



CRANE OPERATOR MANUAL

5004 Series

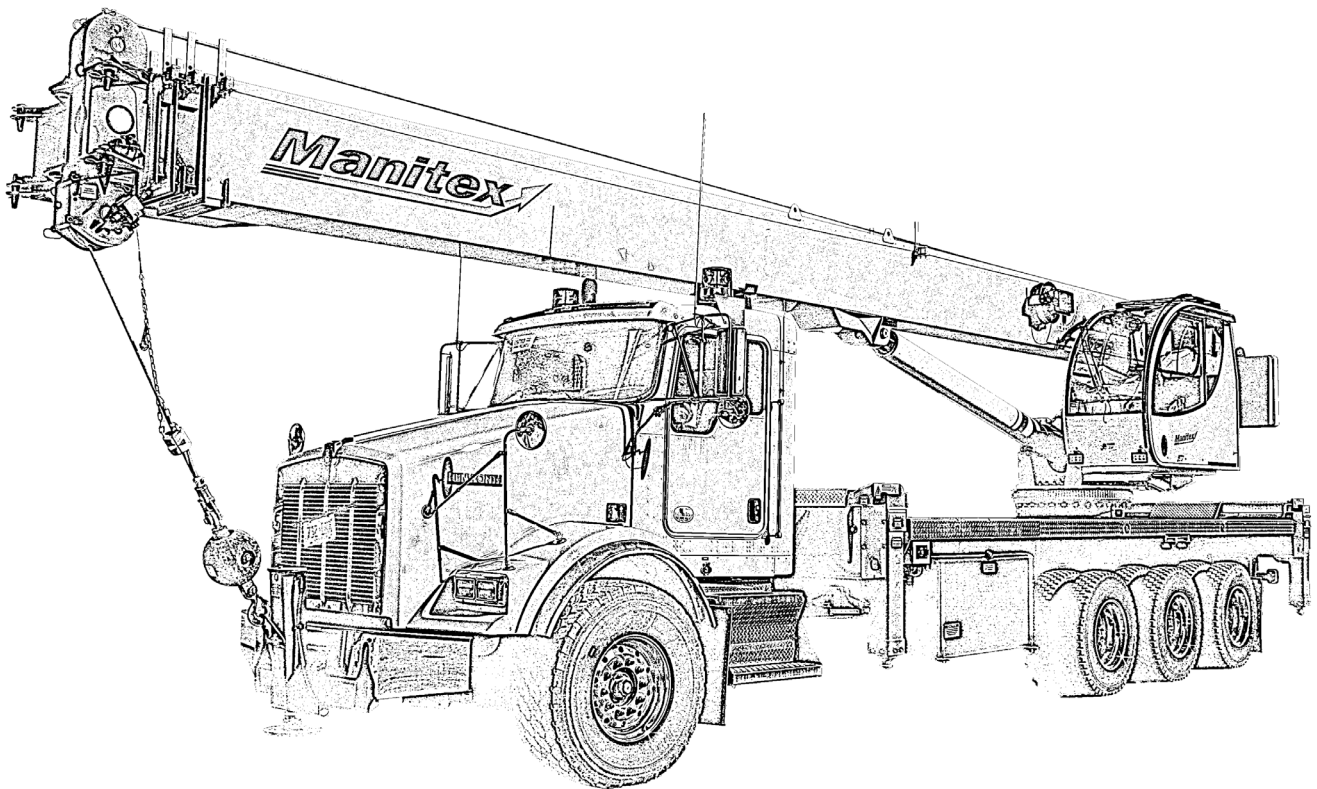


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Introduction

Operator Manual Notice

Safe and efficient operation of a crane requires that it is maintained in proper working order and that operators and maintenance personnel are familiar with the controls and operating capabilities of the crane.

Before placing a crane in service, this manual and the accompanying AEM (Association of Equipment Manufacturers) Safety Manual must be read and understood in its entirety by each person responsible for operation and maintenance of the crane.

CAUTION

Failure to read and observe instructions in these manuals can result in death or serious injury to personnel and damage or destruction of equipment.

The safety information in this manual is intended only as a guide to assist qualified personnel in safe operation and maintenance but it is no substitute for training, experience and common sense. Manitex cannot foresee all potential hazards or misapplications that will arise in the field, therefore, **safety remains the responsibility of the crane owner/operator**. Crane users who have not been properly trained in crane operation and safety by experienced crane operators should not be allowed to operate this equipment.

Existing federal, state and local laws, rules and regulations along with safety codes and insurance requirements take precedence over any information contained in this manual.

Safety Messages



This safety alert symbol appears with most safety statements. It means attention, become alert, your safety is involved! Please read and abide by the message that follows the safety alert symbol.

The words DANGER, WARNING, CAUTION and NOTICE are used throughout this manual to highlight important information. Be certain that the meanings of these alerts are known to all who work on or near the equipment.

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury,

NOTICE

Indicates a situation which can cause damage to the equipment, personal property and/or the environment, or cause the equipment to operate improperly.

Note Indicates a procedure, practice or condition that should be followed in order for the equipment or component to function in the manner intended.

Service/Parts Inquiries

All service inquiries and parts orders should be accompanied by the following information.

- Name, address and telephone number of the crane owner.
- Model and Serial Number of the crane.
- Part numbers or complete description of problem.

Incidents

If a Manitex crane is involved in an incident where there is personal injury or property damage, notify our Product Support Center soon as possible. Provide details of the incident; include crane model, serial number, and photographs of the crane and scene of the incident (digital preferred).

Questions

Manitex carries out a program of continuous product improvement. Because of this, Manitex reserves the right to change the information and specifications given in this manual at any time without notice.

If you have any questions about a Manitex crane or associated literature, please contact your distributor or our Product Support Center.

Manitex
Product Support Center
Georgetown, TX 78626
Telephone: (512) 942-3031
Fax: (512) 942 3094

Chapter 1

Safety and Operation

General

The importance of safe operation cannot be over emphasized. Carelessness and neglect on the part of operators, job supervisors and planners, rigging personnel and job site personnel can result in their death or injury and costly damage to the crane or property.

As stated in the Introduction, the safety information in this manual is intended only as a guide to assist the qualified operator in safe operation and maintenance but it is no substitute for training, experience and common sense. Manitex cannot foresee all potential hazards or misapplications that will arise in the field, therefore, safety remains the responsibility of the crane owner/operator. Crane users who have not been properly trained in crane operation and safety by experienced crane operators should not be allowed to operate this equipment.

Refer to OSHA Cranes and Derricks 29 CFR Part 1926 and ANSI/ASME B30.5-2007 for responsibilities of employers, equipment owners, job site personnel, mechanics and operators as well as standards and requirements regarding safety, planning, operation, inspection and maintenance of crane equipment. The subjects and material presented here are highlights of ANSI/ASME B30.5-2007 and are intended as general information only. Existing federal, state and local laws, rules and regulations along with safety codes and insurance requirements take precedence over any information contained in this manual.

DANGER

Failure to comply with safe operating practices and safety messages in this section may result in death or serious injury to operator and job site personnel and destruction of this crane. Read and understand instructions in this chapter and in the load rating chart before attempting to operate this crane.

Safe Operating Practices

Operation Near High Voltage Power Lines

Operation of this crane near high voltage power lines shall be accordance with the following requirements.

Required Clearance for Normal Voltage in Operation Near High Voltage Power Lines and Operation in Transit with No Load and Boom Lowered.

<i>Normal Voltage, kV (Phase to Phase)</i>	<i>Minimum Required Clearance</i>
Operation Near High Voltage Power Lines	
to 50	10 ft.
Over 50 to 200	15 ft.
Over 200 to 350	20 ft.
Over 350 to 600	25 ft.
Over 500 to 750	35 ft.
Over 750 to 1000	45 ft.
Operation in Transit with No Load and Boom Lowered	
to 0.75	4 ft.
Over 0.75 to 50	6 ft.
Over 50 to 345	10 ft.
Over 345 to 750	16 ft.
Over 750 to 1000	20 ft.

Reference: ANSI B30.5

- Any overhead line shall be considered to be an energized power line unless and until the person owning the line or the electrical utility authority indicates that the line is not an energized power line.
- Before starting crane operations near electric power lines, the person responsible for the job shall notify the owner of the lines or his authorized representative providing them with all pertinent information and requesting their cooperation.
- For all operations where it is difficult for the operator to maintain the required clearance by visual means, a qualified signal person shall be provided. The signal person shall observe the clearance and give the operator timely warnings so as to maintain the minimum clearance.
- Avoid electrocution! If any part of the crane or the load contacts an energized electric power line, the operator shall not attempt to get off the crane. The operator shall remain at the controls until the contact has been cleared or the power line has been de-energized. Do not let anyone on the ground touch the crane.

The above requirements shall be adhered to even if the crane is equipped with cage-type boom guards, insulating links or proximity warning devices.

Wind Conditions

The effects of wind can have a significant affect on loads of various shapes and sizes that may be lifted by a crane. Since wind can exert inordinate dynamic loadings, Manitex recommends that loads not be lifted if the effects of the wind can cause the load to swing uncontrollably or in a hazardous manner.

Additionally, wind forces act differently on a crane depending upon the direction from which the wind is blowing. For example:

1. Wind loads acting upon the rear of the boom can result in decreased forward stability,
2. Winds acting upon the underside of the boom can result in decreased backward stability,
3. Winds acting upon the side of the boom can result in structural damages.

Wind and other factors such as boom length, angle, size and weight of load being lifted, etc. can affect crane stability and crane structures. Practical working loads for each particular job and lift shall be established by the user depending upon conditions that exist at the time the lift is being made. Be extremely cautious if wind velocity approaches 20 mph (miles per hour).

We recommend if wind speed (velocity) exceeds 20 mph (32.2 Km/hr), that crane capacities be reduced to 44% of the allowable stability and structural capacities appearing on the crane's load capacity charts. In addition, all craning operations cease if the wind speed reaches or can exceed 30 mph (48.3 Km/hr). Additionally, all functions concerning the operation of any personnel carriers (e.g., manbaskets) must cease if the wind speed reaches or can exceed 20 mph (32.2 Km/hr).

The chart below may be helpful to the crane operator when estimating prevailing wind conditions.

Wind Force	Wind Velocity	Visible Indications
Beaufort Scale	Designation MPH (Km/ph)	Effects of Wind as Observed on Land
0	Calm <1 (<2)	No wind; Smoke rises vertically
1	Light Air 1-3 (2-5)	Wind direction seen by smoke but not by wind vanes
2	Light Breeze 4-7 (6-11)	Wind felt on face; leaves rustle; wind vane moves slightly
3	Gentle Breeze 8-12 (13-19)	Leaves/small twigs in constant motion; wind extends flag
4	Moderate Breeze 13-18 (21-29)	Raises dust and loose paper; moves small branches
Reduce Crane Load ratings and Operating Parameters @20 mph (32 Km/ph)		
5	Fresh Breeze 19-24 (31-39)	Small trees in leaf begin to sway; on ponds, crested wavelets form
6	Strong Breeze 25-31 (40-50)	Large branches in motion; telegraph wires whistle; umbrellas used with difficulty
Cease All Craning Operations @30 mph (48 Km/ph) Lower and Retract Boom		
7	Moderate Gale 32-38 (52-61)	Whole trees in motion; walking against wind is inconvenient

****This table is only an approximation of wind speed by visual indicators. If the wind is estimated to be in excess of Beaufort Scale 3, confirm by contracting the nearby Weather Bureau or other more accurate sources.

WARNING

Before operating any Manitex equipment, the operator must read and understand the owner's manual and other instructions for a specific serial number crane. This table is only a guide. It is not meant to replace good operator judgment.

Cold Weather

Before operating any Manitex Crane in extreme cold temperatures, please verify that all lubricants including hydraulic oil and other components are suitable. Operators should be well trained and familiar with all content of the operator manual and load chart. The machine shall always be operated within the guidelines documented within the published load chart and operators manual.

General guidelines for crane operations in cold temperatures include but are not limited to the following:

1. Oils & fluids suitable for arctic temperatures shall be used (*not supplied by Manitex*).
2. Oil heaters must be used (*not supplied by Manitex*).
3. Lub points must be lubricated using low temperature grease; this includes rotation bearing, sheaves, load block etc., (*not supplied by Manitex*).
4. Suitable warm up period of truck engine and crane hydraulic system to include cycling of functions and cylinders prior to handling a load.
5. All crane operations to be performed in a slow controlled manner.
6. Shock loading a crane is never allowed and is most critical in cold weather environments, operating in a smooth and controlled manner will help preserve the equipment if used within the limits of the load chart and recommended de-rating factors below.

The de-rating factors below are only for cold temperature adjustments. For crane operations in temperatures up to:

- -20° F (-28° C) the crane can be utilized to 100% of the published load chart
- -30° F (-34° C) the crane shall be de-rated to 50% of the published load chart
- At -40 (-10° C) degrees Fahrenheit lift operations shall cease

A linear calculation could be used to factor temperatures between the documented temperatures.

Signals

- Signals to the operator shall be in accordance with the standard signals shown on the following pages unless communications equipment (telephone, radio, etc.) is used.
- For operations not covered in standard signals illustrations, or for special situations, additional signals may be required. In those cases, the signals used shall be agreed upon in advance by the operator and the signal person. The signals used should not conflict with or have the potential to be confused with the standard signals.
- If it is necessary to give other than the standard signals to the operator, all crane motions shall be stopped.
- The signal person shall:
 - ☐ Be qualified by experience with the operations and knowledgeable of the standard signals.
 - ☐ Position himself in clear view of the operator. The signal person's position shall give him a clear view of the load, the crane, and the operating area.
 - ☐ Direct the load so the load does not pass over personnel.
 - ☐ Keep unnecessary personnel out of the crane's operating area.

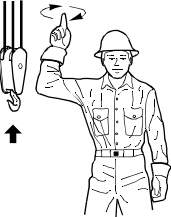
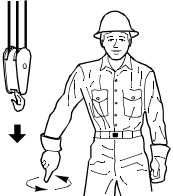
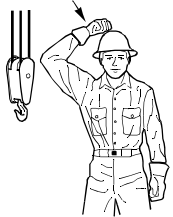
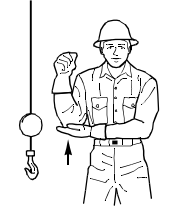
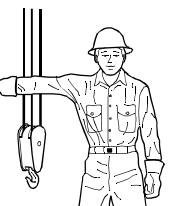
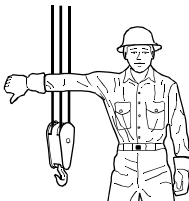
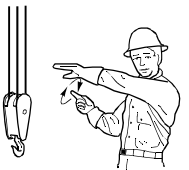
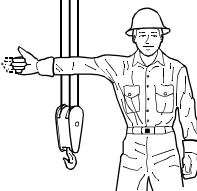
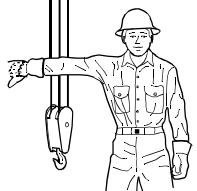
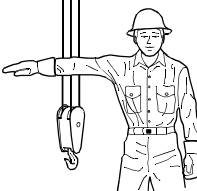
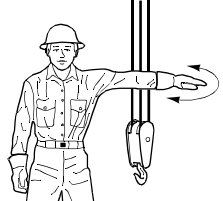
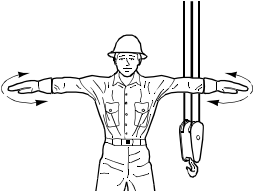
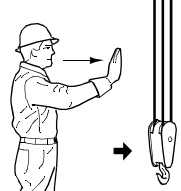
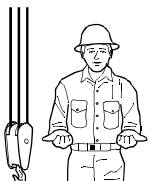
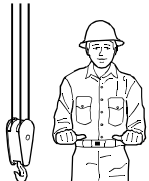
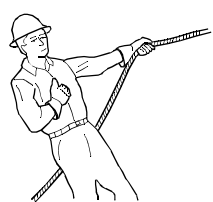
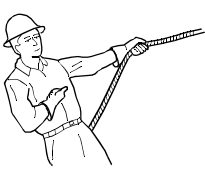
 HOIST. Forearm vertical, forefinger pointing up, move hand in small horizontal circles.	 LOWER. Arm extended downward, forefinger pointing down, move hand in small horizontal circles.	 USE MAIN HOIST. Tap fist on head; then use regular signals.	 USE WHIPLINE. (Auxiliary Hoist.) Tap elbow with one hand; then use regular signals.	 RAISE BOOM. Arm extended, fingers closed, thumb pointing upward.
 LOWER BOOM. Arm extended, fingers closed, thumb pointing downward.	 MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as an example.)	 RAISE BOOM & LOWER LOAD. Arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.	 LOWER BOOM & RAISE LOAD. Arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.	 SWING. Arm extended point with finger in direction of swing of boom.
 STOP. Arm extended, palm down, move arm back and forth horizontally.	 EMERGENCY STOP. Both arms extended, palms down, move arms back and forth horizontally.	 TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.	 DOG EVERYTHING. Clasp hand in front of body.	 TRAVEL. (Both Tracks.) Use both fists in front of body, making a circular motion about each other, indicating direction of travel; forward or backward.
 TRAVEL. (One Track.) Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body.	 EXTEND BOOM. (Telescoping Booms.) Both fists in front of body with thumbs pointing outward.	 RETRACT BOOM. (Telescoping Boom.) Both fists in front of body with thumbs pointing toward each other.	 EXTEND BOOM. (Telescoping Boom.) One Hand Signal. One fist in front of chest with thumb tapping chest.	 RETRACT BOOM. (Telescoping Boom.) One hand signal. One fist in front of chest, thumb pointing outward and heel of fist tapping chest.

Figure 1-1 Standard Hand Signals

Preparing for Road Travel

The following steps shall be taken before the truck is traveled after crane operations:

- The jib shall be stored, if equipped.
- The boom shall be in the boom rest before the outriggers and stabilizers are retracted.
- The swing lock must be engaged and control locked in position.
- The load block or the overhaul ball shall be secured to the truck chassis at the front.
- The outriggers and stabilizers shall be fully retracted.

NOTICE
<i>Always retract front bumper stabilizer, if equipped, before retracting outriggers or rear stabilizers.</i>

- Ensure outrigger floats are stowed and secured onto float storage brackets.
- All cab openings are to be closed and secured, if equipped.
- The PTO shall be disengaged.
- All loose items shall be stored or secured to the flatbed.
- The tires shall be inflated to the proper pressure.
- The total weight of the truck, the crane and any load carried on the flatbed, shall not exceed the allowable gross vehicle weight.

Crane Outriggers

Outrigger Warnings

DANGER

Avoid injury to personnel or damage to crane and property by adhering to the following safety precautions when operating outriggers and stabilizers.

- Warn all personnel to stand clear of outriggers and stabilizers before operating them.
- Set outrigger and stabilizer pads on flat, firm foundation that will support load placed on pads.
- Do not set pads in holes, on rocky ground, or on extremely soft ground. Use wood blocking or steel plates under pads, if necessary, to properly distribute loading on foundation.
- Fully retract outriggers and stabilizers before traveling in the truck.
- The material used under the outrigger pads shall be strong enough to prevent crushing, be free of defects, and be of sufficient length and width to prevent shifting or toppling over under load.
- Return control levers to OFF as soon as outriggers or stabilizers are fully extended or fully retracted, otherwise, oil will flow over relief valve, possibly causing damage to hydraulic system from over-heating.
- All crane operations on outriggers shall be performed with the outriggers set on a firm foundation so the crane is level.
- All crane operations on truck tires shall be limited to the allowed area of operation and conditions indicated on the crane's load rating chart.

Area of Operation

DANGER

Ensure that all lifting and load handling operations are performed within the allowable area of operation as indicated on the crane's load rating chart. Refer to the crane's load rating chart to see how usage of boom, jib or man basket combined with the various available outrigger configurations affect crane capabilities and allowable area of operation.

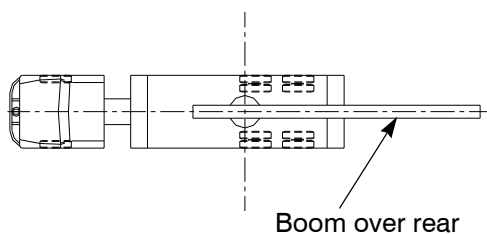
For lifting operations over the front of the truck, the crane must be level on outriggers with the front tires just touching the ground unless a front bumper stabilizer is used, refer to "Leveling the Crane" in this chapter.

For lifting operations on tires, ensure tires are inflated to the tire manufacturer's recommended pressure.

Failure to comply can cause crane to tip possibly resulting in personal injury and damage to crane or property.

ON TIRES

When lifting on tires, the boom must be centered over the rear of the crane with the swing brake and the swing lock engaged.



Note Chart "ON Tires" not available for models 50128S or 50155S

ON OUTRIGGERS

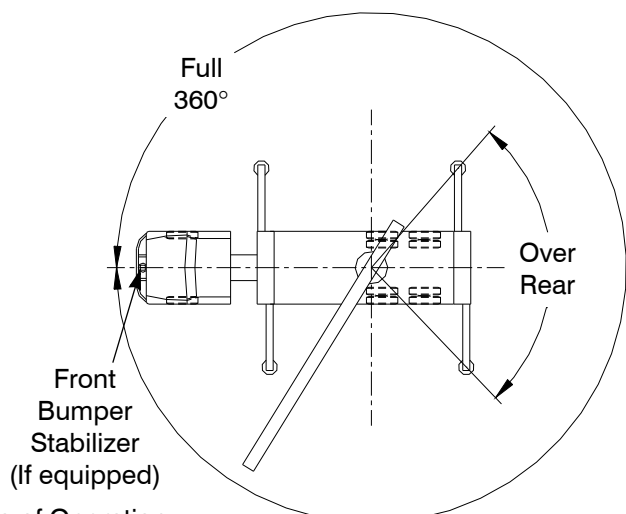


Figure 1-2 Area of Operation

Outrigger Configurations

NOTICE

See Area of Operation and Outrigger Warnings.

Outriggers may be set to three distances - *Full*, *Intermediate* and *Retracted* - by use of Outrigger Pins.

DANGER

Crane capacities and range vary depending on outrigger configuration used. Only the Load Rating Chart and Range Diagram that conforms to your outrigger set-up applies when determining applicable crane capacity and range for each specific lift. All outriggers must be identically set to the same extension. Attempting to use different extensions can result in equipment damage, personal injury, and injuries to others.

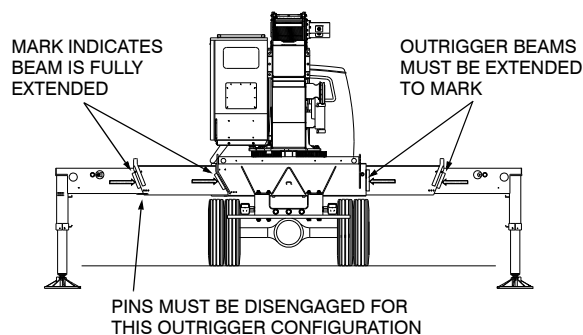
FULL EXTENSION AND RETRACTED SETTINGS

Before setting the outriggers, ensure that the Outrigger Lock Pin for each outrigger is in the Stow Position (*disengaged*); a hole is provided on the clevis lug to stow the pin, see Figure 1-3.

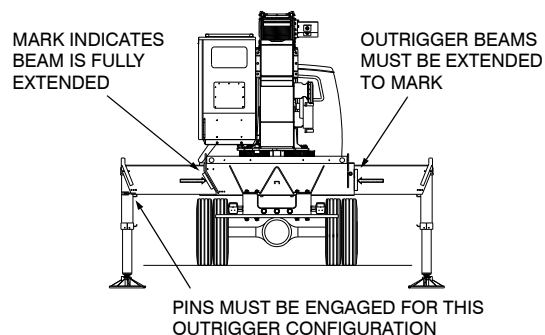
INTERMEDIATE EXTENSION

Before setting the outriggers, ensure that the outriggers are fully retracted. Remove the Outrigger Lock Pin from the clevis lug and place it in the Lock Position (*engaged*) as shown in Figure 1-3. When the lock pins are through all three plates in the clevis, the adjacent outrigger section is engaged and outrigger extension is limited to the appropriate spread.

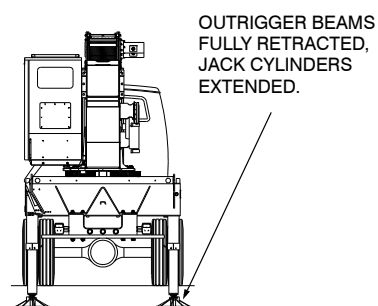
FULLY EXTENDED



INTERMEDIATE



FULLY RETRACTED



Full or Retracted Outrigger Spread
Pin Stow Position - *Disengaged*



Pin Stow Location

Intermediate Outrigger Spread
Pin Lock Position - *Engaged*



Outrigger Lock Pin

Figure 1-3 Outrigger Lock Pin Position and Configurations for Dual-Stage Outriggers

Starting the Crane

Plan your lifting or manbasket operations to determine the optimum positioning of the crane for the task to be performed. Take into consideration space need to install the manbasket or erecting the jib if they will be used.

NOTICE

Ensure all chassis and crane inspections are successfully performed before attempting to use the crane.

The Crane Power Switch in the truck cab is provided for the purpose of supplying positive switched power to the crane components. Constant power to the crane cab heater is supplied independently through an alternate battery source and is not tied to this crane power switch circuit.

The presence of the Crane Power Switch requires that the operator start the machine in a specific sequence for maintenance and crane operations.

Note

- If PTO control is an air switch, you may need to run the truck to bring air pressure to normal levels before operating the PTO switch.
- Always turn Crane Power Switch OFF before travelling the crane. Failure to do so will allow crane components to remain energized possibly resulting in drained truck batteries.
- If the PTO switch is engaged and the Crane Power Switch is turned OFF while engine is running, engine will shut off.
- If Crane Power Switch light is OFF, electrical power to crane components and controls is OFF.

The start procedure must be conducted as follows:



Crane Power Switch 2-Pos ON/OFF

Figure 1-4 Crane Power Switch



PTO Switch 2-Pos ON/OFF

(Dash mounted supplied by chassis manufacturer)

- Ensure truck parking brake is set.
- Press top side of Crane Power Switch (*maintained*).
- Place transmission in neutral gear, depress clutch pedal, Start engine. (*Crane Power Switch will illuminate*)
- While clutch is depressed, engage PTO then slowly release clutch.
- Crane ready to set-up for maintenance or crane operations.

Leveling the Crane

DANGER

Before operating the outriggers, refer to **Setting the Outriggers** earlier in this chapter for outrigger warnings and notes. If lifting over the front, be sure to pay particular attention to the following instructions regarding proper set-up of the front outriggers, front truck tires and front bumper stabilizer (if equipped).

The crane is equipped with sensors to detect if the main outrigger extensions are properly deployed; **DO NOT** operate the crane until the outriggers have been set-up in compliance with all warnings and instructions. Failure to comply can cause crane to tip possibly resulting in personal injury and damage to crane or property.

NOTICE

The crane outriggers must be set in the following sequence and manner described to ensure optimum crane performance.

NOTICE

Due to the grade of the ground, it may become necessary to add cribbing under the outrigger pads to ensure that the tires come off the ground. See "Outrigger Warnings" earlier in this chapter for notes on cribbing if it becomes necessary.

Note The LMI system delivers an audio/visual warning if either of the outrigger extensions is not properly deployed, to clear the warning, correct the offending condition, see danger note above.

Step 1 Ensure that the outrigger pin is in the correct position for the desired outrigger spread configuration before extending the outrigger beams. Refer to Figure 1-3 for illustrations of the various outrigger configurations.

For cranes without a front bumper stabilizer

Step 2 Install outrigger floats then extend the front outrigger beams to the desired spread position, when properly extended the indicator arrow on each beam must be fully exposed.

Step 3 Then, extend the front outrigger jack cylinders until front tires are **barely touching** the ground, adjust each jack cylinder to level the crane from side to side.

Note If loads will not be lifted or carried over the front, then the front of the truck may be set-up with the tires completely off the ground. Proceed to step 4.

For cranes equipped with a front bumper stabilizer

Step 2 Install outrigger floats then extend the front outrigger beams to the desired spread position, when properly extended the indicator arrow on each beam must be fully exposed.

Step 3 Then, extend the front outrigger jack cylinders until front tires are completely off the ground, adjust each jack cylinder to level the crane from side to side.

Step 4 Next, extend the rear outrigger beams to the spread position that matches the front outrigger spread, when properly extended the indicator arrow on each beam must be fully exposed.

Step 5 Then, extend the rear outrigger jack cylinders simultaneously (operate both controls for the jack cylinders at the same time) until the rear tires are completely off the ground; operate the controls simultaneously when adjusting rear jacks to level the crane from front to rear.

NOTICE

Always operate both rear jacks simultaneously to keep from adding unnecessary twist to truck frame and sub-frame during outrigger set-up. Keeping frame twist to a minimum will ensure optimum crane stability.

Step 6 Finally, extend the front stabilizer until oil flows over the relief valve. At this point, the stabilizer will stop extending ensuring the stabilizer is properly loaded.

Retracting Outriggers

DANGER

Never retract the outriggers unless the boom is stored in the boom rest, failure to comply will compromise crane stability resulting in tipping, possible injury to personnel and damage to crane or property.

Step 1 Place the boom in the boom rest and secure overhaul ball or load block for travel.

Step 2 Raise all outrigger jacks in reverse order, always raise front bumper stabilizer first if so equipped.

Step 3 Remove aluminum floats and store in brackets provided.

Step 4 Proceed to fully retract outriggers and lock in stowed position with pins provided, see Figure 1-3.

Outrigger Controls - Radio Remote

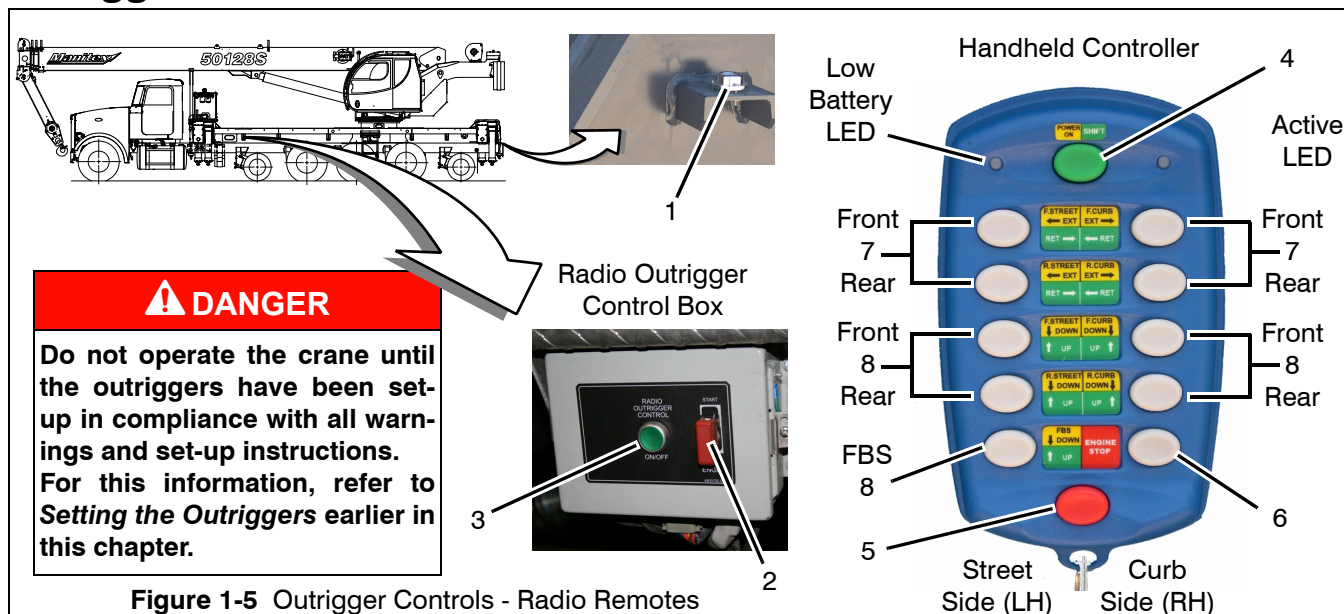


Figure 1-5 Outrigger Controls - Radio Remotes

Control and Position (Figure 1-4)	Function
1. Bubble Level	Indicates if the crane is level, side to side and front to rear. Level is located at the rear of the crane, see also item 34 in Figure 1-6 for in cab indicator.
2. Engine Start/Stop Toggle DOWN from OFF Toggle UP from OFF	Ignition key in truck cab must be in the run position. Lift protective cap to access the toggle switch. ENGINE STOP - Fuel flow to truck engine interrupted to stop engine. ENGINE START - Engine restart; release toggle once engine has started to prevent damage to engine starter.
3. Control Power - Outrigger PRESS (button light ON) PRESS (button light OFF)	See also item 5 in Figure 1-6 for related power control in the cab. POWER ON enables radio and hydraulic power to O/R remote system. POWER OFF disables radio and hydraulic power to O/R remote system.
4. Handheld Power / Shift Key Handheld Power Function Shift Key Function	<i>Note</i> Handheld control will power off after 3 minutes of inactivity. PRESS to turn handheld power ON , Active LED will fast flash when controller is ON and ready to transmit radio signal. When controller is active, PRESS and HOLD Shift button to activate alternate operation shown on each keypad function button.
5. Power Off	PRESS to turn handheld control power OFF .
6. Engine Stop	PRESS to stop truck engine, hydraulic power to crane is OFF .
7. O/R Extension Function Buttons PRESS Function Button Only PRESS Shift + Function Button	Buttons operate the specific outrigger extension selected, see button labels for function identification. EXTENDS selected outrigger extension outward. RETRACTS selected outrigger extension inward.
8. O/R Jack & Front Stabilizer Function Buttons PRESS Function Button Only PRESS Shift + Function Button	Buttons operate the specific outrigger jack selected or optional front bumper stabilizer (FBS), see button labels for function identification EXTENDS selected outrigger jack downward. RETRACTS selected outrigger jack upward.

Outrigger Controls - Manual (Override)

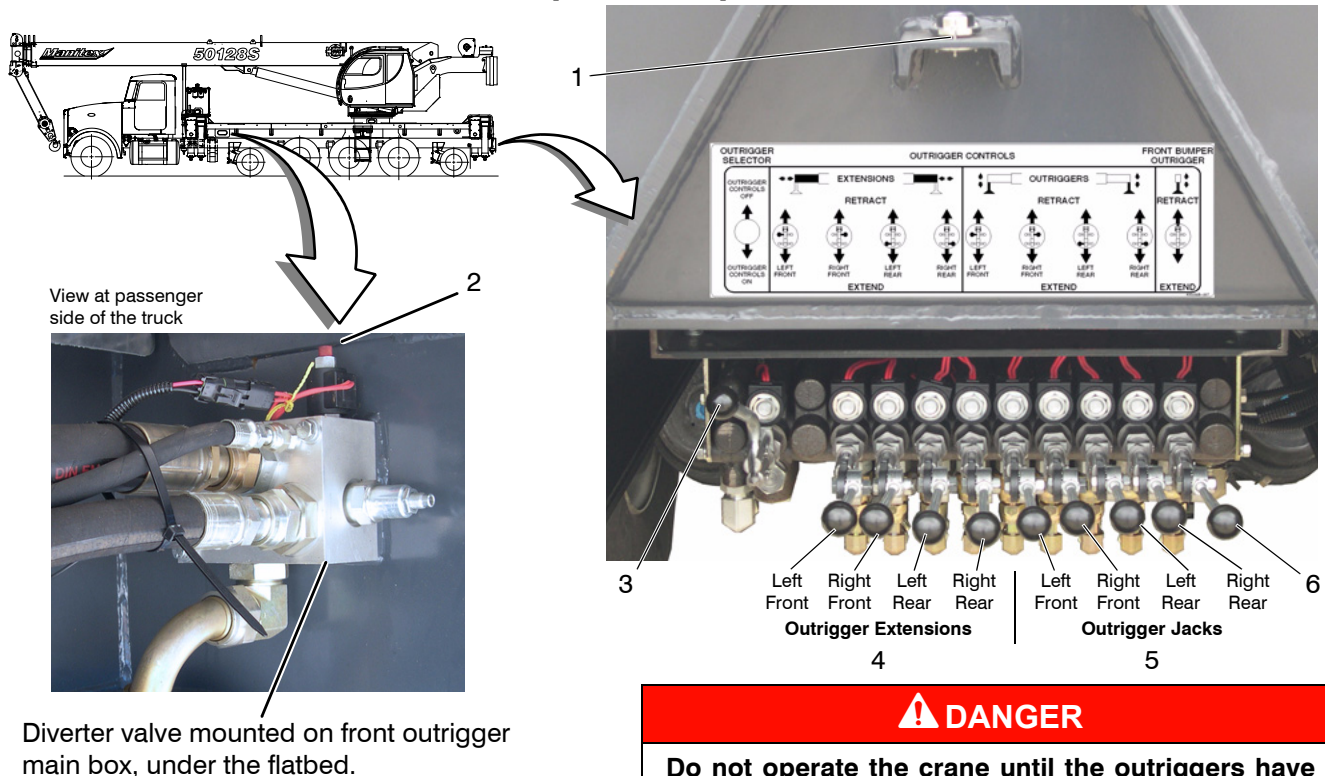


Figure 1-6 Outrigger Controls (at rear of crane)

Control and Position (Figure 1-5)	Function
Note To enable manual controls, the operator must first override the solenoid cartridge in the diverter valve to supply hydraulic power to outrigger control valve. Note All extension and outrigger functions operate by actuating two (2) separate control levers. Selection of only one control lever will not activate the desired function. Note Outrigger controls are fully proportional providing a full range of operating speeds from minimum to maximum. To operate: First, actuate and hold the Outrigger Selector Lever (2). Then, actuate the desired Extension or Jack Control Lever (3 or 4).	
1. Bubble Level	Indicates if the crane is level, side to side and front to rear. Levels are located on the side of the crane and at the crane operator's console.

Control and Position (Figure 1-5)	Function
2. Manual Override Knob Push and turn COUNTERCLOCKWISE  Push and turn CLOCKWISE 	<i>Note</i> The manual override feature is intended for emergency use, not for continuous-duty operation. Knob UP (override) position - Solenoid valve is bypassed, hydraulic power is directed to outrigger control valve. NOTICE <i>Always return override knob to NORMAL position after emergency use; override knob must be in NORMAL position to operate the outriggers with the remote control system and for crane operations from the operator station.</i> Knob DOWN (normal) position - Solenoid valve is electrically controlled by the crane's electro-hydraulic system; hydraulic power is diverted to crane systems as required.
3. Outrigger Selector Lever Lever DOWN - ON Lever UP (spring returned) - OFF	Allows flow of hydraulic fluid to the outrigger control valve, thereby enabling extend or retract functions. Activates warning horn and increases engine speed. Prevents flow of hydraulic fluid to the outrigger control valve, thereby disabling extend or retract functions.
4. Extension Control Levers Lever DOWN from OFF Lever UP from OFF	Levers operate the specific outrigger extension selected, see decal for lever identification. EXTENDS selected outrigger extension outward. RETRACTS selected outrigger extension inward.
5. Outrigger Control Levers Lever DOWN from OFF Lever UP from OFF	Levers operate the specific outrigger jack selected, see decal for lever identification. EXTENDS selected outrigger jack downward. RETRACTS selected outrigger jack upward.
6. Front Stabilizer Lever Lever DOWN from OFF Lever UP from OFF	EXTENDS stabilizer downward. RETRACTS stabilizer upward.

Crane Operation

Operations can be performed from the operator station in the cab (CRANE) or using the controller from the optional radio remote system (REMOTE). The operator may use either of these two control systems to use the machine in one of two available modes; as a material handler (CRANE mode) or a manlift (MANBASKET mode).

In addition the following should always be kept in mind when preparing to use the crane:

- Know and abide by all applicable crane related regulations governing the job site, these take precedence over any conflicting instructions found in this manual.
- Perform all scheduled checks and maintenance procedures before using the machine for crane or manbasket operations. Do not perform crane or manbasket operations until the machine has been cleared and all systems are functioning properly.
- In cold weather conditions, work all functions several times to bring the hydraulic oil to a suitable working temperature before performing crane or manbasket operations. See also Manitex bulletin #TD10016.
- Check current and expected wind conditions before beginning operations, take the necessary precautions and proceed only if the task at hand can be performed safely. See also Manitex bulletin #334A .

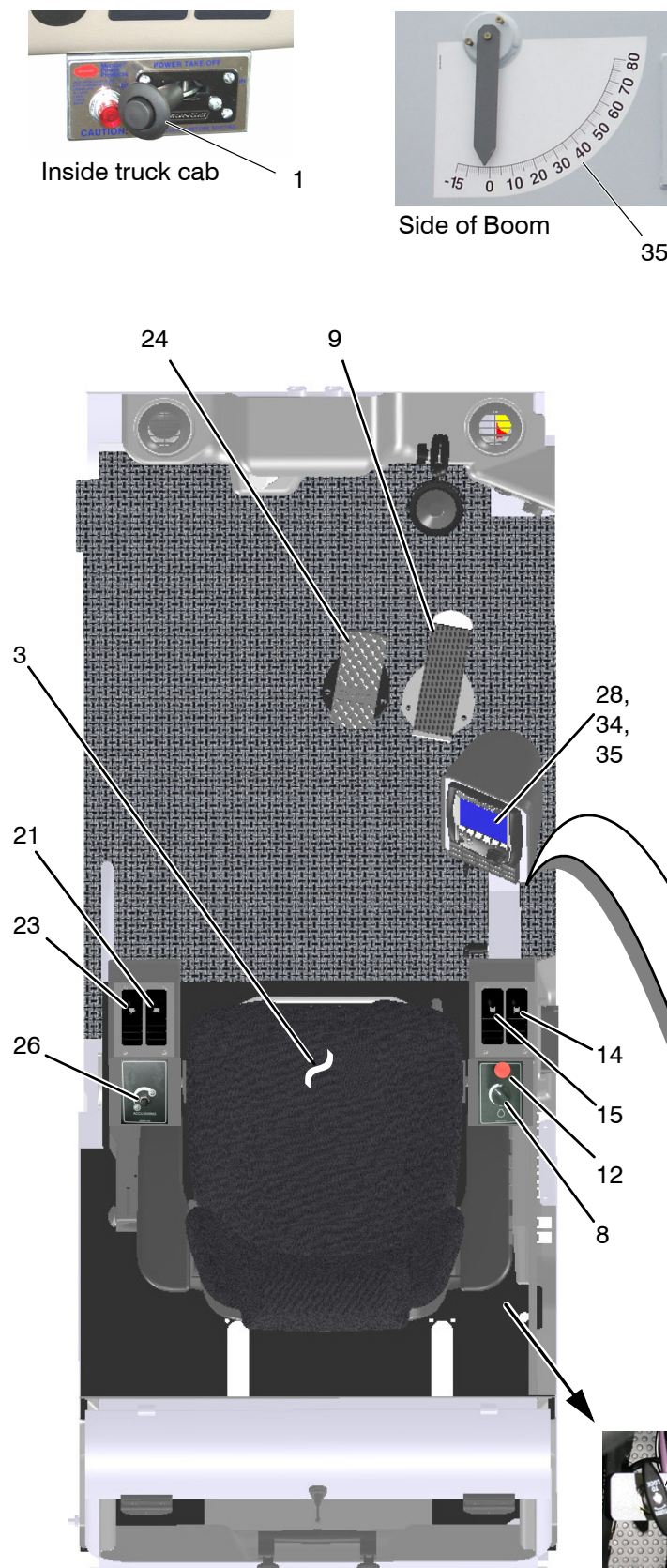
Operations from the Operator Cab

1. Start the truck and set the outriggers as described earlier in this section. If the engine is shut-down after the outriggers are set, ensure that the key is placed in the run position and that the PTO remains engaged.
2. Enter the crane cab and sit in the operator seat.
3. Set Control Power-Crane to "ON" (Fig 1-6 #4) and if equipped, Swing Brake Release to "OFF" (Fig 1-6, #25).
4. Lift Emergency Stop button (Fig 1-6 #12), then start the engine (Fig 1-6, #10).
5. Configure the crane's LMI system per your crane configuration; see "LMI Basic Operation" later in this chapter and the LMI manual provided with your crane for use and set-up instructions.
6. The crane is now ready for operations from the cab. Refer to "Crane Controls and Indicators for important information pertinent to each control.

Note For crane operations using the Radio Remote Control system, see "Operations using the Radio Remote Controller" later in this chapter.

Crane Controls and Indicators

Refer to Figures 1-6 & 1-7.



Operator Station

Standard - Main Winch Only

1. Power Take-Off (PTO) Control
2. Cab Tilt
3. Seat Switch
4. Power - Crane Control
5. Power - Outriggers Control
6. Power - Radio Remote Control
7. Power - Engine Hand Throttle Control
8. Engine Hand Throttle
9. Engine Foot Throttle
10. Engine Start
11. Engine Stop
12. Emergency Stop
13. Horn
14. Boom Hoist Control
15. Main Winch Control w/HDMI
16. Hi Speed Control - Main Winch
17. Lockout - Main Winch
18. n/a
19. n/a
20. n/a
21. Telescope Control
22. n/a
23. Swing Control
24. Swing Brake Pedal
25. Swing Brake Release
26. Accu-Swing Control
27. Swing Lock
28. Monitor - Load Moment Indicator
29. Overload Shutdown Feature *
30. Override-Crane Function Lockouts
31. Warning Horn ATB *
32. Anti-Two Block (ATB) Shutdown *
33. Hydraulic System Pressure
34. Level Indicator
35. Boom Angle Indicator
36. Third Wrap Limiter *

* Item not shown

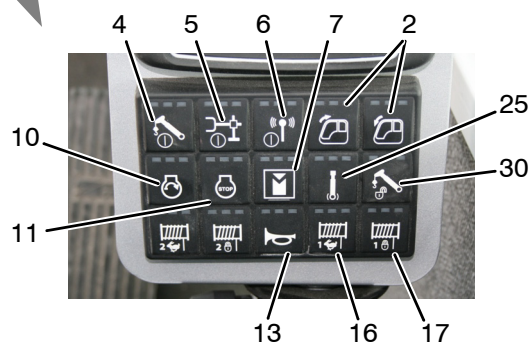


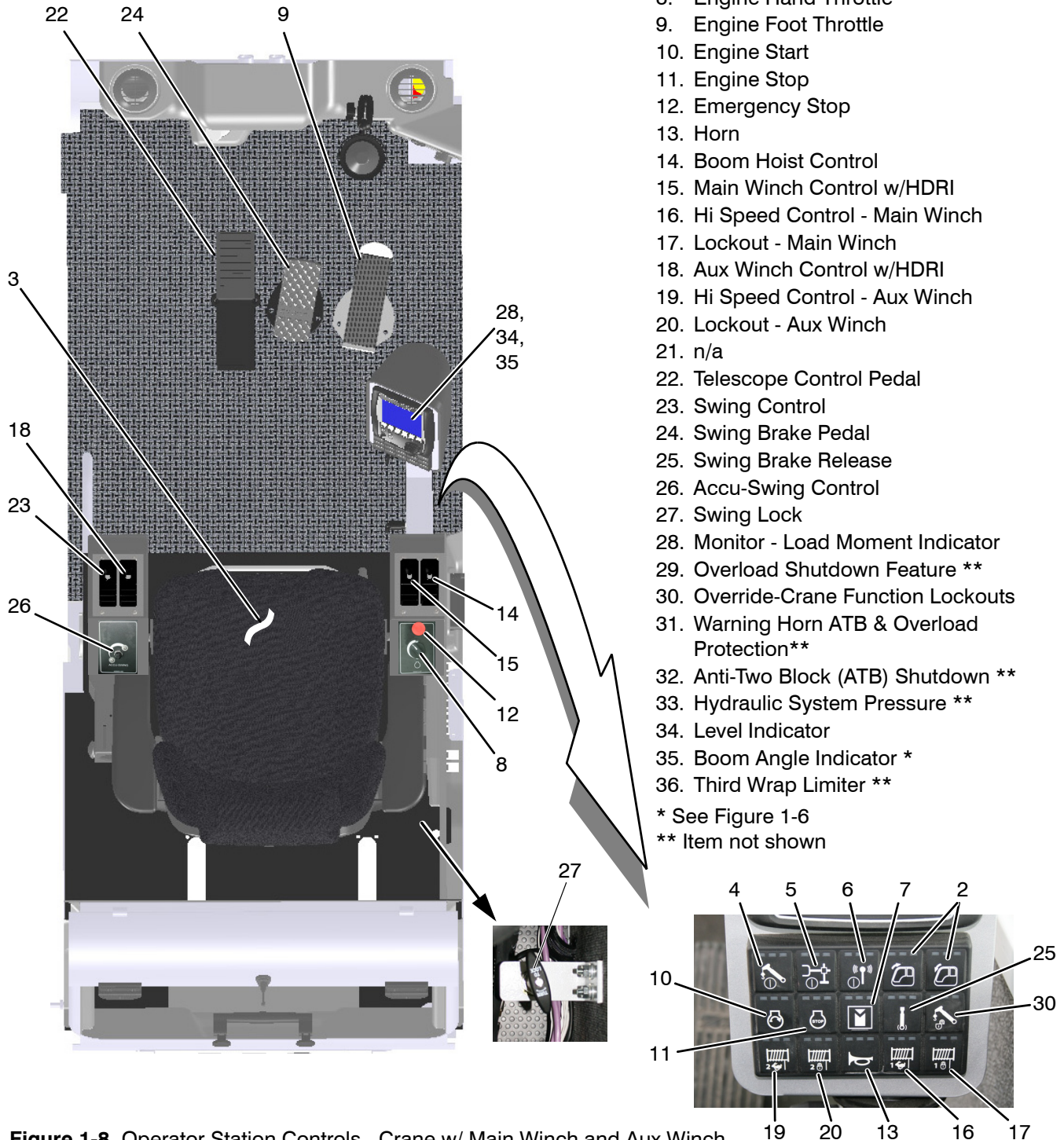
Figure 1-7 Operator Station Controls - Crane w/ Main Winch Only

Operator Station*With Auxiliary Winch option*

1. Power Take-Off (PTO) Control*
2. Cab Tilt
3. Seat Switch
4. Control Power - Crane
5. Control Power - Outriggers
6. Control Power - Radio Remotes
7. Control Power - Engine Hand Throttle
8. Engine Hand Throttle
9. Engine Foot Throttle
10. Engine Start
11. Engine Stop
12. Emergency Stop
13. Horn
14. Boom Hoist Control
15. Main Winch Control w/HDRI
16. Hi Speed Control - Main Winch
17. Lockout - Main Winch
18. Aux Winch Control w/HDRI
19. Hi Speed Control - Aux Winch
20. Lockout - Aux Winch
21. n/a
22. Telescope Control Pedal
23. Swing Control
24. Swing Brake Pedal
25. Swing Brake Release
26. Accu-Swing Control
27. Swing Lock
28. Monitor - Load Moment Indicator
29. Overload Shutdown Feature **
30. Override-Crane Function Lockouts
31. Warning Horn ATB & Overload Protection**
32. Anti-Two Block (ATB) Shutdown **
33. Hydraulic System Pressure **
34. Level Indicator
35. Boom Angle Indicator *
36. Third Wrap Limiter **

* See Figure 1-6

** Item not shown

**Figure 1-8** Operator Station Controls - Crane w/ Main Winch and Aux Winch

- Note** 1. The terms RIGHT, LEFT, FORWARD and BACK refer to the operator's right, left, front and rear when seated at the controls on the operator's station.
2. Crane controls are fully proportional providing a full range of operating speeds from minimum to maximum.

