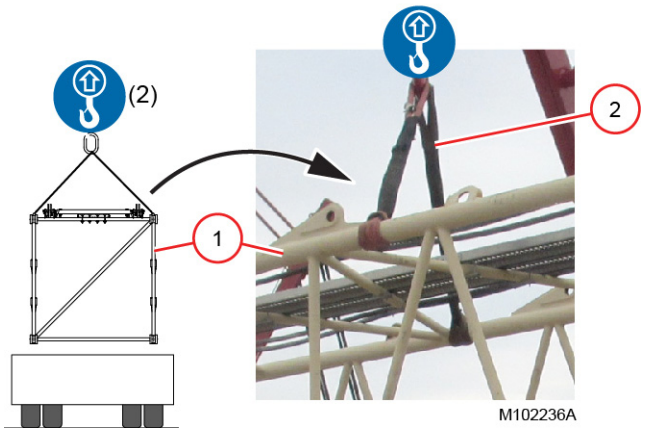
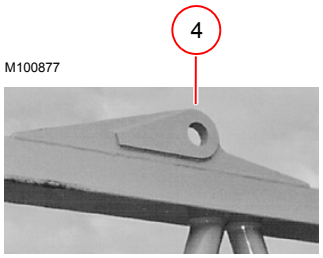

Center of Gravity Symbol
Boom Butt in Shipping Position with Auxiliary Drum
Boom Butt in Shipping Position without Auxiliary Drum
Boom Butt in Working Position with Auxiliary Drum
Boom Butt in Woring Position without Auxiliary Drum
19.7 ft (6 m) Insert with Sheaves
19.7 ft (6 m) Insert without Sheaves, but with Sheave Frames
19.7 ft (6 m) Insert
9.8 ft (3 m) Insert
39.4 ft (12 m) Insert
Manitowoc
Boom Top
M102235

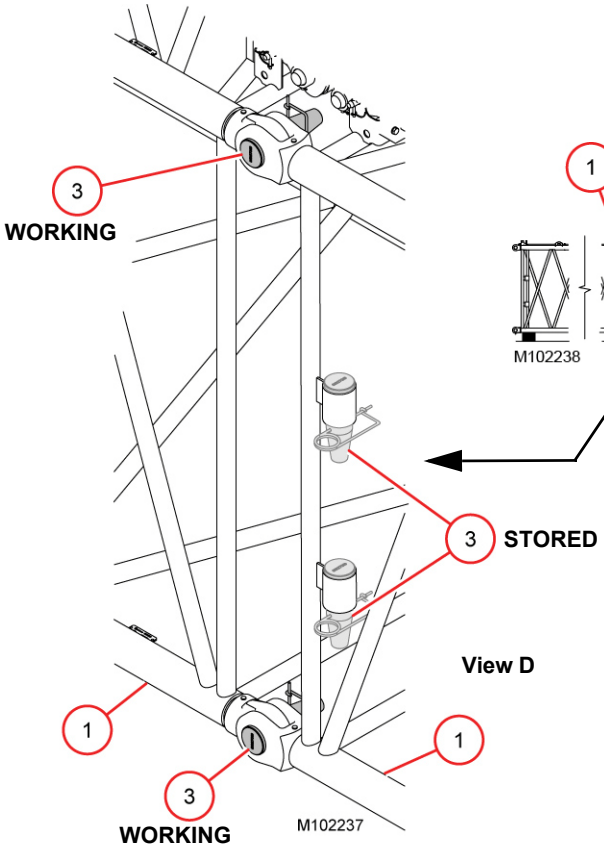
Figure 4-65



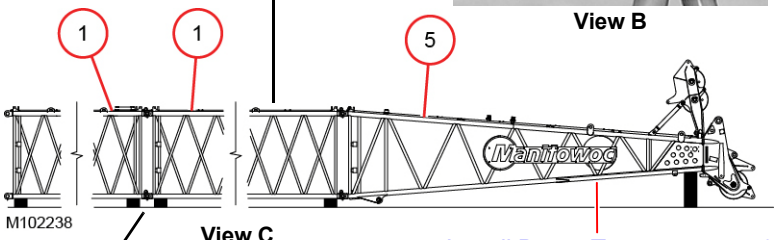
View A



View B



View D



View C

See Install Boom Top on page 4-95

Item	Description
1	Insert
2	Synthetic Lifting Sling (2), 6 ft (1,8 m) Long
3	Connector Pin with Cotter Pins or Safety Pins (4)
4	Backstay Lug (2)
5	Boom Top

Figure 4-66

Boom #74A Assembly

WARNING

Collapsing Boom/Crushing Injury Hazard!

To prevent death or serious injury, do not stand on, inside, or under the boom sections when they are being lifted into place.

Stay outside the boom sections when installing or removing connecting pins. The boom sections can collapse or shift suddenly when the pins are removed. To avoid death or serious injury:

- Do not remove the connecting pins from any boom section when the boom is supported by the straps.
- Do not remove the strap connecting pins until the straps are fully lowered onto the boom sections.
- Do not remove the connecting pins from any boom section when the boom point is resting on the ground and the chain sling is slack.
- Never work or stand inside the boom unless it is lowered and securely blocked.
- Do not stand or walk on top of the boom unless it has catwalks.

Assemble Boom Inserts

See Figure 4-66 for the following procedure.

Assemble the boom in the exact sequence shown in the Boom Assembly Drawing at the end of this section. Start with the shortest insert and end with the longest insert at the top of the boom.

Possible exception: If the 19.7 ft (6 m) insert with sheaves is to be installed, it must be installed next to the boom butt.

Some boom lengths require intermediate suspension. To determine the correct installation position of the intermediate suspension, see the Boom Assembly Drawing and the Intermediate Suspension Strut Assembly Drawing at the end of this section.

CAUTION

Wire Rope Guide Damage

To avoid damage to the upper wire rope guide in the 19.7 ft (6 m) insert with sheaves, remove the upper wire rope guide for clamshell operation.

1. Using the assist crane, remove the insert from the trailer:
   a. Using a choker hitch, attach two synthetic lifting slings (2, View A) to the top chords at the approximate center of gravity of the insert (see Figure 4-65 on page 4-89).
   b. Connect the synthetic lifting slings to the hook of the assist crane.
   c. Adjust the position of the slings so the insert is approximately 9 in (229 mm) out of level when lifted (butt end lower than top end).
   d. Lift the insert off the trailer.
2. Place the first insert (1, View C) on blocking at least 9 in (229 mm) high. This height will allow for installation of the boom top.
3. Adjust the blocking as needed so the insert is level.
4. Repeat step 1 for the next insert.
5. Lift the next insert into position and align the top connector holes.
6. Remove the four connector pins (3, View D) from the storage brackets.
7. Install the top connector pins (3, View D), lower the insert, and install the bottom connector pins. The pin heads must face the outside.
8. Secure the pins with cotter pins or safety pins.
9. Block under the top end of the insert so the insert is level.
10. Disconnect the lifting slings

NOTE If a fixed jib will be installed, the 39.4 ft (12 m) insert with backstay lugs (4, View B) must be installed next to the boom top (5).

If intermediate suspension is required, install the intermediate suspension strut between the required inserts. See Install Intermediate Suspension Strut on page 4-93.

11. Repeat the above steps until all inserts are installed.

4

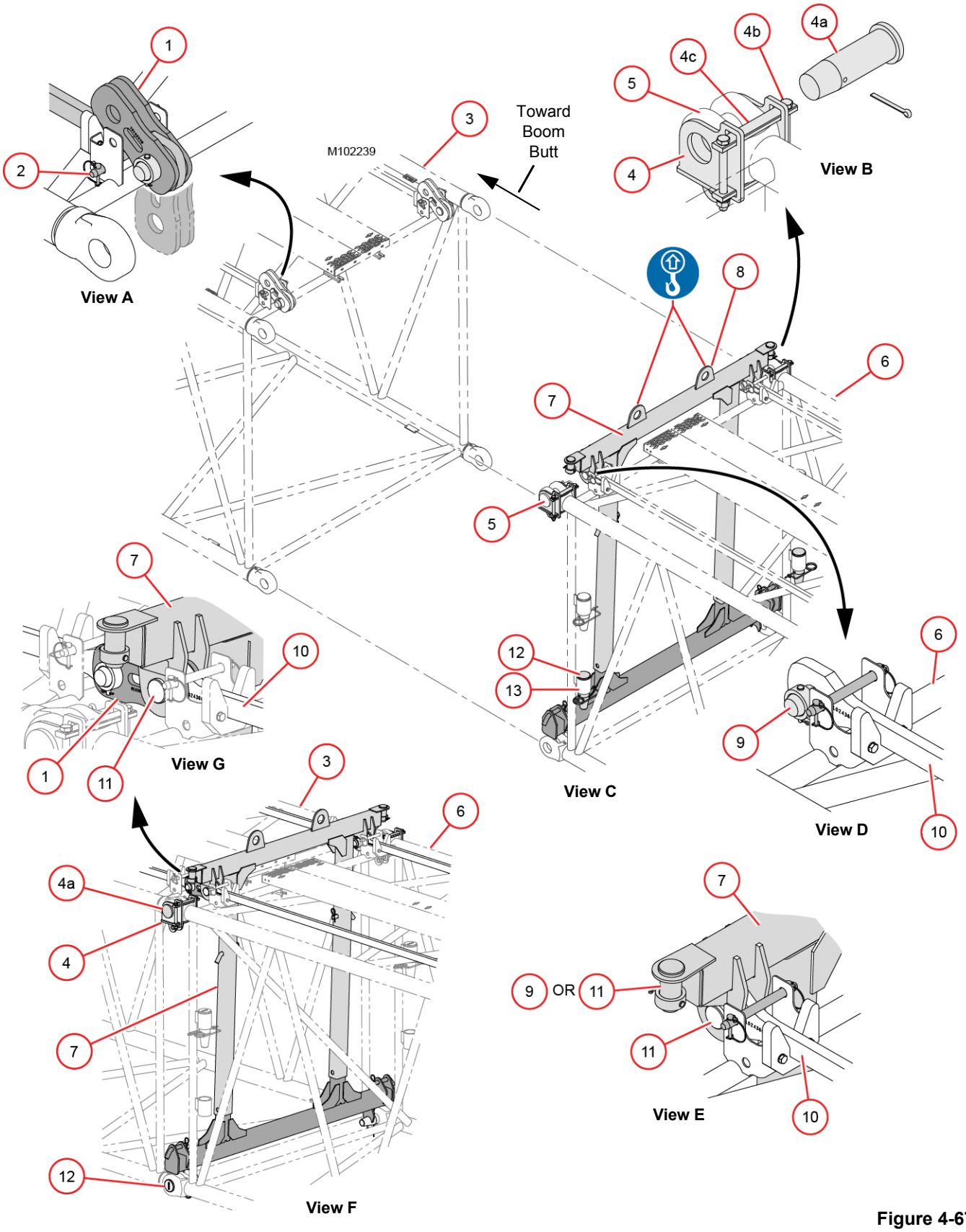

1
2
View A
M102239
3
Toward
Boom
Butt
4a
4b
4c
5
4
View B
8
6
7
5
7
10
1
11
View G
12
13
View C
6
9
10
View D
3
6
4a
4
7
12
View F
7
9 OR 11
11
10
View E

Figure 4-67

Legend for Figure 4-67

Item	Description
1	Strap Link (4)
2	Storage Pin with Safety Pins (2)
3	Boom Insert (nearest boom butt)
4	Bracket (2)
4a	Top Connector Pin with Cotter Pin (2)
4b	Cap Screw with Washers and Nut (2)
4c	Keeper Plate (2)
5	Top Connector (2)
6	Boom Insert (nearest boom top)
7	Intermediate Suspension Strut
8	Lifting Lug (2)
9	Standard Strap Pin with Collar, Clevis Pin, and Cotter Pins
10	Boom Strap
11	Special Strap Pin with Collar, Clevis Pin, and Cotter Pins
12	Bottom Connector Pin with Safety Pin (2)
13	Storage Lug (2)

Install Intermediate Suspension Strut

See Figure 4-67 for the following procedure.

NOTE An assist crane is required for this procedure.

The intermediate suspension strut weighs approximately 551 lb (250 kg).

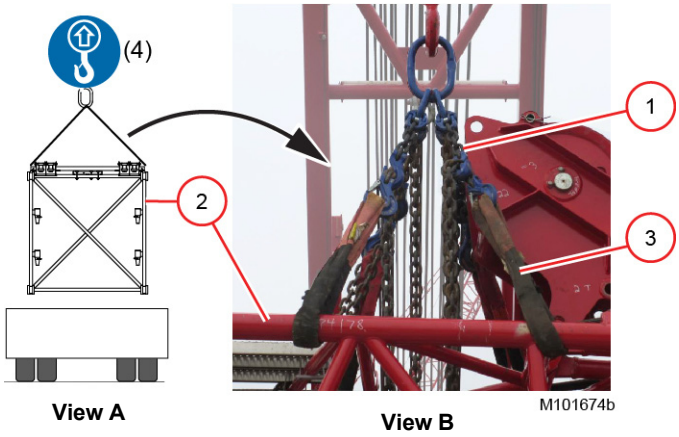
The chain lifting sling supplied by Manitowoc can be used to lift the intermediate suspension strut at the lifting lugs (8, View C).

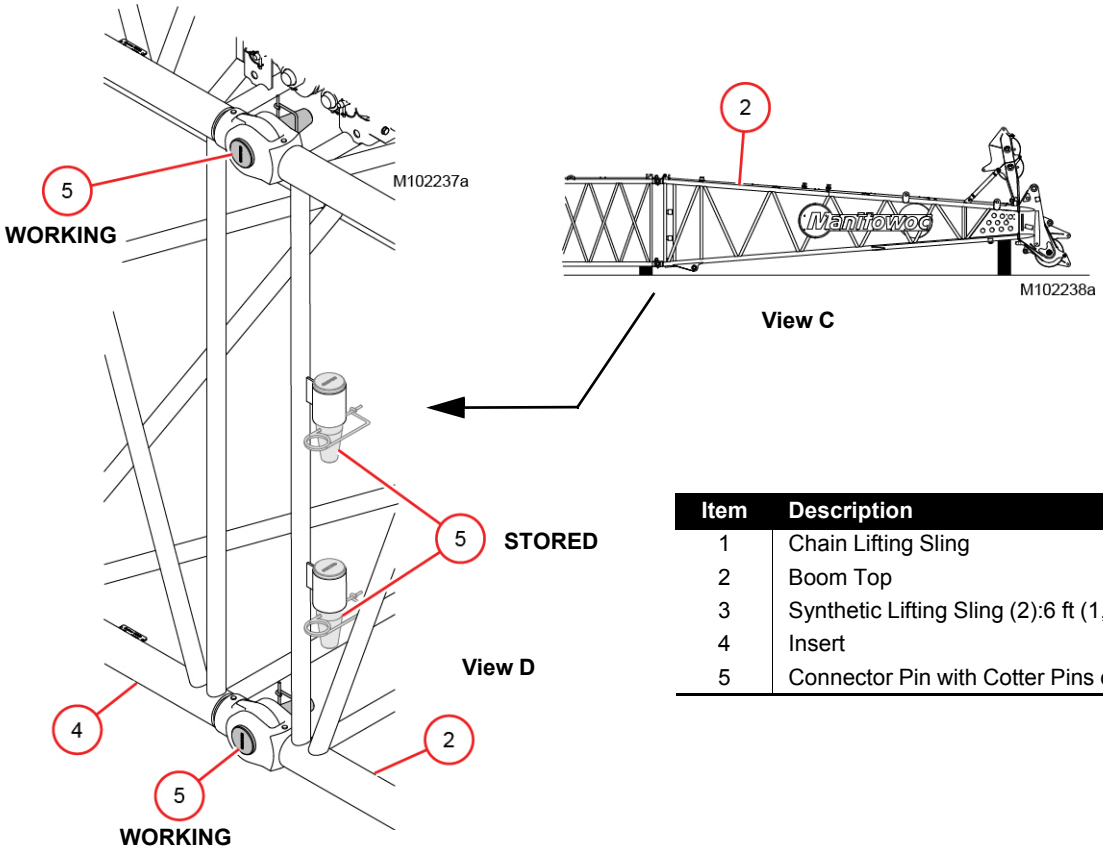
The intermediate suspension strut is symmetrical from side to side.

