National Crane 1400H

OPERATOR AND SERVICE MANUAL

Manitowoc

SECTION 1
SAFETY INFORMATION

SECTION CONTENTS

SAFETY MESSAGES

General

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

To alert personnel to hazardous operating practices and maintenance procedures, safety messages are used throughout the manual. Each safety message contains a safety alert symbol and a signal word to identify the hazard's degree of seriousness.

Safety Alert Symbol

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

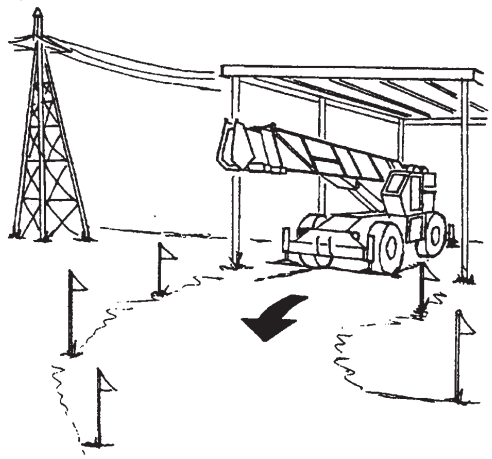
Set-Up and Operation

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

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

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

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



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

Appoint a reliable and qualified signal person, equipped with a loud signal whistle or horn and voice communication equipment, to warn the operator when any part of the crane or load moves near a power source. This person should have no other duties while the crane is working.

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

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

Electrocution Hazard Devices

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

Insulating links installed into the load line afford limited protection from electrocution hazards. Links are limited in their lifting abilities, insulating properties, and other properties that affect their performance. Moisture, dust, dirt, oils, and other contaminants can cause a link to conduct electricity. Due to their capacity ratings, some links are not effective for large cranes and/or high voltages/currents.

The only protection that may be afforded by an insulated link is below the link (electrically downstream), provided the link has been kept clean, free of contamination, has not been scratched or damaged, and is periodically tested (just before use) for its dielectric integrity.

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

Proximity sensing and warning devices are available in different types. Some use boom nose (localized) sensors and others use full boom length sensors. No warning may be given for components, cables, loads, and other attachments located outside of the sensing area. Much reliance is placed upon you, the operator, in selecting and properly setting the sensitivity of these devices.

Never rely solely on a device to protect you and your fellow workers from danger.

Some variables you must know and understand are:

- Proximity devices are advertised to detect the existence of electricity and not its quantity or magnitude.
- Some proximity devices may detect only alternating current (AC) and not direct current (DC).
- Some proximity devices detect radio frequency (RF) energy and others do not.
- Most proximity devices simply provide a signal (audible, visual, or both) for the operator; this signal must not be ignored.
- Sometimes the sensing portion of the proximity devices becomes confused by complex or differing arrays of power lines and power sources.

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

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

Watch the path of the boom and load when swinging. Avoid lowering or swinging the boom and load into ground personnel, equipment, or other objects.

Lift one load at a time. Do not lift two or more separately rigged loads at one time, even if the loads are within the crane's rated capacity.

Never leave the crane with a load suspended. Should it become necessary to leave the crane, lower the load to the ground and stop the engine before leaving the operator's station.

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

Stop the hook block from swinging when unhooking a load.

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

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

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

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

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

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

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

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

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

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

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

Hand Signals

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

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

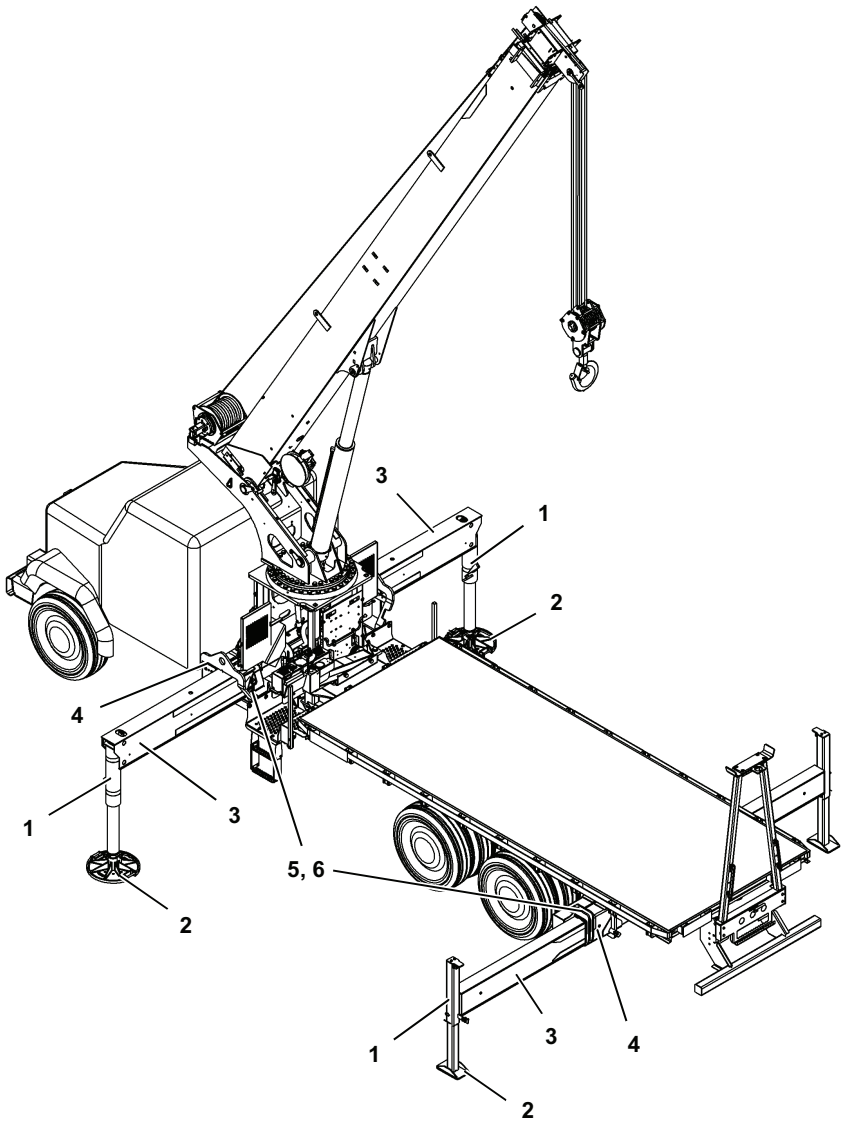
At all times use standardized hand signals - previously agreed upon and completely understood by the operator and signal person.

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

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

Obey a signal to stop from anyone.

Carrier Inspection



OPERATING PROCEDURES

All members of the crew should become thoroughly familiar with the location and operation of controls, the correct operating procedure, the maximum lifting capacities and the safety precautions applicable to the unit before operating. This crane is a complex piece of equipment and can be overloaded in many ways. Carefully follow the operating procedures outlined below and the load rating chart at the operator's station.

