Grove RT9150E

Operator Manual

Grove Manitowoc National Crane Potain

Manitowoc

WIRE ROPE (HOIST CABLE)

General

The following information is a compendium of information from various wire rope manufacturers and includes inspection, replacement, and maintenance guidelines for wire rope as established by ANSI/ASME B30.5, federal regulations, and Manitowoc. The inspection interval shall be determined by a qualified person and shall be based on such factors as expected rope life as determined by experience on the particular installation or similar installations, severity of environment, percentage of capacity lifts, frequency rates of operation, and exposure to shock loads. Periodic Inspections need not be at equal calendar intervals and should be performed at shorter time intervals as the wire rope approaches the end of its useful life. A periodic inspection shall be performed at least once a year. The following provides inspection and maintenance procedures for wire ropes used on Grove products (e.g. wire rope used as load lines [hoisting cables], boom extension and retraction cables, pendant cables, tow winch cables, and hook block tie down cables).

Environmental Conditions

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

Dynamic Shock Loads

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

1. High velocity movement e.g.; hoisting or swinging of a load followed by abrupt stops.
2. Suspending loads while traveling over irregular surfaces such as railroad tracks, potholes, and rough terrain.
3. Moving a load that is beyond the rated capacity of the lifting mechanism, i.e.; overloading.

Lubrication

A wire rope cannot be lubricated sufficiently during manufacture to last it's entire life. Therefore, new lubricant must be added throughout the life of a rope to replace factory lubricant which is used or lost. It is important that lubricant applied as part of a maintenance program shall be compatible with the original lubricant, and to this end, the rope manufacturer should be consulted. Lubricant applied shall be of the type which does not hinder visual inspection. Those sections of rope which are located over sheaves or otherwise hidden during inspection and maintenance procedures require special attention when lubricating rope. The object of rope lubrication is to reduce internal friction and to prevent corrosion.

During fabrication, ropes receive lubrication; the kind and amount depends on the rope's size, type, and anticipated use. This in-process treatment will provide the finished rope with ample protection for a reasonable time if it is stored under proper conditions. But, when the rope is put into service, the initial lubrication may be less than needed for the full useful life of the rope. Because of this possibility, periodic applications of a suitable rope lubricant are necessary.

The following are important characteristics of a good wire rope lubricant:

1. It should be free from acids and alkalis.
2. It should have sufficient adhesive strength to remain on the ropes.
3. It should be of a viscosity capable of penetrating the interstices between wires and strands.
4. It should not be soluble in the medium surrounding it under the actual operating conditions (i.e. water).
5. It should have a high film strength.
6. It should resist oxidation.

Before applying lubrication, accumulations of dirt or other abrasive material should be removed from the rope. Cleaning can be accomplished by using a stiff wire brush and solvent, compressed air, or live steam. Immediately after the wire rope is cleaned, it should be lubricated. Many techniques may be used; these include bath, dripping, pouring, swabbing, painting or pressure spray methods. Whenever possible, the lubricant should be applied at the top of a bend in the rope, because at that point the strands are spread by bending and are more easily penetrated. There should be no load on the rope while it is being lubricated. It should be noted, the service life of wire rope will be directly proportional to the effectiveness of the method used and amount of lubricant reaching the working parts of the rope.

Precautions and Recommendations During Inspection or Replacement

1. Always lock out equipment power when removing or installing wire rope assemblies.
2. Always use safety glasses for eye protection.
3. Wear protective clothing, gloves, and safety shoes as appropriate.
4. Use supports and clamps to prevent uncontrolled movement of wire rope, parts, and equipment.

For detailed information concerning the operation and maintenance of the RCL system installed on the crane, see 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; Manitowoc 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, headache ball, rigging, etc.) comes into physical contact with the boom (boom nose, sheaves, jib, 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 free fall.

Two-blocking is more likely to occur when both the main and auxiliary hoist lines are reeved over the main boom nose and jib 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 jib 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.

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.

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

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

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
  $Awr_{(load)} = Ap \times Cd = 5.45 \times 2.4 = 13.08\ m^2$

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:

$$Awr_{(load)} = Ap \times Cd = 21.85 \times 1.2 = 26.22\ m^2$$

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) < 3.4 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:

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

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:

- 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 Manitowoc 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 dealer not be immediately available, contact Manitowoc Crane Care. 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 Manitowoc distributor or Manitowoc Crane Care.

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.

PERSONNEL HANDLING

The American Society of Mechanical Engineers issued a new American National Standard entitled, *Personnel Lifting Systems,* ASME B30.23-2011:

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

> General requirements. The use of a crane or derrick to hoist employees on a personnel platform is prohibited, except when the erection, use, and dis-

Be sure 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.

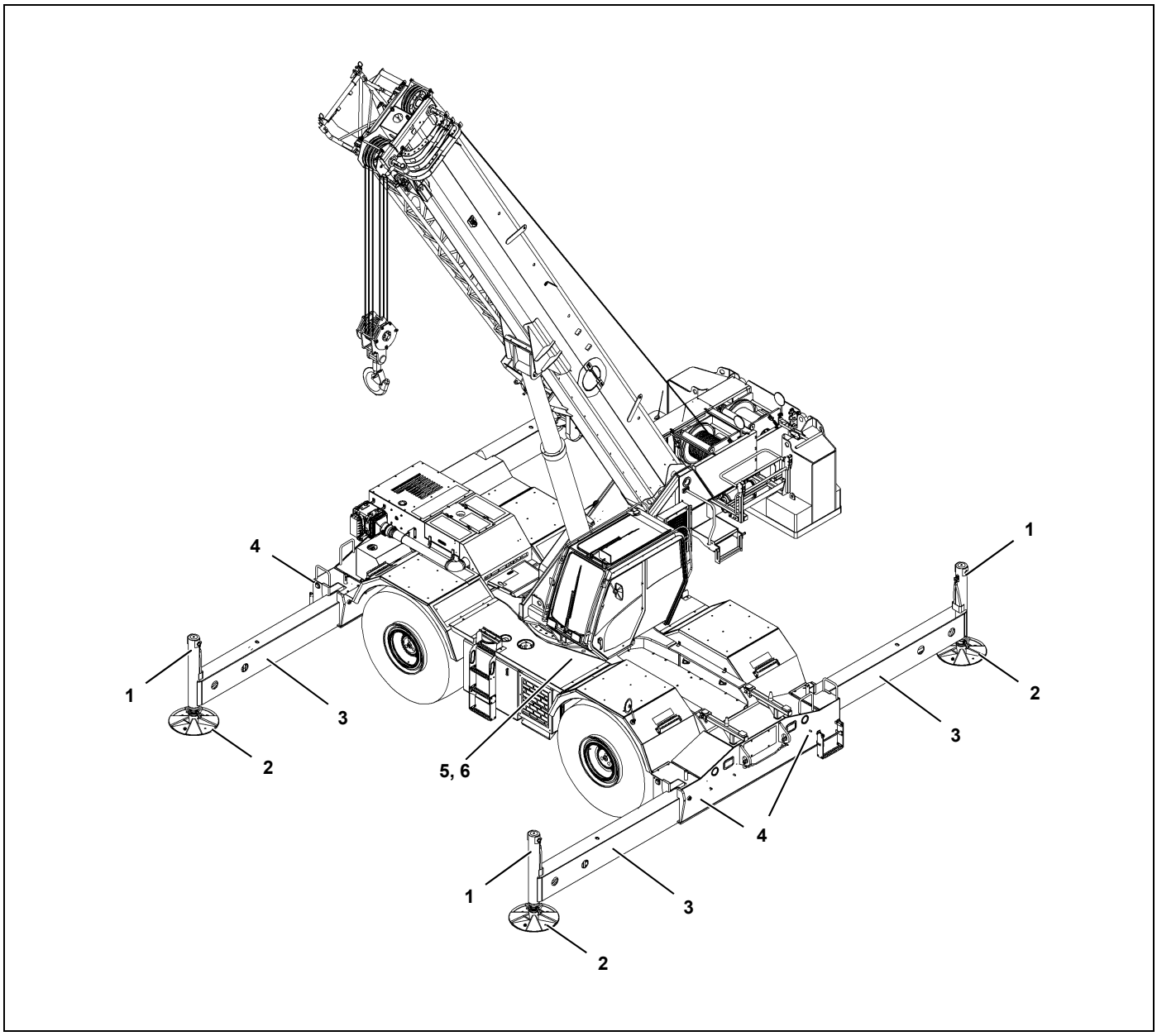
At all times use standardized hand signals - previously agreed upon and completely understood by the operator and signal person.

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.

Carrier Inspection



OVERHEAD CONTROLS AND FEATURES

Refer to Figure 3-5.

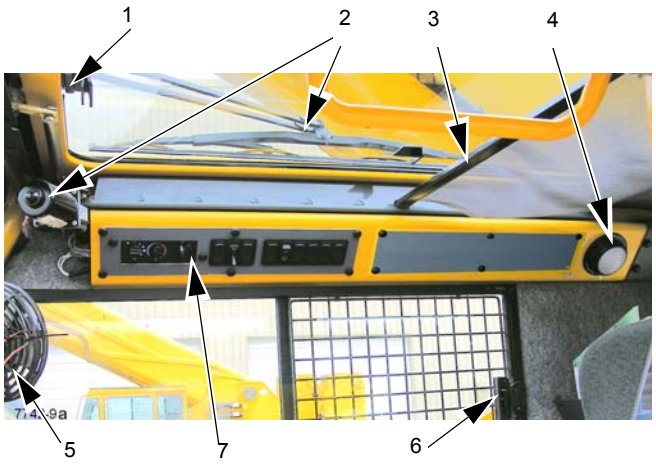


FIGURE 3-5

Item	Description
1	Skylight Window Latch
2	Skylight Wiper
3	Skylight Sunscreen
4	Cab Overhead Light
5	Cab Circulating Fan
6	Window Latch
7	Overhead Console

Skylight Window Latch

The Skylight Window Latch (1) is at the front of the window. Squeeze the latch and slide the window to the rear to open. to close slide the window forward until the latch engages.