1. Determine the correct installation position of the intermediate suspension strut. See the Boom Assembly Drawing and the Intermediate Suspension Strut Assembly Drawing at the end of this section.
2. Unpin the strap links (1, View A) from the stored position on the end of the insert (3) and rotate the links down as shown.
3. Assemble the brackets (4, View B) to the top connectors (5) on the boom insert (6):
   a. Remove the pin (4a).
   b. Loosen the nuts on the cap screws (4b).
   c. Slip the brackets (4) over the top connectors (5).
   d. Align the connecting holes in the brackets with those in the connectors.
   e. Securely tighten the nuts on the cap screws (4b) so the keeper plates (4c) are tight against the flats on the connectors.
4. Attach the intermediate suspension strut (7, View C) to the boom insert (6) as follows:
   a. Lift the intermediate suspension strut (7, View C) into position at the end of the required boom insert (6).
   b. Remove the standard strap pins (9, View D) from the ends of the boom straps (10) on the insert (6).
   c. Remove the special strap pins (11, View E) from the storage lugs on the intermediate suspension strut (7).
   d. Install the standard strap pins (9, View E) in the storage lugs on the intermediate suspension strut (7).

NOTE The special strap pins (11) are slightly longer than the standard strap pins (9) to accommodate the added width of the intermediate suspension strut mounting lugs.

   e. Pin the intermediate suspension strut (7, View E) to the boom straps (10) with the special strap pins (11). The pin heads must face out.
   f. Disconnect the lifting slings.
5. Lift the boom insert (6, View F) (with intermediate suspension strut pinned to it) into position at the end of the boom insert (3) and align the connector holes.
6. Install the top connector pins (4a, View F) and secure them with cotter pins. The pin heads must face out.
7. Remove the bottom connector pins (12, View C) from the storage lugs (13) on the insert (6).
8. Push the bottom of the intermediate suspension strut rearward as needed to align the bottom connector holes.
9. Install the bottom connector pins (12, View F) and secure them with safety pins. The pin heads must face out.
10. Disconnect the lifting slings from the insert (6).
11. Support the intermediate suspension strut with slings from the assist crane and remove the pins (11, View G) connecting the intermediate suspension strut to the straps (10).
12. Rotate the links (1, View G) up and re-pin the intermediate suspension strut to the links (1) and the straps (10) with the pins (11). The pin heads must face out.
13. Disconnect the lifting slings from the intermediate suspension strut (7).
14. Proceed to install the remaining boom sections.





Item	Description
1	Chain Lifting Sling
2	Boom Top
3	Synthetic Lifting Sling (2):6 ft (1,8 m) Long
4	Insert
5	Connector Pin with Cotter Pins or Safety Pins (4)

Figure 4-68

Install Boom Top

See Figure 4-68 for the following procedure.

NOTE Determine if the lower boom point sheave clusters require removal or modification. See Remove or Install Lower Boom Point Sheave Clusters on page 4-99 for instructions.

WARNING

Crane Tipping Hazard!

To raise some boom and jib lengths, the two outer lower boom point sheave clusters shall be removed. The crane will tip if this is not done.

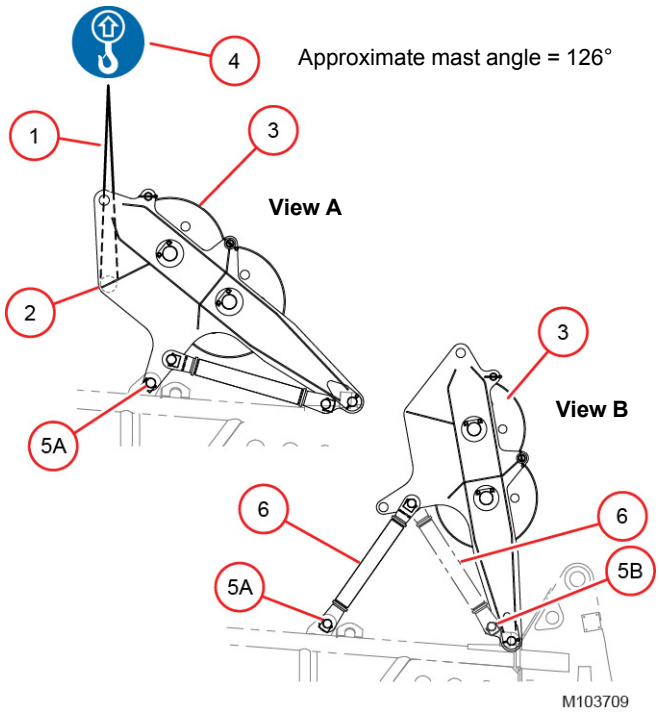
Refer to the appropriate Liftcrane Boom or Jib Capacity Chart to determine the lower boom point sheave requirements and deducts.

1. Using the assist crane, remove the boom top from the trailer:
   a. Using a basket hitch, attach four synthetic lifting slings (3, View B) to the top chords of the boom top (1) at the location shown.
   b. Connect the synthetic lifting slings to the hooks of the assist crane.
   c. Adjust the position of the slings so the boom top is approximately 9 in (229 mm) out of level when lifted (butt end lower than top end).
   d. Lift the boom top off the trailer.
2. Lift the boom top into position at the last insert (4, View C) and align the top connector holes.
3. Remove the four connector pins (5, View D) from the storage brackets.
4. Install the top connector pins (5, View D), lower the boom top and install the bottom connector pins. The pin heads must face the outside.
5. Secure the pins with cotter pins or safety pins.
6. Block under the lower boom point sheaves.
7. Disconnect and remove the lifting slings.

Raise Wire Rope Guide

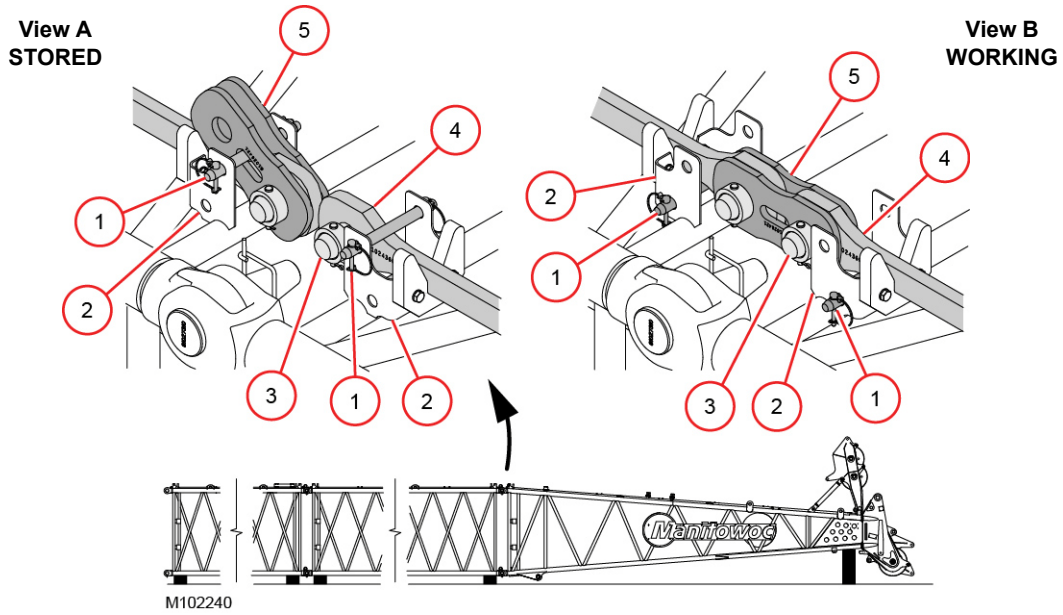
See Figure 4-69 for the following procedure.

1. Using a basket hitch, attach the synthetic lifting sling (1) to the cross brace (2) in the wire rope guide (3, View A).
2. Attach the lifting sling to the hook (4) of the assist crane.
3. Hoist just enough so the pins (5A, View A) are loose and remove the pins (5A).
4. Slowly hoist to rotate the wire rope guide to the working position (View B).
5. Remove pins (5B, View A) and rotate the struts (6) from the stored position to the working position.
6. Install pins (5A, View B) to connect the struts (6) to the lugs on the boom top.
7. Store pins (5B, View B) in the lugs on the wire rope guide.
8. Disconnect the lifting sling.



Item	Description
1	Synthetic Lifting Sling — 6 ft (1,8 m) Long
2	Cross Brace
3	Wire Rope Guide
4	Assist Crane Hook
5	Pin with Cotter Pins (4)
6	Strut

Figure 4-69



Item	Description
1	Storage Pin with Safety Pins
2	Storage Bracket
3	Pin with Collar, Clevis Pins, and Cotter Pins
4	Boom Strap
5	Strap Links

Figure 4-70

Connect Boom Straps

See Figure 4-70 for the following procedure.

1. If desired, install the optional boom ladders to access the straps (see Boom Ladders on page 4-85).

   If equipped with optional catwalks, workers can also access the straps from the top of the inserts. ***Take every precaution to prevent falling off the inserts***.

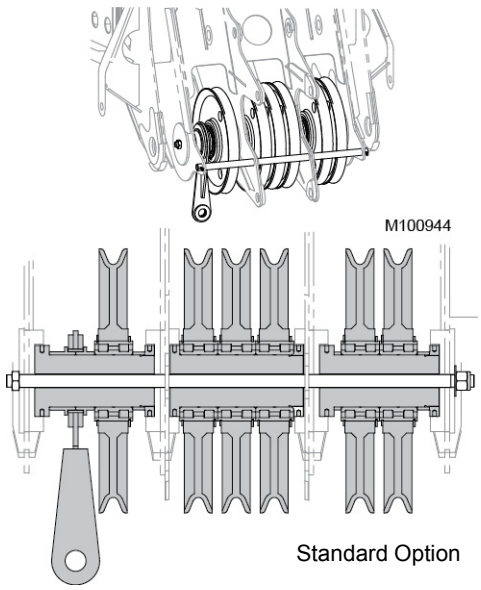
2. Connect the boom straps at the top end of each insert, as follows:

   a. Move storage pins (1) from the stored position (View A) to the working position (View B).

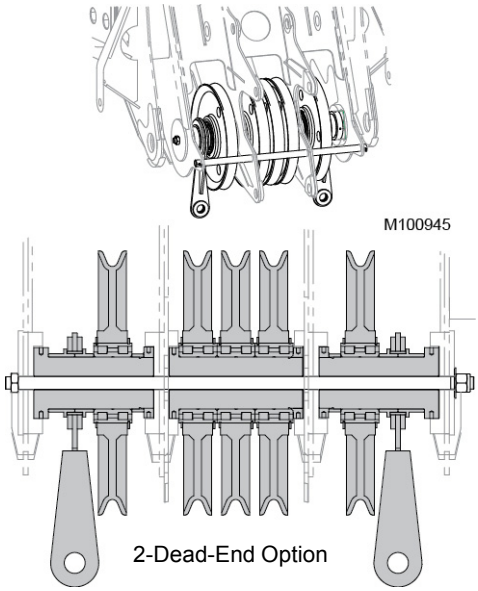
   b. Remove pins (3, View A) and the collars from the ends of boom straps (4).

   c. Rotate links (5, View A) to the working position (View B).

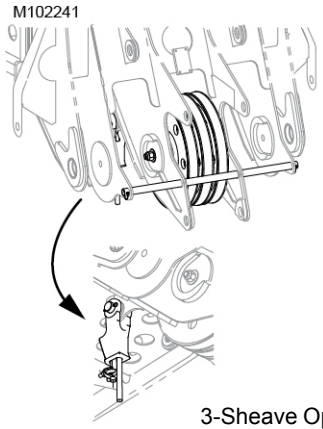
   d. Install pins (4, View B) and the collars so the pin heads are on the INBOARD SIDE.



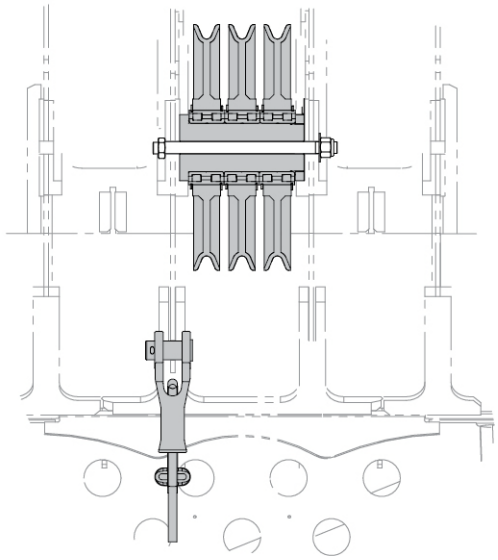
Standard Option

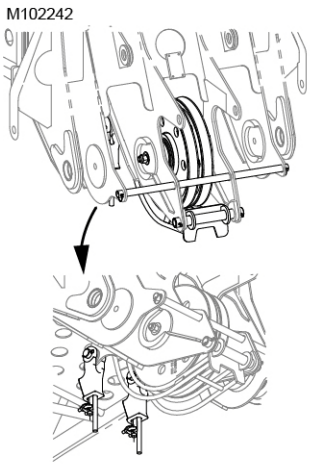


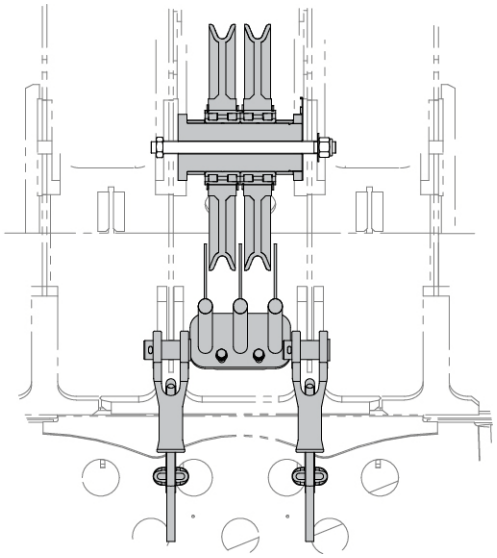
2-Dead-End Option



3-Sheave Option







2-Sheave Option with Guard for Clamshell

Figure 4-71

Item	Description	Item	Description
1	Lock Nut	6	Rope Guard
2	Washer	7	Cotter Pin
3	Shim (16 ga. or 22 ga.)	8	Center Bolt (short or long)
4	Sheave Clusters	9	Saddles
5	Dead End		

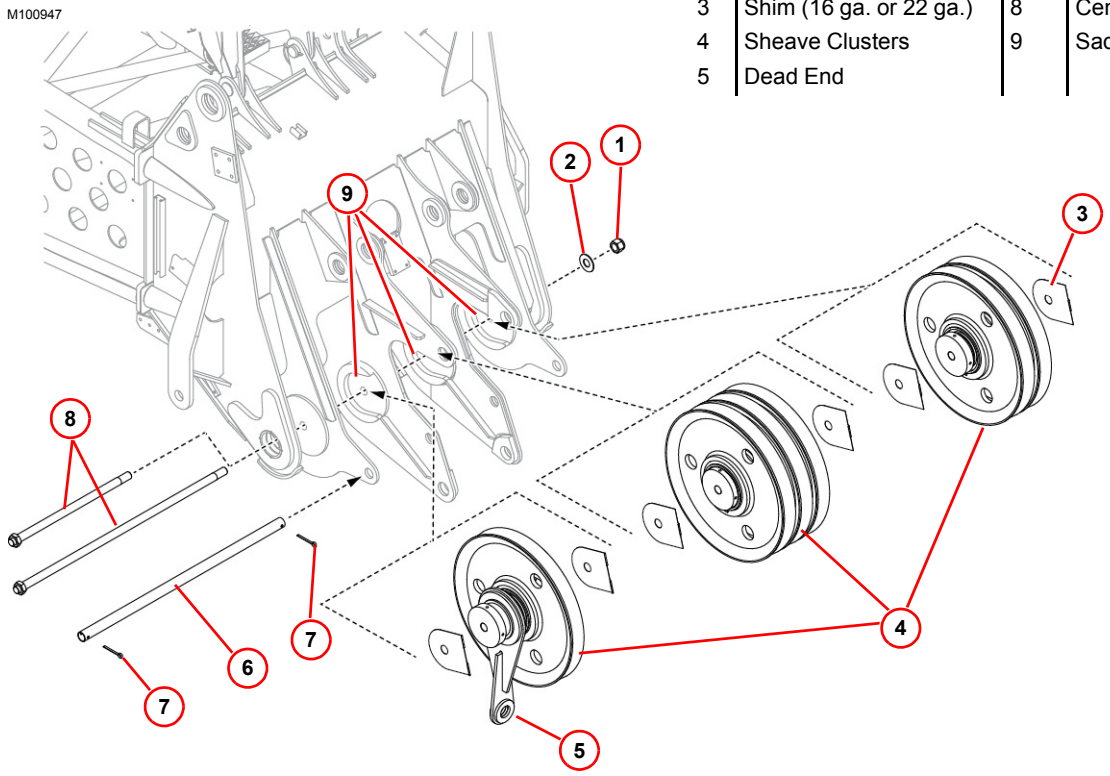


Figure 4-72

Remove or Install Lower Boom Point Sheave Clusters

Removing or installing a lower boom point sheave cluster (Figure 4-72) is necessary to move the dead-end link or prior to lengthening the boom to a length that requires sheaves to be removed.

WARNING

Crane Tipping Hazard!

