

Manitowoc 18000

Operator Manual MAX-ER[®] Attachment



Grove

Manitowoc

National Crane

Potain





OPERATOR MANUAL

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

18000

MAX-ER Model Number

XXXXXRef

MAX-ER Serial Number

This Manual is divided into the following sections:

Introduction


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| SECTION 3 | OPERATING CONTROLS AND PROCEDURES |
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NOTICE

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

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

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

| | |
|---|--|
|  | ! WARNING |
| | <p>To prevent death or serious injury:</p> <ul style="list-style-type: none">• Avoid unsafe operation and maintenance. Crane and attachments must be operated and maintained by trained and experienced personnel. Manitowoc is not responsible for qualifying these personnel.• Do not operate or work on crane or attachments without first reading and understanding instructions contained in Operator Information Manual and Service Manual supplied with crane and applicable attachments.• Store Operator Information Manual and Service Manual in operator's cab. <p>If Operator Information Manual or Service Manual is missing from cab, contact your Manitowoc dealer for a new one.</p> |

THE ORIGINAL LANGUAGE OF THIS PUBLICATION IS ENGLISH

See end of this manual for Alphabetical Index

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SECTION 1 INTRODUCTION

CRANE DATA

See the end of this section for crane data specific to your MAX-ER attachment:

- Basic Specifications
- EC Declaration (if applicable)

CRANE/ATTACHMENT IDENTIFICATION

An identification plate containing the crane model and serial number is attached to the outside of the operator's cab as shown in [Figure 1-1](#) and to the counterweight carrier.

CHANGE OF OWNERSHIP REGISTRATION

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

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

NOTE: The Model 18000 MAX-ER has a Model 21000 designation because the MAX-ER is interchangeable between the two models

MANITOWOC DEALER

For questions about this manual or the 18000 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 Locator.
3. Follow the on-screen prompts to locate your Manitowoc dealer.

CRANE ORIENTATION

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

- Operator's cab is at the front of upperworks.
- The MAX-ER counterweight assembly is at the rear of the upperworks.

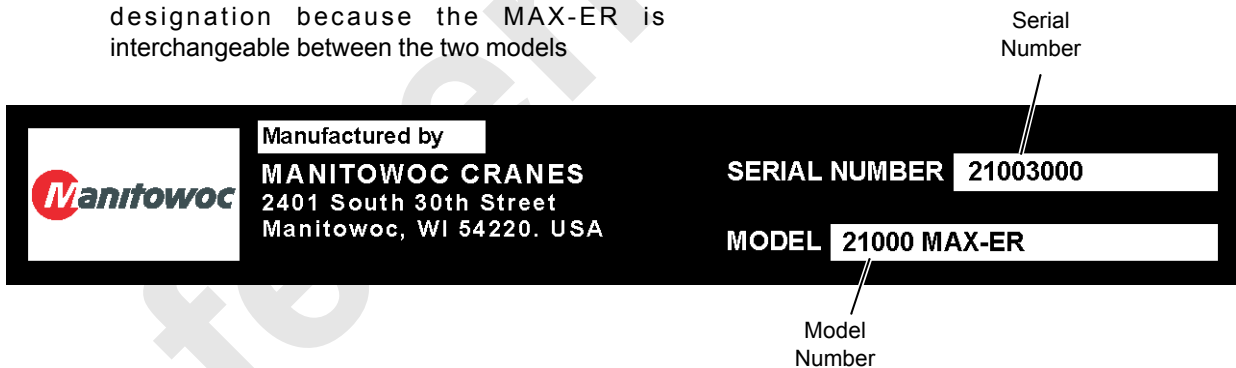
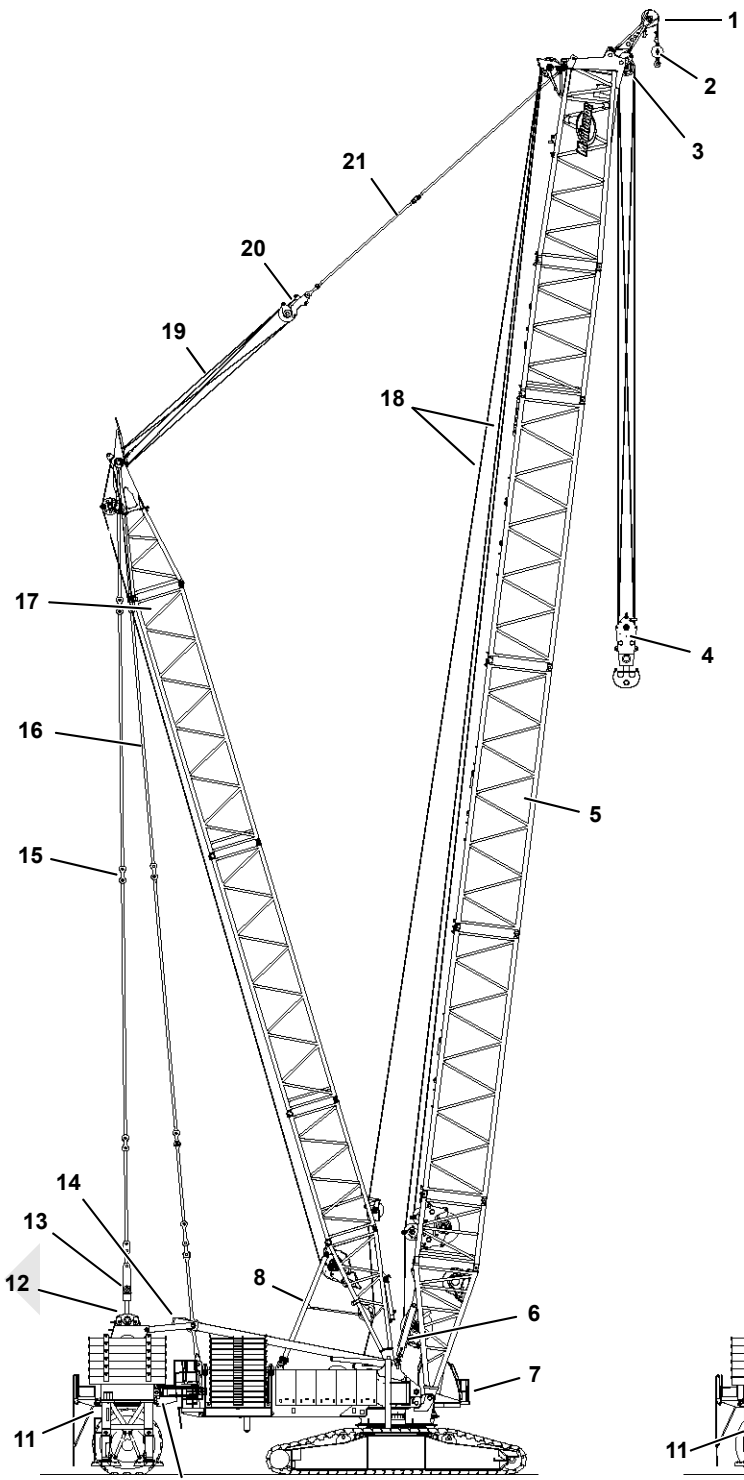


FIGURE 1-1

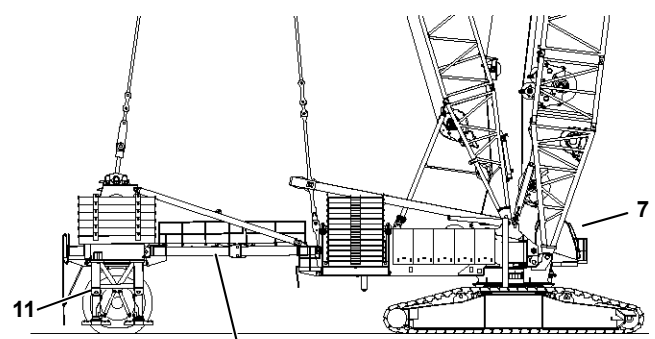
IDENTIFICATION AND LOCATION OF COMPONENTS

MAX-ER with Wheeled Counterweight



| Item | Description |
|------|--------------------------------|
| 1 | Upper Boom Point |
| 2 | Hook and Weighted Ball |
| 3 | Lower Boom Point |
| 4 | Load Block |
| 5 | #55 Boom |
| 6 | Physical Boom Stop |
| 7 | 18000 Crawler Crane |
| 8 | Mast Stop |
| 9 | Support Frame Assembly |
| 10 | 2-Piece Shear Frame |
| 11 | Wheeled Counterweight Assembly |
| 12 | Counterweight Cylinders |
| 13 | Spreader Beam |
| 14 | Live Mast |
| 15 | Counterweight Straps |
| 16 | Mast Straps |
| 17 | 140 ft (42,7 m) #56 Fixed Mast |
| 18 | Load Lines |
| 19 | Boom Hoist Wire Rope |
| 20 | Boom Hoist Equalizer |
| 21 | Boom Straps |

40 ft (12 m) Arrangement



59 ft (18 m) Arrangement

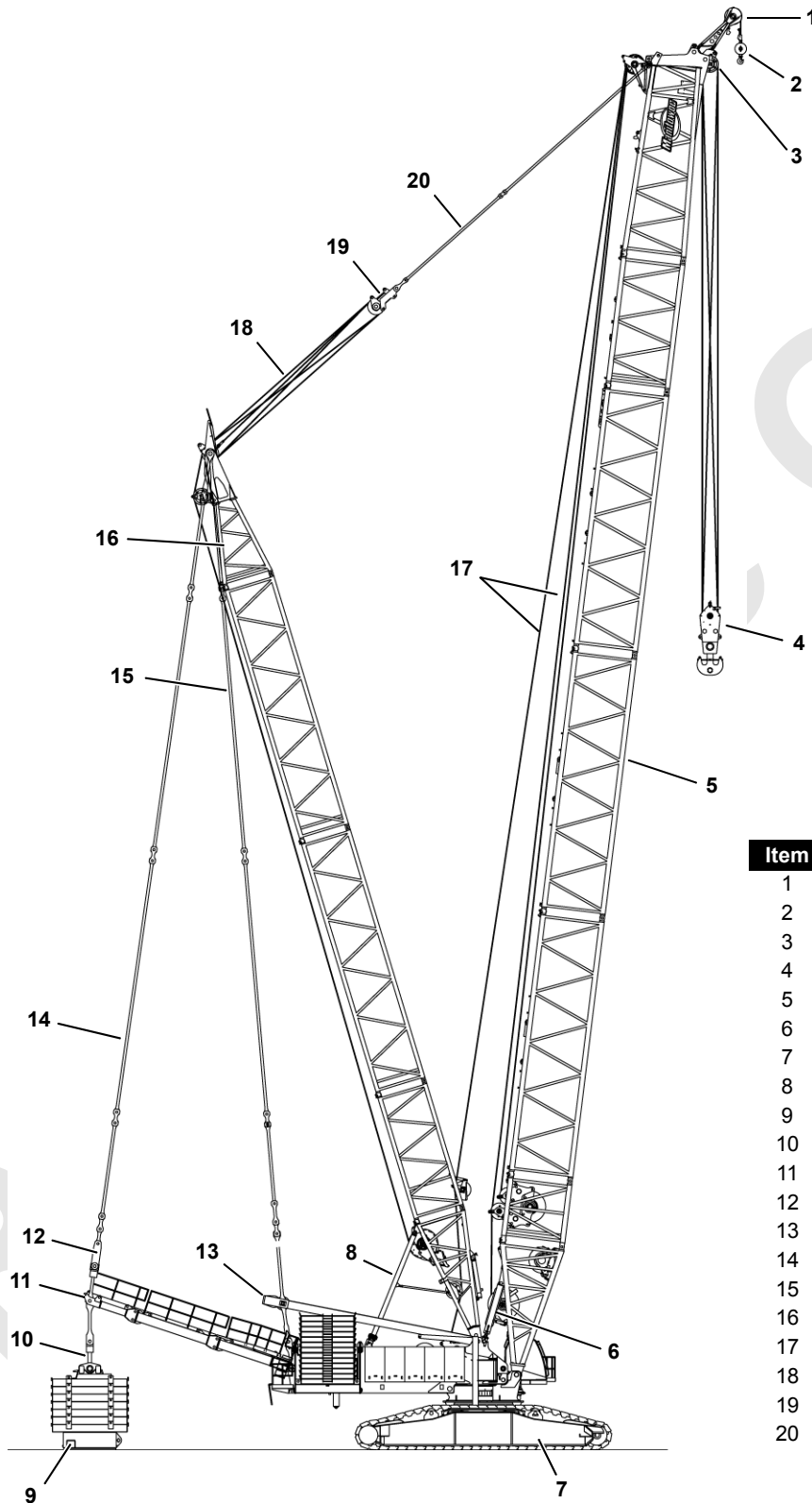
FIGURE 1-2

18000MOM101



MAX-ER with Hanging Counterweight

A1280



| Item | Description |
|------|--------------------------------|
| 1 | Upper Boom Point |
| 2 | Hook and Weighted Ball |
| 3 | Lower Boom Point |
| 4 | Load Block |
| 5 | #55 Boom |
| 6 | Physical Boom Stop |
| 7 | 18000 Crawler Crane |
| 8 | Mast Stop |
| 9 | Hanging Counterweight Assembly |
| 10 | Counterweight Cylinders |
| 11 | Shear Frame Assembly |
| 12 | Spreader Beam |
| 13 | Live Mast |
| 14 | Counterweight Straps |
| 15 | Mast Straps |
| 16 | 140 ft (42,7 m) #56 Fixed Mast |
| 17 | Load Lines |
| 18 | Boom Hoist Wire Rope |
| 19 | Boom Hoist Equalizer |
| 20 | Boom Straps |

FIGURE 1-3

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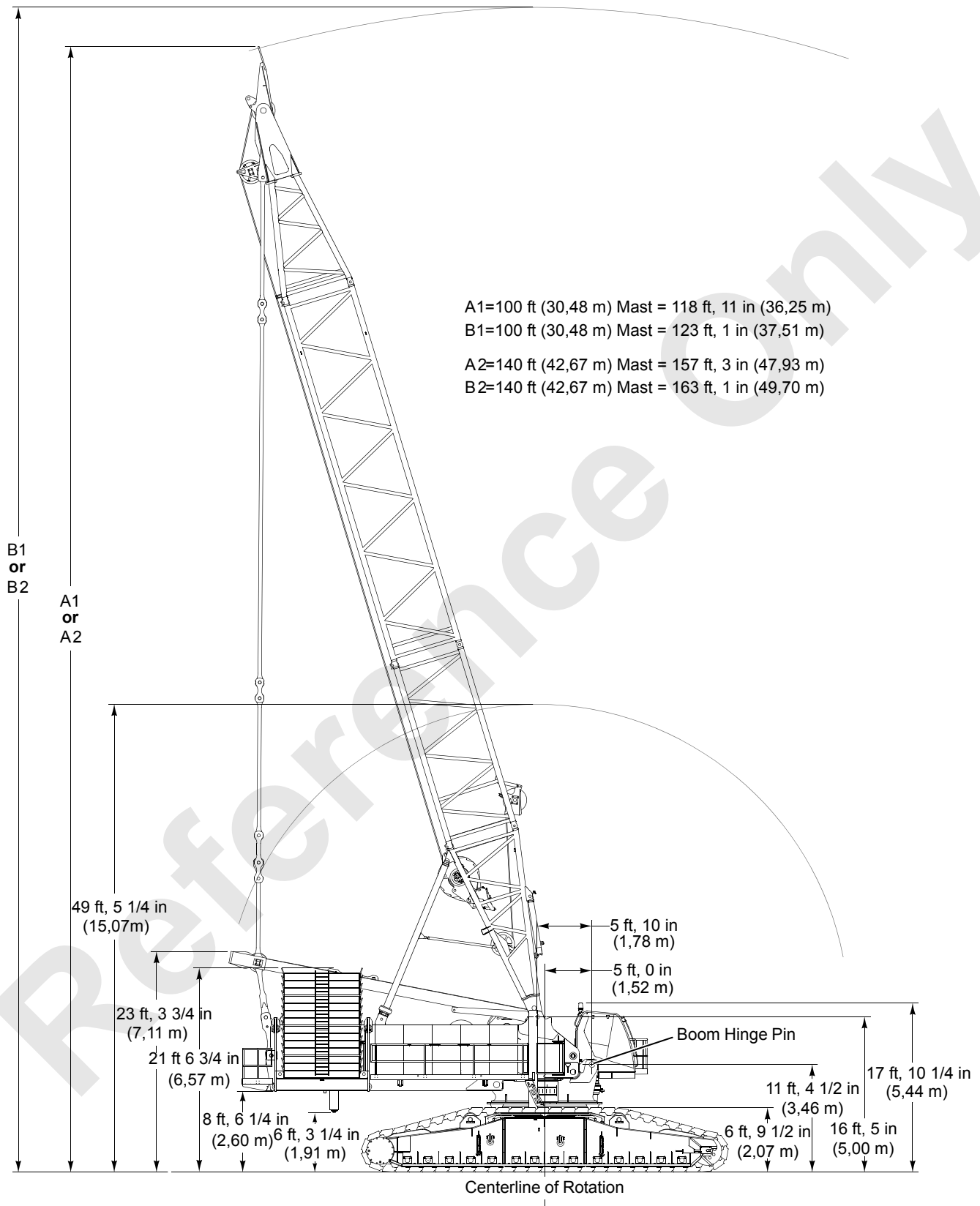
MAX-ER WEIGHTS

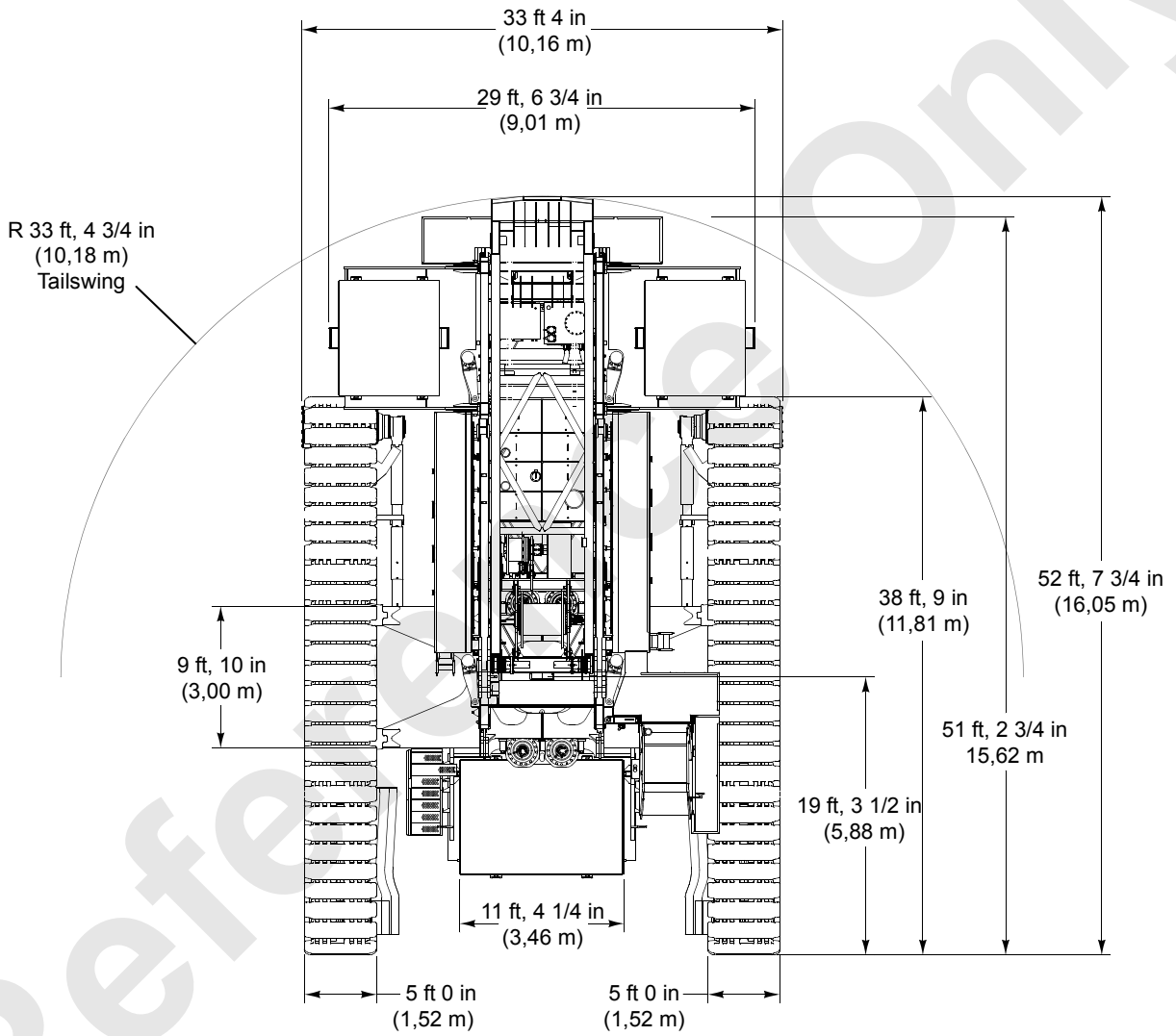
Refer to the Crane Operator Manual and the Luffing Jib Operator Manual for the weights of the crane and the luffing jib components and options.

NOTE: Weights may fluctuate ±3% due to manufacturing tolerances

| Description | Weight | |
|--|-----------|-----------|
| | Pounds | Kilograms |
| LIFTCRANE: | | |
| Upperworks and lowerworks complete, 4 swing drives, crane counterweight, 30 ft (9,1 m) live mast, backhitch, MAX-ER, 860,000 lb (390 090 kg) wheeled counterweight at 59 ft (18 m) position, 140 ft (42,7 m) No. 56 mast, mast stops, fully rigged 140 ft (42,7 m) boom No. 55, heavy duty upper boom point, 661 USt (600 t) block, 30 USt (27 t) hook and weight ball, boom stops and load lines (includes self-erect and luffing jib prep) - - - - - | 2,406,745 | 1 091 681 |
| Complete with MAX-ER, 863,800 lb (391 810 kg) hanging counterweight at 59 ft (18 m) position | 2,412,615 | 1 094 343 |
| COUNTERWEIGHT - WHEELED: | | |
| Counterweight tray - - - - - | 33,910 | 15 381 |
| Side counterweight box (each) (12 required) - - - - - | 44,000 | 19 958 |
| Center counterweight box (each) (4 required) - - - - - | 44,000 | 19 958 |
| Base and wheel assembly - - - - - | 95,355 | 43 252 |
| A-frame assembly (each) (2 required) - - - - - | 8,395 | 3 807 |
| Hydraulic cylinder assembly with fluid (each) (2 required) - - - - - | 5,250 | 2 381 |
| 59 ft (18 m) Position | | |
| Strut [25 ft 7 in (7,8 m)] (each) (2 required) with pins - - - - - | 2,265 | 1 027 |
| Front shear frame with pins and catwalk - - - - - | 9,375 | 4 252 |
| Rear shear frame with pins and railing - - - - - | 7,840 | 3 556 |
| 40 ft (12 m) Position | | |
| Strut [6 ft 11 in (2,1 m)] (each) (2 required) - - - - - | 730 | 331 |
| Support frame with pins and platform - - - - - | 7,675 | 3 481 |
| Total wheeled counterweight (wagon less frame and struts) - - - - - | 860,090 | 390 130 |
| COUNTERWEIGHT - HANGING - 59 ft (18 m) Position: | | |
| Counterweight tray - - - - - | 33,910 | 15 381 |
| Sub-plate for counterweight tray (each) (2 required) - - - - - | 5,360 | 2 431 |
| Side counterweight box (each) (14 required) - - - - - | 44,000 | 19 958 |
| Center counterweight box (each) (4 required) - - - - - | 44,000 | 19 958 |
| A-frame assembly (each) (2 required) - - - - - | 8,395 | 3 807 |
| Hydraulic cylinder assembly with fluid (each) (2 required) - - - - - | 5,250 | 2 381 |
| Hanging links with studs and pins (each) (2 required) - - - - - | 920 | 417 |
| Front shear frame with pins and catwalk - - - - - | 9,375 | 4 252 |
| Rear shear frame with pins and railing - - - - - | 7,880 | 3 574 |
| Shear frame adaptor with railing - - - - - | 5,200 | 2 358 |
| Total hanging counterweight (tray less shear frame) - - - - - | 863,800 | 391 813 |

OUTLINE DIMENSIONS



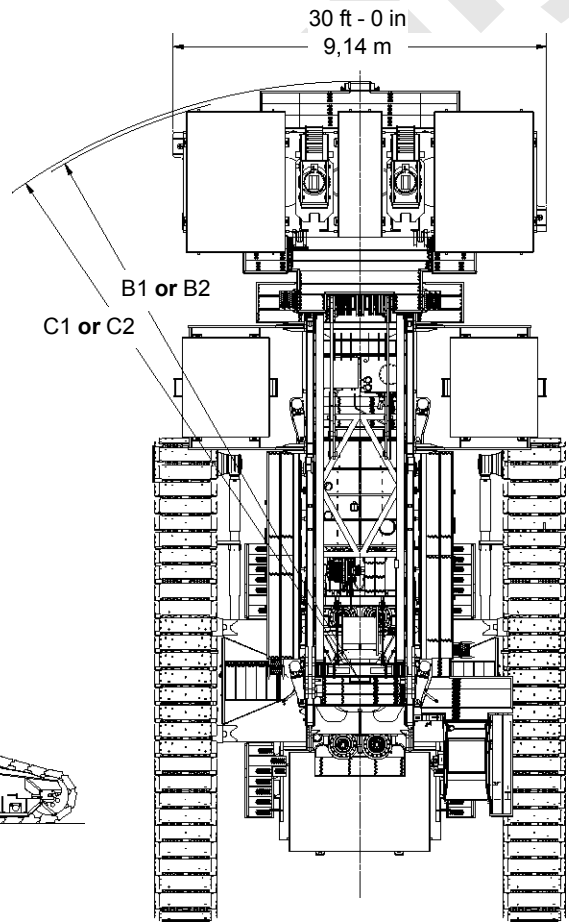
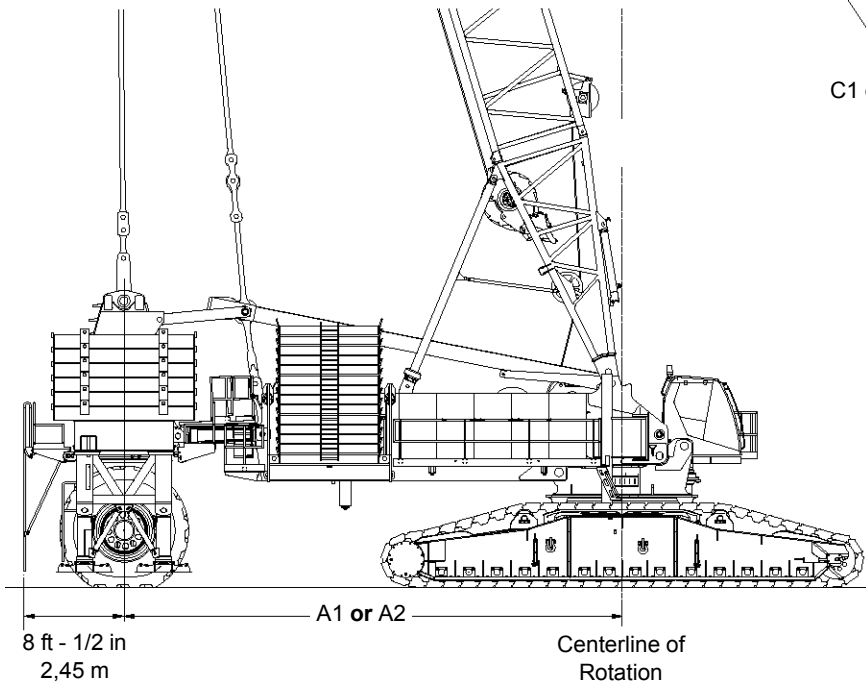


Outline Dimensions Continued on Next Page

A1: 1-Piece Shear Frame = 40 ft 0 in (12,19 m)
 A2: 2-Piece Shear Frame = 59 ft 0 in (17,98 m)

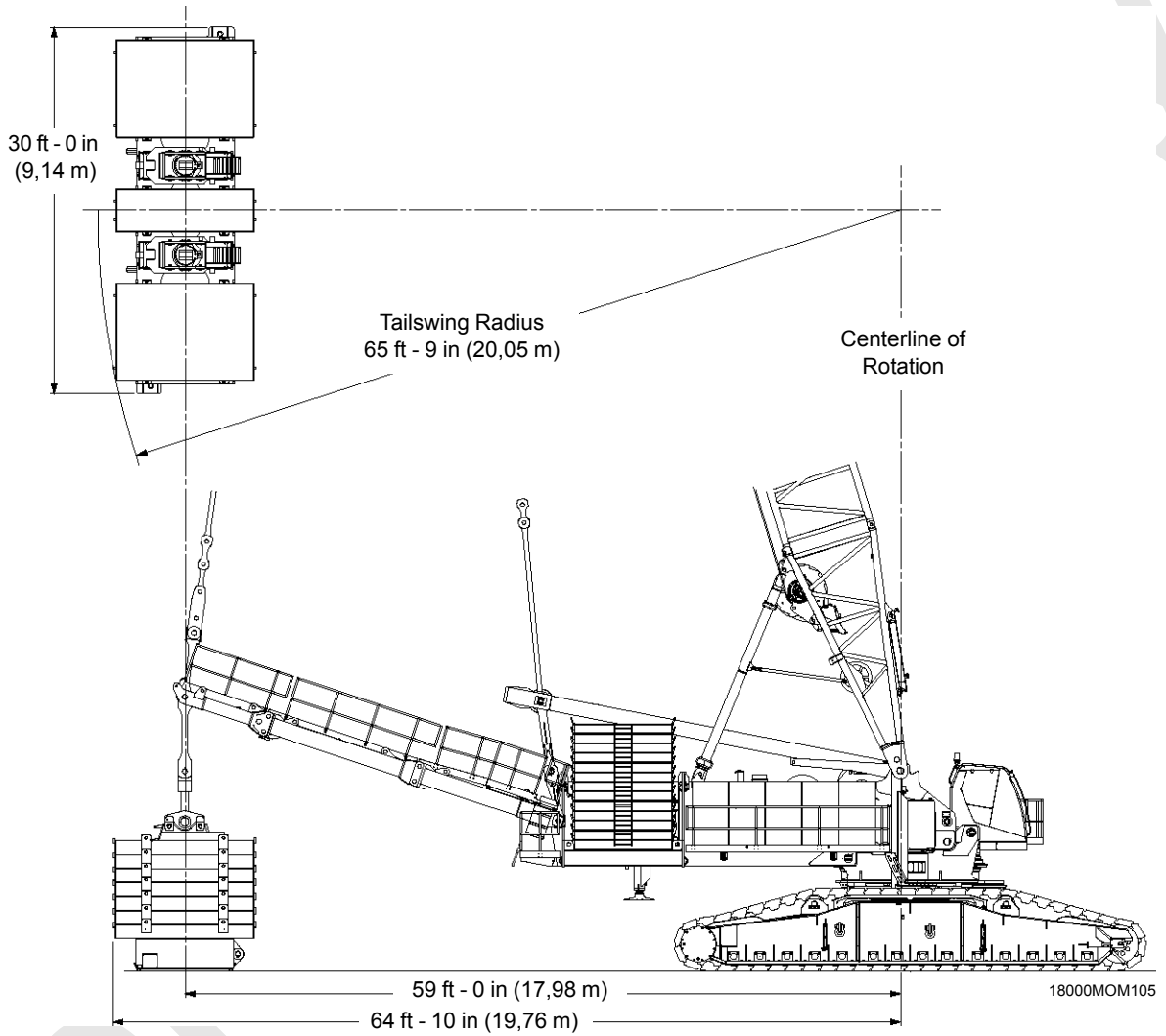
B1: 1-Piece Shear Frame Tail Swing = 47 ft 9 in (14,55 m)
 B2: 2-Piece Shear Frame Tail Swing = 66 ft 2 in (20,16 m)

C1: 1-Piece Shear Frame Tail Swing = 48 ft 1 in (14,66 m)
 C2: 2-Piece Shear Frame Tail Swing = 67 ft 1 in (20,44 m)



18000MOM102

Wheeled Counterweight with 1 Piece Shear Frame Shown



Hanging Counterweight

ENGLISH AND METRIC CONVERSIONS

Inverse Conversion

Direct Conversion

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

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

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

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

| To Convert | Symbol | Application | To | Symbol | Multiply By |
|----------------------|-----------------|-------------------------------|-----------------------|-----------------|-------------------|
| AREA | | | | | |
| Square Inch | in ² | Filter Area Clutch Contact | Square Centimeter | cm ² | 6.4516 |
| Square Foot | ft ² | Ground Contact | Square Meter | m ² | 0.0929 |
| FORCE | | | | | |
| Pound Force | lb | Pedal Effort | KiloNewton Newton | kN N | 0.00445 4.4482 |
| Pound Force | lb | Line Pull | KiloNewton | kN | 0.00445 |
| Pound Force Per Inch | lb/in. | Spring Force | Newton per millimeter | Nmm | 0.1751 |
| Pound Force Per Foot | lb/ft | | Newton per meter | Nm | 14.5939 |
| LENGTH | | | | | |
| Inch | in. | Adjustments | Millimeter | mm | 25.4000 |
| Foot | ft | Outline Dimensions | Meter | m | 0.3048 |
| Mile | miles | Travel Distance | Kilometer | km | 1.6093 |
| POWER | | | | | |
| Horsepower | hp | Engine | Kilowatt | kW | 0.7457 |
| PRESSURE | | | | | |
| Pound/Sq. In. | psi | Hydraulic & Air | Bar | | 0.0689 |
| TEMPERATURE | | | | | |
| Degrees Fahrenheit | °F | Oil, Air, Etc. | Degrees Centigrade | °C | °F - 32 ÷ 1.8 |
| Degrees Centigrade | °C | | Degrees Fahrenheit | °F | °C x 1.8 + 32 |
| TORQUE | | | | | |
| Inch Pound | in lb | Bolt Torque | Newton Meter | Nm | 0.1129 |
| Foot Pound | ft lb | | Newton Meter | Nm | 1.3558 |
| VELOCITY | | | | | |
| Miles Per Hour | mph | Vehicle Speed | Kilometers Per Hour | km/h | 1.6093 |
| Miles Per Hour | mph | Wind Speed | Meters Per Second | m/s | 0.4470 |
| Feet Per Minute | fpm | Line Speed | Meters Per Minute | m/min | 0.3048 |
| VOLUME | | | | | |
| Cubic Yard | yd ³ | Bucket Capacity | Cubic Meter | m ³ | 0.7646 |
| Cubic Foot | ft ³ | | Cubic Meter | m ³ | 0.0283 |
| Cubic Inch | in ³ | Pump Displacement | Cubic Centimeter | cm ³ | 16.3871 |

| To Convert | Symbol | Application | To | Symbol | Multiply By |
|------------------------|--------|------------------|-------------------|--------|-------------|
| 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 |
| Gallon Per Minute | gpm | Pump Flow | Liters Per Minute | L/min | 3.7854 |
| WEIGHT | | | | | |
| Pound | lb | Unit/Component | Kilogram | kg | 0.4536 |
| US Ton (2000 lb) | USt | Load Ratings | Metric Ton | t | 0.9072 |
| US Ton (2000 lb) | USt | | Kilogram | kg | 907.1847 |

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SAFETY INFORMATION

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Reference Only



SECTION 2

SAFETY INFORMATION



WARNING

California Proposition 65

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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 Crane Care in Manitowoc.

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





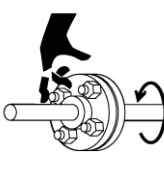















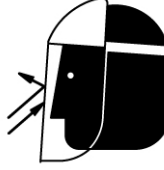




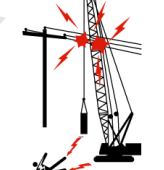


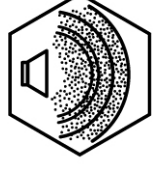









| | | | | | |
|--|--|--|--|--|--|
| Cut or Crush Hazards | | | | | Cut Hazard |
|  M100090 |  M100091 |  M100066 |  M100065 |  M100069 |  M100067 |
| Crush Hazards | | | | | Fire Extinguisher |
|  M100070 |  M100071 |  M100072 |  M100073 |  M100074 |  M100082 |
| Fall Hazards | | | Falling Boom (Crush) 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) | | | | |
|  M100270 |  M100266 | | | | |

SAFETY AND INFORMATION SIGNS

Maintaining Signs

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

Ordering Signs

Order replacement safety and information signs from your Manitowoc dealer.

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

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Reference Only

CRANE ACCESS POINTS



WARNING

Crush Hazard!

Upperworks can swing into and crush personnel climbing on or off crane.

Moving crawlers can crush personnel climbing on or off crane.

To prevent death or serious injury:

- Barricade all accessible areas to crane so personnel cannot be struck or crushed when upperworks is swung.
- Do not climb onto or off crane while upperworks is being swung or crane is being traveled.
- Signal operator for permission to climb onto/off crane.
- Operator: do not swing or travel while personnel are climbing onto or off crane. Stop swing and travel motions. Apply 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 must be repaired as soon as possible. Until they are repaired, the operator shall alert personnel to crane movement using the horn on the control console.

General

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

Manitowoc has provided stairways, ladders, platforms, and catwalks 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 crane. Store clothing and

other personal belongings so they do not interfere with controls in operator's cab or with operation of crane.

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

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

- Tools, oil cans, spare parts, and other necessary equipment must be stored in tool boxes or other appropriate locations. Do not allow these items to lie around loose in operators cab or on steps, ladders, catwalks, and platforms.
- To reduce risk of slipping, non-skid material (sand in paint) has been applied to painted walkways and platforms.

Walkways and platforms can be slippery when wet and when oil or is grease is spilled on them. **Keep walkways and platforms clean and dry to prevent slipping on them.** When non-skid material wears out, reapply it.

- Wear shoes with a highly slip-resistant sole material. Clean any mud or debris from shoes before entering the crane cab or climbing onto the cab. A shoe that is not clean might slip off a control pedal during operation.
- Do not make modifications or additions to the crane's access system that have not been evaluated and approved by Manitowoc.
- 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.

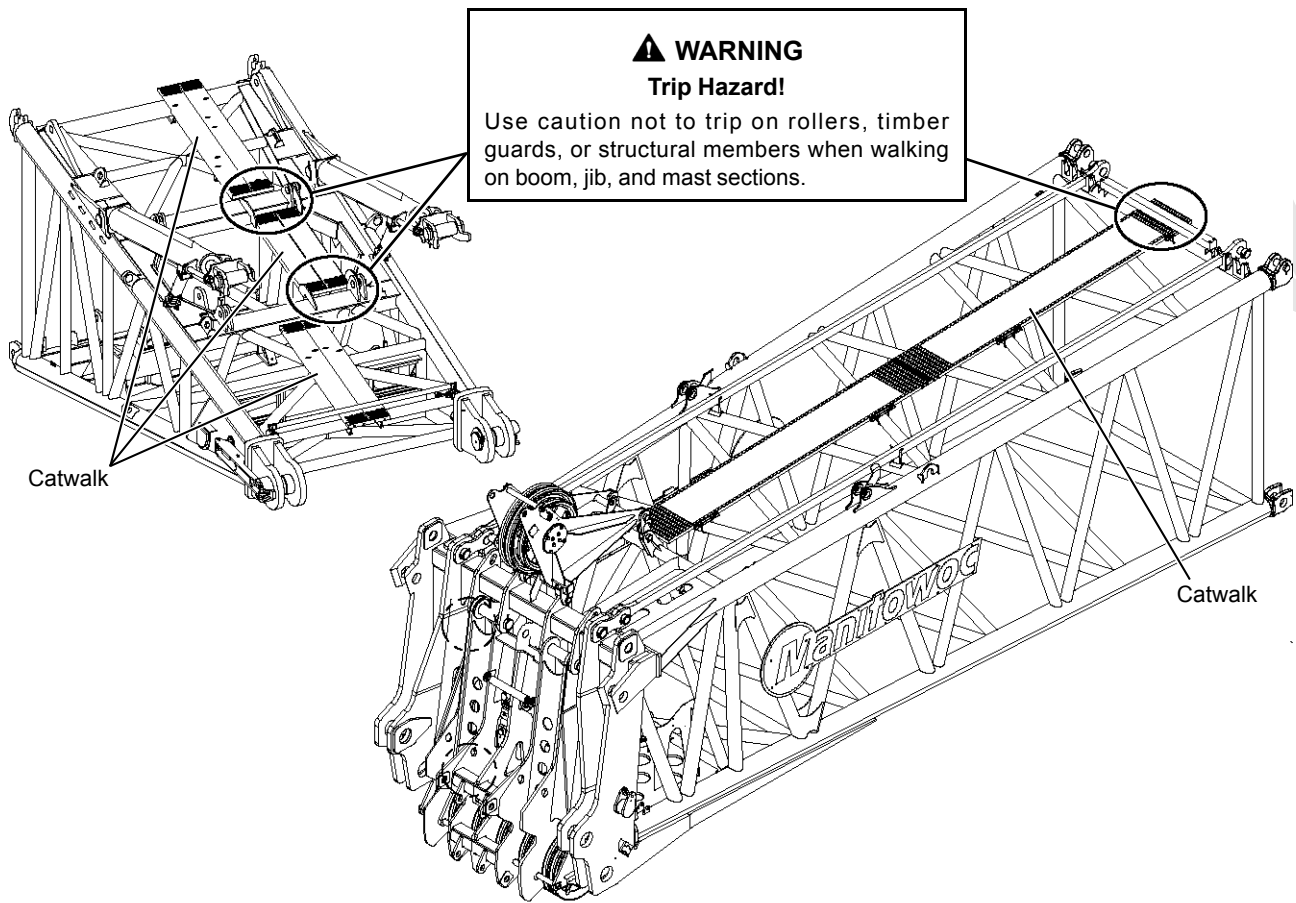
Two optional ladders, stored in 40 ft (12 m) insert next to the boom butt, are available for boom assembly and disassembly. See Boom Ladder Assembly in Section 4 of this manual for instructions.

Getting On or Off Crane

Personnel getting on and off 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.



⚠ WARNING
Trip Hazard!

Use caution not to trip on rollers, timber guards, or structural members when walking on boom, jib, and mast sections.