Crane Controls and Positions

Control and Position (Figure 1-6 & 1-7)	Function
1. Power Take-Off (PTO) Control PTO ENGAGED PTO DIS-ENGAGED	Operation of the PTO will vary; refer to the manufacturer's manual in the truck cab for operating instructions. ENABLES Electrical and Fluid power to crane systems. DISABLES Electrical and Fluid power to crane systems. NOTICE <i>Do not drive truck while PTO is engaged; hydraulic pump may be damaged.</i>
2. Cab Tilt PRESS & HOLD , three orange indicator lights ON RELEASE , indicator lights OFF	Adjusts Cab to any angle between 0° (horizontal) and 20°. Cab will raise or lower until limit is reached. Cab motion stops, set angle is maintained until re-adjusted by operator. Note Cab tilt function is only available when crane control power (4) is ON and the operator is in the seat.
3. Seat Switch Operator IN seat Operator OFF seat	The crane operator seat is fitted with a sensor to monitor if the operator is seated while power to the crane controls is on. ENABLES electrical feed to power switch for crane controls. DISABLES electrical feed to power switch for crane controls. Note If the operator leaves the seat, the crane control power switch will drop off within 5 seconds thereby disabling all crane function controls. To enable crane function controls, get in seat and turn ON power to crane controls (4). NOTICE <i>KEEP CRANE AND LOAD UNDER CONTROL. NEVER leave the operator seat DURING a crane operation. Power to crane controls will shut OFF within 5 seconds and bring all crane motions to an abrupt stop. Bring all functions to a complete stop BEFORE leaving the operator seat.</i>

Crane Controls and Positions

Control and Position (Figure 1-6 & 1-7)	Function
4. Power - Crane Controls PRESS , three green indicator lights ON PRESS , indicator lights OFF	Switch powers crane control systems to enable crane functions. Power ON Activates crane function control levers, Activates Cab Tilt functions (2). Power OFF Deactivates crane function control levers, Deactivates Cab Tilt functions (2). <i>Note</i> Power to crane controls is only available while the operator is seated. If the operator leaves the seat, power to the crane controls will shut off after 5 seconds. NOTICE <i>KEEP CRANE AND LOAD UNDER CONTROL. NEVER turn Crane Power OFF during a crane operation. Power to crane controls will shut OFF and bring all crane motions to an abrupt stop. Bring all functions to a complete stop BEFORE turning Crane Power OFF.</i>
5. Power - Outrigger Controls PRESS , three green indicator lights ON PRESS , indicator lights OFF	When activated, enables fluid and electrical power to outrigger control circuits for outrigger operations by use of the handheld remote controller. Power ON Activates outrigger control circuits. Power OFF Deactivates outrigger control circuits.  DANGER Never operate the outriggers unless the Jib is stored and the boom is properly placed in the boom rest. Failure to comply will compromise crane stability resulting in tipping, possible injury to personnel and damage to crane or property. NOTICE <i>Ensure outriggers and front stabilizer are properly set BEFORE resuming crane operations.</i>
6. Power - Crane Radio Remote Control System PRESS , three green indicator lights ON PRESS , indicator lights OFF	When activated, enables fluid and electrical power to the 4-Function crane radio remote control circuits. Power ON Activates remote control circuits. Power OFF Deactivates remote control circuits. <i>Note</i> For crane operations using the Radio Remote Control system, see “Operations using the Radio Remote Controller” later in this chapter.

Crane Controls and Positions

Control and Position (Figure 1-6 & 1-7)	Function
7. Power - Engine Hand Throttle PRESS , three green indicator lights ON PRESS , indicator lights OFF	Shifts control of engine speed between Hand and Foot throttle controls. ENABLES Hand Throttle Control (8), Engine Foot Throttle (9) becomes inoperable. DISABLES Hand Throttle Control (8), engine speed control is returned to the Engine Foot Throttle (9).
8. Engine Hand Throttle TURN Knob LEFT TURN Knob RIGHT	Control allows the operator to set engine speed to desired RPMs for crane operations, variable speed range is pre-determined by factory programming of the engine ECM. DECREASE engine speed from maximum to minimum. INCREASE engine speed from minimum to maximum. <i>Note</i> The speed of any crane function depends on engine speed.
9. Engine Foot Throttle Pedal DOWN Pedal UP (spring returned) RELEASE Pedal	INCREASE engine speed in relation to how far the pedal is depressed. DECREASE engine speed. Engine returns to IDLE speed <i>Note</i> The speed of any crane function depends on engine speed and on how far the control lever is moved in either direction.
10. Engine Start PRESS , three green indicator lights ON	Turns engine to START .  CAUTION Always stop engine before leaving crane unattended and before servicing crane. <i>Note</i> Before the engine can be started from the crane cab, the key in the truck ignition must be set to the RUN position and the PTO must be engaged. <i>Note</i> If engine turns but will not start, ensure that the Emergency Engine Stop (12) has been reset to enable fuel delivery to engine.
11. Engine Stop PRESS , three green indicator lights ON	Momentarily interrupts fuel delivery to shut down engine. STOP engine. <i>Note</i> If power to the crane is not needed after shutting down the engine, turn engine ignition key to the OFF position to conserve battery power. Place key back in the RUN position before attempting to start the engine from the crane start controls.

Crane Controls and Positions

Control and Position (Figure 1-6 & 1-7)	Function
12. Emergency Engine Stop PRESS Button TURN Knob RIGHT	Interrupts fuel delivery to engine and dumps all fluid power to crane controls to ensure total crane shutdown in emergency situations. STOP engine, fuel supply to engine is cut-off until manual reset. RESET, fuel delivery to engine is ENABLED so engine may be restarted, crane electrical and fluid power is reestablished. <i>Note</i> If power to the crane is not needed after shutting down the engine, turn engine ignition key to the OFF position to conserve battery power. Place key back in the RUN position before attempting to start the engine from the crane start controls.
13. Horn Switch PRESS & HOLD	SOUNDS crane warning horn, RELEASE to silence.
14. Boom Hoist Control Lever FORWARD from OFF Lever BACK from OFF Lever CENTERED (spring returned)	DOWN (lower boom). UP (raise boom). OFF (counterbalance valve holds boom in position). NOTICE <i>Return control lever to OFF as soon as boom is fully raised or fully lowered; otherwise, oil will flow over relief valve, possibly causing damage to hydraulic system from overheating.</i>
15. Main Winch Control w/HDRI Lever FORWARD from OFF Lever BACK from OFF Lever CENTERED (spring returned)	Lever handle is fitted with an electrical thumper to alert the operator that the winch is motion. DOWN (lower load). UP (raise load). OFF (spring-applied brake holds load in position).
16. Hi-Speed Control - Main Winch PRESS , three green indicator lights ON PRESS , indicator lights OFF	HIGH SPEED winch operation. LO SPEED winch operation. <i>Note</i> When HI Speed is activated, a solenoid valve changes the displacement of the 2-speed motor to increase line speed by 150%.
17. Lockout - Main Winch PRESS , three green indicator lights ON PRESS , indicator lights OFF	DISABLES Main winch operations. ENABLES Main winch operations. <i>Note</i> This control defaults to the last operator selected mode, even after a crane restart.
18. Aux Winch Control w/HDRI Lever FORWARD from OFF Lever BACK from OFF Lever CENTERED (spring returned)	Lever handle is fitted with an electrical thumper to alert the operator that the winch is motion. DOWN (lower load). UP (raise load). OFF (spring-applied brake holds load in position).

Crane Controls and Positions

Control and Position (Figure 1-6 & 1-7)	Function
19. Hi-Speed Control - Aux Winch PRESS , three green indicator lights ON PRESS , indicator lights OFF	HIGH SPEED winch operation. LO SPEED winch operation. <i>Note</i> When HI Speed is activated, a solenoid valve changes the displacement of the 2-speed motor to increase line speed by 150%. <i>Note</i> This control is functional only if the crane is equipped with the auxiliary winch option.
20. Lockout - Aux Winch PRESS , three green indicator lights ON PRESS , indicator lights OFF	DISABLES Aux winch operations. ENABLES Aux winch operations. <i>Note</i> This control is functional only if the crane is equipped with the auxiliary winch option. <i>Note</i> This control defaults to the last operator selected mode, even after a crane restart.
21. Telescope Control - Lever Lever FORWARD from OFF Lever BACK from OFF Lever CENTERED (spring returned)	Present only on machines without the Aux winch option. OUT (extend boom sections) IN (retract boom sections). OFF (counterbalance valve holds boom sections in position). NOTICE <i>Return control lever to OFF as soon as boom is fully extended or fully retracted; otherwise, oil will flow over relief valve, possibly causing damage to hydraulic system from overheating.</i> <i>Note</i> Due to variations in loading, boom angle, and slider pad friction, the maximum load that can be telescoped cannot be specified. It is safe, however, to attempt to telescope the boom within the limits of the load rating chart.
22. Telescope Control - Pedal Pedal FORWARD from OFF Pedal BACK from OFF Pedal CENTERED (spring returned)	Present only on machines with the Aux winch option. OUT (extend boom sections) IN (retract boom sections). OFF (counterbalance valve holds boom sections in position). NOTICE <i>Return pedal to OFF as soon as boom is fully extended or fully retracted; otherwise, oil will flow over relief valve, possibly causing damage to hydraulic system from overheating.</i> <i>Note</i> Due to variations in loading, boom angle, and slider pad friction, the maximum load that can be telescoped cannot be specified. It is safe, however, to attempt to telescope the boom within the limits of the load rating chart.

Crane Controls and Positions

Control and Position (Figure 1-6 & 1-7)	Function
23. Swing Control Lever FORWARD from OFF Lever BACK from OFF Lever CENTERED (spring returned)	⚠ DANGER Crane may be continuously rotated in each direction, however, LIFT CAPACITIES vary depending on position of boom relative to crane outriggers. Refer to the load rating charts supplied on the crane to determine allowable AREA OF OPERATION for each lift operation. Failure to comply can cause crane to tip possibly resulting in personal injury and damage to crane or property. Swing RIGHT (clockwise). Swing LEFT (counterclockwise). OFF (spring-applied brake holds boom in position). NOTICE <i>KEEP LOAD UNDER CONTROL. Bring crane to a smooth stop before changing direction of crane rotation.</i> NOTICE <i>Always observe and operate within the Area of Operation restrictions applicable to your crane. The Area of Operation for your specific crane is defined in your crane's load rating chart.</i>
24. Swing Brake Pedal	The proportional dynamic swing brake pedal is supplied when the crane is equipped with the Free Swing feature. Brake effectiveness increases in proportion to brake pedal travel. NOTICE <i>KEEP LOAD UNDER CONTROL. Bring crane to a smooth stop before changing direction of crane rotation.</i>

Crane Controls and Positions

Control and Position (Figure 1-6 & 1-7)	Function
25. Swing Brake Release PRESS , three orange indicator lights ON PRESS , indicator lights OFF	This function is present only when the crane is equipped with the Free Swing feature. ON Static swing brake released; crane is free to rotate. OFF Static swing brake set; prevents crane from rotating, holds crane in position. NOTICE <i>KEEP LOAD UNDER CONTROL. Bring crane to a smooth stop; DO NOT turn Swing Brake Release OFF while the crane is still rotating.</i> <i>Note</i> Upon initial crane start, the default state of this control is OFF. <i>Note</i> Brake Release is functional only when crane control power (3) is ON and the operator is in the seat.
26. Accu-Swing Control Turn knob LEFT Turn Knob RIGHT	The Accu-Swing feature allows the operator to dial the swing speed to adjust for different operating conditions and operator experience. DECREASE crane rotation speed. INCREASE crane rotation speed.
27. Swing Lock Twist- PULL -Lock Twist- PUSH -Lock	Turn knob to unlock, spring assisted return. Swing lock pin DISENGAGED, releases mechanical slewing ring lock and allows crane to swing. Swing lock pin ENGAGED, sets mechanical slewing ring lock and prevents crane from swinging. NOTICE <i>Swing lock is designed to engage only when the boom is positioned directly over the front or over the rear along the truck centerline.</i>  CAUTION Do not engage the swing lock unless the boom is positioned directly over the front or over the rear along the truck centerline. When swing lock is DISENGAGED, do not swing crane unless the knob is positively locked in position. Failure to comply to the above, may allow the lock pin to swing into the swing lock bracket resulting in damage to crane.

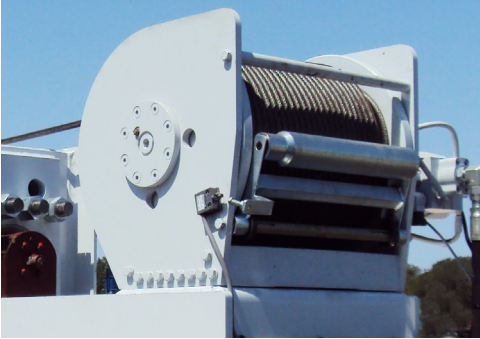
Crane Controls and Positions

Control and Position (Figure 1-6 & 1-7)	Function
28. Monitor - Load Moment Indicator 	The LMI is designed as an operator aid to monitor crane capacities as defined in the Manitex load rating chart for a given machine. LMI operating codes are listed on the crane's load rating chart for each available crane configuration and allowable area of operation. NOTICE <i>If the LMI dis-allows a lifting operation, check the crane's load rating chart to verify that the attempted lift is allowed in your current crane configuration and area of operation and that the LMI operating modes are selected accordingly.</i> Note For specific LMI function, controls and display information, see separate LMI Operator Handbook; the manual is located with the Crane's Owner's Manuals or in the Truck Cab. CAUTION The LMI system is intended as an operational aid only and is not a substitute for sound operating practices or operator experience and judgement. Operation and safety remains the responsibility of the operator; always work within the limits of the load rating chart provided.
29. Overload Shutdown Feature (not shown)	Activates warning horn and automatically stops and prevents further operation of the WINCH UP, TELESCOPE OUT and BOOM DOWN functions when the crane's capacity is exceeded. NOTICE <i>The Overload Shutdown feature WILL NOT shutdown the swing function if a load is swung into an overload position. If the swing function is suddenly stopped, the load will swing out from under the boom or jib point possibly resulting in damage to boom or jib from side loading. Refer to swing control function (item 10) for additional information.</i> DANGER If warning horn comes on due to overload, immediately correct overload condition; failure to do so may result in structural damage or tipping. <i>To correct an overload condition you may:</i> ■ Lower the load to the ground, ■ Retract the boom, ■ Raise the boom.

Crane Controls and Positions

Control and Position (Figure 1-6 & 1-7)	Function
30. Override - Crane Function Lockouts PRESS , three orange indicator lights ON	This momentary switch is used to bypass the Overload Shutdown and ATB Features so the boom can be lowered if locked out at it's maximum boom angle and for maintenance or boom set-up/stow procedures. VERRIDE ON Hold the button long enough to begin or complete your set-up task. ⚠ CAUTION Protect your equipment by allowing crane function lockouts to perform as designed. Only use override switch for the stated purposes above, DO NOT use override switch for any other reason.
31. Warning Horn - Anti-Two-Block (ATB) and Overload Protection <i>(not shown)</i>	The horn BEEPS to warn the operator and surrounding personnel when any of the following conditions occur: ■ Crane configuration has not been confirmed for LMI operation (at start-up). ■ The load block or the overhaul ball is hoisted too high (lifts ATB weight on load line). ■ The crane's capacity is exceeded. NOTICE <i>When the warning horn sounds, immediately correct the offending condition (refer to the function description for the above conditions).</i>
32. Anti-Two-Block (ATB) Shutdown <i>(not shown)</i>	When the load block or overhaul ball lifts the ATB weight, the warning horn sounds and the ATB system STOPS and prevents further operation of the WINCH UP, TELESCOPE OUT and BOOM DOWN functions. NOTICE <i>Always pay out load line while extending boom or booming down to prevent load block or overhaul ball from contacting the two-block weight. Do not hoist load so high that load block or overhaul ball contacts two-block weight.</i> <i>To correct a two-block condition you may:</i> ■ Lower the load, ■ Retract the boom, ■ Raise the boom.
33. Hydraulic System Pressure Monitor	Indicates the hydraulic pressure in the circuit operating under the highest pressure.
34. Level Indicator	Indicates how level the crane is from side to side and from front to rear.
35. Boom Angle Indicator	Indicates the angle of the boom (in degrees) above or below horizontal.

Crane Controls and Positions

Control and Position (Figure 1-6 & 1-7)	Function
36. Third Wrap Limiter (option) 	The winch is equipped with a roller and switch that sense when the drum is down to the last three (3) wraps of load line. When the roller contacts the limit switch the WINCH DOWN function is DEACTIVATED. To RE-ACTIVATE the winch function simply WINCH UP to continue winch operations.

Cab Features and Accessories

Refer to Figures 1-8 & 1-9



Figure 1-9 Cab Features and Accessories

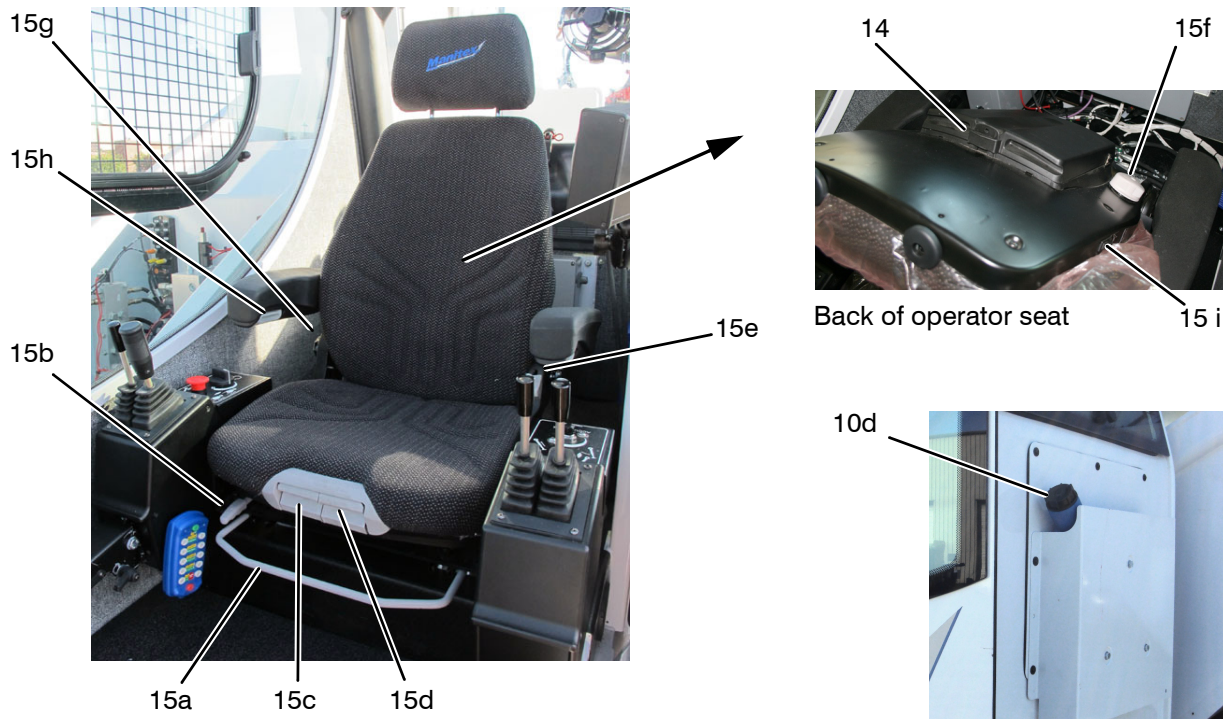


Figure 1-10 Cab Features and Accessories - Operator Seat

Cab Features and Accessories

Accessory or Feature (Figure 1-8 & 1-9)	Description
Note Power to cab accessories is available when truck ignition is set to “run” and PTO control is engaged.	
1. Latch - Door	Heavy duty chrome plated door latch with key lock for secured access. Door latch secures door in open or closed position. a. Flush mount outer handle, PUSH button to unlatch, PULL towards rear of cab to open door. b. Key lock, 2 spare keys supplied. c. Inside latch, PRESS to open, positive detent set only at full open. d. Door release, PULL lever to release door detent, pull door shut.
2. Latch - Side & Rear Window	Positive latch secures slider windows when closed shut.
3. Latch - Top Hatch	Hatch clamped shut by spring loaded latch mechanism, gas cylinders hold latch in full open position. a. PULL handle to unlock clamp and open hatch. b. TURN knob TIGHT to lock hatch in full open or mid-open position.
4. Wiper - Front Glass	Wiper equipped with an electric 2-speed motor and spray washer. Wiper control switch mounted on panel above right window. a. PARK / SLOW / FAST Three position rocker switch controls wiper speed. b. ON / OFF / ON Momentary switch activates spray washer. Press BOTTOM of switch to activate front window washer. c. Washer fluid reservoir.

Cab Features and Accessories

Accessory or Feature (Figure 1-8 & 1-9)	Description
5. Wiper - Top Hatch Glass	Wiper equipped with an electric single-speed motor and spray washer. Wiper control switch mounted on panel above right window. - NULL / PARK / ON Three position rocker switch actuates wiper. - ON / OFF / ON Momentary switch activates spray washer. Press TOP of switch to activate hatch window washer. - Washer fluid reservoir.
6. Cab Flood Lamps -External	ON / OFF Rocker switch on panel above right window. Switch illuminates when lamps are ON.
7. Cab Lamp - Internal	Push lens to activate internal ON / OFF switch.
8. Cooling Fan	Two speed fan features OFF / SLOW / FAST front mounted speed control knob. ON / OFF Rocker switch on panel above right window supplies power to cooling fan. Switch illuminates when power to fan is ON.
9. Accessory Power	12V DC power socket accepts standard US automotive plug connectors (UL 2089). <i>Note</i> Power is available only when the PTO is engaged, see item #1 in Figure 1-6. NOTICE <i>Outlet is intended for use as a power outlet ONLY. DO NOT use with cigarette lighter plugs, a fire could ignite as socket is not designed to withstand the resultant heat a cigarette lighter will produce.</i>
10. Cab Heater	Heater control box is mounted in the RH operator console side plate. Refer to heater manual located in the truck cab for operating warnings and instructions. - Thermostat equipped with ON /OFF switch and temperature adjusting dial. Turn dial left to right to ignite heater and increase temperature setting. - Heater vent, rotates to direct heated air. - Air return, return ducting increases heating efficiency. - Diesel reservoir fill neck & cap, located externally behind cab.
11. Air Conditioner	Cab air conditioner is an option. Air conditioner controls are mounted on switch panel above right window. A/C Switch Position 1 Position 2 Position 3 Three position switch. Air conditioner unit is OFF, fan is OFF. Fan runs constantly, air conditioner is OFF. Air conditioner ON, runs to cool cab interior. Switch illuminates when AC is ON. - Fan Switch OFF / LOW / MED / HIGH switch selects fan speed. - A/C Vent One vent each side, behind the operator seat.

Cab Features and Accessories

Accessory or Feature (Figure 1-8 & 1-9)	Description
12. Hanger Hook	Hook for cap, garment etc.
13. Support Arm	Supports the LMI display and crane control panel. a. Swivel lock lever. Turn latch counter-clockwise to loosen swivel lock, rotate display left to right as desired, turn latch clockwise to tighten and lock display in place. b. Tilt lock lever. Turn latch counter-clockwise to loosen support arm tilt lock, raise or lower arm support as desired, turn latch clockwise to tighten and lock angle of arm support in place. <i>Note</i> Lever position is variable and can be re-positioned to increase adjustment range. Pull lever outward to disengage adjusting mechanism, rotate lever to desired position, release lever to re-engage mechanism and use as described above to adjust support arm.
14. Document Holder	Plastic container holds crane's operator manuals and load rating charts.
15. Operator Seat	Adjustable to accommodate operator preferences. Lever movements are described as if operator is seated. a. Front to back adjustment, Seat Assembly + Side Control Consoles. To unlock lift crossbar; move seat to desired position and release lock in place. b. Front to back adjustment, Seat Assembly only. To unlock lift lever; move seat assembly to desired position and release to lock in place. c. Front to back adjustment, Seat Bottom only (<i>relative to seat back</i>). To unlock lift latch; move seat bottom to desired position and release to lock in place. d. Front Tilt adjustment, Seat Bottom only. To unlock get off seat and lift latch; raise or lower front of seat bottom to desired position and release to latch lock in place. e. Backrest tilt adjustment. Lift lever to adjust backrest tilt, release to lock in position. f. Lumbar support. Rotate knob to adjust lumbar support. g. Armrest height adjustment (one knob on each side). Loosen knob, raise armrest to desired height, tighten knob to lock in place. h. Armrest tilt adjustment. Turn roller to raise or lower front of armrest to desired angle. i. Seat heated cushion ON /OFF switch.
16. Speakers	Two sound speakers included as part of cab accessories.

Cab Features and Accessories

<i>Accessory or Feature (Figure 1-8 & 1-9)</i>	<i>Description</i>
17. Weather Radio	Option; AM/FM/Weather Band radio. If equipped, separate manufacturer's user manual is supplied with the crane.
18. Engine Management System (EMS) Monitor	Option; EMS system allows the crane operator to monitor chassis engine operating conditions during crane operations from the crane cab. Reports conditions such as fuel & DEF fluid levels, engine oil pressure, engine coolant temperature, engine warning indicators, etc. If equipped, separate manufacturer's user manual is supplied with the crane.

LMI Basic Operation

The LMI is designed as an operator aid to monitor crane capacities as defined in the Manitex load rating chart for a given machine. LMI operating codes are listed on the crane's load rating chart for each available crane configuration and allowable area of operation.

NOTICE

If the LMI dis-allows a lifting operation, check the crane's load rating chart to verify that the attempted lift is allowed in your current crane configuration and area of operation and that the LMI operating modes are selected accordingly.

Note For further LMI function, controls and display information, see separate LMI Operator Handbook; the manual is located with the Crane's Owner's Manuals or in the Truck Cab.

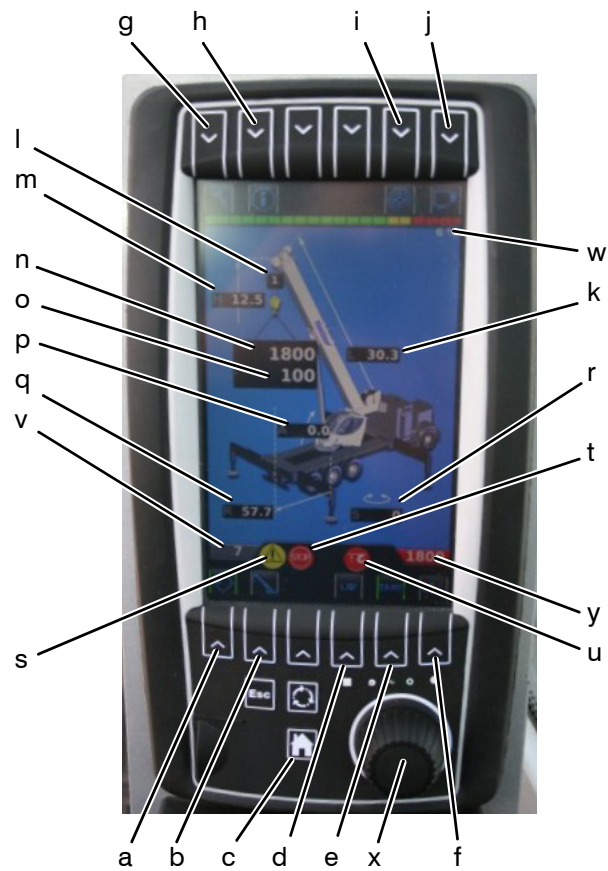
CAUTION

The LMI system is intended as an operational aid only and is not a substitute for sound operating practices or operator experience and judgement. Operation and safety remains the responsibility of the operator; always work within the limits of the load rating chart provided.

The following is a basic outline of the LMI system set-up before initial crane operations can begin. After the outriggers have been properly set as described in the topic "Setting the Outriggers" earlier in this chapter, the operator must select the LMI parameters that match the crane configuration that will be used.

LMI Display Layout

- a. Configure / Back button
- b. Configuration info button
- c. Home Screen
- d. Limits menu (work area definition)
- e. Tare menu (display net load)
- f. Alarm Horn Suppress
- g. Service Menus
- h. Crane Info Key (Model, s/n, I/O inputs & sensors)
- i. Level indicator
- j. Camera (future option)
- k. Boom length
- l. Reeving
- m. Tip height
- n. Safe Load
- o. Actual load
- p. Boom angle
- q. Working radius
- r. Rotation Angle
- s. Pre-warning light
- t. Overload warning light
- u. Hoist limit warning (ATB)
- v. Operating Mode (crane configuration)
- w. Utilization % bar graph
- x. Selection Knob
- y. Error code



Display with Home screen shown

Refer to LMI manual for full explanation and usage instructions for above functions and features.

Powering the LMI system

Before entering the crane cab, be sure that the ignition key in the truck cab is in the run position and that the PTO is engaged. This is necessary to power the LMI and the crane's electrical system.

Configuring the LMI system

Upon initially entering the cab the you will hear the LMI warning horn indicating that the configuration settings for crane operations have not been confirmed. Follow the system prompts and select all configuration variables the LMI system requires to begin monitoring crane operations.

1. The first screen the operator will see upon entering the cab will show the configuration in which the crane was last used (shown on the left).
 - a. If the configuration is correct for the next series of operations, simply press the knob to accept and scroll through each highlighted setting until you reach the crane monitoring screen (shown on the right.)
 - b. If a new configuration is desired select the configure button and follow the prompts to make new selections.
 - c. After the final selection is confirmed, the system will display the crane monitoring screen indicating all settings are confirmed and the system is ready to monitor crane conditions per your selections.



Unconfirmed configuration



Configuration confirmed

Press to acknowledge each setting.

2. Outrigger configuration
 - a. Select "On Tires" or "On Outriggers", use knob to scroll through options, press to select configuration shown by the graphic.

Note If your crane does not offer a load chart "On Tires" the system will not offer this configuration.



Arrows will appear under outriggers or tires as knob is scrolled to view available configurations.

Turn Knob to scroll
Press to select.

- b. Select “Outrigger Spread”, use knob to scroll through options, press to select configuration shown by the graphic.

Note Only outrigger options available for your crane model will be offered.



Outriggers spreads appear as knob is scrolled to view available configurations.

3. Boom & Jib configuration.

- a. First choice is main boom only, no jib is depicted, use knob to scroll through options, press to select configuration shown by the graphic.

Note Jib configuration options will only appear if allowed with your selected outrigger configuration.



Jib is depicted retracted or extended and at 0, 15 and 30 degree offsets as knob is scrolled to view available configurations.

4. Crane or Man-Basket mode.

- a. Use knob to scroll through options, press to select configuration shown by the graphic.

Note An image of an overhaul ball or load block will appear to represent “Crane Mode” configuration option.

Note If operating off the main boom with a load block, be sure to select the load block image when selecting Crane mode.



Crane or Man-Basket option will appear as knob is scrolled to view available configurations.

5. Reeving

- a. Select parts of line to be used if the load block image was selected in the previous screen, roll knob to increase or decrease parts of line, press to select configuration shown by the graphic.



Parts of line indicator.

6. Winch

- a. Use knob to scroll through winch options, press to select winch that will be used for the lift operation.

Note Upon confirmation of the winch configuration, the system will next go to the crane monitoring screen (Home).



Arrow above Main or Auxiliary winch indicates current selection.

Functional and Informational Features

CRANE INFO KEY



Press to display crane model number, serial number and hourmeter. Press Home key to exit Info screen.

Note The Crane Info Key also enables access to the status screens for digital inputs, outputs and CAN Bus sensors.



Access keys to system input, output and sensor status screens.

CONFIGURATION INFO KEY



Press to see graphical representation of current operating mode selected.

Press HOME Key to return to crane monitoring screen.



Current configuration screen



CONFIGURE KEY



Press to enter set-up menus to change crane configuration.



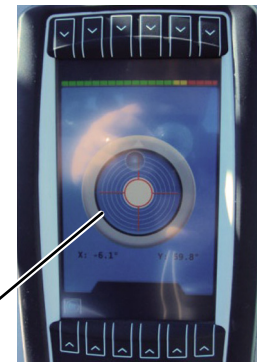
LEVEL INDICATOR



Press to see electronic crane level indicator. Image appears on screen for a period of 10 seconds then returns to previous screen.



Electronic bubble level image



OUTRIGGER WARNING

The outrigger warning graphic appears on the crane monitoring screen upon completion of the configuration acknowledgements if either of the main outrigger extensions is not properly deployed. This warning does not prevent the operator from performing crane operations.



⚠ CAUTION

If the outrigger warning appears on screen, identify the problem and correct before continuing crane operations. Refer to Outrigger Warnings and Instructions earlier in this chapter.

Crane Operations using the Radio Remote Controller

The crane can be controlled by an optional 4-function radio transmitter equipped with proportional electric levers (paddles or joysticks) and control switches. The function lever controls require the use of a safety switch that must be activated in order to actuate each crane function. Multiple functions can be operated at the same time to allow combinations of movements. Crane functions include Swing, Telescope, Boom Elevation & Main Winch.

Note If an Auxiliary winch is present, the auxiliary load line must spooled onto the drum and tied off while the crane is used with the radio remote system, see “Removing the Auxiliary Sheave” in section 2 of this manual.

Note If the crane will be used for manbasket operations the main loadline should also be tied off to simplify crane operations from the radio remote controller. See also “Use of ATB Override Flag” in section 2 of this manual.

Initializing the Radio Remote Controller

The radio remote system can be used for crane (lifting) or manbasket operations. The controller (Figure 1-11) must be initialized in order to start the truck and begin operations from the radio controller:

- At the in-cab operator station control panel, turn “ON” the Power-Radio Remote Control (Figure 1-10).
- Configure the crane’s LMI system per your crane configuration; see “LMI Basic Operation” earlier in this chapter and the LMI manual provided with your crane for use and set-up instructions.

Note If the crane will be used for manbasket operations, ensure that the correct operating mode is selected during the LMI set-up.

- At the radio remote controller, pull the E-Stop (3) out to enable initialization of the controller. Pause for about 5-10 seconds then proceed to initialize radio communications.
- To initialize the radio remote controller, quick press the Start Button (1), Power Indicator Light (2) will flash green. Check that the indicator light on the receiver mounted on the right side of the turret is lit with a steady green light which indicates that transmitter and receiver are now communicating and ready to control crane functions.
- Start the truck engine using the Engine Start/Stop switch (6); toggle to “START” and release once engine is running.
- Test functionality of Engine Start/Stop switch (6) and E-Stop button (3) before utilizing the radio controller for crane operations. Check that the truck engine will restart from the controller after stopping the engine by use of either of these two transmitter controls.
- The Radio Remote Control system is now active and ready for crane operations.

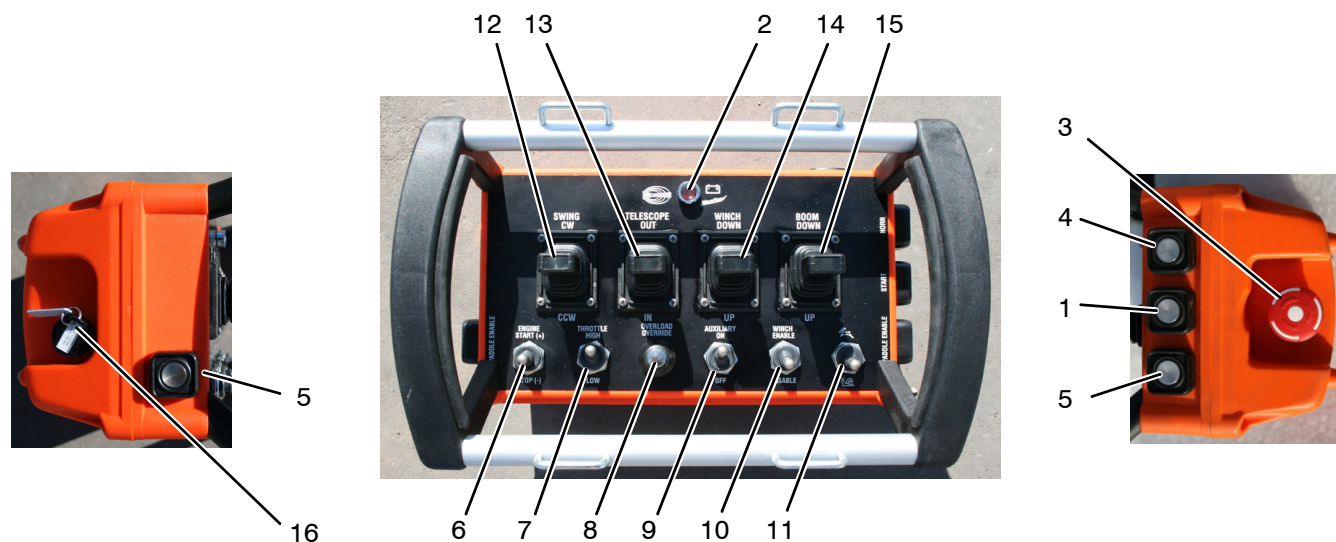
Controller Notes

- Always start with a fully charged battery in the controller (transmitter).
- If the Power-Radio Remote Control (Figure 1-9) is actuated while the engine is running, the engine will shut off. Wait 5-10 seconds before attempting to re-initialize radio communications.
- If the radio connection to the receiver is lost or interrupted, the truck engine will shut down automatically.
- The function levers must be returned to the zero position before the transmitter can be re-initialized.
- To operate a crane function, press and hold either enable button (5, 5a) then actuate the desired function lever.
- Remember to meter all controls for smooth motion of the functions, each movement shall be performed in a carefully controlled manner.
- Always use the E-Stop button to shut-off the transmitter at the end of the crane operations. Never leave an active transmitter unattended. The transmitter will shut itself off after 15 minutes of inactivity to conserve battery power, however it is the operator’s responsibility to shut off the transmitter to prevent inadvertent movement of the crane functions.
- For additional information regarding maintenance and operation of the radio remote system, see system manufacturer’s manuals supplied with the crane.



Power-Radio Remote Control

Figure 1-11 Operator Station Control Panel



2 - Indicator lights
Receiver located on the turret.



Controller secured in place in
basket for aerial operations.



16 - Battery and charger inside
truck cab



Figure 1-12 Radio Remote Control System

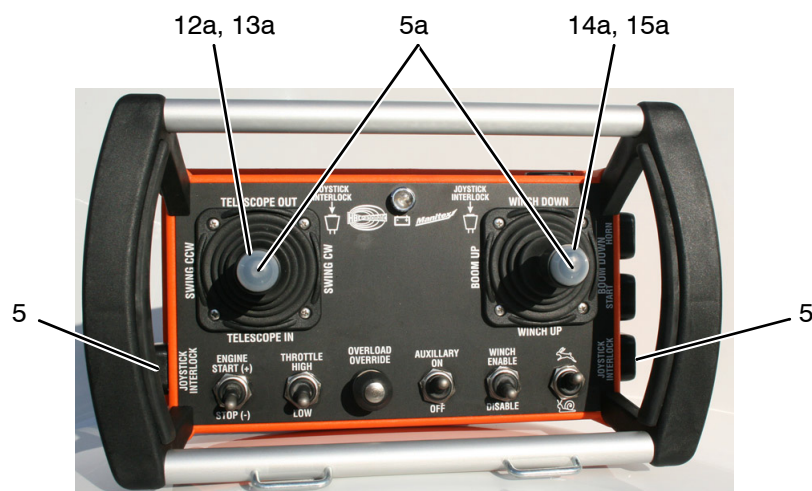


Figure 1-13 Controller with Joysticks

Controller Functions and Controls Descriptions

See Figures 1-11 & 1-12

1. **START** - PUSH Start button to initialize communications between the radio remoter controller (transmitter) and receiver located on the side of the turret. Initialization should take about 5 seconds.
2. **STATUS INDICATOR** - Indicator lights on transmitter and receiver show status of radio remote system.
 - Transmitter
 - a) Indicator light flashes green - transmitter is linked to receiver, ready for crane operations.
 - b) Indicator light flashes red - Replace transmitter battery, otherwise transmitter will shut-off after a few minutes.
 - Receiver
 - a) ON (yellow) is illuminated as soon as operating voltage is present at the receiver. Voltage is supplied to receiver when the Operating Mode Selector switch (13) at the base operator station is set to Base or Remote.
 - b) RF (red) is illuminated whenever the transmitter is switched off after pressing the E-STOP button.
 - c) Si 1 (green) permanently illuminates after the pressing Start on the transmitter and communication with the receiver is established.
 - d) Si 2 (green) illuminates only during receipt of a function signal from the transmitter, if the aerial crane functions are in the zero position, light is off.
3. **E-STOP** - Maintained button, PRESS to bring crane functions to an emergency stop. RAISE button to enable transmitter initialization.

WARNING

In an emergency situation, the E-Stop will immediately stop the oil supply to the crane functions. However, be aware that suddenly stopping any crane function can increase the chances of overload or equipment damage. In addition, with the engine (and pump) OFF, it is impossible to move any function in a direction that may either decrease the overload or move the equipment away from danger.

Note After re-setting the E-Stop, the controller must be re-started (1) to resume crane operations.

4. **HORN** - PUSH to activate signal horn.
5. **ENABLE** - Safety feature ensures that crane movements are achieved only if the function levers are actuated with purpose. PUSH and HOLD button to enable a crane function lever. RELEASE button once the function lever has been returned to neutral.
 - a) Additional button located on tip of Joystick type control, operates same as side buttons.

NOTICE

DO NOT release the Enable button while performing a crane function, doing so will bring the crane function to an abrupt stop.

6. **ENGINE (Ignition)** - Toggle switch OFF / RUN / START. The transmitter must be initialized as described to activate the Truck Ignition switch.

Note The controller requires about 5 seconds to initialize, allow the controller to run through it's internal diagnostics before attempting to start the engine.

NOTICE

Always use the HORN at the beginning of operations with the radio remote system to alert surrounding personnel that the crane is in operation.

7. **THROTTLE** - Toggle LOW / HIGH. PUSH toggle to "HIGH" to increase engine idle to factory pre-set high rpm setting. PUSH toggle to "LOW" to decrease engine rpm to default engine idle speed.

8. **OVERRIDE** - Momentary button, PUSH button to override ATB / LMI lock-outs. Use only for stowing, service or maintenance purposes and to lower the boom from it's maximum elevation angle. Do not override ATB / LMI system for any other reason.

 WARNING

While in OVERRIDE, the overload protection and anti-two-block systems are disabled. Do not operate for extended periods in override mode. To prevent damage to equipment and property or injury to personnel, do not allow the overhaul ball to contact the boom point and always operate within the limits of the load chart provided with your crane.

9. **AUXILIARY** - ON/OFF Switch available for customer supplied option.
10. **WINCH (LOCKOUT)** - Use switch to ENABLE/DISABLE the winch function on the remote controller. When disabled, prevents operation of the winch from the radio controller even if the winch lockout is enabled in the crane cab.

Note As shipped from Manitex, this control only affects the main winch. The optional auxiliary winch cannot be controlled from the radio remote controller.
11. **FUNCTION SPEED CONTROL** - In addition to controlling function speed with the controller's Throttle control, the controller can be programmed to limit the speed accessible to each function lever. use the SLOW/FAST switch to select between slow or max controller function speed.

Note As shipped from Manitex, each lever is programmed to match the maximum throw available at the control valve.
12. **SWING** - PUSH lever to "CW" to rotate the turret / boom clockwise, PUSH lever to "CCW" to rotate the turret / boom counterclockwise. Lever requires the use of the Enable button.
 - a) Dual-axis joystick control combines Swing & Telescope functions in a single lever. Handle is fitted with a built in Enable button on tip. Movement of joystick is multidirectional, allows for single handed, simultaneous operation of Swing & Telescope functions.
13. **TELESCOPE** - PUSH lever to "OUT" to extend the boom, PUSH lever to "IN" to retract the boom. Lever requires the use of the Enable button.
 - a) Dual-axis joystick control combines Swing & Telescope functions in a single lever. Handle is fitted with a built in Enable button on tip. Movement of joystick is multidirectional, allows for single handed, simultaneous operation of Swing & Telescope functions.
14. **WINCH (Main)** - PUSH lever to "DOWN" to lower the load line, PUSH lever to "UP" to raise the load line. Lever requires the use of the Enable button.
 - a) Dual-axis joystick control combines Winch & Boom Elevation functions in a single lever. Handle is fitted with a built in Enable button on tip. Movement of joystick is multidirectional, allows for single handed, simultaneous operation of Winch & Boom Elevation functions.
15. **BOOM** - PUSH lever to "DOWN" to lower the boom / manbasket, PUSH lever to "UP" to raise the boom / manbasket. Lever requires the use of the Enable button.
 - a) Dual-axis joystick control combines Winch & Boom Elevation functions in a single lever. Handle is fitted with a built in Enable button on tip. Movement of joystick is multidirectional, allows for single handed, simultaneous operation of Winch & Boom Elevation functions.
16. **PROGRAM KEY** - Not an operator control, device holds program and identification information necessary for customized settings and system communications. Do not remove.
17. **BATTERY** - The rechargeable NiMH battery is flush mounted at the bottom of the controller. The system is supplied with a portable charger that can be connected to a 12V DC power socket for standard US automotive plug connectors (UL 2089).
 - a) Charge the batteries completely before initial use and at intervals not exceeding 6 months if they are stored.
 - b) Charge the battery fully before storing it for a prolonged period.
 - c) Charge the battery only when the status LED on the transmitter flashes red.
 - d) Always store rechargeable batteries at room temperature.
 - e) Protect the battery from short circuits and always store it in the protective cover provided.

- f) Use only the associated HBC charger supplied with the system to charge the battery. Three LEDs indicate the actual operating state of the battery.
- LED green: Illuminates when battery is charged.
 - LED orange: Illuminates when battery is charging.
 - LED red: Illuminates when battery is deep discharged or defective.

Remote Winch Control (RWC)

The Remote Winch Control is an option that gives the operator the ability to operate the winch remotely to facilitate removal and stowing the overhaul ball or load block at the front of the truck. The RWC system consists of a handheld transmitter and crane mounted receiver integrated to the crane's hydraulic winch control circuits.

⚠ WARNING

During RWC operations, the anti-two-block systems are disabled. To prevent damage to equipment and property or injury to personnel, do not allow the overhaul ball or load block to contact the boom point at any time.

Initializing the RWC Transmitter

- Start the truck engine and engage the PTO as discussed earlier in this section, let the engine idle.
- Locate RWC Transmitter, which should be located in the truck cab.
- At the Radio Outrigger Control Box (Figure 1-4), PRESS the Control Power-Outrigger switch (button light ON) to enable the outrigger operation mode. This mode will be evident when you hear the outrigger alarm.

Note The crane can be set to outrigger operation mode from the lower outrigger control station or from the crane cab.

■ Power ON the RWC transmitter.

- Press and Hold the "ON (+)" button, the green and red LEDs should be flashing; the yellow LED will light ON while establishing communication with the base unit, then turn OFF once communication has been established.
- Both the Green and Red LED's should be flashing during normal operation.
- If only the Green LED is flashing the Base Unit is not powered ON, make sure the PTO is engaged and the crane is in outrigger operation mode.
- If no LED's are flashing check the RWC Transmitter's batteries, the transmitter uses three standard "AAA" batteries.



Right side of turret.

Figure 1-14 Remote Winch Control System

RWC Functions and Controls Descriptions

Operating the Winch function is a two step process when using the RWC. After initiating the transmitter, press the desired function then quick press the fast (+) speed button until the load line begins to move. Keep the function button depressed to winch down or up, release the button to stop winch operation.

Note A long press will ramp up the remote signal to the maximum factory set speed. After a short lag you may find that the winch is moving too quickly. It is best to begin load line movement using quick bumps to the speed button as described above.

1. **Winch (Hoist) DOWN** - Press and hold the Winch Down Function button desired, e.g. Main Winch Down or Aux Winch Down (if equipped). While holding the Winch Down Function button, quickly press and release the "FAST (+)" button once; the selected winch should start moving down slowly.
 - a) Winch speed will increase slightly everytime the "FAST (+)" button is quickly pressed and released.
 - b) The winch speed will ramp up to maximum speed if the button is pressed and held. The longer the button is pressed the faster the winches will turn.
2. **Winch (Hoist) UP** - Press and hold the Winch Up Function button desired, e.g. Main Winch Up or Aux Winch Up (if equipped). While holding the Winch Up Function button, quickly press and release the "FAST (+)" button once; the selected winch should start moving up slowly.
 - a) Winch speed will increase slightly everytime the "FAST (+)" button is quickly pressed and released.
 - b) The winch speed will ramp up to maximum speed if the button is pressed and held. The longer the button is pressed the faster the winches will turn.

NOTICE

The Winch UP function will not operate until the LMI configuration is confirmed at the LMI console in the crane cab. If the LMI system senses an overload or out of area condition the Winch UP function is disabled.

WARNING

During RWC operations, the anti-two-block system warning and lockout functions are disabled. To prevent damage to equipment and property or injury to personnel, do not allow the overhaul ball or load block to contact the boom point at any time.

3. **Power ON** - Press and hold to activate the transmitter.

Status Indicators

- a) Green Transmit
- b) Red Receive
- c) Amber Link

Note The RWC Transmitter powers down automatically after 10 seconds of inactivity. This will be evident when no LED's are flashing.

Note Place the transmitter in the truck cab when not in use.

- 4. **Fast (+)** - Quick press to bump up winch speed in small increments while holding the function button. Long press to ramp up to max line speed.
- 5. **Slow (-)** - Quick press to slow down winch speed in small decrements while holding the function button. Long press to decrease speed to crawl line speed.
- 6. **RWC Receiver** - Power to receiver is established through the Radio Outrigger Control Box (Figure 1-4). The PTO must be engaged and the Radio Outrigger control system must be ON.

Status Indicators

Out	Green	Output Active
Health	Green pulse/sec	OK
TX/RX	Green	Receive
	Red	Transmit
Power	Amber	OK
	Red/Green	Fault

Chapter 2 Rigging

Cutting Wire Rope

The wire rope must be tightly seized on both sides of the point where the wire rope will be cut, as shown in Figure 2-1.

Seize the wire rope with either seizing wire or annealed wire. The seizing will prevent the wire rope strands from unraveling and prevent distortion of the rope ends from the pressure applied during cutting.

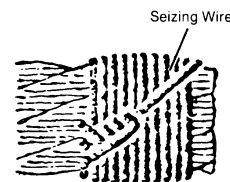


Figure 2-1 Wire Rope Seizing

Anchoring Wire Rope to Drum

⚠ CAUTION

Prevent possibility of wire rope slipping out of drum pocket and dropping the load!

Use only the correct wedge corresponding to the wire size being used. See Parts Manual for exact part number of wedge to be used.

Remove all rough edges and burrs from wedge and drum pocket that may cut wire rope or prevent rope and wedge from seating properly in the pocket.

Dead end of wire rope and seizing must extend past end of wedge, but not out of drum pocket.

If dead end of wire rope is welded, seize the rope near the end and cut weld off before assembling to drum pocket. Weld will not allow strands of wire rope to adjust around the wedge resulting in high strands and wavy rope. This condition can seriously weaken the rope.

Insert the free end of the wire rope through the small opening in the drum pocket as shown in Figure 2-2.

Loop the wire rope and push the free end about three-quarters of the way back into the drum pocket.

Insert small end of the wedge and pull the slack out of the wire to seat the wedge and wire rope in the pocket.

For 9/16" and 5/8" wire rope, insert small end first.

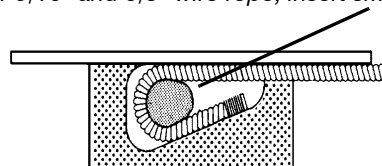


Figure 2-2 Anchoring Wire Rope to Drum

Winding Wire Rope Onto Drum

Carefully inspect the drum and sheaves for defects that might cut the rope or cause excessive wear. If the defects cannot be corrected, replace the faulty part.

Apply tension to the wire rope as it is slowly wound onto drum. The first wrap must be tight against the drum flange for approximately three-fourths of the drum circumference. Tap the adjacent wraps against each other with a soft metal or wooden mallet.

NOTICE

All wraps of first layer must be tight against drum and against each other.

Voids or spaced wraps in first layer will permit movement and wedging action with subsequent layers. Wedging action will cause crushing and abrasion of wire rope. Never allow wire rope to cross wind.