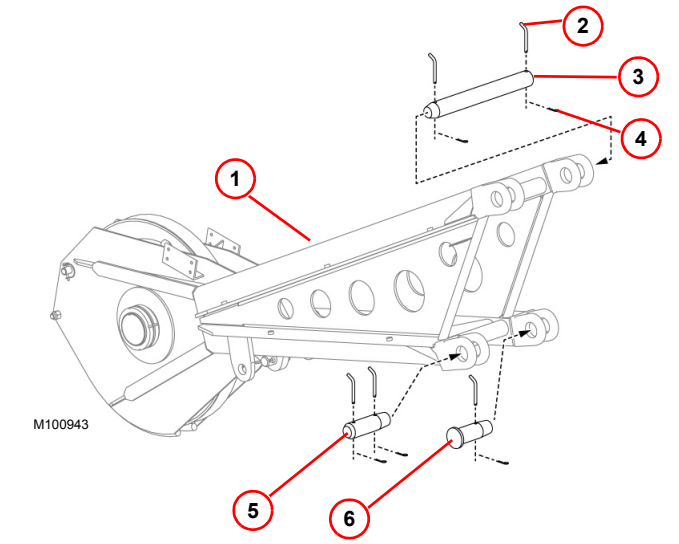
To raise some boom and jib lengths, the two outer lower boom point sheave clusters shall be removed. The crane will tip if this is not done.

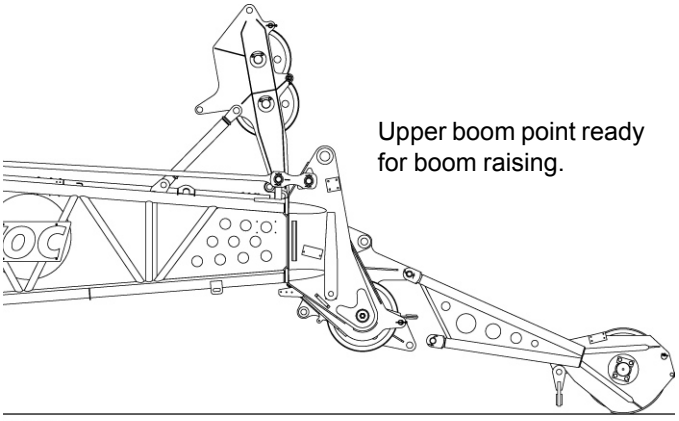
Refer to the appropriate Liftcrane Boom or Jib Capacity Chart to determine the lower boom point sheave requirements and deducts.

The sheave arrangements are shown in Figure 4-71.

1. Block the sheaves to take the weight off the center bolt (8).
2. Remove the rope guard (6).
3. Remove the lock nut (1), washer (2) and center bolt (8).
4. Using appropriate lifting equipment, pull the sheave clusters (4) and dead end (5), as required, out of their saddles in the lower boom point.

   The sheave clusters weigh approximately 518 lb (235 kg).
5. Install an equal thickness of shims (3) into the saddles (9) on both ends of each sheave cluster and dead-end, as applicable.
6. Check that the side-play of each sheave cluster and dead-end is no greater than 1/32 in (0,8 mm). If needed, add another shim on each end.
7. Install the center bolt with flat washers and securely tighten the lock nut.
8. Install the rope guard (6).





Item	Description	Item	Description
1	Upper Boom Point	4	Cotter Pin (quantity 5)
2	Hitch Pin (quantity 5)	5	Pin, 2-hole
3	Pin	6	Pin, Flathead, 1-hole

Figure 4-73

Install the Upper Boom Point

WARNING

Crane Tipping Hazard!

To raise some boom and jib lengths, the upper boom point shall be removed. The crane will tip if this is not done.

Refer to the appropriate Liftcrane Boom or Jib Capacity Chart to determine the upper boom point requirements and deducts.

Refer to Figure 4-73 for the following procedure.

Pins for installing the upper boom point (1) are supplied with the upper boom point and stored in their installation locations.

1. Remove the upper pin (3) from the upper boom point. The lower pins can remain in place.
2. Lift the upper boom point and move it into position at the lower boom point.
3. Rest the upper boom point on the ground and align the upper holes with the holes in the lower boom point.
4. Install the upper pin (3).

   Secure the upper pin on both ends with the supplied hitch pins (2).

   Secure the hitch pins with the supplied cotter pins (4).
5. Install the lower pins (5 and 6) as follows when the boom is raised:

   a. Remove the lower pins from the upper boom point.

   b. Slowly boom up to align the connecting holes.

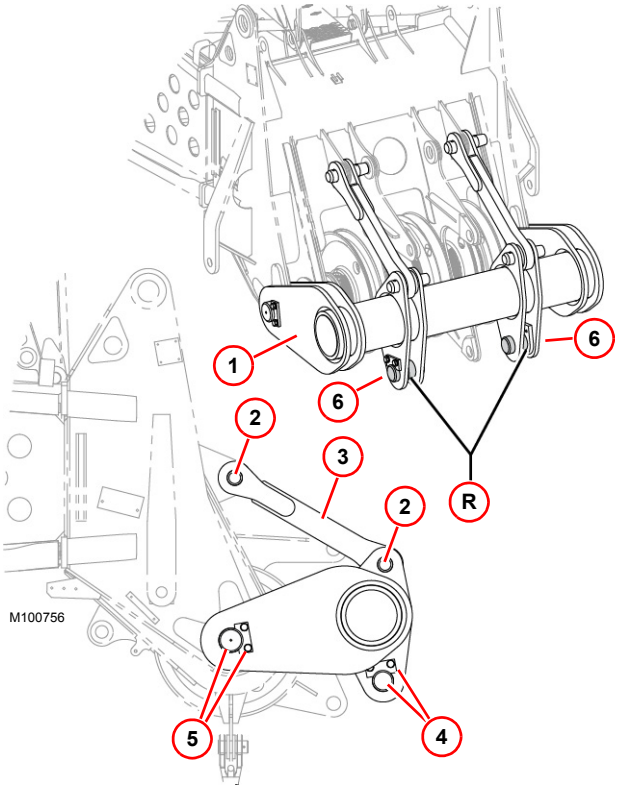
   c. Install the lower pins when the holes are aligned.

NOTE To avoid interference with the wire rope, one pin (6) has a flat head. Install this pin in the correct location and orientation (right side of crane, the head facing inside), as shown.

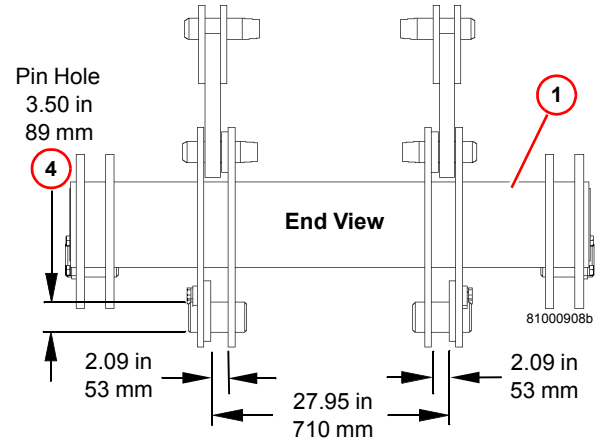
   d. Secure the pins with the supplied hitch pins.

   e. Secure the hitch pins with the supplied cotter pins.

NOTE The upper boom point must be removed for jib installation.



All Linear Dimensions: ± 0.060 in (1,52 mm)



Item	Description
1	Adapter
2	Pin
3	Link
4	Pin with Keeper Plate
5	Pin with Keeper Plate
6	Connection Point
R	Design Load

Figure 4-74

Install Pile Driver Adapter for Fixed Leads

If required, attach the optional pile driver adapter to the boom point as shown in Figure 4-74.

WARNING

Equipment Failure Hazard

The pile driver adapter shall be used only with freely suspended loads.

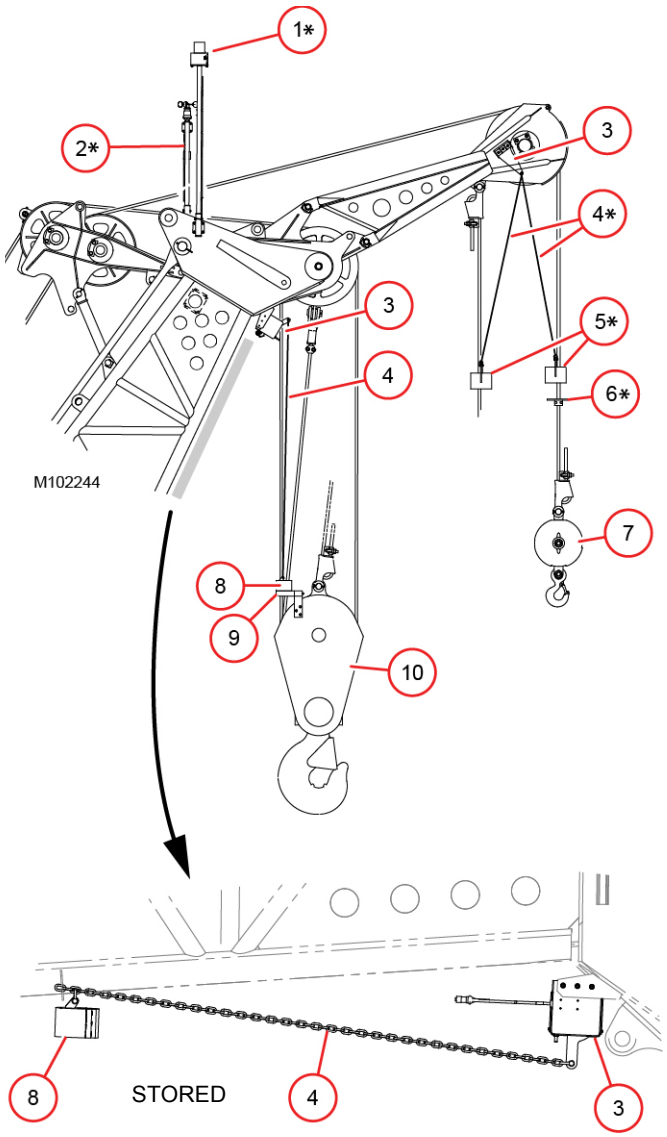
Any side load or torque generated by the owner-supplied attachments will reduce the design loads of the pile driver adapter. In such cases, contact your Manitowoc dealer for the specifications which meet your particular application.

The design loads given below apply to the pile driver adapter only. In all cases, the pile driver adapter loads must not exceed the capacities given in the applicable Liftcrane Boom Capacities chart.

Operating Specifications

- Maximum Boom Length = 137.8 ft (42 m)
- Maximum Load Per Side = Design Load divided by 2
- Design Loads — “R”:
  - 60,000 lb (2 7215,5 kg) at 65° Boom Angle
  - 48,000 lb (2 1772,4) at 55° Boom Angle

4



Item	Description
1	Position Indicator Light
2	Wind Speed Indicator
3	Limit Switch (lower and upper boom point)
4	Chain
5	Weight with 2-Chain Attachments
6	Lift Plate
7	Hook-and-Weight Ball
8	Weight with 1-Chain Attachment
9	Lift Block
10	Load Block
*	Stored in Parts Box

Figure 4-75

Install the Wind Speed and Position Light Components

If any wind speed or position light components (Figure 4-75) have been removed, re-install them now.

Refer to the following drawings at the end of this section:

- Electric Accessory Assembly, Position Indicator Light
- Electric Accessory Assembly, Wind Speed Sensor

NOTE To provide good ground for the wind speed indicator bracket, use star washers to attach the bracket to the boom or jib top.

Connect Boom Wiring

Refer to the ESI Boom Wiring drawing at the end of this section.

1. Connect electric cables in the boom and jib to the proper receptacles.
2. Connect CAN terminators to unused plugs. Failing to perform this step will cause a fault alert and the corresponding function will not operate properly.
3. To prevent dirt and moisture from entering electric components, connect dust caps to all unused plugs, CAN terminators, and receptacles.

Install the Boom Load Lines

1. Route the load lines up the boom. See Figure 4-99 on page 4-127.
2. Pull the load lines approximately 20 ft (6,1 m) past the end of the boom.
3. Install the load block(s) and hook-and-weight ball after the boom is raised to a convenient height. See Boom Raising Procedure on page 4-51.
4. Read the following topics:
   - Wire Rope Installation on page 4-117
   - Load Line Reeving on page 4-126.
   - 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
   - Reeving diagrams at the end of this section

Install the Boom Block-Up Limit Components

Install the block-up limit components (Figure 4-75) according to the ESI Boom Wiring drawing at the end of this section.

Install Tagline Assembly

If equipped with the optional tagline assembly (Figure 4-76), install it as shown in the Tagline Assembly Drawing at the end of this section.

Refer to the manufacturer's manual at the end of this section for operation, installation, and maintenance instructions.

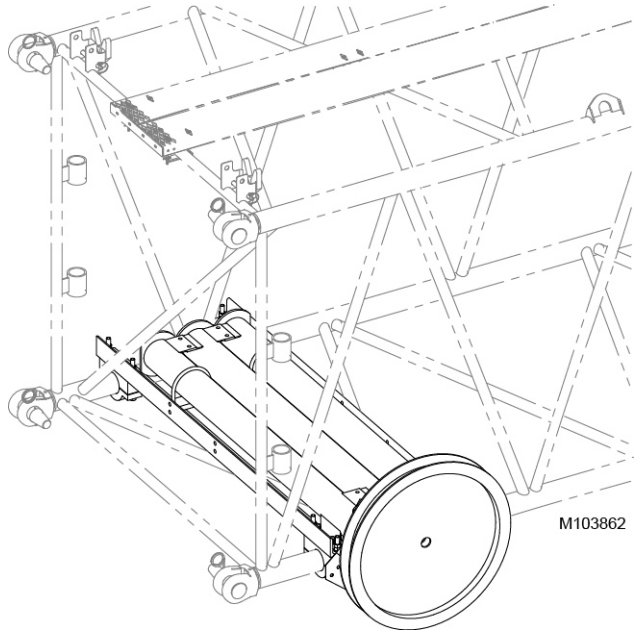


Figure 4-76

Boom #74A 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 MLC165-1 has been disconnected from the boom and is being used to disassemble the boom.

1. 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:
   - Luffing jib (see Luffing Jib Operator Manual for procedure)
   - #134 jib (see Jib #134 Disassembly on page 4-116)
   - If desired, pile driver adapter (see page 4-101)
   - Upper boom point (reverse the installation steps on page 4-100).
   - If equipped, disconnect and remove the wind speed and position light components so they are not damaged during shipping.
   - If equipped, store or remove the boom work light fixtures so they are not damaged during shipping. Disconnect the electric cables between the boom sections.
   - Store the boom top wire rope guide. Reverse the steps on page 4-95.
4. Disconnect and store the boom strap links. Reverse the steps for Connect Boom Straps on page 4-97.

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 assembly steps.
   - If equipped with intermediate suspension, remove it as instructed under Remove Intermediate Suspension Strut on page 4-105.
   - If the MLC165-1 is being used to disassemble its own boom, refer to the following:
     - Figure 4-68 on page 4-94 for handling the boom top
     - Figure 4-66 on page 4-90 for handling the boom inserts
   - If an assist crane is being used to disassemble the boom, refer to Figure 4-64 on page 4-88 and Figure 4-65 on page 4-89 for lifting locations.
   - Be sure to store the straps and links on the boom sections. See View A, Figure 4-70 on page 4-96.

