Grove GRT765/780

Operator Manual

10710-37

Grove Manitowoc National Crane Potain

Manitowoc

WARNING

California Proposition 65

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

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

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

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

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.

The original language of this publication is English.

CHANGE OF OWNERSHIP REGISTRATION

Manitowoc Crane Care strives to maintain up-to-date contact information for crane owners so that we can readily communicate information about improvements and/or engineering developments for cranes that have been in the field for several years.

Manitowoc Crane Care is pleased to announce that we have developed a QR code to allow the customer to register their crane remotely or re-register their crane if it was purchased used.

To register your crane scan the QR code below or visit https://www.manitowoc.com/warranty-registration-form to register your crane.

Manitowoc Cranes

1565 Buchanan Trail East PO Box 21
Shady Grove, PA 17256-0021 T
717 597 8121 F 717 593 5999
www.manitowoc.com

CHANGE OF OWNERSHIP FORM

Constant improvements, engineering progress or manufacturing information may arise after this crane has been in the field for several years that will make it necessary for us to contact future owners of this machine. It is important to you that Manitowoc Crane have up-to-date records of the current owners of the crane should the need arise for us to contact you. Manitowoc Crane is interested in safe efficient operation of its cranes for their lifetime. Therefore, if you are the second, third, or subsequent owner of this crane, please fill out the form below relating the new owner, model of crane and crane serial number information and e-mail or send to the below address.

PREVIOUS COMPANY NAME: _____

CURRENT COMPANY NAME: _____

CONTACT NAME: _____

ADDRESS: _____

CITY/STATE: _____ _____POSTAL CODE: _____

TELEPHONE NUMBER: _____

EMAIL ADDRESS: _____

DATE PURCHASED_____CRANE MODEL_____CRANE SERIAL NUMBER_____

Please e-mail to: warranty.team@manitowoc.com or visit
https://www.manitowoc.com/support/change-ownership

OPERATOR MANUAL

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

GRT765/780

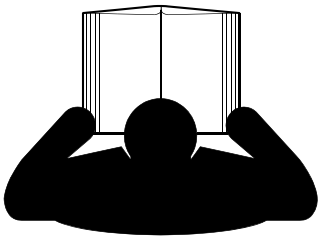
Crane Model Number

This Manual is divided into the following sections:

NOTICE

The crane serial number is the only method your distributor or the factory has of providing you with correct parts and service information.

The crane serial number is identified on the builder's decal attached to the operator cab. ***Always furnish crane serial number*** when ordering parts or communicating service problems with your distributor or the factory.



⚠DANGER

An untrained operator subjects himself and others to death or serious injury. You must not operate this crane unless:

- You have been trained in the safe operation of this machine.
- You read, understand, and follow the safety and operating recommendations contained in the manufacturer's manuals, your employer's work rules, and applicable government regulations.
- You are sure the machine is operating properly and has been inspected and maintained in accordance with the manufacturer's manuals
- You are sure all safety signs, guards, and other safety features are in place and in proper condition.

Avoid Electrocution, tipping, two-blocking, and other operational hazards

© 2025 Grove U.S. L.L.C.
Published 12-2-2025, Control # 724-03

THIS PAGE BLANK

TABLE OF CONTENTS

SECTION 3 . . . . . Operating Controls and Features

TOC

TOC

1

SECTION 1
INTRODUCTION

SECTION CONTENTS

GENERAL

Throughout this *Operator Manual,* reference is made to left, right, front, and rear when describing locations. These reference locations are to be considered as those viewed from the operator seat with the superstructure facing forward over the front of the carrier frame.

This *Operator Manual* provides important information for the operation of the Model GRT765/780 Grove Crane.

The GRT765/780 rough terrain crane incorporates an all welded steel frame using planetary drive axles to provide four-wheel drive. Axle steering is accomplished utilizing hydraulic steer cylinders to provide four-wheel steering:

- 2-wheel front
- 2-wheel rear
- 4-wheel coordinated
- 4 wheel crab

The GRT765/780 Grove crane is driven with the boom centered over the front axle. All-wheel steer enables easy crane positioning, and precise maneuvering on the job site.

The GRT765/780 carrier design includes:

- flat aluminum decking for easy rigging and access
- multiple, lockable storage compartments
- carrier electrical box, centrally located and accessible to store batteries, modules, relays, and fuses
- full LED-lighting package including side-mounted carrier work lights for improved jobsite visibility

The Superstructure Display Module (SDM) is a full-color graphical display on a pivoting arm that provides maximum adjustability for the crane operator.

The SDM allows the operator to program the Rated Capacity Limiter (RCL) using the GRT765/780 *Load Chart Manual* or the RCL setup wizard. The SDM provides electronic display of boom angle, boom length, load radius, boom tip height, maximum permissible load, actual load, and warning of impending two-block condition.

The SDM also allows the operator to:

- monitor performance of the crane systems
- select camera views displayed on the ODM screen
- telescope the boom
- extend and retract the outriggers
- lock and unlock the superstructure
- operate the boom extension stowage actuators
- set the working range limits (WRL) operating indicators, levels, warnings and faults, prior to operating the crane, aiding the operator to avoid obstructions
- view engine, transmission, and crane fault codes
- set controller curves and maximum speeds
- engage and disengage Economy (ECO) mode

- inhibit operation of the engine cleaning system

The engine is mounted at the rear of the crane, and provides motive power through a transmission range-shift with six forward and six reverse speeds. Hydraulic, double box, sliding beam outriggers are integral with the frame. An ECO mode system supports intelligent power management and decreased fuel consumption.

The carrier frame incorporates an integral fifth wheel to which the rear axle is mounted. This integral fifth wheel provides axle oscillation during travel, when the boom and superstructure are centered over the carrier. Axle oscillation lockout occurs automatically when the superstructure rotates from the travel position.

The superstructure is capable of 360° continuous rotation in either direction. All crane functions are controlled from the fully-enclosed cab mounted on the superstructure. The cab seat incorporates armrest-mounted electronic programmable single-axis or dual-axis controllers and a jog dial for easy data input. The GRT780 crane is equipped with a five-section, full power, sequenced and synchronized boom. The GRT765 crane is equipped with a four-section, full power, sequenced and synchronized boom.Additional reach is obtained by utilizing an optional swingaway boom extension. Lifting is provided by a main hoist and an optional auxiliary hoist.

Customer Support

Grove 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.

A compact disc or USB flash drive, which includes sections on Operation, Safety and Maintenance for crane operators and owners, is supplied when the crane is purchased new. Additional copies are available from your Grove distributor.

NEW OWNERS

If you are the new owner of a Grove crane, please register it with Grove Product Support so we have the ability to contact you if the need arises.

Go to: https://www.manitowoc.com/support/change-ownership and complete the form.

NOISE/VIBRATION TEST RESULTS

Noise Level Test Results

With closed cab operation, the guaranteed sound power level at the operator's station is L_{wa} 105 dB(A) as measured by Directive 2006/42/EC. The guaranteed sound power level at the crane operator position is 80 dB(A) as measured by Annex G.1 of EN 13000:2010+A1:2014.

Vibration Level Test Results

With closed cab operation, vibration levels at the operator station are less than 0.5 m/s/s for Whole Body Vibration exposure and are less than 2.5 m/s/s for Hand Arm Vibration exposure when measured according to 89/392/EEC Community Legislation on Machinery per standard ISO 2631/1 – *Evaluation of Human Exposure to Work Body Vibration*, ISO 5349 – *Guidelines for the Measurement and Assessment of Human Exposure to Hand Transmitted Vibrations*, and ISO/DIS 8041 – *Human Response Vibration Measuring Instrumentation*.

SERIAL NUMBER LOCATION

Refer to Figure 1-1.

When contacting your local Grove distributor or Grove Product Support, have the crane serial number available.

Serial numbers are located at these places on the crane:

1. Stamped on frame
2. Data plate inside cab
3. *Operator Manual* cover

Additionally, the crane serial number is located on the *Service Manual*, *Parts Manual*, and *Load Chart Manual*.

10710-1 SERIAL NUMBER LOCATIONS

FIGURE 1-1

GRT765/780 CRANE COMPONENTS

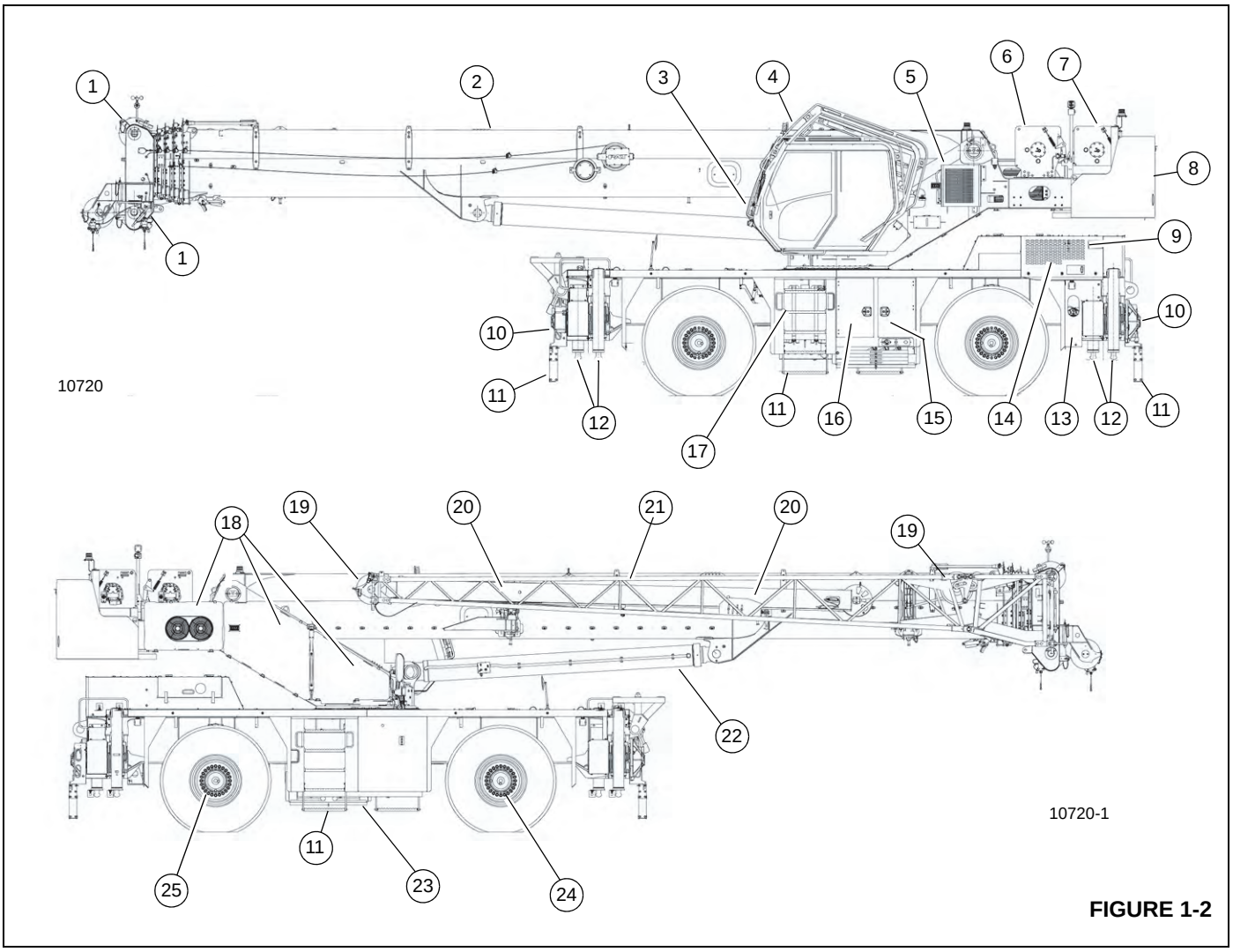


FIGURE 1-2

Item	Description	Item	Description
1	Boom Nose Sheaves	14	Exhaust Aftertreatment
2	Boom	15	Battery and Control Module Compartment
3	Work Lights	16	Battery Disconnect Switch
4	Cab	17	Fuel Tank*
5	Air Conditioning Condenser	18	Superstructure Valve Covers
6	Main Hoist	19	Boom Extension Sheaves
7	Auxiliary Hoist	20	Boom Extension Fly Section
8	Counterweight	21	Boom Extension Base Section
9	Tailpipe	22	Lift Cylinder
10	Outrigger Pads	23	Hydraulic Tank
11	Crane Steps and Grab Handles	24	Axle #1 (Front Drive and Steer)
12	Outrigger Jack Cylinders	25	Axle #2 (Rear Drive and Steer)
13	Diesel Exhaust Fluid (DEF) Tank*		
*Stage V/Tier 4F engines use Ultra Low Sulfur Fuel (Max 15 ppm) and Diesel Exhaust Fluid (DEF)			

LIST OF SPECIFICATIONS

General

Model GRT765/GRT780
Full Vision Cab . . . . . 20° cab tilt
Rated Capacity . . . . See *Load Chart Manual* in cab
Drive . . . . . 4 x 4
Gross Weight . . See Axle Weight Distribution Table

Dimensions – GRT765

NOTE: Dimensions listed are for a crane with all components fully retracted in the travel mode.

Wheelbase . . . . . 4166 mm (164 in)
Length (Carrier). . . . . 8711 mm (343 in)
Length (Overall w/Main Boom) . 14784 mm (582 in)
Length (Overall w/Aux Boom) . . 15274 mm (601 in)
Width. . . . . 2990 mm (118 in)
Height . . . . . 3822 mm (150 in)
Weight (w/Heavy Cwt). . . . . 42607 kg (93931 lb)
Outside Turning Radius
(with Boom Extension Installed)
2 Wheel Steer . . . . . 17.0 m (55 ft 9 in)
4 Wheel Steer . . . . . 12.1 m (39 ft 8 in)
Outside Turning Radius
(without Boom Extension Installed)
2 Wheel Steer . . . . . 16.6 m (54 ft 5 in)
4 Wheel Steer . . . . . 12.0 m (39 ft 5 in)
Outside Curb Clearance
2 Wheel Steer . . . . . 12.7 m (41 ft 10 in)
4 Wheel Steer . . . . . 6.7 m (21 ft 11 in)

Dimensions – GRT780

NOTE: Dimensions listed are for a crane with all components fully retracted in the travel mode.

Wheelbase . . . . . 4166 mm (164 in)
Length (Carrier). . . . . 8711 mm (343 in)
Length (Overall w/Main Boom) . 14786 mm (582 in)
Length (Overall w/Aux Boom) . . 15276 mm (601 in)
Width. . . . . 2997 mm (118 in)
Height . . . . . 3822 mm (150 in)
Weight. . . . . 46948 kg (103501 lb)
Outside Turning Radius
(with Boom Extension Installed)
2 Wheel Steer . . . . . 17.0 m (55 ft 9 in)
4 Wheel Steer . . . . . 12.1 m (39 ft 8 in)
Outside Turning Radius
(without Boom Extension Installed)
2 Wheel Steer . . . . . 16.7 m (54 ft 8 in)
4 Wheel Steer . . . . . 12.1 m (36 ft 7 in)
Outside Curb Clearance
2 Wheel Steer . . . . . 12.7 m (41 ft 10 in)
4 Wheel Steer . . . . . 7.8 m (21 ft 7 in)

Capacities

Fuel Tank (Usable) . . . . . 266 L (70 gal)
Engine Cooling System. . . . . .36 L (9.5 gal)
Engine Cooling System (Liquid Coolant Conditioner). . . . . (test and add, as necessary)
Engine Crankcase with filter . . . . . 18.5 L (4.9 gal)
Hydraulic Tank (Reservoir Capacity)
Total . . . . . 909.2 L (240.2 gal)
Full Level . . . . . 817.3 L (215.9 gal)
Hoist
Model GHP-30A. . . . . .14.2 L (15 qt)
Swing Drive
Gearbox . . . . . 4.14 L (4.4 qt)
Brake Assembly . . . . . .3 L (0.63 pt)
Axle Planetary Hubs and Wheel Bearings (each wheel end) . . . . . .2.8 L (3 qt)
Axle Differentials (each) . . . . . .37 L (9.8 gal)
Transmission (includes Torque Converter) . . . . . .44.5 L (47 qt)
Diesel Exhaust Fluid (DEF) Tank . . . 37.9 L (10 gal)

Transmission

Gear Ratios — Forward and Reverse
Low Range
1st 12.64:1
2nd. 6.11:1
3rd 2.25:1
High Range
4th 4.30:1
5th 2.08:1
6th 0.76:1
Maximum Drive Speed . . . . . .24.1 km/h (15 mph) with counterweight installed

Torque Converter

Stall Ratio 1.806:1
Charge Pump
Capacity . . . 106 L/min (28 gal/min) @ 2000 rpm

Engine

Cummins B6.7L - Stage V / Tier 4F

Type . . . . . .4-cycle, Diesel with single module exhaust system
6-cylinder Turbocharged . . . . After-Cooled Engine
Horse Power Rating . 194kW (260 hp) @ 2500 rpm
Maximum Speed, No Load . . . . . .2700 rpm
Max. Torque . . . . 1152 N·m (850 lbf-ft) at 1500 rpm
24 Volt Electrical System . . . . two 12 Volt Batteries
Fuel. . . . . Maximum 15 ppm sulfur content (ULSD) plus Diesel Exhaust Fluid (DEF)

Cummins B6.7L - non-certified

Type . . . . . .4-cycle, Diesel
6-cylinder Turbocharged . . . . After-Cooled Engine
Horse Power Rating . 194kW (260 hp) @ 2500 rpm
Maximum Speed, No Load . . . . . .2700 rpm
Max. Torque . . . . 1152 N·m (850 lbf-ft) at 1500 rpm
24 Volt Electrical System . . . . two 12 Volt Batteries
Fuel. . . . . Maximum 5000 ppm Sulfur Diesel

Axles

Total Axle Ratio. 24.78:1
Carrier Ratio 4.13:1
Planetary Ratio 6:1

Steering

Type . . . . . Independent Hydraulic Power Steering
Front axle . . . . . controlled via steering wheel
Rear axle . . . . . provides infinite variations controlled via steering wheel (automatic mode) or keypad on armrest (manual mode)
Coordinated Turning Radius
Outside 4 Wheel Steer . . . . . 6.5 m (21 ft 2 in)
Inside 4 Wheel Steer. . . . . .4.6 m (14 ft 11 in)

Brakes

Type . . . . . .4 Wheel Hydraulic Dry Disc Acting on all Wheels w/ Dual Front Single Rear Calipers
Parking . . . . . Front Axle Mounted, Spring Applied Hydraulic Released

Wheels and Tires

Lugs per Wheel 24
Torque . . . . . 650 N·m (480 lbf-ft)
Tire Size . . . . . .23.5 x 25, 36 bias ply rating

NOTE: For roading and lifting pressures, refer to the *Load Chart Manual* in the cab.

Boom – GRT765

Length . . . . . .11.9 to 38.5 m (39 to 126 ft)

Power . . . . . .4 Tele Section, Full Power
Elevation . . . . . -3 to +80 degrees
Extension (Optional)
Manual Bi-Fold . . . . . 10 to 17 m (33 to 56 ft)
Offset 0°, 25°, or 45°

Boom – GRT780

Length . . . . . .11.9 to 47.3 m (39 to 155 ft)

Power . . . . . .5 Tele Section, Full Power
Elevation . . . . . -3 to +80 degrees
Extension (Optional)
Manual Bi-Fold . . . . . 10 to 17 m (33 to 56 ft)
Offset 0°, 25°, or 45°

Outriggers

Outrigger Spread GRT765
Retracted. . . . . .2790 mm (110 in)
Mid Extend . . . . . 4799 mm (189 in)
Fully Extended . . . . . 6809 mm (268 in)
Outrigger Spread GRT780
Retracted. . . . . .2790 mm (110 in)
Mid Extend . . . . . 5245 mm (207 in)
Fully Extended . . . . . 7300 mm (287 in)
Outrigger Pad Diameters
Polymer . . . . . 600 mm (23.6 in)
Aluminum (Optional) . . . . . 612 mm (24.1 in)
Max Individual Outrigger Pad Load . . . . . .42,547 kg (93,800 lb)

Swivel Assembly

Electrical . . . . . 15 Slip Rings
Hydraulic . . . . . 10 ports
Water . . . . . 2 ports
Air Conditioning . . . . . 2 ports

Swing Gearbox

Reduction Ratio 35.2:1
Continuous Torque. . . . . 5650 N·m (4167 lbf-ft)
Max Pinion Torque . . . . . 11298 N·m (8333 lbf-ft)

Hydraulic Pumps

NOTE: Pump flow rate (output) figures are theoretical.

Pump #1

Type . . . . . .Piston
Sections 1
Output - @ loaded engine speed
Section 1 flow rate . . 156 L/min (41.2 gal/min)

Pump #2

Type . . . . . .Piston
Sections 1
Output - @ loaded engine speed
Section 1 flow rate . . 156 L/min (41.2 gal/min)

Pump #3

Type . . . . . .Gear
Sections 1
Output - @ loaded engine speed
Section 1 flow rate . . 94.3 L/min (24.9 gal/min)

Hoists

Drum Dimensions
Diameter . . . . . .381 mm (15 in)
Length (Standard). . . . . 490 mm (19.29 in)
Cable Length-Usable . . . . . 211.5 m (694 ft)
Cable Length-Storable. . . . . 255.6 m (839 ft)
Max. Single Line Speed. . . . 148 m/min (490 ft/min)
Max Permissible Single Line Pull . . . . . 7784 kg (17,160 lb)
Cable, Main, 35x7 Steel
Diameter . . . . . 19 mm (0.75 in)
Length. . . . . .177 m (581 ft)
Cable, Auxiliary, 35x7 Steel
Diameter . . . . . 19 mm (0.75 in)
Length. . . . . .138 m (452 ft)
Cable, Main, 35x7 Steel (Optional)
Diameter . . . . . 19 mm (0.75 in)
Length. . . . . .214 m (702 ft)
Cable, Auxiliary, 35x7 Steel (Optional)
Diameter . . . . . 19 mm (0.75 in)
Length. . . . . .214 m (702 ft)

THIS PAGE BLANK

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.

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 safety alert symbol means **ATTENTION!** Become alert **- your safety is involved!** Obey all safety messages that follow this symbol to avoid possible death or injury.

Signal Words

DANGER

Identifies **hazards** that will result in death or serious injury if the message is ignored**.**

WARNING

Identifies **hazards** that may result in death or serious injury if the message is ignored**.**

CAUTION

Identifies **hazards** that could result in minor or moderate injury if the message is ignored.

CAUTION

Without the safety alert symbol, identifies **hazards** that could result in property damage if the message is ignored.

NOTE: Emphasizes operation or maintenance procedures.

GENERAL

It is impossible to compile a list of safety precautions covering all situations. However, there are basic principles that **must** be followed during your daily routine. Safety is **your primary responsibility**, since any piece of equipment is only as safe **as the person at the controls**.

Read and follow the information located in *Model Specific Information* near the end of this section.

This information has been provided to assist in promoting a safe working atmosphere for yourself and those around you. It is not meant to cover every conceivable circumstance which could arise. It is intended to present basic safety precautions that should be followed in daily operation.

Because you are the only part of the crane that can think and reason, your responsibility is not lessened by the addition of operational aids or warning devices. Indeed, you must guard against acquiring a false sense of security when using them. They are there to assist, not direct the operation. Operational aids or warning devices can be mechanical, electrical, electronic, or a combination thereof. They are subject to failure or misuse and should not be relied upon in place of good operating practices.

You are the only one who can be relied upon to assure the safety of yourself and those around you. Be a **professional** and follow the **rules of safety**.

Remember, failure to follow just one safety precaution could cause an accident that results in death or serious injury to personnel or damage to equipment. You are responsible for the safety of yourself and those around you.

ACCIDENTS

Following any accident or damage to equipment, the Grove distributor must be immediately advised of the incident and consulted on necessary inspections and repairs. Should the distributor not be immediately available, contact should be made directly with Grove Product Safety at the address below. 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 your Grove distributor and/or Grove Product Support.

If this crane becomes involved in a property damage and/or personal injury accident, **immediately** contact your Grove distributor. If the distributor is unknown and/or cannot be reached, contact Product Safety at:

Grove U.S. L.L.C.
1565 East Buchanan Trail
Shady Grove, PA 17256-0021

Phone: 888-777-3378 (888-PSR.DEPT)
717-597-8121
Fax: 717-593-5152
E-mail: product.safety@manitowoc.com

OPERATOR INFORMATION

You must **read** and **understand** this *Operator Manual* and the *Load Chart* before operating your new crane. You must also **view** and **understand** the supplied safety video. This manual and *Load Chart* must be readily available to the operator at all times and must remain in the cab (if equipped) or operator's station while the crane is in use.

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.

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

Allow **No One** other than the operator to be on the crane while the crane is operating or moving, unless they are seated in a two-man cab.

Do not remove the *Load Chart*, this *Operator Manual*, or any decal from this crane.

Inspect the crane every day (before the start of each shift). Make sure that routine maintenance and lubrication are being dutifully performed. Don't operate a damaged or poorly maintained crane. You risk lives when operating faulty machinery—including your own.

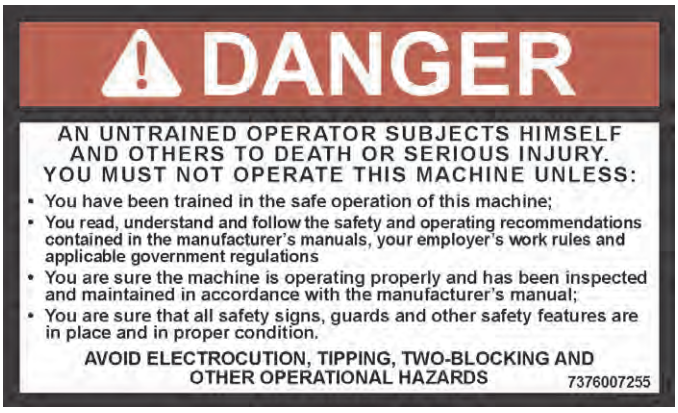
If adjustments or repairs are necessary, the operator shall notify the next operator and personnel responsible for the maintenance and repair of the crane.

OPERATOR QUALIFICATIONS

Qualified person is defined as one who by reason of knowledge, 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.

Make sure that all personnel working around the crane are thoroughly familiar with safe operating practices. You must be thoroughly familiar with the location and content of all decals on the crane. Decals provide important instructions and warnings and must be read prior to any operational or maintenance function.

You must be familiar with the regulations and standards governing this crane and its operation. Work practice requirements may vary slightly between government regulations, industry standards, and employer policies so a thorough knowledge of all such relevant work rules is necessary.



An untrained operator subjects himself and others to death or serious injury.

You must not operate this crane unless:

- You have been trained in the safe operation of this crane.
- You read, understand, and follow the safety and operating recommendations contained in the manufacturer's manuals, your employer's work rules, and applicable government regulations.
- You are sure the crane has been inspected and maintained in accordance with the manufacturer's manuals and is operating properly.
- You are sure that all safety decals, guards, and other safety features are in place and in proper condition.

Do not attempt to operate the crane unless you are trained and thoroughly familiar with all operational functions. Controls and design may vary from crane to crane; therefore, it is important that you have specific training on the particular crane you will be operating.

Training is ESSENTIAL for proper crane operation. Never jeopardize your own well-being or that of others by attempting to operate a crane on which you have not been trained.

You must be mentally and physically fit to operate a crane. Never attempt to operate a crane while under the influence of medication, narcotics, or alcohol. Any type of drug could impair physical, visual and mental reactions, and capabilities.

As operator of this crane, you are granted the authority to stop and refuse to lift loads until safety is assured.

OPERATIONAL AIDS

Operational aids are accessories that provide information to facilitate operation of a crane or that take control of particular functions without action of the operator when a limiting condition is sensed, as stated in the latest revision of the ASME B30.5, and ASME B30.8 standards. Examples of such devices include, but are not limited to, the following: anti-two-block device, rated capacity indicator, rated capacity limiter, boom angle or radius indicator, boom length indicator, crane level indicator, hoist drum rotation indicator, load indicator, and wind speed indicator.

Grove remains committed to providing reliable products that enable users and operators to safely lift and position loads. Grove has been an industry leader in the incorporation of operational aids into the design of its cranes. Federal law requires that cranes be properly maintained and kept in good working condition. The manuals that Grove provides that are specific for each crane and the manufacturer's manuals for the operational aids shall be followed. If an operational aid should fail to work properly, the crane user or owner must assure that repair or recalibration is accomplished as soon as is reasonably possible. If immediate repair or recalibration of an operational aid is not possible and there are exceptional circumstances which justify continued short-term use of the crane when operational aids are inoperative or malfunctioning, the following requirements shall apply for continued use or shutdown of the crane:

- Steps shall be taken to schedule repairs and recalibration immediately. The operational aids shall be put back into service as soon as replacement parts, if required, are available and the repairs and recalibration can be carried out. Every reasonable effort must be made to expedite repairs and recalibration.
- When a *Load Indicator***,** *Rated Capacity Indicator*, or *Rated Capacity Limiter* is inoperative or malfunctioning, the designated person responsible for supervising the lifting operations shall establish procedures for determining load weights and shall ascertain that the weight of the load does not exceed the crane ratings at the radius where the load is to be handled.
- When a *Boom Angle* or *Radius Indicator* is inoperative or malfunctioning, the radius or boom angle shall be determined by measurement.
- When an *Anti-Two-Blocking Device*, *Two-Blocking Damage Prevention Device* or *Two-Block Warning Device* is inoperative or malfunctioning, the designated person responsible for supervising the lifting operations shall establish procedures, such as assigning an additional signal person to furnish equivalent protection. This does not apply when lifting personnel in load-line supported personnel platforms. Personnel shall not be lifted when anti-two-block devices are not functioning properly.
- When a *Boom Length Indicator* is inoperative or malfunctioning, the designated person responsible for supervising the lifting operations shall establish the boom lengths at which the lift will be made by actual measurements or marking on the boom.
- When a *Level Indicator* is inoperative or malfunctioning, other means shall be used to level the crane.

Rated Capacity Limiter (RCL) Systems

Your crane is equipped with an RCL system which is intended to aid the operator. An RCL is a device that automatically monitors radius, load weight, and load rating and prevents movements of the crane, which would result in an overload condition.

Test daily for proper operation. Never interfere with the proper functioning of operational aids or warning devices.

Under **no condition** should it be relied upon to replace the use of *Load Charts* and operating instructions. Sole reliance

upon these electronic aids in place of good operating practices can cause an accident.

Know the weight of all loads and always check the capacity of the crane as shown on the *Load Chart* before making any lifts.

NEVER exceed the rated capacity shown on the *Load Chart*. Always check the *Load Chart* to make sure that the load to be lifted at the desired radius is within the rated capacity of the crane.

For detailed information concerning the operation and maintenance of the RCL system installed on the crane, see the appropriate section later in this manual or the RCL manufacturer's manual supplied with the crane. 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), or an EKS5; Grove refers to these systems as a rated capacity limiter (RCL) throughout its *Operator* and *Service manuals*.

Anti-Two-Blocking Device

This crane should have a functional Anti-Two-Block and Control Lock-Out System. Test daily for proper operation.

Two-blocking occurs when the load block (hook block, overhaul ball, rigging, etc.) comes into physical contact with the boom (boom nose, sheaves, boom extension, etc.). Two-blocking can cause hoist rope (wire rope or synthetic rope), rigging, reeving, and other components to become highly stressed and overloaded in which case the hoist rope may fail allowing the load, block, etc. to fall.

Two-blocking is more likely to occur when both the main and auxiliary hoist lines are reeved over the main boom nose and boom extension nose respectively. An operator, concentrating on the specific line being used, may telescope or lower the boom allowing the other hoist line attachment to contact the boom or boom extension nose, thus causing damage to the sheaves, or causing the hoist rope to fail, dropping the lifting device to the ground and possibly injuring personnel working below.

Caution must be used when lowering the boom, extending the boom or hoisting up. Let out load line(s) simultaneously to prevent two-blocking the boom tip(s) and the hook block, etc. The closer the load is carried to the boom nose the more important it becomes to simultaneously let out hoist rope as the boom is lowered. Keep load handling devices a minimum of 107 cm (42 in) below the boom nose at all times.

Two-blocking can be prevented. Operator awareness of the hazards of two-blocking is the most important factor in preventing this condition. An Anti-Two-Block System is intended to assist the operator in preventing dangerous two-block conditions. It is not a replacement for operator awareness and competence.

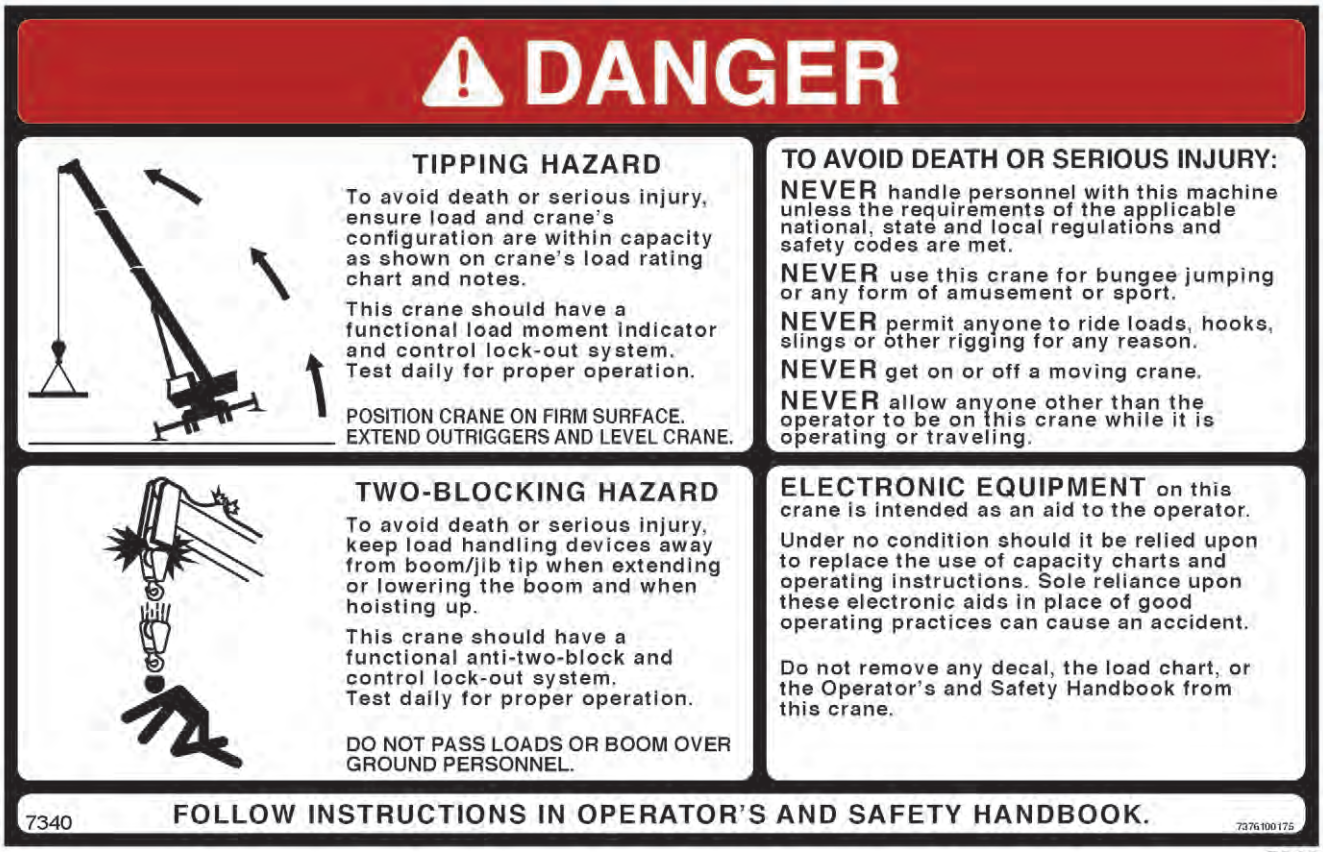
Never interfere with the proper functioning of operational aids or warning devices.

9250 **Example decal. For reference only.**

Working Area Limiter (If Equipped)

This crane may be equipped with a working area limiter as part of the RCL system, designated as either Work Area Definition System (WADS) or Working Range Limiter (WRL). You must read and understand the operator manual before operating the working area limiter system. Become familiar with all proper operating procedures and with the identification of symbol usage.

The working area limiter is intended to be used as an aid to the operator. It is not a substitute for safe crane operating practices, experience and good operator judgments.



7340

CRANE STABILITY/STRUCTURAL STRENGTH

To avoid death or serious injury, make sure that the crane is on a firm surface with load and crane's configuration within capacity as shown on the crane's *Load Chart* and notes.

Make sure that all pins and floats are properly installed and outrigger beams are properly extended before lifting on outriggers. On models equipped with outriggers that can be pinned at the mid-extend position (vertical stripe, if applicable), the outriggers must also be pinned when operating from the mid-extend position.

Use adequate cribbing under outrigger floats to distribute weight over a greater area. Check frequently for settling.

Carefully follow the procedures in this *Operator Manual* when extending or retracting the outriggers. Death or serious injury could result from improper crane setup on outriggers.

The operator must select the proper *Load Chart* and Rated Capacity Limiter (RCL) System program for the outrigger position selected.

Before swinging the superstructure over the side when the outriggers are retracted, check for backwards stability under the sub-section titled *Model Specific Information* later in this section.

Long cantilever booms can create a tipping condition when in an extended and lowered position. Retract the boom proportionally with reference to the capacity of the applicable *Load Chart*.

Check crane stability before lifting loads. Make sure that the outriggers (or tires if lifting on rubber) are firmly positioned on solid surfaces. Make sure that the crane is level, brakes are set, and the load is properly rigged and attached to the hook. Check the *Load Chart* against the weight of the load. Lift the load slightly off the ground and recheck the stability before proceeding with the lift. Determine the weight of the load before you attempt the lift.

Unless lifting within On Rubber capacities, outrigger beams and jack cylinders (plus center front stabilizer, if equipped) must be properly extended and set to provide precise leveling of the crane. Tires must be clear of the ground before lifting on outriggers.

KEEP THE BOOM SHORT. Swinging loads with a long line can create an unstable condition and possible structural failure of the boom.

Load Charts

Load Charts represent the absolute maximum allowable loads, which are based on either tipping or structural limitations of the crane under specific conditions. Knowing the precise load radius, boom length, and boom angle should be a part of your routine planning and operation. Actual loads, including necessary allowances, should be kept below the capacity shown on the applicable *Load Chart*.

Load Chart capacities are based on freely suspended loads.

You must use the appropriate *Load Chart* when determining the capability of the crane in the configuration required to perform the lift.

Maximum lifting capacity is available at the shortest radius, minimum boom length, and highest boom angle.

Do not remove the *Load Charts* from the crane.

Work Site

Prior to any operation, you must inspect the **entire** work site, including ground conditions, where the crane will travel and operate. Make sure that the surfaces will support a load greater than the crane's weight and maximum capacity.

Be aware of all conditions that could adversely effect the stability of the crane.

Be aware of the danger for people entering the working area. Do not allow unnecessary personnel in the vicinity of the crane while operating.

WIND FORCES

There are basic principles that must be followed while operating in windy conditions. This information has been 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 make sure that 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. Grove 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.

NOTE: Not all crane models allow lifting operations in all configurations or speeds of 20.1 m/s (45 mph). Refer to load chart notes for allowable configurations and maximum permissible wind speed.

Table 2-1 Beaufort Wind Scale

Beaufort Number	Description	Maximum Wind Speed 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”.

NOTE: Not all crane models allow lifting operations in all configurations or speeds of 20.1 m/s (45 mph). Refer to load chart notes for allowable configurations and maximum permissible wind speed.

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).

NOTE: This condition is limited to operation with the main boom on fully extended outriggers only.

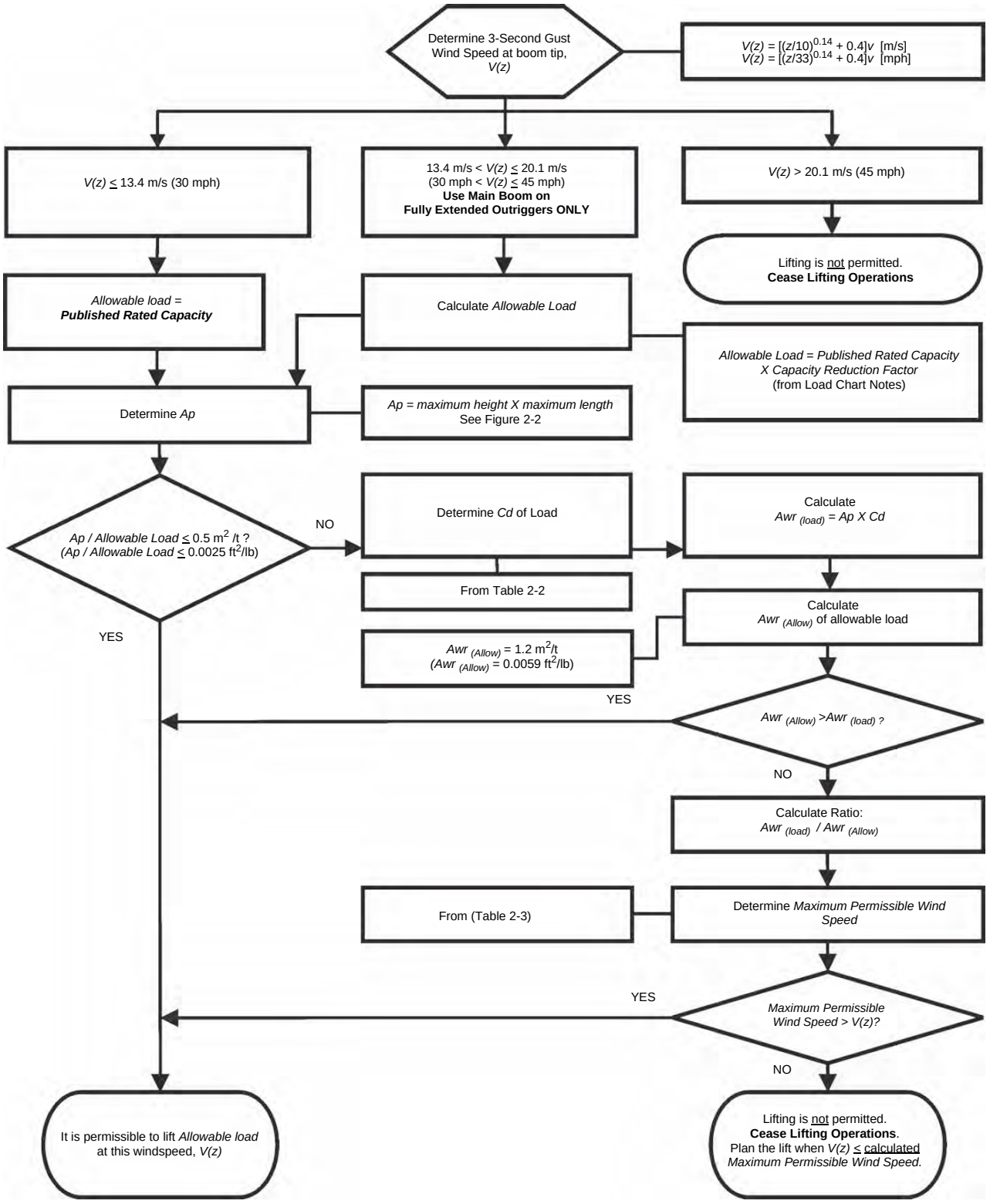
c) If ***V(z)*** is > 20.1 m/s (45 mph), then lifting is NOT permitted. Cease lifting operations and lower and retract the boom.

In both cases **a**) and **b**) above, the lift may also be limited by the projected wind area of the load ***Ap*** and by the wind drag coefficient ***Cd***: This limit can be determined by comparing the **Actual** wind resistance area with the **Allowable** wind resistance area.

Refer to Figure 2-1 for a simplified calculation method to determine permissible wind speed.

NOTE: Not all crane models allow lifting operations in all configurations or speeds of 20.1 m/s (45 mph). Refer to load chart notes for allowable configurations and maximum permissible wind speed.

Simplified Method to Determine Maximum Permissible Wind Speed



V(z) = 3 second gust wind speed at boom tip, m/s (mph)
Ap = Projected Wind Area of Load, m^2 (ft^2)

$Awr_{(load)}$ = Actual Wind Resistance Area for the Load, m^2(ft)
$Awr_{(Allow)}$ = Allowable Wind Resistance Area of the Load, m^2 (ft2
Cd = air drag coefficient of load

FIGURE 2-1

Determination of 3-second wind gust speed at boom tip height:

The following example illustrates how to calculate 3-second wind gust speed at boom tip height based on mean wind speed recorded by the device located at the crane operation site:

V(z) is the 3-second wind gust speed at boom tip height ***Z*** then:

Metric, with ***Z*** [m] and ***V*** [m/s]

$$V(z) = [(Z/10)^{0.14} + 0.4] \times V \quad (2.1)$$

Non-metric, with ***Z*** [ft] and ***V*** [mph]

$$V(z) = [(Z/33)^{0.14} + 0.4] \times V \quad (2.2)$$

where:

V [m/s] [mph] - Mean wind speed at 10 m (33 ft) elevation (upper limit of Beaufort scale)

Example: Suppose you want to lift the load with the maximum boom tip height of 30 m (100 ft) and the recorded mean wind speed by the device located at the crane operation site is 5.5 m/s (13 mph). This mean wind speed of 5.5 m/s (13 mph) corresponds to Beaufort number 4 (see Table 2-1). The maximum wind velocity according to the Beaufort scale of 4 is 7.9 m/s (17.7 mph).

The mean wind speed (upper limit of Beaufort number) at 10 m (33 ft) height, to be used for calculation is:

V = 7.9 m/s (17.7 mph)

Boom tip height for this lift is ***Z*** = 30 m (100 ft)

then:

Metric, with ***Z*** [m] and ***V*** [m/s]

$$V(z) = [(30/10)^{0.14} + 0.4] \times 7.9 = 12.4 \text{ m/s}$$

Non-metric, with ***Z*** [ft] and ***V*** [mph]

$$V(z) = [(100/33)^{0.14} + 0.4] \times 17.7 = 27.8 \text{ mph}$$

Since ***V(z)*** is ≤ 13.4 m/s (30 mph), the allowable loads are the published rated capacities from the Load Chart and can be lifted at this condition.

Size and Shape of the load:

These rated capacities are also based on the assumption that the Wind Resistance Area of load, $Awr_{(load)}$ is not more than 0.0012 square meters per kilogram (0.0059 sq.ft per pound of load. (See below Formulas 2.4 and 2.5.)

The load capacities shall be reduced to account for the larger wind resistance area of load and 3-second wind gust speed at boom tip height. Use tag lines when the wind gust speed is above 13.4 m/s (30 mph) to help control the movement of the load. **Grove recommends that a lift not be made if the wind can cause a loss of control in handling the load.**

NOTE: Not all crane models allow lifting operations in all configurations or speeds of 20.1 m/s (45 mph). Refer to load chart notes for allowable configurations and maximum permissible wind speed.

The lift may also be limited by the projected wind area of the load ***Ap*** and by the wind drag coefficient ***Cd***. This limit can be determined by comparing the actual wind resistance area of the load with the allowable wind resistance area.

$$Awr_{(load)} = Ap \times Cd \quad (2.3)$$

where:

$Awr_{(load)}$ [m^2] [ft^2] . - Wind resistant area of the load

Ap [m^2] [ft^2] - projected wind area,

Cd - wind drag coefficient.

Ap is determined by using the calculation of maximum height x maximum length (see Figure 2-2).

For ***Cd***, refer to Table 2-2. If the ***Cd*** cannot be calculated or estimated, use a value of 2.4.

The allowable wind resistant area of the load $Awr_{(allow)}$ is equal to 0.0012 square meters per kilogram (0.0059 sq.ft per pound) of allowable load:

Metric, with $m_{(load)}$ [kg] - Mass of the allowable load

$$Awr_{(allow)} = 0.0012 \times m_{(load)} \quad (2.4)$$

Non-metric, with $m_{(load)}$ [lb] - Mass of the allowable load

$$Awr_{(allow)} = 0.0059 \times m_{(load)} \quad (2.5)$$

If $Awr_{(load)}$ is greater than $Awr_{(allow)}$, then lifting this load at this wind speed ***V(z)*** is NOT permitted.

Calculation of Projected Wind Area (Ap):

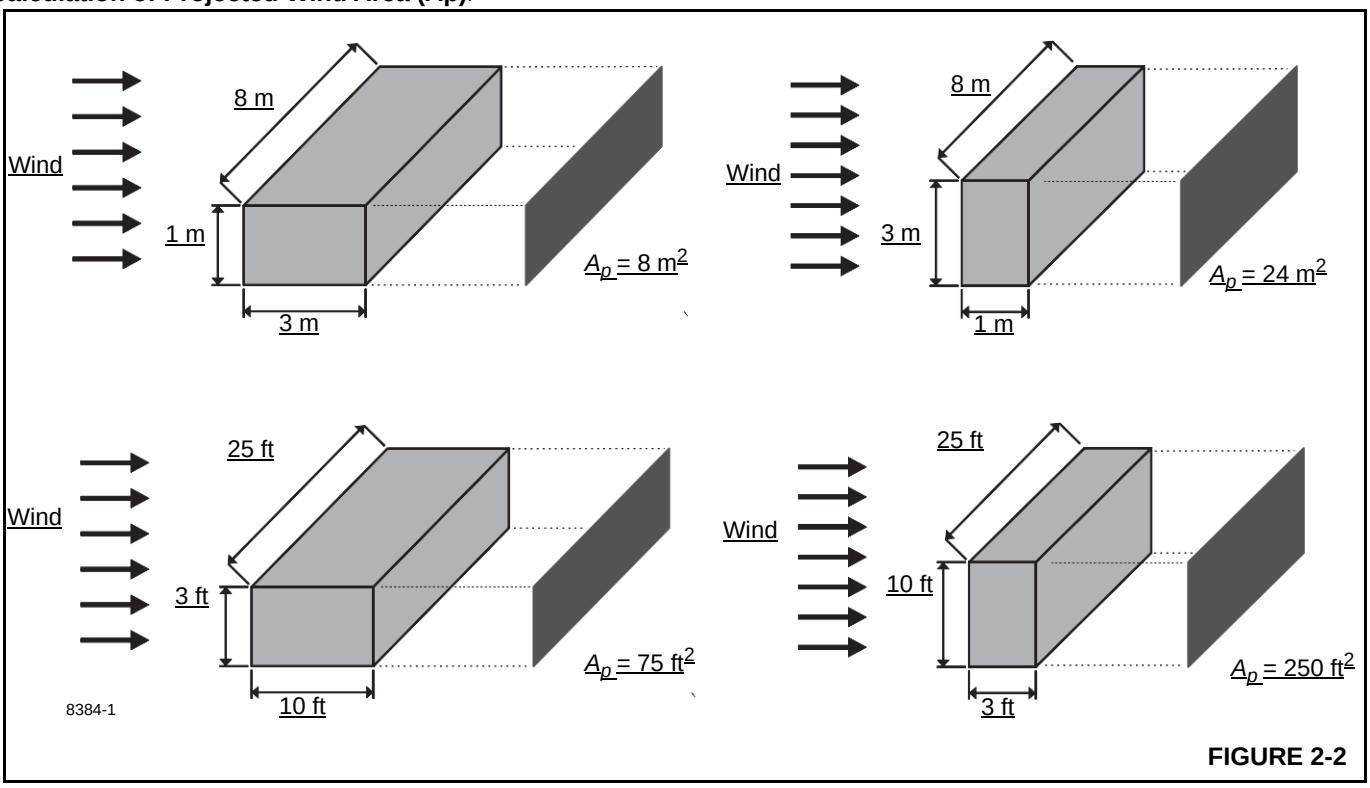


FIGURE 2-2

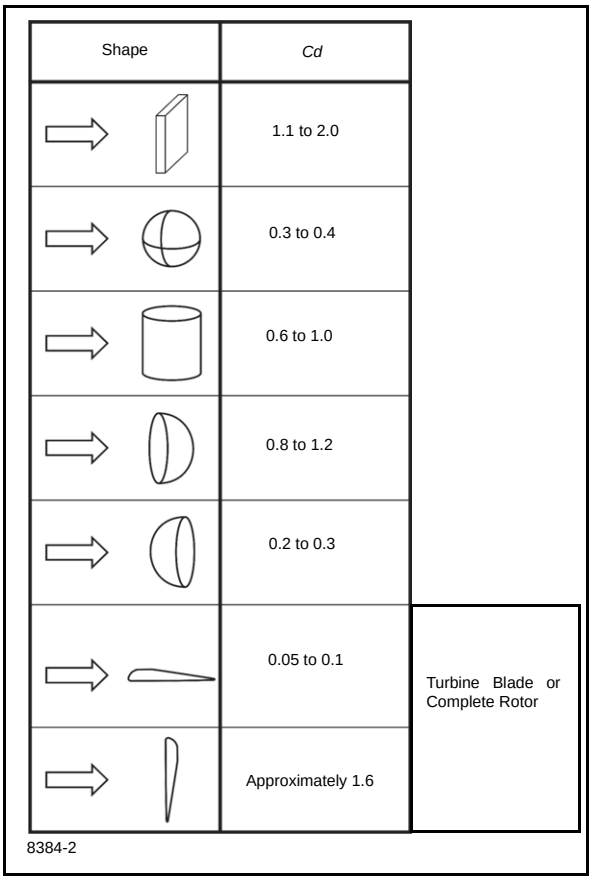
Determining Wind Drag Coefficient (Cd)

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.

Table 2-2 Wind Drag Coefficient



Maximum Permissible Wind Speed

If the wind resistant area of the load ***Awr***$_{(load)}$ is greater than the allowable wind resistant area ***Awr***$_{(allow)}$, the ratio can be used to determine a permissible wind speed ***V(z)*** for the load using (Table 2-3).

Table 2-3 *Awr* Ratio and Permissible Wind Speed *V(z)* - *Imperial units*

Note: Permissible and rated wind speeds in this table are the 3-second gust wind speeds at boom tip height.					
Ratio:	1.2	1.4	1.6	1.8	2
	Maximum Permissible Wind Speed (mph)				
For Rated Capacity at 30 mph	27.4	25.4	23.7	22.4	21.2
For Allowable Capacity at 45 mph	41.1	38.0	35.6	33.5	31.8
NOTE: Not all crane models allow lifting operations in all configurations or speeds of 20.1 m/s (45 mph). Refer to load chart notes for allowable configurations and maximum permissible wind speed.					

Rated Load Chart Example - Metric

RATED LIFTING CAPACITIES IN KILOGRAMS
10.9 m - 33.5 m BOOM

ON OUTRIGGERS FULLY EXTENDED - 360°

Radius in Meters	#0001								
	Main Boom Length in Meters								
	10.9	12.2	15.2	**18.4	21.3	24.4	27.4	30.5	33.5
3	+60,000 (69.5)	40,950 (72)	40,950 (76)						
3.5	53,000 (66.5)	40,950 (69.5)	40,950 (74)	28,350 (78)					
4	47,450 (63.5)	40,950 (66.5)	40,950 (72)	28,350 (75.5)	*18,225 (78)				
4.5	42,875 (60.5)	40,950 (64)	40,950 (70)	28,350 (73.5)	18,225 (76)				
5	39,050 (57.5)	39,025 (61.5)	38,300 (67.5)	28,350 (72)	18,225 (75)	*18,225 (78)			
6	32,950 (50.5)	32,925 (55.5)	32,825 (63.5)	28,350 (68.5)	18,225 (72)	18,225 (75)	*18,225 (78)		
7	28,325 (42.5)	28,300 (49)	28,225 (59)	26,250 (65)	18,225 (69)	18,225 (72)	18,225 (74.5)	*16,725 (78)	*11,400 (78)
8	24,150 (32.5)	24,150 (42)	23,975 (54.5)	23,275 (60)	18,225 (66)	18,225 (69.5)	16,575 (72)	15,250 (74.5)	11,400 (76)
9	20,600 (16.5)	20,550 (33.5)	20,375 (49.5)	20,250 (58)	18,225 (63)	16,575 (67)	15,050 (70)	13,875 (72.5)	11,400 (74.5)
10		17,200 (20.5)	17,175 (43)	17,175 (54)	17,325 (60)	15,125 (65)	13,725 (67.5)	12,700 (70.5)	11,400 (72.5)
12			12,025 (30.5)	12,025 (45.5)	12,575 (53.5)	12,175 (57)	11,600 (63)	10,725 (66.5)	10,050 (69)
14				9,000 (35)	9,360 (46)	9,730 (53.5)	9,955 (58.5)	9,205 (62)	8,620 (65)
16				6,750 (19)	7,175 (37.5)	7,525 (47)	7,920 (53)	7,980 (57.5)	7,470 (61.5)
18					5,525 (29)	5,960 (39.5)	6,340 (47.5)	6,525 (53)	6,530 (57.5)
20						4,755 (30.5)	5,145 (41)	5,320 (48)	5,495 (53)
22						3,790 (16.5)	4,210 (33.5)	4,380 (42.5)	4,545 (48.5)
24							3,435 (23.5)	3,620 (36)	3,780 (43.5)
26								2,975 (28)	3,150 (37.5)
28								2,400 (16)	2,620 (31)
30									2,135 (22)
Minimum boom angle (°) for indicated length (no load)									0
Maximum boom length (m) at 0° boom angle (no load)									33.5

NOTE: ( ) Boom angles are in degrees.
#RCL operating code. Refer to RCL manual for operating instructions.
*This capacity is based on maximum boom angle.
+ 9 parts line required to lift this capacity (using aux. boom nose) when using wire rope with a minimum breaking strength of 36,287 kg. Refer to Operator's & Safety Handbook for reeving diagram.
NOTE: For allowable capacities while operating in 3-second wind gust speeds greater than 13.4 m/s and up to 20.1 m/s, refer to *Capacity Reduction Factors for wind speed (3-second gust speed) V(z) greater than 13.4m/s.*

Lifting Capacities at Zero Degree Boom Angle									
Boom Angle	Main Boom Length in Meters								
	10.9	12.2	15.2	**18.4	21.3	24.4	27.4	30.5	33.5
0°	13,775 (9.2)	11,675 (10.4)	8,145 (13.5)	5,930 (16.6)	4,565 (19.6)	3,535 (22.6)	2,860 (25.7)	2,220 (28.7)	1,770 (31.8)

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

SAMPLE ONLY

8383-1

FIGURE 2-3

Table 2-4 Example-Capacity Reduction Factors for Wind Speed *V(z)* Greater than 13.4 m/s - Metric

(Only for lifting with main boom on fully extended outriggers, with or without stowed extension)

For wind speed ***V(z)*** (3-second gust speed at boom tip height) ***V(z)*** > 13.4 m/s ≤ 20.1 m/s, the Reduced Capacity shall be calculated by multiplying the Published Rated Capacity by the following factors:

	Main Boom Length in Meters								
Wind Speed *V(z)* > 13.4 m/s ≤ 20.1 m/s	10.9	12.2	15.2	18.4	21.[illegible]	24.4	27.4	30.5	33.5
Factor	0.9	0.9	0.8	0.[illegible]	0.8	0.8	0.8	0.7	0.6

Wind resistance area of load, $Awr_{(load)}$ shall not exceed maximum allowable wind resistance area $Awr_{(allow)}$.

Maximum allowable wind resistance area, [m²] $Awr_{(allow)}$ = 0.0012 x calculated reduced capacity in kg.
Wind resistance area of load, $Awr_{(load)}$ = projected wind area ***Ap*** x wind drag coefficient ***Cd*** for the load.

For wind resistance Area of load, $Awr_{(load)}$ > maximum allowable wind resistance area, $Awr_{(allow)}$ refer to crane Operator Manual.

NOTE: Not all crane models allow lifting operations in all configurations or speeds of 20.1 m/s (45 mph). Refer to load chart notes for allowable configurations and maximum permissible wind speed.

SAMPLE

Table 2-5 *Awr* Ratio and Permissible Wind Speed *V(z)* - *Metric*

Note: Permissible and rated wind speeds in this table are the 3-second gust wind speeds at boom tip height.

Ratio:	1.2	1.4	1.6	1.8	2
	Maximum Permissible Wind Speed (m/s)				
For Rated Capacity at 13.4 m/s	12.2	11.4	10.6	10.0	9.5
For Allowable Capacity at 20.1 m/s	18.3	17.0	15.9	15.0	14.2

NOTE: Not all crane models allow lifting operations in all configurations or speeds of 20.1 m/s (45 mph). Refer to load chart notes for allowable configurations and maximum permissible wind speed.

Example and Sample Calculations (metric)

The following example illustrates how to calculate allowable load while operating in wind speed (3-second wind gust speed) above 13.4 m/s (30 mph) and maximum permissible wind speeds with various combinations of lifted load and wind resistance area.

NOTE: Permissible and calculated wind speeds in this example are the **3-second wind gust speeds at boom tip height *V(z)***.

NOTE: Not all crane models allow lifting operations above 13.4 m/s (30 mph). Refer to load chart notes for maximum permissible wind speed.

Example 1: Crane Configuration:

- boom length = 27.4 m,
- load radius = 9 m,
- wind speed is measured at ***V(z)*** ≤ 20.1 m/s.

From the ***Rated Load Chart Example - Metric*** (Figure 2-3), at maximum permissible wind speed, ***V(z)*** = 13.4 m/s, the rated lifting capacity $m_{(allow)}$ for this configuration is 15,050 kg.

The maximum allowable wind resistance area of load is:

$$Awr_{(allow)} = 0.0012 \times m_{(load)} \quad (2.4)$$

$$Awr_{(allow)} = 0.0012 \times 15{,}050 = 18.06 \text{ m}^2$$

Lifting Limits at wind speed V(z) ≤ 13.4 m/s at this configuration:

- Maximum load 15,050 kg
- Maximum wind resistance area of load 18.06 m²

For the allowable wind speed > 13.4 m/s and ≤ 20.1 m/s, reduce the allowable load. Per Table 2-4, the Factor for main boom length of 27.4 m is 0.8, the allowable load is:

$$m_{(allow)} = 0.8 \times 15{,}050 = 12{,}040 \text{ kg}$$

This reduced capacity load has an allowable wind resistance area of:

$Awr_{(allow)}$ = 0.0012 x 12,040 = 14.45 m^2

***Lifting Limits at wind speed V(z) > 13.4 m/s* and ≤ 20.1 m/s,** at this configuration:

- Maximum load 12,040 kg
- Maximum wind resistance area of load 14.45 m^2

At wind speeds greater than 13.4 m/s, it is not permissible to lift a load greater than 12,040 kg, even if the wind resistance area of the load is less than 14.45 m^2.

Refer to the information from the above crane configuration, examine several load conditions.

Load example 1.1:

With known Wind Drag Coefficient of the load ***Cd***, and

- load to be lifted of 11,200 kg,
- Projected Wind Area ***Ap*** = 9.20 m^2,
- Wind Drag Coefficient ***Cd*** = 1.5

wind resistance area of load can be estimated as

$Awr_{(load)}$ = ***Ap*** x ***Cd*** = 9.2 x 1.5 = 13.8 m^2

Refer to the above ***Lifting Limits at wind speed V(z) > 13.4 m/s and ≤ to 20.1 m/s***. Comparing the load and wind resistant area to the allowable:

- Is the load to be lifted less than allowable load?
  11,200 kg ≤ 12,040 kg YES
- Is $Awr_{(load)}$ less than $Awr_{(allow)}$?
  13.8 m^2 ≤ 14.45 m^2 YES

Conclusion: This load is permissible to lift in wind speed up to 20.1 m/s.

Load example 1.2:

With unknown Wind Drag Coefficient of the load ***Cd***,

- Load to be lifted of 10,000 kg,
- Projected Wind Area ***Ap*** = 5.45 m^2,
- Wind Drag Coefficient ***Cd*** = unknown

NOTE: If exact Wind Drag Coefficient is not known, it shall be assumed as 2.4.

- the wind resistance area of load can be estimated as
  $Awr_{(load)}$ = ***Ap*** x ***Cd*** = 5.45 x 2.4 = 13.08 m^2

Refer to the above ***Lifting Limits at V(z) > 13.4* m/s *and ≤ 20.1* m/s**. Comparing the load and wind resistant area to the allowable:

- Is the load to be lifted less than allowable load?
  10,000 kg ≤ 12,040 kg YES
- Is $Awr_{(load)}$ less than $Awr_{(allow)}$?
  13.08 m^2 ≤ 14.45 m^2 YES

Conclusion: This load is permissible to lift in wind speed up to 20.1 m/s.

Load example 1.3a:

With large wind resistance area of the load $Awr_{(load)}$,

- Load to be lifted of 14,000 kg,
- Projected Wind Area ***Ap*** = 21.85 m^2,
- Wind Drag Coefficient ***Cd*** = 1.2

the wind resistance area of load can be estimated as:

$Awr_{(load)}$ = ***Ap*** X ***Cd*** = 21.85 x 1.2 = 26.22 m^2

Refer to the above ***Lifting Limits at wind speed V(z) > 13.4* m/s *and ≤ 20.1* m/s**. Comparing the load to the allowable:

- Is the load to be lifted less than allowable load?
  14,000 kg ≤ 12,040 kg NO

Conclusion: This load is NOT permissible to lift in wind speed up to 20.1 m/s.

Refer to the above ***Lifting Limits at wind speed V(z) < 13.4* m/s**. Comparing the load to the allowable:

- Is the load to be lifted less than allowable load?
  14,000 kg ≤ 15,050 kg YES

The maximum permissible wind speed for this load is 13.4 m/s, depending on the wind resistance area of the load.

- Is $Awr_{(load)}$ less than $Awr_{(allow)}$?
  26.22 m^2 ≤ 18.06 m^2 NO

Conclusion: This load is NOT permissible to lift in wind speed at 13.4 m/s, but is permitted to lift at a reduced wind speed calculated as follows:

Ratio $\frac{Awr_{(load)}}{Awr_{(allow)}} = \frac{26.22}{18.06} = 1.45$

From (Table 2-5), the maximum permissible wind speed at ratio of 1.45 (rounded to next higher table value of 1.6) is 10.6 m/s.

Conclusion: This load is permissible to lift in wind speed up to 10.6 m/s only.

Load example 1.3b:

With large wind resistance area of the load $Awr_{(load)}$,

- Load to be lifted of 8,000 kg,
- Projected Wind Area ***Ap*** = 15.25 m^2,

- Wind Drag Coefficient ***Cd*** = 1.3

the wind resistance area of load can be estimated as

$$Awr_{(load)} = Ap \times Cd = 15.25 \times 1.3 = 19.83\ m^2$$

Refer to the above ***Lifting Limits at wind speed V(z) > 13.4*** **m/s** ***and ≤ 20.1*** **m/s**. Comparing the load and wind resistant area to the allowable:

- Is the load to be lifted less than allowable load?
  8,000 kg ≤ 12,040 kg YES
- Is $Awr_{(load)}$ less than $Awr_{(allow)}$?
  19.83 m^2 ≤ 14.45 m^2 NO

Conclusion: This load is NOT permissible to lift in wind speed up to 20.1 m/s, but permitted to lift at a reduced wind speed calculated as follows:

$$\text{Ratio}\ \frac{Awr_{(load)}}{Awr_{(allow)}} = \frac{19.83}{14.45} = 1.37$$

From (Table 2-5), the maximum permissible wind speed at ratio of 1.37 (rounded to next higher table value of 1.4) is 17.0 m/s.

Conclusion: This load is permissible to lift in wind speed up to 17.0 m/s only.

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)	18,2[illegible] (49.5)	19,100 (55)	18,550 (59.5)	17,350 (62.5)
55					14,300 (33.5)	[illegible] (44)	16,000 (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] (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.

SAMPLE ONLY

8382-1

FIGURE 2-4

Table 2-6 Example-Capacity Reduction Factors for Wind Speed *V(z)* Greater than 30 mph - Non-metric

(Only for lifting with main boom on fully extended outriggers, with or without stowed extension)

For wind speed ***Vz*** (3-second gust speed at boom tip height) is greater > 30> ≤ 45 mph, the Reduced Capacity shall be calculated by multiplying the Published Rated Capacity by the following factors:

	Main Boom Length in Feet								
Wind Speed *Vz*> 30 mph ≤ 45 mph	36	40	50	60	70	80	90	100	110
Factor	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.5

Wind resistance area of load, ***Awr*** $_{(load)}$, shall not exceed maximum allowable wind resistance area ***Awr*** $_{(allow)}$.

Maximum allowable wind resistance area in ft², ***Awr*** $_{(allow)}$ = 0.0059 x calculated reduced capacity in lb.

Wind resistance area of load, ***Awr*** $_{(load)}$ = projected wind area ***Ap*** x wind drag coefficient ***Cd*** for the load.

For wind resistance area of load, ***Awr*** $_{(load)}$ > maximum allowable wind resistance, **Awr** $_{(allow)}$, refer to crane Operator Manual.

NOTE: Not all crane models allow lifting operations in all configurations or speeds of 20.1 m/s (45 mph). Refer to load chart notes for allowable configurations and maximum permissible wind speed.

SAMPLE

Table 2-7*Awr* Ratio and Permissible Wind Speed *V(z)* - *Non-Metric*

Note: Permissible and rated wind speeds in this table are the 3-second gust wind speeds at boom tip height.

Ratio:	1.2	1.4	1.6	1.8	2
	Maximum Permissible Wind Speed (mph)				
For Rated Capacity@ 30 mph	27.4	25.4	23.7	22.4	21.2
For Allowable Capacity@ 45 mph	41.1	38.0	35.6	33.5	31.8

NOTE: Not all crane models allow lifting operations in all configurations or speeds of 20.1 m/s (45 mph). Refer to load chart notes for allowable configurations and maximum permissible wind speed.

Example and Sample Calculations (Non-metric)

The following example illustrates how to calculate allowable load while operating in wind speed (3-second wind gust speed) above 13.4 m/s (30 mph) and maximum permissible wind speeds with various combinations of lifted load and wind resistance area.

NOTE: Permissible and calculated wind speeds in this example are the **3-second wind gust speeds at boom tip height *V(z)***.

NOTE: Not all crane models allow lifting operations in all configurations or speeds of 20.1 m/s (45 mph). Refer to load chart notes for allowable configurations and maximum permissible wind speed.

Example 2:

A crane is configured with:

- boom length = 90 ft,
- load radius = 40 ft, and
- wind speed is measured at ***V(z)*** ≤ 45 mph.

The ***Rated Load Chart Example - Non-metric*** (Figure 2-4), at maximum permissible wind speed, ***V(z)*** = 30 mph, the rated lifting capacity ***m*** $_{(allow)}$ for this configuration is 25,200 lb.

The maximum allowable wind resistance area of load is:

$Awr_{(allow)} = 0.0059 \times m_{(load)}$ (2.5)

$Awr_{(allow)} = 0.0059 \times 25{,}200 = 149\ ft^2$

Lifting Limits at wind speed V(z) < 30 mph at this configuration:

- Maximum load 25,200 lb
- Maximum wind resistance area of load 149 ft^2

For the allowable wind speed > 30 mph and ≤ 45 mph, reduce the allowable load. , the Factor for a main boom length of 90 ft is 0.8, thus the allowable load is:

$m_{(allow)} = 0.8 \times 25{,}200 = 20{,}160$ lb

This reduced capacity load has an allowable wind resistance area of:

$Awr_{(allow)} = 0.0059 \times 20{,}160 = 119\ ft^2$

Lifting Limits at wind speed V(z) > 30 mph and ≤ 45 mph at this configuration:

- Maximum load 20,160 lb
- Maximum wind resistance area of load 119 ft^2

Example, wind speeds greater than 13.4 m/s is NOT permissible to lift a load greater than 20,160 lb, even if the wind resistance area of the load is less than 119 ft^2.

Refer to the above crane configuration for the following load conditions:

Load example 2.1:

With known Wind Drag Coefficient of the load ***Cd***,

- load to be lifted of 19,500 lb,
- Projected Wind Area ***Ap*** = 70 ft^2,
- Wind Drag Coefficient ***Cd*** = 1.5

then the wind resistance area of load can be estimated as

$Awr_{(load)} = Ap \times Cd = 70 \times 1.5 = 105\ ft^2$

Refer to the above ***Lifting Limits at wind speed V(z) > 30 mph and ≤ 45 mph***. Comparing the load and wind resistant area to the allowable:

- Is the load to be lifted less than allowable load?
  19,500 lb **≤** 20,160 lb YES
- Is $Awr_{(load)}$ less than $Awr_{(allow)}$?
  105 ft^2 ≤ 119 ft^2 YES

Conclusion: This load is permissible to lift in wind speed up to 45 mph.

Load example 2.2:

With unknown Wind Drag Coefficient of the load ***Cd***,

- Load to be lifted of 18,000 lb,
- Projected Wind Area ***Ap*** = 45 ft^2,
- Wind Drag Coefficient ***Cd*** = unknown

NOTE: If exact Wind Drag Coefficient is not known, it shall be assumed as 2.4.

the wind resistance area of load can be estimated as

$Awr_{(load)} = Ap \times Cd = 45 \times 2.4 = 108\ ft^2$

Refer to the above ***Lifting Limits at wind speed V(z) > 30 mph and ≤ 45 mph***. Comparing the load and wind resistant area to the allowable:

- Is the load to be lifted less than allowable load?
  18,000 lb **≤** 20,160 lb YES
- Is $Awr_{(load)}$ less than $Awr_{(allow)}$?
  108 ft^2 ≤ 119 ft^2 YES

Conclusion: This load is permissible to lift in wind speed up to 45 mph.

Load example 2.3a:

With large wind resistance area of the load $Awr_{(load)}$,

- Load to be lifted of 22,000 lb,
- Projected Wind Area ***Ap*** = 180 ft^2,
- Wind Drag Coefficient ***Cd*** = 1.2

the wind resistance area of load can be estimated as:

$Awr_{(load)} = Ap \times Cd = 180 \times 1.2 = 216\ ft^2$

Refer to the above ***Lifting Limits at wind speed V(z) > 30 mph and ≤ 45 mph***. Comparing the load to the allowable:

- Is the load to be lifted less than allowable load?
  22,000 lb ≤ 20,160 lb NO

Conclusion: This load is NOT permissible to lift in wind speed up to 45 mph.

Refer to the above ***Lifting Limits at wind speed V(z) up to 30 mph***. Comparing the load to the allowable:

Is the load to be lifted less than allowable load?
22,000 lb **≤** 25,200 lb . . . . . YES

The permissible wind speed for this load is 30 mph, depending on the wind resistance area of the load.

- Is $Awr_{(load)}$ less than $Awr_{(allow)}$,?
  216 ft^2 ≤ 149 ft^2 . . . . . NO

Conclusion: This load is NOT permissible to lift in wind speed at 30 mph, but permitted to lift at a reduced wind speed calculated as follows:

$$\text{Ratio } \frac{Awr_{(load)}}{Awr_{(allow)}} = \frac{216}{149} = 1.45$$

From Table 2-7, the maximum permissible wind speed at ratio of 1.45 (rounded to next higher table value of 1.6) is 23.7 mph.

Conclusion: This load is permissible to lift in wind speed up to 23.7 mph only.

Load example 2.3b:

With large wind resistance area of the load $\boldsymbol{Awr}_{(load)}$,

- Load to be lifted of 12,000 lb,
- Projected Wind Area $\boldsymbol{Ap}$ = 125 ft^2,
- Wind Drag Coefficient $\boldsymbol{Cd}$ = 1.3

the wind resistance area of load can be estimated as:

$\boldsymbol{Awr}_{(load)} = \boldsymbol{Ap} \times \boldsymbol{Cd} = 125 \times 1.3 = 162\ ft^2$

Refer to the above ***Lifting Limits at wind speed V(z) > 30 mph and ≤ 45 mph***. Comparing the load and wind resistant area to the allowable:

- Is the load to be lifted less than allowable load?
  12,000 lb ≤ 20,160 lb YES
- Is $\boldsymbol{Awr}_{(load)}$ less than $\boldsymbol{Awr}_{(allow)}$,?
  162 ft^2 ≤ 119 ft^2 NO

Conclusion: This load is NOT permissible to lift in wind speed up to 45 mph, but permitted to lift at a reduced wind speed calculated as follows:

$$\text{Ratio } \frac{Awr_{(load)}}{Awr_{(allow)}} = \frac{162}{119} = 1.37$$

From Table 2-7, the maximum permissible wind speed at ratio of 1.37 (rounded to next higher table value of 1.4) is 38.0 mph.

Conclusion: This load is permissible to lift in wind speed up to 38.0 mph only.

Lifting Operations

Before lifting, position the crane on a firm surface, properly extend and set the outriggers, and level the crane. Depending on the nature of the supporting surface, adequate cribbing may be required to obtain a larger bearing surface.

The crane is equipped with a bubble level that should be used to determine whether the crane is level. The load line can also be used to estimate the levelness of the crane by checking to make sure that it is in-line with the center of the boom at all points on the swing circle.

If the boom extension, or auxiliary boom nose is to be used, make sure that the electrical cable and the weight for the Anti-Two-Block Switch are properly installed and the Rated Capacity Limiter (RCL) is programmed for the crane configuration. Refer to the RCL operator manual supplied with the crane.

Verify the crane's capacity by checking the *Load Chart* against the weight of the load. Then, lift the load slightly at first to ensure stability before proceeding with the lift.

Make sure that the load is properly rigged and attached. Always determine the weight of the load before you attempt to lift it and remember that all rigging (slings, etc.) and lifting devices (hook block, boom extension, etc.) must be considered part of the load.

Measure the load radius before making a lift and stay within approved lifting areas based on the range diagrams and working area diagrams on the crane's *Load Chart*.

Always keep the load as near to the crane and as close to the ground as possible.

Do not overload the crane by exceeding the capacities shown on the appropriate *Load Chart*. Death or serious injury could result from the crane tipping over or failing structurally from overload.

The crane can tip over or fail structurally if:

- The load and crane's configuration is not within the capacity as shown on the applicable *Load Chart* and notes.
- The ground is soft and/or the surface conditions are poor.
- Outriggers are not properly extended and set. On models equipped with outriggers that can be pinned at the mid-extend position, the outriggers must also be pinned when operating from the mid-extend position.
- Cribbing under the outrigger pads is inadequate.
- The crane is improperly operated.

Do not rely on the crane's tipping to determine your lifting capacity.

Make sure that the hoist line is vertical before lifting. Do not subject the crane to side loading. A side load can tip the crane or cause it to fail structurally.

Load Chart capacities are based on freely suspended loads. Do not pull posts, pilings, or submerged articles. Make sure that the load is not frozen or otherwise attached to the ground before lifting.

If you should encounter a tipping condition, immediately lower the load with the hoist line and retract or elevate the boom to decrease the load radius. Never lower or extend the boom; this will aggravate the condition.

Use tag lines whenever possible to help control the movement of the load.

When lifting loads, the crane will lean toward the boom and the load will swing out, increasing the load radius. Make sure that the crane's capacity is not exceeded when this occurs.

Do not strike any obstruction with the boom. If the boom should accidentally contact an object, stop immediately. Inspect the boom. Remove the crane from service if the boom is damaged.

Never push or pull with the crane boom.

Avoid sudden starts and stops when moving the load. The inertia and an increased load radius could tip the crane over or cause it to fail structurally.

Using only one hoist at a time when lifting loads is recommended. See “Tilt-Up Panel Lifting” on page 2-21 for additional lifting instructions.

Always use enough parts-of-line to accommodate the load to be lifted. Lifting with too few parts-of-line can result in failure of the hoist rope.

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 qualified 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 qualified person to direct the operation.
- Make sure that all signals are coordinated through the lift director or person in charge of the lift.
- 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.
- Make sure that 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.

Lifting Multiple Loads

Grove recommends lifting only one load at a time.

Lifting two or more separately rigged loads at one time is only permitted during steel erection in accordance with 29CFR1926.753 when the following criteria are met:

1926.753(e)(1) A multiple lift shall only be performed if the following criteria are met:

- (i) A multiple lift rigging assembly is used;
- (ii) A maximum of five members are hoisted per lift;
- (iii) Only beams and similar structural members are lifted; and
- (iv) All employees engaged in the multiple lift have been trained in these procedures in accordance with § 1926.761(c)(1).
- (v) No crane is permitted to be used for a multiple lift where such use is contrary to the manufacturer's specifications and limitations.

1926.753(e)(2) Components of the multiple lift rigging assembly shall be specifically designed and assembled with a maximum capacity for total assembly and for each individual attachment point. This capacity, certified by the manufacturer or a qualified rigger, shall be based on the manufacturer's specifications with a 5 to 1 safety factor for all components.

1926.753(e)(3) The total load shall not exceed:

- (i) The rated capacity of the hoisting equipment specified in the hoisting equipment load charts;
- (ii) The rigging capacity specified in the rigging rating chart.

1926.753(e)(4) The multiple lift rigging assembly shall be rigged with members:

- (i) Attached at their center of gravity and maintained reasonably level;
- (ii) Rigged from top down; and
- (iii) Rigged at least 7 feet (2.1 m) apart.

1926.753(e)(5) The members on the multiple lift rigging assembly shall be set from the bottom up.

1926.753(e)(6) Controlled load lowering shall be used whenever the load is over the connectors.

Tilt-Up Panel Lifting

Requirements and recommendations regarding operation and use of Grove cranes are stated on decals and in the Operator Manual 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 Manual, Load Capacity Chart, and decals affixed to the crane.
- The hoist rope from the main hoist shall be reeved over the main boom nose and reeved with sufficient parts of line to support the total load, including rigging.
- The hoist rope from the auxiliary hoist shall be reeved over the auxiliary boom nose, jib or heavy-duty jib and reeved with not more than the maximum parts of line allowable for the boom attachment and applicable load chart rating.
- The load line nearest the crane shall be the main hoist line, and the load line farthest from the crane shall be the auxiliary hoist line.
- The anti-two-block system shall be installed and inspected to confirm that it is active to monitor both main and auxiliary hoist lines.
- The RCL hoist selection shall be set to the main hoist and the actual parts of line reeved.
- The wire rope and sheaves shall be inspected prior to and following the lifting operations for chaffing and/or scrubbing.
- The total load, including all rigging, shall not exceed 80% of the standard load chart. The operator shall be responsible for controlling this limit, as the RCL does not have a feature to set reduced lifting limits.
- The auxiliary hoist line below the sheaves shall be considered part of the rigging deducts to determine net allowable load.
- The panel shall be lifted so that both the main and auxiliary hoist lines remain in line with the crane boom.
- The operator is responsible for controlling the load and preventing rotation and load line interference to ensure both the main and auxiliary hoist lines remain in line with the crane boom.
- The effect of wind loads on the crane and panel shall be taken into consideration. Operations shall be halted if the wind can cause a loss of control in handling the load.
- Unless each load line is equipped with a load indicator readable during the lift by a designated individual, each load line shall be capable of individually supporting the total load.

Make sure that all personnel working on and around the crane are properly trained and thoroughly familiar with operational functions of the crane and safe operating and work practices. Personnel should be thoroughly familiar with regulations and standards governing cranes and their operation. Work practices may vary slightly between government regulations, industry standards, local and job-site rules and employer policies so a thorough knowledge of and compliance with all relevant work rules is necessary.

Counterweight

On cranes equipped with removable counterweights, make sure that 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 "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 Grove 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.

PILE DRIVING AND EXTRACTING

Pile driving and extracting are applications approved by Grove, provided all equipment is operated within factory guidelines. The following operating requirements must be used during pile driving and extracting with a Grove mobile hydraulic crane:

Pile driving and pile extraction using a mobile crane introduces many variable and unknown factors that must be considered when using a crane for this application. Because

of these factors, discretion must be exercised when pile driving or pile extraction is being considered.

It is not the intention of Grove to recommend specific types or makes of pile driving and pile extraction equipment, but rather to advise of the operational requirements to help avoid the detrimental effects that pile driving and pile extraction can have on the crane.

In addition to the operating requirements that are detailed in the operating manuals and on the load capacity chart, pile driving and extracting operations are approved by Grove, provided all guidelines outlined below are followed:

- All pile driving and extracting operations shall be restricted to fully extended outriggers with all tires clear of the ground.
- The combined weight of the driver or extractor, piling, leads, attachments, etc., shall not exceed 80% of the published load chart values for on-outriggers operation.
- The pile driver or pile extractor and attachments shall be kept clear of the boom nose at all times.
- The pile driver and piling shall be suspended from a hoist cable with sufficient line speed to meet or exceed the rate of descent of the driver and piling to preclude impact loading or vibration from being induced into the boom and crane structure.
- Pile driving or extracting shall be restricted to over the main boom only and shall not be permitted over a boom extension.
- Pile extraction using only the crane's hoist line is unsafe and not permitted since load values cannot be accurately determined. Only pile extraction devices that do not transmit vibration or shock loading into the crane are permitted. All possible precautionary measures shall be taken to prevent shock loads or vibration from being imposed on crane components, either directly through the hoist cable or indirectly from ground borne vibration.
- The load lines shall be kept vertical at all times during pile driving and pile extraction operations.
- The operator and other personnel associated with the pile driving and pile extraction operation shall have read and understood all safety standards applicable to crane operations as well as being thoroughly trained in the safe operation of pile driving and extracting equipment.

Crane Equipment

- Hoists shall be equipped with a cable follower to aid in proper spooling of cable.
- All cable retainer pins and cable guides/retainers shall be in place.
- All boom extensions must be removed from the machine before pile driving or extraction begins.
- All hoist hooks shall be equipped with a positive locking latch.

Crane Inspection

- In addition to the crane's frequent and periodic inspections, dated daily records shall be maintained showing inspections were performed on the crane during the time it was used for pile driving or extraction.
- All anti-two-block warning devices and RCL systems shall be inspected daily and verified to be functional.
- All areas of the crane subject to fatigue shall be inspected monthly, and before the crane is to return to lifting service.
- The boom shall be inspected daily to make sure that all wear pads remain in place. Cranes which utilize pinned boom sections shall be inspected daily to make sure that the pinning mechanism operates properly and to check for undue wear at the pins and pinning plates.
- The hoist cable shall be inspected daily to make sure that no chafing or wear is occurring.

ELECTROCUTION HAZARD

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

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

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

DANGER

Electrocution Hazard!

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

If operation within 3 m (10 ft) of any power lines cannot be avoided, the power utility **must** be notified and the power lines **must** be de-energized and grounded **before** performing any work.

Electrocution **can occur** even without direct contact with the crane.

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.

Before operating this 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.

This crane is **not insulated**. Always consider all parts of the load and the crane, including the hoist rope, wire rope, pendant cables, and tag lines, as conductors. You, the operator, are responsible for alerting all personnel of dangers associated with electrical power lines and equipment. 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, tag lines, or rigging gear.

If the load, hoist 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.

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 *Operator Manual* must be followed at all times, even if the electrical power lines or equipment have been de-energized.

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

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

During crane use, assume that every line is energized (“hot” or “live”) and take the necessary precautions.

Set up the crane in a position such that the load, boom, or any part of the crane and its attachments cannot be moved to within 6 m (20 ft) of electrical power lines or equipment. This includes the crane boom (fully extended to maximum height, radius, and length) and all attachments (boom extensions, rigging, loads, etc.). Overhead lines tend to blow in the wind so allow for lines’ movement when determining safe operating distance.

A suitable barricade should be erected to physically restrain the crane and all attachments (including the load) from entering into an unsafe distance from electrical power lines or equipment.

Plan ahead and always plan a safe route before traveling under power lines. Rider poles should be erected on each side of a crossing to assure sufficient clearance is maintained.

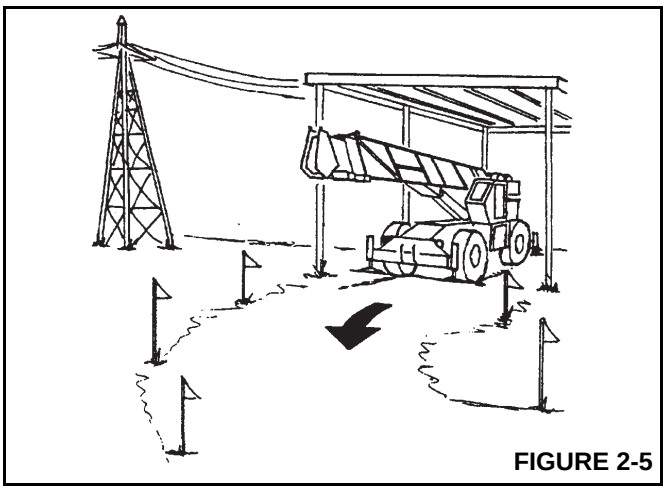


FIGURE 2-5

United States OSHA regulations require a flagman when operating in close proximity to energized power lines.

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 shall have no other duties while the crane is working.

Tag lines should always be made of non-conductive materials. Any tag line that is wet or dirty can conduct electricity.

Do not store materials under power lines or close to electrical power sources.

Electrocution Hazard Devices

The use of insulated links, insulated boom cages/guards, or proximity warning devices does not assure that electrical contact will not occur. Even if codes or regulations require the use of such devices, failure to follow the rules listed here may result in serious injury or death. You should be aware that such devices have limitations and you should follow the rules and precautions outlined in this manual at all times even if the crane is equipped with these devices.

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.

The only protection that may be afforded by an insulated link is below the link (electrically downstream), provided the link has been kept clean, free of contamination, has not been

scratched or damaged, and is periodically tested (just before use) for its dielectric integrity.

Boom cages and boom guards afford limited protection from electrocution hazards. They are designed to cover only the boom nose and a small portion of the boom. Performance of boom cages and boom guards is limited by their physical size, insulating characteristics, and operating environment (e.g. dust, dirt, moisture, etc.). The insulating characteristics of these devices can be compromised if not kept clean, free of contamination, and undamaged.

Proximity sensing and warning devices are available in different types. Some use boom nose (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. Much reliance is placed upon you, the operator, in selecting and properly setting the sensitivity of these devices.

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 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; 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.

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, the condition of the ground, the magnitude of the voltage and current present, and numerous other factors.

Electrical Contact

If the crane should come in contact with an energized power source, you must:

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 may have remained functional.
4. Stay in the crane until the power company has been contacted and the power source has been de-energized. **No one** must 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 operator's station, **jump completely clear of the crane. Do not step off.** Hop away with both feet together. **Do not** walk or run.

Following any contact with an energized electrical source, the Grove distributor must be immediately advised of the incident and consulted on necessary inspections and repairs. Thoroughly inspect the hoist rope and all points of contact on the crane. Should the distributor not be immediately available, contact Grove Product Support. 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 your Grove distributor or Grove Product Support.

Special Operating Conditions and Equipment

Never operate the crane during an electrical thunderstorm.

When operating near transmitter/communication towers where an electrical charge can be induced into the crane or load:

- The transmitter shall be deenergized OR,
- Tests shall be made to determine if an electrical charge will be induced into the crane or load.
- The crane 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 a qualified RF (radio frequency) Consultant. Also refer to local, state, and federal codes and regulations.

When operating cranes equipped with electromagnets, you must take additional precautions. Permit no one to touch the magnet or load. Alert personnel by sounding a warning signal when moving a load. Do not allow the cover of the electromagnet power supply to be open during operation or at any time the electrical system is activated. Shut down the crane completely and open the magnet controls switch prior to connecting or disconnecting magnet leads. Use only a non-conductive device when positioning a load. Lower the magnet to the stowing area and shut off power before leaving the operator's cab (if equipped) or operator's station.

Grounding the Crane

The crane may become charged with static electricity. This may occur especially when using outrigger pads made of plastic or when the outrigger pads are cribbed with insulating material (e.g., wooden planks).

WARNING

Risk of accidents due to electric shock!

Ground the crane before you start to work with it

- Near strong transmitters (radio transmitters, radio stations, etc.)
- Near high-frequency switching stations
- If a thunder storm is forecast

Use electrically conducting material for grounding.

1. Hammer a metal rod (3, Figure 2-6) (length of approximately 2.0 m (6.6 ft)) at least 1.5 m (5 ft) into the ground.
2. Moisten the soil around the metal rod (3) for better conductivity.
3. Clamp an insulated cable (2) to the metal rod (3), cross-section of at least 16 mm² (0.025 in²) (AWG 5).
4. Connect the free end of the cable with a clamp (1) to a good electrically conductive location on the frame.

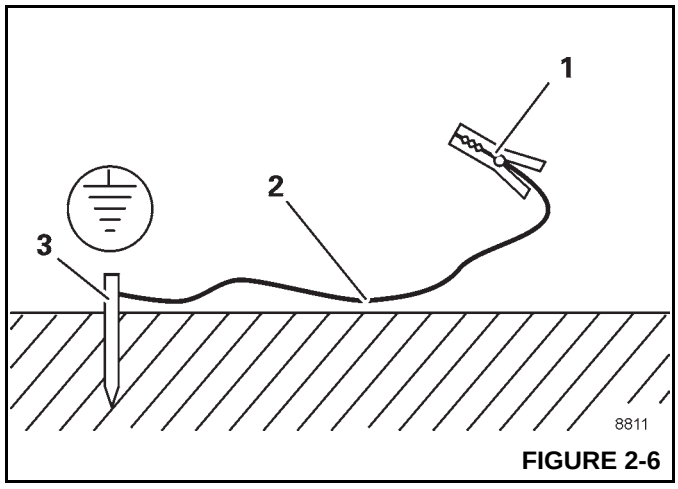


FIGURE 2-6

WARNING

Risk of accidents due to electric shock!

Make sure that the connections between the cable and the clamp are electrically conductive.

Do not attach the clamp to parts that are screwed on, such as valves, covers or similar parts.

PERSONNEL HANDLING

The American Society of Mechanical Engineers published the American National Standard entitled, *Personnel Lifting Systems,* ASME B30.23:

> This Volume establishes the design criteria, equipment characteristics, and operational procedures that are required when hoisting equipment within the scope of the ASME B30 Standard is used to lift personnel. Hoisting equipment defined by the ASME B30 Standard is intended for material handling. It is not designed, manufactured, or intended to meet the standards for personnel handling equipment, such as ANSI/SIA A92 (Aerial Platforms). The equipment and implementation requirements listed in this Volume are not the same as that established for using equipment specifically designed and manufactured for lifting personnel. Hoisting equipment complying with the applicable Volumes of the ASME B30 Standard shall not be used to lift or lower personnel unless there are no less hazardous alternatives to providing access to the, area where work is to be performed. The lifting or lowering of personnel using ASME B30-compliant hoisting equipment is prohibited unless all applicable requirements of this volume have been met.

This standard is consistent with the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) regulations for Construction that state, in 29CFR1926.1431:

> General requirements. 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 worksite, 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 worksite conditions.

Additional requirements for crane operations are stated in ASME B30.5*, Mobile and Locomotive Cranes*, ASME B30.8, *Floating Cranes and Floating Derricks,* and in *OSHA regulations* 29CFR1910.180 *for General Industry* and 29CFR1926.1431 *for Construction*.

Use of a Grove crane to handle personnel is acceptable, provided:

- 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 must remain at the crane controls 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.
- The crane must be equipped with a boom angle indicator that is visible to the crane operator.
- The crane's *Load Chart* is affixed at the operator's station and readily accessible to the operator. The total weight of the loaded personnel platform and related rigging shall not exceed 50 percent of the rated capacity for the radius and configuration of the crane.
- The crane is level within one percent of level grade and located on a firm footing. Cranes with outriggers shall have them all deployed following manufacturer's specifications.
- The crane's *Operator Manual* and other operating manuals are at the operator's station and readily accessible to the operator.
- The platform meets the requirements as prescribed by applicable standards and regulations.
- For hoist rope suspended platforms:
  - The crane is equipped with a hook that can be closed and locked, eliminating the throat opening.
  - The crane is equipped with a functional anti-two-block device.
  - The platform is properly attached and secured to the load hook.
- For boom mounted platforms:
  - 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.
- NEVER allow anyone on the hoist access platform while 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, 07007-2900.

  - or - check online at:

  https://www.asme.org/codes-standards/find-codes-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 Grove 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 make sure that routine maintenance and lubrication are being dutifully performed. **Never** operate a damaged or poorly maintained crane.

Grove continues to recommend that cranes be properly maintained, regularly inspected and repaired as necessary. Grove reminds crane owners to make sure that all safety decals are in place and legible. Grove 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 *Inspection and Lubrication Service Log.* Any questions regarding procedures and specifications should be directed to your Grove 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 specifications, contact your Grove distributor for assistance.

Qualified person is defined as one who by reason of knowledge, 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.

All replacement parts must be Grove approved.

Any modification, alteration, or change to a crane which affects its original design and is not authorized and approved by Grove is **strictly prohibited**. Such action invalidates all warranties and makes the owner/user liable for any resultant accidents.

Hydraulic Fluid

- Do not use your hand or any part of your body to check for hydraulic fluid leaks when the engine is running or the hydraulic system is under pressure. Fluid in the hydraulic system can be under enough pressure that it will penetrate the skin, causing serious injury or death. Use a piece of cardboard, or piece of paper, to search

for leaks. Wear gloves to protect your hands from spraying fluid.

- If any hydraulic fluid is injected into the skin, obtain medical attention immediately or gangrene may result.
- Do not attempt to repair or tighten any hydraulic hose or fitting while the engine is running, or when the hydraulic system is under pressure.
- Never disconnect any hydraulic lines unless the boom is fully lowered, the engine is shut off, and the hydraulic pressure is relieved. To relieve hydraulic pressure, stop the engine, turn the ignition switch to RUN and move the hydraulic controls in both directions several times.

WARNING

Pressurized Fluid Hazard!

Hydraulic pressure may still be present in portions of the hydraulic system due to accumulators or trapped circuitry.

- Hot hydraulic fluid will cause severe burns. Wait for the fluid to cool before disconnecting any hydraulic lines.
- Hydraulic fluid can cause permanent eye injury. Wear appropriate eye protection.

Moving Parts

- Do not place limbs near moving parts. Amputation of a body part may result. Turn off the engine and wait until the fan and belts stop moving before servicing crane.
- Pinch points, which result from relative motion between mechanical parts, are areas of the machine that can cause personal injury or death. Do not place limbs or your body in contact with pinch points either on or around the machine. Care must be taken to prevent motion between pinch points when performing maintenance and to avoid such areas when movement is possible.
- Do not allow persons to stand near extending or lowering outriggers. Foot crushing could occur

Before maintenance or repairs

Before performing any maintenance, service or repairs on the crane:

- The boom should be fully retracted and lowered and the load placed on the ground.
- Do not get under a raised boom unless the boom is blocked up safely. Always block up the boom before doing any servicing that requires the boom to be raised.
- Stop the engine and disconnect the battery.
- Controls should be properly tagged. Never operate the crane if it is **tagged-out** nor attempt to do so until it is restored to proper operating condition and all tags have been removed by the person(s) who installed them.

After maintenance or repairs

- Replace all guards and covers that have been removed.
- Remove all tags, connect the battery, and perform a function check of all operating controls.
- Consult with Grove Product Support to determine if load testing is required after a structural repair is performed.

Lubrication

The crane must be lubricated according to the manufacturer's recommendations for lubrication points, time intervals, and types. Lubricate at more frequent intervals when working under severe conditions.

Exercise care when servicing the hydraulic system of the crane, as pressurized hydraulic oil can cause serious injury. The following precautions must be taken when servicing the hydraulic system:

- Follow the manufacturer's recommendations when adding oil to the system. Mixing the wrong fluids could destroy seals, causing component failure.
- Be certain all lines, components, and fittings are tight before resuming operation.

Tires

WARNING

Possible equipment damage and/or personal injury!

Driving the crane with a tire and split-rim assembly under inflated at 80% or less of its recommended pressure can cause the wheel and/or tire to fail. Per *OSHA Standard 1910.177(f)(2)*, when a tire has been driven under inflated at 80% or less of its recommended pressure, it must first be completely deflated, removed from the axle, disassembled, and inspected before re-inflation.

Inspect the tires for nicks, cuts, embedded material, and abnormal wear.

Make sure that all lug nuts are properly torqued.

Make sure that pneumatic tires are inflated to the proper pressure (refer to the *Load Chart*). When inflating tires, use a tire gauge, clip-on inflator, and extension hose which will permit standing clear of the tire while inflating.

HOIST ROPE

Synthetic Hoist Rope

For detailed information concerning synthetic hoist rope, refer to K100™ Synthetic Crane Hoist Line Manual P/N 9828100734 available by contacting Grove Crane Care.

During installation and setup, care must be taken to avoid overlap and crossing of wire rope and synthetic hoist ropes.

Always make daily inspections of the hoist rope, keeping in mind that all hoist rope will eventually deteriorate to a point where it is no longer usable. Refuse to work with worn or damaged hoist rope.

During regular inspections, operator shall make sure that crane surfaces such as wear pads, sheaves, etc have not been damaged in a manner that can then damage the synthetic hoist rope.

NOTE: Example; if usage of a wire rope has cut grooves with sharp edges in a wear pad, they need to be addressed before the synthetic hoist rope is used in that same position.

Use **only** the hoist rope specified by Grove as indicated on the crane's *Load Chart*. Substitution of an alternate hoist rope may require the use of a different permissible line pull and, therefore, require different reeving.

NOTE: Hoist rope may be purchased by contacting Grove Product Support.

Wire Rope

Always make daily inspections of the rope, keeping in mind that all wire rope will eventually deteriorate to a point where it is no longer usable. Refuse to work with worn or damaged wire rope. Rope shall be taken out of service when any of the following conditions exist:

- For rotation-resistant running ropes: more than two (2) broken wires in a length of rope equal to six (6) times the rope diameter, or more than four (4) broken wires in a length of rope equal to thirty (30) times the rope diameter.
- For running ropes other than rotation resistant: six (6) broken wires in one rope lay or three (3) broken wires in one strand.
- One valley break where the wire fractures between strands in a running rope is cause for removal.
- Abrasion of the rope resulting in a 5% reduction in the original wire diameter.
- Any kinking, bird caging, crushing, corrosion, or other damage resulting in distortion of the rope structure.
- Rope that has been in contact with a live power line or has been used as a ground in an electric circuit (e.g., welding) may have wires that are fused or annealed and must be removed from service.
- In standing ropes, more than three (3) breaks in one rope lay in sections beyond the end connection or more than two (2) broken wires at an end connection.
- Core deterioration, usually observed as a rapid reduction in rope diameter, is cause for immediate removal of the rope.

The following is a brief outline of the basic information required to safely use wire rope.

- Wire ropes wear out. The strength of a rope begins to decrease when the rope is put to use and continues to decrease with each use. Rope will fail if worn-out, overloaded, misused, damaged or improperly maintained.
- The nominal strength, sometimes called catalog strength, of a wire rope applies only to a new, unused rope.
- The nominal strength of a rope should be considered the straight line pull which will actually break a new unused rope. The nominal strength of a rope should never be used as its working load.
- Each type of fitting attached to a rope has a specific efficiency rating which can reduce the working load of the rope assembly or rope system.
- If an operator hoists the hook block up or down too fast when reeved with multiple parts of line and no hook load, the wire rope can bird cage and damage the rope.
- Never overload a rope. This means never use the rope where the load applied to it is greater than the working load determined by the rope manufacturer.
- Never "shock load" a rope. A sudden application of force or load can cause both visible external and internal damage. There is no practical way to estimate the force applied by shock loading a rope. The sudden release of a load can also damage a rope.
- Lubricant is applied to the wires and strands of a wire rope when it is manufactured. The lubricant is depleted when the rope is in service and should be replaced periodically. Refer to the *Service Manual* for more information.
- In the U.S.A., regular inspections of the rope and keeping of permanent records signed by a qualified person are required by OSHA for almost every wire rope application. The purpose of the inspection is to determine whether or not a rope may continue to be safely used on the application. Inspection criteria, including number and location of broken wires, wear and elongation, have been established by OSHA, ANSI,

ASME and similar organizations. See the *Service Manual* for inspection procedures.

When inspecting ropes and attachments, keep all parts of your body and clothing away from rotating hoist drums and all rotating sheaves. Never handle the rope with bare hands.

Some conditions that lead to problems in wire rope systems include:

- Sheaves that are too small, worn or corrugated cause damage to a wire rope.
- Broken wires mean a loss in strength.
- Kinks permanently damage a rope and must be avoided.
- Ropes are damaged by knots. Rope with knots must never be used.
- Environmental factors such as corrosive conditions and heat can damage a wire rope.
- Lack of lubrication can significantly shorten the useful life of a wire rope.
- Contact with electrical wires and resulting arcing will damage a wire rope.

• An inspection should include verification that none of the specified removal criteria for this usage are met by checking for such things as:

- Surface wear; nominal and unusual.
- Broken wires; number and location.
- Reduction in diameter.
- Rope stretch (elongation).
- Integrity of end attachments.
- Evidence of abuse or contact with another object.
- Heat damage.
- Corrosion.

NOTE: A more detailed rope inspection procedure is given in the *Service Manual*.

• ***When a rope has been removed from service because it is no longer suitable for use, it must not be reused on another application.***

Installing a new rope

• Keep all parts of your body and clothing away from rotating hoist drums and all rotating sheaves.

• Never handle the wire rope with bare hands.

• Follow proper instructions for removing rope from a reel.

• Apply back tension to the storage/payoff reel of the new rope to ensure tight, even, spooling onto the hoist drum.

• Operate the new rope—first through several cycles at light load—then through several cycles at intermediate load, to allow the rope to adjust to operating conditions.

When using a wedge socket

- Always inspect socket, wedge, and pin for correct size and condition.
- Do not use parts that are damaged, cracked, or modified.
- Assemble the wedge socket with live end of rope aligned with the centerline of pin. and assure proper length of tail (dead end) protrudes beyond the socket.

Sheaves

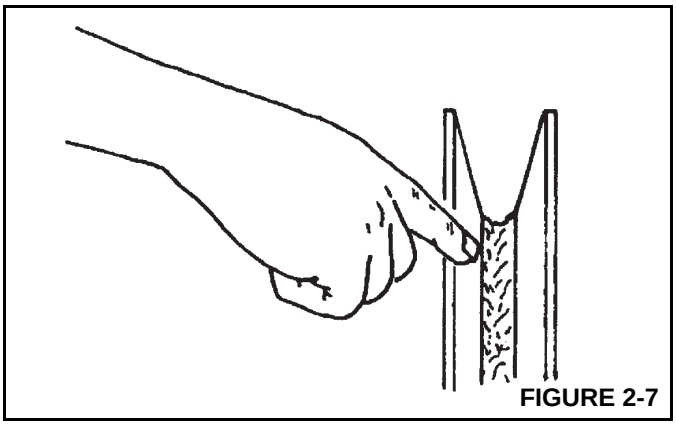


FIGURE 2-7

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.

Make sure that 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. Make sure that 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.** Make sure 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 MAXWELL (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. Make sure 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.

SUPER CAPACITOR KPI (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.

The Super capacitor is service/maintenance free. It should always be handled in the same manner as a battery.

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 required, keep hands clear of the engine fan and other moving parts while performing maintenance.

Be careful of hot surfaces and hot fluids when performing maintenance on or around the engine.

Do not use ether to start the engine on cranes equipped with intake manifold grid heaters.

The engine can enter into an engine exhaust cleaning mode where the exhaust temperature can be high, make sure that the exhaust is not pointed at materials that can melt, burn, or explode.

TRANSPORTING THE CRANE

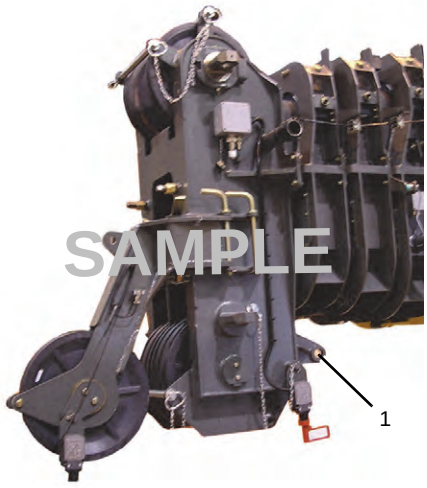
Before transporting the crane, check the suitability of the proposed route with regard to the crane height, width, length, and weight.

Check load limits of bridges on the travel route, and make sure that they are greater than the combined weight of the crane and transporting vehicle.

When loading or unloading the crane on a trailer or railroad car, use a ramp capable of supporting the weight of the crane.

Make sure that the crane is adequately secured to the transporting vehicle and resting on the tires only. Do not extend outrigger jacks onto transport vehicle. Consult with Grove Product Support if you are going to transport with the tires removed.

Do not use the dead end lug (1, (Figure 2-8)) on the boom nose for tying down the boom during transport. Damage to the lug and boom can result from usage as a tie down point.



7116-1A **FIGURE 2-8**

Before transporting the crane on a road or highway, first check state and local restrictions and regulations.

Either the hook block may be reeved over the main boom nose or the overhaul ball may be reeved over the main boom nose or auxiliary boom nose; the other must be removed. If the hook block or overhaul ball remains reeved on the boom, it must be secured at the tie down on the carrier to prevent swinging.

When using hookblock tie downs, excessive loading can be applied by pulling the cable too tight, particularly when reeved with multiple part lines. When the cable is hooked into the hookblock tie down, the cable should be merely “snugged-up” with adequate slack provided at the center line of sheave to anchor point. Do not draw cable taut. Care must be exercised anytime any crane function is being performed while the cable is hooked into the hookblock tie down.

TRAVEL OPERATION

Only the crane operator shall occupy the crane when traveling.

When traveling, the boom should be completely retracted and lowered to the travel position and the turntable pin swing lock, if equipped, should be engaged. If equipped with boom rest, lower the boom into the boom rest and engage the turntable lock.

Strictly adhere to the guidelines and restrictions in the *Load Chart* for pick and carry operations.

GRT cranes are manufactured without an axle suspension system. Traveling at high speeds, especially on rough ground, may create a bouncing effect that can result in loss of control. If bouncing occurs, reduce travel speed.

WARNING

Crushing Hazard!

Death or serious injury could result from being crushed by revolving tires.

Keep clear of revolving tires.

Stunt driving and horse-play are strictly prohibited. Never allow anyone to hitch a ride or get on or off a moving crane.

Follow the instructions in this manual when preparing the crane for travel.

If using a boom dolly/trailer, thoroughly read and understand all the steps and safety precautions in this manual for setup and travel.

When driving the crane make sure that the cab is down, if equipped with a tilting cab.

Secure the hook block and other items before moving the crane.

Watch clearances when traveling. Do not take a chance of running into overhead or side obstructions.

When moving in tight quarters, post a signal person to help guard against collisions or bumping structures.

Before traveling a crane, check suitability of proposed route with regard to crane height, width, and length.

Never back up without the aid of a signal person to verify the area behind the crane is clear of obstructions and/or personnel.

On cranes equipped with mirrors or camera systems, make sure these components are in working order and are properly adjusted.

On cranes equipped with air-operated brakes or hydraulically operated brakes, do not attempt to move the crane until brake system air pressure or hydraulic pressure is at operating level.

Check load limit of bridges. Before traveling across bridges, make sure that they will carry a load greater than the crane's weight.

If it is necessary to take an RT crane on a road or highway, check state and local restrictions and regulations.

Keep lights on, use traffic warning flags and signs, and use front and rear flag vehicles when necessary. Check state and local restrictions and regulations.

Always drive the product supportfully, obeying speed limits and highway regulations.

Stay alert at the wheel.

If equipped, make sure that the hoist access platform hand rail and step are in the travel configuration.

Slopes

- Pick and carry on level surfaces only.
- Refer to the *Operation Section* for more detailed information on traveling on slopes.
- Driving across a slope is dangerous, as unexpected changes in slope can cause tip over. Ascend or descend slopes slowly and with caution.
- When operating on a downhill slope, reduce travel speed and downshift to a low gear, to permit compression braking by the engine, and aid the application of the service brakes.

WORK PRACTICES

Personal Considerations

Always adjust the seat and lock it in position, and fasten the seat belt securely before you start the engine.

Do not wear loose clothing or jewelry that can get caught on controls or moving parts. Wear the protective clothing and personal safety gear issued or called for by the job conditions. Hard hat, safety shoes, ear protectors, reflective clothing, safety goggles, and heavy gloves may be required.

Crane Access

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.

You must take every precaution to make sure that you do not slip and/or fall off the crane. Falling from any elevation could result in serious injury or death.

Never exit or enter the crane cab or deck by any other means than the access system(s) provided (i.e., steps and grab handles). Use the recommended handholds and steps to maintain a three-point contact when getting on or off the crane.

If necessary, use a ladder or aerial work platform to access the boom nose.

Do not make modifications or additions to the crane's access system that have not been evaluated and approved by Grove Crane.

Do not step on surfaces on the crane that are not approved or suitable for walking and working. All walking and working surfaces on the crane should be clean, dry, slip-resistant, and have adequate supporting capacity.

Do not walk on a surface if slip-resistant material is missing or excessively worn.

Do not use the top of the boom as a walkway.

Do not step on the outrigger beams or outrigger pads (floats) to enter or exit the crane.

Use the hoist access platform (if equipped) when working in the hoist area.

Wear shoes with a highly slip-resistant sole material. Clean any mud or debris from shoes before entering the crane cab/operator's station or climbing onto the crane superstructure. Excessive dirt and debris on the handholds, access steps, or walking/working surfaces could cause a slipping accident. A shoe that is not clean might slip off a control pedal during operation.

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.

Job Preparation

Before crane use

- Barricade the entire area where the crane is working and keep all unnecessary personnel out of the work area.
- Make sure that the crane is properly equipped, including access steps, covers, doors, guards, and controls.
- Conduct a visual inspection for cracked welds, damaged components, loose pins/bolts, and wire connections. Any item or component that is found to be loose or damaged (broken, chipped, cracked, worn-through, etc.) must be repaired or replaced. Inspect for evidence of improper maintenance (consult your *Service Manual*).
- Check for proper functioning of all controls and operator aids (for example, RCL).
- Check all braking (for example, wheel, hoist, and swing brakes) and holding devices before operation.

You must make sure that the outriggers and jack cylinders are properly extended and set before performing any lifting operations. On models equipped with outriggers that can be pinned at the mid-extend position, the outriggers must also be pinned when operating from the mid-extend position.

Clear all personnel from the outrigger area before extending or retracting the outriggers. Carefully follow the procedures in this *Operator Manual* when extending or retracting the outriggers. Death or serious injury could result from improper crane set up on outriggers.

Be familiar with surface conditions and the presence of overhead obstructions and power lines.

Working

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 shall resume only after safety concerns have been addressed or the continuation of crane operations is directed by the lift supervisor.

Know the location and function of all crane controls.

Make sure that all persons are away from the crane and the Travel Select Lever is in the "N" (Neutral) position with the Parking Brake engaged before starting the engine.

Sparks from the crane's electrical system and/or engine exhaust can cause an explosion. **Do not** operate this crane in an area with flammable dust or vapors, unless good ventilation has removed the hazard.

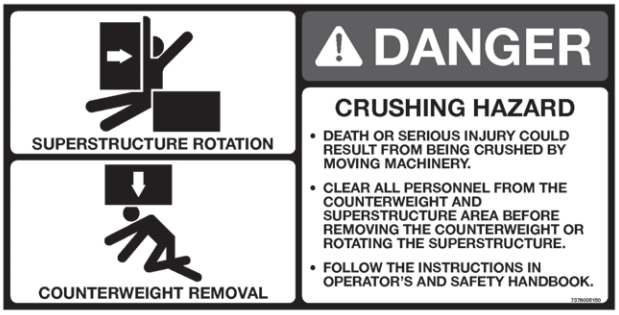
Carbon monoxide fumes from the engine exhaust can cause suffocation in an enclosed area. Good ventilation is very important when operating the crane.

Before actuating swing or any other crane function, sound the horn and verify that all personnel are clear of rotating and moving parts.

Never operate the crane when darkness, fog, or other visibility restrictions make operation unsafe. Never operate a crane in thunderstorms or high winds.

Always be aware of your working environment during operation of the crane. Avoid contacting any part of the crane with external objects.

Clear all personnel from the counterweight and superstructure area before removing the counterweight.



Keep unauthorized personnel clear of the working area during operation.

Only the crane operator shall occupy the crane when in operation.

You must always be aware of everything around the crane while lifting or traveling. If you are unable to clearly see in the direction of motion, you must post a look out or signal person before moving the crane or making a lift. Sound the horn to warn personnel

Operate the crane only from the operator's seat. Do not reach in a window or door to operate any controls.

Operate the crane slowly and cautiously, looking carefully in the direction of movement.

A good practice is to make a "dry run" without a load before making the first lift. Become familiar with all factors peculiar to the job site.

Make sure that the hoist rope is properly routed on the hook block and boom nose (Figure 2-9), and that all rope guards are in place.

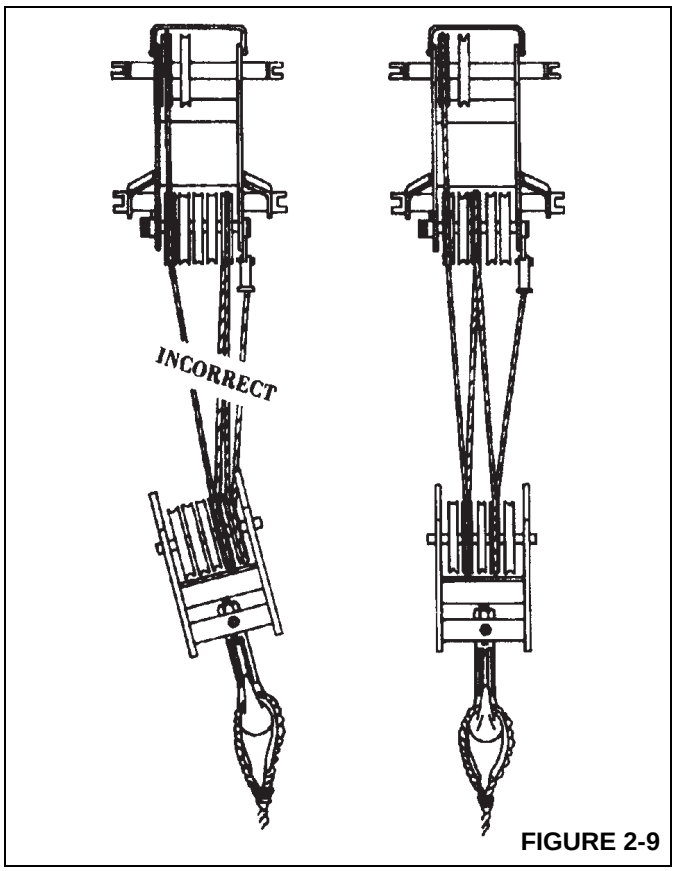


FIGURE 2-9

Lifting

Grove Crane recommends lifting only one load at a time. See "Lifting Operations" on page 2-20.

Use enough parts of line for all lifts and check all lines, slings, and chains for correct attachment. To obtain maximum lifting capacities, the hook block must be set up with enough parts of line. Too few parts of line can result in failure of the hoist rope or hoist. **No less than three wraps of rope** should remain on the hoist drum. When slings, ties, hooks, etc., are used, make sure that they are correctly positioned and secured before raising or lowering the loads.

Make sure that the rigging is adequate before lifting. Use tag lines when possible to position and restrain loads. Personnel using tag lines should be on the ground.

Make sure good rigging practices are being used. Refuse to use any poorly maintained or damaged equipment. Never wrap the hoist cable around a load.

If using a clam bucket, do not exceed 80 percent of the crane's capacity (70 percent for all cranes equipped with pinned booms).

Make certain the boom tip is centered directly over the load before lifting.

Make sure the load is well secured and attached to the hook with rigging of proper size and in good condition.

Check the hoist brake by raising the load a few inches, stopping the hoist and holding the load. Make sure that the hoist brake is working correctly before continuing the lift.

When lowering a load always slow down the load's descent before stopping the hoist. Do not attempt to change speeds on multiple-speed hoists while the hoist is in motion.

Watch the path of the boom and load when swinging. Avoid lowering or swinging the boom and load into ground personnel, equipment, or other objects. Never leave the crane with a load suspended. Should it become necessary to leave the crane, lower the load to the ground and stop the engine before leaving the operator's station.

Remember, all rigging equipment must be considered as part of the load. Lifting capacities vary with working areas. If applicable, permissible working areas are listed in the *Load Chart*. When swinging from one working area to another, make sure that *Load Chart* capacities are not exceeded. Know your crane!

Stop the hook block from swinging when unhooking a load.

Swinging rapidly can cause the load to swing out and increase the load radius. Swing the load slowly. Swing with caution and keep the load lines vertical.

Look before swinging your crane. Even though the original setup may have been checked, situations do change.

Never swing or lower the boom into the carrier cab (if applicable).

Never push or pull loads with the crane's boom. Never drag a load.

Do not subject crane to side loading. A side load can tip the crane or cause it to fail structurally.

If the boom should contact an object, stop immediately and inspect the boom. Remove the crane from service if the boom is damaged.

When lifting a load the boom may deflect causing the load radius to increase—this condition is made worse when the boom is extended. Make sure that the weight of load is within the crane's capacity on *Load Chart*.

Avoid sudden starts and stops when moving the load. The inertia and an increased load radius could tip the crane over or cause it to fail structurally.

Use tag lines (as appropriate) for positioning and restraining loads. Check the load slings before lifting.

Make sure that everyone is clear of the crane and work area before making any lifts.

Never swing over personnel, regardless of whether load is suspended from or attached to the boom.

Hand Signals

A single qualified signal person shall be used at all times when:

- Working in the vicinity of power lines.
- The crane operator cannot clearly see the load at all times.
- Moving the crane in an area or direction in which the operator cannot clearly see the path of travel.

At all times use standardized hand signals ((Figure 2-10)) that have been previously agreed upon and completely understood by the operator and signal person.

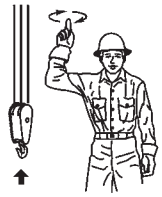
If communication with the signal person is lost, crane movement must be stopped until communications are restored.

Keep your attention focused on the crane's operation. If for some reason you must look in another direction, stop all crane movement first.

Obey a signal to stop from anyone.

STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS

Complies with ASME B30.5-2014

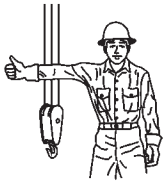


HOIST. With forearm vertical, forefinger pointing up, move hand in small horizontal circle.

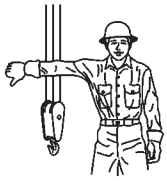
LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circle.

USE MAIN HOIST. Tap fist on head; then use regular signals.

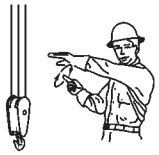
USE WHIPLINE (Auxiliary Hoist). Tap elbow with one hand; then use regular signals.



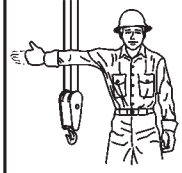
RAISE BOOM. Arm extended, fingers closed, thumb pointing upward.



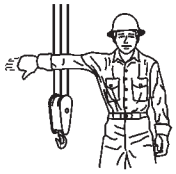
LOWER BOOM. Arm extended, fingers closed, thumb pointing downward.



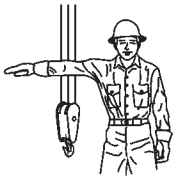
MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal (hoist slowly shown as an example).



RAISE BOOM AND LOWER LOAD. With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.

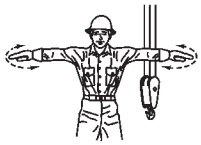


LOWER BOOM AND RAISE LOAD. With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.

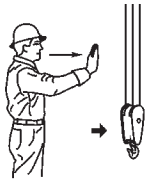


SWING. Arm extended, point with finger in direction of swing of boom.

STOP. Arm extended, palm down, move arm back and forth horizontally.

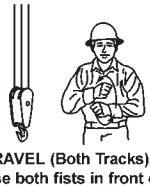


EMERGENCY STOP. Both arms extended, palms down, move arms back and forth horizontally.



TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.

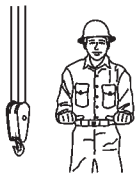
DOG EVERYTHING. Clasp hands in front of body.



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.)

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.)

EXTEND BOOM (Telescoping Booms). Both fists in front of body with thumbs pointing outward.



RETRACT BOOM (Telescoping Boom). Both fists in front of body with thumbs pointing toward each other.

EXTEND BOOM (Telescoping Boom). One Hand Signal. One fist in front of chest with thumb tapping chest.

RETRACT BOOM (Telescoping Boom). One Hand Signal. One fist in front of chest, thumb pointing outward and heel of fist tapping chest.

G7 Reprinted from ASME B30.5-2014, by permission of The American Society of Mechanical Engineers. All Rights Reserved. 80086727

8496-3

FIGURE 2-10

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 the 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 the pins from the front stowage bracket 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

DANGER

Tipping Hazard!

When parking the crane and leaving it unattended follow the instructions in Section 4 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.

Section 4 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, Grove 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 with the jib deployed, 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 extension 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 or 360 degree swing lock (if equipped).
- Disable all crane functions using the crane function Enable/Disable switch (if equipped).
- Place controls in neutral position.
- Shut down the engine and remove the ignition key.
- Wait a minimum of 2 minutes and then turn the battery disconnect switch to the OFF position.
- 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 at least 30 minutes of engine run time for hydraulic oil to warm up.

Plastic components (battery casings, heater controls, dash controls, etc.) are extremely brittle in extreme cold. Use caution handling and operating these components in sub-zero temperatures, avoiding shock loading.

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.

If applicable to your crane, frequently check all air tanks for water in freezing weather.

If applicable to your crane, always handle propane tanks according to the supplier's instructions.

Never store flammable materials on the crane.

If cold weather starting aids are provided on your crane, use them. The use of aerosol spray or other types of starting fluids containing ether/volatiles can cause explosions or fire.

TEMPERATURE EFFECTS ON HOOK BLOCKS

The Hook Block Working Load Limit (WLL) is valid between 60°C (140°F) and the low temperature limit given on the hook block identification plate with normal lifting precautions.

Lifting above 75% of the Working Load Limit, at temperatures between the service temperature given on the identification plate and -40°C (-40°F), must be done at a slow and steady rate to avoid stress spikes.

75% of the Working Load Limit must not be exceeded when lifting in temperatures below -40°C (-40°F).

TEMPERATURE EFFECTS ON HYDRAULIC CYLINDERS

Hydraulic oil expands when heated and contracts when cooled. This is a natural phenomena that happens to all liquids. The coefficient of expansion for API Group 1 hydraulic oil is approximately 0.00077 cm^3 per cm^3 of volume for 1°C of temperature change (0.00043 in^3 per in^3 of volume for 1°F of temperature change). **Thermal contraction will allow a cylinder to retract as the hydraulic fluid which is trapped in the cylinder cools.**

The change in the length of a cylinder is proportional to the extended length of the cylinder and to the change in temperature of the oil in the cylinder. For example, a cylinder extended 7.6 m (25 ft) in which the oil cools 15.5°C (60°F) would retract approximately 196 mm (7 3/4 in) [see Table 2-9 and Table 2-8]. The rate at which the oil cools depends on many factors and will be more noticeable with a larger difference in oil temperature verses the ambient temperature.

Thermal contraction coupled with improper lubrication or improper wear pad adjustments may, under certain conditions, cause a “stick-slip” condition in the boom. This “stick-slip” condition could result in the load not moving smoothly. Proper boom lubrication and wear pad adjustment is important to permit the boom sections to slide freely. Slow movement of the boom may be undetected by the operator unless a load is suspended for a long period of time. To minimize the effects of thermal contraction or “Stick-slip” it is recommended that the telescope control lever is activated periodically in the extend position to mitigate the effects of cooling oil.

If a load and the boom is allowed to remain stationary for a period of time and the ambient temperature is cooler than the trapped oil temperature, the trapped oil in the cylinders will cool. The load will lower as the telescope cylinder(s) retracts allowing the boom to come in. Also, the boom angle will decrease as the lift cylinder(s) retracts causing an increase in radius and a decrease in load height.

This situation will also occur in reverse. If a crane is set up in the morning with cool oil and the daytime ambient temperature heats the oil, the cylinders will extend in similar proportions.

(Table 2-8) and (Table 2-9) have been prepared to assist you in determining the approximate amount of retraction/extension that may be expected from a hydraulic cylinder as a result of change in the temperature of the hydraulic oil inside the cylinder. The chart is for dry rod cylinders. If the cylinder rod is filled with hydraulic oil, the contraction rate is somewhat greater.

Table 2-8: Boom Drift Chart (Cylinder length change in inches)

Coeff. =	0.00043	(in^3/in^3/ °F)								
STROKE	Temperature Change (°F)									
(FT.)	10	20	30	40	50	60	70	80	90	100
5	0.26	0.52	0.77	1.03	1.29	1.55	1.81	2.06	2.32	2.58
10	0.52	1.03	1.55	2.06	2.58	3.10	3.61	4.13	4.64	5.16
15	0.77	1.55	2.32	3.10	3.87	4.64	5.42	6.19	6.97	7.74
20	1.03	2.06	3.10	4.13	5.16	6.19	7.22	8.26	9.29	10.32
25	1.29	2.58	3.87	5.16	6.45	7.74	9.03	10.32	11.61	12.90
30	1.55	3.10	4.64	6.19	7.74	9.29	10.84	12.38	13.93	15.48
35	1.81	3.61	5.42	7.22	9.03	10.84	12.64	14.45	16.25	18.06
40	2.06	4.13	6.19	8.26	10.32	12.38	14.45	16.51	18.58	20.64
45	2.32	4.64	6.97	9.29	11.61	13.93	16.25	18.58	20.90	23.22
50	2.58	5.16	7.74	10.32	12.90	15.48	18.06	20.64	23.22	25.80
55	2.84	5.68	8.51	11.35	14.19	17.03	19.87	22.70	25.54	28.38
60	3.10	6.19	9.29	12.38	15.48	18.58	21.67	24.77	27.86	30.96
Length change in inches = Stroke (Ft.) X Temperature Change (°F) X Coeff. (in^3/in^3/ °F) X 12 in/ft										

Table 2-9Boom Drift Chart (Cylinder length change in millimeters)

Coeff. =	0.000774	(1/ °C)	***Metric***								
STROKE	Temperature Change (°C)										
(m)	5	10	15	20	25	30	35	40	45	50	55
1.5	6	12	17	23	29	35	41	46	52	58	64
3	12	23	35	46	58	70	81	93	104	116	128
4.5	17	35	52	70	87	104	122	139	157	174	192
6	23	46	70	93	116	139	163	186	209	232	255
7.5	29	58	87	116	145	174	203	232	261	290	319
9	35	70	104	139	174	209	244	279	313	348	383
10.5	41	81	122	163	203	244	284	325	366	406	447
12	46	93	139	186	232	279	325	372	418	464	511
13.5	52	104	157	209	261	313	366	418	470	522	575
15	58	116	174	232	290	348	406	464	522	581	639
16.5	64	128	192	255	319	383	447	511	575	639	702
18	70	139	209	279	348	418	488	557	627	697	766
Length change in mm = Stroke (m) X Temperature Change (°C) X Coeff. (1/ °C) X 1000 mm/m											

CRANE STABILITY

The GRT765/780 on rubber 360° load charts show the minimum radius allowed with a load. Without a load, a radius of 1.0 m (3.3 ft) less than the minimum radius shown on the load chart is safe. A radius of less than this must be avoided on rubber 360° because of backward stability considerations.

DANGER

Backward Stability Hazard!

The GRT765/780 on rubber 360° load charts show the minimum radius allowed with a load. Without a load, a radius of 1.0 m (3.3 ft) less than the minimum radius shown on the load chart is safe. A boom radius of less than this could result in the crane tipping over backwards causing property damage, serious injury, or death.

Always ensure the Rated Capacity Limiter is programmed for the appropriate capacity chart based upon crane configuration.

The GRT780 (only) on outriggers fully retracted 360° load charts show the minimum radius allowed with a load. Without a load, a radius of 1.0 m (3.3 ft) less than the minimum radius shown on the load chart is safe. A radius of less than this must be avoided on outriggers fully retracted 360° because of backward stability considerations.

DANGER

Backward Stability Hazard!

The GRT780 on outriggers fully retracted 360° load charts show the minimum radius allowed with a load. Without a load, a radius of 1.0 m (3.3 ft) less than the minimum radius shown on the load chart is safe. A radius of less than this could result in the crane tipping over backwards causing property damage, serious injury, or death.

Always ensure the Rated Capacity Limiter is programmed for the appropriate capacity chart based upon crane configuration.

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.

OVERLOAD INSPECTION

When the Rated Capacity Limiter (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 Grove Product Support 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 Grove Product Support 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.

Boom Inspection

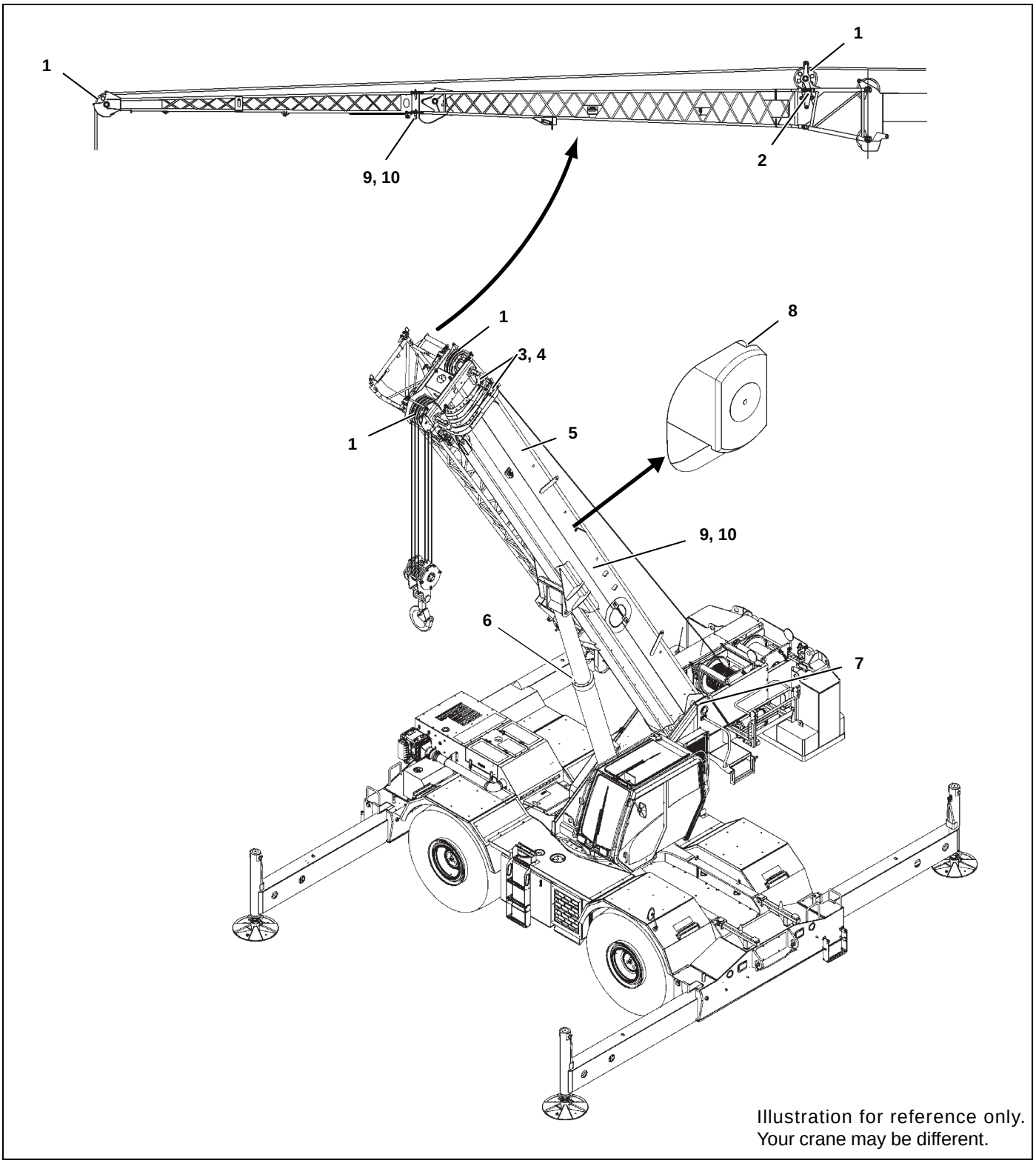


Illustration for reference only.
Your crane may be different.

NOTE: The following checklist includes all features that can be found on Grove cranes. Your crane may not have some features.

Overload less than 25%			
1	Sheaves	Inspect all for damage.	
2	Boom Extension Offset Mechanism/ Cylinder	Inspect for damage/leaks.	
3	Collar-wear pads	Inspect all for damage.	
Overload from 25% to 49%			
1	Sheaves	Inspect all for damage.	
2	Luffing Mechanism/ Cylinder	Inspect for damage/leaks.	
3	Collar-wear pads	Inspect all for damage.	
4	Collar-welds	Inspect all for cracks.	
5	Telescopic Sections	Inspect for bent or twisted sections. Check the boom for straightness.	
6	Lift Cylinder Head Area	Inspect for bends or cracked welds.	
7	Turntable	Inspect for cracked welds.	
8	Locking Area (Pin Booms)	Inspect for elongated holes.	
9	Welds	Inspect for cracks.	
10	Paint	Inspect for cracked paint which could indicate twisted, stretched, or compressed members.	

Superstructure Inspection

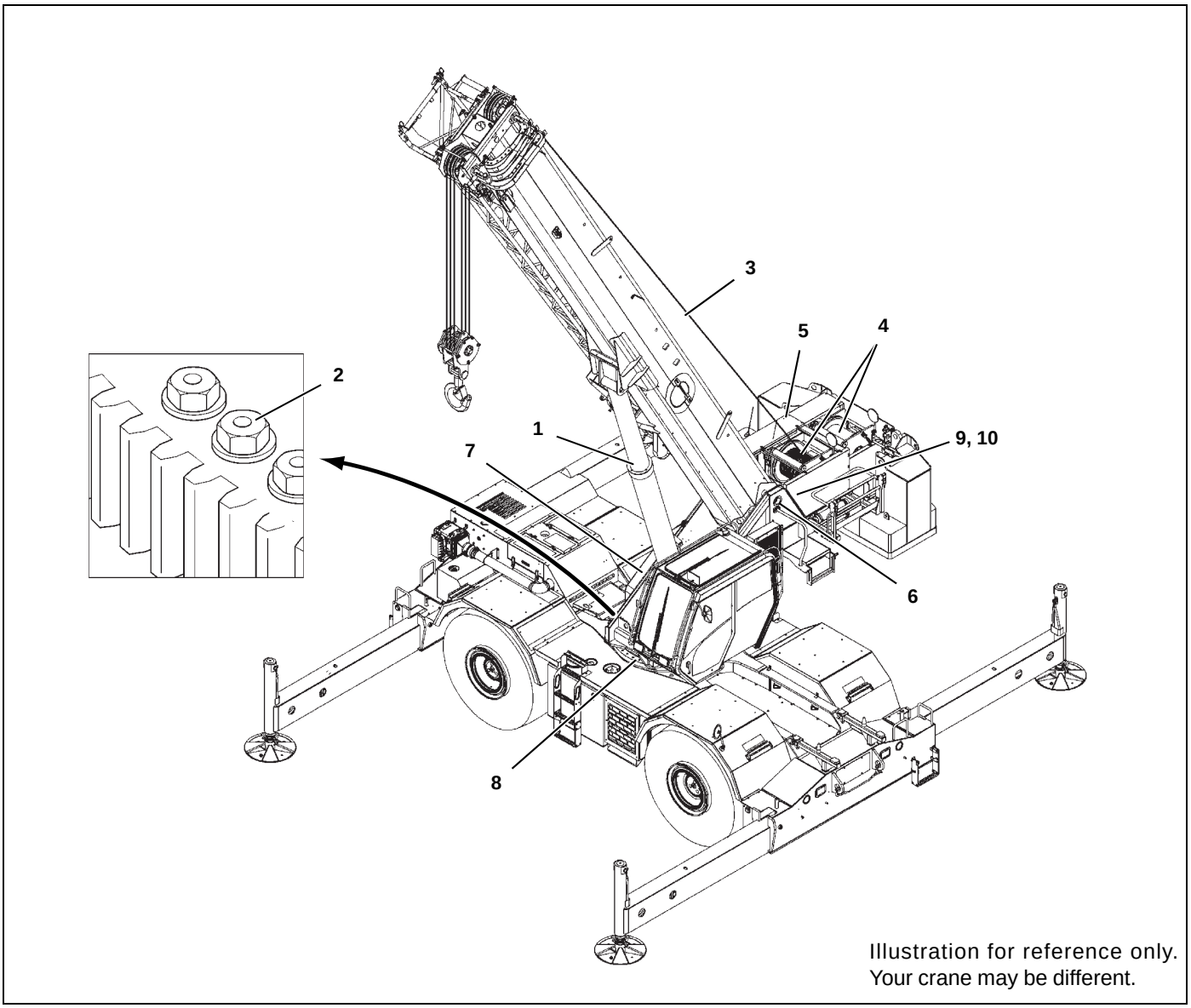


Illustration for reference only.
Your crane may be different.

NOTE: The following checklist includes all features that can be found on Grove cranes. Your crane may not have some features.

Overload less than 25%			
1	Lift Cylinder	Inspect for leaking.	
2	Turntable Bearing	Check bolts for proper torque.	See topic in Swing section of Service Manual.
3	Wire Rope	Inspect all for damage.	See topic in Introduction section of Service Manual.
Overload from 25% to 49%			
1	Lift Cylinder	Inspect for leaking.	
2	Turntable Bearing	Check bolts for proper torque.	See topic in Swing section of Service Manual.
3	Wire Rope	Inspect all for damage.	See topic in Introduction section of Service Manual.
4	Hoist/Drums	Inspect each for damage.	
5	Hoist Brakes	Brakes must hold rated line pull.	
6	Bearing Main Boom Pivot Pin	Inspect for deformation, cracked welds.	
7	Lift Cylinder-lower mount	Inspect pin and welds.	
8	Turntable	Inspect for deformation, cracked welds.	
9	Welds	Inspect for cracks.	
10	Paint	Inspect for cracked paint which could indicate twisted, stretched, or compressed members.	

Carrier Inspection

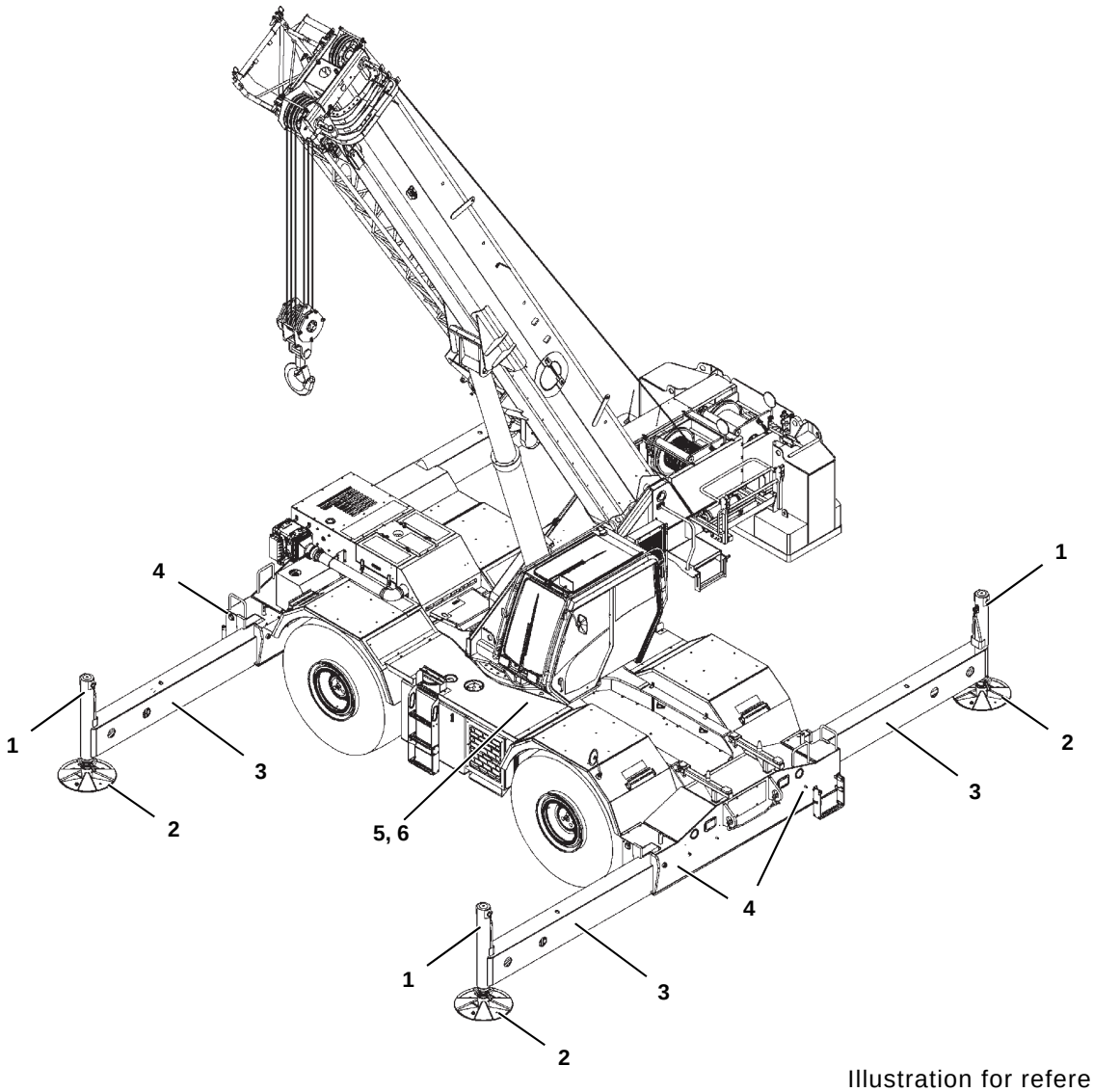


Illustration for reference only.
Your crane may be different.

NOTE: The following checklist includes all features that can be found on Grove cranes. Your crane may not have some features.

Overload less than 25%			
1	Jack Cylinders	Inspect for leaking.	
2	Outrigger Pads	Inspect for deformation and/or cracked welds.	
Overload from 25% to 49%			
1	Jack Cylinders	Inspect for leaking.	
2	Outrigger Pads	Inspect for deformation and/or cracked welds.	
3	Outrigger Beams	Inspect for deformation and/or cracked welds.	
4	Outrigger Boxes	Inspect for deformation and/or cracked welds.	
5	Welds	Inspect for cracks.	
6	Paint	Inspect for cracked paint which could indicate twisted, stretched, or compressed members.	

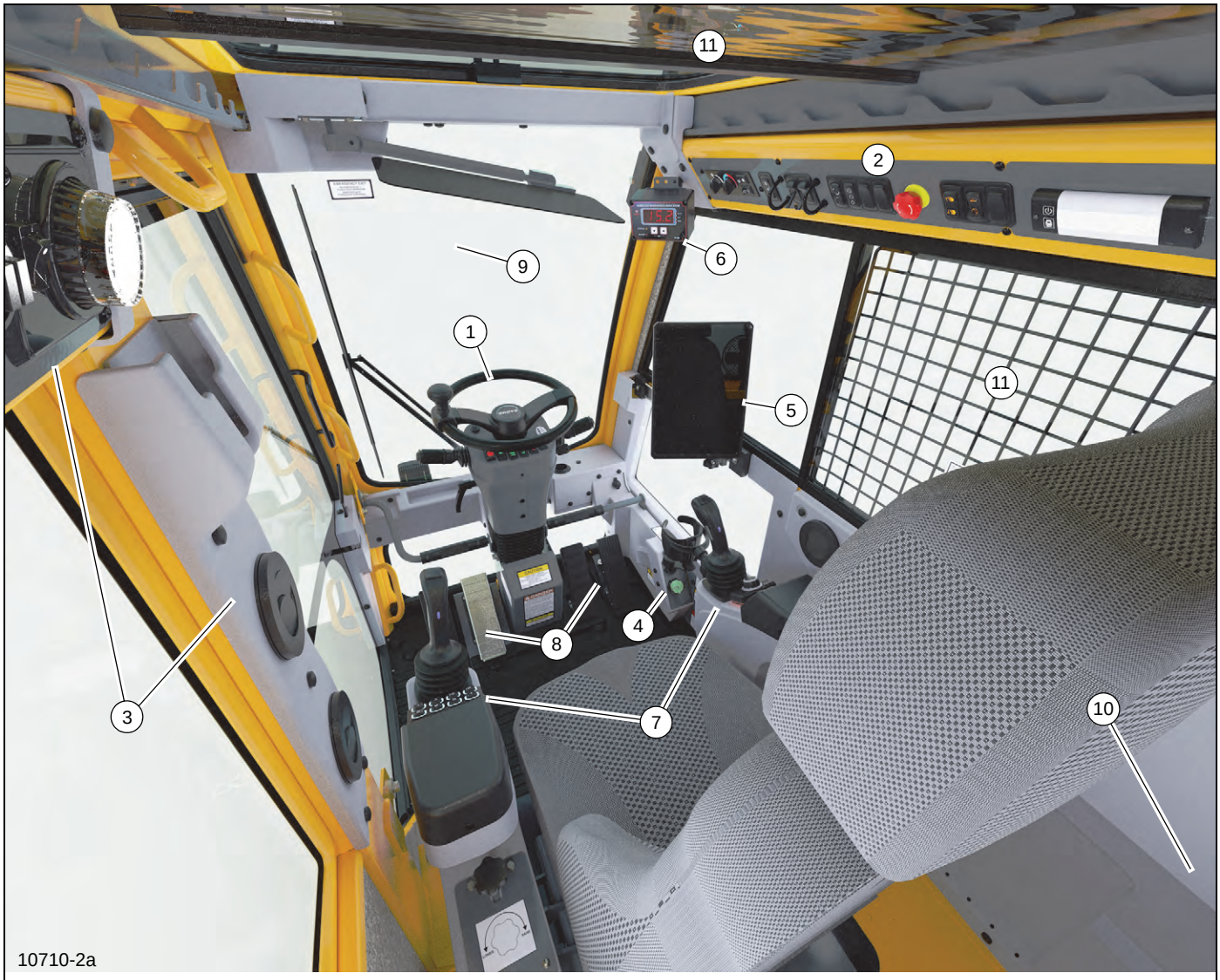
THIS PAGE BLANK

SECTION 3
OPERATING CONTROLS AND FEATURES

SECTION CONTENTS

OPERATOR CAB OVERVIEW

Most of the controls and indicators that are used to operate and monitor crane functions are found inside the operator cab (Figure 3-1).



Item	Description	Page	Item	Description	Page
1	Steering Wheel and Column	3-4	7	Operator Seat and Armrest Controls	3-18
2	Right Overhead Control Panel	3-8	8	Foot Pedal Controls	3-30
3	Left Overhead and Side Panel	3-11	9	Front Cab – Controls and Features	3-32
4	Right Lower Control Panel	3-13	10	Rear Cab – Controls and Features	3-34
5	Superstructure Display Module (SDM)	3-16	11	Right Side Window and Overhead – Controls and Features	3-38
6	Wind Speed Indicator (CE Certified Cranes)	3-16			

FIGURE 3-1

STEERING WHEEL AND COLUMN

The steering wheel and column assembly is a pedestal style tilt and telescoping steering column. It can tilt rearward 30° and telescope 60 mm (2.3 in). The steering column includes the ignition switch as well as levers and switches for operating the crane (Figure 3-2).

Item	Description	Page	Item	Description	Page
1	Steering Wheel	3-5	6	Two-Wheel Drive/Four-Wheel Drive Switch	3-6
2	Turn Signal Lever and Horn Controls	3-5	7	Hazard Lights Switch	3-6
3	Parking Brake Switch	3-5	8	Transmission Shift Lever	3-6
4	Differential Lock Switch (Optional)	3-5	9	Ignition Switch	3-6
5	Headlights Switch	3-6	10	Steering Column Tilt and Telescope Lock Lever	3-7

FIGURE 3-2

Steering Wheel

The Steering Wheel (1, Figure 3-2) is used to turn either the front wheels or both the front and rear wheels, depending on the steering mode selected.

When an automatic steer mode is selected in the Driving View area of the Superstructure Display Module (SDM), the Crane Control System (CCS) will automatically turn the rear wheels as the operator turns the steering wheel.

Refer to the following sections for information about steering the crane using the different automatic and manual steering modes:

- *Steering*, page 5-20
- *Driving View Screen*, page 4-152

Turn Signal Lever and Horn Controls

The Turn Signal Lever (2, Figure 3-2) is located on the left side of the steering column. The Horn Control is located on the end of the Turn Signal Lever.

Push the small button on the end of the turn signal lever to operate the horn.

Push the Turn Signal Lever down to cause the turn signal lights on the carrier, to the left of the operator, to flash. Push the Turn Signal Lever up to cause the turn signal lights on the carrier, to the right of the operator, to flash.

A Horn Button (4, Figure 3-8) is also located on the upper front of the right dual axis controller.

Parking Brake Switch

CAUTION

Avoid Crane Damage!

Do not engage the parking brake while the vehicle is moving. Damage to the crane can occur.

Disengage the parking brake before driving. Damage to the crane can occur.

The Parking Brake Switch (3, Figure 3-2) is located on the front of the steering column.

This two-position, locking rocker switch (ON/OFF) is used to apply and release the parking brake on the drive line.

NOTE: To prevent loading of the drive train when applying the Parking Brake, operator should do the following:

- Stop driving crane by pushing and holding the Service Brake Pedal.
- Set Transmission Shift Lever to Neutral (center) position.
- Apply Parking Brake.
- Let up on Service Brake Pedal.

To apply the parking brake, push bottom of switch. To release the parking brake, first push down on the service brake foot pedal, then slide the red switch at bottom of the rocker switch forward and then push top of the rocker switch.

The Parking Brake Indicator in the Operator Area (15, Figure 4-35) of the Superstructure Display Module (SDM) comes on to indicate the parking brake is applied.

The buzzer comes on if the parking brake is applied and the Transmission Shift Lever (8, Figure 3-2) is in the Forward (up) or Reverse (down) position. Always place Transmission Shift Lever in Neutral (center) position before applying the parking brake.

NOTE: Parking brake must be applied before outriggers can be operated.

Differential Lock Switch (Optional)

The optional Differential Lock Switch (4, Figure 3-2) is a is located on the front of the steering column.

Use Differential Lock Switch to engage the differential lock for additional traction. The Differential Lock can be activated for a maximum of 60 seconds at a time.

NOTE: Crane must be in four-wheel drive to engage the Differential Lock (refer to *Two-Wheel Drive/Four-Wheel Drive Switch*, page 3-6).

CAUTION

Possible Machine Damage!

When driving on hard, dry surfaces with differentials locked, do not turn the wheels. Damage to drive line components can result.

Do not lock differentials when wheels are slipping. Damage to differentials can result.

Push and hold the Differential Lock Switch to engage the Differential Lock. Release the switch to disengage the Differential Lock.