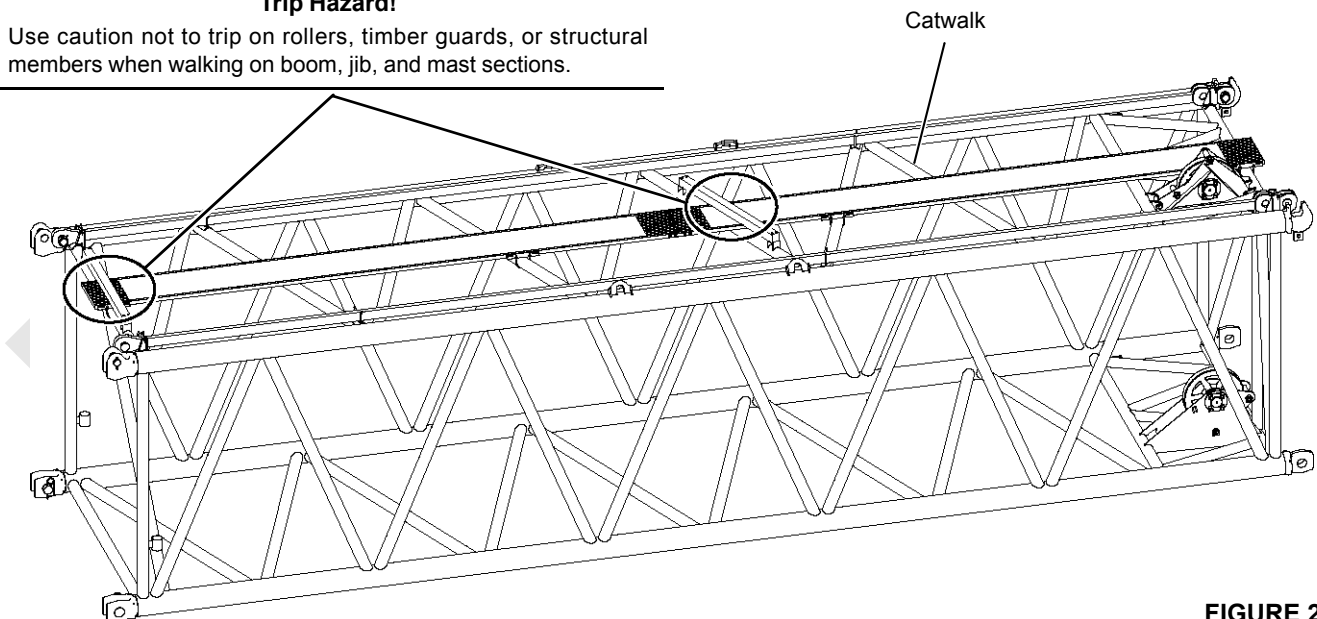
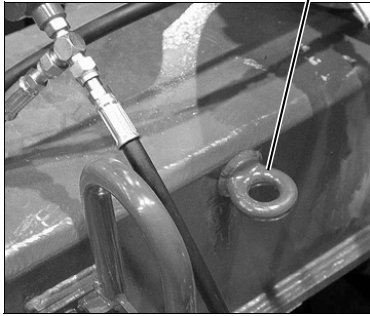


FIGURE 2-1

- Anchor for personnel fall-protection equipment:
- 4 Places Front of Rotating Bed
 - 3 Places on Engine Covers
 - 3 Places on Rear of Rotating Bed (under mast)
 - 2 Places Each Upper Counterweight Tray



P1951

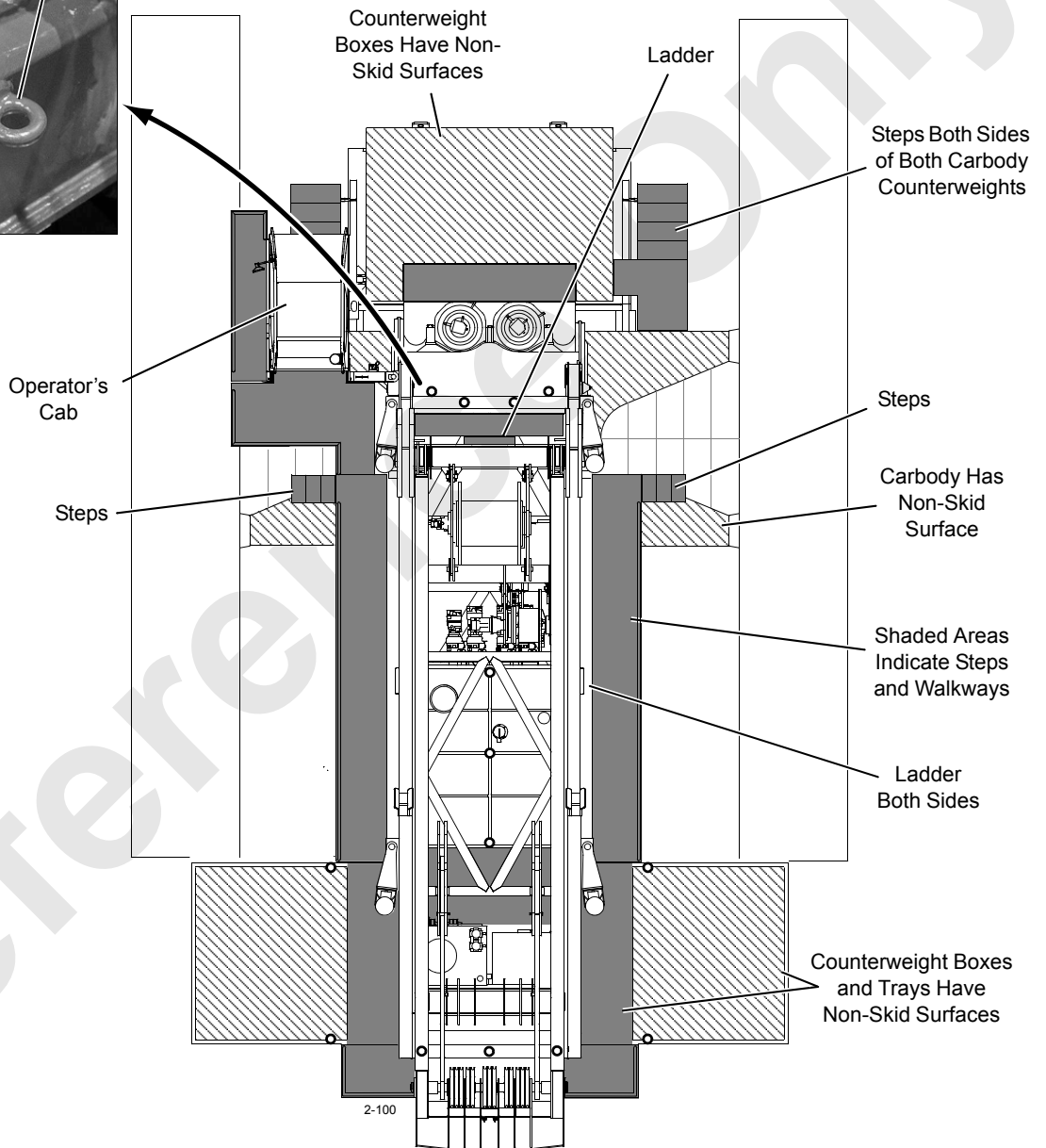


FIGURE 2-1 continued

PERSONNEL FALL-PROTECTION ANCHORS

Manitowoc has provided fourteen anchors on the upperworks (see [FIGURE 2-1 continued](#)) to which workers can attach their personnel fall-protection equipment.



WARNING

Fall Hazard!

Anchors are designed to handle only one person at a time.

Do not use anchors for lifting or pulling loads.

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 Load capacity operation and calibration procedures.
- **Service Manual (Serial Numbered)**
Contains theory of operation, maintenance procedures, crane and wire rope inspection procedures, troubleshooting information, and shop procedures.

The manuals which must be retained in the operator's cab (Operator Manual, Capacity Charts, Maintenance Checks and Lube Guide, and RCL Operation) are supplied in a 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 must 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 crane or attachment if proper Capacity Chart is not in cab.

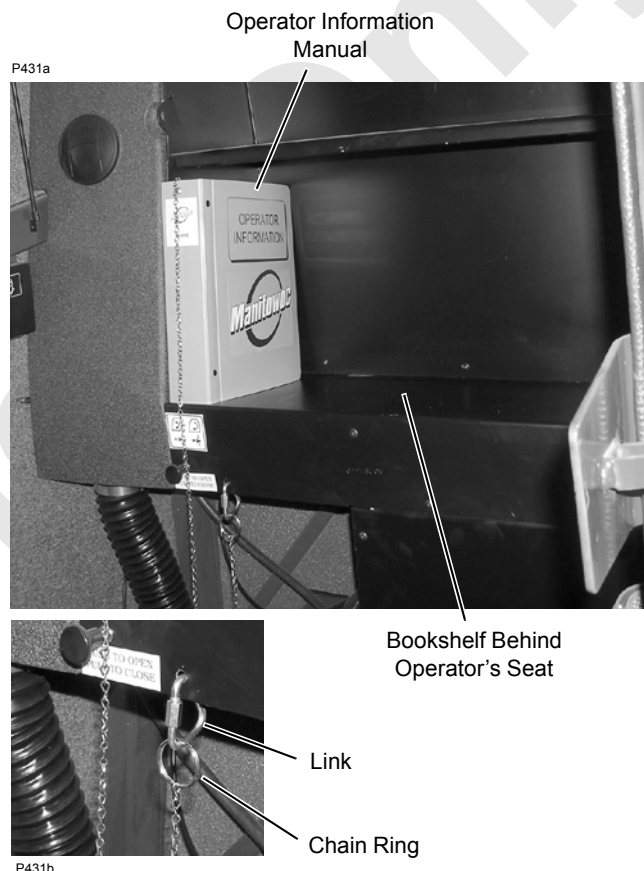


FIGURE 2-2

Storing Manuals

Store a copy of the Operator Manual for the crane and each applicable attachment in the holder provided in the Operator's cab ([Figure 2-2](#)).

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

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

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 in safe operation. Manitowoc cannot foresee all hazards that will arise in the field; therefore, **safety remains responsibility of crane operators and owner.**

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

Read Operator Manual

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

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

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

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

Operator Qualifications

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

- Designated operators
- Trainees under direct supervision of a designated operator
- 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 the crane cab unless performance of

their duties require them to do so, and then only with knowledge of the operator or other qualified person.

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

Operator training and qualification is crane owner's responsibility.

NOTE: The regulations and standards mentioned above and latter 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. Operator shall not engage in any practice which diverts his/her attention while operating crane.
2. Operator shall not operate crane when physically or mentally unfit.
3. Operator shall be responsible for all operations under his/her direct control. When safety of an operation is in doubt, operator shall stop the crane's functions in a controlled manner. Lift operations must resume only after safety concerns have been addressed or the continuation of crane operations is directed by the lift supervisor.
4. Operator shall be thoroughly familiar with operation of crane and its proper care. If adjustments or repairs are necessary or if there are known defects that impair safe

operation, crane must not be operated until unsafe conditions have been corrected.

5. If there is a warning sign at start controls, operator shall not start engine until warning sign has been removed by 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 position and all brakes and locking devices are applied or engaged.
 - c. All personnel are clear of crane. Deploy a swing radius barrier.
7. Operator shall test all controls, limits, and communication systems at start of each shift. Any defects found must be corrected before operation is begun.



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 crane in no way substitutes for or lessens requirement that operator knowledge, experience, and judgment are required to ensure safe operation of crane.

Crane must not be loaded beyond applicable static or dynamic ratings given on capacity chart for 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 of this manual.

8. 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 lift. **Operator shall obey a stop signal at all times, no matter who gives it.**
10. Operator shall verify that the capacity chart being used is the correct one for how the crane is equipped (boom length, load line reeving, counterweight, etc.).
11. Operator shall verify that:

- a. All attachments are properly assembled and attached to the crane according to the rigging drawings called for on the capacity chart.
- b. The counterweight — to include applicable auxiliary counterweight — is in place and of proper weight. **Maximum required counterweight must not be exceeded.**



WARNING

Moving Load/Tipping Crane Hazard!

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

- c. Operator shall perform the following operations before leaving operator's cab for any reason:
 - a. Park crane and position upperworks so 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 boom onto blocking at ground level or onto a boom rest if possible.

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

NOTE: The designated person shall be familiar with the job site limitations, the crane configuration, and the expected weather conditions.

- e. Move all controls to off.
- f. Apply all drum brakes and pawls.
- g. Disengage master clutch, if equipped.
- h. Stop engine.

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

12. 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.

13. If the crane will be operated at night, the operator shall make sure that there is sufficient lighting for safe operation. The load and landing area must be illuminated.

14. 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 c 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.

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

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

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

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

16. Booms, jibs, or masts which are being assembled or disassembled on the ground (with or without support of boom rigging) must be securely blocked to prevent the boom, jib, or mast sections from dropping.

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

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

Handling Load

Size of Load

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

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

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

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

The operator’s judgment must 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 must take priority over RCI/RCL readings.

Attaching Load

1. Attach the hook to the load with slings, or other suitable rigging. Each hook must have a latch that is in proper working order. **Hook latches must not be wired open.**
 - a. Inspect each hook and latch before using.
 - b. Never use a hook or latch that is distorted or bent.
 - c. Make sure spring will force the latch against the tip of the hook.
 - d. Make sure the hook supports the load. The latch must never support the load. Latches are only intended to retain loose slings under slack conditions.
2. Only use slings and other rigging that are in safe operating condition and have a rating equal to or greater than the load to be lifted.
3. Do not wrap the load line around the load.
4. Use suitable protection between slings and any sharp edges on the load. When synthetic slings are used, the synthetic sling manufacturer’s instructions, limitations, specifications, and recommendations must be followed.

5. Secure unused legs of a multi-leg sling before handling a load with one leg of sling.

Lifting/Moving Load

1. Before lifting or moving a load, the operator or qualified person directing the lift shall make the following checks:

- a. Crane has a firm, uniformly supporting foundation under all crawlers. Unless otherwise specified in the Capacity Chart, the foundation must be *level to within 1%* — 1ft (0,3 m) rise or fall in 100 ft (30,5 m) distance.

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

*For ground bearing data go to:
www.manitowoccranes.com/site/EN/
groundbearingpressure.aspx.*

- 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 must 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 must be blocked or cribbed before personnel are allowed to work under or between them.
- j. Before lifting a load which requires the use of outriggers (or anytime outriggers are used), fully extend the outrigger beams and jacks so the truck tires do not bear any load.

Securely fasten the outrigger jack pads or floats to jacks and set them on a flat, firm surface that will support the load placed on the pads or floats. Do not set the jack pads or floats in holes, on rocky ground, or on extremely soft ground.

When dictated by ground conditions, install wood blocking or steel plates under the jack pads or floats to properly distribute the loading on the supporting surface.

Wood blocking or steel plates used under the jack pads or floats must be:

- Free of defects
- Strong enough to prevent crushing, bending, or shear failure
- 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 must be in accordance with the designated person's decision.

- m. Do not lower the load or the boom to a point where less than three full wraps of wire rope 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 must be in accordance with the designated person's decision.

- b. Maintain specified tire pressures (truck cranes).
- c. Avoid sudden starts and stops. Use taglines or other restraints to control the position of the load.

Multiple Load Line Operation



WARNING

Avoid Over Load and Side Load Damage to Crane

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

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

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

1. The qualified lift planner and 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 must be thoroughly inspected by a qualified person prior to setup.
4. The crane must be thoroughly inspected for load line interference caused by routing and reeving of multiple load lines. If interference is found, it must be eliminated.
5. For cranes produced before 2003, Rated Capacity Indicators/Limiters were not required by ASME B30.5 for non-personnel lifting.

To aid the operator in staying within the crane's Capacity Chart with the total applied load, Manitowoc recommends that its cranes be equipped with Rated Capacity Indicators/Limiters to monitor the load on each load line.

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

Holding Load

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

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

SIGNALS

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

SAFETY DEVICES



WARNING

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

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

Manitowoc provides the following safety devices on its cranes.

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

OPERATIONAL AIDS



WARNING

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

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

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

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

Category 1 Operational Aids

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

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

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

Temporary alternative measures if inoperative or malfunctioning:

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

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

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

- d. Clearly mark the boom or luffing hoist cable (so it can easily be seen by a designated signal person) at a point that gives the signal person sufficient time to signal the operator and have the operator stop the boom or jib within the minimum allowable radius.

2. Anti-Two-Block Device

Temporary alternative measures if inoperative or malfunctioning:

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

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

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 must 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 must be completed within 7 calendar days of receiving the parts.

1. Rated Capacity Indicator/Limiter

Temporary alternative measures if inoperative or malfunctioning:

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

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

2. Boom Angle or Radius Indicator

Temporary alternative measures if inoperative or malfunctioning:

- a. Refer to the pendulum boom angle indicator on the boom butt (viewable from operator's 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 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 must be followed at all times, even if the electrical power lines or equipment have been de-energized.

3. Crane operation is dangerous when close to an energized electrical power source. Exercise extreme caution and prudent judgement. Operate slowly and cautiously when in the vicinity of power lines.
4. If the load, wire rope, boom, or any portion of the crane contacts or comes too close to an electrical power source, everyone in, on, and around the crane can be seriously injured or killed.

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

5. The operator is responsible for alerting all personnel to the dangers associated with electrical power lines and equipment. The crane is not insulated. Do not allow unnecessary personnel in the vicinity of the crane while operating. Permit no one to lean against or touch the crane. Permit no one, including riggers and load handlers, to hold the load, load lines, taglines, or rigging gear.
6. Even if the crane operator is not affected by an electrical contact, others in the area may become seriously injured or killed.
7. It is not always necessary to contact a power line or power source to become electrocuted. Electricity, depending on magnitude, can arc or jump to any part of the load, load line, or crane boom if it comes too close to an electrical power source. Low voltages can also be dangerous.

Set-Up and Operation

1. During crane use, assume that every line is energized ("hot" or "live") and take necessary precautions.
2. Position the crane such that the load, boom, or any part of the crane and its attachments cannot be moved to within 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 crane and power lines.
5. Appoint a reliable and qualified signal person, equipped with a loud signal whistle or horn and voice communication equipment, to warn the operator when any part of the crane or load moves near a power

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

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

Electrocution Hazard Devices

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

The insulating characteristics of these devices can be compromised if not kept clean, free of contamination, and undamaged.

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

Some variables you must know and understand are:

- Proximity devices are advertised to detect the existence of electricity and not its distance, quantity, or magnitude.
 - Some proximity devices may detect only alternating current (AC) and not direct current (DC).
 - Some proximity devices detect radio frequency (RF) energy and others do not.
 - Most proximity devices simply provide a signal (audible, visual, or both) for the operator and this signal must not be ignored.
 - Sometimes the sensing portion of the proximity devices becomes confused by complex or differing arrays of power lines and power sources.
8. DO NOT depend on grounding. Grounding of a crane affords little or no protection from electrical hazards. The effectiveness of grounding is limited by the size of the (wire) conductor used, the condition of the ground, the magnitude of the voltage and current present, and numerous other factors.

Electrical Contact

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

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

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

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

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

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

REFUELING

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

FIRE EXTINGUISHERS

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

ACCIDENTS

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

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

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

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

SAFE MAINTENANCE



WARNING

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

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

Maintenance Instructions

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

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

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

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

Safe Maintenance Practices

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

- f. Place a warning sign at the start controls alerting other personnel that crane is being serviced and the engine must not be started. **Do not remove sign until it is safe to return crane to service.**
2. Do not attempt to maintain or repair any part of the crane while the engine is running, unless absolutely necessary.
If the engine must be run, keep your clothing and all parts of your body away from moving parts. **Maintain constant verbal communication between person at controls and person performing maintenance or repair procedure.**
 3. Wear clothing that is relatively tight and belted.
 4. Wear appropriate eye protection and approved hard hat.
 5. Never climb onto or off a moving crane. **Climb onto and off 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 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 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's 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.

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 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 2-3](#)) 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 of this manual before beginning disassembly. Anyone who has a question should ask for an explanation. **One worker who does not fully understand or fails to follow correct procedures can endanger other workers.**

Location

Select a suitable location for boom disassembly. It must be firm, level, and be 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.



FIGURE 2-3

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 2-4](#), View A.
- Do not remove strap connecting pins until straps are fully lowered into supports as shown in [Figure 2-4](#), 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 2-4](#), View B.
- Never work or stand inside boom unless it is lowered and securely blocked as shown in [Figure 2-4](#), View C.
- Do not stand or walk on top of boom unless it has walkways.



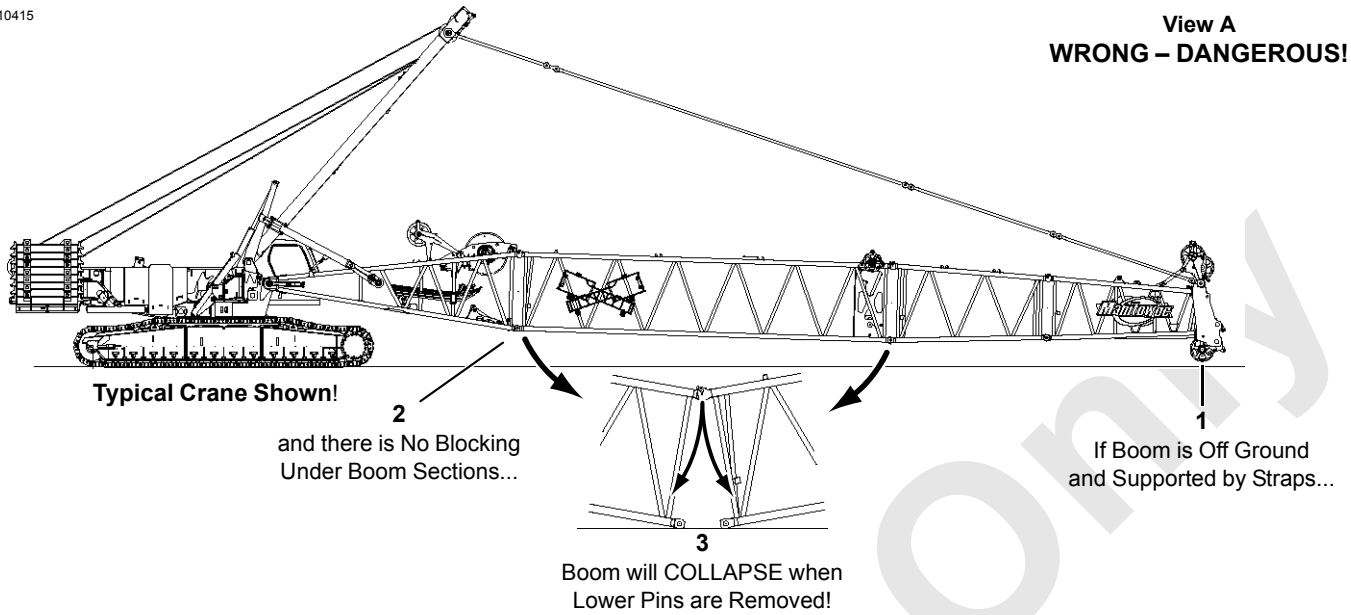
DANGER

Falling Boom Hazard!

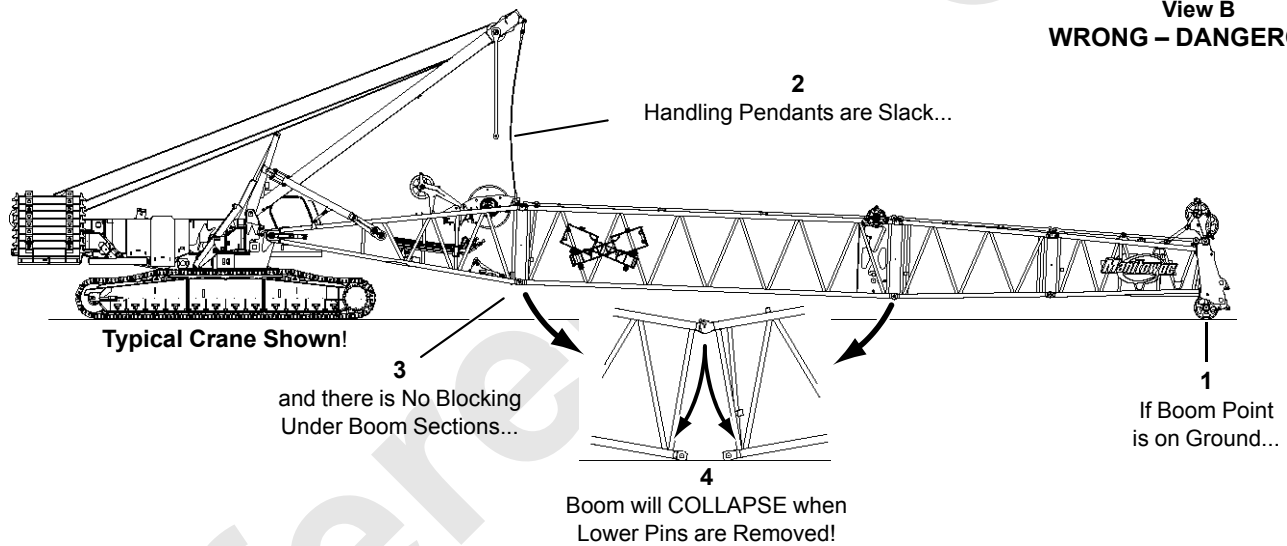
Crane can tip or boom can collapse if excess boom is cantilevered. Never cantilever more boom than allowed in rigging drawings or capacity charts.

A10415

View A
WRONG – DANGEROUS!



View B
WRONG – DANGEROUS!



View C
RIGHT – SAFE

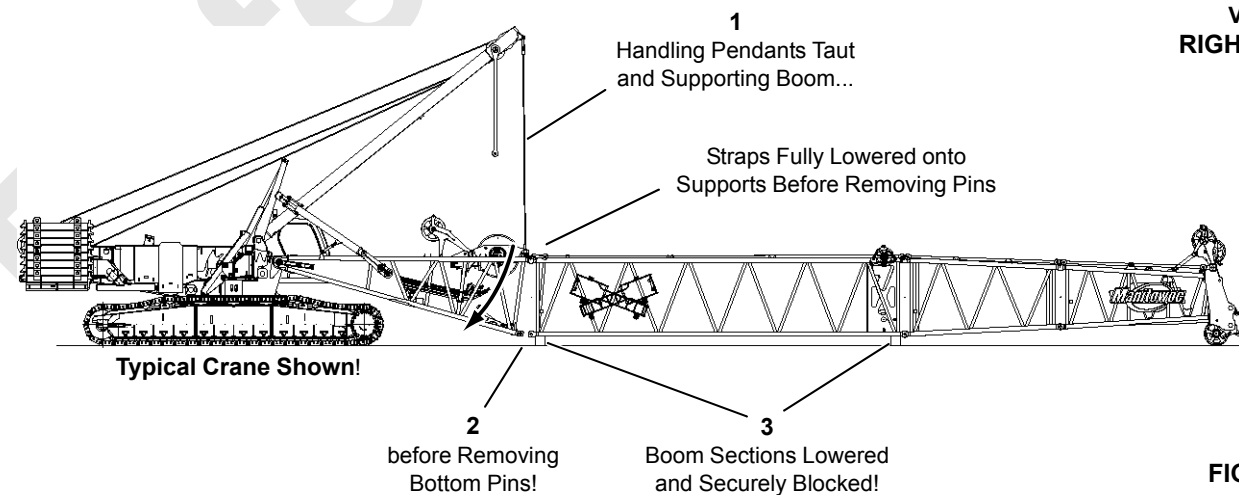


FIGURE 2-4

PERSONNEL HANDLING POLICY

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

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

This new standard is consistent with the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) regulations for Construction that state, in 29CFR1926.1431(a): ***The use of a crane or derrick to hoist employees on a personnel platform is prohibited, except when the erection, use, and dismantling of conventional means of reaching the work site, such as a personnel hoist, ladder, 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 must be

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

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

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

Free fall of the hoist line is prohibited.

- The crane Operator Manual is in the crane's cab, readily accessible to the Operator.
 - The crane's load Capacity Chart is affixed inside the crane cab, readily accessible to the operator. The total weight of the loaded personnel platform and related rigging must not exceed 50 percent of the rated capacity for the radius and configuration of the crane.
 - The crane is uniformly level within one percent of level grade and located on a firm footing. Some Capacity Charts require more stringent levelness criteria.
- Cranes with outriggers or stabilizers must have them all extended and locked. All outriggers or stabilizers must be extended equally in accordance with the Capacity Charts and operating procedures.
- Handling personnel from a platform suspended by wire rope from a luffing jib is acceptable, but only when it is not possible to accomplish the task using a less hazardous means. The crane user and operator shall take into account hazards that may be present when using a luffing jib.
 - Direct attachment of a personnel platform to a luffing jib is prohibited.
 - The platform meets the requirements as prescribed by applicable standards and regulations.
 - Applicable personal protection equipment is provided (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 must not be used in winds exceeding 20 mph (9 m/s) at the hoisted platform height or in electric storms, snow, ice, sleet, or other adverse weather conditions which could affect the safety of personnel.
- Hoisting personnel within 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 PROHIBITED, except for work covered in OSHA 29CFR1926 subpart V.

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

- Automatic brakes such that when the equipment operating controls are released, the motions are brought to rest.

- A holding device (such as a load hold check valve) must be provided in the hydraulic or pneumatic systems to prevent uncontrolled movement of the hoisting equipment in the case of a system failure.

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

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

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

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

PEDESTAL/BARGE MOUNTED CRANES

WARNING Overload Hazard!

A pedestal mounted crane will not tip to indicate to operator that 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 crane to separate from pedestal.

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

Careful planning is required before a crane can be operated on a barge. Crane user shall verify that 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, crane's capacity may be exceeded; hook rollers or other structural components may break, causing crane to separate from pedestal.

WARNING

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

Manitowoc does not permit 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](#)).

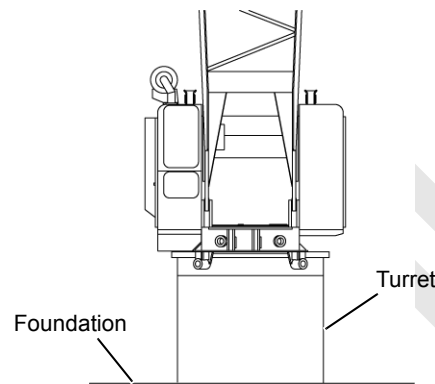
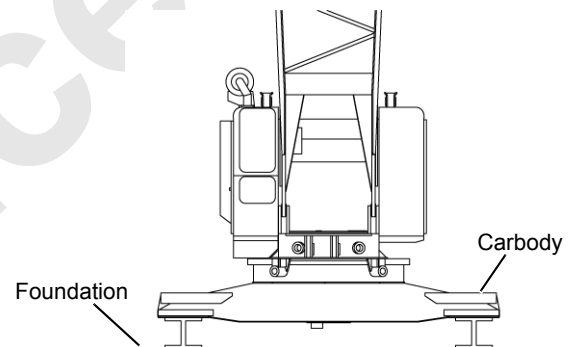


FIGURE 2-5

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



NOTE: If bolting carbody to foundation, contact your Manitowoc dealer for recommended bolt pattern and for type and quantity of bolts to be used.

FIGURE 2-6

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 carbody anchored with tie-downs to the foundation ([Figure 2-7](#)).

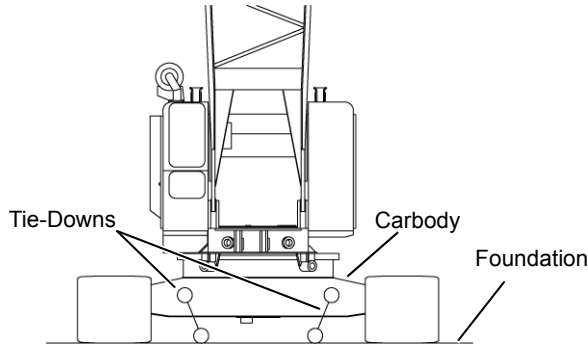
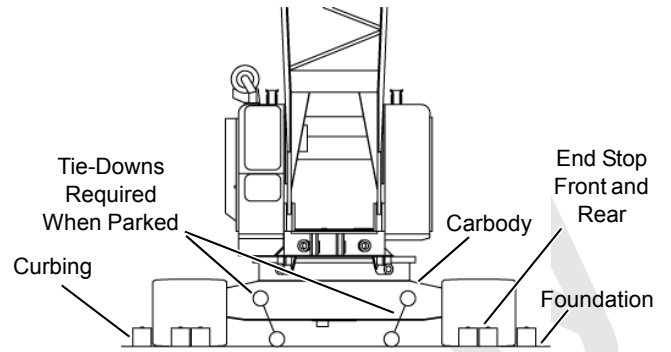


FIGURE 2-7

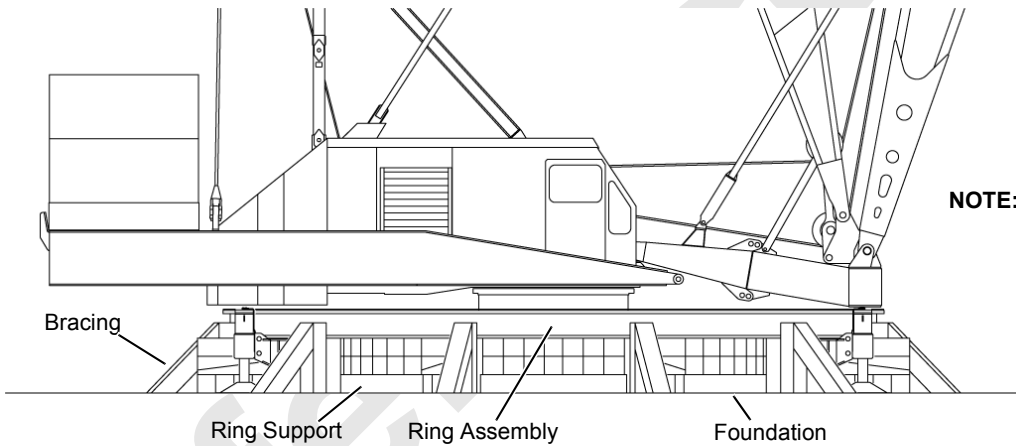


NOTE: Manitowoc does not permit traveling with load.

FIGURE 2-8

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.**

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



NOTE: Ringers must be equipped with hook rollers on boom and counterweight carriers.

FIGURE 2-9

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

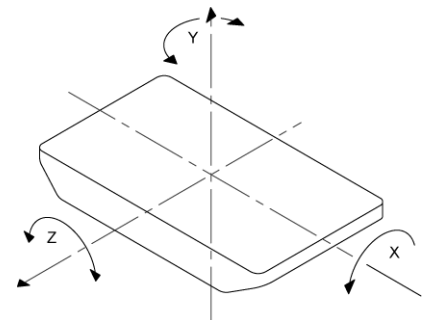


FIGURE 2-10

Capacity Charts

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 crane is securely fastened for use as a pedestal mounted crane.

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

Shock Loading

Definition

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

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

Operation On Barge

General

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

must be taken into account for safe operation on a barge, ship, or floating platform.



WARNING

Tipping Crane Hazard!

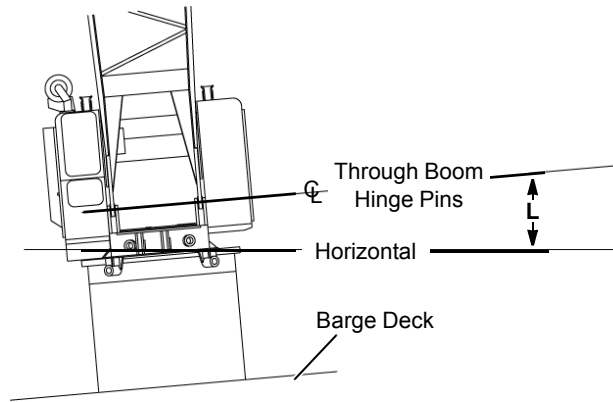
Tie-downs which only prevent crane from shifting as in barge, ship or floating platform mounting, may not provide adequate support when using a Capacity Chart for pedestal mounting. Before operating a crane on a barge, ship or floating platform, crane user shall verify that correct Capacity Chart is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

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

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.
2. **Barge List** (also referred to as heel or trim) causes swing out of the load and may produce side load. When Manitowoc provides a Capacity Chart showing capacities for a 2 degree machine list for example, we are referring to the maximum allowable lifting capacity for the crane when experiencing an out-of-level condition (side-to-side) of 2 degrees as measured by angle between horizontal and a line drawn through centerline of the crane's boom hinge pins.

Unless otherwise specified in the Capacity Chart, barge list (heel or trim) must not exceed the machine list degrees given in the Capacity Chart.
3. **Barge List and Machine List are not 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.



L = Degrees of Machine List
(Maximum allowable is
specified in Capacity Chart)

FIGURE 2-11

Crane Inspection

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

- Boom
- Counterweight

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

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

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

Transporting Crane on Barge

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

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Reference Only

SECTION 3

OPERATING CONTROLS AND PROCEDURES

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SECTION 3
OPERATING CONTROLS AND PROCEDURES


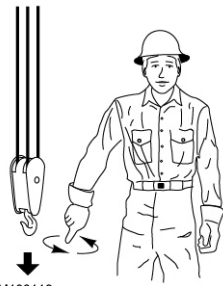
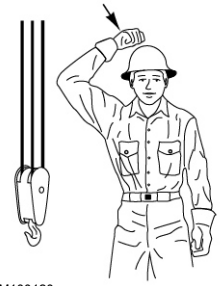
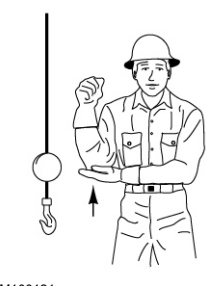


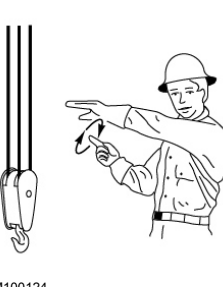
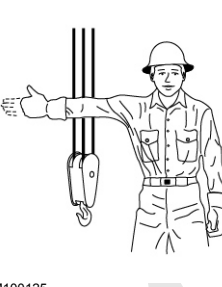
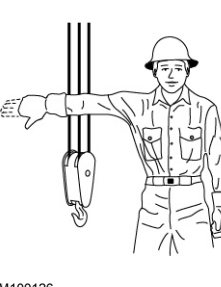
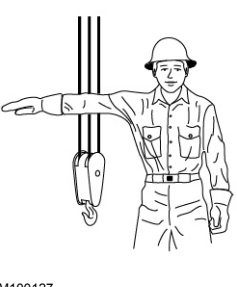

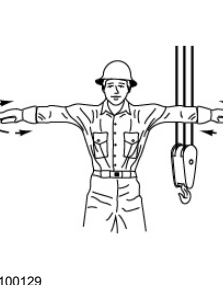
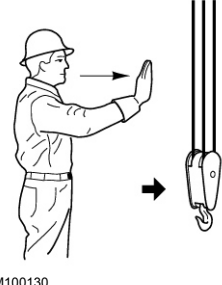
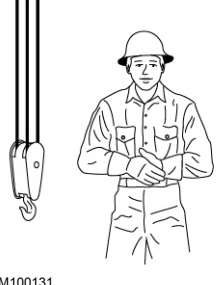
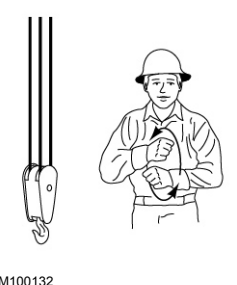
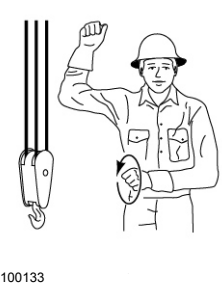
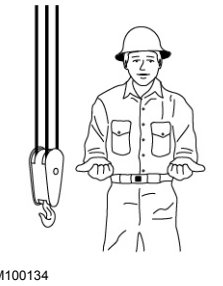
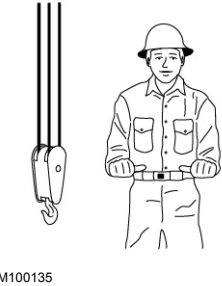
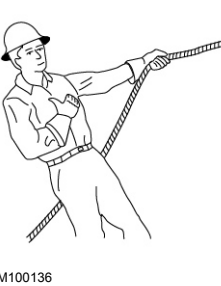

Reference Only

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STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS

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

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

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

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Table 3-1. 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 hands 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. |

SYMBOL IDENTIFICATION

The following symbols are used to identify the operating controls on current production remote controls.

| | | | |
|------------------------|--|-------------------------|--|
| Counterweight, Wheeled | | Remote Control | |
| Raise Counterweight | | Set-Up | |
| Lower Counterweight | | Steering | |
| Jacking Cylinders | | Steering Pins | |
| All | | Disengage | |
| Left Front | | Engage | |
| Left Rear | | | |
| Right Front | | | |
| Right Rear | | | |
| Extend Cylinder | | | |
| Retract Cylinder | | | |
| Power | | Wheels | |
| | | Left | |
| | | Right | |
| | | Rotate Clockwise | |
| | | Rotate Counterclockwise | |

FIGURE 3-1

GENERAL INFORMATION

This section has two purposes:

- To familiarize **qualified operators** with the location and operation of specific controls used for MAX-ER operation
- To alert operators to important safety information

The instructions in this section supplement the operating control instructions in the Crane Operator Manual. Refer to that manual for identification and operation of all controls the crane is equipped with.

If the MAX-ER is equipped with a luffing jib, see Section 3 in the Luffing Jib Operator Manual for identification and operation of the luffing jib controls and additional operating precautions.



WARNING

Prevent Death or Serious Injury to Personnel!

MAX-ER attachment must be installed and operated by experienced personnel trained in erection and operation of construction cranes. These personnel shall read, understand, and comply with instructions in this manual, in Crane Operator Manual, and in Capacity Charts.

COUNTERWEIGHT

See [Figure 3-5](#) and the MAX-ER Capacity Charts for counterweight identification and requirements.

See Crane Operator Manual and Section 4 of this manual for counterweight installation and removal instructions.



WARNING

Tipping Hazard!

Tipping can occur if too little counterweight is installed. Structural damage can occur if too much counterweight is installed.

Do not operate crane with MAX-ER until proper counterweight is installed.

MAX-ER CONTROLS

The following instructions apply to both the wheeled counterweight and the hanging counterweight.

Crane Mode Selector— Crane with Swing Lock

CAUTION

Avoid Damage to Swing Drive Train!

TURN OFF swing park before attempting to travel with MAX-ER attachment connected to crane.

See Section 3 in the Crane Operator Manual for operation of the crane mode selector.

For MAX-ER operation, one of the following modes must be selected and confirmed in addition to the desired main mode (standard, luffing, etc.).

- **MAX-ER** for all load handling operations with the MAX-ER attachment
- **TRAY ATTACHD** for operation when the MAX-ER mode is off, but the tray is attached (i.e. during setup)

The operator must confirm the desired operating mode at start-up.

Additionally on cranes with swing locks, the following question is asked on the second line of the display (Figure 3-2) after the desired operating mode is confirmed:

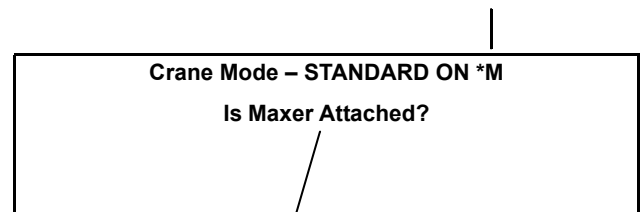
Is Maxer Attached?

The operator must then select either of the following answers with the confirm switch:

- Is Maxer Attached? NO
- Is Maxer Attached? YES

If the operator tries to travel with either MAX-ER mode on — MAX-ER or Tray Attached — and swing parked, the SWING PARKED operating fault will come on. The operator must **turn off swing park** before attempting to travel with the MAX-ER attachment connected to the crane. Otherwise, **major structural damage will occur to swing drive train.**

*M = MAX-ER Mode
TA = Tray Attached Mode



Confirm either:
Is Maxer Attached? YES
OR
Is Maxer Attached? NO

FIGURE 3-2

Crane Mode Selector— Crane without Swing Lock

CAUTION

Avoid Damage to Swing Drive Train!

TURN OFF swing park before attempting to travel with MAX-ER attachment connected to crane.

See Section 3 in the Crane Operator Manual for operation of the crane mode selector.

For MAX-ER operation, the following **MAX-ER** mode must be selected and confirmed in addition to the desired main mode (standard, luffing, etc.).

The operator must confirm the operating mode at start-up.

If you try to travel with the MAX-ER mode on and the swing brake applied, the SWING PARKED operating fault will come on and the crane will not travel. You must **turn off swing park** before attempting to travel with the MAX-ER attachment connected to the crane.

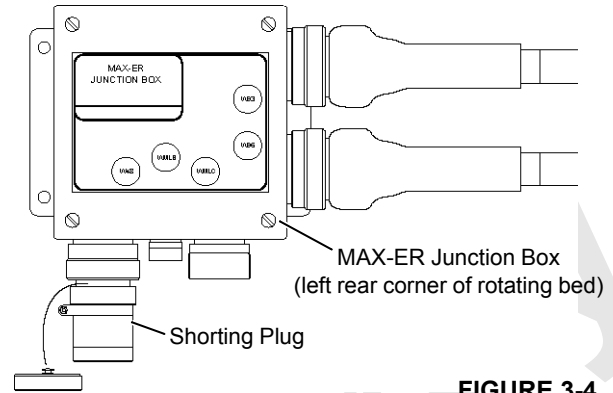


FIGURE 3-4

MAX-ER On

Once selected and confirmed, the modes will appear on the digital display as shown in [Figure 3-2](#) and [Figure 3-3](#). The ***M** on the right end of the screen indicates that the MAX-ER mode is on.

When the MAX-ER mode is on:

- The load sensing pins (counterweight and mast) measure backhitch tension created by the lifted load.
- The load sensing pins send a proportional voltage signal to the programmable controller.
- The programmable controller activates the crane's electric and hydraulic systems to automatically extend and retract the counterweight cylinders (raise and lower counterweight assembly) in response to changes in strap tension as shown in [Table 3-2](#).

*M = MAX-ER Mode

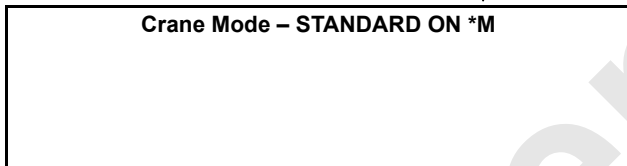


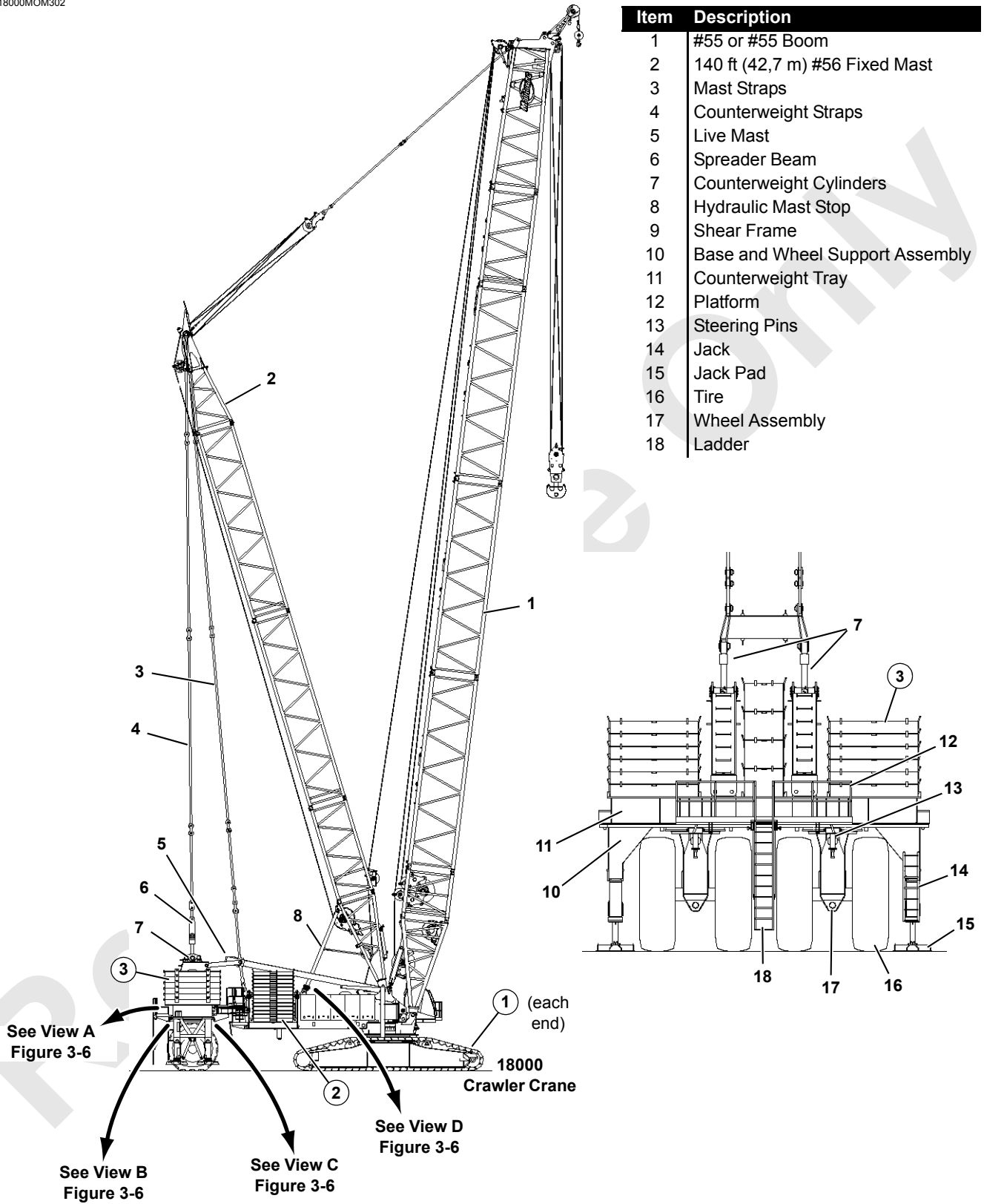
FIGURE 3-3

NOTE: If you don't install the shorting plug at the MAX-ER junction box ([Figure 3-4](#)) when you remove the MAX-ER attachment, the controller will assume the MAX-ER is still attached.