Equipment Checks

Perform the following checks prior to placing the unit in operation:

- Inspect for any unusual conditions such as pools of hydraulic fluid or lubricating oil under the chassis, any outrigger which may have crept down or up and any signs of damage or improper maintenance.
- Check that the tires are inflated to the proper pressure.
- Check the level of the hydraulic reservoir.
- Check the operation of the “emergency stop” and horn circuits.
- Check for missing and loose bolts.
- Check for damaged structural members and welds.
- Check all rope guides and cable keepers.
- Check all sheaves for free turning.
- Check the loadline cable for kinks, broken strands or other damage in accordance with instructions in the “Service & Maintenance” section.
- Check to see that the hydraulic hoses and fittings are in good condition and show no signs of leaking. The hoses should be free from cuts and abrasions and there should be no evidence of binding. Any damage or leakage should be repaired immediately.
- Check RCL and anti-two-block system for proper operation. See RCL Service and Maintenance Procedure.

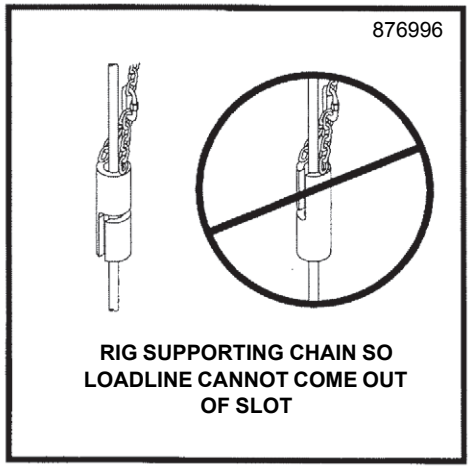
Note: Consult truck manufacturer’s manual for vehicle checks.

RCL Inspection Procedure

Prior to operating the crane, the following electrical connections must be checked to ensure that the system is properly connected for the crane configuration.

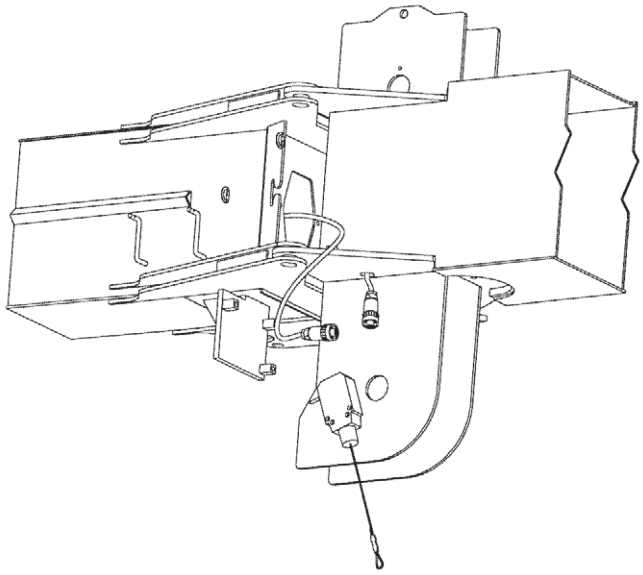
If the crane works only with the boom and without boom extensions (jibs), no additional connections are necessary. Be sure that the weight of the anti-two-block (ATB) switch is properly installed on the hoist load line on the first fall of rope coming off the boom tip.

Proper installation of the ATB weight is as shown in the following picture. Be sure that the wire rope cannot disengage from the weight without disconnecting the link.

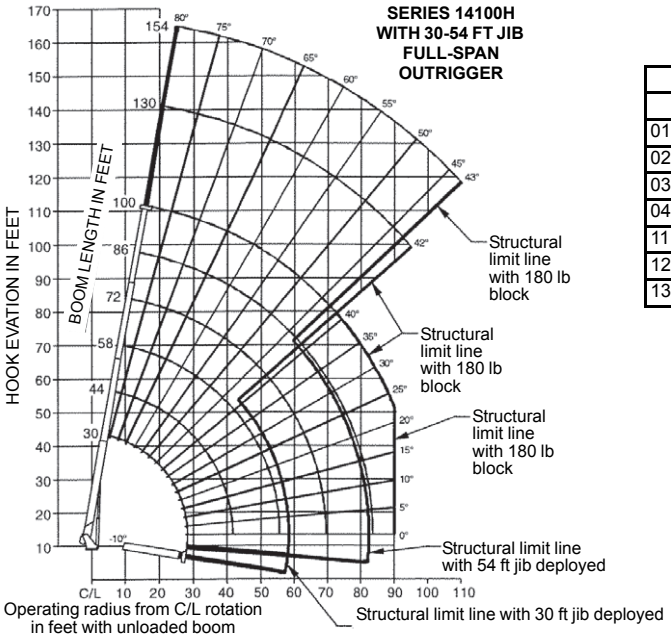


RIG SUPPORTING CHAIN SO LOADLINE CANNOT COME OUT OF SLOT

If the crane works with a boom extension (jib), the female connector at the rear of the jib must be plugged into the male connector at the end of the main boom to make the ATB switch at the tip of the jib operational. This will require unplugging the main boom ATB switch. The weight attached to the main boom ATB switch must also be removed and reinstalled on the jib ATB switch. After removal of the weight, the main boom ATB switch must then be locked with the red ATB retainer (which is attached to the switch with a spring clip). The weight must be reattached to the jib ATB switch and installed on the loadline coming off the jib tip.



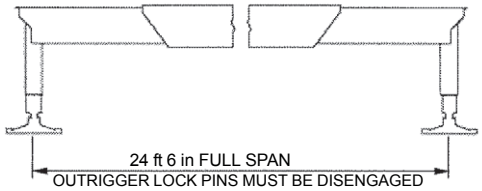
NATIONAL CRANE CORPORATION



RCL OPERATING CODE	
OPERATING MODE	
01	Main Boom - No Jib Stowed
02	Main Boom - Jib Stowed
03	30 ft Tele Jib
04	54 ft Tele Jib
11	Man Basket on Main Boom
12	Man Basket on 30 ft Tele Jib
13	Man Basket on 54 ft Tele Jib

NOTE:

9. Operate with jib by radius when main boom is fully extended, if necessary increase boom angle to maintain loaded radius.
10. Operate with jib by boom angle when main boom is not fully extended. Do not exceed rated jib capacities at any reduced boom lengths.
11. Capacities do not exceed 85% stability.
12. Shaded areas are structurally limited capacities.
13. Handling of personnel is only permitted with full span outriggers.
14. All capacities in pounds, angles in degrees, radii in feet.
15. Loaded boom angles are given as reference only.