Refer to *Differential Lock Operation*, page 5-26 for information about how and when to engage the differential lock as well as the various cautions that must be observed before and during differential lock operation.

The Differential Lock Indicator in the Operator Area (17, Figure 4-35) of the Superstructure Display Module (SDM) comes on to indicate the differential lock is engaged.

Headlights Switch

The Headlights Switch (5, Figure 3-2) is located on the front of the steering column.

This three-position rocker switch (OFF/Marker Lights/Headlight) controls the operation of the instrument and switch lighting as well as the headlights, marker lights, and taillights.

Push bottom of switch to cause the headlights, marker lights, and taillights to go off. Set rocker switch to center position to cause the marker and taillights to come on. Push top of switch to cause the headlights on the front of the crane to come on.

The Marker Light/Headlight Indicator in the Operator Area (14, Figure 4-35) of the Superstructure Display Module (SDM) comes on to indicate the lights are on.

Two-Wheel Drive/Four-Wheel Drive Switch

The Two-Wheel Drive/Four-Wheel Drive Switch (6, Figure 3-2) is located on the front of the steering column.

This two-position rocker switch is used to select two-wheel drive (high range) or four-wheel drive (low range).

NOTE: Transmission Shift Lever (8, Figure 3-2) must be in the Neutral (center) position and Service Brake Pedal (3, Figure 3-13) pushed and held before the transmission can be changed between two-wheel drive and four-wheel drive.

Push top of switch to engage four-wheel drive (low range). Push bottom of switch to engage two-wheel drive (high range).

The related Two-Wheel Drive or Four-Wheel Drive Indicator in the Operator Area (11, Figure 4-35) of the Superstructure Display Module (SDM) comes on to indicate which drive mode is selected.

The Transmission Not-In-Neutral Indicator (APPENDIX C) in the Alerts Bar of the SDM comes on if the operator attempts to shift between two-wheel drive and four-wheel drive without first shifting the Transmission Shift Lever to Neutral (center) and pushing and holding the Service Brake Pedal.

NOTE: Transmission must be shifted to four-wheel drive (low range) before outriggers can be operated.

Hazard Lights Switch

The Hazard Lights Switch (7, Figure 3-2) is located on the front of the steering column.

The switch is a two-position rocker switch (ON/OFF).

Push top of switch to cause the turn signal lights on the front and back of the crane, and the turn signal indicator lights on the steering column, to flash at the same time. Push bottom of switch to cause these lights and indicators to go off.

Transmission Shift Lever

The Transmission Shift Lever (8, Figure 3-2) is located on the right side of the steering column. The lever is used to shift the transmission between forward, neutral, and reverse.

Push Transmission Shift Lever up to shift transmission to forward (F) gear. Push Transmission Shift Lever down to shift transmission to reverse (R) gear.

The lever sits in a detent when in the Neutral (center) position. Thus, operator must first lift up on lever before pushing it up or down.

To shift transmission to first, second, or third gear, rotate knob at end of the lever to I, II, or III.

The transmission has six forward gears and six reverse gears. The transmission must be in Neutral (center) position in order to shift to four-wheel drive low-range. To use the three low gears, set Two-Wheel Drive/Four-Wheel Drive Switch (6, Figure 3-2) to four-wheel drive. To use the three high gears, set switch to two-wheel drive.

NOTE: A shift interlock system prevents the transmission from being shifted into forward or reverse gear without first pushing and holding the Service Brake Pedal.

Refer to *Traveling – Forward*, page 5-19 and *Traveling – Reverse*, page 5-20 for more detailed information about shifting the transmission.

The Direction/Gear Indicator (2, Figure 4-35) in the Operator Area of the Superstructure Display Module (SDM) shows the direction of travel and the gear to which the transmission is shifted.

Ignition Switch

The Ignition Switch (9, Figure 3-2) is located on the right side of the steering column, below the Transmission Shift Lever (8, Figure 3-2).

The Ignition Switch is key-operated and has three positions: 0 (OFF), I (RUN), and II (START).

In the 0 (OFF) position, most electrical power is off. Electrical items that continue to operate include the horn, headlights, turn signal/hazard/stop lights, dome light, and work lights.

Turn Ignition Switch to the I (RUN) position to energize all electrical components except the starting circuit.

Turn Ignition Switch to the II (START) position to energize the start circuit and crank the engine for starting. Release ignition switch when the engine starts.

The Ignition Switch is spring-returned from II (START) to I (RUN). Turn Ignition Switch to the 0 (OFF) position to stop the engine.

The engine starting system has an anti-restart feature. After a failed attempt to start the engine, the Crane Control

System (CCS) prevents the engine from cranking again for approximately 6 seconds.

NOTE: Crane will not power up if the Battery Disconnect Switch (Figure 3-34) is not set to On.

Engine will not start if one or more Emergency Stop Buttons (10, Figure 3-3 and 1, Figure 3-32) are pushed in.

Steering Column Tilt and Telescope Lock Lever

The steering control column can be angled rearward approximately 30° and telescoped approximately 60 mm (2.3 in).

Rotate the Lock Lever (10, Figure 3-2) clockwise to lock the steering column in place. Rotate the lever counterclockwise to release the steering column for adjustment.

WARNING

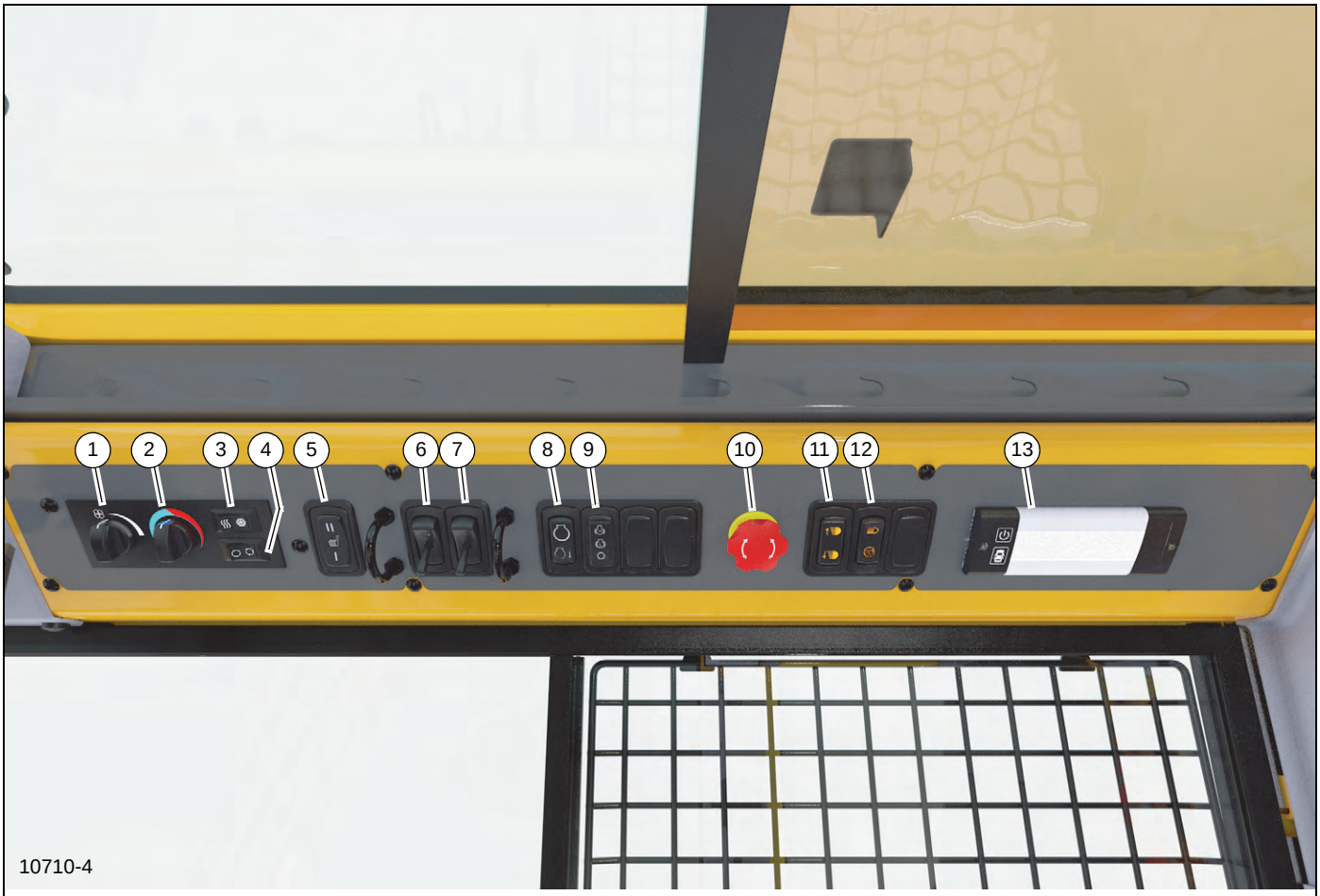
Loss of Steering Control!

Before driving the crane, make sure the steering column is locked in position.

Do not adjust the steering column while driving the crane.

RIGHT OVERHEAD CONTROL PANEL

The right overhead control panel (Figure 3-3) includes controls for operating the heating and air conditioning system, front and skylight window wipers, engine, and craning functions.



Item	Description	Page	Item	Description	Page
1	Heater/Air Conditioner Fan Speed Switch	3-9	8	Engine Wait-To-Start Indicator and SDM Temperature Warning Indicator	3-9
2	Heater/Air Conditioner Temperature Control Switch	3-9	9	Engine Brake Switch	3-10
3	Air Conditioner ON/OFF Switch	3-9	10	Emergency Stop Button (E-Stop)	3-10
4	Fresh Air/Recirculation Air Switch	3-9	11	Boom-Mounted Work Lights Rotate Switch (Optional)	3-10
5	Seat Heater Switch (Optional)	3-9	12	Work Lights Switch	3-10
6	Front Window Wiper and Washer Switch	3-9	13	Cab Dome Light	3-10
7	Skylight Wiper and Washer Switch	3-9			

FIGURE 3-3

Heater/Air Conditioner Fan Speed Switch

The Heater/Air Conditioner Fan Speed Switch (1, Figure 3-3) is located on the right overhead control panel.

The rotary switch controls the cab fan speed and volume of heated or cooled air output. Settings are off, low speed, medium speed, and high speed.

Turn the rotary switch clockwise to increase fan air speed. Turn rotary switch counterclockwise to reduce fan air speed. Turn rotary switch to the fully counterclockwise position to stop fan.

Heater/Air Conditioner Temperature Control Switch

The Heater/Air Conditioner Temperature Control Switch (2, Figure 3-3) is located on the right overhead control panel.

The rotary switch controls the temperature of the air coming out of the heater/air conditioner vents.

Turn the rotary switch clockwise to increase the air temperature. Turn the rotary switch counterclockwise to decrease the air temperature.

Air Conditioner ON/OFF Switch

The Air Conditioner ON/OFF Switch (3, Figure 3-3) is located on the right overhead control panel.

The two-position rocker switch controls the air conditioning system.

Push right side of switch to switch on the air conditioning system. Push left side of switch to switch off the air conditioner system.

Fresh Air/Recirculation Air Switch

The Fresh Air/Recirculation Air Switch (4, Figure 3-3) is located on the right overhead control panel.

The two-position rocker switch controls how outside air is drawn into the cab. Use Recirculation mode for maximum air conditioner performance in warm climates.

Push left side of switch to draw outside air into the cab when operating the heater system or air conditioner system. Push right side of switch to recirculate the air inside the cab and bring a small amount of outside air into the cab.

Seat Heater Switch (Optional)

The optional Seat Heater Switch (5, Figure 3-3) is a three-position, rocker type switch located on the right overhead control panel.

Push bottom of switch to cause seat heater to operate at a low temperature. Push top of switch to cause seat heater to operate at a high temperature. Set switch to center position to cause seat heater to go off.

Front Window Wiper and Washer Switch

The Front Window Wiper and Washer Switch (6, Figure 3-3) is located on the right overhead control panel.

The switch is a six-position toggle switch with integral rocker switch that controls the front window wiper and washer.

Push toggle switch up to operate the front window wiper at a slow intermittent speed. Push toggle switch farther up to operate the wiper at a faster speed. Pull toggle switch down to stop operating the front window wiper.

Push and hold top of rocker switch to spray the windshield with windshield washer fluid for cleaning. Release switch after the desired amount of windshield washer fluid has been sprayed onto the windshield.

Skylight Wiper and Washer Switch

The Skylight Wiper and Washer Switch (7, Figure 3-3) is located on the right overhead control panel.

The switch is a six-position toggle switch with integral rocker switch that controls the skylight wiper and washer on top of the cab.

Push toggle switch up to operate the skylight window wiper at a slow intermittent speed. Push toggle switch farther up to operate the wiper at a faster speed. Pull toggle switch down to stop operating the skylight window wiper.

Push and hold top of rocker switch to spray the skylight window with window washer fluid for cleaning. Release switch after the desired amount of window washer fluid has been sprayed onto the skylight.

Engine Wait-To-Start Indicator and SDM Temperature Warning Indicator

The Engine Wait-To-Start Indicator (8 - top, Figure 3-3) is located on the right overhead control panel.

When the Ignition Switch (9, Figure 3-2) is turned to the I (RUN) position, the Engine Wait-to-Start indicator comes on if the outside ambient temperature is low and preheating of the air inside the air-intake manifold is required.

The Engine Wait-To-Start Alert (APPENDIX C) in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM) also comes on when preheating of the air inside the air-intake manifold is required.

Do not start the engine until these indicators go off.

The SDM Temperature Warning Indicator (8 - bottom, Figure 3-3) is located on the right overhead control panel.

Indicator comes on when the internal temperature of the Superstructure Display Module (SDM) is outside of recommended operating range.

Engine Brake Switch

The Engine Brake Switch (9, Figure 3-3) is located on the right overhead control panel.

The three-position rocker switch (Off–Low–High) controls the engine brake.

Push top of switch (High) to cause the engine brake to operate with full braking action. Set switch to its center position (Low) to cause the engine brake to operate at its intermediate engine braking action. Push bottom of switch to set engine brake to off.

Use engine brake to help slow the crane when traveling down a slope. Use of the engine brake will help reduce the risk of the service brakes overheating.

Emergency Stop Button

The Emergency Stop Button (10, Figure 3-3) is located on the right overhead control panel.

Push red button in to stop the engine and all crane functions. When the Emergency Stop Button is pushed in, the Emergency Stop Button Pushed Alert (APPENDIX C) in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM) comes on.

Rotate and pull out Emergency Stop Button to allow the engine to be re-started and resume normal operation.

Emergency Stop Buttons are located on the left and right sides of the carrier for those cranes equipped with the option (Figure 3-32).

Boom-Mounted Work Lights Rotate Switch (Optional)

The Boom-Mounted Work Lights Rotate Switch (11, Figure 3-3) is located on the right overhead control panel.

The switch controls the direction in which the boom-mounted work lights point. The switch is a three-position momentary rocker switch with center maintained position being OFF.

Push and hold top of switch to rotate the work lights up. Push and hold bottom of switch to rotate the work lights down. Release the switch when the work lights are pointing in the desired direction.

Work Lights Switch

The Work Lights Switch (12, Figure 3-3) is located on the right overhead control panel.

The switch and the Work Lights function panel on the Superstructure Display Module (SDM) are used together to control the following work lights:

- *Side-Mounted Carrier Work Lights*, page 3-53
- *Boom-Mounted Motorized Work Lights (Optional)*, page 3-45
- *Superstructure-Mounted Work Lights*, page 3-46

A work light must first be enabled in the Work Lights function panel before it can be toggled on and off using the Work Light Switch (refer to *Work Lights*, page 4-96 for more information about the Work Lights function panel). After one or more work lights have been enabled, push top of switch to cause the work lights to come on. Push top of switch again to cause the work lights to go off.

Push bottom of switch to quickly access the Work Lights function panel.

NOTE: The *Side-Mounted Carrier Work Lights*, page 3-53, are switched on and off using the Outrigger Extend/Retract function screen on the SDM (refer to *Outrigger Extend/Retract*, page 4-40).

Cab Dome Light

The Cab Dome Light (13, Figure 3-3) is located on the right overhead control panel.

The dome light is controlled by the two buttons on the left side of the light. Push either button to cause the light to come on. Push button again to cause the light to go off.

LEFT OVERHEAD AND SIDE PANELS

The left overhead and side panels (Figure 3-4) include a coat hook, USB charging ports, auxiliary light, mobile phone holder, and heater/air conditioner vents.

10710-5

Item	Description	Page
1	Coat Hook	3-12
2	Auxiliary Cab Heater Controller (Optional)	3-12
3	USB Charging Ports	3-12
4	Auxiliary Light and Switch	3-12
5	Mobile Phone Holder	3-12
6	Heater/Air Conditioner Vents	3-12

FIGURE 3-4

Coat Hook

A Coat Hook (1, Figure 3-4) is located on the left overhead panel, near the rear of the cab.

Auxiliary Cab Heater Controller (Optional)

The Auxiliary Cab Heater Controller (Optional) (2, Figure 3-4) is located on the left overhead panel.

The controller is used to control the auxiliary cab heater system that is part of Grove's Cold Weather Package option. The auxiliary cab heater system is used to quickly heat the cab interior during cold weather operation.

Refer to *Auxiliary Cab Heater*, page 5-6 for more information about the auxiliary cab heater system. Refer to the vendor user manual, shipped with the crane, for information on the operation of the Auxiliary Cab Heater Controller.

USB Charging Ports

Two USB Charging Ports (3, Figure 3-4) are located on the left overhead panel. The ports have a combined current rating of 2.1 Amps.

The ports can be used to charge small electronic devices such as a mobile phone.

Auxiliary Light and Switch

An Auxiliary Light and Switch (4, Figure 3-4) is located on the left overhead panel.

The auxiliary light switch is a two-position switch.

Push top of switch to cause the light to come on. Push bottom of switch to cause the light to go off.

The auxiliary light can be adjusted by hand if necessary.

Mobile Phone Holder

A Mobile Phone Holder (5, Figure 3-4) is located on the left side panel.

Heater/Air Conditioner Vents

Two Heater/Air Conditioner Vents (6, Figure 3-4) are located on the left side panel.

The vents can be adjusted to control the amount and direction of air passing through them.

RIGHT LOWER CONTROL PANEL

The right lower control panel (Figure 3-5) includes the turntable swing lock pin control handle, 12-volt outlet, and on-board diagnostic (OBD) connector.

10710-6

Item	Description	Page
1	Turntable Swing Lock Pin Control Handle	3-14
2	12-Volt Outlet	3-14
3	Engine On-Board Diagnostic (OBD) Connector	3-14
4	Display Programming Port	3-14

FIGURE 3-5

Turntable Swing Lock Pin Control Handle

The Turntable Swing Lock Pin Control Handle (1, Figure 3-5) is located on the right lower control panel.

To lock the superstructure in position, do the following steps:

1. Center the superstructure over the front or rear of the carrier.
2. Turn Swing Lock Pin Control Handle counterclockwise to unlock it.
3. Push down on control handle to cause the swing lock pin to drop into the socket on the carrier frame.
4. Turn control handle clockwise to lock the swing lock in position.

To unlock the superstructure, perform the following steps:

1. Turn control handle counterclockwise to unlock the swing lock.
2. Pull up on the control handle to cause the swing lock pin to pull out of the socket.
3. Turn control handle clockwise to lock it in position.

NOTE: Before driving the crane, always make sure that the boom is centered over the front or rear of the carrier and that the turntable swing lock pin is engaged.

12-Volt Outlet

The 12-Volt Outlet (2, Figure 3-5) is located on the right lower control panel.

The 12-volt Outlet can power and charge electronic devices having a maximum current draw of 15 amps or less.

Engine On-Board Diagnostic (OBD) Connector

The Engine On-Board Diagnostic (OBD) Connector (3, Figure 3-5) is located on the right lower control panel.

The connector allows the Cummins service software tool to be connected to the engine electronic control unit (ECU) for diagnosing issues that may occur.

A second Engine OBD Connector is located in the battery box.

Display Programming Port

The Display Programming Port (4, Figure 3-5) is a USB 2.0 Type A connection for updating the software on the Superstructure Display Module (SDM).

The port has a power rating of 2.5W (5V at 0.5A) and can be used to charge small electronic devices such as a mobile phone.

SUPERSTRUCTURE DISPLAY MODULE AND WIND SPEED INDICATOR

10710-7a

Item	Description	Page
1	Superstructure Display Module (SDM)	3-16
2	Wind Speed Indicator (CE Certified Cranes)	3-16

FIGURE 3-6

Superstructure Display Module

The Superstructure Display Module, referred to as SDM throughout this manual, is a 12 inch touch-screen display located to the right of the steering wheel (1, Figure 3-6).

The SDM allows the operator to monitor crane functions and perform crane operations, to include the following:

- Program the RCL by entering a code number from the *Load Chart Manual* or by using the RCL Setup Wizard
- Monitor performance of crane systems
- Select the camera views displayed on the SDM
- Select the Telescope Mode (semi-automatic and manual modes)
- Extend/retract the outriggers and level the crane
- Operate the 360° superstructure lock mechanism
- Set the working range limits (WRL)
- View engine, transmission, and crane alerts
- Control the work lights on the crane
- View software versions and hours of operation for each crane function
- Set controller curves and maximum speeds, engage/disengage ECO mode, and inhibit operation of the engine cleaning system
- Set units of measure (metric/imperial), screen display brightness, and time (24 hour or AM/PM)

The SDM shows alerts at the top of the screen that inform the operator of the crane's status and limits as well as of critical and non-critical conditions that the crane has encountered. A buzzer, internal to the SDM, will come on to emphasize the importance of different alerts. Alerts that cause the SDM to beep will show a bell symbol below the alert. Multi-colored LEDs at the top right corner of the SDM will flash in sequence with the sound of the buzzer.

The SDM Position Rail and Locking Knob are used to position the SDM closer to or further away from the operator. Loosen the knob (1, Figure 3-7), then slide the SDM to the desired position fore-to-aft along the position rail (2). Re-tighten the knob.

The SDM Orientation Arm and Locking Knob are used to adjust the angle of the SDM to the operator. Loosen the knob (3, Figure 3-7), then adjust the orientation arm (4) until the SDM is set to the desired viewing angle. Re-tighten the knob.

Before operating the crane, always make sure the SDM is securely locked in position.

Refer to *Superstructure Display Module (SDM) – Overview*, page 4-4 for detailed information about how to use the SDM in the operation of the crane.

Wind Speed Indicator (CE Certified Cranes)

The Wind Speed Indicator for CE Certified cranes is located in the front of the cab in the upper right corner (2, Figure 3-6).

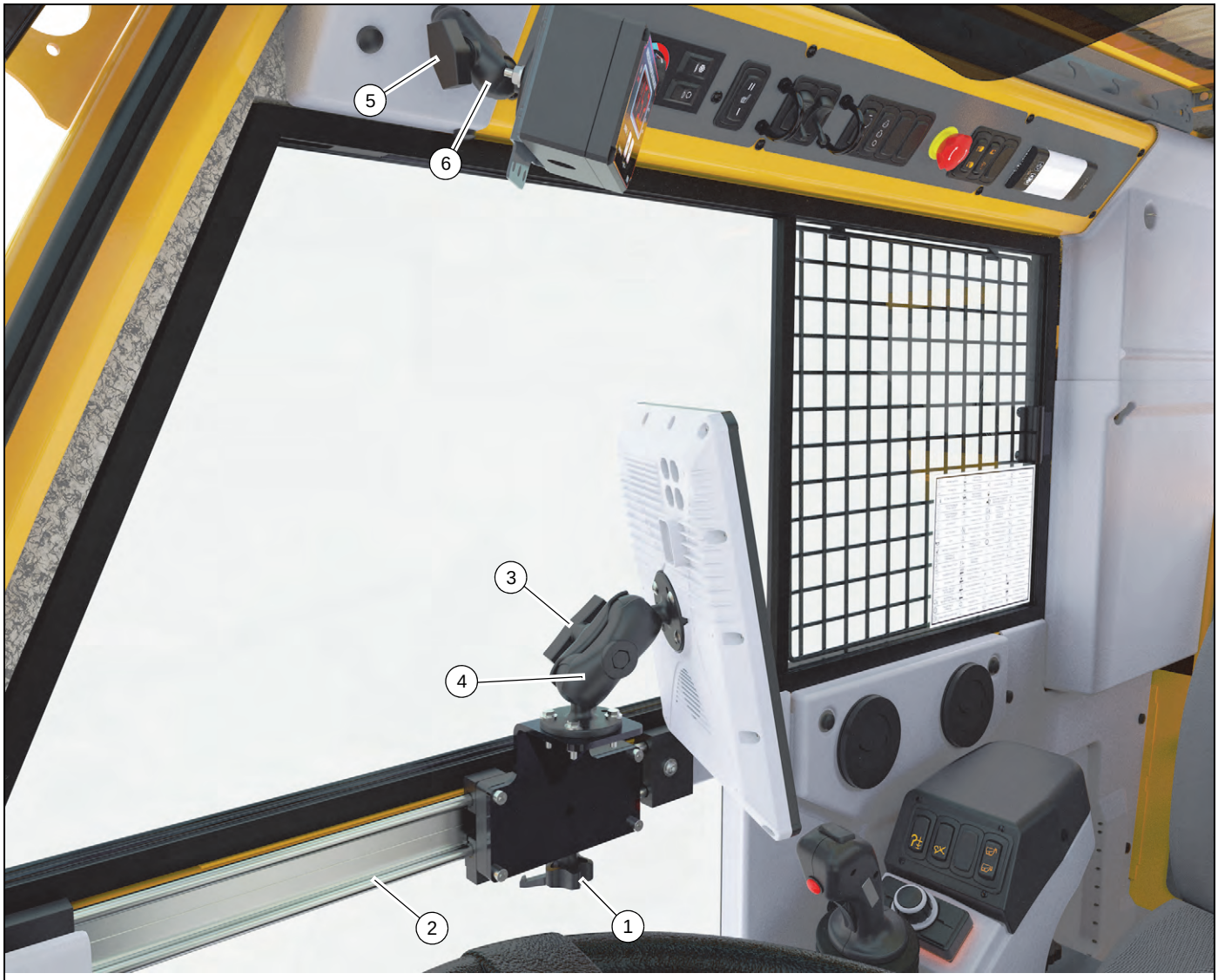
The wireless system consists of the Wind Speed Indicator mounted in the cab and the anemometer device that is mounted to the boom nose (refer to *Anemometer (Optional)*, page 3-47).

The wind speed indicator can be set to show the wind speed in the operator's desired unit of measure.

Refer to the vendor user manual, shipped with the crane, for information about the operation of the Wind Speed Indicator.

The Wind Speed Indicator Orientation Arm and Locking Knob is used to adjust the angle of the indicator to the operator. Loosen the knob (5, Figure 3-7), then adjust the orientation arm (6) until the indicator is set to the desired viewing angle. Re-tighten the knob.

Before operating the crane, make sure the Wind Speed Indicator is securely locked in position.

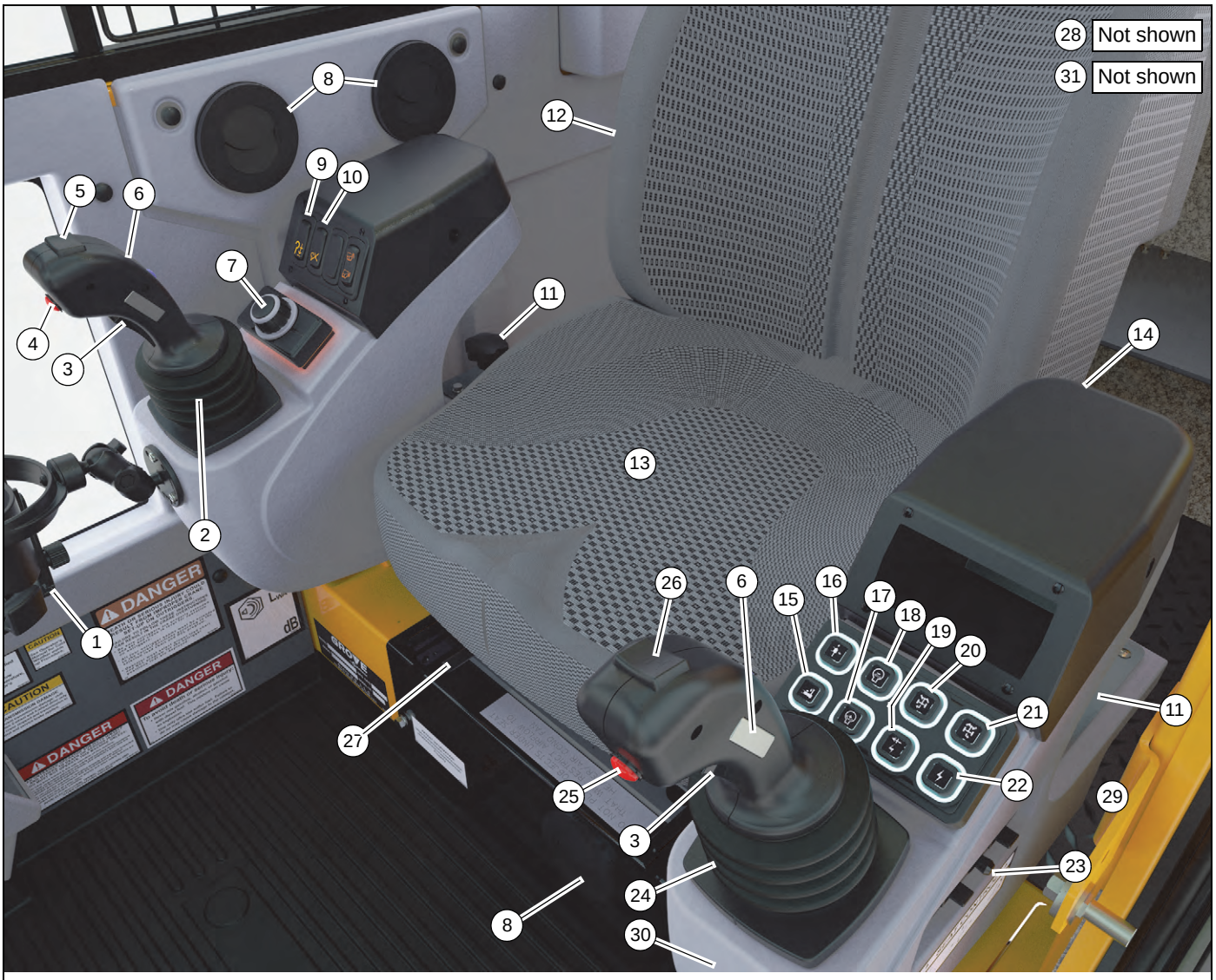


10710-39

FIGURE 3-7

OPERATOR SEAT AND ARMREST CONTROLS (DUAL AXIS)

The operator seat and armrest controls (Figure 3-8) include most of the controls for performing craning operations.



10710-8a

FIGURE 3-8

Item	Description	Page	Item	Description	Page
1	Cup Holder	3-20	17	Engine Increment/Start Button	3-22
2	Boom Lift/Main Hoist Controller (Dual Axis)	3-20	18	Engine Decrement/Stop Button	3-22
3	Deadman Switches (Dual Axis)	3-20	19	Momentary Limit Bypass Button (Non-CE Certified Cranes)	3-23
4	Horn Button	3-20	20	Rear Steer Right Button	3-23
5	Hoist Speed Toggle Switch	3-20	21	Rear Steer Left Button	3-24
6	Hoist Rotation Indicators	3-20	22	Crane Function Enable/Disable Button	3-24
7	Jog Dial	3-21	23	Seat Adjustment Control Panel	3-24
8	Heater/Air Conditioner Vents	3-21	24	Swing/Telescope or Swing/Auxiliary Hoist Controller (Dual Axis)	3-25
9	Limit Bypass Set-up Button (CE Certified Cranes)	3-21	25	Load Centering Button	3-25
10	Boom Up Bypass Button (CE Certified Cranes)	3-21	26	Cab Tilt Switch (Dual Axis)	3-26
11	Armrest Adjustment Knob	3-22	27	Seat Slide Lever	3-26
12	Seat Lumbar Support Adjustment Lever	3-22	28	Seat Headrest	3-26
13	Seat Switch	3-22	29	Seat Armrest Switch	3-26
14	Seat Backrest Adjustment Lever	3-22	30	Dual USB Port Charger	3-26
15	Outrigger Extend Button	3-22	31	Seat Belt	3-26
16	Outrigger Retract Button	3-22			

Cup Holder

The adjustable Cup Holder (1, Figure 3-8) is attached to the front of the right armrest.

Turn knob counterclockwise to loosen cup holder for adjustment. After adjusting, turn knob clockwise to lock cup holder in position.

Boom Lift/Main Hoist Controller (Dual Axis)

The Boom Lift/Main Hoist Controller (2, Figure 3-8) is located on the right armrest.

Push controller to the right to lower the boom. Push controller to the left to raise the boom.

Push controller forward to lower the hoist rope (hoist down). Pull controller rearward to raise the hoist rope (host up).

Move controller in a diagonal direction to operate the two functions at the same time.

Refer to *Raising and Lowering the Boom*, page 5-34 for more detailed information about raising and lowering the boom.

Refer to *Raising and Lowering the Main Hoist Rope*, page 5-36 for more detailed information about raising and lowering the hoist.

Deadman Switches (Dual Axis)

The Deadman Switch (3, Figure 3-8) (Dual Axis) is a momentary type switch located on the front of the left and right controllers.

The crane controllers on the armrests control the following crane functions: hoist, boom telescope, boom lift, and swing. These crane functions will only operate when the operator is seated (closing the Seat Switch circuit) and has the left armrest assembly rotated fully downward (closing the Seat Armrest Switch circuit). Refer to *Seat Switch*, page 3-22 and *Seat Armrest Switch*, page 3-26 for more information about the operation of these switches.

WARNING

Loss of Control!

Operator should always operate the crane from a seated position with the armrests in the down position. Operator seat should be adjusted in a manner that is comfortable for the operator.

If operator must operate the crane functions from an unseated position using the Deadman Switch, he or she must do so with the extreme caution. Operator must be sure he or she is in a stable position to operate the controllers without risk of slipping or falling that could cause accidental crane movement.

To enable the crane functions when the operator is not seated and/or does not have the left armrest assembly rotated fully downward, pull in a Deadman Switch on one of the controllers. While Deadman Switch is pulled in, the operator can operate any of the crane functions.

Horn Button

A Horn Button (4, Figure 3-8) is located on the upper front of the right controller.

Push button to operate the horn.

A Horn Button is also located on the end of the Turn Signal Lever (2, Figure 3-2).

Hoist Speed Toggle Switch

The Hoist Speed Toggle Switch (5, Figure 3-8) is a thumb operated three-position center spring return rocker switch located on top of the right controller.

Push and release the right side of switch to change main hoist speed to high – push and release switch again to return main hoist speed to normal.

When crane is equipped with the optional auxiliary hoist, push and release the left side of switch to change auxiliary hoist speed to high – push and release switch again to return auxiliary hoist speed to normal.

NOTE: Hoist speed cannot be changed while hoist is operating. Before changing hoist speed, the controller must be placed in the Neutral (center) position.

Hoist Speed Indicators (6, 7, Figure 4-38) for standard and high speeds show on the Function Status Bar of the Superstructure Display Module (SDM). They give a visual indication of the current speed selected for the main and optional auxiliary hoists.

Hoist Rotation Indicators

Hoist Rotation Indicators (6, Figure 3-8) for auxiliary and main hoists are located internal to each dual-axis hoist controller (2, 24, Figure 3-8) and can be felt on the sides of the controller at mid-stick.

The Hoist Rotation Indicator mechanically pulses on the auxiliary or main hoist controller when its related hoist is operating.

The pulsing, felt by the operator's hand, indicates to the operator that the hoist is operating.

The Hoist Rotation Indicator also makes an audible click when it pulses.

The frequency of the pulses and clicks increases and decreases as the hoist speed increases and decreases.

Jog Dial

The Jog Dial (7, Figure 3-8) is located on the right armrest.

The Jog Dial is used to interact with the graphical user interface of the Superstructure Display Module (SDM). Refer to *SDM Basic Screen Navigation*, page 4-9 for more information about the jog dial operation.

Heater/Air Conditioner Vents

Two Heater/Air Conditioner Vents (8, Figure 3-8) are located on the right side of the cab, and one vent is located under the seat assembly.

The vents can be adjusted to control the amount and direction of air passing through them.

Limit Bypass Set-Up Button (CE Certified Cranes)

WARNING

Overload Hazard!

The Limit Bypass Button prevents the crane function lockouts from activating.

When the Limit Bypass Button is activated, the operator must make sure that the crane is not overloaded.

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

The Rated Capacity Limiter (RCL) system, when programmed accurately, will lock out the following crane functions—boom up/down, telescope extend, and hoist up—when a lift is attempted at or above crane capacity, or when a two-block condition exists.

Locking out these functions prevents the overload or two-block condition from worsening.

These same craning functions are locked out initially after the crane engine is started and before the RCL system has been programmed.

The Limit Bypass Set-up Button (9, Figure 3-8) is located on the right armrest.

During certain rigging work or to recover the crane, push and release switch to bypass the following limiter systems on the crane:

Push and release button switch to bypass the following limiter systems and their crane function lockouts:

- Anti-Two-Block System (boom up/down, telescope out, hoist up)
- 3rd Wrap Limiter System (hoist down)

When button is pushed and released, all crane functions—boom up/down, telescope out/in, hoist up/down, and swing left/right—will operate at 50% of normal speed when actuated.

Button can also be pushed and released to bypass the following limiter systems and their crane function lockouts:

- RCL System (boom up/down, telescope out, hoist up)
- Working Range Limiter (WRL) system
- Carrier Avoidance System

If RCL is programmed and active and the bypass button is pushed and released, the swing left/right function pressure is reduced to 25% and the boom up/down, hoist up/down, and telescope extend/retract function speeds are reduced to 15% when actuated. If the load exceeds 110% of the indicated capacity, all craning functions will lock out.

If RCL has not been programmed and the limit bypass button is pushed and released, the swing left/right, boom up/down, hoist up/down, and telescope extend/retract functions operate at normal speeds when actuated.

When the button is pushed, the Limit Bypass Set-up Alert (RCL Bypass 1) (APPENDIX C) will show in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM).

All craning functions that are locked out are bypassed until one of the following occurs:

- Limit Bypass Button is again pushed and released while the controllers are in the neutral position
- Controllers are in the neutral position for 10 seconds

Boom Up Bypass Button (CE Certified Cranes)

The Boom Up Bypass Button (10, Figure 3-8) is located on the right armrest.

While the boom lift function is enabled and in an RCL lockout condition, push and released the Boom Up Bypass Button to allow the boom to be raised.

For CE certified cranes only, the speed of the boom up function is reduced by 50% when actuated. For non-CE Certified cranes, the boom up function operates at normal speed when actuated.

When the button is pushed, the Boom Up Bypass Alert (RCL Bypass 2) (APPENDIX C) will show in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM).

The boom up function lockout is bypassed until one of the following occurs:

- Boom Up Bypass Switch is again pushed and released while controllers are in neutral position

- Boom up controller is in neutral position for 10 seconds, and load is greater than 90% crane capacity and less than or equal to 100% crane capacity
- Load is reduced to less than 90% of crane capacity

Armrest Adjustment Knob

An Armrest Adjustment Knob (11, Figure 3-8) is located under the rear of each armrest.

The knobs allow the left and right armrests to be adjusted upward and downward.

Turn the left or right Armrest Adjustment Knob clockwise to rotate the related armrest downward. Turn the knob counterclockwise to rotate the armrest upward.

Seat Lumbar Support Adjustment Lever

The Seat Lumbar Support Adjustment Lever (12, Figure 3-8) is located at the right side of the seat backrest.

The lever can be set to three lumbar support positions.

Rotate lever clockwise to increase the lumbar support. Rotate lever counterclockwise to reduce the lumbar support.

Seat Switch

The Seat Switch (13, Figure 3-8) is located in the seat.

The operator must be sitting in the seat, enabling the switch, before any crane functions can be operated.

Crane functions can be operated while the operator is not seated and/or the left armrest is rotated upward by actuating the Deadman Switch (3, Figure 3-8) on the left or right controller.

Seat Backrest Adjustment Lever

The Seat Backrest Adjustment Lever (14, Figure 3-8) is located at the left rear of the seat.

Lift up the lever to allow the seat backrest angle to be pivoted forward and rearward. Once seat backrest is in the desired position, release the lever to lock the backrest in position.

Outrigger Extend Button

The Outrigger Extend Button (15, Figure 3-8) is a push button switch that is located on the left armrest.

To extend the outrigger beams and jacks, use the Outrigger Extend Button in combination with the buttons on the Jog Dial and the Outrigger Extend/Retract function panel on the Superstructure Display Module (SDM). Refer to *Outrigger Extend/Retract*, page 4-40 for information about extending and retracting the outriggers.

Push and hold the Outrigger Extend Button to quickly open the Outrigger Extend/Retract function panel on the SDM.

Outrigger Retract Button

The Outrigger Retract Button (16, Figure 3-8) is a push button switch that is located on the left armrest.

To retract the outrigger beams and jacks, use the Outrigger Retract Button in combination with the buttons on the Jog Dial and the Outrigger Extend/Retract function panel on the Superstructure Display Module (SDM). Refer to *Outrigger Extend/Retract*, page 4-40 for information about extending and retracting the outriggers.

Push and hold the Outrigger Retract Button to quickly open the Outrigger Extend/Retract function panel on the SDM.

Engine Increment/Start Button

The Engine Increment/Start Button (17, Figure 3-8) is located on the left armrest.

The switch is a push button switch. Use this button to increase engine speed and to start the engine.

With engine running, quickly push and release the button to increase engine speed to high idle. Push and hold the button to incrementally increase engine speed. Release button when desired engine speed is reached.

With ignition switch in the I (RUN) position, start engine by pushing and holding the button until engine starts. Unlike the Ignition Switch, the Engine Increment/Start Button and Engine Decrement/Stop Button (18, Figure 3-8) can be used together to stop and start the engine without disconnecting power to the electrical systems. Thus, using these buttons to start and stop the engine during short breaks in craning operation saves time, as the Superstructure Display Module (SDM) remains fully powered and programmed.

The Increment/Start and Decrement/Stop Buttons are also used to set the engine speed when using the Economy (ECO) Mode feature. Refer to *ECO Mode*, page 4-90 for details of its operation.

Engine Decrement/Stop Button

The Engine Decrement/Stop Button (18, Figure 3-8) is located on the left armrest.

The switch is a push button switch. Use this button to decrease engine speed and to stop the engine.

With engine running, quickly push and release the button to decrease engine speed to low idle. Push and hold the button to incrementally decrease engine speed. Release button when desired engine speed is reached.

With engine speed at low idle, push and hold the button until engine stops. To restart engine, push and hold the Engine Increment/Start Button (17, Figure 3-8) until engine starts. Unlike the Ignition Switch, the Engine Increment/Start Button and Engine Decrement/Stop Button can be used together to stop the engine without disconnecting power to the electrical

systems. Thus, using these buttons to start and stop the engine during short breaks in craning operation saves time, as the Superstructure Display Module (SDM) remains fully powered and programmed.

The Increment/Start and Decrement/Stop Buttons are also used to set the engine speed when using the Economy (ECO) Mode feature. Refer to *ECO Mode*, page 4-90 for details of its operation.

Momentary Limit Bypass Button (Non-CE Certified Cranes)

WARNING

Overload Hazard!

The Limit Bypass Switch prevents the crane function lockouts from activating.

When the Limit Bypass Switch is activated, the operator must make sure that the crane is not overloaded.

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

The Rated Capacity Limiter (RCL) system, when programmed accurately, will lock out the following crane functions—boom up/down, telescope extend, and hoist up—when a lift is attempted at or above crane capacity, or when a two-block condition exists.

Locking out these functions prevents the overload or two-block condition from worsening.

These same crane functions are locked out initially after the crane engine is started and before the RCL system has been programmed.

The Limit Bypass Button (19, Figure 3-8) is located on the left armrest.

During certain rigging work or to recover the crane, push the button to bypass the following limiter systems on the crane.

Push and hold button to bypass the following limiter systems and their crane function lockouts:

- Anti-Two-Block System (boom up/down, telescope extend, hoist up)
- 3rd Wrap Limiter System (hoist down)
- RCL System (boom up/down, telescope extend, hoist up)
- Anti-Two-Block System (boom up/down, telescope extend, hoist up)
- 3rd Wrap Limiter System (hoist down)
- Working Range Limiter (WRL) System
- Carrier Avoidance System
- -29°C Temperature Limiter System (optional)

When the button is pushed, the Momentary Limit Bypass Alert (RCL Bypass 1) (APPENDIX C) will show in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM).

All crane function lockouts are bypassed while the Limit Bypass Switch is pushed in.

Rear Steer Right Button

The Rear Steer Right Button (20, Figure 3-8) is a push button switch located on the left armrest.

The Rear Steer Right Button, when pushed, turns the wheels on the rear axle to the right.(see Figure 3-9).

NOTE: Rear Steer Right and Left Buttons can only be operated when the Manual Rear Steering Mode Button (7, Figure 4-202) is selected on the Driving View area of the Superstructure Display Module (SDM).

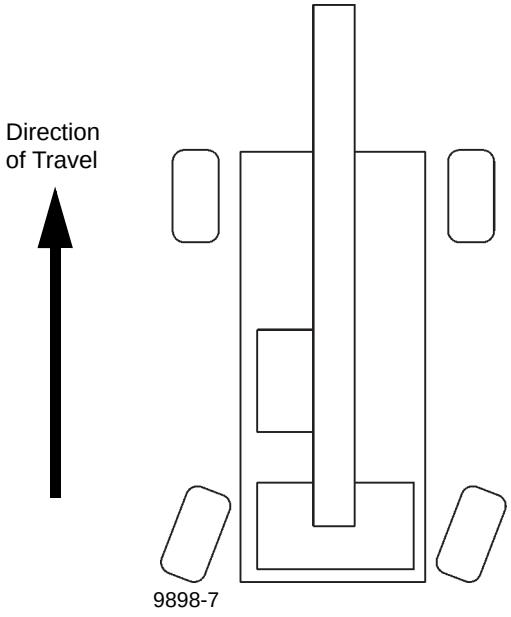


FIGURE 3-9

Refer to *Driving View Screen*, page 4-152 for information about the different automatic and manual steering modes and their use when driving and steering the crane. Refer to *Steering*, page 5-20 for more information about steering the crane using the front and rear wheels and under what conditions rear wheel steering is allowed.

Rear Steer Left Button

The Rear Steer Left Button (21, Figure 3-8) is a push button switch located on the left armrest.

The Rear Steer Left Button, when pushed, turns the wheels on the rear axle to the left (see Figure 3-10).

NOTE: Rear Steer Right and Left Buttons can only be operated when the Manual Rear Steering Mode Button (7, Figure 4-202) is selected on the Driving View area of the Superstructure Display Module (SDM).

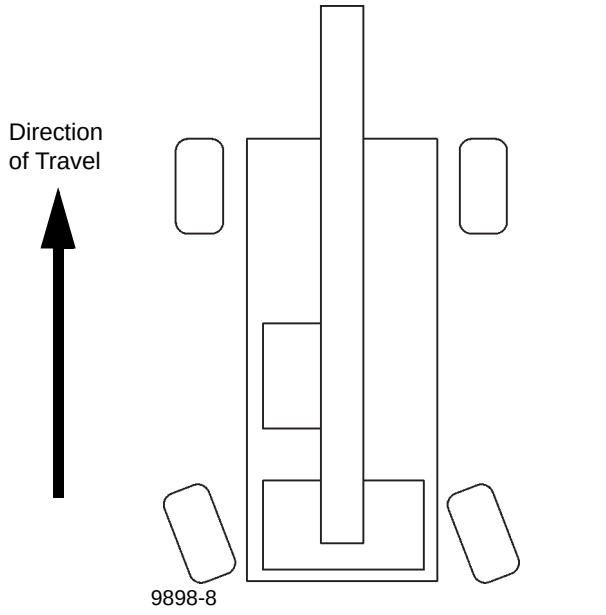


FIGURE 3-10

Refer to *Driving View Screen*, page 4-152 for information about the different automatic and manual steering modes and its use when driving and steering the crane. Refer to *Steering*, page 5-20 for more information about steering the crane using the front and rear wheels and under what conditions rear wheel steering is allowed.

Crane Function Enable/Disable Button

The Crane Function Enable/Disable Button (22, Figure 3-8) is located on the right overhead control panel.

The button lets the operator enable and disable all crane functions that are operated by the controllers on the armrests and the optional telescope foot pedal, to include the following:

- Swing
- Telescope
- Boom Lift
- Main Hoist
- Auxiliary Hoist (optional)

Individual Function Enable/Disable Buttons are included on the Function Status Bar (4, Figure 4-1) of the Superstructure Display Module (SDM) to enable and disable each of the different crane functions.

Push and release Crane Function Enable/Disable Button to enable the crane functions. Push and release the button again to disable all crane functions that are currently enabled.

NOTE: Grove recommends disabling all crane functions before roading the crane to prevent their accidental operation due to bumping the controllers.

Enabling craning functions with the Crane Function Enable/Disable Button will cause the engine speed to increase to 950 rpm. Disabling craning functions with the Crane Function Enable/Disable Button will cause the engine speed to decrease to 700 rpm.

Seat Adjustment Control Panel

The Seat Adjustment Control Panel (23, Figure 3-8) is located at the bottom, left side of the seat.

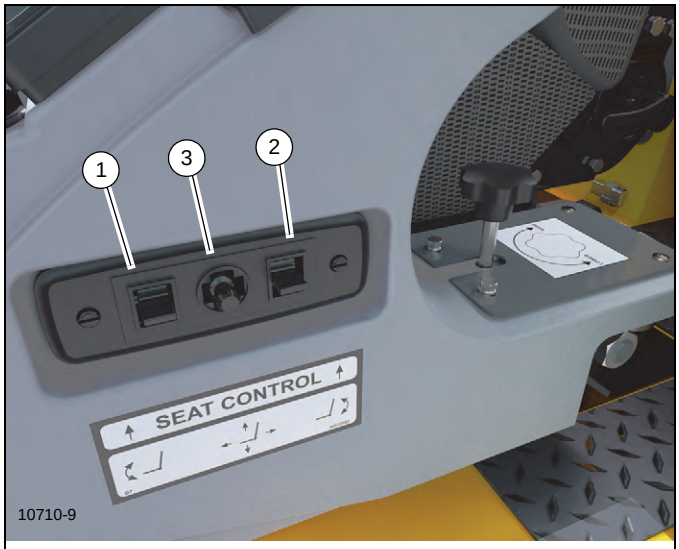
The panel has three electric switches which are used to adjust the position of the seat and armrest assembly.

The Seat Front Adjustment Switch (1, Figure 3-11) controls the height of the front of the seat. Pull switch up to raise front of seat. Push switch down to lower front of seat.

The Seat Rear Adjustment Switch (2, Figure 3-11) controls the height of the rear of the seat. Pull switch up to raise rear of seat. Push switch down to lower rear of seat.

The Seat 4-Way Adjustment Switch (3, Figure 3-11) controls the height of the seat and the seat fore-to-aft position. Pull switch up to raise the seat and armrests. Push switch down to lower the seat and armrests. Push switch forward to move the seat and armrests forward. Push switch rearward to move the seat and armrests rearward.

To adjust the seat relative to the armrests, use the Seat Slide Lever (refer to *Seat Slide Lever*, page 3-26).



Item	Description
1	Seat Front Adjustment Switch
2	Seat Rear Adjustment Switch
3	Seat 4-Way Adjustment Switch

FIGURE 3-11

Swing/Telescope or Swing/Auxiliary Hoist Controller (Dual Axis)

The Swing/Telescope or Swing/Auxiliary Hoist Controller (24, Figure 3-8) is located on the left armrest.

The controller operates the swing and telescope functions when crane is not equipped with an auxiliary hoist.

When crane is equipped with an auxiliary hoist, the controller operates the swing and auxiliary hoist functions. The telescope function moves to the Telescope Control Pedal on the floor (refer to *Telescope Control Pedal (Optional)*, page 3-31).

If crane is not equipped with an auxiliary hoist, push controller forward to extend the boom. Pull controller rearward to retract the boom. Refer to *Telescoping the Boom*, page 5-34 for more detailed information about telescoping the boom.

If crane is equipped with an auxiliary hoist, push controller forward to lower the auxiliary hoist rope (hoist down). Pull controller rearward to raise the hoist rope (hoist up). Refer to *Raising and Lowering the Auxiliary Hoist Rope*, page 5-36 for more detailed information about hoist operation.

Push controller left or right for 360 degree continuous rotation of the superstructure in the desired direction. Refer to *Swinging the Boom and Superstructure*, page 5-33 for more detail information about swinging the boom.

Move controller in a diagonal direction to operate the two functions at the same time.

Load Centering Button

The Load Centering Button (25, Figure 3-8) is located on the upper front of the left controller.

The load centering function is used to align the boom over the center of the load.

The Load Centering Button will not override the swing brake pedal.

The following conditions must be met before the Load Centering Button will operate (release the swing brake):

- Valid rigging code must be confirmed in the Rated Capacity Limiter (RCL)
- Swing function must be enabled
- Swing Controller must be in the neutral position
- Swing velocity must be less than 1.0 degree per second
- 360 turntable lock must be disengaged

When all the conditions above are met, push and hold the Load Centering Button to release the swing brake. While swing brake is released, slowly hoist up until boom centers itself over the load. Release button to re-apply the swing brake.

NOTE: When a MAXbase non-360 degree Load Chart is programmed in to the RCL or a Working Range Limiter (WRL) is defined, the swing angle must be 5 degrees or more away from the swing angle limit for the Load Centering Button to function. If the boom swing angle approaches a swing limit [within (1) degree], the load centering function will be disabled and the swing brake will reapply.

Cab Tilt Switch

The Cab Tilt Switch (26, Figure 3-8) is a thumb operated three-position, center spring return, rocker switch located on top of the left dual axis controller.

The switch is used to tilt the cab up for easy viewing of an elevated boom and load.

Push and hold the right side of switch to tilt the cab up, and push and hold the left side of switch to tilt the cab down. Release the switch when cab is tilted to the desired angle.

NOTE: Cab must be in the fully lowered position to enable the drive functions.

Seat Slide Lever

The Seat Slide Lever (27, Figure 3-8) is located at the lower front of the seat.

Push Seat Slide Lever to the left and hold to allow the seat to be moved forward or backward relative to the armrests. Release lever when the seat is in the desired position. Make sure that the seat has reached a locked position before operating the crane.

Seat Headrest

The Seat Headrest (28, Figure 3-8) is located at the top of the seat backrest.

Pull up to raise the head rest. Push down to lower the head rest.

Seat Armrest Switch

The Seat Armrest Switch (29, Figure 3-8) is located in the left armrest assembly.

The operator must have the left armrest in the lowered (working) position, enabling the switch, before any crane functions can be operated.

Crane functions can be operated while the left armrest is rotated upward and/or the operator is not seated by actuating the Deadman Switch (3, Figure 3-8) on the left or right controller.

Dual USB Port Charger

The Dual USB Port Charger (30, Figure 3-8) is located on the front of the left armrest assembly.

The 10W charger can charge two devices simultaneously.

Seat Belt

The Seat Belt (31 Figure 3-8) helps to keep the operator safe and secure inside the cab. Always fasten the seat belt before operating the crane.

Refer to *Seat Belt Care*, page 5-3 for information on how to properly care for the seat belt.

Refer to *Seat Belt Fitment*, page 5-11 for information on how to properly fasten, adjust, and wear the seat belt.

OPTIONAL SINGLE AXIS CONTROLLERS

The following single axis controllers (Figure 3-12) are available as an option on the GRT765/780 crane.

10710-10

Item	Description	Page
1	Swing Controller	3-28
2	Load Centering Button	3-28
3	Hoist Rotation Indicators	3-28
4	Telescope or Auxiliary Hoist Controller	3-28
5	Horn Button	3-28
6	Boom Lift Controller	3-28
7	Main Hoist Controller	3-28
8	Cab Tilt Switch	3-29
9	Main Hoist Speed Toggle Button	3-29
10	Auxiliary Hoist Speed Toggle Button	3-29

FIGURE 3-12

Swing Controller

The Swing Controller (1, Figure 3-12) is located on the left armrest.

Push controller forward to cause the superstructure to rotate clockwise. Pull controller rearward to cause the superstructure to rotate counterclockwise.

The superstructure can be continuously rotated 360° in the desired direction.

Refer to *Swinging the Boom and Superstructure*, page 5-33 for more detailed information about swinging the boom.

Load Centering Button

The Load Centering Button (2, Figure 3-12) is located on the upper front of the Swing Controller (1, Figure 3-12).

The load centering function is used to align the boom over the center of the load.

The Load Centering Button will not override the swing brake pedal.

The following conditions must be met before the Load Centering Button will operate (release the swing brake):

- Valid rigging code must be confirmed in the Rated Capacity Limiter (RCL)
- Swing function must be enabled
- Swing Controller must be in the neutral position
- Swing velocity must be less than 1.0 degree per second
- 360 turntable lock shall be released

When all the conditions above are met, push and hold the Load Centering Button to release the swing brake. While swing brake is released, slowly hoist up until boom centers itself over the load. Release button to re-apply the swing brake.

When a MAXbase non-360 degree Load Chart is programmed in to the RCL or a Working Range Limiter (WRL) is defined, the swing angle must be 5 degrees or more away from the swing angle limit for the Load Centering Button to function. If the boom swing angle approaches a swing limit [within (1) degree], the load centering function will be disabled and the swing brake will reapply.

Hoist Rotation Indicators

Hoist Rotation Indicators (3, Figure 3-12) for auxiliary and main hoists are located on top of each single-axis hoist controller (4, 7, Figure 3-12).

The Hoist Rotation Indicator pulses on the auxiliary or main hoist controller (4, 7) when its related hoist is operating.

The pulsing, felt by the operator's hand, indicates to the operator that the hoist is operating.

The Hoist Rotation Indicator also makes an audible click when it pulses.

The frequency of the pulses and clicks increases and decreases as the hoist speed increases and decreases.

Telescope or Auxiliary Hoist Controller

The Telescope Controller (4, Figure 3-12) is located on the left armrest.

Push controller forward to extend the boom. Pull controller rearward to retract the boom. Refer to *Telescoping the Boom*, page 5-34 for more detailed information about telescoping the boom.

When the crane is equipped with the optional Auxiliary Hoist, the controller is used to raise and lower the auxiliary hoist rope. The telescope function moves to the Telescope Control Pedal on the floor (refer to *Telescope Control Pedal (Optional)*, page 3-31).

When used for the auxiliary hoist function, push controller forward to lower the auxiliary hoist rope (hoist down). Pull controller rearward to raise the hoist rope (hoist up). Refer to *Raising and Lowering the Auxiliary Hoist Rope*, page 5-36 for more detailed information about hoist operation.

Horn Button

A Horn Button (5, Figure 3-12) is located on the upper front of the Boom Lift Controller (3, Figure 3-12).

Push button to operate the horn.

A Horn Button is also located on the end of the Turn Signal Lever (2, Figure 3-2).

Boom Lift Controller

The Boom Lift Controller (6, Figure 3-12) is located on the right armrest.

Push controller forward to lower the boom. Pull controller rearward to raise the boom. Refer to *Raising and Lowering the Boom*, page 5-34 for more detailed information about raising and lowering the boom.

Main Hoist Controller

The Main Hoist Controller (7, Figure 3-12) is located on the right armrest.

Push controller forward to lower the hoist rope (hoist down). Pull controller rearward to raise the hoist rope (hoist up). Refer to *Raising and Lowering the Main Hoist Rope*, page 5-36 for more detailed information hoist operation.

Cab Tilt Switch

The Cab Tilt Switch (8, Figure 3-12) is a three-position, center spring return, rocker switch located on the right armrest.

The switch is used to tilt the cab up for easy viewing of an elevated boom and load.

Push and hold the bottom of switch to tilt the cab up, and push and hold the top of switch to tilt the cab down. Release the switch when cab is tilted to the desired angle.

NOTE: Cab must be in the fully lowered position to enable the drive functions.

Main Hoist Speed Toggle Button

The Main Hoist Speed Toggle Button (9, Figure 3-12) is a push button switch located on the right armrest.

Push and release the button one time to change main hoist speed to high – push button again to return main hoist speed to normal.

NOTE: Hoist speed cannot be changed while hoist is operating. Before changing hoist speed, the controller must be placed in the Neutral (center) position.

Hoist Speed Indicators (6, 7, Figure 4-38) for standard and high speeds show on the Function Status Bar of the Superstructure Display Module (SDM). They give a visual indication of the current speed selected for the main and optional auxiliary hoists.

Auxiliary Hoist Speed Toggle Button (Optional)

The optional Auxiliary Hoist Speed Toggle Button (10, Figure 3-12) is a push button switch located on the right armrest.

Push and release the button one time to change auxiliary hoist speed to high – push button again to return auxiliary hoist speed to normal.

NOTE: Hoist speed cannot be changed while hoist is operating. Before changing hoist speed, the controller must be placed in the Neutral (center) position.

Hoist Speed Indicators (6, 7, Figure 4-38) for standard and high speeds show on the Function Status Bar of the Superstructure Display Module (SDM). They give a visual indication of the current speed selected for the main and optional auxiliary hoists.

FOOT PEDAL CONTROLS AND FLOOR MAT

The foot pedal controls (Figure 3-13) include the swing brake pedal, telescope control pedal, service brake pedal, and throttle pedal.

10710-11

Item	Description	Page
1	Swing Brake Pedal	3-31
2	Telescope Control Pedal	3-31
3	Service Brake Pedal	3-31
4	Throttle Pedal	3-31
5	Floor Mat	3-31

FIGURE 3-13

Swing Brake Pedal

The Swing Brake Pedal (1, Figure 3-13) is located on the left side of the cab floor.

Push Swing Brake Pedal to slow and stop the swing motion.

Braking increases or decreases proportionately with the amount of foot pressure applied to the pedal.

Telescope Control Pedal (Optional)

The Telescope Control Pedal (2, Figure 3-13) is the second pedal from the left on the cab floor.

When crane is equipped with an optional auxiliary hoist, the telescope control function moves from the Controller on the armrest to the Telescope Control Pedal.

Push top of Telescope Control Pedal to extend the boom. Push bottom of pedal to retract the boom.

The speed at which the boom extends or retracts is proportional to the amount of foot pressure applied to the pedal.

Service Brake Pedal

The Service Brake Pedal (3, Figure 3-13) is the second pedal from the right on the cab floor.

Push Service Brake Pedal to apply the service brakes.

Braking increases or decreases proportionately with the amount of foot pressure applied to the pedal.

Throttle Pedal

The Throttle Pedal (4, Figure 3-13) is located on the right side of the floor.

Push Throttle Pedal to increase engine speed.

Engine speed increases or decreases proportionately with the amount of foot pressure applied to the pedal.

Floor Mat

A Floor Mat (5, Figure 3-13) is provided to make cleaning the cab floor easier.

When dirty, remove floor mat from cab. Clean using water and a soft bristle brush.

WARNING

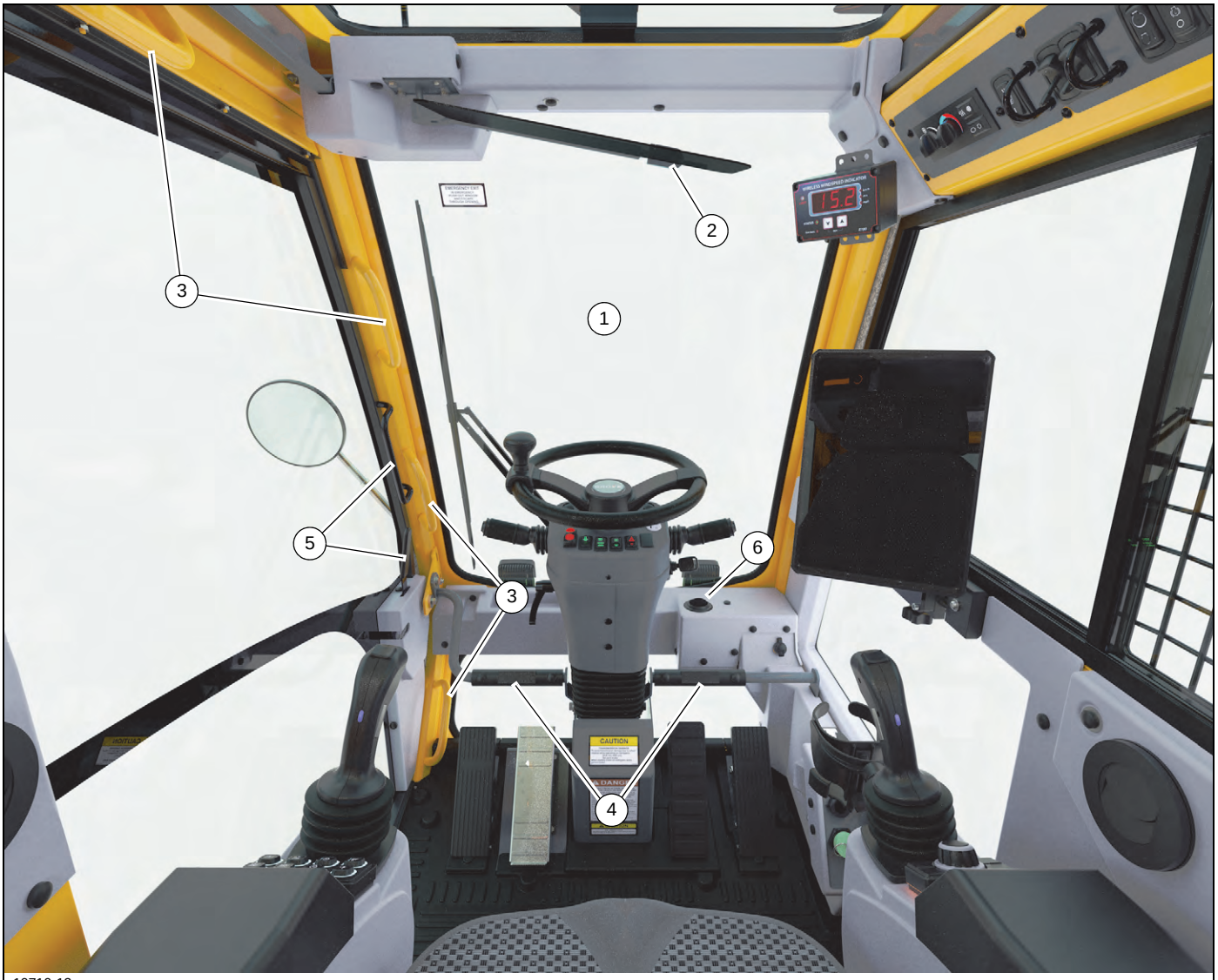
Loss of Crane Control!

A floor mat that is not positioned properly can interfere with the operation of the foot pedals, resulting in a loss of crane control.

Before operating the crane, make sure that the floor mat is in the correct position and does not interfere with the operation of the foot pedals.

FRONT OF CAB – CONTROLS AND FEATURES

Controls and features located at the front of the cab (Figure 3-14) include the front windshield/emergency exit, sun visor, grab handles, and foot rests.



10710-12a

Item	Description	Page
1	Front Windshield/Emergency Exit	3-33
2	Sun Visor	3-33
3	Grab Handles	3-33
4	Foot Rests	3-33
5	Door Release Handle and Grab Handle	3-33
6	Defrost Vent	3-33

FIGURE 3-14

Front Windshield/Emergency Exit

The Front Windshield is the Emergency Exit (1, Figure 3-14).

In an emergency, if the door is blocked or cannot be opened, push out windshield and escape through opening.

Sun Visor

The Sun Visor (2, Figure 3-14) is located at the front of the cab toward the top of the windshield.

The sun visor can be folded down to reduce sunlight coming into the cab through the front windshield.

The sun visor can be rotated 90° to reduce sunlight coming into the cab through the door.

Grab Handles

Grab Handles (3, Figure 3-14) are located around the entrance to the cab to help with entering and exiting the cab.

Always maintain a three-point contact with the crane when entering and exiting.

Foot Rests

Foot Rests (4, Figure 3-14) are located above the foot pedals, to the left and right of the steering column.

The foot rests can be used by the operator to get a more comfortable position when performing craning functions.

Door Release Handle and Grab Handle

The Door Release Handle and Grab Handle (5, Figure 3-14) are located on the door at the front of the cab.

Push Grab Handle forward to closed the door.

To open the door, first release the door latch by pulling rearward on the Door Release Handle, then pull door fully rearward using the Grab Handle. Make sure door is slid to the fully open position and locks in to position before operating the crane with an open door.

Defrost Vent

The Defrost Vent (6, Figure 3-14) directs air coming from the heating and air conditioning system on to the front windshield to help defrost the window.

Make sure vent is not covered up before operating the heating and air conditioning system.

REAR OF CAB – CONTROLS AND FEATURES

Controls and features located at rear of the cab (Figure 3-15) include the radio, fan, fire extinguisher, user manual holder, fuse and relay panel, and limit bypass switch for non-CE certified cranes.

10710-13

Item	Description	Page	Item	Description	Page
1	Bluetooth Digital Media Receiver with AM/FM Radio (Optional)	3-35	6	User Manual Holder	3-35
2	Speakers (Optional)	3-35	7	Fuse and Relay Panel	3-36
3	-29°C (-20°F) Crane Operation Cut-Off Controller (Optional)	3-35	8	Maintained Limit Bypass Switch (Non-CE Certified Cranes)	3-37
4	Fan	3-35	9	First Aid Kit (CE Certified Cranes)	3-37
5	Fire Extinguisher	3-35	10	Rear Window	3-37

FIGURE 3-15

Bluetooth Digital Media Receiver with AM/FM Radio (Optional)

An optional Bluetooth Digital Media Receiver with AM/FM Radio (1, Figure 3-15) is located at the upper left rear corner (as seated in the operator seat) of the cab.

Refer to the vendor user manual, shipped with the crane, for information about the operation of the Bluetooth Digital Media Receiver with AM/FM Radio.

Speakers (Optional)

Two Speakers (2, Figure 3-15) are located at the upper rear corners of the cab when the crane is equipped with the optional radio.

-29°C (-20°F) Crane Operation Cut-Off Controller (Optional)

The optional -29°C (-20°F) Crane Operation Cut-Off Controller (3, Figure 3-15) measures the outside ambient temperature. When an outside ambient temperature below -29°C (-20°F) is measured, the Crane Control System (CCS) will lock out the following crane functions:

- Boom Telescope
- Boom Lift
- Swing
- Main and Auxiliary Hoist

When the system is actively locking out the crane functions, the -29°C (-20°F) Temperature Alert (APPENDIX C) in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM) comes on.

When the outside ambient temperature rises above -29°C (-20°F), the system will again allow normal operation of the crane functions and the temperature alert will go off.

Fan

The Cab Circulating Fan (4, Figure 3-15) is located at the right rear side of the cab.

The fan is situated on a swivel that allows it to be adjusted.

The switch on the fan base controls the fan. It has high, low and off positions.

Fire Extinguisher

A Fire Extinguisher (5, Figure 3-15) is located at the left rear (as seated in the operator seat) corner of the cab.

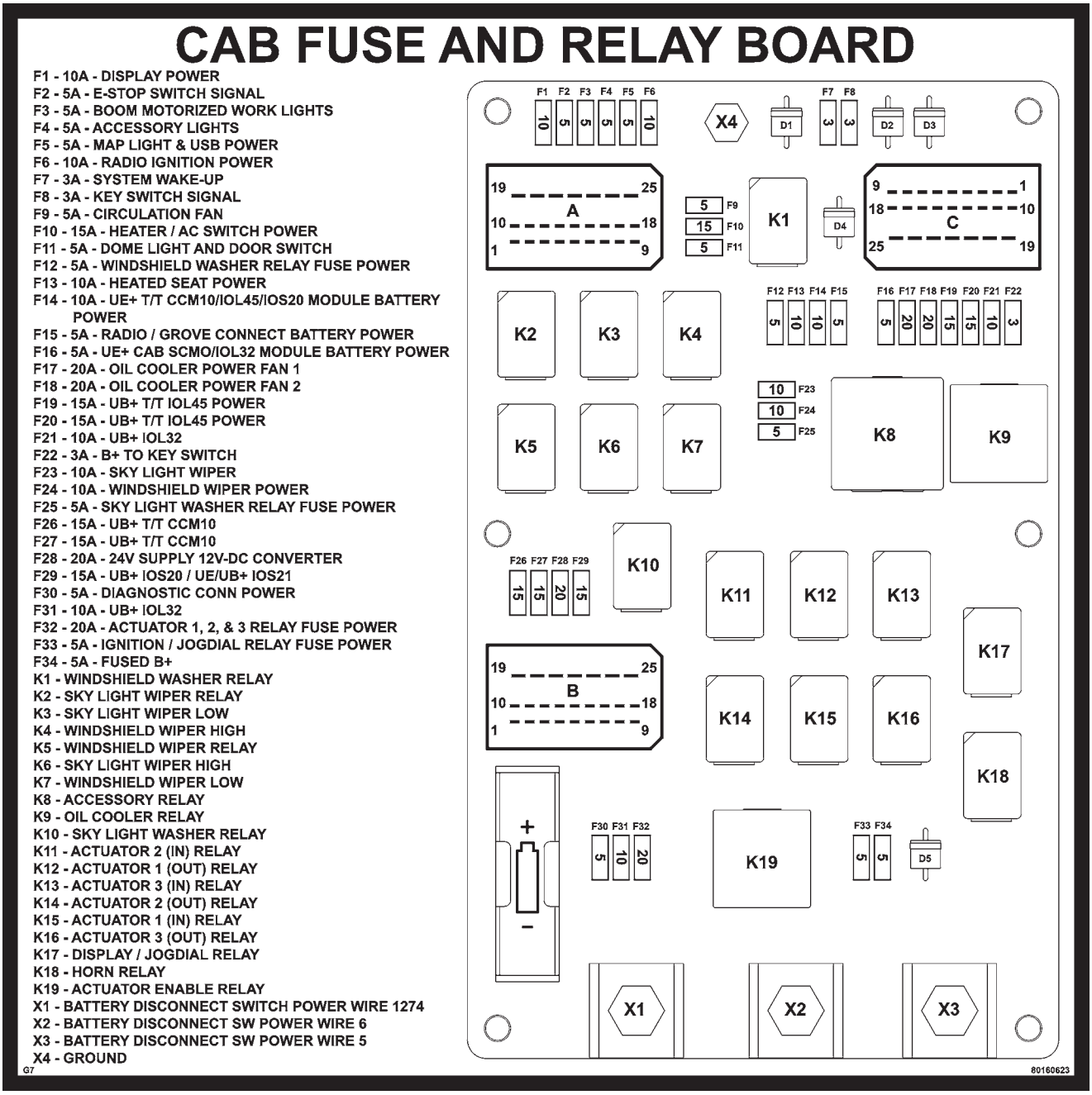
User Manual Holder

A User Manual Holder (6, Figure 3-15) is located at the lower left (as seated in the operator seat) corner of the cab for storing manuals such as this *Operator Manual* and the crane *Load Chart Manual*.

Fuse and Relay Panel – Cab

The Fuse and Relay Panel (7, Figure 3-15) is located behind the operator seat in the right side upper compartment.

The cab fuse and relay panel contains the fuses and relays listed in Figure 3-16.



10741

FIGURE 3-16

Maintained Limit Bypass Switch (Non-CE Certified Cranes)

WARNING

Overload Hazard!

The Limit Bypass Switch prevents the function lockouts from activating.

When the Limit Bypass Switch is activated, the operator must make sure that the crane is not overloaded.

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

The Rated Capacity Limiter (RCL) system, when programmed accurately, will lock out the following crane functions—boom up/down, telescope extend, and hoist up—when a lift is attempted at or above crane capacity, or when a two-block condition exists.

Locking out these functions prevents the overload or two-block condition from worsening.

The Rear Maintained Limit Bypass Switch (8, Figure 3-15) is a two-position, maintained type key switch located behind the operator seat.

During maintenance or troubleshooting work, or to recover the crane, turn switch clockwise to bypass the following limiter systems and their crane function lockouts:

- RCL System (boom up/down, telescope extend, hoist up)
- Anti-Two-Block System (boom up/down, telescope extend, hoist up)
- 3rd Wrap Limiter System (hoist down)
- Working Range Limiter (WRL) System
- Carrier Avoidance System
- -29°C Temperature Limiter System (optional)

When the switch is turned to the bypass position, the Maintained Limit Bypass Switch Alert (RCL Bypass 3) (APPENDIX C) will show in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM).

All craning functions locked out are bypassed while key switch is in the clockwise position.

Overriding the RCL with this switch should only be done by a qualified operator or technician.

NOTE: Before powering up the crane, make sure the Limit Bypass Switch is in the Normal key switch position (counter-clockwise) and not the Bypass position (clockwise) to prevent an error code from being generated.

First Aid Kit (CE Certified Cranes)

A First Aid Kit (9, Figure 3-15) is located in a pouch on the back of the operator's seat on CE Certified cranes.

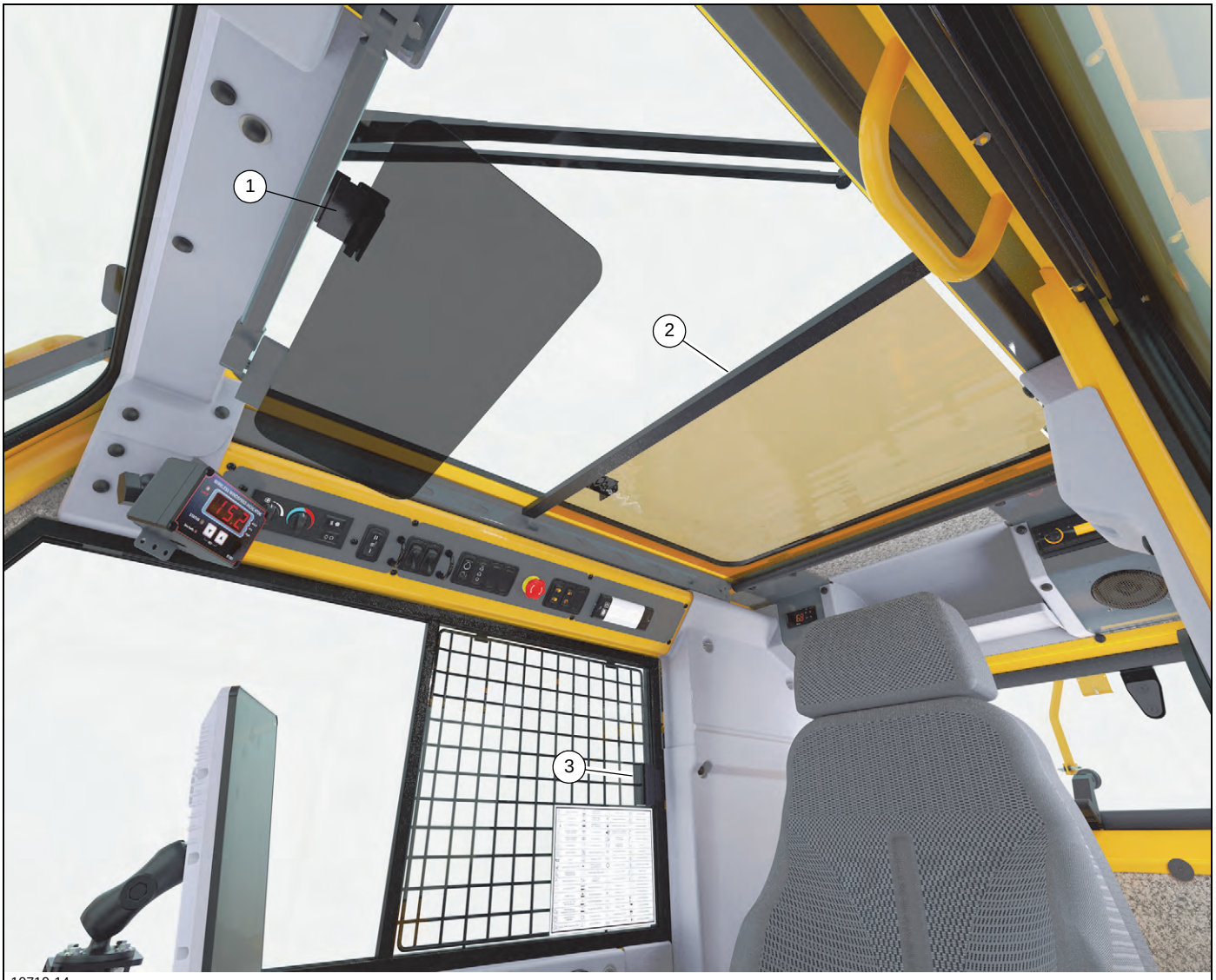
Rear Window

The Rear Window (10, Figure 3-15) can be opened for ventilation.

To open, push outward on the handle located at the bottom of the window.

RIGHT SIDE WINDOW AND OVERHEAD – CONTROLS AND FEATURES

The right window and skylight window (Figure 3-17) can be opened for ventilation. The skylight sun shade can be adjusted to multiple positions to allow varying amounts of light into the cab.



10710-14

Item	Description	Page
1	Skylight Window Latch (Non-CE Certified Cranes)	3-39
2	Skylight Sun Shade	3-39
3	Right Side Window Latch	3-39

FIGURE 3-17

Skylight Window Latch (Non-CE Certified Cranes)

The Skylight Window Latch (1, Figure 3-17) is located at the front of the window.

Squeeze latch and slide window to the rear to open. To close, slide window forward until the latch engages.

Skylight Sun Shade

The Skylight Sun Shade (2, Figure 3-17) reduces direct sunlight coming into the cab.

The sun shade is self-retracting, and can be set to screen all sunlight coming into the cab. The sun shade can also be adjusted to reduce sunlight in the cab by moving it rearward and securing it into the notches provided.

Right Side Window Latch

The window on the right side of the cab can be opened for ventilation.

Squeeze latch (3, Figure 3-17) to release and slide the window forward. To close, slide window rearward until the latch engages.

SUPERSTRUCTURE – CONTROLS AND FEATURES

The following sections describe the controls and features found on the crane superstructure.

Counterweight Control Panels (Optional)

A hydraulic counterweight removal/installation system is available as an option.

The counterweight (2, Figure 3-18) is removed and installed using hydraulic cylinders that are controlled by the Counterweight Control Panel. The counterweight is held in place on the superstructure by locking pins with pin clips.

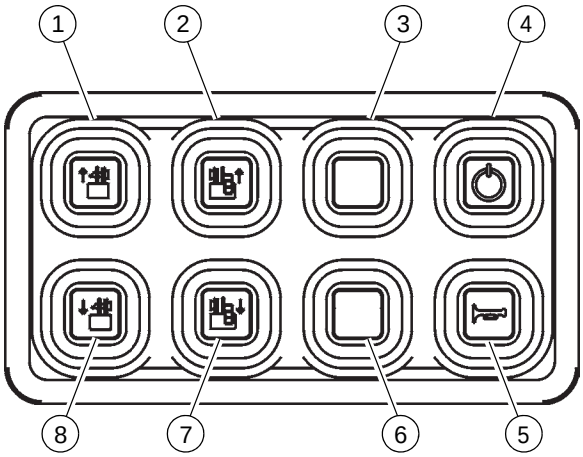
There are two Counterweight Control Panels (1, Figure 3-18), one on each side of the superstructure near the counterweight. Only one control panel can be used at a time.

10738

FIGURE 3-18

The following section provides a description of the buttons which makeup the Counterweight Control Panel. For complete procedures and precautions for how to remove and install the counterweight, refer to *Counterweight Removal and Installation – Hydraulic Version*, page 6-63.

Each Counterweight Control Panel has six push-button switches (Figure 3-19).



8658-2

FIGURE 3-19

Item	Description
1	Right Counterweight Cylinder Raise Button
2	Left Counterweight Cylinder Raise Button
3	Blank (not used)
4	Function Enable Button
5	Horn Button
6	Blank (not used)
7	Left Counterweight Cylinder Lower Button
8	Right Counterweight Cylinder Lower Button

The Counterweight Control Panels will only function when the following conditions are met:

- Parking brake is applied
- Swing brake s applied
- Counterweight is positioned over the counterweight stand on front of crane

RIGHT COUNTERWEIGHT CYLINDER RAISE BUTTON

Push and hold Right Counterweight Cylinder Raise Button (1, Figure 3-19) to raise the right side of the counterweight. Release the button when right side of the counterweight is at the desired position.

LEFT COUNTERWEIGHT CYLINDER RAISE BUTTON

Push and hold Left Counterweight Cylinder Raise Button (2, Figure 3-19) to raise the left side of the counterweight. Release the button when left side of the counterweight cylinder is at the desired position.

BLANK BUTTON

The Blank Button (3, Figure 3-19) is not used.

FUNCTION ENABLE BUTTON

Push and release the Function Enable Button (4, Figure 3-19) to enable the other counterweight function buttons on the control panel. The Function Enable Button must first be pushed and released to enable the Left/Right Counterweight Cylinder Raise/Lower Function Buttons (1, 2, 7, 8, Figure 3-19) on the control panel.

If a counterweight function button is not pushed within 5 seconds of pushing the Function Enable Button, the system will time-out. If this occurs, operator can push and release the Function Enable Button again, then push the desired Left/Right Counterweight Cylinder Raise/Lower Function Button(s).

HORN BUTTON

The Horn Button (6, Figure 3-19) is always active and can be pushed at any time without first pushing the Function Enable Button (4).

Always actuate the horn before initiating any counterweight removal/installation operation.

BLANK BUTTON

The Blank Button (7, Figure 3-19) is not used.

LEFT COUNTERWEIGHT CYLINDER LOWER BUTTON

Push and hold Left Counterweight Cylinder Lower Button (8, Figure 3-19) to lower the left side of the counterweight. Release the button when left side of the counterweight is at the desired position.

RIGHT COUNTERWEIGHT CYLINDER LOWER BUTTON

Push and hold Right Counterweight Cylinder Lower Button (9, Figure 3-19) to lower the right side of the counterweight. Release the button when right side of the counterweight is at the desired position.

Bridging Switch (CE Certified Cranes)

WARNING

Overload Hazard!

The Bridging Switch prevents the function lockouts from activating.

When the Bridging Switch is activated, the operator must make sure that the crane is not overloaded.

Do not operate crane with RCL overridden during normal operations.

The Rated Capacity Limiter (RCL) system, when programmed accurately, will lock out the following crane functions—boom up/down, telescope extend, and hoist up—when a lift is attempted at or above crane capacity, or when a two-block condition exists.

Locking out these functions prevents the overload or two-block condition from worsening.

The Bridging Switch is located inside a key-locked single-door enclosure (Figure 3-20) attached to the outside rear of the operator cab.

During maintenance or troubleshooting work, or to recover the crane, push and release the button switch to bypass the following limiter systems and their crane function lockouts:

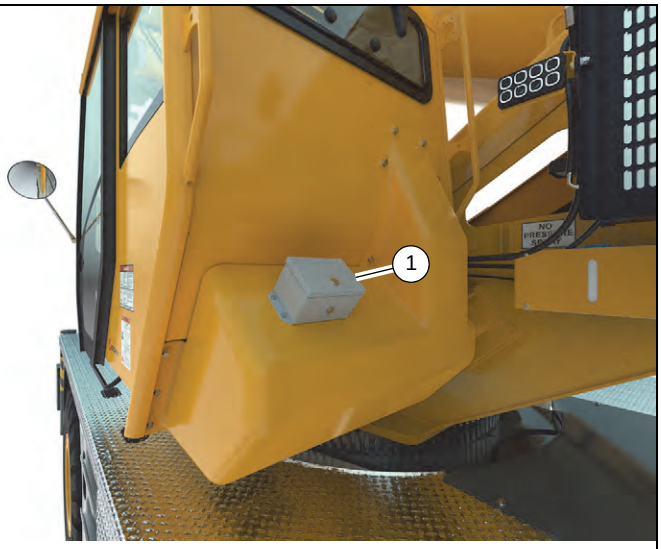
- RCL System (boom up/down, telescope extend, hoist up)
- Working Range Limiter (WRL) System
- Carrier Avoidance System

Upon pushing the Bridging Switch, the swing left/right function pressure is reduced to 25%. The boom down, hoist up, and telescope extend function speeds are reduced to 15% when actuated. Boom up, hoist down, and telescope retract function speeds are not reduced.

When the button is pushed, the Bridging Switch Alert (RCL Bypass 3) (APPENDIX C) will show in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM).

All crane function lockouts are bypassed until one of the following occurs:

- Bridging Switch is again pushed and released.
- 30 minutes have passed since the Bridging Switch was initially pushed, and controllers are in the neutral position.
- Engine is stopped.



10710-15

FIGURE 3-20

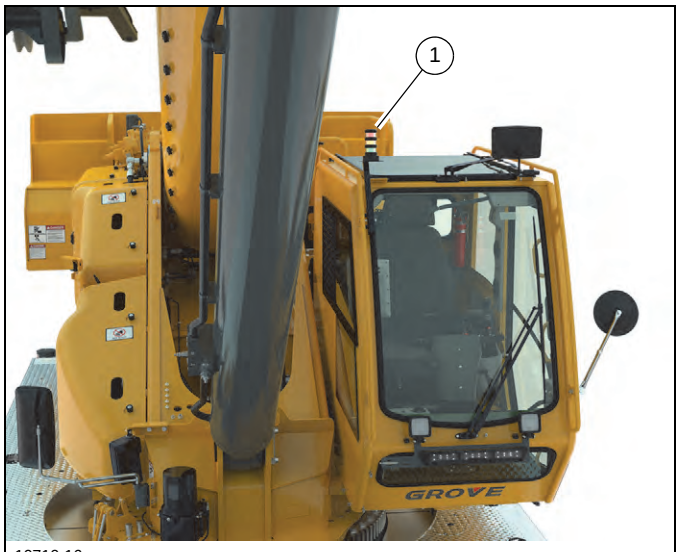
External RCL Light Tower (Optional)

The optional External Rated Capacity Limiter (RCL) Light Tower (1, Figure 3-21) is located on the outside upper right corner of the crane cab.

The External RCL Light Tower is an operational aid. The light tower works with the RCL system to warn the operator and outside personnel of an approaching overload condition that could cause equipment damage, personal injury, or death.

The lights in the light tower come on in the following manner:

- Green LED – when the green LED is on, the load being lifted is less than 90% of crane RCL programmed capacity.
- Yellow LED – when the yellow LED is on, the load being lifted is between 90% to 100% of crane RCL programmed capacity.
- Red LED – when the red LED is on, the load being lifted is greater than 100% of crane RCL programmed capacity.



10710-16

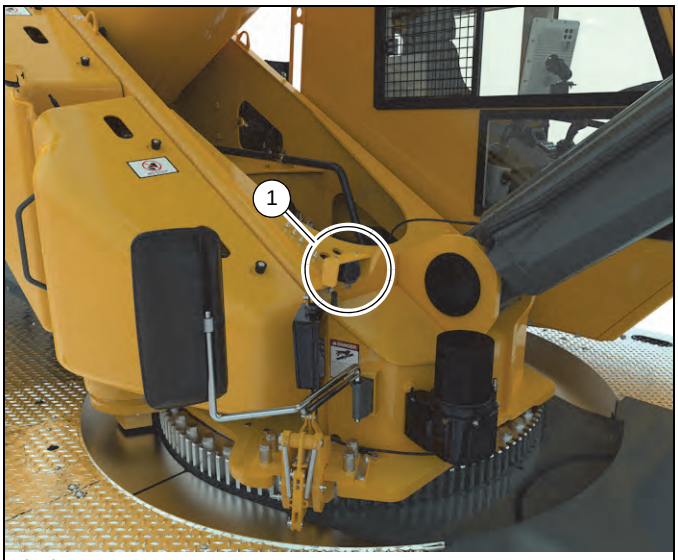
FIGURE 3-21

External RCL Alarm (Optional)

The optional External Rated Capacity Limiter (RCL) Alarm (1, Figure 3-22) is mounted to the superstructure on the right side of the crane.

When accurately programmed, the RCL system will cause the audible External RCL Alarm to come on when an overload condition is sensed (load is ≥100% of capacity).

The alarm also comes on when a limit bypass button or switch is in the bypass mode.



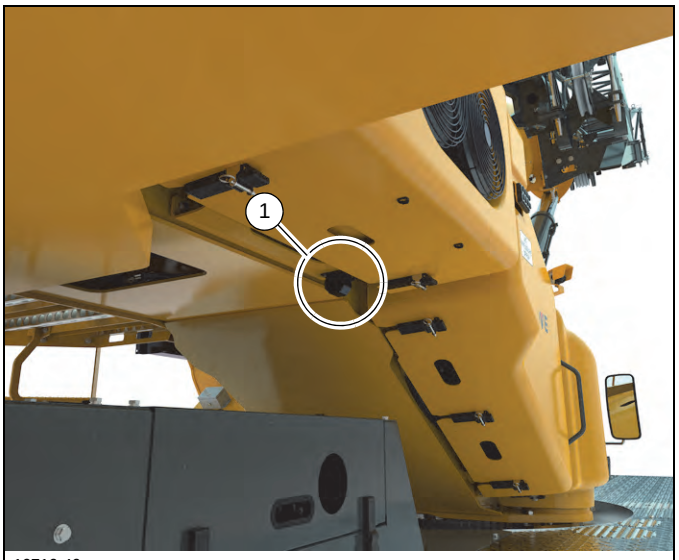
10710-41

FIGURE 3-22

External Superstructure Swing Alarm (Optional)

The optional External Superstructure Swing Alarm (1, Figure 3-23) is mounted underneath the superstructure.

The audible Superstructure Swing Alarm is only on when the superstructure is rotating.



10710-40

FIGURE 3-23

The operation of the External Superstructure Swing Alarm is not affected by the internal cab audible alarm (buzzer) and swing lockouts related to the following functions:

- Working Range Limiter (WRL)
- MAXbase

Strobe Light or Beacon

The standard Strobe Light or Beacon (1, Figure 3-24) is located at the left rear of the superstructure, near the hoist.

The Beacon is on when the Ignition Switch is in the RUN (I) position.

A second beacon (2) is available as an option.

10710-17

FIGURE 3-24

Cab-Mounted Work Lights

Adjustable Cab-Mounted Work Lights (1, Figure 3-25) are located on the front of the cab.

The Cab-Mounted Work Lights are switched on and off using the Work Lights Switch and the Work Lights function panel on the Superstructure Display Module (SDM).

The work lights must first be enabled in the Work Lights function panel before they can be toggled on and off using the Work Lights Switch.

Refer to the following sections for more information about controlling the work lights:

- *Work Lights Switch*, page 3-10
- *Work Lights*, page 4-96

10710-16

FIGURE 3-25

Boom-Mounted Motorized Work Lights (Optional)

The optional Boom-Mounted Motorized Work Lights (1, Figure 3-26) are mounted to the bottom of the boom.

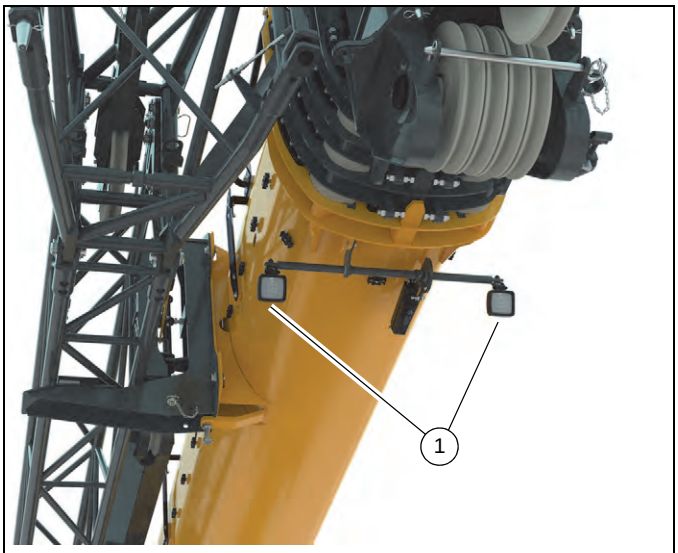
The position of the work lights is adjusted by the *Boom-Mounted Work Lights Rotate Switch (Optional)*, page 3-10.

The Boom-Mounted Motorized Work Lights are switched on and off using the Work Lights Switch and the Work Lights function panel on the Superstructure Display Module (SDM).

The work lights must first be enabled in the Work Lights function panel before they can be toggled on and off using the Work Lights Switch.

Refer to the following sections for more information about controlling the work lights:

- *Work Lights Switch*, page 3-10
- *Work Lights*, page 4-96



10710-19

FIGURE 3-26

3

Superstructure-Mounted Work Lights

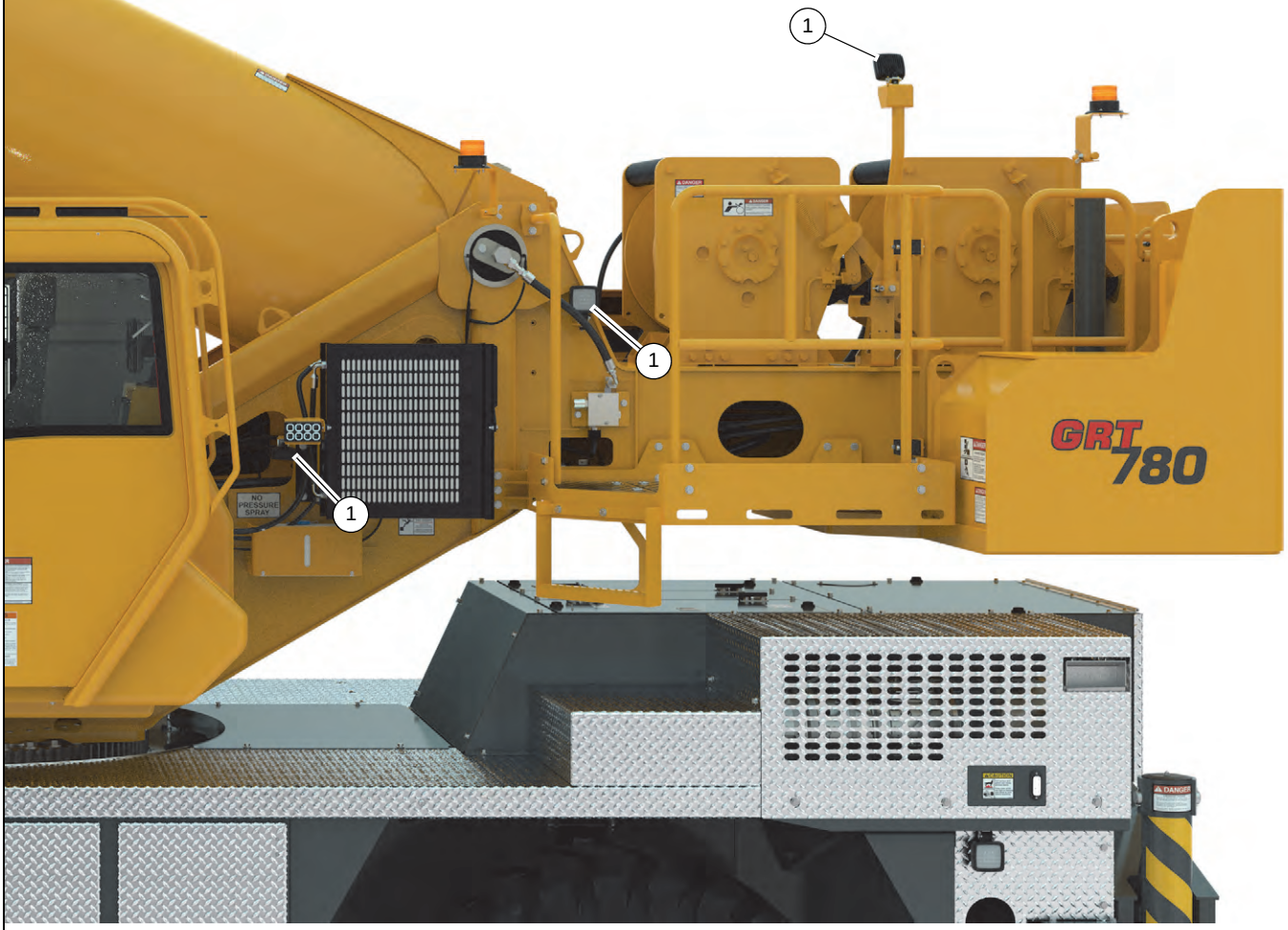
The optional Superstructure-Mounted Work Lights (1, Figure 3-27) are mounted on the left side of the superstructure behind the cab.

The Superstructure-Mounted Work Lights are individually switched on and off using the Work Lights Switch and the Work Lights function panel on the Superstructure Display Module (SDM).

The work light(s) must first be enabled in the Work Lights function panel before they can be toggled on and off using the Work Lights Switch.

Refer to the following sections for more information about controlling the work lights:

- *Work Lights Switch*, page 3-10
- *Work Lights*, page 4-96



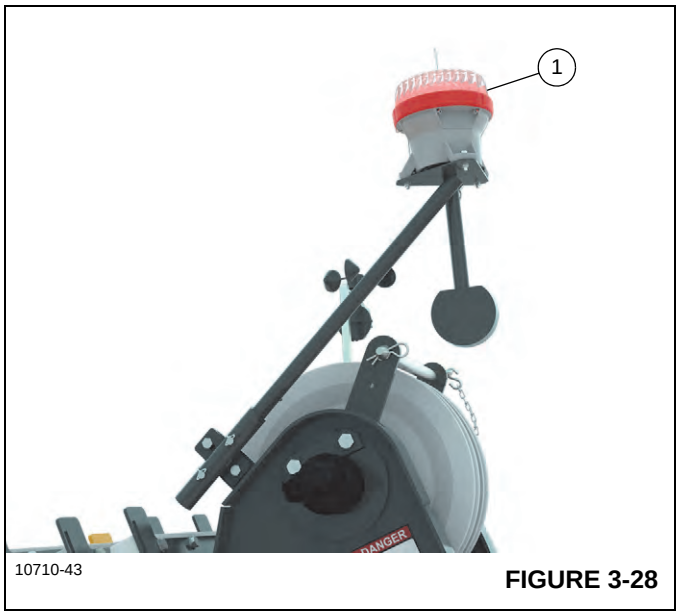
10710-36

FIGURE 3-27

Boom Position Indicator Light (Optional)

The optional Boom Position Indicator Light (1, Figure 3-28) mounts to the tip of the boom nose.

An ON/OFF switch is located on the bottom of the light. When the Boom Position Indicator Light is switched ON, an integral sensor to the light will cause it to automatically come on at dusk and go off at dawn.



10710-43

FIGURE 3-28

NOTE: To prevent damage, Boom Position Indicator Light should always be removed and stored before driving on rough terrain and transporting the crane.

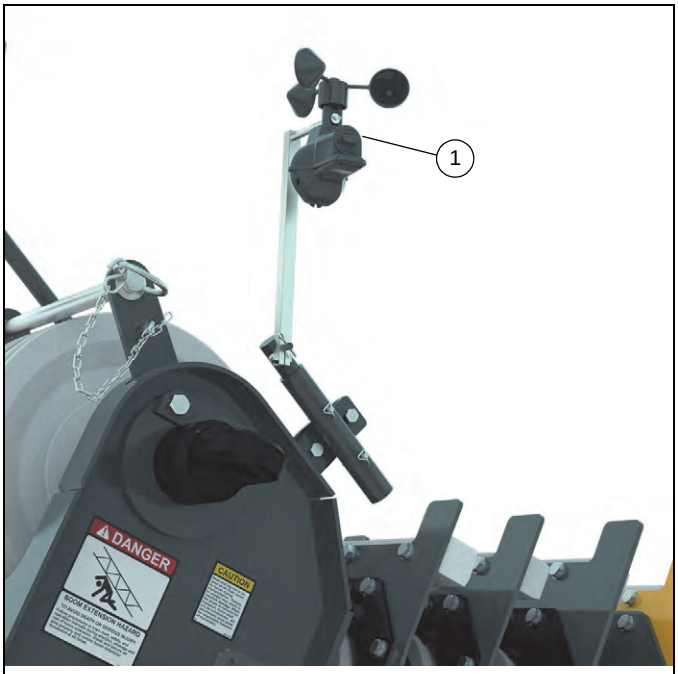
Anemometer (Optional)

The optional Anemometer mounts to the tip of boom nose and measures wind speed.

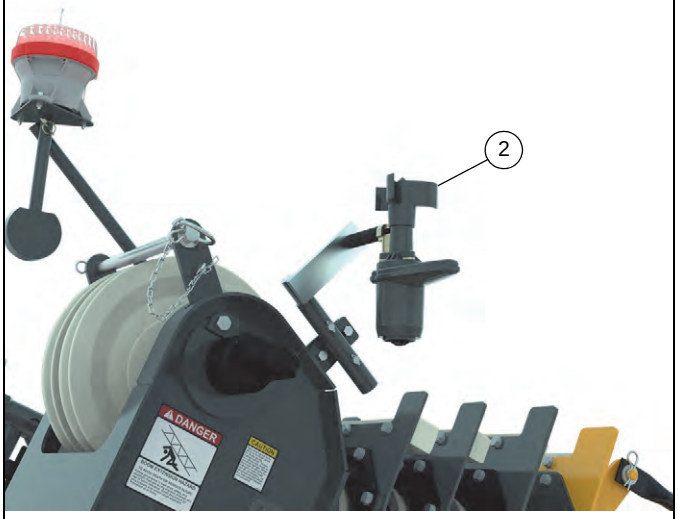
Grove offers an anemometer for non-CE Certified cranes (1, Figure 3-29) and another for CE Certified cranes (2).

The Anemometer wirelessly communicates the wind speed information to the Wind Speed Indicator.

The Wind Speed Indicator readout is located on the Rated Capacity Limiter (RCL) Monitoring Screen of the Superstructure Display Module (SDM) on non-CE Certified cranes (refer to *RCL Monitoring View Screen*, page 4-143). CE Certified cranes have a separate Wind Speed Indicator device mounted inside the cab in the upper right hand corner [refer to *Wind Speed Indicator (CE Certified Cranes)*, page 3-16].



10710-44



10710-45

FIGURE 3-29

NOTE: To prevent damage, Anemometer should always be removed and stored before driving on rough terrain and transporting the crane.

Automatic Superstructure Lubrication System (Optional)

The optional Automatic Superstructure Lubrication System has a two liter reservoir that supplies grease for lubricating the swing bearing, left cylinder lower pivot, and boom pivot.

When the lubrication system is low on grease, the AutoLube Level Low Alert (APPENDIX C) in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM) comes on.

CARRIER – CONTROLS AND FEATURES

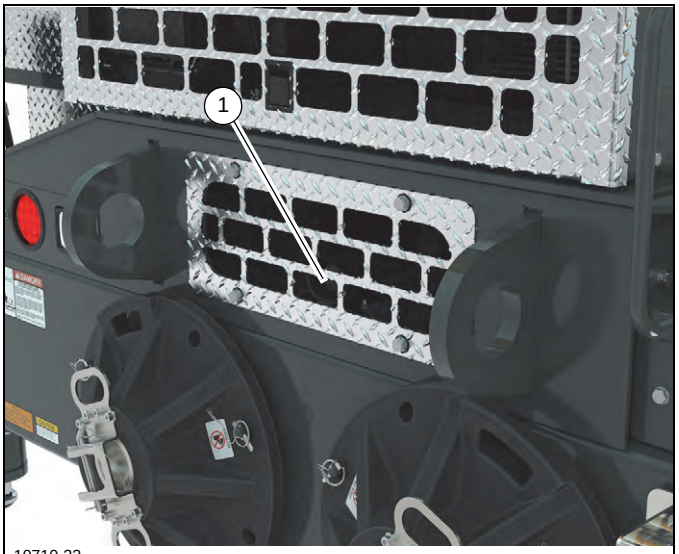
The following sections describe the controls and features found on the crane carrier.

Backup Alarm

The Backup Alarm is an audio system used to warn personnel in the area that the crane is backing up.

The Backup Alarm comes on when the transmission is placed in reverse.

The Backup Alarm is installed on the rear of the carrier (1, Figure 3-30).



10710-33

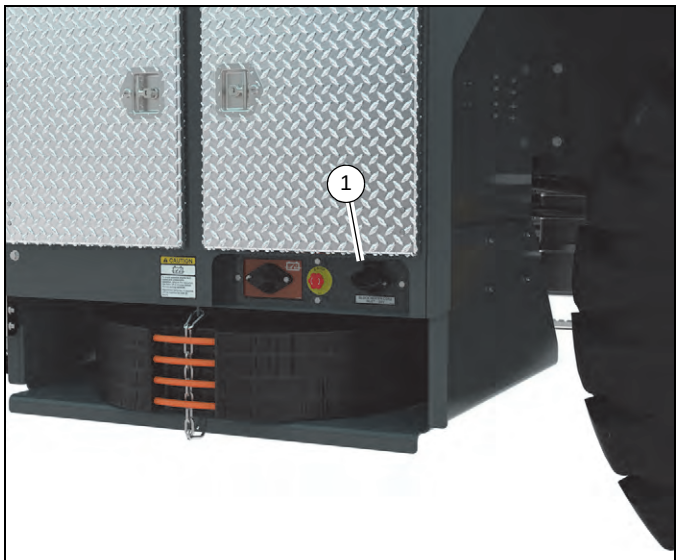
FIGURE 3-30

120V/240V Engine Block Heater and Outlet

The crane is equipped with a standard 120V engine block heater for cold weather operation.

The electrical outlet (1, Figure 3-31) for connecting power to the engine block heater is located on the left side of the crane near the battery disconnect switch.

A 240V engine block heater and outlet is available in place of the 120V version.



10710-18

FIGURE 3-31

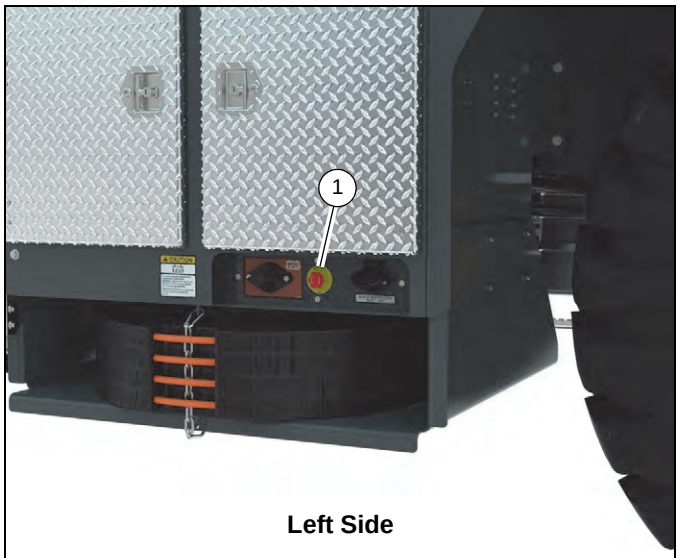
Emergency Stop Buttons (Optional)

The optional Emergency Stop Buttons (1, Figure 3-32 and Figure 3-33) are located on the left and right sides of the carrier.

Push in the red button to stop the engine and all crane functions.

When the Emergency Stop Button is pushed in, the Emergency Stop Button Pushed Alert (APPENDIX C) in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM) comes on.

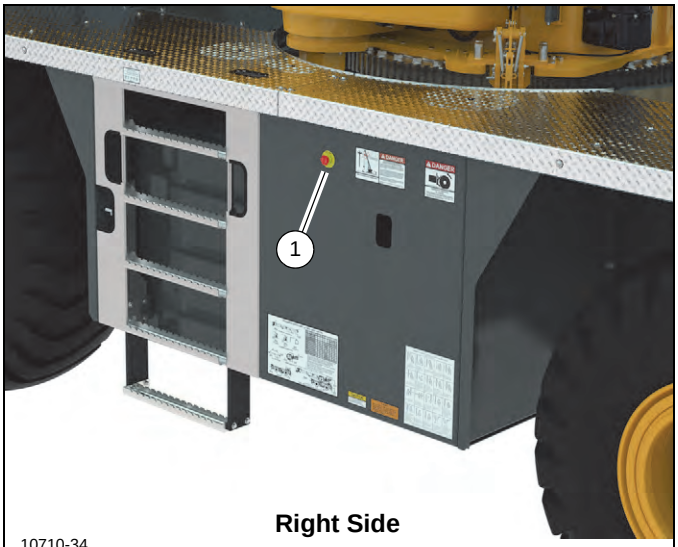
Rotate and pull out button to allow the engine to be re-started and resume normal operation.



Left Side

10710-18

FIGURE 3-32



Right Side

10710-34

FIGURE 3-33

3

Battery Disconnect Switch

The Battery Disconnect Switch (1, Figure 3-34) is located on the left side of the carrier.

The switch is a two-position ON/OFF rotary switch used to disconnect power from the batteries to the crane.

Turn switch clockwise to the ON position and connect the batteries. Turn switch counterclockwise to the OFF position and disconnect the batteries.

Always disconnect batteries using the Battery Disconnect Switch if crane is scheduled to be inactive for over 24 hours.

The Battery Disconnect Switch has an integral lock feature that allows the switch to be held in the ON position (batteries connected) or OFF position (batteries disconnected) when used with a padlock (useful for lockout/tagout programs).

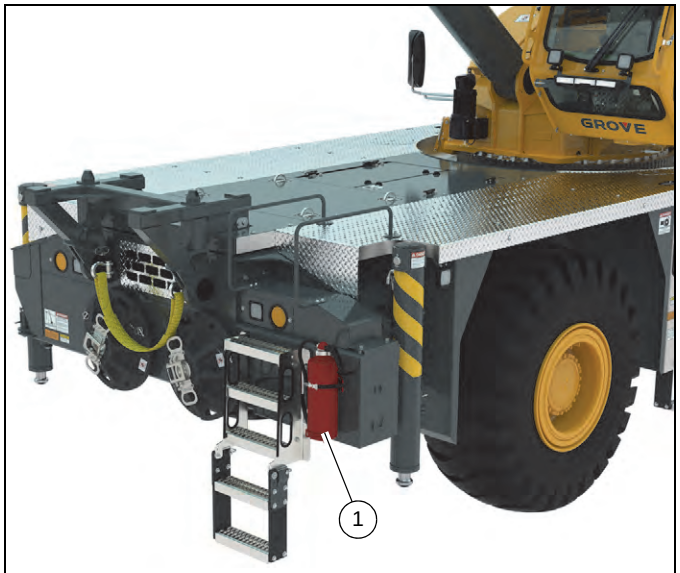
NOTE: To avoid possible engine fault codes and undesirable operation, make sure that the Ignition Switch has been in the 0 (OFF) position for 2 minutes before disconnecting the batteries to the crane.

10710-18

FIGURE 3-34

Fire Extinguisher (CE Certified Cranes)

A Fire Extinguisher (1, Figure 3-35) is mounted to the outrigger box at the left-front corner of the crane on CE Certified cranes

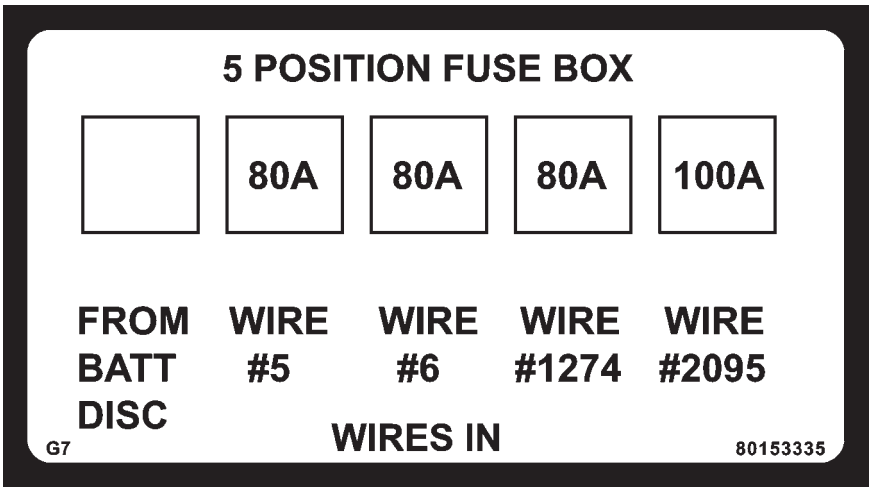


10710-38

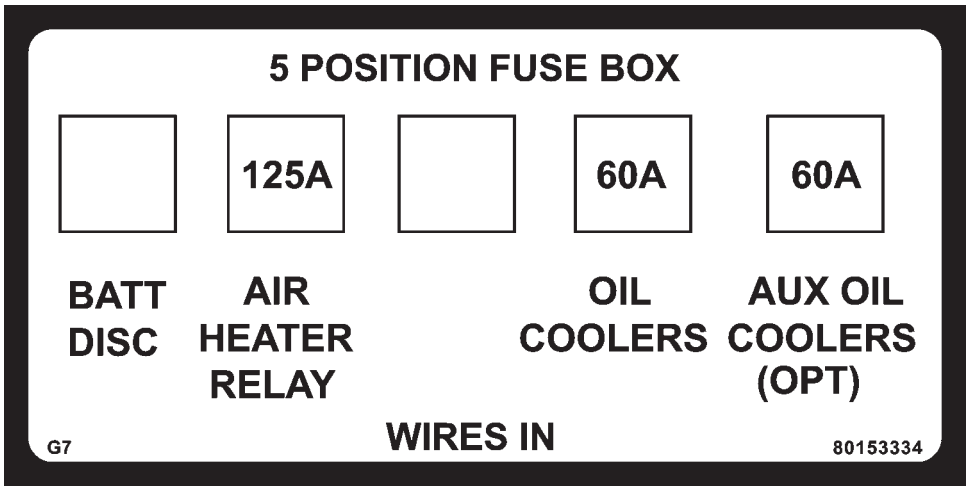
FIGURE 3-35

Fuse Box – Carrier

The Fuse Box is located on the left side of the carrier in the battery box and includes fuses listed in Figure 3-36.



10697

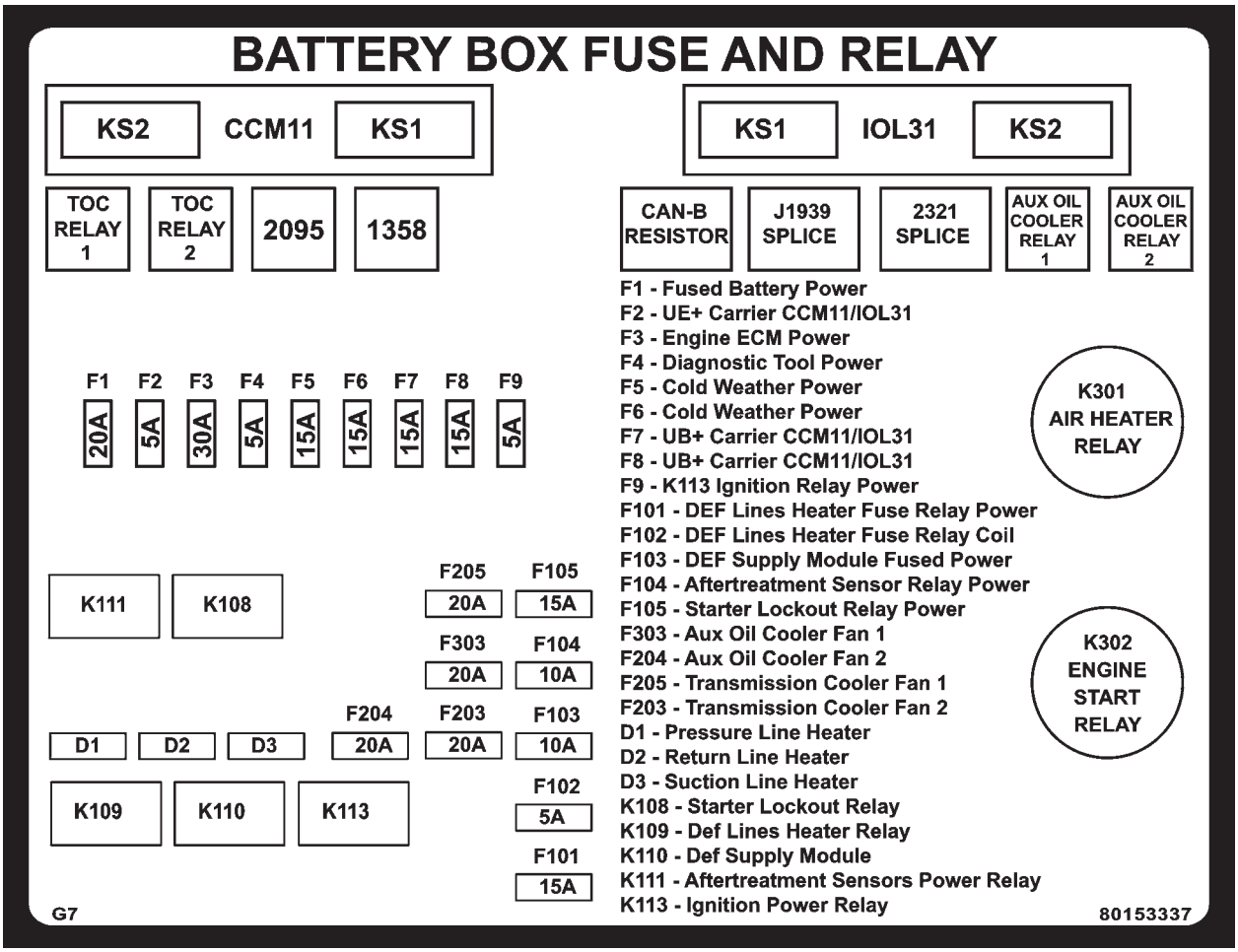


10698

FIGURE 3-36

Fuse and Relay Box – Carrier

The Fuse and Relay Box is located on the left side of the carrier in the battery box and includes fuses and relays listed in Figure 3-37.



10699

FIGURE 3-37

Side-Mounted Carrier Work Lights

Two Side-Mounted Carrier Work Lights (1, Figure 3-38) are located on each side of the carrier. These four lights can be adjusted by hand to illuminate the desired area around the crane.

The set of two right and two left Side-Mounted Carrier Work Lights are independently switched on and off in the Outrigger Extend/Retract function panel of the Superstructure Display Module (refer to *Operating the Side-Mounted Carrier Work Lights*, page 4-47).

10710-20

FIGURE 3-38

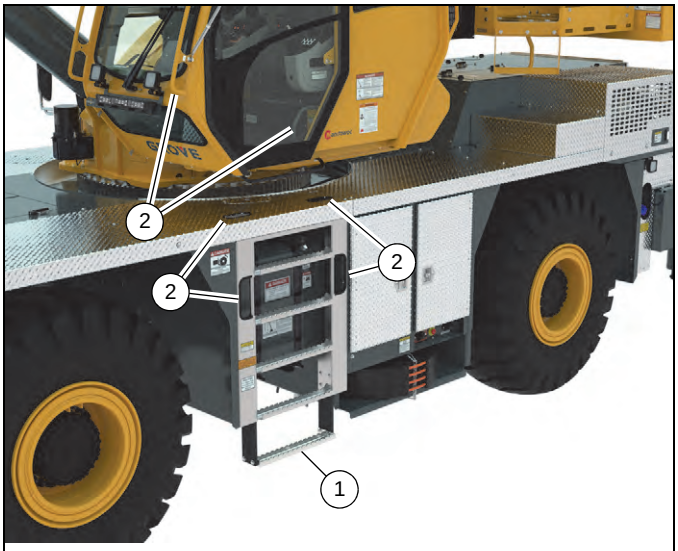
Ladders and Grab Handles

Ladders (1, Figure 3-39 to Figure 3-42) and grab handles (2) are located at the left and right sides of the crane as well as at the front and rear of the crane.

Use these ladders and grab handles to climb and access the carrier deck or the cab.

Always maintain a three-point contact to the crane when using the ladders and grab handles.

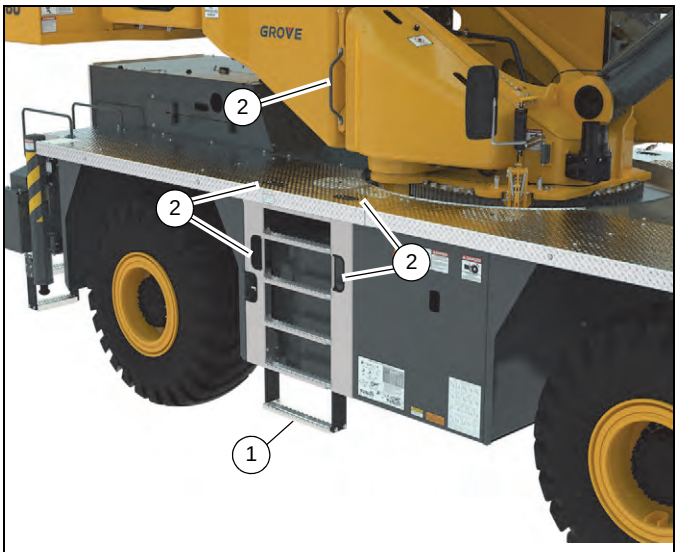
NOTE: Grove recommends folding up the front and rear access ladders before driving the crane to prevent crane damage.



10710-21

LEFT SIDE

FIGURE 3-39

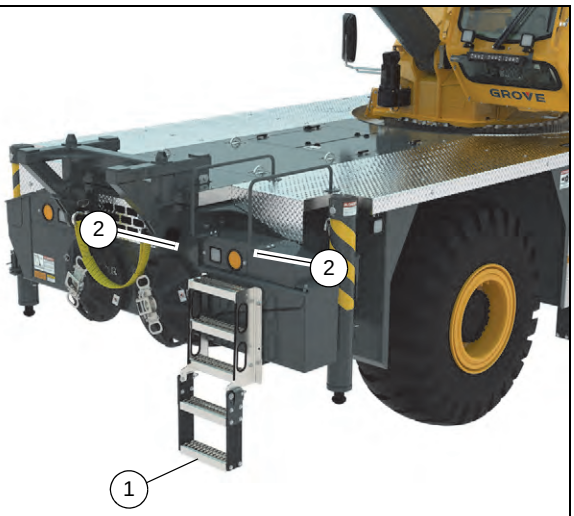


10710-22

RIGHT SIDE

FIGURE 3-40

3



10710-23

FRONT

FIGURE 3-41

10710-24

REAR

FIGURE 3-42

Coolant Heater Button and Indicator (Optional)

Cranes equipped the optional -40°C (-40°F) Cold Weather Package include a coolant heater system to help warm the crane's components before operating in extreme cold environments.

The Coolant Heater Button, accessed through the access hole in the left side panel near the ladder, is used to start and stop the coolant heater system.

Push the button once to start the system, push the button again to stop the system. An LED integral to the button comes on green when the system is operating.

Refer to *Coolant Heater*, page 5-5 for more information about the Coolant Heater and its operation.

SECTION 4
SUPERSTRUCTURE DISPLAY MODULE (SDM)

SECTION CONTENTS

4

SUPERSTRUCTURE DISPLAY MODULE (SDM) – OVERVIEW

The Superstructure Display Module, referred to as SDM throughout this manual, is a touch-screen display located to the right of the steering column. The SDM is powered on when the ignition switch is turned to the I (RUN) position.

The SDM's graphical user interface allows the operator to interface with the Crane Control System (CCS), which monitors and controls most operations of the crane.

The SDM has a touch-screen, similar to most cell phones and tablets. The SDM's touch-screen, as well the Jog Dial on the right armrest, are used to interact with the SDM's graphical user interface. The touch-screen and Jog Dial allow the operator to navigate through the crane status information shown on the display as well as enter settings into the CCS.

Refer to the following sections for information about the screen elements that make up the graphical user interface and how to navigate/interact with them using the touch-screen and Jog Dial.

- *SDM Screen Elements*, page 4-6
- *SDM Basic Screen Navigation*, page 4-9

The SDM screen is divided into five major areas (Figure 4-1), to include the following:

- Alerts Bar
- Rated Capacity Limiter (RCL) Area
- Operator Area
- Function Status Bar
- Menu Bar

Alerts Bar – Shows Alert Icons, which indicate current crane conditions, crane malfunctions, and warnings.

RCL Area – Allows for RCL programming and RCL information monitoring. Also can show information for driving the crane.

Operator Area – Shows the status of crane systems and the different camera views. Crane function panels can also show in this area when opened. These crane function panels allow the operator to operate the related crane function.

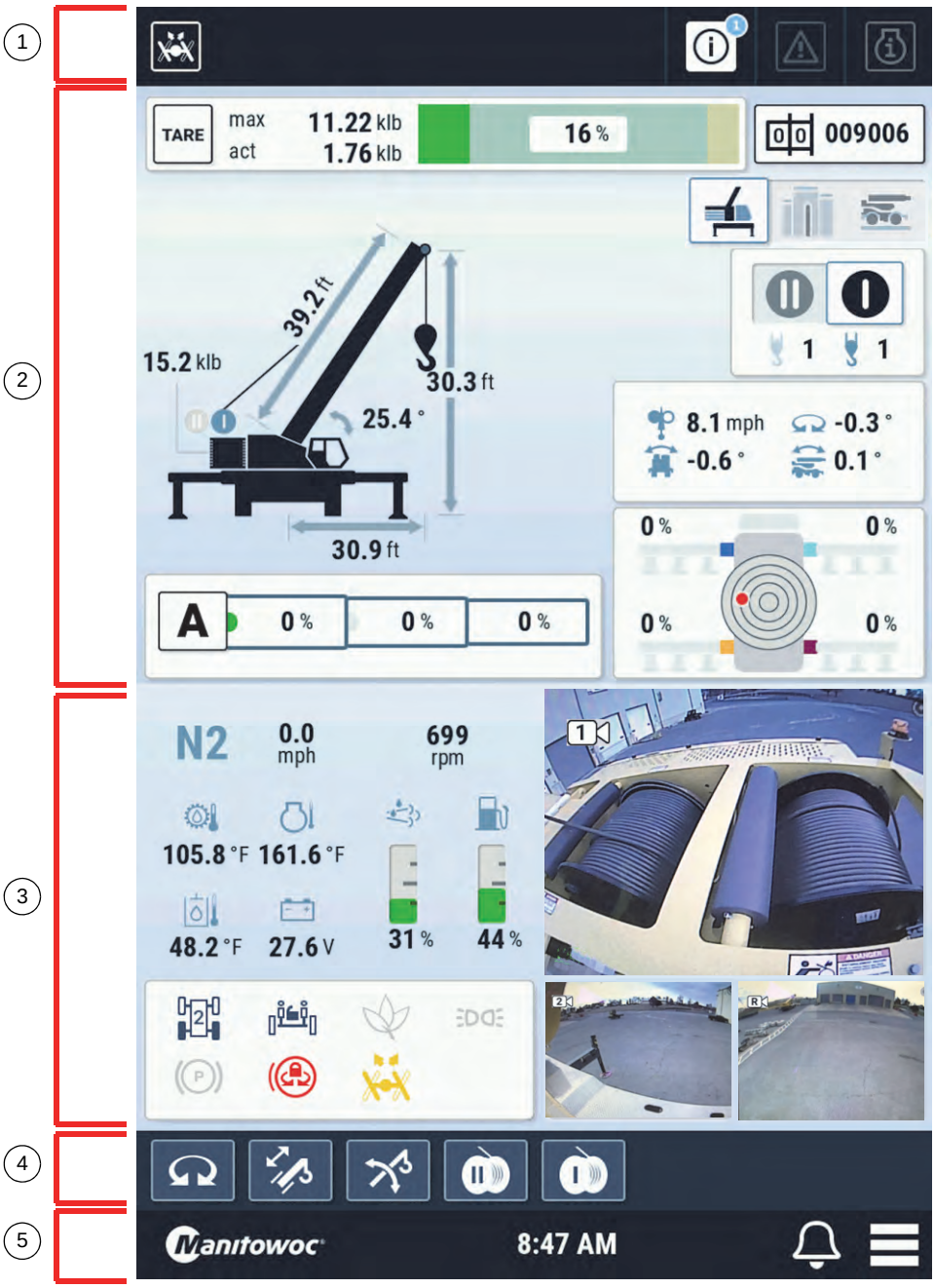
Function Status Bar – Made up of interactive button icons that represent the different craning functions. The buttons allow the craning functions to be enable/disabled and will also show the status of the craning functions.

Menu Bar – Shows the Menu Panel Button Icon, which opens the Menu Panel when selected. The Menu Panels show the crane function button icons that can be selected to perform crane functions and operations. The Menu Bar also includes the Manitowoc logo button and the time. The Manitowoc logo button can be selected to toggle between the Light Mode and Dark Mode screens of the SDM. The current time is also shown on the Menu Bar.

Refer to the following sections for detailed information about these five areas and how they are used in the operation of the crane:

- *SDM Alerts Bar*, page 4-12
- *SDM Rated Capacity Limiter (RCL) Area*, page 4-22
- *SDM Operator Area*, page 4-27
- *SDM Function Status Bar*, page 4-32
- *SDM Menu Bar*, page 4-35

NOTE: All graphics and screenshots shown in the above sections are for reference only. They are examples of what can show on the SDM and may vary from what is shown on your display screen when looking at similar areas of the screen.



Item	Description	Page
1	Alerts Bar	4-12
2	Rated Capacity Limiter (RCL) Area	4-22
3	Operator Area	4-27
4	Function Status Bar	4-32
5	Menu Bar	4-35

10746-2

FIGURE 4-1

4

SDM Screen Elements

This section describes the different types of screen elements that are used in the Superstructure Display Module's (SDM) graphical user interface, to include the following:

ICONS AND INPUT ELEMENTS

Symbols are used in the graphical user interface to communicate information to the operator. Examples of symbols used include Icons and Input Elements.

The specific meanings and definitions of the Icons and Input Elements that show in the different areas of the SDM are defined in the related section of the manual that describes that area.

Input Elements allow the operator to program the CCS by inputting a value or toggling a crane function on or off.

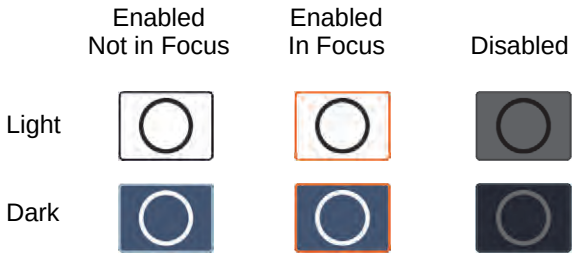
All enabled Input Elements can be selected and controlled by using the touch-screen or Jog Dial.

As the operator operates the crane and interfaces with the SDM using the touch-screen and jog-dial, the Input Elements will change state, or status. These states include the following:

- Enabled, Not In Focus – element can be selected, but is not currently selected (not in focus)
- Enabled, In Focus – element can be selected, and is currently selected (in focus)
- Disabled – element cannot be selected or receive focus

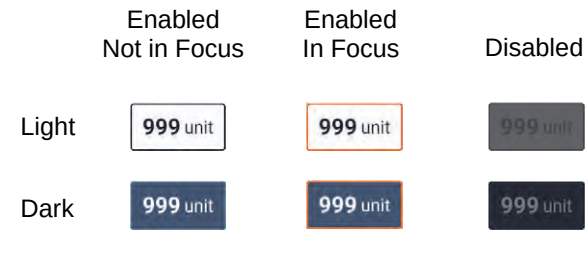
The color of the Input Element changes as its state changes. Also, all SDM screens and their related Icons and Input Elements have two color schemes: Light and Dark. The color scheme shown is dependent upon how the overall display color (Light Mode/Dark Mode) is set in the SDM. Refer to Figure 4-2 through Figure 4-6 for examples of the different types of input elements and their different states (colors) that can be found on the SDM.

- **Button (ON/OFF)**



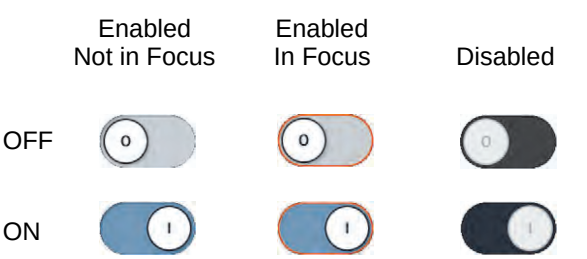
10700-1 **FIGURE 4-2**

- **Button (Value)**



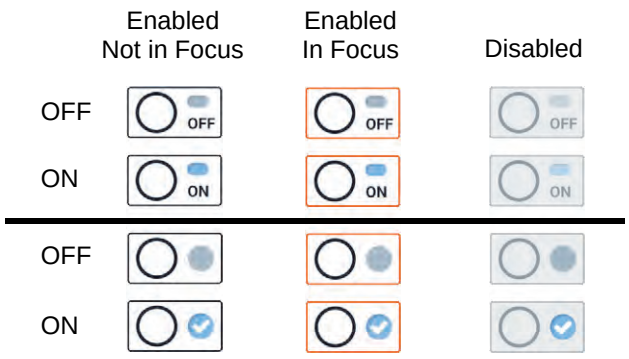
10700-2 **FIGURE 4-3**

- **Switch (ON/OFF)**



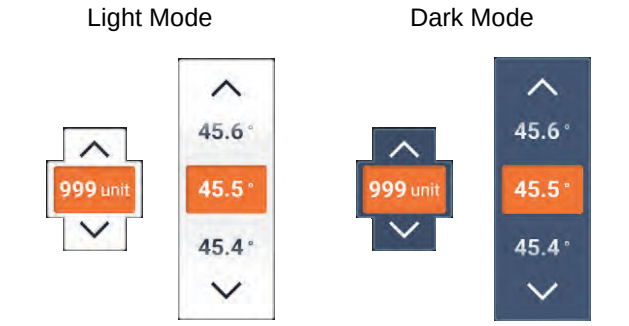
10700-3 **FIGURE 4-4**

- **Toggle Button (ON/OFF – Check Box)**



10700-4 **FIGURE 4-5**

- **Small and Large Spinbox**



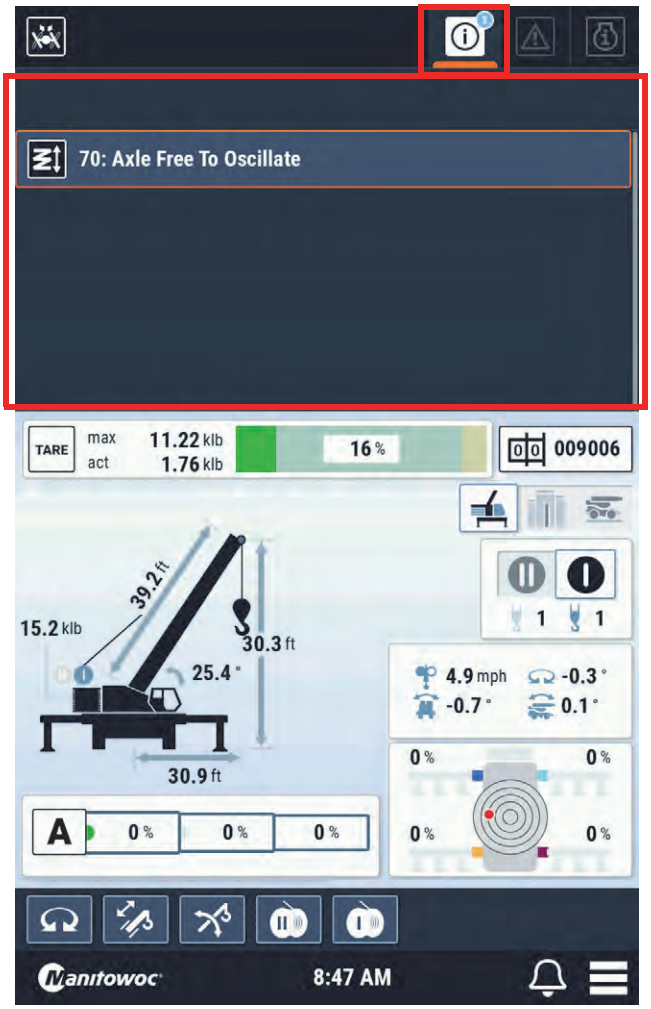
10700-5 and 10700-6 **FIGURE 4-6**

DRAWERS

Information can be shown in screen elements called Drawers. A Drawer is a window of information that slides down and opens below the Alerts Bar to show more information about existing alerts. Each of the four types of alerts shown on the Alerts Bar has a related Drawer that can be opened, to include the following:

- Operating Limits Alert Drawer
- Notifications Alert Drawer
- Crane Faults Alert Drawer
- Engine Faults Alert Drawer

When one of these drawers is opened and slides down below the Alerts Bar, the information in the RCL Area temporarily moves down to remain visible. When the Drawer is closed, the RCL Area information moves back up to its default location under the Alerts Bar. Refer to Figure 4-7 for an example of the Notification Alerts Drawer in its opened state (outlined in red).



10746-3 **FIGURE 4-7**

Refer to *SDM Alerts Bar*, page 4-12 for more information about the four types of alerts that can show, what they mean, and how to view them.

PANELS

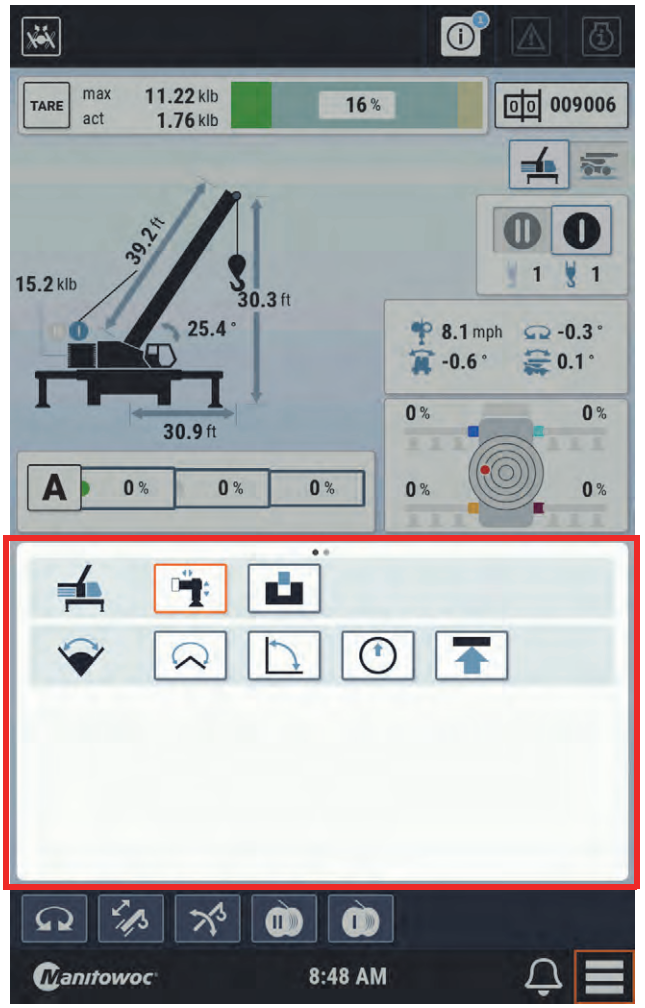
Panels are screen elements that are opened by the operator to perform a crane function or operation. These Panels are rectangular windows that pop-up and show over the Operator Area of the display screen.

Each Panel includes screen elements that allow the operator to perform a crane function or operation by making a selection or inputting a value.

Panels can stack on top of each other forming a Panel Stack. The top Panel is always the active panel. When using the Jog Dial to navigate, the focus of the cursor movement is limited, or constrained, to the top, active Panel.

NOTE: Panels that are open can be closed by tapping somewhere outside of the current Panel or by pushing the Escape Button at the Jog Dial (1, Figure 4-10).

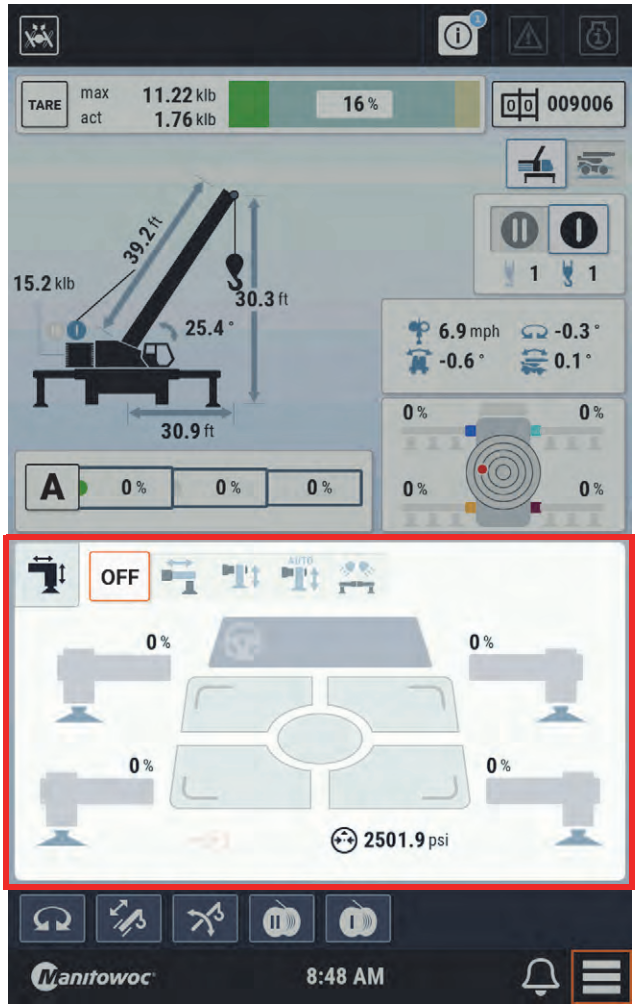
Menu Panels (Figure 4-8) are used to show the different Crane Function Button Icons that can be selected to open their related Crane Function Panels.



10746-4

FIGURE 4-8

See Figure 4-9 for an example of the Outrigger Extend/Retract Panel, which allows the operator to extend the outrigger beams and jacks, and level the crane.



10746-5

FIGURE 4-9

Refer to *SDM Menu Bar*, page 4-35 for more information about the Menu Panel as well as a list of all crane functions and operations that can be launched and performed through the Menu Panels.

SDM Basic Screen Navigation

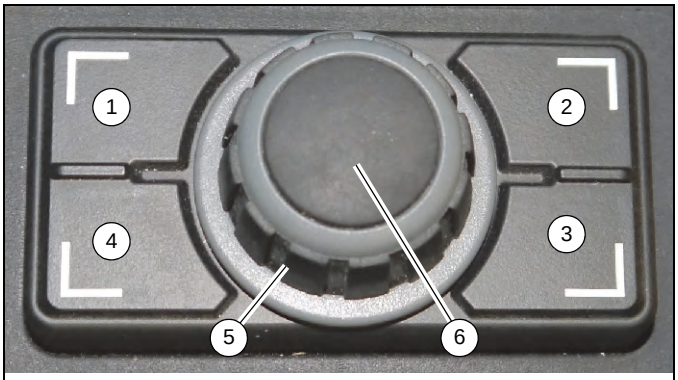
The Superstructure Display Module (SDM) has a touch-sensitive screen. Thus, the operator can use his or her fingers to interact with the SDM in similar ways as one would interact with a cell phone or tablet.

The following terms and descriptions are the types of touch-screen interactions the operator can use to navigate the SDM's graphical user interface:

Term	Description
Tap	Touching and releasing an element on the SDM to open a drawer, panel, or screen view, or to open an input element, such as a spinbox. Also used to toggle an input element on/off or incrementally adjust a value in a spinbox element.
Press-and-Hold	Touching and holding a button element to command a crane function, and releasing the button to stop the function. Also, holding down on a spinbox element to quickly change its value.
Press-and-Drag	Touching the drag-handle of an element, and then sliding it to a new position to change its value, then releasing it.
Swipe	Touching and then sliding up/down or left/right, in a sweeping motion, over a screen element before releasing it. Typically used to show more information that is currently hidden in a drawer or panel.

The Jog Dial, located on the right armrest, can also be used to interact with the SDM's graphical user interface.

The Jog Dial is made up of a large knob surrounded by four push-buttons (Figure 4-10). The large knob can be pushed down as well as rotated continuously 360° in the clockwise and counter-clockwise direction.



Item	Description
1	Button 1
2	Button 2
3	Button 3
4	Button 4
5	Jog Dial (Rotate to move focus)
6	Jog Dial Center Button (Push in to select or confirm)

9221-2

FIGURE 4-10

The Jog Dial and the four buttons are operated in the following manner when navigating the SDM's graphical user interface:

- Button 1 – Push to close the current panel, drawer, or spinbox. Acts like a back button. Also used to operate the left-front outrigger when the Outrigger Extend/Retract function panel is open.
- Button 2 – Only used to operate the right-front outrigger when the Outrigger Extend/Retract function panel is open.
- Button 3 – Push to Mute/Unmute the SDM buzzer. Also used to operate the right-rear outrigger when the Outrigger Extend/Retract function panel is open.
- Button 4 – Push to open the Menu Panel. Also used to operate the left-rear outrigger when the Outrigger Extend/Retract function panel is open.
- Jog Dial (Rotate) – Rotate jog dial to move the focus (or cursor) from one screen element to the next screen element.
- Jog Dial (Push) – Push in jog dial to select/deselect the screen element currently in focus.

The operator can use the described finger interactions and/or the Jog Dial and Jog Dial Buttons to select areas of the screen or individual icons and input elements to bring up additional crane information, change a screen view, make a

selection, or enter a value in to the CCS. The four buttons surrounding the Jog Dial can be used as an alternative to the button elements on the SDM when deploying and stowing the outriggers.

The operator can directly touch an area or icon on the screen to select it. The operator can also select the same area or icon using the Jog Dial. To do so the operator must first rotate the Jog Dial until the area or icon has either an orange rectangle surrounding it or an orange line below it (indicating it is in focus). Once in focus, operator must then push in on the Jog Dial to select it.

Selecting an area or icon will either open another area, drawer, or panel, or allow the operator to make a selection or input a value.

If a Panel or Drawer is open, the operator can close it by tapping somewhere outside of the current Panel or Drawer, or by pushing Button 1 at the Jog Dial (1, Figure 4-10).

When a Panel or Drawer is open, navigation using the Jog Dial is limited to within that Panel or Drawer. When all Panels or Drawers are closed, the Jog Dial can again be used to navigate through the entire SDM screen.

When changing a value within a spinbox element, the operator can push in on the Jog Dial while rotating it to change the value more quickly. The operator can also use a finger tip to Press-and-Hold the up or down arrow of the spinbox, instead of repeatedly tapping it, to quickly change its value.

As a matter of preference, the operator can use either the touch-screen or the Jog Dial, or a combination of the two, as the method for interacting with the SDM.

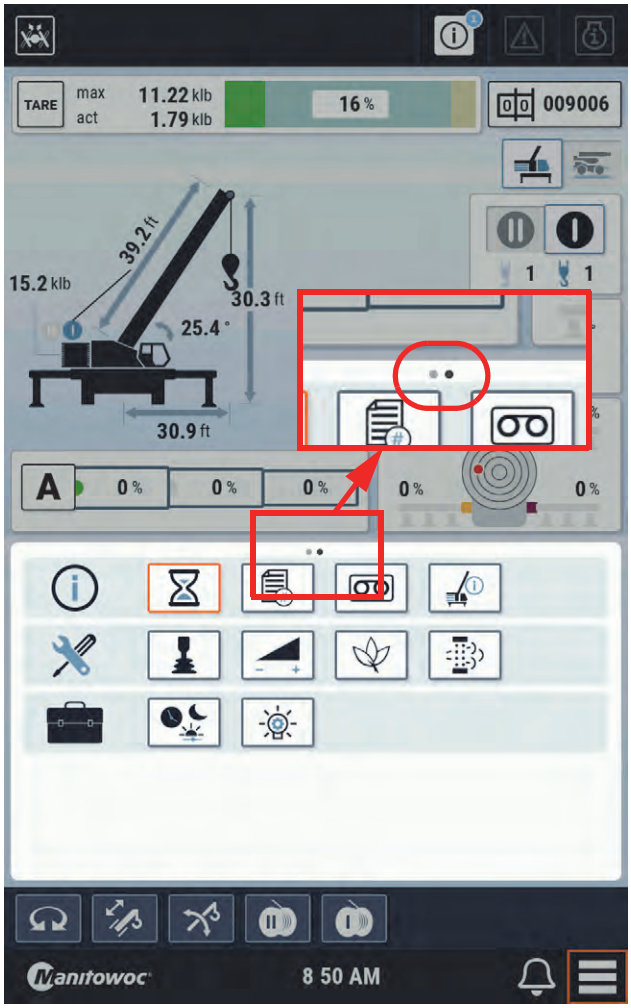
If a drawer includes more information than what can fit in its information window, the graphical user interface will show a Scroll Bar (Figure 4-11 – outlined in red) at the right side of the drawer window.

10746-46

FIGURE 4-11

When a panel includes more information than what can fit in its information window, the graphical user interface will show a Page Indicator (Figure 4-12 – outlined in red) at the top of the panel window.

When a Scroll Bar or Page Indicator is shown, the operator can swipe left/right or up/down to see the additional information. The Jog Dial can also be rotated to move up/down or left/right through the additional information.



10746-6 and 10746-6a

FIGURE 4-12

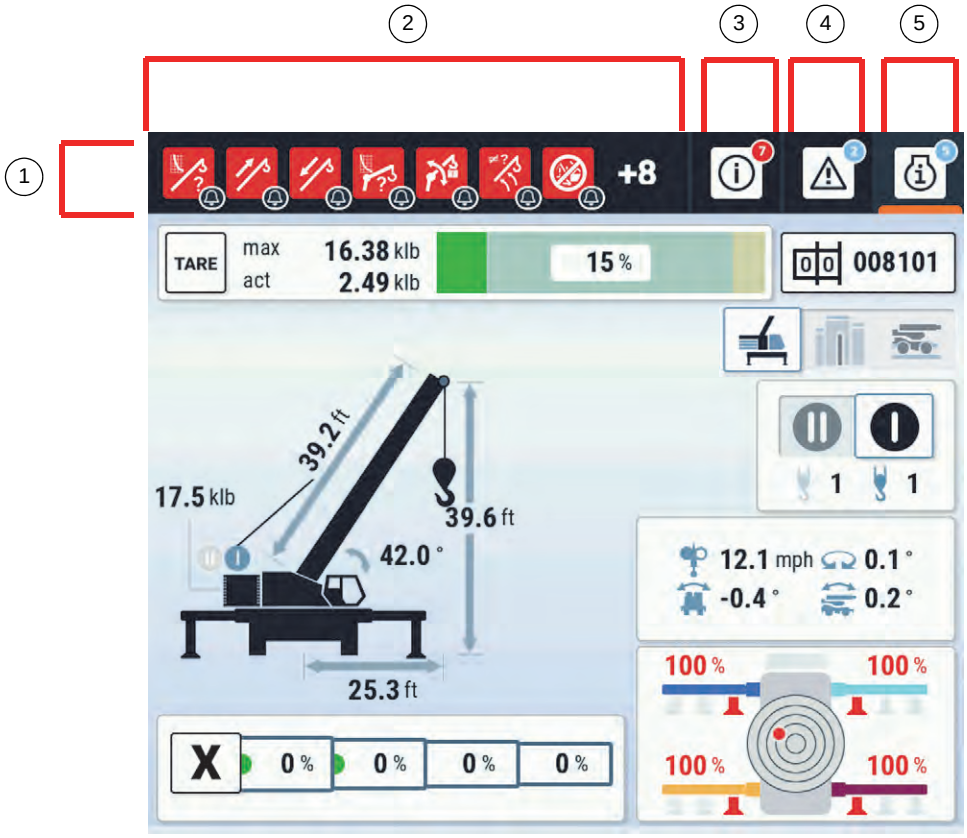
4

SDM ALERTS BAR

The Alerts Bar of the Superstructure Display Module (SDM) (1, Figure 4-13) is located at the top of the display screen and can show four different types of alerts. Refer to the following sections for a description of each of these alerts:

- *Operating Limit Alerts*, page 4-13
- *Notification Alerts*, page 4-15
- *Crane Fault Alerts*, page 4-16
- *Engine Fault Alerts*, page 4-20

All four alert types have alerts that can cause the SDM buzzer to come on. Operator can mute/unmute the buzzer by either tapping the Mute/Unmute Button at the Menu Bar (1, Figure 4-39) or by pushing Button 3 at the Jog Dial (3, Figure 4-10).