Table 3-2

| Backhitch Tension U.S. Tons | Counterweight Cylinders | Counterweight Carrier |
|--------------------------------|---|--------------------------|
| 50 | Retract | Raise |
| 40 | Stop Raising Tray (Tray will also stop rising if limit switch at either cylinder is tripped open.) | |
| 10 | Extend | Lower |
| 15 | Stop Lowering Tray | |

18000MOM301
18000MOM302



3

FIGURE 3-5

- ① = **Carbody Counterweight**
160,000 lb (72 575 kg) — Each End (3 Boxes Each End)
- ② = **Crane Counterweight**
492,000 lb (223 170 kg) — Total (13 Boxes Each Side)
- ③ = **Wheeled Counterweight (Manitowoc Furnished Boxes)**
(6 arrangements, depending on load handling requirements) —
 - 0 lb (0 kg) without Shear Frame Attached
 - 244,000 lb (110 680 kg) —
2 Center Boxes
 - 464,000 lb (210 470 kg) —
2 Boxes Each Side, 3 Center Boxes
 - 596,000 lb (270 340 kg) —
3 Boxes Each Side, 4 Center Boxes
 - 772,000 lb (350 170 kg) —
5 Boxes Each Side, 4 Center Boxes
 - 860,000 lb (390 090 kg) —
6 Boxes Each Side, 4 Center Boxes
- ④ = **Hanging Counterweight (Manitowoc Furnished Boxes)**
(6 arrangements, depending on load handling requirements) —
 - 0 lb (0 kg) with Shear Frame Attached
 - 247,800 lb (112 400 kg) —
4 Center Boxes
 - 467,800 lb (212 190 kg) —
3 Boxes Each Side, 3 Center Boxes
 - 599,800 lb (272 060 kg) —
4 Boxes Each Side, 4 Center Boxes
 - 775,800 lb (351 900 kg) —
6 Boxes Each Side, 4 Center Boxes
 - 863,800 lb (391 810 kg) —
7 Boxes Each Side, 4 Center Boxes

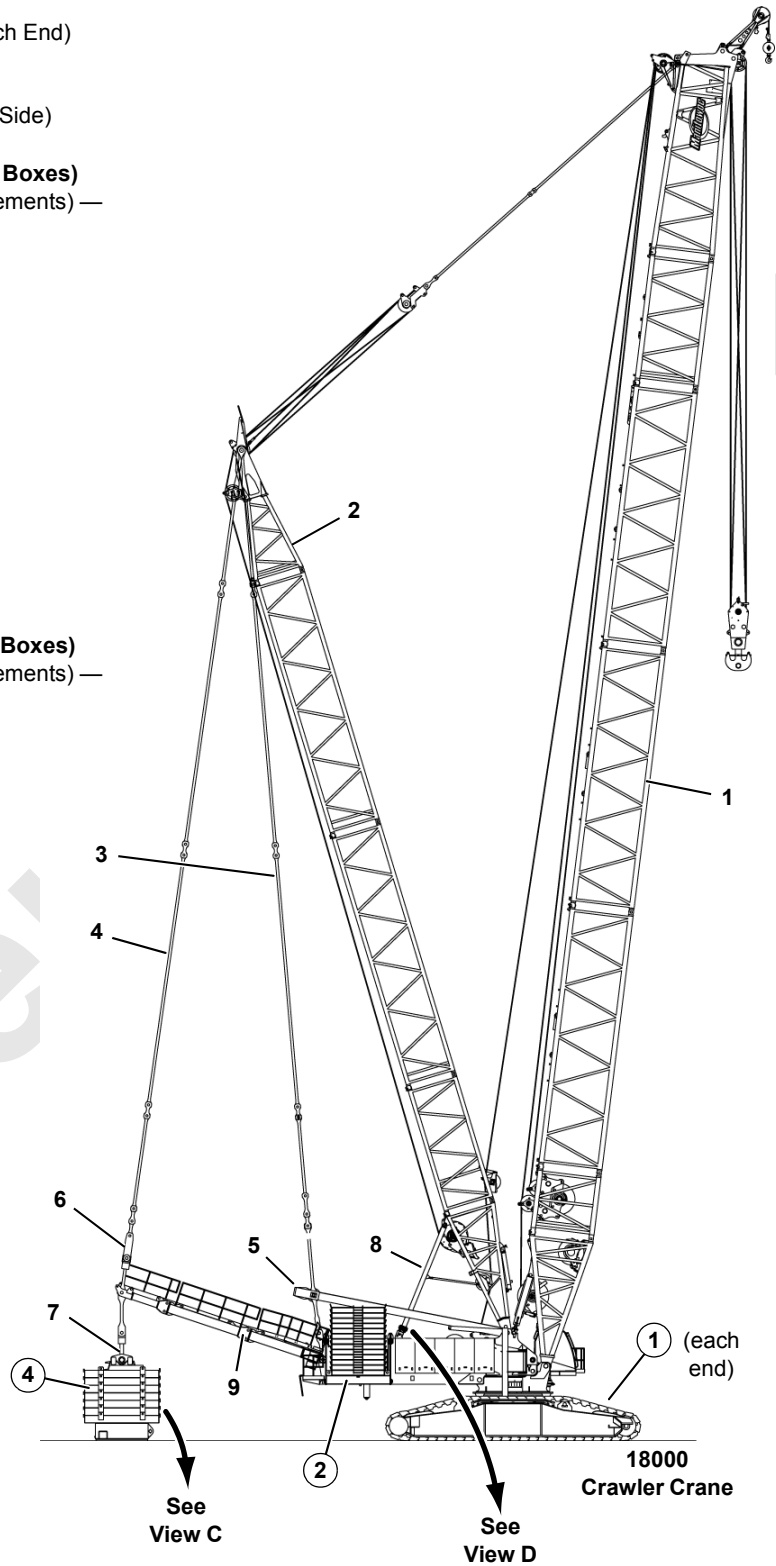
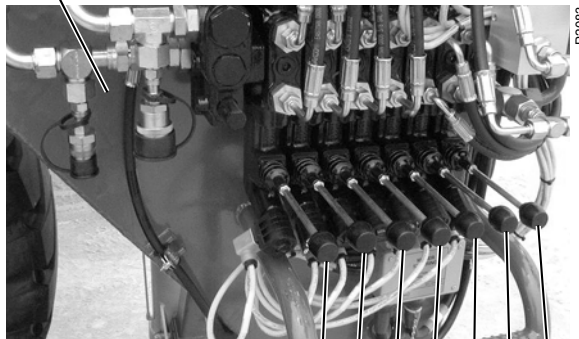


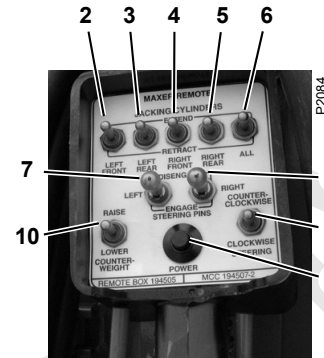
FIGURE 3-5 continued

A1280

Connect Hoses from Power Unit to these Couplers



View A
Right Rear Leg of Base
2 3 7 8 5 4 9



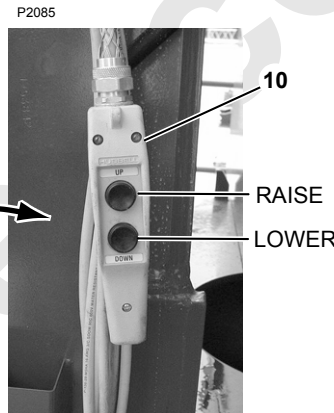
View B
Right Rear Leg of Base

MAX-ER only with Wheeled Counterweight Assembly

MAX-ER with Wheeled or Hanging Counterweight Assembly



View C
Front of Right A-Frame
Counterweight Tray
Junction Box



Counterweight Remote Control (stored)



View D
Base of Both Mast Stops

| Item | Description | Item | Description |
|------|--------------------------------------|------|--|
| 1 | Power Button | 7 | Left Steering Pins Control |
| 2 | Left Front Jacking Cylinder Control | 8 | Right Steering Pins Control |
| 3 | Left Rear Jacking Cylinder Control | 9 | Steering Control |
| 4 | Right Front Jacking Cylinder Control | 10 | Counterweight Control |
| 5 | Right Rear Jacking Cylinder Control | 11 | Mast Stop Accumulator Gauge (2 places) |
| 6 | All Jacking Cylinders Control | | |

FIGURE 3-6

MAX-ER Remote Controls

(see [Figure 3-6](#), Views A, B, C)

NOTE: To operate MAX-ER remote controls (1–10) the electric cables from the remotes and from the crane must be connected to the appropriate junction boxes on the counterweight carrier.

MAX-ER remote controls (1–9) apply only to the wheeled counterweight. They can be operated in any mode.

MAX-ER remote control (10, raise and lower) applies to both the wheeled counterweight and the hanging counterweight. It can be operated only when MAX-ER mode is off.

The valve handles on the right rear leg of the base allow the jacking and steering functions to be operated manually with the power unit provided with the crane (see Section 4 of this manual for details).

1. Power Switch

Button down to TURN ON power to the remote control.

Release button to TURN OFF power to the remote control.

2. Left Front Jacking Cylinder Control

3. Left Rear Jacking Cylinder Control

4. Right Front Cylinder Control

5. Right Rear Jacking Cylinder Control

Toggle up or handle down to EXTEND jacking cylinder (RAISE counterweight).

Release toggle or handle to STOP (lock) jacking cylinder in last position.

Toggle down or handle up to RETRACT jacking cylinder (LOWER counterweight).

6. All Jacking Cylinders Control

Toggle up to EXTEND all jacking cylinders at same time.

Release toggle to STOP (lock) jacking cylinders in last position.

Toggle down to RETRACT all jacking cylinders at same time.

7. Left Steering Pins Control

8. Right Steering Pins Control

NOTE: The knob on each toggle switch must be pulled out before the toggle can be moved.

Toggle or handle up to DISENGAGE steering pins.

Toggle or handle down to ENGAGE steering pins.

9. Steering Control

Toggle or handle up to rotate wheel assembly COUNTERCLOCKWISE.

Release toggle to STOP wheel assembly.

Toggle or handle down to rotate wheel assembly CLOCKWISE.

10. Counterweight Control

Toggle up or top button down to RAISE MAX-ER counterweight (retract cylinders).

This button is provided for set-up purposes only. It allows the counterweight straps to be slackened during counterweight installation and removal.

Release toggle or button to STOP (lock) counterweight in last position.

Toggle or bottom button down to LOWER MAX-ER counterweight (extend cylinders).



DANGER

Tipping Hazard!

Counterweight raise control is provided so counterweight can be raised manually if load sensing pin fails. Any other use of this control is neither intended nor approved.

Follow load sensing pin replacement instructions in this section for proper use of counterweight raise control. Improper use of control will cause crane to tip backwards.

11. Mast Stop Accumulator Gauge (2 places)

Check both gauges WEEKLY. The gauges should read 200–280 psi (13,8–19,3 bar) regardless of outside air temperature.

If proper reading is not indicated at either gauge, determine cause of faulty pressure and take corrective action.



WARNING

Explosion Hazard!

Mast stop cylinders are equipped with nitrogen pre-charged accumulators.

Do not tamper with accumulators unless authorized and trained to do so.

Digital Display

(in operator’s cab)

Figure 3-8 shows a wheeled counterweight, but the following instructions apply to both the wheeled counterweight and the hanging counterweight.

Go to MAX-ER diagnostic screen (Figure 3-7) to monitor MAX-ER operating conditions.

1. CTWT — indicates position of hanging or wheeled counterweight assembly — UP or DOWN.
2. ___ . __ LOAD — indicates corresponding strap tension in U.S. tons.

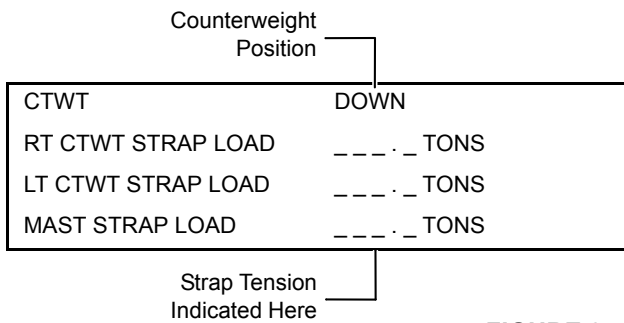


FIGURE 3-7

System Fault Alert

The system fault beeper and red light in the operator’s cab come on to warn the operator if a load sensing pin fails due to faulty voltage output (at or near 0 volts or at or near 10 volts). The fault appears as shown in Figure 3-7 when the operator scrolls to the system faults group of the digital display (only in the MAX-ER mode).

If a load sensing pin fails, the wheeled counterweight assembly will remain in its last position. All other crane functions will remain operable.

The cause of the fault could be a blown fuse or a loose electric cord at the pin. Check those areas first before replacing the load sensing pin. If a fuse or loose cord is not the cause of the fault, replace the load sensing pin as instructed later in this section.

TIRE INFLATION

This topic applies only to the wheeled counterweight.

See Figure 3-9 for the following procedure.

Check tire inflation weekly. Inflate tires equally:

- Goodyear: 135 – 145 psi (9,3 – 10,0 bar)
- Laizhou: 130 – 140 psi (9,0 – 9,7 bar)
- Michelin: 140 – 145 psi (9,6 – 10,0 bar)
- Yokohama: 106 – 116 psi (7,3 – 8,0 bar)

Inspect the tires for damage weekly. Contact a qualified tire dealer for tire and rim servicing.

WHEEL BOLT TORQUE

This topic applies only to the wheeled counterweight.

Check wheel bolt torque monthly. Torque wheel bolts (Figure 3-9) to 500 ft-lbs (678 Nm).

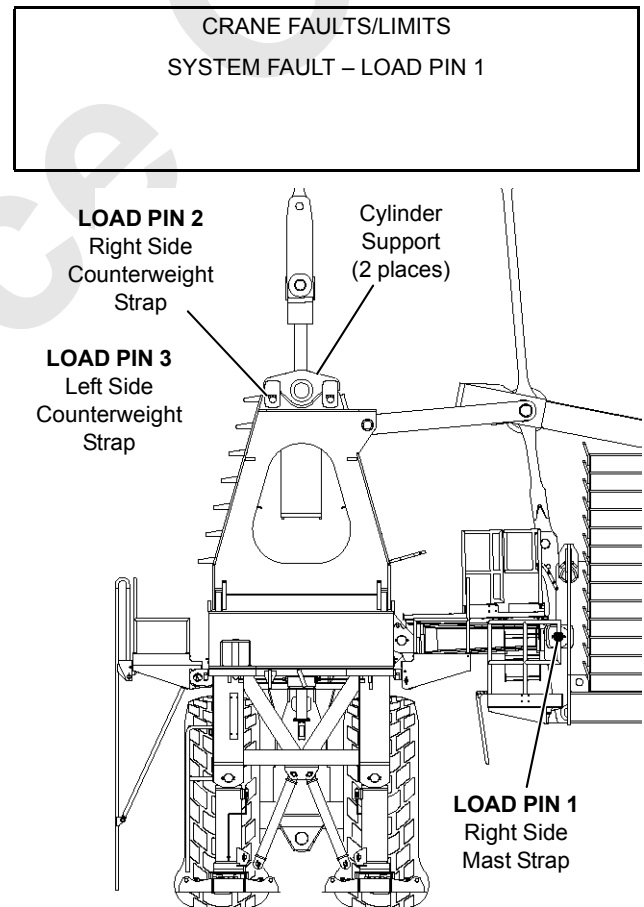


FIGURE 3-8

18000MOM303

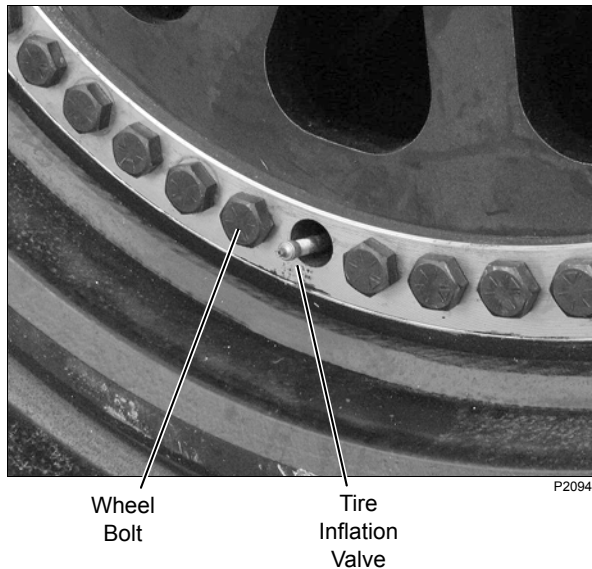


FIGURE 3-9

OPERATING PRECAUTIONS



Observe following operating precautions to prevent tipping or structural failure of attachment.

- Once load is landed (hanging counterweight tray lands), it may be necessary to remove some or all hanging counterweight to travel and swing.
 - When wheeled counterweight tires are on foundation, do not travel or swing crane until wheel assemblies have been rotated and pinned in proper position.
 - For wheeled counterweight 40 ft (12,2 m) swing radius, make sure steering pin adapter plates are rotated and secured in proper position. Steering pin holes must be toward REAR as shown in [Figure 3-11](#).
 - Make sure crawlers are blocked and proper amount of MAX-ER counterweight is installed — both as specified in Capacity Chart — before raising and lowering boom from and to ground.
 - Make sure load sensing pins are operating properly; otherwise, MAX-ER counterweight assembly will not rise off foundation when required.
 - Make sure counterweight cylinder limit switches are adjusted and operating properly; otherwise, MAX-ER counterweight assembly will not rise proper amount when required.
 - Select and confirm desired main mode (standard, luffing, etc.) and MAX-ER mode for operation with MAX-ER counterweight assembly installed. **Counterweight assembly will not rise and lower automatically if MAX-ER mode is not selected.**
- MAX-ER counterweight assembly remains in its last position — up or down — if MAX-ER mode or engine is turned off during operation.
- Access MAX-ER diagnostic screen to monitor MAX-ER operating conditions. Do not attempt to swing or travel when tray is on foundation.
 - Operate only with crane on a firm surface that is uniformly supporting.
 - **With load**, grade must not exceed 1% in any direction — 1 ft in 100 ft (0,3 m in 30 m).
 - **Without load**, see Maximum Allowable Travel Specifications Chart.
 - Make sure foundation under crane and under MAX-ER counterweight assembly is at same level, plus or minus 12 in (305 mm). **Mast can buckle if counterweight is lowered too far below grade.**
 - Do not operate crane, to include raising boom from ground level, if wind exceeds limits given in Capacity Charts. Contact your local weather station for wind velocity. See Wind Conditions topic in this section.
 - Be aware of increased tail swing with MAX-ER counterweight assembly installed. Counterweight

assembly can strike objects or personnel in area of travel and swing paths.

- Warn all personnel to stand well clear of crane. MAX-ER counterweight assembly rises and lowers automatically without warning — it can strike or land on personnel.
- Provide a signal person for all crane operations.

Have signal person watch for clearance under tires or counterweight tray while swinging and traveling. Do not allow tray to contact foundation or strike obstructions.

Depending on lifted load, clearance under tires or tray can be as much as 20 in (508 mm).

- Observe the following precautions for wheeled counterweight jacking cylinders:
 - Make sure foundation is strong enough to support load placed on wheeled counterweight jack pads.

Steel or timber mats must be used to distribute loading as required.

Maximum load on each wheeled counterweight jack is 281,000 lb (127 462 kg).

Area of each jack pad is 2,268 in² (14 632 cm²).

- Prior to operating jacking cylinders when wheeled counterweight assembly is connected to crane, disconnect struts from jacking cylinders ([Figure 3-10](#)). **Struts will be damaged if this step is not performed.**
- Prior to disconnecting wheeled counterweight assembly from crane, connect struts to jacking cylinders ([Figure 3-10](#)). **Wheeled counterweight assembly will fall over if this step is not performed.**

18000MOM304

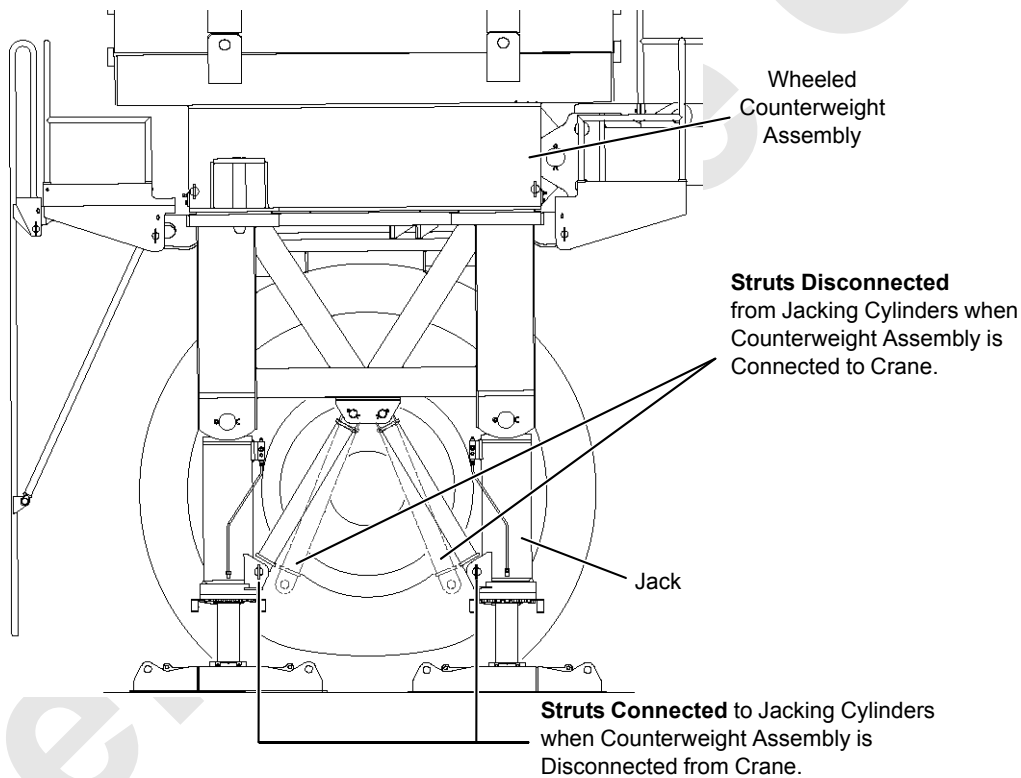
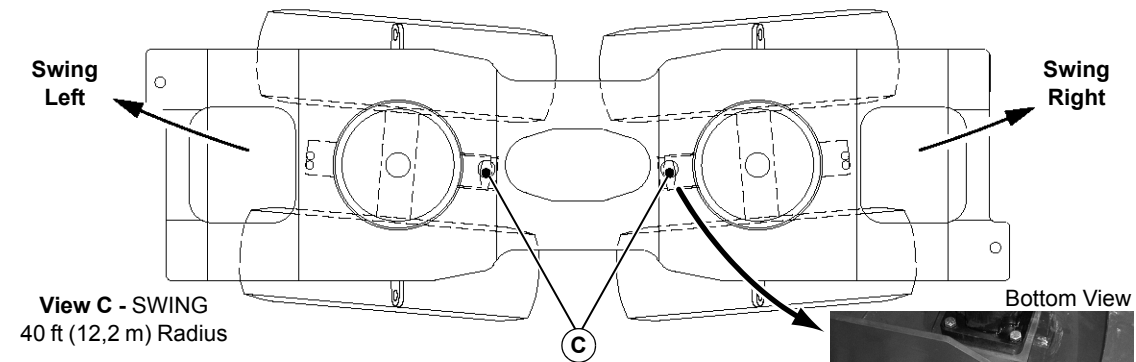
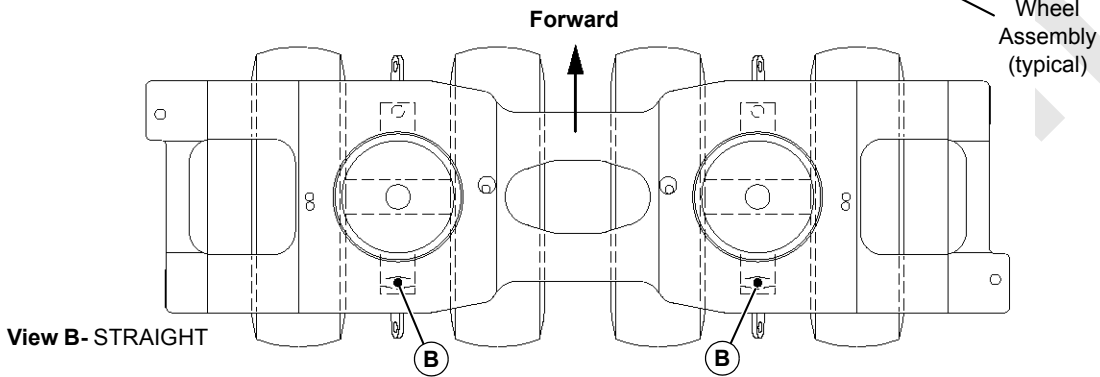
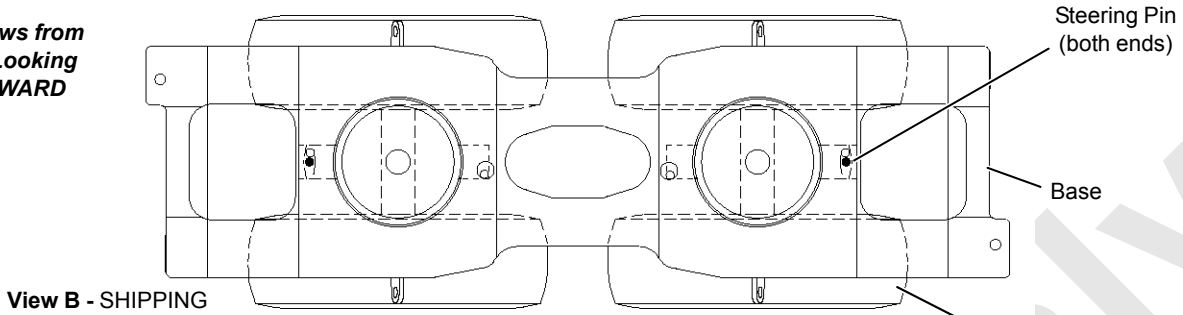


FIGURE 3-10

18000MOM305

All Views from
TOP Looking
FORWARD



For 40 ft (12,2 m) Radius, Rotate Steering Pin Supports (2 places) so Holes are Toward REAR of Base and Wheel Support Assembly

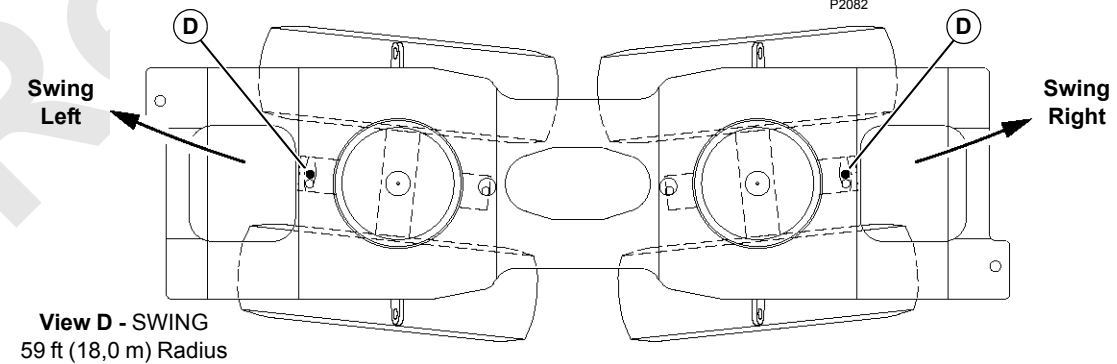
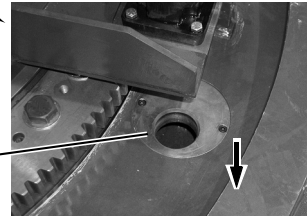


FIGURE 3-11

MAX-ER OPERATION

Handling Loads

1. Select and confirm desired main mode (standard, luffing) and MAX-ER mode.
2. Access MAX-ER diagnostic screen to monitor MAX-ER operating conditions.
3. The counterweight cylinders will automatically lift the wheeled counterweight assembly off the foundation and set it back down when required depending on load (governed by boom angle, boom length, lifted load).

4. When the wheeled counterweight assembly is off the ground, the crane can be swung and traveled in the normal manner to position the crane and load.

When the wheeled counterweight assembly is on the ground, the wheels must be properly positioned before swinging or traveling the crane.

5. Block crawlers if required before lowering boom to ground (see MAX-ER Capacity Chart for requirements).

NOTE: The Travel and Swing procedures which follow, require operation of the remote controls. See MAX-ER Remote Controls in this section for identification and operation of the controls.

Traveling

(with wheels on ground)

Straight Travel / Gradual Turns

See [Figure 3-11](#), View B for the following procedure.

1. Swing upperworks and wheeled counterweight assembly in-line with crawlers (perform Swinging steps).
2. Raise counterweight with jacking cylinders until bulge is out of tires.
3. Disengage steering pins.
4. Rotate wheel assemblies to straight position.
5. Engage steering pins in Holes B.
6. Retract jacking cylinders.
7. Disengage swing lock and release swing brake

CAUTION

Swing Drive Damage!

Do not attempt to travel straight or make turns while swing lock is engaged or swing brake is applied. Damage to swing drives will result.

8. Proceed to travel forward or in reverse.

9. Gradual turns while traveling straight are permitted in forward direction only. However, keep a close watch on tires during this procedure. If tire scraping is excessive, reduce radius of turn.

CAUTION

Machinery Damage!

Do not attempt gradual turns while traveling in reverse. Support frame(s) between wheeled counterweight assembly and crane can be damaged.

Sharp Turns

1. Pin wheels in straight position (perform Straight Travel steps).
2. Disengage swing lock and release swing brake.
3. Counter-rotate crawlers to desired position.

CAUTION

Machinery Damage!

Do not counter-rotate crawlers without first disengaging swing lock, releasing swing brake, and rotating wheels to straight position. Swing drives or support frames between wheeled counterweight assembly and crane can be damaged.

4. Swing upperworks and wheeled counterweight assembly in-line with crawlers (perform Swinging steps).
5. Proceed to travel straight (perform Straight Travel steps).

Swinging

(with wheels on ground)

See [Figure 3-11](#), Views C and D for the following procedure.

1. Raise counterweight with jacking cylinders until bulge is out of tires.
2. Disengage steering pins.
3. Rotate wheels to required swing position:
 - View C for 40 ft (12,2 m) radius
 - View D for 59 ft (18,0 m) radius
4. Engage steering pins in Holes C, View C or Holes D, View D.
5. Retract jacking cylinders.
6. Disengage swing lock and release swing brake.
7. Proceed to swing right or left.

For additional swing and travel information, see Swing and Travel Specifications in MAX-ER Capacity Chart Manual.

LEAVING CRANE UNATTENDED

When crane is left unattended, it shall be parked as instructed in Section 3 of Crane Operator Manual. The following additional steps shall be taken if the boom cannot be lowered to ground.

MAX-ER with Wheeled Counterweight Assembly



WARNING

Tipping Crane Hazard!

Do not leave crane unattended with wheeled counterweight assembly off ground. Pressure in counterweight cylinders can bleed off over extended period of time. This action will allow counterweight to lower. Crane may tip forward when this occurs.

1. Position boom at mid-point of boom angle range given in Capacity Chart.
2. If wheeled counterweight did not lower to ground when step 1 was performed, proceed as follows:
 - a. Turn off MAX-ER mode.
 - b. Lower wheeled counterweight assembly with counterweight control (10, [Figure 3-6](#)) until counterweight is on ground.
 - c. Continue to lower counterweight until counterweight straps just start to slacken (tires will flatten).
If straps do not slacken (crane starts to rock forward), STOP. Raise boom until straps start to slacken.
 - d. Raise wheeled counterweight assembly with raise control (10, [Figure 3-6](#)) until counterweight straps just start to tighten and STOP. **Do not lift counterweight assembly off ground.**

3. Engage boom hoist pawl and secure boom against movement by wind or other outside forces.

MAX-ER with Hanging Counterweight Assembly



WARNING

Tipping Crane Hazard!

Do not leave crane unattended with hanging counterweight lifted off foundation. Pressure in counterweight cylinder can bleed off over extended period of time. This action will allow hanging counterweight to lower onto foundation. Crane may tip forward when this occurs.

1. For 380 ft (115.8 m) boom, install a minimum of 247,300 lb (112 175 kg) hanging counterweight.
2. Position boom at desired angle for which a capacity is shown in **mid-range of Capacity Chart** (refer to boom capacity column of Capacity Chart).
3. If hanging counterweight did not lower onto foundation when step 2 was performed, proceed as follows:
 - a. Turn off Max-Er mode.
 - b. Lower hanging counterweight with counterweight lower control ([Figure 3-6](#)) until hanging counterweight is on foundation with straps taut.
If freezing temperatures are expected, lower hanging counterweight onto wood blocking so tray will not freeze to foundation.
4. Engage boom hoist pawl and secure boom against movement by wind or other outside forces.

REPLACING LOAD SENSING PIN — WHEELED COUNTERWEIGHT

If the load sensing pin fails, the wheeled counterweight assembly will remain in its last position, the system fault alert will come on, and LOAD PIN will appear on the digital display.

The following instructions describe manual operation of the wheeled counterweight assembly so the lift can be completed and the boom safely lowered to the ground.



WARNING

Falling Boom/Mast Hazard!

If load sensing pin fails, land load and boom as soon as possible using following procedure and correct cause of failure.

Read and follow instructions carefully to avoid structural damage to rotating bed, tipping, or possible collapse of attachment.

1. Turn off MAX-ER mode.
2. Make following checks:
 - a. If wheeled counterweight assembly is on ground, inspect crawler rollers at rear of crane. If rollers are off crawler treads, raise wheeled counterweight assembly with raise control (10, [Figure 3-6](#)) only enough to lower crawler rollers into contact with crawler treads. **Do not lift counterweight assembly off ground.**
 - b. If wheeled counterweight assembly is on ground, inspect counterweight straps. If straps are slack, raise wheeled counterweight assembly with raise control (10, [Figure 3-6](#)) until straps just start to tighten. **Do not lift counterweight assembly off ground.**
 - c. If wheeled counterweight assembly is off ground, lower it with counterweight control (10, [Figure 3-6](#)) until tires flatten 1-2 in (25-51 mm).
3. **Without load**, travel and swing as required to move crane to an area where boom can be lowered. Then go to step 7.

With load, proceed as follows:

 - a. Position boom at desired angle within range given on MAX-ER Capacity Chart.
 - b. Travel and swing as required to position load in landing area.
 - c. Slowly lower load until it lightly contacts landing area (land load only enough so it cannot shift).
 - d. Lower wheeled counterweight assembly with counterweight control (10, [Figure 3-6](#)) until counterweight straps just start to slacken (tires will flatten).
 - e. Land and disconnect load.
 - f. Check to see if counterweight straps have slackened. If they have, perform step 5b.
 - g. Travel and swing as required to move crane to an area where boom can be lowered.
4. Travel crawler rollers onto blocking if required to lower boom (see MAX-ER Capacity Chart for requirements).
5. Slowly lower boom onto blocking.
6. Lower wheeled counterweight assembly with counterweight control (10, [Figure 3-6](#)) until counterweight pendants are slack.

See [Figure 3-12](#) for the remaining steps.
7. Disconnect electric cord from load sensing pin.
8. Check to see if load sensing pin is loose. If not, slowly Boom up or down only enough to remove loading on pin.
9. Remove load sensing pin.
10. Check new load sensing pin for proper calibration (see Sensor Adjustments in Section 6 of this manual).
11. Install new load sensing pin and retain with keeper plate.

CAUTION

Load Sensing Pin Damage!

Align connecting holes as closely as possible so load sensing pin can be installed without excessive force.

Avoid hitting pin with a hammer. If it is necessary to hammer pin into place, hold a block of wood against end of pin and hammer against wood.

12. Connect electric cord to load sensing pin.
13. Select and confirm MAX-ER mode. Boom can now be raised.

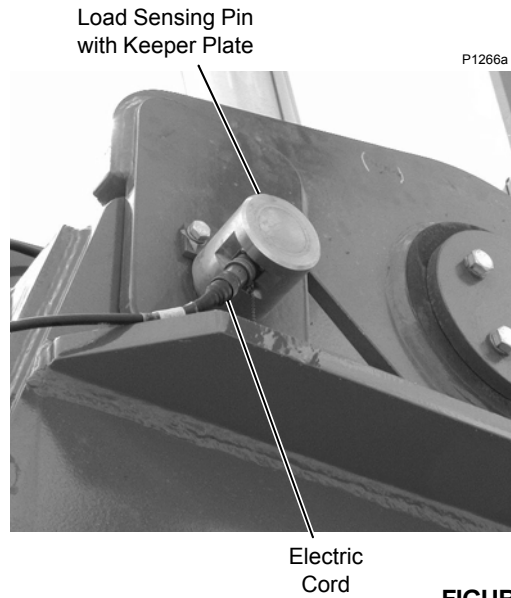


FIGURE 3-12

REPLACING LOAD SENSING PIN — HANGING COUNTERWEIGHT

If the load sensing pin fails, the hanging counterweight assembly will remain in its last position, the system fault alert will come on, and LOAD PIN will appear on the digital display.

The following instructions describe manual operation of the hanging counterweight assembly so the lift can be completed and the boom safely lowered to the ground.

WARNING

Falling Boom/Mast Hazard!

If load sensing pin fails, land load and boom as soon as possible using following procedure and correct cause of failure.

Read and follow instructions carefully to avoid structural damage to rotating bed, tipping, or possible collapse of attachment.

1. Turn off Max-Er mode.
2. If hanging counterweight is off foundation, go to step 4.
3. If hanging counterweight is on foundation, proceed as follows:
 - a. Check counterweight straps before proceeding — they must be tight. If straps are slack, tighten them using RAISE button on remote control, **but do not lift hanging counterweight off foundation.**

- b. **Without load**, position boom at desired angle within range given in Swing and Travel Specifications Chart.

With load, position boom at desired angle within range given in Max-Er Capacity Chart.

- c. Raise hanging counterweight with RAISE button on remote control so there is 6 to 8 in. (152 to 203 mm) clearance between foundation and tray.

4. **Without load**, go to step 5.

With load, proceed as follows:

- a. Travel, swing (*only if permitted*), and boom as required to position load.
- b. Slowly lower load until it lightly contacts landing area (land load only enough so it cannot shift).
- c. Lower hanging counterweight onto foundation using LOWER button on remote control until counterweight straps just start to slacken and STOP.



DANGER

Tipping Hazard!

Lower hanging counterweight onto foundation before:

- Attempting to unhook load.
- Raising boom above angle given in Minimum Boom Capacity to Swing and Travel column of Capacity Chart.
- Raising boom above angle given in Swing and Travel Specifications Chart.

Crane can tip backwards if this precaution is not observed.

- d. Land load and unhook.
- e. Position boom at desired angle within range given in Swing and Travel Specifications Chart.
- f. Raise hanging counterweight with RAISE button on remote control so there is 6 to 8 in. (152 to 203 mm) clearance between foundation and tray.
5. Travel and swing (*only if permitted*) as required to position crane at location where boom will be lowered.
6. Travel crawler rollers onto blocking if required to lower boom (refer to Max-Er Capacity Chart for specifications).
7. Slowly lower boom onto blocking (counterweight will lower).
8. If required, slacken counterweight straps using LOWER button on remote control.

See [Figure 3-12](#) for the remaining steps.

9. Disconnect electric cord from load sensing pin.

10. Check to see if load sensing pin is loose. If not, slowly Boom up or down only enough to remove loading on pin.
11. Remove load sensing pin.
12. Check new load sensing pin for proper calibration (refer to Sensor Adjustments folio in Max-Er Operator's/Parts Manual).
13. Install new load sensing pin and retain with keeper plate.

CAUTION

Load Sensing Pin Damage!

Align connecting holes as closely as possible so load sensing pin can be installed without excessive force.

Avoid hitting pin with a hammer. If it is necessary to hammer pin into place, hold a block of wood against end of pin and hammer against wood.

-
14. Connect electric cord to load sensing pin.
 15. Select and confirm Max-Er mode. Normal operation can now be resumed.

WIND CONDITIONS



WARNING

Tipping Crane Hazard!

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

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

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.

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

Wind speed at the boom or jib point can be greater than 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 and its attachments, see the Wind Conditions publication at the end of this section or, if applicable, in the Capacity Charts provided with this crane and its attachments.

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SECTION 4

SET-UP AND INSTALLATION

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SECTION 4

SET-UP AND INSTALLATION



WARNING

Avoid Death or Serious injury!

Read and understand instructions in this section before attempting to install or remove attachment.

Moving Parts/Pinch Points!

Avoid death or crushing injury during crane assembly and disassembly:

- Assembly personnel – take every precaution to prevent injury when working near moving parts.
- Maintain communication between operator and assemblers to avoid accidents.

KEEP UNAUTHORIZED PERSONNEL WELL CLEAR OF CRANE.

Falling Load Hazard!

To prevent lifting equipment from failing and load from dropping, crane owner/user shall verify following prior to each lift:

- All lifting equipment (shackles, hooks, slings, blocks) has been properly maintained and is safe for use.
- All lifting equipment has a capacity equal to or greater than load to be lifted.

DESCRIPTION

The MAX-ER Attachment has either a wheeled counterweight assembly or a hanging counterweight assembly which supplements the crane's counterweight. Added counterweight increases the crane's capacity while maintaining its ability to travel and swing with and without load (See MAX-ER Capacity Charts for swing and travel limitations).

The attachment consists of the following components ([FIGURE 4-1 continued](#)):

Wheeled Counterweight Assembly suspended from fixed mast by straps and cylinders (fastened to counterweight tray). The wheeled counterweight is connected to the rear of the crane by a support frame and struts or by a 2-piece shear frame.

Hanging Counterweight Assembly suspended from mast by straps and cylinders (fastened to counterweight tray). The hanging counterweight is connected to the rear of the crane by a 3-piece shear frame.

Counterweight Straps and Cylinders which suspend the counterweight assembly from the fixed mast. The cylinders automatically raise and lower the counterweight assembly in response to changes in load (weight of lifted load and boom angle).

Load Sensing Pins (3 each) which monitor counterweight strap loading and mast strap loading. The pins send electric signals to the crane's programmable controller.

See MAX-ER Adjustments in Section 6 for location of each load sensing pin.

Programmable Controller which operates the attachment's electric and hydraulic systems to automatically raise/lower the counterweight assembly in response to signals from the load sensing pins and boom hoist control handle.

Limit Switches which limit how high the counterweight assembly rises.

INSTALLATION AND REMOVAL NOTES

This section contains installation and removal instructions for the wheeled counterweight assembly — both the 40 ft (12,2 m) radius and the 59 ft (18,0 m) radius — and for the hanging counterweight assembly.

- For set-up and installation of the crane, the mast, and the boom, see the instructions in Section 4 of the Crane Operator Manual.
- For set-up and installation of the luffing jib, see the instructions in Section 4 of the Luffing Jib Operator Manual.

