OPERATOR'S MANUAL

FOR THE

MANTIS™ MODEL 14010

70 TON DIESEL POWERED, HYDRAULICALLY-OPERATED CRAWLER CRANE

Manufactured by:

SpanDeck®

INCORPORATED

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1. Overview

The Mantis 14010 is a diesel-powered, hydraulically operated crawler crane. Its maximum load capacity is 70 tons at a 10' radius, depending on boom position and rigging.

The 14010 is operated from the crane operator's cab. This main operating station provides for operation and monitoring of all crane functions, including winch, boom, swing, and travel controls. All controls for normal crane operations are arranged in the standard configuration for crane operation.

DO NOT ATTEMPT TO OPERATE THIS EQUIPMENT UNTIL YOU READ AND FULLY UNDERSTAND ALL OF THE OPERATING INFORMATION IN THIS MANUAL.

FAILURE TO DO SO WILL CREATE A HAZARDOUS SITUATION THAT MAY RESULT IN SERIOUS INJURY, DEATH AND/OR EQUIPMENT DAMAGE.

Although the Mantis 14010 is simple to operate and care for, the operator must be thoroughly familiar with its operating controls and methods before starting any lifting work. Prior to operating the 14010, read and understand the information in this manual.

This machine uses a number of specialized controls and operator aids to enhance operation. Some of these devices may be unfamiliar to you. Your dealer, as part of his service, can explain any control or maintenance functions that are not clear.

The way you operate and maintain the Mantis 14010 for its first 100 hours will largely determine its useful life and freedom from unscheduled maintenance. This manual contains use and regular maintenance instructions for the 14010. Keep it handy, preferably in the operator's cab, and refer to it often.

Manual Organization

This manual is organized as follows:

1. Overview - describes the 14010 in general, lists general cautions for safe crane operation, and explains the crane's systems and the way its documentation is organized.
2. Dash/Control Panels - describes the operator controls.
3. Load Moment Indicator/Anti-Two-Block Control - describes the controls of the LMI/A2B unit.
4. Engine - describes the startup and shutdown procedures and routine checks necessary to make sure the engine is operating properly and to keep it operating reliably.
5. Winch/Auger System - describes the operation of the lifting winch and proper hoisting procedures for the 14010.
6. Boom Controls - describes the operation of the boom up/down and telescope in/out systems.
7. Swing System - describes the swing system and its operation.
8. Travel Controls - describes the operation of the 14010's travel controls.
9. Auxiliary Winch Control - describes the operation of the auxiliary winch system.
10. Tool/Auger Operation - describes the operation of the tool/auger hydraulic circuit controls.
11. Appendices - detail acceptable boom loads, routine maintenance, capacities and specifications, equipment filters, tips for proper operation in cold weather, diagram of crane reeving, proper procedures for mounting and removing counterweights, and a list of terms and abbreviations used in this manual.

Operator Alerts

This manual uses a number of alert levels to warn the operator about certain hazardous conditions. These alerts are listed below.

NOTE or WARNING

Indicates an operating or fault condition which may cause equipment damage if not corrected.

Indicates an operating or fault condition which is very likely to cause equipment or load damage.

Indicates a situation which will cause major equipment damage, operator injury or death.

Directional References

Crane Operations

When the words “right” and “left” designate direction in craning operations, they refer to the right- or left-hand side of the 14010 as viewed from the operator’s cab, no matter which direction the cab is facing.

Travel Operations

When the words “right” and “left” designate direction in travel operations, they refer to the right- or left-hand side of the 14010 as viewed with the operator cab facing forward (boom over the idler end of the undercarriage). If the cab is facing backward (boom over the drive end of the undercarriage), all travel control functions are reversed.

Always use caution when using the 14010’s travel controls as well as any other function.

Capacity Limits and General Conditions

The MANTIS 14010 Crane as manufactured by SpanDeck, Inc. meets the requirements of ANSI

B30.5c (1992) when specifically equipped. Structure and stability have been tested in accordance with SAE J1063 and SAE J765, respectively. Lifting capacities as determined by boom length, angle, or lifting radius apply only to machines as originally equipped by the manufacturer and in a properly maintained condition.

Capacities given are maximum covered by the manufacturer’s warranty and are based on a freely suspended load with no allowance for factors such as out-of-level operation, supporting surface conditions, hazardous surroundings, experience of personnel, etc.

The operator shall establish practical working loads based on prevailing operating conditions such as, but not limited to, those listed above. When making lifts where capacities may be within a zone limited by structural strength, the operator shall determine that the weight of the load is known within ± 10% before making the lift.

DO NOT lift a load without consulting the Load Chart.

Deductions from rated capacities must be made for the weight of the hook block, overhaul ball, slings, spreader bar, or other suspended equipment.

DEATH BY ELECTROCUTION MAY RESULT UNLESS THE OPERATOR MAINTAINS A MINIMUM OF 10 FT (3.3 M) BETWEEN ANY PART OF THE CRANE OR LOAD AND ENERGIZED ELECTRICAL LINES OF 50KV OR LESS.

FOR CLEARANCE FROM LINES GREATER THAN 50KV, SEE SAFETY MANUAL.

ALWAYS ASSUME ANY LINE IS ENERGIZED.

SIDE PULL ON THE BOOM IS EXTREMELY DANGEROUS AND MUST BE AVOIDED.

DO NOT EXCEED THE MANUFACTURER'S SPECIFIED MAXIMUM REEVING.

Load radius is defined as the horizontal distance from the axis of rotation to the center of the lifting device after load is applied.

Boom angle is the included angle between the longitudinal axis of the boom base section and the horizontal axis, after lifting the load. The boom angle before lifting should be somewhat greater than desired to account for boom deflection.

Boom angle/boom length relationships given in the load charts are an approximation of the resulting load radius. The radius should be accurately measured.

Boom height dimensions are measured from ground to center of lower boom head sheave.

It is permissible to attempt to telescope the boom with a load within the limits of rated capacities. However, boom angle, system hydraulic pressure, and/or boom lubrication may affect operation.

The 14010 utilizes a 3B6 unit which monitors crane load, boom position and boom angle to determine whether the 14010 is operating within its limits.

This unit also incorporates an "anti-two-block" control device to prevent the crane's lifting block from contacting the boom head sheaves. See Section 3, P.19, for details of 3B6 operation.

Lubrication and Maintenance

Proper and timely lubrication and service are essential for satisfactory performance of the 14010. Refer to the sections on lubrication and service in this manual.

Tighten all nuts, bolts, and hydraulic and electrical connectors on the 14010 after the first 100 hours of operation, and then periodically re-inspect them to make sure that everything remains tight.

At least once a month, do a thorough walk-around inspection of the crane. Finding and correcting minor problems before they become serious can prevent considerable downtime.

Protect against dirt - Before removing inspection covers, panels, filler caps, etc., from any part of the 14010, clean away all dirt around the opening. Keep all fuel and lubricants clean; use only fuel and lubricants that you know are clean. Keep all filler caps in place except when you are actually adding fluid and then replace them promptly.

If you experience any operating or service problems, contact your Mantis dealer or the factory immediately.

Standard Crane and Equipment

Boom

The boom consists of four full power sections, 37 ft 6 in (11.43 m) retracted and 111 ft 6 in (33.9 m) fully extended. Maximum tip height is 117 ft (35.66 m). The max tip height with the optional jib and extension is 167 ft (50.9 m).

Boom Telescoping & Elevating Systems

The elevating system features a cylinder and counterbalance lock valves which provide boom elevations from -1° to 78°. The telescoping system features a single double-acting hydraulic cylinder and counterbalance lock valves.

Boom Head

Seven 19” (483 mm) diameter, cast nylon sheaves on heavy-duty roller bearings are mounted in the boom head.

Load Moment Indicator & Anti-Two Block*

Standard Rated Capacity Limiter and Anti-Two Block system includes audible and visual warnings and function shutdown. The system's LCD screen provides a continuous electronic display of working boom length, boom angle, working load radius, tip height, parts-of-line (operator set), machine track configuration (operator set), relative load moment, maximum permissible load and actual load. The standard Work Area Definition audio and video warnings aid the operator in avoiding job-site obstructions by pre-setting and defining the work area. The anti-two block weight allows quick reeving of hook blocks and sends an audible alarm of imminent two-block conditions.

Superstructure

Frame

The frame is an all-steel, welded structure, precision machined to accept attachment of the boom and swing devices.

Operator's Cab

The fully-enclosed, air conditioned, all-steel modular cab includes a lockable swinging door, acoustical lining, anti-slip floor and tinted safety glass. Sliding windows are located in the cab door and cab boom side. A vent window is positioned in the rear of the cab. Grab bars and steps are appropriately located for easy access to the cab. Erectable swing barricades are attached to the superstructure.

Standard cab accessories include a two-speed windshield wiper, top glass wiper, defroster, heater, circulating fan, adjustable hand and foot throttles, six-way adjustable fabric seat with headrest, seat belt, dome light, and a dry-chemical fire extinguisher

Instrumentation and Accessories

Dash instrumentation features a tachometer, voltmeter, oil pressure gauge, temperature gauge, hour meter and fuel gauge. Indicators are provided for crane level, load moment, drum rotation, air filter restriction, and hydraulic oil temperature and filter restriction, engine oil pressure and temperature.

A 7 inch display monitor mounted inside the cab gathers input from two cameras allowing the operator a rear view from the counterweight and a view of the winches.

A termination switch is located in the seat and armrest and is capable of immediately disabling all hydraulic functions as the operator rises from the seat or it can be activated by lifting the left hand armrest.

Control

Two-way hydraulic joysticks mounted in the operator’s seat armrests control swing, auxiliary hoist, main hoist and boom hoist. Four two-way hydraulic foot pedals control travel; swing service brake and boom extend function.

Counterweight

The 30,000 lb (13,607 kg) counterweight system consists of two 15,000 lb (6,803 kg) pieces. Each can be removed and installed via a pendant attached to the boom.

Swing

The superstructure rotates 360° around a shear ball slew bearing with an external gear that matches with the swing drive pinion and bolts to the superstructure and the carbody. The hydraulic swing drive powers the system and consists of a gear motor driving into a planetary reducer with a shaft mounted pinion providing infinitely variable speeds of up to 3 rpm.

Swing braking is achieved through a “failsafe”, hydraulically released, spring applied, multi-disc wet brake which includes a foot applied service brake. The brake can be electrically actuated through a cab mounted switch into a “locked-on” (parking) mode. A two position house lock system is included. Regular lubrication of the bearing is achieved through a cab mounted grease applicator.

Fuel System

An 100 US gal (378.5 l) tank is bolted to the superstructure. The fuel filtration system consists of an inline fuel/water separator as well as an engine mounted fuel filter.

Hydraulic System

The load sensing, open-loop hydraulic system is served by two variable volume pumps mounted in tandem. The pumps are horsepower limiting providing a maximum output of 168 gpm (636 l/min) @ 2,200 rpm and maximum operating pressure of 4,850 psi (339.5 kg/cm²). An extra circuit is included for ready adaptation to hydraulic accessories.

The system includes two pilot operated valve banks that are pressure and flow compensated. The 300 US gal (1136 liter) capacity hydraulic oil reservoir has a spin-on filler-breather cap, external sight gauge, clean-out access and a sump type drain. An air to oil remote mounted cooler provides oil cooling with thermostatically-controlled, electrically driven fans. Hydraulic oil filtering is achieved with two 3 micron full flow cartridge type filters designed to return in-tank with bypass protection and an electronic bypass indicator.

System pressure test ports with quick disconnect fittings are provided for diagnostics.

Undercarriage

Carbody

The welded steel, box type carbody is fabricated with square axles to accept the crawler side frames. The top surface is precision machined to receive the swing bearing.

Side Frames

Two welded steel removable side frames are paired with a track group consisting of two top and thirteen bottom oil-filled & sealed rollers. Each frame includes an oil-filled, self-lubricating idler and spring type, track tensioning device. Standard track shoes are 36” (900 mm) wide, 3-bar semi-grousers. Optional shoes are available in 24” (609 mm) and 30” (742 mm) widths flat pad and semi grouser configurations. 30" flat pads are also available. The side frames extend and retract hydraulically and are electrically controlled from the cab.

Travel

Each side frame contains a pilot controlled, two-speed track drive. The drives are hydraulic piston motors which propel the crane at a low speed of 1.5 mph (2.4 km/hr) and at a high speed of 2.5 mph (4.0 km/hr).

The internal brake system is spring applied and automatically released upon actuation of the travel system.

The hydraulic travel system provides skid steering and track counter- rotation and achieves an unladed grade-ability of 59%.

Optional Equipment

Boom Attachments

• **Boom Extension**: 30 ft 0 in (9.1 m), lattice type swingaway that stores alongside of the boom base section and can be used with or without the optional 20 ft 0 in (6.1 m) jib. Head contains two 19 in (483 mm) diameter high strength cast nylon sheaves mounted on heavy duty roller bearings, reeving up to 2 parts of wire rope. With the extension deployed the maximum tip height is 140 ft (42.7 m)

• **Boom Jib**: 20 ft 0 in (6.1 m) lattice type swingaway, attaches to and stores alongside the extension and can only be used with the extension deployed. Offsets are at 15° & 30°. With jib and extension deployed the maximum tip height is 159 ft (48.5 m).

• **Auxiliary Boom Head**: Quick reeve, single 19 in (483 mm) diameter high strength, cast nylon sheave mounted on a heavy duty roller bearing boom tip adapter

• **Wire Rope**: Rotation Resistant, (non-spin,) Dyform-18HSLR

• **Headache Ball - 12 Ton (11 mt)**: ball includes a bottom swivel hook with a safety latch

• **Hook Block - 70 ton (63 mt)**: hook block consists of five 19 in (483 mm) diameter steel sheaves mounted on heavy duty roller bearings with a swivel hook and safety latch.

Hydraulic

• **Auger Ready Package**: includes hoses, fasteners and stowage bracket assembly mounted to the base section of the boom with a flow capability of 40 gpm.

• **Complete Auger Package**: adds a two speed auger motor/gear box and one 60 in (1524 mm) Kelly bar to the Auger Ready Package.

• **Tool Circuit**: provides 5 gpm (19 l/min) and 10 gpm (38 l/min) at 2,500 psi (176 kg/cm²) through a 50' (15.24 m) twin hose reel with quick disconnect fittings to operate open center tools.

Other Options

• **Crane Cab Access Walkways:** a pair of 54.5 in (1.38 m) wide x 25 in (635 mm) deep walkways which attach to both the front and rear of the carbody and allow for easier egress and ingress to the operator's cab when the crane's upper rotating frame is not aligned front to rear.

• **Model WP750 Work Platform**: 36" x 72" (914 mm x 1828 mm), all-steel, welded, two-person platform with a maximum capacity of 750 lb (340 kg). Test weight and boom head adapters are included in the package. Operation and control are by the crane operator from the cab. Radio (RF) controls to enable remote operation from the platform are available.