Anchoring Wire Rope to Wedge Socket

For Installations using conventional wedge and sockets

⚠ CAUTION

Prevent possibility of wire rope slipping out of socket and drop-ping the load!

Use only the correct wedge and socket corresponding to the wire rope size being used. See Parts Manual for exact part number of wedge and socket required.

Remove all rough edges and burrs from wedge and socket that may cut wire rope or prevent rope and wedge from seating properly in the socket.

Do not replace shipping material (bolt, plastic strap or wire) in hole of wedge or socket after assembling. Discard these materials because they can prevent wedge and rope from seating properly in the socket.

Attach wire rope clip to dead end of wire rope after assembling wire rope to wedge and socket. Figure 2-3 shows correct clip attachments.

If dead end of wire rope is welded, seize end of wire rope and cut off weld before assembling to wedge and socket. Weld will not allow strands of wire rope to adjust around bend of wedge, resulting in high strands and wavy rope. This condition can seriously weaken the rope.

Assemble the wire rope and wedge to the socket so the live side of the wire rope is in a straight line with the socket pin hole. Correct and incorrect assemblies are shown in Figure 2-3.

Allow the dead end of the rope to extend past the end of the socket.

Pull on the live side of the wire rope enough to tighten the wedge in the socket.

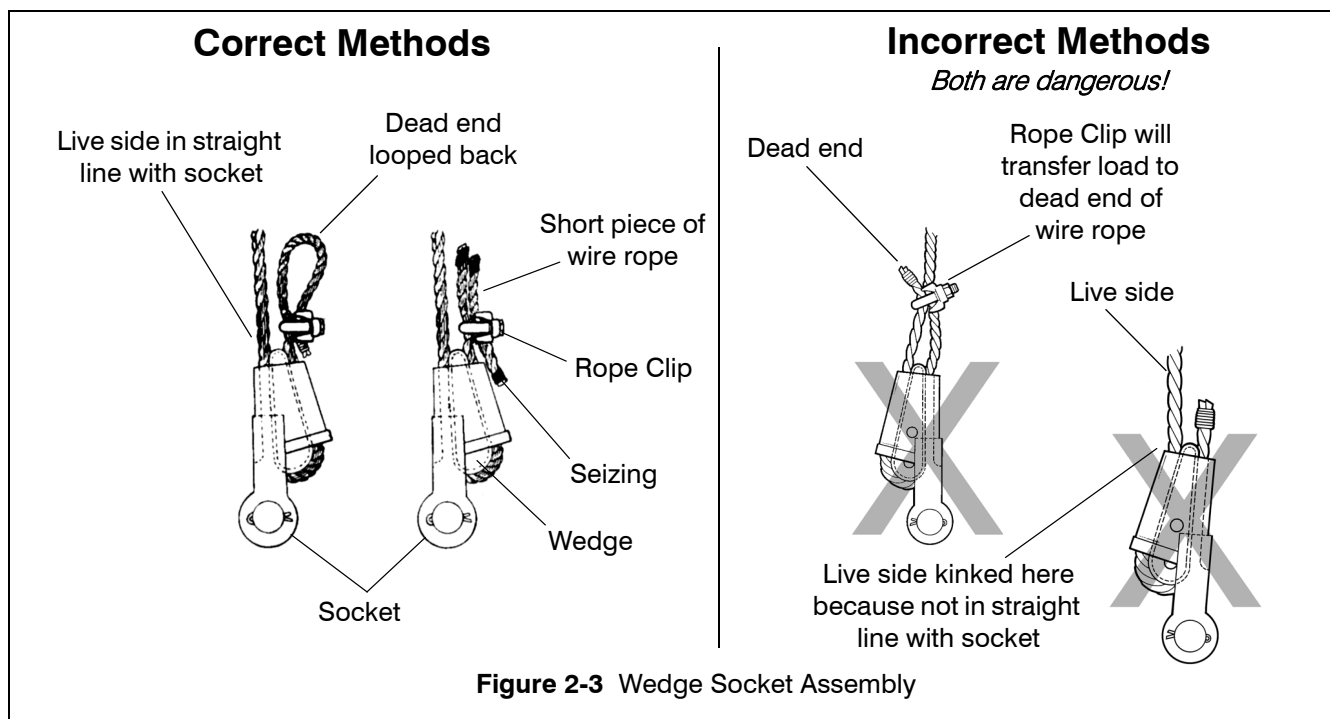


Figure 2-3 Wedge Socket Assembly

Attach a wire rope clip to the dead end of the wire rope using one of the Correct methods shown in Figure 2-3. The rope clip will aid in preventing the wire rope from being pulled out of the socket.

⚠ CAUTION

Do not attach dead end of wire rope to live side of wire rope with a wire rope clip. Wire rope clip will transfer load from live side of wire rope to dead end, seriously weakening attachment.

After the socket is pinned in place (to dead end on boom head, overhaul ball or loadblock), hoist the load slowly so the wedge and rope will seat firmly in the socket. Do not shock load the socket and wedge.

For installations using the Crosby “Terminator” wedge and socket

Note The following text is taken from the Crosby Terminator application sheet.

⚠ WARNING

- **Loads may slip or fall if the Wedge Socket is not properly installed.**
- **A falling load can seriously injure or kill.**
- **Read and understand these instructions before installing the Wedge Socket.**
- **Do not side load the Wedge Socket.**
- **Apply first load to fully seat the Wedge and Wire Rope in the socket. This load should be of equal or greater weight than loads expected in use.**
- **Do not interchange wedges between S-421T and US422T or between sizes.**

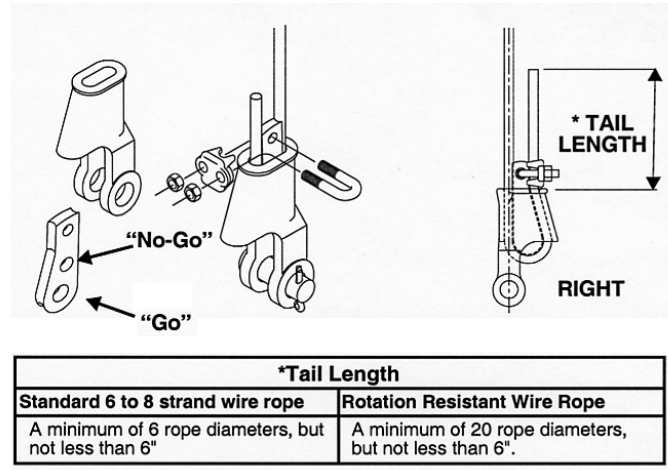


Figure 2-4 Terminator Wedge Socket Assembly

Important Safety Information - Read and Follow

INSPECTION/MAINTENANCE SAFETY

- Always inspect socket, wedge and pin before using.
- Do not use part showing cracks.
- Do not use modified or substitute parts.
- Repair minor nicks or gouges to socket or pin by lightly grinding until surfaces are smooth. Do not reduce original dimension more than 10%. Do not repair by welding.
- Inspect permanent assemblies annually, or more often in severe operating conditions.
- Do not mix and match wedges or pins between models or sizes.
- Always select the proper wedge and socket for the wire rope size.

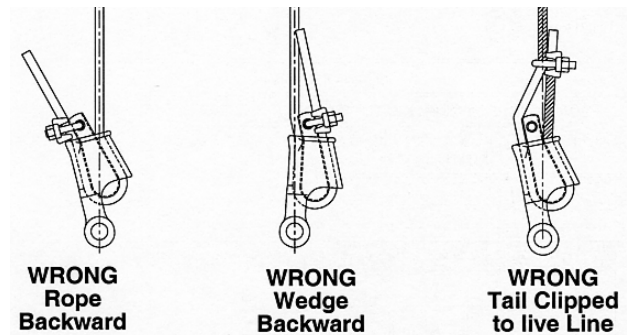


Figure 2-5 Incorrect assembly examples

ASSEMBLY SAFETY

- Use only with standard 6 to 8 strand wire rope of designated size. For intermediate size rope, use next larger size socket. For example: When using 9/16" diameter wire rope use a 5/8" size Wedge Socket Assembly. Welding of the tail on standard wire rope is not recommended. The tail length of the dead end should be a minimum of 6 rope diameters but not less than 6" (See Figure 2-4).

Table 2-1

Rope Size	3/8	1/2	5/8	3/4	7/8	1	1 1/8
Clip Size	3/8	1/2	5/8	3/4	7/8	1	1 1/8
*Torque Ft/lbs	45	65	95	130	225	225	225

** The tightening torque values shown are based upon the threads being clean, dry, and free of lubrication.*

- To use with Rotation Resistant wire rope (special wire rope constructions with 8 or more outer strands) ensure that the dead end is welded, brazed or seized before inserting the wire rope into the wedge socket to prevent core slippage or loss of rope lay. The tail length of the dead end should be a minimum of 20 rope diameters but not less than 6" (See Figure 2-4).
- Properly match socket, wedge and clip (See Table 2-1) to wire rope size.
- Align live end of rope, with center line of pin (See Figure 2-4).
- Secure dead end section of rope. (See Figure 2-4).
- Tighten nuts on clip to recommended torque. (Table 2-1)
- Do not attach dead end to live end or install wedge backwards (See Figure 2-5).
- Use a hammer to seat Wedge and Rope as deep into socket as possible before applying first load.

OPERATING SAFETY

- Apply first load to fully seat the Wedge and Wire Rope in the socket. This load should be of equal or greater weight than loads expected in use.
- Efficiency rating of the Wedge Socket termination is based upon the catalog breaking strength of Wire Rope. The efficiency of a properly assembled Wedge Socket is 80%.
- During use, do not strike the dead end section with any other elements of the rigging (Called two blocking).

Breaking In Wire Rope

After installing a new wire rope, break in the wire rope by operating it several times under light load and at reduced speed. This practice will allow the wire rope to form its natural lay and the strands to seat properly.

Some stretch will occur during the break-in period causing a reduction in the wire rope's diameter as the strands compact around the core.

The dead wraps of wire rope on the winch drum can become slack during operation, even if the utmost care is used during installation of the wire rope. This slackening is caused by the normal stretch that occurs in a new wire rope under tension and periodically throughout the wire rope's life from release of the load.

NOTICE

When slackness is noted, the dead wraps of wire rope should be tightly rewound onto the drum. If left incorrect, a wedging action with subsequent layers will occur, and the resultant abrasion will cause broken wires in the dead wraps.

Reeving

Reeving diagrams for the wire rope are shown in Figure 2-9. The number of parts of line used depends on the load to be lifted. Refer to the Capacity Chart for your specific crane to determine reeving requirements for the various loads that can be lifted.

Make sure the wire rope travels through each set of cable guides on the boom and on the jib, if erected.

The Manitex S-Series crane incorporates a "quick reeve" boom head. When used with our optional "quick reeve" load blocks, this feature allows the rigger to reeve multiple parts of line without removing the wedge and socket from the wire rope.

CAUTION

Ensure that all wire rope retaining pins are in place at all times. This will ensure that the wire rope remains in the sheave groove if they should become unloaded. Failure to comply will allow the wire rope to exit the sheave groove possibly causing damage to the wire rope and sheaves. Refer to Figure 2-6.

Anti-Two Block connections - Boom Point

Your machine will be equipped with either a wired or wireless ATB system; while both properly installed systems offer the same protection there are some slight differences in set-up and functionality.

Verify that the Anti-Two-Block (ATB) system is properly installed after each reeving modification. Figures 2-7 & 2-8 show the proper ATB configurations when the machine is equipped with a Main winch only.

Note If the crane is configured with an Auxiliary Sheave for an Auxiliary Winch, see “Installing the Auxiliary Sheave” later in this chapter for proper ATB configuration.

If the load is to be handled with the Jib, see “Erecting and Storing Jib” later in this chapter for proper ATB configuration.

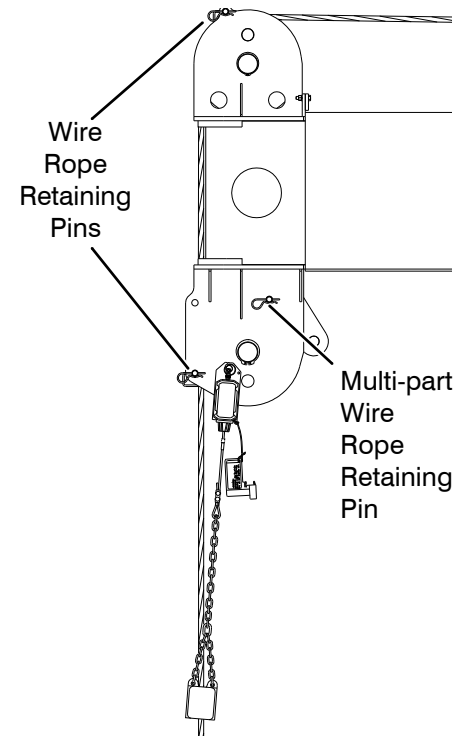


Figure 2-6 Wire Rope Retaining Pins
(All must be in place at all times)

WIRELESS ATB SYSTEMS

- Check that the ATB switch is attached to the post on the side of the boom head and secured in place with lynch pin provided, see Figure 2-7.
- Ensure that the switch is free to rotate on the post.
- Check that the ATB counterweight is connected to the lanyard on the switch.
- Check that the counterweight is installed on the correct part of the line, refer to Figure 2-9.

NOTICE

Do not shorten length of chain/lanyard on ATB counterweight, if shortened, a two-block condition may occur.

- If the ATB system is equipped with an override flag, check that it is not installed on the switch lanyard thereby overriding the switch.

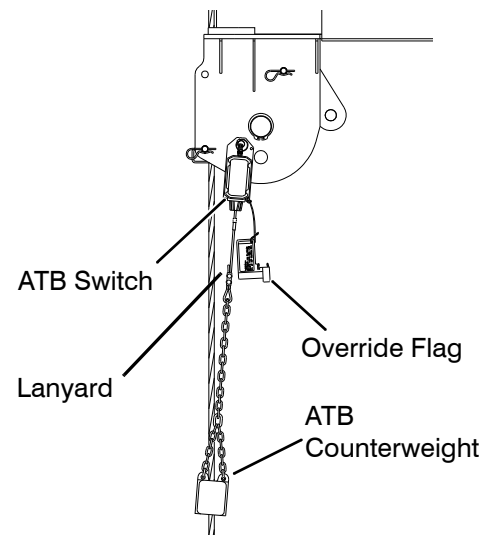


Figure 2-7 Wireless ATB Connections

WIRED ATB SYSTEMS

- Check that the cable from the cable reel on the side of the boom is properly secured to the boom point and connected to the junction box at the ATB switch, see Figure 2-8.
- Check that the **R** connector is connected to the left side of the junction box at the ATB switch.

NOTICE

If either of these connectors are missing or detached, the ATB and LMI systems will not function correctly.

- Check that the ATB counterweight is connected to the lanyard on the switch.
- Check that the counterweight is installed on the correct part of the line, refer to Figure 2-9.

NOTICE

Do not shorten length of chain/lanyard on ATB counterweight, if shortened, a two-block condition may occur.

- If the ATB system is equipped with an override flag, check that it is not installed on the switch lanyard thereby overriding the switch.

After verifying the installation, test the ATB warning horn and shutdown functions for proper operation before placing the crane in service. Refer to Daily Maintenance Checks in Chapter 6.

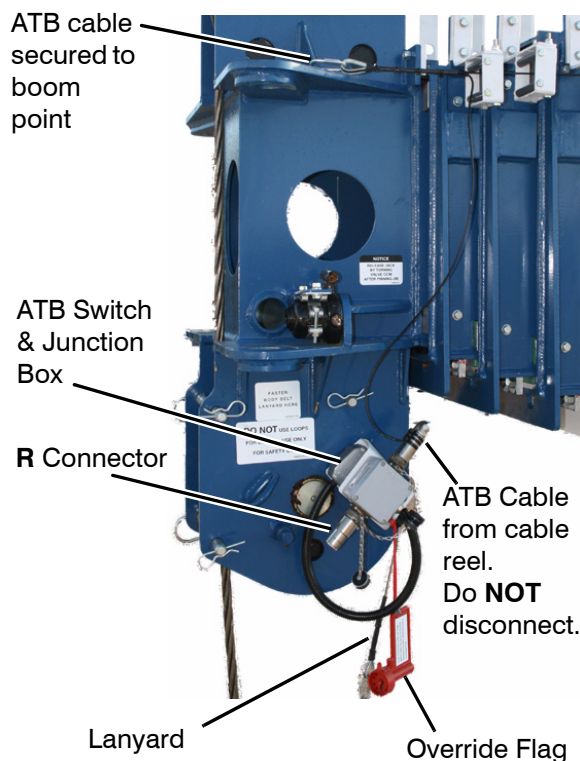


Figure 2-8 Wired ATB Connections

Six - Sheave Boom Head

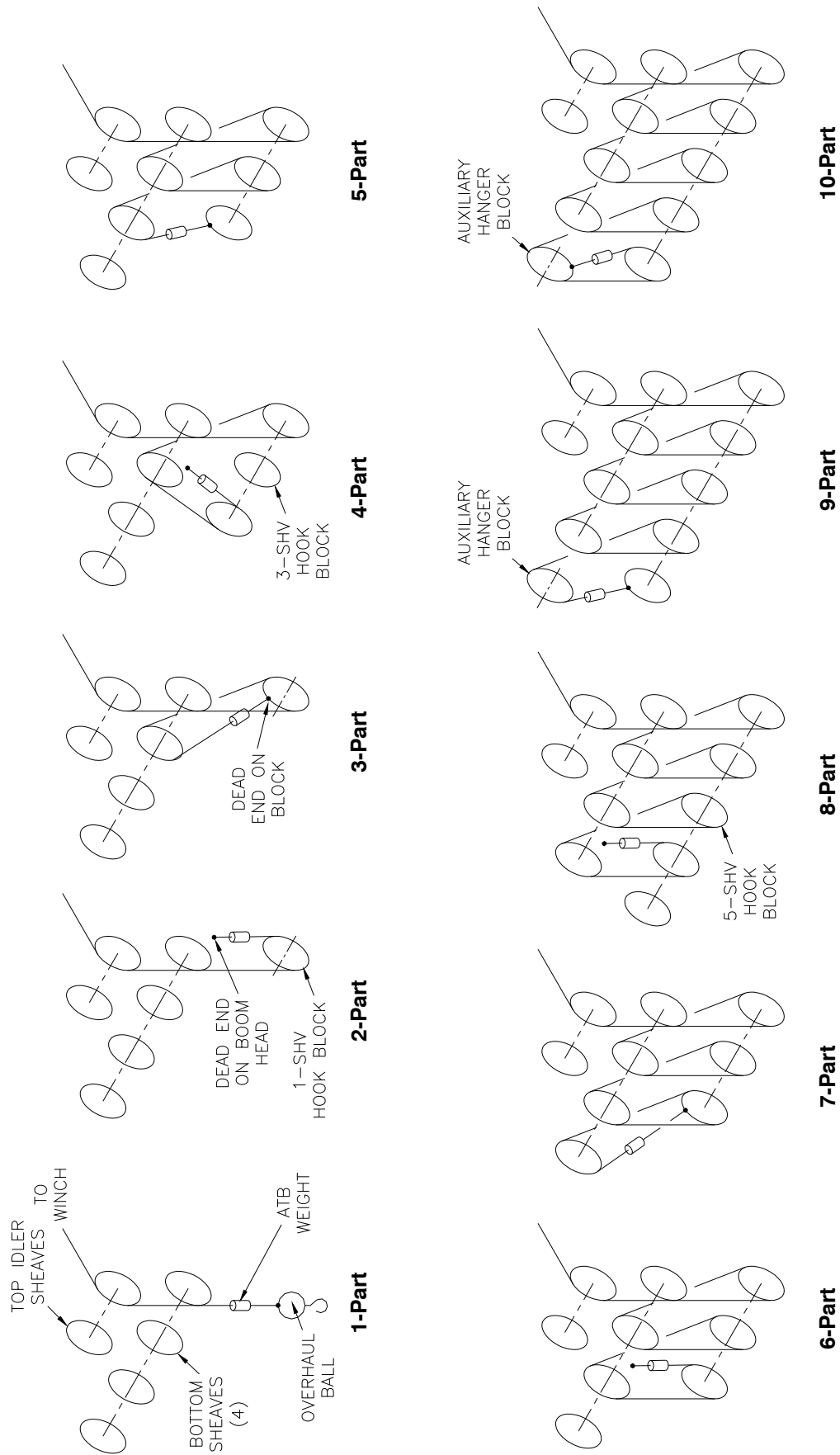


Figure 2-9 Load Line Reeving — Six-Sheave Boom Head

Installing the Auxiliary Sheave

Cranes equipped with Main and Auxiliary Winches

The Auxiliary Sheave is required when the machine is equipped with an Auxiliary Winch. The Auxiliary Sheave assembly attaches to the boom point to provide the operator with a second readily available reeving option.

The Auxiliary sheave bracket assembly weighs about seventy pounds and takes approximately ten minutes to install. The only tool that may be required is a hammer to tap in and seat the hitch pins.

Installing the Auxiliary Sheave Bracket Assembly

- Retract the boom completely and lower it to its lowest position.
- Remove the hairpin cotter clip and wire rope retaining pin from the lower section of the boom head, see Figure 2-6.
- Lift the auxiliary sheave bracket assembly into position and align the mounting holes, ensure that the main load line is seated against the lower head sheave then insert two hitch pins (see Figure 2-10) to secure the bracket in place. Light taps with a hammer may be required to firmly seat the pins.

NOTICE

Hitch pins also serve as wire rope retainers, therefore, be sure the main load line is seated in the sheave groove and held in place by the pins.

- Attach the hairpin cotter clips securely to the hitch pins.
- Remove the wire rope retainer at the auxiliary sheave bracket and also at the top of the boom head, refer to Figure 2-10.
- Move the auxiliary wire rope over the center sheave at the top of the boom head and also over the auxiliary sheave; place rope in sheave grooves, see Figure 2-10.
- Reinstall both wire rope retainer pins and hairpin cotter clips.

The Auxiliary Sheave is now physically secured to the boom; proceed to install Aux ATB switch and weight.

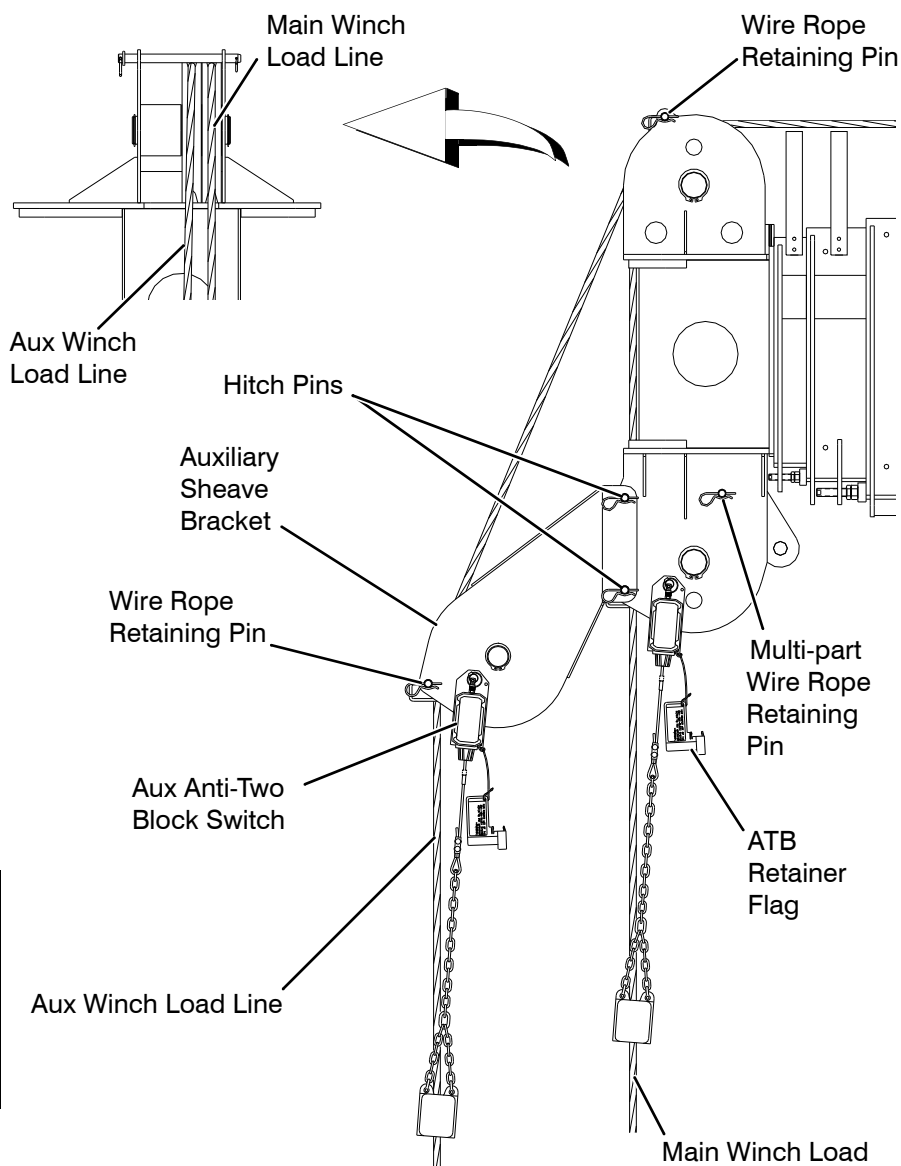


Figure 2-10 Rigging for operations using Main or Aux Winch

NOTICE

Hitch Pins and wire rope retainers must always be present on boom head and auxiliary sheave bracket. Hitch pins also serve as a retainer for the Main Winch load line to prevent the rope from leaving the sheave area. Do not operate crane unless all hitch pins and retaining pins are present and correctly installed.

Installing the Auxiliary Sheave ATB Switch

WIRELESS ATB SYSTEMS

- Attach the Aux ATB switch to the post on the side of the auxiliary sheave bracket (see Figure 2-10) and secure in place with lynch pin provided. Ensure that the switch is free to rotate on the post.
- Assemble the Aux ATB weight to the auxiliary load line and attach the chain to the lanyard on the Aux ATB switch, use the chain connector provided.
- If the ATB system is equipped with an override flag, check that it is not installed on the switch lanyard thereby overriding the switch.

WIRED ATB SYSTEMS

- Detach the **R** connector from the left side of the ATB junction box/switch assembly at the boom point, see Figure 2-8.
- At the auxiliary sheave bracket, detach the Aux ATB switch cable from the storage plug.
- Connect the Aux ATB switch cable to the boom point ATB junction box where the R connector was previously connected.
- Assemble the Aux ATB weight to the auxiliary load line and attach the chain to the lanyard on the Aux ATB switch, use the chain connector provided.
- If the ATB system is equipped with an override flag, check that it is not installed on the switch lanyard thereby overriding the switch.

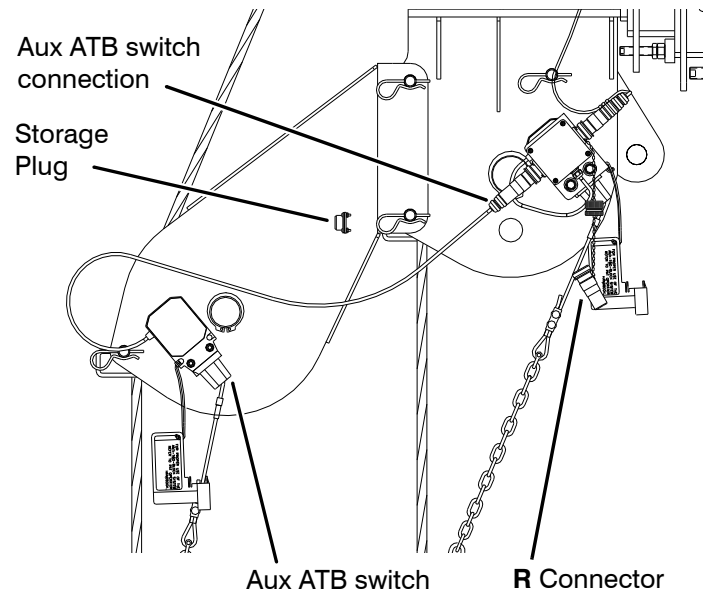


Figure 2-11 Auxiliary Sheave ATB Connections

Test to ensure the ATB warning horn and shutdown operate properly at both the auxiliary sheave and the boom head. Refer to Daily Checks in Section 4.

Both the Main and Auxiliary Sheaves now have active ATB Switches.

Warnings and Notes for Auxiliary Winch Operations

⚠ CAUTION

Prevent a two-block condition. ATB weights must be installed on BOTH main and auxiliary load lines and attached to the corresponding ATB switch at all times. When operating winch and boom functions, both load lines are live and can only be protected if the ATB systems are properly installed.

Do not handle any load with either the auxiliary or main loadline until the ATB warning horn and shut-down features are operational.

Failure to comply may result in a two block condition possibly causing injury to surrounding personnel or damage to crane or property.

⚠ CAUTION

Simultaneous lifts, using the auxiliary and main winch load lines, are UNSAFE and are NOT permitted. Failure to comply may result in possible injury to operator, surrounding personnel or damage to crane or property.

- Cranes equipped with both Main and Auxiliary Winches must have both ATB switches installed and active at all times during crane operations even if only one of the winch systems is to be used.
- If either of the two switches fails or is inactive the ATB system will shutdown the **HOIST UP, TELESCOPE OUT** and **BOOM DOWN** functions.
- Before using the auxiliary winch, verify that the winch operating code is set to Auxiliary on the LMI display.

NOTICE

The procedure to set the operating codes differ depending on the LMI system installed on your machine, refer to the LMI operator manual supplied with your crane for configuration instructions.

CAUTION

Only operators who are thoroughly familiar with the load capacity charts and the use and operation of the LMI system shall set the operating codes. To assure the LMI is properly programmed, verify that the operating code shown in the data display and the load capacity chart match the lifting configuration of the crane.

Failure to properly program the LMI with the correct operating codes will prevent the system's ability to aid the operator in monitoring crane operations possibly resulting in damage to crane or property.

Removing the Auxiliary Sheave

The Auxiliary sheave bracket assembly must be removed temporarily if it becomes necessary to change the parts of line configuration at the main boom point. You may also need to remove the bracket indefinitely if you intend to use the crane for manbasket operations.

To remove the Auxiliary sheave bracket assembly, reverse the installation procedure described in the previous topic.

WHEN EQUIPPED WITH A WIRED ATB SYSTEM

If the crane is equipped with a wired ATB system, the Aux ATB switch has no affect on crane functionality when removed from the boom point (provided that the boom point ATB switch is properly connected), see Figure 2-8.

If the Auxiliary Sheave assembly is removed, check the boom point ATB connections before placing the crane into service.

WHEN EQUIPPED WITH A WIRELESS ATB SYSTEM

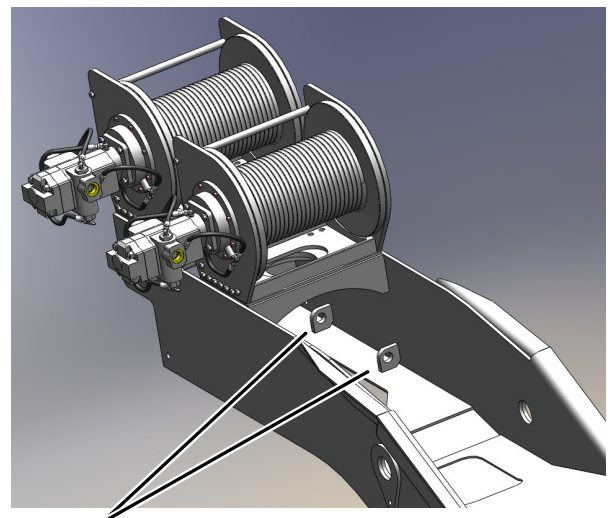
NOTICE

The crane will operate normally only if both Main and Auxiliary ATB systems are operational.

If you elect not to re-install the Auxiliary Sheave assembly or need to leave the assembly off the boom point during crane operations:

- Wrap the auxiliary load line onto the winch drum and attach the end of the load line to the tie down lug located on the winch shelf at the back of the turret.
- Install the ATB Override Flag onto the Aux ATB switch and place switch in crane cab where the receiver can maintain communications with the Aux ATB transmitter. See figure 2-13 for Override Flag installation.

Note If you re-install the Auxiliary Sheave assembly but elect NOT to reeve the auxiliary load line; follow the procedure above, leave the Aux ATB switch on the post and install the Override Flag as instructed.



Tie down lugs for load lines
(view inside winch shelf)

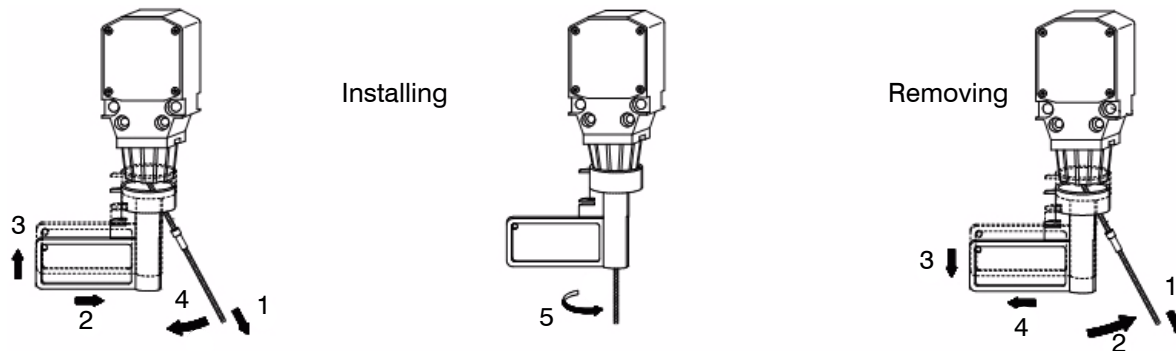
Figure 2-12 Load line tie down points

Use of ATB Override Flag

The ATB system includes an Override Flag for use when necessary to perform certain operations. These operations may include jib set-up, operations with boom attached man-baskets, operations with Auxiliary Sheave assembly removed and general troubleshooting.

When the Override Flag is properly installed, the ATB switch/transmitter will continue to communicate with the ATB system to allow crane operations without the need to use the override switch at the operator station.

See Figure 2-13 for installation and notes regarding the use of the Override Flag; refer to the ATB/LMI manual supplied with the crane for further notes and instructions regarding the use of the Override Flag on wired and wireless systems.



To install Flag:

- ❑ Pull the cable out of the switch and bend back parallel to the boom and hold (1).
- ❑ Slide the retainer from left side with its slot over the cable between the crimped stop and the switch (2). Push it firmly straight onto the cable guide of the Anti Two-Block switch (3).
- ❑ Straighten the cable completely into the slot and release the cable (4).
- ❑ Turn the flag of the retainer for best visibility for the operator (5).
- ❑ Remove by performing steps in order shown.

Override Retainer Flag installed on lanyard (see caution note below).

NOTICE

Do not leave the retainer flag installed as shown for extended periods of time. This measure should only be taken while the crane is in use in this configuration.

To conserve the transmitter's batteries, at the end of the shift, always remove the retainer flag. With flag and weight removed, the switch will enter into sleep mode.

Note When a transmitter enters into sleep mode, the crane acts as if it is two-blocked.

For more information about proper ATB switch storage and battery conservation, refer to the Radio ATB or LMI manual provided with the crane.

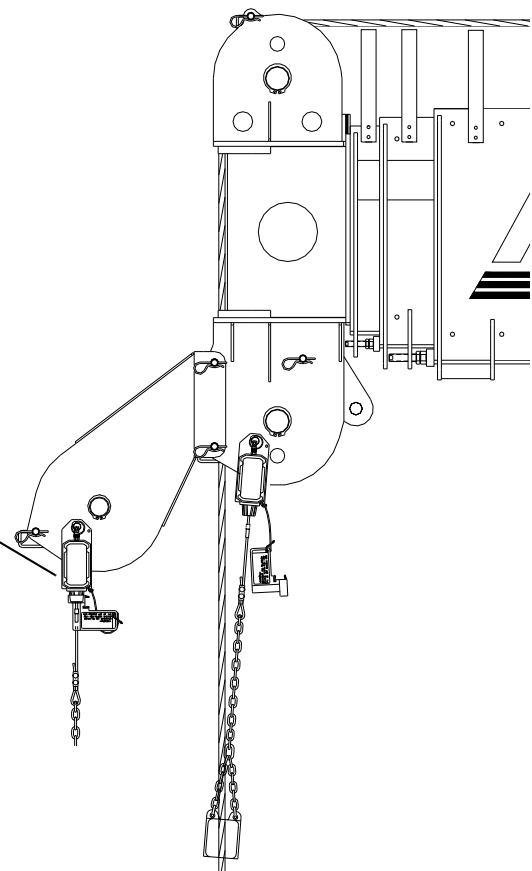
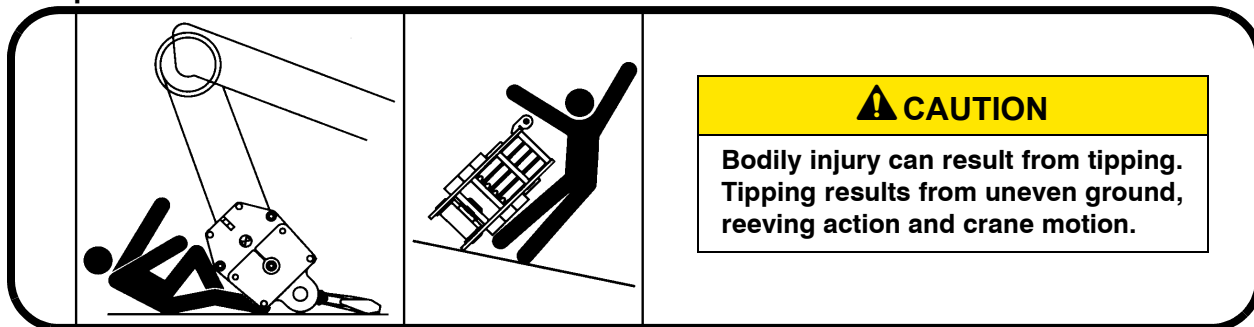


Figure 2-13 Use of ATB Override Flag

⚠ CAUTION

Using the retainer flag in this manner is an **OVERRIDE** and defeats the intended purpose of the ATB system. Remove the retainer flag from the switch's lanyard when the load line is re-installed to resume winch operations. Failure to do so may result in a two block condition possibly causing injury to surrounding personnel or damage to crane or property.

Quick-Reeve Load Block**Wire Rope Installation**

1. Lower Crane boom to horizontal position and engage crane swing lock.

⚠ CAUTION

Crane swing motion during wire rope installation can cause tipping of the Quick-Reeve block.

2. Ensure ground support is firm and level within 5°.

⚠ CAUTION

Soft or uneven ground may lead to tipping of the Quick-Reeve block.

3. Place Quick-Reeve block in the folded position in line and forward of the boom as illustrated in Figure 2-14.

⚠ CAUTION

Improper placement will produce reeving forces that can cause tipping of the block.

4. Remove Rope Guard Keeper Pins at (A), see Figure 2-14.
5. Remove Rope Guard Pins (B).
6. Remove boom sheave guards.
7. Pull wire rope from the hoist drum and pass wire rope over the first boom and block sheave then over the second boom sheave. Ensure load line pull is always against the boom and never against the block.

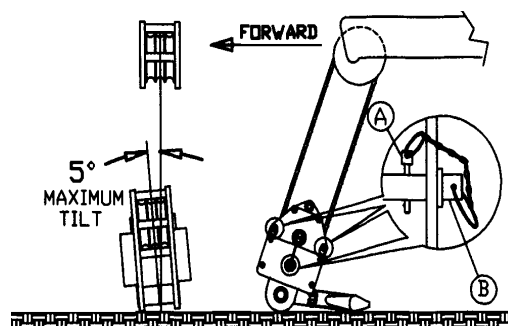


Figure 2-14 Quick-Reeve Load Block Pins

⚠ CAUTION

Load line pull applied against block may cause tipping of the block. Avoid injury. Never stand on block.

8. If multiple part reeving, repeat Step 7 for the next boom and block sheave until reeving is complete.
9. Install wedge socket on wire rope if not already installed.

10. Assemble wedge socket to boom or block dead end connection. Ensure connecting pin keeper is properly installed.
 11. Replace Rope Guard Pins (B).
- Note* OSHA invokes ASME B30.5, which requires the sheaves in the lower load block shall be equipped with close-fitting guards that will prevent ropes from becoming fouled when the block is lying on the ground with loose ropes.
12. Replace Rope Guard Keeper Pins (A).
 13. Replace boom sheave wire rope guards.
 14. Lift block to hanging position by raising boom.

CAUTION

Stand clear while lifting block off the ground.

Wire Rope Removal

1. Lower crane boom to near horizontal position and engage crane upper swing lock.

CAUTION

Crane swing motion during wire rope removal may cause tipping of block.

2. Ensure ground support is firm and level within 5°.

CAUTION

Soft or uneven ground may lead to tipping of the block.

3. Rotate hook into position as shown in Figure 2-15.
4. Lower Quick-Reeve block with hoist drum until hook touches ground.
5. Use a tagline to pull block forward and lower boom simultaneously to start block folding.
6. Continue to pull block forward and lower boom until block rests on ground in folded position.
7. Remove Rope Guard Keeper Pins (A), see Figure 2-14.
8. Remove Rope Guard Keeper Pins (B).
9. Remove boom sheave guards.
10. Disassemble wedge socket from dead end connection.
11. Pull wire rope and wedge socket around first block and boom sheave.

CAUTION

Avoid possible injury. Do not allow wedge socket to fall from boom sheave and never stand on block.

12. If multiple part reeving, repeat Step 11 for the next boom and block sheave until wire rope removal is complete.
13. Replace Rope Guard Pins (B).
14. Replace Rope Guard Keeper Pins (A).

15. Proceed with next rigging arrangement.

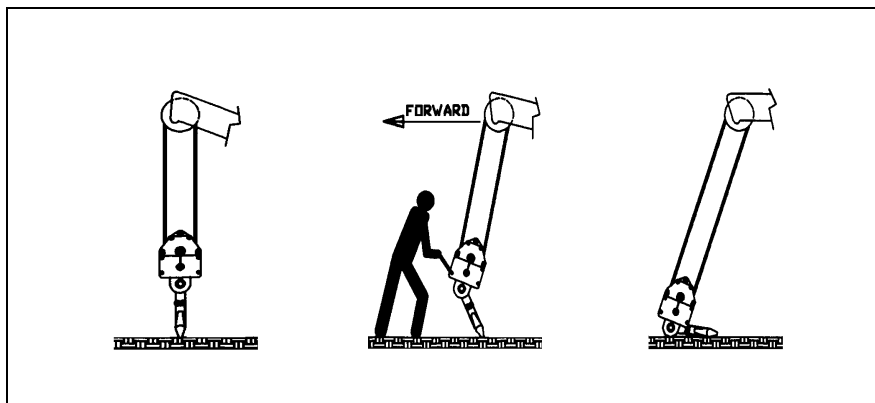


Figure 2-15 Quick-Reeve Wire Rope Removal

Offset Jib

⚠ DANGER

Exceeding jib ratings or failing to comply with jib operating conditions and restrictions given on the crane's Capacity Chart will result in structural damage to crane components, collapse of crane, or tipping.

Read all instructions on Capacity Chart before handling any load with jib.

Do not attempt to erect jib until outriggers and stabilizers are properly set.

Do not retract outriggers and stabilizers until jib is stored and boom is lowered onto boom rest.

Use these formulas to determine the minimum distances required for the side swing-around and rear clearances for the truck when erecting or storing the jib. The lengths are found in the crane's range diagram.

- + Fixed jib length or *Retracted* telescopic jib length
- + 10 Feet

Minimum side swing-around clearance from centerline of crane rotation.

- Retracted boom length
- + *Extended* jib length (or fixed jib length if non-telescopic)
- + 10 Feet

Minimum rear clearance from centerline of crane rotation.

Tools Required

- ☐ 6' Ladder or equivalent, rigger may need to reach a height of approximately 10'.
- ☐ Hand Tools, i.e. pliers, ball peen hammer.

Using the Jib Jack

A hydraulic jack is supplied as standard equipment on cranes equipped with the Jib option. During the erecting or stowing procedure, the jib jack is used to align the fourth jib hole with the corresponding fourth hole in the boom point; when the holes are aligned, the jib pin can be installed or removed with minimum effort. Refer to topics "Erecting the jib" & "Storing the Jib" for jib deployment procedures.

Keep the removable lever secured to the stow bracket on the jib foot at all times when not in use.

NOTICE

Always release pressure to the jack ram immediately after pinning the jib. There is sufficient clearance between the jib holes and the jib pins that if pressure is not relieved, the internal jack seals may be damaged when the jib is loaded.

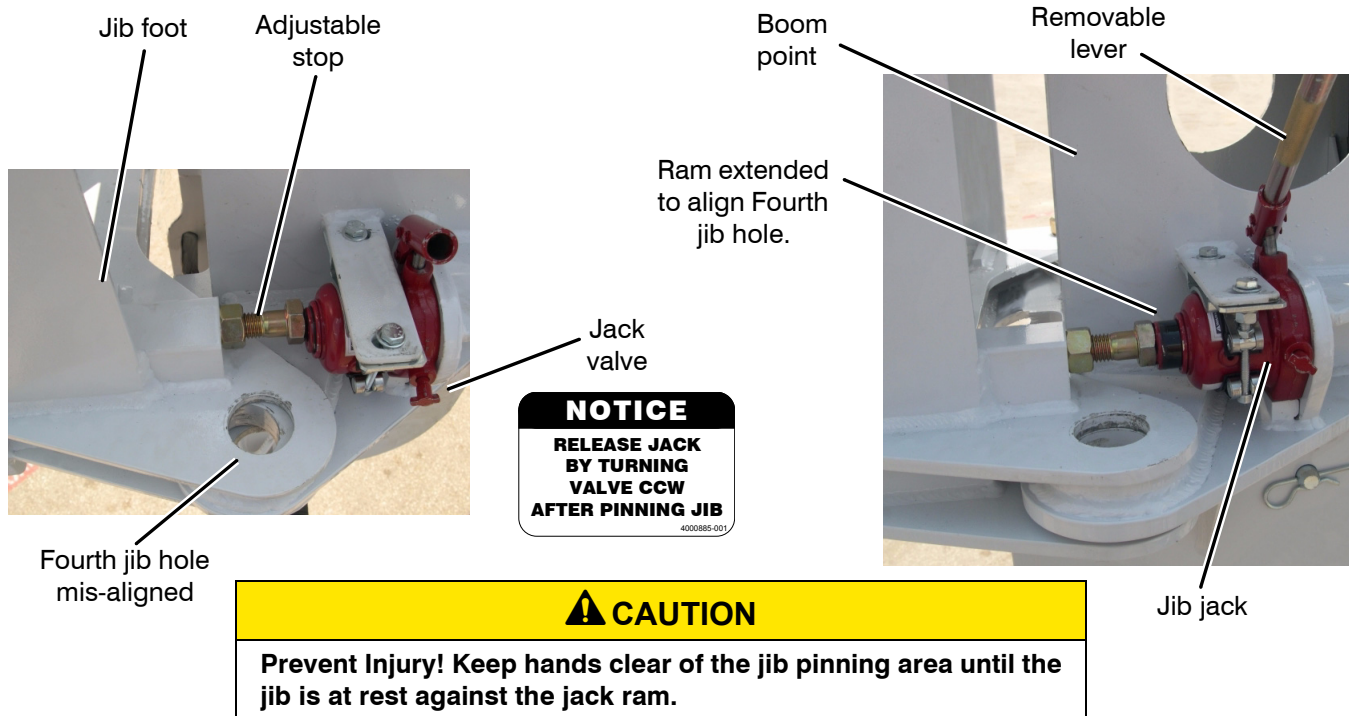
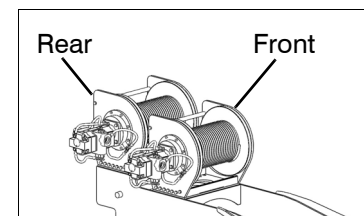


Figure 2-16 Jib Jack

Erecting the Jib

NOTICE

For machines equipped with a main and auxiliary winch; only the load line from the main winch (front) can be reeved for lifting off the jib point. Do not use the load line from the rear winch on jib; damage to wire rope and rope retaining pins will occur.



NOTICE

Be sure to install hairpin cotters to retain all pins

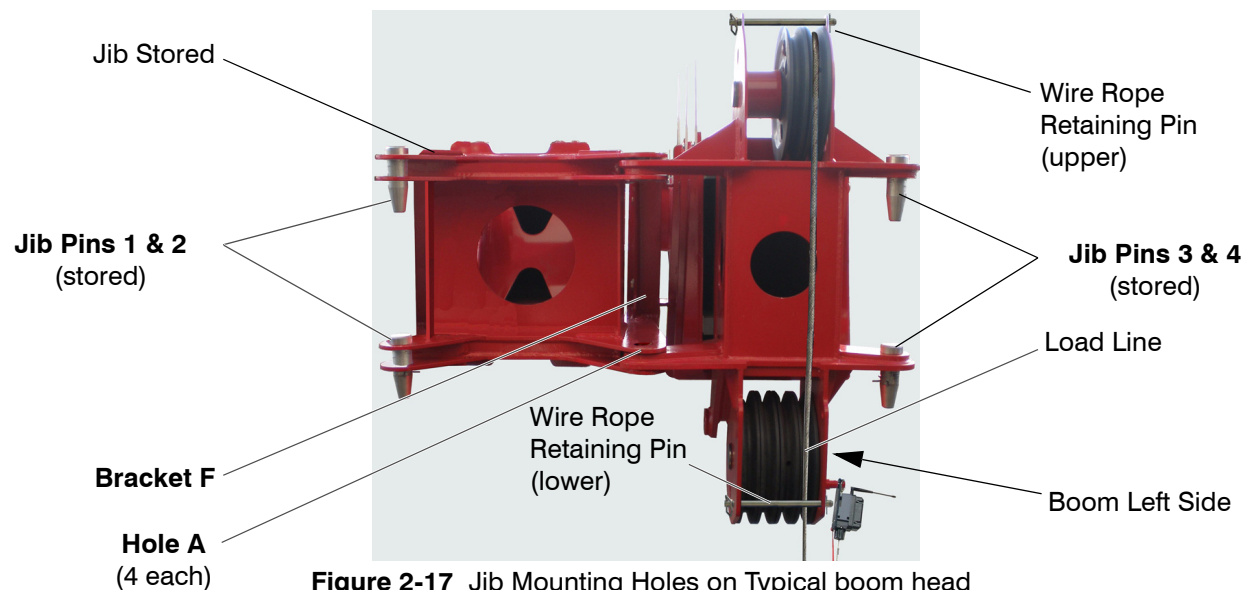


Figure 2-17 Jib Mounting Holes on Typical boom head

- To make lifts with the Jib, the crane must be rigged with a single part of line. Therefore, if the crane is rigged with a load block, break down the rigging to a single part of line and install the Manitex supplied overhaul hook ball.

NOTICE

It is not necessary to remove the auxiliary sheave bracket to erect the jib. The auxiliary load line however, will interfere with the erected jib if not removed. Spool the auxiliary load line onto winch drum and attach it to the tie down lug located on the winch shelf (see Figure 2-12) before erecting the jib.

- Using all applicable safety precautions, extend and set the crane outriggers.
- Operate the crane systems to raise and swing the boom; place the boom point in "Over the Rear" position.
- Keeping the boom above horizontal, operate the telescope lever to extend the boom about three fourths (3/4) its total extended length and lower the headache ball onto the ground.
- Operate the telescope lever, retract boom fully allowing headache ball and wire rope to stay in its extended location. Lower the boom to allow access to anti-two block (ATB) counterweight and boom head or auxiliary sheave bracket.
- With boom lowered, remove the two (2) hair pins from the anti-two block weight on the load line attached to the overhaul ball. Remove the weight from the load line and let it hang on the ATB switch.
- Remove the wire rope retaining pins from the boom head and temporarily lay the main load line to left side of boom head, out of the way of jib attach lugs.