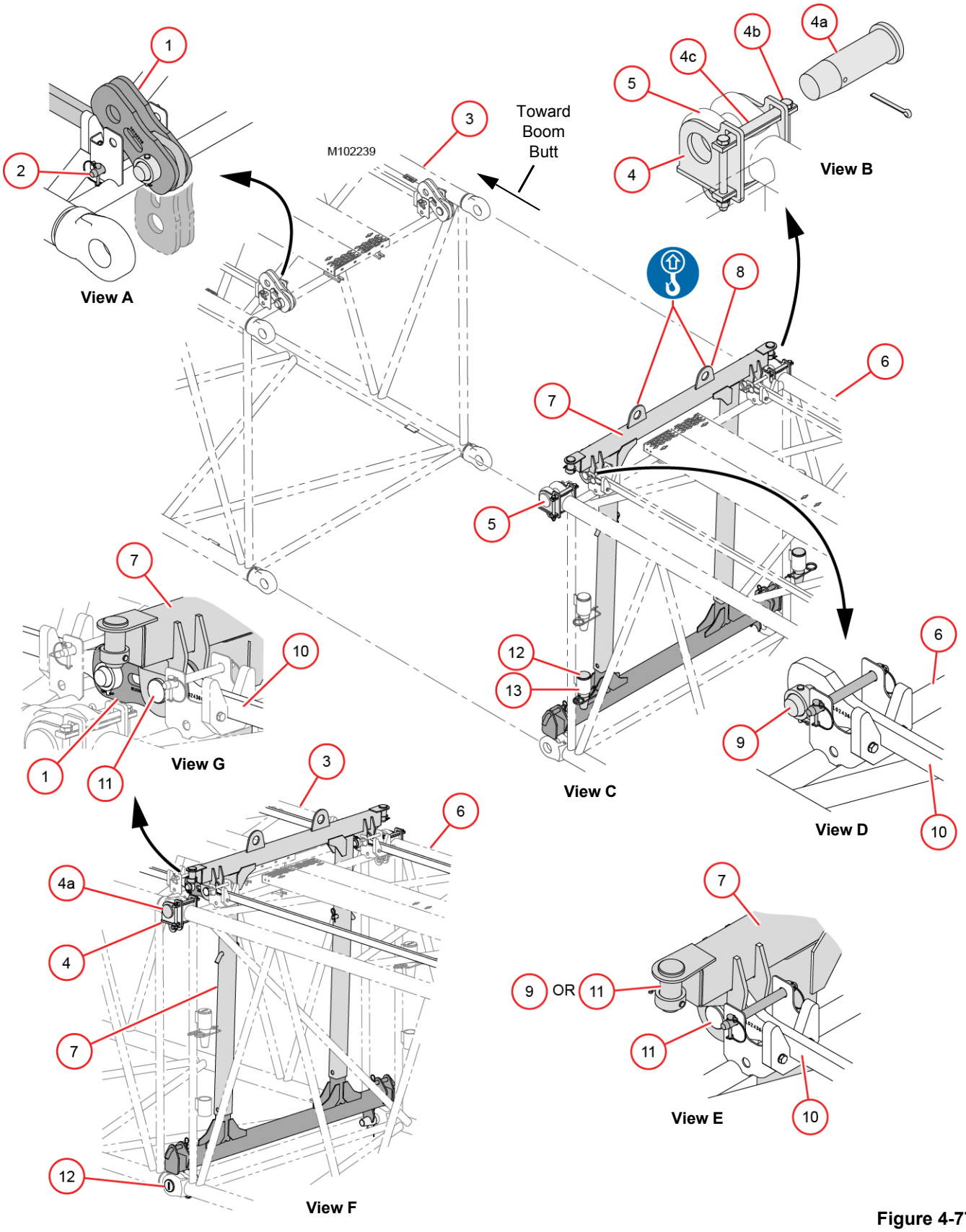

1
2
View A
M102239
3
Toward
Boom
Butt
4a
4b
4c
5
4
View B
8
6
7
5
12
13
View C
6
9
10
View D
7
10
1
11
View G
3
6
4a
4
7
12
View F
7
9 OR 11
11
10
View E

Figure 4-77

Legend for Figure 4-77

Item	Description
1	Strap Link (4)
2	Storage Pin with Safety Pins (2)
3	Boom Insert (nearest boom butt)
4*	Bracket (2)
4a*	Top Connector Pin with Cotter Pin (2)
4b*	Cap Screw with Washers and Nut (2)
4c*	Keeper Plate (2)
5	Top Connector (2)
6	Boom Insert (nearest boom top)
7	Intermediate Suspension Strut
8	Lifting Lug (2)
9	Standard Strap Pin with Collar, Clevis Pin, and Cotter Pins
10	Boom Strap
11	Special Strap Pin with Collar, Clevis Pin, and Cotter Pins
12	Bottom Connector Pin with Safety Pin (2)
13	Storage Lug (2)
*	Stored in Parts Box

Remove Intermediate Suspension Strut

See Figure 4-77 for the following procedure.

NOTE An assist crane is required for this procedure.

The strut weighs approximately 551 lb (250 kg).

The chain lifting sling supplied by Manitowoc can be used to lift the intermediate suspension strut at the lifting lugs (8, View C).

1. Support the intermediate suspension strut (7, View A) with slings from the assist crane.
2. If not already done, install the strap storage pins to secure the straps (10, View G) in the storage brackets. See View A, Figure 4-70 on page 4-96.
3. Remove the pins (11, View G) connecting the intermediate suspension strut to the links (1) and the straps (10).
4. Rotate the links (1, View G) down and re-pin the intermediate suspension strut to the straps (10) with the pins (11). The pin heads must face out.
5. Disconnect the lifting slings from the intermediate suspension strut.
6. Support the insert (6) with lifting slings from the MLC165-1 or from an assist crane, depending on what is being used to disassemble the boom.
7. Remove the bottom connector pins (12, View F) and store them in the storage lugs (13, View C) on the insert (6).
8. Remove the top connector pins (4a, View F).
9. Lift the boom insert (6, View F) (with intermediate suspension strut pinned to it) away from the end of the insert (3) and place the insert (6) on blocking (View C).
10. Store the strap links (1, View A) on the end of the insert (3). See View A, Figure 4-70 on page 4-96.
11. Remove the brackets (4, View B) from the top connectors (5) on the boom insert (6). Store the brackets (4) and pins (4a) in the part box.
12. Remove the intermediate suspension strut (7, View C) from the boom insert (6) as follows:
    a. Support the intermediate suspension strut with slings from the assist crane.
    b. Remove the standard strap pins (9, View E) from the storage lugs on the intermediate suspension strut (7).
    c. Remove the special strap pins (11, View E) connecting the intermediate suspension strut to the straps (10).
    d. Install the special strap pins (11, View E) in the storage lugs on the intermediate suspension strut (7).
    e. Lift the intermediate suspension strut (7, View C) away from the end of the insert (3).
    f. Place the intermediate suspension strut on a shipping pallet and disconnect the lifting slings.
    g. Install the standard strap pins (9, View D) in the ends of the straps (10) and secure the straps for shipping. See View A, Figure 4-70 on page 4-96

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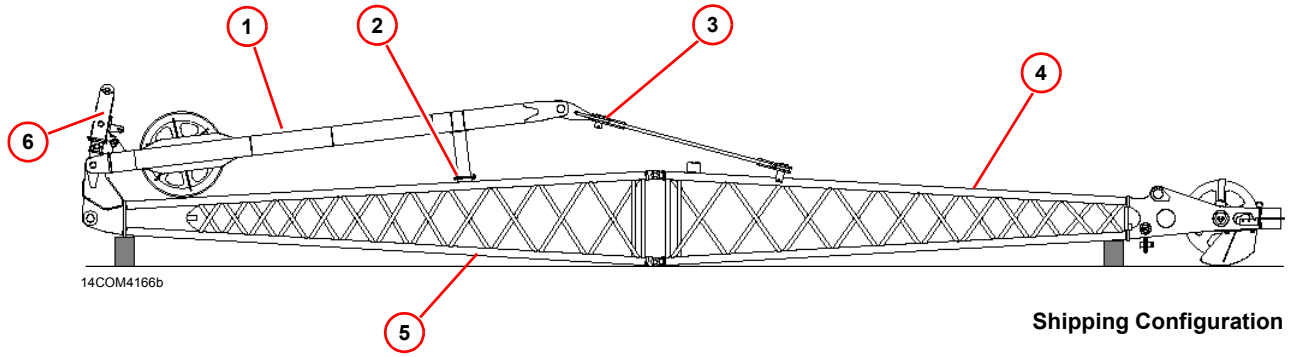


Shipping Configuration

Item	Description	Item	Description
1	Jib Strut	4	Jib Top
2	Bumper	5	Jib Butt
3	Backstay Links and Spreaders	6	Jib Stop

Figure 4-78

Jib #134 Assembly

Assemble the jib in the exact sequence shown in the Jib Assembly Drawing at the end of this section.

Review the topics after Boom and Jib Rigging on page 4-86.

NOTE For guidance on component identification, see Identifying Boom and Jib Components on page 4-86.

For boom and jib length limitations, see the Liftcrane Jib Capacities chart.

NOTE The upper boom point must be removed before the jib can be installed.

WARNING

Crushing Injury Hazard!

To prevent death or serious injury, do not stand on, inside, or under the jib components when they are being lifted into place.

Stay outside the jib components when installing connecting pins.

CAUTION

Avoid Jib Damage!

Use synthetic lifting slings when handling components that do not have lifting lugs.

Handling Jib Sections

When lifting lugs are not provided, as in the case of jibs:

- Lift against the chords only, never against the lacings.
- Use synthetic lifting slings. If wire rope or chain slings are used, use protective covering (such as sections of rubber tire) between the slings and the chords.

4

Connect Jib Butt to Boom Top

1. If not already done, lower the boom onto blocking at ground level

NOTE Make sure the insert with the jib backstay lugs (Figure 4-79) is installed next to the boom top.

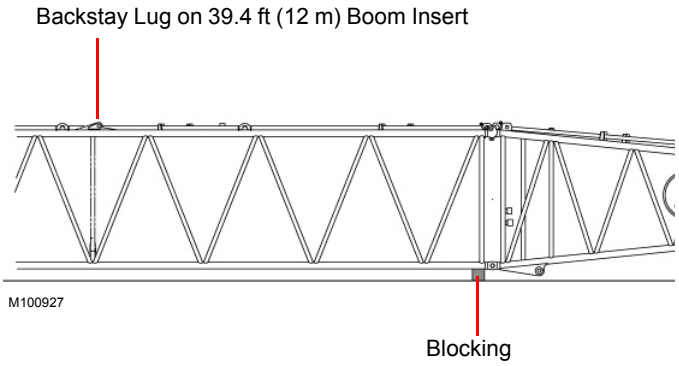


Figure 4-79

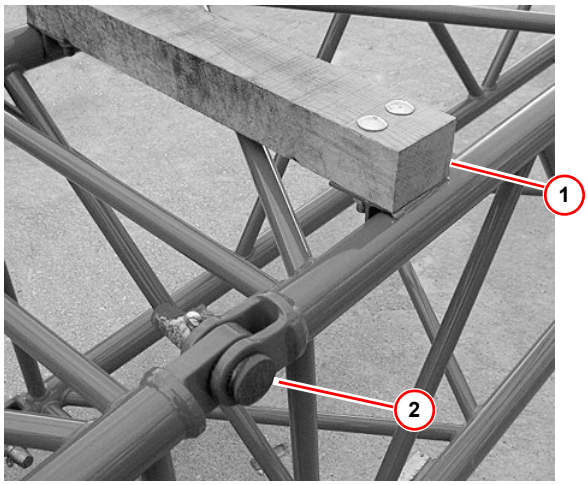
2. Lift the jib butt.
3. Align the holes in the jib butt with the holes in the boom top.
4. Install the pins (Figure 4-80).

Figure 4-80

Install Jib Inserts and Jib Top

NOTE The shortest inserts must be closest to the butt.

1. Using an assist crane, position the insert (Figure 4-81) so the connector holes are aligned with the adjacent jib section.



Item	Description
1	Timber Guard
2	Pin with Cotter Pin

Figure 4-81

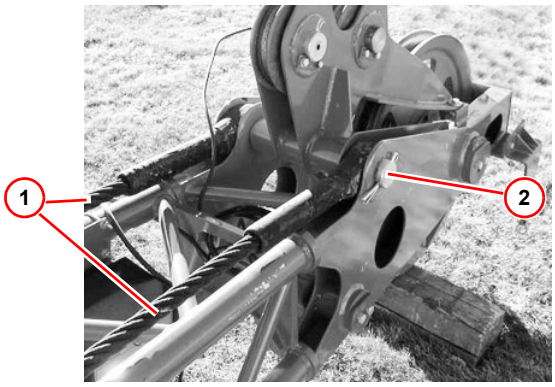
2. Pin the jib insert to the jib butt or adjacent insert as applicable.
   - The wire rope timber guards (1) must face up.
   - The heads of the pins (2) must face toward the outside of the jib.
3. As the assembly progresses, block the inserts.
4. Connect the jib top to the last insert or to the jib butt, as applicable. The pendant lugs on the jib top must face up.

Install Jib Pendants

The jib pendants (and backstay pendants) are furnished in matched sets of two and must be installed in matched sets.

1. Attach the two basic (30 ft 9 in, 9,4 m) pendants (1, Figure 4-82) to the lugs on the jib top using pins and cotter pins (2).
2. Attach any remaining jib pendants according to the jib length. For the correct pendants to use, refer to the table in the Jib Assembly Drawing at the end of this section.

   The shortest pendants must be closest to the butt.
3. Pin the pendants to the jib strut (3).



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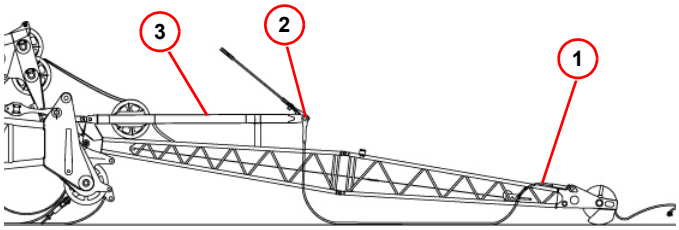

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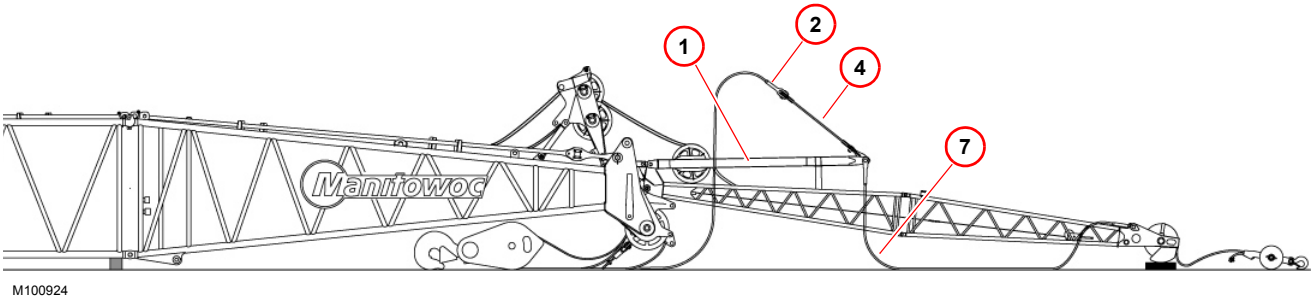
Item	Description
1	Basic Pendants
2	Pin with Cotter Pin
3	Jib Strut

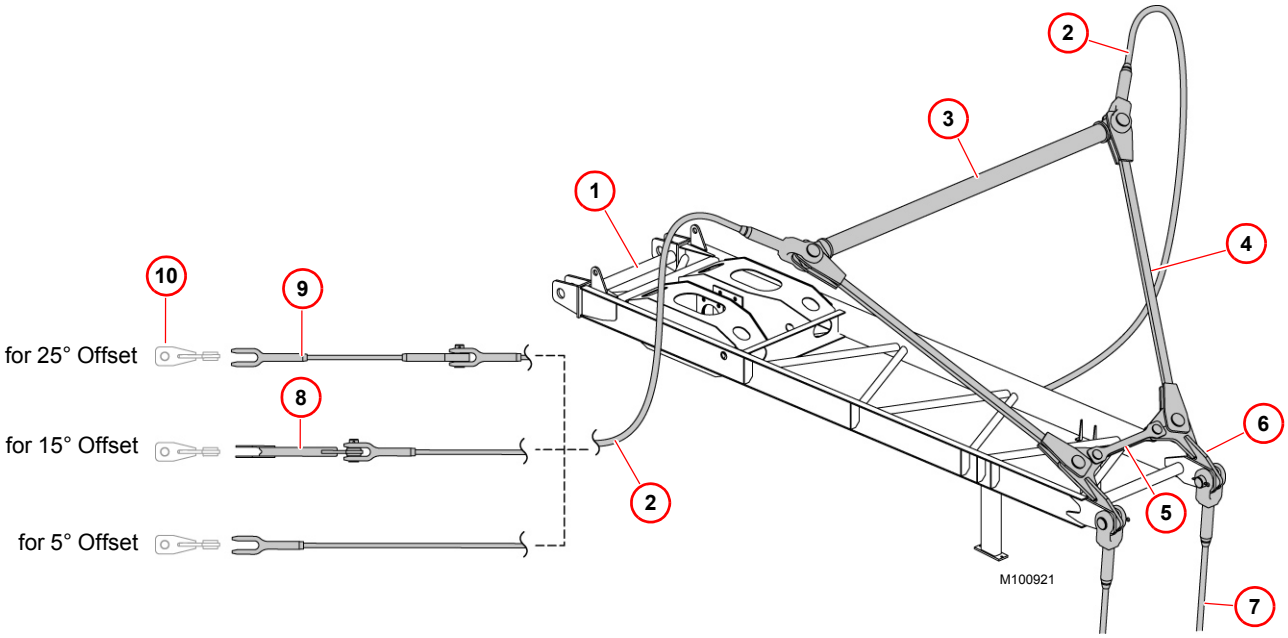
Figure 4-82

4

Assemble Backstay Pendants and Links

1. Install the backstay links (4, Figure 4-83) to the strut links (6).
2. Using the pins and cotter pins, install the backstay links (4) and the link (5) as shown.
3. Install the spreader (3) and the backstay pendants (2) to the backstay links (4).
4. Lay the backstay pendants on the ground alongside the boom.
5. If the jib offset is to be 15° or 25°, attach either of the following to the backstay pendants (2):
   - Offset pendants (9) for a 25° offset OR
   - Offset links (8) for a 15° offset





