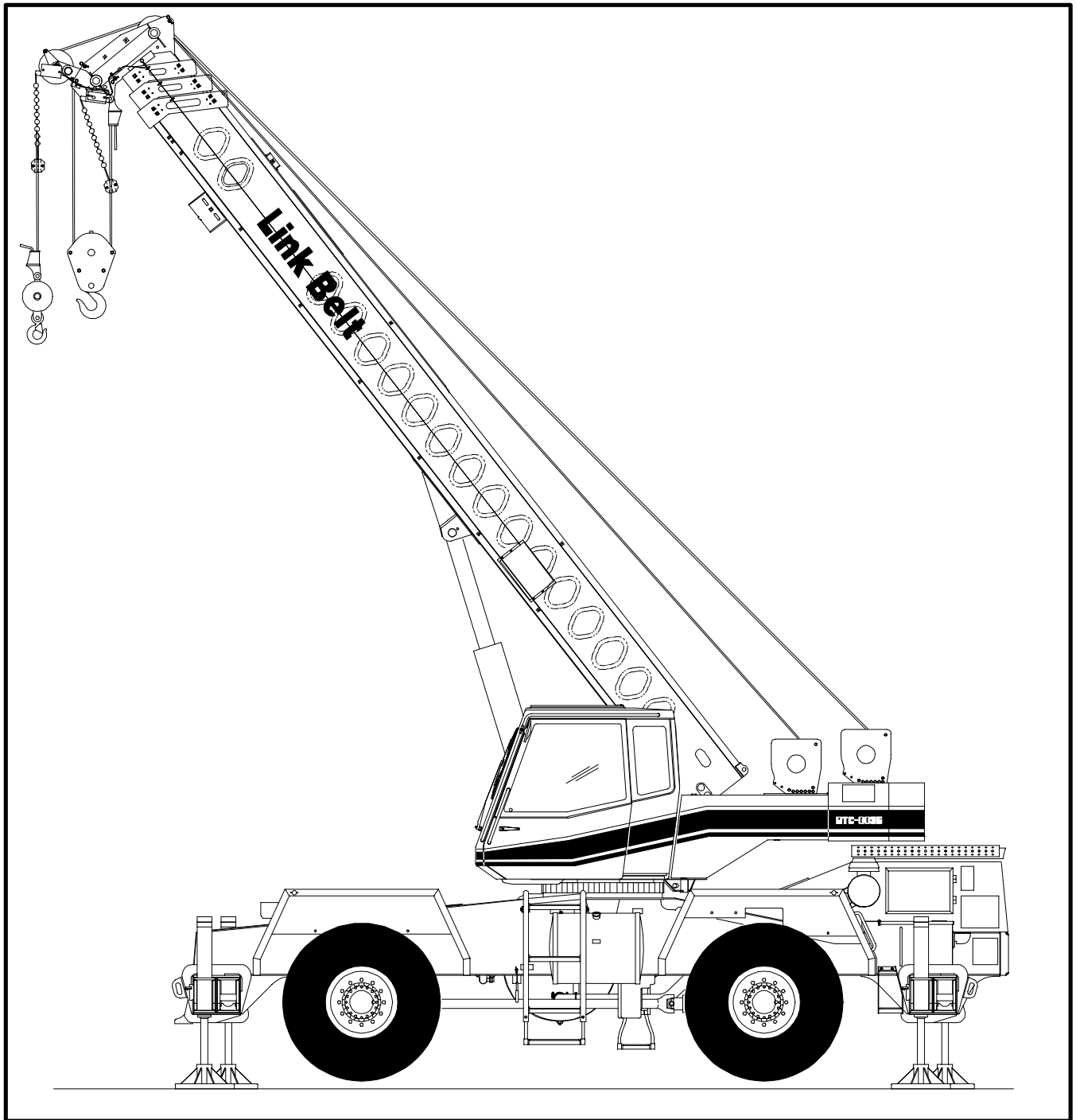


Operator's Manual



Crane Serial Number

The crane serial number is written on the Crane Rating Manual located in the lower right interior of the upper cab. The crane serial number should always be furnished when ordering parts for the crane, or when corresponding with the distributor or factory regarding the crane. The serial number is the only method the distributor or factory has of ensuring that the correct parts will be furnished.

In the event the serial number can not be found on the Crane Rating Manual, the 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 identify the crane.

Operator's Manual



WARNING

CONSTRUCTION EQUIPMENT CAN BE DANGEROUS IF IMPROPERLY OPERATED OR MAINTAINED. THIS MACHINE SHOULD BE OPERATED AND MAINTAINED ONLY BY TRAINED AND EXPERIENCED PEOPLE WHO HAVE READ, UNDERSTOOD, AND COMPLY WITH THE 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 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 manual should be directed to your nearest distributor.

In addition to this Operator's & Maintenance Manual, Parts Manuals and Safety Manuals are supplied with the crane. Safety Manuals include the Link-Belt "Crane Operating Safety" and "Personnel Handling Guidelines". Read and understand all safety guidelines before operating the crane. Additional copies of all manuals are available through your 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.

Operator's Manual

Throughout this 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 manual and on the crane to emphasize important and critical instructions. **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 distributor. For the purpose of this 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, may 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.

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.

Operator's Manual

General Index

A detailed table of contents for each section of this manual is included at the beginning of each section. The following is a description of each section:

Section 1 – Operating Instructions Pages 1–1 Thru 1–76

Section 1 includes the necessary information for safe, productive crane operation. It includes the nomenclature and operation of all control switches, levers, pedals, and instrumentation of the crane.

Section 2 – Lubrication And Preventive Maintenance Pages 2–1 Thru 2–36

Section 2 includes the necessary information for proper lubrication and preventive maintenance for daily operations. It includes the check/change intervals and procedures for maximizing the service life of the crane under normal working conditions. It also includes lubrication types and specifications approved for use in the crane.

Section 3 – Periodic Adjustments Pages 3–1 Thru 3–16

Section 3 includes the adjustments which must be made periodically to keep the crane in proper, safe working order. It includes the procedures and necessary information for adjusting the brakes, mechanical linkages and hydraulic pressures on the crane.

Section 4 – Attachments Pages 4–1 Thru 18

Section 4 includes the use and operation of the crane attachments. It includes the necessary information for installation, erection, storage, and removal of the auxiliary lifting sheave, lattice fly section and telescoping fly.

Section 5 – General Information Pages 5–1 Thru 5–28

Section 5 includes general information on the Crane Rating Manual, serial number and general information on wire rope specifications, inspection, replacement, connections, reeving and general specifications, and schematic diagrams used for the crane.

Section 6 – Fundamental Terms Pages 6–1 Thru 6–4

Section 6 includes a list of terms which are used to refer to crane functions, assembly, operation and maintenance. These terms are defined as to how they are used in this manual.

Operator's Manual

Table Of Contents

On Delivery	1-1
Operating Safety	1-1
General Safety Rules	1-2
Operator Awareness	1-2
Electrical Dangers	1-7
Protective Equipment	1-10
Signalmen And Bystanders	1-10
Crane Inspections And Adjustments	1-11
Wire Rope	1-13
Crane And Area Clearance	1-13
Weights, Lengths, And Radii	1-14
Traveling	1-18
Leaving The Station	1-19
Cab Control & Gauge Panels	1-20
Control Panel	1-20
Gauge Panel	1-22
Shifter Panel	1-23
Rated Capacity Limiter Panel	1-24
Steering Column and Wheel	1-24
Foot Operated Controls	1-25
Shifting The Transmission	1-26
Combination Steering	1-27
Conventional Steer Mode	1-27
4-Wheel Steer Mode	1-27
Crab Steer Mode	1-27
Changing Steering Modes	1-27
Axle Oscillation System	1-28
Conditions for Proper Use of the Axle Oscillation Override Switch	1-28
Axle Oscillation Override Switch Operation	1-28
Hydraulic Pump Disconnect	1-29
Cab Roof Windshield Wiper	1-29

Operator's Manual

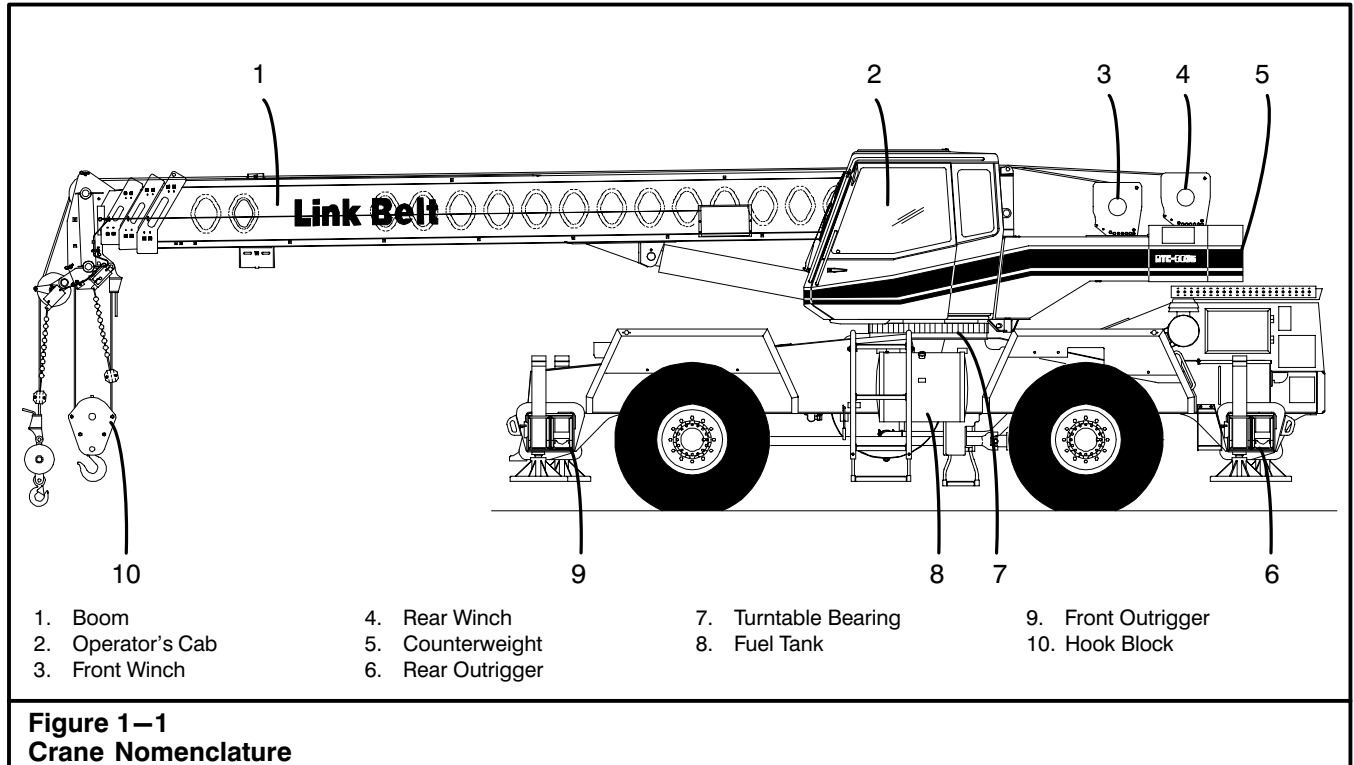
Operator's Seat	1-30
Fuse Panel & Interior Light	1-31
Power Panel Circuit Breakers	1-31
Air Dryer	1-31
Outrigger Operation	1-31
To Extend Outrigger Beams	1-32
To Extend Outrigger Jacks – Raise The Crane	1-32
To Retract Outrigger Jacks – Lower The Crane	1-33
To Retract Outrigger Beams	1-33
Crane System Controls	1-34
Engine Throttle	1-34
Swing System	1-34
Swing Brake Pedal	1-34
Swing Control Lever	1-34
Travel Swing Lock	1-34
Swing Park Brake	1-36
360° Swing Lock (If Equipped)	1-36
Wire Rope Winch System	1-37
Front Winch Control Lever (If Equipped)	1-37
Rear Winch Control Lever	1-37
Winch Operation	1-37
Warm-up Procedure	1-37
Winch Control Switch	1-37
High speed hoist or lower	1-37
To return to standard winch mode	1-38
Winch Disable	1-38
Drum Rotation Indicators	1-38
Boom Hoist System	1-38
Boom Telescope System	1-38
Telescope Control Lever	1-38
Telescope Control Pedal	1-39
Boom Telescope Override Switch	1-39

Operator's Manual

Crane Monitoring System	1-40
Anti—Two Block Warning System	1-40
Boom Head Switch	1-40
Rated Capacity Limiter	1-41
System Description	1-42
Display Unit	1-42
System Operation	1-43
To Perform System Test	1-43
System Bypass	1-44
Emergency Use of Operation Aids	1-44
Configuration Selection	1-45
To Select Rigging/Travel Mode	1-49
To Cancel Audible Alarm and Reset Function Limiters	1-49
Operator Settable Alarms	1-49
Setting Length/Angle/Height/Swing Operator Alarms	1-50
To Set Operator Defined Area Alarm	1-52
Entering And Exiting The Operator's Cab	1-56
Break—In Period	1-57
Before Starting Operations	1-57
Fire Extinguisher	1-57
Engine Starting Procedure	1-58
Engine Shutdown Procedure	1-58
Jump Starting The Crane	1-59
12V Start System	1-59
Jump Starting the Crane Equipped with 12V Start System	1-59
24V Start System	1-60
Jump Starting the Crane Equipped with 24V Start System Using 24V Source	1-60
Jump Starting the Crane Equipped with 24V Start System Using 12V Source	1-61
Carrier Mounted Winch	1-62

Operator's Manual

Cold Weather Aids	1-63
Hydraulic Pump Disconnect	1-63
Engine Block Preheater	1-63
Propane Engine Block Preheater	1-63
Electric Engine Block Preheater	1-64
Ether Start	1-65
Diesel Cab Heater	1-66
Hydraulic Cab Heater	1-67
Air Conditioning	1-68
Crane Operation	1-68
During Operation	1-69
Hand Signals	1-70
Pick And Carry Operation	1-70
Traveling The Crane	1-71
Job Site Travel	1-71
Highway Travel	1-72
Towing The Crane	1-72
Transporting the Crane	1-73
Lifting The Crane	1-73
Crane Storage	1-75
Short Term Storage	1-75
Long Term Storage	1-75



On Delivery

When a new crane is delivered, to a distributor, 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, consult your nearest distributor. A phone call could save someone's life.



⚠ WARNING

Do not lift, suspend, swing or lower loads or attachments over anyone. Do not allow anyone to ride on any part of load or attachment.

SAFETY INSTRUCTIONS

Construction equipment can be dangerous if improperly operated or maintained. This machine should be operated and maintained only by trained and experienced people who have read, understood, and complied with the Operator's Manual.

Before leaving operator's position, lower load to the ground.

Do not use swing brake for swing lock.

When facing over rear some functions will be reversed relative to operator.

Raise the crane on outriggers, or block the wheels before working on the crane. Replace all guards or panels before operating the crane.

Do not deface or remove this label from the machine.

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

Operator's Manual

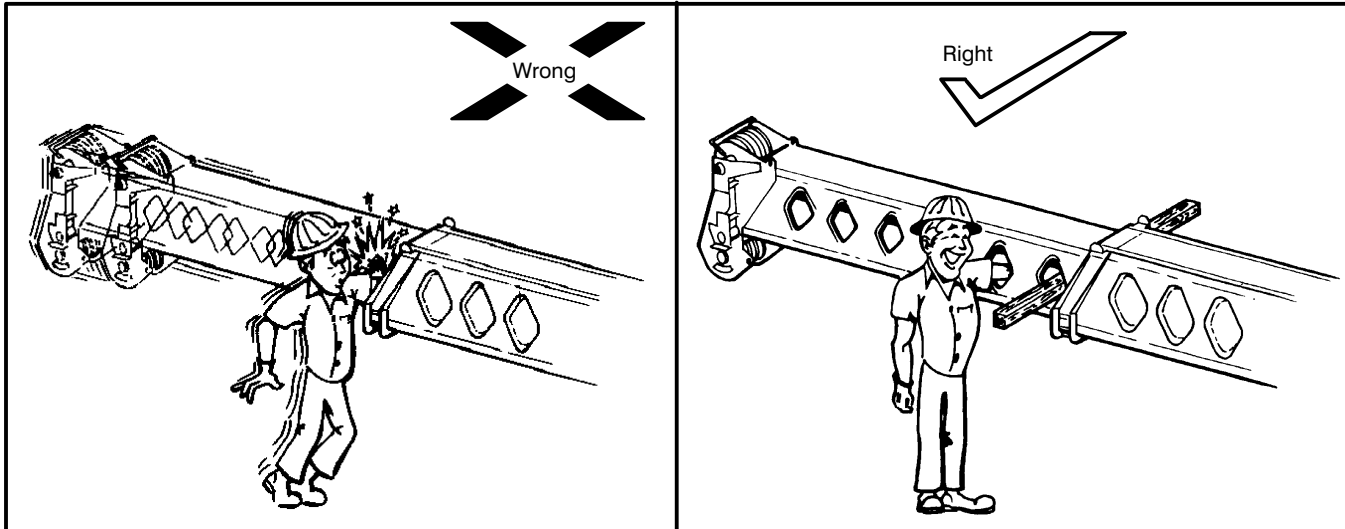


Figure 1-3
Shutdown the engine, ensure that the operator has vacated the operators cab, and insert blocking through the diamond shaped hole, closest to the base section of the boom before putting hands or tools inside a boom section.

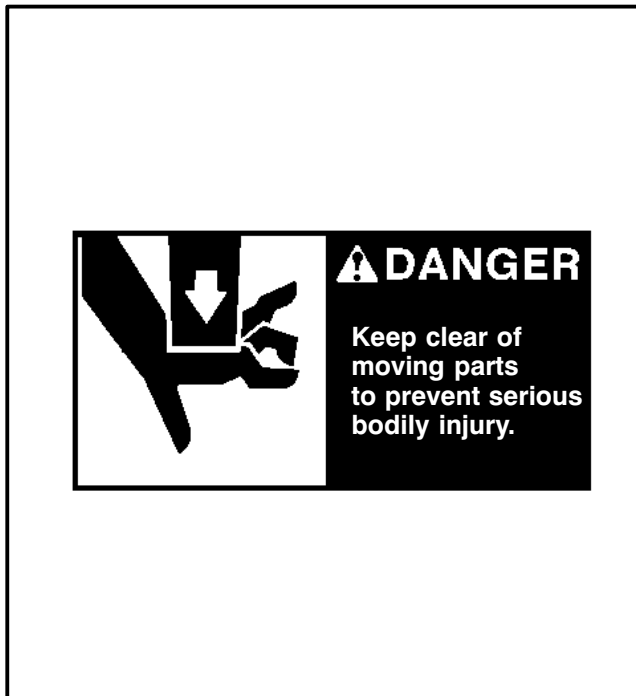


Figure 1-4
Keep hands and tools clear of moving parts.

