Grove GRT8090

Operator Manual

8848-2

SECTION 2
SAFETY INFORMATION

SECTION CONTENTS

SAFETY MESSAGES

General

The importance of safe operation and maintenance cannot be overemphasized. 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.

Calculation of Projected Wind Area (Ap):

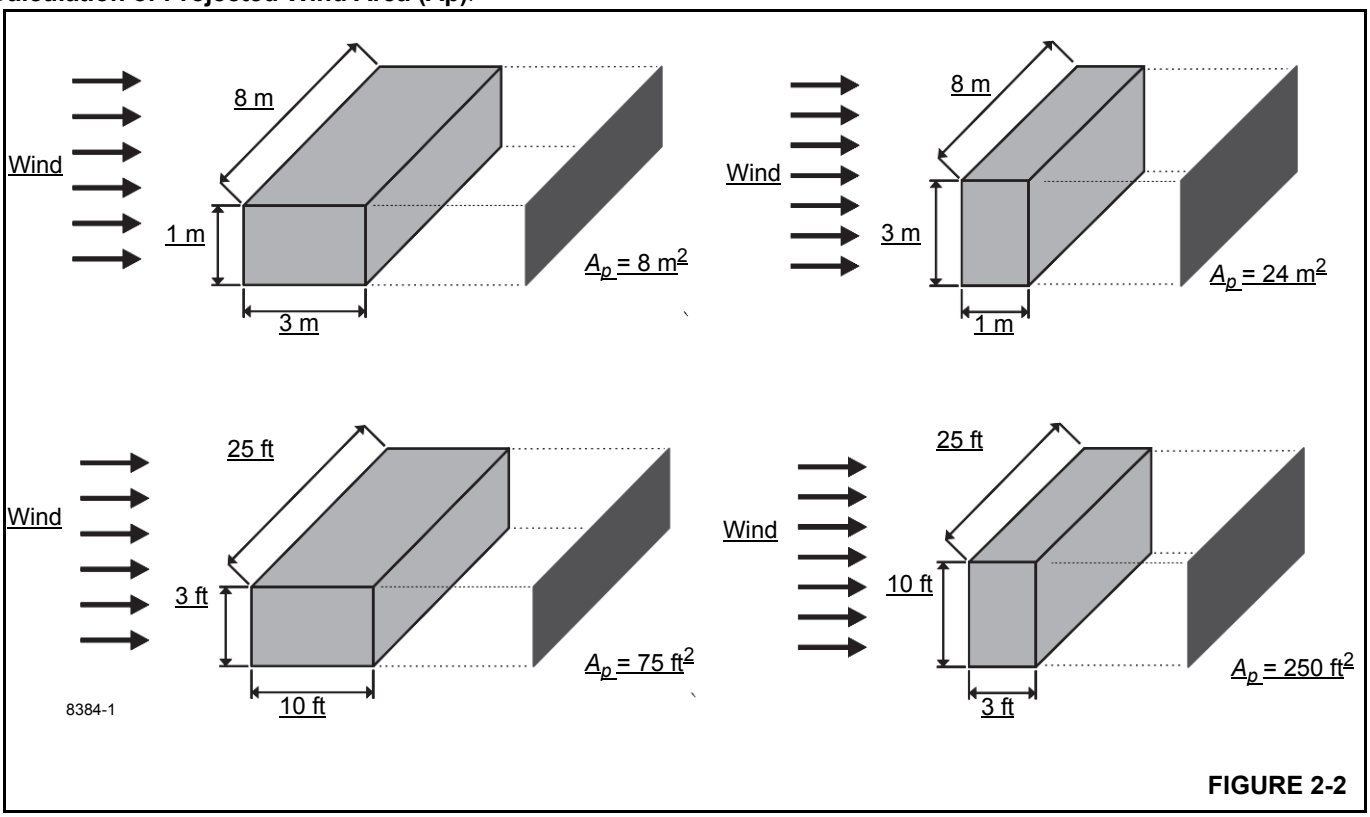

FIGURE 2-2

Determining Wind Drag Coefficient (Cd)

Table 2-2 shows the typical Shapes and corresponding Wind Drag Coefficient ***(Cd)*** values.

If the exact Wind Drag Coefficient of a shape is not known, use the maximum value of the shape's range (Table 2-2).

If the wind drag coefficient of the load cannot be estimated or determined, it shall be assumed that ***(Cd)*** = 2.4.

Counterweight

On cranes equipped with removable counterweights, ensure the appropriate counterweight sections are properly installed for the lift being considered.

Do not add material to the counterweight to increase capacity. United States Federal law prohibits modification or additions which affect the capacity or safe operation of the equipment without the manufacturer's written approval. [29CFR 1926.1434]

Outrigger Lift Off

Regarding "lifting" of an outrigger pad during craning activities, be advised that the rated loads for these cranes, as indicated on the crane's *Load Chart*, do not exceed 85% of the tipping load on outriggers as determined by SAE J765 OCT90 "Cranes Stability Test Code." An outrigger pad may lift off the ground during operation of the crane within the capacity limits of the *Load Chart*, yet the crane will not have reached instability. The "balance point" for stability testing according to SAE and Manitowoc criteria is a condition of loading wherein the load moment acting to overturn the crane is equal to the maximum moment of the crane available to resist overturning. This balance point or point of instability for a crane does not depend on "lifting" of an outrigger but rather on comparison of the "opposing" load moments.

The occurrence of an outrigger lifting from the ground is often attributed to the natural flex in the crane's frame. This may happen when lifting a load in certain configurations within the capacity limits of the *Load Chart* and is not necessarily an indication of an unstable condition.

Provided the crane is properly set up, the crane is in good working condition, that all operator's aids are properly programmed, that the qualified crane operator adheres to the instructions found in the applicable *Load Chart*, *Operator Manual* and decals on the crane, the crane should not be unstable.

Multiple Crane Lifts

Multiple crane lifts are not recommended.

Any lift that requires more than one crane must be precisely planned and coordinated by a designated person. If it is necessary to perform a multi-crane lift, the operator shall be responsible for assuring that the following minimum safety precautions are taken:

- Secure the services of a designated person to direct the operation.
- Use one qualified signal person.
- Coordinate lifting plans with the operators, designated person, and signal person prior to beginning the lift.
- Maintain communication between all parties throughout the entire operation. If possible, provide approved radio equipment for voice communication between all parties engaged in the lift.
- Use outriggers on cranes so equipped.
- Calculate the amount of weight to be lifted by each crane and attach slings at the correct points for proper weight distribution.
- Ensure the load lines are directly over the attach points to avoid side loading and transfer of loading from one crane to the other.
- Do not travel. Lift only from a stationary position.

Tilt-Up Panel Lifting

Requirements and recommendations regarding operation and use of Grove Cranes are stated on decals and in the Operator and Safety Handbook and other manuals provided with each specific model machine. Using the subject crane to perform tilt-up panel lifting with two hoist lines poses new and different hazards than does normal lifting use.