LOAD RATINGS

LOAD RADIUS (ft)	LOADED BOOM ANGLE	30 ft BOOM (lb)	LOADED BOOM ANGLE	A 44 ft BOOM (lb)	LOADED BOOM ANGLE	B 58 ft BOOM (lb)	LOADED BOOM ANGLE	C 72 ft BOOM (lb)	LOADED BOOM ANGLE	D 86 ft BOOM (lb)	LOADED BOOM ANGLE	100 ft BOOM (lb)
6	79.1	66,000										
8	74.9	49,200										
10	70.6	42,200	77.2	37,900								
12	66.3	38,600	74.9	33,400	79.2	29,550						
14	61.7	34,200	72.1	29,400	77.1	26,550	80	23,050				
16	56.8	30,350	69.2	26,900	75.1	24,550	78.6	21,050				
20	46	23,550	63.3	21,400	70.8	19,250	75.3	18,050	78.4	16,800	80	11,600
25	27.4	16,700	55.2	17,400	65.3	16,050	71	14,650	74.9	13,700	77.3	10,950
30			46.1	13,900	59.5	13,550	66.7	12,550	71.3	11,450	74.5	10,550
35			35	10,350	53.1	10,650	61.9	10,550	67.7	9,900	71.8	9,150
40			20	8,000	46.8	8,250	57.6	8,400	64.3	8,550	68.4	8,050
45					38.8	6,500	52.4	6,650	60.1	6,750	65.3	6,850
50					29	5,150	46.7	5,300	55.9	5,400	61.9	5,500
55					12.3	4,150	40.4	4,250	51.5	4,400	58.3	4,450
60							33.2	3,400	46.7	3,550	54.6	3,600
65							23.8	2,750	41.5	2,850	50.7	2,900
70									35.7	2,250	46.6	2,300
75									28.8	1,750	42.2	1,800
80									19.6	1,350	37.3	1,400
85											31.8	1,050
90											25.2	700
	0	11,400	0	7,300	0	4,000	0	1,850	0	900		
ADD TO CAPACITIES WHEN NO JIB STOWED (lb)		800		600		450		350		300		250

LOAD RADIUS (ft)	LOADED BOOM ANGLE	30 ft JIB (lb)	LOADED BOOM ANGLE	54 ft JIB (lb)
30	78.4	5,500		
35	76.5	5,450	78.5	2,650
40	74.6	5,400	76.9	2,600
45	72.4	5,100	75.2	2,500
50	70.1	4,600	73.4	2,400
55	67.8	4,250	71.6	2,300
60	65.5	3,900	69.8	2,200
65	62.7	3,200	67.9	2,100
70	59.9	2,600	66	2,000
75	57.1	2,050	64	1,850
80	54.1	1,650	61.8	1,750
85	51.1	1,250	59.6	1,600
90	47.9	950	57.4	1,500
95	44.5	650	54.8	1,200
100			52.2	950
105			49.4	700
110			46.6	500

LOADLINE EQUIPMENT DEDUCT

Downhaul weight ..... 180 lb
One sheave block ..... 375 lb
Two sheave block ..... 640 lb
Three sheave block ... 870 lb
Four sheave block ..... 970 lb

JIB JACK

Operation

The jib pin alignment device consists of a hydraulic jack mounted horizontally on the underside of the jib. A handle for the jack is provided and is installed above the jack on the side of the jib.

The purpose of the jib pin alignment device is to aid in installing the fourth or “last” jib pin when setting up a jib. This device has been designed to line up the bottom jib pin hole on the left side of the crane.

To use the device, follow the proper procedure outlined in the Owner's Manual to install both jib pins on the right side of crane and the top pin on the left side. Next remove jack handle and using the flattened end, close jack release valve by turning handle clockwise until it is firmly closed. Insert the round end of the handle into the handle sleeve and pump jack until ram contacts boom sheave case. Continue to pump slowly until jib pin hole is exactly aligned with hole in boom ear. At this time the final jib pin can be easily tapped into position.

If hole alignment is “over shot” due to jacking too far, the jack can simply be relieved and the process repeated. To relieve the jack, use the flattened end of jack handle to slowly turn relief valve counter clockwise no more than one full turn.

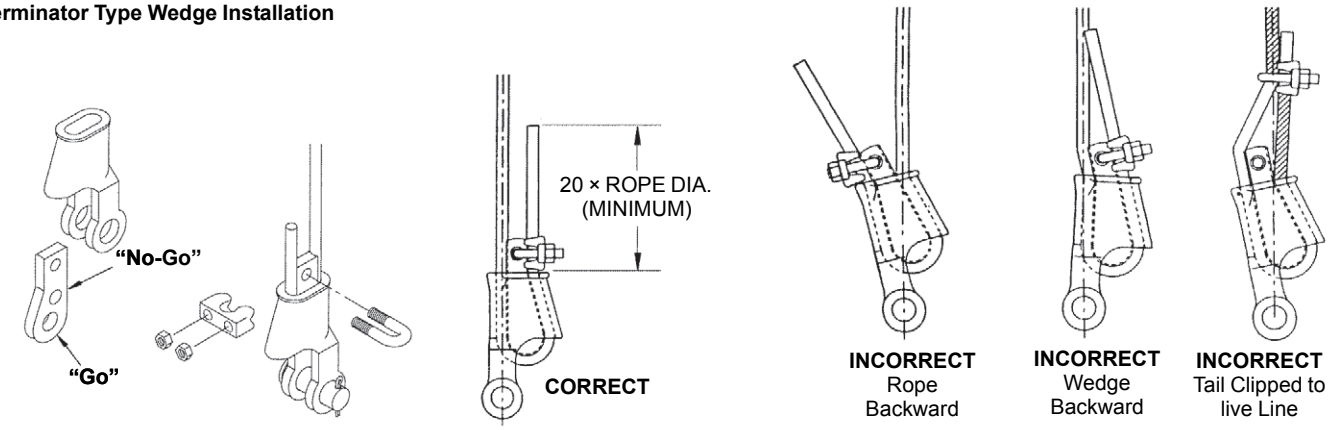
After all jib pins are installed, relieve jack. The jib pin alignment device is also useful when removing the “fourth” pin. Use the jib jack to relieve jib weight induced pressure on the “fourth” pin and it will be much easier to remove.

Once the jib has been erected or stowed, it is important that the jack handle be properly placed back on its stowage hooks and that the cotter key be properly placed in the stowage hook to retain the handle on the hook.

Important: Avoid “shock loads” created by quickly opening and closing the release while jack is under load. This may result in overloading of the hydraulic circuit and possible damage to the jack.

When jib is stowed on side of crane, always leave ram and handle sleeve pushed all the way down to reduce exposure to rusting.

Terminator Type Wedge Installation



Rope Size (inch)	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	1-1/8	1-1/4
*Torque lb-ft	45	65	65	95	95	130	225	225	225	360
* The tightening torque values shown are based upon the threads being clean, dry, and free of lubrication.										

- Properly match socket, wedge and clip to wire rope size. The wire rope must pass through the "go" hole in the wedge. It must not pass through the "no go" hole in the wedge.
- Align live end of rope, with center line of pin.
- Secure dead end section of rope.
- Tighten nuts on clip to recommended torque. (See Table)
- Do not attach dead end to live end or install wedge backwards.
- Use a hammer to seat Wedge and Rope as deep into socket as possible before applying first load.

