National Crane NBT60

Operator Manual

Grove Manitowoc National Crane Potain

Manitowoc

SECTION 1
INTRODUCTION

SECTIONS CONTENTS

This manual has been compiled to assist you in properly operating and maintaining your Model NBT60 Series National Crane (Figure 1-1).

Before placing the crane in service, all operators and persons working around the crane must thoroughly read and understand the contents of this manual pertaining to ***Safety, Operation and Maintenance.*** Before moving a vehicle equipped with the crane, information relating to transporting the vehicle must be read and observed.

This manual must be retained with the crane for use by subsequent operating personnel.

For detailed information concerning the operation and maintenance of the RCL system installed on the crane, see Section 7 - Rated Capacity Limiter in this manual. Manufacturers of rated capacity limiters may refer to them in their manuals as a load moment indicator (LMI), a hydraulic capacity alert system (HCAS), a safe load indicator (SLI); National Crane refers to these systems as a rated capacity limiter (RCL) throughout its *Operator* and *Service Manuals*.)

Information in this manual does not replace federal, state or local regulations, safety codes or insurance requirements.

The NBT60 has been designed for maximum performance with minimum maintenance. With proper care, years of trouble-free service can be expected.

Constant improvement and engineering progress makes it necessary that we reserve the right to make specification and equipment changes without notice.

National Crane and our Distributor Network want to ensure your satisfaction with our products and customer support. Your local distributor is the best equipped and most knowledgeable to assist you for parts, service, and warranty issues. They have the facilities, parts, factory trained personnel, and the information to assist you in a timely manner. We request that you first contact them for assistance. If you feel you need factory assistance, please ask the distributor's service management to coordinate the contact on your behalf.

Supplemental Information

Supplemental Information regarding Safety and Operation, Specifications, Service and Maintenance, Installation, and parts for options such as remote controls, augers, varying control configurations, baskets, grapples, etc. are included in separate manuals.

Whenever a question arises regarding your National product or this publication, please consult your National Crane Distributor for the latest information. Your National Crane Distributor is equipped with the proper tools, necessary parts, and trained personnel to properly maintain and service your crane.

A Safety Compact Disc/USB flash drive which includes sections on Operation, Safety and Maintenance for National Crane operators and owners is supplied when the crane is purchased new. Additional copies are available from your local distributor.

New Owner

If you are the new owner of a National Crane, please register it with Manitowoc Crane Care so we have the ability to contact you if the need arises. Go to: https://www.manitowoccranes.com/en/Parts_Services/ServiceAndSupport/ChangeOfOwnershipForm and complete the form.

Basic Nomenclature

The nomenclature used to describe parts of a National Crane are described in Figure 1-2. This nomenclature is used throughout this manual.

provided to assist in determining safe operation in windy conditions.

Always use extreme caution when windy conditions exist. NEVER exceed the rated capacity shown on the *Load Chart*.

Always check the *Load Chart* to ensure the load to be lifted is within the rated capacity of the crane.

Wind can have a significant effect on loads that may be lifted by a crane. Wind forces act differently on a crane depending upon the direction from which the wind is blowing (e.g., wind on the rear of the boom can result in decreased forward stability, wind on the underside of the boom can result in decreased backward stability, wind on the side of the boom can result in structural damages, etc.)

Wind forces can exert extreme dynamic loads. National Crane recommends that a lift not be made if the wind can cause a loss of control in handling the load.

Wind forces can be determined by typical visible effects on the landscape.To assist you in determining prevailing wind conditions, refer to Table 2-1.

NOTE: The wind speed corresponding to the Beaufort scale in the table is mean wind speed at 10 m (33 ft) elevation over a period of 10 minutes.

Table 2-1 Beaufort Wind Scale

		Maximum Wind Speed			
Beaufort Number	**Description**	**m/s**	**km/h**	**mph**	**Visible Indicator Effects of wind as observed on land**
Zero (0)	Calm	0.3	1.1	0.7	Calm; smoke rises vertically
1	Light Air	1.5	5.4	3.4	Smoke drift indicates wind direction. Leaves and wind vanes are stationary.
2	Light Breeze	3.3	11.9	7.4	Wind felt on exposed skin. Leaves rustle. Wind vanes begin to move.
3	Gentle Breeze	5.4	19.4	12.1	Leaves and small twigs constantly moving. Light flags extended.
4	Moderate Breeze	7.9	28.4	17.7	Dust and loose paper raised. Small branches begin to move.
5	Fresh Breeze	10.7	38.5	23.9	Branches of a moderate size move. Small trees in leaf begin to sway.
6	Strong Breeze	13.8	49.7	30.9	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic bins tip over.
7	High Wind	17.1	61.6	38.3	Whole trees in motion. Effort needed to walk against the wind.
8	Gale	20.7	74.5	46.3	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong Gale	24.4	87.8	54.6	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over.
10	Storm	28.4	102.2	63.5	Trees are broken off or uprooted, structural damage likely.