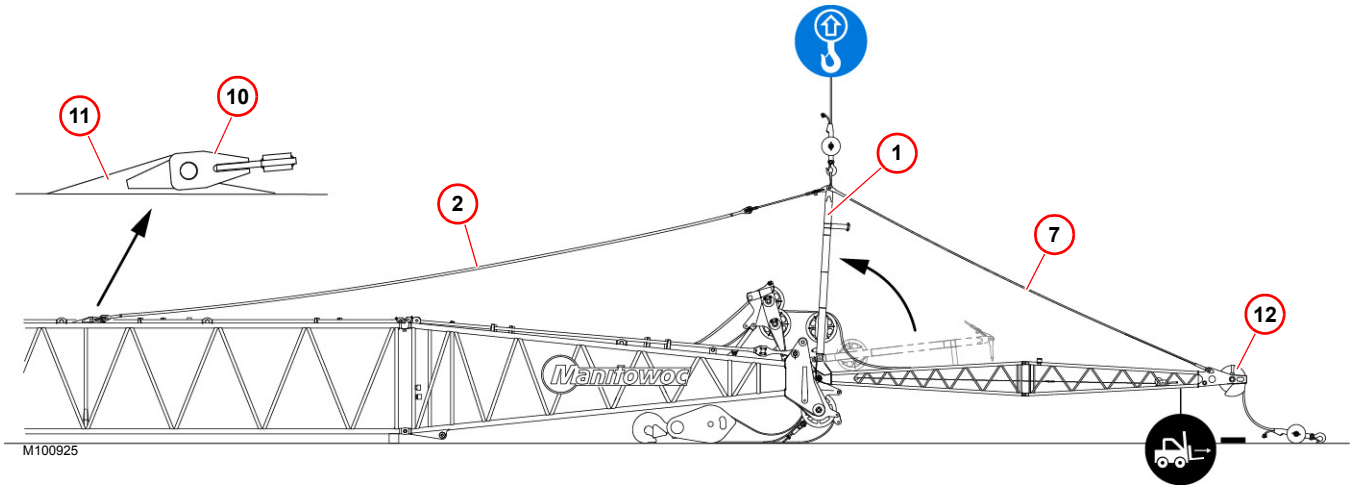
Item	Description
1	Jib Strut
2	Backstay Pendant 44 ft 7 in (13,6 m) with Pin
3	Spreader (1)
4	Backstay Link (2)
5	Link (1)
6	Strut Link (2)
7	Jib Pendant (2)
8	Offset Link 28 in (711 mm) with Pin (2)
9	Offset Pendant 4 ft 8 in (1,4 m) with pin (2)
10	Backstay Link (2) (see Figure 4-84)

Figure 4-83

Connect Backstay Pendants to Boom

See Figure 4-84 for the following procedure.

1. Pin the backstay links (10) to the backstay lugs (11).
2. Raise the jib strut (1):
   a. Using appropriate slings, attach a hook from an assist crane to the jib strut (1).
   b. Slowly lift the strut over-center with the assist crane. Use extreme caution not to side load the strut while lifting.
   c. If required to gain enough slack to allow pinning the backstay pendants (2), raise the jib point (12). Use a fork-lift truck or another crane.
3. Connect the backstay pendants (2):
   - For 0° offset, connect backstay pendants (2) to backstay links (10, Figure 4-84).
   - For 15° offset, connect offset links (8, Figure 4-83) to backstay links (10).
   - For 25° offset, connect offset pendants (9, Figure 4-83) to backstay links (10).
4. Disconnect the lifting slings.



Item	Description
1-9	See Figure 4-83
10	Backstay Link with Pin and Cotter Pins (2)
11	Backstay Lug (2)
12	Jib Point

Figure 4-84

4

Install the Jib Stop

1. Using the fasteners provided, fasten the control cable guide (Figure 4-85) to the plate located on the end of the boom top.

WARNING

Crushing Injury Hazard!

The jib stop pins are spring-engaged. Do not remove the safety pins until the jib stop assembly is connected to the boom top and the control cables are attached and tensioned.

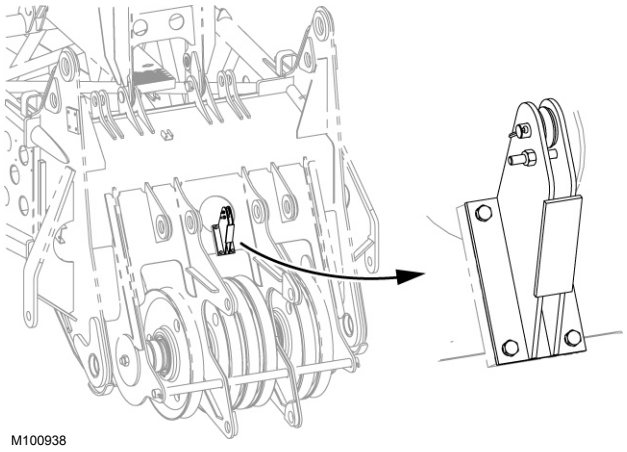


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Figure 4-85

2. Support the jib stop assembly (1, Figure 4-86), remove shipping the pins (13) and pivot the assembly down. It weighs 176 lb (80 kg).

   Reinstall the pins (13) onto the jib frame lugs.

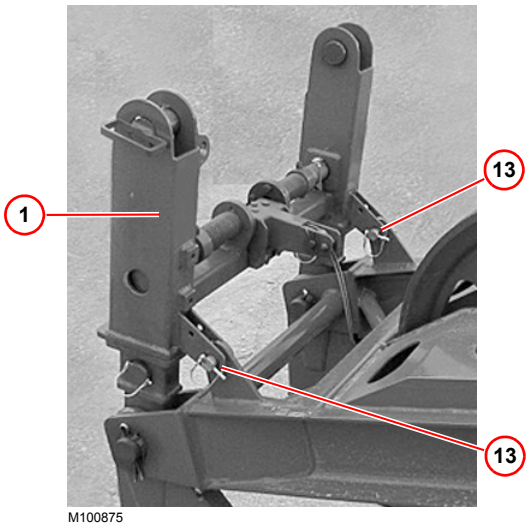

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Figure 4-86

See Figure 4-87 for the remaining steps.

3. Attach the jib stop assembly (1) to the lugs on the boom top using pins (2, View A).
4. Set the jib stop length (View A):
   a. Remove the offset pins (3).
   b. Adjust the position of the inner tubes (5) so the holes in the tubes are aligned with the proper offset holes in the links (4).
   c. Reinstall the offset pins (3).
5. Connect the jib stop control cable:
   a. Route the control cable extension (8, View E, stored in the jib butt) through the sheave (9, View A) located on the boom top.
   b. Using the shackle (7, View A), connect the end of the control cable extension (8) to the control cable (15, View C) from the jib stop.
   c. Using the other shackle (10, View E), connect the other end of the control cable extension to the control cable (11) from the winch on the jib top.
6. Use the winch to take the load off the two safety pins (14, View B) and remove the safety pins.
7. Pay out the control cable to engage the jib stop pins (6, View C). Then pay out an additional 2 ft (0,6 m) of the wire rope.

   The pins will not engage the holes in the jib stop frame until the jib point is lifted clear of the ground.
8. Place the safety pins (14, View C) in their storage location.
9. Install the jib wiring, load lines, and the block-up limit, wind speed, and position light components.

WARNING

Falling Jib Hazard!

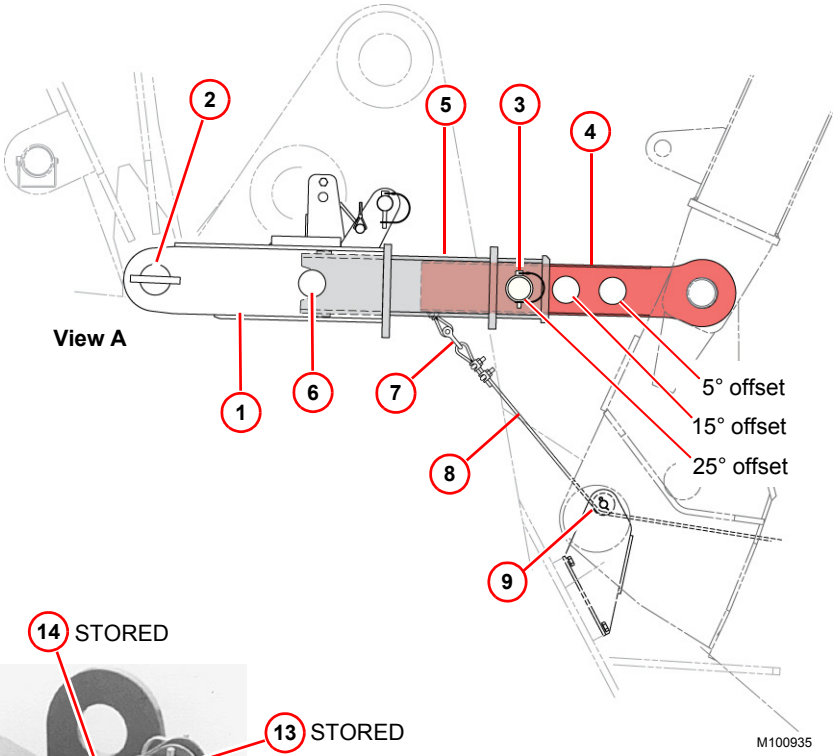
As the boom and jib are raised from the ground, observe the jib stop pins to make sure they fully engage the holes in the jib stop frame.

The jib can be pulled over backward if the jib stop pins do not engage the holes.

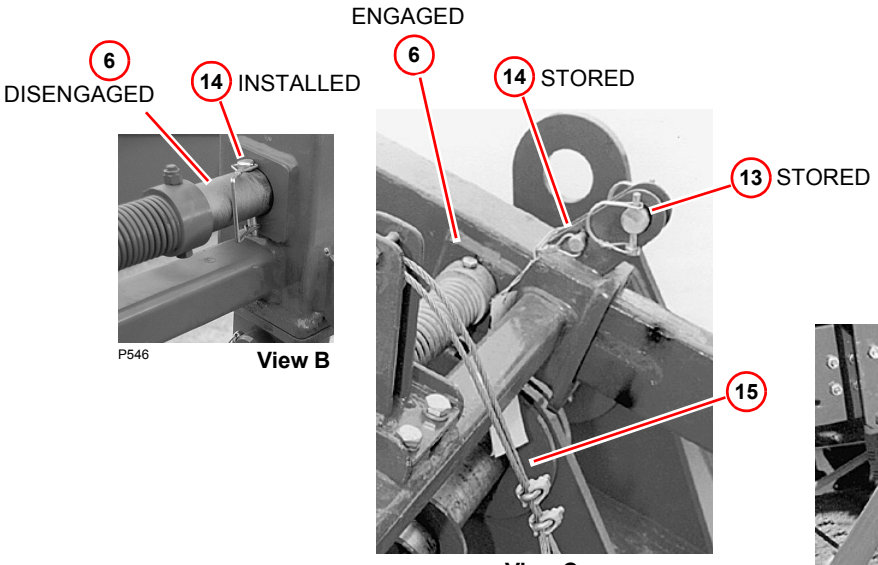
10. Boom up until the jib point just clears the ground.

    Make sure the jib stop pins fully engage the holes in the jib stop frame as the boom and jib are raised from the ground.

Item	Description
1	Jib Stop Assembly
2	Jib Stop-to-Boom Pin
3	Offset Pin
4	Offset Link
5	Inner Tube
6	Jib Stop Pin
7	Shackle
8	Control Cable Extension
9	Sheave
10	Shackle
11	Control Cable from Winch
12	Winch
13	Shipping Pin
14	Safety Pin for Jib Stop Pin
15	Control Cable from Jib Stop

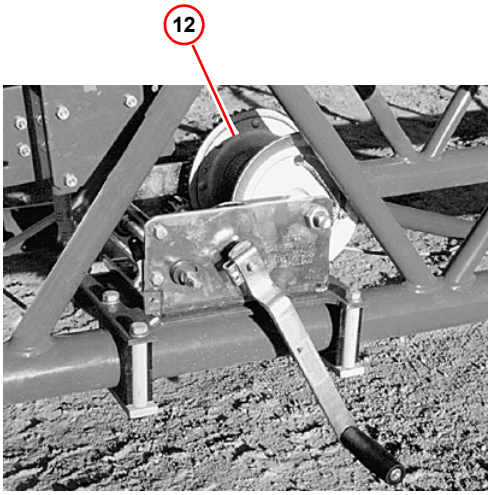


View A

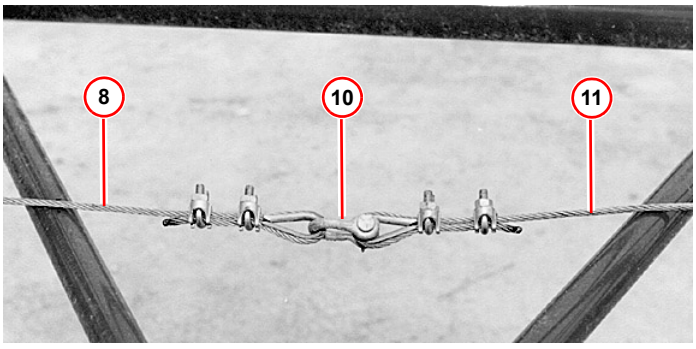


View B

View C

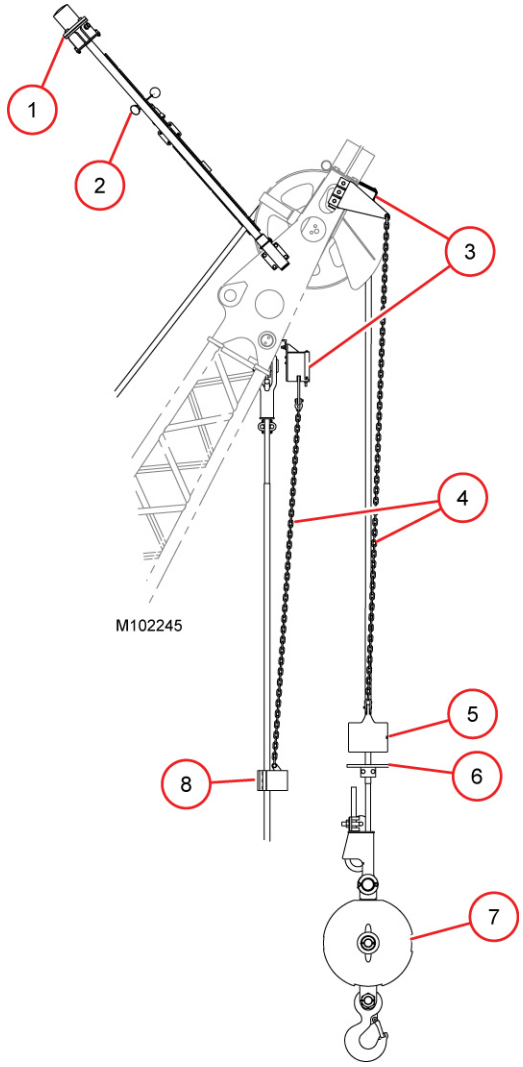


View D



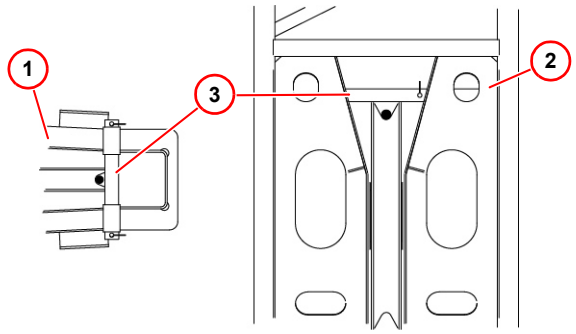
View E

Figure 4-87



Item	Description
1	Position Indicator Light
2	Wind Speed Indicator
3	Limit Switch (lower and upper boom point)
4	Chain
5	Weight with 2-Chain Attachments
6	Lift Plate
7	Hook and Weight Ball
8	Weight with 1-Chain Attachment

Figure 4-88



Item	Description
1	Jib Top
2	Jib Strut
3	Rope Guard with Safety Pin(s)

Figure 4-89

Install the Wind Speed and Position Light Components

If any wind speed or position light components have been removed, re-install them now. They are stored in the job box.

If they are currently located on the boom top, relocate them to the jib top (Figure 4-88).

If any wind speed or position light components have been removed, re-install them now.