Note If necessary, retract the rear outrigger jack cylinders to lower the rear of the crane until the boom head can be reached from the ground, use a step ladder if needed.

- With main load line off to the side, re-install the wire rope retaining pin at the bottom of the boom head (see Figure 2-17) or if present, the hitch pins at the auxiliary sheave bracket (see Figure 2-10).

CAUTION

Do not attempt to telescope the boom at this time. Severe damage to the boom and/or jib will occur if a premature attempt is made to telescope the boom.

- Remove the four **Jib Pins (1 - 4)** from jib base and boom head, see Figure 2-17.
- Install two **Jib Pins (1 & 2)** to fasten the jib to **Holes A** on the **RIGHT** side of the boom head and secure in place with cotter pins provided.

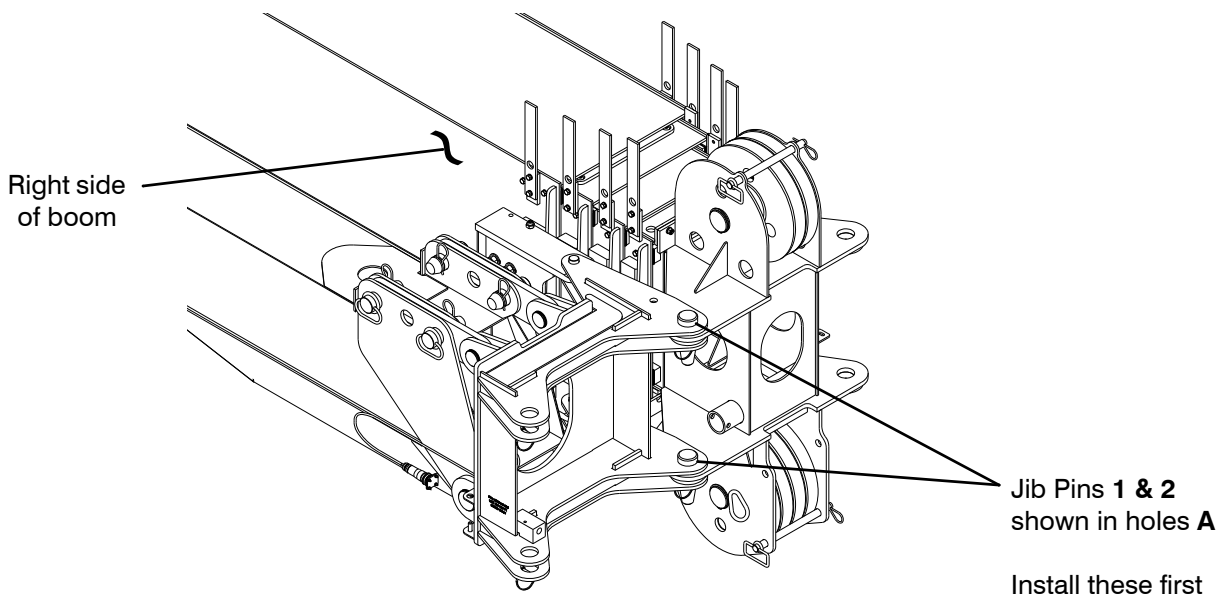


Figure 2-18 Jib pins in Holes A

NOTICE

Extend rear outriggers to level the crane if rear of crane was lowered in previous steps.

- Raise the boom to horizontal.

CAUTION

During the next few steps the jib will swing around uncontrolled if boom is not placed in a horizontal position. A suitable tagline must be attached as described before attempting to deploy the jib.

- Fasten a tagline, approximately twenty feet long, to the bar at the jib point shown in Figure 2-20.
- Remove **Pin 5** from **Bracket B** shown in Figure 2-19.

CAUTION

Do not remove Pin 5 until Jib Pins (1 & 2) are installed on right side of boom head (see Figure 2-18) otherwise, jib may fall from boom causing serious injury to personnel.

- Extend the boom approximately one foot so **Bracket C**, shown in Figure 2-19, is clear of **Bracket B**.

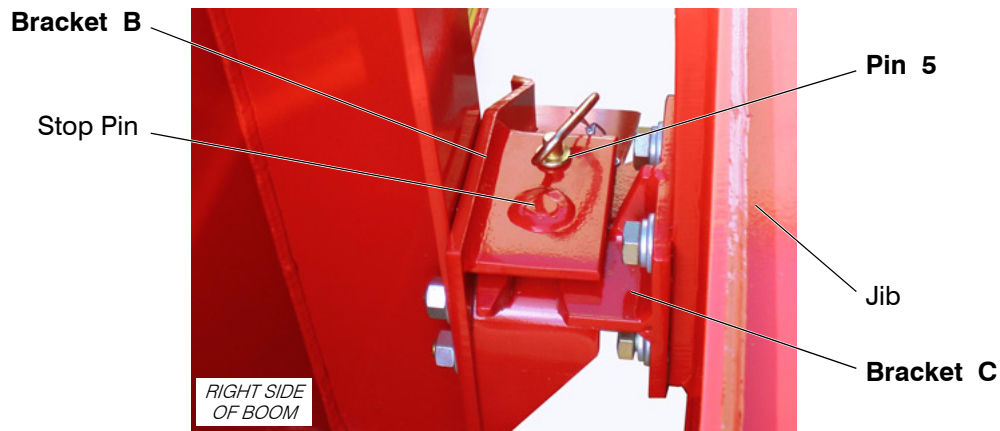


Figure 2-19 Jib Brackets - Mid Boom

- Slowly swing the jib to the extended position with the tagline.
- Lower the boom so the boom head can be reached from the ground.
- Install the two remaining **Jib Pins (3 & 4)** to fasten the jib to **Holes A** on the **LEFT** side of the boom head.

Note Install the top pin first; use the jib jack to align the bottom hole then insert the fourth pin, see Figure 2-16. Secure jib pins in place with cotter pins provided.

- **If the telescopic jib will be operated in the extended position, proceed as follows:**

- Remove **Pin 6** from **Hole D**, refer to Figure 2-20.
- Pull the jib stinger out until it is fully extended. Raise the boom if the jib point touches the ground.
- Re-install **Pin 6** in **Hole D** and secure with hairpin cotter.

Note Pin 6 cannot be installed unless the jib stinger is extended completely.

CAUTION

Do not proceed unless Pin 6 is installed in Hole D and secured in place with cotter pin. Failure to do so will allow jib stinger to retract suddenly when boom is raised resulting in damage to crane and/or injury to personnel when used in man-basket operations.

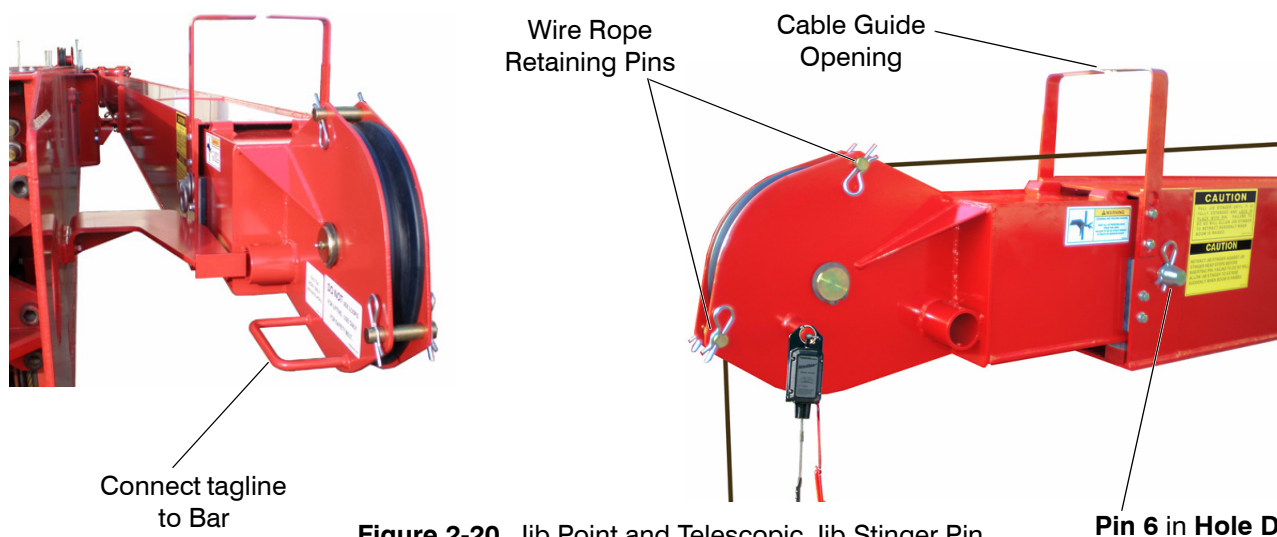


Figure 2-20 Jib Point and Telescopic Jib Stinger Pin

- Lay wire rope over top sheave of boom head and re-install wire rope retaining pin, secure with hair pin.
- Lay wire rope along top plate of jib; at the jib base, insert wire rope through wire rope cable guide using the notch at the top of the guide.
- Remove jib wire rope retainer pins at the jib head. Lay wire rope on jib head sheave groove and re-install retaining pins, secure pin with hair pin, see Figure 2-19.
- If open wedge socket was removed, re-install open wedge wire rope socket onto end of wire rope, see Figures 2-3 through 2-5.

Offsetting Jib

If the job requires an offset jib proceed as follows, otherwise, proceed to the topic “Preparing Anti-Two Block System for Jib Operation”.

- Lower boom slowly until jib tip is lightly resting on a firm, stable, supporting surface.

Note If necessary, retract the rear outrigger jack cylinders to lower the rear of the crane so the jib tip rests on the ground or a firm stable supporting surface.

- To change the jib angle, move the jib offset pins to desired position and secure with the hair pins provided, see Figure 2-21.
- Slowly raised the boom until the offset link engages the offset pin.

Note Jib point will travel forward and aft approximately 6 feet during this operation.

- Once the offset pins are engaged, you may proceed to “Preparing Anti-Two Block System for Jib Operation”.

NOTICE

Extend rear outrigger jack cylinders to level the crane if rear of crane was lowered in previous steps.

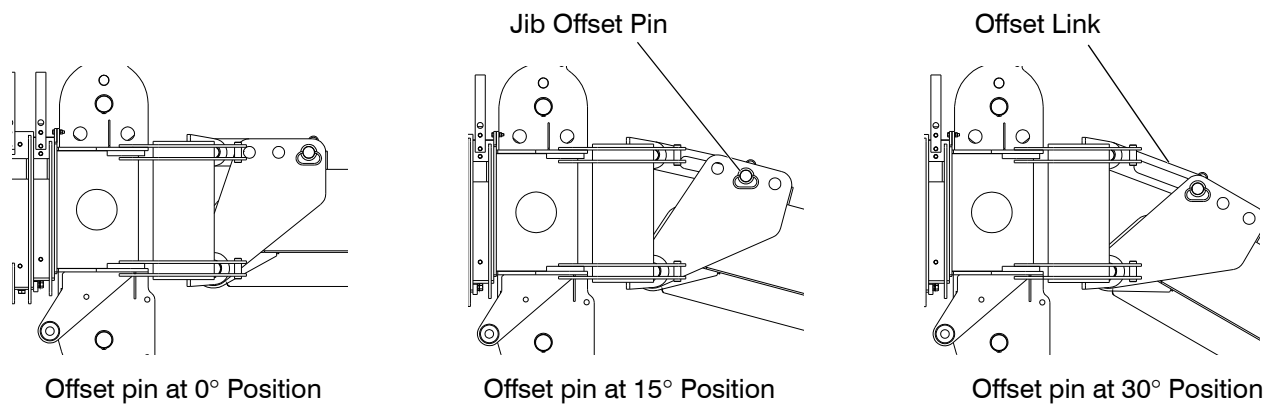


Figure 2-21 Offset Jib Configurations

Preparing Anti-Two Block (ATB) System for Jib Operation

After erecting and/or offsetting the Jib, the ATB must be configured to operate from the Jib head.

CRANES EQUIPPED WITH A WIRELESS ATB SYSTEM

- Remove the ATB switch and weight from the boom head.
- Install ATB switch and weight on post on the left side of the jib head and secure with lynch pin provided.
- Install ATB weight around Load Line.
- Install override flag on ATB switch located on the auxiliary sheave bracket, see Figures 2-13 & 2-22.
- Proceed to “Checking Operational Aids”.

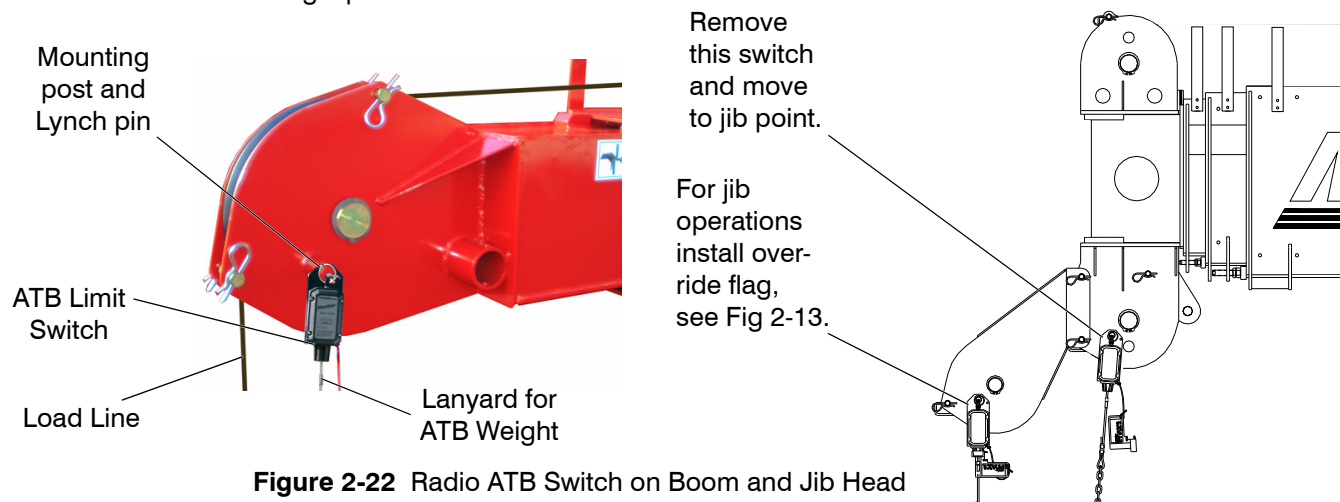


Figure 2-22 Radio ATB Switch on Boom and Jib Head

CRANES EQUIPPED WITH A WIRED ATB SYSTEM

- Check that the cable from the cable reel is connected securely to the ATB junction box on the right side of the ATB switch on the boom head, see Figure 2-23.

NOTICE

Do not Disconnect ATB cable attached from the junction box to the cable reel. Doing so may cause the LMI's boom length sensor to malfunction.

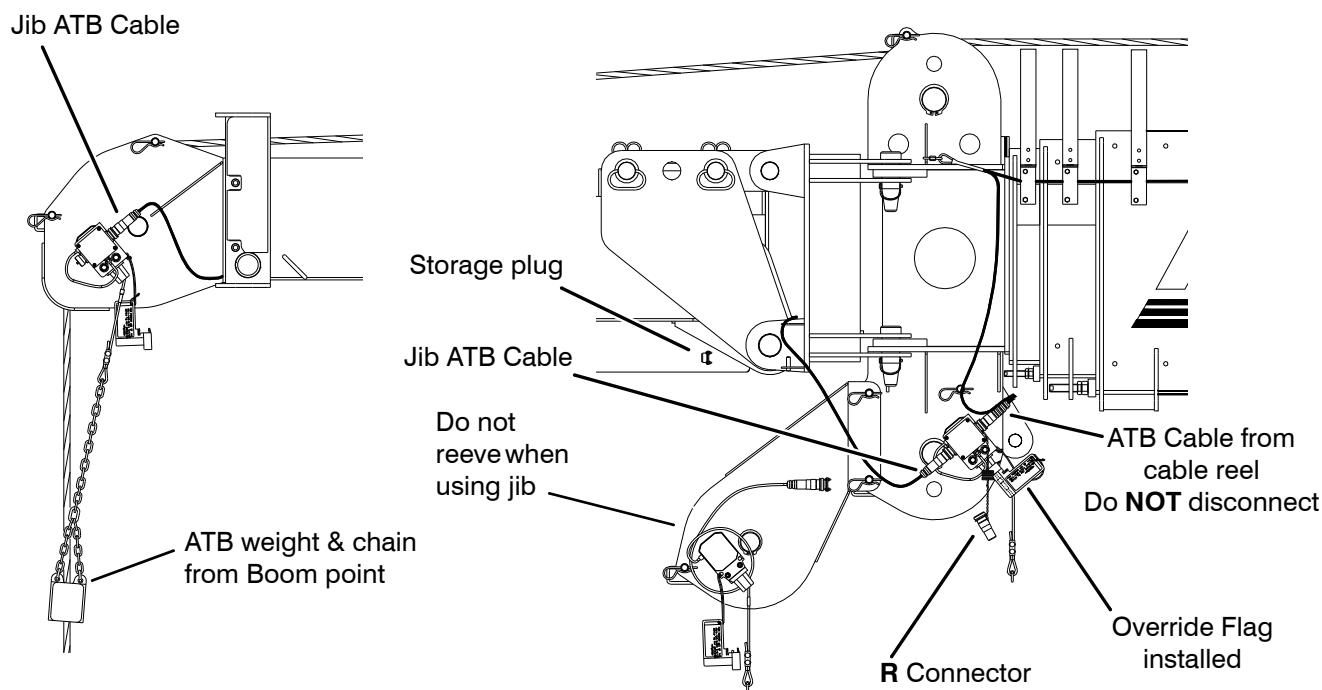


Figure 2-23 ATB connections for Jib operations

- Remove the ATB weight & chain from the ATB switch on the boom point, set it aside for use at the jib point.
- Install the Override Flag to the boom point ATB switch.

Note The Override Flag will remain in place throughout all jib operations. The flag will be removed when the jib is returned to the stowed position.

- Detach the **R** connector from the left side of the ATB junction box/switch assembly at the boom point.
- At the jib foot, detach the jib ATB extension cable from the storage plug.
- Connect the jib ATB extension cable to the ATB junction box at the boom point where the **R** connector was previously connected.
- Take the ATB weight and chain previously removed from the boom point and attach it to the jib ATB switch, assemble the ATB weight around the load line.
- If the jib ATB switch is equipped with an override flag, check that it is not installed on the switch lanyard thereby overriding the switch.
- Proceed to “Checking Operational Aids”.

Checking Operational Aids

- Set the Load Moment Indicator (LMI) to the correct operating mode for the jib. Refer to LMI Operating Codes in the Load Chart.
- Test the ATB warning horn and shutdown for proper operation, refer to Daily Checks in Chapter 6.
- For pre-operational testing of LMI and ATB systems consult each system’s operator manual. A copy of each applicable manual has been placed in your crane’s Owner Manual Package or in the truck cab.

CAUTION

Do not handle any load with jib until the ATB warning horn and shutdown features are operational, otherwise, a two-block condition may occur.

Do not handle any load with the Jib until the LMI has been set to the proper operating mode. Failure to do so will prevent the LMI system from properly monitoring the load capacity of the crane, possibly resulting in damage to crane or property.

Note At this point the ATB circuit and LMI is enabled for lifting from the jib point.

Storing Jib

Using all applicable safety precautions, operate the crane systems to position the boom in area over the rear of the truck where easy access to the jib and boom components is possible. If the jib is configured in an offset position, the jib must be returned to the zero offset configuration before breaking down the jib.

Configuring Jib to Zero Offset

- Retract the boom to within one (1) foot of its fully retracted position.
- Boom down in a controlled smooth motion until the jib point rests on a firm, stable, supporting surface, see Figure 2-24.

Note If necessary, retract the rear outrigger jack cylinders to lower the rear of the crane until the jib tip rests on the ground or on a firm, stable, supporting surface.

- Continue to boom down slowly; the jib will pivot upward towards the zero position as the jib point glides along the ground or supporting surface, see Figure 2-25.

Note Jib point will move forward and aft approximately 6 feet during this operation.

- Once the jib has reached the zero position, move the offset pin to the zero position hole and secure in place with hair pin provided.

NOTICE

Extend rear outrigger jack cylinders to level the crane if rear of crane was lowered in previous steps.

- Proceed to breakdown the jib.

Tip will move forward and aft, keep load line clear of head



Figure 2-24 Jib point on ground

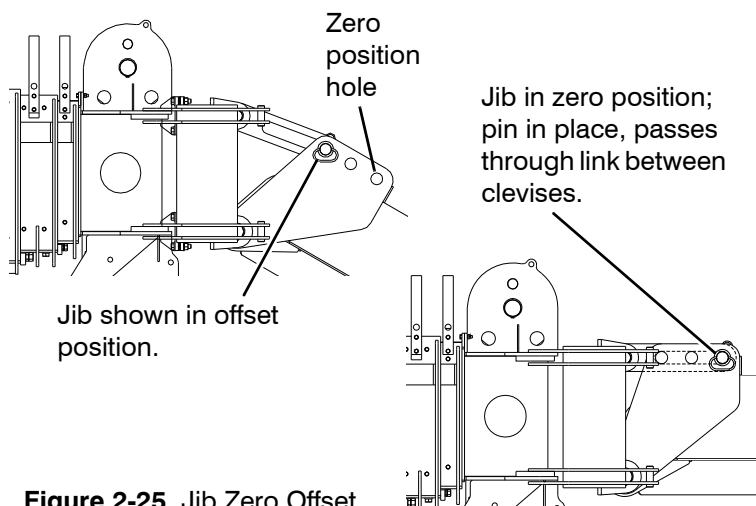


Figure 2-25 Jib Zero Offset

Breaking down the Jib

- If stowing a fixed or retracted jib, proceed to topic “Swinging the Jib”,
- If the telescopic jib stinger is extended, proceed as follows to retract the jib stinger:

Note Two people may be needed to retract the stinger into the jib base when this operation is performed manually. Insert a pipe through the tube at the jib point to assist in this operation. Ideally, the pipe should be long enough to accommodate a person on each side.

- ❑ Lay the overhaul ball on the ground then pay out about 50 feet of load line. Be sure to tension the load line as you pay out to keep from over-running the load line at the winch.
- ❑ Separate the ATB weight from the load line and detach the wedge and socket from the overhaul ball.
- ❑ Attach load line to the lug under the tip end of the jib base, secure the socket pin in place with cotter pin.



Load line attached to lug at tip end of jib base

Removing **Pin 6** from **Hole D**



Stinger retracted using jib load line



Figure 2-26 Using load line to retract jib stinger

- ❑ Ensure load line is properly seated in the sheave at the jib point and secured in place with retainer pins.
- ❑ Remove **Pin 6** from **Hole D**.
- ❑ Slowly operate the winch up function to take in the slack in the jib load line.
- ❑ Continue winch operation to retract the jib stinger completely until the jib stops are snug against the jib base.
- ❑ Re-install **Pin 6** in **Hole D**.

CAUTION

Do not proceed until Pin 6 is properly secured in Hole D. Failure to properly install the pin will allow jib stinger to extend suddenly when the jib is swung around, the boom is raised, or when traveling and could result in possible injury to surrounding personnel and/or damage to crane or property.



Figure 2-27 Pin 6 installed to lock stinger in place

RECONFIGURE WIRED ATB CONNECTIONS ON JIB

Before the jib can be swung back into the stow position, the Jib ATB connections must be reconfigured to prevent damage to the ATB cable. Connecting the jib ATB in this manner also keeps from having to use the override button to perform the jib stow operations.

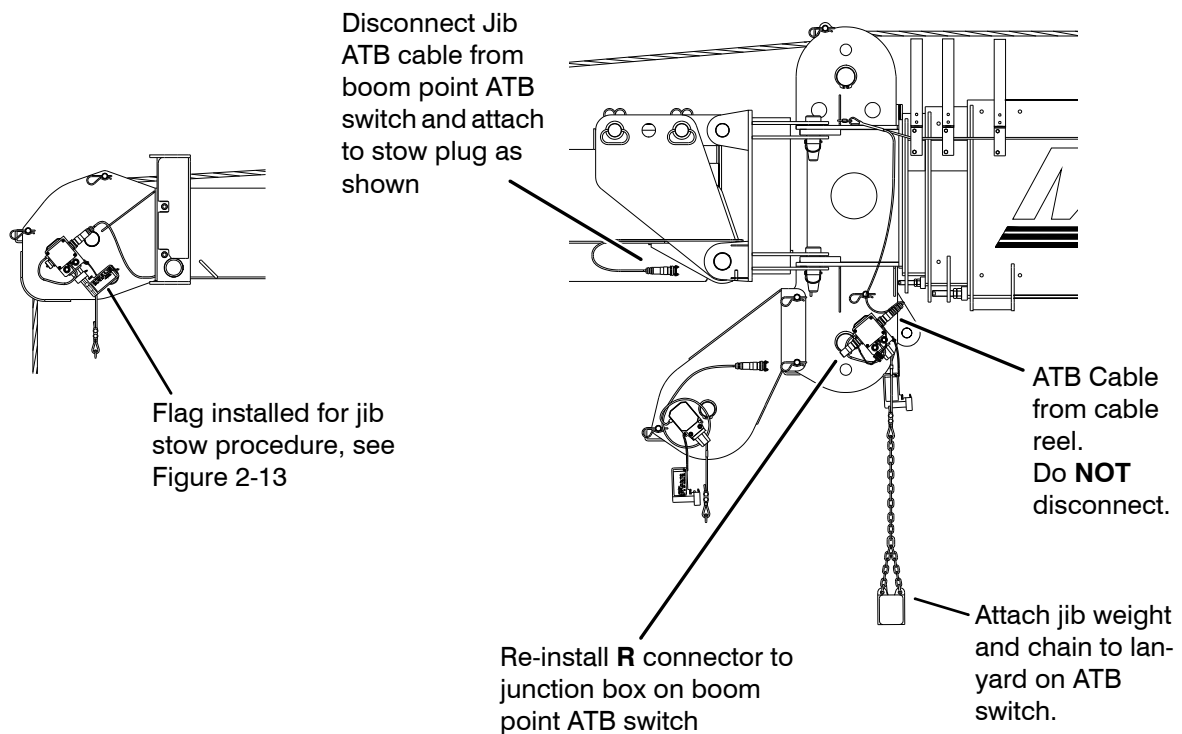


Figure 2-28 ATB connections prior to swinging the Jib

- ☐ Remove the ATB weight and chain from the ATB switch on the jib point and set it aside for use at the boom point.
- ☐ Install the Override Flag to the jib ATB switch.
- ☐ At the boom point, disconnect the jib ATB extension cable from the ATB junction box and connect it to the storage plug located on the jib foot, see Figure 2-28.

NOTICE

Do not Disconnect ATB cable attached from the junction box to the cable reel. Doing so may cause the LMI's boom length sensor to malfunction.

- ☐ Connect the **R** connector to the left side of the ATB junction box/switch assembly at the boom point where the jib ATB cable was attached.
- ☐ Remove the override flag from the boom point ATB switch and attach the ATB weight and chain to the lanyard.

Remove the load line from the end of the jib and pull it out of the way towards the left side of the boom. Be sure to replace the wire rope retaining pins.

NOTICE

Be sure to install hairpin cotters to retaining pins.

Proceed to "Swinging the Jib".

SWINGING THE JIB

Once wired jib ATB connections have been reconfigured for stowing, proceed as follows:

- Fasten a tagline, approximately twenty feet long, to the bar on the jib point, refer to Figure 2-20.
- Remove the **Jib Pins 3 & 4** from **Holes A**, on the **LEFT** side of the boom head.

Note Use the Jib jack to assist in removing Jib Pins 3 & 4, see Figure 2-16.

- Raise the boom to horizontal.
- Swing the jib to the stored position along side of the boom with the tagline.
- Retract the boom so **Bracket C**, on the jib engages the stop pin in **Bracket B** on the boom, refer to Figure 2-30.

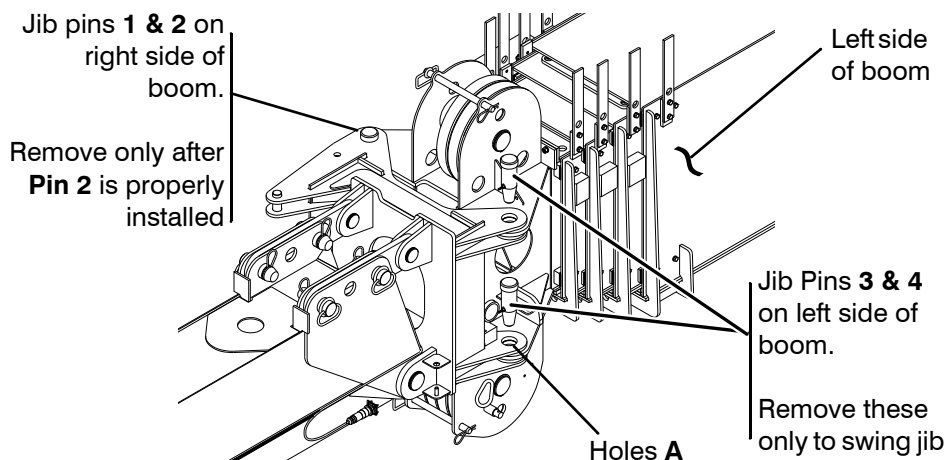


Figure 2-29 Removing jib pins for stowing

⚠ CAUTION

Do not remove Jib Pins 1 & 2 on right side of boom head until Pin 5 is installed, otherwise, jib may fall from boom causing serious injury to personnel, see Figure 2-29.

- Install **Pin 5** in **Bracket B** and secure with keeper pin.

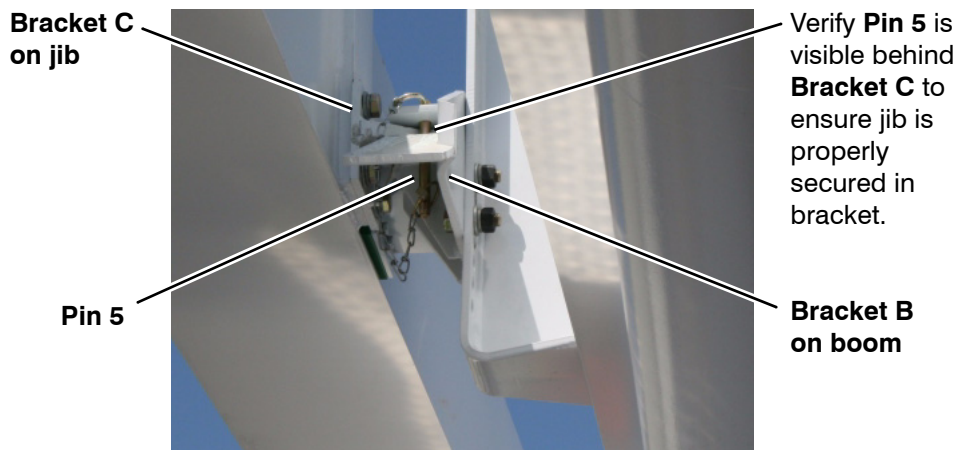


Figure 2-30 Pin 5 installed in Jib storage bracket B

- Remove remaining two **Jib Pins 1 & 2** from holes on the **RIGHT** side of the boom head, refer to Figure 2-29.
- Store all four **Jib Pins** as shown in Figure 2-17 and secure in place with hairpin cotters.

NOTICE

Do not extend boom until *Jib Pins 1 & 2* are removed when *Pin 2* is installed; otherwise, brackets will be damaged.

- Assemble the load line to the appropriate sheaves on the boom head. Be sure to replace the wire rope retaining pins, refer to Figures 2-9 & 2-10.

Preparing for Main Boom Operation

Once the jib is secure in the stow position prepare final ATB connections for crane operation from the main boom. The ATB configuration will depend on how you intend to use the crane for the next job.

- On cranes with a *wireless ATB system*, remove the ATB switch and weight from jib head. For safekeeping, re-install the lynch pin on the post.
- Install the ATB switch and weight on post on the left side of the boom head and secure with lynch pin, see Figure 2-8.
- Next, for both *wired and wireless ATB systems*, If the overhaul ball will be used on the boom point, assemble the ATB weight to the main load line.
- If multiple-part reeving will be used, be sure to install the ATB weight to the dead end of the main load line, refer to Figure 2-9.

Note If the crane is equipped with an Auxiliary winch, refer to topic “Installing the Auxiliary Sheave” earlier in this chapter for remaining reeving and ATB configuration instructions.

- Proceed to “Checking Operational Aids”

Checking Operational Aids

- Reset the Load Moment Indicator (LMI), if equipped, to the correct operating mode for the boom and crane configuration. Refer to the LMI Operating Codes in Load Chart.
- Test the ATB warning horn and shutdown for proper operation, refer to *Daily Checks* in Chapter 6.
- For pre-operational testing of the LMI or ATB, consult each system’s operator manual. A copy of each applicable manual has been placed in your crane’s Owner Manual Package or in the truck cab.

CAUTION

Do not handle any load with boom until ATB warning horn and shutdown functions are operational otherwise, a two-block condition may occur.

Do not handle any load with the boom until the LMI has been set to the proper operating mode. Failure to do so will prevent the LMI system from properly monitoring the load capacity of the crane, possibly resulting in damage to crane or property.

Note At this point the ATB circuit and LMI is enabled for lifting from the boom point.

Jib Adjustments

Storing and deploying the Jib may become difficult if misalignment exists between the Jib and Boom head. Adjust jib storage brackets to shift the jib vertically and horizontally as required to set the jib at the proper height and align pin holes (**Hole A**).

Bracket F (see Figure 2-31) adjusts vertically to position the jib foot just above the boom head lugs. Setting the bracket at the proper height prevents the jib foot from striking the boom head when retracting the boom to store the jib.

Install shims behind **Bracket F** so **Holes A** on the right side of the boom head line up with holes on the jib. Perform this adjustment with the boom fully retracted and the jib stored.

Bracket B (see Figure 2-30) also adjusts vertically. Adjust bracket height so that jib **Bracket C** meets the bottom of the ramp thus facilitating storing of Jib along the boom.

It should be necessary to perform these adjustments only when the pins have worn to the point that they allow the jib to sag while attempting to store the jib.

Alignment

Telescopic Jib Only

Side pads and shims are used to adjust the alignment of the jib stinger. When the jib is fully extended, the stinger must be centered and aligned with the jib base.

Add shims behind the side pads to align the jib stinger, be sure to tighten the all pad mounting screws to secure pads and shims and retain the adjustment.

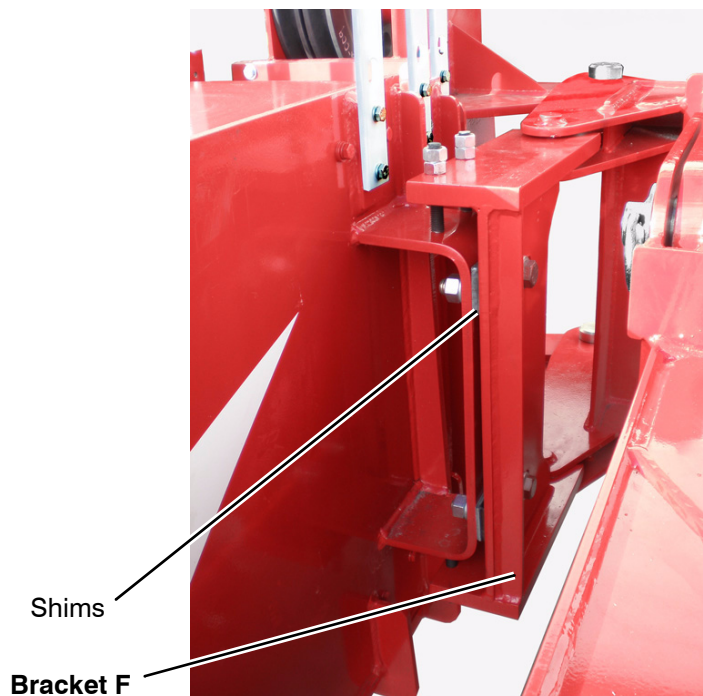


Figure 2-31 Jib Rest Weldment

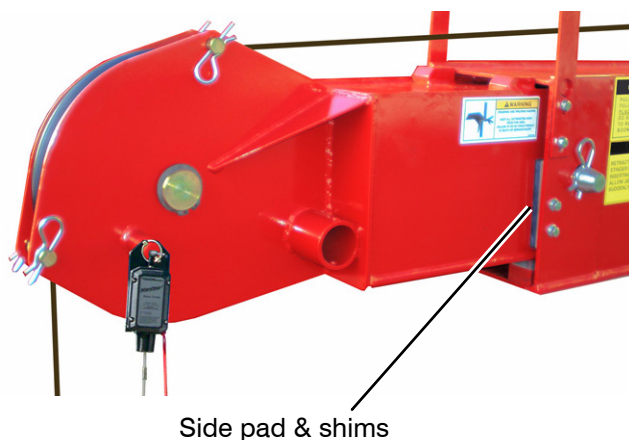


Figure 2-32 Jib side alignment pads

Chapter 3 Lubrication

CAUTION

Avoid injury! Bring all crane functions to complete stop and turn engine OFF before lubricating crane. If necessary, spot grease fittings at access points, then stop engine.

Attach CAUTION sign to start controls to warn personnel that crane is being serviced and engine must not be started.

Do not operate crane until all guards and covers have been securely replaced and all maintenance equipment has been removed.

General

To insure proper operation of this crane, all points requiring lubrication must be serviced with the correct lubricant at the proper interval. All normal wear points requiring lubrication are covered in this section, except for the truck. Lubricate and maintain truck according to instructions in manufacturer's manual.

Intervals

The intervals given in this section are based on normal operating conditions.

Any increase or decrease in these intervals shall be preceded by a complete analysis of how the crane is performing.

Bearings or bushings that are too warm, excessive play in moving parts, excessive or abnormal wear in gears, and rust accumulation are indications of a lack of lubrication. If these conditions are found, the lube interval for the faulty part should be shortened.

NOTICE

Before lengthening intervals, check that all parts are receiving an adequate supply of clean lubricant, otherwise, parts will be damaged from a lack of lubrication.

A laboratory analysis of oil from hydraulic tank and each gear box shall be a major factor used in determining whether oil-change intervals should be lengthened or shortened.

Over-Lubrication

Over-lubrication is not only wasteful but also harmful.

- Oil or grease that drips onto walkways can be slippery and cause injuries to personnel.
- Too high of an oil level can cause churning and foaming of the oil and result in excessive heat and overflow from the hydraulic tank or gear boxes.
- An extra shot of grease, if too stiff or under too much pressure, can pop out a bearing seal.

Service Tips

- Check oil levels before start-up so the oil has had a chance to run down from the gear box walls and all moving parts.
- Avoid introducing dirt into the hydraulic tank or gear boxes. Carefully clean the area around dipsticks, level plugs, fill plugs and breathers before removing them.
- Securely replace level plugs, fill plugs, drain plugs and breathers. Clean any spillage.
- Keep oil and grease dispensers and containers tightly closed and stored in a dirt and moisture free location.
- Clean grease fittings before and after applying grease.
- Apply grease until the bearing is full so grit cannot enter. Wipe away excess grease.
- Do not use tape style sealers; use only liquid style.

Oil Can Points

Oil all pins not equipped with grease fittings with engine oil every month even if the crane is not being operated.

Wire Rope

The wire rope must be lubricated on a regular basis to maintain its strength and lengthen its useful life. Refer to *Wire Rope Maintenance* in Chapter 5 for lubrication instructions.

Oil Capacities

<i>Item</i>	<i>Amount</i>	<i>Oil Type</i>
Hydraulic System		
model 5096S & 50110S	115 gal	Hydraulic
model 50128S & 50155S	150 gal	Hydraulic
Swing Reducer		
Tulsa	1 qt	Gear
Gear Products	2.5 qt	Gear
Winch (main & auxiliary)		
Braden	3 qt	Gear (AGMA 4EP, ISO VG 150)
Dinamic	5.5 qt	Gear (AGMA 4EP, ISO VG 150)

Lubrication Specifications

Grease

Use lithium base, multi-purpose EP grease for all bearings except the swing reducer upper bearings.

Use GL-5 EP heavy fiber type wheel bearing grease for the swing reducer upper bearings.

Open Gear Oil

The slewing ring gear teeth must be lubricated with a heavy oil with the following characteristics.

- Resists being thrown off by turning gears.
- Resists being washed off by water.
- Resists thinning out and dripping off at hottest operating temperature.
- Resists becoming so thick that it chips or peels off at coldest operating temperature.

Gear Oil

Use SAE 80-90 multi-purpose EP gear oil.

For winches use type AGMA 4 EP or ISO VG 150 for use in ambient temperatures of 5°F to 105°F.

Anti-wear Hydraulic Oil

<i>Hydraulic System Operating Temperature Range*</i>	<i>ISO Viscosity Grade</i>
-21°C to 60°C (-5°F to 140°F)	22
-15°C to 77°C (5°F to 170°F)	32
-9°C to 88°C (15°F to 190°F)	46
-1°C to 99°C (30°F to 210°F)	68

* Temperatures shown are cold (ambient) start-up to maximum operating. During cold start-up, avoid high-speed operation of hydraulic components until the system is warmed up to provide adequate lubrication.

Lubrication Points

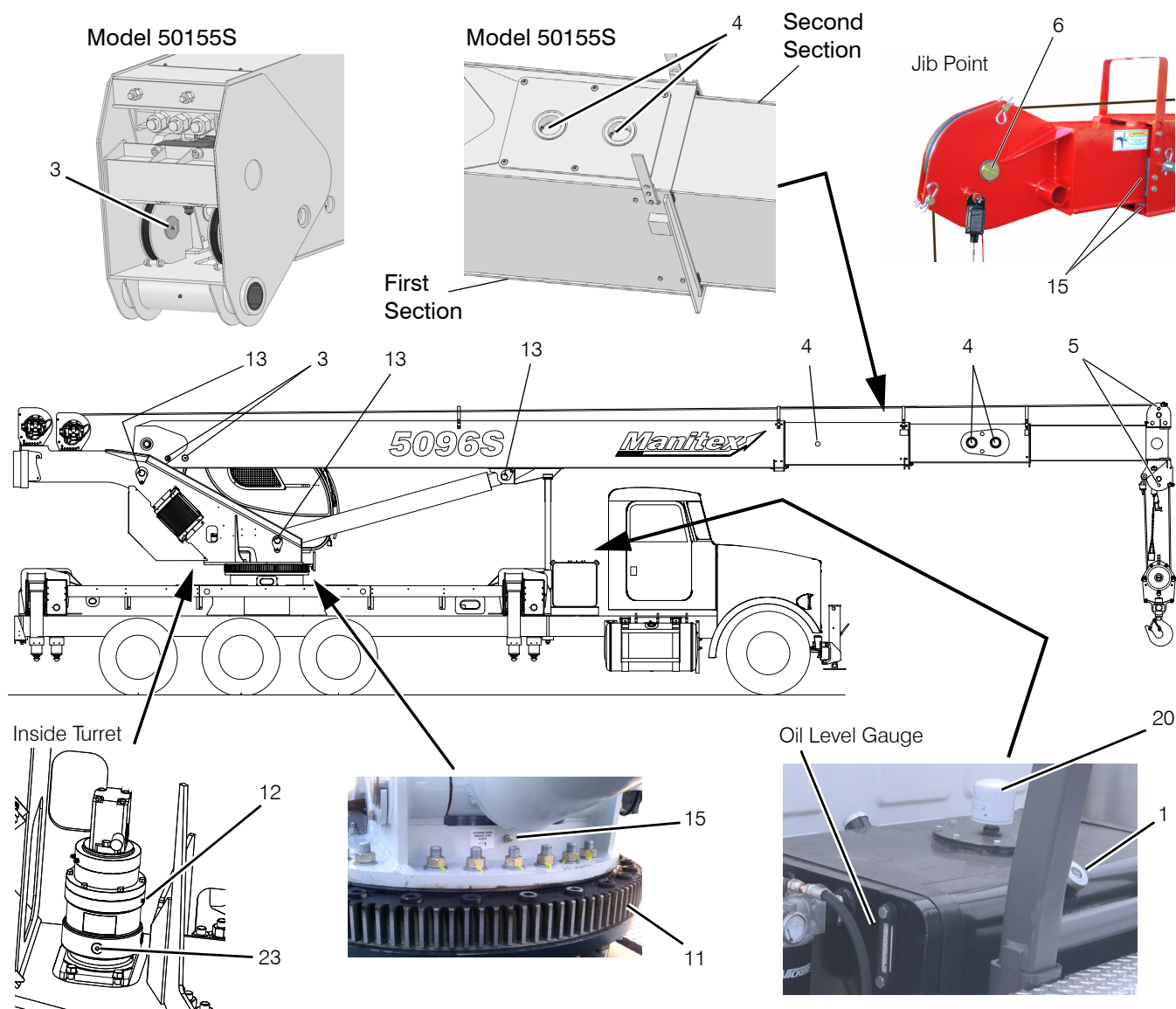
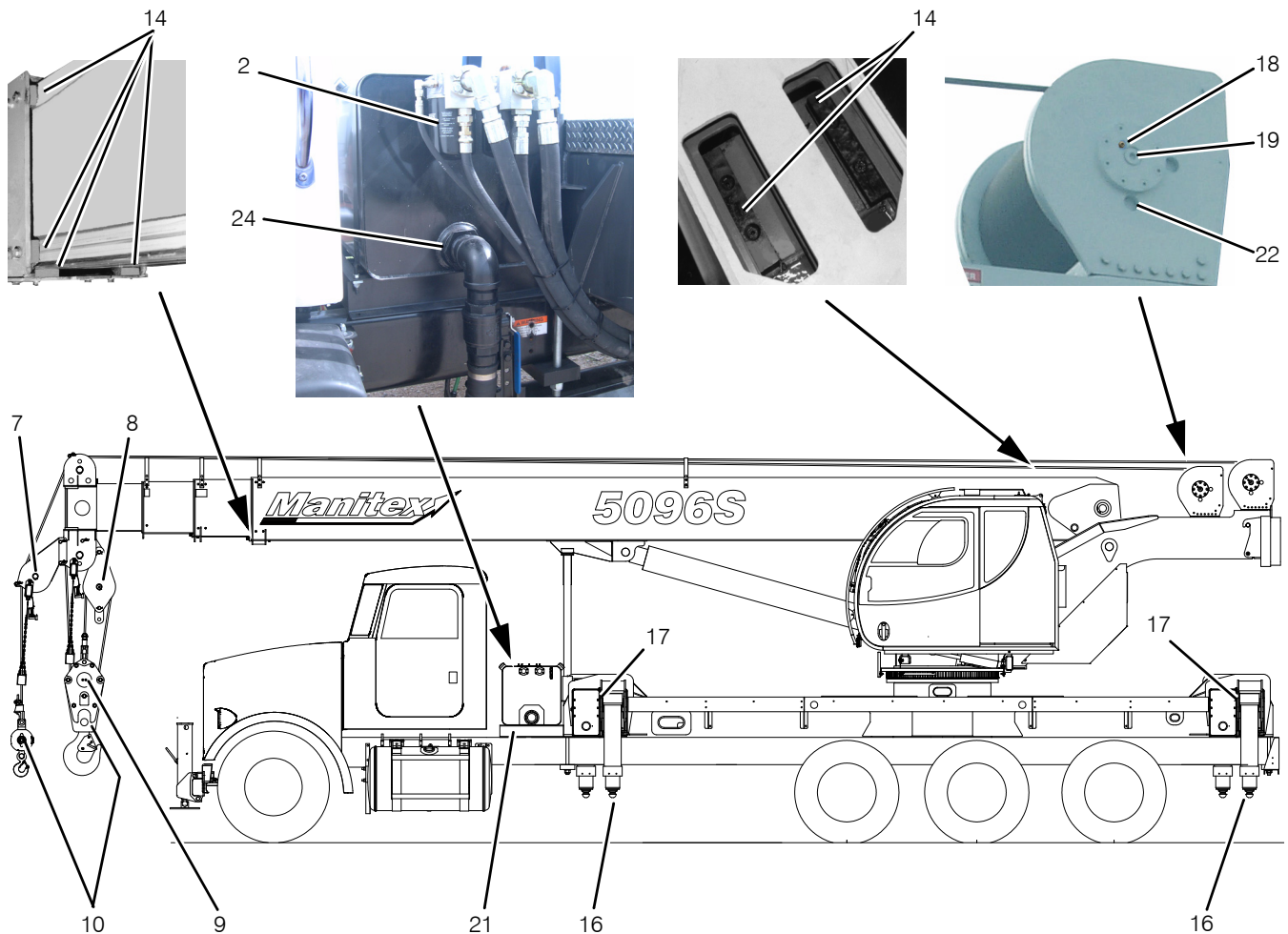


Figure 3-1 Lubrication Points

Identification (Figure 3-1)	Lubricant	Service	Interval	Note
1. Hydraulic Tank Fill Cap	Hydraulic Oil	Check Level	Daily	1
2. Hydraulic Filter	—	Check Pressure	Daily	2
3. Retract Sheaves	Grease	Grease Gun	Weekly	3
4. Extend Sheaves	Grease	Grease Gun	Weekly	4
5. Boom Point Sheaves (1 fitting each sheave)	Grease	Grease Gun	Weekly	—
6. Jib Point Sheave	Grease	Grease gun	Weekly	—
7. Auxiliary Sheave	Grease	Grease Gun	Weekly	—
8. Auxiliary Block	Grease	Grease gun	Weekly	—
9. Load Block Sheave (1 or 2 fittings)	Grease	Grease Gun	Weekly	—
10. Load Block Trunnion or Overhaul Ball Swivel	Grease	Grease Gun	Weekly	—
11. Slewing Ring Gear Teeth	Open Gear Oil	Brush or Spray	Weekly	5
12. Swing Reducer	Gear Oil	Check Level	Weekly	6
13. Boom and Hoist Cylinder Pivot Pins	Grease	Grease Gun	Weekly	7

**Figure 3-1** Lubrication Points (*continued*)

Identification (Figure 3-1)		Lubricant	Service	Interval	Note
14.	Boom Slider Pads	Grease	Brush or Swab	Monthly	9
15.	Slewing Ring Bearing	Grease	Grease Gun	Monthly	8
16.	Ball Cavity (outrigger float pads)	Grease	Brush or Swab	Monthly	10
17.	Outrigger Slider Pads	Grease	Brush or Swab	Monthly	10
18.	Winch Vent Plug	—	Clean	Monthly	11
19.	Winch	Braden Gear Oil	Check	Every 3 Months	6
		Dinamic Gear Oil	Check	Every 250 Hours	6
20.	Hydraulic Tank Breather	—	Replace	Every 3 Months	12
21.	Hydraulic Tank	Hydraulic Oil	Change	Semiannually	13
22.	Winch	Braden Gear Oil	Change	After 1st 100 hrs Then Semiannual	14
		Dinamic Gear Oil	Change	After 1st 500 hrs Then Annually	14
23.	Swing Reducer	Gear Products	Change	After 1st 100 hrs Then Semiannual	14
		Tulsa	Change	After 1st 50 hrs Then every 500 hrs	14
24.	Suction Strainer	—	Clean	At oil change	—

Lubrication Points - Notes

DANGER

Some procedures require that the boom be removed from the boom rest, before raising the boom, the outriggers must be properly set and the crane level to prevent the crane from tipping.