Wind Speeds

The maximum permissible wind speed referred to in the load charts is the 3-second wind gust speed measured at the boom tip height and is designated as ***V(z)***. This value is either recorded at boom tip or calculated based on mean wind speed recorded at crane operation site. For lift planning purposes only, the 3-second wind gust speed, ***V(z)***, may be calculated based on mean wind speed reported at http://www.windfinder.com “Super Forecast”.

This 3-second wind gust is assumed to act on the entire crane and the load. The wind effect on the load can be conservatively estimated as:

a) If ***V(z)*** is ≤ 13.4 m/s (30 mph), then the **allowable** load is the published rated capacity from the Load Chart.

b) If ***V(z)*** is > 13.4 m/s (30 mph) and is ≤ 20.1 m/s (45 mph), the **allowable** load is the published rated capacity multiplied by the Capacity Reduction Factor from Table 2-4 (metric) or (non-metric).

Rated Load Chart Example - Non-metric

RATED LIFTING CAPACITIES IN POUNDS
36 FT. - 110 FT. BOOM

ON OUTRIGGERS FULLY EXTENDED - 360°

Radius in Feet	#0001								
	Main Boom Length in Feet								
	36	40	50	**60	70	80	90	100	110
10	130,000 (69.5)	90,300 (71.5)	90,300 (75.5)	*62,500 (78)					
12	112,500 (65.5)	90,300 (68.5)	90,300 (73)	62,500 (76.5)	*40,200 (78)				
15	93,250 (60)	90,300 (63.5)	90,250 (69.5)	62,500 (73.5)	40,200 (76)	*40,200 (78)			
20	71,550 (49.5)	71,500 (55)	71,300 (63)	62,500 (68)	40,200 (71.5)	40,200 (74.5)	40,200 (78)	*36,900 (78)	
25	56,650 (36.5)	56,600 (45)	56,350 (56)	53,650 (63)	40,200 (67)	40,200 (70.5)	37,950 (73)	34,900 (75)	*25,150 (78)
30	43,500 (11.5)	44,300 (32)	43,950 (48.5)	43,650 (57.5)	40,200 (62.5)	[illegible]	32,750 (69.5)	30,200 (72)	25,150 (74)
35			33,550 (40)	33,700 (51.5)	34,700 (58)	[illegible]	[illegible]	26,400 (69)	24,700 (71.5)
40			25,800 (28)	26,150 (44.5)	[illegible]	[illegible]	25,200 (62.5)	23,300 (66)	21,800 (68.5)
45				[illegible]	[illegible]	22,300 (54)	22,400 (59)	20,700 (62.5)	19,400 (65.5)
50				[illegible]	17,400 (41)	18,25[illegible] (49.5)	19,100 (55)	18,550 (59.5)	17,350 (62.5)
55					14,300 (33.5)	[illegible] (44)	16,000 [illegible]51)	16,400 (56)	15,600 (60)
60					[illegible]	12,700 (38.[illegible]	13,550 (46.5)	13,950 (52.5)	14,100 (56.5)
65						[illegible]00 (31.5)	11,550 (41.5)	11,950 (48.5)	12,300 (53.5)
70						9,010 (22.5)	9,920 (36)	10,250 (44)	10,650 (50)
75							8,510 (29.5)	8,890 (39.5)	9,250 (46)
80							7,260 (21)	7,690 (34.5)	8,050 (42.5)
85								6,620 (28.5)	7,010 (38)
90								5,630 (20)	6,100 (33)
95									5,240 (27)
100									4,480 (19.5)
Minimum boom angle (°) for indicated length (no load)									0
Maximum boom length (ft.) at 0° boom angle (no load)									110

NOTE: ( ) Boom angles are in degrees.
#RCL operating code. Refer to RCL manual for operating instructions.
*This capacity is based on maximum boom angle.
NOTE: For allowable capacities while operating in 3-second wind gust speeds greater than 30 mph and up to 45 mph, refer to *Capacity Reduction Factors for wind speed (3-second gust speed) V(z) greater than 30 mph.*

Lifting Capacities at Zero Degree Boom Angle									
Boom Angle	Main Boom Length in Feet								
	36	40	50	**60	70	80	90	100	110
0°	30,350 (30.1)	25,700 (34.2)	17,950 (44.2)	13,050 (54.6)	10,050 (64.2)	7,790 (74.2)	6,300 (84.2)	4,900 (94.2)	3,900 (104.2)

NOTE: ( ) Reference radii in feet.
** Boom length is with inner-mid fully extended and outer-mid & fly fully retracted.

8382-1

FIGURE 2-4

- The platform is properly attached and secured to the load hook.

- For boom mounted platforms:
  - On cranes equipped with a boom mounted personnel platform, use only a platform approved by National Crane.
  - The platform is properly attached and secure.