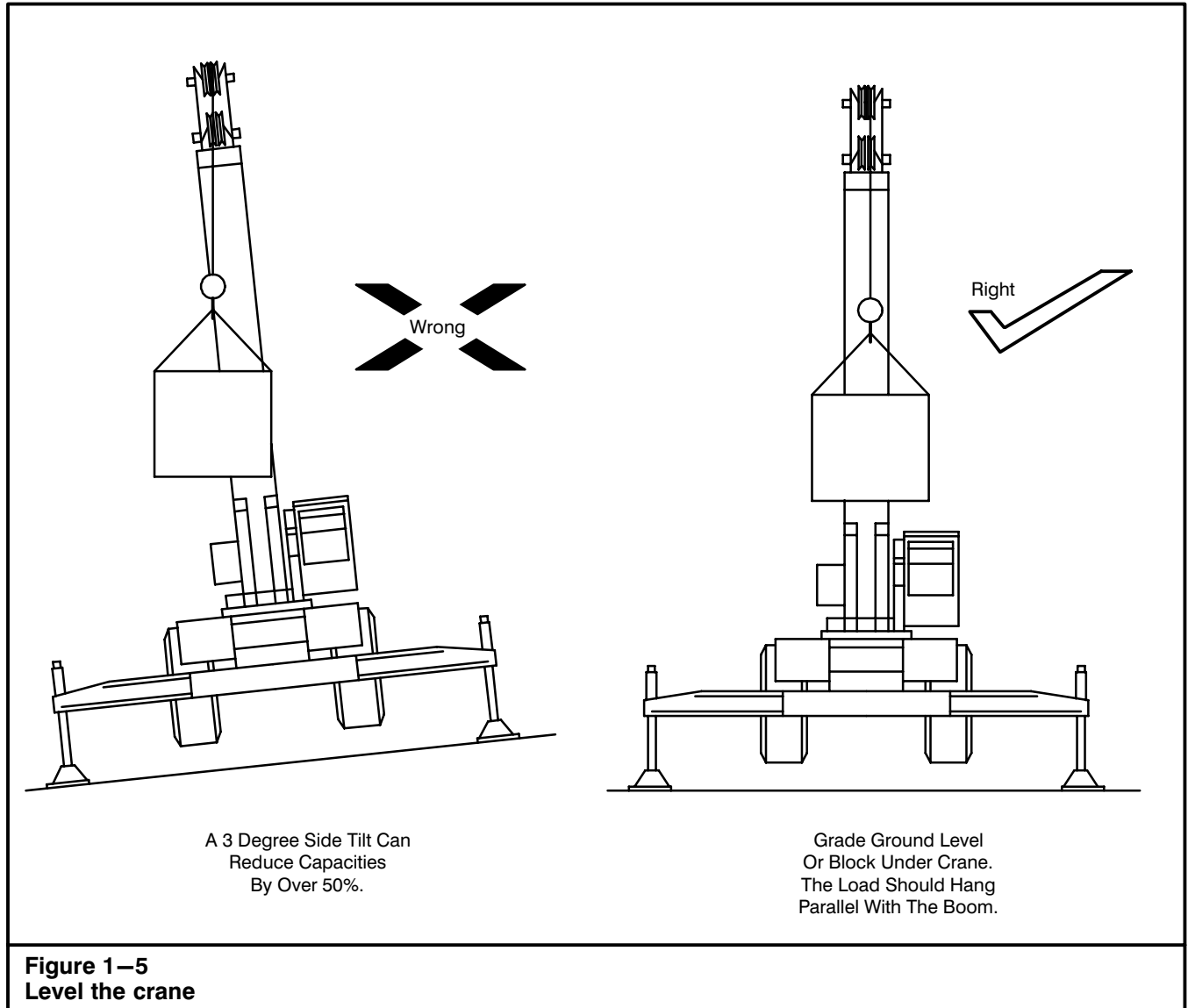
General Safety Rules

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. The 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. 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.
4. 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.
5. Keep fingers, feet, and clothing away from sheaves, drums, and 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 them into the drums or sheaves.
6. 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 of the boom before putting hands or tools inside a boom section. Unexpected movement of the boom sections could sever fingers, hands, arms, etc.

Operator's Manual



7. The operator, supervisor, or person in charge of the load must observe the following rules:
 - a. Loads must be well secured before lifting. Be sure that the rigging cannot slip off or pull away from the load, or get out of position on the load. Be sure the load is rigged so it will not turn 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. Be sure 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 rope around the load. Do not use discarded, worn, or damaged wire ropes for slings. They may break and drop the load.
 - f. The crane must be level before making a lift. Use the bubble level, to level the crane. Check its accuracy frequently with a carpenter's level. Remember, a three degree side tilt can reduce capacities by 50% or more.

Operator's Manual

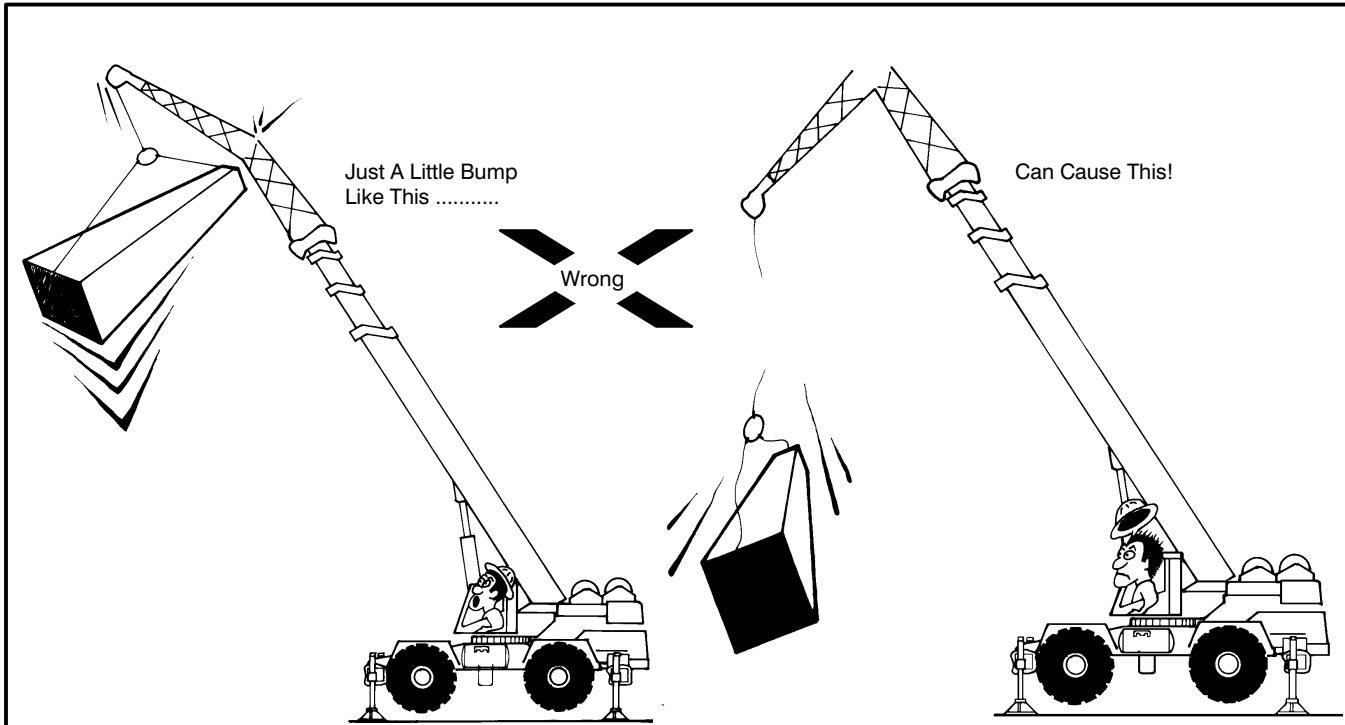


Figure 1-6
Do not let the load hit the boom, fly or jib.

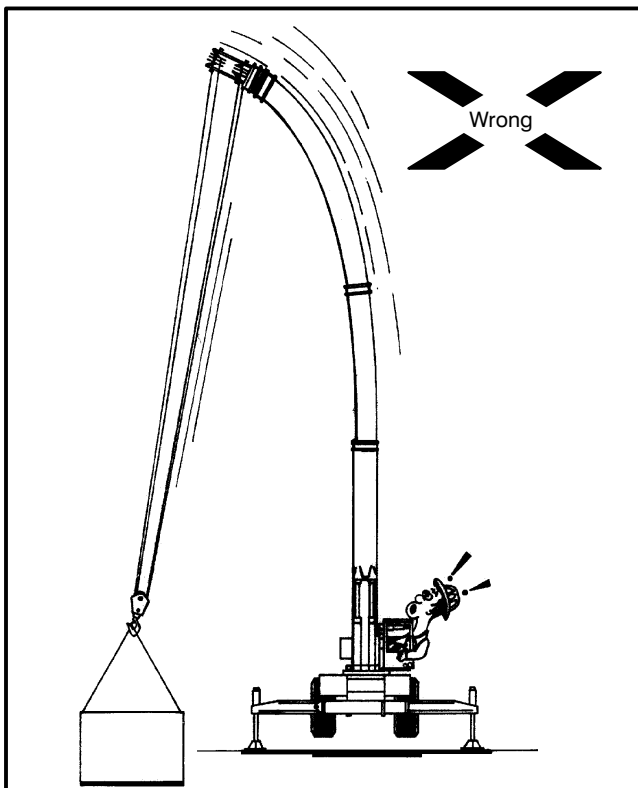


Figure 1-7
Do not use the boom to pull sideways.

8. 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 severe, the attachment could collapse. If a lattice or diagonal bracing member on the fly is broken, cracked, or bent, contact your local 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.
9. Don't pull sideways on the boom, not even a little. Lift straight up on every load. Moving trucks, rail cars, barges, or anything else pulling sideways on the winch rope could buckle the boom. It could also damage the swing mechanism. Pulling sideways on a boom can overturn the crane.
10. Do not "two block" (pulling the hook block into the head machinery) as this can cause winch rope and sheave breakage resulting in an accident.
11. After slack winch rope operation, make sure the winch rope is properly seated in sheaves and on drums before continuing to operate. Use a stick or mallet to set the winch rope, not your hands.

Operator's Manual

12. Do not lower the load beyond the point where only three full wraps of winch rope are left on the drum. This condition could occur when lowering a load beyond ground level. If all the winch rope runs off the drum, the load will jerk which could break the winch rope.
13. Make sure 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.
14. 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 seriously affect the usable capacities and make the entire Crane Rating Manual invalid. Such changes can dangerously overload or weaken critical parts and may cause disastrous failure.
15. 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. Any time the loads exceeds the rated capacities listed in the Crane Rating Manual, the crane is overloaded. Overloads can damage the crane and such damage could cause failure and accidents.
16. When operating on outriggers, all beams must be equally extended; all fully retracted, all intermediate extended or all fully extended. Jacks must be extended so all tires are clear of the ground, and the crane must be level. Be sure 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 outriggers 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, be sure that each pontoon is supported fully – no unsupported pontoon area is permissible. Be sure pontoons are on a smooth surface. Rough surface, rocks, etc., under pontoons will cause unequal loadings, and can puncture them, causing them to collapse.

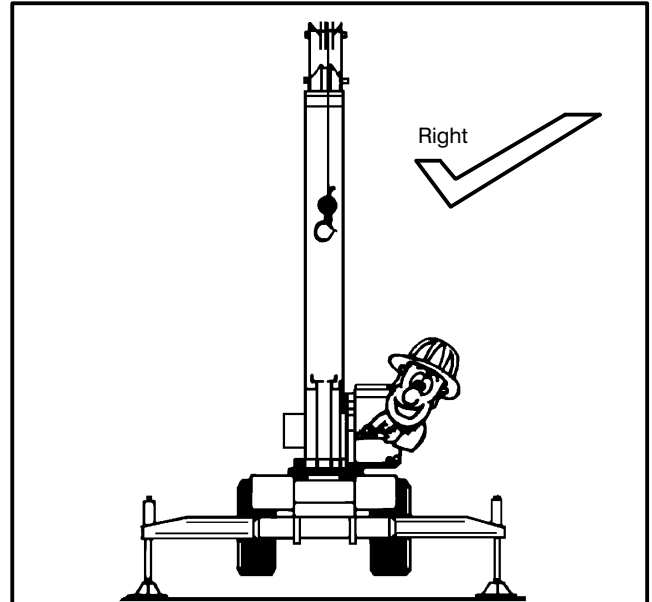


Figure 1–8
Crane level, all beams extended equally (all fully extended, intermediate extended or fully retracted) and tires clear of the ground.

- 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.
17. Before attempting to move the carrier, make sure there is enough air pressure to operate the brakes. Always check the brake operation before traveling the crane.
 18. Brake firmly in one application. Avoid fanning the brakes. This could exhaust air pressure so fast that the compressor may not supply enough air.
 19. Do not coast downhill with the transmission in neutral. It makes control of the crane more difficult and dangerous.
 20. Shift the carrier 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 on an unlevel surface.

Operator's Manual

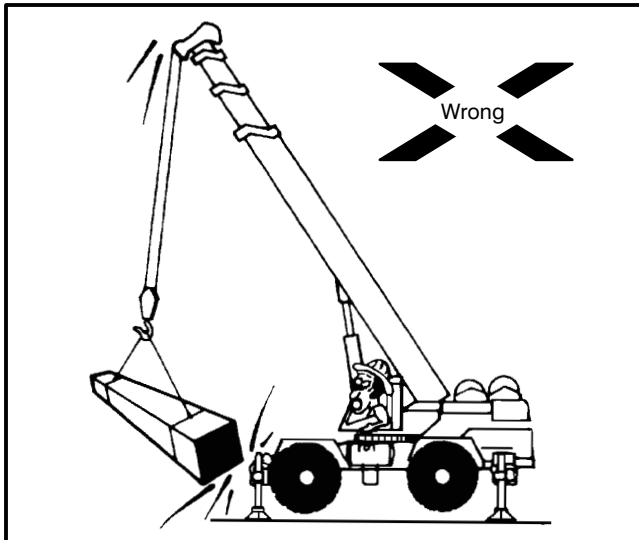


Figure 1-9
Watch that carrier!

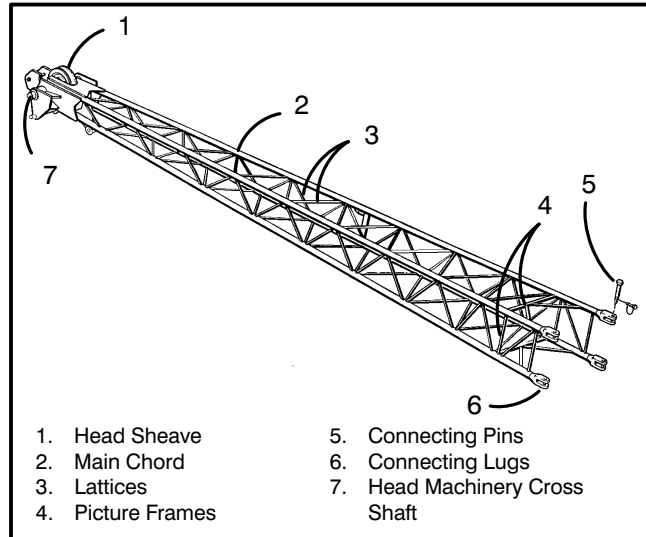
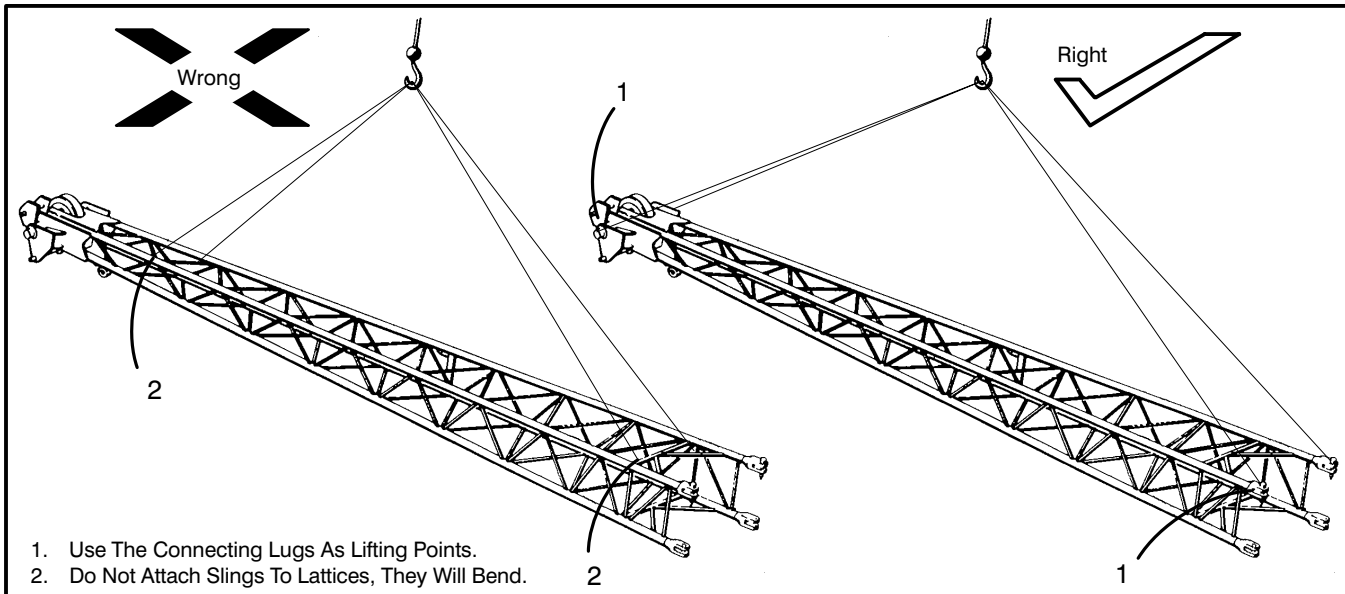


Figure 1-10
Fly Section Nomenclature



1. Use The Connecting Lugs As Lifting Points.
2. Do Not Attach Slings To Lattices, They Will Bend.

Figure 1-11
Handling The Fly Section

21. When operating with the boom at a high angle, use care not to let the load hit the carrier.
22. 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 the attachment, once subjected to loading. Do not attach slings to the lattices, when lifting the fly, as they will bend. Avoid attaching the slings to the main chords. Use the connecting lugs and head machinery cross shaft as the lifting points.
23. Block under and between the fly section when loading it on a transport vehicle. When securing the fly to a transport vehicle, it is best to use syn-

thetic webs or slings. If using wire rope slings, pad the fly to protect it from damage. Do not overtighten the tie downs or you may damage the fly. Do not use chain tie downs, as they may dent and damage the fly section.

24. 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 or jib section that is even slightly damaged. Consult your local distributor for the proper repair procedures.

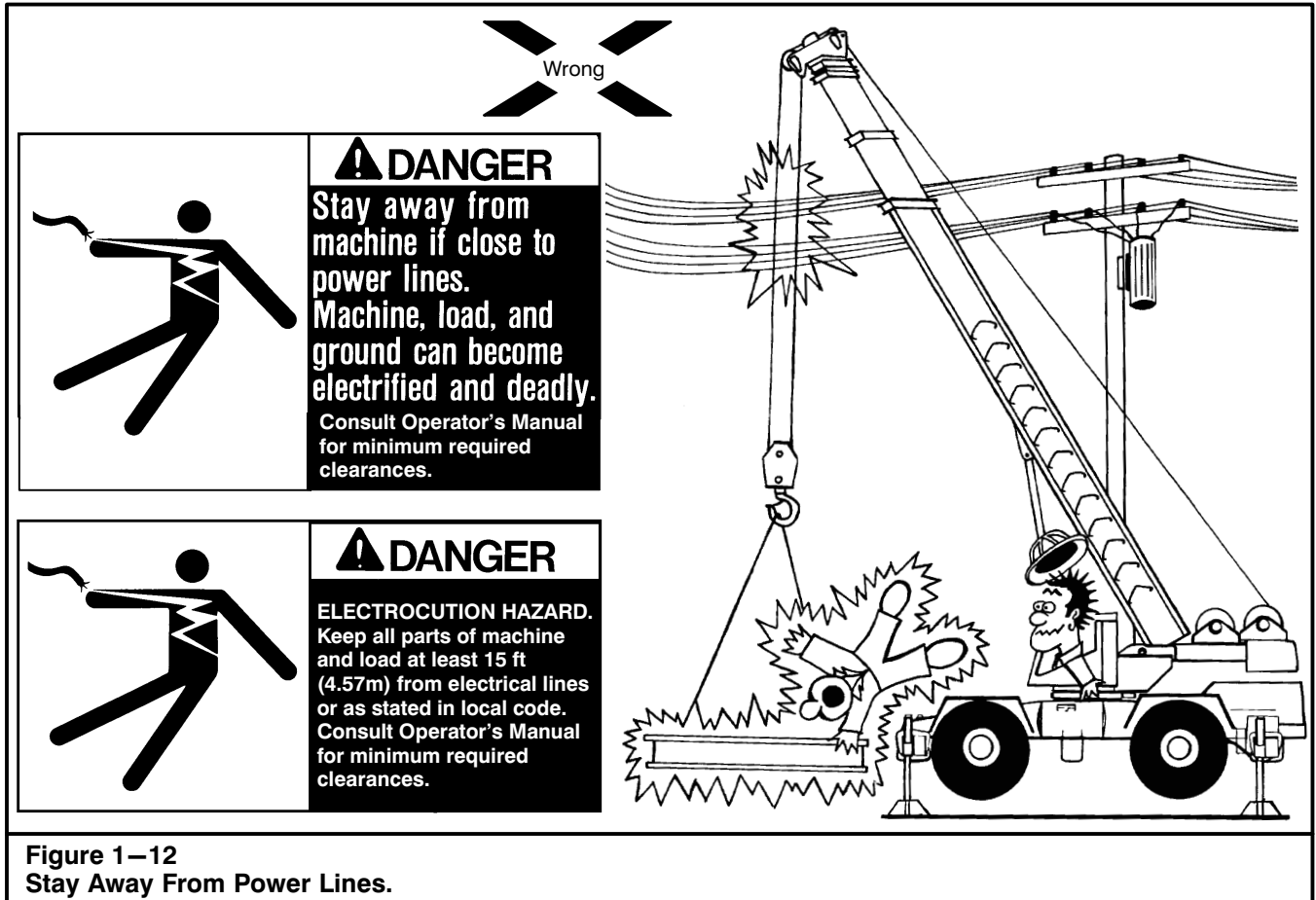


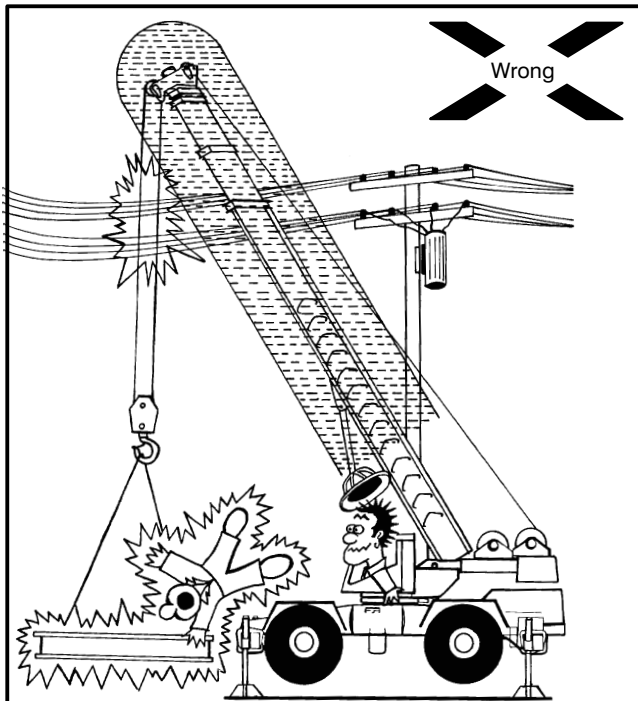
Figure 1–12
Stay Away From Power Lines.