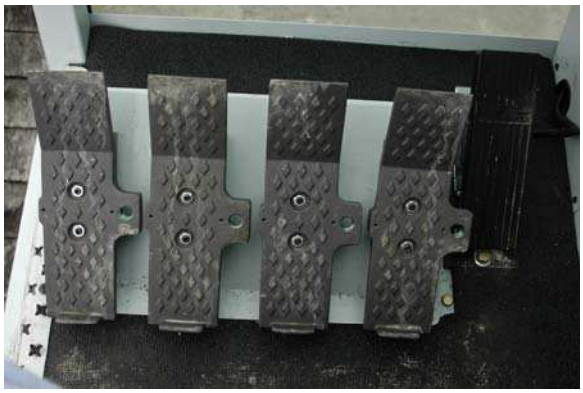
(See separate **WP750 Specification** for a complete description of standard and optional **Work Platform** equipment)

2. Dash/Control Panels

The 14010's operator controls are grouped into nine main functional groups as follows:

- Engine Controls
- Auxiliary Equipment Controls
- Other Operator Controls
- Load Moment Indicator/Anti-Two-Block System
- Swing Right/Left Controls
- Telescope Out/In Control; Auxiliary Winch Control
- Main Winch Lower/Raise Control
- Boom Hoist Raise/Lower Control
- Travel Controls; Tracks Extend/Retract Switch

The illustrations on this page show the layout of the 14010's control panels.



Engine Controls

The View-Tech HC106 is equipped with complete Engine Control and Monitoring, and Hydraulic Monitoring. Electronic information gathered from the engine is delivered to the screen in the form of five gauges. The screen also displays eight warning lights relative to engine and hydraulic monitoring, some of which are associated with the five gauges.

The following are electronic engine controls displayed from the View monitor:

Tachometer Ⓐ

This gauge is positioned in the center of the View's engine information screen indicating the engine rotation speed. The operator can set the engine RPM from the engine information screen by pressing and releasing the F3 pushbutton to engage the "off or idle" engine setting. The operator may then press F1 to increase or F2 to decrease the RPM on the View's monitor.

Battery Ⓑ

This gauge is positioned in the left bottom corner of the View's engine information screen indicating the condition of the 14010's electrical system by displaying the battery voltage. Proper operation is indicated by a reading from 12-15 volts. Readings outside this range indicate a problem with one or more electrical system components.

Engine Oil Pressure Ⓒ

This gauge indicates the engine oil pressure and is located in the upper left quadrant of the View's screen. Proper pressure may vary between 35 and 70 PSI depending on engine and outside temperature, load, and engine speed.

There is a warning light associated with this gauge. If this light becomes illuminated the operator should stop the engine as soon as possible and determine the cause and corrective action prior to restarting the engine.

Water Temperature Ⓓ

This gauge is located in the top right quadrant of the View's screen and indicates engine coolant temperature (water-cooled engines) or cylinder head or oil temperature (air-cooled engines). For water-cooled engines, this gauge should read between 160 and 205°F once the engine has reached operating temperature. Readings outside this range indicate low coolant level (water-cooled engines only) or a problem with one or more cooling system components.

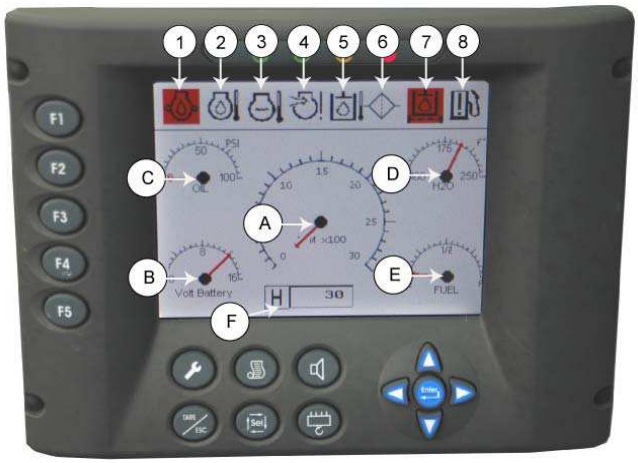
There is a warning light associated with this gauge. This light illuminates to indicate that the engine temperature is too high. If this light becomes illuminated the operator should stop the engine as soon as possible and determine the cause and corrective action prior to restarting the engine.

Fuel Level Gauge Ⓔ

This gauge indicates the fuel remaining in the fuel tank.

Engine Hour Meter Ⓕ

This gauge indicates the engine hours accumulated on the engine.



Engine Controls

Warning Lights: (Located across the top of the View screen)

Engine Oil Pressure ①

This warning light is associated with the ***Engine Oil Pressure gauge***. If this light becomes illuminated indicating low oil pressure the operator should stop the engine as soon as possible and determine the cause and corrective action prior to restarting the engine.

Engine Oil Temperature ②

This warning light will illuminate indicating the engine oil temperature is too high.

Engine Water Temperature ③

This warning light is associated with the ***Engine Water Temperature gauge***. If this light becomes illuminated indicating high water temperature the operator should stop the engine as soon as possible and determine the cause and corrective action prior to restarting the engine.

Air Filter Alert ④

This indicator illuminates to indicate that engine combustion air flow is restricted and the filter needs to be serviced.

Hydraulic Oil Temperature ⑤

This light illuminates to indicate that the hydraulic oil temperature is too high. If the warning light comes on the operator should begin troubleshooting by retracting and lowering the boom allowing cooler oil to filter back into the system.

Pilot Filter Status ⑥

This light illuminates to indicate that the pilot oil filter (for component control systems such as joysticks, foot pedals, etc.) needs to be serviced.

Hydraulic Filter Alert ⑦

This light illuminates to indicate that the return filters in the dirt box need to be serviced.

Water in Fuel ⑧

This light illuminates to indicate there is excess water in the fuel water separator. If the warning light come on the operator should first open the petcock at the bottom of the filter element housing, draining the water. If the light remains illuminated the filter element should be serviced.

Ignition Acc./Off/On/Start

Start Switch Ⓐ

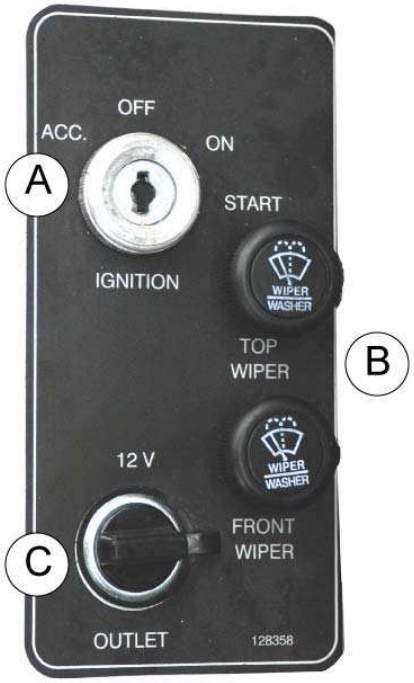
This key-operated rotary switch controls starting and stopping of the engine. See Engine Operation, P.30, for starting and stopping instructions.

Windshield Wiper & Washer Controls Ⓑ

The rotary switch selects low or high speed operation of the windshield wiper or turns it off. Additionally there is a wiper located on the top roof glass. Pressing the switch will squirt fluid on the corresponding windshield.

12V Outlet Ⓒ

This 12V outlet is available to the operator for usage of cell phone charger, PC charger, etc.



Foot Throttle Ⓓ

This pedal controls engine speed; pushing the pedal down increases speed, releasing it decreases speed.

This control does not override the setting of the **F3 Pushbutton** Throttle control (see P. 25). If the operator wishes to control the engine speed with the Foot Throttle, the F3 Pushbutton must be set to the 'Idle' position.

See Engine Operation, P.33, for guidelines on proper engine speeds under various operating conditions.

Swing Right/Left Controls

NOTE:

Speed of operation of the Swing System is directly proportional to engine speed and control lever displacement.

Swing Control/Horn Button Ⓐ

This lever controls the Boom Swing function. Pushing the lever forward swings the boom right and pulling it backward swings the boom left.

The button at the top of this control lever sounds the warning horn when depressed.

Swing Brake Pedal Ⓑ

This pedal engages the swing brake when pushed forward (toe down) and releases it when the pedal is released.

DO NOT REST YOUR FOOT ON THE SWING BRAKE PEDAL.

Swing Brake Switch Ⓒ

This rocker switch engages (ON) or disengages (OFF) the swing park brake.

CAUTION

NEVER ENGAGE THE SWING PARK BRAKE WHEN THE SWING IS IN MOTION.

Telescope Out/In Controls

Boom Telescope Control Lever (A)

For cranes *not* equipped with the optional auxiliary winch, this lever controls the boom telescope function; pushing it forward extends the boom and pulling it backward retracts the boom.

Boom Telescope Pedal (1)

NOTE:

This pedal is not present on cranes without the auxiliary winch option.

For cranes equipped with the optional auxiliary winch, this pedal controls the boom telescope function; pushing it forward (toe down) extends the boom and pushing it backward (heel down) retracts the boom.

Auxiliary Winch Control (Option)

Auxiliary Winch Control (B)

This lever controls the auxiliary winch; pushing it forward lowers the hook block and pulling it backward raises the hook block.

Speed Range Button/"Thumb Thumper" (C) (Optional)

As standard equipment for cranes equipped with the optional auxiliary winch, this button, at the top of the Auxiliary Winch control lever, selects either the low (button not depressed) or high (button depressed) range of auxiliary winch rotation.

If the crane is equipped with the optional "Thumb Thumper" indicators for winch rotation, this button vibrates whenever the auxiliary winch is rotating.

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Main Winch/Boom Hoist Controls

NOTE:

Speed of operation of the Winch and Boom Hoist Controls is directly proportional to engine speed and control lever displacement.

Main Winch/Auger Control Ⓐ

When the AUGER/VIBRO On/Off switch (See Auxiliary Equipment Controls, P.17) is off, this lever controls the main winch: pushing it forward lowers the hook block and pulling it backward raises the block.

Speed Range Button Ⓑ

This button, at the top of the Main Winch/Auger Control lever, selects either the low (button not depressed) or high (button depressed) range of Main Winch rotation speed.

Speed Range Button Ⓓ

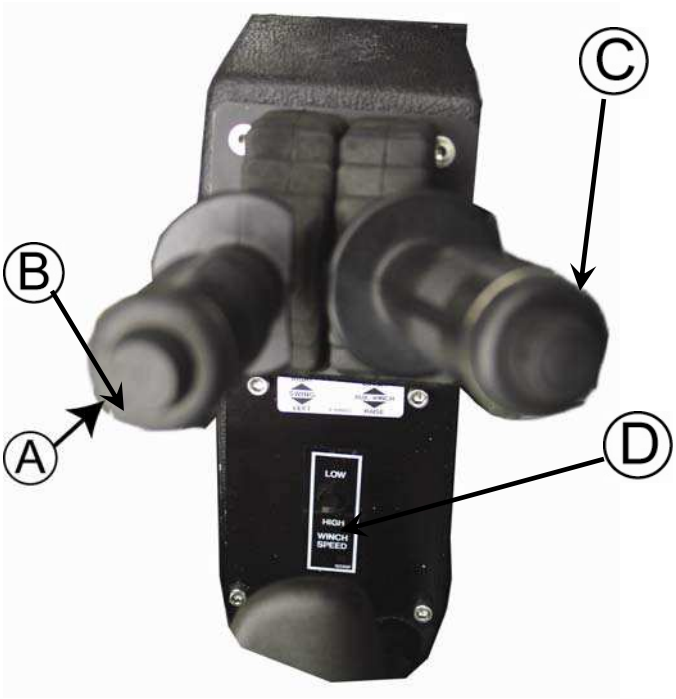
Cranes equipped with an Auger, the controls the Auger rotation speed by selecting either the low speed (button not depressed) or high speed (button depressed).

For cranes equipped with the optional “Thumb Thumper” indicators for winch rotation (see P.13), auger speed range is selected by the Auxiliary Winch Speed Range switch located on the lower panel of the left-side operator console.

If the 9010 is equipped with a Vibro hammer instead of an auger, the speed range button or switch has no function when the AUGER/VIBRO switch is on.

Boom Hoist Raise/Lower Control Ⓒ

This lever controls the Boom Hoist function. Pushing the lever forward lowers the boom; pulling it backward raises the boom.

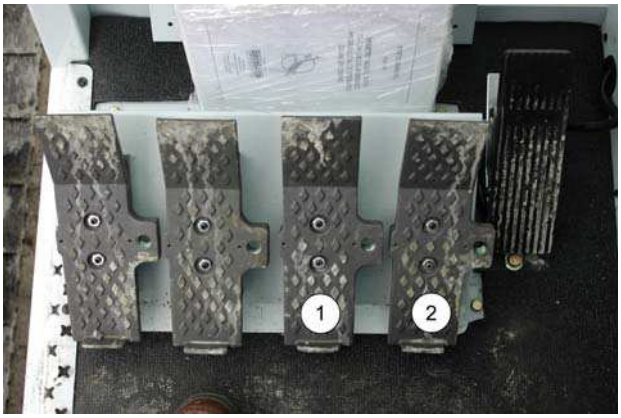


Travel Controls

Left ① /Right ② Track Forward/Track Reverse Pedals

These pedals control the track motion. Pushing either right or left pedal forward (toe down) moves its track forward; pushing either pedal backward (heel down) moves its track backward.

Travel speed is proportional to engine speed and pedal displacement.



Speed High/Low Switch Ⓐ

This rocker switch selects either high (2.5 mph, 4.0 km/h) or low (1.5 mph, 2.4 km/h) travel speed.

Travel Brake On/Off Switch Ⓑ

This rocker switch engages (for crane operation) or disengages (for crane travel) the travel brake.

CAUTION

OPERATOR CAB ORIENTATION AFFECTS THE OPERATION OF THE TRAVEL FUNCTIONS. SEE DIRECTIONAL REFERENCES, P.2.

Tracks Extend/Retract Switch Ⓒ

This rocker switch controls the position of the crane's tracks. The switch is spring-loaded to the center position.

When the switch is pushed toward extend, the tracks move to their wide (18.66 ft, 5.69 m*) configuration for lifting. When it is pushed toward retract, the tracks move to their narrow (12.5 ft, 3.81 m*) configuration for travel or transport.

DANGER!

NEVER LIFT LOADS WITH THE 14010 UNLESS THE TRACKS ARE FULLY EXTENDED (UNLESS SPECIFICALLY ALLOWED BY A "TRACKS RETRACTED LOAD CHART.")

DANGER!

THE OPERATOR MUST ENSURE THAT NO PERSONNEL ARE NEAR THE 14010'S TRACKS BEFORE ENGAGING THE TRACKS EXTEND FUNCTION.

* Overall widths listed above are for the 14010 as equipped with 36" (0.914 m) tracks. Fitting wider or narrower tracks will change these dimensions.

Auxiliary Equipment Controls

Tool High/Off/Low Switch (Option) ①

This rocker switch selects either high (37.8 l/min, 10 GPM) or low (18.9 l/min, 5 GPM) hydraulic fluid volume for the optional tool connector ports or turns the ports off.

Auger/Vibro On/Off Switch (Option) ②

This rocker switch turns pressure to the auger/vibro connection ports on or off to control auger/vibro operation.

Auger Latch Open/Closed Switch (Option) ③

This rocker switch engages or disengages the latch that holds the auger in stowed position.

Other Operator Controls

Hydraulic Cooling System

Auto/Manual Switch ①

This rocker switch selects between thermostatically-controlled (AUTO) and continuous (MANUAL) operation of the hydraulic cooling system. Under normal operation, this switch should be left in Auto. However, the operator may override this automatic operation at any time by switching to Manual.

Circulating Fan Hi/Med/Low Switch ②

This rotary switch selects high, medium, or low speed operation of the circulating fan motor or turns it off.