1. Fill hydraulic tank so oil level is between high and low marks on tank sight gauge. To check the oil level, the crane must be on level surface and in the normal roading position; i.e., the boom must be in the boom rest and all outriggers fully retracted.
2. Check the gauge after start-up each day and periodically throughout each work shift. Replace element if gauge reads 25 psi when engine is at high idle and oil is warm.
3. Retract sheave grease fittings accessible through holes provided on each side of the boom base. Model 50155S has an additional set of retract sheaves serviceable from the rear of the retracted boom.
4. Extend sheave grease fittings accessible through holes on the boom first and second powered sections. The boom must be extended to provide access to lub fittings:

DANGER

Do not place hands or tools into any opening in boom sections while power is on or boom sections are moving.

<i>Model</i>	<i>Extend to</i>	<i>Section</i>	<i>Lub points</i>
5096S	46 ft	First Second	Both sides
50110S	50 ft		Both sides
50128S	53 ft		
50155S	63 ft	First Second	Both sides & top Both sides

5. Open gear oil must be brushed or sprayed on each gear tooth; do not rely on gear rotation to distribute oil.
6. Fill to bottom of plug opening. For Dinamic winch procedure, refer to winch owner manual included.
7. Grease fittings on cylinders are located on the middle of cylinder pin tubes. Fitting on the boom pivot is located on the center of the tube and accessible from the rear of the boom.
8. The slewing ring is equipped with a central lubricating fitting at the front of the turret under the hoist cylinder pin. Use this fitting to lubricate the ball bearings inside the slewing ring. Apply 5 shots of grease and rotate the crane 180° from the stored position; apply another five shots of grease and continue in the same direction until boom is back to the stored position.
9. Fully extend boom and apply a light coat of grease to both sides and bottom of each boom section in areas of slider pad contact.
 - Jib is lubed in similar fashion when stinger is extended.
 - Fully retract boom. Remove cover from rear of boom base (top) to expose top rear slider pads. Coat top rear slider pads with grease. Extend boom as necessary to expose each set of slider pads.
 - Replace cover after greasing.

DANGER

Do not place hands or tools into any opening in boom sections while power is on or boom sections are moving.

Note Chattering or jerking of the boom indicates more frequent lubrication of the boom and pads is required. For recommended boom break-in procedure see chapter 6 under "Boom Service"

10. Refer to Figure 3-2 for lubrication of outrigger slider pads and ball cavity.
11. Clean vent plug by soaking in solvent. Spring loaded pin must move in and out freely. Do not paint over vent plug. Never replace vent plug with a solid plug.
12. Do not attempt to clean breather; if needed, replace at earlier intervals.

13. See Chapter 6 for oil change procedure.
14. To drain winch oil, align plug in drum with drain hole in bottom of side plate. Screw a short piece of 1-inch pipe into large hole in drum. Insert a 5/16-inch allen wrench through pipe and remove drain plug. Replace drain plug and remove pipe after oil has drained. For Dinamic winch procedure, refer to winch owner manual included.

⚠ DANGER

Do not place fingers, pipe or allen wrench into hole in side plate until winch drum has stopped turning and engine is OFF.

⚠ DANGER

Do not place hands or tools into any opening in outrigger sections while power is on or sections are moving.

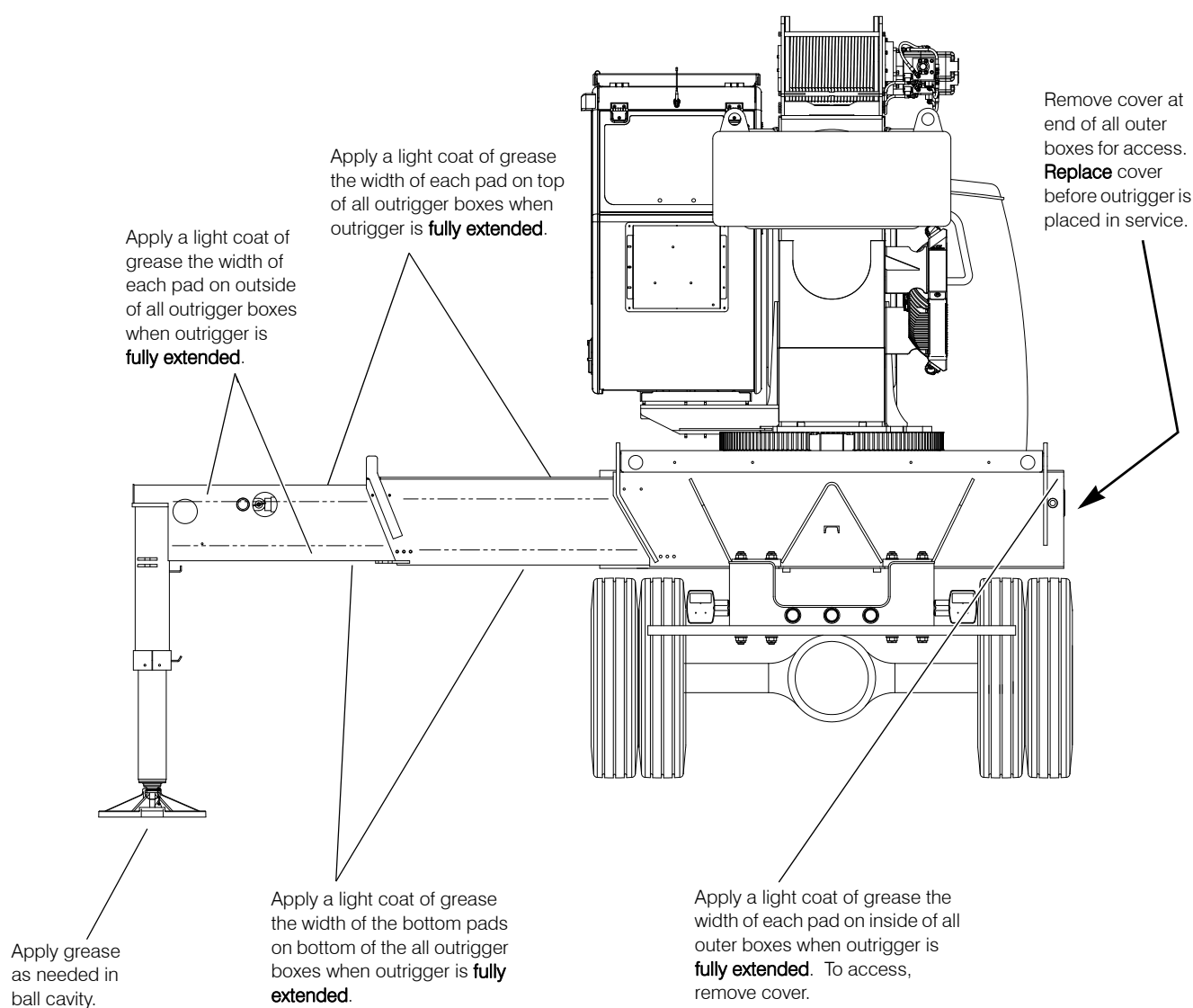


Figure 3-2 Outrigger and Ball Cavity Lubrication

Chapter 4 Capacities

The official chart for your crane is a Manitex supplied laminated chart found in the crane operator's cab. Load charts are identified by part number and revision and are matched to the programming in the factory installed overload warning and protection system on your crane, make sure the correct chart in this booklet is referenced when used for planning purposes.

For replacement charts or if you need assistance identifying the correct load chart for your machine, please contact your Manitex dealer with crane model and serial number. You may also contact the Manitex Product Support Department for assistance if needed at:

Manitex Inc.
3000 South Austin Avenue
Georgetown, TX 78626
PH: 512-942-3031
email: mtxtech@manitex.com

DANGER

Overloading this crane or failing to comply with operating conditions and restrictions given on Capacity Chart can result in structural damage to crane components, collapse of crane, or tipping.

Read all instructions on Capacity Chart before operating crane.

Do not lift any load without first determining total load to be lifted and maximum radius at which load can be lifted.

CAUTION

Radius shall govern load rating. Only use boom angle as a guide in positioning boom near corresponding radius for a given load.

EXCEPTION: Boom angle shall govern load rating of jib when boom is not fully extended.

Load Rating

The load ratings given on the Capacity Chart do not exceed a maximum stability tipping factor of 85 percent.

The main boom and jib load ratings above the heavy line on the Capacity Chart are based on the crane's hydraulic or structural competence and not on stability.

The main boom and jib load ratings below the heavy line are stability limited capacities and do not exceed 85 percent of tipping.

Before lifting any load, the operator shall ensure that:

- The crane is properly mounted on a truck that meets factory specifications.
- The crane is properly counterweighted, if required.
- The outriggers and stabilizers are extended on a firm, uniformly supporting surface so crane is level in all directions.
- The exact weight of the load to be lifted is known.
- The weight of the stored jib, if equipped, and all load handling devices are deducted from the load ratings given on the Capacity Chart. See Total Load near end of section.
- The area of operation shown on the Capacity Chart is not exceeded.
- The load rating has been reduced to compensate for wind, ground conditions, out-of-level conditions, and the dynamic effects of swinging, hoisting, and lowering the load.

Note This model crane has been given a stability test in compliance with ANSI B30.5 requirements. If the crane owner mounts the crane on the truck, he may have to perform a stability test in compliance with special instructions furnished by Manitex on request.

Total Load

The weight of the stored jib, if equipped, and all load handling devices are considered part of the total load.

To determine the total load to be lifted, use the following worksheet.

Component Weights

See Deductions on Capacity Chart.

Pounds

1. Stored Jib (if equipped) _____
2. Overhaul Ball or Load Block - See manufacturer's nameplate. _____
3. Auxiliary Block (if installed) _____
4. Auxiliary Sheave (if installed) _____
5. Hose Reel (if equipped) _____
6. 2-Man Steel Basket (empty weight) - See basket nameplate. _____
7. 1-Man Steel Basket (empty weight) - See basket nameplate. _____
8. 1-Man Fiberglass Basket (empty weight) - See basket nameplate _____
9. Slings and all other Load Handling Devices _____

Totals

- A. Total Component Weights (ADD 1 through 9) _____
- B. Weight of Load to be Lifted _____
- C. Total Load to be Lifted (ADD A and B) _____

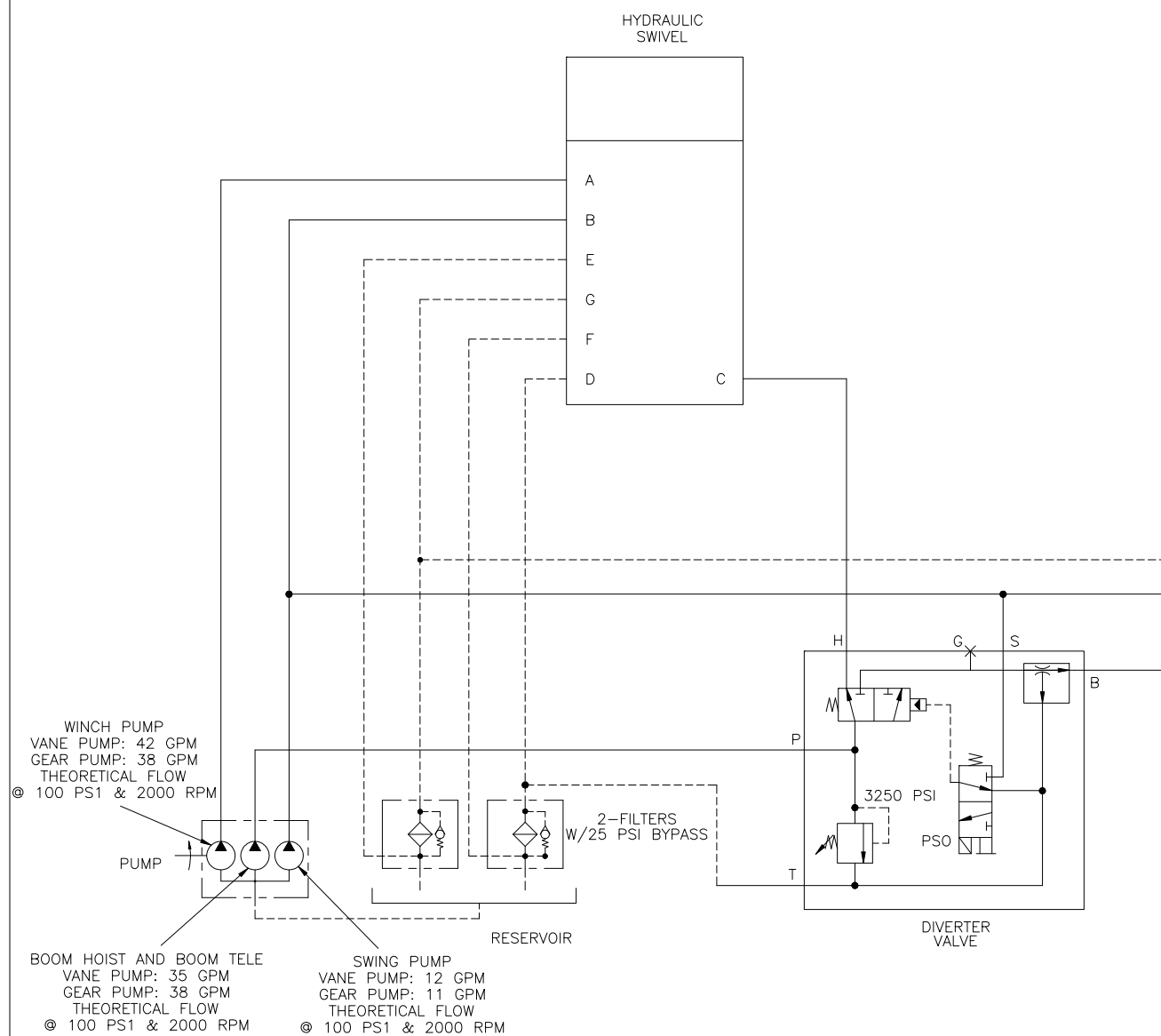
Once the total load has been determined, refer to the Capacity Chart to determine the maximum radius at which the load can be handled. ft.

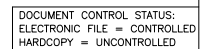
Refer to the Capacity Chart to verify the parts of line required to handle the total load to be lifted.

Chapter 5

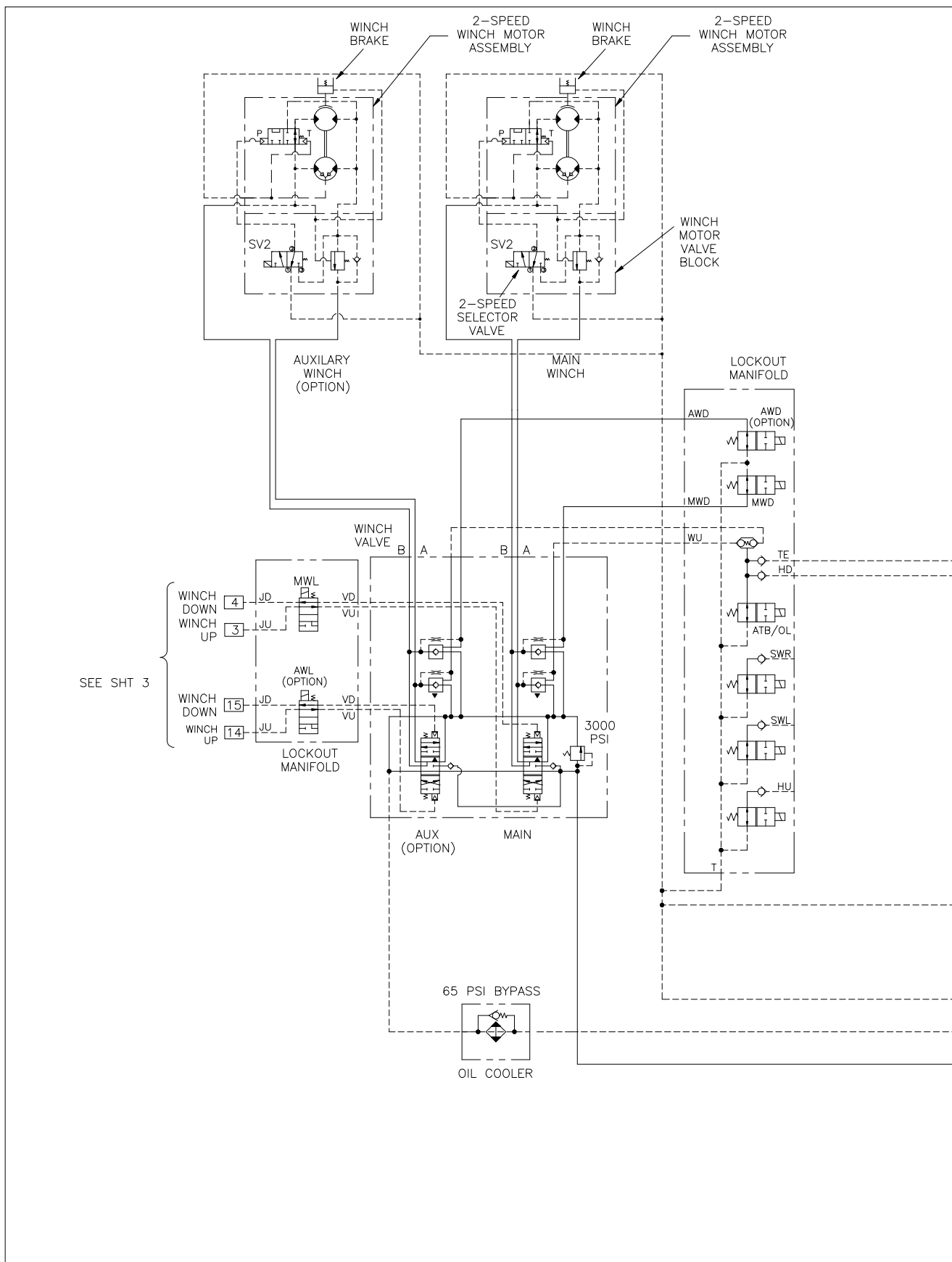
System Schematics

Hydraulic Schematic



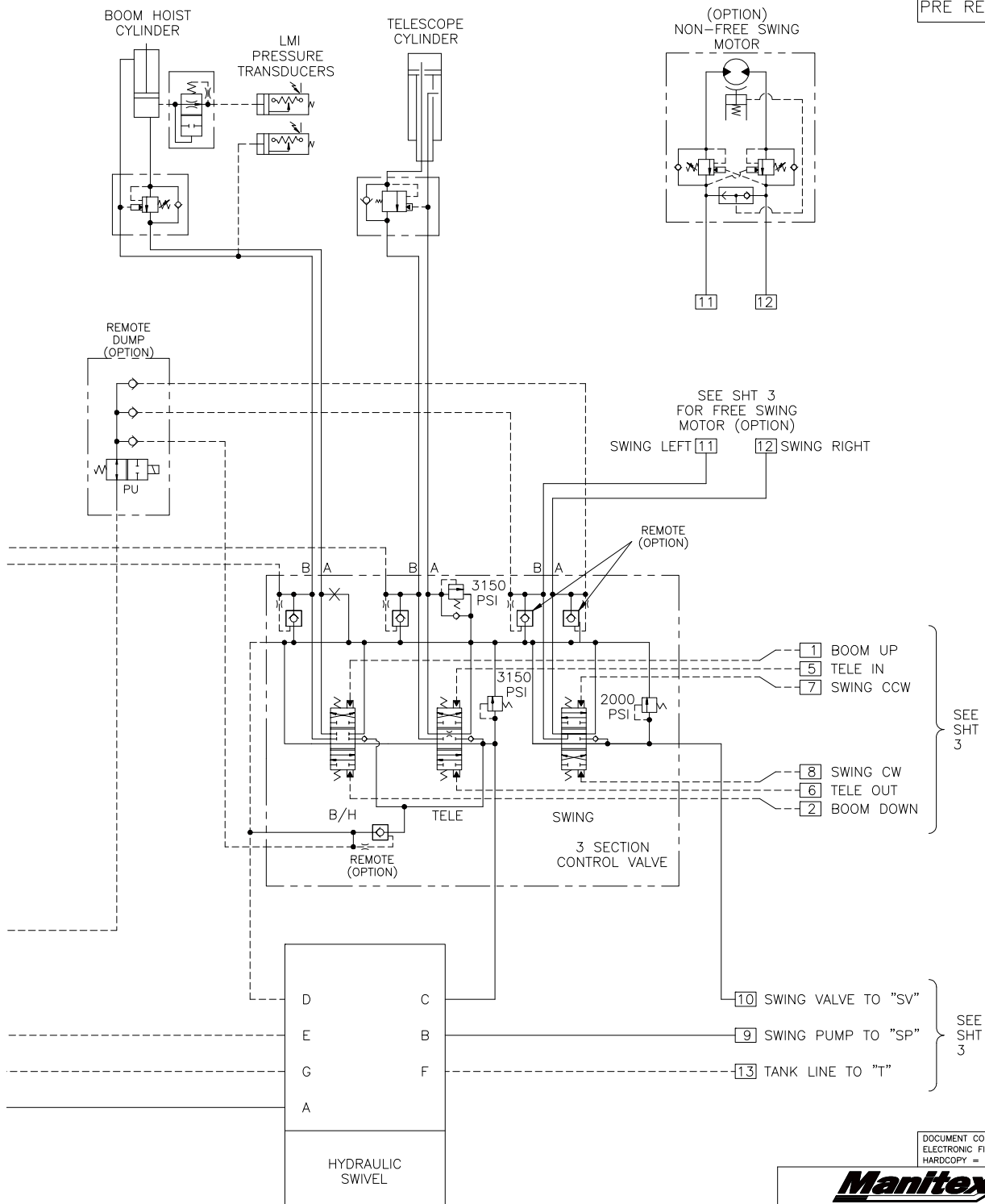


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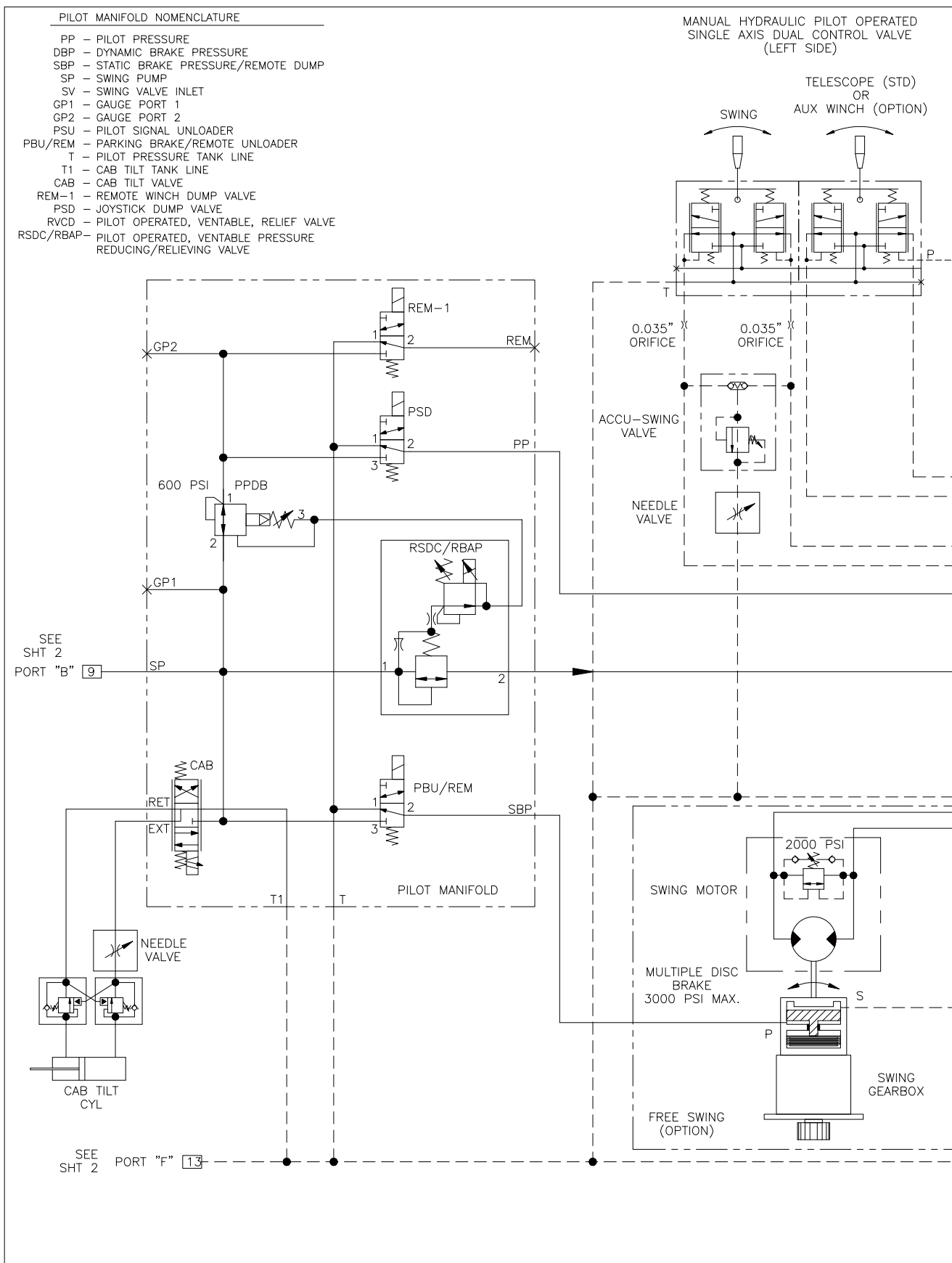
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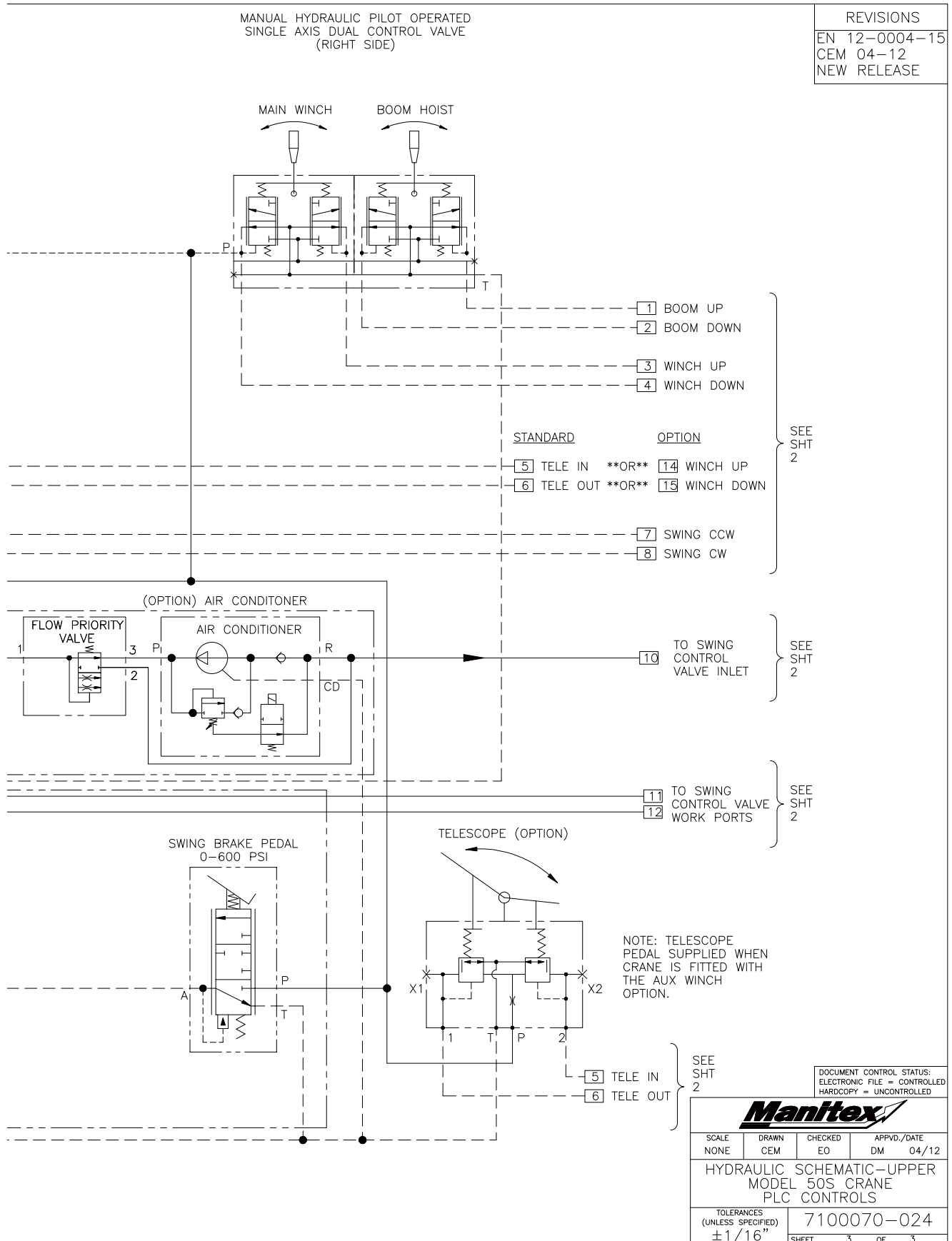


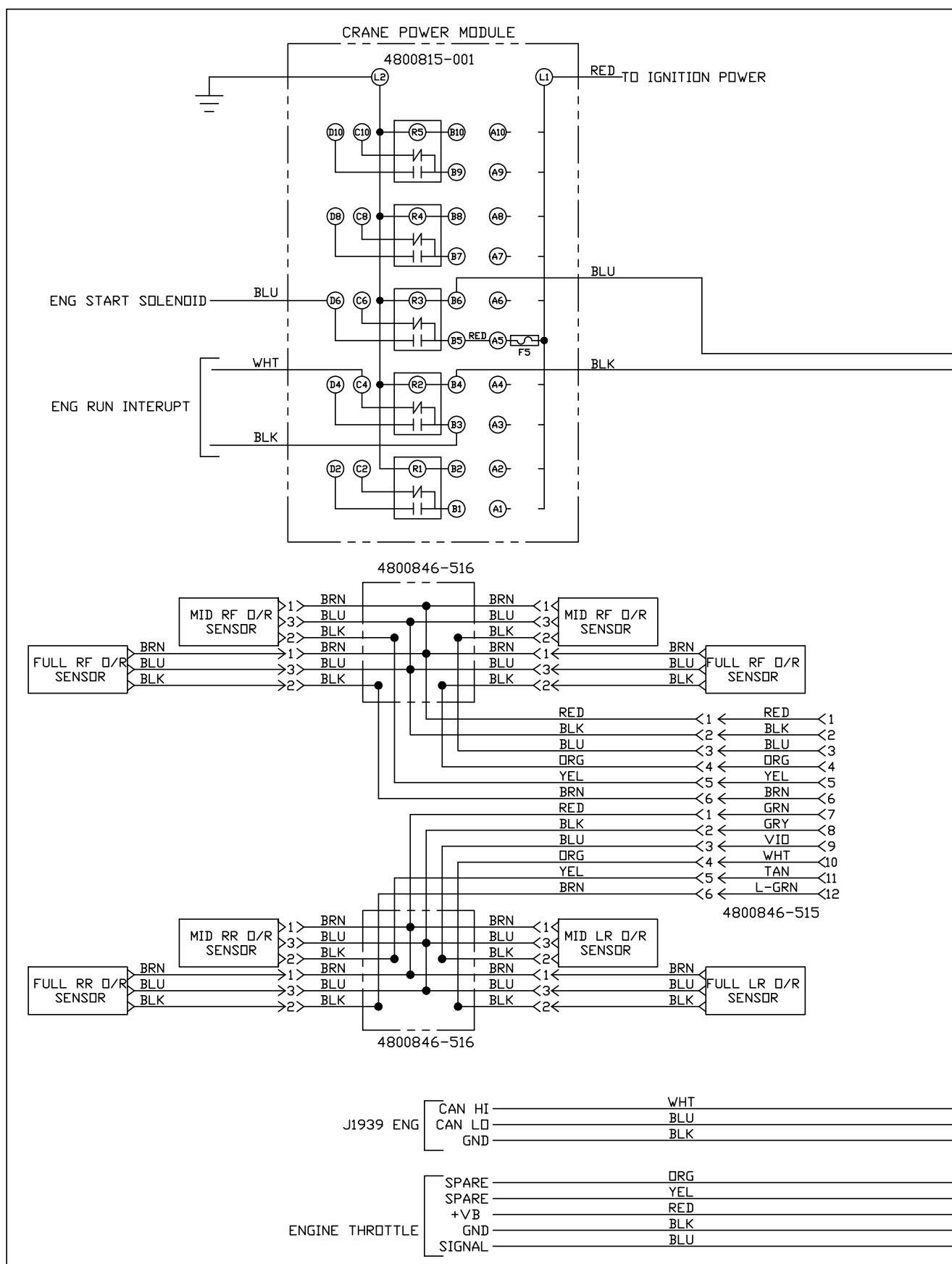
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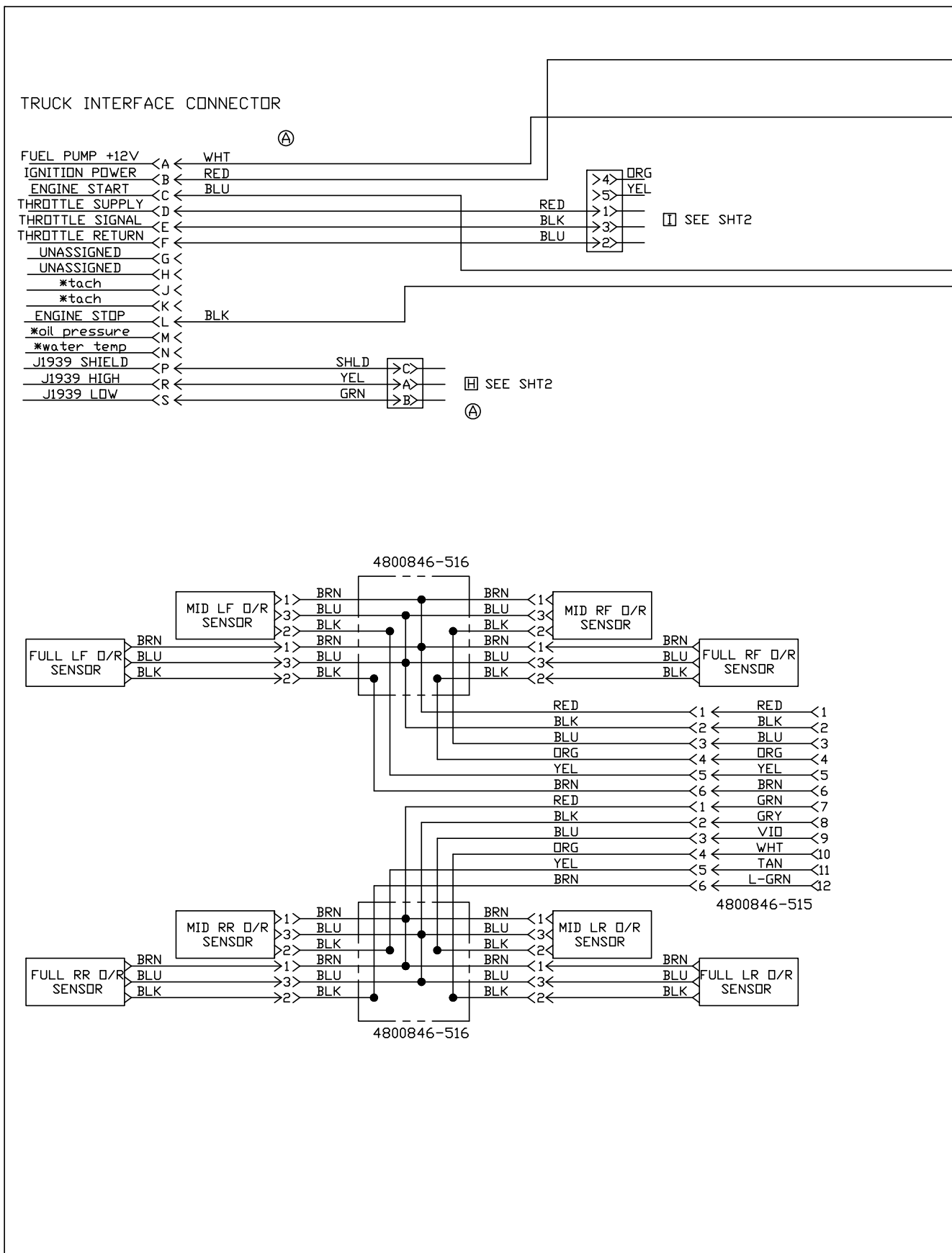
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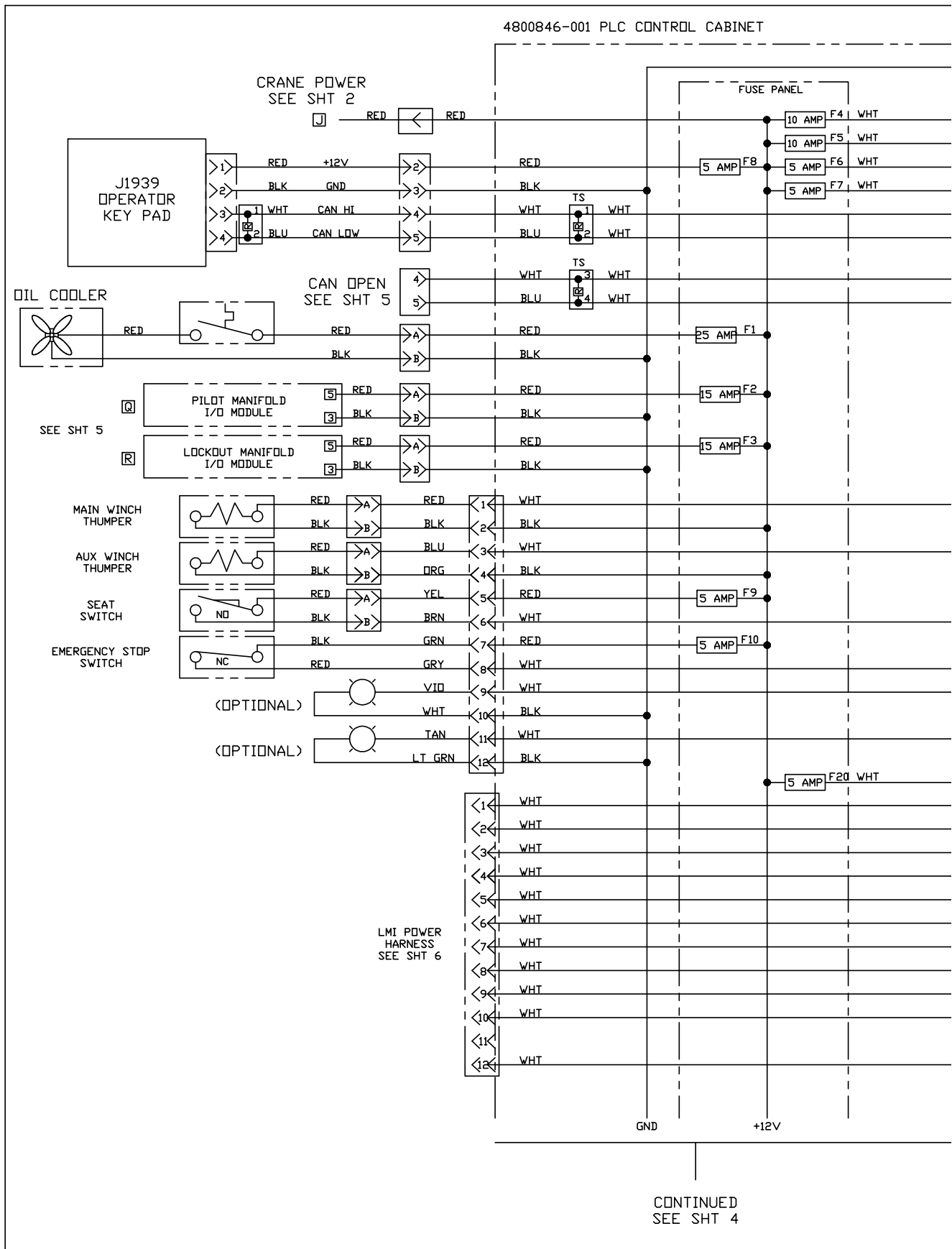


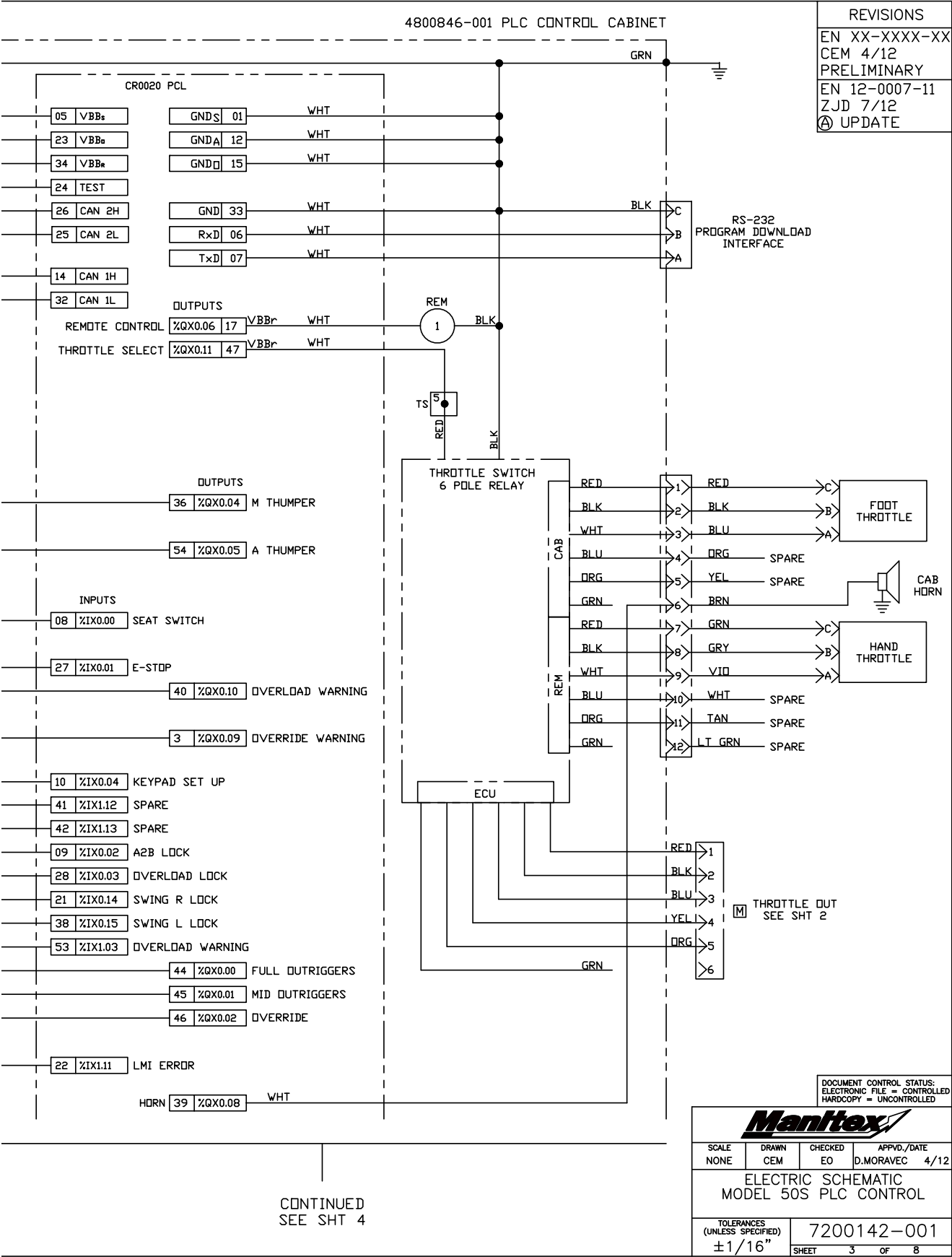
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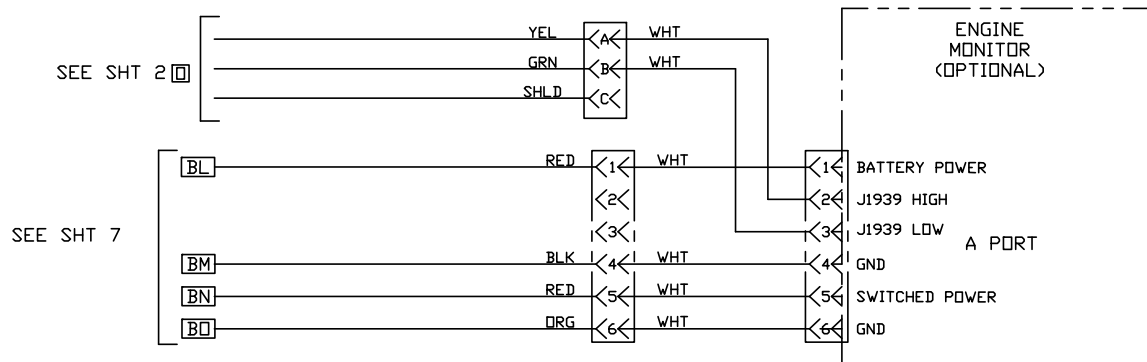
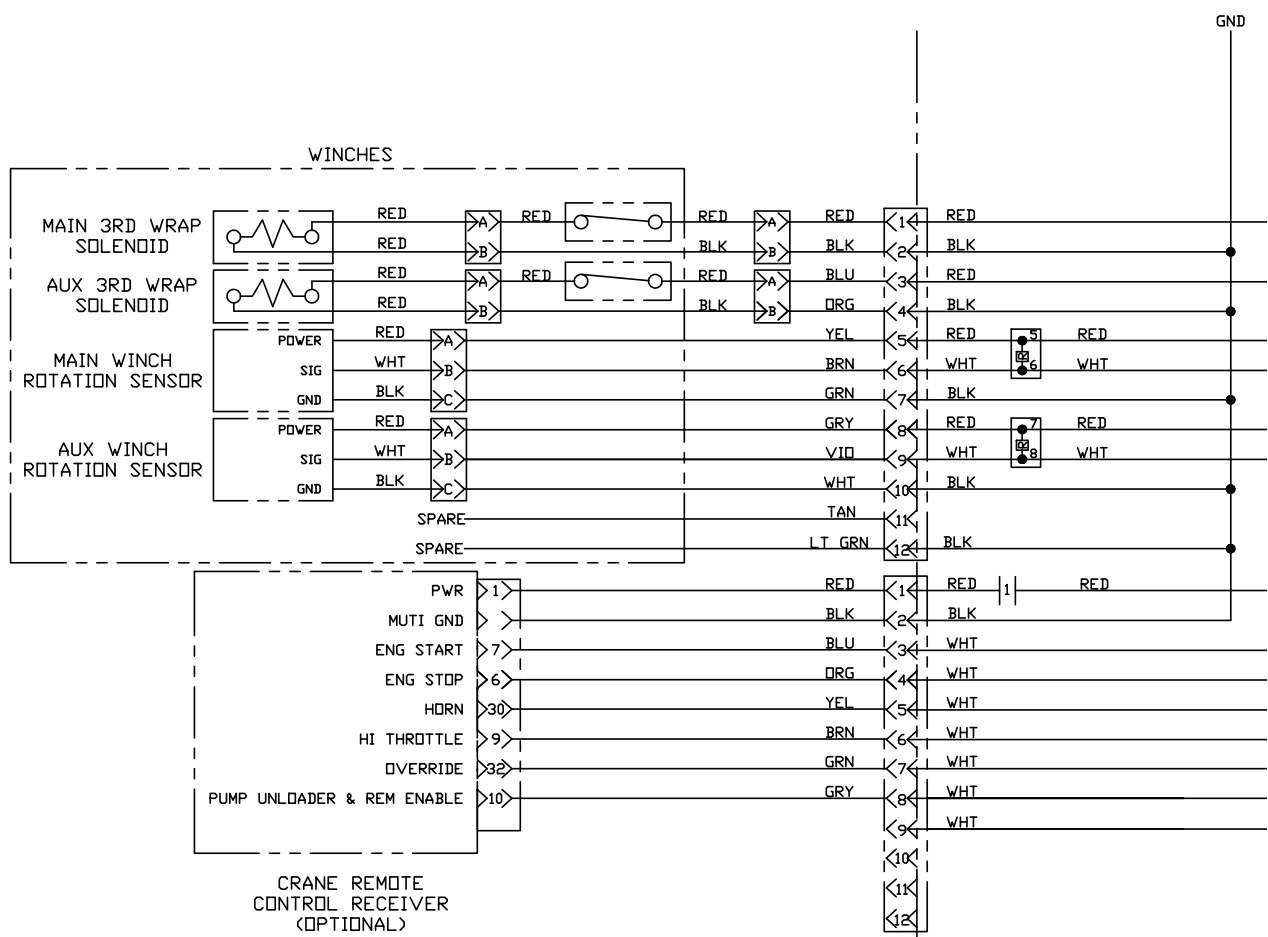