Therefore, the following additional precautions must be taken if it is necessary for the crane to be used to perform tilt-up panel lifting using a crane equipped with two hoists:

- The crane must be set up and operated in accordance with Grove's instructions in the Operator and Safety Handbook, Load Capacity Chart, and decals affixed to the crane.
- The hoist rope from the main hoist shall be reeved over the main boom nose reeved for two parts of line.
- The hoist rope from the auxiliary hoist shall be reeved over the auxiliary boom nose reeved for one part of line.
- The load shall be connected with the main hoist line connected to the end closest to crane and the auxiliary hoist line connected to the end farthest from the crane.
- The anti-two block system shall be installed and inspected to confirm that it is active to monitor both hoist lines.
- The RCL hoist selection shall be set to main hoist and two parts of line.
- The wire rope and sheaves shall be inspected prior to and following the lifting operations for chaffing or scrubbing.
- The total gross load shall not exceed 80% of the standard load chart. The operator shall be responsible to control this as the RCL does not have a feature to set reduced lifting limits.
- The auxiliary hoist line shall be considered part of the deducts to determine net allowable load.

Inspect the boom nose and hook block sheaves for proper operation, excessive wear, and damage every 50 hours or weekly. Inoperable, damaged and/or worn sheaves cause rapid deterioration of rope.

Ensure sheaves carrying ropes that can be momentarily unloaded are equipped with close fitting guards or other devices to guide the rope back into the groove when the load is reapplied. Ensure sheaves in the lower load block are equipped with close fitting guards that will prevent the ropes from becoming fouled when the block is lying on the ground with loose ropes.

To attain maximum hoist rope life and minimize hook block rotation, it is recommended that even numbers of parts-of-line be used in multiple-part reeving whenever possible.

The use of nylon (polyamide) sheaves, as compared with metallic sheaves, may change the replacement criteria of rotation-resistant hoist rope.

NOTE: The use of cast nylon (polyamide) sheaves will substantially increase the service life of rope. However, conventional rope retirement criteria based only upon visible wire breaks may prove inadequate in predicting rope failure. The user of cast nylon sheaves is therefore cautioned that a retirement criteria should be established based upon the user's experience and the demands of his application.

Batteries

Battery electrolyte must not be allowed to contact the skin or eyes. If this occurs, flush the contacted area with water and consult a doctor immediately.

When checking and maintaining batteries, exercise the following procedures and precautions:

- Wear safety glasses when servicing batteries.
- If equipped, disconnect battery with the battery disconnect switch before disconnecting the ground battery cable. For cranes with a Cummins engine using an engine ECM:
  - **a.** Ensure that the key switch has been off for 2 minutes.
  - **b.** Turn the battery disconnect switch to the OFF position.
  - **c.** Remove the ECM power fuse.
  - **d.** Remove negative battery cables.
- Do not break a live circuit at the battery terminal. Disconnect the ground battery cable first when removing a battery and connect it last when installing a battery.
- Do not short across the battery posts to check charge. Short circuit, spark, or flame could cause battery explosion.
- If applicable, maintain battery electrolyte at the proper level. Check the electrolyte with a flashlight.
- If applicable to your crane, check battery test indicator on maintenance-free batteries.
- Check battery condition only with proper test equipment. Batteries shall not be charged except in an open, well-ventilated area that is free of flame, smoking, sparks, and fire.

Super Capacitor (If Equipped)

Capacitor electrolyte must not be allowed to contact the skin or eyes. If this occurs, flush the contacted area with water and consult a doctor immediately.

When checking and maintaining capacitor, exercise the following procedures and precautions:

- Wear safety glasses when servicing.
- If equipped, disconnect battery with the battery disconnect switch before disconnecting the ground battery cable. For cranes with a Cummins engine using an engine ECM:

1. Ensure that the key switch has been off for 2 minutes.
2. Turn the battery disconnect switch to the OFF position.
3. Remove the ECM power fuse.
4. Remove negative battery cables.
5. Remove positive capacitor cable.

- Do not short across the capacitor posts to check charge. Short circuit will cause capacitor terminal damage. Spark or flame could cause capacitor explosion.
- Check capacitor charge level with proper test equipment.Engine

General Maintenance

Fuel the crane only with the engine turned off. Do not smoke while fueling the crane. Do not store flammable materials on the crane.

Be familiar with the location and use of the nearest fire extinguisher.

Be careful when checking the engine coolant level. The fluid may be hot and under pressure. Shut down the engine and allow the radiator time to cool before removing the radiator cap.

Shut down the engine and disconnect the battery before performing maintenance. If unable to do so for the task

Hoist Platform

DANGER

Do not use platform for hauling passengers. Death or serious injury could occur.

No storage of components are allowed on the platform.

Only one person at a time is allowed on the platform.

Travel Position

Hoist platform must be in the travel position when moving the crane. Refer to Figure 2-11.

1. Lower two hoist mirrors (1).
2. Remove two pins and lower rear rail (2). Reinsert pins.
3. Remove two pins and lower side rail (3). Reinsert pins.
4. Lift and slide steps (4) into retaining bracket. Pull out on steps to ensure notch is engaged in bracket.

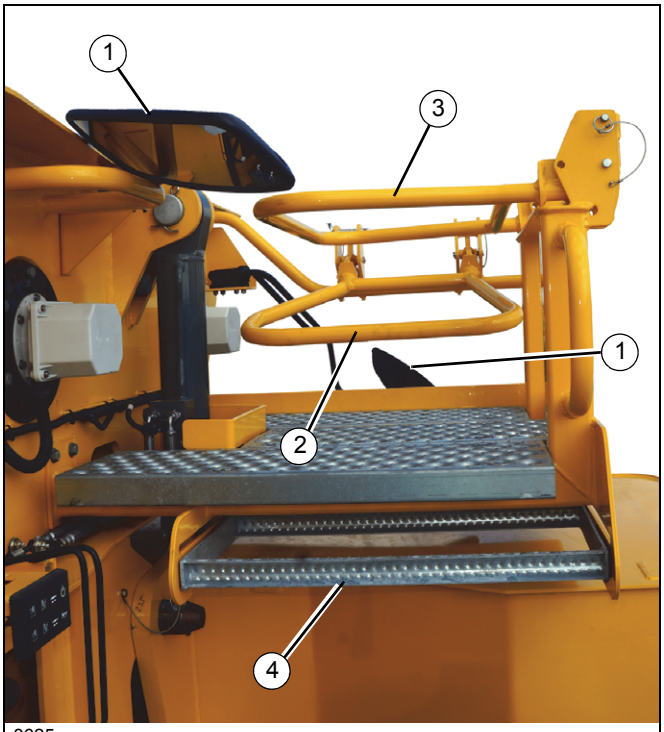

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FIGURE 2-11

OVERLOAD INSPECTION

This information supplements the Rated Capacity Limiter (RCL) manual supplied with each Grove crane.

When the RCL system has acknowledged an overload on your crane, you must carry out specified inspections on the crane.

These inspections apply only to overloads up to 50%. For overloads of 50% or higher, crane operation must be stopped immediately and Crane Care must be contacted for corrective action.

The following illustrations may not be an exact representation of your crane and are to be used for reference only.