Heater /Off/AC Switch ③

This rotary switch selects heat, off or air conditioning operation. **There are two water control valves mounted on the engine block that must be turned off/on to restrict or allow hot water to flow through the cab heater. If the A/C is on the water flow to the heater should be turned off to achieve maximum cooling. If Cab heat is desired the water flow to the heater should be turned on to achieve maximum heat.**

Temperature Switch ④

This rotary switch is used for both the heat and air conditioning modes of operation. Turning to the “Cool” position will cool down the cab in the AC mode, whereas the “Hot” position will heat the cab in the Heat mode.

Battery Cutoff Switch

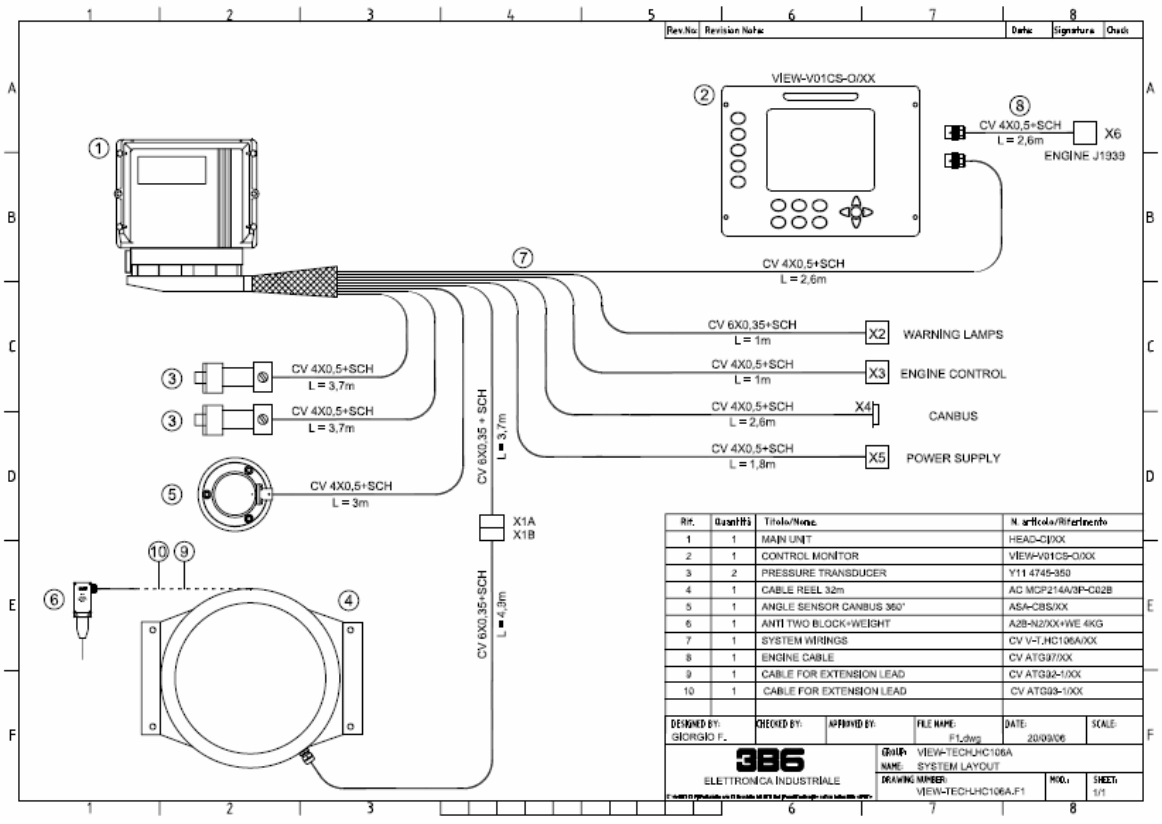
This switch, located in the battery compartment, selects the connection between the 14010’s batteries and electrical system. The operator may connect or disconnect either or both batteries.

For normal operation, both batteries should be connected.

Whenever the crane is left unattended, the operator should turn this switch to off and lock it in this position.

3. ViewTech HC106 (Rated Capacity Limiter 3B6) System

System Layout



View Tech Display

Ref.	Icon	Description
1		Working data display (3 display pages for data)
2		Two Green lights indicating safe operating condition
3		Yellow light indicating pre alarm condition
4		Red light indicating the Overload/A-2-B condition
5	F1	Function pushbutton to Increase Engine RPM
6	F2	Function pushbutton to Decrease Engine RPM
7	F3	Function pushbutton for Engine RPM Off, ISC1 and ISC2
8	F4	Function pushbutton Change Program or Operating Mode
9	F5	Function pushbutton Change Program or Operating Mode
10	Enter	Confirm an action (operating mode, procedure, limit)
11		Scroll up inside the menu in calibration mode
12		Scroll down inside the menu in calibration mode

13		Increase menu / list (operating mode) Calibration mode
14		Decrease menu/list (operating mode) Calibration mode
15		Part of Line Selection
16		Disable audible alarm
17	Sel	Operational in Calibration Mode only
18		Changing Display view or page
19	TARE ESC	Deletes the alarm messages on the display
20		Wrench button to enter the calibration menu. In order to have access and configure the system, the user must scroll up to the operating page. The function is available only if provided with the password

System Startup

The View-Tech HC106 is equipped with multiple pushbutton functions and display pages to indicate and control the machine RPM and machine condition information such as, RCI, Engine and Level/Slope condition. The View display will automatically power up once the machine is started. The unit will indicate the software version and a self test.

The display will briefly indicate the RCI screen and then go directly to the engine screen for engine data.

Once the engine data has been reviewed by the operator, press and release the page pushbutton to check the level of the machine. Press and release the page pushbutton again to set up the RCI.

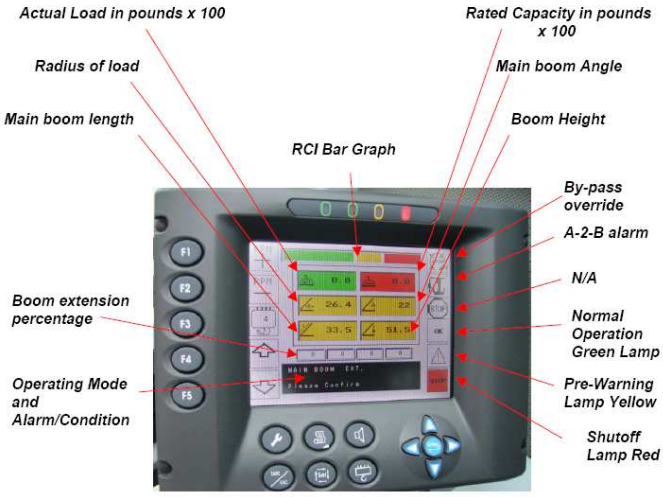
The display will change to the last selected program and part of line in a shut off condition (Red Stop Symbol and Red Light). If the selected program is correct, confirm by pressing and releasing the **ENTER pushbutton.** The system will reset in a normal operational condition.

Pushbutton Functions in RCI screen Operating Mode

The View-Tech HC106 is equipped with multiple pushbutton functions and matching icon for that function to operate the system. These pushbuttons perform the following functions in the RCI screen page. The Hook block icon works with the hook block pushbutton to change the parts of line.

Press and release the pushbuttons to select the functions or change the function. System Selection of Program, Parts of Line, Engine RPM settings, and confirmation is on page 25.

View RCI Display Information



System Selection of Program, Parts of Line, Engine RPM settings, and confirmation is on page 25.

View Engine and Warning Lamps Screen Information

Page Press and release the Page pushbutton to change the display/page.

The View-Tech HC106 is equipped with complete Engine Control/Monitoring and Hydraulic monitoring. The system will indicate different lamps when a condition occurs. This display page replaces the traditional mechanical gauges on the dash and intergraded within the display.

System Selection of Program, Parts of Line, Engine RPM settings, and confirmation on page 25.

View Slope and Leveling Screen Information

The View-Tech HC106 is equipped with a leveling and slope condition of the machine relative to the upper of the machine. When the machine is level the screen will indicate. Just the outline of the range, when green blocks are present, this indicates the degree out of, level.

All Relative RCI data is present on the right hand side of the screen.

Press and release the Page pushbutton to change the display/page.

System Selection of Program, Parts of Line, Engine RPM settings, and confirmation is on page 25.

Program/Operating Mode selection

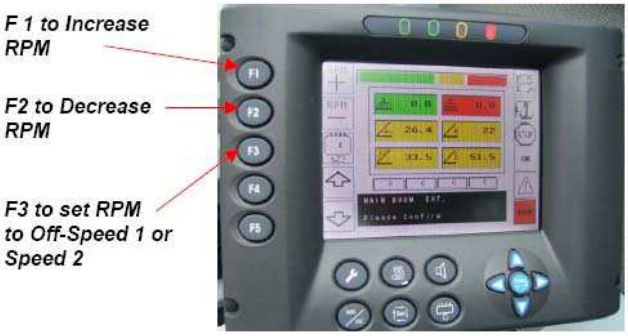
Once the display has completed the start-up process the display will change to the RCI operating page. To change the program/operating mode to the proper machine configuration press and release the **F4 or F5 pushbuttons** until the proper program/operating mode is selected, then press and release the **ENTER pushbutton** to confirm.

Part of Line Selection

Press and release the **Hook Block pushbutton** to change the part of line. The **Hook block Icon** will indicate what part of line is selected to conform press and release the **ENTER pushbutton** to confirm.

Engine RPM Selection

To set the engine RPM, press and release the **F3 pushbutton** for the “Off” (idle), ISC1 (speed1) and ISC2 (speed2)**.** The F1 (increase +) and **F2** (decrease -) pushbuttons are inoperable until the engine setting has been selected to either ISC1 (speed1 or ISC2 (speed 2) settings.



Engine Data

Press and release the Page pushbutton to change the display/page. The F1, F2 and F3 pushbuttons are active in this display page to set the Engine RPM and increase and decrease.

Note:

The F1, F2 and F3 pushbuttons are inactive when system is in the Calibration mode.

Alarm Message Reset

In the event there is a component failure within the system, a fault code is displayed. After the repair of the fault condition, the system must be cleared of the fault alarm by pressing and releasing the **Tare/ESC pushbutton**.

Tare/ESC pushbutton
To Clear Alarm messages

Program/Operating Mode
Alarm/Warning message

Engine alarms

The Mantis 14010 uses the Cummins QSB240 and if any engine alarms are detected by the system the RCI page will automatically change to the Engine page for detecting what alarm Icon is faulted in Red. If the page is changed it will change again back to the engine page for fault detection and continue every 20 seconds, until the fault is corrected.

Icon	Description
STOP	It indicates the RCI by pass key switch override(icon will turn red when active)
	It indicates the A-2-B limit switch status (A-2-B condition icon will be turn red)
STOP	N/A
OK	It indicates the machine is in the normal working condition (green)
!	It indicates the machine is in the pre-alarm working condition (90%) (yellow)
STOP	It indicates the machine is in the Shut off working condition (100%) (red)
	Indication of the Load percentage bar
Act	Indication of the actual load. Value in pounds x 100
MAX	Indication of the maximum load (Rated Capacity)

R	Indication of the main boom's radius. Value in meters or feet
A	Indication of the main boom's angle. Value in degrees
L	Indication of the main boom's length. Value in meters or feet
H	Indication of the height from the ground. Refer to the "head of the boom". Value in feet
0	It indicates the boom extension of the main boom. Value in %
Alarm:	Indication of the Alarm code that its present at the moment
Code:	Indication of the number of operative mode
	Engine Oil Pressure Warning Light
	Engine Oil Temperature warning light
	Engine Water Temperature warning light

	Air Filter Warning Light
	Hydraulic Oil Temperature Warning Light
	Pilot Filter Warning Light
	Hydraulic Oil Filter Warning Light
	Water Fuel Warning Light)
	Increase Engine RPM (F1 pushbutton)
	Decrease Engine RPM (F2 pushbutton)
	Parts of Line Selection (Hook Block pushbutton) number selected is inside icon
	Increase Program/Operating Mode (F4 pushbutton)
	Decrease Program/Operating Mode (F5 pushbutton
	Mantis Crane Logo

Table 1: Alarm/Fault Codes

Message	Cause	Solution
ALARM 6 Length output too Low	-Potentiometer inside Reel is faulty -Possible lack of continuity in wires carrying the signals -Fault in main unit.	-Check Wiring from cable reel to Head Unit -Check 5vdc supply to length pot in cable reel -Replace pot if damaged -Call service

Table 1: Alarm/Fault Codes

ALARM 7 Length output too High	- Potentiometer inside Reel is faulty - Possible lack of continuity in wires carrying the signals - Fault in main unit.	- Check Wiring from cable reel to Head Unit - Check 5vdc supply to length pot in cable reel -Replace pot if damaged -Call service
ALARM 8 Length output actual too low	-Potentiometer inside Reel is faulty -Possible lack of continuity in wires carrying the signals -Fault in main unit	-Check Wiring from cable reel to Head Unit -Check 5vdc supply to length pot in cable reel -Check output or cable reel -Replace pot if damaged -Call service
ALARM 12 Piston Pressure Sensor output too Low	-Piston pressure transducer broken -Possible lack of continuity in connection wires -Fault in main unit	-Check for 15vdc supply -Check for output 0.5 Vdc min -Check connection wires -Check insertion of connector on transducer and wiring -Replace Transducer if faulty -Call service

Table 1: Alarm/Fault Codes		
ALARM 13 Rod Pressure Sensor output too Low	-Piston pressure transducer broken -Possible lack of continuity in connection wires -Fault in main unit	-Check for15vdc supply -Check for output 0.5 Vdc min -Check connection wires -Check insertion of connector on transducer and wiring -Replace Transducer if faulty -Call service
ALARM 15 Angle output too Low	-Angle Sensor inside Reel is faulty -Possible lack of continuity in wires carrying the signals -Fault in main unit	-Check Wiring from cable reel to Head Electronic -Check 5vdc supply to angle sensor in cable reel -Check output or cable reel winding -Replace angle sensor if faulty -Call service
ALARM 22 Piston Pressure Sensor output too High	-Piston pressure transducer broken -Possible lack of continuity in connection wires -Fault in main unit	-Check for 15vdc supply -Check for output -Check connection wires. -Check insertion of connector on transducer and wiring -Call service

Table 1: Alarm/Fault Codes		
ALARM 23 Rod Pressure Sensor output too High	-Piston pressure transducer broken -Possible lack of continuity in connection wires -Fault in main unit	-Check for 15vdc supply -Check for output -Check connection wires. -Check insertion of connector on transducer and wiring -Call service
ALARM 25 Angle output too High	-Angle Sensor inside Reel is faulty -Possible lack of continuity in wires carrying the signals -Fault in main unit	-Check Wiring from cable reel to Head Electronic Check 5vdc supply to Angle Sensor in cable reel -Check output or cable reel winding -Replace Angle Sensor if faulty -Call service
ALARM 56 EEPROM View	-Memory problem in View Display	-Call service
ALARM 190 Head Communication	-Error in comm.	-Check connection wires. -Check insertion of connector on display -Call service
ALARM 191 ASA Slope Sensor	-No Communication between ASA Slope Sensor and Head Unit	-Check connection wires. -Call service

Auto Diagnostic

Hydraulic Pressure Data

Starting from the main RCI screen, press and release the **ENTER pushbutton**. The Program/Operating area will indicate the piston pressure values. When raising the boom PLact should increase in value.

