Crane Serial Number

The crane serial number is on the Crane Rating Manual in the operator's cab. The crane serial number should always be furnished when ordering parts for the crane, or when corresponding with the Link-Belt Distributor or factory regarding the crane. The serial number is the only method the Link-Belt Distributor or factory has of ensuring that the correct parts will be furnished.

In the event the serial number cannot be found on the Crane Rating Manual, a number is stamped on top of the bumper on the right side of the carrier and on the right side of the upper frame just below the boom hoist cylinder lug. This number can then be used to help to identify the crane.

Operator's Manual

⚠ WARNING

CONSTRUCTION EQUIPMENT CAN BE DANGEROUS IF IMPROPERLY OPERATED OR MAINTAINED. THIS CRANE SHOULD BE OPERATED AND MAINTAINED ONLY BY TRAINED AND EXPERIENCED PEOPLE WHO HAVE READ, UNDERSTOOD, AND COMPLY WITH THIS OPERATOR'S & MAINTENANCE MANUAL.

The productive life of construction equipment depends largely on the care and consideration given to it. This especially holds true for hydraulic cranes. This Operator's & Maintenance Manual was compiled to explain the procedures and adjustments necessary for proper operation of this crane.

A study of this Operator's Manual will acquaint the operator and service personnel with the construction of this crane. It will enable them to identify and remedy most problems that may occur. Any questions pertaining to the care and upkeep of this crane which are not covered in this Operator's Manual should be directed to your Link-Belt Distributor.

The Operator's Manual is stored in the operator's cab. The Operator's Manual should remain in the cab and accessible at all times. **If the Operator's Manual becomes lost, damaged, or unreadable, it must be replaced before operating the crane.**

In addition to this Operator's & Maintenance Manual, a Parts Manual, Crane Rating Manual, and Safety Manual are supplied with the crane. Read and understand all safety guidelines before operating the crane. Additional copies of all manuals are available through a Link-Belt Distributor.

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents, and certain vehicle components contain or emit chemicals known to the State of California to cause cancer, birth defects, and other reproductive harm.

Throughout this Operator's Manual, reference is made to the left, right, front, and rear pertaining to direction and locations. These reference directions are relative to the operator, sitting in the operator's seat with the upper directly over the front of the carrier (engine to the rear), unless otherwise stated.

Danger, warning, and caution captions as well as special notes are used throughout this Operator's Manual and on the crane to emphasize important and critical instructions. Labels, decals, plates, etc. should be periodically inspected and cleaned as necessary to maintain good legibility for safe viewing. **If any instruction, caution, warning, or danger labels, decals, or plates become lost, damaged, or unreadable, they must be replaced.** Information contained on such labels, decals, and plates is important and failure to follow the information they contain could result in an accident. Replacement labels, decals, and plates can be ordered through your Link-Belt Distributor. For the purpose of this Operator's Manual, and the labels which are placed on the crane, danger, warning, and caution captions and notes are defined as follows:

DANGER

An operating procedure, practice, etc. which, if not correctly followed, will result in severe personal injury, dismemberment, or loss of life.

WARNING

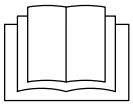
An operating procedure, practice, etc. which, if not correctly followed, may result in personal injury and may result in damage to or destruction of equipment or property.

CAUTION

An operating procedure, practice, etc. which, if not correctly followed, may result in damage to or destruction of equipment or property.

NOTE

Note: An operating procedure step, condition, etc. which is essential in order for the process to be completed properly.



This symbol may appear in this Operator's Manual and/or on a label on the crane to alert personnel that additional instructions are included in this crane Operator's Manual.

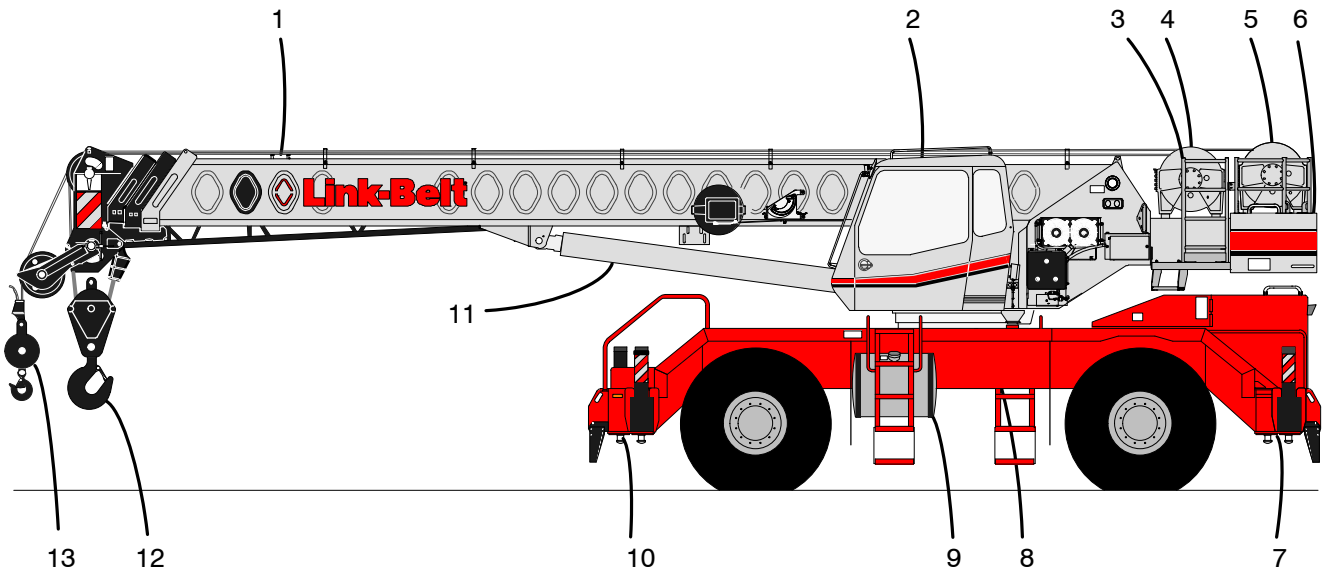
Operator's Manual

General Index

A detailed Table Of Contents for each Section of this Operator's Manual is included at the beginning of each Section. The following is a description of each Section:

Table Of Contents

Operator's Manual



1. Boom
2. Operator's Cab
3. Guard Rails (If Equipped)
4. Front Winch
5. Rear Winch
6. Counterweight
7. Rear Outrigger
8. Turntable Bearing
9. Fuel Tank
10. Front Outrigger
11. Boom Hoist Cylinder
12. Hook Block
13. Hook Ball

Figure 1–1
Crane Nomenclature

On Delivery

When a new crane is delivered, follow the instructions outlined in the latest version of Technical Bulletin General Series #213.

Operating Safety

Remember SAFETY every day. Someone's LIFE may depend on it, MAYBE YOUR OWN.

Safe operations of a hydraulic crane requires a well trained, qualified operator. Crane operation is more involved than it may appear, and operation by a careless or unqualified person can result in a serious accident.

When a hydraulic crane is maintained and used properly it can be a safe, highly productive piece of equipment, but if not used properly, it can be dangerous.

Think Safety - You, the operator, are in charge of an important piece of equipment. It is very important that you know what it can do. It is also important that you know what it should not do. No set of instructions can anticipate all of the situations you will encounter. The rules given here cover the general usage, and some of the more common specific cases. If conditions arise not covered by these rules, contact a Link-Belt Distributor. A phone call could save someone's life.

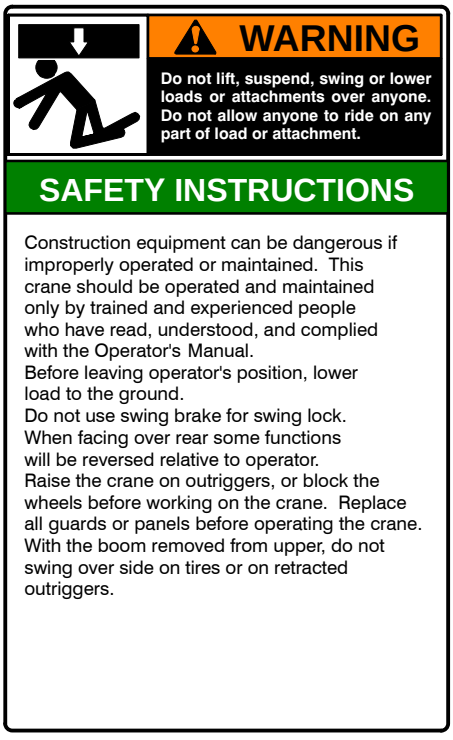


Figure 1–2
Read and understand all points covered in the Operator's Manual before operating the crane.

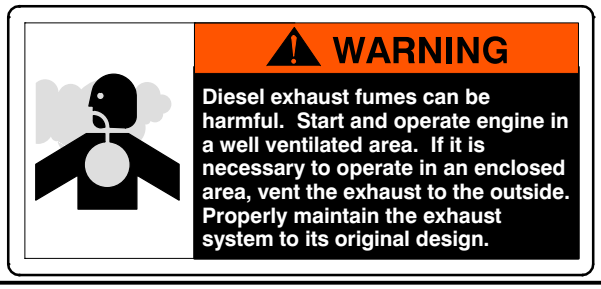


Figure 1–3
Diesel exhaust fumes can be harmful.

Figure 1–4
Do not smoke when fueling, or fuel up near an open flame.

General Safety Rules

The following is a list of safety rules which should be followed during all crane operations.

Operator Awareness

1. Read this Operator's Manual and heed it. This Operator's Manual contains important information.
2. An operator must not eat, read, or otherwise divert his attention while operating a crane. Remember-operating is a full-time job.
3. Start and operate the engine in a well ventilated area. Diesel exhaust fumes can be harmful. If it is necessary to operate in an enclosed area, vent the exhaust to the outside. Properly maintain the exhaust system to its original design.

Figure 1–5
Keep hands and tools clear of moving parts.

4. Don't smoke when fueling, or fuel up near an open flame. Keep the nozzle in contact with the filler neck to prevent static electric sparks. Shutdown the engine when fueling.
5. Keep fingers, feet, and clothing away from sheaves, drums, and wire ropes unless the crane is shutdown and everyone knows what you are doing. Do not place a hand on wire ropes when climbing on the crane. A sudden movement could pull you into the drums or sheaves.
6. Keep your shoes clean. Before entering the operator's cab, wipe clean any mud, gravel, moisture, or grease from your shoes. Slippery shoes could cause momentary loss of control of crucial foot operated controls.
7. Keep all walking surfaces (steps, ladders, platforms, etc) and non-skid materials on the crane clean. Non-skid materials are placed on the crane to assist operators and service personnel with safe access/egress to/from the crane and to/from adjustment and inspection areas. Do not allow non-skid materials to become contaminated with mud, snow, ice, oil, paint, wax, etc. Any contamination can cause the non-skid materials to become slick, reducing their effectiveness for safety while walking on the crane. If any non-skid materials become ineffective due to wear, age, or destroyed in any way, they must be replaced.
8. Use care during all access/egress to/from the crane. Use the hand rails, hand grips, steps ladders, guard rails, etc. to prevent slips and falls. Remain in three point contact (two hands and one foot or two feet and one hand) with the crane at all times.

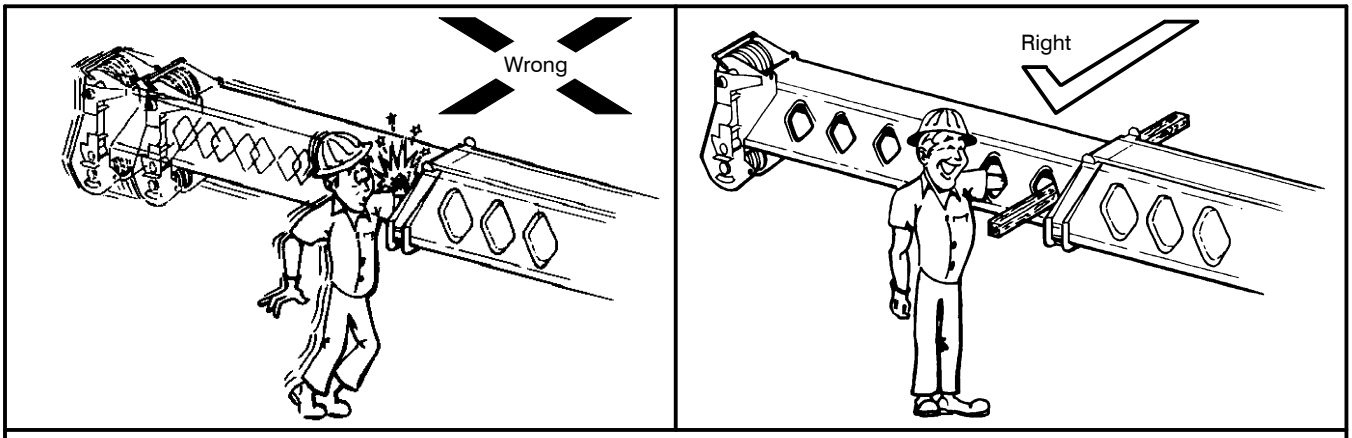


Figure 1—6
Place blocking through the diamond shaped hole, closest to the base section of the boom, before putting hands or tools inside a boom section.

9. Insert blocking through the diamond shaped hole closest to the boom base section, to prevent movement of the individual sections, before putting your hands or tools inside the boom. Unexpected movement of the boom sections could sever fingers, hands, arms, etc.
10. The operator, supervisor, or person in charge of the load must observe the following rules:
    a. Loads must be well secured before lifting. Ensure that the rigging cannot slip off or pull away from the load, or get out of position on the load. Use a three-point sling if necessary to keep the load from rolling or turning over.
    b. Chains and slings must be of adequate size, in good condition, and not twisted around each other.
    c. The load must not catch on an obstruction when lifting or swinging. Ensure the load, fall lines, or any other parts of the crane do not snag or strike any obstruction.
    d. Avoid sudden starts and stops. Lift carefully, swing gently, brake smoothly, lower and set loads carefully. Jerking the load, swinging and engaging swing brake roughly, and lowering the load rapidly and slamming on brakes, will put shock loadings and possible side loadings on the boom. Unnecessary abuse labels the operator as a beginner. Be a professional.
    e. Do not wrap the winch wire rope around the load. Do not use discarded, worn, or damaged wire ropes for slings. They may fail and drop the load.

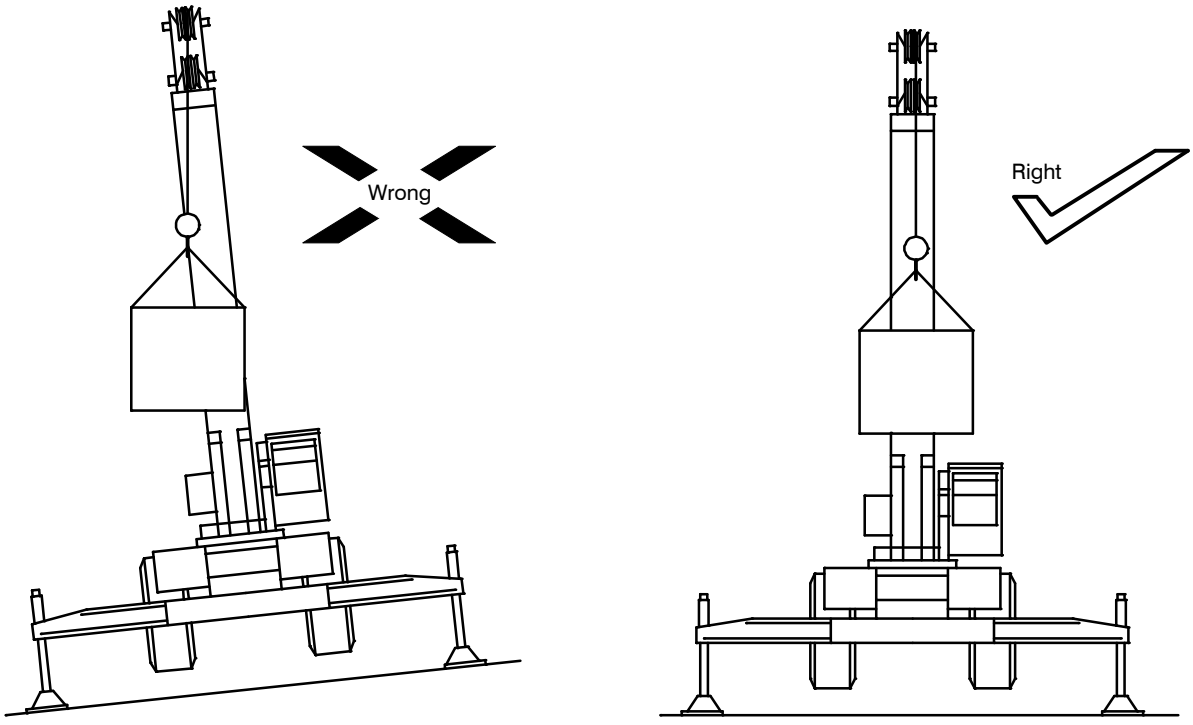


Figure 1–7
Level the crane.

f. The crane must be level on a firm supporting surface before making a lift. Use the bubble level to determine the crane is level. Check its accuracy frequently with a carpenter's level. Remember, a three degree side tilt can reduce capacities by 50% or more.

g. Do not allow the load to rotate out of control. Personal injury to ground personnel, load damage, crane damage, or damage to anti-two block system may occur.

h. When hoisting with single part of line, especially in long fall applications, the design of wire rope and the hook ball is crucial to minimize the potential for uncontrolled wire rope and/or load rotation. Rotation resistant wire rope is recommended for single part of line applications. See Wire Rope Capacity Chart in the Crane Rating Manual for the specific types of rotation resistant wire rope recommended for the crane.

i. If working at night, ensure adequate lighting is provided so the operator and all other workers can see all movements of the crane, attachment, and load.

11. Operate the crane from the operator's seat only. Operating the crane from any other position, such as reaching in a window, constitutes a safety hazard.
12. Watch the load or a signal person at all times. A suspended load must have your undivided attention.

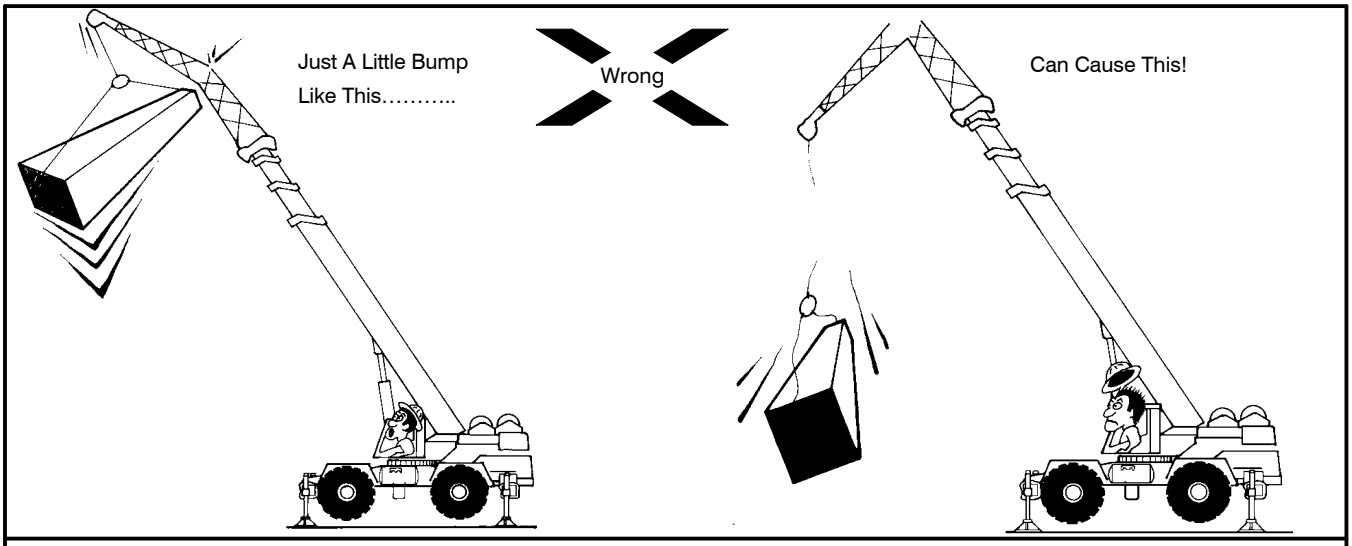


Figure 1—8
Do not let the load hit the boom or fly.

13. Don't let the load or bucket hit the boom or fly. Don't let the boom or attachment rest on, or hit, a building or any other object. A dent or other damage could result, which will weaken the boom or attachment. If the damage is major, the attachment could collapse. If a lattice or diagonal bracing member on the fly is broken, cracked, or bent, contact a Link-Belt Distributor for repair procedures. If the boom or fly is struck, or damaged by anything, STOP. The loading on a boom or attachments increases as they are lowered, therefore their suspension systems could collapse during lowering. Use another crane to lower a damaged boom or attachment.
14. Don't pull sideways on the boom or fly, not even a little. Lift straight up on every load. Moving trucks, rail cars, barges, or anything else pulling sideways on the winch wire rope could buckle the boom or fly. It could also damage the swing mechanism. Pulling sideways on a boom or fly can overturn the crane.
15. Do not "two block" (pull the hook block, hook ball, or load into the head machinery) as this can cause winch wire rope and sheave breakage resulting in an accident.
16. After slack winch wire rope operation, ensure the winch wire rope is properly seated in sheaves and on drums before continuing to operate. Use a stick or mallet to set the winch wire rope, not your hands.
17. Do not lower the load beyond the point where less than three full wraps of winch wire rope are left on the drum. This condition could occur when lowering a load beyond ground level. If all the winch wire rope runs off the drum, the load will jerk which could break the winch wire rope.

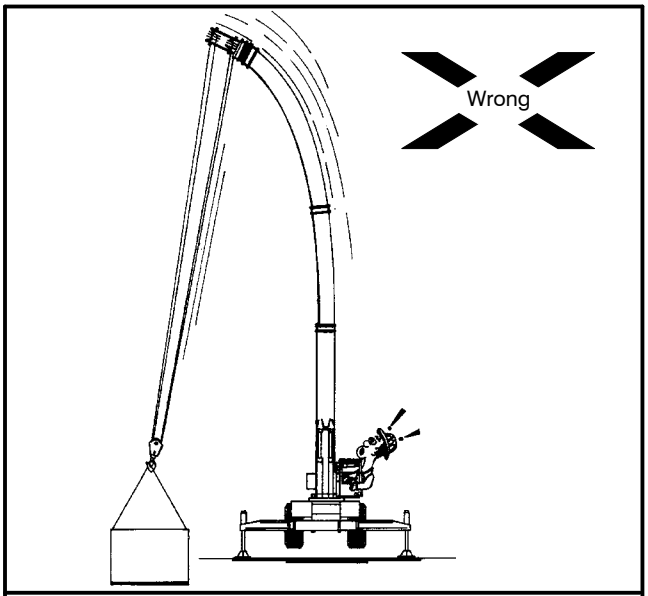


Figure 1—9
Do not use the boom to pull sideways.

18. Ensure there is a safety latch on the hook, and that it works properly. Without a latch, it is possible for slings or chains to come off the hook, allowing the load to fall.
19. Don't alter any part of the crane. Additions to or changes in any part of the equipment can create loadings for which the crane was not designed. Such changes may have a major affect on the usable capacities and make all the capacities in the Crane Rating Manual invalid. Alterations can dangerously overload or weaken critical parts and may cause disastrous failure.

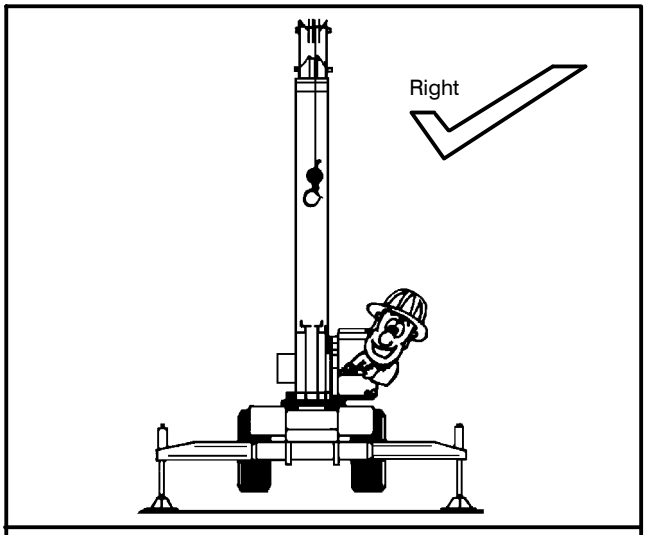


Figure 1—10
Crane level, all beams extended equally (all fully extended, intermediate extended, or fully retracted) and tires clear of the ground.

20. Do not exceed the rated capacities of the crane under any circumstances. While a crane has more stability when lifting over a corner (as compared to straight over the side) the crane capacity is not increased. Anytime the load exceeds the rated capacities listed in the Crane Rating Manual, the crane is overloaded. Overloads can damage the crane and such damage could cause major failure and serious accidents.
21. When operating on outriggers, all beams must be equally extended; all fully retracted, all intermediate extended, or all fully extended. All jacks must be extended so all tires are clear of the ground, and the crane must be level. Ensure that pontoons are set on firm surface, adequate to support the blocking, pontoon, crane, and load without settling, slipping, or collapsing. Blocking or matting under pontoons must form a smooth level surface under the entire pontoon. Do not block under outrigger beams inside the pontoons as this reduces stability. Blocking must be under pontoons only. Remember- there are tremendous loadings on pontoons and blocking - the weight of the entire crane plus any load.

    When blocking or matting under pontoons, ensure that each pontoon is supported fully - no unsupported pontoon area is permissible. Ensure pontoons are on a smooth surface. Rough surface, rocks, etc., under pontoons will cause unequal loadings, and can puncture them, causing them to collapse.

    Capacities are based on all outriggers being equally extended: all fully retracted, all intermediate extended, or all fully extended. Working on outriggers that are not equally extended will reduce capacities and crane stability considerably and could cause an accident. Do not make any lifts while on outriggers without the outrigger beams equally extended.

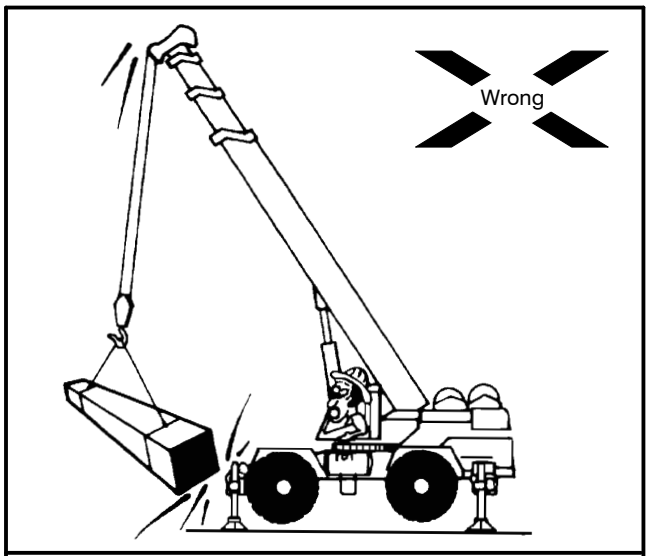


Figure 1—11
Watch that carrier!

22. Before attempting to move the carrier, ensure there is enough oil pressure to operate the brakes. Always check the brake operation before traveling the crane.
23. Brake firmly in one application. Avoid fanning the brakes. This could exhaust oil pressure so fast that the pump may not supply enough oil.
24. Do not coast downhill with the transmission in neutral. It makes control of the crane more difficult and dangerous.
25. Shift the transmission to neutral before operating the crane. Crane operation can cause movement which can damage the transmission or drive line. When parking, shift to neutral and engage the park brake. Block wheels if not on a level surface.
26. When operating with the boom at a high angle, use care not to let the load hit the carrier.
27. Cold weather operation requires some special attention by the operator to allow for changes in everyday routines:
    a. Clean the crane, especially the boom, of accumulated amounts of ice or snow. Operating the crane with an ice covered boom is dangerous. The added weight of the ice or snow can drastically reduce the capacity of the crane. Also, falling ice may pose danger for ground personel.
    b. Clean all snow and ice from steps, ladders, platforms, etc. to eliminate slippery walking surfaces.
    c. If cold weather starting aids are provided on the crane, use them. The use of aerosol starting sprays can be dangerous if the manufacturer's directions are not closely followed.
    d. Pay close attention to the gauges in the operator's cab when starting the engine. Normal "warm up" times will be longer. Confirm that all

pressures and temperatures are within normal ranges before beginning operations.

e. Always handle flammable materials according to the manufacturer's instructions. Propane, diesel, or other fuel for auxiliary heaters can be dangerous if not properly handled. Do not store such fuels on the crane.

f. Use caution when lifting any load during freezing weather, as it may be frozen to the ground or the supporting surface. The added tension, to break the load free, could cause an unexpected overload situation. Also, when the load does finally break loose it could create an erratic motion causing damage or injury.

g. At the end of the work shift, park the crane where it will not freeze to the ground. Major damage to the drive mechanism could occur while trying to free the crane from a frozen surface.

Thermal Effects on Hydraulic Cylinders

Hydraulic oil expands and contracts when heated or cooled. This is a natural occurrence that effects all liquids. The coefficient of expansion for API Group 1 hydraulic oil is approximately 0.00043 cubic inches per cubic inch of volume for 1°F of temperature change. Thermal contraction will allow a cylinder to retract as the trapped hydraulic fluid in the cylinder cools. The change in length of a cylinder is proportional to the extended length of the cylinder and to the change in temperature of the oil in the cylinder. For example, a cylinder extended 20 feet and the oil cools down 40°F would retract the cylinder approximately 4 inches (refer to Cylinder Drift Chart. A cylinder extended 5 feet and the oil cools down 40°F would only retract the cylinder approximately 1 inch. The rate at which the oil cools depends on many factors and will be more noticeable with a larger difference in oil temperature verses the ambient temperature.

Thermal contraction combined with improper lubrication or improper boom wear pad adjustments may cause a "stick-slip" condition in the boom. This condition could result in the load not moving smoothly. Proper boom lubrication and wear pad adjustment is important to permit the boom section to slide freely. Slow movement of the boom may be undetected by the operator unless a load is suspended for a long period of time.

This situation can also occur in reverse. If the crane is setup on a cold morning and as the daytime ambient temperature heats the oil, the cylinders will extend in similar proportions.

The Cylinder Drift chart can assist in determining the approximate amount of retraction/extension that may be expected from a hydraulic cylinder as a result of a change in temperature of the hydraulic oil inside the cylinder. That chart is for dry rod cylinders. If the cylinder rod is filled with hydraulic oil, the contraction rate is somewhat greater.

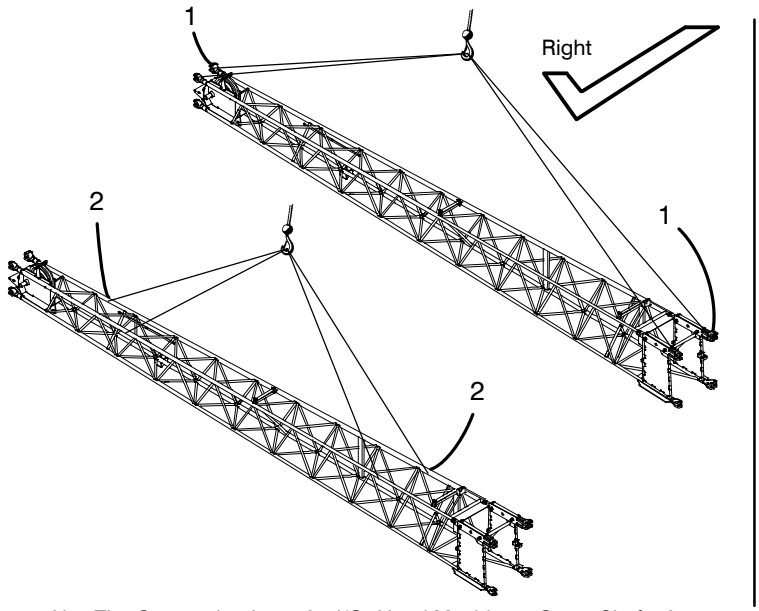
Note: Operators and service personnel must be aware that load movement as a result of thermal expansion/contraction of hydraulic oil within cylinders can be mistaken as leaking cylinder seals or faulty holding valves.

CYLINDER DRIFT (Cylinder Length Change in Inches)

Stroke (Ft.)	Temperature Change (°F)									
	10	20	30	40	50	60	70	80	90	100
5	0.26	0.52	0.77	1.03	1.29	1.55	1.81	2.06	2.32	2.58
10	0.52	1.03	1.55	2.06	2.58	3.10	3.61	4.13	4.64	5.16
15	0.77	1.55	2.32	3.10	3.87	4.64	5.42	6.19	6.97	7.74
20	1.03	2.06	3.10	4.13	5.16	6.19	7.22	8.26	9.29	10.32
25	1.29	2.58	3.87	5.16	6.45	7.74	9.03	10.32	11.61	12.90
30	1.55	3.10	4.64	6.19	7.74	9.29	10.84	12.38	13.93	15.48
35	1.81	3.61	5.42	7.22	9.03	10.84	12.64	14.45	16.25	18.06
40	2.06	4.13	6.19	8.26	10.32	12.38	14.45	16.51	18.58	20.64

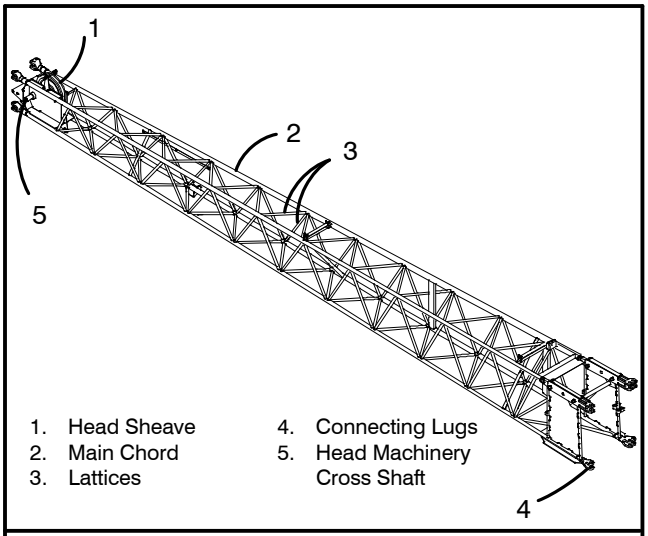
Length change in inches = Stroke (ft.) X Temperature Change (°F) X Coefficient ($in^3/in^3/°F$) X 12 in/ft.

Coefficient = 0.00043 ($in^3/in^3/°F$)



1. Use The Connecting Lugs And/Or Head Machinery Cross Shafts As Lifting Points.
2. Use The Main Chords As Lifting Points With Nylon Straps Only.
3. Do Not Attach Slings To Lattices, They Will Bend.

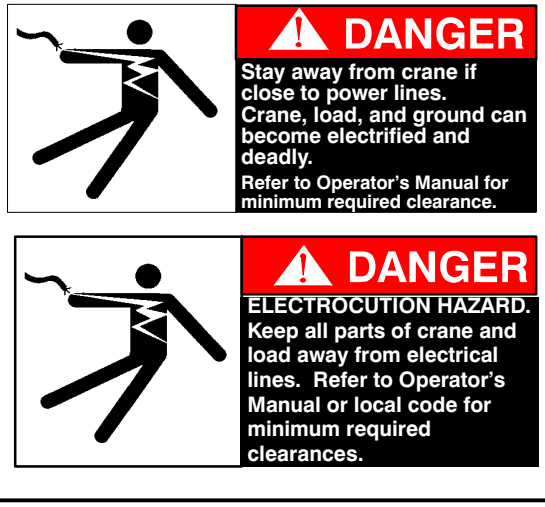
Figure 1–12
Handling The Fly Section(s).



1. Head Sheave
2. Main Chord
3. Lattices
4. Connecting Lugs
5. Head Machinery Cross Shaft

Figure 1–13
Fly Section Nomenclature

28. Use care handling the fly when loading, transporting, and unloading. Damage that occurs during these operations can go undetected and could result in failure of these components, once subjected to loading. Do not attach slings to the lattices, when lifting the fly, as they will bend. Use the connecting lugs and/or head machinery cross shaft as the lifting points. It is also permissible to attach nylon straps around all four main chords.
29. Block under the fly when loading it on a transport vehicle. When securing the fly to a transport vehicle, it is best to use synthetic webs or slings. If using wire rope slings, pad the fly to protect it from damage. Do not overtighten the tie downs or the fly may be damaged. Do not use chain tie downs, as they may dent and damage the fly section(s).
30. Thoroughly inspect all the elements of the fly section before installing it on the crane. Check each main chord, picture frame, diagonal, lattice, and connecting lug for bends, dents, and cracked or corroded welds. Picture frames must be square. Do not use any fly section that is even slightly damaged. Contact a Link-Belt Distributor for the proper repair procedures.



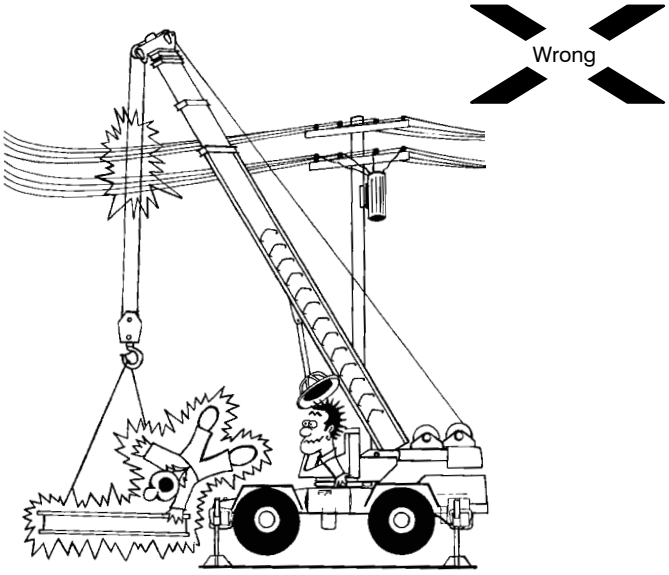
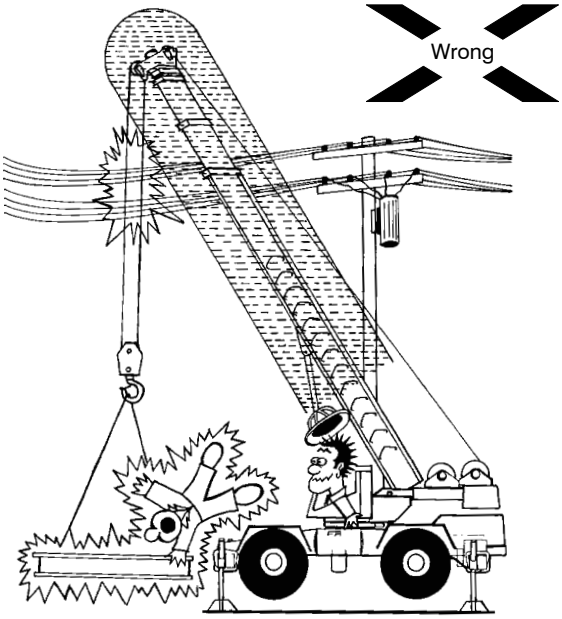


Figure 1–14
Stay Away From Power Lines

Electrical Dangers

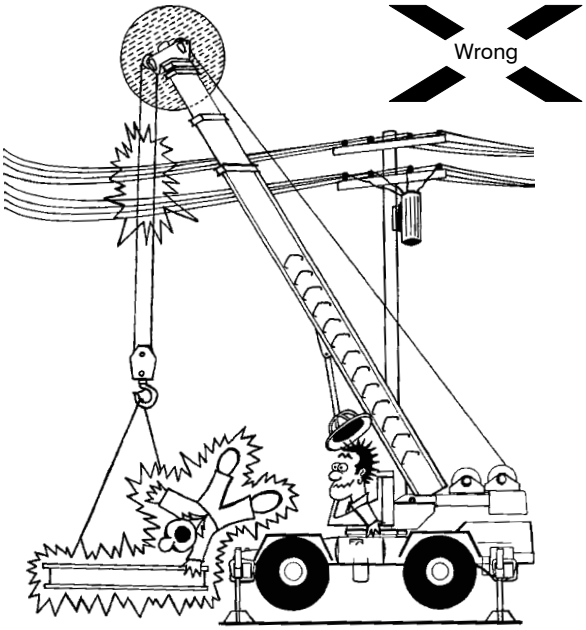
1. All Electrical Power Lines Are Dangerous. Contact with them, whether insulated or not, can cause death or injury. When operating near power lines, the best rule is to have the power company turn off the power and ground the lines. However, in some cases, the operator may be unable to have the power turned off. Follow these rules whether the power is turned off or not. Follow all requirements per OSHA regulations 1926.1407 through 1926.1411 as applicable while assembling, disassembling, operating, and traveling the crane in the vicinity of any power lines.
   a. Be alert. You are working around conditions which can cause death.
   b. Keep all parts of the crane - fall lines, hook block, hook ball, and load - at least the distance from the power line as specified in the "High Voltage Power Line Clearance Chart", or such distance as required by any other state or local requirements.
   c. Assume that every line is "Hot".
   d. Do not perform any crane assembly/disassembly under any energized power line.
   e. Overhead lines can move when the wind blows against them. Allow for this when determining safe operating distances.

Minimum Clearance When Operating Near High Voltage Power Lines Or During Crane Assembly/Disassembly	
Normal Voltage, kV (Phase to Phase)	Minimum Required Clearance, ft (*m*) See Note 1
To 200	15 (*4.57*)
Over 200 To 350	20 (*6.10*)
Over 350 To 500	25 (*7.62*)
Over 500 To 750	35 (*10.67*)
Over 750 To 1000	45 (*13.72*)
Over 1000	As established by the power line owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution.
Minimum Clearance When Traveling With No Load	
To 345	15 (*4.57*)
Over 345 To 750	16 (*4.87*)
Over 750 To 1000	20 (*6.10*)
Over 1000	As established by the power line owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution.
Note 1: Maintain 50 ft (15.2*m*) minimum clearance from power lines if voltage is unknown. If unknown but yet known to be less than 350 kV, maintain 20 ft *(6.1m)* minimum clearance.	
Note 2: Environmental conditions such as wind, fog, smoke, or precipitation may require increased clearances.	
High Voltage Power Line Clearance Chart	



Shaded area shows "sensitivity zone" with full boom length sensor used. Contact can be made outside this zone by the wire rope(s), cab, etc. In such cases the warning will not sound until contact is made, and the crane is electrified and deadly.

Figure 1—15
Crane equipped with proximity warning device on the entire boom.



Shaded area shows "sensitivity zone" with the probe near the boom peak. Contact can be made outside this zone by the wire rope(s), cab, etc. In such cases the warning will not sound until contact is made, and the crane is electrified and deadly.

Figure 1—16
Crane equipped with proximity warning device on boom tip.

f. Appoint a reliable person equipped with a loud signal (whistle or horn) to warn the operator when any part of the crane is working around the power line. This person should have no other duties while the crane is working around the power line.

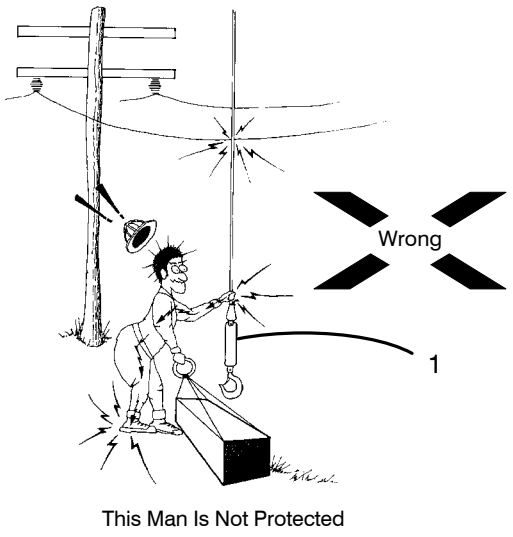
g. Warn all personnel of the potential danger. Con't allow unnecessary persons in the area. Don't allow anyone to lean against or touch the crane. Don't allow workers or load handlers to hold load, load lines, or rigging gear unless absolutely necessary. In these cases, use dry hemp or plastic ropes as tether lines. Make certain everyone stays a minimum distance away from the load as specified in the "High Voltage Power Line Clearance Chart", or such distance as required by any other state or local requirements.

h. The use of boom point guards, proximity devices, insulated hooks or swing limit stops do not assure safety. Even if codes or regulations require the use of such devices, you must follow rules listed here. If you do not follow them, the result could be serious injury or death.

i. Grounding the crane can increase the danger. Poor grounding such as a pipe driven into the ground, will give little or no protection. In addition, a grounded crane may strike an arc so heavy that a live line may be burned down. This could cause the crane and the area around it to be electrified.

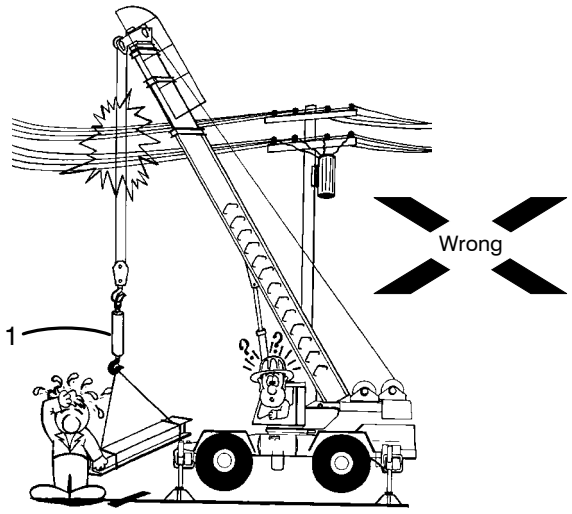
j. When operating near radio or T.V. transmitting stations, high voltage can be induced in metal parts of the crane, or in the load. This can occur even if the crane is some distance from the transmitter or antenna. Painful, dangerous shocks could occur. Contact trained electronic personnel before operating the crane to determine how to avoid electrical hazards.

2. **What do you do if a power line is touched by a crane or load?**
   a. Remain calm - think - a mistake can kill someone.
   b. Warn all personnel to keep clear.
   c. If crane will still operate, try to move it away from contact. You, the operator are reasonably safe in the cab unless the crane is on fire or an arc is cutting through the cab.



1. Insulated Link

Figure 1—17
Crane equipped with insulated link.



1. Insulated Link

Figure 1—18
Crane equipped with insulated link and boom point guard.

d. Move away from contact in the reverse direction to that which caused the contact. Example: If you swing left to the wire, swing to the right to break contact. Remember - once an arc has been struck, it will stretch out much farther than you think before it breaks. Keep moving until the arc has been broken.

e. When the arc breaks, continue moving until you are at least the minimum distance away as specified in the "High Voltage Power Line Clearance Chart", or such distance as required by any other state or local requirements. Stop the crane. Thoroughly inspect crane and repair any damage before further use. Contact a Link-Belt Distributor and request a "Crane Inspection After Contacting Power Line" form which lists necessary inspection items.

f. If you cannot disengage from the electrical line, and the crane is not on fire or no arc is cutting through the cab, stay in your seat until power line can be turned off.

g. If you must leave the crane, don't step off. Leap from the crane as far as you can, landing with feet together, then hop away from the crane with feet together, or shuffle feet to keep them close together. This could help prevent personal injury.

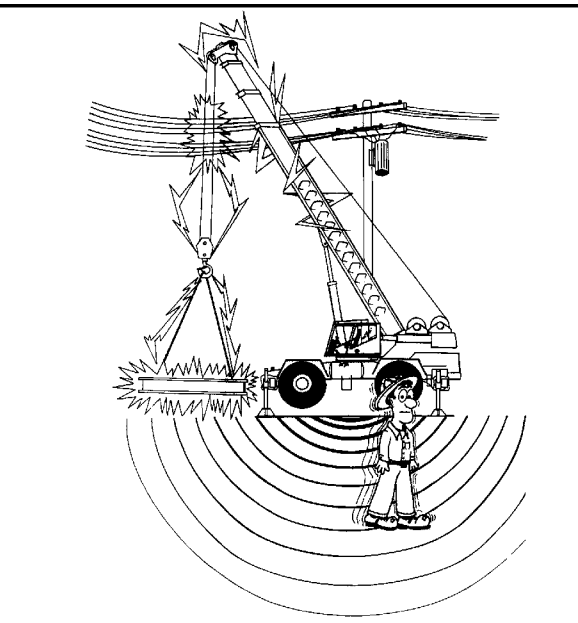


Figure 1—19
If you must leave the crane, do not step off. Leap as far as you can with feet together and hop or shuffle away from the crane.

3. When using a magnet:
   a. Lifting magnet generators produce voltage in excess of 200 volts and present an electrical shock hazard. Only trained personnel should work on the magnet, controller, or wiring. Don't open the controller door with the generator running.
   b. Do not let workers touch magnet or load.
   c. Do not let workers get between magnet and a metal object.
   d. If necessary to position a load, use a dry, wooden stick.
   e. Open magnet disconnect switch at magnet control panel before connecting or disconnecting leads.

Radio Frequency Or Electro Magnetic Interference (RFI Or EMI)

Certain areas may contain high Radio Frequency Or Electro Magnetic Interference (RFI or EMI). In these areas the boom can act like an antenna and produce an electrical current that may cause electrical shocks and/or the crane to malfunction. If operating in an area where these conditions may exist, test the crane or have the area tested for the magnitude of this interference before operating the crane. Operation may not be possible or boom length may be limited. Comply with all local, state, and federal laws when operating in high RFI/EMI areas.

Protective Equipment

1. Always replace protective guards and panels before operating the crane.
2. Always wear hard hats, safety glasses, steel toe shoes, hearing protection, and any other safety equipment required by local job conditions, OSHA, or other regulations.
3. Always wear safety glasses when drilling, grinding or hammering. Flying chips could injure the eyes.
4. Always wear a mask to prevent breathing any dust, smoke, fumes, etc. while cleaning, drilling, welding, grinding, sanding, etc. on any part of the crane. Breathing dust, smoke, fumes, etc. can be very hazardous.
5. The crane is equipped with a fire extinguisher in the operator's cab. Ensure all personnel know that one is available and where it is located. It must be kept in the crane at all times (except when needed). Instruct all operating and maintenance personnel in proper use of the extinguisher. Check periodically to ensure it is fully charged and in working order. Replace immediately if required.
6. Do not tamper with safety devices. Keep them in good repair and properly adjusted. They were put on the crane for your protection.
7. When operating a crane equipped with any form of load indicating mechanism, overload warning system, or any automatic safety device, remember that such devices cannot replace the skill and judgment of a good operator. For instance, such devices cannot tell when a crane is located on a supporting surface that will give away, that too few parts of line are being used to lift a load, cannot correct for the effects of wind, warn that the device may be improperly adjusted, correct for side pulls on the boom, or for many conditions which could occur and create hazards. It requires all the skill, experience, judgment, and safety consciousness that a good operator can develop to attain safe operation. Many safety devices can assist the operator in performing his duties, but he should not rely on them to keep him out of trouble.

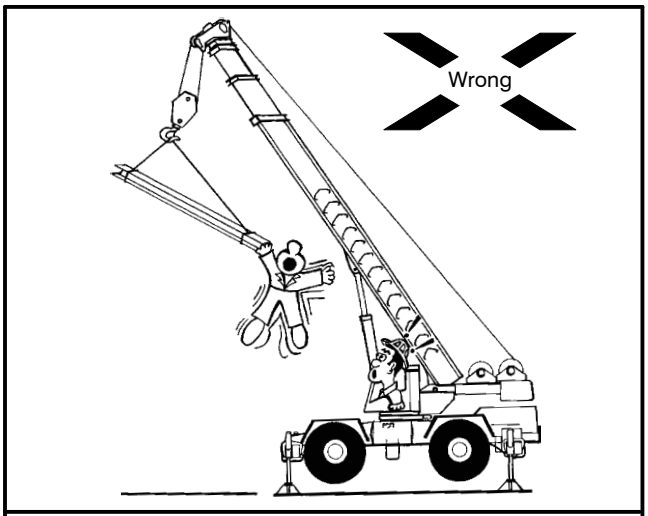


Figure 1–20
No hook riders!

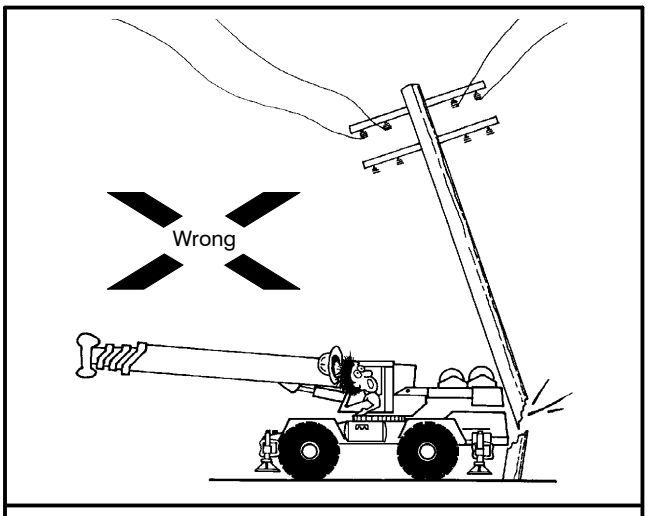


Figure 1–21
Use a signal person, back safely.

Signal Persons And Bystanders

1. Don't allow crane boom or loads to pass over people, or endanger their safety. Remove all loose objects from load. All unnecessary personnel should leave the immediate area when crane is operating.
2. Do not allow anyone to ride on the hook block, hook ball, or any part of the load or attachment for construction work or recreational activities. (This applies to recreational activities such as "bungee jumping" or "bungee cord jumping".) Cranes are intended to lift objects, not people. They are not elevators.
3. Do not carry passengers! There is only one seat and it is for the operator. Do not allow personnel to ride on the carrier deck during operation or while traveling the crane. A fall from the crane can cause death or serious injury.
4. Always look before you back up, or better yet, post a signal person to guide you. Ensure the back up alarm is working properly. Use the horn as a signal. Use a code such as one beep - stop, two beeps - forward, and three beeps - backward. Ensure everyone on the job site knows the code.
5. Do not make a lift which is not in plain sight without a signal person. This can lead to an accident or crane damage.

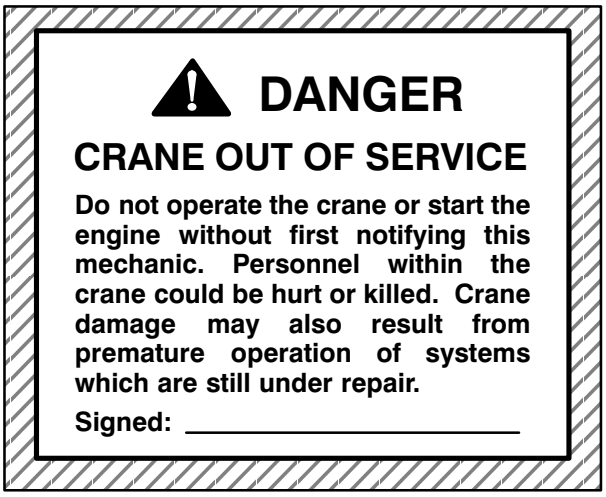


Figure 1–22
Remove the keys from the ignition and post a sign to make others aware of repair activity.

Crane Inspections And Adjustments

1. Inspect crane daily. Do not operate a damaged or poorly maintained crane. Pay particular attention to the clutches, brakes, attachments, and wire ropes. If a component is worn or damaged, replace it before operating.
2. Labels, decals, plates, etc. should be periodically inspected and cleaned as necessary to maintain good legibility for safe viewing. If any instruction, caution, warning, or danger labels, decals, or plates become lost, damaged, or unreadable, they must be replaced.
3. When performing repetitive lift applications, especially at or near maximum strength limited capacities, an inspection of the major structural areas of the crane, for cracks or other damage, should be conducted on a regular basis. (A non-destructive test such as magnetic particle or dye penetrant may even be considered.) Along with inspection for cracks and damage, frequently check the critically loaded fasteners, such as the turntable bearing mounting capscrews, to ensure they have not been stretched. Not only does frequent inspection promote safety, but it is also much easier and less expensive to perform a repair when a crack is small, before it has a chance to traverse through a structural member. Any sign of cracks or damage must be repaired before continuing operations. Contact a Link-Belt Distributor for repairs.
4. When performing maintenance on the crane, do the following:
   a. Fully retract the boom. Ensure the boom will not hit the engine hood or any part of the carrier and lower the boom to the limit of the boom hoist cylinder.
   b. Shutdown the engine, disengage the main pump, (if equipped) and work all control levers back and forth to relieve pressure and relax the attachment.
   c. If the above instructions cannot be followed, block securely under the attachment so it cannot move.
   d. Bleed any precharge off the hydraulic reservoir before opening it or disconnecting a line.
   e. Hydraulic oil becomes hot during operation. In some cases it becomes hot enough to cause severe burns. Be careful not to let hydraulic oil come in contact with skin.
   f. Disconnect battery cables and remove ignition key so crane can't be started. Post warning signs in the operator's cab so no one will try to start the engine. Do not adjust, maintain, or repair a crane while it is in operation without visual and/or verbal contact to ensure the safety of service personnel.

5. When making repairs, which require welding, use proper welding procedures. Also the following precautions must be taken:
   a. All paint and acoustical material in the area should be removed to prevent burning them. The smoke and fumes from the burning paint and/or acoustical material can be very hazardous.
   b. Turn the battery disconnect switches to the "OFF" position to protect any electronic equipment on the crane which may be affected by electric arc welding.
   c. The welding ground cable should be attached to the portion of the crane being welded. If welding on the upper, ground on the upper. If welding on the carrier, ground on the carrier. Failure to take this precaution may result in electrical arcs in the turntable bearing.
   d. The welding ground cable should always be connected as close as possible to the area being welded. This minimizes the distance that electricity must travel.
   e. Disconnect computers and other electronic equipment (such as Rated Capacity Limiters and engine computers) to prevent damage. Contact a Link-Belt Distributor for proper procedures.
   f. If crane is equipped with the 12V to 24V convertor in the power panel, remove the fuses before welding.
   g. Remove all flammables from the proximity of the welding area.
6. Keep the crane clean, in good repair, and in proper adjustment. Oil or grease on the decks may cause falls. Improper adjustments can lead to crane damage, load dropping, or other malfunctions.

Figure 1–23
Allow engine to cool before removing the radiator/surge tank cap.

7. Keep all walking surfaces (steps, ladders, platforms, etc) and non-skid materials on the crane clean. Non-skid materials are placed on the crane to assist operators and service personnel with safe access/egress to/from the crane and to/from adjustment and inspection areas. Do not allow non-skid materials to become contaminated with mud, snow, ice, oil, paint, wax, etc. Any contamination can cause the non-skid materials to become slick, reducing their effectiveness for safety while walking on the crane. If any non-skid materials become ineffective due to wear, age, or destroyed in any way, they must be replaced.
8. Use proper fall protection such as a fall arrest system as required by any applicable codes when working at elevated heights. Falls can lead to severe personal injuries and/or death.
9. Use extreme caution when removing radiator/surge tank caps, hydraulic pressure caps, etc. They can fly off and hit you, or you could be burned by hot oil, water, or steam.

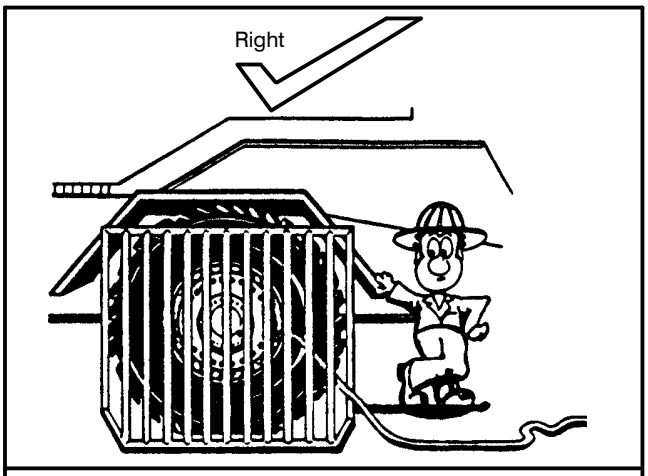


Figure 1—24
Use a guard when inflating tires.

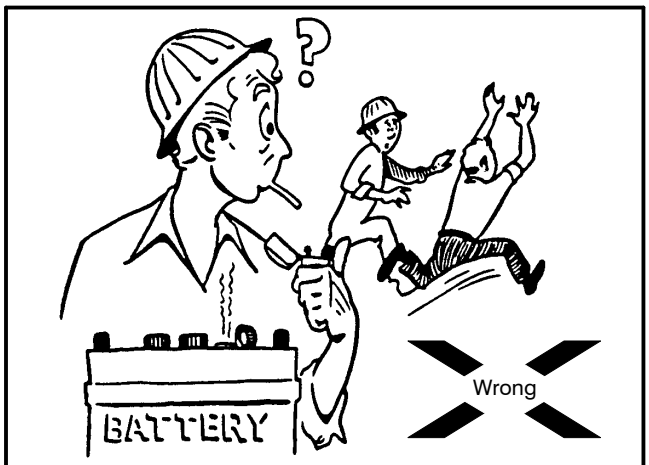


Figure 1—25
Do not use an open flame near the battery.

10. Check tires daily for correct pressure. Do not stand in front of a tire when inflating it. The lock ring can fly off and injure you. Use a clip on inflator, and stand aside. Use a guard in front of the tire.
11. When checking battery fluid level, use a flashlight, not an open flame. If the battery explodes, you can get acid in your eyes, which could cause blindness. Don't check battery charge by shorting across posts. The resulting spark could cause the battery to explode. Check with a tester or hydrometer. Don't smoke near batteries.

⚠ WARNING

Battery posts, terminals, and related accessories contain lead and lead compounds. Wash hands after handling.

12. When using jumper cables to start an engine, always connect the negative post to negative post, and positive post to positive post. Always connect the two positive posts first. Then make one negative post connection. Make the final negative connection a safe distance from the battery. It can be made on almost any bare metal spot on the crane. Any spark could cause the battery to explode. Refer to "Jump Starting The Crane" in this Section of this Operator's Manual for the proper procedures.
13. Test the automatic winch brake by raising the load a few inches *(cm)* and holding. It should hold without slipping. It takes more braking power to hold a load in the air when the drum is full of wire rope than when it is a few inches *(cm)* above the ground with only a few wraps on the drum.
14. Always reduce pressure in hydraulic system to zero before working on any part of the system.
15. Use extreme care when working with circuits with accumulators. Check that hydraulic pressure is relieved before opening the circuit for repairs.
16. When setting pressures, never exceed the manufacturer's ratings. Always follow instructions exactly. Over pressurization can cause hydraulic component damage or failure of mechanical parts on the crane. Either of the above can lead to an accident.

Wire Rope

1. Inspect all wire rope thoroughly. OSHA (Occupational Safety And Health Act) regulations state "a thorough inspection of all wire ropes shall be made once a month and a full written, dated, and signed report of the wire rope condition be kept on file where readily available." A visual inspection must also be performed daily. Replace any worn or damaged wire rope. Pay particular attention to winch wire ropes. Check end connections (pins, sockets, wedges, etc.) for wear or damage.
2. Use at least the number or parts of winch wire rope specified on the Wire Rope Capacity Chart in the Crane Rating Manual to handle the load. Local codes may require more parts of line than is shown. Check code requirements and use them where applicable.
3. Non-rotating, rotation resistant, or spin resistant wire ropes are recommended for single part of line applications. This is of utmost importance for long fall hoist line applications. A swivel hook ball may be used with rotation resistant wire rope only if certain criteria are met . Refer to "Hook Ball Usage With Rotation Resistant Wire Rope" in Section 5 of this Operator's Manual.
4. Do not handle wire rope with bare hands. Always use gloves to prevent possible injury from frayed or damaged spots in the wire rope.
5. Inspect head machinery and hook block sheaves often as damaged or deteriorating sheaves can cause excessive wear of the wire rope.
6. When reeving wire rope on the crane, do not stand, walk, or climb on the boom or attachment. Use a ladder or similar device to reach necessary areas.

Crane And Area Clearance

1. Know your job site conditions. Familiarize yourself with work site obstructions and other potential hazards in the area which might lead to mishaps. If possible, make any necessary arrangements to eliminate any potential hazards.
2. Erect barricades around the immediate work area to prevent unauthorized personnel from wandering onto the job site.

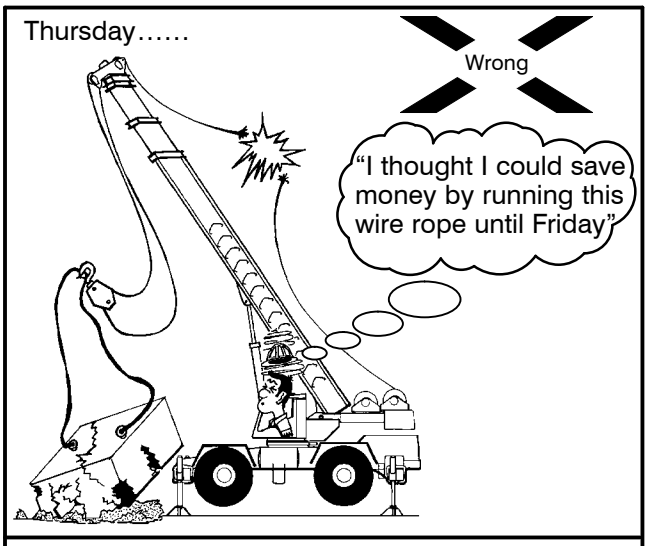


Figure 1–26
Do not operate the crane with worn or damaged wire rope.

3. Ensure the work area is clear. Ensure there is proper clearance for the crane, boom, and load. Don't swing, travel, lift or lower loads, or raise or lower jacks without first making sure no one is in the way. If your vision is obscured, locate a signal person so you can see him, and he can see all areas you can't. Follow his signals. Confirm that you and the signal person understand each other's signals. Refer to the Hand Signals Chart in this Section of this Operator's Manual. Use the horn to signal or warn. Ensure everyone on the job site understands signals before starting operations.
4. When working inside a building, check overhead clearance to avoid a collision. Check load limits on floors or ramps so as not to crash through.
5. Don't operate close to an overhang or deep ditch. Avoid falling rocks, slides, etc. Don't park crane where a bank can fall on it, or it can fall in an excavation. Don't park where rain can wash out footing.
6. Watch the tailswing of the upper frame and counterweight. Even though the original set-up may have been clear, situations change.
7. Do not store material under or near electrical power sources. Make material handlers aware of the dangers involved with storing material under power lines or in the vicinity of any other hazards.

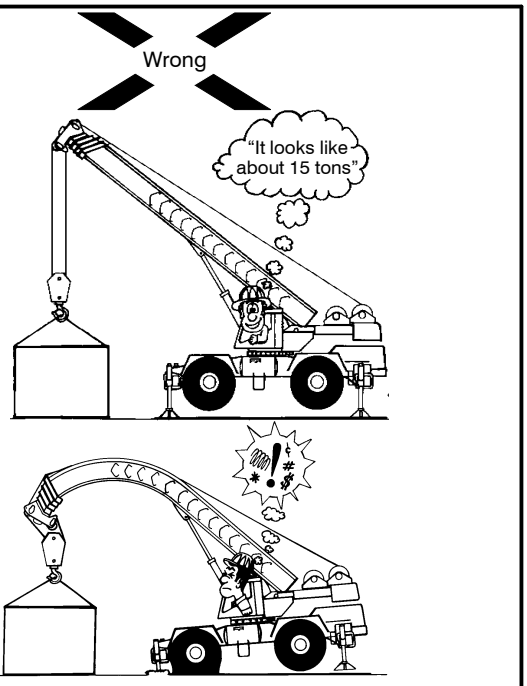


Figure 1—27
Know your load.

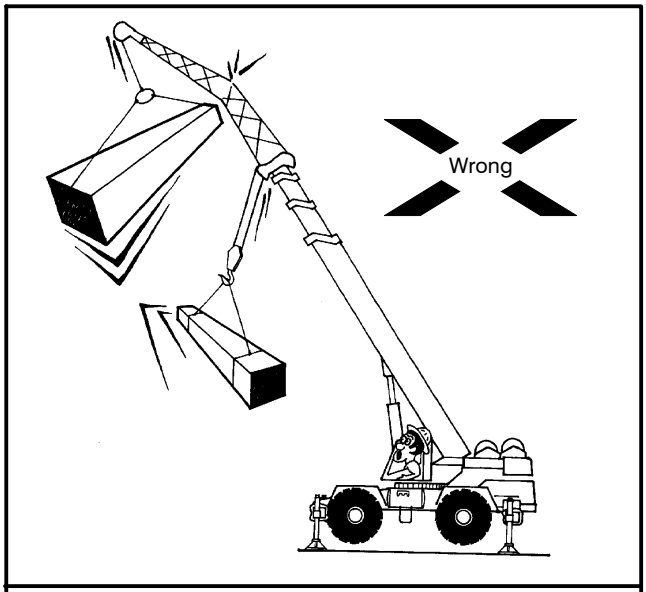


Figure 1—28
Do not lift two loads at the same time.

Weights, Lengths, And Radii

1. Know your load. Don't try to guess or estimate the load. Use a scale or a load indicating system to determine exact weight. Remember the weight you are lifting includes the weight of any lifting slings or gear, the hook block, hook ball, and any other weight on the hook. If lifting off the boom with the fly erected, the weight of the fly and rigging must also be considered as part of the load. (The Rated Capacity Limiter will automatically deduct the weight of the stowed fly to obtain the total allowable load.) The total load weight must never exceed the rated capacity of the crane, as listed in the Crane Rating Manual, for the position, boom length, load radius, and condition of operation being used. Remember - capacity chart ratings in the Crane Rating Manual are based on ideal conditions:
   a. Standing on firm, level surface.
   b. Calm wind.
   c. No side loads or out swing of load.
   d. Good visibility.
   e. Crane in top condition and equipped as when leaving the factory.

   When such conditions cannot be attained, loads being handled must be reduced to compensate. The amount loads are reduced depends upon how good or how poor actual operating conditions are. It is a matter of judgment and experience. Some factors which may require reduction of capacities are:
   a. Soft or unpredictable supporting surfaces.
   b. Wind.
   c. Hazardous surroundings.
   d. Inexperienced personnel.
   e. Poor visibility.
   f. Fragile loads.
   g. Crane in poor condition.
   h. Condition and inflation of tires.

   When in doubt, do not take a chance. Reduce ratings more than you think you need. Avoid working a crane in high winds. If you must work in a wind, reduce capacities as shown in "Wind Speed Restrictions" in the Crane Rating Manual. Wind blowing against the load and the boom produces a side load on the boom and reduces its capacity.

   When lifting loads in a wind which have large surface areas, such as building panels, the movement of the load may pose a danger to workers or building structures. Out swing of a load will increase the load radius, and may overload the crane. This could lead to boom failure or the crane tipping.

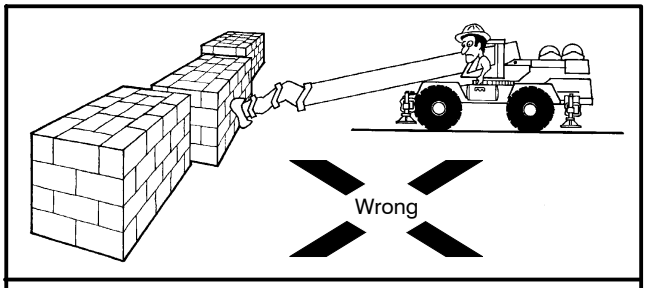


Figure 1—29
Do not push with the boom.

2. When operating off the main boom with the fly erected, deductions must be made for its weight. (The Rated Capacity Limiter will automatically deduct the weight of the stowed fly to obtain the total allowable load.) The weight of the fly must be subtracted to obtain a "NET" capacity. Failure to do so could result in an overloading condition and cause boom failure. Refer to the Crane Rating Manual for amounts to be deducted.
3. When operating off the main boom with the auxiliary lifting sheave installed, the weight of the auxiliary lifting sheave must be deducted. Refer to the Crane Rating Manual for amount to be deducted.
4. Do not lift two loads at the same time, even if the total load weight is within crane capacity. Loads on the boom and fly at the same time, stress the boom and drastically reduce its ability to handle loads. Your full attention cannot be given to both loads, creating a dangerous situation.
5. Lifts where two or more cranes work together can be hazardous and should be avoided. Such lifts should be made only under the direction of a qualified engineer. If a multiple crane lift is unavoidable, observe the following rules:
   a. The cranes must be level and located on firm surfaces.
   b. The cranes should be the same size and capacity, use the same boom length and be reeved similarly.
   c. Cranes must be positioned so that each boom point is directly over its load attaching point. The winch lines must be vertical during all phases of the lift.
   d. The rigging must be placed so each crane lifts a share of the load well within the crane's capacity.
   e. Ensure that during handling more load is not transferred to any crane than it can handle.
   f. Don't attempt to travel when making multiple crane lifts.
   g. Coordinate plans with the other operator before beginning to lift.
   h. Use only one signal person.
   i. Use of an operable load and angle indicating system is desirable.

SAFETYINSTRUCTIONS

Operation under conditions which exceed listed capacities may result in overturning.

Swinging, extending, or lowering boom to radii where no capacities are listed may result in overturning even without a load.

Figure 1—30
Safety Instruction Label

6. Some capacities on hydraulic cranes are based on strength of materials. In these cases, overloads will cause something on the crane to break, before it will tip. Do not use signs of tipping as a warning of overload.
7. Don't tie a crane down. Tying a crane down encourages overloading. Major crane damage and/or serious personal injury could result.
8. Do not shock load and/or overload the crane at anytime. Shock loading or overloading the crane will reduce the fatigue life of crane components and could result in component failure.
9. When performing repetitive lift applications, especially at or near maximum strength limited capacities, be aware that these applications may reduce component life. These applications include repeated lifting (or lifting and swinging) of near 100% strength limited capacities and repeated lifting maximum moment loads. These applications may fatigue the major structural portions of the crane. Although the crane may not break during these applications, they can reduce the fatigue life and shorten the service life of the crane. To improve the service life, while performing repetitive lift applications, consider reducing the capacities to 70% of maximum strength limited capacities to reduce fatigue cracking. Frequently perform a thorough inspection of all the structural areas of the crane. Any sign of cracks or damage must be repaired before continuing operations. Contact a Link-Belt Distributor for repairs.
10. Always refer to the Crane Rating Manual after changing the arrangement of the attachments for the correct lifting capacities.
11. The boom must be extended in the correct manner before making a lift. The capacities listed in the Crane Rating Manual for this crane are based on the boom sections being extended in accordance with boom mode as described in the Crane Rating Manual.

Figure 1–31
Pinch Point Label

12. Do not use the boom to push or pull. It is not designed for this purpose. Such action can damage the boom and lead to an accident.
13. Know the load radius. Don't guess at it. Determine the load radius by using the boom angle indicator, the boom length indicator, and the Crane Rating Manual, or measure it with a steel tape. Remember - Radius is the horizontal distance from the centerline of rotation of the upper to the center of gravity of the load, when the load is hanging free.
14. Do not operate a hydraulic crane at radii or boom lengths where the capacity charts in the Crane Rating Manual shows no capacity. Don't use a fly not designed for your crane. Either of the above can tip the crane over or cause attachment failure. In some cases, the crane can tip over forward or backward with no load on the hook! Also, if the boom is fully extended at a low angle, the crane may tip until the boom touches the ground. In any of these cases, serious injury and/or major crane damage could result.
15. When lifting a load with any crane, the load may swing out, or sideways. The load radius will increase. Due to the design of hydraulic crane booms, (cantilever boom, supported by cylinders and overlapping sections) this increase is much more pronounced. The increase or out swing of the load can overload the boom, and lead to boom failure or tipping. Also, movement of the load can cause it to hit something. Ensure the load being lifted will remain within capacity as it is lifted and the boom deflects.

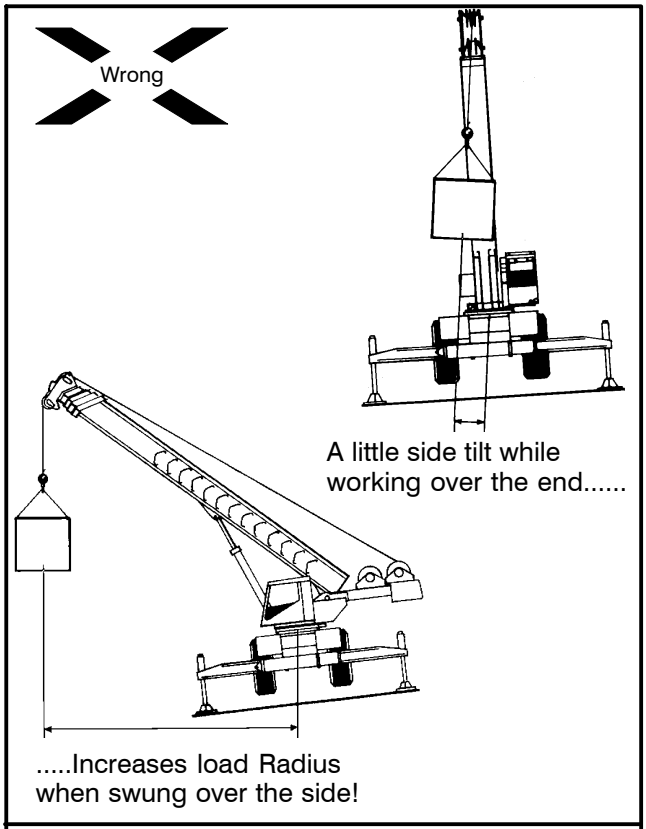
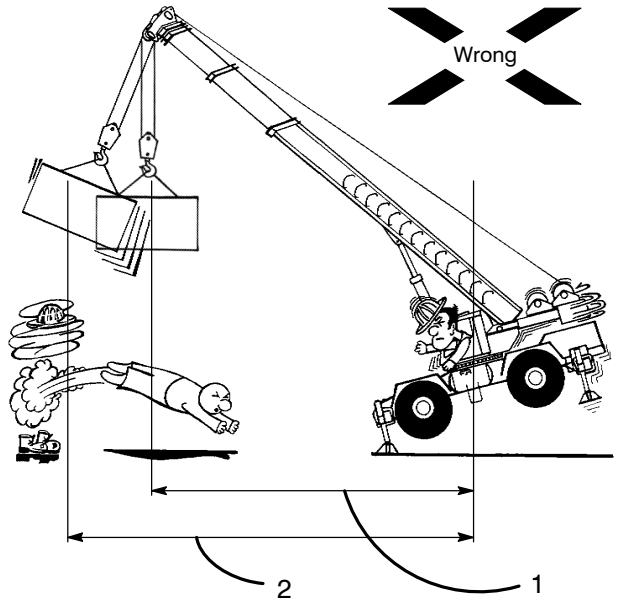


Figure 1–32
Watch that side tilt!

16. When extending or lowering a boom with a load, the load radius increases. As the load radius increases, capacity decreases. If capacity is exceeded, the boom may bend or the crane may tip over. Sometimes at low angles, a hydraulic crane boom can be extended with a load, but cannot be retracted. This is because more power is available in the boom cylinders to extend than to retract. If an operator extends the boom under load, he may not be able to retract the boom and may get into a dangerous situation.
17. Know the boom length. Don't guess. Use of an incorrect boom length can cause an accident.
18. When lowering or retracting the boom, the load will lower. To compensate for this, the operator must hoist up on the winch wire rope. Otherwise, movement of the load may cause an accident. When extending the boom, the load will raise. The operator must hoist down the winch wire rope to keep the load in place. Extending the boom without winching down, can lead to "two blocking". This is when the hook block, hook ball, or the load contacts the head machinery. Two blocking can lead to sheave and/or wire rope damage.

19. The winch wire rope must be vertical when starting to lift. If not, the load will swing in, out, or sideways when lifted from the ground. The crane will lean toward the load when lifting heavy loads. This is caused by elasticity of the crane and the boom. This lean will increase operating radius so the load will swing outward when it clears the ground. This out swing is dangerous to anything in the path of the load, and because of the increase in load radius may overload the crane. To overcome this out swing, boom up as the load is lifted so winch wire ropes remain vertical. When setting the load on the ground, lower boom after the load touches down to avoid hook block and/or hook ball swing when it is unhooked from load.
20. Pinch points, which result from relative motion between mechanical parts, can cause injury. Keep clear of the rotating upper or moving parts.
21. Lifting heavy loads can cause the crane to tilt or lean toward the load. When swinging a load from over the end to over the side, the tilt of the crane will increase. Since tilt acts to increase load radius, it must be compensated for when swinging the load. Swing slowly. Change boom angle (raise the boom) while swinging, to maintain a constant radius, and prevent in swing or out swing of load. If not, a dangerous condition could result.
22. Watch out for centrifugal force when swinging a load. Swing gently. Centrifugal force tends to increase load radius. This increase in radius could overload the crane and cause crane damage or tipping. When stopping the swing, over swing of the load can side load the boom.
23. Keep the winch wire ropes as short as possible to prevent excessive swinging. Always use the shortest boom length which will do the job. Remember - the shorter the boom, the better the capacity.
24. Due to inertia (weight), a load will momentarily tend to stay in position when the crane starts to move. For this reason do not back the crane away from a suspended load when handling near capacity loads. The inertia effect will tend to increase load radius and decrease stability. Use hand lines as required to control the load.



1. Load Radius at Rest
2. Load Radius Increases Due To Centrifugal Force

Figure 1—33
Watch that centrifugal force!

25. Don't increase the counterweight. Don't add anything to the crane that will act as additional counterweight. Remember that anything which has weight, if carried behind the crane's center of gravity, acts as counterweight. Adding counterweight affects backward stability of the crane, particularly when working over the side. It also encourages overloading of the crane.
26. Working areas for cranes are defined per the Working Areas chart in the Crane Rating Manual. Permissible loads, per the Crane Rating Manual, will vary from lifting quadrant to lifting quadrant. The operator must ensure capacity ratings are not exceeded regardless of which quadrant he is operating in, or when swinging from one quadrant to another.
27. When working on tires, the tires must be inflated to pressures shown on the Tire Inflation label on the right side of the carrier or Tire Inflation chart in the Crane Rating Manual.

Traveling

1. Traveling with a suspended load should be avoided if possible. It is especially hazardous when terrain is rough or irregular, on a side slope, or in a hilly area. When traveling with a load, observe the following rules:
   a. Use a hand line to control the load and reduce load swing.
   b. Travel by the smoothest, most level route. If a smooth, level route is not available, don't travel with a suspended load. Grade the route to provide a smooth, level path. If it is not possible to grade the route, move the load by stepping. Level the crane on outriggers, lift the load and set it down ahead of the crane. Travel the unloaded crane beyond the load, level the crane on outriggers, lift the load, swing and set it down farther along the route. Continue this procedure until the load is at its destination.
   c. Carry loads as close to the ground as possible.
   d. Do not allow side swing of the load.
   e. Don't attempt to carry loads which exceed the crane's rating. Refer to On Tires and Pick And Carry capacities shown in the Crane Rating Manual.
   f. Don't travel with a load on soft ground. If the crane sinks into ground, stability can be affected to the point of tipping the crane.
   g. Keep all personnel clear of crane and load. Be prepared to set load down quickly at any time.
   h. Fully extend outrigger beams. Extend or retract jacks until pontoons just clear the ground.
   i. Check clearance for the extra width of the crane with the outriggers extended. Outrigger beams or pontoons must not hang on any obstruction.
   j. Inflate tires as shown on the Tire Inflation label on the right side of the carrier or on the Tire Inflation chart in the Crane Rating Manual when making lifts on tires.
   k. See "Pick And Carry Operation" in this Section of this Operator's Manual for more details.
2. When traveling on the highway, road the crane safely. Watch for narrow bridges and low clearances. Check load limits, heights, width, and length restrictions in the area you are traveling. Ensure the crane complies with all regulations.
3. When roading the crane, note the following:
   a. Operate with lights on. Use proper warning signs, flags and other devices. Use an escort service if required.
   b. Engage the two position house lock (travel swing lock). Release the swing park brake and 360° swing lock, if equipped.
   c. Tie down or otherwise restrain the hook block and/or hook ball.
   d. Check for maximum allowable travel speed and any other travel limitations. Don't exceed these maximums. Crane damage or an accident could result.
   e. Inflate tires as shown on the Tire Inflation label of the right side of the carrier or the Tire Inflation chart in the Crane Rating Manual.
   f. When traveling, outriggers must be fully retracted.
   g. Remove all pontoons from the outrigger jacks and store them properly.
4. If the crane must be towed, refer to "Towing The Crane" in this Section of this Operator's Manual for specific instructions.

Leaving The Station

1. Do not get on or off a crane in motion. When climbing on the crane, remain in three point contact with the crane at all times (two hands and one foot or two feet and one hand). If a ladder is provided, use it.
2. Whenever an operator leaves the control station for any reason, the following must be done:
   a. Lower the load to the ground.
   b. Tie down the hook block and/or hook ball. Do not leave them where the wind could swing them to cause damage to the attachment and/or nearby objects.
   c. Engage the two position house lock (travel swing lock) or apply the swing park brake. Engage the park brake. Shutdown the engine. Remove the keys and lock the operator's cab door.
   d. Do not depend on a brake to suspend a load unless the operator is at the controls, alert and ready to handle the load. Brake slippage, vandalism or mechanical malfunctions could cause the load to drop.
3. Do not leave crane unattended with engine running.
4. When changing work shifts, always notify the next operator of any changes or problems with the crane.
5. Hydraulic cylinders, left extended under load, oftentimes have a tendency to drift in (retract) due to internal fluid passage in the cylinders and/or control valves. Do no shutdown the crane and leave it unattended for extended periods of time, i.e. overnight, with the boom positioned over anything or the crane itself that the boom could damage if it should lower. For instance the boom hoist cylinder may drift allowing the boom to lower and damage the engine hood. Position the boom over the front to avoid the hood on the rear of the crane.

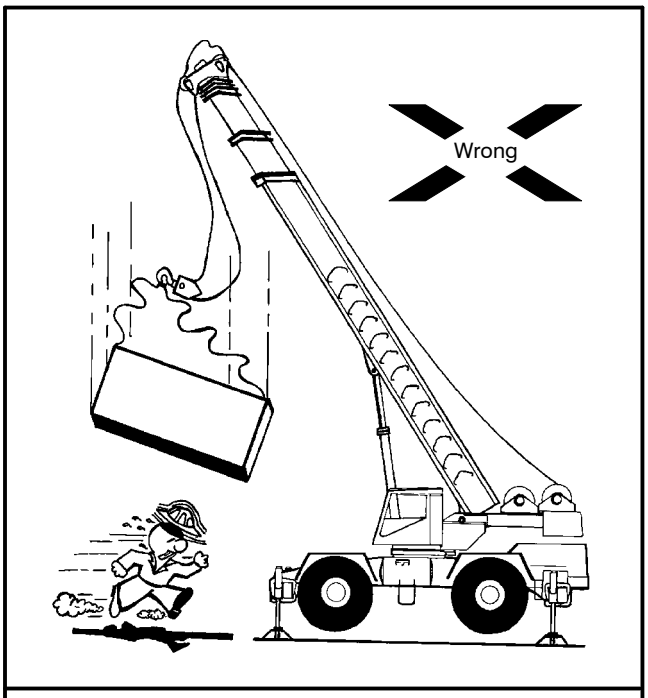


Figure 1—34
Do not leave crane while a load is suspended.

Personnel Handling Guidelines

Introduction

The following information is intended to provide Link-Belt's recommended minimum requirements that must be followed when handling personnel with a personnel basket or work platform (hereafter referred to as a work platform) suspended by wire rope from the boom of Link-Belt cranes. These requirements are based upon several sources and are put forth in recognition of current industry practices. However, safety, when handling personnel, remains the full responsibility of job site management and is dependent upon the responsible action of every person on the job involved in the related work.

This information is intended to supplement and not to supersede or replace any more restrictive federal, state, or local regulations, safety codes, or insurance requirements. It is intended to serve users of personnel work platforms in achieving the following objectives.

1. Reduce risk of personal injuries to users and the public.
2. Inform users of their respective responsibilities.
3. Provide standards of equipment requirements.
4. Provide standards for tests and inspections.
5. Provide standards of operation to promote safety.

Link-Belt cranes are designed and intended for handling material. They are not normally equipped with secondary systems or other devices required by personnel lift or elevator standards and are not intended for handling personnel for construction or amusement purposes. Use of cranes for these purposes is hazardous and is not recommended by Link-Belt. However, Link-Belt understands that circumstances may occur (in construction work) when lifting or lowering personnel on a materials handling crane load line is the only or the least hazardous method available to position personnel. In fact, Occupational Safety and Health Administration (OSHA) Part 29, CFR 1926.1431 states "The use of equipment to hoist employees is prohibited except where the employer demonstrates that the erection, use, and dismantling of conventional means of reaching the work area, such as personnel hoist, ladder, stairway, aerial lift, elevating work platform, or scaffold, would be more hazardous, or is not possible because of the project's structural design or worksite conditions."

Much corollary and supplementary information is contained within the following resource documents pertaining to both cranes and personnel work platforms. Job site management must ensure all requirements listed in these resource documents are followed for all personnel handling operations.

- American National Standards Institute Reference - ANSI Standards A10.28, A92.2, A92.3, B30.5, and B30.23.
- Power Crane and Shovel Association (PCSA) Bureau of the Association of Equipment Manufacturers (AEM) Reference - PCSA Standard No. 4.
- American Petroleum Institute (A.P.I.) Specification 2C.
- OSHA Part 29, CFR 1926.1431 Cranes and Derricks.

Authorization

Authorized use of a work platform may be permitted only after the following on-site procedures have been performed:

1. A competent person on the job site (job site manager) specifically responsible for the overall work function to be performed has determined that there is no practical alternative means to perform the needed work and has authorized a personnel lifting operation.
2. For each instance of such lifting, a competent person responsible for the task has attested to the need for the operation by issuing a written statement describing the operation and its time frame and itemizing that each of the on-site authorization requirements has been met. The written statement, after being approved by a qualified person, shall be retained at the job site. (Refer to *Personnel Handling Pre-Lift Check List For Link-Belt Cranes* in this Section for a sample check list.)
3. Review of crane inspection records has been conducted to ensure the crane being used meets applicable provisions in ANSI B30.5 and B30.23.
4. Review of the work platform inspection records and specifications has been conducted to ensure it meets applicable design standards (refer to ANSI A10-28).
5. Review of the personnel lifting operation practices specified in these instructions have been conducted with job site managers and crane operator(s), foreman, designated signal person, personnel to be lifted, safety supervisor, and any other person(s) who has jurisdiction over the operation to ensure that they are aware of the hazards of the operation and they are aware of provisions of these instructions that must be adhered to before and during the personnel lifting operation.

Equipment

1. The crane system shall be equipped with the following:
   a. A fully functional working operational aid such as a Rated Capacity Limiter (RCL) System - A system consisting of devices that sense crane loading, boom length (extendable booms only), boom angle, and also automatically provide an audible/visual signal when the loading conditions approach, reach, and/or exceed the rated capacity values. When the Actual Load exceeds the Rated Capacity, the system supplies a signal to a function cutout system. The operational aid shall be equipped with these additional devices:
      1. Anti-two block device to prevent damage to the hoist wire rope, other crane components, or attachments, and subsequent endangerment of personnel.
         - It is required that the anti-two block device warn both audibly and visually as well as have the capability to cutout the controls/functions that may cause a two block condition.
      2. Boom angle indicator.
         - Cranes with extendable booms must utilize a boom angle indicator having "high and low" set points and audible/visual alarm(s) capable of activating function cutouts.
   b. Boom hoist and load line shall have power lowering and raising and shall have an automatic brake which is applied when the applicable control is in neutral, or when the anti-two block device is actuated.

c. If the crane is equipped with a "free-fall" hoist, steps shall be taken to ensure its use is not possible during the use of the work platform. (Note: A.P.I. applications do not permit the crane to be equipped with free-fall.)
d. Each crane shall have a mechanical swing park brake or swing lock capable of being set at any swing position, and shall have a variable swing brake or swing controls capable of stopping the upper swing motion smoothly. The swing brake must be properly maintained at all times to ensure its holding capability.

Note: All operational aids and equipment must be maintained in operable condition. Alternative measures are not permitted.

2. The work platform shall be designed by a qualified engineer competent in structural design. Its maintenance, and its attachment to the crane load line, is the responsibility of the job site management. Their arrangement shall comply with the following as a minimum:
   a. The work platform harness must be of sufficient length to prevent any portion of the work platform or the harness from coming in contact with the boom at any working boom angle.
   b. Audible and visual alert systems shall be provided to the personnel in the work platform to signal for assistance in the event of an emergency.
   c. Hooks on hook block assemblies, hook ball assemblies, or other assemblies, shall be of a type that can be closed and locked, (with a working safety latch) eliminating the hook throat opening, and shall be full load-bearing, and contain a manual trigger release.
3. No unauthorized alterations or modifications are allowed to be made to the basic crane.

Maintenance, Lubrication, And Adjustments

1. The crane operator must have a complete understanding of the crane's maintenance, lubrication, and adjustment instructions as outlined in the Operator's Manual.
2. The crane shall be maintained, lubricated, and adjusted, by a designated person, as specified in the Operator's Manual.
3. The crane and work platform decals must be understood and maintained.
4. All decal precautions and instructions shall be strictly observed.

Inspection And Rigging

1. The lift crane and work platform shall be inspected immediately prior to commencement of operation. (Refer to the Crane Operator's Manual and ANSI B30.5, Section 5, Section 5-2. 1.2 and 5.2.4, and ANSI B30.23 for the required inspection procedures for the crane. Refer to ANSI A10-28 for inspection procedures required for the work platform.)
2. The inspection shall be performed once daily when the crane is being used in work platform service or each time the crane is converted from material lifting to personnel handling operation. In the event the operator is replaced, a new inspection is required. Written documentation of all inspections must be kept on the job site during personnel handling operations.
3. Inspect the crane and work platform for any loose, damaged, or missing components.
4. Any structural or functional defect which adversely affects the safe operation of the lift crane shall be corrected before any operation utilizing a work platform begins or continues.
5. The hoist drum shall have at least three full wraps of wire rope remaining on the drum at all times when using a work platform.
6. Minimum load hoist and boom hoist wire rope design factors for the combined weight of the lift attachments, work platform personnel, and tools shall be 10:1 for "Non-Rotating" and "Rotation Resistant" wire ropes. All other wire rope types require a 7:1 design factor. (Note: A.P.I. applications require 10:1 design factor for all wire rope construction.)

Telescopic Booms	Main Boom Head Sheaves	Auxiliary Head Sheaves	Fixed Fly Sheave
	Allowed	Allowed	Allowed
	Offset Fly Sheave	Offset Fly With Extension(s) Sheave	A-F rame Jib Sheave
	Allowed	Allowed	Not Recommended
Conventional Lattice Tubular or Angle Booms	Main Boom Head Sheaves	Tip Extension Sheaves	Jib Head Sheave
	Allowed	Allowed	Allowed

Luffing Attachments	Luffing Boom Auxiliary Head Sheaves	Midfall Sheaves	Luffing Jib Head Sheaves	Fixed Jib Head Sheave
	Not Recommended	Allowed	Allowed	Not Recommended
Lifting Sheaves For Personnel Handling With Suspended Work Platforms				

7. The work platform shall be suspended from a wire rope that is reeved from an allowed lifting sheave. Refer to "Lifting Sheaves For Personnel Handling With Suspended Work Platforms" chart to determine the allowed sheave(s).
8. Inspect the wire ropes, sheaves, hoist drum brakes, and other mechanical and rigging equipment vital to the safe operation of the crane.
9. Ensure that all wire rope sockets and dead end lugs are properly installed and are in good working condition.
10. Ensure that all wire rope guards are in good working order and that they are properly installed and adjusted to prevent wire rope from jumping off sheaves.
11. Inspect all structural members of all boom sections, fly sections, luffing jib sections, and live mast, as equipped.
12. In addition to other regular inspections, visual inspection of the crane and work platform shall be conducted immediately after testing and prior to lifting personnel. The following inspections shall be conducted on extendable booms prior to lifting personnel:
    a. Full power style booms:
        1. Inspection of all extension wire ropes at the access points in the boom where the end connections are visible - Refer to the Operator's Manual for inspection and adjustment procedures.
    b. Pinning and latching style booms:
        1. Inspection of the latching mechanism, sensors, and hydraulic/electrical circuit at the access points.
        2. Inspection of all pins and pinning locations in the individual boom sections and at the fully retracted position.
        3. Verification of the accuracy of the boom length indicator. Refer to the Operator's Manual for the procedures.
13. The following inspections shall be conducted on fixed length style booms prior to lifting personnel:
    a. Inspection of all pendants, pendant links, pendant spreader bars, links, etc.
    b. Inspection of all mechanical linkages, shafts, drums, etc.
14. A written record of all the above inspections must be maintained on the job site.

Crane Test Procedures

The test procedures listed below shall be conducted at the following intervals:

- Daily,
- At each job site before hoisting employees,
- After any repairs or modifications to the equipment,
- When an operator is replaced, and
- When, in the judgement of responsible job site management, or controlling entity, there has been a significant change in the conditions of the personnel lifting operation.

Note: No personnel are allowed to ride the work platform during any of the tests recommended in this Section.

1. The work platform and rigging shall be proof tested to 125 percent of the work platform's rated capacity. (The proof test may be done concurrently with the trial lift by completing the following test procedures.) Do not exceed the rated lifting capacity of the applicable lift crane as listed on the crane capacity charts. (Refer to ANSI A10.28 for suspended work platform testing and inspection.)
    a. This test load shall be tested for stability.
        - The operator and signal person shall conduct this test.
        - This test shall include movement of the work platform through its entire intended range of motion, simulating the specific operation to be undertaken.

- A successful stability test must not produce instability of the crane or cause permanent deformation of any component.

b. This test load shall be raised and lowered at maximum power controlled line speed (NOT FREE-FALL). The acceleration must be smooth and the deceleration capability of the control/braking system shall be confirmed by bringing the work platform to a smooth stop. The work platform shall be held in a suspended position for a minimum of five minutes with the test load evenly distributed on the work platform. (This experience is intended to sharpen the skill of the operator in handling the work platform and to give the operator an opportunity to evaluate the crane's performance.) The work platform shall then be inspected for any evident sign of damage or defect.

2. All limiting and warning devices shall be tested by activation of each appropriate control function.
3. With pinning and latching style extendable booms, a visual inspection shall be conducted to verify that the boom extend pins are properly set in the extended boom sections.
4. At the beginning of each lift, the work platform must be hoisted a few inches *(cm)* with the personnel and materials/tools on board and inspected by a competent person to ensure;
   - The work platform is secure and properly balanced,
   - All wire ropes are free of deficiencies such as kinking, crushing, corrosion, etc.,
   - Any multiple part lines are not twisted,
   - The primary attachment is centered over the work platform, and
   - If any load rope is slack, it must be inspected to ensure that all ropes are properly seated on the drum and in the sheaves.
5. Any condition found during any of these tests/inspections that fails to meet requirements or may create a safety hazard, must be corrected before hoisting personnel.

Operation And Safety

1. The Operator's Manual for the crane shall be read and fully understood by operating personnel. The Crane Operator's Manual shall be available to them at all times.
2. Safety when handling personnel remains the full responsibility of job site management and is dependent upon the responsible action of every person on the job involved in the related work.
3. Mobile lift cranes shall be erected to obtain maximum crane stability. The crane must be level and on firm ground. It is recommended that the outriggers be fully extended and the tires must be clear of the ground before beginning any operation.
4. The operator shall not leave the operator's station when the work platform is occupied. The operator shall remain alert in a position of readiness at the work station with the engine running and the master clutch engaged, if crane is so equipped.
5. Unauthorized personnel shall not be in the operator's cab on the lift crane, or near the lift crane while a work platform is suspended from the load line.
6. Any operation in which a work platform is to be suspended from the load line shall be carefully planned by the operator, supervisory personnel, designated signal person, and personnel to be lifted prior to commencement of such operation. They are to be advised:
   a. That the crane does not have safety devices normally used on personnel handling equipment.
   b. That the safety of the operation depends on the skill and judgment of the crane operator and others present.
   c. Of procedures to enter and leave the work platform and other safety procedures.
7. After positioning of the work platform:
   a. All brakes and locks on the lift crane shall be set before personnel perform any work.
   b. With pinning and latching style extendable booms, a visual inspection shall be conducted to verify that the boom extend pins are properly set in the extended boom sections.
8. Telescope operation is not recommended with any extendable boom with personnel in a suspended work platform.
9. A work platform attached to load line of lift cranes shall not be used for working on any energized electric power line, or any energized device or facility used for electric power generation or transmission. Minimum working clearance shall be at least twice that recommended for material handling operations in ANSI B30.5b section 503.4.5 and ANSI B30.23.
10. The combined weight of the work platform, any attachment device, personnel, tools, and other equipment shall not exceed 50% of the lifting capacity of the applicable lift crane as listed on the crane capacity chart. (Note: A.P.I. applications require 25% of lifting capacity as the limit.)
11. Use caution when utilizing pendant supported lattice jibs on tubular or angle booms as the jib can drift backwards into the jib backstops under certain conditions. This is most likely with short jib lengths with minimum jib offset and maximum boom angle. Pay special attention to detect the possibility of jib drift during the work platform test lift. An additional test lift is recommended with an empty work platform when operation at or near these conditions.