The attachment shall be installed, operated, and removed by experienced personnel trained in erection and operation of construction cranes. These personnel shall read and become thoroughly familiar with instructions in this section, in the Operator Manual supplied with the crane, and in the MAX-ER Capacity Charts before attempting to install, operate, or remove attachment.

Contact the Manitowoc Crane Care Lattice Team for a detailed explanation of any procedure you do not fully understand.

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

Level = 1% of grade or 1 ft (0,30 m) in 100 ft (30,5 m).

The area selected must be large enough to accommodate the 18000 with MAX-ER counterweight assembly, selected boom and jib length, and movement of an assist crane.

CRANE ORIENTATION

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

ACCESSING PARTS

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

Owner/user shall provide workers with approved ladders or aerial work platforms to access those areas of the crane, counterweight assembly, 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.

Do not use top of mast, boom, or telescopic beam as walkways.

ASSIST CRANE REQUIREMENTS

An assist crane is required to install and remove parts.

The heaviest individual weight to be lifted:

- For wheeled counterweight assembly — counterweight base and wheel support assembly which weighs 96,000 lb (43 545 kg)
- For hanging counterweight assembly — counterweight tray (with A-Frames and cylinders) which weighs 71,000 lb (32 206 kg)

Owner/user shall ensure that all rigging used to handle loads (hooks, slings, shackles, etc.) and assist crane are in safe, proper working order and sized to lift applicable load.

NOTE: If the 18000 is equipped with a boom length that can be operated with 0 lb (0 kg) of MAX-ER counterweight:

- The 18000 can be used to assemble and disassemble its own MAX-ER counterweight assembly.
- The 18000 can be traveled and swung to connect and disconnect the counterweight assembly to and from the crane.

Refer to the MAX-ER Capacity Chart to determine operating conditions with 0 lb (0 kg) of MAX-ER counterweight.

MAX-ER WEIGHTS

See Section 1 for the weights of individual MAX-ER components. See Section 1 of the Crane Operator Manual for the weights of boom, jib, and mast components.

OPERATING CONTROLS

Become thoroughly familiar with the location and function of all operating controls provided for the crane and attachment. Read and understand the instructions in Section 3.

COUNTERWEIGHT REQUIREMENT

MAX-ER operation requires the amount of counterweight specified in [FIGURE 4-1 continued](#).



WARNING

Tipping Hazard!

Tipping can occur if proper counterweight is not installed.

Do not operate crane with MAX-ER Attachment until proper counterweight is installed.

BLOCKED CRAWLERS

To prevent crane from tipping, some boom lengths must be raised and lowered over the front of blocked crawlers. See the Capacity Charts for blocked crawler requirements and to the Crawler Blocking Diagram in the Crane Operator Manual for instructions.



DANGER

Tipping Hazard!

Do not attempt to raise or lower boom from or to ground until crawlers are blocked if required. Crane will tip.

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 crane until all connecting pins are installed and properly retained.

MAX-ER MODIFICATIONS

The wheeled counterweight assembly from the 21000 MAX-ER can be used for the 18000 MAX-ER, provided the following modifications are made:

1. **Cylinder Stops** added to A-frame. See A-Frame Drawing 194294 dated 03-19-03.
2. **Strut Storage Brackets** added to A-Frame. See A-Frame Drawing 194294 dated 04-03-03.
3. **Steering Pin Adapter Plates** added to base support for Shear Frame installation. See Base Support Modification Drawing A07478 dated 01-15-03. The plates allow the wheels to be locked in the 40 ft (12,2 m) position for the 18000 MAX-ER or the 72 ft (21,9 m) position for the 21000 MAX-ER.

Reference Only

- ① = **Carbody Counterweight**
160,000 lb (72 575 kg) — Each End (3 Boxes Each End)
- ② = **Crane Counterweight**
493,000 lb (223 621 kg) — Total (13 Boxes Each Side)
- ③ = **Standard Wheeled Counterweight Assembly A07725 or A07727**
(All Boxes Furnish by Manitowoc)
(6 arrangements, depending on load handling requirements) —
- 0 lb (0 kg) without Shear Frame Attached
 - 244,000 lb (110 680 kg) — 2 Center Boxes
 - 464,000 lb (210 470 kg) — 2 Boxes Each Side, 3 Center Boxes
 - 596,000 lb (270 340 kg) — 3 Boxes Each Side, 4 Center Boxes
 - 772,000 lb (350 170 kg) — 5 Boxes Each Side, 4 Center Boxes
 - 860,000 lb (390 090 kg) — 6 Boxes Each Side, 4 Center Boxes

OR

- ③ = **Optional Wheeled Counterweight Assembly A16215 or A16216**
(All Side Boxes Furnish by Manitowoc and Center Boxes Furnish by Customer)
(6 arrangements, depending on load handling requirements) —
- 0 lb (0 kg) without Shear Frame Attached
 - 244,000 lb (110 680 kg) — 4 Center Boxes ¹
 - 464,000 lb (210 470 kg) — 2 Boxes Each Side, 6 Center Boxes ¹
 - 596,000 lb (270 340 kg) — 3 Boxes Each Side, 8 Center Boxes ¹
 - 772,000 lb (350 170 kg) — 5 Boxes Each Side, 8 Center Boxes ¹
 - 860,000 lb (390 090 kg) — 6 Boxes Each Side, 8 Center Boxes ¹

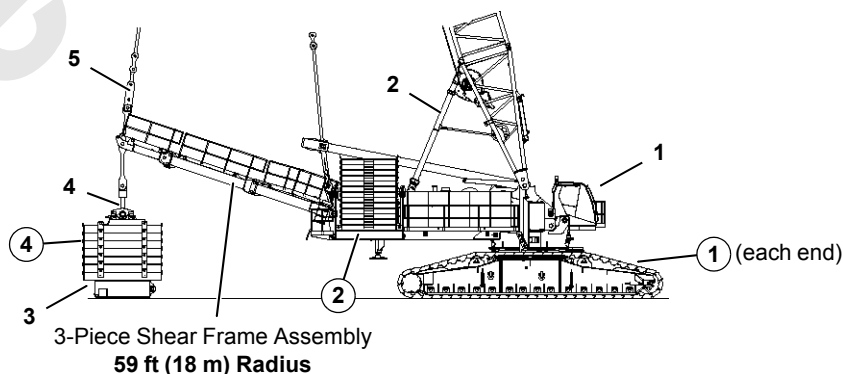
¹ Center Boxes Manufactured per Drawings A16054 and A16055

OR

- ④ = **Hanging Counterweight Assembly (Manitowoc Furnished Boxes)**
(6 arrangements, depending on load handling requirements) —
- 0 lb (0 kg) with Shear Frame Attached
 - 247,800 lb (112 400 kg) — 4 Center Boxes
 - 467,800 lb (212 190 kg) — 3 Boxes Each Side, 3 Center Boxes
 - 599,800 lb (272 060 kg) — 4 Boxes Each Side, 4 Center Boxes
 - 775,800 lb (351 900 kg) — 6 Boxes Each Side, 4 Center Boxes
 - 863,800 lb (391 810 kg) — 7 Boxes Each Side, 4 Center Boxes

OR

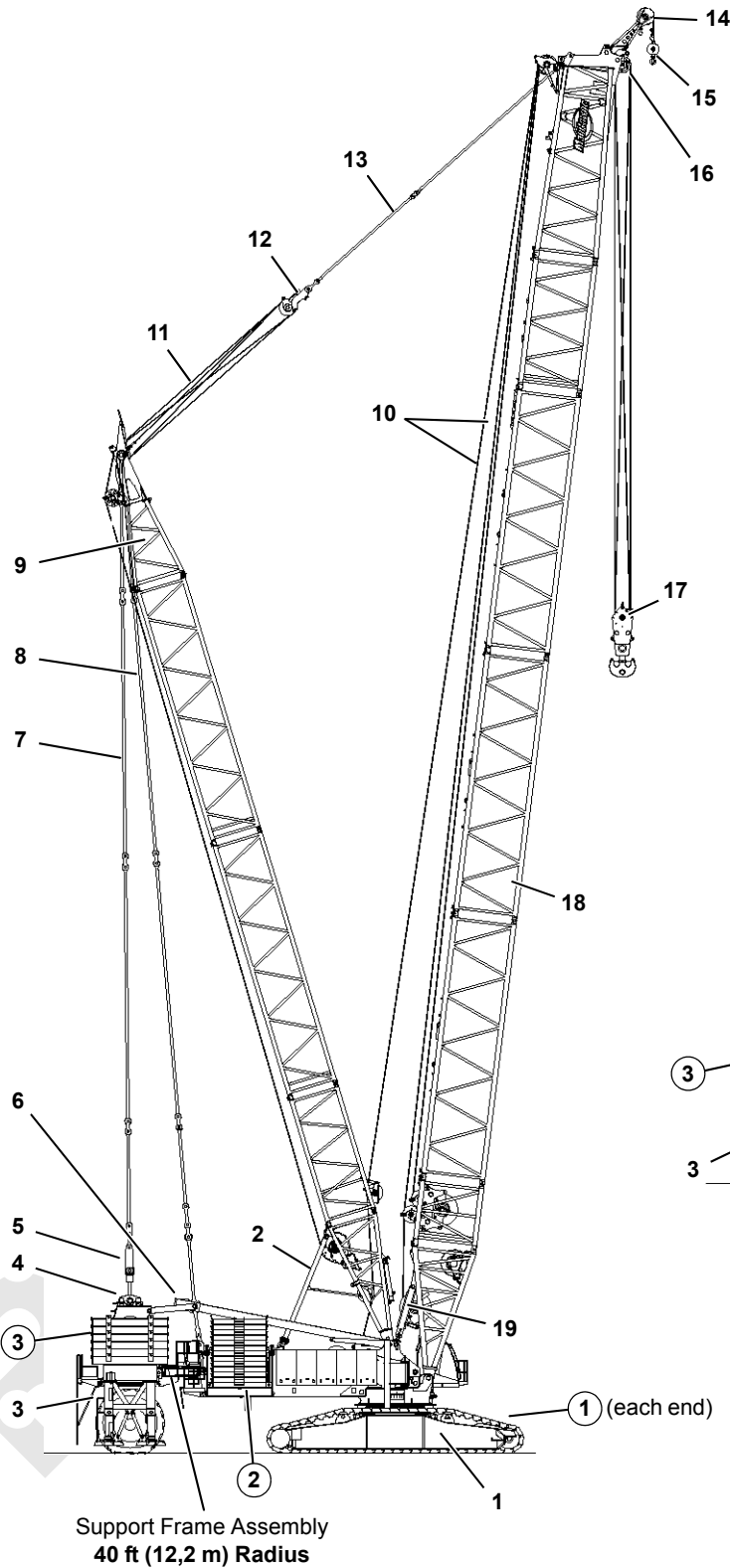
FOR COUNTERWEIGHT ARRANGEMENTS NOT IDENTIFIED ABOVE, SEE
COUNTERWEIGHT ASSEMBLY DRAWING AT THE ENF OF THIS SECTION.



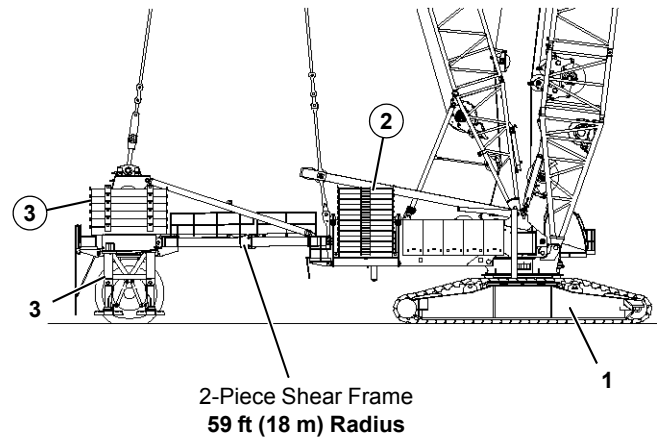
18000MOM4118

FIGURE 4-1

18000MOM4117



| Item | Description |
|------|--------------------------------|
| 1 | 18000 Crawler Crane |
| 2 | Hydraulic Mast Stop |
| 3 | Wheeled Counterweight Assembly |
| 4 | Counterweight Cylinders |
| 5 | Spreader Beam |
| 6 | Live Mast |
| 7 | Counterweight Straps |
| 8 | Mast Straps |
| 9 | 140 ft (42,7 m) #56 Fixed Mast |
| 10 | Load Lines |
| 11 | Boom Hoist Wire Rope |
| 12 | Boom Hoist Equalizer |
| 13 | Boom Straps |
| 14 | Upper Boom Point |
| 15 | Hook and Weighted Ball |
| 16 | Lower Boom Point |
| 17 | Load Block |
| 18 | #55 or #55A Boom |
| 19 | Physical Boom Stop |



4

FIGURE 4-1 continued

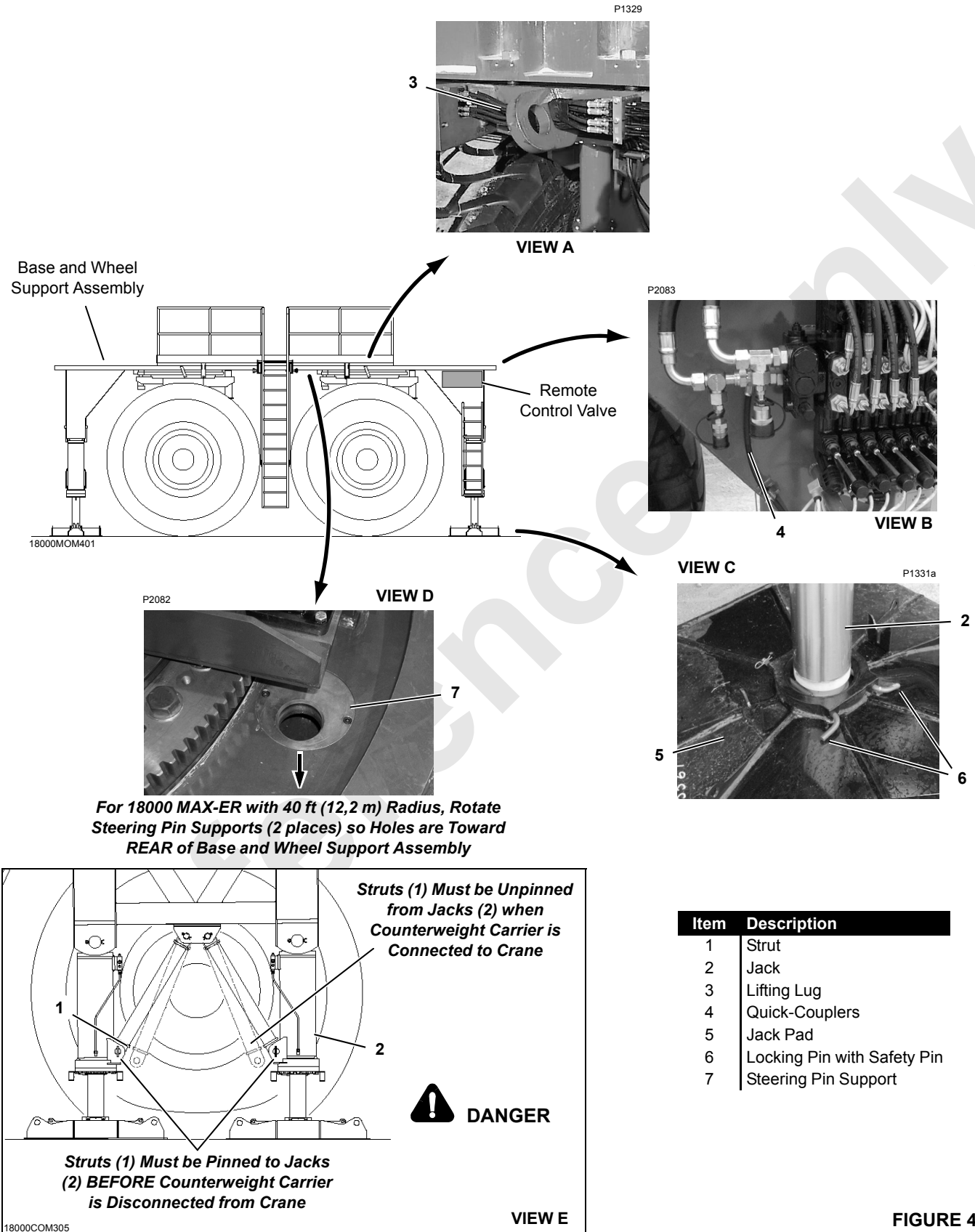


FIGURE 4-2

INSTALLING MAX-ER ATTACHMENT — WHEELED COUNTERWEIGHT

Prepare Crane

The 18000 must be traveled and swung (slightly) to connect the wheeled counterweight assembly to the crane.

If **another crane is used to assemble wheeled counterweight assembly**, connect wheeled counterweight assembly to 18000 before installing mast and boom so 18000 can be traveled and swung.

If **18000 is used to assemble wheeled counterweight assembly** (see Assist Crane Requirements), proceed to completely assemble 18000, including following (see Section 4 of Crane Operator Manual for detailed assembly instructions):

- Carbody counterweight
- Crane counterweight
- 140 ft (42,7 m) mast. Raise mast to operating position.
If boom is used as holdback to raise mast, do not install more than 320 ft (97,5 m) of boom. It will be necessary to raise boom so that crane can be traveled and swung when installing wheeled counterweight assembly.
- Boom — 320 ft (97,5 m) maximum

Assemble Counterweight Carrier

NOTE: The base and wheel support assembly is shipped in the following configuration from Manitowoc:

- Wheels in CRAB position
- Counterweight carrier jacks fully retracted
- Jacks pads removed
- Counterweight tray removed
- Support frame removed

See [Figure 4-2](#) for the following procedure. This procedure applies to 40 ft (12,2m) and 59 ft (18 m) radius.



WARNING

Tipping Hazard!

To prevent base and wheel support assembly from tipping over when counterweight carrier jacks (2) are extended, make sure struts (1, View E) are pinned to jacks.

1. Using assist crane, lift base and wheel support assembly into position on firm level foundation in assembly area.
Lift at four lifting lugs (3, View A) on base.
2. Lower base and wheel support with assist crane until tires are firmly against foundation, but **keep slings taut until step 6 is performed.**



WARNING

Tipping Hazard!

To prevent base and wheel support assembly from tipping over, keep lifting slings (step 2) taut until step 6 is performed.

3. Connect two hydraulic lines from hydraulic power unit (provided with 18000 or 21000) to quick-couplers (4) at remote control valve on right rear corner of base (View B).
4. Lift each jack pad (5, View C) into position and pin to jack (2).

NOTE: Prior to performing step 6, **note level of oil in hydraulic power unit.** Oil level must be returned to starting point before power unit is disconnected from base and wheel support assembly.



WARNING

Tipping Hazard!

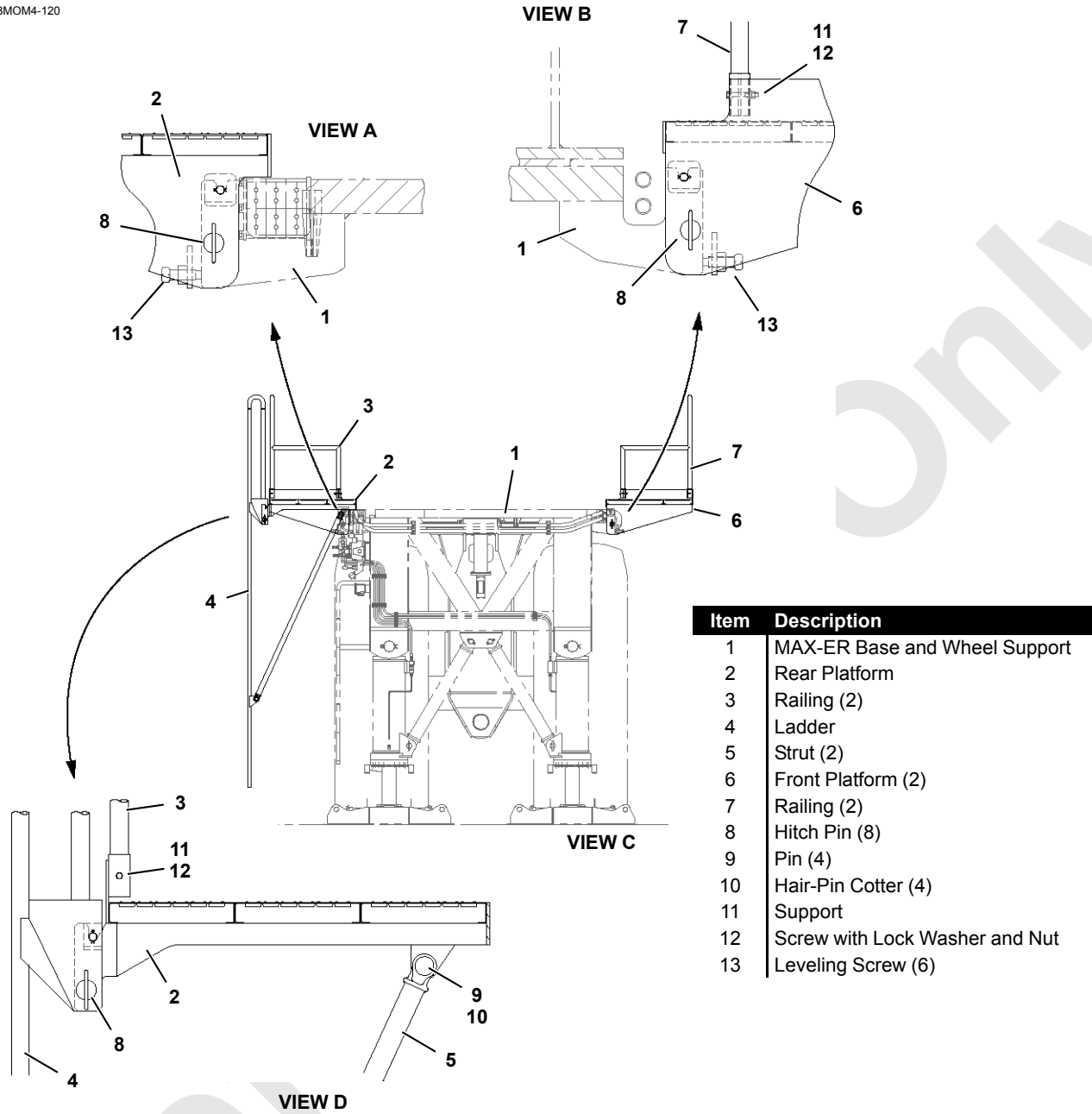
To prevent base and wheel support assembly from tipping over, keep it level from front to rear to within 2 in (51 mm). Keep lifting slings (step 2) taut until step 6 is performed.

5. Start hydraulic power unit.
6. Using manual remote controls, extend counterweight carrier jacks (2) until they are firmly against foundation and base and wheel support assembly is level.

NOTE: See Section 3 for identification and operation of the MAX-ER remote controls.

7. Stop hydraulic power unit.
8. Install platforms on base and wheel support assembly:
 - a. Install the past production platforms, ladder, and railings as shown in [Figure 4-3](#):
 - The platforms and ladder hook onto fixed pins and are secured with hitch pins.
 - Level the platforms with the screws provided.
 - b. Install the current production platforms, ladder, and railings as shown in [Figure 4-4](#):
 - The platforms and ladder hook onto fixed pins and are secured with hitch pins.
 - Raise the platforms from the shipping position (View B) and pin them in the working position (View C).

18MOM4-120



| Item | Description |
|------|--------------------------------|
| 1 | MAX-ER Base and Wheel Support |
| 2 | Rear Platform |
| 3 | Railing (2) |
| 4 | Ladder |
| 5 | Strut (2) |
| 6 | Front Platform (2) |
| 7 | Railing (2) |
| 8 | Hitch Pin (8) |
| 9 | Pin (4) |
| 10 | Hair-Pin Cotter (4) |
| 11 | Support |
| 12 | Screw with Lock Washer and Nut |
| 13 | Leveling Screw (6) |

18MOM4-120

FIGURE 4-3

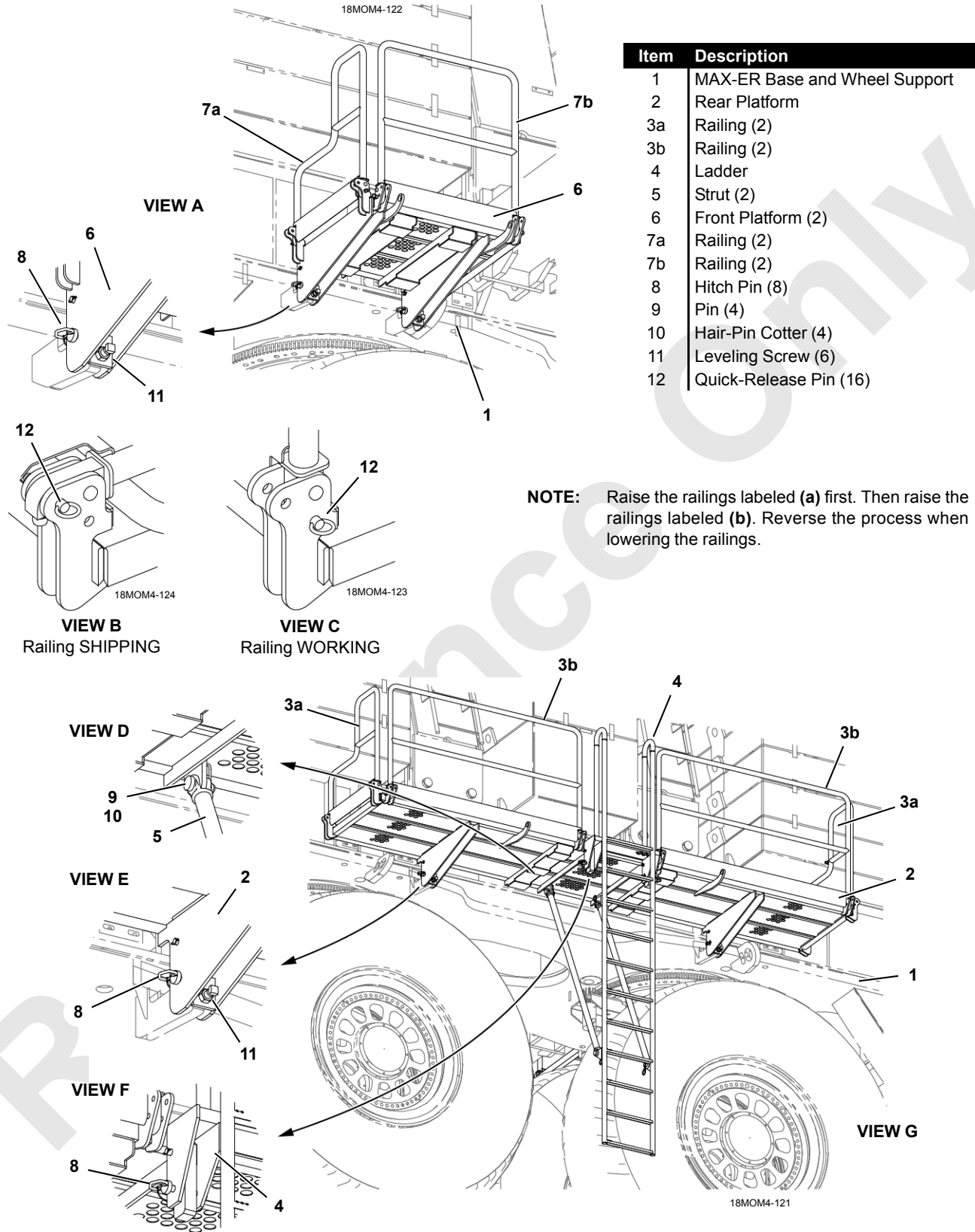
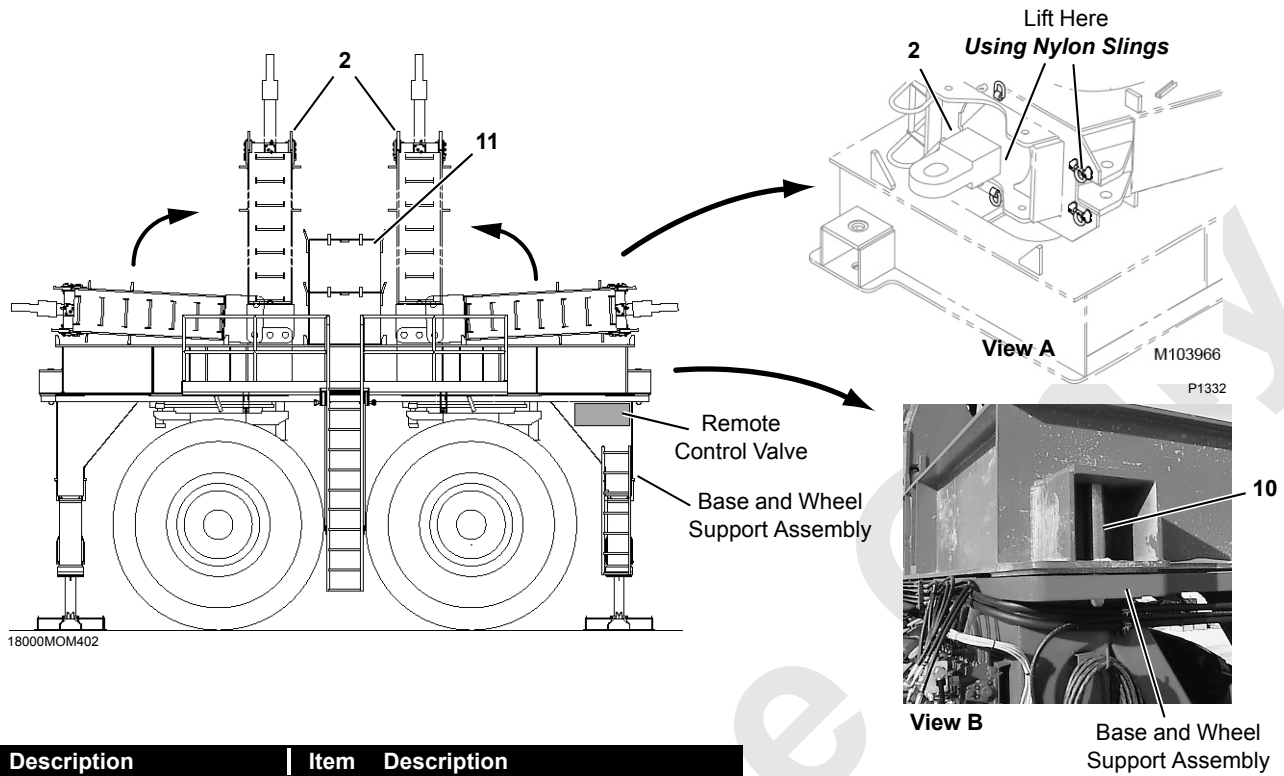


FIGURE 4-4



| Item | Description | Item | Description |
|------|----------------------|------|-----------------------------------|
| 1 | Counterweight Tray | 7 | Bolts |
| 2 | A-Frame and Cylinder | 8 | Setscrew |
| 3 | Sub-Plate | 9 | Nut |
| 4 | Bolt | 10 | Locating Pin |
| 5 | Bracket | 11 | Center Counterweight Box (2 each) |
| 6 | Locking Plate | | |

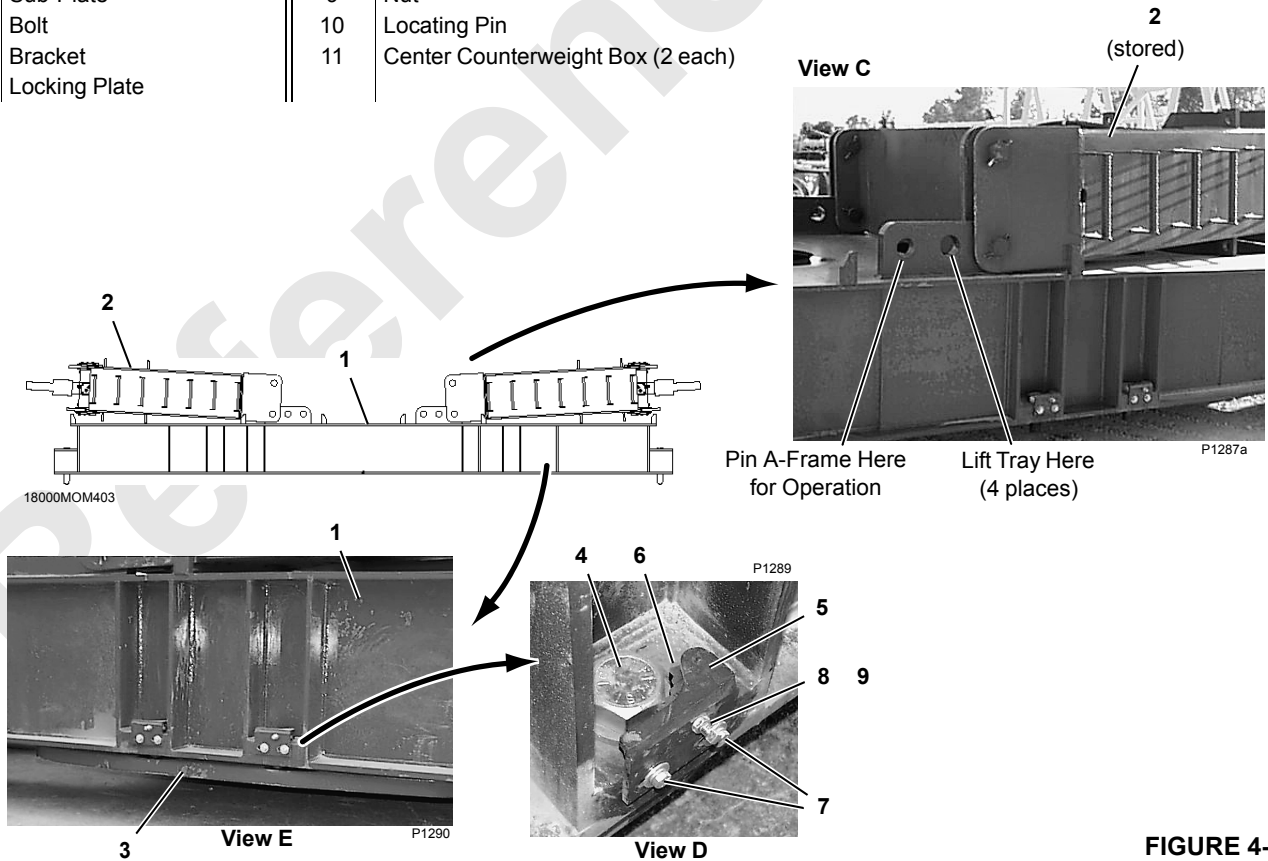


FIGURE 4-5

Assemble Counterweight Carrier (continued)

9. For MAX-ER with 40 ft (12,2 m) radius, attach steering pin supports (7, [Figure 4-2](#), View D) in proper position.

CAUTION**Tire Damage!**

Damage to tires will occur while swinging if step 9 is not performed.

See [Figure 4-5](#) for the following procedure.

NOTE: Counterweight tray (1) is shipped from Manitowoc with A-frame and cylinder assemblies (2) installed and stored as shown in View C. Sub-plates (3, View E) may or may not be installed.

Lift counterweight tray at four lifting holes shown in View C.

10. If not already done, remove each sub-plate (3, View E) from machined holes in bottom of counterweight tray (1), as follows:
- Lift counterweight tray (1) onto blocking approximately 12 in (0,3 m) high.
 - Hook onto sub-plate (3) with a sling from crane and hoist just enough to support sub-plate.
 - A lifting lug is provided in center of each sub-plate.
 - Remove brackets (5) and bolts (4, View D).
 - Lower sub-plate to ground.
11. Install counterweight tray (1) as follows:
- Lift counterweight tray (1) into position over base and wheel support assembly so that solenoid valve assembly on tray is on side opposite remote control valve on base.
- Align locating pins (10, View B) in tray with locating holes in base.
 - Lower tray onto base.
 - Install bolts (4, View D) and securely tighten.
 - Retain each bolt (4) by adjusting position of bracket (5, View D) so a tooth in locking plate (6) engages a corner of bolt (4). Securely tighten bolts (7) to lock position of bracket (5). Securely tighten setscrew (8) and nut (9) to lock position of locking plate (6).
12. Raise and pin A-frame and cylinder assemblies (2) in operating position.
- Lift only at holes in strut connecting lugs or D-rings (current production) on front side of A-frames (View A); use nylon lifting slings to prevent damage to machined holes.**
13. Store sub-plates (3) for future use. **They must be installed whenever counterweight tray is used for hanging counterweight assembly.**
14. For MAX-ER with 59 ft (18 m) radius install **no more or no less than two center counterweight boxes** before proceeding.
- See Install MAX-ER Counterweight Boxes in this section for procedure.

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

Prevent counterweight carrier from tipping over:

- Do not attach 2-piece shear frame to counterweight tray until two center counterweight boxes are installed.

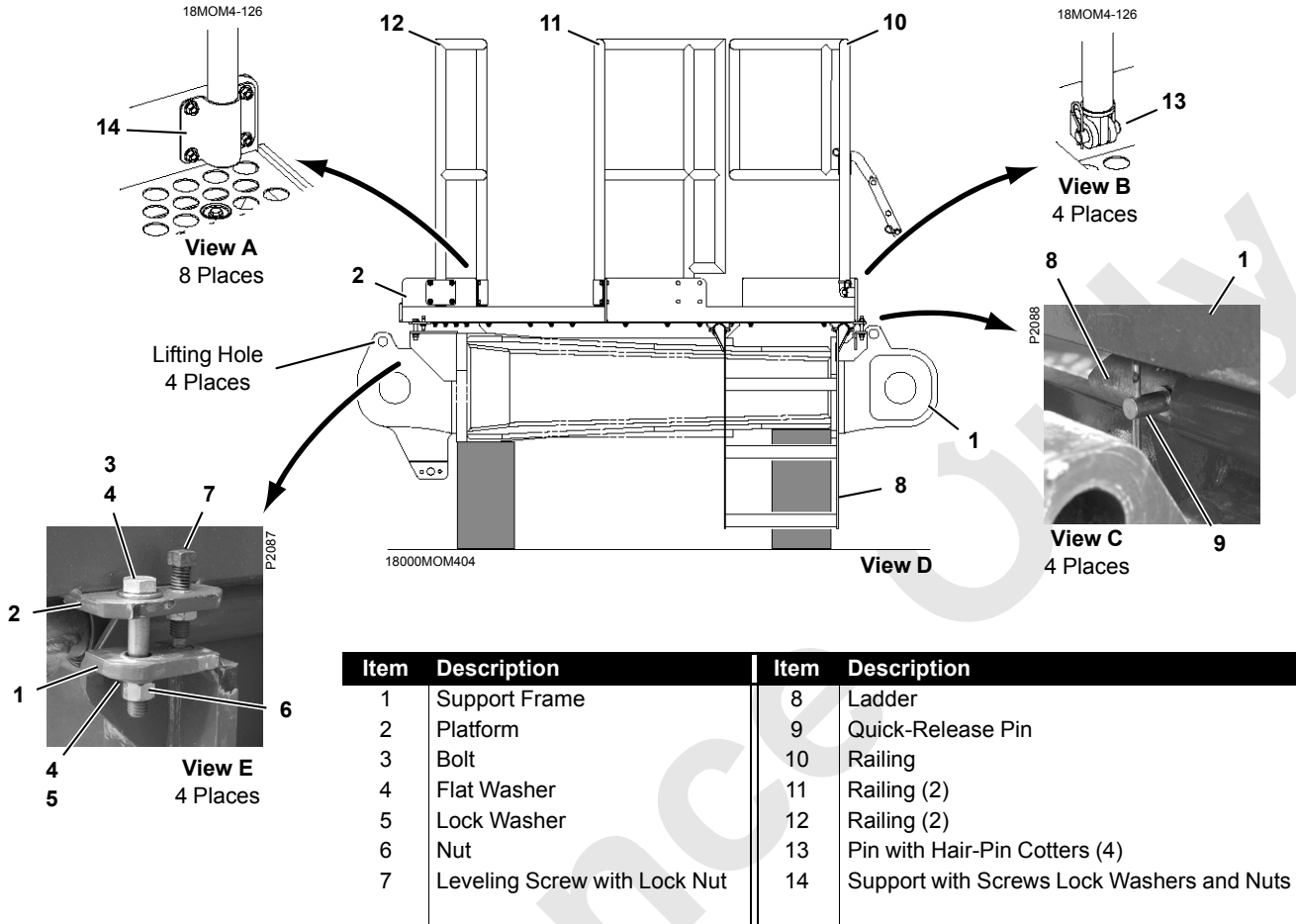


FIGURE 4-6

Install Support Frame – 40 ft (12,2 m) Radius

Install Support Frame Platform

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

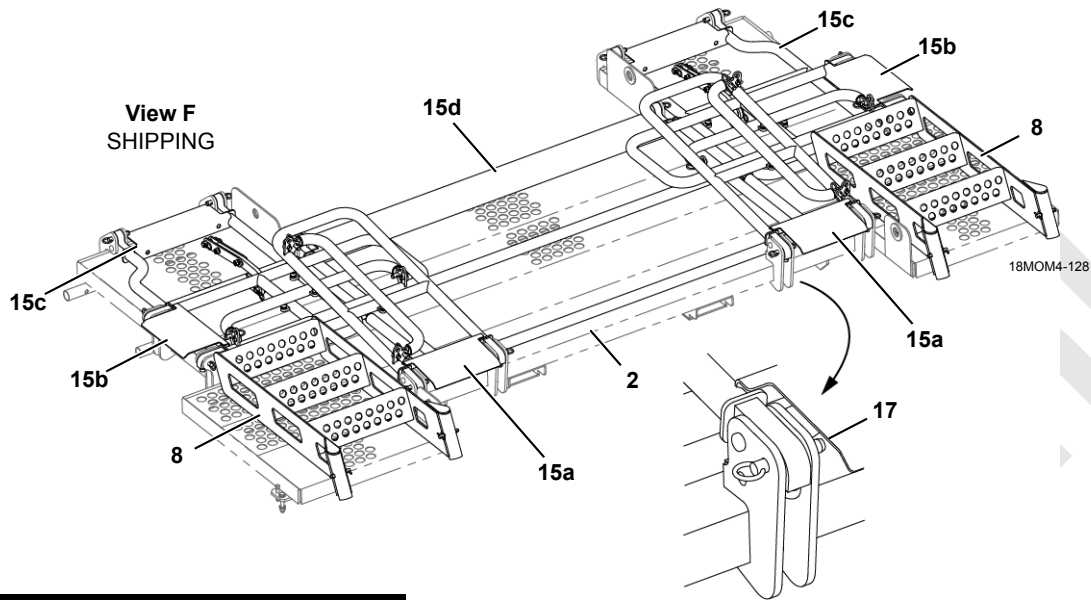
- Using owner-furnished lifting slings, lift support frame (1, View D) onto blocking at least 18 in (457 mm) high. Four lifting lugs are provided.
- Using owner-furnished lifting slings, lift work platform (2, View D) into position on support frame (1). Four lifting lugs are provided.

The current production platform also has fork-lift slots.

- Align connecting holes in platform with holes in support frame and securely install connecting bolts (3, View E).

NOTE: After support frame is installed and connected to rear of crane, adjust leveling screws (7, View E) to level platform (2).

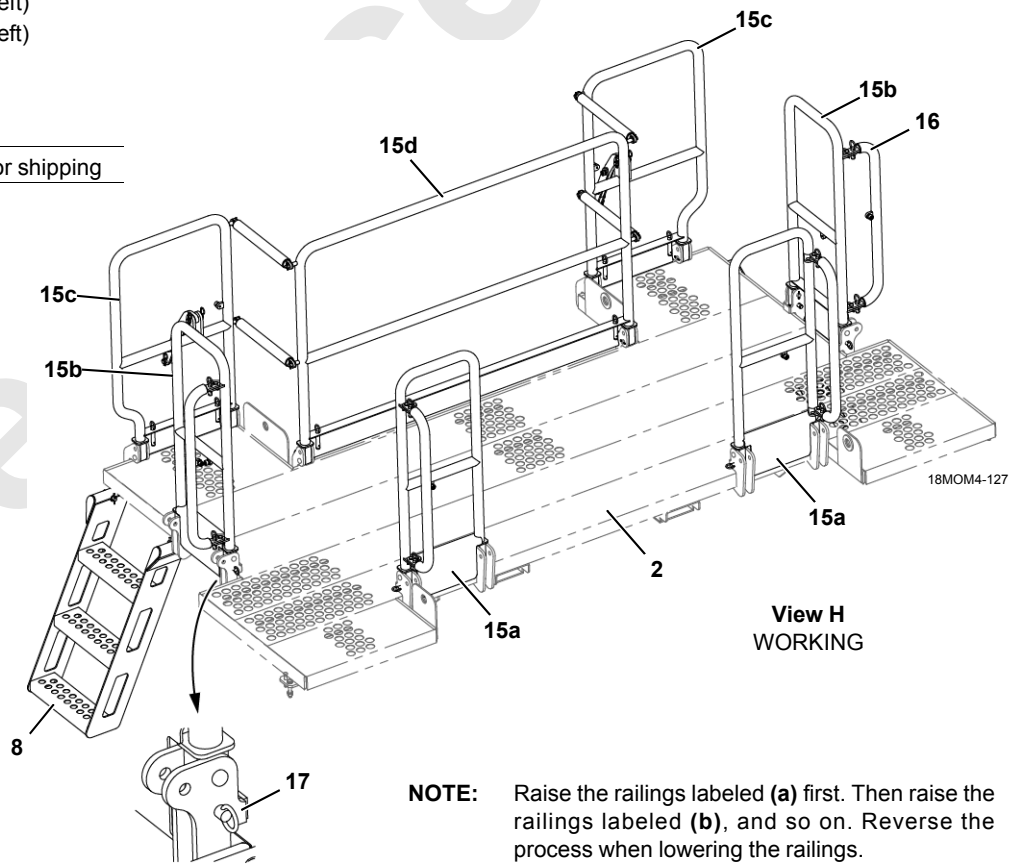
- Install ladders (8, View D) through tubes in platform (2) and install quick-release pins (9, View C).
- Attach past production railings (10, 11, and 12, View D) to the platform as shown in Views A and B.
- Raise the current production railings from the shipping position (View F) and pin them in the working position (View H).