WARNING

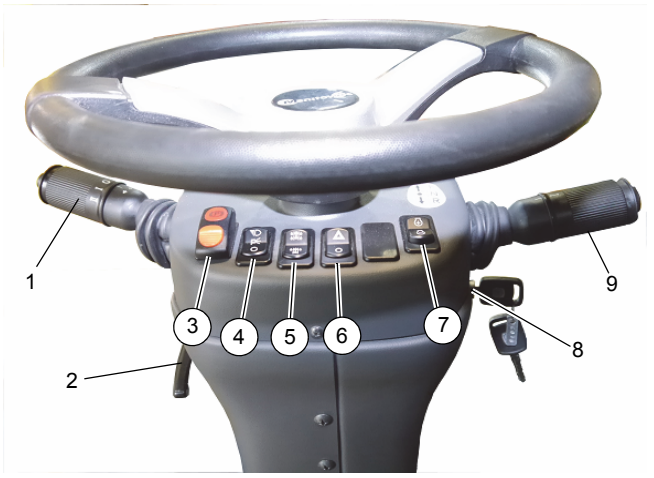
Overload Hazard!

To avoid an accident caused by overload damage to your crane:

- Perform the inspections outlined in this publication for overloads up to 50%.
- Stop operating the crane and contact Manitowoc Crane Care immediately for overloads of 50% and higher.

NOTE: If your crane is equipped with CraneSTAR, an overload warning will be posted to the web site for review by the crane owner.

Overload warnings do NOT indicate real time events! Warnings could be sent 24 hours (or more) after the actual event.



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Item	Description
1	Turn Signal Lever and Windshield Wiper/ Washer/Horn Controls
2	Steering Column Tilt Lever
3	Park Brake Control Switch
4	Headlights Switch
5	Drive Axle Selector Switch
6	Hazard Lights Switch
7	Engine Speed (RPM) Increase/Decrease Switch
8	Ignition Switch
9	Transmission Shift Lever

Turn Signal Lever and Windshield Wiper/ Washer/Headlight/Horn Controls

Turn Signal Lever and Windshield Wiper/washer Controls (1) Figure 3-2 are located on left side of steering column. Pushing turn signal lever down causes left front and left rear turn signals to flash. Pushing turn signal lever up causes right front and right rear turn signals to flash.

The windshield wiper switch is built into the turn signal lever. The knob of the lever has four positions: O, I, II and interval wiping. Pushing button in end of knob energizes the windshield washer pump to spray washer fluid on the windshield. Positioning knob to I operates wiper at low speed. Positioning knob to II operates wiper at high speed. Positioning knob to O turns wiper motor off and automatically returns wiper to parked position.

Push small button on end of lever to sound horn.

Steering Column Tilt Lever

The steering control column can be rotated rearward approximately 30° and raised approximately 60 mm (2.3 in). Rotate control lever (2) Figure 3-2 down to lock steering column in place. Rotating lever up releases steering column for adjustment.

Park Brake Control Switch

Park Brake Control Switch (3) Figure 3-2 is located on front of steering column. This two-position rocker switch (ON/ OFF) is used to apply and release the parking brake on the drive line. The red Park Brake Indicator light on the display is illuminated when pressure switch in the brake release system is activated and brake is applied.

Headlights Switch

The Headlights Switch (4) Figure 3-2 is located on the front of the steering column. This three-position rocker switch (OFF/Park/Headlight) controls operation of the instrument lights, switch LED's, and the marker lights on the front, rear, and side of the crane. The switch is illuminated when the key is in the ON or Start position.

Drive Axle Selector Switch

Drive Axle Selector Switch (5) Figure 3-2 is located on front of the steering column and is illuminated when key is in the ON or Start position. This two-position rocker switch is used to select two-wheel drive (high range) or four-wheel drive (low range).

The switch controls a solenoid valve (energized for two-wheel drive) that operates speed range and axle disconnect cylinders on the transmission.

The drive axle can only be changed when gearshift is in Neutral and brake pedal is pressed.

The icon background on the CCS operating display turns yellow when crane is in four-wheel drive mode. This icon will flash if switch position is changed when engine is running, transmission is not in Neutral, and brake pedal is not pressed.

Hazard Lights Switch

Hazard Lights Switch (6) Figure 3-2 is located on front of the steering column and is a two-position rocker switch (ON/ OFF). When switch is positioned ON, four turn signal lights and turn signal indicator lights on steering column flash at the same time.

Increment/Decrement Switch

The Increment/Decrement Switch (7) (Figure 3-2) is a three position momentary rocker switch with center maintained position being off. Use this switch to adjust engine speed (RPM). Press top or bottom of the Increment/Decrement Switch to increase or decrease low engine idle.

Quickly press top of switch once to go to full engine RPM. Quickly press bottom of switch once to return to low engine idle.

RCL Emergency Override Switch (Non-CE Certified Cranes)

WARNING

Loss of RCL Monitoring Hazard!

The RCL Emergency Override switch is to be used in emergency situations only.

Do not operate the crane with the RCL overridden during normal operations.

When the RCL is overridden always have a helper on the ground to signal you.

The RCL system, when programmed accurately, will lockout nearly every crane function—boom up/down, telescope extend/retract, hoist up, and swing left/right—when a lift is attempted at or above crane's capacity or when a two-block condition exists. Only functions that cause existing lockout conditions are blocked. Locking out these functions prevents the overload or two-block condition from worsening.

The RCL emergency override switch (1) (Figure 3-9) is a key operated switch located inside the operator cab on the panel assembly behind the seat. When actuated (turned clockwise), the switch will override and prevent the RCL from locking out craning functions (Third Wrap Limit and Anti Two-Block) should an overload condition occur. Turn key counter-clockwise to bypass the Anti Two-Block Switch, Telescope extend/retract, 3rd Wrap Indicator (hoist lowering limit) and Boom up/down.

Overriding the RCL with this switch should only be done in an emergency or when servicing the boom.

A flashing light on the RCL display indicates switch has been activated.

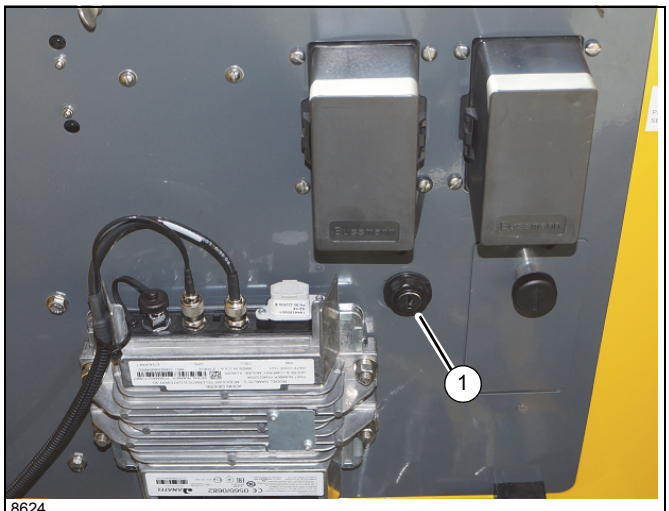

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FIGURE 3-9

RCL Emergency Override Switch and Indicator (CE Certified Cranes)

WARNING

Loss of RCL Monitoring Hazard!

RCL Emergency Override Switch is to be used in emergency situations only.

Do not operate crane with RCL overridden during normal operations.

When RCL is overridden, always have a helper on the ground to signal you.

The RCL system, when programmed accurately, will lockout nearly every crane function—boom up/down, telescope extend/retract, hoist up and swing left/right—when a lift is attempted at or above the crane's capacity or when a two-block condition exists. Only functions that cause existing lockout conditions are blocked. Locking out these functions prevents the overload or two-block condition from worsening.