12. The following actions and operations are strictly prohibited when working with personnel suspended in a work platform:
    a. Cranes shall not travel while personnel are in the work platform.
    b. No lifts shall be made on another of the crane's load lines with personnel suspended in a work platform.
    c. No external load is allowed to be lifted by attaching it to the work platform.
    d. Work platform lifts shall be a single crane operation. A work platform shall not be lifted using two cranes.
    e. Hoisting of personnel shall be discontinued upon indication of any dangerous weather conditions, wind, or other impending danger.
    f. The emergency manual mode operation of pinning and latching style extendable booms shall not be utilized.
    g. Free-fall (if equipped) shall not be used.
13. Movement of the work platform with personnel shall be done in a slow, controlled, cautious manner with no sudden movements of the crane or work platform. Do not use high speed functions, if equipped.
14. Do not use multi-function crane operation. If load hoist, boom hoist, and swing functions must be used to position the work platform, perform each function individually.
15. Clear, unobstructed visibility between personnel on the work platform and the crane operator shall be maintained at all times except where a designated signal person has been assigned and positioned such that he is visible to both. Such designated signal person shall have no other duties to perform when personnel are in the work platform.
16. Voice communication between work platform personnel, the crane operator, and designated signal person, if assigned, shall be maintained.
17. If other cranes or equipment may interfere with the lifting of personnel, signals or other means of communication between all crane or equipment operators shall be maintained to avoid interference with individual operations.
18. If the work platform is not landed, it shall be tied to a structure before personnel mount or dismount the work platform.
19. Personnel in the work platform shall wear personal fall arrest systems. Anchors used for attachment of personal fall arrest equipment shall be independent of any anchors being used to support or suspend work platforms. Personnel shall keep all parts of body, tools, and equipment inside work platform during raising, lowering, and positioning.
20. Personnel shall always stand firmly on the floor of the work platform and shall not sit or climb on the edge of the work platform or use planks, ladders, or other devices for attaining a work position. (This does not apply to offshore personnel transfer baskets. Personnel must ride on the exterior of this type of personnel handling device to assure greater safety of the operation.)
21. When welding is done by personnel in the work platform, the electrode holders shall be protected from contact with metal components of the work platform. If electrically connected electrode holders contact work platform, work platform could be dropped due to burning/melting of wire ropes suspending the work platform.
22. A pre-lift meeting must be conducted with the crane operator, signal person, employee(s) to be hoisted, person responsible for the task to be performed, and anyone else that is directly involved with the lift (as applicable) to review all the requirements and procedures that must be followed to complete the lift.
23. Follow all procedures for determining the rated capacity and perform all testing as outlined in the Crane Operator's Manual, the Crane Rating Manual, and this Safety Manual.

Additional Requirements For Offshore Cranes

1. Link-Belt offshore cranes are designed to handle materials. However, due to the special conditions commonly existing offshore, the use of cranes to transfer personnel between vessels or from a vessel to a work platform is an established practice. The safety of the personnel, if a materials handling crane is used in transferring personnel, depends upon the skill and judgment of the crane operator and alertness of the personnel being transferred. Sea and weather conditions may create additional hazards beyond the skill of persons involved.

   This operation is approved by the American Petroleum Institute (A.P.I.). By adopting procedures for this operation, the institute has determined that the transfer of personnel may be performed safely under certain offshore conditions. Therefore, whenever an offshore crane is used to transfer personnel, all persons involved in the operation must know and implement the A.P.I. procedures and verify that sea and weather conditions are within safe limits for the transfer.

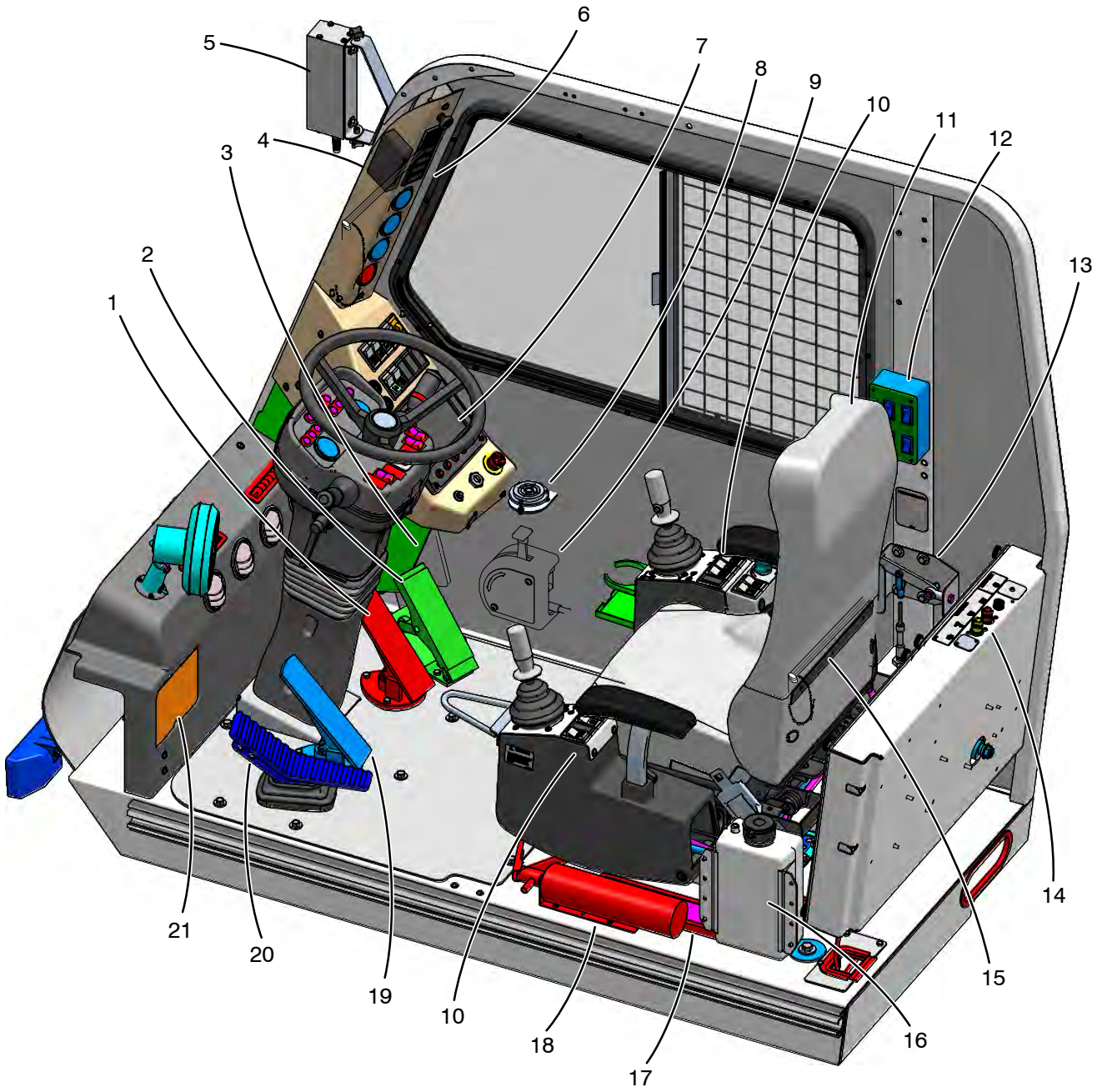
   In addition to all previous requirements in these Instructions, A.P.I. 2C requires the following:

   - Boom and load hoists used shall be approved by the hoist manufacturer for personnel handling and shall be so indicated on their name plate.
   - Refer to A.P.I. 2C Section 6 for further details and procedures.

Personnel Handling
Pre-Lift Check List for Link-Belt Cranes

1	I am the designated person responsible for verifying that all safety requirements are met for this personnel handling operation; Name: _____ Title: _____ Signature: _____ Date: _____/_____/_____	Initials
2	I have verified that there are no conventional means to handle personnel for this operation.	
3	I have a written statement authorizing personnel handling from a competent person on the job who accepts full responsibility, or I accept full responsibility for the operation.	
4	The Crane Operator acknowledges that he has read and fully understands the Crane Operator's Manual and Crane Rating Manual. All personnel involved have been informed and understand the tasks required to complete the personnel lifting operation.	
5	The crane has been maintained, lubricated, and adjusted by a designated person, as specified in the Crane Operator's Manual.	
6	The lift crane is equipped, and all devices operate properly as follows:	
	• Anti-two block device with hydraulic cutouts • Power load raising and lowering with automatic brakes and function cutouts - Free-Fall (if equipped) shall not be used • Boom angle indicator with high and low set points and function cutouts • Boom length indicator (telescopic booms only) and function cutouts • Load Indicating System or Rated Capacity Limiter System • A variable swing brake or swing controls capable of stopping upper swing motion smoothly • A mechanical swing park brake or swing lock to hold the upper in position while personnel are working from the work platform • Hook block or hook ball being used can be closed and locked with a safety latch	
7	A working audible and visual alert system is provided to the personnel in the work platform.	
8	A mechanical and structural crane inspection has been completed by a designated person.	
9	The wire rope used to lift the work platform is reeved from an allowed lifting sheave	
10	Crane travel is not allowed with personnel in the work platform.	
11	Telescoping the boom is not recommended with personnel in the work platform.	
12	When handling personnel with pinning and latching style booms, it is recommended boom be kept in a pinned position. Inspections must be made to ensure boom extend pins are set.	
13	All wire rope sockets and dead end lugs are properly installed and are in good working condition. All Wire rope guards are properly installed and adjusted to hold all ropes on the appropriate sheaves.	
14	Voice communications between the Crane Operator and the personnel in the work platform are present and operational.	
15	Fall arrest systems are present and in use by personnel in the work platform.	
16	Weather and wind conditions are acceptable to safely perform the lift.	
17	A Proof-Test/Trial Lift was completed with 125% of the work platform's rated capacity.	
18	The total load being lifted will not exceed 50% of the standard lift crane capacity charts.	
19	Cranes with outriggers have them equally extended with tires clear of the ground.	
20	A Pre-Lift meeting was held with all appropriate personnel to review all aspects of the lift.	

Note: This checklist is to be used as a supplement to (not a substitute for) the information and procedures supplied for personnel handling operations.



1. Service Brake Pedal
2. Throttle Pedal
3. Crane Rating Manual Holder
4. RCL Overhead Light Bar (If Equipped)
5. RCL External Light Bar (If Equipped)
6. Gauge And Control Panel
7. Rated Capacity Limiter Display
8. Bubble Level
9. 360° Swing Lock (If Equipped)
10. Seat Console Control Switches
11. Operator's Seat
12. Outrigger Control Box
13. Travel Swing Lock Control
14. Diagnostic Panel
15. Operator's Manual Holder
16. Windshield Washer Reservoir
17. Air Conditioner Filter (If Equipped)
18. Fire Extinguisher
19. Swing Brake Pedal
20. Boom Telescope Pedal
21. Fuse Panel

Figure 1–35
Operator’s Cab

Operator's Cab

Several panels which contain the gauges, switches, and controls to operate and monitor crane operations are mounted throughout the operator's cab. Refer to Figure 1-35. The following is a description of each gauge, switch, or control in each panel, along with an explanation of their function and/or operation.

Fire Extinguisher

A fire extinguisher is mounted in the operator's cab below the left console. Raise the left console to gain access to the extinguisher. It is an A B C type fire extinguisher, meaning it is capable of extinguishing most types of fires. The operator should be familiar with its location, the clamp mechanism used to secure it in place, and foremost the operation of the device. Specific instructions, regarding operation, are given on the label attached on the fire extinguisher. A charge indicator on the fire extinguisher monitors the pressure within the tank. Check the indicator daily to ensure the fire extinguisher is adequately charged and ready for use.

Top Hatch

Top Hatch Wiper And Washer

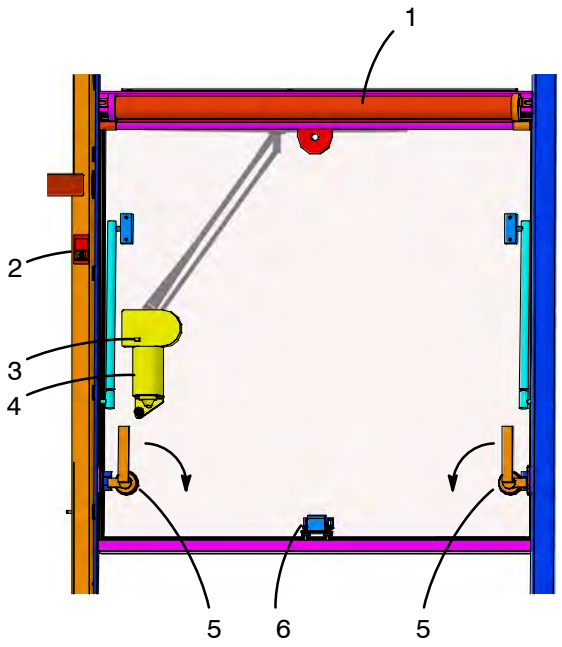
The top hatch wiper is in the top right corner of the cab roof. Refer to Figure 1-36. The switch for the top hatch wiper is on the wiper motor. Move the switch to the "ON" or "OFF" position as desired. To wash the window, push the washer switch to spray washer fluid on the top hatch window.

Top Hatch Window

The top hatch window can be opened to improve cab ventilation. To open the top hatch window, rotate the latches, press the catch release, and push up on the hatch window.

Top Hatch Sunscreen

The top hatch is equipped with a roller sunscreen to assist operator vision when looking up through the top hatch.



1. Sunscreen
2. Washer Switch
3. Control Switch
4. Wiper Motor
5. Latches
6. Catch Release

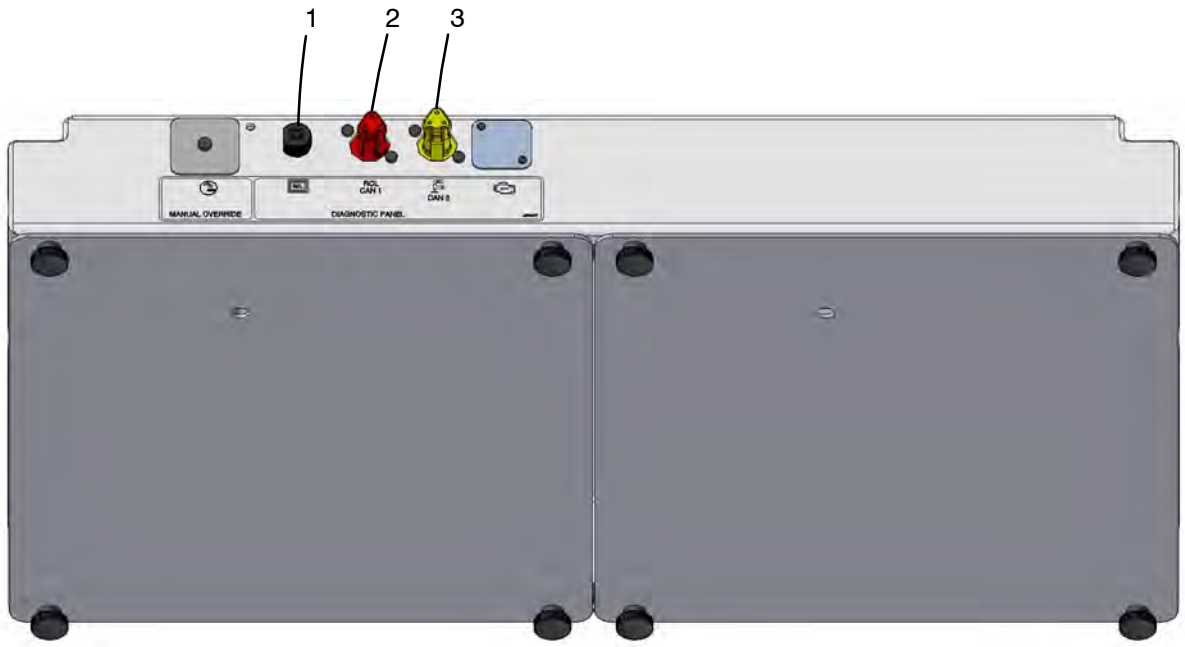
Figure 1—36
Top Hatch

Windshield Washer Reservoir

Check the windshield washer reservoir daily. The reservoir for washer fluid is in the lower right rear of the cab. Refer to Figure 1-35. Visual inspection can determine if the washer fluid is adequate. Do not operate the washer when the reservoir is empty. Use specially formulated windshield washer fluid rather than water because specialty washer fluids contain additives that dissolve road grime.

Bubble Level

The bubble level is provided to assist the operator in leveling the crane on outriggers. It is mounted on the right cab wall. Refer to Figure 1-35.

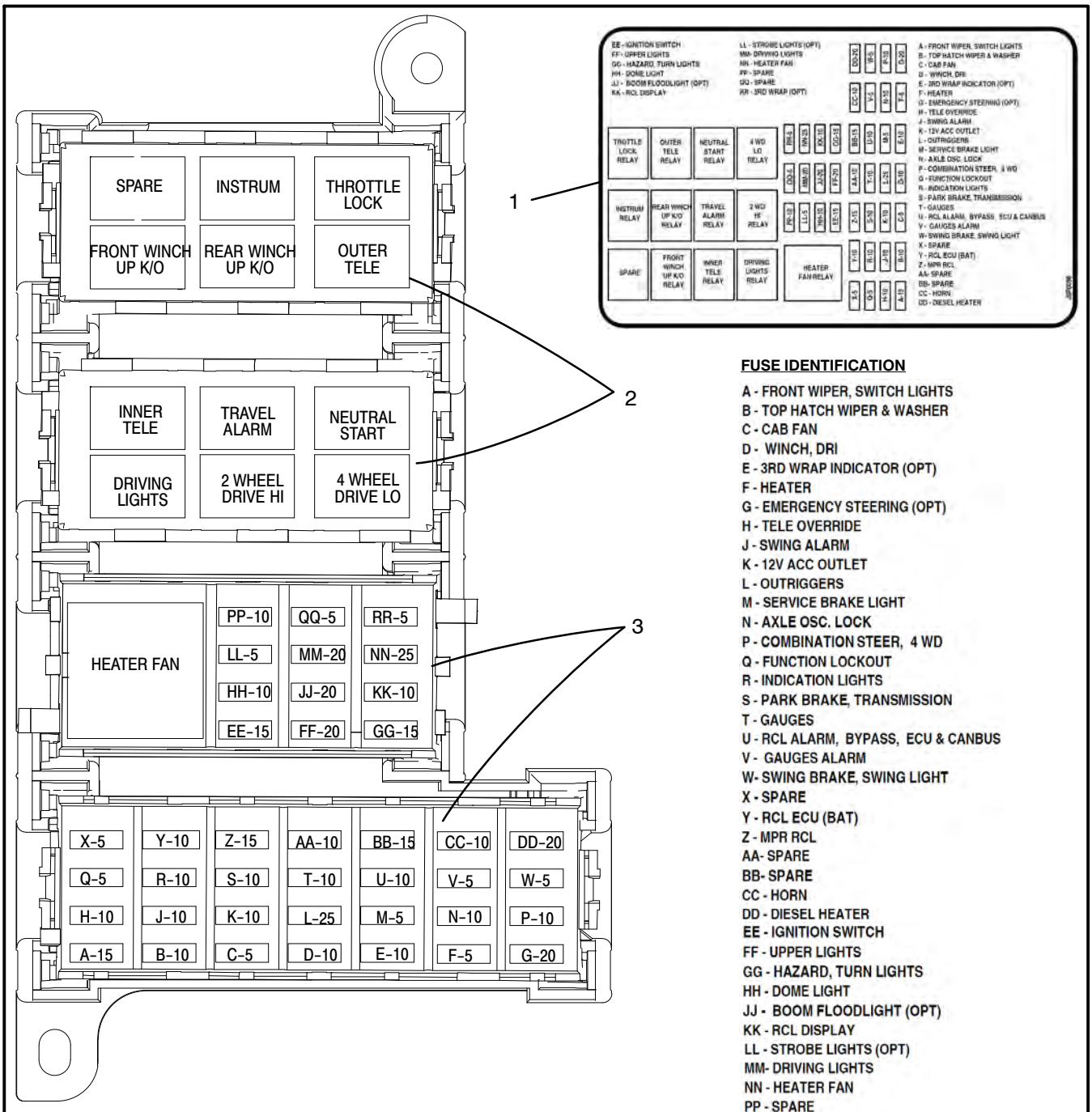


1. RCL USB Connector
2. RCL CAN 1 Connector
3. Outrigger CAN 3 Connector

Figure 1—37
Upper Diagnostic Panel

Upper Diagnostic Panel

The Upper Diagnostic Panel is behind the operator's seat. Refer to Figure 1-35. The central location allows easy access for technicians to retrieve fault codes and conduct systematic troubleshooting of various control systems. A label which identifies each connector is on the panel.

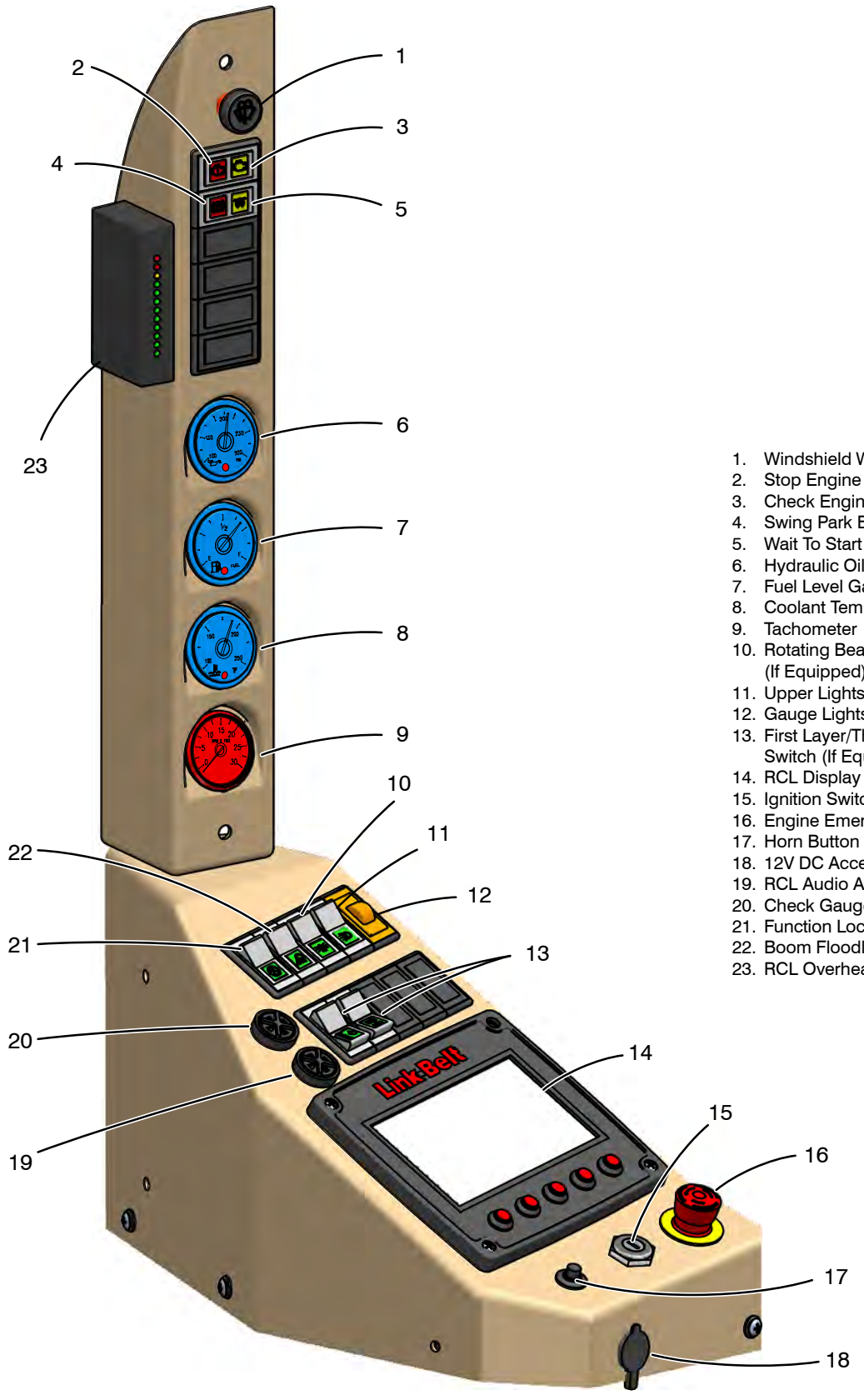


1. Fuse Panel Label - Always refer to the actual label on the crane.
2. Fuses
3. Relays

Figure 1—38
Upper Fuse Box

Operator's Cab Fuse Panel

The fuse panel is in the lower left front corner of the operator's cab. Refer to Figure 1-35. A label which designates the electrical circuit protected by each fuse is behind the fuse panel cover. Refer to Figure 1-38. Each fuse has a letter designation which corresponds to the upper electrical system as shown on the fuse identification label.



1. Windshield Wiper/Washer Switch
2. Stop Engine Indicator Light
3. Check Engine Indicator Light
4. Swing Park Brake Switch
5. Wait To Start Indicator Light
6. Hydraulic Oil Temperature Gauge
7. Fuel Level Gauge
8. Coolant Temperature Gauge
9. Tachometer
10. Rotating Beacon or Strobe Light Switch (If Equipped)
11. Upper Lights Switch
12. Gauge Lights Dimmer Switch
13. First Layer/Third Wrap Calibration Switch (If Equipped)
14. RCL Display
15. Ignition Switch
16. Engine Emergency Shutdown Button
17. Horn Button
18. 12V DC Accessory Outlet
19. RCL Audio Alarm
20. Check Gauges Audio Alarm
21. Function Lockout Switch
22. Boom Floodlight Switch (If Equipped)
23. RCL Overhead Bar-Graph (If Equipped)

Figure 1–39
Gauge And Control Panel

Gauge And Control Panel

A panel that contains the following controls, gauges, and indicators is inside the right front corner of the operator's cab and is shown in Figure 1-39.

1. Windshield Wiper/Washer Switch

Rotate the wiper/washer knob clockwise to activate the windshield wiper. Rotate the knob to the first detent for low speed wiper and to the second detent for high speed wiper. Pushing the wiper/washer knob sprays washer fluid on the windshield to clean the window.

2. Stop Engine Indicator Light

This red indicator light will illuminate along with an alarm buzzer to make the operator aware of critical engine problems. When this light illuminates stop operations immediately and shutdown the engine. Refer to the engine manufacturer's manual and determine the problem before any further operation of the engine.

Note: The stop engine light will illuminate momentarily when the ignition is turned on as a means of testing the indicator light. The light should go out after a short period of time.

3. Check Engine Indicator Light

This amber indicator light will illuminate along with an alarm buzzer to make the operator aware of minor engine problems. When this light illuminates engine operation may continue. However, refer to the engine manufacturer's manual and determine the problem as soon as possible to avoid prolonged operation of the malfunctioning engine which could develop into a major problem.

Note: The check engine light will illuminate momentarily when the ignition is turned on as a means of testing the indicator light. The light should go out after a short period of time.

4. Swing Park Brake Indicator Light

This light will illuminate anytime the swing park brake is applied and the ignition is on. Refer to "Swing System" in this Section of this Operator's Manual for complete operating procedures.

5. Wait To Start Indicator Light

This red indicator light will illuminate when the ignition switch is in the "ON" position to alert the operator not to crank the engine. During cold weather conditions the light illuminates and glow plugs are activated that will heat the engine cylinders. When the cylinders are warm enough the indicator light will go out and the engine can be started. This aids in engine start-up in cold weather conditions. For more information refer to "Cold Engine Starting" in this section of this Operator's Manual.

6. Hydraulic Oil Temperature Gauge

This gauge registers the hydraulic oil temperature in the main return line. Normal operating ranges vary with the oils used in different climates. Refer to Section 2 of this Operator's Manual for proper oil viscosities and operating temperature ranges. If the hydraulic oil exceeds the maximum operating temperature, an indicator light within the gauge will illuminate and an alarm buzzer will sound. Shutdown the crane immediately and correct the problem.

7. Fuel Level Gauge

This gauge registers the level of fuel in the fuel tank. The fuel tank capacity is 75 gal (*284L*). Refer to the engine manufacturer's manual for the correct grade of diesel fuel. When the fuel level reaches an eighth of a tank, an indicator light within the gauge will illuminate.

8. Coolant Temperature Gauge

This gauge registers the engine cooling system temperature. For proper cooling system operating temperature range, refer to the engine manufacturer's manual. If the cooling system overheats, reduce engine speed or shift to a lower gear, or both, until the temperature returns to normal operating range. If engine temperature does not return to normal temperature, refer to engine manufacturer's manual. When the coolant temperature exceeds normal operating range an indicator light within the gauge will illuminate, an alarm buzzer will sound, and the stop engine light will illuminate.

9. Tachometer

The tachometer registers engine speed in revolutions per minute (rpm). Refer to the engine manufacturer's manual for suggested operating speeds.

10. Rotating Beacon or Strobe Light Switch (If Equipped)

This switch controls the cab rotating beacon or strobe light. Push the left side of the switch to turn it on, right side to turn it off.

11. Upper Lights Switch

This switch operates upper floodlights. Push the left side of the switch to turn floodlights on, right side to turn them off.

12. Gauge Lights Dimmer Switch

This switch is used to control the dash lights. Rotate the switch left to dim the dash lights or rotate right to brighten dash lights.

13. First Layer/Third Wrap Calibration Switches (If Equipped)

These switches are used to calibrate the first layer/third wrap warning system. When the winch wire rope is down to the first layer on the drum(s), an audible alarm will sound intermittently, and "First Layer" will appear in the warning message area on the RCL Display to alert the operator that the wire rope is down to the first layer on the winch drum(s). When the wire rope is down to the third wrap on the winch drum(s), an audible alarm will sound continuously, and "Third Wrap" will appear in warning message area on the RCL Display. If equipped and activated, the winch down function will be disabled with the third wrap alarm. Refer to First Layer/Third Wrap Calibration in Section 3 of this Operator's Manual for calibration procedures.

WARNING

Three (3) full wraps of wire rope must be maintained on the winch drum at all times during operation. Wire rope failure may occur.

14. Rated Capacity Limiter Display

This displays the boom length, boom angle, load weight, etc. Refer to "Rated Capacity Limiter" in this Section of this Operator's Manual for complete operating instructions.

15. Ignition Switch

The ignition switch is the conventional, key operated, automotive type. It controls engine off/on/start, accessories, and energizes the instrument panel in the operator's cab.

16. Engine Emergency Shutdown Button

The engine emergency shutdown button is used to shutdown the engine in emergency situations. Press the button to shutdown the engine. Reset the button by turning it counterclockwise.

17. Horn Button

Press this button to sound the horn.

18. 12V DC Accessory Outlet

Use this outlet for electrical accessories.

CAUTION

Do not connect an accessory to any part of the crane other than the accessory outlets or cigarette lighter. Damage to the crane's electrical system may result. If it is necessary to do so, contact your Link-Belt Distributor.

19. RCL Audio Alarm

This buzzer alarm will sound to alert the operator that an abnormal operating condition within the RCL System has been detected. The audio alarm will also be accompanied by a visual alarm on the RCL Display.

20. Check Gauges Audio Alarm

This buzzer alarm will sound to alert the operator that a gauge is detecting an abnormal operating range. The check engine or stop engine light will also illuminate when applicable. The problem should be repaired before operating the crane.

21. Function Lockout Switch

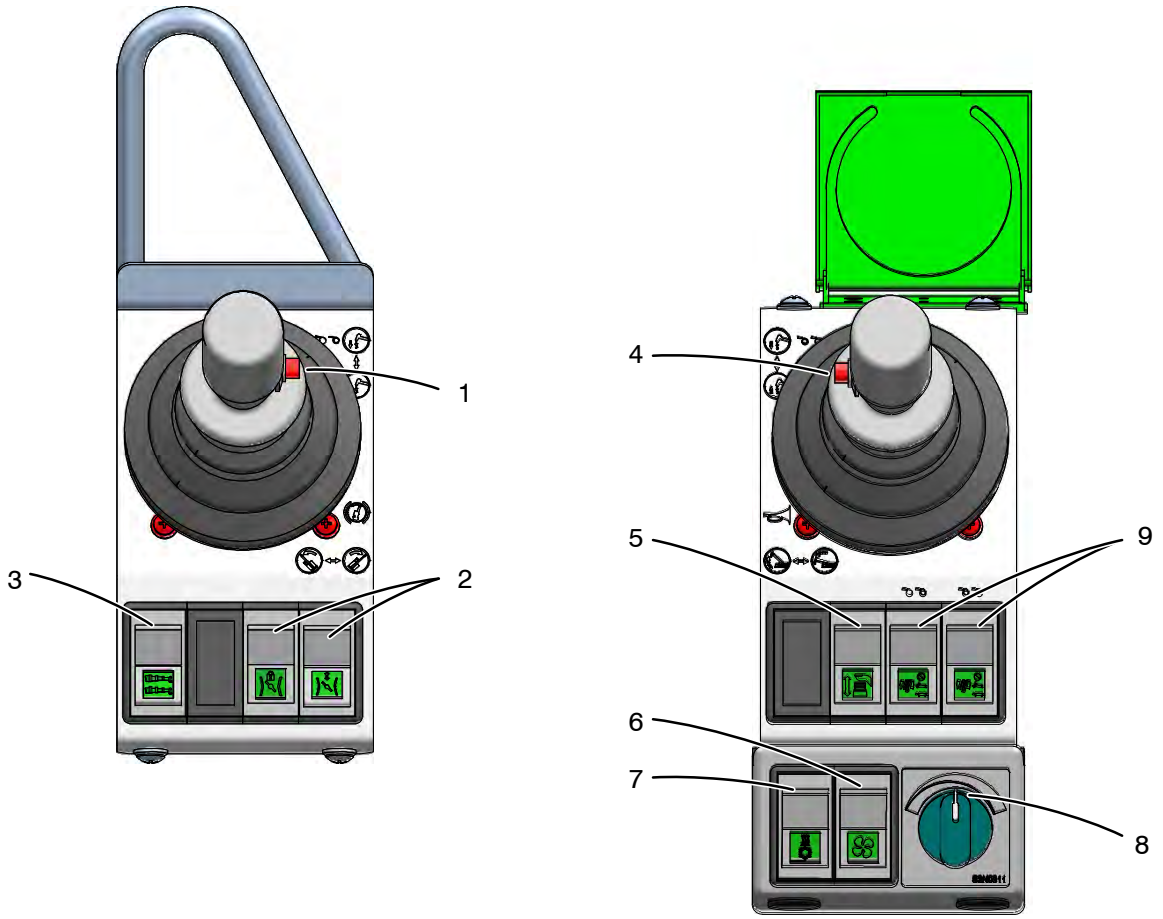
This switch is used to disable hydraulic functions which are operated by the control levers and boom telescope foot pedal. Press the bottom part of the switch to disable hydraulic functions and to prevent inadvertent operation of these controls. To allow normal operation of the control levers and boom telescope foot pedal, press the top part of the function lockout switch. The bottom part of the switch will illuminate to indicate switch is in the ON position.

22. Boom Floodlight Switch (If Equipped)

This switch operates the boom floodlight. Push the left side of the switch to turn floodlight on, right side to turn it off.

23. RCL Overhead Bar-Graph (If Equipped)

The operator's cab may be equipped with an overhead bar-graph which gives a visual indication of how much of the crane's capacity is being used and the rate at which an overload is being approached. This bar-graph operates similar to the bar-graph on the RCL Display. Refer to "Rated Capacity Limiter" in this Section of this Operator's Manual for additional information.



1. Swing Park Brake Switch
2. Throttle Lock Switches
3. Boom Telescope Override Switch
4. Horn Button
5. Drum Rotation Indicator Switch
6. Heater or Fan Speed Switch
7. Heater/Air Conditioner Selector Switch (If Equipped)
8. Temperature Control Knob
9. Winch Control Switches

Figure 1—40
Seat Console Control Switches

Seat Console Control Switches

Control switches are mounted on the left and right consoles of the operator's seat. Refer to Figure 1-35 and Figure 1-40.

1. Swing Park Brake Switch

This switch is used to operate the swing park brake to hold the upper in any position over the carrier. The Swing Park Brake Indicator Light on the gauge and control panel will illuminate to indicate the swing park brake is applied. Refer to "Swing System" in this Section of this Operator's Manual for complete operating procedures.

2. Throttle Lock Switches

These switches are used to hold the engine at a constant speed. This provides the operator with more flexibility for certain job requirements. Refer to "Throttle Lock System" in this Section of this Operator's Manual.

3. Boom Telescope Override Switch

This switch is provided to manually override the telescope system when the boom is not extending/retracting proportionally. Use this switch for that purpose only. While in boom mode "B", the switch will stop one of the boom sections so the boom can be extended/retracted proportionally.

4. Horn Button

Press this button to sound the horn.

5. Drum Rotation Indicator Switch

This switch is used to activate the drum rotation indicator system. To activate the system, press the bottom part of the switch. Press the top part of the switch to deactivate the system. The bottom part of the switch will illuminate to indicate switch is in the ON position. Refer to "Drum Rotation Indicators" in this Section of this Operator's Manual for complete operating procedures.

6. Heater or Fan Speed Switch

This switch controls the cab heater if cab is not equipped with air conditioning. Press the top part of the switch to turn the unit on, bottom part to turn it off. If cab is equipped with air conditioning, this switch controls the fan speed.

7. Heater/Air Conditioner Selector Switch (If Equipped)

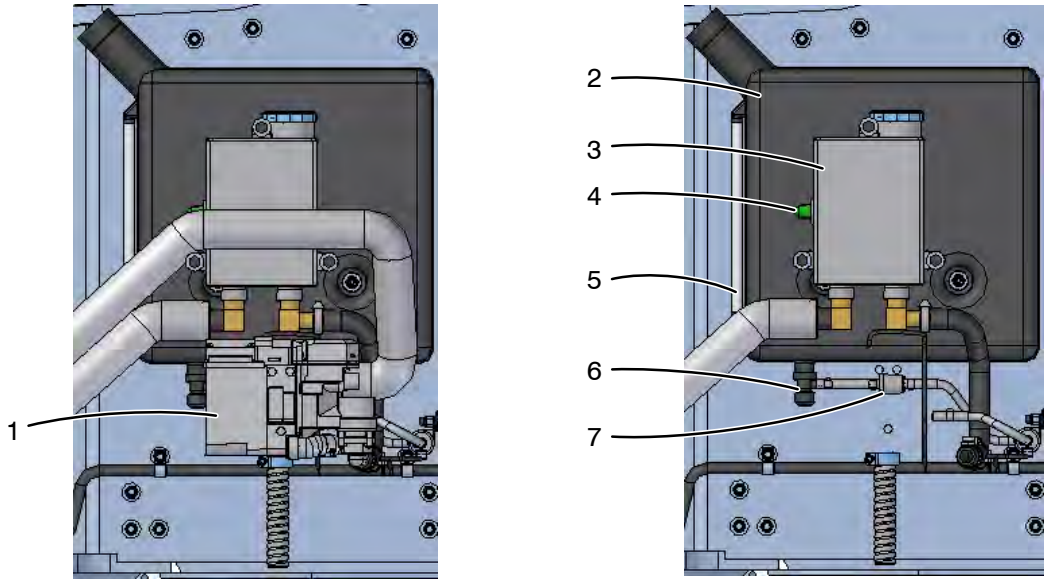
If cab is equipped with air conditioning and heater, this switch selects which system to operate. Press the top part of the switch to turn the heater on, bottom part to turn the air conditioning on.

8. Temperature Control Knob

Turn the temperature control knob to adjust the temperature in the cab.

9. Winch Control Switches

These switches are used to control engaging/disengaging the high speed hoist and disabling the front and/or rear winch. Refer to "Wire Rope Winch System" in this Section of this Operator's Manual for complete operating procedures.



1. Heater/Pump
2. Diesel Fuel Tank
3. Coolant Reservoir
4. Coolant Reservoir Sight Gauge
5. Diesel Fuel Tank Sight Tube
6. Diesel Fuel Shutoff Valve
7. Diesel Fuel Filter

Figure 1—41
Diesel Fired Warm-Water Cab Heater

Cab Heater Operation

This crane may be equipped with a diesel fired warm-water cab heater or an optional engine dependant warm-water cab heater. Refer to the following instructions to operate the cab heater that is used on the crane.

Diesel Fired Warm-Water Cab Heater

This cab heater uses antifreeze circulating through the unit to provide heat. Antifreeze is stored in a reservoir mounted on the left side of the upper revolving frame. This antifreeze is heated by a diesel fired heater/pump and circulated through the heat exchanger in the cab. The diesel fuel tank, for the system, is mounted on the left side of the upper revolving frame. Refer to Figure 1-41. Diesel fuel should be #1, #2, or arctic. The fuel system is equipped with an inline filter and should be changed every 2,000 hours of operation or annually, whichever occurs first. The antifreeze used should be the same type used in the crane's engine. Refer to engine manufacturer's manual for proper antifreeze selection.

Note: Operate the heater at least once a month for 10 minutes.

Note: To improve heater performance when operating the crane in prolonged ambient temperatures below —7°C (20°F), kerosene is the recommended fuel.

WARNING

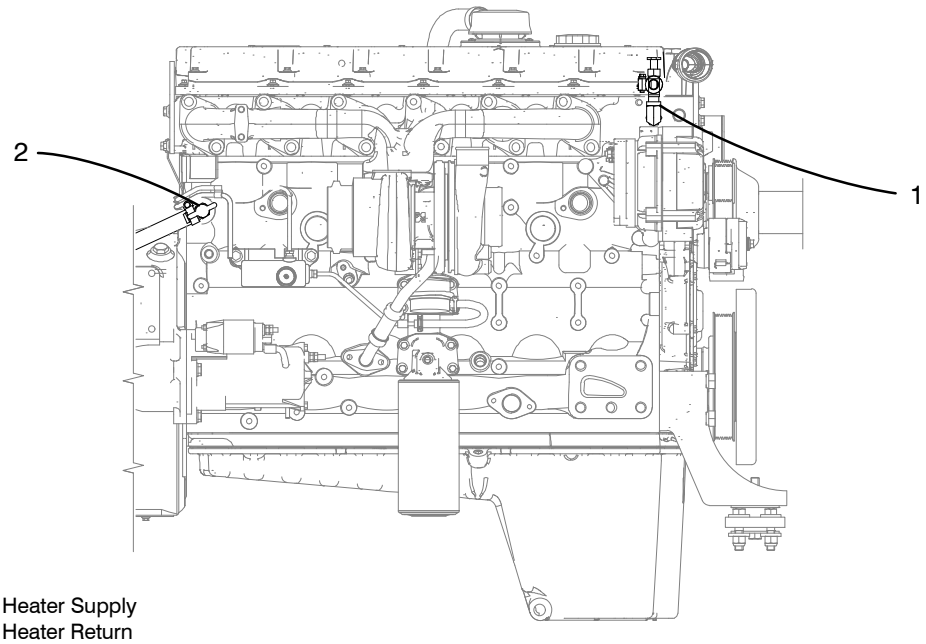
Diesel exhaust fumes can be harmful. Start and operate diesel cab heater in a well ventilated area. If it is necessary to operate in an enclosed area, vent the exhaust to the outside.

To Start The Diesel Fired Warm-Water Cab Heater

1. Before activating the heater, ensure that the diesel fuel tank and the coolant reservoir are full.
2. With the engine running, press the heater switch or if crane is equipped with air conditioning, press the top part of the heater/air conditioner selector switch to turn the heater on. Refer to Figure 1-39.
3. Turn the temperature control knob to the desired setting.
4. If cab is equipped with air conditioning, use the fan speed switch to control the air flow into the cab. If cab is not equipped with air conditioning, use the heater/fan speed switch to control the air flow into the cab.

To Stop The Diesel Fired Warm-Water Cab Heater

1. Press the heater switch to the off position.
2. During warm weather conditions or if the heater is not going to be used for an extended period of time, rotate the temperature control knob to the coolest setting.



1. Shutoff Valve - Heater Supply
2. Shutoff Valve - Heater Return

Figure 1—42
Engine Dependant Warm-water Cab Heater Shutoff

Engine Dependant Warm-Water Cab Heater (If Equipped)

This cab heater uses engine coolant circulating through the unit to provide heat. Normally the engine coolant circulates through the heater in the cab regardless of whether the heater switch is turned on or not. During warm weather conditions, the operator may wish to shutoff the flow of hot engine coolant to the heater to reduce the temperature in the cab. Shutoff valves are on the engine to perform this function. Refer to Figure 1-42.

To Start The Cab Heater

1. With the engine running, press the heater switch or if crane is equipped with air conditioning, press the top part of the heater/air conditioner selector switch to turn the heater on. Refer to Figure 1-39.
2. Turn the temperature control knob to the desired setting.
3. If cab is equipped with air conditioning, use the fan speed switch to control the air flow into the cab. If cab is not equipped with air conditioning, use the heater/fan speed switch to control the air flow into the cab.

To Stop The Cab Heater

1. Press the heater switch to the off position.
2. During warm weather conditions or if the heater is not going to be used for an extended period of time, rotate the temperature control knob to the coolest setting.

Cab Heater Shutoff (If Equipped)

WARNING

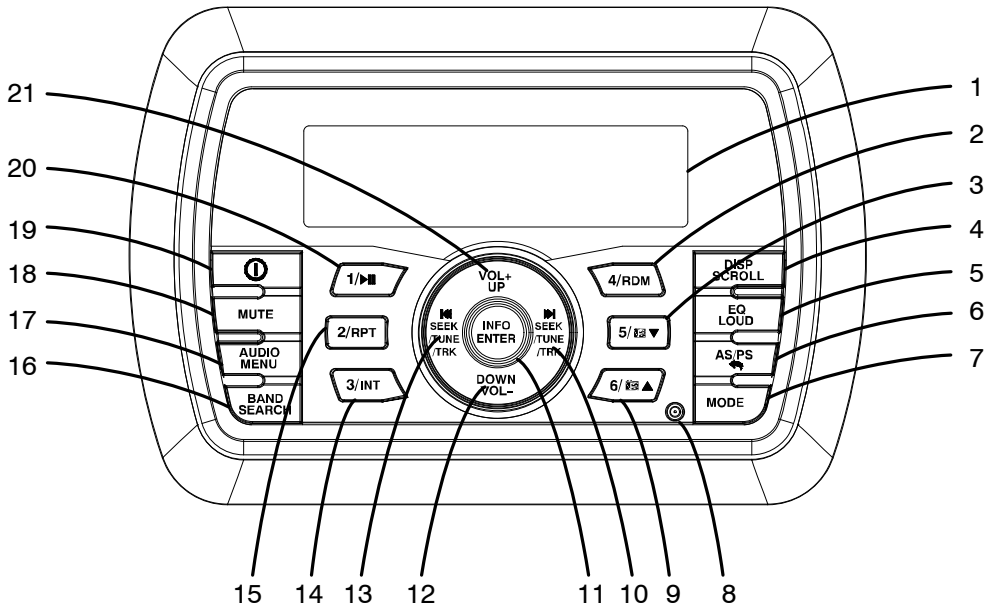
Shutdown the engine and allow it to cool before operating the heater shutoff valves. The valves may be hot and could cause serious burns.

1. Shutdown the engine and rotate the handles on the shutoff valves clockwise to stop the flow of engine coolant to the heater; Counterclockwise to restore it. Refer to Figure 1-42.

Air Conditioning (If Equipped)

The operator's cab may be equipped with an air conditioning unit. Use the following instructions to operate the unit. Refer to Figure 1-39.

1. Start the engine and allow all operating temperatures and pressures to reach their normal range.
2. Press the bottom part of the heater/air conditioner selector switch to activate the air conditioning unit.
3. Press the fan speed switch to control the amount of air blown into the cab.
4. Turn the temperature control knob to the desired setting.
5. To turn the unit off, press the heater/air conditioner selector switch to the off position.



1. Liquid Crystal Display (LCD)
2. 4/RDM Button
3. 5/Previous Folder Button
4. DISP/SCROLL Button
5. EQ/Loud Button
6. Automatically Store/Preset Scan/Quick Exit Hot Key Button
7. Mode Button
8. Reset Button
9. 6/Next Folder Button
10. Seek/Tune/Track Forward Button
11. Info/Enter Button
12. Volume Down Button
13. Seek/Tune/ Track Back Button
14. 3/INT Button
15. 2/RPT
16. Band/Search Button
17. Audio/Menu Button
18. Mute Button
19. Power Button
20. 1/>II Button
21. Volume Up Button

Figure 1—43
Radio

Radio Operation

Note: Keep the volume level low enough to be aware of your surroundings while operating the crane.

The crane may be equipped with an AM/FM radio/audio system. It includes the following features: an AM/FM/EURO tuner with 30 Presets (12 AM and 18 FM), Weather Band with Weather Alert, Bluetooth (Supports A2DP and AVRCP), USB playback of MP3/WMA files, iPod/iPhone USB input, Mute, Preset Equalizer (User, Flat, Pop, Classical, Rock), Electronic Bass, Treble, Balance, and Fade Controls, Output Power (40W x 4), Wired Remote Control Ready, 2 Channel Pre-amp Line Level Outputs, and a Auxiliary Audio Input.

This radio generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

If this radio does cause harmful interference to radio or television reception, which can be determined by turning the radio OFF and ON, the Operator is encouraged to try to correct the interference by one or more of the following measures:

- Relocate the receiving antenna.
- Increase the distance between the radio and receiver.
- Connect the radio into an outlet on a different circuit that to which the receiver is connected.
- Contact your Link-Belt Distributor for the service.

1. Liquid Crystal Display (LCD)

   The LCD shows the reception frequency and activated functions of the system.

   Note: LCD panels may take longer to respond when subjected to cold temperatures for an extended period of time. In addition, the visibility of the numbers on the LCD may decrease slightly. The LCD display will return to normal when the temperature increases to a normal range.

2. 4/RDM Button

   Press the 4/RDM Button to go to preset 4. During playback mode, press the 4/RDM Button to play all songs in the current category in random order. Random order will occur once the current song has finished playing. "Random On" will appear on the LCD. Press the 4/RDM Button again to stop random playback.

3. 5/Previous Folder Button

   Press the 5/Previous Folder Button to go to preset 5. When navigating folders, press the 5/Previous Folder Button to go to the previous folder and begin playback of the first song in that folder.

4. DISP/SCROLL Button

   Press the DISP/SCROLL Button to change the display information from single line default display to Artist/Song Title double line display mode.

5. EQ/Loud Button

   Press the EQ/Loud Button to turn on the equalization function and select between five pre-defined bass and treble curves: User, Flat, Pop, Classical, Rock. Press and hold the EQ/Loud Button to toggle true loudness ON/OFF. When listening to music at low volumes, this feature will boost the bass ranges to compensate for the characteristics of human hearing.

6. Automatically Store/Preset Scan/Quick Exit Hot Key Button

   Automatically Store

   Select an AM or FM band. Press and hold the Automatically Store/Preset Scan/Quick Exit Hot Key Button for more than 2 seconds to automatically select strong stations and store them in all bands. The new stations replace any previous stored stations within the band.

   Preset Scan

   Select a band if needed. Press the Automatically Store/Preset Scan/Quick Exit Hot Key Button to scan all stations stored in all bands. The system will pause for 10 seconds at each preset station. Press the Automatically Store/Preset Scan/Quick Exit Hot Key Button to stop scanning when the desired station is reached.

   Quick Exit Hot Key

   While in system menu operation, searching mode, or audio menu operation press and hold the Automatically Store/Preset Scan/Quick Exit Hot Key Button for 3 seconds to quickly exit the operation without waiting for the system default time out.

7. Mode Button

   Press this button to toggle between modes. Modes include AM/FM Tuner, Weather Band, iPod, USB, AUX In (optional Auxiliary Input), and Bluetooth Audio.

8. Reset Button

   Press the reset button:

   - After initial installation of the radio; after all wiring is complete.
   - If function buttons do not operate.
   - If an error pops up on the display.

   Use a ball point pen or similar sized object to press the reset button.

9. 6/Next Folder Button

   Press the 6/Next Folder Button to go to preset 6. When navigating folders, press the 6/Next Folder Button to go to the next folder and begin playback of the first song in that folder.

10. Seek/Tune/Track Forward Button

    Press the Seek/Tune/Track Forward Button to adjust menu items, seek stations (press to manually seek or press and hold to automatically seek stations in radio mode), and to go to next track in Playback Mode (press and hold to fast forward).

11. Info/Enter Button

    Press the Info/Enter Button to select or enter a function and to get information.

12. Volume Down Button

    Press the Volume Down Button to turn the volume down and to navigate down.

13. Seek/Tune/Track Back Button

    Press the Seek/Tune/Track Back Button to adjust menu items, seek stations (press to manually seek or press and hold to automatically seek stations in radio mode), and to go to previous track in Playback Mode (press and hold to fast reverse).

14. 3/INT Button

    Press the 3/INT Button to go to preset 3. When in playback mode, press the 3/INT Button to play the first ten seconds of each file on the current device. When the desired file is reached, press the 3/INT Button to end the scan and play the selected file.

15. 2/RPT Button

    Press the 2/RPT Button to go to preset 2. When in playback mode, press the 2/RPT Button to repeatedly play the current file. Press the 2/RPT Button again to repeat all songs in the current folder. Press the 2/RPT Button once more to resume normal playback.

16. Band/Search Button

    Press the Band/Search Button to navigate between the three FM bands and the two AM (MV) bands. In playback mode, press the Band/Search Button to enter search mode.

17. Audio/Menu Button

    Press the audio menu button to access the system menu. Continue to press the system menu button to navigate through the system menu. When the proper menu is displayed, press the volume buttons within 5 seconds to adjust that option.

    Bass

    Adjusts from "-6" to "+6".

    Treble

    Adjusts from "-6" to "+6".

    Balance

    Adjusts from "L12" (Full Left) to "R12" (Full Right).

    Fade

    Adjusts from "R12" (Full Rear) to "F12" (Full Front).

18. Mute Button

    Press this button to mute audio output. Press again to enable audio output.

19. Power Button

    Press the power button to turn the system ON; press it again to turn the system OFF.

20. 1/>II Button

    Press the 1/>II Button to go to preset 1. When in playback mode, press the 1/>II Button to pause playback. Press the 1/>II Button once more to resume playback.

21. Volume Up Button

    Press the Volume Up Button to turn the volume up and to navigate up.

System Menu

1. Press and hold the Audio/Menu Button for more than 2 seconds to enter the system menu.
2. Press the Volume Up Button repeatedly to navigate the system menu and select the desired item.
3. Press the Info/Enter Button or Seek/Tune/Track Forward Button to adjust the selected menu item.
4. Press the Automatically Store/Preset Scan/Quick Exit Hot Key Button to go back to the previous operation.

The following items can be adjusted within the System Menu:

- Key Beep (ON/OFF): Turn the audible beep ON/OFF (heard when functions/buttons are selected).

  Note: Beep tone OFF will not affect Battery Alarm audible tone.

- LCD Backlight (1/10-10/10): Adjust LCD brightness.
- LCD Contrast (1/10-10/10): Set LCD contrast.
- Tuning Region (USA/Europe): Set frequency spacing for various regions.
- Weather Alert Configure: Press the Info/Enter Button to see weather alert options:
  - Weather Alert (ON/OFF): Determines if the weather band alert feature is activated.
  - Alert Volume (1/40-40/40): Set default volume for weather alert broadcasts.
- Battery Alarm (ON/OFF): Monitor voltage on ACC line and send alert when voltage is low.
- Battery Auto-OFF (ON/OFF): Automatically turn OFF power to system when battery voltage is low.

  Note: Bluetooth Device and Bluetooth Pair menu options are only available while the Bluetooth feature is ON and the system is in Bluetooth Audio mode.

  Note: A locked Bluetooth device will be overwritten from the list.

- Bluetooth Device (Lock/Unlock, Disconnect/Connect, Delete): View, lock, and delete from a list of previously paired mobile phone device models.
- Bluetooth Pair <ENTER>: Press Info/Enter Button to automatically pair a device.
- Bluetooth (ON/OFF): Choose "Bluetooth ON" or "Bluetooth OFF".
- Volume Preset (1/40-40/40): Select an automatic turn-ON volume.
- Reset to Defaults <ENTER>: Return the EEPROM to factory default set up values. Press the Info/Enter Button to select.

Battery Alarm Operation

If Battery Alarm is set to "ON", an alarm will sound (8 beeps every 30 sec) when the voltage drops to 10.5V (+/- 0.3V). The LCD will display the "low battery" and the current mode alternatively.

Note: "OFF" is the default setting for Battery Alarm. If the audio is muted or the volume is set to 0, the audible beep will not be heard.

Auxiliary Input

To access an auxiliary device:

1. Connect the portable audio player to the AUX IN cables routed from the rear of the system.
2. Press the Mode Button to select Aux In mode.
3. Press the Mode Button again to cancel Aux In mode and switch to the next mode.

Preset Stations

Six numbered preset buttons store and recall stations for each band.

To store a station:

Select a band (if needed), then select a station. Press and hold a preset button for two seconds. The preset number will appear in the display.

To recall a station:

Select a band (if needed). Press a preset button to select the corresponding stored station.

Weather Band Operation

Note: If the system is programmed for European operation, the Weather Band function will be disabled.

Press the Mode Button to access weather band mode.

What is the NOAA Weather Radio?

NOAA is a nationwide system that broadcasts local weather emergency information 24 hours a day. The U.S. network has more than 530 stations covering the 50 states, as well as the adjacent coastal waters, Puerto Rico, the U.S. Virgin Islands and the U.S. Pacific Territories. Each local area has its own transmitting station and there are a total of seven broadcasting frequencies used: 162.400MHz (CH2), 162.425MHz (CH4), 162.450MHz (CH5), 162.475Mhz (CH3), 162.500MHz (CH6), 162.525MHz (CH7) and 162.550MHz (CH1).

How many stations can I expect to receive?

Since the broadcasts pertain to local weather and information, the transmission power is usually very low (much less than AM or FM stations) which means you will usually receive only one station unless you are on the edge of two or more broadcast signals. The most you will receive is two or three.

Is it possible I won't receive any stations?

Depending on location, it's possible to receive a very weak signal or none at all. Also, similar to AM and FM signals, weather band signals are subject to surrounding conditions, weather, obstructions of the signal by hills or mountains, etc. If no NOAA signals are found/received, the tuner will scan all seven NOAA frequencies every 30 seconds.

How will I know I am tuned to the weather band?

When you select the weather band, the "WB" icon will appear on the LCD, along with the current channel indication. Press the Seek/Tune/Track Forward or Back Buttons to tune to each of the seven channels until you find the weather band station broadcasting in your area.

NOAA Weather Alert

The Weather Alert function adds an additional level of user safety by automatically switching from the current function mode to weather band mode for a minimum of 120 seconds if a NOAA warning tone (1050 Hz) is received/detected. If no additional warning tone is received for 60 seconds, the system will switch back to the last known function mode.

The Weather Alert function can be turned ON or OFF by the Audio/Menu Button. When ON, the weather tuner remains active, even when the system is turned OFF (as long as the power is still applied to the system). If a weather alert is issued, the system will turn ON and play the announcement for 60 seconds, then turn back OFF and revert to weather alert monitor mode.

The system will not respond to any weather alerts when it is OFF and will not automatically switch to the weather band if an alert is issued.

MP3/WMA Operation

MP3/WMA File Requirements:

This system can play MP3 (MPEG1, 2, 2.5 Audio Layer 2/3) and WMA (version 7/8/9).

Media Requirements

The following formats are available for the media used in this system. The maximum number of characters used for file name, including the delimiter (".") and three-character extension, are indicated in parentheses:

- ISO 9660 Level 1 (11 characters)
- ISO 9660 Level 2 (31 characters)
- Joliet (31 characters)
- Romeo (31 characters)

The media reproducible on this system has the following limitations:

- Maximum number of nested folders: 8
- Maximum number of files per device: 999
- Maximum number of folders per device: 99

Use the following settings when compressing audio data in MP3 data with the MP3 encoder:

- Transfer bit rate: 32 - 320 kbps
- Sampling frequency
  - MPEG1: 32/44.1/48 KHz
  - MPEG2:16/22.05/24 KHz
  - MPEG2.5: 8/11.025/12KHz
  - WMA: 22/32/44/48KHz
- Maximum file/directory name: 64 bytes

ID3 Support

This system supports ID3 tag versions 1.0, 1.1, 2.0, and 2.3 (Max 32 bytes).

Installing a USB Device

Insert your USB thumb drive into the USB connector routed from the rear of the radio. The system will automatically search for MP3 and WMA files on the device and begin playback. You can access USB mode from any other mode by pressing the Mode Button.

Note: Do not remove the device when USB PLAY mode is active. Press the Mode Button to change to another mode before removing the device.

MP3/WMA Directory Search

1. Press the Band/Search Button to enter directory search mode.
2. The LCD will display the folder list for the current directory. Press the Band/Search Button to view the folder directory list.
3. Navigate the folder list by pressing the Volume Up and Down Buttons.
4. Press the Info/Enter Button to select a folder. The LCD will display the list of files within that folder.
5. Navigate the file list by pressing the Volume Up and Down Buttons.
6. Press the Info/Enter Button to select a file.
7. Use the Automatically Store/Preset Scan/Quick Exit Hot Key Button to reverse navigate the list.

iPod Operation

This system is equipped with an iPod ready function that will allow the Operator to control their iPod (if compatible) using the control panel buttons. The following iPod versions are supported:

- iPod Nano 5G, iPod Nano 6G
- iPod 5G
- iPod Classic
- iPhone 4, iPhone 4S
- iPod Touch 3G, iPod Touch 4G

Note: Earlier model iPods may not be supported because they do not implement the USB control protocol. Also, the iPod Shuffle is not supported because it does not utilize the 30-pin Apple iPod Connector. These unsupported iPod models may be connected to the radio using one of the Auxiliary Inputs.

Accessing iPod Mode

Connect a supported iPod or iPhone to the USB connector. The iPod icon illuminates in the bottom left corner of the LCD whenever an iPod or iPhone is attached to the USB connector. Music playback begins automatically.

To enter iPod mode from any other source, press the Mode Button until "LOADING" appears on the display. If the user connects an iPod containing no songs, the radio will display a message stating "Device No File" when it enters iPod mode.

Turning The iPod ON/OFF

The iPod power turns on automatically when an iPod is connected to the USB connector, as long as the crane ignition is turned ON. You can turn the iPod OFF by disconnecting it or by turning the ignition OFF. When the ignition is turned OFF, the iPod will pause and then enter sleep mode after 2 minutes. While the iPod is connected, the power cannot be turned ON or OFF from the iPod itself.

Note: The iPod will continuously recharge while in iPod playback mode.

iPod Search Mode

1. Press the Band/Search Button to enter iPod search mode and choose from the following search criteria: Playlist, Artist, Album, Song, Genre, Composer, Audiobooks, and Podcasts (consecutively).
2. When search mode is selected, press the Info/Enter Button to confirm selection.
3. Use the Volume Up and Down Buttons to navigate through various list selections.
4. Press Info/Enter Button to make your final selection.
5. Use the Automatically Store/Preset Scan/Quick Exit Hot Key Button to reverse navigate the list.

Bluetooth®Operation

This system includes built-in Bluetooth technology that allows you to connect this system to Bluetooth devices for streaming audio playback.

Bluetooth is a short-range wireless radio connectivity technology developed as a cable replacement for various electronic devices. Bluetooth operates in 2.4 GHz frequency range and transmits voice and data at speeds up to 1 megabit per second. Bluetooth was launched by a special interest group (SIG) comprised of Ericsson Inc., Intel Corp., Nokia Corp., Toshiba and IBM in 1998, and it is currently developed by nearly 2,000 companies worldwide. The Bluetooth word mark and logos are owned by the Bluetooth SIG, Inc. and any use of such marks is under license. Other trademarks and trade names are those of their respective owners.

Note: Some Bluetooth menu options are only available while the system is in Bluetooth Audio mode.

Bluetooth Menu Options

Press and hold the Audio/Menu Button to enter menu adjustment mode. Repeatedly press the Volume Up and Down Buttons to access the "Bluetooth ON/OFF" menu function. Press the Info/Enter Button to turn the Bluetooth function ON or OFF. The following menu options are available when the system is in Bluetooth mode:

- Bluetooth Pair <ENTER>: Press the Info/Enter Button to begin pairing with a Bluetooth enabled device in pairing mode.
- Bluetooth Device: Press the Info/Enter Button to view a list of previously paired mobile phone device models. Press the Seek/Tune/Track Forward and Press the Seek/Tune/Track Back Buttons to view devices from the list. A device that is actively connected cannot be deleted. Press the Info/Enter Button to select the device. Press the Seek/Tune/Track Forward and Press the Seek/Tune/Track Back Buttons to choose Lock/Unlock, Disconnect, or Delete for this device.
  - Lock/Unlock: The system can store up to 5 devices for Bluetooth connection. The devices are stored in FIFO (First In First Out) order. To prevent a device from being bumped from the list when more than 5 devices are used, the device must be locked. To Lock/Unlock a device, press the Info/Enter Button to display/change the Locked or Unlocked icon.
  - Disconnect: To disconnect a paired device, press the Info/Enter Button to temporarily remove the Bluetooth link. The link can be re-established through the phone menu by selecting the system for connection.
  - Delete: To delete a device from the list, press the Info/Enter Button.

Pairing A Bluetooth Device

Before you begin, consult the owner's manual for the Bluetooth device you want to pair with this system.

1. Ensure the device is on and ready to receive a signal from the system. With the system in Bluetooth Audio mode, choose BT PAIR from the system menu and press the Info/Enter Button to select ON. The system is waiting to connect to a mobile phone device. With the Bluetooth function of the mobile phone device turned ON, search for a Bluetooth device.
2. When the Bluetooth device has completed it's search, the mobile phone will display the Bluetooth device name (JHD40BT).
3. Select JHD40BT. The Bluetooth Audio icon (♫) will now be displayed on the LCD.
4. Enter the pairing password (0000), if requested.

After connecting successfully, the Operator can listen to music stored on their Bluetooth enabled device through the system.

Answering A Call

When answering a call using the connected phone, Bluetooth Audio will pause. After hanging up from the call, Bluetooth Audio will continue on some phones. It may be necessary to press the play button to resume Bluetooth Audio.

BT Audio (A2DP)

The A2DP music is available for Bluetooth enabled phones when the phone is connected. To access Bluetooth mode and play songs stored on your phone.

1. Press the Mode Button.
2. While in Bluetooth mode, the Bluetooth Audio icon (♫) illuminates on the it LCD.
3. If the system is changed to another mode, the mobile phone audio will pause. Press the Mode Button to return to Bluetooth mode and resume mobile phone audio playback.

Note: If a Bluetooth device is disconnected due to the power being turned OFF or if the device is disconnected inadvertently, the system will automatically search for the matching Bluetooth mobile phone when the power is restored.

Care And Maintenance

- Keep the system dry. If it does get wet, wipe it dry immediately. Liquids might contain minerals that can corrode the electronic circuits.
- Keep the product away from dust and dirt, which can cause premature wear of parts.
- Handle the system gently and carefully. Dropping it can damage circuit boards and cases, and can cause the system to work improperly.
- Wipe the system with a dampened cloth occasionally to keep it looking new. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the system.
- Use and store the system only in normal temperature environments. High temperature can shorten the life of electronic devices, damage batteries, and distort or melt plastic parts.

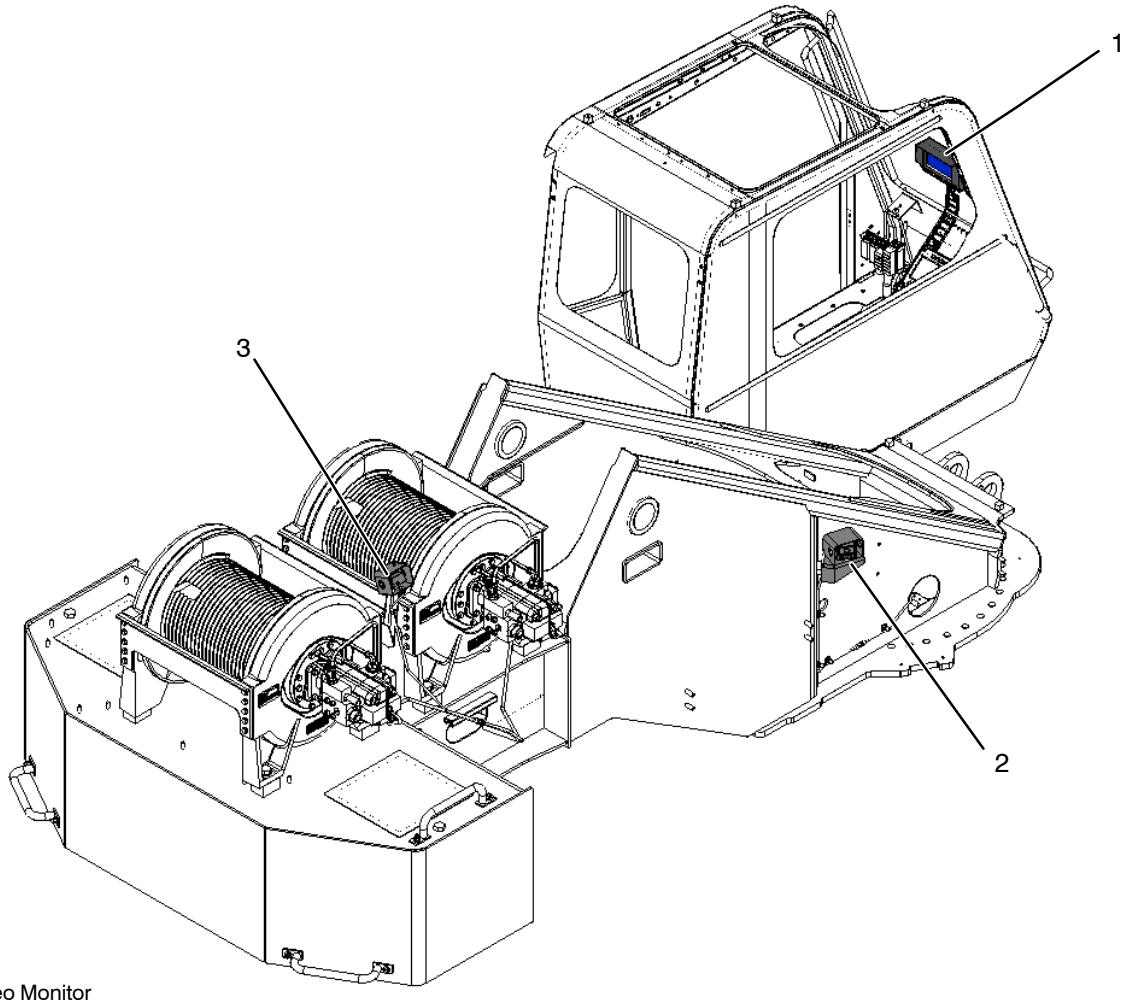
Ignition

- The most common source of noise in reception is the ignition system. This is a result of the radio being placed close to the ignition system (engine). This type of noise can be easily detected because it will vary in intensity of pitch with the speed of the engine.
- Usually, the ignition noise can be suppressed considerably by using a radio suppression type high voltage ignition wire and suppressor resistor in the ignition system. Another method of suppression is the use of additional noise suppressors.

Interference

- Radio reception in a moving environment is very different from reception in a stationary environment (home). It is very important to understand the difference.
- AM reception will deteriorate when passing under a bridge or when passing under high voltage lines. Although AM is subject to environmental noise, it has the ability to be received at great distance. This is because broadcasting signals follow the curvature of the earth and are reflected back by the upper atmosphere.

Radio Troubleshooting		
Symptom	**Cause**	**Solution**
No power	The accessory switch is not ON	If the power supply is properly connected to the cranes accessory terminal, switch the ignition key to "ACC".
	Fuse is blown	Replace the fuse.
No sound	Volume is too low	Adjust volume to audible level.
	Wiring is not properly connected	Check wiring connections.
The operation keys do not work	Built-in microcomputer is not operating properly due to noise	Press the Reset Button.
Cannot tune to radio station, auto-seek does not work	Antenna cable is not connected	Insert the antenna cable firmly.
	Signals are too weak	Select a station manually.



1. Video Monitor
2. Right Swing Camera
3. Winch Camera

Figure 1—44
Upper Camera Locations

Winch And Right Swing View Cameras

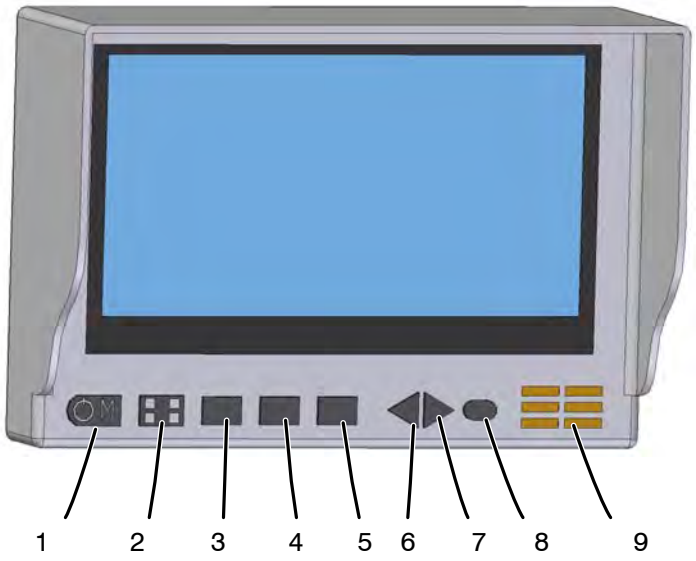
The upper is equipped with two cameras. One camera gives the operator a view of the winches to monitor wire rope spooling on the winch drum(s). The other camera gives a view of the area to the right side the crane to be used before swinging the upper to the right.

During initial crane start up and inspection each day, verify the proper operation of all cameras. If the cameras are found to be damaged or missing, order replacement parts as required to repair or replace the damaged or missing component. Continue operation with caution as you should normally do with all crane operations.

⚠ WARNING

Cameras are being supplied as an operator's aid. They do not relieve the crane operator of any responsibilities during crane operation. Always look directly in the direction of crane travel or at the load during crane lifting operations. Do not rely solely on the camera to determine if an obstruction is present.

When the swing brake is released the monitor will automatically display the right swing view.



1. Power/Menu Button
2. QUAD(PIP) Select Button
3. Auto Scan/Locking Button
4. Camera Select/Up Button
5. AV/Zoom/Down Button
6. Volume Down/Navigate Left
7. Volume Up/Navigate Right
8. CDS Sensor
9. Speaker

Figure 1—45
Winch & Swing Right View Cameras Monitor

Camera Monitor

A video monitor in the Operator's Cab is supplied to help the Operator see areas that can be obstructed from their view. This monitor can distract the Operator from their normal duties if not used properly. Use these monitors as an Operator's aid and not as the sole method of seeing where the crane is going. Primary attention is to be on where the crane is going or the lifted load, not the monitor.

Cameras do not eliminate the requirement for a signal person during crane travel. Do not attempt to move the crane without a signal person. A trained signal person working in conjunction with a trained Operator is required to move the crane.

WARNING

Do not rely solely on the cameras and monitors.

- **The field of vision of the camera may be limited.**
- **Just because the monitor looks clear does not mean that an obstruction does not exist**.
- **Images in the monitor may be farther than they appear**.
- **Images in the monitor may be distorted**.
- **Weather conditions (ice, snow, rain, etc) may distort or block the camera lens and inhibit visibility.**
- **Do not operate the crane using the camera's alone.**
- **Always look before moving the crane.**
- **Always employ a signal person to move the crane.**

1. Power/Menu Button

Power

Press the top left corner of the Power/Menu Button to turn the monitor ON.

Press and hold the top left corner of the Power/Menu Button to turn the monitor OFF.

Menu (While Monitor Is Powered ON)

Press the bottom right corner of the Power/Menu Button to enter MENU MODE.

Press the AV/Zoom/Down Button or Camera Select/Up Button to scroll through the MENUS.

2. QUAD(PIP) Select Button

The QUAD(PIP) Select Button allows the Operator to change the monitor to a split screen display. Refer to "Split Screen Displays" in this section of the Operator's Manual for additional information.

3. Auto Scan/Locking Button

Auto Scan

Press the Auto Scan/Locking button one time to initiate auto scan mode. Auto scan mode will scroll through the camera views for a set period of time as follows: CA1->CA2->CA3->CA4. After the last camera (CA4) is shown in scan mode the screen will automatically go back to the first camera (CA1). Refer to "SCAN Function" in this section of the Operator's Manual for additional information.

Button Lock

Hold the Auto Scan/Locking Button for 3 seconds to lock all of the buttons. At this time all functions of the buttons are disabled. While the buttons are locked, press and hold the Auto Scan/Locking Button for 3 more seconds to unlock the buttons.

4. Camera Select/Up Button

Press the Camera Select/Up Button to scroll through the camera views one by one and to get out of a split screen view. Press the Camera Select/Up Button while in MENU MODE to scroll UP.

5. AV/Zoom/Down Button

Press the AV/Zoom/Down Button to zoom in on a specific camera view. Press the AV/Zoom/Down Button while in MENU MODE to scroll DOWN.

6. Left Arrow Button

The left arrow button turns the volume down and changes functions within the MENUS.

7. Right Arrow Button

The right arrow button turns the volume up and changes functions within the MENUS.

8. CDS Sensor

The CDS Sensor has an auto dimming feature making the monitor available for night viewing.

9. Speaker

The speakers allows the Operator to hear sounds within the camera view.

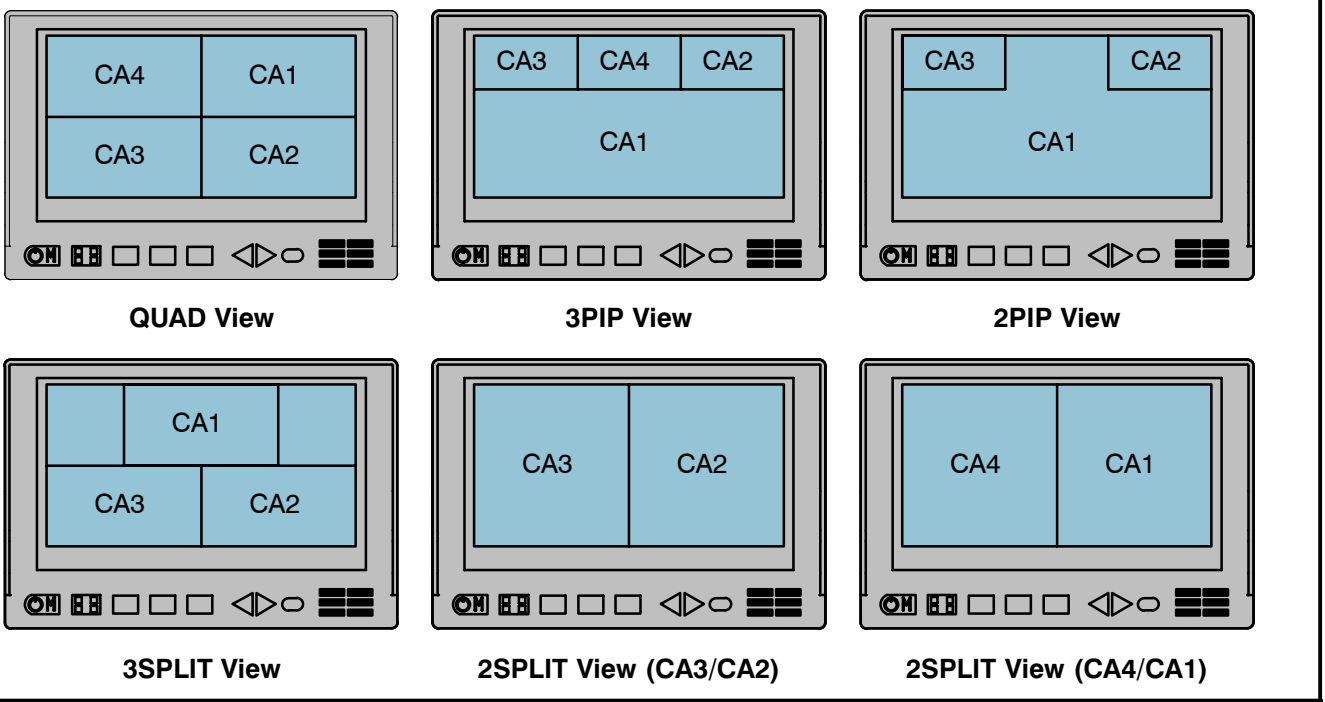


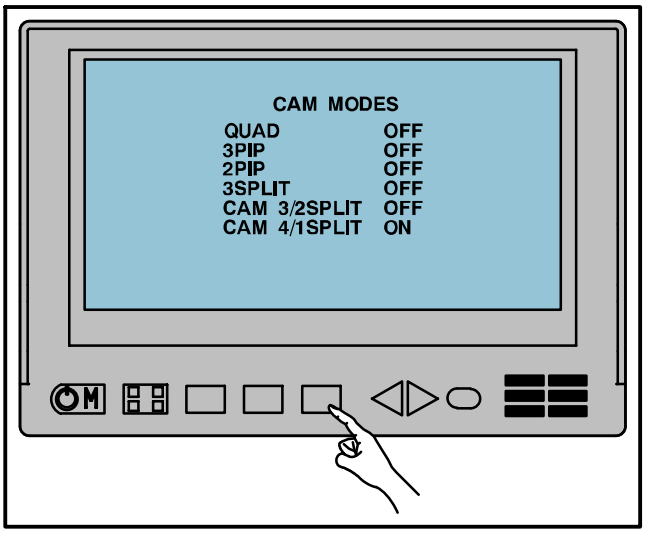
Figure 1—46
Split Screen Function

Split Screen Function

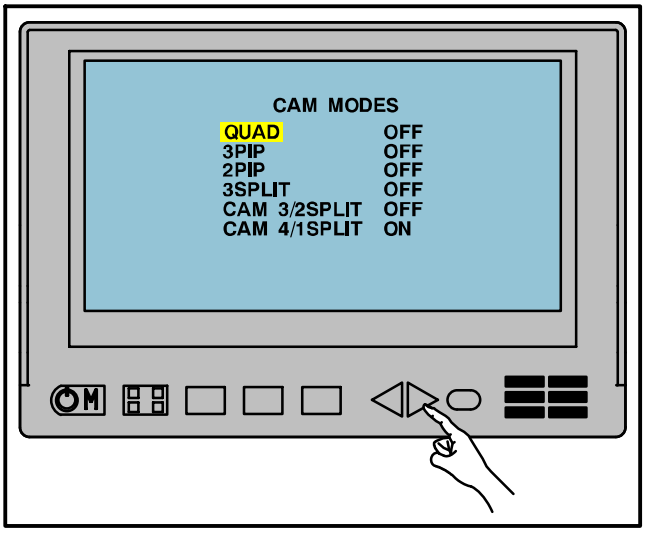
The upper camera has split screen capabilities allowing the Operator to view up to four cameras on one screen. Refer to Figure 1-46. Depending upon which split screen views are turned on, press the QUAD(PIP) Select Button to scroll through the different split screen views. To turn ON/OFF a split screen view:

Refer to Figure 1-45.

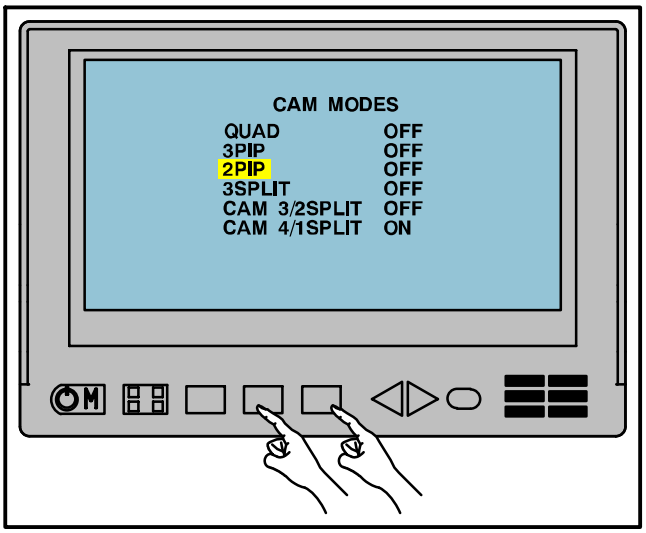
1. Press the Power/Menu Button to enter MENU MODE.



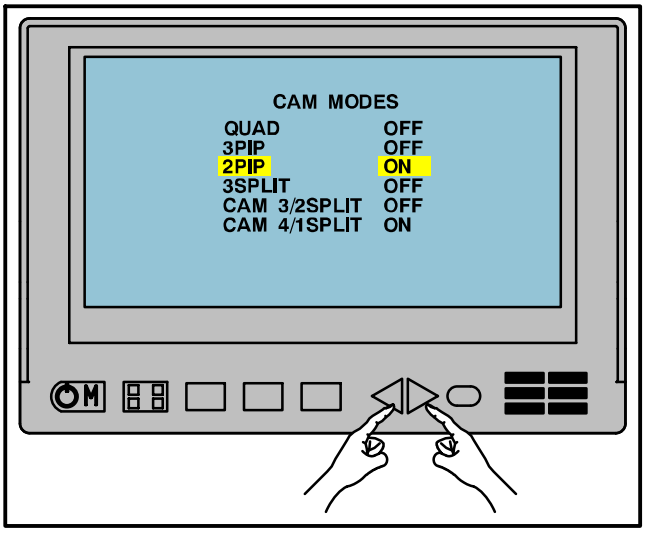
2. Press the AV/Zoom/Down Button until CAM MODES is displayed on the screen.



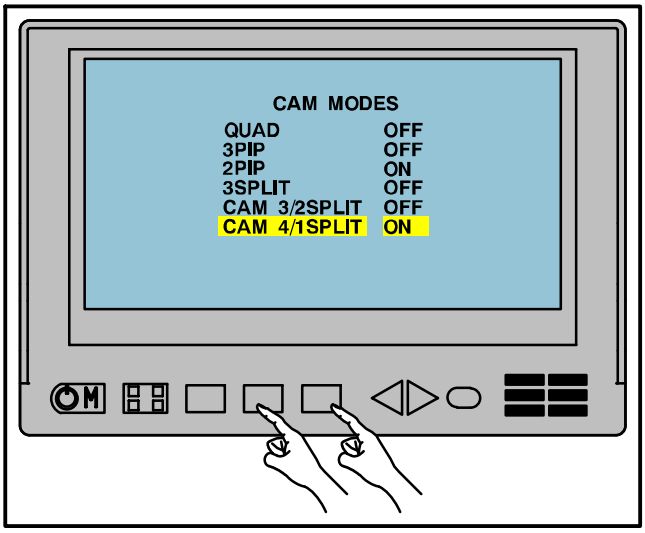
3. Press the Right Arrow Button to enter into CAM MODES.



4. Press the Camera Select/Up or AV/Zoom/Down Button to scroll UP and DOWN within CAM MODES.



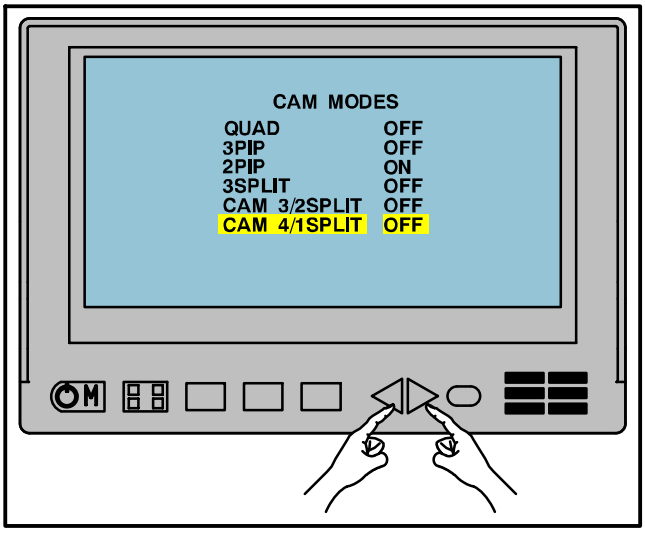
5. When the proper split screen mode is selected press the Left Arrow or Right Arrow Button to turn it ON or OFF.



6. To turn ON or OFF another split screen mode press the Camera Select/Up or AV/Zoom/Down Button to scroll UP and DOWN.

7. Then press the Left Arrow or Right Arrow Button to turn it ON or OFF.
8. To go back to MENU MODE press the Power/Menu Button.

Note: If the crane is equipped with two cameras, only CAM4/1SPLIT MODE needs to be on.



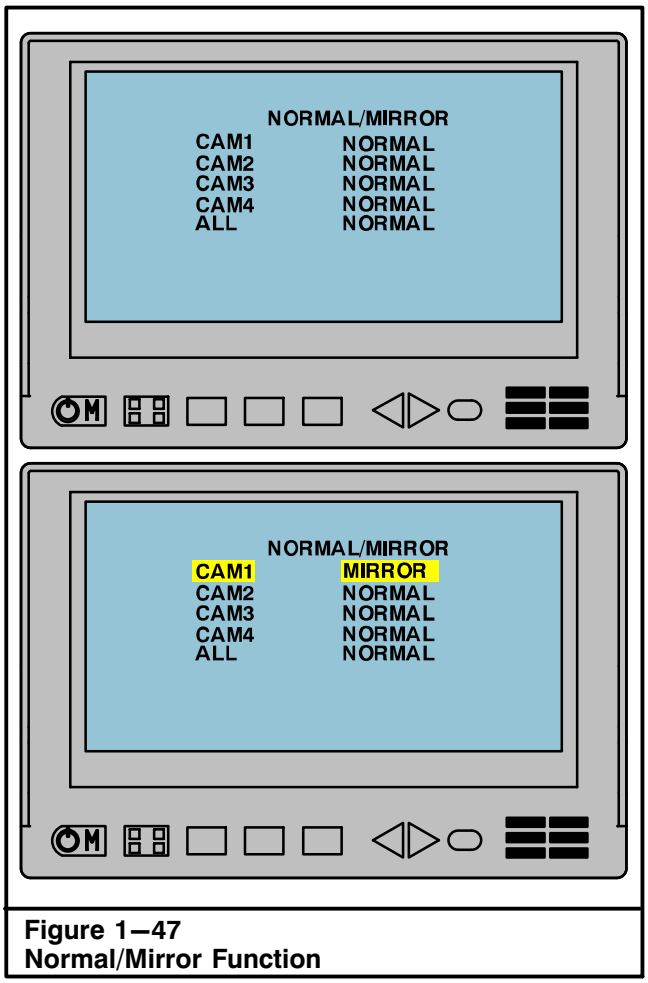


Figure 1—47
Normal/Mirror Function

NORMAL/MIRROR Function

The upper monitor has a NORMAL/MIRROR Function that allows the Operator to mirror the monitor image vertically. Refer to Figure 1-47. To change the monitor image from NORMAL to MIRROR:

Refer to Figure 1-45.

1. Press the Power/Menu Button to enter MENU MODE.
2. Press the AV/Zoom/Down Button until NORMAL/MIRROR is displayed on the screen.
3. Press the Right Arrow Button to enter into NORMAL/MIRROR.
4. Press the Camera Select/Up or AV/Zoom/Down Button to scroll UP and DOWN.
5. Press the Left Arrow or Right Arrow Button to change the camera view from NORMAL to MIRROR.
6. To go back to MENU MODE press the Power/Menu Button.

UP/DOWN Function

The upper monitor has a UP/DOWN Function that allows the Operator to mirror the image horizontally. Refer to Figure 1-48. To change the monitor image from UP to DOWN:

Refer to Figure 1-45.

1. Press the Power/Menu Button to enter MENU MODE.
2. Press the AV/Zoom/Down Button until UP/DOWN is displayed on the screen.
3. Press the Right Arrow Button to enter into UP/DOWN.
4. Press the Camera Select/Up or AV/Zoom/Down Button to scroll UP and DOWN.
5. Press the Left Arrow or Right Arrow Button to change the camera view from UP to DOWN.
6. To go back to MENU MODE press the Power/Menu Button.

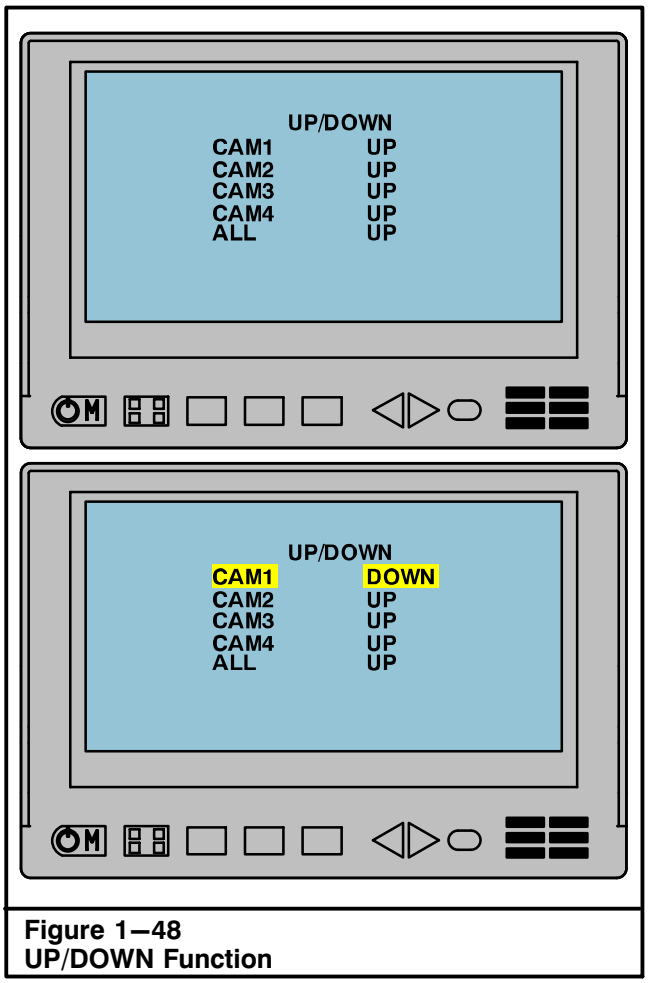


Figure 1—48
UP/DOWN Function

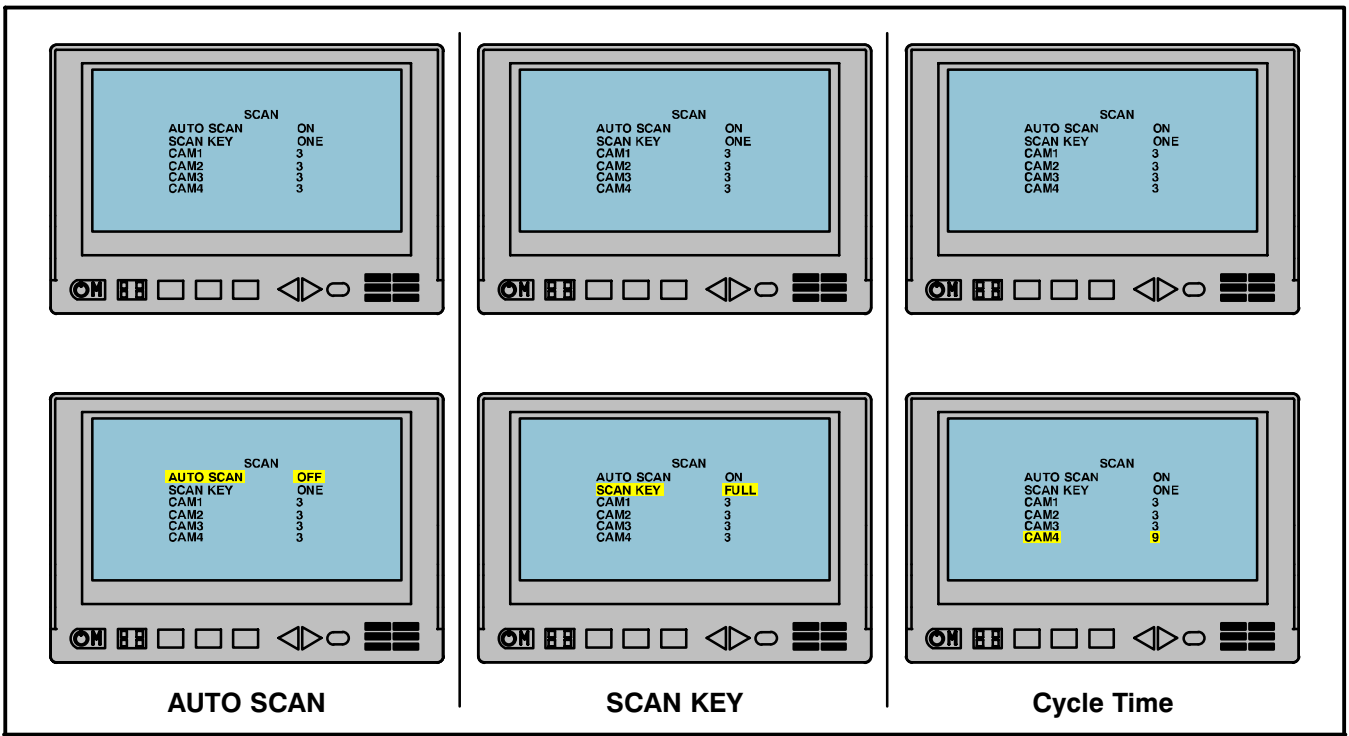


Figure 1—49
SCAN Function

SCAN Function

The upper camera has a SCAN Function that allows the monitor to automatically scan through the different camera views at the press of a button. The SCAN KEY function can be set to cycle through the camera views only one time or continuously scroll through the camera views. Refer to Figure 1-49. To start an AUTO Scan:

Refer to Figure 1-45.
1. Press the Auto Scan/Locking Button.

To turn AUTO SCAN OFF:
1. Press the Power/Menu Button to enter MENU MODE.
2. Press the AV/Zoom/Down Button until SCAN is displayed on the screen.
3. Press the Right Arrow Button to enter into SCAN.
4. Press the Camera Select/Up or AV/Zoom/Down Button to scroll UP and DOWN to AUTO SCAN.
5. Press the Left Arrow or Right Arrow Button to change AUTO SCAN from ON to OFF..
6. To go back to MENU MODE press the Power/Menu Button.

To change the SCAN KEY cycle from ONE to FULL :
1. Press the Power/Menu Button to enter MENU MODE.
2. Press the AV/Zoom/Down Button until SCAN is displayed on the screen.
3. Press the Right Arrow Button to enter into SCAN.
4. Press the Camera Select/Up or AV/Zoom/Down Button to scroll UP and DOWN to SCAN KEY.
5. Press the Left Arrow or Right Arrow Button to change SCAN KEY from ONE to FULL.
6. To go back to MENU MODE press the Power/Menu Button.

To change the SCAN cycle time:
1. Press the Power/Menu Button to enter MENU MODE.
2. Press the AV/Zoom/Down Button until SCAN is displayed on the screen.
3. Press the Right Arrow Button to enter into SCAN.
4. Press the Camera Select/Up or AV/Zoom/Down Button to scroll UP and DOWN to specific camera.
5. Press the Left Arrow or Right Arrow Button to change the time interval (1-9 seconds).
6. To go back to MENU MODE press the Power/Menu Button.

PREFERRED SETTINGS

FUNCTION	
LANGUAGE	ENGLISH
SYSTEM	NTSC/PAL
DIRECTION	0°
DIMMER	1
AUTO POWER	ON
LOGO SET	>
AV OUTPUT	LIVE
SHUTTER	ON
RESET	>

PICTURE	
CONTRAST	15
BRIGHTNESS	15
COLOR	15
TINT	15

NOR/MIR	
CAM1	NORMAL
CAM2	NORMAL
CAM3	NORMAL
CAM4	NORMAL
ALL	NORMAL

UP/DOWN	
CAM1	UP
CAM2	UP
CAM3	UP
CAM4	UP
ALL	UP

TRIGGER	
REAR SCALE	OFF
BLINK MARK	OFF
TRIG 1	CAM1
TRIG 2	CAM2
TRIG 3	CAM3
TRIG 4	CAM4
HAZARD	QUAD

CAMERA NAME	
CAM1	RIGHT
CAM2*	NO CAMERA
CAM3*	NO CAMERA
CAM4*	WINCH

CAM MODES	
QUAD*	OFF
3PIP*	OFF
2PIP*	OFF
3SPLIT*	OFF
CAM3/2 SPLIT*	OFF
CAM4/1 SPLIT	ON

SCAN	
AUTO SCAN	OFF
SCAN KEY	ONE
CAM1	3
CAM2	3
CAM3	3
CAM4	3

*Setting may be different if equipped with a third camera.

Figure 1—50
Monitor Preferred Settings

RESET

Note: Resetting the monitor will reset it to the monitor factory settings. The monitor will then need to be set to the Link-Belt preferred settings. Refer to Figure 1—50.