Skylight Wiper and Wiper Motor

The Skylight Wiper (2) is controlled by the wiper switch, (5) (Figure 3-6), and operated by the indicated motor.

Skylight Sunscreen

The Skylight Sunscreen (3) is used to diminish direct sunlight. The sunscreen is self retracting and can be set to screen all the light or adjusted rearward by moving it into the notches provided.

Overhead Light

The cab Overhead Light (4) is on the right rear corner of the cab overhead console and provides illumination in the cab. The Overhead Light is controlled by a switch on the light.

Cab Circulating Fan

The Cab Circulating Fan (5) is located on the right front side of the cab, above the window frame. A swivel allows the fan to be rotated and a switch on the fan base controls the fan. The switch has a high, low and off position.

Right Side Window Latch

The window on the right side of the cab can be opened. Squeeze latch (6) to release the window and slide forward. To close slide the window rearward until the latch engages.

Overhead Console (Right Side)

Refer to (7) Figure 3-5 and Figure 3-6.

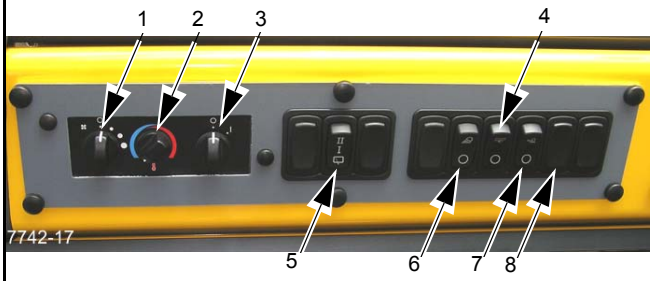


FIGURE 3-6

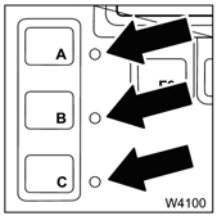
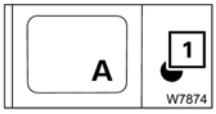
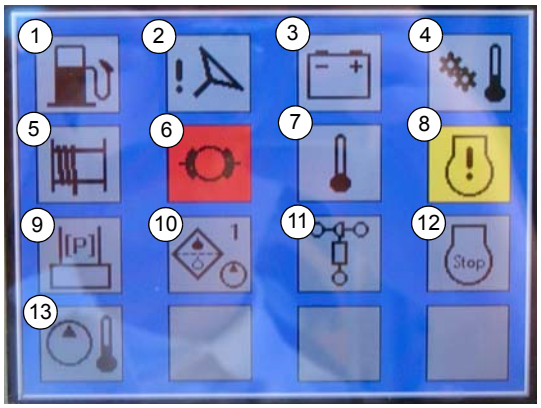
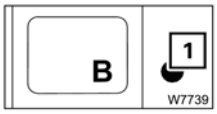
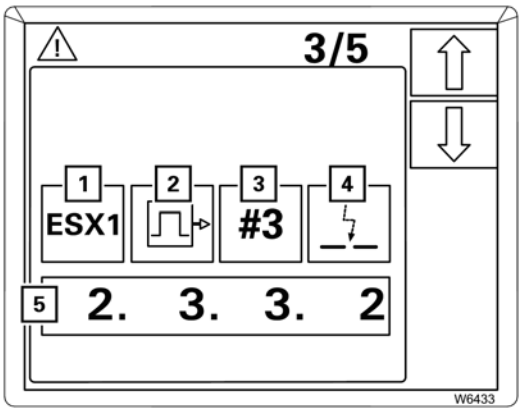
Item	Description
1	Heater/air Conditioner Fan Switch
2	Heater Control Switch
3	Air Conditioning Switch
4	Boom Light Switch (Optional)
5	Skylight Wiper Switch
6	Work Lights Switch
7	Aircraft Warning Light Switch (Optional)
8	Exhaust System Cleaning Switch

Heater/Air Conditioner Fan Switch

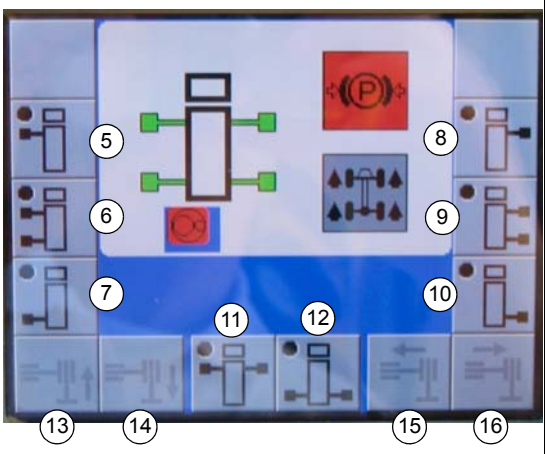
The Heater/Air Conditioner Fan Switch (1) controls the cab fan's speed. Fan speed controls the volume of heated air output (or cooled air output) of the fan. Settings are off, low speed, medium speed, and high speed.

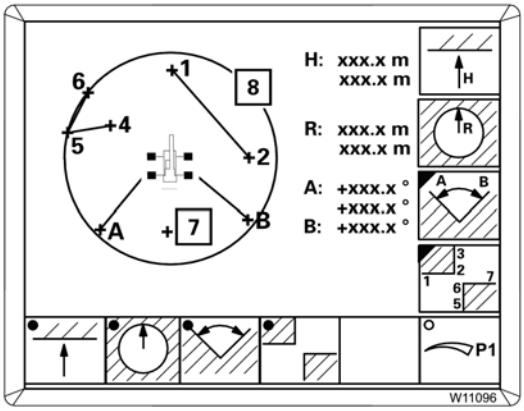
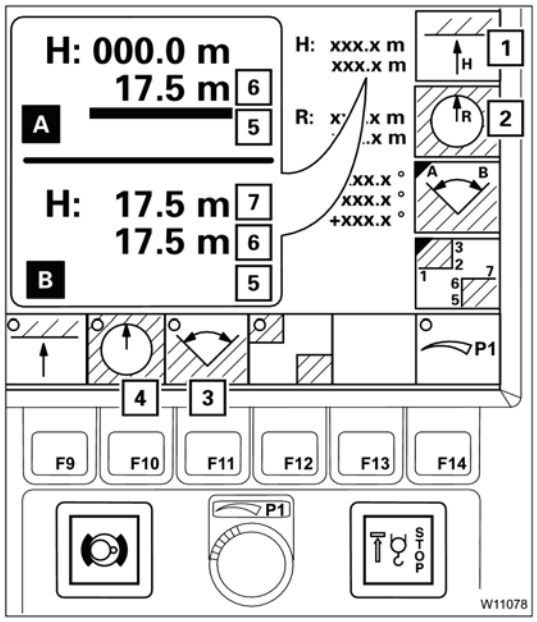
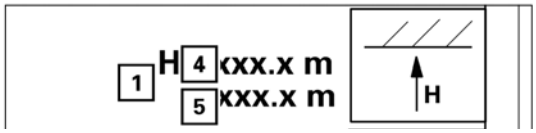
Heater Control Switch

The Heater Control Switch (2) controls intensity of heating. Turn the switch to the right (clockwise) to open the valve for heat. (Heat comes from heated fluid going through the heater coil.) Turn the switch to the left (counterclockwise) to close the valve to stop fluid flow and minimize heat.

Item	Description	Graphic	Explanation
7	**Entering the keycode**		The lamps next to all three buttons will light when the keycode can be entered. Enter keycode: press buttons in the required order and confirm keycode.
7.1	**Opening the warning submenu**		The lamp (**1**) lights up or flashes. Press the button once to enter the Warning Submenu.
	Warning submenu overview		**(1)** Fuel level **(2)** Low steering pressure (CE option) **(3)** Voltage monitoring **(4)** Transmission oil temperature **(5)** Hoist fifth wrap indicator **(6)** Low brake pressure **(7)** Ambient air temperature, -29° C (Russian Option) **(8)** Engine warning **(9)** Pre-tension the counterweight **(10)** Hydraulic oil filter restriction **(11)** Anemometer not connected **(12)** Engine stop **(13)** Hydraulic oil temperature Refer to *Warning Messages,* page 3-62 for more information.
7.2	**Opening the error submenu**		The lamp (**1**) lights up or flashes. Press the button once to enter the Error Submenu.
	Error submenu overview		Each error is defined by an error code (5) and the symbols (1) to (4). The symbols stand for: (1) The faulty device (2) The error group (3) The index within the group (4) The type of error The error code (5) consists of 4 digits, e.g. 2332. Always note down the error code before contacting Crane Care. Refer to *Error Messages,* page 3-66 for more information.

3

Item	Description	Graphic	Explanation
5	Left front outrigger; F2		To operate any outrigger function: • Swing gear must be OFF, red • The parking brake ON, red • Four-wheel drive engaged, yellow. **NOTE:** With the swing gear ON, an exclamation point is displayed when selecting a function and pre-selection does not take place. Press the associated button to pre-select the indicated outriggers/jacks; items (6), (9), (11) and (12) are for jacks only: **Green dot**: Outrigger(s) pre-selected and will remain selected for 10 seconds. **Black dot**: Not selected. After pre-selecting an individual outrigger, items (13) through (16) are active. Only items (13) and (14) are active when jacks are selected. • Press F14, extend outrigger button (16) or F13, the retract outrigger button (15) to move the outrigger(s) out or in. • Press F10, the extend jack button (14) or F9, the retract jack button (13) to move the jack(s) down or up.
6	Left side jacks; F3		
7	Left rear outrigger; F4		
8	Right front outrigger; F6		
9	Right side jacks; F7		
10	Right rear outrigger; F8		
11	Front jacks; F11		
12	Rear jacks; F12		
13	Retract jack cylinder(s), F9		
14	Extend jack cylinder(s), F10		
15	Retract outrigger beam(s), F13		
16	Extend outrigger beam(s), F14		

Item	Description	Graphic	Explanation
1	**Working range limiter display**		With monitoring functions turned on the monitored area is displayed: • **Working radius**: Circle (8), red. • **Permissible swing angle**: Circle sector, clockwise from A to B • **Objects**: Points and lines, e.g. 1 to 2 and 4 to 6. • **Overall height**: No display. The current main boom position (7) is always displayed.
2	**Enter maximum overall height**		The limit values for the overall height and the working radius are entered in the same way. The relevant monitoring function (3) or (4) must be switched off, dot black. • Press the (1) button, the bar (5) turns red, the input mode is turned on. To cancel input, press the Esc button. • (A): Move the main boom head to just before the shutdown point without a load, e.g. at 17.5 m, value (6). • (B): Press the button Enter. The current value (6) is accepted as the limit value (7). The bar (5) goes out. Switch on monitoring, see Items 9-12.
3	**Maximum overall height display**		The display indicates values for (1) overall height The display shows the following values: (4) Limit value, red (5) Current value, blue In case of manual input mode switched on, the display (5) changes.