Refer to the following drawings at the end of this section:

- Electric Accessory Assembly, Boom Top Indicator
- Electric Accessory Assembly, Wind Speed Indicator

NOTE To provide a good ground for the wind speed indicator bracket, use star washers to attach the bracket to the boom or jib top.

Connect the Jib Wiring

Refer to the ESI Boom Wiring drawing at the end of this section.

1. Connect electric cables in the boom and jib to the proper receptacles.
2. Connect CAN terminators to unused plugs. Failing to perform this step will cause a fault alert and the corresponding function will not operate properly.
3. To prevent dirt and moisture from entering electric components, connect dust caps to all unused plugs, CAN terminators, and receptacles.

Install the Jib Load Lines

1. Route the load lines up the boom and jib. See Figure 4-99 on page 4-127.
2. The socket and wedge do not have to be removed from the load line. Removing the rope guards (3, Figure 4-89) allows the wire rope to be routed over the strut and jib point sheaves with the socket and wedge installed. Be sure to reinstall the rope guards when done.
3. Pull the load lines approximately 20 ft (6,1 m) past the end of the jib.
4. Install the load block or hook-and-weight ball after the jib is raised to a convenient height. See Boom Raising Procedure on page 4-51.
5. Read the following topics:
   - Wire Rope Installation on page 4-117
   - Load Line Reeving on page 4-126.
   - 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 hoisting distance for various parts of the line
     - Maximum spooling capacity of the load drums
   - Reeving diagrams in Figure 4-100 on page 4-128.

Install the Jib Block-Up Limit Components

Install the block-up limit components (Figure 4-88) according to the Electrical Control Assembly—Boom Wiring and Limits at the end of this section.

Jib #134 Disassembly

DANGER

Collapsing Jib Hazard!

To prevent death or serious injury, do not stand on, inside, or under the jib during disassembly. Always stand on the outside of the jib when removing connecting pins.

Support the jib properly before removing the pins. Block the sections at the connection points.

WARNING

Crushing Injury!

The jib stop pins are spring engaged. Do not disconnect the control cables until the safety pins are installed.

CAUTION

Jib Stop Damage!

Avoid jib stop damage. Do not allow the jib point to contact the ground until jib stop pins are disengaged.

Lower Boom and Jib

1. Lower the boom until the jib point is approximately 12 in (305 mm) from contacting the ground.

See Figure 4-87 on page 4-113 for the following procedure.

2. Disengage the jib stop pins (6, View A and B) by hauling in the cable on the winch (12, View D). Turn the handle until the cable is tight and engage the winch pawl. ***Visually check that pins are disengaged***.
3. Remove the safety pins (14, View C) from storage and install them in the jib stop pins (6, View B).
4. Lower the boom onto blocking.
5. Remove the hook-and-weight ball or the load block and the wire rope from jib point.
6. Remove the block-up limit parts from the jib point and store them.
7. Disconnect and store the electric cables between the boom and the jib.
8. If equipped, disconnect and remove the wind speed and position light components so they are not damaged during shipping.

Store Jib Stop

See Figure 4-87 on page 4-113 for the following procedure.

1. Store the control cable:
   a. Disconnect the cable extension (8, View A and E) from shackles (7 and 10). Store the shackles with the cable extension.
   b. Disconnect the cable extension (8, View A) from the sheave (9) in the boom top.
   c. Secure the cable extension in the jib butt for storage.
   d. Coil the excess control cable (11, View E) onto the winch (12, View D).
2. Readjust the length of the jib stop by pinning it in the 5° offset position (View A).
3. Remove the shipping pins (13, View C) from storage.
4. Raise the jib stop assembly (1, Figure 4-86 on page 4-112) and pin it to the strut with storage pins (13).

Lower Jib Strut

See Figure 4-84 on page 4-111 for the following procedure.

WARNING!

Pendant Under Tension!

Do not disconnect the pendants until they are slack.

1. Using appropriate slings, attach the hook from the crane being used for disassembly to the front side of the sheave in the jib strut (1). Avoid lifting jib butt/boom top during this step.
2. If required, raise the jib point (12) with another crane or a fork-lift truck to gain enough slack to allow unpinning the backstay pendants.
3. Disconnect the backstay pendants (2) from the links (10).
4. Lay the backstay pendants on the ground alongside the boom.
5. Lower the jib point (12) to the ground and disconnect the assist crane.
6. Lower the jib strut onto the jib butt and disconnect the crane from the jib strut.
7. Remove and store links (10).

Remove Backstay Pendants

See Figure 4-83 on page 4-110

1. Disconnect the backstay pendants (2) from the backstay links (4). The spreader (3) can remain pinned to the links for shipping.
2. Coil the backstay pendants for shipping.

Remove Jib Pendants

See Figure 4-83 on page 4-110 for the following procedure.

1. Disconnect the pendants (7) from the jib strut (1) and from the jib top.
2. Disassemble and remove all jib pendants from the jib.
3. Coil the pendants for shipping.

Disassemble the Jib

1. Reverse the assembly steps to disassemble the jib sections.
2. See Handling Jib Sections on page 4-107.
3. The jib top, the jib butt, the strut, the spreader, and the jib stop can be shipped as an assembled unit as shown in Figure 4-78 on page 4-107.

WIRE ROPE INSTALLATION

NOTE The wire rope manufacturer's recommendations take precedence over the following information.

Wire Rope Specifications

See the Wire Rope Specifications document 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 document 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 and dry indoor location. If outdoor storage is necessary, the wire rope must be covered with a protective wrapper.

Keep the wire rope away from acids, fumes, and other corrosives. Keep the wire rope away from heat that can dry out the lubricant.

If the storage period will be long, lubricate the wire rope and perform periodic inspection given in the Service Manual at least monthly.

Seizing and Cutting Wire Rope

NOTE The wire rope manufacturer's recommendations takes precedence over this information.

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 under-loading of others. Bird-caging and breakage of the wire rope can occur.

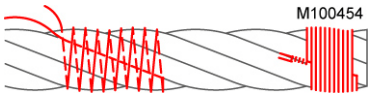
Before cutting the wire rope, apply seizings on both sides of the point where the cut will be made. Then cut the wire rope with a torch, rope cutter, or abrasive cut-off wheel.

See Figure 4-90 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 must be one rope diameter long.

Wire Rope Type	Seizings Required
Preformed	1
Non-Preformed	3

View A—Rope Diameter 1 in (25,4 mm) and Larger:
Place the free end of the seizing wire in the valley between two stands. 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 B—Rope Diameter Smaller than 1 in (25,4 mm):
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.

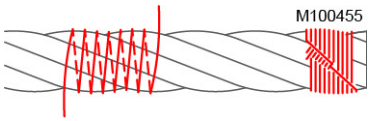


Figure 4-90

4

Anchoring Wire Rope to a Drum

See the Drum and Lagging document in the Capacity Chart Manual for the correct size of drum laggings, if used.

1. Loosely fasten the keeper plates (1, Figure 4-91) to the drum flange using the bolts, lock washers, and flat washers (2) provided.

NOTE Apply Loctite™ 271 to the bolt threads.

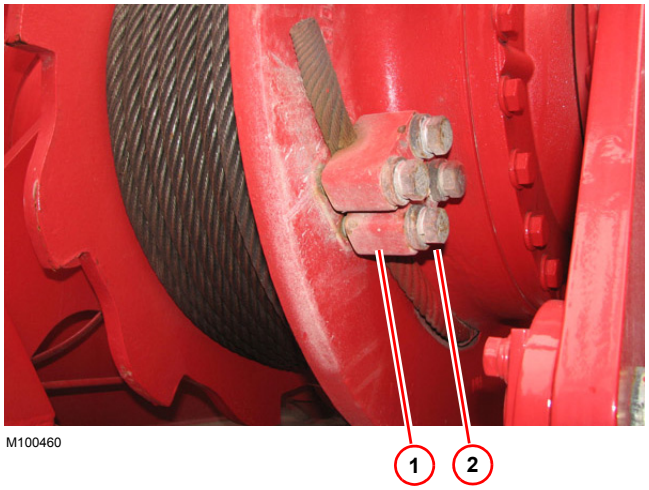
2. Route the wire rope through the hole in the drum flange and under the keeper plates.
3. Securely tighten the bolts.

WARNING

Falling Load Hazard

The wire rope can be pulled out of the drum if the following steps are not taken.

- Make sure the bolts are tight.
- Make sure the end of the wire rope extends beyond the end of clamp.



Item	Description
1	Keeper Plates
2	Bolt, Flat Washer, and Lockwasher

Figure 4-91

Winding Wire Rope onto a Drum

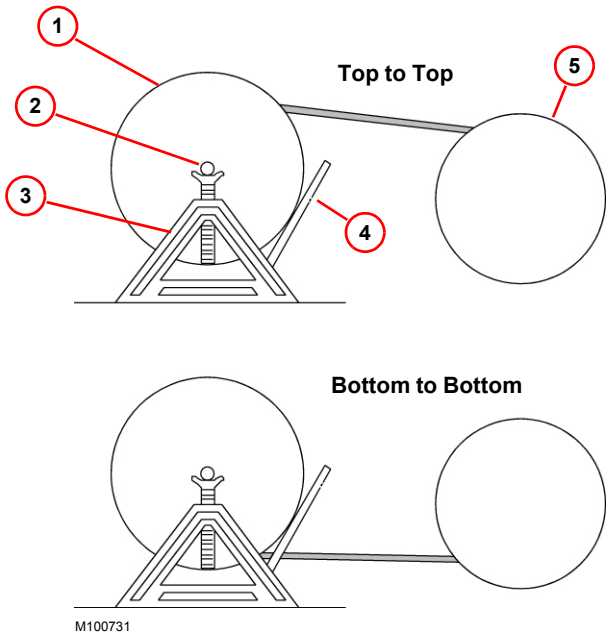
CAUTION

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.

1. Remove the wire rope from the shipping reel:
   a. Mount the wire rope shipping reel (1, Figure 4-92) on a shaft (2) supported at both ends by jacks (3) or blocks.



Item	Description	Item	Description
1	Shipping Reel	4	Brake
2	Shaft	5	Drum
3	Jack Stand		

Figure 4-92

   b. Provide a brake (4) at the shipping reel (1) so that the wire rope can be wound tightly onto the drum (5).

c. Avoid a reverse bend when winding the wire rope onto the drum (5): wind from the top of the shipping reel (1) to the top of drum (4, upper view) or from the bottom of the shipping reel (4) to the bottom of the drum (5, 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 (Figure 4-93, View A).

b. Tap 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.

CAUTION

Avoid Wire Rope Damage

Voids or spaced wraps (Figure 4-93, View B) in the first layer will permit movement and a wedging action with the subsequent layers. The wedging action will cause crushing and abrasion of the wire rope.

Never allow the rope to “cross-wind” on the drums.

Breaking in Wire Rope

After installing a new wire rope, break it in by operating it several times under a 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.

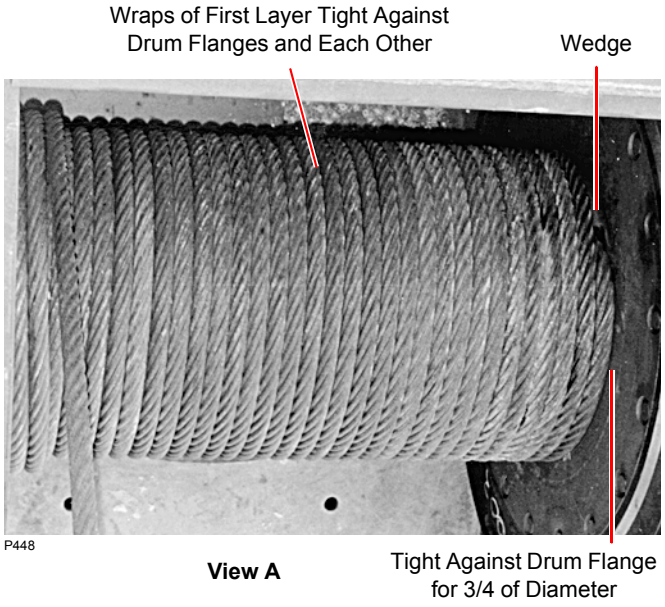


Figure 4-93

4

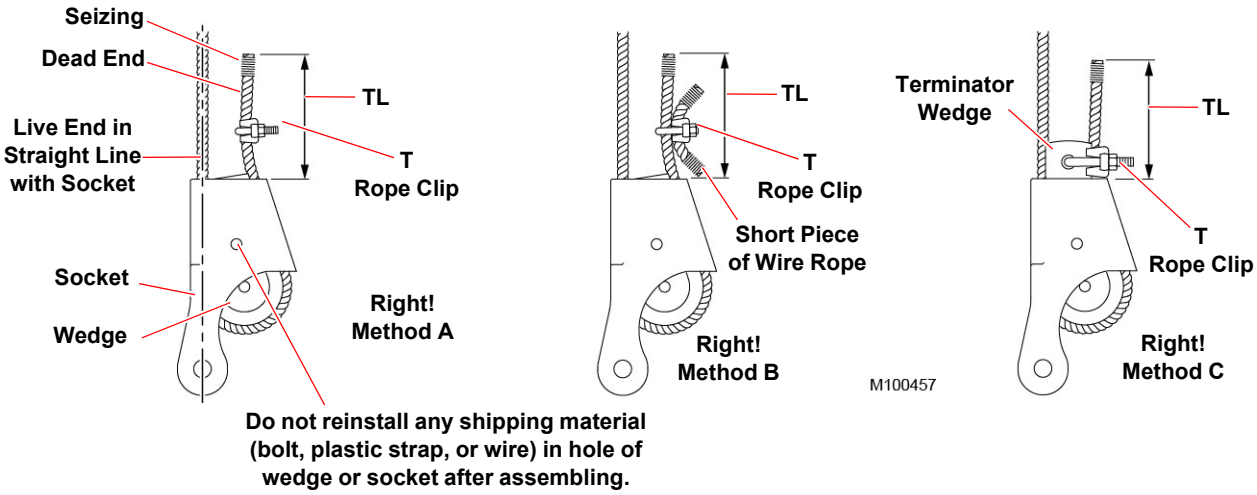
TL (Tail Length)

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).

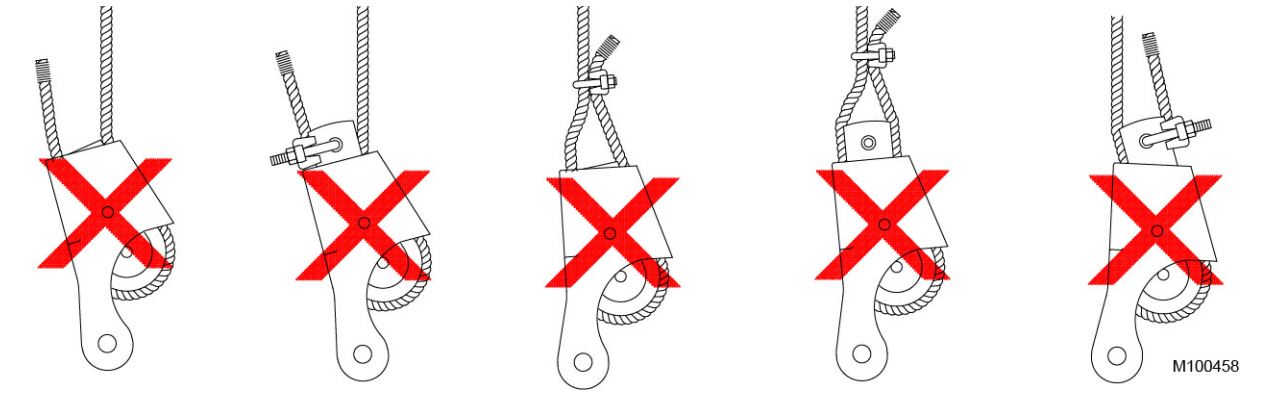
T (Rope Clip Nut Torque)

	Wire Rope/Clip Size			
inch (mm)	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.



ALL ARE DANGEROUS AND PROHIBITED!



WRONG Rope Backward

WRONG Rope Backward

WRONG Dead End Clipped to Live End

WRONG Dead End Clipped to Live End

WRONG Wedge Backward

Figure 4-94

Anchoring Wire Rope to Wedge Socket

WARNING

Falling Load Hazard!

- Inspect all parts prior to use. Do not use parts that are cracked or otherwise defective.
- Remove minor nicks, burrs, or rough edges from the socket, wedge, or pin by lightly grinding. Do not reduce the original dimensions by more than 10%.
- Do not reinstall shipping material (bolt, plastic strap or wire) in the hole 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 that 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.

See Figure 4-94 for the following procedure.

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 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 socket and wedge.

WARNING

Falling Load Hazard!