To reset the monitor settings:

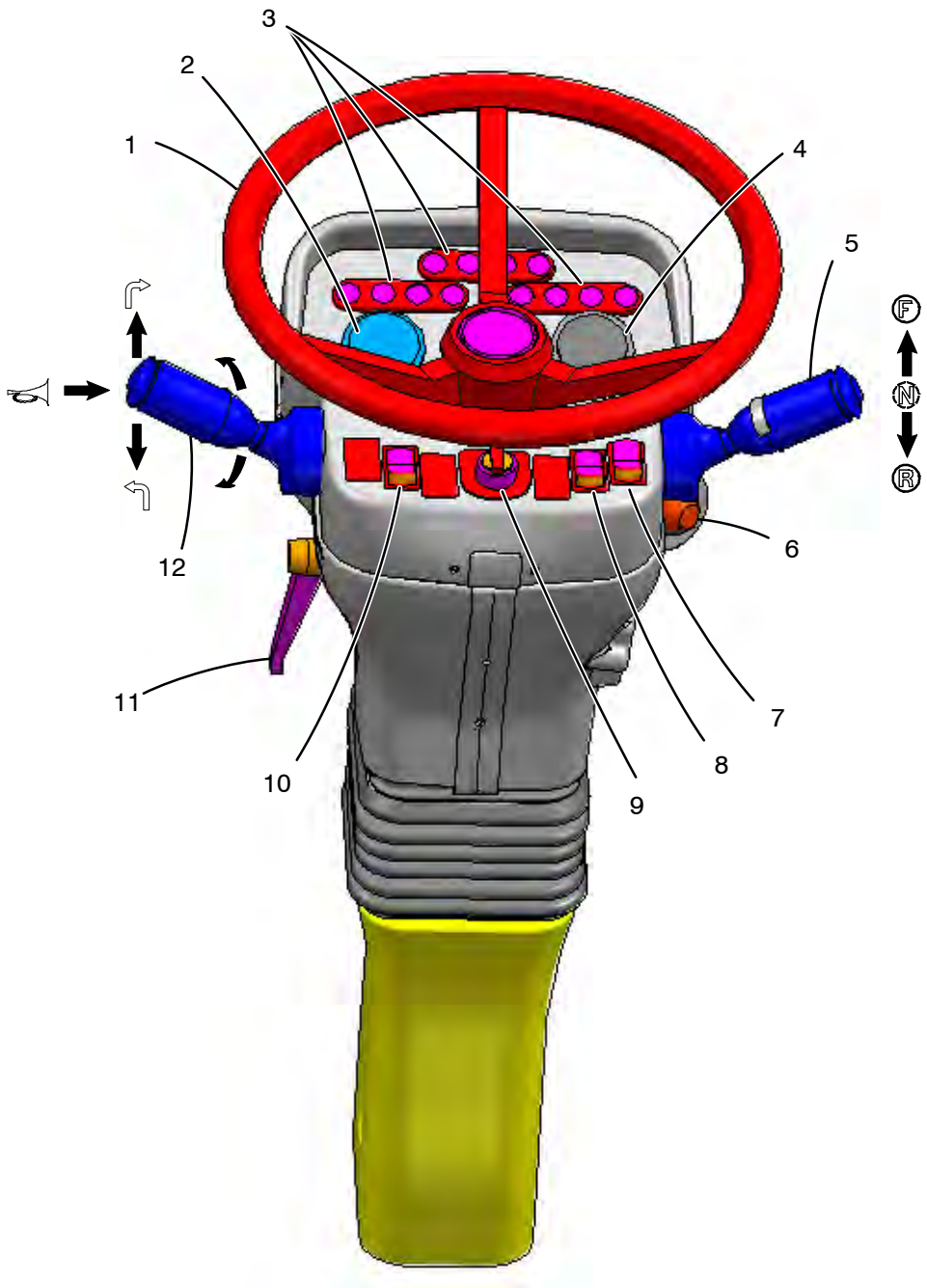
1. Press the Power/Menu Button to enter MENU MODE.
2. Press the AV/Zoom/Down Button until FUNCTION is displayed on the screen.
3. Press the Right Arrow Button to enter into FUNCTION.
4. Press the Camera Select/Up or AV/Zoom/Down Button to scroll UP and DOWN to RESET.
5. Press the Left Arrow or Right Arrow Button to reset the monitor.
6. The monitor will power off during reset.

Care and Maintenance

If crane has been parked in direct sunlight, allow time for the monitor to cool down.

Clean the monitor with a slightly damp cloth. Use a mild household detergent. Do not use strong solvents such as thinner or benzine as they can damage the finish of the monitor.

Contact your Link-Belt Distributor for the proper repair procedures.



1. Steering Wheel
2. Transmission Oil Temperature Gauge
3. Indicator Light Bars
4. Voltmeter Gauge
5. Transmission Shift Lever
6. Emergency Hazard Switch
7. Transmission Gear Switch
8. 4-Wheel Drive/Range Switch
9. Combination Steering Switch
10. Travel Park Brake Switch
11. Tilt/Telescoping Column Lever
12. Turn Signal/Horn/Driving Lights Lever

Figure 1–51
Steering Column And Wheel

Steering Column And Wheel

The following is a description of the controls on the steering column along with an explanation of their function and/or operation. Refer to Figure 1-51.

1. Steering Wheel

   Turn the steering wheel clockwise for right turns and counterclockwise for left turns.

   Note: Relative direction of the steering wheel is based on the position of the upper over the carrier.

2. Transmission Oil Temperature Gauge

   This gauge registers the oil temperature in the transmission torque convertor. Normal operating temperature range is 180-210°F (*82—98° C*). When the oil temperature exceeds normal operating range an indicator light within the gauge will illuminate and an alarm buzzer will sound. If the oil overheats, discontinue operation, shift the transmission to neutral, and run the engine at 1,000-1,200 rpm (do not stop the engine if the cooling system is known to be in working order). Transmission oil temperature should soon lower. Always change the oil and filter after the transmission oil has overheated. Refer to Section 2 of this Operator's Manual for the correct oil change procedure.

3. Indicator Light Bars

   Three indicator light bars are on the steering column and contain the following indicator lights:

   Left Turn Signal - This light will blink to indicate that the left turn signal is on or the hazard lights are flashing.

   Engine Oil Pressure - This indicator light will illuminate when the engine oil pressure is not within normal operating range. If there is no engine oil pressure after 10-15 seconds of running time, shutdown the engine immediately and repair the problem to avoid engine damage.

   Rear Wheel Offset - This indicator light will illuminate to alert the operator that the rear wheels are out of line with the carrier. Refer to "Combination Steering" in this Section of this Operator's Manual for complete operating procedures.

   Emergency Steer - On cranes equipped with emergency steer, this light alerts the operator that power steering pump pressure is low. When the emergency steering indicator light illuminates, there is enough oil in storage to negotiate approximately eight 90° turns. Park the crane and shutdown the engine if this indicator light illuminates. Discontinue further operations until the problem is resolved.

   Travel Park Brake Engaged - This light will illuminate anytime the park brake is engaged and the ignition is on.

   Service Brake Warning - This light will illuminate to warn the operator of an imminent brake failure. When this light illuminates, approximately twelve brake applications can be obtained prior to complete brake system failure. When this light illuminates discontinue operations immediately, park the crane, and correct the problem before placing the crane back into service.

   Right Turn Signal - This light will blink to indicate that the right turn signal is on or the hazard lights are flashing.

4. Voltmeter Gauge

   This gauge registers the charge in the battery and the output of the alternator through the regulator. It should read 12 volts with the ignition switch on, and 12.5 to 14 volts with the engine running. When the charge or the voltage in the battery is not within normal operating range an indicator light within the gauge will illuminate.

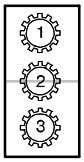
5. Transmission Shift Lever

   The transmission shift lever is used to select the forward or reverse gear in the transmission. To put the transmission in forward or reverse gear, the lever is pushed up then pushed forward to engage the forward gears, or pulled backward to engage the reverse gears.

6. Emergency Hazard Switch

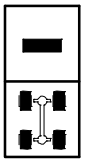
   This switch controls the emergency hazard flashers. Push the switch to turn flashers on, push the switch again to turn them off.

7. Transmission Gear Switch



   This switch is used to shift the transmission. Press the top part of the switch for first gear, middle position for second gear, and bottom part of the switch for third gear.

8. 4-Wheel Drive/Range Switch



This switch is used to select either the 2-Wheel drive mode or 4-Wheel drive mode for the carrier power train by engaging or disengaging the front drive axle. This switch also simultaneously selects either high or low range speeds for the transmission. When the switch is in the "4-WHEEL DRIVE" mode the transmission is in the low speed range. When the switch is in the "2-WHEEL DRIVE" mode the transmission is in the high speed range. Bring the crane to a complete stop and shift the transmission to neutral before changing the position of the 4-Wheel Drive Switch. The top part of the switch will illuminate to alert the operator that 4-wheel drive mode has been engaged.

9. Combination Steering Switch

The crane is equipped with four different modes of steering in order to provide maximum maneuverability on the job site. Refer to "Combination Steering" in this Section of this Operator's Manual for complete operating procedures.

10. Travel Park Brake Switch

This switch controls engaging and releasing the park brake.

WARNING

Do not use the park brake to stop the crane in motion (as a service brake) except in cases of extreme emergency. Application cannot be controlled.

To Engage Park Brake

a. Bring the crane to a complete stop by applying the carrier service brake.
b. Shift the transmission to neutral.
c. Move park brake switch to "ON" position.
d. Park brake indicator light should illuminate.

To Release Park Brake

a. Apply the carrier service brake.
b. Move park brake switch to the "OFF" position.
c. The park brake indicator light should go out.

11. Tilt/Telescoping Column Lever

This lever controls the tilt (angle) and telescoping function of the steering column.

To change steering column height and angle:

a. Bring the crane to a complete stop.
b. Shift the transmission to neutral and engage the park brake.
c. Rotate the tilt/telescoping column lever.
d. Position the steering wheel at the desired height and angle and rotate lever to lock it in place.
e. Check all steering wheel functions before continuing operation.

12. Turn Signal/Horn/Driving Lights Lever

Turn Signal - Pull the lever down for left turn signal, push up on lever for right turn signal.

Horn - Push the end of the lever to sound the horn.

Driving Lights - Rotate the lever to the first detent to illuminate the parking lights, the second detent for headlights. Rotate the lever to the off position to turn all lights off.

Transmission Controls

The transmission controls are on the steering column. Refer to Figure 1-51. The transmission shift lever controls all functions of the powershift transmission. The transmission contains three forward and three reverse high range speeds in 2-wheel drive mode and three forward and three reverse low range speeds in 4-wheel drive mode. See "Traveling The Crane" in this Section of this Operator's Manual for necessary preparations before traveling the crane.

Shifting The Transmission

1. Engage the park brake and place shift lever in neutral position. Start the engine. (Engine will start only when transmission is in neutral.) Allow the transmission oil temperature to reach normal operating range.
2. Engage travel swing lock and release the swing park brake and the 360° swing lock, if equipped.

CAUTION

Do not leave the swing park brake or 360° swing lock engaged during pick and carry operations or when traveling or transporting the crane. Use the travel swing lock. Failure to release the swing park brake and 360° swing lock during these operations may result in damage to the swing gear.

3. Forward Travel
   a. With crane at a complete stop, apply the carrier service brakes, shift the transmission to neutral, and release the park brake.

b. Move transmission shift lever to the "F" position.

Note: Relative direction of the crane is based on the position of the upper over the carrier.

c. Slowly release the service brake while using the throttle pedal to increase the engine speed allowing the crane to accelerate.
d. At full engine speed, press the transmission gear switch to shift to the next gear. Repeat to shift through the desired gears.

4. Reverse Travel
   a. With crane at a complete stop, apply the carrier service brakes, shift the transmission to neutral, and release the park brake.
   b. Move transmission shift lever to the "R" position.

Note: Relative direction of the crane is based on the position of the upper over the carrier.

The travel/back-up alarm will sound anytime the transmission is shifted into reverse. It will also sound anytime the transmission is shifted out of neutral and the upper is not positioned directly over the front of the carrier.

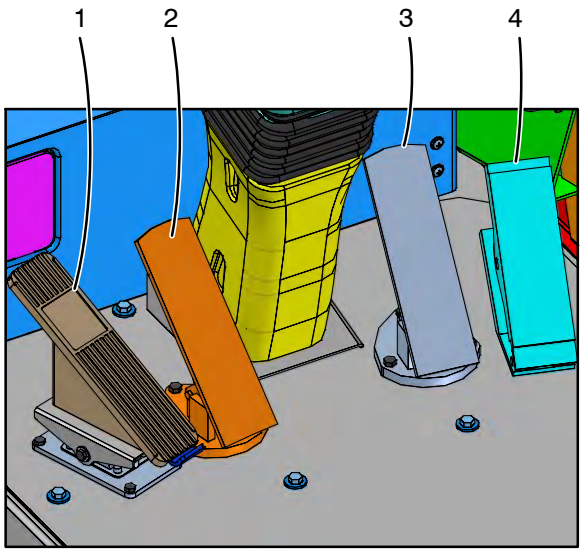
   c. Slowly release the service brake while using the throttle pedal to increase the engine speed allowing the crane to accelerate.
   d. At full engine speed, press the transmission gear switch to shift to the next gear. Repeat to shift through the desired gears.

Foot Operated Controls

The following is a description of the foot controls in the operator's cab along with an explanation of their function and/or operation. Refer to Figure 1-52.

1. Boom Telescope Control Pedal

Depress the toe of the pedal to extend the boom. Depress the heel to retract the boom. Refer to "Boom Telescope System" in this Section of this Operator's Manual for complete operating instructions.



1. Boom Telescope Control Pedal
2. Swing Brake Pedal
3. Service Brake Pedal
4. Throttle Pedal

Figure 1—52
Foot Operated Controls

2. Swing Brake Pedal

The swing brake pedal is used to stop rotation of the upper over the carrier. Refer to "Swing System" in this Section of this Operator's Manual for complete operating instructions.

3. Service Brake Pedal

The carrier service brakes are controlled by the brake pedal. Press the pedal down to apply the service brakes. Release the pedal to release the service brakes.

The distance the service brake pedal is moved determines the braking force. Depress the pedal fully only in cases of emergency as this makes control of the crane difficult.

4. Throttle Pedal

Engine speed is controlled by the throttle pedal. Press the throttle pedal down to increase engine speed. Release the throttle pedal to decrease engine speed.

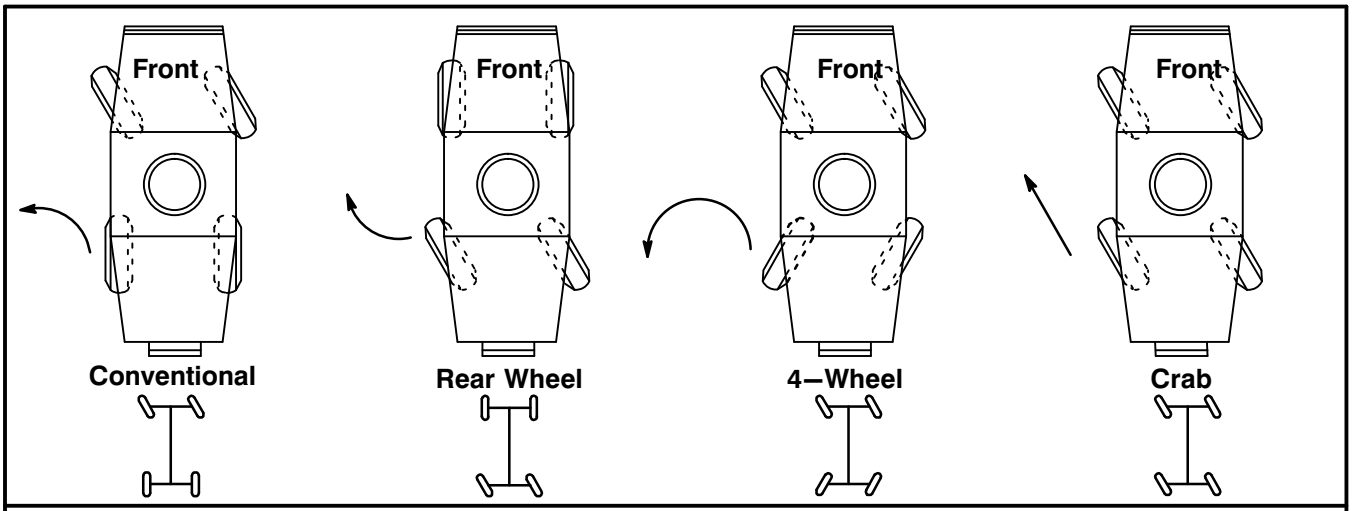


Figure 1—53
Steering Modes

Combination Steering

The crane is equipped with four different modes of steering in order to provide maximum maneuverability on the job site: conventional, rear wheel, 4-wheel, and crab steer. Each steer mode provides slightly different maneuverability to meet job site requirements. Refer to Figure 1-53 for illustration of the different steer modes.

Conventional Steer Mode

This steer mode is similar to that of an automobile. In this steer mode, the front wheels may be turned in either direction and the rear wheels remain stationary. Use this steer mode for all extended or high speed travel.

⚠ WARNING

Do not use rear wheel, 4-wheel, or crab steer mode for extended or high speed travel as steering behavior may be unfamiliar and a loss of crane control could occur.

Rear Wheel Steer Mode

This steer mode is similar to that of a fork truck. In this steer mode, the rear wheels may be turned in either direction and the front wheels remain stationary. Use this steer mode for job site travel only; not for extended or highway travel.

4-Wheel Steer Mode

This steer mode allows steering with all four wheels. The front wheels turn in one direction and the rear wheels turn in the opposite direction. This results in a greatly reduced turning radius that allows extra maneuverability in certain job site conditions. Use this steer mode for job site travel only; not for extended or highway travel.

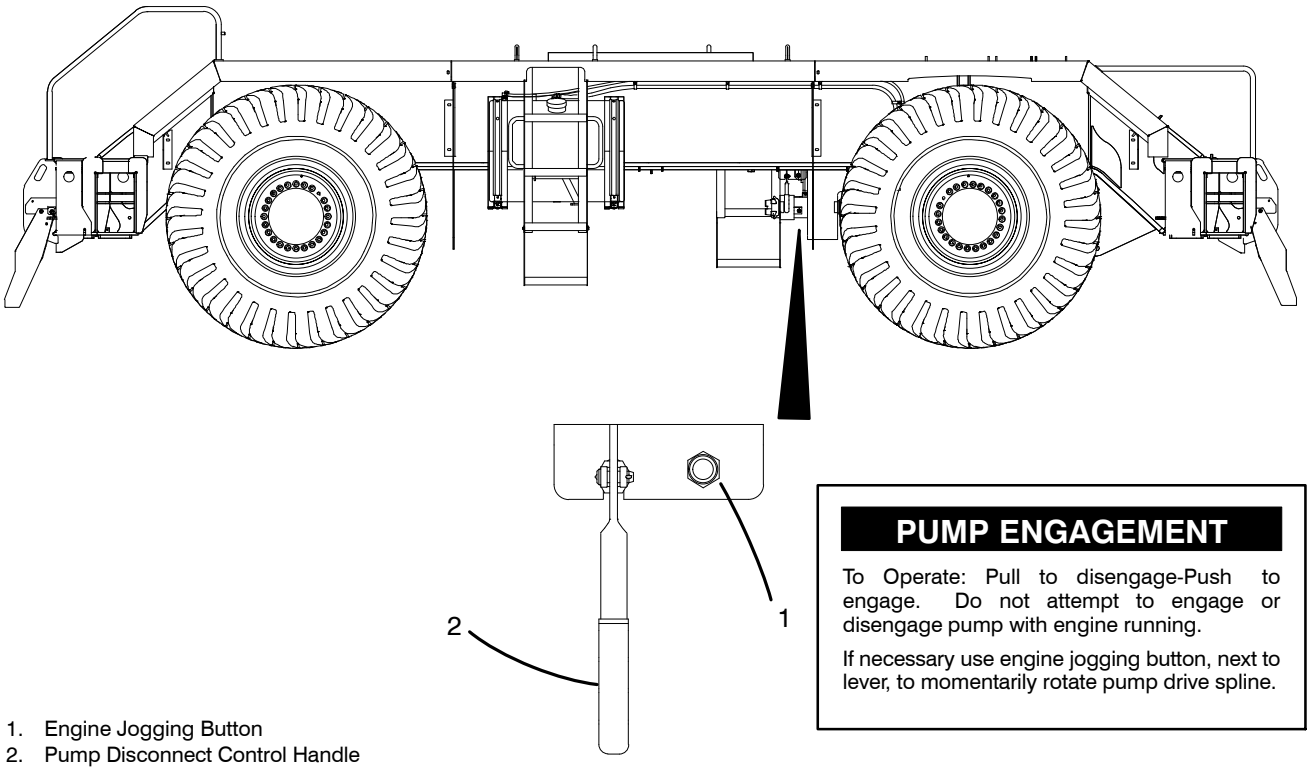
Crab Steer Mode

This steer mode allows steering with all four wheels. The front and rear wheels turn simultaneously in the same direction which moves the crane in the diagonal path of travel. This gives the operator another method of maneuvering the crane where job site conditions require it. Use this steer mode for job site travel only; not for extended or highway travel.

Changing Steering Modes

The rear wheel offset light, on the steering column in the indicator light bars (Figure 1-51), is designed to assist the operator in changing steering modes by determining when the rear wheels are straight. This light will come on anytime the rear wheels are not in-line with the carrier. Use the following procedure when changing steering modes:

1. Bring the crane to a complete stop.
2. Turn the steering wheel until the rear wheel offset light goes off.
3. Move the steer switch to the conventional steering mode.
4. Check all wheels for proper alignment by traveling the crane a short distance, straight ahead, to ensure it tracks straight.
5. Bring the crane to a complete stop and move the steer mode switch to the desired position.



1. Engine Jogging Button
2. Pump Disconnect Control Handle

Figure 1—54
Hydraulic Pump Disconnect

Hydraulic Pump Disconnect (If Equipped)

The hydraulic pump disconnect (if equipped) is used to engage and disengage the main hydraulic pump. Disengaging the main pump aids in engine start-up by reducing cranking resistance. It also allows for disengaging the pump for highway travel. Refer to Figure 1-54 .

The crane is equipped with an engine jogging button, beside the disconnect control handle, to aid in engaging the hydraulic pump.

Note: In extremely cold weather, it is recommended that the pump be allowed to cycle without a load for 3—5 minutes at low engine speed. Throttle engine to half throttle and cycle the boom telescope for another 3—5 minutes. This will help prevent cold oil from damaging the main pump.

To Engage The Main Pump

1. Warm up the engine using the normal start-up and warm-up procedure.
2. Park the crane and engage the park brake.
3. Shift the transmission to neutral and shutdown the engine.

CAUTION

Do not attempt to engage or disengage the pump with the engine running. Damage could occur to the pump and/or pump drive.

4. Push the pump disconnect control handle to the limit of its travel. If control handle cannot be pushed to the limit, push and release the engine jogging button and push the handle to the limit again.

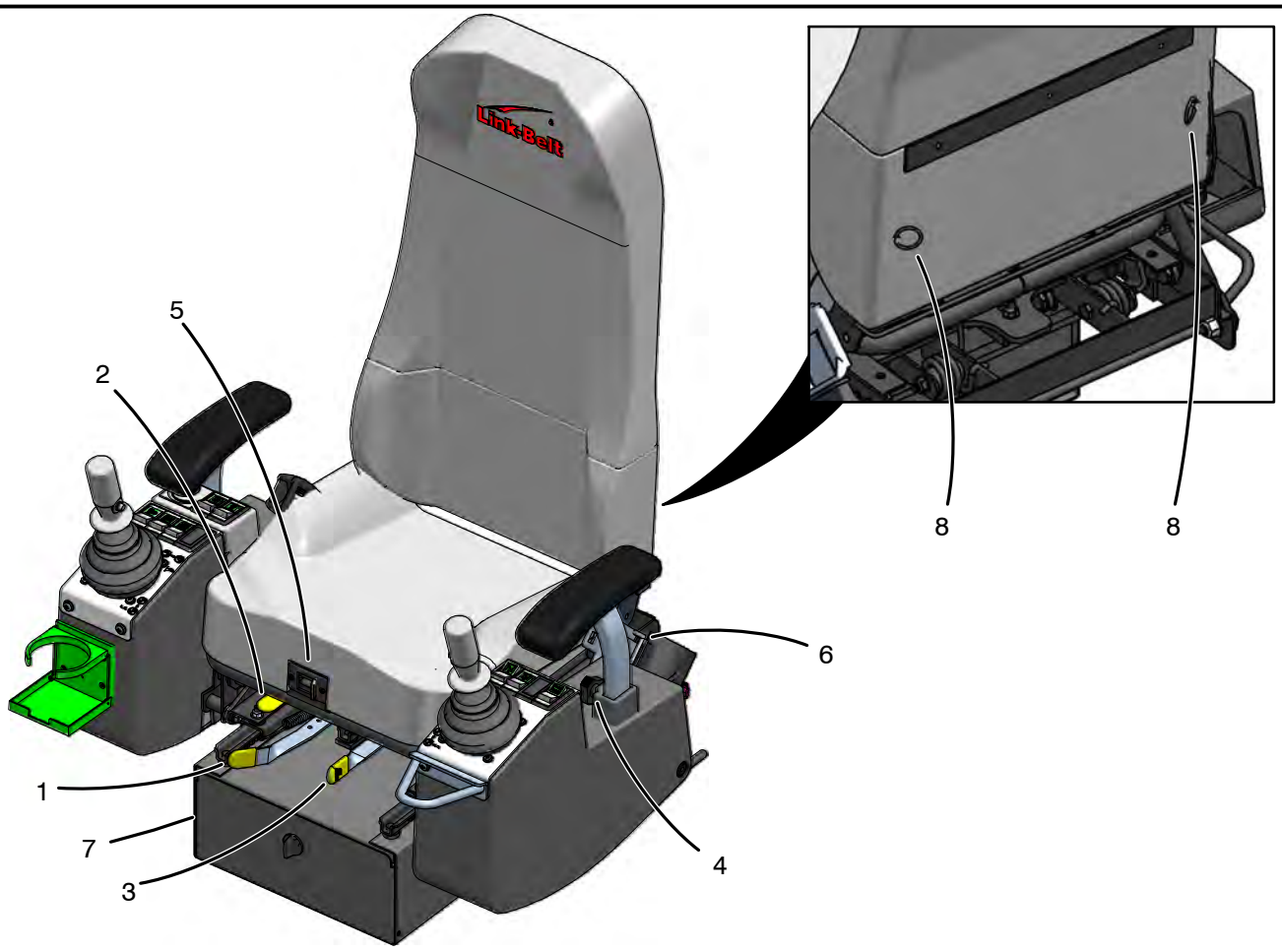
To Disengage The Main Pump

1. Park the crane and engage the park brake.
2. Shift the transmission to neutral and shutdown the engine.

CAUTION

Do not attempt to engage or disengage the pump with the engine running. Damage could occur to the pump and/or pump drive.

3. Pull the handle out, to the limit of its travel.



1. Seat and Console Release Lever
2. Seat Release Lever
3. Seat Height Adjustment Lever
4. Arm Rest Height Adjustment Knob
5. Seat Back Adjustment Lever
6. Seat Belt
7. Tool Box
8. Seat Back Connecting Pins

Figure 1—55
Operator's Seat

Operator's Seat (Style 1)

This 6-way adjustable seat is controlled by manual controls. Refer to Figure 1-55.

WARNING

Do not make seat or console adjustments while operating the crane or while crane is in motion. Discontinue operations and properly park crane before making adjustments.

1. Seat And Console Release Lever

   Move the seat and console release lever to the left and hold. Position the seat as desired and release the lever to lock the seat in place.

2. Seat Release Lever

   Move the seat release lever to the left and hold. Position the seat as desired and release the lever to lock the seat in place.

3. Seat Height Adjustment Lever

   Move the height adjustment lever to the left and hold. Position the seat as desired and release the lever to lock the seat in place.

4. Arm Rest Height Adjustment Knob

   Loosen the knob on the inside of the arm rest. Position the arm rest as desired and tighten knob to lock the arm rest in place.

5. Seat Back Adjustment Lever

   Raise the lever and adjust the seat back to the desired position. Release the lever to lock the seat back in place.

6. Seat Belt

   A seat belt is provided and must be worn during all operations. To fasten the seat belt pull the belt out of the retractor and insert the tongue into the buckle until you hear a snap and feel the latch engage. Ensure the belt is not twisted and is fitting snugly around the hips, not around the waist.

WARNING

Always wear the seat belt while operating the crane. The seat belt must be snug and low across the hips.

7. Tool Box

   A tool box is provided under the operator's seat to store tools and other crane accessories.

8. Seat Back Connecting Pins

   The seat back can be removed for easy access to the electrical panel. To remove, pull the two pins on back of seat and lift the seat back.

Operator's Seat (Style 2)

This 6-way adjustable seat is controlled by manual controls. Refer to Figure 1-56.

WARNING

Do not make seat or console adjustments while operating the crane or while crane is in motion. Discontinue operations and properly park crane before making adjustments.

1. Tool Box

   A tool box is provided under the operator's seat to store the manual control box, the manual boom control box, tools, and other crane accessories.

2. Seat And Console Release Lever

   Move the seat and console release lever to the left and hold. Position the seat as desired and release the lever to lock the seat in place.

3. Seat Release Lever

   Move the seat release lever to the left and hold. Position the seat as desired and release the lever to lock the seat in place.

4. Seat Height Adjustment Lever

   Move the height adjustment lever to the left and hold. Position the seat as desired and release the lever to lock the seat in place.

5. Arm Rest Height Adjustment Knob

   Loosen the knob on the inside of the arm rest. Position the arm rest as desired and tighten knob to lock the arm rest in place.

6. Seat Belt

   A seat belt is provided and must be worn during all operations. To fasten the seat belt pull the belt out of the retractor and insert the tongue into the buckle until you hear a snap and feel the latch engage. Ensure the belt is not twisted and is fitting snugly around the hips, not around the waist.

WARNING

Always wear the seat belt while operating the crane. The seat belt must be snug and low across the hips.

7. Seat Back Adjustment Lever

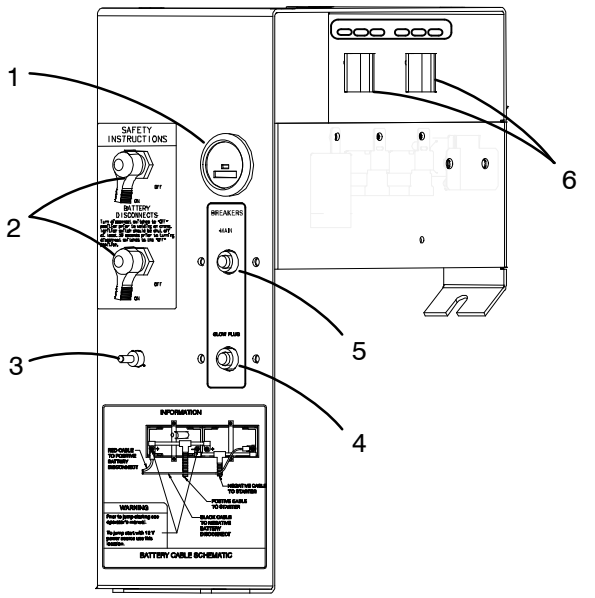
   Raise the lever and adjust the seat back to the desired position. Release the lever to lock the seat back in place.

8. Seat Back Connecting Capscrews

   The seat back can be removed for easy access to the electrical panel. Remove, seat back connecting capscrews on the back of seat (two on one side and one on the other side). Slide the seat to the right towards the cab door and lift the seat back.

1. Tool Box
2. Seat and Console Release Lever
3. Seat Release Lever
4. Seat Height Adjustment Lever
5. Arm Rest Height Adjustment Knob
6. Seat Belt
7. Seat Back Adjustment Lever
8. Seat Back Connecting Capscrews

Figure 1—56
Operator's Seat



1. Hour Meter
2. Battery Disconnect Switches
3. Ambient Temperature Sensor
4. 50 Amp Circuit Breaker
5. 105 Amp Circuit Breaker
6. Fuse Blocks

Figure 1—57
Power Panel

Battery Disconnect Switches

The battery disconnect switches are on the right rear of the crane behind the engine grille. Refer to Figure 1-57.

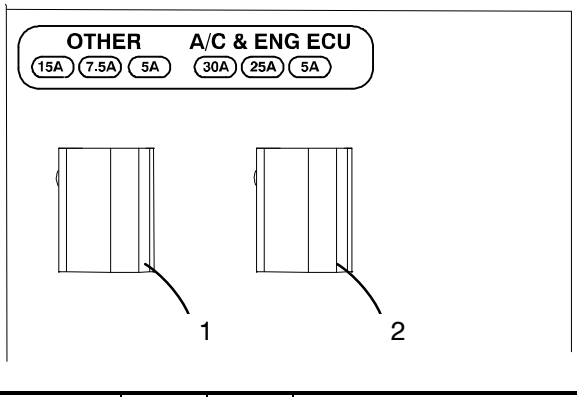
CAUTION

Ignition switch should be shut off at least 70 seconds prior to turning disconnect switches to the "OFF" position.

Major damage may occur to the electronic equipment from welding on the crane prior to turning disconnect switches to the "OFF" position.

Ignition switch should be shut off at least 70 seconds prior to turning disconnect switches to the "OFF" position. Move the disconnect switches to the "Off" position before welding on the crane to protect the crane's electronic components from damage due to an electric arc type welder.

Note: If the batteries are disconnected, the start-up time for on-board computer systems will be longer than normal.



Fuse Block	Amp	Qty	Circuit
1	15	1	Run Relay & 1st & 2nd Gear Relays
	7.5	1	Brake Light Switch
	5	1	Hour Meter
2	30	1	Air Conditioner
	25	1	Engine Control Module (ECM)
	5	1	

Figure 1—58
Fuse Blocks

Power Panel

The power panel is on the right rear of the crane behind the engine grille. Refer to Figure 1-57. The power panel contains two resettable type circuit breakers that service the crane's electrical system as follows:

- 105 amp resettable circuit breaker
  Upper Fuses (Item 5).
- 50 amp resettable circuit breaker
  Cold Engine Starting (Glow Plug) (Item 4).

Fuse Blocks

There are fuse blocks behind the power panel. The fuses contained in the block protect the crane's electrical system per Figure 1-58.

Hour Meter

The hour meter is on the right rear of the crane behind the engine grille. Refer to Figure 1-57. The hour meter registers engine operating hours. It is useful in determining lubrication and maintenance schedules.

Outrigger Operation

The outriggers can be used in any one of three positions; fully retracted, intermediate extended, or fully extended. The outriggers are controlled by switches on a hand held control box connected by a cable (Refer to Figure 1-59) and the extend position levers on the outrigger boxes (Refer to Figure 1-60). Each outrigger switch (Left Front, Left Rear, Right Front, Right Rear) controls all functions of that outrigger beam and jack cylinder. The mode switch controls outrigger cylinder direction, extend/retract. The extend position levers control the extend length of the beams. They allow for beams to be fully extended, or limits them to intermediate extended lengths based on the selected position of the extend position levers.

The outrigger pontoons must set on a smooth, solid surface flush with ground with no hills or valleys under them or they may be damaged or destroyed. If there is any doubt as to the ground conditions, use mats under the pontoons. Check pontoons before and during operations. If they are allowed to settle, they may lose their effectiveness, and make continued operations unsafe.

A bubble level is mounted in operator's cab, to assist in determining when crane is level. Refer to Figure 1-63.

The hand held, tethered control box stores on the right side wall of the cab near the operator's seat. The control box allows the operator to remotely control all outrigger functions.

WARNING

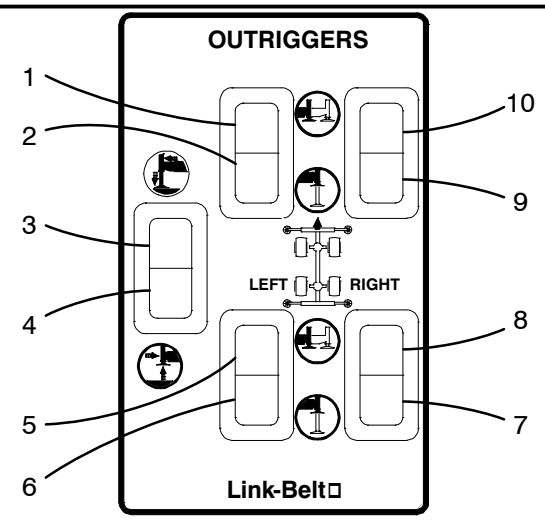
Do not extend or retract an outrigger beam or jack unless it is in full view of the operator or signal person. Ensure all personnel and obstructions are clear from the path of the machinery.

To Extend Outrigger Beams

1. Park crane in the desired location. Engage the park brake, shift the transmission to neutral, and shutdown engine. Engage main hydraulic pump.
2. Remove the pontoons from storage, and attach one to each outrigger jack.

WARNING

Pontoons must be attached to outrigger jacks before crane is set on outriggers. If pontoons should settle, the jacks could disengage from the pontoons, causing a loss of stability.



1. Beam - Left Front
2. Jack - Left Front
3. Extend Mode - Beam/Jack
4. Retract Mode - Beam/Jack
5. Beam - Left Rear
6. Jack - Left Rear
7. Jack - Right Rear
8. Beam - Right Rear
9. Jack - Right Front
10. Beam - Right Front

Figure 1—59
Outrigger Switches

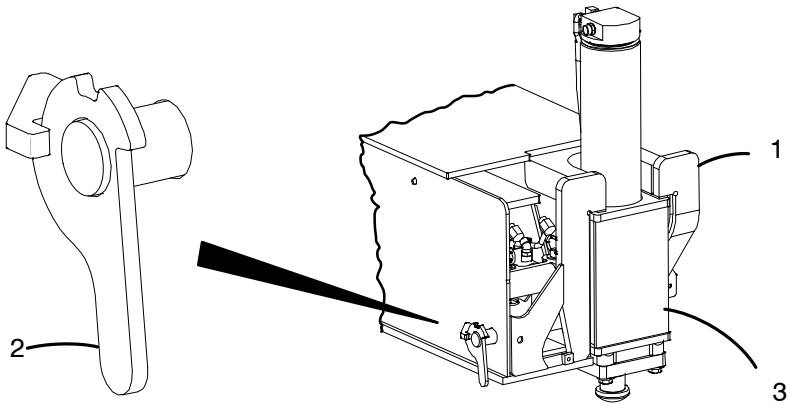
3. Determine the outrigger position desired. Set the extended position levers as required. (Refer to Figure 1-60.)

WARNING

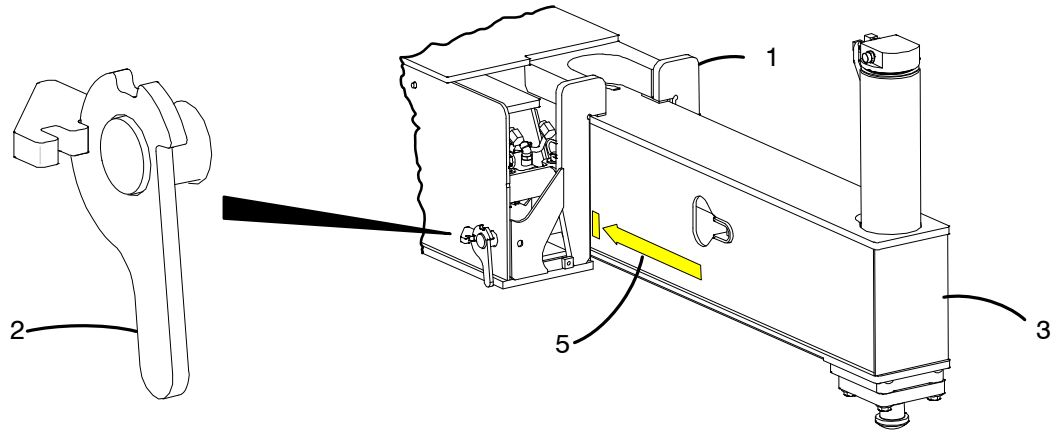
When making lifts on outriggers, all outrigger beams must be equally extended; all fully retracted, all intermediate extended, or all fully extended. Failure to do so will cause a loss of stability and possible crane damage and/or personal injury.

4. Start the engine.
5. Push an outrigger switch to the beam position and hold.
6. Push the mode switch to extend mode on position and hold until the beam reaches the selected position; intermediate extended or fully extended.
7. When beam reaches selected position, release both switches.
8. Repeat Steps 5-7, for each outrigger beam, until all the beams are set to the selected position.

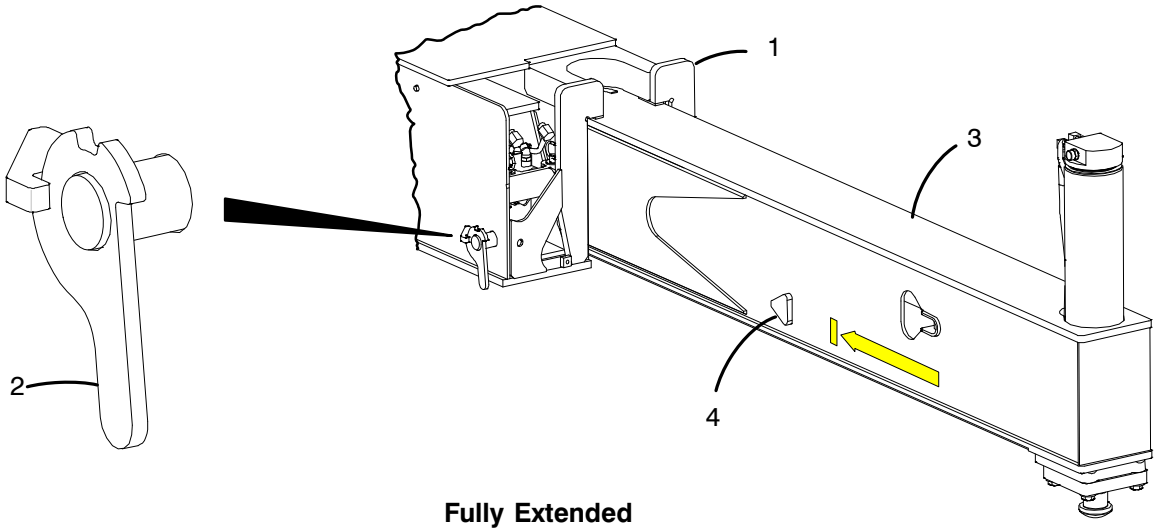
Note: As conditions warrant, a proficient crane operator may operate multiple beams such as one end or side at the same time.



Fully Retracted



Intermediate Extended



Fully Extended

1. Outrigger Box Collar
2. Extend Position Lever
3. Outrigger Beam
4. Stop Plate (For Intermediate Position)
5. Alignment Arrow (For Intermediate Position)

Figure 1–60
Outrigger Extend Position Lever

9. If the intermediate extended beam position is to be used, visually check that all beams are properly positioned in the intermediate extended position. All beams must be extended until the stop plate contacts the extend position lever and the arrow is aligned with the outrigger box collar. Refer to Figure 1-60.
10. Set the rated capacity limiter to the proper setting to match the position of the outrigger beams.

    Note: If an "Outrigger Position Mismatch" warning appears on the RCL Display, ensure the outriggers are in the correct position and select the configuration on the RCL Display to match the current outrigger position.

WARNING

When making lifts with the crane on outriggers, all outrigger beams must be equally extended; fully retracted, intermediate extended, or fully extended.

When making lifts with the outrigger beams in the intermediate extended position, the extend position lever must be in the intermediate extended position. Visually check that all outrigger beams are extended until the stop plate contacts the extend position lever and the arrow is aligned with the outrigger box collar before beginning operations.

Check that the Rated Capacity Limiter is set to the correct outrigger position before beginning operation.

Failure to perform any of the above may cause major crane damage and/or serious personal injury.

To Extend Outrigger Jacks — Raise The Crane

1. With the beams extended to the selected position (fully retracted, intermediate extended, or fully extended), push an outrigger switch to the jack position and hold.

CAUTION

When the hoist line is tied off to the crane or any solid object, the winch system can be overloaded causing major winch, wire rope, or crane damage. Do not extend boom, raise or lower the boom, or raise the crane on outriggers unless wire rope is spooled off the drum to prevent tension on the wire rope.

2. Push the mode switch to extend mode on and hold until the jack cylinder is fully extended.
3. Release both switches.
4. Repeat Steps 1-3 for each outrigger jack.
5. Raise or lower jacks as required to level the crane.

   Note: As conditions warrant, a proficient crane operator may operate multiple jack cylinders such as one end or side at the same time.

   Note: A bubble level is provided on the right side cab wall to assist in determining when the crane is level.

6. Check that all tires are clear of the ground and pontoons are not settling.

WARNING

All capacities listed in the Crane Rating Manual, when on outriggers, are based on all tires clear of the ground, all outrigger beams equally extended (fully retracted, intermediate extended, or fully extended), using the proper chart for the outrigger position and the crane setting level on a firm, solid surface. Major reductions in the crane lifting capacity and unsafe operating conditions can result if these conditions are not met.

To Retract Outrigger Jacks — Lower The Crane

1. Fully retract the boom. Swing the upper over the front of the carrier and engage the travel swing lock.
2. Fully boom down.

WARNING

Do not extend or retract an outrigger beam or jack unless it is in full view of the operator or signal person. Ensure all personnel and obstructions are clear from the path of the machinery.

3. Push an individual outrigger switch to the jack position and hold.
4. Push the center mode switch to retract mode on position and hold until the jack cylinder is fully retracted.
5. Release both switches.
6. Repeat Steps 3-5 for each outrigger jack.

Note: As conditions warrant, a proficient crane operator may operate multiple jack cylinders such as one end or side at the same time.

To Retract Outrigger Beams

1. Set the extend position levers in the fully retracted position. (Refer to Figure 1-60.)
2. Push an individual outrigger switch to the beam position and hold.
3. Push the center mode switch to the retract mode on position and hold until the beam is fully retracted.
4. Release both switches.
5. Repeat Steps 1-4 for each beam.

Note: As conditions warrant, a proficient crane operator may operate multiple beams such as one end or side at the same time.

6. Store all pontoons in the brackets provided.

Figure 1–61
Keep Clear of Pinch Points

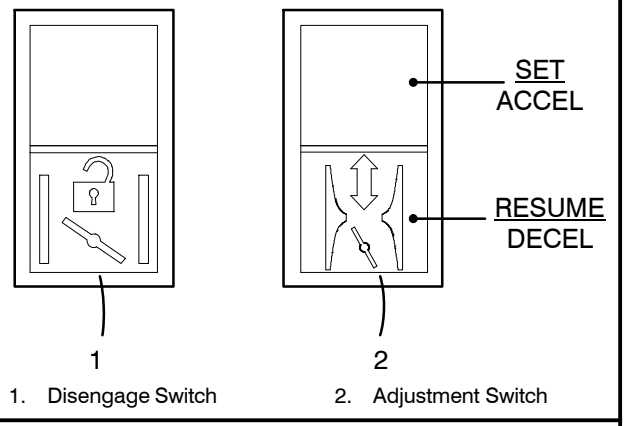


Figure 1–62
Throttle Lock Switches

Crane System Controls

The following pages, along with Figure 1-63, give detailed instructions of individual controls related to crane operation. It is essential that the operator knows the function of each control and its duty in the overall operation of the crane.

WARNING

Read and understand all "Operating Safety" procedures as well as all other operating instructions in this Operator's Manual before attempting to operate the crane. Operation of the crane by unqualified personnel may result in an accident.

Engine Throttle

The crane is equipped with a throttle pedal to control the engine speed. Press down to increase engine speed; release to decrease engine speed.

Throttle Lock System

The throttle lock system gives the operator the ability to set and hold a specific engine speed. Refer to Figure 1-39 for location of throttle switches. This provides the operator with more flexibility for certain job requirements.

To lock the throttle, press the throttle pedal until the desired engine speed is reached and press and release the adjustment switch to the "SET/ACCEL" side. Refer to Figure 1-62. The engine should continue to run at a constant speed when the throttle pedal is released.

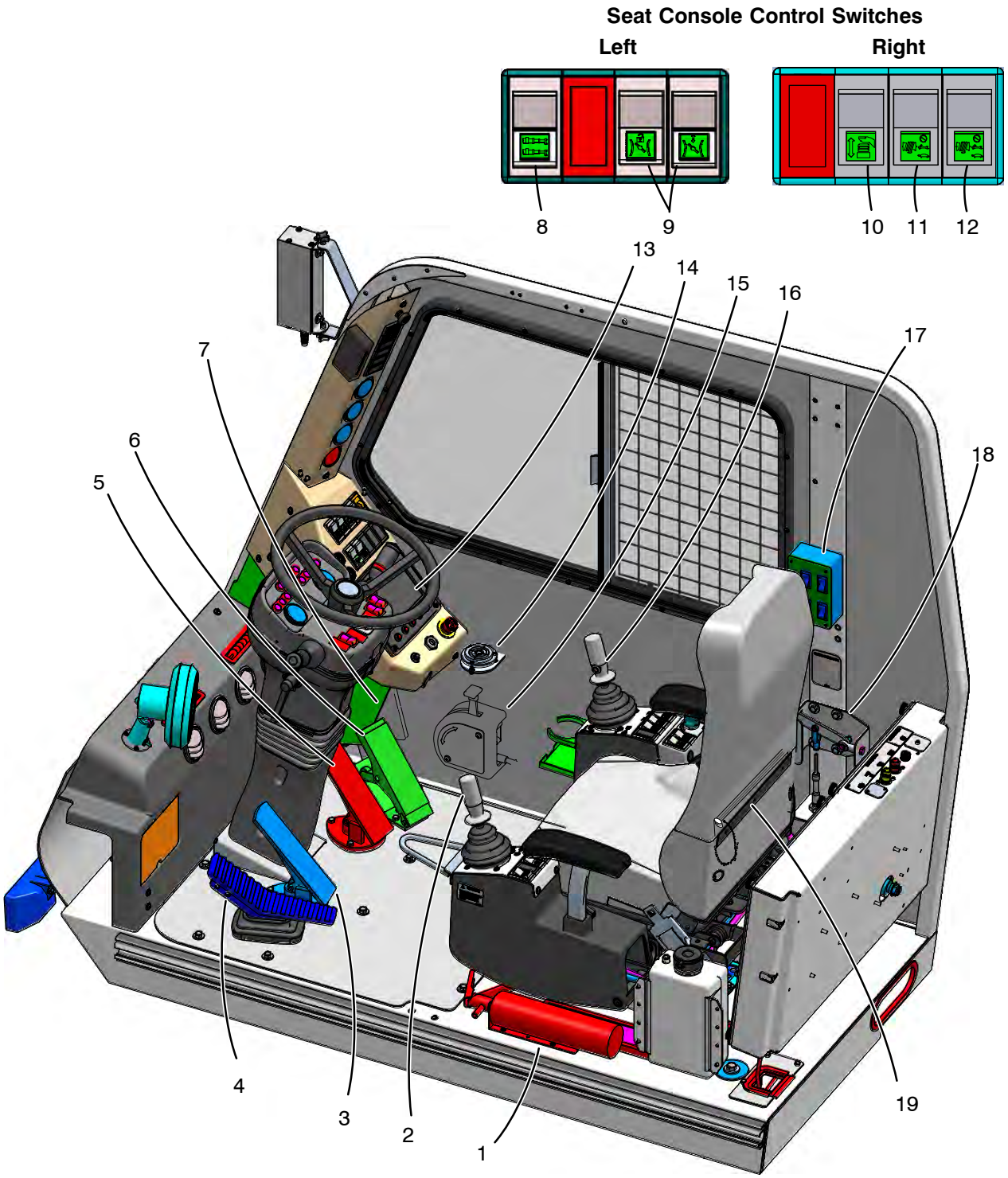
To increase throttle lock setting, either press and hold the adjustment switch to the "SET/ACCEL" side until desired engine speed is reached and release switch, or press the throttle pedal until the desired engine speed is reached and press and release the adjustment switch to the "SET/ACCEL" side. The throttle lock setting can also be increased incrementally by pressing and releasing (tap up) the "SET/ACCEL" side.

To decrease throttle lock setting, press and hold the adjustment switch to the "RESUME/DECEL" side until desired engine speed is reached and release switch. The throttle lock setting can also be decreased incrementally by pressing and releasing (tap down) the "RESUME/DECEL" side.

To return to idle, press and release the bottom part of the disengage switch.

To resume a previous throttle lock setting, press and release the adjustment switch to the "RESUME/DECEL" side.

Note: The throttle lock system is deactivated anytime the ignition switch is turned off.



1. Fire Extinguisher
2. Hydraulic Control Lever (Swing, Front Winch)
3. Swing Brake Pedal
4. Boom Telescope Pedal
5. Service Brake Pedal
6. Throttle Pedal
7. Crane Rating Manual Holder
8. Boom Telescope Override Switch
9. Throttle Lock Switches
10. Drum Rotation Indicator Switch
11. Front Winch Control Switch
12. Rear Winch Control Switch
13. RCL Display
14. Bubble Level
15. 360° Swing Lock (If Equipped)
16. Hydraulic Control Lever (Boom Hoist, Rear Winch)
17. Outrigger Remote Control Box
18. Travel Swing Lock Control
19. Operator's Manual Holder

Figure 1–63
Crane Controls

Swing System

Rotation of the upper over the carrier is controlled by the swing system. Use the following controls to operate the swing function of the crane.

Swing Brake Pedal

The swing brake pedal is used to stop rotation of the upper over the carrier. To apply the swing brake, push down on the swing brake foot pedal. To release the swing brake, release the swing brake foot pedal.

Swing Control Lever

The control lever, on the left side of the operator's seat, is used to operate the swing function of the upper. Move the control lever to the "SWING LEFT" position to swing left; move it to the "SWING RIGHT" position to swing right.

WARNING

When swinging over the side on tires, do not exceed 71° boom angle. Crane may tip over backwards causing serious personal injury and/or major crane damage.

To Swing The Upper

1. Compare the boom configuration and length to the capacity chart in the Crane Rating Manual. Position the boom safely within the limits specified on the capacity chart.
2. Ensure that all personnel are out of the swing path. Dangerous pinch points are created during swinging.
3. Fully apply the swing brake pedal and release the swing park brake and/or swing lock(s).
4. Release the swing brake pedal and begin to engage the swing control lever.

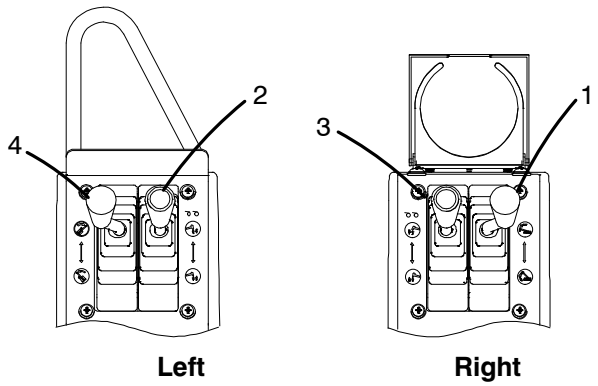
DANGER

Swing slowly and cautiously. Watch for centrifugal force. Out swing of a load increases the load radius and thus decreases capacity. Load out swing may result in tipping or damaging the crane.

All personnel and equipment must be out of the path of the rotating upper. Failure to do so could result in serious personal injury or major equipment damage.

To Stop Upper Swing

1. Ease swing control lever into the neutral position.



Left

1. Hydraulic Control Lever (Boom Hoist)
2. Hydraulic Control Lever (Front Winch)

Right

3. Hydraulic Control Lever (Rear Winch)
4. Hydraulic Control Lever (Swing)

Figure 1–64
Single Axis Controls (If Equipped)

2. Apply the swing brake to bring the upper to a complete stop.
3. Engage the swing park brake as required.
4. Check engagement of the swing park brake by trying to swing right, then left. The upper should not swing.

Travel Swing Lock

Use the travel swing lock to lock the upper directly over either the front or rear of the carrier. The travel swing lock will engage in these two positions only. Use of the travel swing lock is mandatory when traveling or transporting the crane and during pick and carry operations.

To Release The Travel Swing Lock

1. Fully apply the swing brake pedal.
2. Pull the travel swing lock lever up.

   Note: In order to disengage the travel swing lock, it may be necessary to swing the upper slightly to relieve the pressure on the swing lock pin.

3. Move the lever to the right and release. The lever should remain in the released position.

To Engage The Travel Swing Lock

1. Position the upper directly over either the front or rear of the carrier. Fully apply swing brake pedal.
2. Pull the travel swing lock lever up and to the left. Then push the lever down to the locked position.

   Note: In order to engage the travel swing lock, it may be necessary to swing the upper slightly to align the swing lock pin and retaining ring on the carrier deck.

3. Check the engagement of the travel swing lock by trying to swing the upper right, then left. The upper should not swing.

Swing Park Brake

The swing park brake is a multiple disc type brake and is used for holding the upper, in any position, over the carrier during normal, stationary crane operations. Engage the travel swing lock and release the swing park brake anytime the crane is traveled or transported and during pick and carry operations. An indicator light on the bottom part of the rocker switch, on the left console, will illuminate when the swing park brake is applied.

CAUTION

Do not leave the swing park brake applied during pick and carry operations or when traveling or transporting the crane. Use the travel swing lock. Failure to release the swing park brake during these operations may result in damage to the swing mechanism.

To Release The Swing Park Brake

1. Fully apply the swing brake pedal.
2. Push the top part of the swing park brake rocker switch to release the park brake. The indicator light will go out. Refer to Figure 1-63 for rocker switch location.

To Apply The Swing Park Brake

1. Rotate the upper to the desired position over the carrier. Apply the swing brake pedal to bring the upper to a complete stop.
2. Push the bottom part of the swing park brake rocker switch on the left console to apply the swing park brake. Indicator light will illuminate. Refer to Figure 1-63 for rocker switch location.

CAUTION

Do not attempt to apply swing park brake with the upper in motion. This practice will result in damage to the swing mechanism. Use the swing brake pedal to stop rotation of upper.

3. Check engagement of swing park brake by trying to swing upper right, then left. The upper should not swing.

360° Swing Lock

The 360° swing lock, if equipped, is a positive lock against rotation of the upper over the carrier. The upper is mechanically locked by a manually operated pawl that engages the gear teeth in the turntable bearing. Use this swing lock during normal, stationary crane operations. Engage the travel swing lock and release the 360°swing lock anytime the crane is traveled or transported and during pick and carry operations.

CAUTION

Do not leave the 360° swing lock engaged during pick and carry operations or when traveling or transporting the crane. Use the travel swing lock. Failure to release the 360° swing lock during these operations may result in damage to the swing mechanism.

To Release The 360°Swing Lock:

1. Fully apply the swing brake pedal.
2. Move the 360° swing lock lever to the "Disengage" position. Refer to Figure 1-63 for location.

To Engage The 360° Swing Lock:

1. Rotate the upper to the desired position over the carrier. Apply the swing brake pedal to bring the upper to a complete stop.

CAUTION

Do not attempt to engage 360°swing lock with the upper in motion. This practice will result in damage to the swing mechanism. Use swing brake pedal to stop rotation of the upper.

2. Move the 360°swing lock lever to the "Engage" position.

   Note: In order to engage the 360° swing lock, it may be necessary to swing the upper slightly to allow the swing lock pawl to engage in the turntable gear teeth.

3. Check engagement of 360° swing lock by trying to swing upper right, then left. The upper should not swing.

Wire Rope Winch System

This system controls raising and lowering the winch lines. The system is equipped with a two speed motor that, when activated, will approximately double winch line speed. The controls for the system are shown in Figure 1-63 and/or Figure 1-64. Review the following for control descriptions and brief summary of operation.

CAUTION

When the hoist line is tied off to the crane or any solid object, do not extend the boom, raise or lower the boom, or raise the crane on outriggers. The winch system could be overloaded causing major winch or crane damage.

WARNING

Cold weather operation of the winch requires a warm-up procedure. Failure to properly warm-up the winch may result in brake slippage. Warm-up the winch before beginning crane operations.

Warm-Up Procedure

A warm-up procedure is recommended at each start-up and is essential at ambient temperatures below 40°F (*4°C*). Allow the engine to run at idle speed, with the main hydraulic pump engaged and the winch control lever(s) in neutral, for several minutes. Once the hydraulic oil begins to warm, operate the winch at low speed, with no load, lifting and lowering only the hook block and/or hook ball until warm oil circulates throughout the winch.

WARNING

The weight of the load must be known before making a lift. Compare the load weight to the appropriate capacity chart in the Crane Rating Manual to ensure compliance with capacity ratings. Compare the load weight to the Wire Rope Capacity Chart in the Crane Rating Manual to determine the number of parts of line required to lift the load. Rig and set up the crane to ensure compliance with both the appropriate crane capacity chart and Wire Rope Capacity Chart in the Crane Rating Manual. Properly set the Rated Capacity Limiter to the correct crane configuration.

Do not lift a load to the point where the hook block, hook ball, or load contacts the head machinery. "Two blocking" could damage the hook block, hook ball, and/or the head machinery. Always keep load, hook block, and hook ball a safe distance from the boom.

Front Winch Control Lever (If Equipped)

This lever controls the front winch drum. Pull this control lever back, toward the operator to lift the load. Push this control lever forward, away from the operator to lower the load. Refer to "Winch Operation" for more specific instructions.

Rear Winch Control Lever

This lever controls the rear winch drum. Pull this control lever back, toward the operator to lift the load. Push this control lever forward, away from the operator to lower the load. Refer to "Winch Operation" for more specific instructions.

Winch Operation

The following is a brief description of the basic procedure for operating the wire rope winch. Crane operations are to be performed only by a qualified operator who has read and fully understands the entire content of this Operator's Manual.

To Lift A Load: Attach the hook block or hook ball to the load. Position head machinery directly above the load, pull the control lever back toward the operator.

Note: When both winch levers are activated simultaneously, the winch line requiring the most line pull may not function.

To Hold A Load: Return the control lever to the neutral position. The automatic brake in the winch system will hold the load in position.

To Lower A Load: Push the control lever forward. Return the control lever to neutral to stop the load.

Winch Control Switch(es)

This switch is used to control engaging/disengaging the high/low speed hoist and disabling the front or rear winch. Refer to Figure 1-63.

High Speed Hoist Or Lower

Move the control lever to the neutral position to bring the load to a complete stop. Press the winch control switch to the high speed ( ) position. Move the control lever to the winch up or winch down position. The high speed hoist will activate after engaging the control lever. Refer to Figure 1-63 and/or Figure 1-64.

Note: Using the high speed hoist reduces the maximum line pull by approximately one half. It is recommended that the high speed hoist button be activated before engaging the winch control lever(s).

WARNING

Do not activate the high speed hoist if the line pull exceeds the available high speed winch line pull. Crane damage can occur. Always refer to the Crane Rating Manual for the winch available line pulls before lifting or lowering any load.

To Return To Standard Winch Mode: Move the control lever to the neutral position to bring the load to a complete stop. Press winch control switch(es) to the low speed ( ) position. Move the control lever to the or position. Standard winch mode will activate after engaging the control lever(s).

Winch Disable

Press the winch control switch(es) to the disable ( ) position to disable the winch(es) to prevent inadvertent operation of the winch(es) while using the control levers to perform other operations.

Drum Rotation Indicators

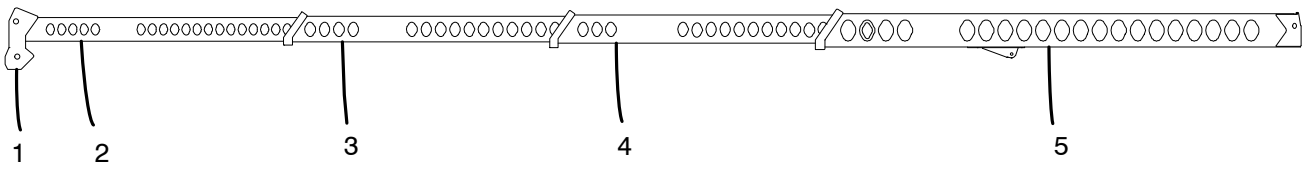
This system is used to monitor winch drum speeds through the use of a mechanical signaling device mounted inside each of the winch control levers. To activate the system, push the bottom part of the drum rotation indicator switch, on the right seat console (Figure 1-63), to the "ON" position. Place your thumb over the end of the control lever being used. As the winch drum rotates, a mechanical signal will be felt with your thumb. The frequency of the mechanical signal is a direct indication of the winch drum speed. Push the top part of the drum rotation switch to deactivate system.

First Layer/Third Wrap Indicator (If Equipped)

The crane may equipped with a first layer/third wrap warning system. This system allows the operator to monitor the wire rope windings on the drum(s). An audible alarm will sound intermittently and "First Layer" will appear in the warning message area of the RCL Display to alert the operator that the wire rope is down to the first layer on the winch drum(s). When the wire rope is down to the third wrap on the winch drum(s), an audible alarm will sound continuously, and "Third Wrap" will appear in warning message area on the RCL Display. If equipped and activated, the winch down function will be disabled with the third wrap alarm. Refer to First Layer/Third Wrap Calibration in Section 3 of this Operator's Manual for calibration procedures.

WARNING

Three (3) full wraps of wire rope must be maintained on the winch drum(s) at all times during operation. Wire rope failure may occur.



1. Boom Head Machinery 2. Tip Section 3. Outer Mid Section 4. Inner Mid Section 5. Base Section

Figure 1—65
Boom Nomenclature

Boom Hoist System

Raising and lowering the boom is controlled by the boom hoist control lever on the right arm rest. Refer to Figure 1-63 or Figure 1-64.

WARNING

When swinging over the side on tires, do not exceed 71° boom angle. Crane may tip over backwards causing serious personal injury and/or major crane damage.

To raise the boom (boom up): Move the right control lever to the "Boom Up" position.

CAUTION

When the hoist line is tied off to the crane or any solid object, do not extend the boom, raise or lower the boom, or raise the crane on outriggers. The winch system could be overloaded causing major winch or crane damage.

To lower the boom (boom down): Move the right control lever to the "Boom Down" position.

CAUTION

Wire rope must be spooled off the winch drum(s) as the boom is lowered. Failure to do so may cause two blocking.

To stop the boom: Release the right control lever. It is spring loaded and should return to neutral and stop the boom.

Boom Telescope System

The crane is equipped with a four section full power boom. The four section boom consists of a base section, inner mid section, outer mid section, and a tip section. Refer to Figure 1-65.

The telescoping feature, of the boom sections, is operated through the use of two hydraulic cylinders and a cable/sheave mechanism which are an integral part of the boom assembly. The boom can be extended or retracted to any desired length using the boom telescope pedal in the operator's cab. Refer to Figure 1-63. The telescope feature has two modes of operation:

Note: Boom must be fully retracted before changing boom modes.

Boom Mode "A": When using boom mode "A" only the inner mid boom section extends/retracts. This mode offers increased strength capacities. Select this mode through the Rated Capacity Limiter.

Boom Mode "B": When using boom mode "B" all boom sections extend/retract simultaneously. This mode offers increased stability capacities. Select this mode through the Rated Capacity Limiter.

Boom Telescope Control Pedal

Figure 1-63 shows the location of the telescope control pedal in the operator's cab. Depress the toe of the telescope control pedal to extend the boom. Depress the heel of the telescope control pedal to retract the boom. Use the telescope mode in conjunction with the telescope control pedal to extend the boom sections to the desired length.

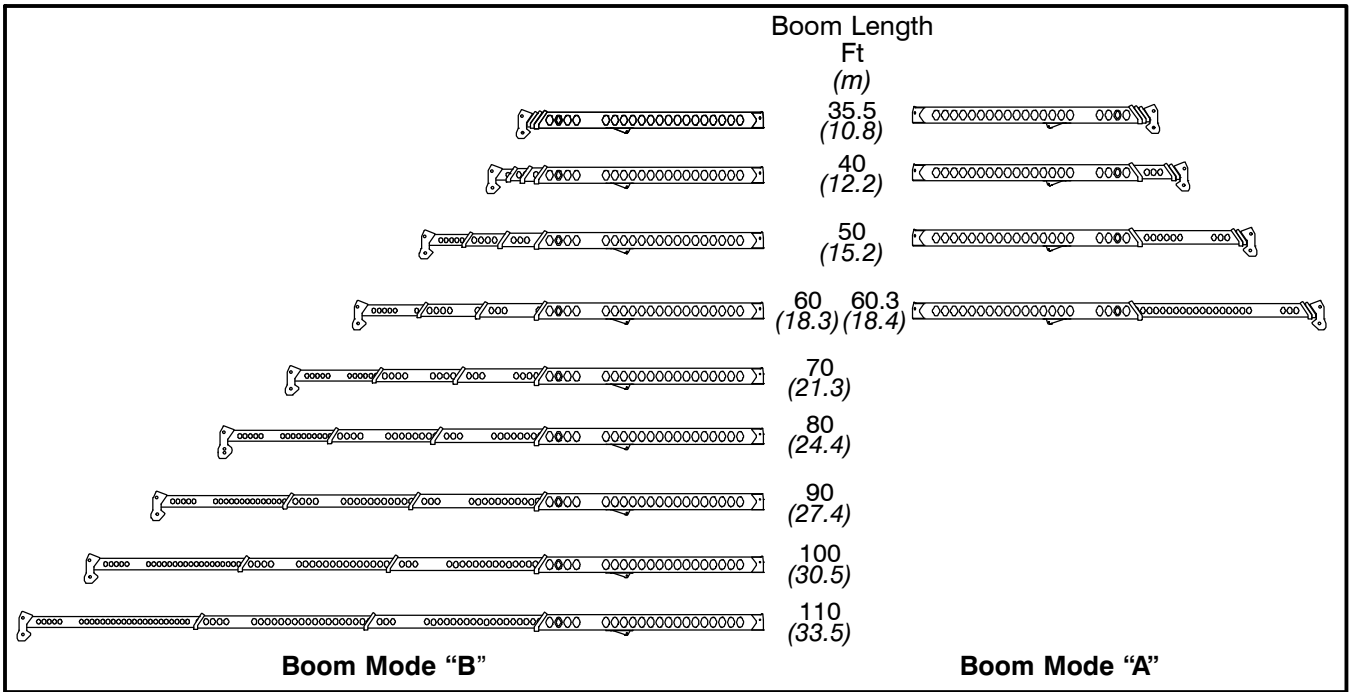


Figure 1—66
Boom Telescope Mode

To Extend The Boom Sections

1. Park the crane on a firm level surface, shift the transmission to neutral, and engage the park brake.
2. Review the appropriate capacity chart in the Crane Rating Manual to establish boom length, angle, and load limitations.

   Note: Boom must be fully retracted before changing boom modes.

3. Set the Rated Capacity Limiter to the desired telescope mode.

CAUTION

When the hoist line is tied off to the crane or any solid object, do not extend the boom, raise or lower the boom, or raise the crane on outriggers. The winch system could be overloaded causing major winch or crane damage.

4. Depress the toe of the telescope control pedal.

CAUTION

Wire rope must be spooled off the winch drum(s) as the boom is extended. Failure to do so may cause two blocking.

5. Stop the boom sections by releasing the telescope control pedal.

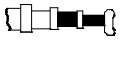
   Note: The telescope control pedal is spring loaded and should return to the neutral position when released.

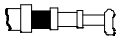
To Retract The Boom Sections

1. Depress the heel of the telescope control pedal.
2. Stop the boom sections by releasing the telescope control pedal.

Boom Telescope Override Switch

The boom telescope override switch is provided to manually override the telescope system if the boom is not extending/retracting proportionally. This switch is to be used for that purpose only. While in boom mode "B", press the  switch to one of the two positions to override its corresponding boom section(s) so the boom can be extended/retracted proportionally. Refer to Figure 1-63 for switch location in the operator's cab. Each position of the switch is defined as follows:


Top position of the switch will override the tip and outer mid sections allowing only the inner mid section to extend and retract.


The bottom position of the switch will override the inner mid section allowing only the tip and outer mid sections to extend and retract.

Crane Monitoring System

A Crane monitoring system is included to assist the operator in safe operation of the crane. The following systems outline some of the aids used for monitoring crane conditions during operation.

Boom Angle Indicator

A mechanical type boom angle indicator is mounted to the right of the operator's cab on the base section of the boom. Refer to Figure 1-67. It must be adjusted properly and the crane must be level for the unit to accurately indicate boom angles. Even under these conditions its readings are only approximate. When making near capacity lifts, measure the load radius to determine crane capacity. Check the adjustment of the boom angle indicator daily to ensure its accuracy.

Anti-Two Block Warning System

Integrated into the Rated Capacity Limiter System is an anti-two block (ATB) warning system. An anti-two block warning system is an electromechanical system designed to alert the operator before the hook block' hook ball or load contacts the head machinery of the main boom, auxiliary lifting sheave, or fly. When a two block situation is imminent, an audio/visual alarm is activated to alert the operator of the pending danger. When the alarm activates it is essential that the operator discontinue operations immediately, and correct the two-block situation.

Three basic components are used to make up the anti-two block system. The anti-two block weight, anti-two block switch with lockout clip, and the display unit in the operator's cab. Refer to Figure 1-68 and Figure 1-69 .

An anti-two block weight is suspended from the head machinery switch(es) where lifts are to be made and is used to hold the switch(es) in the "working" position. When the anti-two block weight is lifted by the hook block, hook ball, or load, it allows the switch to activate the audio/visual alarm on the display unit in the operator's cab. In addition to the audio/visual alarm, function limiters will be activated.

CAUTION

Do not allow the load to spin out of control when hoisting. The anti-two block weight may become entangled with the wire rope and could damage the anti-two block system, wire rope, or boom. Use rotation resistant wire rope during single part line hoisting applications, especially when long fall lifts are involved.

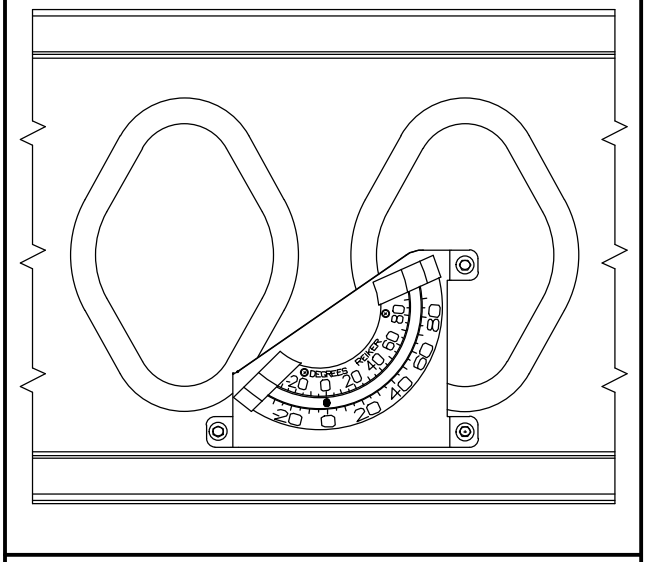


Figure 1—67
Boom Angle Indicator

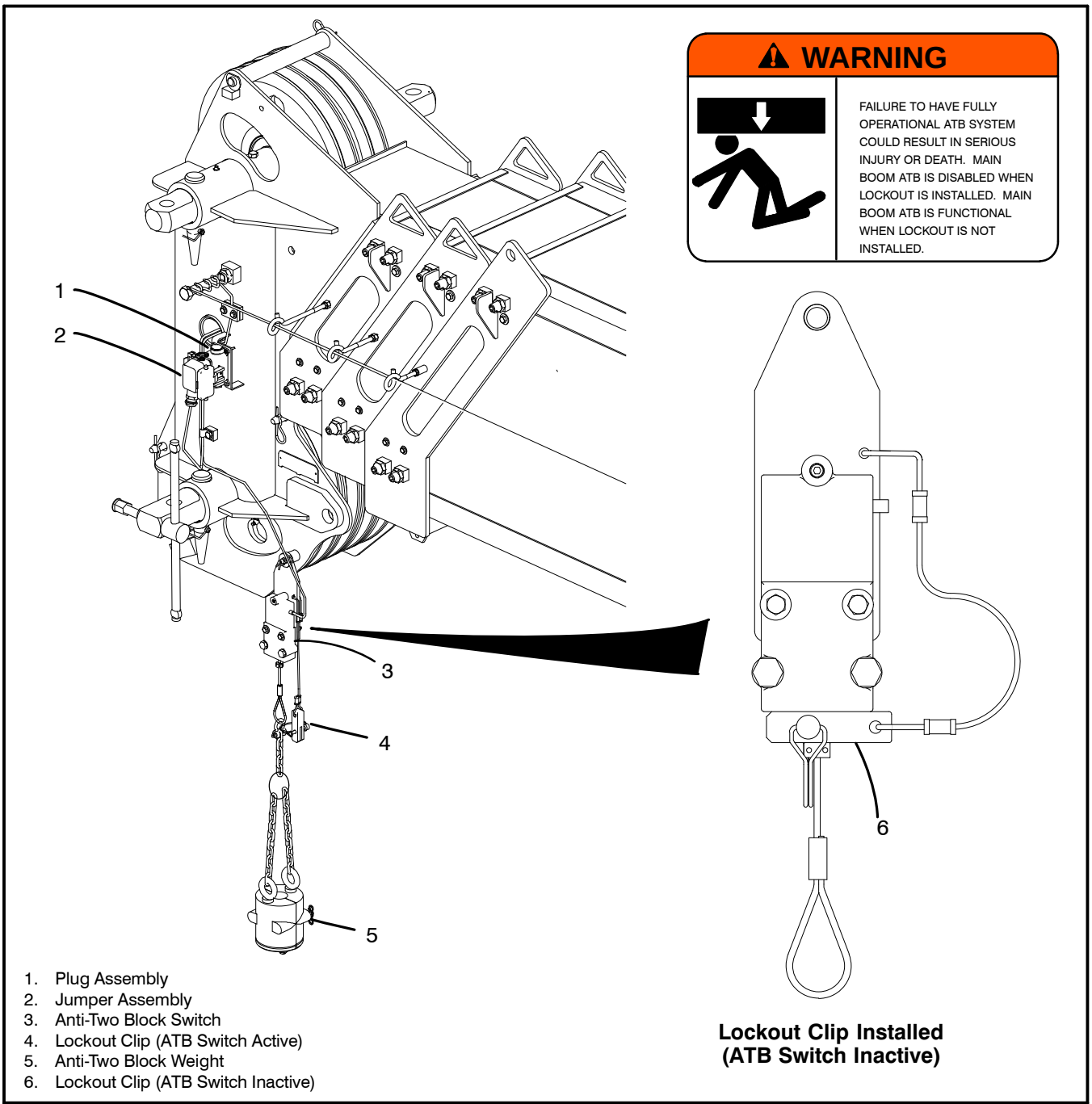
The added feature of hydraulic function limiters, prevents the operator from continuing crane functions which will cause a two block situation to occur. The crane functions of winch up, boom down, and boom extend are disabled when the anti-two block weight is lifted. These functions will remain disabled until the two block situation is corrected or the "Cancel Alarm" button on the display unit is pressed and held to override the system.

Note: Push the "Cancel Alarm" button momentarily once to silence the audible alarm. Press and hold the "Cancel Alarm" button for 2 seconds or longer to temporarily override the system.

The main boom head must always have an anti-two block switch. Each of the added attachments used on the crane must employ a similar head machinery switch as well, in order for that particular attachment to be monitored by the system.

The plug assembly is connected to the jumper assembly on the boom head when operating from the main boom. It is connected to the jumper assembly on the attachment when operating from that attachment.

Check that all the harness connections between the attachments are properly connected and test the system before beginning operations. Test the system by manually lifting the ATB weight and verifying that the functions of winch up, boom down, and boom extend are disabled.



1. Plug Assembly
2. Jumper Assembly
3. Anti-Two Block Switch
4. Lockout Clip (ATB Switch Active)
5. Anti-Two Block Weight
6. Lockout Clip (ATB Switch Inactive)

Figure 1—68
Anti-Two Block Warning System

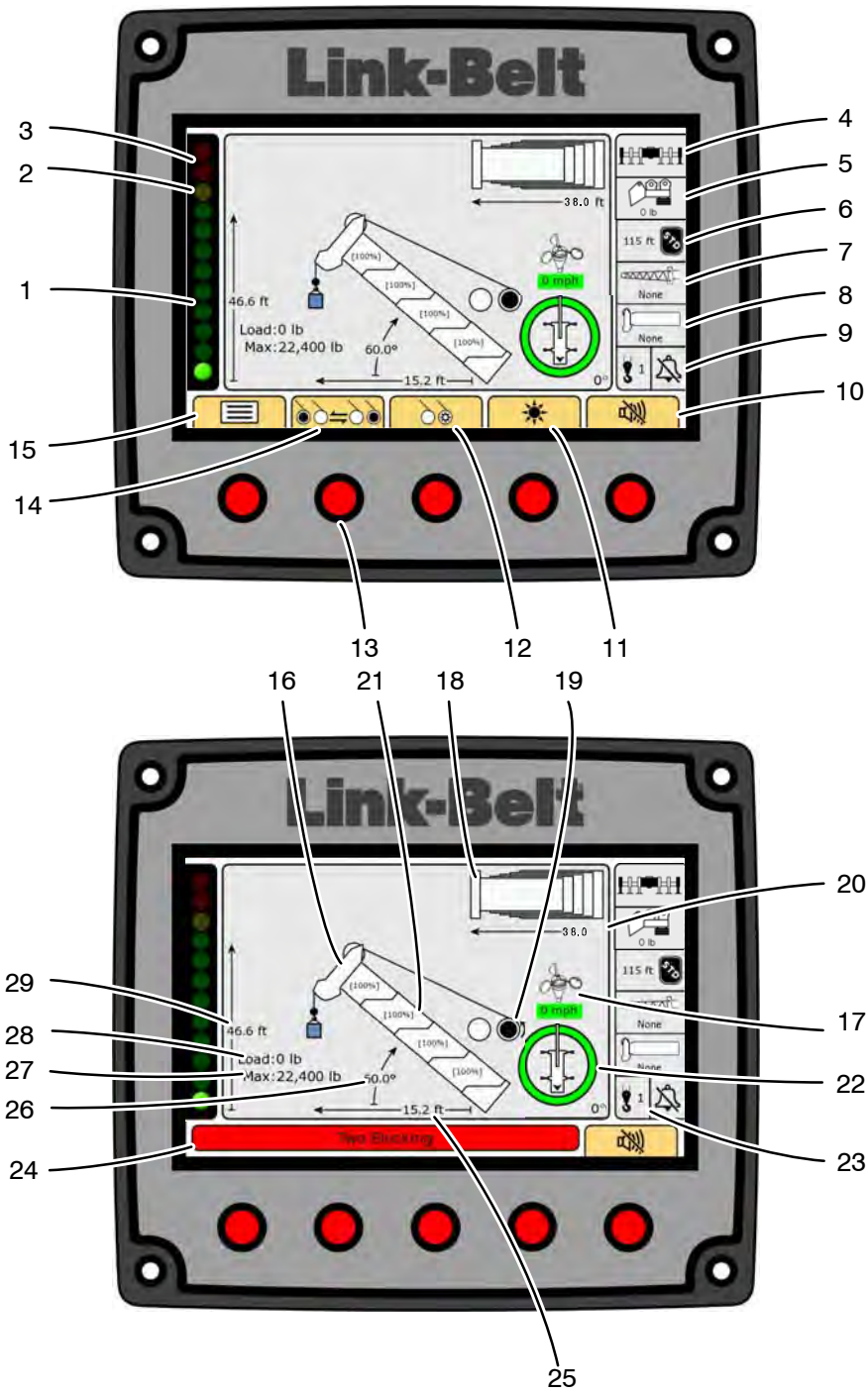
Lockout Clip

The lockout clip is used to hold the main boom anti-two block switch in the "working" position, the same as having a two block weight suspended from the switch.

When operating from the main boom the lockout clip must be removed from the anti-two block weight cable. When operating from an attachment only, the lockout clip must be installed on the anti-two block weight cable.

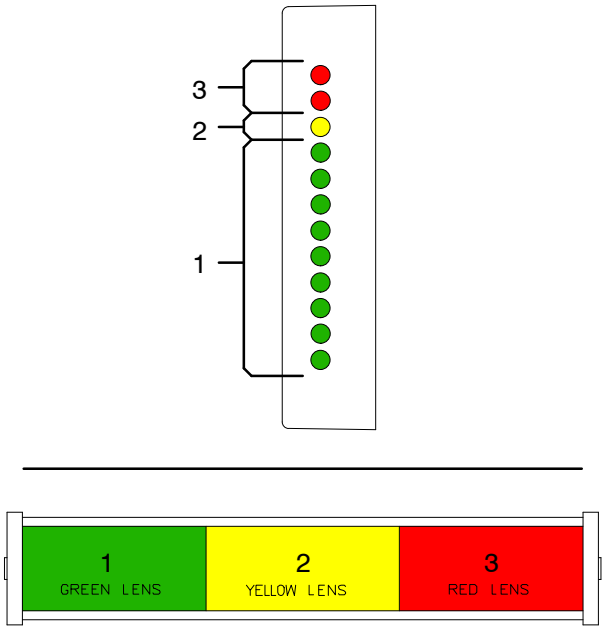
When both main boom and any attachment are reeved for operation, the lockout clip must be removed from the cable.

Note: When using main boom and any attachment, an anti-two block weight must be suspended from the anti-two block switch on the main boom and on each attachment that is to be monitored.



1. Bar-Graph
2. Pre-Alarm Indicator
3. Overload Indicator
4. Outrigger Configuration
5. Counterweight Configuration
6. Boom Extension Mode
7. Attachment Configuration
8. Stowed Attachment Configuration
9. Operator Alarm Indicator
10. Cancel Alarm Icon
11. Brightness Icon
12. Winch Setup Icon
13. Selection Buttons
14. Winch Select Icon
15. Main Menu Icon
16. Crane Representation Image
17. Wind Speed Display
18. Boom Telescope Animation Display
19. Drum Rotation Direction Indicator
20. Boom Length Display
21. Boom Section Length Display
22. Working Area Display
23. Parts Of Line Display
24. Warning Message Area
25. Load Radius Display
26. Boom Angle Display
27. Maximum Rated Capacity Display
28. Actual Load Display
29. Boom Head Height Display

Figure 1—69
Rated Capacity Limiter



1. Green Lights - P ercentage of Rated Load
2. Yellow Lights - Approaching Overload
3. Red Lights - Overload

Figure 1—70
Overhead Bar-Graph And External Light Bar (If Equipped)

Rated Capacity Limiter

The following describes the function and operation of the Rated Capacity Limiter (RCL). The system is intended to aid the operator in the efficient operation of the crane by continually monitoring the load and warning of an approach to an overload or unsafe condition.

WARNING

Although the system will alert the operator of an approaching overload or unsafe condition, it remains the responsibility of the operator to operate the crane safely at all times.

This system must never be substituted for the good judgment of the crane operator using safe operating procedures. The operator is solely responsible for safe operation of the crane.

!!THIS SYSTEM IS AN OPERATOR'S AID — NOT A SAFETY DEVICE!!

System Description

The system monitors crane functions by means of high accuracy sensors and continuously compares the load with a copy of the crane capacity chart which is stored in the computer memory. If an overload is approached, the system warns by means of audible and visual alarms and is configured to cause function limitation.

The Rated Capacity Limiter provides the operator with a continuous display of:

- Rated Capacity
- Actual Load
- Radius of the Load
- Angle of the Main Boom
- Crane Configuration
- Length of the Main Boom
- Height of the Main Boom Head Above the Carrier Deck

Note: The function of the RCL System is an operational aid to warn or to indicate to the operator when the load being lifted approaches, meets, or exceeds the rated capacity of the crane. The RCL System does not function as a scale or weighing device.

The actual load displayed by the RCL System is less accurate when the actual load lifted is a small percentage of the allowable load. This typically occurs when lifting light loads with a short boom length at high boom angles. Crane configurations of this type produce low pressures in the boom hoist cylinder resulting in less accuracy of the RCL sensors and calculated load. The RCL load accuracy improves greatly when the actual load lifted approaches the rated load (higher boom hoist cylinder pressures).

An additional feature of the system is the provision of operator alarms. These alarms, when properly set, provide a method of obstacle avoidance. This is achieved by means of maximum boom length, maximum boom angle, maximum load radius, maximum boom head height, left and right swing, and defined area alarms. These alarms can be programmed for each job site and set rapidly for the prevailing site conditions thereby aiding the operator in safe operation of the crane.

Display Unit

The following is a description of the control buttons, indicators, and windows on the display unit. Use them along with Figure 1-69.

1. Bar-Graph

   The Bar-Graph is a series of twelve colored lights which gives a visual indication of how much of the crane's capacity is being used and the rate at which an overload is being approached. Each green light represents 10% of the crane's rated capacity being used. Yellow indicates 90-99.9%, and the red lights indicate an overload.

   Note: System may be equipped with an overhead bar-graph or an external light bar which operates similar to the bar-graph on the display. Refer to Figure 1—70.

2. Pre-Alarm Indicator

   The Pre-Alarm Indicator illuminates yellow at a pre-set value of 90% of Maximum Rated Capacity and provides a visual indication of an approach to an overload.

3. Overload Indicator

   The Overload Indicator illuminates red at a pre-set value of 100% of the Maximum Rated Capacity and provides a visual indication of Maximum Allowed Load. It will also illuminate whenever a wire rope limit is exceeded. Function limiters will occur simultaneously for an Overload, Wire Rope Limit, or a Two-Block condition, but function limiters will not occur when exceeding an operator settable alarm. An audible alarm will sound and a message will appear in the warning message area for all 4 conditions.

4. Outrigger Configuration

   This area displays the current outrigger configuration. It will also display rigging and travel modes.

5. Counterweight Configuration

   This area displays the current counterweight configuration.

6. Boom Extension Mode

   This area displays the current boom extension mode. It also shows the maximum boom length for the current boom extension mode.

7. Attachment Configuration

   This area displays the current attachment configuration.

8. Stowed Attachment Configuration

   This area displays the current stowed attachment configuration.

9. Operator Alarm Indicator

   This indicator will display whether or not an operator alarm is set.

10. Cancel Alarm Icon

    The button below this icon can be pushed once to silence the audible alarm when the alarm has occurred as a result of either an Overload, a Two Block, or an Operator Settable alarm. It is also used to reset the function limit relay when it is necessary to bypass a function limit which has occurred as a result of either an Overload or a Two Block alarm. This requires the button be pressed and held for 2 seconds or longer.

11. Brightness Icon

    The button below this icon is used to adjust the display brightness.

12. Winch Setup Icon

    The button below this icon is used to enter the active winch setup screen. The active winch setup screen allows the user to configure lift point and parts of line for the active winch.

13. Selection Buttons

    The selection buttons are used to activate each of the icons at the bottom of the screen. The icons will change depending on the current menu display.

14. Winch Select Icon

    The button below this icon is used to select which winch will be in use.

15. Main Menu Icon

    The button below this icon navigates to the main menu. The main menu contains items such as: Crane Configuration, Operator Alarms, Diagnostics, Setup, About.

16. Crane Representation Image

This crane representation image is a generic representation of the boom, active winch configuration, auxiliary head configuration (on or off), and fly configuration (on or off). The attachment image will not change with installed attachment.

17. Wind Speed Display

The current wind speed is displayed here.

18. Boom Telescope Animation Display

The Boom Telescope Animation Display is an approximate representation of the location of the boom sections. Always visually verify that the boom is extending/retracting in accordance with the selected boom mode.

19. Drum Rotation Direction Indicator (DRDI)

This Drum Rotation Direction indicator is used to monitor Winch Up , Winch Down , and Error states .

Note: If the error state indicator appears, contact a Link-Belt Distributor or the factory for service.

20. Boom Length Display

The Boom Length Display gives a continuous indication of the boom length in feet (*m*). It is the distance from the centerline of the boom foot pin to the centerline of the boom head machinery.

21. Boom Section Length Display

The Boom Section Length Display shows the current section lengths as a percentage of their absolute maximum length (not in the current boom mode). The maximum length for each section in the current boom mode is shown in brackets.

22. Working Area Display

This area displays a graphical representation of the allowable lifting quadrant(s) based on the selected configuration. A quadrant not allowed will be filled red, an allowable quadrant will be filled green.

23. Parts Of Line Display

The Parts Of Line Display shows the parts of line currently selected for the winch in use.

24. Warning Message Area

The Warning Message Area displays text messages of various alarms which may occur during normal operation of the system. When an alarm occurs, the rectangular area fills in red. The Warning Message Area will only be shown when there is an active message. Otherwise the navigation button icons will be shown. Refer to Figure 1-72. Press any of the selection buttons, except the cancel alarm button, to temporarily replace the Warning Message Area with the navigation icons.

25. Load Radius Display

The Load Radius Display gives a continuous indication of the radius of the load in feet. It is the horizontal distance from the centerline of rotation to the centerline of the hook.

26. Boom Angle Display

The Boom Angle Display gives a continuous indication of the angle of the main boom relative to horizontal.

27. Maximum Rated Capacity Display

The Maximum Rated Capacity Display is a digital display of the maximum permitted capacity. It is derived from a copy of the crane's capacity chart which is stored in the computer memory and is the reference capacity for any lifting operation. It is dependent on the configuration currently selected, which is shown in the crane configuration screen, and which determines the section of the capacity chart to be used as the rated capacity reference.

28. Actual Load Display

The Actual Load Display is a digital display of the total load suspended below the boom or fly head. It includes the load, any slings, pins, or tackle used to secure the load and the hook block or ball.

29. Boom Head Height Display

The Boom Head Height Display gives a continuous display of the height of the boom head or attachment head above the carrier deck.

System Operation

The following is a list of procedures which are used to operate the multiple features of the Rated Capacity Limiter. Use these procedures in conjunction with the previous display unit control descriptions.

System Bypass

In emergency situations, the Rated Capacity Limiter computer can be bypassed. There is a RCL Status keyswitch on the back of the operator's cab, to bypass the system. Refer to Figure 1-71. Move the keyswitch to the "RCL BYPASSED" position to bypass the system. For emergency use while the system is bypassed, refer to "System Inoperative Or Malfunctioning" in this Section of this Operator's Manual.

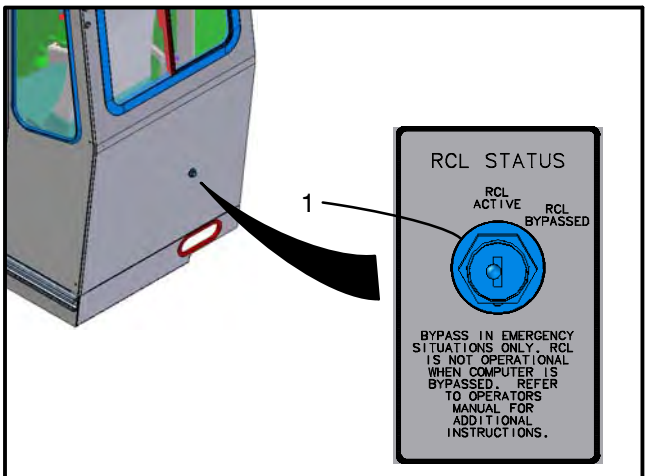
WARNING

The RCL System is not operational when the computer is bypassed. Bypass the system in emergency situations only.

System Inoperative Or Malfunctioning

When operational aids are inoperative or malfunctioning, the following recommendations for continued use of the crane should be followed or the crane should be shutdown.

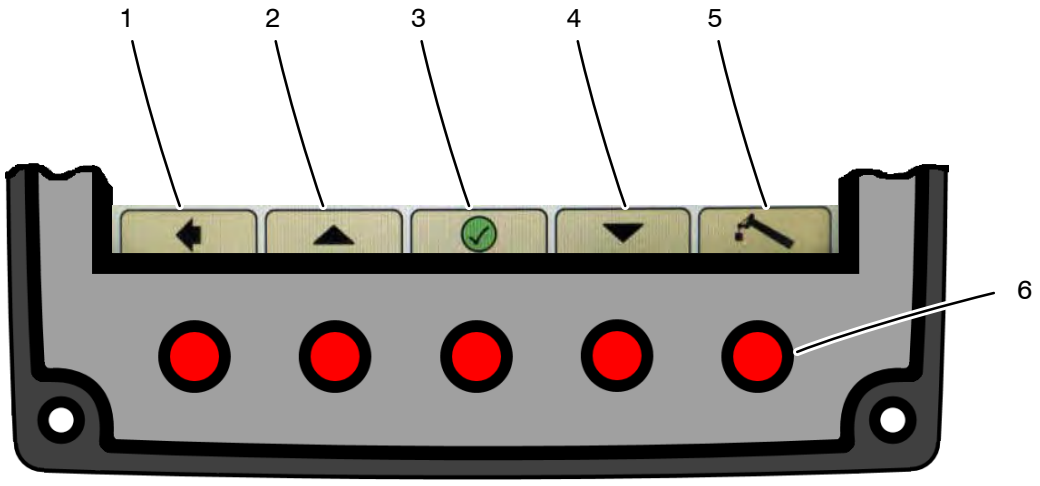
1. Steps shall be taken to schedule repairs and recalibration immediately. The operational aids shall be put back into service as soon as replacement parts, if required, are available and the repairs and recalibration can be carried out. Every reasonable effort must be made to expedite the repairs and recalibration.
2. When the Rated Capacity Limiter is inoperative or malfunctioning, the designated person responsible for supervising the lifting operations shall establish procedures for determining load weights and shall ascertain that the weight of the load does not exceed the crane ratings at the radius where the load is to be handled.
3. When a boom angle or radius indicator is inoperative or malfunctioning, the radius or boom angle shall be determined by measurement.



1. RCL Status Keyswitch

Figure 1—71
Rated Capacity Limiter Status Keyswitch

4. When the anti-two block warning device is inoperative or malfunctioning, the designated person responsible for supervising the lifting operations shall establish procedures, such as assigning an additional signal person, to furnish equivalent protection. This does not apply when lifting personnel in load line supported baskets. Personnel shall not be lifted in load line supported baskets when the anti-two block devices are not functioning properly.
5. When a boom length indicator is inoperative or malfunctioning, the designated person responsible for supervising the lifting operations shall establish the boom length at which the lift will be made by actual measurement or markings on the boom.
6. When a level indicator is inoperative or malfunctioning, other means shall be used to level the crane.
7. In situations where inconsistency exists, verified weights, measured radii, boom lengths, and authorized crane capacities must always take precedence over indicator readings.



1. Back Icon
2. Scroll Up Icon
3. OK/Enter Icon
4. Scroll Down Icon
5. Working Screen Icon
6. Selection Buttons

Figure 1—72
Menu Navigation Icons & Selection Buttons

System Navigation

The RCL Display has two main display modes; the working screen and the menu. The working screen displays all information relevant to the safe operation of the crane. This includes crane configuration as well as live data such as boom length and load radius. The menu is used to navigate to various setup and diagnostic screens needed to properly setup the system. Although the five navigation icons at the bottom of the screen will change depending on what the display is currently showing, the five primary icons for menu navigation are as follows. Refer to Figure 1-72. If a task associated with a button is not available, that button will be disabled and greyed out.

1. Back Icon

   The selection button below the Back Icon navigates back one menu.

2. Scroll Up Icon

   The selection button below the Scroll Up Icon scrolls up one menu item each time it is pressed.

3. OK/Enter Icon

   The selection button below the OK/Enter Icon selects the menu item currently highlighted.

4. Scroll Down Icon

   The selection button below the Scroll Down Icon scrolls down one menu item each time it is pressed.

5. Working Screen Icon

   The selection button below the Working Screen Icon immediately navigates to the working screen when it is pressed.

6. Selection Buttons

   These buttons are used to select the function of the icon displayed above them.

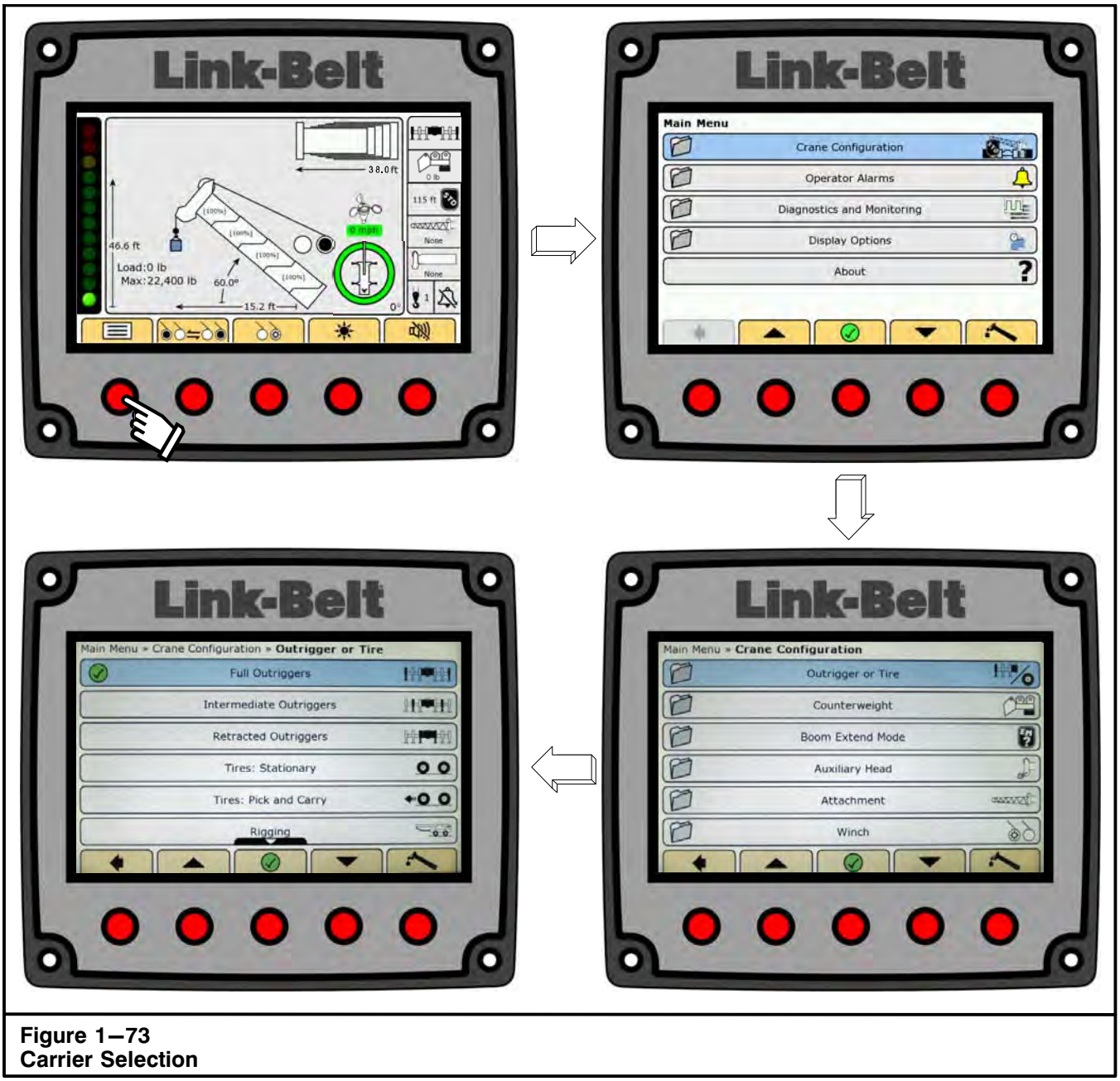


Figure 1—73
Carrier Selection

Configuration Selection

In the normal operational mode the system is programmed to remember the last configuration selected. Each time the system is powered up it will automatically default to that last configuration. Only when the crane is rigged differently must a new configuration be selected. Use the following procedure to select the crane configuration.