COUNTERWEIGHT SUBMENU

Press the counterweight submenu button (Figure 3-45) in the main menu to open the this submenu.

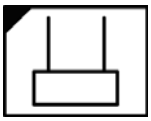


FIGURE 3-45

Counterweight Submenu

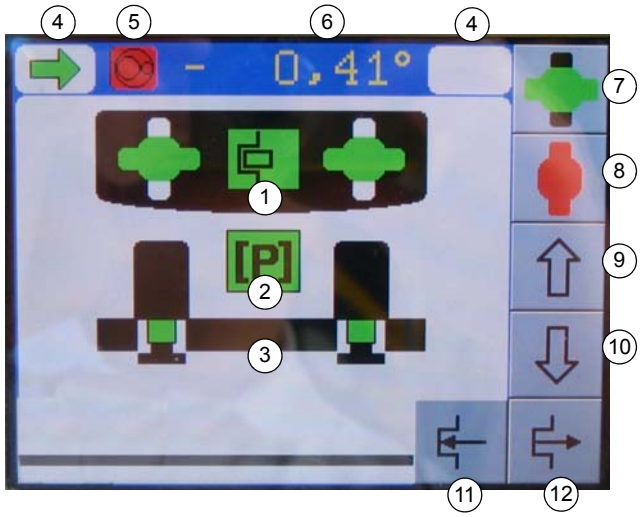
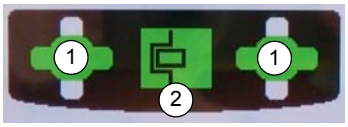


FIGURE 3-46

Item	Description
1	Lock status; lift and locking cylinders
2	Pre-tensioning pressure status
3	Lifting cylinders position
4	Swing gear direction indicators
5	Swing gear on/off indicator
6	Current swing angle display
7	Lock lift cylinders, F5
8	Unlock lift cylinders, F6
9	Retract lift cylinders, F7
10	Extend lift cylinders, F8
11	Engage lock cylinders, F13
12	Retract lock cylinders, F14.

Refer to the following table for a description of each item listed above.

Item	Description	Graphic	Explanation
1	Lock status; lift and locking cylinders		The current status of the counterweight lift (1) and lock (2) cylinders are shown by different symbols: **Green**: locked **Red**: unlocked **Yellow**: intermediate position **Violet**: error
2	Pre-tensioning pressure status		Pre-tensioning the counterweight is required to make sure the counterweight remains secure. To pre-tension the counter weight, continue to retract the counterweight lift cylinders until the symbol is green. **Green**: pre-tensioning pressure reached **Red**: pre-tensioning pressure too low, repeat the retract procedure. Refer to *Retracting the Lifting Cylinders,* page 3-119.

Operating Hours

Press the Settings submenu button in the Main menu and then press the Operating hours button (1) (Figure 3-55) to open the Operating Hours submenu.

FIGURE 3-55

Operating Hours Submenu

The operating hours are displayed below the symbols, e.g. 1,680 hours and 12 minutes for the telescoping mechanism (3).

NOTE: The value below the Unlock telescopic section symbol (6) (Figure 3-56) indicates how often the cycle has been operated, e.g. 13,750 times.

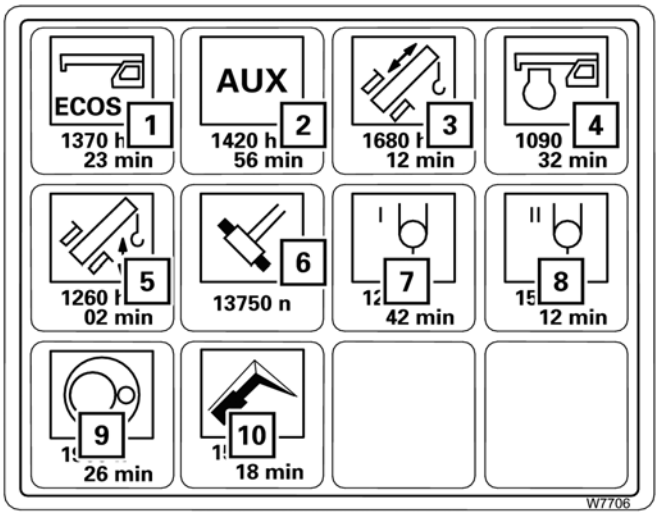
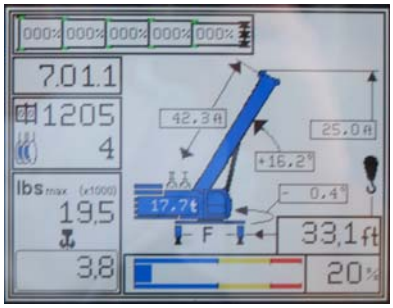
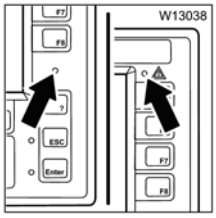
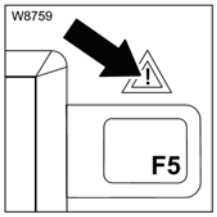
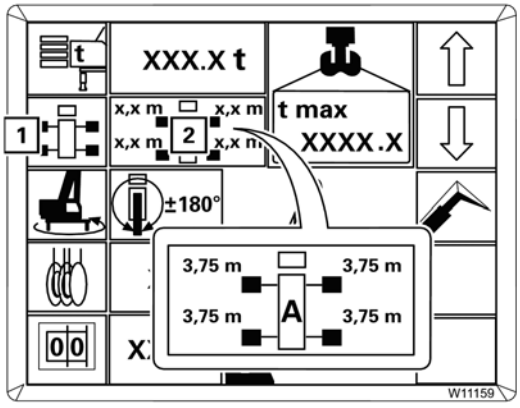
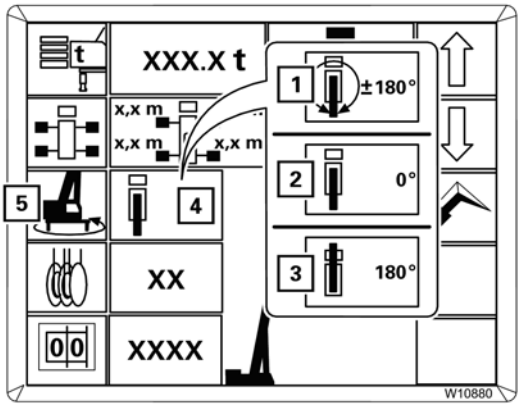
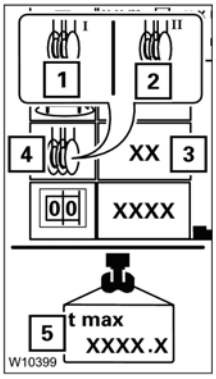
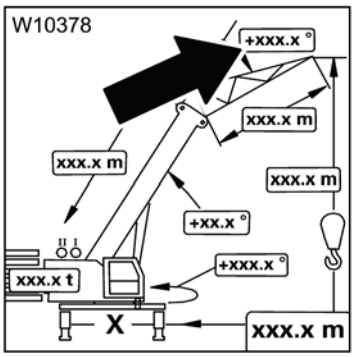
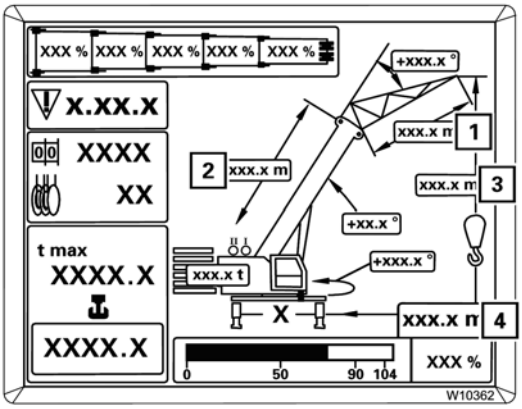
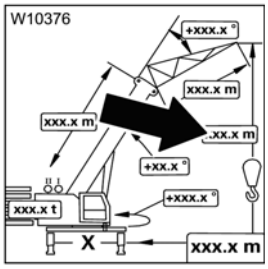
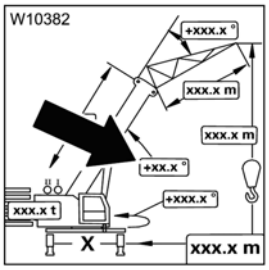


FIGURE 3-56

Item	Description
1	ECOS
2	Auxiliary systems: Counterweight cylinders Crane cab cylinder
3	Telescoping mechanism
4	Engine operation
5	Lift cylinder
6	Telescope locking system
7	Main hoist
8	Auxiliary hoist
9	Swing gear
10	Boom extension

Item	Description	Graphic	Explanation
1	**RCL display**		**After a standstill of up to 48 hours** Ignition on: Monitoring submenu opens. Refer to *RCL Monitoring Submenu,* page 3-86.
			**After a standstill of more than 48 hours** Ignition on: Enter rigging mode submenu opens. Refer to *Rigging Mode Monitoring Submenu,* page 3-85.
	Main menu overview		The main menu shows symbols for further submenus and symbols for current displays. Refer to *RCL Main Menu,* page 3-75.
2	**Sensor for brightness**[1]		Registers the brightness of the operating environment. The brightness of all displays are automatically adjusted. Refer to *Adjusting the Brightness of the Display,* page 3-57 to manually set the minimum brightness.
3	**Error/warning message**		• **Flashing**: New warning message or error has occurred • **On**: Error acknowledged, but still present • **Off**: No warning message or error present

Item	Description	Graphic	Explanation
2	**Enter outrigger span, F2**		• **Start Input mode**: press the F2 button (1) once, symbol turns green • **Input mode on**: press either the F5 button ⇧ or the F6 button ⇩ once, to bring up the next outrigger configuration(2): 100%, full extend 50%, mid-extend. Refer to *Outrigger Deployment,* page 3-82.
3	**Enter swing range, F3**		• **Start Input mode**: press the F3 button (1) once, symbol turns green • **Input mode on**: press either the F5 button ⇧ or the F6 button ⇩ once, to bring up the next permissible swing range (4): (1) 360° swing range (2) Working position 0° to the rear * (3) Working position 180° to the front * * Swing gear must be off. Refer to *Swing Range,* page 3-83.
4	**Enter reeving, F4**		• **Start Input mode**: **For main hoist**: press the F4 button (4) until symbol (1) is green **For auxiliary hoist**: press the F4 button (4) until symbol (2) is green • **Input mode on**: press either the F5 button ⇧ or the F6 button ⇩ once: To change reeving by one line (3) and display the relevant maximum load (5) for that reeving. Refer to *Entering the Reeving,* page 3-83.
5	**Maximum load display**		Maximum load in tons (t) or kilo pounds (klbs) for displayed RCL code. Refer to the *RCL Monitoring Submenu,* page 3-86 for more information.