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.
 - a. Be alert. You are working around conditions which can cause death.
 - b. Keep all parts of the crane, fall lines, hook block, and load, at least 15 ft (4.57m) away from power lines or as specified in the “High Voltage Power Line Clearance Chart” or other distances specified by applicable codes. Slow down crane operation.
 - c. Assume that every line is “Hot”.
 - d. 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.

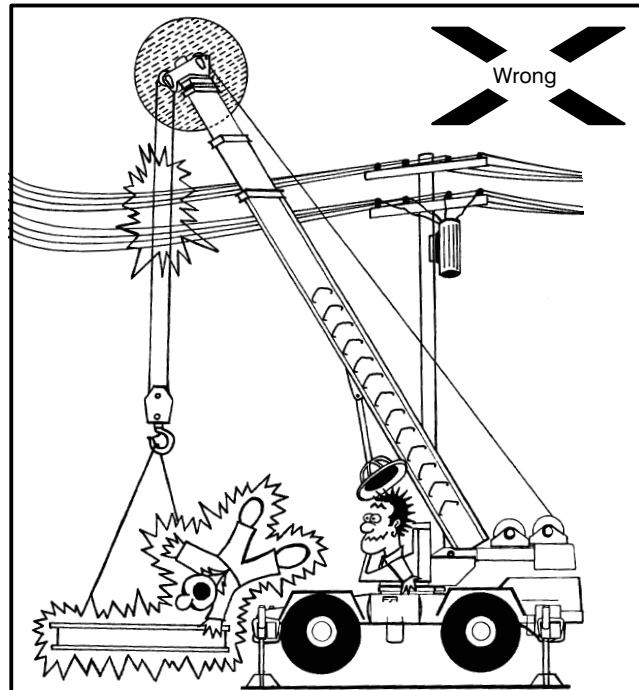
Minimum Required Clearance For Normal Voltage In Operation Near High Voltage Power Lines And Operation In Transit With No Load And Boom Or Mast Lowered.	
Normal Voltage, kV (Phase to Phase)	Minimum Required Clearance, ft (m) See Note 1
Operation Near High Voltage Power Lines	
To 200	15 (4.57)
Over 200 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)
Operation in Transit with no Load and Boom or Mast Lowered	
To 345	15 (4.57)
Over 345 To 750	16 (4.87)
Over 750 To 1000	20 (6.10)
Note 1: Environmental conditions such as fog, smoke, or precipitation may require increased clearances.	
High Voltage Power Line Clearance Chart	

Operator's Manual



Shaded area shows "sensitivity zone" with full boom length sensor used, and adjusted for 15 ft. (4.57m) clearance. Contact can be made outside this zone by the fall lines, winch rope, cab, etc. In such cases, the alarm will not sound, but the crane will be electrified and deadly.

Figure 1-13
Crane equipped with proximity warning device on the entire boom.



Shaded area shows "sensitivity zone" with the probe near the boom peak and adjusted for 15 ft. (4.57m) clearance. Contact can be made outside this zone by the fall lines, winch rope, cab, etc. In such cases, the alarm will not sound, but the crane will be electrified and deadly.

Figure 1-14
Crane equipped with proximity warning device on boom tip.

- e. Warn all personnel of the potential danger. Don't allow unnecessary persons in the area. Don't allow anyone to lean against or touch the crane. Don't allow ground workers to hold load lines, or rigging gear unless absolutely necessary. In these cases use dry plastic ropes as tether lines. Make certain everyone stays at least 15 ft (4.57m) away from the load, or a distance specified in the "High Voltage Power Line Clearance Chart", or such distance as required by applicable codes.
- f. 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.
- g. 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.

- h. 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. Consult 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.
 - 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.

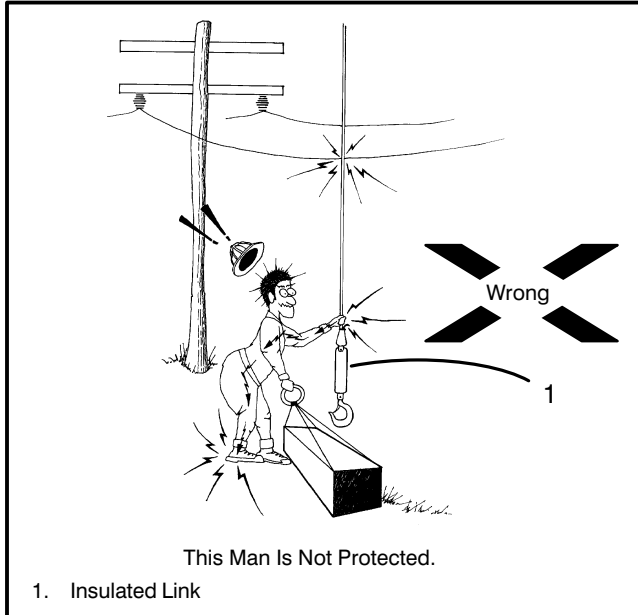


Figure 1-15
Crane equipped with insulated link.

- e. When the arc breaks, continue moving away until you are at least 15 ft (4.5m) away (or a distance specified in the "High Voltage Power Line Clearance Chart" or as specified by local codes). Stop the crane. Make a thorough inspection for crane damage before further use.
 - 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.
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 workmen touch magnet or load.
 - c. Do not let workmen 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.

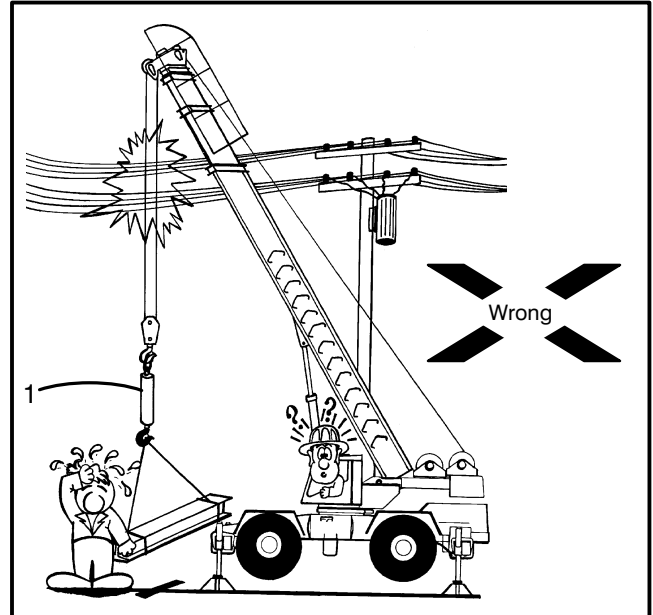


Figure 1-16
Crane equipped with insulated link and boom point guard.

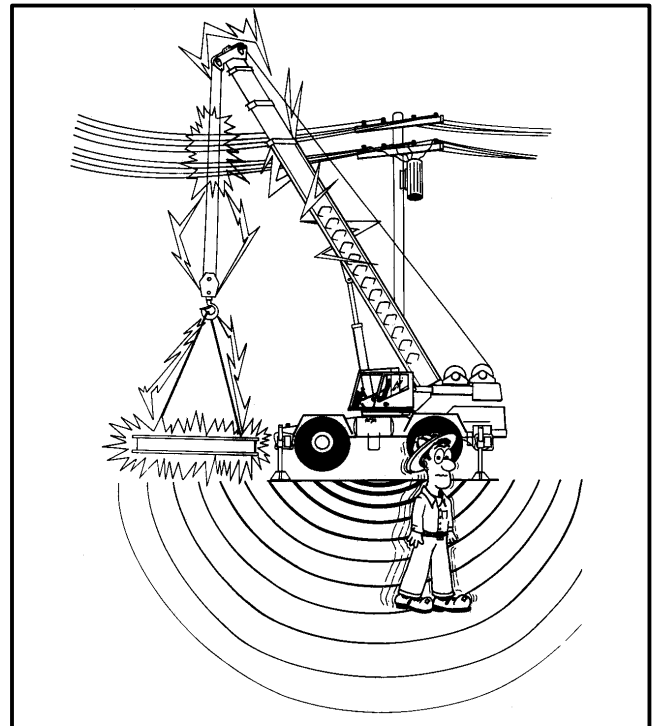
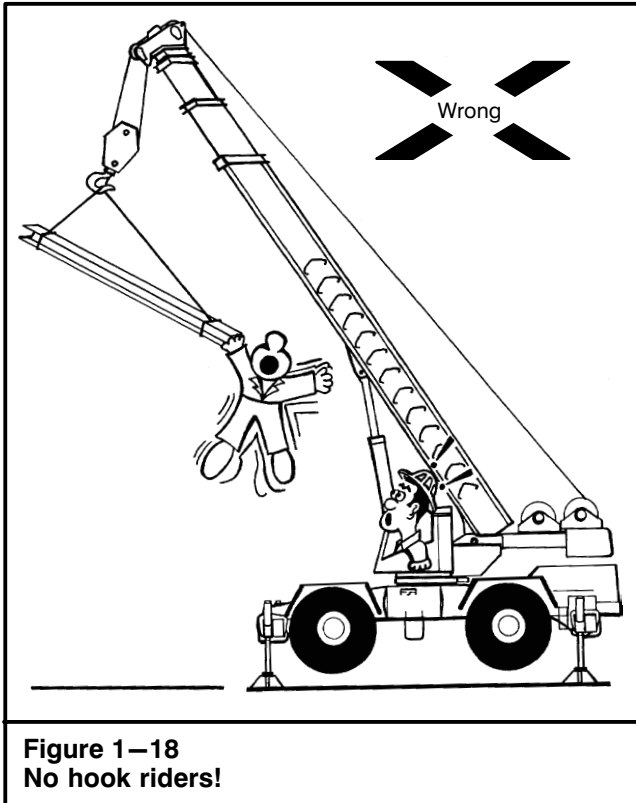


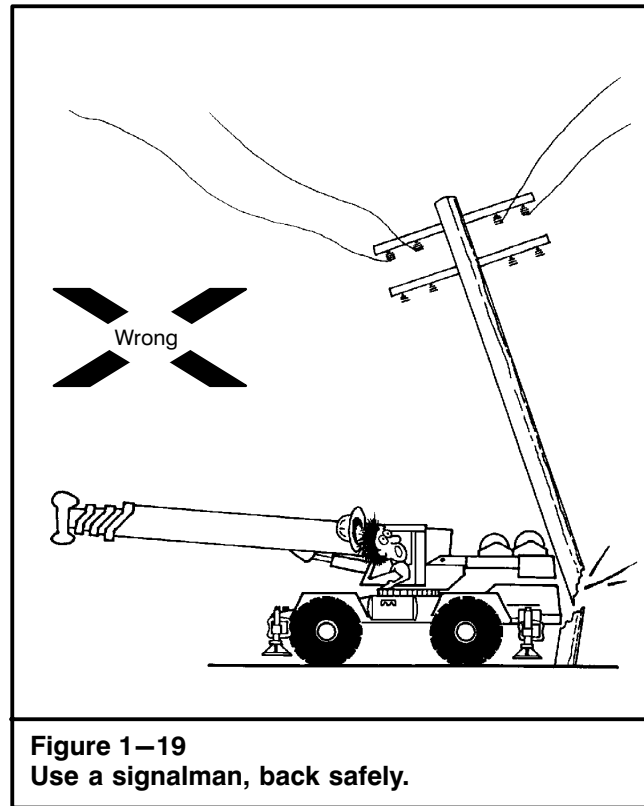
Figure 1-17
If you must leave the crane, do not step off. Leap as far as you can with feet together and hop or shuffle away.

Operator's Manual



Protective Equipment

1. Always replace protective guards and panels before operating the crane.
2. Always wear hard hats, safety glasses, steel toe shoes, and any other safety equipment required by local job conditions or regulations.
3. Always wear safety glasses when drilling, grinding or hammering. Flying chips could injure the eyes.
4. Keep a dry chemical or carbon dioxide fire extinguisher of 5BC rating or larger in the cab or in the immediate area of the crane at all times. Instruct all operating and maintenance personnel in proper use of the extinguisher. Check periodically to make sure it is fully charged and in working order.
5. Do not tamper with safety devices. Keep them in good repair and properly adjusted. They were put on the crane for your protection.
6. 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



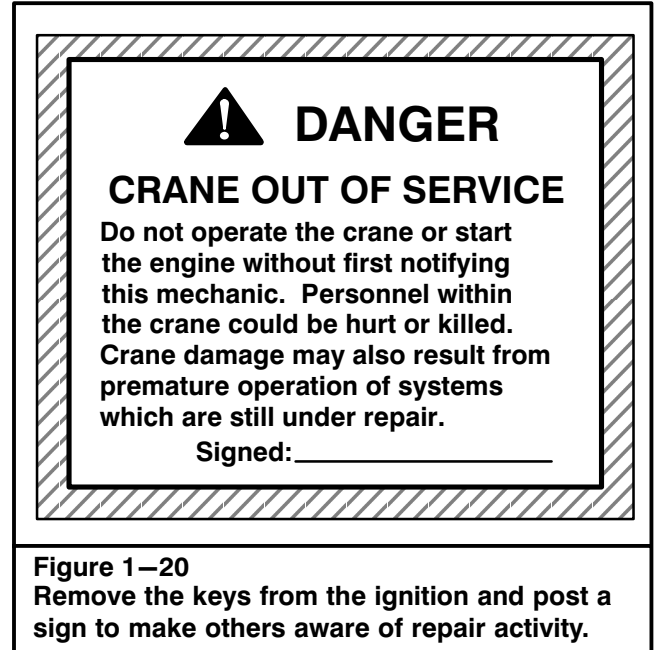
occur and create hazards. It requires all the skill, experience, judgment, and safety consciousness that a good operator can develop to attain safe operation. Many safety devices can assist the operator in performing his duties, but he should not rely on them to keep him out of trouble.

Signalmen And Bystanders

1. Don't allow crane 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 ball, hook block 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. Always look before you back up, or better yet, post a signalman to guide you. If crane is equipped with a back up alarm, make sure it is working properly. Use the horn as a signal. Use a code such as one beep – stop, two beeps – forward, and three beeps – backward. Make sure everyone on the job site knows the code.
4. Do not make a lift which is not in plain sight without a signalman. This can lead to an accident or crane damage.

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. 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. Consult your distributor for repairs.
3. When performing maintenance on the crane, do the following:
 - a. Fully retract the boom. Lower the boom to the limit of the boom hoist cylinders.
 - b. Shutdown the engine, disengage the main pump, 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. Post warning signs in cab so no one will try to start the engine. Never adjust, maintain, or repair a crane while it is in operation.



4. When making repairs, which require welding, use proper welding procedures. Also the following precautions must be taken:
 - a. All paint in the area should be removed to prevent burning the paint. The smoke and fumes from the burning paint can be very hazardous.
 - b. 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.
 - c. 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.
 - d. Disconnect computers and other electronic equipment (such as rated capacity limiters and engine computers) to prevent damage. Contact the distributor or for proper procedures.
 - e. If crane is equipped with the 12V to 24V convertor located in the power panel, remove the fuses before welding.
 - f. Remove all flammables from the proximity of the welding area.

Operator's Manual



Figure 1–21
Allow engine to cool before removing the radiator cap.

5. 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.
6. Use extreme caution when removing radiator caps, hydraulic pressure caps, etc. They can fly off and hit you, or you could be burned by hot oil, water, or steam.
7. 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.
8. 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.

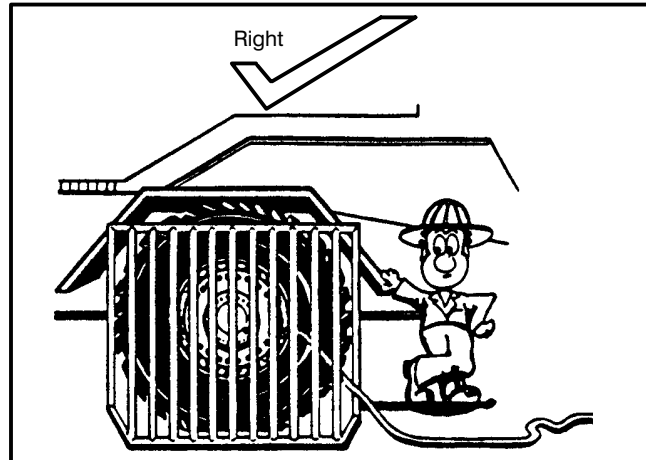


Figure 1–22
Use a guard when inflating tires.

! WARNING

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

9. When using jumper cables to start an engine, be sure to connect 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.
10. Test the automatic winch brake by raising the load a few inches 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 rope than when it is a few inches above the ground with only a few wraps on the drum.
11. Always reduce pressure in hydraulic system to zero before working on any part of the system.
12. Use extreme care when working with circuits with accumulators. Check that hydraulic pressure is relieved before opening the circuit for repairs.
13. 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.

Operator's Manual

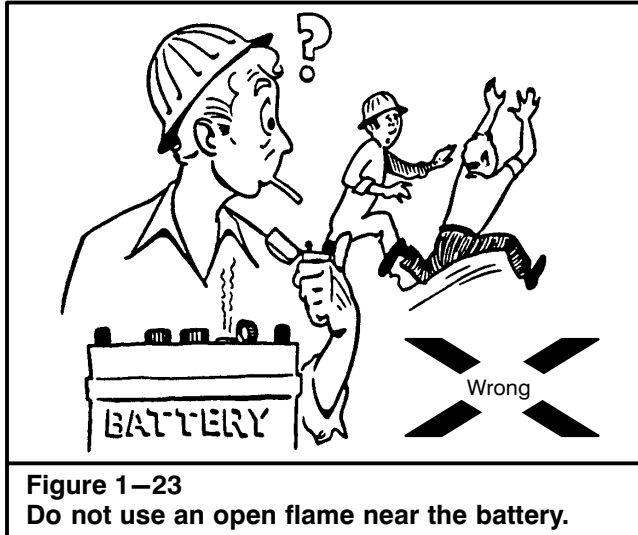


Figure 1-23
Do not use an open flame near the battery.

Wire Rope

1. Inspect all wire rope thoroughly. OSHA (Occupational Safety And Health Act) regulations state “a thorough inspection of all ropes shall be made once a month and a full written, dated, and signed report of the rope condition be kept on file where readily available.” A visual inspection must also be performed daily. Replace any worn or damaged rope. Pay particular attention to winch ropes. Check end connections (pins, sockets, wedges, etc.) for wear or damage.
2. Use at least the number or parts of winch line specified on the Wire Rope Strength chart located 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. Do not handle wire rope with bare hands. Always use gloves to prevent possible injury from frayed or damaged spots in the rope.
4. Inspect head machinery and hook block often as damaged or deteriorating sheaves can cause undo wear of the wire rope.
5. 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.
6. Only if certain criteria are met may a swivel hook ball be used with rotation resistant rope. Refer to “Hook Ball Usage With Rotation Resistant Rope” found in section 5 of this Operator's Manual.