- PLadc: Value (bit) directly from the pressure sensor

- PLact: Value of the pressure on the bottom side

Press and release the **RIGHT ARROW pushbutton**. The display will indicate the Rod pressure values. When raising the boom PHact should stay relatively stable at the value displayed.

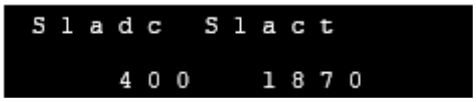
- PHadc: Value (bit) directly from the pressure sensor

- PHact: Value of the pressure on the rod side

Continuing to press and release the RIGHT ARROW pushbutton will allow viewing of other system data information for troubleshooting. To return to the main RCI screen, press and release the TARE/ESC pushbutton.

Length and Angle Data

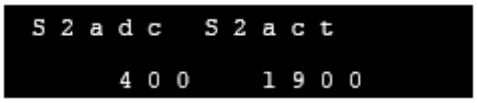
Press and release the **RIGHT ARROW pushbutton** the display will indicate the length (S1) values.



- S1adc : Value (bit) directly from the potentiometer of the Length 1
- S1act: Value (centimeters) of the main boom length

Press and release the **RIGHT ARROW pushbutton** the display will indicate the length (S2) values.

This feature is not utilized on the HC106 system.



- S2adc : Value (bit) directly from the potentiometer of the Length 2
- S2act: Value (centimeters) of the main boom length

Press and release the **RIGHT ARROW pushbutton** the display will indicate the main boom angle (A1) values.

- A1adc : Value (bit) directly from the angle sensor
- A1act: Value (degree x 10) of the main boom angle

Digital Sensor Inputs

Press and release the **RIGHT ARROW pushbutton,** the display will indicate the digital input s. if an asterisk is present, the input is active. If the asterisk is not present the input is inactive.

Digital Sensor Outputs

Press and release the RIGHT ARROW pushbutton the display will indicate the digital output s. if an asterisk is present, the input is active. If the asterisk is not present the output is inactive.

External Components

Press and release the **RIGHT ARROW pushbutton** the display will indicate the external component values.

- HEAD: counter control value for the Head unit. The value will count to indicate the head is active.
- ENCODER: This feature is not used on the HC106 system.

Language Setting

Starting from the main RCI screen, press and release the **Wrench pushbutton**. The display will change to the Language menu.

Press and release the **ENTER pushbutton,** the display changes to allow a new selection of the language. Then press and release the LEFT and RIGHT ARROW to move the asterisk over the value to change it.

Press and release the **UP or DOWN pushbutton** to select the proper language number.

To confirm this setting press and release the **ENTER pushbutton**.

Language settings

0 = English

1 = Spanish

2 = French

3 = Italian

4. Engine Operation

Alarm Systems

The Mantis 14010 uses the Cummins QSB240 diesel engine with an integral hydraulic pump to provide power for all machine functions.

The 14010 incorporates a number of alarm systems to protect the engine from abnormal operating conditions.

These alarm systems provide a visual warning to signal the operator that an abnormal operating condition exists.

Alarms are triggered by low oil pressure or high coolant temperature. Each alarm will continue until the cause of the alarm condition is corrected.

See Section 2, Dash/Control Panels for a description of the 14010's engine alarms.

Walk-Around Inspection

For maximum service life of your engine, make a thorough inspection before starting the engine. Look for such items as oil or coolant leaks, loose fasteners, worn fan belts, and trash build-up. Remove trash build-up and have repairs made as needed. Perform required periodic maintenance before starting the engine. Make a walk-around inspection of the equipment. A few minutes spent making minor corrections can prevent major repairs later.

NOTE:

Accumulated grease and oil on an engine or platform is a fire hazard. Remove this debris with steam cleaning or high pressure water at least monthly or whenever any significant quantity of oil (or other fluid) is spilled on or near an engine and working area.

Wipe fittings, caps, and plugs clean before servicing.

Air Intake System

- Observe the dash-mounted Air Filter Warning Light. Service the air cleaner when the light comes on.
- Inspect the air intake system hoses, piping, elbows and gaskets for cracks or damage. Replace items as needed. Check for loose clamps and tighten if necessary.

Water-Cooled Engine Cooling System

- Inspect the cooling system for leaks and trash build-up. Clean any accumulation with compressed air or high-pressure water.
- Inspect the water pump for leaks.

NOTE:

The water pump seal is lubricated by the engine coolant. A small amount of leakage as the engine cools down and parts contract is acceptable.

- Inspect the system hoses and crankcase breather hose for cracks and loose clamps.
- Inspect the fan and accessory drive belts for cracks, breaks, or other damage. Check for proper belt tension.

Water-Cooled Engine Cooling Systems

- Check the coolant level with the engine stopped and cold. Remove the filler cap slowly to relieve pressure gradually.

DO NOT SPRAY WATER ON A HOT ENGINE.

- Maintain the coolant level to within 13 mm (½in) of the bottom of the fill pipe. Install the filler cap.

NOTE:

To prevent engine damage, never add coolant to an overheated engine. Allow the engine to cool first.

- After starting, operate the engine at slow speed until it reaches operating temperature. Check the coolant level and add coolant if necessary. Check for any obvious cooling system leaks or loose connections. Inspect the water pump for evidence of leaks.

- Disconnect any battery chargers that are not protected against the high current drain created when the electric starter engages.

- Inspect the fan and accessory drive belts for cracks, breaks, or other damage. Check for proper belt tension.

Electrical System

Wiring must be kept in good condition, properly routed and firmly attached. Routinely inspect wiring for wear or deterioration. Loose connectors or dangling wiring must be tightened or reattached. Do not bypass fuses.

Tight connections and properly maintained cables will help prevent sparking that could cause a fire.

- Inspect the engine-to-frame rail ground strap for good connection and condition.
- Check the battery and battery cables for poor connections and corrosion.

Fuel and Lube Systems

- Make sure fuel lines are properly clamped and tight. Check for loose fittings or leaks.
- Drain water fromthe water separator.
- Check for lubrication leaks at areas such as the front and rear crankshaft seals, crankcase, oil filter, oil gallery plugs, sensors, and valve covers.

NOTE:

If you observe leaking fluid, find the source and correct the leak. If you suspect a fluid leak, check the fluid levels more frequently than the recommended service intervals until you either find a leak or prove to your satisfaction that there is no leak.

Pre-Start Checks

- All guards must be in place. Repair or replace all guards that are damaged or missing.
- Measure the engine crankcase oil level. The correct oil level is between the High (H) and

  Low (L) marks on the dipstick. Oil capacity from the low to high marks is 1.9l (2.0 US quarts).

NOTE:

Make sure the crane is level when checking the engine oil level.

- Check the oil level(s) on driven equipment.

WARNING:

Diesel engine exhaust contains products of combustion which may be harmful to your health. Always start and operate the engine in a well ventilated area, and, if in an enclosed space, vent the exhaust to the outside.

Do not start the engine or move any of the controls if there is a “DO NOT OPERATE” or similar warning tag attached to the start switch or controls.

The operator must be satisfied that no one will be endangered before starting the engine.

If the engine has not been run for several weeks, fuel may have drained and allowed air into the filter housing.

Also, when fuel filters have been changed, some air space will be left in the housing.

In these instances, prime the fuel system.

NOTE:

Do not engage the starter when the engine is turning.

Do not start the engine under load.

For starting below -18° C (0° F), use of optional cold weather starting aids is recommended. A coolant heater or extra battery capacity may be required.

For temperature below -23° C (-10° F), consult your local diesel engine dealer.

ELECTRIC STARTING

NOTE:

Starting ability will be improved at temperatures below 16° C (60° F) by the use of a starting aid and/or use of a jacket water (coolant) heater or other means to heat the cylinder block.

Start the engine using the following procedure:

1. Make sure that all hydraulic control levers are in their neutral positions.
2. Turn the starter switch to the START position. Crank the engine. Release the switch as soon as the engine starts.

NOTE:

Do not crank the engine for more than 30 seconds. Allow the starter to cool for two minutes before cranking again.

Turbocharger damage can result if the engine rpm is not kept low until the engine oil light or gauge verifies the oil pressure is sufficient.

Consult the engine operating manual for complete details on proper operating speeds.

Additional injections of ether may also be required to achieve a low idle speed.

If the engine fails to start within 30 seconds, release the starter switch and wait two minutes to allow the starter motor to cool before using it again.

3. Once the engine starts, allow it to run at low idle speed for three to five minutes, or until the engine temperature gauge indicator has begun to rise. Increase engine speed to high idle only after the engine is running smoothly at low idle.
4. Allow the white smoke to clear up and proceed with normal operation. Do not apply load to the engine or increase engine speed until the oil pressure gauge indicates normal. Oil pressure should rise within 15 seconds after the engine starts.

NOTE:

If oil pressure does not rise within 15 seconds after the engine starts, stop the engine and follow necessary troubleshooting procedures before restarting.

5. Operate the engine at low load and rpm until the engine temperature is within its normal range. Monitor all gauge readings during this warm-up period.

Starting With Jumper Cables

WARNING:

Batteries give off flammable fumes that can explode.

Improper jumper cable connections can cause an explosion resulting in personal injury.

Prevent sparks near the batteries. Sparks could cause vapors to explode. Do not allow jumper cable ends to contact each other or the engine.

Do not smoke when observing the battery electrolyte levels.

Always wear protective glasses when working with batteries.

Electrolyte is an acid and can cause personal injury if it contacts skin or eyes.

Engines installed without separate engine-to-frame rail ground straps can be damaged by electrical discharge.

To prevent electrical discharge damage, check to make sure the engine's electrical system has a separate engine-to-frame rail ground strap. For engines which have the alternator connected to an engine component, the ground strap must connect that component to the frame.

Some engines have starter-to-frame ground straps, but many of these starters are not electrically grounded to the engine. They have electrical insulation systems.

For this reason, the starter-to-frame ground strap may not be an acceptable engine ground.

When boost starting, refer to the instructions that follow to properly start the engine.

NOTE:

When using an external electrical source to start your engine, turn the START switch OFF and turn off all electrical accessories before attaching cables.

Your engine may be equipped with a 12 or 24 volt starting system. Use only the same voltage for boost starting. Use of a welder or higher voltage will damage the electrical system.

When using jumper cables, always connect POSITIVE (+) cable to POSITIVE (+) battery terminal which is connected to starter solenoid and NEGATIVE (-) cable from external source to starter NEGATIVE (-) terminal. If not equipped with a starter NEGATIVE terminal, connect to the engine block.

Do not reverse the battery cables. The alternator can be damaged.

Attach the ground cable last and remove it first.

1. Connect one end of the cable to the POSITIVE (+) terminal of the battery being started. Connect the other end to the POSITIVE (+) terminal of the power source.
2. Connect one end of the other cable to the NEGATIVE (-) terminal of the power source. Connect the other end to the starter NEGATIVE (-) terminal or to the engine block. This prevents potential sparks from igniting combustible gases produced by some batteries.
3. Begin cranking engine to start and achieve idle speed.
4. After the engine starts, disconnect the cable from the starter NEGATIVE (-) terminal or engine block. Disconnect the other end from the NEGATIVE (-) terminal of the power source.
5. Disconnect the cable from the POSITIVE (+) terminal of the battery on the engine being started. Disconnect the cable from the POSITIVE (+) terminal of the power source.

After Starting the Engine

As soon as the engine starts, release the starter switch and reduce rpm to low idle.

NOTE:

Keep engine speed low until the engine oil pressure registers on the gauge or the engine oil light goes out. If the gauge does not register or the light does not go out within fifteen seconds, stop the engine and investigate the cause before starting again. Failure to do so can cause engine damage.

Allow a cold engine to warm up at LOW IDLE for at least five minutes. Do not apply load to the engine or increase engine rpm until the oil pressure gauge indicates normal.

When idling the engine for warm up, observe the following recommendations:

- In temperatures above 0° C (32° F), warm-up requires approximately 15 minutes.
- In temperatures below 0° C (32° F), warm-up requires approximately 30 minutes or more.
- In temperatures below -18° C (0° F), warm-up requires more than 30 minutes.

Operate the engine at low load and rpm until the engine temperature reaches its normal operating range. Check all gauges during the warm-up period.

After the engine is started and the cold idle operation is completed, the engine can be operated at low speed and low power. The engine will reach normal operating temperature faster when operated at low speed and low power demand than when idled at no load.

Maximum no-load speed for a warm engine is 2200 rpm. Exceeding this limit may cause severe engine damage.

Check all gauges and warning lights frequently during operation.

Engine Stopping

NOTE:

Stopping the engine immediately after it has been working under load can result in overheating and accelerated wear of the engine components. Follow the stopping procedure outlined below to allow the engine to cool. Excessive temperatures in the turbocharger center housing could cause oil coking problems.

Make sure that you understand the Engine Stopping procedure before operating the engine.

Manual Stop Procedure

1. Reduce engine speed to LOW IDLE.
2. Remove load from engine by ceasing all hydraulic-powered operations.
3. Increase engine speed to no more than half Full Load (rpm) speed for two minutes to cool the engine.
4. Reduce engine speed to low idle for five minutes to cool the engine and prevent oil coking problems in the turbocharger center housing.
5. Stop the engine by turning the Ignition Switch to Off.

After Stopping the Engine

1. After the engine cools, fill the fuel tank to prevent accumulation of moisture in the fuel.

Water-cooled engines only:

2. Maintain the cooling system to 13 mm (½ inch) from bottom of the fill pipe.

If you expect freezing temperatures, allow the engine jacket water cooling system to cool, and then check the coolant for proper antifreeze protection. The system must be protected against freezing to the lowest expected outside temperature.

Add a coolant mix of antifreeze and water. Refer to Appendix C of this manual for information about acceptable water and antifreeze concentrations.

3. Check the engine crankcase oil level. The correct oil level is between the High (H) and Low (L) marks on the dipstick. Oil capacity from the low to high marks is 1.9 l (2.0 US quarts).

NOTE:

Make sure the crane is level when checking the engine oil level.

Always wait at least five minutes after shutting off the engine before checking the oil level to allow oil to drain back into the oil pan.

4. Repair any leaks, perform minor adjustments, tighten loose bolts, etc.
5. Observe the service meter reading. Perform periodic maintenance as indicated in Appendix B, Maintenance Chart.
6. If the crane will be left unattended for an extended period of time (overnight or over a weekend, for example), turn off and lock the Battery Cutoff Switch. This will help prevent unauthorized use of the crane and/or accidental battery discharge.

5. Winch/Auger Controls

Mounted at the left (inside) position of the right hand seat-mounted console is the control lever for the main winch raise/lower function. The main winch system consists of a manifold-mounted directional control valve that routes oil to the 2-speed winch motor causing the motor to rotate in the desired direction. The winch is equipped with an integral spring-applied, hydraulically-released disc brake that holds the load in position. Pressure applied to the brake valve unlocks the brake allowing the load to be lowered.

Winch Operation

To raise a load, the control lever is pulled rearward; to lower a load, the control lever is pushed forward. As with all other functions, speed is directly proportional to engine speed and control displacement.

A momentary pushbutton located on top of the winch control lever actuates the winch speed shifter valve.

Pressing and holding the button selects high speed; releasing it selects low speed. The winch may be shifted from high to low or from low to high at any time during operation.

If the crane is equipped with the optional “Thumb Thumper” indicators for winch rotation, this button vibrates whenever the auxiliary winch is rotating. When so equipped, auxiliary winch speed range is selected by the Main Winch Speed Range switch located on the lower panel of the right-side operator console.