To avoid death or serious injury:

- NEVER use this crane for bungee jumping or any form of amusement or sport.
- NEVER handle personnel on the loadline unless the requirements of applicable national, state and local regulations and safety codes are met.
- NEVER permit anyone to ride loads, hooks, slings or other rigging for any reason.
- NEVER get on or off a moving crane.
- NEVER allow anyone other than the operator to be on this crane while the machine is operating or traveling.

The following standards and regulations regarding personnel handling are available by mail at the following addresses:

- *ASME (formerly ANSI) B30 Series American National Safety Standards For Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings*; *ASME B30.5, Mobile And Locomotive Cranes, and ASME B30.23, Personnel Lifting Systems*, are available by mail from the ASME, 22 Law Drive, Fairfield, New Jersey, 0700-2900

  - or -

  online at: www.asme.org/kb/standards
- *US DOL/OSHA Rules and Regulations* are available by mail from the Superintendent of Documents, PO Box 371954, Pittsburgh, PA, 15250-7954.

ENVIRONMENTAL PROTECTION

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

Potentially harmful waste used in National 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, observe the following:

- 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 clean up any spills.

MAINTENANCE

The crane must be inspected prior to use on each work shift. The owner, user, and operator must ensure that routine maintenance and lubrication are being dutifully performed. **Never** operate a damaged or poorly maintained crane.

National Crane continues to recommend that cranes be properly maintained, regularly inspected and repaired as necessary. National Crane reminds crane owners to ensure that all safety decals are in place and legible. National Crane continues to urge crane owners to upgrade their cranes with rated capacity limiter and control lever lockout systems for all lifting operations.

Shut down the crane while making repairs or adjustments.

Always perform a function check after repairs have been made to ensure proper operation. Load tests should be performed when structural or lifting members are involved.

Follow all applicable safety precautions in this manual when performing crane maintenance as well as crane operations.

Keep the crane free of mud, dirt, and grease at all times. Dirty equipment introduces hazards, wears-out faster, and makes proper maintenance difficult. Cleaning solutions used should be non-flammable, non-toxic and appropriate for the job.

Routine maintenance and inspection of this crane must be performed by a qualified person(s) according to the recommendations in the *Manitowoc Crane Care Maintenance and Inspection Manual*. Any questions regarding procedures and specifications should be directed to your National Crane distributor.

Service and Repairs

WARNING

Fall Hazard!

Working at elevated heights without using proper fall protection can result in severe injury or death.

Always use proper fall protection as required by local, state or federal regulations.

Service and repairs to the crane must only be performed by a qualified person. All service and repairs must be performed in accordance with manufacturer's recommendations, this manual, and the service manual for this machine. If there is any question regarding maintenance procedures or

BOOM EXTENSION

To avoid death or serious injury, follow the procedures in this manual during erection, stowage, and use of the boom extension.

Install and secure all pins properly.

Control movement of boom extension at all times.

Do not remove right side boom nose pins unless boom extension is properly pinned and secured on front and rear stowage brackets.

DANGER

Boom Extension Hazard!

To avoid death or serious injury, follow procedures in *Load Chart*, safety, and operation manuals during erection, stowage and use of boom extension. Install and secure all pins properly and control boom extension movement at all times.

Do not remove all the pins from both front and rear stowage brackets unless the boom extension is pinned to the right side of the boom nose.

Properly inspect, maintain, and adjust boom extension and mounting.

When assembling and disassembling boom extension sections, use blocking to adequately support each section and to provide proper alignment.

Stay outside of boom extension sections and lattice work.

Watch for falling or flying pins when they are being removed.

PARKING AND SECURING

WARNING

Tipping Hazard!

When parking the crane and leaving it unattended follow the instructions for the Controls and Operating Procedures of this manual.

Failure to comply with these instructions may cause death or serious injury

When parking on a grade, apply the parking brake and chock the wheels.

The Controls and Operating Procedures section of this manual provides instructions for parking and securing a crane when it is to be left unattended. These instructions are intended to allow the crane to be placed in the most stable and secure position. However, National Crane recognizes that certain jobsite conditions may not permit the boom and boom extension of a crane to be fully lowered to the ground. When a qualified person at a jobsite determines that it is not practical to lower the boom to the ground, we recommend the following additional instructions be followed:

- The crane should be left in the smallest, most stable, valid operational configuration that the job site practically allows.
- The crane can not be left running, with a load on the hook, or in erection mode, or in wind conditions in excess of allowed values.
- The boom should be retracted as far as is practical, the crane configured in as stable a configuration as possible (boom angle, superstructure orientation, boom extension angle, etc.)
- In high winds the boom and boom extensions should be lowered, or secured. Changing weather conditions including but not limited to: wind, ice accumulation, precipitation, flooding, lightning, etc. should be considered when determining the location and configuration of a crane when it is to be left unattended.

SHUT-DOWN

Use the following steps when shutting down the crane:

- Engage the parking brake.
- Fully retract and lower the boom.
- Engage the swing lock pin and/or 360 degree swing lock.
- Place controls in neutral position.
- Shut down the engine and remove the ignition key.
- Chock the wheels, if not on outriggers.
- Lock the operator’s cab (if applicable) and install vandal guards, if used.