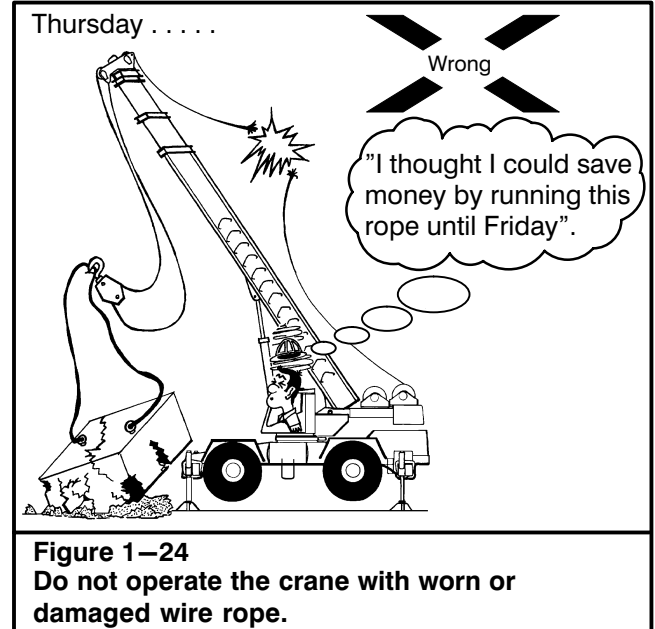


Figure 1-24
Do not operate the crane with worn or damaged wire rope.

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. Make any necessary arrangements to eliminate any potential hazards, if possible.
2. Erect barricades around the immediate work area to prevent unauthorized personnel from wandering onto the job site.
3. Be sure your work area is clear. Make sure you have proper clearance for the crane, boom, and load. Don't swing, travel, lift, or lower loads, raise or lower jacks, without first making sure no one is in the way. If your vision is obscured, locate a signalman so you can see him, and he can see all areas you can't. Follow his signals. Be sure you and the signalman understand each other's signals. See hand signal chart Figure 1-77. Use the horn to signal or warn. Make sure 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 tail swing of the upper revolving 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.

Operator's Manual

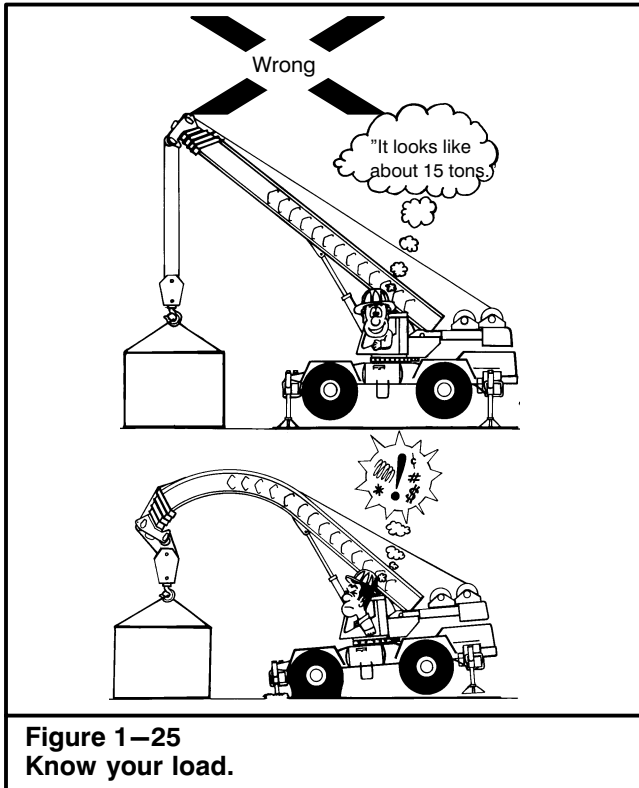


Figure 1-25
Know your load.

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, and any other weight on the hook. If lifting off the boom with the jib and/or fly installed, the weight of the jib and/or fly, and rigging must also be considered as part of the 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.

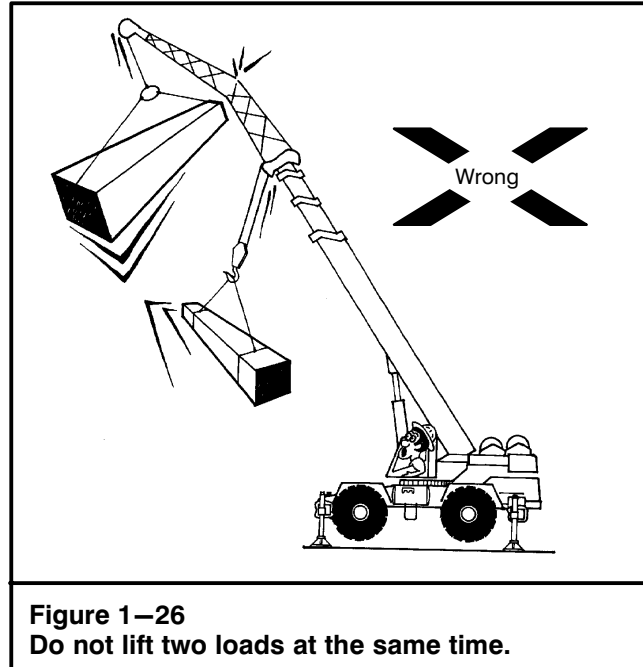


Figure 1-26
Do not lift two loads at the same time.

- When such conditions can not 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 considerably below those shown 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 workmen 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.

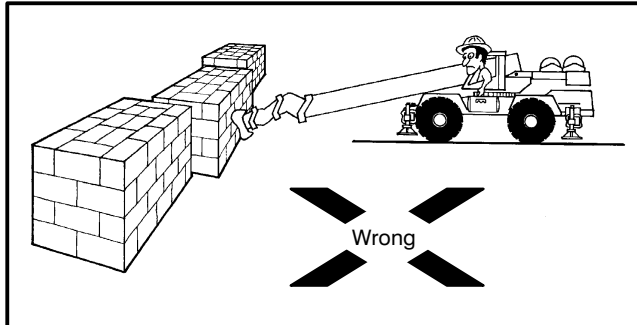


Figure 1–27
Do not push with the boom.

2. When operating off the main boom with the jib and/or fly erected, or the jib and/or fly stored on the boom, deductions must be made for their weight. The weight of the fly, pendants, etc., 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 or jib 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. 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.
6. Don't lash a crane down. Lashing a crane down encourages overloading. Crane damage or injury could result.
7. 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.

SAFETY INSTRUCTIONS

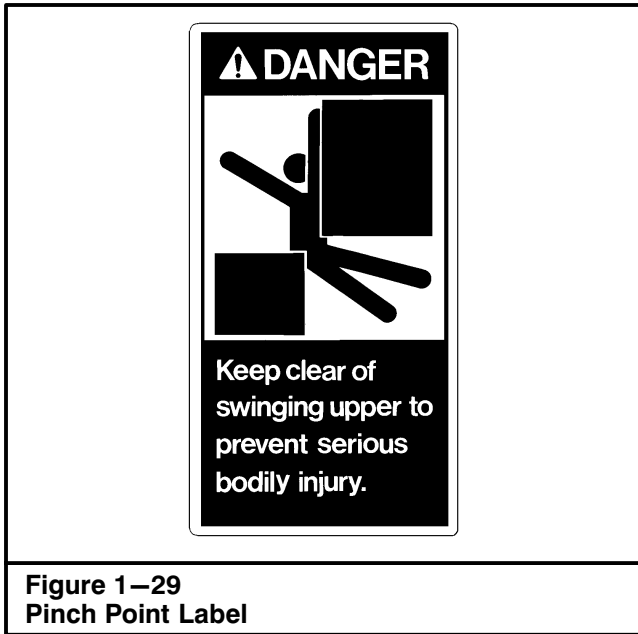
Operating under conditions which exceed listed capacities may result in overturning.

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

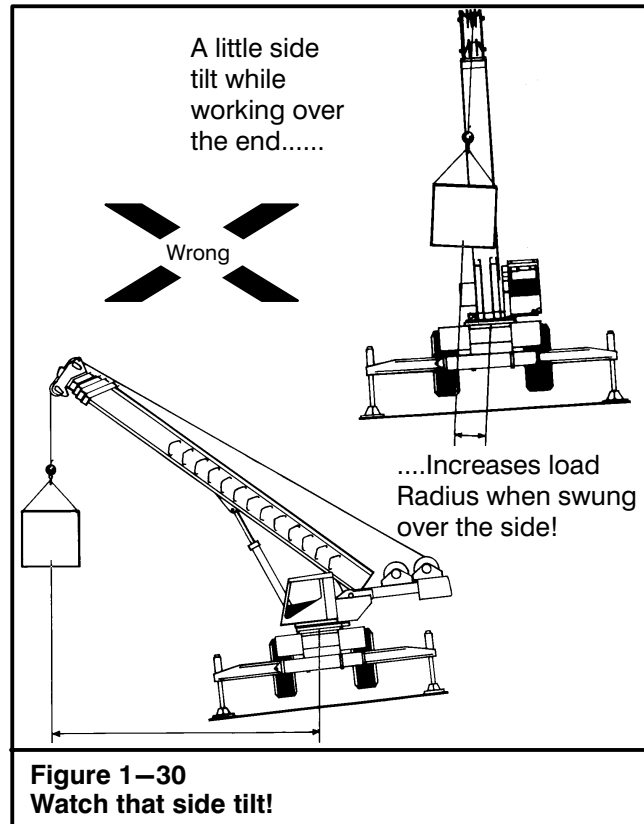
Figure 1–28
Safety Instruction Label

8. 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. Consult your distributor for repairs.
9. Always refer to the Crane Rating Manual after changing the arrangement of the attachments for the correct lifting capacities.
10. The boom must be extended in the correct manner before making a lift. Telescope the power boom sections equally. The capacity charts in the Crane Rating Manual for this crane are based on equally extended power boom sections.
11. 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.
12. 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.

Operator's Manual



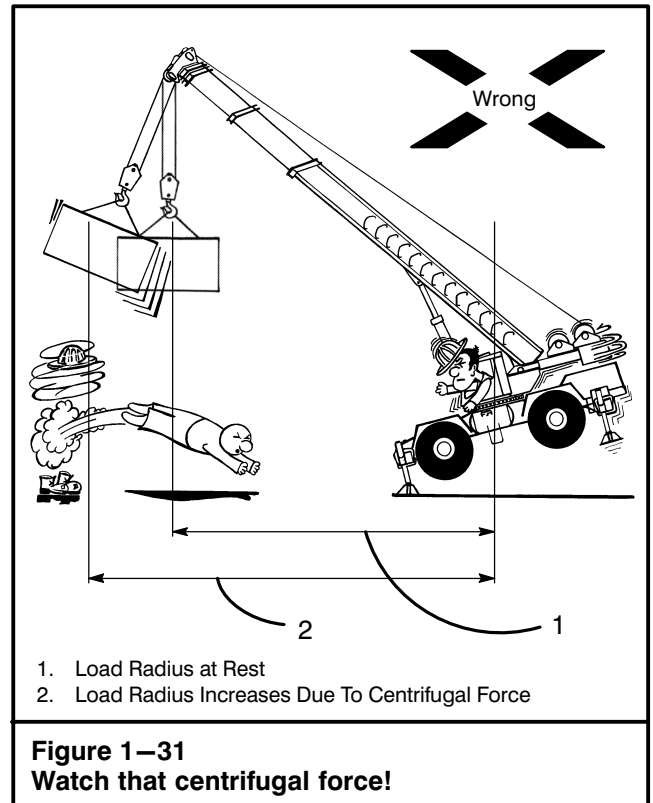
13. Do not operate a hydraulic crane at radii or boom lengths where the capacity charts in the Crane Rating Manual shows no capacity. Don't use a fly not shipped with or for your crane. Either of the above can tip the crane over or cause attachment failure. In some cases, the crane can tip over with no load on the hook, forward or backward! 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, injury or crane damage could result.
14. When you lift 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. Make sure the load being lifted will remain within capacity as it is lifted and the boom deflects.
15. 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.



16. Know the boom length. Don't guess. Use of an incorrect boom length can cause an accident.
17. When lowering or retracting the boom, the load will lower. To compensate for this, the operator must hoist up on the winch 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 rope to keep the load in place. Extending the boom without winching down, can lead to "two blocking". This is when the hook block or the hook ball contacts the head machinery. Two blocking can lead to sheave or wire rope damage.
18. The winch 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 ropes remain vertical. When setting the load on the ground, lower boom after the load touches down to avoid hook block swing when it is unhooked from load.

Operator's Manual

19. Pinch points, which result from relative motion between mechanical parts, can cause injury. Keep clear of the rotating upper or moving parts.
20. 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.
21. 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.
22. Keep the winch 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.
23. 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.
24. 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.



25. 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 make sure capacity ratings are not exceeded regardless of which quadrant he is operating in, or when swinging from one quadrant to another.
26. When working on tires, the tires must be inflated to pressures shown on the Tire Inflation label located on the rear exterior of the carrier.

Operator's 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 when making lifts on tires or in the Crane Rating Manual.
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. Make sure your 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 travel swing lock. Release the 360° swing lock.
 - c. Lash down or otherwise restrain the hook block.
 - 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.
 - 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" found later in this Section of the Operator's Manual for specific instructions.

Operator's Manual

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 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. Engage swing lock. Engage the park brake. Shutdown the engine and remove the keys.
 - c. 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.

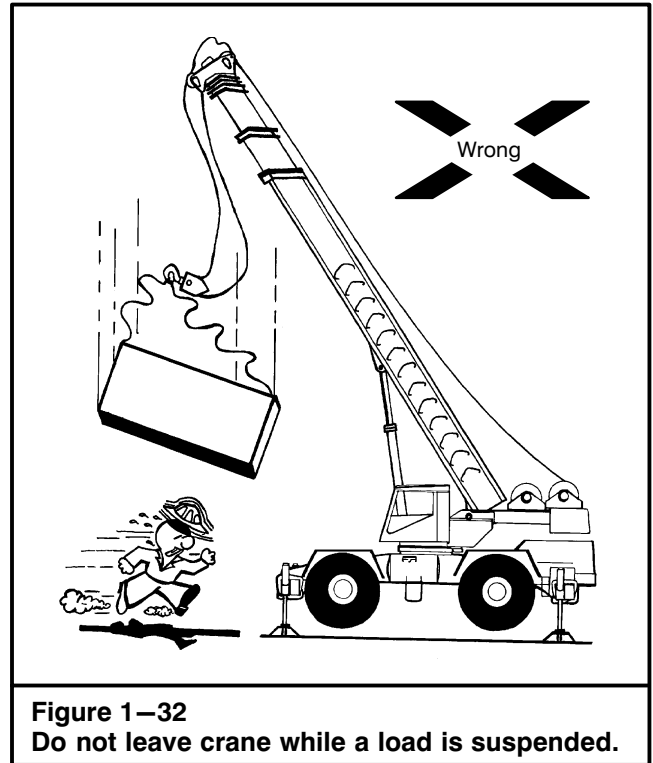


Figure 1–32
Do not leave crane while a load is suspended.

Operator's Manual

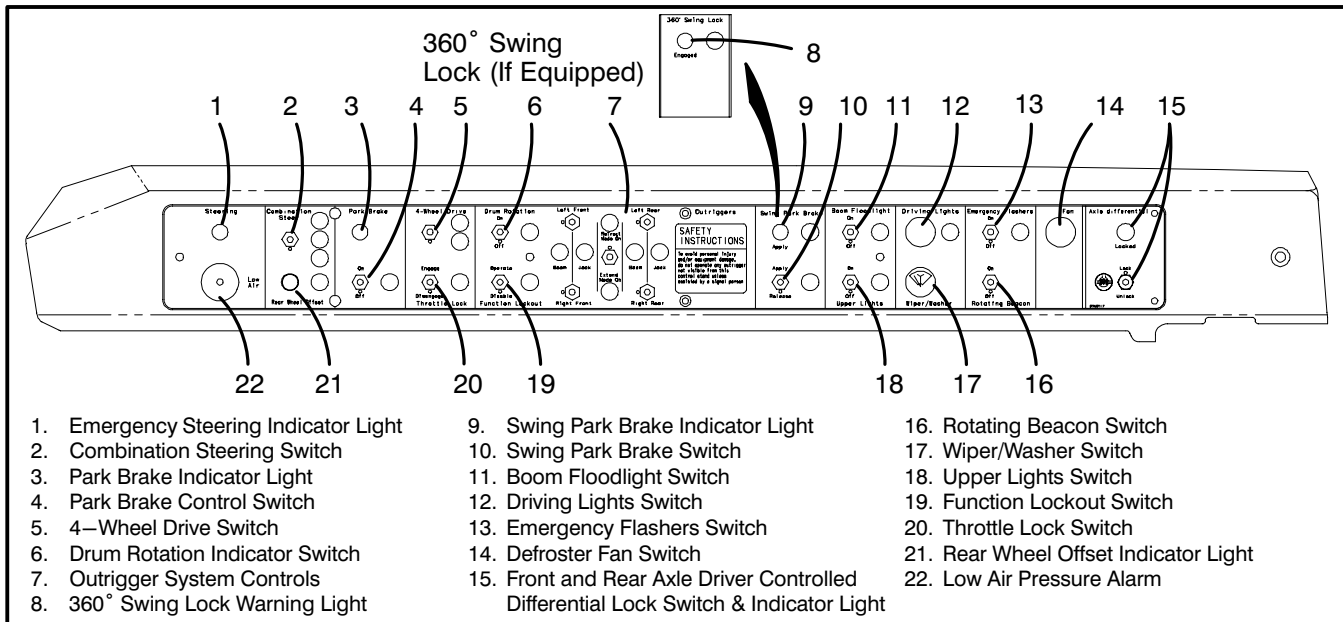


Figure 1-33
Cab Control Panel

Cab Control & Gauge Panels

Located throughout the cab are several panels which contain the controls, switches and gauges to operate and monitor crane operations. The following is a description of each gauge, switch or control in each panel, along with an explanation of their function and/or operation.

Control Panel

Located above and to the right of the operator, the control panel contains the following controls and is shown in Figure 1-33.

1. Emergency Steering Indicator Light (If Equipped)

On machines 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.

2. Combination Steering Switch

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

3. Park Brake Indicator Light

This light will come on anytime the park brake is engaged and the ignition is on.

4. Park Brake Control Switch

This switch controls engaging and releasing the park brake.

To Engage Park Brake

- Bring the crane to a full stop.
- Shift the transmission to neutral.
- Move park brake switch to "ON" position.
- Park brake indicator light should illuminate.

To Release Park Brake

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

Note: If the park brake indicator light stays illuminated, check the air system pressure. It must be at least 60 psi (414kPa) before the brake will release.



WARNING

Avoid using the park brake to stop the crane in motion (as a service brake) except in cases of extreme emergency. Brake wear will not be distributed evenly and application cannot be controlled.

Operator's Manual

5. 4–Wheel Drive 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.

6. Drum Rotation Indicator Switch

This switch is used to activate the drum rotation indicator system. To activate the system, flip the switch up to the “ON” position. Flip the switch down to the “OFF” position to deactivate the system. Refer to “Drum Rotation Indicators” found later in this Section of the Operator's Manual for complete operating procedures.

7. Outrigger System Controls

These controls are used to operate the outrigger system. Refer to “Main Outrigger Operation” found later in this Section of the Operator's Manual for complete operating instructions.

8. 360° Swing Lock Warning Light (If Equipped)

This light will illuminate along with an audio alarm behind the control panel to alert the operator that the 360° swing lock is engaged if the transmission is shifted out of neutral.

9. Swing Park Brake Indicator Light

This light will illuminate anytime the swing park brake is applied.

10. Swing Park Brake Switch

This switch is used to hold the upper in any direction over the carrier. Refer to “Swing System” found later in this Section of the Operator's Manual for complete operating procedures.

11. Boom Floodlight Switch (If Equipped)

This switch operates the boom floodlight if equipped. Flip the switch up to turn floodlight on, down to turn it off.

12. Driving Lights Switch

Pull the knob out to illuminate the headlights and parking lights. To turn the lights off, push knob in.

13. Emergency Flashers Switch

This switch controls the warning flashers. Flip the switch up to turn flashers on, down to turn them off.

14. Defroster Fan Switch

This switch controls the defroster fan. Rotate the switch to operate the defroster fan.

15. Front and Rear Axle Driver Controlled Differential Lock Switch & Indicator Light (If Equipped)

Under normal driving conditions the axle differential selector switch should remain in the “UNLOCK” position. This position allows the wheel ends of each axle to turn at different speeds for increased steering control in limited turning areas. To provide increased traction on slippery roads and soft ground, use the “LOCK” position to force both wheel ends of each axle to turn together. Use caution, if ground conditions do not allow the tires to slip during a turn, locking the axle differentials significantly restricts the maneuverability of the crane and increases powertrain loading.

CAUTION

Do not engage the differential lock on good traction surfaces. Damage to the axle shafts could occur. Use the differential lock to increase traction on slippery roads and soft ground.

The indicator light, not the switch position, should be used to determine the state of the differentials. It will illuminate anytime either axle differentials are locked and the ignition is on. If the indicator light does not go out when the selector switch is moved to the “UNLOCK” position, proceed with caution, the differentials are still locked. Maneuverability and powertrain loading are still affected.

Note: The differential lock switch is a momentary contact type. The differential lock function occurs only as long as the switch is held in the “LOCK” position.

Operator's Manual

To Lock The Front & Rear Axle Differentials:

Note: It is recommended that the 4-wheel drive mode be used to increase traction. If adequate traction is still not available, engage the differential lock.