DO NOT OPERATE THE WINCH IN HIGH SPEED IN THE LOWERING DIRECTION WITH A HEAVY LOAD DUE TO THE POSSIBILITY OF “OVERRUNNING” THE MOTOR AND CAUSING DAMAGE TO THE MOTOR OR THE WINCH.

Winch Warm-Up Procedure

Performing a warm-up procedure is recommended at each start-up and is essential at ambient temperatures below 4° C (40° F).

FAILURE TO PROPERLY WARM UP THE WINCH, PARTICULARLY IN LOW TEMPERATURES, MAY RESULT IN TEMPORARY BRAKE SLIPPAGE. SUCH OPERATION WILL CREATE A HAZARDOUS SITUATION THAT MAY RESULT IN SERIOUS INJURY, DEATH AND/OR EQUIPMENT DAMAGE.

To properly warm up the winch, run the 14010’s diesel engine at its minimum recommended RPM with the hydraulic winch control lever in its neutral position.

Once the engine has reached operating temperature, operate the winch with no load at low speeds, forward and reverse, several times to prime all lines with warm hydraulic oil and to circulate gear lubricant through the planetary gear sets.

Anti-Two-Block Control

The winch functions employ an LMI/A2B operator aid to prevent a “two-block” situation.

When the load block or overhaul ball trips the anti two-block switch, the switch actuates a solenoid valve which blocks control (pilot) pressure to the function.

Auger Operation

If the 14010 is equipped with the optional auger package, the winch control lever also controls the direction and speed of the auger motor. The auger/winch selection is made by setting the dash-mounted **“Auger/Vibro” ON/OFF** rocker switch to the appropriate position.

This switch energizes solenoid valves that divert pilot pressure to the directional control valve for the selected function. The momentary push button at the top of the control lever also controls the speed of the auger, as it does with the winch. See *Winch Operation*.

6. Boom Controls

Boom Hoist

The joystick control lever mounted in the far right position of the right hand console controls the Boom UP/DOWN function. This function consists of a manifold-mounted directional control valve which is connected to a single double-acting cylinder. The cylinder is fitted with an integral counterbalance valve that holds the cylinder in the extended position until pressure is applied to the retract port, unlocking the valve and allowing the cylinder to lower the boom.

To raise the boom, the control lever is pulled rearward; to lower the boom, the lever is pushed forward.

As with all functions, the speed is directly proportional to engine speed and control displacement.

The hydraulic system is not designed to raise the extended boom from an angle of less than 40 degrees.

Boom Telescope

For cranes *not* equipped with the optional auxiliary winch, the boom telescope function is controlled by the Telescope OUT/IN control lever, located to the right of the Swing lever.

For cranes equipped with the optional auxiliary winch, the boom telescope function is controlled by the Boom Telescope pedal, located just to the right of the Swing Brake pedal.

The four-stage boom is operated by a combination of a hydraulic cylinders, cables, and sheaves. The second stage will extend to its maximum position before the third and fourth stages start to extend. As further hydraulic pressure is applied, the third and fourth stages will begin to extend proportionally. Conversely, when retracting the boom, the third and fourth stages will retract proportionally and fully prior to the second stage retraction.

The boom telescope cylinder is equipped with an integral counterbalance valve that holds the boom in the extended position until pressure is applied to the retract port, unlocking the counterbalance valve and allowing the cylinder to retract. As with all other functions, retract speed is directly proportional to engine speed and control displacement.

Anti-Two-Block (A2B) CONTROL

The Boom Down and Boom Telescope Out functions employ the LMI/A2B operator aid to prevent a “two-block” situation.

When the load block or overhaul ball trips the anti-two-block switch, the switch actuates a solenoid valve which blocks control (pilot) pressure to the function.

7. Swing Controls

In the far left position of the left-hand console is the swing control. The swing system consists of a directional control valve, hydraulic motor, a spring applied/hydraulically-released park brake with an integral spring-released hydraulically-applied service brake and a gear reducer mounted to the upper structure of the crane.

The console-mounted control lever supplies pilot pressure to the directional control valve which routes pump flow to the swing motor, which through the brake, causes the reducer to turn the shaft-mounted pinion gear, meshed with the slew ring, and the upper structure.

To swing left, the control lever is pulled rearward; to swing right, and the lever is pushed forward. As with all functions of the crane, speed is directly proportional to engine speed and control lever displacement.

Swing Park Brake

The park brake is controlled by the Swing Park Brake ON/OFF switch. The park brake is used to hold the upper structure in position for extended periods of time.

NEVER USE THE PARK BRAKE TO STOP THE SWING MOTION OF THE UPPER STRUCTURE UNDER ANY CIRCUMSTANCES

Swing Service Brake

The service brake is controlled by the floor-mounted foot pedal (far left) and is used to slow and stop the swing motion of the crane upper structure.

NEVER REST YOUR FOOT ON THE SWING BRAKE PEDAL DURING SWING OPERATION; EVEN SLIGHT PRESSURE WILL CAUSE EXCESSIVE WEAR ON THE SWING BRAKE MECHANISM.

At the top of the swing control lever is the horn button. When depressed, the horn will sound, alerting all personnel that swing or some other function is about to be put into motion. It is good practice to sound the horn before putting any functions into motion.

8. Travel Controls; Tracks Extend/Retract

Tracks Forward/Reverse

The travel function is controlled by two floor-mounted foot pedals which actuate control valves to route pilot pressure to the manifold-mounted directional control valves. In the forward direction (boom over the idler end) the left pedal controls the left track and the right pedal controls the right track.

Pushing the pedal(s) toe-down, moves the crane forward. For reverse travel, push the pedals heel down, this will move the crane backward. The speed of travel, as with all other functions, is directly proportional to engine speed and control displacement.

To skid-steer, one of the pedals is pushed farther down than the other, causing one track to pull ahead of the other.

Counter-rotation (turning the crane on its own axis) is achieved by moving one pedal toe-down and the other heel-down, depending on the desired direction.

The track drive motors are equipped with spring applied, pressure-released park brakes controlled by the dash-mounted Park Brake ON/OFF rocker switch. The park brake switch must be set to off before travel can be initiated. Also connected to the park brake switch is the motion alarm, which will sound any time the park brake switch is turned off. This alarm will alert all personnel that travel can occur at any time.

The track drive motors are two-speed and are shifted by pilot pressure through a solenoid valve controlled by a dash-mounted rocker switch, marked Travel Speed HIGH/LOW.

DO NOT SHIFT BETWEEN TRAVEL SPEEDS WHILE THE CRANE IS IN MOTION.

Maximum effort is realized with the motors in “low” speed, the engine at top speed and maximum pedal displacement.

Tracks Extend/Retract

The 14010’s track extend/retract function powers the crawler frames in or out. The track extend/retract function is actuated by the dash-mounted Tracks- EXTEND/RETRACT rocker switch. The carbody mounted extend/retract cylinders are fitted with integral cross-flow check valves to prevent the cylinders from drifting in or out unless pressure is applied.

NEVER OPERATE THE CRANE WITHOUT FIRST FULLY EXTENDING THE CRAWLER FRAMES*.

ATTEMPTING TO LIFT LOADS WITH THE CRAWLER FRAMES RETRACTED WOULD VERY LIKELY CAUSE OVERTURNING, WHICH WILL RESULT IN SERIOUS INJURY, DEATH AND/OR EQUIPMENT DAMAGE*.

**UNLESS OPERATIONS ARE WITHIN PARAMETERS SPECIFICALLY ALLOWED BY THE “TRACKS RETRACTED LOAD CHART” FOR THIS MODEL.*

9. Auxiliary Winch Control

Auxiliary Winch (Optional)

If the crane is equipped with the optional two-speed auxiliary winch, winch operation is controlled by the Auxiliary Winch control lever on the left-side operator's console. Moving the lever back raises the load and moving it forward lowers the load.

As standard equipment for cranes equipped with the optional auxiliary winch, the winch speed range is controlled by the pushbutton switch at the top of the control lever. This button selects either the low (button not depressed) or high (button depressed) range of auxiliary winch rotation. As with other crane functions, speed ranges is directly proportional to engine speed and control displacement.

If the crane is equipped with the optional "Thumb Thumper" indicators for winch rotation, this button vibrates whenever the auxiliary winch is rotating.

The auxiliary winch also employs an LMI/A2B operator aid, in the "raise" direction, to aid the operator in preventing a two blocking situation when the switch mounted weight at the boom, stand off, extension or jib tip is raised by the hook block or overhaul ball.

NEVER LEAVE THE CRANE CAB WITH THE ENGINE RUNNING.

10. Tool/Auger Operation

The MANTIS 14010 may be equipped with the optional tool circuit for operating hydraulic impact wrenches, tampers, etc. The tool circuit is designed to deliver either 5 or 10 GPM at 2100 PSI (18.9 or 37.8 l/min @ 147 bar), to the reel-mounted hose at the left side of the crane, behind the operator's cab. Hoses on the reel are fitted with quick-disconnect couplings to attach the desired tool. The tool circuit is activated by the dash-mounted **Tool HIGH/ OFF/LOW** rocker switch.

Digging with the Auger

NOTE:

All auger controls described below are located in the right-hand operator's console.

The optional auger circuit utilizes the winch control lever to control the direction and speed of auger rotation. The operator selects auger operation by setting the **Auger/ Winch** rocker switch to the AUGER position.

Use the following steps to prepare the auger for digging:

1. Set the **Auger/Winch** switch to the AUGER position and remove the safety pin from the auger storage latch.
2. Slowly push the **Winch/Auger Control** lever forward to be sure the wind-up cable is supporting the auger.
3. Open the latch by setting the **Auger Latch OPEN/CLOSE** rocker switch to the OPEN position.
4. With the latch open, slowly pull the control lever rearward to lower the auger out of the latch until the wind-up cable swings clear.

With the auger in digging position, push the winch control lever forward to dig and pull it rearward for reverse. As with all other functions, auger rotation speed is directly proportional to engine speed and control lever displacement.

Lower the auger into the earth by pushing the **Boom UP/DOWN** lever forward; raise the auger by pulling the lever backward. The operator must determine proper digging and lowering rates depending on soil conditions.

High or low range of auger rotation speed is selected with the **Auger Speed HIGH/LOW** Switch.

Stowing the Auger

When digging is complete, return the auger to the stowed position in the storage latch using the following steps:

1. Attach the wind-up cable to the auger shaft. Move the **Auger Latch OPEN/CLOSE** switch to OPEN.
2. Push the **Winch/Auger Control** lever forward to draw the auger into the latch.
3. After the auger shaft contacts the torque limiting valve and the motor stops rotating, set the **Auger Latch OPEN/CLOSE** switch to CLOSE, install the safety pin, and pull the control lever rearward, lowering the auger shaft to the latch plunger.

When not in use, the auger may be left in the digging position with the **Auger/Winch** switch set to WINCH, if desired, to prevent spending excessive time in storing and rigging the auger.

Appendix A: Boom Load Charts

Capacity Limits and General Conditions

The MANTIS 14010 Crane as manufactured by SpanDeck, Inc. meets the requirements of ANSI B30.5c (1992) when specifically equipped. Structure and stability have been tested in accordance with SAE J1063 and SAE J765, respectively. Lifting capacities as determined by boom length, angle, or lifting radius apply only to machines as originally equipped by the manufacturer and in a properly maintained condition.

Capacities given are maximum covered by the manufacturer's warranty and are based on a freely suspended load with no allowance for factors such as out-of level operation, supporting surface conditions, hazardous surroundings, experience of personnel, etc.

The operator shall establish practical working loads based on prevailing operating conditions such as, but not limited to, those listed above.

When making lifts where capacities may be within a zone limited by structural strength, the operator shall determine that the weight of the load is known within ± 10% before making the lift.

DO NOT lift a load without consulting the Load Chart. Deductions from rated capacities must be made for the weight of the hook block, overhaul ball, slings, spreader bar, or other suspended equipment.

SIDE PULL ON THE BOOM IS EXTREMELY DANGEROUS AND MUST BE AVOIDED.

DO NOT EXCEED THE MANUFACTURER'S SPECIFIED MAXIMUM REEVING.

Load radius is defined as the horizontal distance from the axis of rotation to the center of the lifting device after load is applied.

Boom angle is the included angle between the longitudinal axis of the boom base section and the horizontal axis, after lifting the load. The boom angle before lifting should be somewhat greater than desired to account for boom deflection.

Boom angle/boom length relationships given in the load charts are an approximation of the resulting load radius. The radius should be accurately measured.

Boom height dimensions are measured from ground to center of lower boom head sheave.

It is permissible to attempt to telescope the boom with a load within the limits of rated capacities. However, boom angle, system hydraulic pressure, and/or boom lubrication may affect operation.

THE LOAD MOMENT INDICATOR SYSTEM USED ON THE 14010 IS AN OPERATIONAL AID THAT WARNS THE CRANE OPERATOR OF APPROACHING OVERLOAD CONDITIONS AND ALSO WARNS OF OVERHOIST CONDITIONS WHICH COULD CAUSE DAMAGE TO EQUIPMENT AND INJURY TO PERSONNEL.

THE DEVICE IS NOT, AND SHALL NOT BE, A SUBSTITUTE FOR GOOD OPERATOR JUDGMENT, EXPERIENCE, AND THE USE OF ACCEPTED CRANE OPERATING PROCEDURES.

THE RESPONSIBILITY FOR THE SAFE OPERATION OF THE CRANE SHALL REMAIN WITH THE CRANE OPERATOR, WHO SHALL ENSURE THAT HE UNDERSTANDS AND OBSERVES ALL SUPPLIED WARNINGS AND INSTRUCTIONS.

PRIOR TO OPERATING THE CRANE, THE OPERATOR MUST CAREFULLY AND THOROUGHLY READ AND UNDERSTAND THE INFORMATION IN THIS MANUAL TO ENSURE THAT HE KNOWS THE OPERATION AND LIMITATIONS OF THE LMI/A2B SYSTEM AND CRANE.

PROPER FUNCTIONING IS DEPENDENT UPON PROPER DAILY INSPECTIONS AND UPON OBSERVATION OF THE OPERATING INSTRUCTIONS SET FORTH IN THE LMI/A2B MANUAL.

Appendix B: Maintenance Chart

ENGINE / Frequency	10 Hr/Daily	50 Hr/Weekly	100 Hr	200 Hr	500 Hr	1000 Hr	COMMENTS
Crankcase							
Check oil level	●						Check at dipstick
Check for leaks	●						Repair, See Capacities & Specifications Chart
Change oil and filter				●			See Manufacturer Maintenance manual
Check valve lash				●			
Clean crankcase breather				●			
Cooling System							
Check coolant level	●						Check "cold," add as required
Check for leaks	●						Repair, See Capacities & Specifications Chart
Fuel System							
Check fuel level	●						Fill at end of each day
Drain fuel/water separator	●						
Drain dirty fuel		●					Drain until clean fuel evident
Replace fuel filter				●			See Manufacturer Maintenance manual
Drain water/sediment				●			
Clean fuel inlet & screen				●			
Air Supply							
Clean air pre-cleaner	●						
HYDRAULIC SYSTEM							
Check hydraulic oil level	●						Check for "desired level" at tank sight gage, all cylinders fully retracted and oil at operating temperature. Add as required, see Capacities & Specification Chart.
Check filter condition indicator	●					●	Change as required, or at least every 1000 hours.
Check for leaks	●						"Walk around" inspection of entire machine, repair as required.
Clean hydraulic tank					●		Clean with solvent.
Drain hydraulic tank						●	Drain, clean, and refill. See Capacities & Specification Chart.
Change hydraulic filters							
New or rebuilt machines			●				
After 1st filter change						●	After initial filter change at 100 hours.
TRAVEL/TRACKS							
Check track drive reducers		●					Check level at "level" plug with "fill" and "drain" plugs in vertical alignment. Add as required. See Capacities & Specification Chart.