Note: When selecting configurations allowed on outriggers, all beams must be equally extended; all fully retracted, intermediate extended, or fully extended.

Depending on how the crane is equipped or which selections have been made, some screens shown may not appear or may not appear as illustrated. The system cannot be programmed for configurations not allowed by the capacity charts in the Crane Rating Manual.

1. From the normal working screen, press the Main Menu button .
2. Scroll to Crane Configuration, and press the OK/Enter button .
3. Scroll to Outrigger or Tire, and press the OK/Enter button . Refer to Figure 1-73.

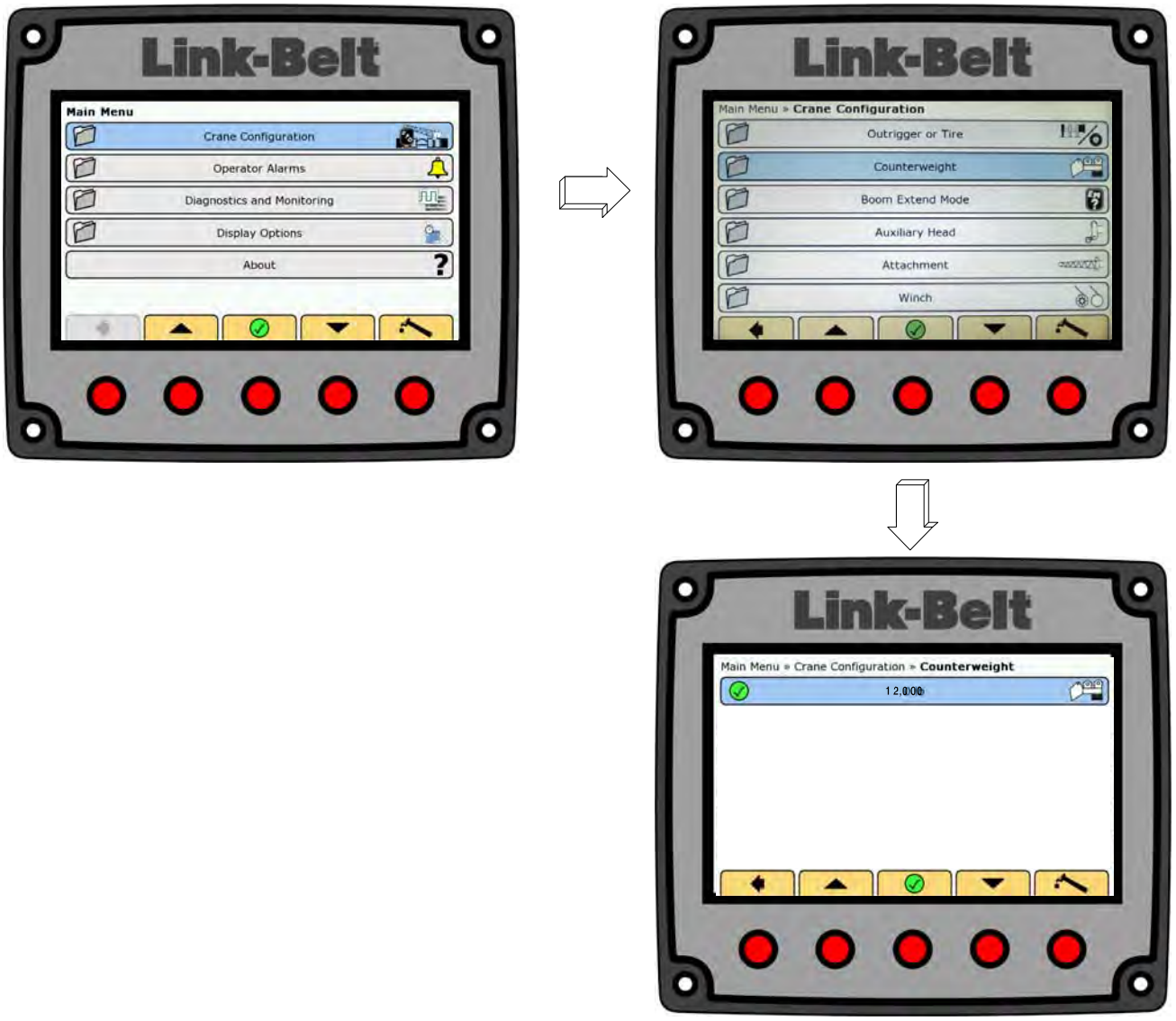


Figure 1—74
Counterweight Selection

4. The menu will change and graphically display the carrier options. Scroll to the desired carrier configuration, and press the OK/Enter button. If rigging is desired, refer to "To Select Rigging And Travel Modes" in this Section of this Operator's Manual.

WARNING

The RCL System is not operational when in the Rigging or Travel Modes. Return the RCL System to normal operation before operating the crane.

5. After a selection is made, the display will automatically return to the Crane Configuration menu.
6. On the Crane Configuration menu, scroll to Counterweight, and press the OK/Enter button.
7. Scroll to the desired counterweight, and press the OK/Enter button. Refer to Figure 1-74.
8. After a selection is made, the display will automatically return to the Crane Configuration menu.

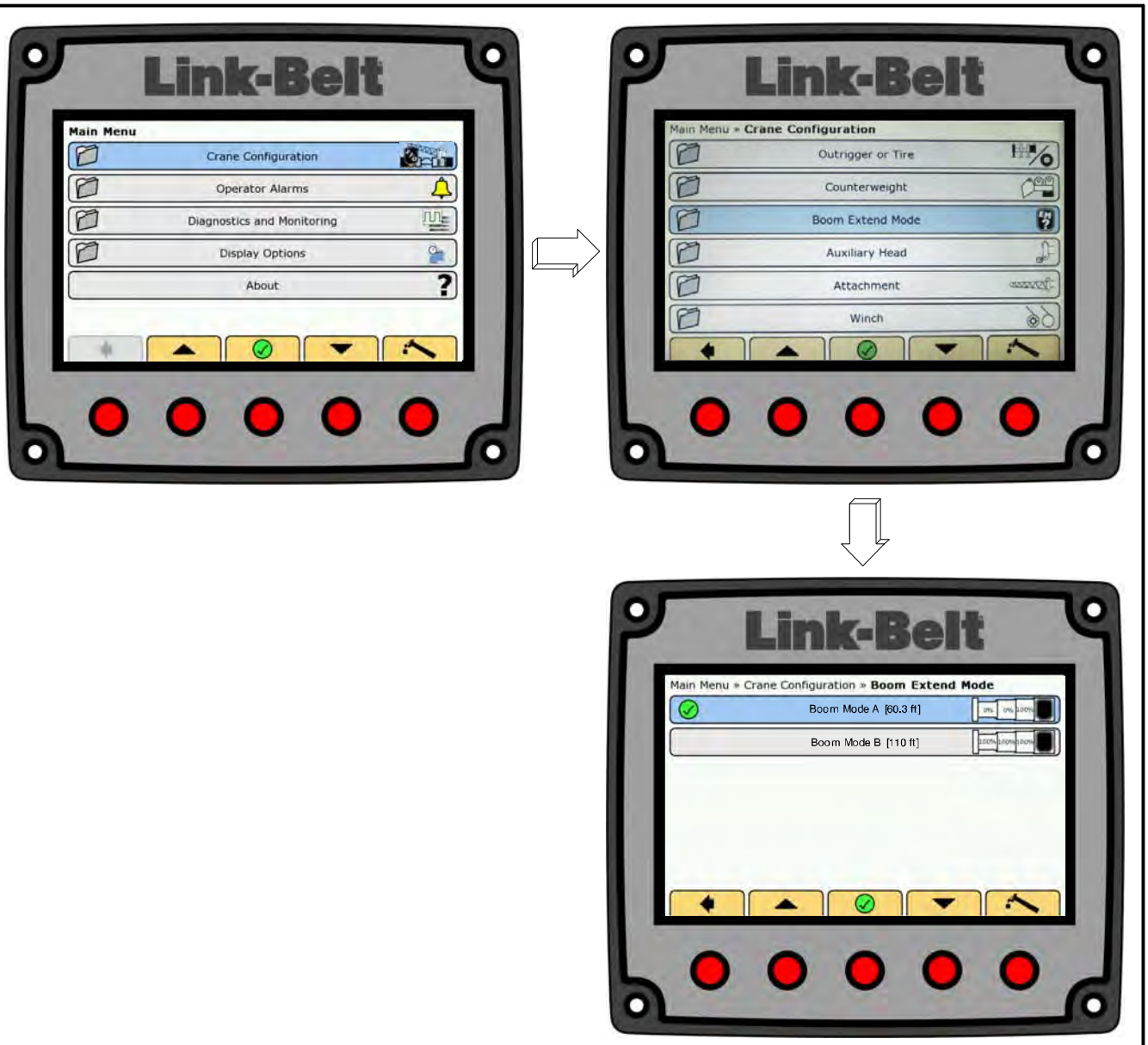


Figure 1—75
Boom Extend Mode Selection

9. On the Crane Configuration menu, scroll to Boom Extend Mode, and press the OK/Enter button. Refer to Figure 1-75.
10. Scroll to the desired boom extend mode, and press the OK/Enter button.

    Note: Refer to the Crane Rating Manual to determine the best boom mode to maximize lifting capacity at working radius. Boom mode options will only be displayed when the boom is fully retracted and the telescope cylinder unlatched from all boom sections.

11. After a selection is made, the display will automatically return to the Crane Configuration menu.

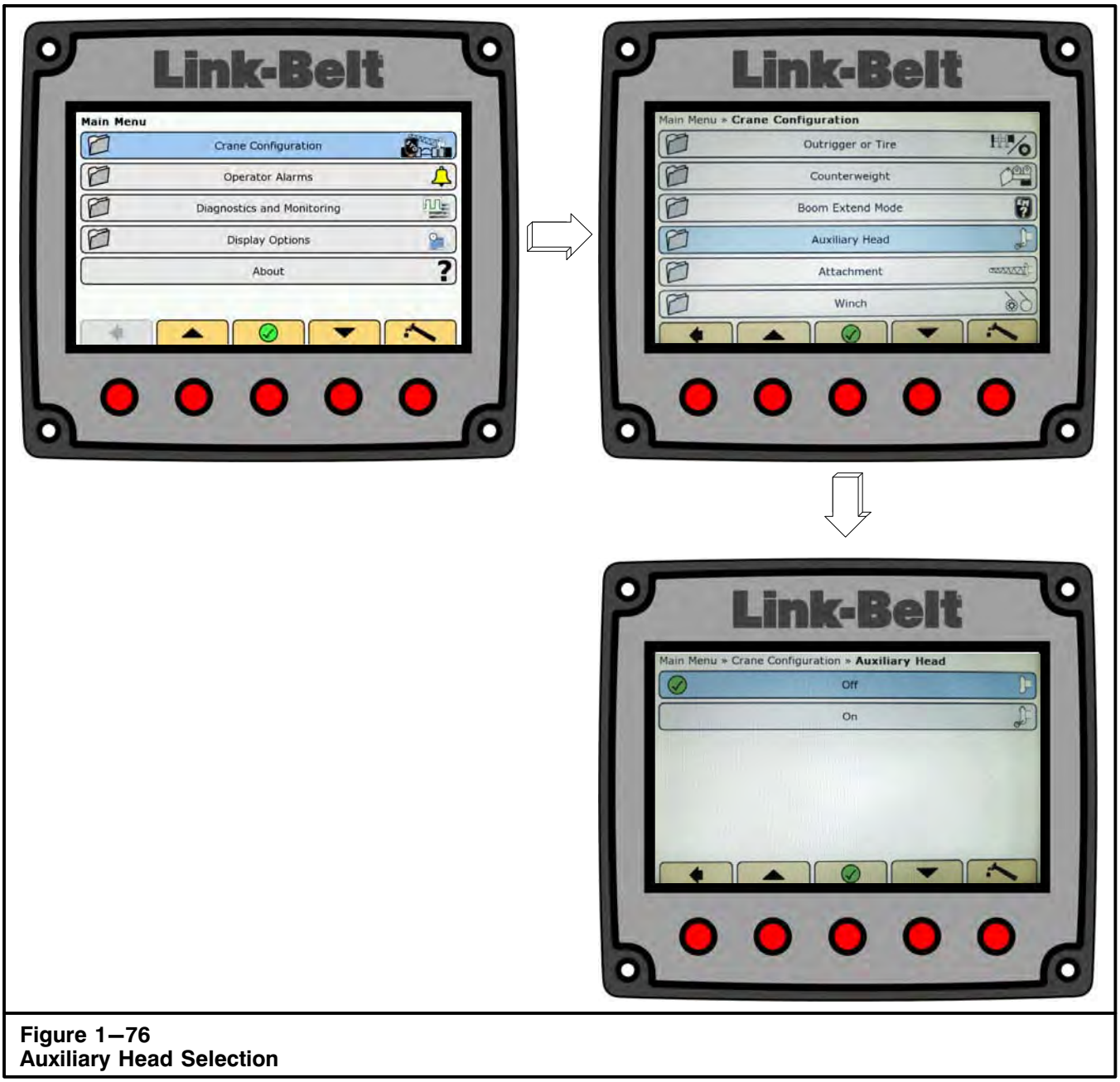


Figure 1—76
Auxiliary Head Selection

12. On the Crane Configuration menu, scroll to Auxiliary Head, and press the OK/Enter button. Refer to Figure 1-76.
13. Scroll to the desired auxiliary head (off or on), and press the OK/Enter button.
14. After a selection is made, the display will automatically return to the Crane Configuration menu.
15. On the Crane Configuration menu, scroll to Attachment, and press the OK/Enter button.
16. Scroll to Erected Attachment, and press the OK/Enter button to display the fly options. Scroll to the desired erected fly, if required, and press the OK/Enter button. Refer to Figure 1-77.
    a. If Nothing Erected is selected, the display will automatically return to the Crane Configuration menu.
    b. If an erected attachment is selected, the display will change and graphically display the available offsets as required.
    c. Scroll to the desired offset angle, and press the OK/Enter button. Refer to Figure 1-78.
    d. After a selection is made, the display will automatically return to the Crane Configuration menu.

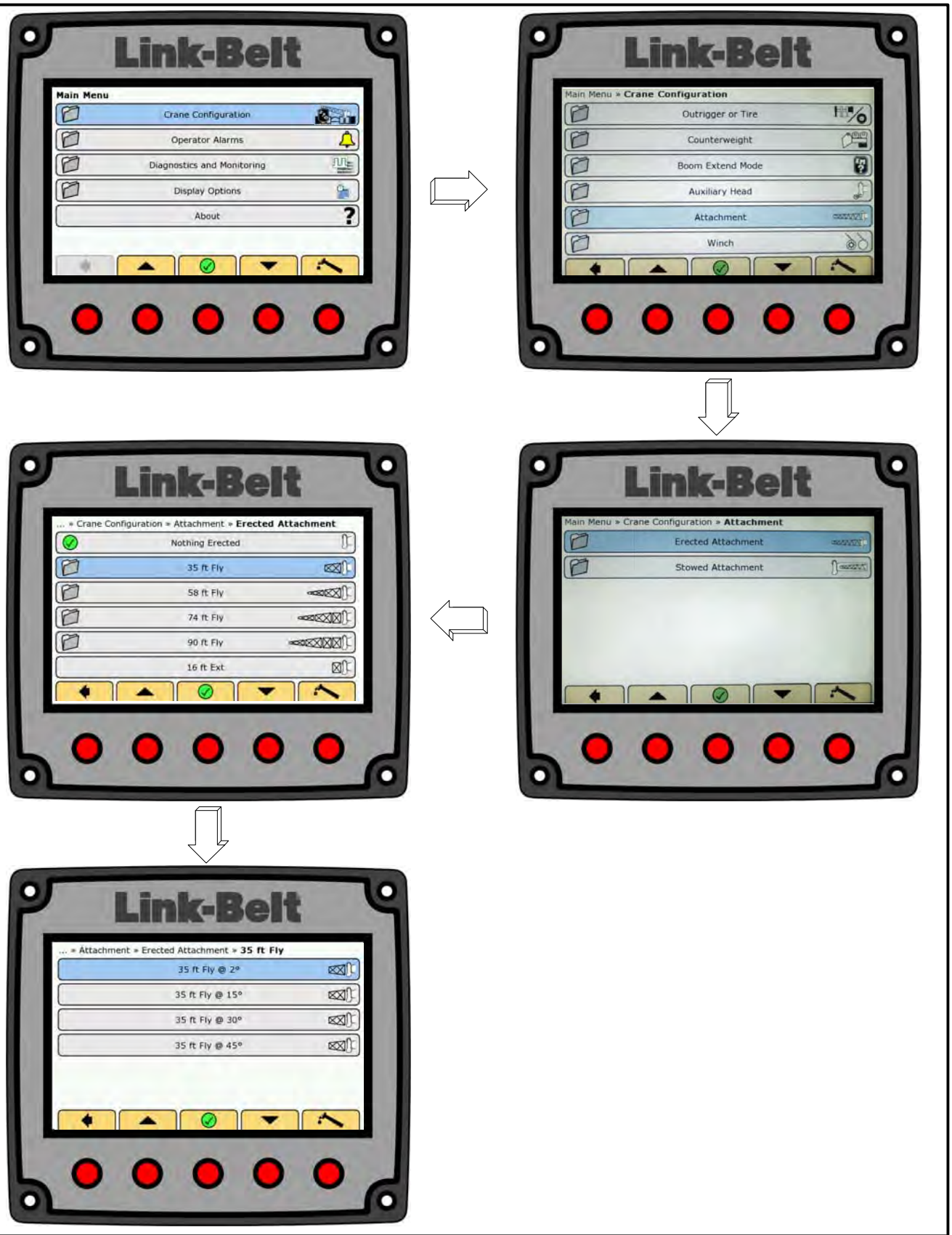


Figure 1—78
Erected Attachment Selection

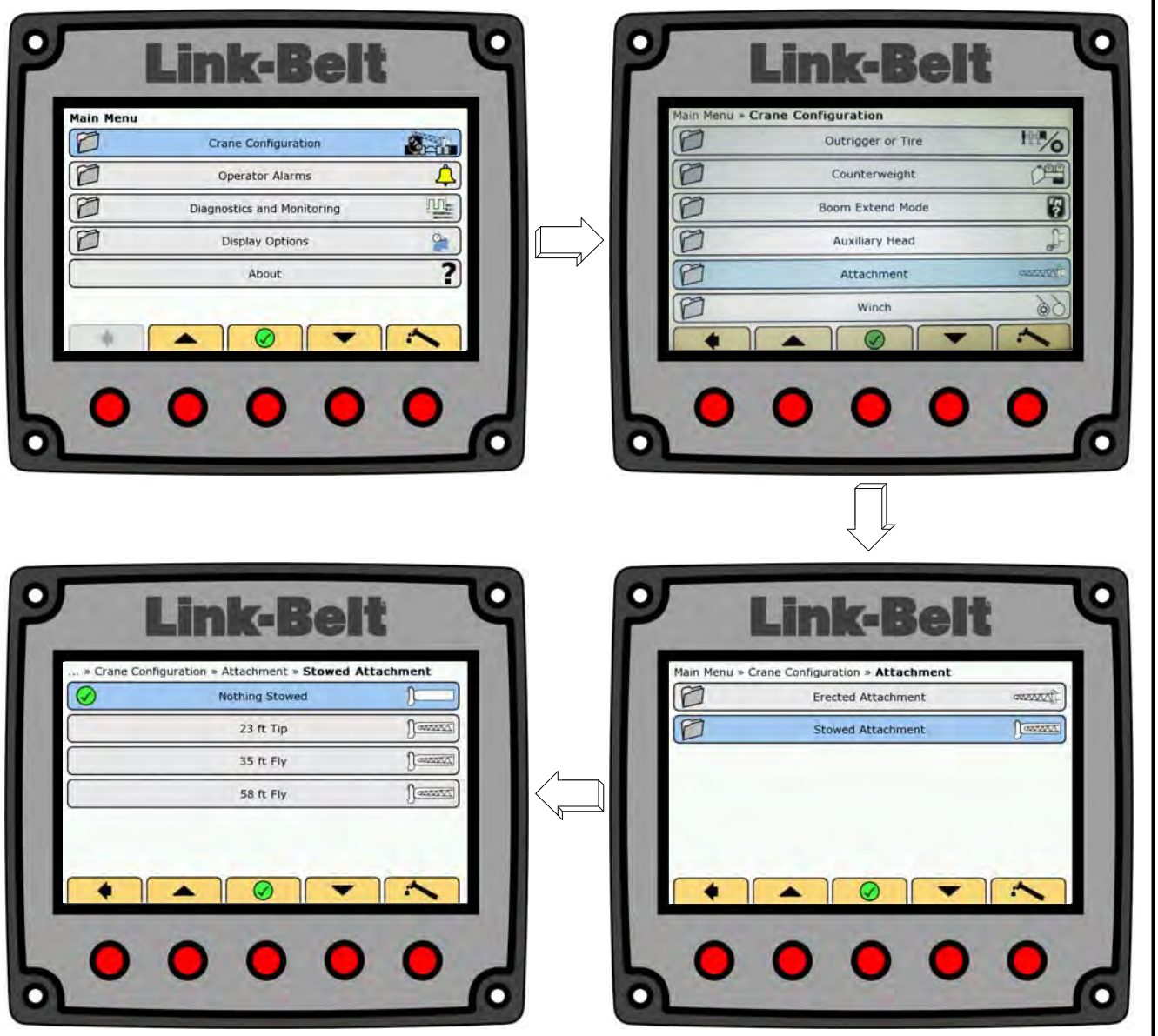


Figure 1—79
Stowed Attachment Selection

17. If the crane is equipped with a fly and was not selected as an erected attachment, on the Crane Configuration menu, navigate to Attachment » Stowed Attachment to display the stowed fly options. Scroll to the desired stowed deduct, if required, and press the OK/Enter button. Refer to Figure 1-79.

18. After a selection is made, the display will automatically return to the Crane Configuration menu.

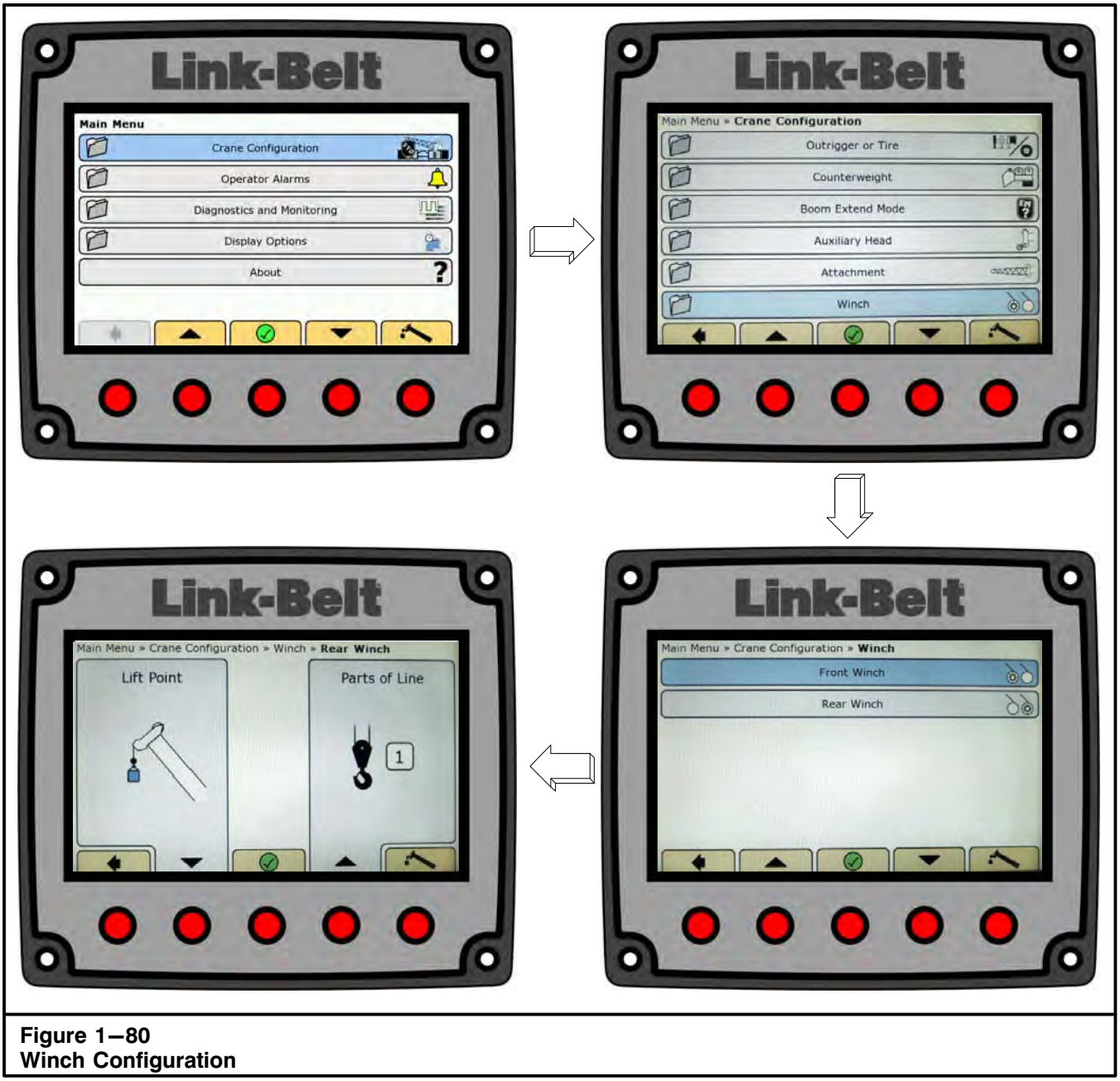


Figure 1—80
Winch Configuration

19. On the Crane Configuration menu, scroll to Winch, and press the OK/Enter button to display the front and rear winch items. Refer to Figure 1-80.

    a. Scroll to the desired winch menu item, and press the OK/Enter button. This will only configure the selected winch. The winch select button on the working screen is used to change the active winch.

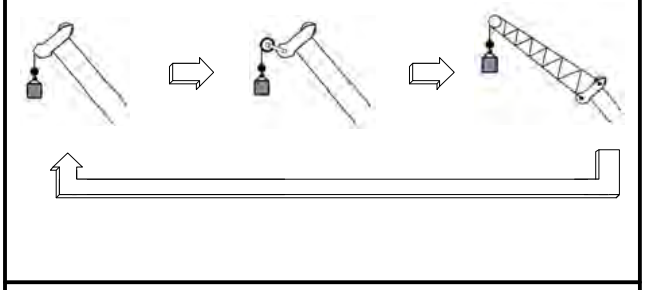


Figure 1–81
Lifting Point Selection

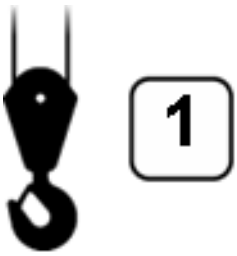


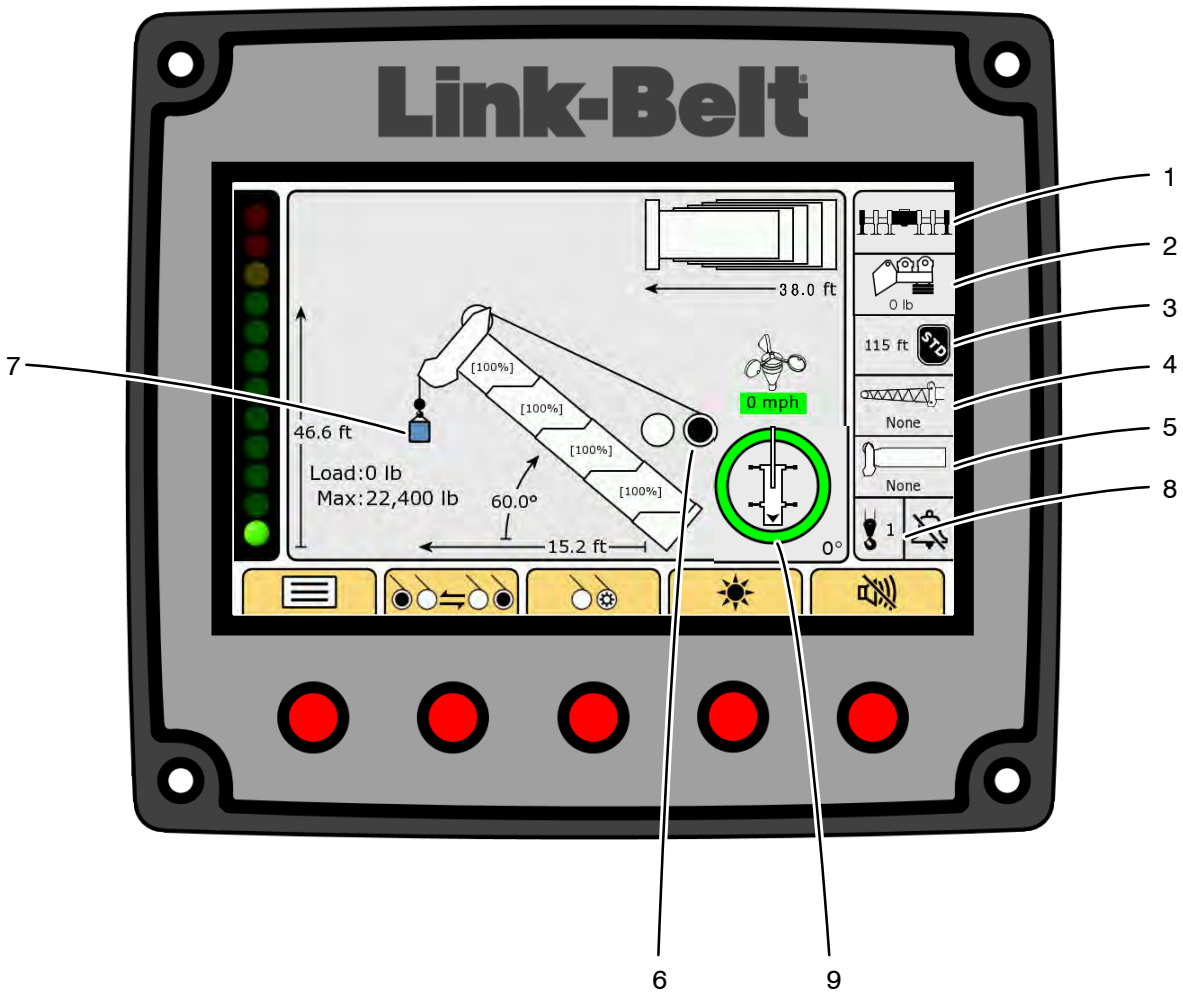
Figure 1–82
Parts Of Line Selection

b. Scroll through the available lifting points until the desired lifting point, for the winch selected, is displayed. Refer to Figure 1-81.
c. Scroll through the available parts of line until the desired parts of line, for the winch selected, is displayed. Refer to Figure 1-82.
d. Press the OK/Enter button to confirm the selections for lifting point and parts of line. If the back button or working screen button is pressed before pressing the OK/Enter button, the changes made to lifting point and parts of line will not be saved.
e. Repeat Steps a through d for the other winch, if required.

20. Press the back button to navigate back to the Crane Configuration menu.

    Note: A change to any selection can be made at anytime during the configuration routine. When on the Crane Configuration menu, simply navigate to the desired configuration menu to go directly to that sub-routine.

21. Press the Working Screen button to return to the normal working screen and graphically display the crane configuration as previously selected.



In this example the crane is setup on fully extended outriggers (1), 0 lb of counterweight (2), boom mode STD (standard (3), no fly installed (4), no stowed attachment (5), the front winch available with the fly and the rear winch selected (6), with the winch wire rope reeved over the main boom head (7), with one part of line (8), and 360 degree capacities with the boom currently positioned over the rear (9).

Figure 1—83
Normal Working Screen Example

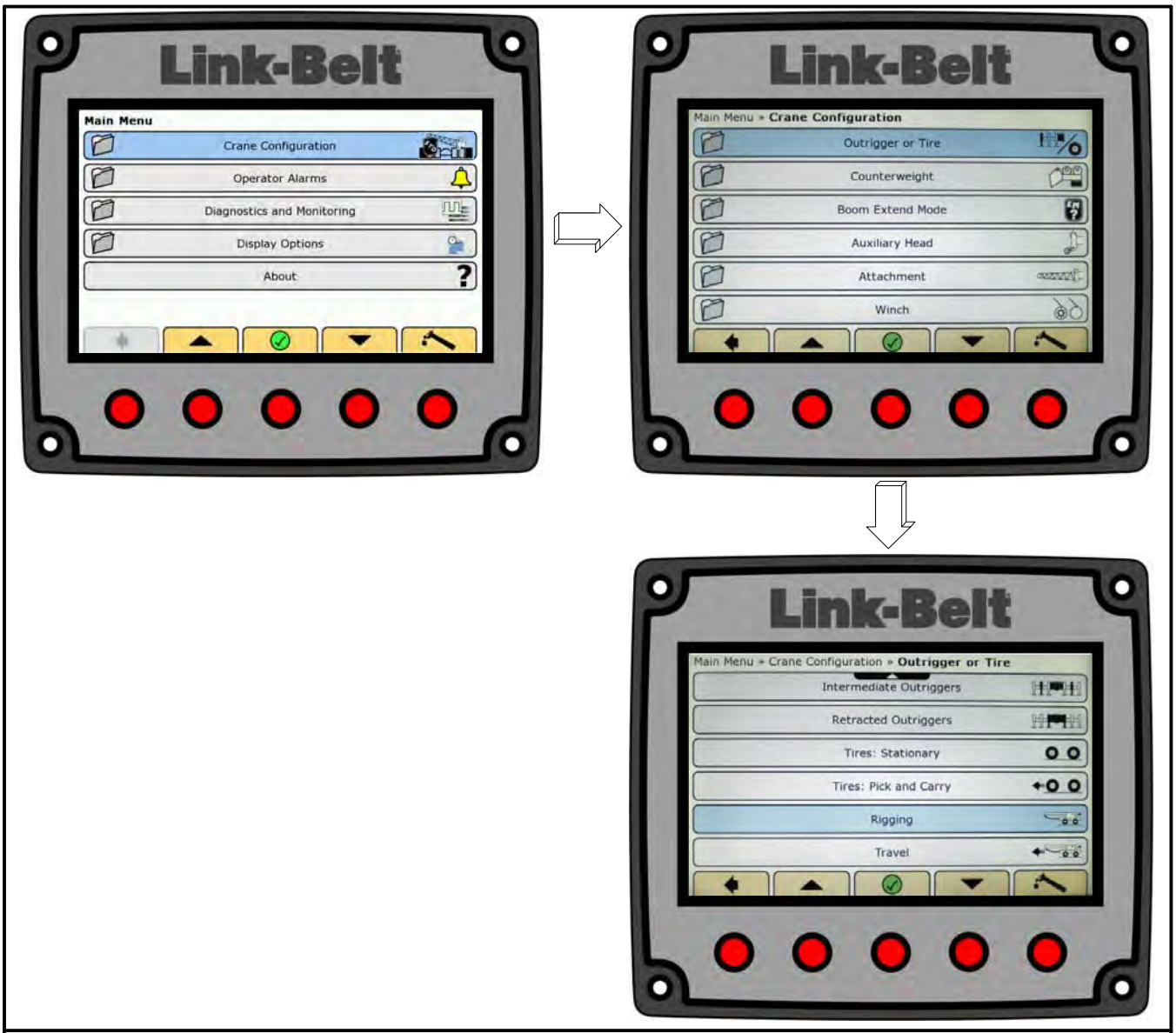


Figure 1—84
Rigging And Travel Modes

To Select Rigging And Travel Modes

The Rigging and Travel modes are used to facilitate rigging and travel of the crane by inhibiting function limiters and the audible alarm while selected. Refer to Figure Figure 1-84. To resume crane operation, select proper outrigger or tire configuration per the proper procedure.

WARNING

The RCL System is not operational when in the Rigging or Travel modes. Return the RCL System to normal operation before operating the crane.

1. From the normal working screen, press the Main Menu button .
2. Navigate to Crane Configuration » Outrigger or Tire.
3. Scroll to Rigging or Travel.
4. Select Rigging for rigging of the crane. Select Travel when traveling the crane.

Note: Boom must be fully retracted to enter Travel Mode.
When changing from Travel Mode to Rigging Mode, an outrigger selection and boom mode selection must be made prior to selecting Rigging mode.

Cancel Audible Alarm And Reset Function Limiters

The CANCEL ALARM button  is used to cancel the audible alarm when the alarm has occurred as a result of either an Overload, a Two Block alarm, or an Operator settable alarm. The audible alarm may be canceled by pressing and releasing the CANCEL ALARM button. The audible alarm remains canceled until the condition which caused the alarm has been removed. For example, if the audible alarm was canceled because of an overload condition, it will remain canceled until the overload condition is removed. However, if a different alarm, e.g. two block condition, was to occur when the audible alarm was still canceled for an earlier overload condition, the new alarm condition would cause the audible alarm to be sound.

WARNING

Once the function limiters have been bypassed, the crane is no longer protected against the condition that initially caused the function limiters to occur.

Note: The CANCEL ALARM feature is a temporary function. The audible alarm or function limit is automatically reset when the condition which caused the alarm is no longer present.

The CANCEL ALARM is also used to reset the function limiters when it is necessary to bypass the function limiters which has occurred as a result of either an Overload, a Two Block alarm, or a Rope limit. Function limiters are reset by first canceling the audible alarm (as described above) and then pressing and holding the CANCEL ALARM button for about 2 seconds, after which the function limiters will be reset to allow operation. However, should another different alarm condition occur when the function limiters had previously been over-ridden, then the newly occurring alarm condition would cause the function limiters to occur again.

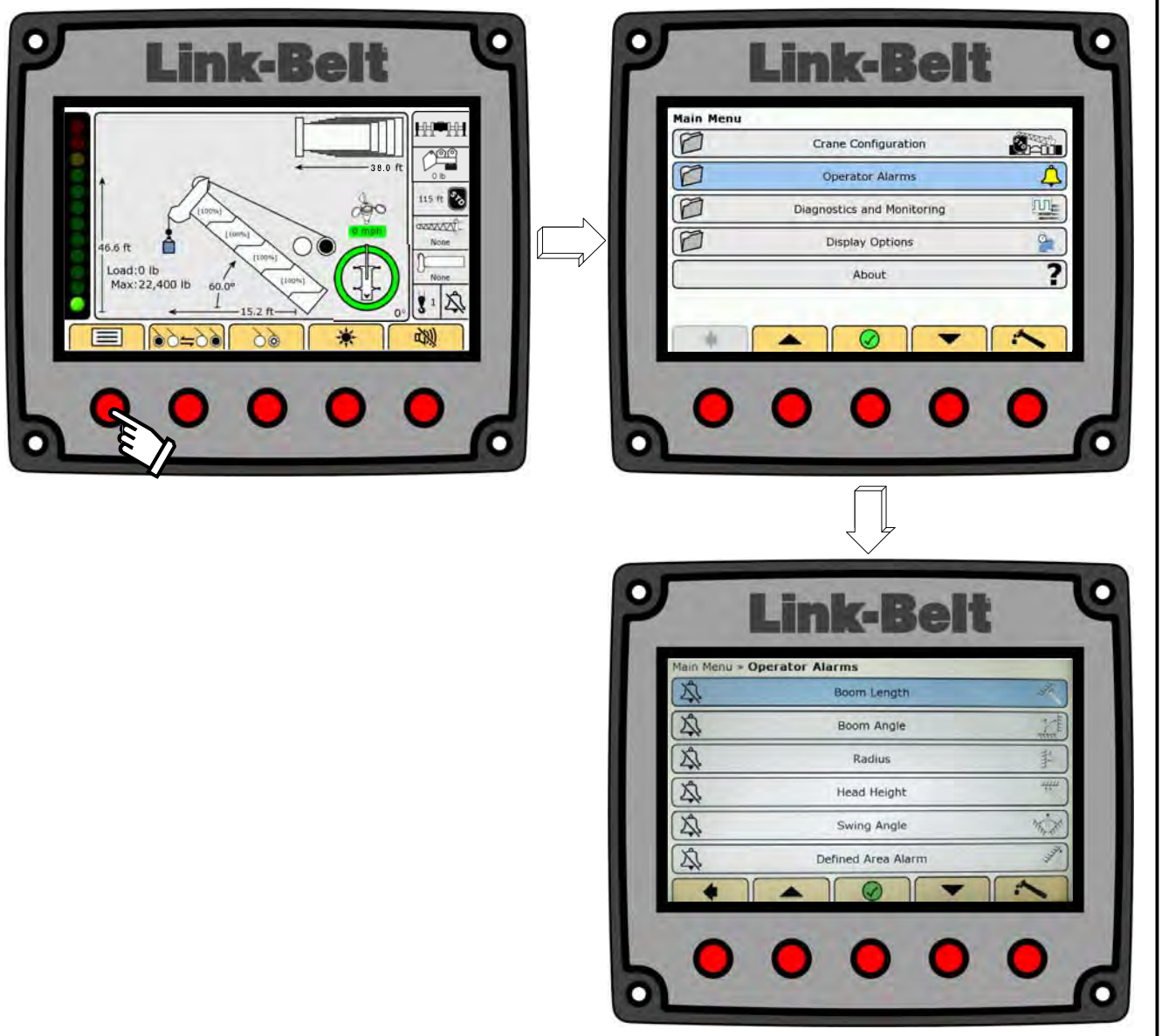


Figure 1—85
Operator Settable Alarms

Operator Settable Alarms

Some alarms occur automatically as a result of limitations imposed by the capacity chart. The operator has control over additional alarms which can be set to operate within the normal chart limitations and which are, in addition to those already set by the chart.

Operator alarms will be stored in the computer memory, even if the crane is shutdown, until they are disabled. Refer to Figure 1-85.

The following alarms are available for operator use.

Minimum Angle	Maximum Load Radius	Left and Right Swing
Maximum Angle	Maximum Boom Length	
Maximum Height	Operator Defined Area	

WARNING

The operator settable alarms are a warning device. All functions remain operational when entering the operator defined bad area. For safe operation, adequate distance must be maintained to allow for operator reaction time to avoid entering the bad area. It is the responsibility of the operator to set points which ensure that the crane's boom, attachment, load, rigging, etc. maintains a safe working distance and complies with local safety regulations.

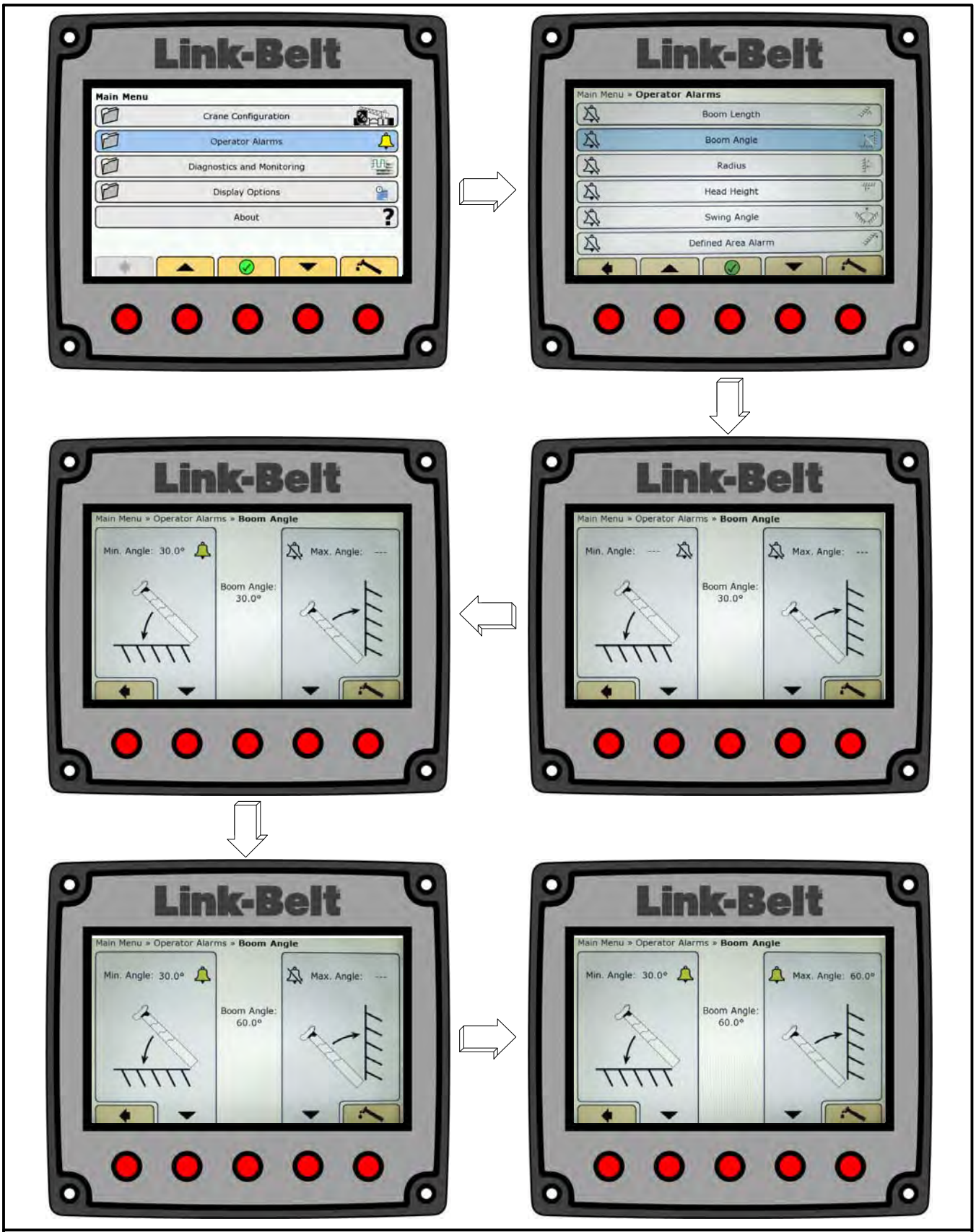


Figure 1—86
Boom Angle Alarm

Setting Angle, Length, Height, Radius, And Swing Operator Settable Alarms

1. From the normal working screen, press the Main Menu button .
2. Scroll to Operator Alarms, and press the OK/Enter button . Refer to Figure 1-85.
3. Scroll to the desired alarm to be set, and press the OK/Enter button .

WARNING

Avoid positioning the boom, attachment, load, rigging, etc. into the bad area when setting the alarm values.

When selecting the alarm values, ensure that the load will maintain a safe distance from the obstacle.

4. Place the crane in the desired position depending upon the alarm to be set. The numerical value for the value being set will be the current position of the crane.

   Note: If an alarm had been previously set, the alarm value displayed will be the previously set alarm value and indicated by the icon. The previous alarm must first be disabled, then set the new alarm. Alarms which are disabled are indicated by the icon.

5. Press the corresponding selection button to set the alarm value.
6. Press the back button to return to the Operator Alarms menu or press the Working Screen button again to return to the normal working screen.
7. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching the alarm set point, the audible alarm will sound intermittently and a warning message will appear in the warning message area. When exceeding the alarm set point, the audible alarm will sound continuously and a warning message will appear in the warning message area.

   Note: An alarm icon will appear on the normal working screen to alert the operator that an operator alarm has been set. If no operator alarm is set, the alarm disabled icon will appear.

8. Use the following examples to understand the use of the procedure.

WARNING

If crane or obstacle is moved or if a different size load is lifted, the alarm(s) must be reset.

WARNING

Check the crane's current configuration, capacity chart, and Working Areas chart in the Crane Rating Manual to ensure safe, stable operation under conditions described in the following examples.

To Set Minimum Angle Alarm

Example: To have an alarm whenever the boom is below a 30 degree angle, use the following procedure:

1. From the normal working screen, press the Main Menu button .
2. Scroll to Operator Alarms, and press the OK/Enter button . Refer to Figure 1-86.
3. Scroll to Boom Angle , and press the OK/Enter button .
4. Move the boom to a 30 degree angle.
5. Press the corresponding button for "Min. Angle" to set the alarm. The displayed value will be the alarm setting. The will appear to indicate that the alarm is set.
6. Press the back button to return to the Operator Alarm menu or press the Working Screen button again to return to the normal working screen.
7. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching 30 degree boom angle, the audio will sound intermittently and "Approaching Minimum Angle" will appear in the warning message area. The audible alarm will sound continuously and "Minimum Angle" will appear in warning message area whenever the boom is lowered below 30 degrees.

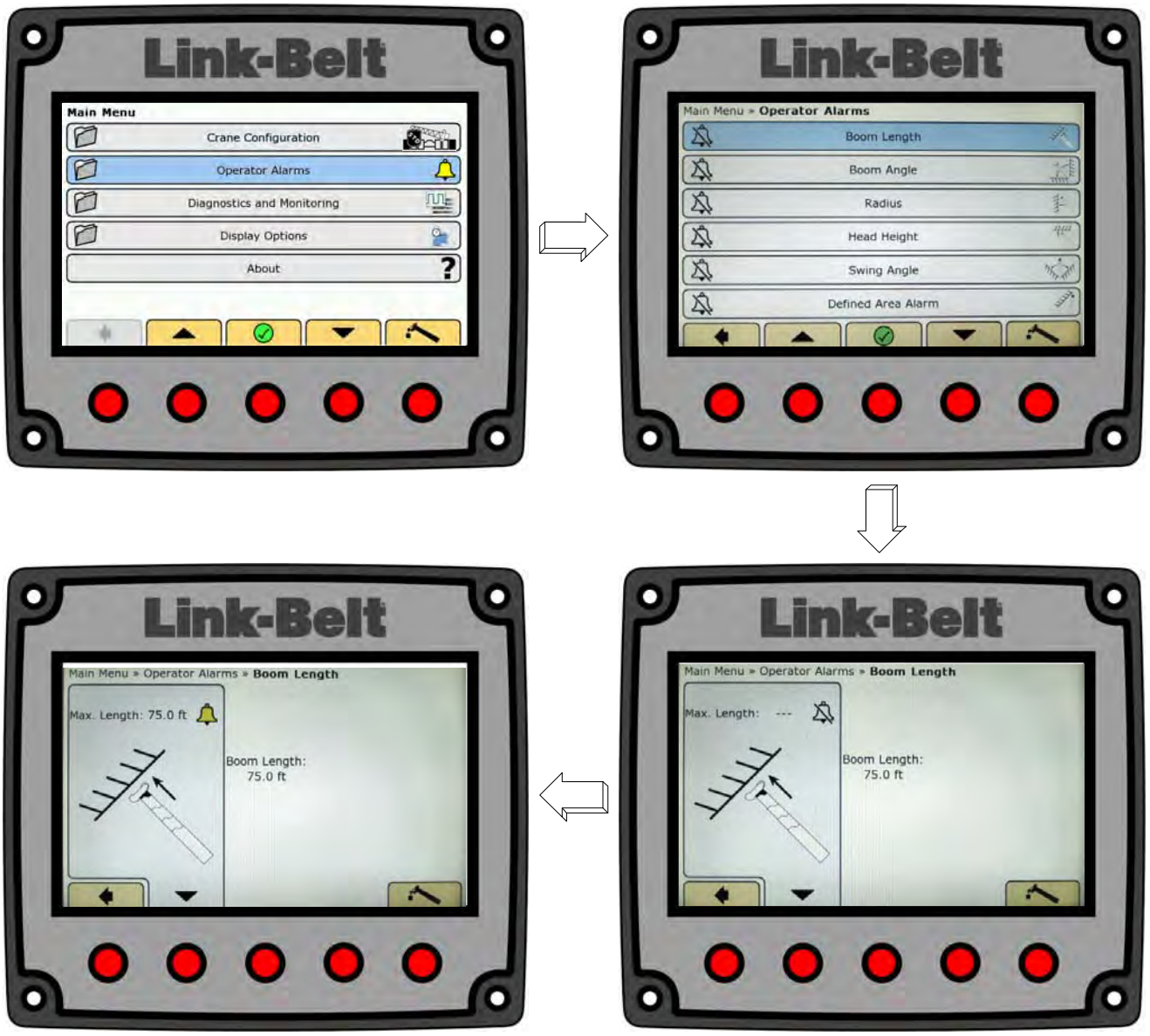


Figure 1—87
Boom Length Alarm

To Set Maximum Angle Alarm

Example: To have an alarm whenever the boom is above a 60 degree angle use the following procedure:

1. From the normal working screen, press the Main Menu button .
2. Scroll to Operator Alarms, and press the OK/Enter button .
3. Scroll to Boom Angle , and press the OK/Enter button .
4. Move the boom to a 60 degree angle.
5. Press the corresponding button for "Max. Angle" to set the alarm. The displayed value will be the alarm setting. The will appear to indicate that the alarm is set.
6. Press the back button to return to the Operator Alarms menu or press the Working Screen button again to return to the normal working screen.

7. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching 60 degree boom angle, the audio will sound intermittently and "Approaching Maximum Angle" will appear in the warning message area. The audible alarm will sound continuously whenever the boom is raised above 60 degrees and "Maximum Angle" will appear in warning message area.

To Set Maximum Length Alarm

Example: To have an alarm whenever the boom length exceeds 75 feet, use the following procedure:

1. From the normal working screen, press the Main Menu button .
2. Scroll to Operator Alarms, and press the OK/Enter button .
3. Scroll to Boom Length , and press the OK/Enter button .
4. Extend the boom so that the length is 75 feet.
5. Press the corresponding button for "Max. Length" to set the alarm. The displayed value will be the alarm setting. The will appear to indicate that the alarm is set.
6. Press the back button to return to the Operator Alarms menu or press the Working Screen button again to return to the normal working screen.
7. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching 75 foot boom length, the audio alarm will sound intermittently and "Approaching Maximum Length" will appear in the warning message area. The audible alarm will sound continuously whenever the boom length exceeds 75 feet and "Maximum Length" will appear in the warning message area.

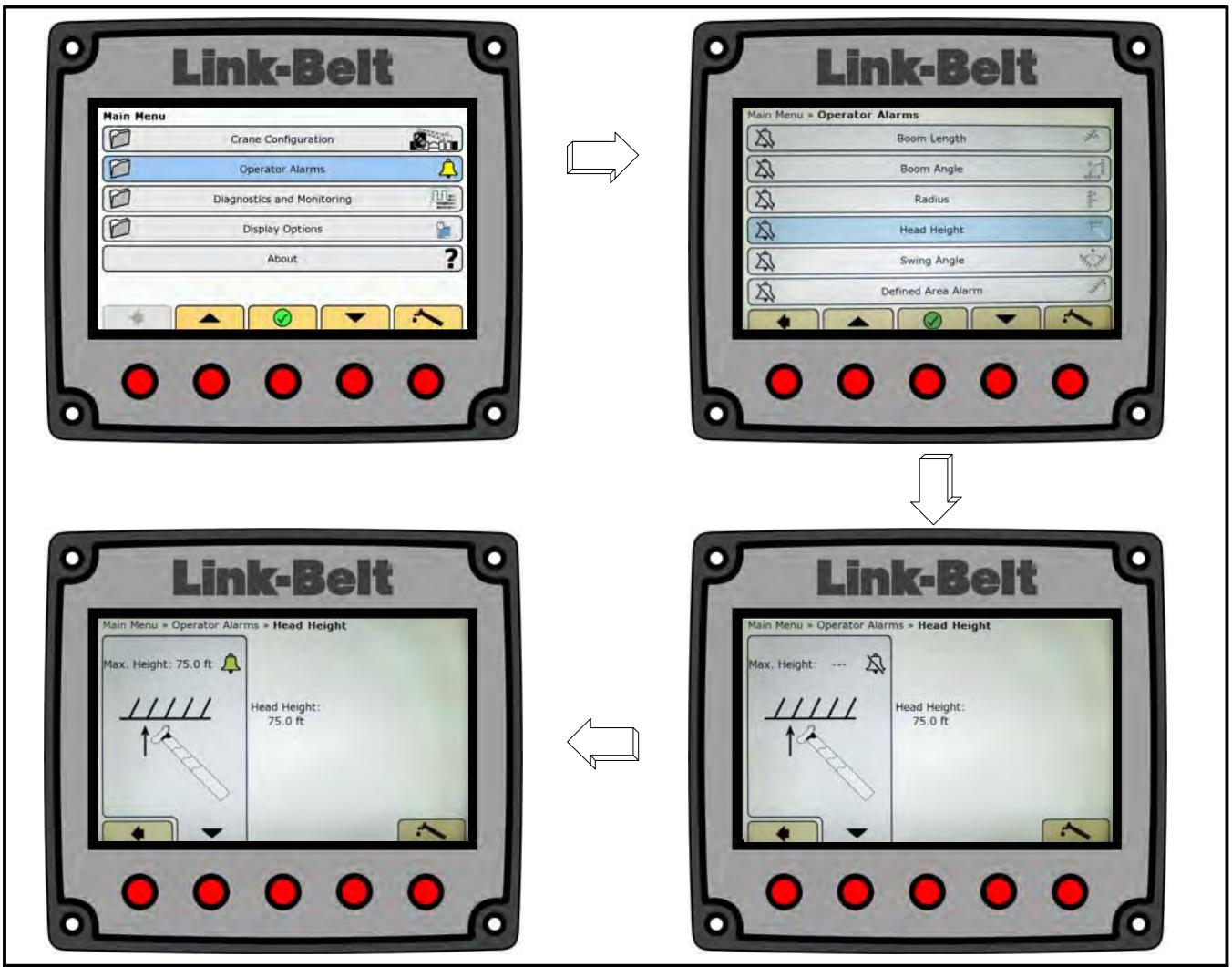


Figure 1—88
Boom Height Alarm

To Set Maximum Height Alarm

Note: The height measured here is from the carrier deck to the tip of the attachment.

Example: To have an alarm whenever the boom tip height exceeds 75 feet, use the following procedure:

1. From the normal working screen, press the Main Menu button .
2. Scroll to Operator Alarms, and press the OK/Enter button .
3. Scroll to Head Height , and press the OK/Enter button .
4. Extend the boom and/or adjust the boom angle so that the head height is 75 feet.
5. Press the corresponding button for "Max. Height" to set the alarm. The displayed value will be the alarm setting. The will appear to indicate that the alarm is set.
6. Press the back button to return to the Operator Alarms menu or press the Working Screen button again to return to the normal working screen.
7. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching 75 foot boom tip height, the audio alarm will sound intermittently and "Approaching Maximum Height" will appear in the warning message area. The audible alarm will sound continuously whenever the boom tip height exceeds 75 feet and "Maximum Height" will appear in the warning message area.

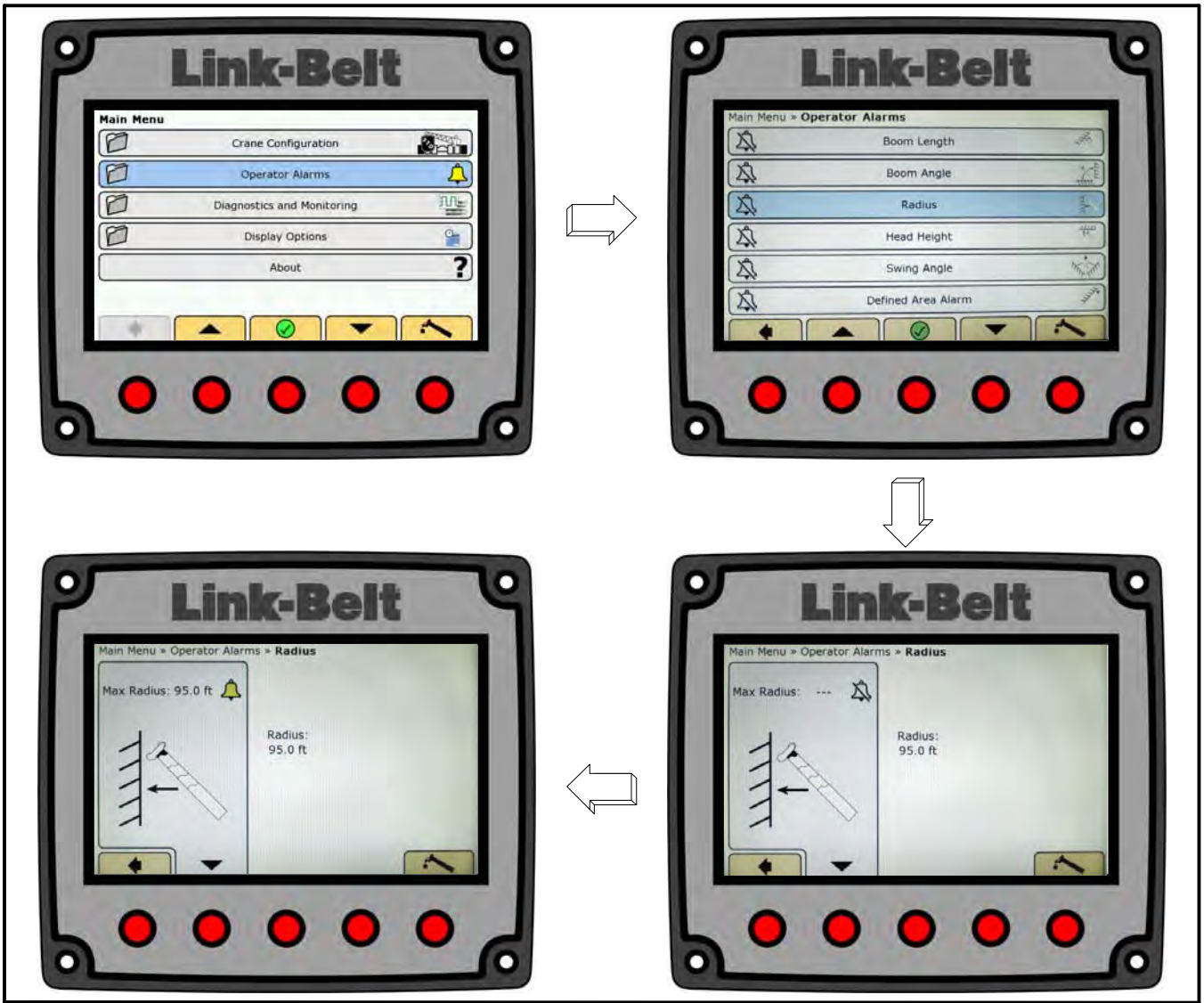


Figure 1—89
Load Radius Alarm

To Set Maximum Radius Alarm

Example: To have an alarm whenever the boom radius exceeds 95 feet, use the following procedure:

1. From the normal working screen, press the Main Menu button .
2. Scroll to Operator Alarms, and press the OK/Enter button .
3. Scroll to Radius , and press the OK/Enter button .
4. Extend the boom and/or adjust the boom angle so that the radius is 95 feet.
5. Press the corresponding button for "Max. Radius" to set the alarm. The displayed value will be the alarm setting. The will appear to indicate that the alarm is set.
6. Press the back button to return to the Operator Alarms menu or press the Working Screen button again to return to the normal working screen.
7. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching 95 foot boom radius, the audio will sound intermittently and "Approaching Maximum Radius" will appear in the warning message area. The audible alarm will sound continuously whenever the boom radius exceeds 95 feet and "Maximum Radius" will appear in warning message area.

Figure 1—90
Swing Alarm

To Set Left And Right Swing Alarms

Example: To have an alarm whenever the LEFT SWING AND RIGHT SWING exceed pre-determined alarm points, use the following procedure:

1. From the normal working screen, press the Main Menu button .
2. Scroll to Operator Alarms, and press the OK/Enter button . Refer to Figure 1-90.
3. Scroll to Swing Angle , and press the OK/Enter button .
4. Swing the boom to the left alarm point.
5. Press the corresponding button for "Left Angle" to enter the left alarm point. The displayed value will be the left alarm setting. The will appear to indicate that the angle is set.
6. Swing the boom to the right alarm point.
7. Press the corresponding button for "Right Angle" to enter the right alarm point. The displayed value will be the right alarm setting. The will appear to indicate that the angle is set.
8. When both angles are set, the will appear to indicate that the alarm is set.
9. Press the back button to return to the Operator Alarms menu or press the Working Screen button again to return to the normal working screen.
10. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching the set alarm point, the audio alarm will sound intermittently and "Approaching Swing Angle Limit" will appear in the warning message area. The audible alarm will sound continuously whenever the swing exceeds the alarm points and "Swing Angle Limit" will appear in warning message area.

    Note: Both the left and right swing alarms must be set for the system to determine the operator set working area.

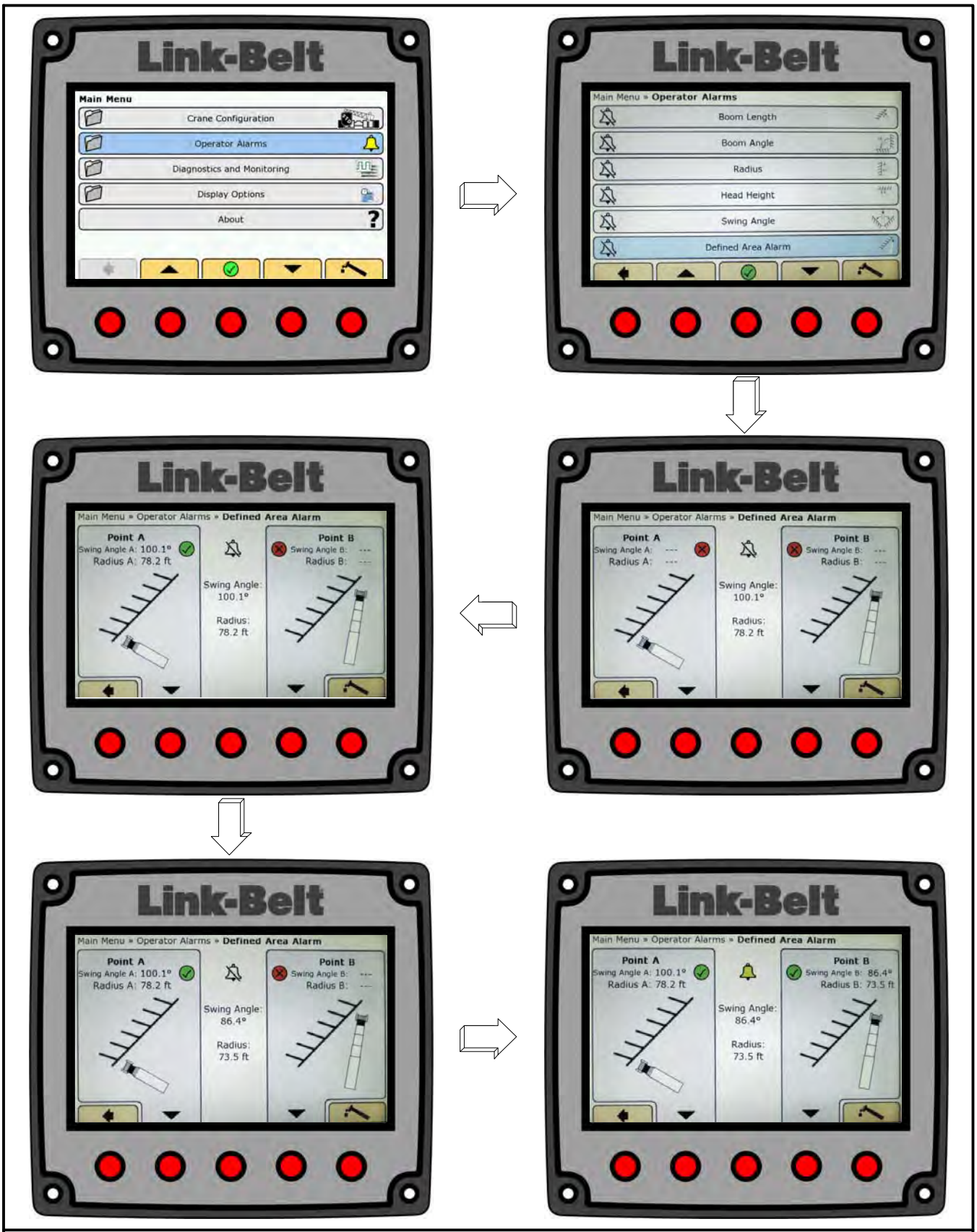


Figure 1—91
Operator Defined Area Alarm

Operator Defined Area Alarm

The operator defined area alarm, when set, will define an imaginary vertical plane between two set points to optimize the working area. When approaching the plane, the audio alarm will sound intermittently, and the message "Approaching Defined Area" will appear in the warning message area. When passing the plane, the audio alarm will sound continuously and the message "Defined Area" will appear on the warning message area. Use the following procedure, Figure 1-91, and Figure 1-92 to set the operator defined area alarm.

WARNING

The operator defined area alarm is a warning device. All functions remain operational when entering the operator defined bad area. For safe operation, adequate distance must be maintained to allow for operator reaction time to avoid entering the bad area. It is the responsibility of the operator to set points which ensure that the crane's boom, attachment, load, rigging, etc. maintains a safe working distance and complies with local safety regulations.

Setting Operator Defined Area Alarm

1. From the normal working screen, press the Main Menu button .
2. Scroll to Operator Alarms, and press the OK/Enter button .
3. Disable any previously set left and right swing alarms if required. Refer to "To Disable Operator Settable Alarms" in this Section of this Operator's Manual.

   Note: It is recommended to clear the left and right swing alarms prior to setting the defined area alarm.

4. Scroll to Define Area , and press the OK/Enter button .

WARNING

Avoid positioning the boom, attachment, load, rigging, etc. into the bad area when setting the left or right alarm points.

When selecting the left and right alarm points, ensure that the load will maintain a safe distance from the obstacle. Also ensure that the two points are set so that the tailswing of the crane will not enter the bad area.

5. Position the boom, attachment, load, rigging, etc. to the desired Point A and press the corresponding button for "Point A" to set the first point. The displayed values for swing angle and radius will be the set point. The will appear to indicate that Point A is set.
6. Position the boom, attachment, load, rigging, etc. to the desired Point B and press the corresponding button for "Point B" to set the second point. The displayed values for swing angle and radius will be the set point. The will appear to indicate that Point B is set.

   Note: For best results, the two points should be separated by a minimum of 10 ft (*3m*) or 30 degrees.

7. When both angles are set, press the back button to return to the Operator Alarm menu or press the Working Screen button again to return to the normal working screen.
8. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching the plane, the audio alarm will sound intermittently and the message "Bad Working Area" will appear on the warning message area. When passing the plane, the audio alarm will sound continuously and the message "Bad Working Area" will appear on the warning message area.

WARNING

If crane or obstacle is moved or if a different size load is lifted, the area alarm must be reset.

To Disable Operator Settable Alarms

1. From the normal working screen, press the Main Menu button .
2. Scroll to Operator Alarms, and press the OK/Enter button .
3. Scroll to the desired alarm to be disabled, and press the OK/Enter button .
4. Press the corresponding button for each alarm. The icon indicates the alarm has been cleared.
5. When all desired alarms are disabled, press the back button to return to the Operator Alarm menu or press the Working Screen button again to return to the normal working screen.

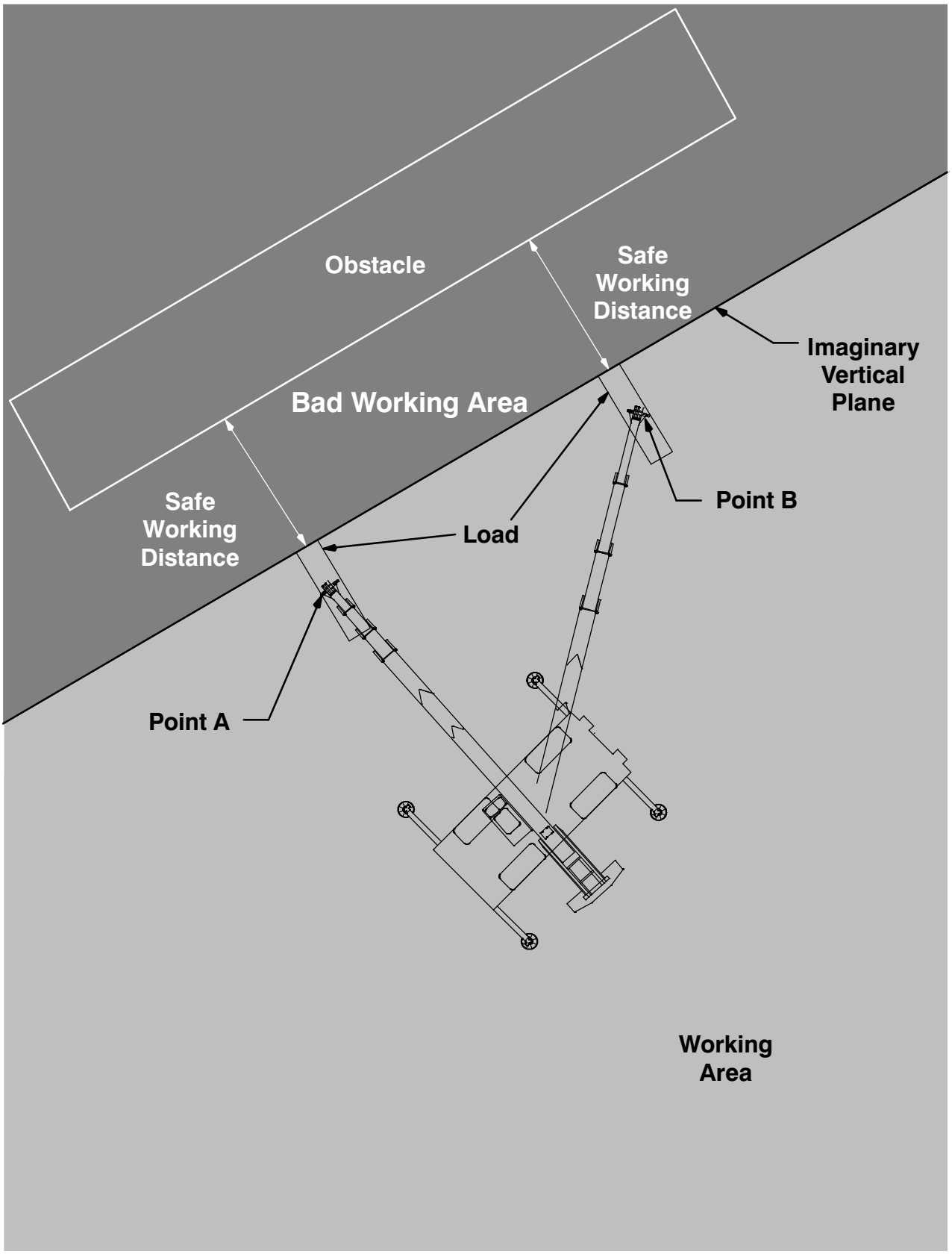


Figure 1—92
Operator Defined Area Alarm

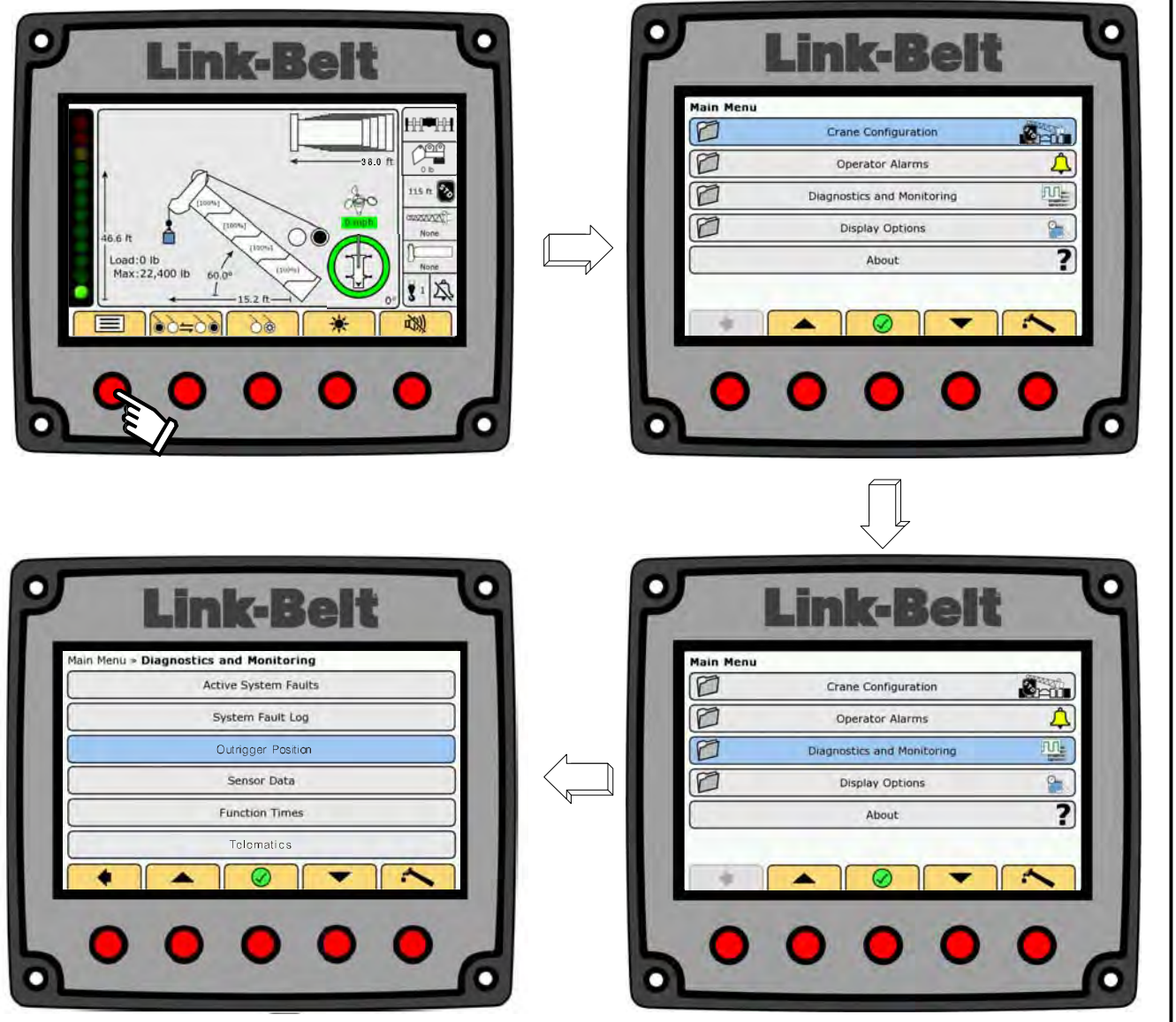


Figure 1—93
Outrigger Position Screen Access

Outrigger Position Screen

The calibrated position of each outrigger beam will be graphically displayed on the screen. Also the outrigger beam length will be displayed from the centerline of the crane. Refer to Figure 1-93 and Figure 1-94.

1. From the normal working screen, press the Main Menu button .
2. Scroll to Diagnostics, and press the OK/Enter button .
3. Scroll to Outrigger Position and press the OK/Enter button .

WARNING

The outrigger position screen is used to display outrigger beam position. Properly extend the outrigger beams using the outrigger extend position lever/pin to ensure correct outrigger beam position. Failure to do so may cause a loss of stability and possible serious personal injury and/or major crane damage.

!!THIS SCREEN IS AN OPERATOR'S AID — NOT A SAFETY DEVICE!!

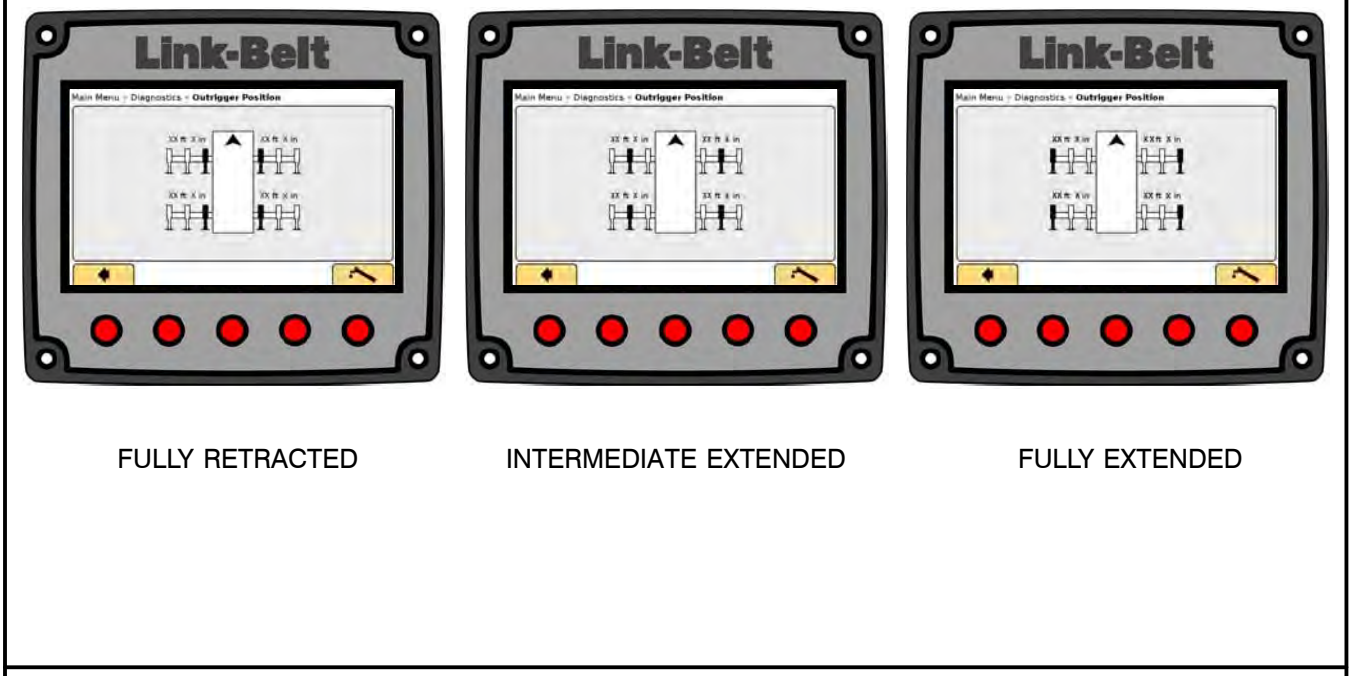


Figure 1—94
Outrigger Position Screen

4. Outrigger position and length of each beam, from crane centerline to pontoon centerline, will be displayed.
5. Press the Working Screen Button to return to the normal working screen.

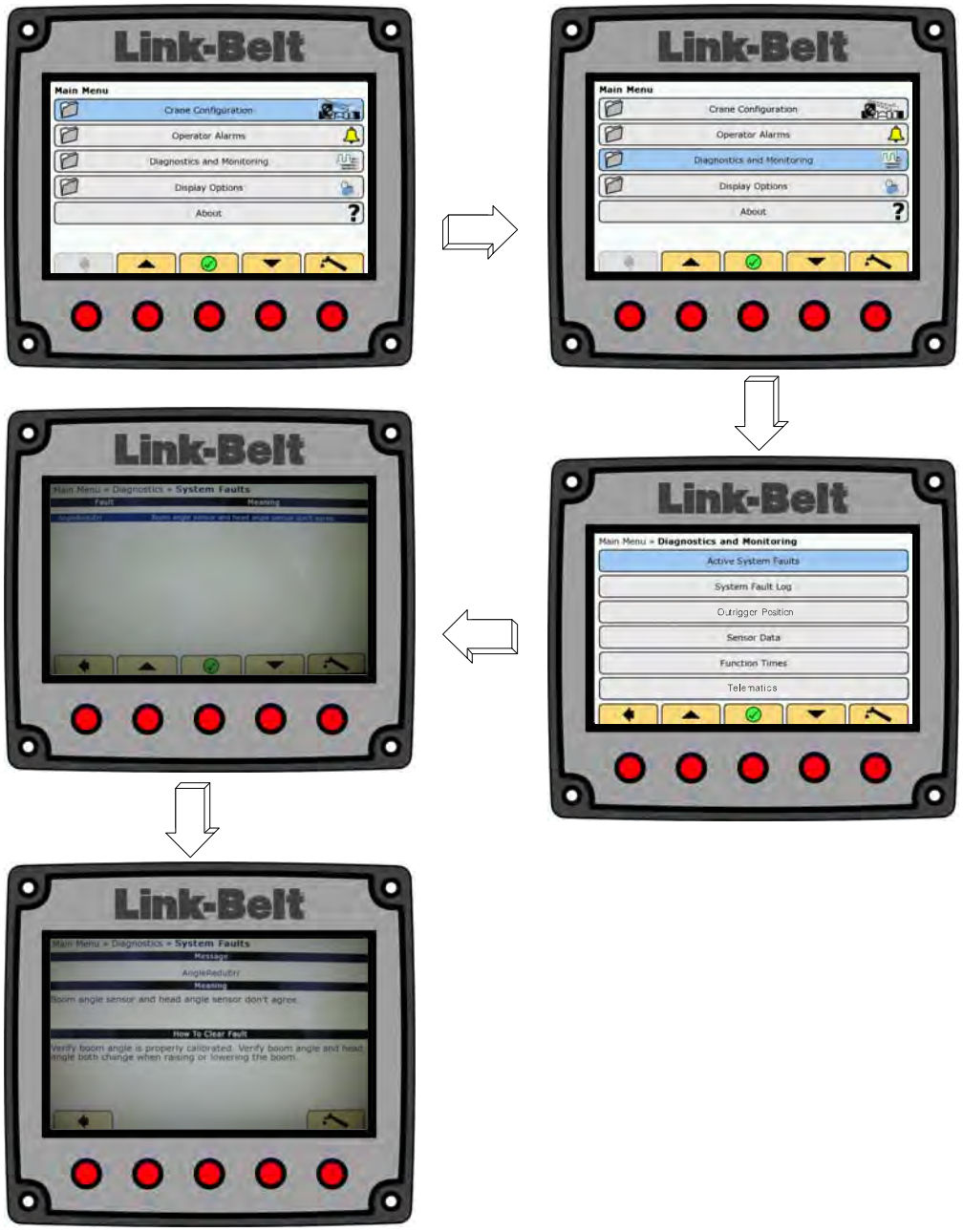


Figure 1—95
Active System Faults

Active System Faults

The Active System Faults menu displays current system faults. Refer to Figure 1-95 and the System Faults Messages chart.

1. From the normal working screen, press the Main Menu button .
2. Scroll to Diagnostics, and press the OK/Enter button .
3. Scroll to Active System Faults, and press the OK/Enter button .
4. Scroll to the fault code to be addressed, and press the OK/Enter button .
5. The message selected, meaning of the message, and how to clear the message will be displayed.
6. Press the back button to return to the System Faults menu or press the Working Screen button to return to the normal working screen.

Active System Faults Messages		
Message	**Meaning**	**How To Clear Message**
DispComErr	Display communication lost.	Verify display is properly connected to the CAN bus. Check all CAN bus wiring including termination resistors.
ATBComErr	ATB switch communication lost.	Verify boom reel is properly connected to the CAN bus. Check all CAN bus wiring including termination resistors.
ATBShort	ATB switch short circuit.	Verify ATB switch is functioning properly. Check wiring between ATB switch and boom reel.
LenComErr	Boom length sensor communication lost.	Verify boom reel is properly connected to the CAN bus. Check all CAN bus wiring including termination resistors.
LenDataErr	Boom length sensor data is invalid.	Verify boom length is properly calibrated. Verify boom length value changes when extending or retracting the boom.
LenReduErr	Boom length sensor and boom controller length don't agree.	Verify boom length and boom controller are properly calibrated. Verify sensor boom length and boom controller length both change when extending or retracting the boom.
AngleComErr	Boom angle sensor communication lost.	Verify boom reel is properly connected to the CAN bus. Check all CAN bus wiring including termination resistors.
AngleDataErr	Boom angle sensor data is invalid.	Verify boom angle is properly calibrated. Verify boom angle value changes when raising or lowering the boom.
AngleReduErr	Boom angle sensor and head angle sensor don't agree.	Verify boom angle is properly calibrated. Verify boom angle and head angle both change when raising or lowering the boom.
HeadComErr	Head angle sensor communication lost.	Verify boom reel is properly connected to the CAN bus. Check all CAN bus wiring including termination resistors.
HeadDataErr	Head angle sensor data is invalid.	Verify head angle is properly calibrated. Check wiring between head angle sensor and boom reel. Verify head angle changes when raising or lowering the boom.
HPresComErr	Head pressure sensor communication lost.	Verify head pressure sensor is properly connected to the CAN bus. Check all CAN bus wiring including termination resistors.
RPresComErr	Rod pressure sensor communication lost.	Verify rod pressure sensor is properly connected to the CAN bus. Check all CAN bus wiring including termination resistors.
DispIOComErr	Display I/O communication lost.	Verify display is properly connected to the CAN bus. Check all CAN bus wiring including termination resistors.
BoomComErr	Boom controller communication lost.	Verify boom controller is properly connected to the CAN bus. Check all CAN bus wiring including termination resistors.
Telematic-sModComErr	Telematics module communication lost.	Verify telematics module is properly connected to the CAN bus. Check all CAN bus wiring including termination resistors.

Figure 1–96
Sensor Data Screen

Sensor Data

The Sensor Data menu displays data being read by various sensors on the crane. Refer to Figure 1-96.

1. From the normal working screen, press the Main Menu button .
2. Scroll to Diagnostics, and press the OK/Enter button .
3. Scroll to Sensor Data, and press the OK/Enter button .
4. The data being generated by the various sensors will be displayed.
5. Press the back button to return to the Diagnostics menu or press the Working Screen button to return to the normal working screen.

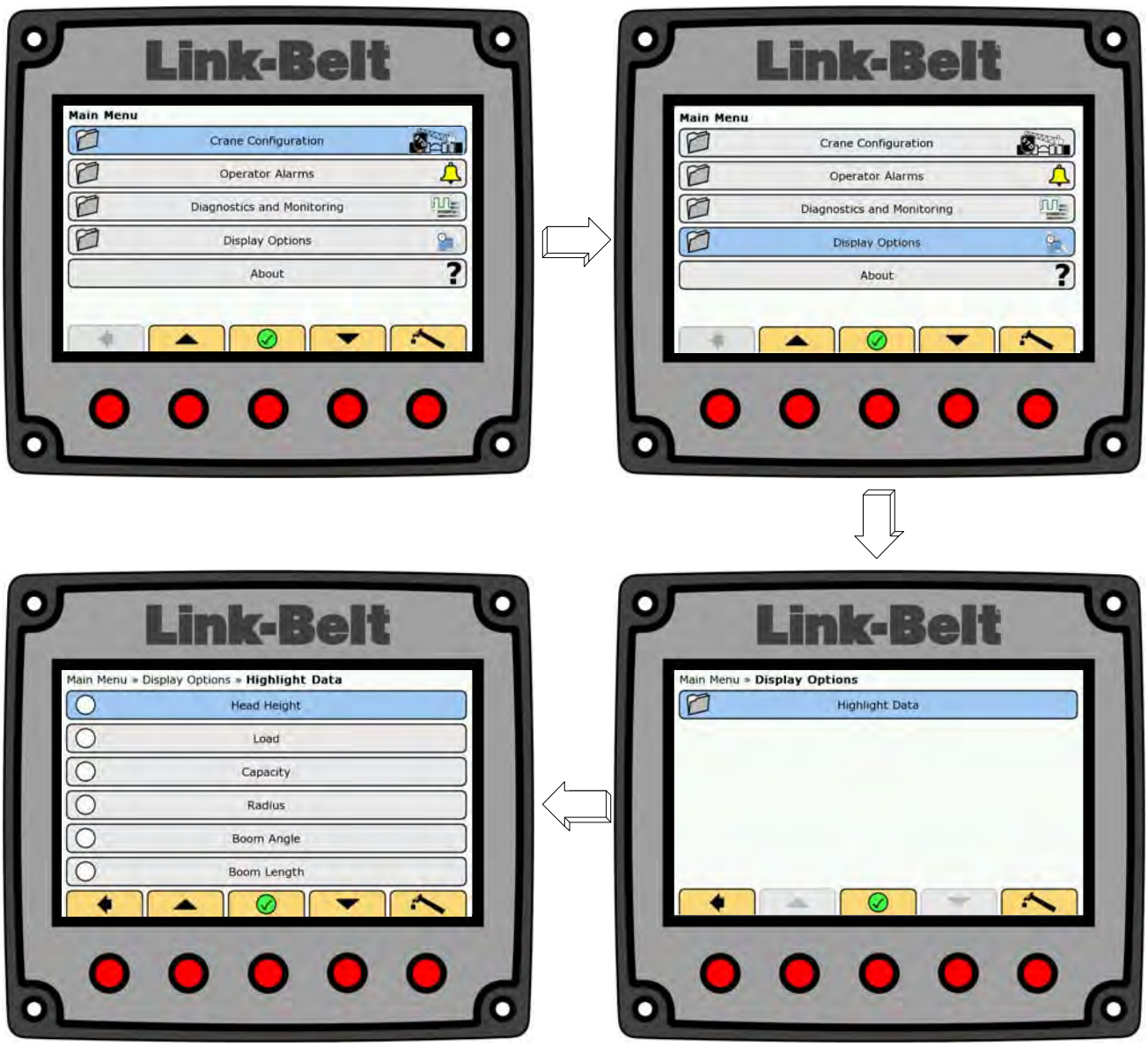


Figure 1—97
Highlight Data

Highlight Data Menu

The Highlight Data menu allows the Operator to select specific data to be highlighted on the normal working screen. The data will appear with a purple highlighting. Refer to Figure 1-97.

1. From the normal working screen, press the Main Menu button .
2. Scroll to Crane Configuration, and press the OK/Enter button .
3. Scroll to Display Options, and press the OK/Enter button .
4. Scroll to Highlight, and press the OK/Enter button .
5. Scroll to the information to be highlighted, and press the OK/Enter button .
6. Repeat Step 5 for each item to be highlighted.
7. Press the back button to return to the Display Options menu or press the Working Screen button to return to the normal working screen.

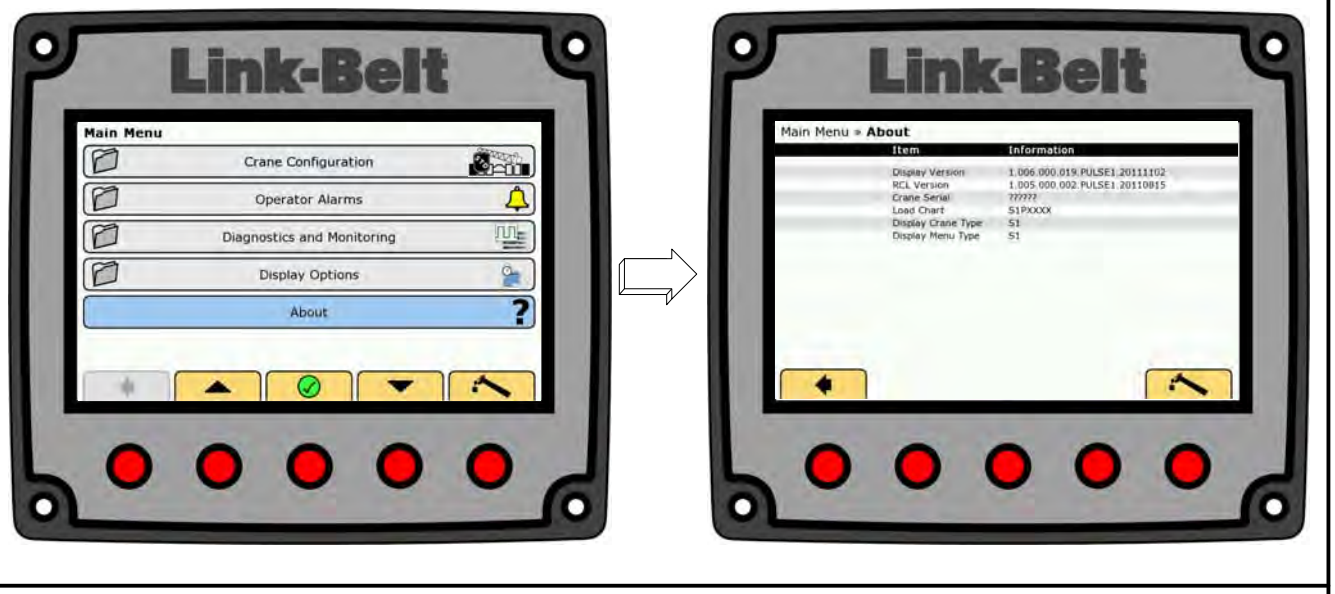


Figure 1—98
About Screen

About Menu

The About menu displays which version of the Display, ECM, and Boom Controller software is currently installed. Refer to Figure 1-98. The crane serial number is also displayed on this screen.

1. From the normal working screen, press the Main Menu button .
2. Scroll to About, and press the OK/Enter button .
3. Press the back button to return to the Main menu or press the Working Screen button to return to the normal working screen.

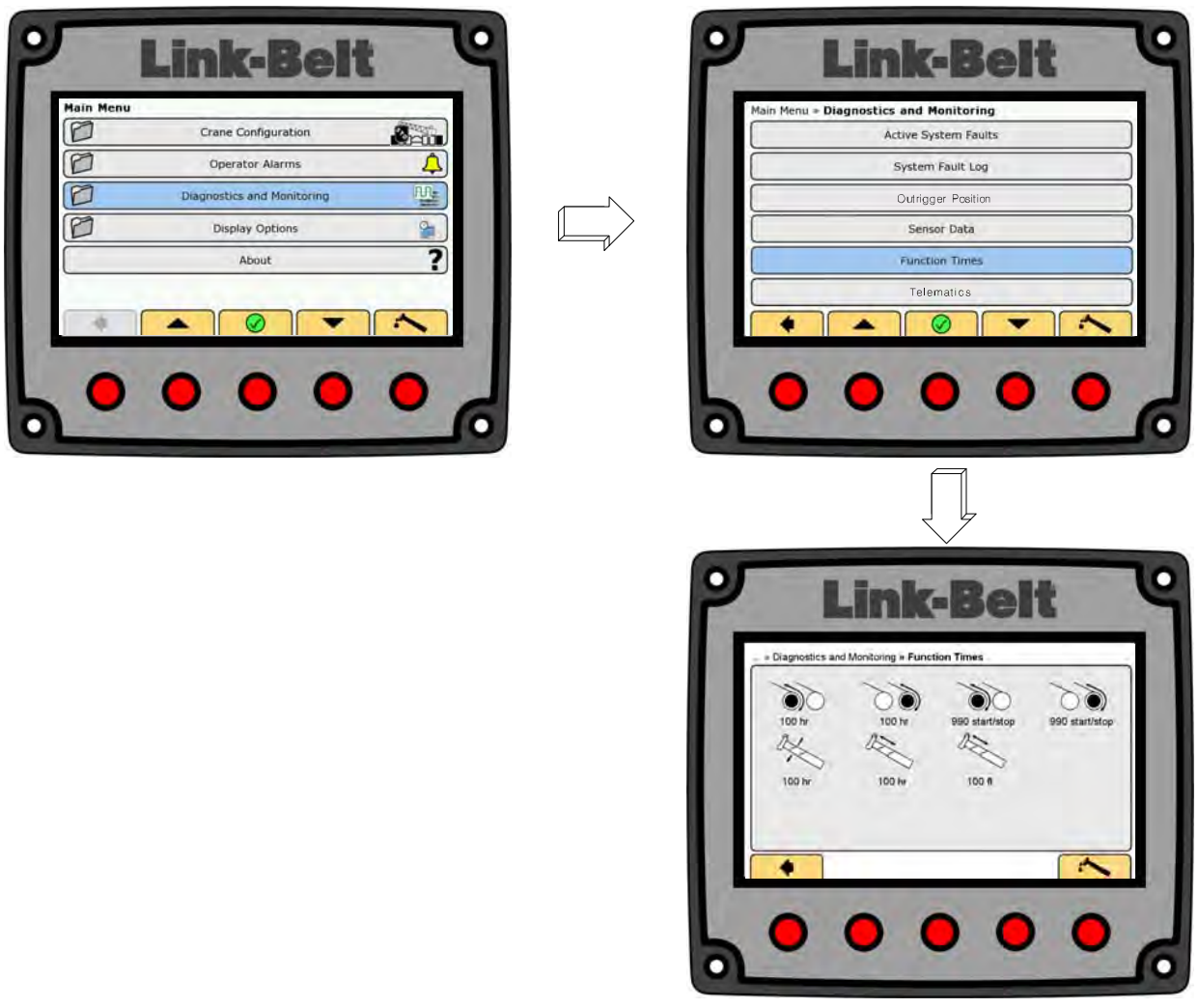


Figure 1—99
Function Time

Function Time Monitoring

The function time monitoring screen enables the operator to monitor the hours of use for the winch(s), boom hoist cylinder, and boom telescope cylinder for service purposes. The screen also displays the number of times the winch(s) has been started and stopped along with the total cumulative distance the boom has been extended and retracted.

1. From the normal working screen, press the Main Menu button .
2. Scroll to Diagnostics and Monitoring, and press the OK/Enter button .
3. Scroll to Function Time, and press the OK/Enter button . Refer to Figure 1-99.
4. From this screen, monitoring of the winch(s), boom hoist cylinder, and boom telescope cylinder can be done.
5. Press the back button to return to the Diagnostics and Monitoring menu or press the Working Screen button to return to the normal working screen.

Telematics

TELEMATICS - refers to the use of wireless devices and computer module technologies to transmit data in real time back to an organization.

This Link-Belt crane is equipped with one or more onboard computers that monitor and/or control the crane's performance. Crane owners may access electronic data by subscribing to the optional telematics feature offered by our telematics partner.

Specific electronic data transmitted by the onboard computers may be, but is not limited to, water temperature, oil temperature, engine rpm, fuel consumption, crane location, and other data that may be transmitted via satellite to our telematics partner. A crane owner may access this data by subscribing to the telematics feature through our telematics partner. A crane owner may then use some or all of the data transmitted from the crane's onboard computers to monitor the crane's activity, location, maintenance/service schedule, and/or other areas to assist them in managing this crane.