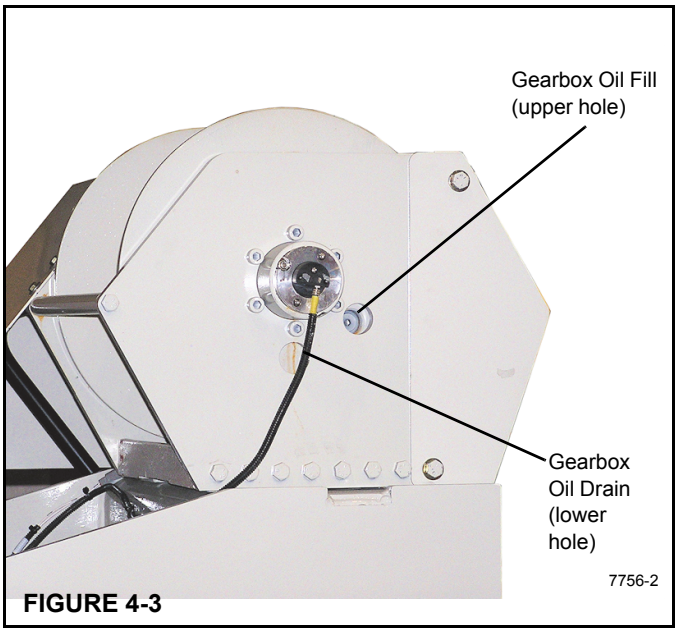


FIGURE 4-3

Swing Gearbox and Brake Oil

Check Swing Gearbox oil level:

The oil in the gearbox and brake sections is recommended to be changed after first 50 hours of operation and every 1000 hours or 6 months of usage.

1. Examine the used oil for signs of significant metal deposits.
2. Fill the swing gearbox with the appropriate amount and type of oil and then replace plug and vent. *See "Lubrication" on page 3 of this manual.*

Gearbox oil level inspection is achieved by removing the gearbox fill/vent plug and visually inspecting the oil level. Maximum oil level is to be 1" below the port for this gearbox with of gear lube oil.

Hydraulic Oil Reservoir Level

The hydraulic oil reservoir has a sight gauge and decal located on the side of the reservoir (Figure 4-4). The oil in the hydraulic reservoir is sufficient when the level is between the upper and lower marks on the decal with the crane parked on a level surface in the transport position and the oil cold.

If the oil level is too low, add the recommended hydraulic oil until the oil level is even with the upper mark. If the oil level is high, drain oil until the oil level is even with the upper mark.

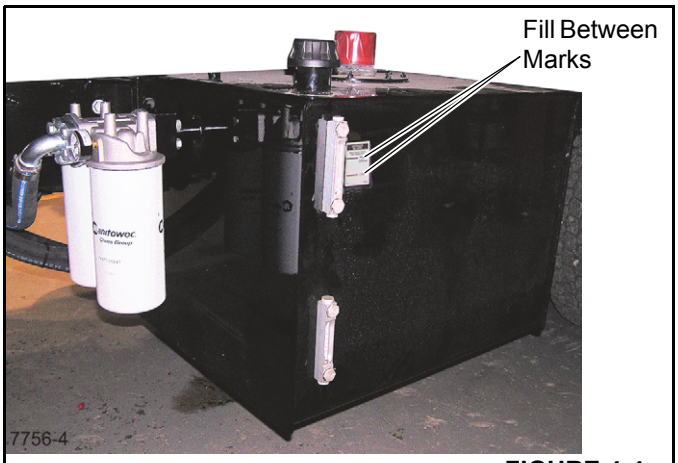


FIGURE 4-4

WIRE ROPE LUBRICATION

Wire rope is lubricated during manufacture and the lubricant applied does not last the life of the rope. The wire rope must be lubricated as part of a regularly scheduled maintenance program. The lubricant applied must be compatible with the original lubricant and not hinder visual inspection of the rope. Consult the rope manufacturer for proper lubricant. The sections of rope which are located over sheaves or otherwise hidden during inspection and maintenance procedures require special attention.

The object of rope lubrication is to reduce internal friction and to prevent corrosion. The type and amount of lubrication applied during manufacture depends on the rope size, type, and anticipated use. This lubrication provides the finished rope with protection for a reasonable time if the rope is stored under proper conditions. When the rope is put into service, periodic applications of a suitable rope lubricant are necessary. Characteristics of a good wire rope lubricant are that it should be:

- free from acids and alkalis.
- have sufficient adhesive strength to remain on the rope.
- of a viscosity capable of penetrating the interstices between wires and strands.
- not be soluble in the medium surrounding it under the actual operating conditions (i.e. Water).
- have a high film strength.
- resistant to oxidation.

Before applying lubrication, accumulations of dirt or other abrasive material should be removed from the rope. Clean with a stiff wire brush and solvent, compressed air, or live steam. Lubricate the rope immediately after the rope is cleaned. Techniques that can be used include:

- bath

Fatigue of Welded Structures

Experience has shown that highly stressed welded structures when repeatedly subjected to varying stresses caused by twisting, shock, bending, and intentional and/or unintentional overloads, often become subject to weld cracking which may be attributed to fatigue of the welded joint. This condition is not uncommon in construction equipment.

Equipment should be periodically inspected for evidence of weld fatigue. The frequency of these inspections should increase with the age of the equipment and the severity of the application.The following are known high stress areas applicable to Grove machines, and a visual inspection of these areas should be made part of an owner's planned preventive maintenance program:

- Telescopic Boom: wear pad retaining structures, hydraulic cylinder attaching points, boom pivot shaft retaining structures.
- Outrigger pads, beams, boxes and attachment structures.
- Main frame: generally in the area of doubler plates and crossmembers; at the junction of front and rear frame members on truck cranes.
- Turntable bearing connection—where bearing is welded to the crane superstructure or chassis.
- Counterweight support structures.
- Chassis axle and suspension mounting structures.
- Hydraulic cylinder end connections.

The above is provided only as a guide, and your inspection plan should not be limited to the areas listed. A thorough visual inspection of all weldments is good practice.

Anyone requiring more detailed inspection instructions and/or repair procedures may request same by contacting your local Manitowoc distributor.

Loctite

⚠ CAUTION

Skin and/or Eye Hazard!

Loctite type adhesives contain chemicals that may be harmful if misused. Read and follow the instructions on the container.

Always follow the directions on the Loctite® container, as not all Loctite® types are suitable for all applications.Various types of Loctite® are specified throughout the Service Manual. The following types of Loctite® brand adhesives are available from the Parts Department of the local Manitowoc distributor.

Application of Medium Strength Loctite®

NOTE: The fastener may be re-used; the adhesive may be re-applied over cured adhesive residue.

The following procedure covers the proper application and curing method for medium strength Loctite® adhesive/sealant (Loctite® #243).

NOTE: Ensure the threaded surface, both male and female, is clean of contaminants and free of dirt and oil. Adhesive/Sealant Application

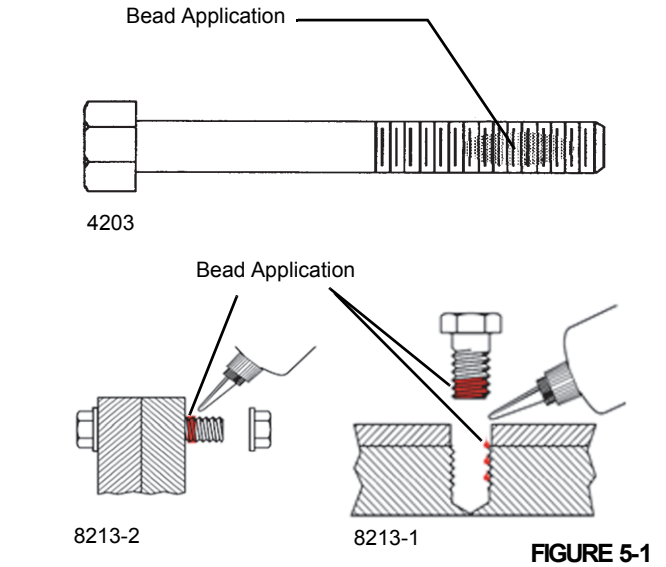


FIGURE 5-1

1. Apply a bead perpendicular to the thread, several threads wide, in the approximate area of threaded engagement (see Figure 1-1).
2. In a blind hole application, a bead of several drops of adhesive should be applied into the bottom of the hole to be hydraulically forced up during engagement.