The RCL emergency override switch is located inside a key-locked single-door enclosure (1) (Figure 3-10) attached to the outside rear of the operator's cab. The switch is a two-position momentary rocker switch that, when actuated, will override and prevent the RCL, for a period of 30 minutes, from locking out craning functions (boom down, telescope extend, third wrap limit and hoist up) should an overload condition occur.

The other RCL emergency override switch (19) (Figure 3-6) is a key operated switch located inside the operator cab below the CCS screen, in front of the Emergency Stop Switch. When actuated (turned clockwise), the switch will override and prevent the RCL from locking out craning functions (Third Wrap Limit and Anti Two-Block) should an overload condition occur. Turn key counterclockwise to bypass the Anti Two-Block Switch, Telescope extend/retract, 3rd Wrap Indicator (hoist lowering limit), and Boom up/down.

Overriding the RCL with this switch should only be done in an emergency or when servicing the boom.

Upon activation, all craning function movements are reduced to 15% of normal maximum speeds.

The RCL override function is automatically canceled after 30 minutes. The RCL override function can also be canceled by pressing the RCL emergency override switch a second time or turning off the engine. However, turning off crane functions does not disable the RCL override.

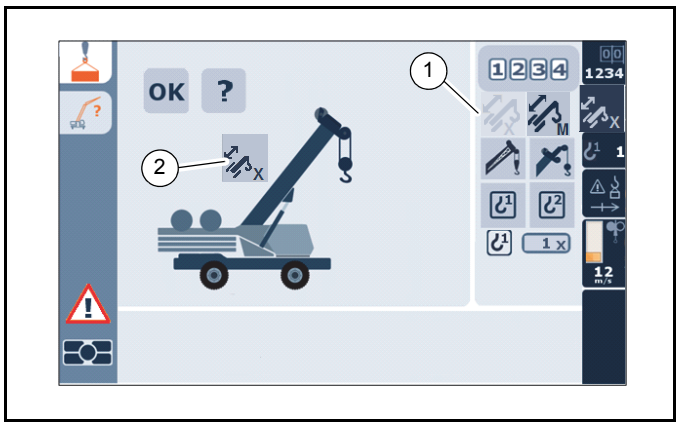
NOTE: Before powering up crane, ensure RCL Override Switch is in the Normal (not Override) position to avoid an error code.

A&B Modes Disabled - No Load Chart For Selected Rigging Code

Example: Operator manually selects a rigging code for “On Rubber” using numeric spin boxes. The code is for Mode A, which is disabled.

Any enabled mode not available for selection is grayed out (1).

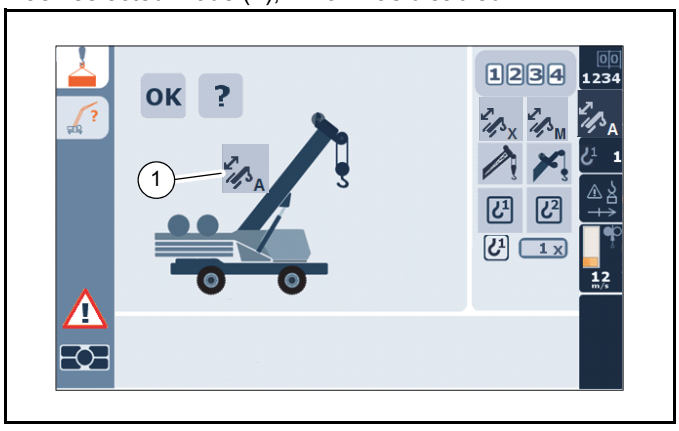
The selected mode (2) not available for the entered rigging code flashes.



A & B Modes Disabled When “A” Mode Confirmed

Example: Operator disables an automatic mode on the Telescoping Configuration Screen when mode is currently active on the Operating Screen.

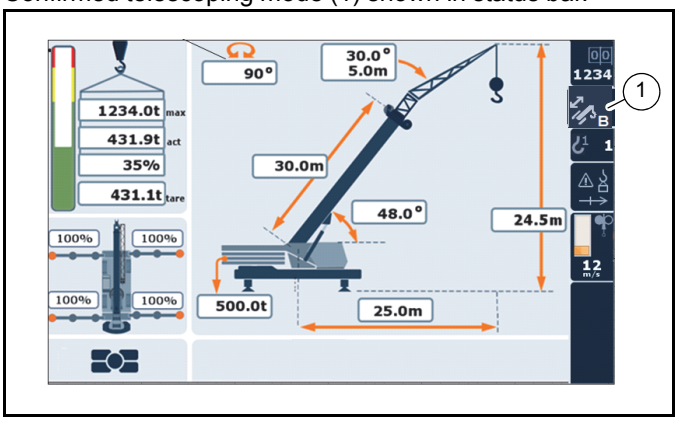
Flash selected mode (1), which was disabled.



RCL Display Operating Screen

Confirmed Telescoping Mode

Confirmed telescoping mode (1) shown in status bar.

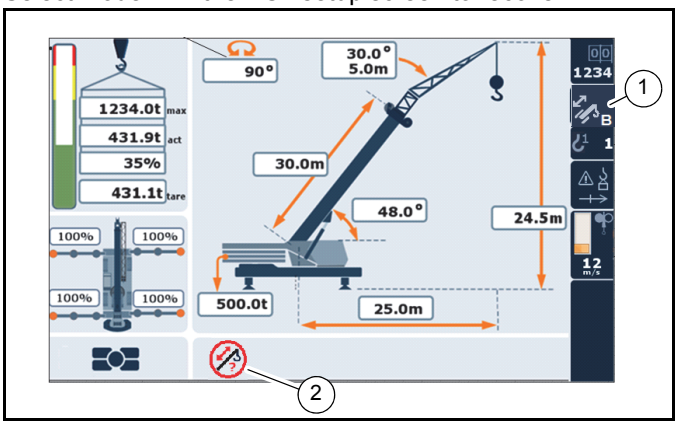


Out of Sequence

Confirmed telescoping mode (1) shown in status bar.

Out of sequence symbol (2) displayed. RCL is locked out with audible and visual indications.

Select mode M in the RCL setup screen to recover.



Operating Screen

Mode M: active telescoping section T1 (1) or T2-4 (2) always shown in the status bar

Mode A,X,B: T1 (1) or T2-4 (2) only shown when telescoping is active.