Item	Description	Graphic	Explanation
11	Boom extension angle display		With a boom extension installed and the proper RCL code entered, the following is displayed: • Hydraulic boom extension; the current angle, in degrees (°), between the boom extension and main boom. • Offsettable boom extension; the angle, in degrees (°), between boom extension and main boom, for the displayed RCL code. If the displayed RCL code does not apply to a boom extension, there is no display of the extension.
12	**Current length of boom extension**		(1) Current length of boom extension in meters (m). If the displayed RCL code does not apply to a boom extension, there is no display of the extension.
13	**Current overall height**		Overall height is the vertical distance between the lower edge of the outrigger pad and the highest point of the main boom or boom extension. The displayed value applies to fully extended support cylinders on the largest outrigger span. The value is displayed either in meters (m) or in feet (ft), depending on the setting.
14	**Current main boom angle display**		Shows the current main boom angle in relation to the horizontal. Angles below the horizontal are displayed with a minus sign, e.g. –3°.

SETTINGS SUBMENU

The settings submenu is where you set the time and date. It also displays the data when a service device is connected. The other settings should only be changed by a qualified technician.

Opening the Submenu

In the Main menu, press the F4 button (1) (Figure 3-99) once, the Settings submenu opens.

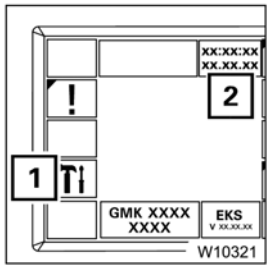


FIGURE 3-99

Settings Submenu

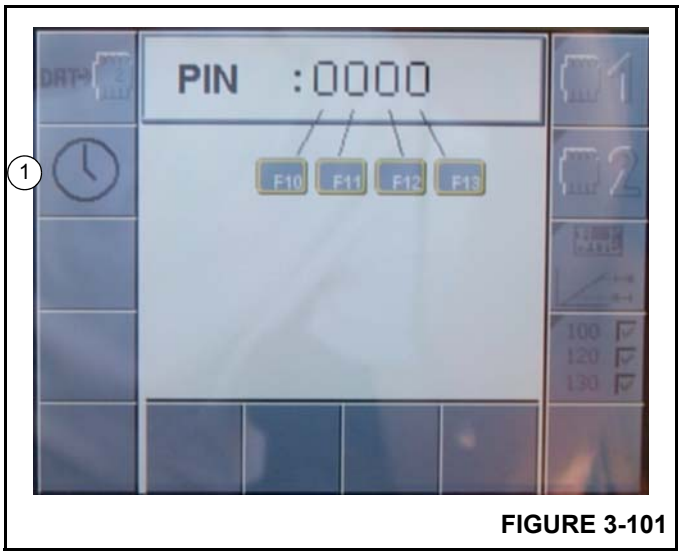


FIGURE 3-101

Cancel the Input

You can exit the Settings submenu at any time without saving your input.

Press the *Esc* button (1) (Figure 3-100) once.

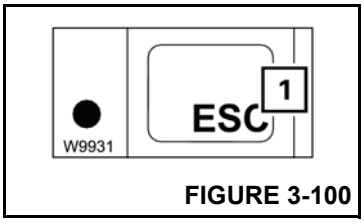


FIGURE 3-100

NOTE: Buttons/displays (3) (Figure 3-101) are only shown if a service device is connected.

Item	Description
1	Enter the time/date

Refer to the following table for a description of each item listed above.

3

Hydraulic Oil System

Operating Limits and Warm-up Procedures:

- **From 4°C to -10°C (40°F to 15°F):** Crane operation without a load is allowed with medium engine RPM and medium function speed (joystick 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 there is any unusual sound coming from the crane's hydraulic pumps or motors, stop operation and engine immediately and contact a Manitowoc distributor.
- **From 10°C to 4°C (50°F to 40°F):** Crane operation with a load is allowed with medium engine RPM and medium function speed (joystick position) until fluid reaches at least 10°C (50°F).
- **From 95°C to 10°C (200°F to 50°F):** Crane operation with a load is allowed with no restrictions.
- **Above 95°C (200°F)**: No crane operation is allowed. Let crane's hydraulic oil cool by running engine at idle with no functions actuated.

Battery Disconnect

The battery disconnect switch is located near the battery box and the left rear wheel on the left side of the crane. To disconnect the batteries, place the battery disconnect switch to OFF. Place the switch to ON to connect the batteries.

Engine Operation

Starting and shutdown procedures for most diesel engines generally follow the same pattern. Therefore, the following procedures can be applied except where specific differences are noted. (Refer to the applicable engine manufacturer's manual for detailed procedures.)

Starting Procedure

Make an under-the-hood inspection for fuel, oil, and coolant leaks, worn drive belts, and trash build-up.

If the crane was inactive for over 24 hours and the batteries were disconnected, make sure to connect the batteries before proceeding with start-up procedure.

WARNING

Diesel engine exhaust can be harmful to your health. Only operate the engine in a well ventilated area or vent exhaust outside.

Before starting the engine, apply the parking brake and engage the swing lock.

CAUTION

Never crank the engine for more than 30 seconds during an attempted start. If the engine fails to start after 30 seconds, stop and allow the starter motor to cool for approximately two minutes before attempting another start.

If the engine fails to start after four attempts, correct the malfunction before attempting further starts.

Damage to the starter or other components could result if these warnings are not followed.

Warm Engine

WARNING

Do not spray starting fluid into the air inlet. The spray will contact the heater elements and could explode causing personal injury.

NOTE: The engine ECM monitors the engine and, under certain conditions, cycles the air heater on and off at start-up and during operation.

The engine is equipped with an electric air heater grid at the air inlet elbow to aid in cold starting and reduce white smoke at start-up. In the preheat mode, the engine should not be cranked until the WAIT-TO-START lamp turns off.

1. Ensure the service brake pedal is depressed, parking brake is set and the transmission is in neutral.

NOTE: Engine will not crank unless service brake pedal is depressed and transmission shift lever is in neutral.

2. Turn the IGNITION switch to START and release immediately when the engine starts. Do not push or hold the throttle down. The ECM will automatically provide the proper amount of fuel to start the engine.
3. Immediately check the engine instruments for proper indications after starting. Shut down the engine if the oil pressure gauge does not reach the proper reading within 15 seconds.

CAUTION

If temperature indicator(s) do not display proper readings, shut down the engine and correct the malfunction before resuming operation.

4. Allow engine to warm up at least five minutes before applying a load. Do not race engine for a faster warmup.

A lifting diagram is included to describe over side, over rear, and over front lifting areas. The lifting area diagram shows that the locations of the outrigger jack cylinders in the fully extended position are used to mark the boundaries of the lifting areas.

A boom extension capacity chart and notes are included to list the capacities for the extension length, load radius, and boom angle.

Another section contains the notes for lifting capacities. Be sure to read and understand all the notes concerning lifting capacities.

The load chart also gives weight reductions for Grove load handling devices such as hook blocks, headache balls, boom extensions, etc., which must be taken into consideration as part of the load. Remember, the weight of any other load handling devices such as chains, slings, or spreader bars must be added to the weight of the load.

Counterweight Installation/Removal

Refer to Figure 3-111.

DANGER

Crushing Hazard!

Ensure no one is on the counterweight platform while the counterweight is being lifted or lowered.

Before lifting or lowering the counterweight, ensure there are no objects on top of or below it.

Serious injury or death may result if these warnings are not followed.

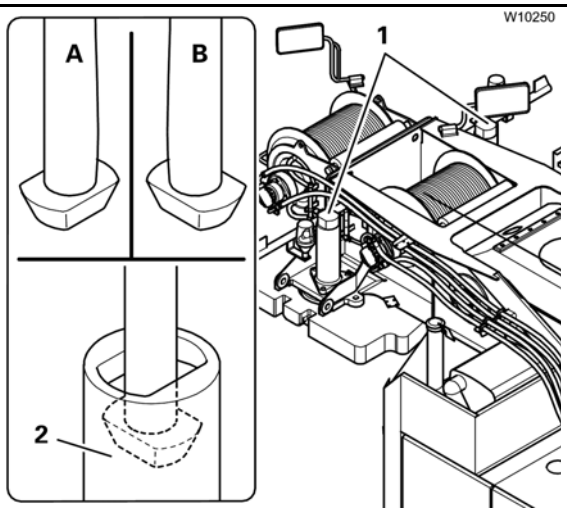


FIGURE 3-111

The lifting cylinders (1) can be:

- extended and retracted and
- turned to the positions Unlocked (A) or Locked (B).

To lift and lower the counterweight, the lifting cylinders have to be locked in the counterweight tubes (2).