COLD WEATHER OPERATION

Cold weather operation requires additional caution on the part of the operator.

Check operating procedures in this manual for cold weather starting.

Don’t touch metal surfaces that could freeze you to them.

Clean the crane of all ice and snow.

Allow ample time for hydraulic oil to warm up.

In freezing weather, park the crane in an area where it cannot become frozen to the ground. The drive line can be damaged when attempting to free a frozen crane.

SECTION 3
CONTROLS AND OPERATING PROCEDURES

SECTION CONTENTS

Item	Description	Item	Description
1	Outrigger Control Pad	13	Program/Diagnostic Connector
2	Swing Brake Pedal	14	Crane Level
3	Boom Telescope Pedal (Optional)	15	Truck Engine Hi/Low Switch
4	Foot Throttle Pedal	16	Crane Function Power Switch
5	Display Panel Assembly	17	Remote Power Switch (Optional)
6	RCL Bypass Switch	18	Work Light Switch
7	Reserved	20	Skylight Wiper Switch
8	Reserved	21	Windshield Wiper Switch
9	Emergency Stop Switch	22	A/C Heater Function Switch
10	A/C Heater Vent	23	A/C Heater Temperature Control
11	Ignition Switch	24	A/C Heater Fan Speed
12	Receptacle (12v)		

If the crane is equipped with a jib that is deployed and rigged for work, repeat the test procedure for the jib A2B block switch.

RCL Check

Perform the following checks to verify proper RCL operation.

- Check that the display of the main boom length agrees with the actual boom length.
- Check that the display of the main boom angle agrees with the actual boom angles.
- Check that the display of the operating radius of the crane agrees with the actual radius.

Check the load display by lifting a load of known weight. The accuracy of the load indication shall be within the tolerance of SAE J159.

DANGER

A deviation between displayed and actual values indicates a malfunction and a RCL service representative shall be called for repair and/or recalibration of RCL system.

HOIST SYSTEM OPERATION

The hoist may have lifting capabilities greater than that of the crane limits. Therefore, care must be taken to ensure that the load lifted is within the crane rating. General rules for hoist operation are:

- Lower the hoist rope when extending the boom.
- Use the anti-two-block system only as an aid.
- Make sure the rope is not twisted or kinked and that it is properly seated in the hoist and in sheaves.
- Always have at least three full wraps of wire rope and eight wraps of synthetic rope on the hoist.
- Check the hoist brake when approaching the load limit of the hoist. Raise the load a few inches and return the control to neutral to check the brake.
- Do not drag the load with the hoist.
- Do not try to lift loads that are not free such as, frozen down material or poles.
- Keep tension on the rope to prevent it from becoming twisted, kinked, or improperly seated on the hoist.

WORK SITE LOCATION

Select a location that is firm, level, and dry. Avoid uneven, rocky or muddy terrain, steep grade or locations with overhead obstructions. The outrigger jacks must be supported on a firm level surface at the fully retracted, mid-span, or fully extended positions. Avoid overhead power lines.

Before Leaving the Truck Cab

- Position the truck so that the outriggers can be extended with no obstructions.
- Position the truck transmission to neutral.
- Set the truck park brake. Wheel chocks may also be required.
- Engage the power takeoff.
- Turn the truck cab ignition switch to OFF.

DANGER

Truck must be in neutral with the park brake set before starting engine from crane cab to avoid sudden potential movement of truck.

Stowing and Parking

WARNING

Tipping Hazard!

Never park the crane near holes, or on rocky or extremely soft surfaces. This may cause the crane to overturn.

Failure to comply with these instructions may cause death or serious injury.

When parking the crane, it should be placed in the smallest, most stable operational configuration that the job site practically allows by doing the following steps:

1. Park the crane on a stable surface.
2. Remove the load from the hook.
3. Stow the swingaway jib, if erected.
4. Fully retract the boom and position it in the normal travel position, then perform the following and proceed to Step 6:
   - **a.** Engage the swing brake and/or swing lock pin.
   - **b.** Retract all outrigger jack cylinders and outrigger beams.