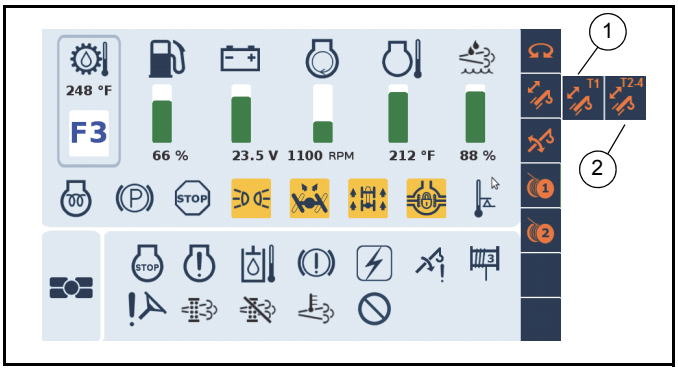


Table 3-2: Alarm Characteristics

LIMITATION	POSITION	ALARM
Height Limitation	10 ft before limit	Slow beeping
	5 ft before limit	Fast beeping
	At limit	Solid sound
Boom Up/Down	10 deg before limit	Slow beeping
	5 deg before limit	Fast beeping
	At limit	Solid sound
Radius	10 ft before limit	Slow beeping
	5 ft before limit	Fast beeping
	At limit	Solid sound
Swing	10 deg before limit	Slow beeping
	5 deg before limit	Fast beeping
	At limit	Solid sound
Virtual wall	10 ft before limit	Slow beeping
	5 ft before limit	Fast beeping
	At limit	Solid sound

Note that the audible alarm can be canceled. It is the Tab button on the display. Refer to item 1 in Figure 3-18. It can be canceled once the boom is no longer being moved. When boom motion again becomes apparent in the control system, the audible alarm will be restored.

When a limit is reached, the Main Screen shows an indicator for this condition (again in addition to audible alarms and potential effects on the crane functions). Figure 3-19 shows the Main Screen example; the swing limit has been reached. There are similar symbols for the other limitations; Table 3-3: shows the boom up/down (boom angle) limitation active symbol; the radius limitation active symbol; the height limitation active symbol; and the wall limitation active symbol. If there are multiple limitations active (such as a swing limitation and a height limitation), then the appropriate symbols are cycled on the display with a time interval.

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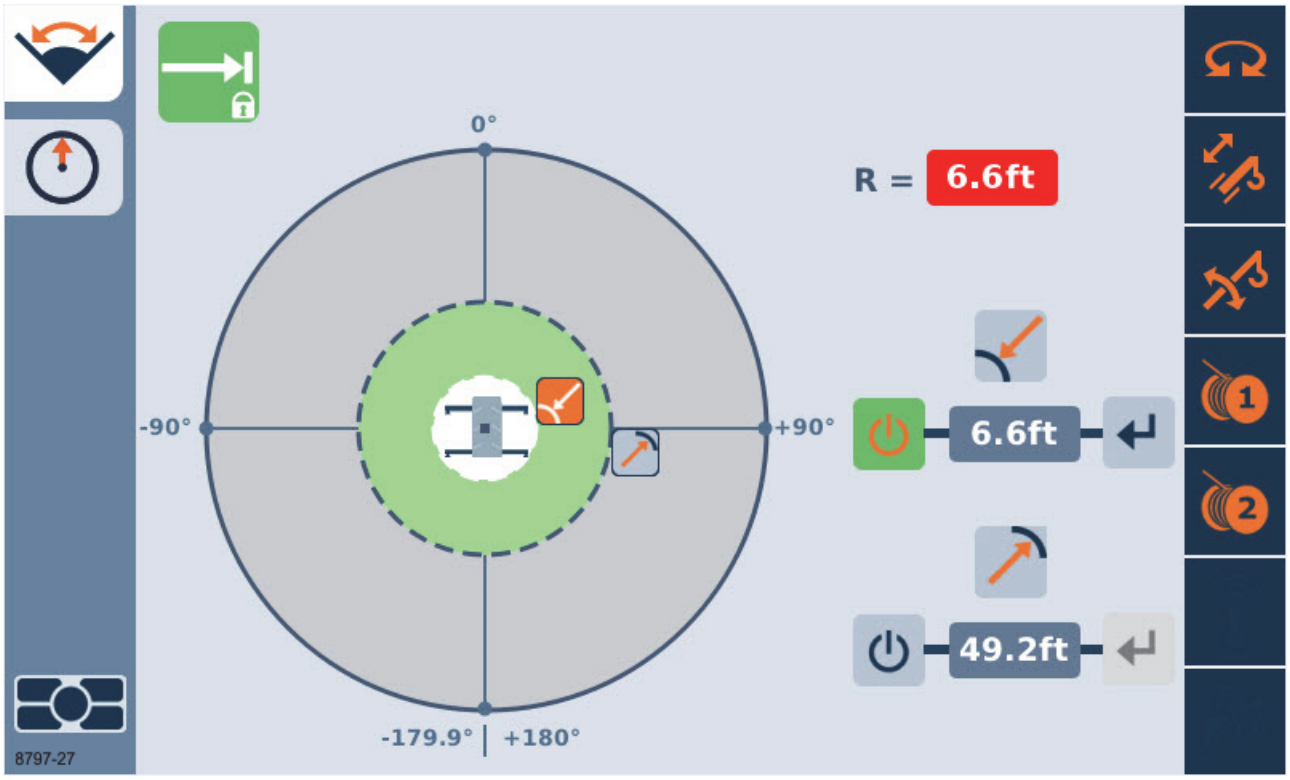
FIGURE 3-18



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Radius Limitation Screen

FIGURE 3-23

Using the Left Arrow and Right Arrow function on the display or the jog dial changes the object highlighted on the screen. As the arrow keys are pressed, the highlight will move between the objects, with the color orange typically meaning that the object is selected and can be affected by subsequent actions. In Figure 3-23, one can see that the  symbol for minimum radius is selected since it has the orange color highlighting. Table 3-6: shows the objects available on the Radius Limitation Screen. Note that the boom angle cannot be typed in (as is possible with the Height Limitation).

ECO mode is forced to inactive when the crane's transmission is being shifted to Forward or Reverse, or all crane functions are disabled.

When active, ECO mode will ramp the throttle percent from 0 to setpoint when any crane function command goes above 5% command. Once ECO mode's output is at the setpoint, the output will stay at the setpoint until no crane functions are being commanded for 3 seconds. Then the ECO mode's throttle command is to be set to 0% (step down).

NOTE: Ramp time for increasing throttle percent is 2 seconds from 0% to 100% throttle (slope = 50% per second).

Operation

- Crane is able to idle at 700 RPM when crane functions are not enabled.
- Crane idles at 900 RPM when any crane function has been enabled.
- New feature added to Operating Display menu that allows user to turn on "ECO Mode" and set the operating RPM for the crane.
- When user turns ECO mode ON:
  - Crane ramps engine from idle to operating RPM using the first 15% of the joystick movement to control the ramp.
  - Crane maintains operating RPM while crane functions are active and for a period of 3 seconds after crane functions go inactive.
  - Crane ramps engine speed back down to idle point.

Benefits

- Less noise and less fuel consumption versus maintaining crane at fixed "operating RPM".
- Set point for engine operating speed is easily changed by the user.
- User can command additional engine speed at any time using the accelerator pedal.
- Lower idle speed is better for "creep speed" driving, and improves braking performance.

CAUTION

If oil pressure and/or temperature indicator(s) do not display the proper readings, shut down engine and correct malfunction.

6. Allow engine to warm up for about five minutes before applying a load. Do not race engine for a faster warm up.

Idling Engine

Idling engine unnecessarily for long periods of time wastes fuel and fouls injector nozzles. Unburned fuel causes carbon formation; oil dilution; formation of lacquer or gummy deposits on valves, pistons and rings; and rapid accumulation of sludge in the engine.

NOTE: When prolonged engine idling is necessary, maintain at least 800 rpm.