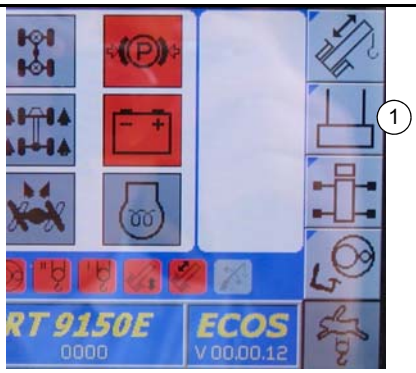


FIGURE 3-112

To operate the counterweight hoist unit, you must open the Counterweight submenu:

1. If necessary, open the main menu, press *Esc* button.
2. In the Main menu, press the F6 button (1) (Figure 3-112) once.

   The Counterweight submenu opens.

NOTE: If an error symbol (1) (Figure 3-113) is displayed during subsequent operation, please contact Crane Care.

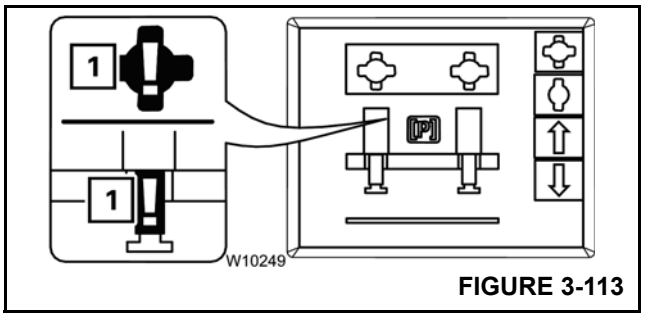


FIGURE 3-113

The extension or retraction of the lifting cylinders will only take place when both lifting cylinders are fully in the locked or unlocked positions.

Extending the Lifting Cylinders

Extension is only enabled when the superstructure is in the 180°, boom over-the-rear position.

CAUTION

Equipment Damage Hazard!

The hoist unit can become damaged by moving the lifting cylinders against the counterweight in the locked position.

Rotating the Superstructure

Refer to *Main Menu,* page 3-21 and *Swing Gear and Brake Submenu,* page 3-30 for information on using the ECOS system.

DANGER

Tipping Hazard!

Always check before rotating the superstructure whether it is permitted in the crane's current rigging mode (counterweight, outrigger span, working radius).

Before activating swing, sound the horn and verify that all personnel are clear of rotating and moving parts.

Death or serious injury could result from being hit by the load or moving machinery.

CAUTION

Machine Damage Hazard!

Disengage the swing brake and the swing lock pin and/or 360° swing lock before attempting to swing.

Never push or pull the swing control lever through neutral to the opposite direction to stop swing motion. Use the swing brake foot pedal to stop swing rotation.

Do not accelerate the slewing speed to such a degree that the load starts swinging.

Damage to the crane may result from improper swing operation.

NOTE: Automatic rear axle oscillation lockout will activate when the superstructure swings right or left of the 0° forward position.

Swing Operation Prerequisites

The following prerequisites must be fulfilled before rotating the superstructure:

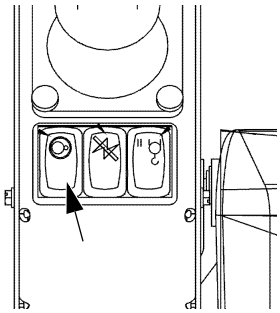
- The Swing Lock is released.
- The counterweight lifting cylinders are fully retracted.
- Slewing is permissible with the current rigging mode, refer to *Rotating Superstructure with Counterweight,* page 3-129.
- The current rigging mode is entered on the RCL.

If slewing is not permissible with the current rigging mode, the slewing gear is disabled.

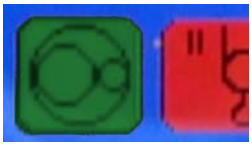
Rotating the Superstructure

To rotate the superstructure, use the controls on the left-hand armrest:

1. Push the top of the Swing Gear switch once.



2. ECOS indicator must be green.



NOTE: If an RCL code has been entered for the working position 180° to the rear or Free-on-wheels, an RCL shutdown will occur after switching on the swing gear, and rotation will be disabled. To acknowledge the shutdown, you must either switch off the swing gear or set down the load and enter an RCL code for the 360° working range.

3. Apply the swing foot brake or leave the control lever at the neutral position, depending on which control is selected in the Main menu.


Foot Brake


Control Lever

4. Release the Swing Lock by pulling up on the lever.

5. Pull the Swing Lock Pin handle out to release the pin lock.

3

2. Move the control lever for extending and hold it there.

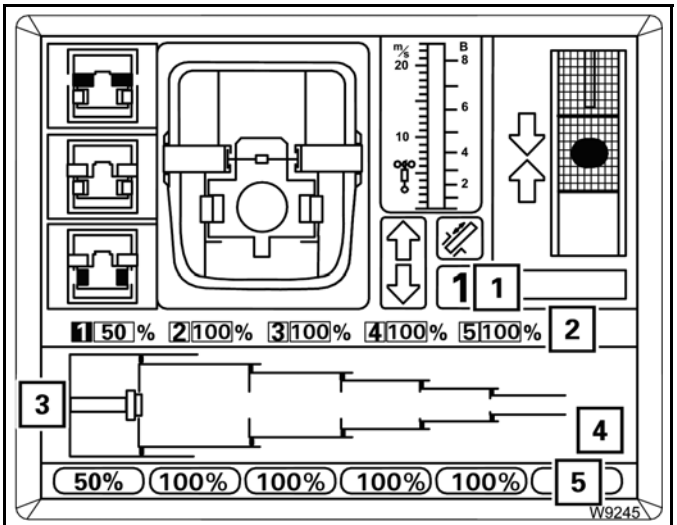


FIGURE 3-150

ECOS now automatically moves telescopic sections 5, 4, 3 and 2 to the full extent and stops when telescopic section 1 reaches the set value of 50%.

3. Move the control lever to the zero position.
   - The display (4) goes out.
   - The display (1) is active again.
   - The values in the display (5) are red.
   - The display (2) shows the current telescoping, e.g. 50/100/100/100/100.
   - The display (3) shows the current telescoping graphically.

   Teleautomation is switched off.

NOTE: To extend telescopic section 1 to 60%, for example, you can now further extend this telescopic section manually.

Manual Telescoping

To telescope manually, you must initiate all locking and unlocking processes, which are then carried out automatically.

The following sections describe the operating procedures necessary to extend/retract the boom manually.

NOTE: The operating order depends on the current initial position. For an overview of the telescope process, refer to *Telescope System Overview,* page 3-133.

- *Checking the Initial Position,* page 3-138
- unlocking the telescoping cylinder,
- moving the telescoping cylinder (without telescopic section),
- locking the telescoping cylinder,
- unlocking the telescopic section,
- telescoping the telescopic section,
- locking the telescopic section.

NOTE: The lengths given in the following illustrations are purely sample values, and may therefore deviate from the actual values displayed.

Checking the Initial Position

Before telescoping, you must check the following statuses:

- The *Current Telescope Status,* page 3-139,
- the *Position of the Telescope Cylinder,* page 3-139,
- the *Position of the Locking Pins,* page 3-139.

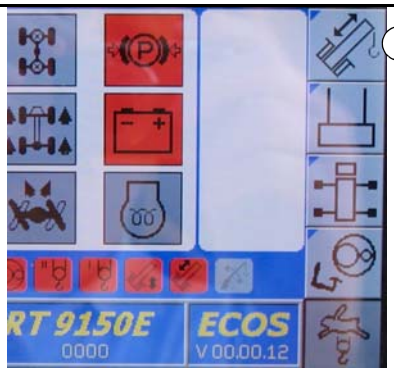


FIGURE 3-151

If necessary, open the main menu by pressing the *Esc* button, then press the F5 button (1) once (Figure 3-151).

The Telescoping submenu opens.

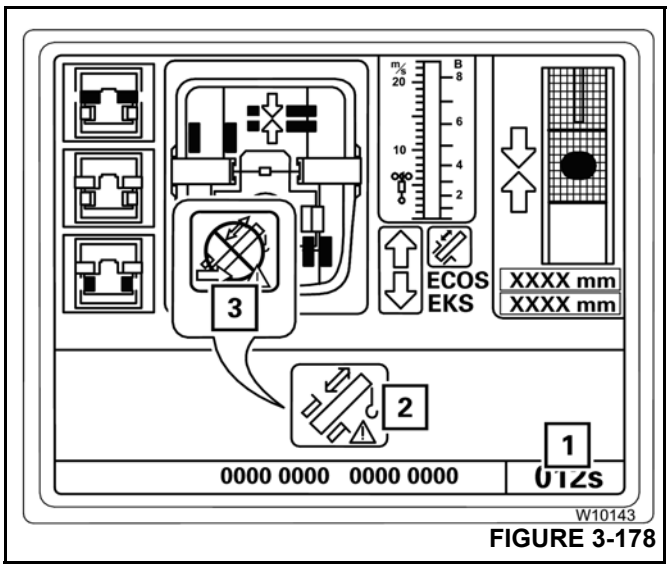


FIGURE 3-178

The emergency program is active if:

- The symbol (2) is displayed and
- the display (1) is shown; a time span of about 360 seconds elapses.

The telescoping mechanism can be operated with the emergency program within this time.

After this time has elapsed, the symbol (3) appears, and you need to restart the emergency program.

Determining the Type of Error

Refer to Figure 3-179.

CAUTION

Equipment Damage Hazard!

In emergency mode, there is no monitoring of prerequisites; functions are performed **immediately** after pressing a button.

Ensure you constantly monitor the status of the telescoping mechanism before you initiate locking or unlocking.