CAUTION

Do not actuate the axle differential lock when the wheels are slipping or spinning without traction. Do not allow wheels to spin with axle differential in the "UNLOCKED" position. Either situation can damage differential gears.

- Maintain a constant crane speed 5 mph (8km/h) or less.
- Move switch to the "LOCK" position and hold.
- Let up on the throttle pedal momentarily to allow the differential lock to engage.
- Proceed with caution.

To Unlock The Front and Rear Axle Differentials:

- Maintain a constant crane speed 5 mph (8km/h) or less.
- Release switch to the "UNLOCK" position.
- Let up on the throttle pedal momentarily to allow the differential lock to disengage.
- Proceed with caution.

16. Rotating Beacon Switch (If Equipped)

This switch controls the cab rotating beacon. Flip the switch up to turn beacon on, down to turn it off.

17. 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, to the second detent for high speed wiper. Pushing the wiper/washer switch sprays washer fluid on the windshield to clean the window.

18. Upper Lights Switch

This switch operates upper floodlights. Flip switch up to turn floodlights on, down to turn them off.

19. Function Lockout Switch

This switch is used to disable hydraulic functions which are operated by the control levers and boom telescope foot pedal. Move switch to the "DISABLE" position to prevent inadvertent operation of these controls. To allow normal

operation of the control levers and boom telescope foot pedal, move function lockout switch to the "OPERATE" position.

20. Throttle Lock Switch

This switch is used to hold the engine at a constant speed. To lock the throttle, shift the transmission to neutral, press the throttle pedal until the desired engine speed is reached. Flip the throttle lock switch up. The engine should continue to run at a constant speed when the throttle pedal is released. Flip the switch down to return to idle or to increase the throttle setting.

21. Rear Wheel Offset Indicator Light

Cranes which are equipped with combination steering use this indicator light to alert the operator when the rear wheels are out of line with the carrier. Refer to "Combination Steering" found later in this Section of the Operator's Manual for complete operating procedures.

22. Low Air Pressure Alarm

This light and buzzer will activate if the air system pressure falls below a safe operating range. If this light illuminates, stop the machine and correct the problem before continuing operations.

Gauge Panel

Located to the front right of the operator, the gauge panel contains the following controls and is shown in Figure 1-34.

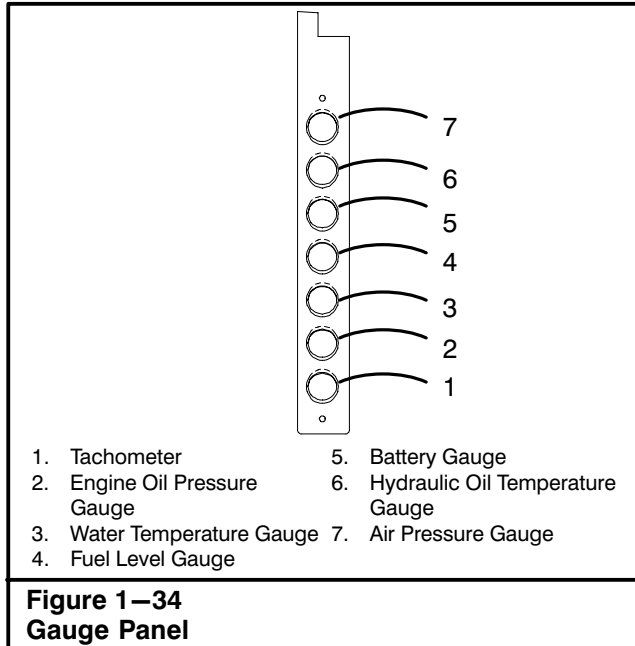
1. Tachometer

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

2. Engine Oil Pressure Gauge

This gauge registers the engine oil pressure. For proper oil pressure operating range, refer to the engine manufacturer's manual. 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.

Note: When the engine is started on cranes equipped with an audio/visual warning system, a buzzer is likely to sound due to initially low engine oil pressure. Unless there is a problem, the buzzer will silence after a few seconds once the oil pressure has had time to increase.



3. Water 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.

4. Fuel Level Gauge

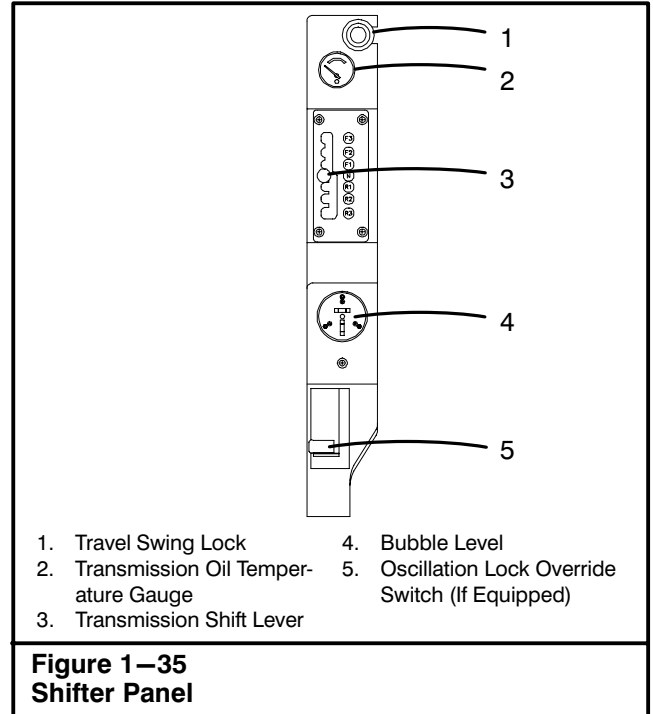
This gauge registers the level of fuel in the fuel tank. The fuel tank capacity is 75 gal (284 L). Refer to the engine manufacturer's manual for the correct grade of diesel fuel.

5. Battery 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 key on, and 12.5 to 14 volts with the engine running.

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 the "Hi Performance Hydraulic Oil" chart located in Section 2 of this Operator's Manual for proper oil viscosities and operating temperature ranges. If the hydraulic oil exceeds the maximum operating temperature, shutdown the crane immediately and correct the problem.



7. Air Pressure Gauge

This gauge registers the air pressure at the front and rear brake sensors. Normal operating range of the system is 100–120 psi (690–827kPa). If they do not register within this range, correct the problem before operating.

Shifter Panel

Located to the right of the operator is the shifter panel. It contains the following controls and is shown in Figure 1-35.

1. Travel Swing Lock

This lever is used to lock the upper directly over either the front or rear of the carrier. Refer to "Swing System" found later in this Section of this Operator's Manual for complete operating procedures.

2. Transmission Oil Temperature Gauge

This gauge registers the oil temperature in the transmission torque converter. Normal operating temperature range is 180–200°F (82–93°C). If the oil overheats, shutdown the engine immediately and locate the problem. 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.

Operator's Manual

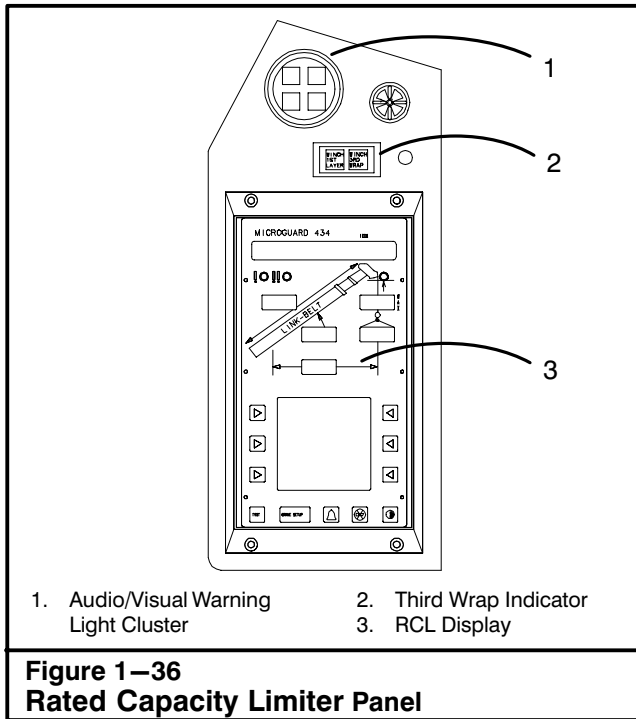


Figure 1–36
Rated Capacity Limiter Panel

3. Transmission Shift Lever

This lever is used to shift the transmission to the appropriate gear. Refer to “Transmission Shift Lever” found later in this section of this Operator’s Manual.

4. Bubble Level

The bubble level is provided to assist the operator in leveling the crane on outriggers.

5. Oscillation Lock Override Switch (If Equipped)

This switch, if equipped, is used to override the axle oscillation system. Refer to “Axle Oscillation System” found later in this section of this Operator’s Manual.

Rated Capacity Limiter Panel

Located to the lower right of the operator is the Rated Capacity Limiter panel. It contains the following and is shown in Figure 1–36.

1. Audio/Visual Warning Light Cluster (If Equipped)

Four individual indicator lights are contained in this one gauge. The appropriate indicator will illuminate and a buzzer will sound for any one of the following conditions:

- Low engine oil pressure
- High engine coolant temperature

- High hydraulic oil temperature
- High transmission oil temperature

Note: When the engine is started, the buzzer is likely to sound due to initially low engine oil pressure. Unless there is a problem, the buzzer will silence after a few seconds once the oil pressure has had time to increase.

2. Third Wrap Indicator (If Equipped)

The crane may be equipped with the third wrap indicator. It has two indicator lights. A red warning light will illuminate to alert the operator that there is one layer of winch rope on the drum. Another red warning light will illuminate and a buzzer will sound to alert the operator that the winch rope is down to the third wrap.



WARNING

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

3. Rated Capacity Limiter Display

This displays the boom length, boom angle, load weight etc. See “Crane Monitoring System” found later in this section of the Operator’s Manual for complete operating instructions.

Steering Column and Wheel

The steering column and wheel are equipped with tilt and telescope functions. The following is a description of the switches and controls on the steering column, along with an explanation of their function and/or operation. Refer to Figure 1–37.

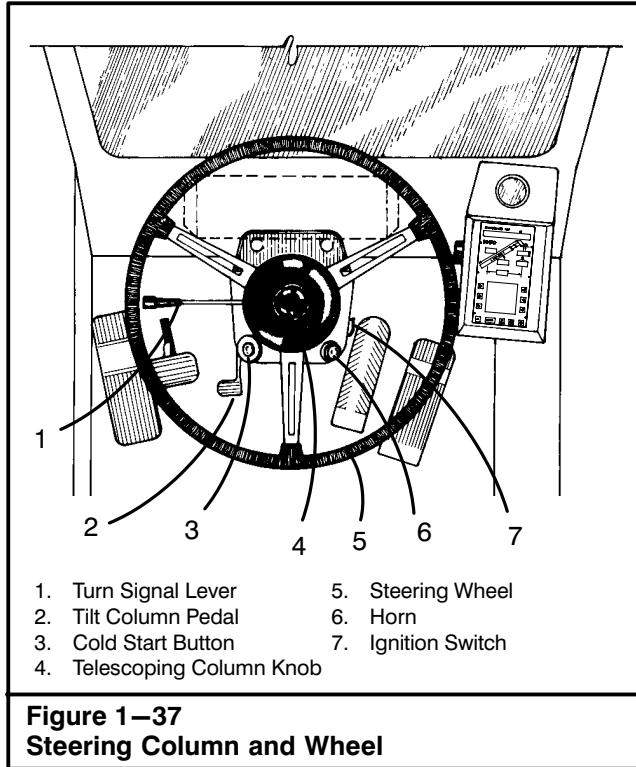
1. Turn Signal Lever

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

2. Tilt Column Pedal

This pedal controls the tilt (angle) function of the steering column. To change steering column angle:

- Bring the crane to a complete stop.
- Engage the park brake and shift the transmission to neutral.
- Depress the tilt column pedal.
- Position the steering wheel at the desired angle and release pedal to lock it in place.
- Check all steering wheel functions before continuing operation.



3. Ether Start Button (If Equipped)

The ether start system is activated by pressing this button while cranking the engine. Refer to "Ether Start" in this Section of the Operator's Manual for additional details and operating instructions.

4. Telescoping Column Knob

This knob controls the telescoping function of the steering wheel. To change steering wheel height:

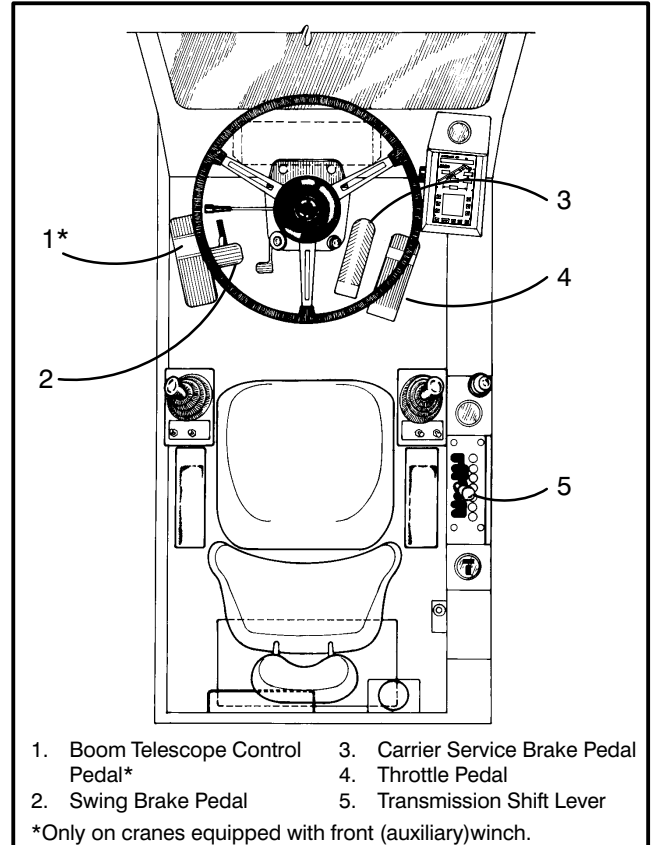
- Bring the crane to a complete stop.
- Engage the park brake and shift the transmission to neutral.
- Turn control knob counter clockwise.
- Position steering column at the desired height and turn control knob clockwise to lock it in place.
- Check all steering wheel functions before continuing operation.

5. Steering Wheel

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

6. Horn

The button on the right of the steering column activates the horn. Press the button to sound the horn.



7. Ignition Switch

The ignition switch is the key operated, conventional, automotive type. It controls engine acc/off/run/start and energizes the instrument panel gauges in the cab.

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 1-38.

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" found later in this Section of the Operator's Manual for complete operating instructions.

Note: On cranes not equipped with the front (auxiliary) winch, the boom telescope function is controlled by the left controller.

Operator's Manual

2. Swing Brake Pedal

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

3. Carrier Service Brake Pedal

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

The distance the service brake pedal is moved determines the braking force. Do not fan the service brake pedal. This wastes compressed air and increases stopping distance. 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 down on the throttle pedal to increase engine speed. Release the throttle pedal to decrease engine speed.

Shifting The Transmission

The transmission shift lever is located on the shifter console to the right of the operator. Refer to Figure 1–38. It controls all functions of the powershift transmission. The transmission contains three forward speed ranges and three reverse speeds. See "Traveling The Crane" found later in this Section of the Operator's Manual for necessary preparations before traveling the crane.

1. Engage the park brake and place shift lever in neutral position. Start the engine. (Engine will start only when transmission is in neutral.)
2. Engage travel swing lock and release the 360° swing lock.

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.

3. Forward Travel
 - a. Fully apply the carrier service brake and release the park brake.
 - b. Move shift lever to position "F1".
 - c. Slowly release the service brake while using the throttle pedal to increase the engine speed to full throttle, allowing the crane to accelerate.
 - d. At full engine speed, shift lever to position "F2".
 - e. When engine is at full speed move shift lever to position "F3".
 - f. To slow down or stop, release throttle pedal and allow engine rpm's to decrease. Down shift transmission as speed and engine rpm decrease.
4. Reverse Travel
 - a. With crane at a full stop, apply the carrier service brakes move shift lever to position "R1".

Note: 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.

- b. Slowly release the service brake while using the throttle pedal to increase the engine speed to full throttle, allowing the crane to accelerate.
- c. At full engine speed, shift lever to position "R2".
- d. When engine is at full speed move shift lever to position "R3".
- e. To slow down or stop, release throttle pedal and allow engine rpm's to decrease. Down shift transmission as speed and engine rpm decrease.

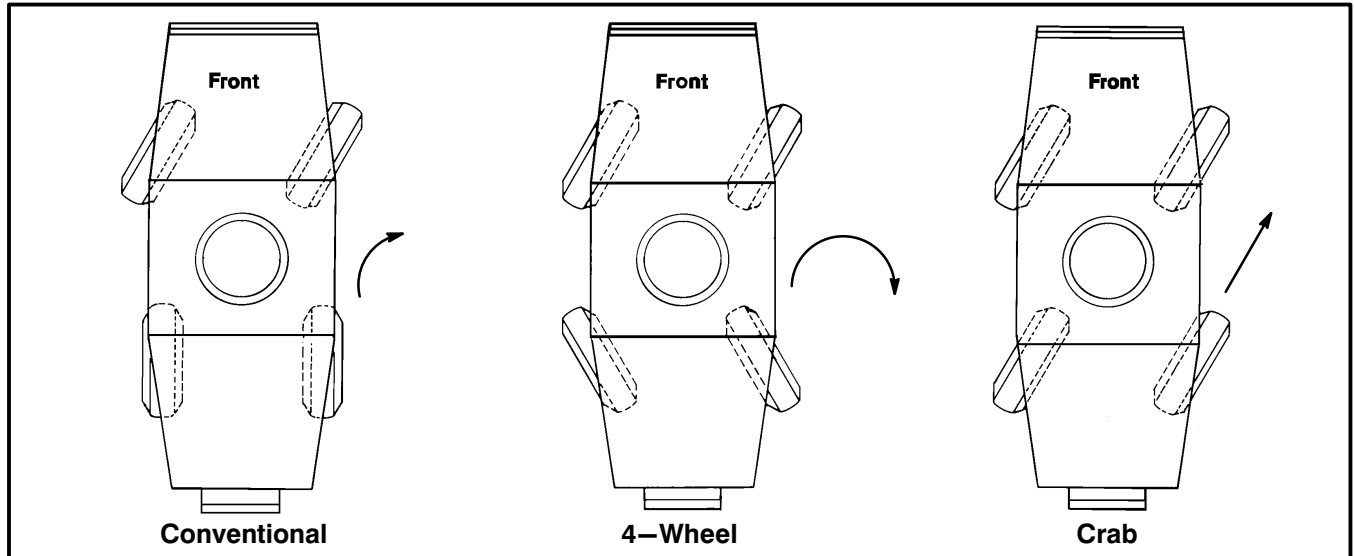


Figure 1-39
Steering Modes

Combination Steering

The crane is equipped with three different modes of steering in order to provide maximum maneuverability on the job site: conventional, 4-wheel and crab steer. Each steer mode provides slightly different maneuverability to meet job site requirements. Refer to Figure 1-39 for illustration of the three 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.

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 machine in the diagonal path of travel. This gives the operator another method of maneuvering the machine where job site conditions require it. Use this steer mode for job site travel only; not for extended or highway travel.



WARNING

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

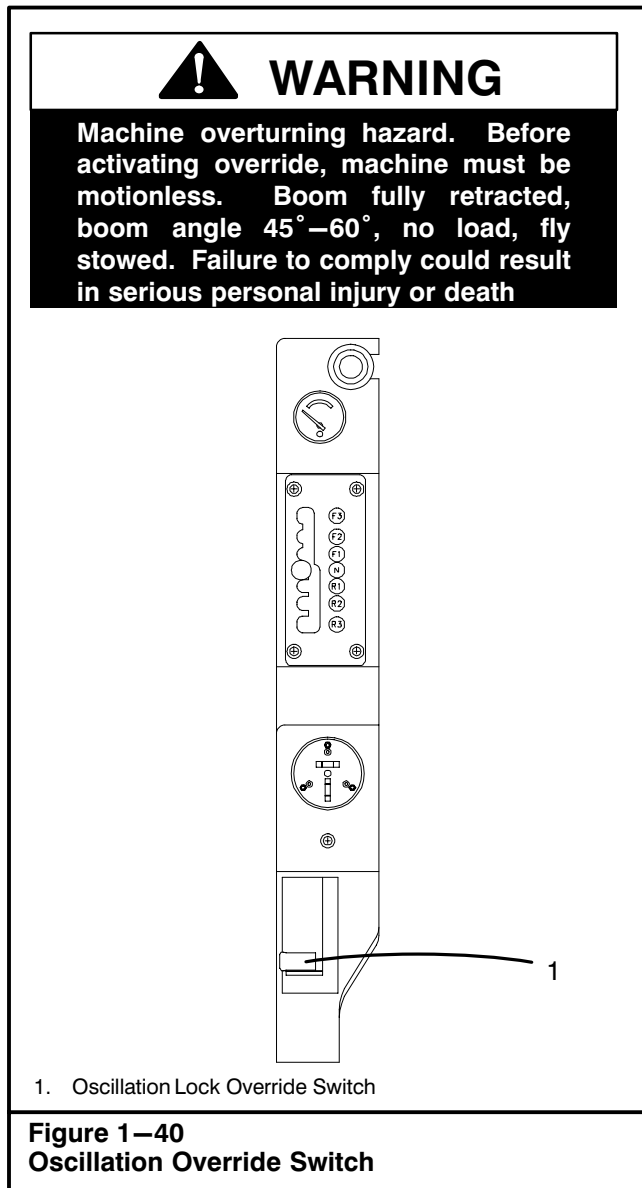
Do not travel with the upper over the side. The machine may tip over causing personal injury and/or machine damage.