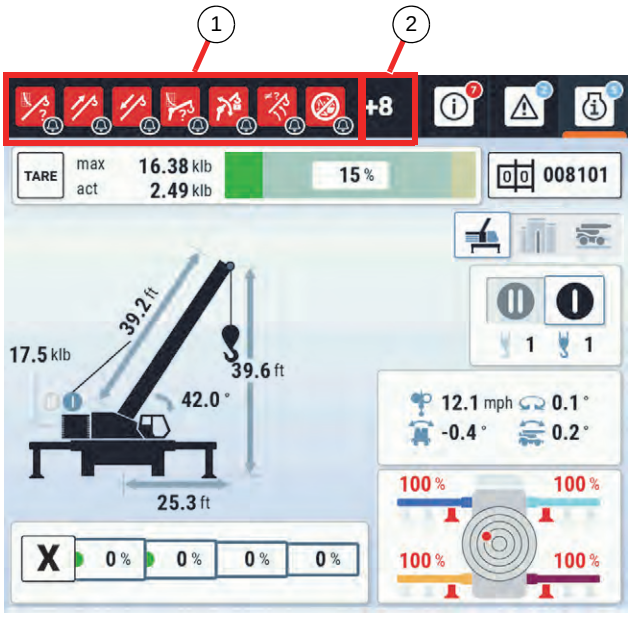
Item	Description	Page
1	Alerts Bar	–
2	Operating Limits Alerts	4-13
3	Notifications Alerts	4-15
4	Crane Fault Alerts	4-16
5	Engine Faults Alerts	4-20

10746-120

FIGURE 4-13

Operating Limit Alerts

Operating Limit Alerts (1, Figure 4-14) will show across the Alerts Bar if the operator attempts to perform a crane operation that the Crane Control System (CCS) does not currently allow because of an existing crane condition. These Operating Limit Alerts indicate to the operator that the CCS is limiting or stopping a crane function or operation.

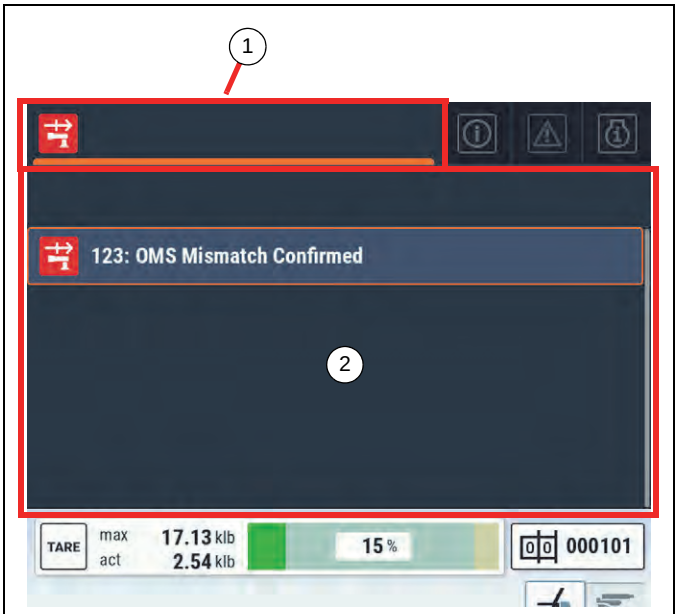


10746-121

FIGURE 4-14

The Alerts Bar can show one or more Operating Limit Alerts at a time. If more Operating Limit Alerts exist than what can be shown, the Alerts Bar will indicate the total number of Operating Limit Alerts (+8, +9, +10...) that are not showing (2, Figure 4-14).

To see all current Operating Limit Alerts, tap somewhere on the Operating Limit Alert Area (1, Figure 4-15) of the display to open the Operating Limit Alerts Drawer (2).



10746-49

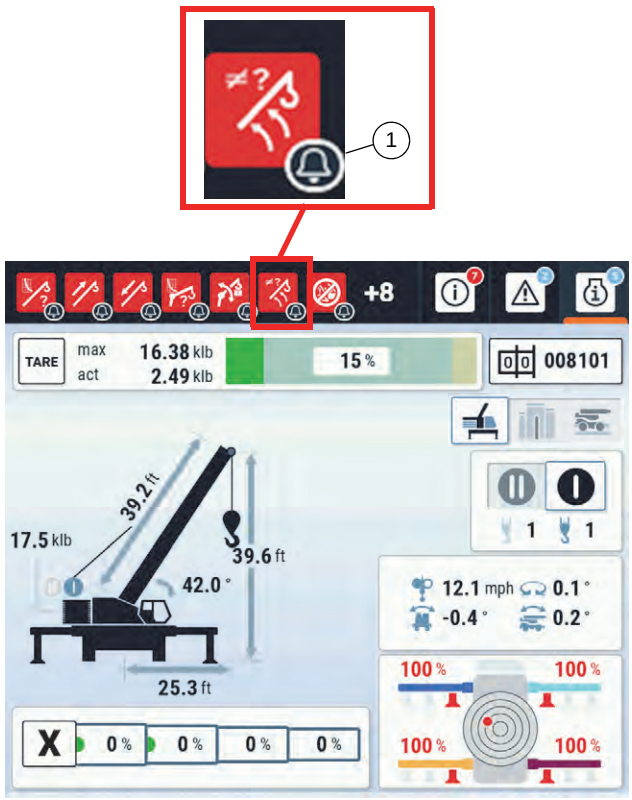
FIGURE 4-15

Operating Limit Alerts can show in one of three different colors: Blue, Yellow, or Red. The color of the alert indicates the importance of the alert:

- Blue – Non-Critical
- Yellow – Warning
- Red – Critical

4

Some Operating Limit Alerts will cause the SDM buzzer to beep. If the alert causes the SDM to beep, a related blue, yellow, or red LED will flash at the upper right side of the display and a bell symbol (1, Figure 4-16) will show below and to the right of the alert.



10746-50 and 10746-121

FIGURE 4-16

One example of an Operating Limit Alert is the Cab Not Fully Down Alert, shown below:

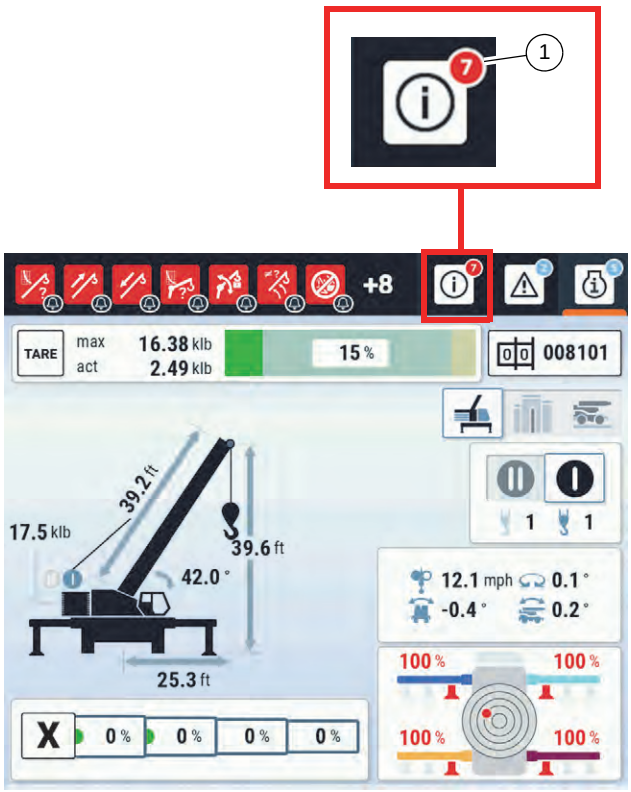
The Cab Not Fully Down Alert comes on when the cab is tilted up and the operator is trying to perform a crane function that requires the cab to be fully tilted down. An example would be if the operator attempts to drive the crane (by placing the Transmission Shift Lever into forward or reverse) while the cab is currently tilted up. In this scenario, the Cab Not Fully Down Alert comes on until the operator either fully lowers the cab or places the Transmission Shift Lever back to the Neutral (center) position.

Refer to APPENDIX C – ALERT ICONS at the back of the manual for a complete list of the names and descriptions of the alerts that can show.

Notification Alerts

Notification Alerts indicate to the operator the state or status of crane functions and operations.

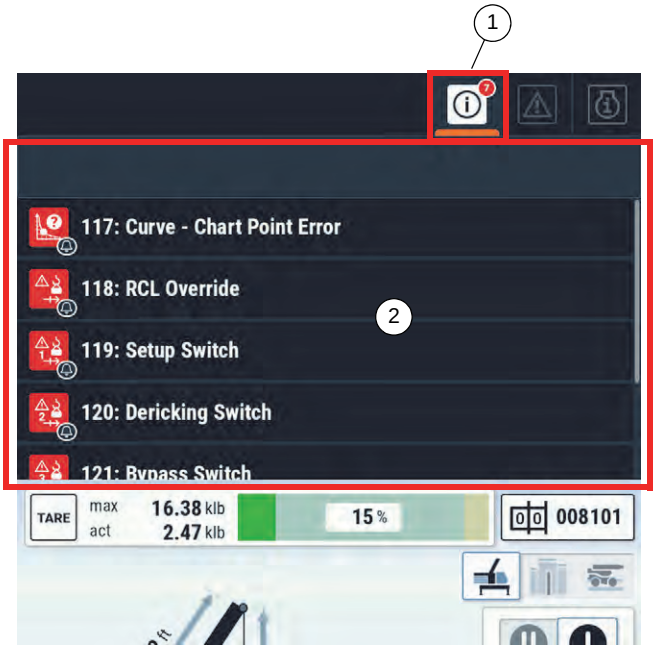
The Active Notification Alerts Badge (1, Figure 4-17) on the Alerts Bar will show a number in a red circle to indicate there is one or more Notification Alerts that the operator has not viewed. The red circle changes to blue after the operator has viewed all currently existing Notification Alerts. The alert badge changes back to red again when a new alert occurs which has not been viewed.



10746-52 and 10746-121

FIGURE 4-17

To see the active Notification Alerts, tap on the Active Notification Alerts Badge (1, Figure 4-18) to open the Notification Alerts Drawer (2).



10746-51

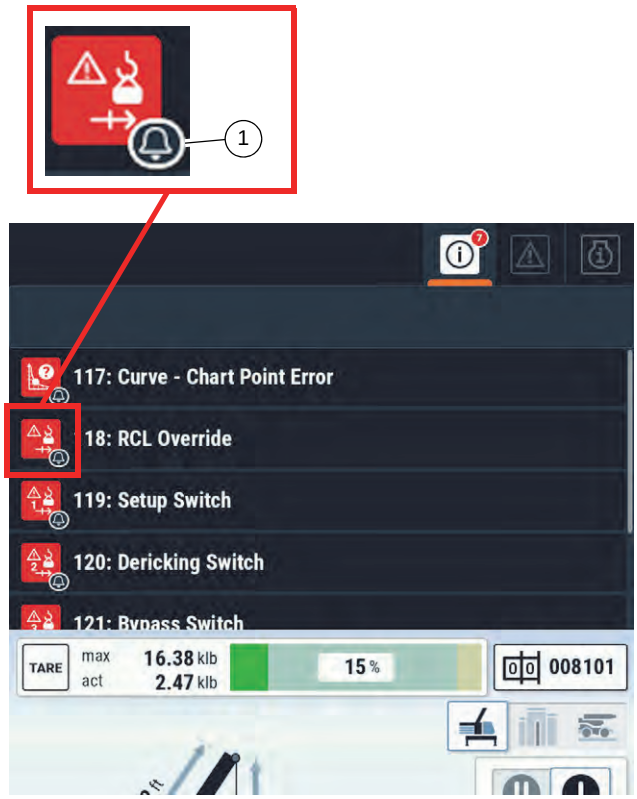
FIGURE 4-18

Notification Alerts can show in one of three different colors: Blue, Yellow, or Red. The color of the alert indicates the importance of the alert:

- Blue – Non-Critical
- Yellow – Warning
- Red – Critical

4

Some Notification Alerts will cause the SDM buzzer to beep. If the alert causes the SDM to beep, a related blue, yellow, or red LED will flash at the upper right side of the display and a bell symbol (1, Figure 4-19) will show below and to the right of the alert in the Notification Alerts Drawer.



10746-51 and 10746-53

FIGURE 4-19

One example of a Notification Alert is the Low Fuel Level Alert, shown below:

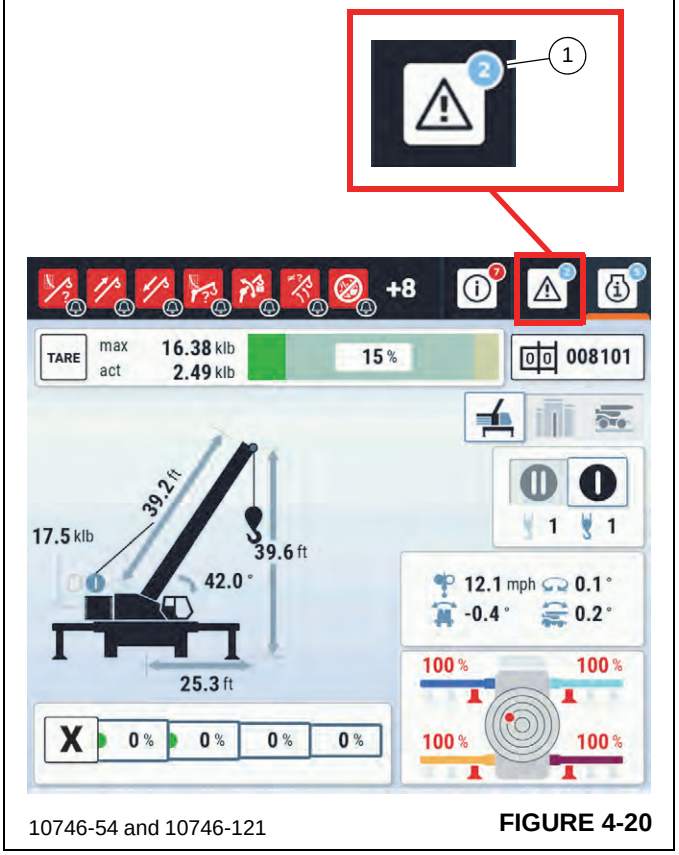
The Low Fuel Level Alert Icon comes on to indicate the fuel level is low.

Refer to APPENDIX C – ALERT ICONS at the back of the manual for a complete list of the names and descriptions of the alerts that can show.

Crane Fault Alerts

Crane Fault Alerts indicate to the operator there are issues with crane components or systems (does not include the engine and transmission).

The Crane Fault Alert Badge (1, Figure 4-20) on the Alerts Bar will show a number in a red circle to indicate there is one or more crane faults that the operator has not viewed. The red circle changes to blue after the operator has viewed all existing Crane Fault Alerts. The alert badge changes back to red again when a new alert occurs which has not been viewed.



10746-54 and 10746-121

FIGURE 4-20

To see the Crane Fault Alerts, tap on the Crane Fault Alert Badge (1, Figure 4-21) to open the Crane Fault Alerts Drawer (2).

10746-55

FIGURE 4-21

Some Crane Fault Alerts will cause the SDM buzzer to beep. If the fault alert causes the SDM to beep, a related blue, yellow, or red LED will flash at the upper right side of the display.

A list of all crane fault codes and their definitions are available through the Manitowoc Diagnostic Code Mobile Application. Refer to *Manitowoc Diagnostic Code Mobile Application*, page 4-18 for more information about using the application.

MANITOWOC DIAGNOSTIC CODE MOBILE APPLICATION

The Manitowoc Diagnostic Code Mobile Application is a free mobile application that enables the user to enter and retrieve information about specific crane fault codes on a mobile device.

The application is available from the Google and Apple stores and is compatible with most Android and Apple mobile devices.

To look up a fault code with the Manitowoc Diagnostic Code mobile application, do the following:

1. Open the *Manitowoc Diagnostic Code Mobile Application* on the mobile device.

   The diagnostic code application splash screen will show on the screen (Figure 4-22).

FIGURE 4-22

2. Tap on the *CCS Mobile Cranes* menu button to open the CCS input screen (Figure 4-23).

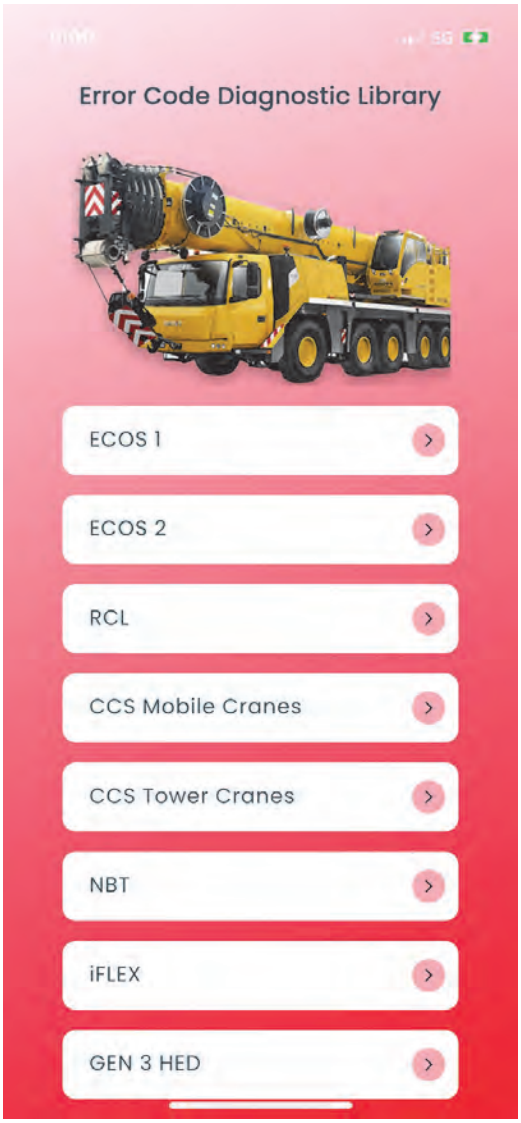


FIGURE 4-23

3. Input the following crane fault code information (shown in the Crane Fault Alerts Drawer of the SDM) in to the CCS screen (Figure 4-24):
   - Select Crane Type – Select the crane model from the drop down list.
   - Component – Enter the component information from the fault code.
   - Condition – Enter the condition information from the fault code.
   - Device – Enter the device number from the fault code.
   - Index – Enter the index number information from the fault code.

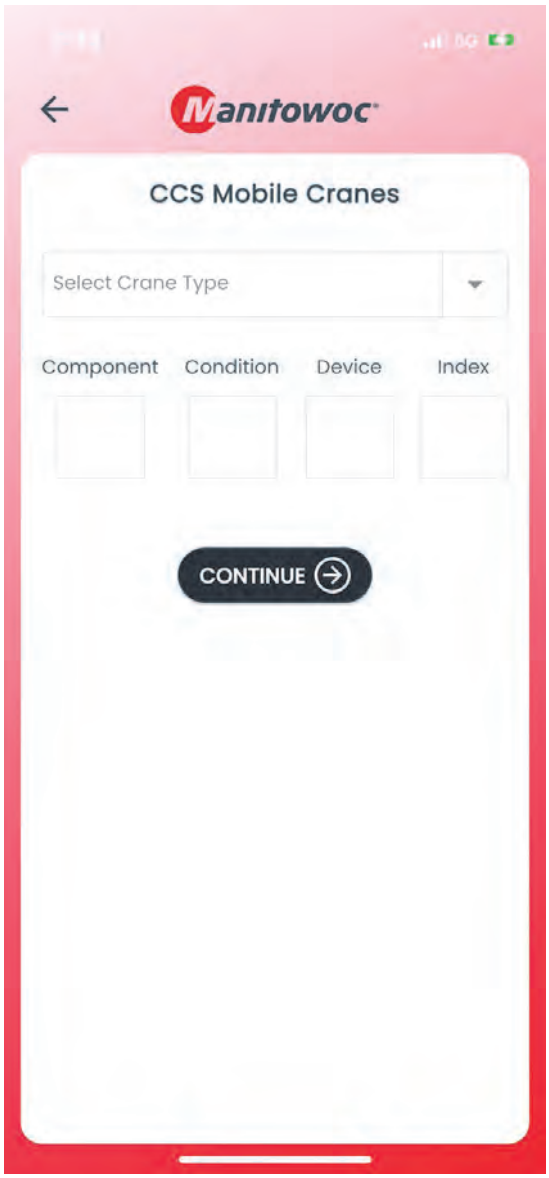
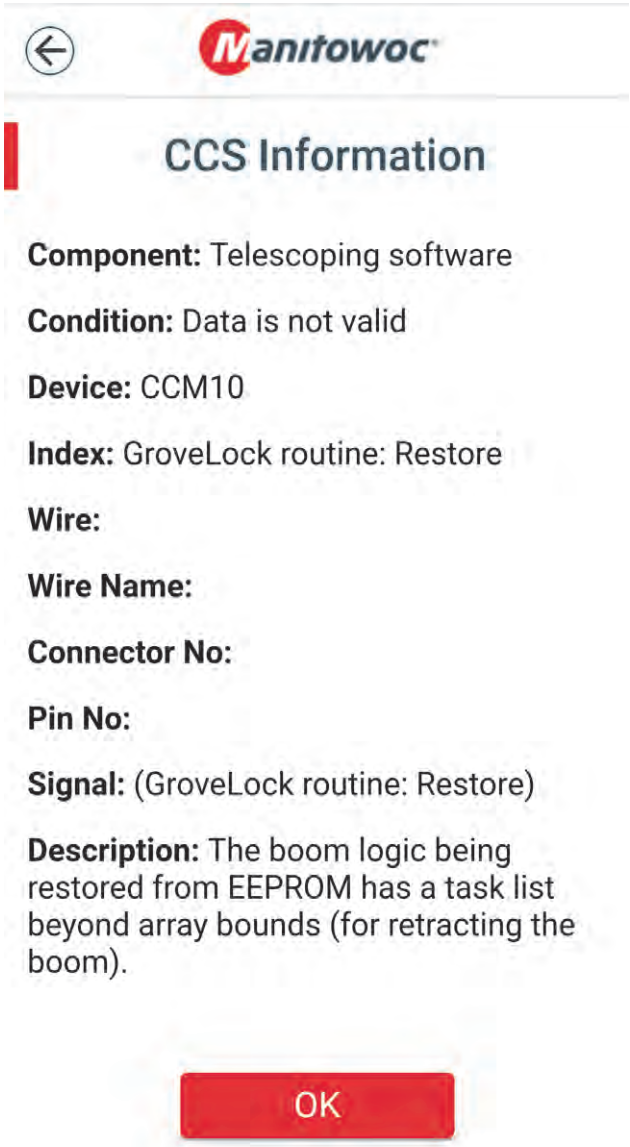


FIGURE 4-24

4. Tap on the *Continue* button.

   The fault code information will show in the *CCS Information* screen (Figure 4-25).



10158

FIGURE 4-25

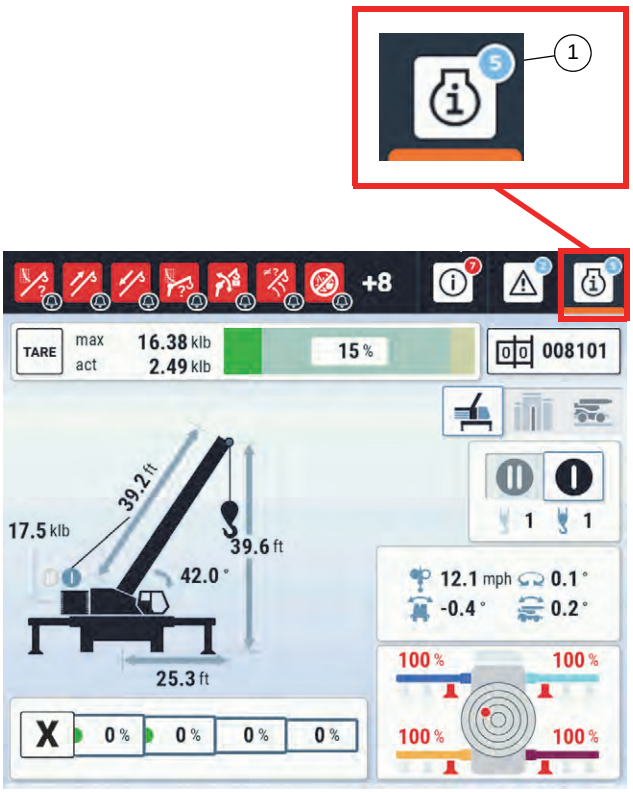
5. Tap the OK button to return to the main screen.

4

Engine Fault Alerts

Engine Fault Alerts indicate to the operator there are issues with the engine or transmission.

The Engine Fault Alert Badge (1, Figure 4-26) on the Alerts Bar will show a number in a red circle to indicate there is one or more engine faults that the operator has not viewed. The red circle changes to blue after the operator has viewed all Engine Fault Alerts. The alert badge changes back to red again when a new alert occurs which has not been viewed.



10746-56 and 10746-121

FIGURE 4-26

To see the engine fault alerts, tap on the Engine Fault Alert Badge (1, Figure 4-27) to open the Engine Fault Alerts Drawer (2).

The Engine Fault Alerts Drawer lists all active fault codes and the following crane information:

- Engine speed (rpm) (3, Figure 4-27)
- Engine coolant temperature (4)
- DEF level (5)
- Fuel level (6)

The Engine Fault Alerts Drawer also includes Alert Icons that will come on to alert the operator of the following conditions:

- Engine stop condition (7, Figure 4-27)
- Engine warning condition (8)
- DEF level low (9)
- Active exhaust cleaning process (10)
- Exhaust cleaning process inhibited (11)
- High exhaust temperature (12)

Some Engine Fault Alerts will cause the SDM buzzer to beep. If the alert causes the SDM to beep, a related blue, yellow, or red LED will flash at the upper right side of the display.

Item	Description	Item	Description
1	Engine Fault Alert Badge	7	Engine Stop Alert
2	Engine Fault Alert Drawer	8	Engine Warning Alert
3	Engine Speed (rpm)	9	DEF Level Low Alert
4	Engine Coolant Temperature	10	Exhaust Cleaning Process Active Alert
5	DEF Level	11	Exhaust Cleaning Process Inhibited Alert
6	Fuel Level	12	High Exhaust Temperature Alert

10746-57

FIGURE 4-27

4

SDM RATED CAPACITY LIMITER (RCL) AREA

The Rated Capacity Limiter (RCL) is an electro-mechanical sensing system designed to alert the crane operator of impending capacity when the system has been accurately programmed. When an overload condition is sensed, the system provides the operator with visual and audible warnings, and locks out the controller functions to prevent raising and lowering the boom, extending the boom, swinging left or right, and raising the main and optional auxiliary hoist ropes.

DANGER

Electronic equipment on this crane is intended as an aid to the operator. Under no condition should it be relied on to replace the use of Load Charts and operating instructions.

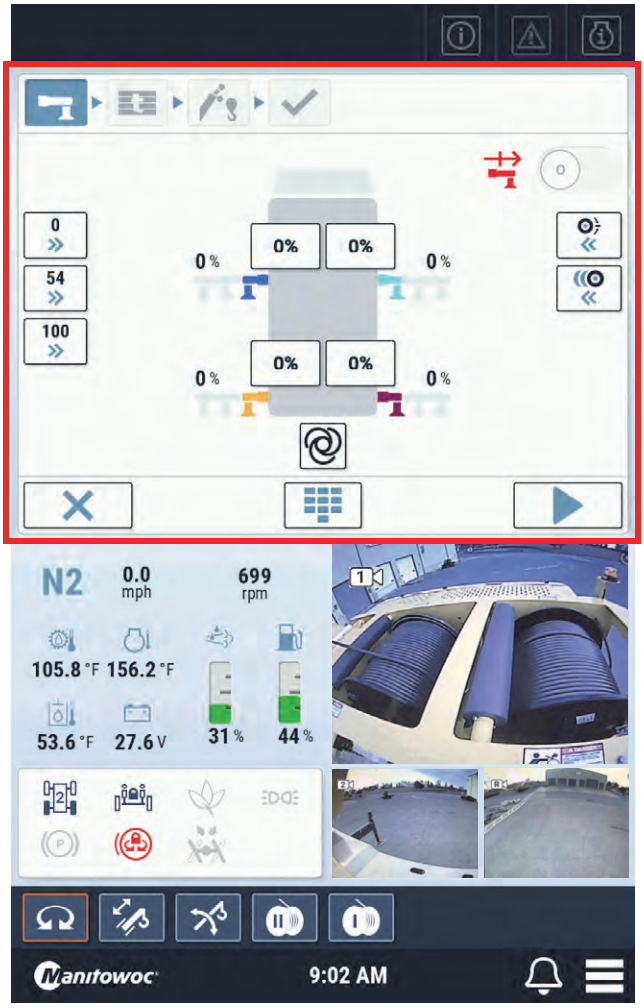
Sole reliance on these electronic aids in place of good operating practices can cause an accident.

The RCL Area (2, Figure 4-1) of the Superstructure Display Module (SDM) can show different screens of information for RCL functions, to include screens for programming the RCL as well as screens for monitoring the crane status and configuration after the RCL has been programmed. The RCL Area can also show a screen that includes information related to driving the crane.

Refer to the sections that follow for detailed information about each of the screens that can show in the RCL Area of the SDM.

The RCL Area will show one of the following two screens when the SDM is first powered on:

- *RCL Wizard Screens*, page 4-106



10746-7

FIGURE 4-28

- *RCL Confirmation Screen*, page 4-125

10746-123

FIGURE 4-29

4

Other screens that can show in the RCL Area include the following:

- *RCL Manual Entry Screen*, page 4-120

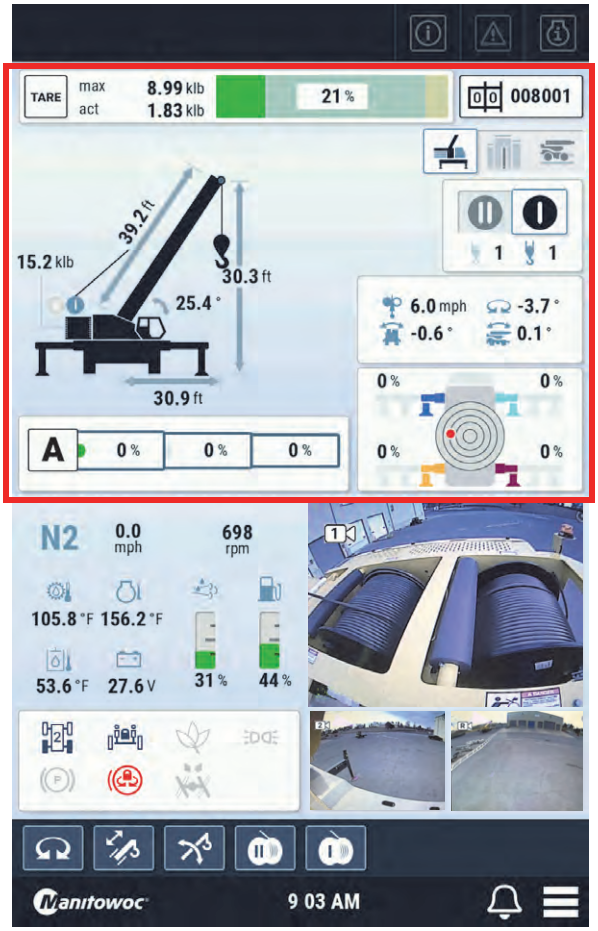
10746-8

FIGURE 4-30

- *Multifunction View Screen*, page 4-133

The Multifunction View Screen can be set to show two different views for RCL monitoring during craning operations and one view for driving the crane. These three views include the following:

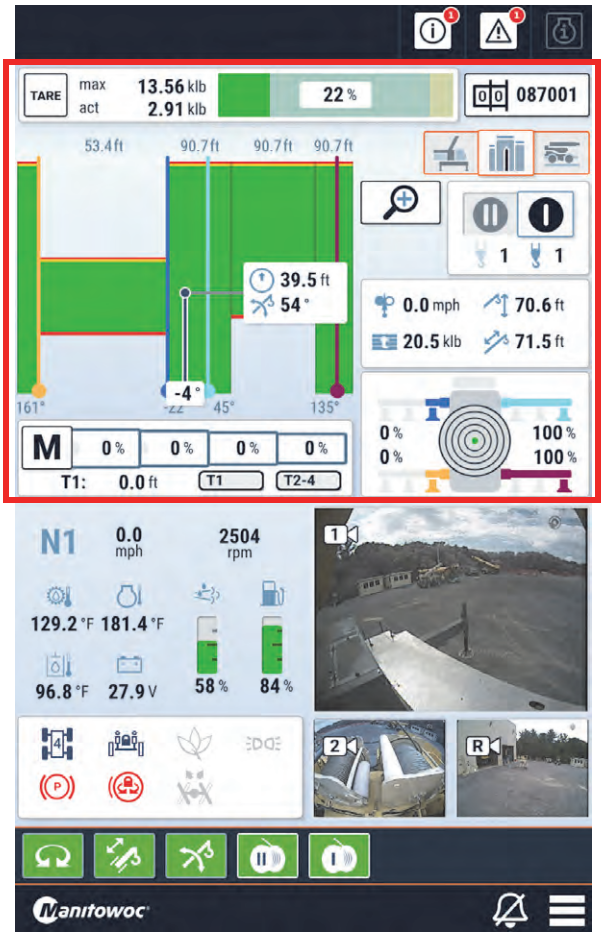
- *RCL Monitoring View Screen*, page 4-143



10746-9

FIGURE 4-31

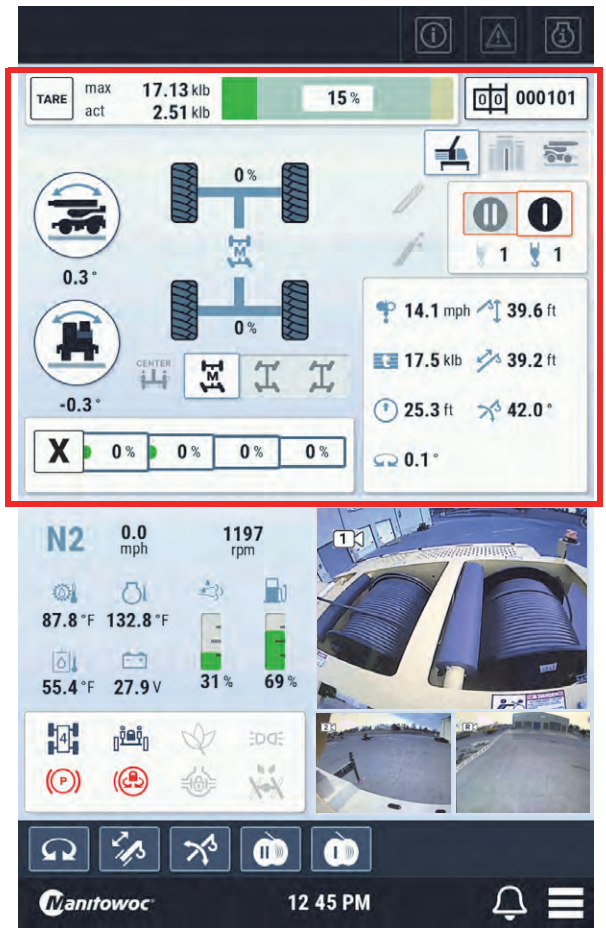
- *RCL Panorama View Screen*, page 4-145



10753-8

FIGURE 4-32

- *Driving View Screen*, page 4-152

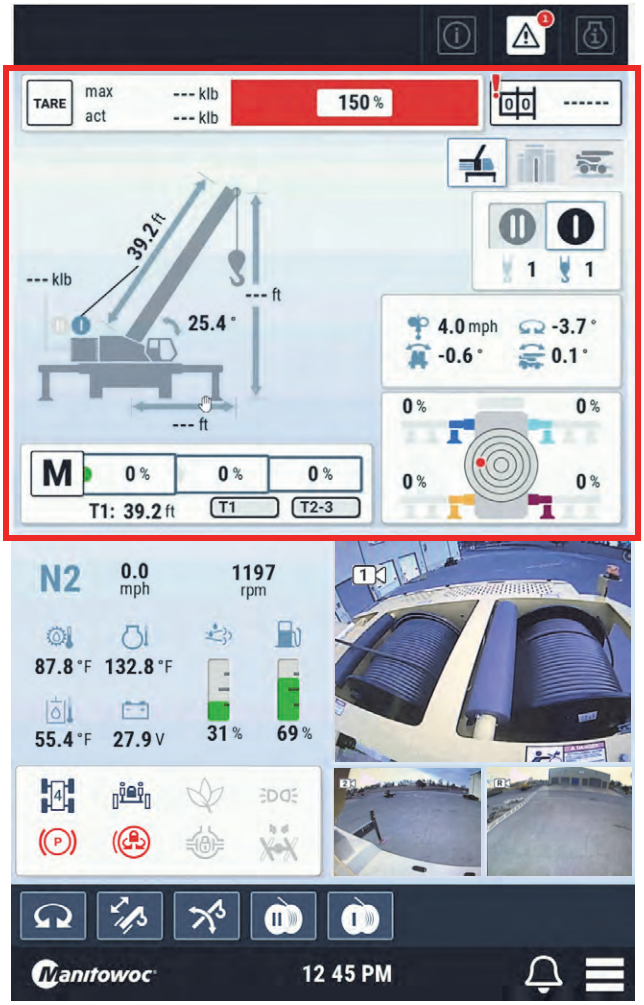


10746-124

FIGURE 4-33

4

- *RCL Not Programmed Warning Screen*, page 4-156



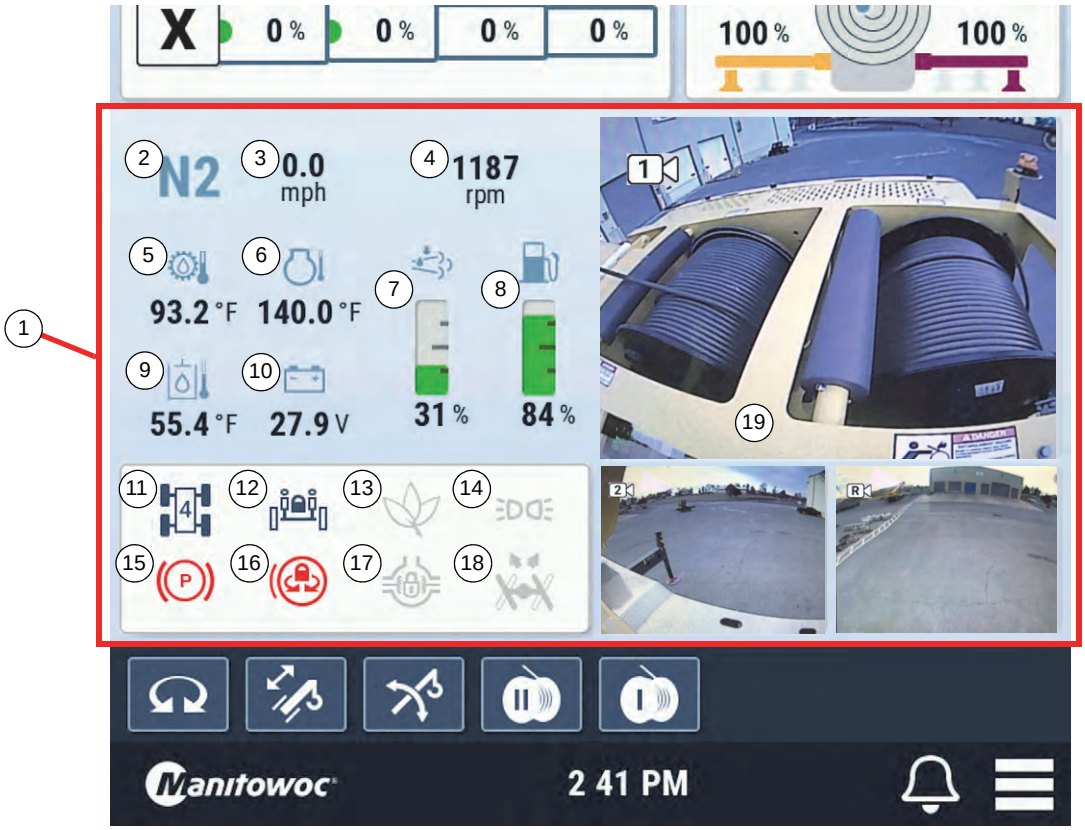
10746-125

FIGURE 4-34

SDM OPERATOR AREA

The Operator Area (3, Figure 4-1) of the Superstructure Display Module (SDM) is located in the bottom half of the display screen.

The Operator Area shows dynamic information about the crane's different systems. Refer to Figure 4-35 and the information that follows for a list of the indicators and their definitions that show in this area.



Item	Description	Page	Item	Description	Page
1	Operator Area	–	11	Two-Wheel Drive/Four-Wheel Drive Indicator	4-28
2	Direction/Gear Indicator	4-28	12	Suspension Control Indicator	4-28
3	Speed Indicator	4-28	13	Economy (ECO) Mode Indicator	4-29
4	Engine Speed Indicator	4-28	14	Marker Light/Headlight Indicator	4-29
5	Transmission Oil Temperature Indicator	4-28	15	Parking Brake Indicator	4-29
6	Engine Coolant Temperature Indicator	4-28	16	Swing Brake Indicator	4-29
7	Diesel Exhaust Fluid (DEF) Level Indicator	4-28	17	Differential Lock Indicator	4-29
8	Diesel Fuel Level Indicator	4-28	18	Rear Wheels Not Centered Indicator	4-30
9	Hydraulic Oil Temperature Indicator	4-28	19	Camera Views	4-30
10	Battery/Charging Voltage Indicator	4-28			

10746-68

FIGURE 4-35

Direction/Gear Indicator

The Direction/Gear Indicator (2, Figure 4-35) shows if the transmission is in neutral (N), forward (F), or reverse (R) and what gear is selected [first gear (1), second gear (2), or third gear (3)].

Speed Indicator

The Speed Indicator (3, Figure 4-35) shows the crane travel speed in the selected unit of measure (km/h - mph).

Engine Speed Indicator

The Engine Speed Indicator (4, Figure 4-35) shows engine speed in revolutions per minute (RPM).

Transmission Oil Temperature Indicator

The Transmission Oil Temperature Indicator (5, Figure 4-35) shows the transmission oil temperature in the selected unit of measure (°C / °F).

Engine Coolant Temperature Indicator

The Engine Coolant Temperature Indicator (6, Figure 4-35) shows engine coolant temperature in the selected unit of measure (°C / °F).

Diesel Exhaust Fluid (DEF) Level Indicator

The Diesel Exhaust Fluid (DEF) Level Indicator (7, Figure 4-35) shows the DEF level as a percentage.

Diesel Fuel Level Indicator

The Diesel Fuel Level Indicator (8, Figure 4-35) shows the diesel fuel level as a percentage.

Hydraulic Oil Temperature Indicator

The Hydraulic Oil Temperature Indicator (9, Figure 4-35) shows the hydraulic oil temperature in the selected unit of measure (°C / °F).

Battery/Charging Voltage Indicator

The Battery/Charging Voltage Indicator (10, Figure 4-35) shows the battery voltage when the engine is off and the charging voltage when the engine is running.

Two-Wheel Drive/Four-Wheel Drive Indicator

The Two-Wheel Drive/Four-Wheel Drive Indicator (11, Figure 4-35) shows if the transmission is in two-wheel drive high range or four-wheel drive low range.

Symbol	Description
	Transmission is shifted to two-wheel high range.
	Transmission is shifted to four-wheel low range

Suspension Control Indicator

The Suspension Control Indicator (12, Figure 4-35) shows if the suspension on the rear axle is locked or unlocked.

Symbol	Description
	Suspension is unlocked and the rear axle is free to oscillate from side to side.
	Suspension is locked and axle oscillation is prevented.

Economy (ECO) Mode Indicator

The Economy (ECO) Mode Indicator (13, Figure 4-35) will show the state of the ECO Mode.

Symbol	Description
	ECO mode is disabled.
	ECO mode is enabled (refer to *ECO Mode*, page 4-90) but is not active.
	ECO mode is enabled and actively lowered the engine speed to 950 rpm.
	ECO mode is enabled and actively lowered the engine speed to idle (700 rpm)

Marker Light/Headlight Indicator

The Marker Light/Headlight Indicator (14, Figure 4-35) shows if the marker lights and headlights are on or off.

Symbol	Description
	Marker lights and headlights are off.
	Marker lights and/or headlights are on.

Parking Brake Indicator

The Parking Brake Indicator (15, Figure 4-35) shows if the Parking Brake is applied or released.

Symbol	Description
	Parking brake is released.
	Parking brake is applied.

Swing Brake Indicator

The Swing Brake Indicator (16, Figure 4-35) shows if the Swing Brake is applied or released.

Symbol	Description
	Swing brake is released.
	Swing brake is applied.

Differential Lock Indicator

The Differential Lock Indicator (17, Figure 4-35) shows if the Differential Lock is engaged or disengaged.

Symbol	Description
	Differential lock is disengaged.
	Differential lock is engaged.

Rear Wheels Not Centered Indicator

The Rear Wheels Not Centered Indicator (18, Figure 4-35) shows if the rear wheels on the rear axle are straight ahead or turned to the left or right.

Symbol	Description
	Rear wheels are centered.
	Rear wheels are NOT centered.

Camera Views

The crane is equipped with three cameras. The three camera views are shown at the right side of the Operator Area of the SDM (19, Figure 4-35).

Camera 1 shows the view of the main hoist and optional auxiliary hoist. By default, Camera 1 - Hoist View is set as the larger of the three camera views (1, Figure 4-36).

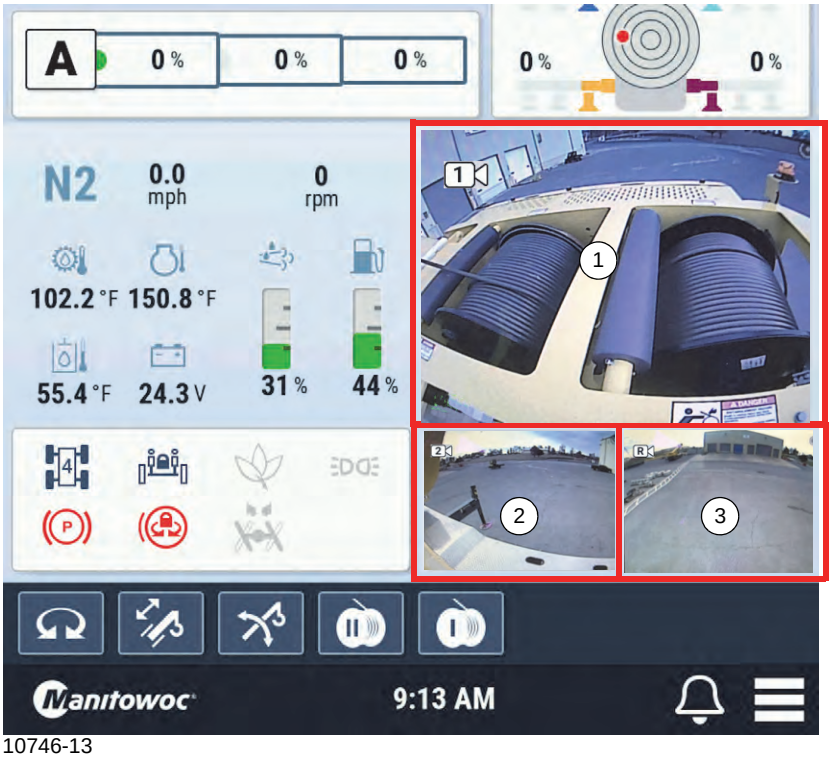
Camera 2 shows the view of the right side of the crane. By default, Camera 2 - Right Side View is set as one of the smaller views at the bottom left side (2).

Camera R shows the view looking out the rear of the crane. By default, Camera R - Rear View is set as one of the smaller views at the bottom right side (3).

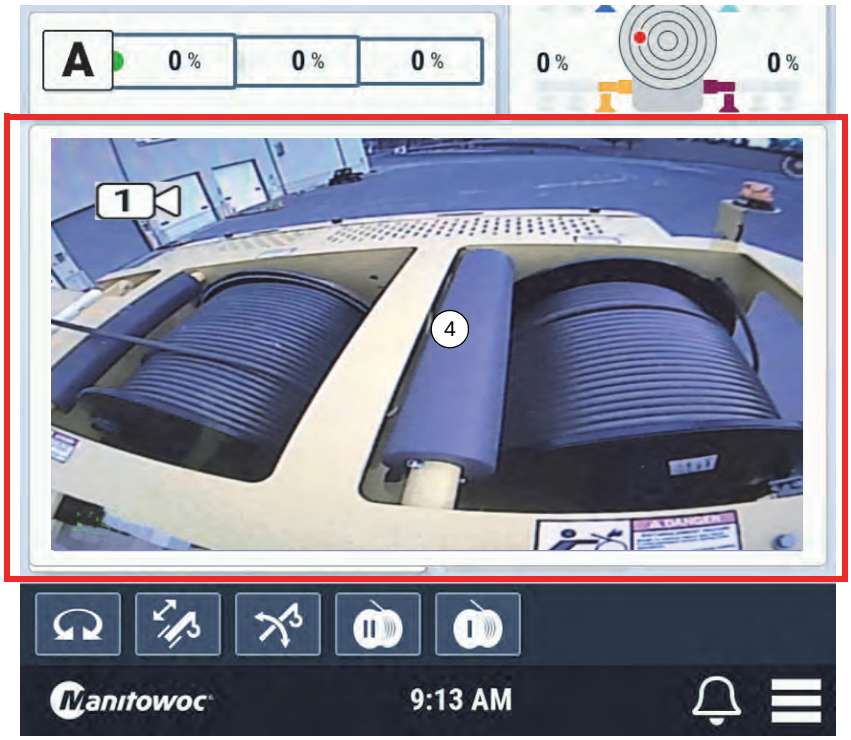
The three camera views can be rearranged and enlarged as desired.

By default, the larger top camera view is of the hoist(s). Each of the two smaller bottom camera views (2 and 3) can be moved to the larger top camera view position (1) by selecting the desired smaller camera view (2 or 3). The Crane Control System (CCS) will switch the smaller bottom camera view (2 or 3) with the larger top camera view (1).

Selecting the larger top camera view (1) will cause it to enlarge further and fill the entire Operator Area (4) (full screen mode). To reduce a camera view set to full screen, select the full screen camera view (4) again to return the screen view to its default configuration of three camera views (1, 2, and 3).



10746-13



10746-14

FIGURE 4-36

4

SDM FUNCTION STATUS BAR

The Function Status Bar of the Superstructure Display Module (SDM) (1, Figure 4-38) is located toward the bottom of the display screen.

The button icons that show in the Function Status Bar represent the crane functions that are operated by the controllers on the armrests and the foot pedal, to include the following:

- Swing
- Telescope
- Boom Lift
- Main Hoist
- Auxiliary Hoist (Optional)

These interactive buttons are used to set the related crane function to On or Off.

One or more of these crane functions can be set to Off for the purpose of preventing accidental operation in certain scenarios. As an example, Grove recommends setting all craning functions to Off before driving the crane.

Crane functions can also be disabled by setting its function speed to 0% (zero) in the Controller Speed function panel. Setting a function speed to zero will disable the function and prevent it from being toggle On and Off at the Function Status Bar. Refer to *Controller Speed*, page 4-88 for more information.

As the status of a crane function changes (On to Off, and back), the related button on the Function Status Bar will change color.

The following is a list of the possible statuses and related colors each button can have as well as there descriptions:

Status	Button Color	Description
On	Green	Crane function is On and can be commanded by the related controller or foot pedal.
Off	Blue	Crane function is Off and cannot be commanded by the related controller or foot pedal
Standby	Yellow	Crane function is in a Standby mode for one of two reasons: **a.** Crane function is being commanded [controller is moved out of neutral (center) position], and the operator is either not seated (refer to *Seat Switch*, page 3-22) or the left armrest is not in the down position (refer to *Seat Armrest Switch*, page 3-26). The crane function is re-enabled by either sitting in the operator seat, lowering the left armrest, or by actuating a dead-man switch on the left or right dual axis controllers [refer to *Deadman Switches (Dual Axis)*, page 3-20]. **b.** Crane function is being commanded [controller is moved out of neutral (center) position] when the crane function is changed from Off to On. Allow controller to return to its neutral position, then re-set the crane function to On.
Disabled	Ghosted	Crane function is Disabled, preventing the crane function from being set to On or Off. Crane function speed has been set to 0% (zero).

Refer to Figure 4-37 for a list of the actual crane function button icons and their status colors that can show in the Function Status Bar.

FIGURE 4-37

10746-15

10746-16

Item	Description
1	Function Status Bar
2	Swing Button
3	Telescope Button
4	Boom Lift
5	Aux Hoist
6	Main Hoist - Normal Speed Selected
7	Main Hoist - High Speed Selected

FIGURE 4-38

SDM MENU BAR

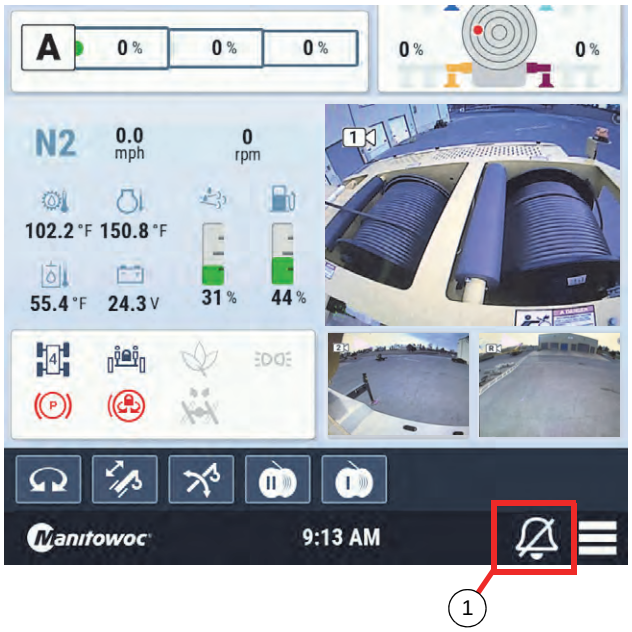
The Menu Bar (1, Figure 4-40) of the Superstructure Display Module (SDM) is located at the bottom of the display screen.

On the left side of the Menu Bar is the Manitowoc Logo – Screen Light/Dark Mode Button (2). Select this button to toggle the display screen between its light and dark modes. The display's Light Mode makes it easier to see the screen during the daytime, and the Dark Mode is easier to view during the nighttime. Toggling between Light and Dark Modes can also be done in the Light-Dark Mode Panel of the SDM (refer to *Settings*, page 4-94).

The current time of day (3) is shown in the middle of the Menu Bar.

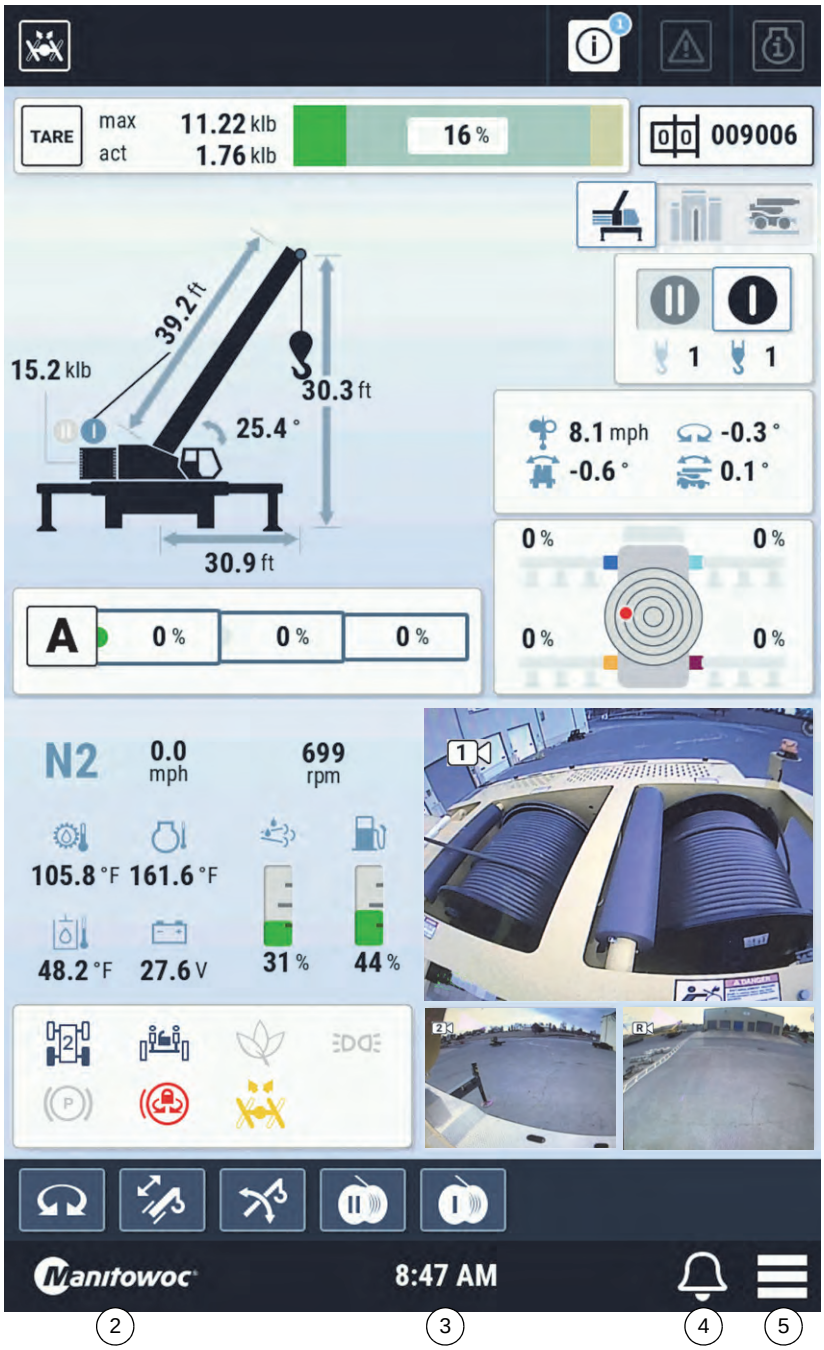
Near the right side of the Menu Bar is the Buzzer Mute/Unmute Button Icon (bell symbol) (4, Figure 4-40). This button icon always shows on the Menu Bar. If the Crane Control System (CCS) causes the SDM's buzzer to come on, the button can be selected to temporarily mute the buzzer.

When the buzzer is muted, the button icon will show a diagonal line through the bell symbol (1, Figure 4-39).



10746-122 **FIGURE 4-39**

The Menu Button (5, Figure 4-40), when selected, opens the Menu Panel. The Menu Panel includes crane function buttons that represent the related crane functions and operations that can be performed when a button is selected. With the Menu Panel open, the operator can select the desired crane function button to open its related crane function panel and perform that crane function or operation. Refer to Figure 4-41, Figure 4-42, and Figure 4-43 for a list of the crane functions buttons and their functions/operations they perform.

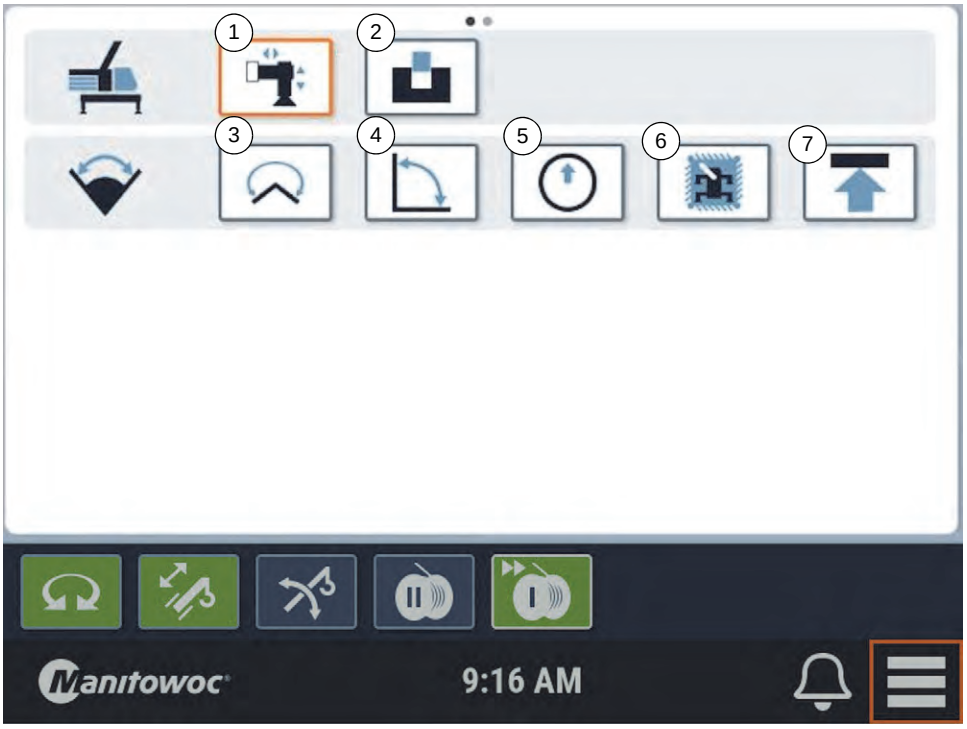


Item	Description
1	Menu Bar
2	Manitowoc Logo – Screen Light/Dark Mode Button
3	Current Time
4	Buzzer Mute/Unmute Button
5	Menu Button

10746-2

FIGURE 4-40

Menu Panel 1



Item	Description	Page
1	Outrigger Extend/Retract Button	4-40
2	360° Superstructure Swing Lock Button	4-48
3	WRL Swing Angle Button	4-52
4	WRL Boom Angle Button	4-58
5	WRL Radius Button	4-64
6	WRL Virtual Walls Button	4-69
7	WRL Boom Height Button	4-77

10746-144

FIGURE 4-41

4

Menu Panel 2

Item	Description	Page
1	Operating Hours Button	4-82
2	Software Version Button	4-84
3	Data-logger Button	4-84
4	Controller Sensitivity Button	4-85
5	Controller Speed Button	4-88
6	ECO Mode Button	4-90
7	Exhaust System Cleaning Button	4-93
8	Settings Button	4-94
9	Work Lights Button	4-96

10753-13

FIGURE 4-42

Menu Panel 3

Item	Description	Page
1	Hydraulic Pressure Information Screen Button	4-99
	Crane Service Tools Buttons:	4-102
2	Electronic Bubble Level Sensor Calibration Button	
3	Foot Pedal Sensor Calibration Button	
4	Swing Angle Sensor Calibration Button	
5	Boom Angle Sensor Calibration Button	
6	Boom Length Sensor Calibration Button	
7	Outrigger Monitoring System Sensor Calibration Button	
8	CAN Node ID Reset Button	

10753-4

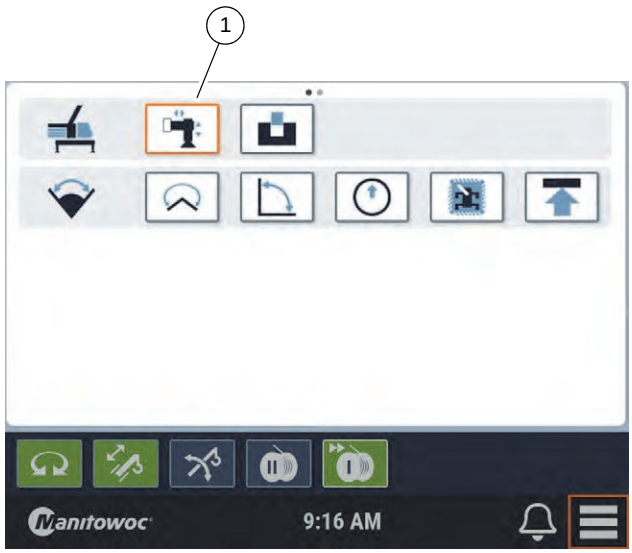
FIGURE 4-43

4

Outrigger Extend/Retract

The Outrigger Extend/Retract function panel allows the operator to set the outriggers and level the crane using either a manual or semi-automatic mode. The Outrigger Extend/Retract function panel is also used to retract and stow the outriggers as well as operate the side mounted carrier work lights.

To open the Outrigger Extend/Retract Panel, select the Outrigger Extend/Retract Button (1, Figure 4-44) on the Menu Panel.



10746-145

FIGURE 4-44

NOTE: Before operating the outriggers, operator must read, understand, and follow the information and procedures given under the section titled *Using the Outriggers*, page 5-28. This section provides more procedures to set the outriggers and level the crane, and procedures to stow the outriggers.

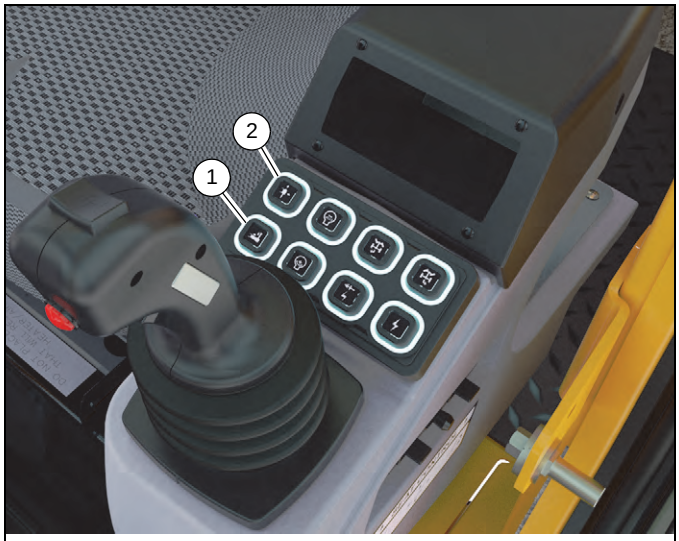
NOTE: The outriggers are to be deployed with the boom centered over the front axle. In this configuration, the direction the operator is facing is considered the front of the crane.

The Steering Wheel Indicator (6, Figure 4-47) shown on the Outrigger Extend/Retract Panel corresponds to the front of the crane. The terms left and right correspond to the operator's left and right sides when looking forward over the front (axle) of the crane.

NOTE: Outrigger controls are only enabled when the following conditions are met:

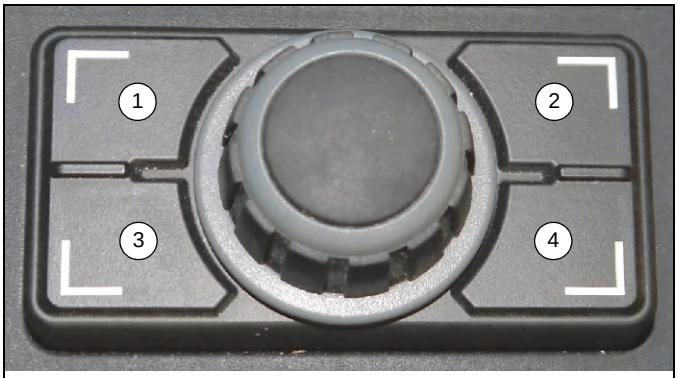
- Engine is on.
- Parking brake is applied.
- Transmission is shifted to neutral.
- Four-wheel low is selected.

To extend and retract the outriggers, operator must push and hold the applicable Outrigger Extend Button (1, Figure 4-45) or Outrigger Retract Button (2, Figure 4-45) located at the left armrest. Operator must also push and hold one or more of the four buttons that relate to the four outrigger beams/jacks. These outrigger beam/jack buttons are shown on the Outrigger Extend/Retract Panel (12, Figure 4-47) on the SDM. The four buttons (1 thru 4, Figure 4-46) surrounding the Jog Dial at the right armrest can also be used when extending/retracting the outriggers.



10710-8b

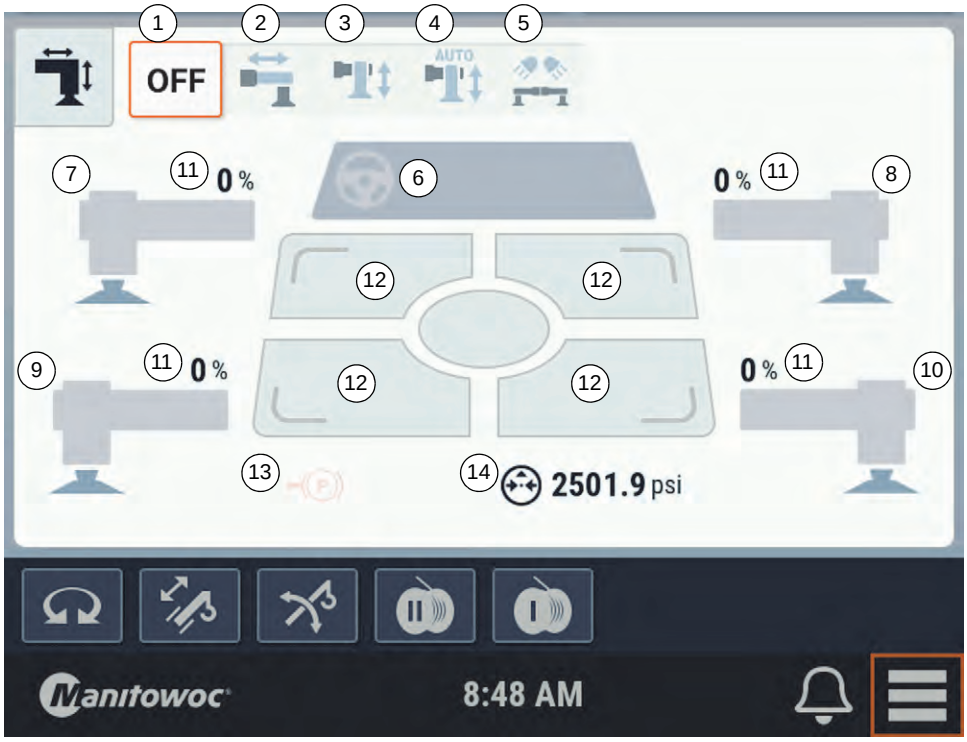
FIGURE 4-45



Item	Description
1	Left-Front Beam
2	Right-Front Beam
3	Left-Rear Beam
4	Right-Rear Beam

FIGURE 4-46

4



Item	Description	Item	Description
1	OFF Button	8	Right-Front Beam/Jack
2	Outrigger Beams Button	9	Left-Rear Beam/Jack
3	Outrigger Jacks Button	10	Right-Rear Beam/Jack
4	Auto-level Button	11	Percentage Outrigger Beam is Extended
5	Side Mounted Carrier Work Lights ON/OFF Button	12	Keypad Buttons
6	Steering Wheel Indicator (to indicate front of crane)	13	Parking Brake Indicator
7	Left-Front Beam/Jack	14	Outrigger Hydraulic System Pressure

10746-71

FIGURE 4-47

EXTENDING/RETRACTING THE OUTRIGGERS BEAMS

To extend or retract the outrigger beams, perform the following procedure:

1. Select the Outrigger Beams Button (1, Figure 4-48).
2. To extend the outrigger beams, do the following:
   a. Push and hold the Outrigger Extend Button (1, Figure 4-45).
   b. Push and hold one or more of the related outrigger buttons at the Jog Dial (Figure 4-46) or at the Keypad (12, Figure 4-47) on the Outrigger Extend/Retract Panel.

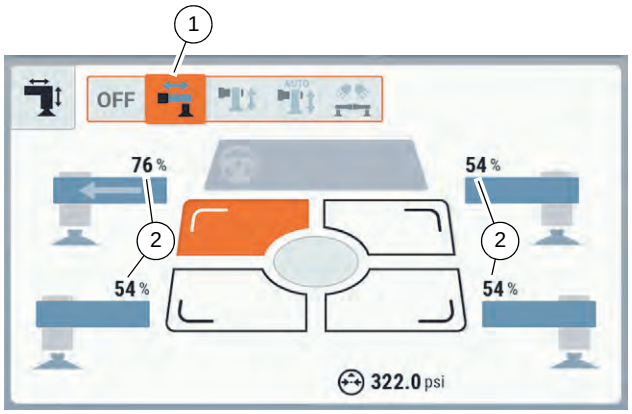
      Release the buttons when the beams are extended to the desired positions.
3. To retract the outrigger beams, do the following:
   a. Push and hold the Outrigger Retract Button (2, Figure 4-45).
   b. Push and hold one or more of the related outrigger buttons at the Jog Dial or the Keypad on the Outrigger Extend/Retract Panel.

      Release the buttons when the beams are retracted to the desired positions.

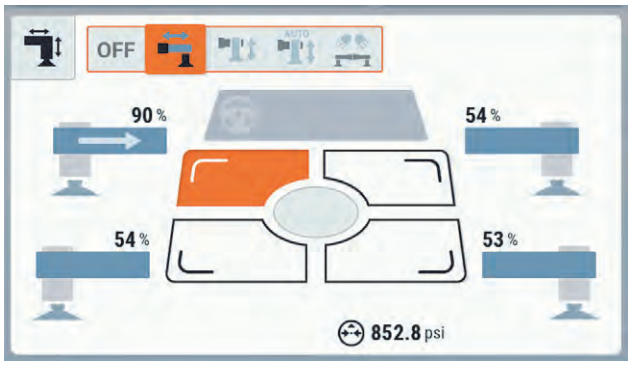
When a button at the Jog Dial or Outrigger Extend/Retract Panel is pushed and held, the related outrigger beam image will show an arrow to indicate the beam is moving and in what direction (extending or retracting). In Figure 4-48, the top image shows the left-front outrigger beam is extending and the bottom image shows the left-front outrigger beam is retracting.

NOTE: To be recognized as a valid outrigger configuration, the RCL requires the OMS measured length of the outrigger beam position to be within ±3% of the target outrigger position.

If operating the crane with the outrigger beams in the mid-extended position (50% for GRT765 / 54% for GRT780), use the Percentage Outrigger Beam is Extended field (2, Figure 4-48) to help achieve the desired position.



10746-69



10746-70

FIGURE 4-48

EXTENDING/RETRACTING INDIVIDUAL OUTRIGGER JACKS

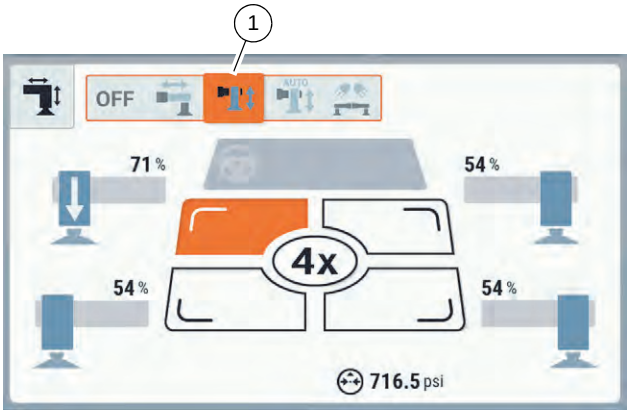
To extend or retract individual outrigger jacks, perform the following procedure:

1. Select the Outrigger Jacks Button (1, Figure 4-49).
2. To extend the outrigger jacks, do the following:
   a. Push and hold the Outrigger Extend Button (1, Figure 4-45).
   b. Push and hold one or more of the related buttons at the Jog Dial (Figure 4-46) or at the Keypad (12, Figure 4-47) on the Outrigger Extend/Retract Panel.

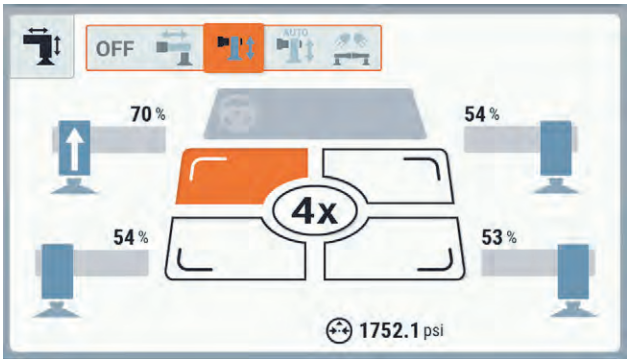
      Release the buttons when the jacks are extended to the desired positions.
3. To retract the outrigger jacks, do the following:
   a. Push and hold the Outrigger Retract Button (2, Figure 4-45)
   b. Push and hold one or more of the related buttons at the Jog Dial or at the Keypad on the Outrigger Extend/Retract Panel.

      Release the buttons when the jacks are retracted to the desired positions.

When a button at the Jog Dial or Outrigger Extend/Retract Panel is pushed and held, the related outrigger jack image will show an arrow to indicate the jack is moving and in what direction (extending or retracting). In Figure 4-49, the top image shows the left-front outrigger jack is extending and the bottom image shows the left-front outrigger jack is retracting.



10746-72



10746-73

FIGURE 4-49

EXTENDING/RETRACTING THE FOUR OUTRIGGER JACKS AT THE SAME TIME (4X)

To extend or retract all four outrigger jacks at the same time, perform the following procedure:

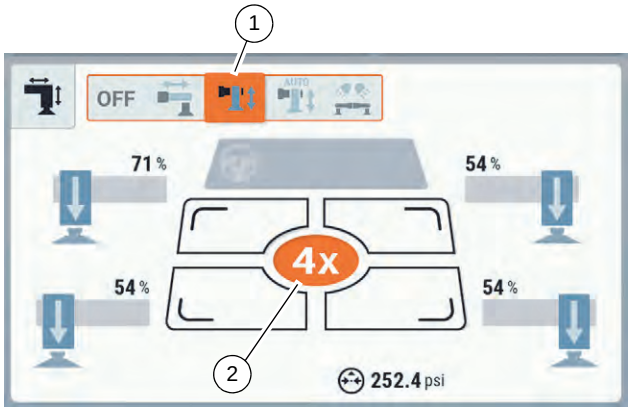
1. Select the Outrigger Jacks Button (1, Figure 4-49).

   The Outrigger Extend/Retract Panel will show the “4x” Button (2, Figure 4-50).

2. Push and hold the related Outrigger Extend or Retract Button.

3. Push and hold the either the “4x” Button (2, Figure 4-49) on the Outrigger Extend/Retract Panel or push in the Jog Dial and hold.

   Release the button/Jog Dial when the jacks are extended/retracted to the desired position.



10746-75

FIGURE 4-50

4

LEVELING THE CRANE USING AUTO-LEVEL

Before starting the auto-level process, operator must read, understand, and follow the additional information and procedures given under the section titled *Setting the Outriggers Using the Auto-Level Feature*, page 5-31.

NOTE: Before starting the auto-level process, operator must manually extend the outrigger jacks until all four tires are slightly off the ground.

To level the crane using the auto-level process, perform the following procedure:

1. Select the Auto-level Button (1, Figure 4-51).

The Outrigger Extend/Retract Panel will show the Auto-level Icon Button (2, Figure 4-51).

2. To begin the auto-level function, do the following:

a. Push and hold the Outrigger Extend Button (1, Figure 4-45).

b. Push and hold the Auto-level Icon Button (2, Figure 4-51) on the Outrigger Extend/Retract Panel or push in the Jog Dial and hold.

The crane will react in the following manner:

a. Briefly extend all four outrigger jacks.

b. Briefly extend the two front jacks.

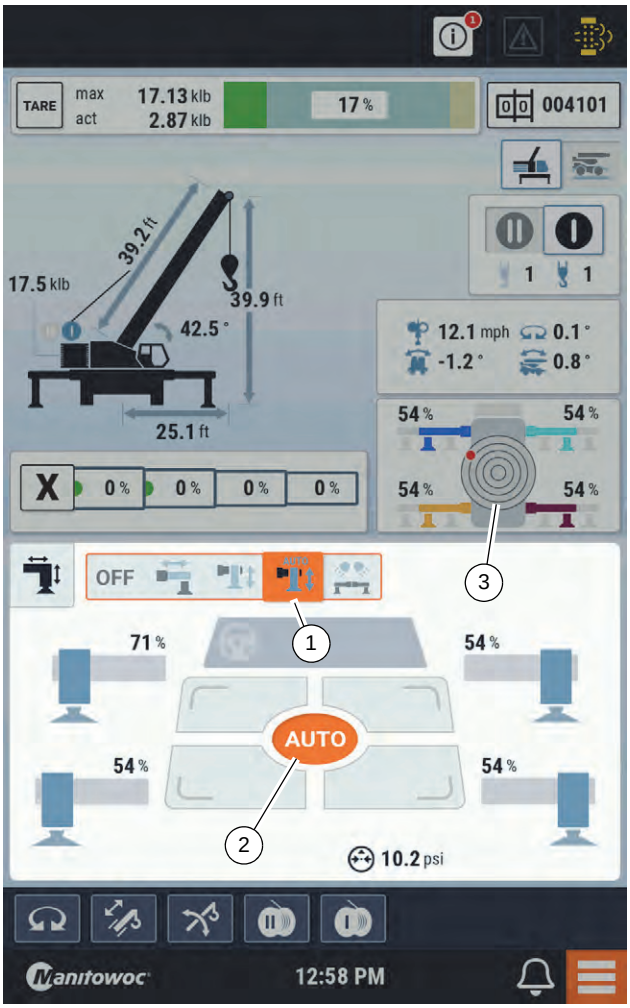
c. Briefly extend the two rear jacks.

d. Crane will continue to adjust the two left side or two right side jacks until a level position is reached.

There may be several long pauses after the crane makes a jack height adjustment for the inclination sensor to stabilize – keep holding the buttons through each pause.

Auto-level process is complete and the buttons can be released when the crane is out-of-level by ≤1%, as shown on the digital bubble level (3, ,Figure 4-51).

NOTE: After the auto-level process has completed, operator must verify that all four tires are off the ground before making a lift. If one or more tires are touching the ground, the operator must add cribbing under the outrigger floats and re-level the crane.



10746-74

FIGURE 4-51

OPERATING THE SIDE-MOUNTED CARRIER WORK LIGHTS

The carrier has two left side-mounted work lights and two right side-mounted work lights which can be used to illuminate the area around the crane (refer to *Side-Mounted Carrier Work Lights*, page 3-53).

To toggle the left and/or right sets of work lights on and off, do the following:

1. Select the Side Mounted Carrier Work Lights Button (1, Figure 4-52).

   The Left and Right Side-Mounted Carrier Work Lights ON/OFF Icons (2, 3, Figure 4-52) will show.

2. Select either of the upper or lower Left Side Mounted Carrier Work Lights ON/OFF Buttons (4) to switch on the left side work lights.

   Select either of the upper or lower Right Side-Mounted Carrier Work Lights ON/OFF Buttons (5) to switch on the right side work lights.

3. Select either one of the left or right sets of buttons again to switch the related work lights off.

The top image in Figure 4-52 shows both the left and right side-mounted work lights are off. The bottom image shows the left side set of work lights is on (green in color) and the right side set is off.

Refer to *Side-Mounted Carrier Work Lights*, page 3-53 for more information about the work lights.

10746-23

10746-76

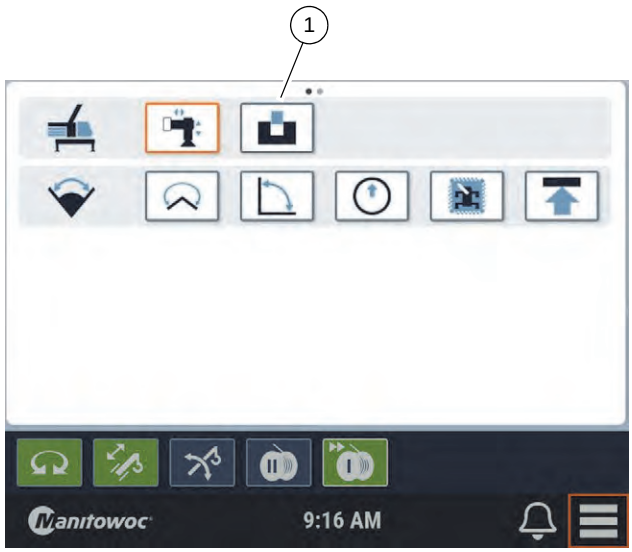
FIGURE 4-52

4

360° Superstructure Swing Lock

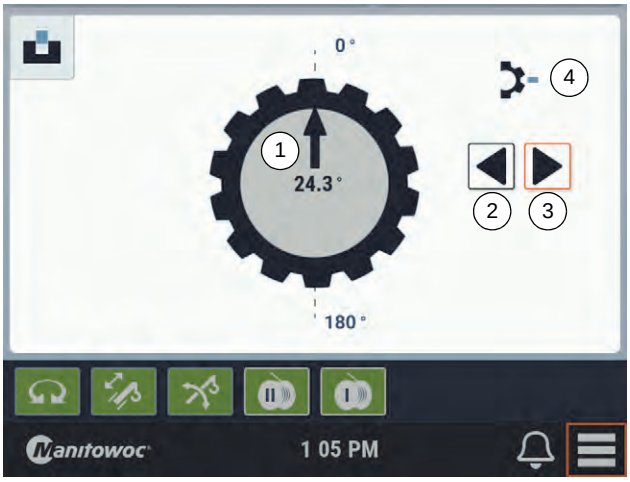
The 360° Superstructure Swing Lock function is used to mechanically lock the superstructure in position anywhere throughout its 360° rotation.

To open the 360° Superstructure Swing Lock Panel, select the 360° Superstructure Swing Lock Button (1, Figure 4-53) on the Menu panel.



10746-145 **FIGURE 4-53**

The 360° Superstructure Swing Lock Panel (Figure 4-54) shows the current Swing Angle (1), the Lock and Unlock Buttons for operating the lock function, and the Swing Lock Status Indicator (4) (locked/unlocked).



Item	Description
1	Swing Angle
2	Lock Button
3	Unlock Button
4	Swing Lock/Unlock Status Indicator (shown in the unlocked position)

10746-78 **FIGURE 4-54**

LOCKING THE SUPERSTRUCTURE

1. Swing the superstructure to the desired position.
2. Maintain superstructure position by pushing and holding the swing brake pedal.
3. Select the Lock Button (1, Figure 4-55).

   When the lock is engaged, the Locked Status Indicator (2) will show.

10746-77 **FIGURE 4-55**

UNLOCKING THE SUPERSTRUCTURE

1. Press and hold the swing brake pedal.
2. Select the Unlock Button (1, Figure 4-56).

   When the lock is disengaged, the Unlocked Status Indicator (2) will show.

10746-78

FIGURE 4-56

Working Range Limiter (WRL) – Overview

The Working Range Limiter (WRL) is a feature of the Crane Control System (CCS) that lets the operator define boundaries or limits for crane operation. With obstacles and limits accurately defined, the WRL will aid the operator in identifying when the boom and/or load is nearing an obstacle by giving both visual and audible alerts.

CAUTION

The WRL is an operator aid and should not be relied upon in place of good operating practice. The crane functions can be affected to slow and stop with respect to a set limit. This behavior is referred to as lock-out. A qualified signal person to observe and direct the lifting operation should be used when necessary.

Refer to Table 4-1 – WRL Alarm Characteristics for a list of the visual and audible alarms that can occur when the boom approaches and reaches a defined limit.

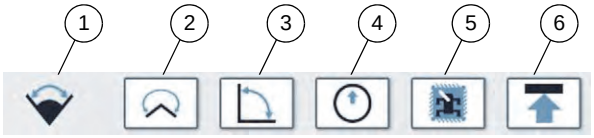
DANGER

For standard cranes NOT equipped with the WRL Lock-Out Function, the WRL System is an audio/visual indicator only. The system will not stop the movement of the crane when the limit is reached. The operator must continue to control and stop the movement of the crane when alerted by the WRL Indicator.

If the crane's WRL is configured with the Lock-Out Function, the crane functions can be affected to slow and stop with respect to the programmed limits.

When the Lock-Out feature of the WRL System is enabled, the operator must continue to operate the crane functions with caution.

The WRL Menu Group (1, Figure 4-57) and sub-menu (2 through 6) allows the operator to set limits on the location of the boom.



Item	Description	Page
1	WRL Menu Group	
2	WRL Swing Angle Limitation	4-52
3	WRL Boom Angle Limitation	4-58
4	WRL Working Radius Limitation	4-64
5	WRL Virtual Walls Limitation	4-69
6	WRL Boom Height Limitation	4-77

10746-79

FIGURE 4-57

The following limitations are available under the WRL Menu Group (1, Figure 4-57).

- Swing Angle Limitation Button (2): Swing angle limits for swing left and swing right directions can be defined.
- Boom Angle Limitation Button (3): Boom up/down limits can be defined for a minimum and maximum boom angle.
- Working Radius Limitation Button (4): Working radius limits can be defined for minimum and maximum radius working zones.
- Virtual Wall(s) Limitation Button (5): Up to five virtual walls can be defined to be jobsite objects or warning zones.
- Boom Height Limitation Button (6): Boom height limit can be defined for a maximum boom elevation.

CAUTION

Turning the ignition switch to the OFF position, and thereby switching off the power to the Crane Control System (CCS), will set all WRL limitations to OFF. While powering OFF the CCS will disable all WRL limitations, the limitation values defined (for example, Swing Angles) will be retained.

Table 4-1 – WRL Alarm Characteristics

LIMITATION	POSITION	ALARM	INDICATOR
Swing Angle Limitation	10 deg before limit	Slow beeping	Amber
	5 deg before limit	Fast beeping	Red
	At limit	Constant on	
Boom Angle Limitation	10 deg before limit	Slow beeping	Amber
	5 deg before limit	Fast beeping	Red
	At limit	Constant on	
Boom Height Limitation	10 ft before limit	Slow beeping	Amber
	5 ft before limit	Fast beeping	Red
	At limit	Constant on	
Working Radius Limitation	10 ft before limit	Slow beeping	Amber
	5 ft before limit	Fast beeping	Red
	At limit	Constant on	
Virtual Walls Limitation	10 ft before limit	Slow beeping	Amber
	5 ft before limit	Fast beeping	Red
	At limit	Constant on	

WRL – Swing Angle

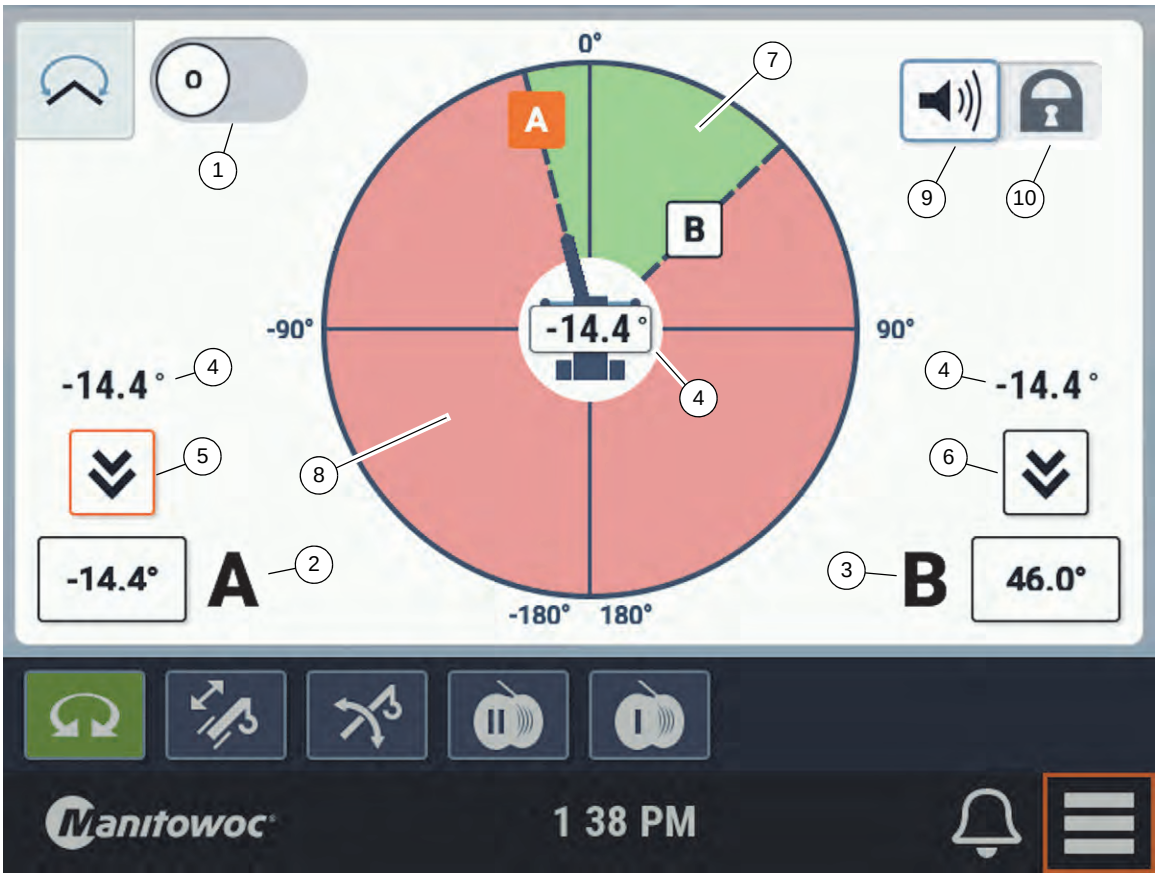
The Working Range Limiter – Swing Angle function is an electronic aid that helps prevent the load/boom from swinging in to an area that the operator deems restricted.

To open the WRL – Swing Angle Panel, select the WRL – Swing Angle Button (1, Figure 4-58) on the Menu panel.

10746-145

FIGURE 4-58

The WRL – Swing Angle Panel (Figure 4-59) lets the operator set the WRL – Swing Angle function to ON or OFF. The panel also lets the operator set the swing left and swing right angle limits and if the Crane Control System (CCS) gives an audible alert, or gives an audible alert and locks out crane functions, when a limit is reached. The panel also shows the current swing angle in degrees.



Item	Description	Item	Description
1	ON/OFF Button	6	Input Current Swing Angle - Right Button
2	Left Swing Angle Limit	7	Permitted Swing Angle Area (Green)
3	Right Swing Angle Limit	8	Restricted Swing Angle Area (Red)
4	Current Swing Angle	9	Audible Alert (only) Button
5	Input Current Swing Angle - Left Button	10	Audible Alert with Lock-out Button

10746-85

FIGURE 4-59

4

The ON/OFF Button (1, Figure 4-59) is used to set the Swing Angle Limit function to ON or OFF. When the function is set to ON, the WRL Swing Limit Enabled Alert in the Notification Alerts section of the SDM comes on (refer to *Notification Alerts*, page 4-15).

The Current Swing Angle Indicator (4, Figure 4-59) shows the crane's current swing angle in degrees.

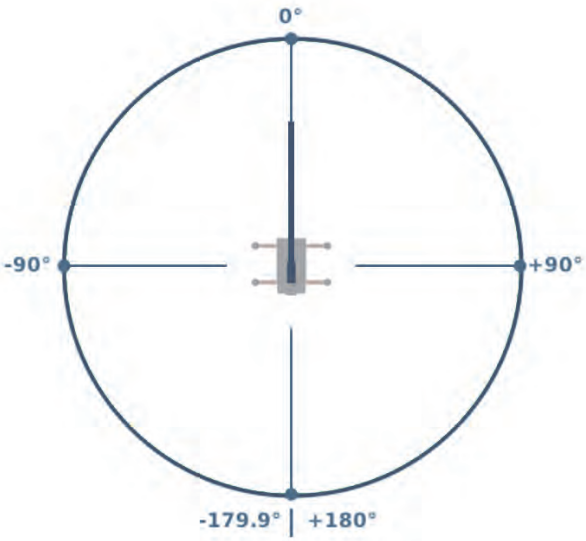
The Swing Left and Right Angle Limit elements (2, 3, Figure 4-59) show the related swing angle limits that are currently programmed in to the CCS. When one of these elements is selected, a spinbox will show to let the operator manually change the related swing angle limit.

The Input Current Swing Angle Buttons (5, 6, Figure 4-59), when selected, input the Current Swing Angle (4) in to the related Swing Left or Swing Right Angle Limit elements (2, 3).

In the center of the WRL – Swing Angle Panel is a pictorial that shows a top-down view of the crane with extended boom. A circle around the crane image illustrates the full 360° swing range. 0° means that the superstructure is positioned over the front of the crane carrier.

A full turn from this working position is divided into two semi-circles (Figure 4-60).

Angles in the left semi-circle are shown as negative values (0° to -179.9°). Angles in the right semicircle are shown as positive (0° to 180°).



10083

FIGURE 4-60

When the WRL – Swing Angle function is ON and both swing angle limits are set, the pictorial will show the Permitted Swing Angle Area (7, Figure 4-59) in green and the Restricted Swing Angle Area (8) in red.

The Audible Alert (only) and Audible Alert With Lock-Out Buttons (9, 10, Figure 4-59) let the operator choose between receiving either an audible alert or an audible alert with crane function lock-out when a swing angle limit is approached or reached.

When the crane approaches or reaches a swing angle limit, the CCS will show an alert in the Operating Limit Alerts area, cause the buzzer to come on, and when set to do so, reduce and stop the swing motion. Refer to Table 4-2 for a list of Alerts (and their definitions) that can show when the crane approaches and reaches a swing angle limit.

Table 4-2 – WRL Swing Angle Alert Definitions

Alert	Name	Description
	WRL Swing Limit Enabled	Indicates the left and right swing angle limits are defined.
	WRL Swing Limit Warning	Indicates the swing angle is within 10° of a swing angle limit setpoint. The warning buzzer slowly beeps when the swing angle is within 10° of the swing angle limit setpoint and changes to a fast beep when the swing angle is within 5° of the swing angle limit setpoint. For cranes that are equipped with the WRL Lock Out Function, when the swing angle is within 10° of the swing angle lock out setpoint, the swing function commanded by the controller may be reduced or suspended depending upon the weight of the load and the swing speed.
	WRL Swing Limit Stop	Indicates the swing angle is at a swing angle limit setpoint. The warning buzzer is on (constant). For cranes that are equipped with the WRL Lock Out Function, the swing left or swing right crane function is locked out, depending upon which limit is reached.

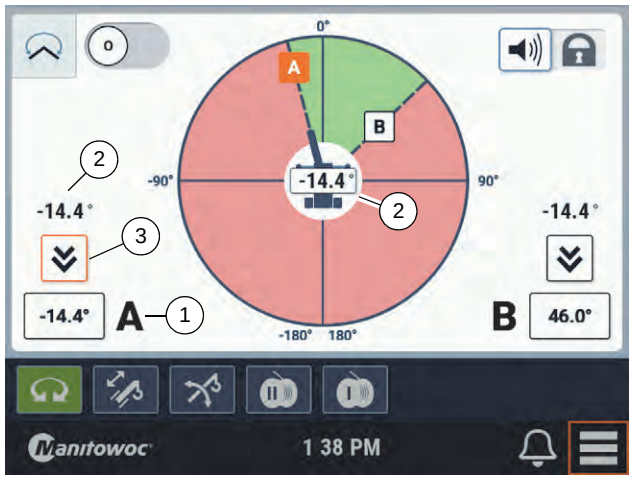
Perform the following procedure to enable the WRL – Swing Angle function.

1. Program the Rated Capacity Limiter (RCL).
2. Open the WRL – Swing Angle Panel by selecting the WRL – Swing Angle Button (1, Figure 4-61) on the Menu Panel.

10746-145 **FIGURE 4-61**

3. Specify the value for the Left Swing Angle Limit (1, Figure 4-62) by doing one of the following:
   - Swing the boom to the left until the boom is at the restricted area.

     Select the Input Current Swing Angle Button (3, Figure 4-62). This causes the current swing angle (2) to be set in to the Left Swing Angle Limit element (1).



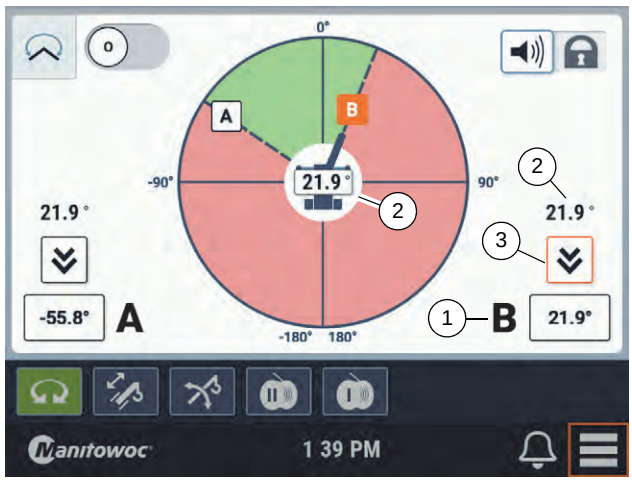
10746-80 **FIGURE 4-62**

   - Or, select the Left Swing Angle Limit element to open the spinbox (1, Figure 4-63), then input the desired swing angle.

10746-81 **FIGURE 4-63**

4. Specify the value for the Right Swing Angle Limit (1, Figure 4-64) by doing one of the following:
   - Swing the boom to the right until the boom is at the restricted area.

     Select the Input Current Swing Angle Button (3, Figure 4-64). This causes the current swing angle (2) to be set in to the Right Swing Angle Limit element (1).



10746-82 **FIGURE 4-64**

- Or, select the Right Swing Angle Limit element to open the spinbox (1, Figure 4-65), then input the desired swing angle.

10746-83 **FIGURE 4-65**

5. Select either the Audible Alert Button (1, Figure 4-66) or the Audible Alert With Lock-out Button (2).

10746-84 **FIGURE 4-66**

6. To prevent the warning buzzer coming on and the WRL Swing Angle Limit Alert showing, move the boom nose away from the limits before setting the Swing Angle Limit function to ON.

Select the ON/OFF switch (1, Figure 4-67) and set it to ON.

10746-84 **FIGURE 4-67**

4

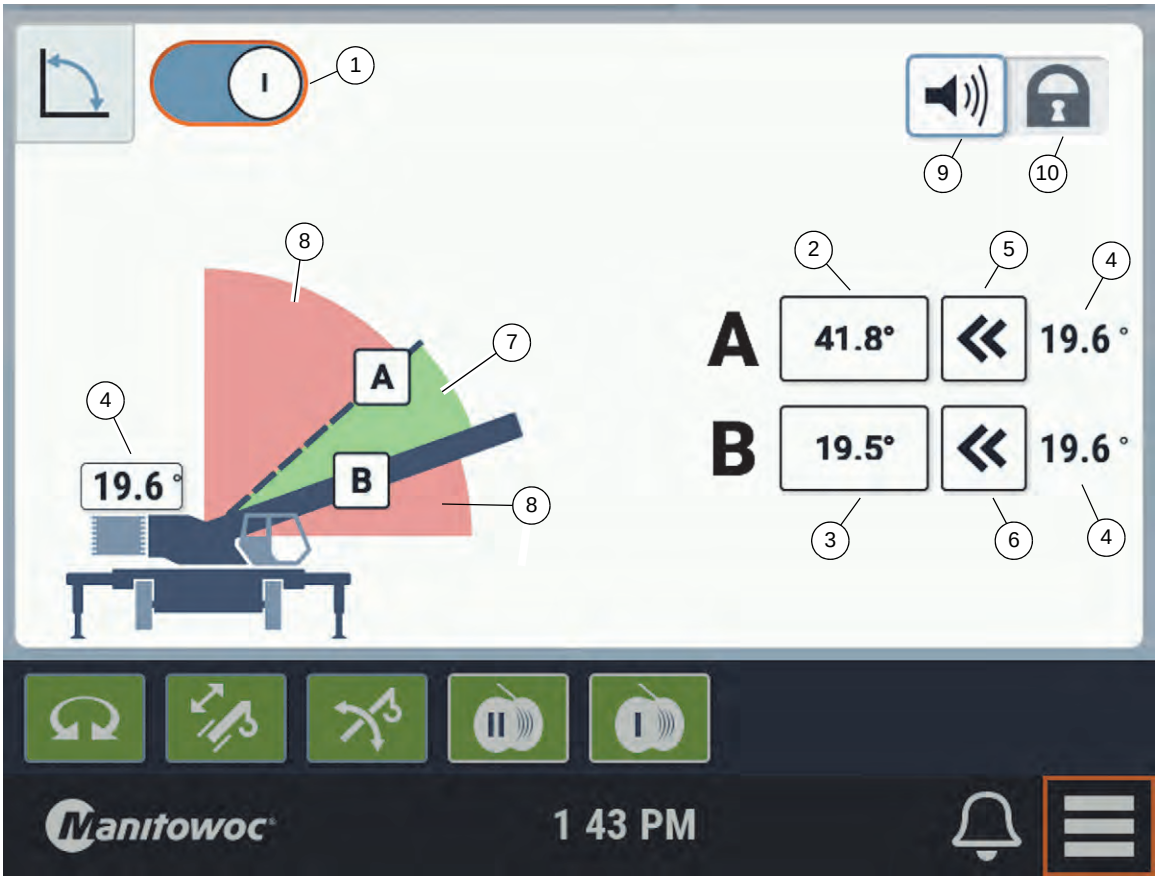
WRL – Boom Angle

The Working Range Limiter – Boom Angle function is an electronic aid that helps prevent the boom from entering in to an area that the operator deems restricted.

To open the WRL – Boom Angle Panel, select the WRL – Boom Angle Button (1, Figure 4-68) on the Menu panel.

10746-145 **FIGURE 4-68**

The WRL – Boom Angle Panel (Figure 4-69) lets the operator set the WRL – Boom Angle function to ON or OFF. The panel also lets the operator set the minimum and/or maximum boom angle limits and if the Crane Control System (CCS) gives an audible alert, or gives an audible alert and locks out crane functions, when a limit is reached. The panel also shows the current boom angle in degrees.



Item	Description	Item	Description
1	ON/OFF Button	6	Input Current Boom Angle - Minimum Button
2	Maximum Boom Angle Limit	7	Permitted Boom Angle Area (Green)
3	Minimum Boom Angle Limit	8	Restricted Boom Angle Area (Red)
4	Current Boom Angle	9	Audible Alert (only) Button
5	Input Current Boom Angle - Maximum Button	10	Audible Alert with Lock-out Button

10746-91

FIGURE 4-69

4

The ON/OFF Button (1, Figure 4-69) is used to set the Boom Angle Limit function to ON or OFF. When the function is set to ON, the WRL Boom Angle Limit Enabled Alert in the Notification Alerts section of the SDM comes on (refer to *Notification Alerts*, page 4-15).

The Current Boom Angle element (4, Figure 4-69) shows the crane's current boom angle in degrees.

The Maximum and Minimum Boom Angle Limit elements (2, 3, Figure 4-69) show the related boom angle limits that are currently programmed in to the CCS. When one of these input elements is selected, a spinbox will show to let the operator manually change the related boom angle limit.

The Input Current Boom Angle Buttons (5, 6, Figure 4-69), when selected, input the Current Boom Angle (4) in to the related Minimum and Maximum Boom Angle Limit elements (2, 3).

To the left of center of the WRL – Boom Angle Panel is a pictorial that shows a side view of the crane with extended boom. An arc to the front of the crane illustrates the path the boom nose follows as it is raised and lowered. The horizontal line reaching out from the boom pivot point represents a 0° boom angle. The vertical line reaching out from the boom pivot point represents a 90° boom angle.

When the WRL – Boom Angle function is ON and the minimum and/or maximum boom angle limits are set, the pictorial will show the Permitted Boom Angle Area (7, Figure 4-69) in green and the Restricted Boom Angle Area (8) in red.

The Audible Alert (only) and Audible Alert With Lock-Out Buttons (9, 10, Figure 4-69) let the operator choose between receiving either an audible alert or an audible alert with crane function lock-out when a boom angle limit is approached or reached.

When the crane approaches or reaches a boom angle limit, the CCS will show an alert in the Operating Limit Alerts section, cause the buzzer to come on, and when set to do so, reduce and stop the boom up or down motion. Refer to Table 4-3 for a list of Alerts (and their definitions) that can show when the crane approaches and reaches a boom angle limit.

Table 4-3 – WRL Boom Angle Alert Definitions

Alert	Name	Description
	WRL Boom Angle Limit Enabled	Indicates that the minimum boom angle limit, the maximum boom angle limit, or both the minimum and maximum boom angle limits are defined.
	WRL Boom Angle Limit Warning	Indicates the boom angle is within 10° of a boom angle limit setpoint. The warning buzzer slowly beeps when the boom angle is within 10° of the boom angle limit setpoint and changes to a fast beep when the boom angle is within 5° of the boom angle limit setpoint.
	WRL Boom Angle Limit Stop	Indicates the boom angle is at a boom angle limit setpoint. The warning buzzer is on (constant). For cranes that are equipped with the WRL Lock Out Function, the boom up or boom down crane function is locked out, depending upon which limit is reached.

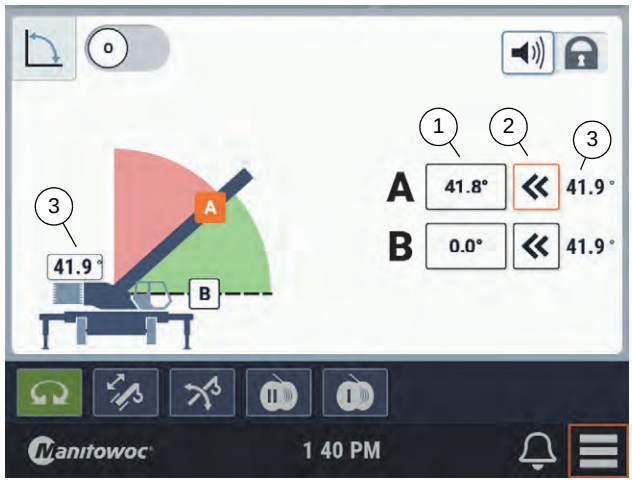
Perform the following procedure to enable the WRL – Boom Angle function.

1. Program the Rated Capacity Limiter (RCL).
2. Open the WRL – Boom Angle Panel by selecting the WRL – Boom Angle Button (1, Figure 4-70) on the Menu Panel.

10746-145 **FIGURE 4-70**

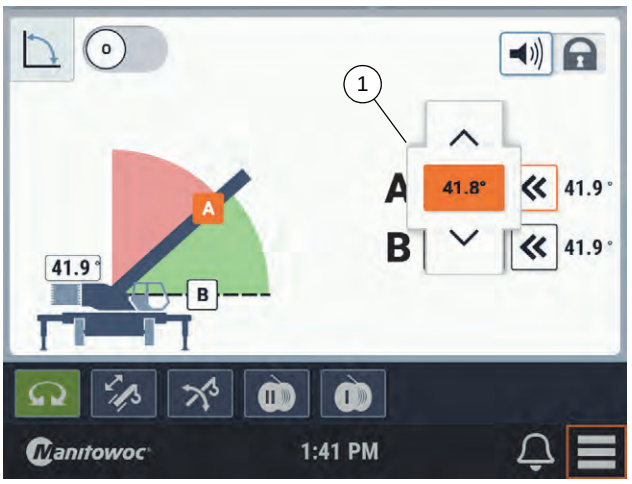
3. If necessary, specify the value for the Maximum Boom Angle Limit (1, Figure 4-71) by doing one of the following:
   - Raise the boom until the boom is at the maximum boom angle limit.

     Select the Input Current Boom Angle – Maximum Button (2, Figure 4-71). This causes the current boom angle (3) to be set in to the Maximum Boom Angle Limit element (1).



10746-86 **FIGURE 4-71**

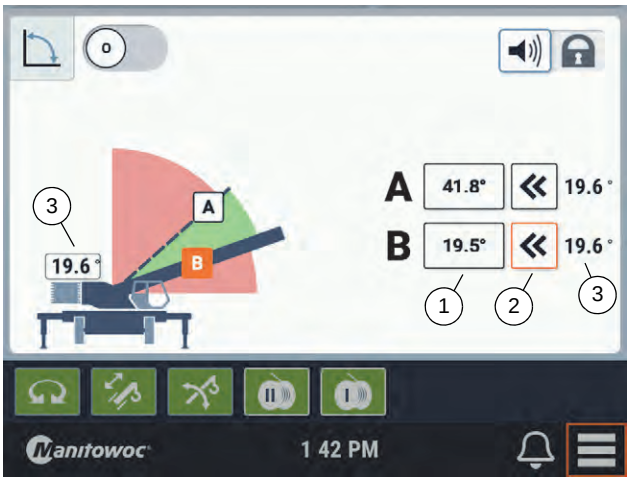
   - Or, select the Maximum Boom Angle Limit element to open the spinbox (1, Figure 4-72), then input the desired boom angle.



10746-87 **FIGURE 4-72**

4. If necessary, specify the value for the Minimum Boom Angle Limit (1, Figure 4-73) by doing one of the following:
   - Lower the boom until the boom is at the minimum boom angle limit.

     Select the Input Current Boom Angle – Minimum Button (2, Figure 4-73). This causes the current boom angle (3) to be set in to the Minimum Boom Angle Limit element (1).

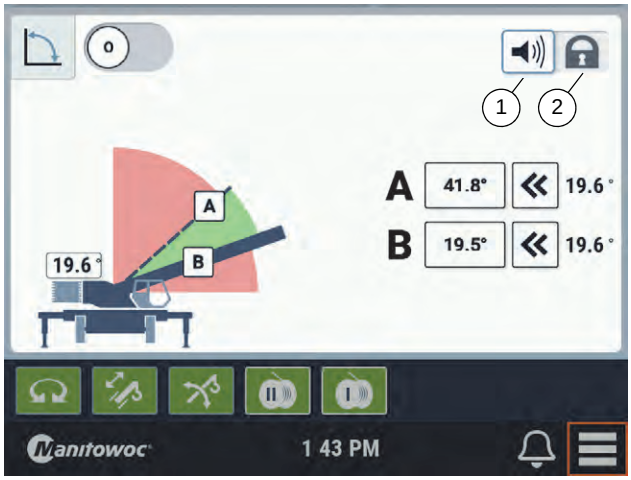


10746-88 **FIGURE 4-73**

- Or, select the Minimum Boom Angle Limit element to open the spinbox (1, Figure 4-74), then input the desired boom angle.

10746-89 **FIGURE 4-74**

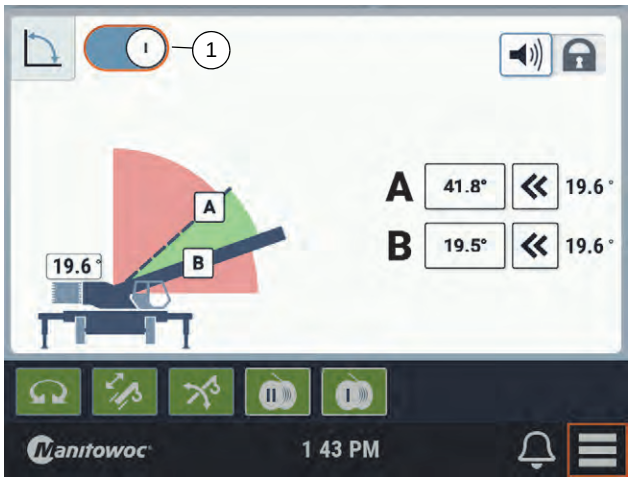
5. Select either the Audible Alert Button (1, Figure 4-75) or the Audible Alert With Lock-out Button (2).



10746-90 **FIGURE 4-75**

6. To prevent the warning buzzer coming on and the WRL Boom Angle Limit Alert showing, move the boom away from the boom angle limits before setting the Boom Angle Limit function to ON.

   Select the ON/OFF switch (1, Figure 4-76) and set it to ON.



10746-90 **FIGURE 4-76**

4

WRL – Radius

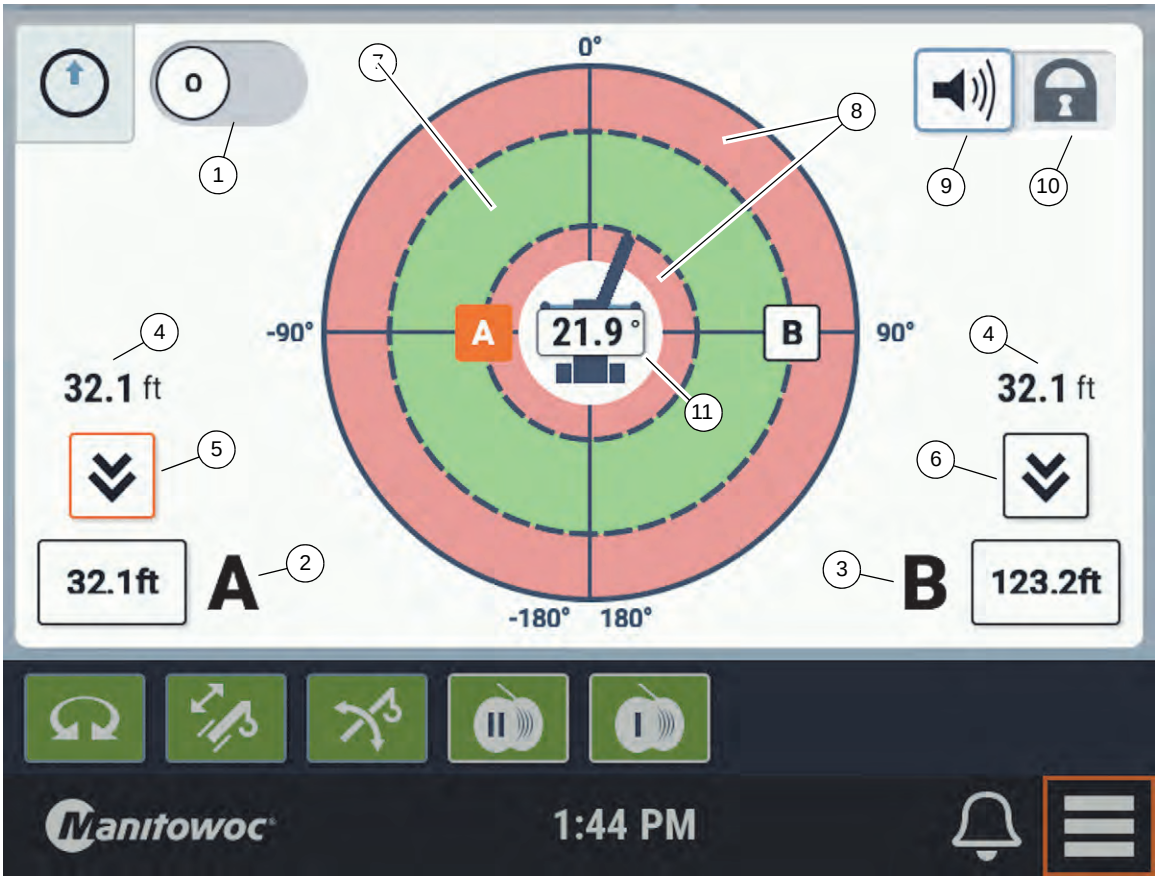
The Working Range Limiter – Radius function is an electronic aid that helps prevent the load/boom from entering in to an area that the operator deems restricted.

To open the WRL – Radius Panel, select the WRL – Radius Button (1, Figure 4-77) on the Menu panel.

10746-145

FIGURE 4-77

The WRL– Radius Panel (Figure 4-78) lets the operator set the WRL – Radius function to ON or OFF. The panel also lets the operator set the minimum and/or maximum radius limits and if the Crane Control System (CCS) gives an audible alert, or gives an audible alert and locks out crane functions, when a limit is reached. The panel also shows the CCS calculated boom radius in the selected unit of measure.



Item	Description	Item	Description
1	ON/OFF Button	7	Permitted Radius Area (Green)
2	Minimum Radius Limit	8	Restricted Radius Area (Red)
3	Maximum Radius Limit	9	Audible Alert (only)
4	Current Radius	10	Audible Alert with Lock-out
5	Input Current Radius - Minimum Button	11	Current Swing Angle
6	Input Current Radius - Maximum Button		

10746-92

FIGURE 4-78

4

The ON/OFF Button (1, Figure 4-78) is used to set the Radius Limit function to ON or OFF. When the function is set to ON, the WRL Boom Radius Limit Enabled Alert in the Notification Alerts section of the SDM comes on (refer to *Notification Alerts*, page 4-15).

The Current Radius element (4, Figure 4-78) shows the crane's current boom radius as calculated by the CCS.

The Minimum and Maximum Radius Limit elements (2, 3, Figure 4-78) show the related radius limits that are currently programmed in to the CCS. When one of these elements is selected, a spinbox will show to let the operator manually change the related radius limit.

The Input Current Radius Buttons (5, 6, Figure 4-78), when selected, input the Current Radius (4) in to the related Minimum and Maximum Radius Limit elements (2, 3).

In the center of the WRL – Radius Panel is a pictorial that shows a top-down view of the crane. The circles shown around the crane image represent the Minimum Radius Limit (2, Figure 4-78) and the Maximum Radius Limit (3).

When the WRL – Radius function is ON and the minimum and/or maximum radius limits are set, the pictorial will show the Permitted Radius Area (7, Figure 4-78) in green and the Restricted Radius Area (8) in red.

The Audible Alert (only) and Audible Alert With Lock-Out Buttons (9, 10, Figure 4-78) let the operator choose between receiving either an audible alert or an audible alert with crane function lock-out when a radius limit is approached or reached.

When the crane approaches or reaches a radius limit, the CCS will show an alert in the Operating Limit Alerts section, cause the buzzer to come on, and when set to do so, reduce and stop the boom telescope and/or boom lift functions. Refer to Table 4-4 for a list of alerts (and their definitions) that can show when the crane approaches and reaches a radius limit.

Table 4-4 – WRL Radius Alert Definitions

Alert	Name	Description
	WRL Boom Radius Limit Enabled	Indicates the minimum boom angle limit, the maximum boom angle limit, or both the minimum and maximum boom angle limits are defined.
	WRL Boom Radius Limit Warning	Indicates the boom radius is within 3 m (10 ft) of a radius limit setpoint. The warning buzzer slowly beeps when the boom radius is within 3 m (10 ft) of the radius limit setpoint and changes to a fast beep when the radius is within 1.5 m (5 ft) of the radius limit setpoint.
	WRL Boom Radius Limit Stop	Indicates the boom radius is at a radius limit setpoint. The warning buzzer is on (constant). For cranes that are equipped with the WRL Lock Out Function, the boom up and telescope in, or boom down and telescope out, crane functions are locked out, depending upon which limit is reached.

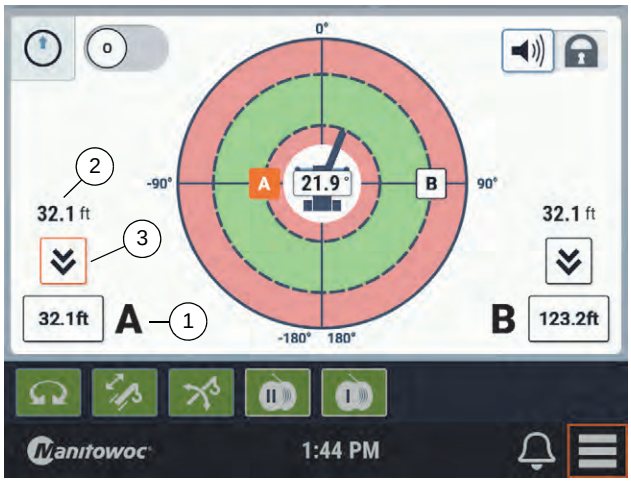
Perform the following procedure to enable the WRL – Radius function.

1. Program the Rated Capacity Limiter (RCL).
2. Open the WRL – Radius Panel by selecting the WRL – Radius Button (1, Figure 4-79) on the Menu panel.

10746-145 **FIGURE 4-79**

3. If necessary, specify the value for the Minimum Radius Limit (1, Figure 4-80) by doing one of the following:
   - Maneuver the boom in to a position in which the boom nose is at the minimum radius limit.

     Select the Input Current Radius - Minimum Button (3, Figure 4-80). This causes the current radius (2) to be set in to the Minimum Radius Limit element (1).



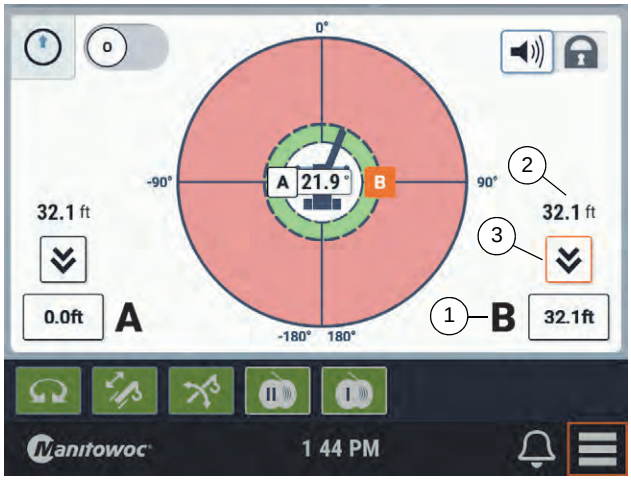
10746-93 **FIGURE 4-80**

   - Or, select the Minimum Radius Limit element to open its spinbox (1, Figure 4-81), then input the desired value for the radius limit.

10746-94 **FIGURE 4-81**

4. If necessary, specify the value for the Maximum Radius Limit (1, Figure 4-82) by doing one of the following:
   - Maneuver the boom in to a position in which the boom nose is at the maximum radius limit.

     Select the Input Current Radius - Maximum Button (3, Figure 4-82). This causes the current radius (2) to be set in to the Maximum Radius Limit element (1).



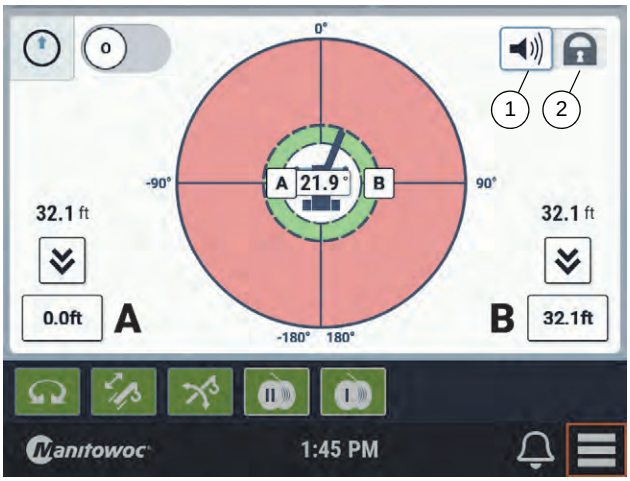
10746-95 **FIGURE 4-82**

4

- Or, select the Maximum Radius Limit element to open its spinbox (1, Figure 4-83), then input the desired value for the radius limit.

10746-96 **FIGURE 4-83**

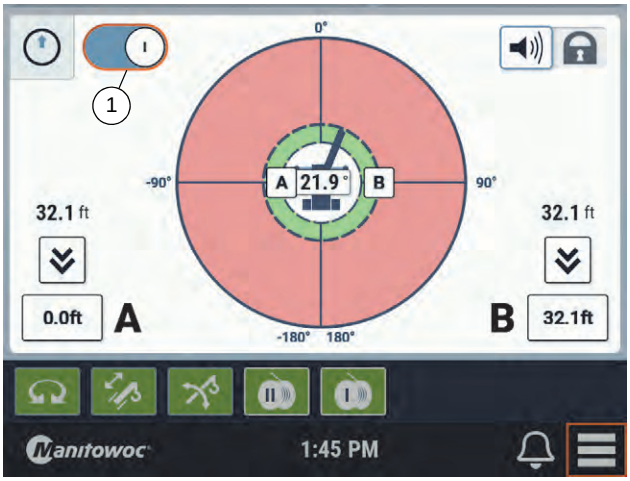
5. Select either the Audible Alert Button (1, Figure 4-84) or the Audible Alert With Lock-out Button (2).



10746-97 **FIGURE 4-84**

6. To prevent the warning buzzer coming on and the WRL Radius Limit Alert showing, move the boom nose away from the radius limits before setting the Radius Limit function to ON.

   Select the ON/OFF switch (1, Figure 4-85) and set it to ON.



10746-97 **FIGURE 4-85**

WRL – Virtual Walls

The Working Range Limiter – Virtual Walls function is an electronic aid that helps prevent the load/boom from entering in to an area that the operator deems restricted.

To open the WRL – Virtual Walls Panel, select the WRL – Virtual Walls Button (1, Figure 4-86) on the Menu Panel.

10746-145 **FIGURE 4-86**

The WRL – Virtual Walls Panel (Figure 4-87) lets the operator set the WRL – Virtual Walls function to ON or OFF and set up to five vertical walls around the work area. The panel also lets the operator set if the Crane Control System (CCS) gives an audible alert, or gives an audible alert and locks out crane functions, when a wall is reached.

Item	Description	Item	Description
1	ON/OFF Button	7	Add New Virtual Wall Button
2	Virtual Wall Start Point A	8	Delete Virtual Wall Button
3	Virtual Wall End Point B	9	Permitted Working Area (Green)
4	Input Current Boom Point - A Button	10	Restricted Working Area (Red)
5	Input Current Boom Point - B Button	11	Audible Alert (only) Button
6	Virtual Wall Number (1 through 5)	12	Audible Alert with Lock-out Button

10746-137

FIGURE 4-87

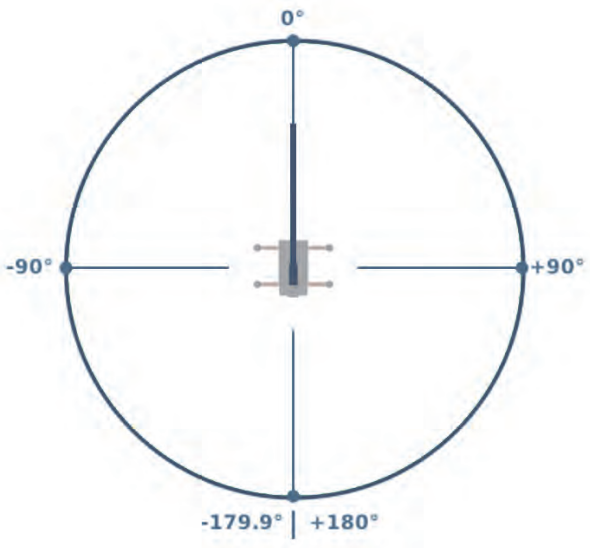
The ON/OFF Button (1, Figure 4-87) is used to set the Virtual Walls function to ON or OFF. When the function is set to ON, the WRL Virtual Wall Limit Enabled alert in the Notification Alerts section of the SDM comes on (refer to *Notification Alerts*, page 4-15).

The Virtual Wall Number element (6, Figure 4-87) shows the number of the virtual wall shown. Up to five virtual walls can be created. To add a virtual wall, the operator selects the Add New Virtual Wall Button (7). To delete a virtual wall, the operator selects the Delete Virtual Wall Button (8).

In the center of the WRL – Virtual Wall Panel is a pictorial that shows a top-down view of the crane with extended boom. A circle around the crane image illustrates the full 360° swing range. 0° means that the superstructure is positioned over the front of the crane carrier.

A full turn from this working position is divided into two semi-circles (Figure 4-88).

Angles in the left semi-circle are shown as negative values (0° to -179.9°). Angles in the right semicircle are shown as positive (0° to 180°).



10083

FIGURE 4-88

A virtual wall is created by defining two points at or near the restricted area. To define the two points, the operator maneuvers the boom nose to two different points, at least 10 feet or more apart, that are at or near the restricted area. These points are referred to as Virtual Wall Start Point A (2, Figure 4-87) and Virtual Wall End Point B (3) elements and define the vertical plane for the related virtual wall.

The Input Current Boom Point - A and Input Current Boom Point - B Buttons (4, 5, Figure 4-87), when selected, define the related Virtual Wall Start Point A (2) and Virtual Wall End Point B (3) elements.

When the WRL – Virtual Walls function is ON and at least one virtual wall is defined, the pictorial will show the Permitted Working Area (9, Figure 4-87) in green and the Restricted Working Area (10) in red.

The Audible Alert (only) and Audible Alert With Lock-Out Buttons (11, 12, Figure 4-87) let the operator choose between receiving either an audible alert or an audible alert with crane function lock-out when the boom nose approaches or reaches a virtual wall.

When the crane approaches or reaches a virtual wall, the CCS will show an alert in the Operating Limit Alerts section, cause the buzzer to come on, and when set to do so, reduce and stop the crane motion. Refer to Table 4-5 for a list of alerts (and their definitions) that can show when the crane approaches and reaches a virtual wall.

Table 4-5 – WRL Virtual Walls Alert Definitions

Alert	Name	Description
	WRL Virtual Wall Limit Enabled	Indicates that one or more virtual walls are defined.
	WRL Virtual Wall Limit Warning	Indicates the boom tip is within 6 m (20 ft) of a virtual wall that has been set. The warning buzzer slowly beeps when the boom tip is within 6 m (20 ft) of a virtual wall and changes to a fast beep when the boom tip is within 1.5 m (5 ft) of a virtual wall.
	WRL Virtual Wall Limit Stop	Indicates the boom tip is at a virtual wall that has been set. The warning buzzer is on (constant). For cranes that are equipped with the WRL Lock Out Function, the telescope out, boom down, and swing left or swing right crane functions are locked out.

DEFINING THE FIRST VIRTUAL WALL

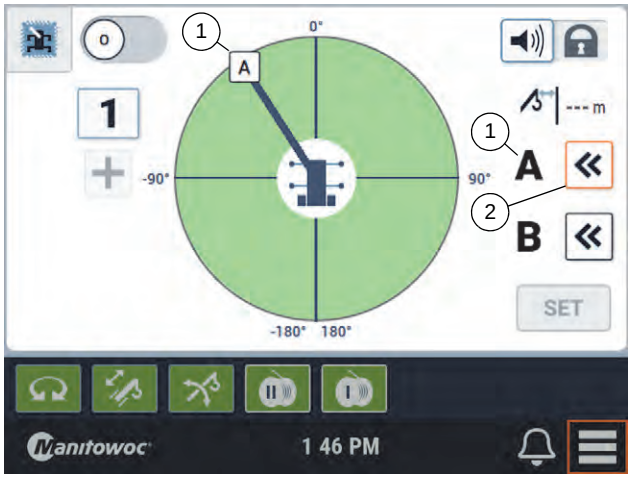
Perform the following procedure to enable the WRL – Virtual Wall function and define the first virtual wall.

1. Program the Rated Capacity Limiter (RCL).
2. Open the WRL – Virtual Wall Panel by selecting the WRL – Virtual Wall Button (1, Figure 4-89) from the Menu Panel.

10746-145 **FIGURE 4-89**

3. Begin to define the Virtual Wall Start **Point A** (1, Figure 4-90) by maneuvering the boom nose to a point that is at or near the restricted area.

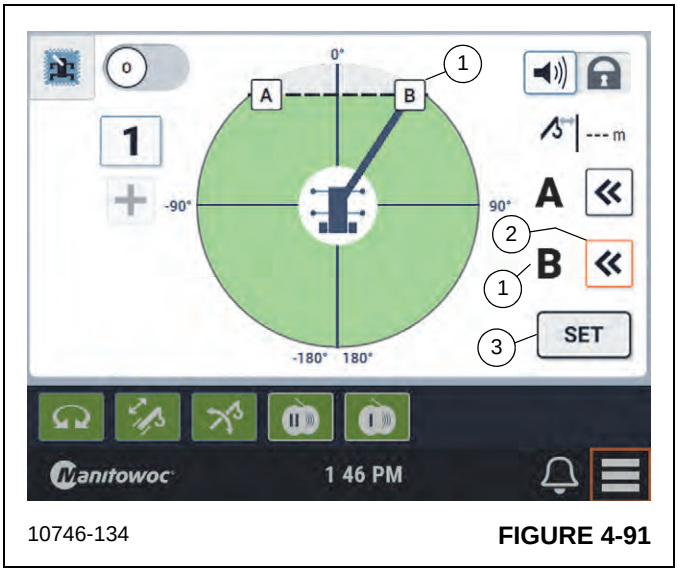
   Then select the Input Current Boom **Point - A** Button (2). This defines **point A** of the first virtual wall. The letter “A” will show on the crane pictorial at the center of the panel (Figure 4-90).



10746-133 **FIGURE 4-90**

4. Define the Virtual Wall End **Point B** (1, Figure 4-91) by maneuvering the boom nose to a point that is at least 3 m (10 ft) or more away from Point A and is at or near the restricted area.

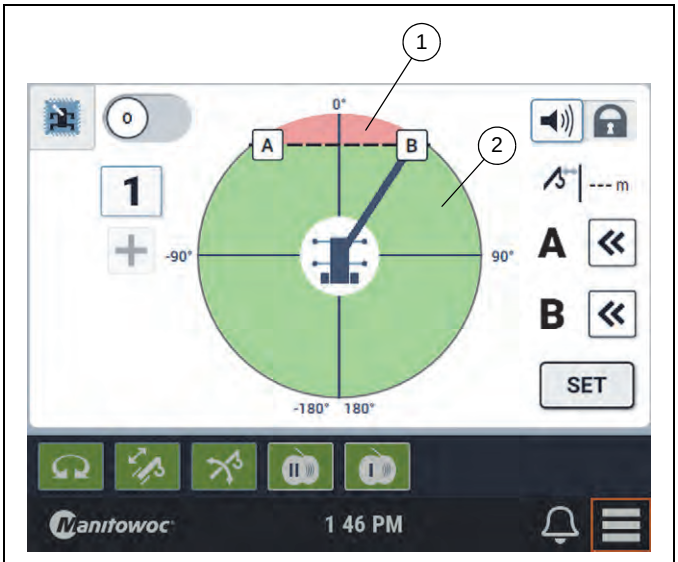
   Then select the Input Current Boom **Point - B** Button (2). This defines **point B** of the first virtual wall. The letter “B” will show on the crane pictorial at the center of the panel (Figure 4-91).



10746-134 **FIGURE 4-91**

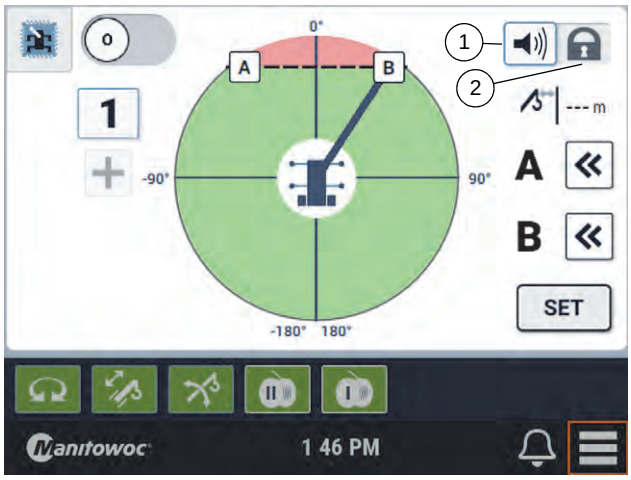
   With both Point A and Point B defined, the new virtual wall will show as a dotted line on the pictorial at the center of the panel (Figure 4-91).

5. Select the Set Button (3, Figure 4-91) to complete the setup of the virtual wall. The newly defined Restricted Working Area (1, Figure 4-92) will show in red and the Permitted Working Area (2, Figure 4-92) will show in green.



10746-135 **FIGURE 4-92**

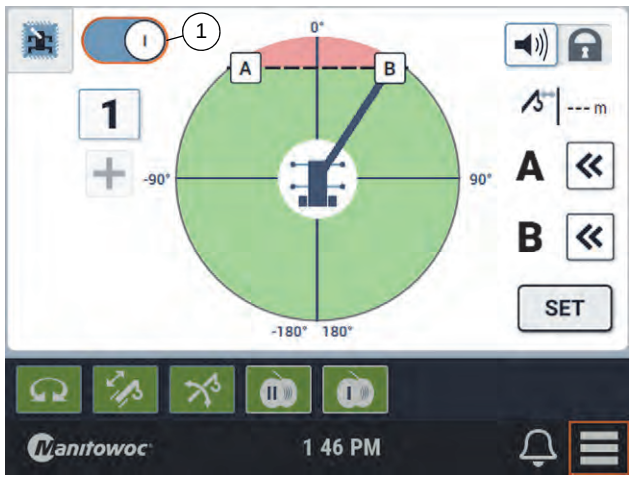
6. Select either the Audible Alert Button (1, Figure 4-93) or the Audible Alert With Lock-out Button (2).



10746-135 **FIGURE 4-93**

7. To prevent the warning buzzer coming on and the WRL Virtual Wall Limit Alert showing, move the boom nose away from the virtual wall before setting the Virtual Wall function to ON.

   Select the ON/OFF switch (1, Figure 4-94) and set it to ON.



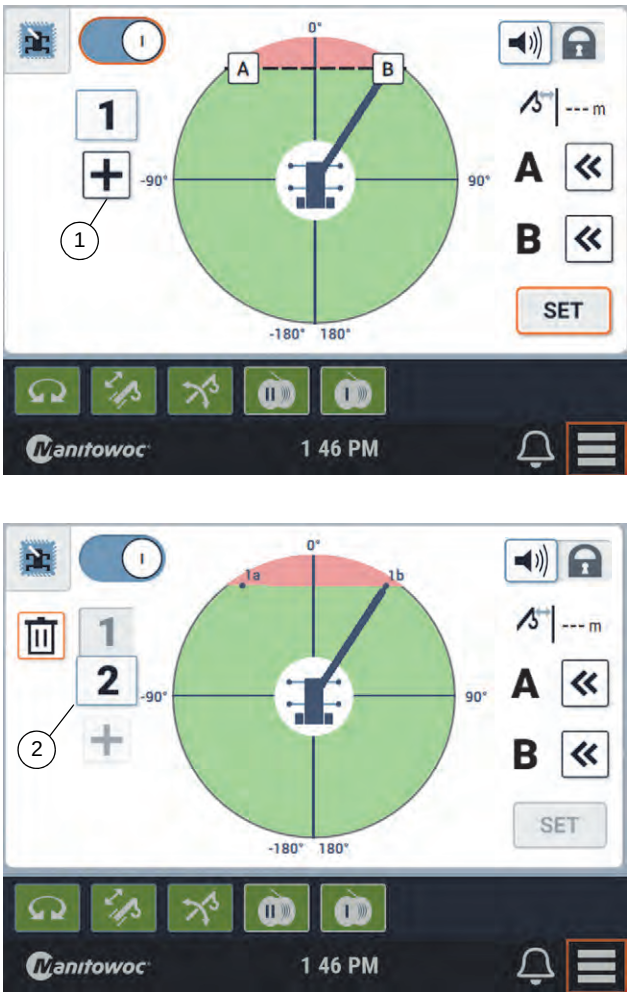
10746-135 **FIGURE 4-94**

DEFINING ADDITIONAL VIRTUAL WALLS

Perform the following procedure to add a virtual wall.

1. Select the Add New Virtual Wall Button (1, Figure 4-95).

   A second Virtual Wall Number Button (#2) (2, Figure 4-95) will show.

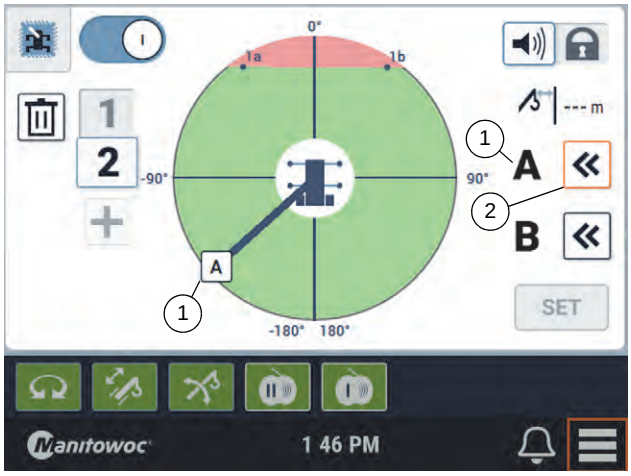


10746-136 and 10746-138 **FIGURE 4-95**

The first virtual wall (#1) shown on the crane illustration will now show “1a” and “1b” as the starting and ending points, and virtual wall #2 can now be defined (points A and B).

2. Begin to define the #2 Virtual Wall Start **Point A** (1, Figure 4-96) by maneuvering the boom nose to a point that is at or near the restricted area.

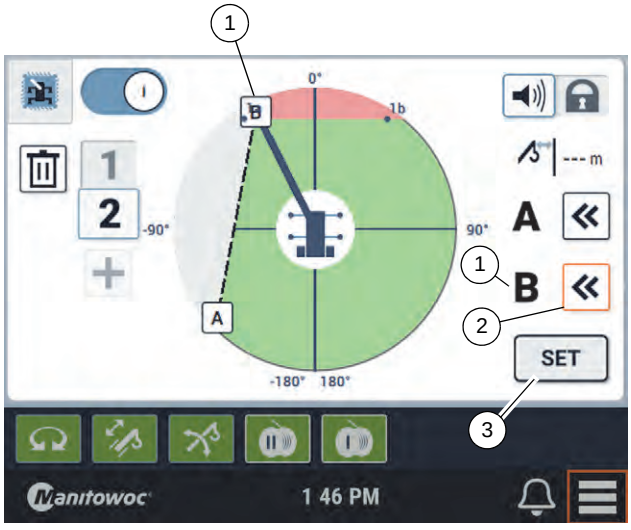
   Then select the Input Current Boom **Point - A** Button (2). This defines **point A** of the second virtual wall. The letter “A” will show on the crane pictorial at the center of the panel (Figure 4-96).



10746-139 **FIGURE 4-96**

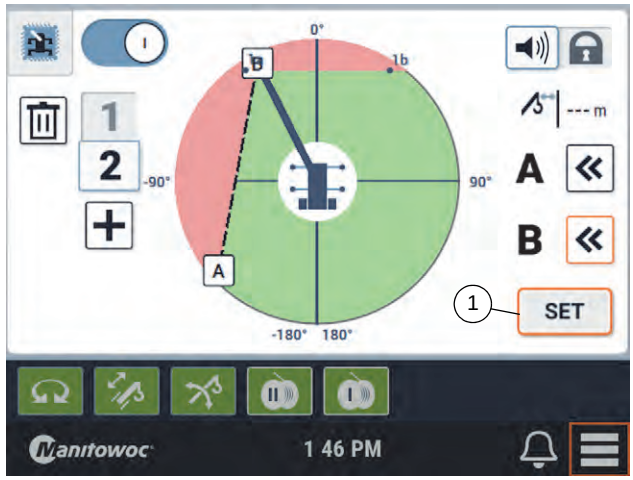
3. Define the #2 Virtual Wall End **Point B** (1, Figure 4-97) by maneuvering the boom nose to a point that is at least 3 m (10 ft) or more away from Point A and is at or near the restricted area.

   Then select the Input Current Boom **Point - B** Button (2). This defines **point B** of the second virtual wall. The letter “B” will show on the crane pictorial at the center of the panel (Figure 4-97).



10746-140 **FIGURE 4-97**

4. Select the Set Button (1, Figure 4-98) to complete the setup of the virtual wall.



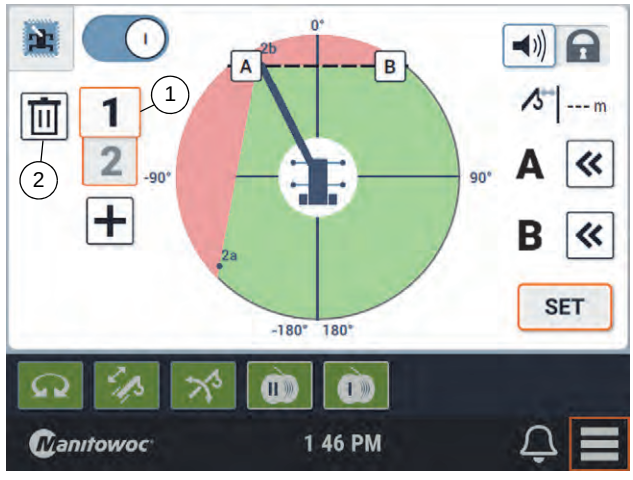
10746-141 **FIGURE 4-98**

DELETING A VIRTUAL WALLS

Perform the following procedure to delete a virtual wall.

1. Select the Virtual Wall Number Button (#1 through #5) of the virtual wall in which the operator wants to delete. In Figure 4-99, virtual wall #1 is selected for deletion.

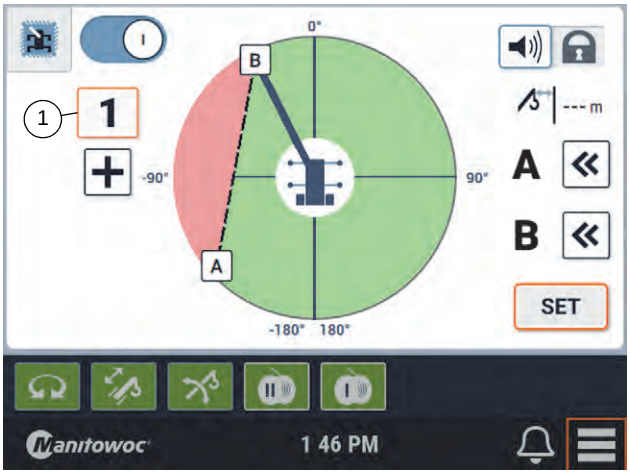
   When a Virtual Wall Number Button (1, Figure 4-99) is selected, the Delete Virtual Wall Button (2) will show beside it. Also, to help identify the virtual wall, Points “A” and “B” of the selected virtual wall are shown on the crane pictorial at the center of the panel. All other virtual wall points will show as “2a” and “2b”, “3a” and “3b”, and so on.



10746-142 **FIGURE 4-99**

2. Delete the selected virtual wall by selecting the Delete Virtual Wall Button (1, Figure 4-99).

Once deleted, the remaining Virtual Wall Number Buttons (1, Figure 4-100) will renumber in to consecutive numbers themselves.



10746-143

FIGURE 4-100

WRL – Boom Height

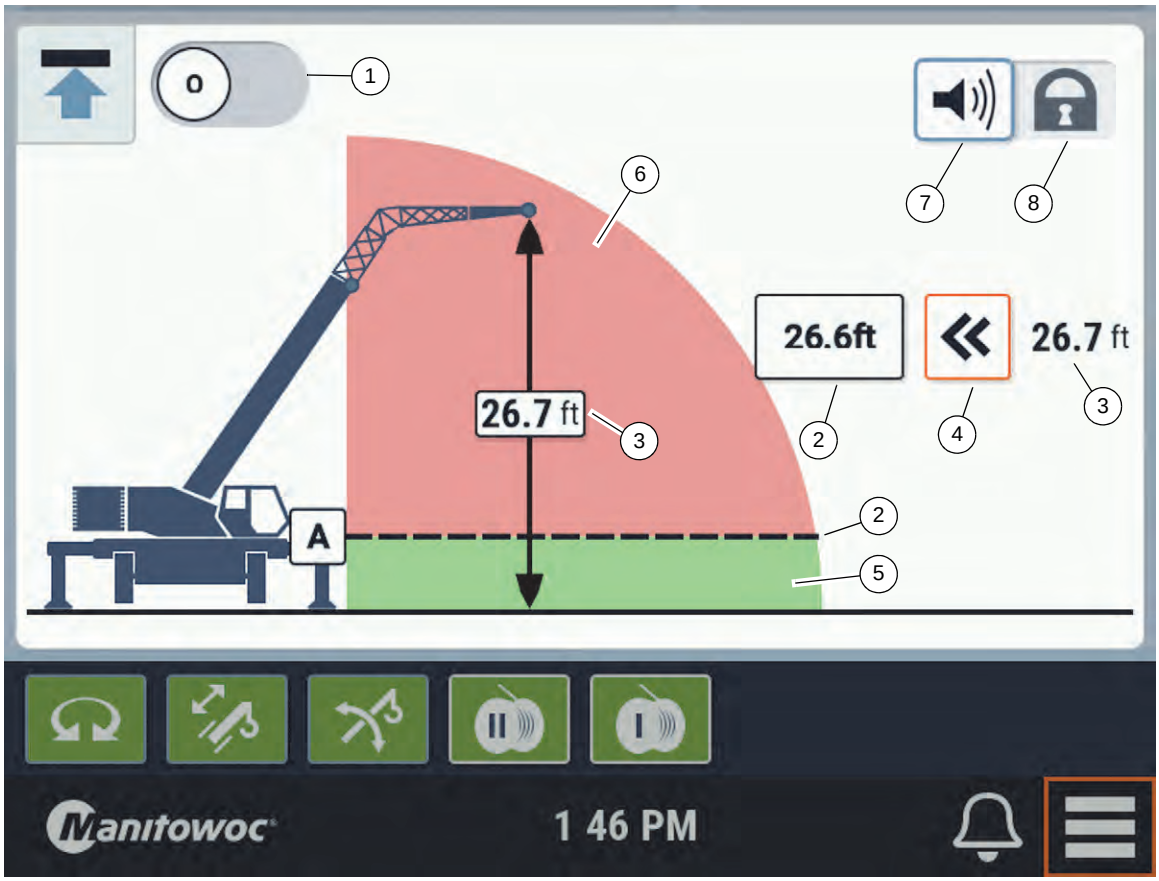
The Working Range Limiter – Boom Height function is an electronic aid that helps prevent the tip of the boom nose from entering in to an area that the operator deems restricted.

To open the WRL – Boom Height Panel, select the WRL – Boom Height Button (1, Figure 4-101) on the Menu panel.

10746-145 **FIGURE 4-101**

The WRL – Boom Height Panel (Figure 4-102) lets the operator set the WRL – Boom Height function to ON or OFF. The panel also lets the operator set the height limit and if the Crane Control System (CCS) gives an audible alert, or gives an audible alert and locks out crane functions, when the limit is reached. The panel also shows the CCS calculated boom height in the selected unit of measure.