TRAVEL/TRACKS (Continued)	Frequency	10 Hr/Daily	50 Hr/Weekly	100 Hr	200 Hr	500 Hr	1000 Hr	COMMENTS
Check/Adjust track tension			●					Add or release grease A/R at valve behind cover plate inside track frame at roller end; keep tension as loose as possible for surface conditions; adjust for normal clicking sound but no popping.
Clean/Grease track extend beams			●					
Inspect undercarriage						●		
WINCH(ES)								
Check oil level			●					Add as required
Check for leaks			●					Repair as required
Change oil (1st time)				●				See Capacities & Specification Chart
Change oil (after 1st change)							●	See Capacities & Specification Chart
BOOM								
Grease boom sheave			●					Inspect for damage, replace as required. See Capacities & Specifications Chart.
Grease boom bearing pads			●					Inspect for damage, replace as required. See Capacities & Specifications Chart.
Grease boom pins			●					Inspect for damage, replace as required. See Capacities & Specifications Chart.
Change swing drive reducer oil							●	Drain at operating temperature (initial oil change). See Capacities & Specification Chart. NOTE: After initial change at 50 hours.
Grease slew ring race			●					Grease while rotating until grease is visible at seal. See Capacities & Specifications Chart.
Grease slew ring teeth			●					Check for damage, replace as required.
Check wire rope			●					
AUXILIARY GENERATOR (OPTION)								
Check oil level			●					
Change oil			●					Initial oil change
Replace air cleaner element				●				
Clean fins				●				Clean cooling air flow path.
CAB INSTRUMENTATION								
Check for proper operation		●						Repair or replace as required.

Appendix C: Capacities & Specifications

Equipment	Material	Capacity/Quantity	Comments
Auxiliary Generator -Lube Oil -Fuel Tank	Optional feature Same as engine Same source as engine	0.8 liters (0.85 US qt.)	Same source as engine
Auger Motor*	GL-5 EP SAE 80/90	4.7 liters (5 US qt.)	Eskridge Model 74
Batteries	Distilled Water	Fill to 'split rings' under caps	All Cranes
Boom Bearing Pads	EP 2	As required	All Cranes
Boom Cylinder Pin	EP 2	Until 'new' grease is visible	All Cranes
Boom Foot Pin	EP 2	Until 'new' grease is visible	All Cranes
Boom Sheaves	Shell Alvania EP2 or equivalent	Until 'new' grease is visible	All Cranes
Diesel Fuel Tank	No. 1 or No. 2 Diesel	398 liters (105 US gallons) 302 liters (80 US gallons) 208 liters (55 US gallons) 757 liters (200 US gallons)	14010 6010, 8012, 9010, 10010Mx 3612 200RS
Engine, Cooling System	Water/Anti-Freeze Mix	24.2 liters (26.7 US qt.) 18.9 liters (20 US qt.) 26.5 liters (28 US qt.) 59 liters (62 US qt.)	Caterpillar 3116 & Cummins B5.9 Cummins 8.3C Cummins QSB Cummins QSX-15
Engine, Lube Oil	API: CF/SG & CH 4/SJ 15w/40	18.5 liters (19.5 US qt) 15.0 liters (16 US qt) 23.8 liters (25.2 US qt.) 83.25 liters (88 US qt.)	Deutz BF6L Caterpilller 3116, Cummins B5.9 & QSB Cummins 6C 8.3 Cummins QSX-15
Hydraulic Tank	Shell Tellus T-32	567 liters (150 US gallons) 1135 liters (300 US gallons) 1704 liters (450 US gallons)	3612 & 6010 8012,9010, 10010MX, 14010 200RS
Slew Ring Race	Shell Alvania EP2 or equivalent	As required	Grease while rotating until new grease becomes visible at the seal
Slew Ring Teeth	Texaco 'Crater' 2X or 5X	Coat teeth at each greasing	All Cranes
Swing Drive Reducer	EP 90	Fill to 4.5 cm (1.75 inches) below the outside of housing fill/check plug (minimum)	All Cranes
Track Drive Reducers	EP 90	4.7 liters (5 US qt.) 6 liters (6.4 US qt) 6.8 liters (7.5 US qt.) 6.8 liters (7.5 US qt.) 13.5 liters (14.25 US qt.)	3612/6010 (KYB) 10010, 12010, 14010 (Linde GK 80) 6610, 8010, 8012 (KYB) 8012, 9010, 10010MX, 14010 (BonTras) 200RS (O&K)
Track Idlers	EP 90	0.45 kg (0.99 lbs)	All Crawler Cranes
Track Rollers**	EP 90	0.23 liters (0.24 US qt)	All Crawler Cranes
Track Tension	Shell Alvania EP2 or equivalent	As required	See Maintenance chart for adjusment procedure
Winch, Auxiliary***	Texaco Meropa (-20F to 80F) Mobil SCH 630 Synthetic	PD 12C: 1.4 liter (1.5 US qt) CH 175: 4.3 liter (4.5 US qt)	3612,6010,6610/8012,9010 10010, 12010, 14010
Winch, Carbody	Texaco Meropa (-20F to 80F) Mobil SCH 630 Synthetic	15 liters (16 US qt)	200RS
Winch, Main	Texaco Meropa (-20F to 80F) Mobil SCH 630 Synthetic	PD 12C: 1.4 liter (1.5 US qt) CH 175: 4.3 liter (4.5 US qt) CH 185: 17 liter (18 US qt) CH 210A: 17 liter (18 US qt) CH 400A: 31.25 liter (33 US qt)	3612, 6010 8010 10010, 12010, 14010 14010 200RS
Winch, w/Freefall	Texaco Meropa (-20F to 80F) Mobil SCH 630 Synthetic	G2H30:'Fill to Plug'	10010,12010, 14010 (optional aux winch)

*Test level w/fill plug removed, maximum level: No overflow from fill hole @ 40 degree tilt above horizontal axis; minimum level: overflow from fill hole @ 10 degree above horizontal axis.
** Measure to middle of primary planet gears when the auger is in the vertical position. Tilt back slightly when filling through oil fill hole to achieve proper capacity.
***The auxiliary winch w/freefall option is lubricated w/hydraulic fluid; no routine changes are required.

Appendix D: Filter Specifications

Filter Specifications														
	Model	3612 6010	6010	6610 8012 10010MX	6610	6610 8010 12010	6610 8010 10010 12010	8010 10010 12010 14010	8010 10010 12010	8012 10010MX 14010	8012 9010 10010MX 14010	10010XHD	8012XHD	200RS
	Engine	Deutz BF6L 913	Cummins QSB	Cummins 6B-5.9L	Cummins 6B-5.9L	Caterpillar 3116	Caterpillar 3116	Cummins 6C-8.8L	Cummins 6C-8.8L	Cummins QSB	Cummins QSB	Cummins M11	Cummins QSM	Cummins QSX
Lubricating Oil	Manufacturer Part Number	Duetz 117-4420	Fleetgard LF 3970	Fleetgard LF 3349	Fleetgard LF 3349	Caterpillar IR-0740	Caterpillar IR-0740	Fleetgard LF 3000	Fleetgard LF 3000	Fleetgard LF 3970	Fleetgard LF 3970	Fleetgard LF 3000	Fleetgard LF 9001	Fleetgard LF 9000
Fuel	Manufacturer Part Number	Duetz 117-4423	Fleetgard FF 105D	Fleetgard FF 105D	Fleetgard FF 105D	Caterpillar IR-0741	Caterpillar IR-0741	Caterpillar FS 1280	Caterpillar FS 1280	Fleetgard FF 105D	Fleetgard FF 105D	Fleetgard FS 1000	Fleetgard FS 1000	Fleetgard FS 1041
Fuel/Water Seperator	Manufacturer Part Number	Donaldson P92-0711	Donaldson P92-0711	Donaldson P92-0711	Donaldson P92-0711	Donaldson P92-0711	Donaldson P92-0711	Donaldson P92-0711	Donaldson P92-0711	Fleetgard FS 19519	Fleetgard FS 19519	Donaldson P92-0711	Fleetgard FS 19519	Fleetgard FS 19519
Engine Air	Manufacturer Part Number	Farr P-32	Farr T-519	Farr P-40/T-519*	Farr P-40	Farr T-519	Farr T-519	Farr P-40	Farr P-40	Farr T-519	Farr T-519	Farr P-40/T-519*	Farr T-519	Farr T-528
Cooling System (precharge**)	Manufacturer Part Number	N/A	N/A	N/A	N/A	N/A	N/A	Fleetgard WF 2073	Fleetgard WF 2073	N/A	N/A	Fleetgard DCA-4	Fleetgard WF 2073	Fleetgard WF 2073
Cooling System (service)	Manufacturer Part Number	N/A	N/A	N/A	N/A	N/A	N/A	Fleetgard WF 2071	Fleetgard WF 2071	N/A	N/A	Fleetgard WF 2071	Fleetgard WF 2071	Fleetgard WF 2071
Hydraulic Return	Manufacturer Part Number	Parker 932678Q	Parker 932678Q	Parker 932678Q	Donaldson P16-4703	Parker 932678Q	Donaldson P16-4703	Parker 932678Q	Donaldson P16-4703	Parker 932678Q	Hydac 0500R003BN3HC	Parker 932678Q	Parker 932678Q	Hydac 0500R003 BN3HC
Hydraulic Pilot	Manufacturer Part Number	Parker 932611Q	Parker 932611Q	Parker 932611Q	Fairey-Arlon 170-Z-110A	Parker 932611Q	Fairey-Arlon 170-Z-110A	Parker 932611Q	Fairey-Arlon 170-Z-110A	Parker 932611Q	Hydac 02060902	Parker 932611Q	Parker 932611Q	Hydac 02060902

*Front-mount air fiter housing uses Farr P-40; Top-mount uses T-519

**Contains additive to protect coolant system from corrosion; use this filter only at a complete coolant change

Appendix E: Pressure & Flow Settings

CRANE FUNCTION	NOMINAL PRESSURE SETTING (PSI)						
	3612	**6010**	**8012**	**9010**	**10010MX**	**14010**	**200RS**
Right Track	4800	4800	4800	4800	4800	4800	4800
Hoist	2500	2500	2500	2500	2500	2500	4200
Extend	2500	2500	2500/2700	2500/2700	2500/2700	2500/2700	2900/2700
Carbody Winch	-	-	-	-	-	-	3600/1450
Auxiliary Winch	N/A	N/A	3400/2900	3400/2900	3400/2900	3900/1900	N/A
Auger	2500	2500	2500	2500	2500	2500	N/A
Left Track	4800	4800	4800	4800	4800	4800	4800
Main Winch	3400/2900	3400/2900	3900/1900	3900/1900	3900/1900	3900/1900	4500/1450
Swing	2500	2500	2500	2500	2500	2500	2500
Track Extend	2500	2500	3000	3000	3000	3000	3000/3000
Tool Circuit (Option)	2100	2100	2100	2100	2100	2100	2100
Counterweight Winch	-	-	-	-	-	-	2200

CRANE FUNCTION	NOMINAL FLOW (GPM)						
	3612	**6010**	**8012**	**9010**	**10010MX**	**14010**	**200RS**
Right Track	50	50	50	50	50	50	144
Hoist	29/18	35/18	50/25	50/25	50/25	50/25	50/25
Extend	29/12	35/12	52/17	52/17	52/17	52/17	50/17
Carbody Winch	-	-	-	-	-	-	62
Auxiliary Winch	N/A	N/A	45	45	45	50	N/A
Auger	34	34	34	34	34	34	N/A
Left Track	50	50	50	50	50	50	144
Main Winch	45	45	50	50	50	50	75
Swing	10	10	30	30	30	30	44
Track Extend	10	10	10	10	10	10	10/10
Tool Circuit (Option)	12/6	12/6	12/6	12/6	12/6	12/6	12/6
Counterweight Winch	-	-	-	-	-	-	20

Appendix F: Cold Weather Operation

Diesel engines can operate effectively in cold weather. Engine operation in cold weather, however, is dependent on the type of fuel used and how well the fuel moves through the fuel-related components. The purpose of this appendix is to explain some of the problems and steps that can be taken to minimize fuel problems during cold weather operation when the engine area is colder than 40° F (5° C).

Fuel Selection

During cold weather operation, you may need to use No. 2 diesel fuel since quantities of No. 1 diesel fuel are limited and generally are only available during the winter months and in the colder climates.

There are two major differences between No. 1 and No. 2 diesel. No. 1 diesel has a lower cloud point and a lower pour point.

The cloud point is the temperature at which a cloud or haze of wax crystals begins to form in the fuel and cause fuel filters to plug. The pour point is the temperature at which diesel fuel begins to thicken and becomes more resistant to flow through fuel pumps and lines.

Be aware of these fuel values when purchasing your diesel fuel and anticipate the average outside (ambient) temperature for the area where your Mantis crane will be operating. Engines fueled in one climate may not operate satisfactorily if moved to another because of problems that result from cold weather.

NOTE:

The average No. 1 diesel fuel has a lower heat content (kJ or BTU) rating per unit volume of fuel than the average No. 2 diesel fuel. When using No. 1 diesel fuel, you may notice a drop in power and fuel efficiency, but you should not experience any other operating effects.

Before troubleshooting for low power or poor performance in winter months, check the type of fuel you are using.

The use of starting aids, engine oil pan heaters, coolant heaters, fuel heaters, and fuel line insulation also provide some means of minimizing starting and fuel problems in cold weather when No. 2 fuel is used.

Fuel Heaters

Fuel heaters prevent plugging of the fuel filters due to waxing in cold weather. Mantis cranes intended for use in cold climates are equipped with suitable fuel heaters and control circuitry. See the Maintenance Manual for your crane for details.

Make sure that the fuel heater is deactivated in warm weather. A loss of engine power can occur if the fuel supply temperature exceeds 85° F (30° C).

Fuel Filters

Mantis diesel-powered cranes are equipped with a water separator between the fuel tank and the engine-mounted fuel filter. The micron rating and location of the water separator are chosen for proper operation in cold weather. The water separator and its fuel supply line are the components most commonly affected by cold fuel.