VIEW G
Railing SHIPPING

| Item | Description |
|-----------------|--------------------------------|
| 2 | Platform |
| 15a | Railing (1, Right and 1, Left) |
| 15b | Railing (1, Right and 1, Left) |
| 15c | Railing (1, Right and 1, Left) |
| 15d | Railing |
| 16 ¹ | Railing Extension (4) |
| 17 | Quick-Release Pin (14) |

¹ Rotate out for working and in for shipping



View H
WORKING

VIEW J
Railing WORKING

NOTE: Raise the railings labeled (a) first. Then raise the railings labeled (b), and so on. Reverse the process when lowering the railings.

FIGURE 4-6 continued

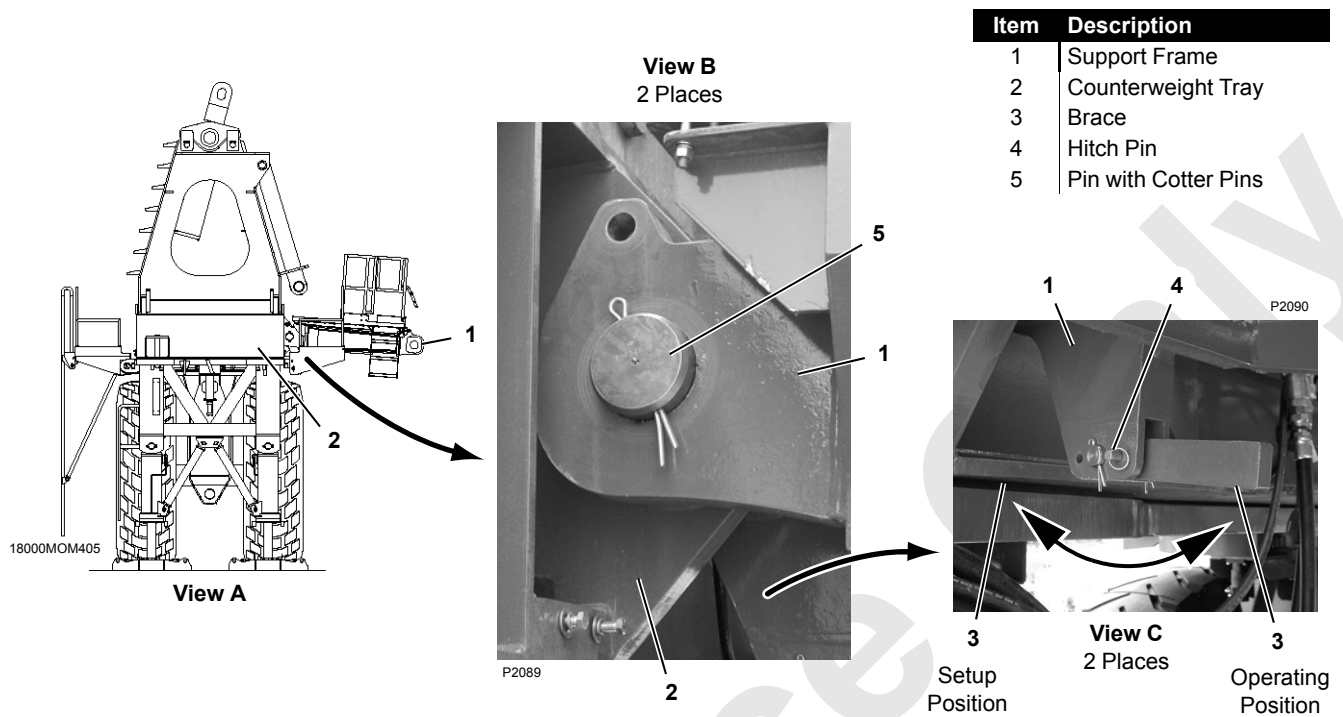


FIGURE 4-7

Install Support Frame

See [Figure 4-7](#) for the following procedure.

- Using owner-furnished lifting slings, lift support frame (1, View A) into position at front end of counterweight tray (2) – **wide side of frame toward tray**.
- Remove hitch pins (4, View C), rotate braces (3) to the setup position, and reinstall hitch pins (4).
- Align connecting holes and install pins (5, View B) to connect support frame (1) to counterweight tray (2).
- Lower support frame until lifting slings are slack. Braces (3) will hold the support frame in the setup position.
- Disconnect assist crane and remove lifting slings.

Install Pin Puller Brackets

See [Figure 4-8](#) for the following procedure.

For current production cranes with hydraulic pin pullers for connecting and disconnecting the MAX-ER support frame

pins, attach bracket (1) and strut (2) to both sides of the rotating bed with quick-release pins (3).

The pin puller cylinder and bracket assemblies are stored in the job box provided with the MAX-ER.

| Item | Description |
|------|-------------------|
| 1 | Bracket |
| 2 | Strut |
| 3 | Quick-Release Pin |

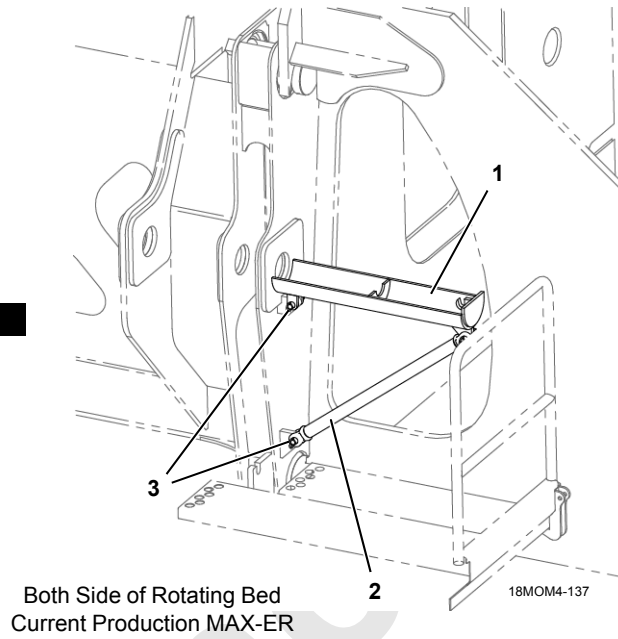
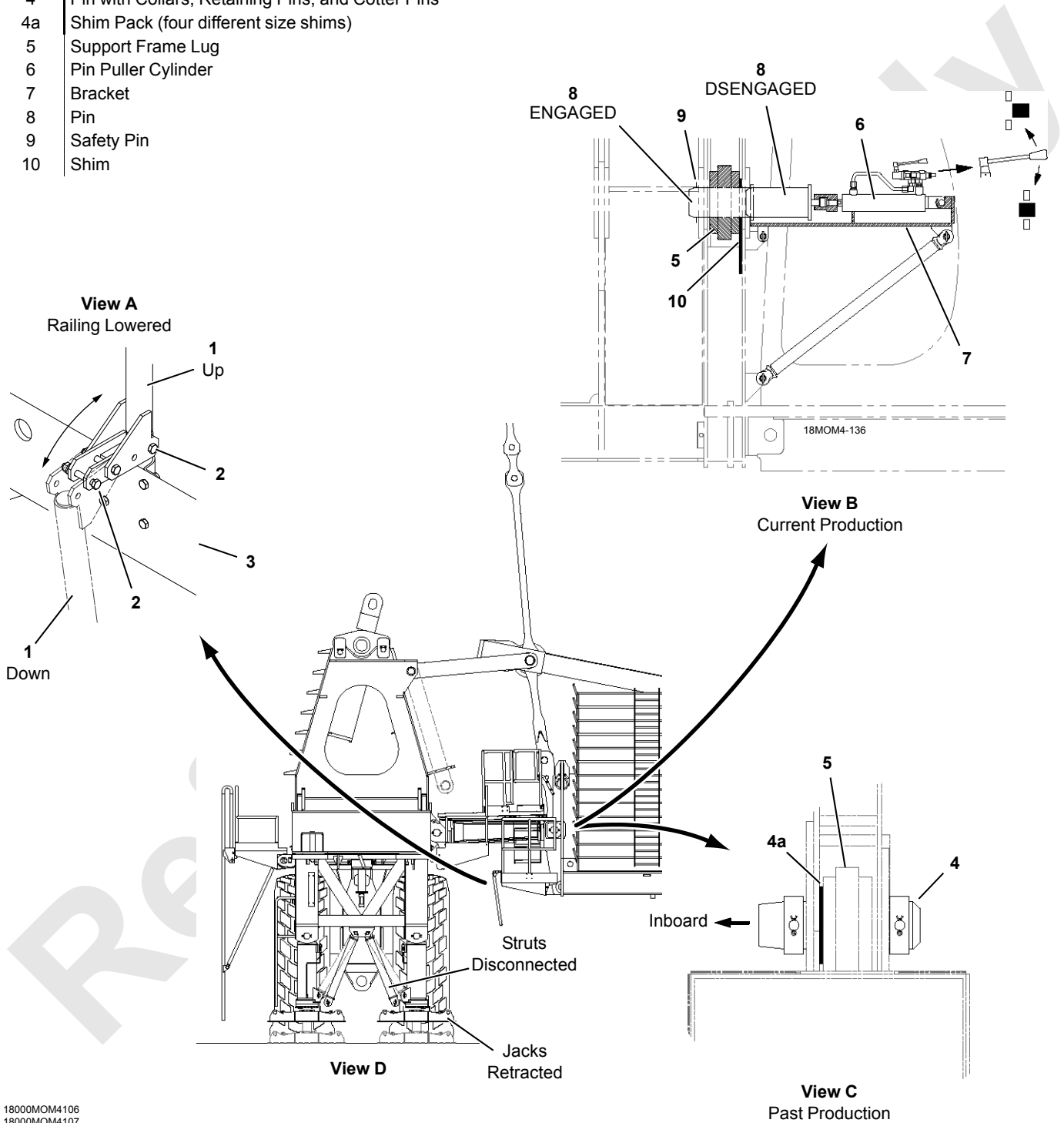


FIGURE 4-8

| Item | Description |
|------|---|
| 1 | Railing |
| 2 | Bolt with Lock Washer and Nut |
| 3 | Platform at Rear of Crane |
| 4 | Pin with Collars, Retaining Pins, and Cotter Pins |
| 4a | Shim Pack (four different size shims) |
| 5 | Support Frame Lug |
| 6 | Pin Puller Cylinder |
| 7 | Bracket |
| 8 | Pin |
| 9 | Safety Pin |
| 10 | Shim |



18000MOM4106
 18000MOM4107
 18000MOM4119

FIGURE 4-9

Connect Support Frame to 18000

See [Figure 4-9](#) for the following procedure.

1. Lower railing at rear of crane, as follows:
 - a. Support railing (1, View A) with slings from assist crane.
 - b. Remove bolts (2).
 - c. Lower railing and reinstall bolts (2, View A).
2. If disconnected, connect two hydraulic lines from hydraulic power unit (provided with 18000 or 21000) to quick-couplers (4, [Figure 4-2](#), View B) at remote control valve on right rear corner of base.
3. Start hydraulic power unit.
4. For past production MAX-ER, remove pins (4, View C) and shims (4a) and place them to the side.
5. For current production MAX-ER, proceed as follows (see View B):
 - a. Connect pin puller cylinder (6) to the hooked lug on bracket (7) on either side of the rotating bed.
 - b. Connect the hydraulic hoses from the pin puller cylinder to the hydraulic power unit.
 - c. Extend the pin puller cylinder as needed and connect the cylinder rod end to pin (8).
 - d. Remove safety pin (9).
 - e. Grasp the handle of shim (10).
 - f. Retract pin (8) and remove shim (10).
 - g. Repeat the above steps on the other side of the crane.
6. Travel and swing the 18000 as required to align the connecting holes in the rear of the rotating bed with the connecting holes in the support frame. **Use extreme**

caution not to knock over counterweight carrier with crane.

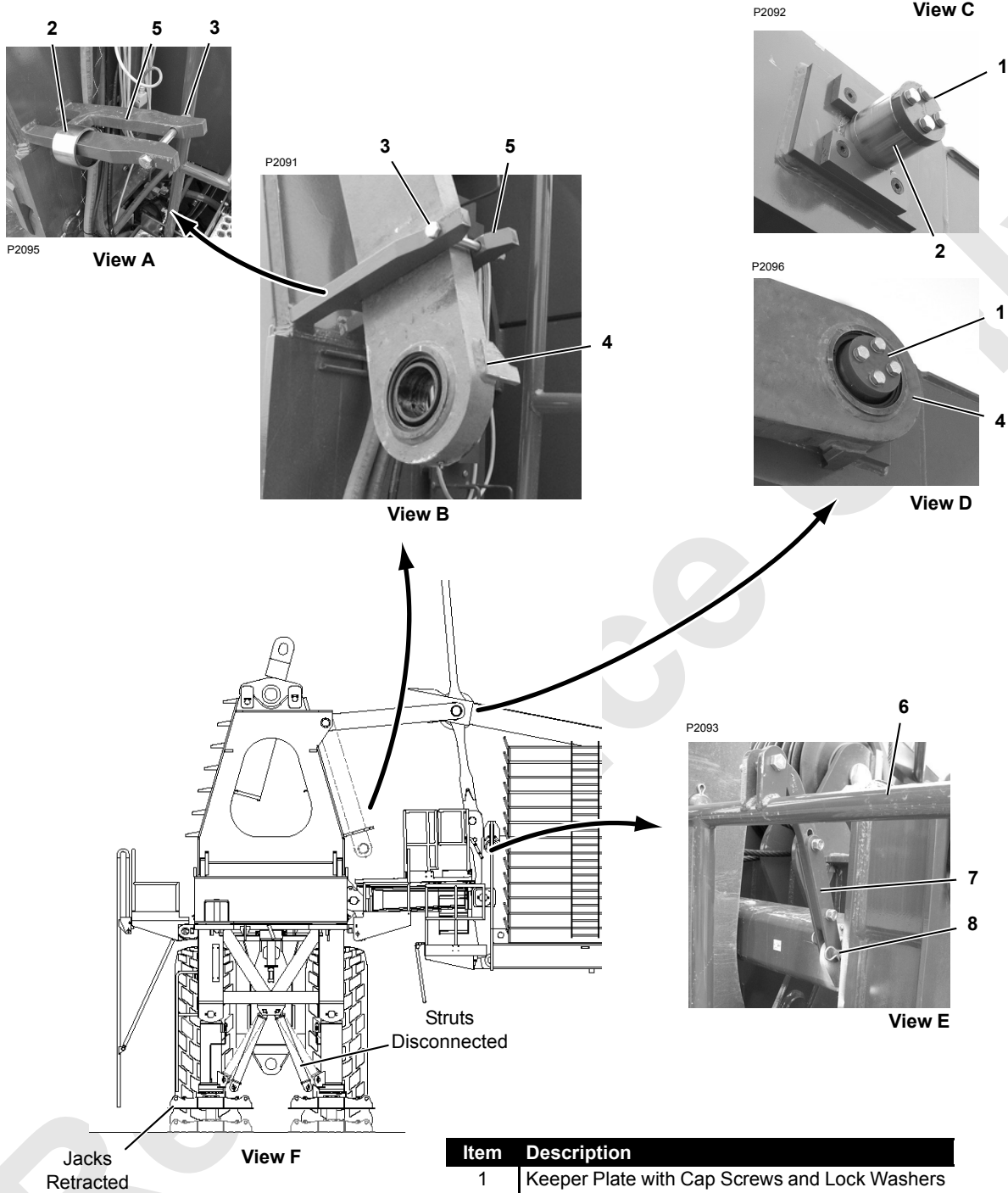
7. Using manual remote controls, extend and retract counterweight carrier jacks as required to assist in aligning connecting holes.

NOTE: See Section 3 for identification and operation of MAX-ER remote controls.

 **WARNING**
Tipping Hazard!

Prevent counterweight carrier from tipping over:

- Do not raise or lower connecting holes in support frame more than 7 in (179 mm) from level.
-
8. Once connecting holes are aligned on past production MAX-ER, proceed as follows:
 - a. Install connecting pins (4, View C).
 - b. Install shims (4a, View C) on **inboard side** of both support frame lugs (2) to limit side play.
 9. Once connecting holes are aligned for current production MAX-ER, proceed as follows (see View B):
 - a. On side with pin puller cylinder, align hole in shim (10) with holes in rotating bed and support frame. Shims must be installed on **outboard side** of both support frame lugs (2) to limit side play.
 - b. Extend the pin puller cylinder to engage pin (8).
 - c. Install safety pin (9).
 - d. Move the pin puller cylinder to the other side of the crane and repeat the steps.
 - e. Disconnect hydraulic power unit and store pin puller cylinder when done.



| Item | Description |
|------|---|
| 1 | Keeper Plate with Cap Screws and Lock Washers |
| 2 | Spacer |
| 3 | Bolt with Lock Washer and Nut |
| 4 | Strut |
| 5 | Bracket |
| 6 | Railing |
| 7 | Strut |
| 8 | Pin with Hair-Pin Cotter |

FIGURE 4-10

10. Connect struts to live mast, one side at a time, as follows:
 - a. Remove keeper plate (1, View C) and spacer (2) from end of mast shaft.
 - b. Remove bolt (3, View B) securing strut (4) to bracket (5).
 - c. Using sling from assist crane, raise strut (4) to operating position and securely connect it to end of mast shaft with keeper plate (1, View D).

Extend or retract counterweight carrier jacks and travel 18000 forward and back as required to assist in aligning hole in strut with mast shaft.
 - d. Store spacer (2) on bracket (5, View A) and install bolt (3).
 - e. Repeat steps for other strut.
11. Unpin struts from counterweight carrier jacks (View F) **before you retract jacks.**

If you fail to perform this step, struts and jacks can be damaged.
12. Fully retract counterweight carrier jacks using manual remote controls. This step must be performed to return hydraulic oil to its original level in hydraulic power unit.

If you fail to perform step, excess oil in crane's hydraulic system will overflow hydraulic tank.
13. Rotate railing (6, View E) to operating position and pin struts (7) to rear of rotating bed.
14. Rotate and pin braces (3, [Figure 4-7](#) View C) in operating position. ***Damage will occur if you don't perform this step.***

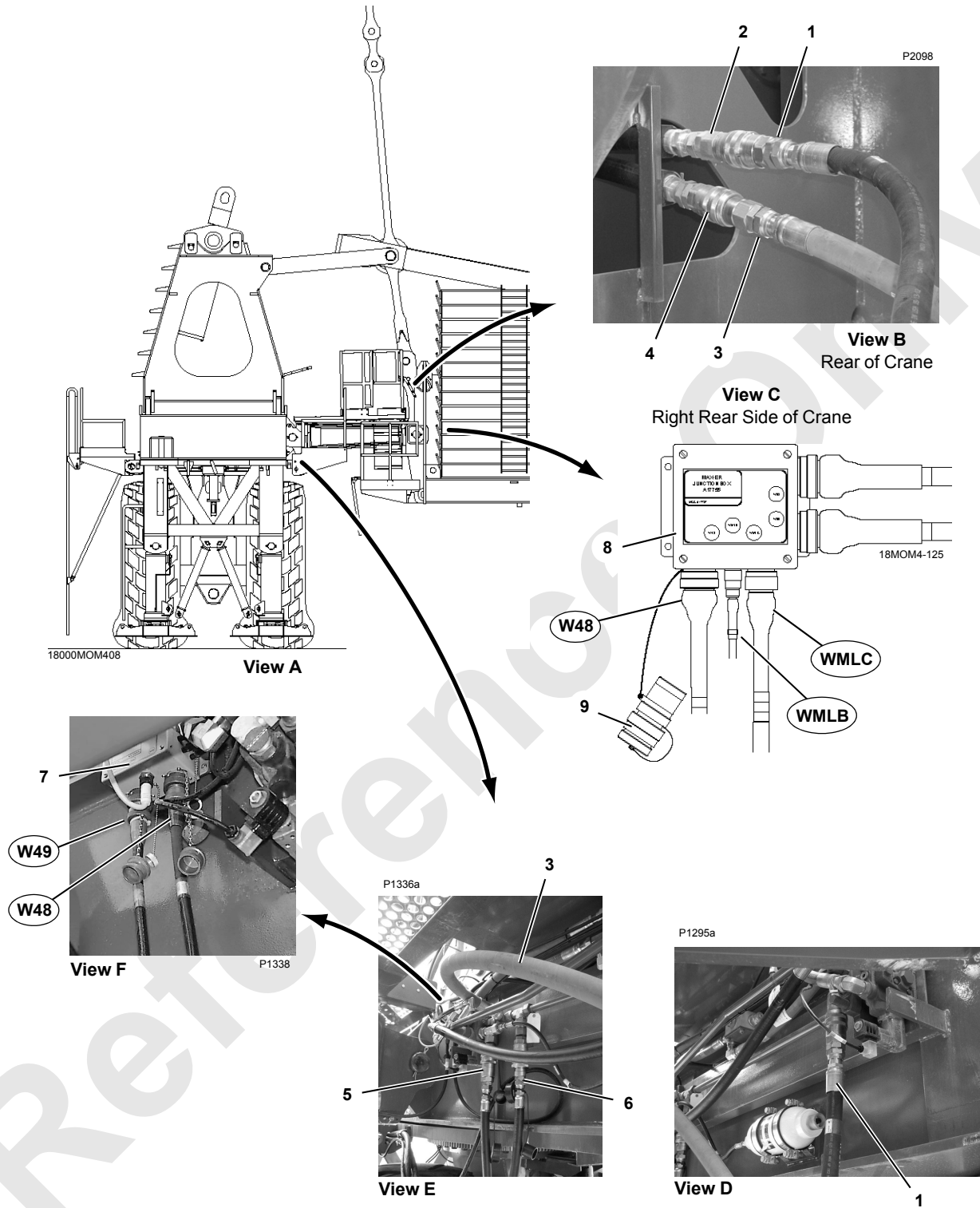


FIGURE 4-11

Connect Hydraulic Hoses

See [Figure 4-11](#) for the following procedure.

1. Connect coupler on end of hydraulic hose (1, View D) to nipple (2, View B) at rear of crane.
2. Connect nipple on end of hydraulic hose (3, View E) to coupler (4, View B) at rear of crane.
3. Connect hydraulic hoses (5 and 6, View E) from manual remote control on right rear corner of base and wheel support assembly to couplers on front of counterweight tray.

Connect Electric Cables

See [Figure 4-11](#) for the following procedure.

1. For current production crane, disconnect shorting plug (9, View C) from junction box (8, View C) on right rear corner of crane. Fasten the dust cap to the shorting plug.
2. Connect electric cable (W48) from junction box (7, View F) on front of counterweight tray to junction box (8, View C).
3. Connect electric cable (WMLC) from counterweight tray to junction box (8, View C).
4. Connect electric cable (W49) from base and wheel support assembly to junction box (7, View F).
5. Connect electric cable (WMLB) from live mast load pin to junction box (8, View C).

Component Identification for [Figure 4-11](#)

| Item | Description | Item | Description |
|------|---|------|-----------------------|
| 1 | Hydraulic Return Hose | 8 | Junction Box on Crane |
| 2 | Nipple | 9 | Shorting Plug |
| 3 | Hydraulic Supply Hose | | |
| 4 | Coupler | W48 | Electric Cable |
| 5 | Hydraulic Hose from Manual Remote Control | W49 | Electric Cable |
| 6 | Hydraulic Hose from Manual Remote Control | WMLB | Electric Cable |
| 7 | Junction Box on Counterweight Tray | WMLC | Electric Cable |

18000MOM409

| Item | Description |
|------|-------------------------------|
| 1 | Railing |
| 2 | Bolt with Lock Washer and Nut |
| 3 | Platform at Rear of Crane |

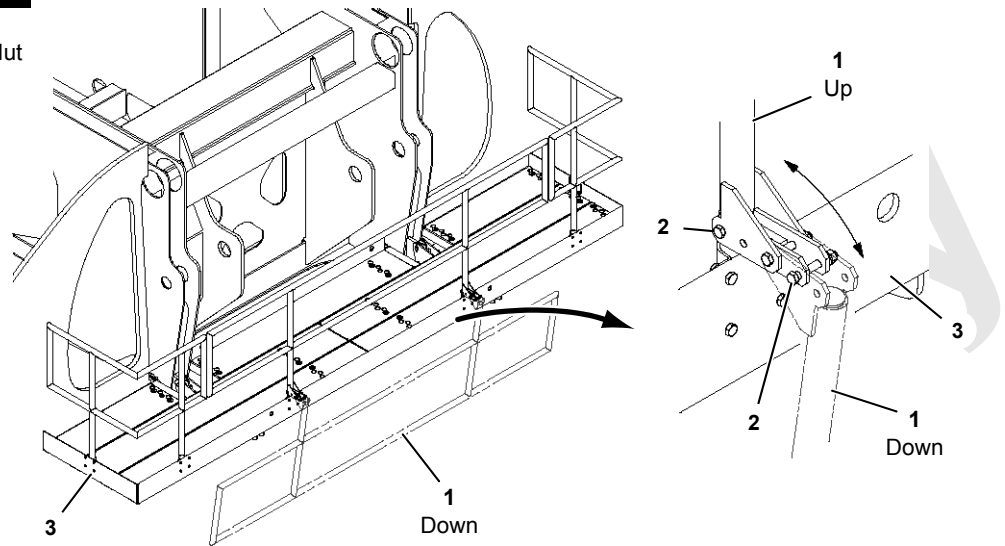
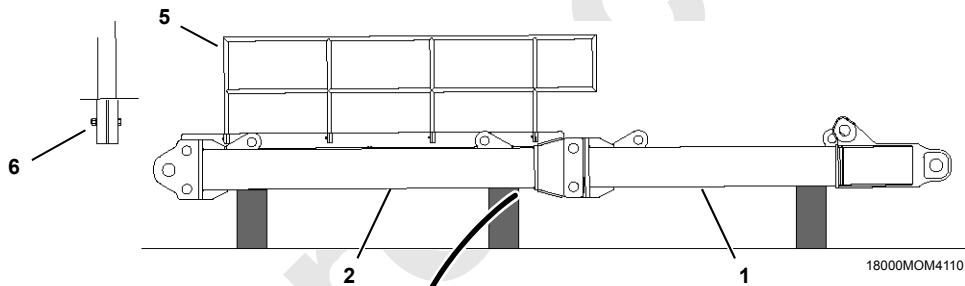


FIGURE 4-12



18000MOM4110



| Item | Description |
|------|--|
| 1 | Front Shear Frame |
| 2 | Rear Shear Frame |
| 3 | Connecting Pins with Cotter Pins |
| 4 | Lifting Lug (4 each frame) |
| 5 | Railing (2) |
| 6 | Support with Screw, Lock Washer, and Nut (8) |

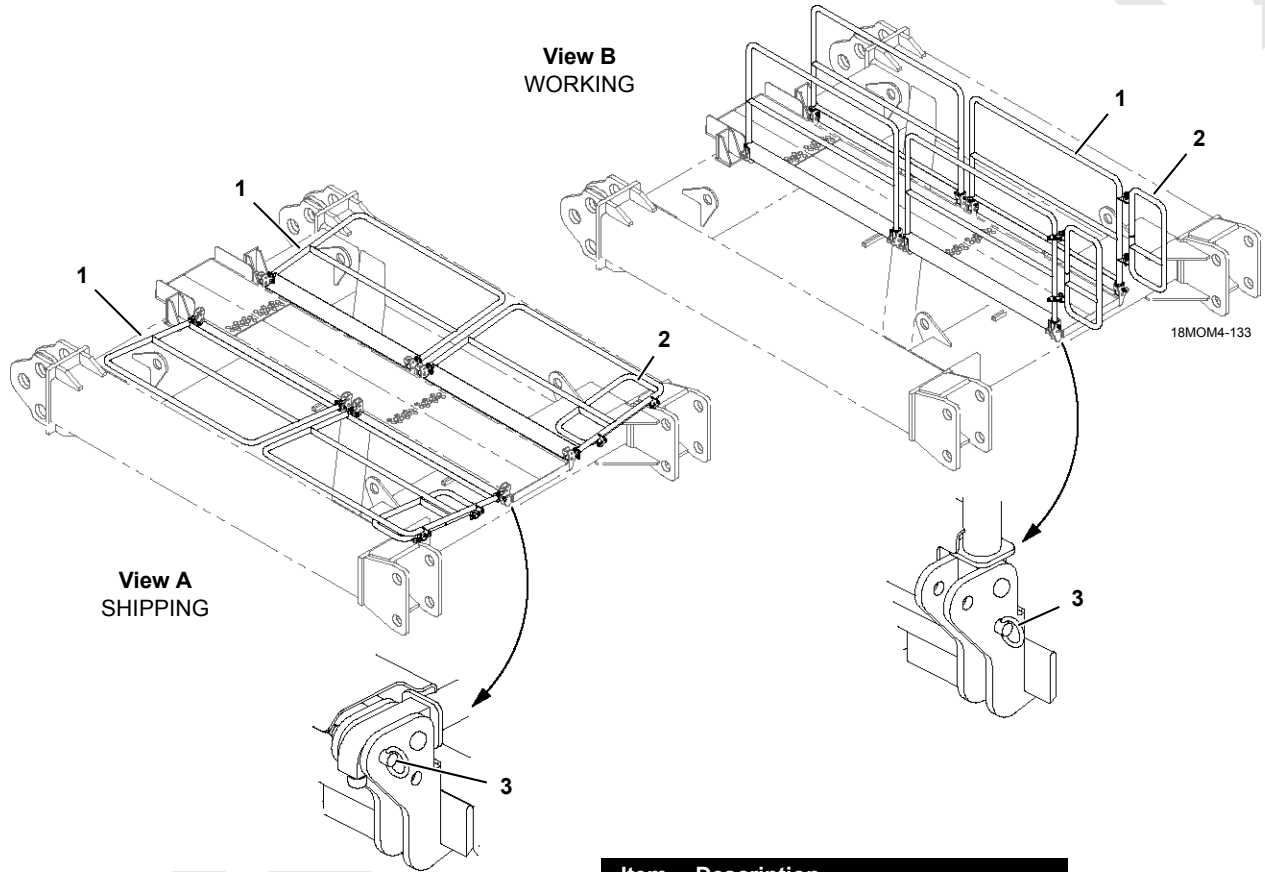
FIGURE 4-13

Install Shear Frame – 59 ft (18 m) Radius

Assemble Shear Frame

See [Figure 4-13](#) for the following procedure.

1. Lift front shear (1) onto blocking approximately 12 in (0,3 m) high. Lift at four lifting lugs (4) provided on shear frame.
2. Lift rear shear frame (2) into position at front shear frame (1) and align connecting holes. Lift at four lifting lugs (4) provided on shear frame.
3. Install pins (3, View A) to connect rear shear frame (2) to front shear frame (1).
4. Block under rear shear frame.
5. On past production MAX-ER, fasten railings (5) to brackets (6).
6. For current production MAX-ER, raise the railings from the shipping position (View A, [Figure 4-14](#)) and pin them in the working position (View B).



| Item | Description |
|----------------|--------------------------------|
| 1 | Railing (2, Right and 2, Left) |
| 2 ¹ | Railing Extension (2) |
| 3 | Quick-Release Pin (8) |

¹ Rotate out for working and in for shipping

FIGURE 4-14

18000MOM411
18000MOM412
18000MOM413

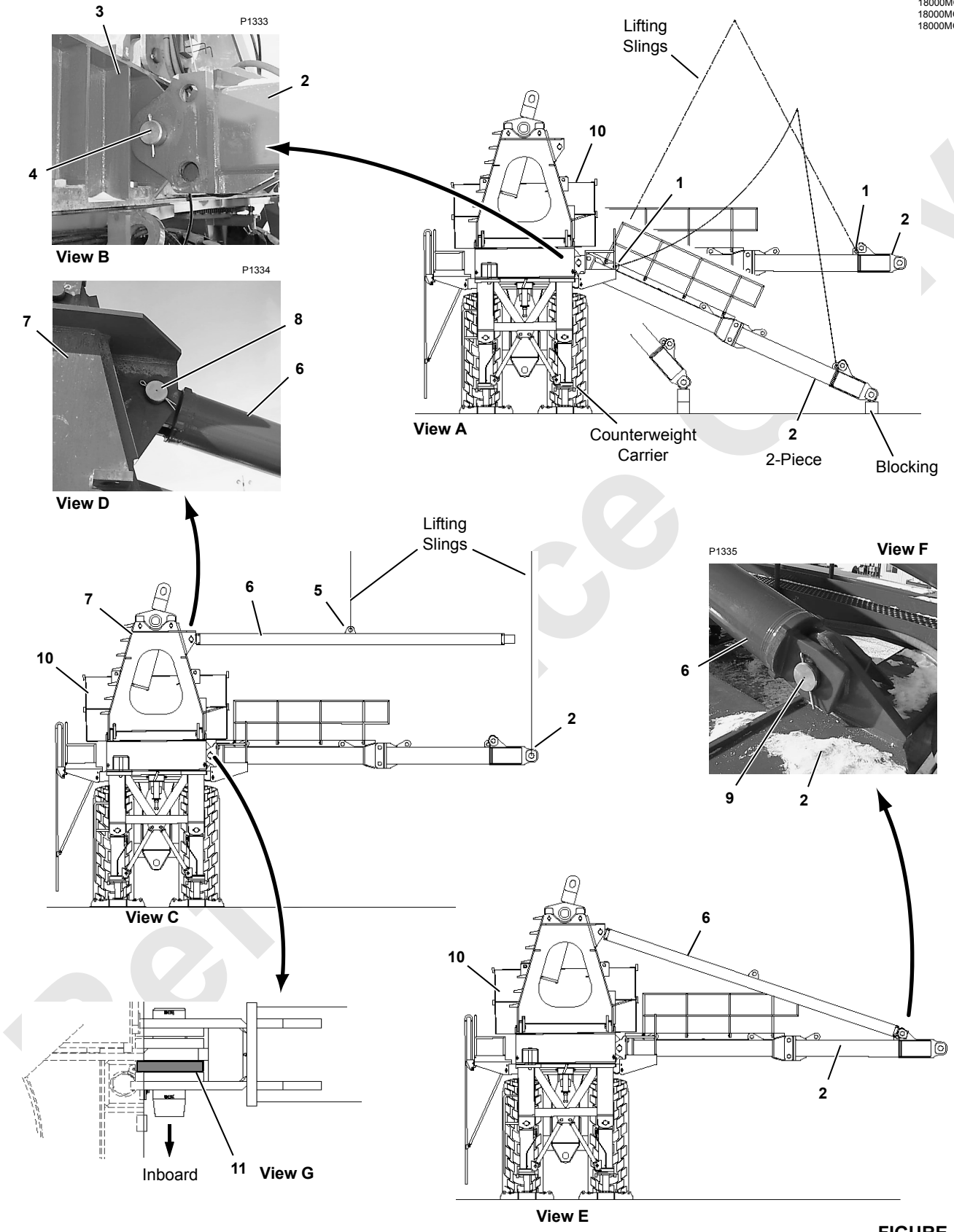


FIGURE 4-15

Component Identification for [Figure 4-15](#)

| Item | Description |
|------|---------------------------------------|
| 1 | Lifting Lugs |
| 2 | Shear Frame |
| 3 | Counterweight Tray |
| 4 | Pin with Cotter Pins |
| 5 | Lifting Lug |
| 6 | Shear Frame Strut |
| 7 | A-Frame |
| 8 | Pin with Cotter Pins |
| 9 | Pin with Cotter Pins |
| 10 | Center Counterweight Box (2 each) |
| 11 | Shim Pack (four different size shims) |

Install Shear Frame

See [Figure 4-15](#) for the following procedure.

- If not already done, **install two center counterweight boxes (10) before installing 2-piece shear frame.**
 - Using four lifting lugs (1) on shear frame (2), lift shear frame into position at front of counterweight carrier (View A).
 - Align connecting holes on shear frame with holes (2, View B) to counterweight tray (3).
 - Once holes are aligned, install connecting pins (4, View B).
Install shims (11, View G) on **inboard side** of both support frame lugs to limit side play.
 - Lower shear frame assembly onto blocking 12 in (305 mm) high at ground level.
- NOTE:** Two cranes are required for steps [6](#) and [7](#).
- Reconnect lifting slings to shear frame (2) as shown in View C and lift shear frame to horizontal.
 - Install each shear frame strut (6), as follows:
 - Using lifting lug (5) on shear frame strut (6), lift shear frame strut into position at A-frame (7, View C).
 - Align connecting holes and pin either end of shear frame strut (6) to A-frame (7, View D). *Both ends of strut are same.*
 - Lower shear frame strut (6), align connecting holes, and pin to shear frame (2, View F).
 - Disconnect cranes and remove slings.

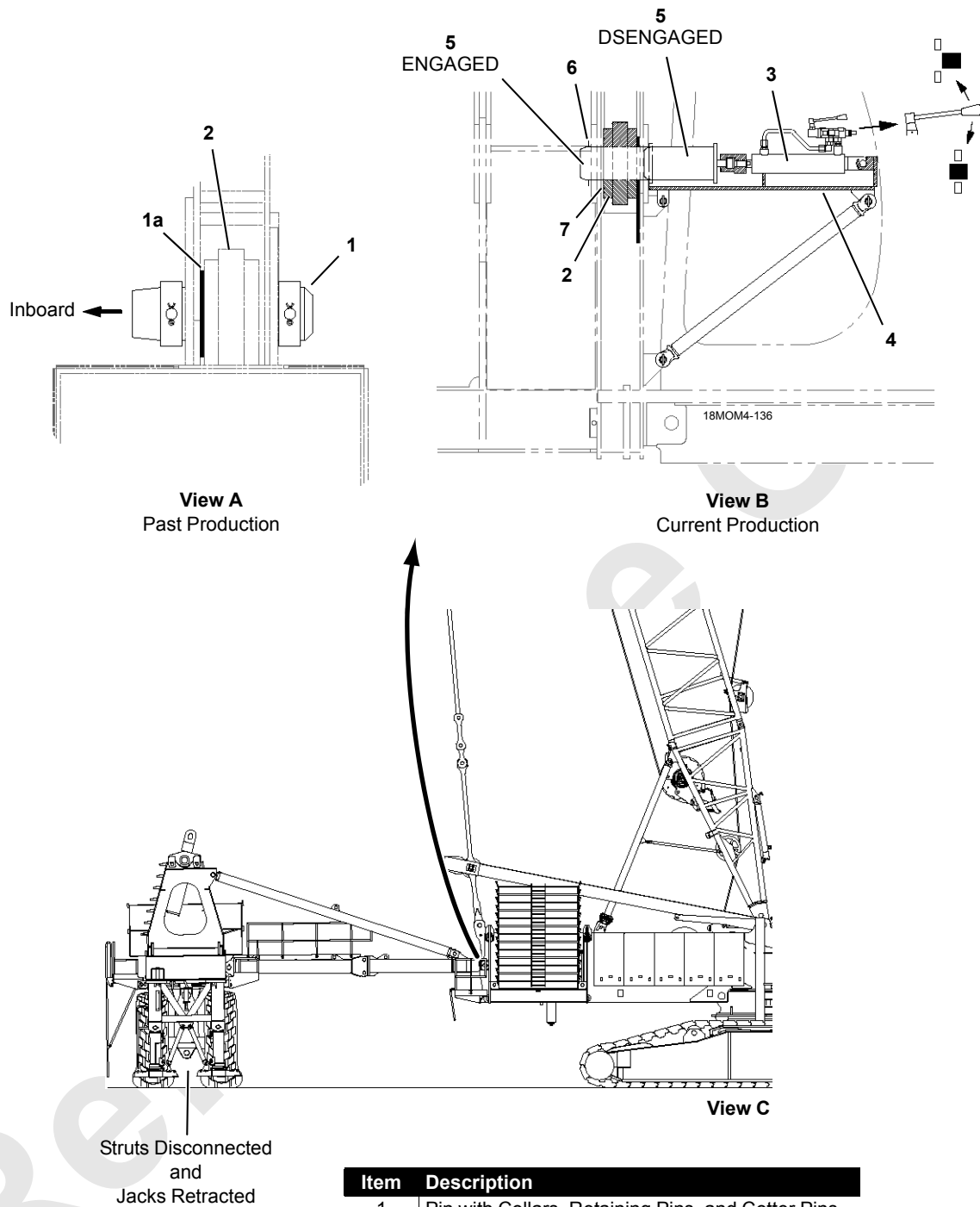


FIGURE 4-16

Connect Shear Frame to 18000

See [Figure 4-16](#) for the following procedure.

1. If disconnected, connect two hydraulic lines from hydraulic power unit (provided with 18000 or 21000) to quick-couplers (4, [Figure 4-2](#), View B) at remote control valve on right rear corner of base.

Start hydraulic power unit.

2. For past production MAX-ER, remove pins (1, View A) and shims (1a) and place them to the side.
3. For current production MAX-ER, proceed as follows (see View B):
 - a. Connect pin puller cylinder (3) to the hooked lug on bracket (4) on either side of the rotating bed.
 - b. Connect the hydraulic hoses from the pin puller cylinder to the hydraulic power unit.
 - c. Extend the pin puller cylinder as needed and connect the cylinder rod end to pin (5).
 - d. Remove safety pin (6).
 - e. Grasp the handle of shim (7).
 - f. Retract pin (5) and remove shim (7).
 - g. Repeat the above steps on the other side of the crane.
4. Travel and swing the 18000 as required to align the connecting holes in the rear of the rotating bed with the connecting holes in the support frame. **Use extreme caution not to knock over counterweight carrier with crane.**

5. Using manual remote controls, extend and retract counterweight carrier jacks as required to assist in aligning connecting holes.

NOTE: See Section 3 for identification and operation of MAX-ER remote controls.



WARNING

Tipping Hazard!

Prevent counterweight carrier from tipping over:

- Do not raise or lower connecting holes in support frame more than 12 in (305 mm) from level.
6. Once connecting holes are aligned on past production MAX-ER, proceed as follows:
 - a. Install connecting pins (1, View A).
 - b. Install shims (1a, View G) on **inboard side** of both shear frame lugs (2) to limit side play.
 7. Once connecting holes are aligned for current production MAX-ER, proceed as follows (see View B):
 - a. On side with pin puller cylinder, align hole in shim (7) with holes in rotating bed and shear frame. Shims must be installed on **inboard side** of both shear frame lugs (2) to limit side play.
 - b. Extend the pin puller cylinder to engage pin (5).
 - c. Install safety pin (6).
 - d. Move the pin puller cylinder to the other side of the crane and repeat the steps.
 - e. Store pin puller cylinder when done.