NOTE: The horizontal dotted line that represents the Boom Height Limit (2, Figure 4-102) is dynamic and will move up and down as the limit is changed. The crane pictorial, which shows a crane with extended boom, is not dynamic. The boom and its tip height remains static as the Boom Height Limit is changed. Always make sure that the Current Boom Height (3, Figure 4-102) is below the Boom Height Limit (2, Figure 4-102).



Item	Description	Item	Description
1	ON/OFF Button	5	Permitted Height Area (Green)
2	Boom Height Limit	6	Restricted Height Area (Red)
3	Current Boom Height	7	Audible Alert (only) Button
4	Input Current Boom Height Button	8	Audible Alert with Lock-out Button

10746-101

FIGURE 4-102

The ON/OFF Button (1, Figure 4-102) is used to set the Boom Height Limit function to ON or OFF. When the function is set to ON, the WRL Boom Height Limit Enabled Alert in the Notification Alerts section of the SDM comes on (refer to *Notification Alerts*, page 4-15).

The Current Boom Height element (3, Figure 4-102) shows the crane's current boom height as calculated by the CCS.

The Boom Height Limit element (2, Figure 4-102) shows the boom height limit that is currently programmed in to the CCS. When this element is selected, a spinbox will show to let the operator manually change the boom height limit.

The Input Current Boom Height Button (4, Figure 4-102), when selected, inputs the Current Boom Height value (3) in to the Boom Height Limit element (2).

In the center of the WRL – Height panel is an pictorial that shows a side view of the crane with extended boom. The doted line shown above the crane image represents the Boom Height Limit (2, Figure 4-102).

When the WRL – Height function is ON and the height limit is set, the pictorial will show the Permitted Height Area (5, Figure 4-102) in green and the Restricted Height Area (6) in red.

The Audible Alert (only) and Audible Alert With Lock-Out Buttons (7, 8, Figure 4-102) let the operator choose between receiving either an audible alert or an audible alert with crane function lock-out when the height limit is approached or reached.

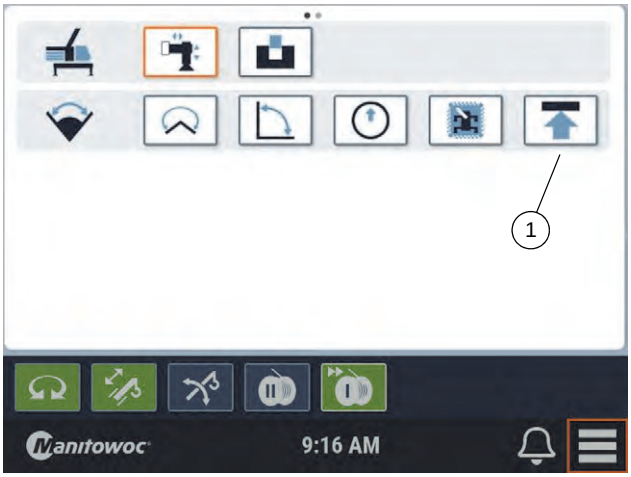
When the crane approaches or reaches the height limit, the CCS will show an alert in the Operating Limit Alerts section, cause the buzzer to come on, and when set to do so, reduce and stop the boom telescope out and boom up functions. Refer to Table 4-6 for a list of alerts (and their definitions) that can show when the crane approaches and reaches the height limit.

Table 4-6 – WRL Boom Height Alert Definitions

Alert	Name	Description
	WRL Boom Height Limit Enabled	Indicates the boom height limit is defined.
	WRL Boom Height Limit Warning	Indicates the boom tip height is within 3 m (10 ft) of the boom height limit setpoint. The warning buzzer slowly beeps when the boom tip is within 3 m (10 ft) of the boom height limit setpoint and changes to a fast beep when the boom tip is within 1.5 m (5 ft) of the boom height limit setpoint.
	WRL Boom Height Limit Stop	Indicates the boom tip height is at the boom height limit setpoint. The warning buzzer is on (constant). For cranes that are equipped with the WRL Lock Out Function, the telescope out and boom up crane functions are locked out.

Perform the following procedure to enable the WRL – Height function.

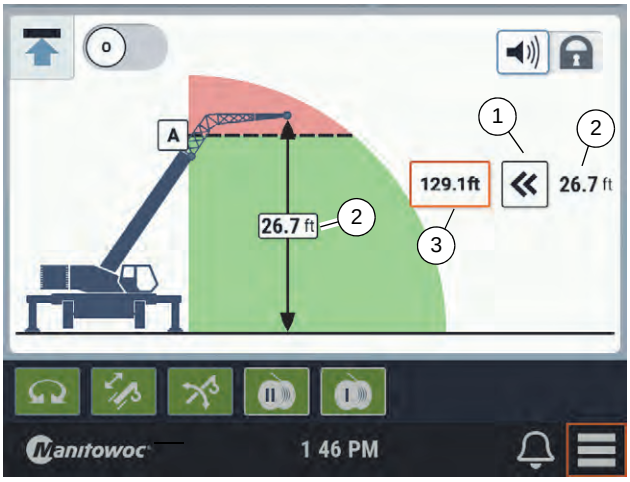
1. Program the Rated Capacity Limiter (RCL).
2. Open the WRL – Height Panel by selecting the WRL – Height Button (1, Figure 4-103) on the Menu panel.



10746-145 **FIGURE 4-103**

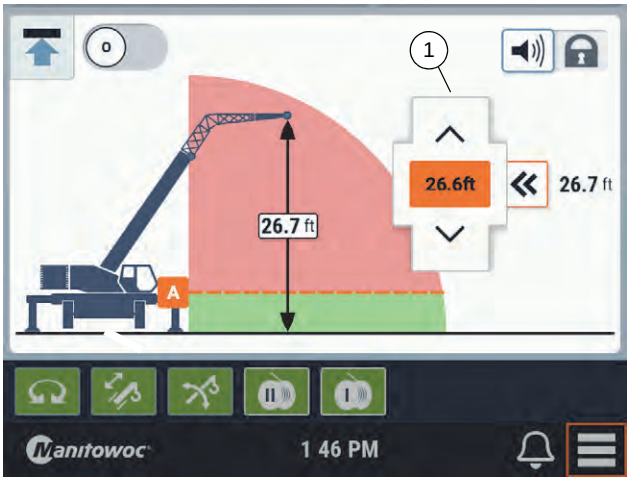
3. Specify the value for the Boom Height Limit (3, Figure 4-104) by doing one of the following:
   - Maneuver the boom in to a position in which the boom nose is at the height limit (or restricted area).

     Select the Input Current Boom Height Button (1, Figure 4-104). This causes the current height (2) to be set in to the Boom Height Limit element (3).



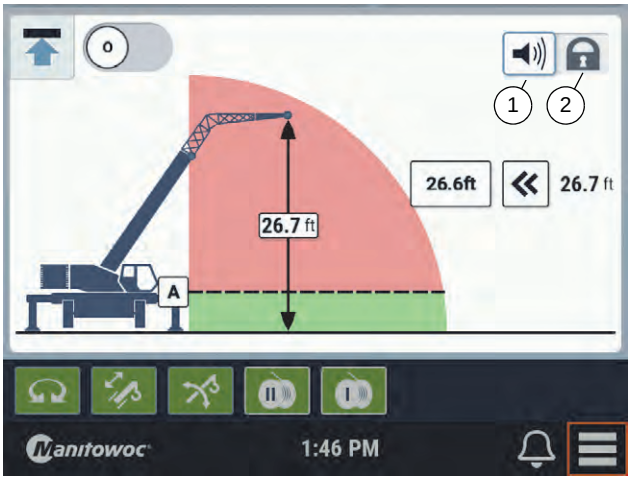
10746-98 **FIGURE 4-104**

   - Or, select the Boom Height Limit element to open its spinbox (1, Figure 4-105), then input the desired value for the height limit.



10746-99 **FIGURE 4-105**

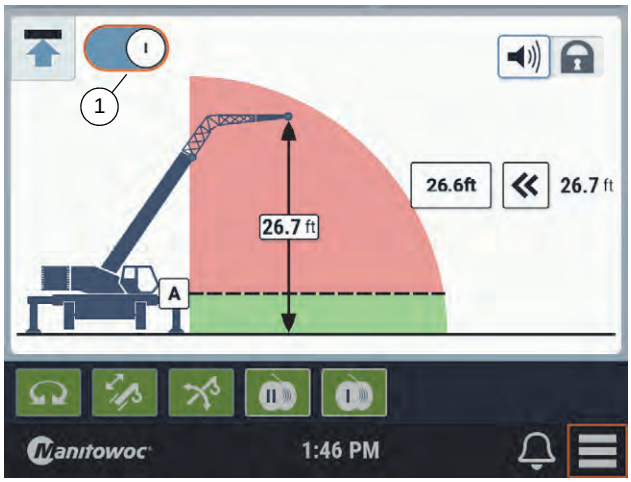
4. Select either the Audible Alert Button (1, Figure 4-106) or the Audible Alert With Lock-out Button (2).



10746-100 **FIGURE 4-106**

5. To prevent the warning buzzer coming on and the WRL Boom Height Limit Alert showing, move the boom nose away from the boom height limit before setting the Boom Height function to ON.

Select the ON/OFF Button (1, Figure 4-107) and set it to ON.



10746-100

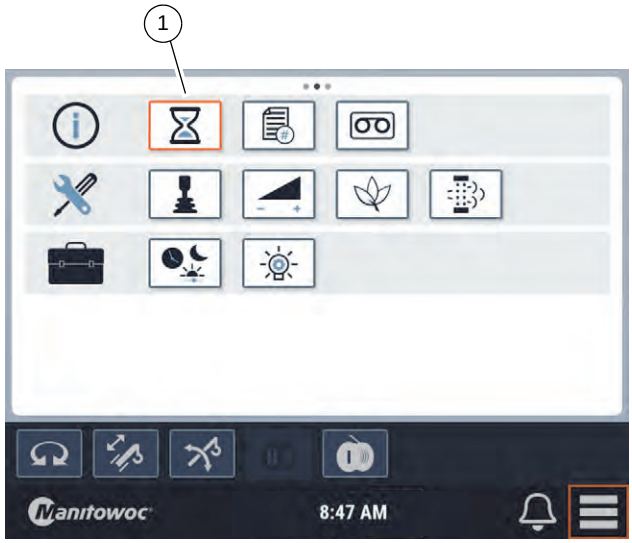
FIGURE 4-107

4

Operating Hours

The total operating hours for each crane function can be viewed in the Operating Hours Panel.

To open the Operating Hours Panel, select the Operating Hours Button (1, Figure 4-108) on the Menu Panel.

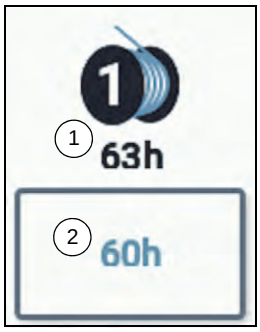


10753-13a

FIGURE 4-108

The Operating Hours Panel (Figure 4-110) shows the total accumulated operating hours for the different crane functions. The panel also includes a resettable trip meter for each crane function.

The top number for each crane function shows the total accumulated hours (1, Figure 4-109). The bottom number is a trip meter and shows total hours since the last reset (2).



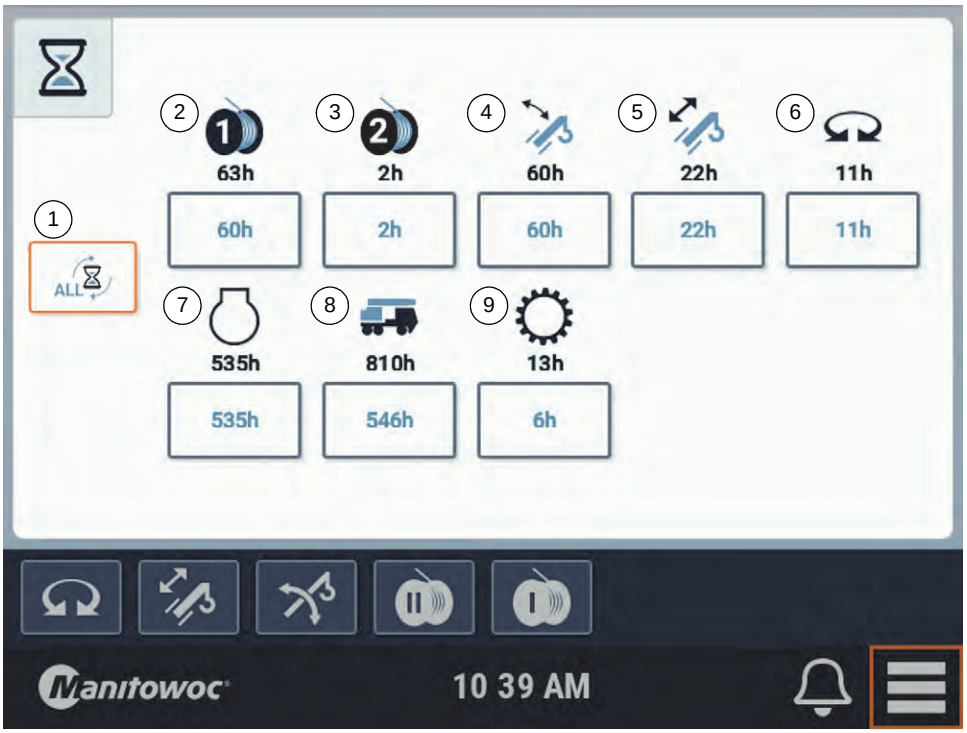
1076-25

FIGURE 4-109

If crane is equipped with a pinning boom, the Boom Pinning Count shows how many times the boom has been pinned. All other craning functions are in hours.

To reset the trip meter for a crane function, push and hold the hours button under the crane function icon that is to be reset.

To reset all crane function operating hours and counts to zero (0), select the Reset All Button (1, Figure 4-110).



10746-24

Item	Description	Item	Description
1	Reset All Button	6	Swing Operating Hours
2	Main Hoist Operating Hours	7	Engine Operating Hours
3	Auxiliary Hoist Operating Hours	8	Ignition On Hours
4	Boom Lift Operating Hours	9	Transmission Operating Hours
5	Boom Telescope Operating Hours		

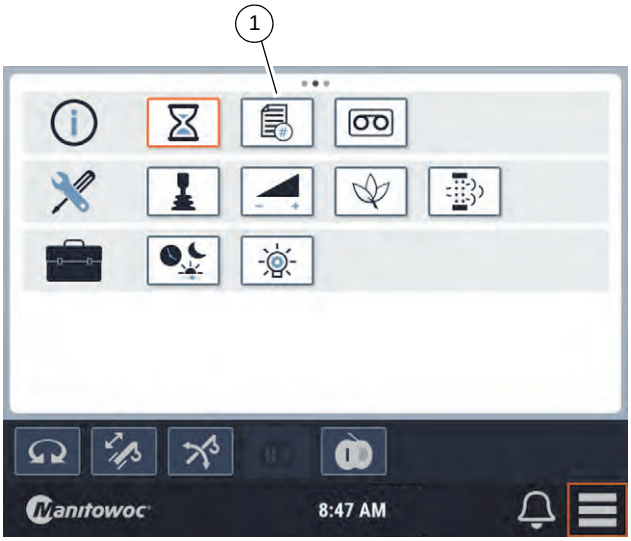
FIGURE 4-110

4

Software Versions

The software versions installed on the crane can be viewed in the Software Versions Panel.

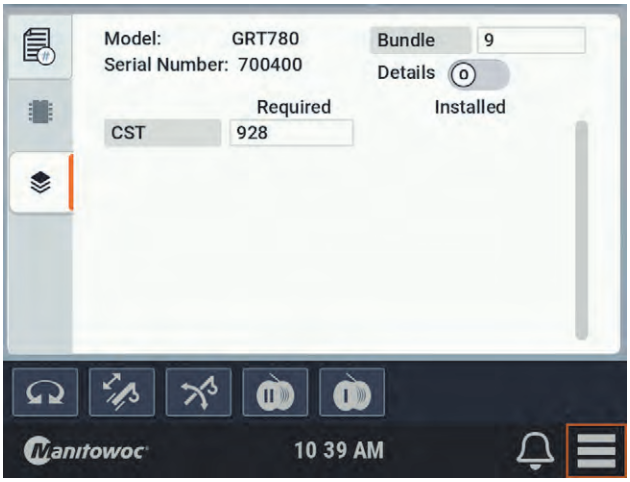
To open the Software Versions Panel, select the Software Versions Button (1, Figure 4-111) on the Menu Panel.



10753-13a

FIGURE 4-111

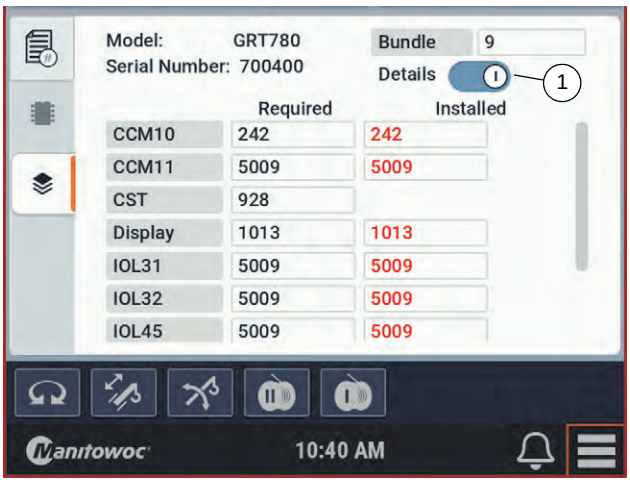
The Software Versions Panel (Figure 4-112) shows the current software versions for all of the software installed on the crane.



10746-26

FIGURE 4-112

To show all details of the software, select the Details button (1, Figure 4-113.



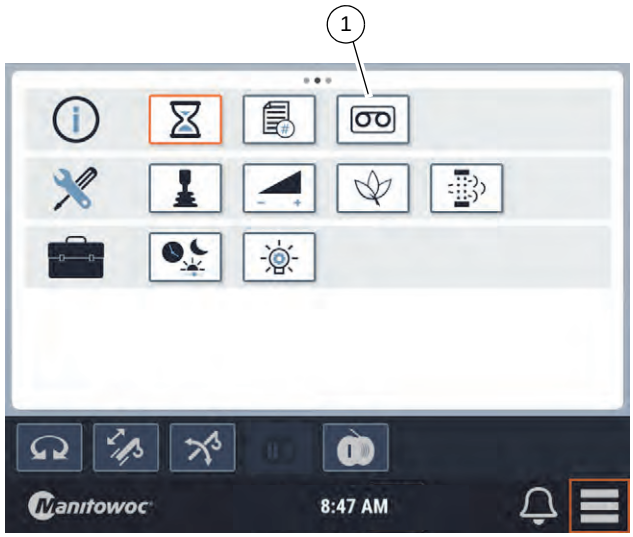
10746-27

FIGURE 4-113

Data-logger

The Data-logger function panel allows a service technician to download the different crane information that is recorded by the Crane Control System (CCS) onto a USB stick.

Before opening the Data-logger Panel, operator should insert a USB stick into the Display Programming Port (4, Figure 3-5) at the right lower control panel. To open the Data-logger Panel, select the Data-logger Button (1, Figure 4-114) on the Menu Panel.



10753-13a

FIGURE 4-114

If Data-logger Panel (Figure 4-115) is opened without first inserting a USB stick, the following screen will show:

10746-127

FIGURE 4-115

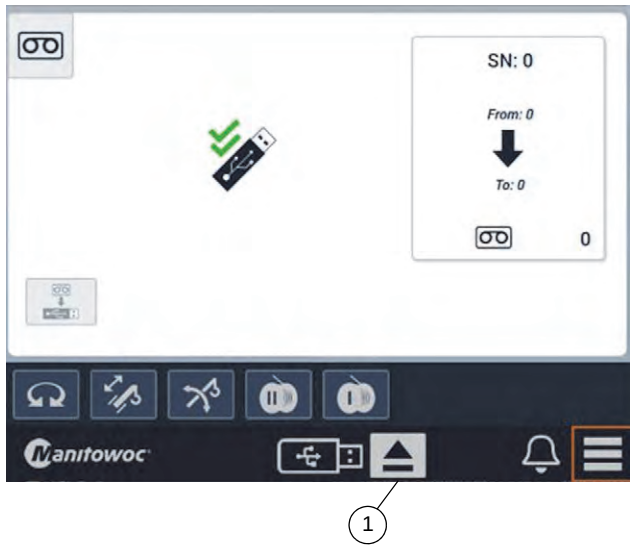
With a USB stick inserted, the following screen will show (Figure 4-116):

10746-128

FIGURE 4-116

Operator must select the Data-logger Download Button (1, Figure 4-116) to begin the downloading process. The Progress Bar (2) shows the progress of the download.

When the download is completed the following screen will show. Operator can safely eject the USB stick by selecting the USB Eject Button (1, Figure 4-117).



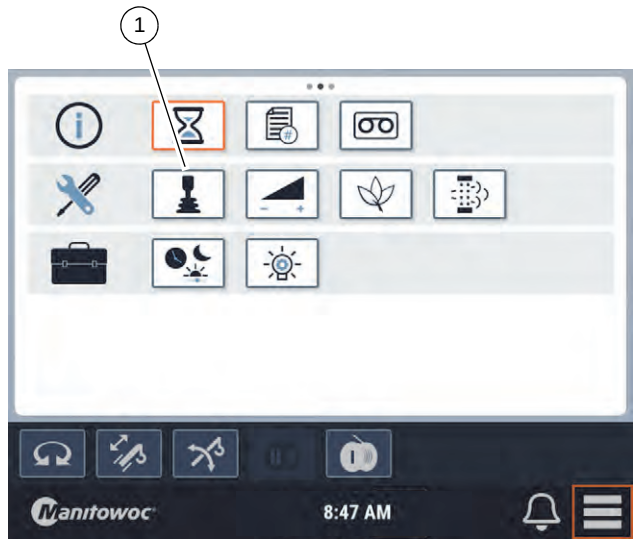
10746-129

FIGURE 4-117

Controller Sensitivity

The Controller Sensitivity function lets the operator change the sensitivity of each controller. The sensitivity of a controller is defined by the speed at which a crane function operates (example: boom swing) relative to the position of the controller. In the Controller Sensitivity Panel, the operator can adjust the speed of the crane function to be faster or slower relative to the same movement of the controller.

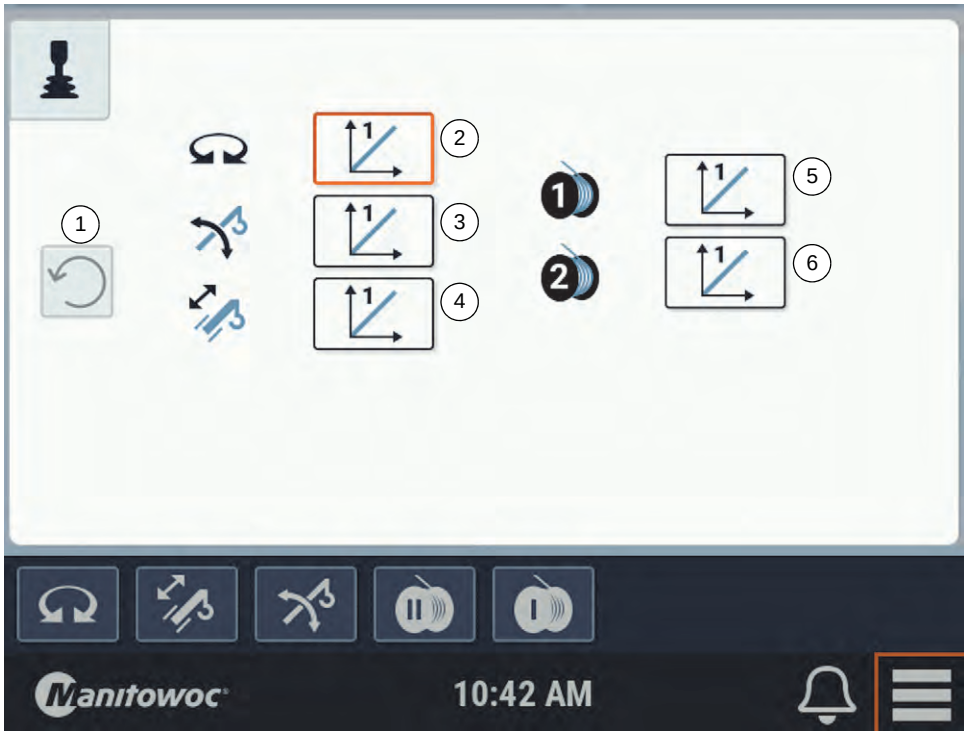
To open the Controller Sensitivity Panel, select the Controller Sensitivity Button (1, Figure 4-118) on the Menu Panel.



10753-13a

FIGURE 4-118

The Controller Sensitivity Panel (Figure 4-119) lets the operator adjust the sensitivity of the following crane functions controlled by the controllers and foot pedal.



Item	Description	Item	Description
1	Reset All Button	4	Boom Telescope Curve Button
2	Swing Curve Button	5	Main Hoist Curve Button
3	Boom Lift Curve Button	6	Auxiliary Hoist Curve Button

10746-28

FIGURE 4-119

Five different sensitivity curves are available to select from (curves 1 through 5). Sensitivity curve 1 is the default curve and causes the function speed to increase or decrease equally with an equal amount of movement of the controller (Figure 4-120).

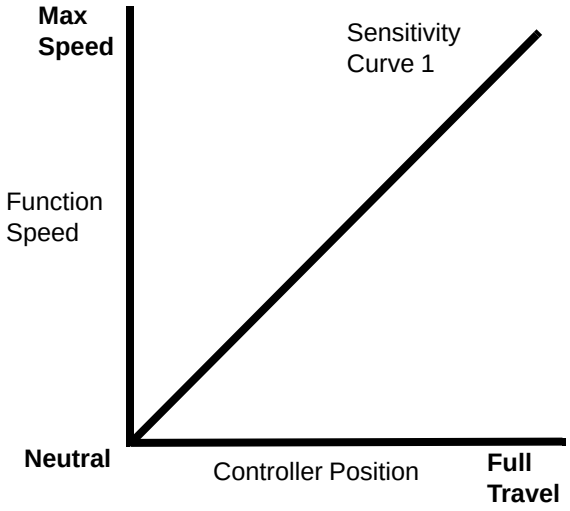


FIGURE 4-120

Selecting a sensitivity curve of 2 through 5 causes the function speed to be reduced, from the default sensitivity curve 1, relative to the same controller position over the full travel of the controller (Figure 4-121).

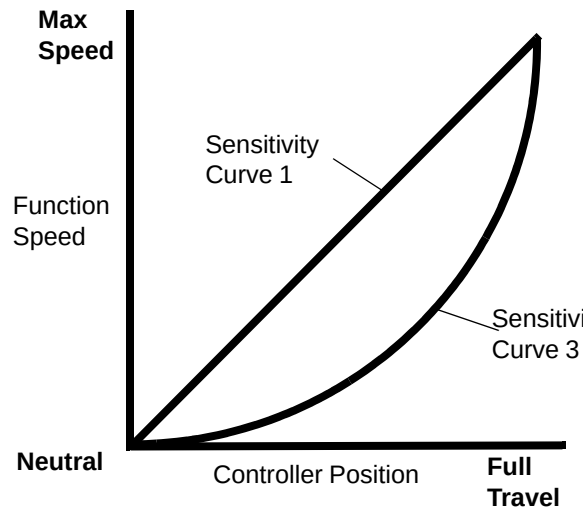
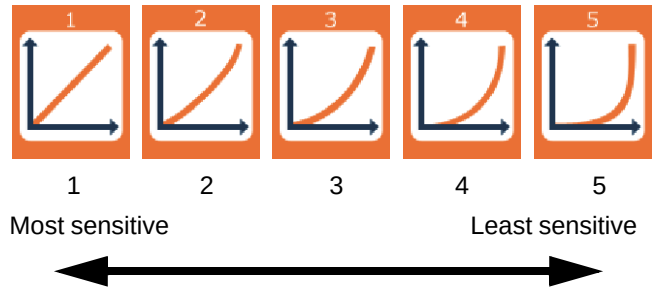


FIGURE 4-121

Sensitivity curve 1 (default) is the most sensitive and sensitivity curve 5 is the least sensitive (Figure 4-122).



Sensitivity Curves 1 through 5

FIGURE 4-122

Adjust the sensitivity of a controller function by doing the following:

1. Select the desired controller function button (2 thru 6, Figure 4-119) to open its spinbox.
2. Use the spinbox button to select one of the five available sensitivity curves.(Figure 4-122).

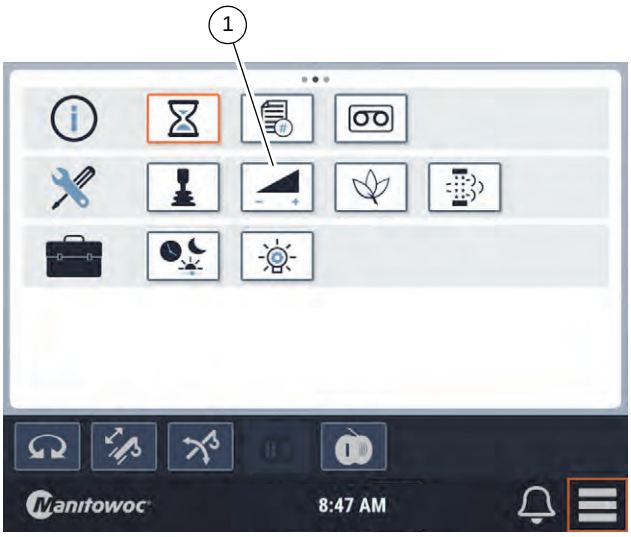
Select the Reset All Button (1, Figure 4-119) on the Controller Sensitivity Panel to set the sensitivity of all functions to the factory default setting (default setting = Curve 1).

4

Controller Speed

The Controller Speed function lets the operator adjust the crane function speeds relative to the position of the controllers. Adjustment is made as a percentage of full rated speed.

To open the Controller Speed Panel, select the Controller Speed Button (1, Figure 4-123) on the Menu Panel.



10753-13a

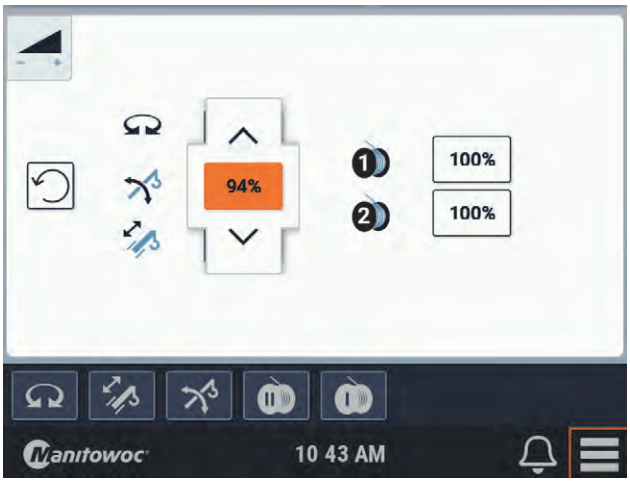
FIGURE 4-123

The Controller Speed Panel (Figure 4-125) lets the operator adjust the speed of the crane functions controlled by the controllers and foot pedal.

A setting of 100% results in the crane function moving at full rated speeds relative to the position of the controller. A setting of 75% results in the crane function moving at 75% of full rated speeds throughout the range of the controller.

Adjust the speed of a controller function by doing the following:

1. Select the desired controller function button (2 thru 6, Figure 4-125) to open a spinbox button (Figure 4-124).



10746-30

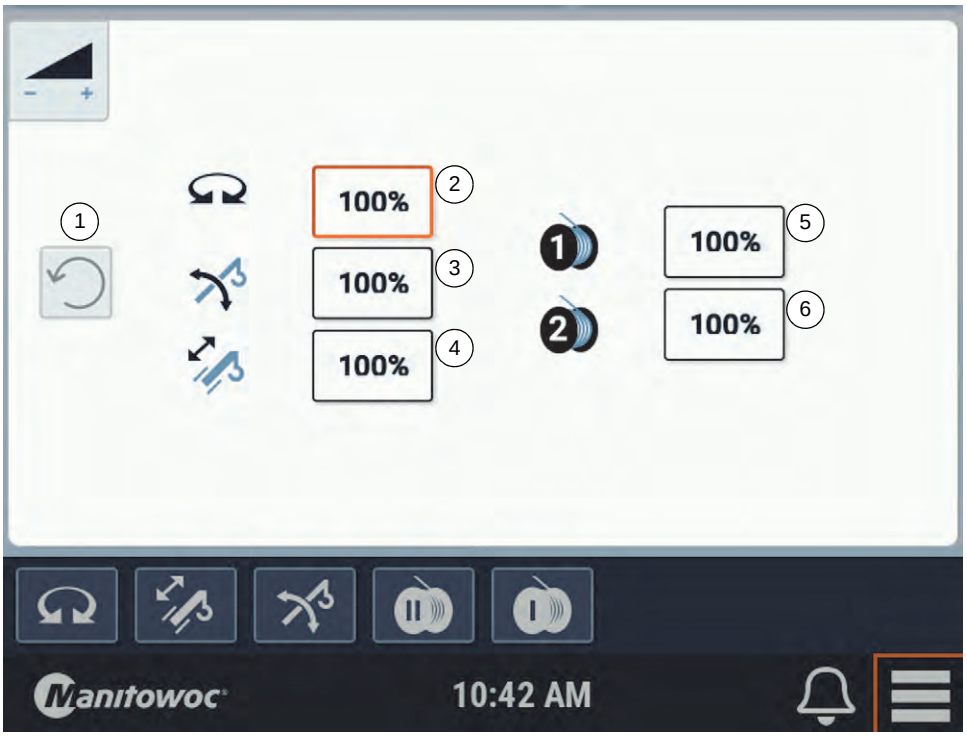
FIGURE 4-124

2. Use the spinbox button to select the desired speed percentage.

Select the Reset All Button (1, Figure 4-125) on the Controller Speed Panel to set the speeds of all functions to the factory default setting (default setting = 100%).

NOTE: A crane function speed can be set to 0% (zero) to prevent movement of that function. Crane functions set to a speed of 0% are shown as disabled in the Function Status Bar of the SDM. Refer to *SDM Function Status Bar, page 4-32* for more information.

Disabling a crane function is useful in a situation where, for example, a hoist is wound with rope and the rope is tied-off at the hoist. The operator can prevent (disable) that hoist from operating by setting its speed to 0%.



Item	Description	Item	Description
1	Reset All Button	4	Boom Telescope Speed Button
2	Swing Speed Button	5	Main Hoist Speed Button
3	Boom Lift Speed Button	6	Auxiliary Hoist Speed Button

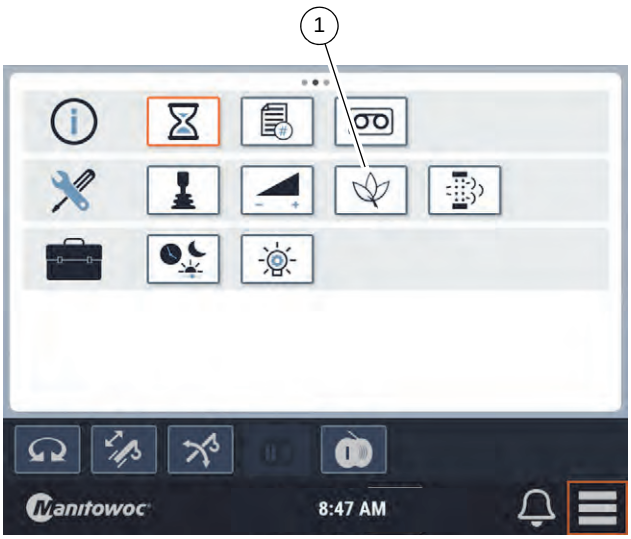
10746-29

FIGURE 4-125

ECO Mode

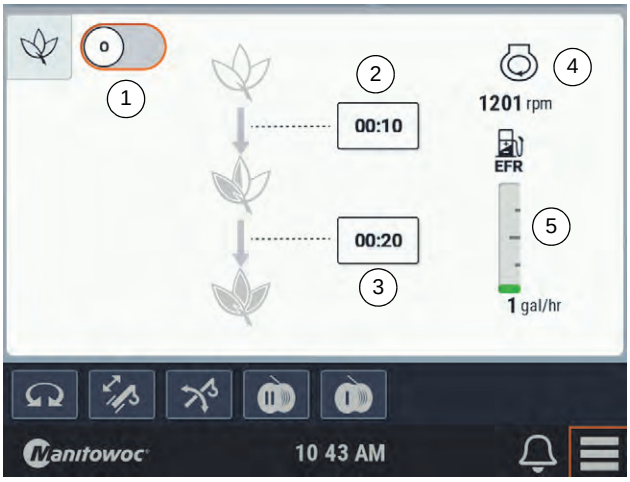
The Economy (ECO) Mode function offers the operator a convenient way to reduce noise and fuel consumption during craning operation. ECO Mode does this by automatically increasing the engine speed to an operator specified engine working speed when craning functions are operated and then decreasing the engine speed to idle speeds when no craning functions are operated.

To open the ECO Mode Panel, select the ECO Mode Button (1, Figure 4-126) on the Menu Panel.



10753-13a **FIGURE 4-126**

The ECO Mode Panel (Figure 4-127) lets the operator set the ECO Mode function to ON or OFF (1). The panel also lets the operator specify the lengths of time (2, 3) of crane function inactivity before the crane's engine speed is reduced from the working engine speed to the two idle speeds. The panel also shows current engine speed (4) and fuel usage information (5).



Item	Description
1	ON/OFF Button
2	Idle Speed 1 Time Delay Setting Button
3	Idle Speed 2 Time Delay Setting Button
4	Current Engine Speed
5	Fuel Usage Rate

10746-31 **FIGURE 4-127**

The ON/OFF Button (1, Figure 4-127) is used to set the ECO Mode function to ON or OFF.

The Idle Speed 1 Time Delay Setting Button (2, Figure 4-127) is used to specify the period of time the craning functions must be inactive (controllers in neutral position) before the engine speed is reduced from the operator specified working engine speed to the idle speed of 950 rpm.

The Idle Speed 2 Time Delay Setting Button (3, Figure 4-127) is used to specify the period of time the craning functions must be inactive (controllers in neutral position) before the engine speed is reduced from the operator specified working engine speed to the idle speed of 700 rpm.

The Current Engine Speed element (4,Figure 4-127) shows the current engine speed in revolutions per minute.

The Fuel Usage Rate graphic (5, Figure 4-127) shows fuel usage rate in the selected unit of measure.

By default, ECO Mode is set to OFF from the factory. Once set to ON by the operator, ECO Mode remains on until the operator sets it to OFF. The crane software maintains the ECO Mode setting of ON or OFF regardless of whether the engine is shut off or if the battery disconnect switch is set to the off position.

If the crane's transmission is shifted to forward or reverse, or if all crane functions are enabled, ECO Mode will stay on, but the Engine Working Speed setting will decrease and reset to idle. When this occurs, the operator must again set the Engine Working Speed using the Increment and Decrement Switches (refer to *Engine Increment/Start Button*, page 3-22 and *Engine Decrement/Stop Button*, page 3-22).

If ECO Mode is ON or OFF, the operator can always increase the engine speed above the current engine speed by using the Foot Throttle Pedal.

NOTE: ECO Mode only operates when operating craning functions and does not operate when operating the outriggers.

When ECO Mode is set to OFF, the crane operates in the following manner:

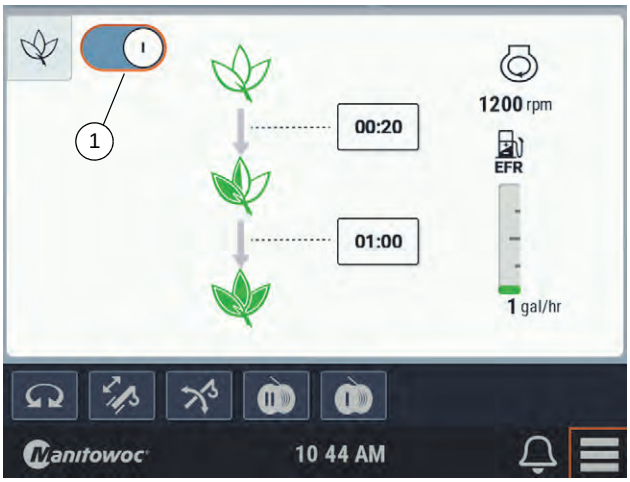
- Engine will idle at 700 rpm when no craning functions are enabled.
- Engine speed will increase and idle at 950 rpm when a craning function is enabled.
- Engine speed will return to 700 rpm when all crane functions are disabled.
- Foot Throttle Pedal and Increment/Decrement Switches can be used to set the engine speed between the system specified minimum and maximum engine speeds.

When ECO Mode is set to ON and the two time delays have been specified in the ECO Mode Panel, the crane operates in the following manner:

- Engine will idle at 700 rpm when no craning functions are operated.
- Working Engine Speed is set using the Increment/Decrement Switches.
- Engine speed will automatically increase from idle to the Working Engine Speed when a craning function is operated (controller is moved out of neutral position).
- Engine speed will stay at the Working Engine Speed while craning functions are operated.
- Engine speed will automatically decrease to the idle speed of 950 rpm after all craning functions have stopped (controllers in neutral position) and the time period that was specified in the Idle Speed 1 Time Delay Setting (2, Figure 4-127) has past.
- Engine speed will automatically decrease to the idle speed of 700 rpm after all craning functions are disabled and the time period that was specified in the Idle Speed 2 Time Delay Setting (3, Figure 4-127) has past.
- Engine speed can always be increased above current engine speed using the Foot Throttle Pedal.

Perform the following procedure to set the ECO Mode function parameters.

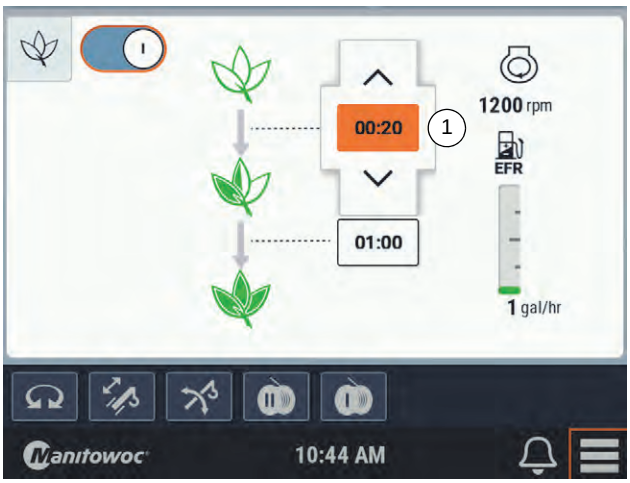
1. With the ECO Mode Panel open, select the ON/OFF switch (1, Figure 4-128) and set it to ON.



10746-32

FIGURE 4-128

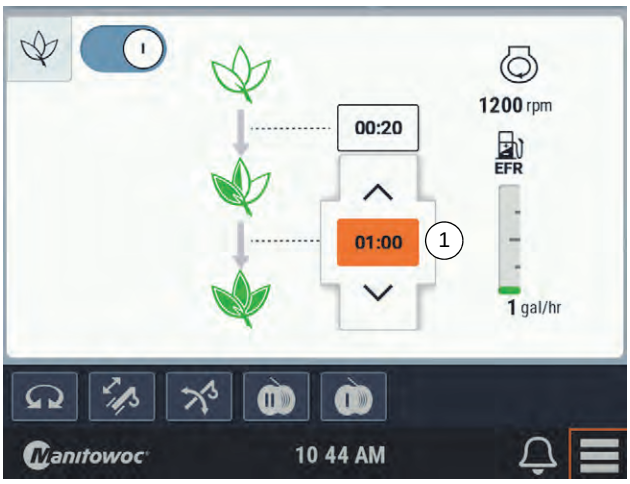
2. Select the Idle Speed 1 Time Delay Setting Button to open the spinbox (1, Figure 4-129), then input the desired time delay.



10746-33

FIGURE 4-129

3. Select the Idle Speed 2 Time Delay Setting Button to open the spinbox (1, Figure 4-130), then input the desired time delay



10746-34

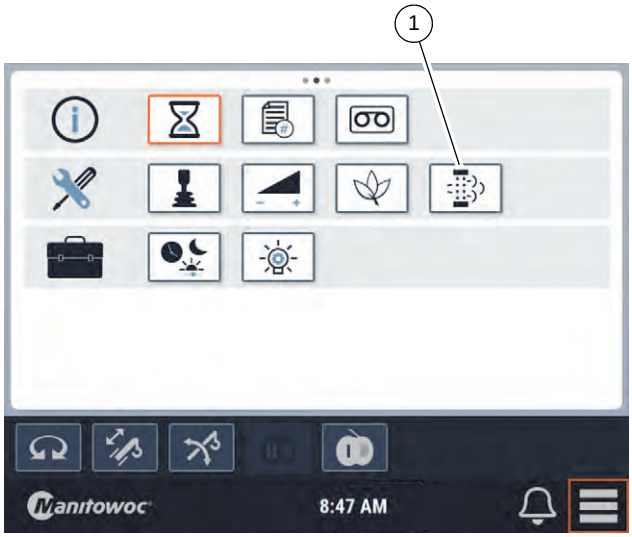
FIGURE 4-130

4. Exit the ECO Mode Panel.

Exhaust System Cleaning (Tier 4/Stage 5 Engine Only)

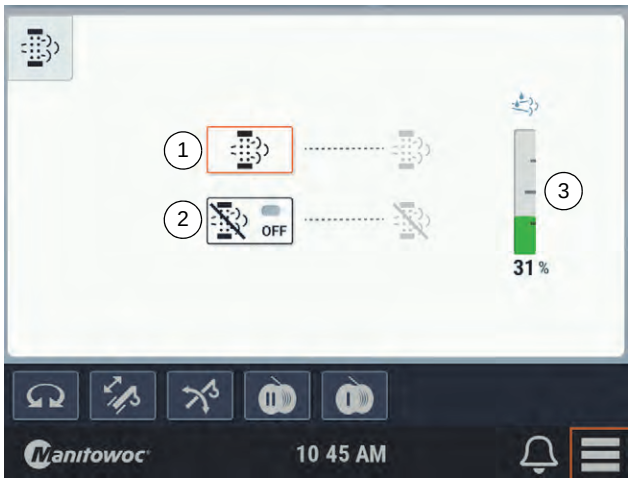
The Exhaust System Cleaning function allows the operator to initiate or inhibit the exhaust system cleaning process.

To open the Exhaust System Cleaning Panel, select the Exhaust System Cleaning Button (1, Figure 4-131) on the Menu Panel.



10753-13a

FIGURE 4-131



Item	Description
1	Initiate Manual Cleaning Process Button
2	Inhibit Cleaning Process Button
3	DEF Level Indicator

10746-35

FIGURE 4-132

MANUAL EXHAUST SYSTEM CLEANING

If the Regen Needed Alert (APPENDIX C) comes on in the Alerts Bar (Figure 4-13) of the SDM, perform the following manual exhaust cleaning process as soon as possible.

WARNING

Burn/Fire Hazard!

During the cleaning process, the exhaust and tailpipe become very hot. Keep personnel and flammable objects away from the exhaust. Do not park vehicle near flammable objects.

1. Make sure crane is not parked near flammable objects.
2. Set up a safe area around the crane's exhaust. Remove tools, rags, grease, or any debris from engine exhaust area.
3. Place transmission in to neutral.
4. Engage the crane parking brake,
5. Release the service brake pedal and throttle pedal.
6. Select the Initiate Manual Cleaning Process Button (1, Figure 4-132).

   Within 5 seconds the engine speed will increase to 1000 to 1400 rpm. The engine will continue to run at this speed for up to 45 minutes.

   As a warning, the High Exhaust System Temperature (HEST) light (1, Figure 4-133) near the exhaust pipe (2) will flash during exhaust system cleaning.

10710-25

FIGURE 4-133

4

Pushing the service brake pedal or throttle pedal during cleaning or selecting the Inhibit Cleaning Process Button (2, Figure 4-132) will interrupt the manual cleaning process.

Make sure the crane and surrounding area are monitored during manual cleaning. If any unsafe condition occurs, stop engine immediately.

Engine will return to normal idle speed when the manual cleaning process is complete.

INHIBIT EXHAUST SYSTEM CLEANING

CAUTION

Crane Damage!

Exhaust system damage can occur if crane is operated for long periods of time with the exhaust cleaning system set to inhibit.

During normal operation of the crane, do not set the exhaust system cleaning to inhibit.

NOTE: Refer to section *Exhaust System Cleaning*, page 5-9 for more information about the manual and automatic exhaust cleaning modes.

To inhibit, or prevent, the exhaust system from entering the active cleaning mode or to stop the exhaust cleaning process that was manually initiated, select the Inhibit Cleaning Process Button (2, Figure 4-132). The Regen Inhibited Alert (APPENDIX C) comes on in the Alerts Bar (Figure 4-13) of the SDM, and the active and manual modes of exhaust system cleaning are prevented.

Settings

The Settings Panel allows the operator to do the following:

- Set the display screen to either light or dark mode.
- Set the display screen units of measure (metric/imperial).
- Set the time by defining the time zone in which the crane is being operated in.
- Set the display screen brightness.

To open the Settings Panel, select the Settings Button (1, Figure 4-134) on the Menu Panel.

10753-13a

FIGURE 4-134

The 12-inch display screen has a light mode and a dark mode. Light Mode allows for easier viewing of the screen elements during daylight operation. Dark Mode allows for easier viewing of the screen elements during night-time operation. Set the display screen to either Light Mode or Dark Mode by setting the Light-Dark Mode Slider Button (1, Figure 4-135) to the desired position.

The Metric/Imperial Slider Button (2, Figure 4-135) allows the operator to change the units of measure (metric/imperial) that are used throughout the SDM. Set the units of measure for the display by setting the Metric/Imperial Slider Button to the desired position.

The brightness of the display screen can be set to automatically increase or decrease based on the light entering the cab. To allow the display screen to automatically adjust its brightness, set the Automatic Screen Brightness Control ON/OFF Button (3, Figure 4-135) to ON. Set the button to OFF to stop the display screen from automatically adjusting its brightness.

To manually adjust the brightness of the display screen, make sure the Automatic Screen Brightness Control ON/OFF Button (3, Figure 4-135) is set to OFF, then move the Screen Brightness Slider Bar (4, Figure 4-135) left or right until the desired brightness is achieved. Sliding the bar to the left decreases the screen brightness and sliding it to the right increases the screen brightness.

The Time Set function allows the operator to set the time and the time format that is shown at the bottom of the SDM screen.

Coordinated Universal Time (UTC) is used as the basis for setting the time. The usage of UTC is based upon a twenty four hour clock and the 0 degrees longitude meridian, referred to as the Greenwich meridian in Greenwich, England. Thus, to set the time the operator must know what time zone he or she is in relative to the UTC.

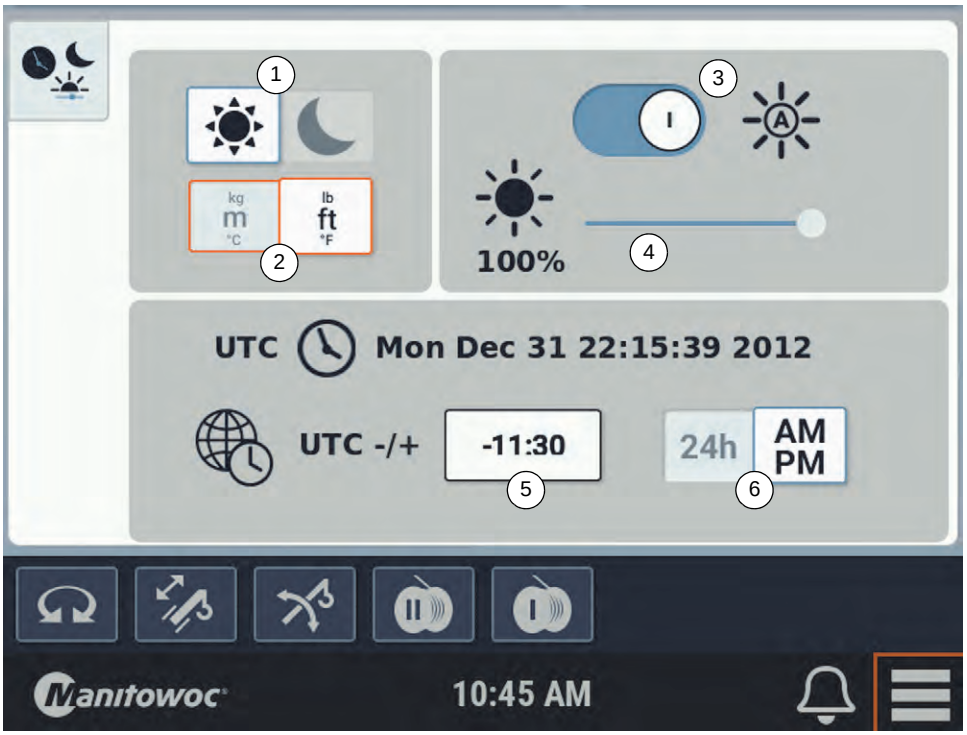
The following is a list of the United States GMT/UTC Offsets:

US Time Zone	UTC Offset Standard Time	UTC Offset Daylight Savings Time
Atlantic	UTC -4h	
Eastern	UTC -5h	UTC -4h
Central	UTC -6h	UTC -5h
Mountain	UTC -7h	UTC -6h
Pacific	UTC -8h	UTC -7h
Alaska	UTC -9h	UTC -8h
Hawaii - Aleutian	UTC -10h	UTC -9h

Refer to APPENDIX D – *TIME ZONES AND UTC OFFSETS*, page D-1 for a list of worldwide time zones and their UTC offsets.

To set the time and time format, do the following:

1. Select the UTC Offset Button (5, Figure 4-135) to open its spinbox, then input the correct UTC offset using the information from the table.
2. Set the desired time format by selecting either 24h or AM/PM using the Time Format Slider Button (6, Figure 4-135).



Item	Description	Item	Description
1	Light-Dark Mode Slider Button	4	Screen Brightness Slider Bar
2	Metric/Imperial Slider Button	5	UTC Offset Button
3	Automatic Screen Brightness Control ON/OFF Button	6	Time Format Slider Button

10746-36

FIGURE 4-135

Work Lights

The Work Lights function allows the operator to control the various crane work lights.

To open the Work Lights Panel, select the Crane Lights Button (1, Figure 4-136) on the Menu Panel.

NOTE: Work Lights Panel can also be quickly opened by pushing bottom of Work Light Switch.

10753-13a

FIGURE 4-136

The Work Lights Panel (Figure 4-137) and the Work Lights Switch on the right overhead control panel are used together to control the following work lights:

- *Cab-Mounted Work Lights*, page 3-45
- *Boom-Mounted Motorized Work Lights (Optional)*, page 3-45
- *Superstructure-Mounted Work Lights*, page 3-46
- *Side-Mounted Carrier Work Lights*, page 3-53

A work light must first be enabled in the Work Lights Panel before it can be switched on and off using the Work Light Switch (refer to *Work Lights Switch*, page 3-10). After one or more work lights have been enabled, push top of Work Lights Switch to switch on the enabled work lights. Push top of switch again to switch off the work lights.

An Exit Lighting feature allows the operator to set individual work lights to stay on for a specified time period after turning the ignition switch to the 0 (OFF) position.

Some work lights are optional equipment. If the crane is not equipped with an optional work light, the related work light buttons and icons will not show in the Work Lights Panel.

ENABLING/DISABLING THE WORK LIGHTS

Refer to Figure 4-137 for the following procedures.

To enable ALL work lights, do the following:

1. Select the Work Lights Settings Button (4).
2. Select the Enable All Work Lights Button (1).

   All work light buttons (6 thru 12) will switch to ON.

   The work lights can then be switched on and off using the Work Lights Switch.

To disable ALL work lights, do the following:

1. Select the Work Lights Settings Button (4).
2. Select the Disable All Work Lights Button (2).

   All work light buttons (6 thru 12) will switch to OFF.

To enable individual work lights, do the following:

1. Select the Work Lights Settings Button (4).
2. Set the work light On/Off buttons (6 thru 12) to ON for those work lights you wish to enable.

   The work lights can then be switched on and off using the Work Light Switch.

To disable individual work lights, do the following:

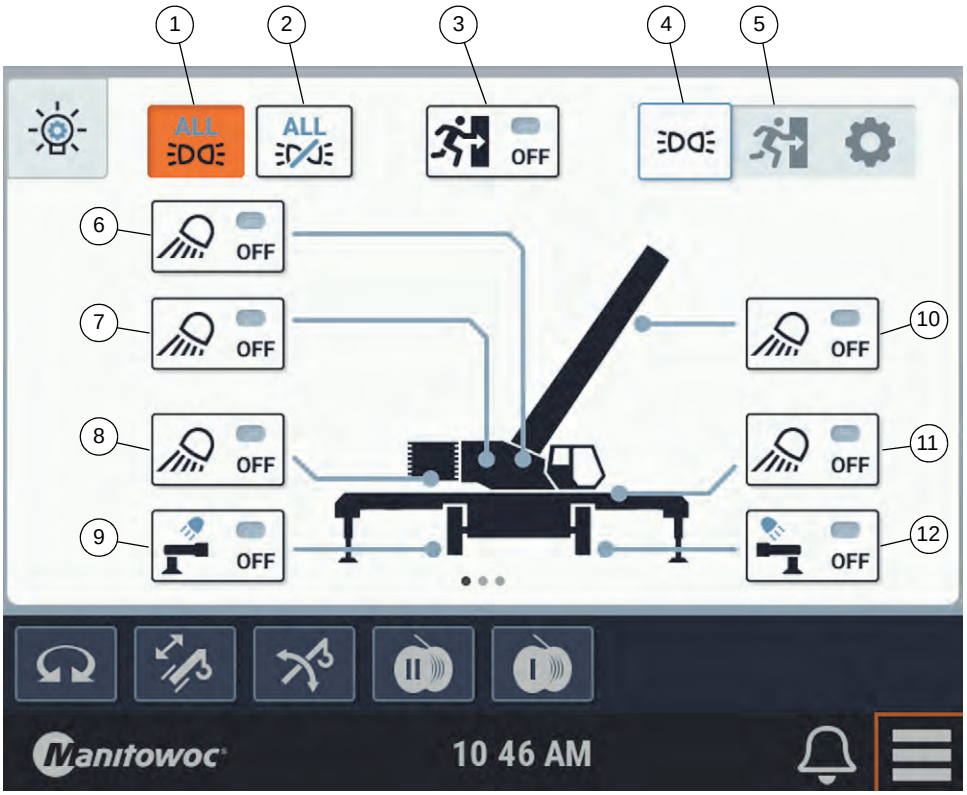
1. Select the Work Lights Settings Button (4).
2. Set the work light On/Off buttons (6 thru 12) to OFF for those work lights you wish to disable.

SETTING UP THE EXIT LIGHTING FEATURE

To setup and enable the Exit Lighting feature, refer to Figure 4-138 and do the following:

1. Select the Exit Lighting Button (5).

   The Exit Lighting Panel will show (Figure 4-138)
2. Either select the Enable All Work Lights Button (1) to have all work lights stay on for a specified time period or set the individual work light On/Off buttons (7 thru 13) to ON.
3. Select the Exit Lighting Timer Button (6) to open its spinbox, then set the time delay (minutes and seconds) in which the enabled work lights will switch off after the ignition switch is turned to the 0 (OFF) position.
4. Select the Exit Lighting On/Off Button (3) and set it to ON.

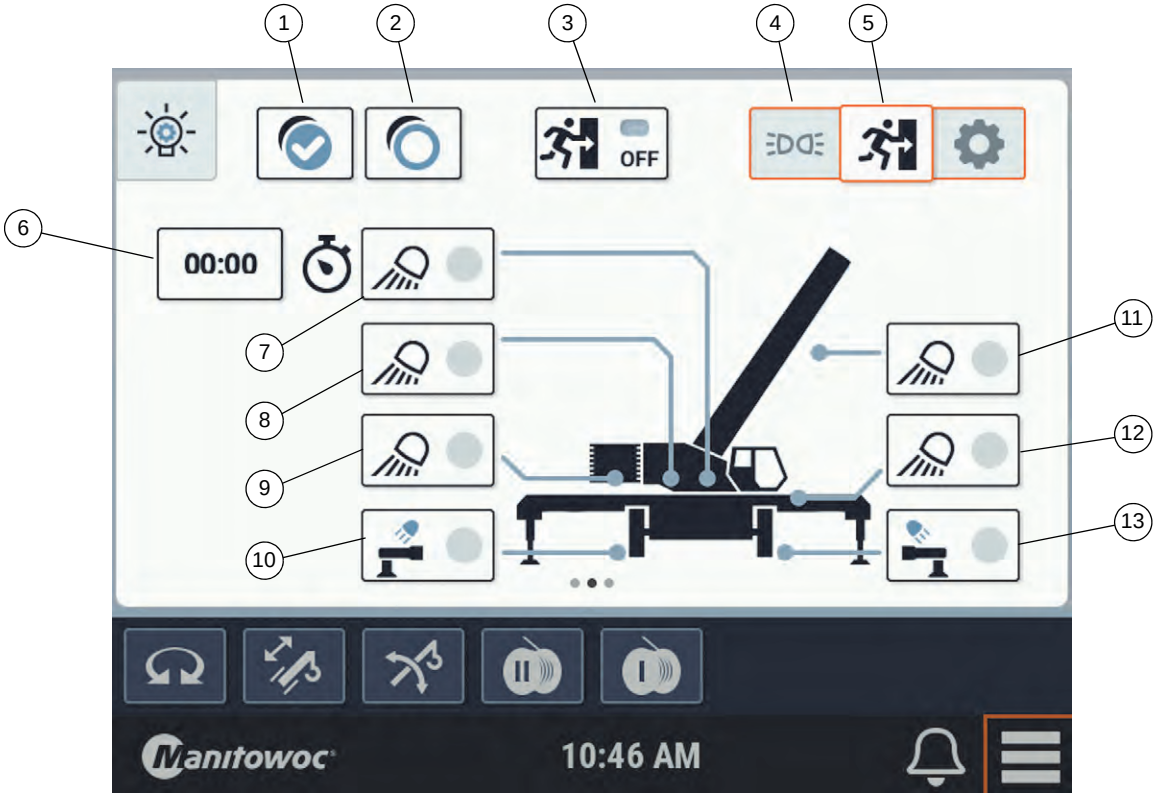


Item	Description	Item	Description
1	Enable All Work Lights Button	7	Superstructure-Mounted Work Light 2 On/Off Button
2	Disable All Work Lights Button	8	Superstructure-Mounted Work Light 3 On/Off Button
3	Exit Lighting On/Off Button	9	Left Side-Mounted Carrier Work Lights On/Off Button
4	Work Lights Settings Button	10	Boom-Mounted Motorized Work Lights On/Off Button
5	Exit Lighting Button	11	Cab-Mounted Work Lights On/Off Button
6	Superstructure-Mounted Work Light 1 On/Off Button	12	Right Side-Mounted Carrier Work Lights On/Off Button

10746-130

FIGURE 4-137

4



Item	Description	Item	Description
1	Enable All Work Lights Button	8	Superstructure-Mounted Work Light 2 On/Off Button
2	Disable All Work Lights Button	9	Superstructure-Mounted Work Light 3 On/Off Button
3	Exit Lighting On/Off Button	10	Left Side-Mounted Carrier Work Lights On/Off Button
4	Work Lights Settings Button	11	Boom-Mounted Motorized Work Lights On/Off Button
5	Exit Lighting Button	12	Cab-Mounted Work Lights On/Off Button
6	Exit Lighting Timer Button	13	Right Side-Mounted Carrier Work Lights On/Off Button
7	Superstructure-Mounted Work Light 1 On/Off Button		

10746-132

FIGURE 4-138

Hydraulic Pressure Information

The Hydraulic Pressure Information function screen allows the operator and service technician to see hydraulic oil pressures for the various crane systems.

To open the Hydraulic Pressure Information Panel, select the Hydraulic Pressure Information Screen Button (1, Figure 4-139) on the Menu Panel.

10753-4a

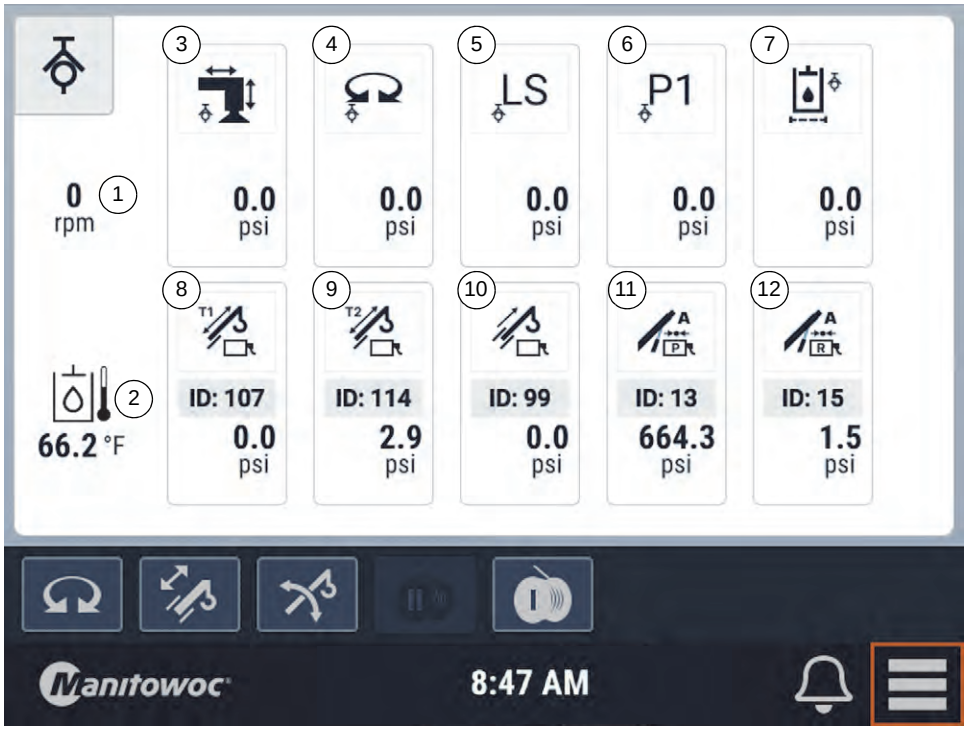
FIGURE 4-139

Refer to Figure 4-140 and Figure 4-141 for a list of the hydraulic pressures that can show on the Hydraulic Pressure Information Screen Panel.

The icon element for the Lift Cylinder Piston Pressure (11, Figure 4-140) includes the letter “P” in its icon, which denotes it is the **P**iston-side pressure sensor. The icon element for the Lift Cylinder Rod Pressure (12, Figure 4-140) includes the letter “R” in its icon, which denotes it is the **R**od-side pressure sensor.

Also, the Lift Cylinder Piston and Rod Pressure icon elements (11 and 12, Figure 4-140) include the letter “A” in their icons, which denotes they are the primary pressure sensors. CE Certified cranes show an additional set of Lift Cylinder Piston and Rod Pressure icon elements on the Hydraulic Pressure Information function screen, which are redundant pressure sensors. These two redundant pressure sensor icon elements include the letter “B” in their icons (1 and 2, Figure 4-141), which denotes they are the secondary (redundant) pressure sensors.

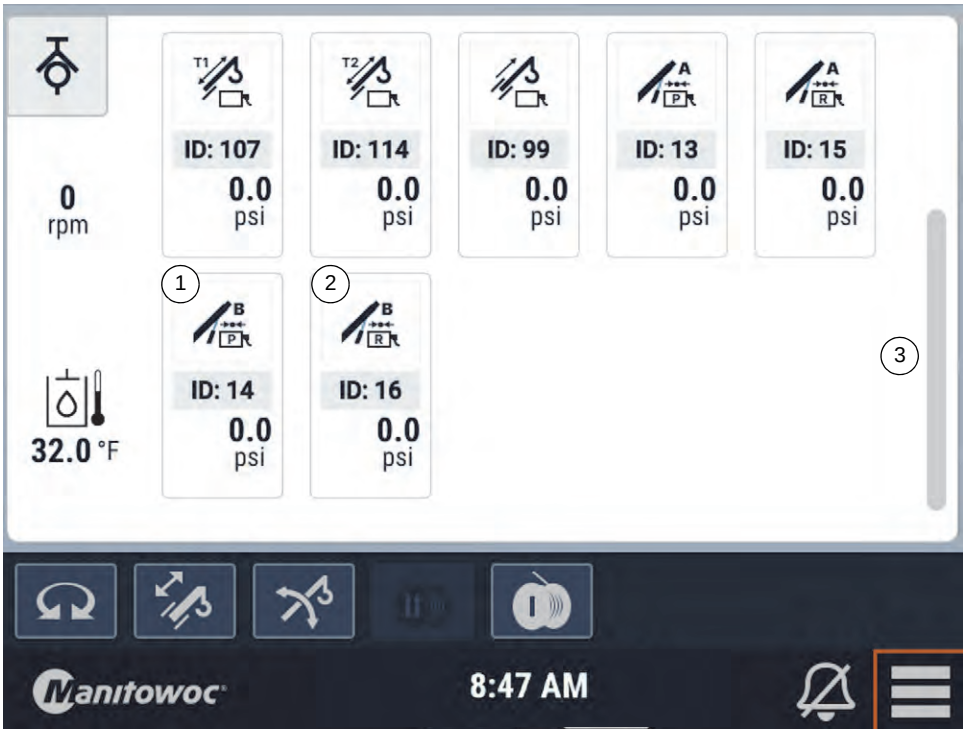
When there are more pressure icon elements than what it can show on one page, a Scroll Bar (3, Figure 4-141) will show on the right side of the panel.



Item	Description	Item	Description
1	Engine RPM	7	Hydraulic Oil Filter Pressure
2	Hydraulic Oil Temperature	8	T1 Pressure
3	Outrigger System Pressure	9	T2 Pressure
4	Swing System Pressure	10	Tele Extend Pressure
5	Load Sense Line Pressure	11	Lift Cylinder Piston Pressure (Primary)
6	Pump Supply Pressure/Main Directional Pressure	12	Lift Cylinder Rod Pressure (Primary)

10753-14

FIGURE 4-140



Item	Description
1	Lift Cylinder Piston Pressure (Secondary)
2	Lift Cylinder Rod Pressure (Secondary)
3	Scroll Bar

10753-16

FIGURE 4-141

Crane Service Tools

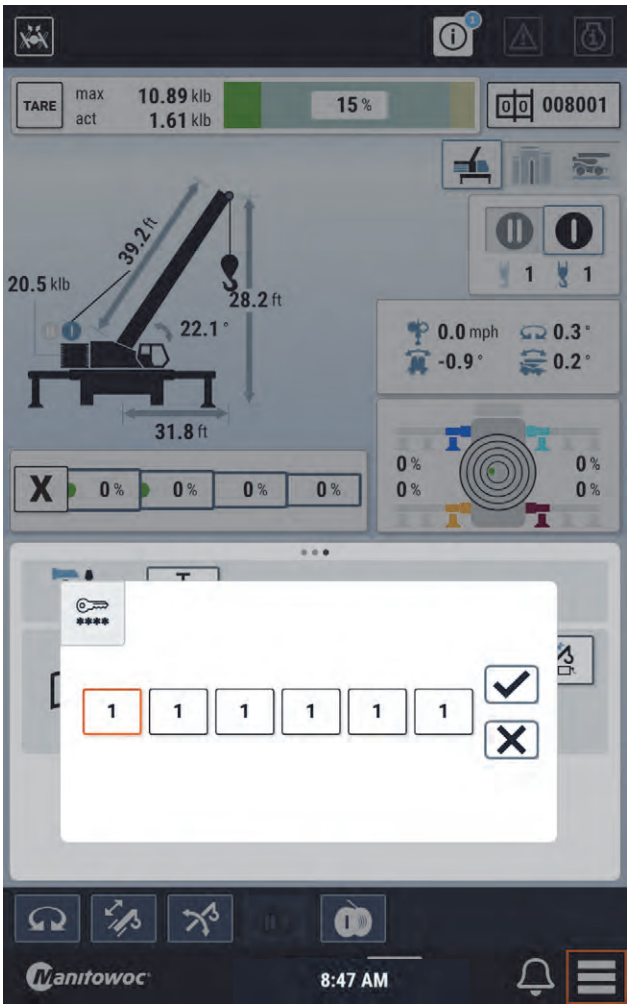
Several Crane Service Tool function panels are available for use by Grove and Grove-certified Service Technicians.

Refer to the following list and the Menu Page panel (Figure 4-143) for the crane service tool function panels that are available:

- Electronic Bubble Level Sensor Calibration
- Throttle Foot Pedal Sensor Calibration
- Swing Angle Sensor Calibration
- Boom Angle Sensor Calibration
- Boom Length Sensor Calibration
- Outrigger Monitoring System Sensor Calibration
- CAN Node ID Reset

To access any of the Crane Service Tool function panels, the service technician must first select the related crane service tool button. Once a button has been selected, the SDM (Superstructure Display Module) will show a Pass-code Screen panel (Figure 4-142) and prompt the user for a pass-code. The service technician must enter the correct pass-code to get access to the crane service tool function panel.

NOTE: Only Grove and Grove-certified service technicians are equipped with the proper pass-code.



10753-15

FIGURE 4-142

PROGRAMMING THE RCL – OVERVIEW

Item	Description
1	Electronic Bubble Level Sensor Calibration Button
2	Foot Pedal Sensor Calibration Button
3	Swing Angle Sensor Calibration Button
4	Boom Angle Sensor Calibration Button
5	Boom Length Sensor Calibration Button
6	Outrigger Monitoring System Sensor Calibration Button
7	CAN Node ID Reset Button

10753-4

FIGURE 4-143

There are two methods for programming the RCL, to include the following:

- RCL Wizard Method
- RCL Manual Entry (or Direct Entry) Method

DANGER

Overload/Tipover hazard!

The RCL is an operator aid. If it is programmed incorrectly, the system may not warn the operator of impending overload and may not activate function lockouts.

Ensure the RCL is properly programmed to correspond to the actual crane configuration being used.

The **RCL Wizard Method** uses a series of screens with selectable buttons that represent the different crane configurations (rigging) that are possible. In this method the operator programs the RCL system by selecting the applicable buttons that define how the crane is currently configured.

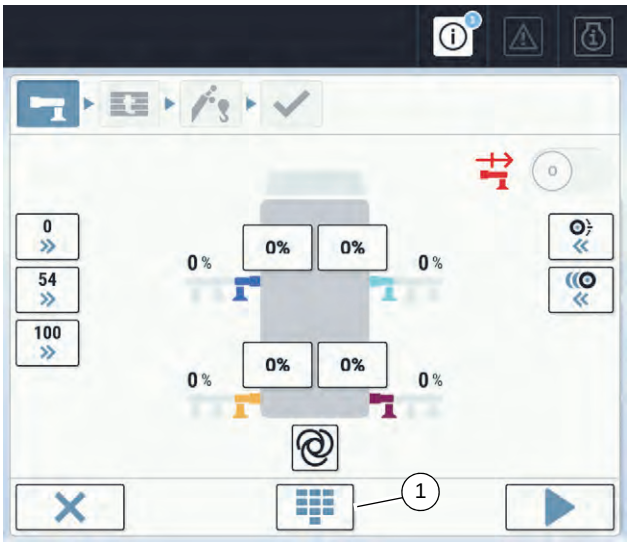
The **RCL Manual Entry Method** allows the Load Chart Rigging Code number to be typed directly into the RCL system. The Load Chart Rigging Code number can be looked up in the *Load Chart Manual* or in the Load Chart Rigging Code Library feature of the RCL Manual Entry method screen, which provides a list of all available Load Chart Rigging Codes which can be selected.

To program the RCL using either the RCL Wizard method or RCL Manual Entry method, select the RCL Programming Button/Indicator (1, Figure 4-144).

10746-39

FIGURE 4-144

After selecting the RCL Programming Button/Indicator, the RCL Wizard Screen will show (Figure 4-145) in the top half of the Superstructure Display Module (SDM).



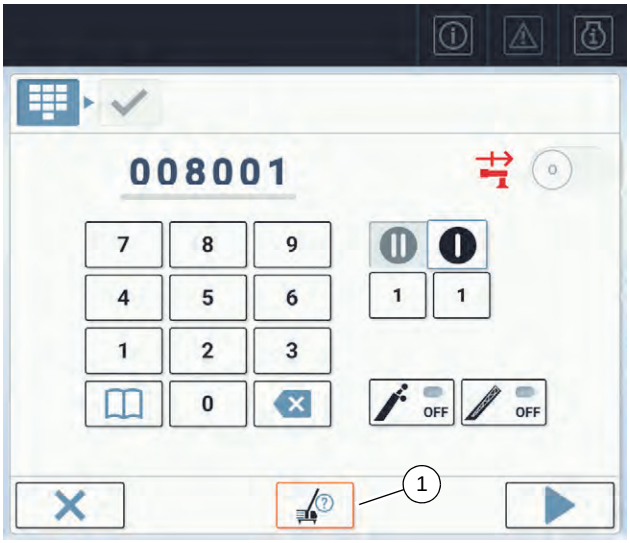
RCL Wizard Screen

10746-37

FIGURE 4-145

Operator can begin programming the RCL using the RCL Wizard Screen or switch to the RCL Manual Entry Screen by selecting the RCL Manual Entry Button (1, Figure 4-145).

After selecting the RCL Manual Entry Button, the RCL Manual Entry Screen will show (Figure 4-146).



RCL Manual Entry Screen

10746-38

FIGURE 4-146

To change from the RCL Manual Entry Screen to the RCL Wizard Screen, tap the RCL Wizard Button (1, Figure 4-146).

NOTE: When starting the crane for the first time of the work day or if more than two hours has passed since the crane power was cycled off, the RCL Setup Panel will show (default to) the RCL Wizard Screen (Figure 4-145).

The Crane Control System (CCS) remembers the last-used RCL entry method. Therefore, after the operator has programmed the RCL using one of the two possible methods (RCL Wizard or RCL Manual Entry), the display will revert to the same RCL entry method when the operator must re-program the RCL (change the Load Chart Rigging Code and/or crane configuration).

Refer to the following sections for detailed information about how to program the RCL using the related method:

- *Programming the RCL Using the Wizard Method*, page 4-106
- *Programming the RCL Using the Manual Entry Method*, page 4-120

PROGRAMMING THE RCL USING THE WIZARD METHOD

The Wizard Method for programming the RCL uses a series of ordered screens with selectable buttons that represent the different crane configurations (rigging) that are possible. In this method the operator programs the RCL system by selecting the applicable buttons on each screen that defines how the crane is currently configured.

RCL Wizard Screens

The On Rubber / On Outrigger Screen (Figure 4-148), which is the first screen in the series of RCL Wizard Screens, will show in the RCL Area of the SDM when the operator turns the ignition switch to the I (RUN) position and the following has occurred:

- Two hours has passed since the ignition switch was turned to the 0 (OFF) position.

  - or -

- No rigging code was confirmed in the RCL the last time the SDM was powered off.

The RCL Wizard Screen can also be opened by selecting the RCL Programming Button/Indicator (1, Figure 4-147) at the top right corner of the RCL Area.

The screens and buttons that show during the RCL Wizard programming method will vary as the operator progresses through the different screens, because selections made on an earlier screen will affect what screens and buttons will show following that screen.

As such, the sub-sections below describe all of the screens and their buttons that can show during RCL Wizard programming. Operator must understand that not all of these screens and buttons will show for every crane configuration that is programed into the RCL system.

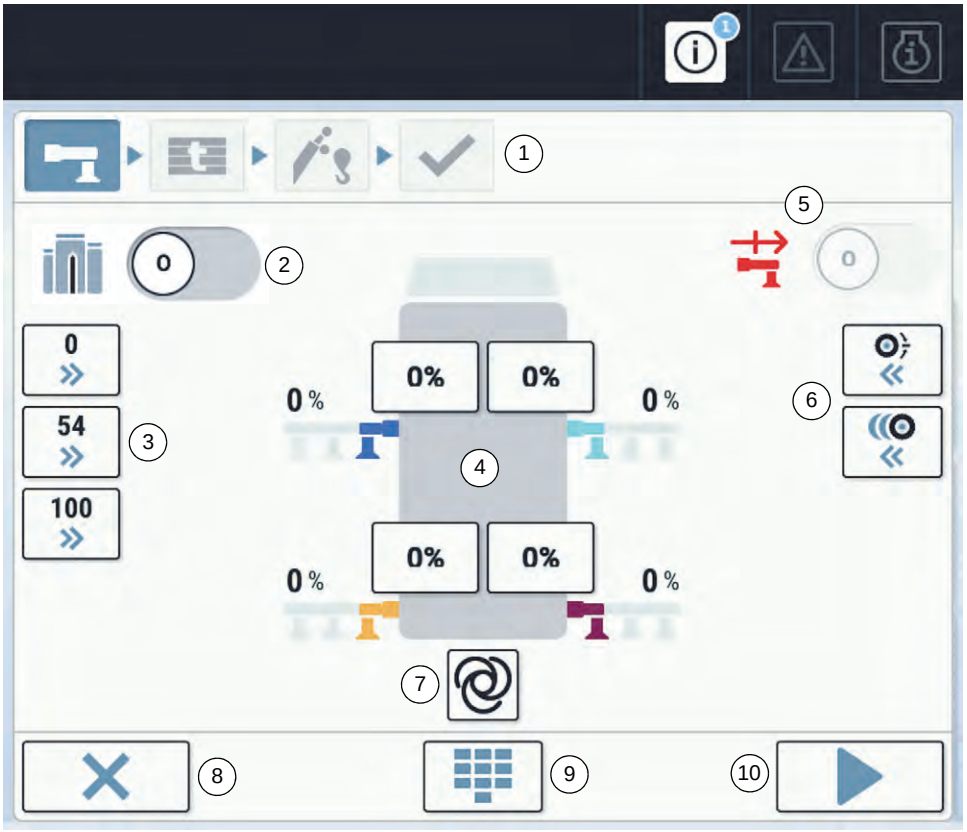
10746-39

FIGURE 4-147

RCL Wizard – On Rubber / On Outrigger Screen

The On Rubber / On Outrigger Screen is used to program the RCL with either an On Rubber Load Chart or an On Outrigger Load Chart.

All buttons shown on the On Rubber / On Outrigger Screen (Figure 4-148) are described below in their related sub-sections.



Item	Description	Page	Item	Description	Page
1	Progress Bar	4-108	6	On Rubber Stationary / Pick and Carry Buttons	4-113
2	MAXbase – Asymmetrical Outrigger Positions Button	4-108	7	Automatic Outrigger Beam Sync Button	4-114
3	Outrigger Beam Position Buttons	4-109	8	Exit Button	4-114
4	Outrigger Beam Configuration Area	4-109	9	RCL Manual Entry Button	4-114
5	Outrigger Monitoring System Override Icon and Button	4-112	10	Accept Button	4-114

10746-40

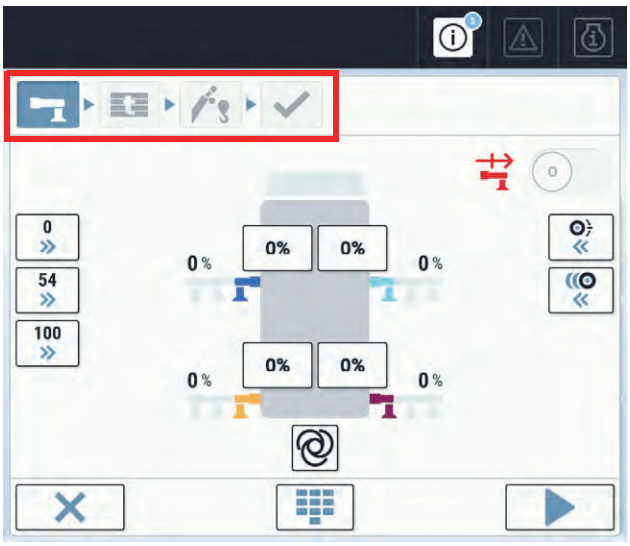
FIGURE 4-148

PROGRESS BAR

The Progress Bar (1, Figure 4-148) shows an ordered list of buttons that represents the different screens, or steps, the operator must progress through to program the RCL.

When programming the RCL using the wizard method, there are several screens the operator must complete. These screens and the buttons that show on them will vary depending upon how the crane is configured. The crane configuration choices made on a screen will affect what other buttons are shown on the screen as well as future screens.

Refer to Figure 4-149 for an example of the buttons that can show in the Progress Bar.



10746-37 **FIGURE 4-149**

The related button in the Progress Bar, which represents the current screen that the operator is on, will be ON.

The Progress Bar allows the operator to go back, or re-open, a previous screen by selecting its related button in the Progress Bar.

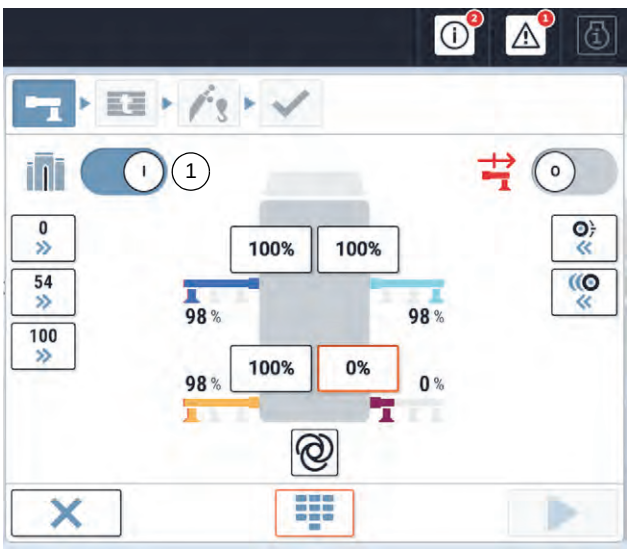
The Progress Bar shows on all of the different Wizard Screens.

MAXBASE – ASYMMETRIC OUTRIGGER POSITIONS BUTTON

The MAXbase - Asymmetric Outrigger Positions Button (2, Figure 4-148) is shown on cranes equipped with the optional MAXbase feature. Cranes not equipped with MAXbase will not show this button.

Cranes equipped with MAXbase can have their outrigger beams positioned to asymmetrical positions, following what is shown in the *Load Chart Manual*.

Operator must set the MAXbase - Asymmetric Outrigger Positions Button to ON (1, Figure 4-150) when programming the RCL with asymmetrical outrigger beam positions.



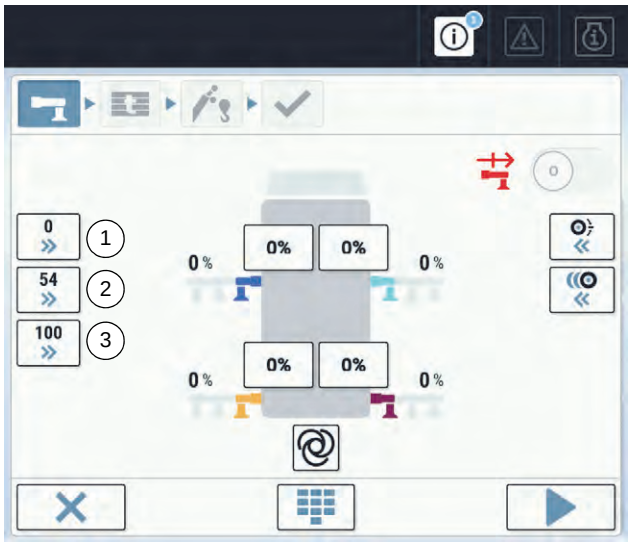
10753-6a **FIGURE 4-150**

When the button is set to ON, the operator will then be able to individually set the outrigger beams to asymmetrical positions in the Outrigger Beam Configuration Area of the screen. Refer to *Outrigger Beam Configuration Area*, page 4-109 for information about how to program the outrigger beam positions.

OUTRIGGER BEAM POSITION BUTTONS

The Outrigger Beam Position Buttons (3, Figure 4-148) are used to program the RCL with one of the three pre-defined outrigger beam positions.

Refer to Figure 4-151 for the definition of these buttons.

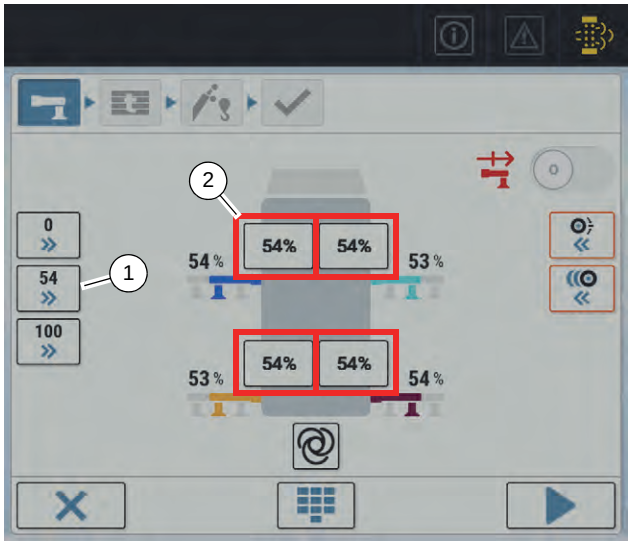


Item	Description
1	Fully Retracted (0%) Button
2	Mid-Extended (50%) Button - GRT765 Mid-Extended (54%) Button - GRT780
3	Fully Extended (100%) Button

10746-37 **FIGURE 4-151**

Operator must select the proper Outrigger Beam Position Button (1 thru 3, Figure 4-151) that relates to the actual outrigger beam positions. When one of the three Outrigger Beam Positions Buttons is selected, its value will show in all four of the Outrigger Beam Percentage Extended Value boxes (2, Figure 4-152) in the Outrigger Beam Configuration Area of the screen.

Figure 4-152 shows an example of what the Outrigger Beam Configuration Area pictorial looks like when the operator selects the Mid-Extended Button (1). The mid-extended value of 50% for GRT765 or 54% for GRT780 will populate the four Outrigger Beam Percentage Extended Values boxes (2).



10746-102 **FIGURE 4-152**

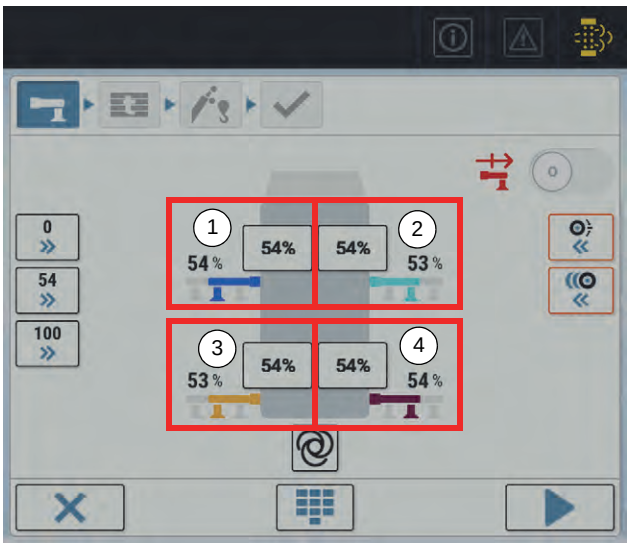
Refer to *Outrigger Beam Configuration Area*, page 4-109 for information about how the Outrigger Beam Configuration Area is used to in the programming of the RCL.

OUTRIGGER BEAM CONFIGURATION AREA

The Outrigger Beam Configuration Area (4, Figure 4-148) is a pictorial that represents the horizontal outrigger beam positions for the four outriggers.

The pictorial shows a top-down view of the crane with the four outrigger beams. Each outrigger beam shown is color coded to match and relate to the actual color of the top cap at each outrigger jack. The three pre-defined horizontal outrigger beam positions are shown, to include the following: fully retracted, mid-extended, and fully extended. Two percentage extended values are shown for each outrigger. One set of values is for the operator programmed outrigger beam positions, and the other set of values is the outrigger beam positions detected by the Outrigger Monitoring System (OMS).

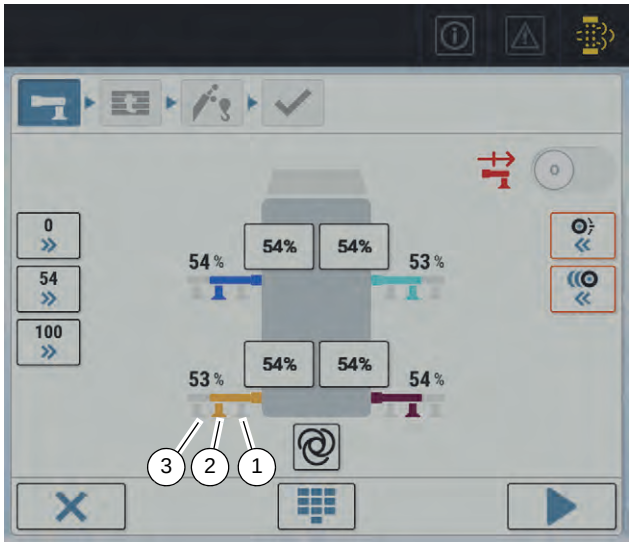
Refer to Figure 4-153, Figure 4-154 and Figure 4-155 for definitions of the different information shown in the Outrigger Beam Configuration Area.



Item	Description
1	Left-Front Outrigger Beam
2	Right-Front Outrigger Beam
3	Left-Rear Outrigger Beam
4	Right-Rear Outrigger Beam

10746-102

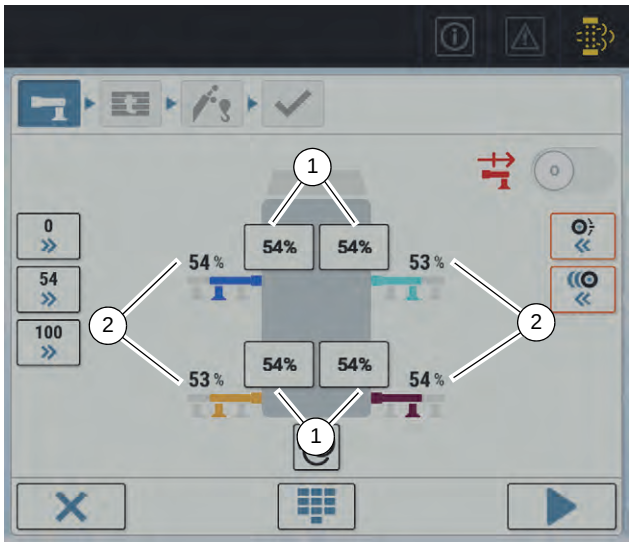
FIGURE 4-153



Item	Description
1	Fully Retracted (0%)
2	Mid-Extended (50%) - GRT765 Mid-Extended (54%) - GRT780
3	Fully Extended (100%)

10746-102

FIGURE 4-154



Item	Description
1	Programmed Outrigger Beam Position Values
2	OMS Detected Outrigger Beam Position Values

10746-102

FIGURE 4-155

Unless the crane is equipped with the MAXbase option and the operator intends to use a MAXbase load chart (asymmetrical outrigger positions), all four outriggers must be equally deployed to one of the three pre-defined positions.

The operator programs the RCL with the proper outrigger beam positions by selecting the related Outrigger Beam Positions Button (3, Figure 4-148) that shows on the left side of the screen (Refer to *Outrigger Beam Position Buttons*, page 4-109 for information about these buttons). When an Outrigger Beam Positions Button is selected, its related percentage extended value populates into the four Programmed Outrigger Beam Position Values boxes (1, Figure 4-155).

On standard cranes, the value in the four Programmed Outrigger Beam Position Values boxes (1, Figure 4-155) are static and cannot be selected or changed. Cranes equipped with the optional MAXbase feature can have asymmetrical outrigger beam positions and, therefore, the four Programmed Outrigger Beam Position Values boxes (1, Figure 4-155) will change to spinboxes if the MAXbase - Asymmetric Outrigger Positions Button (2, Figure 4-148) is first set to ON. If the MAXbase - Asymmetric Outrigger Positions Button (2, Figure 4-148) is set to ON, then the values in the four Programmed Outrigger Beam Position Values boxes (1, Figure 4-155) can be selected and changed to asymmetrical values. The asymmetric values that can be selected are limited to the three pre-defined outrigger positions (fully retracted, mid-extended, fully extended) and should match an actual load chart in the *Load Chart Manual* and match the OMS Detected Outrigger Beam Position Values (2, Figure 4-155).

The OMS (Outrigger Monitoring System) Detected Outrigger Beam Position Values (2, Figure 4-155) are determined by the OMS. These values are dynamic and will automatically change for each outrigger beam as it is extended and retracted.

The outrigger beam positions programmed or selected during the RCL setup should match the outrigger beam positions detected by the OMS. When they do, the following will show in the Outrigger Beam Configuration Area pictorial:

- The outrigger beam/jack symbols for each outrigger will be correctly color coded and extended to their programmed positions: fully retracted, mid-extended, or fully extended.
- The Programmed Outrigger Beam Position Values and the OMS Detected Outrigger Beam Position Values will be shown in BLACK text and will be within 3% of the following values:
  - Fully Retracted = 0%
  - Mid-extended = 50% for GRT765 / 54% for GRT780
  - Fully Extended = 100%

NOTE: The OMS requires the detected length of the outrigger beam position to be within ±3% of the programmed outrigger beam position to be recognized as a valid setup.

Figure 4-156 shows an example of what the Outrigger Beam Configuration Area pictorial looks like when the programmed outrigger beam positions **match** the OMS detected outrigger beam positions.

The figure shows that the operator programmed the RCL with the outrigger beams extended to the mid-extended positions. The outrigger beam percentage extended values, detected by the OMS, are within ±3% of the pre-defined value of 50% for GRT765 or 54% for GRT780. Therefore, the outrigger beam percentage extended values are shown in BLACK text.

10746-102

FIGURE 4-156

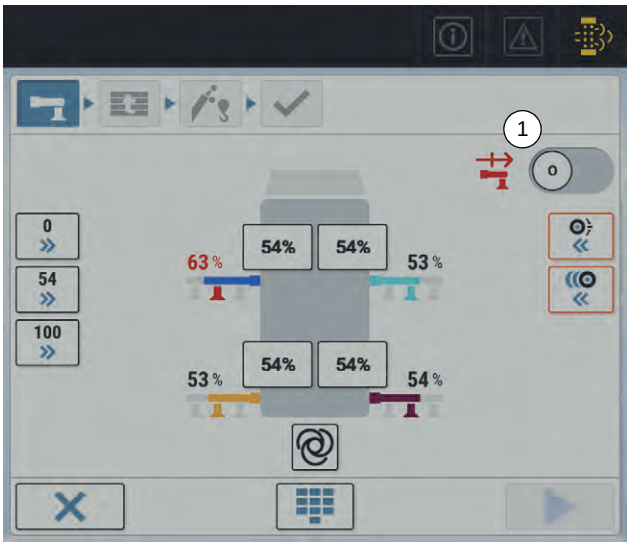
If one or more of the programmed outrigger beam positions **do not match** the outrigger beam positions detected by the OMS. the following will show in the Outrigger Beam Configuration Area:

- The outrigger jack symbol(s) for the affected outriggers will be RED in color and extended to their programmed positions: fully retracted, mid-extended, or fully extended.
- The Programmed Outrigger Beam Position Values and their related OMS Detected Outrigger Beam Position Values for the affected outriggers will **not** be equal to each other.
- The OMS Detected Outrigger Beam Position Values of the affected outriggers will be shown in RED text.

Figure 4-157 shows an example of what the Outrigger Beam Configuration Area pictorial looks like when the programmed

outrigger beam positions **do not match** the OMS detected outrigger beam positions.

The figure shows that the operator programmed the RCL with the outrigger beams extended to the mid-extended positions. The OMS Detected Outrigger Beam Position Values show the left front beam position is 63%, which is not within the ±3% tolerance of the pre-defined value of 50% for GRT765 or 54% for GRT780. Therefore, the OMS Detected Outrigger Beam Position Value for the left front beam is shown in RED text and the outrigger jack symbol is RED in color.



10746-103

FIGURE 4-157

In this scenario, the operator must choose to do one of the following:

- Change the Programmed Outrigger Beam Position Values and/or the OMS Detected Outrigger Beam Position Values (actual outrigger positions) so that the two values are equal.

  - or -

- Override the OMS by setting the OMS Override Button (1, Figure 4-157) to ON (highlighted).

  By setting the OMS Override Button to ON, the operator is acknowledging that he or she wants to operate the crane in its current outrigger beam configuration even though the RCL programmed outrigger beam configuration **does not match** the actual outrigger beam configuration.

DANGER

Crane Tipping Hazard!

When the Outrigger Monitoring System (OMS) is overridden, the RCL will not provide protection from overload. Death or serious injury will result if the crane tips over.

The operator is responsible for ensuring that the crane is not overloaded or operated in excess of the allowable published capacities for the actual outrigger configuration.

A qualified person shall be consulted to determine if any capacity reductions, special operating procedures, or limitation are required.

OUTRIGGER MONITORING SYSTEM OVERRIDE ICON AND BUTTON

The operator can override the OMS by setting the OMS Override Button (5, Figure 4-148) to ON.

By setting the OMS Override Button to ON, the operator is acknowledging that he or she wants to operate the crane in its current outrigger beam configuration even though the RCL programmed outrigger beam configuration **does not match** the actual outrigger beam configuration detected by the OMS. Refer to *Outrigger Beam Configuration Area*, page 4-109 for detailed information about how to properly program the outrigger configuration into the RCL.

DANGER

Crane Tipping Hazard!

When the Outrigger Monitoring System (OMS) is overridden, the RCL will not provide protection from overload. Death or serious injury will result if the crane tips over.

The operator is responsible for ensuring that the crane is not overloaded or operated in excess of the allowable published capacities for the actual outrigger configuration.

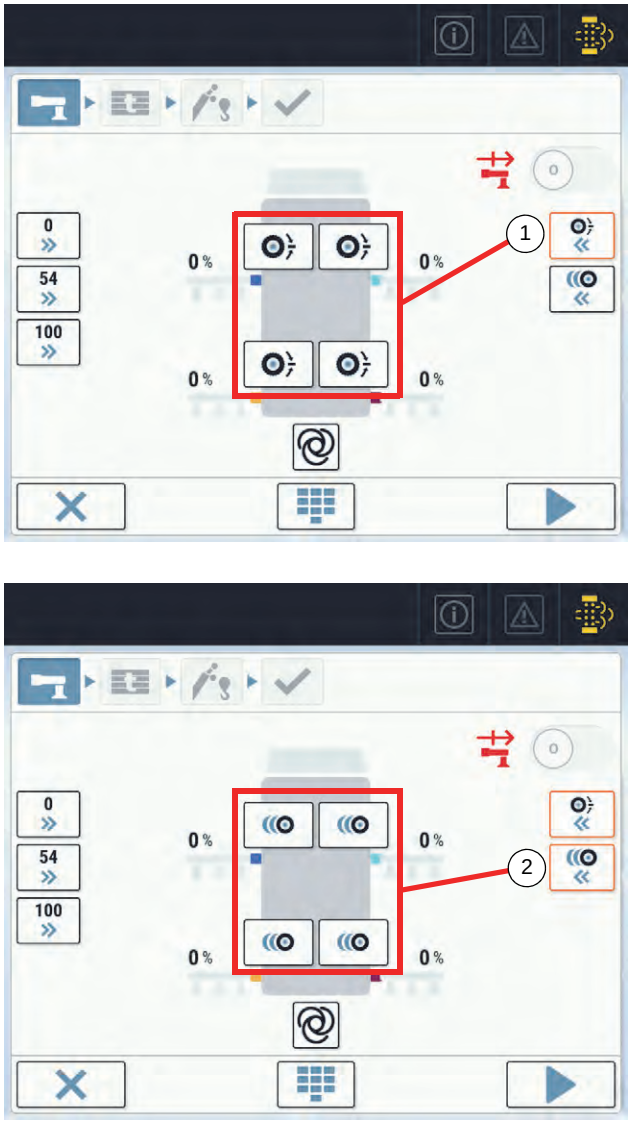
A qualified person shall be consulted to determine if any capacity reductions, special operating procedures, or limitation are required.

ON RUBBER STATIONARY / PICK AND CARRY BUTTONS

The On Rubber Stationary / Pick and Carry Buttons (6, Figure 4-148) allow the operator to select an On-Rubber Load Chart Code Number.

Operator must select one of the following buttons shown in Figure 4-158 when lifting On Rubber:

- On Rubber Stationary Button (1)
- Pick and Carry Button (2)



10746-104 and 10746-105

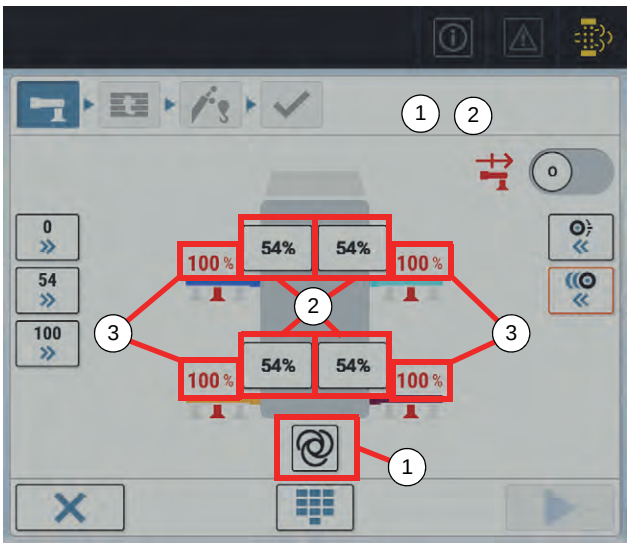
FIGURE 4-158

4

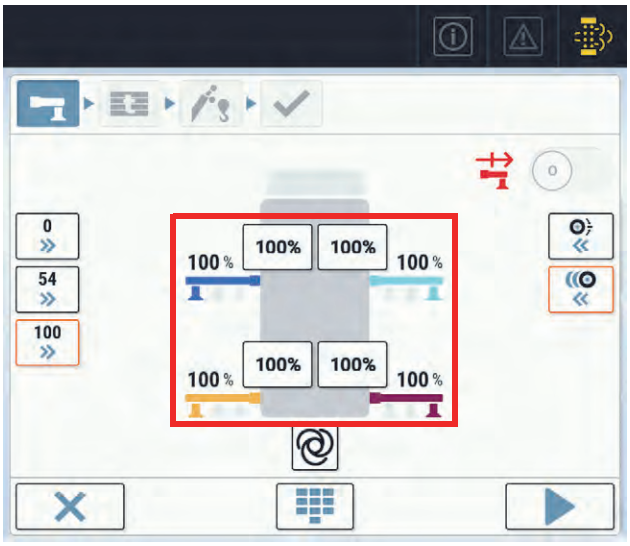
AUTOMATIC OUTRIGGER BEAM POSITION SYNC BUTTON

The Automatic Outrigger Beam Position Sync Button (7, Figure 4-148) is used to quickly program the RCL.

Operator can select the Automatic Outrigger Beam Position Sync Button (1, Figure 4-159) to automatically update the Programmed Outrigger Beam Position Values (2, Figure 4-159) to match their related OMS Detected Outrigger Beam Position Values (3, Figure 4-159).



Unsynchronized



Synchronized

10746-106 and 10746-107

FIGURE 4-159

EXIT BUTTON

The Exit Button (8, Figure 4-148) is used to exit from the RCL Wizard Screen and return to the RCL Area view (2, Figure 4-1).

The Exit Button shows on all of the different Wizard Screens.

RCL MANUAL ENTRY BUTTON

The RCL Manual Entry Button (9, Figure 4-148), when selected, switches the screen view from the current RCL Wizard Screen to the RCL Manual Entry Screen.

The RCL Manual Entry Button shows on all of the different Wizard Screens.

ACCEPT BUTTON

The Accept Button (10, Figure 4-148) shows on all of the different Wizard Screens

The Accept Button is used to advance to the next RCL Wizard Screen. If the operator is satisfied with the selections made on the current screen, he or she can tap the Accept Button to proceed to the next RCL Wizard Screen to continue programming the RCL.

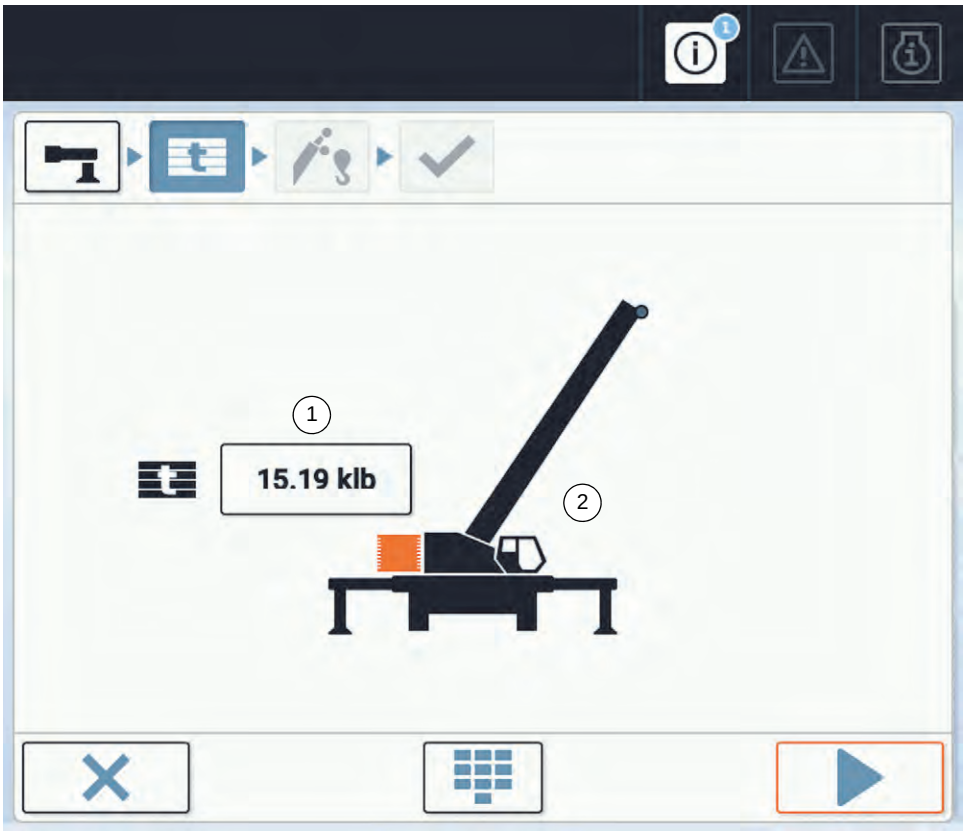
When all Wizard Screens have been completed, the operator can select the Accept Button to proceed to the RCL Confirmation Screen (*RCL Confirmation Screen*, page 4-125).

.

RCL Wizard – Counterweight Screen

The Counterweight Screen is used to program the RCL with the proper counterweight configuration.

All buttons shown on the Counterweight Screen (Figure 4-160) are described below in their related sub-sections.



Item	Description	Page
1	Counterweight Selection Button	4-116
2	Crane Configuration Area	4-116

10746-41

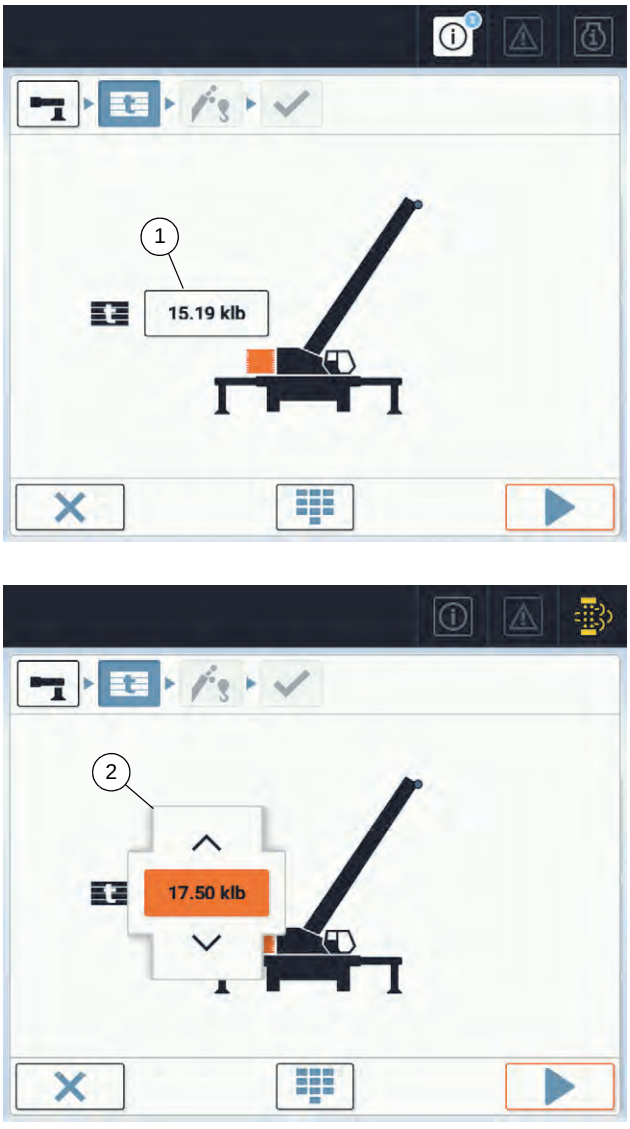
FIGURE 4-160

4

COUNTERWEIGHT SELECTION BUTTON

The Counterweight Selection Button (1, Figure 4-160) is used to program the RCL with a value equal to the counterweight that is installed.

Select the Counterweight Selection Button (1, Figure 4-161) to open a spinbox (2), then select the proper counterweight value.



10746-108 and 10746-109 **FIGURE 4-161**

CRANE CONFIGURATION VIEW AREA

The Crane Configuration View Area (2, Figure 4-160) shows a pictorial which represents the side view of the crane.

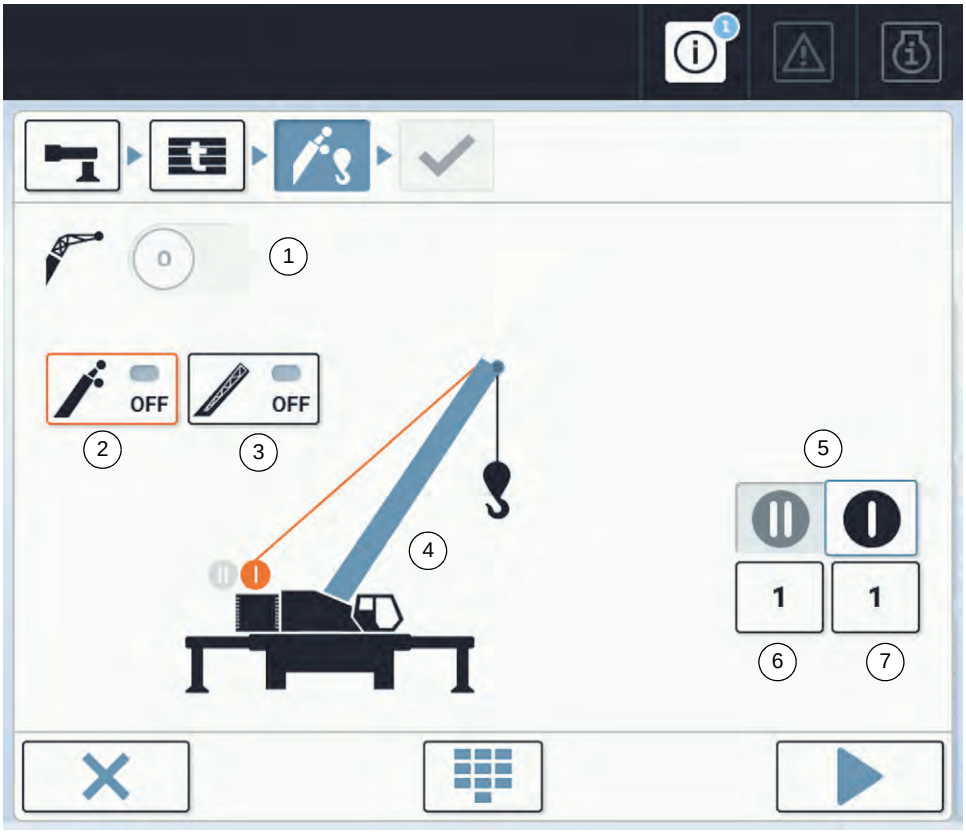
The pictorial is dynamic and will change to show the crane configuration as selections are made on the screen.

RCL Wizard – Auxiliary Boom Nose / Boom Extension / Hoist Selection Screen

The Auxiliary Boom Nose / Boom Extension / Hoist Selection Screen is used to program the RCL with the following crane configurations:

- Auxiliary Boom Nose Installed
- Boom Extension Stowed on Side of Main Boom or Erected
- Erected Boom Extension Length and Offset
- Main/Auxiliary Hoist Selection and Reeving

All buttons shown on the Auxiliary Boom Nose / Boom Extension / Hoist Selection Screen (Figure 4-162) are described below in their related sub-sections.



Item	Description	Page	Item	Description	Page
1	Boom Extension Erected Button	4-118	5	Main/Auxiliary Hoist Selection Slider Button	4-119
2	Auxiliary Boom Nose Installed Button	4-118	6	Auxiliary Hoist Reeving Button	4-119
3	Boom Extension Stowed on Main Boom Button	4-118	7	Main Hoist Reeving Button	4-119
4	Crane Configuration View Area	4-118			

10746-42

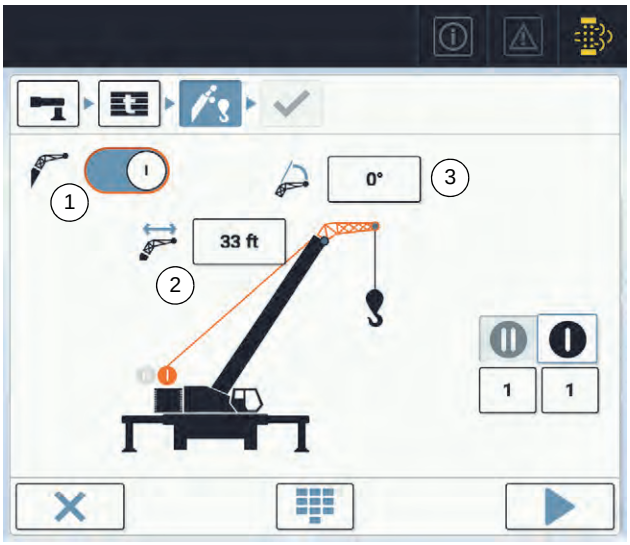
FIGURE 4-162

BOOM EXTENSION ERECTED BUTTON

The Boom Extension Erected Button (1, Figure 4-162) is shown on cranes equipped with the optional boom extension. Cranes not equipped the boom extension will not show this button.

If boom extension is erected on the end of the boom nose, operator must set the Boom Extension Erected Button to ON (1, Figure 4-163).

When the button is set to ON, the current screen will change to show buttons for setting the boom extension length (2, Figure 4-163) and boom extension offset (3).



Item	Description
1	Boom Extension Length Button
2	Boom Extension Offset Button

10746-110

FIGURE 4-163

Operator must then select the Boom Extension Length Button and Boom Extension Offset Button to open the related spinbox and set the proper values for the current crane configuration.

Possible boom extension lengths include:

- 10 m (33 ft)
- 17 m (56 ft)

Possible boom extension offsets include:

- 0°
- 25°
- 40°

AUXILIARY BOOM NOSE INSTALLED BUTTON

The Auxiliary Boom Nose Installed Button (2, Figure 4-162) is shown on cranes equipped with the optional auxiliary boom nose. Cranes not equipped the auxiliary boom nose will not show this button.

When lifting over the auxiliary boom nose, operator must set the Auxiliary Boom Nose Installed Button to ON. If not lifting over the auxiliary boom nose, set the button to OFF.

NOTE: When performing a lift over the auxiliary boom nose, set the Auxiliary Boom Nose Installed Button to ON. The predicted radius in the RCL will include the added length of the auxiliary boom nose.

When performing a lift over the main boom nose and the auxiliary boom nose is installed, set the Auxiliary Boom Nose Installed Button to OFF. The predicted radius will be that of the main boom nose and the mass of the auxiliary boom nose will be considered part of the load.

BOOM EXTENSION STOWED ON MAIN BOOM BUTTON

The Boom Extension Stowed on Main Boom Button (3, Figure 4-162) is shown on cranes equipped with the optional boom extension. Cranes not equipped with the boom extension will not show this button.

If boom extension is stowed on the side of the main boom, operator must set the Boom Extension Stowed on Main Boom Button to ON (highlighted).

CRANE CONFIGURATION VIEW AREA

The Crane Configuration View Area (4, Figure 4-162) shows a pictorial which represents the side view of the crane.

The pictorial is dynamic and will change to show the crane configuration as selections are made on the screen.

MAIN/AUXILIARY HOIST SELECTION SLIDER BUTTON

The Main/Auxiliary Hoist Selection Slider Button (5, Figure 4-162) is shown on cranes equipped with the optional auxiliary hoist. Cranes not equipped the auxiliary hoist will not show this slider button.

The operator must select the hoist in which he or she intends to make a lift with.

Selecting the main hoist (I) or auxiliary hoist (II) for operation can also be done from the *RCL Monitoring View Screen*, page 4-143 after the RCL has been programmed.

AUXILIARY HOIST REEVING BUTTON

The Auxiliary Hoist Reeving Button (6, Figure 4-162) is shown on cranes equipped with the optional auxiliary hoist. Cranes not equipped the auxiliary hoist will not show this button.

The operator must select the reeving configuration, or parts of line, in which he or she is operating with. Selecting the button will open a spinbox where the parts of line can be set.

MAIN HOIST REEVING BUTTON

The Main Hoist Reeving Button (7, Figure 4-162) is always shown on cranes regardless of whether the crane is equipped with the optional auxiliary hoist.

The operator must select the reeving configuration, or parts of line, in which he or she is operating with. Selecting the button will open a spinbox where the parts of line can be set

PROGRAMMING THE RCL USING THE MANUAL ENTRY METHOD

The Manual Entry Method for programming the RCL uses one screen with a numeric keypad as well as selectable buttons that represent the different crane configurations (rigging) that are possible. In this method the operator programs the RCL system by entering the Load Chart Rigging Code number, taken from the *Load Chart Manual*, and by selecting the applicable buttons that define how the crane is currently configured,

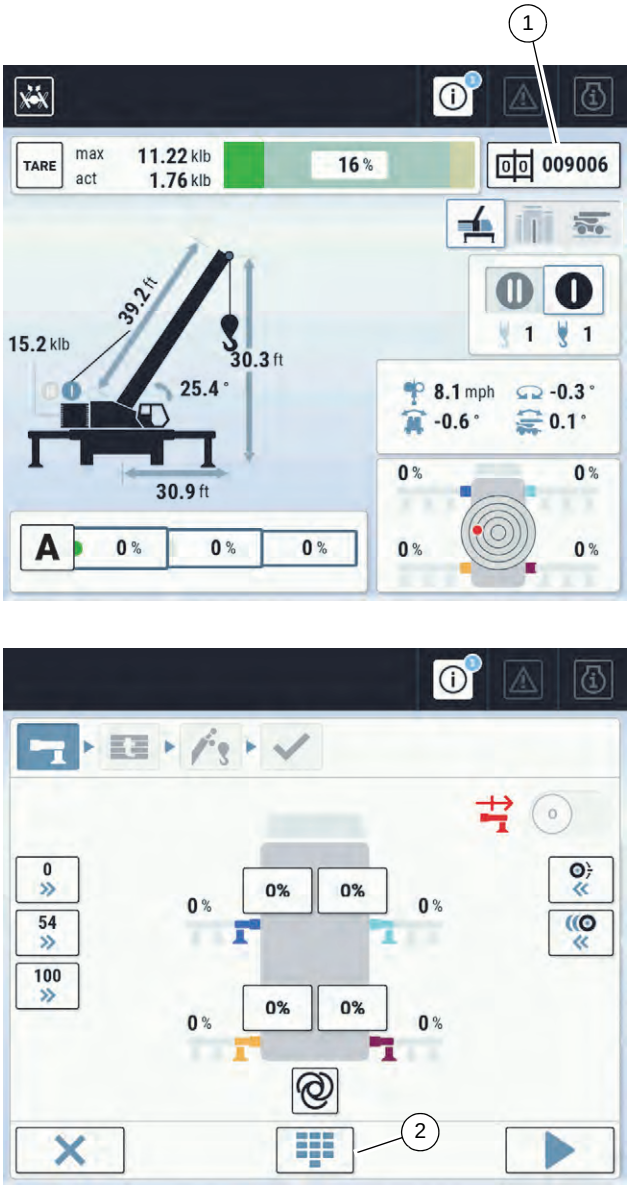
RCL Manual Entry Screen

The Rated Capacity Limiter (RCL) Manual Entry Screen is accessed by first opening the RCL Wizard Screen. To open the RCL Wizard Screen, select the RCL Programming Button/Indicator (1, Figure 4-164) at the top right corner of the RCL Area. After opening the RCL Wizard Screen, select the RCL Manual Entry Screen Button (2, Figure 4-164).

The RCL Manual Entry Screen allows the Load Chart Rigging Code number to be manually typed into the RCL system using a 10-digit keypad. A Load Chart Rigging Code Library feature is provided that shows a list of all valid Load Chart Rigging Codes which can then be selected.

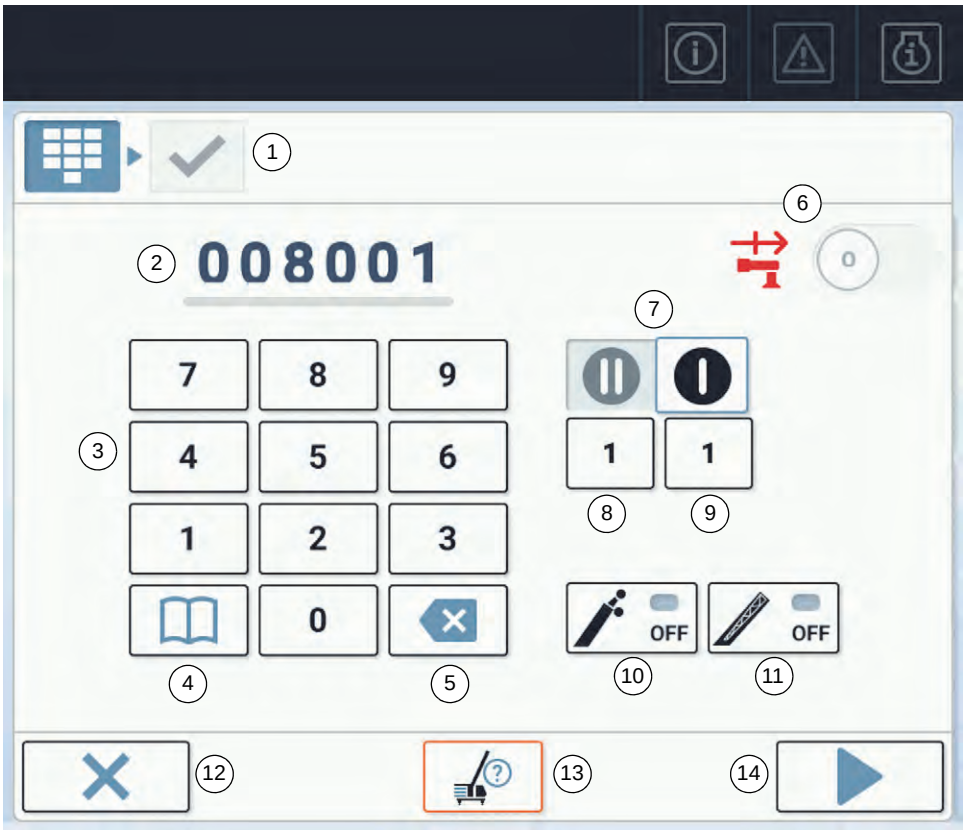
Hoist selection and reeving buttons are shown as well as buttons for indicating if the auxiliary boom nose is installed or if the boom extension is stowed on the side of the main boom.

All buttons shown on the RCL Manual Entry Screen (Figure 4-165) are described below in their related sub-sections.



10746-39 and 10746-111

FIGURE 4-164



10746-43

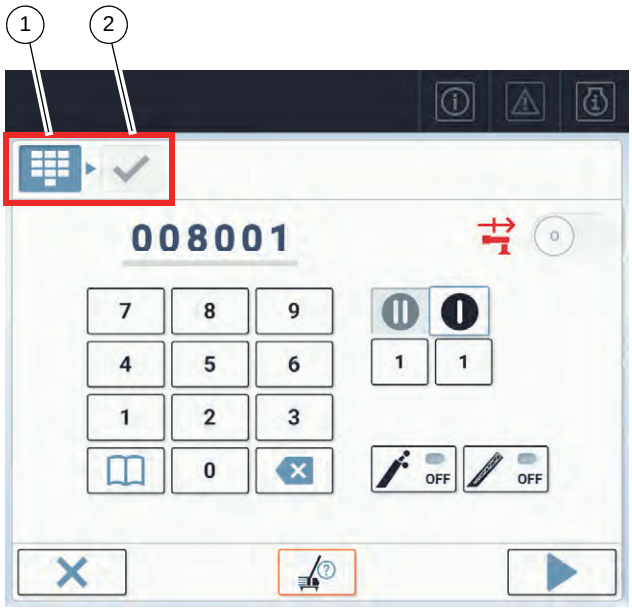
Item	Description	Page	Item	Description	Page
1	Progress Bar	4-122	8	Auxiliary Hoist Reeving Button	4-123
2	Load Chart Rigging Code	4-122	9	Main Hoist Reeving Button	4-124
3	Keypad	4-122	10	Auxiliary Boom Nose Installed Button	4-124
4	Load Chart Rigging Code Library Button	4-122	11	Boom Extension Stowed Button	4-124
5	Back Button	4-123	12	Exit Button	4-124
6	Outrigger Monitoring System Override Icon and Button	4-123	13	RCL Wizard Button	4-124
7	Main/Auxiliary Hoist Selection Slider Button	4-123	14	Accept Button	4-124

FIGURE 4-165

PROGRESS BAR

The Progress Bar (Figure 4-165) shows an ordered list of buttons that represents the different screens, or steps, the operator must progress through to program the RCL.

When programming the RCL using the Manual Entry Method, there are two screens the operator must complete, to include the RCL Manual Entry Screen and the RCL Manual Entry Confirmation Screen (Figure 4-166):



Item	Description
1	RCL Manual Entry Screen
2	RCL Manual Entry Confirmation Screen

10746-45 **FIGURE 4-166**

The related button in the Progress Bar, which represents the current screen that the operator is on, will be ON (highlighted).

The Progress Bar allows the operator to go back, or re-open, a previous screen by selecting its related button in the Progress Bar.

LOAD CHART RIGGING CODE

The Load Chart Rigging Code field (2, Figure 4-165) shows the load chart rigging code that has been typed in manually using the Number Pad keys (3, Figure 4-165) or has been selected through the Load Chart Rigging Code Library Button (4, Figure 4-165).

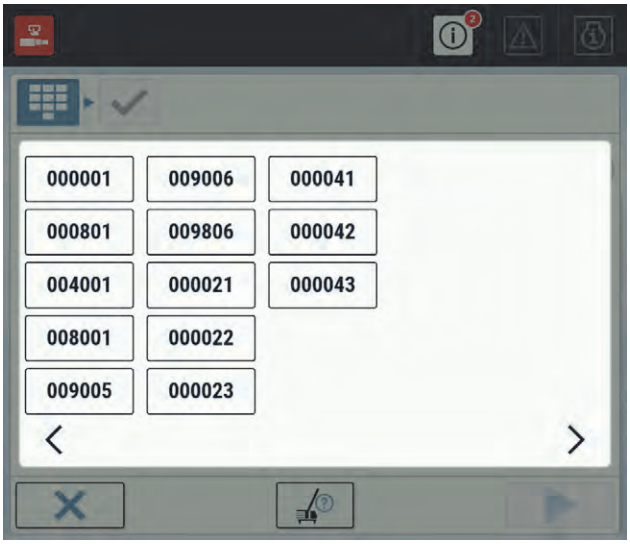
When the Load Chart Rigging Code number in this field is valid, the Check Mark in the Progress Bar (1, Figure 4-165) and the Accept Button (14, Figure 4-165) are On.

KEYPAD

The Keypad (3, Figure 4-165) has ten buttons representing the numbers zero (0) through nine (9). The Keypad Buttons are used to manually enter a load chart rigging code directly into the Load Chart Rigging Code field (2, Figure 4-165).

LOAD CHART RIGGING CODE LIBRARY BUTTON

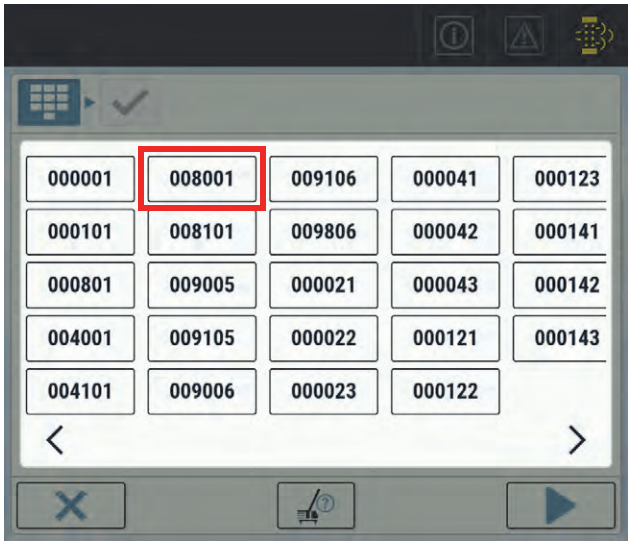
The Load Chart Rigging Code Library Button (4, Figure 4-165) opens the Load Chart Rigging Codes Library Panel (Figure 4-167), which lists all valid load chart rigging codes that can be selected.



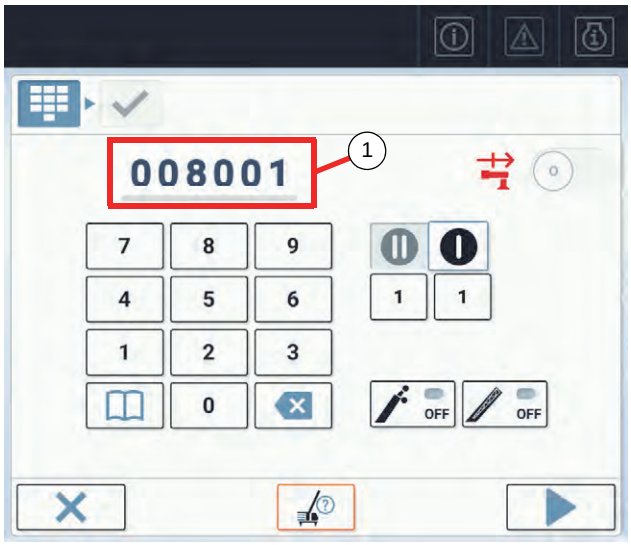
10746-44 **FIGURE 4-167**

The operator can scroll through the list of valid load chart rigging codes by either swiping left or right, or by using the Jog Dial to select the left or right arrow button at the bottom of the screen.

After the applicable load chart rigging code is selected, the RCL Manual Entry Screen will re-open and show the selected load chart rigging code number in the Load Chart Rigging Code field (1, Figure 4-168).



Load Chart Rigging Code Library Panel



RCL Manual Entry Screen

10746-45 and 10746-112 **FIGURE 4-168**

BACK BUTTON

The Back Button (5, Figure 4-165), when selected, will delete the last entry, or number, entered into the Load Chart Rigging Code field (2, Figure 4-165).

OUTRIGGER MONITORING SYSTEM OVERRIDE ICON AND BUTTON

The Outrigger Monitoring System (OMS) Override Icon and Button (6, Figure 4-165) is used to override the Outrigger Monitoring System (OMS) when the operator has programed the RCL with outrigger beam positions that **do not match** the OMS detected outrigger beam positions.

The operator can override the OMS by setting the OMS Override Button to ON.

By setting the OMS Override Button to ON, the operator is acknowledging that he or she wants to operate the crane in its current outrigger beam configuration even though the RCL programmed outrigger beam configuration **does not match** the actual outrigger beam configuration.

DANGER

Crane Tipping Hazard!

When the Outrigger Monitoring System (OMS) is overridden, the RCL will not provide protection from overload. Death or serious injury will result if the crane tips over.

The operator is responsible for ensuring that the crane is not overloaded or operated in excess of the allowable published capacities for the actual outrigger configuration.

A qualified person shall be consulted to determine if any capacity reductions, special operating procedures, or limitation are required.

MAIN/AUXILIARY HOIST SELECTION SLIDER BUTTON

The Main/Auxiliary Hoist Selection Slider Button (7, Figure 4-165) is shown on cranes equipped with the optional auxiliary hoist. Cranes not equipped with the auxiliary hoist will not show this slider button.

The operator must select the hoist in which he or she intends to make a lift with.

Selecting the main hoist (I) or auxiliary hoist (II) for operation can also be done from the *RCL Monitoring View Screen*, page 4-143 after the RCL has been programmed.

AUXILIARY HOIST REEVING BUTTON

The Auxiliary Hoist Reeving Button (8, Figure 4-165) is shown on cranes equipped with the optional auxiliary hoist. Cranes not equipped the auxiliary hoist will not show this button.

The operator must select the reeving configuration, or parts of line, in which he or she is operating with. Selecting the button will open a spinbox where the parts of line can be set.

MAIN HOIST REEVING BUTTON

The Main Hoist Reeving Button (9, Figure 4-165) is always shown on cranes regardless of whether the crane is equipped with the optional auxiliary hoist.

The operator must select the reeving configuration, or parts of line, in which he or she is operating with. Selecting the button will open a spinbox where the parts of line can be set

AUXILIARY BOOM NOSE INSTALLED BUTTON

The Auxiliary Boom Nose Installed Button (10, Figure 4-165) is shown on cranes equipped with the optional auxiliary boom nose. Cranes not equipped with the auxiliary boom nose will not show this button.

When lifting over the auxiliary boom nose, operator must set the Auxiliary Boom Nose Installed Button to ON. If not lifting over the auxiliary boom nose, set the button to OFF.

NOTE: When performing a lift over the auxiliary boom nose, set the Auxiliary Boom Nose Installed Button to ON. The predicted radius in the RCL will include the added length of the auxiliary boom nose.

When performing a lift over the main boom nose and the auxiliary boom nose is installed, set the Auxiliary Boom Nose Installed Button to OFF. The predicted radius will be that of the main boom nose and the mass of the auxiliary boom nose will be considered part of the load.

BOOM EXTENSION STOWED ON MAIN BOOM BUTTON

The Boom Extension Stowed on Main Boom Button (11, Figure 4-165) is shown on cranes equipped with the optional boom extension. Cranes not equipped with the boom extension will not show this button.

If boom extension is stowed on the side of the main boom, operator must set the Boom Extension Stowed on Main Boom Button to ON.

EXIT BUTTON

The Exit Button (12, Figure 4-165) is used to exit from the RCL Manual Entry Screen and return to the RCL Area view (2, Figure 4-1).

RCL WIZARD BUTTON

The RCL Wizard Button (13, Figure 4-165), when selected, switches the screen view from the current RCL Manual Entry screen to the RCL Wizard screen.

ACCEPT BUTTON

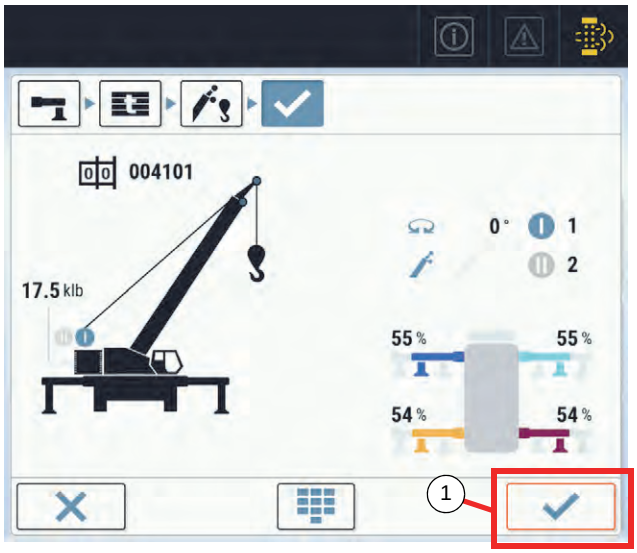
The Accept Button (14, Figure 4-165) will be ON when a valid load chart rigging code has been entered into the Load Chart Rigging Code field (2, Figure 4-165). If the operator is satisfied with the current selections, he or she can tap the Accept Button to proceed to the RCL Confirmation Screen (refer to *RCL Confirmation Screen*, page 4-125).

RCL CONFIRMATION SCREEN

The RCL Confirmation Screen shows after the operator has programmed the RCL with the current crane configuration using either the RCL Wizard method or the RCL Manual Entry method.

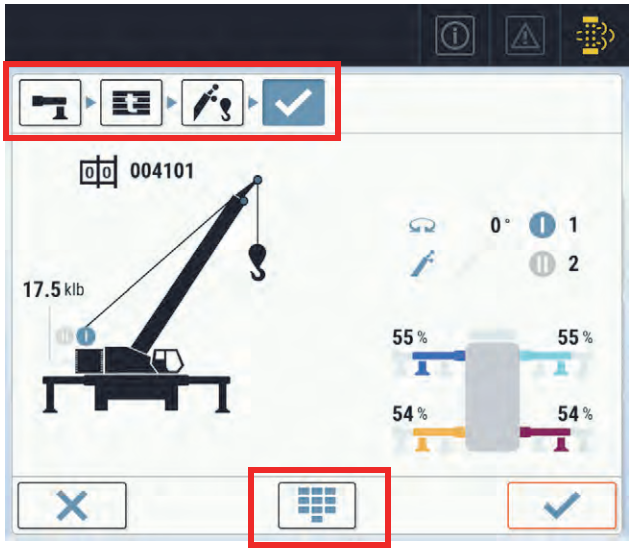
The RCL Confirmation Screen shows a pictorial overview of the crane configuration that was selected by the operator during RCL programming. Refer to Figure 4-171 and Figure 4-172 for examples of what the RCL Confirmation Screen can look like and the names and definitions of the screen elements that can show on it.

Operator must view and verify that the crane configuration shown in the RCL Confirmation Screen matches the actual crane configuration. When operator is satisfied the two configurations match (actual and programed), he or she can select the Confirm Button (1, Figure 4-169), which completes the RCL programming. Operator can then begin operating the crane.

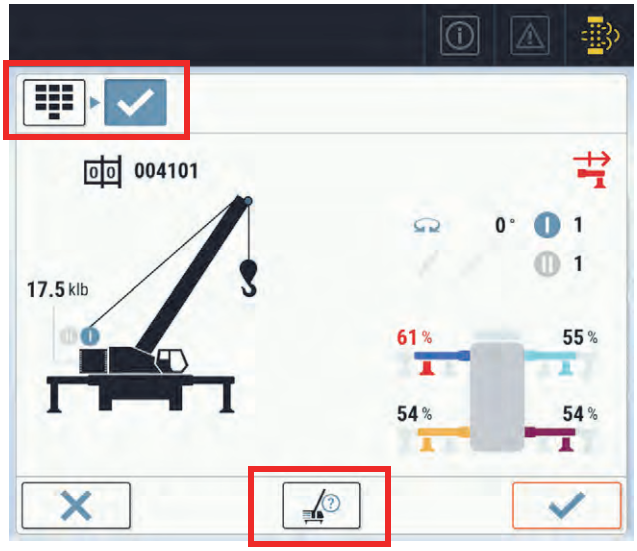


10746-116 **FIGURE 4-169**

The top and bottom navigation areas of the RCL Confirmation Screen (Figure 4-170) will vary slightly in appearance depending on which method (Wizard or Manual Entry) was used to program the RCL.



Wizard Confirmation Screen



Manual Entry Confirmation Screen

10746-116 and 10746-117 **FIGURE 4-170**

Refer to the related sections below for information about the buttons found in the navigation areas of the RCL Confirmation Screen:

- *Programming the RCL Using the Wizard Method*, page 4-106
- *Programming the RCL Using the Manual Entry Method*, page 4-120

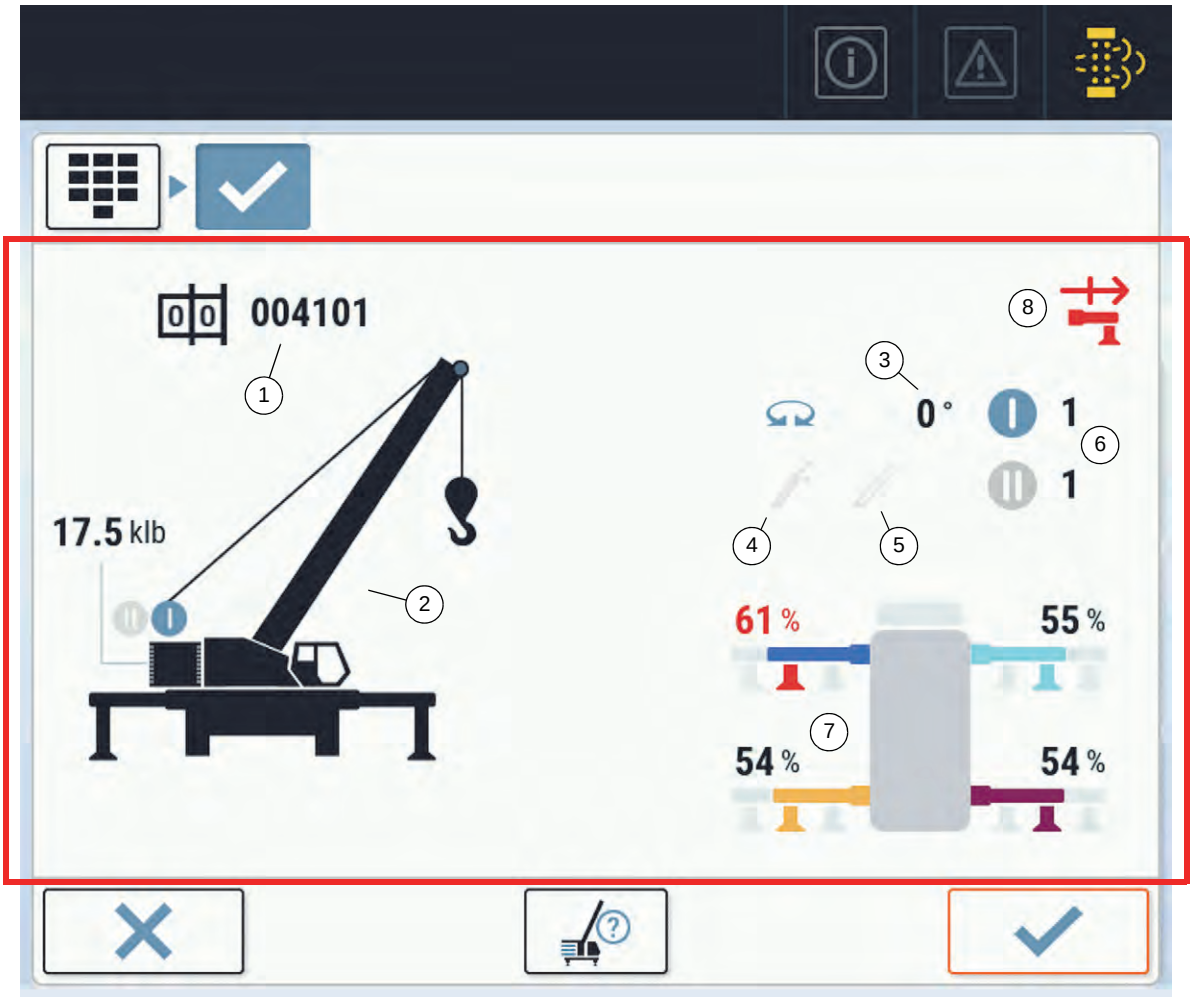
4

RCL Confirmation Screen

Item	Description	Page	Item	Description	Page
1	Load Chart Code Number Indicator	4-128	5	Boom Extension Stowed On Main Boom Indicator	4-128
2	Crane Configuration View Area	4-128	6	Hoist Selection/Reeving Indicator Area	4-129
3	Current Swing Angle Indicator	4-128	7	Outrigger Beam Configuration Area	4-129
4	Auxiliary Boom Nose Installed Indicator	4-128	8		

10746-113

FIGURE 4-171



RCL Confirmation Screen - OMS Overridden

Item	Description	Page	Item	Description	Page
1	Load Chart Code Number Indicator	4-128	5	Boom Extension Stowed On Main Boom Indicator	4-128
2	Crane Configuration View Area	4-128	6	Hoist Selection/Reeving Indicator Area	4-129
3	Current Swing Angle Indicator	4-128	7	Outrigger Beam Configuration Area	4-129
4	Auxiliary Boom Nosed Installed Indicator	4-128	8	Outrigger Monitoring System Override Indicator	4-132

10746-115

FIGURE 4-172

Load Chart Code Number Indicator

The Load Chart Code Number Indicator (1, Figure 4-171 and Figure 4-172) shows the load chart code number that was programmed into the RCL using either the Wizard Method or Manual Entry Method.

Crane Configuration View Area

The Crane Configuration View Area (2, Figure 4-171 and Figure 4-172) shows a pictorial which represents the side view of the crane.

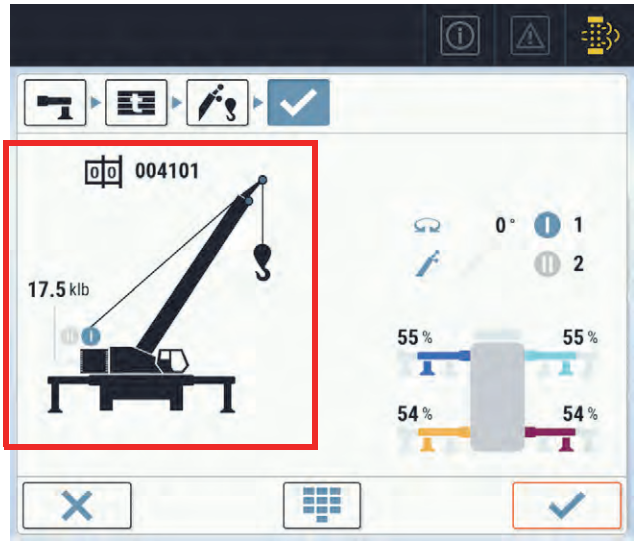
The pictorial is dynamic and will change to show the crane configuration that was selected by the operator during programming of the RCL.

The pictorial can show the following crane configurations:

- Counterweight Installed
- On Rubber or On Outrigger
- Main Hoist (I) or Auxiliary Hoist (II) Selected
- Hoist Reeving (Parts-of-Line)
- Auxiliary Boom Nose Deployed
- Boom Extension Stowed on Main Boom
- Boom Extension Erected (plus Length and Offset)

Refer to Figure 4-173 for an example of a crane configuration view area showing the following setup:

- On Outriggers
- Main Hoist Selected
- 17.5 klb Counterweight Installed
- Lifting from Auxiliary Boom Nose



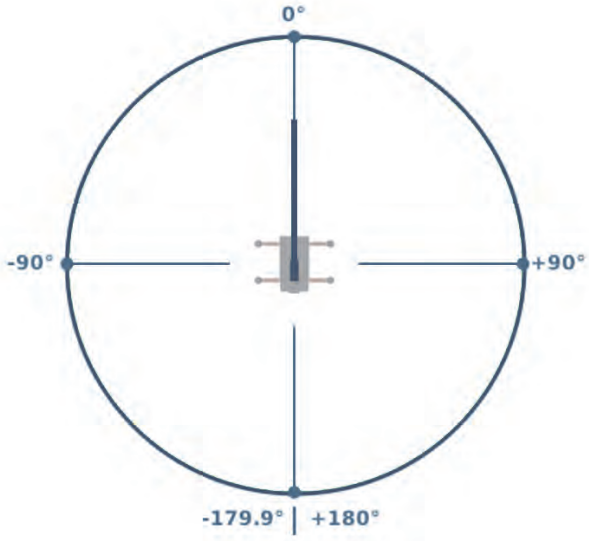
10746-116

FIGURE 4-173

Current Swing Angle Indicator

The Current Swing Angle Indicator (3, Figure 4-171 and Figure 4-172) shows the swing angle (in degrees) of the boom/superstructure relative to the carrier.

Figure 4-174 shows an illustration of how the swing angle is measured around a 360° full rotation of the boom/superstructure.



10083

FIGURE 4-174

In the center of the illustration is a top-down view of the crane with extended boom. A circle around the crane image illustrates the full 360° swing range. 0° means that the superstructure is positioned over the front of the crane carrier.

A full turn from this working position is divided into two semi-circles. Angles in the left semi-circle are shown as negative values (0° to -179.9°). Angles in the right semicircle are shown as positive (0° to 180°).

Auxiliary Boom Nose Installed Indicator

The Auxiliary Boom Nose Installed Indicator (4, Figure 4-171 and Figure 4-172) is ON if the operator indicated the auxiliary boom nose is attached to the main boom nose.

Boom Extension Stowed On Main Boom Indicator

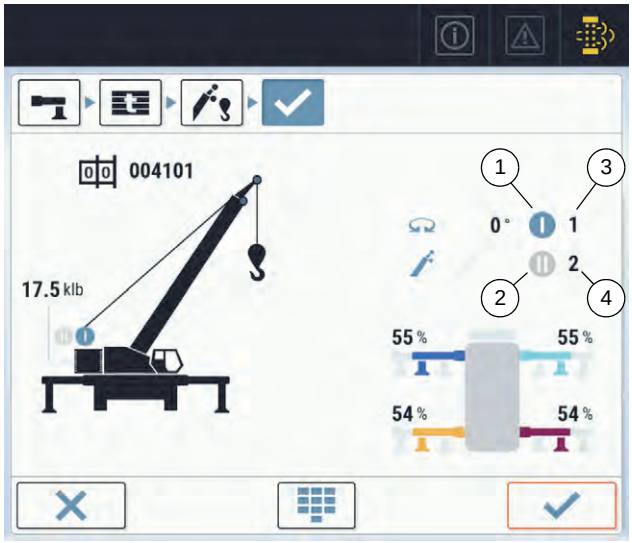
The Boom Extension Stowed On Main Boom Indicator (5, Figure 4-171 and Figure 4-172) is ON if the operator indicated the boom extension is stowed on the side of the main boom.

Hoist Selection/Reeving Indicator Area

The Hoist Selection/Reeving Indicator Area (6, Figure 4-171 and Figure 4-172) includes indicators that show which hoist (main or auxiliary) is selected for operation and its related reeving (parts of line).

The related indicator for the main or auxiliary hoist (1, 2, Figure 4-175) will be ON to indicate it is selected for operation. The reeving for each hoist is shown as a numeric value (3, 4, Figure 4-175).

NOTE: The auxiliary hoist selection and reeving indicators will only show if the crane is equipped with the optional auxiliary hoist.