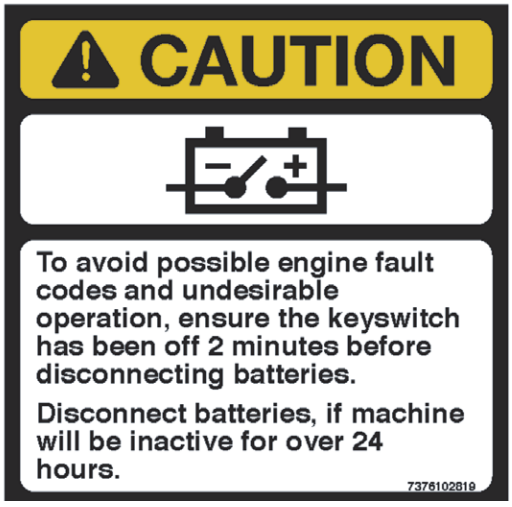
Racing Engine

DO NOT race engine during warm-up period or operate beyond governed speed (as might occur in downhill operation or down-shifting). Engine bearings, pistons, and valves may be damaged if these precautions are not taken.

Shutdown Procedure

1. Allow engine to run at fast idle speed for about five minutes to avoid high internal heat rise and allow for heat dissipation.
2. Position ignition switch OFF (vertical position).
3. Drain fuel filter-water separator.

Battery Disconnect



Battery disconnect switch is located on battery box cover on left side of the crane. To disconnect batteries, turn battery disconnect switch OFF. Turn switch ON to connect batteries.

Crane Travel Operation

Seat Belts

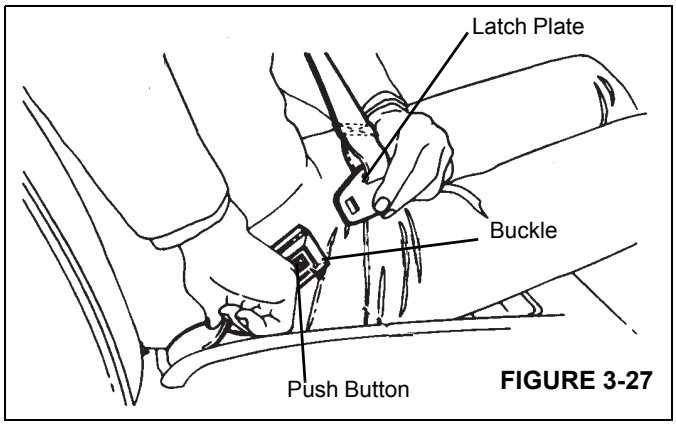


FIGURE 3-27

1. Before fastening a seat belt, always adjust driver's seat to position in which you will drive.
2. Pull belt across your lap and push latch plate into buckle until it clicks Figure 3-27.
3. To reduce risk of sliding under belt during a collision, position belt across your lap as low on your hips as possible and pull it toward door to a snug fit.

Traveling — General

WARNING

Inadvertent Operation Hazard!

Before traveling, ensure crane functions are fully disabled. The crane function enable switch is a spring return switch and cannot be put in a specific OFF position.This will prevent inadvertent operation of craning functions due to bumping controllers while traveling.

GRT machines are subject to the same road regulations as any truck, regarding gross weight, width, and length limitations.

Although GRT machines are specifically designed for rough terrain, the operator should be extremely cautious and aware of terrain operating conditions.

4. After deploying the four outrigger beams to fully retracted, mid-extend, or fully extended positions, navigate to Jack Operation on the CCS screen. Select Jack Extend on the Outrigger Function Enable Switch.

   Extend each outrigger jack, using either the CCS display buttons or the jog dial, positioning the pad as necessary, until the locking levers of the pad engage the jack cylinder barrel.

NOTE: More than one jack can be extended at a time.

5. Extend front jacks approximately 8 to 10 cm (3 to 4 in).

6. Extend rear jacks approximately 8 to 10 cm (3 to 4 in).

NOTE: Ensure tilting cab is in the lowered position before leveling machine.

7. Repeat step 4 until all wheels are clear of the ground and crane is level as indicated by the level indicator located on the right side of the cab.

NOTE: If it is suspected the level indicator is out of adjustment, verify and adjust the level using the procedures under *Level Indicator Adjustment*, page 3-72.

DANGER

Tipping Hazard!

The mid-extend outrigger beam lock pin must be engaged before operating on any beam from the mid-extend position.

For cranes not equipped with an Outrigger Monitoring System (OMS), the operator must select the proper rigging code from the load chart and RCL program for the outrigger position selected. The OMS will NOT change the rigging code to match the existing outrigger position.

Outrigger Monitoring System (OMS) (Optional—Standard in North America and European Union Countries)

The Outrigger Monitoring System (OMS) aids the operator in accurately programming the Rated Capacity Limiter (RCL) by automatically identifying the horizontal position of each outrigger beam. The OMS uses four sensors, one per outrigger beam, to indicate when an outrigger beam is positioned to one of three pre-defined locations, including fully retracted, mid-extend, and fully extended.

Outrigger setup is the same for cranes equipped with OMS; refer to “The crane also allows operations with outriggers fully retracted. Reference the load chart for capacities.” on page 72.

If crane is setup on outriggers and “On Outriggers” is selected when programming the RCL, then the OMS indicates to the RCL the horizontal position of each of the four outrigger beams. When outriggers are at the proper position, the screen icon is transparent; if an outrigger is not in the proper position it will be shown as red. The RCL does not lock out the crane or select a different chart based on outrigger position.

Engaging the Mid Extend Lock Pin

NOTE: It may be necessary to jog the outrigger extension/retraction switch slightly to ensure proper pin engagement.

1. With outriggers fully retracted, turn locking pin 90° from its stowed position and allow pin to slip into the lug on the jack beam. If pin will not slip into the lug, slowly extend or retract the outrigger beam, allowing locking pin to drop into the lug.

2. Slowly extend or retract outrigger beam, allowing locking pin to drop into the hole in top of the outrigger beam, engaging outrigger beam at the desired length.

Stowing the Outriggers

NOTE: To enable outrigger functions, crane must be in four wheel drive, parking brake must be engaged, and swing must be off.

1. Use screen buttons or jog dial with Outrigger Function Enable Switch to select left or right rear outrigger on the CCS screen. Retract until rear jacks have adequate clearance.

2. Use screen buttons or jog dial with Outrigger Function Enable Switch to select left or right front outrigger on the CCS screen. Retract until front jacks have adequate clearance.

DANGER

Keep feet and hands clear of outrigger pads when unlocking the pads from the jacks.

3. Repeat steps 1 and 2 until crane is resting on all wheels and outrigger jack pads are several inches off the ground.

4. Release locking levers and allow outrigger pads to drop to the ground.

5. Continue to retract jacks until fully retracted.

6. Use screen buttons or jog dial with Outrigger Function Enable Switch to select and retract each outrigger beam. Refer to *Stowing the Mid-Extend Lock Pin* below if crane was operated at mid-extend position.

NOTE: More than one outrigger beam may be retracted at a time.

Figure 4-10 shows methods for securing dead-ends of wire ropes in a wedge socket assembly. While the loop-back method (C, D, E) is acceptable, take care to prevent the loop becoming entangled with tree branches and other components during crane transport, or the anti-two block system and other components during crane operation.