LCD SCREEN LAYOUTS

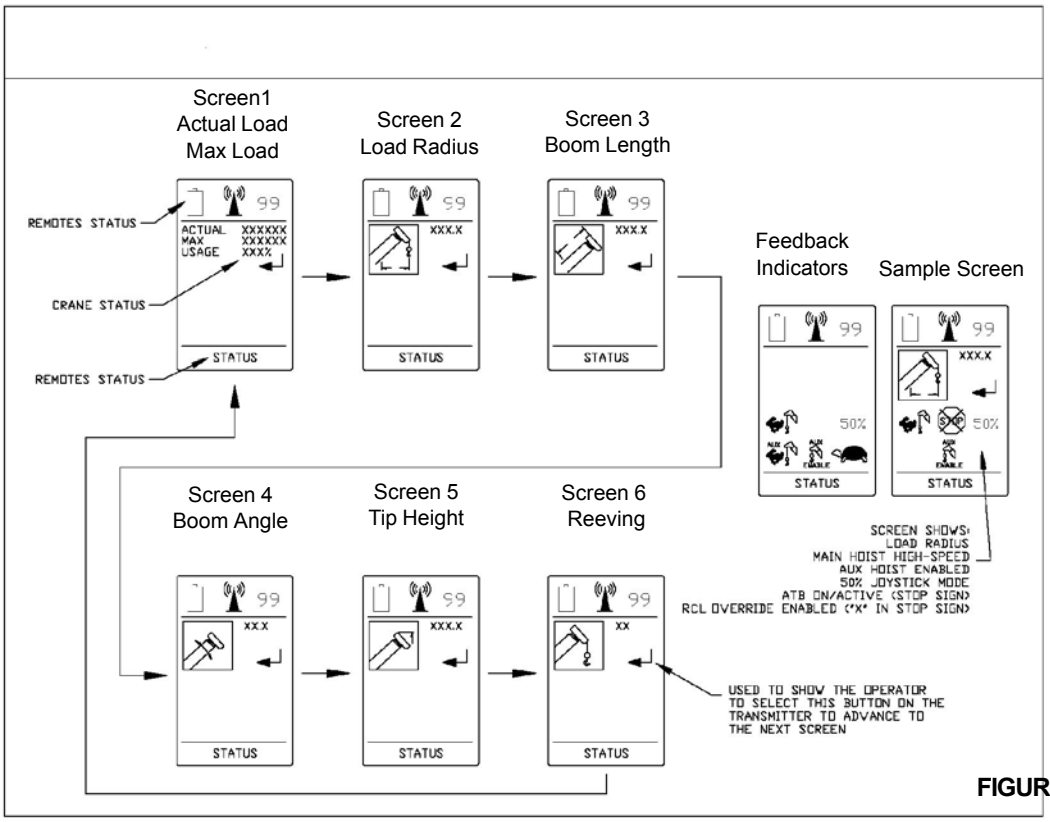

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FIGURE 3-21

3

To remove the jib, proceed as follows:

1. Using boom telescope function, fully retract boom.
2. Using lift function, lower boom so that attachment pins (6 and 7, Figure 4-3) are easily accessible from the ground.

NOTE: When lowering the boom below horizontal, two persons may be required. With the telescope control in neutral, the boom may slide out when below horizontal.

3. Install right side attachment pins (6, Figure 4-3) in upper and lower jib lugs, secure with retainer spring clips. These pins are used as a pivot point to swing jib into the deployed position.
4. Locate the stowed position of attachment pins (7, Figure 4-3). If in jib attachment holes or boom sheave case jib holes, remove pins from storage location.
5. Remove jib swing pin (5, Figure 4-3) from top ear of jib.
6. Remove stow pin (1, Figure 4-3) and stow in hook bracket (3), secure with spring clip.
7. Attach tag line to sheave case end of jib.
8. Using the lift function, raise the boom to the horizontal position.

⚠ CAUTION

Use caution during this step. The jib is free to swing away from the boom upon boom extension.

9. Using telescope function, slowly extend boom approximately one foot. This procedure will pull the jib out of the hook bracket (3, Figure 4-3).
10. Support and raise the jib at its balance point, then remove right side attachment pins (6, Figure 4-3) in upper and lower jib lugs. Jib is now free of boom.
11. To install, proceed in reverse order of removal.

JIB MAINTENANCE

1. Lubricate as outlined in the section titled *Lubrication Procedure and Charts*, page 5-1.
2. Check for free rotation of jib sheave daily when using jib.

Setting the Offset

CAUTION

The mast assembly (10, Figure 4-4) must be positioned on top of the base section before attempting to offset the swingaway to 30 degrees. Failure to do so can cause damage to the mast and/or swingaway adapter.

1. Extend and set the outriggers. Swing the boom over rear of truck chassis.
2. To set the offset from zero degrees (0°) to thirty degrees (30°), perform the following:

CAUTION

Do not overload the swingaway or the attachment points when lowering the boom.

   a. Slowly lower the boom until the tip of the swingaway is on the ground and the pressure on the offset pin is relieved.
   b. Remove the lock pin, two washers, and offset pin.
   c. Slowly elevate and telescope the boom at the same time until the offset shaft takes the full load of the swingaway.

3. To set the offset from thirty degrees (30°) to zero degrees (0°), perform the following:
   a. Slowly lower the boom until the tip of the swingaway is on the ground and the offset pin can be installed.
   b. Install the offset pin, two washers, and lock pin.
   c. Raise the boom and operate as desired.

Setting the Offset Mast

NOTE: The hoist cable must be routed over the mast assembly and under the roller on the mast for all configurations.

CAUTION

The mast assembly (10, Figure 4-4) must be positioned on top of the base section before attempting to offset the swingaway to 30 degrees. Failure to do so can cause damage to the mast and/or swingaway adapter.