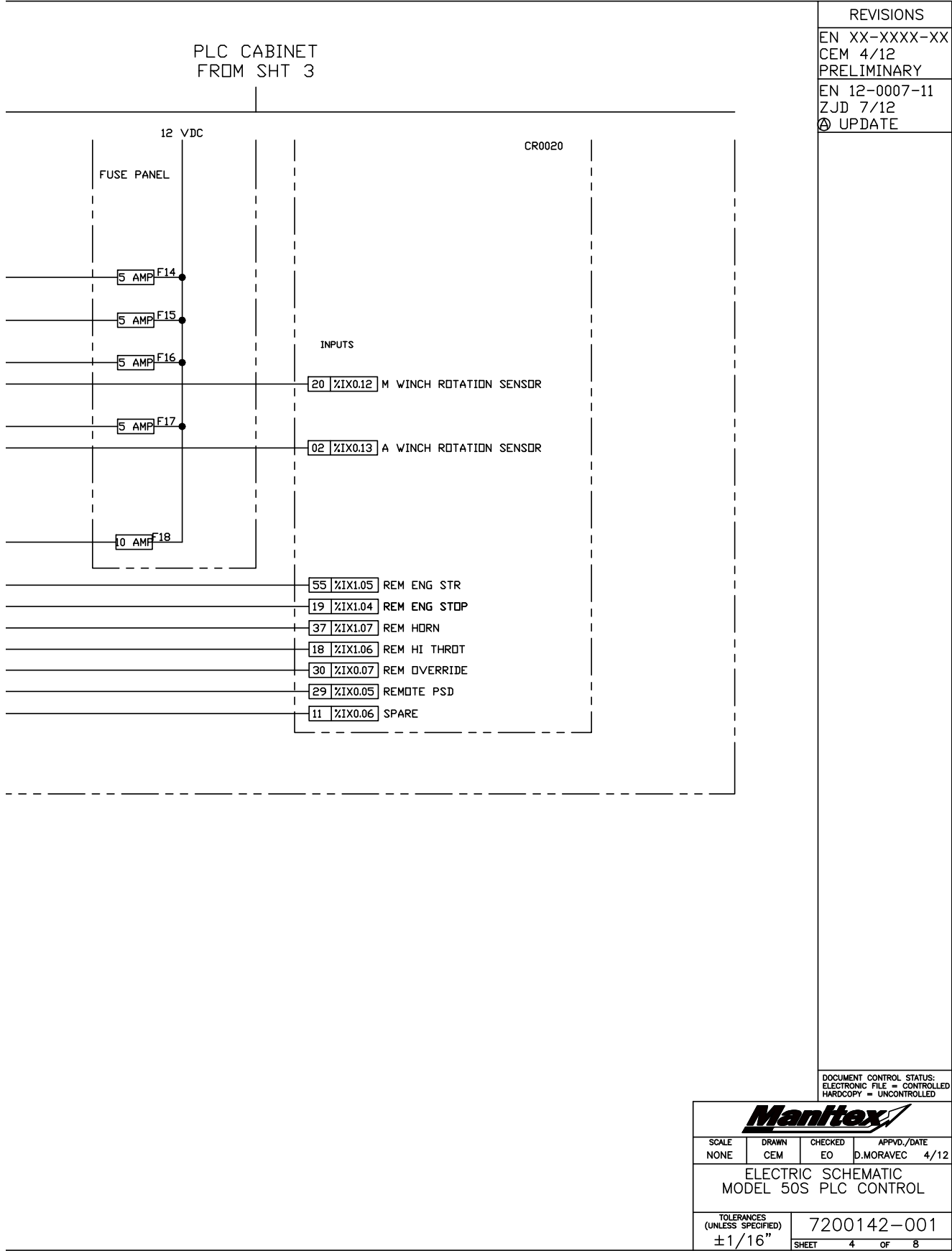


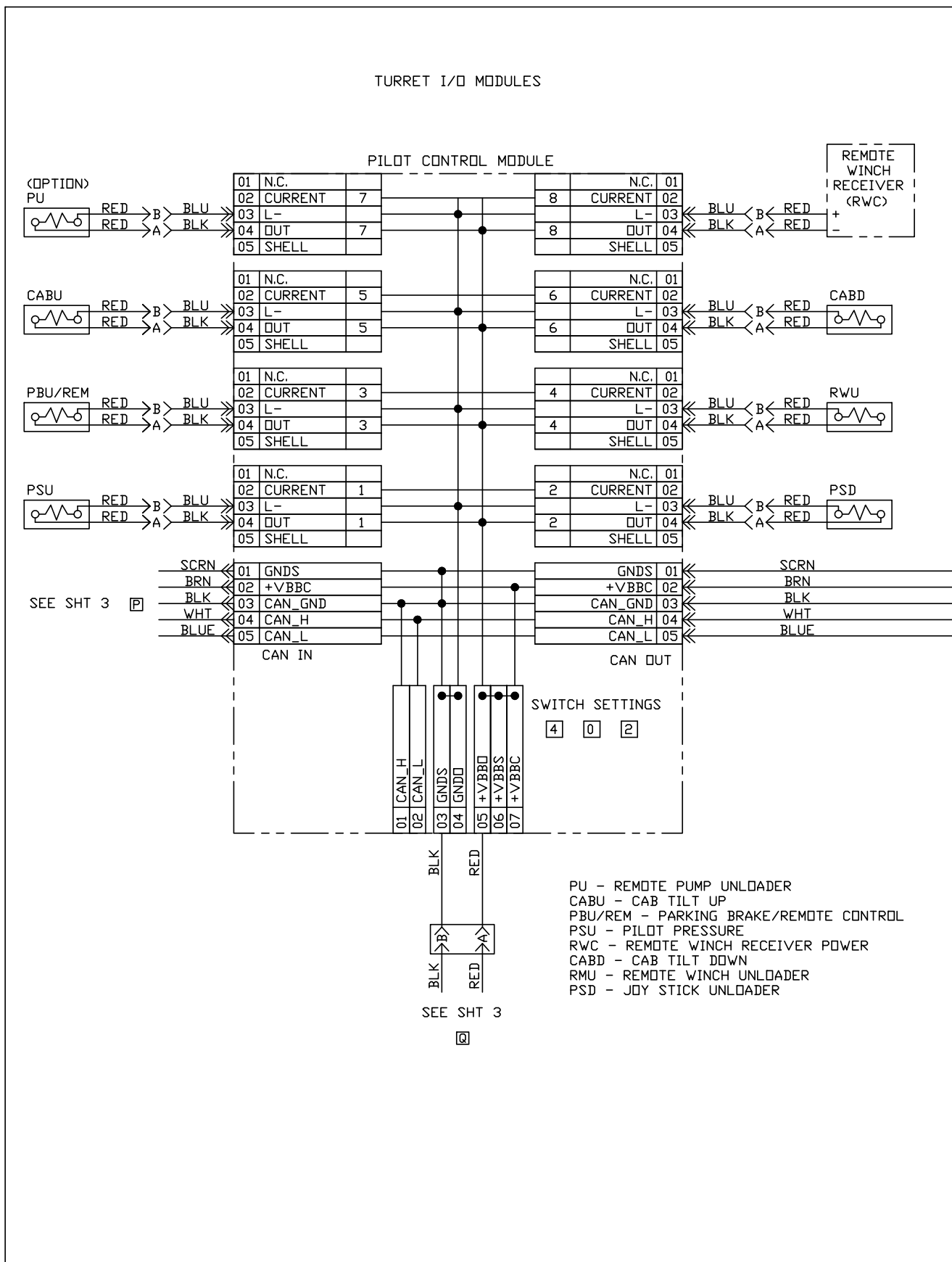


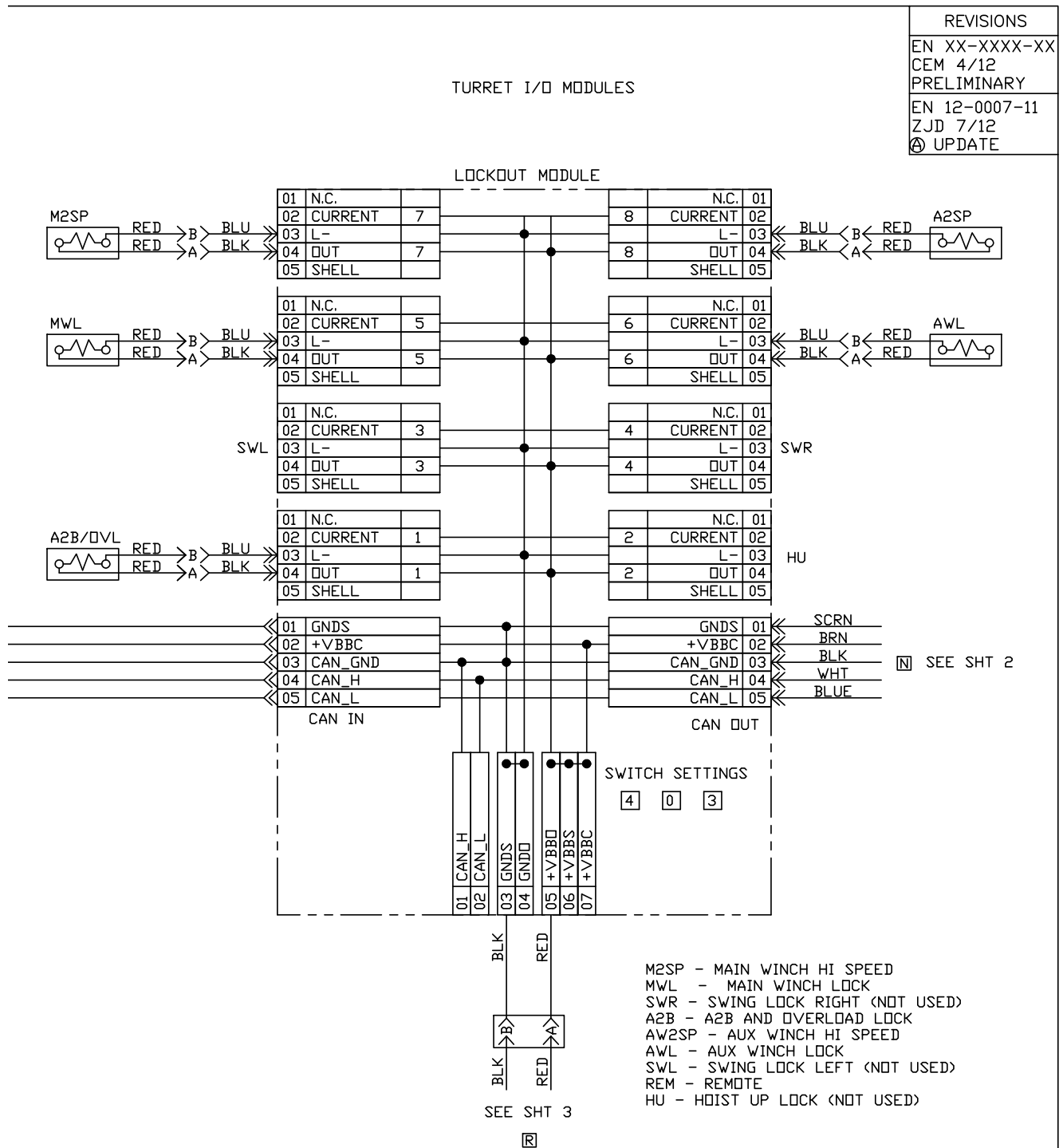


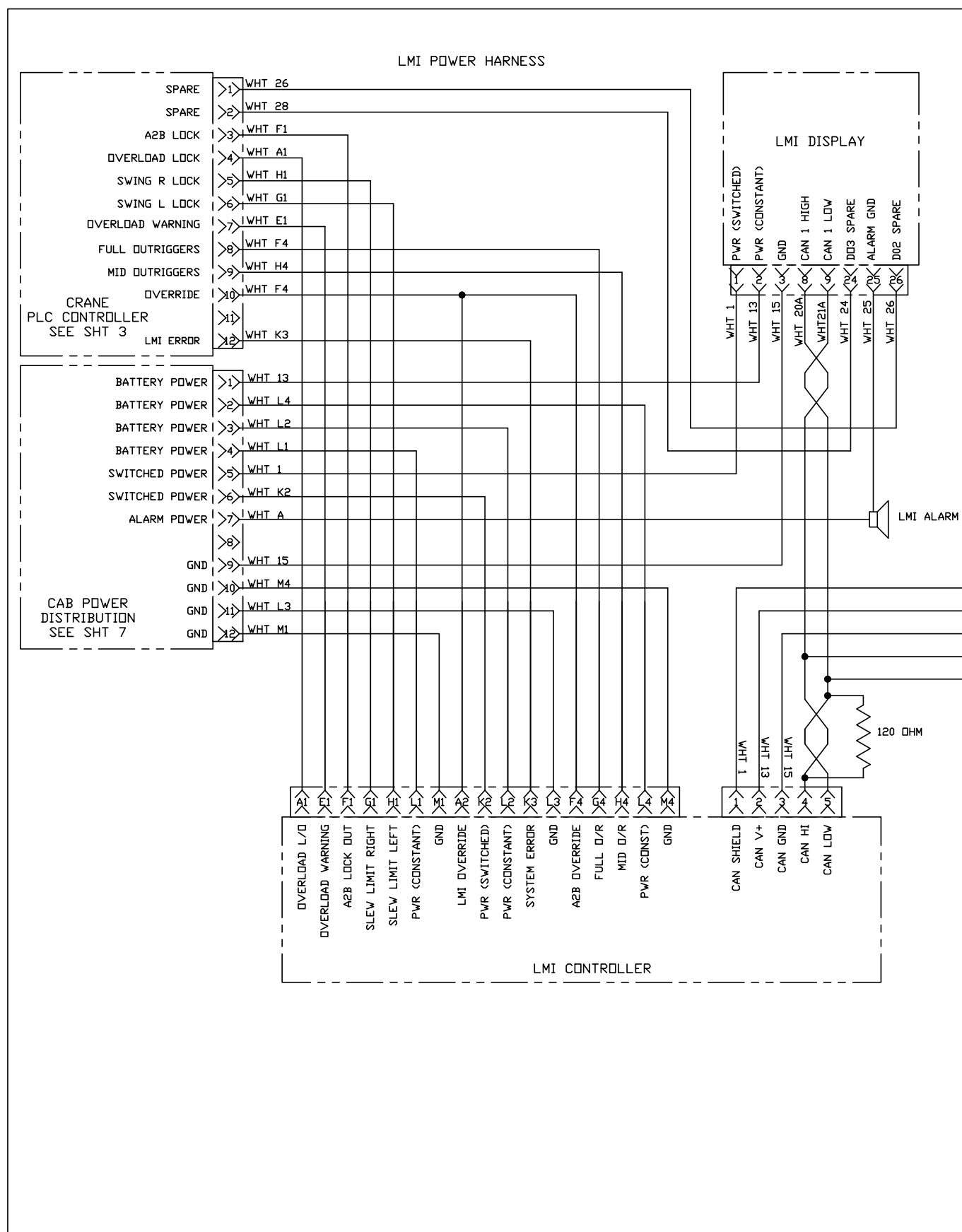






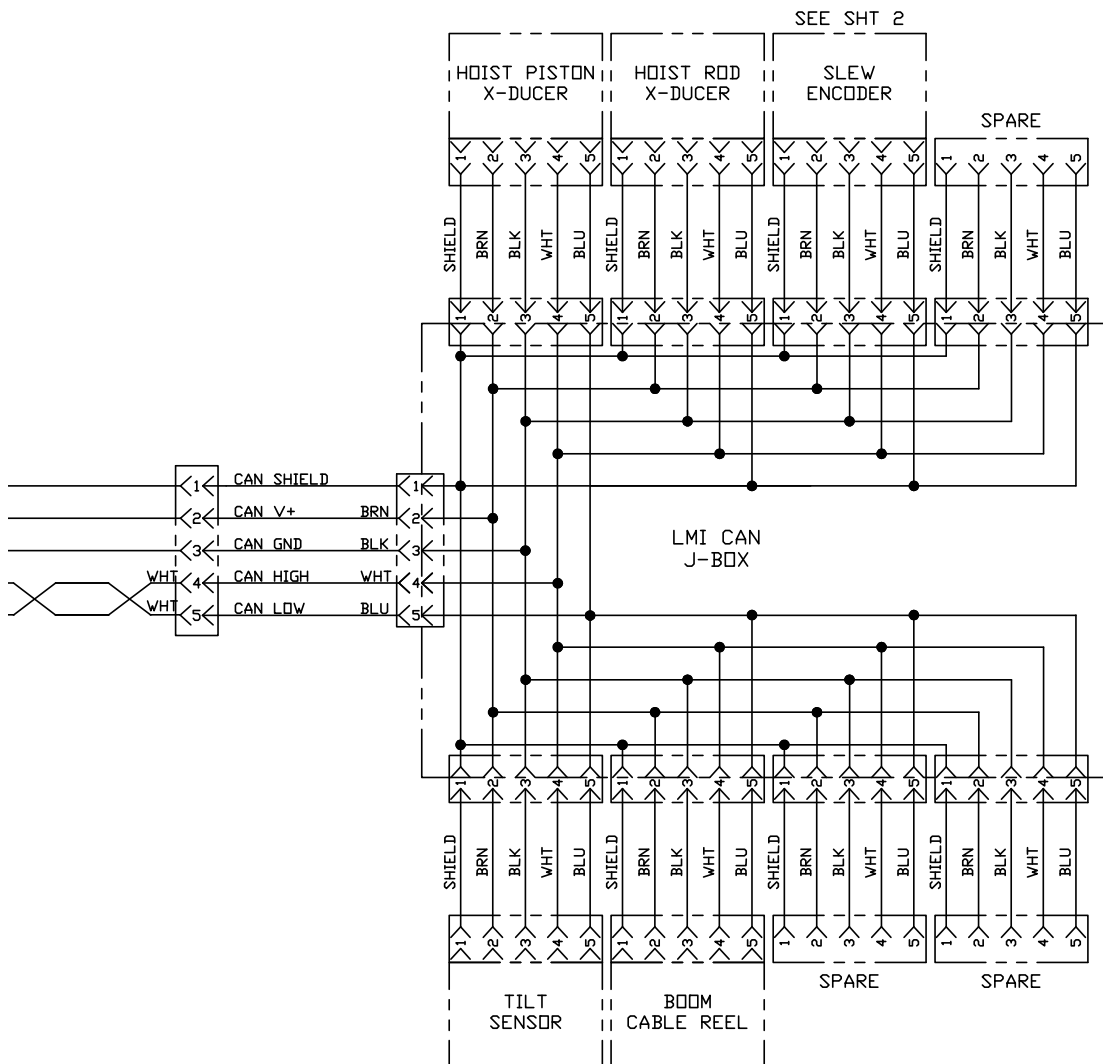






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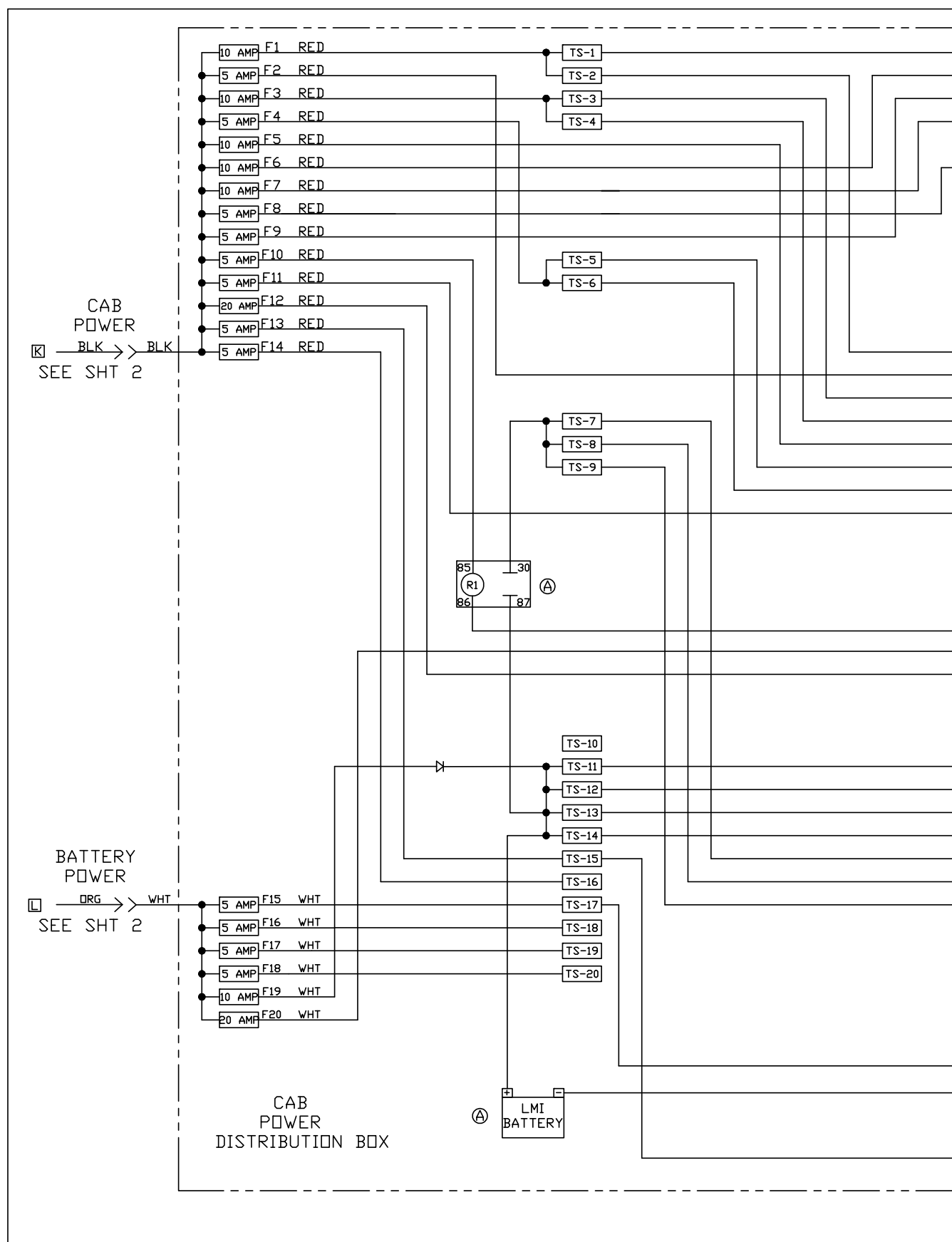
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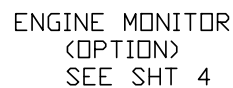


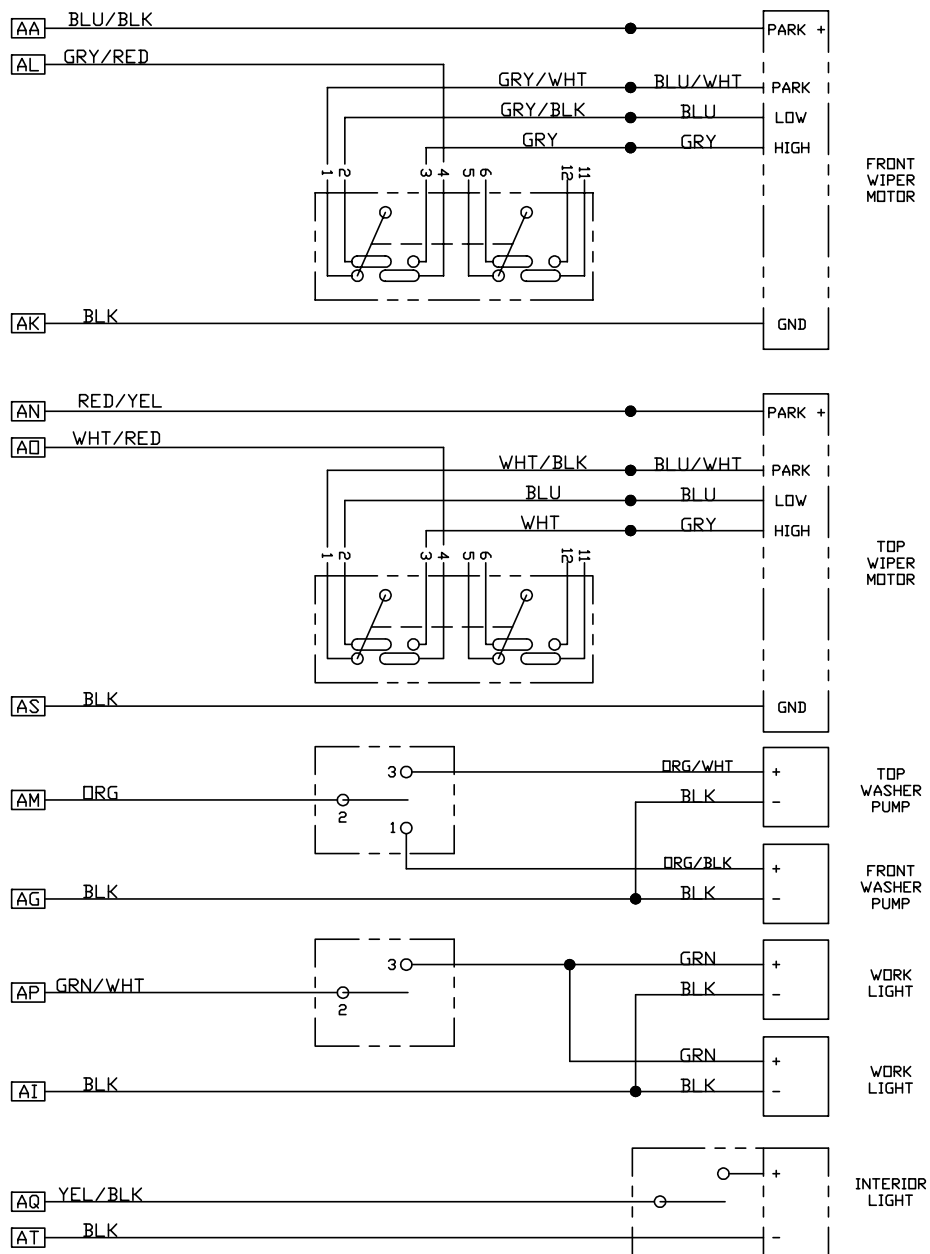
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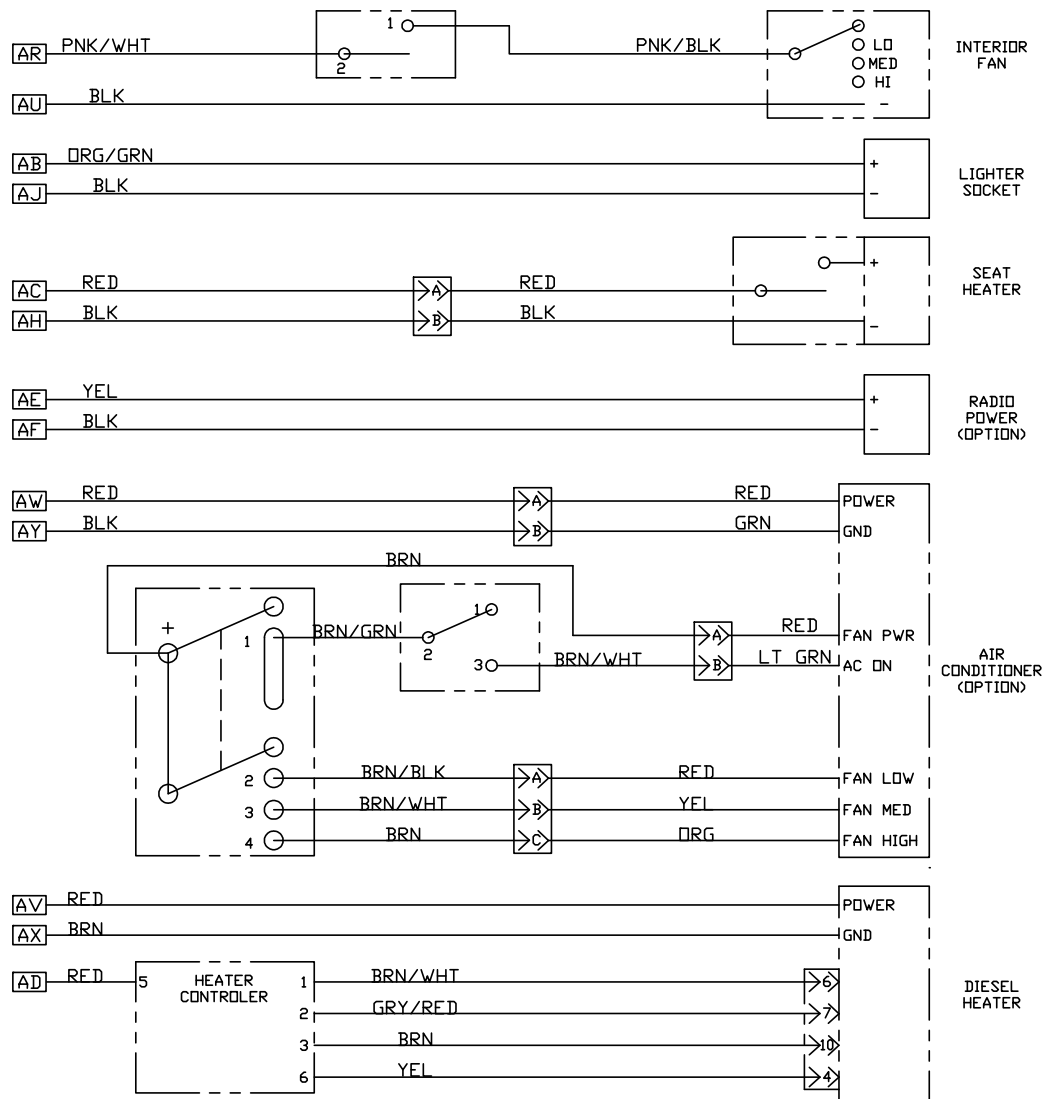
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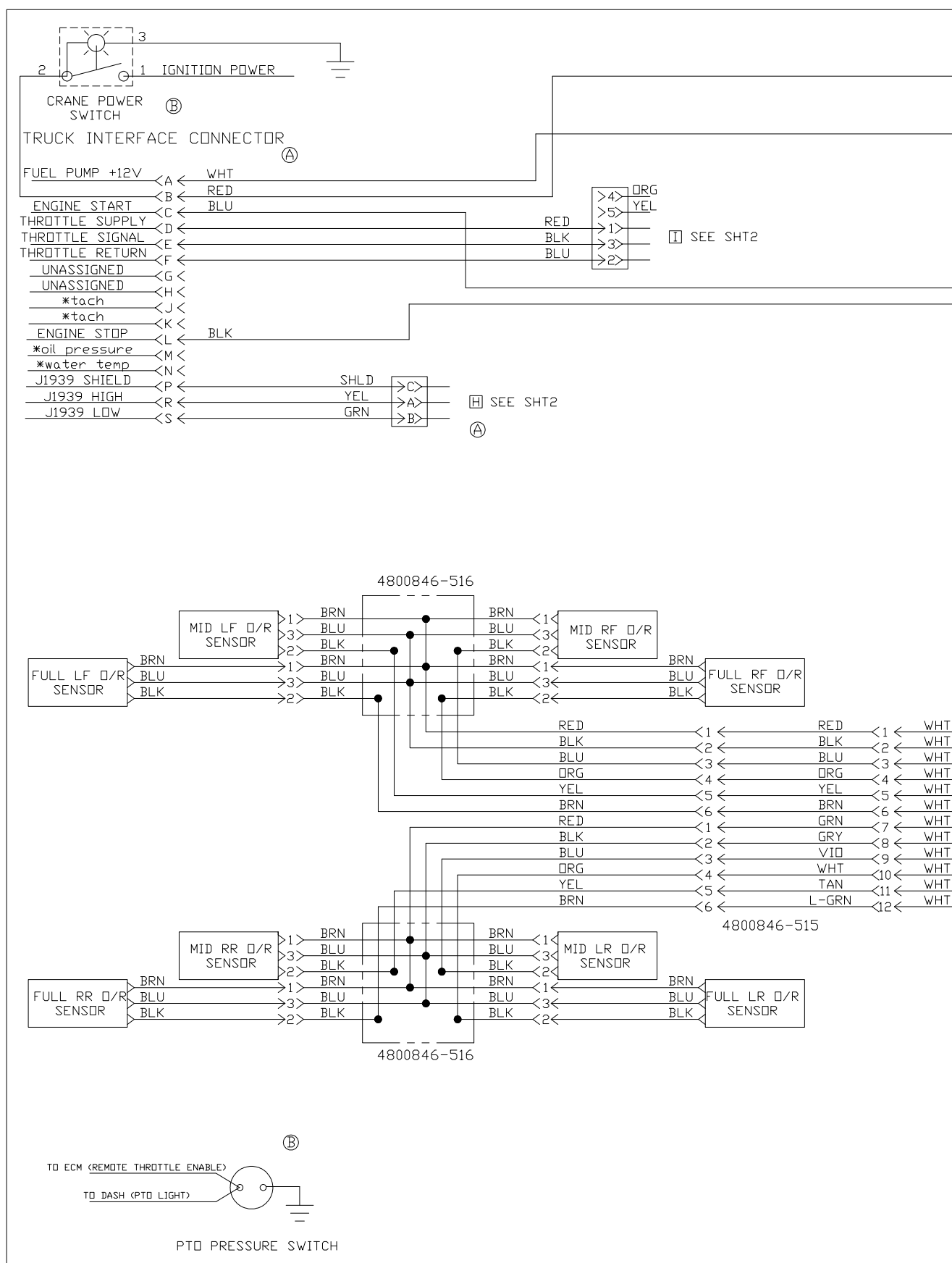
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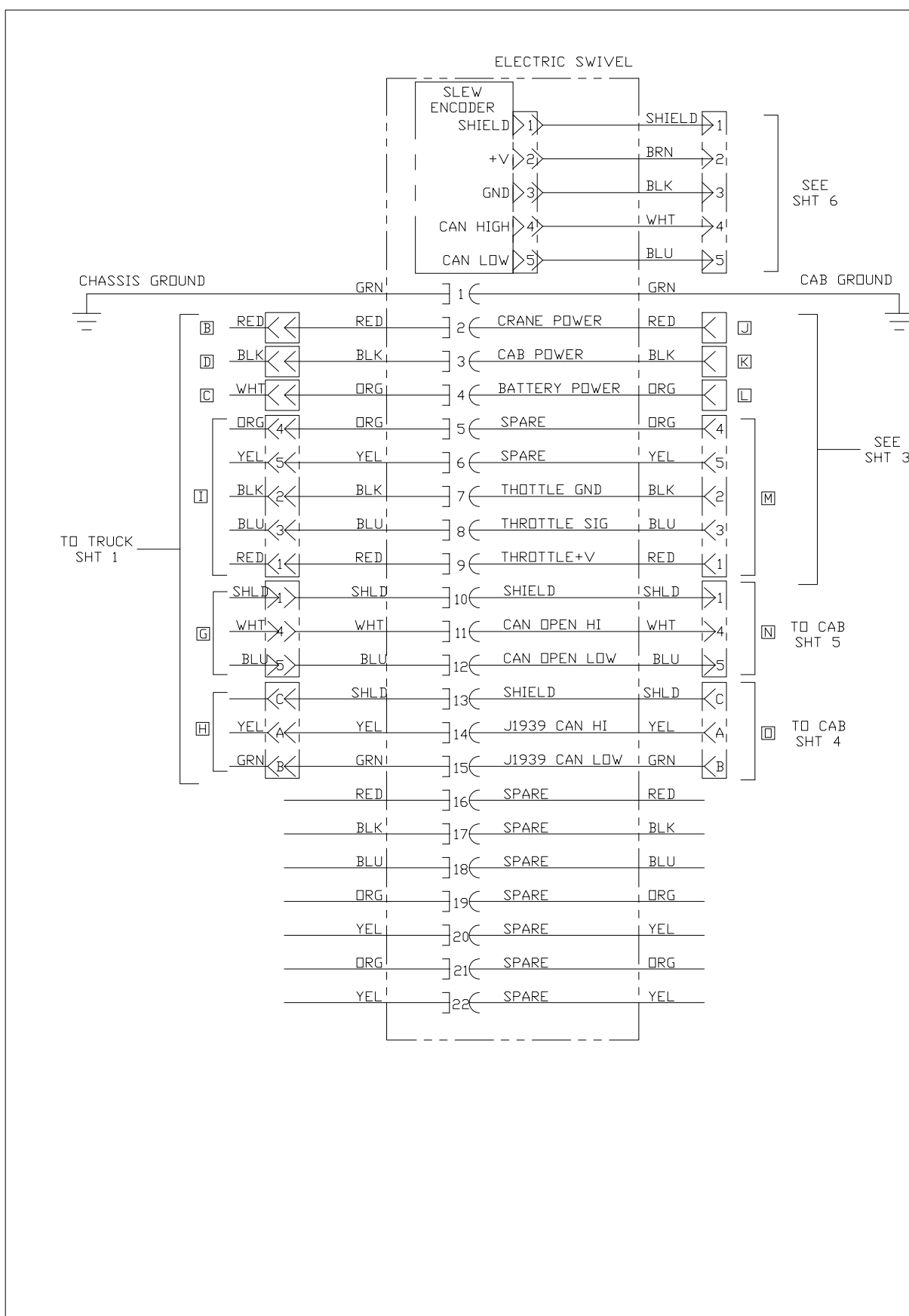
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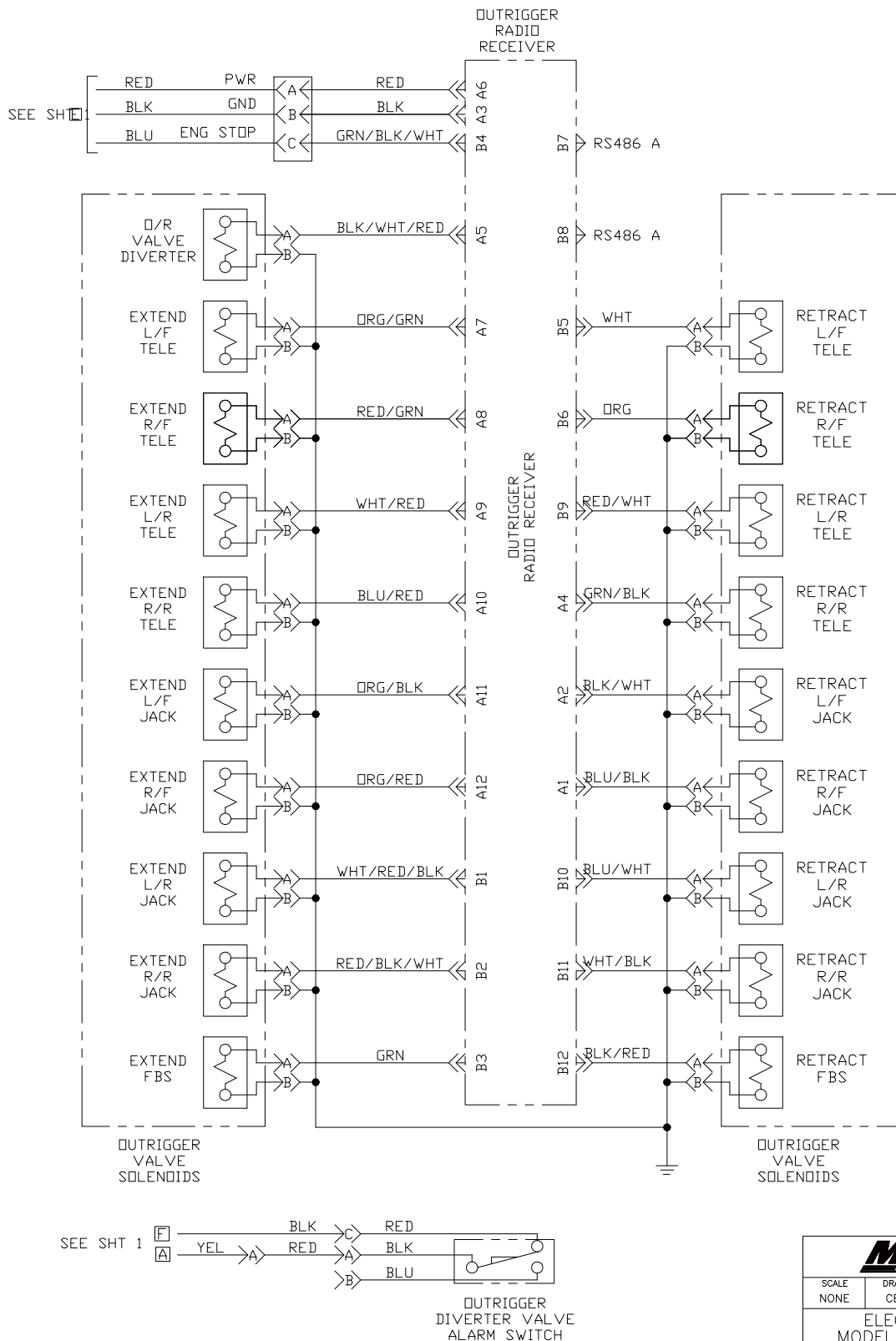
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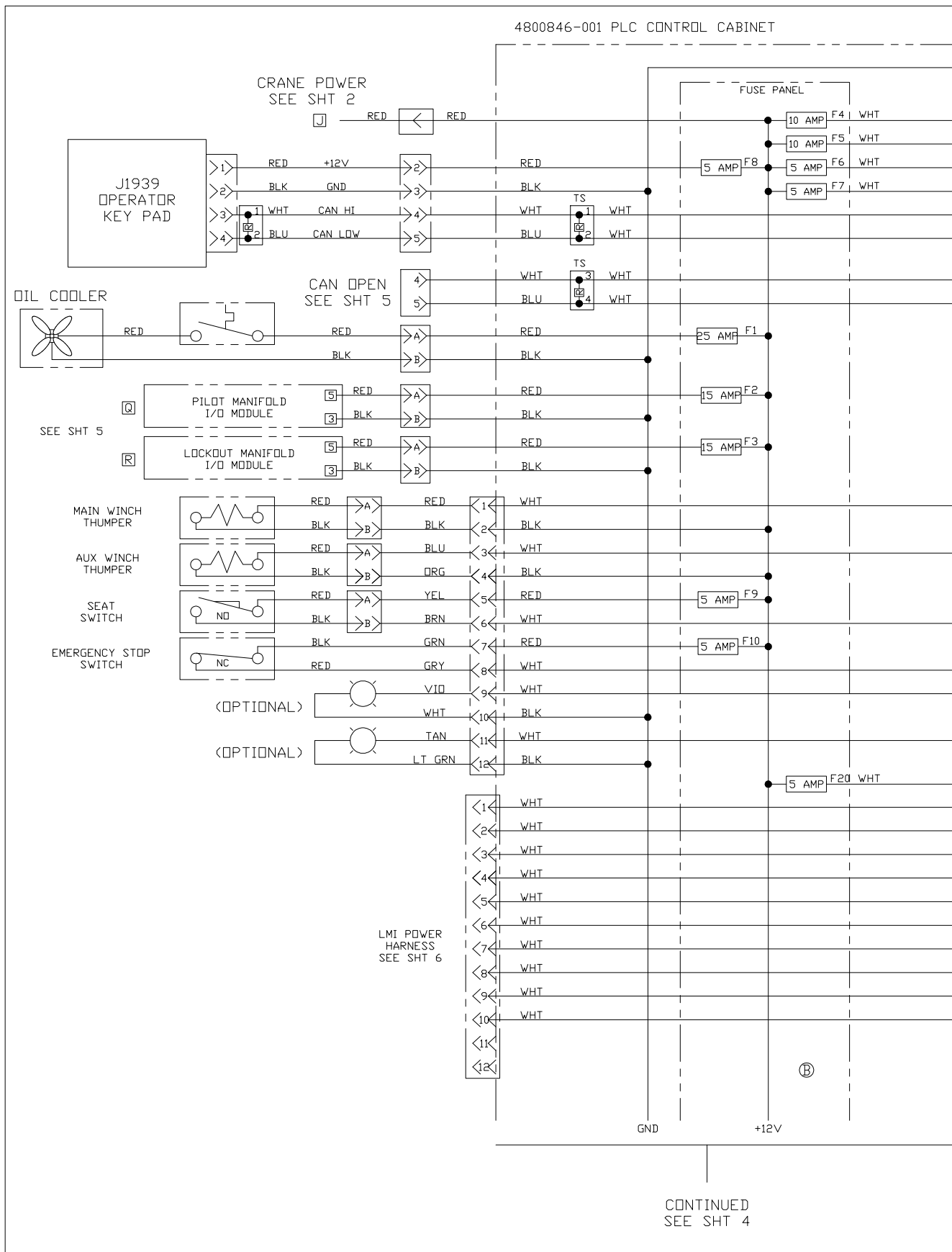
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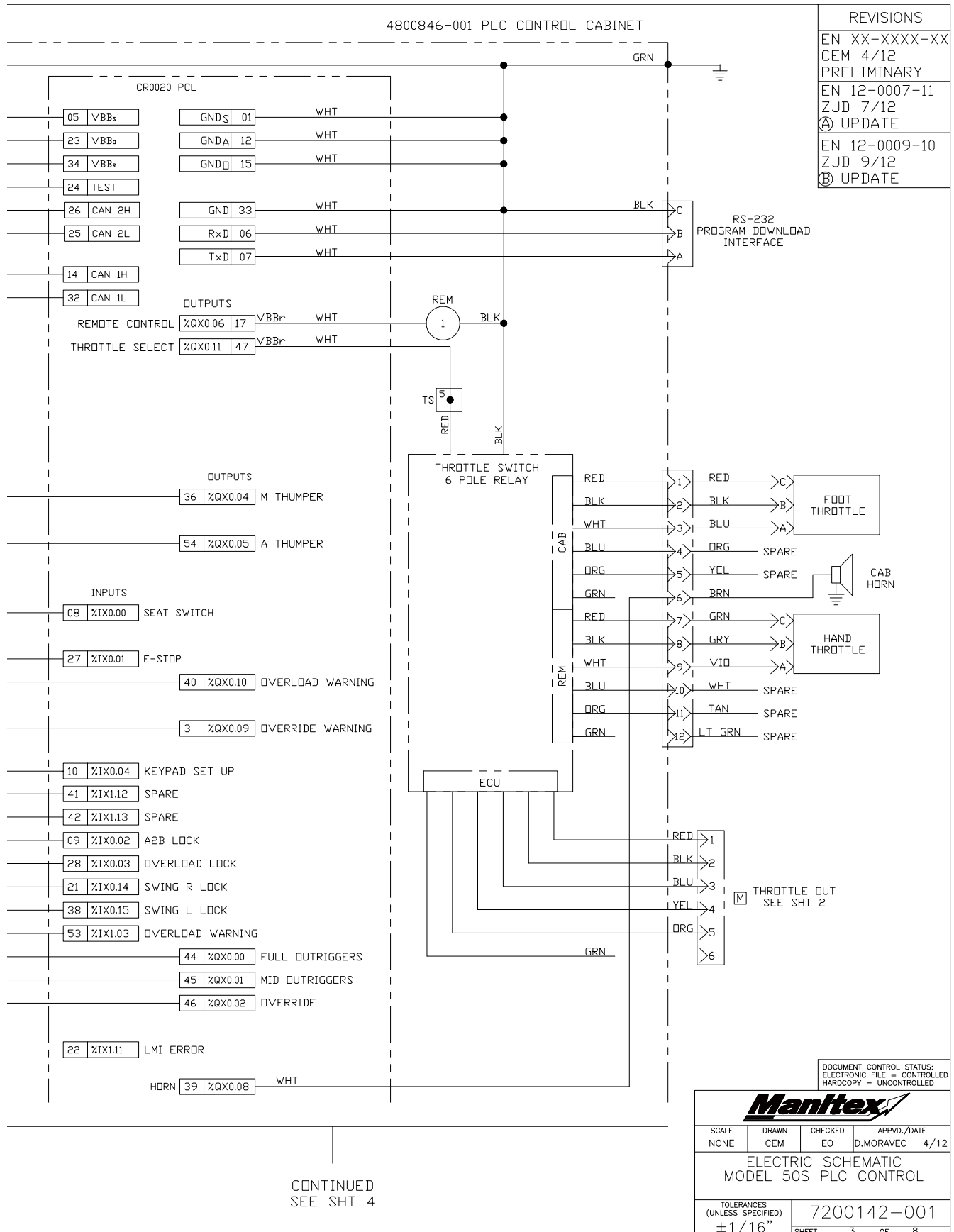
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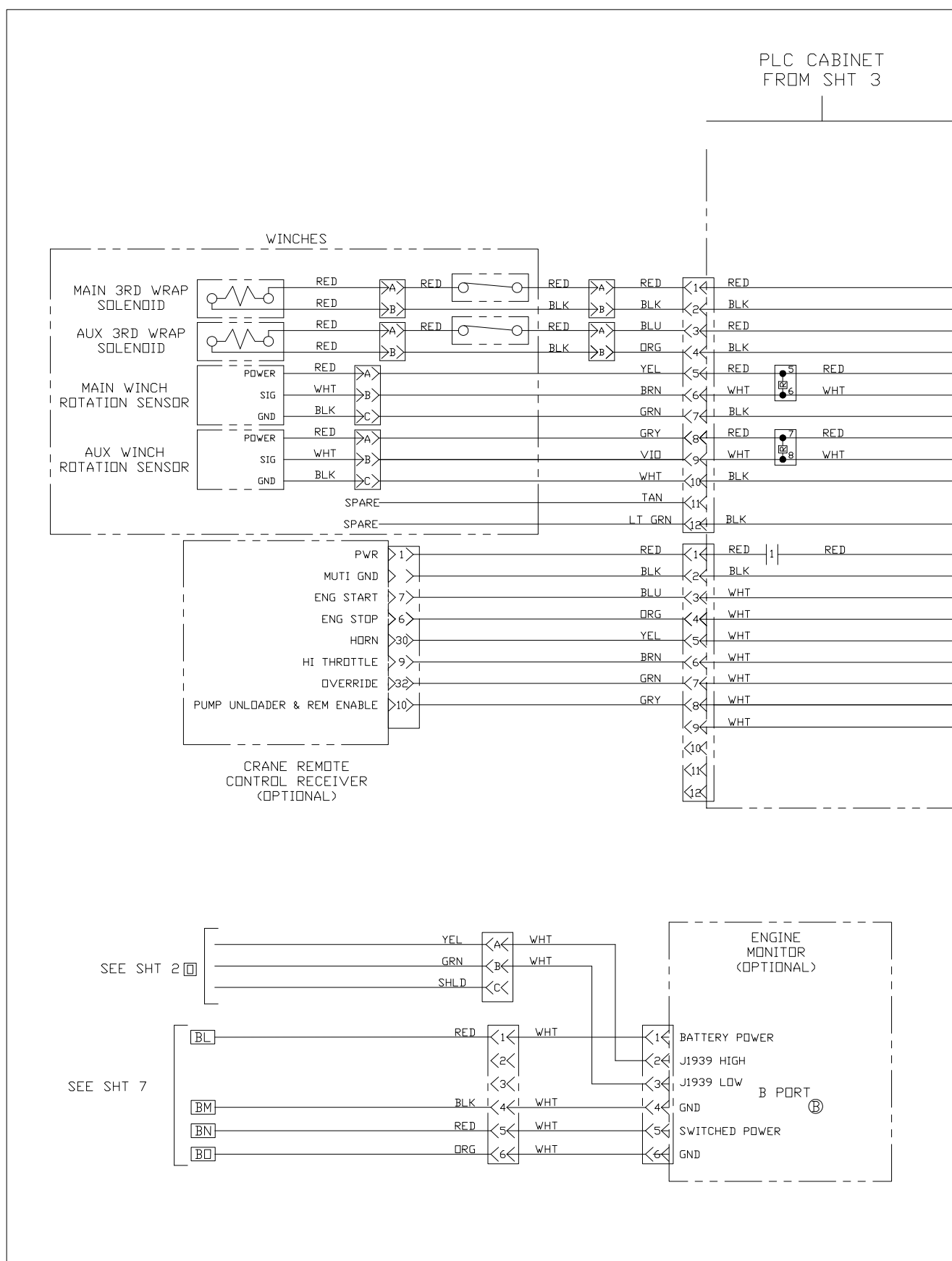
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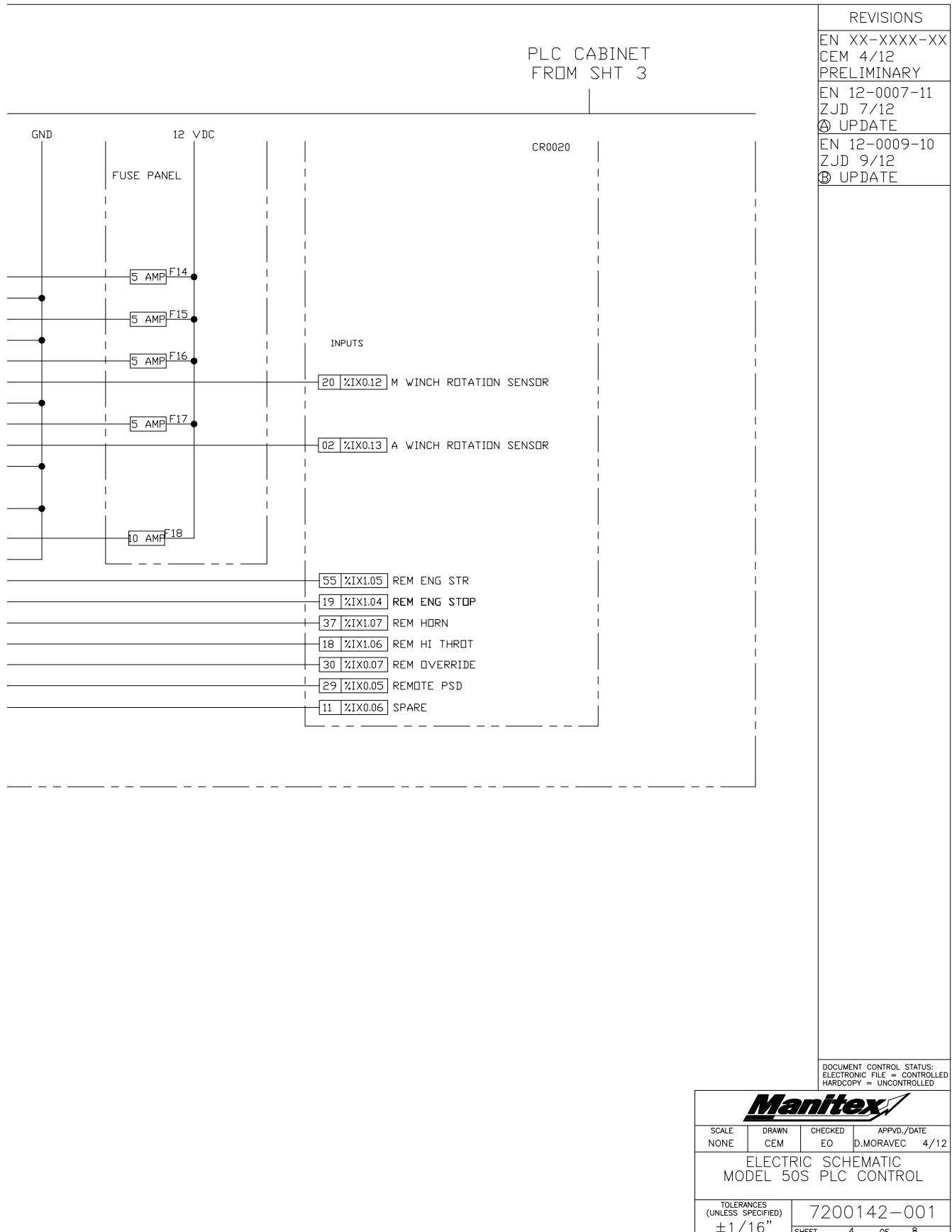
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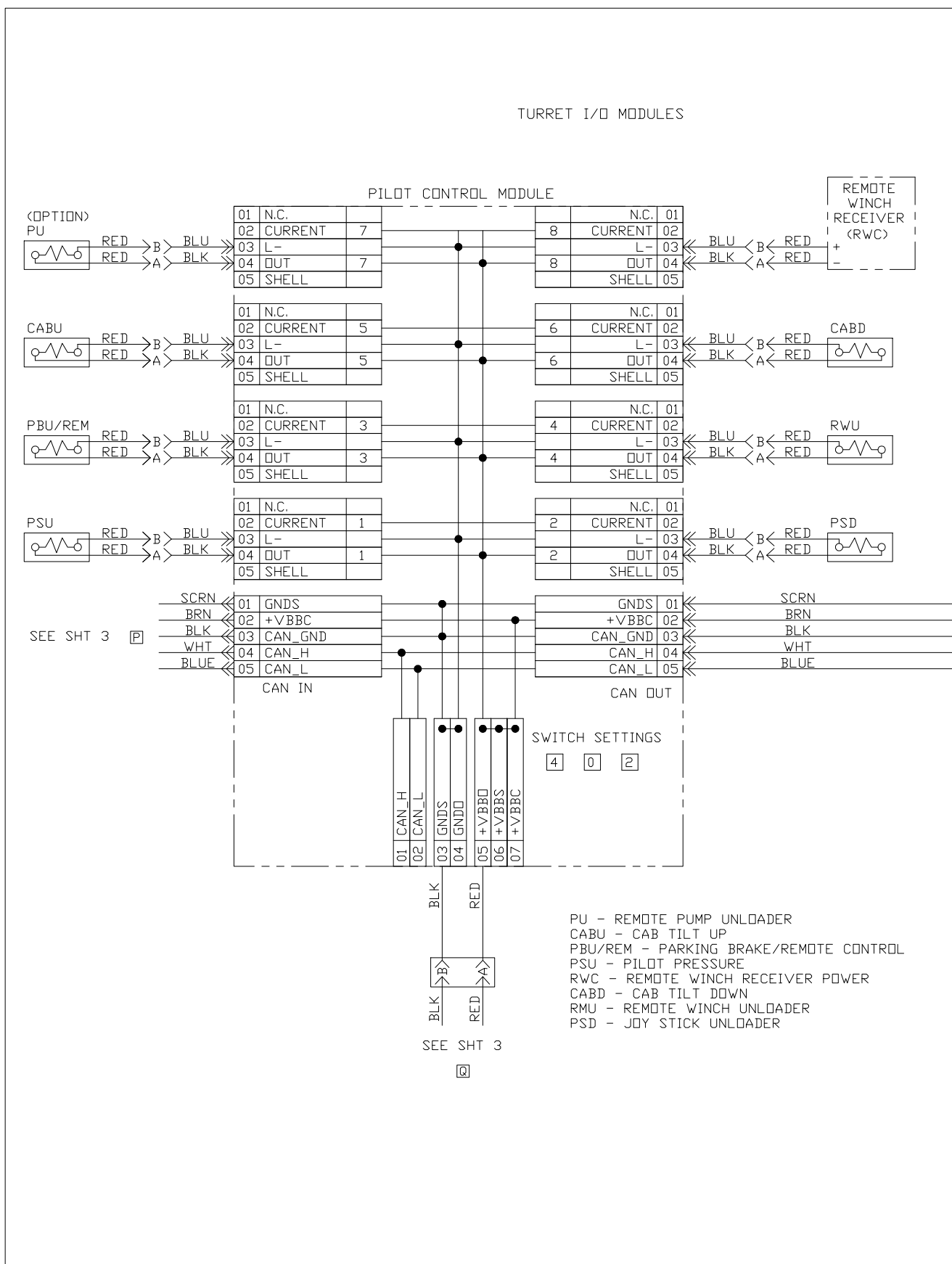
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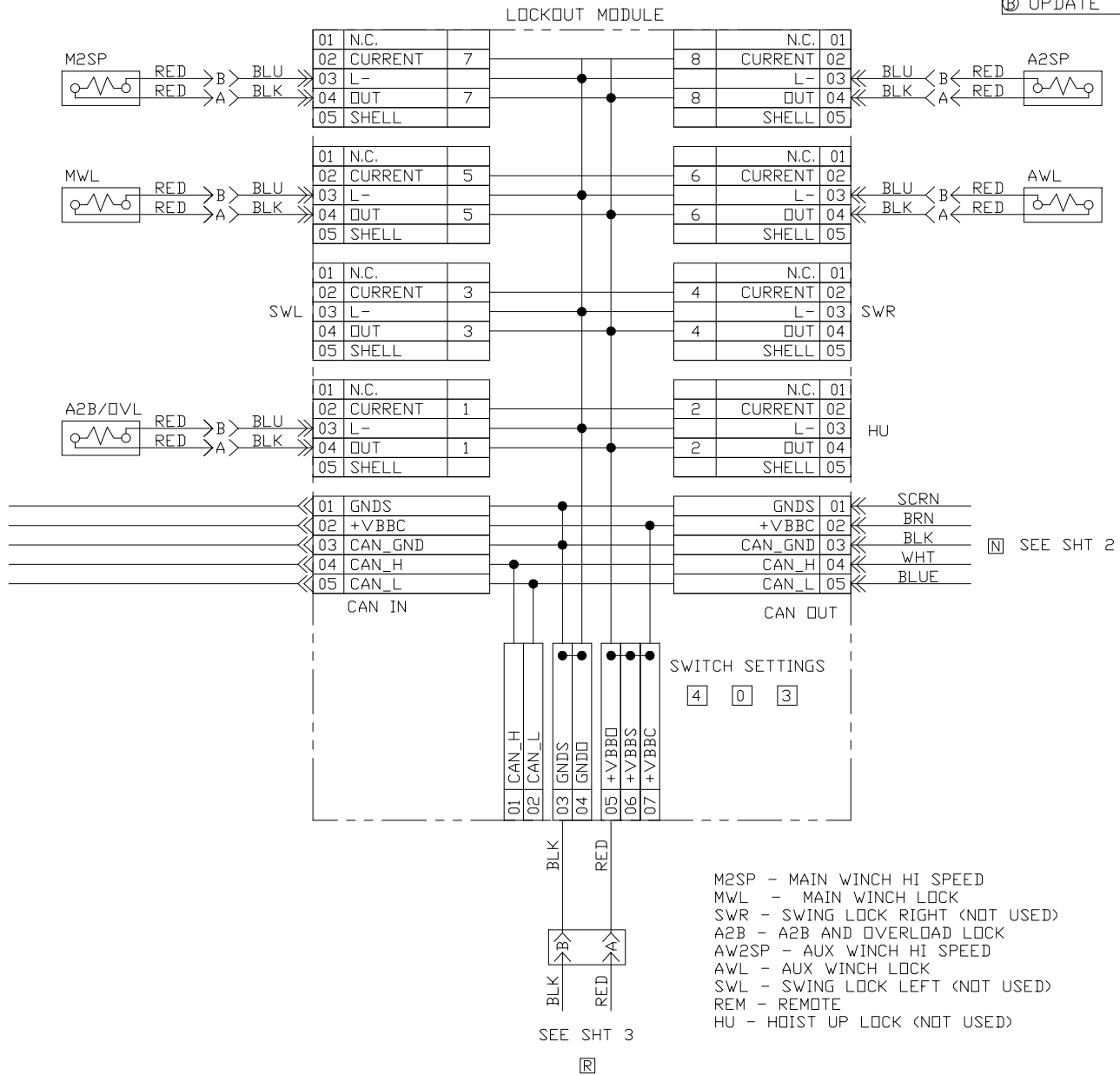