Engine Compartment Temperature

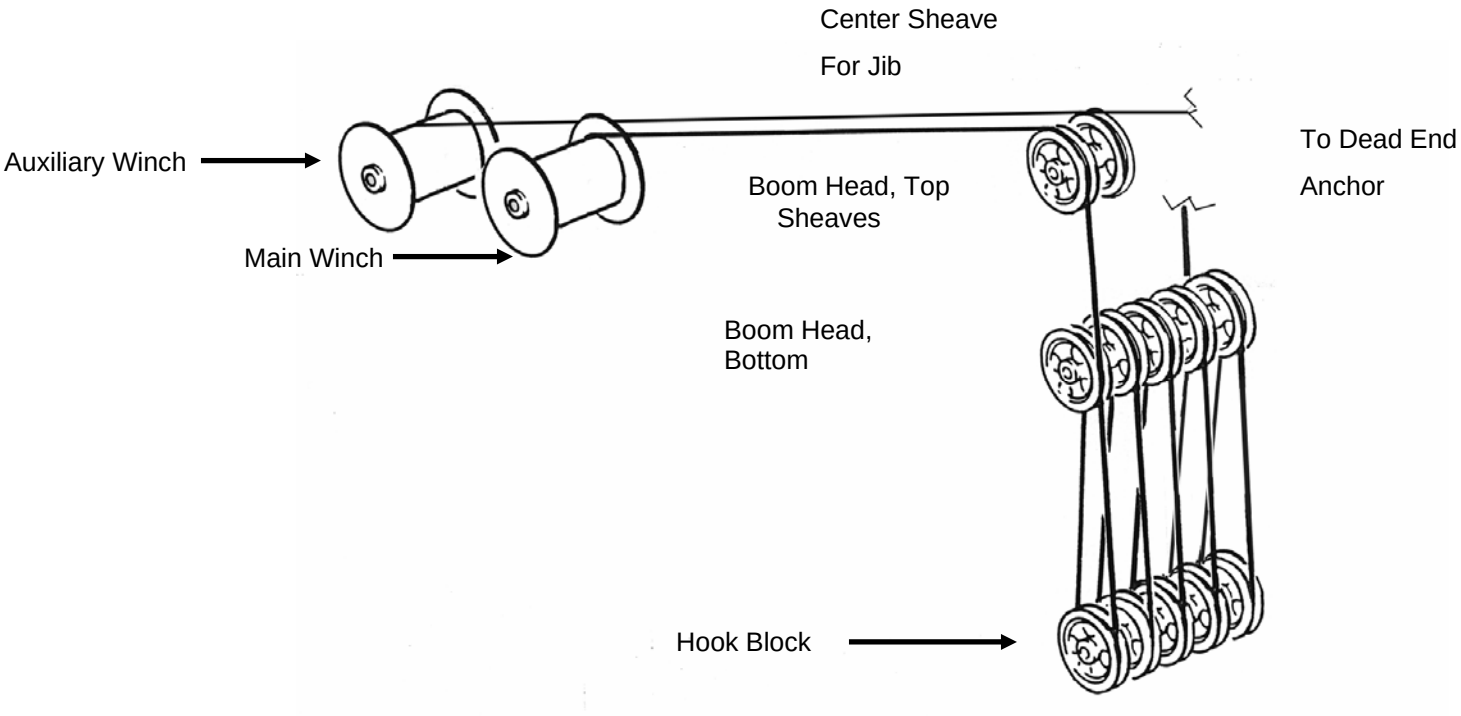
Maintaining as high a temperature as possible in the engine compartment can be very helpful in avoiding cold weather problems in your Mantis crane.

Always keep all engine covers and access panels closed in cold weather to retain as much engine heat as possible.

Depending on the options you specified, your crane may have a radiator shutter, winter front, and/or thermostatically controlled (clutch-type) fan to minimize warm-up times.

At coolant temperatures below 160° F (71° C) the clutch fan should be off; at temperatures above 205° F (96° C) the fan should operate. If your engine will not maintain proper operating temperature, check the fan for proper operation.

Appendix G: Reeving Diagram



Note:

10-PART REEVING IS REQUIRED FOR FULL CAPACITY LIFTING

DANGER!

DO NOT EXCEED THE MANUFACTURER'S SPECIFIED MAXIMUM REEVING OF 10 PARTS OF LINE

Appendix H: Preparation for Shipping

Due to the weight and overall width of the Mantis 8012/9010/10010MX/14010 cranes, it may be necessary to remove certain components from the machine for transport in your area. The procedures in the following appendices will guide you through disassembly and reassembly of your crane if the need arises.

WHEN INSTALLING OR REMOVING ANY COMPONENT OF A MANTIS CRANE, USE THE SAME SAFETY PROCEDURES THAT YOU USE WHEN MAKING ANY OTHER LIFT WITH THE CRANE.

Removable Component Weights & Dimensions Weights are given in KIPs (pounds)					
Crane Model	8012	9010	10010MX	12010/14010	200RS
Crawler Frame	11.8 (11,800)	11.8 (11,800)	11.8 (11,800)	17.5 (17,500)	26.24 (26,240)
Counterweight(s)	10.0 (10,000)	15.0 (15,000)	20.0 (20,000)	30.0 (30,000)	30.0 (30,000)
# of Counterweights	1	1	1	2 @ 15.0	2 @ 15.0
Lattice Jib	0.7 (700)	0.7 (700)	0.7 (700)	0.7 (700)	N/A
Lattice Extension	1.1 (1,100)	1.1 (1,100)	1.1 (1,100)	1.1 (1,100)	N/A
Main Boom	13.7 (13,700)	16.8 (16,800)	19.7 (19,700)	19.7 (19,700)	11.0 (11,000)
Foot Pin to Boom (center of gravity)	5.9m (19.4 ft)	5.6m (18.3 ft)	5.4m (17.8 ft)	5.4m (17.8 ft)	3.9m (12.75 ft)

NOTE:

The disassembly and reassembly of crane components will be much easier if performed on a smooth, stable, level surface.

The easily-removed components are:

- counterweight(s);
- lattice jib and extension;
- main boom; and
- Crawler frames intact.

Disassembly or reassembly of any of these parts of the crane will require a crane or other lifting machine of rated capacity to handle the components to be removed.

Appendix I: Counterweight Removal/Installation

The counterweight of the 14010 is installed or removed by using the crane's Boom Telescope Out/In Control (see Page 13) with special counterweight handling rigging installed.

WHEN INSTALLING OR REMOVING THE COUNTERWEIGHT, USE THE SAME SAFETY PROCEDURES THAT YOU USE WHEN MAKING ANY OTHER LIFT WITH THE 14010.

NOTE:

Installing or removing the counterweight is much easier if the crane is on a level surface. If you can not level the crane completely, select a position that levels it from side to side.

Installing the Counterweight

1. Set the counterweight on level ground behind the crane, directly below its installed position.
2. Install the counterweight handling sheave in the sheave bracket slot. The rear edge of the sheave should be directly above the counterweight lifting lug.
3. Lower the boom fully and attach one end of the counterweight handling pendant to the upper boomhead lug. Run the pendant cable over the sheave installed in Step 2 and attach the free end to the counterweight lifting lug.
4. Raise the boom far enough so that the pendant cable clears both the main and auxiliary winches.
5. Using the Boom Telescope Control, extend the boom until the counterweight support lugs align with the mounting lugs on the 14010.
6. Install the counterweight support pins; release the tension on the pendant cable by retracting the boom.
7. Lower the boom fully; detach the counterweight handling pendant from the counterweight and boomhead lugs.
8. Install the two bolts that secure the lower edge of the counterweight to the crane body.

Removing the Counterweight

1. Remove the two bolts that secure the lower edge of the counterweight to the crane body.
2. Install the counterweight handling sheave in the sheave bracket slot. The rear edge of the sheave should be directly above the counterweight lifting lug.
3. Lower the boom fully and attach one end of the counterweight handling pendant to the upper boomhead lug. Run the pendant cable over the sheave installed in Step 2 and attach the free end to the counterweight lifting lug.
4. Raise the boom far enough so that the pendant cable clears both the main and auxiliary winches.
5. Using the Boom Telescope Control, extend the boom until the pendant cable is taut and supports the counterweight. The counterweight support pins should now be bearing no weight.
6. Remove the counterweight support pins; lower the counterweight to the ground by retracting the boom.
7. Lower the boom fully; detach the counterweight handling pendant from the counterweight and boomhead lugs.

Appendix J: Jib/Extension Removal/Installation

WHEN INSTALLING OR REMOVING THE JIB/EXTENSION, USE THE SAME SAFETY PROCEDURES THAT YOU USE WHEN MAKING ANY OTHER LIFT WITH THE CRANE.

TO PREVENT DAMAGE TO THE JIB/EXTENSION WHEN REMOVING IT FROM THE MAIN BOOM, ALWAYS USE NYLON SLINGS OF RATED CAPACITY TO HANDLE THE LOAD.

SLING ONLY AROUND THE MAIN CHORDS OF THE JIB AND/OR EXTENSION. APPLYING THE SLING TO LATTICE WORK WILL DAMAGE THE JIB OR EXTENSION.

See the figures on the next page for placement of slings to attain the best balance of components. It is advisable to have the jib and extension in the stowed position and remove both as a unit, since both components are supported by the storage brackets on the main boom.

Removing the Jib and Extension

To remove the jib and extension as a unit, follow the steps outlined below.

1. Lower the main boom to a level position.
2. Attach slings at the locations shown in the figure. Attach tag lines to each end of the load.
3. ”Snug up” on the slings to be sure the load is secure. Do not lift the load at this time. Check to be sure all rigging is secure.
4. Remove the pin from the jib storage bracket at the rear of the boom; remove the wing nut at the jib tip sheave location storage bracket; and remove the pins at the extension attachment to the main boom head.
5. Using the tag lines to maneuver the load, slowly lift the jib/extension off the support brackets and move it away from the main boom. Lower the jib/extension to the ground, clear of the work area, and set it on supporting blocking.

DO NOT SET THE JIB/EXTENSION DIRECTLY ON THE GROUND; DAMAGE TO LATTICE WORK MAY OCCUR.

6. Store all attachment hardware in the crane storage box located under the hydraulic tank.

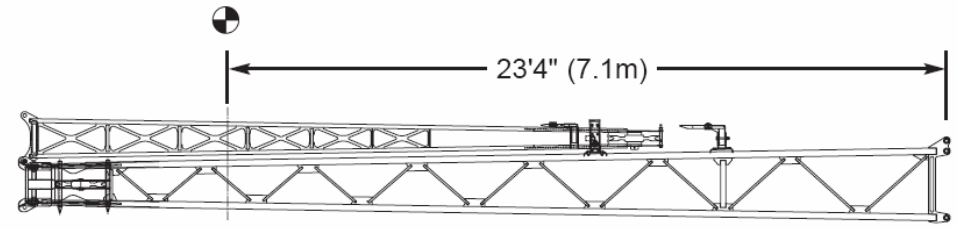
Installing the Jib and Extension

To install the jib and extension as a unit, follow the steps outlined below.

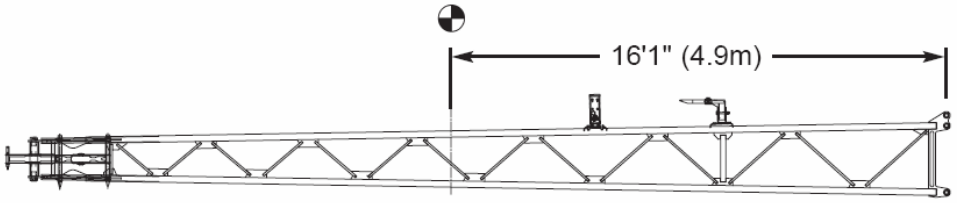
1. Lower the main boom to a level position.
2. Attach slings to the jib/extension at the locations shown in the figure. Attach tag lines to both ends of the load.
3. Using the tag lines to maneuver the load, slowly lift the jib/extension off the supporting blocking and move it toward the main boom.
4. Align the attachment lugs on the extension with the corresponding lugs on the boom head. Install the pins through the attachment lugs and secure them.
5. Install and tighten the wing nut at the jib tip sheave location storage bracket.
6. Release tension on the lifting slings and disconnect them from the extension.

LIFTING POINTS FOR JIB ALONE, EXTENSION ALONE, AND JIB & EXTENSION TOGETHER

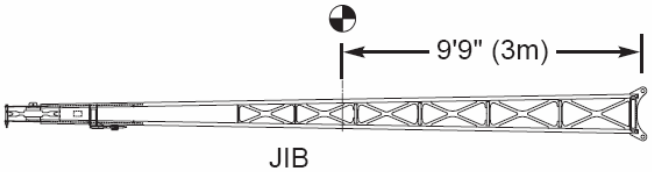
Center lifting slings around the points indicated
DRAWING NOT TO SCALE



JIB & EXTENSION TOGETHER



EXTENSION



JIB

Appendix K: Main Boom Removal/Installation

WHEN INSTALLING OR REMOVING THE MAIN BOOM, USE THE SAME SAFETY PROCEDURES THAT YOU USE WHEN MAKING ANY OTHER LIFT WITH THE CRANE.

PARTS OF THIS PROCEDURE REQUIRE USE OF THE CRANE'S POWER. NEVER ACTIVATE ANY OF THE CRANE CONTROLS WHILE PERSONNEL ARE IN CONTACT WITH ANY PART OF THE BOOM.

BE SURE ALL RIGGING AND LIFTING EQUIPMENT IS OF ADEQUATE CAPACITY TO HANDLE THE BOOM OR CYLINDER SAFELY. SEE THE COMPONENT WEIGHT & DIMENSIONS CHART, APPENDIX H, FOR SPECIFICS.

Removing the Main Boom

To remove the main boom, you must support both the boom and boom hoist cylinder while removing the cylinder rod end pin. DO NOT drive the pin out and allow the boom hoist cylinder to "drop."

1. Start the crane's engine. Using the Boom Telescope Out/In control, retract the boom fully.
2. Using the Boom Hoist Raise/Lower control, lower the boom until the boom head is supported on wood blocking on the transport truck/trailer. Block up at a position which maintains 6" (150mm) of extension of the boom hoist cylinder. Remove the hook block(s); roll all wire rope onto the winch drum(s) and secure.
3. Attach a nylon sling to the boom hoist cylinder in a "half hitch" to prevent slippage, and connect to rigging "straddling" the boom. Snug up on the load.
4. Remove the boom hoist cylinder pin retainer bolts and plates at both the rod end and butt end; stow these parts, as well as all other parts removed during this procedure, in the crane storage box located under the hydraulic tank.
5. Check for loading on the rod end pin by striking the end of the pin with a hammer. Increase or decrease tension on the nylon sling to minimize loading. Drive the pin out.

ALWAYS WEAR EYE PROTECTION WHEN STRIKING ANY OBJECT WITH A HAMMER.

6. With the boom hoist cylinder rod end pin removed, lower the cylinder until it rests on the upper structure base plate.
7. Remove the operator aid male plug from its receptacle at the rear left of the boom butt stage. Disconnect the boom extend cylinder and boom hoist cylinder hydraulic lines at the cylinder end. Cap or plug all disconnected fittings. Secure the hydraulic lines to the upper structure to protect them from damage.
8. Locate the center of gravity (see Appendix H) of the main boom assembly. Using chokers around the boom, attach the boom to a crane or other lifting machine.
9. Remove the boom foot pin bolts and retainer located on the engine (right) end of the foot pin. Attach a tag line at the boom head.
10. Raise the boom slightly to remove the blocking supporting the boom head, and then lower it to a level position.
11. Check loading on the boom foot pin by striking the pin with a hammer. If necessary, relieve loading at the pin by raising or lowering the boom slightly.
12. Remove the boom foot pin by driving it out with a hammer and wood block or by using a slide hammer (pin is tapped 1"-8 UNC).
13. Move the boom to a waiting truck or storage area and support it with appropriate blocking.

14. Support the boom hoist cylinder with a sling near its center. Remove the cylinder butt end pin by driving it out with a hammer and wood block.