Note: Link-Belt recognizes that each individual crane's data transmitted via telematics is the property of the crane owner.

Data sharing is offered by Link-Belt through our telematics partner in an effort to provide Link-Belt distributors and our crane owners with overall enhanced product support through filed troubleshooting, expedited parts procurement, infield repairs and other various support outlets. Any data shared by the crane owner is a "snapshot" of the data from the crane.

Link-Belt may request the crane owner "share data". The crane owner should determine who and when specific data related to their crane is shared. Link-Belt and its representatives may be in possession of specific crane data only when the crane owner selects "share data".

Shared data received by Link-Belt is not intended to be "stored" in any permanent data file at our factory. Shared data may exist at the factory location through the normal course of business until deleted by automatic expiration.

Link-Belt reserves the right to modify this policy as required and make every reasonable attempt to notify telematics subscribers of changes to this policy.

Transmitting Data

1. From the normal working screen, press the Main Menu button .
2. Scroll to Diagnostics and Monitoring, and press the OK/Enter button .
3. Scroll to Telematics, and press the OK/Enter button . Refer to Figure 1-100.
4. Scroll to the data that you would like to send, and press the OK/Enter button .
5. A confirmation screen will pop up. Press to send the data or press to cancel and return to the previous screen.
6. A will be shown beside the data selected while the data is being sent. The Telematics Module will send data every 10 seconds for 10 minutes or until ignition is turned off.
7. Press the back button to return to the Diagnostics and Monitoring menu or press the Working Screen button to return to the normal working screen.

Computer Return And Stored Data Disclosure

In the event the Rated Capacity Limiter (RCL), Load Moment Indicator (LMI), or other computer containing recorded/stored data on this crane is returned to Link-Belt Construction Equipment Company (LBCE) or the original equipment manufacturer (OEM) of an onboard computer, for service or replacement, the crane owner must submit a written request to have the recorded/stored data on that computer downloaded to an electronic device that is to be returned to the crane owner before any examination and/or work is started on that specific computer.

Should LBCE direct the crane owner to return an onboard computer to the OEM of that computer, LBCE recommends the crane owner submit a written request to the OEM requesting the OEM download the recorded/stored data to an electronic device and return that device to the crane owner prior to any examination and/or work being started on that specific computer.

In some instances, in order to read data recorded/stored in an onboard computer special equipment is required, and access to the crane and/or the computer is needed. Link-Belt or the OEM of the computer has the special equipment necessary to retrieve the recorded data, or directions on how the data may be retrieved. Please contact your nearest Link-Belt distributor for assistance.

It is the position of Link-Belt that the crane owner owns any data that is recorded and stored in the onboard computer system(s) installed on our cranes.

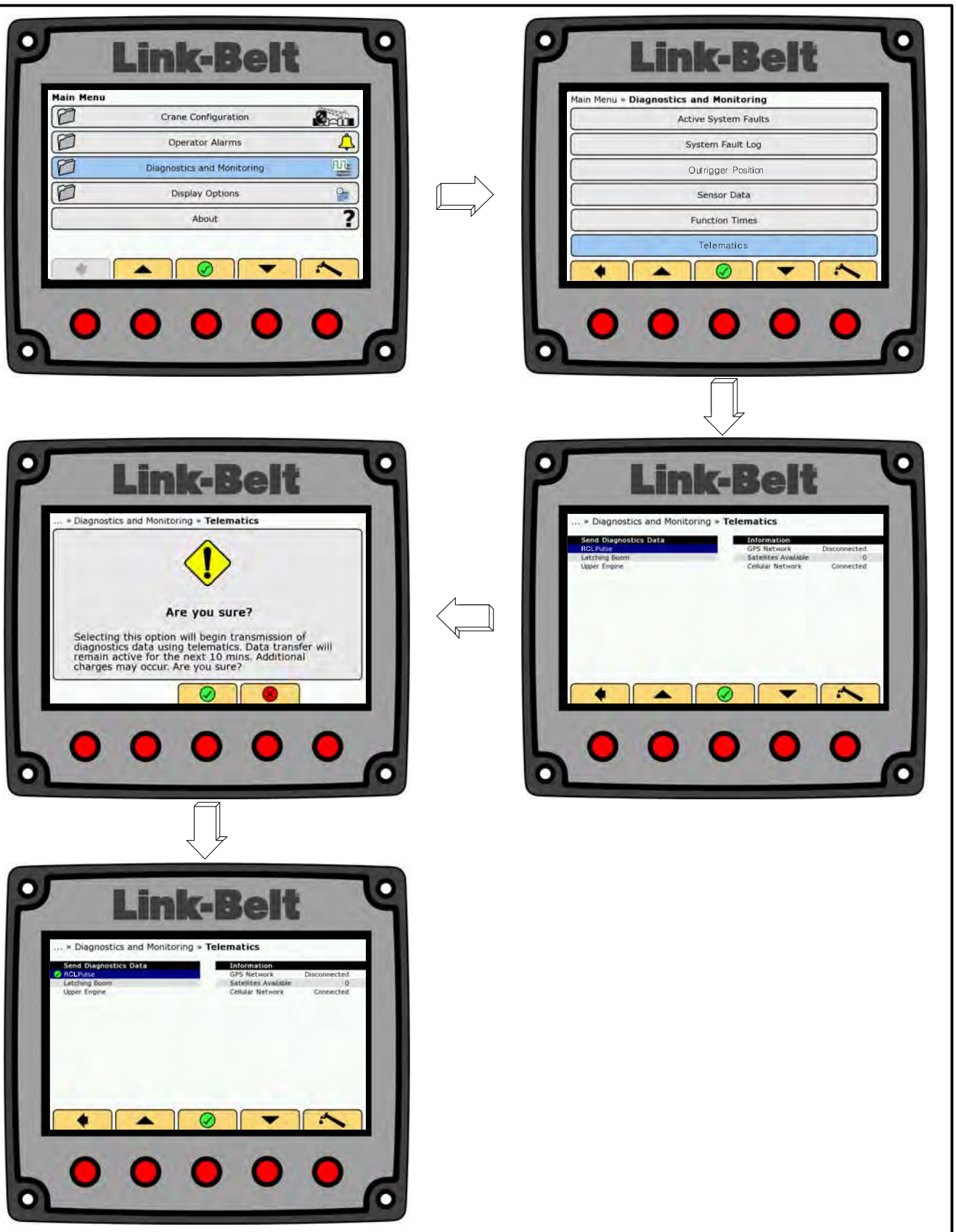
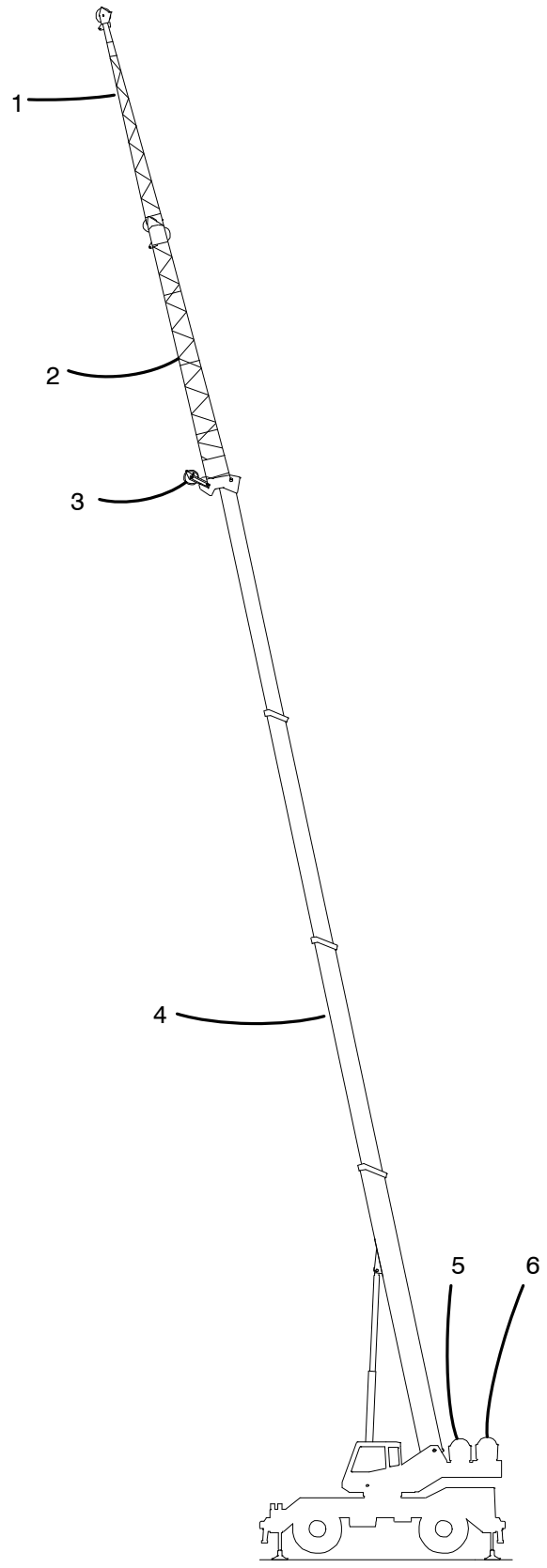
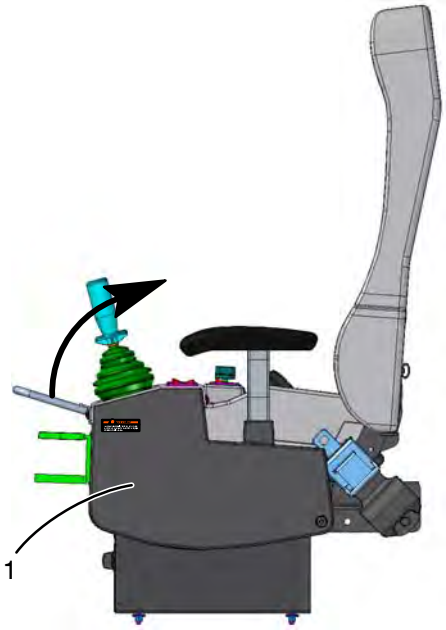


Figure 1—100
Telematics



1. Offset Lattice Fly Tip Section
2. Offset Lattice Fly Base Section
3. Auxiliary Lifting Sheave
4. Four Section Boom
5. Front (Auxiliary) Winch
6. Rear (Main) Winch

Figure 1—101
Typical Crane Attachment Setup (Provided for correct identification of attachments)



WARNING

To prevent personal injury do not attempt to enter the operator's cab prior to raising the left console stand.

1. Left Side Console
2. Function Lockout Switch

Figure 1—102
Movable Left Side Console And Function Lockout Switch

Entering And Exiting The Operator's Cab

Entering or exiting the operator's cab could be hazardous if certain aspects are not taken into consideration. The elevation of the carrier deck and operator's cab alone could cause serious injury if someone was to fall. For this reason ladders are mounted on each side of the carrier to provide easy access to the carrier deck and the operator's cab. Numerous hand grips are also attached to the operator's cab as well as non-skid safety strips on the surface of the carrier deck, to provide safe entry to the operator's cab. Use these features to make climbing on the crane as safe as possible. Remain in three point contact with the crane at all times (two hands and one foot or two feet and one hand).

Function Lockout Switch

This switch is used to disable the hydraulic functions which are operated by the control levers and boom telescope foot pedal. The switch is on the right side control console. Refer to Figure 1-102. Press the left part of the switch to disable hydraulic functions and to prevent inadvertent operation of these controls. To allow normal operation of the control levers and boom telescope foot pedal, press the right part of the function lockout switch. The right part of the switch will illuminate to indicate the switch is in the "OPERATION" position. This switch must always be in the "DISABLE" position before entering or exiting the operator's seat.

Movable Left Side Console

The left side console is hinged at the rear to allow the operator to lift the console up, out of the way while entering or exiting the operator's cab. A spring assists lifting the console.

Lifting the left side console also performs the same duty as the function lockout switch, disabling all hydraulic functions related to the control levers and boom telescope foot pedal. Lifting the left side console also automatically applies the swing park brake. Ensure the left side console is lifted up, out of the way before attempting to enter or exit the operator's cab.

One more feature which is available to ease entry and exit of the operator's cab, is the adjustable operator's seat. Lift the left arm rest up out of the way and move the seat and/or console back as required to allow safe entry. This feature also provides operator comfort during crane operation as well. Refer to "Operator's Seat" in this Section of this Operator's Manual for complete seat operating instructions.

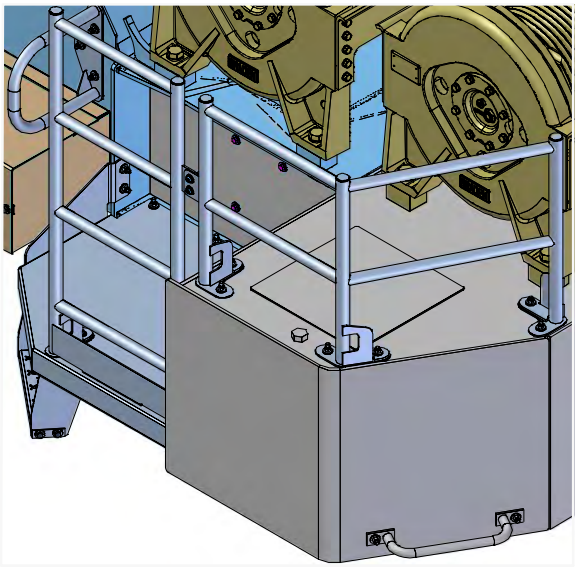


Figure 1—103
Upper Guard Rails (If Equipped)

Upper Guard Rails (If Equipped)

If equipped, the crane will have guard rails on the upper to make access to upper components safer when servicing the crane. Refer to Figure 1-103.

Break-In Period

Operate a new crane at half throttle for the first twenty (20) hours of operation. A break-in period under moderate loads will assist in providing long, trouble-free performance.

Before Starting Operations

Before starting daily operations, make the following checks and inspections:

Engine

Check fuel, oil, and cooling systems for proper fluid levels. Check for leaks. Repair or fill as required. Refer to engine manufacturer's manual for additional details.

Gear Cases

Visually inspect all gear cases for leaks or damage. If leaks or damage exists, repair and fill case to proper lubrication level. Refer to Section 2 of this Operator's Manual for additional information.

Hydraulic System

Check all hoses for chafing, bulging, or other damage. Replace as necessary. Inspect hydraulic system for external leaks. Repair as needed. Check hydraulic reservoir oil level. Add oil if necessary.

Lubrication

Lubricate the crane as outlined in Section 2 of this Operator's Manual.

Note: Operators may have nothing to do with lubrication or maintenance of the crane, but it could be advantageous for them to be familiar with it. Knowledge of preventive maintenance makes the operator more aware of malfunctions in the crane so repairs can be made with a minimum of downtime.

Tires And Wheels

Check tire inflation. Inflate to pressures per the "Tire Inflation Label" on the crane or on the "Tire Inflation Chart" in the Crane Rating Manual. Check wheel lug nut torque, each day, for the first five (5) days of operation and every 100 hours of operation thereafter. Refer to Section 3 of this Operator's Manual for additional information.

Wire Rope And Sheaves

Inspect all wire rope and sheaves for damage or deterioration. Replace as necessary. Refer to Section 5 in this Operator's Manual for additional information. Lubricate the wire rope and sheaves as required. Refer to Section 2 of this Operator's Manual for additional information.

General Inspection

Visually inspect the entire crane for loose or missing cotter pins or bolts, or damaged fly chords or lattices. Check for oil or fluid leaks. Make repairs as needed.

Electrical System

Check the operation of all lights, windshield wipers, horns, turn signals, etc. Repair as needed.

Brakes

Start the engine and allow the hydraulic system pressure to reach its normal operating range. Check that the service brake indicator light is not lit. Check the park brake and service brake operations. Adjust or repair as needed.

Controls

Check all controls for proper operation and adjustment. Repair as needed.

Fire Extinguisher

A fire extinguisher is mounted in the operator's cab under the left console. Refer to Figure 1-55 . Raise the left console to gain access to the extinguisher. It is an A B C type fire extinguisher, meaning it is capable of extinguishing most types of fires. The operator should be familiar with its location, the clamp mechanism used to secure it in place, and foremost the operation of the device. Specific instructions, regarding operation, are given on the label attached on the fire extinguisher. A charge indicator on the fire extinguisher monitors the pressure within the tank. Check the indicator daily to ensure the fire extinguisher is adequately charged and ready for use.

Engine Starting Procedure

WARNING

This Operator's Manual must be thoroughly read and understood by the operator before starting the engine. Major crane damage and/or serious personal injury could result from improper operating procedures.

WARNING

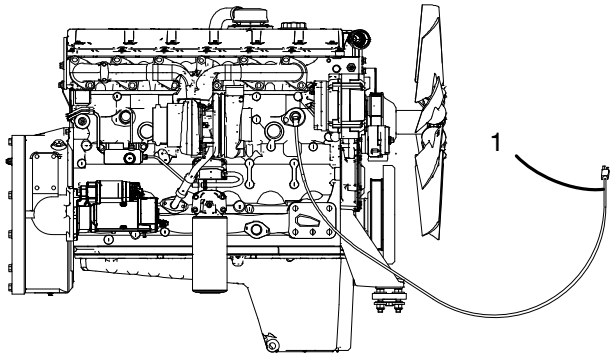
Diesel exhaust fumes can be harmful. Start and operate engine in a well ventilated area. If it is necessary to operate in an enclosed area, vent the exhaust to the outside. Properly maintain the exhaust system to its original design.

Before attempting to start the engine, the operator should carefully read and understand the engine starting instructions in the engine manufacturer's manual and this Operator's Manual. Attempting to start or run the engine before studying these instructions may result in engine damage. The operator should learn and obey all applicable "Rules of the Road" and if not already a competent driver, obtain instructions to attain these necessary skills. With the crane fully serviced and the operator familiar with all gauges, switches, and controls and having read and fully understood this entire Operator's Manual and the engine manufacturer's manual, start the engine using the following procedures:

1. Walk around the crane to verify that there are no persons under, or in close proximity to the crane.
2. Engage the park brake.
3. Shift the transmission to neutral. (Engine will not start unless the transmission is in neutral.)
4. Sound the horn twice in succession, wait 10-15 seconds while making a visual check to verify that there are no persons under or in close proximity to the crane.
5. Turn the ignition switch to the on position to energize the engine electrical system.
6. Turn the ignition switch to the start position. Release the ignition switch immediately after the engine starts. If the engine fails to start in 30 seconds, release the ignition switch and allow the starter motor to cool a few minutes before trying to start again. If the engine fails to start after four attempts, refer to the engine manufacturer's manual for instructions.
7. Warm Up - Run the engine at low throttle with no load while engine is warming up. Observe the following instruments for proper indications.
   a. Engine Oil Pressure - If there is no oil pressure after the engine runs 10-15 seconds, shutdown the engine immediately and repair the problem to avoid major engine damage. Refer to engine manufacturer's manual for proper oil pressure operating range.
   b. Battery Gauge - Observe gauge to ensure battery and electrical system is working properly. The gauge should indicate 12.5 to 14.0 volts while engine is running. (It should read 12.0 volts when the ignition switch is on, without the engine running.)
8. When the engine has thoroughly warmed up, after all pressures and temperatures are within operating ranges, and all daily checks have been made, the crane is ready for operation.

Engine Shutdown Procedure

1. Lower any load to the ground and secure it properly.
2. Engage the travel swing lock and apply the swing park brake.
3. Throttle the engine back to idle.
4. Turn the ignition switch to the "OFF" position.
5. Remove the ignition keys from the operator's cab and lock the doors if the crane is to be left unattended.



1. Preheater Power Cord

Figure 1–104
Electric Engine Block Preheater

Electric Engine Block Preheater

The electric engine block preheater uses electrical power to heat the coolant and circulate it through the engine during cold ambient conditions. The electric engine block preheater power cord is on the right side of the engine. Refer to Figure 1-104.

To Start The Electric Engine Block Preheater

1. Park crane in suitable area for storage, engage the park brake, shift the transmission to neutral, and shutdown the engine.
2. Plug preheater power cord into 110V to120V electrical source.

⚠ WARNING

Areas adjacent to the preheater must be clean and free of oil and debris to avoid possible fire hazard.

Note: Unplug the engine block preheater before starting the engine.

To Stop Electric Engine Block Heater

1. Unplug preheater power cord from electrical source.
2. Store the power cord.

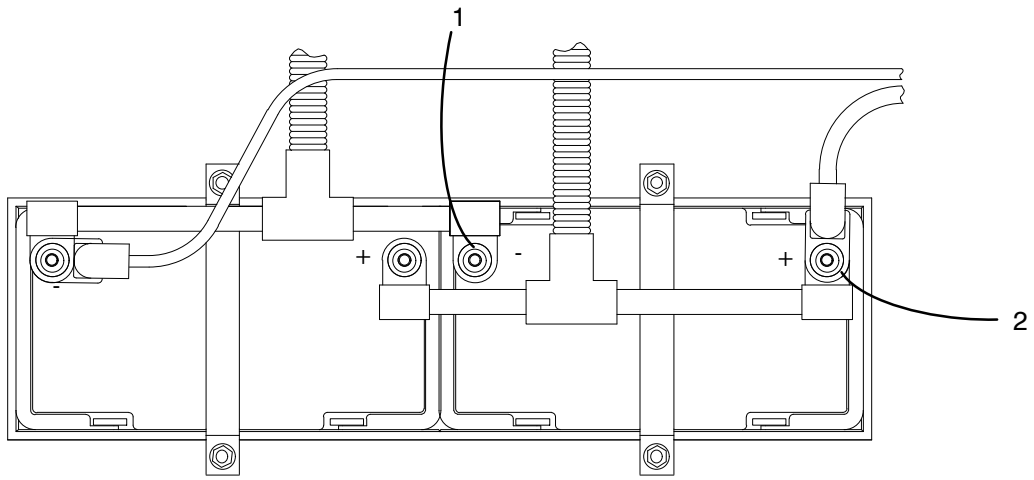
Figure 1–105
Starting Fluid Warning Label

Cold Engine Starting

⚠ DANGER

Do not use starting fluids to aid in engine start up. This engine is equipped with a glow plug type cold starting aid and use of a starting fluid can cause an explosion resulting in serious personal injury or death.

To help ignition in cold ambient conditions, glow plugs are used to warm the cylinders prior to starting the engine. This improves combustion efficiency which aids in starting a cold engine. With the ignition switch in the ON position, the ECM senses ambient air temperature then determines if the glow plugs must be energized to warm the cylinders. A "Wait To Start" indicator light will illuminate to alert the operator not to crank the engine because the combustion chamber is too cold for fuel ignition. Refer to Figure 1-39 for location of the indicator light. When the cylinders are warm enough to ignite the first charges of fuel, the indicator light will go out and the engine can be started.



1. Negative Terminal
2. Positive Terminal

Figure 1—106
Battery Cable Connections

Jump Starting The Crane

The crane has two (2) 12V batteries in the battery box at the rear of the crane.

WARNING

To avoid serious personal injury and/or major equipment damage, follow these procedures in the order they are given.

WARNING

Battery posts, terminals, and related accessories contain lead and lead compounds. Wash hands after handling.

Wear protective clothing and shield your face and eyes when working around batteries. Batteries contain sulfuric acid which burns skin, eyes, and clothing.

Do not jump start a damaged battery. Ensure vent caps are tight and level. If another vehicle is used, ensure booster vehicle and crane are not touching.

The gases around the battery can explode if exposed to open flames or sparks. An explosion could result in serious personal injury and/or major equipment damage.

1. Check all battery terminals and remove any corrosion before attaching jumper cables.
2. Connect one end of the first jumper cable to the 12V positive (+) terminal of the discharged battery.
3. Connect the other end of the first cable to the 12V positive (+) terminal of the 12V power source or booster battery.
4. Connect one end of the second jumper cable to the negative (-) terminal of the 12V power source or booster battery.
5. Connect the other end of the second cable to a ground location on the carrier frame as far away from crane batteries as possible.
6. If another vehicle is used to jump start the crane, start the booster vehicle. Ensure booster vehicle and crane are not touching. Run the booster vehicle's engine at a moderate speed.
7. Start the disabled crane. After the crane is started, remove jumper cables in reverse order.
8. Let the crane's engine run for a few minutes to charge the discharged batteries.
9. Check the battery gauge in the operator's cab. The gauge reading should be increasing toward 14 volts.

   Note: If the batteries are at very low charge, voltage may increase slowly. If voltage does not increase, replace the batteries and/or check the electrical system.

Crane Operation

Cranes are used primarily for making heavy lifts. In order to do this properly, certain procedures must be followed. The following is a suggested procedure for making typical lifts:

1. Determine the weight to be lifted. Add the weight of the hook block or hook ball, slings, rigging, fly, etc. Determine height to which the load must be lifted.
2. Refer to the capacity chart, Working Areas, and Working Range charts in the Crane Rating Manual in the operator's cab. Find the shortest boom length and load radius that will accomplish the job.
3. Position the crane so a minimum swing is necessary. Do not swing the upper or extend the boom into areas not covered on the capacity chart in the Crane Rating Manual, as the crane could tip, even without a load on the hook in these areas.
4. The crane must be supported by a firm, solid level surface before starting to lift. All capacities in the Crane Rating Manual are based on the crane being level in all directions. If the crane is not level, out swing or side swing of the load will greatly reduce lifting capacities and could cause crane damage or an accident. If the ground is soft, use mats.
5. If outriggers are used, the following points must be observed:
   a. The outrigger beams must all be equally extended (all fully retracted, intermediate extended, or fully extended) to lift the loads shown in the Crane Rating Manual. Major reductions in lifting capacity will result if beams are not in the same position and this could lead to major crane damage or a serious accident.
   b. Outrigger pontoons must be on solid, smooth footing, flush with the ground (no hills, or valleys under pontoons), otherwise pontoons may be damaged or destroyed. If there is any doubt, use mats.
   c. All capacities listed for the crane on outriggers are based on the outrigger jacks being used to raise the crane so that all tires are clear of the ground and the crane is level. A bubble level is provided in the operator's cab to assist the operator in determining the crane is level.
6. When making lifts on tires, the following points must be observed:
   a. All tires must be inflated to pressures as listed on the Tire Inflation Label on the crane or the Tire Inflation Chart in the Crane Rating Manual.
   b. On tire lifts are to be made from the main boom only. Do not use the auxiliary lifting sheave or fly.
   c. Lifts while on tires must be from firm level surface. Use mats and/or grade the supporting surface as required to ensure safe lift.
7. Ensure the Rated Capacity Limiter is properly set to match the crane configuration.
8. Raise the boom and swing over the load. Extend the boom to the desired length. Ensure power boom sections are equally extended.
9. Lower the hook block or hook ball and fasten it onto the load. The following points must be observed:
   a. The boom peak must be directly above the load. Booms are made to lift, and should never be used to drag a load sideways.
   b. Always use chains, wire ropes, or slings of ample size and make periodic checks of their condition.
   c. Always use sufficient parts of line. Refer to Wire Rope Capacity Chart in the Crane Rating Manual in the operator's cab for the number of parts of line needed for a given lift.
   d. When lifting loads, care should be taken to prevent sudden loading or unloading of the winch wire rope. Ease into the load. Lift the load a few inches *(cm)* off ground and hold to check the winch brakes.
10. Boom to the desired angle. Lift the load to the desired height. Be careful when booming down or swinging the load, as these increase the load radius and result in a decrease in capacity. Ensure the load being lifted remains within the lifting capacity of the crane at the boom length and radius being used.
11. Control the load at all times. Use hand lines to guide the load. Do not guide loads into place with your hands. Swing slowly and smoothly. Avoid jerks when starting or stopping swings.
12. If the crane is to travel with a suspended load, refer to "Pick And Carry Operation" in this Section of this Operator's Manual for further instructions.

During Operation

The operator must remain alert to possible malfunctions of the crane while operating. If the crane does malfunction, lower the load and shutdown the crane until the problem is found and corrected. During operation, the operator must:

1. Remain alert to any noise or loss of power, or bad response to control of the crane. Watch the engine oil pressure and water temperature gauges for proper operating ranges. If either exceeds the limits, correct the problem immediately.
2. Watch the hydraulic system oil temperature gauge. If the temperature exceeds maximum temperature, shutdown the crane until the problem is corrected. (Refer to Section 2 of this Operator's Manual for the maximum temperature for each viscosity of hydraulic oil.)
3. Listen for any unusual noises in the hydraulic system, power train, or the gear boxes. If any, correct problem.
4. Ensure all controls work freely and easily, with no sticking or binding. Lubricate or adjust as necessary.
5. Watch for oil leaks or any loss of control. If any develop, correct before continuing operation.
6. If working on outriggers, periodically check the outriggers to confirm that the crane is level and stable. If working on tires, ensure the tires are inflated to the proper pressure. (Refer to the Tire Inflation Label on the crane or the Tire Inflation Chart in the Crane Rating Manual for proper tire pressure.)
7. Heed all DANGER, WARNING, and CAUTION labels. Observe good safety practices at all times.

Standard Hand Signals For Controlling Crane Operations

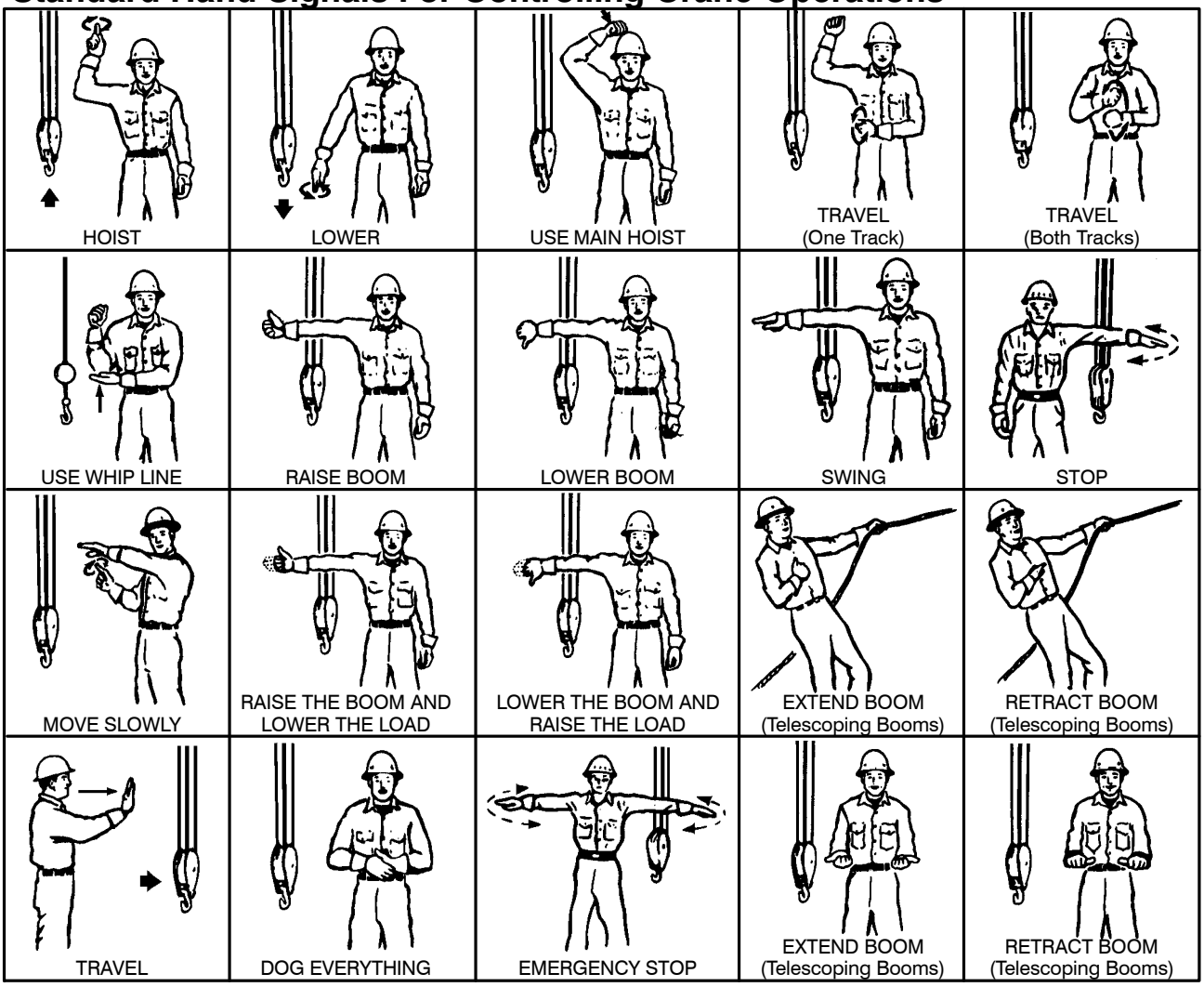


Figure 1—107
Hand Signals

Hand Signals

Hand signals are important for communications between the designated signal person and the operator. A Hand Signals Chart, Figure 1-107, is included in this Section of this Operator's Manual. A copy is also on the power panel box on the left side of the crane.

These signals should be used at all times unless voice instructions with a radio or telephone are being used. One person should be designated as a signal person and their signals obeyed by the operator. Obey a stop signal from anyone.

Pick And Carry Operation

Travel during pick and carry operations is restricted to speeds of 2.5 mph (*4km/h*) or less, and creep, on a firm, level surface. Creep is defined as crane movement limited to 200 ft (*61m*) in a 30 minute period and not to exceed 1mph (*1.6km/h*) maximum speed. Lifts are to be made off the main boom only, with the crane prepared as follows:

1. Inflate the tires to the required pressure listed on the Tire Inflation Label or on the Tire Inflation Chart in the Crane Rating Manual.
2. Do not exceed On Tires, Pick And Carry capacities. Refer to Creep or 2.5 mph (*4km/h*) capacity charts in the Crane Rating Manual.

3. Check the suspension system and adjust if required. Refer to "Axle Suspension System" in Section 3 of this Operator's Manual.
4. Level the crane on fully extended outriggers with the tires clear of the ground.
5. Position the upper over the front of the carrier and engage the travel swing lock. Release the swing park brake and/or the 360° swing lock if equipped.

CAUTION

Do not leave swing park brake applied or 360° swing lock lever in the engaged position during pick and carry operations. Failure to release these devices during this operation may result in damage to the swing mechanism.

6. Boom must be extended in accordance with boom mode "A" or "B".
7. Properly store the fly, if equipped.
8. Ensure the Rated Capacity Limiter is properly set to match the crane configuration.
9. Retract all outrigger jacks just clear of the ground but leave the outrigger beams fully extended.
10. Attach as many hand lines as necessary to prevent the load from swinging during travel.
11. Carefully attach the load to the winch wire rope and lift it only as high as necessary.
12. Carefully travel at no more than 2.5 mph (*4km/h*) and creep depending on chart selection. Take extra care due to the increased overall width caused by the extended outrigger beams. The outriggers or pontoons must not be allowed to hit any obstructions. Maintain a safe distance from all personnel and obstructions. Travel only on a firm, level surface.
13. Once the desired destination is reached, shift the transmission to neutral and apply the park brake.

Traveling The Crane

Certain conditions must be met for safe travel. Refer to the following outlined procedures before traveling the crane.

WARNING

Do not use rear wheel, 4-wheel, or crab steer mode for extended or high speed travel as steering behavior may be unfamiliar and a loss of crane control could occur.

Do not travel with upper over the side. Crane may tip over causing serious personal injury and/or major crane damage. Position the upper over the front or rear and use travel swing lock.

Job Site Travel

Job site travel is limited to speeds of 2.5 mph (*4km/h*) or less. The crane may be traveled on the job site with no load per the following procedure:

1. Inflate the tires to pressure listed on the Tire Inflation Label or Tire Inflation Chart in the Crane Rating Manual for 2.5 mph (*4km/h*) maximum speed.
2. Level the crane on fully extended outriggers.
3. If traveling on a firm, smooth, and level surface, position the boom between 0° to 45°. Do not move the boom during travel. Position the upper and attachments in one of the following arrangements:
   a. The upper over the front of the carrier. The boom fully retracted. The fly base and tip stored.
   b. The upper over front of the carrier. The boom fully retracted. The fly base and tip erected and in the 2° offset position.
4. If traveling on a slope, travel directly up or down the slope. Position the upper and attachments in the following arrangement:
   a. The upper over the front of the carrier. The boom fully retracted at 0°. The fly base and tip stored.
5. Engage the travel swing lock. Release the swing park brake and/or the 360° swing lock if equipped.

CAUTION

Do not leave the swing park brake applied or the 360° swing lock lever in the engaged position when traveling the crane. Failure to release these devices while traveling may result in major damage to swing mechanism.

6. Fully retract all outrigger jacks and beams and properly store the pontoons.

CAUTION

When the hoist line is tied off to the crane or any solid object, do not extend the boom, raise or lower the boom, or raise the crane on outriggers. The winch system could be overloaded causing major winch or crane damage.

7. Secure hook block and/or hook ball to prevent excessive swinging.
8. Carefully travel at no more than 2.5 mph (*4km/h*). Maintain a safe distance from all obstructions, structures, and power lines.
9. Once the desired destination is reached, shift the transmission to neutral and apply the park brake.

Highway Travel

Highway travel is considered to be any travel of the crane over 2.5 mph (*4km/h*). The following conditions and precautions must be met for any highway travel.

1. If equipped, the fly must be secured in the stored position on the boom.
2. The boom must be over the front of the crane with the travel swing lock engaged. Release the swing park brake and/or the 360° swing lock if equipped.

CAUTION

Do not leave the swing park brake applied or the 360° swing lock lever in the engaged position when traveling the crane. Failure to release these devices during this operation may result in major damage to the swing mechanism.

3. All boom sections must be fully retracted with the boom at 0° angle. Secure the hook block and/or hook ball to prevent excessive swinging.

CAUTION

When the hoist line is tied off to the crane or any solid object, do not extend the boom, raise or lower the boom, or raise the crane on outriggers. The winch system could be overloaded causing major winch or crane damage.

4. All outriggers must be fully retracted (jacks and beams) with all pontoons removed from jacks and stored properly.
5. The drive train must be set to 2-Wheel drive and the steering selection switch in the conventional steer mode.
6. Check all tires for correct pressure, adjust if required. Refer to the Tire Inflation Label on the carrier or the Tire Inflation Chart in the Crane Rating Manual.
7. During highway travel, there must be at least a 30 minute rest period every 50 miles of driving or 2 hours of sustained operation whichever occurs first and a 60 minute rest period after 4 hours of operation.
8. Obey all "Rules of the Road" and travel carefully.

Towing The Crane

Always use good judgment and reliable equipment when towing the crane. Use extra caution when towing the crane on the highway and in traffic. When making connections between the crane and towing vehicle, ensure none of the connections will cause damage to either vehicle. Pay particular attention to tie rods, brake lines, power steering cylinders, and power steering lines. The recommended connecting points on the crane are the lifting lugs. Refer to Figure 1-108. Confirm that towing equipment is of ample size and strength.

Always exercise safety and follow all local codes when towing the crane. Prepare the crane as follows before towing it.

1. If equipped, store the fly on the boom.
2. The boom must be over the front of the crane with the travel swing lock engaged. Release swing park brake and/or the 360° swing lock if equipped.

CAUTION

Do not leave the swing park brake applied or the 360° swing lock engaged when towing the crane. Failure to release these devices during this operation may result in damage to the swing mechanism.

3. All boom sections must be fully retracted with the boom at a 0° angle. Secure the hook block and/or hook ball to prevent excessive swinging.

CAUTION

When the hoist line is tied off to the crane or any solid object, do not extend the boom, raise or lower the boom, or raise the crane on outriggers. The winch system could be overloaded causing major winch or crane damage.

4. All outriggers must be fully retracted (jacks and beams) with all pontoons removed from jacks and stored properly.
5. All control levers in the operator's cab must be in the neutral position.

CAUTION

Failure to disconnect the drive tubes including u-joints before pushing or towing the crane can cause major transmission damage.

6. Remove the drive tubes (front and rear) between the transmission and axle including u-joints.
7. Unlock the steering column by turning the ignition switch to the "ON" position. Turn on the hazard flashers.
8. Release the park brake when the crane is attached to the towing vehicle and ready to be towed.

Transporting The Crane

When transporting the crane, precautions should be taken in securing the crane to the trailer, barge, or other means of conveyance. The towing shackles are the recommended tie down points. If the crane is not equipped with towing shackles, chains may be looped around the outrigger boxes or the axle housings to secure the crane down.

CAUTION

If chains are wrapped around the axle housing, be certain the chains will not damage the tie rods, brake lines, power steering cylinders, or power steering lines.

If chains are wrapped around the outrigger box collar, be certain the chains will not damage the hydraulic lines and fittings. The chains should be wrapped around the outrigger box, not the outrigger beam.

Always exercise safety and follow all local codes when loading, unloading, or transporting the crane.

⚠ WARNING

Do not use towing shackles as a means of lifting crane. These shackles are not intended to be used to lift the crane and may break if subjected to the entire weight of the crane. Serious personal injury and/or major equipment damage may result from this practice.

Prepare crane as follows before transporting it:

1. If equipped, store the fly on boom.
2. The boom must be over the front of the crane with the travel swing lock engaged. Release the swing park brake and/or the 360° swing lock if equipped.

CAUTION

Do not leave the swing park brake applied or the 360° swing lock engaged when transporting the crane. Failure to release the 360° swing lock during this operation may result in damage to the swing mechanism.

3. All boom sections must be fully retracted with the boom at a 0° angle. Secure the hook block and/or hook ball to prevent excessive swinging.

CAUTION

When the hoist line is tied off to the crane or any solid object, do not extend the boom, raise or lower the boom, or raise the crane on outriggers. The winch system could be overloaded causing major winch or crane damage.

4. All outriggers must be fully retracted (jacks and beams) with all pontoons removed from jacks and stored properly.
5. Shift the transmission to neutral and engage the park brake.
6. All control levers in the operator's cab must be in the neutral position and function lockout switch on.
7. Securely cover the exhaust to prevent air being forced into the exhaust. Covering the exhaust will also help prevent any water or other contamination from entering the exhaust which could also damage the turbocharger.

CAUTION

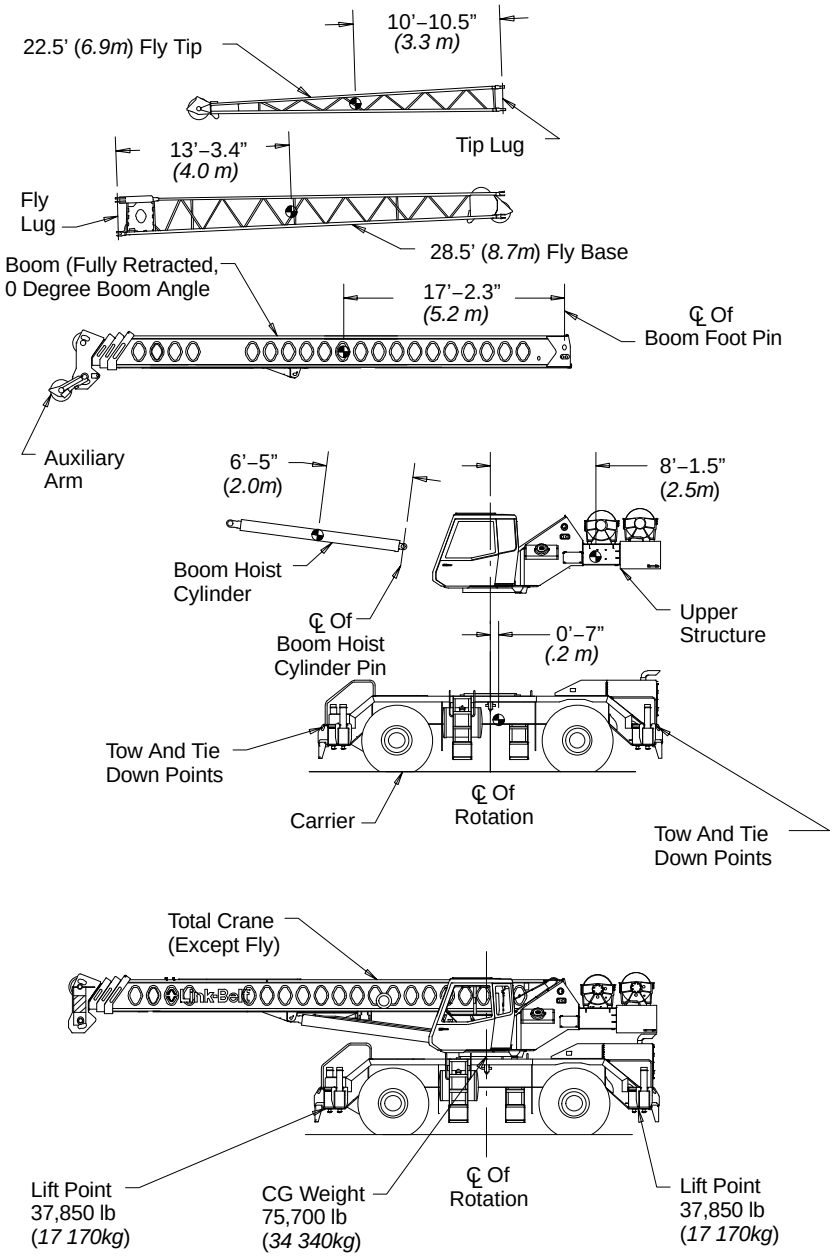
When a turbocharged engine is not running, air forced into the exhaust will cause the turbocharger impeller to spin. Without the engine running, the turbocharger bearing is not lubricated. When transporting the crane and the exhaust is facing in a direction such that the travel speed continually forces air into the exhaust, it may cause major damage to, or total destruction of the turbocharger.

8. Remove the keys from the crane and lock all windows and doors.
9. Depending on the specific situations, further preparations may be needed to protect the crane from the environment or vandalism. See "Crane Storage" in this Section of this Operator's Manual for further suggestions.

Lifting The Crane

The entire crane (except the fly) can be lifted or the components may be removed from the crane and lifted individually. Refer to Figure 1-108 for the center of gravity (CG) and weights for the entire crane and the individual components. The following conditions and precautions must be met before lifting the crane or removing any component.

1. The crane must be parked on a firm level surface with the travel swing lock engaged and if equipped, the 360° swing lock disengaged.
2. Use lifting equipment, shackles, slings, etc., of suitable size and strength. All lifting equipment must be inspected before lifting the crane. The inspection must be recorded and dated in accordance with current OSHA regulations.
3. When lifting the entire crane (without fly), extend the outrigger beams to the intermediate position and install slings around the beams. Protect slings from any sharp edges.
4. The weights and locations of all CG's include all possible options (heaviest crane) except the fly. Use the CG's as a starting point. Center hoist line on the CG, lift a few inches *(cm)* and adjust the hoist line to keep the crane/component(s) level at all times.
5. Removal of any component(s) from the crane will shift the CG of the entire crane. Adjust hoist line to account for the removal of any component(s).
6. The hook block and hook ball are assumed to be stored in the front carrier storage compartment.
7. Do not lift crane with fly attached to boom. Damage to the fly may result. Remove the fly from the crane before lifting. Refer to Section 4 of this Operator's Manual for the correct procedures for removing the fly.
8. Use only properly attached nylon straps to lift fly base or fly tip to prevent damage to the component. Protect the straps from sharp edges. Refer to Figure 1-12 for fly lifting points.
9. Do not allow the hoist lines to contact boom while lifting crane. Damage to the boom may result.



Description	Weight
Carrier	33,600 lb (*15 240kg*)
Upper Structure	23,570 lb (*10 690kg*)
Boom Hoist Cylinder	1,840 lb (*835kg*)
Boom With Foot Pin	15,120 lb (*6 860kg*)
Auxiliary Arm	100 lb (*45kg*)
28.5' Fly Base	1,290 lb (*585kg*)
22.5' Fly Tip	570 lb (*260kg*)
Hook Block &Ball	1,470 lb (*670kg*)
Total Crane	77,560 lb (*35 180kg*)

Figure 1—108
Towing And Lifting The Crane

Crane Storage

Anytime the crane is going to be left unattended it should be prepared so that it will not be damaged by the elements, be an attraction to vandals, or a plaything for children.

Short Term Storage

1. Do not leave crane where it will be a traffic hazard.
2. Lower all loads to the ground.
3. The travel swing lock must be engaged.
4. Fully retract the boom. Boom down to 0°. The fly may be erected if the crane is on outriggers.
5. Tie off the hook block and/or hook ball to the towing shackles. Winch lines should be snug.
6. All control levers must be in the neutral position and function lockout switch on.
7. Shift the transmission to neutral, engage the park brake, and shutdown the engine. Block the wheels to prevent the crane from rolling if on tires.
8. If the crane is on outriggers, the outriggers must be properly set and supported so the crane will remain level.
9. In cold weather, locate the crane where it will not freeze to the ground.
10. Remove the keys from the crane and lock all windows and doors.

Long Term Storage

1. Store the crane inside a building if possible.
2. Thoroughly clean the crane.
3. Touch up any spots where paint has chipped. This will prevent rusting.
4. Lubricate the entire crane as per the Lubrication Chart on the crane or in Section 2 of this Operator's Manual. Confirm that all gear cases are filled to their proper oil level.
5. Inflate tires to proper pressure as shown on the Tire Inflation Label on the crane or the Tire Inflation Chart in the Crane Rating Manual. Check tire pressures periodically during storage to ensure they do not go flat. If possible block the crane up so the tires are clear of the ground. Ensure the blocking is placed so the crane cannot fall off it. If this is not possible, set the crane on planks so the tires will not sink in the ground. Block tires to prevent crane from rolling.
6. Fully retract all hydraulic cylinders if possible. Fully retract the boom and store the fly, if equipped. Cover all cylinder rods and machined and unpainted surfaces with a coat of grease.
7. Position all control levers in neutral and function lockout switch on.
8. Shift the transmission to neutral, engage the park brake, and shutdown the engine.
9. Prepare the engine as per the engine manufacturer's manual. Ensure antifreeze protection is sufficient to prevent the engine from freezing. If antifreeze protection is not adequate, completely drain the engine block and radiator.
10. After the engine has cooled, cover all open areas around the engine, operator's cab, etc. to prevent entry of water. Cover the entire engine area with a tarp if possible.
11. Remove the keys and lock the operator's cab doors. If in a location where vandalism may occur, cover all operator's cab glass with plywood or boards to prevent glass breakage. Provide a means of locking the engine access doors, fuel tank, and hydraulic reservoir.
12. Drain all moisture from the air reservoirs to prevent rust and deterioration.
13. Store the crane so it does not provide a plaything for children. Such a unit can be an "attractive nuisance" for children to play on. If they fall off it or get entangled, serious injury may result.
14. While in storage, the crane should be "exercised" every 60 days to ensure the working condition of the crane. Remove necessary tarps and covers, start the engine and operate all switches, controls, and hydraulic functions several times to circulate lubricants and to keep all mechanisms and linkages operative.

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General Lubrication Information

The crane should be regularly and systematically lubricated in accordance with the Lubrication Chart shown on the following pages. Refer to Figure 2-1. Another copy of the chart is on the carrier. The time intervals shown on the Lubrication Chart are intended as a guide only. Under unusual working conditions, such as working in dry, dusty conditions, in water or mud, or around a corrosive atmosphere, more frequent lubrication could be necessary. In these cases, the oiler must use his best judgment and work out his own lubrication schedule.

In addition to the points on the Lubrication Chart, all movable linkages and control cables should be periodically lubricated to resist wear.

There are some very practical reasons for lubricating and lubricant changes. Lubricants serve more than one purpose. They not only lubricate, but they transport chemically reactive additives, wash away minute wear particles, serve as a corrosion inhibitor, and act as a heat transfer medium. Draining and refilling any gear unit with a fresh supply of oil also assists in eliminating wear particles not trapped by magnetic plugs.

⚠ WARNING

Shutdown engine before fueling or lubricating crane. To avoid a fire hazard, do not smoke or handle fuel around an open flame. To avoid major crane damage and to prevent serious injury, do not lubricate gears or any assemblies while they are in motion.

The following procedures are important for proper lubrication of the crane:

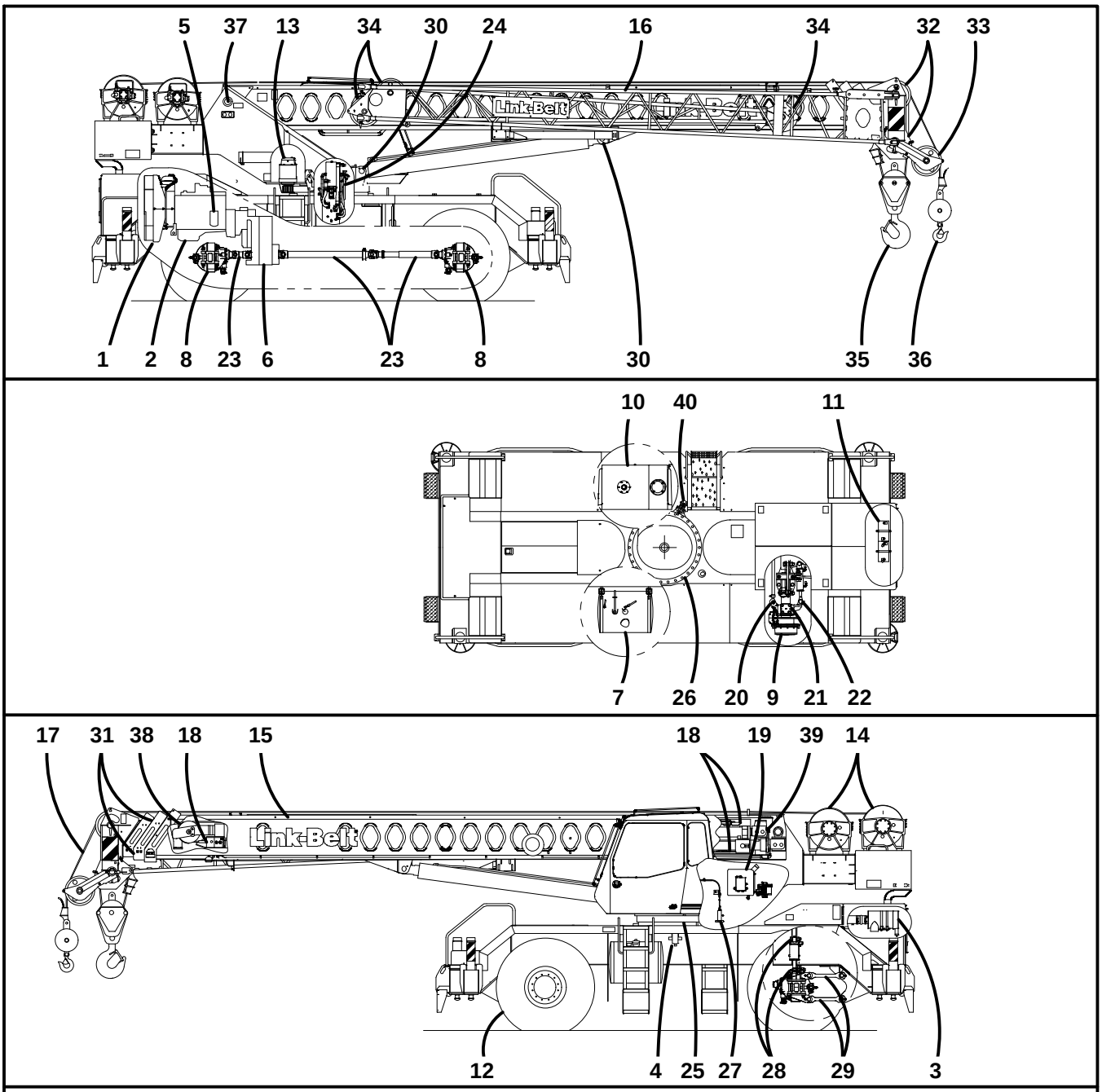
1. Clean the grease gun nozzle and grease fitting before lubricating. This will help keep dirt and grit from entering the bushing or bearing.
2. Keep all grease and oil cans and containers clean. Always replace the lid on containers when finished to prevent entry of foreign materials. Wipe off oil can covers before using.
3. Drain oil cases when hot to drain off accumulated sludge.
4. Watch for signs of incorrect lubrication such as failure of clean grease to purge the old grease.
5. Bleed off hydraulic pressure before opening or removing a line or fitting.
6. Replace all guards before starting crane.
7. Use a clean funnel equipped with a strainer for pouring lubricants.
8. Clean the area around check and fill plugs before removing them to prevent entry of foreign particles.

⚠ DANGER

When it is required to operate the crane during maintenance and/or adjustments, use extreme caution as service personnel may have to work near and/or under moving machinery. Serious personal injury and/or death may result. Always remain in visual and/or verbal contact to ensure the safety of service personnel. Use a signal person if necessary.

Note: See specific instructions in this Section of this Operator's Manual for lubrication check and change procedures on all gear compartments.

Keep grease, oil containers, and guns clean. Wipe all fittings before lubrication. Raise the crane on outriggers or block the wheels and shutdown the engine before working on the crane. Replace all guards and panels before operating the crane.



CAPACITY

Location	Gallons	Liters
Engine Oil	4.60	17.4
Engine Coolant	11.00	41.6
Transmission	6.75	25.5
Axle Differential (ea)	7.50	28.4
Wheel End Planetary (ea)	0.81	3.1
Fuel Tank	75.00	283.9
Hydraulic System	210.00	794.9
Hydraulic Reservoir	131.00	495.9
Swing Speed Reducer	1.06	4.0
Winch Drum (ea)	4.00	15.1
Cab Heater Coolant Reservoir	0.79	3.0
Cab Heater Fuel Tank	3.20	12.1

LUBRICATION CODE IDENTIFICATION

Lube Code	Recommended Type
A	Bearing Grease NLGI Grade No. 2
C	SAE 10W/30 Detergent Engine Oil
H	Open Gear Grease (Summer Grade)
V	Molybdenum Disulfide Compound Lubricant
HH	Gear Lubricant
KK	Arctic Bearing Grease NLGI Grade No. 1
LL	SAE 75W/90 Extreme Pressure Gear Oil
MM	5W/30 Multi-Purpose Synthetic Fluid
OO	Synthetic Gear Oil
WW	Type TO–4 Transmission and Torque Fluid

Figure 2–1
Lubrication Chart

MAINTENANCE

Location	Reference Number	Service Interval (Hours)	Operation	Key	Lube Code Above –10° F	Lube Code Below –10° F
Radiator/Surge Tank	1	10	*,X	1,2,3	Key 2	Key 2
Engine	2	10	*	1,2	Key 2	Key 2
Engine Air Cleaner	3	10	0	1,3	N/A	N/A
Engine Fuel Filter/Water Separator	4	10	$	1,3	Key 3	Key 3
		500	#	1,3	Key 3	Key 3
Engine Fuel Filter – Secondary	5	500	#	1,2	Key 2	Key 2
Transmission	6	10	*	1,3	WW	MM
		500	#	1,3	WW	MM
		1000	+	1,3	WW	MM
Fuel Tank	7	10	0	1,2	Key 2	Key 2
Axle Differentials	8	50	*	1,3	HH	LL
		1000	+	1,3	HH	LL
Planetary Wheel End (4)	9	50	*	1,3	HH	LL
		1000	+	1,3	HH	LL
Hydraulic Reservoir	10	10	*,$	1,3	Key 3	Key 3
		500	#	1,3	Key 3	Key 3
		2000	+	1,3	Key 3	Key 3
Batteries	11	50	0	1	N/A	N/A
Tires	12	10	0	1,3	N/A	N/A
Swing Speed Reducer & Brake	13	50	*	1,3	HH	QQ
		1000	+	1,3	HH	QQ
Winch Drum (s)	14	50	*	1,3	HH	QQ
		1000	+	1,3	HH	QQ
Boom	15	10	0	1,3	V,H	V,H
Fly	16	10	0	1,3	N/A	N/A
Wire Rope	17	10	0	1,3	C	C
Boom Extend & Retract Wire Rope Anchors	18	250	0	1,3	N/A	N/A
Diesel Cab Heater Coolant Reservoir	19	10	*	1,3	Key 3	Key 3
Diesel Cab Heater Fuel Tank & Filter		10	*	1,3	Key 3	Key 3
		2000	#	1,3	Key 3	Key 3

LUBRICATION

Location	Reference Number	Number of Points	Lube Interval (Hours)	Lube Code Above –10° F	Lube Code Below –10° F
Tie Rod Ends	20	4	50	A	KK
Steering Knuckles	21	All	50	A	KK
Steering Cylinder Pins	22	8	50	A	KK
Axle Drive Tubes/U-joints	23	6	50	A	KK
Rotating Joint	24	1	250	A	KK
Turntable Bearing	25	2 Key 4	50	A	KK
Turntable Gear Teeth	26	All	50	H	H
Travel Swing Lock	27	1	250	A	KK
Oscillation Cylinder Pins	28	4	250	A	KK
Suspension Linkage	29	10	50	A	KK
Boom Hoist Cylinder Pins	30	2	10	A	KK
Boom Sliding Surfaces	31	All	Key 3	V,H	V,H
Boom Head Sheaves	32	All	50	A	KK
Auxiliary Lifting Sheave (option)	33	1	50	A	KK
Fly Sheaves (Base & Tip)	34	3	50	A	KK
Hook Block & Sheaves	35	All	Key 3	A	KK
Hook Ball	36	1	Key 3	A	KK
Boom Foot Pins	37	2	10	A	KK
Boom Extend Sheaves	38	2	50	A	KK
Boom Retract Sheaves	39	2	50	A	KK
360 Degree Swing Lock (option)	40	4	50	A	KK

KEY

1. SYMBOLS:
   - * Check fluid level and fill as required.
   - 0 Inspect, lubricate, adjust, repair, or replace as required.
   - + Change oil (and filter if applicable).
   - # Change filter only.
   - X Clean fins if needed.
   - $ Drain water.
   - N/A Not applicable.

A,B,C, etc. Lubrication codes. Refer to Lubrication Code Identification on this chart. Link-Belt recommends the lubrication types on this chart, however if an equivalent is to be used, refer to the Operator's Manual for detailed specifications to ensure a correct equivalent is used.

2. Refer to engine manufacturer's manual for proper maintenance, lubrication, fuel or coolant grade, and additional information.
3. Refer to the Operator's Manual for additional information.
4. Lubricate the turntable bearing through the grease fittings on the front of the upper frame. Use a low pressure handgun and pump grease until clean grease comes out. Rotate the upper a few degrees and pump grease until clean grease comes out again. Repeat throughout the 360° cycle.

Lubrication Specifications

The following specifications are approved for use in Link-Belt cranes. The specifications are identified by a code letter. When a code letter appears on the lubrication or maintenance chart, it is referring to one of the lubricants as described on the following pages. These lubricants are listed by specifications and by one brand name. Most reputable oil companies can provide a lubricant to match a particular specification. It may then be used in the crane no matter what the brand name. When using other brand names, the user assumes all responsibility for product and patent liability.

Type A

Bearing Grease
NLGI Grade No. 2

This grease shall be a homogeneous combination of refined mineral oil and lithium soap. This grease shall not contain any fillers which adversely affect the lubricating qualities of the product. It may have additives that give a high degree of protection against corrosion of metals and oxidation of the grease. Also contains lead soap and extreme pressure additives.

The mineral oil shall meet the following specifications:

Viscosity at 100°F (38°C) SUS	1086
Viscosity at 210°F (99°C) SUS	82.5
Viscosity at Index (Minimum)	65
Timken Test Lever Load (Minimum)	40 lb
Pour Point (°F) Maximum	15
(°C) Maximum	-9.44

The grease shall have the following physical and chemical properties:

Penetration, Worked at 77°F (25°C) (60 Strokes) Units	280
Penetration, Unworked at 77°F (25°C) (60 Strokes) Units	295
Penetration Change After 10,000 Strokes (%) Maximum	15
Dropping Point (°F)	365
(°C)	185
Lithium Soap (%)	6.0
Lead Soap (%)	1.1
Recommended Maximum Temperature (°F)	250
(°C)	121
Recommended Minimum Temperature (°F)	-20
(°C)	-28.8
Water (%) Maximum	0.10

Texaco Marfak — All Purpose or Equivalent.

Type C

SAE 10W/30 Detergent Engine Oil

A heavy duty refined petroleum product made with high quality solvent refined neutral stocks combined with a balanced detergent, dispersive additive combination to provide a margin of safety in oxidation stability, anti-wear and extreme pressure, bearing corrosion protection, and high and low temperature deposit control. With high viscosity indices, low pour points and excellent foam resistance.

Meets requirements of specification MIL-L-46152, and exceeds the requirements of MIL-L-2104B. Meets API service classifications SE, SD, SC, SB, CC, CB and CA.

Physical Properties:

SAE Viscosity Number	10W-30
Gravity, ° API	29.0
Flash Point (Minimum) COC	425
Viscosity at 100°F (38°C) SUS	425
Viscosity at 210°F (99°C) SUS	331
Viscosity Index (Minimum)	167
Ash (%) Sulfur	1.4
Pour Point (°F)	-40
(°C)	-40

Mobil Delvac or Equivalent.

Type H

Open Gear Grease

For open gear applications. Satisfactory down to -40 °F (-40 °C) on dry gears. Good adhesiveness on open gears at 73°F (22.7°C) and good retention. The grease with use will become tacky and will resist leaking. Used on cast tooth gears and ring gear teeth. Extremely resistant to water washing.

Physical Properties:

Mineral Oil Component:

Viscosity at 100°F (38°C) SUS	4104
Viscosity at 210°F (99°C) SUS	180
Load Wear Index	53
Penetration, Worked at 77°F (25°C) (60 Strokes) Units	270
Penetration, Unworked at 77°F (25°C)	242
Dropping Point (°F) Minimum	222
(°C) Minimum	105
Soap Base - Calcium (%)	8.0
With 22% graphite and 3% Molybdenum Disulfide	
Water (%)	0.6
Recommended Maximum Temperature (°F)	175
(°C)	79.4
Consistency	Buttery Grease

Texaco Texclad #2 or Equivalent.

Type V

Molybdenum Disulfide Compound Lubricant

Recommended use for grease on cut tooth gears.

A grease consistency mixture containing purified molybdenum disulfide powder M_0S_2. Powder to meet or exceed specification MIL-L-7866 (AER) with max particle size of 40 microns.

Compound to have mineral oil base not to exceed 50% by volume containing not less than 40% M_0S_2.

Non-melting molybdenum disulfide compound. It is impervious to water and is not affected by most acids or alkalis. Helps prevent galling and seizing at bearing pressures well over 100,000 psi *(689 500kPa)*. Has excellent lubricating qualities at sub-zero temperatures and elevated temperatures up to 750°F (398°C) under certain conditions. Has a high film strength, low coefficient of friction and tenacious adherence to metal surfaces. Will prevent corrosion. Excellent lubrication on parts exposed to water.

Physical Properties:

M_0S_2 (%)	.40
Drop Point	None
Mineral Oil (%)	42
Viscosity, Base Oil @ 100°F (38°C)	2690
Corrosion	.NIL
Water (%)	0
Alkali (%)	0
Fillers (%)	0
Consistency	Medium
Jelling Agent	Pyrogenic Silicone

Bel-Ray Co. Molylube Anti-seize or Equivalent.

Type HH

Gear Lubricant

This gear lubricant is suitable for use in a wide variety of mobile equipment gear and brake applications. Has good oxidation and thermal stability, is non-corrosive to most gear and bearing materials, is inhibited to provide good foam resistance and water separation characteristics. Has moderate concentration of EP additives

Must Meet performance requirements of AGMA Specification 250.04 for extreme pressure lubricants. Is suitable for API service designations of GL2 and GL3.

Physical Properties:

Appearance	Very Dark Red
Gravity, °API	26.7 to 29
Flash COC, °F min	410°F (210°C)
Pour Point, °F max	-10 °F (-23.3 °C)
Viscosity	
cSt @ 104°F (40°C)	150.0
cSt @ 212°F (100°C)	14.4
SUS @ 100°F (38°C)	796.0
SUS @ 210°F (99°C)	76.0
Viscosity Index	95-100
Sulfur, %	0.66
Phosphorous, %	0.03
Timken OK Load (Minimum)	60 lb
AGMA No. EP	4

Shell Code No. 65104, OMALA 150 or Equivalent.

Type KK

Arctic Bearing Grease
NLGI Grade No. 1

Low temperature, extreme pressure, all purpose grease made from a low pour point hydrocarbon lubricant, thickened with a modified bentonite clay. The grease is fortified with an extreme pressure additive and a rust inhibitor to provide even better equipment protection.

A multi-purpose grease that can be pumped from normal grease dispensing equipment at temperatures down to a -65 °F (-54 °C). Good for heavy duty operation.

Recommended for use in centralized lube systems, wheel bearings. chassis bearings, universal joints and all other applications requiring a grease of this type. This grease offers full protection regardless of the season. Pumpable at - 65°F (-54 °C), even in a hand grease gun. Excellent anti-wear and load carrying ability, stays in place better than lighter greases, waterproof to resist washout, good shear stability. Assures good high temperature performances. Compatibility of this grease with ordinary greases presents no problems below an operating temperature of 200°F (93.3°C). Above this temperature, its compatibility is like any other bentone thickened grease.

Physical Properties:

Thickener	Bentone
Penetration worked @ 77°F (25°C) (ASTM D217)	
60 stroke units	340
10,000 units	368
Roll Stability (ASTM D1831)	
Penetration Change	28
Oil Separation, WT.% (ASTM D1742)	12.6
Dropping Point (°F) (ASTM D2265)	500
(°C)	262
Viscosity @ -30°F (-34°C) cSt (ASTM D446)	6750
Wheel Bearing Leakage Wt.% (D1263)	2.83
Water Washout Wt.% 77°F (25°C) (D1264)	1.2
Rust Properties (ASTM D1743)	1
Falex Test (ASTM D2670)	
Teeth Wear	28
Seizure, PSI	3175
Four Ball, EP (ASTM D2596)	
Wear, mm	0.5
Weld, kg	240
LWI	40
No Seizure, kg	80
Color	Natural Tan

Continental Oil Co. (CONOCO) DN600 Grease or Equivalent.

Type LL

SAE 75W/90 Extreme Pressure Gear Oil

A synthetic, extreme pressure gear oil designed for cold weather operation in hypoid, spiral bevel and planetary gear axles. Must meet the requirements of Military Specification MIL-PRF-2105E . Meets API GL-5 and MT-1 performance ratings

Physical Properties:

Gravity, °API . . . . . 25.2 to 33.3
(ASTM D-1298)

Kinematic Viscosity
@ 212°F (100°C), cSt . . . . . 15.5 Min
@ 104°F (40°C) . . . . . 126 Max
(ASTM D-443)

Apparent Viscosity @ -40 °F (-40 °C), ml
(Brookfield) (ASTM 2983) . . . . . 150,000 max.

Flash Point (ASTM D-92) (°C) . . . . . 204 Min.

Pour Point (ASTM D-97) (°C) . . . . -45 Max.

Viscosity Index (ASTM D-2270) . 140 to 151

Copper Corrosion,
3 hrs. @ 250°F (121°C) (ASTM D-130) 3 Max.

Foaming Characteristics (ASTM D-892)
(Foaming readings taken immediately after 5 minutes aeration)
@ 75°F (24°C), ml . . . . . 20 Max.
@ 200°F (94°C), ml . . . . . 50 Max.

Storage Stability, %
(FTMS 791B Method 3440) . . . . . 0.25 Max.

Compatibility
(FTMS 791B Method 3430) . . . . . Note 1

The latest revision of all referenced specifications and test methods shall be used.

FTMS= Federal Test Method Standard.

Note 1: Use approved per Eaton PS-163 and Mack GO-J Plus.

Mobil Oil Molilube SHC 75W/90, Code No. 51100-6 or Equivalent.

Type MM

5W/30 Multi-Purpose Synthetic Fluid (Winter Grade)

Multi-purpose synthetic fluid for use in cold climate as crankcase oil, hydraulic oil and torque convertor fluid. Exceeds the requirements of engine service classifications SF-CC or SF-CD as defined by the API, SAE and ASTM. It meets the requirements of MIL Specification MIL-L-46152C, MIL-L-46167, MIL-L46167A , Ford specification M2C153-E and General Motors specification GM 6048M and 6085M. This fluid is approved for use in Allison automatic transmission in place of type C-3 fluid.

Physical Properties:

Gravity, °API 35.1
Flash Point (ASTM D-92)
(°F) 420
(°C) 215
Viscosity. cPs (ASTM D-2602)
@ -13 °F (-25 °C) 3100
Viscosity, cSt (ASTM D-445)
@ 104°F (40°C) 72.8
@ 212°F (100°C) 11.7
Viscosity, SUS (ASTM D-2161)
@ 100°F (38°C) 386
@ 210°F (99°C) 65
Viscosity Index (ASTM D-2270) . . . . . 156 Min
Pour Point (ASTM D-97)
(°F) . . . . . -55
(°C) . . . . . -48
High Temperature, High (Tapered Bearing Simulator {TBS})
Shear Rate Viscosity, cP 3.3
Borderline Pumping Temperature (ASTM D-3829)
(°F) . . . . . -85
(°C) . . . . . -65
Total Base Number (ASTM D-2896) 8.8
Total Acid Number (ASTM D-974) 3.0
Sulfated Ash, Wt. % (ASTM D-874) 0.91

Continental Oil Co. (CONOCO) High Performance Synthetic Motor Oil or Equivalent.

Type QQ

Synthetic Gear Oil

A specially formulated lubricant for applications where service conditions are severe because of high operating and bulk oil temperatures. Typical applications are spur, helical, herringbone, bevel, and planetary gears. This lubricant is derived from synthetic based oils that are more resistant to thermal and oxidation degradation. It can offer advantages of extension of lubricant life and reduced risk of damage to crane elements.

Physical Properties:

AGMA Grade No.	4 EP
Gravity, °API	25.4-34.4
ISO Viscosity Grade	150
Viscosity @ 100°F (38°C), Cst	140.0
Viscosity @ 212°F (100°C), Cst	14.0
Viscosity @ 100°F (38°C), SUS	737
Viscosity @ 210°F (99°C), SUS	75-100
Viscosity Index	96-150
Flash COC	460°F (238°C)
Pour Point	-10 °F (-23 °C)
Rust Test, Distilled Water	Pass
Copper Corrosion Test	
24 hr. -30 hr. @ 212°F (100°C)	1 b
Timken Extreme Pressure Test	
Pass Value	60 lb
FZG Test, Stages, Pass	12
Phosphorus, Wt. %	.005-.03

Mobil SHC 629 or Equivalent.

Type WW

Transmission And Torque Fluid, Type TO—4

High viscosity index characteristics permit use over a wide temperature range by providing excellent low temperature fluidity and at the same time retaining their desired viscosity at high temperature conditions. High temperature oxidation resistance, dispersancy, detergency, anti-corrosion, and rust protection. Has special friction characteristics and compatibility with the various automatic transmission components such as elastomeric seals. Compatible with synthetic and rubber seals as Buna N, polyacrylate and silicone in transmissions minimizing the possibility of leakage.

To meet all the requirements of Caterpillar hydraulic transmission fluid type TO-4 specifications.

Physical Properties:

Gravity, °API	35.2
Viscosity @ 100°F *(38 °C)*, SUS	546 Max
Viscosity @ 210°F *(99 °C)*, SUS	50.9 Min
Viscosity Index	134 Min
Flash COC °F *(°C)*	408 *(208)* Min
Pour Point °F *(°C)*	-38 *(—39)* Max
Ash % (Sulfated)	<1.0

Exxon Mobil — Mobil Trans AST or Equivalent.

HI Performance Hydraulic Oil

Important

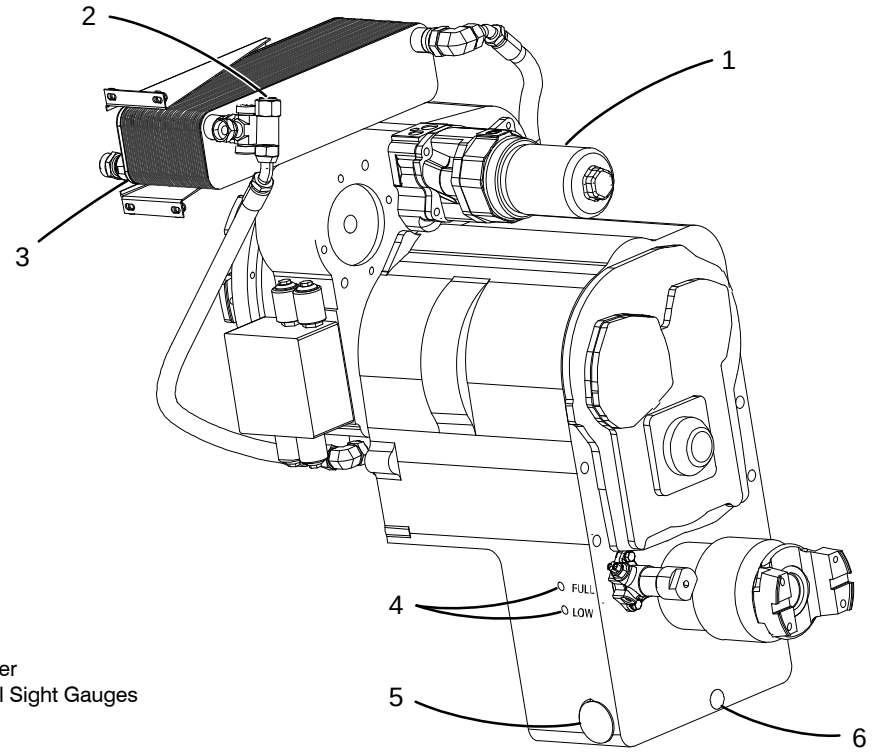
Use only pre-filtered hydraulic oil. Warranty is void if incorrect oil is used. Incorrect oil may result in major damage to hydraulic components. Hi Performance Hydraulic Oil is available through a Link-Belt Distributor in the following grades and quantities.

Oil Grade	Temperature Range		Container Capacity		Part Number
	Ambient Temperature Use	Maximum Hydraulic System Temperature	Gallons	*Liters*	
Grade 22	-45 °F to 80°F -43 °C to 27°C	150°F 65°C	5 55	*18.9* *208.2*	830666001 830666002
Grade 46	10°F to 100°F -12 °C to 38°C	200°F 93°C	5 55	*18.9* *208.2*	830663001 830663002
All Temperature	-40 °F to 100°F -40 °C to 38°C	200°F 93°C	5 55	*18.9* *208.2*	830673001 830673002

Disposal Of Used Lubricants, Fluids, Etc.

Properly dispose of used lubricants, fluids, anti-freeze, and used filters. Every drop of these misplaced items damage the environment. Each year literally thousands of gallons of these used items are dumped into our fields and streams or buried in community landfills. These methods of disposal permanently damage the world around us. You can see that these used items are properly disposed of by sending them to a recycling center. Most local automobile service stations are happy to receive these used items and will see to it that they are recycled and/or properly disposed of in a safe manner.

Figure 2–2
Please Don't Do It!



1. Transmission Oil Filter
2. Transmission Fill Plug
3. Transmission Oil Cooler
4. Transmission Oil Level Sight Gauges
5. Sump Screen
6. Drain Plug

Figure 2–3
Transmission And Torque Convertor

Transmission And Torque Convertor Lubrication

The transmission and torque convertor share the same oil which is serviced at the transmission. In order for both units to work properly, the correct oil level must be maintained and the oil and filters changed periodically. If the oil level is low, the internal transmission and convertor parts may not receive adequate lubrication. This will cause poor performance and lead to failure. If the oil level is too high, the oil will aerate and overheat which can also cause component failure.

Transmission Oil Level Check

Check the transmission oil level daily. Dirt or foreign material should not be permitted to enter the transmission oil system. It can cause valves to stick, oil passages to clog, and excessive wear on internal transmission parts.

1. Operate the crane in a drive range until the transmission oil reaches its normal operating temperature 180-200 °F (*82–93 °C*).

Note: Under certain conditions it may be necessary to stall out the convertor to bring the transmission oil to operating temperature. To stall out the convertor, shift the transmission to "3", hold the brakes and accelerate engine to full throttle. Continue in this position until proper operating range is reached.

CAUTION

Using full throttle speed and stalling out the convertor for an excessive length of time will overheat the convertor.

2. Park the crane on a firm level surface, apply the park brake, and shift the transmission to neutral. Leave the engine running at idle speed.
3. Locate the transmission oil level sight gauges on the left side of the transmission. Refer to Figure 2-3. Oil should be visible within the sight gauge marked "FULL".
4. Shutdown the engine and add oil as required through the fill plug hole to bring the level to the sight gauge marked "FULL". Use only the oil type specified on the Lubrication Chart. Do not overfill.

Transmission Filter Change

Change the transmission oil filter after the first 50 and 100 hours of operation and every 500 hours of operation thereafter. The transmission oil filter is mounted on the transmission. Refer to Figure 2-3.

1. Park the crane on firm level ground, shift the transmission to neutral, apply the park brake, and shutdown the engine.
2. Clean the area around the filter housing to prevent contamination from entering the system.
3. Turn the filter housing counterclockwise to remove it.
4. Remove filter element and o-ring seal. Properly dispose of the used filter element and seal.
5. Coat the new o-ring seal with clean transmission fluid before installation.
6. Install new seal and filter element. Install filter housing onto the filter adaptor.
7. Check transmission oil level.
8. Start the engine and inspect the system for leaks.
9. Properly dispose of the used oil and filter.

Transmission Oil Change

Change the transmission oil every 1,000 hours of operation or seasonally, whichever occurs first. Change it more often if job site conditions demand. If the oil has overheated, change it and the filter immediately.

1. Operate the crane in a drive range until the transmission oil reaches its normal operating temperature 180-200 °F (*82—93 °C*).

   Note: Under certain conditions it may be necessary to stall out the convertor to bring the transmission oil to operating temperature. To stall out the convertor, shift the transmission to "3", hold the brakes and accelerate engine to full throttle. Continue in this position until proper operating range is reached.

CAUTION

Using full throttle speed and stalling out the convertor for an excessive length of time will overheat the convertor.

2. Park the crane on firm level ground, shift the transmission to neutral, apply the park brake, and shutdown the engine.
3. Clean the area around the drain plug and sump screen. Refer to Figure 2-3.
4. Remove the transmission drain plug. Allow the oil to drain into a suitable container.
5. Remove sump screen, clean and reinstall it.
6. Replace transmission filter.
7. Install transmission drain plug.
8. Fill transmission with oil to the sight gauge marked "LOW". Use only the oil specified on the Lubrication Chart.
9. Start the engine and let it idle a few minutes. This will prime the convertor lines.
10. Recheck the transmission oil level with the engine idling. Add oil until it comes to the sight gauge marked "LOW".
11. Operate the crane until the oil reaches 180-200 °F (*82—93 °C*). Make final oil level check. Add oil as required to bring the level to the sight gauge marked "FULL".
12. Check the system for leaks.
13. Properly dispose of the used oil and filter.

Figure 2–4
Allow engine to cool before removing the fill cap.

Engine Cooling System

The coolant in the engine cooling system must be maintained at the proper level and proper concentration levels to adequately keep the engine operating at safe temperatures.

Antifreeze must be used in all climates for both freezing and boiling protection. It broadens the operating temperature range by lowering the coolant freezing point and by raising its boiling point. Refer to engine manufacturer's manual for proper coolant selection.

WARNING

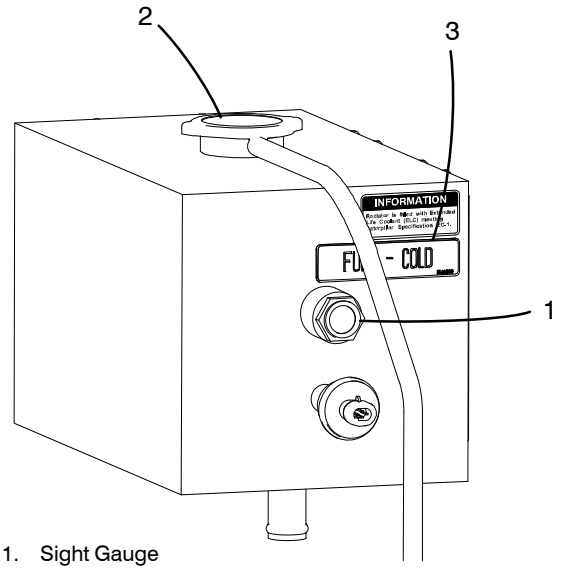
Avoid prolonged and repeated skin contact with antifreeze. Such prolonged, repeated contact can cause skin disorders or other bodily injury. Keep out of reach of children.

Coolant is toxic. Keep away from children and pets. If not reused, dispose of in accordance with local environmental regulations.

Cooling System Test

Check the glycol (antifreeze) concentration and the freezing point protection as outlined in the engine manufacturer's manual.

Testing the engine coolant is important to ensure that the engine is protected from internal cavitation and from corrosion. Refer to engine manufacturer's manual for additional information on coolant system analysis.



1. Sight Gauge
2. Fill Cap
3. Coolant Level Label

Figure 2–5
Engine Coolant Surge Tank

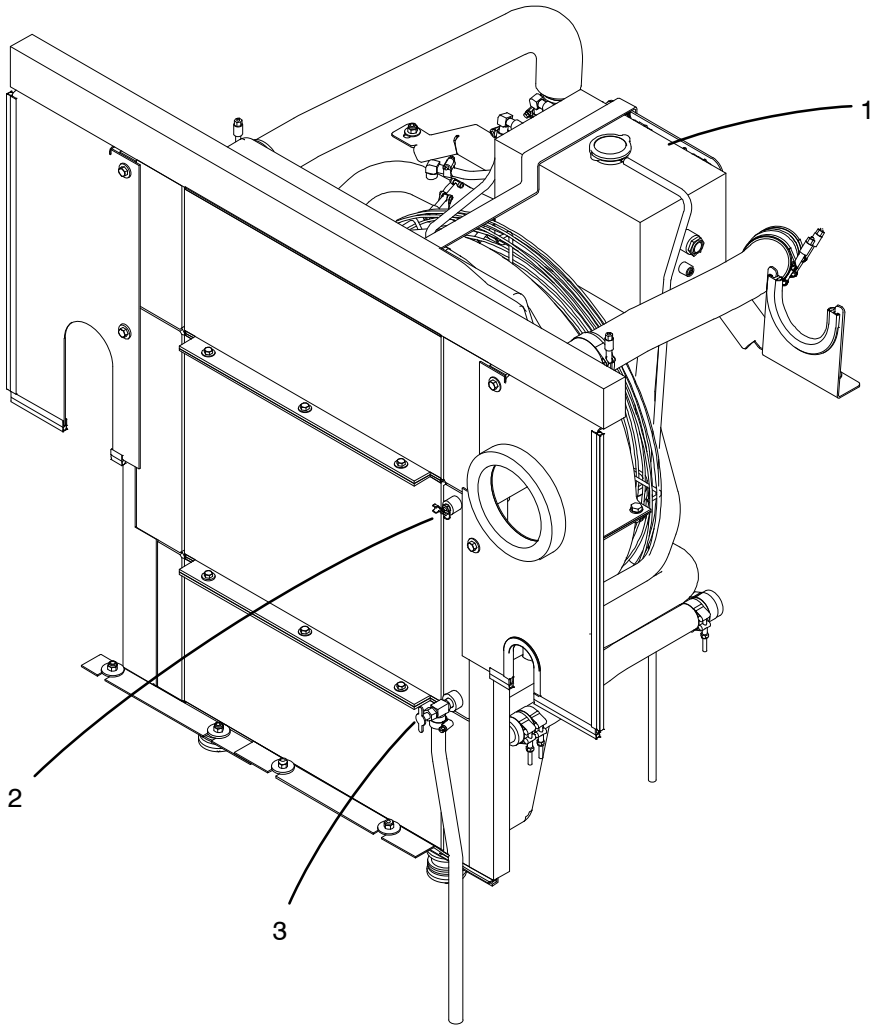
Cooling System Level Check

Check the coolant level in the surge tank every 10 hours of operation.

1. Park the crane on a firm, level surface, shift the transmission to neutral, apply the park brake, and shutdown the engine.
2. Check that the coolant level in the surge tank is at least up to the "Full-Cold" level on the side of the tank. Refer to Figure 2-5.

WARNING

Engine cooling system is pressurized. Do not remove fill cap from a hot engine. Heated coolant spray or steam can cause personal injury. Wait until the engine has cooled before slowly removing fill cap.



1. Surge Tank
2. Vent Valve
3. Drain Valve

Figure 2—6
Engine Cooling System

CAUTION

Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool until the coolant temperature is below 122°F (*50°C*) before adding coolant.

Never use a sealing additive to stop leaks in the cooling system. This can result in cooling system plugging and inadequate coolant flow, causing the engine to overheat.

If additional coolant must be added, it must be pre-mixed before being added to the system. Since the ability of antifreeze to remove heat from the engine is not as good as water, pouring antifreeze into the system first could contribute to an overheated condition before the liquids are completely mixed.

3. If coolant must be added, allow the engine to cool until the the coolant temperature is below 122°F (*50°C*).
4. Slowly remove the fill cap. Open the vent valve and add coolant, as required, to completely fill the tank. Use a pre-mixed solution per the engine manufacturer's specification. Refer to engine manufacturer's manual for proper coolant selection.
5. Replace fill cap and close the vent valve. Inspect and clean any debris from the radiator fins.
6. Start the engine and let it run until it reaches normal operating temperature. Shutdown the engine and repeat Step 2.

Cooling System Coolant Change

Drain, flush, and fill the engine cooling system at the intervals outlined in the engine manufacturer's manual. Use a pre-mixed solution per the engine manufacturer's specification. Refer to the engine manufacturer's manual for proper coolant selection.

CAUTION

Protect the environment: Handling and disposing of used antifreeze is subject to federal, state, and local regulations. Use authorized waste disposal facilities, including civic amenity sites and garages providing authorized facilities for the receipt of used antifreeze. If in doubt, contact your local authorities or the EPA for guidance as to proper handling of antifreeze.

1. Park the crane on a firm, level surface, shift the transmission to neutral, apply the park brake, and shutdown the engine.
2. Allow the engine to cool until the coolant temperature is below 122°F (*50°C*).

WARNING

Engine coolant may be hot and could cause burns. Avoid prolonged and repeated skin contact with antifreeze. Such prolonged, repeated contact can cause skin disorders or other bodily injury. Keep out of reach of children.

Coolant is toxic. Keep away from children and pets. If not reused, dispose of in accordance with local environmental regulations.

3. Drain the cooling system by opening the drain valve on the radiator and engine block. Allow the coolant to drain into a suitable container. Properly dispose of used antifreeze. Refer to Figure 2-6.
4. Check for damaged hoses and hose clamps. Hoses must be firm to the feel. If they are soft and spongy they must be replaced. Replace as required. Check the radiator for leaks, damage, and build up of dirt. Clean and replace as required.
5. Inspect and clean any debris from the radiator fins.
6. Close the drain valve on the radiator and engine block.

WARNING

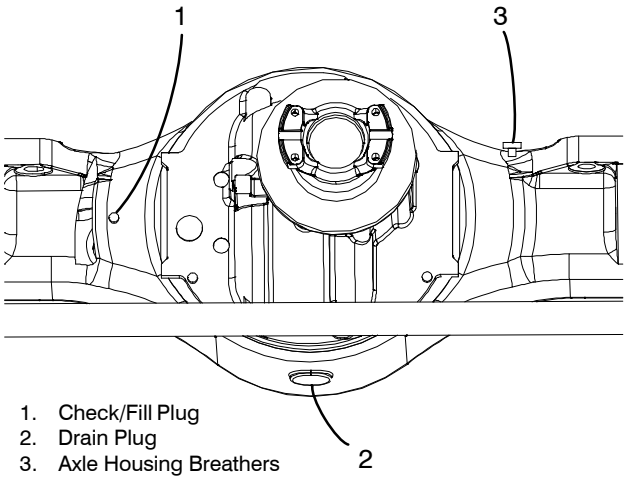
Engine cooling system is pressurized. Do not remove fill cap from a hot engine. Heated coolant spray or steam can cause personal injury. Wait until the engine has cooled before slowly removing fill cap.

7. Remove the fill cap from the surge tank.

CAUTION

During filling, air must be vented from the engine coolant passages. Wait 2 to 3 minutes to allow air to be vented. Air trapped in the system may cause damage to the engine.

8. Flush the system as outlined in the engine manufacturer's manual. If the engine is warm, fill slowly to prevent the rapid cooling and distortion of the metal castings.
9. Flush the system as many times as required until the water is clean.
10. Open the vent valve and add coolant, as required, to completely fill the tank. Use a pre-mixed solution per the engine manufacturer's specification. Refer to the engine manufacturer's manual for proper coolant selection. Do not install the fill cap.
11. Close the vent valve. Start the engine and let it run at low idle. Increase engine to 1,500 rpm. Run the engine at high idle for approximately 1 minute to purge trapped air from the system. Shutdown the engine.
12. Check the coolant level to confirm that the coolant level has risen to the "Full-Cold" level on the side of the tank.
13. Install the fill cap on the surge tank.
14. Start the engine. Check system for leaks and for proper operating temperature.



1. Check/Fill Plug
2. Drain Plug
3. Axle Housing Breathers

Figure 2—7
Axle Differential

Axle Differentials Lubrication

For troublefree operation, over a period of years, the axle differentials of any crane must be properly lubricated. Check the oil level in each axle differential every 50 hours of operation. The oil in a new or rebuilt axle should be changed after the first 500 hours of operation. Change the oil every 1,000 hours or seasonally thereafter, whichever occurs first.

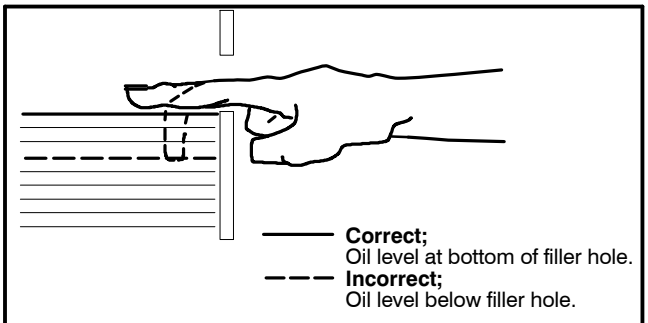
Axle Differentials Oil Level Check

Check the oil level in both of the axle differentials using the following procedure:

1. Park the crane on a firm level surface, shift transmission to neutral, engage the park brake, and shutdown the engine.
2. From the underside of the carrier, locate the check/fill plug of the differential. Refer to Figure 2-7.
3. Clean the area around the check/fill plug.
4. Remove the check/fill plug and check the oil level. Oil must be level with the bottom of the check/fill hole. Refer to Figure 2-8.
5. Add oil as required, until it begins to flow from the check/fill hole. Refer to Lubrication Chart for correct grade of oil.

   Note: It is recommended that types and brands of oil not be intermixed because of possible incompatibility.

6. Clean and install the check/fill plug.
7. Check and clean the axle housing breathers, on the top of the axle housings. Refer to Figure 2-7.



Correct;
Oil level at bottom of filler hole.
Incorrect;
Oil level below filler hole.

Note: Oil level close enough to the hole to be seen or touched is not sufficient. It must be level with the bottom of the hole.

Figure 2—8
Checking The Oil Level

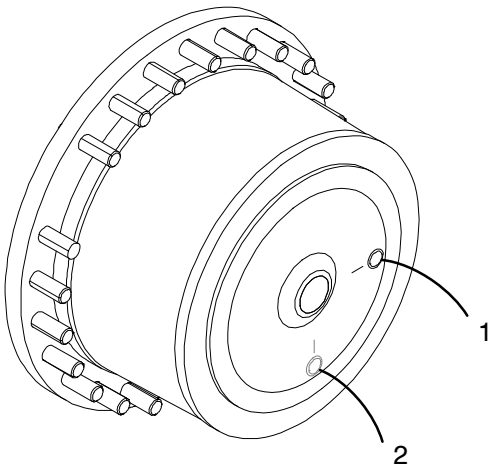
Axle Differentials Oil Change

The best time to change oil in the differentials is immediately after the crane has been driven. At this time, the lubricant will be warm and easily drained. This procedure is especially desirable in cold weather conditions. Change the oil in each of the axle differentials using the following procedure:

1. Park the crane on a firm level surface, shift transmission to neutral, engage the park brake, and shutdown the engine.
2. Locate the drain plug in the bottom of the differential. Refer to Figure 2-7.
3. Clean the area around the drain plug.
4. Remove the drain plug and allow the oil to drain into a suitable container. The drain plug is magnetic and should be inspected for large quantities of metal particles. After the initial oil change, this is a sign of damage or extreme wear within the unit, and a complete internal inspection may be necessary.
5. Check and clean the axle housing breathers on the top of the axle housings.
6. Clean the drain plug and install it after the oil has thoroughly drained.
7. Locate the check/fill plug on the side of the differential. Refer to Figure 2-7.
8. Clean the area around the check/fill plug, and remove it.
9. Fill the differential with oil until it is level with the bottom of the check/fill hole. Refer to Figure 2-8. Refer to the Lubrication Chart for correct quantity and grade of oil.

   Note: It is recommended that types and brands of oil not be intermixed because of possible incompatibility.

10. Clean and install check/fill plug.
11. Properly dispose of the used oil.



1. Plug - Horizontal Position - Check/Fill
2. Plug - Vertical Position - Drain

Figure 2—9
Wheel End Planetary

Planetary Wheel End Lubrication

Check the oil level in each wheel end every 50 hours of operation. The oil in a new or rebuilt wheel end should be changed after the first 500 hours of operation. Change the oil every 1,000 hours or seasonally thereafter, whichever occurs first.

Planetary Wheel End Oil Level Check

1. Park the crane on a firm level surface, shift the transmission to neutral, and apply the park brake.
2. Properly level the crane on outriggers, disengage the park brake, and shutdown the engine.
3. Rotate the wheel end until the line next to the check/fill/drain plug is in the horizontal position. Refer to Figure 2-9.
4. Clean the area around the check/fill/drain plug to prevent foreign material from entering the wheel end.
5. Remove the check/fill/drain plug and check the oil level. Oil should be level with the bottom the of the hole. Refer to Figure 2-8.
6. Add oil as required until it begins to flow from the hole. Refer to the Lubrication Chart for the correct grade of oil.

   Note: It is recommended that types and brands of oil not be intermixed because of possible incompatibility.

7. Clean and install the check/fill/drain plug.
8. Repeat Steps 3 through 7 for the other planetary wheel ends. Confirm that the park brake is applied before lowering the crane from the outriggers.

Planetary Wheel End Oil Change

Perform the following procedure on all of the planetary wheel ends simultaneously to minimize the time spent to change the oil.

1. Drive the crane for 5 minutes to agitate and warm the oil.
2. Park the crane on a firm, level surface, shift the transmission to neutral, and apply the park brake.
3. Properly level the crane on outriggers, disengage the park brake, and shutdown the engine.
4. Rotate the wheel ends until the line next to the check/fill/drain plug is in the vertical position. Refer to Figure 2-9.
5. Clean the area around the check/fill/drain plug to prevent foreign material from entering the wheel end.
6. Remove the check/fill/drain plug and allow the oil to drain into a suitable container.

⚠ WARNING

Oil draining from the planetaries may be hot and could cause serious burns. Use caution when removing the plugs.

7. After thoroughly draining the oil, the wheel ends should be flushed.
   a. Rotate the wheel ends until the line next to the plug is in the horizontal position.
   b. Fill the wheel ends with a light flushing oil or kerosene and install the check/fill/drain plug.
   c. Operate the wheel ends for a short period of time at a very low speed.
   d. Rotate the wheel ends until the line next to the check/fill/drain plug is in the vertical position.
   e. Remove the check/fill/drain plugs and allow all the flushing solution to drain into a suitable container.
8. Rotate the wheel ends until the line next to the check/fill/drain plug is in the horizontal position.
9. Fill the wheel ends with oil until it begins to flow from the check/fill/drain hole. Refer to Figure 2-8. See the Lubrication Chart for the correct grade and quantity of oil.

   Note: It is recommended that types and brands of oil not be intermixed because of possible incompatibility.

10. Clean and install the check/fill/drain plugs.
11. Properly dispose of used oil and flushing solution.

Wheel Bearing Lubrication

Under normal operating conditions, the axle wheel bearings are lubricated by oil in the planetary wheel ends. In short, as long as the axle planetaries are operating with the proper oil levels, and using the correct grade of oil, the wheel bearings are properly lubricated.

Hydraulic Reservoir

The hydraulic reservoir is used to store hydraulic oil needed to operate all hydraulic functions of the crane. The hydraulic reservoir, as shown in Figure 2-10, is equipped with a sight gauge for checking the oil level.

A filter housing is mounted on the top of the tank. It has a contamination indicator which signals when the filter is being bypassed. Drain any water from the hydraulic reservoir, check the oil level, and inspect the contamination indicator daily. Operating the crane with the oil level below the full mark or with the filter element bypassed can lead to hydraulic component failure.

Water Drain

Drain the water from the hydraulic reservoir daily before start-up. Contaminated oil will damage the systems hydraulic components.

1. Relieve any trapped hydraulic system pressure by pushing the pressure relief plunger on the relief valve. Refer to Figure 2-10.

⚠ WARNING

All trapped hydraulic pressure must be exhausted from the system before removing any plug or cover. A sudden release of hot oil could cause burns or other serious injury.

2. Loosen the water drain plug and allow the water to drain into a suitable container. The water drain plug is slotted and need not be completely removed to drain the water.
3. When a clean flow of hydraulic oil begins to drain from the water drain plug, tighten the plug.
4. Check the oil level in the hydraulic reservoir before beginning operation of the crane. Add oil if necessary. Properly dispose of the contaminated water.

Hydraulic Reservoir Oil Level Check

1. Park the crane on a firm level surface, shift the transmission to neutral, and engage the park brake. Fully retract all hydraulic cylinders and shutdown the engine.
2. With the hydraulic oil cold (approximately 62°F *17 °C*), check its level through the sight gauge on the front of the hydraulic reservoir. Refer to Figure 2-10. The proper level must be maintained at all times. Add hydraulic oil as necessary to bring the oil level between the "FULL" and "ADD" marks. Use only Hi Performance Hydraulic Oil or an approved substitute. Do Not Overfill.