1. Extend and set the outriggers.
2. Swing the boom over rear of truck chassis.

CAUTION

Do not overload the swingaway or the attachment points when lowering the boom.

3. Deploy the jib as outlined in (*JIB Operation*, page 4-4).
4. Remove the pin (3, Figure 4-5) from the mast stowage bracket (4).
5. Swing the mast (1 Figure 4-5) from the stowed position to the top of the jib boom (2).

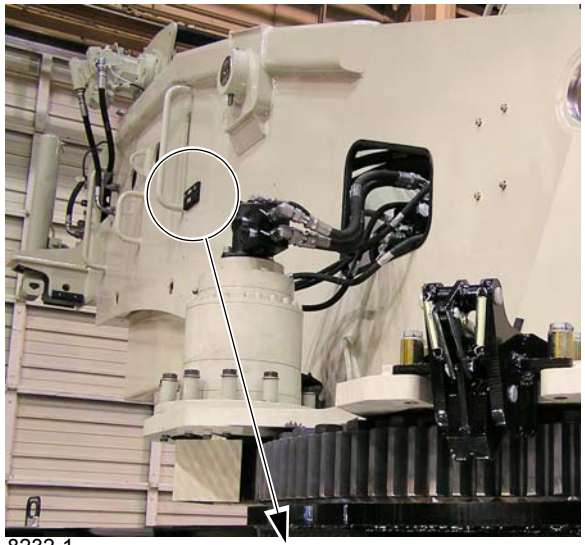
c. Release the left and right Counterweight Removal Cylinder Raise Buttons when the cylinders are at the fully raised position.

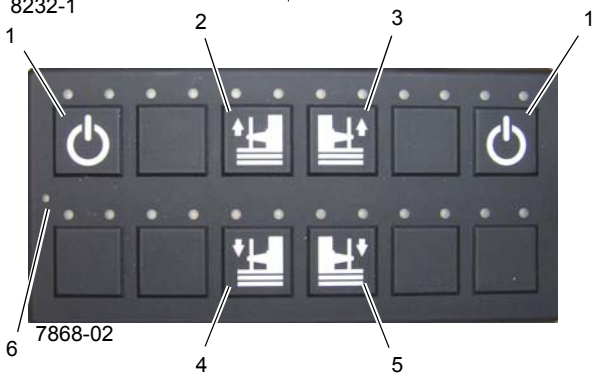
NOTE: If top counterweight hits wear pads on the superstructure when raising, swing crane to re-align counterweight to mounting lugs, lower counterweight back down onto mounting lugs on carrier deck to realign counterweight on cylinder pins, then raise counterweight again.

11. Secure Removable Counterweight to left and right sides of superstructure using pins (4, Figure 4-12).

NOTE: It may be necessary to jog the cylinders up and down to install pins.

12. Slightly lower left and right cylinders to relieve the weight of the counterweight from the cylinder pins.





Counterweight Switch Panel

1	Power Buttons
2	Right Cylinder Raise Button
3	Left Cylinder Raise Button
4	Right Cylinder Lower Button
5	Left Cylinder Lower Button
6	Panel Power Indicator (LED)

FIGURE 4-13

Stowing the Counterweight

1. Position crane on a firm, level surface.

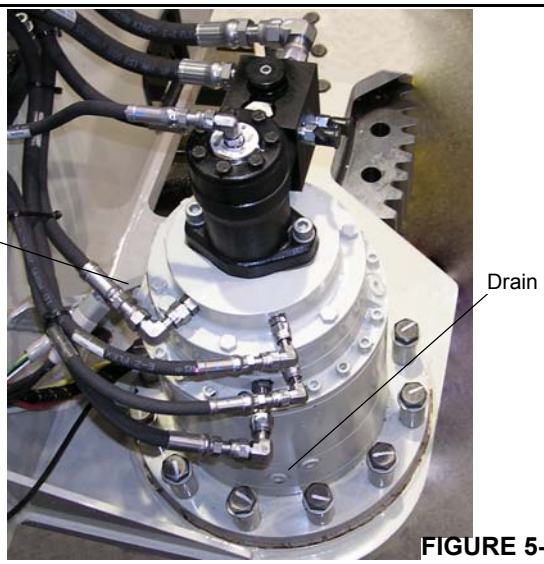
2. Fully extend and set the outriggers, then level the crane (see *Setting the Outriggers*, page 4-2).

3. Set display in Operator's Console to the RCL Operating Mode Screen (Figure 4-11) (see *Section 7, Rated Capacity Limiter*).

4. While watching the display, rotate superstructure until Counterweight Removal Slew Position Indicator (yellow arrows) (1, Figure 4-11) appears in the display, which

Gearbox oil level inspection is achieved by removing the gearbox fill/vent plug and visually inspecting the oil level. Maximum oil level is to be 1” below the port for this gearbox with 3.3 l (3.50 qt) of gear lube oil.