After application and engagement of mated threads, fixturing will occur within five (5) minutes. Time required to achieve full strength is 24 hours.

Fasteners and Torque Values

Use bolts of the correct length. A bolt which is too long may bottom before the head is tight against the part it is to hold. If a bolt is too short, there may not be enough threads engaged to hold the part securely. Threads can be damaged. Inspect them and replace fasteners, as necessary.

Torque values should correspond to the type bolts, studs, and nuts being used.

The torque tables are provided by Manitowoc for reference when performing maintenance.

RCL SERVICE AND MAINTENANCE

Daily maintenance of the rated capacity limiter consists of inspecting:

1. The electrical wiring connecting the various parts of the system. If electrical wiring is damaged, it shall be replaced immediately.
2. If the insulation is worn on the length sensor cable or cable guides are damaged, these parts shall be replaced.
3. Check the anti-two-block limit switches for freedom of movement.
4. The cable reel shall be under tension to operate properly.
5. Check the pressure transducers at the lift cylinder and the connecting hoses for oil leakage.

Other than correcting the problems identified in the Malfunctions Table and replacing faulty mechanical parts and cables, no other repairs shall be performed by nonexpert personnel.

Operating Errors

Malfunctions in the system which are caused by range exceedings or operating errors by the crane operator himself are indicated on the display together with an explanation. These error codes are E01, E02, E03, E04 and E05 and they can normally be eliminated by the crane operator himself. Refer to PAT manual in the book for more detail on error codes.

ANTI-TWO-BLOCK WIRE WITH EXTERNAL REEL

Operation

Boom is equipped with an anti-two-block utilizing a reel on the outside of the boom. As the boom extends, the wire pays off of the reel and is routed through a sheave on the hoist end of the boom. The wire is then routed through roller guides attached at the hoist end of the 2nd, 3rd and 4th of the 4 section boom or 2nd, 3rd, 4th and extend cylinder of the 5 section boom. A switch at the sheave case on the last boom section controls switching of the signal.

Maintenance

In the event of a break in continuity of the anti-two-block wire, the hydraulic portion of the system will be disabled and make certain crane functions inoperative. Before replacement of the wire, check for continuity loss at the anti-two-block switch, connector damage or corrosion, and overall system condition. Due to the environmental exposure of the system, a thorough check of the circuit should be performed. If the wire on the reel is determined to be faulty, replace the wire.

Do not, under any circumstances, work at an elevated height without using proper fall protection as required by local, state or federal regulations.

Alternative #1

This method pulls the replacement wire through the boom using the defective wire as the installation tool.

Special tools and equipment

- Two end-to-end electrical butt connectors
- 40 ft (12,2 m) flexible wire or light cord

1. Retract boom completely.
2. Unplug electrical connector at sheave case end of boom.
3. Remove electrical connector from the anti-two-block wire running to the reel.
4. Remove the capscrew, washers and nut, anchoring the anti-two-block wire at the sheave case end of the last section.
5. Pull the wire about 2 ft (0,6 m) out the sheave case end of the boom.
6. Cut the thimble off of the wire.
7. Attach the 40 ft (12,2 m) length of flexible wire or light cord to the end of the anti-two-block wire using the end-to-end electrical butt connector.
8. Let the spring tension on the reel slowly pull the wire or cord back through the boom.
9. Remove old wire from reel and replace with new anti-two-block wire.
10. Route the new wire through the sheave at the hoist end of the boom and attach the end of the anti-two-block wire to the end of the wire routed through the boom using the second end-to-end butt connector.
11. Draw all of the light cord or flexible wire through the boom plus an additional length of anti-two-block wire long enough to install the first thimble for the sheave case end of the boom. Install thimble per instructions.
12. Attach thimble end to capscrew anchor point in sheave case.
13. Tension extendable length of cable at anti-two-block reel by wrapping cable around reel until proper tension is achieved.
14. Attach the electrical connector and connect to the switch.
15. Slowly operate the boom to make sure that the anti-two-block wire runs freely in the boom and that the cable reel runs properly.

in (0,8mm) off center in the wear pad. Various combinations of rotation of these parts allow the adjustment.plates function as rear side clearance adjustment.

22. Position sheave and sheave pin located in cable loop on top of 3rd to allow capscrew installation, through top plate of 2nd. Install capscrews and torque to specification, clamping sheave pin and sheave to the bottom of the 2nd section top plate.

23. Assemble retract sheaves, retract sheave pins and cable keeper plates in rear of 2nd section. Coat surfaces of bearings with grease before assembly.

24. Place retract cables anchored to 3rd over top of retract sheaves attached to rear of 2nd. Install keeper capscrew above sheave to hold retract cables in place.

25. Reeve cables over retract sheave and install keeper/ wear pad to bottom rear of 2nd section. This pad acts as a side pad, bottom pad, and a cable retainer.

26. Assemble exterior extend cylinder components. Install and center sheave pin sheave case end of extend cylinder. Install bearings into extend cable sheaves. Coat surface of bearings with grease and assemble extend sheaves on sheave pin.

27. Wrap approximately 10 ft (300 cm) of each 7/8 in (22.22 mm) diameter 2/3/4 extend cable around extend sheaves and install 4th section extend cable anchor around cables at button end. Do not tighten capscrews clamping anchor together completely. These capscrews if tightened completely will not allow cable anchor to install into 4th section.

28. Install wear pad over extend cylinder sheave side plates. This serves as a wear pad to keep the end of the extend cylinder centered in the boom, as well as an extend cable retainer.

29. Slide extend cylinder/extend cables into 2nd-3rd-4th boom assembly enough to assemble extend cable anchor into bottom rear of 4th section. Be aware of extend cable location when inserting cylinder into boom sections, inadvertent crushing or other damage to cables will warrant replacement.

30. Tighten capscrews clamping extend cable anchor together. This will also lock anchor in place in the anchor cutouts in the 4th section.

31. Visually verify that the extend cables are properly routed on their sheaves and continue to slide with the extend cylinder and cables into the boom sections. Keep extend cables supported and slightly tensioned during insertion of cylinder to maintain proper cable placement.

32. As the extend cylinder nears complete insertion into the 2nd-3rd-4th section assembly, adjust the height of the cylinder to allow the cylinder anchor collars to access the cylinder keeper cutouts in the doubler plates on the sides of the 2nd and 3rd sections.

33. Drop the cylinder down into the vertical cutouts in the doubler plates on the sides of the 2nd and 3rd sections. Cylinder length or boom section placement may have to be adjusted to allow cylinder collars to drop into their proper position.

34. Install lock bar and capscrews to the extend cylinder collar in the 3rd section.

35. Install large extend cable anchor into anchor cutouts in the doubler plates in the rear of the 2nd by routing the 7/ 8 in (22,22 mm) extend cables through the anchor and the small 7/16 in (11,11 mm) cable over the anchor. Slide anchor fully into cutout.