Item	Description
1	Main Hoist Selection Indicator
2	Main Hoist Reeving Indicator
3	Auxiliary Hoist Selection Indicator
4	Auxiliary Hoist Reeving Indicator

10746-116 **FIGURE 4-175**

Outrigger Beam Configuration Area

The Outrigger Beam Configuration Area (7, Figure 4-171 and Figure 4-172) is a pictorial that represents the horizontal outrigger beam positions.

The pictorial shows a top-down view of the crane with the four outrigger beams. Each outrigger beam symbol shown is color coded to match and relate to the actual color of the top cap at each outrigger jack. The three pre-defined horizontal outrigger beam positions are shown, to include the following: fully retracted, mid-extended, and fully extended. A percentage extended value is also shown for each outrigger.

Unless the crane is equipped with the MAXbase option and a MAXbase load chart is selected in the RCL Setup Screen, all four outriggers must be equally deployed to one of the three pre-defined positions.

The outrigger beam positions that were programmed or selected during the RCL setup should match the outrigger beam positions detected by the Outrigger Monitoring System (OMS). When they do, the following will show in the Outrigger Beam Configuration Area:

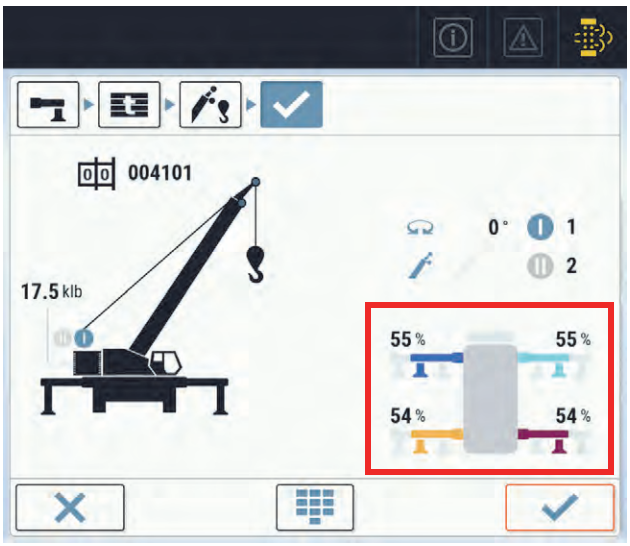
- The outrigger beam/jack symbols for each outrigger will be correctly color coded and extended to their programmed positions: fully retracted, mid-extended, or fully extended.
- The outrigger beam percentage extended values, determined by the OMS, will show in BLACK text and be within 3% of the following values:
  - Fully Retracted = 0%
  - Mid-extended = 50% for GRT765 / 54% for GRT780
  - Fully Extended = 100%

NOTE: The OMS requires the detected length of the outrigger beam position to be within ±3% of the RCL programmed outrigger position to be recognized as a valid setup.

4

Figure 4-176 shows an example of what the Outrigger Beam Configuration Area pictorial looks like when the programmed outrigger beam positions match the OMS detected outrigger beam positions. The figure shows that the operator programmed the RCL with the outrigger beams extended to the mid-extended positions. The outrigger beam percentage extended values, detected by the OMS, are within ±3% of the pre-defined value of 50% for GRT765 or 54% for GRT780. Therefore, the following will show on the pictorial:

- All outrigger jack symbols are shown in the mid-extended position and are correctly color coded
- All outrigger beam percentage extended values are shown in BLACK text and differ by less than 3% of the mid-extended value of 50% for GRT765 and 54% for GRT780



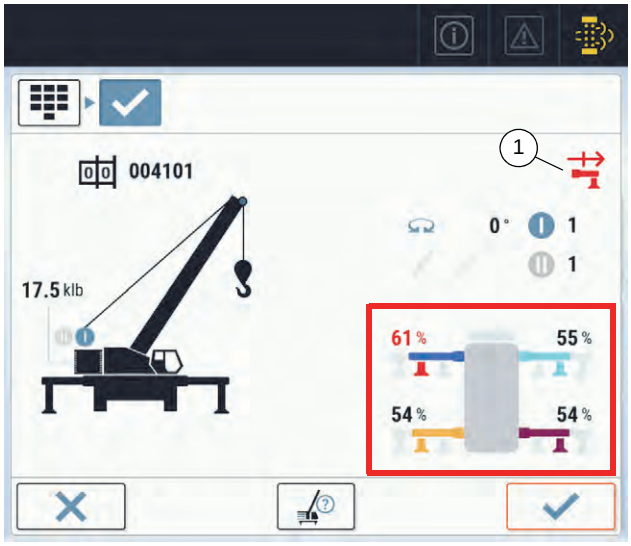
10746-116 **FIGURE 4-176**

If one or more of the RCL programmed outrigger beam positions **do not match** the outrigger beam positions detected by the OMS. the following will show in the Outrigger Beam Configuration Area pictorial:

- The outrigger jack symbol(s) for the affected outrigger(s) will be RED in color and extended to their programmed positions: fully retracted, mid-extended, or fully extended.
- The outrigger beam percentage extended values, determined by the OMS, will show in RED text and differ from the following values by more than 3%:
  - Fully Retracted = 0%
  - Mid-extended = 50% for GRT765 / 54% for GRT780
  - Fully Extended = 100%
- Outrigger Monitoring System (OMS) Override Indicator (8, Figure 4-172) will be ON as an additional indicator.

Figure 4-177 shows an example of what the Outrigger Beam Configuration Area pictorial looks like when the programmed outrigger beam positions **do not match** the OMS detected outrigger beam positions. The figure shows that the operator programmed the RCL with the outrigger beams extended to the mid-extended positions. The outrigger beam percentage extended values, detected by the OMS, show the left-front beam position is 61%, which is not within the ±3% tolerance of the pre-defined value of 50% for GRT765 or 54% for GRT780. Therefore, the following will show on the pictorial:

- Outrigger jack symbol for the left-front beam is shown in the mid-extended position but is RED in color
- Outrigger beam percentage extended value for the left-front beam is shown in RED text and differs by ±3% of the mid-extended value of 50% for GRT765 or 54% for GRT780
- OMS Override Indicator (1, Figure 4-177) is ON



10746-117 **FIGURE 4-177**

DANGER

Crane Tipping Hazard!

When the Outrigger Monitoring System (OMS) is overridden, the RCL will not provide protection from overload. Death or serious injury will result if the crane tips over.

The operator is responsible for ensuring that the crane is not overloaded or operated in excess of the allowable published capacities for the actual outrigger configuration.

A qualified person shall be consulted to determine if any capacity reductions, special operating procedures, or limitation are required.

Outrigger Monitoring System Override Indicator

The Outrigger Monitoring System (OMS) detects (senses) the horizontal position of each outrigger beam. The system will alert the operator if one or more of the outrigger beam positions, programmed into the RCL system by the operator, are different than what is detected by the OMS. Refer to *Outrigger Monitoring System (OMS) (Optional—Standard in North America and European Union Countries)*, page 5-32 for more information about how the OMS operates.

DANGER

Crane Tipping Hazard!

When the Outrigger Monitoring System (OMS) is overridden, the RCL will not provide protection from overload. Death or serious injury will result if the crane tips over.

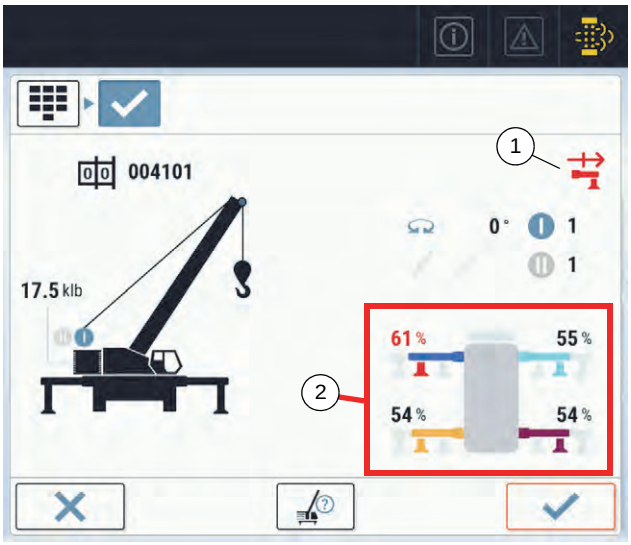
The operator is responsible for ensuring that the crane is not overloaded or operated in excess of the allowable published capacities for the actual outrigger configuration.

A qualified person shall be consulted to determine if any capacity reductions, special operating procedures, or limitation are required.

The Outrigger Monitoring System (OMS) Override Indicator (8, Figure 4-172) will be ON if the operator indicated on the RCL Setup Screen that one or more of the outrigger beams are extended to a position that is different than what is detected by the OMS.

If the operator overrode the OMS during the RCL programming, the OMS Indicator (1, Figure 4-178) will show on the Confirmation Screen. Also, the Outrigger Beam Configuration Area (2, Figure 4-178) will show the specific differences between the outrigger beam positions that were programmed by the operator and the outrigger beam positions detected by the OMS. Refer to *Outrigger Beam Configuration Area*, page 4-129 for more information.

NOTE: The OMS requires the detected length of the outrigger beam position to be within ±3% of the programmed outrigger position to be recognized as a valid setup.



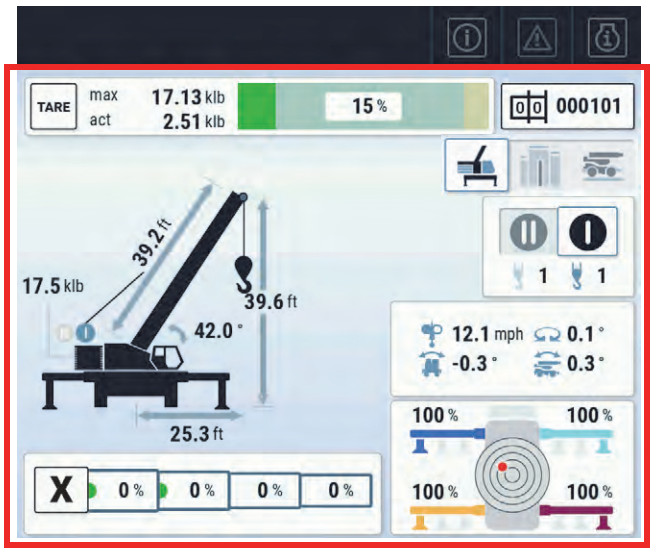
10746-117 **FIGURE 4-178**

MULTIFUNCTION VIEW SCREEN

The Multifunction View Screen in the RCL Area of the Superstructure Display Module (SDM) can be set to show information for monitoring the crane status and configuration after the RCL has been programmed as well as information useful when driving the crane. This information is shown in three screen view variations which can be selected by the operator.

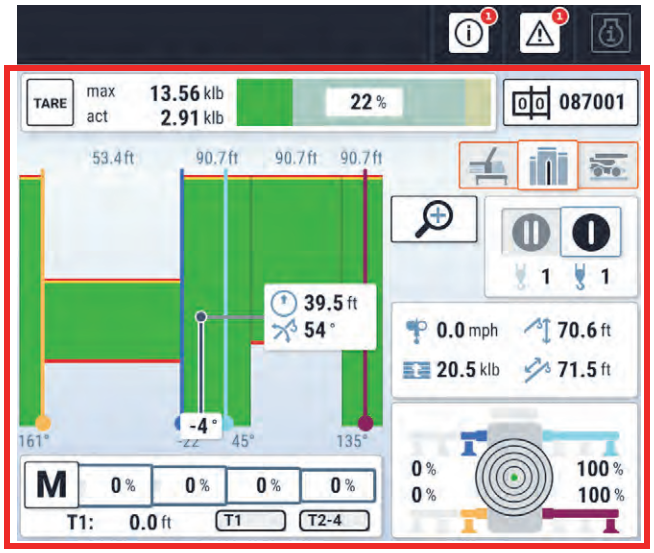
The three screen view variations include the following:

- RCL Monitoring View Screen



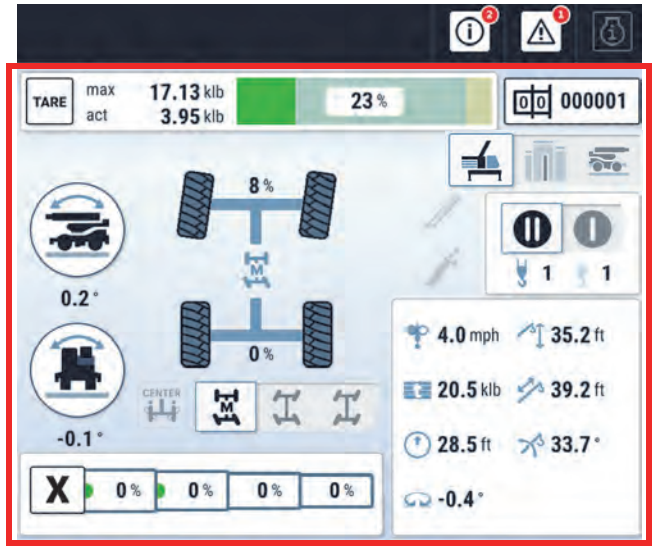
10746-59 **FIGURE 4-179**

- RCL Panorama View Screen



10753-10 **FIGURE 4-180**

- Driving View Screen



10746-58 **FIGURE 4-181**

A button for each screen view is shown on the three screen variations and allows the operator to easily toggle between the screen views during crane operation.

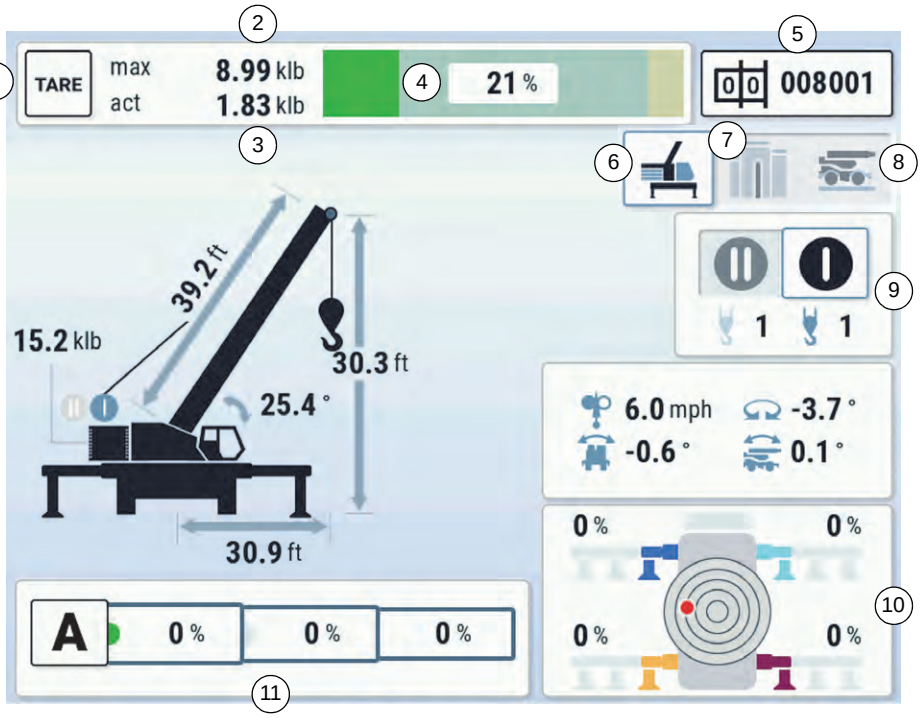
The three screen view variations include common information, which shows on all three screens, as well as specific information, which shows only on that particular screen view.

Refer to Figure 4-182 thru Figure 4-183 for descriptions of the information that is common on all three screen views.

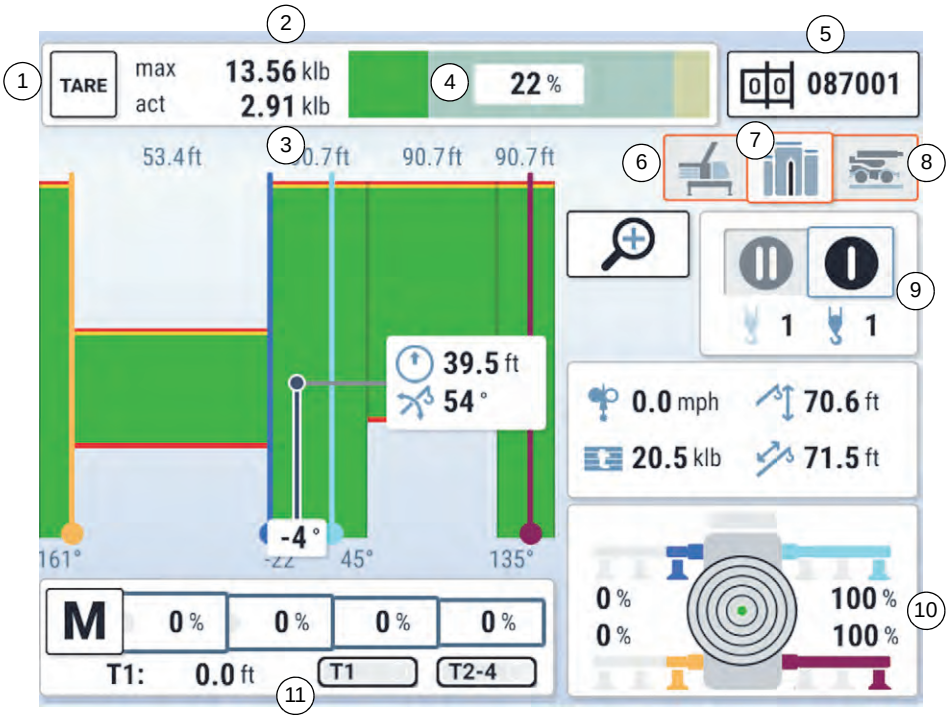
Refer to a section shown in the bulleted list below for descriptions of the information that is shown only on that specific screen view.

- *RCL Monitoring View Screen*, page 4-143
- *RCL Panorama View Screen*, page 4-145
- *Driving View Screen*, page 4-152

4



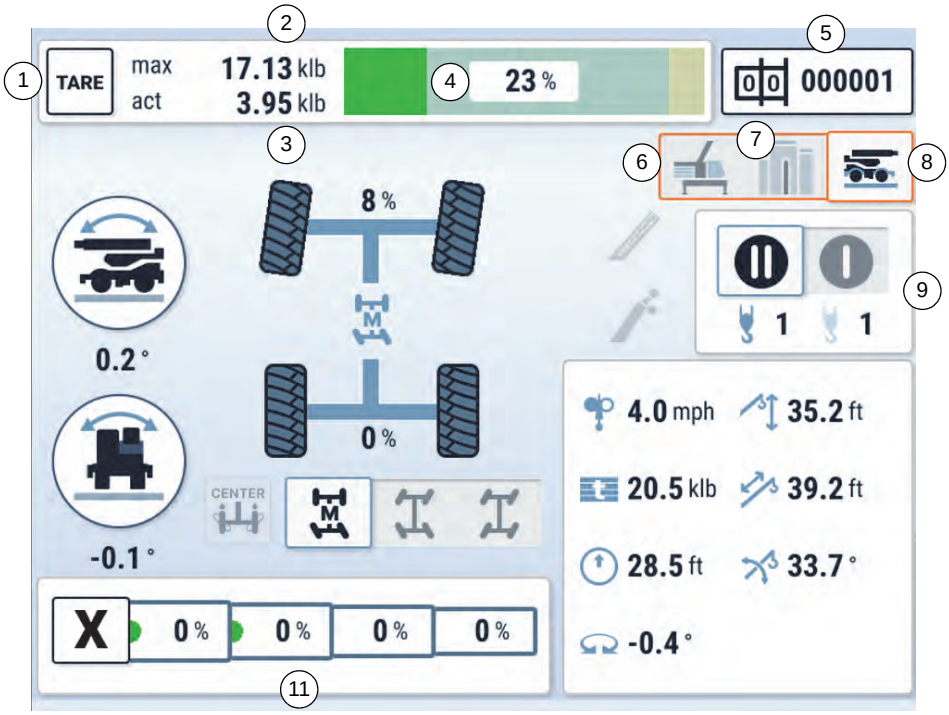
RCL Monitoring View Screen



RCL Panorama View Screen

10746-10 and 10753-11

FIGURE 4-182



Driving View Screen

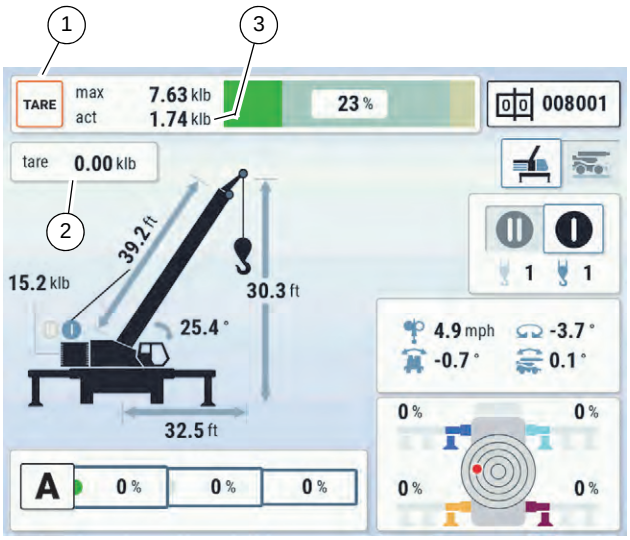
Item	Description	Page	Item	Description	Page
1	Tare Button	4-136	7	RCL Panorama View Screen Button	4-137
2	Maximum Capacity Indicator	4-136	8	Driving View Screen Button	4-138
3	Actual Load Indicator	4-136	9	Hoist Selection Buttons / Reeving Indicators Area	4-138
4	Capacity Bar	4-136	10	Outrigger Beam Status Area	4-139
5	RCL Programming Button/Indicator	4-136	11	Boom Mode Selector/Indicator Area	4-140
6	RCL Monitoring View Screen Button	4-137			

10746-10

FIGURE 4-183

Tare Button

The Tare Button (1, Figure 4-182 thru Figure 4-184), when selected, will show the Tare Weight Indicator (2, Figure 4-184), equal to zero, directly below the Actual Load Indicator (3, Figure 4-184).



10746-11

FIGURE 4-184

To reset the Tare Weight Indicator to zero when performing a new lift, tap the Tare Button once to toggle the Tare Weight Indicator OFF and then tap the button again to reopen the Tare Weight Indicator with a value of zero.

NOTE: The tare function does not change nor override the value of the Actual Load, and it does not affect the RCL and its function lockouts.

Maximum Capacity Indicator

The Maximum Capacity Indicator (2, Figure 4-182 and Figure 4-183) shows the maximum allowable weight (capacity) that can be lifted as determined by the current Load Chart and crane configuration that are programmed into the RCL.

Actual Load Indicator

The Actual Load Indicator (3, Figure 4-182 and Figure 4-183) shows the actual weight, or hook load, that is currently being lifted as calculated by the RCL.

Capacity Bar

The Capacity Bar (4, Figure 4-182 and Figure 4-183) is a visual aid that shows the ratio between the two RCL calculated values: Maximum Capacity and Actual Load.

The ratio of these loads is computed as a percentage and is displayed in the Capacity Bar. The Capacity Bar is filled according to this value. The color of the bar changes from green to yellow at 90% capacity and from yellow to red at 100% capacity. The bar is completely filled at 110% capacity.

RCL Programming Button/Indicator

The RCL Programming Button/Indicator (5, Figure 4-182 and Figure 4-183) shows the load chart rigging code number that is currently programmed into the Rated Capacity Limiter (RCL) system.

The RCL Programming Button/Indicator, when selected, opens the RCL Setup Panel where the RCL system is programmed. The RCL Setup Panel offers the operator two methods (or screens) for programming the RCL system:

- RCL Wizard
- RCL Manual Entry (or Direct Entry)

The **RCL Wizard method** uses a series of screens with selectable buttons that represent the different crane configurations (rigging) that are possible. In this method the operator programs the RCL system by selecting the applicable buttons that define how the crane is currently configured.

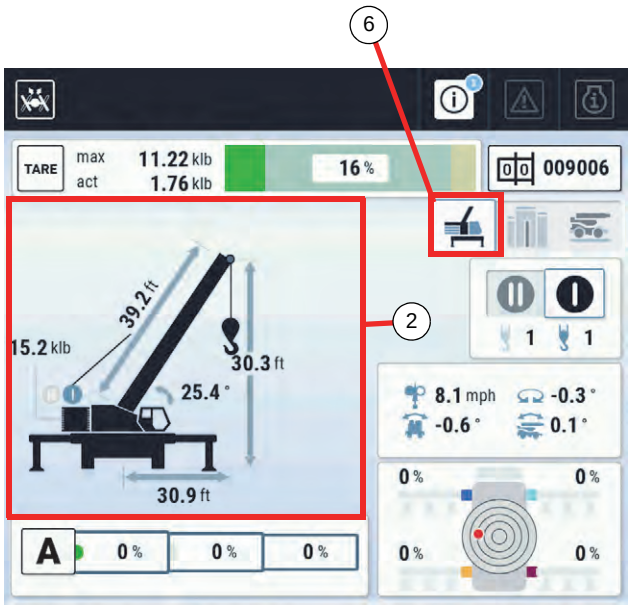
The **RCL Manual Entry method** allows the Load Chart Rigging Code number to be typed directly into the RCL system using an electronic keypad. A load chart rigging code library feature is provided that shows a list of all available Load Chart Rigging Codes which can then be selected.

Refer to *Programming the RCL – Overview*, page 4-103 for detailed information about how to program the RCL using the two methods.

RCL Monitoring View Screen Button

The RCL Monitoring View Screen Button (6, Figure 4-182, Figure 4-183, Figure 4-185), when selected, causes the RCL Monitoring View (2, Figure 4-185) to show in the RCL Area.

Refer to *RCL Monitoring View Screen*, page 4-143 for details about the specific information that shows on the RCL Monitoring View Screen and how it is used in the operation of the crane.



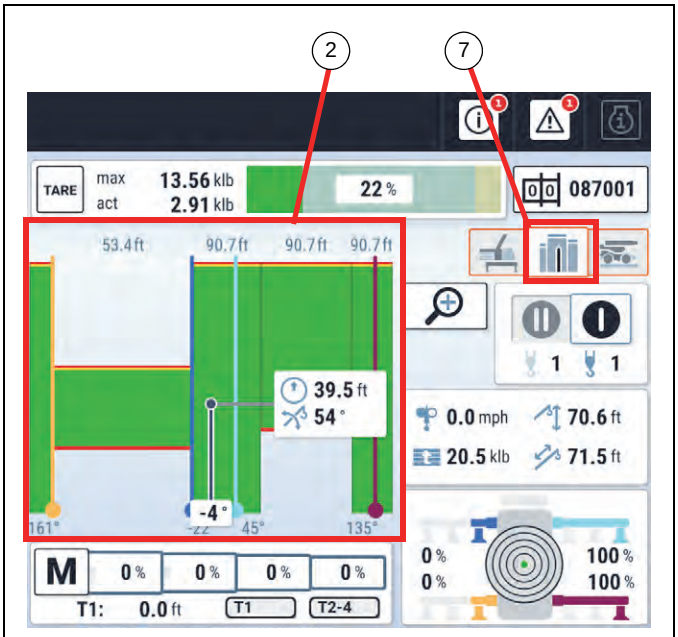
10746-39 and 10746-118

FIGURE 4-185

RCL Panorama View Screen Button

The RCL Panorama View Screen Button (7, Figure 4-182, Figure 4-183, Figure 4-186), when selected, causes the RCL Panorama View Screen (2, Figure 4-186) to show in the RCL Area.

Refer to *RCL Panorama View Screen*, page 4-145 for details about the specific information that shows on the RCL Panorama View Screen and how it is used in the operation of the crane.



10753-10

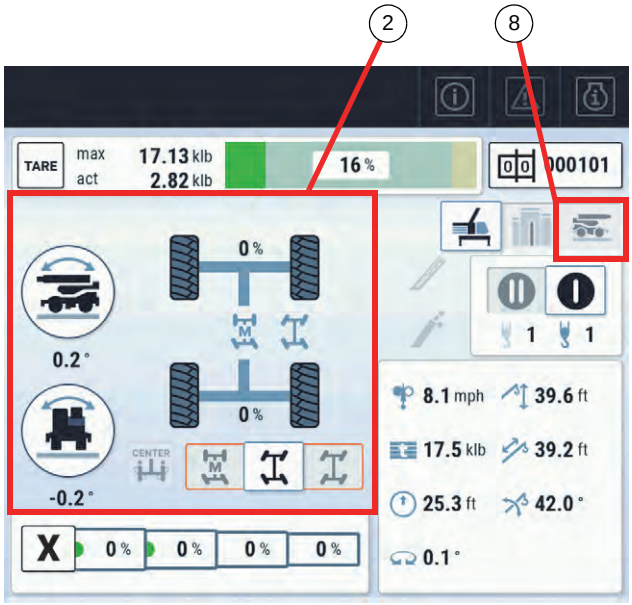
FIGURE 4-186

4

Driving View Screen Button

The Driving View Screen Button (8, Figure 4-182, Figure 4-183, Figure 4-187), when selected, causes the Driving View Screen (2, Figure 4-187) to show in the RCL Area.

Refer to *Driving View Screen*, page 4-152 for details about the specific information that shows on the Driving View Screen and how it is used in the operation of the crane.

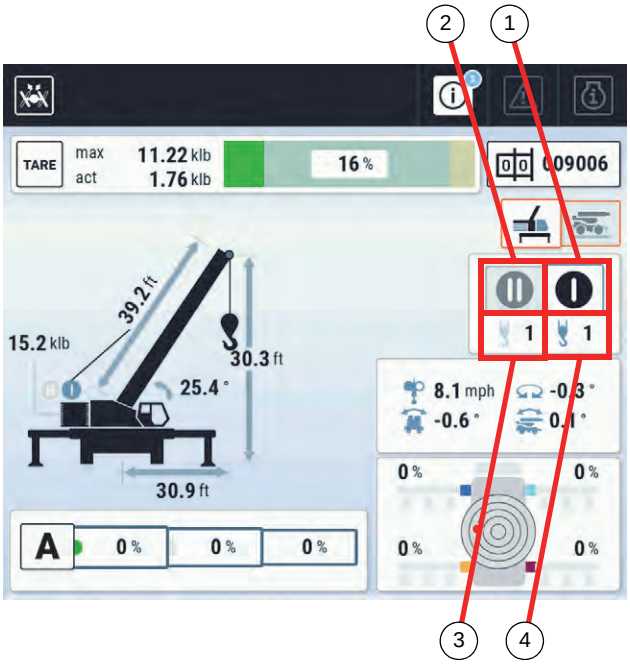


10746-118 **FIGURE 4-187**

Hoist Selection Buttons / Reeving Indicators Area

The Hoist Selection Buttons / Reeving Indicators Area (9, Figure 4-182 and Figure 4-183) includes buttons for selecting the main hoist and optional auxiliary hoist.

Below the Main and optional Auxiliary Hoist Selection Buttons are the Main and Auxiliary Reeving (parts of line) Indicators. Refer to Figure 4-188 for more details about these buttons and indicators.



Item	Description
1	Main Hoist (I) Selection Button
2	Auxiliary Hoist (II) Selection Button
3	Auxiliary Hoist Reeving Indicator
4	Main Hoist Reeving Indicator

10746-39 **FIGURE 4-188**

The Auxiliary Hoist Selection Button and related Auxiliary Hoist Reeving Indicator only show in the RCL Area if the crane is equipped with the optional auxiliary hoist.

When crane is equipped with the optional auxiliary hoist, the operator must tap the related Main or Auxiliary Hoist Selection Button to select that hoist for operation. The button for the selected hoist will be ON to show that it is selected.

NOTE: Cranes equipped with the auxiliary hoist only allow one hoist to be selected and operable at a time.

The Main and Auxiliary Reeving Indicators only show the reevings that have been set for each hoist. To change one or both values, operator must reprogram the RCL.

Outrigger Beam Status Area

The Outrigger Beam Status Area (10, Figure 4-182 and Figure 4-183) shows the current configuration of the outriggers as sensed by the Outrigger Monitoring System (OMS) and as specified by the load chart rigging code the operator programmed into the RCL. The Outrigger Beam Status Area also includes a digital bubble level to show how level the crane is.

NOTE: The Outrigger Beam Status Area only shows on the RCL Monitoring View Screen and the RCL Panorama View Screen. The Outrigger Beam Status Area does not show on the Driving View Screen as the outriggers should be stowed when driving the crane.

If a crane is not level within 1% of grade, allowable capacities must be reduced. Therefore, when lifting on rubber or outriggers, it is essential the crane is level to within 1% of grade.

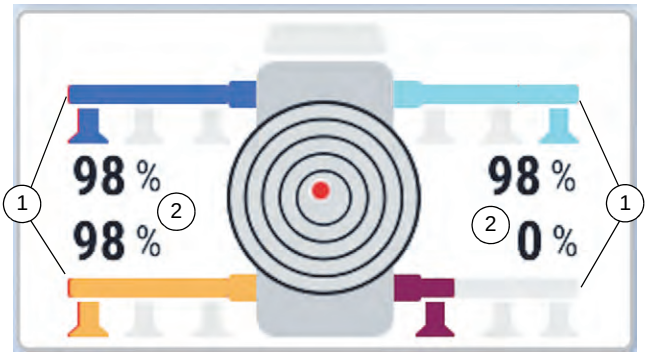
The digital bubble level has five rings. Each ring represents 1% of grade, with the inner ring representing 1% of grade and the outer ring (ring 5) representing 5% of grade. When the bubble is inside the inner most ring, the crane is level within 1% of grade.

After setting the crane up on outriggers for the first time and before making the first lift, the crane must be leveled to within 1% of grade. Also, a crane can settle during lifting operations, making it necessary to periodically check and ensure the crane remains level.

Refer to the following sections for information explaining how to set up the crane on outriggers as well as how to properly configure the crane when checking its levelness:

- *Proper Crane Leveling*, page 5-27
- *Using the Outriggers*, page 5-28
- *Outrigger Extend/Retract*, page 4-40

The Outrigger Beam Status Area (Figure 4-189) is a pictorial that represents the horizontal outrigger beam positions.



10753-7 **FIGURE 4-189**

The pictorial shows a top-down view of the crane with the four outrigger beams. Each outrigger beam/jack symbol (1, Figure 4-189) shown is color coded to match and relate to the actual color of the top cap at each outrigger jack. The three pre-defined horizontal outrigger beam positions are shown, to include the following: fully retracted, mid-extended, and fully extended. Each color coded beam/jack symbol will be shown in the position to which it was defined during the programming of the RCL. A percentage extended value (2) is also shown for each outrigger beam, which is determined by the Outrigger Monitoring System (OMS).

Unless the crane is equipped with the MAXbase option and a MAXbase load chart is selected in the RCL, all four outriggers must be equally deployed to one of the three pre-defined positions.

The outrigger beam positions that were programmed or selected during the RCL setup (1, Figure 4-189) should match the outrigger beam positions detected by the OMS (2). When they do, the following will show in the Outrigger Beam Status Area pictorial:

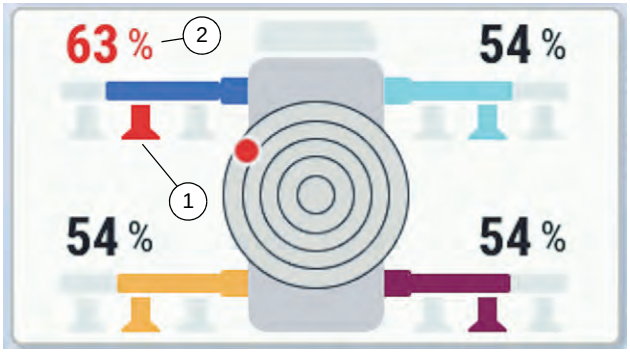
- The outrigger beam/jack symbols for each outrigger will be correctly color coded and extended to their programmed positions: fully retracted, mid-extended, or fully extended.
- The outrigger beam percentage extended values, determined by the OMS, will show in BLACK text and be within 3% of the following values:
  - Fully Retracted = 0%
  - Mid-extended = 50%(GRT765), 54% (GRT780)
  - Fully Extended = 100%

NOTE: The OMS requires the detected length of the outrigger beam position to be within ±3% of the

RCL programmed outrigger position to be recognized as a valid setup.

If one or more of the RCL programmed outrigger beam positions **do not match** the outrigger beam positions detected by the OMS, the following will show in the Outrigger Beam Status Area pictorial:

- The outrigger jack symbol(s) for the affected outrigger(s) will be RED in color and extended to their programmed positions: fully retracted, mid-extended, or fully extended (1, Figure 4-190).
- The outrigger beam percentage extended value(s), determined by the OMS, will show in RED text and differ from the following values by more than 3% (2, Figure 4-190):
  - Fully Retracted = 0%
  - Mid-extended = 50% (GRT765), 54% (GRT780)
  - Fully Extended = 100%



10746-61 **FIGURE 4-190**

DANGER

Crane Tipping Hazard!

When the Outrigger Monitoring System (OMS) is overridden, the RCL will not provide protection from overload. Death or serious injury will result if the crane tips over.

The operator is responsible for ensuring that the crane is not overloaded or operated in excess of the allowable published capacities for the actual outrigger configuration.

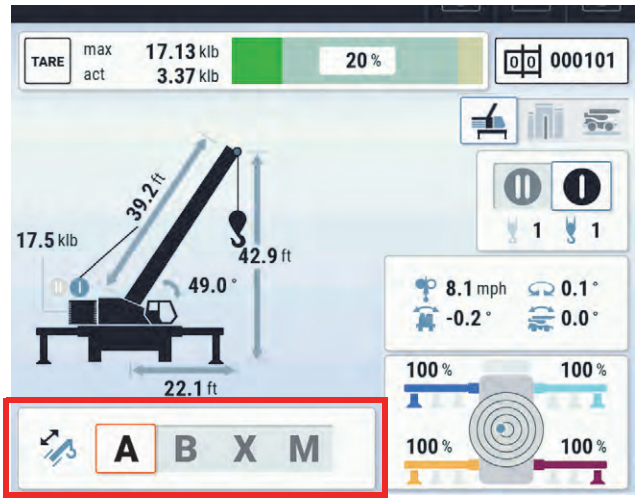
A qualified person shall be consulted to determine if any capacity reductions, special operating procedures, or limitation are required.

Boom Mode Selector/Indicator Area

The Boom Mode Selector/Indicator Area (11, Figure 4-182 and Figure 4-183) allows the operator to select the desired boom mode (A, B, X, and M) for extending and retracting the boom.

The selected Load Chart Rigging Code programmed into the RCL can restrict the boom modes available in the Boom Mode Indicator Area.

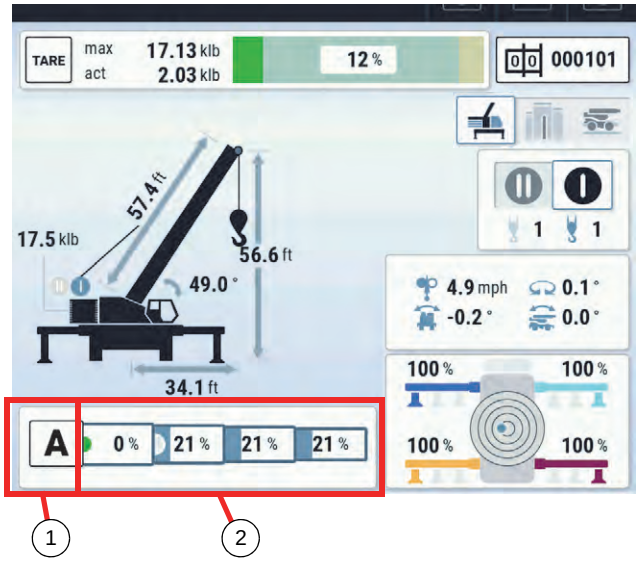
In Figure 4-191, all four boom modes are available and selectable.



10746-62 **FIGURE 4-191**

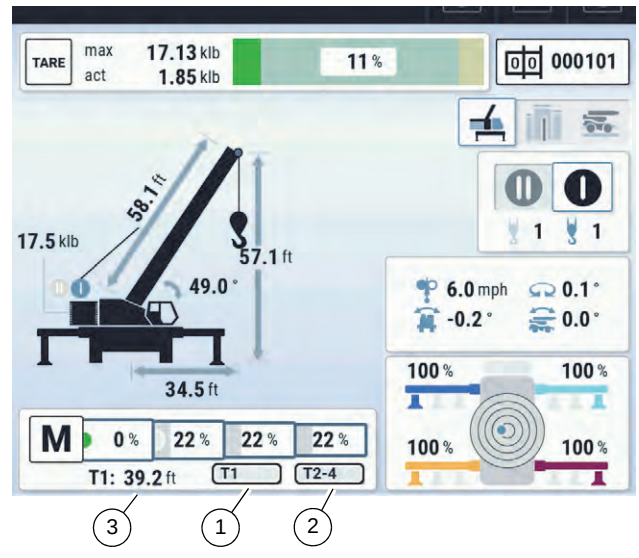
NOTE: For a description of the A, B, X, and M telescope modes, refer to *Telescoping the Boom*, page 5-34.

Once a boom mode is selected, the Boom Mode Selector/Indicator Area will show the selected boom mode at the left side of the area (1, Figure 4-192) and will also dynamically show the percent extended values (2) of each tele section as the boom is extended and retracted.



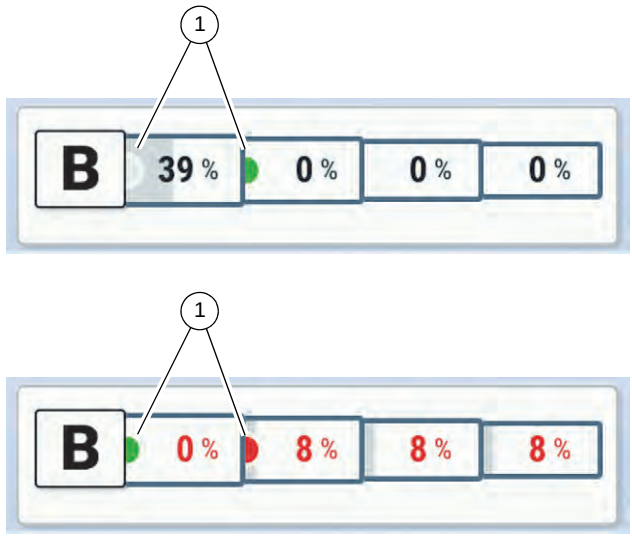
10746-63 **FIGURE 4-192**

When the M (manual) boom mode is selected, the Boom Mode Selector/Indicator Area will show a T1 Button (1, Figure 4-193), a T2-4 Button (2) (T2-3 Button for GRT765), and a Length Indicator for the T1 section (3). The operator can control the desired tele section(s) by first selecting the related button, then actuating the left controller (standard) or the telescope foot pedal (cranes with optional auxiliary hoist).



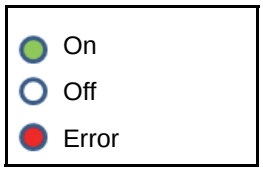
10746-63 **FIGURE 4-193**

Two proximity switches, internal to the boom, are used in the control of the telescope system. The status of these proximity switches (1, Figure 4-194) are shown on the Boom Mode Indicator Area.



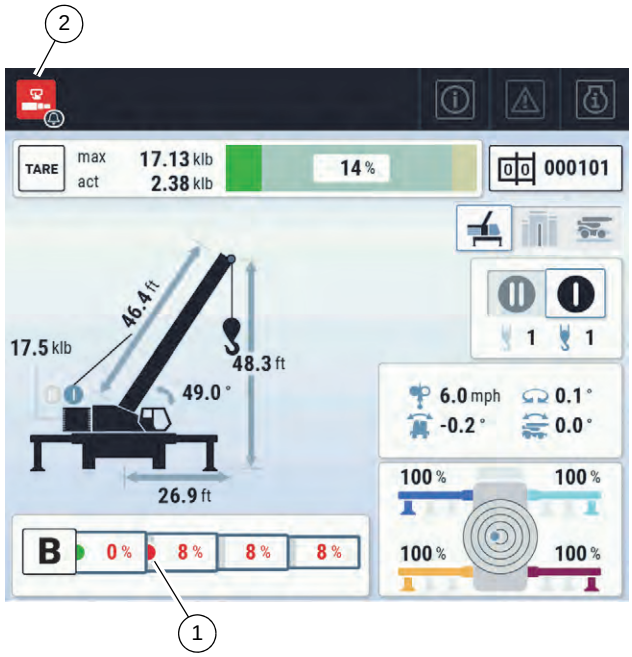
10746-65 and 10746-66 **FIGURE 4-194**

Each proximity switch can have the following status:



4

If an “out-of-sequence” error occurs due to a proximity switch, the related proximity switch status will be red in color (1, Figure 4-195) and the Invalid Tele Section Sequence Position Alert (2) will show in the Alerts Bar at the top of the SDM.



10746-67 **FIGURE 4-195**

MANUALLY RECOVER OUT-OF-SEQUENCE BOOM

To manually recover a boom that has become out-of-sequence, do the following:

1. Select M mode in the Boom Mode Indicator Area.
2. Review the Boom Mode Indicator Area to determine which component(s) of the telescope system is out-of-sequence.
3. Select the button (either T1 or T2-4) of the related telescope section that you wish to manually control.
4. Use the left controller (standard) or the telescope foot pedal (cranes with optional auxiliary hoist) to fully retract the telescope section(s) that is out-of-sequence.

   When telescope system is reset to “in-sequence”, the related percentage values and proximity switch status will show in their normal colors and the Tele Section Sequence Position Alert in the Alerts Bar will go off.

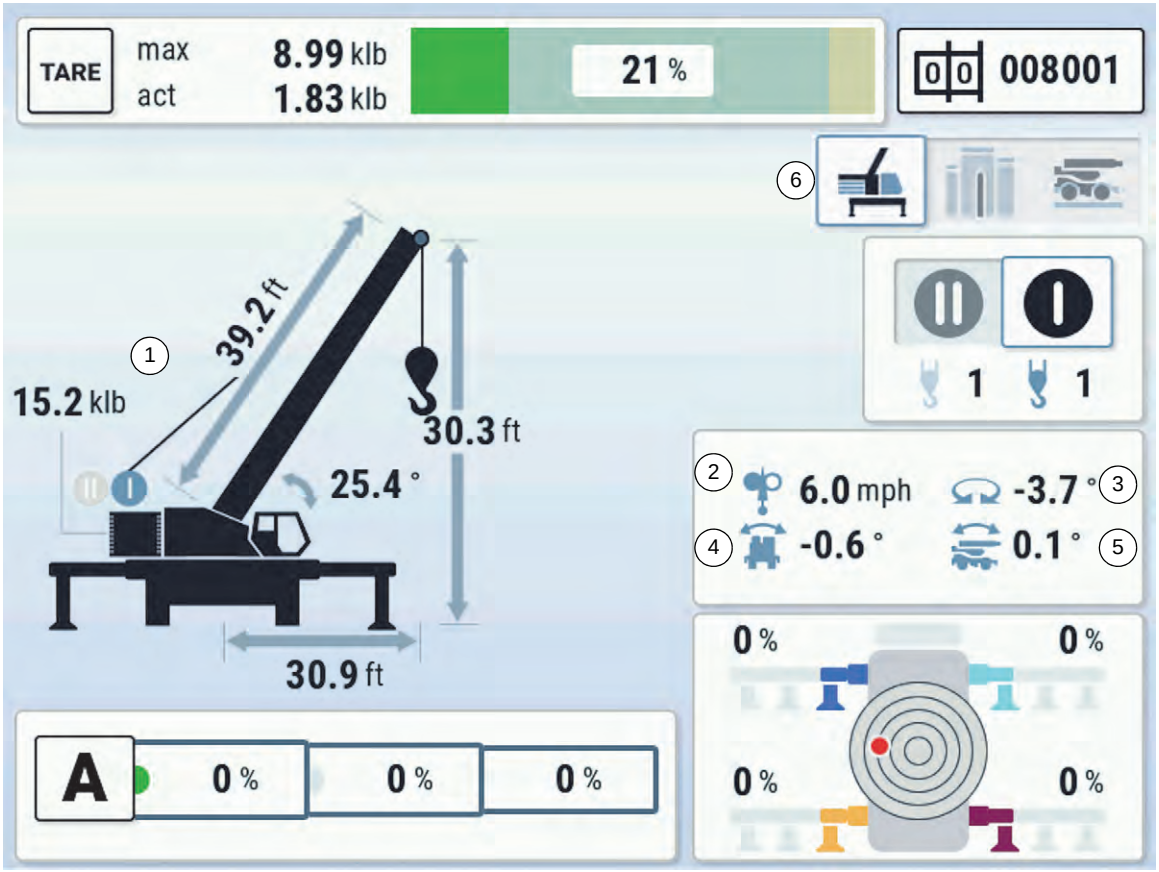
RCL MONITORING VIEW SCREEN

The Rated Capacity Limiter (RCL) Monitoring View Screen (Figure 4-196) is one of the many screens that can show in the RCL Area of the Superstructure Display Module (SDM). Refer to *SDM Rated Capacity Limiter (RCL) Area*, page 4-22 for a list of all screens that can show in this area.

The RCL Monitoring View Screen shows a crane side view pictorial that is representative of the crane configuration defined during the RCL programming as well as dynamic information calculated by the Crane Control System (CCS) during craning operation.

The RCL Monitoring View Screen will show after the RCL has been programmed. The screen can also be brought up by selecting the RCL Monitoring View Button (6, Figure 4-196).

Refer to Figure 4-196 and the sub-sections that follow for descriptions of the information that show on the RCL Monitoring View Screen.



Item	Description	Page
1	Crane Side View	4-144
2	Wind Speed Indicator	4-144
3	Swing Angle Indicator	4-144
4	Crane Tilt – Side-to-Side Indicator	4-144
5	Crane Tilt – Fore-to-Aft Indicator	4-144
6	RCL Monitoring View Screen Button	4-144

10746-10

FIGURE 4-196

Crane Side View

The Crane Side View pictorial (1, Figure 4-196) on the RCL Monitoring View Screen shows information about the crane configuration that was programmed into the RCL as well as information calculated by the Crane Control System (CCS).

Information shown that the operator selected during RCL programming includes the following:

- Counterweight Installed
- Hoist Selected for Operation
- Auxiliary Boom Nose Installed (Optional)
- Boom Extension Installed (Optional) and Offset Angle

Dynamic information shown that is calculated in real time by the CCS during crane operation includes the following:

- Boom Length
- Boom Angle
- Boom Nose Height
- Boom Nose Radius

Wind Speed Indicator

The Wind Speed Indicator (2, Figure 4-196) receives wind speed information from the optional anemometer that is attached to the boom nose.

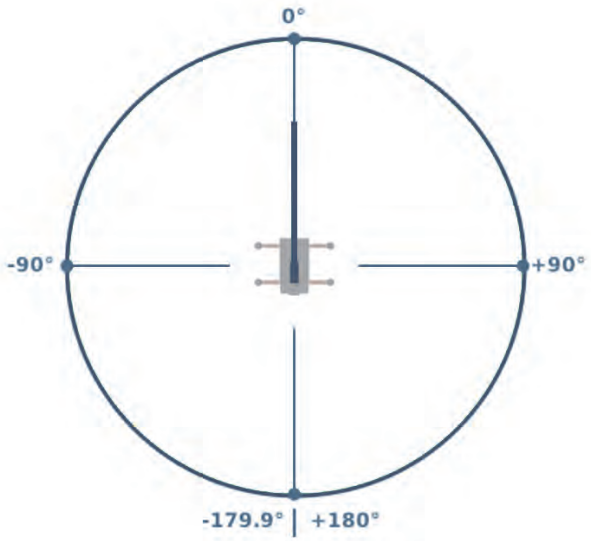
The Wind Speed Indicator shows in real-time the wind speed at the boom nose. The Wind Speed Indicator is black in color when the wind speeds are below 24 km/h (15 mph). The indicator color is yellow when the wind speed is between 24 km/h (15 mph) and 48 km/h (30 mph). The buzzer comes on and the indicator color is red when the wind speed is 48 km/h (30 mph) or greater.

Refer to the sub-section *Wind Forces*, page 2-7 in *Section 2 - Safety Information* for instructions about determining safe operation in windy conditions.

Swing Angle Indicator

The Swing Angle Indicator (3, Figure 4-196) shows the swing angle (in degrees) of the boom/superstructure relative to the carrier.

Figure 4-197 shows an illustration of how the swing angle is measured around a 360° full rotation of the boom/superstructure.



10083

FIGURE 4-197

In the center of the illustration is a top-down view of the crane with extended boom. A circle around the crane image illustrates the full 360° swing range. 0° means that the superstructure is positioned over the front of the crane carrier.

A full turn from this working position is divided into two semi-circles. Angles in the left semi-circle are shown as negative values (0° to -179.9°). Angles in the right semicircle are shown as positive (0° to 180°).

Crane Tilt – Side-to-Side Indicator

The Crane Tilt – Side-to-Side Indicator (4, Figure 4-196) shows the inclination of the crane, from left to right, in degrees.

Crane Tilt – Fore-to-Aft Indicator

The Crane Tilt – Fore-to-Aft Indicator (5, Figure 4-196) shows the inclination of the crane, from front to back, in degrees.

RCL Monitoring View Screen Button

The RCL Monitoring View Screen Button (6, Figure 4-196), when selected, causes the RCL Monitoring View Screen to show in the RCL Area.

RCL PANORAMA VIEW SCREEN

The Rated Capacity Limiter (RCL) Panorama View Screen (Figure 4-198 and Figure 4-199) is one of the many screens that can show in the RCL Area of the Superstructure Display Module (SDM). Refer to *SDM Rated Capacity Limiter (RCL) Area*, page 4-22 for a list of all screens that can show in this area.

The RCL Panorama View Screen aids the operator, especially on cranes equipped with the MAXbase option, by monitoring the crane's load status (% of capacity) throughout the crane's 360° swing range. Because the MAXbase feature uses several load charts throughout the crane's 360° rotation, the load on the boom may be within the crane's capacity at some swing angles but not at other swing angles.

The RCL Panorama View Screen will show after the RCL has been programmed. The screen can also be brought up by selecting the RCL Panorama View Button (20, Figure 4-198).

Refer to Figure 4-198, Figure 4-199, and the sub-sections that follow for descriptions of the information that show on the RCL Panorama View Screen.

MAXbase equipped cranes use different load charts throughout the crane's 360° rotation. Therefore, it is important for the operator to use the correct load chart from the *Load Chart Manual* for a given swing range. Refer to *MAXbase (Optional)*, page 4-157 in this manual and the *Load Chart Manual* in the crane cab for more information about the MAXbase load charts.

Multiple load charts are used by MAXbase to allow operation of the crane on non-symmetrically extended outriggers. In general, there are four swing ranges defined by the position of the outrigger jacks. The load chart changes when the boom swings over each outrigger. In some cases the lifting capacities may not change because the limitations of the capacity are not related to the outrigger position. In other cases the change in the lifted capacity may be large, or swinging into the next range may not be permitted. In this case the Crane Control System (CCS) will override the operators swing command and may apply braking to stop the boom and load from swinging into another swing range (for more information on how and when CCS affects the swing motion, refer to *Limiting the Swing Speed Based on Utilization*, page 4-163 and *Stopping the Swing Motion*, page 4-161).

The Panorama View Screen on cranes with or without the MAXbase option has two screen variations: a 120° Panorama View (Figure 4-199) and a 360° Panorama View (Figure 4-198).

The two Panorama Views show the location of the boom (black line) and boom nose (black dot) (4, Figure 4-198 and Figure 4-199) and gives a top view of the working range of the crane based on the current status of the crane.

The Panorama Views in Figure 4-198 and Figure 4-199 show a color plot of load radius (1, on the vertical axis) and the swing angle (2, on the horizontal axis).

Cranes use color-coded outrigger beam/jack icons (7 thru 10, Figure 4-198 and Figure 4-199) to represent each of the outriggers in the Outrigger Beam Status Area (19). The color of the outrigger beam/jack icons on the Outrigger Beam Status Area matches the color painted on the top of the related outrigger jack. The same color is displayed in the Panorama Views as a vertical line. The vertical lines correspond to the swing angle at which the boom crosses over each of the color-coded outrigger jacks. This visual system gives the operator the ability to relate the information on the Panorama Views to the crane's actual boom swing angle.

The Panorama Views also show gray vertical lines to the left and right of each of the color-coded vertical lines. These gray lines show where the different load charts begin and end when a MAXbase rigging code is programmed into the RCL.

The RCL system uses the boom length, the telescoping sequence, and the measured hook load to determine the minimum and maximum working radius allowed for the current hook load.

The radius where the hook load is between 90% to 99% utilization is indicated by a yellow line (12, Figure 4-198 and Figure 4-199). The radius at which the hook load is at 100% to 110% utilization is indicated by a red line (13).

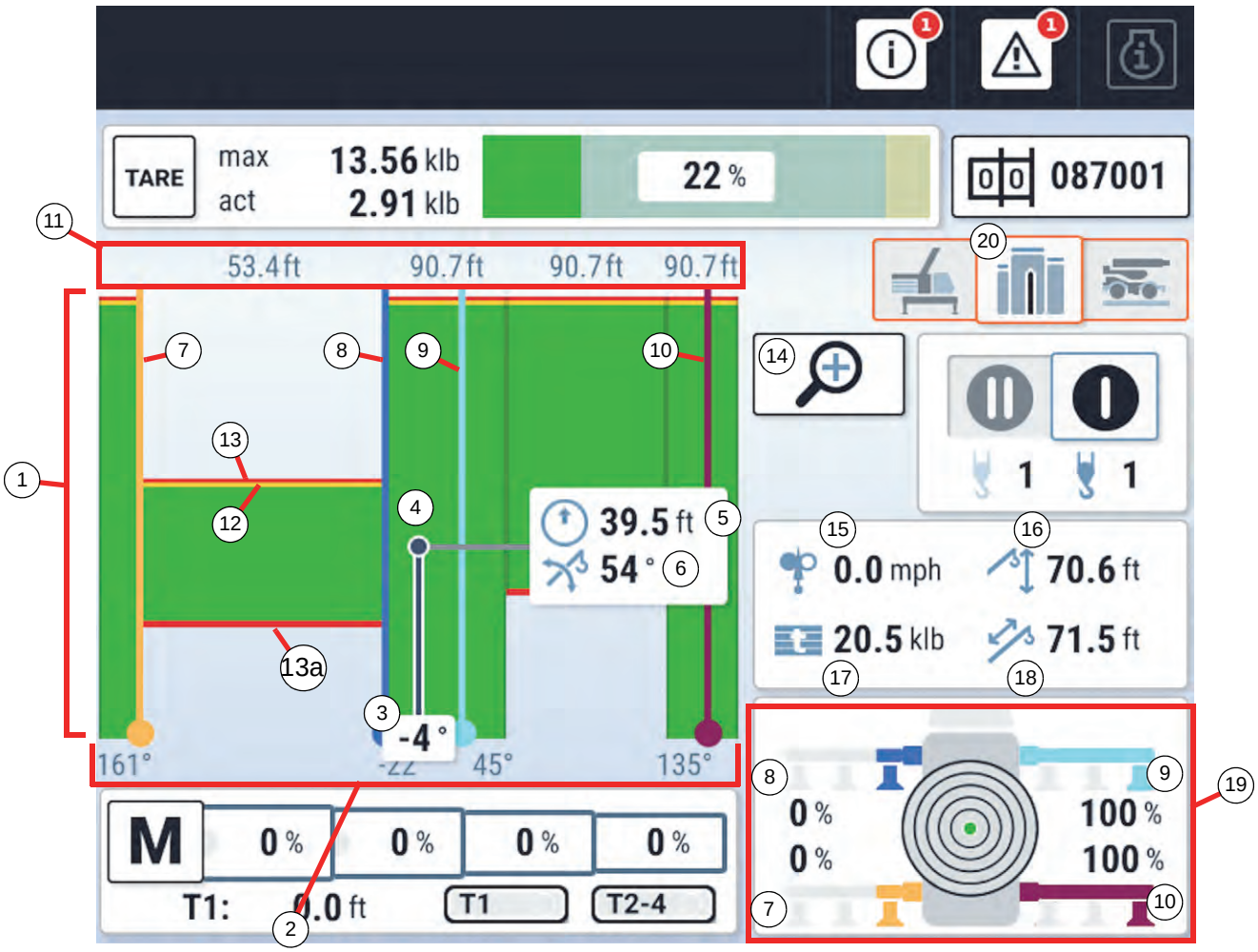
NOTE: Some outrigger steps result in limitations of the working radius based on backward stability. In this scenario the Panorama Views will show a red line at the minimum working radius (13a, Figure 4-198 and Figure 4-199).

The CCS system will slow and then stop motions that would cause the crane to decrease the load radius below the minimum working radius. These motions include booming up or telescoping in.

CCS will also slow and stop swing motion that would result in the boom and load crossing into a swing angle range that is not permitted because of backward stability. For information on how and when the CCS affects the swing motion, refer to the following sub-sections:

- *Limiting the Swing Speed Based on Utilization*, page 4-163
- *Stopping the Swing Motion*, page 4-161).

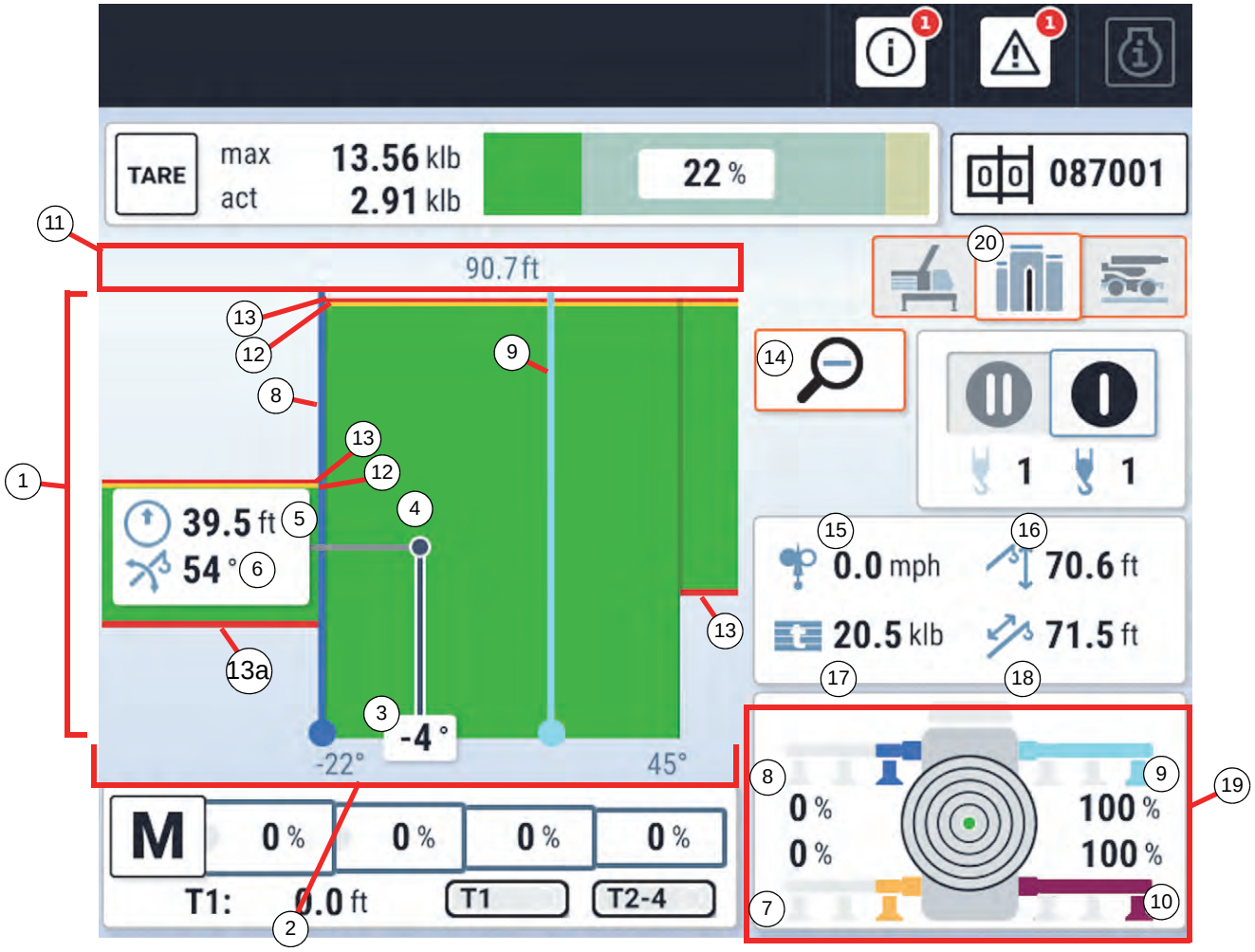
When the CCS is stopping motions such as swinging left or right, booming up or down, and telescoping in or out, the RCL will show a related alert in the Alerts Bar (1, Figure 4-1) to warn the operator (refer to APPENDIX C – ALERT ICONS for a list of all alerts and their definitions that can show).



Item	Description	Page	Item	Description	Page
1	Boom Nose Radius Axis	4-149	11	Boom Nose Radius at 110% Capacity Indicator Bar	4-150
2	Boom Swing Angle Axis (**360°** Field of View shown)	4-149	12	Capacity Warning Indicator (Yellow Line –90% to 99%)	4-150
3	Current Boom Swing Angle Indicator	4-149	13	Capacity Overload Indicator (Red Line – 100% to 110%)	4-150
4	Boom and Boom Nose Indicator	4-149	14	120°/360° Swing Angle View Button	4-150
5	Current Boom Nose Radius Indicator	4-149	15	Wind Speed Indicator (Optional)	4-150
6	Current Boom Angle Indicator	4-149	16	Boom Nose Height Indicator	4-151
7	Outrigger Indicator - Left-Rear	4-149	17	Counterweight Installed Indicator	4-151
8	Outrigger Indicator - Left-Front	4-149	18	Boom Length Indicator	4-151
9	Outrigger Indicator - Right-Front	4-149	19	Outrigger Beam Status Area	4-151
10	Outrigger Indicator - Right-Rear	4-149	20	Panorama View Screen Button	4-151

10753-12

FIGURE 4-198



Item	Description	Page	Item	Description	Page
1	Boom Nose Radius Axis	4-149	11	Boom Nose Radius at 110% Capacity Indicator Bar	4-150
2	Boom Swing Angle Axis (**120°** Field of View shown)	4-149	12	Capacity Warning Indicator (Yellow Line –90% to 99%)	4-150
3	Current Boom Swing Angle Indicator	4-149	13	Capacity Overload Indicator (Red Line – 100% to 110%)	4-150
4	Boom and Boom Nose Indicator	4-149	14	120°/360° Swing Angle View Button	4-150
5	Current Boom Nose Radius Indicator	4-149	15	Wind Speed Indicator (Optional)	4-150
6	Current Boom Angle Indicator	4-149	16	Boom Nose Height Indicator	4-151
7	Outrigger Indicator - Left-Rear	4-149	17	Counterweight Installed Indicator	4-151
8	Outrigger Indicator - Left-Front	4-149	18	Boom Length Indicator	4-151
9	Outrigger Indicator - Right-Front	4-149	19	Outrigger Beam Status Area	4-151
10	Outrigger Indicator - Right-Rear	4-149	20	Panorama View Screen Button	4-151

10753-17

FIGURE 4-199

Boom Nose Radius Axis

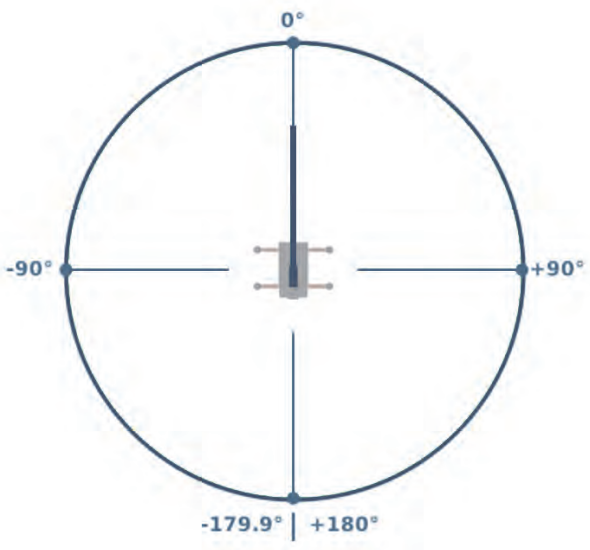
The Boom Nose Radius Axis (1, Figure 4-198 and Figure 4-199) is used to show the current boom nose position relative to the boom nose radiuses at which the crane is near or at capacity for the given RCL crane configuration.

Boom Swing Angle Axis

The Boom Swing Angle Axis (2, Figure 4-198 and Figure 4-199) is used to show the position of the current boom swing angle, throughout its 360° of rotation, relative to the positions of the four outrigger jacks that are deployed (useful when lifting using a MAXbase load chart).

The Boom Nose Indicator (4, Figure 4-198 and Figure 4-199) is stationary and remains centered on the boom swing angle axis. The values shown at the bottom of the boom swing angle axis, which represent the values for a 360° boom rotation, will change as the boom is swung left and right. These values represent the boom swing angle relative to the front of the carrier.

Refer to Figure 4-200 for how the swing angle is measured around a 360° full rotation of the boom/superstructure relative to the carrier.



10083

FIGURE 4-200

In the center of the illustration is a top-down view of the crane with extended boom. A circle around the crane image illustrates the full 360° swing range. 0° means that the superstructure is positioned over the front of the crane carrier.

A full turn from this working position is divided into two semi-circles. Angles in the left semi-circle are shown as negative values (0° to -179.9°). Angles in the right semicircle are shown as positive (0° to 180°).

Current Boom Swing Angle Indicator

The Current Boom Swing Angle Indicator (3, Figure 4-198 and Figure 4-199) shows the swing angle at which the boom is currently positioned throughout its 360° rotation.

Boom and Boom Nose Indicator

The Boom and Boom Nose Indicator (4, Figure 4-198 and Figure 4-199) on the Panorama Views is shown as a black line with a black dot at the top. The black line represents the boom and the black dot represents the boom nose.

The Boom and Boom Nose Indicator is dynamic and will increase and decrease in height along the Boom Nose Radius Axis (1, Figure 4-198 and Figure 4-199) as the operator changes the crane's boom nose/load radius. The Boom and Boom Nose Indicator is stationary, or always centered, along the Boom Swing Angle Axis (2, Figure 4-198 and Figure 4-199).

Current Boom Nose Radius Indicator

The Current Boom Nose Radius Indicator (5, Figure 4-198 and Figure 4-199) shows the radius for the current boom nose position.

Current Boom Angle Indicator

The Current Boom Angle Indicator (6, Figure 4-198 and Figure 4-199) shows the angle for the current boom position.

Outrigger Indicators

The Outrigger Indicators (7, 8, 9, 10, Figure 4-198 and Figure 4-199) show on the Panorama Views as vertical lines, each one in a unique color that matches the color of the related Outrigger Indicator shown in the Outrigger Beam Status Area (19, Figure 4-198 and Figure 4-199). Each color also corresponds to the color painted on the top of the related outrigger jack. The vertical lines correspond to the swing angles at which the boom crosses over the related outrigger jack. This visual system gives the operator the ability to relate the information on the Panorama Views to the crane's actual boom swing angle.

The Outrigger Indicators are positioned on the Boom Swing Angle Axis (2, Figure 4-198 and Figure 4-199) relative to their rotational angle from directly over the front of the carrier (0°). Refer to *Boom Swing Angle Axis*, page 4-149 for information on how the RCL calculates boom and outrigger position angles around the crane.

The Outrigger Indicators shown in Figure 4-198 and Figure 4-199 are defined as follows:

- Left-Rear Outrigger (7)

- Left-Front Outrigger (8)
- Right-Front Outrigger (9)
- Right-Rear Outrigger (10)

Boom Nose Radius at 110% Capacity Indicator Bar

The Boom Nose Radius at 110% Capacity Indicator Bar (11, Figure 4-198 and Figure 4-199) shows the boom nose radius values at which the crane would be at 110% capacity for a given boom swing angle. These 110% capacity boom nose radius values relate to swing angles shown along the Boom Swing Angle Axis (2, Figure 4-198 and Figure 4-199) and are calculated by the RCL using the current RCL programming and crane configuration.

Capacity Warning Indicator (Yellow Line – 90% to 99%)

The Capacity Warning Indicator (12, Figure 4-198 and Figure 4-199) shows as a yellow horizontal line on the Panorama View. The yellow capacity warning indicator lines are a visual aid that helps show the boom swing angles and boom nose radiuses at which the crane is at 90% to 99% of its capacity.

The positions of the yellow capacity warning lines relative to the Boom and Boom Nose Indicator (4, Figure 4-198) are calculated by the current RCL programming and crane configuration.

The green portion of the Panorama View Screen as well as the yellow and red capacity indicator lines coincide with the Capacity Bar (4, Figure 4-182 and Figure 4-183) shown at the top of the screen (refer to *Capacity Bar*, page 4-136 for information about the Capacity Bar's use in the operation of the crane).

As the Capacity Bar (4, Figure 4-182 and Figure 4-183) is filled in with the three colors (green, yellow, and red) while making a lift, the position of the black dot that represents the boom nose (4, Figure 4-198 and Figure 4-199) on the Panorama View will change relative to the position of the yellow capacity warning indicator line for the current boom swing angle.

If the crane reaches 90% to 99% utilization during a lift, the RCL will show the boom nose (black dot) on the Panorama View within the yellow capacity warning indicator line. At the same time the Capacity Bar (4, Figure 4-182 and Figure 4-183) will be filled in with yellow and show the calculated percentage of utilization (between 90% to 99%).

Capacity Overload Indicator (Red Line – 100% to 110%)

The Capacity Overload Indicator (13, Figure 4-198 and Figure 4-199) shows as a red horizontal line on the Panorama View. The red capacity overload indicator lines are a visual aid that helps show the boom swing angles and boom nose radiuses at which the crane is at 100% to 110% of its capacity.

The positions of the red capacity overload lines relative to the Boom and Boom Nose Indicator (4, Figure 4-198 and Figure 4-199) are calculated by the current RCL programming and crane configuration.

The green portion of the Panorama View Screen as well as the yellow and red capacity indicator lines coincide with the Capacity Bar (4, Figure 4-182 and Figure 4-183) shown at the top of the screen (refer to *Capacity Bar*, page 4-136 for information about the Capacity Bar's use in the operation of the crane).

As the Capacity Bar (4, Figure 4-182 and Figure 4-183) is filled in with the three colors (green, yellow, and red) while making a lift, the position of the black dot that represents the boom nose (4, Figure 4-198 and Figure 4-199) on the Panorama View will change relative to the position of the red capacity overload indicator line for the current boom swing angle.

If the crane reaches 100% to 110% utilization during a lift, the RCL will show the boom nose (black dot) on the Panorama View within the red capacity overload indicator line. At the same time the Capacity Bar (4, Figure 4-182 and Figure 4-183) will be filled in with red and show the calculated percentage of utilization (100% and above).

120°/360° Swing Angle View Toggle Button

The 120°/360° Swing Angle View Toggle Button (14, Figure 4-198 and Figure 4-199) is used to toggle between the two available Panorama Views: 120° Swing Angle View and the 360° Swing Angle View.

The 360° Swing Angle View shows Panorama View information for the boom's full 360° of rotation about the carrier. The 120° Swing Angle View gives a magnified view by showing only 120° of information on the Panorama View.

Select the 120°/360° Swing Angle View Toggle Button to change between the two different views.

NOTE: Some cranes show a 90° swing angle view instead of the 120° swing angle view.

Wind Speed Indicator (Optional)

The Wind Speed Indicator (15, Figure 4-198 and Figure 4-199) receives wind speed information from the optional anemometer that is attached to the boom nose.

The Wind Speed Indicator shows in real-time the wind speed at the boom nose. The Wind Speed Indicator is black in color when the wind speeds are below 24 km/h (15 mph). The indicator color is yellow when the wind speed is between 24 km/h (15 mph) and 48 km/h (30 mph). The buzzer comes

on and the indicator color is red when the wind speed is 48 km/h (30 mph) or greater.

Refer to the sub-section *Wind Forces*, page 2-7 in *Section 2 - Safety Information* for instructions about determining safe operation in windy conditions.

Boom Nose Height Indicator

The Boom Nose Height Indicator (16, Figure 4-198 and Figure 4-199) shows the height of the boom nose above the ground in the unit of measure selected in the SDM.

The Boom Nose Height Indicator value is dynamic and will change in real-time as the boom nose height changes positions.

Counterweight Installed Indicator

The Counterweight Installed Indicator (17, Figure 4-198 and Figure 4-199) shows the counterweight value that was selected during the programming of the RCL.

Operator should always make sure that the value shown in the Counterweight Installed Indicator matches the actual counterweight that is installed on the crane.

Boom Length Indicator

The Boom Nose Height Indicator (18, Figure 4-198 and Figure 4-199) shows the overall length of the boom in the unit of measure selected in the SDM.

The Boom Length Indicator value is dynamic and will change in real-time as the boom is extended and retracted

Outrigger Beam Status Area

The Outrigger Beam Status Area (19, Figure 4-198 and Figure 4-199) shows the current configuration of the outriggers as sensed by the Outrigger Monitoring System (OMS) and as specified by the load chart rigging code the operator programmed into the RCL. The Outrigger Beam Status Area also includes a digital bubble level to show how level the crane is.

The color of each of the four outrigger icons shown in the Outrigger Beam Status Area relates to the four color-coded vertical lines on the Panorama View as well as to the color painted on the top cap of the four outrigger jacks. This visual system gives the operator the ability to relate the information on the Panorama Views to the crane's actual boom swing angle.

Panorama View Screen Button

The Panorama View Screen Button (20, Figure 4-198 and Figure 4-199), when selected, causes the Panorama View Screen to show in the RCL Area.

DRIVING VIEW SCREEN

The Driving View Screen is one of the many screens that can show in the RCL Area of the Superstructure Display Module (SDM). Refer to *SDM Rated Capacity Limiter (RCL) Area*, page 4-22 for a list of all screens that can show in this area.

The Driving View Screen shows information that is essential when driving the crane, to include the following:

- Crane tilt indicators
- Active driving mode indicator
- Front and rear wheel turning angle indicators
- Driving mode selection buttons

This information is dynamic and will change as the crane is operated.

The crane tilt information is useful when driving over ground that is not level. Refer to *Traveling on Slopes*, page 5-13 for slope limitations and precautions before driving the crane on slopes.

The GRT765/780 crane is equipped with wheels on the rear axle that can be turned left or right to provide greater maneuverability on the jobsite. The rear wheels can be turned in the same direction (crab steering) or opposite direction (coordinated steering) as the front wheels for even greater maneuverability (Figure 4-201).

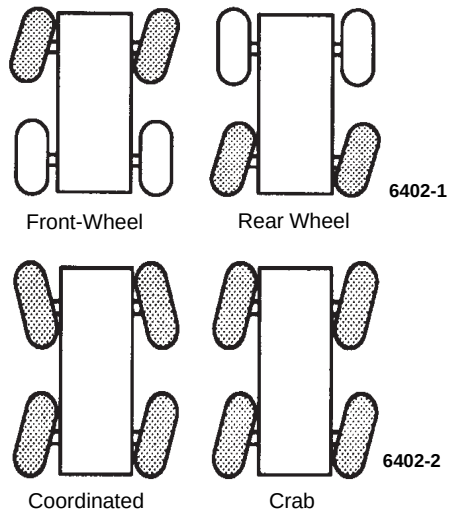


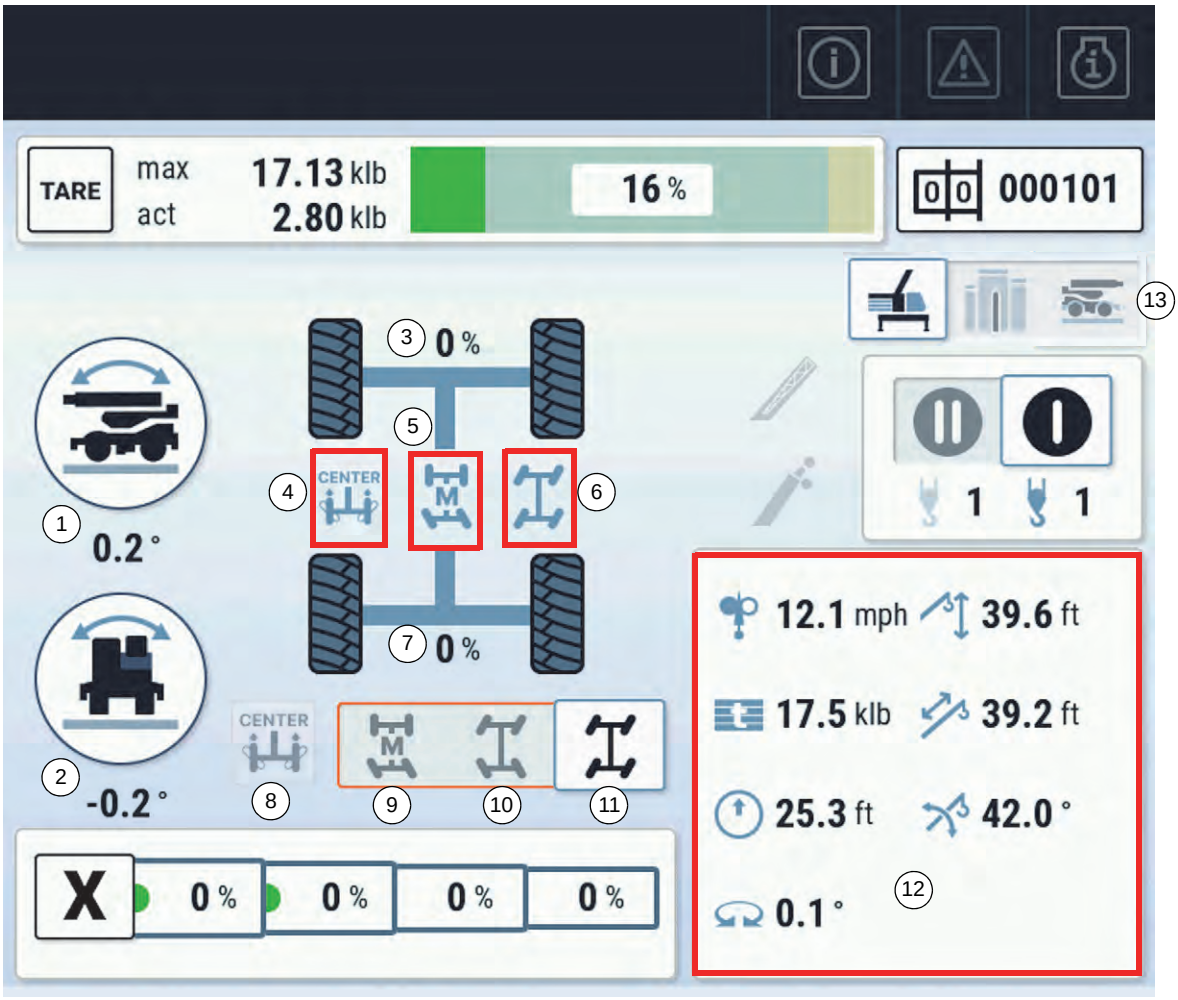
FIGURE 4-201

The rear wheels can be set to turn automatically when the steering wheel is turned, or they can be turned manually. Buttons on the Driving View Screen are used to select automatic or manual control of the rear wheel steering.

Refer to *Steering*, page 5-20 for more information about steering the crane using the front and rear wheels and under what conditions the rear wheel steering and auto-centering functions will operate.

The Driving View Screen can be brought up by selecting the Driving View Screen Button (13, Figure 4-202).

Refer to Figure 4-202 and the sub-sections that follow for descriptions of the information that show on the Driving View Screen and how it is used in the operation of the crane.



Item	Description	Page	Item	Description	Page
1	Crane Tilt – Fore-to-Aft Indicator	4-154	8	Auto Center Rear Wheels Button	4-154
2	Crane Tilt – Side-to-Side Indicator	4-154	9	Manual Rear Steering Mode Button	4-155
3	Front Wheel Steer Angle Indicator	4-154	10	Automatic Coordinated Steering Mode Button	4-155
4	Auto Center Rear Wheels Button Selected Indicator	4-154	11	Automatic Crab Steering Mode Button	4-155
5	Current Steering Mode Indicator	4-154	12	RCL Information	4-155
6	Requested Steering Mode Indicator	4-154	13	Driving View Screen Button	4-155
7	Rear Wheel Steer Angle Indicator	4-154			

10746-119

FIGURE 4-202

Crane Tilt – Fore-to-Aft Indicator

The Crane Tilt – Fore-to-Aft Indicator (1, Figure 4-202) shows the inclination of the crane, from front to back, in degrees.

Crane Tilt – Side-to-Side Indicator

The Crane Tilt – Side-to-Side Indicator (2, Figure 4-202) show the inclination of the crane, from left to right, in degrees.

Front Wheel Steer Angle Indicator

The Front Wheel Steer Angle Indicator (3, Figure 4-202) shows the angle (in degrees) in which the front wheels are turned from the straight ahead position (0°).

The value for the front wheel steer angle is dynamic and will change as the front wheels are turned left and right.

Auto Center Rear Wheels Button Selected Indicator

The Auto Center Rear Wheels Button Selected Indicator (4, Figure 4-202) only shows when the operator has selected the Auto Center Rear Wheels Button (8, Figure 4-202), but the Crane Control System (CCS) is preventing the rear wheels from centering because the crane is not moving at a speed of 1.5 to 8 km/h (1 to 5 mph).

When the crane begins to move or slows to a speed of approximately 1.5 to 8 km/h (1 to 5 mph), the CCS will automatically straighten the rear wheels and switch off the Auto Center Rear Wheels Button Selected Indicator.

Current Steering Mode Indicator

The Current Steering Mode Indicator (5, Figure 4-202) shows the steering mode in which the Crane Control System (CCS) is currently operating in.

Figure 4-203 shows the related indicators for the three steering modes that can be selected:

- Manual Rear Steering Mode (1)
- Automatic Coordinated Steering Mode (2)
- Automatic Crab Steering Mode (3)

FIGURE 4-203

When the operator selects a different steering mode, the following will occur:

- Newly requested steering mode will engage.
- Current Steering Mode Indicator will change to show the new steering mode.
- Steering angle of the rear wheels will change as needed to match the newly selected rear steering mode.

If operator selects an Automatic Crab or Coordinated Steering Mode and the crane is not moving at a speed of 1.5 to 8 km/h (1 to 5 mph), the new steering mode will not engage. In this scenario, the Current Steering Mode Indicator will not change and the newly selected steering mode indicator will show in the Requested Steering Mode Indicator field (6, Figure 4-202). The crane will continue to operate in and show the original rear steering mode indicator. When the crane begins to move or slows to a speed of approximately 1.5 to 8 km/h (1 to 5 mph), the newly selected steering mode will automatically engage and update in the Current Steering Mode Indicator field.

Requested Steering Mode Indicator

The Requested Steering Mode Indicator (6, Figure 4-202) shows the steering mode indicator that the operator has requested but cannot be engaged because the crane is not moving at a speed of 1.5 to 8 km/h (1 to 5 mph).

When the crane begins to move or slows to a speed of approximately 1.5 to 8 km/h (1 to 5 mph), the Crane Control System (CCS) will automatically engage the newly requested steering mode and switch off the Requested Steering Mode Indicator.

Rear Wheel Steer Angle Indicator

The Rear Wheel Steer Angle Indicator (7, Figure 4-202) shows the angle (in degrees) in which the rear wheels are turned from the straight ahead position (0°).

The value for the rear wheel steer angle is dynamic and will change as the rear wheels are turned left and right.

Auto Center Rear Wheels Button

The Auto Center Rear Wheels Button (8, Figure 4-202), when selected, causes the Crane Control System (CCS) to automatically center the rear wheels.

Button only centers the rear wheels and will not affect the front wheels when selected. Rear wheels will automatically center themselves when button is pushed and certain crane conditions are met.

Manual Rear Steering Mode Button

The Manual Rear Steering Mode Button (9, Figure 4-202), when selected, allows the operator to manually turn the rear wheels by using the Rear Steer Right Button and Rear Steer Left Button that are located on the left armrest.

Refer to *Rear Steer Right Button*, page 3-23 and *Rear Steer Left Button*, page 3-24 for information about these buttons.

Automatic Coordinated Steering Mode Button

The Automatic Coordinated Steering Mode Button (10, Figure 4-202), when selected, causes the rear wheels to automatically turn in the opposite direction in which the front wheels are being turned by the steering wheel.

Automatic Crab Steering Mode Button

The Automatic Crab Steering Mode Button (11, Figure 4-202), when selected, causes the rear wheels to automatically turn in the same direction in which the front wheels are being turned by the steering wheel.

RCL Information

When the Driving View Screen is selected for viewing, the RCL Information (12, Figure 4-202) that is normally shown with a crane side view pictorial is abbreviated and shown in the lower right corner of the RCL Area.

Driving View Screen Button

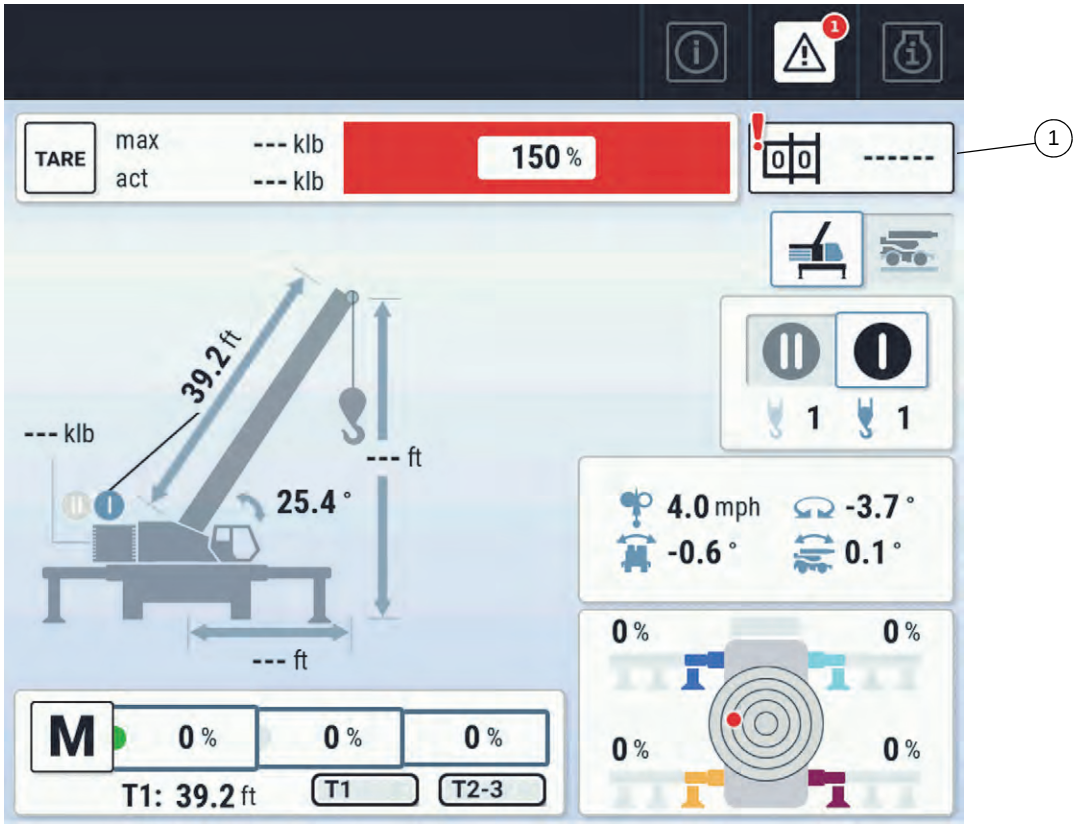
The Driving View Screen Button (13, Figure 4-202), when selected, causes the Driving View Screen to show in the RCL Area.

RCL NOT PROGRAMMED WARNING SCREEN

The RCL Not Programmed Warning Screen (Figure 4-204) will show when the operator has exited the RCL programming screen without programing the RCL.

Operator should never operate the crane without first programming the RCL.

Operator must select the RCL Programming Button/Indicator (1, Figure 4-204) to open the RCL programming screens and complete the RCL programming. Refer to *Programming the RCL – Overview*, page 4-103 for detailed information on how to program the RCL using either the RCL Wizard Method or the RCL Manual Entry Method.



10746-126

FIGURE 4-204

MAXBASE (OPTIONAL)

The optional MAXbase feature on the GRT765/780 crane offers capacities for particular swing angles based on outrigger configuration as compared to a similar 360° Load Chart.

The MAXbase feature offers these capacities by using four different load charts throughout the crane's rotation. In comparison a standard 360° chart only uses one load chart. The MAXbase load charts calculate capacities based on four different swing angle ranges. This allows for increased capacities for some swing angle ranges based on the crane configuration when compared to another swing angle range. These swing angle ranges are identified in the MAXbase Load Charts and Rated Capacity Limiter (RCL) as follows:

- Over the Front
- Over the Rear
- Over the Sides
- Directly Over the Outriggers (±10 Degrees)

The MAXbase feature also allows for the crane to be set up on outriggers that are not equally extended horizontally. This allows the crane to be more easily set up in work areas that have obstacles that may prevent the outriggers from being extended to equal horizontal lengths.

To program the RCL with a MAXbase load chart rigging code, refer to the following sections:

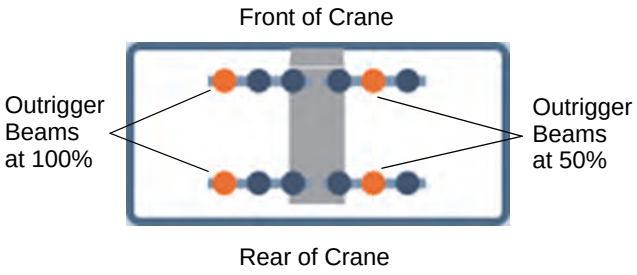
- *Programming the RCL Using the Wizard Method*, page 4-106
- *Programming the RCL Using the Manual Entry Method*, page 4-120

NOTE 1: When the crane's RCL is programmed with a MAXbase load chart, the operator can bring up the Panorama View Screen to aid in performing lifts. The Panorama View Screen helps the operator by showing the capacities of the crane throughout its 360° rotation. Refer to *RCL Panorama View Screen*, page 4-145 for more information about the Panorama View Screen and its use in the operation of the crane.

For a list of the supported MAXbase Load Charts and their outrigger configurations, refer to the section titled *MAXbase Load Charts*, page 4-157

MAXbase Load Charts

The MAXbase outrigger setups provided as standard on the GRT765/780 crane are shown in the *Load Chart Manual*, and duplicated below. Each setup is shown in graphical form as a top view of the carrier with the front of the crane pointed upward on the picture (Figure 4-205). The orange dots represent the position of the outrigger jacks (100%, 50% or 0%).



10431-8

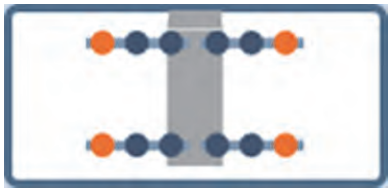
FIGURE 4-205

Refer to Figure 4-206 thru Figure 4-208 for the standard MAXbase Load Charts and their outrigger configurations available on the GRT765/780 crane.

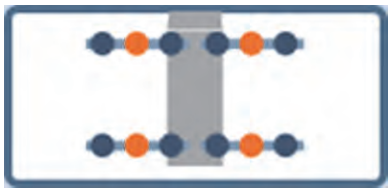
NOTE: Additional setups may be acquired by contacting Grove Product Support for a *Lift Solution.*

Three symmetrical outrigger extensions (Figure 4-206).

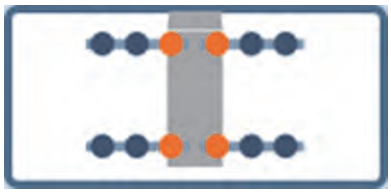
10001



14001

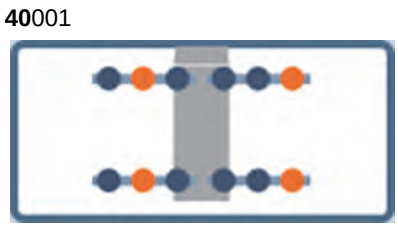


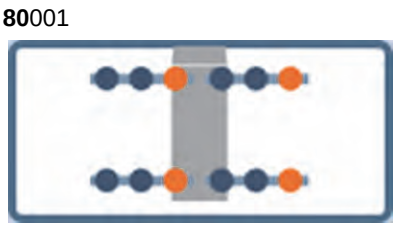
18001

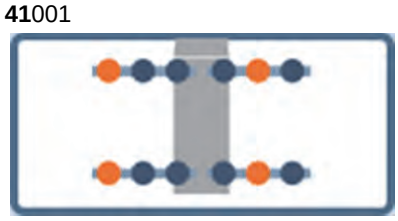


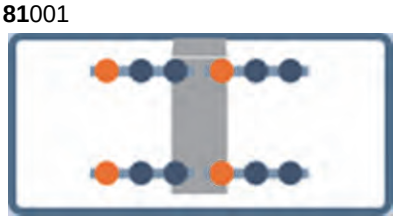
10431-19 to 10431-21 **FIGURE 4-206**

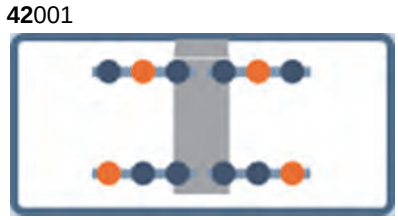
The standard MAXbase setups have at least two adjacent outrigger beams extended to 100%. The other two outrigger beams may be extended to 50% or 0% as shown in Figure 4-207.

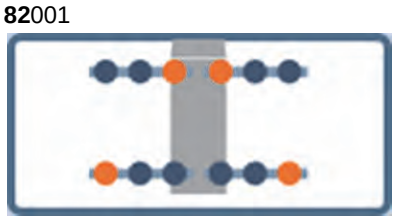


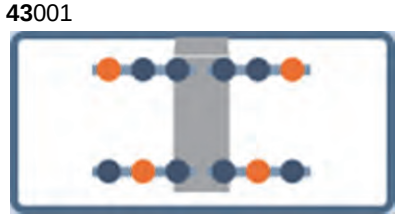


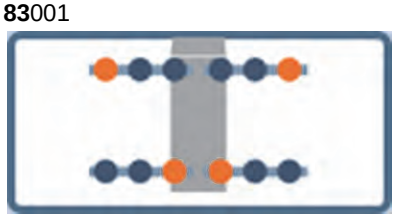












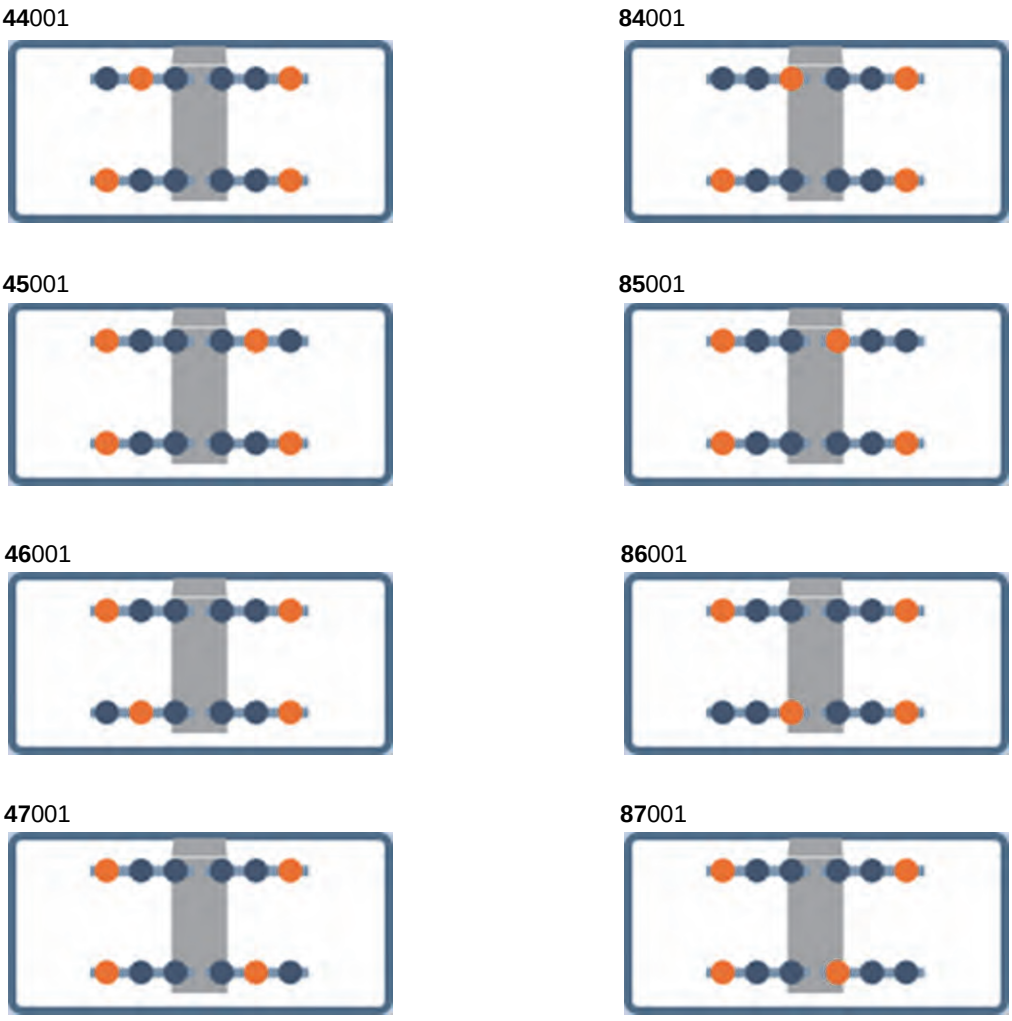
10431-7 to 10431-10

10431-3 to 10431-6

FIGURE 4-207

4

The standard GRT8100-1 MAXbase setups also allow lifting with 3 outrigger beams extended to 100%. The remaining beam may be extended to 50% or 0% as shown in Figure 4-208.



10431-15 to 10431-18

10431-11 to 10431-14

FIGURE 4-208

OPERATION OF SWING BRAKE RELEASE BUTTON ON MAXBASE EQUIPPED CRANES

The Swing Brake Release Button, located on the upper front of the left controller, is disabled when a MAXbase Rigging Code is selected in the Rated Capacity Limiter (RCL). This prevents the button from being used to release the swing brake and cause the boom and superstructure to rotate toward a swing range/limit that is prohibited.

LIMITING SWING MOTION

Stopping the Swing Motion

When operating the crane with the Rated Capacity Limiter (RCL) programed to a MAXbase Rigging Code, the Crane Control System (CCS) may stop the swing motion in some conditions. To stop the swing motion in a smooth manner and prevent excessive side-loading of the boom, CCS performs the swing stop according to Figure 4-210.

The speed reduction slope is scaled based on the total rotational mass of the crane system. When the hook load is large or the radius is long, the angular distance for stopping increases. In some cases the maximum speed of the swing system will be limited.

When nearing a swing stop, the swing speed is limited to about 0.8 degrees or less per second over the last 4 degrees of rotation. Speed is then reduced to 0 deg/s while still 1.0 degree from the stop target. The swing brake is also ramped on over the final 1.0 degree to the stop target.

The approximate swing speed of the crane is shown by the dashed line in Figure 4-210. To stop the swing motion, CCS may reduce the swing command below what is being commanded by the operator. In some conditions, CCS may also send a counter-swing command to reduce the swing speed according to the target lines shown.

WARNING

Crane Tipping Hazard!

The MAXbase swing motion stop function is an operational aid that should stop the swing motion before the boom enters a swing angle range that is unsafe for the crane's configuration or current load.

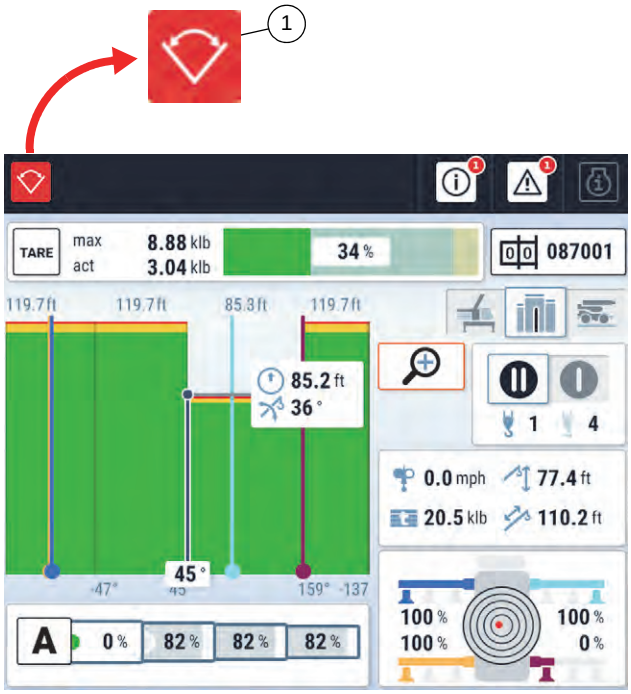
For the swing motion stop function to function properly the crane must be level to within 0.10° on the digital bubble level of the Operator Display Module (ODM).

At all times the operator can slow and stop the swing motion by doing the following:

- Further reduce the swing command
- Add counter-swing command (to stop faster)
- Add swing braking command (by the foot pedal)

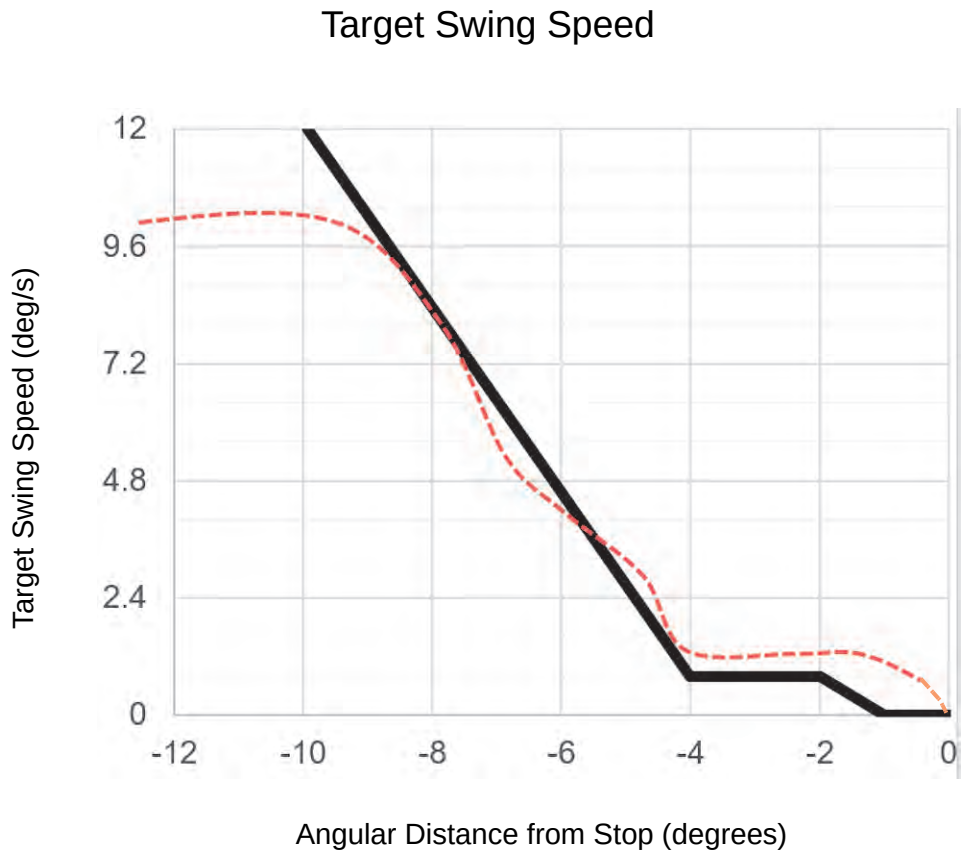
When the CCS senses that the current boom swing angle is near a swing angle limit/range that is prohibited, the buzzer will make a slow intermittent sound. The buzzer will change to a fast intermittent sound when the current boom swing angle is within 5° of the prohibited swing angle limit/range. A constant buzzer sound will come on when the swing angle has reached the prohibited swing angle limit/range.

When the boom swing angle has reached the prohibited swing angle limit/range, the Swing Stop Alert (1, Figure 4-209) is shown in red in the Alerts Bar.



10431-30; 10753-2

FIGURE 4-209



10431-23

FIGURE 4-210

Limiting the Swing Speed Based on Utilization

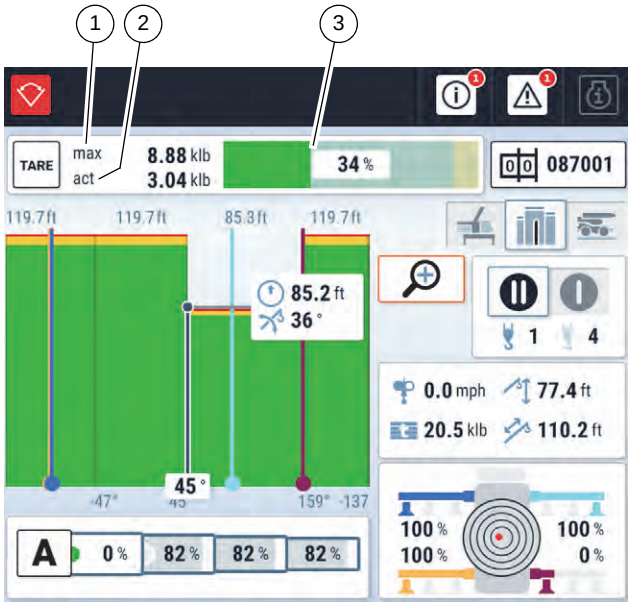
The Crane Control System (CCS) monitors the allowable hook load (shown as 'max' on the Multifunction View Screen – 1, Figure 4-211) and the measured hook load (shown as 'act' – 2, Figure 4-211). The ratio of these values is shown as a percentage in the Capacity Bar (3, Figure 4-211).

As the utilization of the crane approaches 100%, function speeds are limited to reduce the dynamic effect of stopping the swing motion. When swinging loads near 100% utilization, the swing speed is limited to 20% of the maximum speed (Figure 4-212). The swing motion is reduced to 0 deg/s when the utilization is 110%. This prevents the crane from suddenly stopping the swinging motion.

WARNING

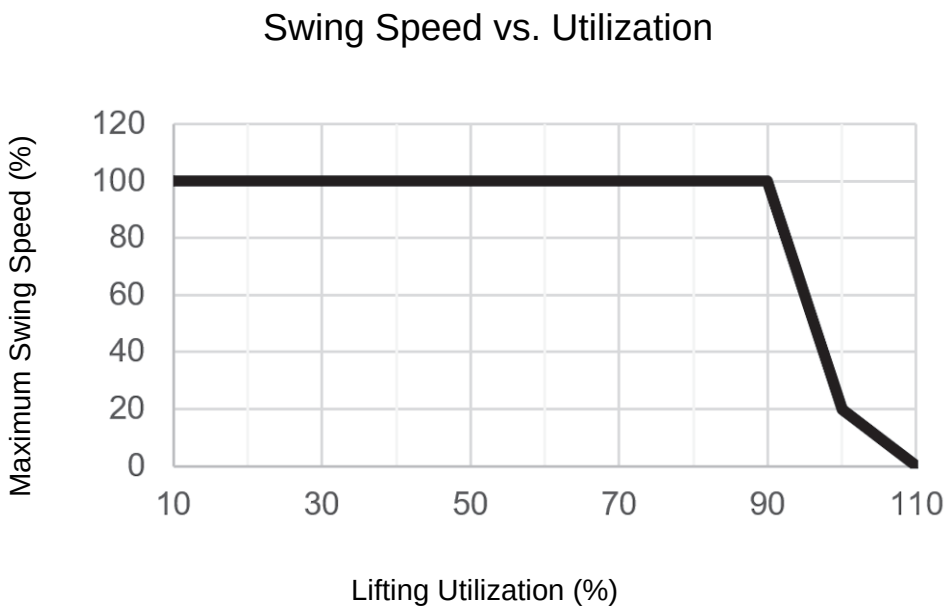
Crane Tipping Hazard!

Deflection of the crane structure may result in the load radius increasing slightly while swinging. Be aware that maintaining the load radius may require booming up or telescoping in. Do not operate the crane above 100% capacity.



10753-2

FIGURE 4-211



10431-24

FIGURE 4-212

THIS PAGE BLANK

SECTION 5
OPERATING PROCEDURES

SECTION CONTENTS

5

PRE-STARTING CHECKS

A complete walk-around visual inspection of the crane should always be made with special attention to structural damage, loose equipment, leaks, or other conditions that would require immediate correction for safe operation.

The following items are suggested to be checked to make sure the crane is prepared for starting the day's work.

Fuel Supply

Fill fuel tank and make sure cap is on tight.

Engine Oil

CAUTION

Do not overfill.

Check oil level in the crankcase and make sure it is within the ADD and FULL marks on the dipstick. Do not overfill.

Engine Coolant

DANGER

Do not loosen radiator cap while engine and radiator are hot. Steam or hot coolant will cause severe burns.

Check surge tank coolant level sight gauge and fill to the proper level. Do not overfill. Make sure surge tank cap is secure.

Batteries

Check battery cables and clamps are tight and not corroded.

Hydraulic Reservoir and Filter

Check hydraulic level sight gauge on the hydraulic tank. Hydraulic fluid should be at normal operating temperature, with boom and outriggers in a retracted position, and boom level.

Check breather for cleanliness and make sure it is secure.

Hoist Rope

Inspect hoist rope in accordance with applicable regulations, standards, and instructions provided in the Grove manuals. Sheaves, guards, guides, drums, flanges, and any other surfaces that come in contact with the rope should be inspected for any condition that could cause possible damage to the rope.

Hook Block and Overhaul Ball

Inspect for nicks, gouges, cracks, and evidence of any other damage. Replace a hook that has cracks or shows evidence of excessive deformation of the hook opening (including twist). Be sure safety latch is free and aligned.

Seats and Mirrors

Adjust seat and mirrors for clear vision and safe driving.

Cameras

Make sure hoist, rear view, and side view cameras function properly and are properly adjusted. Make sure cameras are kept clean.

Seat Belt Care

SEAT BELT MAINTENANCE

Seat belt assemblies are maintenance-free, however, they should be periodically inspected to make sure they are not damaged and are in proper operating condition, especially if they have been subjected to severe stress.

CLEANING SEAT BELT WEBBING

Wash seat belt webbing with mild soap or detergent. Do not use commercial solvents. Bleaching or re-dyeing the webbing is not recommended because of possible loss of webbing strength.

Floor Mat

Make sure floor mat is correctly in place, is free of debris, and does not interfere with the operation of the foot pedals.

Signal and Running Lights

Check all signal and running lights for proper operation. Replace lights that are not working with those of the same number, or equivalent.

Service and Parking Brakes

Check for proper operation.

1. With parking brake applied, start the engine. Allow engine and transmission to warm for three to five minutes.
2. Apply service brakes by pushing and holding the Service Brake Foot Pedal.
3. Shift transmission into four-wheel drive, 1st gear, in either the forward or reverse direction.
4. With crane engine idling, slowly release the service brakes and observe for crane motion.

   If parking brake is operating properly, crane should not move.
5. With engine still running and parking brake applied, apply service brakes by **pushing and holding** the Service Brake Foot Pedal.

6. Release the parking brake.
7. Shift transmission into one of the following selections:
   - Two-wheel drive, 2nd gear
   - Two-wheel drive, 3rd gear
   - Four-wheel drive, 4th gear
8. Increase engine speed as much as possible using the Throttle Pedal and hold for 15 seconds.

   If service brakes are operating properly, crane should not move.
9. Once operation is confirmed, do the following:
   a. Gradually reduce the engine speed to idle.
   b. Shift the transmission to neutral.
   c. Apply the parking brake.
   d. Allow the transmission/oil temperatures to equalize by idling the engine for three to five minutes.

      After idling the engine for the recommended time, operator can shut down the engine or begin operating the crane.

Tires

Check for severe cuts, foreign objects embedded in treads, and for correct inflation pressures. A tire inflation chart, providing the correct air pressures, is located in the *Load Chart Manual* in the crane cab.

Wheels

Maintain proper torque on wheel lugs and check for proper wheel mounting. Re-torque lug nuts 300 hours after wheel installation. Check lug nuts for proper torque every 500 hours thereafter.

Axle Oscillation Lock Outs Operation

The following procedure should be used to check the axle oscillation system and make sure it is in proper working condition.

1. Make sure tires are inflated to recommended pressure. Refer to *Load Chart Manual* in the crane cab for proper inflation pressures.
2. Program the RCL with a travel rigging code based on the configuration of the crane.
3. Center the rear wheels.
4. With hook unloaded, boom fully retracted and centered over the front at no more than a 10° to 15° boom angle, position the left or right side rear tire on blocks so that the rear tires approximately 15 to 30 cm (6 to 12 in) above the level of the opposite tire.
5. Slowly swing the superstructure at least 2° to left or right of center to activate the axle oscillation lock out valve.When the suspension is locked, the Suspension Control Indicator (12, Figure 4-35) will come on in the Operating Area of the SDM. Do not swing beyond tire track.
6. Slowly drive off of blocks and stop. Rear tire should be touching the road surface and the opposite front tire should be light or slightly off road surface.
7. Swing superstructure until it is centered over the crane again. If axle oscillation lock out valve is functioning properly, crane will re-level itself; if valve is not working properly, crane will not re-level itself.

DANGER

Tipping Hazard!

Do not operate crane if axle oscillation lock out system is not functioning properly.

Failure to comply with this warning may result in death or serious injury.

If rear axle does not lock or unlock properly, do not operate the crane until the lock out system has been evaluated and repaired as necessary.

Equipment Check

Check all lights, windshield wipers, washers, washer liquid supply, horn, instruments, signaling devices, etc.

Daily Lubrication

Make sure all components requiring daily lubrication have been serviced. Refer to *Maintenance and Lubrication*, page 7-1.

Boom

Before extending boom, make sure access covers on top of boom base section and on face of boom nose are installed.

Air Cleaner (Tier 3 Engines Only)

Check the filter restriction Indicator. Replace the filter when indicator is in red. Reset the restriction indicator after each filter change.

Air Intake Restriction Monitoring (AIRM) Communications System (Tier 4/Stage 5 Engines Only)

The engine includes the Cummins AIRM Communications System. This system calculates real-time air filter restriction at operational flow rate using the temperature and pressure

input from the TBAP sensor, which is included on the Direct Flow air cleaner.

When the air filter becomes dirty and needs replaced, alerts will show on the Superstructure Display Module (SDM). Replace the air filter at the next maintenance interval.

If the air filter becomes more dirty, a severe warning fault is generated and the Engine Warning Alert comes on. A progressive engine derate will occur to protect the engine from damage.

The generated Crane Fault Alerts are shown in the Alerts Bars (1, Figure 4-13) of the SDM. Additional information on a Crane Fault Alert can be viewed through the use of the *Manitowoc Diagnostic Code Mobile Application*, page 4-18.

COLD WEATHER OPERATION

The following recommendations are for operating Grove cranes in regions with ambient temperatures below -9°C (15°F) which are considered arctic.

NOTE: Additional information about engine cold weather operation is available through your Cummins dealer/service center under Service Bulletin 3379009.

Use particular care to make sure cranes operated in very cold temperatures are operated and maintained in accordance with procedures provided by Grove. Always make sure there is adequate lubrication during system warm-up. Regardless of crane lubricant viscosity, always follow cold weather warm-up procedures described in the section *Crane Warm-up Procedures*, page 5-10. For proper cold weather lubricants, refer to the section *Arctic Lubricants and Conditions*, page 7-6.

If in doubt of suitability for a specific fluid or lubricant, check with an authorized Grove distributor or Grove Product Support. Cranes should have appropriate hydraulic oil, lubricants, and other auxiliary items required for operation in arctic temperatures.

Grove recommends the crane be equipped with the following cold weather accessories:

Down to -29°C (-20°F) Package

- Battery heater
- Transmission heater
- In-line fuel heater
- Engine hood insulation
- Radiator shutters
- Hydraulic tank with heater port
- Fan clutch
- Diesel fired cab heater
- Fluids suitable to -29°C (-20°F)
  - Arctic windshield washer fluid
  - Arctic fuel

Down to -40°C (-40°F) Package

- Coolant heater (to circulate warm coolant through heaters and engine)
- Transmission heater
- Battery heater
- In-line Fuel heater
- Engine hood insulation
- Fan clutch
- Diesel fired cab heater
- Super-capacitor starting system
- Fluids suitable to -40°C (-40°F):
  - Arctic windshield washer fluid
  - Arctic fuel

Individual crane components must be sufficiently warmed prior to performing a lift. Follow the warm-up procedures found in section *Crane Warm-up Procedures*, page 5-10.

For crane operation below -40°C (-40°F), derate load chart capacities by 6.60% for each degree Celsius or by 3.67% for each degree Fahrenheit below -40°C (-40°F).

Operation of craning functions must be performed in a manner that ensures smooth operation and avoids shock loading.

Coolant Heater

A diesel fueled coolant heater circulates warm coolant through engine and crane components when operating during arctic temperatures. The coolant heater should be activated 2 hours before starting the crane to allow sufficient time to preheat fluids and assist with easy start-up conditions.

WARNING

Explosion Hazard!

Before switching on, check if heater can be operated at current site of the crane. There is a danger of explosion when using heater around combustible objects! Do not park vehicle near objects that are flammable.

Use caution near heater exhaust tailpipe as it will also become very hot.

5

NOTE: Operation of heater is NOT allowed:

- At locations where flammable gas or vapors are found or can be formed (example: at fuel stations and chemical factories)
- At locations where explosive dust is found or can be formed (example: coal, wood or grain dust).
- There is a risk of suffocation when using the heater!
- Do not operate heater in enclosed spaces (example: garages).

To activate the heater, first make sure battery disconnect switch is turned to the ON position. Push the Coolant Heater Button, accessed through the access hole in the left side panel near the ladder, one time to activate the heater. The LED integral to the button comes on green to indicate the system is operating. The start-up and shutdown cycles may take approximately 2 minutes for initialization. Make sure coolant, transmission heater, swivel, battery heater, in-line fuel pump, in-line fuel heater, and hydraulic reservoir heater are heating properly.

To deactivate the heater, push button again. The green light will go off to indicate the system is deactivated. Shutdown cycle takes approximately 2 minutes. The heater system has a timer that will automatically deactivate the system after 2 hours.

NOTE: Batteries will quickly discharge if crane engine is switched off. If heater is operated with crane engine stopped, batteries will need to be recharged after a short period of time.

Auxiliary Cab Heater

The crane cab is heated with an auxiliary air heating system that runs independently of the engine. Heat is generated by burning fuel taken from the heater fuel reservoir located behind the cab.

To heat the operator's cab, activate the auxiliary diesel heater and adjust the temperature using the Auxiliary Cab Heater Controller (2, Figure 3-4) mounted in the left overhead panel. The heating system fan delivers warm air into an air distribution box. Air is circulated according to control settings and then delivered into the cab by a fan through various air extraction and air delivery vents.

Do not cover vents with bags, articles of clothing or any other objects. Keep hot air inlet and hot air outlet free of dirt and foreign material. Soiled or blocked hot air lines may cause overheating, and result in damage.

The crane auxiliary cab heater can be operated when engine is running or stopped as part of the programmable auxiliary heating system. Maximum cab temperature is achieved by running only the auxiliary heater and using the standard cab heater fan when engine is sufficiently warmed up. The standard hot water crane cab heater can also be turned on after engine has started and is warmed to operating temperature.

NOTE: When using heater at high altitudes, factory heater setting must be re-calibrated for proper heater operation.

- Heating at altitudes up to 1,500 m (4,900 ft)

  Unlimited heating is possible

- Heating at altitudes over 1,500 m - 3,000 m (4,900 ft - 9,900 ft):

  Heating is possible for short periods at this altitude (example: driving over a mountain pass or taking a break while traveling between job sites).

During longer stays, (example: construction job project), the fuel supply must be adjusted to the altitude or the heater will malfunction. This can be done by installing an air pressure sensor kit (Grove part number 90037674). Contact an authorized Grove distributor or Grove Product Support for additional assistance.

NOTE: Accelerated discharging of battery will occur when crane engine is switched off. If heater is operated with crane engine stopped, batteries will need to be recharged after a short period of time.

Battery Heater

An in-line battery coolant heater circulates warm coolant under the battery when temperature is below -9°C (15°F). The battery coolant heater should be activated 2 hours before starting the crane to allow sufficient time to preheat batteries and provide easy start-up conditions.

Make sure battery heater coolant valve is turned OFF in ambient temperatures above -9°C (15°F).

Super Capacitor

The super capacitor provides additional cranking during cold weather startup. The Super Capacitor is service/maintenance free.

NOTE: Always handle Super Capacitor in the same manner as a battery.

Diesel Fuel

Diesel fuel with low temperature characteristics is required to operate the engine when ambient temperatures get near or below 0°C (32°F). Refer to the applicable engine manual for proper specifications.

Use correct grade of fuel for prevailing temperature. Diesel fuel should have a cloud point of 6°C (10°F) less than the lowest expected temperature. In case of emergency, kerosene may be added to the fuel to bring the cloud point

down to the required temperature.This will minimize clogging of filters and small passages by wax crystals. Addition of kerosene is NOT recommended for general use. Refer to *Arctic Lubricants and Conditions*, page 7-6 of this operator manual.

CAUTION

Engine Damage Hazard!

If Ultra Low Sulfur fuel is not used in engines that require it, engine performance will quickly deteriorate and the engine may stop running. The engine warranty will also be voided.

ENGINE OPERATION

Start-up and shutdown procedures for most diesel engines are generally the same. Therefore, the following procedures can be applied, except where specific differences are noted. (Refer to applicable engine manufacturer's manual for detailed procedures).

Jump Starting Hazard

Do not attempt to jump start the crane.

CAUTION

Do not jump start the crane with a different vehicle, portable power pack, or other power source. The surge of power from these sources can damage the crane electronic controls and computer systems. Jump starting the crane batteries with a different vehicle while the engine is running can also damage the donor vehicle electronics.

This crane has multiple computer systems (crane control, RCL, engine & transmission control) that are highly susceptible to voltage/amperage surges in the electrical system.

The batteries should be completely disconnected from the crane electrical system and charged using a battery charger of appropriate voltage level or replace the batteries with fully charged batteries. Refer to *Charging the Batteries*, page 5-7.

Charging the Batteries

When charging the batteries, do not turn on the battery charger until the charging leads have been connected to the battery(s). Also, if the battery(s) are frozen, do not attempt to charge them. Remove the battery(s) from the crane, allow them to thaw, and then charge the battery(s) to full capacity.

"Slow charging" is preferred to "fast charging". Fast charging saves time but risks overheating the battery(s). Slow charging at six (6) amps or less develops less heat inside the battery and breaks up the sulfate on the battery plates more efficiently to bring the battery up to full charge. The use of a "smart charger" that automatically adjusts the charging amperage rate is recommended.

Start-Up Procedure

DANGER

Diesel engine exhaust can be harmful to your health. Only operate engine in a well ventilated area or vent exhaust outside.

CAUTION

Never crank engine for more than 30 seconds during an attempted start. If engine does not start after 30 seconds, allow starter motor to cool for two minutes before attempting another start.

If engine does not start after four attempts, correct malfunction before attempting another start.

1. Make an under-the-hood inspection for fuel, oil, and coolant leaks, worn drive belts, and trash build-up.
2. Use the correct grade of oil in the crankcase for the prevailing temperature to prevent hard cranking.
3. Make sure diesel fuel has a cloud point of 6°C (10°F) less than the lowest expected temperature. In case of an emergency, white kerosene can be added to the fuel to bring the pour point down to the required temperature. This will prevent clogging of filters and small passages by wax crystals. The addition of kerosene is NOT recommended for general use.
4. Make sure battery disconnect switch handle is in the ON position.
5. Make sure Emergency Stop Buttons are not pushed.
6. Make sure parking brake is set to On position and the transmission shift lever is positioned to Neutral.

NOTE: Engine will not crank unless transmission shift lever is in neutral.

NOTE: An engine block heater and grid heater are provided to aid in cold-starting.

7. Turn ignition switch clockwise to position I (RUN).

   If the Engine Wait-to-Start Alert (APPENDIX C) is on in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM), do not crank engine until the alert goes off.

   If the Engine Stop Alert is on, correct the malfunction before cranking the engine.

8. Operate the horn by pushing the button on the right controller or by pushing the button on the end of the turn signal lever on the steering column.
9. Turn the ignition switch clockwise to position II (START) and release immediately when the engine starts.

   Do not push or hold the throttle pedal down. The ECM automatically provides the proper amount of fuel to start the engine.

CAUTION

If the Engine Warning Indicator or the Engine Stop Indicator is on, immediately stop the engine and correct the malfunction.

NOTE: The ignition system has an anti-restart feature. After a failed attempt to start the engine, the Crane Control System (CCS) prevents the engine from cranking again for approximately six seconds.

10. Warm up engine and all crane components following the procedures under *Crane Warm-up Procedures*, page 5-10.

Idling the Engine

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

Idling the 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. These conditions become worse in colder climates.

For these reasons the Crane Control System will automatically increase the engine idle speed to approximately 1200 rpm when the following conditions are met for a period of 5 minutes:

- Transmission is in neutral
- Parking brake is applied
- Brake pedal is not pushed
- Engine speed is less than 1125 rpm
- Controllers are not actuated
- Engine coolant temperature is below 71°C (160°F)
- Manual exhaust system cleaning process has not been initiated
- Automatic exhaust system cleaning process is not active

The crane control system will automatically return the engine idle speed to its usual setting when one of the following conditions occur:

- Transmission is shifted to forward or reverse
- Parking brake is released
- Brake pedal is pushed
- Controller is actuated
- Engine coolant temperature rises above 79°C (175°F)
- Exhaust System Cleaning Switch is set to the Manual Cleaning position
- Exhaust system cleaning process is active

Racing the 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.

Exhaust System Cleaning

WARNING

Burn/Fire Hazard!

During the cleaning process, the exhaust and tailpipe become very hot. Keep personnel and flammable objects away from the exhaust. Do not park vehicle near flammable objects.

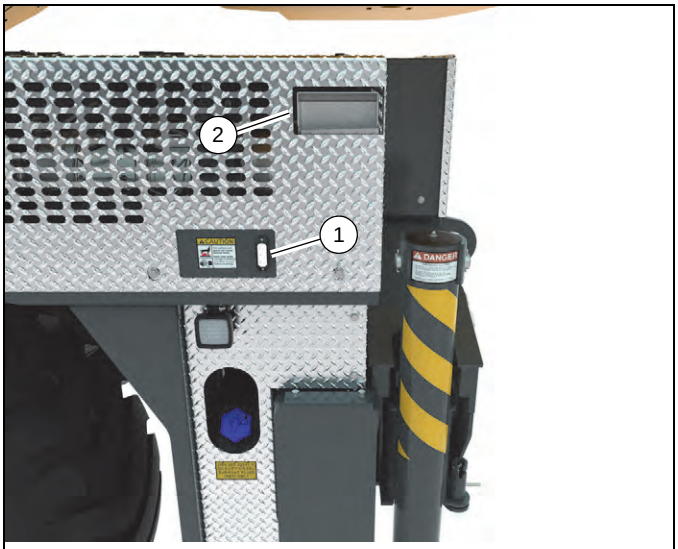
The exhaust system cleaning process can take place in three different modes:

- **Passive**: Exhaust is hot enough during normal working operation to burn off the hydrocarbon (soot) accumulation
- **Active**: Active cleaning occurs when there is insufficient heat in the exhaust system to convert all the hydrocarbon being collected in the exhaust system. Exhaust temperatures are raised by injecting a small amount of fuel. The resulting chemical reaction raises exhaust gas temperatures high enough to oxidize the hydrocarbon system. This is done without operator input.
- **Manual**: Manual, or stationary, cleaning is the same as active cleaning but takes place when crane is not being operated. It allows the operator to perform cleaning outside of the normal duty cycle.

If the exhaust system begins to clog and needs cleaned, the Regen Needed Alert (APPENDIX C) comes on in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM).

If the Regen Needed Alert is on, start the manual cleaning process at the next opportune time. Refer to *Exhaust System Cleaning (Tier 4/Stage 5 Engine Only)*, page 4-93 for procedures about how to manually clean the exhaust.

As a warning, the High Exhaust System Temperature (HEST) strobe light (1, Figure 5-1) near the exhaust pipe (2, Figure 5-1) will flash during exhaust system cleaning.



10710-25

FIGURE 5-1

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. Turn ignition switch counter-clockwise to the 0 (OFF) position.
3. Drain fuel filter-water separator.
4. If crane is to be inactive for more than 24 hours, disconnect the batteries using the battery disconnect switch

   To avoid possible engine fault codes and undesirable operation, make sure the keyswitch has been off for 2 minutes before disconnecting the batteries.

5

CRANE WARM-UP PROCEDURES

The following procedures must be followed to properly warm different crane components before operating the crane.

NOTE: For temperatures below -9°C (15°F), refer to arctic lubricants and conditions in the Operator and Service Manuals.

Before starting crane, make sure appropriate lubricants are used for ambient temperatures in which the crane will operate (a list of lubricants and temperature ranges can be found in section titled *Maintenance and Lubrication*, page 7-1, by contacting your local Grove distributor, or by contacting Grove Product Support directly).

CAUTION

Crane Damage Hazard!

Operating crane with incorrect lubricants and fluids for the prevailing ambient temperature and/or failing to adequately warm crane before cold weather operation can lead to a failure of a crane component or system.

Always use Grove recommended lubricants and fluids for prevailing ambient temperature. Properly start and warm crane using cold weather procedures found in this Operator Manual and supplement before operating crane at full load.

Engine

Warm-up Procedures for All Temperature Ranges:

1. After starting, allow engine to idle for 3 to 5 minutes before operating with a load.
2. Cold Engine Startup: After allowing engine to warm by idling it for 3 to 5 minutes, slowly increase engine speed to provide adequate lubrication to bearings and to allow oil pressure to stabilize.

Transmission

For full-load functionality, a minimum sump temperature of 20°C (68°F) is required. Operating the transmission with a sump temperature less than 20°C (68°F) is limited to:

- operating in the neutral gear or
- driving with an unloaded crane while not exceeding 1500 engine RPM and not exceeding half throttle.

Warm-up Procedures for Rough Terrain (GRT) Cranes:

1. Setup crane on outriggers.
2. Engage transmission with four-wheel drive selected and allow crane to run at idle until the temperature of the transmission sump reaches 20°C (68°F).

NOTE: Warm-up operation of four-wheel drive transmission engaged in two-wheel drive only could cause transmission damage.

Alternate Warm-up Procedures for Rough Terrain (GRT) Cranes:

1. Engage parking brake and apply service brake.
2. Shift transmission into the highest gear and increase engine speed to 1500 for 15 seconds, then allow engine speed to return to idle.
3. Repeat Step 2 until the temperature of the transmission sump reaches 20°C (68°F).

Hoist

Warm-up procedures are recommended at every startup and required at ambient temperatures below 4°C (40°F).

Warm-up Procedures - Standard Hydraulic Oil:

1. Without operating the hoist function, warm the hydraulic oil (refer to *Hydraulic Oil System*, page 5-11).
2. Once hydraulic system is warm, operate the unloaded hoist, in both directions, at low speeds several times to prime all hydraulic lines with warm hydraulic oil and to circulate gear lubricant through the planetary gear sets.

Warm-up Procedures - Cold Weather Hydraulic Oil:

Operate the unloaded hoist, in both directions, at low speeds several times to circulate gear lubricant through the planetary gear sets.

Swing Drive and Turntable Bearing

Warm-up Procedures for Temperatures Above -7°C (20°F):

1. Setup crane on fully extended outriggers, with boom fully retracted and near maximum boom angle with no load applied.
2. Rotate superstructure at a speed of less than one RPM for at least one complete revolution in one direction, then rotate superstructure at a speed of less than one RPM for at least one complete revolution in opposite direction.

Warm-up Procedures for Temperatures Below -7°C (20°F):

1. Setup crane on fully extended outriggers, with boom fully retracted and near maximum boom angle with no load applied.
2. Rotate superstructure at a speed of less than one-half RPM for at least two complete revolutions in one direction, then rotate superstructure at a speed of less than one-half RPM for at least two complete revolutions in the opposite direction.

Axles

Warm-up Procedures for Temperatures Below -35°C (-30°F):

1. Setup crane on outriggers.
2. Engage transmission with four-wheel drive selected and allow crane to run at idle until transmission sump temperature reaches normal operating temperature.

NOTE: Warm-up operation of four-wheel drive transmission engaged in two-wheel drive only could cause transmission damage.

Hydraulic Oil System

Operating Limits and Warm-up Procedures:

NOTE: Ambient temperatures between -10°C and -40°C (15°F and -40°F) require the use of a cold weather hydraulic oil (refer to cold weather lubricants in the section *Maintenance and Lubrication*, page 7-1). With cold weather hydraulic oil installed, warming the hydraulic oil before operating the crane is not required.

- **Hydraulic Oil Temperatures from 4°C to -10°C (40°F to 15°F):** Crane operation, less hoist, without a load is allowed with medium engine speed and medium function speed (controller position) until fluid reaches at least 10°C (50°F). It is then recommended that all crane functions be cycled to remove cold fluid from all components and cylinders of the hydraulic system. If any unusual sound comes from the crane's hydraulic pumps or motors, stop operation and engine immediately and contact a Grove distributor.
- **Hydraulic Oil Temperatures from 10°C to 4°C (50°F to 40°F):** Crane operation, less hoist, with a load is allowed with medium engine speed and medium function speed (controller position) until fluid reaches at least 10°C (50°F).
- **Hydraulic Oil Temperatures from 95°C to 10°C (200°F to 50°F):** Crane operation with a load is allowed with no restrictions.

Hydraulic oil temperature above 95°C (200°F): No crane operation is allowed. Let hydraulic oil cool by running engine at idle with no functions actuated.

DRIVING THE CRANE

Seat Belt Fitment

Seat belt safety guidelines include the following:

- Lap belt must be secured across the pelvis.
- Lap belt shall rest across the hips, not your stomach.

Use the following procedures to fasten, adjust, and remove the seat belt:

1. Before fastening the seat belt, always adjust operator's seat to a comfortable position in which you will drive.
2. Pull belt across your lap and push latch plate (2) into buckle (1) until it clicks (Figure 5-2).
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.
4. To release seat belt, push the push button (3) at the buckle (1).

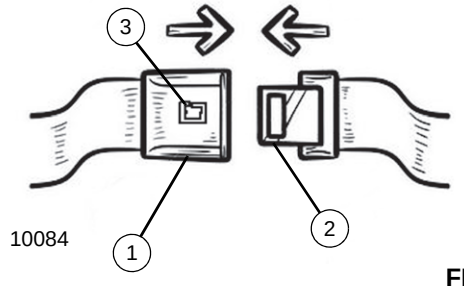


FIGURE 5-2

Traveling – General

WARNING

Accidental Operation Hazard!

Before traveling, make sure all crane functions are fully disabled by pressing the Crane Function Enable/Disable Switch. Disabling the crane functions will prevent accidental operation of the craning functions due to hitting the controllers while traveling.

It is the responsibility of the crane user to determine the suitability of travel conditions taking into consideration slopes, surface conditions and compaction. Always travel at a speed suitable for the conditions that exist.

5

When driving on roadways, the operator must follow all applicable regulations and/or restrictions.

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

WARNING

Tipping Hazard!

Avoid holes, rocks, extremely soft surfaces, and any other obstacles which might subject crane to undue stresses or possible overturn.

Do not drive crane with boom off center because automatic oscillation lock out will occur, making crane subject to tipping on uneven surfaces. Center boom over front, disable swing functions, and engage Turntable Swing Lock Pin.

Fully retract boom. Make sure swingaway boom extension is properly stowed and secured.

CAUTION

Machine Damage Hazard!

Do not travel with an empty hook in a position where it can swing freely (except where noted). Remove hook block and/or overhaul ball from hoist rope and stow securely or make sure hook block or overhaul ball is properly secured to tie down provided for that purpose.

Do not drive crane with lift cylinder fully retracted. At a minimum, position boom to horizontal.

Fully retract outrigger beams and jacks and properly stow floats.

Disengage pumps (if applicable) for extended traveling.

- Use four-wheel drive only when greater traction is necessary or as instructed in the following sections. (Refer to *Four-Wheel Drive Operation*, page 5-26 for operating instructions.)
- Make sure outrigger beams and jacks are fully retracted with floats properly stowed.
- Conduct all travel with assistance of a ground person to warn operator of any change in terrain conditions.

Traveling – Towing/Pulling

CAUTION

Machine Damage Hazard!

Grove recommends towing or pulling another vehicle with the optional pintle hook (if equipped) or by attaching at a point no higher than the pintle hook height, or severe damage may occur to the drivetrain.

Do not tow or pull by attaching to the tie-down lugs unless the attaching point is no higher than the pintle hook height.

Always use four-wheel drive (low range) to avoid severe damage to the drivetrain.

Should the crane become mired down, use a tow truck or tractor to free the vehicle. Severe damage to the drivetrain may occur if the operator attempts to free the crane unassisted.

To avoid severe damage to the drivetrain while using the crane to tow or pull another vehicle, follow these recommendations:

- Make sure boom is in a horizontal position and not elevated above 0°.
- Make sure outrigger beams and jacks are fully retracted with the floats properly stowed.
- Tow or pull on open ground when possible.
- Connect to the optional pintle hook (if equipped) or attach cables/straps to the crane at a point no higher than the pintle hook height.
- Select four-wheel drive (low range) (Refer to *Four-Wheel Drive Operation*, page 5-26 for operating instructions.)
- Should the crane become mired down, use a tow truck or tractor to free the vehicle. Severe damage to the drivetrain may occur if the operator attempts to free the crane unassisted.
- Conduct all travel with the assistance of a ground person to warn the operator of any changing conditions in the terrain being traversed.

Traveling – Being Towed/Pulled

Grove recommends connecting to a pintle hook (if equipped) or evenly attaching to the tie-down lugs when being towed by another vehicle.

CAUTION

Machine Damage Hazard!

It is recommended to attach cables/straps to the optional pintle hook (if equipped) or by attaching at a point no higher than the pintle hook height if being towed by another vehicle.

Do not attach to the tie-down lugs unless the attaching point is no higher than the pintle hook height.

Should the crane become mired down, use a tow truck or tractor to free the vehicle. Severe damage to the drivetrain may occur if the operator attempts to free the crane unassisted.

- Make sure boom is in a horizontal position and not elevated above 0°.
- Make sure outrigger beams and jacks are fully retracted with floats properly stowed.

To avoid severe damage to drivetrain while crane engine is disabled:

- Disconnect drivelines if towing crane for more than 75 m (250 ft).
- Disengage parking brake by manually turning parking brake adjustment until axle turns free.

DANGER

Run-away Crane Hazard!

Disabling parking brake may result in crane rolling away freely without the ability of the operator to stop the crane.

Make sure that the crane is attached to an adequately sized tow vehicle before disabling the parking brake.

Death or serious injury and damage to machinery could result from moving machinery.

- Secure steering to prevent turning while towing.
- Conduct all travel with assistance of a ground person to warn operator of any changing conditions in terrain being traversed.

Traveling on Slopes

Crane operators must exercise caution when operating the crane on uneven surfaces.

Refer to *Pre-load Check*, page 5-38 for information about the electronic crane tilt gauges (fore-to-aft and side-to-side) that are to be used when traversing sloped terrain.

Travel on slopes is permitted under the following conditions described below.

GENERAL CONDITIONS

- Travel must be on an improved surface or hard-packed dry earth. Crane operators are required to inspect the surface for good tire adhesion.
- Counterweight shall be installed.
- Limit travel to a forward direction only.
- All boom sections must be fully retracted.
- Boom extension must be in stowed position or removed from the crane (if traveling with an erected boom extension, follow the requirements under the section *Traveling with Boom Extension Erected – GRT780*, page 5-18).
- Position boom over front of crane. Swing brake must be applied and turntable lock pin engaged.
- Either the hook block may be reeved over the main boom nose, or the overhaul ball may be reeved over the main boom nose or auxiliary boom nose; the other must be removed. If hook block or overhaul ball remains reeved on the boom, it must be secured at the tie down on the carrier to prevent swinging.
- Tires must be inflated to the recommended pressure indicated in the *Load Chart Manual*.
- Hydraulic tank must be filled to specified level. Fuel tank must be over half full.
- Engine and transmission fluids must be filled to the specified levels.
- Axle differentials and planetary hub fluids must be filled to the specified levels.
- No loads may be supported by the boom (i.e., no pick and carry loads) while traversing a slope.
- All cribbing or other non-standard accessories must be removed from the crane.
- Avoid holes, rocks, extremely soft surfaces, and any other obstacles that might subject crane to undue stresses and possible overturn.
- Operator is to check for changing road conditions and utilize a ground person if deemed necessary.

SLOPE LIMITATIONS – FORE/AFT TRAVEL

- Refer to Table 5-1 – *Fore and Aft Travel - No Load*, page 5-15.
- When traversing a fore/aft slope that is less than or equal to 15% (8.5°), the maximum allowable boom angle is 20°.

  When traversing a fore/aft slope that is greater than 15% (8.5°), the boom angle must be limited to horizontal (0°).
- When traversing a fore/aft slope that is between 15% and 25% (8.5° and 14°), shift transmission to four-wheel drive and limit travel speed to 10 km/h (6 mph). If crane must be parked, make sure the transmission is in four-wheel drive and the wheels are chocked.
- When traversing a fore/aft slope that is equal to or greater than 25% (14°), use an assist vehicle and shift the crane's transmission to four-wheel drive. Do not park crane on a slope equal to or greater than 25% (14°).
- Travel on a fore/aft slope of 30% (16°) or more, such as ramps, is permitted for short distances at low speed [(up to 1.6 km/h (1 mph)]. Consideration must be given for the terrain at the end of the slope (for example, does the terrain level out so that the crane can stop).
- For mine applications and similar, where the slopes and the travel distance can be significant, brake fade must be taken into consideration. Also, refer to *Extended Traveling*, page 5-19 for precautions when driving the crane for long distances.
- For slope limitations when traveling with an elevated boom or an erected boom extension and inserts, refer to *Traveling with Boom Extension Erected – GRT765*, page 5-17. or *Traveling with Boom Extension Erected – GRT780*, page 5-18.

SLOPE LIMITATIONS – SIDE SLOPE TRAVEL

- Refer to Table 5-2 – *Side Slope Travel - No Load*, page 5-15.
- Do not exceed a 15% (8.5°) side slope.
- When traversing a side slope that is between 0% and 10% (0 and 5.7°), the maximum allowable boom angle is 20°.

  When traversing a side slope that is greater than 10% (5.7°), the boom angle must be limited to horizontal (0°).
- When traversing a side slope that is between 10% and 15% (5.7° and 8.5°), shift transmission to four-wheel drive and limit travel speed to 1.6 km/h (1 mph).

Traveling on a slope should only be attempted under controlled conditions specified in these guidelines, and must be conducted with the utmost diligence and care to make sure safety of all personnel performing the operation and/or working around the crane.

Should operator need to traverse slopes outside the criteria defined in the above guidelines, contact Grove U.S. L.L.C. for further guidance.

Table 5-1 Fore and Aft Travel - No Load

Crane Condition	0 - 15% (0 - 8.5°)	15 - 25% (8.5 - 14°)	25 - 30% (14 - 16.7°)	30% + (16.7° +)
Boom Angle	0° to 20°	0°	0°	0°
Two-Wheel Drive/High Range	Yes, up to 24 kph (15 mph)	No	No	No
Four-Wheel Drive/Low Range	Yes, up to 10 kph (6 mph)	Yes, up to 10 kph (6 mph)	Yes, up to 5 kph (3 mph)	Yes, up to 1.6 kph (1 mph)
Park using Park Brake only	Yes	No	No	No
Park using Park Brake, Chock Wheels, and Four-Wheel Drive		Yes	No, do not park on slopes greater than 25%	No, do not park on slopes greater than 25%
Assist Vehicle Required for Braking and Propulsion	No	No	Yes	Yes
Short Distance Travel allowed (on ramps)				Yes, but do not park on slopes greater than 25%
Consider Brake Fade possibility if traveling long distance	Yes	Yes	Yes	Yes

Table 5-2 Side Slope Travel - No Load

Crane Condition	0 - 5% (0 - 2.9°)	5 - 10% (2.9 - 5.7°)	10 - 15% (5.7 - 8.5°)	15% + (8.5° +)
Boom Angle	0° to 20°	0° to 20°	0°	0°
Two-Wheel Drive/High Range	Yes, up to 24 kph (15 mph)	Yes, up to 15 kph (9 mph)	No	No
Four-Wheel Drive/Low Range	Yes, up to 10 kph (6 mph)	Yes, up to 10 kph (6 mph)	Yes, up to 1.6 kph (1 mph)	No

Traveling with Elevated Boom

WARNING

Overhead Objects Hazard

Contacting overhead objects while driving crane may result in death, severe injury, and/or equipment damage. Traveling with boom elevated should only be attempted under controlled conditions specified in this section.

Exercise caution whenever driving crane with boom elevated. Travel with the boom elevated is permitted under the following conditions:

- Limit travel to firm, level surfaces (if traveling on slopes, follow the requirements under the section *Traveling on Slopes*, page 5-13).
- Inspect route of travel before moving crane. Look for any changing conditions of terrain being traversed. Avoid any overhead obstructions.
- Travel must be performed in a controlled manner.
- Do not exceed a speed of 24 km/h (15 mph).
- Counterweight shall be installed.
- Inflate tires to recommended pressure for travel operations.
- When using towing attachments, boom must remain horizontal.
- Fully retract all boom sections.
- Refer to *Traveling with Boom Extension Erected – GRT780*, page 5-18 if boom extension is in the erected position.
- Position boom over front of crane.
- Engage swing brake and turntable lock pin.
- Hook block may be reeved over the main boom nose. Overhaul ball may be reeved over the main boom nose or auxiliary boom nose. Block and ball may be suspended below the boom nose. It is also acceptable to secure the block or ball to carrier tie down point to prevent swinging if necessary.
- Limit boom angle to a maximum of 20°.
- Do not support any load from the boom (refer to Pick and Carry Load chart for limitations for this application).
- Remove all cribbing or other non-standard accessories from crane.
- Avoid holes, rocks, extremely soft surfaces and any other obstacles that might subject crane to undue stresses and possible overturn.
- Make sure adequate clearance to any overhead obstructions crane may be required to travel beneath.
- Make sure all personnel involved in the operation and those working around crane are aware of any hazards that may be encountered and are trained how to avoid them.

Traveling with Boom Extension Erected – GRT765

- Main Boom shall be fully retracted and positioned directly over the front or rear of the crane (see table below). Swing lock shall be engaged.
- Boom extension shall be erected at minimum (0°) offset.
- If not being used, fly section must be removed from the crane or stowed on the boom base section, not on the extension base section.
- Jobsite travel shall be only on firm, level surface (if traveling on slopes, follow the requirements under the section *Traveling on Slopes*, page 5-13).
- Maximum travel speed: 4 km/h (2.5 mph).
- Auxiliary hoist (with rope) or IPO counterweight must be installed.
- Tires shall be properly inflated (refer to *Load Chart Manual*).
- Hook block must be removed from main boom nose.
- Overhaul ball may be reeved over boom extension, hanging 1.4 m (5.5 ft) below sheave.
- Permitted boom extension, swing position, and boom elevation configurations are shown in the following table:

GRT765 - CONDITIONS FOR ALLOWABLE TRAVEL WITH BOOM EXTENSION (UNLESS NOTED)		
Extension	**Main Boom Elevation – Boom Over Front**	**Main Boom Elevation – Boom Over Rear**
10 m (33.1 ft) - fly section removed from crane or stowed on boom base section	0 - 40°	0 - 40°
17 m (56.1 ft) - using fly section	**Not Permitted**	0 - 40°

NOTE: After traveling with an erected boom extension, operator must make sure hoist rope is properly routed along boom, boom extension, and all sheaves before making a lift.

Traveling with Boom Extension Erected – GRT780

- Main Boom shall be fully retracted and positioned directly over the front or rear of the crane (see table below). Swing lock shall be engaged.
- Boom extension shall be erected at minimum (0°) offset.
- If not being used, fly section must be removed from the crane or stowed on the boom base section, not on the extension base section.
- Jobsite travel shall be only on firm, level surface (if traveling on slopes, follow the requirements under the section *Traveling on Slopes*, page 5-13).
- Maximum travel speed: 4 km/h (2.5 mph).
- Auxiliary hoist (with rope) or IPO counterweight must be installed.
- Tires shall be properly inflated (refer to *Load Chart Manual*).
- Hook block must be removed from main boom nose.
- Overhaul ball may be reeved over boom extension, hanging 1.4 m (5.5 ft) below sheave.
- Permitted boom extension, swing position, and boom elevation configurations are shown in the following table:

GRT780 - CONDITIONS FOR ALLOWABLE TRAVEL WITH BOOM EXTENSION (UNLESS NOTED)			
Extension	**Counterweight**	**Main Boom Elevation – Boom Over Front**	**Main Boom Elevation – Boom Over Rear**
10 m (33.1 ft) - fly section removed from crane or stowed on boom base section	17.5 - 20.5 k lb	0 - 40°	0 - 40°
17 m (56.1 ft) - using fly section	17.5 - 20.5 k lb	0 - 20°	0 - 40°

NOTE: After traveling with an erected boom extension, operator must make sure hoist rope is properly routed along boom, boom extension, and all sheaves before making a lift.

Extended Traveling

Depending upon the tire manufacturer, the higher inflation pressures normally specified for lifting on rubber are not recommended for site to site traveling over extended distances. The higher static/creep 4 km/h (2.5 mph) inflation pressures may remain in the tire while operating the crane on site within a distance of less than 6.4 km (4 mi).

CAUTION

Tire Damage Hazard!

For extended travel, check cold tire pressure before start (refer to tire inflation chart in *Load Chart Manual*). After every one hour of travel time, regardless of ambient temperature, stop and allow tires to cool for at least 30 minutes. At destination, tires must be allowed to cool to ambient temperature before crane lifting on rubber.

Traveling – Forward

CAUTION

Machine Damage Hazard!

Engage turntable lock pin for travel. Failure to engage lock pin may allow superstructure to swing uncontrolled, damaging machine and/or property.

NOTE: Cab must be in the fully lowered position for the drive functions to operate. If cab is not in the fully lowered position and the Transmission Shift Lever is positioned to F (forward) or R (reverse) position, the Cab Not Fully Down Alert (APPENDIX C) will come on in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM).