Changing Steering Modes

The rear wheel offset light, located on the control panel, is designed to assist the operator in changing steering modes by determining when rear wheels are straight. This light will come on anytime 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 out.
3. Move steer switch to conventional steering mode.
4. Check all wheels for proper alignment by traveling the machine a short distance, straight ahead, to insure it tracks straight.
5. Bring the crane to a complete stop and move the steer mode switch to the desired position.

Operator's Manual



Axle Oscillation System

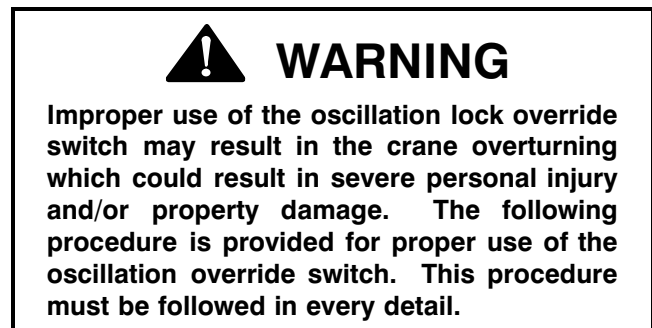
The axle oscillation system is provided to improve machine stability. It also improves four wheel contact with the ground when traveling over rough terrain.

The rear axle pivots on an axis at the centerline of the carrier. Two hydraulic cylinders are connected between the axle frame and carrier that allow a gradual oscillation of the rear axle when the upper is over the front of the carrier.

When performing crane operations over the side, a rigid rear axle suspension is needed to increase machine stability. Therefore, a valve is included in the rear axle oscillation 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, this valve is shifted to the “locked” position. This system is automatically activated by rotating the upper.

In some situations it may be desirable to override the oscillation system to stabilize the crane after moving it. To assist in stabilizing the crane in these situations, some cranes are equipped with an oscillation lock override switch located on the transmission shifter panel. Refer to Figure 1–40.



Conditions for Proper Use of the Axle Oscillation Override Switch

1. There must be no load on the hook block or ball, the boom head, or the auxiliary lifting sheave.
2. The fly must be properly stored if the crane is equipped with it.
3. The boom must be fully retracted and positioned between a 45 and 60 degree angle.

Note: Verify the accuracy of the boom angle indicator. Refer to Section 3 of this Operator's Manual for the correct procedure.

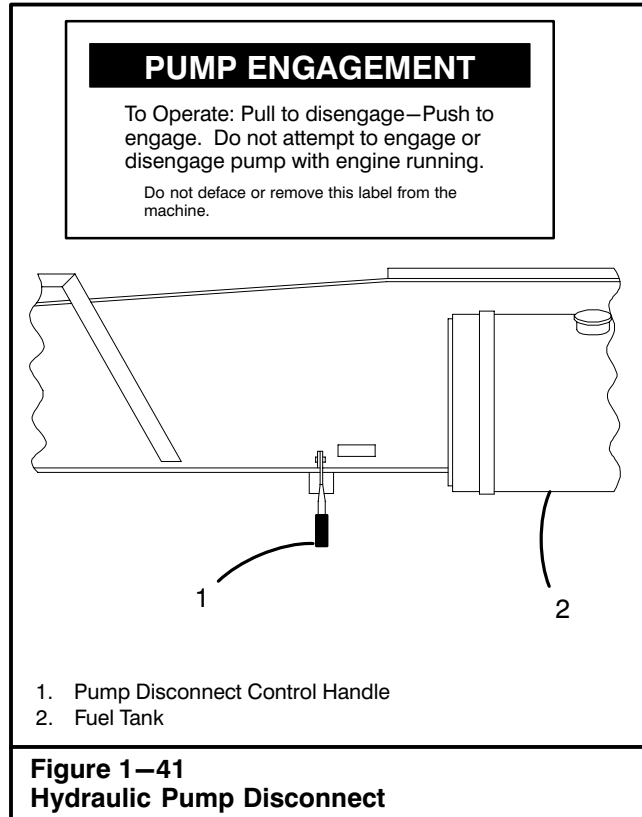
4. The crane must be stopped and motionless.

Axle Oscillation Override Switch Operation

1. Comply with steps 1–4 above and proceed as follows.
2. Push the oscillation lock override switch to the “ON” position. Hold it there until the crane has stopped shifting and is motionless.

Note: The oscillation lock override switch is a momentary contact type. The override function occurs only as long as the switch is held in the “ON” position.

3. Release the switch and proceed with operations.



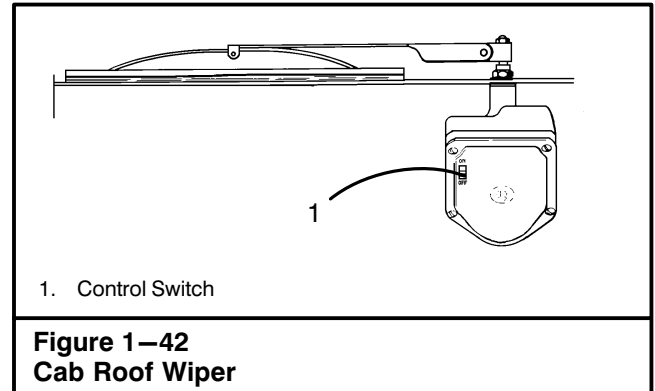
Hydraulic Pump Disconnect

The hydraulic pump disconnect 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—41.

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.

CAUTION

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



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.
4. Push the pump disconnect control handle in, to the limit of its travel.

To Disengage The Main Pump

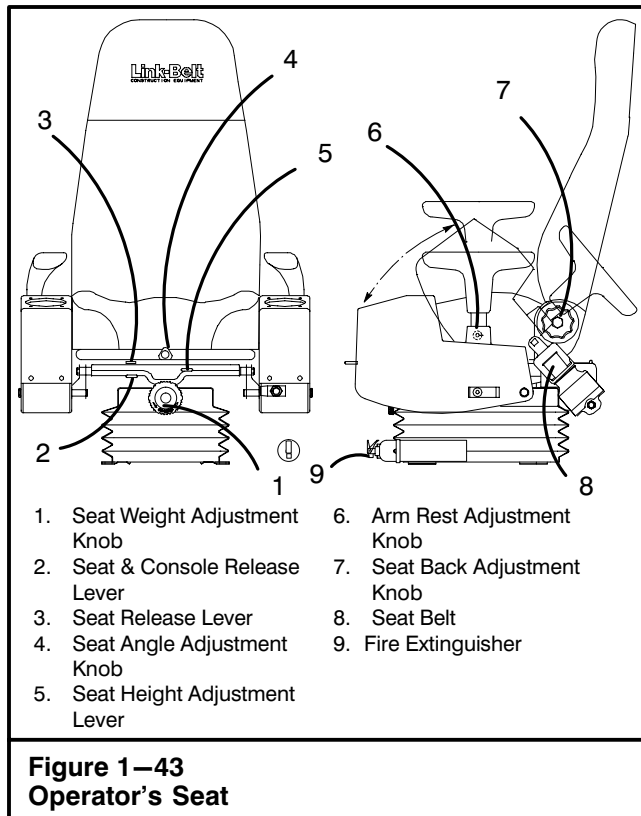
1. Park the crane and engage the park brake.
2. Shift the transmission to neutral and shutdown the engine.
3. Pull the handle out to the limit of its travel.

Note: Disengage the main pump for all highway travel. This will prevent unnecessary wear on the pump and hydraulic components.

Cab Roof Windshield Wiper

The switch for the cab roof windshield wiper is located in the top right corner of the cab roof on the wiper motor. Move the switch to “ON” or “OFF” as desired. Refer to Figure 1—42.

Operator's Manual



Operator's Seat

This 6-way adjustable seat is controlled by manual controls. Refer to Figure 1—43.



WARNING

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

1. Seat Weight Adjustment Knob

Turn seat weight adjustment knob until desired suspension is attained. Increase weight adjustment for heavy bumps and decrease for light, smooth conditions. Do not adjust suspension to the point where the seat may bottom out.

2. Seat & Console Release Lever

Move the seat & 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 Angle Adjustment Knob

Rotate seat angle knob until the desired angle is attained. Do not apply weight to the seat while adjusting seat angle.

5. 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.

6. Arm Rest Adjustment Knob

Loosen the knob on the inside of the arm rest. Position the arm rest as desired and tighten knob screw.

7. Seat Back Adjustment Knob

Rotate the seat back adjustment knob until the desired position is reached. Do not apply weight to the seat while adjusting seat angle.

8. 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. Be sure 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.

9. Fire Extinguisher

A fire extinguisher is located in the operator's cab underneath 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.

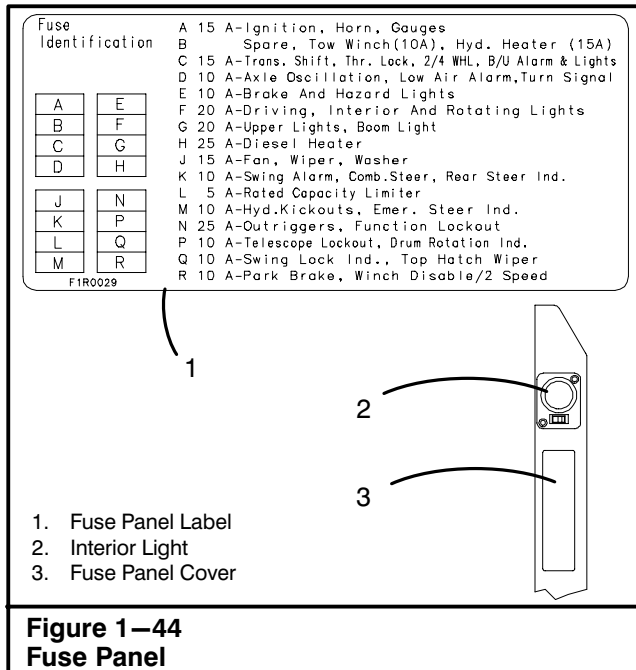


Figure 1-44
Fuse Panel

Fuse Panel & Interior Light

The fuse panel is located in the upper right rear corner of the operator's cab. Located behind the fuse panel cover is a label which designates the electrical circuit protected by each fuse. Located above the fuse panel cover is the interior light. Use the switch below the light to turn the light on or off. Refer to Figure 1-44.

Power Panel Circuit Breakers

The power panel is located on the left hand side of the crane just inside of the engine access door. Refer to Figure 1-45. The power panel contains two reset type circuit breakers, a 105 amp and 15 amp. If the crane is equipped with air conditioning the power panel will be equipped with an additional 20 amp breaker. The breakers service the crane's electrical system as follows:

- 105 amp – Upper Electrical
- 20 amp – Air Conditioner Only (If Equipped)
- 15 amp – Fuel Solenoid, Air Dryer (If Equipped)

Air Dryer

The crane may be equipped with an air dryer which automatically exhausts moisture from the air system. This unit is located inside the battery box compartment on the left rear of the crane. Refer to Section 2 of this Operator's Manual for details on servicing the air dryer.

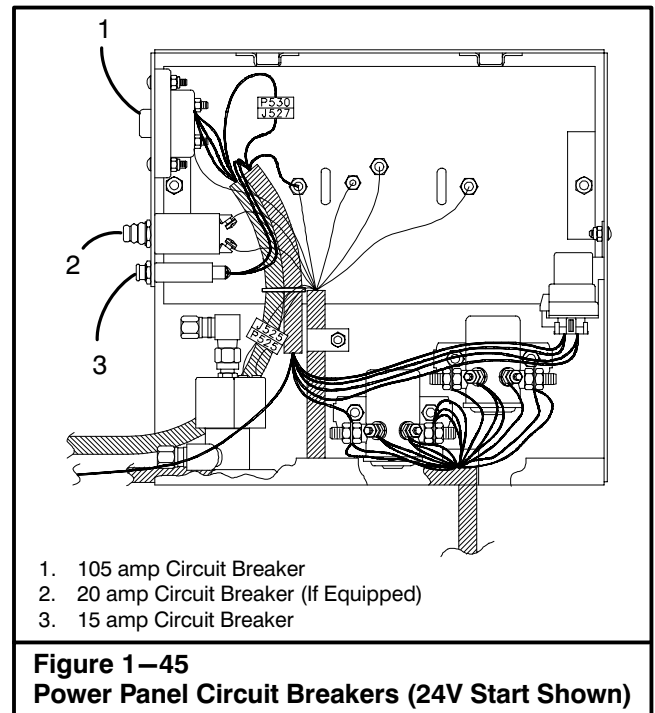


Figure 1-45
Power Panel Circuit Breakers (24V Start Shown)

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 located on the control panel (Refer to Figure 1-46) and the extend position levers located on the outrigger boxes (Refer to Figure 1-47). 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. Each extend position lever controls the extend length of the beam. It allows for beams to be fully extended, or limits them to intermediate extended lengths based on the selected position of the extend position lever.

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 provided on the shifter panel, in operator's cab, to assist in determining when crane is level.

Operator's Manual

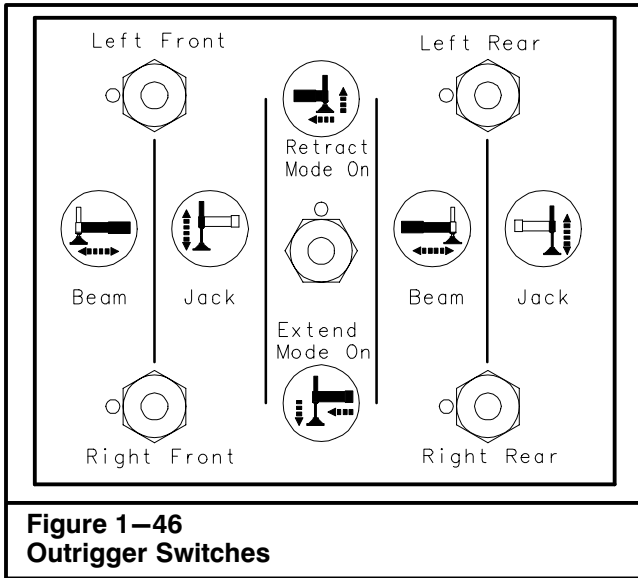


Figure 1–46
Outrigger Switches

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.

3. Determine the outrigger position desired. Set the extended position lever as required (Refer to Figure 1–47).

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.

WARNING

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

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.
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. Refer to Figure 1–47.
10. Set the rated capacity limiter to the proper setting to match the position of the outrigger beams.

WARNING

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

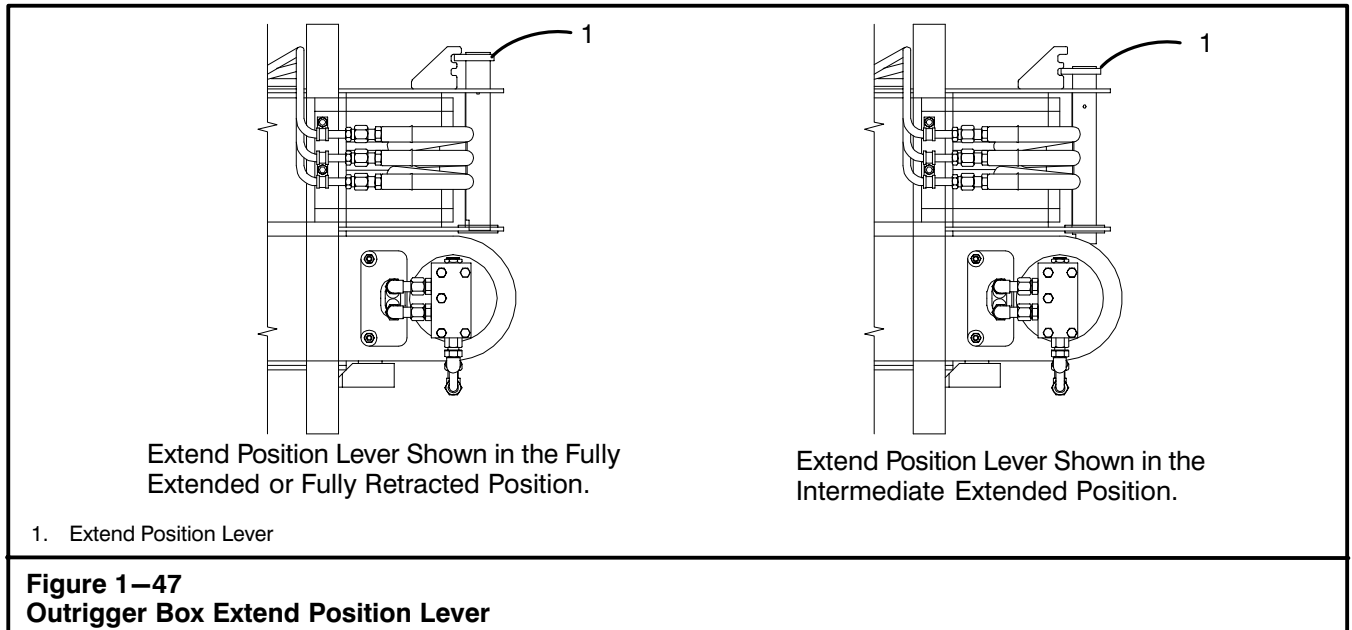
When making lifts with the outrigger beams in the intermediate extended position, the extend position lever must be in the intermediate extended position. Visually check that all outrigger beams are extended until the stop plate contacts the extend position lever before beginning operations.

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 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.
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.

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

Note: A bubble level is provided on the shifter panel, in the operator's cab, to assist in determining when the crane is level.



WARNING

All capacities listed on the capacity charts 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. Serious 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

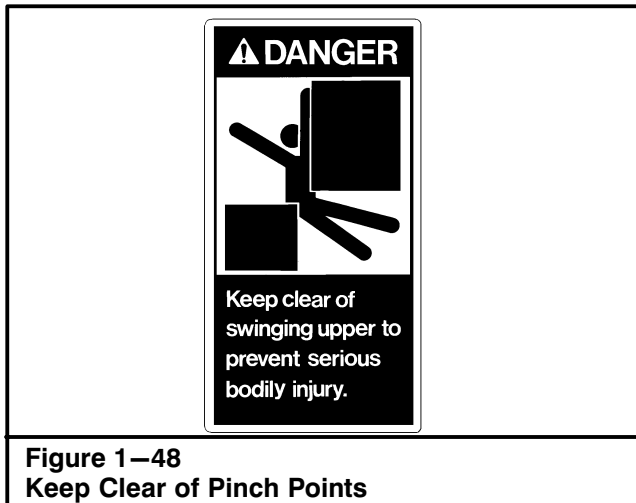
1. Fully retract the boom. Swing the upper over the front of the carrier and engage the travel swing lock.
2. Fully boom down.
3. Push an individual outrigger switch to the “JACK” position and hold.
4. Push the center mode switch to “RETRACT MODE ON” position and hold until the jack cylinder is fully 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

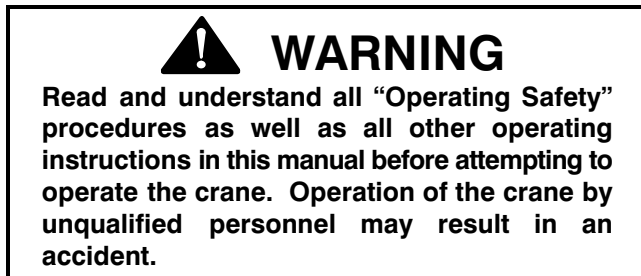
1. Set the extended position lever in the fully retracted position. (Refer to Figure 1-47.)
2. Push an individual outrigger switch to the “BEAM” position and hold.
3. Push the center mode switch to the “RETRACT MODE ON” position and hold until the beam is fully retracted.
4. Release both switches.
5. Repeat steps 1–4 for each beam.
6. Store all pontoons in the brackets provided.

Operator's Manual



Crane System Controls

The following pages, along with Figure 1—49, 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.