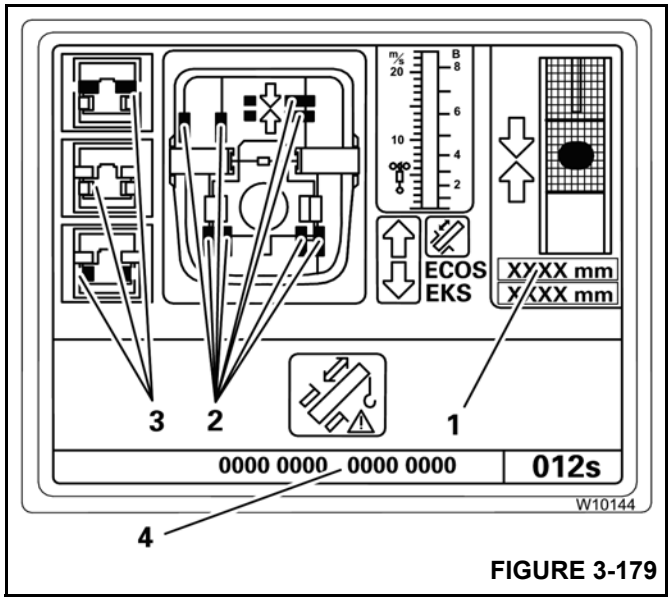


FIGURE 3-179

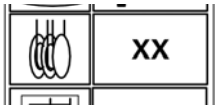
Check which emergency program procedure is suitable for the current error:

- If the display (1) shows no value, there is an error on the length indicator.
- If a symbol (2) is violet, there is an error on the proximity switch.
- The buttons next to the symbols (3) are active.

  After pressing the button, locking or unlocking is performed immediately.

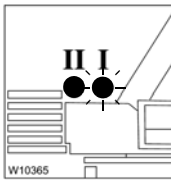
NOTE: Note down the error code (4) first if you intend to contact Crane Care before carrying out the emergency program.

7. In the reeving display, enter the quantity of reeved ropes of the auxiliary hoist on the boom extension.



8. Switch on the main hoist by pressing its switch on the right-hand controls.

   The ECOS indicator turns green. The auxiliary hoist indicator **II** remains on and the main hoist indicator **I** flashes.



9. Enter RCL code according to the Load Chart for the actual rigging mode of the crane with the rigged boom extension.

The RCL is now set for two-hook operation. It now takes into account:

- The reeving for the auxiliary hoist
- The *Load Chart* for the boom extension.

Stowing and Parking

WARNING

Tipping Hazard!

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

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

When parking, the crane should be left in the smallest, most stable, valid operational configuration that the job site practically allows, do the following:

1. Park the crane on a stable surface.
2. Remove the load from the hook.
3. Stow the swingaway boom extension, if erected.
4. Fully retract the boom and position it in the normal travel position or at least as far as is practical to make the crane as stable as possible, including, boom angle, superstructure orientation, jib angle, etc. In high winds the boom and jibs should be lowered or secured.
5. Engage the swing brake and/or swing lock pin.
6. Retract all jack cylinders and outrigger beams.
7. Apply the parking brake.
8. Put all operating controls in the neutral position.
9. Actuate the Crane Function switch.
10. Shut down the engine following the proper procedures specified in this manual and the applicable engine manual.
11. Remove the keys.

CAUTION

To avoid possible engine fault codes and undesirable operation, ensure the keyswitch has been off 2 minutes before disconnecting batteries.

12. Disconnect batteries, if machine will be inactive for over 24 hours.
13. Close and lock all windows, covers, and doors.

Unattended Crane

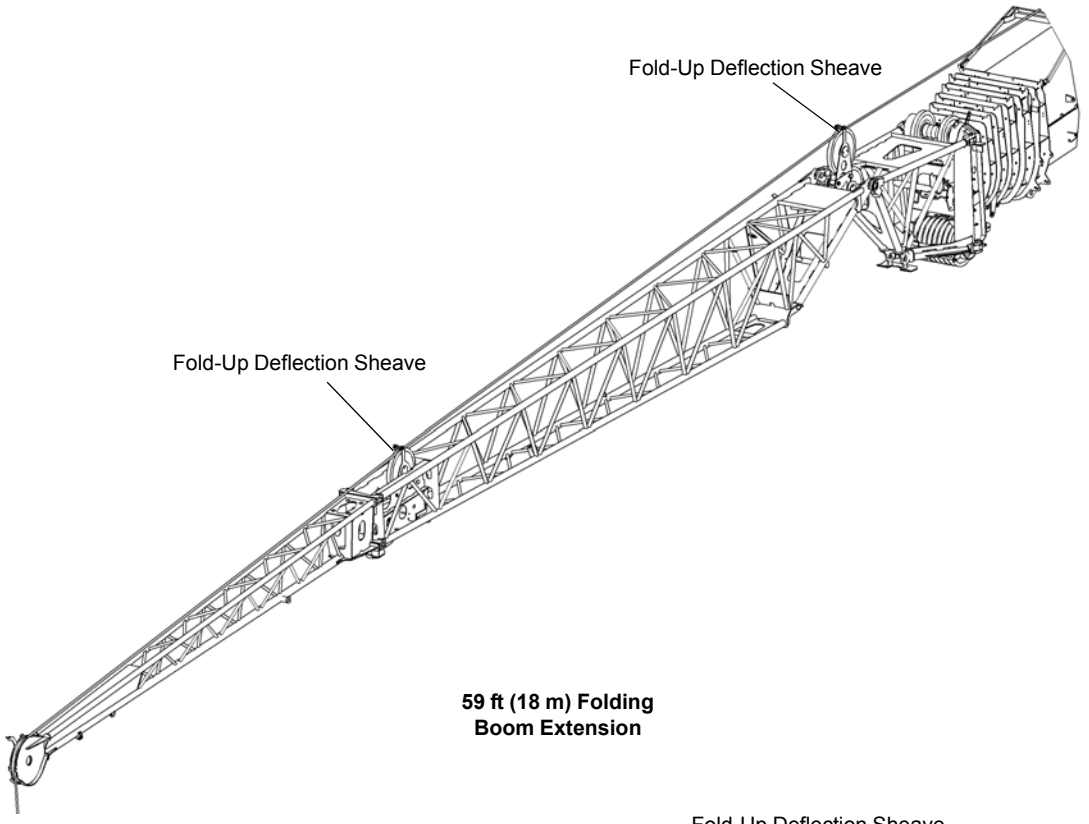
DANGER

Tipping Hazard!

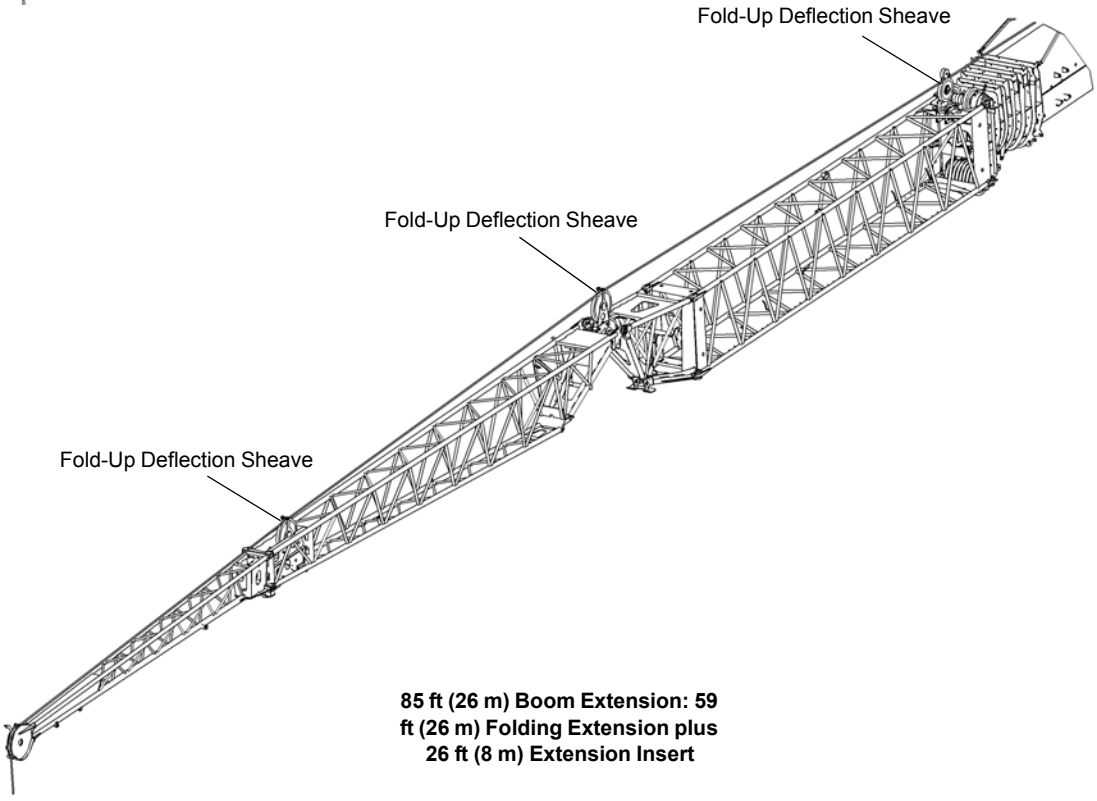
Changing weather conditions including but not limited to: wind, ice accumulation, precipitation, flooding, lightning, etc. should be considered when determining the location and configuration of a crane when it is to be left unattended.

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.



59 ft (18 m) Folding Boom Extension



85 ft (26 m) Boom Extension: 59 ft (26 m) Folding Extension plus 26 ft (8 m) Extension Insert

FIGURE 4-12 continued

4

OUTRIGGER REMOVAL AND INSTALLATION

DANGER!

Tipping Hazard

When lifting the outrigger box on rubber the machine may tip over. The boom must be fully retracted and limited to a 6 m (20 ft) maximum radius.

With one outrigger box installed the machine may become unstable. Do not swing over the end with the outrigger box already installed while installing the other outrigger box.

The boom angle must not be less than 35° when over sides of the machine; loss of stability will occur causing a tipping condition. To lower boom below 35° boom angle, boom must be swung over front or rear and RCL bypass activated.

Bleed Valve Operation

The manual pressure bleed-off valve (1) (Figure 4-19) is located on the back of the right rear fender. The purpose of the valve is to reduce the effort required to separate and connect the hydraulic quick disconnect couplers when removing or installing the front and rear outrigger boxes.