36. Install keeper plates and hardware. This keeper plate retains both the horizontal movement of the extend anchor and the vertical movement of the extend cylinder.

37. Install 2nd-3rd-4th section boom assembly into 1st section boom, use caution when sliding sections together, 3rd retract cables must maintain their position to prevent damage, do not let boom rest on cables. Damage will result.

38. Assemble bottom front wear pads for 1st section and Teflon plugs.

39. Using appropriate lifting device, lift 2nd-3rd-4th section assembly to allow for wear pad installation in front of 1st. Install wear pads. Slide sections together within 12 in (30 cm) of full retraction.

40. Install upper spacer to front of 1st section.

41. Install front side wear pads with appropriate shims between 2nd and 1st sections. If boom has been disassembled, and no sections have been replaced, use same shim quantity and location as was previously used. If locations are in question, refer to shim calibration section in this book.

42. Push boom together until extend cylinder butt plate makes contact with the rear cylinder anchor plates in the rear of the 1st section. Install spacers, washers and capscrews, attaching cylinder to 1st section boom. If cylinder is misaligned with anchor points, cylinder butt plate can be rotated to achieve proper alignment (holding valve up, parallel with boom top plate).

43. Assemble top rear wear pads to the top of the 2nd boom section with the cam plates and install through the hoist mount end of the boom. Install capscrew through holes in outer boom sections.

The wear pads on each side at the top/rear of the boom can be adjusted over a range of 3/16 in (4,8 mm) by rotating, end for end, the wear pad and plate or the wear pads and plate independently. This is possible because

17. Install a nut on the threaded ends of the 5/4/3 retract cables, to keep the cable ends from pulling thru the anchor as the sections are pushed together.

18. Push the 4th-5th section inside the 3rd section, until it is within 36 in (90 cm) of full insertion.

19. Install side wear pads with appropriate shims on front inside of the 3rd section boom. Install upper spacer bar and cable guide with wear pad and related hardware on the top to the 3rd section. Shim according to calibration instructions, or as pads were originally removed and tagged.

20. Slide 4th-5th section inside 3rd until the end of the 4th section hits against the doubler bars in the 3rd section. Use caution as the 5/4/3 retract cable threaded end gets close to the grooves in the lower front pad plate, adjust as necessary to allow proper placement. A scribe mark on the 4th section at full retraction will aid in cable tensioning for proper boom sequence later.

21. Assemble top rear wear pads with the cam plates to the top of the 4th section. See step #11 for pad installation detail.

22. Uncoil 4/3/2 retract cables out of the 5th section, assemble 3rd section retract sheaves and pins into the inside of the 3rd section rear, using proper hardware and loctite 243, reeve cable over sheave installing upper keeper capscrew and lower rear pad, this pad serves as a cable keeper, lower pad and side pad for the rear of the section.

23. Pull threaded end of 4/3/2 retract cables, now under the 3rd section, towards front of boom.

24. Assembly step 22 completes the 5/4/3 boom section stage, at this point the Hydraulic extension cylinder and related cables and components are inserted into the 3rd-4th-5th section assembly starting with step 24

25. Support extension cylinder in a workable location and install the 3 extend sheaves in the sheave case end of the cylinder, orientate the pin so that the bearing grease holes are on the unloaded side of the pin (towards cylinder butt plate). Slide pin in thru round area of keyway shaped slot, installing sheaves one at a time, as the pin is slide thru the sheave case. Align slots in pin with square keyway side plate cutouts and push pin/ sheaves rearward (towards cylinder butt plate) into slot.

26. Install 3 2/3/4 extend cables over sheaves by placing button end thru opening between the sheave and the front double tapered plate on the cylinder. After the cables are in place, install the plastic tapered cylinder pads on the top and bottom shelves of the cylinder sheave case, these pads when secured in place act as cable retainers as well as wear pads, again apply loctite and jam nuts in these locations.

27. Pull the 3 button ends thru the extend cylinder sheave case until there is enough slack to install the 2/3/4 extend cable anchor, install cable anchor on extend cables, keep capscrews clamping the two halves of the anchor together just tight enough to not let the cables escape from their positions, this will allow easier assembly into the 4th section anchor point.

28. Drape 2/3/4 extend cables that come off the top of the sheaves in an area to avoid damage, preferably on the top of the extend cylinder, this will put them in their approximate location as the cylinder is installed into the 5th/4th/3rd boom assembly.

29. Slide extend cylinder into the 3rd-4th-5th boom assembly approximately 36 inches (90cm) Raise cylinder up at an angle slightly to allow easier access to the 2/3/4 extend cable anchor in the rear of the 4th section. Install 2/3/4 extend cable anchor and cable ends into the anchor point. Install keeper plates over the retract cable ends, these keepers are shaped to retain the 2/3/4 anchor as well as the retract cable ends. Tighten capscrews holding the two halves of the 2/3/4 anchor assembly together.

30. Lower extend cylinder to a position parallel with the 3rd-4th-5th boom assembly and slowly push the cylinder into the 3rd-4th-5th boom assembly until the cylinder collar makes contact with the 3rd section rear vertical doubler plates. Monitor 2/3/4 extend cable location as cylinder slides into boom sections to avoid damaging cables.

31. Raise extend cylinder up to allow cylinder collar to slide thru and align with the anchor pocket on the back of the 3rd, lower cylinder, collar will move down into cylinder anchor pocket, if properly positioned over pocket. Assemble lock bar and proper hardware to the cylinder collar, this will retain the cylinder into the anchor pocket.

32. Attach button end of 1/2/3 small extend cables into anchor point on the rear top plate of the 3rd section, a thin plate on the bottom and a thicker anchor plate on the top of the 3rd section top are required for proper cable retention, assemble with proper hardware and Loctite 243.

33. Lay 1/2/3 extend cables on the top of the 3rd section with the proper sheaves and pins that eventually will attach to the top plate of the 2nd section. Arrange cables per illustration (see figure 1).

34. The 3rd-4th-5th and cylinder assembly is now ready to assemble into the 2nd section boom.

35. Slide 3rd-4th-5th and cylinder assembly into the 2nd section boom approx. 36 in (90 cm) keep the 3rd-4th-5th and cylinder assembly suspended to avoid damage to the 4/3/2 retract cables.

HYDRAULIC SYSTEM

The hydraulic system of this machine is an open center type, consisting of a fixed displacement three section high pressure pump which supplies oil to a two inlet main control valve and a one inlet turn/outrigger/ stabilizer control valve.

The hydraulic oil is supplied by a truck mounted oil reservoir and is equipped with replaceable canister type return oil filters. The truck power take off driven hydraulic pump is sized to supply 32 gpm (121 lpm) to the hoist circuit, 32 gpm (121 lpm) to the boom lift and telescope circuits, and 16 gpm (61 lpm) to the turn and outrigger circuits at 2,000 rpm pump/pto shaft speed. Higher pump speeds may result in excessive heat generation in the hydraulic system. The pump rotation direction is reversible. Consult pump manual for changing rotation direction if necessary to match PTO output direction.

The main control valve is equipped with two inlet sections and one mid-outlet section. One inlet supplies oil from the front (shaft end) section of the pump to the hoist function(s). The other inlet section distributes flow from the middle pump section to the boom and telescope functions. Return oil is routed thru various outlet ports on the main control valve. The main control valve contains inlet section relief valves or port reliefs which limit pressure in the hydraulic system to acceptable levels and control crane movements. See specification section for proper pressure settings.