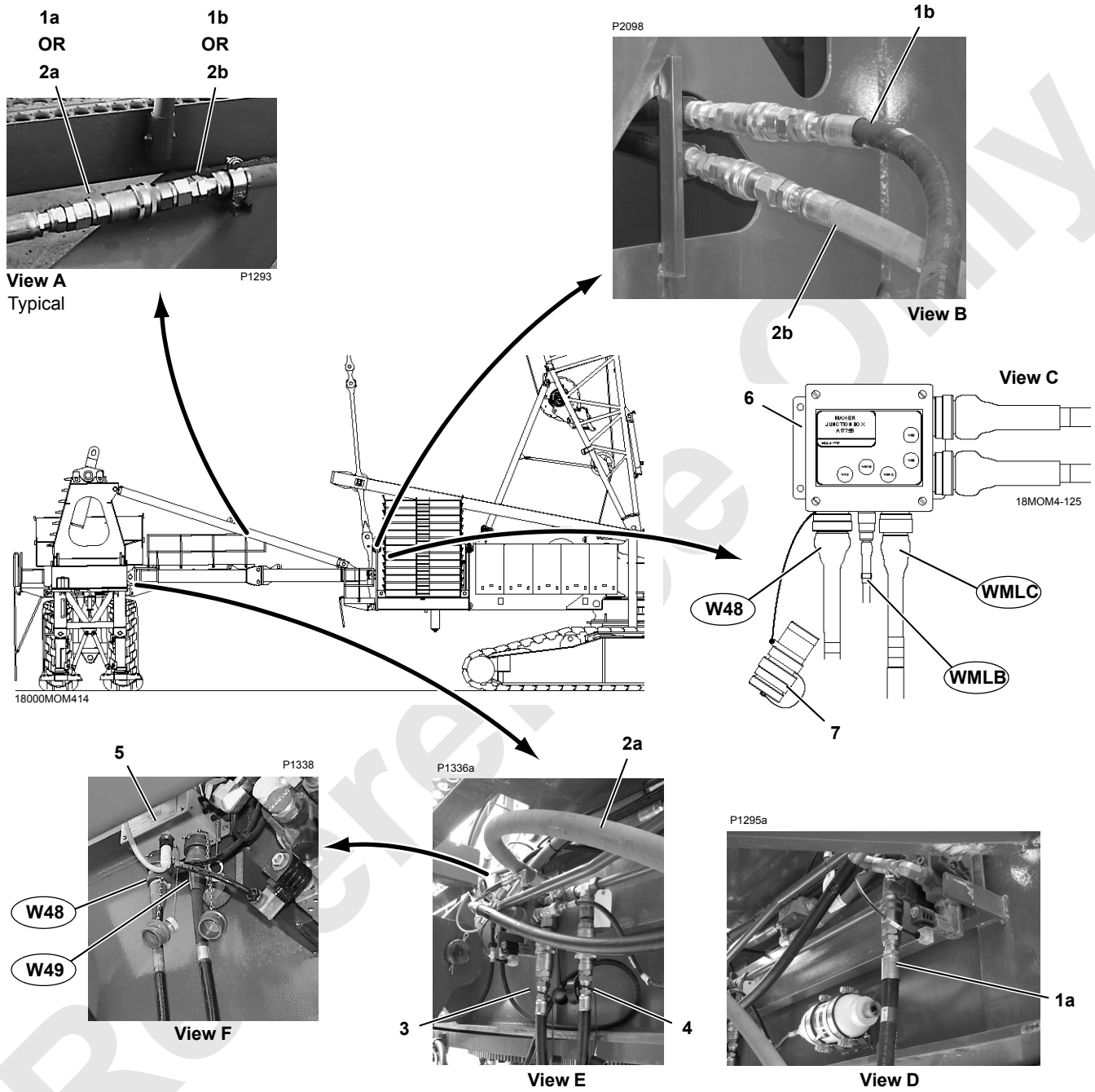


FIGURE 4-17

Component Identification for [Figure 4-17](#)

| Item | Description |
|------|---|
| 1a | Hydraulic Return Hose |
| 1b | Hydraulic Return Hose |
| 2a | Hydraulic Supply Hoses |
| 2b | Hydraulic Supply Hoses |
| 3 | Hydraulic Hose from Manual Remote Control |
| 4 | Hydraulic Hose from Manual Remote Control |
| 5 | Junction Box on Counterweight Tray |
| 6 | Junction Box on Crane |
| 7 | Shorting Plug |
| W48 | Electric Cable |
| W49 | Electric Cable |
| WMLB | Electric Cable |
| WMLC | Electric Cable |

Connect Hydraulic Hoses

See [Figure 4-17](#) for the following procedure.

1. Before proceeding, **disconnect hydraulic power unit from right rear corner of base**. Oil will overflow from the power unit if this step is not performed.
2. Connect hydraulic hoses (1a, View D) and (2a, View E) on counterweight tray to hydraulic hoses (1b and 2b, View A) on shear frame.

3. Connect hydraulic hoses (1b and 2b) from shear frame to fittings on rear of crane (View B).

NOTE: Nipple and coupler arrangement on ends of hoses allow hoses to be connected only one way.

4. Connect hydraulic hoses (3 and 4, View E) from manual remote control on right rear corner of base and wheel support assembly to couplers on front of counterweight tray.

Connect Electric Cables

See [Figure 4-17](#) for the following procedure.

1. For current production crane, disconnect shorting plug (7, View C) from junction box (6) on right rear corner of crane. Fasten the dust cap to the shorting plug.
2. Connect electric cable (W48) from junction box (5, View F) on front of counterweight tray to junction box (6, View C).
3. Connect electric cable (WMLC) from counterweight tray to junction box (6, View C).
4. Connect electric cable (W49) from base and wheel support assembly to junction box (6, View C).
5. Connect electric cable (WMLB) from live mast load pin to junction box (6, View C).

18000MOM303
18000MOM415
18000MOM416

| Item | Description | Item | Description |
|------|--|------|--|
| 1 | Links | 7 | Pin with Collar, Retaining Pin and Cotter Pins |
| 2 | Strap | 8 | Center Box ¹ |
| 3 | Mast Strap | 9 | Lifting Lug |
| 4 | Pin with Collar, Retaining Pin and Cotter Pins | 10 | Locating Lug |
| 5 | Spreader Beam | 11 | Counterweight Tray |
| 6 | Counterweight Cylinder | 12 | Side Box |

¹ Center boxes can be supplied by Manitowoc or by customer. See [Figure 4-1](#) for quantities of boxes. Customer furnished center boxes must be manufactured according to Drawings A16054 and A16055. Customer furnished center boxes must be stacked in alternating order — A16055 first, A16054 next, and so on.

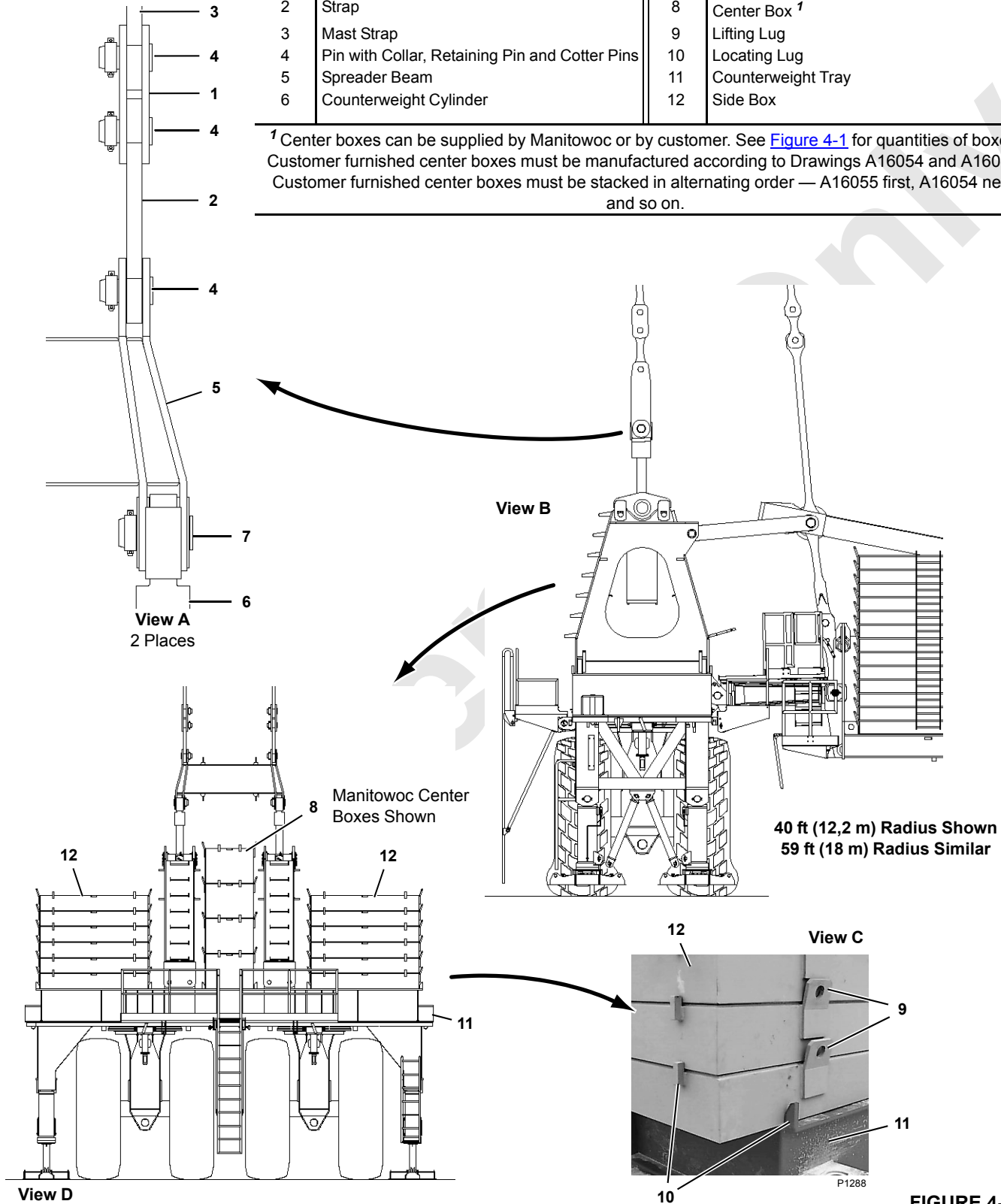


FIGURE 4-18

Connect Counterweight Straps

See [Figure 4-18](#) for the following procedure.

1. Pin links (1, View A) and straps (2) to mast straps (3) with connecting pins (4).
2. Using slings from assist crane attached to lifting lugs on spreader beam (5), lift spreader beam – **wide side down** – into position over counterweight cylinders (6, View A).

NOTE: Either side of spreader beam can face crane.

3. Align bottom connecting holes in spreader beam with holes in cylinder rod ends and install (7, View A).
4. Align connecting holes and pin straps (2) to spreader beam (5).

Extend counterweight cylinders as required using counterweight remote control to assist in aligning connecting holes.

Install Wheeled Counterweight Boxes



WARNING

Falling Load Hazard!

Do not attempt to lift more than one counterweight box at a time. Lifting lugs may break allowing counterweight boxes to fall.

See [Figure 4-18](#) for the following procedure.

1. See [FIGURE 4-1 continued](#) in this section and MAX-ER Capacity Chart for counterweight requirements.
2. Install required center boxes (8, View D).

Each box has four lifting lugs (9, View C). Center first box between locating lugs (10) on counterweight tray (11).

3. Install required side boxes (12, View D).

Each box has four lifting lugs (9, View C). Center first box between locating lugs (10) on counterweight tray (11). Install one box at a time alternating from side to side.

Ready Crane for Operation

MAX-ER attachment with wheeled counterweight is now ready for operation.

1. If required, lower boom onto blocking at ground level and perform the following steps:
 - a. Lengthen boom (add inserts).
 - b. Install upper boom point.
 - c. Install jib: fixed or luffing.
2. Install load lines. See Section 4 of Operator Manual supplied with crane.
3. **Make sure struts are disconnected at counterweight carrier jacks** ([Figure 4-2](#), View E), and rotate wheels to desired position. See Section 3 for detailed instructions.
4. **Make sure braces are in operating position** ([Figure 4-7](#), View C).

Adjustments

See Section 6 for adjustment procedures:

- Load sensing pin calibration
- Counterweight cylinder limit switch adjustment (for controlling how high counterweight rises)

MAX-ER Operation

See Section 3 for operating precautions and a description of the MAX-ER Operating Controls. To operate in the MAX-ER mode, select and confirm MAX-ER mode.

REMOVING MAX-ER ATTACHMENT — WHEELED COUNTERWEIGHT



DANGER

Read Capacity Charts!

Before you disconnect wheeled counterweight assembly from crane, read Capacity Charts to determine following requirements:

- Are blocked crawlers required to raise and lower boom and jib (if equipped)?
- Is wheeled counterweight required to lower boom and jib (if equipped)?

If required per Capacity Chart, make sure crawlers are blocked and counterweight carrier and required counterweight is installed before lowering boom and jib to ground.

Failing to observe this precaution will result in tipping and possible collapse of boom and jib.

General

The 18000 must be traveled slightly to disconnect the support frame or shear frame from the crane.

- If the 18000 is equipped with 320 ft (97,5 m) of boom or less (without jib), the 18000 can be used to disassemble the wheeled counterweight assembly.
- If another crane is used to disassemble the wheeled counterweight assembly, then disconnect it after the 18000 boom and mast are removed so the 18000 can be traveled (see Section 4 of the Crane Operator Manual for detailed disassembly instructions).

Prepare Counterweight Carrier

NOTE: *Do not use hydraulic power unit to perform steps 1 and 2.* Excess oil will overflow power unit's hydraulic tank.

1. Rotate wheels to CRAB position. **Wheels must be in this position for shipping on a trailer.**
2. Fully retract counterweight carrier jacks using remote controls.

Disconnect Support Frame – 40 ft (12,2 m) Radius – from Crane

Remove MAX-ER Counterweight Boxes

Reverse installation steps to remove counterweight boxes.

Disconnect Counterweight Straps

Reverse installation steps to disconnect counterweight straps from counterweight cylinders.

Fully retract cylinders once straps are disconnected.

Disconnect Hydraulic Lines

Reverse assembly steps to disconnect hydraulic lines between crane and wheeled counterweight assembly.

1. Disconnect hydraulic lines (1 and 3, [Figure 4-11](#), View B), couple the lines together, and tie them to counterweight tray for storage. Attach dust caps to all disconnect lines.
2. Disconnect hydraulic lines (5 and 6, [Figure 4-11](#), View E), couple the lines together, and tie them to base and wheel support for storage. Attach dust caps to all disconnect lines.

Disconnect Electric Cables

Reverse assembly steps to disconnect electric cables between crane and wheeled counterweight assembly.

1. Fasten sealing caps to ends of cables.
2. Coil electric cable (W48, [Figure 4-11](#), View C) around brackets on right side A-frame.
3. Coil electric cable (WMLC, [Figure 4-11](#), View C) and tie it to counterweight tray.
4. Disconnect electric cable (W49, [Figure 4-11](#), View F) from junction box (7). Coil cable and tie it to base and wheel support.
5. Connect shorting plug (9, [Figure 4-11](#), View C) to W48 receptacle.

Connect Hydraulic Power Unit

1. Connect two hydraulic lines from hydraulic power unit (provided with 18000) to quick-couplers (4) at remote control valve on right rear corner of base ([Figure 4-2](#), View C).

NOTE: *Do not perform steps 2 and 3 until hydraulic lines are disconnected between crane and wheeled counterweight assembly.* Excess oil will overflow power unit's hydraulic tank.

2. Start hydraulic power unit.

- Using manual remote controls, extend counterweight carrier jacks until they are firmly against foundation.

Disconnect Support Frame from 18000



DANGER

Tipping Hazard!

Prevent counterweight carrier from tipping over:

- Pin struts ([Figure 4-2](#), View E) to counterweight carrier jacks before you disconnect shear frames from rear of crane.



WARNING

Tipping Hazard!

Prevent counterweight carrier from tipping over when removing connecting pins:

- Do not raise or lower connecting holes in shear frame more than 7 in (179 mm) from level.
- Reverse steps on [page 4-19](#) to disconnect and store struts (4, [Figure 4-10](#), View D).
 - Install spacers (2, [Figure 4-10](#), View C) and keepers (1) on mast shafts.
 - Using manual remote controls, extend and retract counterweight carrier jacks as required to assist in loosening connecting pins between support frame and rotating bed.
 - For past production MAX-ER, remove pins (4, [Figure 4-9](#), View C) and shims (4a). Store the pins with the support frame.
 - For current production MAX-ER, reverse step 5 on [page 4-17](#) to disengage pins (8, [Figure 4-9](#), View B)
- Once the crane is traveled clear of the support frame, re-engage the pins. Then remove and store the pin puller cylinder and bracket assemblies.
- Travel 18000 clear of support frame. **Use extreme caution not to knock over counterweight carrier with crane.**
 - Using manual remote controls, extend and retract counterweight carrier jacks as required so **wheeled counterweight assembly is level for remainder of disassembly steps.**

Disconnect Shear Frame – 59 ft (18 m) Radius – from Crane

Remove MAX-ER Counterweight Boxes

Reverse installation steps to remove all but two center counterweight boxes from counterweight carrier.



DANGER

Tipping Hazard!

Prevent counterweight carrier from tipping over:

- Leave two center counterweight boxes installed.
- Do not disconnect shear frame from crane until two center counterweight boxes are installed.

Disconnect Counterweight Straps

Reverse installation steps on page 31 to disconnect counterweight straps from counterweight cylinders.

Fully retract cylinders once straps are disconnected.

Disconnect Hydraulic Lines

Reverse assembly steps to disconnect hydraulic lines between crane and wheeled counterweight assembly.

- Disconnect hydraulic lines (1b and 2b, [Figure 4-17](#), View B), couple the lines together, and tie them to counterweight tray for storage. Attach dust caps to all disconnect lines.
- Disconnect hydraulic lines (3 and 4, [Figure 4-17](#), View E), couple the lines together, and tie them to base and wheel support for storage. Attach dust caps to all disconnect lines.

Disconnect Electric Cables

Reverse assembly steps to disconnect electric cables between crane and wheeled counterweight assembly.

- Fasten sealing caps to ends of cables.
- Coil electric cable (W48, [Figure 4-17](#), View C) around brackets on right side A-frame.
- Coil electric cable (WMLC, [Figure 4-17](#), View C) and tie it to counterweight tray.
- Disconnect electric cable (W49, [Figure 4-17](#), View F) from junction box (5). Coil cable and tie it to base and wheel support.
- Connect shorting plug (7, [Figure 4-17](#), View C) to W48 receptacle.

Connect Hydraulic Power Unit

1. Connect two hydraulic lines from hydraulic power unit (provided with 18000 or 21000) to quick-couplers (4) at remote control valve on right rear corner of base ([Figure 4-2](#), View C).

NOTE: *Do not perform steps 2 and 3 until hydraulic lines are disconnected between crane and wheeled counterweight assembly.* Excess oil will overflow power unit's hydraulic tank.

2. Start hydraulic power unit.
3. Using manual remote controls, extend counterweight carrier jacks until they are firmly against foundation.

Disconnect Shear Frame from 18000



DANGER Tipping Hazard!

Prevent counterweight carrier from tipping over:

- Pin struts ([Figure 4-2](#), View E) to counterweight carrier jacks before you disconnect shear frames from rear of crane.



WARNING Tipping Hazard!

Prevent counterweight carrier from tipping over when removing connecting pins:

- Do not raise or lower connecting holes in shear frame more than 12 in (305 mm) from level.

1. Make sure two center counterweight boxes are installed before proceeding.



DANGER Tipping Hazard!

Prevent counterweight carrier from tipping over:

- Do not disconnect 2-piece shear frame from counterweight tray until two center counterweight boxes are installed.

2. For past production MAX-ER, remove pins (1, [Figure 4-16](#), View A) and shims (1a). Store the pins with the support frame.

3. For current production MAX-ER, reverse step 3 on [page 4-27](#) to disconnect pins (5, [Figure 4-16](#), View B).

Once the crane is traveled clear of the shear frame, re-engage the pins. Then remove and store the pin puller cylinder and bracket assemblies.

4. Using manual remote controls, extend and retract counterweight carrier jacks as required to assist in loosening connecting pins.
5. Travel 18000 clear of shear frame. **Use extreme caution not to knock over counterweight carrier with crane.**
6. Using manual remote controls, extend and retract counterweight carrier jacks as required so **wheeled counterweight assembly is level for remainder of disassembly steps.**

Finish Removal

Reverse installation steps, as required, to:

- Remove support frame or shear frame
- Store A-frame and cylinder assemblies
- Remove counterweight tray
- Remove or store platforms and railings

Retract Jacks and Remove Jack Pads

1. If base and wheel support assembly is going to be stored on job site, leave jack pads installed and counterweight carrier jacks extended to level base and wheel support assembly.
2. If base and wheel support assembly is going to be shipped to another location, proceed as follows:
 - a. Connect slings from assist crane to four lifting lugs (3, [Figure 4-2](#), View B) on base.
 - b. Hoist until lifting slings are taut.
 - c. Start hydraulic power unit.
 - d. Using manual remote controls, fully retract counterweight carrier jacks.
 - e. Stop hydraulic power unit and disconnect it from quick-couplers (4, [Figure 4-2](#), View C).
 - f. Remove and store jack pads (5, [Figure 4-2](#), View D).
 - g. Lift base and wheel support assembly into position so tires are firmly against transport trailer, but keep slings taut until steps [2h](#) and [2i](#) are performed.

! **WARNING**
Tipping Hazard!

To prevent base and wheel support assembly from tipping over, keep lifting slings (step [2g](#)) taut until steps [2h](#) and [2i](#) are performed.

- h. Block between base and axles as shown in [Figure 4-19](#) so base cannot tip when lifting slings are removed.
- i. Securely fasten base and wheel support assembly to transport trailer. ***It is owner/user's responsibility to make sure base and wheel support cannot fall off trailer during transport.***
Tie-downs can be attached to four lifting lugs (3, [Figure 4-2](#), View B) on base.
- j. Disconnect assist crane.

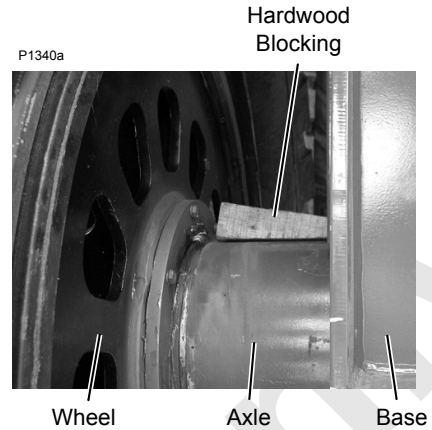
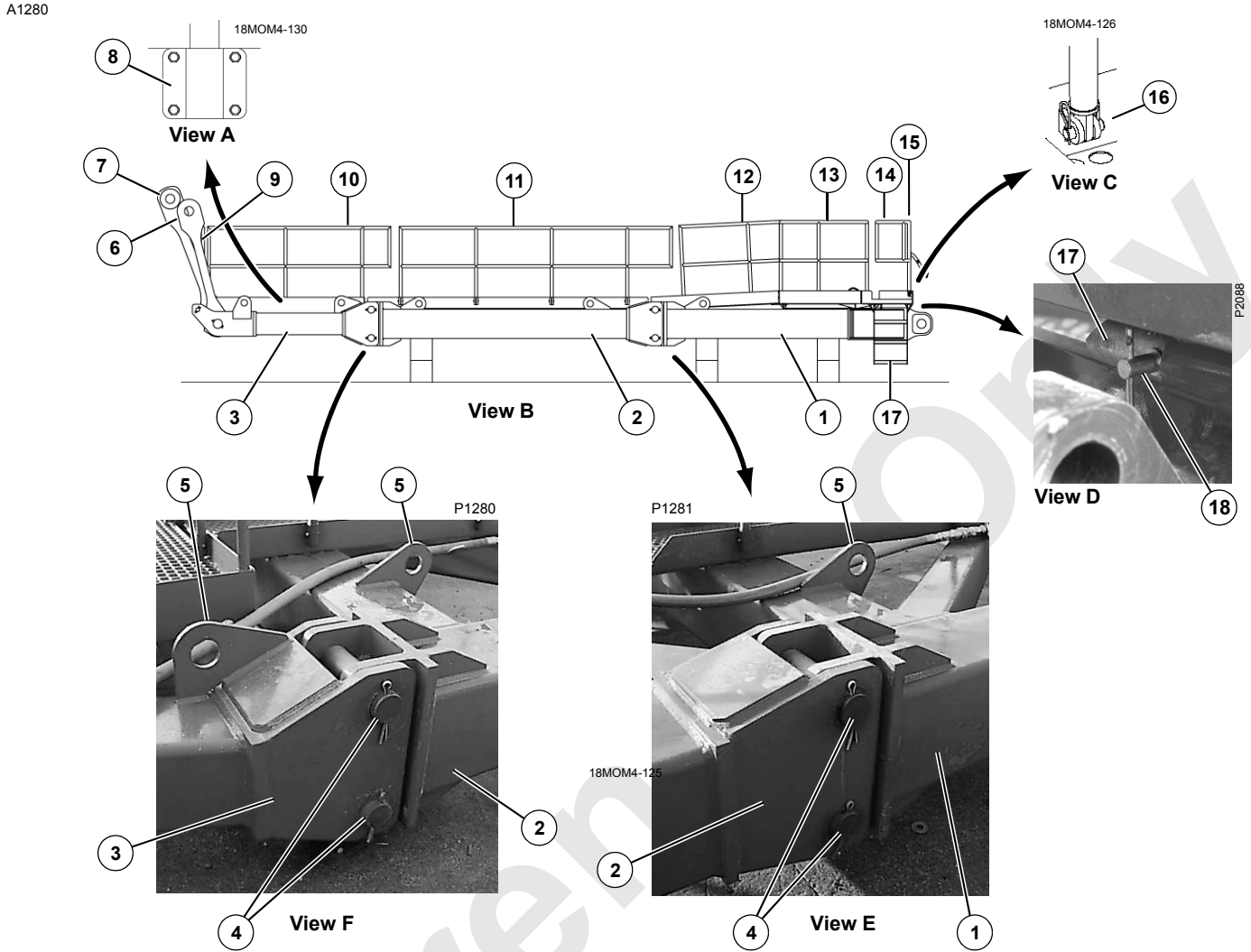


FIGURE 4-19



| Item | Description | | |
|------|--|----|-------------------------------|
| 1 | Front Shear Frame | 10 | Railing (1 left and 1 right) |
| 2 | Middle Shear Frame | 11 | Railing (1 left and 1 right) |
| 3 | Rear Shear Frame | 12 | Railing (1 left and 1 right) |
| 4 | Connecting Pins with Cotter Pins | 13 | Railing (1 left and 1 right) |
| 5 | Lifting Lug (4 each frame) | 14 | Railing (1 left and 1 right) |
| 6 | Top Shear Frame Links | 15 | Railing (1 end) |
| 7 | Bottom Shear Frame Links | 16 | Pin with Hail-Pin Cotters (6) |
| 8 | Clamp with Screws, Lock Washers, Nuts (33) | 17 | Ladder (2) |
| 9 | Railing (1 end) | 18 | Quick-Release Pin (4) |

FIGURE 4-20

INSTALLING MAX-ER ATTACHMENT — HANGING COUNTERWEIGHT

Prepare Crane

The 18000 must be traveled and swung (slightly) to connect the wheeled counterweight assembly to the crane.

If **another crane is used to assemble hanging counterweight assembly**, connect hanging counterweight assembly to 18000 before installing mast and boom so 18000 can be traveled and swung.

If **18000 is used to assemble hanging counterweight assembly**, proceed to completely assemble 18000, including following (see Section 4 of Crane Operator Manual for detailed assembly instructions):

- Carbody counterweight
- Crane counterweight
- 140 ft (42,7 m) mast. Raise mast to operating position.

If boom is used as holdback to raise mast, do not install more than 340 ft (103,6 m) of boom. It will be necessary to raise boom so that crane can be traveled and swung when installing wheeled counterweight assembly.

- Boom — 340 ft (103,6 m) maximum

Install Pin Puller Brackets

See [Figure 4-8](#) for the following procedure.

For current production cranes with hydraulic pin pullers for connecting and disconnecting the MAX-ER shear frame pins, attach bracket (1) and strut (2) to both sides of the rotating bed with quick-release pins (3).

The pin puller cylinder and bracket assemblies are stored in the job box provided with the MAX-ER.

Assemble Shear Frame Components

See [Figure 4-20](#) for the following procedure.

1. Lift front shear (1, View B) onto blocking approximately 12 in. (0.3 m) high. Lift at four lifting lugs (5, View A) provided on shear frame.
2. Lift middle shear frame (2, View B) into position at end of front shear frame and align connecting holes. Lift at four lifting lugs (5) provided on shear frame.
3. Install pins (4, View E) to connect middle shear frame to front shear frame.
4. Block under middle shear frame.

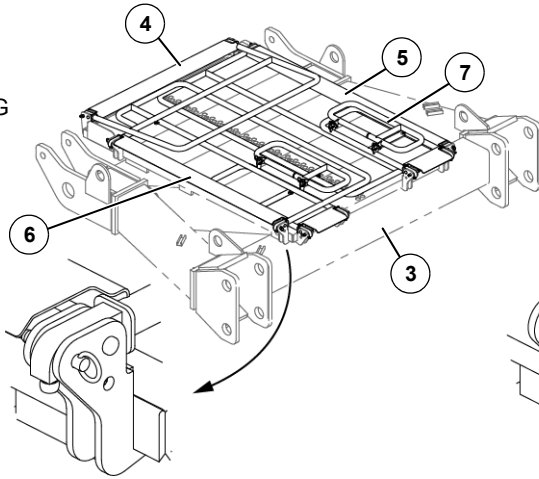
5. Lift rear shear frame (3, View B) into position at middle shear frame (2) and align connecting holes. Lift at four lifting lugs (5, View F) provided on shear frame.
6. Install pins (4, View F) to connect rear shear frame (3) to middle shear frame (2).
7. On past production MAX-ER, attach the railings to the platforms as shown in Views A and C.
8. On past production MAX-ER, install ladders (17, View D) through tubes in platform and install quick-release pins (18).
9. For current production MAX-ER, proceed as follows:

See [Figure 4-21](#) for the following procedure.

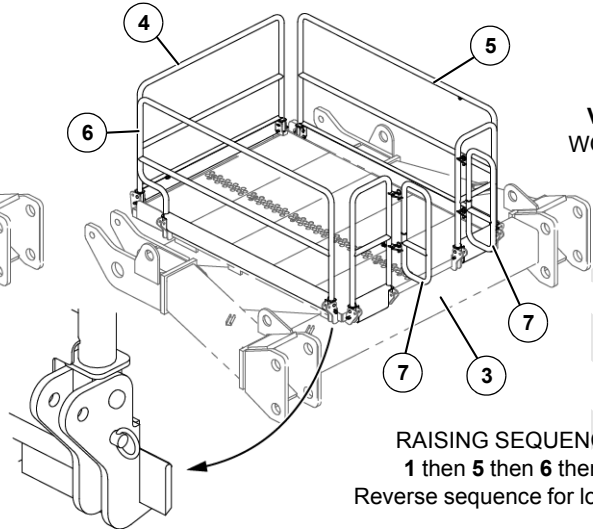
- a. Using owner-furnished lifting slings, lift platform (11, View J) into position on shear frame (1, View G). Four lifting lugs are provided.
- b. Align connecting holes in platform with holes in support frame and securely install connecting screws (25, View H).
- c. Adjust leveling screws (26, View H) to level platform.
- a. Using owner-furnished lifting slings, lift platform (14, View L) into position on shear frame (1, View G). Four lifting lugs are provided.
- b. Align connecting holes in platform with holes in shear frame and securely install connecting screws (27, View H).
- c. Adjust leveling screws (28, View H) to level platform.
- d. Fasten ladders (15, View M) to platform (14) with screws and nuts provided.
- e. Raise the railings on all platforms from the shipping position (View A) and pin them in the working position (View C).
Where necessary, follow the raising sequence given in the illustration.
- f. Rotate railing extensions (7, View D), (10, View F) and (25, View M) from the shipping position and pin them to the working position.
- g. Disconnect guard chains (26, View M) from the shipping position and connect them to the working position.

18MOM4-132

View B
SHIPPING



View A
SHIPPING



View C
WORKING

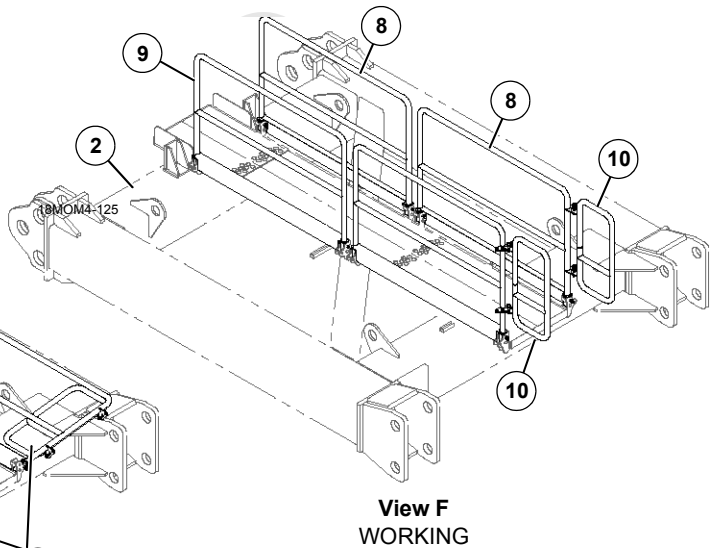
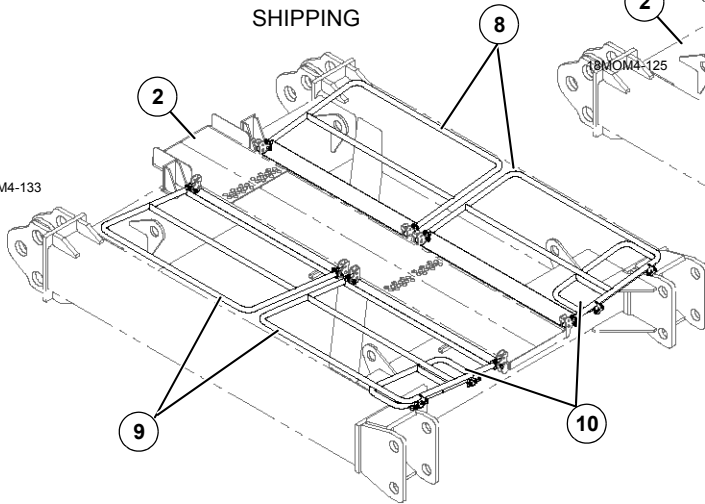
View D
WORKING

RAISING SEQUENCE:
1 then 5 then 6 then 7
Reverse sequence for lowering.

View E
SHIPPING

View E
SHIPPING

18MOM4-133



View F
WORKING

18MOM4-131

View G

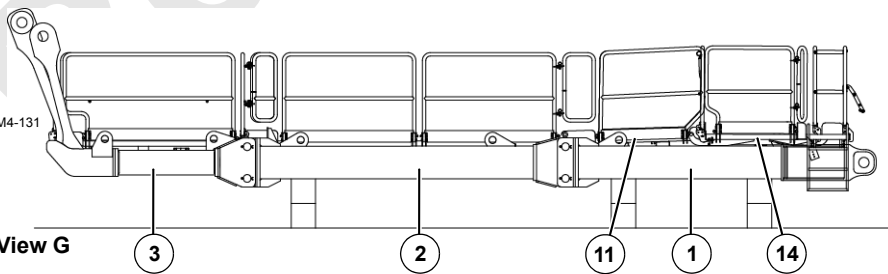
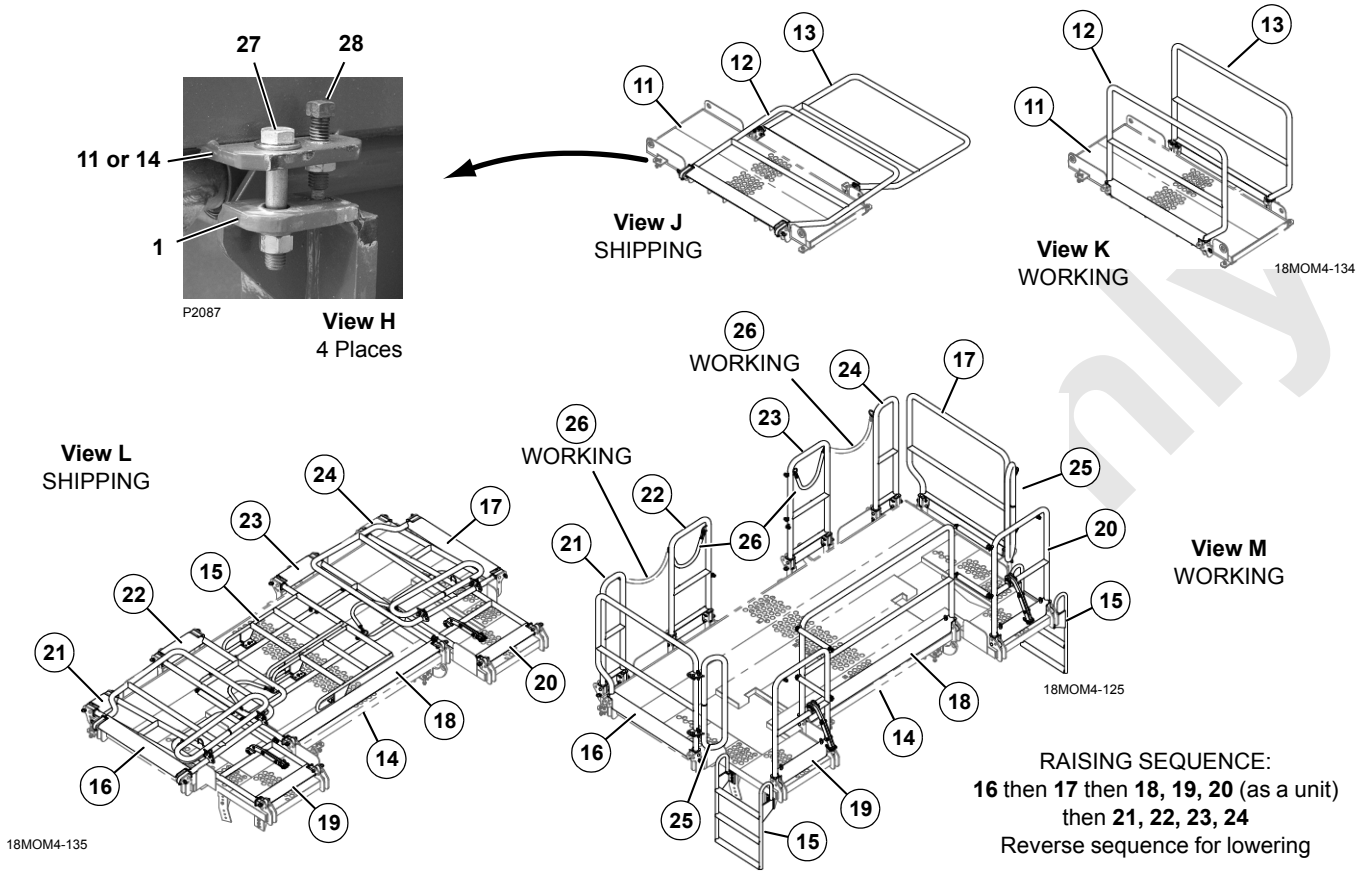


FIGURE 4-21



| Item | Description | Item | Description |
|-----------------|-----------------------------------|---|--------------------------------------|
| 1 | Front Shear Frame | 16 | Railing |
| 2 | Middle Shear Frame | 17 | Railing |
| 3 | Rear Shear Frame | 18 | Railing |
| 4 | Railing | 19 | Railing |
| 5 | Railing | 20 | Railing |
| 6 | Railing | 21 | Railing |
| 7 ¹ | Railing Extension (2) | 22 | Railing |
| 8 | Railing (2) | 23 | Railing |
| 9 | Railing (2) | 24 | Railing |
| 10 ¹ | Railing Extension (2) | 25 | Railing Extension (2) |
| 11 | Platform | 26 | Guard Chain (2) |
| 12 | Railing | 27 | Screw with Flat Washers and Nuts (8) |
| 13 | Railing | 28 | Locking Screw (8) |
| 14 | Platform | ¹ Rotate out for working and in for shipping | |
| 15 | Ladder (with screws and nuts) (2) | | |

FIGURE 4-21 continued

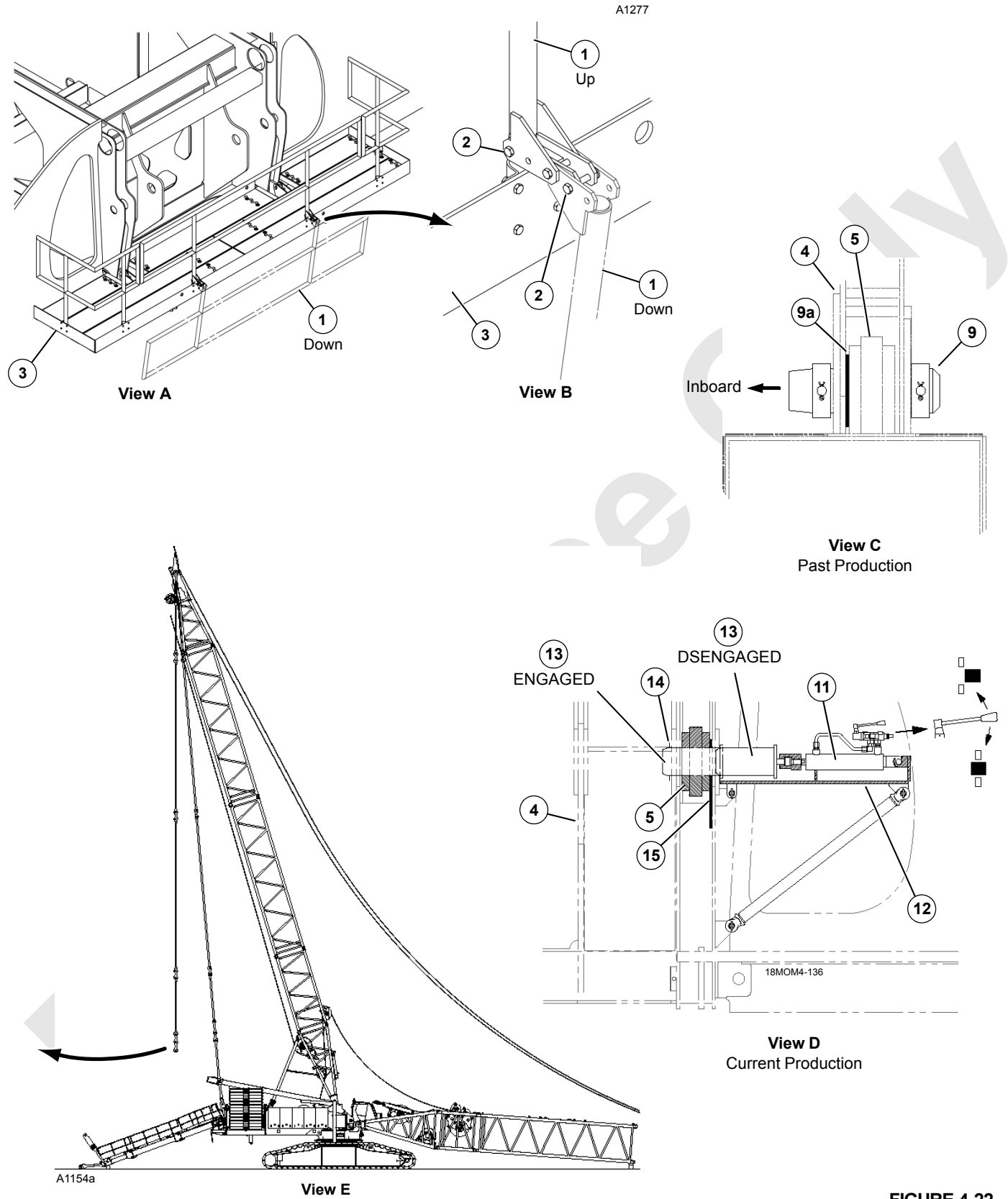


FIGURE 4-22

Component Identification for [Figure 4-22](#)

| Item | Description |
|------|---|
| 1 | Railing |
| 2 | Bolt with Lock Washer and Nut |
| 3 | Platform at Rear of Crane |
| 4 | Rotating Bed |
| 5 | Front Shear Frame |
| 6 | Top Shear Frame Links |
| 7 | Bottom Shear Frame Links |
| 8 | Rear Shear Frame |
| 9 | Pin with Collars, Retaining Pins, and Cotter Pins |
| 9a | Shim Pack (four different size shims) |
| 10 | Storage Pin |
| 11 | Pin Puller Cylinder |
| 12 | Bracket |
| 13 | Pin |
| 14 | Safety Pin |
| 15 | Shim |

Install Shear Frame Assembly

See [Figure 4-22](#) for the following procedure.

- Lower counterweight catwalk railings (1) as shown in Views A and B.

Railings will be damaged if this step is not performed.

- For past production MAX-ER, remove pins (9, View C) and shims (9a) and place them to the side.
- For current production MAX-ER, proceed as follows (see View D):
 - Connect pin puller cylinder (11) to the hooked lug on bracket (12) on either side of the rotating bed.
 - Connect the hydraulic hoses from the pin puller cylinder to the hydraulic power unit and start the power unit.
 - Extend the pin puller cylinder as needed and connect the cylinder rod end to pin (13).
 - Remove safety pin (14).
 - Grasp the handle of shim (15).
 - Retract pin (13) and remove shim (15).
 - Repeat the above steps on the other side of the crane.

- Using lifting lugs on shear frames, lift shear frame assembly into position at rear of rotating bed (4, View C).
- Align connecting holes in front shear frame (5, View C) with connecting holes in rotating bed.
- For past production MAX-ER, proceed as follows:
 - Install connecting pins (9, View C).
 - Install shims (9a, View C) on **inboard side** of both shear frame lugs (5) to limit side play.
- For current production MAX-ER, proceed as follows (see View D):
 - On side with pin puller cylinder, align hole in shim (15) with holes in rotating bed and shear frame. Shims must be installed on **inboard side** of both shear frame lugs (5) to limit side play.
 - Extend the pin puller cylinder to engage pin (13).
 - Install safety pin (14).
 - Move the pin puller cylinder to the other side of the crane and repeat the steps.
 - Disconnect hydraulic power unit and store pin puller cylinder when done.
- Lower shear frame assembly onto blocking at ground level (View E).

NOTE: Top and bottom shear frame links (6 and 7) are shipped in stored position on rear shear frame as shown in [Figure 4-23](#).

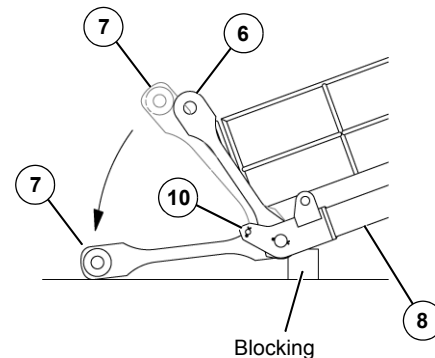


FIGURE 4-23

- On both sides of rear frame (8, [Figure 4-23](#)), support top shear frame links (6) and bottom shear frame links (7) so they cannot fall, remove pin (10) and lower links (7) to ground.
- Store pins (10) in pin storage brackets.