FIGURE 4-19

1. Shut off the engine.
2. Turn the handle counterclockwise to open the bleed valve.
3. Wait approximately 20 to 30 seconds.
4. As necessary, separate or connect the quick disconnects.
5. Immediately close the bleed valve.
6. Restart the engine if necessary.

Outrigger Box Removal

FIGURE 4-20

1. Remove the quick release pins (1) Figure 4-20 from the ends of each of the pinning cylinder rod ends.
2. Using the crane boom for the lifting operation, fasten lifting slings to the lifting lugs provided on each end of the outrigger box.
3. Lift the outrigger box enough to remove the pressure off of the ends of the pinning cylinder rod ends.

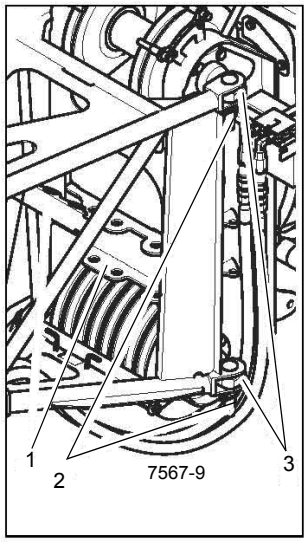


FIGURE 4-35

Erecting Procedure: 59 ft (22 m) Extension

The 59 ft extension includes the 36 ft extension with the 23 ft extension unfolded and attached to the nose of the 36 ft extension.

WARNING

Falling Hazard!

To prevent serious injury or death, do not stand on decking until extensions are secure.

1. Visually check to ensure all pins securing the extension are installed.

NOTE: The crane should be setup on outriggers using normal setup procedures. Refer to *Deploying the Outriggers, page 3-122*.

2. Retract and lower boom to horizontal for erecting over the front of the crane.
3. Attach a tag line (3) (Figure 4-37) at the front of the extension.
   a. Guide the tag line around the end of the extension and through the bracket (4) on the main boom and back again.
   b. If possible, have a helper hold the tag line tight while releasing the connections.
4. Release the spring latch (1) (Figure 4-36). Fold out the run-up rail (2) until the locking pin (3) engages the tab (4).

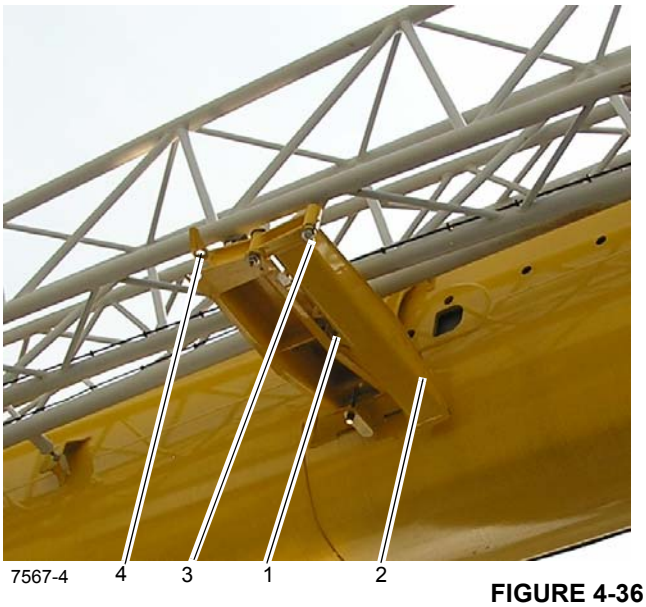


FIGURE 4-36

DANGER

Crushing Hazard!

Before disconnecting the rear pins, ensure the extension is secured with the tag line, is on the run-up ramp and attached at the front latch.

This will prevent extensions from falling when disconnected, causing death or serious injury.

5. Remove the retainer clip (1) (Figure 4-37) and pull the pin (2) out of connecting lug. Insert pin into holder and secure with retainer clip.

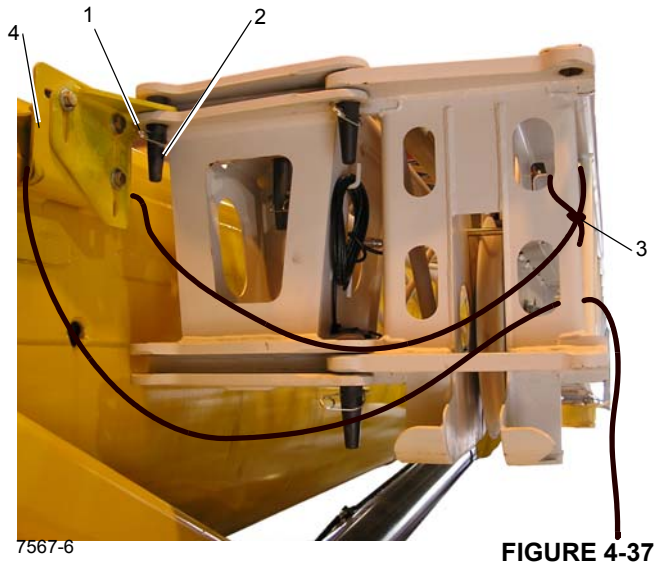


FIGURE 4-37

CAUTION

Risk of Damage to the Wire Rope!

Unreeve the hook block and lay the hoist cable beside the boom extension before you set the angle of the extension.

This prevents the cable from being damaged when the head of the extension is set on the ground.

Entering the RCL Code

Enter the RCL rigging code for the boom extension angle in accordance with the current rigging mode of the crane, refer to the *Load Chart, Chapter Remarks*.

When adjusting the angle without an auxiliary crane, you must enter an RCL rigging code, refer to *Entering the Rigging Mode, page 3-81*. The RCL rigging code depends on:

- the rigged outrigger span
- the rigged counterweight
- the working position.

The superstructure must be in a working position permitted by the *Load Chart* for the RCL rigging code that was entered.

Setting an Angle of 20° or 40°

This section assumes that the extension has been pinned in front of the main boom and the unreeved cable has been laid beside the extension.

1. Enter the RCL rigging code for the extension angle, refer to *Entering the Rigging Mode, page 3-81*.
2. Extend the main boom as far as is permitted for the RCL rigging code set, or as far as possible given the space available.
3. Lower the main boom until the lattice extension head touches the ground.
4. If the ground cannot be reached, you can incline the crane further, refer to *Inclining the Crane, page 4-39*.

NOTE: In the steps which follow, the extension head is pulled or pushed over the ground. Lay boards or similar under the skids on the extension head so that it is not damaged.

WARNING

Crushing Hazard!

If the extension is lowered onto timbers or some other structure to set the angle, keep in mind that as the extension is raised the extension head will slide towards the crane until the set angle is reached.

The extension could slip off an unsuitable structure, fold down and cause serous injury or death.

5. If necessary, relieve the load on the adjusting pin (1) (Figure 4-57) by lowering the boom slightly.
6. Raise or lower the main boom so the pin (1) can be inserted into the position for the angle required, refer to *Extension Angle Adjusting Mechanism, page 4-38*.
7. Raise the main boom slowly until the extension head is no longer touching the ground. The head of the extension will be pulled across the ground.
8. The extension will then be inclined by the angle set.
9. If you inclined the crane using the outriggers in order to set the angle, align it to the horizontal again.
10. Fully retract the main boom. While doing so, the lattice extension must not touch the ground; raise the boom as necessary.
11. Set down the head of the lattice extension on the ground.
12. If you inclined the crane using the outriggers, align it to the horizontal now so that the lattice extension sections can be folded more easily.

Inclining the Crane

In order to set the angle of the adjustable extension, you must set it down on the ground by extending and lowering the main boom.

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 head of the 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 rear outriggers and jack cylinders.
2. Fully extend the front outriggers.
3. Extend the front jack cylinders to raise the front wheels off the ground.

4. Stow the long hoses (1) (Figure 4-77) on the holders (2) provided.

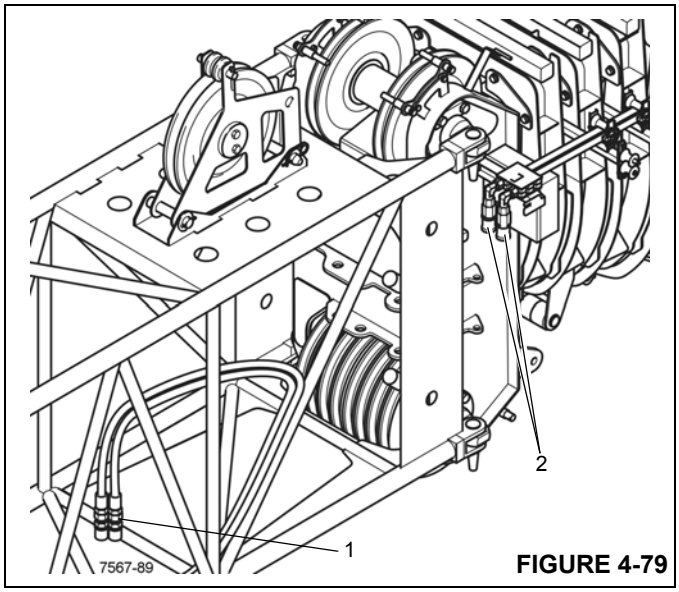


FIGURE 4-79

5. Disconnect the short end hoses (1) (Figure 4-79) from the 26 ft (8 m) extension from the boom nose connectors (2).

6. Install protective caps on the hose ends.

Folding the Deflection Sheave on the 26 ft (8 m) Extension

NOTE: For folding and unfolding the deflection sheaves on the 36 ft section refer to *Folding Deflection Sheaves, page 4-36*.