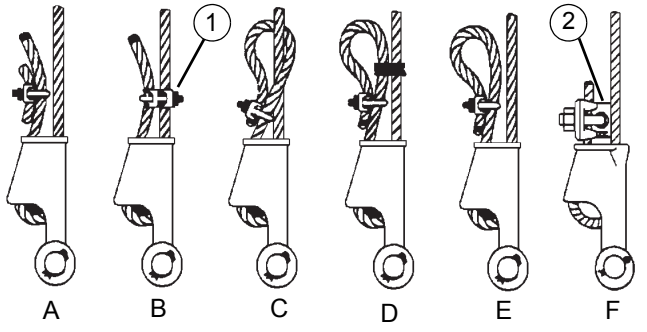


FIGURE 4-10

Of methods shown, Grove prefers method A or F be used on Grove cranes, i.e., clipping a short piece of wire rope to the dead-end or using a commercially available specialty clip (1) or wedge (2). It is recommended the dead-end tail length be a minimum of 6 rope diameters, but not less than 15.2 cm (6 in) for standard 6 to 8 strand ropes and 20 rope diameters, but not less than 15.2 cm (6 in) for rotation resistant wire ropes.

When using method A, place a wire rope clip around the dead end by clamping a short extra piece of rope to the rope dead end. DO NOT CLAMP LIVE END. U-bolt should bear against the dead end. Clip saddle should bear against the short extra piece. Torque U-bolts to values listed in Table 4-1.

NOTE: Use of swivels is not allowed with non-rotation resistant wire ropes.

Other sources for information with which crane users should be familiar and follow is provided by the American Society of Mechanical Engineers, American National Standard, ASME B30.5, latest revised. ASME (formerly ANSI) B30.5 applies to cableways, cranes, derricks, hoists, hooks, jacks, and slings.

It states, in section 5-1.7.3, “(c) Swagged, compressed, or wedge socket fittings shall be applied as recommended by the rope, crane or fitting manufacturer.” Wire ropes are addressed in ASME B30.5, section 5-1.7.2, ROPES, It states, in pertinent part, “(a) The ropes shall be of a construction recommended by the rope or crane manufacturer, or person qualified for that service.” Additional information is published by the Wire Rope Technical Board in *Wire Rope Users Manual*, latest revision.

Table 4-1. Wire Rope Clip Torque Values

Clip Size		Torque*	
mm	**In**	**Nm**	**ft-lb**
3.18	1/8	6	4.5
4.76	3/16	10	7.5
6.35	1/4	20	15
7.94	5/16	40	30
13.28	3/8	60	45
11.11	7/16	90	65
12.70	1/2	90	65
14.29	9/16	130	95
15.88	5/8	130	95
19.05	3/4	175	130
22.23	7/8	300	225
25.40	1	300	225
28.58	1-1/8	300	225
31.75	1-1/4	490	360
38.68	1-3/8	490	360
38.10	1-1/2	490	360

*Torque values are based on threads being clean, dry, and free of lubrication.

5. Slowly elevate and telescope boom at the same time so extension does not move off blocking until offset links take full weight of the extension.
6. If operating with a 0° offset, stow mast assembly:
   a. Remove pin from the upright position lug on the extension
   b. Lower the mast assembly and install the pin in the stowed position lug.
   c. Secure with clip pin.
   d. Reeve hoist cable as described under normal erecting procedures.

Setting Boom Extension Hydraulic Offset

1. Extend and set outriggers. Swing boom over front and raise above horizontal.
2. To change offset, press the Hydraulic Luffing Jib On/Off Switch to ON.
3. Using the Hydraulic Luffing Jib Adjustment Switch or the Luffing Jib Adjustment Switch on the luffing jib, press the appropriate button to increase or decrease the offset angle.

ERECTING AND STOWING BI-FOLD BOOM EXTENSION WITH 6 M (20 FT) INSERT

DANGER

Crushing Hazard!

Before attempting to erect or stow bi-fold extension with insert, read and follow all safety decals installed on boom/boom nose, boom extension, insert, and stowage brackets.

Erecting

NOTE: Auxiliary boom nose (rooster sheave) does not have to be removed. However, if reeved, the hoist cable must be removed from the sheave.

1. Fully extend and set outriggers.
2. Position boom over front of crane.
3. Fully retract the boom.
4. Lower boom to minimum elevation.
5. If not already done so, deploy the boom extension by performing the procedures under *Erecting Boom Extension, page 4-11*, but do not make the anti-two block connection or hydraulic connection (if required) at the boom nose.
6. Extend boom as necessary to permit sufficient clearance for installation of the 6.1 m (20 ft) Extension Insert, then lower it until tip of bi-fold extension assembly is laying on the ground. Block under bi-fold extension, approximately 2.4 m to 3.0 m (8 ft to 10 ft) ahead of the boom nose.
7. Remove four retainer clips and attachment pins that secure bi-fold extension to the boom nose.
8. Retract boom leaving bi-fold extension on blocking.
9. Using main or auxiliary hoist cable, lift Insert by the lifting lugs and position it at base end of bi-fold extension.
10. Attach Insert to bi-fold extension by installing the four attaching pins and retainer clips removed in step 7.
11. With hoist cable still attached to Insert, lift assembled unit. Move blocking erected in step 6, 2.4 m to 3.0 m (8 ft to 10 ft) ahead of boom nose attach end of Insert.
12. Lower bi-fold and insert assembly to blocks. Remove hoist cable.
13. Retract boom and lower to minimum elevation.
14. Rig hoist cable for single part line with only wedge socket on cable end.
15. Extend boom and mate attachment lugs on Insert with anchor fittings on boom nose. Raise or lower boom slightly to mate attach lugs as needed.

NOTE: If Insert attach lug holes are not in lateral alignment with holes in the boom nose anchor fittings to install the pins, adjust upper and lower cross strut adjustment screws on the Insert to align the holes.

16. Remove retainer clips from attachment pins stowed on Insert. Install in attachment and anchor fittings on both sides of boom nose. Install retainer clips.

CAUTION

Possible Equipment Damage!

Do not attempt to swing boom extension to right side of insert. Damage to insert may result.

17. Make anti-two block electrical connections between the insert and the boom nose and extension. If required, make hydraulic connections between the insert and the boom nose and extension.
18. Slowly elevate boom and remove blocking from under Insert and bi-fold extension.
19. If required, erect the fly section. Refer to *Erecting Boom Extension Fly Section, page 4-13*.
20. Rig hoist cable.
21. If required, set offset. Refer to the applicable procedures in this section.

SECTION 5
LUBRICATION

SECTION CONTENTS

GENERAL

Following designated lubrication procedures is important in ensuring maximum crane lifetime and utilization. Procedures and lubrication charts in this section include information on types of lubricants used, location of the lubrication points, frequency of lubrication, and other information.

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 container clearly marked with what they contain.
- Always fill or add fluids with a funnel or filling pump.
- Immediately clean up spills.

LUBRICANTS AND LUBRICATION INTERVALS

The service intervals specified are for normal operation where moderate temperature, humidity, and atmospheric conditions prevail. In areas of extreme conditions, the service periods and lubrication specifications should be altered to meet existing conditions.

For information on extreme condition lubrication, contact your local Manitowoc Cranes distributor or Manitowoc Crane Care.