Engine Throttle

The crane is equipped with a throttle pedal used to control the engine speed. Press down to increase engine speed. Release to decrease engine speed. When a constant engine speed is desired use the throttle lock switch located on the control panel.

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

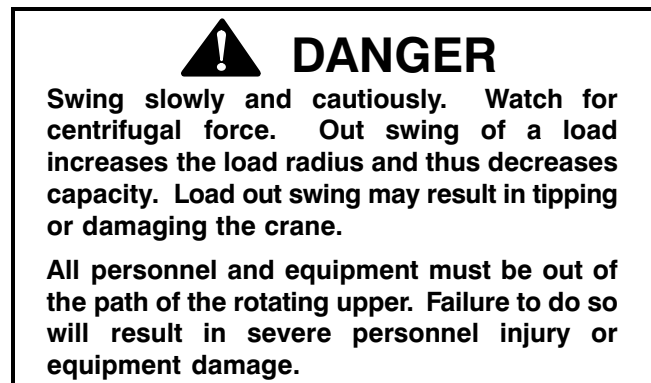
The swing brake pedal is used to stop rotation of the upper over the carrier. To apply the swing brake, push down on the swing brake foot pedal. To release the swing brake, release the swing brake foot pedal.

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 appropriate position to swing the upper.

To Swing The Upper

1. Properly level the crane on outriggers.
2. 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.
3. Fully apply the swing brake pedal and release the swing lock(s) or the swing park brake.
4. Release the swing brake pedal as you begin to engage the swing control lever.



To Stop Upper Swing

1. Ease swing control lever into the neutral position.
2. Apply the swing brake to bring the upper to a complete stop.
3. Engage the swing lock as required.
4. Check engagement of the swing lock 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. Press the button in the center of the travel swing lock knob and pull the knob up.
3. Release the button and knob. The knob should remain in the released position.

Operator's Manual

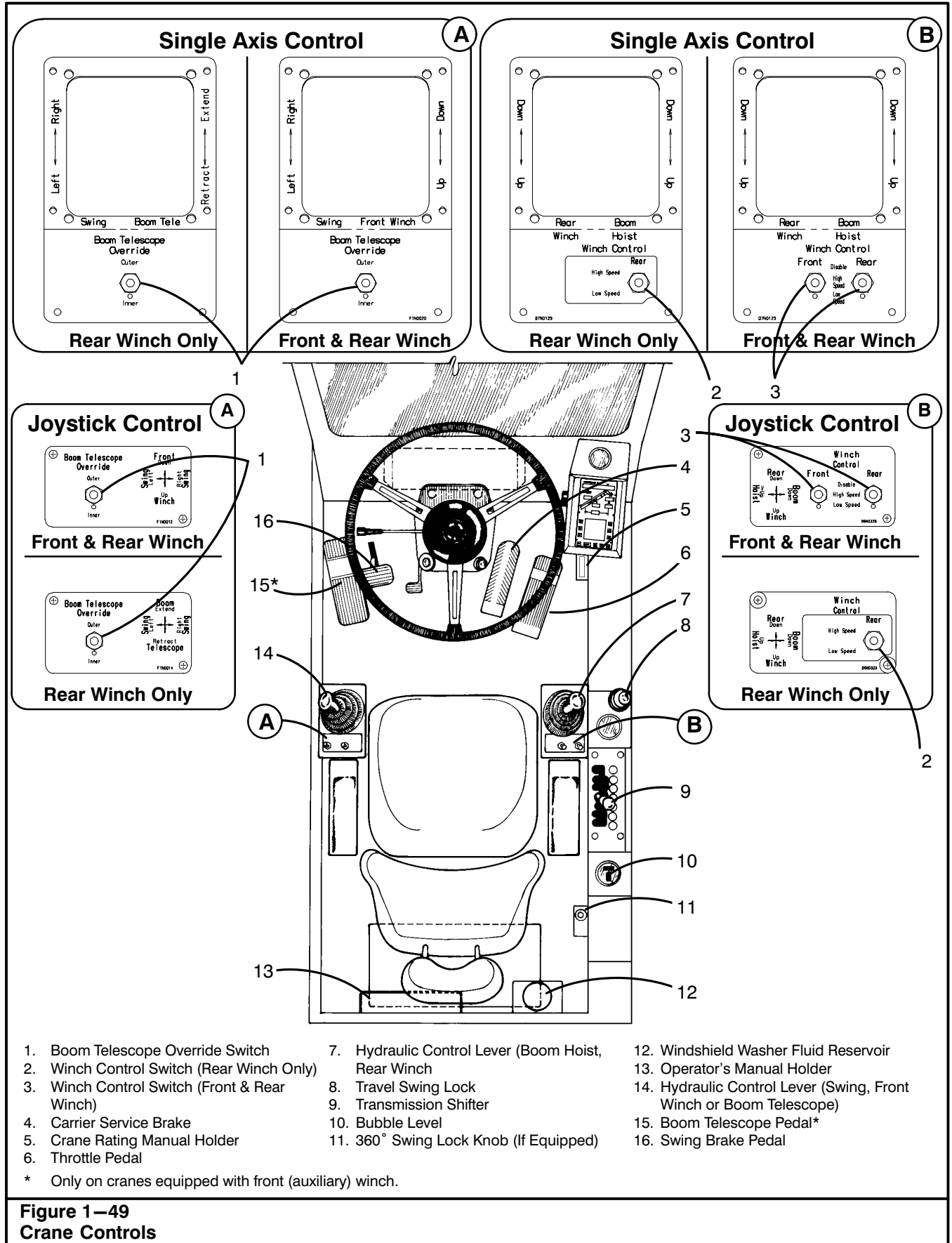


Figure 1—49
Crane Controls

Operator's Manual

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. Press the button in the center of the travel swing lock knob and push the knob down.

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 self contained dry multiple disc type 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. An indicator light on the control panel 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. Flip the swing park brake toggle switch on the control panel to the "RELEASE" position. The indicator light will go out. Refer to Figure 1–33 for toggle switch and indicator light 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. Flip the swing park brake toggle switch on the control panel to the "APPLY" position. Indicator light will illuminate. Refer to Figure 1–33 for toggle switch and indicator light 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 lock by trying to swing upper right, then left. Upper should not swing.

360° Swing Lock (If Equipped)

The 360° swing lock is a positive lock against rotation of the upper over the carrier. The upper is mechanically locked by a manually operated locking pin that engages through holes in the swing brake disc rotor. This locks the rotor in place which in turn locks up the reduction unit and keeps the upper from rotating. 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. An audio alarm behind the control panel and a warning light on the control panel is provided to alert operator that the 360° swing lock is engaged if the transmission is shifted out of neutral.

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. Press the button in the center of the 360° swing lock knob and pull the knob up.
3. Release the button and knob. The knob should remain in the released position.

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. Press the button in the center of the 360° swing lock knob and push the knob in.

Note: In order to engage the 360° swing lock, it may be necessary to swing the upper slightly to align the swing lock pin with the swing speed reducer brake disc.

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

Operator's Manual

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 increase winch line speed approximately 1.66 times. The controls for the system are shown in Figure 1–49. Review the following for control descriptions and brief summary of operation.



WARNING

The weight of the load must be known before making a lift. Compare the load weight to the 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 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 contacts the head machinery. “Two blocking” could damage the hook block and/or the head machinery. Always keep load and hook block 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 manual.



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 hookblock until warm oil circulates throughout the winch.

To lift a load

Attach the hook block or 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

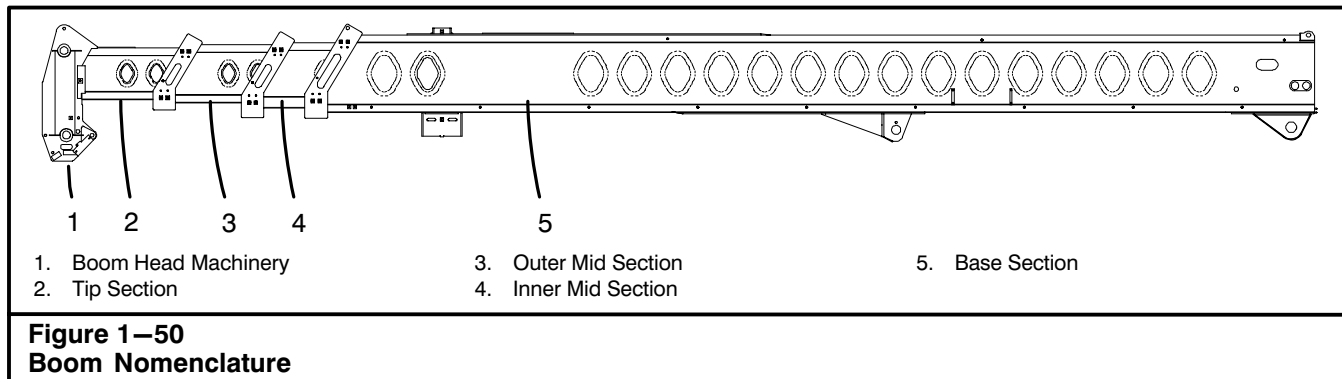
This switch is used to control engaging/disengaging the high/low speed hoist and disabling the front or rear winch.

High speed hoist or lower

Move the winch control switch to the “HIGH SPEED” position. Move the control lever to the “UP” or “DOWN” position. The high speed hoist will activate after engaging the control lever. Refer to Figure 1–49.

Note: Using the high speed hoist reduces the maximum line pull by approximately one-half. The high speed hoist button can be activated at anytime during either winch mode. Switching the high speed hoist button before engaging the winch control lever will make the system work smoother.

Operator's Manual



To return to standard winch mode

Move winch control switch to the “LOW SPEED” position. Winch will immediately return to standard speed.

Winch Disable

Move 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, move the drum rotation indicator switch, on the control console (Figure 1–33), 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. Move drum rotation switch to the “OFF” position to deactivate system.

Boom Hoist System

Raising and lowering the boom is controlled by the boom hoist control lever located on the right arm rest. Refer to Figure 1–49.

To raise the boom (boom up): Move the right joystick control lever to the left. If equipped with single axis controllers, move the right control back towards the operator.

To lower the boom (boom down): Move the right joystick control lever to the right. If equipped with single axis controllers, move the right control forward away from the operator.

CAUTION

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

To stop the boom: Return the right control lever to neutral.

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 1–50.

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 the desired length using the control in the operator's cab. The telescope feature has two modes of operation:

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 system.

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 system.

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

When telescoping the boom, remember the capacities on the capacity chart in the Crane Rating Manual are based on having all of the boom sections extended in accordance with boom modes “A” or “B”.

Depending on how the crane is equipped use one of the following controls to operate the boom telescope system:

Telescope Control Lever

On cranes equipped with a rear (main) winch only, use the left control lever to extend or retract the boom. Move the control lever forward to extend the power sections of the boom. Move the control lever rearward to retract the power sections.

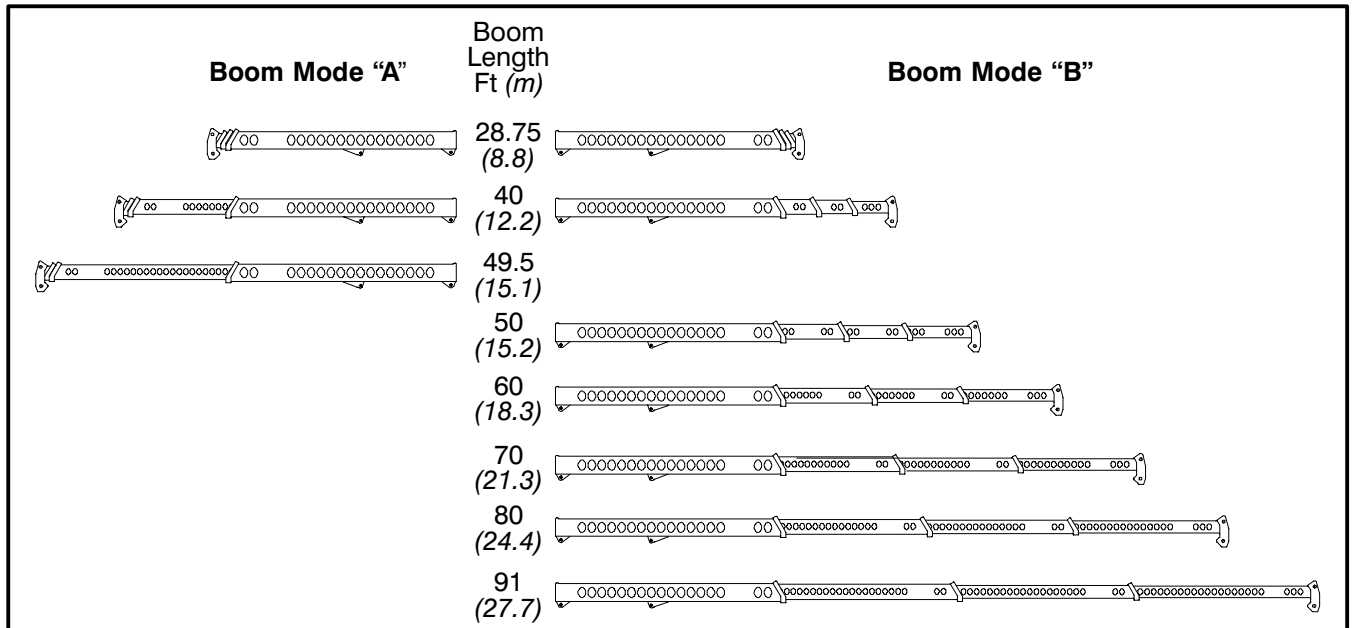


Figure 1–51
Boom Telescope Mode

Telescope Control Pedal

Figure 1–49 shows the location of the telescope control pedal in the operator's cab. On cranes equipped with a front (auxiliary) winch use the telescope control pedal to extend or retract the boom. Depress the toe of the telescope control pedal to extend the boom. Depress the heel of the telescope control pedal to retract the boom.

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. Refer to Figure 1–49 for switch location in the upper operator's cab.

To Extend The Boom Power Sections

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

3. Set the rated capacity limiter to the desired boom mode.
4. Move the left control lever forward or 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.

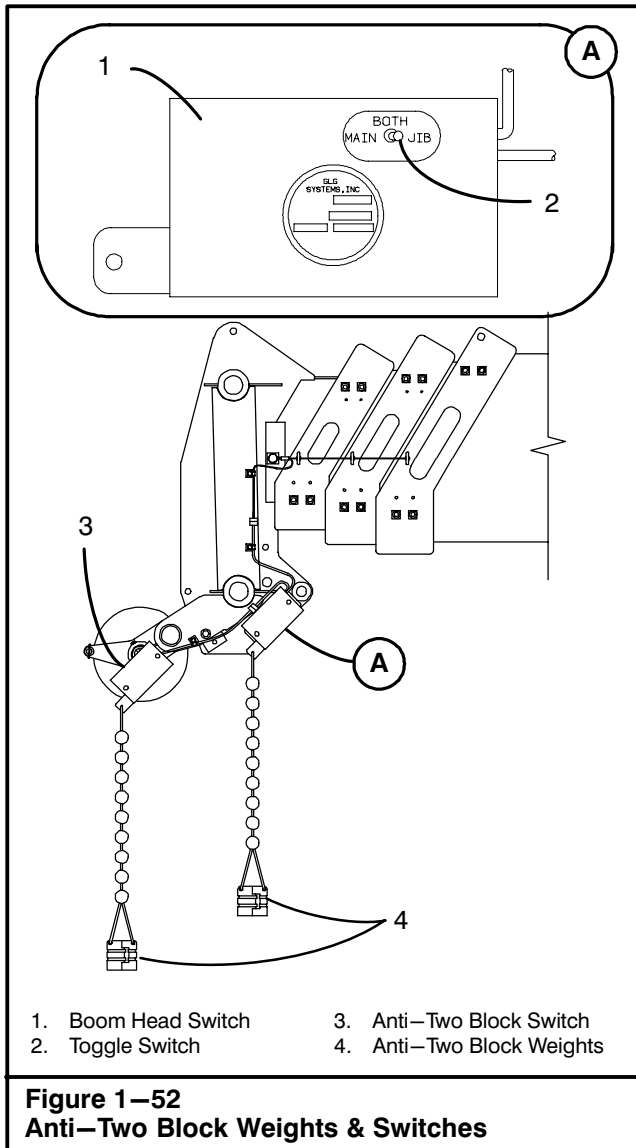
5. Move the left control lever to the neutral position or release the telescope control pedal to stop the boom.

Note: The left control lever and the telescope control pedal are spring loaded and will return to the neutral position when released.

To Retract The Boom Power Sections

1. Move the left control lever rearward or depress the heel of the telescope control pedal.
2. Stop the power sections by releasing the left control lever or the telescope control pedal.

Operator's Manual



Three basic components are used to make up the anti-two block system. The anti-two block weight, the head machinery switches, and the display unit in the operator's cab. Refer to Figure 1-52.



WARNING

Use rotation resistant wire rope only. The chain on the anti-two block weight may get entangled with non rotation resistant wire rope causing a two block alarm condition.

An anti-two block weight is suspended from each of the head machinery switches and is used to hold the switch in the off position. When the anti-two block weight is lifted by the hook block, 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 also activate.

The hydraulic function limiters prevent 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 utilized.

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

Boom Head Switch

The switch used on the main boom head is different from the other head machinery switches used in the two block system. It has its own three position switch, which must be properly set by the operator in order for the system to work. This toggle type switch is used to designate the arrangement of the attachments being monitored by the system. Manually set the switch on:

Main: When wire rope is reeved from the boom head machinery only.

Jib: When wire rope is reeved from any attachment (auxiliary lifting sheave, fly or telescoping fly) only.

Both: When wire rope is reeved from the boom head machinery and any attachment at the same time.

Note: In addition to the proper boom head switch setting, the cable connections must also be made to the attachment to be monitored (auxiliary lifting sheave, fly or telescoping fly).

Crane Monitoring System

Crane monitoring systems are available for monitoring boom length, boom angle, load weight and two block situations.

Anti-Two Block Warning System

An anti-two block warning system is an electromechanical system designed to alert the operator before the hook block or hook ball contacts the head machinery of the main boom, auxiliary lifting sheave, fly or telescoping fly. When a two block situation is imminent, an audio/visual alarm and function limiters are 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.

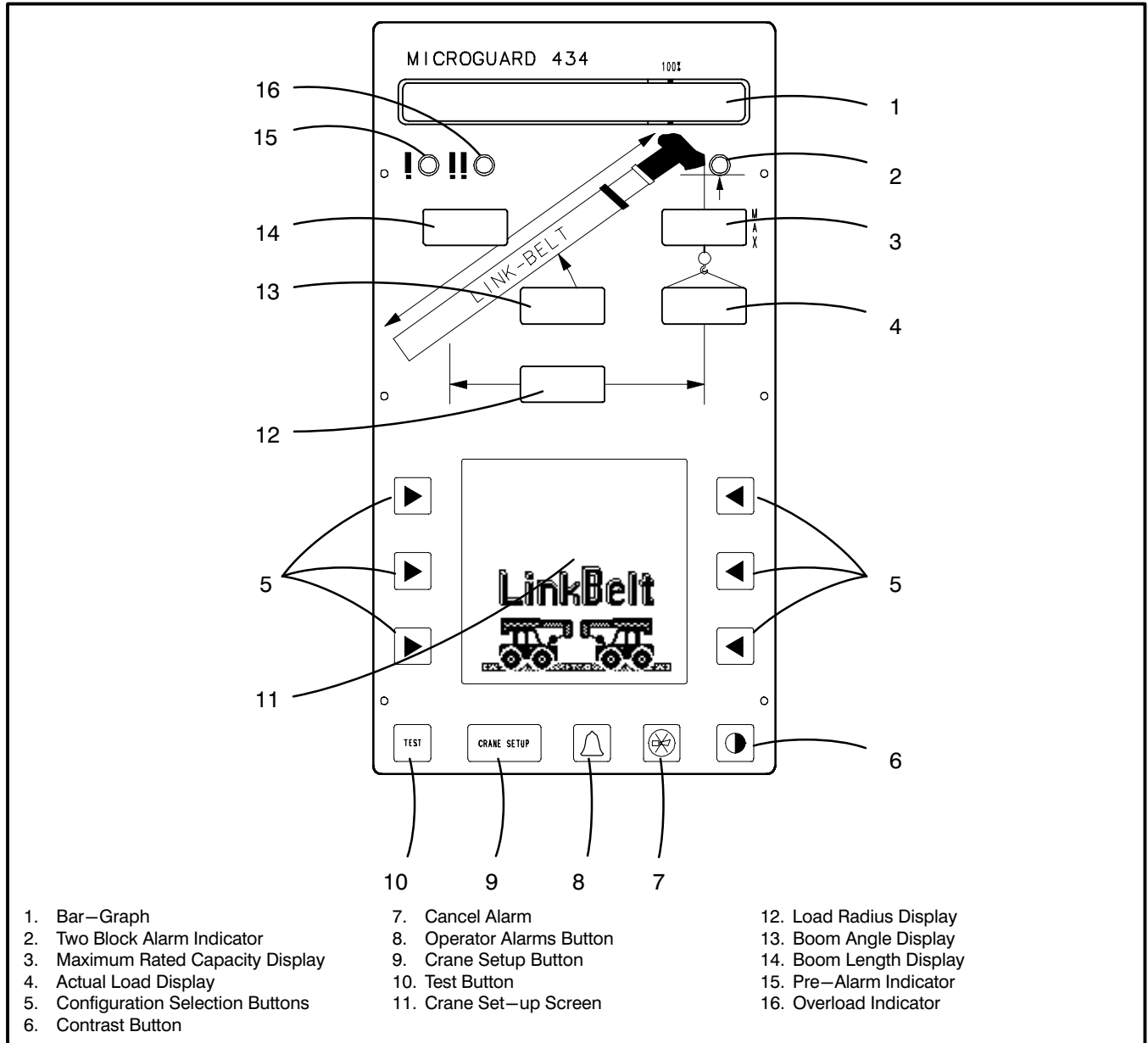


Figure 1–53
Microguard 434 Rated Capacity Limiter

Rated Capacity Limiter

The following describes the function and operation of the Microguard 434 Rated Capacity Limiter. 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!!