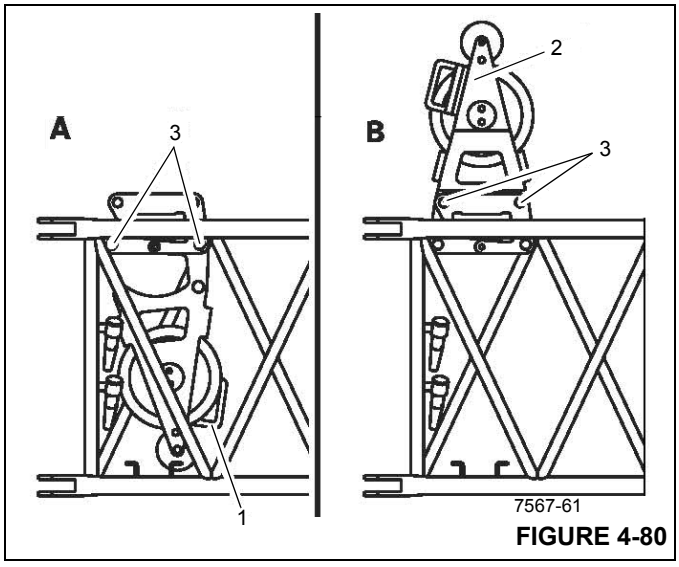


FIGURE 4-80

Folding Out the Deflection Sheave

1. Remove the retaining clips from the pins (3) (Figure 4-80).

2. Hold the deflection sheave by the handle (1) and pull out the pins (3).

3. Fold the deflection sheave up by the handle (1) and insert the pins (3).

4. Secure the pins using the retaining clips.

Folding In the Deflection Sheave

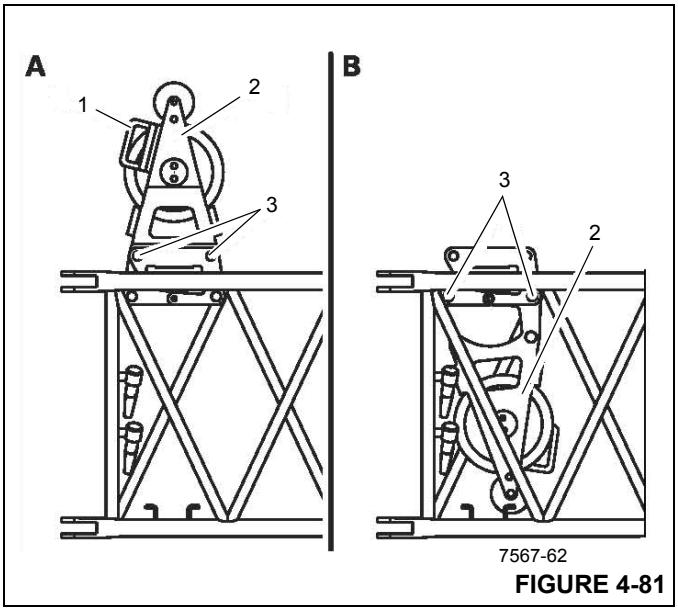


FIGURE 4-81

1. Remove the retaining clips from the pins (3) (Figure 4-81).

2. Hold the deflection sheave by the handle (1) and pull out the pins (3).

3. Fold the deflection sheave (2) downwards and fasten it in this position with the pins (3).

4. Secure the pins (3) using retaining clips.

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, i.e. weekly, monthly, etc.

All oil levels are to be checked with the crane parked on a level surface in transport position, tires on the ground, and the suspension set at the proper ride height.

Lubrication checks must be performed while the oil is cool and has not been operated within the past 30 minutes, unless otherwise specified.

On plug type check points, the oil levels are to be at the bottom edge of the fill plug hole. The hoists have an oil level indicator.

All grease fittings are SAE STANDARD unless otherwise indicated. Grease non-sealed fittings until grease is seen extruding from the fitting. 28 grams (one ounce) of EP-MPG equals one pump on a standard one pound (0.45 kg) grease gun.

Over lubrication on non-sealed fittings will not harm the fittings or components, but under lubrication will definitely lead to a shorter lifetime.

On sealed U-joints, care must be exercised to prevent rupturing seals. Fill only until expansion of the seals first becomes visible.

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 relubricate to ensure complete lubrication of the entire wear area.

CraneLUBE

Manitowoc highly recommends the use of CraneLUBE lubricants to increase your crane's reliability and performance. Contact your Manitowoc distributor for information about the Manitowoc's CraneLUBE lubrication program.

Safety

To lubricate many of the locations the engine will need to be started. After positioning areas of the crane for lubrication the engine must be turned off and the areas to be lubricated made stable before proceeding.

DANGER

Crushing Hazard!

Movement of the superstructure and the boom may create a crushing and/or pinching hazard. Failure to observe this warning could result in death or serious injury.

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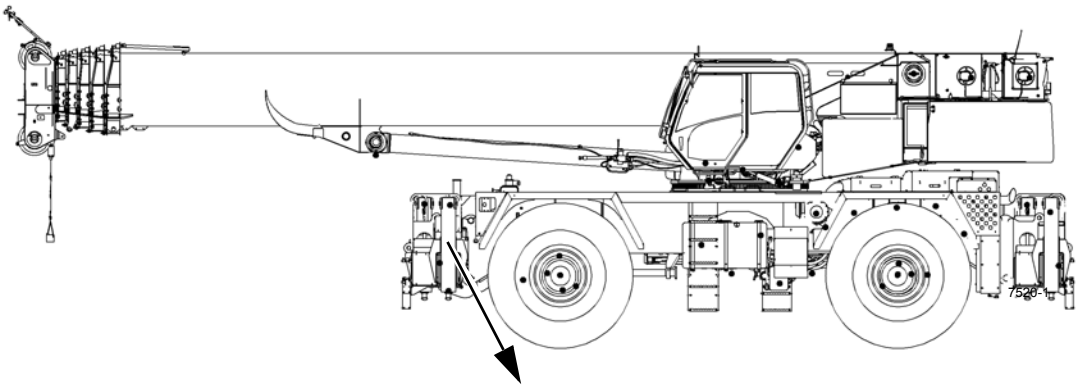

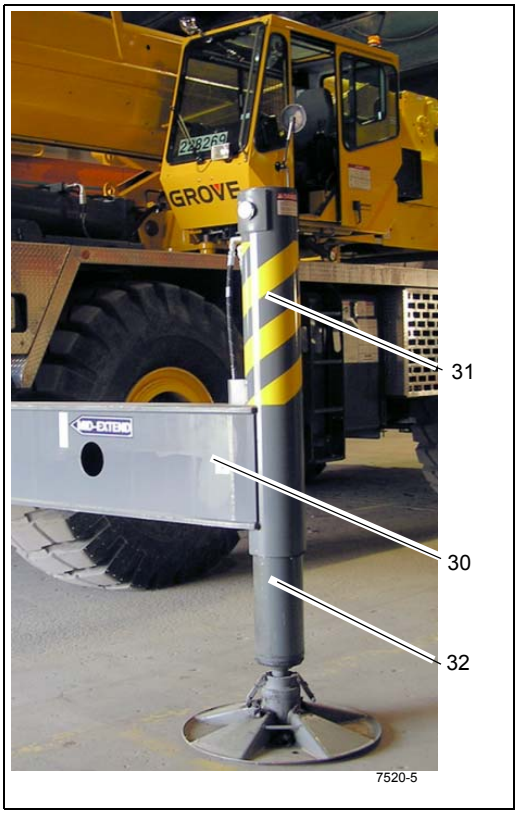

FIGURE 5-5

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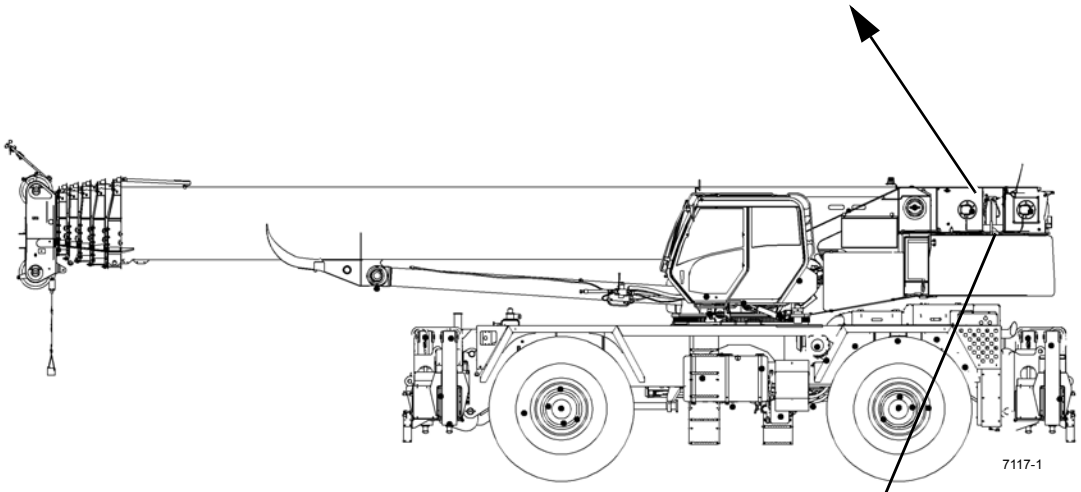

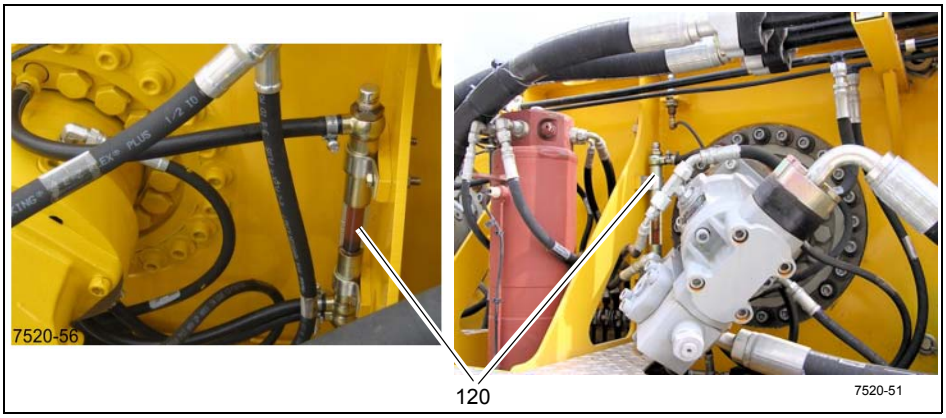

FIGURE 5-10

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