1. With Transmission Shift Lever (8, Figure 3-2) in neutral (N) position and the parking brake applied, start engine and allow it to adequately warm up.
2. Push and hold Service Brake Pedal (1, Figure 3-13).

DANGER

Run-away Crane Hazard!

Releasing the parking brake while the low service brake pressure alert is on and the buzzer is sounding, indicating service brakes are inoperable, may result in the crane rolling away freely without the ability of operator to stop crane.

Never release parking brake while low service brake pressure alert and buzzer are on.

3. Release parking brake (3, Figure 3-2).
4. Position Two-Wheel Drive/Four-Wheel Drive Switch (6, Figure 3-2) to two-wheel high or four-wheel low.

CAUTION

Use four-wheel drive only when more traction is required.

5. Lift Transmission Shift Lever up out of detent and push lever to the forward (F) position. Rotate the Transmission Shift Lever Knob to the first (I) gear position. Gear selection “F1” appears in the Operator Area (3, Figure 4-35) of the Superstructure Display Module (SDM) to indicate forward propulsion and first (1) gear are selected.

NOTE: If Service Brake Pedal is not pushed before shifting to a gear, the Park Brake Not Applied Alert (APPENDIX C) will come on in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM), and the transmission will not shift.

6. Let up on Service Brake Pedal and push Throttle Pedal (4, Figure 3-13) until maximum first gear speed is reached. Rotate Transmission Shift Lever Knob to the second (II) gear position to continue to increase speed. For additional speed, continue shifting to a higher gear.

CAUTION

Possible Machine Damage!

Do not down-shift to a lower gear if road speed is greater than maximum speed of the lower gear.

Traveling – Reverse

CAUTION

Machine Damage Hazard!

Engage turntable lock pin for travel. Failure to engage lock pin may allow superstructure to swing uncontrolled, damaging machine and/or property.

CAUTION

Possible Machine Damage!

Apply service brakes and bring crane to a complete stop before shifting transmission into reverse.

NOTE: Cab must be in the fully lowered position for the drive functions to operate. If cab is not in the fully lowered position and the Transmission Shift Lever is positioned to F (forward) or R (reverse) position, the Cab Not Fully Down Alert (APPENDIX C) will come on in the Alerts Bar (Figure 4-13) of the Superstructure Display Module (SDM).

Traveling in reverse is similar to traveling forward, except for shifting Transmission Shift Lever to reverse (R). Refer to *Traveling – Forward*, page 5-19

Steering

Before driving the crane, be sure to fully read, understand, and follow the information in this section and in the following sections:

- *Steering Wheel*, page 3-5
- *Rear Steer Right Button*, page 3-23 and *Rear Steer Left Button*, page 3-24
- *Driving View Screen*, page 4-152

Steering is accomplished by the Steering Wheel, the Rear Steer Left and Right Switches, and the buttons on the Driving View screen of the Superstructure Display Module (SDM).

These controls allow the operator to individually operate the front or rear wheel steering, and allow for automatic front and rear coordinated steering and crab steering as shown in Figure 5-3.

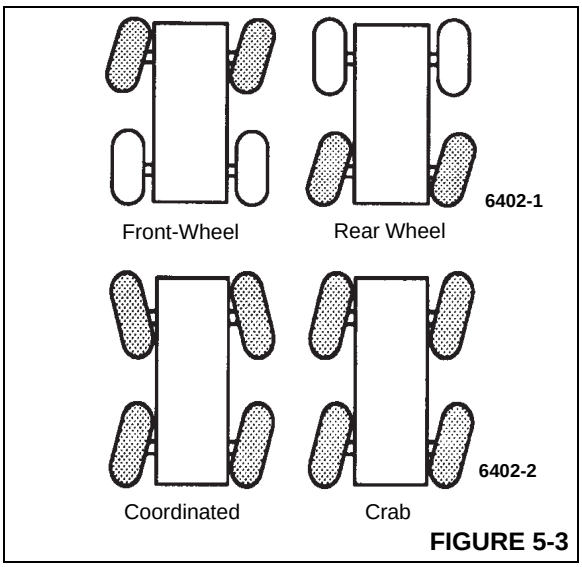


FIGURE 5-3

Front wheel steering occurs manually through direct operator inputs to the steering wheel.

Rear wheel steering can occur manually or automatically.

Three steering modes are available:

Steering Modes	Icon
Manual Rear Steering Mode	
Automatic Coordinated Steering Mode	
Automatic Crab Steering Mode	

The Manual Rear Steering Mode allows the operator to turn only the front wheels (using the Steering Wheel) or turn only the rear wheels [using the Rear Steer Right Button (1) and the Rear Steer Left Button (2) - Figure 5-4].

10710-8b **FIGURE 5-4**

NOTE: Rear Steer Right and Left Buttons, located at the left armrest, are only operable when the crane is in the Manual Rear Steering Mode. If the buttons are pushed when the Crane Control System (CCS) has them locked out and not operable, the buttons will illuminate red. When buttons are operable, they will illuminate green when pushed.

The two Automatic Steering Modes, Coordinated and Crab, allow the operator to turn the front wheels (using the steering wheel) while the Crane Control System (CCS) automatically turns the rear wheels. The Automatic Coordinated Steering Mode allows the operator to turn the front and rear wheels equally in the opposite directions while the Automatic Crab Steering Mode allows the operator to turn the front and rear wheels equally in the same direction.

The Current Active Steering Mode Icon field (1, Figure 5-5) on the Driving View screen of the SDM shows the steering mode that the crane is currently operating in.

If operator selects a different steering mode and conditions have not been met to allow the change, the icon for the newly requested steering mode will show in the Requested Steering Mode Icon field (3, Figure 5-5). When conditions are met, the control system will change to the new steering mode and update the Current Active Steering Mode Icon field (1, Figure 5-5) to show the new steering mode icon. The icon in the Requested Steering Mode Icon field will switch off.

AUTOMATIC REAR WHEEL MOVEMENT – OVERVIEW

DANGER

Rollover Hazard!

Operate rear steer ONLY at slow speeds. Operation of rear steer at high speed may result in loss of steering control and/or rollover of the crane. Death or serious injury could occur.

When the automatic rear steering modes are selected, the new mode will only engage (become active) if the crane is moving at a speed of between approximately 1.5 and 8 km/h (1 and 5 mph). If the crane is stationary or moving at more than 8 km/h (5 mph), the control system will alert the operator of the pending action but not engage the new mode until the crane starts moving or slows to less than 8 km/h (5 mph). The mode will change and the rear wheels will automatically change position to match the selected steering mode when the crane is moving at between 1.5 and 8 km/h (1 and 5 mph).

Similarly, when the automatic center rear wheels button is selected, the rear wheels will automatically center themselves only if the crane is moving at a speed of between approximately 1.5 and 8 km/h (1 and 5 mph). If the crane is stationary or moving at more than 8 km/h (5 mph), the control system will alert the operator of the pending action but not center the rear wheels until the crane starts moving or slows to less than 8 km/h (5 mph). The rear wheels will automatically center themselves and the steering mode will change to Manual Rear Steering Mode when the crane is moving at between 1.5 and 8 km/h (1 and 5 mph).

CHANGING FROM MANUAL REAR STEERING MODE TO AUTOMATIC STEERING MODE

To change from the Manual Rear Steering Mode to either the Coordinated or Crab Automatic Steering Mode, the following conditions must be met:

- Crane must be currently operating in the Manual Rear Steering Mode.
- Operator must select either the Automatic Coordinated Steering Mode Button (6, Figure 5-5) or the Automatic Crab Steering Mode Button (7) in the Driving View screen of the SDM.
- Crane must be moving at a speed of between approximately 1.5 and 8 km/h (1 and 5 mph).

When the steering mode is changed from Manual Rear Steering Mode to the Automated Coordinated Steering Mode and the above conditions are met, the control system will automatically turn the rear wheels in the opposite direction to which the front wheels are turned and to an equal steering

angle as indicated in the Front and Rear Wheel Steering Angle fields (8 and 9, Figure 5-5).

When the steering mode is changed from Manual Rear Steering Mode to the Automated Crab Steering Mode, and the above conditions are met, the CCS will automatically turn the rear wheels in the same direction to which the front wheels are turned and by an equal steering angle.

CHANGING FROM AUTOMATIC STEERING MODE TO MANUAL REAR STEERING MODE

To change from either the Automatic Coordinated or Crab Steering Mode to the Manual Rear Steering Mode, the operator must only select the Manual Rear Steering Mode Button (5, Figure 5-5) in the Driving View screen of the SDM.

NOTE: Italian cranes only - Crane speed must be less than 24 km/h (15 mph).

If rear wheels are turned left or right of center when the Manual Rear Steering Mode is selected, the rear wheels will remain in their current position. Operator can than manually turn the rear wheels using the Rear Steer Left and Right Buttons or center the rear wheels using the Center Rear Wheels Button.

CHANGING BETWEEN AUTOMATIC STEERING MODES

To change from one Automatic Steering Mode (Coordinated or Crab) to the other, the following conditions must be met:

- Crane must be currently operating in one of the Automatic Steering Modes (Coordinated or Crab).
- Operator must select the other automatic steering mode button in the Driving View screen of the SDM: Automatic Coordinated Steering Mode Button (6, Figure 5-5) or the Automatic Crab Steering Mode Button (7).
- Crane must be moving at a speed of between approximately 1.5 and 8 km/h (1 and 5 mph).

When the steering mode is changed from Automatic Crab Steering Mode to the Automated Coordinated Steering Mode, and the above conditions are met, the CCS will automatically turn the rear wheels in the opposite direction to which the front wheels are turned and to an equal turning angle as indicated in the Front and Rear Wheel Steering Angle fields (8 and 9, Figure 5-5) (refer to Figure 5-3).

When the steering mode is changed from Automatic Coordinated Steering Mode to the Automated Crab Steering Mode, and the above conditions are met, the CCS will automatically turn the rear wheels in the same direction to which the front wheels are turned and by an equal turning angle (refer to Figure 5-3).

CENTERING THE REAR WHEELS

When rear wheels have been turned left or right of center (are not straight ahead), either during operation in the Manual or Automatic Steering Mode, they can be automatically brought back to the straight ahead position using the Auto Center Rear Wheels Button.

To automatically center the rear wheels, the following conditions must be met:

- Operator must select the Auto Center Rear Wheels Button (2, Figure 5-5) in the Driving View screen of the SDM.
- Crane must be moving at a speed of between approximately 1.5 and 8 km/h (1 and 5 mph)

After centering the rear wheels using the Auto Center Rear Wheels Button, the Crane Control System (CCS) will set the crane to the Manual Rear Steering Mode.

NOTE: Rear wheels can also be centered while in the Manual Rear Steering Mode using the Rear Steer Left and Right Buttons on the left armrest. To center rear wheels, push the applicable Rear Steer Button until the Rear Wheels Not Centered Alert goes off.

MANUAL REAR STEERING MODE OPERATION

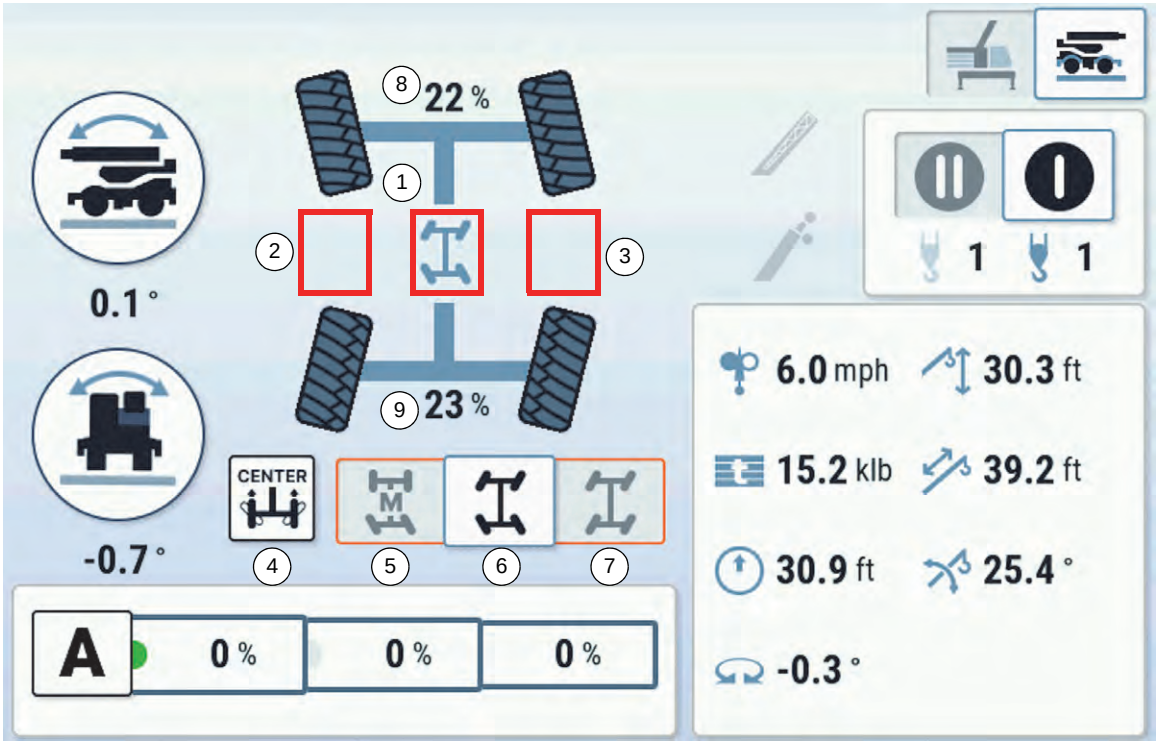
When crane is in the Manual Rear Steering Mode and the following conditions exist:

- rear wheels are manually turned left or right of center (are not straight ahead), and
- crane travel speed is increased to greater than 8 km/h (5 mph),

...the following will occur:

- Engine Over-speed Alert (APPENDIX C) will show on Alerts Bar (Figure 4-13) of the SDM.
- Speed Indicator (3, Figure 4-35) will flash on the SDM.
- Warning Buzzer at SDM will come on.

When crane travel speed is decreased to less than 8 km/h (5 mph), the warnings will stop.



10746-1

Item	Description	Item	Description
1	Current Active Steering Mode Icon Field	6	Automatic Coordinated Steering Mode Button
2	Auto Center Rear Wheels Button Selected Icon	7	Automatic Crab Steering Mode Button
3	Requested Steering Mode Icon Field	8	Front Wheel Steering Angle Field
4	Auto Center Rear Wheels Button	9	Rear Wheel Steering Angle Field
5	Manual Rear Steering Mode Button		

FIGURE 5-5

5

FRONT WHEEL STEERING

Conventional front wheel steering is done with the Steering Wheel. This method of steering should always be used when traveling at higher speeds. Also, the rear wheels should be centered when traveling at high speeds.

To turn only the front wheels, without the rear wheels turning, do the following:

1. Select the Manual Rear Steering Mode Button (5, Figure 5-5) in the Driving View screen of the SDM.
2. Turn steering wheel counter-clockwise to steer crane to the left.

   Turn steering wheel clockwise to steer crane to the right.

MANUAL REAR WHEEL STEERING (ONLY)

DANGER

Rollover Hazard!

Operate rear steer ONLY at slow speeds. Operation of rear steer at high speed may result in loss of steering control and/or rollover of the crane. Death or serious injury could occur.

NOTE: Before driving and steering the crane with the rear wheels, the operator must become familiar with the steering characteristics of a rear-steering axle, including the tail-swing of the crane.

To turn only the rear wheels, without the front wheels turning, do the following:

1. Select the Manual Rear Steer Mode Button (5, Figure 5-5) in the Driving View screen of the SDM.
2. Push and hold the Rear Steer Left Button (2, Figure 5-4) to turn the wheels on the rear axle to the left. Release the button when the wheels are turned to the desired position.

   Push and hold the Rear Steer Right Button (1, Figure 5-4) to turn the wheels on the rear axle to the right. Release the button when the wheels are turned to the desired position.

When the front wheels are straight ahead (centered) and the rear wheels are turned left of center, the crane will turn to the right as shown in Figure 5-6. Be aware of crane tail swing

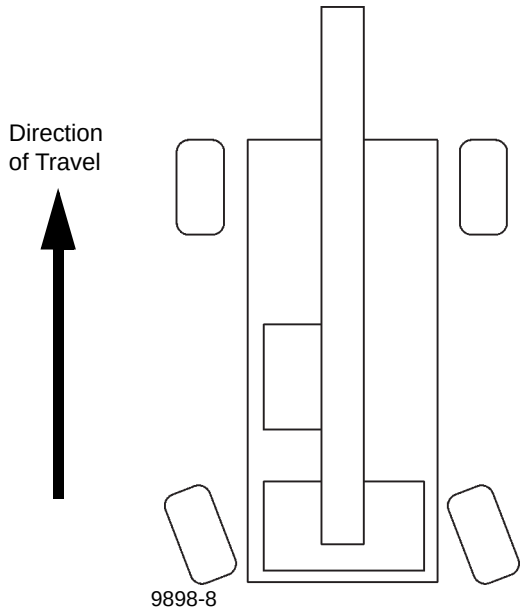


FIGURE 5-6

When the front wheels are straight ahead (centered) and the rear wheels are turned right of center, the crane will turn to the left as shown in Figure 5-7. Be aware of crane tail swing

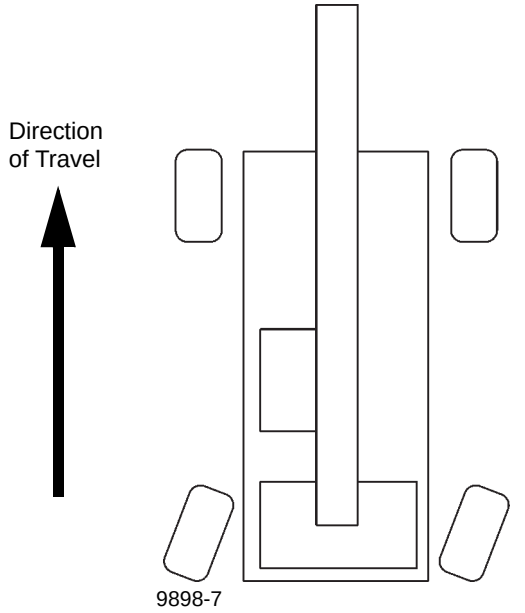


FIGURE 5-7

When rear wheels are not centered, the Rear Wheels Not Centered Alert (APPENDIX C) comes on in the Alerts Bar (Figure 4-13) of the SDM.

To straighten the rear wheels, select the Auto Center Rear Wheels Button (4, Figure 5-5) on the Driving View screen.

CRAB STEERING

Crab Steering occurs when the front wheels are turned in one direction and the rear wheels are turned in the same direction. This type of steering causes the crane to drive diagonally, or crab-like as shown in Figure 5-8.

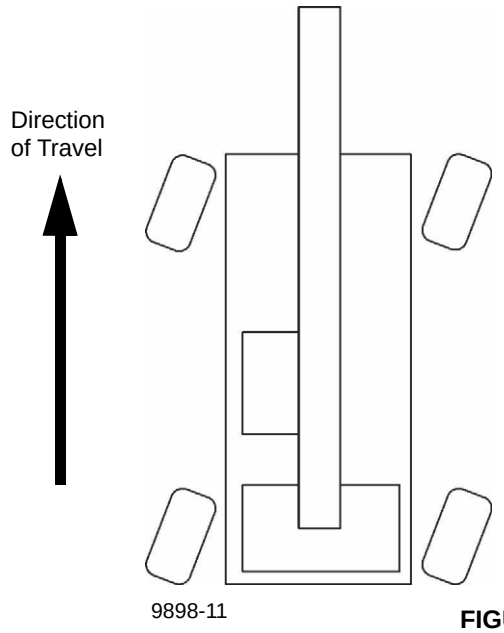


FIGURE 5-8

Crab steering can occur automatically or manually.

To drive the crane in the Automatic Crab Steering Mode, do the following:

1. Select the Automatic Crab Steering Mode Button (7, Figure 5-5) in the Driving View screen of the SDM.
2. Drive crane and turn steering wheel left or right as needed.

   CCS will automatically turn the rear wheels, by an equal amount, in the same direction in which the operator turns the steering wheel (front wheels).
3. To return to front wheel or rear wheel steering only, select the Manual Rear Steering Mode Button (5, Figure 5-5) in the Driving View screen.

To manually drive the crane in a crab steering manner, do the following:

1. Select the Manual Rear Steering Mode Button (5, Figure 5-5) in the Driving View screen of the SDM.
2. Drive crane and turn steering wheel to the left (counter-clockwise) while also pushing the Rear Steer Left Button (2, Figure 5-4) to turn rear wheels to the left of center,

   or

   Drive crane and turn steering wheel to the right (clockwise) while also pushing the Rear Steer Right Button (1, Figure 5-4) to turn rear wheels to the right of center.

COORDINATED STEERING

Coordinated Steering occurs when the front wheels are turned in one direction and the rear wheels are turned in the opposite direction. This type of steering causes the crane to drive with a smaller turning radius as shown in Figure 5-9.

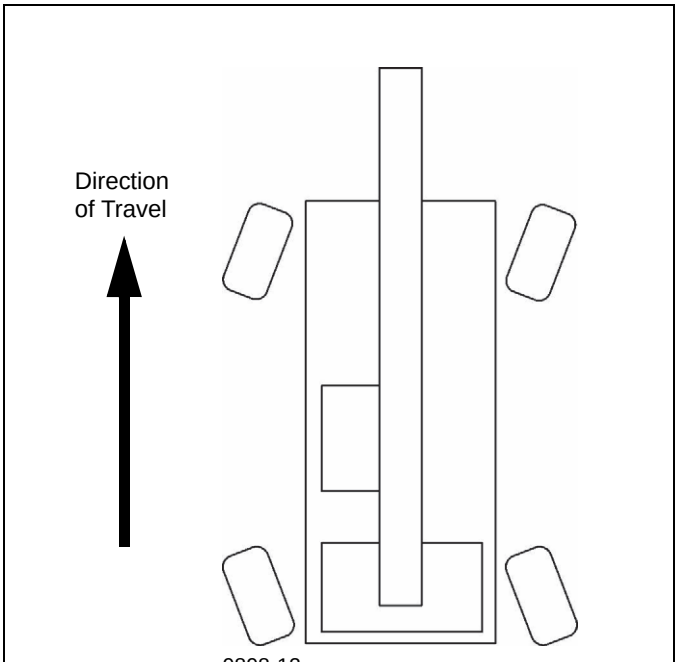


FIGURE 5-9

Coordinated steering can occur automatically or manually.

To drive the crane in the automatic coordinated steering mode, do the following:

1. Select the Automatic Coordinated Steering Mode Button (6, Figure 5-5) in Driving View screen of the SDM.
2. Drive crane and turn steering wheel left or right as needed.

   CCS will automatically turn the rear wheels, by an equal amount, in the opposite direction in which the operator turns the steering wheel (front wheels).
3. To return to front wheel or rear wheel steering only, select the Manual Rear Steering Mode Button (5, Figure 5-5) in the Driving View screen.

To manually drive the crane in a coordinated steering manner, do the following:

1. Select the Manual Rear Steering Mode Button (5, Figure 5-5) in the Driving View screen of the SDM.
2. Drive crane and turn steering wheel to the left (counter-clockwise) while also pushing the Rear Steer Right Button (1, Figure 5-4) to turn rear wheels to the right of center,

   or

   Drive crane and turn steering wheel to the right (clockwise) while also pushing the Rear Steer Left Button (2, Figure 5-4) to turn rear wheels to the left of center.

Four-Wheel Drive Operation

CAUTION

Machine Damage Hazard!

Do not tow or pull in 1st gear with Two-Wheel Drive/Four-Wheel Drive Switch in the two-wheel drive position. Severe damage to drivetrain will result. Always engage four-wheel drive.

If more traction is required due to slipping or spinning wheels, engage the rear axle drive as follows:

CAUTION

Possible Machine Damage!

Before shifting from two-wheel drive to four-wheel drive (or from four back to two), crane travel must be stopped.

1. Stop crane by pushing Service Brake Foot Pedal.
2. Position Transmission Shift Lever to neutral (N) position.
3. Position Two-Wheel Drive/Four-Wheel Drive Switch to four-wheel drive.
4. Select gear speed and direction of travel with Transmission Shift Lever and Knob.
5. Drive crane following the instructions provided in *Traveling – Forward*, page 5-19.
6. Return Two-Wheel Drive/Four-Wheel Drive Switch to two-wheel drive position as soon as two-wheel traction will suffice and crane motion has stopped.

   Service Brake Foot Pedal must be pushed and Transmission Shift Lever must be in Neutral (N) position to shift from four-wheel drive to two-wheel drive.

Differential Lock Operation

CAUTION

Unexpected Operation!

When using differential lock, steering characteristics may be affected.

Use four-wheel drive to gain adequate traction before using differential lock.

Do not operate differential lock when traveling downhill; at speeds greater than 8 km/h (5 mph); on hard, dry surfaces; and/or during axle spin-out.

NOTE: Differential lock will not operate unless the Two-Wheel Drive/Four-Wheel Drive Switch (6, Figure 3-2) is in the four-wheel drive position.

GENERAL

The purpose of the differential lock is to provide maximum traction and control on poor road or highway surfaces. When differential locks are engaged, the clutch collar completely locks the differential case, gearing, and axle shafts together, maximizing traction to both wheels of each axle. The lock position will also protect against spin-out.

When normal driving conditions exist (during periods of good traction), differential locks should not be disengaged. Axles should be allowed to operate with differential action between both wheels.

WARNINGS

Obey the following warnings when using the differential lock function.

CAUTION

Possible Machine Damage!

When driving on hard, dry surfaces with differentials locked, do not turn the wheels. Damage to drive line components can result.

Do not lock differentials when crane is moving or when wheels are slipping. Damage to differentials can result.

CAUTION

Possible Loss of Vehicle Stability!

Do not lock differentials when vehicle is traveling down steep grades and traction is minimal.

1. Engage the differential locks only when additional traction is needed.
2. Disengage the differential locks when traction is regained.
3. Engage the differential locks only when crane is stopped and transmission is in four-wheel low.
4. If differential locks fail to engage, slightly move the crane forward or reverse while pushing and holding the Differential Lock Switch.
5. Do not use full engine power while differential locks are engaged.
6. When driving with differentials locked, always keep front and rears wheels in the straight ahead position. Do not turn the front or rear wheels from a straight path more than absolutely necessary.
7. Locked differentials cause the crane's turning radius to increase, creating an understeer condition. Use caution, good judgment, and drive at low speeds when operating vehicle with locked differentials.
8. Engage differential locks only when maximum traction is needed on poor road or highway surfaces. Always disengage differential locks when the need for maximum traction has passed or when traveling on good road or highway surfaces.

OPERATION

Engage differential locks by doing the following:

NOTE: The Crane Control System (CCS) only allows the differential locks to be engaged for a maximum of 60 seconds at a time, regardless of whether the Differential Lock Button is pushed and held for a longer time period.

1. With the crane stopped and the transmission shifted to four-wheel low, push and hold the Differential Lock Switch (4, Figure 3-2).

NOTE: When differentials are locked, the Differential Lock Indicator (17, Figure 4-35) comes on in the Operator Area of the Superstructure Display Module (SDM).

2. Cautiously drive over poor road condition.

When adverse condition has passed, disengage the differential locks by doing the following:

1. Stop the crane, then release the Differential Lock Switch.
2. If differential locks do not disengage, slightly move the crane forward or backward until the Differential Lock Indicator goes off.
3. Resume driving at a normal speed using good driving judgment.

CRANING FUNCTIONS

Controller Operation

The controller operation for crane functions is proportional, which means the closer the lever is to neutral (center), the slower the system responds.

NOTE: Always operate controllers with slow, even pressure.

Proper Crane Leveling

If a crane is not level within 1% of grade, allowable capacities must be reduced. Therefore, if lifting on rubber or outriggers, it is essential the crane is level to ≤1% of grade. The digital bubble level located in the Outrigger Beam Status Area (15, Figure 4-196) of the Superstructure Display Module (SDM) is calibrated to be accurate within 0.1° of grade.

To properly level the crane, the boom must be positioned over front of the crane, fully lowered to horizontal and fully retracted, and the cab must be in its fully lowered position. Raise and level crane following instructions in the section *Using the Outriggers*, page 5-28.

A working crane may settle during lifting operations. Frequently check the crane for level. When rechecking the crane for level, the boom must again be positioned over the front of the crane, fully lowered to horizontal and fully retracted, and the cab must be in its fully lowered position. If necessary, level the crane again following instructions in the section *Using the Outriggers*, page 5-28.

5

Using the Outriggers

DANGER

Death or serious injury could result from being crushed by moving machinery or by improper setup on outriggers.

Make sure all pins and floats are properly installed and the outrigger beams are properly extended before lifting on outriggers.

Stand clear while outriggers are being extended and retracted.

WARNING

Be sure the outriggers are properly extended and set, and the crane is level for operation on outriggers.

All four outrigger beams must be equally set to the fully retracted, mid-extend, or fully extended position before beginning operation unless crane is equipped with the MAXbase option and a MAXbase load chart is selected.

WARNING

When operating the crane on outriggers, the outriggers should always be extended and set in the proper position corresponding to the load capacity chart to be used.

CAUTION

Possible Machine Damage!

After the crane has been manually or auto-leveled to ≤1% of grade, the operator must verify that all four tires are off the ground before making a lift.

Performing a lift with tires touching the ground can result in damage to the crane axles.

If one or more tires are touching the ground, the operator must add more cribbing under the outrigger floats and then re-level the crane.

SETTING THE OUTRIGGERS MANUALLY

NOTE: ECO mode does not work when operating the outriggers.

1. Enable the outrigger function by doing the following:
   - Shift transmission to neutral
   - Engage the parking brake
   - Engage four-wheel drive
   - Disable all crane functions
   - Fully lower cab
2. Position the outrigger floats on the ground directly out from where the outriggers will be properly extended (fully retracted, mid-extend, or fully extended).
3. If required, extend the outrigger beams to the mid-extend (50% for GRT765 / 54% for GRT780) or fully extended (100%) position using the Outrigger Extend and Retract Buttons (15, 16, Figure 3-8) and the Superstructure Display Module (SDM) (refer to *Outrigger Extend/Retract*, page 4-40).

   Each outrigger beam is equipped with a internal length sensor that shows the extended length of an outrigger beam as a percentage in the Outrigger Beam Status Area (15, Figure 4-196) of the SDM screen.

   When fully extending the outriggers (100%), remove the mid-span pin. When extending the outriggers to the mid-extend position (50% for GRT765 / 54% for GRT780), install the mid-span pin.

DANGER

Tipping Hazard!

Unless crane is equipped with the MAXbase option and a MAXbase load chart is selected in the Rated Capacity Limiter (RCL), all four outrigger beams must be **equally** deployed to one of three positions matching the load chart to be used before beginning operation, which include fully retracted, mid-extend, or fully extended. Do not operate the crane with the outriggers in any other position.

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

4. Make sure the pin is removed from each of the four outrigger floats, then extend the outrigger jacks using the Outrigger Extend Button and the SDM.

   Extend the outrigger jacks until the ball at the end of each jack is seated inside its related float socket. Secure the floats to the jacks by re-installing the pins.

   Refer to *Extending/Retracting Individual Outrigger Jacks*, page 4-44 to operate individual outrigger jacks.

   Refer to *Extending/Retracting the Four Outrigger Jacks at the Same Time (4x)*, page 4-45 to operate the four jacks at the same time.

5. Extend the jacks as necessary until all tires are off the ground and crane is level as indicated by the digital bubble level located in the Outrigger Beam Status Area (15, Figure 4-196) of the SDM screen.

NOTE: After leveling the crane manually, operator must verify that all four tires are off the ground before making a lift. If one or more tires are touching the ground, the operator must add cribbing under the outrigger floats and re-level the crane.

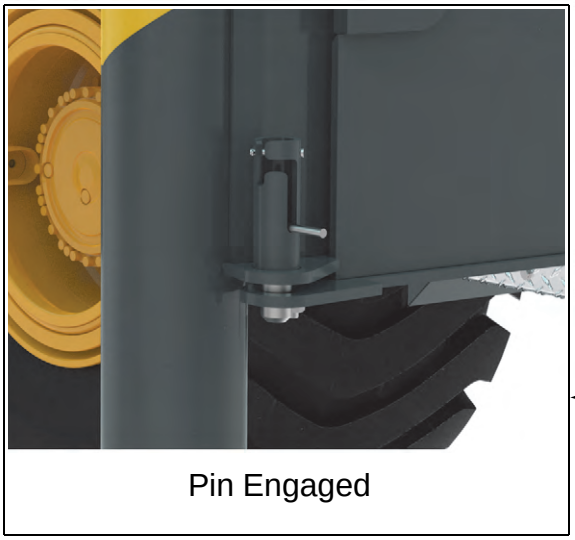
DANGER

Tipping Hazard!

Operator must select the proper rigging code from the load chart and RCL program for the outrigger position selected. The Outrigger Monitoring System (OMS) will NOT change the rigging code to match the actual outrigger position.

Pin Disengaged

Outriggers in Fully Extended Position



Pin Engaged

Outriggers in Mid-Extended Position

10710-42a to 10710-42d

FIGURE 5-10

SETTING THE OUTRIGGERS USING THE AUTO-LEVEL FEATURE

NOTE: ECO mode does not work when operating the outriggers.

1. Enable the outrigger function by doing the following:

- Shift transmission to neutral
- Engage the parking brake.
- Engage four-wheel drive
- Disable all crane functions
- Fully lower cab

2. Position the outrigger floats on the ground directly out from where the outriggers will be properly extended (fully retracted, mid-extend, or fully extended).

3. If required, extend the outrigger beams to the mid-extend (50% for GRT765 / 54% for GRT780) or fully extended (100%) position using the Outrigger Extend and Retract Buttons (15, 16, Figure 3-8) and the Superstructure Display Module (SDM) (refer to *Outrigger Extend/Retract*, page 4-40).

Each outrigger beam is equipped with a internal length sensor that shows the extended length of an outrigger beam as a percentage in the Outrigger Beam Status Area (15, Figure 4-196) of the SDM screen.

When fully extending the outriggers (100%), remove the mid-span pin. When extending the outriggers to the mid-extend position (50% for GRT765 / 54% for GRT780), install the mid-span pin.

DANGER

Tipping Hazard!

Unless crane is equipped with the MAXbase option and a MAXbase load chart is selected in the Rated Capacity Limiter (RCL), all four outrigger beams must be **equally** deployed to one of three positions matching the load chart to be used before beginning operation, which include fully retracted, mid-extend, or fully extended. Do not operate the crane with the outriggers in any other position.

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

4. Make sure the pin is removed from each of the four outrigger floats, then extend the outrigger jacks using the Outrigger Extend Button and the SDM.

Extend the outrigger jacks until the ball at the end of each jack is seated inside its related float socket. Secure the floats to the jacks by re-installing the pins.

Refer to *Extending/Retracting Individual Outrigger Jacks*, page 4-44 to operate individual outrigger jacks.

Refer to *Extending/Retracting the Four Outrigger Jacks at the Same Time (4x)*, page 4-45 to operate the four jacks at the same time.

NOTE: Before starting the auto-level process, operator must manually extend the outrigger jacks until all four tires are slightly off the ground.

5. Start the automatic level process using the Outrigger Extend Button and the SDM (refer to *Leveling the Crane Using Auto-level*, page 4-46).

The crane will react in the following manner:

a. Briefly extend all four outrigger jacks.

b. Briefly extend the two front jacks.

c. Briefly extend the two rear jacks.

d. Adjust the two left side or two right side jacks until a level position is reached.

There may be several long pauses after the crane makes a jack height adjustment for the inclination sensor to stabilize – keep holding the buttons through each pause.

Auto-level process is complete when crane is out-of-level by ≤1% of grade.

NOTE: After the auto-level process has completed, operator must verify that all four tires are off the ground before making a lift. If one or more tires are touching the ground, the operator must add cribbing under the outrigger floats and re-level the crane.

DANGER

Tipping Hazard!

Operator must select the proper rigging code from the load chart and RCL program for the outrigger position selected. The Outrigger Monitoring System (OMS) will NOT change the rigging code to match the actual 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 detecting 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 (0%), mid-extend (50% for GRT765 / 54% for GRT780), and fully extended (100%).

If crane is setup on outriggers and an on-outrigger load chart is selected when programming the RCL, then the OMS indicates to the RCL the horizontal position of each of the four outrigger beams. If the outrigger beam configuration programmed by the operator does not match that which is detected by the Outrigger Monitoring System, an Outrigger Monitoring System Override Indicator will show on the Confirmation Screen of the Superstructure Display Module (SDM) (refer to *RCL Confirmation Screen*, page 4-125).

The RCL does not lock-out the crane or select a different load chart based on the outrigger beam position that is identified by the OMS.

NOTE: The OMS requires the detected length of the outrigger beam position to be within ±3% of the target (programmed) outrigger position to be recognized as a valid setup.

STOWING THE OUTRIGGERS

1. Enable the outrigger functions by doing the following:
   - Shift transmission to neutral
   - Engage the Parking Brake.
   - Engage four-wheel drive
   - Disable all crane functions
   - Fully lower cab
2. Retract the four outrigger jacks using the Outrigger Retract Button and the Superstructure Display Module (SDM).

   Retract the four outrigger jacks until there is sufficient clearance to remove the outrigger floats.

   Refer to *Extending/Retracting Individual Outrigger Jacks*, page 4-44 to operate individual outrigger jacks.

   Refer to *Extending/Retracting the Four Outrigger Jacks at the Same Time (4x)*, page 4-45 to operate the four jacks at the same time.

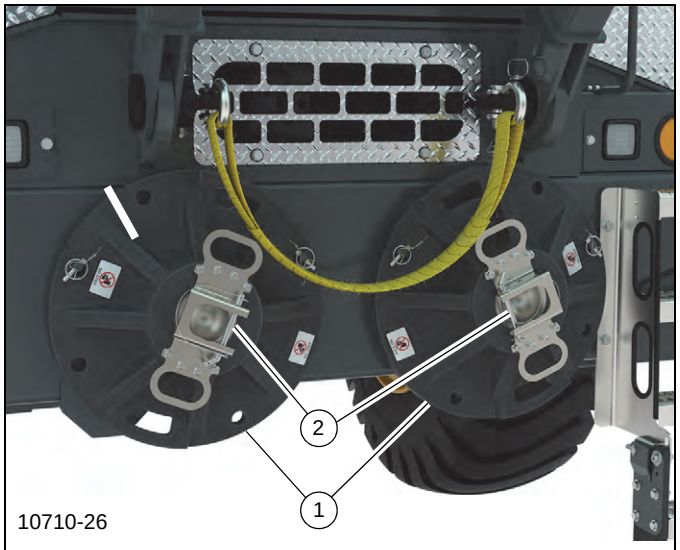
DANGER

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

3. Unlock the outrigger floats from the jacks by removing the pin from each of the floats. Keep feet and hands clear as the floats fall to the ground.
4. Continue to retract jacks until all four jacks are fully retracted.
5. If required, fully retract the outrigger beams using the Outrigger Retract Button and the SDM.

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

6. Stow outrigger floats (Figure 5-11).



Item	Description
1	Outrigger Float Assembly
2	Quick Pin with Lanyard

FIGURE 5-11

Swinging the Boom and Superstructure

DANGER

Crushing Hazard!

Death or serious injury could result from being crushed by moving machinery. Before activating swing, sound the horn and verify all personnel are clear of rotating and moving parts.

Make sure the area around the boom, turntable and counterweights are clear of all obstructions and personnel before swinging.

NOTE: The swing brake automatically releases when the swing controller is moved from the center (neutral) position and it re-engages when the controller is returned to the center position.

The Swing Brake Indicator (16, Figure 4-35) on the Superstructure Display Module (SDM) comes on when the swing brake is applied and goes off when the swing brake is released.

NOTE: The Crane Control System (CCS) automatically applies counter pressure to the swing motor to slow the swing speed if the superstructure is rotating faster than the controller is commanding. The operator may increase the counter pressure by pushing the controller toward the opposite direction of swing motion.

NOTE: Always operate controller with a slow, even pressure.

NOTE: Swing Controller can be pushed through neutral and toward opposite direction of swing to help slow and stop the swing motion.

1. Push the Swing Enable/Disable Button on the Function Status Bar (4, Figure 4-38) of the Superstructure Display Module (SDM) to enable the swing function.
2. **Dual-Axis Controllers** – Push controller on left armrest to the right and hold to swing right (rotates turntable clockwise) or push controller to the left and hold to swing left (rotates turntable counterclockwise).

   Single-Axis Controller (optional) – Push outer controller on left armrest forward and hold to swing right (rotates turntable clockwise) or pull controller rearward and hold to swing left (rotates turntable counterclockwise).
3. To stop swinging, let swing controller return to the center (neutral) position and apply the swing brake using the Swing Brake Pedal (refer to *Swing Brake Pedal*, page 3-31).

5

Raising and Lowering the Boom

RAISING THE BOOM

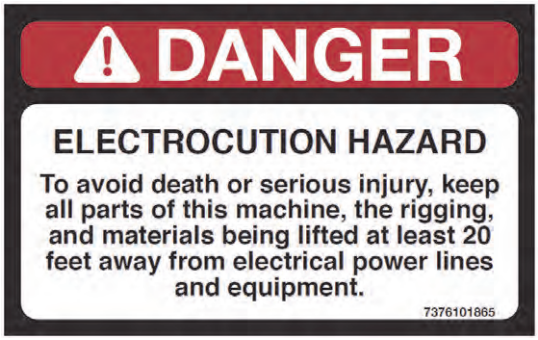
DANGER

Crushing Hazard!

Keep area above and below boom clear of all obstructions and personnel when elevating the boom.

CAUTION

Before raising boom, ensure large access cover on top of boom base section is installed.



1. Push the Boom Lift Enable/Disable Button on the Function Status Bar (Figure 4-38) of the Superstructure Display Module (SDM) to enable the boom lift function.
2. **Dual-Axis Controllers** – Push controller on right armrest to the left and hold to raise the boom.

   Single-Axis Controllers (optional) – Pull inner controller on right armrest rearward and hold to raise the boom.
3. When boom angle reaches the desired elevation, let controller return to the center (neutral) position to stop boom lift function.

LOWERING THE BOOM

DANGER

Crushing and/or Tipping Hazard!

Keep area beneath boom clear of all obstructions and personnel when lowering boom.

Long cantilever booms can create a tipping condition, even when unloaded in an extended, lowered position. Do not lower the boom below the minimum boom angle shown on load chart.

DANGER

Two-Block Hazard!

To avoid death or serious injury, keep load handling devices away from tip of boom or boom extension when extending or lowering the boom and when hoisting up.

When lowering boom, simultaneously let out hoist rope to prevent two-blocking the boom nose and the hook block.

CAUTION

The closer the load is carried to the boom nose, the more important it becomes to simultaneously let out hoist rope as boom is lowered.

1. Push the Boom Lift Enable/Disable Button on the Function Status Bar (Figure 4-38) of the Superstructure Display Module (SDM) to enable the boom lift function.
2. **Dual-Axis Controllers** – Push controller on right armrest to the right and hold to lower the boom.

   Single Axis Controller (optional) – Push inner controller on right armrest forward and hold to lower the boom.
3. When boom angle reaches the desired elevation, let controller return to the center (neutral) position to stop boom lower function.

Telescoping the Boom

The GRT765 is equipped with a four-section, full power, sequenced and synchronized boom. The GRT780 is equipped with a five-section, full power, sequenced and synchronized boom. The operator must use the telescope controller (standard) or telescope foot pedal (cranes with auxiliary hoist) in combination with the automatic and manual telescope modes selected in the Superstructure Display Module (SDM) to telescope the boom.

The boom telescope system has three automatic telescope modes and a manual mode, as described in the following two tables.

TABLE 6. GRT765 Crane Telescope Modes

Mode	Description
A	T1 remains retracted until T2-3 are fully extended. Control system manages telescoping sequence.
X	T2-3 remain retracted until T1 is extended to 50%. Then T2-3 extend to 100%. Then T1 extends to 100% Control system manages telescoping sequence.
B	T2-3 remain retracted until T1 is fully extended. Control system manages telescoping sequence.
M	T1 and T2-3 have no defined extend or retract order. Operator controls telescoping sequence. Charted capacities strictly based on boom length, not percentage extension. No “out of sequence” possible.

TABLE 7. GRT780 Crane Telescope Modes

Mode	Description
A	T1 remains retracted until T2-4 are fully extended. Control system manages telescoping sequence.
X	T2-4 remain retracted until T1 is extended to 50%. Then T2-4 extend to 100%. Then T1 extends to 100% Control system manages telescoping sequence.
B	T2-4 remain retracted until T1 is fully extended. Control system manages telescoping sequence.
M	T1 and T2-4 have no defined extend or retract order. Operator controls telescoping sequence. Charted capacities strictly based on boom length, not percentage extension. No “out of sequence” possible.

The operator selects the desired telescope mode in the Superstructure Display Module (SDM). Refer to *Boom Mode Selector/Indicator Area*, page 4-140 for more information about selecting the Telescope Boom Mode.

When extending the boom with either the telescope foot pedal or the telescope controller, be aware of the following.

DANGER

Crushing Hazard!

Check *Load Chart* for the maximum load at a given radius, boom angle, and boom length before extending boom with a load.

CAUTION

Before extending boom, ensure large access cover on top of boom base section is installed.

When extending boom, simultaneously let out hoist cable to prevent two-blocking boom nose and hook block.

When retracting the boom, be aware of the following.

DANGER

Crushing Hazard!

When retracting the boom, the load will lower unless the hoist cable is taken in at the same time

1. Push the Telescope Enable/Disable Button on the Function Status Bar (Figure 4-38) of the Superstructure Display Module (SDM) to enable the telescope function.
2. **Dual-Axis Controllers** (cranes not equipped Auxiliary hoist) – Push controller on left armrest forward and hold to extend the boom. Pull controller rearward and hold to retract the boom.

   Single-Axis Controllers – Push inner controller on left armrest forward and hold to extend the boom. Pull controller rearward and hold to retract the boom.

   Telescope Pedal (cranes equipped with auxiliary hoist) – Push on top of pedal and hold to extend the boom. Push on bottom of pedal and hold to retract the boom.
3. When boom has extended or retracted to the desired length, let controller or pedal return to neutral position to stop boom movement.

Raising and Lowering the Main Hoist Rope

DANGER

Crushing Hazard!

Keep area beneath load clear of all obstructions and personnel when lowering or raising rope (load).

DANGER

Crushing Hazard!

Do not jerk controller when starting or stopping hoist. Jerking controller causes load to bounce, which could result in possible damage to the crane.

NOTE: When load is stopped at desired height, the automatic brake will engage and hold the load as long as the controller remains in neutral.

LOWERING THE MAIN HOIST ROPE

1. Push the Main Hoist Enable/Disable Button on the Function Status Bar (Figure 4-38) of the Superstructure Display Module (SDM) to enable the main hoist function.
2. **Dual-Axis Controllers** – Push controller on right armrest forward and hold to lower the main hoist rope.

   Single-Axis Controllers (optional) – Push outer controller on right armrest forward and hold to lower the main hoist rope.
3. When hook block/overhaul ball gets to the desired height, let controller return to the center (neutral) position to stop lowering the main hoist rope.

NOTE: When the main hoist controller is pushed forward to lower the rope, the Hoist Rotation Indicator (6, Figure 3-8) pulses to indicate to the operator that the main hoist is operating.

RAISING THE MAIN HOIST ROPE

DANGER

Two-Block Hazard!

To avoid death or serious injury, keep load handling devices away from the tip of the boom or boom extension when extending or lowering the boom and when hoisting up.

1. Push the Main Hoist Enable/Disable Button on the Function Status Bar (Figure 4-38) of the Superstructure Display Module (SDM) to enable the main hoist function.
2. **Dual-Axis Controllers** – Pull controller on right armrest rearward and hold to raise the main hoist rope.

   Single-Axis Controllers (optional) – Pull outer controller on right armrest rearward and hold to raise the main hoist rope.
3. When hook block/overhaul ball gets to the desired height, let controller return to the center (neutral) position to stop raising the main hoist rope.

NOTE: When the main hoist controller is pulled rearward to raise the rope, the Hoist Rotation Indicator (6, Figure 3-8) pulses to indicate to the operator that the main hoist is operating.

Raising and Lowering the Auxiliary Hoist Rope

DANGER

Crushing Hazard!

Keep area beneath load clear of all obstructions and personnel when lowering or raising rope (load).

DANGER

Crushing Hazard!

Do not jerk controller when starting or stopping hoist. Jerking controller causes load to bounce, which could result in possible damage to the crane.

NOTE: When load is stopped at desired height, the automatic brake will engage and hold the load as long as the controller remains in neutral.

LOWERING THE AUXILIARY HOIST ROPE

1. Push the Auxiliary Hoist Enable/Disable Button on the Function Status Bar (Figure 4-38) of the Superstructure Display Module (SDM) to enable the auxiliary hoist function.
2. **Dual-Axis Controllers** – Push controller on left armrest forward and hold to lower the auxiliary hoist rope.

   Single-Axis Controllers (optional) – Push inner controller on left armrest forward and hold to lower the auxiliary hoist rope.
3. When hook block/overhaul ball gets to the desired height, let controller return to the center (neutral) position to stop lowering the auxiliary hoist rope.

NOTE: When the auxiliary hoist controller is pushed forward to lower the rope, the Hoist Rotation Indicator (6, Figure 3-8) pulses to indicate to the operator that the auxiliary hoist is operating.

RAISING THE AUXILIARY HOIST ROPE

DANGER

Two-Block Hazard!

To avoid death or serious injury, keep load handling devices away from the tip of the boom or boom extension when extending or lowering the boom and when hoisting up.

1. Push the Auxiliary Hoist Enable/Disable Button on the Function Status Bar (Figure 4-38) of the Superstructure Display Module (SDM) to enable the auxiliary hoist function.
2. **Dual-Axis Controllers** – Pull controller on left armrest rearward and hold to raise the auxiliary hoist rope.

   Single-Axis Controllers (optional) – Pull inner controller on left armrest rearward and hold to raise the auxiliary hoist rope.
3. When hook block/overhaul ball gets to the desired height, let controller return to the center (neutral) position to stop raising the auxiliary hoist rope.

NOTE: When the auxiliary hoist controller is pulled rearward to raise the rope, the Hoist Rotation Indicator (6, Figure 3-8) pulses to indicate to the operator that the auxiliary hoist is operating.

Selecting the Hoist Speed Range

CAUTION

Do not change hoist speed while hoist is operating.

Hoist speed cannot be changed while hoist is operating. Before changing hoist speed, the controller must be placed in the Neutral (center) position.

When the main or optional auxiliary hoist function is enabled at high speed, the related Main Hoist High Speed Indicator (7, Figure 4-38) or Auxiliary Hoist High Speed Indicator in the Status Bar area of the SDM will come on. These indicators give a visual indication of the current speed selected for the related hoist.

DUAL-AXIS CONTROLLERS

On dual-axis controllers (2, 21, Figure 3-8), push and release the right side of Hoist Speed Toggle Switch (5, Figure 3-8) to change main hoist speed to high – push and release switch again to return main hoist speed to normal.

When crane is equipped with the optional auxiliary hoist, push and release the left side of Hoist Speed Toggle Switch (5, Figure 3-8) to change auxiliary hoist speed to high – push and release switch again to return auxiliary hoist speed to normal.

NOTE: Hoist speed cannot be changed while hoist is operating. Before changing hoist speed, the controller must be placed in the Neutral (center) position.

SINGLE-AXIS CONTROLLERS

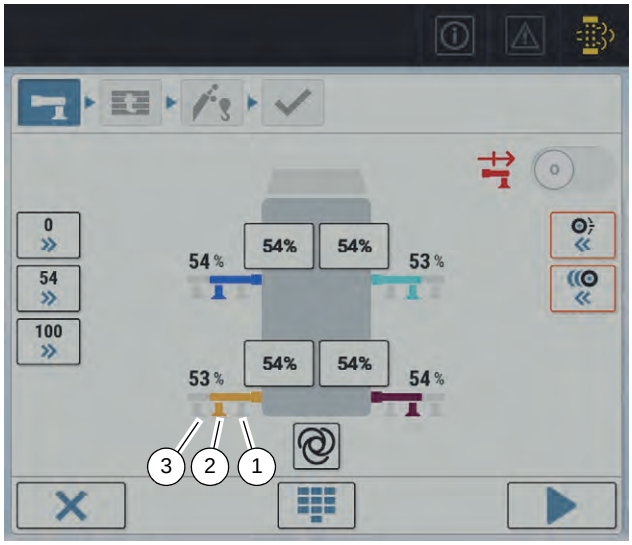
On cranes equipped with single-axis controllers, the hoist speed is toggled by buttons at the right armrest.

Push and release the Main Hoist Speed Toggle Button (9, Figure 3-12) one time to change main hoist speed to high – push button again to return main hoist speed to normal.

Push and release the optional Auxiliary Hoist Speed Toggle Button (10, Figure 3-12) one time to change auxiliary hoist speed to high – push button again to return auxiliary hoist speed to normal.

5

PRE-LOAD CHECK



Item	Description
1	Fully Retracted (0%)
2	Mid-Extended (50%) - GRT765 Mid-Extended (54%) - GRT780
3	Fully Extended (100%)

10746-102 **FIGURE 5-12**

After crane has been readied for service, an operational check of all crane functions (with no load applied) should be performed. Refer to *Craning Functions*, page 5-27 for details as to how to operate the different crane functions.

Pre-load check is as follows:

CAUTION

Run engine at or near governed RPM during operation of all crane functions.

1. Extend and set outriggers and level crane.
2. Raise, lower, and swing boom right and left at least 45°.
3. Fully telescope boom out and back in at a 75° boom angle, ensuring all sections extend and retract properly.
4. With boom fully retracted and at maximum boom angle, lower the hook block/overhaul ball to near ground level.

   Fully extend the boom while keeping the block/ball at near ground level.

CAUTION

Hoist Rope Damage Hazard!

Hoist rope that is not properly tensioned can cause rope diving, which could result in rope damage.

Always properly tension the hoist rope by spooling as much of the rope onto the hoist with as much load available and allowable as indicated by the *Load Chart*.

5. With a load applied, fully retract the boom while keeping the hook block/overhaul ball at near ground level.

   Once boom is fully retracted, raise block/ball up to boom tip.

   If block/ball rotates more than 90° during this procedure, turn dead-end becket one revolution opposite the direction that the block/ball rotates as the fall length increases. Repeat as necessary until block/ball rotates no more than 90°.

Using the Load Chart

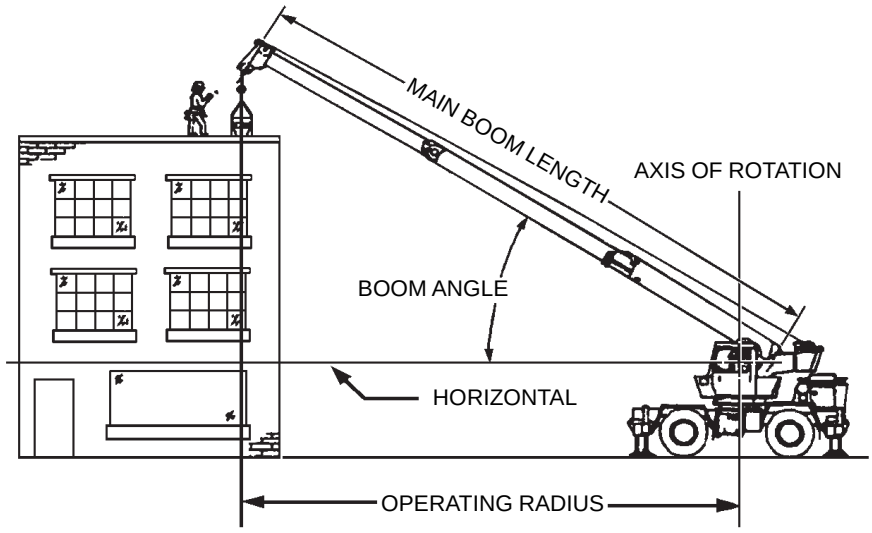
NOTE: One of the most important tools of every Grove crane is the *Load Chart Manual* in the crane operator's cab.

NOTE: Refer to Figure 5-13 for terms to know in determining lifting capacities.

The *Load Chart Manual* contains crane lifting capacities in all allowable lifting configurations and must be thoroughly understood by the operator.

A sample load chart is shown in Figure 5-14. The left column is the load radius, which is the distance from axis of crane rotation to load center of gravity. The top row lists various boom lengths from fully retracted to fully extended (with swingaway boom extension). The number at the intersection of the left column and top row is the total load limit for that load radius and boom length. The boom angle is also shown in parenthesis.

Another important section is the range diagram shown in Figure 5-15. The range diagram shows operating radius and tip height that can be achieved at a given boom length and angle. If the operator knows radius and tip height required for a specific lift, the angle and boom length can quickly be determined from the range diagram. Or, if an operator knows boom length and angle, they can quickly determine tip height and operating radius.



TERMS TO KNOW

4605

FIGURE 5-13

A standard lifting diagram is included for 360 degrees of swinging operation. This diagram shows locations of the outrigger jack cylinders in full extended position and is used to mark lifting area boundaries.

Another section contains notes for lifting capacities. Be sure to read and understand all notes concerning lifting capacities.

Capacity reductions for wind speed are also included in the *Load Chart Manual*.

The load chart also gives weight reductions for Grove load handling devices such as hook blocks, overhaul balls, boom extension sections, etc., which must be considered as part of the load. Weight of any other load handling devices such as chains, slings, or spreader bars must also be added to the weight of the load.

NOTE: Information in the following paragraph is an example only of how to compute a lift. Numbers may not match load chart in the crane cab.

Example: A concrete beam weighing 2268 kg (5000 lb) needs to be lifted to a height of 9.1 m (30 ft) at a radius of 15.2 m (50 ft) (maximum). The range diagram (Figure 5-15) indicates the boom must be extended to 20.8 m (68.2 ft) to reach a height of 9.1 m (30 ft) at a radius of 15.2 m (50 ft).

First check the crane for load handling devices. In our example, the crane is equipped with a auxiliary boom nose (rooster sheave) and a five ton overhaul ball. The rooster sheave is 50 kg (110 lb), and the overhaul ball is 78 kg (172 lb) for a total of 128 kg (282 lb). The lift requires slings and spreader bars weighing 159 kg (350 lb) which makes the total weight for the load handling devices 286 kg (632 lb).

A check of the load chart (Figure 5-14) for a 15.2 m (50 ft) radius and 20.8 m (68.2 ft) of boom length shows a capacity of 9480 kg (20900 lb) on outriggers 360 degrees.

Subtract load handling weight of 286 kg (632 lb) from load capacity of 9480 kg (20900 lb). The result is a weight capacity of 9194 kg (20268 lb) for 360 degrees.

The load chart allows us to make the lift for 360 degrees with a boom angle about 38 degrees.

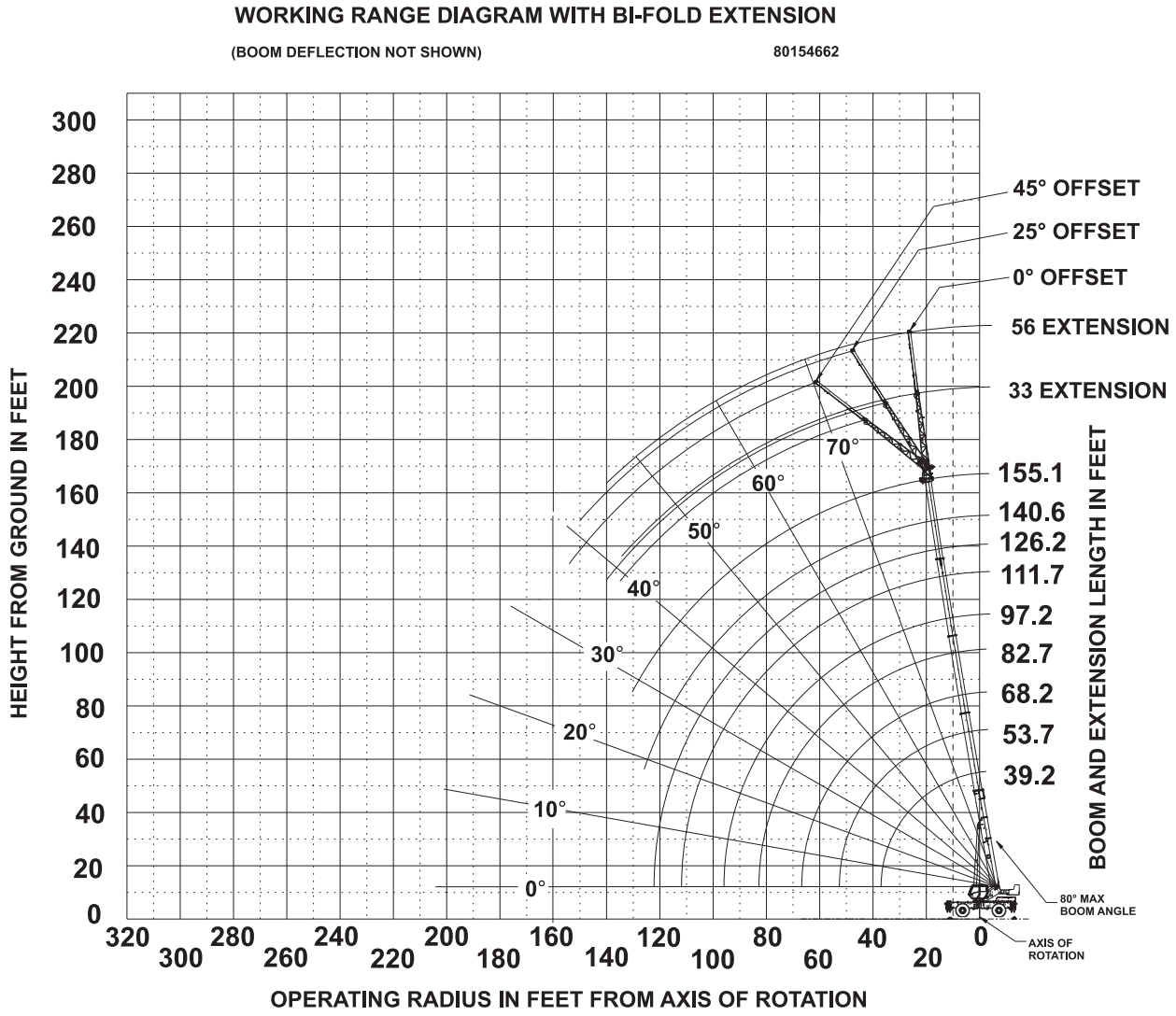
RATED LIFTING CAPACITIES IN POUNDS
39.19 FT. - 155.14 FT. BOOM
WITH 17,500 LB. COUNTERWEIGHT
ON OUTRIGGERS FULLY EXTENDED - 360°

Radius in Feet	#0101															
	Main Boom Length in Feet															
	39.2	53.7	53.7	53.7	68.2	68.2	68.2	68.2	82.7	82.7	82.7	82.7	97.2	97.2	97.2	97.2
Tele Sec I Tele Sec II Tele Sec III Tele Sec IV	0% 0% 0% 0%	0% 17% 17% 17%	50% 0% 0% 0%		0% 33% 33% 33%	50% 17% 17% 17%	100% 0% 0% 0%		0% 50% 50% 50%	50% 33% 33% 33%	100% 17% 17% 17%		0% 67% 67% 67%	50% 50% 50% 50%	100% 33% 33% 33%	
Mode	A, X, B,M	A	X, B	M	A	X	B	M	A	X	B	M	A	X	B	M
8	152,000 (73.5)	46,650 (78.5)	117,500 (78.5)	46,650 (78.5)												
10	134,500 (70.5)	46,650 (76.5)	117,500 (76.5)	46,650 (76.5)	46,500 (79.5)	57,850 (80)	37,950 (80)	37,950 (80)								
12	120,000 (67)	46,650 (74)	117,500 (74)	46,650 (74)	46,500 (78)	57,850 (78)	37,950 (78)	37,950 (78)	*46,350 (80)	*57,700 (80)	*37,800 (80)	*37,800 (80)				
15	102,500 (62)	46,650 (70.5)	102,000 (70.5)	46,650 (70.5)	46,500 (75.5)	57,850 (75.5)	37,950 (75.5)	37,950 (75.5)	46,350 (78.5)	57,700 (78.5)	37,800 (78.5)	37,800 (78.5)	*29,000 (80)	*55,450 (80)	*37,700 (80)	*29,000 (80)
20	78,650 (53)	46,650 (64.5)	77,650 (64.5)	46,650 (64.5)	46,500 (71)	57,850 (71)	37,950 (71)	37,950 (71)	46,350 (74.5)	57,700 (74.5)	37,800 (75)	37,800 (75)	29,000 (77.5)	55,450 (77.5)	37,700 (77.5)	29,000 (77.5)
25	59,300 (42.5)	46,650 (58.5)	58,350 (58.5)	46,650 (58.5)	46,500 (66)	57,850 (66.5)	37,950 (66.5)	37,950 (66.5)	46,350 (71)	57,700 (71)	37,800 (71)	37,800 (71)	29,000 (74.5)	55,450 (74.5)	37,700 (74.5)	29,000 (74.5)
30	46,550 (27.5)	46,650 (51.5)	45,650 (51.5)	45,650 (51.5)	46,500 (61.5)	47,650 (61.5)	37,950 (61.5)	37,950 (61.5)	45,300 (67)	48,900 (67)	37,800 (67.5)	37,800 (67.5)	29,000 (71.5)	49,800 (71.5)	37,700 (71.5)	29,000 (71.5)
35		39,500 (44)	36,050 (44)	36,050 (44)	40,750 (56.5)	37,500 (56.5)	34,900 (56.5)	34,900 (56.5)	40,450 (63.5)	38,750 (63.5)	35,950 (63.5)	35,950 (63.5)	29,000 (68)	40,050 (68)	33,850 (68)	29,000 (68)
40		30,250 (34.5)	27,350 (34.5)	27,350 (34.5)	32,050 (51)	28,850 (51)	26,600 (51)	26,600 (51)	32,900 (59.5)	30,100 (59.5)	27,850 (59.5)	27,850 (59.5)	27,050 (64.5)	31,350 (64.5)	29,100 (65)	27,050 (64.5)
45		23,700 (21.5)	21,150 (21.5)	21,150 (21.5)	25,650 (45)	22,800 (45)	20,750 (45)	20,750 (45)	26,750 (55)	24,050 (55)	21,950 (55)	21,950 (55)	24,600 (61.5)	25,250 (61.5)	23,150 (61.5)	23,150 (61.5)
50					20,900 (38)	18,250 (38)	16,300 (38)	16,300 (38)	22,200 (50.5)	19,550 (50.5)	17,600 (50.5)	17,600 (50.5)	22,400 (58)	20,750 (58)	18,700 (58)	18,700 (58)
55					17,150 (29.5)	14,650 (29.5)	12,500 (29.5)	12,500 (29.5)	18,650 (45.5)	16,050 (45.5)	14,000 (45.5)	14,000 (45.5)	18,900 (54)	17,300 (54)	15,300 (54)	15,300 (54)
60					14,200 (17)	11,800 (17)	9,530 (17)	9,530 (17)	15,850 (40)	13,250 (40)	11,100 (40)	11,100 (40)	16,100 (50)	14,450 (50)	12,500 (50.5)	12,500 (50.5)
65									13,550 (34)	10,900 (34)	8,720 (34)	8,720 (34)	13,850 (46)	12,100 (46)	10,150 (46)	10,150 (46)
70									11,600 (26)	8,970 (26)	6,720 (26)	6,720 (26)	12,000 (41.5)	10,200 (41.5)	8,260 (41.5)	8,260 (41.5)
75									9,900 (13.5)	7,320 (13.5)	5,040 (14)	5,040 (14)	10,350 (36.5)	8,570 (36.5)	6,630 (36.5)	6,630 (36.5)
80													8,950 (30.5)	7,140 (30.5)	5,210 (30.5)	5,210 (30.5)
85													7,710 (23)	5,910 (23)	3,990 (23.5)	3,990 (23.5)
90													6,620 (10.5)	4,830 (10.5)	2,910 (11)	2,910 (11)
Min. boom angle for indicated length (no load)																
Max. boom length at 0° boom angle (no load)																

#RCL operating code. Refer to RCL manual for operating instructions.
NOTE: ( ) Boom angles are in degrees.
*This capacity is based on maximum boom angle.

****The above Load Chart is for reference only. Always refer to the Load Chart Manual in the crane cab for specific information for your crane****

FIGURE 5-14



****The above Range Diagram is for reference only. Always refer to the Load Chart Manual in the crane cab for specific information for your crane****

FIGURE 5-15

5

STOWING AND PARKING

DANGER

Tipping Hazard!

Never park crane near holes, on rocky surfaces, or on soft spots. This may cause crane to overturn, resulting in injury or death to personnel.

When parking crane, do the following:

1. Remove load from hook.
2. Fully retract all boom sections.
3. Lower boom to normal travel position.
4. Engage swing brake and swing lock pin.
5. Retract all jack cylinders and outrigger beams.
6. Park crane on a stable surface.

CAUTION

Avoid Crane Damage!

Do not engage the parking brake while the vehicle is moving. Damage to the crane can occur.

Disengage the parking brake before driving. Damage to the crane can occur.

7. Apply parking brake and if necessary, chock wheels.
8. Make sure all operating controls are in neutral position.
9. Shut down engine following proper procedures specified in this *Operator Manual* and applicable engine manual.
10. Remove keys.
11. Close and lock, if applicable, all windows, covers, and doors.

    To avoid possible engine fault codes and undesirable operation, make sure that the Ignition Switch has been in the OFF (0) position for 2 minutes before disconnecting the batteries from the crane.
12. Set battery disconnect switch (1, Figure 5-16) to the OFF position if machine will be inactive for over 24 hours.

9838-36

FIGURE 5-16

LEAVING THE CRANE UNATTENDED

WARNING

Tipping Hazard!

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.

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

The configuration in which the crane should be left while unattended shall be determined by a qualified, designated individual familiar with the job site, configuration, conditions, and limitations.

LONG-TERM STORAGE

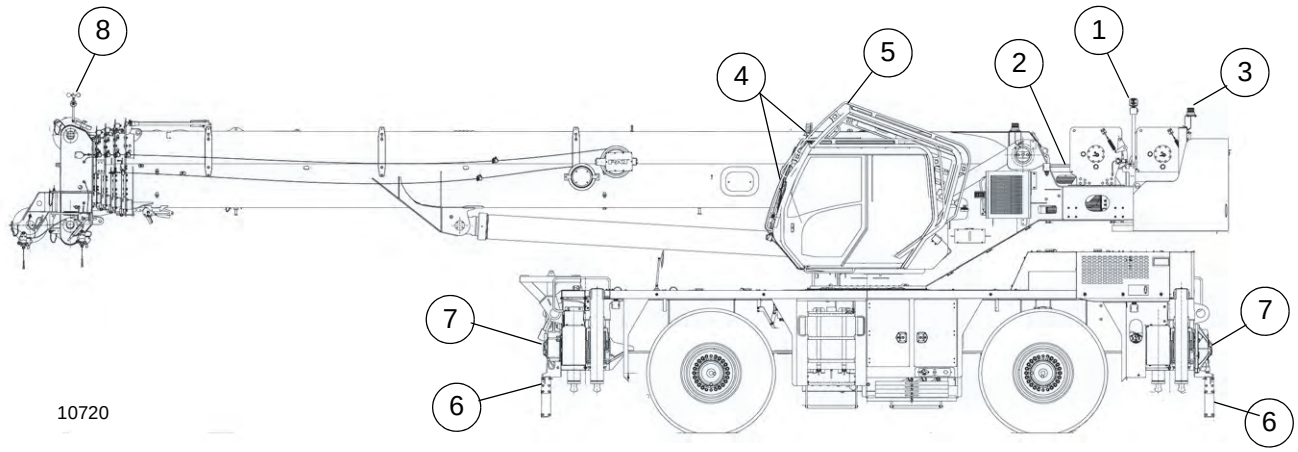
Guidelines for tires on cranes parked for long periods:

1. If possible, set crane up on outrigger jacks that are not fully extended to allow for thermal expansion and remove the load from the tires.

   If the crane cannot be placed on outriggers, move the crane at least once a month to prevent permanent distortion of tires.
2. Keep the inflation pressure as recommended.

SECTION 6
SET-UP AND INSTALLATION

SECTION CONTENTS



Item	Description	Page
1	Hoist Camera	6-3
2	Hoist Platform	6-4
3	Beacon Lights (Optional)	6-5
4	Cab Mirror	6-6
5	RCL Light Tower (Optional)	6-7
6	Access Ladders	6-8
7	Outrigger Floats	6-9
8	Anemometer (Optional)	6-10

FIGURE 6-1

SETUP OF CRANE BEFORE AND AFTER TRANSPORTING

Figure 6-1 shows the components that must be placed in to their transport positions before transporting the crane.

Securing all valve cover latches with tie-straps is recommended to prevent accidental opening during transportation. After transporting the crane, place these components into their working positions.

Hoist Camera

The hoist camera (1, Figure 6-2) is located at the rear of the superstructure. The camera should be raised for operation and lowered for transport.

LOWERING THE HOIST CAMERA FOR TRANSPORT

1. Pull the retractable lock (2). Lower the hoist camera (1).
2. Push the retractable lock (2) in the locked position to secure the hoist camera in the transport position.

RAISING THE HOIST CAMERA FOR OPERATION

1. Pull the retractable lock (2). Raise the hoist camera (1).
2. Push the retractable lock (2) in to the locked position to secure the hoist camera (2) in the working position.

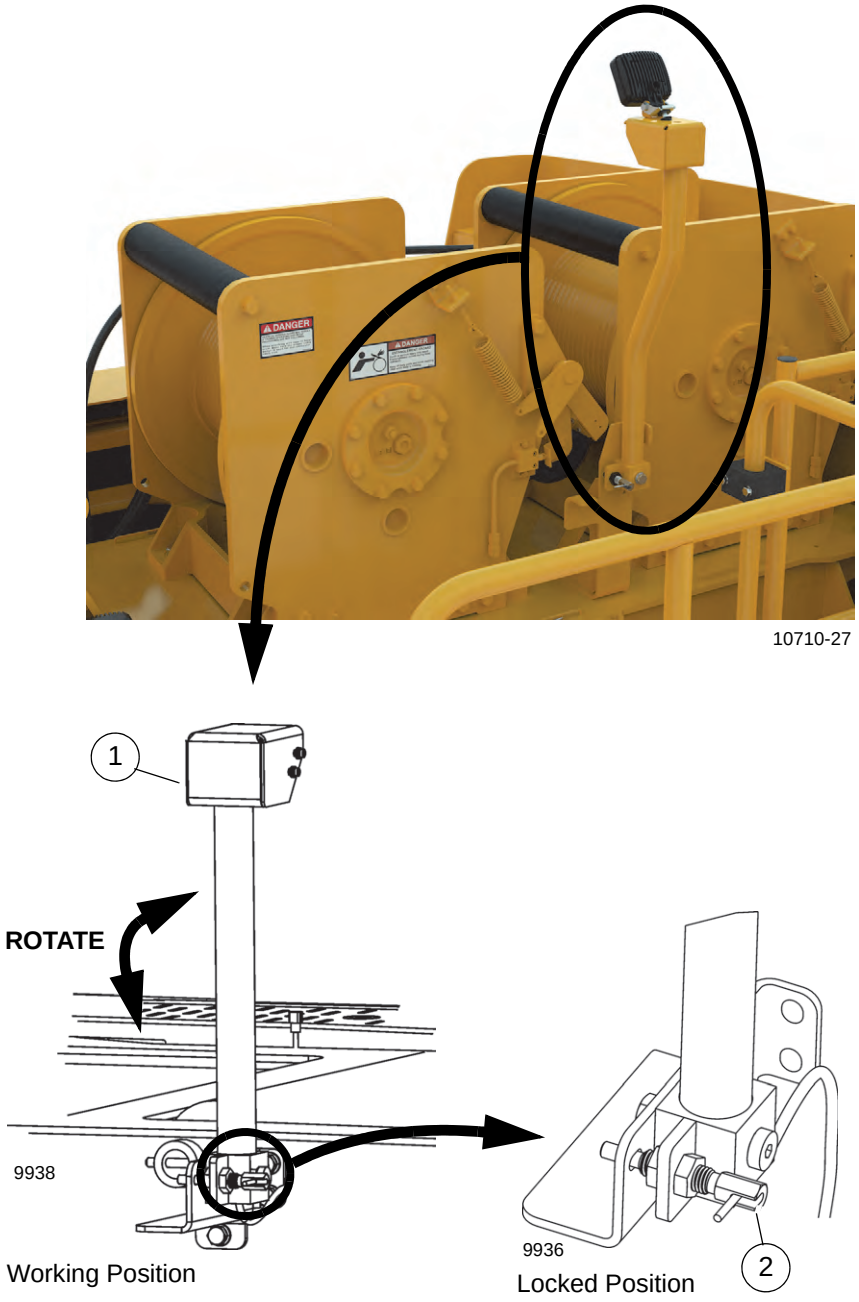


FIGURE 6-2

Hoist Platform

DANGER

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

No storage of components is allowed on the platform.

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

The hoist platform (Figure 6-3) is located at the rear of the superstructure near the main and auxiliary hoists.

10721

FIGURE 6-3

Beacon Lights (Optional)

The optional beacon lights (1, Figure 6-4) can be installed as part of the optional Auxiliary Lighting and Convenience Package. When installed, the beacons are located on the rear of the superstructure. The beacons must be lowered for transport and raised for operation.

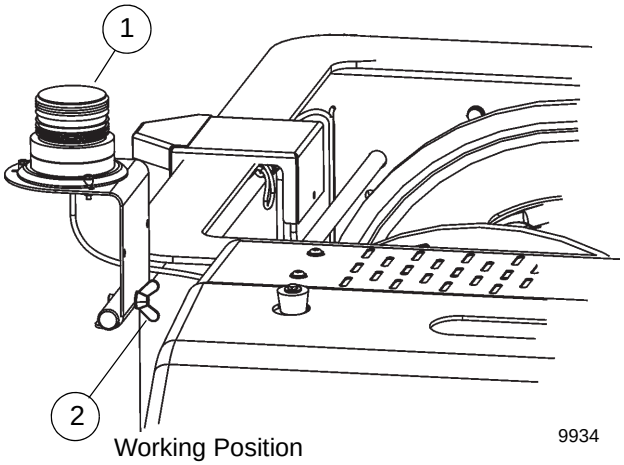
LOWERING THE BEACON LIGHT FOR TRANSPORT

1. Loosen the wing nut (2). Lower the beacon light (1).
2. Tighten the wing nut (2) to secure the beacon light (1) in the transport position.

RAISING THE BEACON LIGHT FOR OPERATION

1. Loosen the wing nut (2). Raise the beacon light (1).
2. Tighten the wing nut (2) to secure the beacon light (1) in the working position.

10729



Working Position

9934

Transport Position

9933

FIGURE 6-4

6

Cab Mirror

Figure 6-5 shows the working and transport positions for the side (1) cab mirror. The operator can use the side mirror to view behind the left side of the cab. The cab mirror must be retracted for stowed during transport and moved to working position for operation.

Transport Position 10710-30

Working Position 10710-31

FIGURE 6-5

RCL Light Tower (Optional)

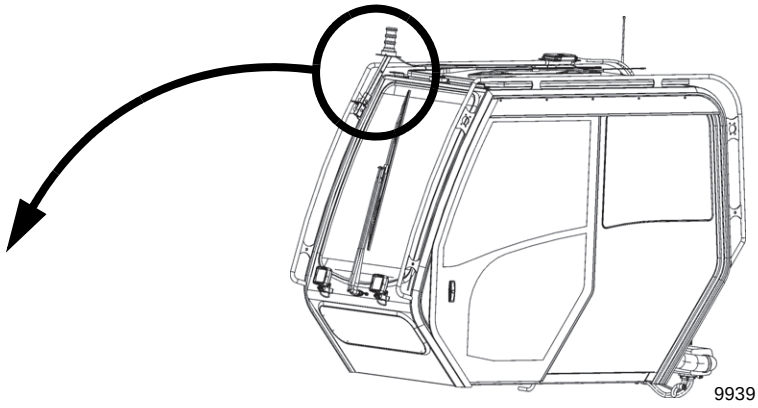
The RCL Light Tower (1, Figure 6-6) is an optional feature located on the front right of the crane cab. It must be retracted for transport and extended for operation.

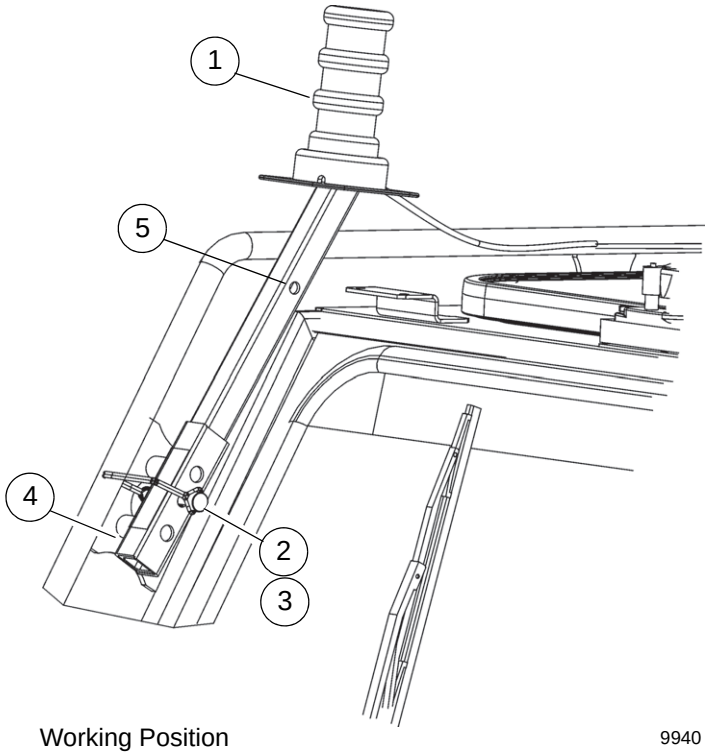
RETRACTING THE RCL LIGHT TOWER FOR TRANSPORT

1. Remove retaining clip (2) and pin (3) from the mounting bracket (4).
2. Slide the RCL light tower down to the retracted position. Align the retract position hole (5) in the tower post with the hole in the mounting bracket.
3. Install the pin (3) in the mounting bracket (4) and tower post. Secure the pin with the retaining clip (2).

EXTENDING THE RCL LIGHT TOWER FOR OPERATION

1. Remove the retaining clip (2) and pin (3) from the mounting bracket (4).
2. Slide the RCL light tower (1) up to the extended position. Align the extend position hole (6) in the tower post with the hole in the mounting bracket (4).
3. Install the pin (3) in the mounting bracket (4) and tower post. Secure the pin (3) with the retaining clip (2).





Working Position 9940

Transport Position 9941

FIGURE 6-6

Folding Access Ladders

The access ladders (1, Figure 6-7) are located on the front and rear outrigger boxes. The access ladders must be raised for transport.

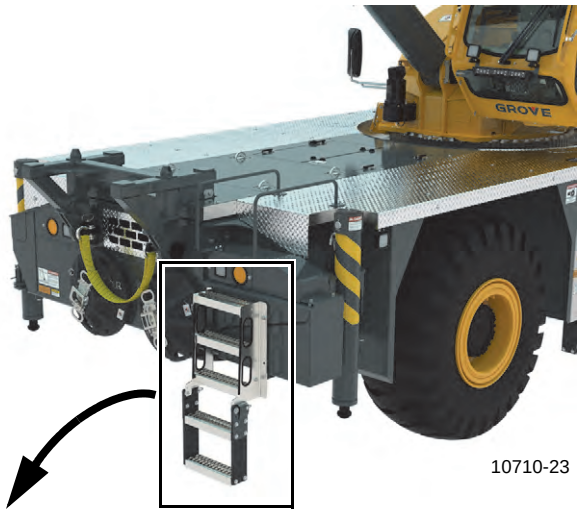
Grove recommends folding up the access ladders before driving the crane to prevent crane damage.

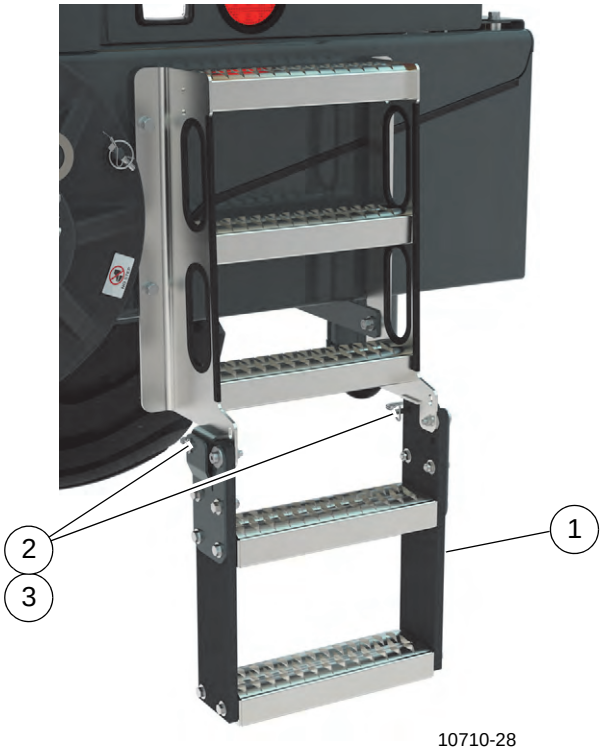
RAISING THE ACCESS LADDER FOR TRANSPORT

1. Remove retaining clips (3) and pins (2).
2. Raise the ladder (1) in to transport position.
3. Install pins (2). Install retaining clips (3) to secure the pins.

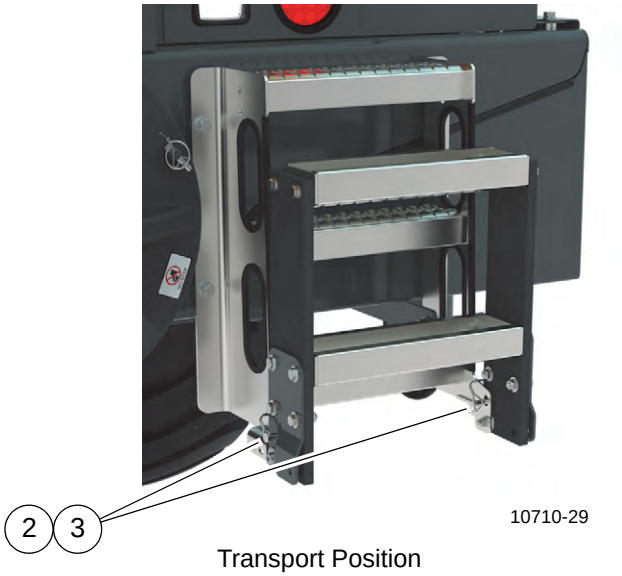
LOWERING THE ACCESS LADDER

1. Remove retaining clips (3) and pins (2).
2. Lower the ladder (1).
3. Install pins (2). Install retaining clips (3) to secure the pins.





Working Position



Transport Position

FIGURE 6-7

Outrigger Floats

The outrigger floats (1, Figure 6-8) are stowed on the outrigger boxes. The outrigger floats must be stowed prior to transport.

10710-26

Transport Position

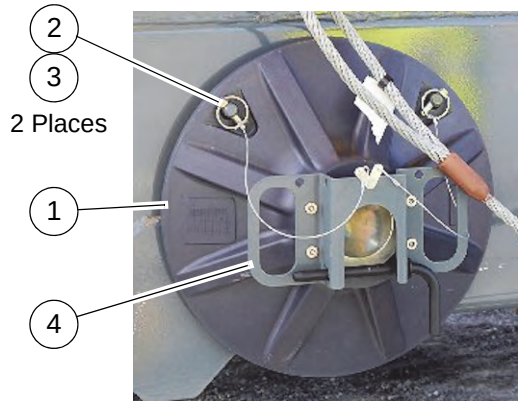


FIGURE 6-8

STOWING AN OUTRIGGER FLOAT FOR TRANSPORT

NOTE: An outrigger float weighs approximately 30 kg (65.0 lbs).

1. Remove pins (3) from stowage posts (2).
2. Lift outrigger float into position using handles (4).
3. Install outrigger float (1) on stowage posts (2) on the outrigger box.
4. Install pins (3) in posts (2) to secure the outrigger float.

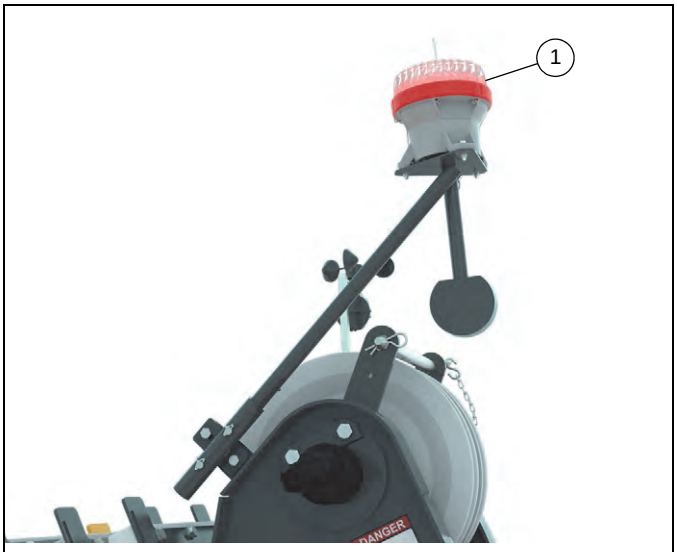
REMOVING AN OUTRIGGER FLOAT FROM STOWAGE

NOTE: An outrigger float weighs approximately 30 kg (65.0 lbs).

1. Hold the handle (4) and remove pins (3) from posts (2).
2. Remove the outrigger float (1) from stowage posts (2) on the outrigger box.
3. Install pins (3) in stowage posts (2).

Boom Obstruction Light (Optional)

The boom obstruction light assembly (1, Figure 6-9) must be removed and stowed for transport.



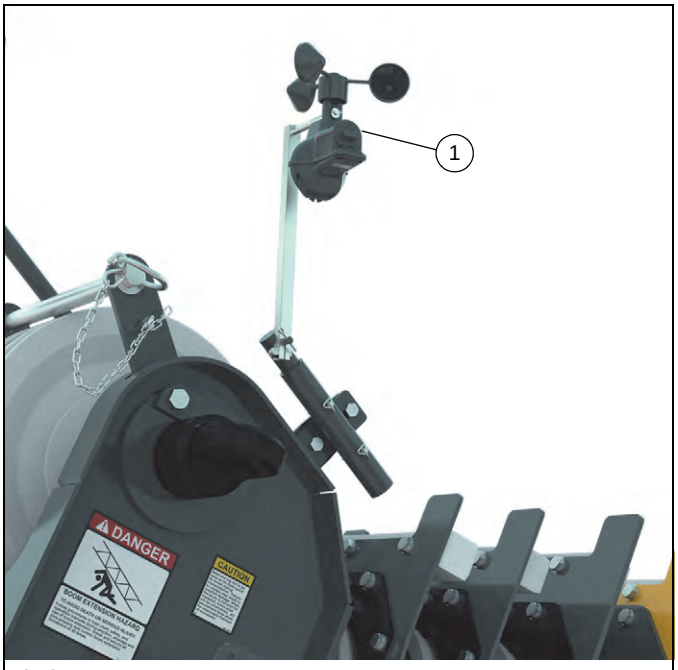
10710-43

FIGURE 6-9

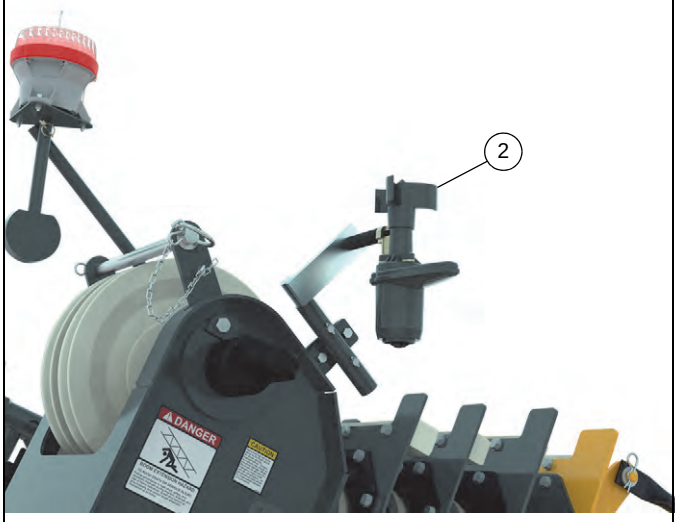
6

Anemometer (Optional)

The anemometer assembly (1 or 2, Figure 6-10) must be removed and stowed for transport.



10710-44



10710-45

FIGURE 6-10

INSTALLING CABLE ON THE HOIST

CAUTION

If cable is wound from the storage drum, the reel should be rotated in the same direction as the hoist.

NOTE: The cable should preferably be straightened before installation on the hoist drum.

Install cable on the hoist drum in accordance with the following procedure.

1. Position the cable over the boom nose sheave and route to the hoist drum.
2. Position the hoist drum with the cable anchor slot on top.

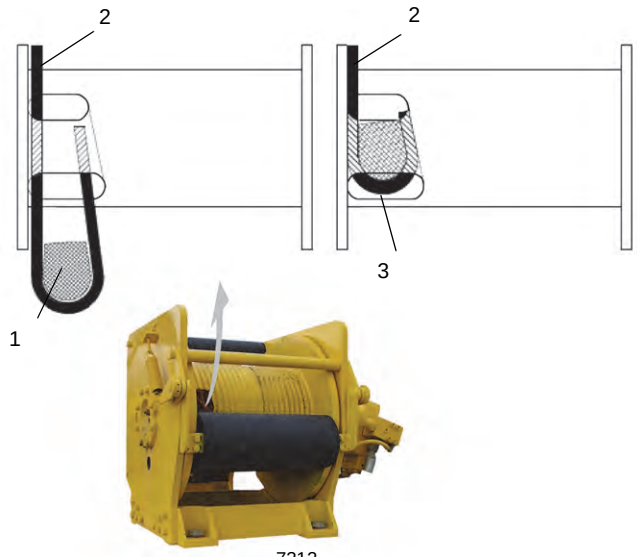


FIGURE 6-11

3. Insert the cable through the slot and position around the anchor wedge (1, Figure 6-11).

NOTE: The end of the cable should be even with the bottom of the slot for the anchor wedge (1).

4. Position the anchor wedge in the drum slot; pull firmly on the free end (2) of the cable to secure the wedge.

NOTE: If the wedge does not seat securely in the slot, carefully tap (3) the top of the wedge with a mallet.

7196

5. Slowly rotate the drum, ensuring the first layer of cable is evenly wound onto the drum.
6. Install the remainder of the cable, as applicable.

6

ANTI-TWO BLOCK (A2B) SWITCH

Two anti-block switches must be installed to allow crane operation. If a single hoist rope has been reeved and two A2B switches are installed, the unused A2B switch must be locked (disabled) with A2B weight removed to allow all crane operations.

Locking

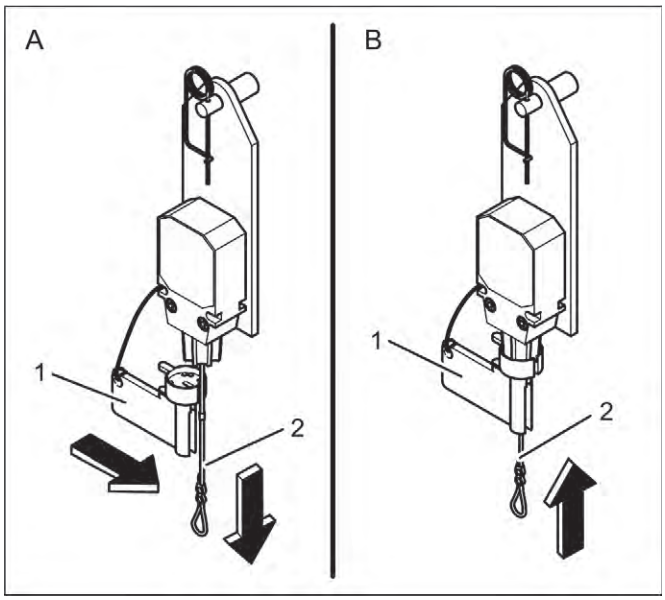
DANGER

Two-Block Hazard!

To avoid death or serious injury, keep load handling devices away from the tip of the boom or boom extension when extending the boom and when hoisting up.

If the A2B switch is locked (disabled), the hook block could hit the main boom head or extension. Never lock an A2B switch when a hoist rope is installed to that attachment.

1. Remove A2B weight.
2. (A) Remove cap (1) from switch.
3. Pull lanyard (2) down.
4. (B) Secure lanyard (2) in this position using cap (1). A2B switch is locked (disabled).



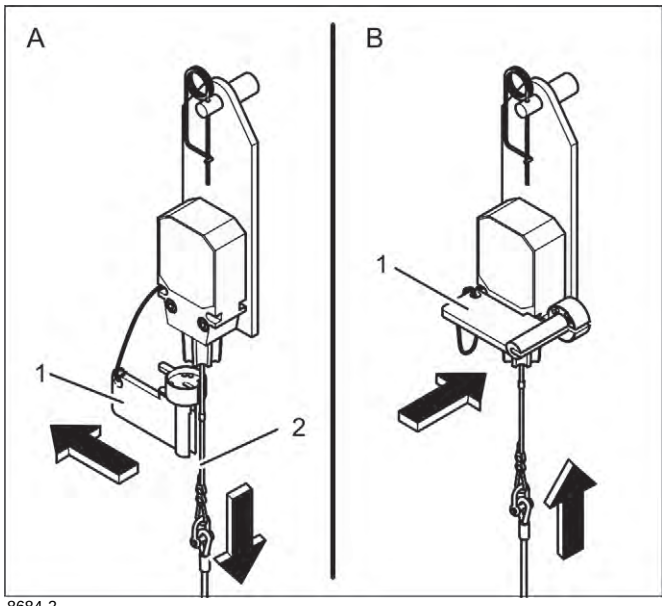
8684-1

FIGURE 6-12

Unlocking

NOTE: Always remove the switch lock (enable) before installing an A2B weight around the hoist rope.

1. (A) Pull down lanyard (2) and remove cap (1). Switch is unlocked (enabled).
2. (B) Install cap (1) on A2B switch.



8684-2

FIGURE 6-13

Checking Before Operation

Check the following electrical connections before operating the crane to make sure the RCL system is properly connected for the crane configuration.

CRANES WITH MAIN HOIST ONLY

If the crane is operated only with the boom and without boom extension or lattice insert, no additional connections are necessary. It must however be ensured that the A2B switch weight is correctly mounted on the main boom hoist rope. With even numbers of rope lines, the lifting limit switch weight shall be attached to the “dead end” of the hoist rope. With odd numbers of rope lines, the lifting limit switch weight shall be attached to the rope line with the lowest operating speed.

If the crane is operated with a main boom extension or lattice insert, the connecting cable must be mounted between the connector on the boom extension or lattice insert and the connector on the main boom. The main boom A2B switch weight must be disconnected and mounted on the extension or fly section A2B switch.

WARNING

Failure to reposition the A2B weight will prevent the A2B system from functioning properly. No weight shall be mounted on the A2B switch of the main boom when working with the boom extension/lattice insert.

CRANES WITH MAIN AND AUXILIARY HOISTS

If the main boom extension or fly section is not used, the A2B switch must be plugged into the connector on the main boom and the A2B switch weight must be mounted on the main boom.

If the crane is operated with a main boom extension and the main boom is equipped with a hoist rope, then the connecting cable must be mounted between the connector on the extension or lattice insert and the connector on the main boom. In addition, weights must be fitted to both the A2B switch of the main boom and the extension or fly section.

If the boom extension is in working position and if the main boom is not equipped with a hoist rope, then the A2B switch on the main boom must be placed into its locked position.

After electrical connections have been checked to make sure the system is properly connected for the respective crane configuration, the following checks must be made:

1. Check electrical wiring connecting various parts of the system for physical damage.
2. Check A2B switches and weights for free movement.
3. Inspect RCL cable drum for smooth running, initial drum tension, and correct cable winding.

WARNING

The following tests must be performed with care to prevent personnel injury or crane damage. Proper functioning of the Anti-two Block System (A2B) requires successful completion of these tests before starting work.

If the operator cannot see the hook block approaching the boom nose, this task must be assigned to an assistant.

The crane operator must be prepared to stop the crane immediately if the Anti-two Block System is not working correctly, that is when the warning indicators do not display, the acoustic alarm does not sound, and the crane movements such as raising, extending and luffing are not disabled.

Check A2B warning light and acoustic alarm for both A2B switches as follows:

1. Position boom over front of crane.
2. Manually raise weight fitted on the A2B switch. As soon as weight is raised, the acoustic alarm should sound and the A2B indicator should display.
3. Using the main hoist, pull hook block slowly against the A2B switch weight. As soon as the hook block raises the weight, the acoustic alarm should be triggered, the A2B indicator should display, and the main hoist should switch off. Lower the hook block slightly to eliminate this condition.
4. Slowly lower the boom to bring about a potential two block situation. As soon as the hook block raises the weight, the acoustic alarm should sound, the A2B indicator should display, and boom lower should switch off. Lower the hook block slightly to eliminate this condition.
5. Slowly extend (telescope out) the boom to bring about a potential two block situation. As soon as the hook block raises the weight, the acoustic alarm should sound, the A2B indicator should display, and the telescoping function should switch off. Lower the hook block slightly to eliminate this condition.

WARNING

If warning indicators and audible alarm do not function as described and crane movements are not switched off, the system is not working properly. The malfunction must be corrected before starting work.

6. If crane is equipped with a boom extension, the inspection procedure must be repeated for the A2B switch of the extension.
7. Verify display of main boom length agrees with actual boom length.
8. Verify display of main boom angle agrees with actual boom angles.
9. Verify display of the crane operating radius agrees with the actual radius.
10. Verify load display by lifting a load of known weight. Load display accuracy must be within the tolerance range.

HOIST ROPE REEVING

NOTE: 35 x 7 (rotation resistant) hoist rope is used on this crane.

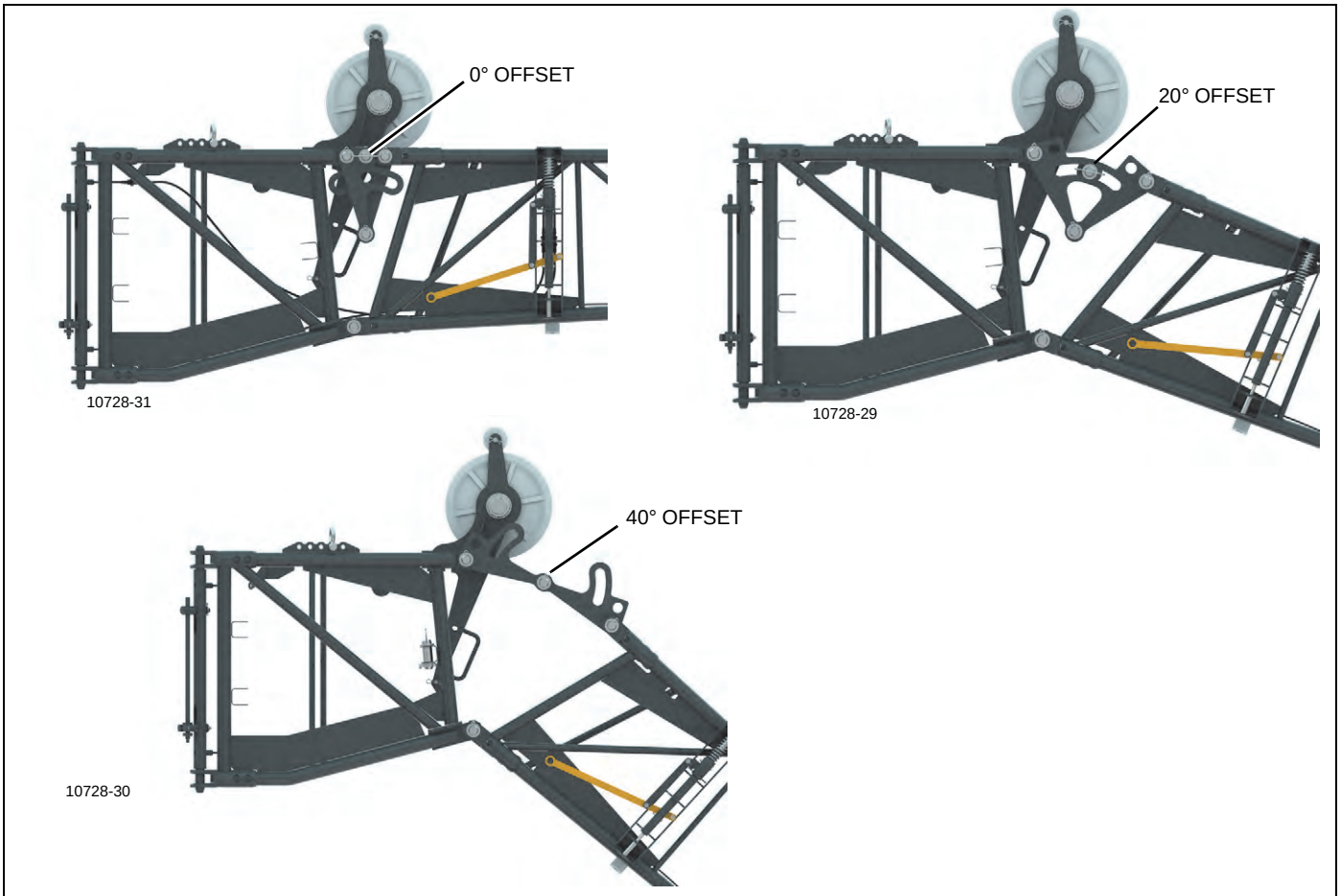
Within load and range chart limits and permissible line pull, multi-part line reeving allows the operator to raise a greater load than can be raised with a single line part. A qualified rigger should do the reeving using standard rigging procedures. The load lifted must be within the limits contained in the load chart.

Possible Reeving Combinations

NOTE: The maximum load bearing capacity of individual hook blocks does not correspond to the maximum load bearing capacity of the GRT765/780 together with this hook block. The load bearing capacity of the GRT765/780 depends on the rope pull, the reeving and friction force. It is lower than the load bearing capacity of the hook block.

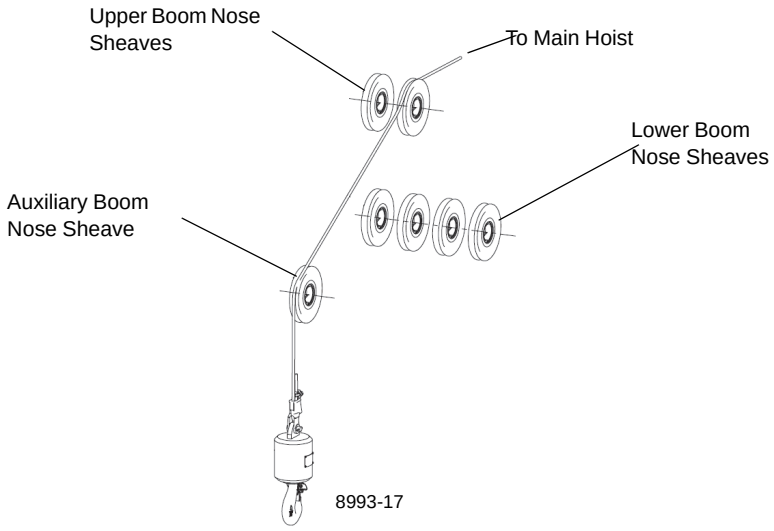
NOTE: Please note that the maximum load bearing capacities already include the weight of the hook block and the lifting gear. You must subtract these weights in order to obtain the actual payload.

NOTE: The recommended hook-blocks are designed to be of sufficient weight to overhaul the rope properly when using the parts of line required for the allowed load at the chosen boom length. Operating with a higher number of parts of line than is necessary for a particular boom length may result in poor rope spooling behavior and loosely stored rope, which can result in future rope damage. If operation in these extended ranges is desired, extra weight should be carried by the hookblock or a heavier hookblock should be used.



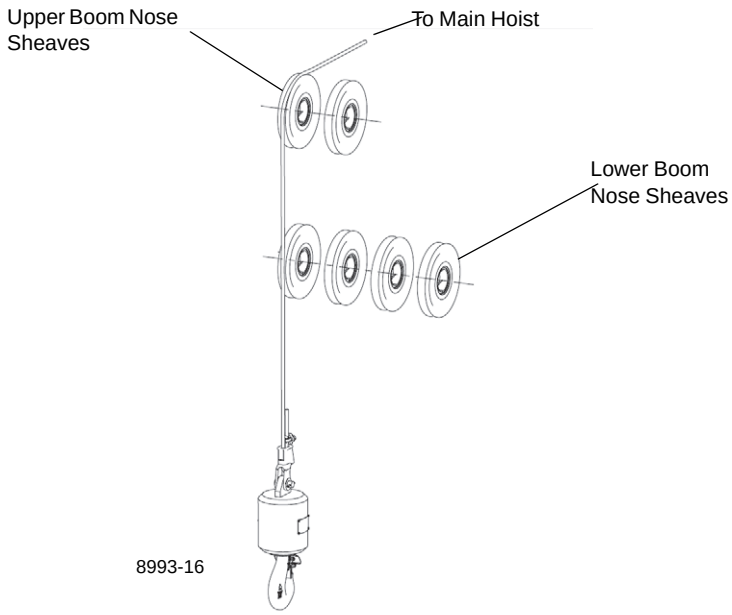
SINGLE PART LINE USING BOOM EXTENSION

FIGURE 6-14

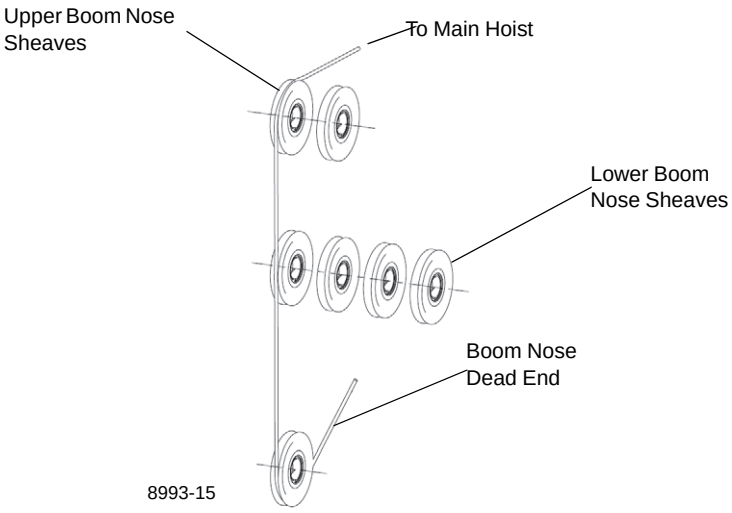


Single Part Line - Auxiliary Nose

FIGURE 6-14 continued

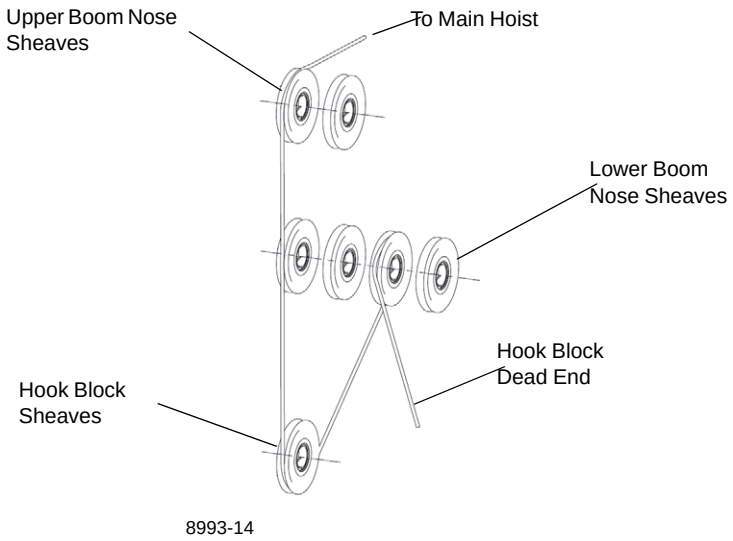


Single Part Line

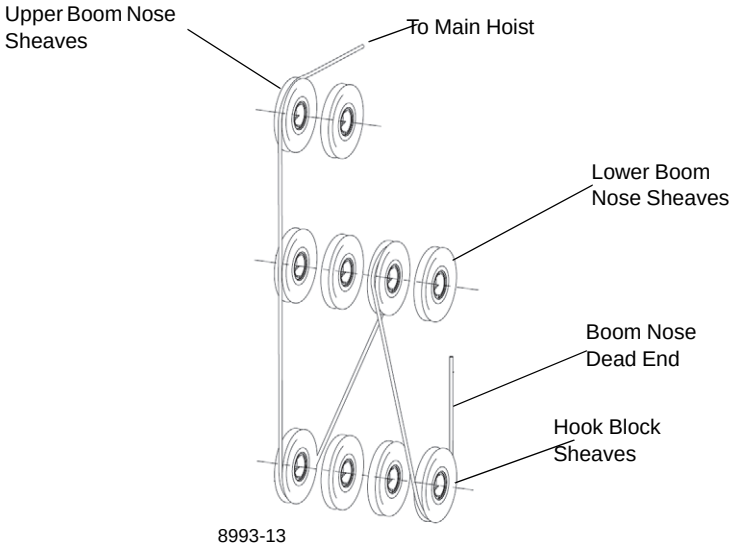


2 Parts Line - 1 Sheave Hook Block

FIGURE 6-14 continued



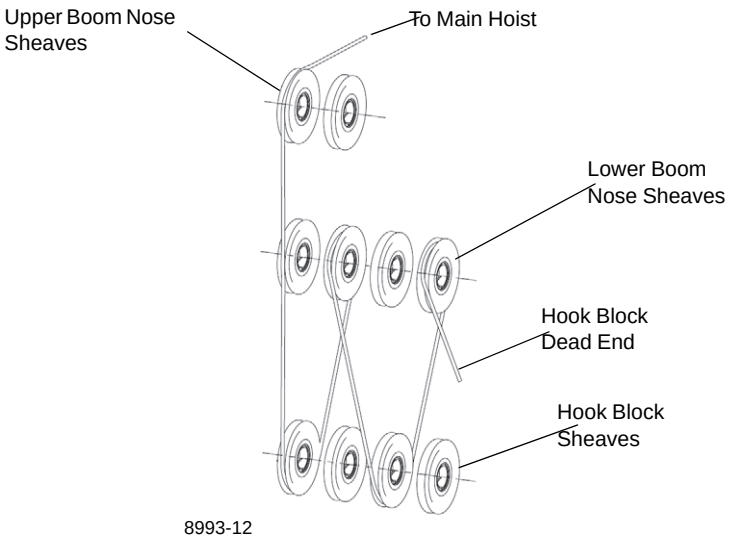
3 Parts Line - 1 Sheave Hook Block



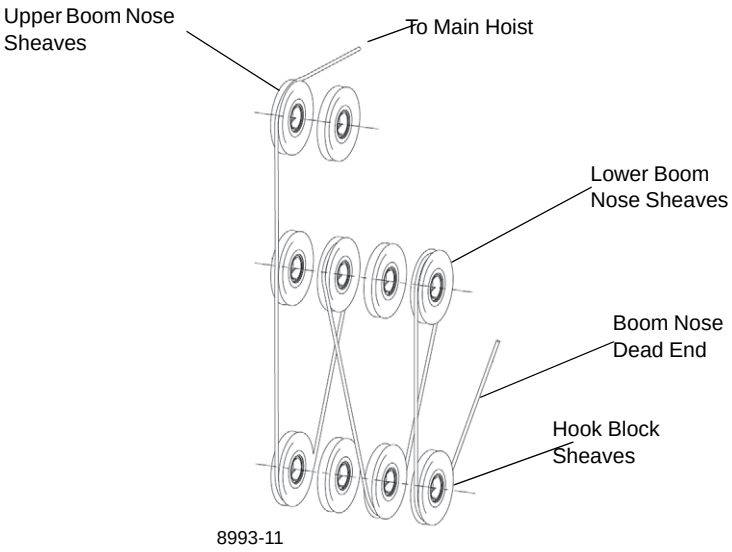
4 Parts Line - 4 Sheave Hook Block

FIGURE 6-14 continued

6

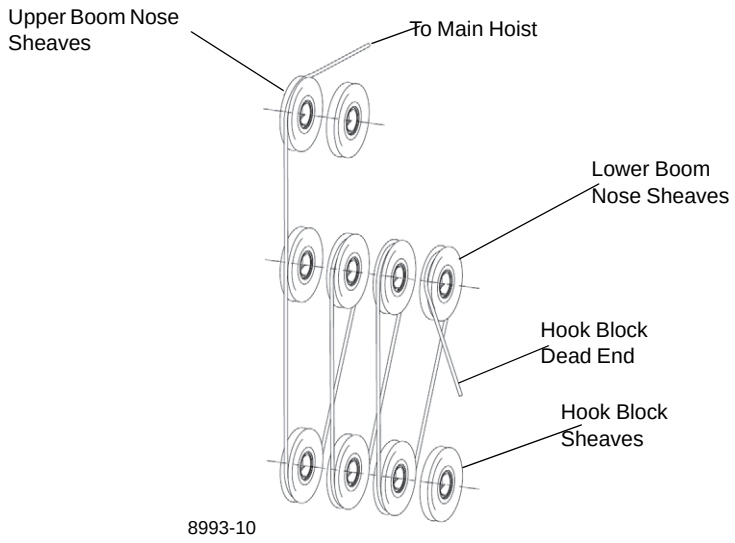


5 Parts Line - 4 Sheave Hook Block

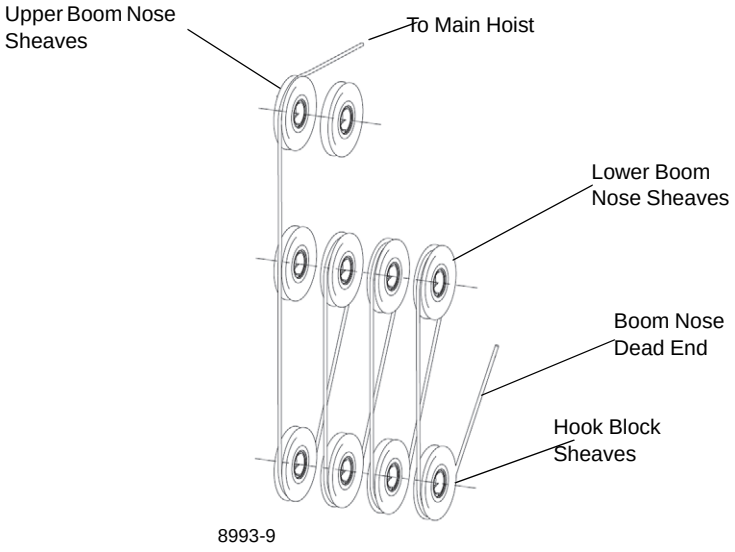


6 Parts Line - 4 Sheave Hook Block

FIGURE 6-14 continued



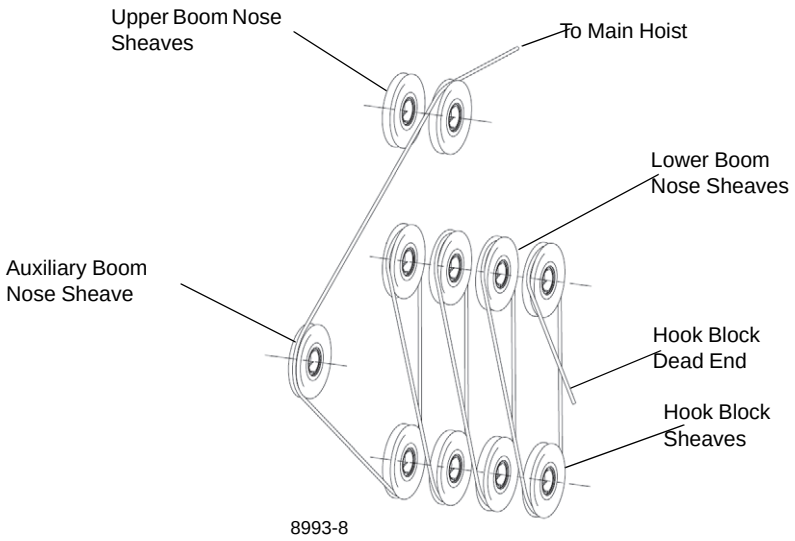
7 Parts Line - 4 Sheave Hook Block



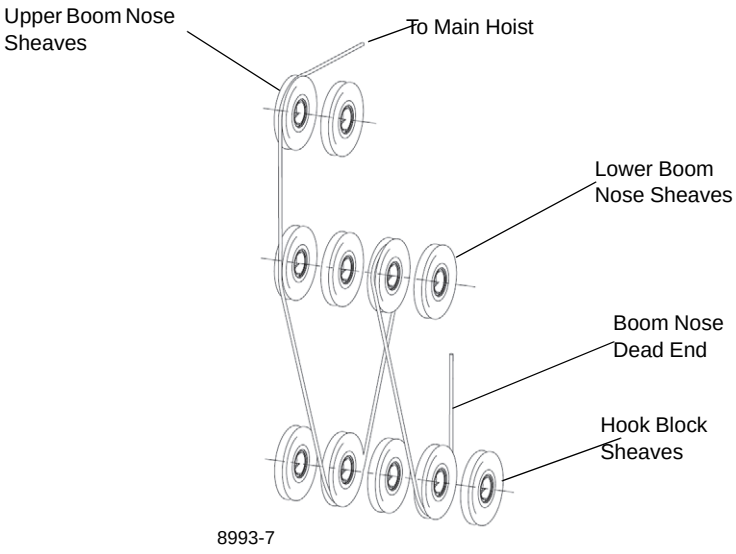
8 Parts Line - 4 Sheave Hook Block

FIGURE 6-14 continued

6

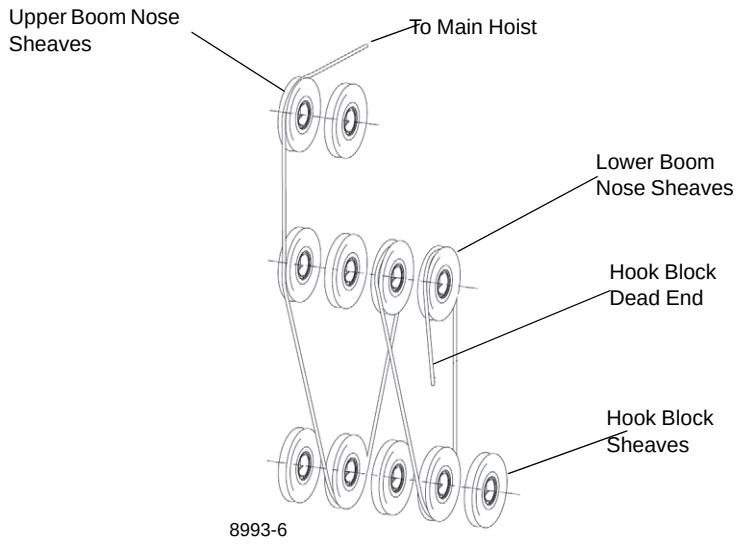


9 Parts Line - 4 Sheave Hook Block with Auxiliary Boom Nose

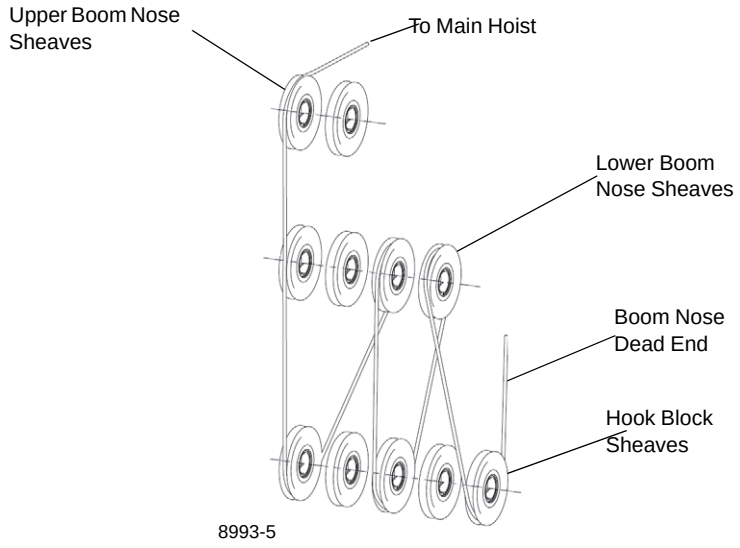


4 Parts Line - 5 Sheave Hook Block

FIGURE 6-14 continued



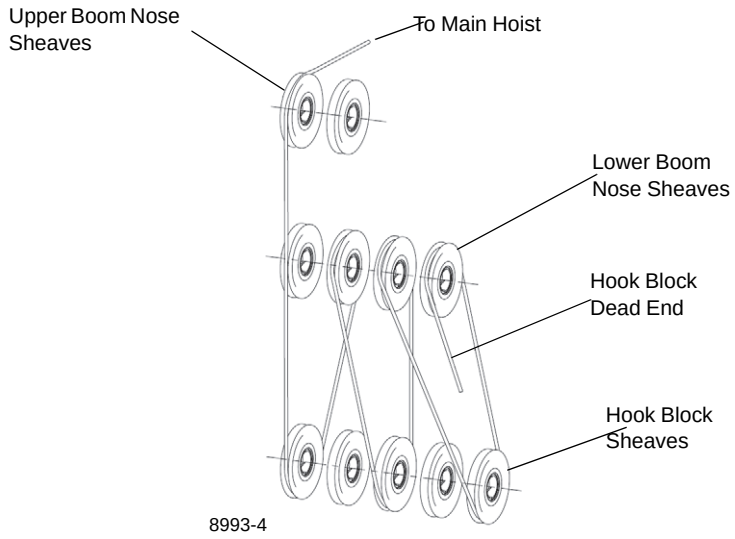
5 Parts Line - 5 Sheave Hook Block



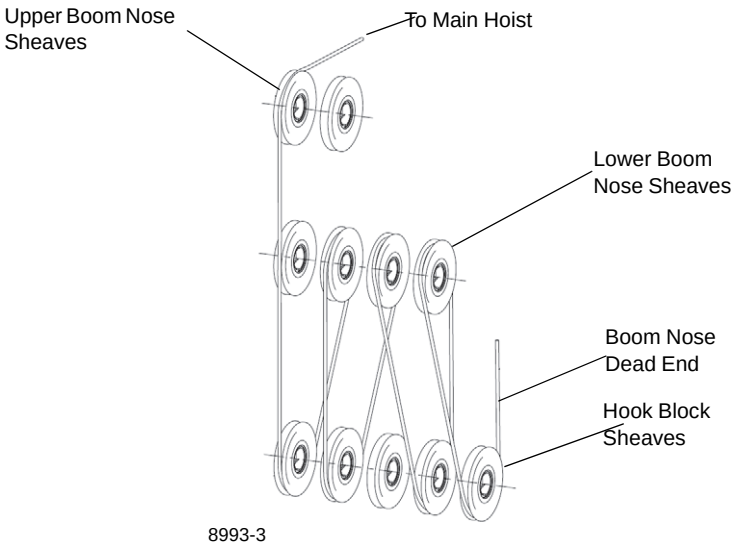
6 Parts Line - 5 Sheave Hook Block

FIGURE 6-14 continued

6

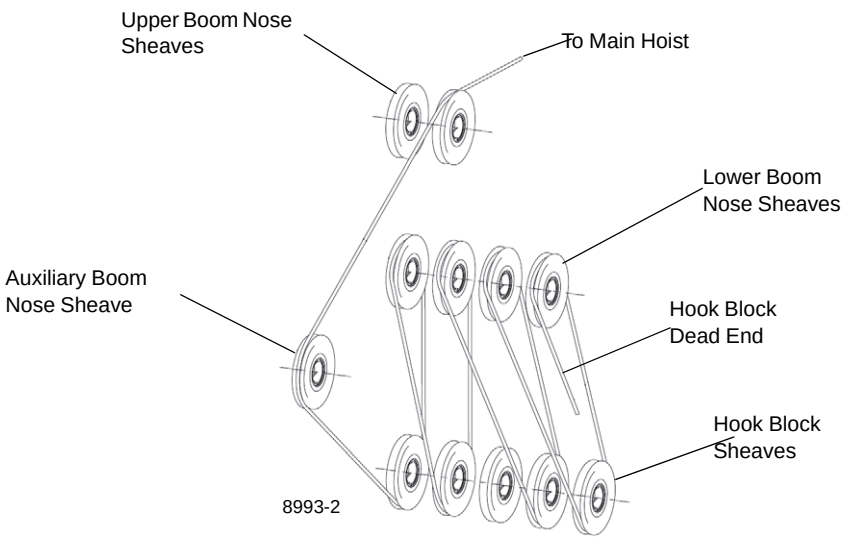


7 Parts Line - 5 Sheave Hook Block

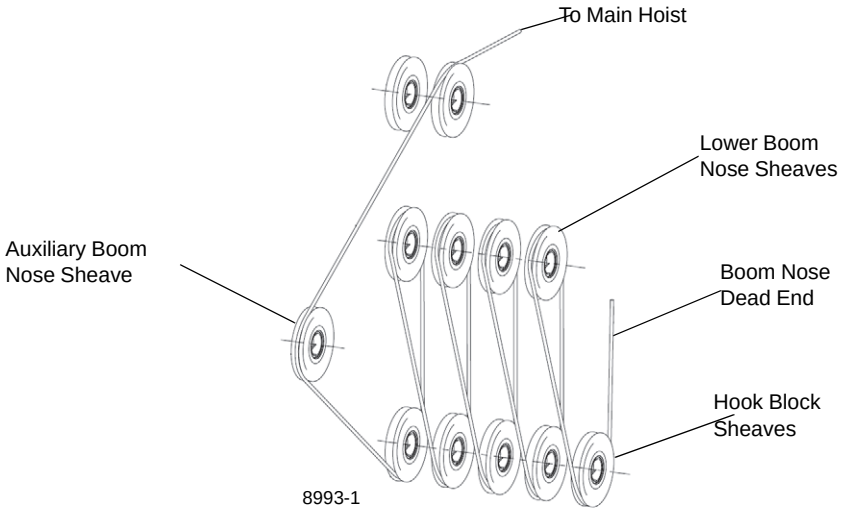


8 Parts Line - 5 Sheave Hook Block

FIGURE 6-14 continued



9 Parts Line - 5 Sheave Hook Block with Auxiliary Boom Nose



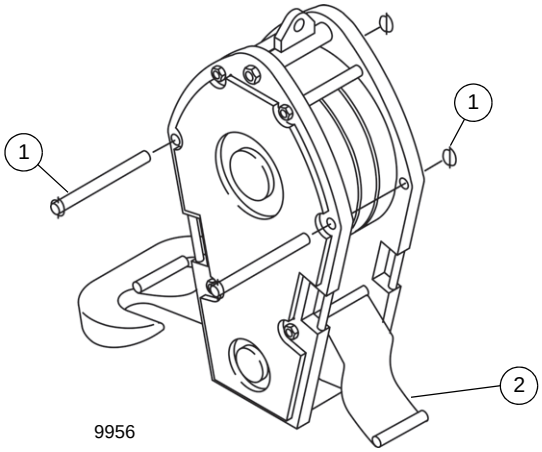
10 Parts Line - 5 Sheave Hook Block with Auxiliary Boom Nose

FIGURE 6-14 continued

6

Quick Reeving the Hook Block

To quick reeve the hook block without removing the wedge socket on end of hoist rope, remove the retaining clips from the two pins (1, Figure 6-15), then lower the two rope guards (2) to their lowered positions.



Item	Description
1	Pin
2	Rope Guard

FIGURE 6-15

Reeving Hoist Rope Over the Boom

CAUTION

Reeve only the main hoist rope through the rope guide. Do not reeve the auxiliary rope through the rope guide.

Never reeve multiple ropes through the rope guide at the same time. Rope damage can occur.

Always reeve main hoist rope through rope guide (1, Figure 6-16). Always reeve auxiliary hoist rope *outside* of the rope guide.

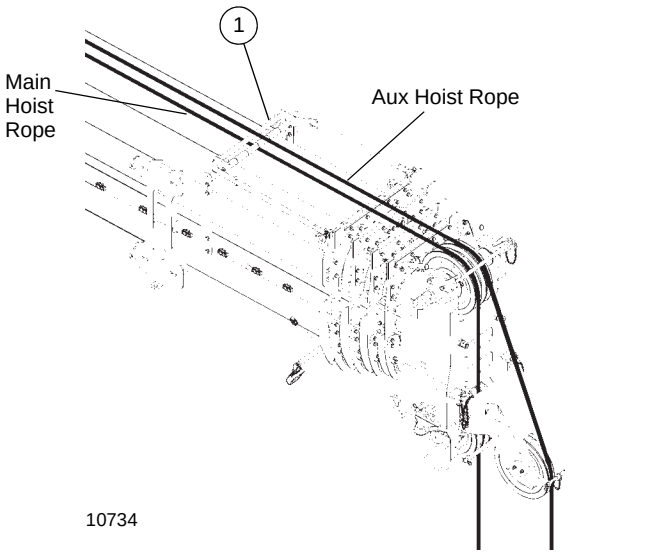


FIGURE 6-16

Reeving/Unreeving the Hoist Rope

Use the following procedures to reeve and unreeve the hoist rope.

Reeving Hoist Rope

CAUTION

Falling Objects Hazard!

Always make sure sheaves and pins that secure the hoist rope are secured with clips. This prevents components from coming loose, falling and causing injury.

1. Make sure the main hoist rope is in the rope guide. If necessary, make sure the auxiliary hoist rope is over the rope guide. For more information, refer to *Reeving Hoist Rope Over the Boom*, page 6-24.
2. Remove the retaining rods (1, Figure 6-17).
3. Guide the rope over the upper boom nose sheave (2).
4. Guide the rope over the lower boom nose sheave (3).
5. Install the hook tackle or the hook block.
6. Reinstall all the retaining rods (1) and secure with retaining clips.

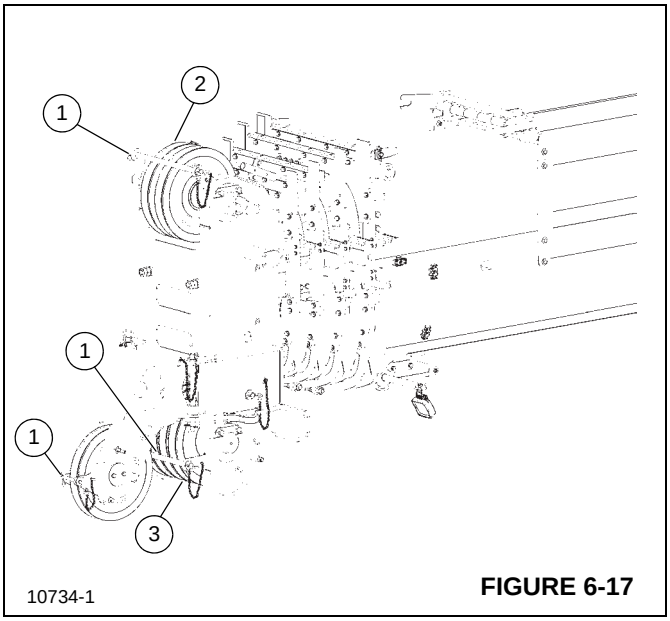


FIGURE 6-17

Unreeving Hoist Cable

1. Remove the retaining rods (1, Figure 6-17).
2. Unreeve the hook block.
3. Take the hoist rope off of the upper boom nose sheave (2) and place it on the ground on the left side. Spool the hoist rope on the hoist drum.
4. Replace all retaining rods and secure them with retaining clips.

Dead-End Rigging/Wedge Sockets

Wedge socket assemblies are popular rigging accessories used for decades to terminate hoist ropes on mobile cranes. A wedge socket assembly is easily installed and dismantled, but must be installed and used correctly. Use only a wedge and socket of the correct size for the rope fitted. Failure to do so may result in rope pulling through fitting.

Since state and local laws may vary, alternate attachment methods may be necessary depending upon work conditions. If alternate methods are selected, the user is responsible and should proceed in compliance with the regulations in force. If there are any questions, contact your local Grove distributor or Grove Product Support.

Do not mix components from different manufacturers. The selection, installation, and use of a wedge socket assembly must be in accordance with requirements of the wedge socket manufacturer and hoist rope manufacturer upon whose hoist rope the wedge socket assembly will be used.

Grove specifies size, type, class, and line pulls for hoist rope; predominately rotation resistant hoist rope, and rigging accessories such as overhaul balls and hook blocks for use with each new crane it manufactures.

Other hoist ropes and rigging accessories are available from various vendors. Different hoist rope manufacturers have differing requirements for construction, handling, cutting, seizing, installation, termination, inspection, and replacement of hoist ropes they produce. Their advice should be sought for each specific type of hoist rope a crane user intends to install on a mobile crane.

When assembly is complete, raise boom to a working position with a load suspended to firmly seat wedge and rope in socket before crane is used operationally.

CAUTION

If socket is not positioned with flat face toward boom sections, structural damage will occur.

When anchoring socket to the boom, make sure flat face of socket is toward boom sections.

INSTALLING WEDGE AND SOCKET

1. Inspect wedge and socket. Remove rough edges and burrs.
2. Seize hoist rope end using soft or annealed wire or strand. If end of rope is welded, welded end should be cut off unless otherwise stated by the rope manufacturer. This allows distortion of the rope strands, caused by the bend around the wedge, to adjust themselves at the end of the line.
3. Make sure live end side (Figure 6-18) of rope is directly in line with ears of socket and direction of pull to which the rope will be subjected. If rope is loaded into socket incorrectly, under a load the rope will bend as it leaves the socket. The edge of the socket will wear into the rope causing damage and eventual failure.

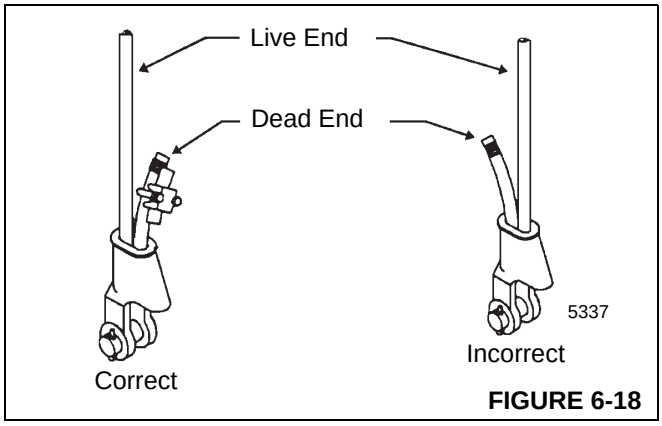


FIGURE 6-18

4. Insert hoist rope end in socket, form a loop in the rope, and route rope back through socket allowing the “dead” end to protrude from the socket. Make sure dead end of the rope is long enough to apply end treatment after wedge is seated.

5. Insert wedge in loop. Pull live end of rope until wedge and rope are snug inside socket. It is recommended wedge be seated inside socket to properly secure the hoist rope using the crane's hoist to first apply a light load to the live line.
6. After final pin connections are made, increase loads gradually until wedge is properly seated.
7. Wire rope and wedge must be properly secured inside socket before placing crane into lifting service. It is the wedge that secures the hoist rope inside the socket. The dead-end treatment is used to keep wedge from becoming dislodged from socket should the rope suddenly become unloaded from the overhaul ball or hook block striking the ground, etc.

Figure 6-19 shows methods for securing dead-ends of hoist 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.

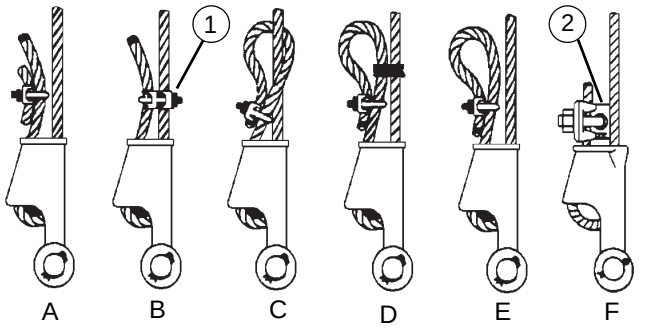


FIGURE 6-19

Of the methods shown, Grove prefers method A or F be used on Grove cranes, i.e., clipping a short piece of hoist 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. For rotation resistant rope, the dead-end tail length must be a minimum of 20 rope diameters, but not less than 15.2 cm (6 in).

When using method A, place a hoist 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 .

NOTE: Use of swivels is not allowed with non-rotation resistant hoist 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 applies to cableways, cranes, derricks, hoists, hooks, jacks, and slings.

It states, in section 5-1.7.3, "(c) Swaged, 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 6-1 Wire Rope Clip Torque Values

Clip Size		Torque*	
mm	**In**	**N-m**	**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.

BOOM EXTENSION

Fully read and understand the information under this section before erecting and stowing the boom extension.

DANGER

To prevent serious injury or death, always wear personal protective equipment, such as a hard hat, eye protection, gloves and metatarsal boots.

Refer to Figure 6-20 for a diagram of the boom extensions available for this crane.

The GRT780 can be used with the 10 m to 17 m (33 ft to 56 ft) manual offsettable bi-fold swingaway boom extension with mechanical offset mechanism for offsets of 0, 25, and 45 degrees.

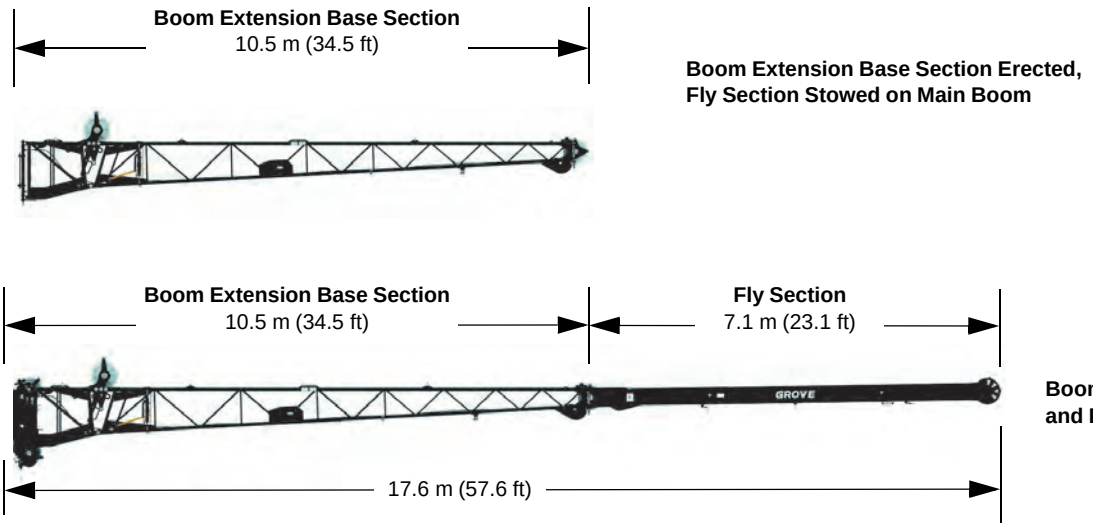
A boom extension is built specifically for the crane with which it was sold. Each extension is stamped with the crane's serial number.

CAUTION

Equipment Damage Hazard!

To prevent malfunctions and damage to the equipment, operate the crane only with the boom extension which has the same serial number as the crane

To use a single boom extension on several Grove cranes, contact Grove Product Support or your authorized Grove Distributor.



10728 and 10728-1

FIGURE 6-20

6

General Warnings

DANGER

Make sure the boom is fully retracted during the erection and stowage of the boom extension.

If the boom is extended during this process, the pins may not engage properly and/or the boom extension could move in an uncontrolled manner resulting in death or serious injury.

DANGER

To prevent serious injury or death, always wear personal protective equipment, including a hard hat, eye protection, gloves, and metatarsal boots.

Before attempting to erect or stow the boom extension, read and strictly adhere to all danger decals installed on the boom/boom nose, boom extension, and stowage brackets to prevent serious injury or death.

Controlling the boom extension during erecting and stowing procedures is accomplished by use of a tag line and by raising or lowering the boom. Failure to control the boom extension could cause serious injury or death.

Boom Extension Pin Interlock Mechanism

The boom extension pin interlock mechanism (1, Figure 6-21) interlocks the front boom extension stowage bracket pin (3) and the right side boom extension mounting pins (4) to make sure that the boom extension is erected and stowed properly.

The front boom extension stowage bracket pin (3) is extended and retracted manually using an impact wrench and the provided extension and socket. Push/pull cables (2) connect the front boom extension stowage bracket pin (3) and the right side boom extension mounting pins (4). When the front boom extension stowage bracket pin (3) is extended, the cables (2) retract the interlock pins (6) from the right side boom extension mounting pins (4), unlocking them. When the front boom extension stowage pin (3) is retracted, the cables (2) insert the interlock pins (6) into the right side boom extension mounting pins (4), locking them in the extended position. If the right side boom extension mounting pins (4) are in the retracted position, the front boom extension mounting bracket pin cannot be retracted.

FRONT BOOM EXTENSION STOWAGE BRACKET PIN

The front boom extension stowage bracket pin (3, Figure 6-21) is extended/retracted by turning the separate front boom extension stowage bracket jack screw (4, Figure 6-22) using an impact wrench and the extension and socket supplied with the crane. When the front boom extension stowage bracket pin is extended, the right side boom extension mounting pins (4, Figure 6-21) are unlocked, allowing the right side boom extension mounting pins to be extended or retracted. The right side boom extension mounting pins can only be retracted when the front boom extension stowage bracket pin is extended.

RIGHT SIDE BOOM EXTENSION MOUNTING PINS

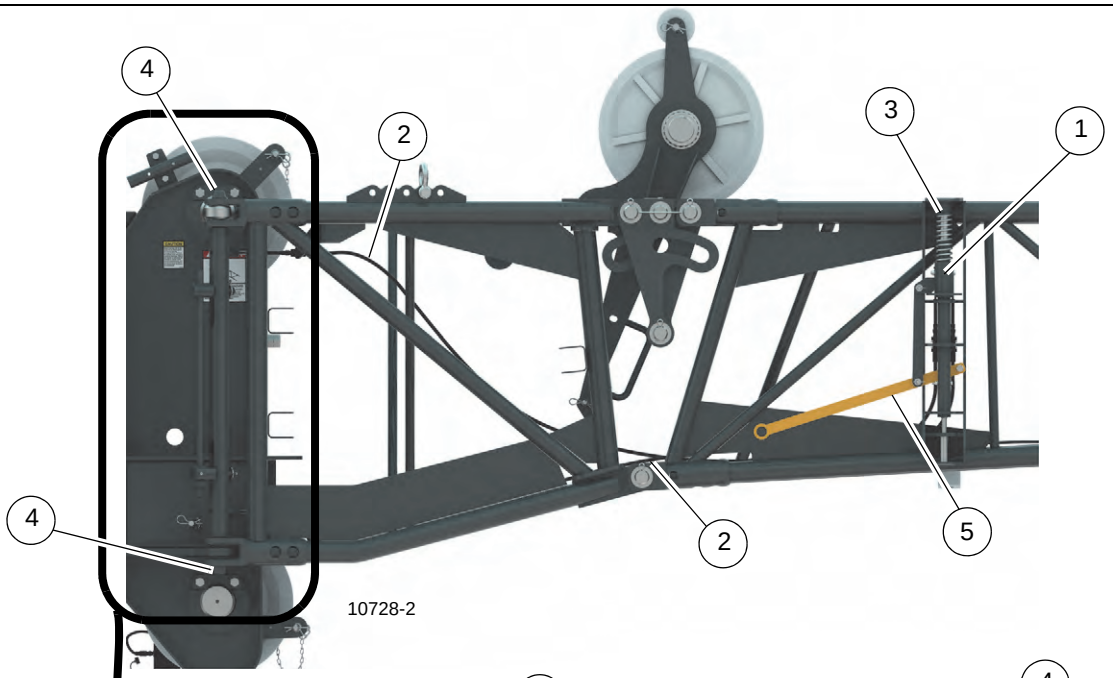
The right side boom extension mounting pins (4, Figure 6-21) are used as a pivot to swing the boom extension from its stowed position on the side of the main boom to its erected position on the end of the boom nose, and then back again. Mechanical interlock pins (6) lock and unlock the right side boom extension mounting pins (4) based on the position of the front boom extension stowage bracket pin (3). When the front boom extension stowage bracket pin (3) is retracted, it is disengaged from the front boom extension stowage bracket (3, Figure 6-22) and the right side boom extension mounting pins (4, Figure 6-21) are locked in the extended position. When the front boom extension stowage bracket pin (3) is extended, the right side boom extension mounting pins (4) are unlocked, allowing the right side boom extension mounting pins (4) to be extended or retracted. An impact wrench is required to extend and retract the right side boom extension mounting pins (4).

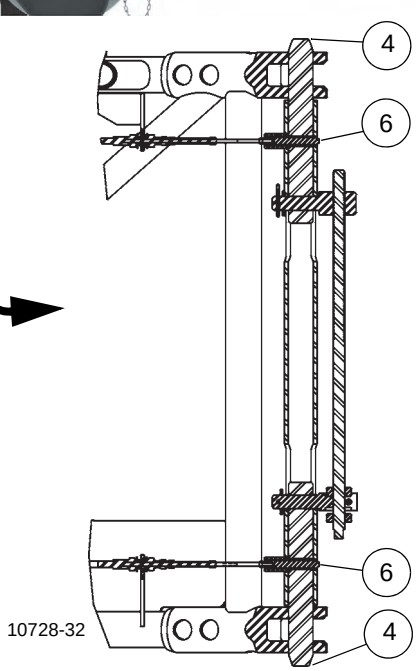
Front Boom Extension Stowage Bracket Pin Handle

The front boom extension stowage bracket pin handle (5, Figure 6-21) moves in unison with the front boom extension stowage bracket pin (3), providing a visual cue for operators outside of the operator cab to know the status of the front boom extension stowage bracket pin (3):

- Handle up – The front boom extension stowage bracket pin (3) is extended in the front boom extension stowage bracket (3, Figure 6-22) and the right side boom extension mounting pins (4, Figure 6-21) are unlocked.
- Handle down – The front boom extension stowage bracket pin (3, Figure 6-21) is retracted and the right side boom extension mounting pins (4, Figure 6-21) are locked.

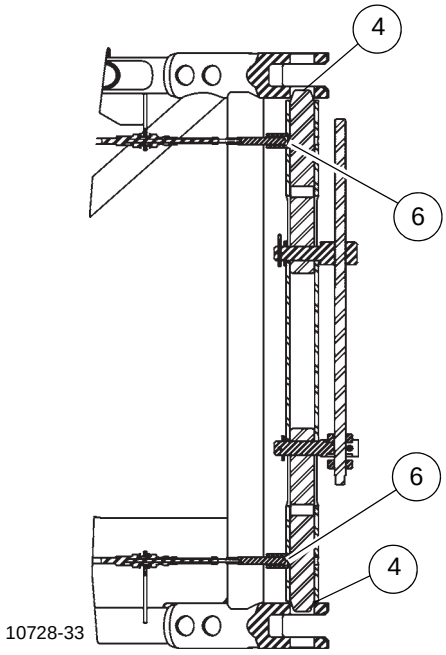
The handle is also used to manually release the front boom extension mounting pin interlock when removing the boom extension from the crane.





Right Side Boom Extension Mounting Pins (4) Locked

Front Mounting Pin (3) Unlocked



Right Side Boom Extension Mounting Pins (4) Unlocked

Front Mounting Pin (3) Locked

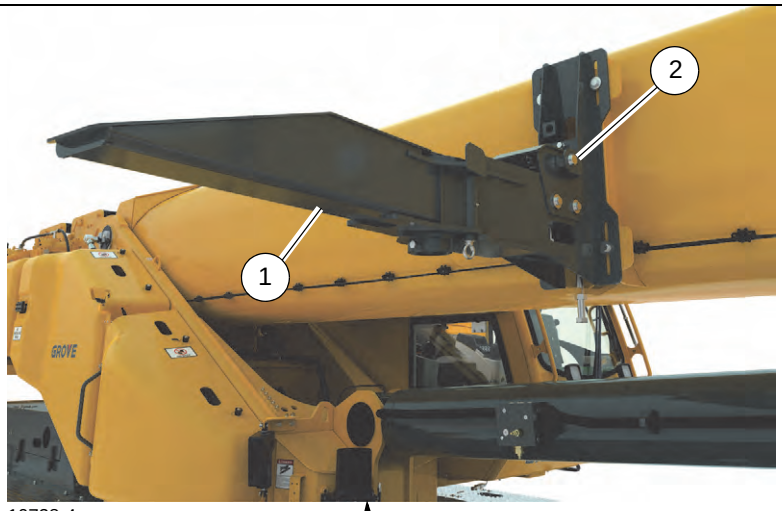
FIGURE 6-21

Boom Extension Stowage Brackets

NOTE: The fly section and boom extension base section must be connected together in the stowed position to secure the boom extension to the side of the boom.

The main boom has the following stowage brackets for stowing the fly section and boom extension base section:

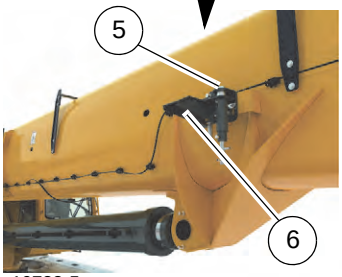
- Rear Boom Extension Stowage Bracket – Located nearest to the superstructure cab is the rear boom extension stowage bracket (1, Figure 6-22). The boom extension base section is pinned to the fly section. The fly section is secured to the side of the main boom at the rear stowage bracket using the manually operated pin (2).
- Front Boom Extension Stowage Bracket – Located nearest the boom nose is the front boom extension stowage bracket (3, Figure 6-22). The boom extension base section is secured to the side of the main boom at the front stowage bracket with the pin (3, Figure 6-21), which is part of the Boom Extension Pin Interlock Mechanism. For more information, refer to *Boom Extension Pin Interlock Mechanism*, page 6-28. The pin (3, Figure 6-21) is extended/retracted by turning the separate front boom extension stowage bracket jack screw (4, Figure 6-22) using an impact wrench and the extension and socket supplied with the crane.
- Middle Fly Section Stowage Bracket – Located near the lift cylinder pin. The middle fly section stowage bracket (6, Figure 6-22) secures the fly section to the main boom with the manually operated pin (5, Figure 6-22).