NOTE: All fluids and lubricants may be purchased by contacting an authorized Manitowoc distributor or Manitowoc Crane Care Parts Department.

CAUTION

Possible Equipment Damage!

Chassis grease lubricants must not be applied with air pressure devices as this lubricant is used on sealed fittings.

The multipurpose grease applied during manufacturing is of a lithium base. Use of a noncompatible grease could result in damage to equipment.

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NOTE:

- Check transmission fluid level with engine running at 850 rpm idle and converter oil at 82°C to 93°C (180°F to 200°F). Do not attempt an oil level check with cold oil. To bring oil temperature to this range, it is necessary to work the crane or stall the converter. Converter stall should be accomplished by engaging shift lever in forward high range with brakes applied and then accelerating engine to half or three-quarter throttle. Hold stall until required converter temperature is reached and stabilized.

NOTICE

Do not operate converter at stall condition for longer than 30 seconds at one time. Shift to neutral for 15 seconds and repeat procedure until desired temperature is reached. Excessive temperature, i.e, 120°C (250°F) maximum will damage transmission clutches, fluid, converter and seals.

- Drain oil at 65°C to 93°C (150°F to 200°F).
- Transmission filters are located on the outside left hand frame in the area of the hydraulic oil cooler.
- To add fluid:
  - **a.** Fill to FULL mark on dipstick.
  - **b.** Run engine at 850 rpm to prime torque converter and lines.
  - **c.** Check oil level with engine running at 850 rpm and converter oil at 82°C to 93°C (180°F to 200°F). Add oil to bring oil level to FULL mark on dipstick.

6	Engine Oil Filter	Figure 5-1	Refer to Item 3.	• 500 hours (0-500 ppm sulfur fuel) • 400 hours (500-5000 ppm sulfur fuel) • 250 hours (>5000 ppm sulfur fuel)	

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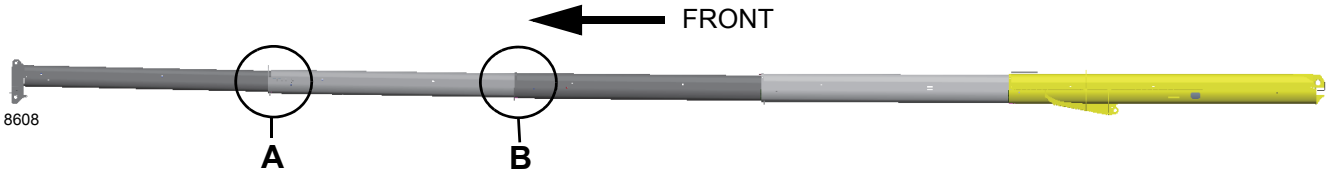

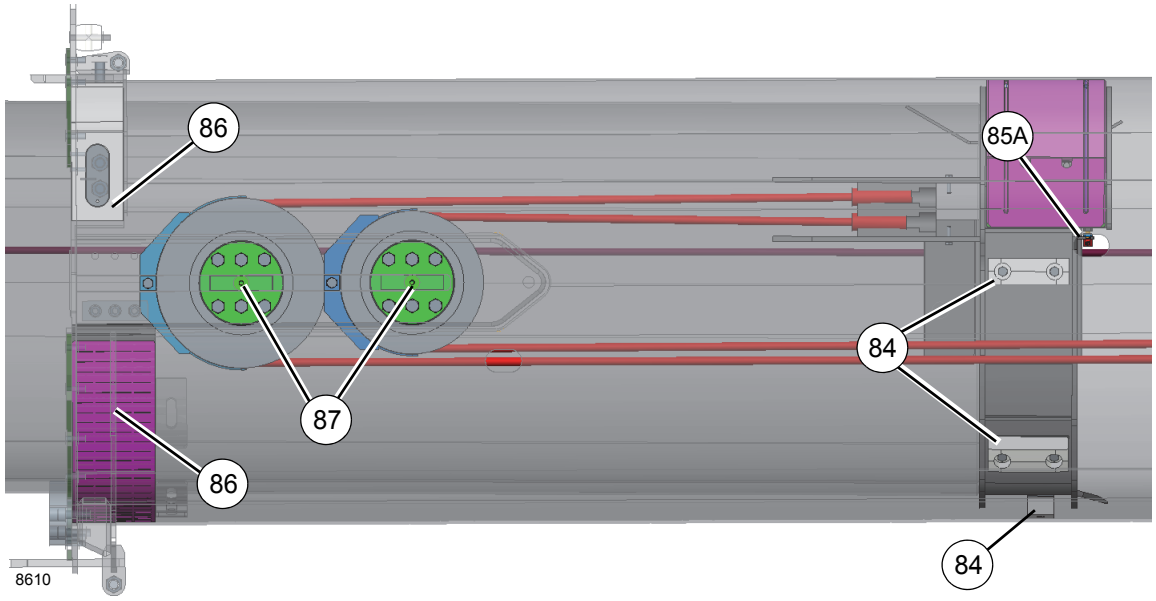

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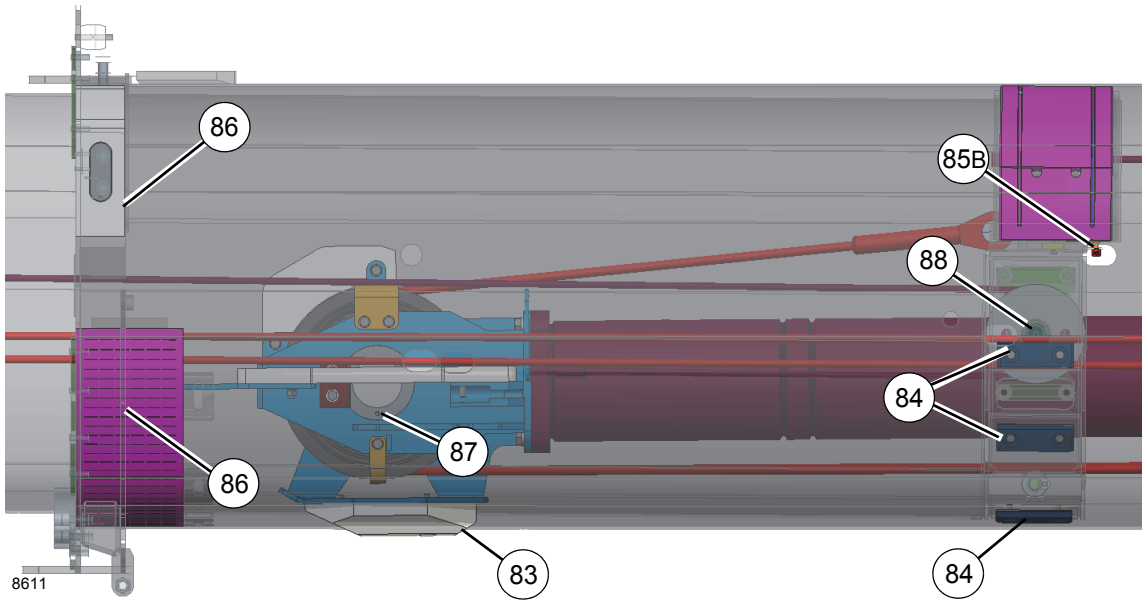

B

FIGURE 5-11

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