Gearbox lubricants are satisfactory for standard operation in temperatures from -23° C to 82° C (-10° F to +180° F). For operation outside this range, contact Manitowoc Crane Care for recommendations.

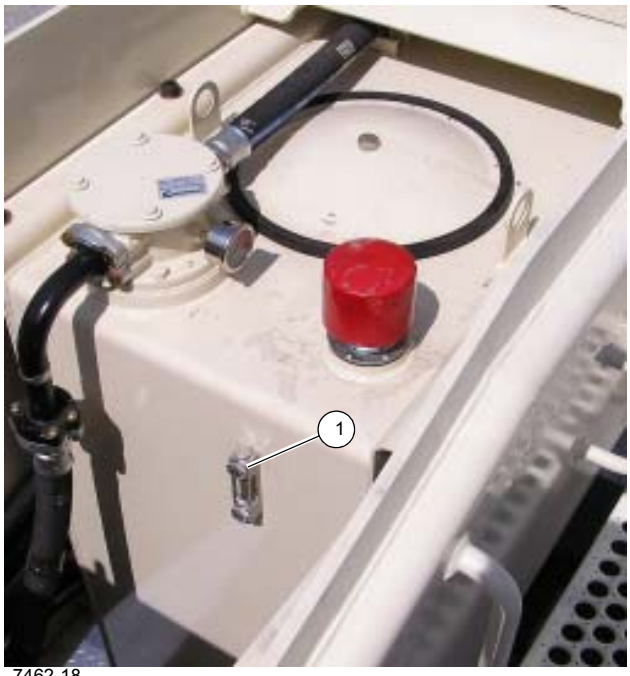


8256-2 **FIGURE 5-5**

Hydraulic Oil Reservoir Level

The hydraulic oil reservoir has a sight gauge (1,Figure 5-6) located on the side of the reservoir. The oil in the hydraulic reservoir is sufficient when the level is between the High and Low marks on the sight gauge with the crane parked on a level surface in the transport position and the oil cold.

If the oil level is to low, add the recommended hydraulic oil until the oil level is even with the upper mark. If the oil level is high, drain oil until the oil level is even with the upper mark.



7462-18 **FIGURE 5-6**

Surface Protection for Cylinder Rods

Steel cylinder rods include a thin layer of chrome plating on their surfaces to protect them from corroding. However, chrome plating inherently has cracks in its structure which can allow moisture to corrode the underlying steel. At typical ambient temperatures, hydraulic oil is too thick to penetrate these cracks. Normal crane operating temperatures will allow hydraulic oil to warm sufficiently to penetrate these cracks and if cranes are operated daily, protect the rods. Cranes that are stored, transported, or used in a corrosive environment (high moisture, rain, snow, or coastline conditions) need to have the exposed rods protected more frequently by applying a protectant. Unless the crane is operated daily, exposed rod surfaces will corrode. Some cylinders will have rods exposed even when completely retracted. Assume all cylinders have exposed rods, as corrosion on the end of the rod can ruin the cylinder.

It is recommended that all exposed cylinder rods be protected using Boeshield® T-9 Premium Metal Protectant. Manitowoc Crane Care has Boeshield T-9 Premium Metal Protectant available in 12 oz. cans that can be ordered through the Parts Department.

NOTE: Cylinder operation and inclement weather will remove the Boeshield protectant. Inspect cranes once a week and reapply Boeshield to unprotected rods.

7. Cylinders for:
   a. Damaged rods
   b. Dented barrels
   c. Drift from oil leaking by piston
   d. Leaks at rod seals, welds, or holding valves.
8. PTO drive line system for proper alignment, lubrication and tightness.
9. Hydraulic hose and tubing for evidence of damage such as blistering, crushing, or abrasion.
10. Top and bottom wear pads for excessive wear.
11. Inspect all electrical wires and connections for worn, cut or deteriorated insulation and bare wire. Replace or repair wires as required.
12. Extend and retract cables, sheaves, pins, and bearings for wear or abrasion.
13. Main frame and jack mount bolts for proper torque (see Torque Chart).
14. Rotation bearing and gearbox mounting bolts for proper torque (see Torque Chart).
15. Missing or unreadable warning labels.
16. Missing or unusable/unsafe condition of steps, ladders, handrails, guards or seat.

Special Boom Inspection

If the boom has not been disassembled and inspected in the last five years or 3,000 hours of use, the boom is to be completely torn down to allow a thorough inspection of the extend and retract cables, sheaves, and pins.

Stability

Stability of crane throughout working area. Check the stability procedure in Installation Section of the Service Manual annually or when any changes are made to crane or truck.

HOIST ROPE INSPECTION AND MAINTENANCE

⚠ WARNING

Worn or Damaged Equipment Hazard!

Never use a worn or damaged hoist rope. Death or serious injury could result from using worn or damaged hoist rope.