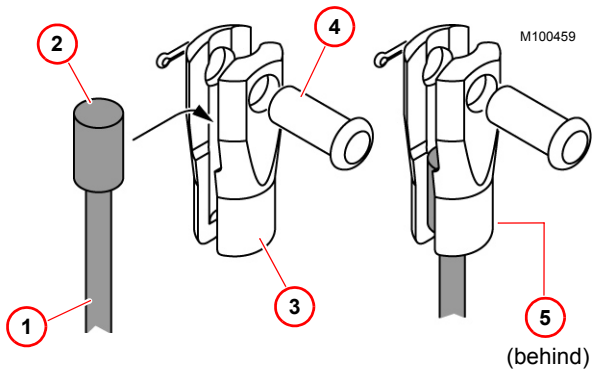
The wire rope can break if the following precaution is not observed:

- Do not attach the dead end of the wire rope to the live end of the wire rope with a wire rope clip. The wire rope clip will transfer the load from the live side of wire rope to the dead end, seriously weakening the attachment.

Anchoring Wire Rope to Button Socket

See Figure 4-95 for the following procedure.

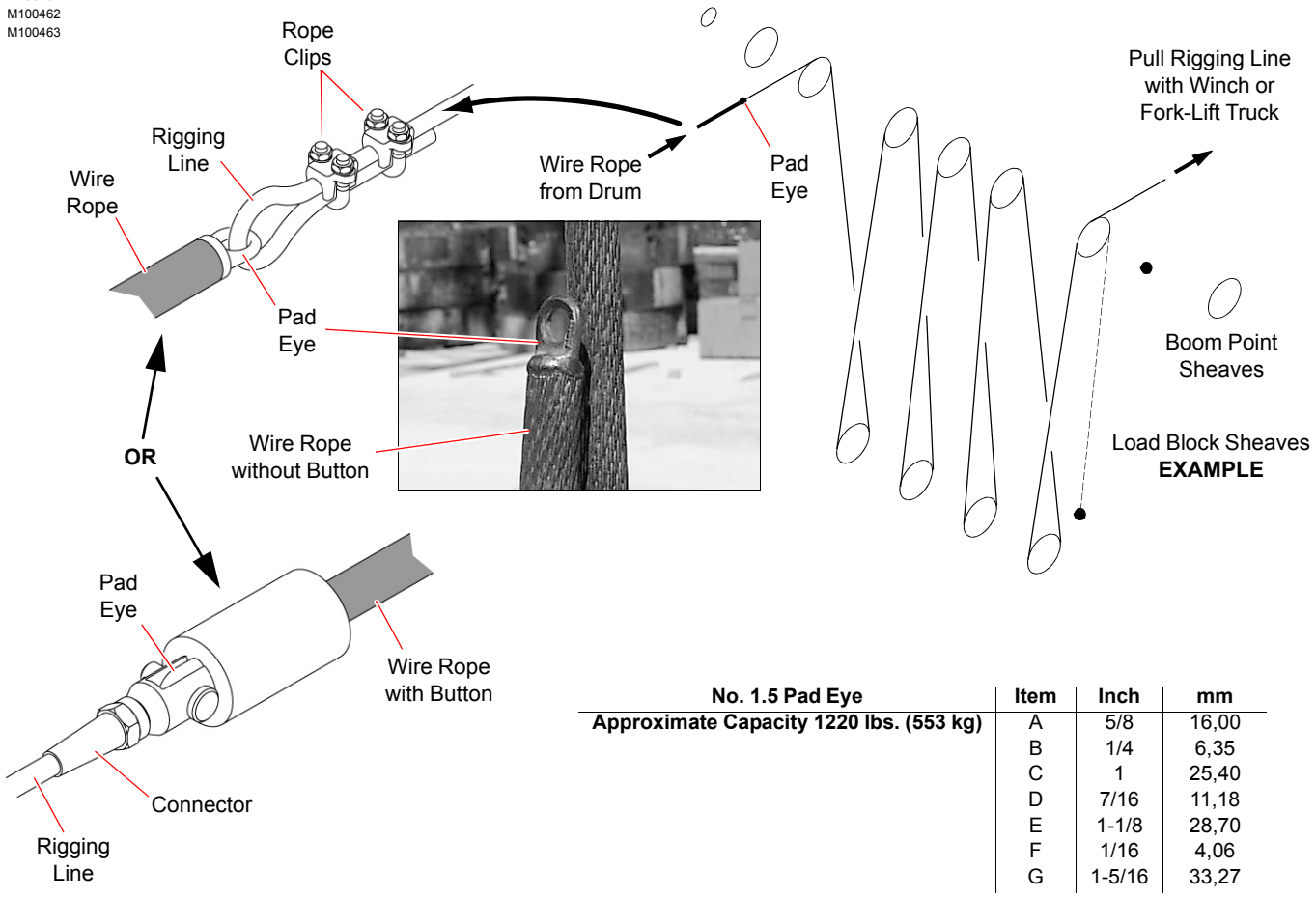
1. Remove the pin (4) from the button socket (3).
2. Install the button (2) end of load line (1) in the button socket (3).
3. Pin the button socket (3) to the dead-end anchor point (not shown).
4. If equipped, securely tighten the locking screw (5).



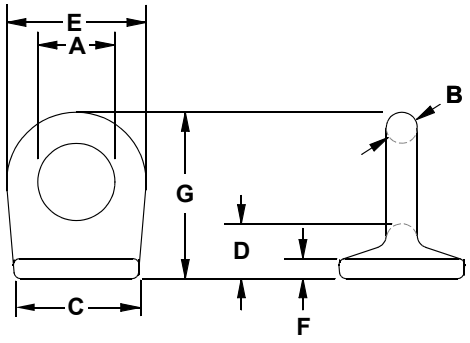
Item	Description
1	Load Line
2	Button
3	Button Socket
4	Pin
5	Locking Screw (if equipped)

Figure 4-95

M100461
M100462
M100463



No. 1.5 Pad Eye	Item	Inch	mm
Approximate Capacity 1220 lbs. (553 kg)	A	5/8	16,00
	B	1/4	6,35
	C	1	25,40
	D	7/16	11,18
	E	1-1/8	28,70
	F	1/16	4,06
	G	1-5/16	33,27



No. 1 Pad Eye	Item	Inch	mm
Approximate Capacity 1220 lbs. (553 kg)	A	3/8	9,65
	B	1/4	6,35
	C	7/8	22,40
	D	13/32	10,40
	E	7/8	22,40
	F	1/8	3,30
	G	1-1/32	25,40

No. 2 Pad Eye	Item	Inch	mm
Approximate Capacity 2600 lbs. (1179 kg)	A	3/4	19,05
	B	3/8	9,65
	C	1-1/16	26,92
	D	1/2	12,70
	E	1-1/2	38,10
	F	3/16	4,83
	G	1-5/8	41,26

Figure 4-96

Pad Eye Usage for Wire Rope Reeving

See Figure 4-96 for the following procedure.

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.

Safety

1. Do not exceed the capacities given Figure 4-96.
2. Make sure the rigging line and attaching hardware (clips and rope connectors) are rated for the capacities given Figure 4-96.
3. Inspect the pad eye prior to each use, replace if:
   - Any original dimensions have changed
   - Cracks or breaks exist in the metal or weld

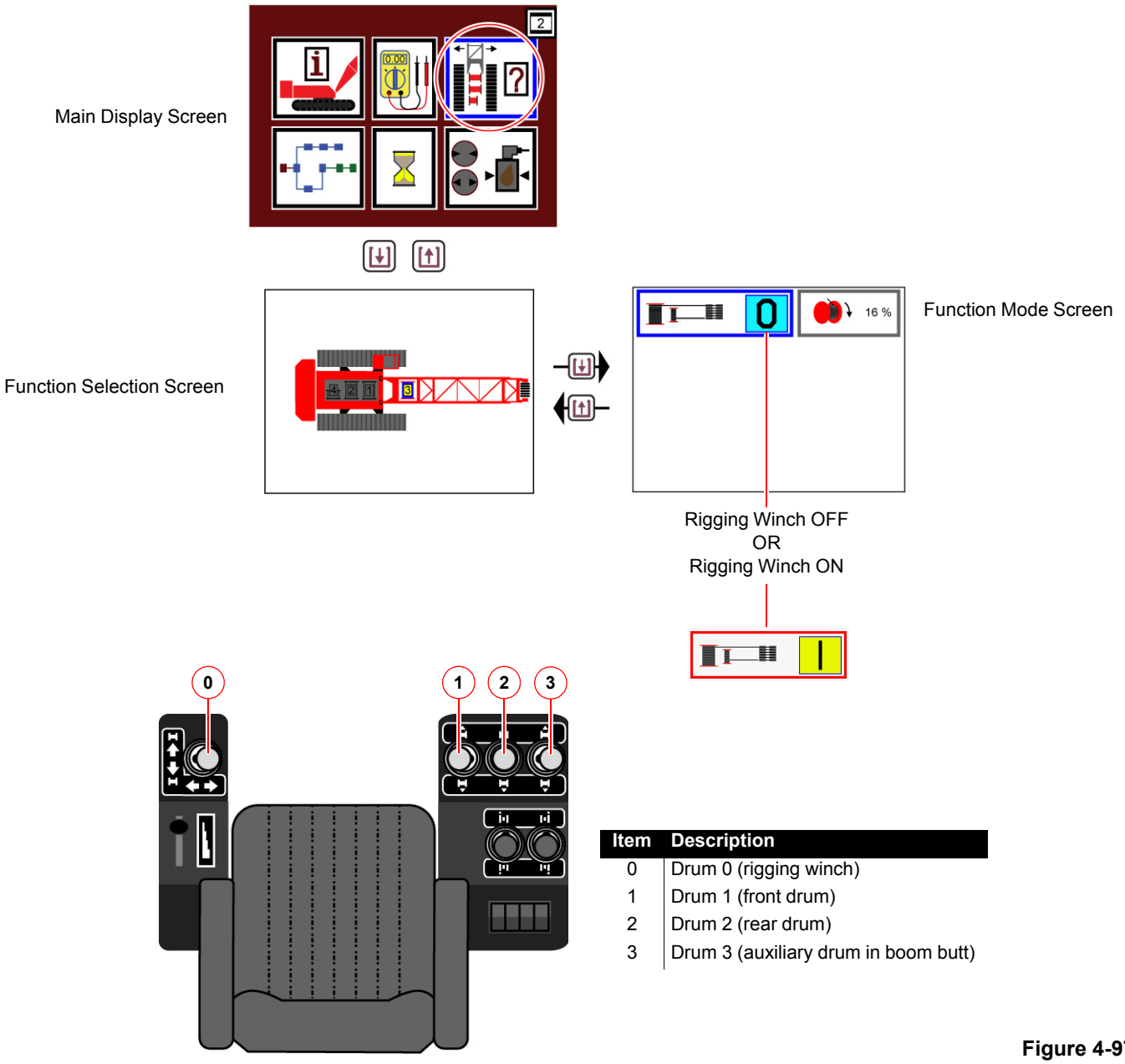
WARNING

Flying Part Hazard!

The pad eye on the end of the 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.

4



Item	Description
0	Drum 0 (rigging winch)
1	Drum 1 (front drum)
2	Drum 2 (rear drum)
3	Drum 3 (auxiliary drum in boom butt)

Figure 4-97

RIGGING WINCH OPERATION

See Figure 4-97 for the following instructions.

If your crane is equipped with the optional rigging winch (Drum 0), it can be used to assist in reeving the desired load line through the boom point and load block sheaves.

See the Rigging Winch Assembly drawing at the end of this section for wire rope routing.

Selecting Rigging Winch Mode

TO TURN RIGGING WINCH MODE ON —

1. Navigate to the desired Function Mode screen in the main display.

   See the MLC165-1 Main Display Operation Manual for detailed instructions.

2. Enter the function mode screen.

3. Select and confirm the "**I**" icon to TURN ON the rigging winch.
4. The yellow box with the "**I**" icon will appear.
5. The Drum 4 handle (boom hoist) will now control the rigging winch (Drum 0). "0" will appear in the indicator at the boom hoist handle.
6. TO TURN RIGGING WINCH MODE OFF —
7. Navigate to the Drum 3 Function Mode screen in the main display.
8. Enter the function mode screen.
9. Select and confirm the "**O**" icon to TURN OFF the rigging winch.
10. The blue box with the "**O**" icon will appear.

NOTE The rigging mode will automatically TURN OFF when power to the control system is turned off.

Operating Rigging Winch

1. Turn on the rigging winch mode.
2. Turn off the Drum 0 park switch.
3. Pay out the rigging line by moving the Drum 0 control handle forward.
4. Reeve the rigging line through the load block and boom point sheaves and connect the rigging line to the desired load line as shown in the Rigging Winch Assembly drawing at end of this section.
5. Use the engine throttle to snug up the rigging line prior to paying out the load line from selected load drum. Faulty operation will result if there is slack in the rigging line before engaging the automatic part of operation.

NOTE Use the engine throttle to increase and decrease rigging winch line pull.

6. Use the engine throttle to control line slack at rigging winch.
7. Move the Drum 0 control handle to off and push the corresponding load drum control handle forward to pay out the load line. The rigging winch will haul in rigging line automatically.

NOTE The stall line pull of the rigging winch is regulated with a proportional relief valve controlled by the crane's programmable controller.

CAUTION!

Avoid Rigging Winch or Wire Rope Damage!

The rigging winch will not automatically pay out line if the selected load drum control handle is pulled back to the hoist position.

Structural damage to winch or rigging line will occur!

If it is necessary to haul in the load line on the load drum when the load line is connected to the rigging line, proceed as follows:

- Pay out the rigging line with the Drum 0 control handle while hauling in the load line with the load drum control handle.
- Keep the rigging line slacker than the load line with the engine throttle.

WARNING

Flying Object Hazard!

Do not attempt to disconnect the rigging line from the load line until the lines are slack.

The lines could fly apart with explosive force and strike personnel.

8. Once the load line is reeved through the load block and boom point sheaves:
   - **a.** Move the load drum control handle to off.
   - **b.** Pay out the rigging line to slacken the load line by pushing the Drum 0 handle forward.
   - **c.** Disconnect the rigging line from the load line.
   - **d.** Haul in the rigging line for storage on the rigging winch by pulling the Drum 0 control handle back.
   - **e.** Secure the end of the rigging line to the rigging winch for storage.
   - **f.** Connect the load line to the dead-end socket. See the instructions in this section.
   - **g.** Turn OFF the rigging winch mode.

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

The boom top guide sheaves must be positioned as shown in Figure 4-98. The bolts and lock nuts (5) must be inserted in the black shaded holes.

See Figure 4-99 on page 4-127 for identification of the load drums and the guide sheaves.

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 Locations

See Figure 4-100 on page 4-128 and Figure 4-101 on page 4-129 for the dead end locations.

Load Block Identification

See the Boom Assembly 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.

- 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 hoists

Load Block Reeving

For reeving of the lower boom point, see the Reeving Diagrams at the end of this section.

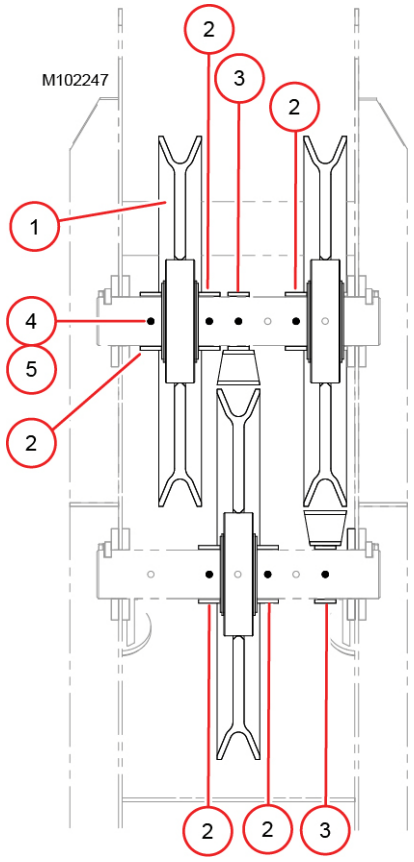
For reeving of the fixed jib or upper boom point, see Figure 4-100 on page 4-128.

Reeving in any manner other than shown can result in excessive block twist.

CAUTION

Wire Rope Damage!