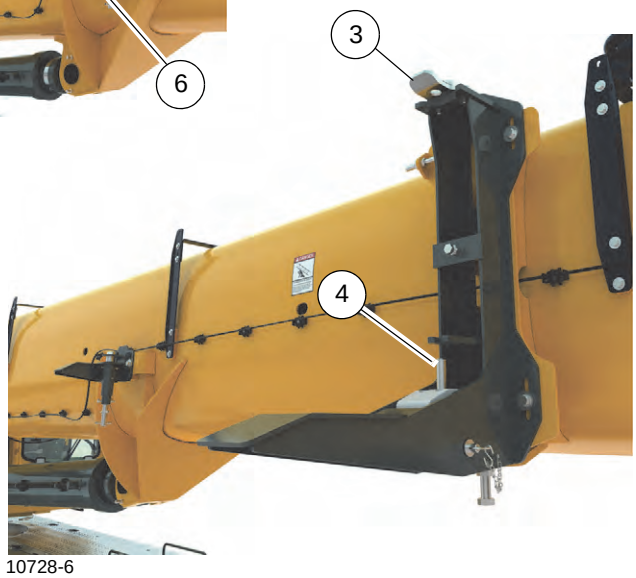
10728-4

10728-3

Rear **Front**



10728-5



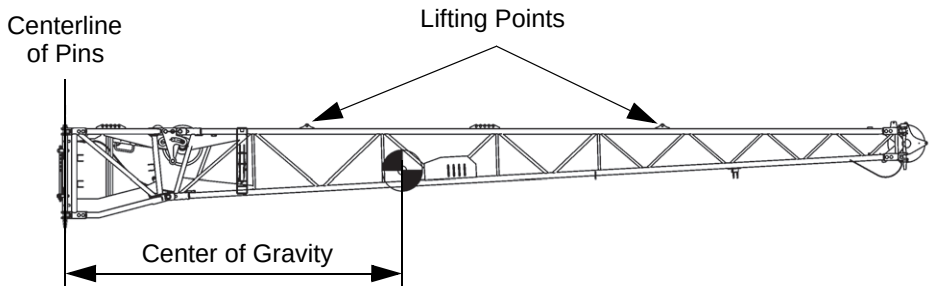
10728-6

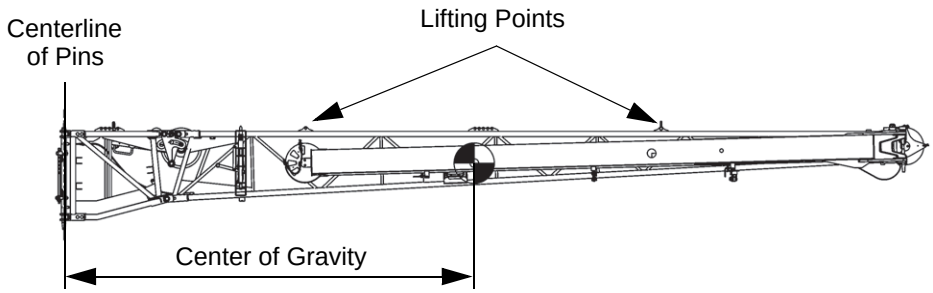
Item	Description
1	Rear Boom Extension Stowage Bracket
2	Rear Boom Extension Stowage Bracket Pin
3	Front Boom Extension Stowage Bracket
4	Front Boom Extension Stowage Bracket Jack Screw
5	Middle Fly Section Stowage Bracket Pin
6	Middle Fly Section Stowage Bracket

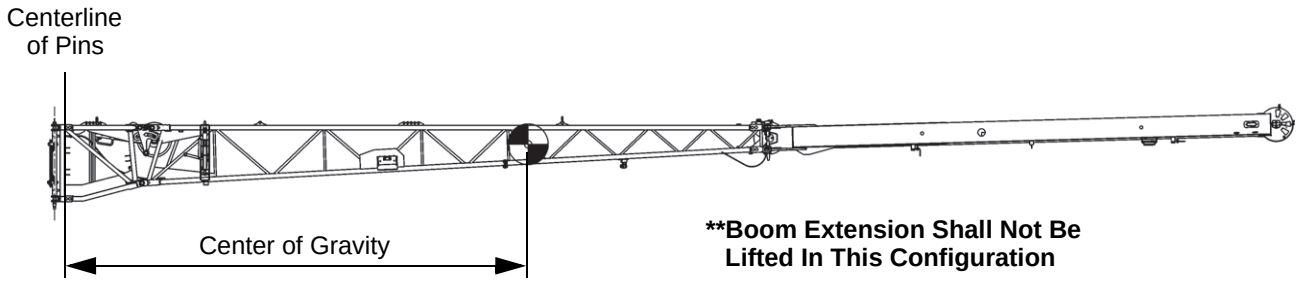
FIGURE 6-22

Lifting Points

Figure 6-23 and Figure 6-24 show the sling attaching points and center of gravity locations for lifting the boom extension.







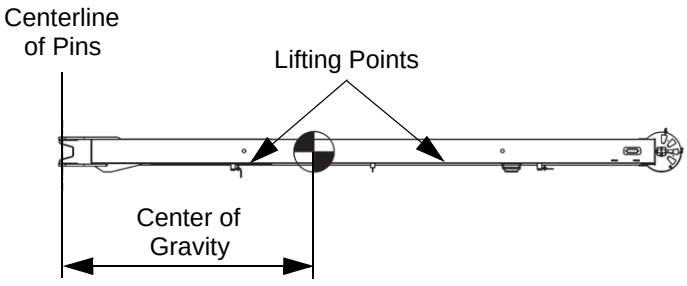


FIGURE 6-23

6

Description	Weight	Center of Gravity
10 m (33 ft) Boom Extension	802 kg (1769 lb)	399 cm (157 in)
10 m (33 ft) Boom Extension With 7 m (23 ft) Boom Extension Stowed	1140 kg (2500 lb)	485 cm (191 in)
17 m (56 ft) Boom Extension	1140 kg (2500 lb)	658 cm (259 in)
7 m (23 ft) Boom Extension	334 kg (736 lb)	297 cm (117 in)

FIGURE 6-24

Installing the Folding Boom Extension

DANGER

Boom Extension Hazard!

To avoid death or serious injury, follow procedures and cautions in the Operator and Safety Manuals and decals during erection, stowage and use of boom extension. Install and secure all pins properly and control boom extension movement at all times.

DANGER

To prevent serious injury or death, always wear personal protective equipment: hard hat, eye protection, gloves and metatarsal boots.

Use this procedure to install the boom extension base section with or without the fly section that are separate from the crane on to the boom nose.

Required Tools	• 1/2 in Impact Wrench • 24 in — 1/2 in Drive Impact Extension • 1/2 in Square Drive Socket — 14mm impact rated hex socket • Double Sided 1/2 in Square Drive impact rated special socket

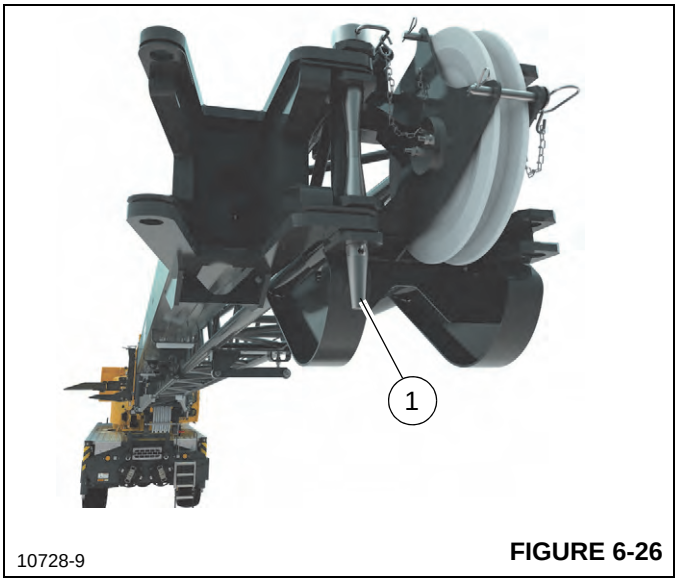
NOTE: This procedure assumes the boom extension is completely removed from the boom nose and the fly section is stowed on the boom extension base section.

NOTE: An auxiliary crane with sling is required to install the boom extension on to the boom nose.

1. Make sure the counterweight is installed. For more information about installing the counterweight, refer to *Counterweight Removal and Installation – Hydraulic Version*, page 6-63.
2. Make sure the crane is set up on fully-extended outriggers. For more information, refer to *Using the Outriggers*, page 5-28.
3. Fully retract and lower the boom to horizontal.
4. Attach a tag line to the end of the boom extension base section with the nose sheave.
5. Make sure the connecting link (1, Figure 6-25) is in place that connects the fly section to the boom extension base section.

10728-8 **FIGURE 6-25**

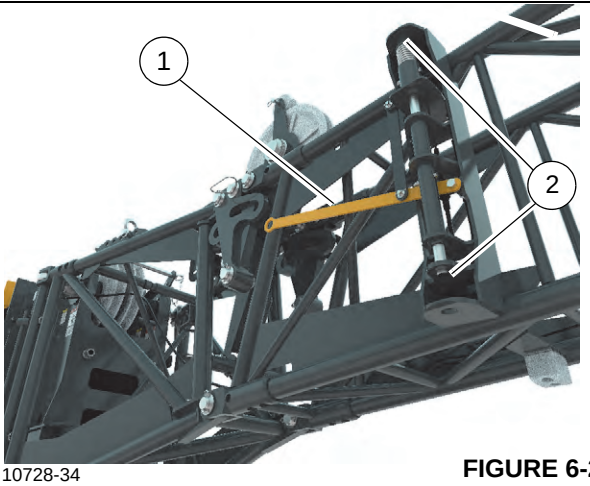
6. Make sure the attachment pin (1, Figure 6-26) and retaining clip are in place that connects the ends of the fly section and the boom extension base section together.



10728-9 **FIGURE 6-26**

6

7. If necessary, raise the front boom extension stowage bracket pin handle (1, Figure 6-27) to unlock the right side boom extension mounting pins (4, Figure 6-29).



10728-34 **FIGURE 6-27**

8. If necessary, turn the jack screw (3, Figure 6-29) clockwise using an impact wrench and the provided extension and socket to fully retract the right side boom extension mounting pins (4)

DANGER

When installing the boom extension, make sure that all personnel and equipment are kept clear of the swing path.

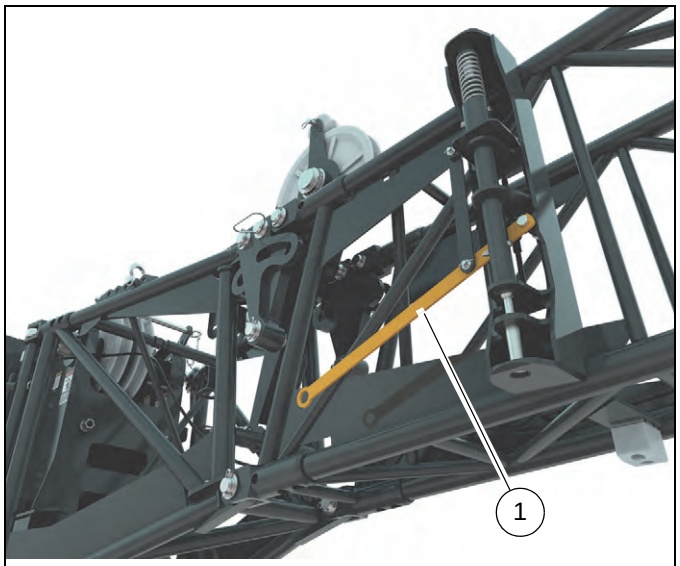
9. Using a sling attached to an auxiliary crane, lift the boom extension in front of the boom nose. For more information about attaching points for the sling, refer to *Lifting Points*, page 6-33.

10. Raise and lower the boom extension as necessary to align the boom extension anchor fitting holes (1, Figure 6-29) with the boom nose attachment lug holes (2).

    Remove the two left side boom extension mounting pins (5, Figure 6-29) from the storage holders on the boom extension. Align and secure the left side of the boom extension to the boom nose by installing the two boom extension mounting pins (5). Secure the two mounting pins (5) with retaining clips (6).

    Align and secure the right side boom extension mounting pins (4) in the holes in the boom nose. Using an impact wrench and the provided extension and socket, turn the jack screw (3) counterclockwise to extend the right side boom extension mounting pins (4) into the boom nose attachment lugs. Extend jack screw until the bolts and washers are at the end of the slots. Verify that the mounting pins (4) are fully engaged.

11. Lower the front boom extension stowage bracket pin handle (1, Figure 6-28) to lock the right side boom extension mounting pins (4, Figure 6-29).



10728-11 **FIGURE 6-28**

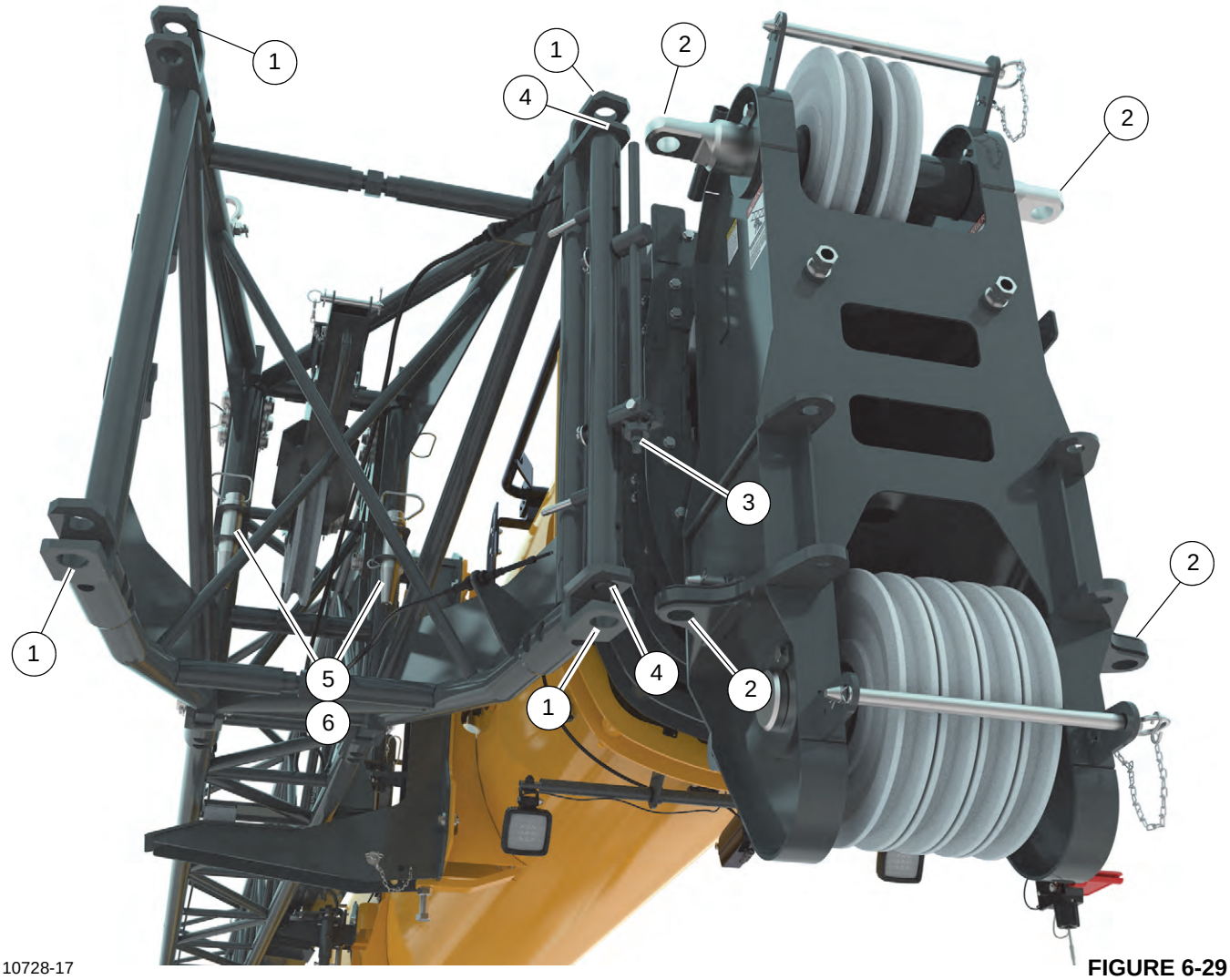
12. Remove the slings from the boom extension.

13. Operator must do one of the following:

- Stow the boom extension on the side of the main boom (refer *Stowing the 17 m (56 ft) Boom Extension*, page 6-45)

  - or -

- Erect the boom extension fly section (refer to *Erecting the Fly Section*, page 6-43



10728-17

FIGURE 6-29

Removing the Folding Boom Extension

DANGER

Boom Extension Hazard!

To avoid death or serious injury, follow procedures and cautions in the Operator and Safety Manuals and decals during erection, stowage and use of boom extension. Install and secure all pins properly and control boom extension movement at all times.

Use the following procedure to remove the boom extension from the boom nose.

NOTE: This procedure assumes the boom extension is erected on the boom nose and the fly section is stowed on the boom extension base section. If the fly section is erected, stow the fly section. For more information, refer to *Stowing the Fly Section*, page 6-44.

This procedure would also be used to remove only the boom extension base section. In this case the fly section must be left stowed on the main boom base section.

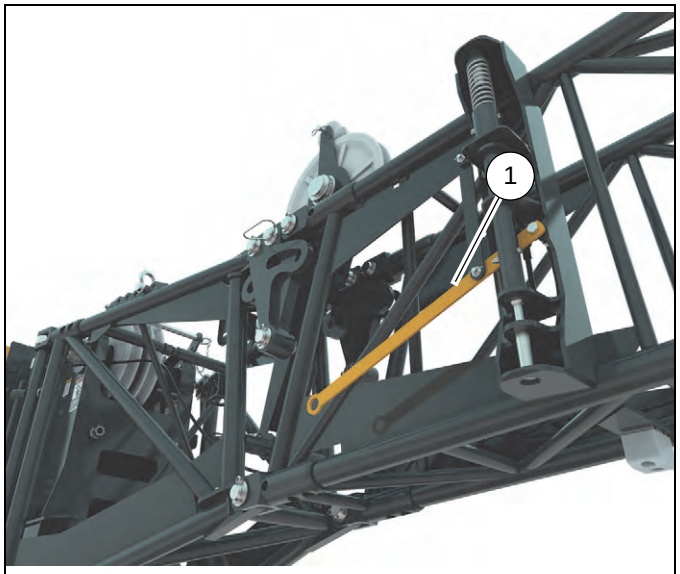
Required Tools	• 1/2 in Impact Wrench • 24 in — 1/2 in Drive Impact Extension • 1/2 in Square Drive Socket — 14mm impact rated hex socket • Double Sided 1/2 in Square Drive impact rated special socket

NOTE: An auxiliary crane with sling is required to remove the boom extension from the main boom.

1. Make sure the counterweight is installed. For more information about installing the counterweight, refer to *Counterweight Removal and Installation – Hydraulic Version*, page 6-63.
2. Make sure the crane is set up on fully extended outriggers. For more information, refer to *Using the Outriggers*, page 5-28.
3. Make sure the boom extension offset is set to the 0° position. For more information, refer to *Setting Boom Extension Manual Offset*, page 6-61.
4. Fully retract and lower the boom to horizontal.
5. If equipped, remove the anemometer and boom position light from the boom extension and install it on the boom nose.
6. If necessary, remove the anti-two block switch from the end of the boom extension and install it on the boom nose. For more information, refer to *Boom Extension Electrical Connections*, page 6-56.
7. If necessary, unreeve the hoist rope from the boom extension sheave and mast sheave. Lay the hoist rope down on the left side of the boom extension.

   Lower the mast sheave assembly. For more information, refer to *Raising and Lowering the Mast Sheave*, page 6-60.

   Once the hoist rope is unreeved, make sure that all hoist rope retaining pins are reinstalled and secured with retaining clips.
8. Using a sling attached to an auxiliary crane, attach the auxiliary crane to the boom extension attaching points. For more information about attaching points for the sling, refer to *Lifting Points*, page 6-33.
9. Attach a tag line to the end of the boom extension base section with the nose sheave.
10. Make sure that the right side boom extension mounting pins (4, Figure 6-29) are fully extended in to the holes in the boom nose and that the front boom extension stowage bracket pin handle (1, Figure 6-30) is in the down position (locking the mounting pins).



10728-11 **FIGURE 6-30**

11. Raise the front boom extension stowage bracket pin handle (1, Figure 6-30) to unlock the right side boom extension mounting pins (4, Figure 6-29)

DANGER

When removing the boom extension, make sure the boom extension is properly supported by the auxiliary crane and the movement of the boom extension is controlled at all times.

12. With the boom extension properly secured and supported by the auxiliary crane, do the following:

a. Disengage the boom extension mounting pins (4, Figure 6-29) securing the boom extension to the **right** side of the boom nose. Use an impact wrench and the provided extension and socket to turn the jack screw (3, Figure 6-29) clockwise. Make sure the mounting pins are fully disengaged.

b. Remove the two boom extension mounting pins (5, Figure 6-29) securing the boom extension to the **left** side of the boom nose. Place the two mounting pins in the storage holders on the boom extension and secure them in place with the retaining clips (6, Figure 6-29).

13. Using the auxiliary crane and the tag line, remove the boom extension from the boom nose. Move the boom extension to a suitable location.

Erecting the 17 m (56 ft) Boom Extension

DANGER

Boom Extension Hazard!

To avoid death or serious injury, follow procedures and cautions in the Operator and Safety Manuals and decals during erection, stowage and use of boom extension. Install and secure all pins properly and control boom extension movement at all times.

DANGER

To prevent serious injury or death, do not stand on crane decking unless boom extension is secure.

Use the following procedure to erect the boom extension.

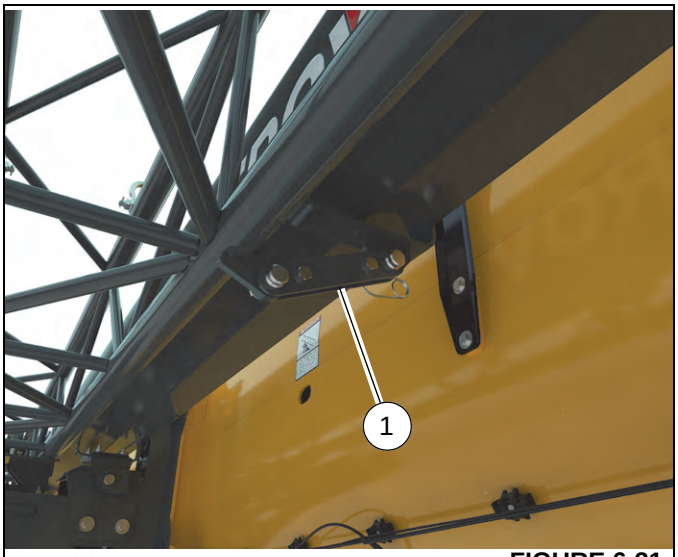
NOTE: This procedure assumes the boom extension base section and fly section are stowed on the side of the main boom.

1. Make sure the counterweight is installed. For more information, refer to *Counterweight Removal and Installation – Hydraulic Version*, page 6-63.

2. Make sure the crane is set up on fully-extended outriggers. For more information, refer to *Using the Outriggers*, page 5-28.

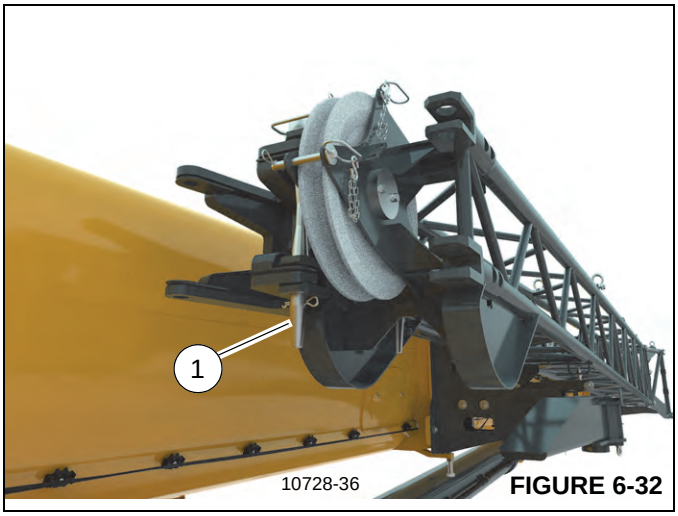
3. Fully retract and lower the boom to horizontal.

4. Make sure the connecting link (1, Figure 6-31) is in place that connects the fly section to the boom extension base section.



10728-35 **FIGURE 6-31**

5. Make sure the attachment pin (1, Figure 6-32) and retaining clip are in place that connects the ends of the fly section and the boom extension base section together.



10728-36 **FIGURE 6-32**

6. Attach a tag line to the end of the boom extension base section. The tag line will assist when swinging the boom extension to the front of the boom nose.

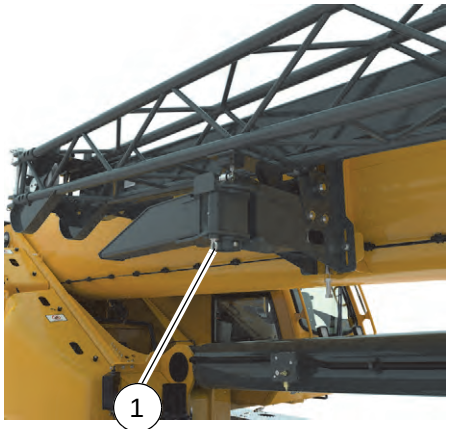
7. Deploy the ramp at the rear boom extension stowage bracket by doing the following:

a. Retract the retaining pin (1, Figure 6-33) to release the rear boom extension ramp (2) from the stowed position.

b. Fully swing the rear boom extension ramp (2) into the deployed position.

c. Make sure the spring-actuated retaining pin (1) locks into position.

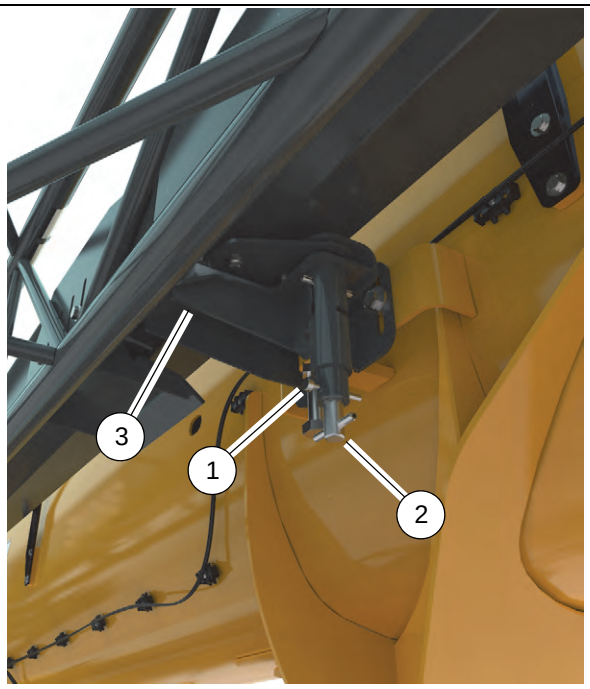
10728-13 DEPLOYED POSITION



10728-12 STOWED POSITION

FIGURE 6-33

8. Detach the fly section from the middle fly section stowage bracket by doing the following:
   a. Remove the retaining clip (1, Figure 6-34) from the pin (2) at fly section stowage bracket (3).
   b. Pull pin (2) downward and turn counterclockwise to lock in place.
   c. Reinstall the retaining clip into the pin.



10728-14

FIGURE 6-34

9. Detach the fly section from the rear boom extension stowage bracket by doing the following:
   a. Remove the retaining clip (2, Figure 6-35) from the pin (1) at the rear stowage bracket.
   b. Pull pin (1) towards the rear of the crane and turn counterclockwise to lock in place.
   c. Reinstall the retaining clip (2) in the pin (1).

10728-20

FIGURE 6-35

10. Using the tag line, swing the boom extension out on the rear stowage bracket ramp so that the right side boom extension mounting pins (4, Figure 6-29) align with the holes in the boom nose attachment lugs.
11. Using an impact wrench and the provided extension and socket, turn the jack screw (3, Figure 6-29) counterclockwise to extend the right side boom extension mounting pins (4) into the boom nose attachment lugs. Extend jack screw until the bolts and washers are at the end of the slots. Verify that the pins (4) are fully engaged.

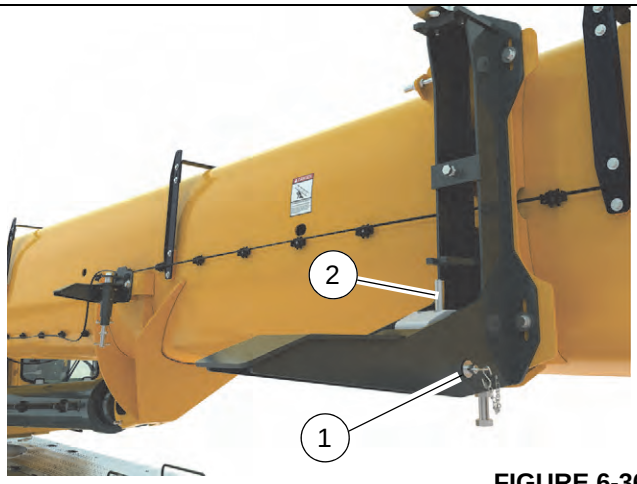
DANGER

Crush Hazard

To avoid death or serious injury, ensure boom extension mounting pins (4, Figure 6-29) are engaged prior to retracting the front stowage bracket pin (2, Figure 6-27).

6

12. Remove the cross pin (1, Figure 6-36) at the front boom extension stowage bracket. Place the cross pin in the storage holder and secure with retaining clip.



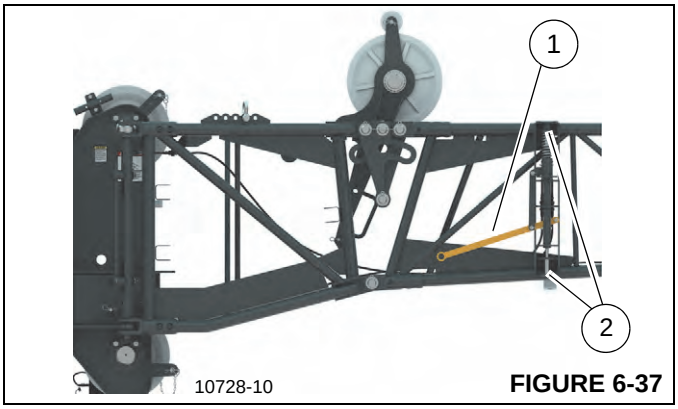
10728-6 **FIGURE 6-36**

WARNING

After disengaging the boom extension from the front boom extension stowage bracket, the boom extension is free to swing out from the side of the main boom.

13. Detach the boom extension from the front boom extension stowage bracket by using an impact wrench and the provided extension and socket to turn the jack screw (2, Figure 6-36) counterclockwise. Make sure the jack screw bottoms out and the front boom extension stowage bracket pin (2, Figure 6-37) is fully disengaged (retracted).

NOTE: The front boom extension stowage bracket pin (2, Figure 6-37) will not unlock unless the right side boom extension mounting pins are fully engaged (extended). If the front stowage bracket pin (2) does not unlock, make sure the right side boom extension mounting pins (4, Figure 6-29) are fully engaged and the interlock pins are inserted through the pins.



10728-10 **FIGURE 6-37**

DANGER

When erecting the boom extension, make sure that all personnel and equipment are kept clear of the swing path.

14. Slightly raise and/or lower the boom to help control the boom extension. Using the tag line, swing the boom extension to the front of the boom nose. Align the left side boom extension anchor fitting holes (1, Figure 6-29) with the left side boom nose attachment lug holes (2).

15. Remove the two boom extension mounting pins and retaining clip (5, 6, Figure 6-29) from the storage holders on the boom extension. Attach the boom extension to the left side of the boom nose by installing the two mounting pins (5). Secure the mounting pins with retaining clips (6).

16. Raise the mast sheave assembly. For more information, refer to *Raising and Lowering the Mast Sheave*, page 6-60.

17. Remove the anti-two block switch from the boom nose and install it on the nose of the boom extension base section. For more information, refer to *Boom Extension Electrical Connections*, page 6-56.

18. Remove the tag line.

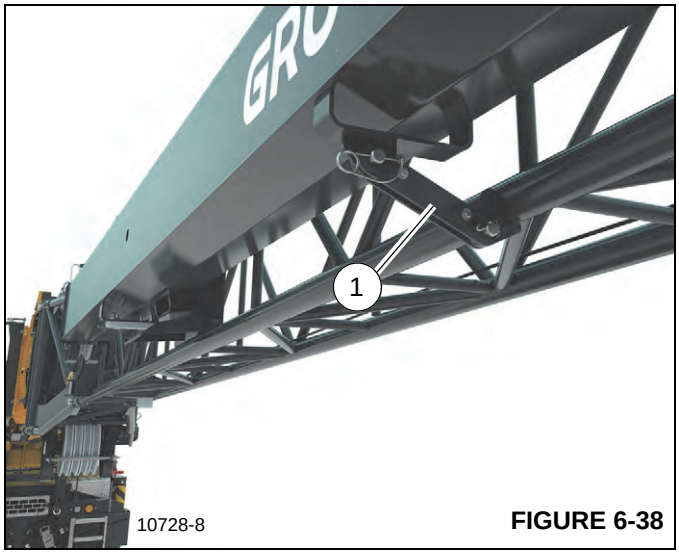
19. Erect the boom extension fly section following the procedures under *Erecting the Fly Section*, page 6-43

Erecting the Fly Section

Use this procedure to erect the boom extension fly section.

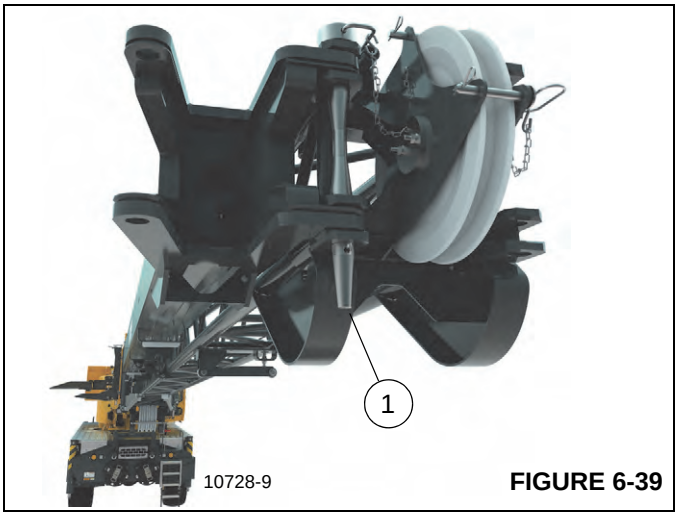
NOTE: This procedure assumes the boom extension base section is erected and set to 0° offset and that the fly section is folded along the side of the boom extension base section.

1. Make sure the counterweight is installed. For more information, refer to *Counterweight Removal and Installation – Hydraulic Version*, page 6-63.
2. Make sure the crane is set up on fully-extended outriggers. For more information, refer to *Using the Outriggers*, page 5-28.
3. Fully retract and lower the boom to horizontal.
4. Make sure the connecting link (1, Figure 6-38) is in place that connects the fly section to the boom extension base section.



10728-8 **FIGURE 6-38**

5. Make sure the attachment pin (1, Figure 6-39) and retaining clip are in place that connects the ends of the fly section and the boom extension base section together.



10728-9 **FIGURE 6-39**

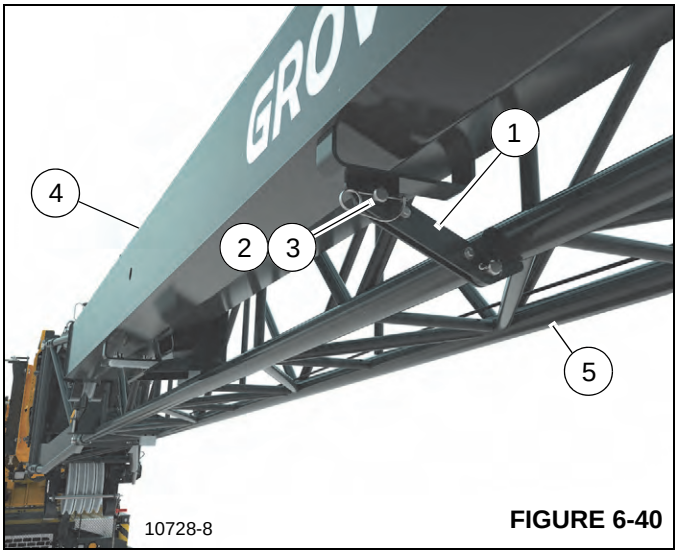
6. Attach a tag line to the end of the fly section.

CAUTION

After detaching the fly section from the boom extension base section, the fly section is free to swing out.

7. Detach the fly section (4, Figure 6-40) from the boom extension base section (5) by removing the retaining clip (2) and pin (3) securing the connecting link (1) to the fly section (4).

   With connecting link (1) detached, reinstall the pin (3) and secure with the retaining clip (2).

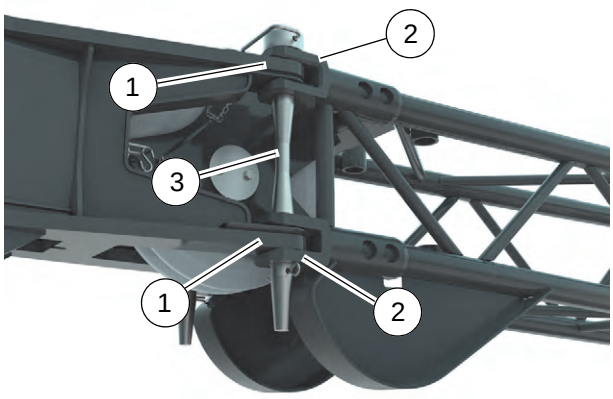


10728-8 **FIGURE 6-40**

DANGER

When erecting the fly section, make sure that all personnel and equipment are kept clear of the swing path.

8. Slightly raise and/or lower the boom to help control the boom extension. Using the tag line, swing the fly section around and align the fly section anchor fitting holes (1, Figure 6-41) with the boom extension base section attachment lug holes (2).



10728-21

FIGURE 6-41

9. Remove the mounting pin (3, Figure 6-41) from its storage holder on the boom extension and insert it into the holes of the left side anchor fittings and attachment lugs (1, 2). Secure the pin with the retaining clip.

10. Reeve the hoist rope over the mast sheave and boom extension sheave. For more information, refer to *Hoist Rope Reeving*, page 6-14.

Once the hoist rope is reeved, make sure that all hoist rope retaining pins are reinstalled and secured with retaining clips.

11. Remove the anti-two block switch from the boom nose and install it on the nose of the fly section. For more information, refer to *Boom Extension Electrical Connections*, page 6-56.

12. If equipped, remove the anemometer and boom position light assembly from the boom nose and install it on the end of the fly section.

13. Remove the tag line from the end of the fly section.

Stowing the Fly Section

Use the following procedure to stow the fly section on the boom extension base section.

NOTE: This procedure assumes the boom extension base section and fly section are fully erected and positioned to a 0° offset.

1. Make sure the counterweight is installed. For more information, refer to *Counterweight Removal and Installation – Hydraulic Version*, page 6-63.

2. Make sure the crane is set up on fully-extended outriggers. For more information, refer to *Using the Outriggers*, page 5-28.

3. Fully retract and lower the boom to horizontal.

4. Attach a tag line to the end of the fly section. This tag line will aid in swinging the fly section into position.

5. If equipped, remove the anemometer and boom position light assembly from the end of the fly section and attached to the boom nose.

6. Remove the anti-two block switch from the end of the fly section and install it on the boom nose. For more information, refer to *Boom Extension Electrical Connections*, page 6-56.

7. Unreeve the hoist rope from the fly section sheave assembly and the mast sheave. Lay the hoist rope down on the left side of the boom extension.

Lower the mast sheave.For more information, refer to *Raising and Lowering the Mast Sheave*, page 6-60.

Once the hoist rope is unreeved, make sure that all hoist rope retaining pins are reinstalled and secured with retaining clips.

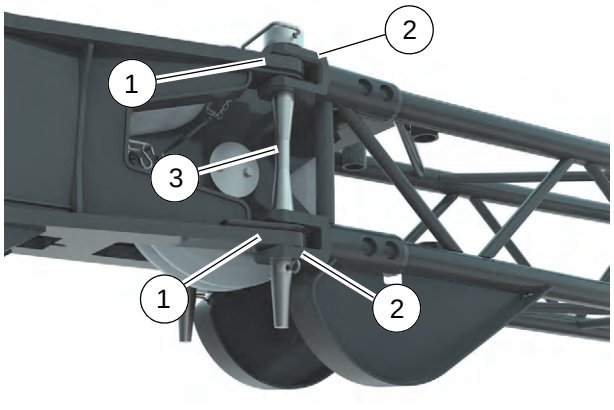
DANGER

When stowing the fly section, make sure that all personnel and equipment are kept clear of the swing path.

CAUTION

After removing the attachment pin that connects the left side of the fly section to the boom extension base section, the fly section is free to swing out.

8. Remove the left side retaining clip and attachment pin (3, Figure 6-42) that connects the fly section to the boom extension base section. Place the attachment pin (3) in the storage holder on the boom extension base section and secure with retaining clip.

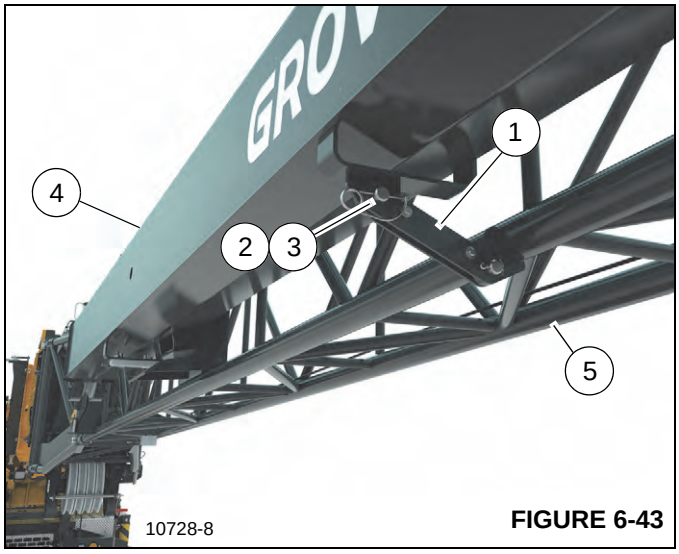


10728-21

FIGURE 6-42

9. Slightly raise and/or lower the boom to help control the boom extension. Swing and stow the fly section on to the side of the boom extension base section.

10. Attach the fly section (4, Figure 6-43) to the boom extension base section (5) using the connecting link (1). Secure connecting link with pin (3) and retaining clip (2).



10728-8

FIGURE 6-43

11. Remove the tag line from the end of the fly section.

Stowing the 17 m (56 ft) Boom Extension

DANGER

Boom Extension Hazard!

To avoid death or serious injury, follow procedures and cautions in the Operator and Safety Manuals and decals during erection, stowage and use of boom extension. Install and secure all pins properly and control boom extension movement at all times.

DANGER

To prevent serious injury or death, do not stand on crane decking unless boom extension is secure.

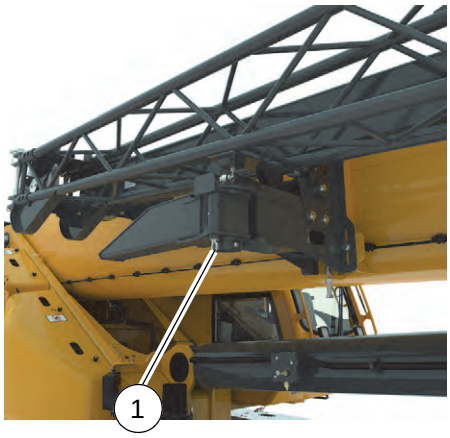
Use this procedure to stow the boom extension to the side of the main boom.

NOTE: This procedure assumes the fly section is stowed on the boom extension base section. For more information about stowing the fly section, refer to *Stowing the Fly Section*, page 6-44.

1. Make sure the counterweight is installed. For more information about installing the counterweight, refer to *Counterweight Removal and Installation – Hydraulic Version*, page 6-63.

2. Make sure the crane is set up on fully extended outriggers. For more information, refer to *Using the Outriggers*, page 5-28.

10728-13



10728-12

FIGURE 6-44

3. Make sure the boom extension offset is set to the 0° position. For more information, refer to *Setting Boom Extension Manual Offset*, page 6-61.

4. Fully retract and lower the boom to horizontal.

5. If necessary, stow the fly section. For more information, refer to *Stowing the Fly Section*, page 6-44.

6. Make sure the rear boom extension stowage bracket ramp (2, Figure 6-44) is in the deployed position.

If the ramp is not deployed, do the following:

a. Retract the retaining pin (1, Figure 6-44) to release the rear boom extension ramp (2) from the stowed position.

b. Fully swing the rear boom extension ramp (2) into the deployed position.

c. Make sure the spring-actuated retaining pin (1) locks into position.

7. Make sure the rear boom extension stowage bracket pin (1, Figure 6-45) is retracted. If pin is not retracted, do the following:
   a. Remove the retaining clip (2, Figure 6-45) from the pin (1) at the rear boom extension stowage bracket.
   b. Pull pin (1) towards the rear of the crane and turn counterclockwise to lock in place.
   c. Reinstall the retaining clip (2) in the pin.

10728-20 **FIGURE 6-45**

8. Attach a tag line to the end of the boom extension base section.
9. If not already done, unreeve the hoist rope from the boom extension sheave assembly and the mast sheave. Lay the hoist rope down on the left side of the boom extension. For more information, refer to *Reeving/Unreeving the Hoist Rope*, page 6-24.

   Lower the mast sheave assembly. For more information, refer to *Raising and Lowering the Mast Sheave*, page 6-60.

   Once the hoist rope is unreeved, make sure that all hoist rope retaining pins are reinstalled and secured with retaining clips.
10. If not already done, remove the anti-two block switch from the end of the boom extension and install it on to the boom nose. For more information, refer to *Boom Extension Electrical Connections*, page 6-56.

CAUTION

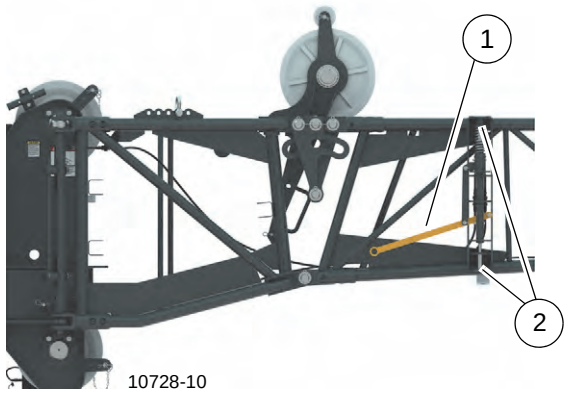
After removing the two left side boom extension mounting pins (5, Figure 6-29), the boom extension is free to swing to the side of the main boom.

11. Remove the two boom extension mounting pins (5, Figure 6-29) securing the boom extension to the **left** side of the boom nose. Place the two mounting pins in the storage holders on the boom extension and secure them in place with the retaining clips (6, Figure 6-29).

DANGER

When stowing the boom extension, make sure that all personnel and equipment are kept clear of the swing path.

12. Slightly raise and/or lower the boom to help control the boom extension. Using the tag line, swing the boom extension to the intermediate position on the side of the boom base section. Make sure the wheels engage the ramps of the front (3, Figure 6-22) and rear (1) boom extension stowage brackets.
13. Raise the boom as needed to move the boom extension in against the main boom so that the front boom extension stowage bracket pin (2, Figure 6-46) can be engaged.

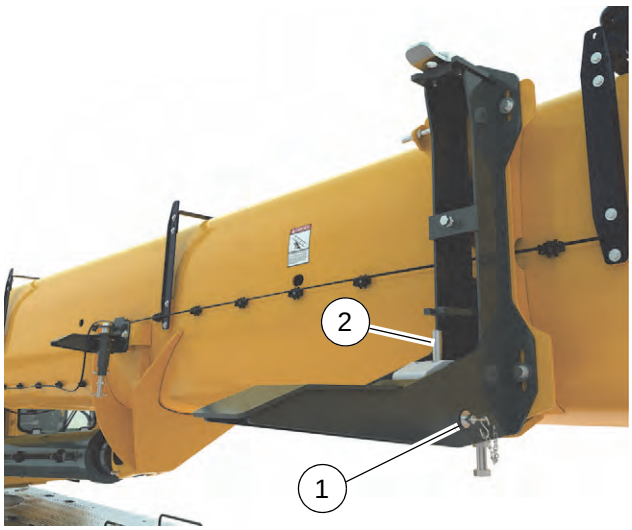


10728-10 **FIGURE 6-46**

14. Lower the boom to a horizontal position.

6

15. Attach the boom extension to the front boom extension stowage bracket by using an impact wrench and the provided extension and socket to turn the jack screw (2, Figure 6-47) clockwise. Make sure the jack screw bottoms out and the front boom extension stowage bracket pin (2, Figure 6-46) is fully engaged (spring will be compressed).



10728-6

FIGURE 6-47

16. At the front boom extension stowage bracket, install the cross pin (1, Figure 6-47) in to the holes underneath the jack screw. Secure the cross pin (1) in place with the retaining clip.

DANGER

Crush Hazard

To avoid death or serious injury, make sure the front boom extension stowage bracket pin (2, Figure 6-46) is engaged and the handle (1, Figure 6-46) is in the up (locked) position before retracting the right side boom extension mounting pins (4, Figure 6-29) using the jack screw (3, Figure 6-29).

17. Visually confirm that the front boom extension stowage bracket pin (2, Figure 6-46) is engaged. The handle should be in the up position. When the handle is in the up position, the front stowage bracket pin is extended and the boom installation pins are unlocked.

18. Disengage the mounting pins (4, Figure 6-29) securing the boom extension to the right side of the boom nose. Use an impact wrench and the provided extension and socket to turn the jack screw (3, Figure 6-29) clockwise. Make sure the mounting pins are fully disengaged.

19. Using the tag line, swing the boom extension towards the boom until it fully engages the rear boom extension stowage bracket. Raise the boom as necessary to help the boom extension engage the rear stowage bracket.

20. At the rear boom extension stowage bracket, attach the boom extension to the main boom by doing the following:

a. Remove the retaining clip (2, Figure 6-48) from the pin (1) at the rear boom extension mounting bracket.

b. Turn pin clockwise to unlock, then push the pin (1) towards the front of the crane.

c. Reinstall the retaining clip in the pin.

10728-20

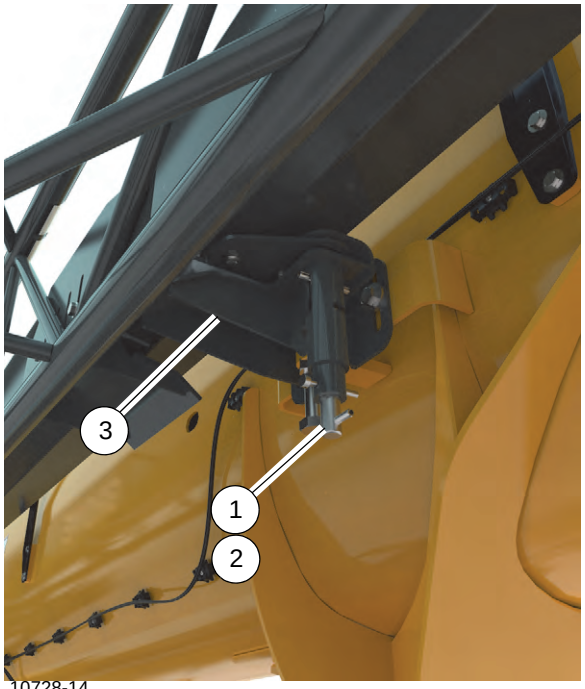
FIGURE 6-48

21. At the middle fly section stowage bracket, attach the fly section to the boom base section by doing the following:

a. Remove retaining clip (1, Figure 6-49) from pin (2) at fly section stowage bracket (3).

b. Turn pin (2) clockwise, allowing the spring-action pin to lock into the fly section.

c. Reinstall the retaining clip (1) into the pin (2).



10728-14

FIGURE 6-49

22. Remove tag line.

Erecting the 10 m (33 ft) Boom Extension Base Section Only

DANGER

Boom Extension Hazard!

To avoid death or serious injury, follow procedures and cautions in the Operator and Safety Manuals and decals during erection, stowage and use of boom extension. Install and secure all pins properly and control boom extension movement at all times.

Use the following procedure to erect only the boom extension base section. During this procedure, the boom extension base section is detached from the fly section and attached to the boom nose. The fly section remains stowed to the side of the main boom.

NOTE: This procedure assumes the boom extension and fly section are stowed on the side of the main boom.

1. Make sure the counterweight is installed. For more information about installing the counterweight, refer to *Counterweight Removal and Installation – Hydraulic Version*, page 6-63.

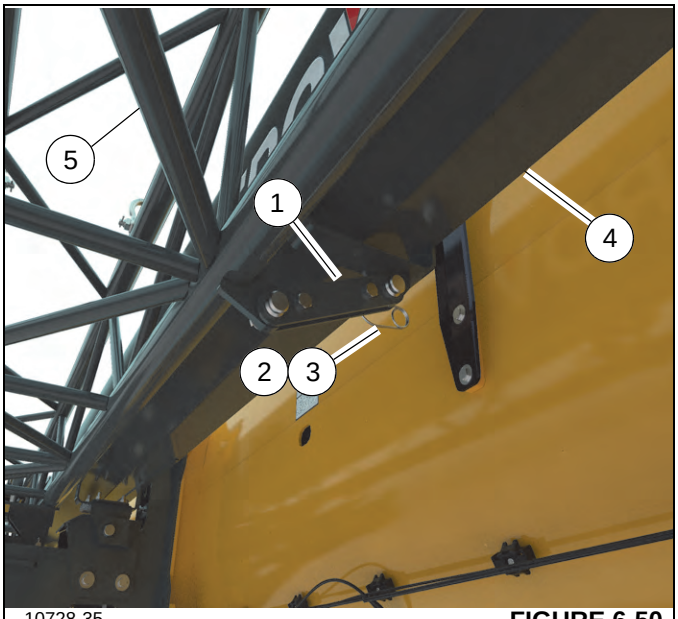
2. Make sure the crane is set up on fully extended outriggers. For more information, refer to *Using the Outriggers*, page 5-28.

3. Fully retract and lower the boom to horizontal.

4. Visually confirm that the pins at the front, middle, and rear boom extension stowage brackets (3, 6, 1, Figure 6-22) are extended (engaged) and properly secure the boom extension to the main boom.

5. Attach a tag line to the tip of the boom extension base section near the sheave. The tag line will assist when swinging the boom extension to the boom nose.

6. Detach the boom extension base section (5, Figure 6-50) from the fly section (4) by removing the retaining clip (2) and pin (3) securing the connecting link (1) to the fly section (4).



10728-35

FIGURE 6-50

6

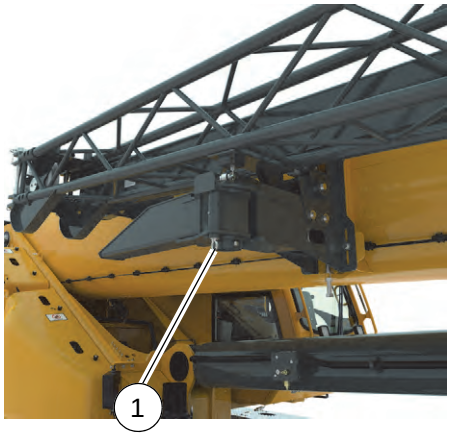
7. Deploy the ramp at the rear boom extension stowage bracket by doing the following:

   a. Retract the retaining pin (1, Figure 6-51) to release the rear boom extension ramp (2) from the stowed position.

   b. Fully swing the rear boom extension ramp (2) into the deployed position.

   c. Make sure the spring-actuated retaining pin (1) locks into position.

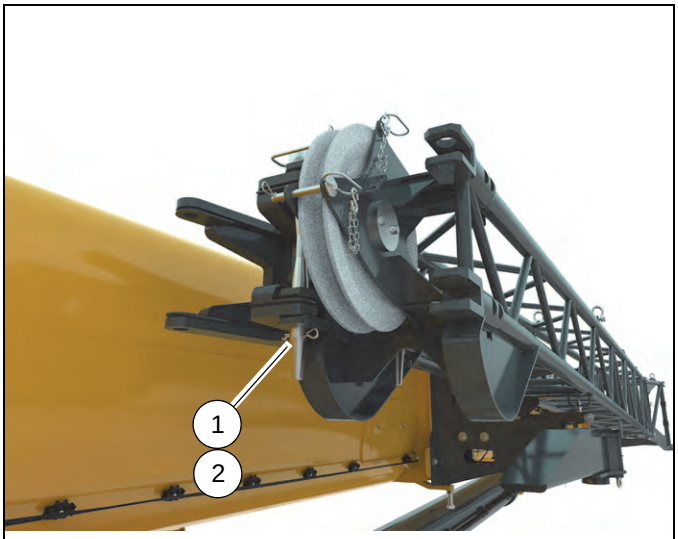
10728-13



10728-12

FIGURE 6-51

8. Remove retaining clip (1, Figure 6-52) and attachment pin (2) to detach the boom extension base section from the fly section. Place the attachment pin in its storage holder on the boom extension base section and secure with retaining clip.



10728-36 **FIGURE 6-52**

9. Using the tag line, swing the boom extension on to the rear stowage bracket ramp so that the right side boom extension mounting pins (4, Figure 6-29) align with the holes in the boom nose attachment lug holes (2).

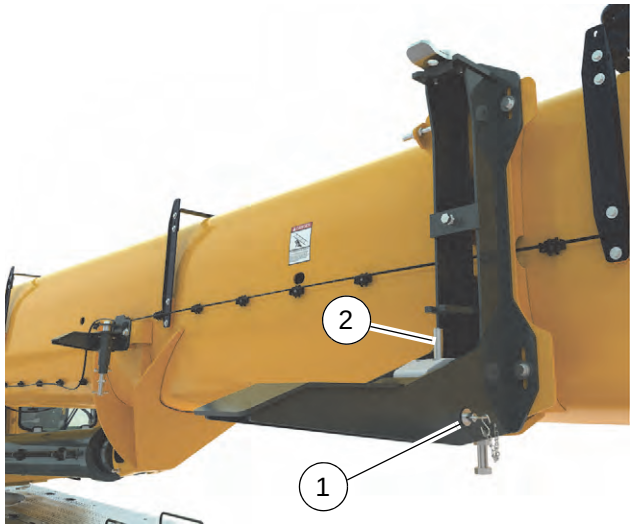
10. Using an impact wrench and the provided extension and socket, turn the jack screw (3, Figure 6-29) counterclockwise to extend the right side boom extension mounting pins (4) into the boom nose attachment lug holes. Extend jack screw until the bolts and washers are at the end of the slots. Verify that the mounting pins (4) are fully engaged.

DANGER

Crush Hazard

To avoid death or serious injury, make sure right side boom extension mounting pins (4, Figure 6-29) are installed prior to retracting the front boom extension stowage bracket pin (2, Figure 6-53).

11. Remove the cross pin (1, Figure 6-53) at the front boom extension stowage bracket. Place the cross pin in the storage holder and secure with retaining clip.



10728-6 **FIGURE 6-53**

CAUTION

After retracting the front boom extension stowage bracket pin that secures the boom extension base section to the main boom base section, the boom extension is free to swing away from the side of the main boom.

6

12. Detach the boom extension from the front stowage bracket by using an impact wrench and the provided extension and socket to turn the jack screw (2, Figure 6-53) counterclockwise. Make sure the jack screw bottoms out and the top attachment pin (2, Figure 6-54) is fully disengaged.

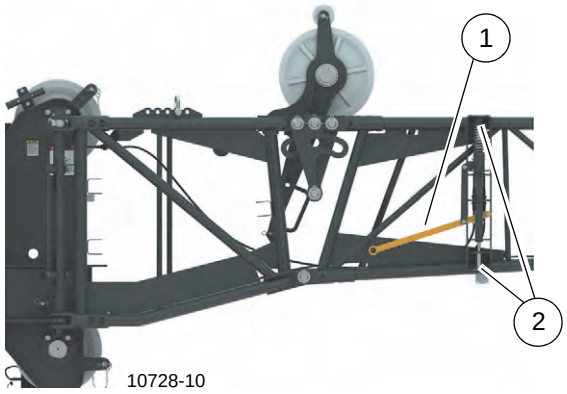


FIGURE 6-54

NOTE: The front boom extension stowage bracket pin (2, Figure 6-54) will not unlock unless the right side boom extension mounting pins (4, Figure 6-29) are fully engaged. If the front boom extension stowage bracket pin (2, Figure 6-54) does not unlock, make sure the right side boom extension mounting pins are fully engaged and the interlock pins (6, Figure 6-21) are inserted through the mounting pins (4, Figure 6-29).

DANGER

When erecting the boom extension, make sure that all personnel and equipment are kept clear of the swing path.

13. Slightly raise and/or lower the boom to help control the boom extension. Using the tag line, swing the boom extension to the front of the boom nose. Align the left side boom extension anchor fitting holes (1, Figure 6-29) with the boom nose attachment lug holes (2).

14. Remove the two boom extension mounting pins (5, Figure 6-29) from the storage holders on the boom extension. Attach the boom extension to the left side of the boom nose by installing the two mounting pins (5). Secure the mounting pins with retaining clips (6).

15. Raise the mast sheave assembly. For more information, refer to *Raising and Lowering the Mast Sheave*, page 6-60.

16. Reeve the hoist rope over the mast sheave and boom extension sheave.

Once the hoist rope is reeved, make sure that all hoist rope retaining pins are reinstalled and secured with retaining clips.

17. Remove the anti-two block switch from the boom nose and install it on the end of the boom extension. For more information, refer to *Boom Extension Electrical Connections*, page 6-56.

18. If equipped, remove the anemometer and boom position light assembly from the boom nose and install it on the boom extension.

19. Remove the tag line.

Stowing the 10 m (33 ft) Boom Extension Base Section Only

DANGER

Boom Extension Hazard!

To avoid death or serious injury, follow procedures and cautions in the Operator and Safety Manuals and decals during erection, stowage and use of boom extension. Install and secure all pins properly and control boom extension movement at all times.

Use the following procedure to stow the boom extension base section to the side of the main boom.

NOTE: This procedure assumes that only the boom extension base section is erected and that the fly section is stowed on the side of the main boom.

1. Make sure the counterweight is installed. For more information about installing the counterweight, refer to *Counterweight Removal and Installation – Hydraulic Version*, page 6-63.

2. Make sure the crane is set up on fully extended outriggers. For more information, refer to *Using the Outriggers*, page 5-28.

3. Make sure the boom extension offset is set to the 0° position. For more information, refer to *Setting Boom Extension Manual Offset*, page 6-61.

4. Fully retract and lower the boom to horizontal.

5. Attach a tag line to the tip of the boom extension base section near the sheave.

6. If equipped, remove the anemometer and boom position light assembly from the end of the boom extension and install it on boom nose.

7. Remove the anti-two block switch from the end of the boom extension and install it on the boom nose. For more information, refer to *Boom Extension Electrical Connections*, page 6-56

8. Unreeve the hoist rope from the boom extension base section sheave and mast sheave. Lay the hoist rope down on the left side of the boom extension.

   Lower the mast sheave assembly. For more information, refer to *Raising and Lowering the Mast Sheave*, page 6-60.

   Once the hoist rope is unreeved, make sure that all hoist rope retaining pins are reinstalled and secured with retaining clips.

9. Make sure rear boom extension mounting bracket ramp (2, Figure 6-55) is in the deployed position.

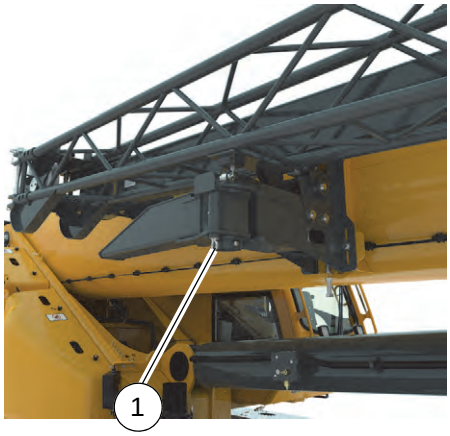
   If the ramp is not deployed, do the following:

   a. Retract the retaining pin (1, Figure 6-44) to release the rear boom extension ramp (2) from the stowed position.

   b. Fully swing the rear boom extension ramp (2) into the deployed position.

   c. Make sure the spring-actuated retaining pin (1) locks into position.

10728-13



10728-12

FIGURE 6-55

10. Make sure the right side boom extension mounting pins (4, Figure 6-29) are engaged.

CAUTION

After removing the two left side boom extension mounting pins (5, Figure 6-29), the boom extension is free to swing to the side of the main boom.

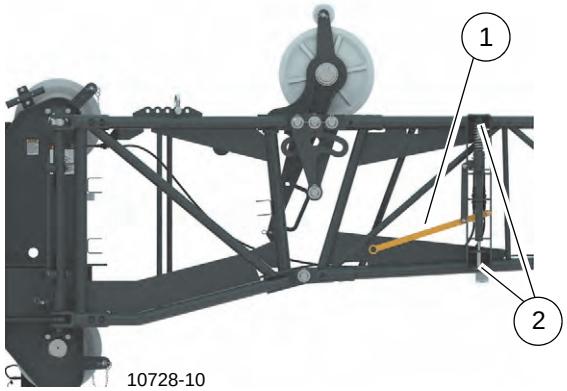
11. Remove the two boom extension mounting pins (5, Figure 6-29) securing the boom extension to the left side of the boom nose. Place the two mounting pins in the storage holders on the boom extension. Secure the mounting pins in place using the retaining clips (6, Figure 6-29).

DANGER

When stowing the boom extension, make sure that all personnel and equipment are kept clear of the swing path.

12. Slightly raise and/or lower the boom to help control the boom extension. Using the tag line, swing the boom extension to the intermediate position on the side of the main boom base section. Make sure the wheels engage the ramps of the front (3, Figure 6-22) and rear (1, Figure 6-22) boom extension stowage brackets.

13. Raise the boom as needed to move the boom extension in against the main boom so the front boom extension stowage bracket pin (2, Figure 6-56) can be engaged.

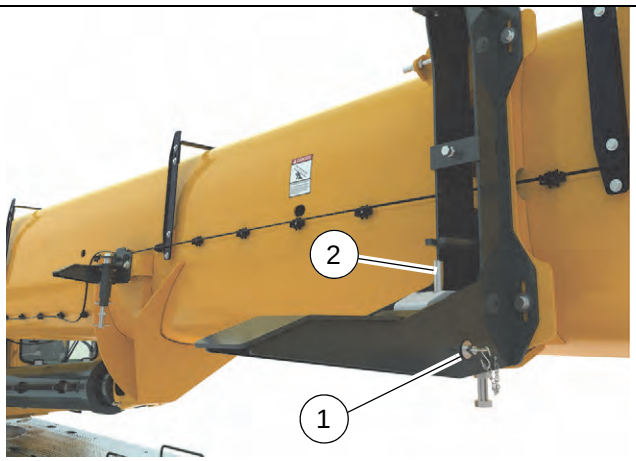


10728-10

FIGURE 6-56

14. Lower the boom to a horizontal position.

15. Attach the boom extension to the front stowage bracket by using an impact wrench and the provided extension and socket to turn the jack screw (2, Figure 6-57) clockwise. Make sure the jack screw bottoms out and the top pin (2, Figure 6-56) is fully engaged (spring will be compressed).



10728-6

FIGURE 6-57

16. At the front stowage bracket, install the cross pin (1, Figure 6-57) in to the holes underneath the jack screw. Secure the cross pin in position with retaining clip.

DANGER

Crush Hazard

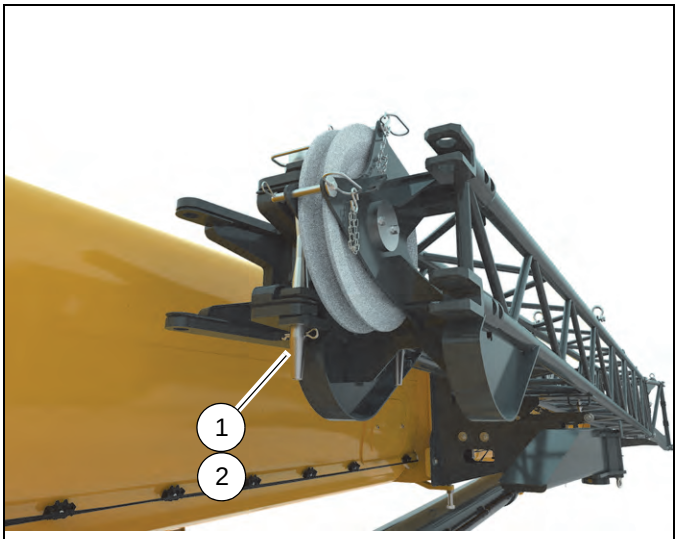
To avoid death or serious injury, make sure the front boom extension stowage bracket pin (4, Figure 6-56) is engaged and the handle (1, Figure 6-56) is in the up (locked) position before retracting the right side boom extension mounting pins (4, Figure 6-29).

17. Visually confirm that the front boom extension stowage bracket pin (2, Figure 6-56) is engaged. The handle (1, Figure 6-56) should be in the up position. When the handle is in the up position, the front boom extension stowage bracket pin is extended and the right side boom extension mounting pins are unlocked.

18. Disengage the mounting pins (4, Figure 6-29) securing the boom extension to the right side of the boom nose. Use an impact wrench and the provided extension and socket to turn the jack screw (2, Figure 6-57) clockwise. Make sure the mounting pins are fully disengaged.

19. Using the tag line, swing the boom extension towards the boom until it fully engages the rear boom extension stowage bracket. Raise the boom as necessary to help the boom extension engage the rear stowage bracket.

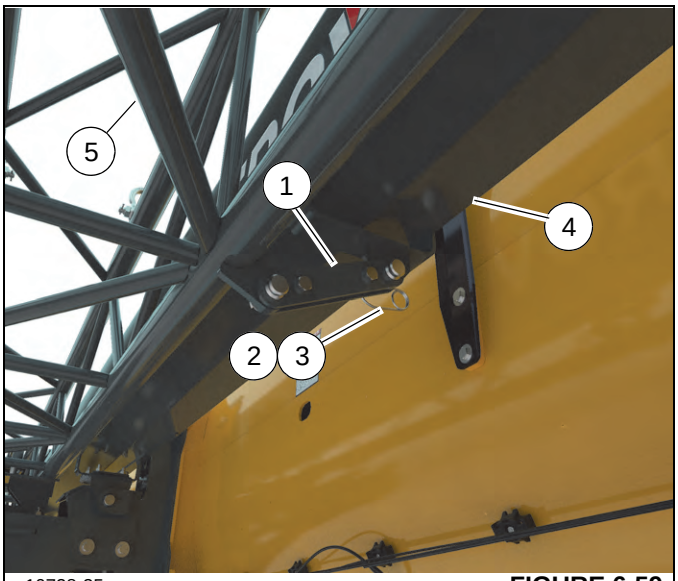
20. Remove the pin from its storage holder on the boom extension base section. Attach the boom extension base section to the fly section by installing the pin (2, Figure 6-58). Secure the pin in place with the retaining clip (1).



10728-36 **FIGURE 6-58**

21. Remove the tag line from the boom extension.

22. Attach the boom extension base section (5, Figure 6-59) to the fly section (4) using the connecting link (1). Secure connecting link with pin (3) and retaining clip (2).



10728-35 **FIGURE 6-59**

23. Reeve the hoist rope over the auxiliary boom nose.

Once the hoist rope is reeved, make sure that all hoist rope retaining pins are reinstalled and secured with retaining clips.

6

Boom Extension Electrical Connections

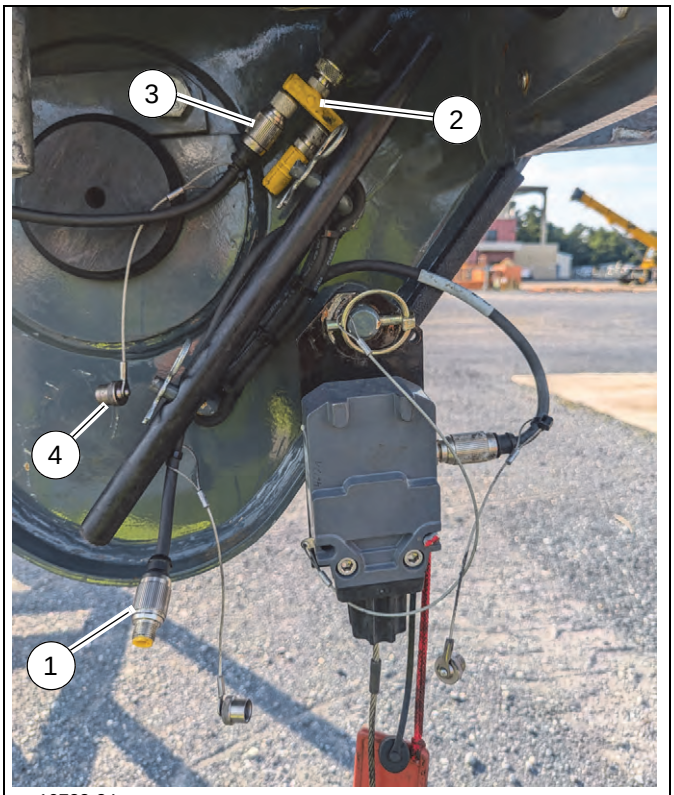
Use the following procedures to connect and disconnect the boom extension electrical connections.

ELECTRICAL CONNECTION BETWEEN BOOM EXTENSION AND BOOM NOSE

Connecting

Use the following procedure and refer to Figure 6-60 to connect the boom extension Anti-Two Block Switch wire harness to the boom nose:

1. At the boom nose, disconnect the cable end connector (1) of the Anti-Two Block Switch from the Anti-Two block Switch plug (2).
2. Remove the cable end connector of the boom extension Anti-Two Block Switch wire harness (3) from its storage clip on the boom extension.
3. Route the boom extension Anti-Two Block Switch wire harness through the boom extension and over to the Anti-Two Block Switch plug (2) at the boom nose.
4. Connect the cable end connector of the boom extension Anti-Two Block Switch wire harness (3) to the Anti-Two Block Switch plug (2) at the boom nose.



10728-24

FIGURE 6-60

Disconnecting

Use the following procedure and refer to Figure 6-60 to disconnect the boom extension Anti-Two Block Switch wire harness from the boom nose.

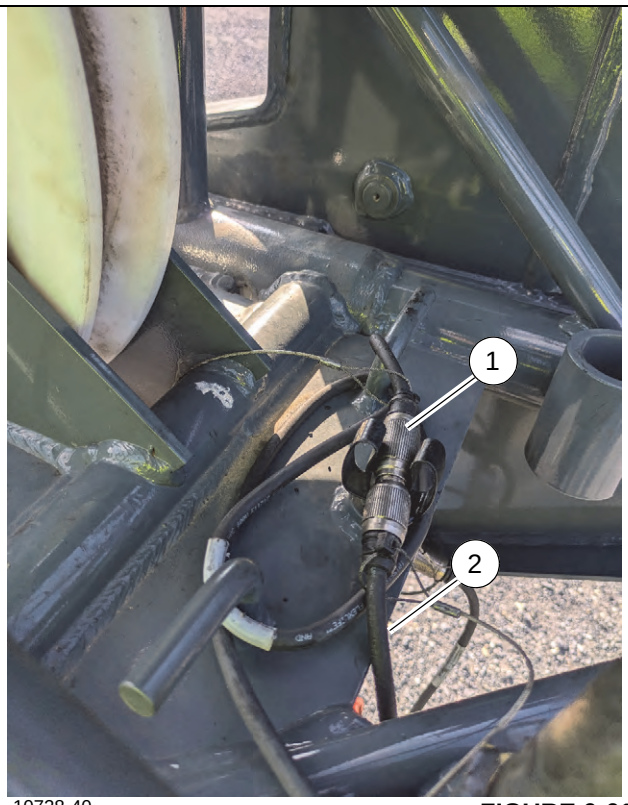
1. At the boom nose, disconnect the cable end connector of the boom extension Anti-Two Block Switch wire harness (3) from the Anti-Two Block Switch plug (2).
2. Connect the cable end connector of the Anti-Two Block Switch cable (1) to the Anti-Two block Switch plug (2).
3. Install the protective cap (4) onto the cable end connector of the boom extension Anti-Two Block Switch wire harness, then route the wire harness back through the boom nose and over to the boom extension.
4. Secure the cable end connector of the boom extension Anti-Two Block Switch wire harness (3) in the storage clip on the boom extension.

ANTI-TWO BLOCK SWITCH CONNECTION AT NOSE OF BOOM EXTENSION BASE SECTION

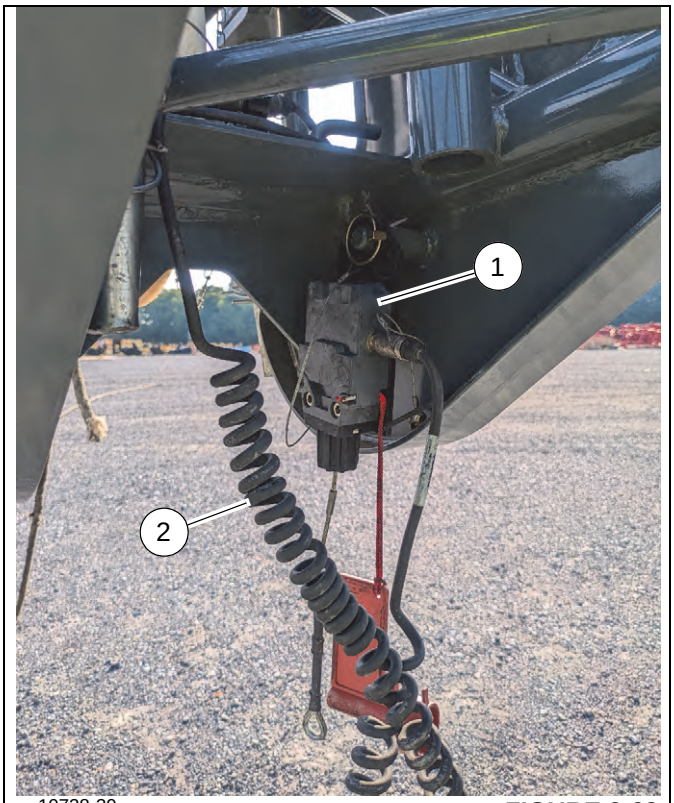
Connecting

Use the following procedure to connect the Anti-Two Block Switch to the nose of the boom extension base section:

1. Install the Anti-Two Block Switch at the nose of the boom extension base section (1, Figure 6-62).
2. Route the Anti-Two Block Switch cable (2, Figure 6-61 and Figure 6-62) through the boom extension and connect it to the cable end connector of the boom extension Anti-Two Block Switch wire harness (1, Figure 6-61)
3. Secure the two cable end connectors in the storage clip on the boom extension.



10728-40 **FIGURE 6-61**



10728-39 **FIGURE 6-62**

Disconnecting

Use the following procedure to disconnect the Anti-Two Block Switch from the nose of the boom extension base section:

1. Disconnect the boom extension Anti-Two Block Switch wire harness (1, Figure 6-61) from the Anti-Two Block Switch cable (2, Figure 6-61 and Figure 6-62).
2. Install the protective cap onto the cable end connector of the boom extension Anti-Two Block Switch wire harness, then secure the cable end connector in the storage clip on the boom extension.

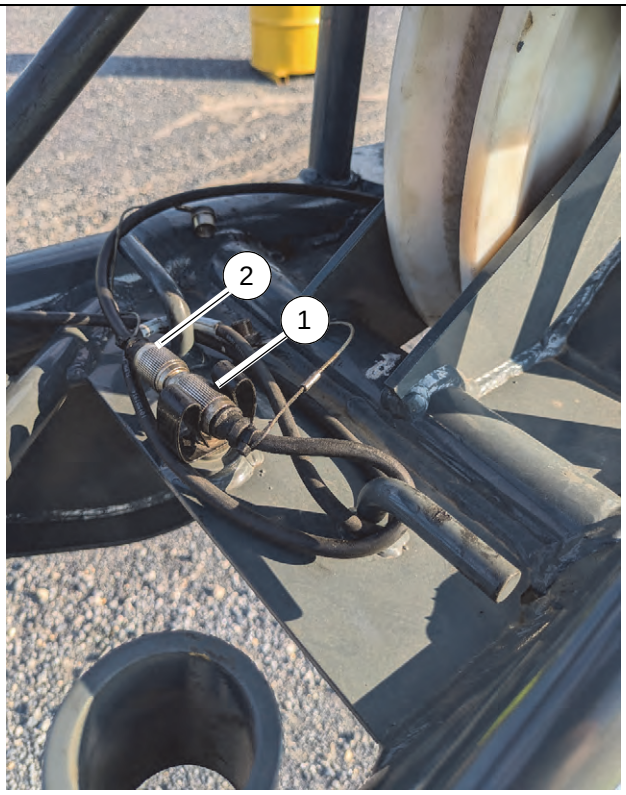
ELECTRICAL CONNECTION BETWEEN BOOM EXTENSION BASE SECTION AND FLY SECTION

Connecting

Use the following procedure to connect the Anti-Two Block Switch wire harnesses of the boom extension base section and the fly section together, and connect the Anti-Two Block Switch to the fly section wire harness:

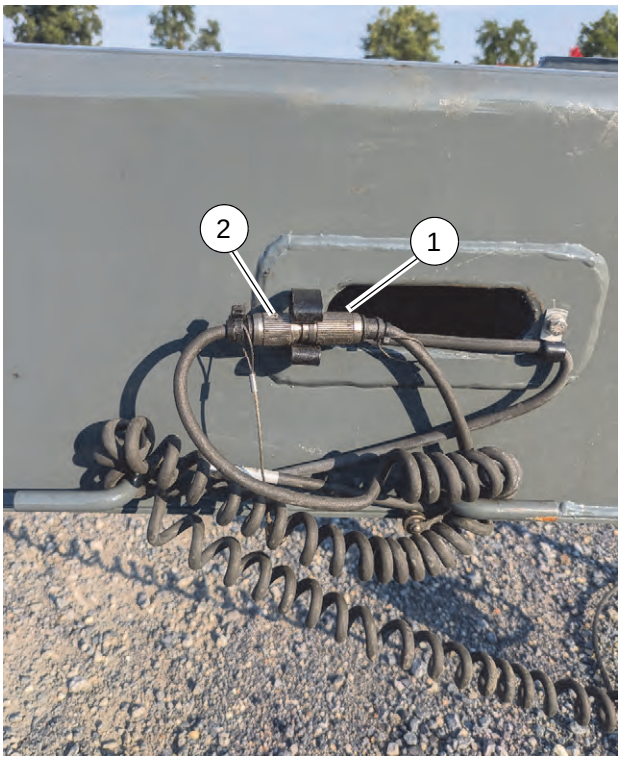
1. At the nose of the boom extension base section, connect together the cable end connectors of the boom extension base section Anti-Two Block Switch wire harness (1, Figure 6-63) and the boom extension fly section Anti-Two Block wire harness (2, Figure 6-63).

   Secure the cable end connectors in the storage clip on the nose of the boom extension base section.



10728-41 **FIGURE 6-63**

2. Mount the Anti-Two Block Switch on the nose of the boom extension fly section.
3. Connect the Anti-Two Block Switch cable connector (2, Figure 6-64) to the cable end connector of the fly section Anti-Two Block Switch wire harness (1). Secure the cable end connectors in the storage clip on the side of the fly section.



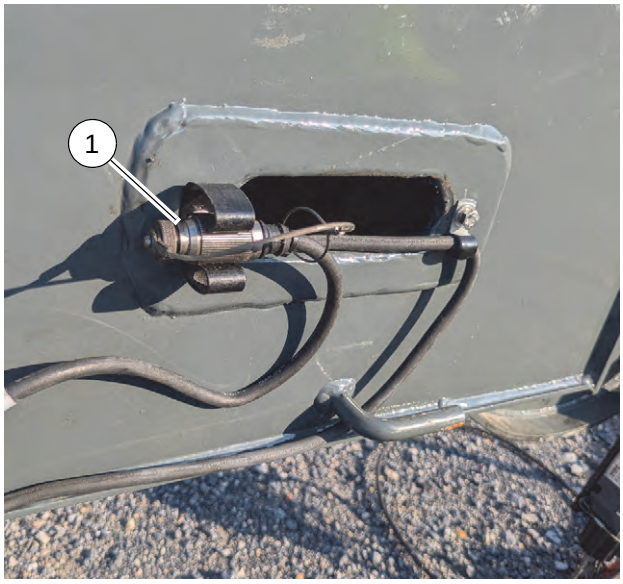
10728-42 **FIGURE 6-64**

Disconnecting

Use the following procedure to disconnect the Anti-Two Block Switch wire harnesses of the boom extension base section and the fly section from each other, and disconnect the Anti-Two Block Switch from the fly section wire harness:

1. At the nose of the fly section, disconnect the Anti-Two Block Switch cable connector from the cable end connector of the fly section Anti-Two Block Switch wire harness (1, Figure 6-65).

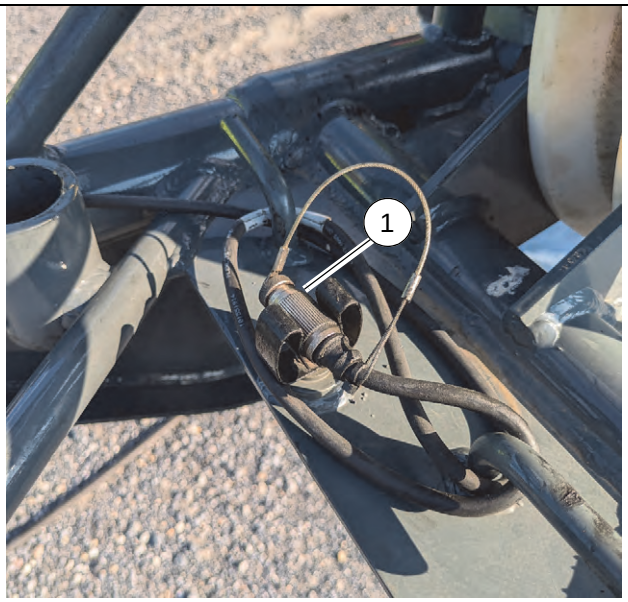
   Install the protective cap onto the cable end connector of the fly section wire harness and secure it in the storage clip on the fly section.



10728-43 **FIGURE 6-65**

2. At the front of the boom extension base section, disconnect the cable end connectors between the fly section Anti-Two block Switch wire harness and the boom extension base section Anti-Two Block Switch wire harness (1, Figure 6-66).

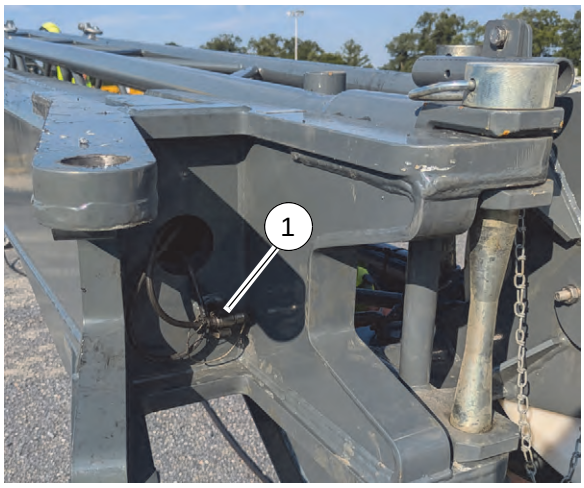
   Install the protective cap onto the cable end connector of the base section wire harness and secure it in the storage clip on the front of the base section.



10728-44 **FIGURE 6-66**

3. Install the protective cap onto the cable end connector of the fly section Anti-Two Block Switch wire harness.

   Route fly section wire harness and cable end connector over to the rear of the fly section. Feed any excess cable into the rear of the fly section and then secure the cable end connector in the storage clip (1, Figure 6-67).



10728-18 **FIGURE 6-67**

6

Raising and Lowering the Mast Sheave

Always raise the mast sheave when the boom extension is erected.

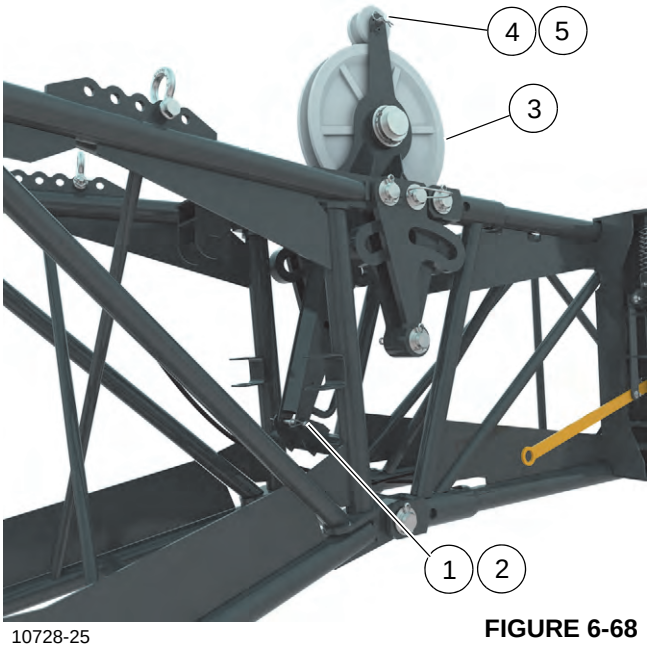
Refer to Figure 6-68 for the following procedures.

RAISING THE MAST SHEAVE

1. Remove the retaining clip (1) and pin (2) that secures the mast sheave (3) in the stowed position.
2. Fully raise the mast sheave to the deployed position, then reinstall the pin (2) and retaining clip (1).
3. To allow the hoist rope to be installed, remove the retaining clip (4) and hoist rope retaining pin (5) from the mast sheave.

LOWERING THE MAST SHEAVE

1. Remove the retaining clip (4) and hoist rope retaining pin (5) from the mast sheave (3). Remove the hoist rope from the mast sheave.
2. Reinstall the hoist rope retaining pin (5) and secure with the retaining clip (4).
3. Remove the retaining clip (1) and pin (2) that secures the mast sheave in the deployed position.
4. Lower the mast sheave to the stowed position and reinstall the pin (2) and retaining clip (1).



10728-25

FIGURE 6-68

Setting Boom Extension Manual Offset

DANGER

Crushing Hazard!

Ensure blocking material is adequate to support weight of extension assembly without tipping or falling.

CHANGING OFFSET FROM 0° TO 25° OR 40°

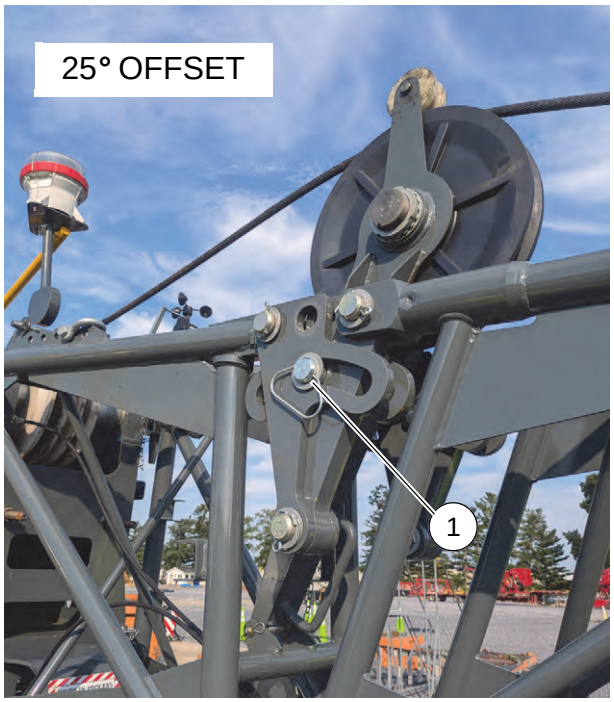
1. Extend and set outriggers. If necessary, incline the crane to position boom closer to ground. Refer to *Inclining the Crane*, page 6-62.
2. Raise and lock the mast assembly. Refer to Figure 6-68.
3. Raise boom above horizontal.
4. Block under tip of boom extension section.

CAUTION

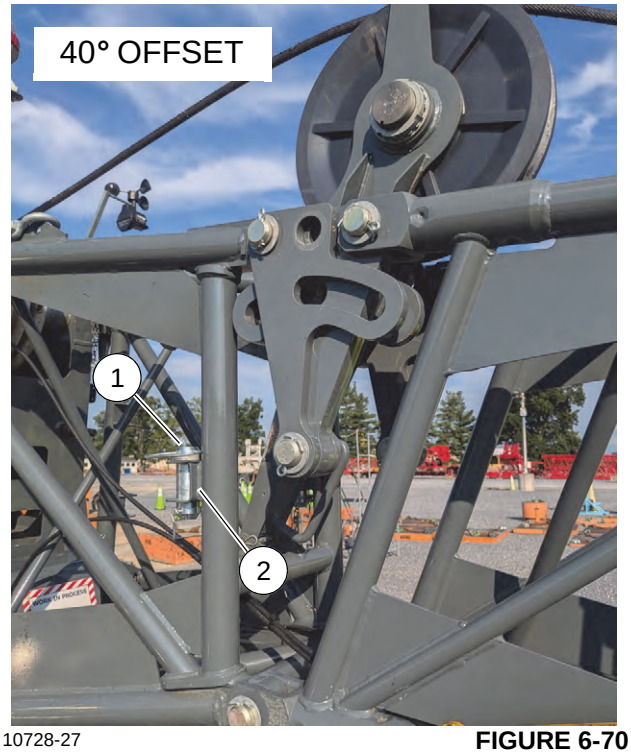
Possible Equipment Damage!

Do not overload boom extension anchor fittings or boom extension base section when lowering the boom.

5. Slowly lower boom until weight is removed from offset assembly.
6. Remove offset clips and pins securing offset assembly in the lesser degree offset position. If going to intermediate (25°) offset, install pin (1, Figure 6-69) in offset hole for that degree of offset. If going to maximum offset position, install pins (1, Figure 6-70) into holder (2, Figure 6-70) and secure with clips.



10728-26 **FIGURE 6-69**



10728-27 **FIGURE 6-70**

7. Reeve hoist cable as described under normal erecting procedures.

6

8. Slowly elevate and telescope boom at the same time so boom extension does not move off of the blocking until offset assembly takes full weight of the boom extension.

CHANGING OFFSET FROM 40° TO 25° OR 0°

CAUTION

Do not overload boom extension anchor fittings or boom extension base section when lowering the boom.

1. Extend and set outriggers. If necessary, incline the crane to position boom closer to ground. Refer to *Inclining the Crane*, page 6-62.
2. Block under tip of boom extension section.
3. Slowly lower boom until weight is removed from offset assembly.
4. Remove clip and pins (1, Figure 6-71) from offset assembly. Lower boom until holes for lesser degree offset position align in offset assembly. If going to intermediate (25°) offset, install pin (1, Figure 6-69) in offset hole for that degree of offset. Install offset pin and clip (1, Figure 6-71). If going to intermediate (0°) offset, install pin (1, Figure 6-69) in offset hole for that degree of offset.
5. Slowly elevate and telescope boom at the same time so boom extension does not move off blocking until offset links take full weight of the extension.

10728-28 **FIGURE 6-71**

INCLINING THE CRANE

In order to set the offset angle of the adjustable extension, you must set it down on the ground by extending and lowering the main boom over the rear.

Depending on the space available, the condition of the terrain or a limitation on the telescoping due to the current rigging mode, it may be that the nose of the boom extension cannot be set on the ground by telescoping and lowering the main boom.

In this case, you can use the outriggers to incline the crane.

1. Fully extend the front outriggers and jack cylinders.
2. Fully extend the rear outriggers.
3. Extend the rear jack cylinders until the rear wheels are just off the ground.

WARNING

Tipping Hazard!

Make sure that the wheels do not touch the ground when the crane has been inclined. This prevents a reduction in the stability of the crane, which could lead to it tipping over when setting the angle of the lattice extension or overloading the axles, causing serious injury or death.

COUNTERWEIGHT REMOVAL AND INSTALLATION – HYDRAULIC VERSION

DANGER

Falling counterweight can crush and cause death or serious injury.

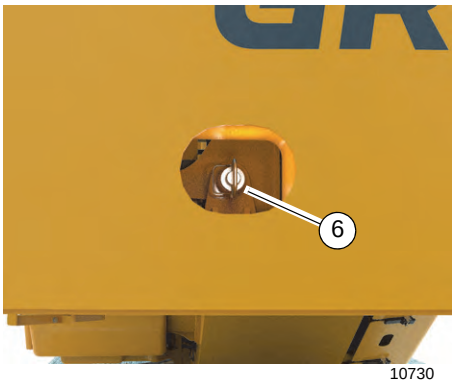
Ensure all mounting pins are properly installed and locked, during and after operating the counterweight removal system.

Counterweight is installed and removed using hydraulic cylinders controlled by a counterweight control panel located on each side of the superstructure. The counterweight assembly is pinned to the hydraulic cylinders then mounted to the superstructure using manual locking pins with pin clips.

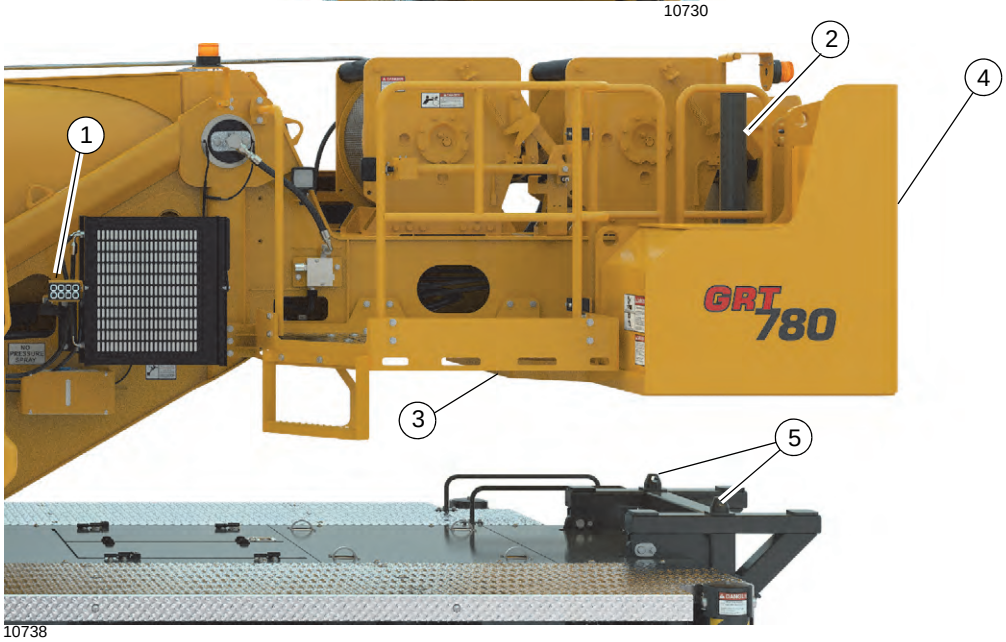
Counterweight is lowered or lifted from two centering pins on the counterweight stand, located at the front of the carrier.

DANGER

Travel is not permitted with removable counterweight on carrier deck.



10730



10738

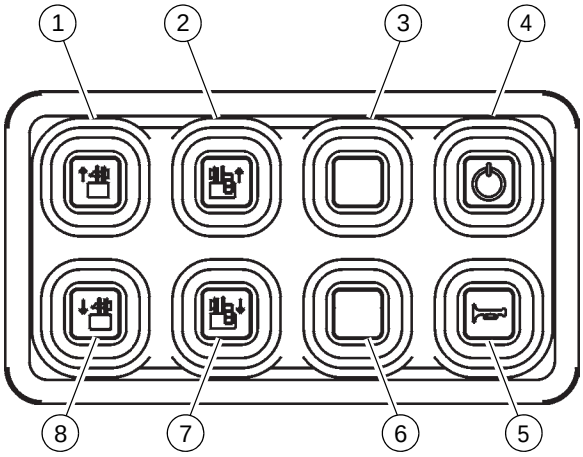
Item	Description	Item	Description
1	Control Panel	4	Counterweight
2	Lift Cylinder	5	Centering Pins
3	Leveling Bolt	6	Manual Locking Pin

FIGURE 6-72

6

Counterweight Control Panels

Counterweight control panels are located on each side of the superstructure between the boom pivot and main hoist. Only one control panel can be used at a time. The crane engine must be running with parking brake ON and no other functions enabled for system to be fully operational.



8658-2 **FIGURE 6-73**

Item	Description
1	Right Counterweight Cylinder Raise Button
2	Left Counterweight Cylinder Raise Button
3	Blank (not used)
4	Function Enable Button
5	Horn Button
6	Blank (not used)
7	Left Counterweight Cylinder Lower Button
8	Right Counterweight Cylinder Lower Button

The back light of the buttons are illuminated blue when power is on.

Back lights for each button indicates the following:

- Green - Function enabled.
- Yellow - Error condition.
- Red - Function not available or system not enabled.

NOTE: The Horn Button (3) is always active. Function Enable Button does not have to be pushed before using the operating the horn.

The Function Enable Button (2) must be pushed and released before selecting a counterweight function button. Counterweight function button must be pushed within five seconds after releasing the Function Enable Button or the system will time out and the Function Enable Button must be pushed and released again.

If the Function Enable Button is pushed and held for more than 2 seconds, the back light of the Function Enable Button will illuminate red. No other functions are available until the button is released and pushed again.

Removing the Counterweight - Hydraulic Version

Refer to Figure 6-73.

CAUTION

When raising or lowering the counterweight, make sure that the weight remains level by using the left and right cylinder control buttons

1. Position crane on a firm level surface. Fully extend and set outriggers.
2. Rotate superstructure so that the boom is over rear of crane and the counterweight is centered at front of vehicle. Engage turntable swing lock.
3. Make sure counterweight support (1, Figure 6-74) is securely attached at front of carrier.

10730-2

FIGURE 6-74

4. Remove pin clips from manual locking pin (6, Figure 6-72) on each side of superstructure.
5. Remove manual locking pins (6, Figure 6-72).
6. Check area is clear around counterweight and carrier front deck. Push horn button (3).

CAUTION

To prevent machine damage, make sure that the Lock Cylinder Pins are fully retracted and the counterweight is hanging freely from the lifting cylinders before lowering the counterweight

CAUTION

When lowering the counterweight, make sure that the weight remains level to avoid crane damage.

7. Push and release Enable button (2). Push and hold Left (6) and Right (7) Counterweight Cylinder Lower buttons until counterweight is completely lowered on centering pins and front deck/counterweight support.
8. Remove lock pins and retaining pins from lift cylinders and counterweight.

NOTE: Operate left or right cylinder as needed to remove pins.

NOTE: Do not leave cylinder rods extended. Corrosion or other damage may occur.

9. Push and release Enable button (2). Push and hold Left (8) and Right (9) Counterweight Cylinder Lift buttons until cylinder rods are completely retracted. Reinstall lock pins and retaining pins.
10. Reinstall manual locking pins (6, Figure 6-72).

DANGER

Travel is not permitted with removable counterweight on carrier deck.

11. Release turntable swing lock. Rotate superstructure 180°.

NOTE: The standard GRT780 counterweight weighs 7900 kg (17,500 lb). Optional one-piece counterweight weighs 9300 kg (20,500 lb). Optional three-piece counterweight weighs 9300 kg (20,500 lb). GRT765 counterweight weighs 6900 kg (15,200 lb).

12. Select proper “Without Counterweight” operating code on the RCL.

Removing the counterweight increases loading on the front axle. Refer to the *Load Chart Manual* and the section *Driving the Crane*, page 5-11 in this manual for details about travel with counterweight removed.

13. Lift counterweight from carrier deck to transport vehicle.

6

Installing the Counterweight - Hydraulic Version

Refer to Figure 6-73.

CAUTION

When raising or lowering the counterweight, make sure that the weight remains level by using the left and right cylinder control buttons

1. Position crane on a firm level surface. Fully extend and set outriggers.
2. Make sure counterweight support (1, Figure 6-75) is securely attached at front of carrier.

10730-2

FIGURE 6-75

3. Select proper “Without Counterweight” operating code on the RCL.

NOTE: The standard GRT780 counterweight weighs 7900 kg (17,500 lb). Optional one-piece counterweight weights 9300 kg (20,500 lb). Optional three-piece counterweight weighs 9300 kg (20,500 lb). GRT765 counterweight weighs 6900 kg (15,200 lb).

4. Lift counterweight from transport vehicle and position on front deck centering pins.
5. Place superstructure with boom centered over rear of vehicle. Engage turntable lock.
6. Remove lock pins and retaining pins from counterweight lift cylinders.

DANGER

Hand Crushing Hazard!

Do not place hand between counterweight cylinders and the top of the counterweight while cylinders are in motion.

7. Push and release Enable button (2). Push and hold Left (6) and Right (7) Counterweight Cylinder Lower buttons until cylinder rod ends engage counterweight.
8. Install lock pins and retaining pins in lift cylinders and counterweight.

NOTE: Operate left or right cylinder as needed to install pins.

CAUTION

When raising the counterweight, make sure that the weight remains level to avoid crane damage.

9. Push and release Enable button (2). Push and hold Left (8) and Right (9) Counterweight Cylinder Lift buttons until counterweight engages superstructure and manual locking pin holes are aligned on both sides.

NOTE: Operate left or right cylinder as needed to align manual locking pin holes.

10. Install manual locking pins (6, Figure 6-72).
11. Install pin clips in counterweight manual locking pins on each side of superstructure.
12. Adjust four counterweight bolts and jam nuts to provide a consistent stop and proper alignment with the pinning holes.
13. Select proper counterweight operating code on the RCL.
14. Crane is now ready for operation with counterweight installed.

REMOVING AND INSTALLING THE COUNTERWEIGHT – PIN-ON VERSION

The standard GRT765/780 counterweight is mounted to the superstructure using pins and clips. The counterweight must be lifted into position manually.

Removing the Counterweight - Pin-On Version

DANGER

Death or serious injury could result from being crushed by a falling counterweight.

NOTE: Use of a forklift to remove/install the fixed counterweight is not recommended.

1. Fully extend and set the outriggers.

NOTE: Turntable lock pin can only be engaged with boom over front or rear of carrier.

2. Rotate the superstructure so the counterweight is over the front of the carrier to gain additional clearance.

NOTE: The standard GRT780 counterweight weighs 7900 kg (17,500 lb). Optional one-piece counterweight weighs 9300 kg (20,500 lb). Optional three-piece counterweight weighs 9300 kg (20,500 lb). GRT765 counterweight weighs 6900 kg (15,200 lb).

3. Lower and fully retract the boom
4. Engage the 360° swing lock (if equipped).
5. Shut down crane.

CAUTION

When lifting/handling the counterweight, keep the chains/straps vertical to minimize side pull on the lifting lugs.

6. Attach an adequate lifting device to the four lifting lugs on the counterweight.
7. Loosen the four jam nuts, then back off the jack bolts that center the counterweight on the superstructure.
8. Remove the two cotter pins that secure the large attachments pins in place. Remove the two attachment pins.
9. Slightly lift counterweight off of superstructure. Without raising or lowering the height of the counterweight, move the counterweight rearward until it clears the tail of the superstructure. Move counterweight far enough from crane to allow the superstructure to clear during repositioning.
10. Reinstall attachment pins in holes on superstructure, then secure with cotter pins.
11. Rotate superstructure to the normal travel position.

Installing the Counterweight - Pin-On Version

1. Fully extend and set the outriggers.
2. Rotate the superstructure so the counterweight will be over the front of the carrier to gain additional clearance.
3. Shut down crane.

CAUTION

When lifting/handling the counterweight, keep the chains/straps vertical to minimize side pull on the lifting lugs.

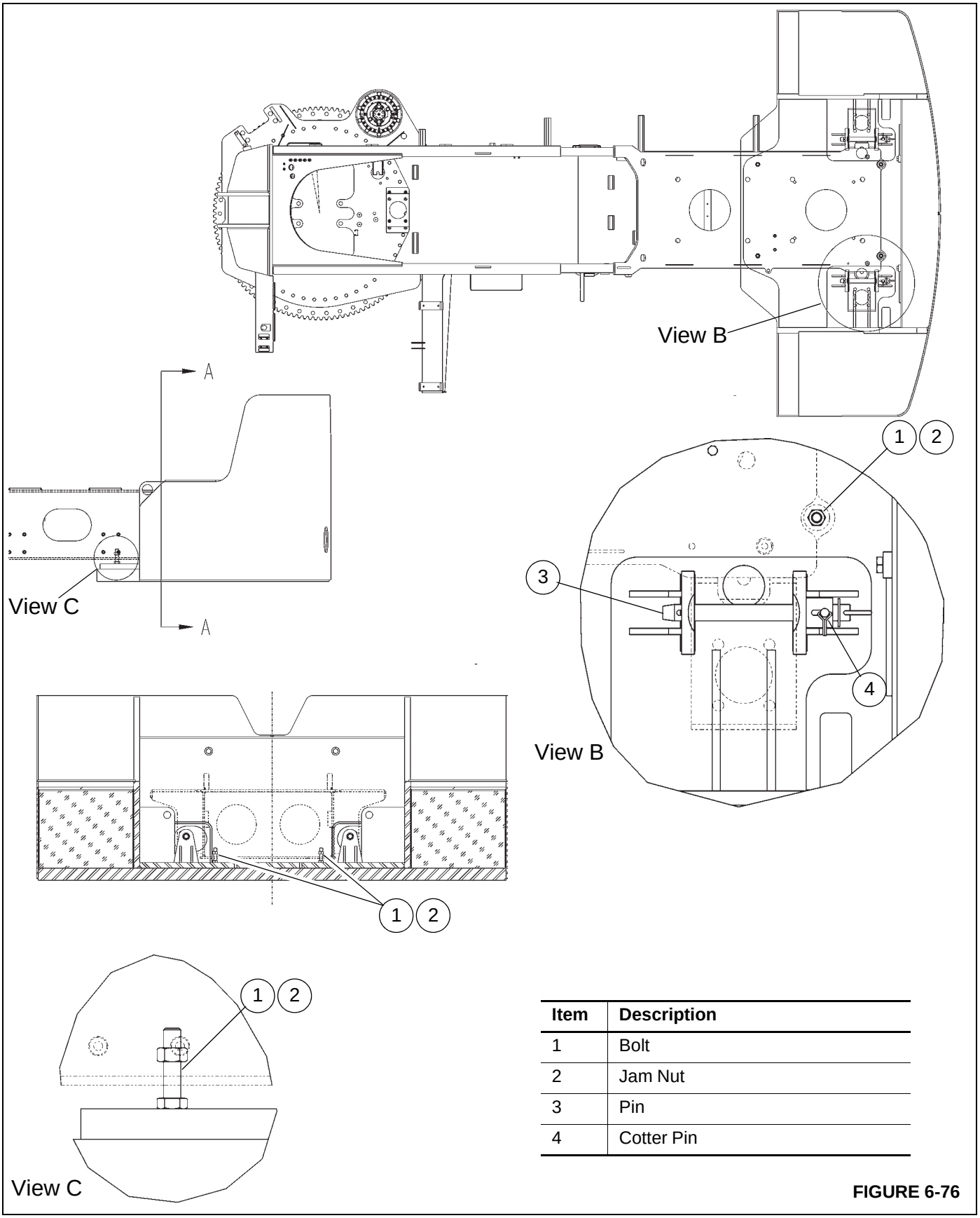
NOTE: The standard GRT780 counterweight weighs 7900 kg (17,500 lb). Optional one-piece counterweight weighs 9300 kg (20,500 lb). Optional three-piece counterweight weighs 9300 kg (20,500 lb). GRT765 counterweight weighs 6900 kg (15,200 lb).

NOTE: Use of a forklift to remove/install the fixed counterweight is not recommended.

4. Remove the two large attachment pins from the superstructure.
5. Attach an adequate lifting device to the four lifting lugs on the counterweight. Lift the counterweight into place on the superstructure.
6. Secure the counterweight to the superstructure using the two attachment pins. Secure the attachment pins with cotter pins.

NOTE: If the attachment pin holes in the counterweight do not align with the holes in the superstructure, adjust the jack bolts until they align, then tighten the jam nuts.

7. Adjust the four jack bolts such that the counterweight is centered on the superstructure. Do not over-tighten the bolts. Tighten the jam nut at each bolt.
8. Remove the lifting device from the counterweight.



Item	Description
1	Bolt
2	Jam Nut
3	Pin
4	Cotter Pin

FIGURE 6-76

THREE-PIECE COUNTERWEIGHT (OPTIONAL)

Figure 6-77 shows the lift points for the counterweight and sections. Attach the slings to the points identified when lifting the counterweight and sections.

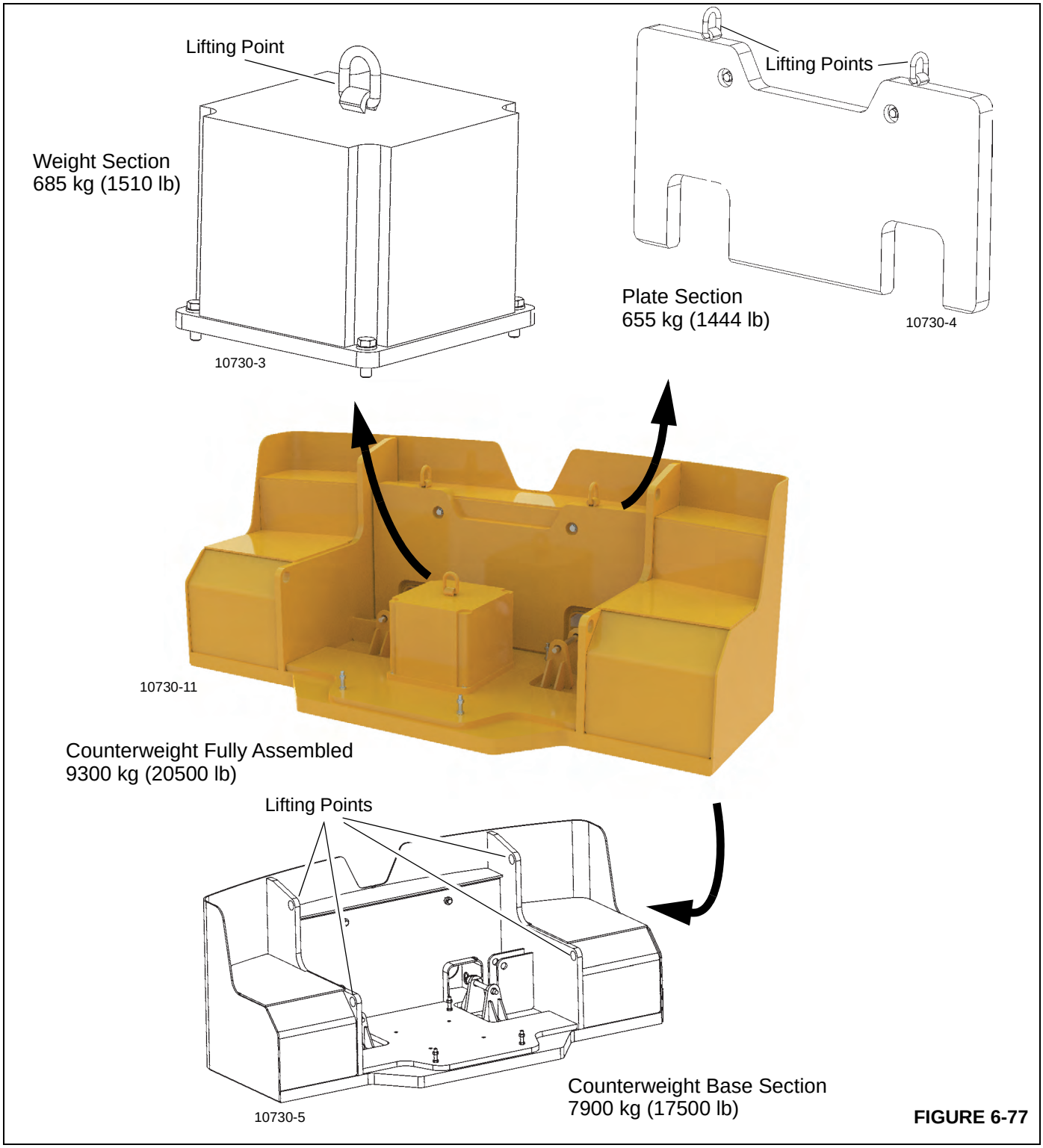


FIGURE 6-77

Assembling the Counterweight for Operation

Use this procedure to assemble the 9300 kg (20500 lb) counterweight for operation. The base counterweight section must be on a stable supporting surface prior to assembly.

DANGER

Prior to installing counterweight on the crane, outrigger beams must be fully extended and set.

NOTE: Both counterweight sections must be installed together or not at all. A load chart is not provided for use with only one section.

1. Attach lift slings to the lifting points on the weight counterweight section (Figure 6-77).
2. Install the weight counterweight section on to the base counterweight section. Make sure the mounting holes on the base section align with those on the weight section. Secure with bolts and washers.
3. Attach lift slings to the lifting points on the plate counterweight section (Figure 6-77).
4. Install the plate counterweight section on to the base section. Make sure the mounting holes on the base section align with those on the plate section. Secure with bolts and washers.
5. Install the assembled counterweight on the carrier counterweight platform. For more information, see *Counterweight Removal and Installation – Hydraulic Version*, page 6-63 or *Removing and Installing the Counterweight – Pin-On Version*, page 6-67.

Disassembling the Counterweight for Transport

Use the following procedure to disassemble the counterweight for transport.

1. Remove the assembled counterweight from the carrier counterweight platform. For more information, see *Counterweight Removal and Installation – Hydraulic Version*, page 6-63 or *Removing and Installing the Counterweight – Pin-On Version*, page 6-67.
2. Attach a suitable lifting device to the plate counterweight section lifting points (Figure 6-77). Remove bolts and washers and lift the plate section from the base section.
3. Attach a suitable lifting device to the weight counterweight section lifting points (Figure 6-77). Remove bolts and washers and lift the weight section from the base section.

SECTION 7
MAINTENANCE AND LUBRICATION

SECTION CONTENTS

GENERAL

Following the designated lubrication procedures is important to ensure 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.

Refer to your *Inspection and Lubrication Service Log* for routine checks which will help maintain the safety, dependability, and productivity designed into your crane.

One copy of the *Inspection and Lubrication Service Log* is provided in the original package of manuals shipped with the crane. Additional copies are available through the Grove distributor network or Grove Product Support.

Refer to your *Service Manual* for specific maintenance and adjustment procedures.

ENVIRONMENTAL PROTECTION

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

Potentially harmful waste used in Grove cranes includes—but is not limited to—oil, fuel, grease, coolant, filters, air conditioning refrigerant, 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 filling pump.
- Immediately clean up any spills.

LUBRICANTS AND LUBRICATION INTERVALS

Use lubricants as listed in this section of the *Operator Manual*. See also your GRT765/780 *Service Manual* for maintenance and lubrication instructions.

CAUTION

Possible Equipment Damage!

The multipurpose grease installed during manufacture of this crane contains a lithium base.

Do not apply chassis grease lubricants with air pressure devices, as chassis contains sealed fittings.

Use of non-approved lubricant may damage components and/or invalidate published lubricant intervals.

Failure to follow this instruction may cause damage to equipment.

Grove recommends the use of Standard lubricants for Grove cranes operating in regions where moderate ambient temperature, humidity, and atmospheric conditions prevail. These Standard lubricants are effective in ambient temperatures down to -9°C (+15°F).

Cold weather temperatures below -9°C (+15°F) are considered arctic. Grove recommends the use of Cold Weather lubricants for Grove cranes operating in arctic conditions.

In regions where Grove cranes are operating with arctic conditions down to -29°C (-20°F), Grove recommends the use of the Cold Weather lubricants found in Table 7-2.

In regions where Grove cranes are operating with arctic conditions down to -40°C (-40°F), Grove recommends the use of the Cold Weather lubricants found in Table 7-3.

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

Standard Lubricants

Standard lubricants are used on all Grove cranes. Cranes can also be ordered with Cold Weather lubricants. The Standard lubricants listed in Table 7-1 are effective in ambient temperatures down to -9°C (+15°F).

Table 7-1 : **Standard Lubricants [Down to -9°C (+15°F)]**

Lubricant/Fluid	Grove Spec.	Recommended Lubricant		
		Type	Grade	Classification
Gear Lube: Axles Swing Drive Gear Box	6829012964	Century Unigear Semi-synthetic Texaco Multigear SS Chevron DELO Gear Lubricant Phillips 66 Triton® Synlube LDO Kendell SHP Syngear FE Super MPGO Castrol SP Gear	80W-90	GL-5
Engine Oil (SAE) (CK-4)	80130244	Mobil Delvac 1300 Super Mobil HDEO Mobil Delvac MX ESP Phillips 66 Fleet Supreme EC 15W-40 Chevron DELO 400 SDE 15W-40 Chevron DELO 400 XLE 15W-40 Shell Rotella T6 15W-40 Shell Rotella T5 15W-40	15W-40	CK-4
Engine Oil (SAE) (CI-4)	6829003483	Exxon XD-3 Conoco Fleet Supreme Phillips 66 Super HD II 15W-40 Phillips 66 Power-D Engine Oil Mobil Delvac MX F2 15W-40	15W-40	CI-4
Hydraulic/Transmission Oil	6829006444	Phillip 66 PowerTran XP Exxon Mobil 424	ISO 46/68	Must meet John Deere Standard JDM J20C
Extreme Pressure Gear Lube: Hoist Swing Drive Gearbox Brake Assembly	6829100213	Mobil Mobilgear 600XP 150 Gear Oil Texaco Meropa 150 Phillips 66 Extra Duty Gear Oil	AGMA EP-4	AGMA No. 4 EP

Table 7-1 : **Standard Lubricants [Down to -9°C (+15°F)] (Continued)**

Lubricant/Fluid	Grove Spec.	Recommended Lubricant		
		Type	Grade	Classification
Extreme Pressure Multipurpose Grease (EP-MPG)	6829003477	Citgo Lithoplex MP# 2 (red) Chevron Starplex EP-2 (red) Phillips 66 Multiplex Red (red) Mobil Mobilgrease XHP 222 (dark blue) Ipiranga Ipiflex Li-Comp EP-2 (red) Fuchs Renolit Hi-Temp 220 (ivory)	NLGI 2	GC-LB Certified
Open Gear Lube (EP-OGL)	6829102971	Fuchs Ceplattyn 300 Spray	NLGI 1-2	
Antifreeze Coolant (early model cranes)	6829101130	Old World Industries, Inc. Fleet SCA Pre-charged (red) Caterpillar DEAC (magenta) Fleetguard ES Compleat EG (blue) Purus Heavy Duty Pre-charged (red) Kostusa Defendal Heavy Duty Pre-charged (red) Prestone Command Heavy Duty Pre-charged	AFC - 50/50 Mix 50/50	
Liquid Coolant Conditioner (LCC) (early model cranes)	6829012858	Fleetguard DCA4 Fleetguard DCA2 Penray Pencool 3000	LCC	
Antifreeze Coolant (late model cranes)	80005136	Final Charge Global Nitrite-free Extended Life Fleetcool OAT DefendAL HD Nitrite-free Extended Life Prestone Command Nitrite-free ELC with Cor-Guard Mobil Delvac Extended Life GUARDOL Heavy Duty Nitrite-free OAT Extended Life	Mix 50/50	
Diesel Exhaust Fluid (DEF)	80019225	Fleetguard StableGuard™ Urea 32 Premix AdBlue® TerraCair Ultrapure® DEF	DEF	

Table 7-1 : **Standard Lubricants [Down to -9°C (+15°F)] (Continued)**

Lubricant/Fluid	Grove Spec.	Recommended Lubricant		
		Type	Grade	Classification
Extreme Pressure Multipurpose Grease (Boom) -- High Graphite	6829104537	Mobile Mobilith SHC 1000 Special (gray-black) Old Line XR 1000 Super Syn Grease (gray-black)	NLGI 2	
BECHEM PAL1	01373458			
BECHEM RHUS SW-2	03325216		NLGI 1-2	

ARCTIC LUBRICANTS AND CONDITIONS

Arctic Conditions Below -9°C (+15°F)

Regions with ambient temperatures below -9°C (+15°F) are considered arctic. In general, petroleum based fluids developed especially for low temperature service may be used with satisfactory results. However, certain fluids, such as halogenated hydrocarbons, nitro hydrocarbons, and phosphate ester hydraulic fluids, might not be compatible with hydraulic system seals and wear bands. If you are in doubt about the suitability of a specific fluid or lubricant, check with an authorized Grove distributor or Grove Product Support.

NOTE: All fluids and lubricants may be purchased by contacting your local Grove distributor or Grove Product Support.

Regardless of temperature and oil viscosity, always follow the cold weather start-up and operating procedures, as described in SECTION 7 *Superstructure Display Module (SDM)*, to ensure adequate lubrication during system warm-up and proper operation of all crane functions.

Cold Weather Package and Lubricants

Grove recommends specific Cold Weather lubricants for use in ambient temperatures down to -29°C (-20°F). Refer to Table 7-2 for a list of these recommended Cold Weather lubricants.

Additionally, Grove recommends specific Cold Weather lubricants for use in ambient temperatures down to -40°C (-40°F). Refer to Table 7-3 for a list of these recommended Cold Weather lubricants.

These recommended Cold Weather lubricants alone are not sufficient to operate the crane in extreme low temperatures (arctic conditions). Therefore, Grove recommends that the crane be equipped with specific cold weather accessories, as listed under the section titled *Crane Warm-up Procedures*, page 5-10.

Table 7-2 : **Cold Weather Lubricants in Arctic Conditions [Down to -29°C (-20°F)]**

Lubricant/Fluid	Grove Spec.	Recommended Lubricant		
		Type	Grade	Classification
Synthetic Gear Lube: Axles Swing Drive Gear Box	6829014058	CITGO Synthetic Gear Lube Eaton Roadranger EP Mobil Mobilube SHC Mobil Delvac Synthetic Gear Shell Spirax S6 Sunoco Duragear EP Petro-Canada Traxon E Synthetic Phillips 66 Triton Syngear FE Kendell SHP Full Syngear FE Chevron Delo Syn-Gear HD Chevron Delo Syn-Gear XDM	75W-90	OEM Meritor 076N (GL-5)
Engine Oil (SAE) (CK-4)	80130247	Shell Rotella® T6 Mobil Delvac 1 ESP Caterpillar Cat DE0-ULS Cold Weather	0W-40	CJK-4
Engine Oil (SAE) (CI-4)	6829101560	Mobile Delvac 1 – 5W-40	5W-40	CI-4
Hydraulic Oil	6829006993	Exxon Mobil Univis HVI 26	ISO 26	
Transmission Oil	6829101559	Petro-Canada Duratran Synthetic THF Chevron All Weather THF Texaco TDH Oil SS		Must Meet John Deere Std. JDM J20C & J20D
Synthetic Gear Lube: Hoist Swing Drive Gear Box Brake Assembly	6829103636	Petro-Canada Enduratex Synthetic EP 150 Mobil SHC 629 Mobil Mobilgear SHC 150 Phillips 66 Syncon® EP Plus	ISO 150	AGMA No. 4 EP
Extreme Pressure Multipurpose Grease (EP-MPG)	6829104275	Mobil Mobilith SHC 220 (red) Petro-Canada Precision Synthetic EP1 Phillips 66 Multiplex FS 220 (purple)	NLGI 2	GC-LB Certified
Open Gear Lube	6829102971	Fuchs Ceplattyn 300 Spray	NLGI 1-2	

Table 7-2 : **Cold Weather Lubricants in Arctic Conditions [Down to -29°C (-20°F)] (Continued)**

Lubricant/Fluid	Grove Spec.	Recommended Lubricant		
		Type	Grade	Classification
Antifreeze Coolant (early model cranes)	6829101130	Old World Industries, Inc. Fleet SCA Pre-charged (red) Caterpillar DEAC (magenta) Fleetguard ES Compleat EG (blue) Purus Heavy Duty Pre-charged (red) Kostusa Defendal Heavy Duty Pre-charged (red) Prestone Command Heavy Duty Pre-charged	AFC - 50/50 Mix 50/50	
Liquid Coolant Conditioner (early model cranes)	6829012858	Fleetguard DCA4 Fleetguard DCA2 Penray Pencool 3000	LCC	
Antifreeze Coolant (late model cranes)	80005136	Final Charge Global Nitrite-free Extended Life Fleetcool OAT DefendAL HD Nitrite-free Extended Life Prestone Command Nitrite-free ELC with Cor-Guard Mobil Delvac Extended Life GUARDOL Heavy Duty Nitrite-free OAT Extended Life		
Diesel Exhaust Fluid (DEF)	80019225	Fleetguard StableGuard™ Urea 32 Premix AdBlue® TerraCair Ultrapure® DEF		
Extreme Pressure Multipurpose Grease (Boom) -- High Graphite	6829104537	Mobile Mobilith SHC 1000 Special (gray-black) Old Line XR 1000 Super Syn Grease (gray-black)	NLGI 2	
Windshield Washer Fluid	90037773	Splash De-icer		
Diesel Fuel	80069407	NOCO Kerosene, 3, UN1223, III Product #1	#1	NLOCK08
BECHEM PAL1	01373458			
BECHEM RHUS SW-2	03325216		NLGI 1-2	

Table 7-3 : **Cold Weather Lubricants in Arctic Conditions [Down to -40°C (-40°F)]**

Lubricant/Fluid	Grove Spec.	Recommended Lubricant		
		Type	Grade	Classification
Synthetic Gear Lube: Axles Swing Drive Gear Box	6829014058	CITGO Synthetic Gear Lube Eaton Roadranger EP Mobil Mobilube SHC Mobil Delvac Synthetic Gear Shell Spirax S6 Sunoco Duragear EP Petro-Canada Traxon E Synthetic Phillips 66 Triton Syngear FE Kendell SHP Full Syngear FE Chevron Delo Syn-Gear HD Chevron Delo Syn-Gear XDM	75W-90	GL-5
Engine Oil (SAE) (CK-4))	80130247	Shell Rotella® T6 Mobil Delvac 1 ESP Caterpillar Cat DE0-ULS Cold Weather	0W-40	CK-4
Engine Oil (SAE) (CI-4)	6829101560	Mobile Delvac 1 – 5W-40	5W-40	CI-4
Hydraulic Oil	6829006993	Exxon Mobil Univis HVI 26	ISO 26	
Transmission Oil	6829101559	Petro-Canada Duratran Synthetic THF Chevron All Weather THF Texaco TDH Oil SS		Must Meet John Deere Std. JDM J20C & J20D
Synthetic Gear Lube: Hoist Swing Drive Gear Box Brake Assembly	6829103636	Petro-Canada ENDURATEX Synthetic EP 150 Mobil SHC629		AGMA No. 4 EP
Extreme Pressure Multipurpose Grease (EP-MPG)	6829104275	Mobil Mobilith SHC 220 (red) Petro-Canada Precision Synthetic EP1 Phillips 66 Multiplex FS 220 (purple)	NLGI 2	GC-LB Certified
Open Gear Lube	6829102971	Fuchs Ceplattyn 300 Spray	NLGI 1-2	
Antifreeze Coolant (early crane models)	6829104212	Old World Industries, Inc. Fleet Charge SCA Pre-charged Fleetguard Compleat EG Petro-Canada Purus® Heavy Duty	Mix 60/40	
Liquid Coolant Conditioner (LCC) (early crane models)	6829012858	Fleetguard DCA4 Fleetguard DCA2 Penray Pencool 3000	LCC	

Table 7-3 : **Cold Weather Lubricants in Arctic Conditions [Down to -40°C (-40°F)] (Continued)**

Lubricant/Fluid	Grove Spec.	Recommended Lubricant		
		Type	Grade	Classification
Antifreeze Coolant (late crane models)	80161178	Old World Ind., Inc. Final Charge Global Extended Life Fleetguard ES COMPLEAT OAT Fleetguard FLEET COOL OAT KOSTUSA DefendAL HD Nitrite-free Extended Life Prestone COMMAND HD Nitrite-free ELC with Cor-Guard OAT Mobile Delvac Extended Life Pre-diluted Phillips 66 GUARDOL OAT HD Pre-diluted	Mix 60/40	
Diesel Exhaust Fluid (DEF)	80019225	Fleetguard StableGuard™ Urea 32 Premix AdBlue® TerraCair Ultrapure® DEF		
Extreme Pressure Multipurpose Grease (Boom) -- High Graphite	6829104537	Mobile Mobilith SHC 1000 Special (gray-black) Old Line XR 1000 Super Syn Grease (gray-black)	NLGI 2	
Windshield Washer fluid	90037773	Splash De-icer		
Diesel Fuel	80069407	NOCO Kerosene, 3, UN1223, III	#1	NLOCK08
BECHEM PAL1	01373458			
BECHEM RHUS SW-2	03313195		NLGI 2	

CYLINDER ROD SURFACE PROTECTION

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. Grove Product Support has Boeshield® T-9 Premium Metal Protectant available in 12 oz. aerosol cans by ordering part number 9999101803 through the Parts Department.

Cylinder operation and inclement weather will remove the Boeshield® protectant; therefore, inspect crane once a week and reapply Boeshield® to unprotected rods.

WIRE ROPE LUBRICATION

Wire rope is lubricated during manufacturing so that the strands, and individual wires in strands, may move as the rope moves and bends. A wire rope cannot be lubricated sufficiently during manufacture to last its entire life. Therefore, new lubricant must be added periodically throughout the life of a rope to replace factory lubricant which is used or lost. For more detailed information concerning the lubrication and inspection of wire rope, refer to *Wire Rope* in *Section 1 - Introduction* of the *Service Manual*.

LUBRICATION POINTS

A regular frequency of lubrication must be established for all lubrication points. Normally, this is based on component operating time. The most efficient method of keeping track of lube requirements is to maintain a job log indicating crane usage. The log must use the engine hourmeter to ensure coverage of lube points that will receive attention based on their readings. Other lubrication requirements must be made on a time basis, for example, weekly, monthly, etc.

Check all oil levels with crane parked on a level surface in transport position, while oil is cold, unless otherwise specified.

On plug type check points, oil levels are to be at the bottom edge of the check port.

All grease fittings are SAE STANDARD unless otherwise indicated. Grease non-sealed fittings until grease is seen extruding from the fitting. One pump on a standard 0.45 kg (1 lb) grease gun equals 28 grams (1 oz) of EP-MPG.

Over-lubrication on non-sealed fittings will not harm fittings or components, but under-lubrication will definitely lead to a shorter lifetime.

Unless otherwise indicated, items not equipped with grease fittings, such as linkages, pins, levers, etc., should be lubricated with oil once a week. Motor oil, applied sparingly, will provide the necessary lubrication and help prevent the formation of rust. An Anti-Seize compound may be used if rust has not formed, otherwise the component must be cleaned first.

Grease fittings that are worn and will not hold the grease gun, or those that have a stuck check ball, must be replaced.

Where wear pads are used, cycle the components and lubricate again to make sure that the entire wear area is fully lubricated.

CraneLUBE

Grove highly recommends use of Manitowoc CraneLUBE lubricants to increase crane reliability and performance. Contact your Grove distributor for information about the Manitowoc CraneLUBE lubrication program.

Cummins Oil Registration List

Cummins has a program that lists engine oils that have been tested and meet the requirements of Cummins Engineering Specifications. A listing of recommended oils is on QuickServe® Online. Log on to quickserve.cummins.com and login with a current username and password. Or create a new account by selecting “Create an Account” under information, then choose Limited Owners Plan, and register. Once logged in, click on the “Service” Tab in the top red bar, “Service Tools” mini-tab and “Oil Registration Lists” link within the Service Tools list. This will load a list of the different Cummins Engineering Specification numbers. Select the one that applies to your engine, and view the registered oils.

Safety

WARNING

Crushing Hazard!

Movement of the superstructure the boom, and outriggers may create a crushing and/or pinching hazard.

Make sure that personnel maintain an adequate clearance from moving parts when these parts are operated during lubrication of the crane.

Failure to follow this instruction may cause serious injury or death to personnel.

To lubricate many of the locations on the crane, the engine must be started. Parts of the crane, to include the boom, superstructure, outriggers, and the like, must be retracted or extended, or swung left or right, which movement may cause pinching and crushing hazards.

After positioning areas of the crane for lubrication, turn off the engine and make sure that the moving parts of the crane are stopped before approaching.

Table 7-4 : **Approved Lubricant Reference Table**

Ref.	Approved Lubricant	Lube Specification Down To -9˚C (+15˚F)	Lube Specification Down To -29˚C (-20˚F)	Lube Specification Down To -40˚C (-40˚F)
A	Extreme Pressure Multipurpose Grease	6829003477	6829104275	6829104275
B	Gear Lube (GL-5)	6829012964	6829014058	6829014058
C	Fully Formulated Anti-Freeze Coolant (early model cranes)	6829101130	6829101130	6829104212
D	Liquid Coolant Conditioner (LCC) (early model cranes)	6829012858	6829012858	6829012858
E	Tractor Hydraulic Fluid	6829006444	6829101559	6829101559
F	Engine Oil (SAE) (CK-4)	80130244 (15W-40)	80130247 (0W-40)	80130247 (0W-40)
G	Open Gear Lube	6829102971	6829102971	6829102971
H	Extreme Pressure Gear Lube	6829100213	6829103636	6829103636
J	Hydraulic Oil	6829006444	6829006993	6829006993
K	Diesel Exhaust Fluid (DEF)	80019225	80019225	80019225
L	Extreme Pressure Multipurpose Grease (Boom) - High Graphite	6829104537	6829104537	6829104537
M	Engine Oil (SAE) (CI-4)	6829003483 (15W-40)	6829101560 (5W-40)	6829101560 (5W-40)
N	Fully Formulated Anti-Freeze Coolant (late model cranes)	80005136	80005136	80161178

THIS PAGE BLANK

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Drive Train						
1	Air Cleaner Filter	Figure 7-1	—	—	When engine fault shows in SDM **See** NOTE 2**.**	REPLACE air cleaner filter **See** NOTE 1**.**
NOTE 1: OPEN rear engine hood to access Engine Air Cleaner Filter element. **NOTE 2:** REPLACE Air Cleaner Primary Element when engine fault comes on in the Alerts Bar of the Superstructure Display Module (SDM).						
Throughout the production of the GRT765/780 cranes, two different anti-freeze coolants were used in their engine cooling systems (see Items 2a and 2b below). The two anti-freeze coolants are NOT compatible with one another. See NOTE 8 below to determine which anti-freeze coolant was used in your crane.						
2a	Engine Cooling System (early model cranes)	Figure 7-1	C **See** NOTE 8**.**	36 L (9.5 gal) **See** NOTE 3**.**	Every 10 hours or daily, whichever interval comes first	CHECK level using sight gauge **See** NOTE 4**.**
					LIFETIME See Service Manual.	DRAIN and FILL **See** NOTE 5**.**
	Liquid Cooling Conditioner (LCC)		D	As necessary	Every 1000 hours or 6 months, whichever interval comes first	TEST and ADD **See** NOTE 6**.**
2b	Engine Cooling System (late model cranes)	Figure 7-1	N **See** NOTE 8**.**	36 L (9.5 gal) **See** NOTE 3**.**	Every 10 hours or daily, whichever interval comes first	CHECK level using sight gauge **See** NOTE 4**.**
					LIFETIME See Service Manual.	DRAIN and FILL **See** NOTE 5**.**
				As necessary	Every 1000 hours or 6 months, whichever interval comes first	TEST and ADD **See** NOTE 7**.**
NOTE 3: Anti-Freeze Coolant (AFC) capacities indicated are for a fully formulated mixture of 50% AFC and 50% water. **NOTE 4:** CHECK Coolant level using sight gauge visible through radiator grille at rear of crane. FILL Surge Tank to bottom of filler neck. OPERATE engine through two (2) thermal cycles. CHECK coolant level and FILL as necessary. **NOTE 5:** Refer to *Engine Cooling System section* in the *Service Manual* for specific levels of contaminates in which the coolant is to be (condemned) drained, flushed, and replaced. See same section for the draining and flushing procedures. **NOTE 6:** See *Antifreeze/Liquid Cooling Conditioner Maintenance* in the *Service Manual* for information about Liquid Cooling Conditioner (LCC) levels. Test LCC levels using the Grove Coolant Test Kit (p/n 9414101675). If coolant additives are low, add LCC following the procedures included with the test kit. **NOTE 7**: Test coolant additive levels using the Grove Coolant Test Kit (p/n 80165087). If coolant additives are low, drain some fluid from the system and then replace with new anti-freeze coolant following the procedures included with the test kit.						

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Drive Train (Continued)						

NOTE 8: Refer to the following information to determine the original anti-freeze coolant used in your crane. The anti-freeze coolant used in the crane can be changed to the other anti-freeze coolant type, but requires the cooling system to be completely drained, flushed, and then refilled (refer to the *Engine Cooling System section* in the *Service Manual* for details).

Model	Serial#	Coolant Spec.
GRT765	237891	C, D
GRT780	237892	C, D
GRT780	237893	C, D
GRT780	237894	C, D
GRT780	237895	C, D
GRT780	237924	C, D
GRT780	237925	C, D
GRT780	237926	N
GRT780	237931	C, D
GRT780	237935	N
GRT765	237936	C, D
GRT780	237937	C, D
GRT780	237940	N
GRT780	237941	C, D
GRT780	237942	C, D
GRT780	237943	C, D
GRT780	237948	C, D

Model	Serial#	Coolant Spec.
GRT780	237949	C, D
GRT780	237955	C, D
GRT780	237956	C, D
GRT765	237959	C, D
GRT780	237960	C, D
GRT780	237961	C, D
GRT780	237962	C, D
GRT780	237963	C, D
GRT780	237964	N
GRT765	237965	C, D
GRT780	237966	C, D
GRT780	237967	C, D
GRT780	237968	C, D
GRT780	237969	C, D
GRT780	237970	C, D
GRT765	237979	C, D
GRT765	237980	N

Model	Serial#	Coolant Spec.
GRT765	237982	C, D
GRT780	237983	N
GRT780	237985	N
GRT780	237987	N
GRT780	237998	C, D
GRT780	237999	C, D
GRT780	238012	N
GRT780	238013	N
GRT780	238014	N
GRT765	238029	N
GRT780	238031	N
GRT780	238032	N
GRT765	238056	N
GRT765	238057	N
GRT765	238060	N
GRT765	238067	N
GRT765 /780	238068 and up	N

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Drive Train (Continued)						
3	Engine Crankcase with Filter - Stage V / Tier 4F	Figure 7-1	F	Stage V / Tier 4F 18.5 L (4.9 gal)	Every 10 hours or daily, whichever interval comes first	CHECK oil level ADD oil to FULL on DIPSTICK **See** NOTE 9**.**
					After first 500 hours or 6 months, whichever interval comes first Every 800 hours or 1 year thereafter	DRAIN crankcase REPLACE filter FILL oil to FULL **See** NOTE 9**.** **See** NOTE 10**.**
	Engine Crankcase with Filter - Tier 3 / non-certified		F, M	Non-certified / Tier 3 18.5 L (4.9 gal)	Every 10 hours or daily, whichever interval comes first	CHECK oil level ADD oil to FULL **See** NOTE 9**.**
					Every 500 hours or 6 months, whichever interval comes first **See** NOTE 11 when using sulfur fuel that is >500 ppm	DRAIN crankcase REPLACE filter FILL oil to FULL **See** NOTE 9**.**

NOTE 9: Engine Oil Fill is on top of the valve cover. Engine Oil Filter is located on inside left side of the frame, under the transmission, accessible from the bottom of the machine. Engine Oil Dipstick is on the top right side of the crankcase near Engine Oil Fill.

NOTE 10: Extended oil drain intervals apply only when ultra-low sulfur diesel (ULSD) fuel is used. Oil drain intervals for bio-diesel blends greater than B8 should not exceed 500 hours.

NOTE 11: Frequency for Engine Oil and Filter service intervals will increase in special circumstance when using CK-4 oil and sulfur fuel that is >500 ppm. Drain the engine crankcase and replace your engine oil filter using the following intervals:

- If using 500–5000 ppm sulfur fuel in the engine, then drain the crankcase and replace your engine oil filter every 400 hours of service.
- If using >5000 ppm sulfur fuel in the engine, then drain the crankcase and replace your engine oil filter every 250 hours of service. Grove **does not recommend** using >5000 ppm sulfur fuel in the engine.

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Drive Train (Continued)						
4	Transmission and Torque Converter	Figure 7-1	E	44.5 L (11.75 gal)	**PERFORM** every 10 hours or daily, whichever interval comes first	CHECK fluid level **See** NOTE 12. **See** NOTE 13. FILL transmission sump to FULL on DIPSTICK **See** NOTE 15.
					PERFORM after first 500 hours or 6 months, whichever interval comes first Then **PERFORM** every 1000 hours or 6 months, whichever interval comes first	DRAIN transmission sump **See** NOTE 14. REPLACE transmission and torque converter filter **See** NOTE 16. CLEAN magnetic drain plug INSTALL magnetic plug in drain port FILL transmission sump to FULL on DIPSTICK **See** NOTE 15.

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Drive Train (Continued)						

NOTE 12: Check Transmission Fluid level using the dipstick that is located on the right side of the carrier, behind the steps, adjacent to the hydraulic tank. Check fluid level with boom fully retracted and lowered, and all outrigger cylinders retracted.

NOTE 13: Level should be checked with engine running at 850 rpm idle and torque converter fluid temp at 65°C to 93°C (150°F to 200°F). To bring fluid temperature to this range, it is necessary to work the crane or stall the converter.

CAUTION

Possible Equipment Damage!

Do not operate torque converter at stall condition for longer than 30 seconds at one time.

Shift to neutral for 15 seconds, and repeat procedure until desired fluid temperature is reached.

Excessive fluid temperature [120°C (250°F) maximum] will damage transmission clutches, transmission fluid, torque converter, and seals.

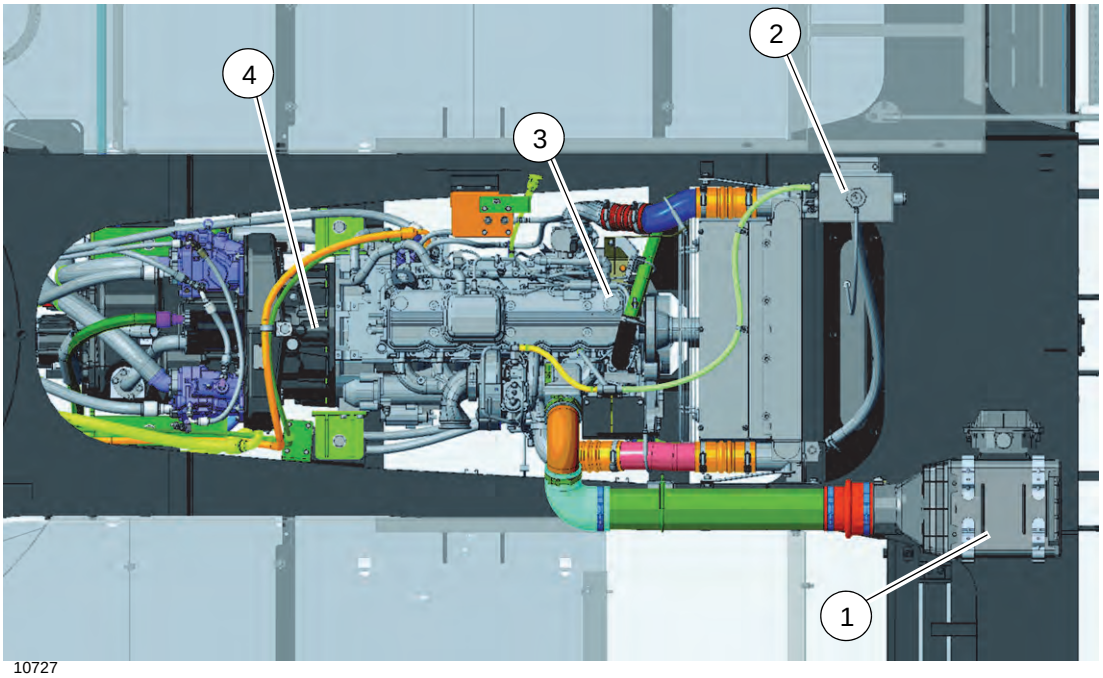
Failure to follow this instruction may cause damage to equipment.

NOTE 14: Follow these specified Transmission and Torque Converter Fluid DRAIN instructions:

- **a.** DRAIN Transmission and Torque Converter Fluid at a temperature of 65°C to 93°C (150°F to 200°F).
- **b.** CLEAN magnetic drain plug when changing lubricant.

NOTE 15: Follow these specified Transmission and Torque Converter Sump Fluid FILL instructions:

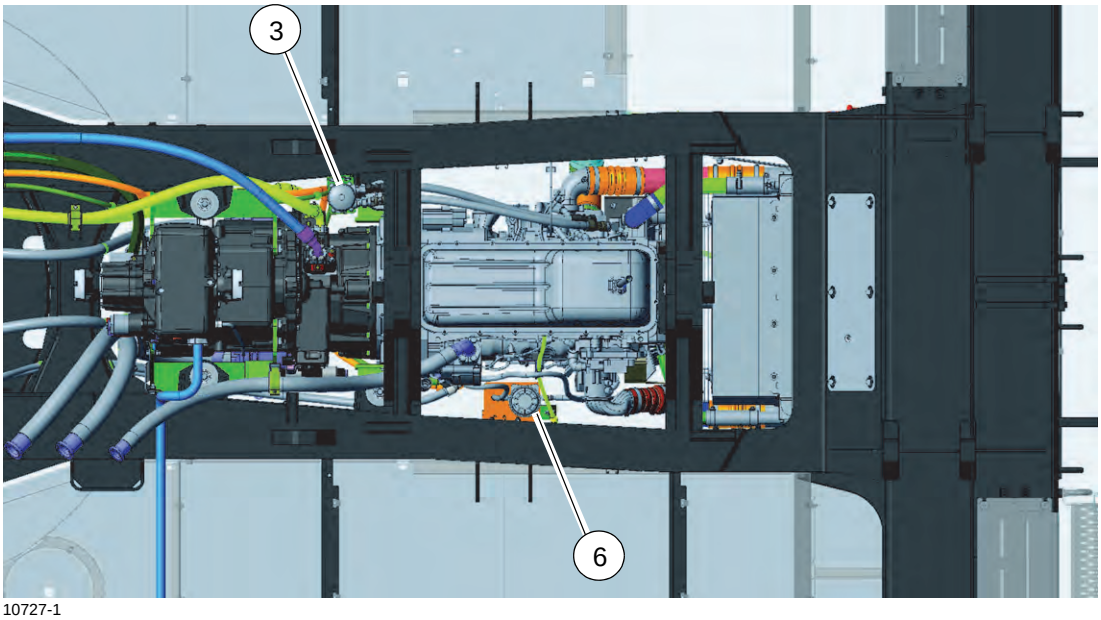
- **a.** Dipstick is used to FILL the Transmission and Torque Converter Sump, and is located on the right side of the carrier, behind the steps, adjacent to the hydraulic tank. Open cap on the DIPSTICK for the Transmission and Torque Converter sump, and FILL with transmission fluid through the DIPSTICK opening. FILL to FULL on DIPSTICK.
- **b.** OPERATE engine at 850 rpm to prime torque converter and lines.
- **c.** CHECK fluid LEVEL with engine running at 850 rpm and torque converter fluid at 65°C to 93°C (150°F to 200°F).
- **d.** ADD transmission fluid, as necessary. FILL to FULL on DIPSTICK.



10727

FRONT

TOP VIEW OF CARRIER, ENGINE AREA



10727-1

BOTTOM VIEW OF CARRIER, ENGINE AREA

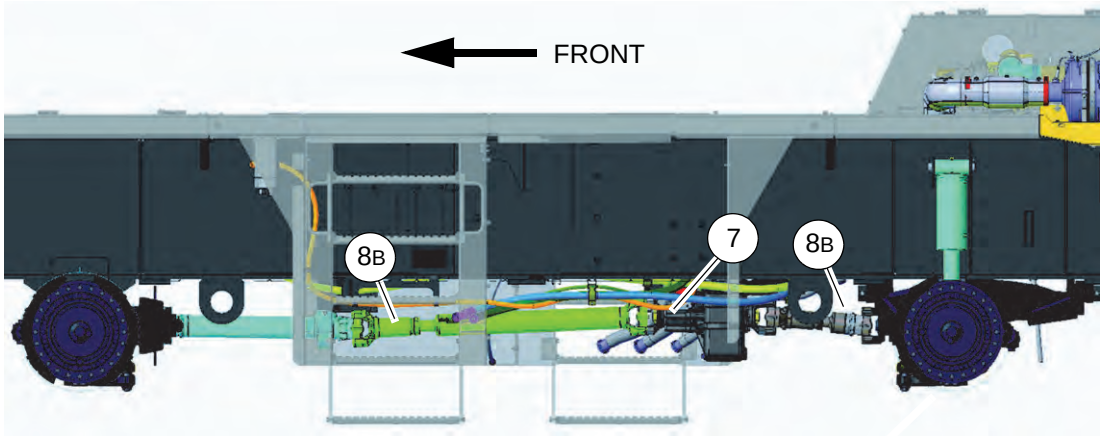
FIGURE 7-1

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Drive Train (Continued)						
5	Transmission and Torque Converter Filter	Figure 7-2	—	—	**PERFORM** after first 500 hours or 6 months, whichever interval comes first Then **PERFORM** every 1000 hours or 6 months, whichever interval comes first	REPLACE filter **See** NOTE 16**.**
6	Fuel Filter	Figure 7-1	—	—	**PERFORM** every 500 hours or 6 months, which- ever interval comes first	REPLACE fuel filter **See** NOTE 17**.**
7	Coolant Strainer	Figure 7-2	—	—	**PERFORM** after first 100 hours	CLEAN strainer
					Then every 2000 hours or 1 year thereafter	REPLACE strainer
8A	Driveline – Slip	Figure 7-2	A	Until grease extrudes	Every 500 hours or 3 months, whichever interval comes first	LUBRICATE 1 service point
8B	Driveline – Slip	Figure 7-2	A	Until grease extrudes	Every 500 hours or 3 months, whichever interval comes first	LUBRICATE 1 service point
9	Fuel/Water Separator	Figure 7-2	—	—	Every 10 hours/daily	DRAIN water trap
10	DEF Supply Module Filter (Stage V / Tier 4)	Figure 7-2	—	—	Every 4500 hours or 3 years, whichever interval comes first	CHECK DEF Supply Module filter
11	DEF Tank (Stage V / Tier 4)	Figure 7-2	K	37.9 L (10 gal)	Every 10 hours/daily	CHECK DEF Tank Level and FILL **See** NOTE 18**.**
12	DEF Tank Filter (Stage V / Tier 4)	Figure 7-2	—	—	Every 2000 hours or 1 year, whichever interval comes first	CHECK DEF Tank filter

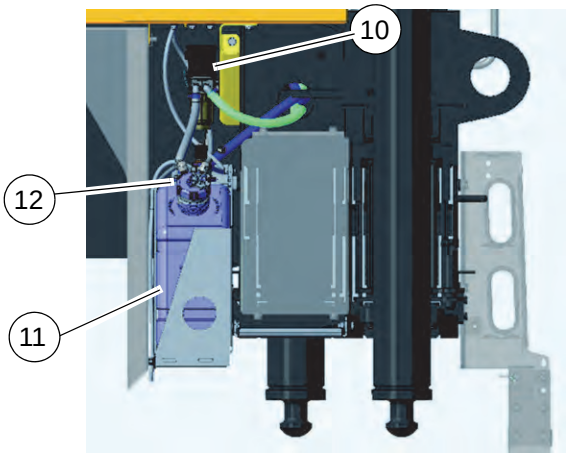
NOTE 16: Transmission and Torque Converter filter is located on the outside left side of the frame behind the fuel tank.