Installing the Main Boom

1. Move the crane, boom hoist cylinder, and boom within range of the lifting device to be used.
2. Attach a sling around the boom hoist cylinder near its center of gravity; use a “half hitch” to prevent slippage. Raise the cylinder into position and install the cylinder butt end pin by driving it in with a hammer and wood block; bolt the pin retainer into position. Lower the cylinder slowly until there is no tension on the lifting device, and remove the sling.
3. Locate the center of gravity (Appendix G) of the main boom assembly. Using chokers around the boom, attach the boom to the lifting machine. Attach a tag line to the boom head.
4. Lift the boom into position and install the boom foot pin; bolt the foot pin retainer into position.
5. Support the boom head with wood blocking. Release tension on the lifting device and remove the chokers.
6. Remove the caps and plugs from the boom extend cylinder and boom hoist cylinder hydraulic line fittings and attach the lines to their respective ports.
7. Attach a nylon sling to the boom hoist cylinder in a “half hitch” and connect it to rigging “straddling” the boom. Raise the cylinder into position.
8. Start the crane’s engine. Using the crane’s hydraulic power, extend the boom hoist cylinder slowly with the Boom Up/Down control lever until the cylinder rod end aligns with its attachment point on the boom.
9. Install the rod end pin; bolt the pin retainer into position. Release tension on the sling around the boom hoist cylinder and remove the sling.
10. Again using crane hydraulic power, raise the boom fully while checking to make sure that the hydraulic lines is not pinched or binding.
11. Install and rig the hook block(s).

Appendix L: Crawler Frame Removal/Installation

WHEN INSTALLING OR REMOVING THE CRAWLER FRAMES, USE THE SAME SAFETY PROCEDURES THAT YOU USE WHEN MAKING ANY OTHER LIFT WITH THE CRANE.

PARTS OF THIS PROCEDURE REQUIRE USE OF THE CRANE'S POWER. NEVER ACTIVATE ANY OF THE CRANE CONTROLS WHILE PERSONNEL ARE IN CONTACT WITH ANY PART OF THE CRAWLER FRAMES.

Removing the Crawler Frames

The Mantis 14010 crawler frames are held in place by cap plates and fasteners at the end of each of the four extend beams. The frames are removed while the crane is supported on a trailer.

1. With tracks fully extended, drive the crane over a lowered detachable goose neck trailer, or beam trailer and position it so the crane is centered.
2. Raise the trailer so the tracks are no longer in contact with ground. Block under the trailer directly below the front and rear extend beams to stabilize it for track removal.
3. Using the trailer/truck power, lower the trailer onto the blocking, ensuring that the tracks are not in contact with the ground.
4. Remove screws, washers, and cap plates from the end of each extend beam.
5. Start the crane. Using the Tracks EXTEND/RETRACT rocker switch, retract and extend the crawler frames slightly.
6. Raise the boom to a high angle and keep the boom fully retracted. Swing the boom directly over the side, positioning the hook over the center of the first track to be removed.
7. Install the three factory supplied lifting lugs on the track frame. Rig lugs using a three part bridle. Use rigging that is appropriately sized for the load. (See Appendix H for weights of tracks and other removable equipment.)

Installing the Crawler Frames

1. Have the crane positioned on a blocked and lowered trailer with extend beams retracted. Tracks should be on a trailer beside the crane.
2. Remove screws, washers, and cap plates from the end of each extend beam.
3. Start the crane. Raise the boom to a high angle and keep the boom fully retracted. Swing the boom directly over the side, positioning the hook over the center of the first track to be installed.
4. Install the three factory supplied lifting lugs on the first track frame. Rig lugs using a three part bridle. Use rigging that is appropriately sized for the load. (See Appendix H for weights of tracks and other removable equipment.)
5. Insert the track frame onto the extend beams. Tilt the track frame so the outside is slightly higher than the inside to aid the engagement with the extend beams. Connect chain ratchets between the crane's carbody and the track frames to keep the tracks from swinging outward. Use the track extend/retract control to help with engagement.
6. Install cap plates and fasteners to secure crawler frame. Ensure that the frame is fully engaged on the extend beam, and that the cap plate sits against the end plate of the extend beam.

Appendix M: Extension/Jib Erection & Rigging

The 8012/9010/10010MX/14010 cranes may be equipped with the optional 30-foot lattice extension and 20-foot lattice jib.

The extension may be used alone or with the jib. The jib is used only with the extension.

When the extension is used alone, it is rigged either 1-part with an overhaul ball or 2-part with a hook block. When the extension and jib are used together, rigging is 1-part with an overhaul ball.

The extension and jib are stowed alongside the main boom when not in use.

PARTS OF THIS PROCEDURE REQUIRE USE OF THE CRANE'S POWER. NEVER ACTIVATE ANY OF THE CRANE CONTROLS WHILE PERSONNEL ARE IN CONTACT WITH ANY PART OF THE BOOM, EXTENSION, OR JIB.

NOTE:

Erecting or stowing the jib & extension is much easier if the crane is on a level surface.

All left and right directional references are as viewed from the crane operator's seat.

Erecting and Rigging the Extension

Follow the steps below to erect the extension alone from its stowed position. See the figures on the following pages for location of the details mentioned in this procedure.

1. Retract the boom fully and lower it to a horizontal position.
2. The two far right pin bosses on the boom head should be aligned with the pin bosses on the extension. Insert two pins "A" into the two aligned holes of the boom head and extension and install retainers on them.
3. Remove the two pins "B" which connect the jib to the jib transition bracket in the stowed position. Remove the retainers from the extension slider pins and release the jib-to-extension retainer pin. Extend the boom slowly until the extension slider pins clear their mating pockets and the extension hook clears the extension alignment ramp.
4. Use the tag line to swing the extension into alignment with the main boom. The four remaining pin bosses on the boom head should now be aligned with the pin bosses on the extension. Insert four additional pins "A" into the four aligned pairs of bosses on the boom head and extension. Install retainers on all pins "A".
5. Rigging with the extension only does not require the jib transition bracket. Remove the two pins "C" securing the jib transition bracket to the extension tip and remove the bracket. The pins are retained by through-bolts near the handle end of the pins.
6. Install the extension lower sheave. Route the wire rope from the auxiliary winch drum over the top wire rope guide in the boom head and over the extension upper and lower sheaves. Install the lower sheave wire rope guide assembly and pin.

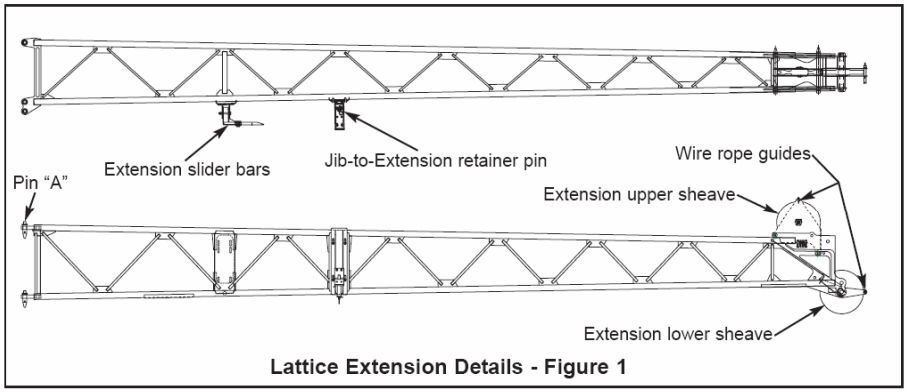
WARNING:

Do not route the wire rope under the top guide in the boom head.

7. For 1-part rigging, install the wedge and socket (becket) and overhaul ball.
8. For 2-part rigging, route the wire rope end around the hook block sheave. Install the becket and attach it to the dead end anchor point on the extension tip.
9. Install the A2B jumper cable between the boom head and extension. Plug the male connectors into the female receptacles. Install the A2B switch at the pivot location on the extension lower sheave and plug it into its receptacle.

Stowing the Extension

1. Retract the boom fully and lower it to a horizontal position. Remove the wire rope guides and retainers at the upper and lower extension sheaves.
2. Remove the becket and overhaul ball; retract the wire rope onto the auxiliary winch drum and secure it. Remove the extension lower sheave.
3. Unplug the A2B switch at the pivot location on the extension lower sheave and remove it from its pivot location. Remove the A2B jumper cable between the boom head and extension.
4. Install the jib transition bracket and the two pins “C” securing it to the extension tip. Install the through-bolts near the handle end of the pins.
5. Extend the boom approximately 1 meter (3 ft). Remove all but the two far right pins “A” from the extension and main boom bosses. Swing the extension back alongside the jib and main boom.
6. Raise the boom to approximately 30º above horizontal, or until the extension settles fully on its stowage brackets. Lower the boom to horizontal and install the retainers at the extension slider pin locations on the main boom.
7. Replace the two pins “B” which connect the jib to the jib transition bracket in the stowed position.
8. Remove the pins “A” attaching the extension to the far right pin bosses on the boom head. Stow these pins and their retainers, as well as all other parts removed during this procedure, in the crane storage box under the hydraulic fluid tank.



Lattice Extension Details - Figure 1

Erecting and Rigging the Extension and Jib

Follow the steps below to erect the extension and jib from their stowed position.

1. Retract the boom fully and lower it to a horizontal position.
2. The two far right pin bosses on the boom head should be aligned with the pin bosses on the extension. Insert two pins “A” into the two aligned holes of the boom head and extension and install retainers on them.
3. Attach a tag line to the lower chord of the extension near the butt end of the main boom. Remove two pins “B” connecting the jib to the stowage bracket on the main boom. Remove the retainers from the extension and jib slider pin locations on the main boom.
4. Raise the boom to a position slightly above horizontal. Extend the boom slowly until the extension and jib slider pins clear their mating pockets and the extension hook clears the extension alignment ramp.
5. Lower the boom to a full horizontal position. Use the tag line to swing the extension and jib into alignment with the main boom. The four remaining pin bosses on the boom head should now be aligned with the pin bosses on the extension. Insert four additional pins “A” into the four aligned pairs of bosses on the boom head and extension. Install retainers on all pins “A”.
6. Attach a tag line to a lower chord of the jib tip. Unlock the jib-to-extension retainer pin and swing the jib into alignment with the extension. The two remaining pin bosses on the extension tip should now be aligned with the pin bosses on the jib. Insert two additional pins “B” into the two aligned pairs of bosses on the extension and jib. Install retainers on all pins “B”. To offset the jib to 15º or 30º positions, proceed with Step 7. Otherwise skip ahead to Step 10.
7. Remove the 0º offset retaining pins and store them. Lower the boom until the jib tip rests on wood blocking on a truck or trailer.

Lower the boom further until there is no pressure on the offset ratchet bolts and the ratchet plates can swing up free of the bolts.

NOTE:

Do not remove the offset ratchet bolts to perform this operation.

8. Using a pry bar, lift the ratchet plates and hold them clear of the ratchet bolts. Raise the boom slowly. When the ratchet bolts begin to slip into the proper notch (2nd notch = 15º offset, 3rd notch = 30º) in the ratchet plates, remove the pry bar. Continue raising the boom until the jib tip rises clear of the blocking.

WARNING:

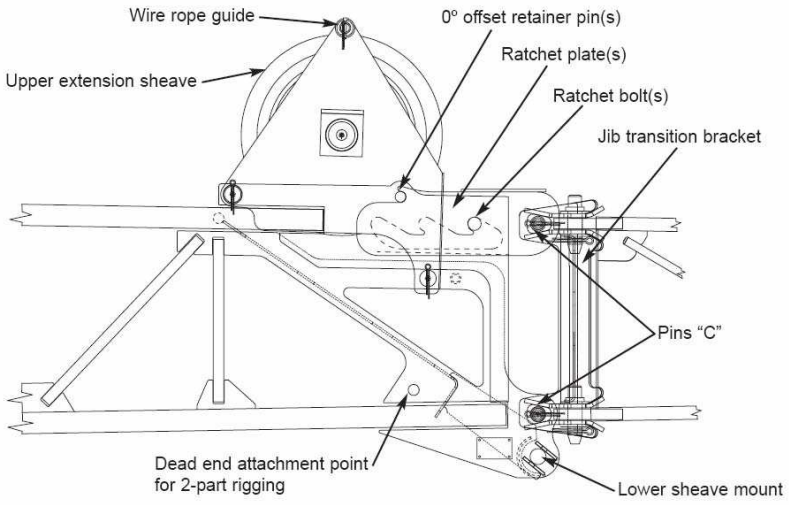
Do not lift the ratchet plates with your hands; always use a pry bar and keep your hands completely clear of all pinch points.

9. Install the jib tip sheave and rope guide pins. Install all pin retainers.
10. Route the wire rope from the auxiliary winch drum over the top wire rope guide in the boom head, over the top sheave at the extension tip, and over the jib tip sheave. Install the wedge and socket (becket) and overhaul ball.

WARNING:

Do not route the wire rope under the top guide in the boom head.

11. Install the wire rope guide at the top extension tip sheave and the two guides at the jib tip sheave. Check to see that all pins and retainers are properly installed and secured.
12. Install A2B jumper cables between the boom head and extension and between the extension and jib. Plug the male connectors into the female receptacles. Install the A2B switch at the pivot location on the jib head and plug it into its receptacle.



Stowing the Extension and Jib

1. Retract the boom fully and lower it to a horizontal position. Remove the wire rope guide and retainer at the top extension tip sheave and the two guides and retainers at the jib tip sheave.
2. Remove the becket and overhaul ball; retract the wire rope onto the auxiliary winch drum and secure it. Remove the jib tip sheave.

If the jib is in the 15º or 30º offset position, proceed with Step 3. Otherwise skip ahead to Step 5.

3. Lower the boom until the jib tip rests on wood blocking on a truck or trailer.
4. Lower the boom further until the ratchet bolts slip into the 0º notches of the ratchet plates. Raise the boom until the jib tip rises clear of the blocking. Install and secure the 0º offset retaining pins. Raise the boom to a horizontal position.
5. Attach a tag line to a lower chord of the jib tip. Remove the two pins “B” and their retainers from the left side bosses on the extension tip. Swing the jib back alongside the extension until the jib-to-extension retaining pin locks the jib and extension together.
6. Extend the boom approximately 1 meter (3 ft). Remove all but the two far right pins “A” from the extension and jib bosses. Swing the extension and jib back alongside the main boom.
7. While holding pressure on the tag line to force the jib and extension toward the boom, slowly retract the boom. Watch to make sure that all hooks, slider pins, and corresponding mounts are engaging properly. Retract the boom as far as it will go.
8. Raise the boom to approximately 30º above horizontal, or until the extension and jib settle fully on their stowage brackets. Lower the boom to horizontal and install the retainers at the extension and jib slider pin locations on the main boom.
9. Recheck all pin retainers; make sure that the jib-to-extension retaining pin is securely set.
10. Remove the pins “A” attaching the extension to the far right pin bosses on the boom head. Stow these pins and their retainers, as well as all other parts removed during this procedure, in the crane storage box under the fuel tank.

Appendix N: Terms & Abbreviations

ENGLISH/METRIC AND OTHER EQUIVALENTS USED IN THIS MANUAL

1 quart (qt) = 0.946 liter (l)

1 gallon (gal) = 3.78 liter

1 foot (ft) = 0.304 meter (m)

1 pound (lb) = 0.45 kilogram (kg)

1 kilo pound (KIP) = 1,000 pounds

1 ton (T) = 2,000 pounds

1 ton = 0.907 metric ton (t)

1 mile (mi) = 1.61 kilometer (km)

14.28 lb/in_2 (psi) = 1 bar