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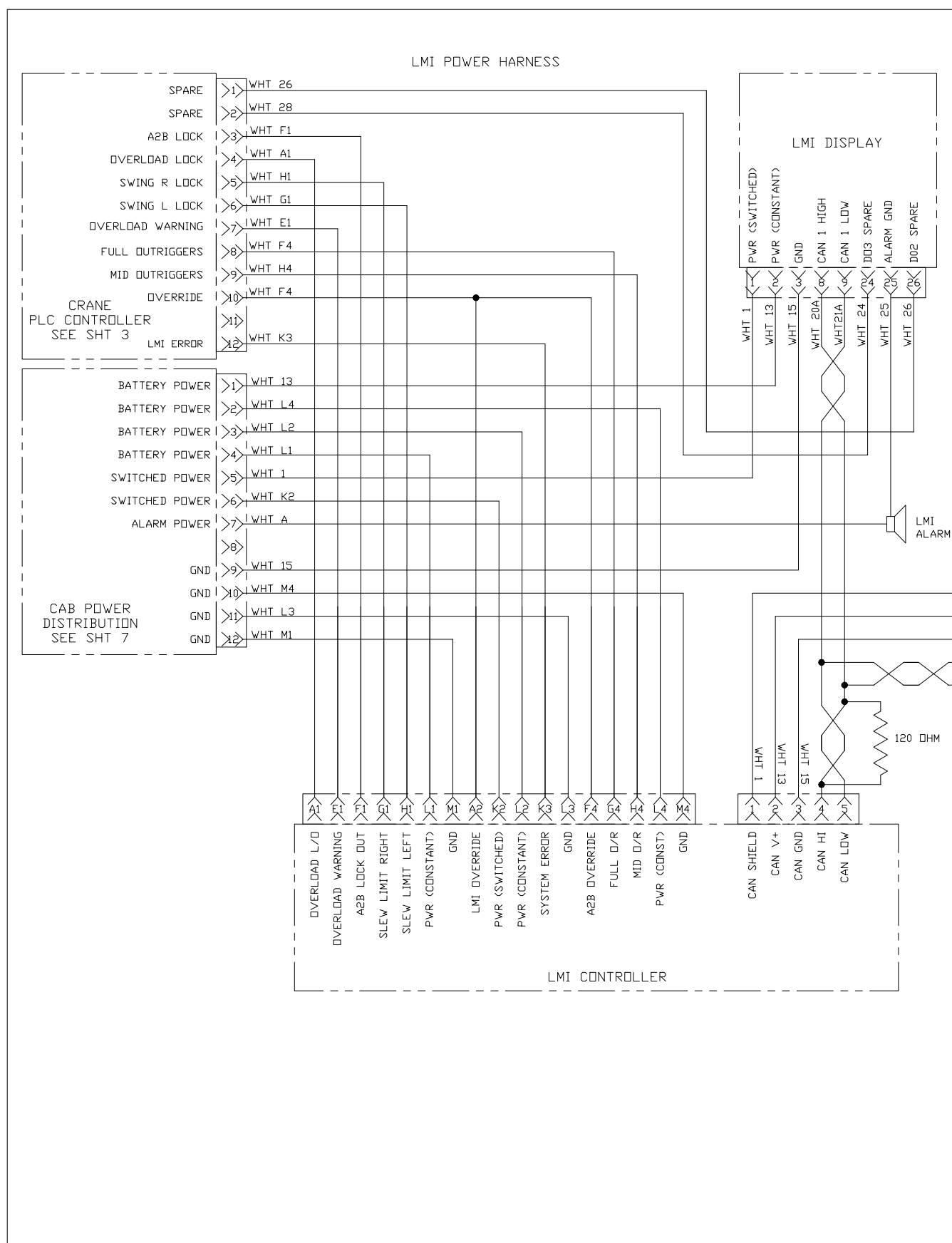
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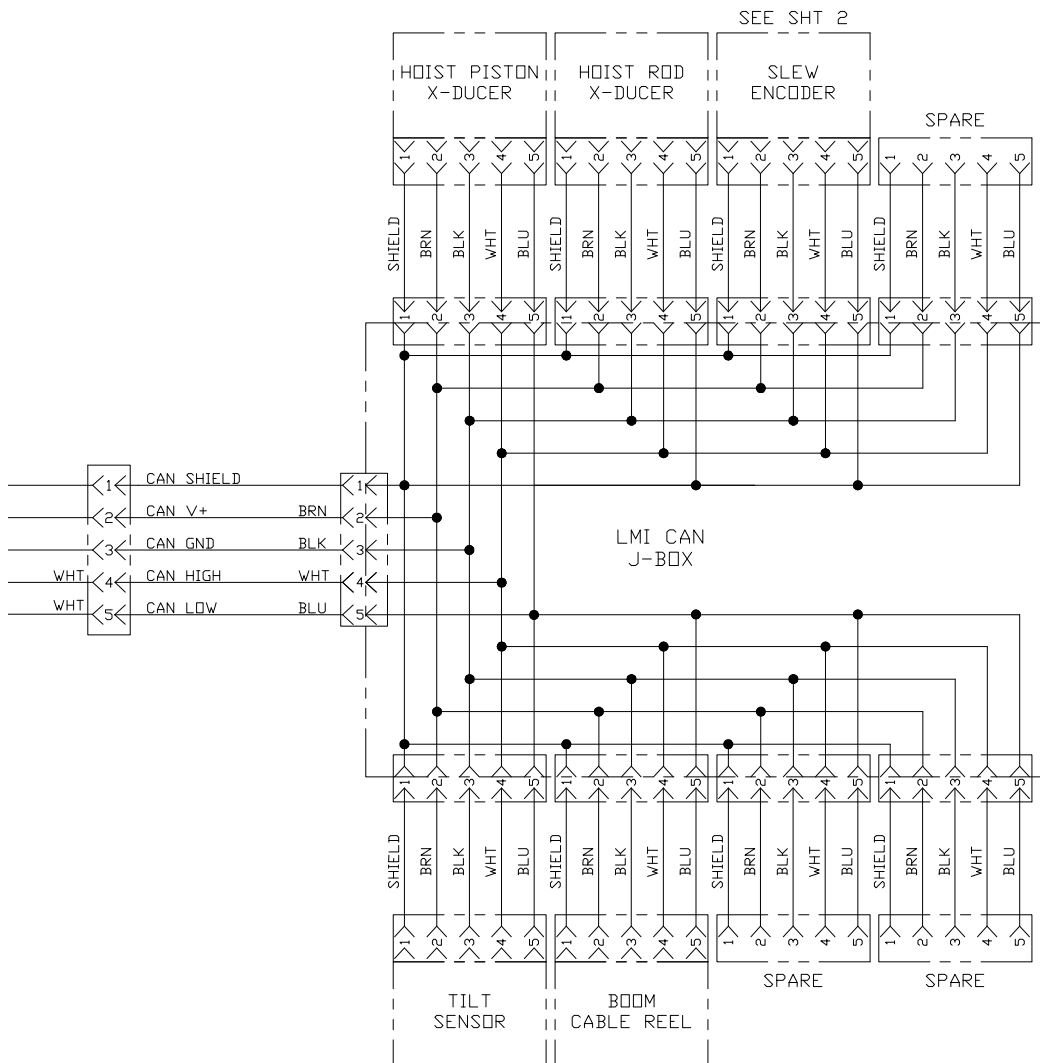
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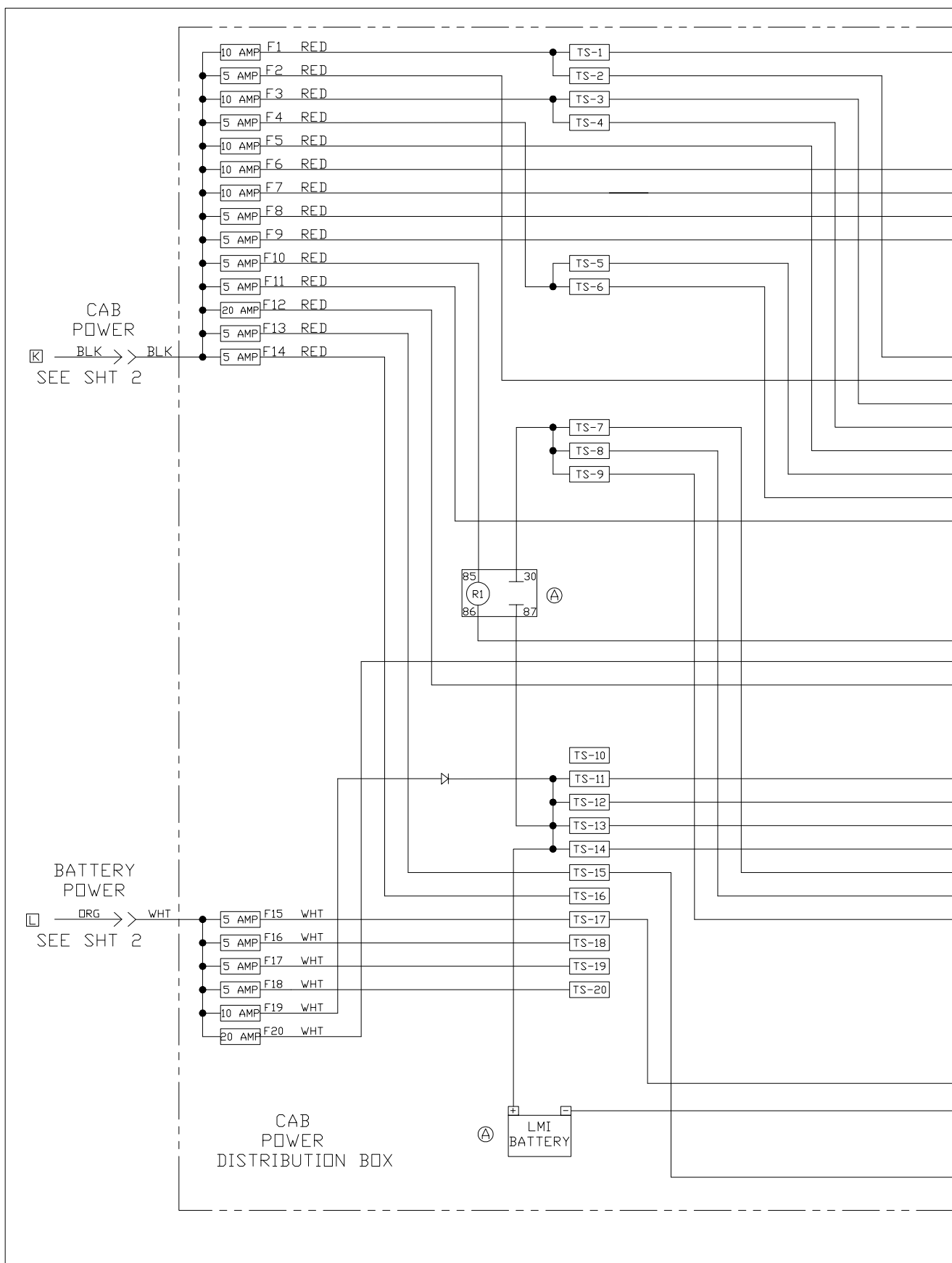
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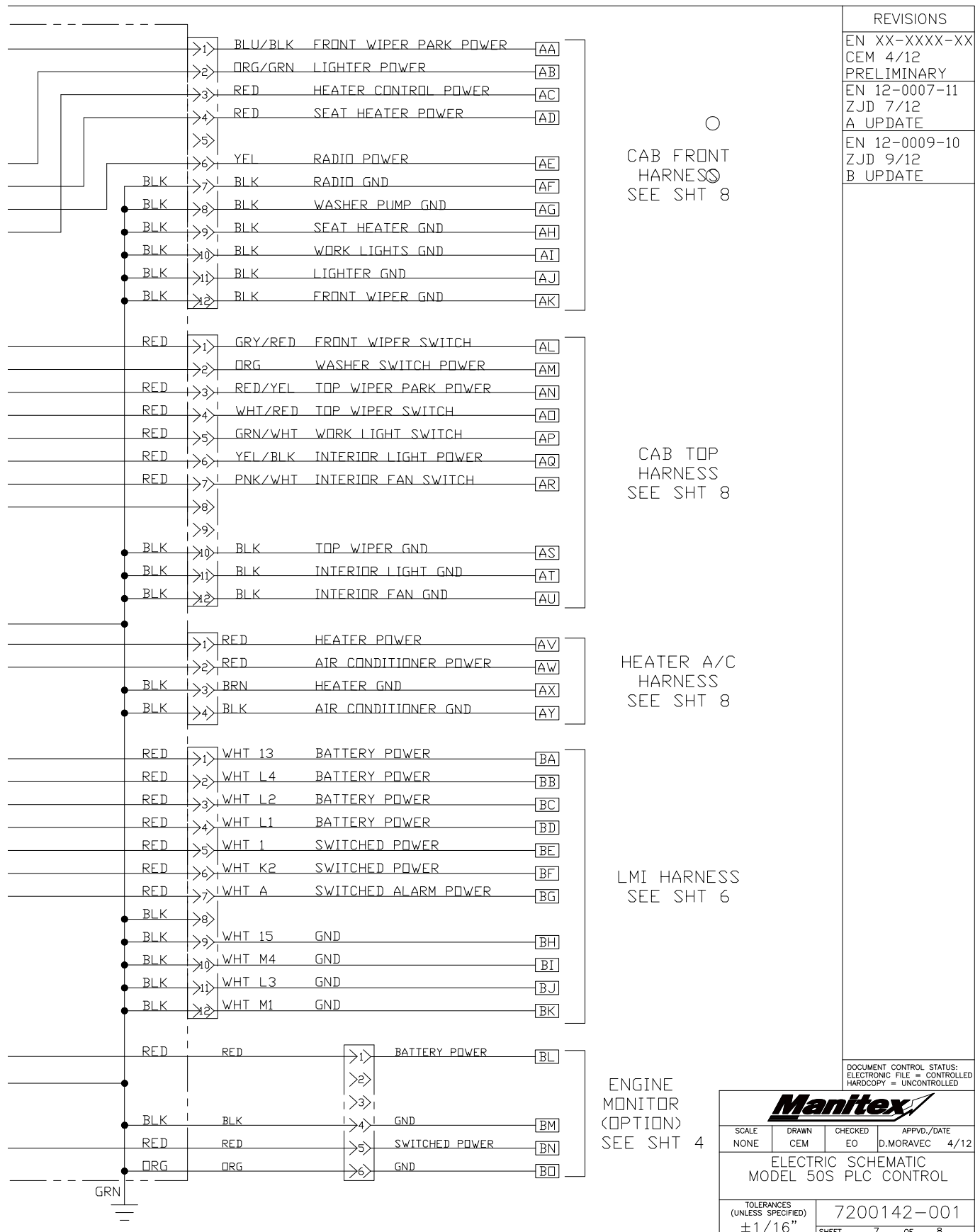


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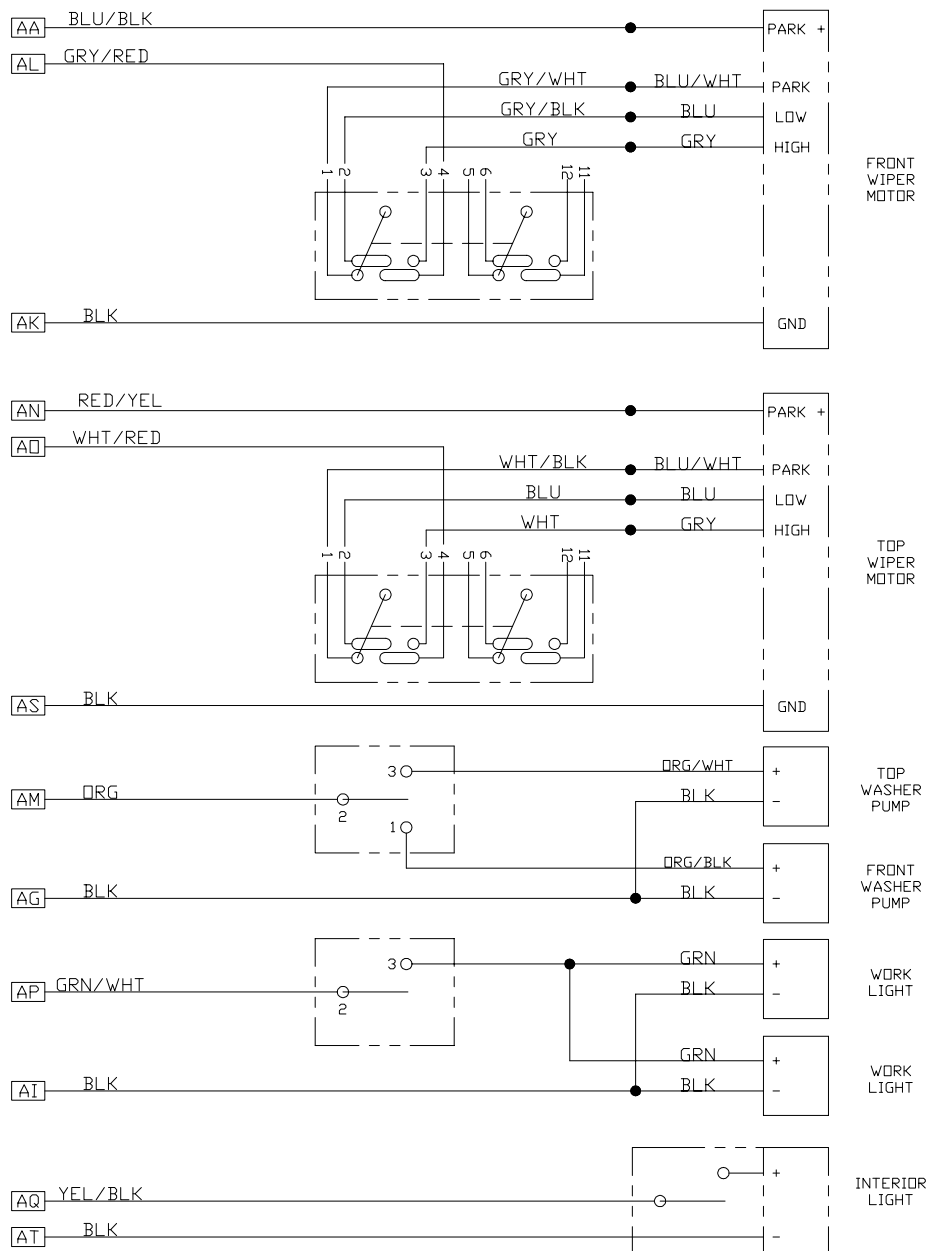
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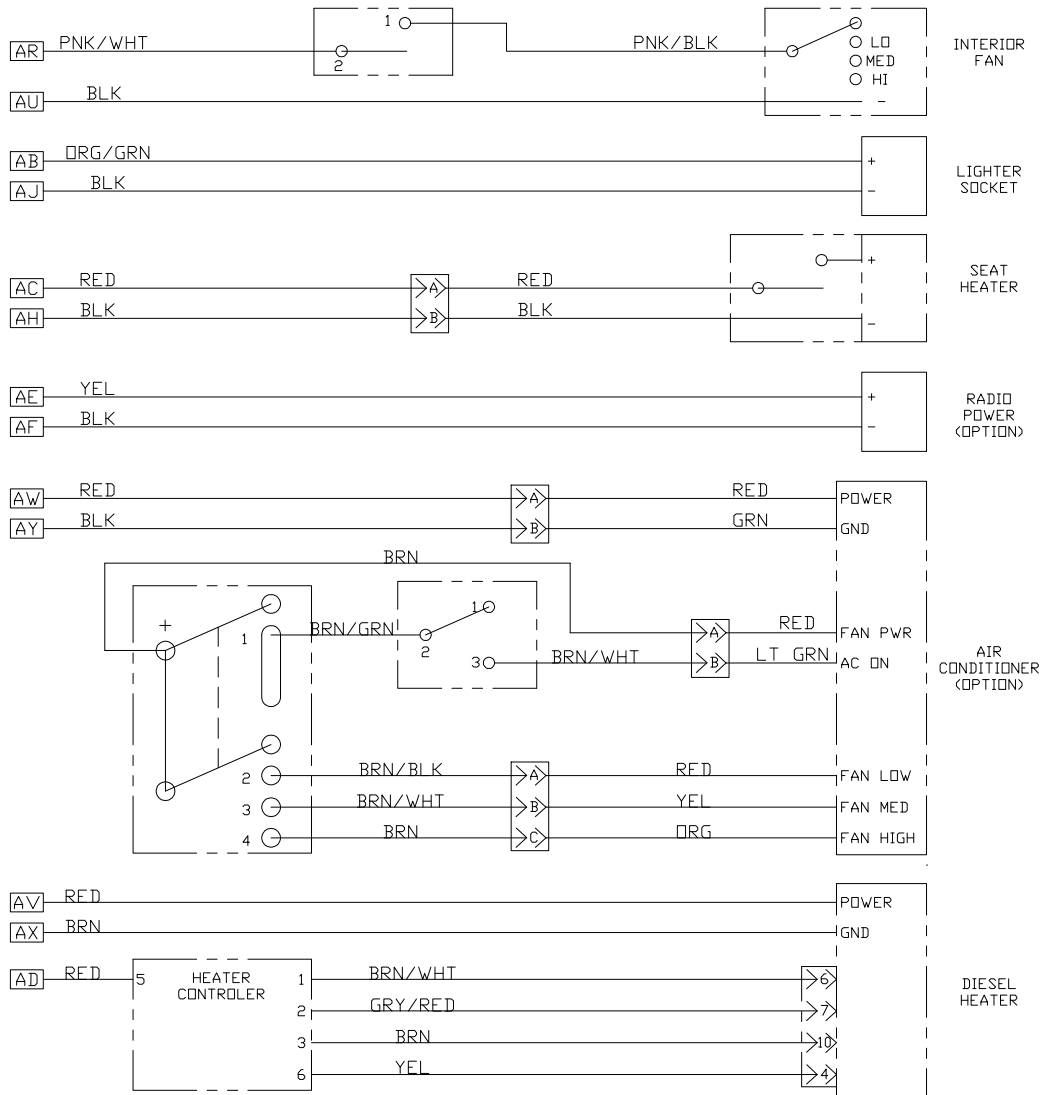
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REVISIONS

EN XX-XXXX-XX
CEM 4/12
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Chapter 6

Maintenance and Repair

NOTICE

This section does not contain maintenance and repair instructions for the truck. Refer to the truck manufacturer's manual for instructions pertaining to the truck.

Safety

CAUTION

Prevent injury to personnel or damage to crane and property. Take the following precautions when making maintenance checks, adjustments, or repairs to crane.

- Apply truck parking brakes.
- Lower all loads to ground so wire rope is slack.
- Move all controls to OFF.
- Disengage Power Take-Off (PTO) and turn engine OFF.
- Attach CAUTION sign to start controls warning personnel that crane is being serviced and must not be started.
- Do not place hands or tools into any opening in boom sections while power is on or boom sections are moving.
- Do not perform maintenance, adjustment, or repair procedures unless authorized to do so. Make sure all applicable instructions have been read and are thoroughly understood.
- Do not check for hydraulic leaks with hands. Oil under pressure can penetrate human skin causing serious injury. Oil under pressure can be nearly invisible; therefore, check for hydraulic leaks with a piece of cardboard or wood
- Hydraulic oil is flammable; do not check inside hydraulic tank with open flame.
- Do not alter specified flow and pressure settings. Higher than specified flow and pressure can cause damage to crane and hydraulic components. Lower than specified flows and pressures can result in loss of control.
- Do not weld or burn close to hydraulic lines and components without first placing a protective cover over them.
- Do not remove cylinders until working parts are resting on ground or are securely blocked from movement.
- Components are heavy. Do not attempt to lift them by hand; use a chain hoist, jacks, or blocking.
- Do not place crane back into service until all guards and covers have been securely replaced and all service equipment has been removed.
- Personnel getting on or off the crane must do so only while the truck is parked. Do not attempt to get on or off the crane while it is moving.
- This crane has ladders for climbing on and off the crane from either side. Crane owner/user shall provide sturdy ladders for personnel to gain access to components that cannot be reached from the ground, operator platform or top of flatbed. Do not allow personnel to climb onto winch or top of boom; use a sturdy ladder to gain access to these locations.

Storing Components

Store new components, such as, valves, pumps, motors, cylinders, hoses, tubes and fittings in a clean, dry indoor location.

Do not unpack components or remove port plugs until the components are needed.

Once unpacked, carefully inspect each component for damage that may have occurred during shipping.

Fittings, hoses, and tubes that are not equipped with shipping caps or plugs must be carefully cleaned before they are used. Flush the fittings, hoses, and tubes with clean hydraulic oil. Then seal all openings until use at assembly.

NOTICE
<i>Do not use rags to plug openings. Use clean plastic shipping plugs and caps.</i>

Labeling Components at Disassembly

Before disconnecting wires, hoses, or tubes, tag them for proper identification at reassembly.

Before removing a component, such as a pump, motor, or a valve, match-mark its mounting position with relation to the adjacent component.

Before disassembling any multiple section component, such as a pump, motor or a valve, match-mark the position of each section with relation to each other. Do not mix parts from one section with those from another; keep parts segregated.

Before removing shims, tie them together and identify their location.

Cleanliness

Before removing a component from the crane, thoroughly, clean the area around it to prevent dirt from entering the mating component or the hydraulic system. Cover all openings with plastic to prevent dirt and water from entering.

Carefully clean the area around fittings before disconnecting hoses and tubes. Install plastic plugs or caps on the ends of hoses and tubes and the mating ports of all components to prevent dirt and water from entering.

Disassemble components on a clean work bench that is free from dust, dirt, metal particles and other contaminants.

Use tools that are clean and in proper working order.

Clean metal parts in nonflammable safety solvent. Clean rubber parts in warm water and soap. Lubricate all parts with clean oil at assembly.

Torque Values

The fasteners that must be torqued to a specific value are identified in Table 6-1 and shown in Figure 6-2. Refer to drawings in the crane's Parts Manual for torque values.

DANGER

Loose or improperly torqued subframe mounting studs and slewing ring mounting bolts will cause studs or bolts to fail, possibly allowing crane to come off truck.

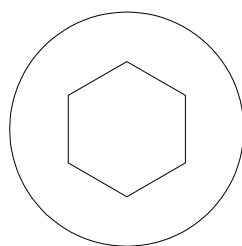
NOTICE

Observe following precautions when installing fasteners; failure to do so will seriously weaken attachment.

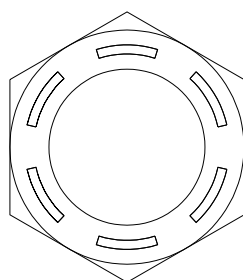
- Make sure each fastener is of correct size, length and grade. If in doubt, refer to parts manual for specifications.
- Do not interchange Grade-5 fasteners with Grade-8 fasteners and vice versa, refer to Figure 6-1 for identification.
- Use Grade-8 nuts with Grade-8 bolts.

Note Use Grade-2 nuts with Grade-5 bolts. Grade-2 nuts do not have any grade markings.

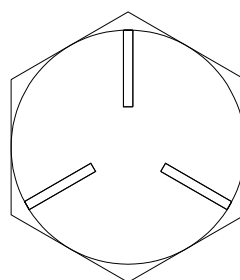
- Use hardened flat washers under head of screws and under each nut of bolts and studs.
- Make sure threads are clean and free of burrs.
- Use a torque wrench that is properly calibrated. Check calibration of torque wrench on a regular basis.
- Torque fasteners to proper torque values shown on drawings in crane's parts manual.



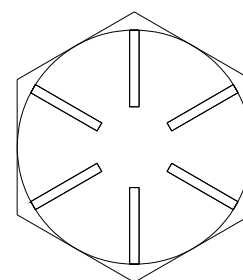
Special Socket
Head Bolt or Screw
Has no marking



Grade 8 Nut
6 Radial lines



Grade-5 Bolt or Screw
3 Diagonal lines in head



Grade-8 Bolt or Screw
6 Diagonal lines in head

Figure 6-1 Fastener Grade Markings

Table 6-1 Fastener Torque Values

Item No.	Description	Size	Torque (ft-lbs)	
			Grade	
1	Pump Mounting Screws	1/2-13 UNC	5	55
2	Subframe Mounting Stud	1 1/4-7 UNC	Special	840
3	Subframe Clamp Locknut	5/8-11 UNC	5	110
4	Slewing Ring Bolts	1-8 UNC	Special	820
5	Swing Reducer Motor Screws	1/2-13 UNC	5	55
6	Swing Reducer Mounting Screws	3/4-10 UNC	8	280
7	Winch Mounting Bolts	3/4-10 UNC	8	280
8	Winch Motor Mounting Screws	1/2-13 UNC	5	55
9	Telescope Cylinder Mtg Bracket Screws models 5096S, 50110S	7/8-9 UNC	Special	550
		3/4-10 UNC	Special	350
10	Pin Retaining Screws	5/8-11 UNC	5	110

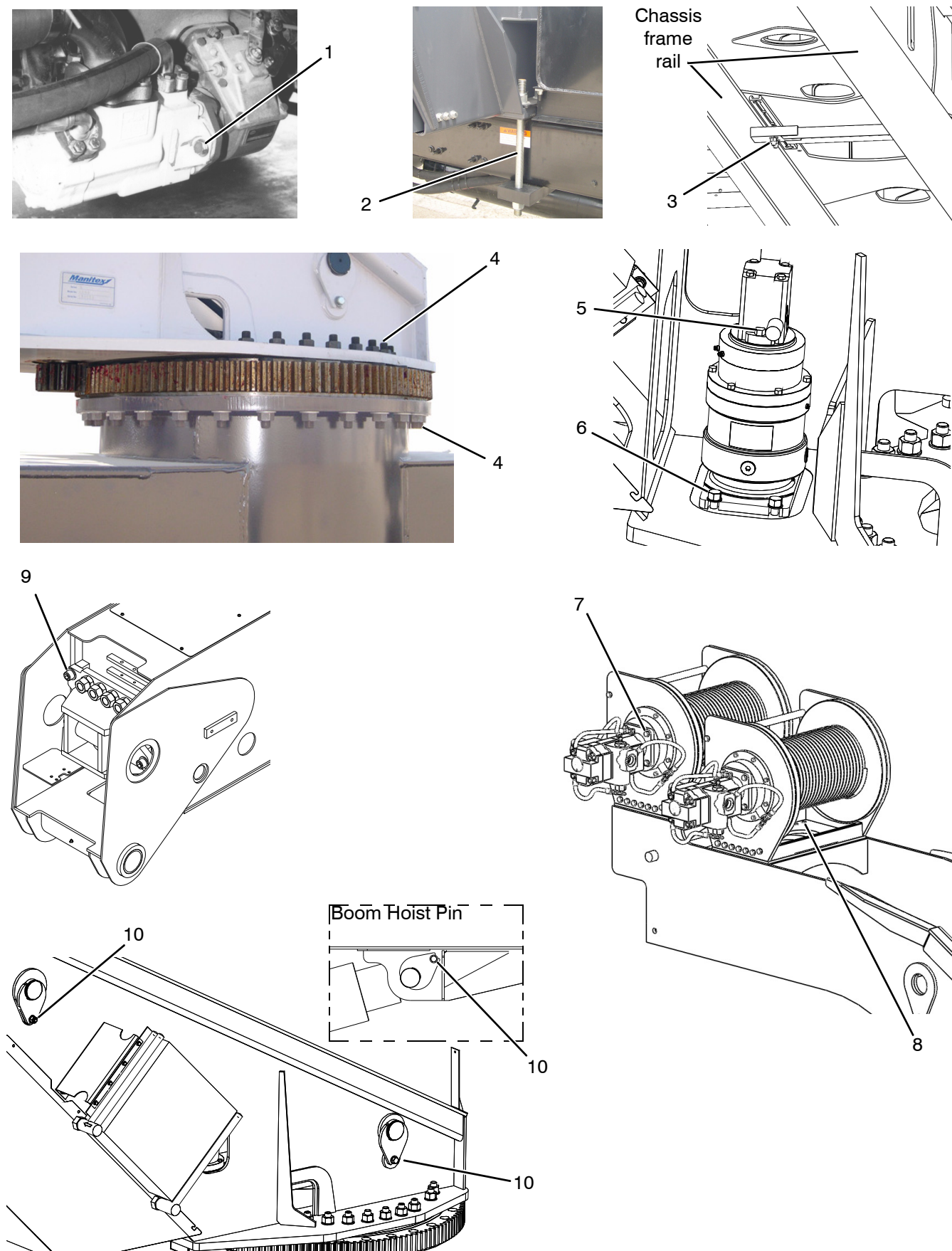


Figure 6-2 Fastener Locations

Maintenance Checks

General

The following is a list of safety and preventive maintenance checks that should be made to maintain the safety, dependability and productivity built into the crane.

Inspection Intervals

The intervals given are provided as a guide only. Follow these intervals until adequate experience is gained to establish intervals that meet your operating conditions.

Any increase or decrease in the intervals should be preceded by a complete analysis of crane performance. Carefully study previous maintenance and repair records before making any changes in the intervals.

Records

Dated and signed records of all defects and repairs must be kept on file so future maintenance needs can be accurately forecast.

Repairs

Any hazardous or abnormal conditions found while making the maintenance checks must be corrected **before the crane is placed back into service**. All adjustments and repairs must be made by authorized personnel only.

Note Maintenance checks that require the engine to be running and the Power Take-Off (PTO) to be engaged are identified with a ✓.

CAUTION

Take every precaution to prevent injury from moving parts when power is on.

Daily Checks

- Perform the daily lube services.
- Clean all debris and dirt from the crane.
- Check for fluid and air leaks.
- Verify all guards, covers, and platforms are securely in place.
- Inspect the crane for signs of damage.
- Inspect the wire rope for signs of wear and damage.
- Check the wire rope for proper spooling on the winch drum and reeving through all sheaves. Check that all sheaves turn freely.
- Make sure the load line is properly fastened to the load block or the overhaul ball.
- Check the load block or the overhaul ball whichever is being used, for loose or missing nuts, screws, and cotter pins. Observe during operation for indications of inadequate performance.
- Check all slings and other loose gear to be used to make lifts are safe for operation.
- Inspect the hook latch for proper operation.
- Check that the Capacity Chart is present at each control station.
- Perform all daily inspections according to the prime mover and PTO manufacturers' specifications.
- ✓ ■ Test the Load Moment Indicator (LMI) (if equipped).
 - Refer to Pre-Operation Inspections section in the PAT LMI System Operator's Handbook for daily check routine to be performed. The PAT LMI Operator's Handbook is part of the package issued with the crane.
- ✓ ■ Test the anti-two-block/overload warning horn.
 - Start the truck engine and engage the PTO.
 - Lift the anti-two-block weight by hand so the chain is slack.
 - The warning horn should sound and the Winch Up, Telescope Out and Boom Down functions should be inoperable.
 - Release the weight so it hangs freely. The warning horn should go off and all crane functions should be operable.

✓ ■ Test the overload warning system.

- Identify a known load and a near overload radius for the load from the capacity chart. Lift and luff the load to the determined radius. The overload warning horn and shutoff device should sound. The Winch Up, Telescope Out and Boom Down functions should be inoperable. Refer to PAT LMI Operator Handbook for further instructions.

Note The crane may simulate an overload condition when the boom is raised to 80° and hydraulic pressure is allowed to build on the extend side of the hydraulic cylinder. To lower the boom from this position, do the following.

1. Press the override button and lower the boom. The warning buzzer will stop sounding once the boom has lowered a few degrees.
2. Release the override button and continue to lower the boom to the desired angle.

✓ ■ Check for proper operation of the engine and PTO.

✓ ■ Check for proper operation of all accessory devices such as horn, start/stop switch and so forth.

✓ ■ Check for proper operation of each crane function in response to control lever movements.

Note All crane controls, when set to *Off* or returned to the *Neutral* position, must bring the crane function to a complete stop and maintain its position.

Note Exception to above note; cranes equipped with the free swing feature are not held in position by the swing function when the control is returned to the neutral position. The crane operator must apply the swing brake using the foot brake to stop the swinging motion completely, then set the swing brake switch to maintain the crane in position.

- Remove all rust, corrosion, and dirt from the oil cooler core to ensure proper heat transfer. Steam clean the core, if necessary.

Note The oil cooler fan comes on only when the temperature of the hydraulic oil rises to 120°F.

Weekly Checks

- Perform the daily and weekly lube services.
- Perform the daily inspection checks.
- Check all mechanical control linkage for excessive wear and binding; oil the linkage as required.
- Clean the vent plug on the winch.
- Check for missing bolts, pins, keeper plates, retaining rings, and cotter pins.
- Check the winch drum and all sheaves for excessive wear, cracks or other damage.
- ✓ ■ Check the boom angle indicators and readout on the LMI, if equipped, for accuracy over the full range of boom elevation.
- ✓ ■ Check LMI, refer to separate PAT LMI Operator's Handbook weekly check routine to be performed.

Monthly Checks

- Perform the daily, weekly and monthly lube services.
- Perform the daily and weekly maintenance checks.
- Check the boom and all structural components of the crane for deformed, cracked or corroded members. Pay close attention to all welds.
- Clean, prime and paint any rusted surfaces.
- Thoroughly inspect the wire rope for damage.
- Check that the hook and hook housing on the load block and the swivel on the overhaul ball rotate freely without excessive play. Faulty operation indicates faulty bearings or inadequate lubrication.
- Check the load block or the overhaul ball for signs of overloading; spread side plates, elongated holes, bent or elongated tie bolts, and cracks.
- Check the gap between the shank and the barrel of the swivel on the overhaul ball. The gap must not exceed 1/16 inch.

- Carefully check the hook on the load block or the overhaul ball for signs of distortion or cracks.

NOTICE

Hooks are to be discarded if cracks exist or if throat opening is 15 percent more than original throat opening. Hooks should also be discarded if bent or twisted more than 10° from plane of normal configuration.

- Check that the wire rope clip is tight at the dead end wedge socket.
- Inspect all electrical wiring and devices for malfunctioning, signs of deterioration, and dirt or moisture accumulation.
- Inspect all hydraulic hoses and tubes for the following.
 - Evidence of excessive scrubbing or abrasion on the outer surface of hoses, tubing, and fittings.
 - Dented, kinked or cracked tubing.
 - Evidence of leakage at the surface of hoses caused by blistering or abnormal deformation of the outer cover.
 - Leakage at threaded, clamped or welded connections.
- ✓ ■ Check the hydraulic pumps and motors for the following.
 - Loose bolts or fasteners.
 - Leaks at joints between sections.
 - Shaft seal leaks.
 - Unusual noise and vibration.
 - Loss of operating speed or pressure.
 - Excessive heating of the oil.
- Check the hydraulic valves for the following.
 - Cracks in the valve housings.
 - Leaks at the spools or between the sections.
 - Sticking spools.
- Check the hydraulic cylinders for the following.
 - Drift caused by internal leakage.
 - Rod seal leakage.
 - Leaks at welded joints.
 - Scored, nicked or dented cylinder rods.
 - Dented case (barrel).
 - Loose or deformed rod eyes or connecting joints.
- Check that all nameplates and safety decals are readable and securely attached at the proper locations on the crane.
- Check all control levers for proper adjustment.
- ✓ ■ Check the foot throttle settings for the proper engine speed.

Semiannual Checks

- Perform the daily, weekly, monthly and semiannual lube services.
- Perform the daily, weekly, and monthly maintenance checks.
- Tighten all fasteners on the crane. Tighten those fasteners that require torquing to the specified value, including slewing ring bolts.
- ✓ ■ Check the adjustment of the crowd rope system in the boom.
 - Check the boom slider pads for wear and proper adjustment.
- ✓ ■ Check relief valve settings for all crane functions, refer to Hydraulic Schematic.

Annual Checks

- Perform all lube services.
- Perform the daily, weekly, monthly and semiannual maintenance checks.
- Check each hook for cracks using a nondestructive test.
- ✓ ■ Check the Foot Air Throttle controller for correct settings, operating performance and leakage. Replace rubber and all worn parts as needed.

Wire Rope Maintenance

Lubrication

New wire rope is lubricated during manufacturing, however, this lubrication is adequate only for initial storage and the early stages of operation. The wire rope must be lubricated at regular intervals to prevent the damaging effects of corrosion and to reduce wear.

The lubrication interval and the type of lubricant to be used depend on the type of wire rope, the severity of duty and the type of corrosive elements the wire rope is subjected to, therefore, contact the nearest wire rope dealer for lubrication recommendations.

The wire rope must be properly protected at all times. The gaps between the strands and wires must be filled with lubricant to provide a complete seal. Use one of the methods shown in Figure 6-3 to lubricate the wire rope. For maximum penetration, the lubricant should be applied where the wire rope opens up as it travels around a sheave or winds onto the drum.

The wire rope must be clean and dry before applying the lubricant. An air jet, steam, and a wire brush are some suggested cleaning methods.

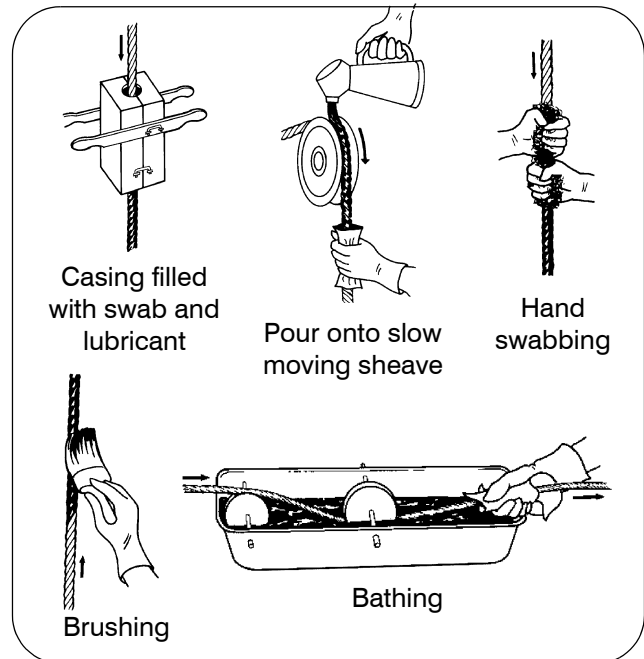


Figure 6-3 Lubricating Wire Rope

Inspection

It is impossible to predict when a wire rope will break, however, regular careful inspection will indicate when the potential for breakage exists.

The wire rope needs to be visually inspected each work shift for obvious signs of gross damage by a qualified person.

Each month, the entire length of wire rope must be thoroughly and carefully inspected by a qualified person. This interval also applies to any rope being placed into service that has been idle for one month or longer.

A dated and signed report of the wire rope's condition at each inspection interval must be kept on file at all times. The data from these reports can then be used to determine when the wire rope needs to be replaced.

When inspecting the wire rope, pay particular attention to the condition of the wire rope in the following areas.

- **Pick-Up Points**—sections of wire rope that are repeatedly stressed during each lift, such as those sections in contact with sheaves.
- **End Attachments**—the point where a fitting is attached to the wire rope or the point where the wire rope is attached to the drum.
- **Abuse Points**—points where the wire rope is subjected to abnormal scuffing and scraping.

Replacement

No precise rules can be given for determining when to replace a wire rope. Wire rope replacement depends upon the good judgment of the qualified person making the inspection and the comparison of the data recorded on previous inspection reports. Any deterioration resulting in an appreciable loss of wire rope strength is sufficient cause for removing the wire rope from service.

Guidelines for replacement are listed in the following paragraphs.