The turn, outrigger and stabilizer functions are controlled by a separate control valve. Oil from the rear section of the pump is routed to the main inlet of the valve. The control valve contains inlet section relief valves which limit pressure in the hydraulic system to acceptable levels and control crane movements. See specification section for proper pressure settings.

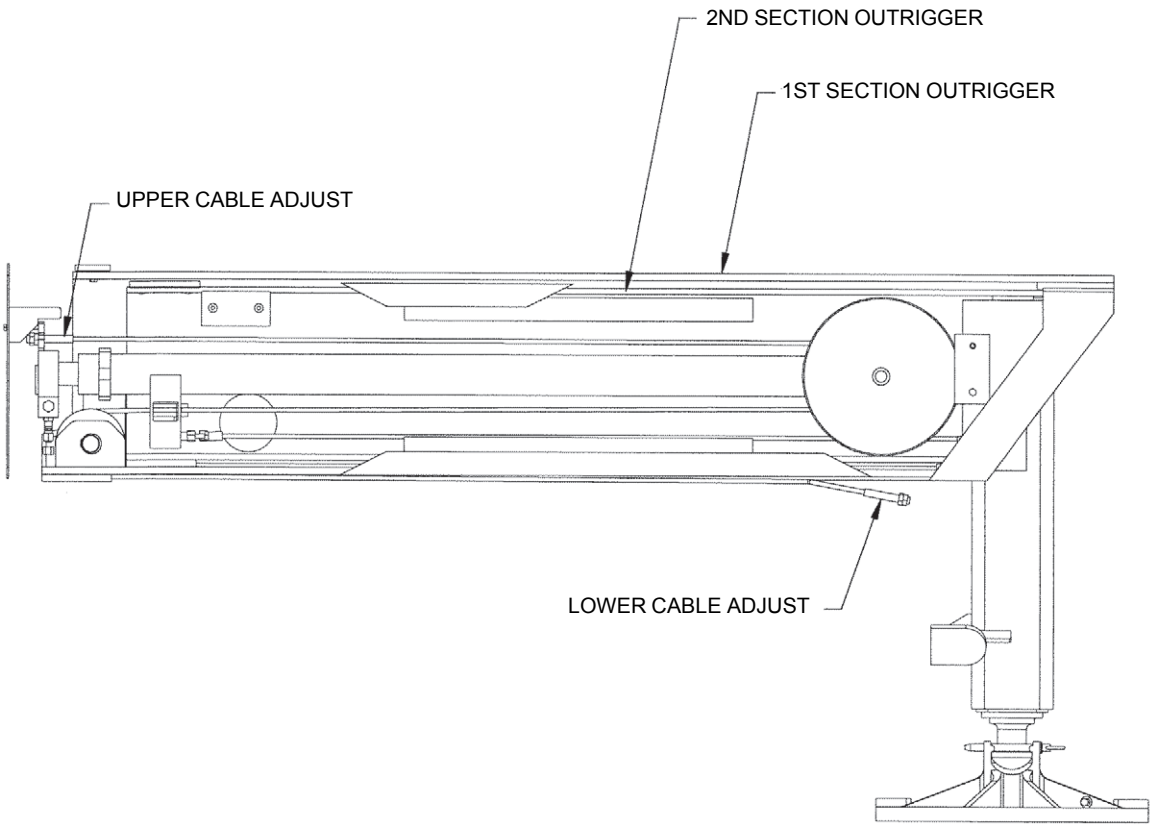
The crane hydraulic system includes a rated capacity limiter (RCL) system. This system monitors lift cylinder pressure. As the pressure in the lift cylinder approaches a maximum predetermined level, which can be monitored on the RCL display console, a signal is sent to a solenoid which dumps oil flowing to crane functions which increase the over capacity condition.

All load bearing cylinders on this machine are protected from inadvertent movement or collapse due to hose failure by pilot operated check valves or by pilot operated counterbalance valves if overhung loads must be controlled.

The standard swing gearbox is locked in place by an integrally mounted spring applied brake and a dual counterbalance motor holding valve. The swing brake and counterbalances are piloted open and closed by operating swing left or right and are automatically reapplied by ceasing the swing function. Maximum swing speed can be limited using the swing speed adjustment valve.

See “Specifications” section for system pressures and flows.

OUTRIGGER CABLE TENSIONING



1. With outriggers assembled and operational, cycle the outriggers and front stabilizer through full stroke out and down then up and in for five complete cycles to remove air in cylinders.
2. Fully retract outriggers. At full retraction, the base of the 1st section outrigger bottoms out in the base of the main outrigger and the base of the 2nd section outrigger bottoms out against the sheave cable anchor plates in the base of the 1st section outrigger. This may be viewed through the hole in the main outrigger.
3. If the 1st section outrigger does not bottom out in the main outrigger, loosen the upper cable adjustment. If the 2nd section outrigger does not bottom out in the 1st section outrigger, loosen the lower cable adjustment. After cables have been adjusted to allow full retraction of sections, torque cables to 30-35 lb-ft (40-47 Nm) by first tensioning the lower cable adjustments, then the upper

MINIMUM TRUCK REQUIREMENTS

Many factors must be considered in the selection of a proper truck for a 1400H series crane. Items which must be considered are:

1. **Axle Rating.** Axle ratings are determined by the axles, tires, rims, springs, brakes, steering and frame strength of the truck. If any one of these components is below the required rating, the gross axle rating is reduced to its weakest component value.
2. **Wheelbase (WB), Cab-to-Trunnion (CT) and Bare Chassis Weight.** The wheelbase, CT and chassis weights shown are required so the basic 1400H can be legally driven in all states and meet stability requirements. The dimensions given assume the sub-base is installed properly behind the truck cab. If exhaust stacks, transmission protrusions, etc. do not allow a close installation to the cab, the WB and CT dimensions must be increased. Refer to the Mounting Configuration pages for additional information.
3. **Truck Frame.** Try to select a truck frame that will minimize or eliminate frame reinforcement or extension of the after frame (AF). Many frames are available that have the necessary after frame (AF) section modulus (S.M.) and resistance to bending moment (RBM) so that reinforcing is not required. The optional front stabilizer used for a 360° working range around the truck. The frame under the cab through the front suspension must have the minimum S.M. and RBM because reinforcing through the front suspension is often difficult because of engine, radiator mounts and steering mechanics. See “Truck Requirements” and “Frame Strength” pages for the necessary section modulus and resistance to bending moment values.
4. **Additional Equipment.** In addition to the axle ratings, wheelbase, cab-to-axle requirements and frame, it is recommended that the truck is equipped with electronic engine control, increased cooling and a transmission with a PTO opening available with an extra heavy duty PTO. See “PTO Selection” pages. A conventional cab truck should be used for standard crane mounts.
5. **Neutral Start Switch.** The chassis must be equipped with a switch that prevents operation of the engine starter when the transmission is in gear.

TRUCK PREPARATION

Plan installation completely before any work is done. Plan the location of the crane for the final front and rear axle weights and boom overhang. Check final weight (see Counterweighting Section to verify that final truck weight with crane, reinforcement, counterweight and options such as jib, etc. complies with the appropriate laws).