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| Item | Description |
|----------------|--------------------------------|
| 1 | Counterweight Strap |
| 2 | Links |
| 3 | Strap |
| 4 (a,b,c,d) | Retaining Pin |
| 5 | Spreader Beam |
| 6 | Top Shear Frame Links |
| 7 | Shear Frame Assembly |
| 8 | Bottom Shear Frame Links |
| 9 | Collar |
| 10 | Retaining Pin with Cotter Pins |

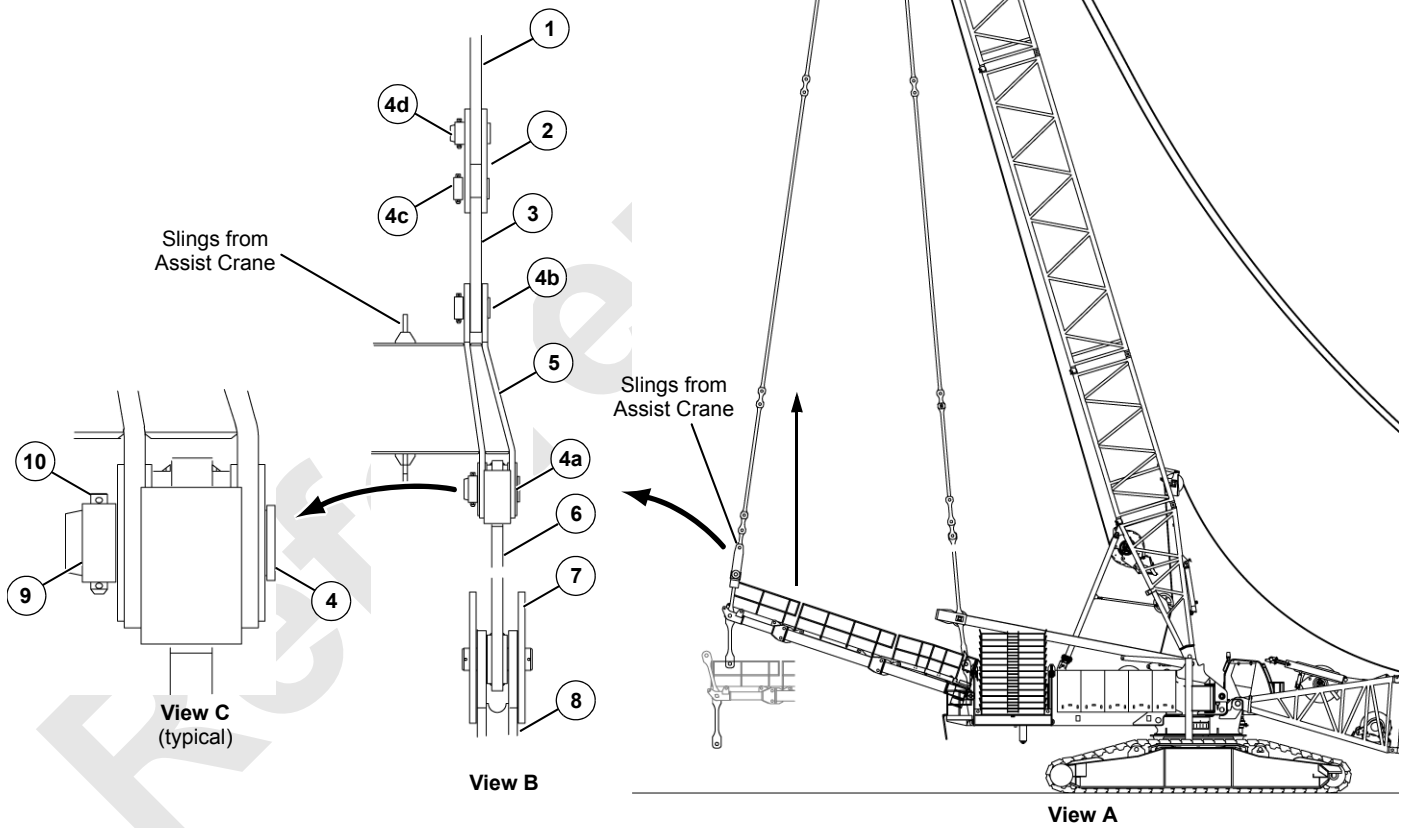


FIGURE 4-24

Connect Shear Frame Assembly to Counterweight Straps

See [Figure 4-24](#) for the following procedure.

Attach Spreader Beam (5) to Shear Frame Assembly (7) View B

- Using slings from assist crane attached to lifting lugs on spreader beam (5), lift spreader beam – **wide side down** – into position above top shear frame links (6, View A).

NOTE: Either side of spreader beam can face crane.



WARNING

Tipping Hazard!

To prevent spreader beam assembly from tipping off top shear frame links, keep lifting slings taut.

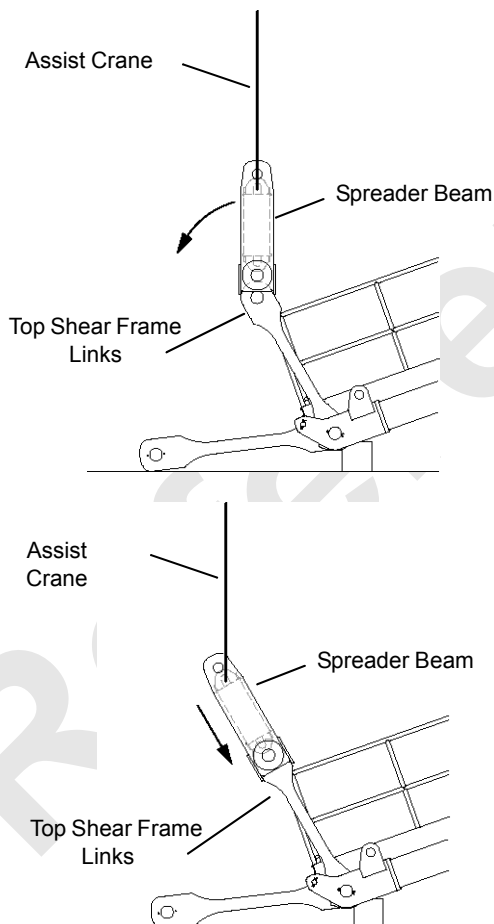


FIGURE 4-25

- Lower spreader beam (5) until it to slide over top shear frame link and allows insertion of pin (4).

NOTE: Spreader beam must be allowed to rotate as shown in [Figure 4-18](#) in order to slide down onto top shear frame links.

- Pin spreader beam (5) to top shear frame links (6) with retaining pin (4a, View B). Install collars (9, View C) and retaining pins (10).

Connect Spreader Beam (5) to Strap (3)

- Pin links (2, View B) and straps (3) to mast counterweight straps (1) with connecting pins (4c) and (4d). Install collars (9, View C) and retaining pins (10).
- Attach a tagline to counterweight straps (1) and pull straps out ([Figure 4-22](#), View D) to mate strap (3) with spreader beam (5).
- Using slings from assist crane attached to lifting lugs on spreader beam (5), lift spreader beam with attached shear frame assembly to operating position and attach spreader beam (5) to strap (3) with retaining pin (4b View B). Install collars (9, View C) and retaining pins (10).
- Lower shear frame assembly until it is supported by counterweight straps and remove lifting slings.
- If equipped with 340 ft (103,6 m) of boom or less, the boom can now be raised. The 18000 can be used to assemble the MAX-ER counterweight assembly.

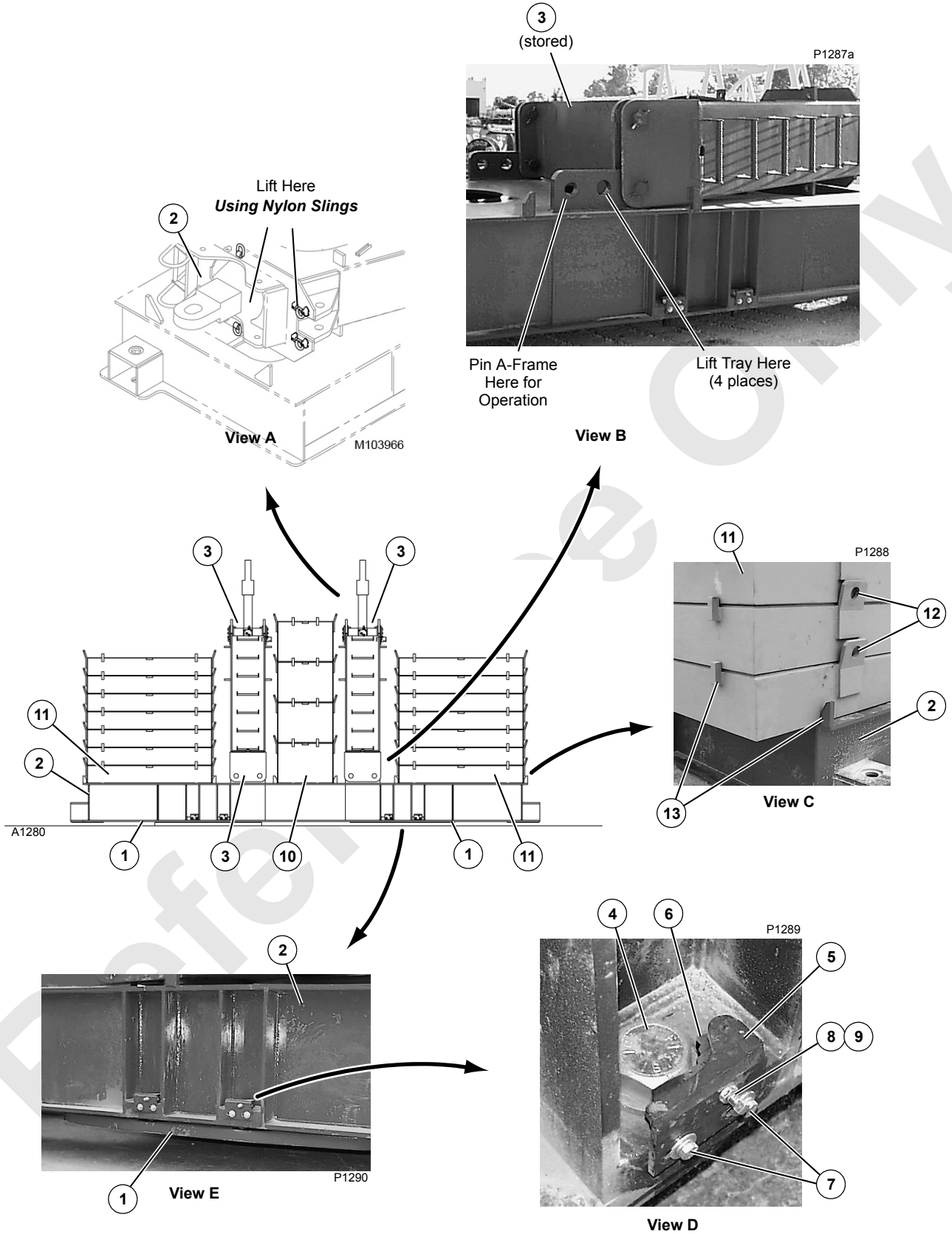


FIGURE 4-26

Prepare Hanging Counterweight Tray

See [Figure 4-26](#) for the following procedure.

1. If not already done, install sub-plates (1, View E) over machined holes in bottom of counterweight tray (2):
 - a. Place sub-plates (1) on ground so they are centered with each other 12 ft 5 in. (3.8 m) apart.
A lifting lug is provided in center of each plate.
 - b. Lift counterweight tray (2) into position over sub-plates (1) and block tray approximately 12 in. (0.3 m) high.
Lift counterweight tray at four lifting lugs shown in View B.
 - c. Lift sub-plates (1) into position under counterweight tray (2), align holes and install bolts (4, View D) hand tight.
 - d. Retain each bolt (4) by adjusting position of bracket (5, View D) so a tooth in locking plate (6) engages a corner of bolt (4). Securely tighten bolts (7) to lock position of bracket (5). Securely tighten setscrew (8) and nut (9) to lock position of locking plate (6).

2. Lift counterweight tray (2) onto ground at desired assembly site location. Lift at four lifting holes (View B).
3. A-frames (3) are shipped in stored position on counterweight tray as shown in View B.

Raise and pin A-frames in operating position. **Lift only at holes in strut connecting lugs or D-rings (current production) on front side of A-frames (View A); use nylon lifting slings to prevent damage to machined holes.**

Install Hanging Counterweight Boxes

See [Figure 4-26](#) for the following procedure.

1. Refer to [Figure 4-1](#) in this folio and to MAX-ER Capacity Chart for number of counterweight boxes required.
2. Install required middle boxes (10).
Each box has four lifting lugs (12). Center first box between locating lugs (13) on counterweight tray (2).
3. Install required side boxes (11).
Each box has four lifting lugs (12). Center first box between locating lugs (13) on counterweight tray (2).

Component Identification for [Figure 4-26](#)

| Item | Description | Item | Description |
|------|--------------------|------|----------------------------|
| 1 | Sub-Plate | 8 | Setscrew |
| 2 | Counterweight Tray | 9 | Nut |
| 3 | A-Frame | 10 | Middle Counterweight Boxes |
| 4 | Bolt | 11 | Side Counterweight Boxes |
| 5 | Bracket | 12 | Lifting Lugs (4 each box) |
| 6 | Locking Plate | 13 | Locating Lugs |
| 7 | Bolts | | |

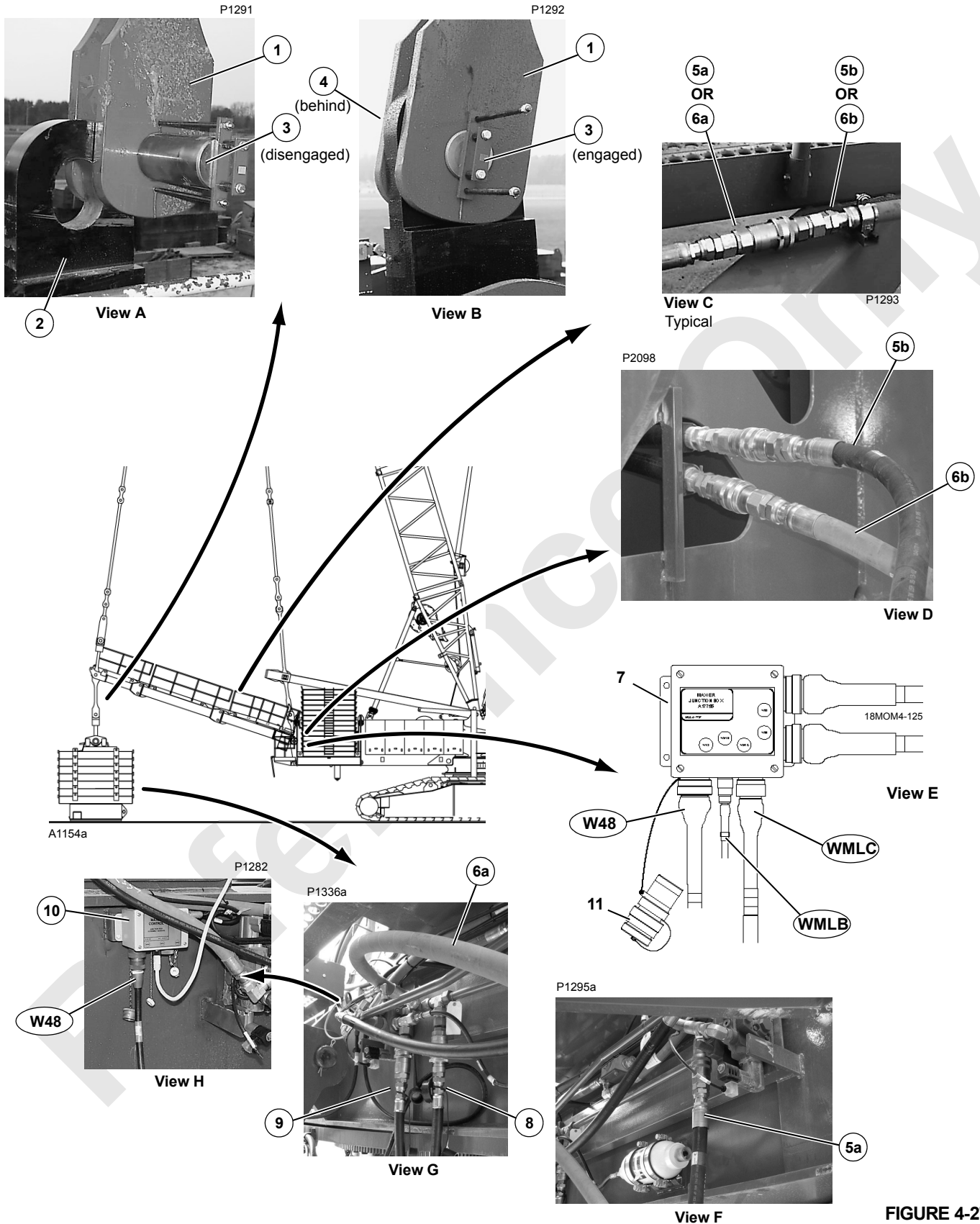


FIGURE 4-27

Connect Hydraulic Hoses

See [Figure 4-27](#) for the following procedure.

1. Connect hydraulic hoses (5a, View F) and (6a, View G) on counterweight tray to hydraulic hoses (5b and 6b, View C) on shear frame.
2. Connect hydraulic hoses (5b and 6b) from shear frame to rear of crane (View D).

NOTE: Nipple and coupler arrangement on ends of hoses allow hoses to be connected only one way.

3. Connect hydraulic hoses (8 and 9, View G) from manual remote control on right rear corner of base to couplers on front of counterweight tray.

Connect Electric Cables

See [Figure 4-27](#) for the following procedure.

1. For current production crane, disconnect shorting plug (11, View E) from junction box (7) on right rear corner of crane. Fasten the dust cap to the shorting plug.
2. Connect electric cable (W48) from junction box (10, View H) on front of counterweight tray to junction box (5, View E) on right rear corner of crane.
3. Connect electric cable (WMLC) from counterweight tray to junction box (5, View E).
4. Connect electric cable (WMLB) from live mast load pin to junction box (5, View E).

Connect Shear Frame Straps to Counterweight Cylinders

See [Figure 4-27](#) for the following procedure.

1. Using counterweight remote control, extend counterweight cylinders as required to align connecting holes in bottom shear frame links (1) with connecting hole in end of each counterweight cylinder (2).
2. Engage connecting pins (3, View B) to connect bottom shear frame links (1) to counterweight cylinders (3).
3. Install safety pin (4) in end of each connecting pin (3).

Ready Crane for Operation

MAX-ER attachment with hanging counterweight is now ready for operation. If required, lower boom onto blocking at ground and perform the following steps:

- Lengthen boom (add inserts)
- Install upper boom point
- Install luffing jib

Adjustments

See Section 6 for adjustment procedures:

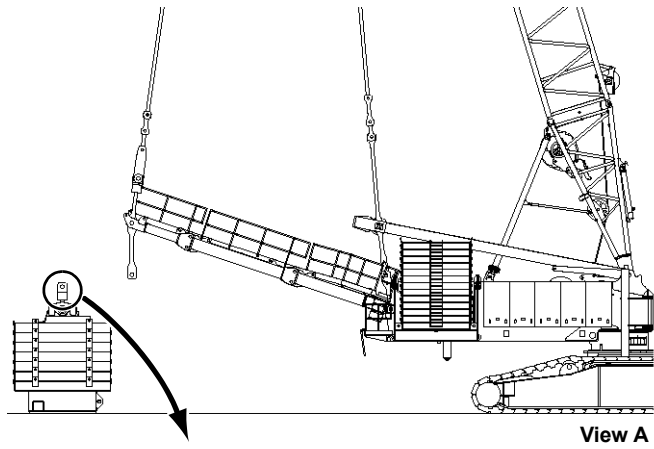
- Load sensing pin calibration
- Counterweight cylinder limit switch adjustment (for controlling how high counterweight tray rises)

Operation

See Section 3 for operating precautions and a description of the MAX-ER Operating Controls. To operate in the MAX-ER mode, select and confirm MAX-ER mode.

Component Identification for [Figure 4-27](#)

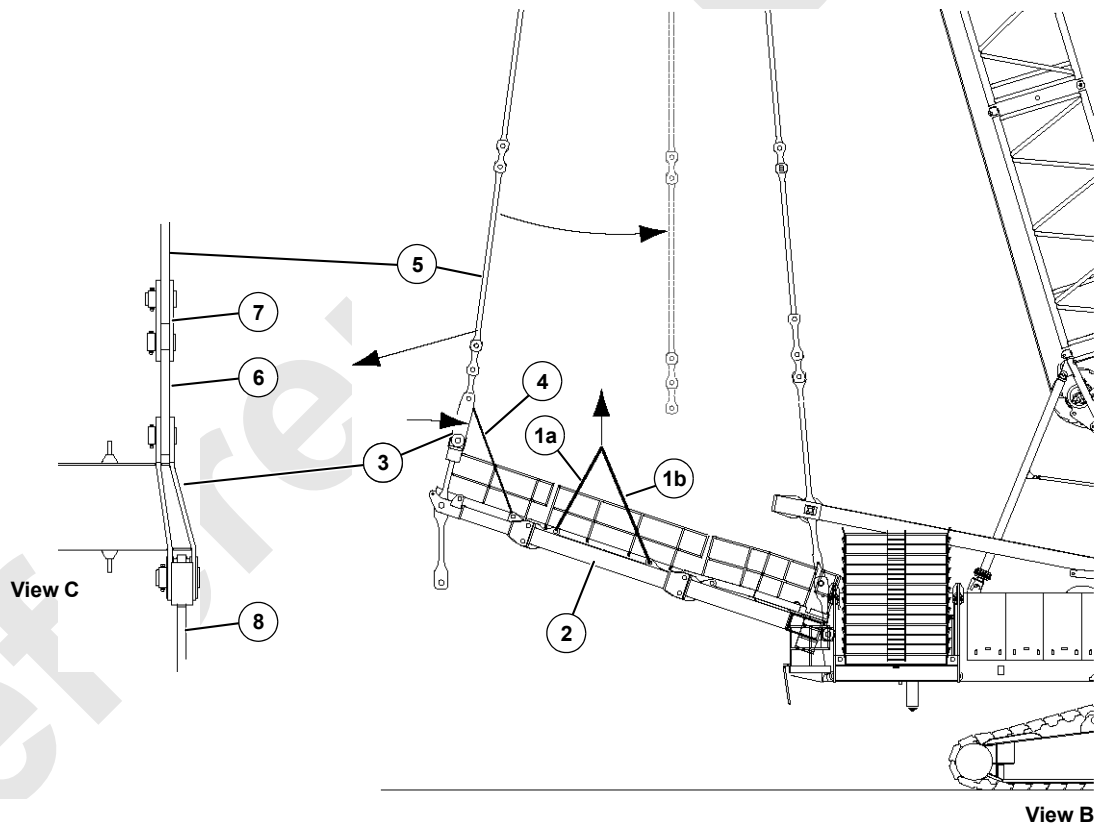
| Item | Description | Item | Description |
|------|--------------------------|------|---|
| 1 | Bottom Shear Frame Links | 6a | Hydraulic Supply Hose |
| 2 | Counterweight Cylinder | 6b | Hydraulic Supply Hose |
| 3 | Connecting Pin | 7 | Junction Box on Crane |
| 4 | Safety Pin | 8 | Hydraulic Hose from Manual Remote Control |
| 5a | Hydraulic Return Hose | 9 | Hydraulic Hose from Manual Remote Control |
| 5b | Hydraulic Return Hose | 10 | Junction Box on Counterweight Tray |
| | | 11 | Shorting Plug |



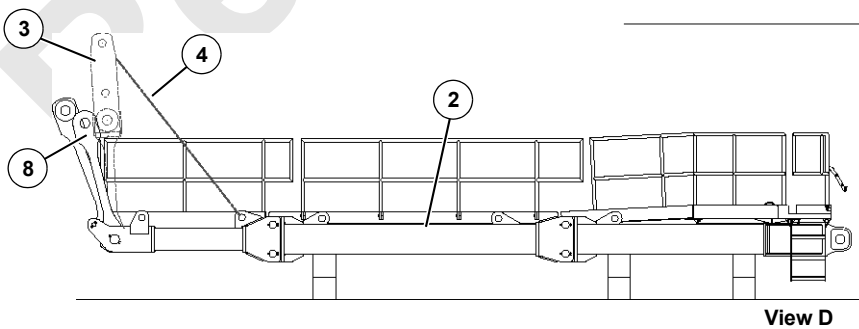
See [Figure 4-27](#),
Views A and B

| Item | Description |
|------|---|
| 1a | Lifting Slings — 91 in (2,31) Minimum |
| 1b | Lifting Slings — 118 in (2,99 m) ¹ |
| 2 | Shear Frame Assembly |
| 3 | Spreader Beam |
| 4 | Lever-Operated Hoist |
| 5 | Strap |
| 6 | Link |
| 7 | Links |
| 8 | Link |

¹ Lifting slings (1b) must be 1.3 times longer than lifting slings (1a).



View B



View D

FIGURE 4-28

REMOVING MAX-ER ATTACHMENT — HANGING COUNTERWEIGHT



DANGER

Read Capacity Charts!

Before disconnecting hanging counterweight assembly from crane, read Capacity Charts to determine following requirements:

- Are blocked crawlers required to raise and lower boom and luffing jib (if equipped)?
- Is hanging counterweight required to lower boom and luffing jib (if equipped)?

If required per Capacity Chart, make sure crawlers are blocked and required hanging counterweight is installed before lowering boom and luffing jib to ground.

Failing to observe this precaution will result in tipping and possible collapse of boom and luffing jib.

Disconnect Shear Frame Straps from Counterweight Cylinders

1. Perform one of the following steps to land the hanging counterweight assembly:
 - a. If the 18000 is equipped with 340 ft (103,6 m) of boom or less (without jib), position the boom at an angle from the 0 lb (0 kg) column of the capacity chart that will cause the hanging counterweight tray to lower to the ground.
- OR**
- b. Lower the boom onto blocking at ground level.

See [Figure 4-27](#) for the following procedure.

2. Turn off the MAX-ER mode.
3. Using the counterweight remote control, extend counterweight cylinders (2, View B) as required to loosen straps (1).
4. Disengage connecting pins (3, View A) and allow straps (1) to swing forward.
5. Fully retract counterweight cylinders (2).

Disconnect Electric Cables

See [Figure 4-27](#), View E for the following procedure.

1. Fasten sealing caps to ends of cables.
2. Disconnect electric cable (W48) from junction box (7) on right rear corner of crane.
3. Disconnect electric cable (WMLC) from junction box (7).
4. Disconnect electric cable (WMLB) from junction box (7).

5. Connect shorting plug (11) to W48 receptacle.

Disconnect Hydraulic Hoses

See [Figure 4-27](#) for the following procedure.

1. Disconnect hydraulic hoses (5a, View F) and (6a, View G) from hoses (5b and 6b, View C) on shear frame.
2. Disconnect hydraulic hoses (5b and 6b) from rear of crane (View D).
3. Disconnect hydraulic hoses (8 and 9, View G) from couplers on front of counterweight tray.

Disassemble Hanging Counterweight Assembly

1. If the 18000 is equipped with 340 ft (103,6 m) of boom or less (without jib), the 18000 can be used to disassemble the hanging counterweight assembly. Otherwise, an assist crane must be used.
2. Disassemble hanging counterweight assembly by reversing the following steps:
 - Install Hanging Counterweight Boxes, [page 4-45](#)
 - Prepare Hanging Counterweight Tray, [page 4-45](#)

Remove Shear Frame Assembly

See [Figure 4-28](#) for the following procedure.

1. If not already done, lower boom onto blocking at ground level.
2. Attach slings (1, View B) from assist crane to lugs on the center section of shear frame assembly (2).

NOTE: The shear frame will be balanced when lifted at the specified points with the sling lengths given in the table.

3. Hoist against shear frame assembly (2) just enough to allow spreader beam (3) to tip forward as far as it will go.
4. Secure spreader beam (3) to shear frame assembly (2) with a lever-operate hoist (4).

If this step is not performed, the spreader beam will tip rearward approximately 12 in (305 mm) when the shear frame assembly is removed.

5. Attach a tagline to both straps (5).
6. Secure the taglines to another crane or to a fork-lift truck. Each tagline must support 1,000 lb (454 kg).
7. Unpin links (6, View C) from spreader beam (3).
8. For past production MAX-ER, remove pins (9, [Figure 4-22](#), View C) and shims (9a). Store the pins and shims with the shear frame.

9. For current production MAX-ER, reverse step 7 on [page 4-41](#) to disconnect pins (13, [Figure 4-22](#), View D).
Once the shear frame is removed, re-engage the pins. Then remove and store the pin puller cylinder and bracket assemblies.
10. Lift shear frame assembly (2) clear of crane and place it on blocking as shown in View D.
11. Pay out taglines until straps (5) are vertical.
12. Disconnect taglines.
13. Disconnect links (6, View C) and (7) from straps (5) and store.
14. Remove spreader beam (3, View D) from links (8) on shear frame assembly (2).
15. Reverse Assemble Shear Frame Components steps on [page 4-37](#) to disassemble the shear frame assembly as needed.
16. The 18000 can now be disassembled as instructed in the Crane Operator Manual.

**SECTION 5
LUBRICATION**

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Lubrication 5-1

Reference Only

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SECTION 5 LUBRICATION

LUBRICATION

See F2104 at the end of this section.

Reference Only

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Reference Only

SECTION 6 MAINTENANCE

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SECTION 6 MAINTENANCE

GENERAL

This section contains maintenance and adjustment instructions for the MAX-ER attachment.

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

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

LOAD SENSING PIN CALIBRATION

[Figure 6-3](#) shows a wheeled counterweight, but the following instructions apply to both the wheeled counterweight and the hanging counterweight.

The MAX-ER attachment is equipped with three load sensing pins as shown in [Figure 6-3](#).

When replacing a load sensing pin, check its calibration prior to installation, as follows:

1. Start engine.
2. Select and confirm MAX-ER mode ([Figure 6-1](#)).



MAX-ER Mode
ON

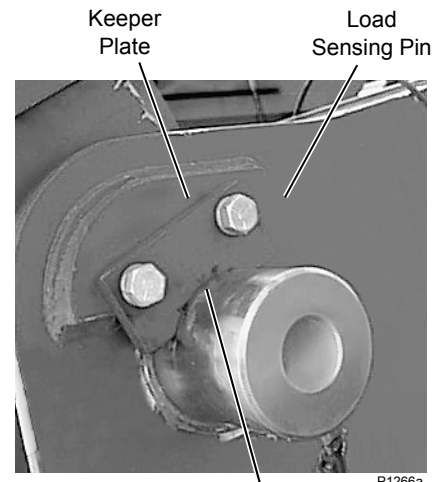
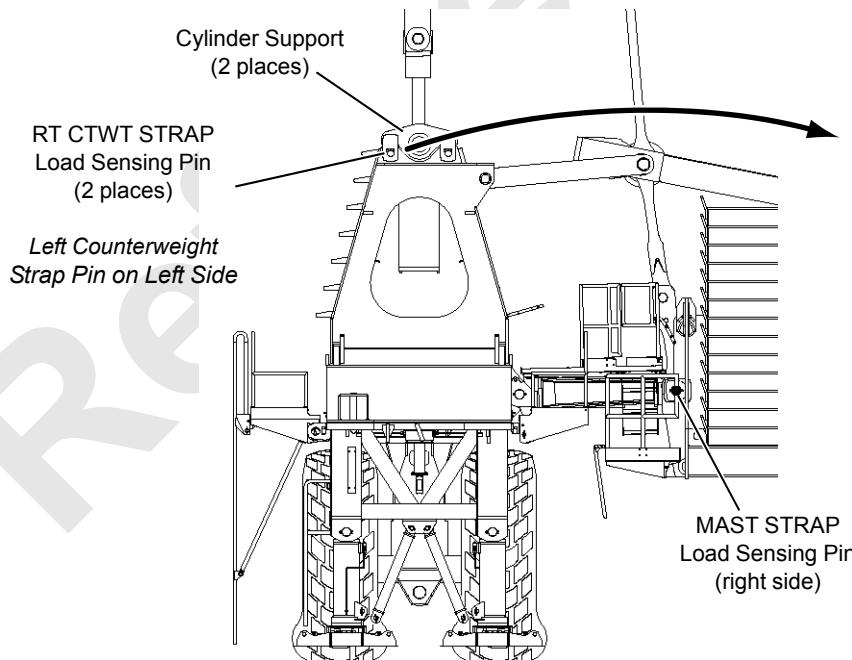
FIGURE 6-1

3. Go to MAX-ER diagnostic screen ([Figure 6-2](#)).
4. Stop engine and connect electric cord to receptacle on end of pin.
5. Start engine.
6. Strap load on digital display should be 0 ± 5 TONS (U.S.).
7. Install pin.

| CTWT | DOWN |
|--------------------|---------------|
| RT CTWT STRAP LOAD | ___ . __ TONS |
| LT CTWT STRAP LOAD | ___ . __ TONS |
| MAST STRAP LOAD | ___ . __ TONS |

Strap Load
Indicated Here

FIGURE 6-2



P1266a

P1266a
18000MOM303

FIGURE 6-3

COUNTERWEIGHT CYLINDER LIMIT SWITCH ADJUSTMENT

The following instructions apply to both the wheeled counterweight and the hanging counterweight.

Each cylinder has a limit switch which serves two purposes:

- Limit how high the counterweight assembly lifts off the foundation
- Turn off oil flow to the cylinders

CAUTION

Hydraulic Cylinder Damage!

Cylinders will remain pressurized (stalled out) after counterweight assembly lifts off foundation if limit switch is not adjusted properly. This action can result in damage to cylinders and other parts from overheating.

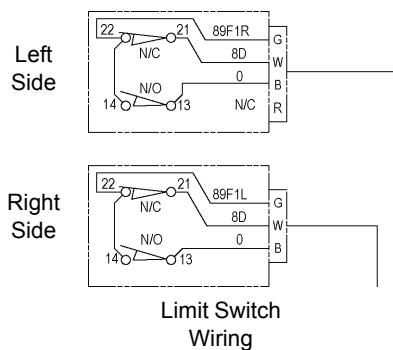
The following procedure assumes:

- Counterweight assembly is installed and counterweight straps are connected to cylinders.
- Counterweight assembly is resting on foundation (cylinders are extended clear of limit switches as shown in [Figure 6-4](#)).

Perform the following steps at both limit switches.

1. Securely fasten limit switch to bracket.
2. Connect electric cord to limit switch.
3. Loosen setscrew in limit switch lever.
4. Position lever so center of roller is at specified dimension.
5. Securely tighten setscrew in limit switch lever to lock adjustment.

Dimension given allows wheels or hanging tray to rise about 20 in (508 mm). If less clearance is desired, increase dimension (adjust lever upward).



| Item | Description |
|------|---------------|
| 1 | Bracket |
| 2 | Electric Cord |
| 3 | Limit Switch |
| 4 | Lever |
| 5 | Roller |
| 6 | Rod End |
| 7 | Cylinder |

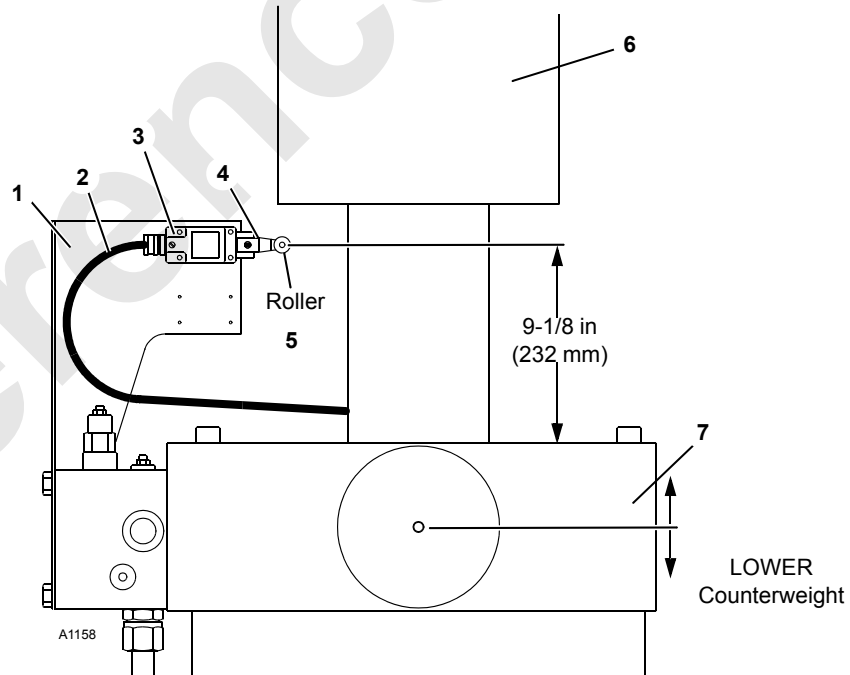


FIGURE 6-4

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Reference Only

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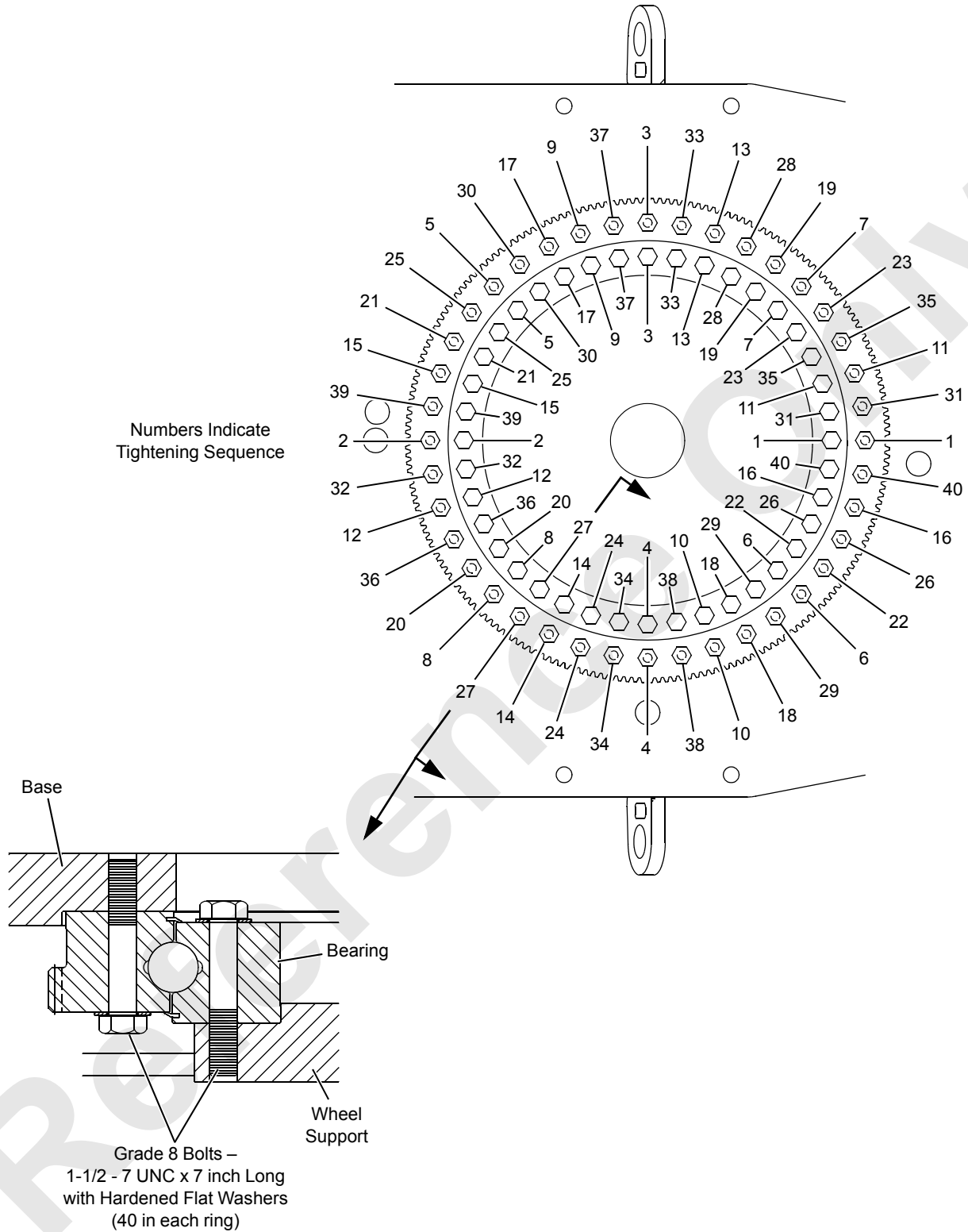


FIGURE 6-5

WHEEL SUPPORT BEARING BOLT TORQUE



WARNING

Bolt Failure!

Loose or improperly torqued bolts can cause bolts or bearing to fail, possibly allowing MAX-ER counterweights to break away from wheels.

General

The wheeled counterweight assembly is equipped with two bearings, one between each wheel support and the base. To gain access to the bolts in the inner ring of the bearings, the counterweight tray must be removed.

The following instructions apply to both bearings of only the wheeled counterweight.

Lubrication

Before installing the bearing bolts, lubricate the threads of each bolt with Never-Seez (MCC No. 361010) or an equivalent anti-seizing lubricant.

Torque Values

Torque each turntable bearing bolt to 1,300 ft-lb (1 763 Nm).

When new bolts are installed, torque them in two steps: first to 450 ft-lb (610 Nm) and then to 1,300 ft-lb (1 763 Nm).

Torque Sequence

Torque one bolt at a time in the numbered sequence given in [Figure 6-5](#).

Torque Intervals

Initial Operation

Retorque all bolts to the specified value after the first 50 hours of operation.

Yearly Or Every 2,000 Hours Of Operation (whichever comes first)

Retorque all bolts to the specified value.

Bolt Replacement

If at the yearly inspection interval, one or more bolts are found to be torqued to less than 1,040 ft-lb (1 410 Nm), replace each loose bolt. Also, replace the bolt on each side of each loose bolt.

If at the yearly inspection interval eight or more bolts in either ring are found to be torqued to less than 1,040 ft-lb (1 410 Nm), replace all of the bolts in the corresponding ring.

Replace all of the bolts every 7 years or 14,000 hours of operation (whichever comes first) and each time a new turntable bearing is installed.

AUTOMATIC BOOM STOP ADJUSTMENT

Maximum Operating Angles

Boom stop limit switch (5, [Figure 6-7](#)) automatically stops the boom and applies the boom hoist brake when the boom is raised to **Angle A** (see [Figure 6-6](#) and [Table 6-1](#)).

Operation

See [Figure 6-7](#) for the following description.

When the boom is below the maximum angle, limit switch (5) is closed and its LED (if equipped) is ON (View B). The boom hoist can be operated.

When the boom is raised to the maximum angle, boom butt (1) pushes adjusting rod (2a or 2b) in and actuator rod (11, View A) opens limit switch (5). The LED (if equipped) then goes OFF. Boom hoist operation stops automatically because the open limit switch turns off power to the boom hoist electric circuit. The boom hoist pump shifts to neutral and the brake applies to stop boom movement.

WARNING

Falling Attachment Hazard!

If boom fails to stop for any reason, stop engine immediately. Troubleshoot system to determine problem.

Do not resume operation until problem has been corrected.

Maintenance

At least once weekly, check that the automatic boom stop stops the boom at the specified maximum angle. If not, replace any worn or damaged parts and/or adjust the boom stop.

Once the automatic boom stop is properly adjusted, it should not require periodic adjustment. Adjustment is required, however, when:

- The luffing jib is installed or removed.

- Parts are replaced.



WARNING

Falling Attachment Hazard!

Do not operate crane unless automatic boom stop is properly adjusted and operational. Do not adjust maximum operating angle higher than specified. Boom could be pulled over backwards or collapse, causing death or serious injury.

Table 6-1 — Automatic Boom Stop Angles

| Angle A (see Figure 6-6) | Attachment |
|---|--|
| 83° ¹ | #55-79A, #55, or 55A Boom without Luffing Jib |
| OR | |
| 84° ² | #55-79A, #55, or 55A Boom without Luffing Jib |
| When Boom Up Limit <i>Can be Bypassed</i> * | |
| 85° | #44 or 79A Luffing Jib on 140 – 180 ft (42,7 – 54,9 m) of Boom |
| 87° | #44 or 79A Luffing Jib on 200 – 340 ft (61,0 – 103,6) of Boom |
| When Boom Up Limit <i>Cannot be Bypassed</i> * | |
| 86° | #44 or 79A Luffing Jib on 140 – 180 ft (42,7 – 54,9 m) of Boom |
| 88° | #44 or 79A Luffing Jib on 200 – 340 ft (61,0 – 103,6) of Boom |

* To determine if the boom up limit on your crane can be bypassed or not, perform Bypass Limit Test given below.

¹: Past production with 4-3/4 in (121 mm) long adjusting rod

²: Current production with 4-1/2 in (114 mm) long adjusting rod

Bypass Limit Test

Perform the following test to determine if the boom up limit on your crane can be bypassed or not.