Adding Oil To The Hydraulic Reservoir

1. Park the crane on a firm level surface. Shift the transmission to neutral, engage the park brake, and shutdown the engine.
2. Relieve any trapped hydraulic system pressure by pushing the pressure relief plunger on the relief valve. Refer to Figure 2-10.

⚠ WARNING

All trapped hydraulic pressure must be exhausted from the system before removing any plug or cover. A sudden release of hot oil could cause burns or other serious injury.

3. Clean the top of the hydraulic reservoir, the filter housing, and filter housing cover to prevent foreign material from entering the hydraulic system.
4. Remove the filter housing cover.
5. Add oil as required through the filter element to bring the oil level to the "FULL" mark by the sight gauge.
6. Install filter housing cover.

Hydraulic Reservoir Filter Change

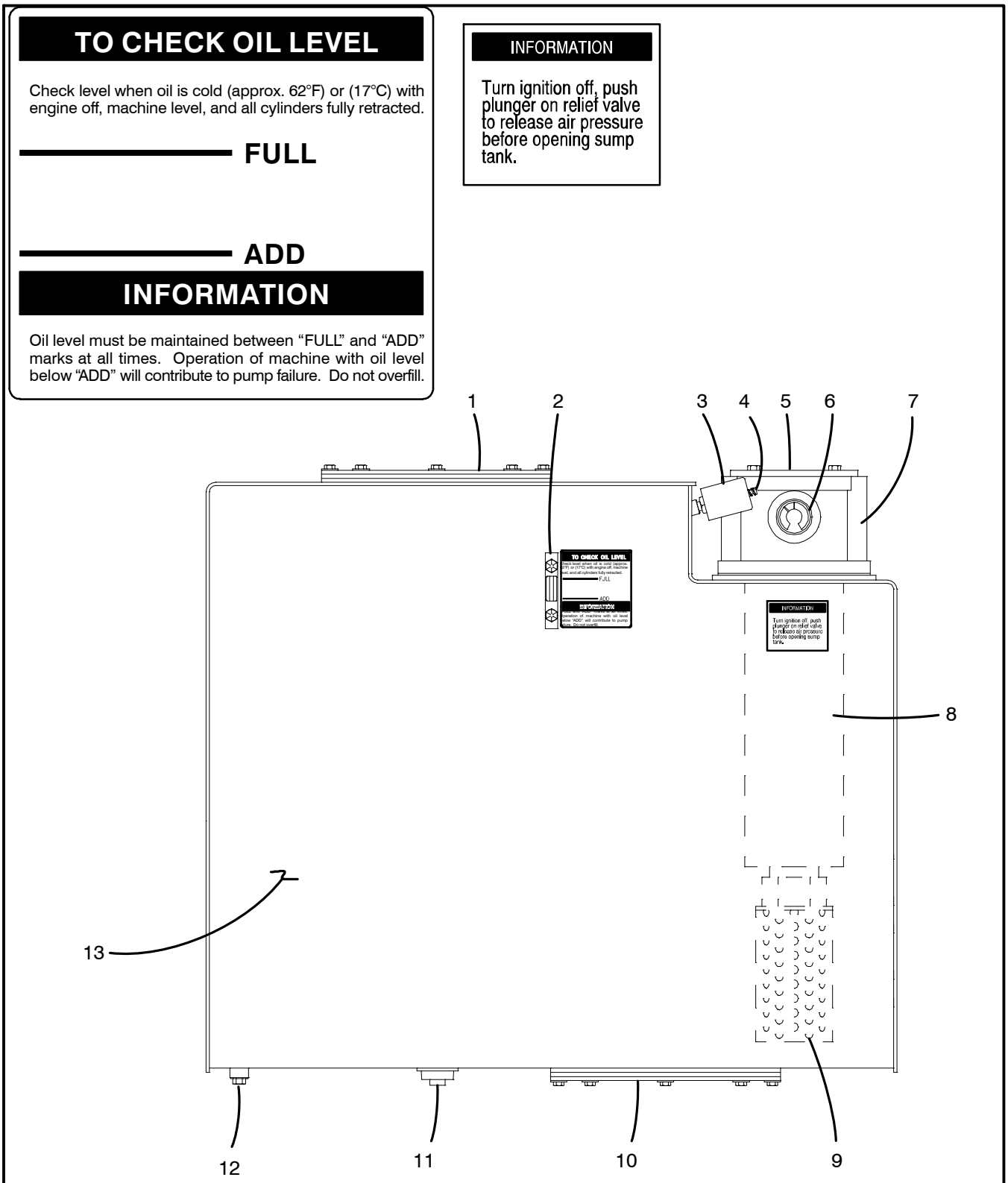
Change hydraulic reservoir filter element after the initial 50 hours of operation and every 500 hours of operation thereafter. Change the filter element immediately if the contamination indicator needle is in the red area.

1. Park the crane on a firm level surface. Shift the transmission to neutral, engage the park brake, and shutdown the engine.
2. Relieve any trapped hydraulic system pressure by pushing the pressure relief plunger on the relief valve. Refer to Figure 2-10.

⚠ WARNING

All trapped hydraulic pressure must be exhausted from the system before removing any plug or cover. A sudden release of hot oil could cause burns or other serious injury.

3. Clean the top of the hydraulic reservoir, the filter housing, and filter housing cover to prevent foreign material from entering the hydraulic system.
4. Remove the filter housing cover.
5. Remove the filter element and inspect it for contamination. Any dirt or foreign particles on the filter element may indicate excessive system contamination or imminent system component failure. Once the filter has been thoroughly inspected, dispose of it properly.
6. Install new filter element and filter housing cover.
7. Start engine and check the filter housing for leaks.
8. Check the hydraulic reservoir oil level. Add oil if necessary.



1. Top Access Panel
2. Sight Gauge
3. Relief Valve
4. Pressure Relief Plunger
5. Filter Housing Cover
6. Contamination Indicator
7. Filter Housing
8. Element
9. Diffuser
10. Bottom Access Panel
11. System Drain Plug
12. Water Drain Plug
13. Hydraulic Reservoir

Figure 2–10
Hydraulic Reservoir

Hydraulic Reservoir Oil Change

The hydraulic reservoir oil should be changed every 2,000 hours of operation or seasonally, whichever occurs first. Change the hydraulic reservoir oil at the end of a working day when any foreign particles will be suspended in the warm oil. If this is not possible, cycle the crane until the oil is warm and proceed as follows:

1. Park the crane on a firm level surface, shift the transmission to neutral, and engage the park brake. Fully retract all hydraulic cylinders and shutdown the engine.
2. Relieve any trapped hydraulic system pressure by pushing the pressure relief plunger on the relief valve. Refer to Figure 2-10.

⚠ WARNING

All trapped hydraulic pressure must be exhausted from the system before removing any plug or cover. A sudden release of hot oil could cause burns or other serious injury.

3. Thoroughly clean the exterior surface of the hydraulic reservoir to prevent foreign materials from entering the system, once the access panels and filter housing are opened.
4. Remove the top access panel and pump the hydraulic oil into suitable containers. Refer to the Lubrication Chart to determine the volume of oil to be removed.

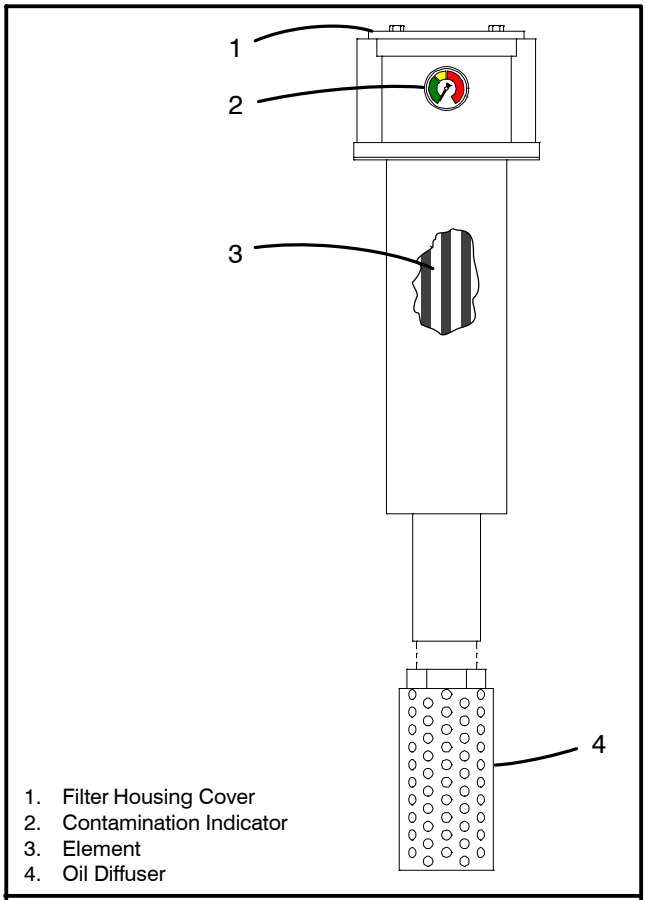
   Note: If a pump is not available to remove the oil from the reservoir, place a suitable container under the system drain plug. Open the plug and drain one container full at a time, until the oil has thoroughly drained from the reservoir. Do not remove bottom access panel to drain reservoir.

⚠ WARNING

Do not remove the bottom access panel before the hydraulic reservoir has completely drained. A large volume of hot oil may suddenly be released resulting in serious personal injury and/or major crane and/or property damage. Drain the oil from the hydraulic reservoir before removing the bottom access panel.

5. Remove the bottom access panel, filter housing cover, and the filter element. Properly dispose of the filter element.
6. Clean any old gasket material off the access panels and hydraulic reservoir.
7. Remove and clean the oil diffuser in the bottom of the filter housing.
8. Clean the interior of the hydraulic reservoir with clean diesel fuel or kerosene.
9. Allow the diesel fuel or kerosene to drain into a suitable container until the hydraulic reservoir is thoroughly drained. Inspect the interior of the hydraulic reservoir for foreign material and wipe clean.
10. Clean and install the system drain plug.
11. Clean the filter housing. Install oil diffuser in the bottom of filter housing. Install a new filter element.
12. Install the access panels, using new gaskets.
13. Using clean, uncontaminated oil, fill the reservoir through the filter element until it reaches the "FULL" mark by the sight gauge.
14. Install the filter housing cover.
15. Engage the main pump and start the engine. Allow the engine to idle several minutes to ensure oil is being cycled properly. Check for any leaks.
16. Check the oil level in the hydraulic reservoir for proper level. Add oil if necessary. Properly dispose of the used oil.

    Note: In case of hydraulic system component failure, a more thorough oil change procedure is required. Contact a Link-Belt Distributor for this procedure.



1. Filter Housing Cover
2. Contamination Indicator
3. Element
4. Oil Diffuser

Figure 2—11
Filter Assembly

Hydraulic Reservoir Filter Change

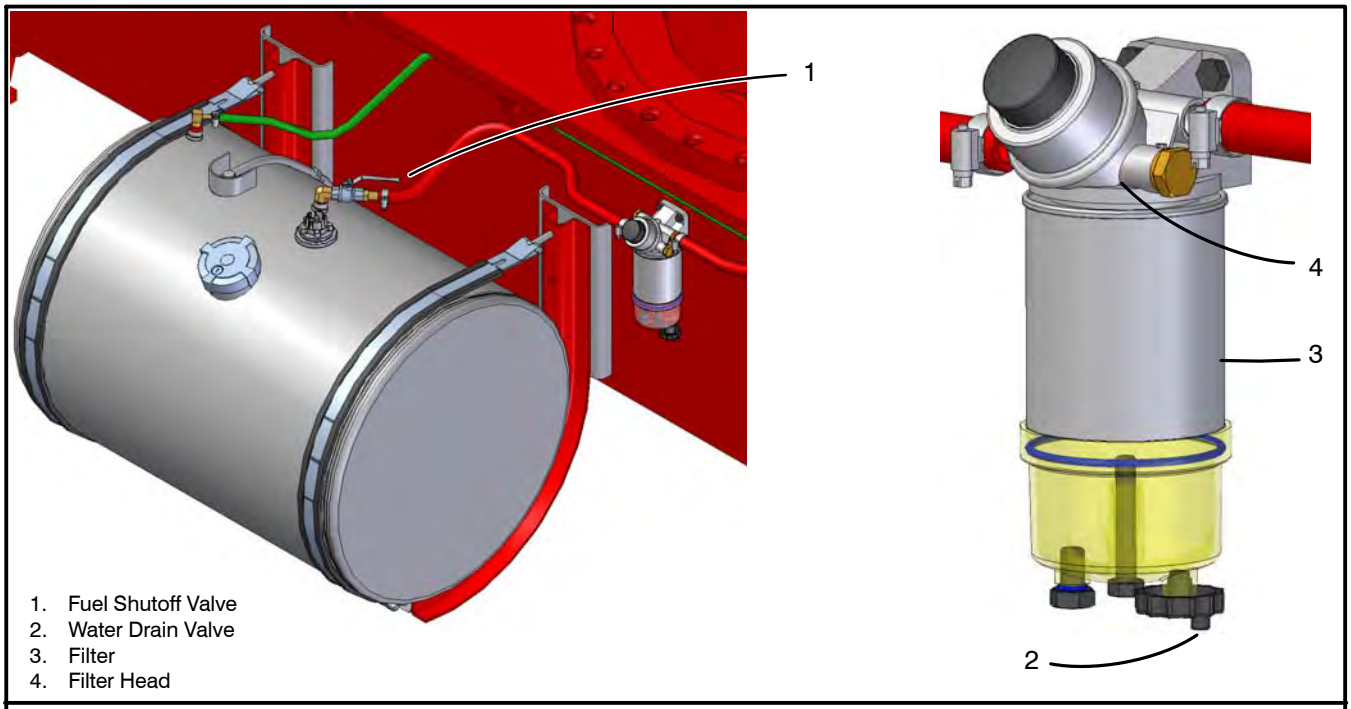
Change hydraulic reservoir filter element after the initial 50 hours of operation and every 500 hours of operation thereafter. Change the filter element immediately if the contamination indicator needle is in the red area.

1. Park the crane on a firm level surface. Shift the transmission to neutral, engage the park brake, and shutdown the engine.
2. Relieve any trapped hydraulic system pressure by loosening the filler breather cap, located on the hydraulic reservoir, 1/4 turn until pressure is fully relieved. Refer to Figure 2-10.

WARNING

All trapped hydraulic pressure must be exhausted from the system before removing any plug or cover. A sudden release of hot oil could cause burns or other serious injury.

3. Clean the top of the hydraulic reservoir, the filter housing and filter housing cover to prevent foreign material from entering the hydraulic system.
4. Remove the filter housing cover. Refer to Figure 2-11.
5. Remove the filter element and inspect it for contamination. Any dirt or foreign particles on the filter element may indicate excessive system contamination or imminent system component failure. Once the filter has been thoroughly inspected, dispose of it properly.
6. Install new filter element and filter housing cover.
7. Start engine and check the filter housing for leaks.
8. Check the hydraulic reservoir oil level. Add oil if necessary. Use only Hi Performance Hydraulic Oil or an approved substitute.



1. Fuel Shutoff Valve
2. Water Drain Valve
3. Filter
4. Filter Head

Figure 2—12
Fuel-Water Separator Filter

Fuel-Water Separator/Filter

The function of the fuel-water separator/filter is to remove water and contaminants from the fuel before they enter the fuel filter. Removal of water and contaminants is important for troublefree operation and long life of the fuel system. The fuel-water separator is mounted on the carrier frame rail next the fuel tank. Water should be drained daily before start-up. Change the element every 500 hours or 6 months whichever occurs first. Use the following procedures along with Figure 2-12.

Fuel-Water Separator Water Drain

1. Park the crane on a firm level surface, shift transmission to neutral, engage the park brake, and shutdown the engine.
2. Place a suitable container under the drain valve. Turn the drain valve counterclockwise approximately 1 and 1/2 to 2 turns until draining occurs.
3. Continue draining until clear fuel is visible.

CAUTION

Do not over-tighten the drain valve. Over-tightening the drain valve can damage the threads.

4. Turn the drain valve clockwise to close it.
5. Properly dispose of contaminated water.

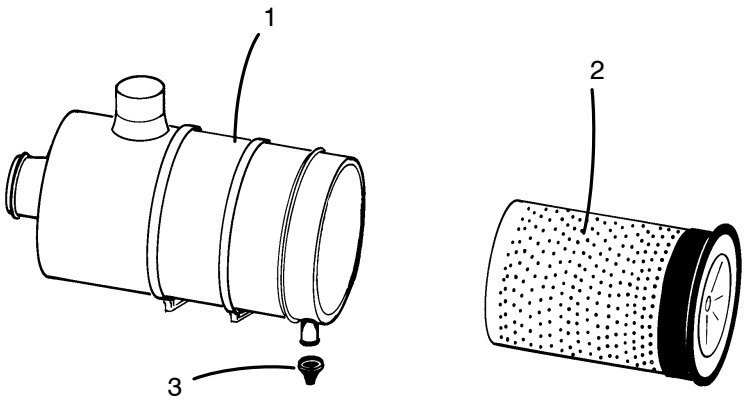
Fuel-Water Separator Filter Change

1. Park the crane on a firm level surface, shift transmission to neutral, engage the park brake, and shutdown the engine.
2. Close the fuel shutoff valve.
3. Clean the area around the filter head.
4. Place a suitable container under the drain valve. Turn the drain valve counterclockwise approximately 3 turns until draining occurs. Drain all fuel from filter.
5. Remove the filter from head and discard.
6. Fill the new filter with clean fuel and lubricate the o-ring with clean engine oil.
7. Install new filter on filter head and tighten by hand.

CAUTION

To prevent fuel leaks, ensure the filter is installed tightly but do not over-tighten. Mechanical tightening will damage the filter.

8. Open the fuel shutoff valve
9. Properly dispose of filter and drained fuel.



1. Air Cleaner Body
2. Element
3. Dust Exhaust Valve

Figure 2—13
Engine Air Cleaner

Engine Air System Inspection

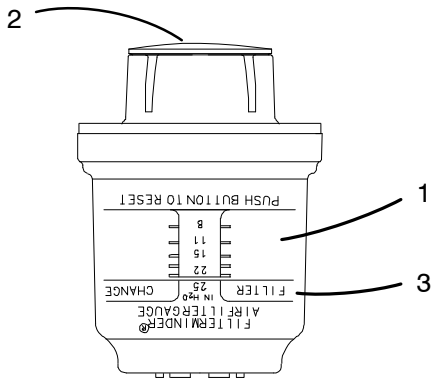
It is recommended that the engine air system be inspected every 250 hours or 6 months. Inspect the air system pipes, hoses, and turbocharger systems, as equipped. (Inspect all the pipes and hoses associated with the turbocharger, air cleaner, and air intake.) Check for any cracks, corrosion, loose clamps, wear points, leaks, or punctures which can allow contaminants to enter the system and damage the air system components and/or the engine. All hoses should be kept free of oil contaminants, both internally and externally. Disassemble and clean as required. Tighten or replace parts as necessary to ensure that the air system does not leak.

Engine Air Cleaner

Variations in job site conditions prevent establishing a set interval for air cleaner servicing. For this reason a vacuum operated service indicator is mounted on the air cleaner to assist in determining the condition of the air cleaner element. Refer to Figure 2-14. Anytime the yellow indicator reaches the red line, service the air cleaner immediately. Clean or replace the air cleaner element as often as required. Replace the air cleaner element after the sixth cleaning or annually, whichever occurs first.

Changing The Air Cleaner Element

1. Park the crane on a firm level surface. Shift the transmission to neutral, engage the park brake, and shutdown the engine.
2. Inspect the service indicator (Figure 2-14) to see if the yellow indicator has reached the filter change (red) line. If it has not reached the red line, there is no reason to service the air cleaner. Over servicing the air cleaner will shorten the life of the element and unnecessarily increase downtime. If the yellow indicator has reached the filter change (red) line, proceed with the following steps.
3. Remove the cover from the air cleaner body (1). Refer to Figure 2-13.
4. Remove element (2) from the air cleaner body (1).
5. Remove the dust exhaust valve (3) and inspect it for damage or wear. Replace it if required.
6. Wipe the inside of the air cleaner body (1) clean using a damp cloth. Install the dust exhaust valve (3).
7. Clean or replace the element (2) as required.
8. Slide the element (2) into the air cleaner body (1).
9. Install the cover to the air cleaner body (1).
10. Reset the service indicator (Figure 2-14) by pressing the reset button on top of it.



1. Service Indicator
2. Reset Button
3. Filter Change (Red) Line

Figure 2—14
Air Cleaner Service Indicator

Figure 2—15
Clean The Air Cleaner Element By Soaking

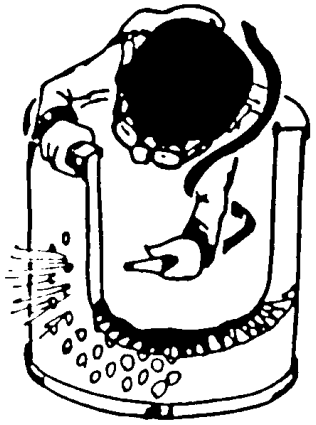


Figure 2—16
Clean The Air Cleaner Element With Compressed Air

Cleaning The Air Cleaner Element

The air cleaner element can be cleaned by washing or using compressed air. Compressed air is recommended when the element is to be reused immediately. A washed element must dry before reuse, however the washing method does a better job and must be used when exhaust soot has lodged in the fine pores of the filter media. Use one of the following procedures to clean the air cleaner element.

Figure 2—17
Inspecting The Air Cleaner Element

Washing

Soak the air cleaner element for 15 minutes or more, in a solution of water and Donaldson D-1400 detergent, or equivalent. Refer to Figure 2-15. Thoroughly rinse the element by spraying it with a hose in the direction opposite the air flow. Use water pressure of less than 40 psi (*276kPa*) to prevent damage to the filter paper within the element. Rinse until the water is clear; air dry. Do not attempt to dry the element using compressed air or a heat source. This may damage the element. Thoroughly inspect the element after cleaning.

Compressed Air

Hold an air hose nozzle at least 1 inch (*25mm*) away from the air cleaner element. Spray air through the element in the direction opposite to normal air flow. Move the nozzle up and down while rotating the element. Use air pressure of less than 100 psi (*690kPa*) to prevent damage to the filter paper within the element. Refer to Figure 2-16. Thoroughly inspect the element after cleaning.

Inspecting The Air Cleaner Element

Place a bright light inside the air cleaner element and rotate the element. Inspect the element from the outside looking for ruptures, tears, and holes. Refer to Figure 2-17. If any damage is discovered, replace the element.

Swing Speed Reducer Lubrication

Check the oil level in the swing speed reducer after every 50 hours of operation. The oil in a new or rebuilt swing speed reducer should be changed after the initial 200 hours of operation. Thereafter, change the oil with each 1,000 hours of operation or seasonally, whichever occurs first.

Swing Speed Reducer Oil Level Check

1. Park the crane on a firm, level surface. Shift the transmission to neutral and engage the park brake.
2. Engage the travel swing lock and shutdown the engine.
3. Clean the speed reducer around the swing unit check/fill plug to prevent contamination from entering the system. Remove the swing unit check/fill plug. Refer to Figure 2-18.
4. Oil should be within 0.5 in (*6mm*) of the bottom of the plug hole. Add oil as required to bring the oil to the proper level. Refer to the Lubrication Chart for the correct grade of oil.
5. Clean and install the swing unit check/fill plug.

Swing Speed Reducer Oil Change

1. Park crane on a firm, level surface, shift the transmission to neutral, and engage the park brake.
2. Level the crane on fully extended outriggers and swing the upper for several minutes, to agitate and warm the oil within the swing speed reducer.
3. Engage the travel swing lock, fully lower the boom, and shutdown the engine.
4. Thoroughly clean the exterior surface of the swing speed reducer around the swing unit check/fill and drain plugs to prevent contamination from entering the unit. Refer to Figure 2-18.
5. Remove the swing unit check/fill and drain plugs and allow the oil to drain into a suitable container. The drain plug is magnetic and should be inspected for large quantities of metal particles. After the initial oil change, this is a sign of damage or extreme wear within the unit, and a complete internal inspection may be necessary.
6. Remove and clean the swing unit vent plug. Install swing unit vent plug.
7. After the oil has thoroughly drained, clean and install the swing unit drain plug.
8. Fill the unit with oil through the swing unit check/fill hole, until the oil is within 0.25 in (*6mm*) of the bottom of the hole. For the correct grade and quantity of oil, refer to the Lubrication Chart.
9. Clean and install the swing unit check/fill plug. Properly dispose of the used oil.

Swing Brake Lubrication

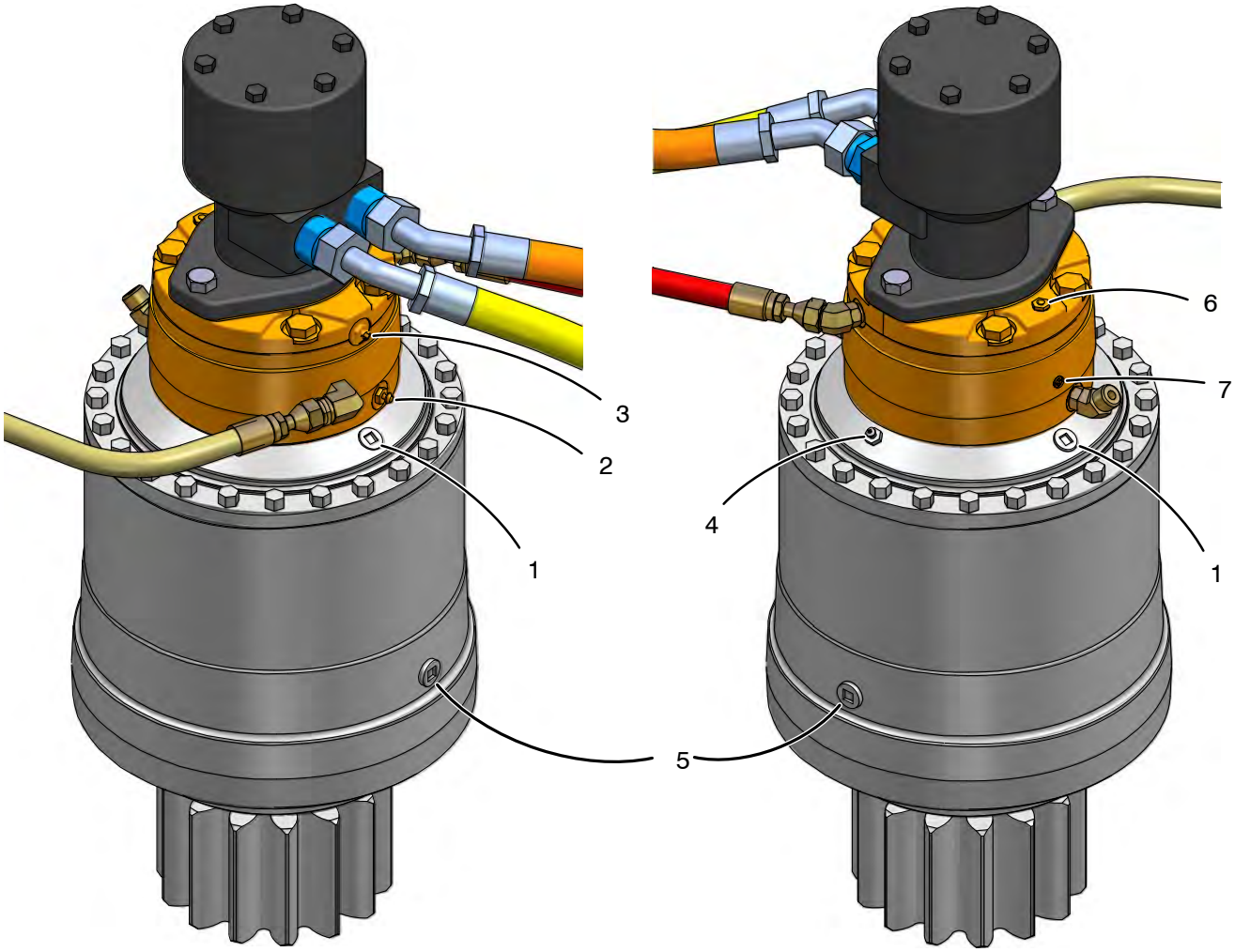
Check the oil level in the swing brake every 50 hours of operation. Change the oil with each 1,000 hours of operation or seasonally, whichever occurs first.

Swing Brake Oil Level Check

1. Park the crane on a firm, level surface. Shift the transmission to neutral and engage the park brake.
2. Engage the travel swing lock and shutdown the engine.
3. Clean the brake around the brake check/fill plug to prevent contamination from entering the system. Remove the brake check/fill plug. Refer to Figure 2-18.
4. Oil should be within 1 in (*25.4mm*) from the top of the brake housing. Add clean, uncontaminated hydraulic oil through the brake check/fill hole as required to bring the oil to the proper level. Refer to the Hi Performance Hydraulic Oil Chart for the correct grade of oil.
5. Clean and install the brake check/fill plug.

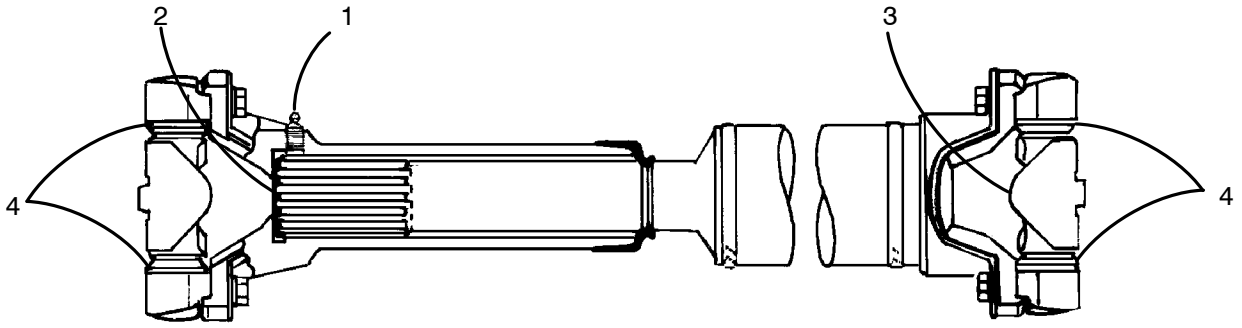
Swing Brake Oil Change

1. Park the crane on a firm, level surface. Shift the transmission to neutral and engage the park brake.
2. Engage the travel swing lock and shutdown the engine.
3. Clean the brake around the swing brake check/fill plug to prevent contamination from entering the system. Remove the brake check/fill plug. Refer to Figure 2-18.
4. Position a suitable container under the swing brake drain plug. Remove the drain plug and allow the oil to drain in the container.
5. After the oil has thoroughly drained, clean and install the swing brake drain plug.
6. Using clean, uncontaminated hydraulic oil, fill the swing brake through the brake check/fill hole as required to bring the oil within 1 in (*25.4mm*) from the top of the brake housing. Refer to the Hi Performance Hydraulic Oil Chart for the correct grade of oil.
7. Clean and install the brake check/fill plug.
8. Test all swing brake functions before placing the crane into service.



1. Swing Unit Check/Fill Plug
2. Swing Brake Bleeder
3. Swing Park Brake Bleeder
4. Swing Unit Vent Plug
5. Swing Unit Drain Plug
6. Swing Brake Check/Fill Plug
7. Swing Brake Drain Plug

Figure 2—18
Swing Speed Reducer And Brake



1. Slip Yoke Fitting*
2. Slip Yoke Grease Purge Location
3. U-joint Fitting (Each End)
4. U-joint Grease Purge Locations

* Some slip yokes are not equipped with a grease fitting.

Figure 2—19
Drive Tube And U-Joint Lubrication

Drive Tube And U-Joint Lubrication

Drive tubes and u-joints are used to transmit torque from one drive line component to another. They also help absorb shock loadings. Because they are so critical to crane operation, thorough lubrication is necessary. Use the following procedure to lubricate the drive tubes and u-joints every 50 hours of operation.

1. Park the crane on a firm level surface, shift transmission to neutral, engage the park brake, and shutdown the engine. Follow Steps 2 through 7 on each drive tube.
2. Check the slip yoke for looseness or side play.
3. Apply grease through the fitting at the slip yoke (if equipped) until all the old grease is purged from the slip yoke. Refer to Figure 2-19 for grease fitting locations.
4. Check each u-joint for looseness.
5. Apply grease through the fitting on each u-joint until all the old grease is purged. Purging should occur at all four seals on each u-joint. Refer to Figure 2-19 for grease fitting locations.
6. If grease does not purge from each seal, manipulate the u-joint until purging occurs.
7. If the above is not successful, remove the u-joint and inspect it. If the grease is rusty, gritty, or burnt, replace the u-joint.

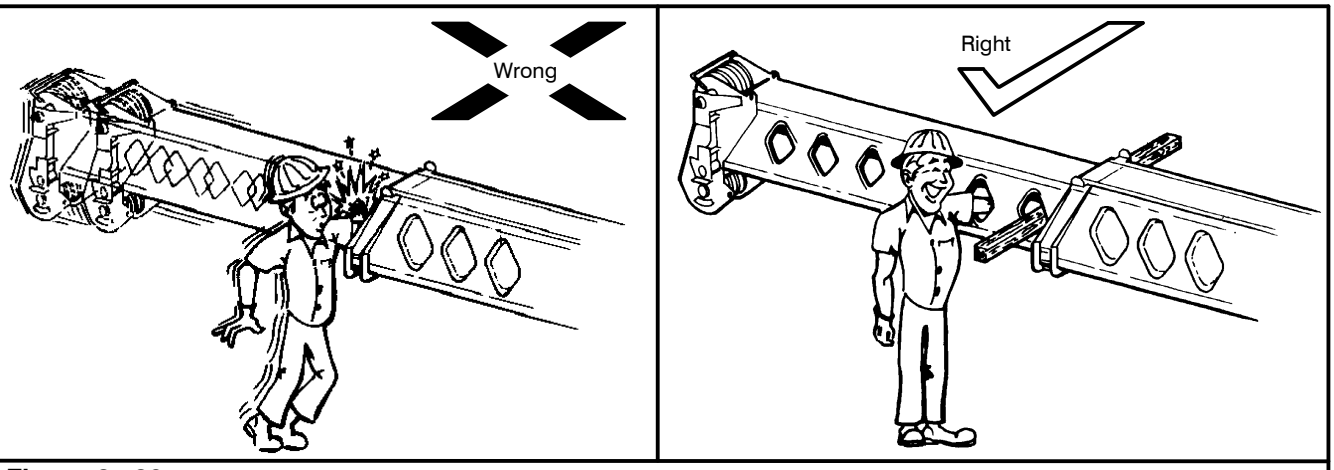


Figure 2–20
Shutdown the engine, ensure that the operator has vacated the operator's cab, and insert blocking through the diamond shaped hole closest to the base section of the boom before putting hands or tools inside a boom section.

Figure 2–21
Do not climb on boom or attachments.

Boom Lubrication And Inspection

Boom lubrication is important to extend wear shoe life and to aid in smooth performance of the boom. Lubrication involves covering all boom sliding surfaces with a film of grease. This is accomplished by applying grease directly to boom surfaces and the wear shoes that slide on the boom and telescope cylinder surfaces. In addition, ensure that the surfaces of the boom chord corner angles, where the wear blocks slide during extension and retraction of the boom, are coated with a film of grease. Refer to Figure 2-22 for wear shoe locations.

⚠ WARNING

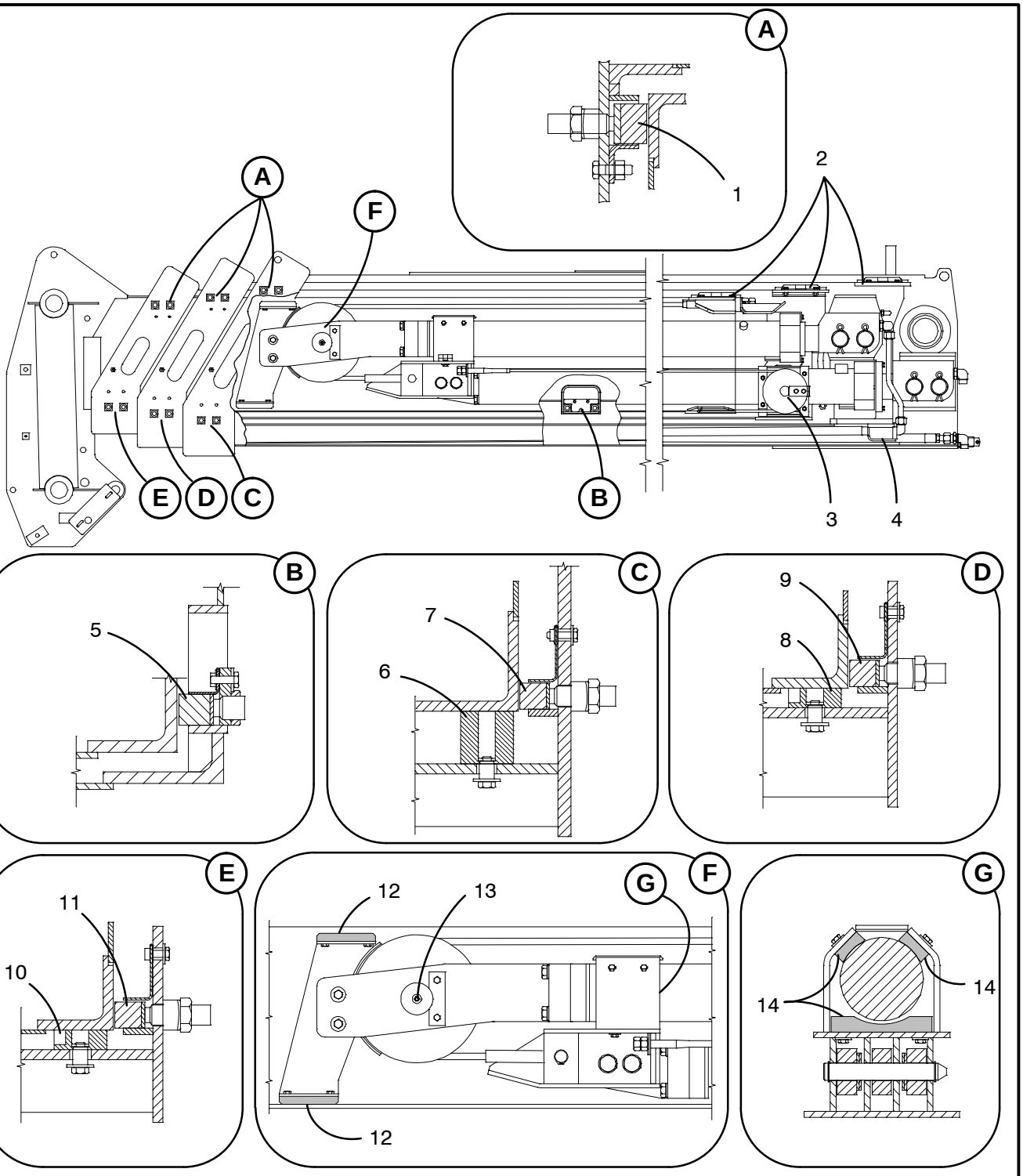
To avoid personal injury, do not climb, stand, or walk on the boom or fly. Use a ladder or similar device to reach necessary areas.

Do not put any part of your body through the holes in the boom sections. Movement of the boom could cause serious injury.

Do not use a crane that has a damaged boom. The structural integrity of the boom is lost and could collapse with any load. Use the crane only after the boom has passed a thorough inspection. Contact a Link-Belt Distributor for the proper inspection procedures.

Inspect the boom daily for adequate lubrication and grease it as necessary. Visually inspect all boom sections daily for damaged or cracked members or welds. If any dents, bends, cracked welds, etc. are found, do not use the crane. Contact a Link-Belt Distributor for repair procedures. Also check for damaged or leaking hoses, fittings, valves, cylinders, etc. Repair as necessary. At 250 hour intervals, grease all boom head sheaves and check all boom wear shoes for proper adjustment. See "Boom Wear Shoe Adjustment" in Section 3 of this Operator's Manual for further details on boom wear shoe adjustments.

Grease boom extend and retract sheaves at 50 hour intervals. It is also recommended that every 4,000 hours of operation the boom should be disassembled and the extend and retract wire ropes inspected, lubricated, and/or replaced as required. See "Wire Rope Lubrication" in this Section and "Wire Rope Inspection And Replacement Recommendations" in Section 5 of this Operator's Manual.



1. Side Wear Shoe - Top (6 Places)
2. Top Wear Shoe - (6 Places)
3. Grease Fitting - Retract Sheave (2 Places)
4. Side Wear Shoe - Inner Mid (2 Places)
5. Side Wear Shoe - Bottom (4 Places)
6. Bottom Wear Shoe - Base (2 Places)
7. Side Wear Shoe - Base (2 Places)
8. Bottom Wear Shoe - Inner Mid (2 Places)
9. Side Wear Shoe - Inner Mid (2 Places)
10. Bottom Wear Shoe - Outer Mid (2 Places)
11. Side Wear Shoe - Outer Mid (2 Places)
12. Telescope Cylinder Slider Bracket Wear Shoes (4 Places)
13. Grease Fitting - Extend Sheaves (2 Places)
14. Telescope Cylinder Wear Shoes (3 Places)

Figure 2—22
Boom Lubrication And Inspection

Winch Drum Lubrication

For maximum operating efficiency and service life of the winch drum, check oil level after every 50 hours of operation. The oil, in a new or rebuilt winch drum, should be changed after the initial 100 hours of operation. Thereafter, change oil with each 1,000 hours of operation or seasonally, whichever occurs first.

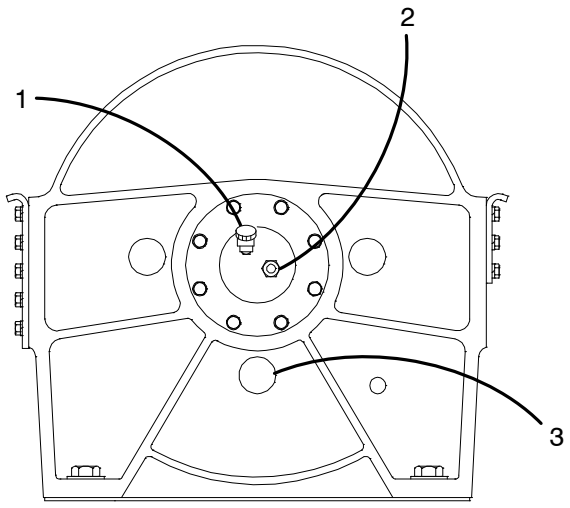
It is also recommended that every 2,000 hours of operation, the winch should be disassembled and thoroughly inspected for damaged or worn parts. Replace damaged or worn parts as required.

Winch Drum Oil Level Check

1. Park the crane on a firm level surface, shift the transmission to neutral, engage the park brake, and shutdown the engine.
2. Oil should be visible in the sight gauge. Refer to Figure 2-23.
3. If necessary, remove the fill cap and add oil through the fill port as required, until it reaches the proper level. Refer to the Lubrication Chart for the correct grade of oil.
4. Clean and install the fill cap.

Winch Drum Oil Change

1. Park the crane on a firm level surface, shift the transmission to neutral, and engage park brake and travel swing lock.
2. Cycle winch for several minutes, without a load to agitate and warm the oil within winch drum.
3. Rotate the winch drum until the drain plug is aligned with the bottom alignment hole in the side support. Shutdown the engine.
4. Thoroughly clean the exterior surface of the winch drum around the sight gauge, fill cap, and drain plug to prevent contamination from entering the unit. Refer to Figure 2-23.
5. Remove the fill cap.
6. Install a short piece of 1 inch (*25.4mm*) diameter pipe in the larger threads of the drain hole.



1. Fill Cap
2. Sight Gauge
3. Drain Plug Alignment Hole

Figure 2—23
Winch Drum

7. Remove drain plug through the pipe and allow the oil to drain into a suitable container
8. After the oil has thoroughly drained, remove the sight gauge.
9. Clean and install the sight gauge and drain plug.
10. Remove the 1 inch (*25.4mm*) diameter pipe.
11. Fill the unit with oil through the fill port, until oil is visible in the sight gauge. Refer to Figure 2-23. Refer to the Lubrication Chart for the correct grade and quantity of oil.
12. Clean and install the fill cap. Properly dispose of the used oil.

Wire Rope Lubrication

Wire rope is like a machine in that it has moving parts which require lubrication. Each time a wire rope bends over a sheave or straightens from a slack position many wires move against each other. Lubrication is necessary to help prevent wear caused by this movement. Lubrication also helps prevent deterioration of wire rope due to rust and corrosion.

WARNING

Rusty wire rope is dangerous since there is no way to determine its remaining strength.

Most wire ropes are lubricated during manufacture, but the lubricant does not last the life of the wire rope. The lubricant is squeezed out of the wire rope as it runs over sheaves under tension, or washed off by rain.

For the above reasons, wire rope MUST BE periodically lubricated. Crude or used oils and grease should not be used as lubricants because they may be grit or acid laden. Either of these conditions can cause damage to the wire rope.

No set rule can be given for lubrication frequency. This will depend on the type of conditions under which the wire rope is used. A wire rope used in wet conditions would need to be lubricated more often than one used in dry conditions, to prevent rust and corrosion.

Lubricants used for wire rope lubrication should have the following properties:

1. They must have enough adhesive strength to stay on the wire rope.
2. They must be able to penetrate between the wires and strands.
3. They must have high film strength.
4. They must resist oxidation.
5. They must remain soft and pliable.

Application Of Wire Rope Lubricant

Wire ropes that have been in service should be cleaned before relubricating them. Use a wire brush and compressed air to clean the wire rope. All possible foreign material and old lubricant should be removed from the wire rope before relubricating it. Use one of the following methods to apply the lubricant.

1. Continuous Bath

   Run the wire rope through a container filled with lubricant. A sheave mounted in the center of the container will hold the wire rope submerged as it passes through the container. Use swabbing to remove excess lubricant as the wire rope leaves the container.

2. Dripping

   Place a container above a sheave so a spigot can be opened to drip oil on the wire rope as it passes through the sheave groove.

3. Swabbing And Painting

   Two fast methods are swabbing the lubricant on with rags or painting it on with a brush.

4. Spraying

   Light lubricants may be applied with a spray gun. Aerosol cans of lubricant are also available.

Lattice Fly Inspection And Lubrication

Inspect all parts of the lattice fly daily. Lubricate all fly sheaves as required. Pay particular attention to the chords and lattice. If any dents, bends, cracked welds, etc. are found, do not use the lattice fly. Contact a Link-Belt Distributor for repair procedures.

WARNING

Do not use a fly which has been damaged. The structural integrity of the fly is lost and the attachment could collapse with any load. Use the fly only after it has passed a thorough inspection.

Crane Monitoring System

Maintenance of the Rated Capacity Limiter System consists of the following daily inspection prior to the first operation:

1. Check that the system is operating normally as described in Section 1 of this Operator's Manual.
2. Check the electrical cables connecting the various parts of the system.
3. Check insulation on the boom reeling drum cable.
4. Check boom reeling drum cable for proper tension.
5. Check all anti-two block switches for freedom of movement.
6. Check that the anti-two block weights are installed and working properly with the anti-two block switches.
7. Inspect the pressure transducers and the connecting hoses for oil leaks.
8. Test that the function limiters activate properly by simulating a two-block condition. (Do this by manually lifting the ATB weight.)
9. Using a known test weight, check that the displayed weight agrees with the test load. The displayed load includes the hook block and/or hook ball and any lifting equipment such as slings, pins, shackles, etc.
10. If crane capacities are rated for specific areas e.g. side, front, rear, check the system by swinging the boom into the permitted areas and checking that the rated capacity reading agrees with the crane capacities as listed in the Crane Rating Manual.
11. Check for erratic readings on the boom angle, the boom length, and the operating radius displays. Check the boom angle, boom length, and the operating radius for accuracy every 30 days.

⚠ WARNING

Any unusual or erratic system operation must be investigated and corrected immediately. If any problem is found with any of the above inspection steps, the problem must be corrected/repaired as soon as possible. If necessary to continue crane operations, refer to "System Inoperative Or Malfunctioning" in Section 1 of this Operator's Manual.

Hydraulic Hose Assembly Inspection

The frequency of inspection and replacement of hose assemblies should be determined by the operating environment, the potential risk from a hose failure, and past experience of hose failures in the application and environment.

⚠ WARNING

Always wear safety glasses when working with or inspecting pressurized hose assemblies. Do not search for leaks by running your hand or finger along a hydraulic hose. Hot hydraulic oil, under high pressure leaking through a small pinhole in a hose, can puncture gloves, your skin, and penetrate several inches *(centimeters)* into soft body tissue causing serious personal injury.

A daily visual inspection is recommended for all hose assemblies in service.

1. Check all hose end fittings for cracks, crushing, corrosion, slippage on the hose, leakage, or any other damage.
2. Check all hoses for cracks, exposed reinforcement, chafing, bulging, loose covers, or any other damage.
3. Check the installation of all hose assemblies for any kinked, crushed, flattened, or twisted hoses.

Replace any damaged hose assemblies, hose end mating fittings, and seals as required.

Hook Block, Hook Ball, And Swivel Inspection And Maintenance

1. All nuts, setscrews, pins, bolts, and retainers should be checked for tightness every 14 to 30 days, depending on the operating conditions and the product involved.
2. Inspect the components carefully at least once a month.

   Swivels: Check for excessive gap distance between the rotating parts. Check threaded parts that are installed together to see that they are secure and tight. Check all setscrews to see that they are tight and staked.

   Hook Blocks: Check all pins and bolts for tightness, spreading of side plates, weld cracks, sheave wear, bearing wear, spreading of hook, and that setscrews are tight and staked. Check that hook latch is operative.

   Hook Balls: Check pin, nut, and washer to ensure ball halves are held securely together. Check locating pin for excessive wear. Inspect swivel parts as specified previously. Check that hook latch is operative.
3. If a swivel is constantly overloaded, it will cause damage to the unit. The first sign of damage is often bearing brinelling (dimpling of the bearing races). This condition is determined by spinning the swivel by hand. If the motion is rough or has a ratchet-like effect, the bearing has been damaged and should be replaced.
4. The distance between the swivel barrel and shank or rotating members are pre-set with a factory clearance of 0.020-0.050 in (*0.5—1.2mm*). If this distance increases more than 0.060 in (*1.5mm*) over the above distance, it is a good indication of bearing fatigue and the unit should be removed from service.

Item	Under Intermittent Operating Conditions	Under Continuous Operating Conditions
Swivels, Swivel Overhaul Hook Balls, Swivel Hook Balls	14 days	24 hours
Hook Blocks with Bronze Bushed Sheaves	14 days	8 hours
Hook Blocks with Roller Bearing Sheaves	14 days	24 hours

Chart A — Hook Block, Hook Ball, & Swivel Lubrication Frequency

Item	Frequency	What to Check For	Appropriate Action
Swivels	14 days under continuous operation 30 days under intermittent operation	End play or gap of more than 0.06 in (*1.5mm*) along the axis.	Remove from service immediately.
		Rough turning.	Defective bearing. Remove from service immediately.
		Elongated eye holes, bent clevis pins.	Indicates overload. Remove for repairs.
Sheaves	14 days under continuous operation 30 days under intermittent operation	Misalignment, as evidenced by wobble or uneven groove flange wear.	Indicates major bearing wear. Remove from service. Check for wear in bronze spacers where used.
		Striations or corrugations in sheave groove.	Result of wire rope wear. If major, replace.
Hook Latch	When Used	Missing, off center, bent, broken spring, or defective.	Replace immediately
Hooks	Daily or When Used	Permanent deformation or stretching.	An indication of overload. If serious, replace.
			Any suspicion of fractures calls for an immediate investigation and, if necessary, replacement of part.
		Crack or other defects.	Hooks should be tested at least once a year by magnafluxing, x-ray, or other qualified method. Intermittent tests can be conducted by a less accurate oil stain method.

Chart B — Hook Block, Hook Ball, & Swivel Inspection Frequency

Turntable Bearing Capscrew Torque

Maintaining the proper torque on turntable bearing mounting capscrews is critical. If the bearing has been replaced or the crane undecked for any reason, capscrews should be replaced. Reuse of turntable bearing mounting capscrews is not recommended.

CAUTION

All turntable bearing capscrews use Loctite® 571 Pipe Sealant, or equivalent. The sealant or coating is used to protect the threads of the capscrews from rust and corrosion. Unprotected capscrews will not maintain the proper torque. Always use sealant or coating when installing turntable bearing capscrews.

Turntable Bearing Capscrew Inspection Schedule

Capscrews should be inspected and/or torqued after the initial 250 hours of operation of any new crane or if the crane has been undecked for any reason. Inspect and/or torque capscrews per the Turntable Bearing Capscrew Torque Inspection Schedule, thereafter. Torque capscrews to 1,500-1, 650 ft lb (*2 034—2 237Nm*).

Turntable Bearing Capscrew Torque Inspection Schedule

Schedule	Interval	Requirements
A	500 Hrs	• Perform an initial torque of the capscrews after the first 250 hours of operation of a new crane, or if the crane has been undecked for any reason, to establish capscrew torque baseline. **Note: Use the minimum applicable torque value when checking.**
		• After the next 500 hours of operation, if any of the capscrew torques have degraded, tighten capscrews to the proper torque. **Note: Use the minimum applicable torque value when checking.**
		• If the crane is utilized for duty cycle work, Schedule A must be continuously maintained during duty cycle applications.
		• Inspection Schedule A must be maintained until such a time that no capscrews require tightening after 500 hours of operation. Schedule B can then be followed.
		• The minimum applicable torque value is acceptable for the turntable bearing capscrew torque inspection.
B	Annually	• If the capscrew torque has degraded at any annual check, Torque Inspection Schedule A must be followed until such time that no loss of capscrew torque is observed.
		• The minimum applicable torque value is acceptable for the turntable bearing capscrew torque inspection.

Paint Maintenance

Knowledgeable equipment owners realize the value of periodic preventative maintenance and responsible care. A regular surface care program should be followed to protect the equipment's paint finish and maintain a like-new appearance. There is no one correct/ultimate procedure since the uniqueness of every crane's operating environment and owner/operator maintenance habits differ. However, it is important to remove surface contaminants before they have time to bond or etch into the paint finish.

Regular Preventative Maintenance

1. Regular washing is the best way to remove surface contaminants.
2. Always use mild cleaners and soaps, and rinse thoroughly after washing. Do not use harsh detergents, such as household laundry detergents, or cleaners that contain phosphates, as they will "burn" the paint, strip off protective coating, diminish the gloss and accelerate the contamination process.
3. Periodic waxing will enhance the luster and protect the paint surface.

If environmental damage to the paint finish is detected (loss of some of its luster due to lack of or inability to maintain as recommended) the paint finish can be restored to near-new appearance by following a simple polishing and waxing procedure.

Polishing And Waxing Procedure

1. Clean surface thoroughly by hand washing or power washing with a mild detergent. Rinse thoroughly with water before buffing.
2. Apply a polishing compound, such as Meguiar's M8432, or equivalent, to a surface area approximately two feet by two feet (*0.6 by 0.6m)* at a time. Ensure the cleaner is applied liberally to entire area and work on only that area with the buffing wheel.
3. Buff surface with an electric or air buffer at 1,000 rpm using a 3M Superbuff polishing pad, or equivalent, with light to medium pressure until a uniform high gloss is obtained. Hand wipe with a clean cloth.
4. After surface has been buffed, apply a quality automotive wax such a Meguiar's M- 26 Hi-Tech Yellow Wax, or equivalent, and hand buff until the cloth moves freely. The original luster of coating should be restored.

Cab Dash Cleaning

Care should be taken when cleaning the cab dash, especially the new polycarbonate dashes. If the incorrect cleaning agent is used, the finish of the material could be destroyed. It is recommended by the dash manufacturer that only the following materials be used for cleaning:

1. Soap and water
2. Denatured alcohol
3. Joy or Palmolive dishwashing liquids
4. Windex with Ammonia D
5. Formula 409
6. Fantastik
7. Mr. Clean

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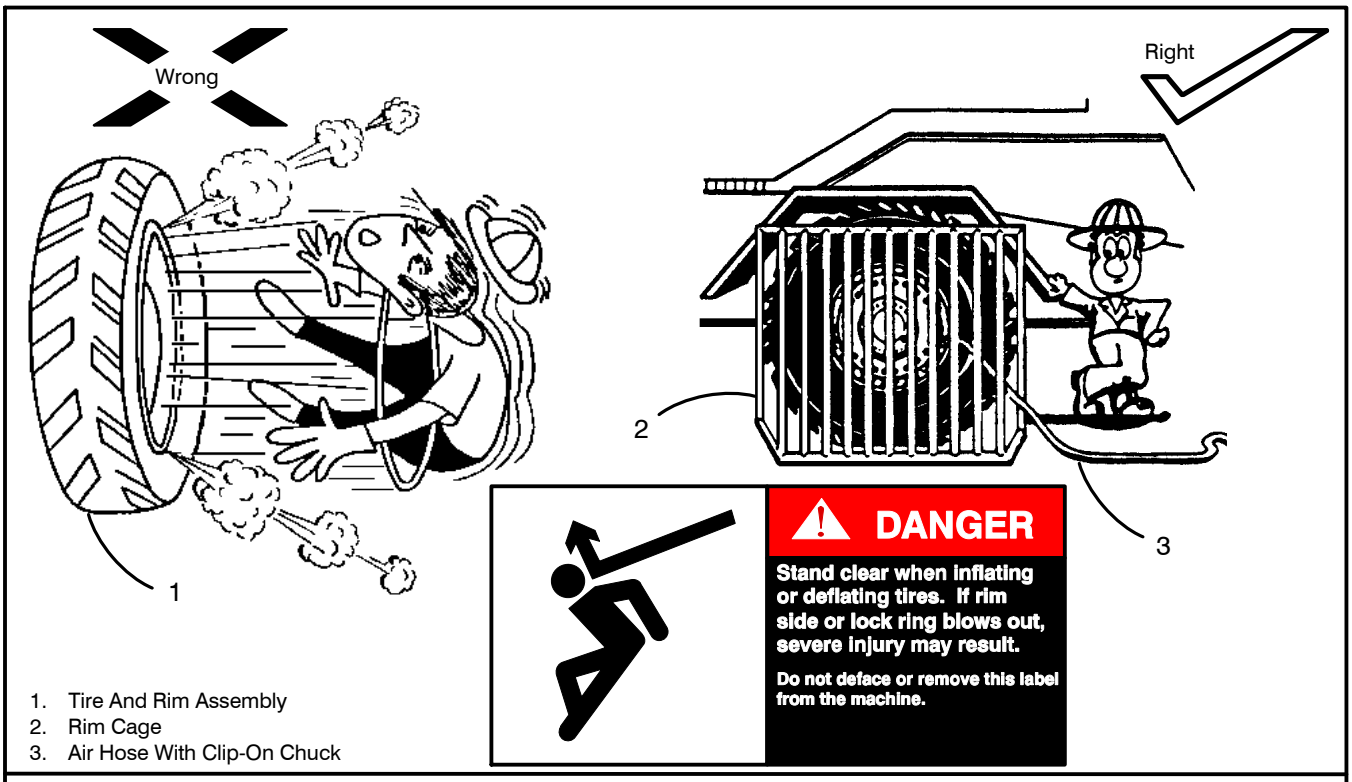
Notes:



1. Tire And Rim Assembly
2. Rim Cage
3. Air Hose With Clip-On Chuck

Figure 3–1
Use a Rim Cage When Inflating Tires

Tire Inspection

Inspect the tire treads daily and remove any debris that may be wedged in the tire grooves. Check for nails, screws, glass, or anything that may penetrate the tire and permit air to leak from the tires. Check the side walls and treads for cuts, bulges, and other damage. If internal damage to any tire is suspected, have it demounted and checked. Make all necessary repairs or replace as required.

When replacing tires, all tires should be of the same manufacturer, size, type, load rating, and construction. Refer to the tire manufacturer and follow all recommendations regarding tire inspection and replacement.

Tire Inflation

Check the tire inflation pressures daily when the tires are cold. Use the Tire Inflation label, on the carrier or the Tire Inflation chart in the Crane Rating Manual, to determine the correct tire pressure for the type of operation being performed. This label contains recommended tire pressures for different operating conditions. A rim cage should be used when inflating tires to protect the mechanic and any bystanders from the danger of "rim explosion". Improperly assembled or damaged rim components are subject to explode when tires are inflated. Refer to Figure 3-1.

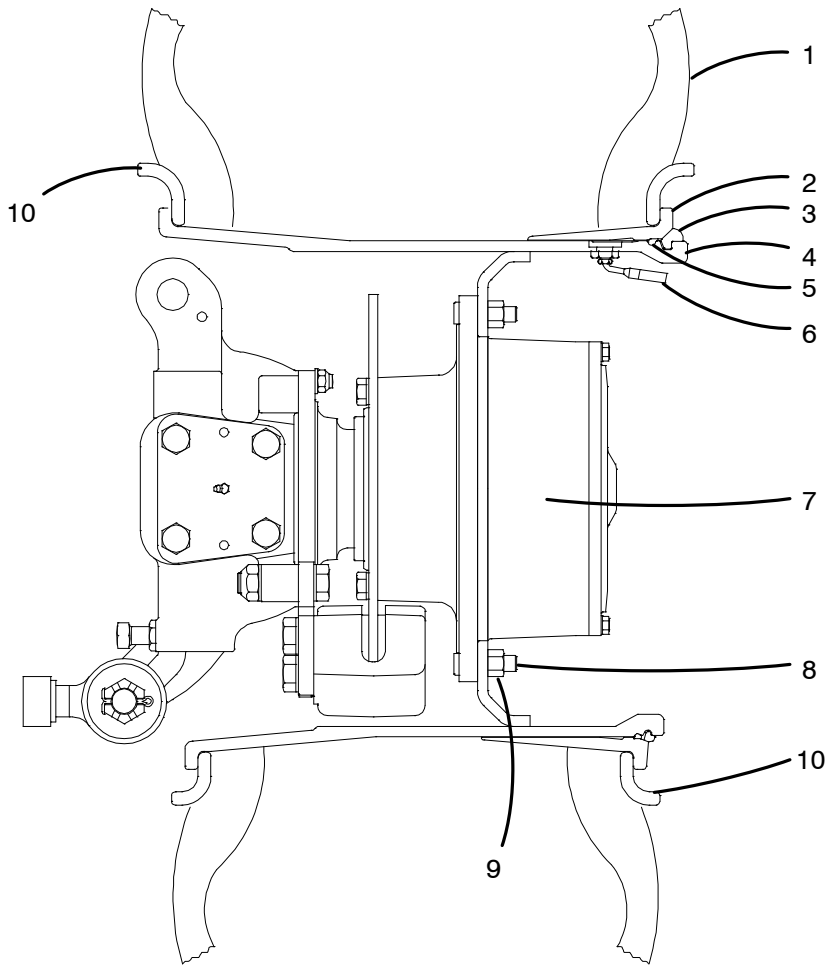
DANGER

Use a rim cage when inflating tires. Lock ring or side flange may explode if damaged or improperly assembled. Always use a rim cage and stand clear of the tire while inflating it.

Two categories of inflation pressures are listed on the Tire Inflation label, "Maximum Lifts On Rubber" and "Maximum Speed". While the crane is at the job site, the tires should be inflated to the pressure listed under "Maximum Lifts On Rubber" as all job site travel is limited to speeds less than 2.5 mph (*4km/h*). The crane should not be road driven with the tires inflated to "Maximum Lifts On Rubber" pressures.

"Maximum Speed" pressures are for highway travel only. Even with the tires inflated to the "Maximum Speed" pressures, speed is limited to 25 mph (*40km/h*) with a 30 minute rest period after each 50 miles (*80km*) of driving or 2 hours of sustained operation, whichever comes first. One hour minimum stop should be observed after each four hours of operation.

Inspect the wheel rims, clamps, nuts, studs, etc., on a weekly basis. If any damage is apparent, repair or replace before operating the crane.



1. Tire
2. Bead Seat
3. Lock Ring
4. Rim
5. O-Ring
6. Valve Stem
7. Axle
8. Mounting Stud
9. Lug Nut
10. Flange

Figure 3–2
Typical Tire And Rim Assembly

DANGER

Servicing the tire and rim assemblies can be extremely dangerous. For your protection, read and understand all safety instructions before removing or installing a tire and rim assembly.

Tire And Rim Safety Instructions

1. Always remove the valve cores, and exhaust all air pressure from the tire, prior to removing it. Rim components are under extreme pressure and could fly off.
2. Use a rim cage and stand clear when deflating and inflating tires. A damaged or misassembled rim assembly may burst. The operator should stand well away from the potentially explosive force.
3. After deflating the tire, check the valve stem by running a piece of wire through the stem, to ensure it is not clogged and the tire is completely deflated. Ice may form as the air leaves the tire or foreign material may clog the stem.
4. Do not reinflate a tire that has been run flat or extremely under inflated. Demount the tire and inspect it, the rim components, and wheel end for damage. These components may have been damaged or dislocated during the time the tire was under inflated.
5. Clean and inspect parts prior to assembly. Do not use bent, worn, damaged or rusted parts.

6. When assembling the tire and rim assembly, use only parts of the same type, manufacturer and correct size. Mismatched parts may appear to fit but when the tire is inflated they may fly apart with explosive force.
7. Always double check to ensure rim components are properly installed before inflating the tire. Misassembled parts could fly off during inflation.
8. When inflating a tire, use a air hose with a clip-on chuck and in-line pressure gauge. Ensure the air hose is long enough, to permit the person inflating the tire, to stand clear of the rim cage.
9. Inflate the tire to 10 psi (*68kPa*), and check the rim components for proper fit, before completely inflating. If the assembly is not correct, completely deflate the tire and correct the problem. Do not hammer on an inflated tire and rim assembly. Properly matched and assembled rim components will seat without tapping.
10. Once it is determined that the tire and rim are properly assembled, inflate the tire to the pressure listed on the Tire Inflation label on the carrier or the Tire Inflation chart in the Crane Rating Manual. Do not over-inflate the tire.
11. Always check rims and wheel ends for damage during normal tire inspection. Early detection of potential component failure may prevent serious injury.
12. Do not attempt to rework, weld, heat, or braze any damaged rim components. Heating may weaken the part and result in complete failure of the component and possible personal injury.

Tire And Rim Removal And Installation

Carefully read and understand the safety instructions in this Section of this Operator's Manual before servicing the tire and rim assemblies.

DANGER

Servicing the tire and rim assemblies can be extremely dangerous. For your protection, read and understand all safety instructions before removing or installing a tire and rim assembly.

Removal

1. Properly park the crane and engage the park brake. Level the crane on outriggers with all tires clear of the ground. Shutdown the engine.
2. Position a rim cage in front of the tire and rim assembly before deflating the tire.

DANGER

Exhaust all air pressure from the tire before removing it. Use a rim cage and stand clear when deflating a tire. Rim components are under extreme pressure and may fly off. Failure to exhaust air pressure, or use a rim cage, could result in a fatal accident.

3. Carefully remove the valve core from the valve stem (6). Refer to Figure 3-2. Allow the air pressure to exhaust from the tire (1). Install the valve core back in the valve stem. Remove the rim cage.
4. Remove all but four of the lug nuts (9) from the mounting studs (8). The four remaining lug nuts should be equally spaced around the rim (4).
5. Properly support the tire and rim assembly with an appropriate lifting device.
6. Remove the remaining lug nuts (9) from the mounting studs (8).
7. Carefully remove the tire and rim assembly from the axle (7).

Installation

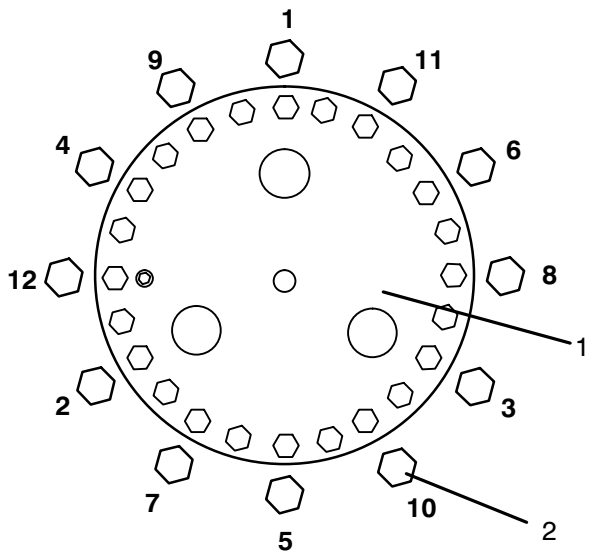
Correct installation and tightening of the tire and rim assembly is one of the most important operations in tire and rim maintenance. When tire or rim problems occur, incorrect installation and tightening procedures are usually found to be the cause of the problem. The following procedures must be carefully followed to ensure safe and dependable service.

1. Check the tire (1) to ensure it is completely deflated. Refer to Figure 3-2. Inspect the flanges (10), bead seat (2), o-ring (5), lock ring (3), and rim (4) for damage and proper assembly.

DANGER

All air pressure must be exhausted from the tire before installing it. An inflated tire may cause improperly assembled rim components to fly off. Failure to deflate the tire could result in a fatal accident.

2. Thoroughly clean the mounting surfaces of the rim (4) and axle (7). Remove any dirt, rust, excess paint, or other foreign materials. Also clean, but do not lubricate, the lug nuts (9) and mounting studs (8).



1. Wheel End
2. Lug Nut

Figure 3–3
Lug Nut Torquing Sequence for a Twelve Stud Wheel End.

3. Properly support the tire and rim assembly with an appropriate lifting device. Lift the tire and rim assembly and carefully position it on the axle (7).
4. Install the lug nuts (9) on the mounting studs (8). Tighten the lug nuts evenly to ensure the rim (4) is properly seated on the axle (7).
5. Tighten the lug nuts (9) to 225 ft lb (*305Nm*). See Figure 3-3 for the proper torquing sequence.
6. Repeat the proper torquing sequence and tighten the lug nuts (9) to their final recommended torque value of 450 ft lbs (*610Nm*).

⚠ CAUTION

Using improper torque values or torque procedure can cause distortion, slippage, or misalignment of the tire and rim assembly.

7. Properly position a rim cage in front of the tire and rim assembly.

⚠ DANGER

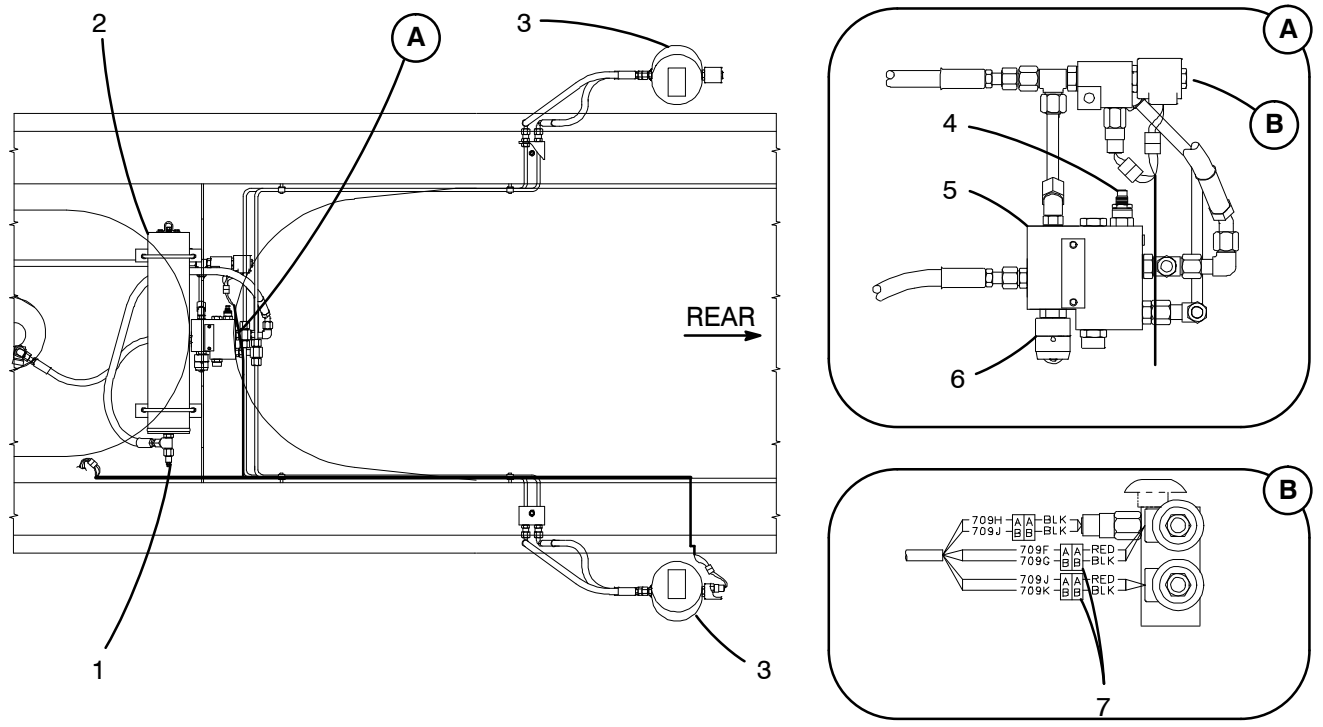
Use a rim cage and stand clear when inflating tires. Rim components are under extreme pressure and may fly off. Failure to use a rim cage could result in a fatal accident.

8. Inflate the tire to the pressure specified on the Tire Inflation label on the carrier or the Tire Inflation chart in the Crane Rating Manual.
9. Start the engine, fully retract the outrigger jacks and beams, and drive the crane approximately 1 mile (*1.6km*). Tighten the lug nuts again using the proper torquing sequence (Figure 3-3).

   Note: Each time a tire and rim assembly is installed the lug nuts should be retightened to the recommended torque value after each 10 hours of operation for the first 50 hours of operation. Check the lug nut torque every 50 hours of operation thereafter.

Brake Adjustments

The crane is equipped with disc brakes which have an automatic adjustment system. Therefore, the brakes should not require any adjustment. However, the brake linings should be periodically inspected for wear and replaced as required.



1. Accumulator Bleeder Valve
2. Accumulator (If Equipped)
3. Suspension Cylinders
4. Needle Valve
5. Manual Adjust Valve
6. Spool Valve
7. Solenoid Connectors

Figure 3—4
Axle Suspension Hydraulic System

Axle Suspension System

The axle suspension system is provided to improve crane stability. It also improves four wheel contact with the ground when traveling over rough terrain.

The front axle is rigidly bolted to the carrier frame. The rear axle is suspended on hydraulic cylinders with motion of the axle controlled by a four link suspension system. Two hydraulic cylinders are connected between the axle and carrier frame that allows an oscillation of the rear axle when the upper is over the front of the carrier.

When performing crane operations over the side on tires, a rigid rear axle suspension is needed to increase crane stability. Therefore, check valves are included in the rear axle suspension circuit to "lock" the rear axle frame when operations are performed other than over the front. When the upper is rotated to a position other than directly over the front, these check valves are shifted to the "locked" position. This system is automatically activated by rotating the upper.

An accumulator and additional solenoid operated check valve may be installed in the suspension hydraulic circuit to provide a hydro-gas suspension for a smoother ride.

The suspension should be checked and adjusted as required on a periodic basis. It also must be checked and adjusted prior to performing pick and carry operations. Refer to Figure 3-4.

Suspension Check And Adjustment

1. Park the crane on a firm level surface, shift the transmission to neutral, and apply the park brake.
2. Position the upper directly over the front of the carrier, fully retract boom at 0 degree angle, and engage the travel swing lock .
3. Measure the non painted rod length on the left and right suspension cylinder. The sum of the exposed rods should equal 4 in ± 0.125 in (*10cm ± 0.3cm*). If suspension cylinders are not within specification proceed to the next step.

4. If equipped with the hydro-gas suspension, label for assembly purposes the connectors (wires 709F, 709G, 709J, 709K BRN) going to the solenoids next to the manual adjust valve and disconnect. Refer to Figure 3-4.
5. Bleed the oscillation system.
   a. Level the crane on fully extended outriggers with all tires clear of the ground.
   b. Loosen the jam nut and open the needle valve on the manual adjust valve.
   c. Rotate the spool valve on the manual adjust valve counterclockwise to the extend position and fully extend the suspension cylinders.

      Note: The tires must be off the ground in this position.

   d. Rotate the spool valve clockwise to the retract position and by extending an outrigger jack over relief with engine at idle, fully retract the suspension cylinders.
   e. Rotate the spool valve counterclockwise to the extend position and extend the suspension cylinders.
   f. Rotate the spool valve to the retract position with the engine at idle and use the bleeder valves on both suspension cylinders to remove all of the air out of the retract sides.

      Note: The suspension cylinders should remain in the fully extended position for this bleeding process even though oil is being supplied to the retract sides of the suspension cylinders.

   g. Rotate the spool valve to the neutral position and lower the crane on tires.
   h. Rotate the spool valve clockwise to the retract position with the engine at idle and retract the suspension cylinders.
   i. Rotate the spool valve counterclockwise to the extend position with the engine at full throttle and use the bleeder valves on both suspension cylinders to remove all air out of the extend side of each cylinder. Also, if equipped bleed the hydro gas accumulator.

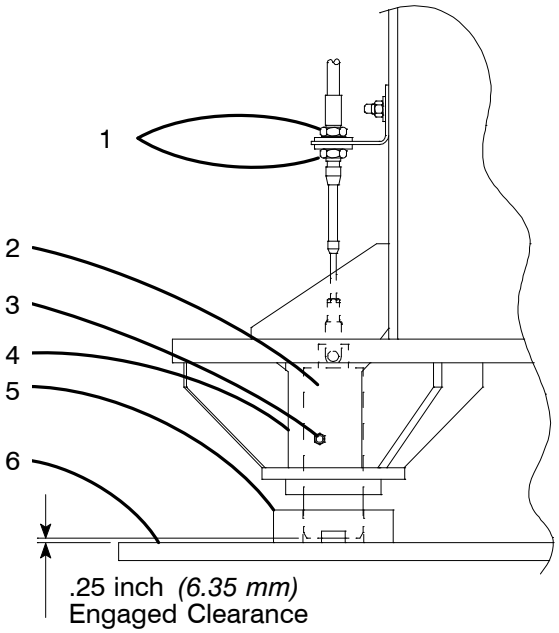
      Note: The suspension cylinders should remain in the retracted position for this bleeding process even though the manual valve is in the extend position.

6. With the outrigger jacks and beams in a safe fully retracted position, retract an outrigger jack over relief and rotate the spool valve on the manual adjust valve counterclockwise to the extend position.
7. Extend the suspension cylinders until the measured sum of the exposed rod equals 4 in ± 0.125 in (*10cm ± 0.3cm*) and then rotate the spool valve to the neutral position.

   Note: Do not retract suspension cylinders to obtain the measured sum of the exposed rods.

8. Measure the non-painted rod length on the left suspension cylinder. Length should equal approximately 2 in (*5cm*).
9. Measure the non-painted rod length on the right suspension cylinder. Length should equal approximately 2 in (*5cm*).
10. With the spool valve in the neutral position and holding the outrigger beam over relief, fully close the needle valve and tighten the jam nut.
11. If equipped with the hydro-gas suspension, reconnect the solenoid valve.

    Note: Wires 709F, 709G connect to the top solenoid.



1. Cable Adjusting Nuts
2. Swing Lock Pin
3. Grease Fitting
4. Pin Guide Tube
5. Retainer Ring
6. Carrier Deck

Figure 3—5
Travel Swing Lock Adjustment

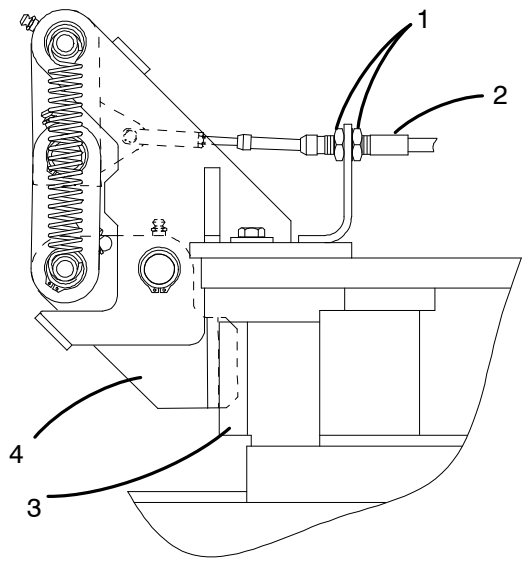
Travel Swing Lock Adjustment

The travel swing lock is a two position, positive lock of the upper over the carrier to prevent swinging of the upper. The travel swing lock must be kept in adjustment.

1. Park the crane on a firm level surface. Shift transmission to neutral and engage the park brake. Level the crane on outriggers.
2. Check that the travel swing lock is engaged and shutdown engine. Refer to Figure 3-5.

   Note: The travel swing lock control cable should only operate after the release button in the center of the control knob is depressed. Replace the control cable if the release button does not operate properly.

3. Check the engagement of the swing lock pin in the retainer ring on the carrier deck. The pin should extend in the retainer plate to within .25 of an inch (*6.35mm*) of the carrier deck.
4. Adjust the stroke of the swing lock as required by using the cable adjusting nuts.
5. Test the swing lock in each working position (over front and over rear) before operating the crane.



1. Cable Adjusting Nuts
2. Control Cable
3. Swing Gear
4. Swing Lock Pawl

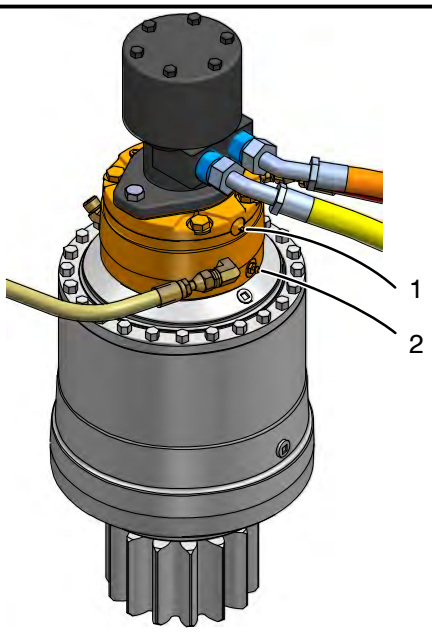
Figure 3—6
360 Degree Swing Lock Adjustment

360 Degree Swing Lock

The 360° swing lock, if equipped, functions to prevent rotation of the upper over the carrier by engaging a pawl in the external swing gear teeth. For the swing lock to operate properly it must be adjusted correctly.

360° Swing Lock Inspection And Adjustment

1. Park the crane on a firm level surface, shift the transmission to neutral, and engage the park brake. Level the crane on outriggers.
2. Engage the travel and 360° swing locks. Shutdown the engine.
3. Visually inspect the 360° swing lock pawl. The pawl should be fully engaged with the linkage just over center. Refer to Figure 3-6.
4. If the pawl is not fully engaged and the linkage is not just over center, use the cable adjusting nuts to correctly position it.
5. Tighten the adjusting nuts and test the 360° swing lock before operating the crane.



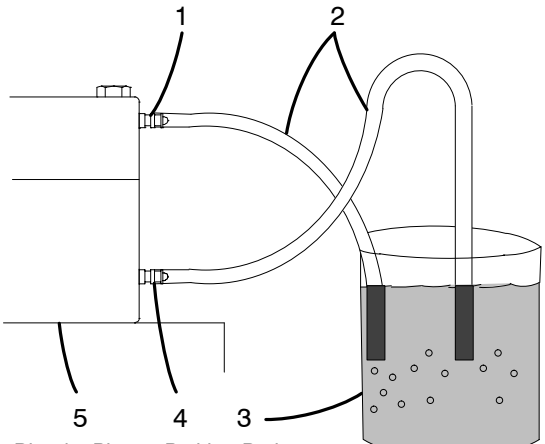
1. Swing Park Brake Bleeder Plug
2. Swing Service Brake Bleeder Plug

Figure 3–7
Swing Unit

Swing Brake Bleeding

Bleed the swing brake whenever a hydraulic line is removed from the swing unit to remove any air that may have been trapped in the circuit. Removal of any trapped air within the brake assembly is essential for proper operation of the swing and service park brake. The following procedure requires two people.

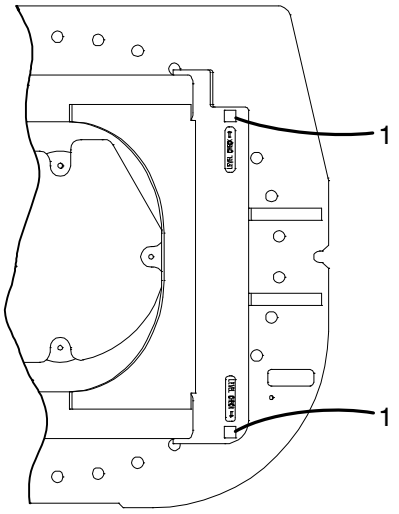
1. Park the crane on a firm level surface, shift the transmission to neutral, and engage the park brake.
2. Engage the travel swing lock and shutdown engine.
3. Check that all control levers are in the neutral position and move the function lockout switch to the "DISABLE" position.
4. Shutdown the engine and disengage the main hydraulic pump.
5. Thoroughly clean the bleed plugs and surrounding area with an approved cleaning solvent to prevent contamination from entering the oil circuits. Allow the area to air dry.
6. Attach one end of a rubber hose to each of the bleeder plugs. Refer to Figure 3-8. Ensure that each rubber hose fits securely on the bleeder plugs.
7. Fill a clean, clear container with clean hydraulic oil, and place the open end of each rubber hose into the container. For the correct grade, refer to "Hi Performance Hydraulic Oil" found in Section 2 of this Operator's Manual.
8. Start the engine.



1. Bleeder Plug - Parking Brake
2. Rubber Hose
3. Container
4. Bleeder Plug - Service Brake
5. Swing Brake

Figure 3–8
Swing Brake Bleeding Procedure

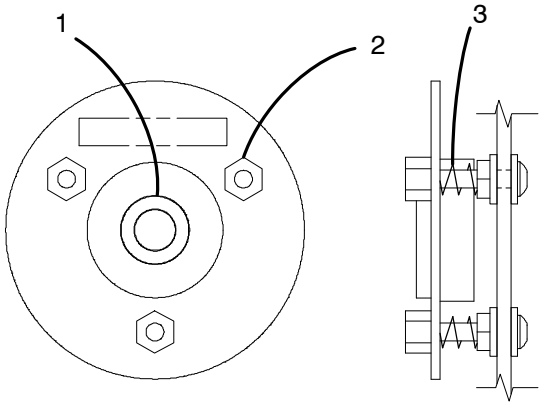
9. Bleed the service brake portion of the swing brake:
   a. With the engine running at idle speed and the swing park brake released, slowly loosen the bleeder plug.
   b. With one person stationed in the operator's cab and another observing the container, the person in the cab should slowly apply and release the swing brake pedal while the other observes the container for air bubbles after loosening bleeder fitting. Repeat the process until no air bubbles are observed.
   c. Securely close the bleeder plug and tighten to 9-12 ft lb (*12–16Nm*).
10. Bleed the park brake portion of the swing brake:
   a. With the engine running at idle speed, apply the swing park brake and slowly loosen the bleeder plug.
   b. With one person stationed in the operator's cab and another observing the container, the person in the cab should apply and release the swing park brake, utilizing the swing park break switch, while the other observes the container for air bubbles after loosening bleeder fitting. Repeat the process until no air bubbles are observed.
   c. Securely close the bleeder plug and tighten to 9-12 ft lb (*12–16Nm*).
11. Remove the rubber hoses from the bleeder plugs.
12. Check the hydraulic oil level. Refer to "Hydraulic Reservoir Oil Level Check" found in Section 2 of this Operator's Manual.
13. Test all swing brake functions before operating the crane.
14. Properly dispose of used oil.



Front of Upper Frame

1. Level Check Location

Figure 3—9
Level Check Location



1. Glass Vial
2. Adjusting Nut
3. Spring

Figure 3—10
Bubble Level Adjustment

Bubble Level Adjustment

A bubble level, for assisting with leveling the crane on outriggers, is mounted in the operator's cab on the right side of operator's cab wall. It should be checked periodically to ensure proper adjustment.

1. Park the crane on a firm level surface, shift the transmission to neutral, and engage the park brake.
2. Level the crane on fully extended outriggers. Position the upper over the front of the carrier and engage the travel swing lock. Fully retract the power sections of the boom. Boom down to 0° angle.
3. Verify the crane is level by placing a carpenter's level across the level check locations on the front of upper frame. Refer to Figure 3-9. Check levelness with the upper over the rear and over the side of the crane. Adjust the outriggers as necessary.
4. If necessary, rotate the adjustment nuts as required until the bubble is centered within the vial. Refer to Figure 3-10.

   Note: Do not flatten out the springs under the bubble level. Loosen rather that overtighten the adjustment nuts to gain the necessary adjustment.

Crane Monitoring System

A properly calibrated Rated Capacity Limiter is critical for safe crane operation. The boom angle and length are crucial factors in determining crane capacities. The Rated Capacity Limiter must be checked for accuracy on a daily basis and calibrated as needed. Refer to "Crane Monitoring System" in Section 2 of this Operator's Manual for the daily check list for the system.

The Rated Capacity Limiter should be calibrated by a qualified technician only. Contact your Link-Belt Distributor to arrange for a qualified technician to perform the calibration procedures.

Hydraulic System Relief Valve Adjustment

The following instructions pertain to checking and setting all relief valve pressures in the hydraulic system. All cranes are tested and properly adjusted before leaving the factory and should not need checking when first put into operation. Each 250 hours of operation, the relief valve pressure settings should be checked. A drop in relief valve pressure setting may be noticed the first time checked. This is normal and is probably due to lessening of spring tension or stress relief in relief valve parts.

If a new or rebuilt pump is installed, all relief valve pressures must be backed off and reset, as outlined in this Section before putting the crane in operation. The purpose of this is to avoid the possibility of damaging the new pump from over pressurization, if relief valves are set incorrectly. Do not operate the crane over relief pressures for extended periods of time to avoid overheating of hydraulic oil.

DANGER

When it is required to operate the crane during maintenance and/or adjustments, use extreme caution as service personnel may have to work near and/or under moving machinery. Serious personal injury and/or death may result. Always remain in visual and/or verbal contact to ensure the safety of service personnel. Use a signal person if necessary.

CAUTION

Relief valves are provided to protect the hydraulic system. Do not increase relief valve pressures above specifications or hydraulic system damage may occur.

Preparing the Crane For Checking Relief Pressures

1. Park the crane on firm level surface. Shift the transmission to neutral and engage the park brake.
2. Level the crane on outriggers and operate the hydraulic functions as required to bring the hydraulic oil temperature to its normal operating range. Refer to Section 2 of this Operator's Manual for oil operating temperature ranges.
3. Engage the travel swing lock with the upper directly over the front of the carrier.
4. Fully retract and lower the boom. Shutdown the engine.

   Note: Checking relief valve pressures is simplified by using two persons, one in the operator's cab to operate the controls and one to check and adjust the relief valves.

Relief Valve Pressure Checking Instructions

Refer To Figure 3-11 and Figure 3-12 for relief valve and quick disconnect fitting locations.

1. Use a gauge of known accuracy. Have the gauge calibrated if necessary. Use a snubber or gate valve to reduce shock loading in the gauge.
2. Release the hydraulic system precharge pressure by pushing the pressure relief plunger on the relief valve on the hydraulic reservoir.
3. Turn the ignition switch to the "ON" position but do not start the engine and work the control or switch, for the circuit being checked, back and forth to relieve any trapped hydraulic pressure.

WARNING

All trapped hydraulic pressure must be exhausted from the system before installing a gauge in any quick disconnect. A sudden release of hot oil could cause burns or other serious injury.

4. Install the pressure gauge on the quick disconnect fitting.
5. Refer to the "Hydraulic Pressure Setting" chart to determine the correct pressure setting for the circuit being checked. Also, review the procedure for checking that particular circuit outlined in the chart.
6. Start the engine.
7. If applicable, fully engage the control for the circuit being checked and hold it in that position.
8. With the engine running at the speed specified in the "Hydraulic Pressure Settings" chart, check the gauge for the correct reading, adjust as required.

   Note: Obtain each final pressure by bringing the pressure up to the proper setting, not by backing down to it.

9. Allow the engine to return to idle before shutting it down.
10. Release the hydraulic system precharge pressure and work the control back and forth to relieve any hydraulic pressure before removing pressure gauge from the quick disconnect fitting.

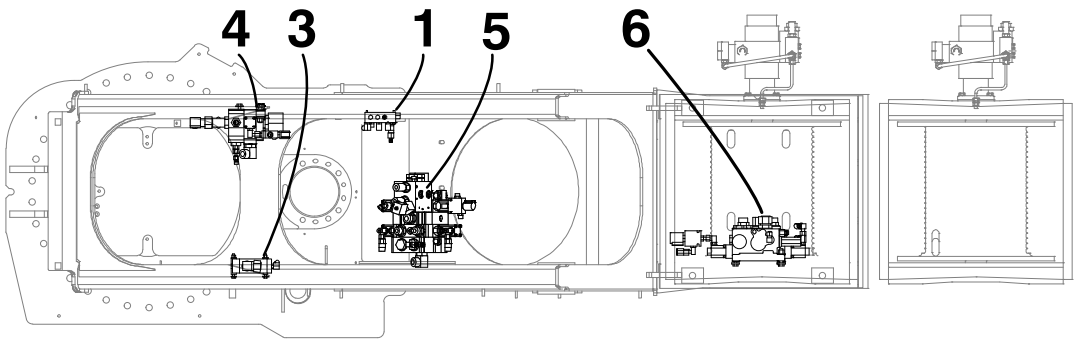
Hydraulic Pressure Settings

Relief Valve	Hydraulic Circuit	Quick Disconnect & Adjustment Location	Relief Valve Setting*	Procedure For Setting The Relief Valve
1	Pilot Control	Figure 3-12 A & B	500 psi +0 -50 psi (*3 448kPa*) (*+0 −344kPa*)	Engage swing park brake. Swing left and hold. Adjust with engine at idle.
2	Outrigger	Figure 3-12 C & D	3,000 psi (*20 685kPa*)	Fully Retract An Outrigger Beam & Hold. Engine At Full Throttle.
3	Steering (See Note 1)	Figure 3-12 C & E	2,500 psi (*17 237kPa*)	Crane on Tires, Boom Fully Retracted, Travel Swing Lock Engaged with Boom Over Front & 2-Wheel Steer Engaged. Fully Steer Left Or Right & Hold, Check Pressure. Engine At Idle. **Note: Outrigger relief valve must be properly set before setting steering relief.**
4	Boom Hoist	Figure 3-12 F & G	3,500 psi (*24 133kPa*)	Crane on Fully Extended Outriggers, Travel Swing Lock Engaged, Boom Fully Retracted & Over Front. Fully Boom Up & Hold. Engine At Full Throttle.
		Figure 3-12 F & H	2,000 psi (*13 790kPa*)	Crane on Fully Extended Outriggers, Travel Swing Lock Engaged, Boom Fully Retracted & Over Front. Fully Boom Down & Hold. Engine At Full Throttle.
5	Swing	Figure 3-12 I & J	1,500 psi (*10 342kPa*)	Travel Swing Lock Engaged with Boom Over Front. Swing Left & Hold, Check Pressure. Swing Right & Hold, Check Pressure. Engine At Idle.
	Boom Telescope	Figure 3-12 K & J	3,000 psi (*20 685kPa*)	Crane on Tires, Boom Fully Retracted, Travel Swing Lock Engaged with Boom Over Front. Simultaneously Retract Telescope Cylinders and Outrigger Beam & Hold. Engine At Full Throttle.
6	Front & Rear Winch	Figure 3-12 L & M	3,600 psi (*24 822kPa*)	Travel Swing Lock Engaged with Boom Over Front. Remove & Plug Line to the Winch Brake. Engage Winch Down & Hold. Engine At Full Throttle.

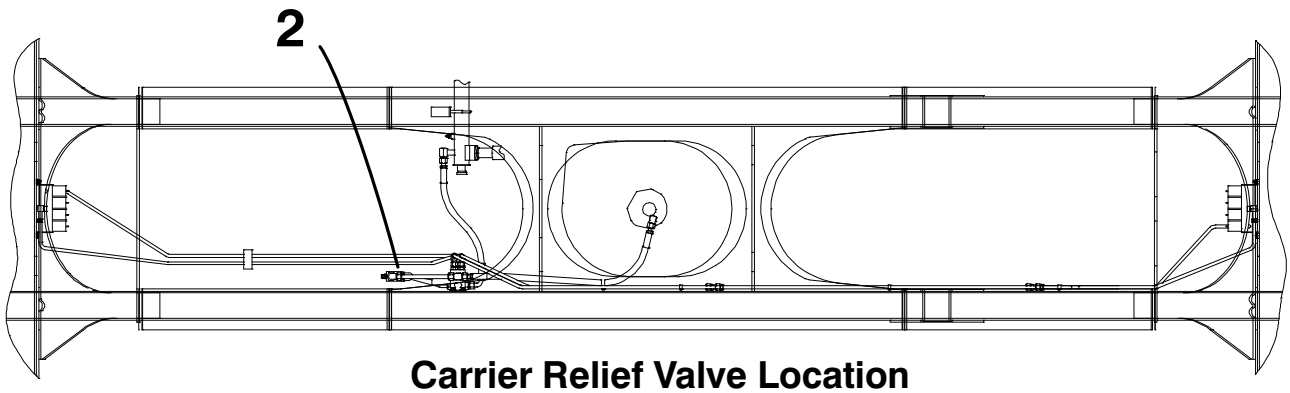
***Adjust All Pressures to Within ±50 psi (*344kPa*) Except Where Noted.**

Note 1: Some valves are equipped with non-adjustable reliefs. Only a pressure check is required.

Figure 3—11
Relief Valves Pressures & Adjusting Procedures



Upper Relief Valve Locations



Carrier Relief Valve Location

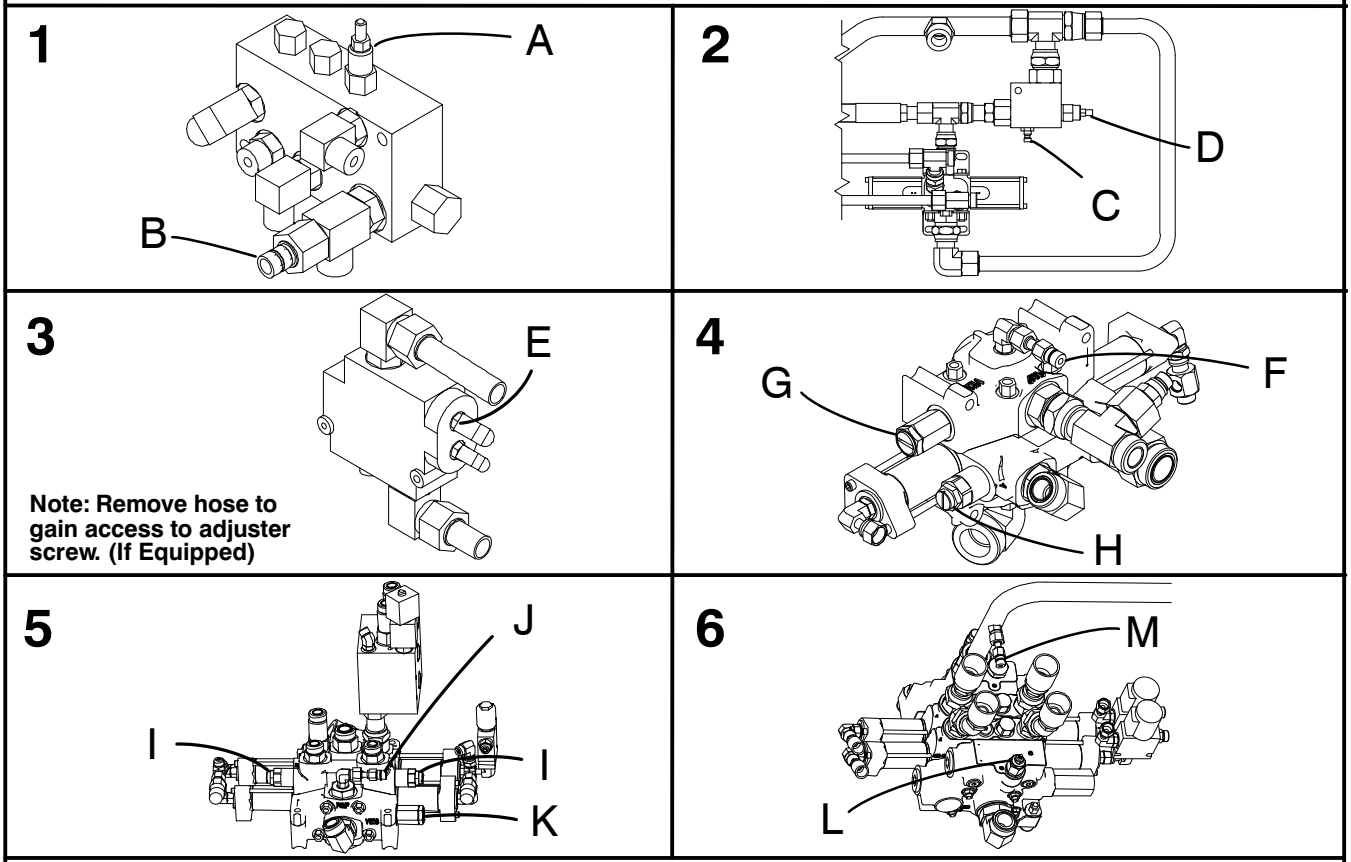


Figure 3–12
Relief Valves

Emergency Steer Accumulator Pressure Check (If Equipped)

In the event of hydraulic pressure failure the emergency steer accumulator is used to supply the hydraulic steering circuit with enough pressure to allow the operator to negotiate approximately eight 90° turns. The accumulator pressure should be checked at 250 hour intervals to ensure the accumulator is properly pressurized. To check the accumulator pressure use the following procedures along with Figure 3-13.