Welding Precautions

Sensitive truck computer system and crane's LMI computer system components may be damaged by welding on the truck or crane. The following precautions should be taken:

- Disconnect truck battery cables (positive and negative)
- Attach welding ground lead as close as possible to area to be welded.

Positioning Crane On Truck

The final user of the crane must be aware of all state axle and length laws in force at the time of crane mounting and position the crane on the truck accordingly. Following are items which must be considered.

1. **Overall Length:** Most states have a maximum straight truck length limit of 40 ft (12,19 m). Using too long a WB truck could cause the unit to exceed this limit.
2. **Axle Weights:** All states allow 20,000 lb (9072 kg) single axle weight and 34,000 lb (15 422 kg) tandem axle weights on primary roads, however, some states restrict axle weight to less on secondary roads or at certain times throughout the year. Be aware of your state's axle laws and the roads the machine will operate on for weight restrictions due to secondary roads, bridges, winter driving conditions, etc.
3. **Overhang:** The most restrictive overhang laws call for a maximum of 3 ft (0,91 m) in front of the truck. Many states have a maximum of 4 ft (122 cm) overhang in back of the truck. Check on your state requirements.
4. **Federal Bridge Law.** The Federal Bridge Law in effect currently states that in order to carry 54,000 lb (24 494 kg) on a three axle truck, the extremes of any group of axles must be at least 23.5 ft (7,16 m) apart. This equates to a truck with a wheelbase of at least 258 in (655 cm) with a minimum length of 24 in (61 cm) from the center of tandems to the center of the rear axle.

PTO, Pump, Reservoir

1. Select the PTO according to the PTO Selection pages shown earlier in this section. PTO's are not furnished by the factory.
2. Install the PTO and PTO shifting mechanism according to the PTO manufacturer's instructions. If PTO has a reverse gear, it must be blocked out. Pump must not run backwards.
3. If PTO integral mount flanges are to be used, the pump can be mounted directly to the PTO. Direct mount pumps require lubrication of the spline shaft coupling. See “Service and Maintenance” Section for lubrication information. Be sure adequate clearance exists for this type of pump mount. Sometimes the pump is powered through a drive line with the pump located no more than 42 in (107 cm) from the PTO. The drive line should not exceed a 15° angle. The drive line U-joint yokes on both ends of the drive shaft must be parallel with each other. Drive lines should be sized so they can safely carry the maximum pump horsepower requirements. See “PTO Selection” pages. Drive lines are not normally furnished by the factory.
4. Plan the location of the pump mounting bracket and drive line, if used, so that ample clearance is maintained between pump and truck drive shaft or exhaust system. Pump should be situated so that hydraulic lines can be connected without sharp bends especially the large suction line from the reservoir. Pump mounting brackets may be attached to existing frame crossmembers or a 6 in (15 cm) channel crossmember can be made and installed.
5. Install pump mounting bracket (if used) securely to frame. Attach pump to pump mounting plate or to PTO using capscrews provided. Install the support bar at the rear of the pump and bolt or weld the upper end to a crossmember if the pump is mounted with a drive line or install the support bar to a transmission bolt if the pump is direct mounted to the PTO.

Note: Some of the pipe fittings used are sealed by means of two threaded tapered sections, one male and one female. When these two tapers meet, you will note a sudden increase in the force required to screw the fittings together. This is true of all tapered pipe threads. Further tightening will not only fail to increase the pressure tightness of the Joint, but may ruin the connections and make correct assembly impossible.

Other fittings are of the O-ring boss type. These are installed by first screwing the lock nut flush to the upper thread land and installing fitting into port until the nut contacts the surface of the port. Adjust fitting to desired direction. Tighten locknut.

Most pressure fittings are the O-ring face seal types. A small O-ring is compressed between the male and the female fittings of the joint. Be sure the O-ring is present on the fitting and seated properly in its groove before the fittings are tightened.

6. Remove the dust covers from the pump inlet and outlet and determine that the suction and pressure sides of the pump are correct while rotating the pump in the same direction as the PTO. Rotate the pump in the mounting bracket so suction side is toward the reservoir suction port. An arrow is cast into the rear pump housing to identify rotation. Make sure pump is correct rotation.

PIN BEARING INSPECTION AND INSTALLATION PROCEDURE

Pin Inspection

1. Remove the protective covering from pins and inspect each pin for nicks, gouges or deep wide scratches. A small nick or gouge up to 1/8 in (3 mm) diameter can be repaired by dressing the edges of the imperfection with a file so that no metal protrudes above the circular surface of the pin.
2. A circular scratch of up to 1/16 in (1,5 mm) wide or deep can be repaired as in 1 above.
3. A lengthwise scratch on the pin of up to 1/32 in (0,8 mm) wide or deep can be repaired as in 1 above.
4. Pins with defects larger than those listed in 1, 2 or 3 should be replaced.

Bearing Inspection

1. The bearings furnished with this machine are made up of a tough epoxy impregnated wound glass backing shell with a thin inner layer of filament wound bearing material. The outer bearing material should be visually checked for imperfections. Bearings with cracks or gouges larger than 1/4 in (6 mm) diameter on the outside diameter should be replaced.
2. Inspect the inner diameter surface of the bearing, any scratches, cut or gouges which have penetrated through the inner liner may cause premature failure of the bearing. The bearing should be replaced.

Trunnion Inspection

1. The trunnion bore should either have a machined step or have a spring spacer installed to prevent inward movement of the bearing. If equipped with a spring spacer, check to make sure the opening is positioned over the grease hole.

Installation

1. Two bearings are to be installed in the boom pivot trunnion located directly below the hoist and the remaining four bearings are to be installed in the lift cylinder, two at each side of the rod end of the cylinder and two at each side of the butt end of the cylinder.
2. The bearings should be started in their respective bores by rotating the bearing while applying inward pressure with the hand. Once the bearing has been started squarely into its bore, it can be driven to its full counter bored depth by tapping lightly with a rubber mallet. The head diameter of the mallet should exceed the outside diameter of the bearing to ensure that the bearing is not damaged during assembly into the bore.
3. If the bearing appears to be loose in the bore (if it can be pushed in with hand pressure alone), it is permissible to tighten the bearing by center punching the bore diameter in approximately 50 places around and throughout the 2 in (51 mm) deep bored area. Center punching will raise the metal around the edge of the punch mark and this raised metal will hold the bearing firmly in place during machine operation.
4. After all bearings have been installed and before attempting to assemble the machine, insert the pins through both bearings in each end of the lift cylinder and through the boom pivot bearings to insure alignment and fit are correct. Also check the two sets of pin holes in the turret and the pin holes in the boom ears to ensure that the pins will slide freely through the leading hole and start in the opposite hole. If a pin starts to bind through the leading hole, do not force the pin any further to avoid damaging the pin surface finish. Remove the pin and clean any corrosion of burrs out of the holes with a round file or emery cloth.
5. When pinning the boom to the turret, and the lift cylinder to the turret and boom, use a round smooth bar of approximately 1 -1/2 in (38 mm) diameter as a pry bar to align the pin holes. A pry bar with a sharp edge, such as a crowbar, can gouge or cut bearing and this may lead to premature bearing failure.