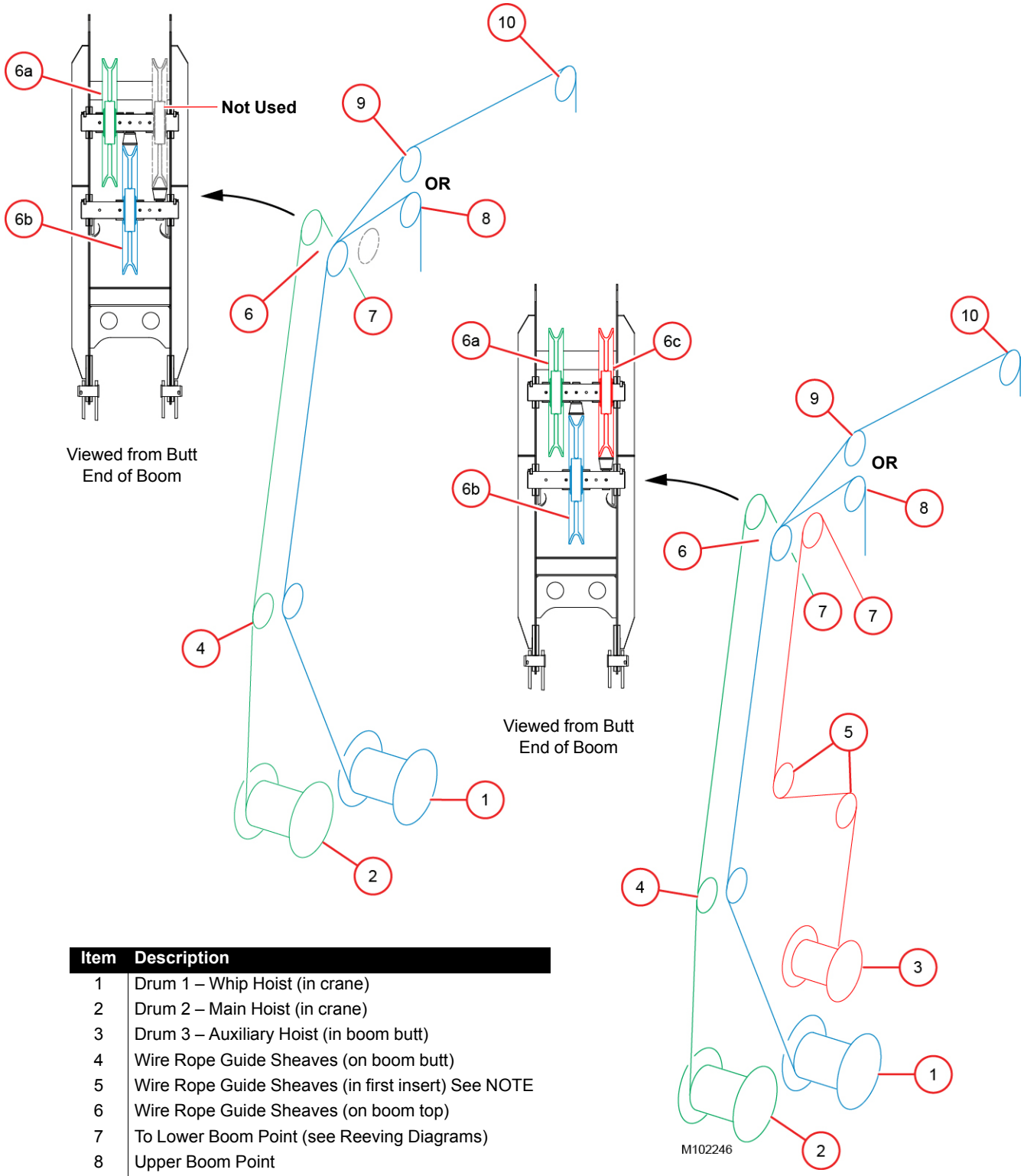
Do not hoist the load block closer to the boom point than shown on the Range Diagram in the Capacity Chart Manual. Improper fleet angle or contact with other parts can damage the wire rope.



Viewed from Butt End of Boom

Item	Description
1	Sheave (3)
2	Collar (5)
3	Collar with Guard (2)
4	Alignment Hole (7 each shaft)
5	Bolt with Locknut (7) in Black Holes Only

Figure 4-98



Item	Description
1	Drum 1 – Whip Hoist (in crane)
2	Drum 2 – Main Hoist (in crane)
3	Drum 3 – Auxiliary Hoist (in boom butt)
4	Wire Rope Guide Sheaves (on boom butt)
5	Wire Rope Guide Sheaves (in first insert) See NOTE
6	Wire Rope Guide Sheaves (on boom top)
7	To Lower Boom Point (see Reeving Diagrams)
8	Upper Boom Point
9	Jib Strut
10	Jib Point

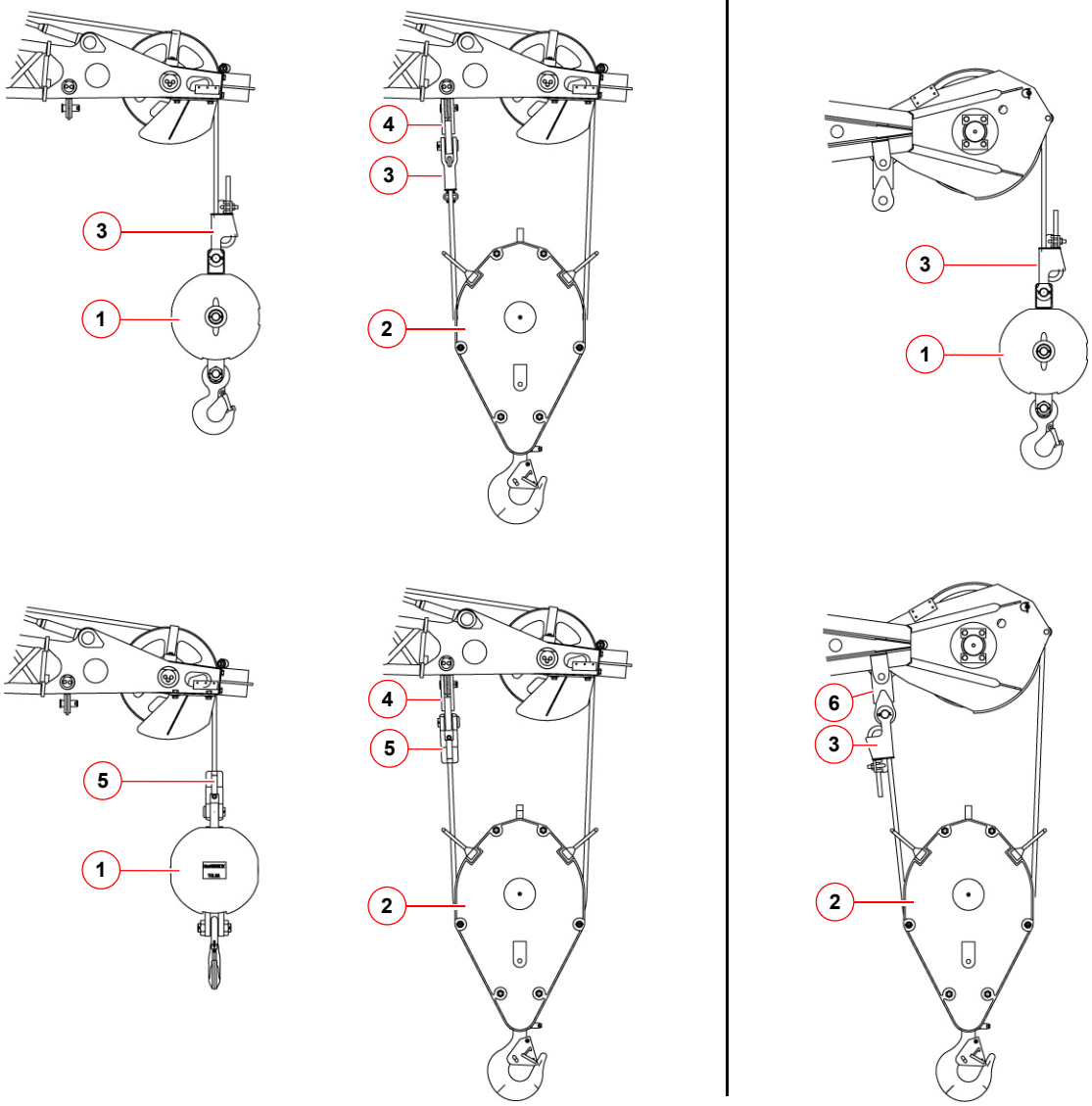
NOTE: Guide sheaves (5) located in 6 m (19.7 ft) insert are optional. They are provided only when Drum 3 is purchased.

Figure 4-99

Fixed Jib Point

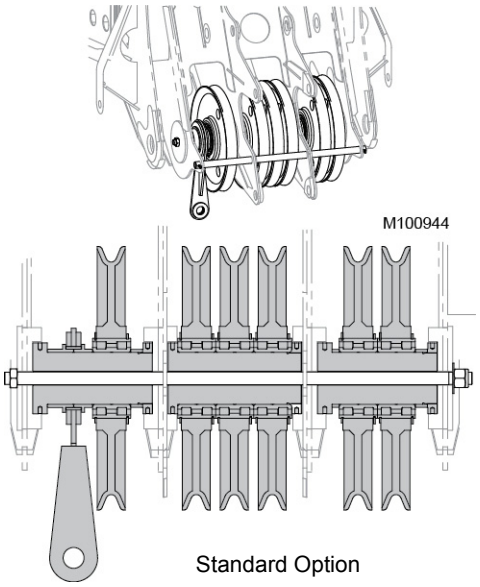
Upper Boom Point

M101615

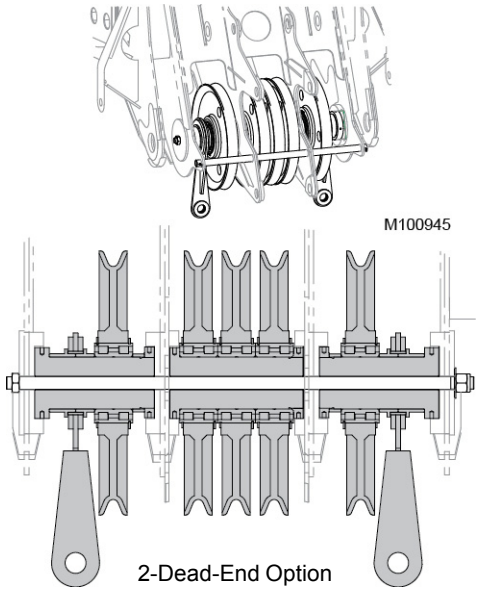


Item	Description
1	Hook-and-Weight Ball
2	Load Block (single sheave)
3*	Wedge Socket
4*	Adapter
5*	Button Socket
6*	Adapter
*	Stored in Parts Box

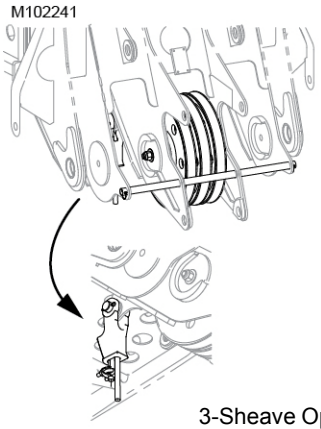
Figure 4-100



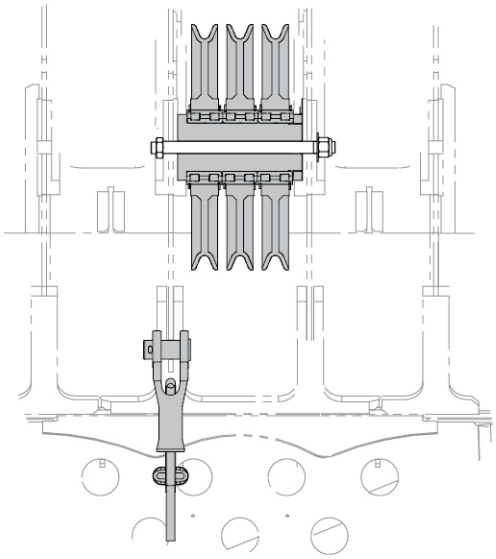
Standard Option

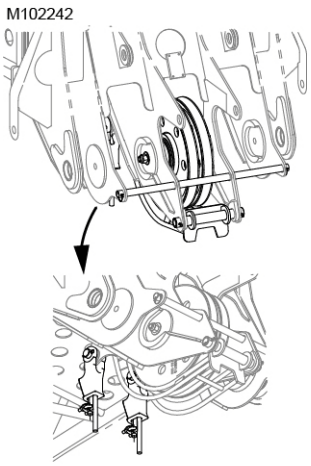


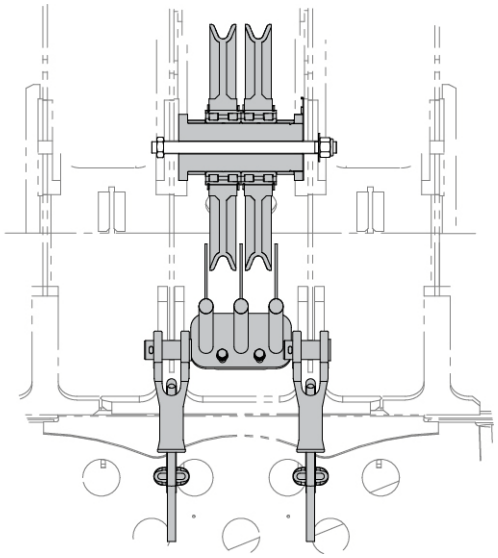
2-Dead-End Option



3-Sheave Option







2-Sheave Option with Guard for Clamshell

Figure 4-101

4

LOAD BLOCK TIEBACK

Standard on crane s/n 91651011 and above. Contact the Manitowoc Crane Care Lattice Team for field installation on cranes built prior to Serial Number 91651011.

General

Tieback lug (1, Figure 4-102) is provided on the front of the rotating bed for tying back the load block when not in use.

Specifications

Shackle

See Figure 4-102 for the tieback opening size. Size the shackle accordingly.

Sling Length

The sling must be long enough to connect it to the shackles in the tieback holes and to the hook of the freely suspended load block. This will prevent personnel from having to swing the block in, toward the crane, to make the connection.

Sling Capacity

The sling 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, 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 lug for tying back the load block. Using the lug for any other purpose could result in damage to the lug and the rotating bed.

Item	Description
1	Tieback Lug with 2-1/2 in (64 mm) x 6 in (152 mm) Opening
2	Sling with Shackles (owner furnished)
3	Load Block

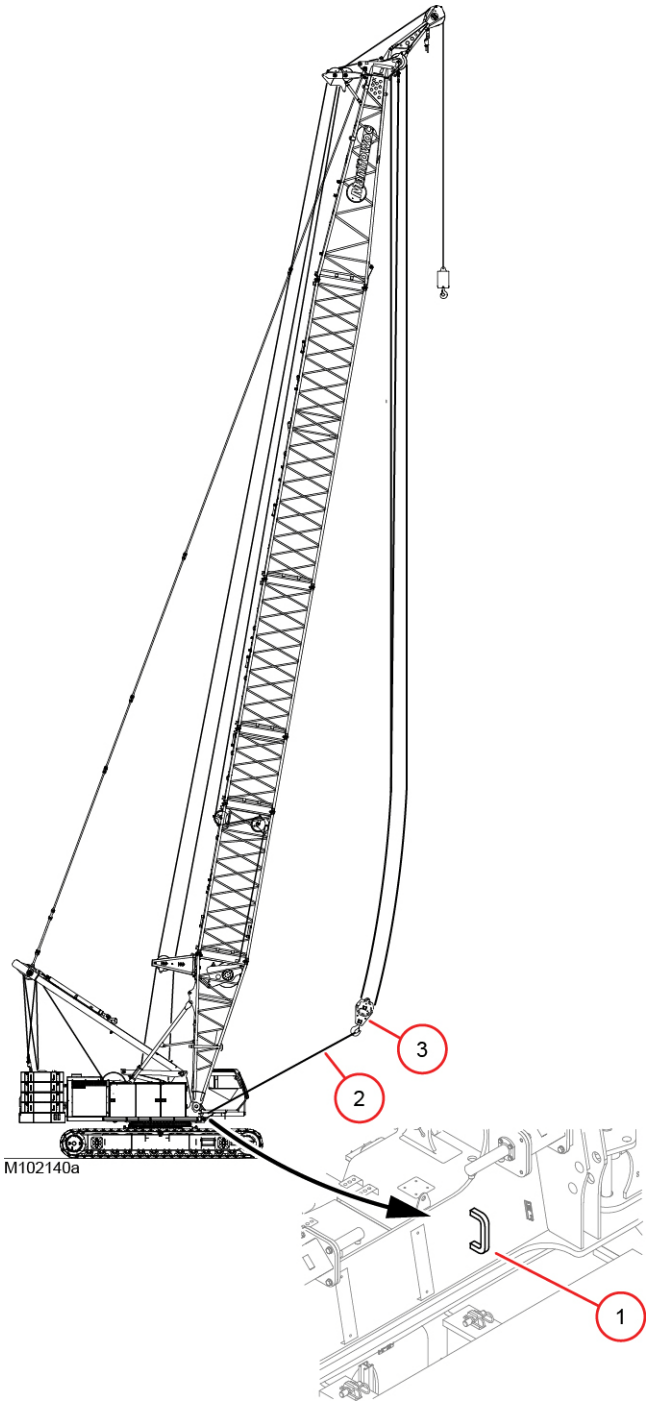


Figure 4-102

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LUBRICATION

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LUBRICATION

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LUBE AND COOLANT PRODUCT GUIDE

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