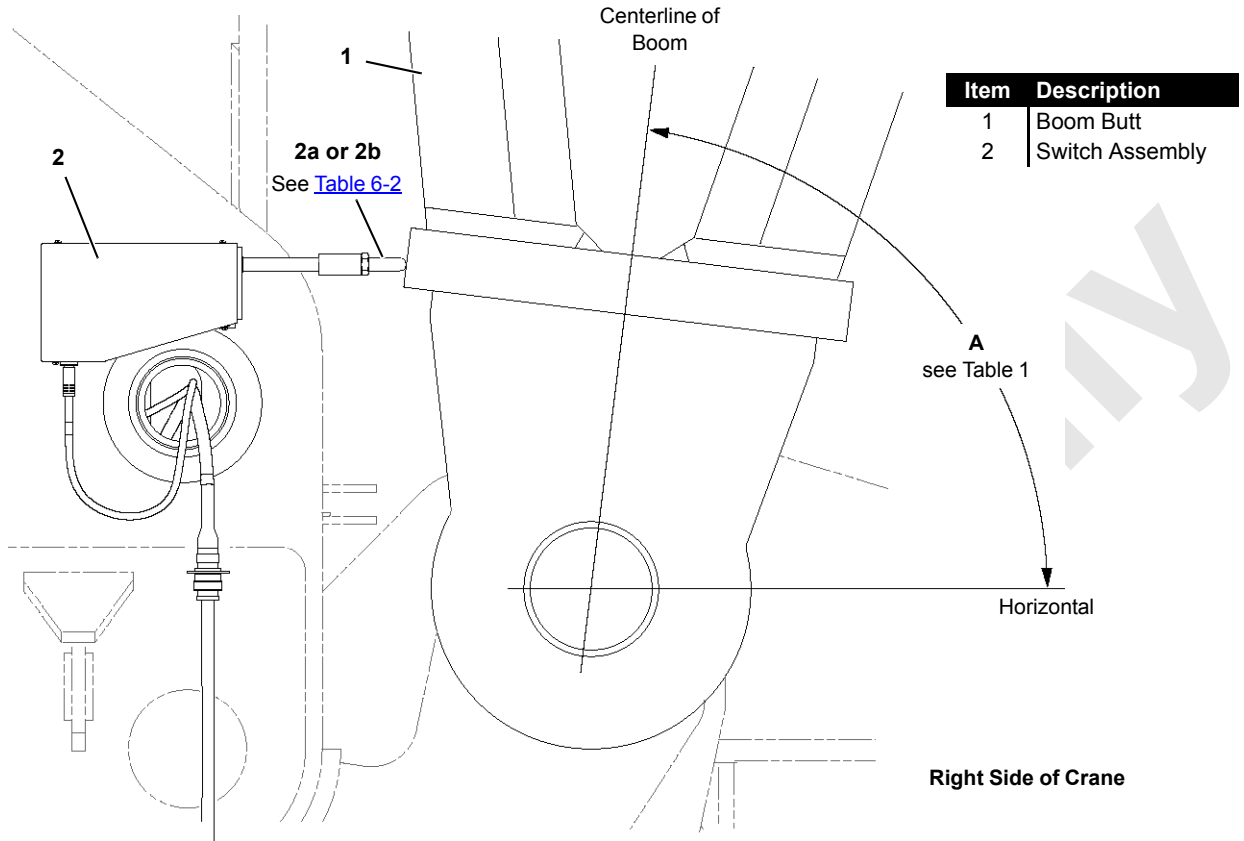
WARNING

Crush Hazard!

Maintain constant communication between operator and assistant during following steps.

Stay clear of moving parts.

1. Lower the boom onto blocking at ground level.
2. Have an assistant push adjusting rod (2a or 2b [Figure 6-7](#)) in to trip the boom stop limit switch open.
3. Rotate the limit bypass key (in crane cab) to the bypass position and hold.
4. Try to boom up — do not raise the boom any higher than necessary to perform the test:
 - a. If the boom rises, your boom up limit **can be bypassed**.
 - b. If the boom does not rise, your boom up limit **cannot be bypassed**.
5. The test is complete. Release the limit bypass key and the adjusting rod to the normal operating positions.



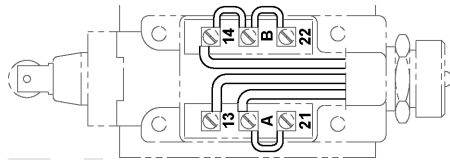
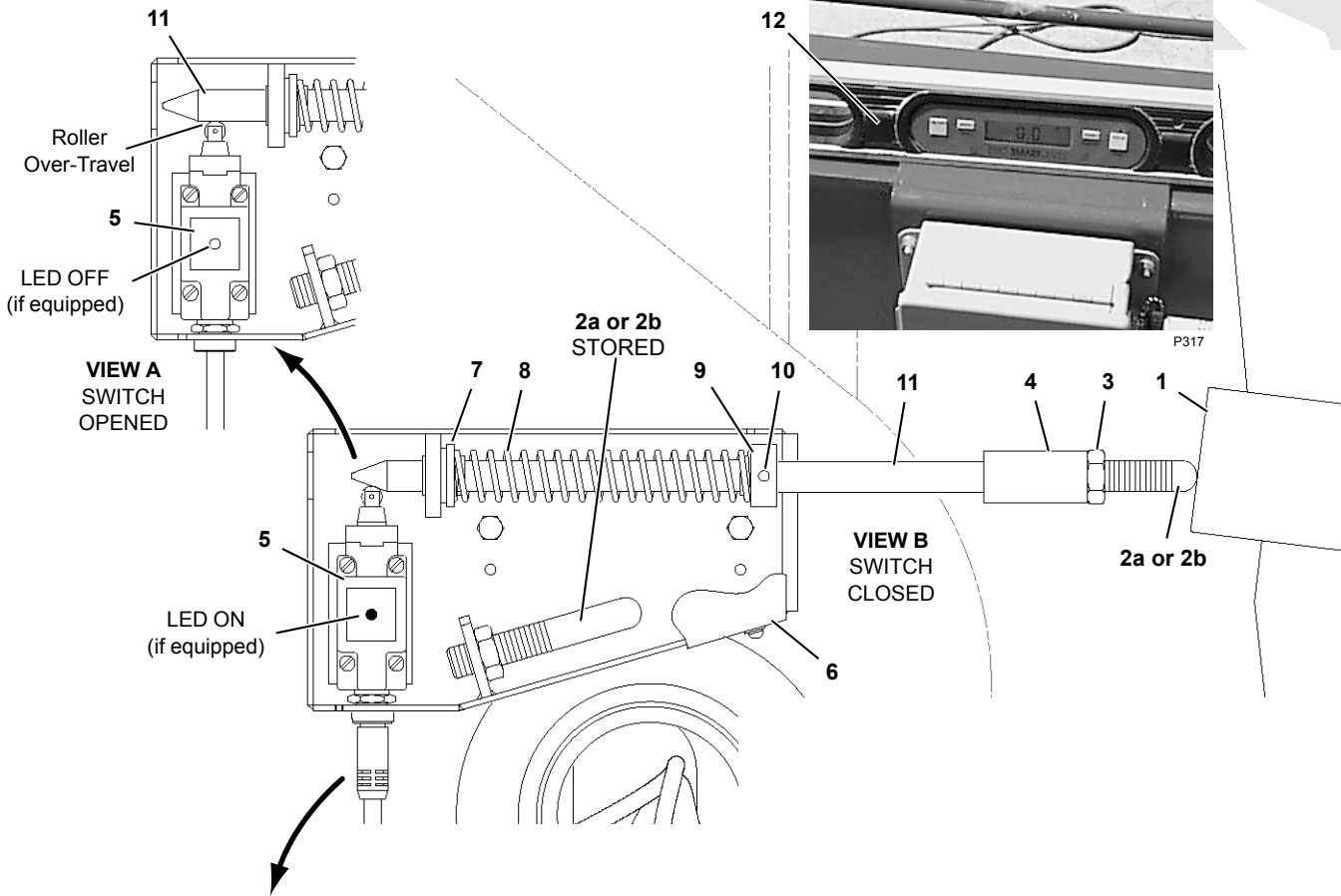
| Item | Description |
|------|-----------------|
| 1 | Boom Butt |
| 2 | Switch Assembly |

FIGURE 6-6

Table 6-2 — Adjusting Rods

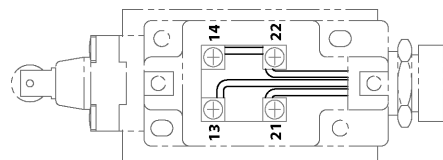
| Adjusting Rod Length | |
|---|------------------------|
| 2a Boom Only | 2b With Luffing Jib |
| When Boom Up Limit <i>Can be Bypassed</i> | |
| 4-3/4 in (121 mm) for 83° | 3-3/4 in (83 mm) |
| 4-1/2 in (114 mm) for 84° | |
| When Boom Up Limit <i>Cannot be Bypassed</i> | |
| 4-3/4 in (121 mm) for 83° | 3-1/4 in (83 mm) |
| 4-1/2 in (114 mm) for 84° | |

| Item | Description | Item | Description |
|------|---|------|-------------------------------------|
| 1 | Boom Butt | 7 | Spring Washer |
| 2a | Adjusting Rod – Boom only | 8 | Spring |
| 2b | Adjusting Rod – Boom with Luffing Jib (see Table 6-2) | 9 | Spring Washer |
| 3 | Jam Nut | 10 | Dowel Pin 1/4 in (6,35 mm) Diameter |
| 4 | Coupling | 11 | Actuator Rod |
| 5 | Limit Switch | 12 | Digital Level |
| 6 | Cover | | |



Limit Switch Wiring with LED

| Receptacle | Switch Terminals | Function |
|------------|------------------|---------------|
| 1 (green) | 22 B 14 | Max Angle |
| 2 (black) | A 13 | LED |
| 3 (white) | 21 | 12 VDC Supply |



Limit Switch Wiring without LED

| Receptacle | Switch Terminals | Function |
|------------|------------------|---------------|
| 1 (green) | 22 14 | Max Angle |
| 2 (black) | 13 | |
| 3 (white) | 21 | 12 VDC Supply |

FIGURE 6-7

| Boom Stop Angle | Digital Level Angle |
|-----------------|---------------------|
| 83° | 70.7° |
| 84° | 71.7° |
| 85° | 72.7° |
| 86° | 73.7° |
| 87° | 74.7° |
| 88° | 75.7° |

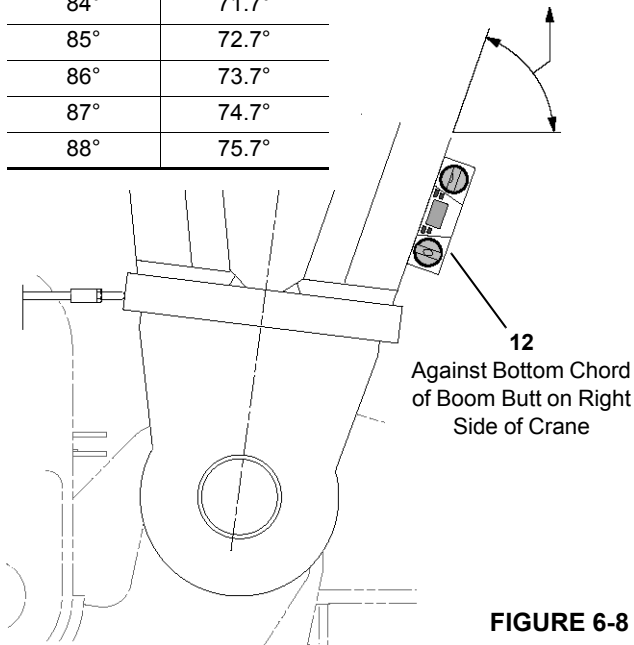


FIGURE 6-8

Adjustment

- Park the crane on a firm level surface or level the crane by blocking under the crawlers.
- Make sure the proper adjusting rod is installed (see [Table 6-2](#)):
 - Rod (2a) for BOOM ONLY
 - Rod (2b) for boom WITH LUFFING JIB
- Raise the boom to specified **Angle A** ([Figure 6-6](#)) while monitoring the angle on the mechanical indicator or on the operating conditions screen of the front-console display.
- Verify that the boom is at the proper Angle A:
 - Place an accurate digital level (12) on the boom butt as shown in [Figure 6-8](#). The corresponding **Digital Level Angle** should appear on the digital level.
 - Raise or lower the boom as necessary.
- If the boom stops at the specified angle, further adjustment is not needed.
 - If the boom stops before reaching the specified angle, go to step 6.
 - If the boom reaches the specified angle before it stops, go to step 7.

See [Figure 6-7](#) for the remaining steps.

- If the boom stops before reaching the specified angle:
 - Loosen jam nut (3, View B).
 - Turn adjusting rod (2a or 2b) all the way into coupling (4).
 - Boom up slowly until the boom reaches specified angle.
 - Turn adjusting rod (2a or 2b) out against boom butt (1) until limit switch (5) “clicks” open and the LED (if equipped) is OFF (View A).
 - Tighten jam nut (3).
- If the boom reaches the specified angle before it stops:
 - Loosen jam nut (3, View B).
 - Turn adjusting rod (2a or 2b) out against boom butt (1) until limit switch (5) “clicks” open and the LED (if equipped) is OFF (View A).
 - Tighten jam nut (3).
- Check that actuator rod (11) over-travels the limit switch as shown in View A.
- Test the adjustment as follows:
 - Lower the boom several degrees below the specified Angle A.
 - Slowly raise the boom.
 - Boom must stop at specified Angle A.** If the boom does not stop at the specified angle:
 - Stop raising the boom (move control handle to off).
 - Lower the boom several degrees below the specified angle.
 - Repeat adjustment steps 2 through 9.

Actuator Rod Replacement

See [Figure 6-7](#), View B for the following procedure.

- Remove damaged actuator rod (11).
- Slide spring washers (7 and 9) and spring (8) over new actuator rod (11) while sliding the actuator rod into the bracket assembly.
- Position actuator rod (11) so the tapered end just touches limit switch (5) roller (View B). The actuator rod must not depress the limit switch roller.
- Drill a 1/4 in (6,35 mm) hole through spring washer (9) and actuator rod (11).
- Install dowel pin (10).
- Install proper adjusting rod (2a or 2b).
- Adjust the boom stop.

PHYSICAL BOOM STOP



WARNING

Falling Attachment Hazard!

Physical boom stops must be installed and pinned in working position for all crane operations.

Physical boom stops do not automatically stop boom at maximum operating angle. Automatic boom stop must be installed and properly adjusted.

The following instructions apply to both the wheeled counterweight and the hanging counterweight.

General

The physical boom stops ([Figure 6-4](#)):

- Assist in stopping the boom smoothly at any angle above 77°
- Assist in preventing the boom rigging from pulling the boom back when traveling or setting loads with the boom at any angle above 77°
- Assist in moving the boom forward when lowering the boom from any angle above 77°
- Provide a physical stop at 89°

Operation

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

1. When boom is raised to 77°, springs in boom stop tubes begin to compress.
2. As boom is raised higher, spring compression increases to exert greater force against boom.
3. If for any reason boom is raised to 89°, boom stop springs fully compress to provide a physical stop.

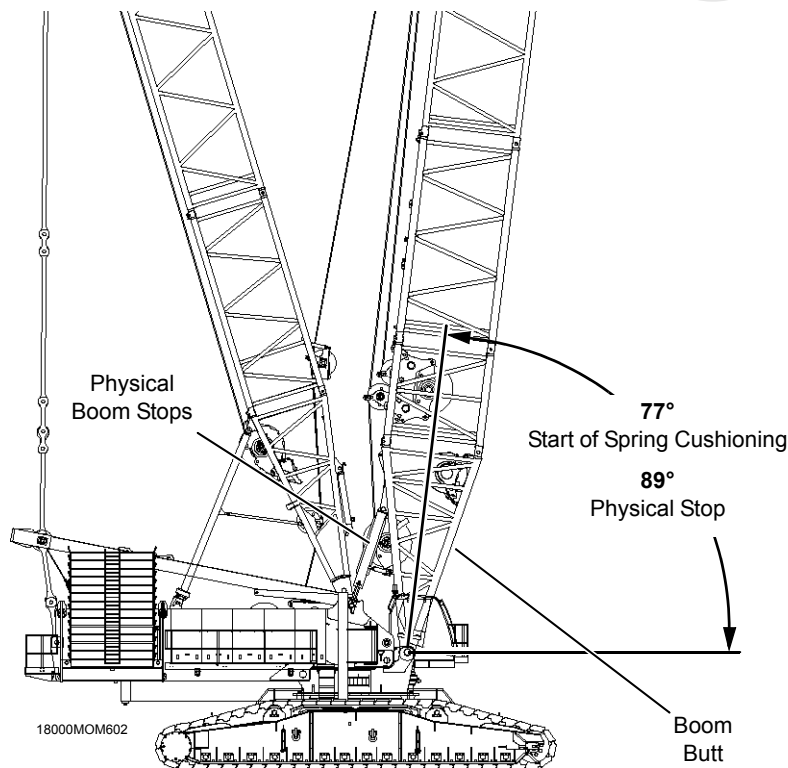
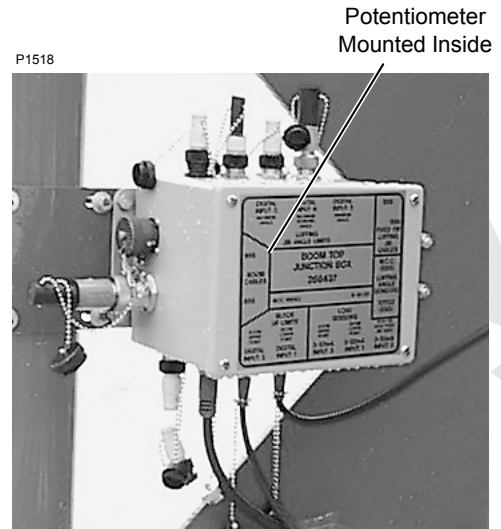


FIGURE 6-9

BOOM AND LUFFING JIB ANGLE INDICATOR CALIBRATION

The following instructions apply to both the wheeled counterweight and the hanging counterweight.

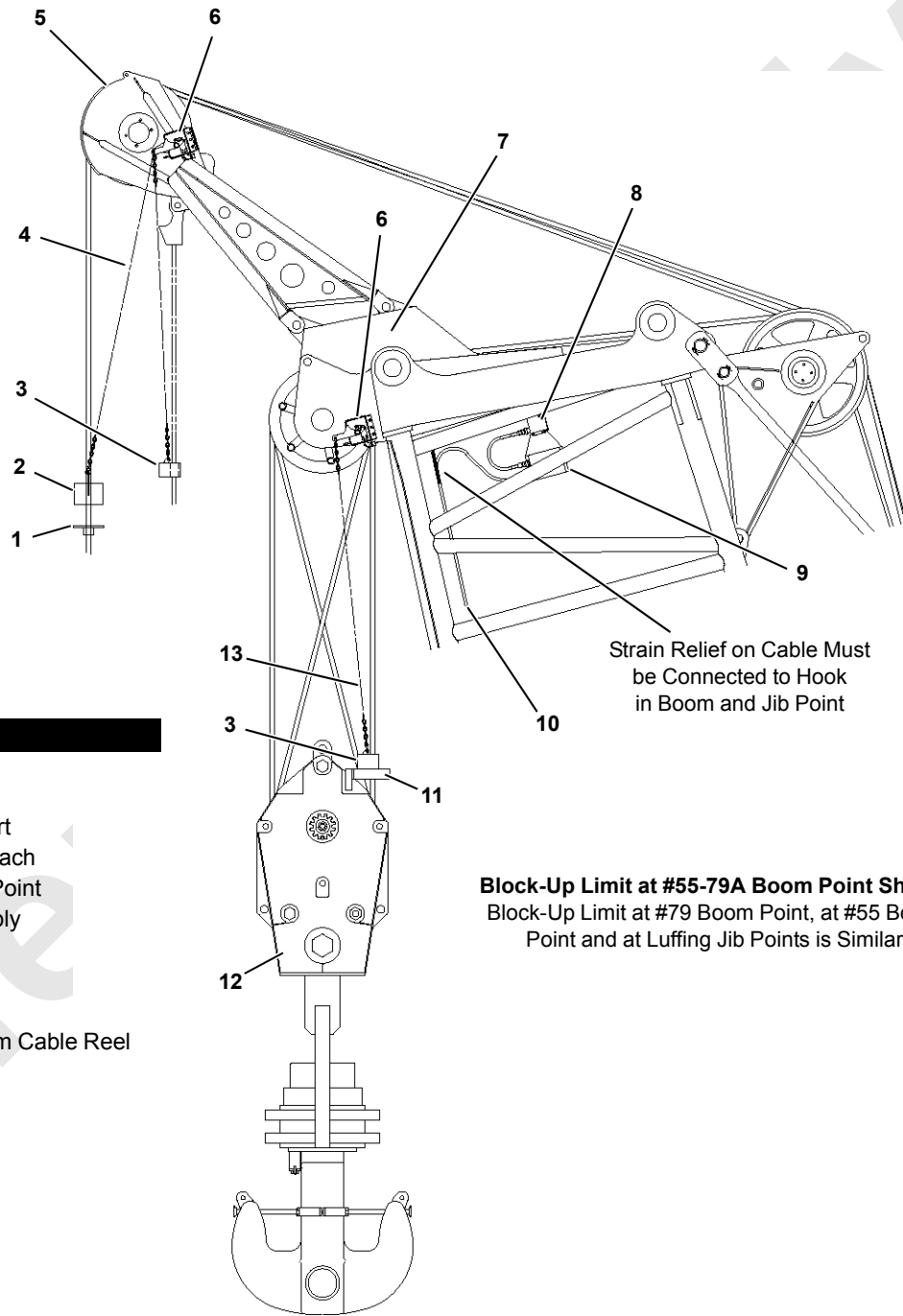
The angle indicator potentiometers are located inside the node controllers mounted on the boom top and on the luffing jib top. The boom and luffing jib angles are calibrated automatically by the crane's programmable controller as part of the load indicator calibration procedure (See Rated Capacity Indicator/Limiter Operation manual for instructions).



Typical Node Controller Installation
on Boom or Luffing Jib Top

FIGURE 6-10

18000MOM603



| Item | Description |
|------|----------------------------------|
| 1 | Lift Block |
| 2 | Weight - 1-Part |
| 3 | Weight - Multiple Part |
| 4 | 8 Ft (2,4 m), 1 or 2 each |
| 5 | Upper Boom or Jib Point |
| 6 | Limit Switch Assembly |
| 7 | Lower Boom Point |
| 8 | Boom Node |
| 9 | Load Cell Receiver |
| 10 | Electrical Cable From Cable Reel |
| 11 | Lift Plates |
| 12 | Load Block |
| 13 | Chain - 12 ft (3,7 m) |

Block-Up Limit at #55-79A Boom Point Shown
 Block-Up Limit at #79 Boom Point, at #55 Boom Point and at Luffing Jib Points is Similar

FIGURE 6-11

BLOCK-UP LIMIT ADJUSTMENT

The following instructions apply to both the wheeled counterweight and the hanging counterweight.

A block-up limit (also called anti two-block device) is a *two-blocking prevention device* which automatically stops the load drum from hoisting and the boom from lowering when a load is hoisted a predetermined distance.

DEFINITION: Two-blocking is the unsafe condition in which the load block or the weight ball contacts the sheave assembly from which either is suspended.

Two-blocking can result in failure of sheaves and wire rope, possibly causing load to fall.

The block-up limit controls must be installed according to Boom Wiring, Limits and Load Indicator Electrical Assembly drawing in Crane Operator Manual.



WARNING

Two-Blocking Hazard!

Block-up limit is a protective device designed only to assist operator in preventing a two-blocking condition; any other use is neither intended nor approved.

Block-up limit may not prevent two-blocking when load is hoisted at maximum single line speed. Operator must determine fastest line speed that allows block-up limit to function properly and, thereafter, not exceed that line speed.

The block-up limit system consists of the following components (see [Figure 6-11](#)):

- Normally closed limit switch assembly fastened at any or all of the following locations:
 - Lower boom point
 - Upper boom point
 - Lower luffing jib point
 - Upper luffing jib point

- Fixed jib point

- Weight freely suspended by chain from each limit switch actuating lever (weight encircles load line as shown in [Figure 6-13](#))

- Lift block fastened to load line or lift plates fastened to load block (see [Figure 6-13](#))

Block-Up Limit Control Operation

See [Figure 6-1](#) through [Figure 6-15](#) for component identification.

During normal operation, the weight overcomes spring force and rotates the actuating lever away from the limit switch lever. This action allows the limit switch to close the load drum UP and boom DOWN electric circuits. Therefore, the load can be hoisted and the boom can be lowered.

When the weight is lifted by the lift block or the lift plates, spring force rotates the actuating lever against the limit switch lever. This action causes the corresponding limit switch to open the load drum UP and boom DOWN electric circuits.

The load drum and boom hoist pumps stroke to off. At the same time, the load drum and boom parking brakes apply to stop the load drum from hoisting and the boom from lowering.

Storing Electric Cable

See [Figure 6-12](#) for the following procedure.

The electric cables for the boom and jib are long enough to accommodate the maximum length of each attachment.

Store excess electric cable for the boom and luffing jib by winding it onto the reel on mounted on the respective butt. The reel is equipped with a locking pin. Disengage the locking pin to allow the reel to be wound. Engage the locking pin to lock the reel in position. The electric cable from the crane to the reel must be disconnected before the reel can be wound.

Store excess electric cable for the fixed jib by winding it around the brackets on the fixed jib.

A1131

| Item | Description |
|------|------------------|
| 1 | Electrical Cable |
| 2 | Cable Reel |
| 3 | Fixed Jib Butt |
| 4 | Brackets |
| 5 | Cable |

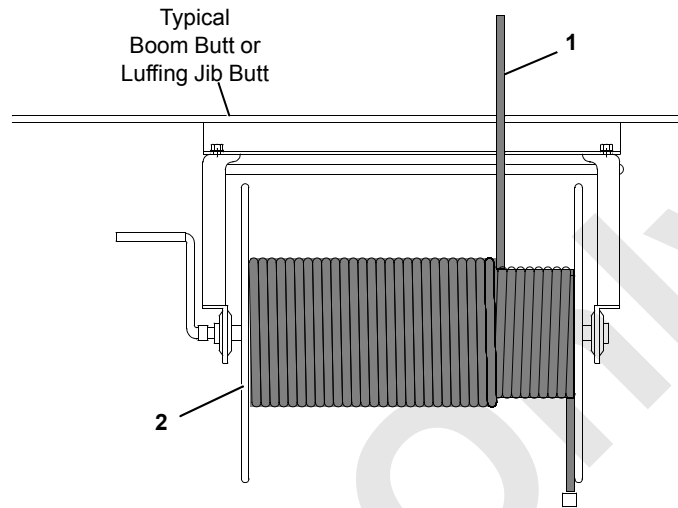
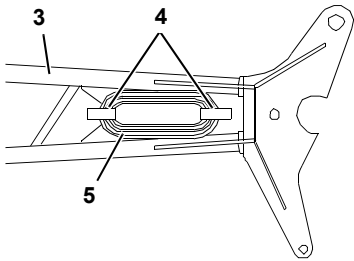
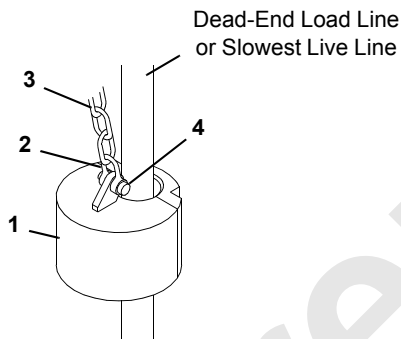
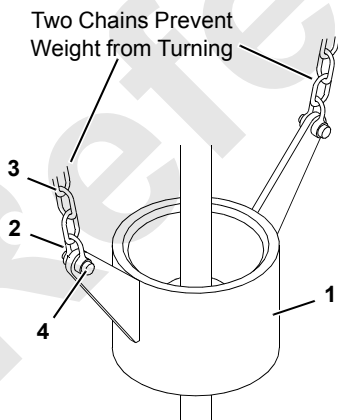


FIGURE 6-12

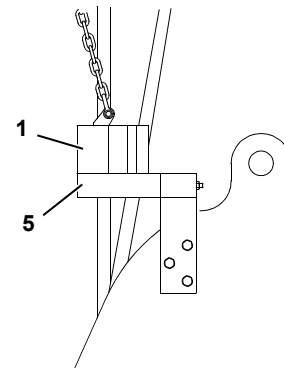


Lower or Upper Boom Point (multiple part)



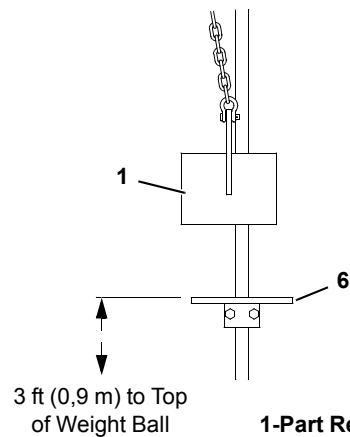
Upper Boom Point (1-part)
Upper Jib Point (1-part)
Lower Jib Point (1-part)

| Item | Description |
|------|----------------|
| 1 | Weight |
| 2 | Shackle |
| 3 | Chain |
| 4 | Connecting Pin |
| 5 | Lift Plate |
| 6 | Lift Block |



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See Load Block Reving in Section 4 for Suggested Location of Weight



1-Part Reving

FIGURE 6-13

Reference Only

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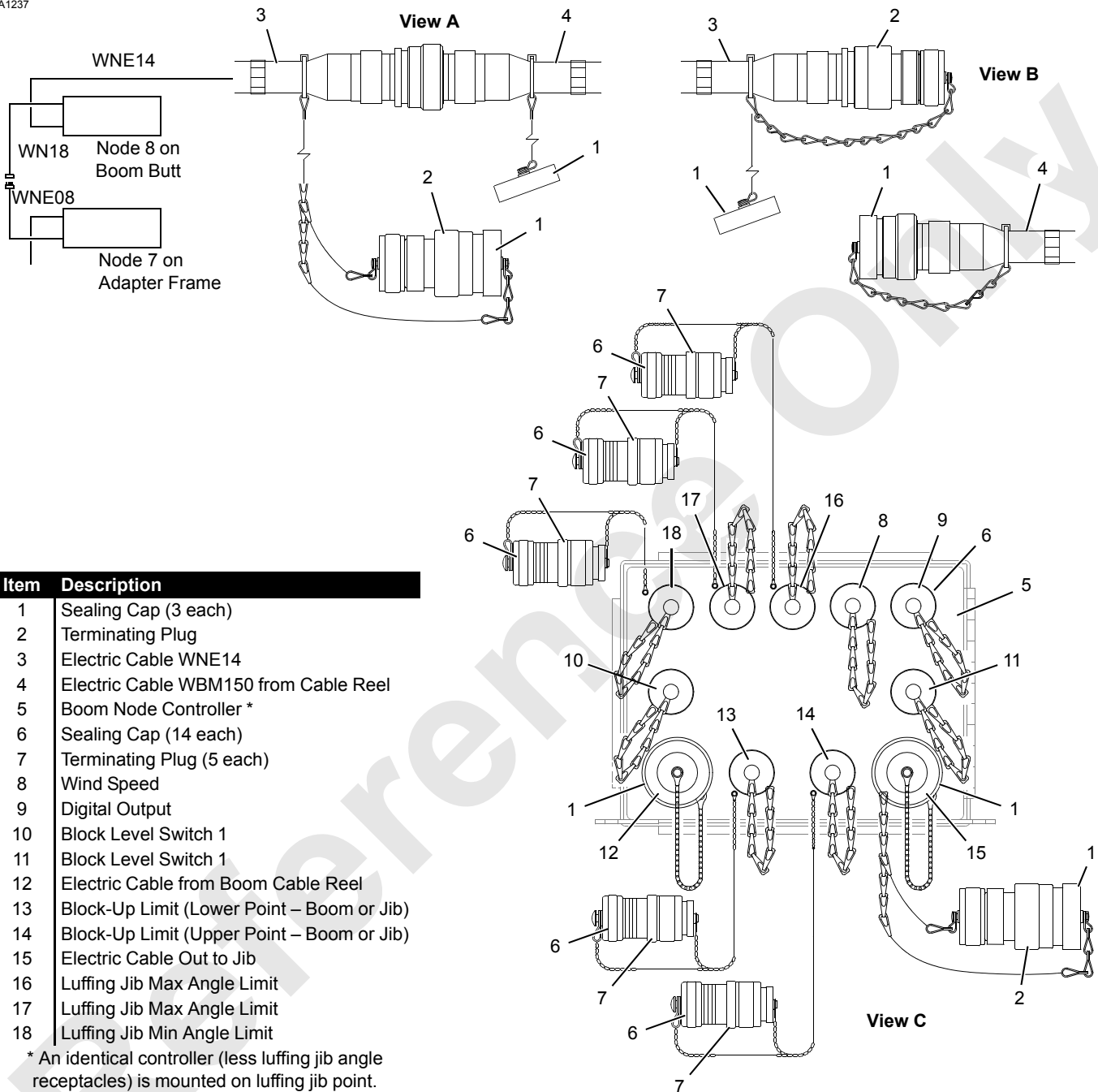


FIGURE 6-14

Disconnecting Block-Up Limit Control

See [Figure 6-14](#) for the following procedure.

Terminating plug (2, Views A and B) is provided so the block-up limit control can be disconnected for the following reasons:

- Crane setup and rigging
- Maintenance

NOTE: When electric cable (3) is terminated, all of the block-up limits (on boom and jib), the RCL, the block level sensor, and the wind speed indicators are disabled.

To disconnect the block-up limits, the RCL, and the wind speed indicators, proceed as follows:

1. Unscrew sealing cap (1, View A) from terminating plug (2).
2. Disconnect electric cable (3, View B) from cable (4).
3. Connect sealing cap (1, View A) to electric cable (4).
4. Connect terminating plug (2, View B) to electric cable (2).

Failing to perform this step will prevent load drums from hoisting and boom from lowering. Operating limits alert will come on.

5. Reverse above steps to reconnect the block-up limits, the RCL, the block level sensor, and the wind speed indicator.

Removing Upper Boom Point or Jib point

Failing to perform following steps will prevent load drums from hoisting and boom (or luffing jib) from lowering. Also operating limits alert will come on.

Remove terminating plugs and reconnect electric cables to proper receptacles when corresponding attachment is reinstalled.

See [Figure 6-14](#) for the following procedures.

If Upper Boom Point, Upper Luffing Jib Point, or Fixed Jib is Removed:

1. Disconnect cable from receptacle (14, View C).
2. Unscrew sealing cap (6, View C) from terminating plug (7) and attach to receptacle (14).
3. Connect sealing cap to end of cable and store on upper boom point or upper jib point.

If Luffing Jib Is Removed:

1. Unscrew sealing cap (1, View C) from terminating plug (2).
2. Disconnect cable from receptacle (15, View C).
3. Connect terminating plug (2, View C) to receptacle (15).
4. Connect sealing cap to end of cable and coil cable onto cable reel (luffing jib butt).
5. Remove sealing caps (7, View C) from terminating plugs (6) and connect terminating plugs to jib stop receptacles (16, 17, and 18).

Maintenance

Inspect and test the block-up limits **weekly or every 40 hours of operation**, as follows:

| Item | Description | Item | Description |
|------|--------------------------------|------|--------------------|
| 1 | From Boom or Jib Node | 7 | Grease Fitting |
| 2 | Elbow with Cord Gripper | 8 | Actuating Lever |
| 3 | Setscrew | 9 | Roller |
| 4 | Spring | 10 | Limit Switch Lever |
| 5 | Enclosure | 11 | Shaft |
| 6 | Spring Tension Adjusting Screw | 12 | Cover |

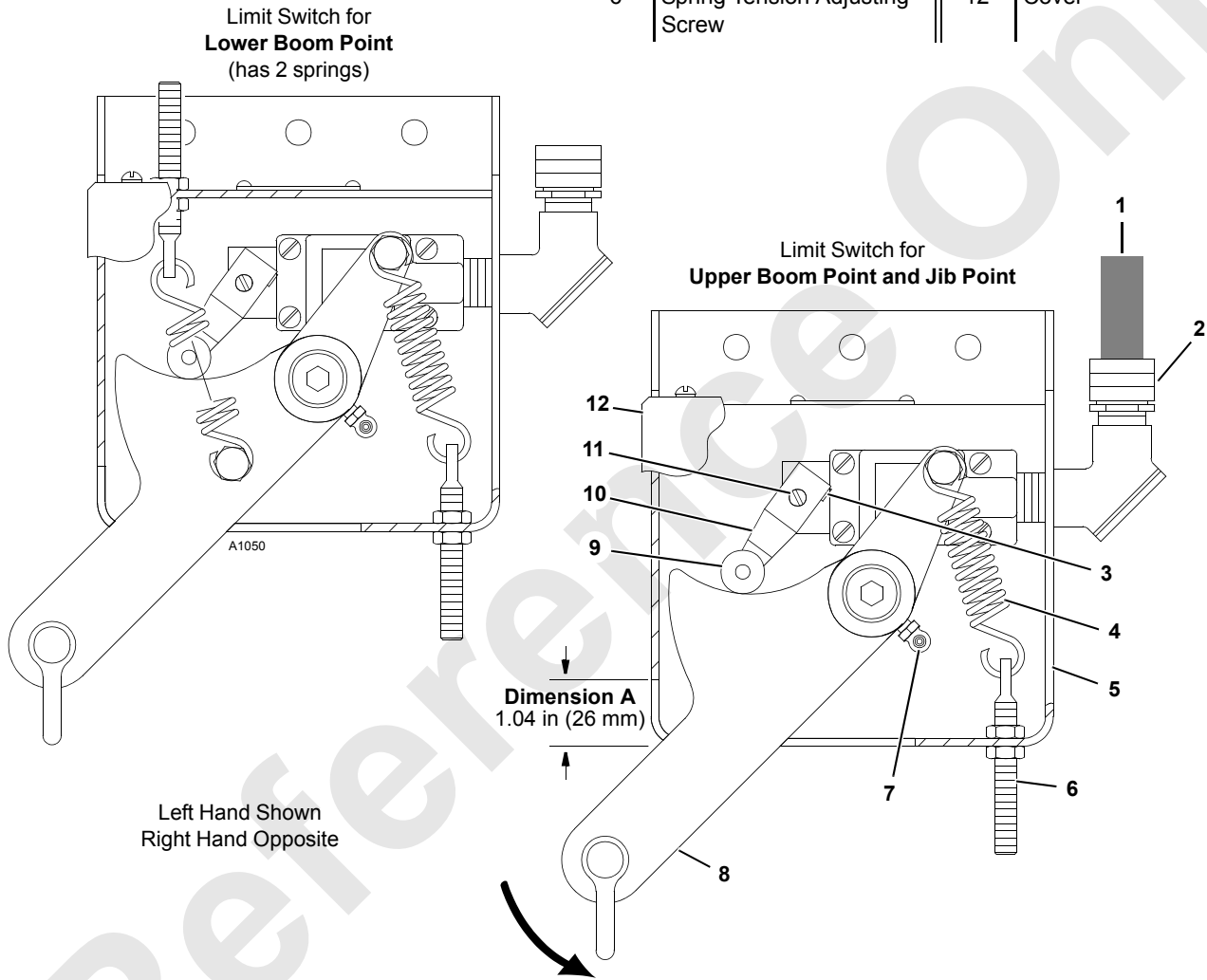


FIGURE 6-15

CAUTION

Avoid Machinery Damage!

To prevent two-blocking from occurring, do not operate crane until cause for improper operation and all hazardous conditions have been found and corrected.

1. Lower the boom and jib onto blocking at ground level and carefully inspect following items:
 - a. Inspect each limit switch lever and actuating lever (see [Figure 6-15](#)) for freedom of movement. Apply one-half shot of grease to fitting on the actuating lever; wipe away any excess grease.
 - b. Inspect each weight ([Figure 6-13](#)) for freedom of movement on the load line.
 - c. Inspect each weight, each chain, each shackle and each connecting pin ([Figure 6-13](#)) for excessive or abnormal wear. Make sure cotter pins for shackles are installed and spread.
 - d. Inspect entire length of each electric cable for damage.
 - e. Check that electric cables are clear of all moving parts on boom and jib and that cables are securely fastened to boom and jib with nylon straps.
 - f. Check that all plugs ([Figure 6-14](#)) are securely fastened.
2. Test block-up limits for proper operation using either of following methods:
 - g. **BOOM LOWERED:** Manually lift each weight — **one at a time** — while engine is running. Load drum should not operate in **hoist** direction and boom hoist should not operate in **lower** direction.

- h. **BOOM RAISED:** **Slowly** hoist each load block and weight ball — **one at a time** — against weight. When chain goes slack, corresponding load drum should stop **HOISTING** and boom hoist should not operate in **LOWER** direction.
-

CAUTION

Avoid Sheave Damage!

Use extreme care when testing block-up limits when boom is raised. If a block-up limit fails to stop load, immediately stop load by moving drum control handle to off; otherwise, two-blocking may occur.

Adjustment

See [Figure 6-15](#) for the following procedure.

Lower boom onto blocking at ground level and adjust each limit switch as follows:

1. Adjust spring tension so there is enough force to lift weight of chain and rotate actuating lever when weight is lifted.
2. Loosen setscrew in limit switch lever so lever is free to rotate.
3. Manually lift weight to allow actuating lever to rotate upward.
4. Hold lever at Dimension A.
5. Hold roller on limit switch lever against actuating lever while performing step 6.
6. Turn limit switch shaft **Clockwise** only enough to “click” *limit switch open and hold*. Then securely tighten setscrew in limit switch lever.
7. Test limit switch for proper operation (see Maintenance topic); repeat adjustment steps until limit switch operates properly.

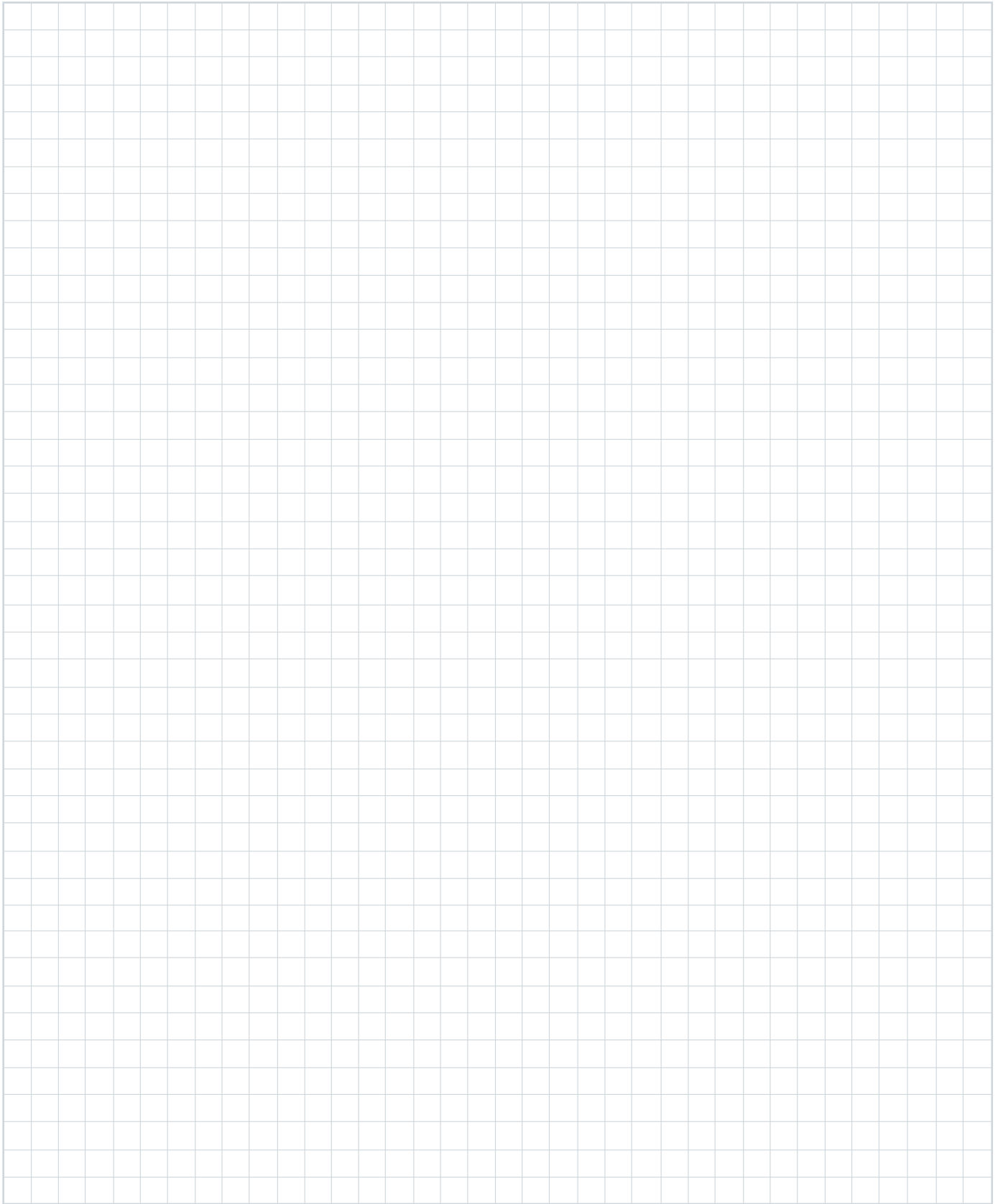
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Reference Only

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