- Six randomly distributed broken outer wires in one rope lay length or three broken outside wires in one strand of one rope lay length. Refer to Figure 6-4.
- One broken outside wire at the point the wire contacts the core. The broken wire will have worked its way out of the rope structure and either protrude or loop out from the rope structure. Additional inspection of this area of the wire rope is required to determine if there is core damage
- Wear of one-third the original diameter of outside wires.
- Kinking, crushing, bird-caging, core protrusion or any other damage resulting in distortion of the rope structure.
- Evidence of heat damage from any cause.
- Reductions from the nominal diameter of more than the following limits.
 - 1/64 Inch for rope diameters through 5/16 inch.
 - 1/32 Inch for rope diameters 3/8 inch through 1/2 inch.
 - 3/64 Inch for rope diameters 9/16 inch through 3/4 inch.
 - 1/16 Inch for rope diameters 7/8 inch through 1-1/8 inch.
 - 3/32 Inch for rope diameters 1-1/4 inch through 1-1/2 inch.

Note Measure the wire rope diameter only across the crowns of the strands so the true diameter is measured as shown in Figure 6-5.

- Core failure. This type of damage is usually indicated by a reduction in the nominal diameter or by an increase in rope lay length. When a reduction in diameter or an increase in rope lay length is noted, open up the wire rope as shown in Figure 6-6 and carefully inspect the core. The wire rope should be replaced if any wires in the core are broken.
- Severe corrosion.

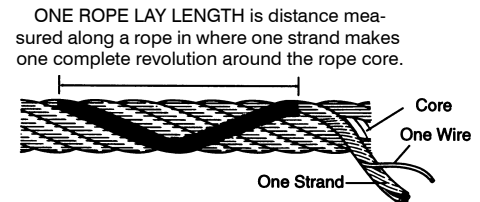


Figure 6-4 Rope Lay Length

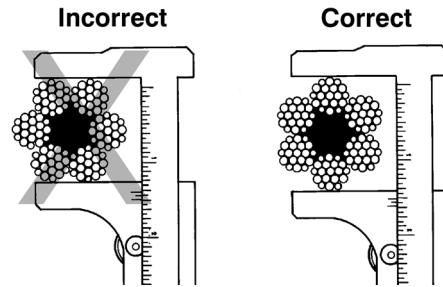


Figure 6-5 Measuring Wire Rope Diameter

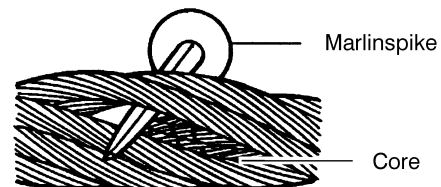


Figure 6-6 Wire Rope Core Inspection

Sheave and Drum Inspection

Proper operation of the sheaves and the winch drum has a direct affect on wire rope wear; therefore, the sheaves and winch drum must be inspected monthly for the following defects.

- Check the depth, width, and contour of each sheave using a groove gauge as shown in Figure 6-7. Replace sheaves that have over or undersized grooves.
- Replace the winch drum or any sheave that has broken or cracked flanges.
- Check that the winch drum and all sheaves turn true on the shafts. If the drum or any sheave has a wobble to it, replace the bearings.

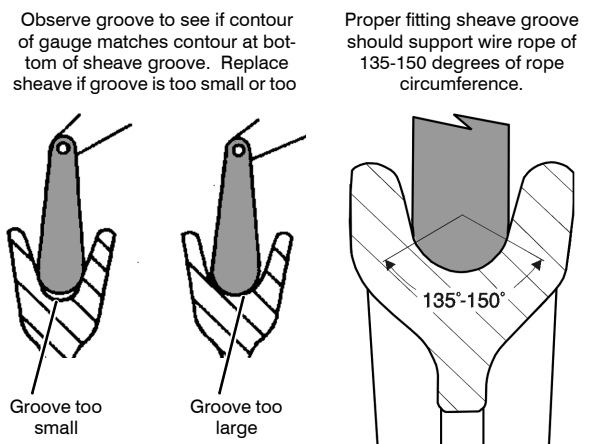


Figure 6-7 Sheave Inspection Measurement

Replacing Hydraulic Filter Element

Refer to Figure 6-8.

Replace the filter element when the pressure gauge on the head reads 25 psi with the engine at high idle and the oil warm from operation. The filter has a 25 psi bypass that opens when the element is plugged with dirt.

NOTICE

Do not operate crane when filter is bypassing oil (gauge reads 25 psi); otherwise, unfiltered oil will be drawn into system and faulty operation or damage to parts will occur.

- Stop engine.
- Remove and discard the old element.
- Wipe clean the base of the filter head.
- Apply clean oil to the gasket on the new element.
- Thread the new element onto the head until the gasket contacts the head. Hand tighten the element an additional 3/8-1/2 turn. Do not use a wrench to tighten element.
- Check the element for leaks during operation. If necessary, tighten the element until the leak stops.

Replacing Hydraulic Tank Breather

Note If equipped with a spin-on breather, replace it at least once every three months. Do not attempt to clean and reuse the breather.

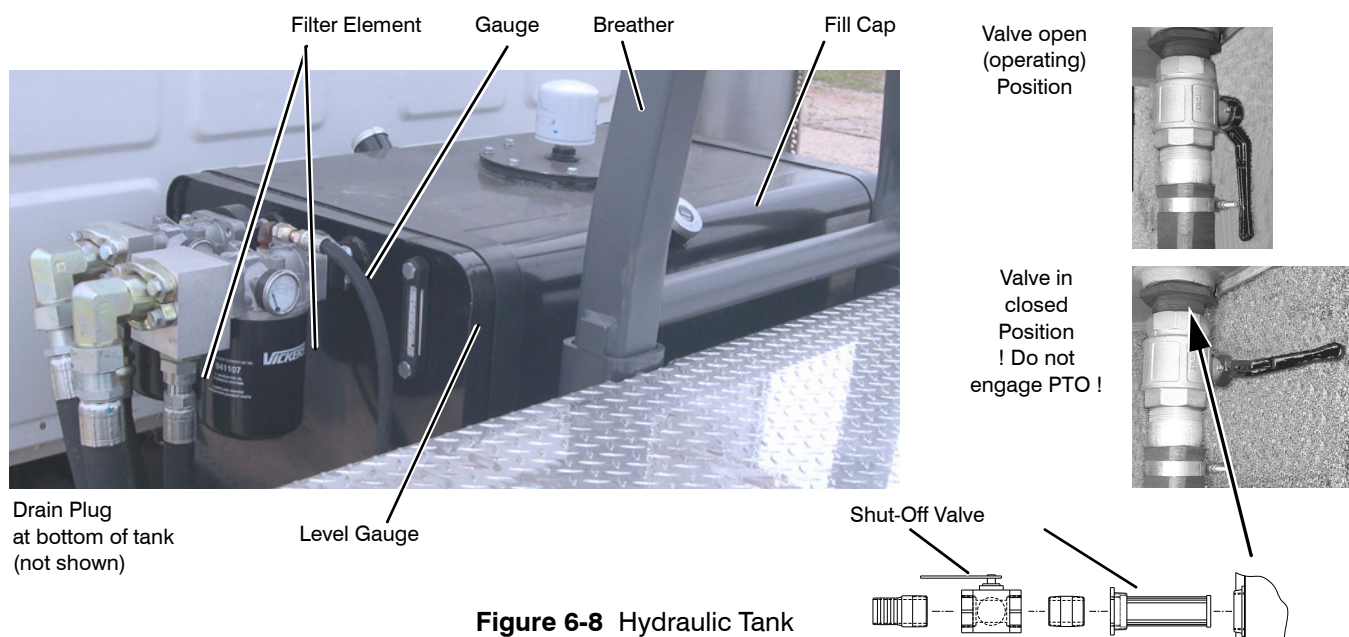


Figure 6-8 Hydraulic Tank

- Remove and discard the old breather.
- It is not necessary to apply thread sealant to the threads of the breather. Install the new breather hand tight; do not tighten with a wrench.

Changing Oil

Drain and refill the hydraulic system every six months unless an alternate interval has been established by an oil analysis program.

- Operate the crane until the oil is at its normal operating temperature. This step will help prevent impurities from settling in the system.
- Move all controls to OFF and stop engine.
- Remove the drain plug from the bottom of the tank to drain the oil, see Figure 6-8.

Note Crack open one of the hydraulic fittings in a line at the high point of the system. This step will vent the system so that all of the oil drains out. Tightly close fitting once oil has drained.

- Thoroughly clean all dirt from the access cover on the tank and remove the access cover.
- Clean out any sediment from inside the tank.
- Remove and clean the suction strainer. Soak in solvent and blow out with compressed air. Securely install the strainer.
- Replace the cover on the hydraulic tank. Replace gasket if necessary.
- Replace the filter element
- Replace the spin-on breather.
- Clean any metal particles from the drain plug. Install and securely tighten the drain plug.

Note If a new pump or motor has been installed, fill all ports with clean oil before connecting any lines. This step will provide initial lubrication of the unit.

- Fill the hydraulic tank to the proper level with approved hydraulic oil, see Lubrication Section.

NOTICE

Filter new oil through a 25-micron element when filling tank.

- Connect and securely tighten any hydraulic lines that are disconnected.
- Open suction line shut-off valve before starting engine or engaging PTO; otherwise, the pump will cavitate and be ruined. See Figure 6-8.
- Start the engine, engage the PTO, and operate the pump for at least two minutes with no load at lowest possible rpm. During this priming period, the pump should run smoothly and not develop excessive heat.
- Gradually increase speed and operate all functions (cylinders and motors) to purge all air from the system. Operation will be sluggish or erratic until all air is purged.
- Once the functions are operating smoothly, speed and loading can be increased to normal.
- Stop the engine.
- Fill the hydraulic tank to the proper level.

NOTICE

If hydraulic system is extremely dirty (gum or lacquer formation on parts indicated by jerky, sluggish, or erratic operation) repeat Changing Oil procedure after next 48 hours of operation.

Adjusting Levels

Check the adjustment of the bubble levels on the operator console and at the outrigger valve location every month using the following procedure.

- Extend all outriggers and level the crane using the level gauge located next to the outrigger control valve (factory mounted on the subframe behind the front left outrigger).
- Raise the boom to the maximum angle of 80° and fully retract the boom.

CAUTION

Do not swing boom over either side of truck until this step has been performed; otherwise, crane may tip over.

- Place an accurate carpenter's level on either side of the turret, see Figure 6-9. Do not lay the level across the top of the bolts.
- Adjust the outriggers so the crane is level from front to rear according to the carpenter's level.
- Swing the boom 90° over either side of the truck and adjust the outriggers so the crane is level from side to side according to the carpenter's level.
- Repeat Adjusting Levels procedure until the crane is level with all tires off the ground.
- Check the bubble level at the outrigger control station and at the operator console. If necessary, adjust the levels as follows.

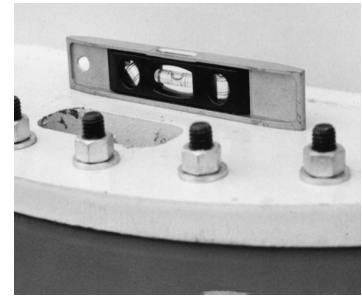


Figure 6-9 Carpenter Level

Note Verify the spring washer is installed correctly. The cone shaped washer should be installed with the large diameter bearing against the bubble level. If not installed correctly, the spring will not spring back into shape when the fasteners are loosened.

- ❑ Loosen adjusting screws, see Figure 6-10, until spring under level is no longer compressed.
- ❑ Preload spring by tightening adjusting screws evenly. Do not over-tighten as this will cause loss of adjustment range.
- ❑ Turn adjusting screws until the bubble is centered in the circle.

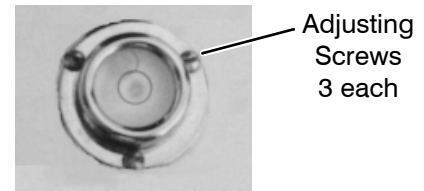


Figure 6-10 Bubble Level

Boom Service

Recommended Boom/Slider Pad Break In

Frequent lubrication of the top rear boom slider pads and bottom plate of the powered boom sections is required during machine break in to prevent boom chatter and slider pad damage. As the slider pads seat against the boom shims and sliding surfaces, it is important to check all related slider pad fasteners for proper torque on regular intervals.

Note Loctite-242 or equal thread lock is used on all of the top rear and most of the bottom forward slider pad fasteners. If loose hardware is found, re-application of thread lock is required. Follow manufacture's recommendations to ensure best results.

Frequency of lubrication and duration of break in period will vary depending on use. In normal use, the boom slider pads should be lubed daily for the first two weeks and at least once a week after that. More frequent lubrication will be required on job sites requiring frequent extension and retraction of the boom. Chattering or jerking of the boom indicates more frequent lubrication is required. Lubrication intervals will become less frequent as the unit breaks in. The duration of the break in period is approximately 2-3 months.

Inspection Intervals

The daily, weekly, semi-annual and annual Maintenance Checks discussed earlier in this chapter also apply to the boom assembly when boom components are accessible. Inspection of boom internal components is not covered in the Maintenance Checks topic because this would entail a major service procedure requiring boom disassembly.

There is no definitive rule regarding how often a boom should be disassembled specifically for inspection purposes. During the service life of a crane, events will take place that will dictate when a boom must be disassembled for service. When a boom is disassembled for repair in such instances, Manitex recommends that boom components be inspected thoroughly before re-assembling them onto the boom.

EVENTS THAT GENERALLY DICTATE BOOM DISASSEMBLY:

- ❑ Problems that become evident during daily crane inspection that can be attributed to internal boom components and cannot be addressed without disassembling the boom.
- ❑ Replacement or major repair of telescope cylinder due to failure or leaks (internal or around rod seal).
- ❑ Excessive lateral movement of the middle sections; evident when the boom is telescoped and the fault can be attributed to the rear side slider pads.
- ❑ Failures of internal boom components, such as extend or retract ropes, extend or retract sheaves.
- ❑ Boom section failure.
- ❑ Crane electrocution.

Note When inspecting crowd ropes, refer to instructions regarding wire rope maintenance in this section for guidelines regarding Lubrication, Inspection and Replacement.

NOTICE

If no events have taken place for a significant period of time that warrants boom disassembly, Manitex has on occasion recommended a complete boom inspection after the boom's 5th operating anniversary. However, it is the responsibility of the crane owner, operator or service personnel to recommend this level of inspection when such personnel are aware of information that warrants boom disassembly. This should take into account, but not limited to:

- ☐ Knowledge of deficiencies not perceived in the routine maintenance and inspection procedures performed by others.
- ☐ Knowledge of crane abuse or overload.
- ☐ Knowledge of conditions that could be perceived as a safety hazard.
- ☐ Acquisition of equipment that has no service records where routine inspection gives cause for concern.

Alternatively, the crane owner, operator or service personnel may at their discretion, extend the full inspection beyond the 5th anniversary period when knowledge of the condition of the crane is favorable due to its limited use or service history.

INSPECTION OF INTERNAL BOOM COMPONENTS

When the boom is disassembled for inspection or repair, the following services shall be performed:

- ☐ Inspect all slider pads for wear or damage. Replace the slider pads if they have worn down to the Replace Thickness given in Table 6-2 in this section.
- ☐ Inspect all bearings for wear. The sheaves must turn true on the shafts without any wobble.
- ☐ Inspect the extend and retract ropes for wear and damage; see Wire Rope Maintenance in this section for maintenance, lubrication and replacement instructions.
- ☐ Inspect the sheaves for wear and damage; see Sheave and Drum Inspection in this section.

Slider Pad Inspection and Lubrication

BOTTOM FORWARD AND SIDE PADS:

With the crane properly set up on outriggers and leveled, fully extend the boom over rear of the unit and lower the boom point to the ground while insuring the hook is kept close to the ground while lowering. Apply extreme pressure (EP) chassis lube lubrication to the sliding surfaces of the powered sections. Manitex recommends using a 2"-3" nap roller to apply a thin film of lubrication. Refer to figure 6-13.

Inspection and lubrication of internal lube points in the boom can be performed at this time as well; refer to Figure 3-1 in section 3 of this operator's manual for table of lubrication points.

Use the boom hoist function to raise the boom to 65-75° and fully retract the boom. Retracting the boom from low boom angles will scrub the lubrication from the powered sections.

TOP REAR PADS:

⚠ DANGER

Do not place hands or tools into openings in boom sections until engine or prime mover is shut OFF. Keep arms, hands, and fingers away from moving boom components. Ensure the prime mover is shut-down when servicing the boom. Serious injury will result if boom is telescoped while hands are in openings.

With the boom in the boom rest, remove the inspection cover from the top of the boom base. There are up to four sets of top rear slider pads. Inspect each slider pad for loose hardware and shims. Apply a ½" thick coating of extreme pressure grease to the pads of each section with a spatula or similar tool. The boom will have to be extended slowly to bring each set of slider pads into view in the access area for inspection and lubrication. Refer to figure 6-12.

Raise the boom to 65-75° and fully extend the boom to carry lubrication up inside the powered sections.

Slider Pad Adjustment/Replacement

Refer to the Boom Assembly drawings in the crane's Parts Manual for identification of slider pads and shims used with the crane being serviced.

Shims are matched to slider pads and are not interchangeable. It is possible to have more shims on one side of the boom than on the other side, as long as the boom is straight. Shims come in three thicknesses.

0.0478-inch (3/64-inch) (18 ga)

0.0747-inch (5/64-inch) (14 ga)

0.1345-inch (9/64-inch) (10 ga)

Table 6-2 Boom Slider Pads

Size and Description		Location	New Thickness	Replace Thickness
7-Inch Pad	2-Hole with Threaded Insert	A	3/8 Inch	5/16 Inch
7-Inch Pad	2-Hole with Threaded Insert	B	1/2 Inch	3/8 Inch
7-Inch Pad	2-Hole with Threaded Insert	C	1 Inch	3/4 Inch
9-Inch Pad	2-Hole with Threaded Insert	D	1/2 Inch	3/8 Inch
9-Inch Pad	3-Hole	E	1/2 Inch	3/8 Inch

Visual verification of pad size used is required; table is for reference only, refer to Boom Assembly drawings in Parts Manual before ordering parts for boom service.

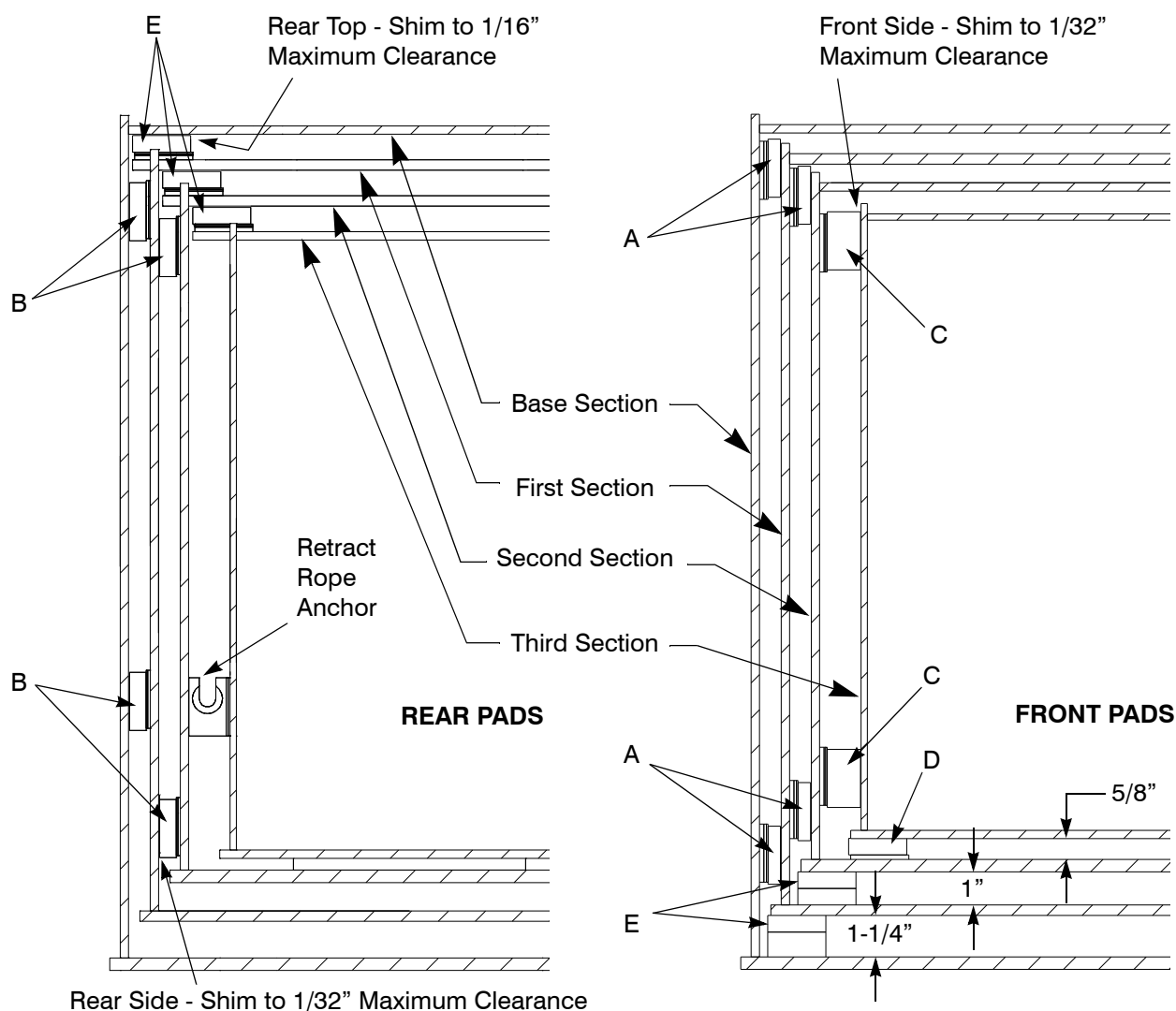


Figure 6-11 Boom Slider Pad Locations

Rear Top Slider Pads

Refer to Figures 6-11 and 6-12.

- Remove the access cover from the rear of the boom base.
- Retract the boom so rear top slider pads on the last section line up with the access holes in the rear of the boom.
- Stop engine.
- Measure the thickness of the slider pads. Replace both slider pads if either has worn to the dimension given in Table 6-2.
- Measure the clearance between rear top slider pads and the adjacent section.
- If necessary, loosen the mounting screws and add shims under the slider pads to provide the clearance given in Figure 6-11.
- Securely tighten the mounting screws to the torque specifications on the appropriate boom assembly drawing after the shims are installed.
- Repeat procedure for each section.

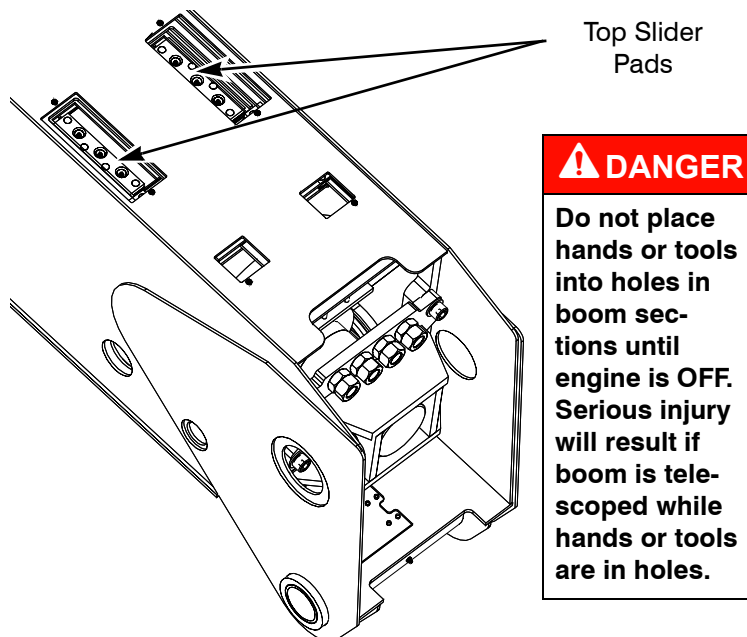


Figure 6-12 Rear Top Slider Pads (cover removed)

Front Side Slider Pads

Refer to Figure 6-11 and 6-13.

Note Rear side slider pads can only be replaced and adjusted when the boom is disassembled.

- Extend the boom approximately 36 inches.
- Stop engine.
- Measure the thickness of front side slider pads. Replace all of the front side slider pads for the respective section if any front side slider pad has worn down to the thickness given in Table 6-2.
- Fully extend the boom and stop engine.
- Adjust the sections from side to side so the boom is as straight as possible. If necessary, add shims behind the front side slider pads to keep the boom straight.
- Securely tighten the mounting screws to the torque specifications on the appropriate boom assembly drawing after the shims are installed.

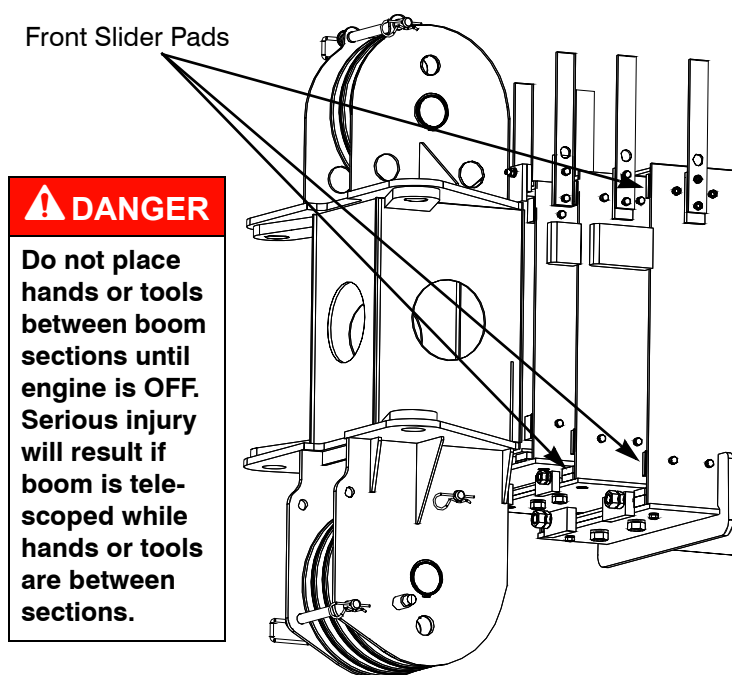


Figure 6-13 Front Side and Bottom Slider Pads

NOTICE

End of mounting screws for front side slider pads must not rub against adjacent section. If necessary, install washers under head of mounting screws so screws fully engage nuts in slider pads, but do not rub against section.

Front Bottom Slider Pads

See Figure 6-11 and 6-13.

- Extend the boom approximately 36 inches.

- Stop engine.
- Measure the thickness of front bottom slider pads. Replace both front slider pads for the respective section if either slider pad has worn to the dimension given in Table 6-2.

Note It will be necessary to lift the ends of the sections with a hoist to remove and adjust the front bottom slider pad. Front bottom slider pads are fastened to mounting pads, therefore, the mounting pads must be removed to gain access to the slider pads. Be sure to re-adjust extend and retract ropes after replacing the mounting pads between the base and first sections.

- Measure the clearance between the sections. If necessary, add shims under the front bottom slider pads to provide the clearance given in Figure 6-11.
- Securely tighten the mounting screws to the torque specifications on the appropriate boom assembly drawing after the shims are installed.

Crowd Rope Adjustment

Adjustment of the crowd ropes may be desirable when the boom is not properly synchronized. To inspect for proper synchronization, retract the boom completely and observe the following characteristics:

- All powered sections must come to a complete stop at the same time, visually observe movement of each section during the retraction of the boom, also listen for multiple sounds as the boom sections stop against each other.
- All stop pads at the front of the boom shall be in contact with the adjacent section when the boom is fully retracted.

Proper boom synchronization can be achieved by turning the adjustment nuts at the end of the extend and retract ropes. Use Table 6-3 to determine the number of turns the adjusting nut should be moved to move the corresponding boom section approximately 1/8 inch. For example, if the rope being adjusted has an adjusting nut of 7/8 inch, then 3-1/2 turns will move the corresponding section 1/8 inch.

Table 6-3 Crowd Rope Adjustment

Adjusting Nut Size	Number of Turns	Distance Section Moves
9/16 Inch	3	1/8 Inch
7/8 Inch	3-1/2	1/8 Inch
3/4	2-1/2	1/8 Inch
1-1/4 Inch	1-3/4	1/8 Inch
<i>Note</i> Extend and retract ropes have wrench flats to hold the ropes stationary while tightening the nuts.		

1. Remove the access cover from the top of the base section at rear.

DANGER

Do not place hands or tools into any opening in boom sections while power is on or boom sections are moving.

Note If locking nuts bottom out on threaded cable adjustment ends on both the extend and retract cables (no threads remain before adjustment dimension or torque can be obtained) cables are stretched and need to be replaced.

Note Always replace cables for each boom section in sets, i.e. all third and second section extend cables or all third and second section retract cables.

2. Loosen the adjusting nut and the lock nut on each extend rope (**D**) and on retract ropes (**E**) so the ropes are slack, see Figure 6-15.

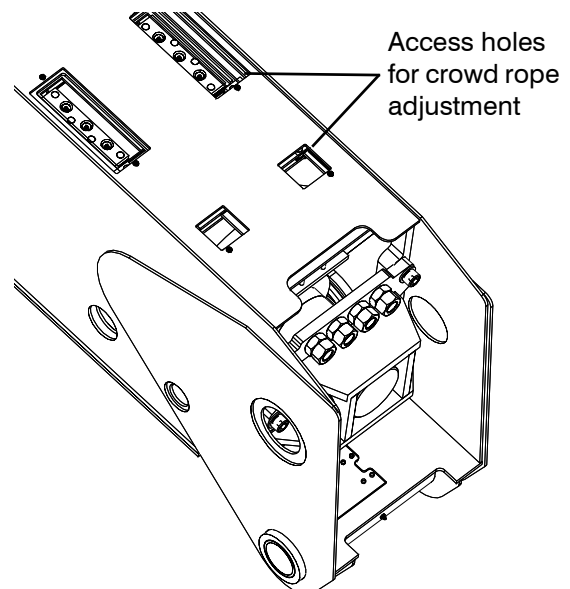


Figure 6-14 Access Cover Removed

3. Cycle the boom, extend to about 6 feet and retract two or three times. Listen for any cables hitting the inside of the boom sections, this indicates slack in the cables.
4. Extend the boom so extend ropes (**F**) are accessible through the access hole at the rear (top) of the base section and stop engine. Back off the lock nuts and tighten the adjusting nut on the loosest rope until both sets of ropes (left and right side) are tensioned equally.
5. At the front of the boom, tighten the adjusting nut equally on each retract rope (**G**) until all slack in each cable is removed.
6. Tighten the adjusting nut on each extend rope (**D**) until the distance from the end of each rope to the mounting plate is about 2 1/2 inches.
7. Fully extend the boom and stop engine.
8. Visually inspect the tension of each extend rope (**D**) through the access hole at the rear (top) of the base section. Tighten the adjusting nut on the loosest rope until all four ropes are tensioned equally.
9. Fully retract the boom while watching the third and second sections, observe whether the third section Stop contacts the second section at location (**C**) before Stop at location (**B**) comes in contact with the first section.
10. Extend the boom approximately six inches and repeat previous step as slowly as possible. Release the telescope lever to OFF as soon as the third or second section stops, whichever occurs first.
11. Determine the remaining stroke to fully retract the boom, as follows:
 - If the third section stopped first, measure the remaining stroke (gap) between the end of the first section and the Stop at location (**B**).
 - If the second section stopped first, measure the remaining stroke (gap) between the end of the second section and the Stop at location (**C**).
12. If the remaining stroke is greater than 1/8-inch, proceed as follows.
Note Refer to Table 6-3 for number of turns necessary for each size of threaded stud on the ropes.
13. Extend the boom until ropes (**F**) are accessible through cut-out on top of boom and stop engine.
 - If the third section stopped first:
 - ☐ Loosen the adjusting nut on each retract rope (**E**) the correct number of turns for each 1/8 inch of remaining stroke.
 - ☐ Tighten the adjusting nut on each extend rope (**F**) the correct number of turns for each 1/8 inch of remaining stroke.
 - If the second section stopped first:
 - ☐ Loosen the adjusting nut on each extend rope (**F**) the correct number of turns for each 1/8 inch of remaining stroke.
 - ☐ Tighten the adjusting nut on each retract rope (**E**) the correct number of turns for each 1/8 inch of remaining stroke.
 - Repeat previous steps until the remaining stroke is 1/8 inch or less.
14. Fully retract the boom while watching the second and first sections, observe which section stops first.
15. Extend the boom approximately six inches and repeat previous step as slowly as possible. Release the telescope control lever to OFF as soon as the corresponding section stops.
16. Determine the remaining stroke to fully retract the boom as follows:
 - If the second section stopped first, measure the remaining stroke (gap) between the end of the base section and the Stop at location (**A**).
 - If the first section stopped first, measure the remaining stroke (gap) between the end of the first section and the Stop at location (**B**).
17. If the remaining stroke is greater than 1/8 inch, proceed as follows.
 - Extend the boom approximately six feet and stop engine.
 - If the second section stopped first.
 - ☐ Loosen the adjusting nut on each retract rope (**G**) the correct number of turns for each 1/8 inch of remaining stroke.

- ❑ Tighten the adjusting nut on each extend rope (**D**) the correct number of turns for each 1/8 inch of remaining stroke.
 - If the first section stopped first.
 - ❑ Loosen the adjusting nut on each extend rope (**D**) the correct number of turns for each 1/8 inch of remaining stroke.
 - ❑ Tighten the adjusting nut on each retract rope (**G**) the correct number of turns for each 1/8 inch of remaining stroke.
 - Repeat previous steps until the remaining stroke is 1/8 inch or less.
18. Replace all locking nuts and tighten against adjusting nuts.
 19. Cycle the boom two or three more times and check that all boom sections are properly synchronized per the above instructions. If not, check which sections require readjustment and perform the proper adjustment procedure for those sections.
 20. Repeat until the boom is properly synchronized.
 21. Re-install the access cover on the base section.

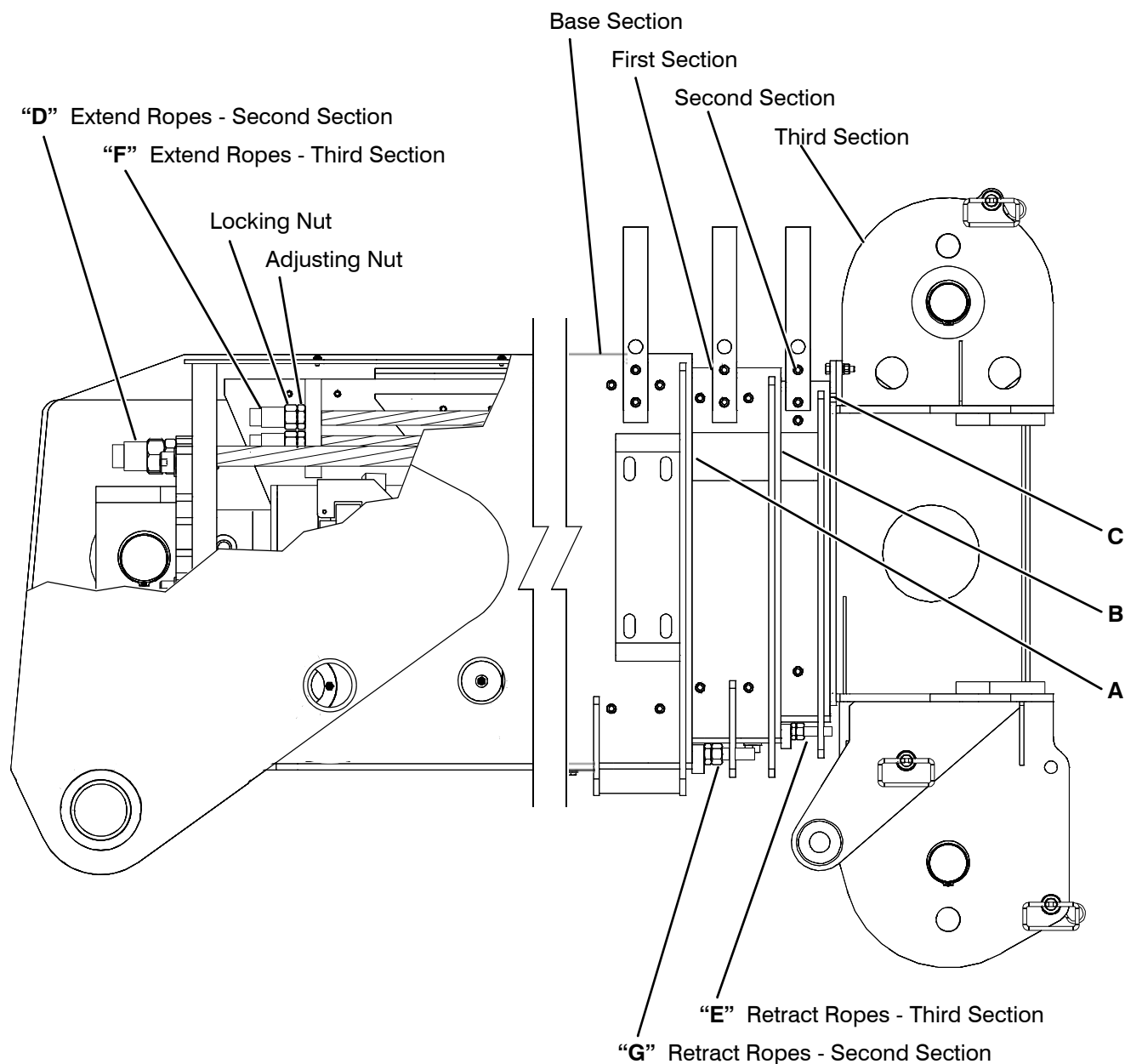


Figure 6-15 Extend and Retract Crowd Ropes

Chapter 7

Hydraulic System Troubleshooting

General

The following troubleshooting information is provided as a general guide to identify, locate and correct problems that may be experienced with the hydraulic system of this crane.

It is expected that all troubleshooting and testing will be performed by a qualified hydraulic technician.

Troubleshooting Steps

A good troubleshooting program should include the following steps.

■ Know the System.

- ☐ Study the Hydraulic Schematic.
- ☐ Know what the relief valve settings and pump outputs should be.

■ Ask the operator.

- ☐ Ask how did the crane acted when it started to fail or what is unusual about the crane's operation.
- ☐ Ask if any valve setting was changed.
- ☐ Discuss how the crane is being used and when preventive maintenance is being performed; many problems can be traced to abuse of the crane or poor maintenance.

■ Operate the Crane.

- ☐ How is the crane's performance? Is any function slow, erratic, or not operating at all?
- ☐ Do the controls feel solid or spongy?
- ☐ Smell any unusual odors? Any signs of smoke?
- ☐ Hear any unusual noises? Where, at what speeds, and during what cycles?

■ Inspect the Crane

- ☐ Inspect the entire crane for any signs of trouble.
- ☐ Inspect the hydraulic tank. Is the oil at the proper level? Is the oil foamy or milky? Does the oil smell scorched? Does the oil appear too thin, too thick, or excessively dirty?
- ☐ Is the filter bypassing (clogged with dirt)? If so, replace the element.
- ☐ Feel the tank and the lines. Are they hotter than normal? Are they caked with dirt, mud, or dry oil? Is the paint peeled from any components? Are there kinked or collapsed hoses or tubes?
- ☐ Inspect all lines for oil leaks.
- ☐ Check for air leaks, usually accompanied by a sucking sound.
- ☐ Look closely at each component. Inspect for cracked welds, hairline cracks in housings, and loose mounting bolts or tie bolts.

■ List the Problems.

- ☐ Make a list of the problems found while inspecting the crane.

■ Reach a Conclusion.

- ☐ Study the list of problems and determine the possible causes using the Troubleshooting List as a guide.

Note If all of the hydraulic circuits are bad, the problem is in a component common to all circuits, such as the pump. If, on the other hand, only one circuit is bad, concentrate on the parts of that circuit.

■ Take Corrective Action.

- ☐ Once the problem has been isolated and the possible cause has been determined, take the necessary corrective action.
- ☐ Fully test the crane before returning it to service.

Troubleshooting List

Hydraulic Oil Condition

■ Oil milky or dirty.

- ☐ Water in oil (milky).
- ☐ Filter failure (dirty).

- ☐ Metal particles (mechanical failure).
- ☐ Oil discolored or has burned odor.
- ☐ See *Oil Overheating*.
- ☐ System Inoperative
- **Power Take-Off (PTO) not engaged.**
 - ☐ Engage PTO.
- **No oil in system.**
 - ☐ Fill tank to proper level. Check system for leaks.
- **Oil viscosity too high.**
 - ☐ Refer to Lubrication Chapter for proper viscosity.
- **Suction line plugged.**
 - ☐ Drain oil and clean suction line. Locate source of contamination.
- **Ball valve closed.**
 - ☐ Make sure this valve is fully open.
- **Restriction in system.**
 - ☐ Oil lines could be dirty or have inner walls that are collapsing and cutting off the oil supply. Clean or replace lines.
- **Air leaks in pump suction line.**
 - ☐ Repair or replace suction line.
- **Dirt in pump.**
 - ☐ Clean and repair pump. If necessary, drain and flush hydraulic system. Locate source of contamination.
- **Badly worn pump.**
 - ☐ Repair or replace pump.
- **Badly worn components.**
 - ☐ Examine and test valves, motors, and cylinders for external and internal leaks. If wear is abnormal, locate the cause.
- **Oil leak in pressure lines.**
 - ☐ Tighten fittings or replace defective lines.
- **Relief valves improperly adjusted or defective.**
 - ☐ Test relief valves to make sure they are opening at specified pressures. Refer to Hydraulic Schematic.
 - ☐ Examine seals for damage that could cause leaks. Clean relief valves and check for broken springs and other possible causes.
- **Pump rotating in wrong direction. *Applies to knockdown units only.***
 - ☐ Reverse to prevent damage.

NOTICE

Pump rotation must be matched with PTO and transmission.

- **Operating system under excessive load.**
 - ☐ Check Capacity Chart for load limits.
- **Hoses attached improperly.**
 - ☐ Attach correctly and tighten securely.
- **Broken PTO.**
 - ☐ Replace defective parts.
- **Pump not operating.**
 - ☐ Check for broken pump shaft.

System Operates Erratically**■ Air in system.**

- ☐ Examine suction line for leaks. Make sure oil level is correct (leaks on pressure side of system could account for oil loss).

■ Cold oil.

- ☐ Viscosity of oil may be too high at start-up. Allow oil to warm before operating controls.

■ Components sticking or binding.

- ☐ Check for dirt or gummy deposits. If dirt is caused by contamination, locate the source. Check for worn parts.

■ Pump damaged.

- ☐ Check for broken or worn parts. Determine cause of pump damage.

■ Dirt in relief valves.

- ☐ Clean relief valves.

■ Restriction in suction line.

- ☐ Suction line could be dirty or have inner walls that are collapsing and cutting off the oil supply. Clean or replace suction line.

System Operates Slowly**■ Cold oil.**

- ☐ Allow oil to warm before operating controls.

■ Oil viscosity too high.

- ☐ Refer to Lubrication Chapter for proper viscosity.

■ Insufficient drive speed.

- ☐ Make sure PTO is matched to transmission. Troubleshoot engine.

■ Low oil supply.

- ☐ Check tank and add oil if necessary. Check system for leaks that could cause loss of oil.

■ Air in system.

- ☐ Check suction line for leaks.

■ Badly worn pump.

- ☐ Repair or replace pump. Check for problems causing pump wear such as misalignment or contaminated oil.

■ Restriction in suction line.

- ☐ Suction line could be dirty or have inner walls that are collapsing and cutting off the oil supply. Clean or replace suction line.

■ Ball valve closed.

- ☐ Make sure this valve is fully open.

■ Relief valves not properly set or leaking.

- ☐ Test relief valves to make sure they are opening at specified pressures. Examine valves for damaged seats that could leak.

■ Badly worn components.

- ☐ Examine and test valves, motors, and cylinders for external and internal leaks. If wear is abnormal, locate the cause.

■ Valves plugged.

- ☐ Clean dirt from components. Clean orifices. Find source of dirt and correct.

■ Oil leak in pressure lines.

- ☐ Tighten fittings or replace defective lines. Examine mating surfaces of fittings for irregularities.

Oil Overheating**■ Operator holds control levers in power position too long, causing relief valve to open.**

- ☐ Return control levers to NEUTRAL position when not in use.

■ **Using incorrect oil.**

- Drain and refill system with proper oil. See Lubrication Chapter.

■ **Low oil level.**

- Fill tank to proper level. Look for leaks.

■ **Dirty oil.**

- Drain and refill with clean oil. Look for source of contamination.

■ **Engine running too fast.**

- Troubleshoot engine.

■ **Incorrect relief valve pressures.**

- Check and reset pressures; clean or replace relief valve.

■ **Internal oil leakage.**

- Examine and test valves, cylinders, and motors for internal leaks. If wear is abnormal, locate the cause.

■ **Restriction in pump suction line.**

- Clean or replace suction line.
- Dented, obstructed or undersized oil lines.
- Remove obstructions or replace defective oil lines.

■ **Control valve stuck in partially open position.**

- Free spool so it returns to NEUTRAL position.

■ **Heat not radiating properly.**

- Clean dirt and debris from oil cooler, hydraulic tank, oil lines and all other components.
- Make sure oil cooler fans are operating properly. The oil cooler fans should turn on when the oil temperature rises above 120°F. Make sure oil is circulating through oil cooler.

Oil Foaming

■ **Low oil level.**

- Fill tank to proper level. Look for leaks.

■ **Water in oil.**

- Drain and replace oil.
- Wrong kind of oil being used. Drain and refill system with proper oil. See Lubrication Chapter.

■ **Air leak in suction line.**

- Tighten or replace suction line.

■ **Kink or dent in oil lines (restricts oil flow).**

- Replace oil lines.

■ **Worn seal around pump shaft.**

- Clean sealing area and replace seal. Check oil for contamination or pump for misalignment.

Pump Makes Noise

■ **Low oil level.**

- Fill tank to proper level. Check system for leaks.

■ **Oil viscosity too high.**

- Drain and refill system with proper oil. See Lubrication Chapter.

■ **Pump speed too fast.**

- Operate pump at recommended speed.

■ **Suction line plugged or pinched.**

- Clean or replace suction line.

■ **Ball valve closed.**

- Make sure this valve is fully open.

- **Sludge and dirt in pump.**
 - Disassemble and inspect pump and lines. Clean hydraulic system. Determine cause of dirt.
- **Tank breather plugged.**
 - Replace breather.
- **Air in oil.**
 - Tighten or replace suction line. Check system for leaks. Replace pump shaft seal.
- **Worn or scored pump bearings or shafts.**
 - Replace worn parts or complete pump if parts are badly worn or scored. Determine cause of scoring.
- **Broken or damaged pump parts.**
 - Repair pump. Look for cause of damage like contamination or too much pressure.
- **Sticking or binding parts.**
 - Repair binding parts. Clean parts and change oil if necessary.

Pump Leaks Oil

- **Damaged seal around drive shaft.**
 - Replace seal. Trouble may be caused by contaminated oil. Check oil for abrasives and clean entire hydraulic system. Locate source of contamination. Check the pump drive shaft; misalignment could cause the seal to wear. If shaft is not aligned, check the pump for other damage.
- **Loose or broken pump parts.**
 - Make sure all bolts and fittings are tight. Check gaskets and seals. Examine pump casting for cracks. If pump is cracked, look for a cause like too much pressure or hoses that are attached incorrectly.

Motor Leaks Oil

- **Damaged seal around drive shaft.**
 - Replace seal. Trouble may be caused by contaminated oil. Check oil for abrasives and clean entire hydraulic system. Locate source of contamination. Check the motor drive shaft; misalignment could cause the seal to wear. If shaft is not aligned, check the motor for other damage.
- **Loose or broken motor parts.**
 - Make sure all bolts and fittings are tight. Check gaskets and seals.
 - Examine motor casting for cracks. If motor is cracked, look for a cause like too much pressure or hoses that are attached incorrectly.
- **Back pressure too high.**
 - Check if return filter is bypassing; if so, replace element.
 - Check for and remove any obstruction in return line.

Valve Sticks or Works Hard

- **Tie bolts too tight on valve stacks.**
 - Use manufacturer's recommendation to adjust tie bolt torque.
- **Valve broken or scored internally.**
 - Repair broken or scored parts. Locate source of contamination that caused scoring.

Valve Leaks Oil (External)

- **Tie bolts too loose on valve stacks.**
 - Use manufacturer's recommendation to adjust tie bolt torque.
- **Worn or damaged O-rings.**
 - Replace O-rings (especially between valve stacks). If contamination has caused O-rings to wear, clean system and look for source of contamination.
- **Broken valve parts.**
 - If valve is cracked, look for a cause such as too much pressure or hoses that are attached incorrectly.

Cylinder Leaks Oil (External)

- Damaged cylinder barrel.
 - Replace cylinder barrel. Correct cause of barrel damage.
- Rod seal leaking.
 - Replace seal. If contamination has caused seal to wear, look for source. Wear may be caused by external as well as internal contaminants. Check piston rod for scratches or misalignment.
- Loose parts.
 - Tighten parts until leakage has stopped.
- Piston rod damaged.
 - Check rod for nicks or scratches that could cause seal damage or allow oil leakage. Replace defective rod.

Cylinder Drifts or Will Not Hold Load**NOTICE**

See Cylinder Leaks Oil (External).

- Excessively worn or damaged piston seals.
 - Disassemble cylinder and replace faulty parts.
- Counterbalance valve or check valve stuck open.
 - Replace valve.

Cylinder Will Not Extend or Not Retract**NOTICE**

See System Inoperative.

- Counterbalance valve or check valve stuck closed.
 - Replace valve.

Boom Cannot Be Extended or Lowered

- LMI function lockout.
 - See LMI Operating Instructions.

Swing Inoperative or Erratic**NOTICE**

See System Inoperative or System Operates Erratically.

- Swing parking brake switch.
 - Brake not releasing.
 - Check for a collapsed, restricted, or leaking brake release hose. Clean or replace the hose.

Note The brake should fully release at 260 psi.

- Improper backlash between the swing pinion and the slewing ring gear.
 - Adjust the backlash between the gears.
- Damaged slewing ring bearing.
 - Replace the slewing ring.

Swing Brake Does Not Hold

- Brake return springs broken or brake discs worn or damaged.
 - Disassemble the brake and replace the faulty parts.

Winch Will Not Lower Load or Lowers Load Erratically**NOTICE**

See System Inoperative or System Operates Erratically.

■ Brake not releasing.

- Check for a collapsed, restricted, or leaking pilot line to the brake. Clean or replace the hose.

Note The winch brake should fully release at 350 psi to 450 psi.

■ Counterbalance valve not opening.

- Check for a collapsed, restricted, or leaking pilot line to the counterbalance valve. Clean or replace the hose.

Winch Will Not Hold Load in Neutral

■ Excessive back pressure acting on the brake causing brake to release partially.

- Back pressure must not exceed 150 psi. Inspect the return lines between the control valve and tank for restrictions.

■ Brake return springs broken or brake discs worn or damaged.

- Disassemble the winch and replace the faulty brake parts.

■ Clutch slipping.

- Improper oil being used in winch can cause the clutch to slip. Drain the winch and refill with proper oil, see Lubrication Chapter.
- The clutch may be damaged or worn. Disassemble the winch and replace the clutch.

Winch Will Not Raise Load**NOTICE**

See System Inoperative.

■ Load too heavy.

- Refer to the Capacity Chart for load limits and applicable reeving diagram.

■ LMI function lockout.

- See LMI operating instructions.

Boom Chatters When Extending or Retracting Boom

■ Boom sections not lubricated.

- Lubricate the boom sections as instructed in the Lubrication Chapter.

■ Slider pads worn or improperly adjusted.

- Check the slider pads for wear and proper adjustment.

Boom Does Not Sequence Properly

■ Crowd rope system improperly adjusted.

- Adjust the crowd ropes.