Rope should be inspected frequently/daily and periodically/ yearly in accordance with the following information excerpted from a National Consensus Standard as referenced by Federal Government Agencies. Recommended inspection intervals may vary from crane to crane and may vary based on environmental conditions, frequency of lifts, and exposure to shock loads. The inspection time intervals may also be predetermined by state and local regulatory agencies.

NOTE: Rope may be purchased through Manitowoc Crane Care.

Any deterioration observed in the rope should be noted in the equipment inspection log and an assessment concerning rope replacement should be made by a qualified person.

Keeping Records

A signed and dated report of the rope's condition at each periodic inspection must be kept on file at all times. The report must cover all inspection points listed in this section. The information in the records can then be used to establish data which can be used to determine when a rope should be replaced.

It is recommended that the rope inspection program include reports on the examination of rope removed from service. This information can be used to establish a relationship between visual inspection and the rope's actual internal condition at the time of removal from service.

Environmental Conditions

The life expectancy of rope may vary due to the degree of environmental hostility and other conditions to which these mechanical devices are subjected. Variation in temperature, continuous excessive moisture levels, exposure to corrosive chemicals or vapors or subjecting the rope to abrasive material may shorten normal rope life. Frequent/periodic inspections and maintenance of rope is recommended for preventing premature wear and to insure long-term satisfactory performance.

NOTE: Refer to *Wire Rope Lubrication*, page 5-10 for wire rope lubrication requirements.

Dynamic Shock Loads

Subjecting rope to abnormal loads beyond the endurance limit will shorten the rope life expectancy. Examples of this type of loading are listed below.

- High velocity movement, for example; hoisting or swinging of a load followed by abrupt stops.
- Suspending loads while traveling over irregular surfaces such as railroad tracks, potholes, and rough terrain.
- Lifting a load that is beyond the rated capacity of the lifting mechanism, such as overloading.

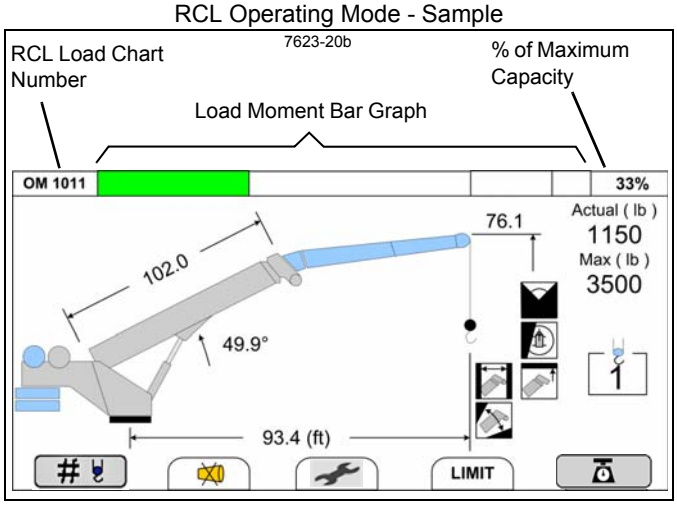
SECTION 7
RATED CAPACITY LIMITER

SECTION CONTENTS

- — Horn Silence indicates the RCL warning horn is temporarily disabled for 15 seconds. The horn silence button icon will be shaded when active.
- — Reeving selecting screen — pressing this button returns to the reeving configuration screen for number of parts of line selection.
- — Wrench — pressing this button returns to the diagnostics screen.
- LIMIT — Pressing enables the RCL Limits Menu screen and WADS options main menu.
- TARE — Pressing will enable/disable Tare or zeros out the current load indicated on the screen to show the active weight of the load only. TARE button icon will flash BLUE when active.
- — Delete — Pressing this key deletes the current setting or value.
- I/O — Real Time I/O - Pressing this button will navigate to the Real Time I/O screen.
- — General Warning — See Diagnostic Screen to see which warning is active.
- — Barge Mode — Icon shown when barge mode was selected.
- — Counterweight Removal Position — Shown to indicate that the operator is now approaching (YELLOW) region where the CWT slab(s) can be pinned and/or unpinned to the turret/tbox.

The following *RCL Operating Mode - Sample* has been set up with extended jib @ 30° offset, all limits set and displays the following:

RCL Operating Mode - Sample



- Boom Length (BL) = 102.0 ft
- Boom Angle (BA) = 49.9°
- Load Radius (LR) = 93.4 ft
- Boom Tip Height (TH) = 76.1 ft
- # Parts of Line (#) = 1
- Maximum Allowable Load (ML) = 3,500 lb
- Actual Load (AL) = 1,150 lb
- % of Maximum Capacity = 33%
- All Active Limits

TARE Function

The TARE function calculates the net weight of the load (Total Load –Hook Block). The TARE function must be activated before lifting. To use the TARE function:

- Rig the load to the hook block.
- Before lifting the load, press the TARE function.
- Lift the Load. The net load is shown in the actual number display.

The TARE button icon will flash blue in color when active.

Changing the boom angle or length automatically returns the actual load display back to the total weight (Load +Hook Block).