NOTE 17: The Fuel Filter is located on the inside right side of the engine hood.

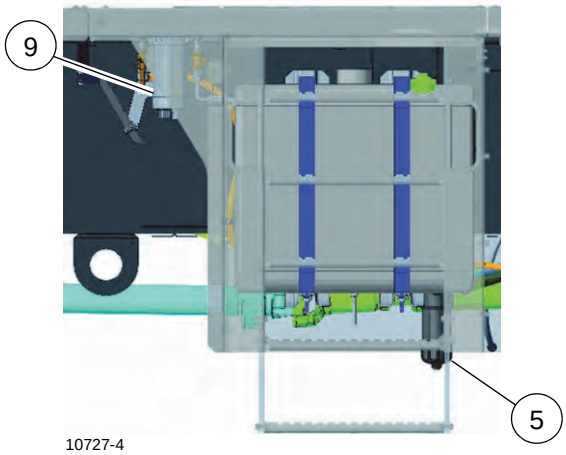
NOTE 18: The Diesel Exhaust Fluid (DEF) Level Indicator in the Operator Area of the Superstructure Display Module (SDM) comes on YELLOW when the DEF tank is 4%–10% FULL and RED when the tank is <5% FULL.



10727-2



10727-3



10727-4

SIDE VIEW OF CARRIER

10024-02c

FIGURE 7-2

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Steering and Suspension – Kessler Axles						
40	Steering Cylinder Pivot Pins	Figure 7-3	A **See** NOTE 19**.**	Until grease extrudes	Every 50 hours or weekly, whichever interval comes first	LUBRICATE 4 fittings per axle, 8 service points
41	King Pins (upper and lower)	Figure 7-3	A **See** NOTE 19**.**	Until grease extrudes	**PERFORM** after first 100 hours	LUBRICATE 4 fittings per axle, 8 service points
				Until grease extrudes	**REPEAT** every 500 hours or 3 months thereafter, whichever interval comes first	LUBRICATE 4 fittings per axle, 8 service points
42	Tie Rod Pivot Pins	Figure 7-3	—	—	Maintenance Free	NO SERVICE
43	Lockout Cylinder Pivot Pins	Figure 7-3	A **See** NOTE 19**.**	Until grease extrudes	Every 500 hours or 3 months, whichever interval comes first	LUBRICATE 2 fittings per axle, 4 service points

CAUTION

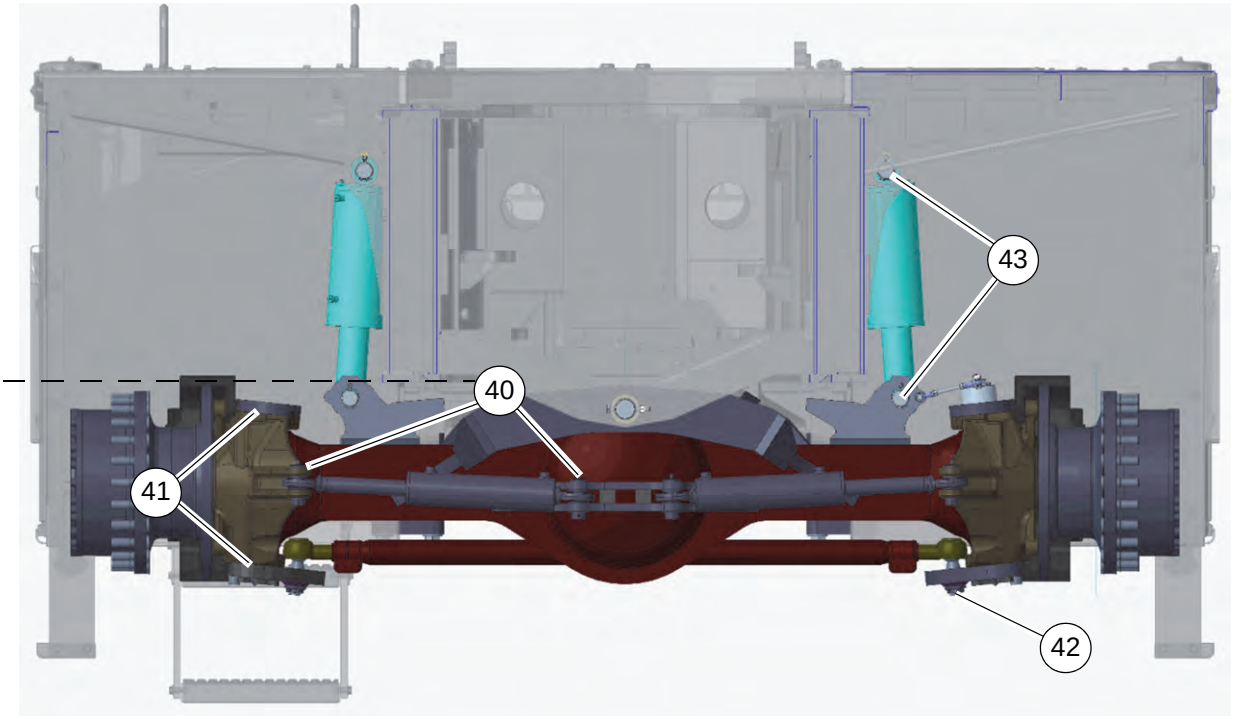
Possible Equipment Damage!

Use specified semi-synthetic or synthetic lubricants as listed in your GRT765/780 *Operator Manual*. See also your GRT765/780 *Service Manual* for maintenance and lubrication instructions.

Use of non-approved, non semi-synthetic lubricant may damage components and/or invalidate published lubricant intervals.

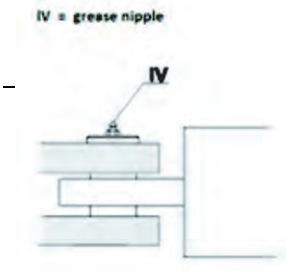
Failure to follow this instruction may cause damage to equipment.

NOTE 19: Use grease fittings provided. **DO NOT USE non semi-synthetic lubricant**. Use of non-approved lubricant may damage components.



10727-5

KESSLER AXLE



10727-6

FIGURE 7-3

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Steering and Suspension – Fifth Wheel Pivots						
44	Fifth Wheel Pivot Pins	Figure 7-4	A **See** NOTE 20.	Until grease extrudes	Every 500 hours or 3 months, whichever interval comes first	LUBRICATE 2 service points

NOTE 20: Use grease fittings provided. **DO NOT USE non semi-synthetic lubricant**. Use of non-approved lubricant may damage components.

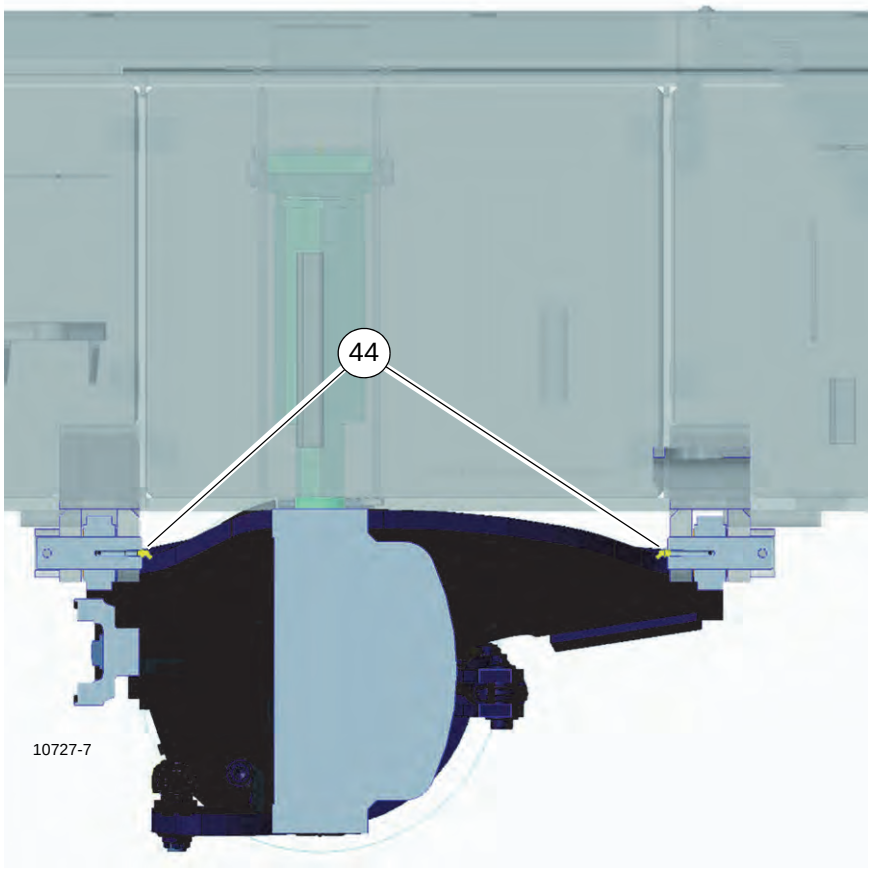
CAUTION

Possible Equipment Damage!

Use specified semi-synthetic or synthetic lubricants as listed in your GRT765/780 *Operator Manual*. See also your GRT765/780 *Service Manual* for maintenance and lubrication instructions.

Use of non-approved, non semi-synthetic lubricant may damage components and/or invalidate published lubricant intervals.

Failure to follow this instruction may cause damage to equipment.



FIFTH WHEEL PIVOTS

FIGURE 7-4

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Axle Lubrication – Kessler Axles						
50	Differentials	Figure 7-5	B **See** NOTE 22 **See** NOTE 24	23 L (6.1 gal) ea NOTE 23**.**	Every 100 hours or 1 month, whichever interval comes first	CHECK and FILL 2 service points
					PERFORM after first 100 hours **REPEAT** every 1000 hours or 1 year thereafter, whichever interval comes first	DRAIN and FILL 2 service points CLEAN magnetic drain plug INSTALL magnetic plug in drain port
51	Planetary Hubs & Wheel Bearings	Figure 7-5	B **See** NOTE 22 **See** NOTE 24	2.8 L (2.9 qt) ea Wheel End NOTE 23**.**	Every 250 hours or 1 month, whichever interval comes first	CHECK and FILL 4 service points **See** NOTE 21**.**
	Detail View, Planetary DRAIN and FILL ports	Figure 7-5			Every 3000 hours or 2 years, whichever interval comes first	DRAIN and FILL 4 service points **See** NOTE 21**.**

NOTE 21: Planetary Hubs and Wheel Bearings must be filled to oil fill level indicated on axle hub. To provide sufficient lubrication, final fluid level MUST BE LEVEL with the filler plug hole at the Wheel End, with fluid even slightly dripping from the hole. CLEAN magnetic plug, then INSTALL magnetic plug in drain port.

NOTE 22: Before operating crane in cold weather (arctic) ambient temperatures below -9°C (+15°F), Standard bearing lubricant must be fully purged and replaced with Cold Weather lubricant meeting Grove U.S. L.L.C. specifications as shown in Table 7-4*: Approved Lubricant Reference Table*, page 7-12. See also your GRT765/780 *Service Manual* for maintenance and lubrication instructions.

NOTE 23: **If the makeup amount of fluid is substantially more than 0.23 L (0.5 pt)**, CHECK for leaks.

CAUTION

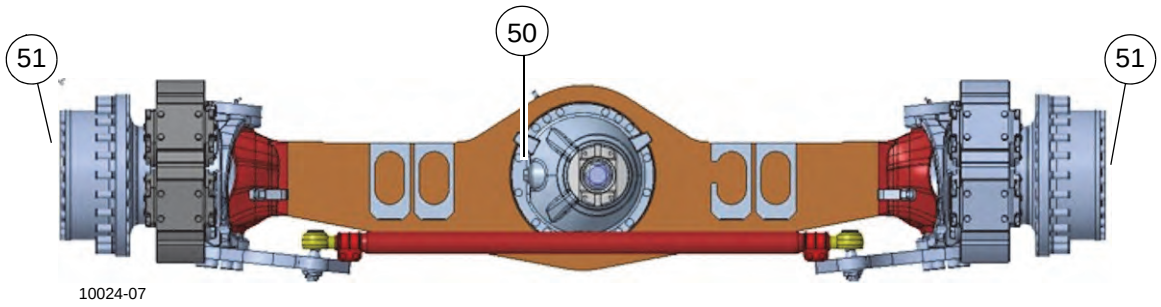
Possible Equipment Damage!

Use specified semi-synthetic or synthetic lubricants as listed in the GRT765/780 *Operator Manual*. See also your GR780/765 *Service Manual* for maintenance and lubrication instructions.

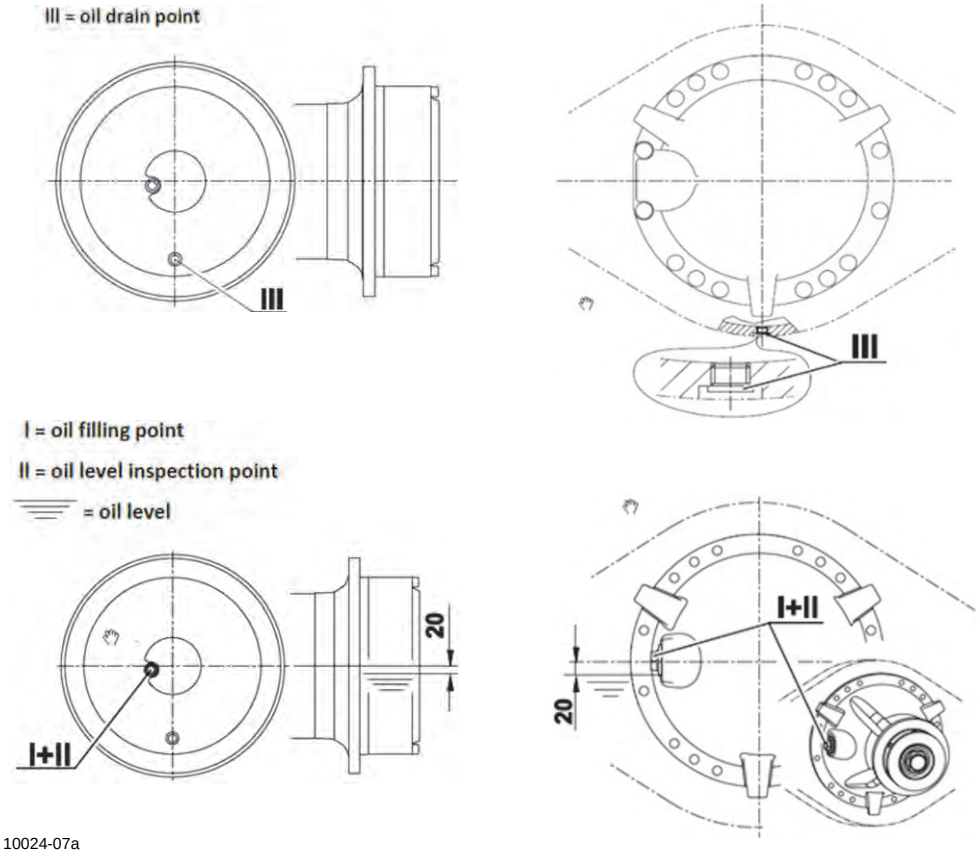
Use of non-approved, non semi-synthetic lubricant may damage components and/or invalidate published lubricant intervals.

Failure to follow this instruction may cause damage to equipment.

NOTE 24: **DO NOT USE non semi-synthetic lubricant**. Use of non-approved lubricant may damage components.



KESSLER DRIVE AXLE – FRONT VIEW



KESSLER DRIVE AXLE DETAIL VIEW

FIGURE 7-5

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Outrigger Lubrication						
60	Wear Pads	Figure 7-6	L **See** NOTE 25	Brush on	Every 50 hours, or 1 week of service, whichever interval comes first	BRUSH ON TOP wear pads and BOTTOM wear pads of each outrigger beam 10 service points each beam **See** NOTE 26. **See** NOTE 27.
61	Outrigger Beams	Figure 7-6	L **See** NOTE 25	Brush on	Every 50 hours, or 1 week of service, whichever interval comes first	BRUSH ON TOP and BOTTOM bump-outs on each side of outrigger beam 4 service points each beam **See** NOTE 26. **See** NOTE 27.
62	Jack Cylinder Support Tubes	Figure 7-6	L **See** NOTE 25	Brush on	Every 50 hours, or 1 week of service, whichever interval comes first	BRUSH ON I.D. of 4 service points **See** NOTE 28.

NOTE 25: **DO NOT USE non semi-synthetic lubricant**. Use of non-approved lubricant may damage components.

CAUTION

Possible Equipment Damage!

Use specified semi-synthetic or synthetic lubricants as listed in the GRT765/780 *Operator Manual*. See also your GR780/765 *Service Manual* for maintenance and lubrication instructions.

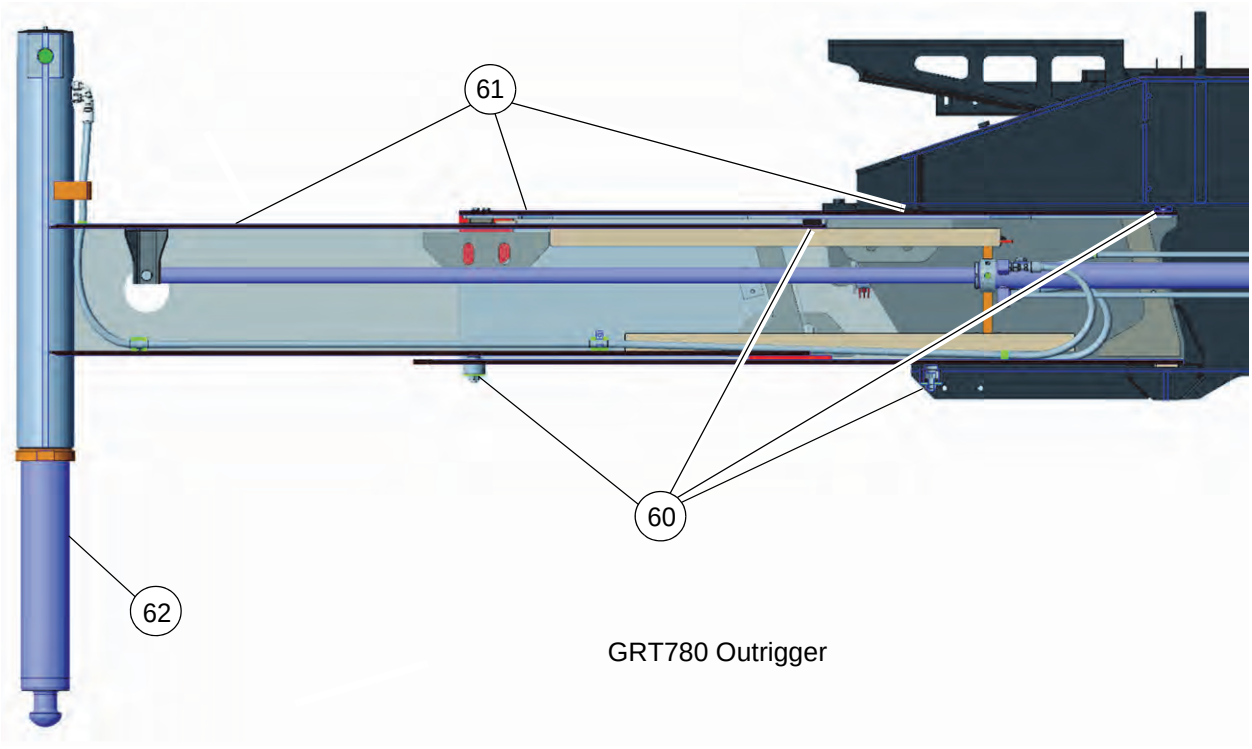
Use of non-approved, non semi-synthetic lubricant may damage components and/or invalidate published lubricant intervals.

Failure to follow this instruction may cause damage to equipment.

NOTE 26: Brush lubricant on TOP and BOTTOM wear pads of Outrigger Beams.

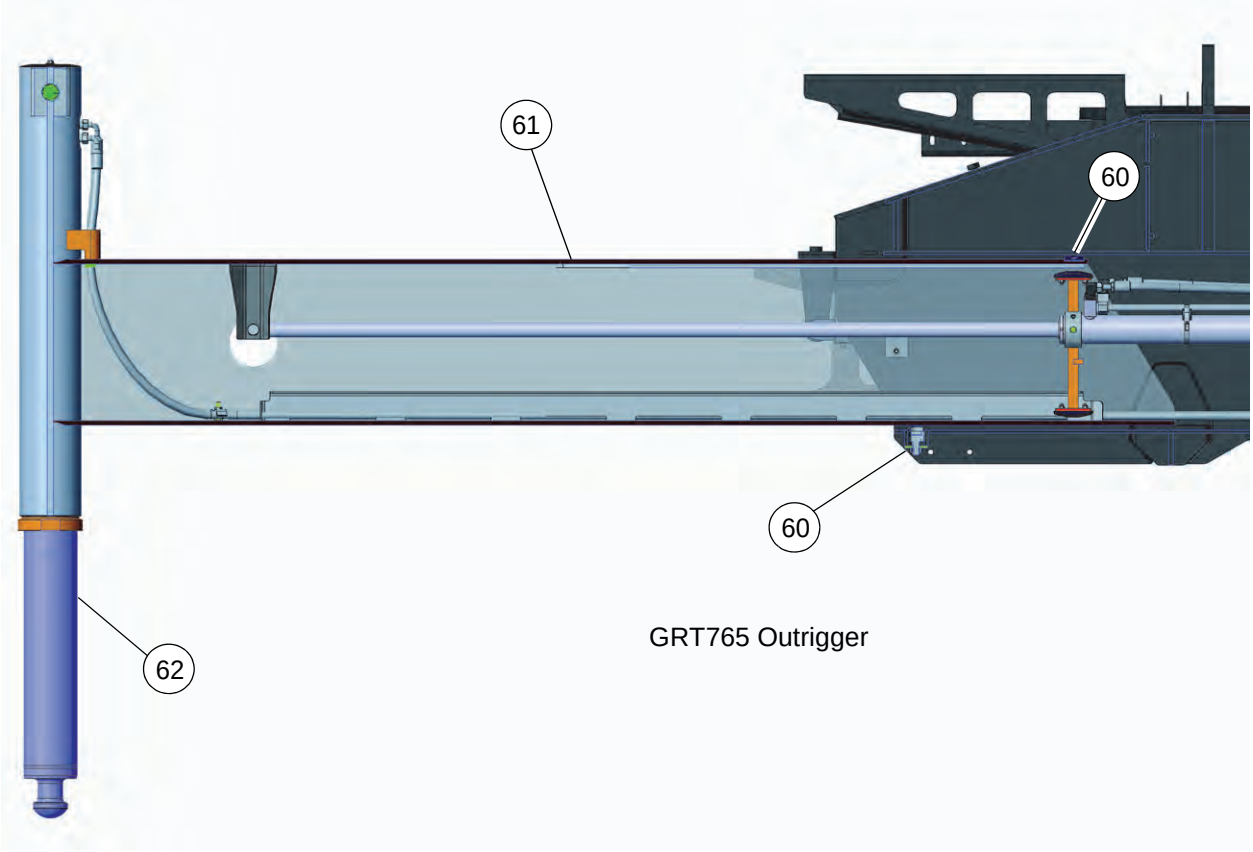
NOTE 27: Brush lubricant on TOP and BOTTOM of Outrigger Beams contact area.

NOTE 28: Brush lubricant in I.D. of Jack Cylinder Support Tubes and Wear Bands before installing Jack Cylinders.



GRT780 Outrigger

10727-8



GRT765 Outrigger

10727-26

FIGURE 7-6

Item	Lube Point Description	Figure No.	Approved Lubricant	Lube Capacity	Lube Interval	Application
Hydraulics Lubrication						
70	Hydraulic Tank	Figure 7-7	J	817.3 L (215.9 gal) Tank only	Every 10 hours or daily, whichever interval comes first	CHECK oil level FILL hydraulic tank to LEVEL in SIGHT GLASS **See** NOTE 29**.**
					PERFORM SERVICE INSPECTION every 3 to 6 months **See** NOTE 31**.** **See** NOTE 33**.**	PERFORM SERVICE INSPECTION of oil, filters, and breathers **See** NOTE 32**.**
					SAMPLE hydraulic oil every 3 to 6 months	SAMPLE hydraulic oil
71	Hydraulic Filter and Breather	Figure 7-7	—	—	REPLACE hydraulic oil filter when the red **Hyd Oil Filter Clogged** alert shows on the SDM	REPLACE hydraulic filter element **See** NOTE 30**.** **See** NOTE 33**.**

NOTE 29: Check Hydraulic oil level using sight glass on tank with boom fully retracted and lowered, and all outrigger cylinders retracted.

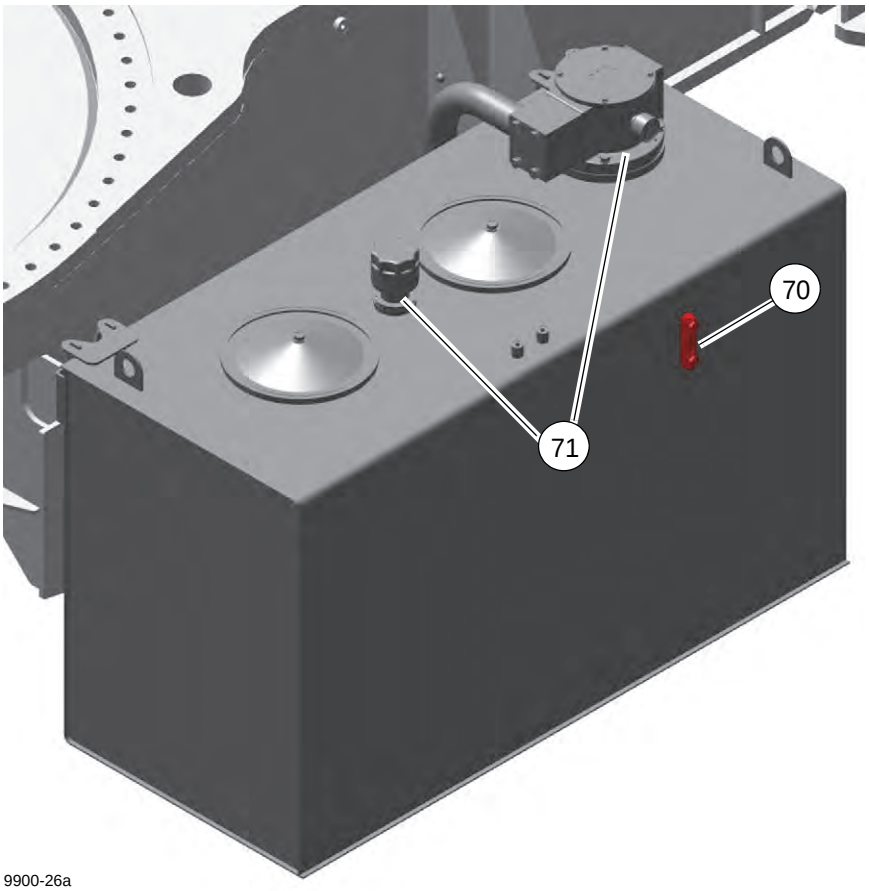
NOTE 30 REPLACE hydraulic filter element when the red Hydraulic Oil Filter Clogged alert shows on the SDM and oil is at operating temperature.

NOTE 31: REPLACE hydraulic filter at **first 50-hours of service** and **repeat after another 50-hours**, for a total of **100 hours of service**, thereafter, at normal intervals.

NOTE 32: Hydraulic oil MUST BE at operating temperature at hydraulic filter and tank inspection and service. Hydraulic oil MUST be drained at a temperature of 65°C to 90°C (150°F to 200°F).

NOTE 33: **Hydraulic oil SHALL MEET or EXCEED ISO 4406 class 17/14 cleanliness level** (reference SAE J1165).

- Working in harsh environmental conditions can dramatically affect the performance and condition of hydraulic oil, filters, and breathers. Therefore, specific intervals for servicing/changing hydraulic oil, filters, and hydraulic tank breathers cannot be set. Thus, it is imperative for the continued satisfactory performance of Grove cranes, that service inspections be performed on the basis of how and where each crane is used.
- Under normal operating conditions, Grove recommends that **hydraulic oil**, **filters**, and **breathers** be serviced, and **hydraulic oil sampled** at least every 3 to 6 months. Service inspections should be for airborne or ingested particles and water that deteriorates and contaminates the hydraulic oil. Contaminated hydraulic oil appears “milky” or no longer has a transparent clear to amber color. The return filter by-pass indicator should be observed daily to determine if the contaminant content is high. If the filter by-pass indicator reaches the red zone or indicates a by-pass condition, the hydraulic oil must be sampled. Perform service to **make sure that the hydraulic oil tank breather does not restrict air flow IN, or air flow OUT of the reservoir**.
- FILL procedure for Hydraulic Tank operation below -9°C (+15°F):
  - **a.** DRAIN existing oil.
  - **b.** FILL tank with oil per 6829101559 and cycle all cylinders.
  - **c.** DRAIN oil.
  - **d.** FILL tank with oil per 6829101559.
- See also your GRT780/765 *Service Manual* for further details on Hydraulic Oil Sampling Test. Should you have any questions, please contact your local authorized Grove distributor.



HYDRAULIC TANK

FIGURE 7-7

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Turntable (Swing Drive) Lubrication						
80	Turntable (Swing Drive) Gearbox	Figure 7-8	B	4.14 L (4.4 qt)	**After first 50 hours of service** **Thereafter**, every 50 hours or 1 week, whichever interval comes first **See** NOTE 34**.**	CHECK oil level FILL swing drive gearbox 1 service point **See** NOTE 35**.**
					After first 100 hours of service **Thereafter**, every 2000 hours or 12 months, whichever comes first **See** NOTE 34**.**	DRAIN swing drive gearbox FILL swing drive gearbox 1 service point **See** NOTE 35**.**
81	Turntable (Swing Drive) Gearbox – Brake Assembly	Figure 7-8	B	0.3 L (0.63 pt) each gearbox	**After first 50 hours of service** **Thereafter**, every 50 hours or 1 week, whichever interval comes first **See** NOTE 34**.**	CHECK oil level FILL swing drive gearbox brake assembly 1 service point **See** NOTE 36**.**
					After first 100 hours of service **Thereafter**, every 2000 hours or 12 months, whichever interval comes first **See** NOTE 34**.**	DRAIN swing drive gearbox FILL swing drive gearbox brake assembly 1 service point **See** NOTE 36**.**
82	Turntable (Swing Drive) Gear and Drive Pinion	Figure 7-8	G	SPRAY ON	Every 500 hours or 6 months, whichever interval comes first	SPRAY ON LUBRICATION swing drive gear and drive pinions COAT ALL TEETH 2 service points

NOTE 34: If using swing function hours from the SDM instead of engine hours to determine service interval, change oil after first 50 swing function hours, then at intervals of 1000 swing function hours or 12 months, whichever comes first.

NOTE 35: Check level in Swing Drive Gearbox, and FILL to BOTTOM of FILL HOLE.

NOTE 36 Check level in Swing Drive Gearbox Brake Assembly, and FILL to TOP of ELBOW.

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Turntable (Swing Drive) Lubrication (Continued)						
83	Turntable Bearing	Figure 7-8	A **See** NOTE 37 **See** NOTE 38	**ROTATE** the S/S 90° then grease again **REPEAT** until the S/S has made one full rotation	Every 500 hours or 6 months, whichever interval comes first	LUBRICATE 6 grease fittings at front of super-structure (S/S) 6 service points **See** NOTE 40**.**
84	Turntable Swivel Lock Pin	Figure 7-8	G	SPRAY ON	Every 500 hours or 6 months, whichever interval comes first	SPRAY ON LUBRICATION 1 service point **See** NOTE 39**.**

NOTE 37: Apply grease to six (6) fittings at front of superstructure. Then rotate superstructure 90° and apply grease to fittings once more. Repeat rotating the superstructure in 90° increments and applying grease to the fittings until the entire superstructure has made a full rotation.

NOTE 38: The turntable bearing in this crane is lubricated with *Cold Weather* (arctic) bearing grease capable of ambient temperatures between -40°C and +49°C (-40°F to +120°F). If operating the crane in regions expecting sustained winter/cold season temperatures below 15°F, top off bearing grease using Table 7-2, *Cold Weather Lubricants in Arctic Conditions [Down to -29°C (-20°F)]*. If temperatures below -9°C (15°F) are rare and intermittent, then greases from Table 7-1, *Standard Lubricants [Down to -9°C (+15°F)],* are acceptable.

CAUTION

Possible Equipment Damage!

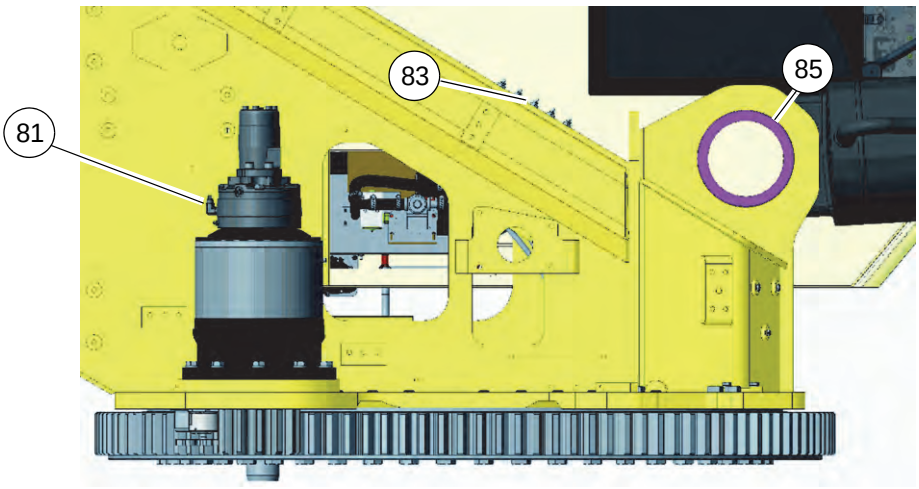
Use specified semi-synthetic or synthetic lubricants as listed in this section of your GRT765/780 *Operator Manual*. See also your GRT765/780 *Service Manual* for maintenance and lubrication instructions.

Use of non-approved, non semi-synthetic lubricant may damage components and/or invalidate published lubricant intervals.

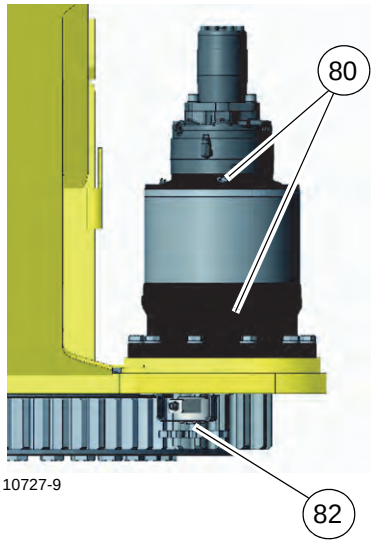
Failure to follow this instruction may cause damage to equipment.

NOTE 39: **DO NOT USE non semi-synthetic lubricant**. Use of non-approved lubricant may damage components.

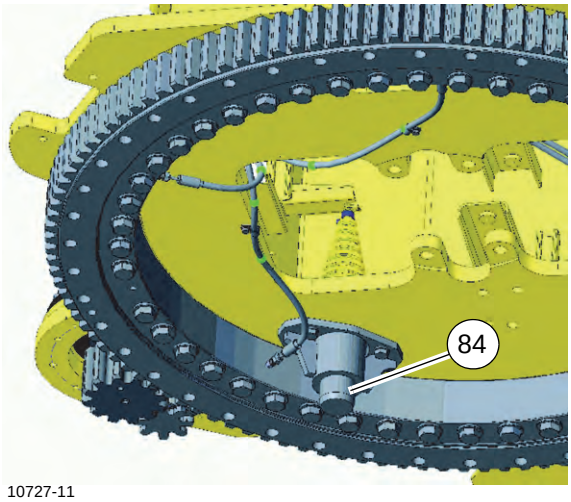
NOTE 40: If Auto-Lube option is installed, these service points are not manually lubricated.



10727-10



10727-9



10727-11

FIGURE 7-8

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Lift Cylinder Lubrication						
85	Lower Lift Cylinder Pivot Pin	Figure 7-9	L **See** NOTE 41 **See** NOTE 42	Until grease extrudes	Every 500 hours or 3 months, whichever interval comes first	LUBRICATE 1 grease fitting, 1 service point **See** NOTE 43**.**

CAUTION

Possible Equipment Damage!

Use specified semi-synthetic or synthetic lubricants as listed in your GRT765/780 *Operator Manual*. See also your GRT765/780 *Service Manual* for maintenance and lubrication instructions.

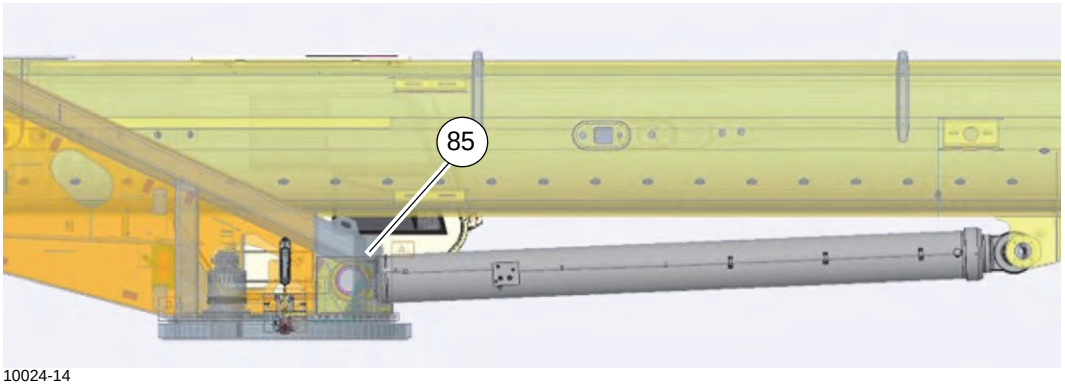
Use of non-approved, non semi-synthetic lubricant may damage components and/or invalidate published lubricant intervals.

Failure to follow this instruction may cause damage to equipment.

NOTE 41: **DO NOT USE non semi-synthetic lubricant**. Use of non-approved lubricant may damage components.

NOTE 42: Before operating crane in cold weather (arctic) ambient temperatures below -9°C (+15°F), Standard grease must be fully purged and replaced with Cold Weather grease meeting Grove U.S. L.L.C. specifications as shown in Table 7-4*: Approved Lubricant Reference Table*, page 7-12. See also your GRT765/780 *Service Manual* for specified maintenance and lubrication instructions.

NOTE 43: If Auto-Lube option is installed, these service points are not manually lubricated.



10024-14

LIFT CYLINDER

FIGURE 7-9

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Cab Tilt Lubrication						
86	Cab Tilt Cylinder Pivot Pins	Figure 7-10	A		Every 500 hours or 3 months, whichever interval comes first	LUBRICATE 2 service points **See** NOTE 44**.**
87	Pillow Block	Figure 7-10	A		Every 500 hours or 3 months, whichever interval comes first	LUBRICATE 4 service points **See** NOTE 44**.**
88	Cab Door Track and Rollers	Figure 7-11	Light Oil		Every 6 months	LUBRICATE top and bottom door track and rollers 2 service points
89	Air Conditioner Condenser Filter	Figure 7-12	–		Every 1000 hours or 6 months, whichever interval comes first	CHECK and CLEAN condenser filter 1 service point

NOTE 44: USE grease fittings provided.

CAUTION

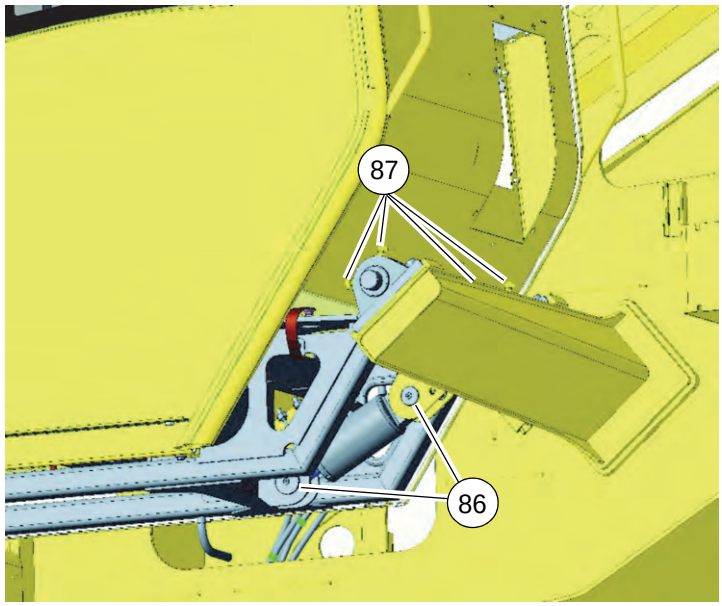
Possible Equipment Damage!

Use specified semi-synthetic or synthetic lubricants as listed in your GRT765/780 *Operator Manual*. See also your GRT765/780 *Service Manual* for maintenance and lubrication instructions.

Use of non-approved, non semi-synthetic lubricant may damage components and/or invalidate published lubricant intervals.

Failure to follow this instruction may cause damage to equipment.

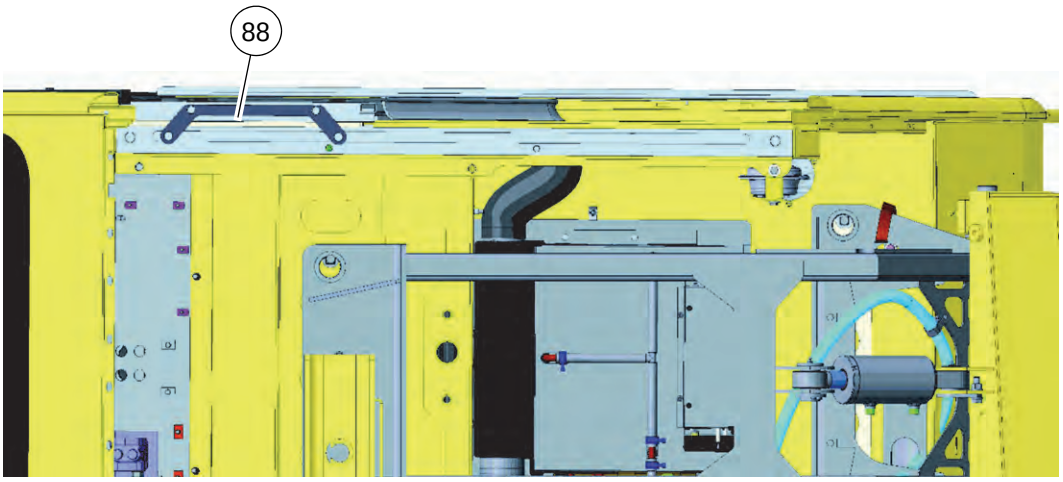
NOTE 45: **DO NOT USE non semi-synthetic lubricant**. Use of non-approved lubricant may damage components.



10727-12

SIDE VIEW – SUPERSTRUCTURE

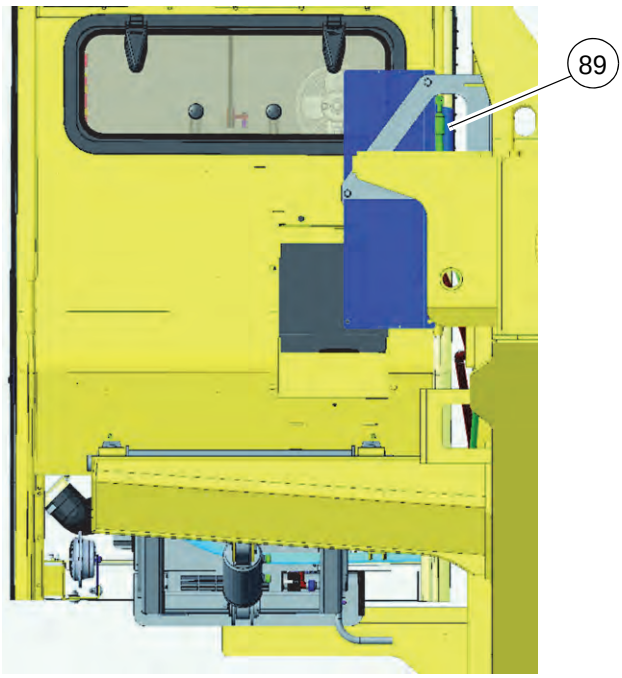
FIGURE 7-10



10727-13

UNDERSIDE OPERATOR CAB DOOR TRACK AND ROLLERS

FIGURE 7-11



10727-14

REAR OF OPERATOR CAB – AIR CONDITIONER CONDENSER FILTER

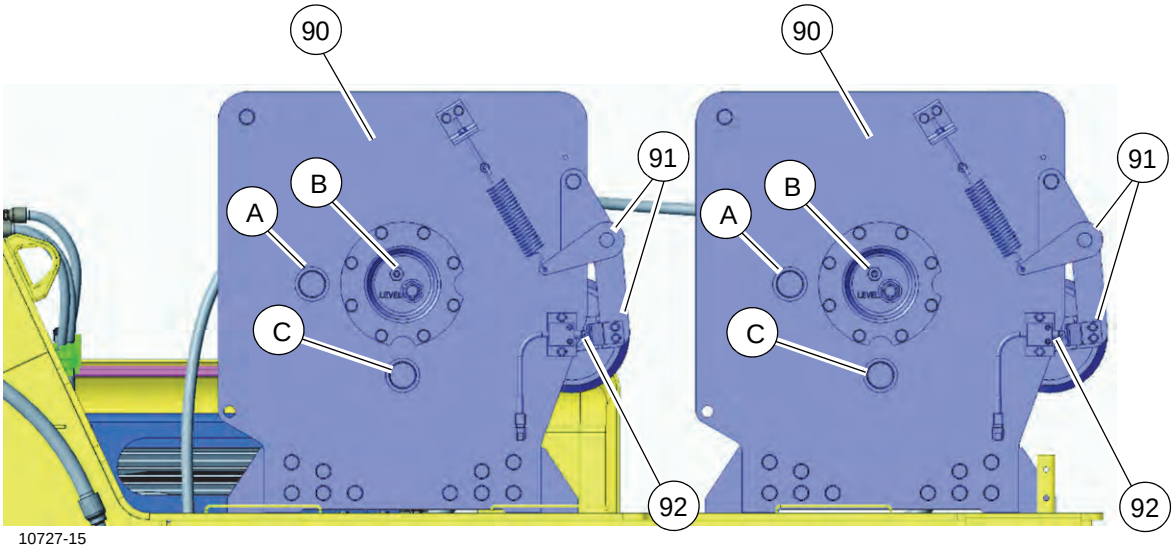
FIGURE 7-12

Item	Lube Point Description	Figure No.	Approved Lubricant	Approximate Capacity	Service Interval	Service Application
Hoist Lubrication						
90	Hoist Drums (Main & Auxiliary)	Figure 7-13	H	14.2 L (15 qt)	Every 50 hours or weekly, whichever interval comes first **See** NOTE 47**.**	ALIGN fill/drain plug with upper access hole. CHECK oil level 2 service points REMOVE fill/drain plug to FILL FILL hoist drums to LEVEL visible in sight glass 2 service points **See** NOTE 46**.**
					After first 300 hours of service **Thereafter**, every 1000 hours or 12 months, whichever interval comes first **See** NOTE 47**.** **See** NOTE 48**.**	ALIGN fill/drain plug with lower access hole. REMOVE fill/drain plug to DRAIN oil DRAIN hoist drums 2 service points
						ALIGN fill/drain plug with upper access hole. FILL hoist drums to LEVEL visible in sight glass **See** NOTE 46**.**
91	Cable Follower (Arm)	Figure 7-13	G		Every 250 hours, or 3 months, whichever interval comes first **See** NOTE 47**.**	SPRAY ON LUBRICATION 8 service points
92	Hoist Lower Limit Switch	Figure 7-13	G		Every 250 hours or 3 months, whichever interval comes first **See** NOTE 47**.**	BRUSH ON 2 service points

NOTE 46: Line up the Fill/Drain Plug with the upper access hole (A). Check oil level in hoist drum sight glass. Hoist oil level MUST be between the high and low marks on sight glass. If oil is not visible, hoist may be underfilled. If oil is escaping from the vent plug (B), hoist may be overfilled. When replacing the oil, align the Fill/Drain Plug with the lower access hole (C) and drain the oil.

NOTE 47: If the weather is very bad or operating conditions are poor, then more frequent intervals are necessary. Monitor the service points and adjust lubrication intervals, as necessary.

NOTE 48: If using hoist function hours from the SDM instead of engine hours to determine service interval, change oil after first 150 hoist function hours, then at intervals of 500 hoist function hours or 12 months, whichever comes first.



10727-15

HOIST DRUMS – (MAIN and AUXILIARY)

FIGURE 7-13

Boom

NOTE: Crane Setup GRT765: Machine shall be set up on firm level surface with fully extended outriggers and minimum 6895 kg (15,200 lb) counterweight installed. Ensure crane is level. Set boom angle at zero degrees (0°).

- Boom must be directly over the front with house lock engaged.
- Do not exceed 34.0 m (111.7 ft) boom length in Auto Mode A and X.
- Do not exceed 35.5 m (116.5 ft) boom length in Auto Mode B.

NOTE: Crane Setup GRT780: Machine shall be set up on firm level surface with fully extended outriggers and minimum 7938 kg (17,500 lb) counterweight installed. Ensure crane is level.

- Boom must be directly over the front with house lock engaged.
- Do not exceed 42.9 m (140.6 ft) boom length in Auto Mode A and X.
- Do not exceed 34.0 m (111.7 ft) boom length in Auto Mode B.

NOTE: Do not fully extend boom at zero degrees (0°), machine will tip.

NOTE: Refer to load chart for zero degrees (0°) telescoping capability.

CAUTION: Do not operate crane in RCL bypass to lubricate the boom.

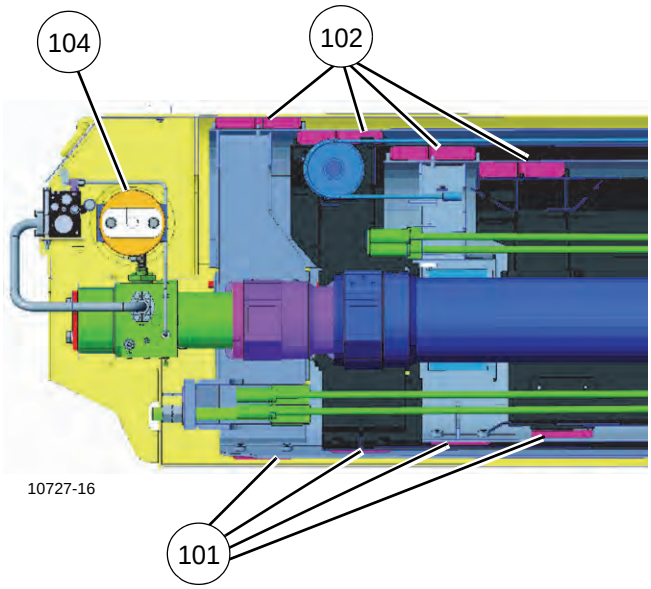
Item	Lube Point Description	Figure No.	Approved Lubricant	Lube Capacity	Lube Interval	Application
100	Telescope Cylinder Wear Pads	Figure 7-14	L	Thoroughly coat all areas wear pad moves on	Apply grease at assembly or tear-down.	BRUSH ON 4 service points
101	Internal Side and Bottom Wear Pads - Inner Sections	Figure 7-14	L	Thoroughly coat all areas wear pad moves on	Apply grease at assembly or tear-down.	BRUSH ON • 18 places on GRT765 • 24 places on GRT780
102	**GRT765** Four-Section Boom	Figure 7-14	L	Thoroughly coat all areas the wear pad moves on	50 hours/1 week	LUBRICATE • 6 places on GRT765

Location Name	Boom Mode	Boom Length* m (ft)	Boom Length* %	Service Points
T1 Rear Upper Wear Pads	B or X	14.6 (47.9)	30% - 0% - 0%	2
T2 Rear Upper Wear Pads	A or X	33.9 (111.3)	50% - 99% - 99%	2
T3 Rear Upper Wear Pads	A or X	33.9 (111.3)	50% - 99% - 99%	2

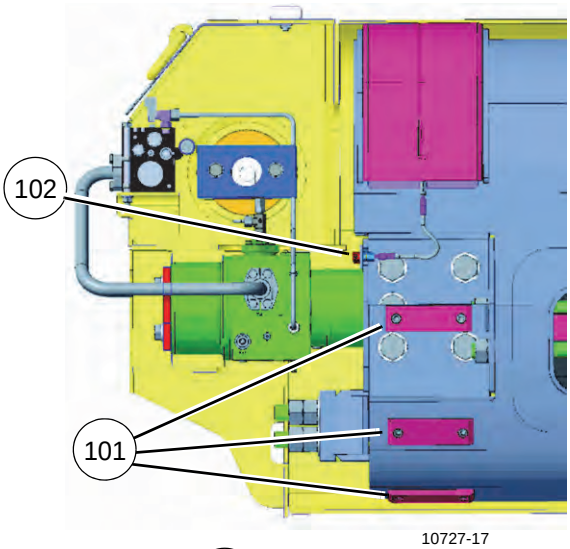
*Boom length is approximate. Adjust the boom length so the access holes line up with the grease fittings.

<table>
<tr><th>Item</th><th>Lube Point Description</th><th>Figure No.</th><th>Approved Lubricant</th><th>Lube Capacity</th><th>Lube Interval</th><th>Application</th></tr>
<tr><td colspan="7">Boom (Continued)</td></tr>
<tr><td rowspan="2">102</td><td>GRT780
Five-Section Boom</td><td>Figure 7-14</td><td>L</td><td>Thoroughly coat all areas the wear pad moves on</td><td>50 hours/1 week</td><td>LUBRICATE
• 8 places on GRT780</td></tr>
<tr><td colspan="6">
<table>
<tr><th>Location Name</th><th>Boom Mode</th><th>Boom Length* m (ft)</th><th>Boom Length* %</th><th>Service Points</th></tr>
<tr><td>T1 Rear Upper Wear Pads</td><td>B or X</td><td>14.6 (47.9)</td><td>30% - 0% - 0% - 0%</td><td>2</td></tr>
<tr><td>T2 Rear Upper Wear Pads</td><td>X</td><td>36.7 (120.3)</td><td>50% - 77% - 77% - 77%</td><td>2</td></tr>
<tr><td>T3 Rear Upper Wear Pads</td><td>X</td><td>36.7 (120.3)</td><td>50% - 77% - 77% - 77%</td><td>2</td></tr>
<tr><td>T4 Rear Upper Wear Pads</td><td>X</td><td>36.7 (120.3)</td><td>50% - 77% - 77% - 77%</td><td>2</td></tr>
</table>
*Boom length is approximate. Adjust the boom length so the access holes line up with the grease fittings.
</td></tr>
<tr><td>103</td><td>Boom Section Front Lower & Upper Wear Pads</td><td>Figure 7-14</td><td>L</td><td>Thoroughly coat all areas wear pad moves on</td><td>50 hours/1 week</td><td>BRUSH ON
• 18 places on GRT765
• 22 places on GRT780</td></tr>
<tr><td>104</td><td>Boom Pivot Shaft</td><td>Figure 7-14</td><td>L</td><td>Until grease extrudes</td><td>250 hours or 3 months</td><td>LUBRICATE
4 grease fittings
See NOTE 49.</td></tr>
<tr><td colspan="7">NOTE 49: If Auto-Lube option is installed, these service points are not manually lubricated.</td></tr>
<tr><td rowspan="2">105</td><td>Extend Cable Sheave(s)</td><td>Figure 7-14</td><td>A</td><td>Until grease extrudes</td><td>250 hours or 3 months
See NOTE 50.</td><td>LUBRICATE
See NOTE 51.</td></tr>
<tr><td colspan="6">GRT765 Four-Section Boom
<table>
<tr><th>Location Name</th><th>Boom Mode</th><th>Boom Length* m (ft)</th><th>Boom Length* %</th><th>Service Points</th></tr>
<tr><td>Extend Cable Sheave on Tele. Cylinder</td><td>A, B or X</td><td>11.9 (39.2)
Fully Retracted</td><td>0% - 0% - 0%</td><td>2</td></tr>
</table>
*Boom length is approximate. Adjust the boom length so the access holes line up with the grease fittings.
</td></tr>
</table>

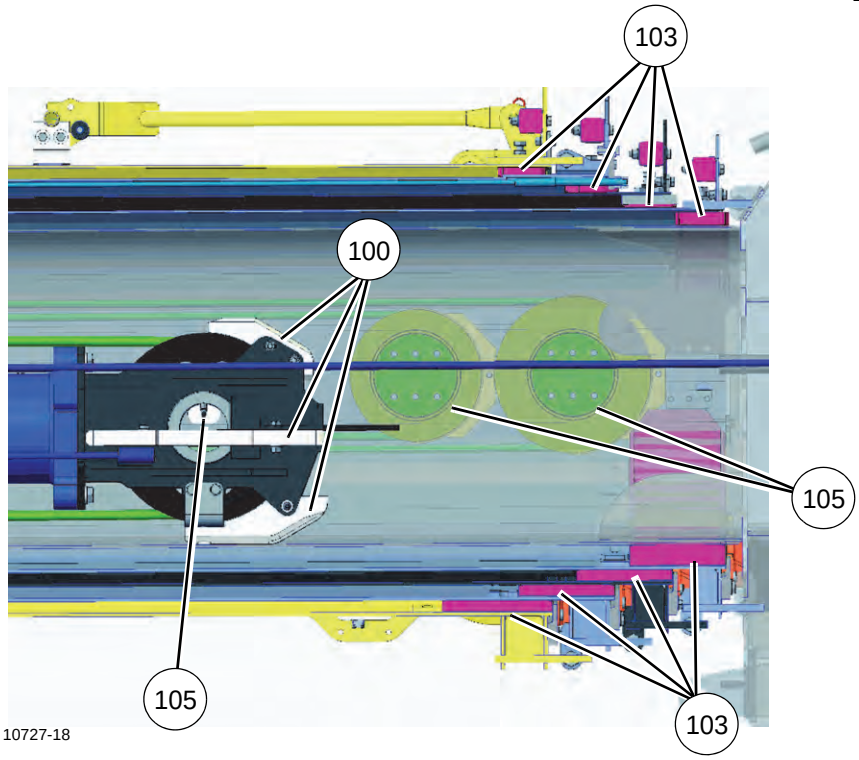
<table>
<tr><th>Item</th><th>Lube Point Description</th><th>Figure No.</th><th>Approved Lubricant</th><th>Lube Capacity</th><th>Lube Interval</th><th>Application</th></tr>
<tr><td colspan="7">Boom (Continued)</td></tr>
<tr><td rowspan="2">105</td><td>Extend Cable Sheave(s)</td><td>Figure 7-14</td><td>A</td><td>Until grease extrudes</td><td>250 hours or 3 months
See NOTE 50.</td><td>LUBRICATE
See NOTE 51.</td></tr>
<tr><td colspan="6">GRT780 Five-Section Boom
<table>
<tr><th>Location Name</th><th>Boom Mode</th><th>Boom Length*
m (ft)</th><th>Boom Length*
%</th><th>Service Points</th></tr>
<tr><td>Extend Cable Sheave on Tele. Cylinder</td><td>A, B or X</td><td>11.9 (39.2)
Fully Retracted</td><td>0% - 0% - 0% - 0%</td><td>2</td></tr>
<tr><td>Extend Cable Sheaves on T3</td><td>X</td><td>36.7 (120.3)</td><td>50% - 77% - 77% - 77%</td><td>4</td></tr>
</table>
*Boom length is approximate. Adjust the boom length so the access holes line up with the grease fittings.</td></tr>
<tr><td colspan="7">NOTE 50: Lubricate items more frequently than interval in table if environmental conditions and/or operating conditions require.
NOTE 51: CAUTION: Do not apply excessive pressure or force when greasing wear pads. This can cause grease fitting to separate from wear pad. Only apply grease until resistance is felt.</td></tr>
</table>



10727-16



10727-17

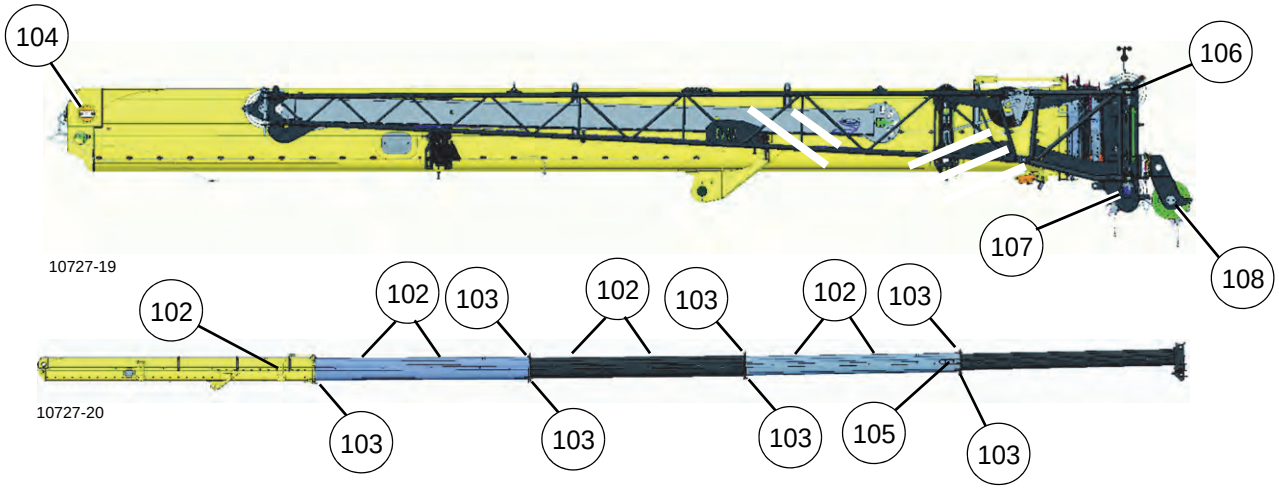


10727-18

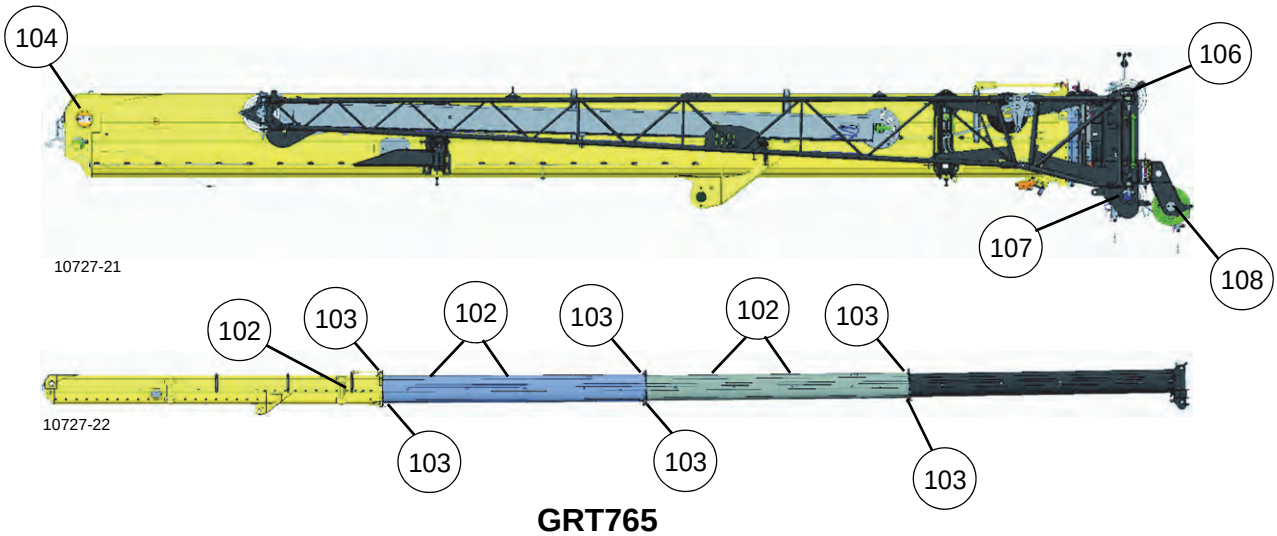
FIGURE 7-14

7

Item	Lube Point Description	Figure No.	Approved Lubricant	Lube Capacity	Lube Interval	Application
Boom (Continued)						
106	Upper Boom Nose Sheave	Figure 7-15	A	Thoroughly coat	Apply grease at assembly or tear down.	LUBRICATE 2 service points (1) per sheave
107	Lower Boom Nose Sheave	Figure 7-15	A	Thoroughly coat	Apply grease at assembly or tear down.	LUBRICATE 4 service points (1) per sheave
108	Auxiliary Boom Nose Sheave	Figure 7-15	A	Until grease extrudes	250 hours or 3 months **See** NOTE 52**.**	LUBRICATE 1 grease fitting
109	Mast Sheave	Figure 7-15	A	Until grease extrudes	500 hours or 12 months **See** NOTE 52**.**	1LUBRICATE grease fitting
110	Jib Sheaves	Figure 7-15	A	Until grease extrudes	250 hours or 3 months **See** NOTE 52**.**	LUBRICATE 2 grease fittings
111	Jib Rollers	Figure 7-15	A	Until grease extrudes	250 hours or 3 months **See** NOTE 52**.**	LUBRICATE 2 grease fittings
NOTE 52: Lubricate items more frequently than interval in table if environmental conditions and/or operating conditions require.						



GRT780



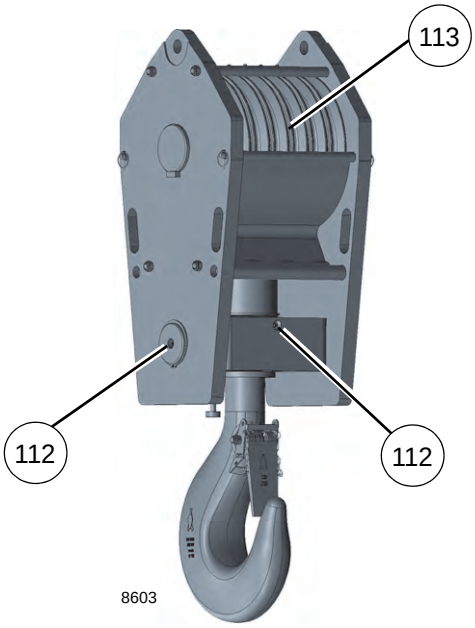
GRT765

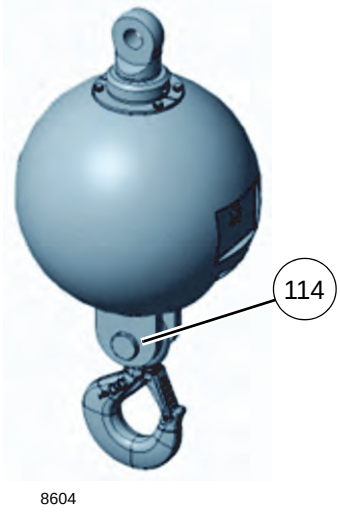
JIB ASSEMBLY

FIGURE 7-15

7

Item	Lube Point Description	Figure No.	Approved Lubricant	Lube Capacity	Lube Interval	Application
Hookblock and Overhaul Ball/Weight						
112	Hook Block Swivel Bearing	Figure 7-16	A	Until grease extrudes	250 hours or 3 months	3 grease fitting
113	Hook Block Sheaves	Figure 7-16	N/A	N/A	250 hours or 3 months	Inspect. **See** NOTE 53**.**
NOTE 53: Rotate sheaves and check for rough or dry operation. Look for grease leakage. Replace sheave if either is found.						
114	Overhaul Ball	Figure 7-16	A	Until grease extrudes	250 hours or 3 months	1 grease fitting
115	Overhaul Weight	Figure 7-16	A	Until grease extrudes	250 hours or 3 months	1 grease fitting





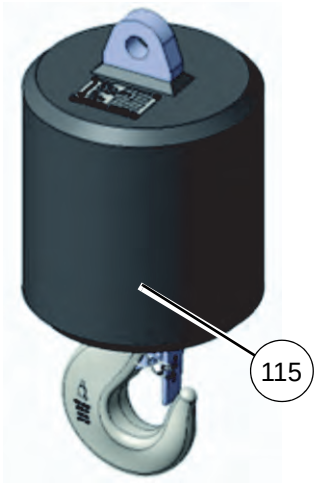


FIGURE 7-16

Item	Lube Point Description	Figure No.	Approved Lubricant	Lube Capacity	Lube Interval	Application
Auto-Lube (Optional)						
118	Grease Pump	Figure 7-17	A	2 L	CHECK for **AutoLube Level Low** alert on SDM. When alert comes on, refill grease pump.	FILL grease pump until grease level is at “MAX” mark.
83	Turntable Bearing	–	–	–	–	Auto Lubricate
85	Lower Lift Cylinder Pivot Pin	–	–	–	–	Auto Lubricate
104	Boom Pivot Shaft	–	–	–	–	Auto Lubricate

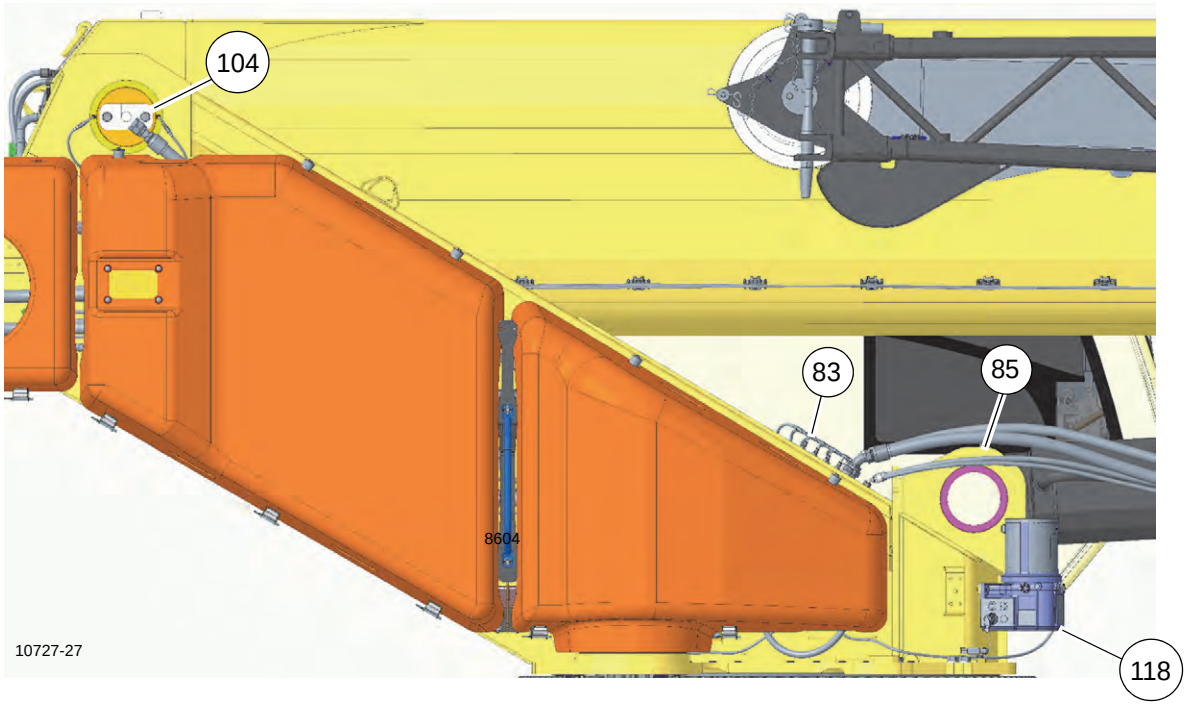


FIGURE 7-17

RUST PROTECTION

Protecting Cranes From Rusting

Grove cranes are manufactured to high quality standards, including the type of paint finish demanded by today's industry. In partnership with our paint supplier, we are also doing our part to help prevent premature corrosion of cranes.

Grove cranes are treated with Carwell® T32 (CP-90) rust inhibitor. While a rust inhibitor cannot guarantee that a crane will never rust, this product helps protect against corrosion on Grove cranes.

Carwell® is a treatment, not a coating. It contains no silicones, solvents, chlorofluorocarbons (CFC), or anything that would be classified as hazardous under OSHA Regulation 29CRF 1910.1200. The product is a liquid blend of petroleum derivatives, rust inhibitors, and water-repelling/water-displacing agents.

Special equipment is used to spray a light film on the entire undercarriage and various other areas of each new crane before shipment. When applied, the product has a red tint to allow applicators to view coverage. This red tint turns clear within approximately 24 hours after application.

Once applied, treatment can appear to leave a slightly “oily” residue on painted surfaces and until the red tinting fades, could be mistaken for a hydraulic oil leak. While the product is not harmful to painted surfaces, glass, plastic or rubber, it must be removed using standard steam-cleaning techniques.

This treatment works in various ways: (1) it eliminates the moisture containing salt, dirt and other pollutants by lifting and removing them from the metal surface; (2) the film creates a barrier to repel further moisture from coming in contact with the metal; and (3) it penetrates crevices.

In addition to the factory-applied treatment, Grove crane owners must provide proper maintenance and care to help ensure long-term protection of their crane against corrosion. This procedure provides information and guidelines to help maintain the paint finish on Grove cranes.

The most common causes of corrosion include the following:

- Road salts, chemicals, dirt, and moisture trapped in the hard-to-reach areas;
- Chipping or wear of paint, caused by minor incidents or moving components;
- Damage caused by personal abuse, such as using the decks to transport rigging gear, tools, or cribbing; and
- Exposure to harsh environmental hazards such as alkaline, acids, or other chemicals that can attack the crane's paint finish.

While crane surfaces that are easily seen have the biggest impact on appearance, particular attention should be given to the undercarriage to minimize harmful effects of corrosion.

Exercise special care and increase frequency of cleaning if crane is operated:

- on roads where large quantities of salt or calcium are applied to treat icy and snowy road surfaces;
- in areas that use dust control chemicals;
- anywhere there are increased levels of wetness, especially near salt water;
- during prolonged periods of exposure to damp conditions (for example, moisture held in mud), where certain crane parts may become corroded even though other parts remain dry; or
- in high humidity, or when temperatures are just above the freezing point.

Cleaning Procedures

To help protect against corrosion of Grove cranes, Grove Product Support recommends washing the crane at least monthly to remove all foreign matter. More frequent cleaning may be needed when operating in harsh environmental conditions. To clean the crane, follow these guidelines:

- High pressure water or steam is effective for cleaning the crane undercarriage and wheel housings. Keeping these areas clean will decrease the rate of corrosion and improve the ability to identify possible issues before they grow into larger problems.

CAUTION

High pressure water can be forced into spaces and infiltrate beyond seals. Avoid pressure washing near electrical controls, panels, wiring, sensors, hydraulic hoses and fittings, or anything that can be damaged by high pressure cleaning/spraying.

- Rinse dirt and dust off before washing the crane. Dirt can scratch the crane's finish during washing/cleaning.
- Hard to clean spots caused by road tar or bugs should be treated and cleaned after rinsing and before washing. Do not use solvents or gasoline.
- Wash the crane only with soaps and detergents recommended for automotive paint finishes.
- Rinse all surfaces thoroughly to prevent streaking caused by soap residue.
- Allow crane to dry thoroughly. You can increase the speed of evaporation by using compressed air to remove excess water.

NOTE: Polishing and waxing (using automotive-type wax) is recommended to maintain original paint finish.

Inspection and Repair

- Immediately following cleaning of the Grove crane, Grove Product Support recommends an inspection to detect areas that may have become damaged by stone chips or minor mishaps. A minor scratch (one that has not penetrated to the substrate surface) can be buffed with an automotive-type scratch remover. It is recommended that a good coat of automotive wax be applied to this area afterwards.
- Any area scratched through to bare metal should be touched up and repaired as soon as possible to prevent flash rusting. To repair a major scratch (down to bare metal) or minor damage, follow these procedures:

NOTE: Grove Product Support recommends a qualified body repair technician prepare, prime, and paint any major scratch(es) or minor damage.

CAUTION

To the extent any damage is structural in nature, Grove crane must be contacted and consulted as to what repairs may be required.

For scratches and marks in highly visible areas:

1. Sand to remove scratch. Feather outward from the mark to blend repair into the original surface. Apply body putty as necessary to hide the defect; then sand smooth.
2. Cover all bare metal with a primer compatible with the original paint finish and allow to dry thoroughly.
3. Prepare surface before applying finish coat of paint.
4. Apply a finish coat using accepted blending techniques. Use of original paint colors is recommended to ensure the best color match possible.

For scratches and marks in areas of low visibility:

- Consider touching up the spots with a brush technique to cover the bare metal. This will decrease the rate of corrosion, and enable you to do the repair later during a normal maintenance interval.

Spots should be touched up with quality paint. Primers tend to be porous; using a single coat of primer only will allow air and water to penetrate the repair over time.

Application

Depending on the environment in which a crane is used and/or stored, initial factory application of Carwell® T32 (CP-90) should help inhibit corrosion for approximately 12 months.

It is recommended the treatment be periodically reapplied by the crane owner, after that time, to help continue protection against corrosion of the crane and its components.

However, if a crane is used and/or stored in harsh environments (such as islands, coastal regions, industrial areas, areas where winter road salt is regularly used, etc.), reapplication of treatment is recommended sooner than 12 months, for example, repeat treatment in 6 to 9 months.

- Do not apply to recently primered and painted areas for at least 48 hours after paint is properly dried and cured. For minor touch up areas a 24-hour period is needed for cure time before applying treatment.

NOTE: The crane must be completely dry before applying treatment.

- Do not allow product to puddle or build-up on weather stripping, rubber gaskets, etc. The crane should not have puddles or runs evident anywhere.
- To ensure proper coverage, product needs to be fogged on the crane.
- Use of pressure pots to apply treatment is recommended.
- Carwell® treatment is available in 16-ounce spray bottles from Grove Product Support (order part number 8898904099).
- After treatment application is complete, wash or clean film residue from lights, windshield, grab handles, ladders/steps and all crane access areas, as necessary.

Contact your local Grove distributor or Grove Product Support should you have any questions.

Areas of Application

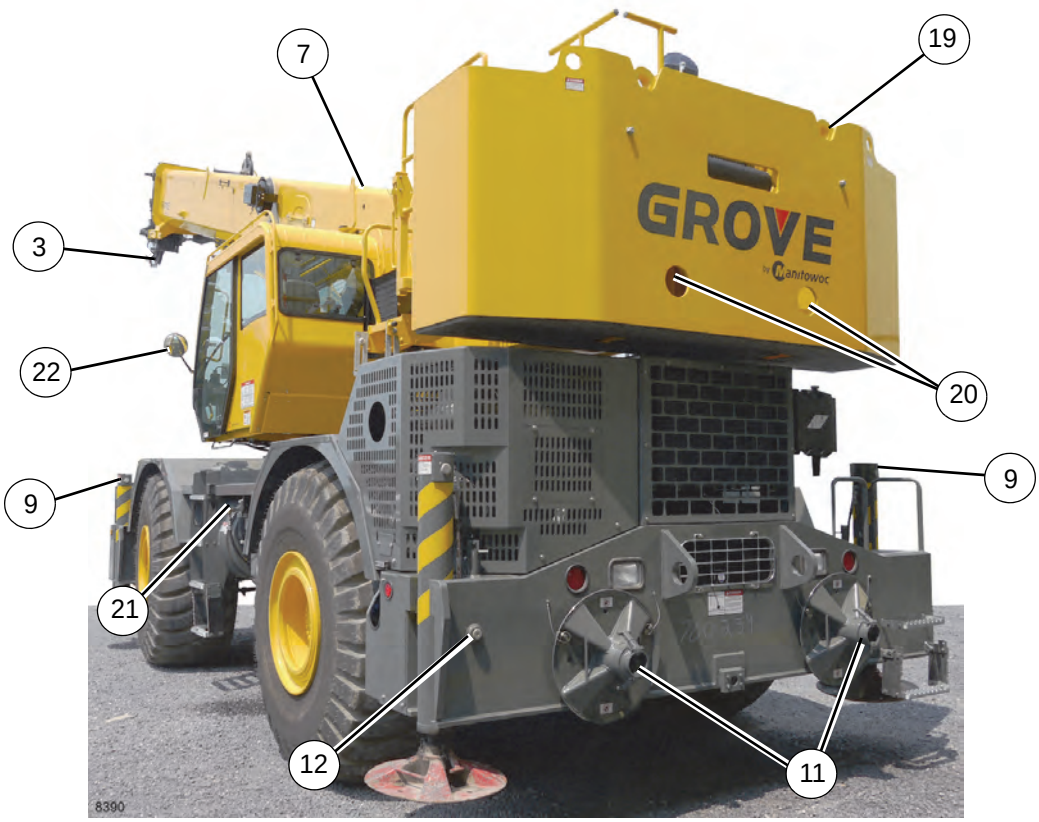
Refer to Figure 7-18 and Figure 7-19 for location of crane components that need periodic application of Carwell® T32 (CP-90) for continued protection against corrosion.

- Underside of crane will have full coverage of the rust inhibitor. These are the only areas that a full coat of rust inhibitor is acceptable on painted surfaces. Areas include; Valves, hose end and fittings, Swivel, pumps, axles, drive lines, transmission, slew ring fasteners and all interior surfaces of the frame.
- Frame application areas are; hose ends and fittings, all unpainted fasteners and hardware, all bare metal surfaces, outrigger pads, and back up alarm hardware.
- Superstructure applications are; hose end and fittings, wire rope on hoist roller tensioning springs on hoists, all unpainted fasteners and hardware, valves, slew ring fasteners and all bare metal surfaces.
- Boom applications areas are; pivot pins, hose end and fittings, jib pins and shafts, all bare metal surfaces, overhaul ball pins/ hook block pins and fasteners.
- All hardware, clips, pins, hose connections not painted will have treatment applied.

7650-75

Picture may not be same model as your crane, it is for reference only.

Figure 7-18



Picture may not be same model as your crane, it is for reference only.

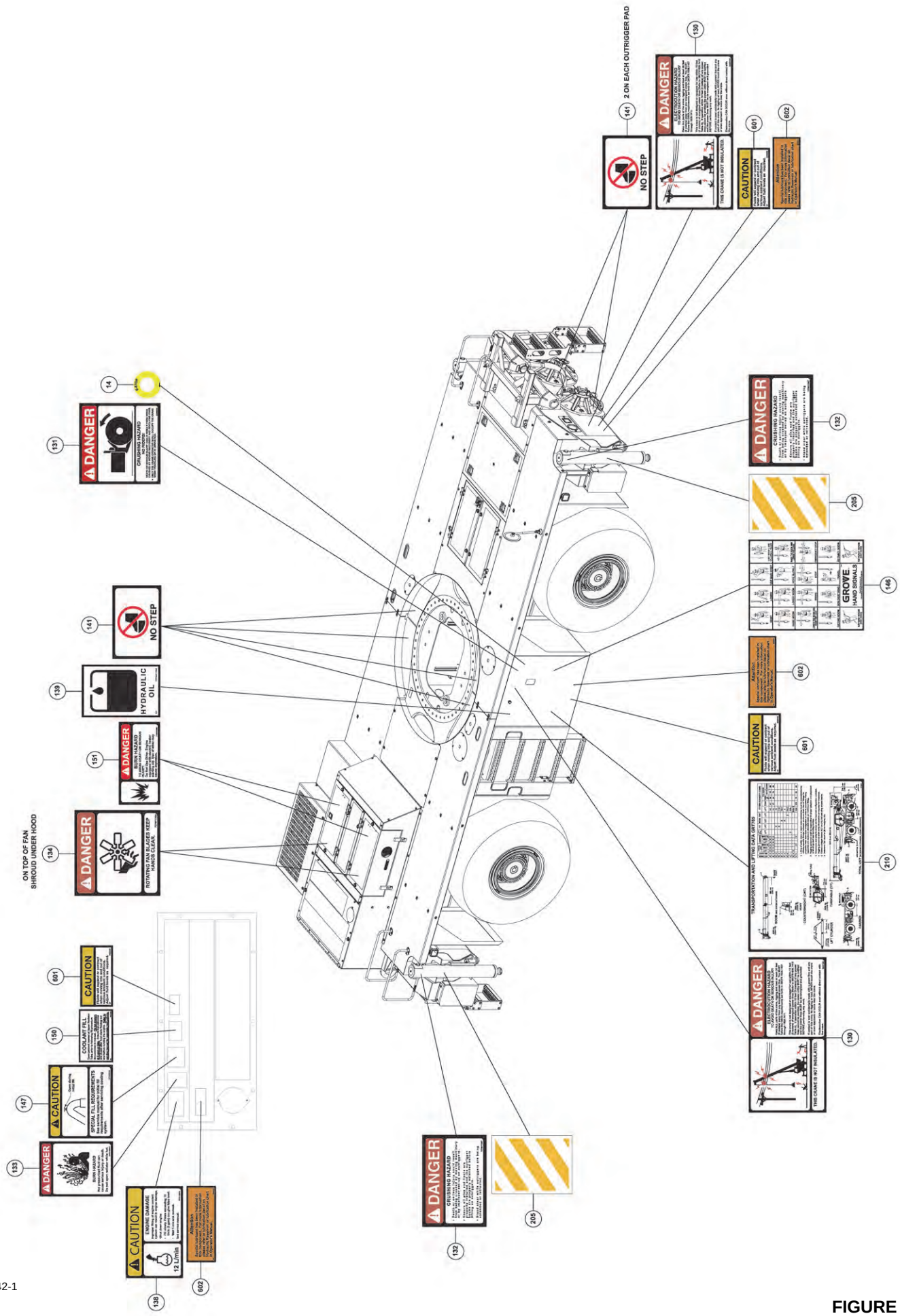
Figure 7-19

Table 7-1 Rust Inhibitor Application Locations

1	Boom Extension Pins, Clips	12	Entire underside of crane
2	Boom Nose Pins, Clips	13	Turntable Bearing Fasteners
3	Hook Block/Overhaul Ball	14	Powertrain Hardware Inside Compartment
4	Boom Extension Hanger Hardware	15	Valve Bank
5	Pivot Shaft	16	Hoist Hose Connections
6	Hose Connections Inside Turntable	17	Tension Spring
7	All Hardware, Clips, Pins, Hose Connections not painted Outrigger Pins, Clips	18	Wire Rope
8	Outrigger Hose Connections	19	Counterweight Mounting Hardware
9	Hook Block Tiedown Cable	20	Counterweight Pins
10	Outrigger Pins, Clips	21	Hose Connections
11	O/R Beam Wear Pad Adjustment Hardware	22	Mirror Mounting Hardware

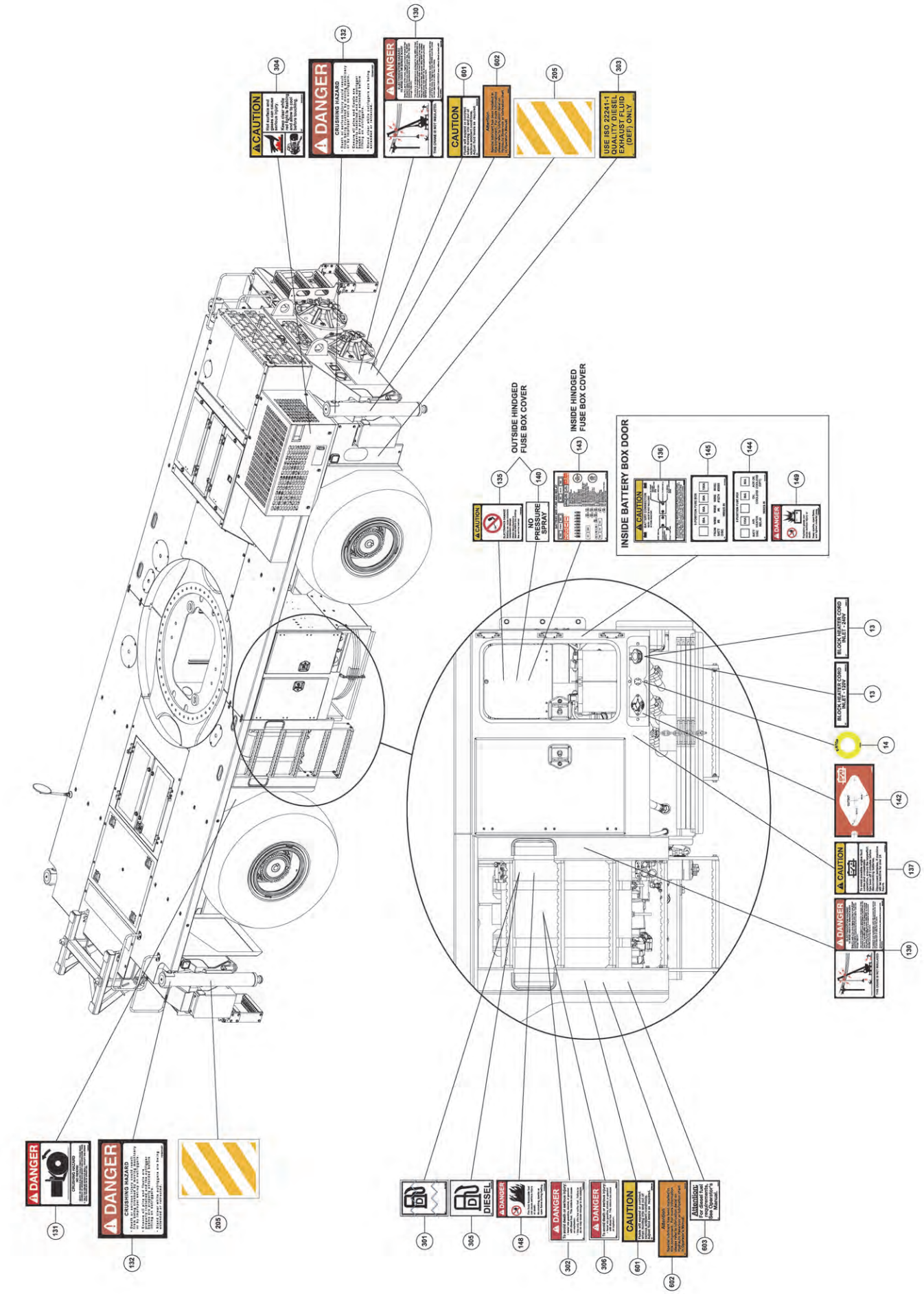
APPENDIX A
GRT765 DECALS

Figure A-1 shows the locations of the decals on the **GRT765**.



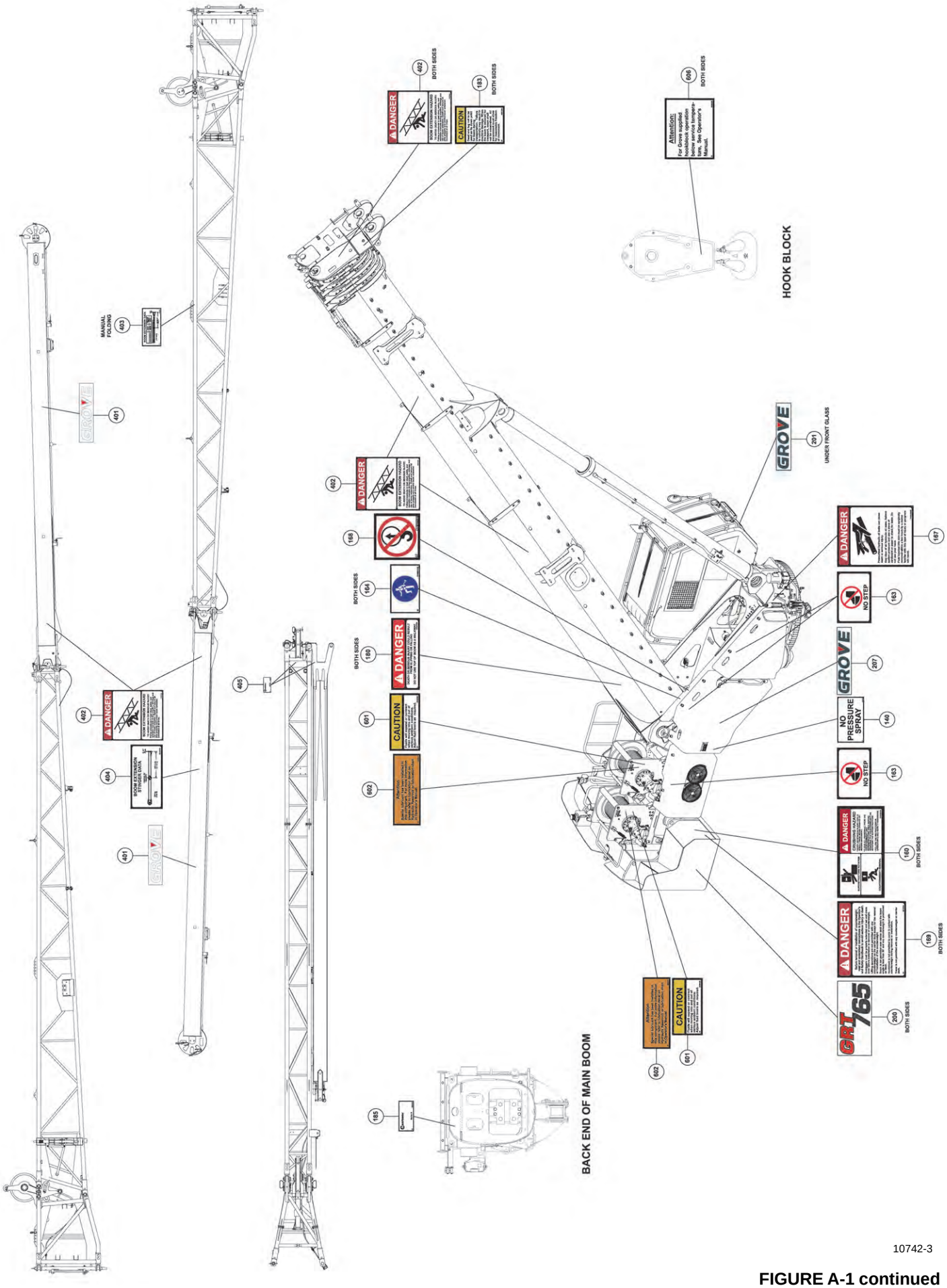
10742-1

FIGURE A-1



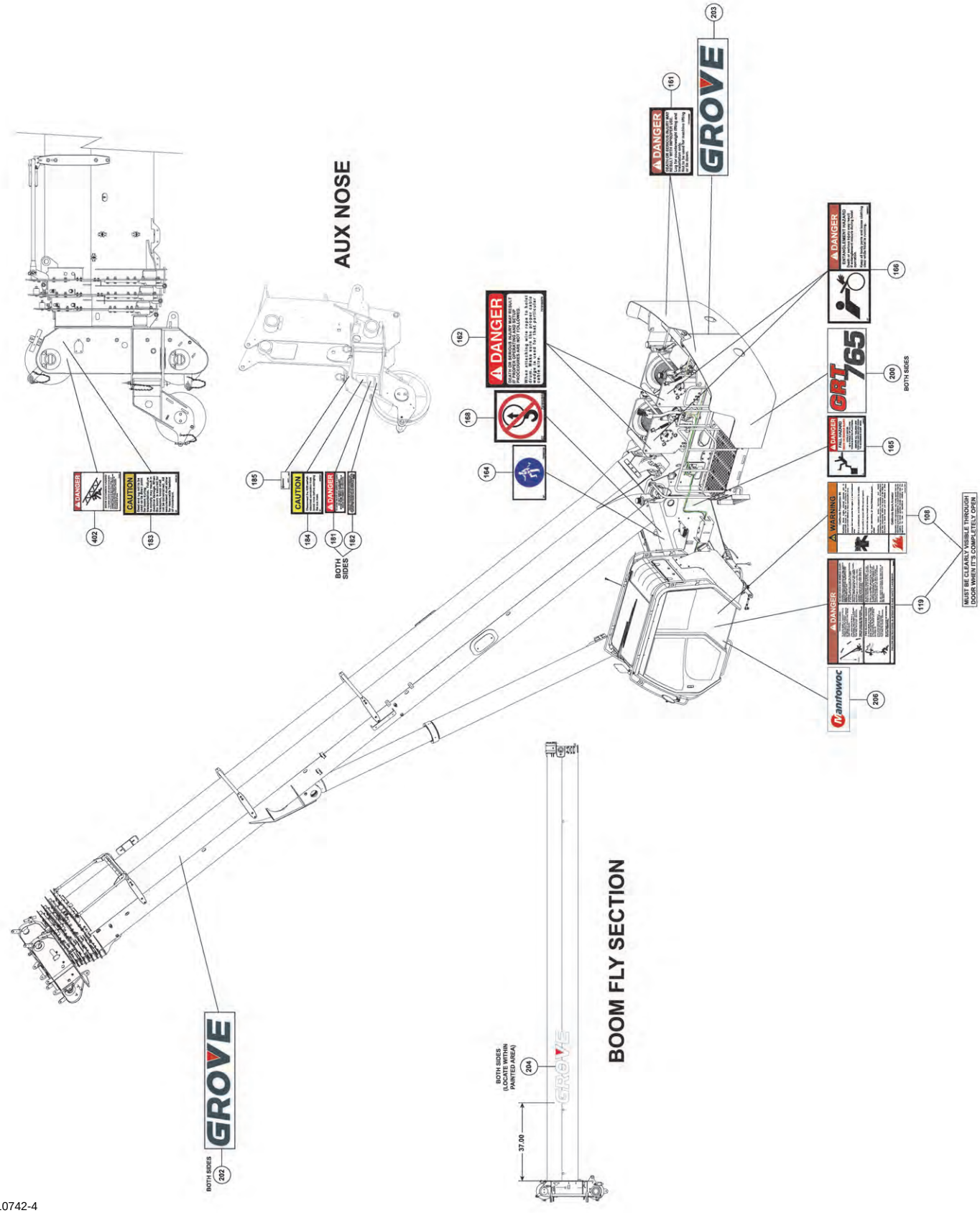
10742-2

FIGURE A-1 continued



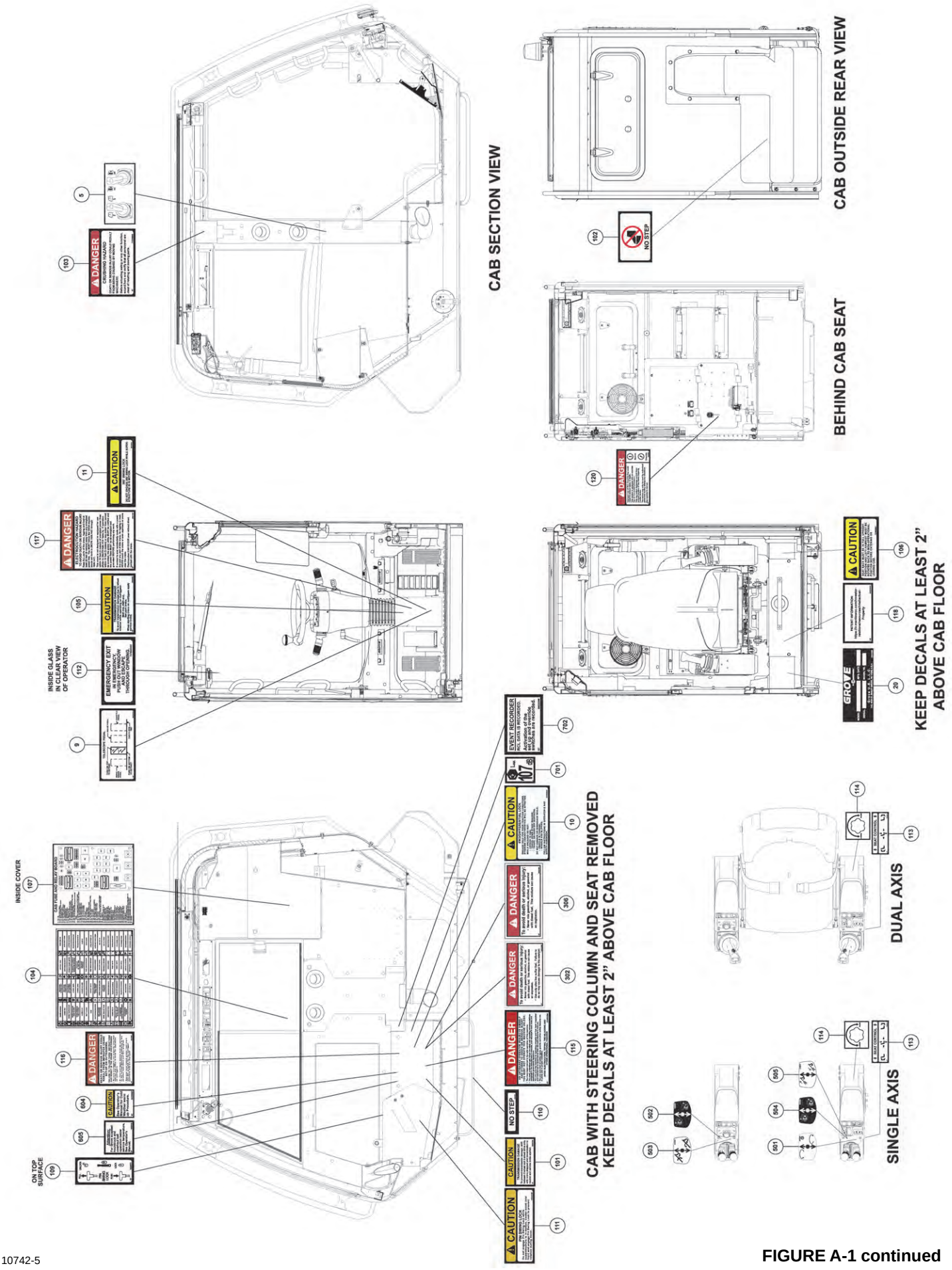
10742-3

FIGURE A-1 continued



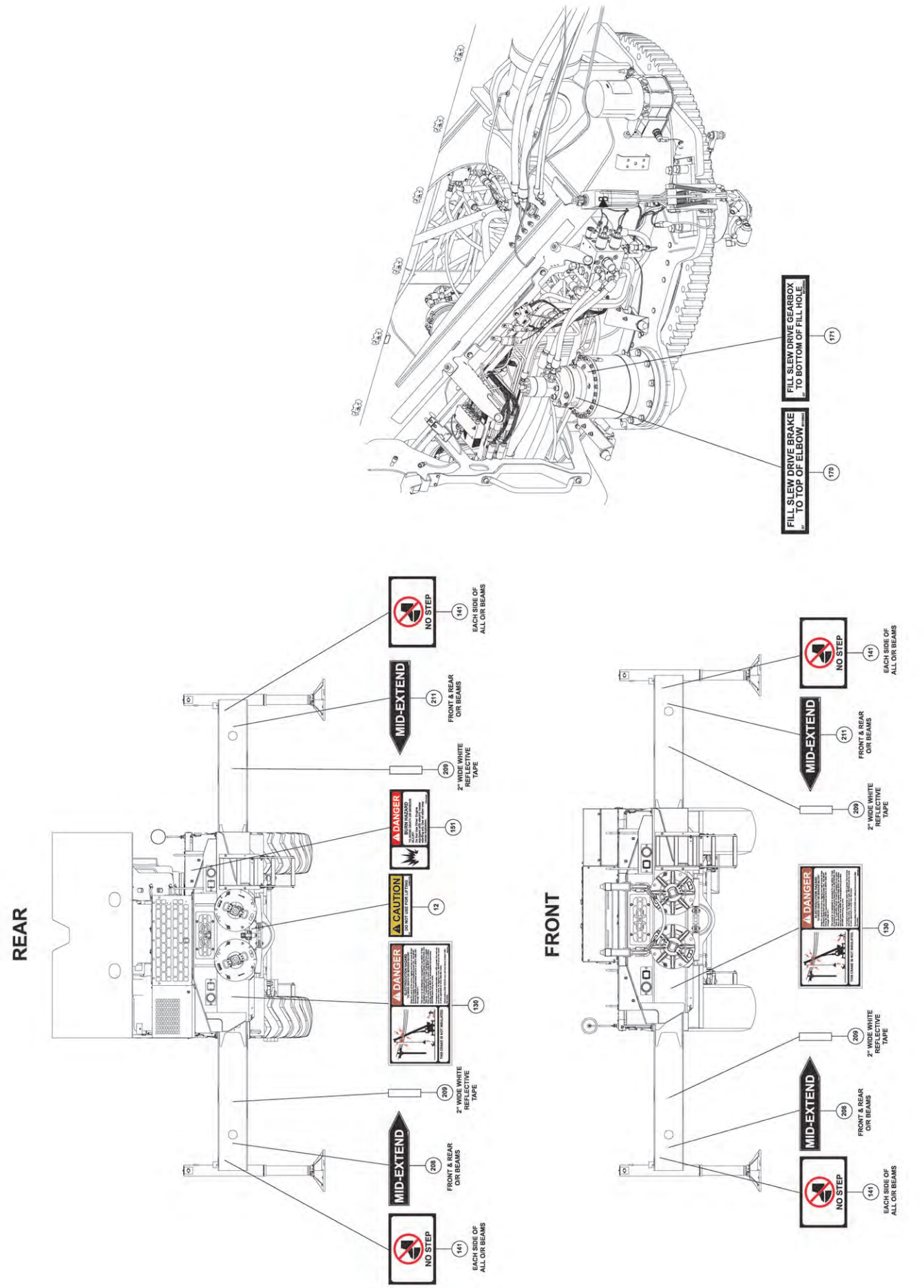
10742-4

FIGURE A-1 continued



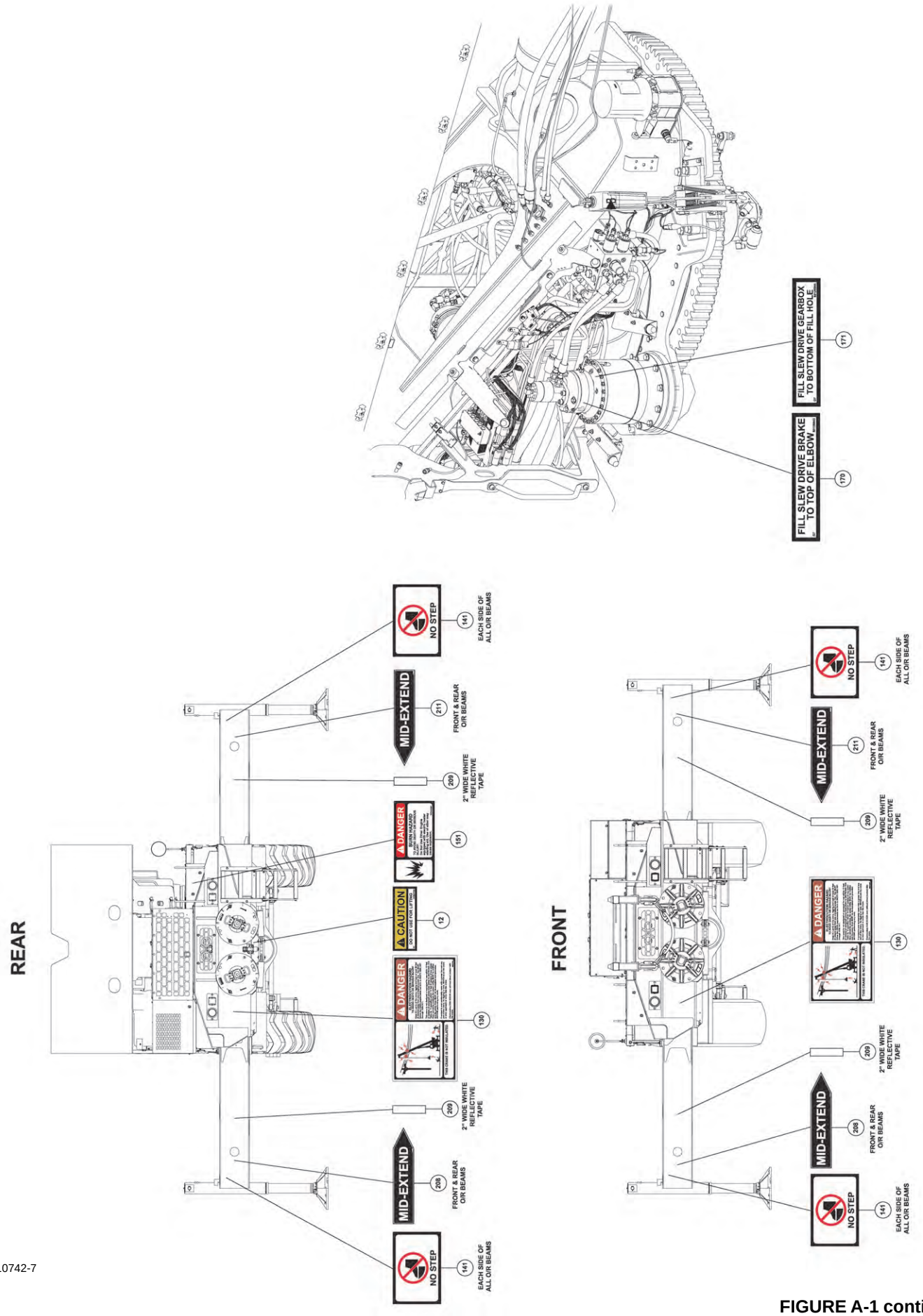
10742-5

FIGURE A-1 continued



10742-6

FIGURE A-1 continued



10742-7

FIGURE A-1 continued

Table A-1 – Legend for Figure A-1

Item	Description
5	Cab Tilt
8	Window Cling-Serial Number
9	Tele Pedal
10	Caution-4wd/Diff Lock
11	Caution-360 Swing Lock
12	Caution Lifting
13	Engine Block Heater-120V
13	Engine Block Heater-240V
14	E-Stop
20	Panel-Nameplate
101	Caution-Trans Damage
102	No Step
103	Danger-Superstructure Swing Hazard
104	Symbol ID
105	Caution-Trans Damage
106	Caution Armrest Position
107	Cab Fuse & Relay Board
108	Warning-California Prop 65
109	Pin Swing Lock
110	No Step
111	Caution-Pin Swing Lock
112	Emergency Exit
113	Seat Control
114	Decal Console Adjustment
115	Danger-Untrained Operator
116	Danger-O/R Mid Extend
117	Danger-Electrocution Hazard
118	Patent
119	Danger-Tip/2-Blocking Hazard
120	Danger-RCL Override Switch
121	Decal - Grove Connect
130	Danger-Electroc Hazard
131	Danger-Revolving Tires
132	Danger-O/R Crush Hazard
133	Danger-Pressurized Fluid
134	Danger-Rotating Blades Hazard
135	Caution-Electronics Damage
136	Battery Connection
137	Caution-Batt Disconnection
138	Caution-Engine Coolant Fill
139	Hydraulic Oil

Table A-1 – Legend for Figure A-1 (Continued)

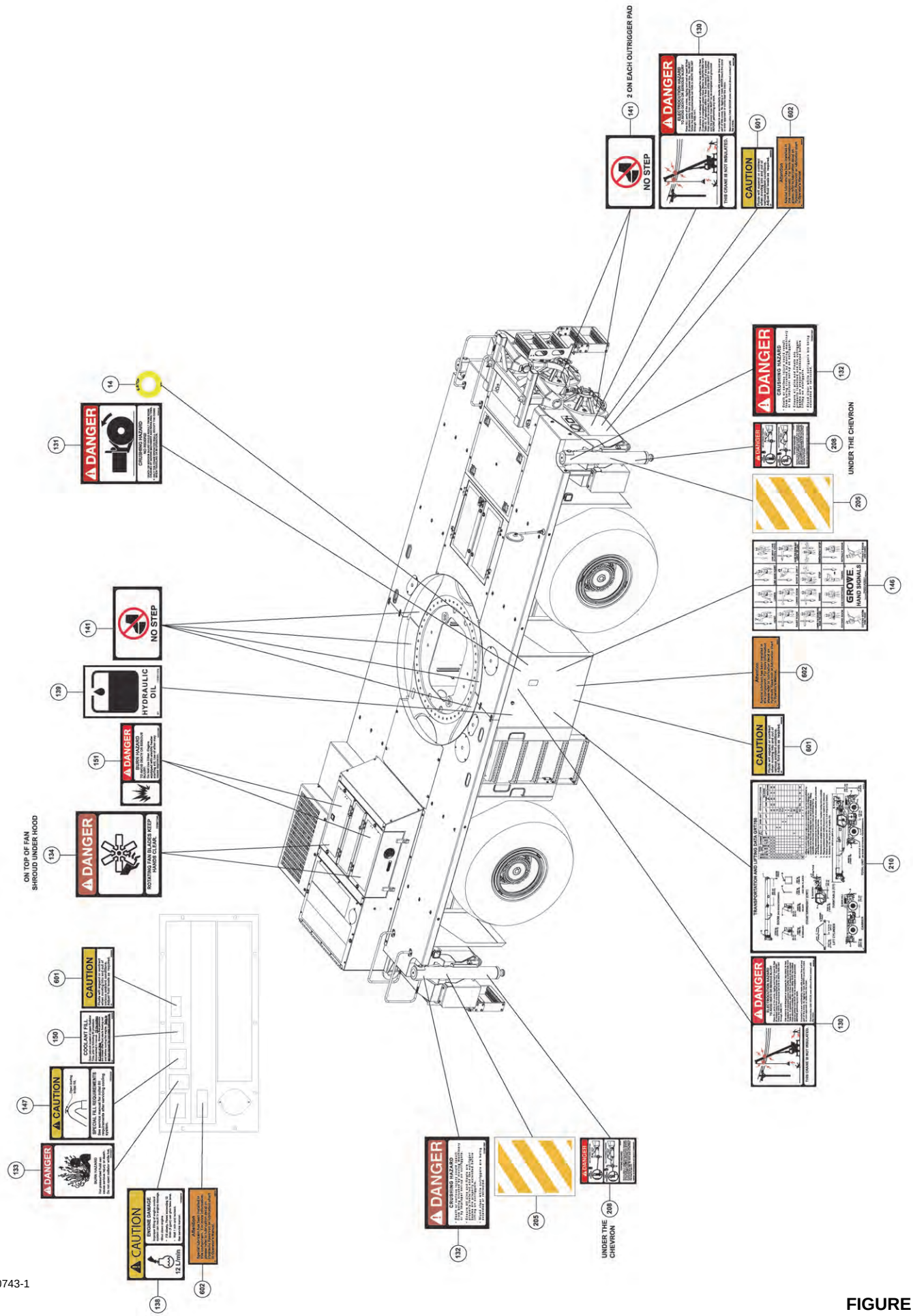
Item	Description
140	No Pressure Spray
141	No Step
142	Battery Disconnect
143	Battery Box Fuse & Relay
144	5-Position Fuse
145	5-Position Fuse
146	Hand Signals
147	Caution-Special Fill
148	Danger-Fire Hazard
149	Danger-Battery Explosion
150	Coolant Fill Instruction
151	Danger-Ether Hazard
160	Danger-Cwt Crushing Hazard
161	Danger-Cwt Lift Hazard
162	Danger-Cable Wedge
163	No Step
164	Wear Body Harness
165	Danger-Falling Hazard
166	Danger-Hoist Entanglement
167	Danger-Press Oil Leak
168	Tie Down Or Lift Point Prohibited
169	Danger-Cwt Removal Instruction
170	Slew Drive Brake Fill
171	Slew Drive Gearbox Fill
180	Danger-Boom Not Walkway
181	Danger-Aux Boom Nose
182	Aux Boom Nose
183	Caution-Dead End Lug
184	Caution-Disconnect A2b
185	Panel-Serial Number
200	Grt765 ID
201	Grove-3” Gray
202	Grove-6.5” Gray
203	Grove-7.7” Gray
204	Grove-5” White
205	Chevron-Outrigger Jack
206	Manitowoc Cg-Gry/Red-3”
207	Grove-4.5” Gray
208	Mid Extend O/R ->
209	Reflector Striping
210	T & L GRT765

Table A-1 – Legend for Figure A-1 (Continued)

Item	Description
211	Mid Extend O/R <-
301	Low Sulfur Diesel Fuel
302	Danger-Ultra Low Sulfur
303	Qty Diesel Fluid
304	Caution-Hot Surface & Gases
305	Diesel
306	Danger-Mixing Fuel
401	Grove-7” White
402	Danger-Boom Extion Hazard
403	T&L-Boom Extension
404	T & L-Stinger
405	Panel-Serial Number
501	Swing
502	Main Hoist
503	Boom Lift
504	Aux Hoist
505	Boom Telescope
601	Caution-Fluids
602	Special Lube
603	Fuel
604	Caution-Cold Weather
605	Attention Hook Block
606	Attention Hook Block
607	Danger-Super Capacitor Explode
608	Caution-Capacitor Conn.
609	Caution-Cold Weather Aid
701	107 dB
702	Event Recorder
703	Reflective Striping LH
704	Reflective Striping RH

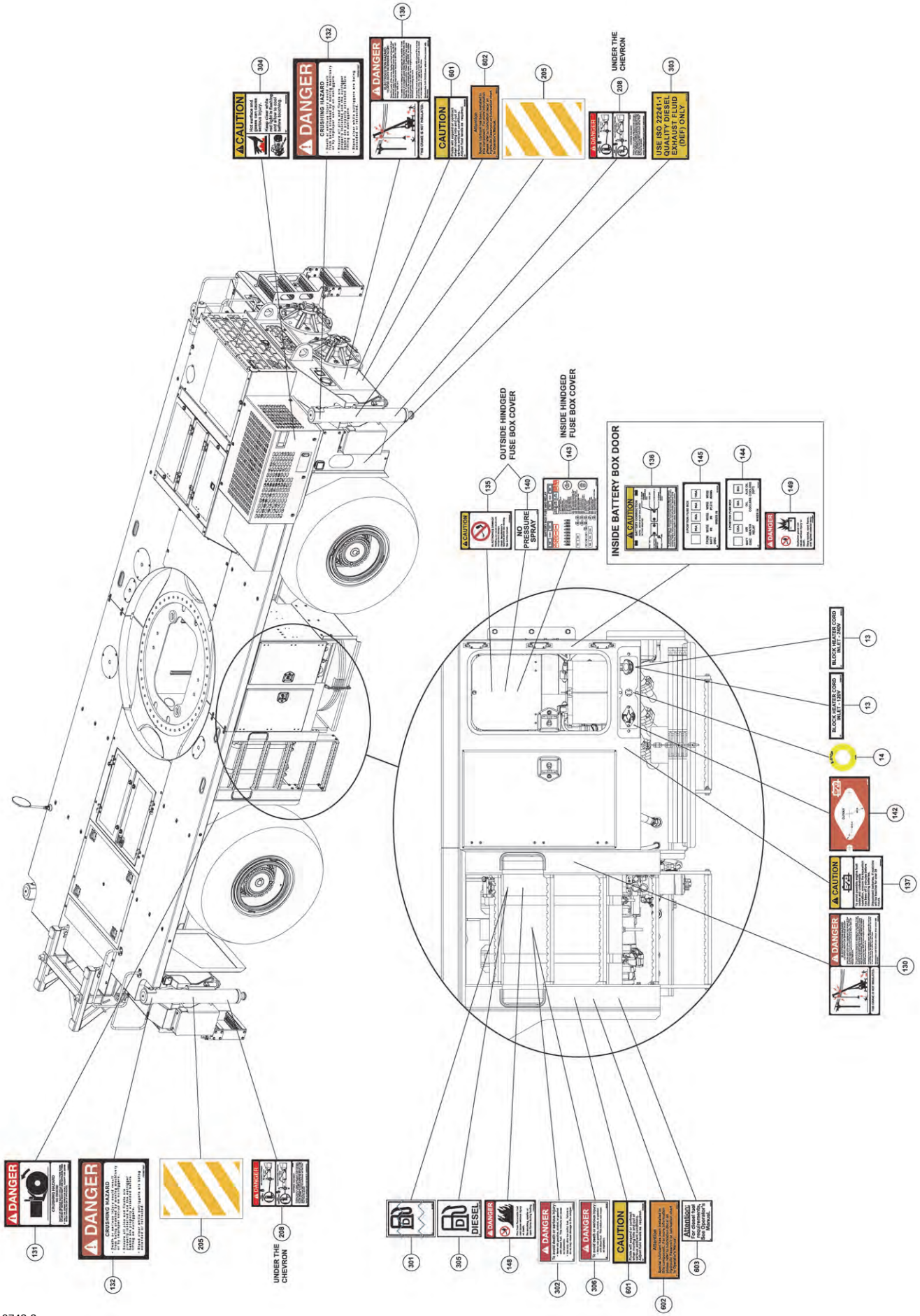
APPENDIX B
GRT780 DECALS

Figure B-1 shows the locations of the decals on the **GRT780**.



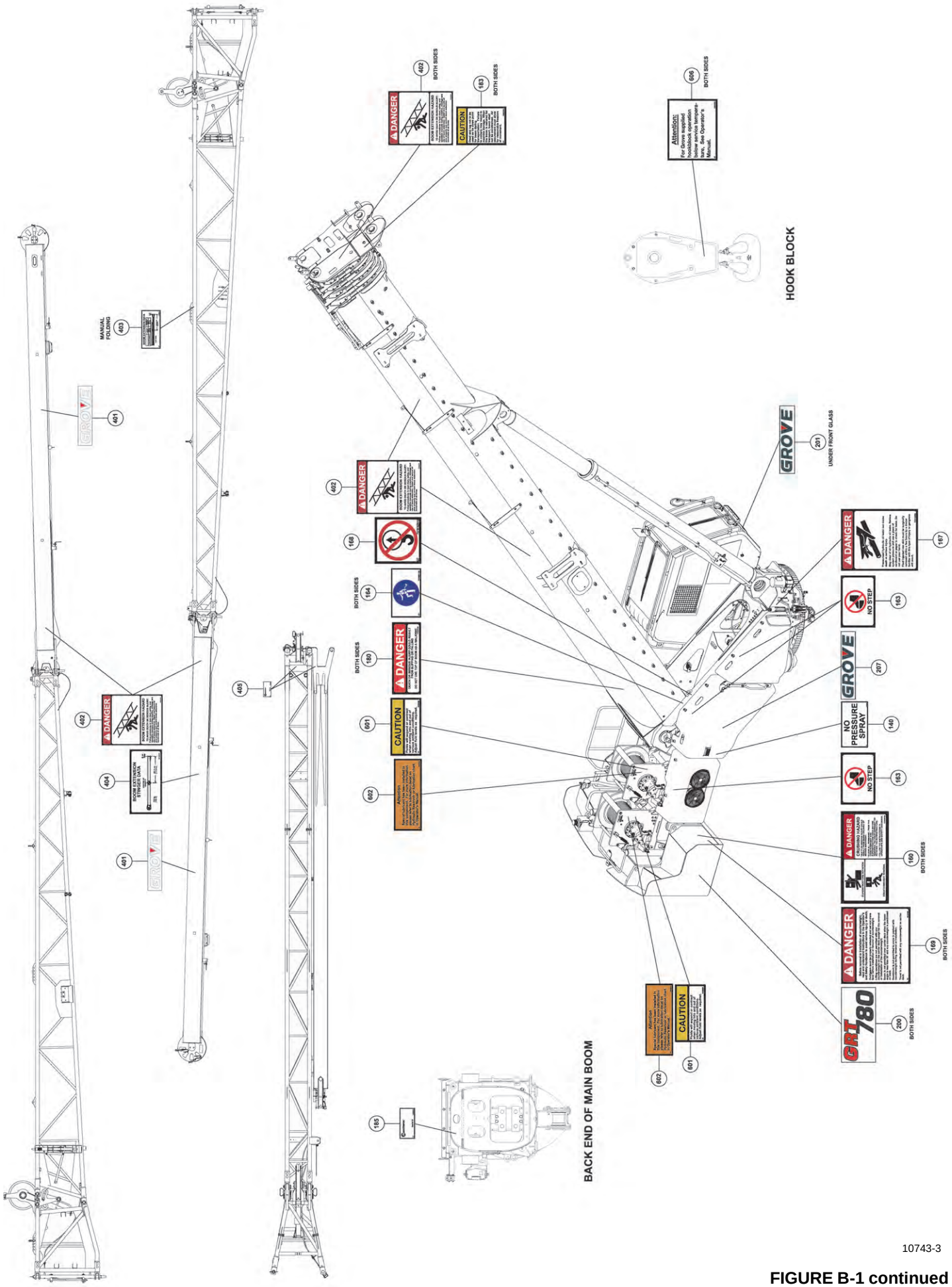
10743-1

FIGURE B-1



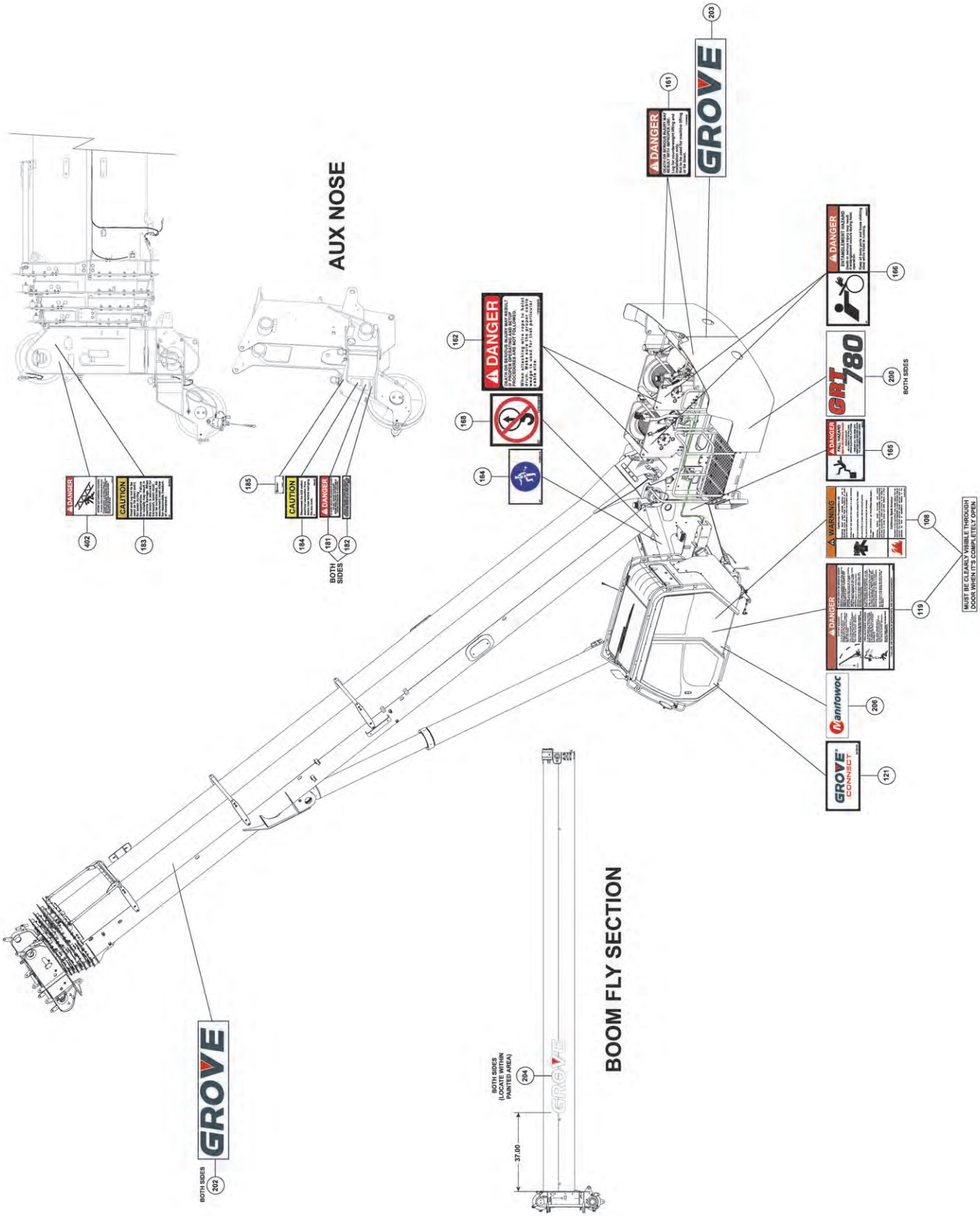
10743-2

FIGURE B-1 continued



10743-3

FIGURE B-1 continued

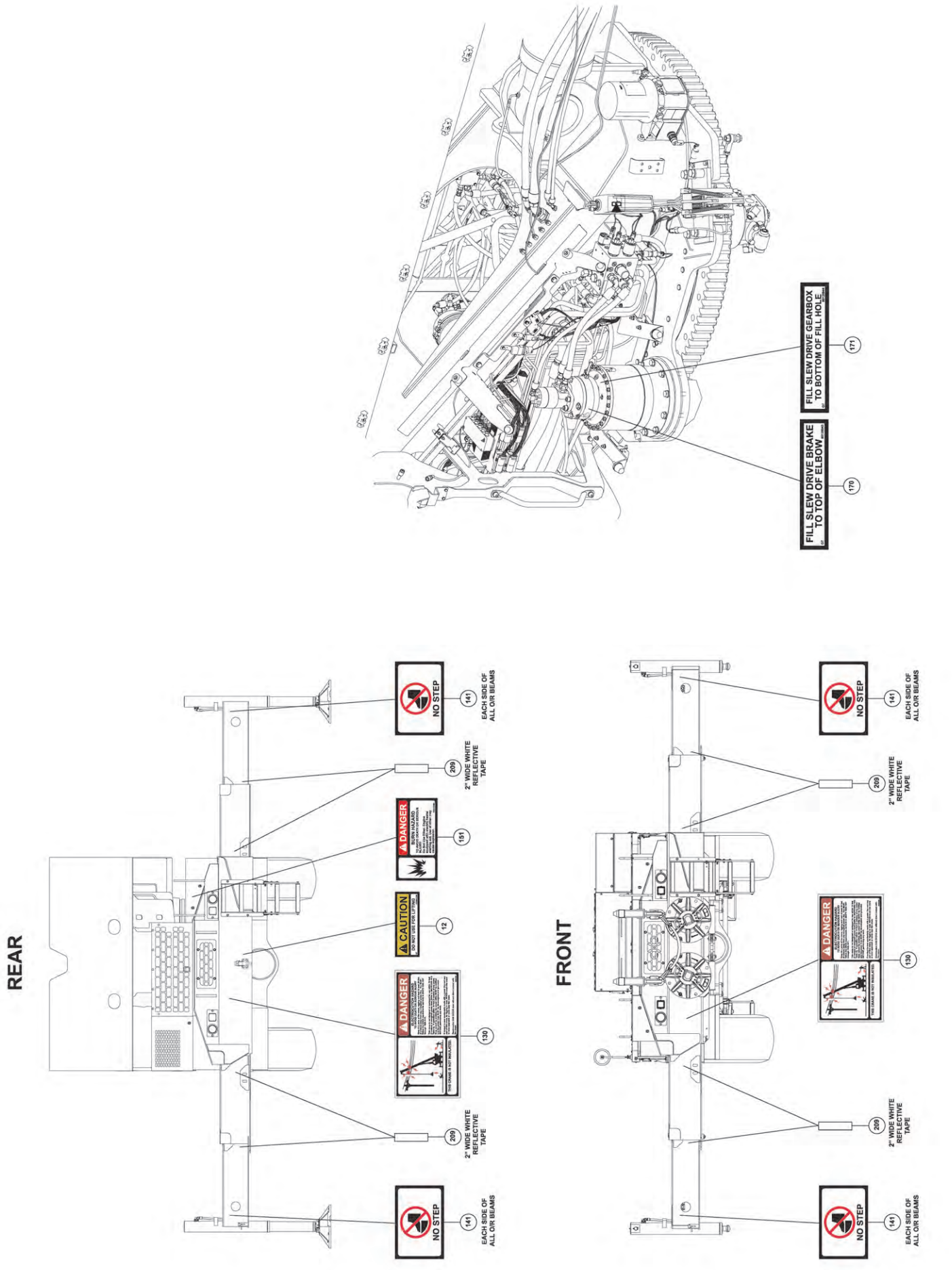


10743-4

FIGURE B-1 continued

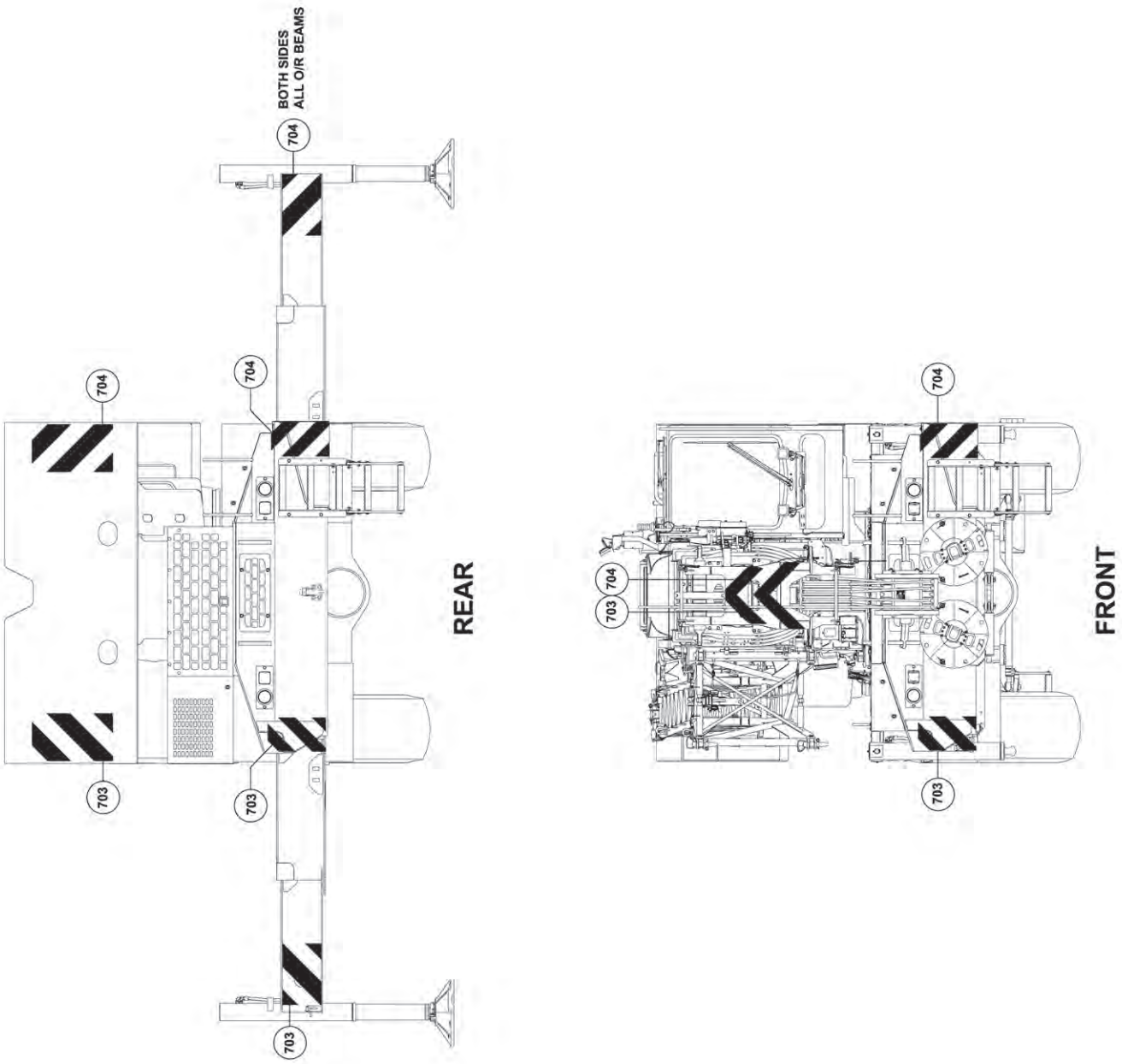
10743-5

FIGURE B-1 continued



10743-6

FIGURE B-1 continued



10743-7

FIGURE B-1 continued

Table B-1 – Legend for Figure B-1

Item	Description
5	Cab Tilt
8	Window Cling-Serial Number
9	Tele Pedal
10	Caution-4wd/Diff Lock
11	Caution-360 Swing Lock
12	Caution Lifting
13	Engine Block Heater-120V
13	Engine Block Heater-240V
14	E-Stop
20	Panel-Nameplate
101	Caution-Trans Damage
102	No Step
103	Danger-Superstructure Swing Hazard
104	Symbol ID
105	Caution-Trans Damage
106	Caution Armrest Position
107	Cab Fuse & Relay Board
108	Warning-California Prop 65
109	Pin Swing Lock
110	No Step
111	Caution-Pin Swing Lock
112	Emergency Exit
113	Seat Control
114	Decal Console Adjustment
115	Danger-Untrained Operator
116	Danger-O/R Mid Extend
117	Danger-Electrocution Hazard
118	Patent
119	Danger-Tip/2-Blocking Hazard
120	Danger-RCL Override Switch
121	Decal - Grove Connect
130	Danger-Electroc Hazard
131	Danger-Revolving Tires
132	Danger-O/R Crush Hazard
133	Danger-Pressurized Fluid
134	Danger-Rotating Blades Hazard
135	Caution-Electronics Damage
136	Battery Connection
137	Caution-Battery Disconnection
138	Caution-Engine Coolant Fill
139	Hydraulic Oil

Table B-1 – Legend for Figure B-1 (Continued)

Item	Description
140	No Pressure Spray
141	No Step
142	Battery Disconnect
143	Battery Box Fuse & Relay
144	5-Position Fuse
145	5-Position Fuse
146	Hand Signals
147	Caution-Special Fill
148	Danger-Fire Hazard
149	Danger-Battery Explosion
150	Coolant Fill Instruction
151	Danger-Ether Hazard
160	Danger-Cwt Crushing Hazard
161	Danger-Cwt Lift Hazard
162	Danger-Cable Wedge
163	No Step
164	Wear Body Harness
165	Danger-Falling Hazard
166	Danger-Hoist Entanglement
167	Danger-Press Oil Leak
168	Tie Down Or Lift Point Prohibited
169	Danger-Cwt Removal Instruction
170	Slew Drive Brake Fill
171	Slew Drive Gearbox Fill
180	Danger-Boom Not Walkway
181	Danger-Aux Boom Nose
182	Aux Boom Nose
183	Caution-Dead End Lug
184	Caution-Disconnect A2b
185	Panel-Serial Number
200	GRT780 ID
201	Grove-3” Gray
202	Grove-6.5” Gray
203	Grove-7.7” Gray
204	Grove-5” White
205	Chevron-Outrigger Jack
206	Manitowoc Cg-Gry/Red-3”
207	Grove-4.5” Gray
208	Mid Extend O/R ->
209	Reflector Striping
210	T & L GRT780

Table B-1 – Legend for Figure B-1 (Continued)

Item	Description
211	Mid Extend O/R
301	Low Sulfur Diesel Fuel
302	Danger-Ultra Low Sulfur
303	Qty Diesel Fluid
304	Caution-Hot Surface & Gases
305	Diesel
306	Danger-Mixing Fuel
401	Grove-7” White
402	Danger-Boom Extion Hazard
403	T&L-Boom Extension
404	T & L-Stinger
405	Panel-Serial Number
501	Swing
502	Main Hoist
503	Boom Lift
504	Aux Hoist
505	Boom Telescope
601	Caution-Fluids
602	Special Lube
603	Fuel
604	Caution-Cold Weather
605	Attention Hook Block
606	Attention Hook Block
607	Danger-Super Capacitor Explode
608	Caution-Capacitor Conn.
609	Caution-Cold Weather Aid
701	107 dB
702	Event Recorder
703	Reflective Striping LH
704	Reflective Striping RH

APPENDIX C
ALERT ICONS

Refer to *Table C-1* for a list of alert icons that can show in the Operation Limits section and/or the Notifications section of the Alerts Bar on the Superstructure Display Module (SDM) (refer to *SDM Alerts Bar*, page 4-12).

Alerts can show in one of three different colors: Blue, Yellow, or Red. The color of the icon indicates to the operator the importance of the alert:

- Red – Critical
- Yellow – Warning
- Blue – Non-Critical (Limit/Status)

Table C-1 – Alert Icons and Descriptions

Alert Icon			Alert Name	Alert Description
Critical	Warning	Non-Critical (Limit/Status)		
			Low Fuel Level	Fuel level is low.
			High Hydraulic Oil Temperature	Hydraulic oil temperature is too high.
			Invalid Hydraulic Temperature	Hydraulic oil temperature input to the crane control system is invalid.
			High Transmission Oil Temperature	Transmission oil temperature is too high.
			Invalid Transmission Oil Temperature	Transmission oil temperature input to the crane control system is invalid.
			High Engine Temperature	Engine coolant temperature is too high.
			Low Engine Oil Pressure	Engine oil pressure is too low.
			Forbidden Zone Bypassed	Working range limitation is being reached or has been reached. A warning buzzer will sound.
			Forbidden Zone Bypassed Blocking Range	Working range limitation is being reached or has been reached. A warning buzzer will sound. If the crane is configured with the Lock-Out function, function lockout will occur when limitation has been reached.
			Engine Over-Speed	Engine speed is too fast.

Table C-1 – Alert Icons and Descriptions (Continued)

Alert Icon			Alert Name	Alert Description
Critical	Warning	Non-Critical (Limit/Status)		
			Invalid Engine Data	Crane control system is not receiving the expected data from the engine ECM.
			Alternator Charge Error	Alternator charge error.
			Alternator Charge Low	System voltage is too low, or the alternator is not charging.
			Cab Not Fully Down	Cab is not fully lowered.
			Low Temperature	Ambient temperature is below -29°C (-20°F). All crane functions are locked out.
			Main Hoist Wraps	Minimum number of wraps of rope required has been reached on the main hoist.
			Auxiliary Hoist Wraps	Minimum number of wraps of rope required has been reached on the auxiliary hoist.
			Engine Wait To Start	Outside air temperature is low and preheating of the air inside the air intake manifold is required.
			Not In Neutral	Operator is trying to perform an operation that requires the transmission to be in neutral.
			Emergency Stop	One or more Emergency Stop buttons are pushed in. When the alert comes on, a warning buzzer will sound.
			Boom Angle Too High	Boom angle is greater than the maximum boom angle limit allowed by the selected load chart or the boom angle is greater than 78 degrees.
			Boom Angle Too Low	Boom angle is lower than the minimum boom angle limit allowed by the selected load chart or the boom angle is less than -1 degrees.
			Engine Stop	There is one or more active engine fault codes. When the indicator comes on, the warning buzzer will sound.
			Park Brake Not Applied	The operator is trying to perform an operation that requires the park brake to be applied.
			Auto-Level Sensor Error	The operator is trying to auto-level the crane and there is a malfunction with the level sensor.

Table C-1 – Alert Icons and Descriptions (Continued)

Alert Icon			Alert Name	Alert Description
Critical	Warning	Non-Critical (Limit/Status)		
			Joystick Speed/Curve Setting Not At Default	One or more of the controller functions are not set to the factory default setting.
			Load Centering Not Allowed	The operator is trying to perform a Load Centering operation but prerequisite conditions are not satisfied.
			Telescoping Extend Pressure	Pressure in the telescope extend circuit is too high for the given boom length. The crane control system will reduce the system pressure and eventually stop the telescope extend function to protect boom components. If the boom is not fully extended, the load must be relieved from the crane before continuing to extend the boom.
			Rear Wheels Not Centered	Rear wheels are not centered.
			Service Brake Pedal Not Depressed	Service brake pedal is not depressed.
			4-Wheel Drive Not Active	The operator is trying to perform an operation that requires the crane to be in four-wheel drive.
			Differential Lock	The operator is trying to actuate the axle differential lock while the transmission is in two-wheel drive or the axle differential lock has been engaged for more than 60 seconds.
			Boom Angle Limit Active	Boom angle limitation has been defined in the Working Range Limiter.
			Boom Angle Limit Enabled	Boom angle feature of the Working Range Limiter is enabled.
			Tip Height Limit Active	Boom tip height limitation has been defined in the Working Range Limiter.
			Tip Height Limit Enabled	Boom tip height feature of the Working Range Limiter is enabled.
			Radius Limit Active	Load radius limitation has been defined in the Working Range Limiter.
			Radius Limit Enabled	Radius feature of the Working Range Limiter is enabled.

Table C-1 – Alert Icons and Descriptions (Continued)

Alert Icon			Alert Name	Alert Description
Critical	Warning	Non-Critical (Limit/Status)		
			Swing Limit Active	Swing limitation has been defined in the Working Range Limiter.
			Swing Limit Enabled	Swing angle feature of the Working Range Limiter is enabled.
			WRL Walls Limit Active	One or more virtual walls have been defined in the Working Range Limiter.
			WRL Walls Limit Enabled	Virtual walls feature of the Working Range Limiter is enabled.
			Exhaust High Temp	Exhaust temperature is above 640°C (1184°F) during the active exhaust system cleaning process. Indicator remains ON until the temperature falls below 625°C (1157°F). Indicator also is ON constant during the manual exhaust system cleaning process.
			Regen Needed	Exhaust system is clogged and needs to be regenerated.
			Regen Inhibited	Exhaust system cleaning is inhibited.
			Brake Pressure Low	Hydraulic pressure in the service brake circuit is below normal operating requirements. When the indicator comes on (red), the warning buzzer will sound. Do not drive crane until brake pressure malfunction is corrected.
			Rear Axle Oscillation Locked	Rear axle system is locked and axle oscillation is prevented.
			Steering Pressure Low	Pressure in the steering circuit is low.
			DEF Level Low	Diesel exhaust fluid level is low.
			Invalid Engine Temperature	Engine coolant temperature input to the crane control system is invalid
			AutoLube On	Automatic lubrication system is on.

Table C-1 – Alert Icons and Descriptions (Continued)

Alert Icon			Alert Name	Alert Description
Critical	Warning	Non-Critical (Limit/Status)		
			AutoLube Level Low	Grease level in automatic lubrication system is low.
			Transmission Fault	Indicates a fault in the transmission.
			Hydraulic Oil Filter Clogged	Condition of the hydraulic oil filter. Red: Filter has entered into bypass mode. Replace filter immediately.
			Operator Out Of Seat	Operator is out of the seat. Crane functions may be disabled.
			Armrest Not Down	Left armrest is not in the fully down position. Crane functions will be disabled.
			Joystick Deadman Switch Not Engaged	At least one Deadman Switch on the controller is not engaged. Crane functions may be disabled.
			A2B Active	Crane is in a two-block condition where the hook block or overhaul ball has reached the boom nose and activated the anti-two-block switch.
			A2B Override Active	Anti-two-block system is being bypassed.
			Vehicle Speed Exceeds Limits	Vehicle speed is exceeding limits for the given crane configuration.
			Engine Braking On, Low Level	Engine brake is on and providing a low level of engine braking.
			Engine Braking On, High Level	Engine brake is on and providing a full level of engine braking.
			RCL Off Chart	No load chart found for the given crane configuration (off chart).
			Boom Radius Too Short	Radius is less than the minimum radius in the selected load chart.
			Boom Radius Too Long	Radius is greater than the maximum radius in the selected load chart.
			Invalid Tele Section Sequence Position	Boom is out of sequence.

Table C-1 – Alert Icons and Descriptions (Continued)

Alert Icon			Alert Name	Alert Description
Critical	Warning	Non-Critical (Limit/Status)		
			Status Light Bar Error	RCL Status Light Bar input to the crane control system is invalid
			Main Boom - No Load Chart Available	Main boom load chart is not available with the currently entered rigging mode or current operating state.
			Boom Extension - No Load Chart Available	Boom extension load chart is not available with the currently entered rigging mode or current operating state.
			Outside RCL Bypass Switch Error	Outside RCL Bypass Switch input to the crane control system is invalid.
			Curve - Chart Point Error	No load chart found for the given crane configuration.
			RCL Override	RCL system is being bypassed.
			Setup Button (CE Version) Momentary Limit Bypass (Non-CE Versions)	RCL Bypass 1 is activated.
			Boom Up Bypass Button	RCL Bypass 2, Boom Up Override, is activated.
			Maintained Limit Bypass Switch (Non-CE Version) Bridging Switch (CE Version)	RCL Bypass 3 is activated.
			OMS Mismatch Confirmed	Outrigger Monitoring System has detected that one or more outrigger beams are extended to a position that does not match the outrigger beam configuration defined by the programmed rigging code.
			OMS Out Of Tolerance	Measured length of a outrigger beam position exceeds +/-3% of the target outrigger position to be recognized as a valid setup.
			High Wind Speed	Excessive wind speed.
			Tele 1 Extend Speed Restriction	Tele 1 extension speed is too fast. The control system will limit telescope extension speed based on hydraulic oil temperature.

APPENDIX D
TIME ZONES AND UTC OFFSETS

Refer to *Table D-1* for a list of time zones and UTC offsets.

The list is to be used to help set the proper time on the Superstructure Display Module (SDM).

Refer to the section titled *Settings*, page 4-94 for instructions on how to set the time in the SDM.

Table D-1 – Time Zones and UTC Offsets

Time Zones	UTC Offset
American Samoa	-11:00
International Date Line West	-11:00
Midway Island	-11:00
Hawaii	-10:00
Alaska	-09:00
Pacific Time (US & Canada)	-08:00
Tijuana	-08:00
Arizona	-07:00
Chihuahua	-07:00
Mazatlan	-07:00
Mountain Time (US & Canada)	-07:00
Central America	-06:00
Central Time (US & Canada)	-06:00
Guadalajara	-06:00
Mexico City	-06:00
Monterrey	-06:00
Saskatchewan	-06:00
Bogota	-05:00
Eastern Time (US & Canada)	-05:00
Indiana (East)	-05:00
Lima	-05:00
Quito	-05:00
Caracas	-04:30
Atlantic Time (Canada)	-04:00
Georgetown	-04:00
La Paz	-04:00
Santiago	-04:00
Newfoundland	-03:30
Brasilia	-03:00
Buenos Aires	-03:00
Greenland	-03:00

Table D-1 – Time Zones and UTC Offsets (Continued)

Time Zones	UTC Offset
Mid-Atlantic	-02:00
Azores	-01:00
Cape Verde Is.	-01:00
Casablanca	+00:00
Dublin	+00:00
Edinburgh	+00:00
Lisbon	+00:00
London	+00:00
Monrovia	+00:00
UTC	+00:00
Amsterdam	+01:00
Belgrade	+01:00
Berlin	+01:00
Bern	+01:00
Bratislava	+01:00
Brussels	+01:00
Budapest	+01:00
Copenhagen	+01:00
Ljubljana	+01:00
Madrid	+01:00
Paris	+01:00
Prague	+01:00
Rome	+01:00
Sarajevo	+01:00
Skopje	+01:00
Stockholm	+01:00
Vienna	+01:00
Warsaw	+01:00
West Central Africa	+01:00
Zagreb	+01:00
Zurich	+01:00
Athens	+02:00

Table D-1 – Time Zones and UTC Offsets (Continued)

Time Zones	UTC Offset
Bucharest	+02:00
Cairo	+02:00
Harare	+02:00
Helsinki	+02:00
Istanbul	+02:00
Jerusalem	+02:00
Kyiv	+02:00
Pretoria	+02:00
Riga	+02:00
Sofia	+02:00
Tallinn	+02:00
Vilnius	+02:00
Baghdad	+03:00
Kuwait	+03:00
Minsk	+03:00
Moscow	+03:00
Nairobi	+03:00
Riyadh	+03:00
St. Petersburg	+03:00
Volgograd	+03:00
Tehran	+03:30
Abu Dhabi	+04:00
Baku	+04:00
Muscat	+04:00
Tbilisi	+04:00
Yerevan	+04:00
Kabul	+04:30
Ekaterinburg	+05:00
Islamabad	+05:00
Karachi	+05:00
Tashkent	+05:00
Chennai	+05:30
Kolkata	+05:30
Mumbai	+05:30
New Delhi	+05:30
Sri Jayawardenepura	+05:30
Kathmandu	+05:45
Almaty	+06:00

Table D-1 – Time Zones and UTC Offsets (Continued)

Time Zones	UTC Offset
Astana	+06:00
Dhaka	+06:00
Novosibirsk	+06:00
Urumqi	+06:00
Rangoon	+06:30
Bangkok	+07:00
Hanoi	+07:00
Jakarta	+07:00
Krasnoyarsk	+07:00
Beijing	+08:00
Chongqing	+08:00
Hong Kong	+08:00
Irkutsk	+08:00
Kuala Lumpur	+08:00
Perth	+08:00
Singapore	+08:00
Taipei	+08:00
Ulaanbataar	+08:00
Osaka	+09:00
Sapporo	+09:00
Seoul	+09:00
Tokyo	+09:00
Yakutsk	+09:00
Adelaide	+09:30
Darwin	+09:30
Brisbane	+10:00
Canberra	+10:00
Guam	+10:00
Hobart	+10:00
Magadan	+10:00
Melbourne	+10:00
Port Moresby	+10:00
Solomon Is.	+10:00
Sydney	+10:00
Vladivostok	+10:00
New Caledonia	+11:00
Auckland	+12:00
Fiji	+12:00

Table D-1 – Time Zones and UTC Offsets (Continued)

Time Zones	UTC Offset
Kamchatka	+12:00
Marshall Is.	+12:00
Wellington	+12:00
Samoa	+12:00
Tokelau Is.	+13:00

THIS PAGE BLANK

WORD INDEX

Numerics

A

B

C

D

E

F

G

H

N

O

P

R

S

T

U

V

W