1. Park crane on firm level surface. Shift the transmission to neutral and apply the park brake.
2. Level the crane on outriggers, position the upper directly over the front of the carrier, and engage the travel swing lock.
3. Properly check and adjust the steering relief valve as outlined in "Hydraulic System Relief Valve Adjustment" in this Section of this Operator's Manual.
4. Shutdown the engine and bleed all pressure from the accumulator by rotating the steering wheel back and forth until no pressure is available to move the wheels.

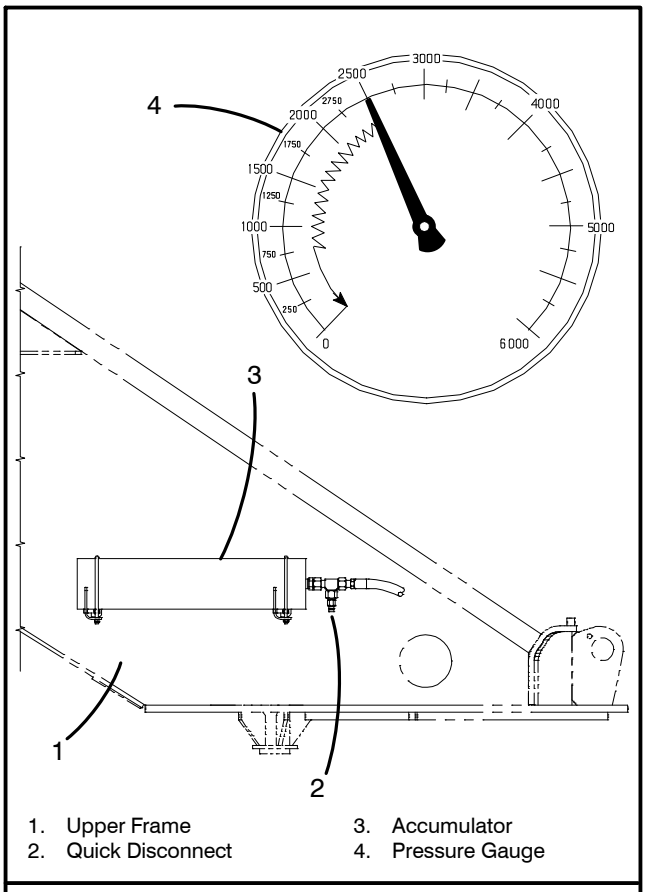
⚠ WARNING

All trapped hydraulic pressure must be exhausted from the system before installing a gauge in any quick disconnect. A sudden release of hot oil could cause burns or other serious injury.

5. Connect the pressure gauge to the quick disconnect on the hydraulic input to the accumulator.

   Note: Pressure gauge must be accurate up to 3,000 psi (*20 685kPa*).

6. Start the engine and align the tires straight ahead. Engage two wheel steer.
7. To charge the accumulator, engage the outrigger jack cylinder control switches to the "EXTEND" position and hold until pressure gauge reads 2,500 psi (*17 237kPa*). The engine should be running at half throttle.
8. Shutdown the engine and turn the ignition switch to the "ON" position but do not start the engine.



1. Upper Frame
2. Quick Disconnect
3. Accumulator
4. Pressure Gauge

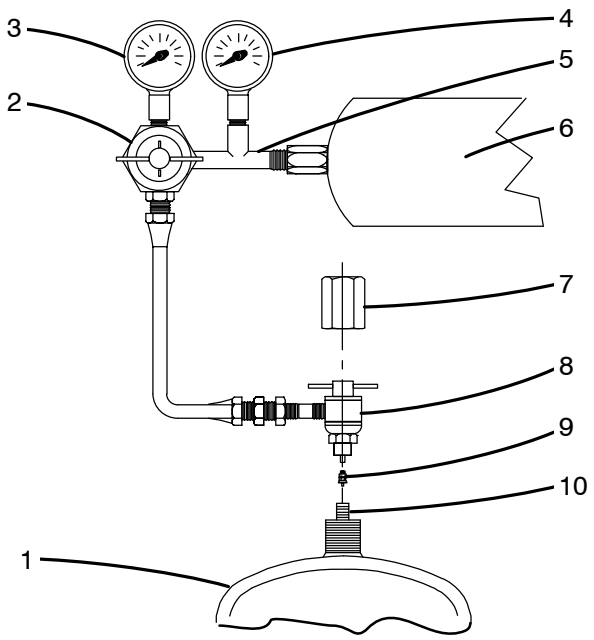
Figure 3—13
Emergency Steer Accumulator

9. Turn the steering wheel to full left, then full right, then full left while counting the number of cycles as wheel crosses the straight ahead position.

   Note: One full cycle equals center, to full left, to full right, to center.

10. Observe the pressure gauge while accumulator pressure is being steered down. Note the pressure reading at which the accumulator pressure drops off rapidly. This is the accumulator precharge pressure, which should be between 700-800 psi (*4 827—5 516kPa*).

    Note: Two cycles (eight 90°turns), minimum should be obtained from a complete accumulator precharge.



1. Accumulator
2. Regulator Valve
3. Regulator Gauge
4. Supply Gauge
5. Regulator Assembly
6. Dry Nitrogen Tank
7. Cap
8. Chuck
9. Adaptor *
10. Charging Valve

*** An Adaptor May Be Required To Connect Chuck To Valve.**

Figure 3—14
Typical Accumulator Charging Regulator Arrangement

Accumulator Check/Charging

The crane may be equipped with up to four accumulators. These accumulators are pressurized with dry nitrogen. The accumulator pressure should be checked at 250 hour intervals to ensure the accumulator is properly pressurized.

There are three bladder type accumulators on the upper. Two are in the carrier service brake hydraulic circuit and one is in the pilot control circuit. If the crane is equipped with the hydro-gas suspension, a piston type accumulator is on the carrier within that hydraulic circuit.

The accumulators may be checked and/or charged with the unit installed or removed from the crane. If unit must be removed from the crane, refer to the crane Shop Manual for the correct procedure. Use the following procedure to check and/or charge the accumulators.

1. Lower, detach, and secure load, as required.
2. Stabilize the crane for service as follows:
   a. Park the crane out of the way on a firm and level surface.
   b. Engage the park brake and/or properly block the tires.
   c. Engage the swing park brake and/or travel swing lock, as required.
   d. Level the crane on fully extended outriggers.
   e. Fully retract and lower the boom, as required.
3. Shutdown the engine and disengage the main hydraulic pump.

⚠ WARNING

Solvents and cleaning solutions can be hazardous. Serious personal injury may result from misuse of these products. Read and follow all the manufacturer's recommendations concerning solvents and cleaning solutions.

4. Thoroughly clean area to be disassembled with an approved cleaning solvent to prevent contamination from entering the hydraulic oil circuits. Allow the area to air dry.

⚠ WARNING

Hydraulic oil is under pressure and may be hot. A sudden release of hot oil could cause burns or other serious injury. Shutdown the engine and exhaust all trapped hydraulic pressure from the system before removing any line or component.

5. To relieve hydraulic system pressure:
   a. Turn the ignition switch to **"ON"**, but **DO NOT START THE ENGINE.** Move the function lock-out switch to the "OPERATE" position.
   b. Work the crane control levers and outrigger switches back and forth several times.
   c. Rotate the steering wheel back and forth repeatedly until steering becomes hard. (On cranes equipped with emergency steering system, it will take several rotations of steering wheel before steering becomes hard.)
   d. Turn the ignition switch to the **"OFF"** position**.**
6. Check that all control levers are in the neutral position and move the function lockout switch to the "DISABLE" position.
7. Remove cap (7) from the accumulator. Refer to Figure 3-14.
8. Close the regulator valve (2) and the valve on the dry nitrogen tank (6).
9. Connect the regulator assembly (5) to the dry nitrogen tank (6).
10. Open the valve on the dry nitrogen tank (6). The regulator gauge (3) should read 0 psi (*0kPa*). If required, close the regulator valve (2) to achieve the zero pressure at the regulator gauge (3).
11. Note the reading on the supply gauge (4). The dry nitrogen tank must contain sufficient volume and pressure to charge the accumulator.
12. Connect chuck (8) to the charging valve (10) and turn the t-handle clockwise to open the charging valve (10).
13. When charging a new accumulator (1), open the regulator valve (2) slowly until the regulator gauge (3) reads 5 psi (*34kPa*).
14. Slowly open the regulator valve (2) until the regulator gauge (2) reaches the correct pressure. Refer to the following table for the correct pressure.

Accumulator	Pressure	
	psi	*kPa*
Carrier Service Brake Circuit (2)	1,400	*9 653*
Pilot Control Circuit	100	*689*
Hydro-Gas Suspension Circuit	450	*3 103*

15. Close the valve on the dry nitrogen tank (6) and turn the t-handle of the chuck (8) counterclockwise to close the charging valve (10).
16. Remove the chuck (8) from the charging valve (10) and inspect the charging valve (10) for leaks. There will be a slight discharge of nitrogen when the chuck (8) is removed.

    Note: Allow accumulator to rest 10—15 minutes after charging. This will allow gas temperature to adjust and equalize. Recheck gas pressure and adjust as necessary.

17. Check the charging valve (10) for leaks with soapy water. If leaks are present, repair as required.
18. If no leaks are present, install the cap (7) on the accumulator (1).
19. Check hydraulic reservoir oil level. Add oil as required. Refer to Section 2 of this Operator's Manual for correct type and procedure.
20. Start the engine and let idle for five minutes. Inspect the connections on the hydraulic lines for leaks. Repair if needed.
21. Test all hydraulic functions of the crane for proper operation before placing the crane into service.

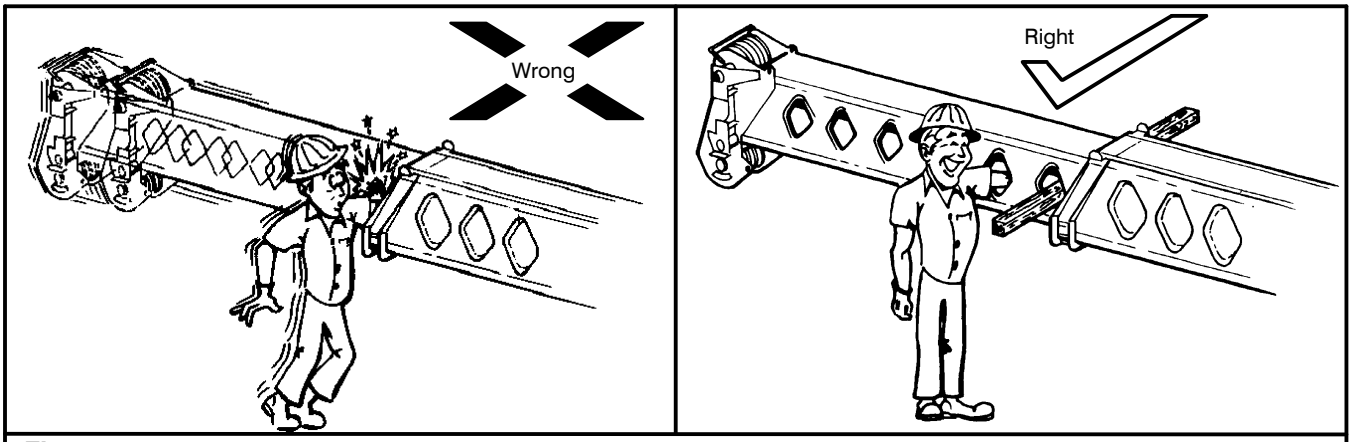


Figure 3–15
Shutdown the engine, ensure that the operator has vacated the operator's cab, and insert blocking through the diamond shaped hole closest to the base section of the boom before putting hands or tools inside a boom section.

Figure 3–16
Do not climb on boom or attachments.

Boom Wear Shoe Adjustment

Boom wear shoes are provided as a means of keeping the boom working smoothly. They must be adjusted periodically to prevent excessive deflection of the boom sections. Refer to Figure 3-17.

1. Level the crane on fully extended outriggers with all tires clear of the ground. Swing the upper over the front of the carrier and engage the travel swing lock. Lower the boom and extend each boom section as required to gain access to each wear shoe.
2. Center each boom section within the next and adjust the top side wear shoes (1) to maintain a 0.09 in (*2.3mm*) maximum clearance. Adjust the bottom side wear shoes (4, 5, 7, 9, & 11) to maintain a 0.03 in (*0.8mm*) maximum clearance.

⚠ WARNING

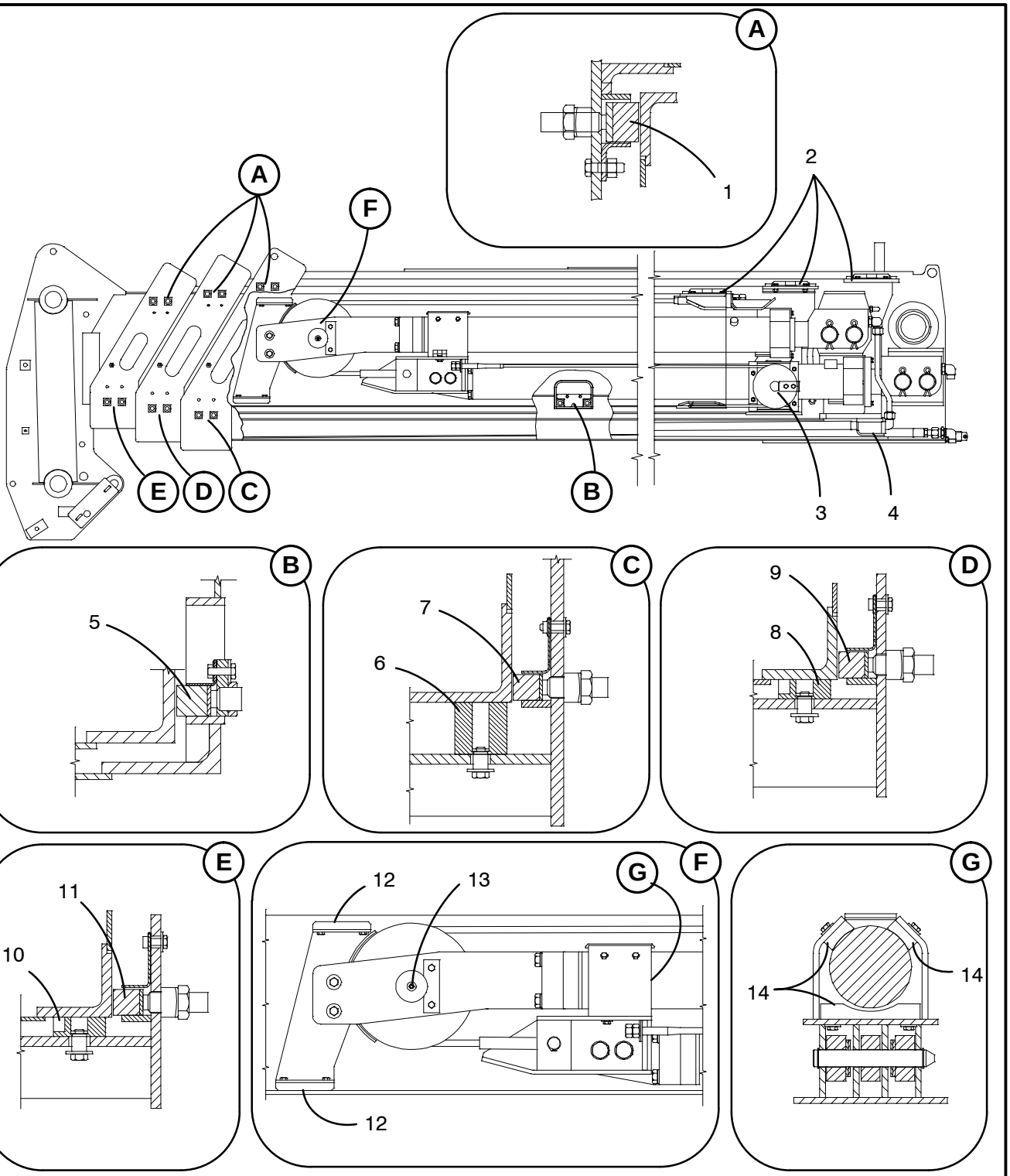
To avoid personal injury, do not climb, stand, or walk on the boom. Use a ladder or similar device to reach necessary areas.

To prevent movement of individual boom sections, shutdown the engine, ensure that the operator has vacated the operators cab, and insert blocking through the diamond shaped hole closest to the base section before putting hands or tools inside the boom.

3. Check the thickness of the wear shoes in the chart below for the minimum allowed for each wear shoe. Replace the shoes in pairs as required.

Minimum Wear Shoe Thickness			
Item	**Wear Shoe**	**Inches**	**mm**
2	Top Wear Shoes	0.5	*12.7*
6	Bottom Wear Shoes - Base	1.75	*44.45*
8 & 10	Bottom Wear Shoes - Inner mid, Outer Mid	0.5	*12.7*
12	Slider Bracket Wear Shoes	0.5	*12.7*
14	Cylinder Wear Shoes	0.38	*9.7*

4. After adjusting the boom wear shoe clearances, boom up to a 60° angle and fully extend the boom. Confirm that the boom is straight and the sections are centered within each other. Thoroughly lubricate all boom wear shoes and their sliding surfaces as outlined in Section 2 of this Operator's Manual.



1. Side Wear Shoe - Top (6 Places)
2. Top Wear Shoe - (6 Places)
3. Grease Fitting - Retract Sheave (2 Places)
4. Side Wear Shoe - Inner Mid (2 Places)
5. Side Wear Shoe - Bottom (6 Places)
6. Bottom Wear Shoe - Base (2 Places)
7. Side Wear Shoe - Base (2 Places)
8. Bottom Wear Shoe - Inner Mid (2 Places)
9. Side Wear Shoe - Inner Mid (2 Places)
10. Bottom Wear Shoe - Outer Mid (2 Places)
11. Side Wear Shoe - Outer Mid (2 Places)
12. Telescope Cylinder Slider Bracket Wear Shoes (4 Places)
13. Grease Fitting - Extend Sheaves (2 Places)
14. Telescope Cylinder Wear Shoes (3 Places)

Figure 3—17
Boom Lubrication And Inspection

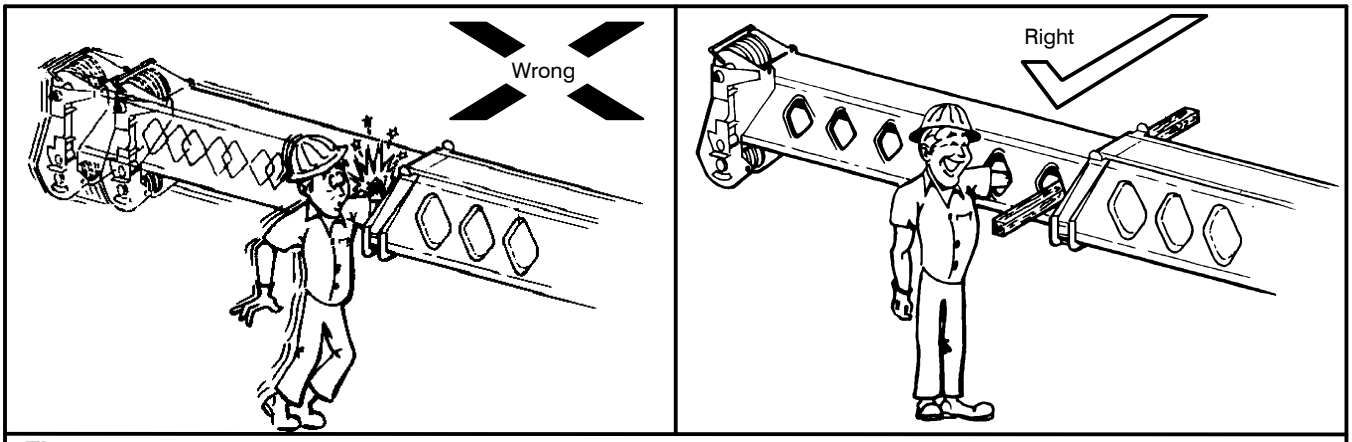


Figure 3–18
Shutdown the engine, ensure that the operator has vacated the operator's cab, and insert blocking through the diamond shaped hole closest to the base section of the boom before putting hands or tools inside a boom section.

Boom Extend And Retract Wire Rope Inspection And Adjustment

The boom extend and retract cables must be periodically inspected, adjusted, and lubricated for optimum performance and maximum service life. The boom extend and retract wire rope anchors must also be torqued periodically to compensate for stretching of the wire rope.

Safety Instructions

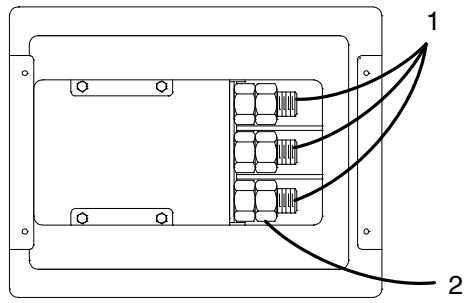
WARNING

Read and understand the following safety instructions before attempting to perform any of the tasks. Potential for severe injury is present if all safety instructions are not strictly followed.

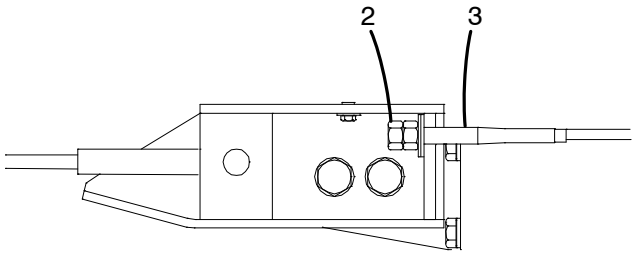
1. Insert blocking material through the diamond shaped holes in the boom to prevent movement of the individual sections before putting your hands or tools inside the boom. Unexpected movement of the boom sections could sever fingers, hands, arms, or other extremities.
2. Properly shutdown the crane, check that all control levers are in the neutral position and move the function lockout switch to the "DISABLE" position before working inside the boom sections.
3. To avoid personal injury, do not climb, stand, or walk on the boom. Use a ladder or similar device to reach necessary areas.
4. Remove blocking from boom before modifying the boom length and once servicing is completed.

Extend And Retract Cables Inspection And Lubrication

1. Lower, detach, and secure load, as required.
2. Stabilize the crane for service as follows:
   a. Park the crane out of the way on a firm and level surface.
   b. Apply the park brake and/or properly block the tires.
   c. Engage the swing park brake or travel swing lock, as required.
   d. Level the crane on fully extended outriggers.
3. Using the boom telescope override switch, fully extend the outer mid and tip sections at 0° angle. Retract the sections 6-12 in (*15–30cm*) to remove the load from the extend wire ropes.
4. Properly shutdown the crane, check that all control levers are in the neutral position, and move the function lockout switch to the "DISABLE" position.



Boom Extend Wire Rope Anchors



Boom Retract Wire Rope Anchor

1. Extend Wire Rope Anchors
2. Jam Nut
3. Retract Wire Rope Anchor (Both Sides)

Figure 3—19
Boom Extend And Retract Wire Rope Anchors

5. Visually inspect the extend and retract cables through the diamond shaped cutouts in the side of the boom sections:
   a. Check each of the cables for damage, wear, and corrosion. Refer to "Wire Rope Inspection and Replacement Recommendations" in Section 5 of this Operator's Manual for complete criteria.
   b. Check that the retract cable is taut and has 25-100 ft lb (*34—135Nm*) of torque on the threaded end of the cable. Refer to Figure 3-19.
   c. Each of the extend cables must be at least 1.50 in (*38mm*) off the bottom, inside surface of the boom when measured at mid span of the cable. Refer to Figure 3-20.
   d. All of the extend cables must sag equally within 1 in (*25mm*) of each other.
   e. If any of the above requirements are not met, replace any damaged equipment as required and proceed to Extend and Retract Cables Adjustment.
6. Properly lubricate the extend and retract cables. Refer to "Wire Rope Lubrication" in Section 2 of this Operator's Manual for complete information.

Extend And Retract Cables Adjustment

1. Lower, detach, and secure load, as required.
2. Stabilize the crane for service as follows:
   a. Park the crane out of the way on a firm and level surface.
   b. Apply the park brake and/or properly block the tires.
   c. Engage the swing park brake or travel swing lock, as required.
   d. Level the crane on fully extended outriggers.
3. Fully retract the boom and position it at a 0° boom angle.
4. Extend tip section of the boom approximately 3 ft (*1m*) and then fully retract the boom.
5. Check that the tip section contacts the collar of the next section. (0 to 1/8 inch (*0—3mm*) clearance is acceptable.)
6. If tip section does not contact the collar of next section, the retract cable must be tightened.
   a. Extend the inner section(s) of the boom, but leave the tip section fully retracted.
   b. Access the retract cable ends through the diamond shaped cutouts in the side of the boom sections, toward the boom head.
   c. Loosen the outer jam nuts on both ends of the retract cable. Refer to Figure 3-19.
   d. Equally tighten the retract cable on each end until the tip section contacts the collar of the the next section.

      Note: If the torque on the inner jam nuts approaches 100 ft lb (*135Nm*) and the tip is still not touching the next section, the extend cables will need to be loosened. Each of the extend cables should be loosened by the same amount.

   e. When the tip section contacts the collar of the next section, tighten the outer jam nuts on the ends of the retract cable.

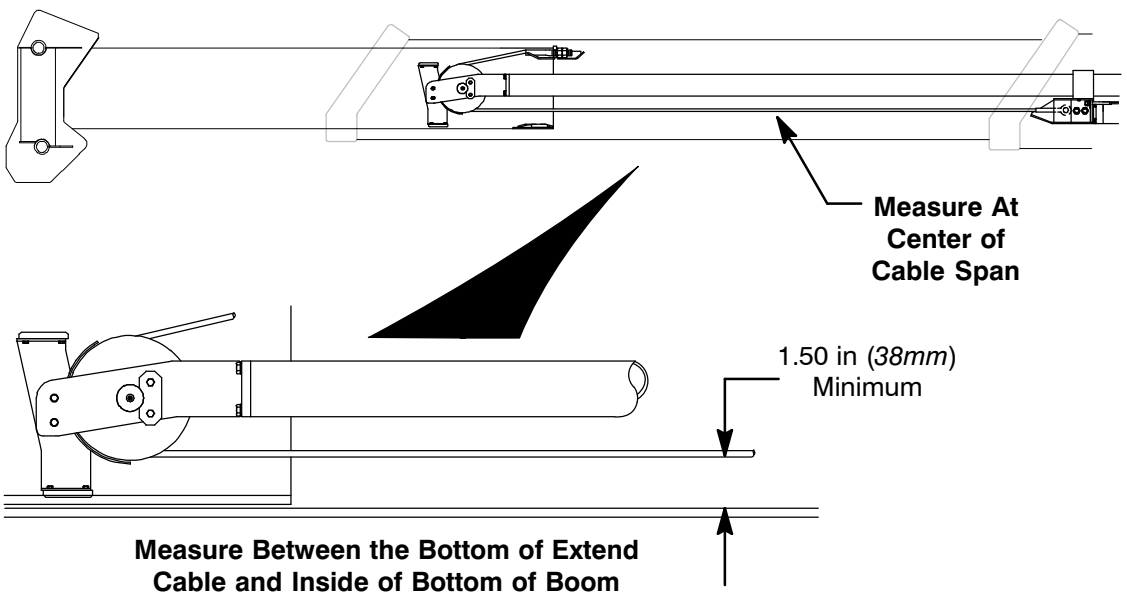
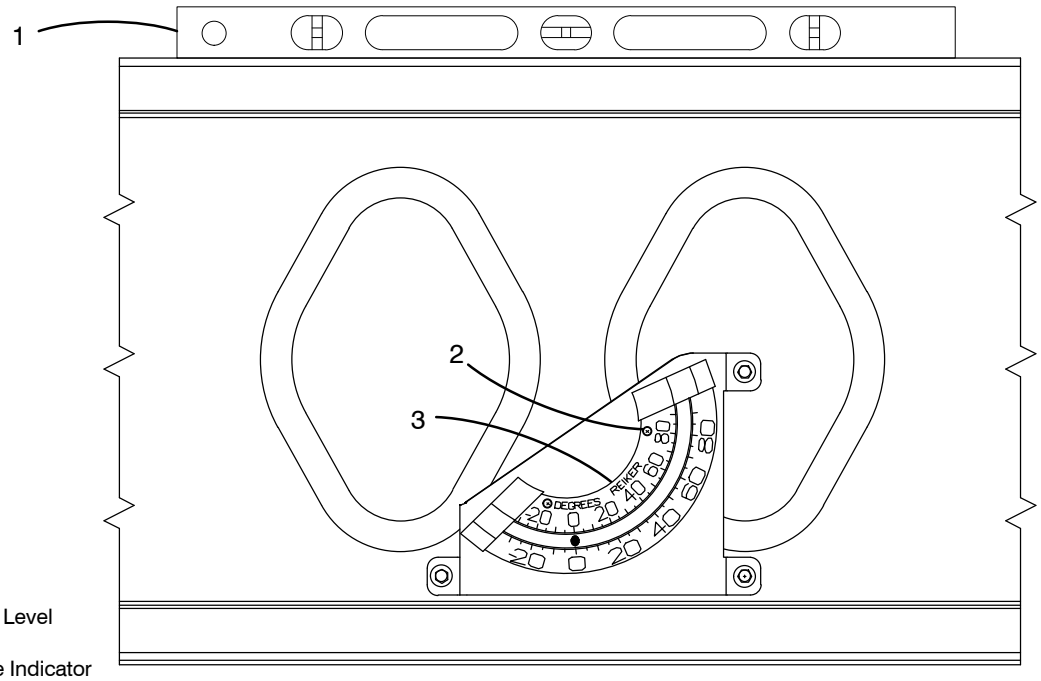


Figure 3—20
Extend Cables Tension Adjustment

7. Using the boom telescope override switch, fully extend the outer mid and tip sections at 0° angle. Retract the sections 6-12 in (*15—30cm*) to remove the load from the extend wire ropes.
8. Visually inspect the extend cables through the diamond shaped cutouts in the side of the boom sections:
   a. Each of the extend cables must be taut and a minimum of 1.50 in (*38mm*) from the bottom of the inside surface of the boom when measured at mid span of the cable. Refer to Figure 3-20.
   b. All of the extend cables must sag equally within 1 in (*25mm*) of each other.
   c. If either of the above requirements are not met, the extend cables need adjustment.
9. Fully retract the boom.
10. Remove the access cover on the top, rear of the boom base section.
11. Loosen the outer jam nuts and torque each of the inner jam nut on the extend cable ends to 20-25 ft lb (*28—34Nm*). Refer to Figure 3-19. Repeat the torque on each cable until all the cables have the same torque value.

    Note: A 2 inch (*50.8mm*) "crows foot" wrench is provided to aid in this adjustment.

12. Repeat Steps 7 and 8 and adjust the torque on each of the extend cables until all the requirements in Step 8 are met.
13. Repeat Steps 3 through 5 to confirm the tip section contacts the collar of the next boom section (0 to 1/8 inch (0- *3mm*) clearance is acceptable.)
14. Ensure that all outer jam nuts are properly tightened and the access cover on the top, rear of the boom base section is installed before returning the crane to service.



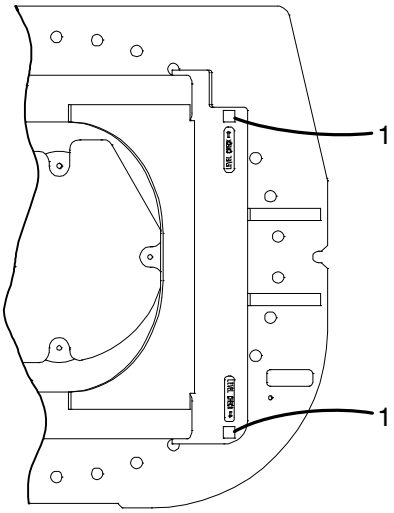
1. Carpenter's Level
2. Screw
3. Boom Angle Indicator

Figure 3—21
Boom Angle Indicator

Boom Angle Indicator Adjustment

A mechanical type boom angle indicator is mounted to the right of the operator's cab on the base section of the boom. Refer to Figure 3- 21. It must be adjusted properly and the crane must be level for the unit to accurately indicate boom angles. Check the adjustment of the boom angle indicator daily to ensure its accuracy.

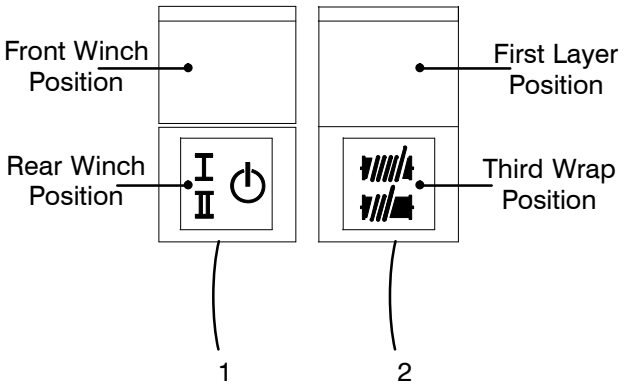
1. Park the crane on a firm level surface, shift the transmission to neutral, and engage the park brake.
2. Level the crane on fully extended outriggers. Position the upper over the front of the carrier and engage the travel swing lock. Fully retract the power sections of the boom. Boom down to 0° angle.
3. Verify the crane is level by placing a carpenter's level across the level check locations on the front of upper frame. Refer to Figure 3-22. Check levelness with the upper over the rear and over the side of the crane. Adjust the outriggers as necessary.
4. Once the crane is level, verify that the boom is at 0 degrees by placing carpenter's level on top of the boom. Refer to Figure 3-21. Adjust the boom as necessary.
5. If necessary, loosen the screw and adjust the angle indicator until the bubble within the vial is at the 0° mark. Tighten the screw.



Front of Upper Frame

1. Level Check Location

Figure 3—22
Level Check Location



Right Side Control Console

1. Winch Selector Switch
2. First Layer/Third Wrap Switch

Figure 3–23
First Layer/Third Wrap Calibration Switches

First Layer/Third Wrap Calibration

The crane may equipped with a first layer/third wrap warning system. This system allows the operator to monitor the wire rope windings on the drum(s). In order for this system to function correctly, it must be properly calibrated using the switches on the right side control console. Refer to Figure 3-23. Calibrate the system anytime wire rope is installed on the winch drum(s) or the live end of the wire rope is wound past the winch.

WARNING

The first layer/third wrap system will not function properly if the live end of the hoist wire rope is wound past the winch. Wire rope failure may occur. Recalibrate the first layer/third wrap system so that three (3) full wraps of wire rope is maintained on the winch drum(s) at all times during operation.

1. Park the crane on a firm level surface, position transmission shifter to neutral, and engage the park brake.
2. Set the RCL system to Rigging mode.

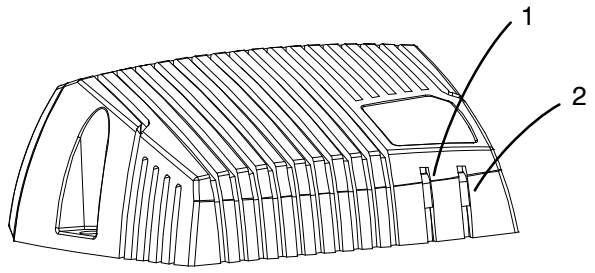
WARNING

The RCL system is not operational when in the RIGGING/TRAVEL Mode. Return the RCL system to normal operation before operating the crane.

3. Spool wire rope off the front drum until only four full wraps are left on the drum. Or if installing wire rope on the drum, properly install the drum wedge to anchor the wire rope to the drum. Refer to Section 5 of this Operator's Manual. Properly wind four full wraps on the drum.
4. Visually verify that three full wraps are on the drum before proceeding.
5. Press the Winch Selector switch to the Front Winch position and hold. Refer to Figure 3-23.
6. Press the First Layer/Third Wrap switch to the Third Wrap position and hold for one second and then release both switches.
7. Spool wire rope onto the drum until the first layer is wound fully onto the drum. Visually verify that one full layer is spooled correctly on the drum before proceeding.
8. Press the Winch Selector switch to the Front Winch position and hold.
9. Press the First Layer/Third Wrap switch to the First Layer position and hold for one second and then release both switches.
10. Properly spool the remaining wire rope on the drum. Refer to Section 5 of this Operator's Manual.
11. Repeat procedure for rear winch.
12. Return RCL system to normal operating mode.
13. Check the First Layer/Third Wrap Control Module behind the operator's seat to confirm the system is functioning normally. Refer to First Layer/Third Wrap Control Module Error Codes in this Section of this Operator's Manual.

First Layer/Third Wrap Control Module Error Codes

The First Layer/Third Wrap Control Module controls and monitors the first layer/third wrap system. The module is behind the upper operator's seat. The module contains two LED indicators to determine the status of the system. The green LED on top of the module indicates power on. The yellow flashing LED indicates normal status. If there is an error detected, the module will present a message on the display. The module also indicates error status through the red/yellow flashing LED. Refer to the following charts for error message information.



1. Yellow/Red Status LED
2. Green Power On

Figure 3—24
First Layer/Third Wrap Control Module

First Layer/Third Wrap Control Module Modes	
Status	Flash (Yellow)
Normal Operation	
Application Not Loaded	
No Application Available	
Bad Application	
Busy	

First Layer/Third Wrap Control Module Error Codes			
Error Code	Error	Primary Flash (Red)	Secondary Flash (Yellow)
1:1	Output		
1:2	Input		
1:3	Vref (Reference Voltage)		
2:1	Power Supply		
2:2	Temperature		
2:3	Clock		
3:1	CAN Error		
3:2	Address Error		
4:1	Internal Error		
SCS	Safe Crash State		

Notes:

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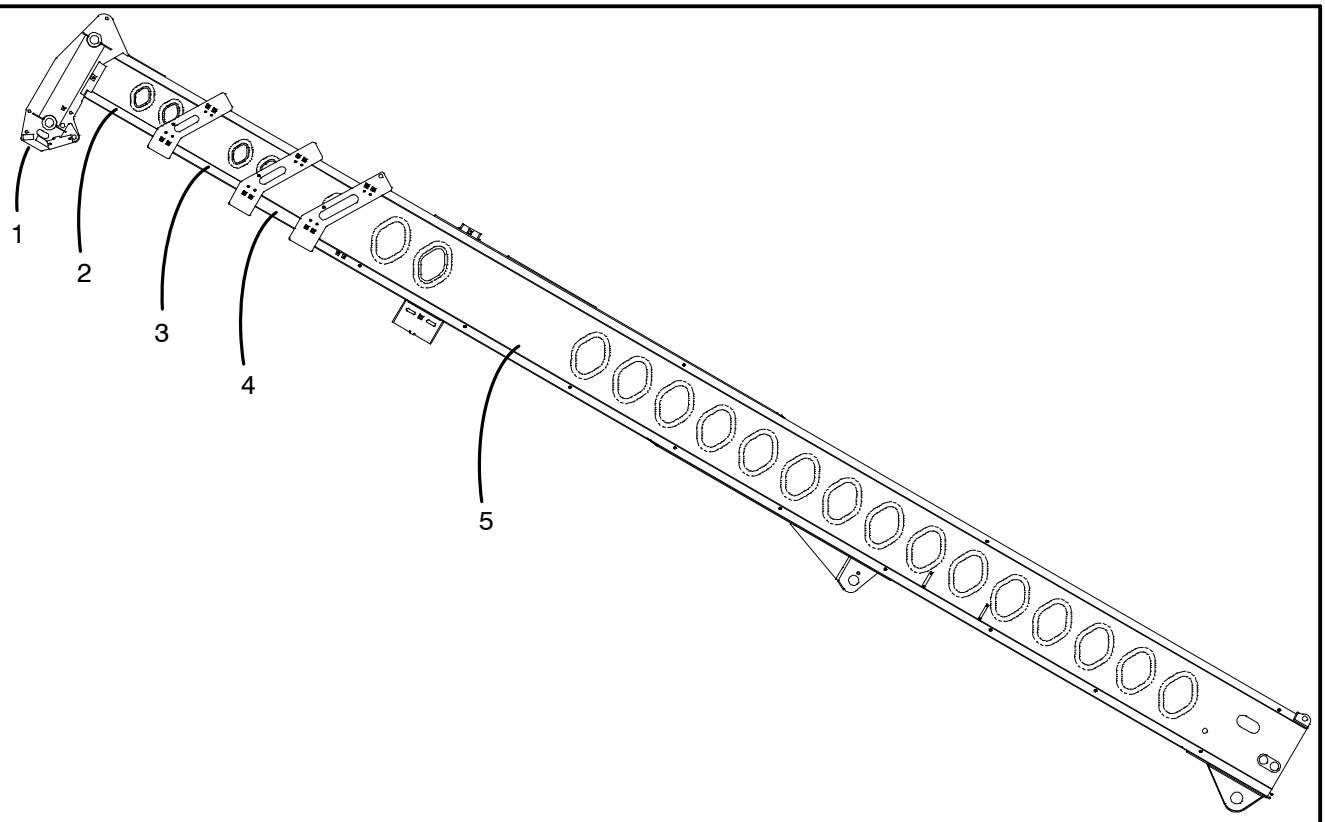


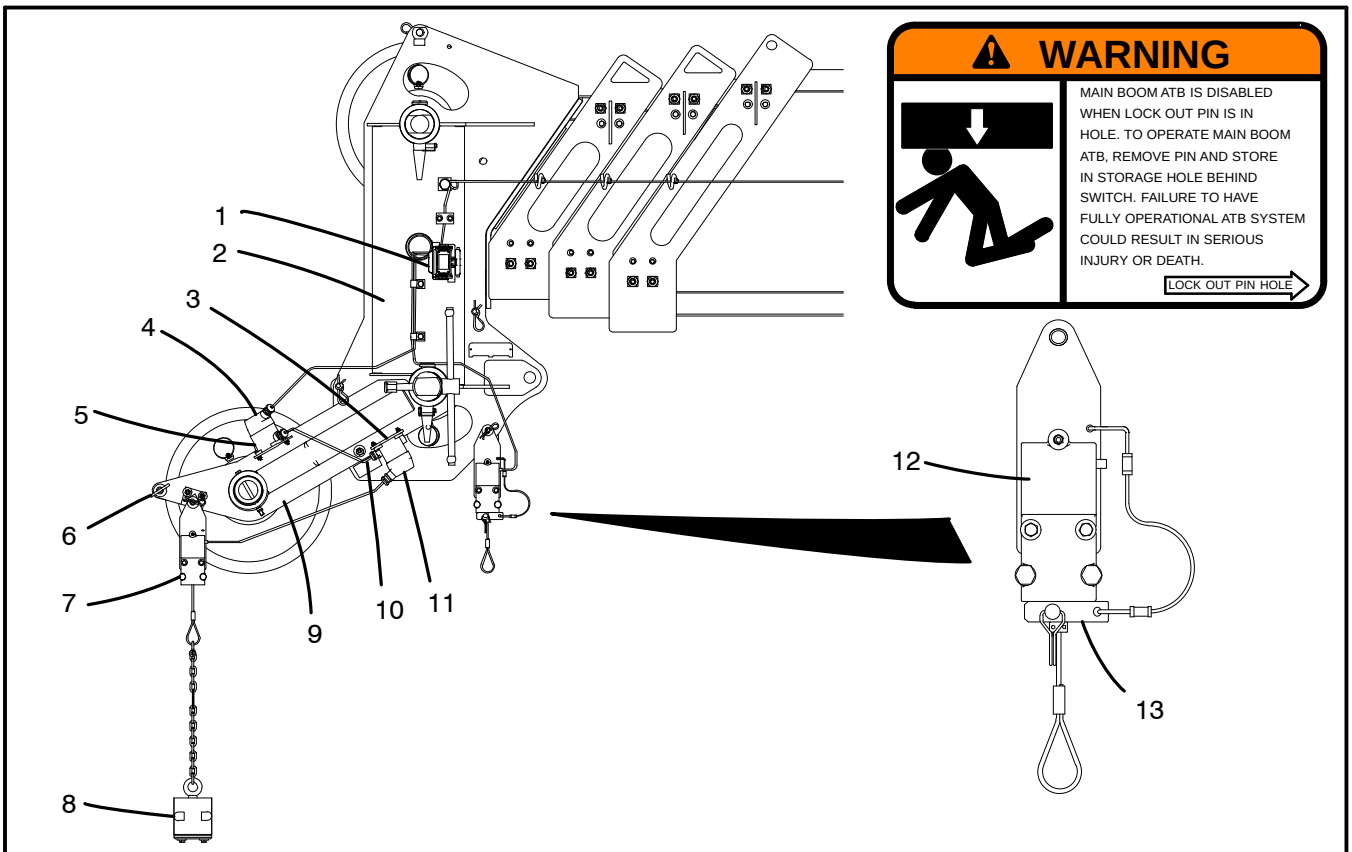
1. Boom Head Machinery
2. Tip Section
3. Outer Mid Section
4. Inner Mid Section
5. Base Section

Figure 4—1
Boom Nomenclature

Boom

The crane is equipped with a four section boom. Refer to Figure 4-1. It consists of four basic parts: a base section, an inner mid section, an outer mid section, and a tip section. The base section is connected to the upper revolving frame. It is raised and lowered by the boom hoist cylinder.

The telescoping feature of the boom sections is operated through the use of two hydraulic cylinders and a cable sheave mechanism which are an integral part of the boom assembly. The inner mid, outer mid, and tip sections of the boom are "power sections". Power sections can be extended or retracted using the boom telescope control in the operator's cab. Refer to Section 1 of this Operator's Manual for complete operating instructions.



1. Jumper Assembly
2. Main Boom Head
3. Auxiliary Lifting Sheave Anti-Two Block Switch Connector
4. Plug Assembly
5. Auxiliary Lifting Sheave Connector
6. Auxiliary Lifting Sheave Wire Rope Guard
7. Auxiliary Lifting Sheave Anti-Two Block Switch
8. Anti-Two Block Weight
9. Auxiliary Lifting Sheave
10. Capscrew, Locknut, & Washer
11. Auxiliary Lifting Sheave Anti-Two Block Switch Plug
12. Main Boom Anti-Two Block Switch
13. Lockout Clip (Installed)

Figure 4—2
Auxiliary Lifting Sheave

Auxiliary Lifting Sheave

The auxiliary lifting sheave connects to the boom head machinery. It is used for reeving winch wire rope for the second winch drum. Once installed, it may be left in place without interfering with installation, erection, or storage of other boom attachments.

WARNING

The auxiliary lifting sheave adds weight to the boom which must be considered in lifting capacities. When making lifts from the main boom or fly, refer to Crane Rating Manual for the appropriate deductions from lifting capacities.

Auxiliary Lifting Sheave Installation

1. Park crane on a firm level surface. Shift transmission to neutral and engage the park brake.
2. Fully retract the boom and position the upper over the front of the carrier. Engage the travel swing lock.
3. Boom down and/or extend the boom as required, to ease access to the head machinery.
4. Adequately support the auxiliary lifting sheave with an appropriate lifting device. It weighs approximately 95 lb (*43kg*). Position the auxiliary lifting sheave frame under the boom head cross shaft. Refer to Figure 4-2. Align the holes in the auxiliary lifting sheave frame with the lugs in the main boom and install capscrews, locknuts, and washers.

WARNING

To avoid personal injury, do not climb, stand, or walk on the boom. Use a ladder or similar device as required to reach necessary areas.

5. Remove the wire rope guard from the auxiliary lifting sheave. Reeve the winch wire rope on the boom deflector sheave, then over the sheave on the auxiliary lifting sheave. Install the wire rope guard.

CAUTION

All wire rope guards must be in proper position during operation.

6. Properly change the anti-two block system connections as follows:
   a. Disconnect plug assembly from jumper assembly on the main boom head and connect it to the auxiliary auxiliary lifting sheave connector. Refer to Figure 4-2.
   b. Install the auxiliary lifting sheave ATB switch to the auxiliary lifting sheave.
   c. Connect the auxiliary lifting sheave ATB switch plug to the auxiliary lifting sheave ATB switch connector.
   d. Install the anti-two block weight to the auxiliary lifting sheave anti-two block switch.
   e. Properly install lockout clip on main boom anti-two block switch cable.

   Note: When the lockout clip is installed, the anti-two block switch is inactive.

   When both main boom and auxiliary sheave are reeved for operation, the lockout clip must be removed and an anti-two block weight must be suspended from each anti-two block switch.
7. Properly set the Rated Capacity Limiter to the correct crane configuration. Refer to Section 1 of this Operator's Manual.
8. Check the Crane Rating Manual in the operator's cab for necessary deductions with the auxiliary lifting sheave installed before continuing operations.

WARNING

The auxiliary lifting sheave adds weight to the boom which must be considered in lifting capacities. When making lifts from the main boom or fly with the auxiliary lifting sheave installed, refer to the Crane Rating Manual for the appropriate deductions from lifting capacities.

Auxiliary Lifting Sheave Removal

1. Park crane on a firm level surface. Shift the transmission to neutral and engage the park brake.
2. Fully retract the boom and position the upper over the front of the carrier. Engage travel swing lock.
3. Boom down and/or extend the boom as required to ease access to the head machinery.

WARNING

To avoid personal injury, do not climb, stand, or walk on the boom. Use a ladder or similar device to reach necessary areas.

4. Properly disconnect the anti-two block system as follows:
   a. Disconnect the plug assembly from the auxiliary lifting sheave and connect it to the jumper assembly on the main boom head. Refer to Figure 4-2.
   b. Remove the lockout clip from the main boom head anti-two block switch weight cable.
   c. Remove the anti-two block weight from the auxiliary lifting sheave and install it on the main boom anti-two block switch.
   d. Disconnect the auxiliary lifting sheave ATB switch plug from the auxiliary lifting sheave ATB switch connector.
   e. Remove the auxiliary lifting sheave ATB switch from the auxiliary lifting sheave.
5. Remove the wire rope guard from the auxiliary lifting sheave. Remove the winch wire rope and install the wire rope guard for storage.
6. Adequately support the auxiliary lifting sheave. It weighs approximately 95 lb (*43kg*). Remove the capscrews, locknuts, and washers. Remove the auxiliary lifting sheave.
7. Properly store the auxiliary lifting sheave, the capscrews, locknuts, washers, and the winch wire rope which was used on the auxiliary lifting sheave.
8. Properly set the Rated Capacity Limiter to the correct crane configuration. Refer to Section 1 of this Operator's Manual.

Offset Lattice Fly

The crane may be equipped with either a one or two piece offset lattice fly. The offset lattice fly, as shown in Figure 4-3, connects to the main boom head. The fly can be mounted in one of three offset positions: 2°, 20° or 40°. The fly extends the boom length for greater heights. The tip section of the fly extends its overall length from 28.5 ft (*8.7m*) to 51 ft (*15.5m*). Once installed, the offset lattice fly can be stored on the right side of the boom base section.

Note: Refer to Figure 1—12 in Section 1 of this Operator's Manual for proper handling of the fly sections.

Offset Lattice Fly Installation

1. Park the crane on a firm level surface, shift the transmission to neutral, and engage the park brake.
2. Level the crane on fully or intermediate extended outriggers with all tires clear of the ground.
3. Position the upper directly over the front of the carrier and engage the travel swing lock.

WARNING

Install the offset fly with the crane level on fully or intermediate extended outriggers, all tires clear of the ground, the upper directly over the front of the carrier, and the travel swing lock engaged.

The fly adaptor lug and offset connecting pins must be in the 2° offset position to remove, install, store, or erect the offset fly.

Refer to the Crane Rating Manual for the maximum boom length the fly can be raised/lowered to/from the ground.

Failure to do the above could result in the personal injury and/or the crane tipping.

4. Check that the fly adaptor lug and offset connecting pins are installed in the 2° offset position. Refer to Figure 4-5.
5. Pin the fly base and tip together on secure blocking approximately 3.5 ft (*1.1m*) at the base and 89 ft (*27m*) from the boom foot of the crane. Refer to Figure 4-4 . The base fly section weighs 1,290 lb (*585kg*) and the tip fly section weighs 570 lb (*260kg*).

   Note: Fly base section may be installed by itself if desired.

6. Remove the winch wire rope from the main boom head machinery or the auxiliary lifting sheave, whichever is to be used on the fly, and lay it aside to prevent damage to it during installation of the fly.

WARNING

To avoid personal injury, do not climb, stand, or walk on the boom or fly. Use a ladder or similar device to reach necessary areas.

7. Lower the boom and extend it to the fly. Slowly raise or lower the boom to engage the fly lugs with the head machinery cross shafts.
8. Remove the four fly connecting pins from the storage rings at the rear of the fly base section. Refer to Figure 4-3. Install all four pins to connect the fly lugs to the head machinery cross shafts on the right side of the boom. (Install the pins with the head on top and keeper on the bottom.) Install the pin keepers.
9. Remove the two fly connecting pins from the boom head machinery cross shaft on the left side of the boom head. Refer to Figure 4-3. Install the top pin to connect the fly lug to the head machinery cross shaft on the left side of the boom head. Turn the t-handle to push and align the bottom left fly lug and the bottom boom head cross shaft. Install the bottom left fly connecting pin. (Install the pins with the head on top and keeper on the bottom.) Install the pin keepers.

WARNING

All fly tip and base connecting pins must be properly installed before operating the crane with the fly erected. Damage to the fly and/or personal injury could occur if all connecting pins are not properly installed.

10. Remove the wire rope guards from the fly base and boom head deflector sheaves. Reeve the winch wire rope over the boom deflector sheave, then on the fly base deflector sheave.
11. Remove the wire rope guards from either the fly base or fly tip head sheaves, whichever is to be used. Reeve the winch wire rope over the appropriate head sheave and install the wire rope guards.

CAUTION

All wire rope guards must be in proper position during operation.

12. Properly change the anti-two block (ATB) system connections as follows:
    a. Disconnect boom head plug from jumper assembly on the main boom head and connect it to the fly base connector.
    b. Install the fly head ATB switch to the fly head and install the ATB weight to the switch cable.
    c. Connect the fly head ATB switch plug to the fly head connector.
    d. Properly install lockout clip on the main boom ATB switch weight cable.

    Note: When lockout clip is installed, the main boom ATB switch is inactive.

    When both main boom and fly are reeved for operation, the lockout clip must be removed and an ATB weight must be suspended from each ATB switch.

13. Properly set the Rated Capacity Limiter to the correct crane configuration. Refer to Section 1 of this Operator's Manual.
14. Check the Crane Rating Manual, in the operator's cab, for deductions from the lifting capacities with the fly installed before continuing operations.

WARNING

The fly adds weight to the boom which must be considered in lifting capacities when the fly is erected. When making lifts from the main boom or auxiliary lifting sheave with the fly erected, refer to the Crane Rating Manual for the appropriate deductions from lifting capacities. Do not use the offset lattice fly while on tires or fully retracted outriggers, level the crane on fully or intermediate extended outriggers.

Offset Lattice Fly Removal

1. Park the crane on a firm level surface. Shift transmission to neutral and engage the park brake.
2. Level the crane on fully or intermediate extended outriggers with all tires clear of the ground.
3. Position the upper directly over the front of the carrier and engage the travel swing lock.

WARNING

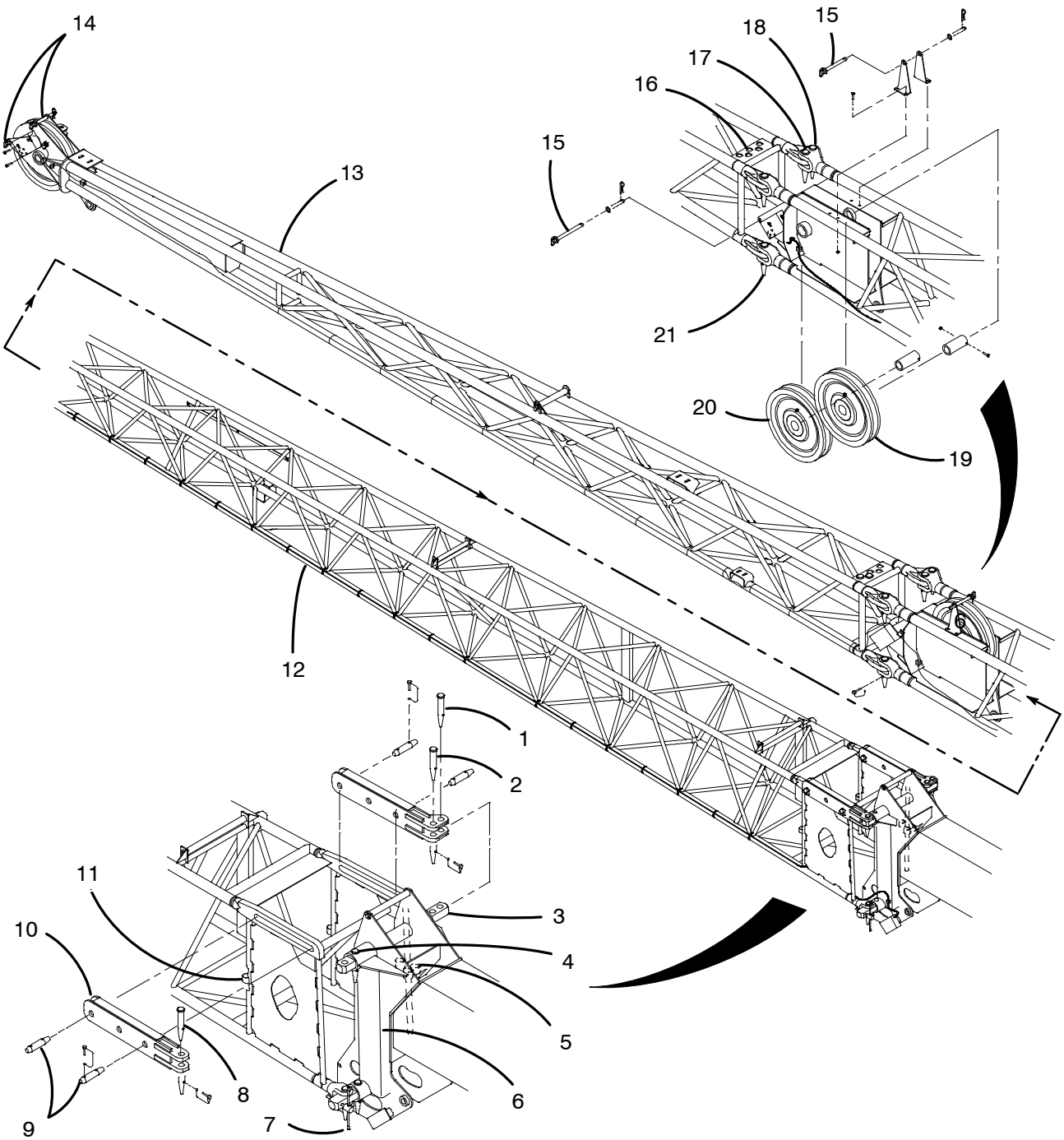
Remove the offset fly with the crane level on fully or intermediate extended outriggers, all tires clear of the ground, the upper directly over the front of the carrier, and the travel swing lock engaged.

The fly adaptor lug and offset connecting pins must be in the 2° offset position to remove, install, store, or erect the offset fly.

Refer to the Crane Rating Manual for the maximum boom length the fly can be raised/lowered to/from the ground.

Failure to do the above could result in the personal injury and/or the crane tipping.

4. If the fly is not in the erected position, erect it per "Erection Of The Fly Base & Tip Sections From The Stored Position" in this Section of this Operator's Manual.
5. Check that the fly adaptor lug and offset connecting pins are installed in the 2° offset position. Refer to Figure 4-5. If necessary change the fly offset to the 2° position. Refer to "Changing The Fly Offset" in this Section of this Operator's Manual for detailed instructions.



1. Right Side Fly Base Connecting Pin (Pivot Pin)
2. Right Side Fly Base Connecting Pin
3. Boom Head Machinery Cross Shaft
4. Left Side Fly Base Connecting Pin (Fly Stored Position)
5. Fly Connecting Pin Storage Rings
6. Boom Head
7. T-Handle
8. Left Side Fly Base Connecting Pin (Fly Erected Position)
9. Offset Connecting Pins (2° Position Shown)
10. Fly Adaptor Lug
11. Offset Connecting Pin Storage Ring
12. Fly Base Section
13. Fly Tip Section
14. Fly Tip Wire Rope Guards
15. Fly Base Wire Rope Guards
16. Fly Tip Connecting Pin Storage Location
17. Right Side Fly Tip Connecting Pin
18. Right Side Fly Tip Connecting Pin (Pivot Pin)
19. Fly Base Deflector Sheave
20. Fly Base Head Sheave
21. Left Side Fly Tip Connecting Pin

Figure 4—3
Offset Lattice Fly Sections

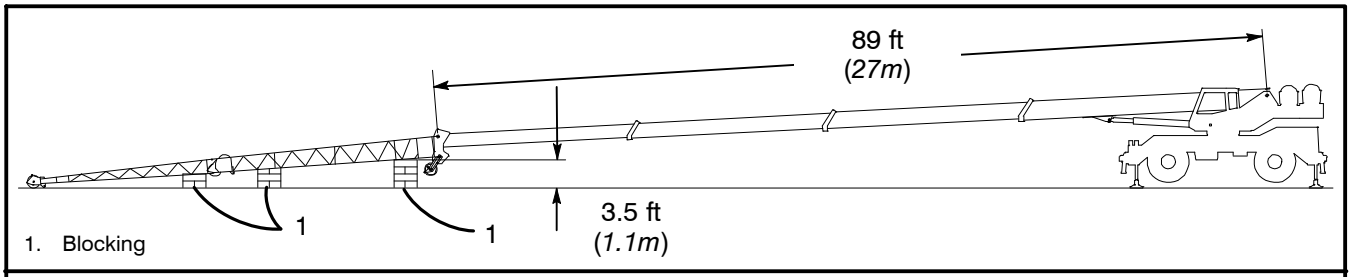


Figure 4—4
Installation And Removal Of The Fly

WARNING

To avoid personal injury, do not climb, stand, or walk on the boom or fly. Use a ladder or similar device to reach necessary areas.

6. Remove all fly base and tip wire rope guards. Remove boom head and deflector sheave wire rope guards and lay the winch wire rope aside.
7. Install all fly base and tip wire rope guards at the deflector and head sheaves.
8. Carefully extend the boom approximately 89 ft (*27m*) and lower the boom until the fly tip head sheave is resting on the ground. Use a signal person to alert the operator when the sheave is resting on the ground.

   Note: If the crane is not equipped with the fly tip section or the fly tip section is not erected, lower the fly base section until the fly base head sheave is resting on the ground.

CAUTION

Do not extend the boom or boom down to the point of over stressing the offset lattice fly section. Structural damage to the fly could occur if care is not taken. Use a signal person to aid the operator in lowering the fly head sheave to the ground.

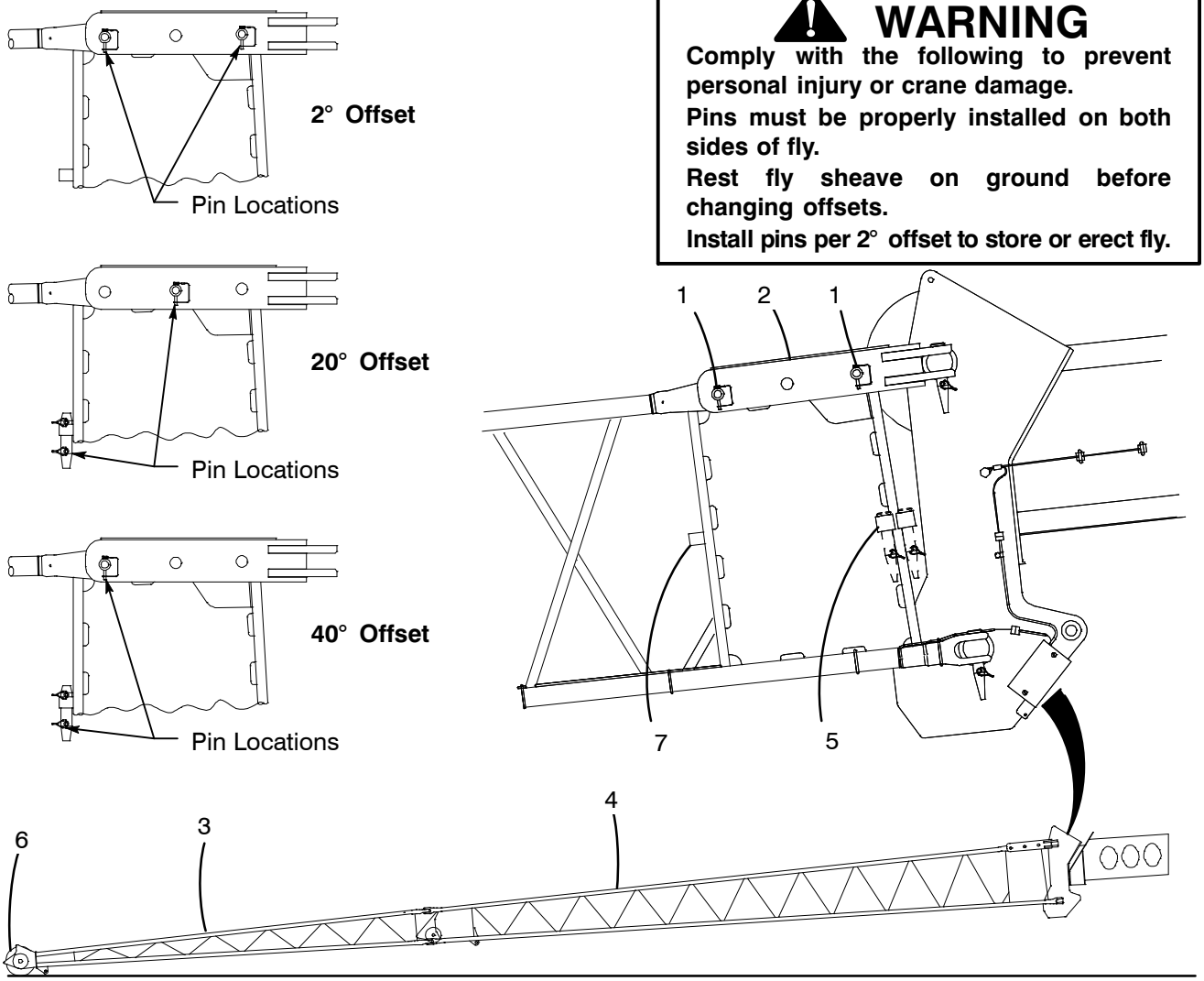
9. Securely block up the fly to support it. Refer to Figure 4-4. The base fly section weighs 1,290 lb (*585kg*) and the tip fly section 570 lb (*260kg*).
10. Properly change the anti-two block (ATB)system connections as follows:
    a. Remove the fly head ATB weight from the fly ATB switch and install it on the main boom head ATB switch.
    b. Unplug and remove the fly head ATB switch from the fly head.
    c. Remove the lockout clip from the main boom ATB switch weight cable.
    d. Remove the plug from the fly base connector and connect it to the jumper assembly on the main boom head.

WARNING

Use extreme care when removing the tapered fly connecting pins. They could pop out suddenly and cause personal injury.

Note: If only the fly tip section is to be removed, remove the connecting pins from the fly tip lugs.

11. Remove the six fly connecting pins and store four of the pins and keepers in the storage rings at the rear of the fly. Install the remaining two pins and keepers in the storage holes on the left side of the boom head machinery cross shafts to prevent the shaft from rotating. Refer to Figure 4-3
12. Retract the boom away from the fly.
13. Properly reeve or secure the winch wire rope which was used on the fly.
14. Properly set the Rated Capacity Limiter to the correct crane configuration. Refer to Section 1 of this Operator's Manual.
15. Properly store fly section(s) to prevent damage.



WARNING

Comply with the following to prevent personal injury or crane damage.

Pins must be properly installed on both sides of fly.

Rest fly sheave on ground before changing offsets.

Install pins per 2° offset to store or erect fly.

1. Offset Connecting Pins (2° Position Shown)
2. Fly Adaptor Lug
3. Offset Lattice Fly Tip Section
4. Offset Lattice Fly Base Section
5. Fly Connecting Pin Storage Ring
6. Fly Tip Head Sheave
7. Offset Connecting Pin Storage Location

Figure 4–5
Changing The Fly Offset Angle

Changing The Fly Offset Angle

1. Park the crane on a firm level surface. Shift the transmission to neutral and engage the park brake.
2. Level the crane on fully or intermediate extended outriggers with all tires clear of the ground.
3. Position the upper directly over the front of the carrier and engage the travel swing lock.

WARNING

Change the fly offset angle with the crane level on fully or intermediate extended outriggers with all tires clear of the ground, the upper directly over the front of the carrier, and the travel swing lock engaged.

Refer to the Crane Rating Manual for the maximum boom length the fly can be raised/lowered to/from the ground.

Failure to do the above could result in the crane tipping.

4. If the offset lattice fly section is not in the erected position, erect it per "Erection Of The Fly From The Stored Position" in this Section of this Operator's Manual.
5. Carefully extend and/or lower the boom until the fly tip head sheave is resting on the ground. Use a signal person to alert the operator when the sheave is resting on the ground.

   Note: If the crane is not equipped with the fly tip section or the fly tip section is not erected, lower the fly base section until the fly base head sheave is resting on the ground.

CAUTION

Do not extend the boom or boom down to the point of over stressing the offset lattice fly section. Structural damage to the fly could occur if care is not taken. Use a signal person to aid the operator in lowering the fly head sheave to the ground.

6. Use one of the following procedures and the information label, on the offset lattice fly section, to determine the correct offset connecting pin locations for the desired offset angle of the fly. Refer to Figure 4-5.

   If the existing offset angle is 2°:
   a. Remove one of the offset connecting pins from each side of the fly and place it in the storage ring provided.
   b. Locate the other offset connecting pin in the correct location for the desired offset angle.
   c. Properly locate the offset connecting pins on both sides of the fly and ensure that the keeper pins are securely installed.
   d. Slowly boom up to allow the fly section to adjust itself to the desired offset angle.

   If the existing offset angle is 20° and a 2° offset is desired:
   a. Carefully extend and/or lower the boom until the 2° angle is reached.
   b. Remove the offset connecting pin from the storage ring on the fly and install it through the fly adaptor lug, in one of the 2° offset holes.
   c. Relocate the other offset connecting pin from the 20° offset position to the 2° offset position.
   d. Properly locate the offset connecting pins on both sides of the fly and ensure that the keeper pins are securely installed.
   e. Slowly boom up to allow the fly section to adjust itself to the 2° offset angle.

   If the existing offset angle is 20° and a 40° offset is desired:
   a. Relocate the offset connecting pin from the 20° offset position to the 40° offset position.
   b. Properly locate the offset connecting pins on both sides of the fly and ensure that the keeper pins are securely installed.
   c. Slowly boom up to allow the fly section to adjust itself to the 40° offset angle.

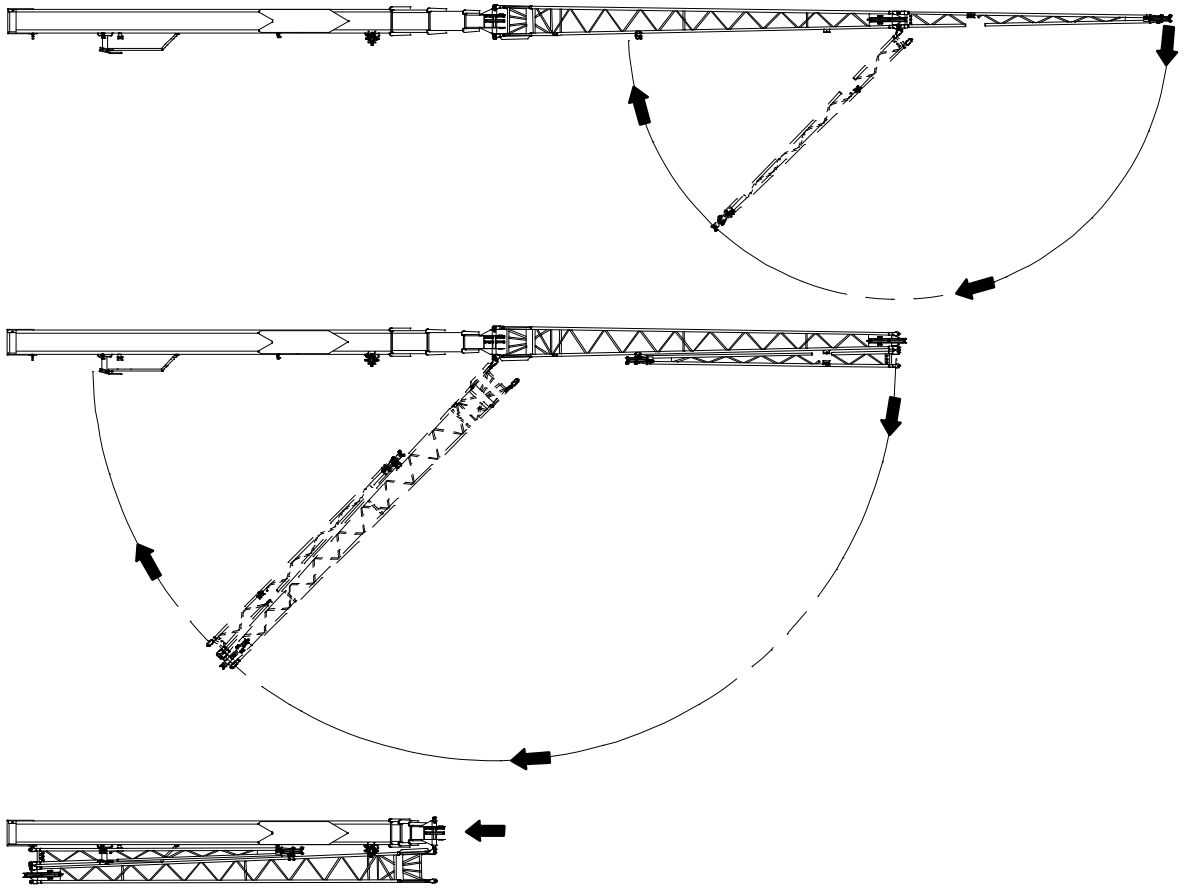
   If the existing offset angle is 40° and a 2° offset is desired:
   a. Carefully extend and/or lower the boom until the 2° angle is reached.
   b. Remove the offset connecting pin from the storage ring on the fly and install it through the fly adaptor lug, in the 2° offset hole.
   c. Properly locate the offset connecting pins on both sides of the fly and ensure that the keeper pins are securely installed.
   d. Slowly boom up to allow the fly section to adjust itself to the 2° offset angle.

   If the existing offset angle is 40° and a 20° offset is desired:
   a. Carefully extend and/or lower the boom until the 20° angle is reached.
   b. Relocate the offset connecting pin from the 40° offset position to the 20° offset position.
   c. Properly locate the offset connecting pins on both sides of the fly and ensure that the keeper pins are securely installed.
   d. Slowly boom up to allow the fly section to adjust itself to the 20° offset angle.
7. Properly set the Rated Capacity Limiter to the correct crane configuration before continuing operations. Refer to Section 1 of this Operator's Manual.
8. Check the Crane Rating Manual, in the operator's cab, for deductions from the lifting capacities with the fly installed before continuing operations.

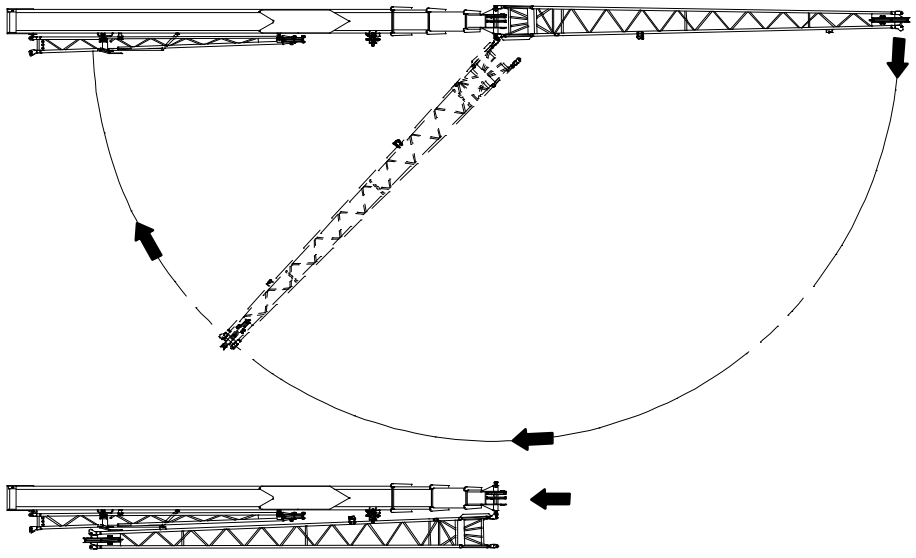
WARNING

The fly adds weight to the boom which must be considered in lifting capacities when the fly is erected. When making lifts from the main boom or auxiliary lifting sheave with the fly erected, refer to the Crane Rating Manual for the appropriate deductions from lifting capacities. Do not use the offset lattice fly while on tires or fully retracted outriggers, level the crane on fully extended or intermediate extended outriggers.

Top View



Swinging the Fly Base & Tip Sections



Swinging the Fly Base Section

Figure 4—6
Swinging the Fly

Storage Of The Fly Base Section From The Erected Position

1. Park crane on a firm level surface. Shift the transmission to neutral and engage the park brake.
2. Level the crane on fully or intermediate extended outriggers with all tires clear of the ground.
3. Position the upper directly over the front of the carrier and engage the travel swing lock.

WARNING

Store the fly with the crane level on fully or intermediate extended outriggers with all tires clear of the ground, the upper directly over the front of the carrier, and the travel swing lock engaged.

The fly adaptor lug and offset connecting pins must be in the 2° offset position to remove, install, store, or erect the offset fly.

Refer to the Crane Rating Manual for the maximum boom length the fly can be raised/lowered to/from the ground.

Failure to do the above could result in the personal injury and/or the crane tipping.

4. Check that the offset connecting pins (1) are installed in the 2° offset position. Refer to Figure 4-5. If necessary change the fly offset to the 2° position. Refer to "Changing The Fly Offset Angle" in this Section of this Operator's Manual for detailed instructions.

CAUTION

Do not extend the boom beyond the 2—5 ft (*0.6—1.5m*) length. Extending the boom beyond the 2—5 ft (*0.6—1.5m*) may cause boom damage.

5. Position the boom at a 0° angle and a boom length of 2-5 ft (*0.6—1.5m*).

WARNING

To avoid personal injury, do not climb, stand, or walk on the boom or fly. Use a ladder or similar device to reach necessary areas.

6. Properly change the anti-two block (ATB) system connections as follows:
   a. Remove the fly head ATB weight from the fly ATB switch and install it on the main boom head ATB switch.
   b. Unplug and remove the fly head ATB switch from the fly head.
   c. Remove the lockout clip from the main boom ATB switch weight cable.
   d. Remove the plug from the fly base connector and connect it to the jumper assembly on the main boom head.
7. Remove wire rope guards from fly base head sheave, fly base deflector sheave, the boom head sheave and boom deflector sheave. Refer to Figure 4-3 . Remove the winch wire rope and lay it aside. Install wire rope guards at all fly sheaves for storage.
8. Properly store winch wire rope which was used on fly. Attach a hand line to the tip of the fly base.
9. Remove the two fly base connecting pins (8) on the left side of the fly and store them in the storage holes (4) on the boom head machinery cross shafts (3) on the left side of the boom.

WARNING

Do not remove the fly connecting pivot pins on the right side of the boom until the fly is pinned to the storage brackets. Fly could fall causing major crane damage and/or serious personal injury.

Use extreme care when removing the tapered fly connecting pins. They could pop out suddenly causing personal injury.

10. Remove the two fly base connecting pins (2) on the right side of the fly. Refer to Figure 4-3. Store the two pins and keepers in the storage rings (5) on the rear picture frame lattice of the fly base section (12).

WARNING

Use a hand line to control fly swing. Fly could swing around the boom rapidly. Keep all personnel clear of swing path to avoid injury.

11. Using a hand line for control, slowly swing the fly base section around to the right side of the boom while slowly booming up to 20°. Refer to Figure 4-6.
12. Align the lug on the front storage bracket with the mounting hole on the rear of the fly base. Refer to Figure 4-8.
13. Slowly retract the boom to slide the storage lug on the front of the fly base into the slot on the rear storage bracket (10). Refer to Figure 4- 8. (At the same time the lug on the front storage bracket (15) should engage through the hole on the rear of the fly base.

14. Boom down to 0°. Pull down and rotate retaining pin (16). Release retaining pin to engage the pin through the lug on the front storage bracket (15).

⚠ WARNING

Do not remove the fly connecting pivot pins on the right side of the boom until the fly is pinned to the storage brackets. The fly could fall causing major crane damage and/or serious personal injury.

15. Remove two fly base connecting pivot pins (1) from the right side of the boom. Refer to Figure 4-3 . Store pins and keepers in storage rings (5) on the rear picture frame lattice of the fly base section (12).

CAUTION

Before operating or traveling the crane ensure the right side fly connecting pins are properly stored in their storage rings, and the left side connecting pins are stored in their storage holes in the boom head cross shafts. Damage could result to the fly and/or boom if fly connecting pins are not properly stored.

16. Properly set the Rated Capacity Limiter to the correct crane configuration. Refer to Section 1 of this Operator's Manual.
17. Check the Crane Rating Manual for lifting capacities with the fly in the stored position before continuing operations.

⚠ WARNING

The fly adds weight to the boom which must be considered in lifting capacities when the fly is erected. When making lifts from the main boom or auxiliary lifting sheave with the fly erected, refer to the Crane Rating Manual for the appropriate deductions from lifting capacities.

Storage Of The Fly Base And Tip Sections From The Erected Position

1. Park crane on a firm level surface. Shift the transmission to neutral and engage the park brake.
2. Level the crane on fully or intermediate extended outriggers with all tires clear of the ground.
3. Position the upper directly over the front of the carrier and engage the travel swing lock.

⚠ WARNING

Store the fly with the crane level on fully or intermediate extended outriggers with all tires clear of the ground, the upper directly over the front of the carrier, and the travel swing lock engaged.

The fly adaptor lug and offset connecting pins must be in the 2° offset position to remove, install, store, or erect the offset fly.

Refer to the Crane Rating Manual for the maximum boom length the fly can be raised/lowered to/from the ground.

Failure to do the above could result in the personal injury and/or the crane tipping.

4. Check that the offset connecting pins (1) are installed in the 2° offset position. Refer to Figure 4-5. If necessary change the fly offset to the 2° position. Refer to "Changing The Fly Offset Angle" in this Section of this Operator's Manual for detailed instructions.

CAUTION

Do not extend the boom beyond the 2—5 ft (*0.6—1.5m*) length. Extending the boom beyond the 2—5 ft (*0.6—1.5m*) may cause boom damage.

5. Position the boom at a 0° angle and extend to a length of 2-5 ft (*0.6—1.5m*).

⚠ WARNING

To avoid personal injury, do not climb, stand, or walk on the boom or fly. Use a ladder or similar device to reach necessary areas.

6. Properly change the anti-two block (ATB) system connections as follows:
   a. Remove the fly tip head ATB weight from the fly ATB switch and install it on the main boom head ATB switch.
   b. Unplug and remove the fly tip head ATB switch from the fly head.
   c. Remove the fly tip plug from fly base head connector on the fly base section. Install the plug to the fly tip storage connector at the base of the fly tip section.

d. Remove the lockout clip from the main boom ATB switch weight cable.
e. Remove the plug from the fly base connector and connect it to the jumper assembly on the main boom head.

7. Remove wire rope guards from fly base head sheave, fly base deflector sheave, the boom head sheave and boom deflector sheave. Refer to Figure 4-3. Remove the winch wire rope and lay it aside. Install wire rope guards at all fly sheaves for storage.
8. Properly store winch wire rope which was used on fly. Attach a hand line to the tip of the fly tip section.

WARNING

Do not remove fly tip connecting pivot pins on the right side of the fly until the fly is pinned to the storage brackets. Fly tip could fall causing major crane damage and/or serious personal injury.

Use extreme care when removing the tapered fly connecting pins. They could pop out suddenly causing personal injury.

9. Remove the two fly tip connecting pins (21) on the left side of the fly tip section (13). Refer to Figure 4-3. Store pins and keepers in the storage holes (16) on the rear of the fly tip section.
10. Remove the two fly tip connecting pins (17) on the right side of the fly tip section (13). Refer to Figure 4-3. Store pins and keepers in the storage holes (16) on the rear of the fly tip section.

WARNING

Use a hand line to control fly swing. Fly tip could swing around fly base rapidly. Keep all personnel clear of swing path to avoid injury.

11. Using the hand line attached to the fly tip section, slowly swing the fly tip section around to the right side of the fly base section. Refer to Figure 4-6.
12. Align the storage bracket on the fly tip section with the storage bracket on the fly base section. Refer to Figure 4-8. Install the hitch pin (12) through the storage brackets and secure the hitch pin.
13. Remove the two fly base connecting pins (8) on the left side of the fly base section and store them in the storage holes (4) on the boom head machinery cross shafts (3) on the left side of the boom. Refer to Figure 4-3.

WARNING

Do not remove fly base connecting pivot pins on the right side of the boom until the fly is pinned to the storage brackets. Fly could fall causing major crane damage and/or serious personal injury.

14. Remove the two fly base connecting pins (2) on the right side of the fly. Refer to Figure 4-3. Store the two pins and keepers in the storage rings (5) on the rear picture frame lattice of the fly base section (12).

WARNING

Use a hand line to control fly swing. Fly could swing around the boom rapidly. Keep all personnel clear of swing path to avoid injury.

15. Attach a hand line to the tip of the fly base section. Slowly swing the fly base section around to the right side of the boom while slowly booming up to 20°. Refer to Figure 4-6.
16. Align the lug on the front storage bracket with the mounting hole on the rear of the fly base. Refer to Figure 4-8.
17. Slowly retract the boom to slide the storage lug on the front of the fly base into the slot on the rear storage bracket (10). (At the same time the lug on the front storage bracket (15) should engage through the hole on the rear of the fly base.
18. Boom down to 0°. Pull down and rotate retaining pin (16). Release retaining pin to engage the pin through the lug on the front storage bracket (15).

WARNING

Do not remove the fly base connecting pivot pins on the right side of the boom until the fly is pinned to the storage brackets. The fly could fall causing major crane damage and/or serious personal injury.

19. Remove two fly base connecting pivot pins (1) from the right side of the boom. Refer to Figure 4-3 . Store pins and keepers in storage rings (5) on the rear picture frame lattice of the fly base section (12).

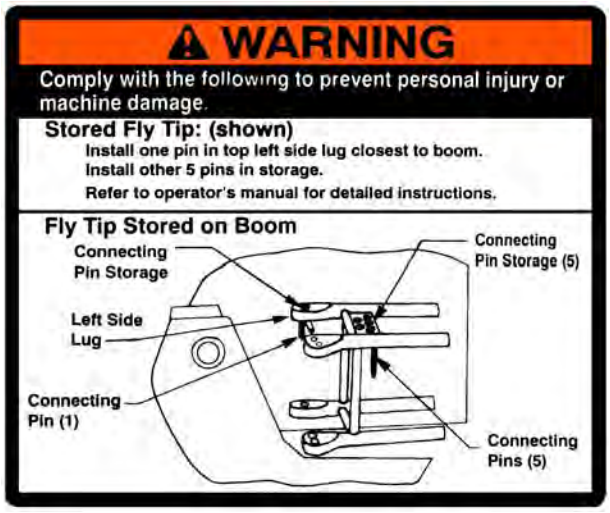


Figure 4–7
Fly Tip Storage Label

CAUTION

Before operating or traveling the crane ensure the right side fly connecting pins are properly stored in their storage rings, and the left side connecting pins are stored in their storage holes in the boom head cross shafts. Damage could result to the fly and/or boom if fly connecting pins are not properly stored.

20. Remove the two fly tip connecting pivot pins (3) on the right side of the fly tip section. Refer to Figure 4-8. Store one pin and keeper in the storage hole (2) on the rear of the fly tip section and one pin and keeper in the top fly tip connecting lug (1) on the left side of the fly tip section.

WARNING

A connecting pin and keeper must be installed in the top fly tip connecting lug on the left side of the fly tip section when the fly tip is in the stored position. The fly tip could fall causing major crane damage and/or serious personal injury.

21. Properly set the Rated Capacity Limiter to the correct crane configuration. Refer to Section 1 of this Operator's Manual.
22. Check the Crane Rating Manual for lifting capacities with the fly in the stored position before continuing operations.

WARNING

The fly adds weight to the boom which must be considered in lifting capacities when the fly is erected. When making lifts from the main boom or auxiliary lifting sheave with the fly erected, refer to the Crane Rating Manual for the appropriate deductions from lifting capacities.

Erection Of The Fly Base Section From The Stored Position

1. Park crane on a firm level surface. Shift the transmission to neutral and engage the park brake.
2. Level the crane on fully or intermediate extended outriggers with all tires clear of the ground.
3. Position the upper directly over the front of the carrier and engage the travel swing lock.

WARNING

Erect the fly with the crane level on fully or intermediate extended outriggers with all tires clear of the ground, the upper directly over the front of the carrier, and the travel swing lock engaged.

The fly adaptor lug and offset connecting pins must be in the 2° offset position to remove, install, store, or erect the offset fly.

Refer to the Crane Rating Manual for the maximum boom length the fly can be raised/lowered to/from the ground.

Failure to do the above could result in the personal injury and/or the crane tipping.

4. Check that the fly tip connecting pins are in the stored position.
5. Check that the offset connecting pins are installed in the 2° offset position. Refer to Figure 4-5. If necessary change the fly offset to the 2° position. Refer to "Changing The Fly Offset Angle" in this Section of this Operator's Manual for detailed instructions.
6. Retract the boom to engage the fly lugs with the head machinery cross shafts on the right side of the boom. Fully lower the boom.
7. Remove two fly connecting pins from the storage rings on the rear fly picture frame lattice on the fly base section. Install them through the fly base pivot lugs (18) on the right side of the boom. Refer to Figure 4-8. (Install the pins with the head on top and the keeper on the bottom.) Install the pin keepers.

WARNING

To avoid personal injury, do not climb, stand or walk on the boom or fly. Use a ladder or similar device to reach necessary areas.

8. Remove the winch wire rope from the head machinery or the auxiliary lifting sheave whichever is to be used on the fly and lay it aside to prevent damage to it during erection of the fly.

WARNING

Check that the fly base connecting pins are installed on the right side of the boom in the pivot holes before disconnecting the fly from the storage brackets. Fly could fall causing major crane damage and/or serious personal injury.

9. Pull down the retaining pin (16) to disengage the pin from the lug on the front storage bracket. Rotate and release the retaining pin to lock it in the disengaged position.

CAUTION

Do not extend the boom beyond the 2—5 ft (*0.6—1.5m*) length. Extending the boom beyond the 2—5 ft (*0.6—1.5m*) may cause boom damage.

10. Attach a hand line to the tip of the fly base and boom up to 20°. Slowly extend the boom approximately 2-5 ft (*0.6—1.5m*) to slide the fly off the storage brackets.

WARNING

Use a hand line to control fly swing. The fly could swing around the boom rapidly. Keep all personnel clear of the swing path to avoid injury.

11. Slowly lower the boom to 0° angle to swing the fly base around the boom head until the fly lugs engage with the head machinery cross shafts on the left side of the boom. Refer to Figure 4-6.
12. Remove the two connecting pins from the storage rings (11) on the rear fly picture frame lattice on the fly base section and install them in the cross shafts (23) on the right side of the boom. (Install the pins with the head on top and the keeper on the bottom.) Install the pin keepers.

13. Remove the two fly connecting pins from the storage location (24) on the boom head machinery cross shaft on the left side of the boom. Refer to Figure 4-8. Install one pin through the top fly lug (21) on the left side of the boom. Turn the t-handle to push and align the bottom left fly lug and the bottom boom head cross shaft. Install the bottom left fly connecting pin. (Install the pins with the head on top and the keeper on the bottom.) Install the pin keepers.

⚠ WARNING

All six fly base connecting pins must be properly installed before operating the crane with the fly base erected. Damage to the fly base and/or personal injury could occur if all connecting pins are not properly installed.

14. Remove the wire rope guard from the fly base head and deflector sheaves. Refer to Figure 4-3. Reeve the winch wire rope on the boom deflector sheave then over the fly deflector and head sheaves. Install all wire rope guards.

CAUTION

All wire rope guards must be in proper position during operation.

15. Properly change the anti-two block (ATB) system connections as follows:
    a. Disconnect the boom head plug from the jumper assembly on main boom head and connect it to the fly base connector.
    b. Install the fly head ATB switch and weight to the fly head.
    c. Connect the fly head ATB switch plug to the fly head connector.
    d. Properly install lockout clip on main boom head ATB switch cable.

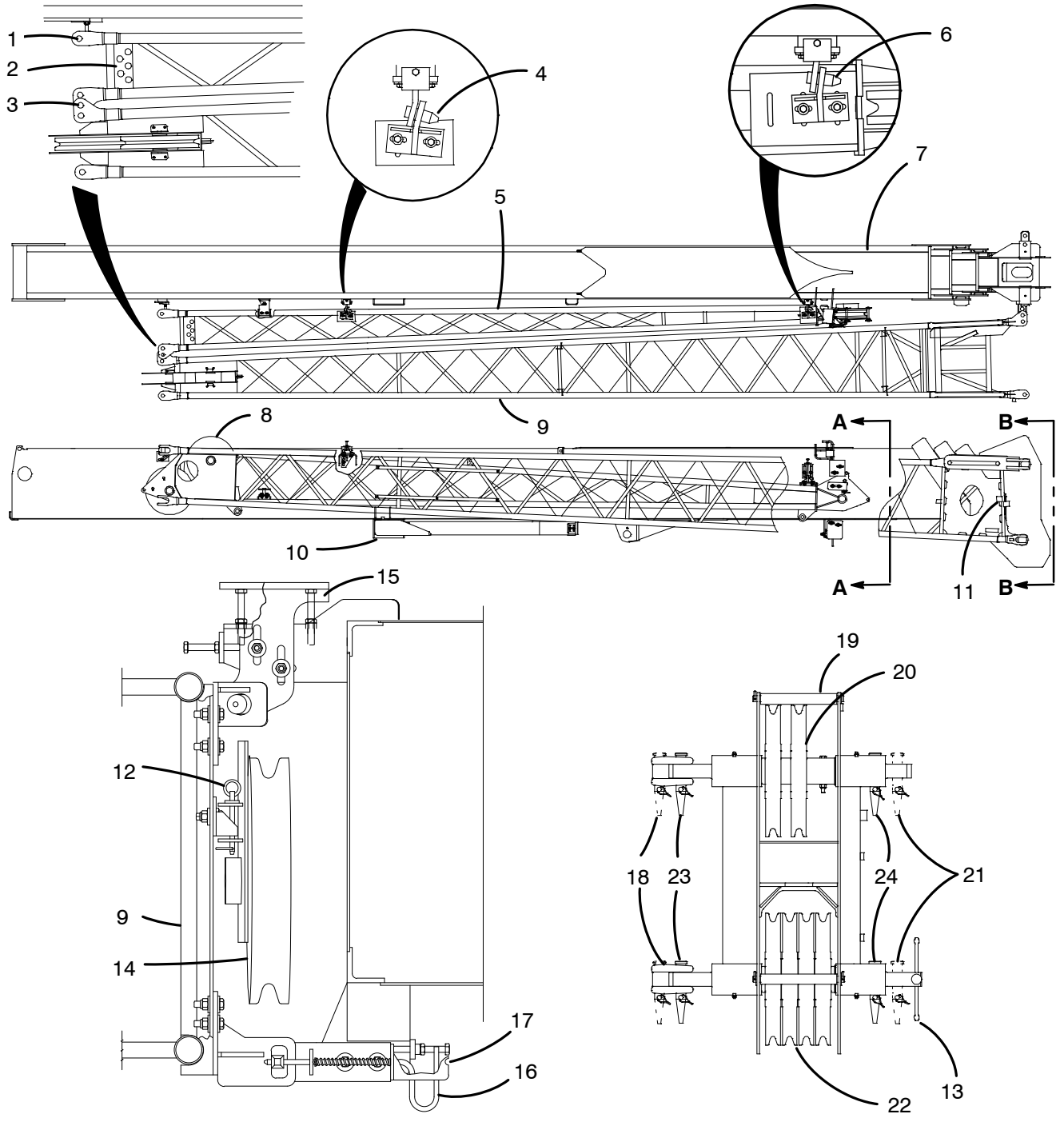
    Note: When lockout clip is installed, the main boom ATB switch is inactive.

    When both main boom and fly are reeved for operation, the lockout clip must be removed and an ATB weight must be suspended from each ATB switch.

16. Properly set the Rated Capacity Limiter to the correct crane configuration. Refer to Section 1 of this Operator's Manual.
17. Check the Crane Rating Manual for lifting capacities with the fly installed before continuing operations.

⚠ WARNING

The fly adds weight to the boom which must be considered in lifting capacities when the fly is erected. When making lifts from the main boom or auxiliary lifting sheave with the fly erected, refer to the Crane Rating Manual for the appropriate deductions from lifting capacities. Do not use the offset lattice fly while on tires or fully retracted outriggers, level the crane on fully extended or intermediate extended outriggers.



VIEW A—A

VIEW B—B

1. Left Side Fly Tip Connecting Pin Storage Location
2. Fly Tip Connecting Pin Storage Holes
3. Fly Tip Pivot Hole
4. Rear Fly Tip Storage Lug
5. Offset Lattice Fly Tip Section
6. Front Fly Tip Storage Lug
7. Boom
8. Fly Base Deflector Sheave
9. Offset Lattice Fly Base Section
10. Rear Fly Storage Bracket
11. Fly Base Connecting Pin Storage Location
12. Hitch Pin
13. T-Handle
14. Fly Tip Head Sheave
15. Front Fly Storage Bracket
16. Retaining Pin in Engaged Position
17. Retaining Pin in Disengaged Position
18. Fly Base Pivot Pins
19. Boom Deflector Sheave Wire Rope Guard
20. Boom Deflector Sheave
21. Left Side Fly Base Connecting Pin
22. Boom Head Sheaves
23. Right Side Fly Base Connecting Pin
24. Fly Base Connecting Pin Storage Location

Figure 4—8
Fly Erection And Storage

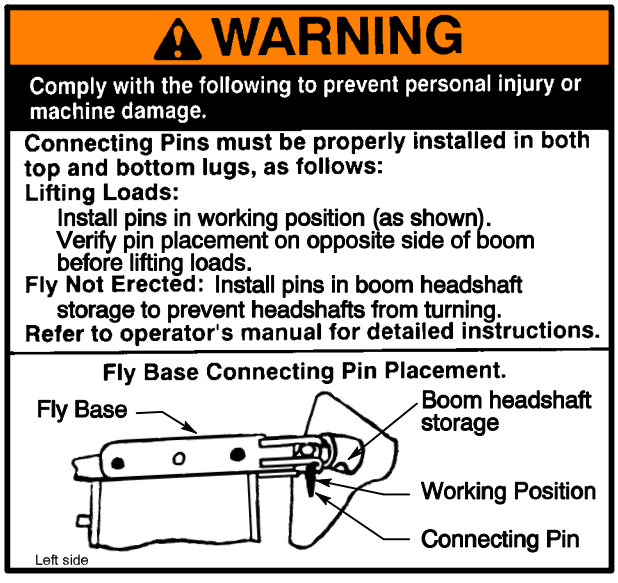


Figure 4–9
Left Side Fly Base Connecting Pin Label

Erection Of The Fly Base And Tip Sections From The Stored Position

1. Park crane on a firm level surface. Shift the transmission to neutral and engage the park brake.
2. Level the crane on fully or intermediate extended outriggers with all tires clear of the ground.

WARNING

Erect the fly with the crane level on fully or intermediate extended outriggers with all tires clear of the ground, the upper directly over the front of the carrier, and the travel swing lock engaged.

The fly adaptor lug and offset connecting pins must be in the 2° offset position to remove, install, store, or erect the offset fly.

Refer to the Crane Rating Manual for the maximum boom length the fly can be raised/lowered to/from the ground.

Failure to do the above could result in the personal injury and/or the crane tipping.

3. Position the upper directly over the front of the carrier and engage the travel swing lock.
4. Check that the offset connecting pins are installed in the 2° offset position. Refer to Figure 4-5 . If necessary change the fly offset to the 2° position. Refer to "Changing The Fly Offset Angle" in this Section of this Operator's Manual for detailed instructions.
5. Fully lower the boom. Retract the boom to engage the fly lugs with the head machinery cross shafts on the right side of the boom.

WARNING

To avoid personal injury, do not climb, stand, or walk on the boom or fly. Use a ladder or similar device to reach necessary areas.

6. Remove two fly connecting pins from the storage rings (11) on the rear fly picture frame lattice on the fly base section. Install them through the fly base pivot lugs (18) on the right side of the boom. Refer to Figure 4- 8. (Install the pins with the head on top and the keeper on the bottom.) Install the pin keepers.
7. Remove the connecting pin and keeper from the top fly tip connecting lug (1) on the left side of the fly tip section. Remove another fly tip connecting pin from the storage hole (2) on the rear of the fly tip section. Refer to Figure 4-8 . Install them through the fly tip pivot lugs (3). (Install the pins with the head on top and the keeper on the bottom.) Install the pin keepers.
8. Remove the winch wire rope from the head machinery or the auxiliary lifting sheave whichever is to be used on the fly and lay it aside to prevent damage to it during erection of the fly.
9. Check that the hitch pin (12) is installed through the lugs on the fly tip and base sections.

WARNING

Check that the fly base and tip connecting pins are installed in the pivot holes before disconnecting the fly from the storage brackets. Also check that the hitch pin is installed through the lugs on the fly tip and base sections. The fly could fall causing major crane damage and/or serious personal injury.

10. Pull down the retaining pin (16) to disengage the pin from the lug on the front storage bracket. Refer to Figure 4-8. Rotate and release the retaining pin to lock it in the disengaged position.

WARNING

Use a hand line to control fly swing. The fly could swing around the boom rapidly. Keep all personnel clear of the swing path to avoid injury.

11. Attach a hand line to the tip of the fly base and boom up to 20°.

CAUTION

Do not extend the boom beyond the 2—5 ft (*0.6—1.5m*) length. Extending the boom beyond the 2—5 ft (*0.6—1.5m*) may cause boom damage.

12. Slowly extend the boom approximately 2-5 ft (*0.6—1.5m*) to slide the fly base and tip off the storage brackets.
13. Slowly lower the boom to 0° angle to swing the fly base and tip around the boom head until the fly lugs engage with the head machinery cross shafts on the left side of the boom. Refer to Figure 4-6.
14. Remove the two connecting pins from the storage rings (11) on the rear fly picture frame lattice on the fly base section and install them in the cross shafts (23) on the right side of the boom. Refer to Figure 4-8. (Install the pins with the head on top and the keeper on the bottom.) Install the pin keepers.
15. Remove the two fly connecting pins from the storage location (24) on the boom head machinery cross shaft on the left side of the boom. Install one pin through the top fly lug (21) on the left side of the boom. Turn the t-handle to push and align the bottom left fly lug and the bottom boom head cross shaft. Install the bottom left fly connecting pin. (Install the pins with the head on top and the keeper on the bottom.) Install the pin keepers.

WARNING

All six fly base connecting pins must be properly installed before operating the crane with the fly base erected. Damage to the fly base and/or personal injury could occur if all connecting pins are not properly installed.

16. Attach a hand line to the tip of the fly tip section. Remove the hitch pin (12) which connects the fly tip section to the fly base section. Refer to Figure 4-8. Store the hitch pin back in the lug on the fly tip section once it is erected.
17. Swing the fly tip section around the fly base section until the fly tip lugs engage with the fly base lugs on the left side of the fly.

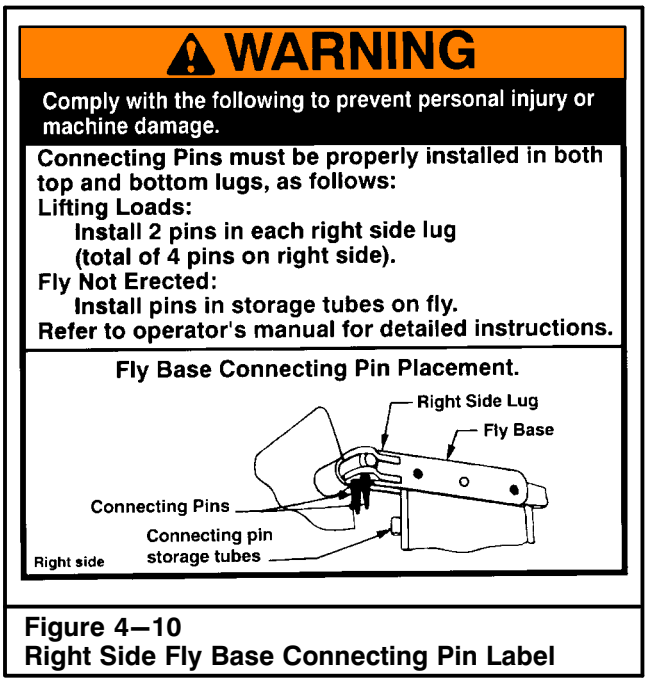


Figure 4—10
Right Side Fly Base Connecting Pin Label

18. Remove the fly tip connecting pins from the storage holes on the rear of the fly tip section. Install them through the fly tip connecting lugs on both sides of the fly. (Install the pins with the head on top and the keeper on the bottom.) Install the pin keepers.

WARNING

All six fly tip connecting pins must be properly installed before operating the crane with the fly tip erected. Damage to the fly tip and/or personal injury could occur if all connecting pins are not properly installed.

19. Remove the wire rope guards from the fly base head, deflector, and fly tip head sheaves. Refer to Figure 4-3. Reeve the winch wire rope on the boom deflector sheave then over the fly deflector, and fly tip head sheaves. Install all wire rope guards.

CAUTION

All wire rope guards must be in proper position during operation.

20. Properly change the anti-two block (ATB) system connections as follows:
    a. Disconnect boom head plug from jumper assembly on the main boom head and connect it to the fly base connector.

       Note: When lockout clip is installed, the main boom ATB switch is inactive.

       When both main boom and fly are reeved for operation, the lockout clip must be removed and an ATB weight must be suspended from each ATB switch.

    b. Properly install lockout clip on the main boom ATB switch weight cable.
    c. Remove the fly tip plug from the fly tip storage connector at the base of the fly tip section. Install the plug to the fly base head connector on the fly base section.
    d. Install the fly head ATB switch to the fly head and install the ATB weight to the switch cable.
    e. Connect the fly head ATB switch plug to the fly head connector.
21. Properly set the Rated Capacity Limiter to the correct crane configuration. Refer to Section 1 of this Operator's Manual.
22. Check the Crane Rating Manual for lifting capacities with the fly installed before continuing operations.

⚠ WARNING

The fly adds weight to the boom which must be considered in lifting capacities when the fly is erected. When making lifts from the main boom or auxiliary lifting sheave with the fly erected, refer to the Crane Rating Manual for the appropriate deductions from lifting capacities. Do not use the offset lattice fly while on tires or fully retracted outriggers, level the crane on fully extended or intermediate extended outriggers.

Table Of Contents

Crane Rating Manual And Serial Number

The Crane Rating Manual is mounted in the lower right interior of the operator's cab. The Crane Rating Manual has the crane serial number on it. The serial number is also stamped on the top of the bumper on the right side of the carrier and on the right side of the upper frame just below the boom hoist cylinder lug. The serial number must be used with any correspondence with the Link-Belt Factory or Distributor concerning parts or warranty. The Crane Rating Manual lists the maximum allowable lifting capacities for the crane. The Crane Rating Manual should be checked for the proper lifting capacities before making any lifts.

If the Crane Rating Manual becomes lost, damaged, or unreadable, it must be replaced before operating the crane. Information contained in the Crane Rating Manual is important and failure to follow the information it contains could result in an accident. A replacement Crane Rating Manual can be ordered through a Link-Belt Distributor.

WARNING

The Crane Rating Manual in the crane is the only authorized listing of lifting capacities for the crane. It supercedes any other printed literature which lists lifting capacities. It alone is to be used for determining crane capacities.

Wire Rope Capacity Chart

The Wire Rope Capacity Chart gives the maximum lifting capacities based on wire rope strength. A typical example is shown Figure 5-1. The actual chart is in the Crane Rating Manual. It lists the maximum load that should be lifted with different sizes and types of wire rope. The weights shown are based on wire rope strength alone. Exceeding these load weights may result in wire rope damage or failure.

Before making a lift, compare the weight being lifted (remember to add the weight of the hook block, hook ball, slings, and riggings to the actual load weight) with the Wire Rope Capacity Chart in the Crane Rating Manual.

Check the chart for the number of parts of line required to make the lift. Use at least that number of parts of line to make the lift. When making a lift with more parts of line than is needed to make the lift, remember to add one (1) pound (*.45kg*) for each one (1) foot (*.3m*) of extra wire rope required to reeve the extra parts of line to the actual load weight. The extra parts of line act as additional load weight.

WARNING

Do not exceed the capacities listed for wire rope strength or crane capacity, whichever is less, when making a lift. Serious personal injury or major crane damage may result.

Wire Rope Specifications

The specifications for the wire rope used on this crane are on the Wire Rope Capacity Chart in the Crane Rating Manual. Refer to Figure 5-1 for a typical example. Always refer to the Wire Rope Capacity Chart in the Crane Rating Manual and the crane Parts Manual when ordering replacement wire rope.

Wire Rope Diameter

In standard practice, the nominal diameter of wire rope is the minimum acceptable diameter. It is always made larger, not smaller, than the nominal diameter according to the allowable tolerances shown in the following chart:

Nominal Wire Rope Diameter	Allowable Limits	
Thru 1/8" (*3.2mm*)	-0	+8%
Over 1/8" (*3.2mm*) thru 3/16" (*4.8mm*)	-0	+7%
Over 3/16" (*4.8mm*) thru 5/16" (*8.0mm*)	-0	+6%
Over 5/16" (*8.0mm*)	-0	+5%

Wear and stress tend to reduce the diameter. It should be measured periodically and replaced if the size is below the nominal size of the wire rope being used as shown in the chart on page 5-4 . It should always be measured across the largest diameter that will fit inside a true circle. Refer to Figure 5-2.

Wire Rope Capacity

Maximum Lifting Capacities Based On Wire Rope Strength

Parts of Line	3/4" Type RB	3/4" Type ZB	Notes
1	12,920	15,600	Capacities shown are in pounds and working loads must not exceed the ratings on the capacity charts in the Crane Rating Manual.
2	25,840	31,200	
3	38,760	46,800	Study the Operator's Manual for wire rope inspection procedures and single part of line applications.
4	51,680	62,400	
5	64,600	78,000	
6	77,520	93,600	
7	90,440	109,200	
8	103,360	124,800	

LBCE TYPE	DESCRIPTION
RB	18 X 19 Rotation Resistant - Compacted Strand - High Strength - Preformed, Right Regular Lay
ZB	34 X 7 Non-Rotating - Extra Improved Plow Steel - Right Regular Lay or Right Lang Lay

Note: The Wire Rope Capacity Chart depicted above is shown as an example only. Use the official Wire Rope Capacity Chart in the Crane Rating Manual. Use it to determine the correct parts of line required for the given wire rope type and diameter.

Note: Always refer to the Crane Parts Manual when ordering wire rope.

Figure 5—1
Typical Wire Rope Capacity Chart (Example Only)

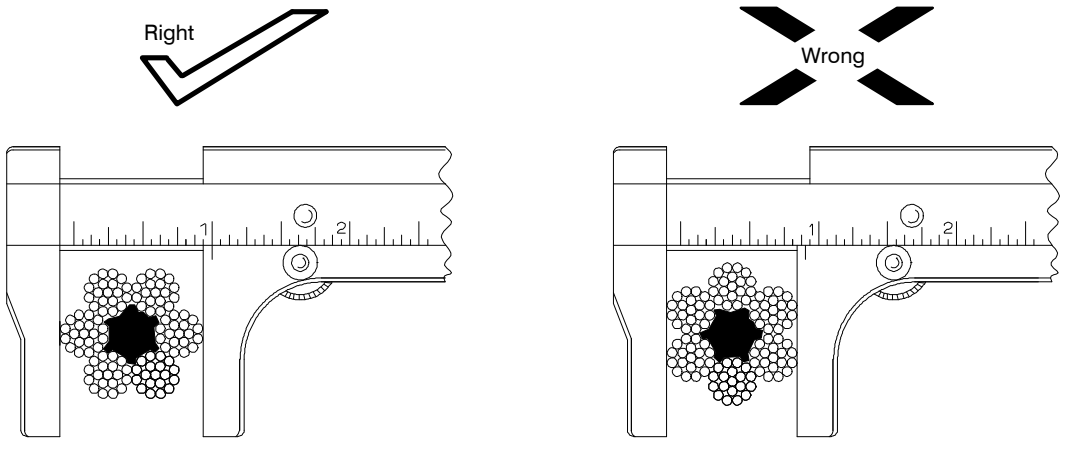


Figure 5—2
Measuring Wire Rope Diameter

WIRE ROPE INSPECTION REPORT

Crane S/N _____ Owned By _____ Crane Location _____

Date of Inspection _____ Wire Rope Application _____ Wire Rope Description _____

Manufacturer's Ident. No. _____ Applicable Standards _____

Criteria for Removal				1/3 of Outside Wire Dia.	1							
Location on Wire Rope	Measured Diameter	Broken Wires: In 1 Rope Lay	Broken Wires: In 1 Strand of 1 Lay	Excessive Wear	End Attachments: Broken Wires	End Attachments: Corrosion of Rope	End Attachments: Fitting Condition	Rope Damage	Sheave Condition	Drum Condition		Wire Rope Lay Measurement

Signature: _____

Figure 5—3
Typical Wire Rope Inspection Report

Wire Rope Inspection And Replacement Recommendations

The three basic reasons for deterioration of wire rope are abrasion, corrosion, and damage, caused by fatigue bending, crushing, kinking, and forces, or abuse, acting against the wire rope during normal usage.

When wire rope is replaced, use the type specified on the Wire Rope Capacity Chart in the Crane Rating Manual. Cranes are designed to use a specific type and size of wire rope. Using wire ropes other than those recommended may result in short life or even failure of the wire rope.

According to ASME standards, all wire ropes in active service MUST BE visually inspected daily. A qualified, trained person should be appointed to conduct the inspection. Also on a monthly basis, that person is required to inspect all wire ropes and keep a dated, written record noting any damage, and recording when wire ropes are replaced.

These inspections should be done to determine the degree of deterioration of the wire rope at any given section (refer to the following on wire rope replacement). This will determine the suitability of the wire rope for continued service. A sample inspection report is shown in Figure 5-3. (It can be reproduced and used if desired.)

Wire Rope Inspection

Any of the following are reasons to question wire rope safety:

1. More than one broken wire in any one strand should be cause for caution. Breaks that occur on the worn crowns of the outside wires usually indicate normal deterioration. Breaks that occur in the valleys between strands can indicate an abnormal condition, possibly fatigue, and breakage of other wires that are not readily visible. One or more valley breaks should be cause for replacement.
2. Wire breaks generally occur in those portions of wire rope which pass over sheaves, wind onto drums, or receive mechanical abuse. Breaks that occur near attached fittings are apt to result from fatiguing stresses concentrated in these localized sections. Breaks of the latter type should be cause for replacement of the wire rope or renewal of the attachment to eliminate the locally fatigued area. When running wire ropes over nylon sheaves, inspect the wire rope where it travels over the sheaves. Inspect for a loss of diameter and then bend the wire rope to inspect the internal wires for breaks and wear.
3. Heavy wear, or broken wires, may occur in sections under equalizer sheaves or other sheaves where wire rope travel is limited, or in contact with saddles. Particular care should be taken to inspect wire rope at these points. If wire rope wear is detected at these locations, these wear points can be shifted by removing the wire rope from the drum and cutting a 20 ft (*6.1m*) section off at the drum end. This may assist in extending the wire rope life.
4. Wire rope stretch is generally greatest during initial stages of operation when the strands are becoming adjusted and seated. This is accompanied by some reduction in wire rope diameter.
5. Time for wire rope replacement is indicated by the extent of abrasion, scrubbing and peening on the outside wires, broken wires, evidence of pitting or major corrosion, kink damage, or other mechanical abuse resulting in distortion of the wire rope structure.
6. Sheaves, guards, guides, drums, flanges, and other surfaces contacted by wire rope during operation should be examined at the time of inspections. Any condition harmful to the wire rope in use at the time should be corrected. The same equipment, and particularly sheave and drum grooves, should be inspected and placed in proper condition before a new wire rope is installed.

Wire Rope Replacement

Any of the following are reasons for wire rope replacement:

1. In running wire ropes, six randomly distributed broken wires in one wire rope lay, or three broken wires in one strand in one wire rope lay.

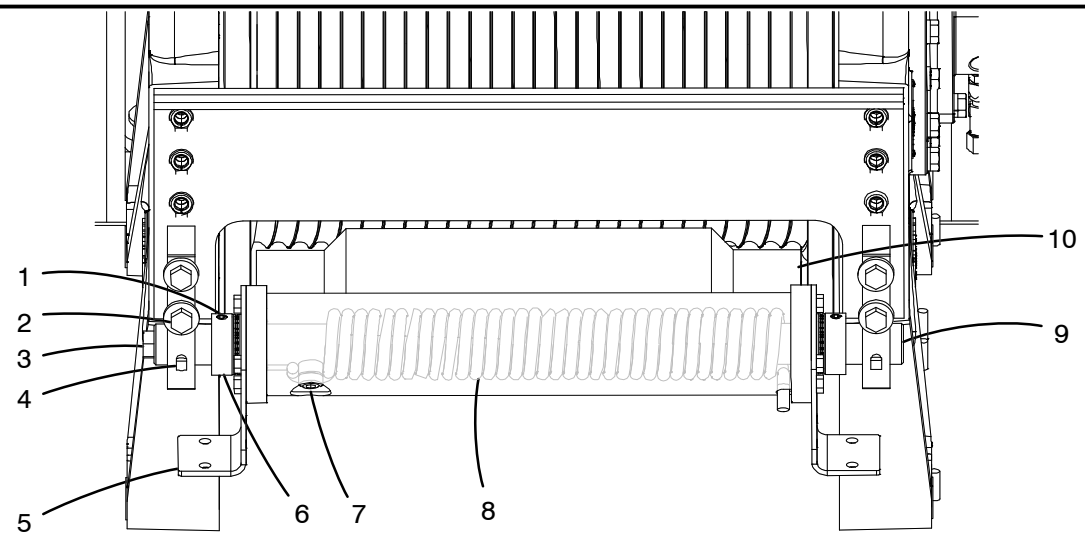
   For rotation resistant wire ropes, two randomly distributed broken wires in six wire rope diameters, or four randomly distributed broken wires in thirty wire rope diameters.
2. In pendants or standing wire ropes, evidence of more than two broken wires in one lay in sections beyond end connections or more than one broken wire in one wire rope lay at end connection.
3. One outer wire broken at the contact point with the core of the wire rope which has worked its way out of the wire rope structure and protrudes or loops out from the wire rope structure.
4. Abrasion, scrubbing or peening causing loss of more than 1/3 the original diameter of individual wires.
5. Evidence of wire rope deterioration from corrosion.
6. Kinking, crushing, "bird caging", or other damage resulting in distortion of the wire rope structure.
7. Evidence of any heat damage.
8. Marked reduction in diameter indicates deterioration of the core resulting in lack of proper support for the load carrying strands. Excessive wire rope stretch or elongation may also be an indication of internal deterioration. Reduction from nominal diameter or more than:

Reduction of	Nominal Wire Rope Diameters
1/64" (*.4mm*)	up to and including 5/16" (*8mm*)
1/32" (*.79mm*)	over 5/16" (*9.5mm*) to 1/2" (*13mm*)
3/64" (*1.2mm*)	over 1/2" (*13 mm*) to 3/4" (*19mm*)
1/16" (*1.6mm*)	over 3/4" (*19mm*) to 1-1/8" (*29mm*)
3/32" (*2.4mm*)	over 1-1/8" (*29mm*)

9. Noticeable rusting or development of broken wires in the area of connections.

Wire Rope Installation

When installing wire rope, the primary concern is getting the wire rope onto the drum without trapping any twist that may have been induced during handling. Use the following procedures to install the wire rope on the crane.



1. Setscrew
2. Capscrew
3. Capscrew
4. Setscrew
5. Roller Stop
6. Lock Collar
7. Shoulder Bolt
8. Spring
9. Torque Shaft
10. Roller

Figure 5—4
Winch Roller Alignment

Winch Roller Adjustment

Before installing wire rope on the drum, adjust the drum roller. Refer to Figure 5-4 . If the roller is not aligned to the drum, it may cause excessive wear on the wire rope, winch roller, or impede spooling of the wire rope on the drum. To adjust the roller, loosen the capscrews (2) and adjust roller assembly as required to align the roller parallel to the drum. Roller should lay flat across each full layer of wire rope on the drum and be centered between the drum flanges. Center the roller between the drum flanges by loosening the setscrews (1) in the lock collars (6), centering the roller (10), and tightening the setscrews. After roller is aligned and centered, preload the spring using the following procedure.

⚠ WARNING

Do not attempt to service winch roller before properly relieving torsion spring tension. If proper directions are not followed, the torsion spring could rapidly and forcefully uncoil. This may result in serious personal injury and component damage. Always release tension on torsion spring before attempting any winch roller repair.

1. Properly release torsion spring (8) tension as follows.

   This procedure is greatly simplified by using two service technicians. One to hold the breaker bar/wrench, the other to loosen and tighten setscrews.

   a. Ensure capscrew (3) is tightened securely in torque shaft (9).
   b. Using a breaker bar or long handle wrench, hold tension on torsion spring (8) while loosening the setscrews (4) on both ends of torque shaft (9).
   c. Allow torque shaft (9) to rotate counterclockwise, as far as possible while maintaining control of the torque shaft (9), then securely tighten setscrews (4).
   d. Reposition breaker bar or wrench on capscrew (3).
   e. Repeat Steps b through d until tension is fully relieved from torsion spring (8).
2. Turn the capscrew (3), which will rotate the torque shaft (9), until the bolt (7) through the torque shaft contacts the spring (8).

CAUTION

Do not overtighten the spring. Damage to the wire rope may occur.

3. With the roller stop (5) resting against the drum flange or with the roller resting evenly on the first layer of wire rope on the drum, use 105 ft lb (*124Nm*) of torque to rotate the spring not to exceed one revolution (360°).
4. Tighten setscrews (4). The roller should roll freely when the drum rotates.

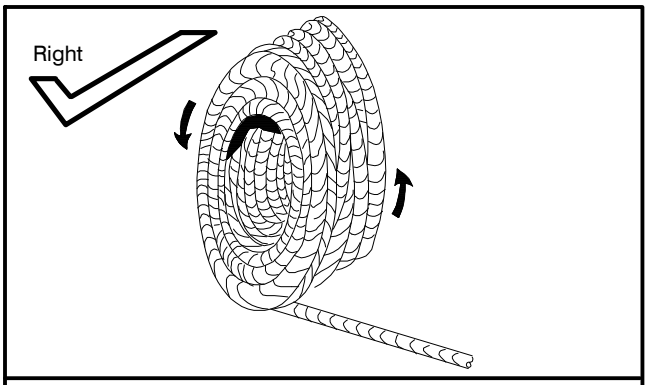


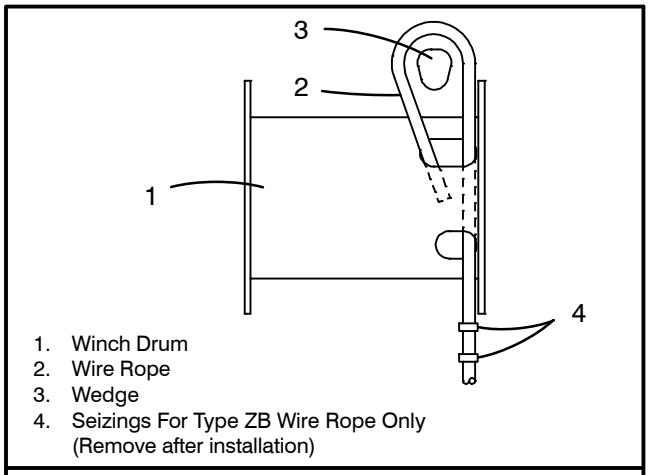
Figure 5—5
Uncoiling Wire Rope

Uncoiling Wire Rope

1. To avoid twists, unreel the entire wire rope on the ground in line with the boom deflector sheave and drum. Set the reel up horizontally so it can rotate as the wire rope is reeled off. Refer to Figure 5-5. Reel the wire rope off slowly, so the reel won't tend to "throw" the wire rope off. If the new wire rope cannot be laid out on the ground, further steps are necessary:
   a. Mount the reel on a shaft through flange holes and on jack stands, making sure the reel is set to be unreeled over the top. Do not allow the reel to "free-wheel". Brake the reel by applying pressure to a flange. Do not apply braking pressure to the wire rope on the reel or pass wire rope between blocks of wood or other material.
2. Reeve the wire rope over the boom deflector sheave and anchor it to the drum.

   Note: When replacing wire rope, the sheaves and grooves in drums should be checked for wear or damage and replaced if necessary. Damaged, worn, or undersized sheaves will damage the wire rope. On older equipment, remember that new wire rope is usually larger in diameter than the worn wire rope it replaces. The sheave grooves may be worn to the smaller diameter of the old wire rope.

   A new wire rope should be broken in by running it slowly through its working cycle for a short period under a light load. Refer to "Wire Rope Break-In" in this Section of this Operator's Manual.



1. Winch Drum
2. Wire Rope
3. Wedge
4. Seizings For Type ZB Wire Rope Only (Remove after installation)

Figure 5—6
Anchoring Wire Rope To Drum

Anchoring Wire Rope To Drum

CAUTION

The ends of type ZB wire rope must be fuse welded. Failure to do so may cause the core to slip and/or the strands to loosen causing major wire rope damage.

If crane is equipped with type ZB wire rope, attach two seizings (hose clamps are an effective and efficient alternative if traditional seizings are not available) about 24 inches (*61cm*) from the end with a 3 inch (*7.62cm*) space between them. Refer to Figure 5-6. The seizings will prevent any looseness of the outer strands from traveling up the wire rope during installation. Insert the free end of the wire rope into the small opening of the anchor pocket. Loop the wire rope and push the free end about ¾ of the way back through the pocket. Install the wedge, then pull the slack out of the wire rope. If using type ZB wire rope, remove the seizings after the wire rope is secured in the drum. Keep tension on the wire rope to prevent the wire rope from becoming slack and forming loops or kinks and also to allow uniform winding on the drum. It is important that original wire rope lay is maintained at all times.

Winding Wire Rope On Drum

Proper winding of the first layer of wire rope on a multiple wrap drum is important. If the first layer is properly wound, succeeding layers will be easier to control.

This is especially important on ungrooved drums. When starting new wire rope on such drums, drive each wrap of the first layer lightly with a wooden mallet so each wrap barely contacts the preceding one. Keep tension on the wire rope to prevent the wire rope from becoming slack and forming loops or kinks and also to allow uniform winding on the drum. It is important that original wire rope lay is maintained at all times.

It's important to apply a tensioning load while spooling the wire rope on the drum. (If not, the lower layers may be loose enough that the upper layers become wedged into the lower layers under load, which can cause major damage to the wire rope.) The tensioning load should range from 1 to 2% of the wire rope's nominal strength.

Wire Rope Reeving

Hook blocks should be reeved correctly so they hang straight and do not cause excessive wear on the wire rope and sheaves. Refer to Figure 5-7.

⚠ WARNING

To avoid personal injury, do not climb, stand, or walk on the boom or fly. Use a ladder or similar device to reach necessary areas when reeving the crane.

Only if certain criteria are met, a swivel hook ball may be used with rotation resistant wire rope. Refer to "Hook Ball Usage With Rotation Resistant Wire Rope" in this Section of this Operator's Manual.

The crane can use multiple parts of line when reeving the main winch depending on the lift being made and the number of sheaves available. When reeving the winches, odd parts of line dead end at the hook block and even parts dead end at the boom head. The auxiliary lifting sheave may be reeved with either one or two parts of line.

Note: Do not use a swivel at the dead end of a multi-part reeving.

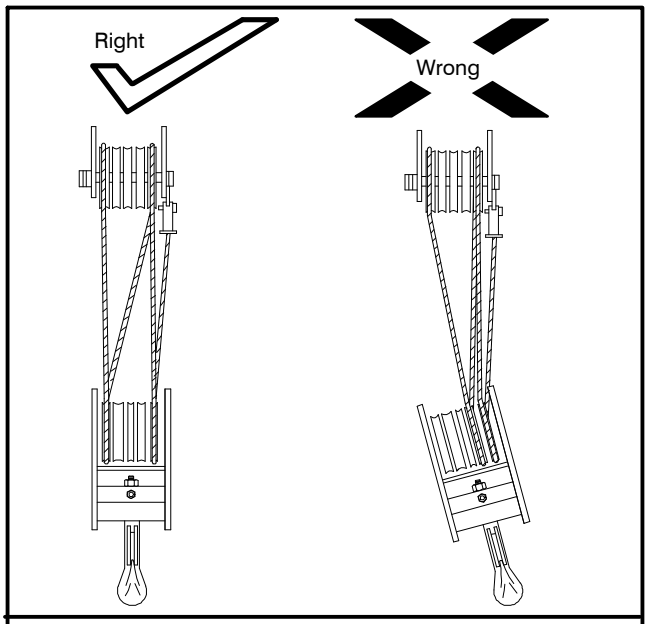
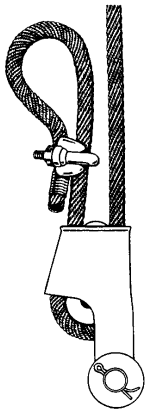


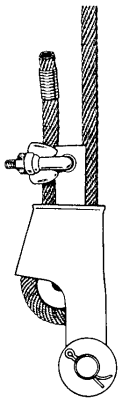
Figure 5—7
Hook Block Reeving

The fly section may be reeved with two parts of line for better line control. Figure 5-18 and Figure 5-19 gives the proper reeving for various parts of line. The reeving patterns illustrated must be used at all times. To determine how many parts of line to use for a particular lift, check the Wire Rope Capacity Chart, and the Winch Performance chart, in the Crane Rating Manual.

Note: Wire rope guards must always be used during operations. They must be pinned in place to prevent wire rope from jumping off the sheaves.

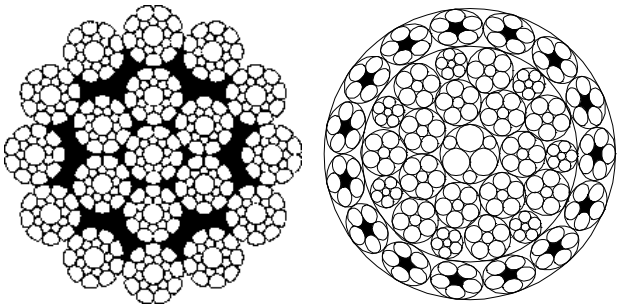


Socket And Wedge
<u>Without</u> Extended Wedge
Refer to page 5—9



Socket And Wedge
<u>With</u> Extended Wedge
Refer to page 5—10

Figure 5—8
Sockets And Wedges



Type RB **Type ZB**

Figure 5—9
Wire Rope Identification

Sockets And Wedges

This crane may be equipped with either of two styles of sockets and wedges. One style socket uses an extended wedge and the other does not. The wedges for each style are installed differently. Refer to Figure 5-8 to determine which style your crane has and where to find the appropriate information for use and installation.

⚠ WARNING

Do not interchange sockets and wedges. Loads may slip or fall if socket and wedge are not properly matched. Use an extended wedge with a socket for an extended wedge and a non-extended wedge with a non-extended wedge socket.

Socket And Wedge — Without Extended Wedge

CAUTION

Use the proper size wedge with a wire rope socket or lagging. The use of an off-size wedge in a socket or lagging is dangerous as it may not hold. Wedges and sockets shipped from the factory are stamped with size and type identification. A lagging or socket may be stamped for two or more sizes of wire rope and a wedge for one or two. The size on the lagging, socket, and wedge must correspond with the size of wire rope being used.

The correct and incorrect methods of attaching a socket and wedge to wire rope are shown in Figure 5-10. The dead end of the wire rope must always be on the sloped portion of the socket. The load line must be in a straight line pull with the eye of the socket. If the wire rope is installed wrong as shown in Figure 5-10, a permanent set will develop at the point where the wire rope enters the socket. This permanent set will weaken the wire rope and accelerate wear at this point.

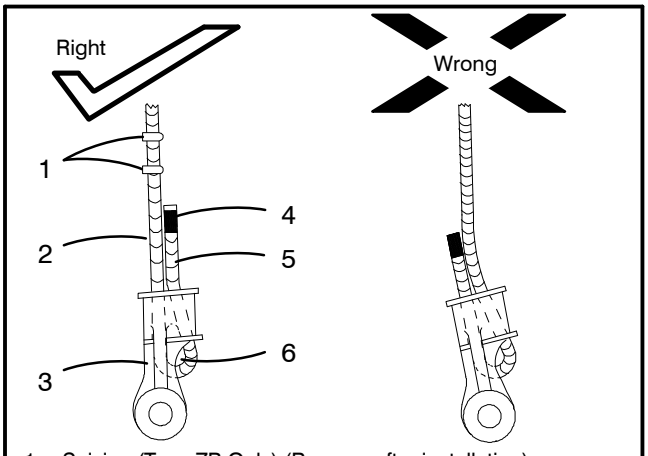
Before installing type ZB wire rope into a socket or wedge attach two seizings (hose clamps are an effective and efficient alternative if traditional seizings are not available) approximately 3-4 ft (*0.9—1.2 m*) from the end with a 3 in (*76.2 mm*) space between them. Refer to Figure 5-10.

The dead end must also be seized and a minimum tail length of 20 wire rope diameters [15" (38cm) for 3/4" (19mm) wire rope] is required. The seizings will help prevent core slippage and any looseness of the outer strands from traveling up the wire rope during installation while still allowing the wire rope strands to be free to adjust. If using type ZB wire rope, remove seizings from the live end after wire rope is securely installed into the socket.

Note: Refer to Figure 5—9 to identify which type of wire rope is installed on the crane.

CAUTION

The ends of type ZB wire rope must be fuse welded and the tail length of the dead end must be a minimum of 20 wire rope diameters [15" (38cm) for 3/4" (19mm) wire rope]. Failure to do so may cause the core to slip and/or the strands to loosen causing major wire rope damage.



1. Seizing (Type ZB Only) (Remove after installation)
2. Wire Rope Live End
3. Socket
4. Dead End Seizing
5. 20 Wire Rope Diameters Minimum Tail Length
6. Wedge

Figure 5—10
Socket And Wedge Connections

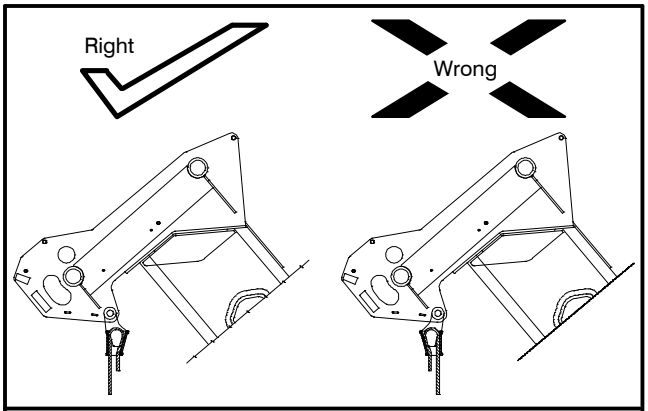
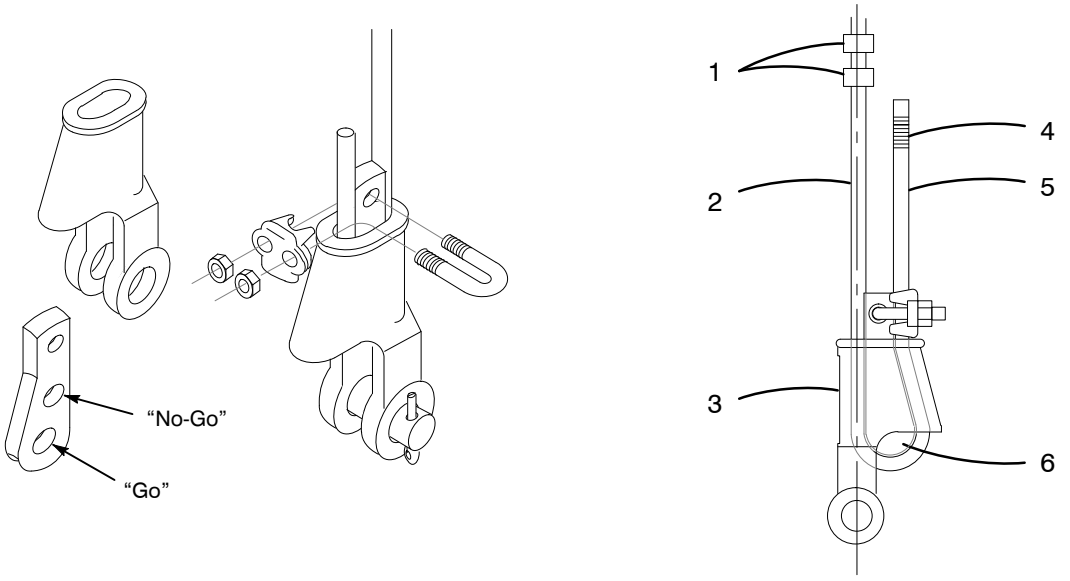


Figure 5—11
Socket And Wedge Installation

When anchoring the socket to the boom head, ensure the flat face is facing out as shown in Figure 5-11. If socket is not installed correctly structural damage to the boom head may occur.

It is recommended that the wire rope socket and wedge connection be reestablished on an annual basis. This can be accomplished by cutting the wire rope 6 in (*0.15m*) above the socket and wedge connection. See "Cutting Wire Rope" in this Section of this Operator's Manual. Install the socket and wedge connection as shown in Figure 5-10.



1. Seizings (Type ZB Wire Rope Only) (Remove after installation)
2. Wire Rope Live End
3. Socket
4. Dead End Seizing
5. Tail Length - 20 Wire Rope Diameters Minimum for Rotation Resistant Wire Ropes, 6 Wire Rope Diameters Minimum for 6 to 8 Strand Wire Rope
6. Extended Wedge

Figure 5—12
Socket & Wedge Assembly — With Extended Wedge

Socket And Wedge Assembly — With Extended Wedge

WARNING

Use the proper size wedge with a wire rope socket or drum. The use of an incorrect size, type, or brand of wedge in a socket or drum is dangerous as it may not hold. Wedges and sockets shipped from the factory are stamped with size and type identification. A drum or socket may be stamped for two or more sizes of wire rope and a wedge for one or two. The size on the drum, socket, and wedge must correspond with the size of wire rope being used.

WARNING

Do not interchange sockets and wedges. Loads may slip or fall if socket and wedge are not properly matched. Use an extended wedge with a socket for an extended wedge and a non-extended wedge with a non-extended wedge socket.

The correct and incorrect methods of attaching a socket and wedge to wire rope are shown in Figure 5-12 and Figure 5-13. The dead end of the wire rope must always be on the sloped portion of the socket. The load line must be in a straight line pull with the eye of the socket. If the wire rope is installed wrong as shown in Figure 5-13, a permanent set will develop at the point where the wire rope enters the socket. This permanent set will weaken the wire rope and accelerate wear at this point.

Wedges and sockets shipped from the factory are stamped with size and type or pair identification. A socket or wedge may be stamped for two or more sizes of wire rope. The size on the socket and wedge must correspond with the size of wire rope being used. The wedge also has a "go"/"no-go" feature cast into the wedge to assist in determining the proper size wire rope that can be used with that particular socket and wedge. Refer to Figure 5-12. The proper size wire rope is determined when: 1) the wire rope passes through the "go" hole in the wedge, and 2) the wire rope does not pass through the "no-go" hole in the wedge. The part number may also be stamped on the socket and wedge. Refer to the crane Parts Manual for confirmation. If there is any doubt as to the matching of the socket and wedge, contact a Link-Belt Distributor.

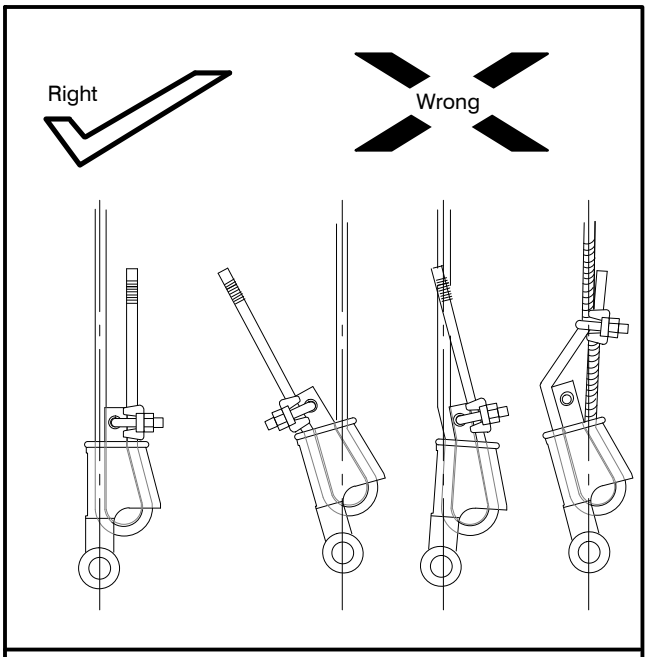


Figure 5—13
Socket & Wedge Connections

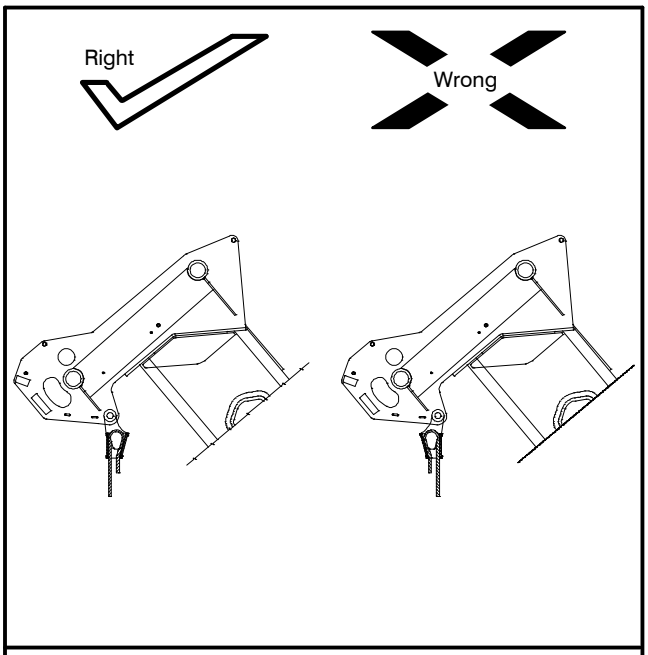


Figure 5—14
Socket & Wedge Installation

The dead end must also be seized and a minimum tail length of 20 wire rope diameters [15" (38cm) for 3/4" (19mm) wire rope] for rotation resistant wire ropes and 6 wire rope diameters minimum for 6 to 8 strand wire rope is required. Refer to Figure 5-12.

Note: Refer to Figure 5—9 to identify which type of wire rope is installed on the crane.

Use a hammer to seat the wedge and wire rope into the socket before applying first load. Lift the first load a few inches *(cm)* from the ground 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.

Secure the dead end section of the wire rope by installing the clip through the wedge as shown in Figure 5-12. Tighten the nuts on the clip to the recommended torque as shown on the table in Figure 5-16.

When anchoring the socket to the boom head, ensure the flat face is facing out as shown in Figure 5-14. If socket is not installed correctly structural damage to the boom head may occur.

It is recommended that the wire rope socket and wedge connection be reestablished on an annual basis. This can be accomplished by cutting the wire rope 6 in (*0.15m*) above the socket and wedge connection. See "Cutting Wire Rope" in this Section of this Operator's Manual. Install the socket and wedge connection as shown in Figure 5-12.

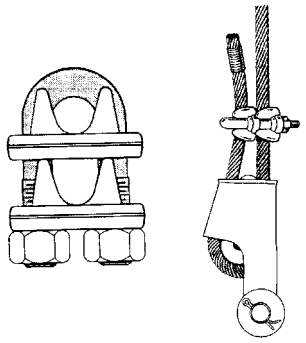
Wire Rope Break-In

After the wire rope has been installed and the ends secured in the correct manner, the new wire rope must be run through a break-in period. This allows the component parts of the new wire rope to gradually adjust itself to actual operating conditions.

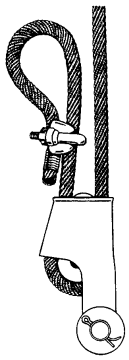
1. Level the crane on fully extended outriggers with all tires clear of the ground. Position the upper over the front of the carrier and engage the travel swing lock.
2. Fully raise and fully extend the boom. Attach a light load at the hook and raise it a few inches *(cm)* off the ground. Allow to stand for several minutes.
3. Run the wire rope through a cycle of operation at very slow speeds. During this trial operation, a very close watch should be kept on all working parts-sheaves, drums, roller, etc. to make certain that the wire rope runs freely and without any obstructions as it makes its way through the system.

   Note: Run these loads with reeving that places the loads on the hook block with all wire rope off the drum except the last three wraps. If this is not possible, alternate methods must be used to assure proper tensioning of the wire rope on the drum.

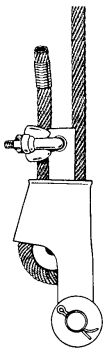
4. If no problems appear in running the wire rope, repeat procedure with an increased load.



The Double-Saddle — Clip Method



The Loop Back Method



The Extended Wedge Method

Figure 5—15
Wire Rope Socket With Clip

Hook Ball Usage With Rotation Resistant Wire Rope

The rotation resistant characteristic is achieved by laying the outer strands around an independent wire rope that is wound in the opposite direction. When the wire rope has tension on it, opposing rotational forces are created between the core and outer strands. If a swivel hook ball is utilized with rotation resistant wire rope, the wire rope is allowed to twist. The outer strands unwind and get longer while the inner core is forced to rotate in the same direction and shortens in length. As a result of this treatment, the inner core sees a disproportionately greater load, and core damage may occur due to shock loading or overloading. A rotating load on an unrestrained, non-swivel hook ball without a tagline, also affects the internal loading of the wire rope in this manner. This practice, or any other which allows the wire rope to rotate while in service, leads to unbalanced loading between the inner and outer layer of strands, which may result in core failure. Wire rope manufacturer's testing has shown that rotation resistant wire rope utilized with a swivel hook ball has reduced the breaking strength by as much as 50% if excessive rotation occurs.

Non-Swivel Usage

A non-swivel hook ball, in conjunction with a tagline or other device to control load spin, should be used when the crane is equipped with rotation resistant wire rope. This is to avoid unrestrained rotation of the wire rope.

Swivel Usage

A swivel hook ball can be used with rotation resistant wire rope if:

1. The wire rope is not shock loaded or overloaded.
2. Wire rope working strength is reduced to maintain original design factors.
3. The wire rope is inspected frequently as outlined below.

Wire Rope Inspection

Marked reduction in diameter indicates deterioration of the core resulting in lack of proper support for the load carrying strands. Excessive wire rope stretch or elongation may also be an indication of internal deterioration.

Major concerns and replacement recommendations include:

1. Loss of wire rope diameter (in excess of those listed in the table in "Wire Rope Replacement" in this Section of this Operator's Manual), abnormal lengthening of wire rope lay, or protrusion of wires between the outer strands.
2. 2 randomly distributed broken wires in 6 wire rope diameters, or 4 randomly distributed broken wires in 30 wire rope diameters.

Clip Size		Minimum No. of Clips	Amount OF Wire Rope To Turn Back*		Torque	
Inches	*mm*	Quantity	Inches	*mm*	ft lb	*Nm*
1/4	*3.2*	2	3-1/4	*82.5*	---	———
3/16	*4.7*	2	3-3/4	*95.2*	---	———
1/4	*6.3*	2	4-3/4	*120.6*	15	*20.0*
5/16	*7.9*	2	5-1/4	*133.3*	30	*40.7*
3/8	*9.5*	2	6-1/2	*165.1*	45	*60.1*
7/16	*11.1*	2	7	*177.8*	65	*86.8*
1/2	*12.7*	3	11-1/2	*292.1*	65	*86.8*
9/16	*14.3*	3	12	*304.8*	95	*126.9*
5/8	*15.9*	3	12	*304.8*	95	*126.9*
3/4	*19.0*	4	18	*457.2*	130	*173.6*

* If a greater number of clips are used than shown in this table, the amount of wire rope turnback should be increased proportionally.

Figure 5—16
Wire Rope Clip Application Recommendation

Wire Rope Sockets With Clips

Some codes require the use of a wire rope clip in conjunction with a socket and wedge connection. Figure 5-15 illustrates some typical methods of clip installation with sockets. In some cases, particularly in wrecking ball work, there is a chance that the wedge can loosen, releasing the socket from the wire rope. This could be caused by the banging action and alternate loading and unloading of the wire rope that occurs during this type work.

⚠ WARNING

Regularly inspect the integrity of the wire rope at the point of exit at the dead end side. High velocity spin of wire rope when loading and unloading can cause the wire rope to flip-flop, fatigue, and finally break off.

The use of wire rope clips with a socket and wedge connection can weaken the connection if done improperly. Do not attach the dead end of the wire rope to the live side with the clip as this will weaken the connection. The clip may ultimately take the load and may deform or break the wire rope.

If using the loop back method, the loop formed must not be allowed to enter the wedge, or the connection will be weakened. The tail length of the dead end must be a minimum of 20 wire rope diameters [15" (38cm) for 3/4" (19mm) wire rope].

CAUTION

The ends of type ZB wire rope must be fuse welded and the tail length of the dead end must be a minimum of 20 wire rope diameters [15" (38cm) for 3/4" (19mm) wire rope]. Failure to do so may cause the core to slip and/or the strands to loosen causing major wire rope damage.

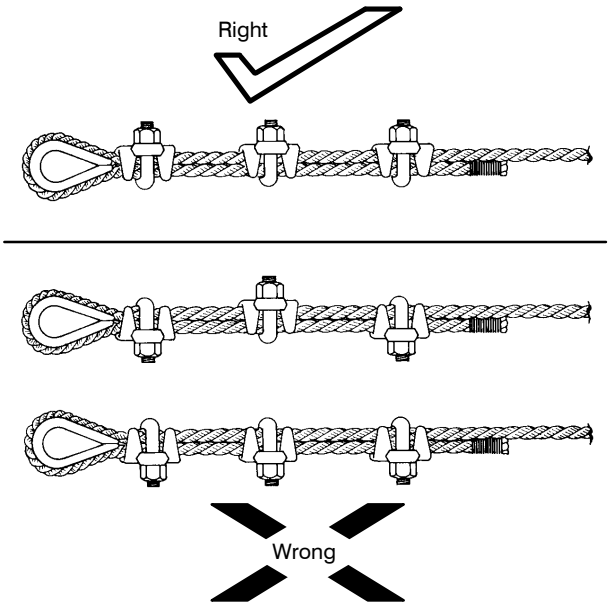


Figure 5—17
Wire Rope Clip Installation

Wire Rope Clip Installation

The correct method of installing wire rope clips is shown in Figure 5-17. The u-bolt must always be over the short end of the wire rope and the base must always contact the long end.

Clips should not be staggered, that is u-bolt of one clip over short end and u-bolt of next clip over long end. This practice will not only distort the wire rope excessively, but will prevent maximum strength of this type fastening. Placing all clips with the u-bolt over the long end of the wire rope will damage strands and result in an unsafe condition.

The distance between clips should be not less than six times the wire rope diameter. In relation to size of wire rope, the minimum number of clips recommended for safe connections is given in Figure 5-16.

CAUTION

Apply the initial load and retighten nuts to the recommended torque. Wire rope can stretch and reduce in diameter when loads are applied. Inspect periodically and retighten as required.

Cutting Wire Rope

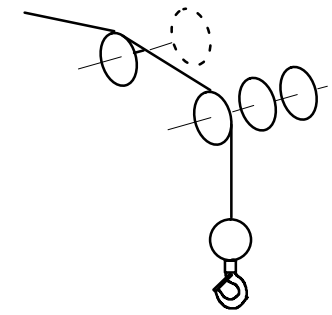
CAUTION

The ends of type ZB wire rope must be fuse welded. Failure to do so may cause the core to slip and/or the strands to loosen causing major wire rope damage.

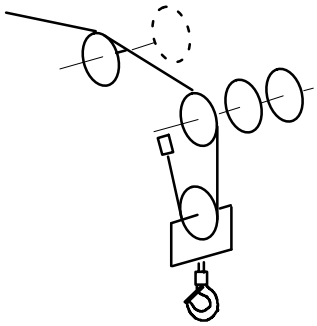
When wire rope is to be cut, seizings should be placed on each side of the point where the wire rope is to be cut, to keep the strands in place. On preformed wire rope such as type RB, one seizing on each side of the cut is enough. On non-preformed wire rope less than 7/8 inch (*22mm*) diameter such as type ZB, two seizings are recommended. On non-preformed wire rope over 7/8 inch (*22mm*) diameter, three seizings are recommended. Original wire rope lay must be maintained at all times.

Three Basic methods of cutting wire rope are recommended:

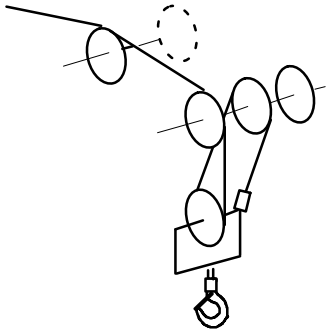
1. Abrasive cutting tools.
2. Shearing tools. (Wire cutters on small wire rope, a wire rope cutter, and hammer for larger wire ropes.)
3. Oxy/acetylene fuel torch. This is the only suggested method for cutting type ZB wire rope.



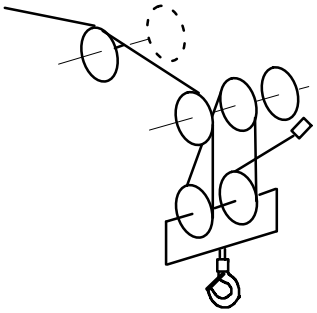
1 Part



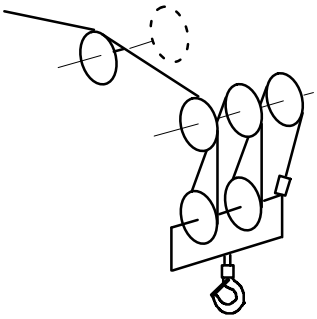
2 Parts



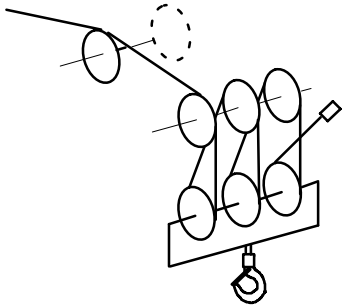
3 Parts



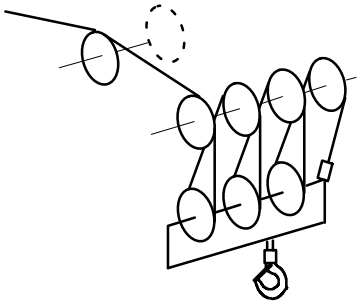
4 Parts



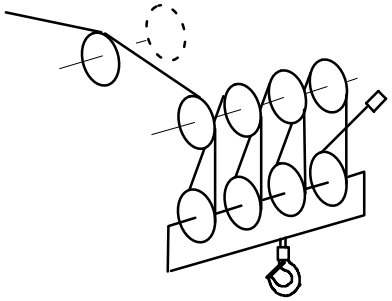
5 Parts



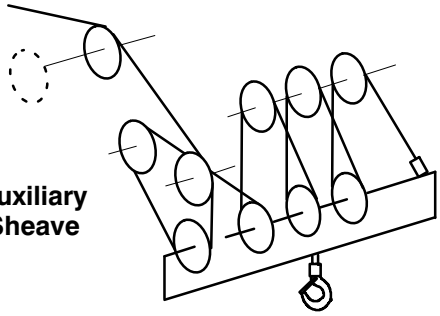
6 Parts



7 Parts



8 Parts

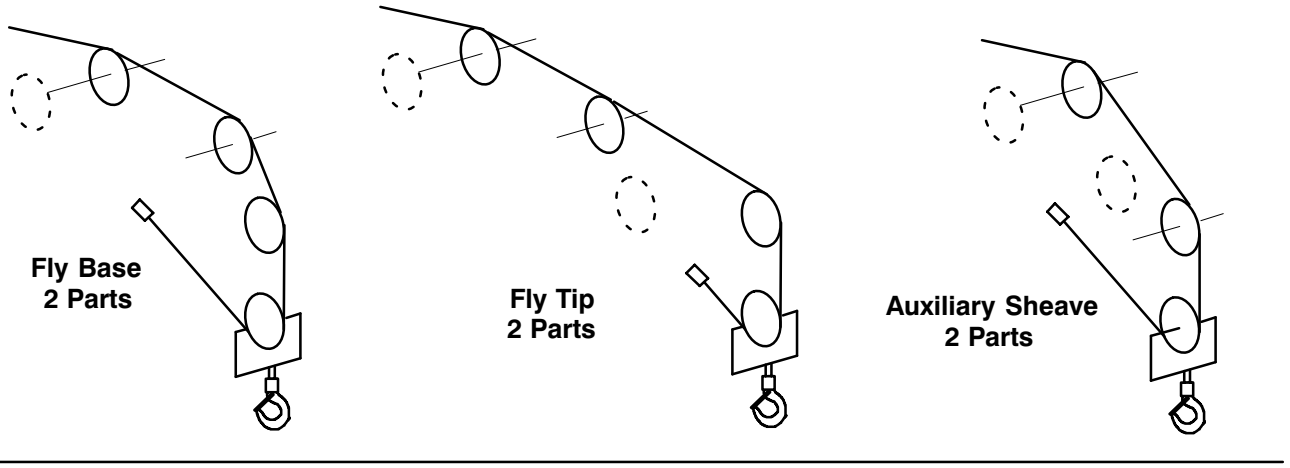


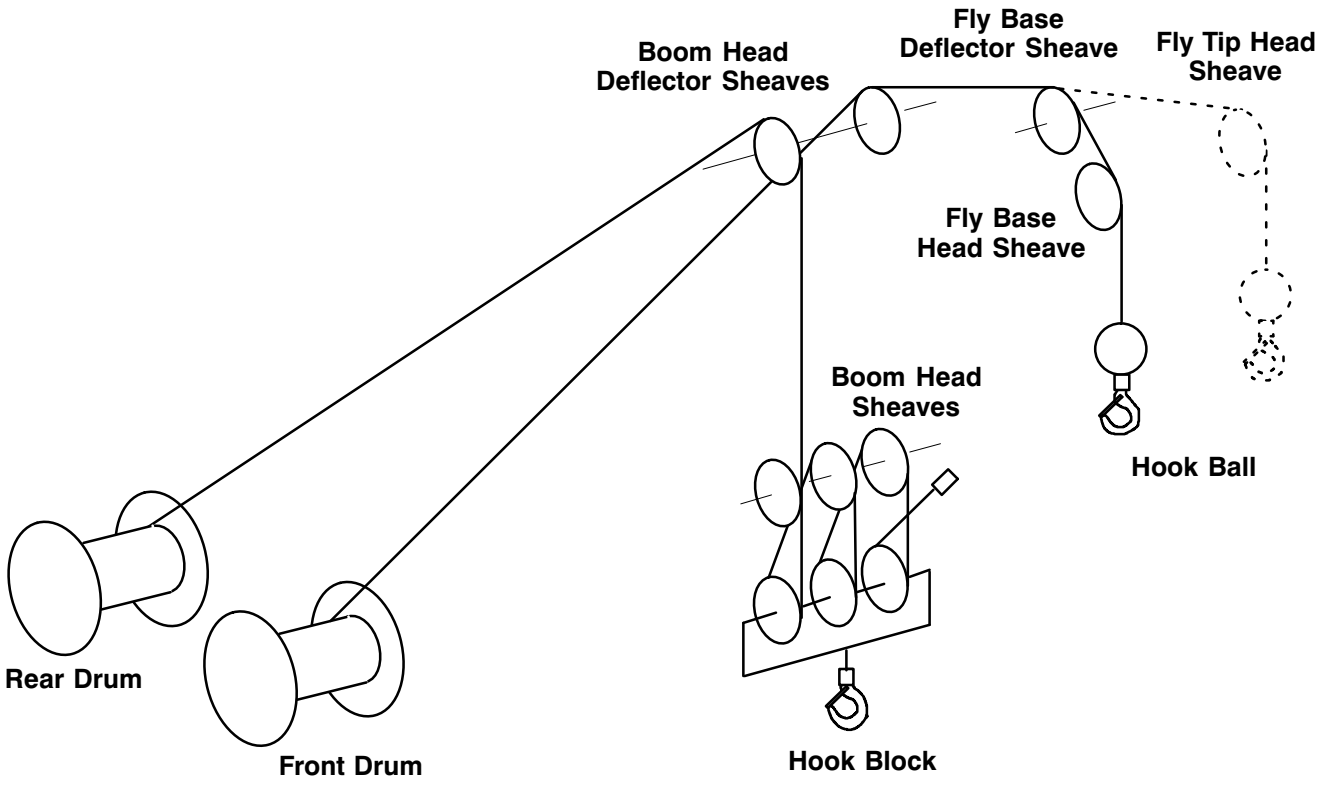
9 Parts

CAUTION

This reeving is only applicable for maximum rated capacity lifts that require additional parts of line to maintain the required wire rope safety factor.

Figure 5—18
Wire Rope Reeving Diagrams





Note: Reeving shown is typical. Either drum may be reeved over head sheaves or fly sheave.

Figure 5—19
Wire Rope Reeving Diagrams

Event Data Recording

This Link-Belt crane is equipped with one or more computers that monitor and/or control the crane's performance. This crane uses computer modules to monitor and retain crane operation, crane configuration, and as well as crane functions. These modules may aid the operator in the operation of the crane. The modules may also store data to help the Link-Belt dealer/distributor technician service the crane.

Event Data Recorder

This Link-Belt crane has an Event Data Recorder (EDR) system. The main purpose of the EDR is to record data relating to the crane operation and configuration that will assist in understanding how the crane's operating systems perform. The EDR is designed to record data related to crane dynamics and safety systems for a short period of time. The EDR in this crane is designed to record such data as:

- How various systems in the crane were operating
- How the crane was configured (counterweight, boom length, operational mode, etc.)
- What control functions were being used

This data will help provide valuable information as to how the crane was functioning and/or being operated.

Data And Recording Privacy

Important: EDR data is recorded in the crane only if a non-trivial situation occurs; no data is recorded by the EDR under normal operating conditions and no personal data (e.g., name, gender, age, or crane location) is recorded. However, other parties, such as law enforcement, or similar government offices, could combine the EDR data with the type of personal identifying data routinely acquired during a crane accident investigation.

To read data recorded by this EDR system, special equipment is required, and access to the crane and/or the EDR is needed. Link-Belt has the special equipment necessary to retrieve the recorded data.

It is the position of Link-Belt that the crane owner owns any data that is recorded and stored in the EDR or other onboard computer system(s). Link-Belt will not access this data, interpret data, or share the data with others, except by written request from the crane owner(s). The request by the crane owner may be due to an official request of police or similar government offices; as part of Link-Belt's defense of litigation through the discovery process; or as required by law. Data that Link-Belt retrieves may also be used for Link-Belt or component manufacturers for research purposes, where a need is shown and data is not tied to a specific crane or crane owner.

Link-Belt will retrieve crane data only by written request from the crane owner. The Electronic Data Recorder Request Form found at the end of this Operator's Manual can be used for this purpose.

Crane Specifications

The information is general in nature and is used for reference purposes only. Depending upon the vintage of the crane, some features may no longer be available. Standard and optional features may vary from crane to crane. Contact a Link-Belt Distributor or the factory to verify the specific information if required.

Boom, Attachments, And Upper Structure

■ Boom

Design - Four section, box type construction of high tensile steel consisting of one base section and three telescoping sections. The vertical side plates have diamond shaped steel impressions for superior strength to weight ration. The first telescoping section extends independently by means of one double-acting, single stage hydraulic cylinder with integrated holding valves. The second and third telescoping sections extend proportionally by means of one double-acting, single stage cylinder with integrated holding valves and cables.

Boom

- 35 ft 6 in-110 ft (*10.8—33.5m*) four section full power boom
- Two mode boom extension: "A" mode provides superior capacities by extending the first telescoping section to 60 ft 4 in (*18.4m*). "B" mode synchronizes all the telescoping sections proportionally to 110 ft (*33.5m*). Controlled from the operator's cab.
- Mechanical boom angle indicator
- Maximum tip height for "A" mode is 70 ft (*21.3m*) and "B" mode is 118 ft 5 in (*36.1m*).

Boom Head

- Four 16.5 in (*41.9cm*) root diameter nylon sheaves to handle up to eight parts of line
- Easily removable wire rope guards
- Wire rope dead end lugs on each side of the boom head
- Boom head is designed for quick-reeve of the hook block

Boom Elevation

- One double acting hydraulic cylinder with integral holding valve
- Boom elevation: -3° to 78°

Auxiliary Lifting Sheave — Optional

- Single 16.5 in (*41.9m*) root diameter nylon sheave
- Easily removable wire rope guards
- Does not affect erection of the fly or use of the main head sheaves

Hook Blocks And Hook Balls — Optional

- 40 ton (*36.3mt*) 4 sheave quick-reeve hook block with safety latch
- 60 ton (*54.4mt*) 4 sheave quick-reeve hook block with safety latch
- 8.5 ton (*7.7mt*) swivel and non-swivel hook balls with safety latch

Fly — Optional

- 28 ft 6 in (*8.7m*) one piece lattice fly, stowable, offsettable to 2°, 20°, and 40°. Maximum tip height is 146 ft (*44.5m*).
- 28 ft 6 in-51 ft (*8.7—15.5m*) two piece bi-fold lattice fly, stowable, offsettable to 2°, 20°, and 40°. Maximum tip height is 168 ft (*51.2m*).

■ Operator's Cab And Controls

Environmental Operator's Cab - Fully enclosed, one person operator's cab of galvaneal steel structure with acoustical insulation. Equipped with:

- Tinted and tempered glass windows
- Extra large fixed front window with windshield wiper and washer
- Swing up roof window with windshield wiper
- Sliding left side door with large fixed window
- Sliding rear and right side windows for ventilation
- Six way adjustable, cushioned seat with seat belt and storage compartment
- Engine dependent warm-water heater with air ducts for front windshield defroster and operator's cab floor
- Defroster fan for the front window
- Bubble level
- Circulating fan
- Adjustable sun visor
- Dome light
- Cup holder
- Fire extinguisher
- Left side viewing mirror
- Two position travel swing lock

Air Conditioning — Optional - Integral with operator's cab heating system utilizing the same ventilation outlets

Engine Dependent Heater — Optional - Flameless, warm-water system that does not have a separate fuel tank

Steering Column - Pedestal type with tilt and telescope functions for operator comfort. Column includes the following controls and indicators:
Left and right levers include:
- Horn button
- Turn signal switch
- Driving light switch
- Transmission direction switch

Panel mounted switches for:
- Travel park brake
- Steer mode selector
- 4 wheel drive
- Transmission gear selector
- Hazard flasher

Panel mounted indicator/warning lights for:
- Transmission display
- Transmission temperature
- Engine oil pressure
- Travel park brake
- Service brake
- Turn signals
- Rear wheel offset
- Emergency steer - optional

Hydraulic Controls - Two dual axis hydraulic joystick controllers or optional single axis hydraulic controls for:
- Swing
- Boom hoist
- Main rear winch
- Auxiliary front winch - optional

Armrest Controls
- Drum rotation indication
- Drum rotation indicator activation switch
- Winch high/low speed and disable switch(es)
- Telescopic override switch
- Warning horn button
- Swing park brake
- Engine throttle lock
- Heating controls
- Air conditioning - optional

Outrigger Controls - Hand held control box with umbilical cord gives the operator the freedom to view operation while setting the outriggers.

Foot Controls
- Boom telescope
- Swing brake
- Engine throttle

Right Front Console — Controls and indicators for:
- Engine ignition
- Engine throttle lock
- Function disable
- Front windshield wiper and washer
- Cab floodlights
- Warning horn
- Console dimmer switch
- Bubble level
- 12 volt power connections
- E-stop switch
- Ignition switch on indicator light
- Boom floodlight - optional
- Rotating beacon/Strobe light - optional
- Third wrap set and activate switches - optional

Operator's Cab Instrumentation - Ergonomically positioned, analog instrumentation for crane operation including:
- Engine coolant temperature with warning indicator
- Hydraulic oil temperature with warning indicator
- Fuel level with warning indicator
- Tachometer

Diagnostic Center — Located behind the operator's seat.
- Engine diagnostic
- RCL CANBUS diagnostic
- Crane Controller USB diagnostic
- RCL controller USB diagnostic

Link-Belt Pulse – The Link-Belt designed, total crane operating system that utilizes the display as a readout and operator interface for the following systems:
- **Rated Capacity Limiter** – LCD graphic audio – visual warning system integrated into the dash with anti – two block and function limiter. Operating data includes:
  - Crane configuration
  - Boom length and angle
  - Boom head height
  - Allowed load and % of allowed load
  - RCL light bar
  - Boom angle
  - Radius of load
  - Actual load
  - Wind speed
  - Unit Conversion
  - Multiple language capabilities
  - Highlighted unit of measurement on working screen
  - Telescope operation displayed in real time
  - Counterweight installation/removal
  - Third wrap indicator
  - Diagnostics
  - Operator settable alarms (include):
    - Maximum and minimum boom angles
    - Maximum tip height
    - Maximum boom length
    - Swing left/right positions
    - Operator defined area (imaginary plane)
- **Extend control module (ECM)**
  - Controls the extend modes
  - Diagnostics

Integrated Third Wrap Indicator — Optional - Pulse color display visually and audibly warns the operator when the wire rope is on the first/bottom layer and when the wire rope is down to the last three wraps.

Internal RCL Light Bar — Optional - Visually informs the operator when crane is approaching maximum load capacity with a series of green, yellow, and red lights.

External RCL Light Bar — Optional - Visually informs the ground crew when crane is approaching maximum load capacity with a series of green, yellow, and red lights.

■ Swing

Motor/Planetary - Bi-directional hydraulic swing motor mounted to a planetary reducer for 360° continuous smooth swing at 2.5 rpm.

Swing Park Brake - 360°, electric over hydraulic, (spring applied/hydraulic released) multi-disc brake mounted on the speed reducer. Operated by a switch from the operator's cab.

Swing Brake - 360°, foot operated, hydraulic applied disc brake mounted to the speed reducer.

Swing Lock - Two-position swing lock (boom over front or rear) operated from the operator's cab.

360° Positive Swing Lock — Optional - Meets New York City requirement.

■ Electrical

Swing Alarm - Audio warning device signals when the upper is swinging.

Lights

- Two working lights on front of the operator's cab
- One rotating amber beacon on top of the operator's cab - optional
- One amber strobe beacon on top of the operator's cab - optional
- Boom floodlight - optional

■ Load Hoist System

Load Hoist Performance

Main (Rear) and Auxiliary (Front) Winches — 3/4 in (*19mm*) Wire Rope										
	Maximum Line Pull		Normal Line Speed		High Line Speed		Layer		Total	
Layer	lb	*kg*	ft/min	*m/min*	ft/min	*m/min*	ft	*m*	ft	*m*
1	15,390	*6 980.8*	168	*51.2*	337	*102.7*	114	*34.7*	114	*34.7*
2	14,150	*6 418.3*	183	*55.8*	366	*111.6*	124	*37.8*	238	*72.5*
3	13,094	*5 939.3*	198	*60.4*	396	*120.7*	134	*40.8*	372	*113.4*
4	12,185	*5 527.0*	212	*64.6*	425	*129.5*	144	*43.9*	516	*157.3*
5	11,394	*5 168.2*	227	*69.2*	455	*138.7*	154	*46.9*	670	*204.2*

Wire Rope Application		Diameter		Type
		in	*mm*	
Main (Rear) Winch	Standard	3/4	*19*	Type RB
	Optional	3/4	*19*	Type ZB
Auxiliary (Front) Winch	Standard	3/4	*19*	Type RB
	Optional	3/4	*19*	Type ZB

Note: Always refer to the Crane Rating Manual and crane Parts Manual when ordering wire rope.

2M Main And Optional Auxiliary Winch

- Bi-directional gear-type (2-speed) hydraulic motor driven through planetary reduction unit for positive control under all load conditions.
- Grooved lagging
- Power up/down mode of operation
- Hoist drum cable follower
- Drum rotation indicator
- Drum diameter: 16 in (*40.6cm*)
- Wire rope length:
  - Main: 600 ft (*182.9m*)
  - Auxiliary: 600 ft (*182.9m*)
- Maximum wire rope storage: 834 ft (*254.2m*)
- Terminator style socket and wedge

Third wrap indicator — optional - Visually and audibly warns the operator when the wire rope is on the first/bottom layer and when the wire rope is down to the last three wraps.

■ Hydraulic System

Counterbalance Valves - All hoist motors, boom extend cylinders, and boom hoist cylinders are equipped with counterbalance valves to provide load lowering and prevents accidental load drop when hydraulic power is suddenly reduced.

■ Counterweight

Total of 12,500 lb (*5 670kg*) of counterweight bolted to the upper structure frame with capacities for the 12,500 lb (*5 670kg*) configuration.

Carrier

■ General

- 10 ft 10.5 in (*3.31m*) wide
- 12 ft 7 in (*3.83m*) wheelbase (centerline of first axle to centerline of second axle).

Frame - Box-type, torsion resistant, welded construction made of high tensile steel. Equipped with front and rear towing and tie down lugs, tow connections, and access ladders.

■ Outriggers

Boxes - Double box, front and rear welded to carrier frame.

Beams and Jacks - Four single stage beams with Confined Area Lifting Capacities (CALC™) provide selectable outrigger extensions of full, intermediate, and retracted. Hydraulically controlled from the operator's cab with integral check valves.

Pontoons - Four lightweight, quick release, 19.25 x 19.25 in (*48.90 x 48.90cm*), steel pontoons with contact area of 307 in^2 (*1 980.6cm^2*) can be stored for road travel in storage racks on the carrier.

Main Jack Reaction - 63,500 lb (*28 803kg*) force and 213 psi (*1 469kPa*) ground bearing pressure.

■ Steering And Axles

Steering - Four independent modes consisting of two wheel front, two wheel rear, four wheel, and crab. Each mode is controlled from the steering wheel and is selected by a switch in the operator's cab.

Drive - Two modes: 4 x 2 and 4 x 4 for off highway travel

Axle 1 - Steered, non-driven for 4 x 2 and steered, driven for 4 x 4

Axle 2 - Steered, driven

■ Suspension

Front - Rigid mount to the carrier frame

Rear - The rear axle is suspended on the oscillation cylinders with motion of the axle controlled by a four bar linkage system. The oscillation cylinders lockout when the upper structure rotates 2.5° past centerline.

- Hydro-gas rear suspension - optional

■ Tires And Wheels

Front and Rear - Four (single) 23.5 x 25-20 ply rating, earthmover type tires on steel disc wheels

- Spare tires and wheels - optional

■ Brakes

Service - Full hydraulic, dual circuit, disc type brakes on all wheel ends

Parking/Emergency - Spring loaded type, acting on front axle

■ Electrical

Three batteries provide 12 volt operation and starting

Lights

- Front lighting includes two main headlights and two parking/directional indicators.
- Side lighting includes two parking/directional indicators per side.
- Rear lighting includes two parking/directional indicators, two parking/brake lights, and two reversing lights.
- Other equipment includes hazard/warning system, operator's cab light, instrument panel light, and signal horn.

■ Engine

Specification	CAT C6.6
Numbers of Cylinders	6
Cycle	4
Bore and Stroke: inch (*mm*)	4.13 x 5.00 (*105 x 127*)
Piston Displacement: in^3 (*L*)	402.7 (*6.6*)
Max. Brake Horsepower: hp (*kW*)	174 (*130*) @ 2,200 rpm
Peak Torque: ft lb (*Nm*)	512 (*694*) @ 1,500 rpm
Alternator: volts - amps	12 - 150
Crankcase Capacity: qt (*L*)	18.4 (*17.4*)

- Mechanically driven fan and thermostatically controlled radiator
- Water/Fuel separator
- 110-volt block heater
- Glow plugs/block heater

■ Transmission

Powershift - Fully automatic transmission with six speeds forward and six reverse. Rear axle disconnect for two or four wheel drive. Rear axle disconnects automatically in forward fourth and higher gears.

■ Carrier Speeds And Gradeability

Dana Spicer			Speed		Gradeability (@ 70% Convertor efficiency)
Gear		Ratio	mph	*km/h*	% Grade
6th	Forward 2WD Hi	0.82	22.4	*36.05*	3.0
5th		2.25	8.2	*13.20*	11.8
4th		4.67	3.9	*6.28*	27.4
3rd	Forward 4WD Low	2.40	7.6	*12.23*	12.7
2nd		6.54	2.8	*4.51*	40.9
1st		13.60	1.3	*2.09*	137.3
2nd	Reverse 2WD	4.67	3.9	*6.28*	27.4
1st	Reverse 4WD	13.60	1.3	*2.09*	137.3

Based on a gross vehicle weight of 80,000 lb (*36 287kg*)

Crane operating angle must not exceed 35° (70% grade).

■ Fuel Tank

One 75 gallon (*283.9L*) capacity tank

■ Hydraulic System

All functions are hydraulically powered allowing positive precise, control with independent or simultaneous operation of all functions.

Main Pumps

- Two fixed displacement gear pumps for the main and auxiliary winch, swing, boom hoist, and telescope circuits with a manual disconnect to aid during cold weather starts.
- One gear pump for the outriggers, power steering, brakes, swing, and telescope circuits. One gear pump for the winch and boom hoist circuits
- Combined pump capacity of 133 gpm (*503.46Lpm*).

Hydraulic Reservoir - 131 gal (*495.9L*) capacity equipped with sight level gauge. Diffusers built in for deaeration.

Filtration - One 10 micron, full flow, line filter in the control circuit. All oil is filtered prior to return to reservoir. Accessible for easy filter replacement.

■ Pump Drive

All pumps are mechanically driven by the diesel engine. Pumps may be mounted to an optional mechanical pump disconnect on the transmission torque convertor to aid in cold weather starting.

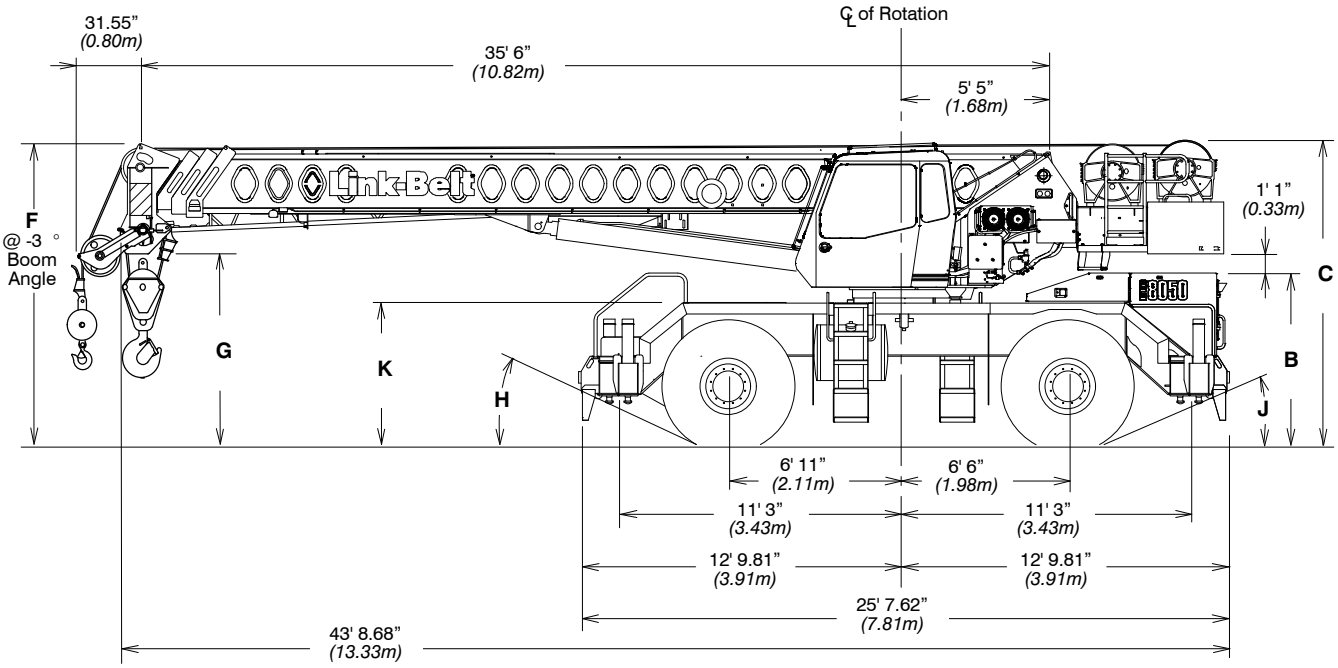
Axle Loads

Base crane with full tank of fuel	Gross Vehicle Weight ([1])		Upper Facing Front				Upper Facing Rear			
			Front Axles		Rear Axles		Front Axles		Rear Axles	
	lb	*kg*	lb	*kg*	lb	*kg*	lb	*kg*	lb	*kg*
	72,495	***32 883***	**33,996**	***15 420***	**38,499**	***17 463***	**32,896**	***14 921***	**39,599**	***17 962***
23.5R25 tires and wheels	368	*167*	183	*83*	185	*84*	183	*83*	185	*84*
Pintle hook, front	13	*6*	18	*8*	-5	*−2*	18	*8*	-5	*−2*
Pintle hook, rear	13	*6*	-5	*−2*	18	*8*	-5	*−2*	18	*8*
Rear steer indicator	3	*1*	0	*0*	3	*1*	0	*0*	3	*1*
Hydro-gas suspension	52	*24*	18	*8*	34	*15*	18	*8*	34	*15*
Winch roller - rear winch	93	*42*	-39	*−18*	132	*60*	129	*59*	-36	*−17*
Winch roller - front winch	93	*42*	-19	*−9*	112	*51*	109	*49*	-16	*−7*
2M auxiliary (front) winch	19	*9*	-2	*−0.9*	21	*10*	21	*10*	-2	*−0.9*
600 ft (*182.9m*) of 3/4 in (*19mm*) wire rope on auxiliary (front) winch	669	*303*	-88	*−40*	757	*343*	734	*333*	-65	*−30*
Air conditioning in operator's cab	315	*143*	74	*34*	241	*109*	231	*105*	84	*38*
360° swing lock	76	*34*	28	*13*	48	*22*	45	*20*	31	*14*
Emergency steer system	136	*62*	15	*7*	121	*55*	116	*53*	20	*9*
Fly storage brackets to boom base section for fly options	99	*45*	146	*66*	-47	*−21*	-51	*−23*	150	*68*
28.5 ft (*8.68m*) offset fly - stowed	1,291	*585*	2,237	*1 015*	-947	*−430*	-990	*−449*	2,281	*1 035*
28.5-51 ft (*8.68−15.54m*) offset fly - stowed	1,861	*844*	3,060	*1 388*	-1,199	*−544*	-1,263	*−573*	3,124	*1 417*
Floodlight to boom base section	10	*5*	23	*10*	-13	*−6*	-13	*−6*	23	*10*
60 ton (*54.4mt*) hook block at front/rear bumper	1,109	*503*	1,530	*694*	-421	*−191*	-459	*−208*	1,568	*711*
40 ton (*36.3mt*) hook block at front/rear bumper	720	*327*	994	*451*	-274	*−124*	-298	*−135*	1,108	*462*
8.5 ton (*7.7mt*) hook ball at front/rear bumper	360	*163*	497	*225*	-137	*−62*	-149	*−68*	509	*231*
Auxiliary lifting sheave	91	*41*	257	*117*	-166	*−75*	-169	*−77*	260	*118*

Tire	Maximum Load @ 25 mph (*40.2km/h*)
23.5 x 25 (20-PR)	38,000 lb (*17 237kg*)
23.5R25 2 Star	37,500 lb (*17 010kg*)

([1]) Adjust gross vehicle weight and axle loading according to component weight.
Note: All weights are ±3%.

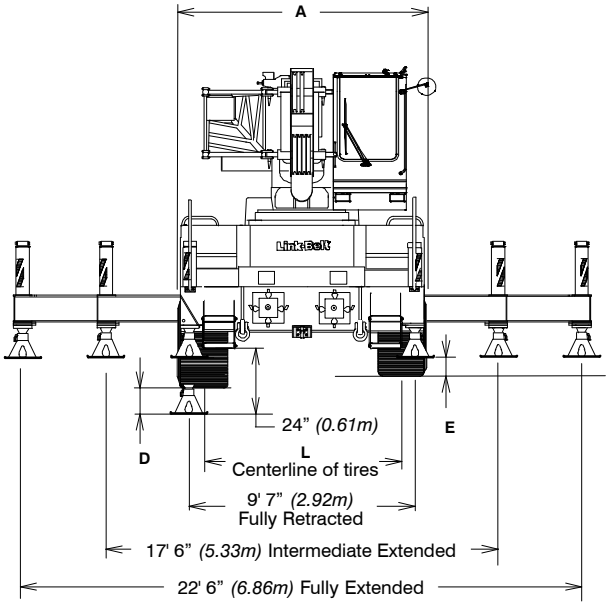
General Dimensions



Turning Radius — Front Wheel (4x2) Steering	English	*Metric*
Wall to wall over carrier	39' 0"	*11.9m*
Wall to wall over boom	47' 7"	*14.5m*
Wall to wall over boom attachment	49' 7"	*15.1m*
Curb to curb	37' 3"	*11.4m*
Centerline of tire	36' 0"	*11.0m*

Turning Radius — All Wheel (4x4) Steering	English	*Metric*
Wall to wall over carrier	23' 4"	*7.1m*
Wall to wall over boom	34' 0"	*10.4m*
Wall to wall over boom attachment	35' 6"	*10.8m*
Curb to curb	21' 4"	*6.5m*
Centerline of tire	20' 0"	*6.1m*

Tailswing	English	*Metric*
With counterweight	12' 8"	*3.9m*
Without counterweight	N/A	*N/A*



General Dimensions	Tire Size			
	23.5 x 25 bias		23.5R25 radial	
	English	*Metric*	English	*Metric*
A	10' 3.5"	*3.14m*	10' 3"	*3.12m*
B	6' 7.75"	*2.03m*	6' 9.5"	*2.06m*
C	11' 11.75"	*3.65m*	12' 1.5"	*3.70m*
D	7.75"	*0.20m*	7"	*0.18m*
E	10"	*0.25m*	11.75"	*0.30m*
F	10' 0.25"	*3.05m*	10' 2"	*3.10m*
G	7' 6"	*2.29m*	7' 7.75"	*2.33m*
H	24°	––	24.8°	––
J	21°	––	22°	––
K	6' 6.75"	*1.69m*	6' 8.5"	*1.74m*
L	8' 3"	*2.51m*	8' 3"	*2.51m*

Not To Scale

Table Of Contents

Notes:

Fundamental Terms

Many terms are used which refer to crane function, assembly, operation, and maintenance. The following list gives a brief definition as to how the terms are used in this Operator's Manual and how they fit this particular crane.

Accumulator: A container in which fluid is stored under pressure as a source of hydraulic energy.

Aeration: The condition when air is present in the hydraulic fluid. This causes the fluid to appear milky and components to operate erratically because of the compressibility of air trapped in the fluid.

Anemometer: An instrument for measuring the direction and force, or velocity, of the wind; a wind gauge.

Annually: Once a year

Anti-Two Block System: A system of electromechanical devices used to alert or prevent the crane operator from two blocking the crane. See "Two Block".

Attachment: The boom assembly, offset fly section, auxiliary lifting sheave, or the combination of them.

Audio/Visual Warning System: Alarm device that signals the operator of low engine oil pressure, high engine coolant temperature, and high hydraulic oil and transmission oil temperature.

Automatic Brake: Drum brake system that is applied automatically when the drum control lever is in neutral.

Auxiliary Lifting Sheave: A unit which connects to the boom head machinery and is used for reeving winch wire rope for a second winch drum.

Backward Stability: Resistance to overturning of the crane in rearward direction.

Base Section: The segment of the boom which attaches to the upper frame by the boom foot pin.

Boom: The assembly of the base, inner mid, outer mid, and tip sections used as the telescoping extension.

Boom Angle: The angle above or below horizontal of the longitudinal axis of the boom base section.

Boom Angle Indicator: An accessory which measures the angle of the boom above horizontal.

Boom Foot: Base of boom where it attaches to the upper revolving frame.

Boom Hoist: The hydraulic method of raising and lowering the boom to different boom angles.

Boom Length: The straight line through the centerline of the boom foot pin to the centerline of the boom head sheave shaft, measured along the longitudinal axis of the boom.

Boom Section: The base, inner mid, outer mid, and tip segments which are used as the telescoping extension.

Bypass: A secondary passage of fluid flow, in addition to the main flow path.

Capacity Chart: The chart(s) in the Crane Rating Manual in the crane which gives rated lifting capacities for the crane under different load conditions.

Carrier: The portion of the crane located below the turntable bearing.

Carrier Frame: The main structure of the carrier section of the crane.

Cavitation: A condition where air is induced into a cavity, line, or chamber normally filled with oil. This condition can cause damage to pumps, cylinder walls, etc.

Check Valve: A valve which permits flow in one direction only.

Circuit: A complete or partial path over which current or fluid may flow.

Closed Center Circuit: The condition where the fluid only flows through the main control valves when a control valve spool is actuated. This can be done two different ways: (1) using a pressure compensated pump, or (2) using a fixed displacement pump, unloading valve, and an accumulator.

Collector Ring (Slip Ring): A device used to transmit the electrical power from the carrier to the upper utilizing a rotating disk to allow rotation of the upper**.**

Compressibility: The change in volume of fluid when it is subjected to a unit change in pressure.

Counterbalance Valve (Holding Valve): A valve which regulated fluid flow by maintaining resistance in one direction, but allows free flow in the other direction.

Counterweight: Weight used to supplement the weight of the crane in providing stability for lifting loads.

Cracking Pressure: The pressure at which a pressure actuated valve begins to open to allow flow.

Crane Configuration: The relative position and arrangement of the parts or elements of the crane e.g. amount of counterweight, attachment position, outrigger position, etc.

Crane Rated Capacity: The maximum weight allowed to be lifted with the crane setup in a particular crane configuration.

Crane Rating Manual: A compilation of the necessary information needed to plan a safe lift with the crane. It includes instructions such as the allowable lifting capacity charts, Working Range Diagrams, Working Areas Diagram, etc.

Crane Set Up: The act or instance of preparing the crane for operation which entails the positioning of the crane and its elements. It concerns details or items such as finding a suitable location to perform the lift, setting the outrigger position, leveling, cribbing, or blocking of the crane, etc.

Cylinder: A device which converts fluid power into mechanical force and motion. It usually consists of a moveable element such as a piston and piston rod, which operates within a cylindrical bore.

Delivery: The volume of fluid discharge by a pump in a given time, usually expressed in gallons per minute (gpm) or liters per minute (*L/min*).

Displacement: The quantity of fluid which can pass through a pump, motor, or cylinder in a single revolution or stroke.

Double Acting Cylinder: A cylinder in which fluid force can be applied in either direction.

Drum Lagging: See "Winch Drum".

Drum Rotation Indicator: A system that is used to monitor winch drum speeds.

Filter: A device which functions to remove insoluble contaminants from a fluid by a porous media.

Flow Divider: A valve which divides a flow of oil into two streams.

Fly Base Section: Boom tip extension supported only at its base.

F**ly Tip Section:** An additional extension with head machinery which mounts to the fly base section to increase the length of the fly.

Force: Any cause which tends to produce or modify motion. In hydraulics, total force is expressed by the product of pressure (P) and the area of the surface (A) on which the pressure acts. (Formula: F = P X A).

Frame: Structure on which either upper or carrier machinery is attached.

Freely Suspended Load: Load hanging free with no direct external force applied except by the hoist line.

Friction: The property which tends to resist the relative motion of one surface in contact with another surface. It always exerts a "Drag" in the direction opposite of the motion, thus consumes power.

Full Flow: In a filter, the condition where all the fluid must pass through the filter element.

Full Load Speed: The speed at which an engine runs when it is delivering its full rated horsepower.

Function Limiters (Function Lockout, Hydraulic Cut-outs, Hydraulic Kickouts): Devices incorporated into the anti-two block system which will disable the crane function of winch up, telescope out, and/or boom down (as applicable) as a two block situation approaches.

Gradeability: The slope which a crane can climb expressed as a percentage.

Ground Pressure: Weight of crane divided by the area of the surface directly supporting the crane.

Guard Rails: Rails used to help provide safety (prevent falls) for personnel when required to be on the upper platforms of the crane during maintenance and/or adjustment procedures.

Head Machinery: An arrangement of sheaves on the end of an attachment used to reeve wire rope.

High Idle: Governed engine speed at full throttle and no load.

Hoist: Function of lifting and lowering loads.

Hoist Drum: See "Winch Drum".

Hoist Wire Rope: The wire rope used to reeve the winch and the attachments for lifting loads.

Holding Valve: See "Counterbalance Valve".

Hook Ball: Ball with hook attached used in lifting service. It is used with one part of line only.

Hook Block: Block with hook attached used in lifting service. It may have a single sheave for double or triple line, or multiple sheaves for four or more parts of line.

Hydraulic Reservoir (Sump Tank): The storage tank for hydraulic fluid.

Inner Mid Section: The segment of the boom which is attached to the base and outer mid sections.

Instability: A "tipping condition" in which the moments acting to overturn a crane exceed the moments acting to resist overturning.

LBCE: Link-Belt Construction Equipment.

Lifting Capacity: The rated load for any given load radius and boom angle under specified operating conditions.

Line Pull: The wire rope pull generated off a wire rope drum or lagging at a specified pitch diameter.

Line Speed: The wire rope velocity at a wire rope drum or lagging at a specified pitch diameter.

Load Factor: Load applied at the boom tip which gives the same moment effect as the boom mass.

Load Indicator: A device for measuring and displaying the net load being lifted.

Load Line: Another term for "Hoist Wire Rope". In lifting crane service it refers to the main hoist. The secondary hoist is referred to as a "Whip Line".

Load Radius: The horizontal distance from the centerline of rotation of the upper to the center of gravity of a suspended load.

Loaded Boom Angle: The angle between the boom base section and horizontal with a freely suspended load at the rated radius.

Mat: Support, usually of timber or wire construction, for supporting the pontoons on soft surfaces where the pontoon areas are not large enough to support the load without settling.

Motor (Hydraulic): A rotary motion device which changes hydraulic energy into mechanical energy, a rotary actuator.

No Load Stability Limit: The radius or boom angle beyond which it is not permitted to position the boom because the crane can overturn without any load on the hook.

Offset Fly: A fly section that is capable of being pinned at different angles.

Oil Cooler: A heat exchanger used to remove heat from the hydraulic or transmission fluid.

Open Center Circuit: A circuit where the pump continuously circulates fluid through the control valves when they are in a neutral position.

Operational Aid: An accessory that provides information to facilitate operation of a crane or that takes control of particular crane functions without action of the operator when a limiting condition is sensed.

Operator's Cab (Upper Cab): A housing which covers the operator's station.

Outer Mid Section: The segment of a the boom which is attached to the inner mid and tip sections.

Outrigger: An extendable supporting device used to level the crane and increase stability.

Outrigger Beam: The part of the outrigger which extends horizontally and acts as the support for the outrigger jack.

Outrigger Jack: The hydraulic cylinder on the outrigger beam which extends vertically to raise and lower the crane.

Pick And Carry: The crane operation of lifting a load and traveling with the load suspended.

Pilot Pressure: Auxiliary pressure used to actuate or control hydraulic components.

Pinion: Usually the small gear in a gear train which drives the other gears.

Pitch Diameter: Root diameter of drum, lagging, or sheave, plus the diameter of the wire rope.

Planetary: A set of gears used to either speed up or slow down the input vs the output to gain speed or power whichever is applicable.

Platform: A device (basket, work platform, bucket, cage, etc.) designed and fabricated with its intended use being to position personnel.

Pontoon: The support which attaches to the outrigger jack to increase the supporting area.

Poppet: A disc, ball, or cone shaped part of certain valves, which when closed against a seat prevents flow.

Port: The open end of a passage. May be within or at the surface of a hydraulic component housing or body.

Pressure: Force per unit of area usually expressed in pounds per square inch (psi) or Kilopascals (*kPa*).

Pressure Drop: The reduction in pressure between two points in a line or passage due to the energy lost in maintaining flow.

Pressure Reducing Valve: A valve which limits the maximum pressure at its outlet regardless of the inlet pressure.

Pump Disconnect: Engages and dIsengages the main hydraulic pump. Disengaging the pump aids in engine start-up by reducing cranking resistance.

Pump (Hydraulic): A device which converts mechanical force and motion into hydraulic fluid power.

Radius Of Load: The horizontal distance from the centerline of rotation of the crane to the center of gravity of the suspended load.

Rated Capacity Indicator (RCI): A device that automatically monitors radius, load weight, and load rating and warns the crane operator of an overload condition.

Rated Capacity Limiter (RCL): A device that automatically monitors radius, load weight, and load rating and prevents movements of the crane that would result in an overload condition.

Reeving: Passing of wire ropes over pulleys or sheaves.

Relief Valve: A pressure operated valve which by-passes pump delivery to the reservoir, limiting system pressure to a predetermined maximum valve.

Reservoir: A container for storage of fluid in a fluid power system.

Restriction: A reduced cross-sectional area in a line which produces a pressure drop.

Rigging Switch (System Override Switch): A switch which can be used to override any or all of the function limiters (cutouts) which have been activated on the crane during crane rigging/set up.

Rope: Refers to wire rope unless otherwise specified. See "Wire Rope".

Rotating Joint: Component which transfers fluid between a stationary and a rotating member.

Schematic: A diagram or representation of a system showing everything in a simple way. No attempt is made to show the various devices in their actual relative positions. A schematic points out the operation of a circuit for troubleshooting purposes.

Seasonally: Four times per year.

Semiannually: Twice per year.

Service Brake: A foot operated brake which regulates the amount of air (or fluid) delivered to the brake chamber, which determines the braking force.

Shall: The word shall is to be understood as mandatory.

Should: The word should is to be understood as advisory.

Side Loading: A load applied at an angle to the vertical plane of the boom.

Single Acting Cylinder: A cylinder in which fluid power can only be used in one direction. Another force must be used to return the cylinder.

Spool: Term loosely applied to almost any moving cylindrically shaped part of a hydraulic component which moves to direct flow through the component.

Strainer: A filtering device for the removal of coarse solids from a fluid.

Stroke: The length of travel of a piston or spool.

Suction Line: The hydraulic line connecting the pump inlet port to the hydraulic reservoir.

Sump Tank: See "Hydraulic Reservoir".

Surge: A very sudden rise in hydraulic pressure in a circuit.

Swing: The rotation of the upper with the carrier remaining stationary.

Swing Brake: A foot operated brake which is used to stop the rotation of the upper over the carrier.

Swing Lock: A mechanical lock that engages with the upper frame in any position over the lower frame.

Swing Motor: Hydraulic device which uses a planetary gear system to rotate the upper on the carrier.

Swing Park Brake: A self contained brake used for holding the upper, in any position, during normal, stationary crane operations.

System Override Switch: See "Rigging Switch".

Tailswing: The swing radius from the centerline of rotation of the upper frame to the extreme rear of the crane, usually the counterweight.

Tip Section: The outer most segment of the boom.

Torque: Turning or twisting force usually measured in foot-pounds (ft lb) or Newton meters (*Nm*).

Travel Swing Lock (2 Position Swing Lock): A mechanical lock that engages with the upper directly over either the front or the rear of the carrier only. Use of the travel swing lock is mandatory when traveling, transporting, or lifting the crane and during pick and carry operations.

Turntable Bearing: A large bearing which attaches the upper to the carrier allowing the upper to rotate on the carrier.

Two Block: The situation when the crane's hook block, hook ball, or load contacts the attachment's head machinery.

Two Block Warning System: A system of electromechanical devices used to warn the crane operator of an impending two block condition.

Two Position House Lock (Travel Swing Lock): A mechanical lock that engages with the upper directly over either the front or the rear of the carrier only. Use of the two position house lock is mandatory when traveling, transporting, or lifting the crane and during pick and carry operations.

Unloading Valve: A valve which by-passes flow to tank when a set pressure is maintained on its pilot port.

Upper: The portion of the crane located above the turntable bearing.

Upper Cab: See "Operator's Cab".

Upper Revolving Frame: The main structure of the upper section of the crane which serves as mounts for other components in the upper section.

Valve: A device for controlling flow rate, flow direction, or pressure of a fluid.

Viscosity: The resistance to flow. High viscosity indicates a high resistance, low viscosity, a low resistance.

Whip Line: Secondary hoist line. Also see "Load Line".

Winch: Function of lifting and lowering loads.

Winch Drum: A rotating cylindrical spool with side flanges used to wrap the winch wire rope during the raising and lowering with the winch.

Winch Wire Rope: The wire rope used to reeve the winch and the attachments for lifting loads.

Wire Rope: A flexible, multiwired member usually consisting of a core member around which a number of multiwired strands are helically wrapped.

Wiring Diagram: A diagram which included all the devices in an electrical system and shows their functional relationships to each other. Such a diagram gives the necessary information for actual wiring or physically tracing circuits when troubleshooting is necessary.

Working Area: Area measured in a circular arc about the centerline of rotation as shown on the Working Areas diagram.

Working Weight: Weight of crane with full radiator, half full fuel tank, and attachments installed.

360° Swing Lock: A positive mechanical lock against rotation of the upper over the carrier during normal, stationary crane operations.

Notes:

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ELECTRONIC DATA RECORDER REQUEST FORM

We, _____, hereby request
(Company Name)
Link-Belt Construction Equipment Company (LBCE) retrieve, interpret, and provide a summary of the electronic data recovered from the computer system installed by LBCE on model _____, with assigned serial number _____.

We request the following data be retrieved:
(Place check mark in box for information requested)

- ☐ Engine Performance Data (engine temperature, engine speeds, fluid temperature, etc.)
- ☐ Operational Mode (computer set-up)
- ☐ Boom Length
- ☐ Boom Angle
- ☐ Load Radius
- ☐ Counterweight Configuration
- ☐ Lifted Load(s)
- ☐ Number of Lifts
- ☐ Anti –Two Block (ATB) Status
- ☐ Status
- ☐ Other

Date(s) and Time Range(s) of data requested:_____
_____
_____

The time to reply to this inquiry will be three (3) weeks from the time the data is received by the LBCE Technical Product Support Department in Lexington Kentucky. The reply time may increase due to the amount of Data, and/or the Date and Time Range requested.

LBCE may assess a charge to provide the service of retrieve and interpretation of the data requested, plus travel time that may be involved by an LBCE representative to retrieve the data.

_____ _____
Requesting Company Representative *Date*