Operator's Manual

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 MicroGuard 434 Rated Capacity Limiter provides the operator with a continuous display of:

- Rated Capacity
- Actual Load
- Percentage of Rated Capacity
- Radius of the Load
- Angle of the Main Boom
- Crane Configuration
- Length of the Main Boom

Note: The head height may be displayed by accessing the angle/length/height operator settable alarm screen.

An additional feature of the system is the provision of operator settable alarms. These alarms, when properly set, provide a method of obstacle avoidance. This is achieved by means of minimum and maximum boom angle, maximum boom length, maximum 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 1–53.

1. Bar–Graph

The Bar–Graph is an analog 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. The 100% RATED CAPACITY indicator above the bar–graph marks the point at which 100% of the rated capacity of the crane has been reached. The leading edge of the bar–graph aligns with three colored bands around the bar–graph window. Red indicates an overload. Between the red and yellow is a black notch which indicates 100% of rated capacity. Yellow indicates 90–99.9%, and green indicates below 90% rated capacity.

Note: System may be equipped with an overhead bar graph which operates similar to the bar graph on the display. Refer to Figure 1–54.

2. Two Block Alarm Indicator

The Two Block Alarm Indicator illuminates anytime a two block situation is imminent. An audible alarm and function limiters will also activate when a two block situation is imminent. Once the two block situation is corrected the system will return to normal working mode.

3. Maximum Rated Capacity Display

The Maximum Rated Capacity 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 set–up screen, and which determines the section of the capacity chart to be used as the rated capacity reference.

Note: All maximum rated load data shown is X 1,000 lb (kg), e.g. 12.6=12,600 lb (kg).

4. Actual Load Display

The Actual Load Display is a digital display which shows 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.

Note: All actual load data shown is X 1,000 lb (kg), e.g. 12.6=12,600 lb (kg).

5. Configuration Selection Buttons

These buttons are used during the crane configuration selection routine. Refer to “Configuration Selection” found later in this section of the Operator's Manual.

6. Contrast Button

This button is used to adjust the display contrast.

7. Cancel Alarm Button

This button is used 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 by–pass function limit which has occurred as a result of either an Overload or a Two Block alarm.

8. Operator Alarms Button

This button is used to start the operator settable alarms routines. Refer to “Operator Settable Alarms” found later in this Operator's Manual.

9. Crane Set Up Button

This button is used to start the configuration selection routine. Refer to "Configuration Selection" found later in this section of the Operator's Manual.

10. Test Button

This button is used to initiate a system self test and also used to display fault codes. Refer to "To Perform System Test" found later in this section of the Operator's Manual.

11. Crane Set-Up Screen

The Crane Set-Up Screen provides the operator with a graphical representation of the crane's current configuration during the normal working mode. It also provides graphical icons used during the crane configuration selection routine.

12. Load Radius Display

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

13. Boom Angle Display

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

14. Boom Length Display

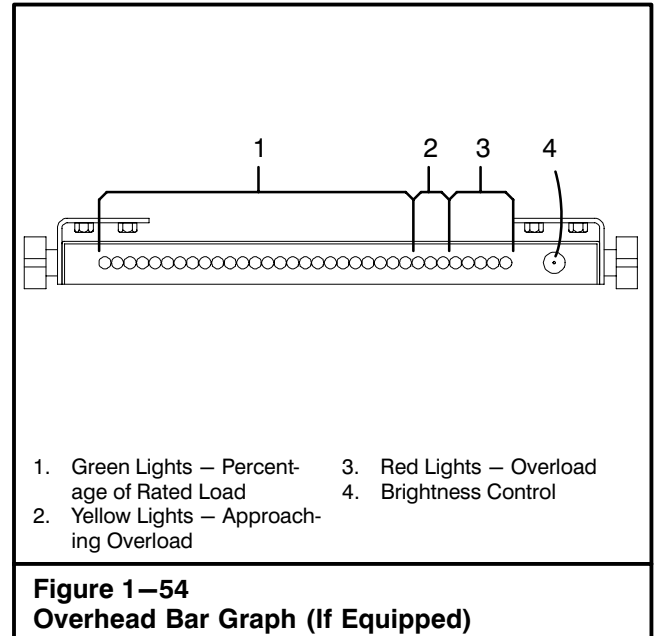
The Boom Length Display gives a continuous indication of the boom length in feet (m). It is the distance from the centerline of the boom foot pin to the centerline of the boom head machinery.

15. The Pre-Alarm indicator

The Pre-Alarm (amber) Indicator illuminates at a pre-set value of 90% of Maximum Rated Capacity and provides a visual indication of an approach to an overload. The pre-alarm indicator will also illuminate when an operator settable alarm value is approached.

16. Overload Indicator

The Overload Indicator (red) illuminates at a pre-set value of 100% of Maximum Rated Capacity and provides a visual indication of Maximum Allowed Load. It will also illuminate whenever a wire rope limit is exceeded or an operator settable alarm has been reached or 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 for all 4 conditions.



System Operation

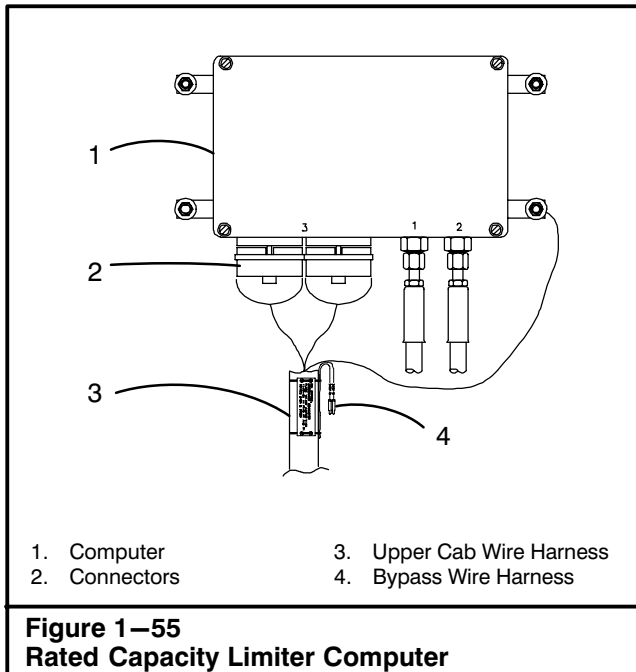
The following is a list of procedures which are used to operate the multiple features of the rated capacity limiter. Use these procedures in conjunction with the previous display unit control descriptions.

To Perform System Test

At start-up the system automatically performs a self test after which it goes directly to the normal working screen. The self-test can be initiated any time during normal operation of the system by using the TEST button.

One press (press and release) will cause the system to execute a self test routine during which all lamps, audible alarms and digital displays will be functionally tested and all memory areas checked for accuracy. If faults in the system are detected during a test, the crane set-up screen will show the words FAULT DETECTED. If the words FAULT DETECTED occurs, press and hold the TEST button. This will cause the display to change to the FAULT mode. In this mode, information about the fault condition will be displayed in the crane set-up screen by means of an error code. Contact your local distributor for details of the fault codes.

Operator's Manual



System Bypass

In emergency situations, the Rated Capacity Limiter computer can be bypassed. The computer is located on the back of the operator's cab. There is a bypass instruction label and a bypass wire harness attached to the upper cab wire harness. Follow the instructions on the label to install the bypass wire harness when required. For emergency use while the system is bypassed, refer to "Emergency Use of Operation Aids" found in this Operator's Manual.



WARNING

The Microguard 434 is not operational when the computer is bypassed. Bypass the system in emergency situations only.

Emergency Use of Operation Aids

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 recalibration or repairs 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 at which the load is to be handled.
3. When a boom angle or radius indicator is inoperative or malfunctioning, radii or boom angle shall be determined by measurement.
4. When the anti-two block warning system 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 system is 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 marking on the boom.
6. When a level indicator is inoperative or malfunctioning, other means shall be used to level the crane.

Operator's Manual

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 choose that configuration. Only when the crane is rigged differently must a new configuration be selected. Use the following procedure along with Figure 1–56 to select the crane configuration (the following step numbers correspond with the numbered screens in Figure 1–56).

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

Note: Depending on how the crane is equipped or which selections have been made, some screens shown in Figure 1–56 may not appear or may not appear as illustrated. The system cannot be programmed for configurations not allowed by the capacity charts listed in the Crane Rating Manual.

1. From the normal working screen press the CRANE SET UP button. The crane set–up screen will change and graphically display the carrier options. Press the corresponding configuration selection button to select the desired carrier configuration.



WARNING

The Microguard 434 is not operational when in the RIGGING/TRAVEL Mode. Return the Microguard 434 to normal operation before operating the crane.

2. The crane set–up screen will change and graphically display the boom mode options. Press the corresponding configuration selection button to select the desired boom mode.
3. The crane set–up screen will change and graphically display the auxiliary lifting sheave fitted or not fitted. Press the corresponding configuration selection button to select the desired auxiliary lifting sheave.
4. If the crane is equipped with a fly, the crane set–up screen will change and graphically display an erected attachment. Press the corresponding configuration selection button to select the desired erected attachment if required.
5. If an offset fly was previously selected, the crane set–up screen will change and graphically display the available offset angles. Press the correspond-

ing configuration selection button to select the desired offset angle if required.

6. The crane set–up screen will change and graphically display the rear winch lifting point. Press the corresponding configuration selection button to select the desired rear winch lifting point as indicated by the flashing arrows. Or press the corresponding configuration selection button to select the rear winch not in use.
7. If the crane is equipped with a front winch, the crane set–up screen will change and graphically display the front winch lifting point. Press the corresponding configuration selection button to select the desired front winch lifting point as indicated by the flashing arrows. Or press the corresponding configuration selection button to select the front winch not in use.
8. If the crane is equipped with a fly and was not selected as an erected attachment, the crane set–up screen will change and graphically display the stowed deduct. Press the corresponding configuration selection button to select the desired stowed deduct if required.
9. The crane set–up screen will change to the normal working screen and graphically display the crane configuration as previously selected. Press the corresponding configuration selection button to select the desired parts–of–line for the rear winch.
10. If the crane is equipped with a front winch and it was selected, press the corresponding configuration selection button to select the front winch. Press the corresponding configuration selection button to select the desired parts–of–line for the front winch.

Note: From the normal working screen, after crane setup has been established, only two selection buttons are active; the winch select button and the parts of line button.

To change winches, push the winch select button to toggle between winches. The winch lifting points cannot be changed without going through the crane setup routine.

The parts of line can be changed for the selected winch by pressing the parts of line button to scroll through the available options for that winch.

Refer to Figure 1–57 and Figure 1–58 for examples of some normal working screens.

Operator's Manual

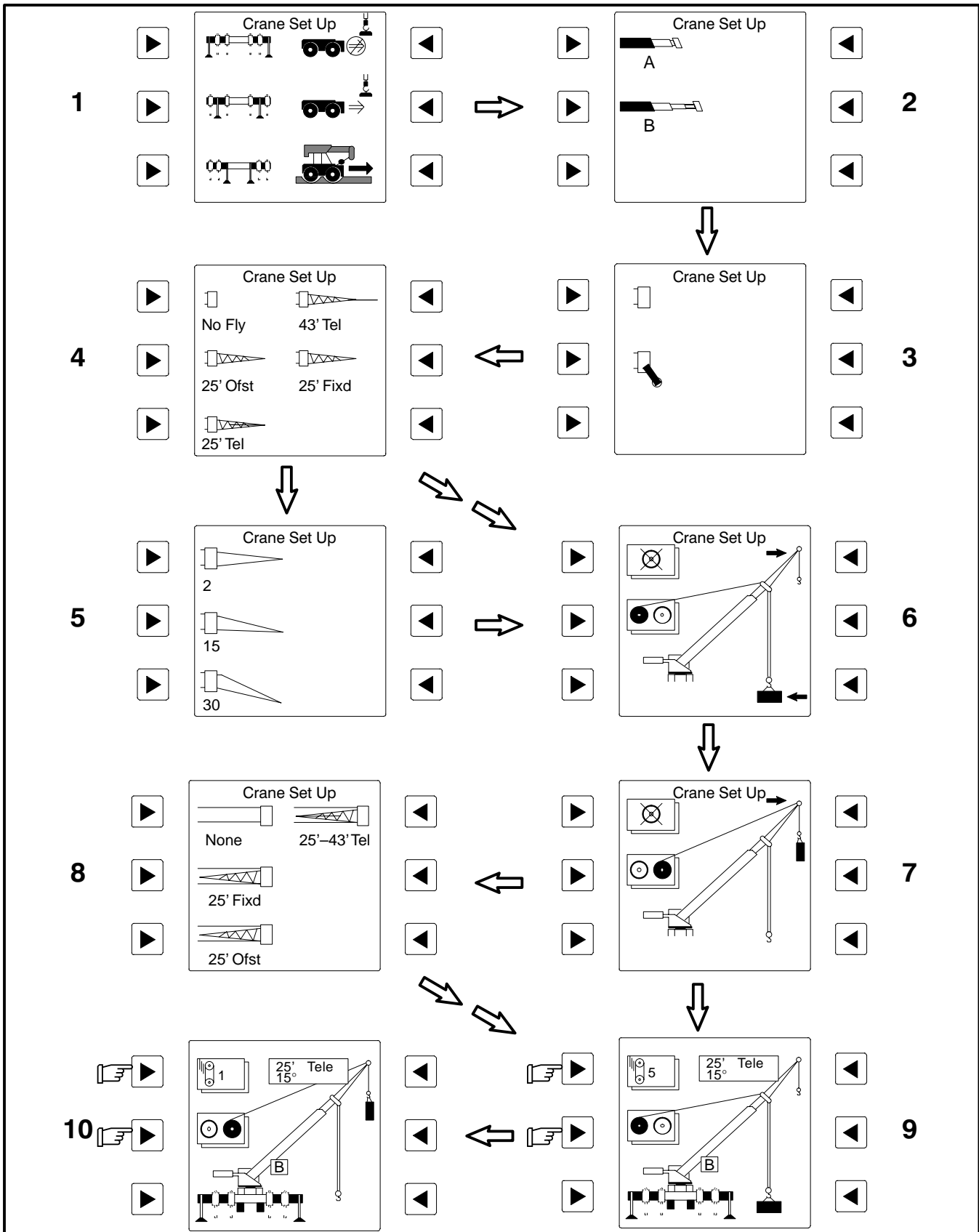
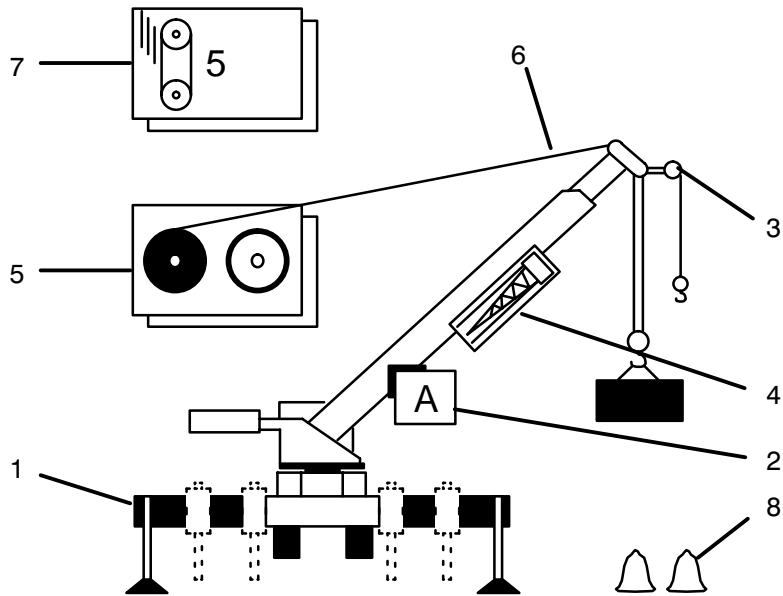
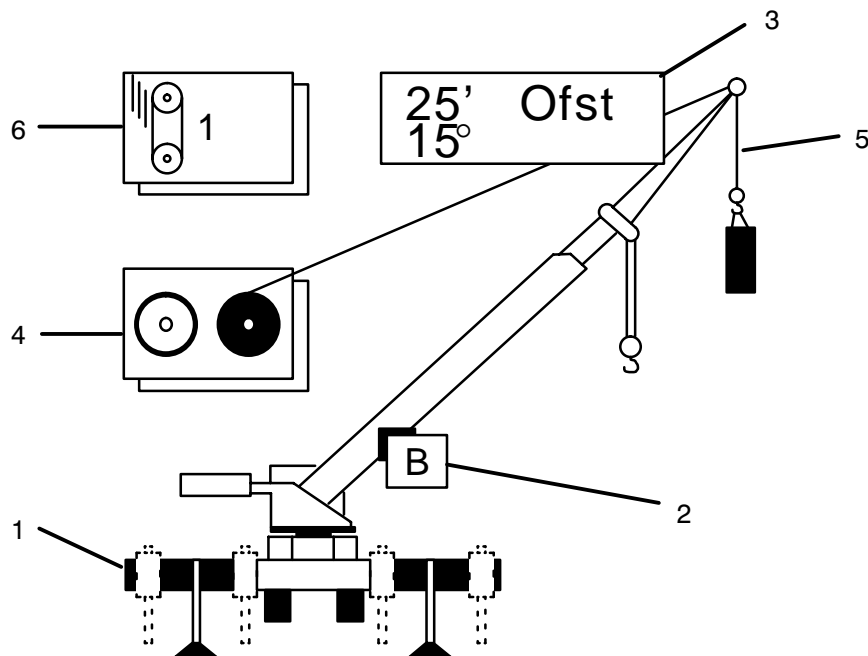


Figure 1-56
Configuration Selection Flow Chart

Operator's Manual



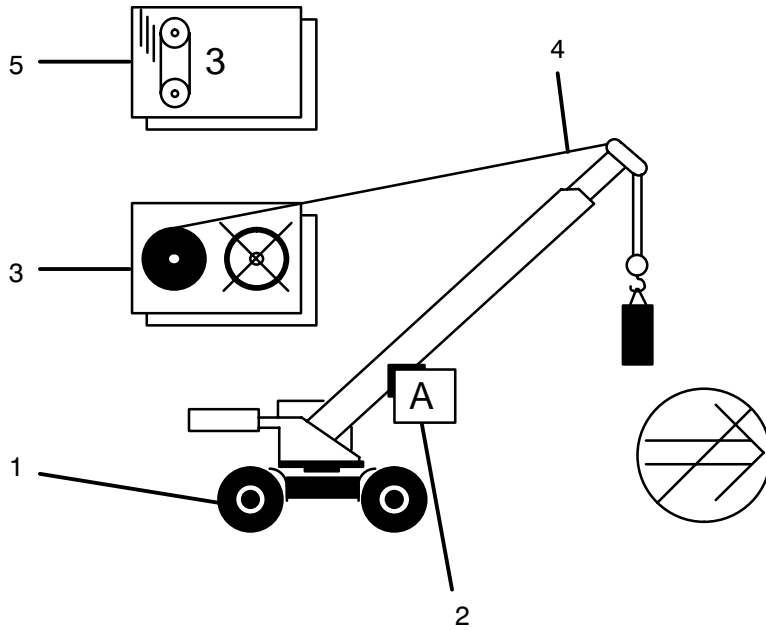
In this example the crane is setup on fully extended outriggers (1), boom mode A (2), auxiliary head fitted (3), 25' fly stowed (4), the front winch available with the aux head and the rear winch selected (5) with the winch rope reeved over the main boom (6), with five parts of line (7), two operator alarms have been set (8).



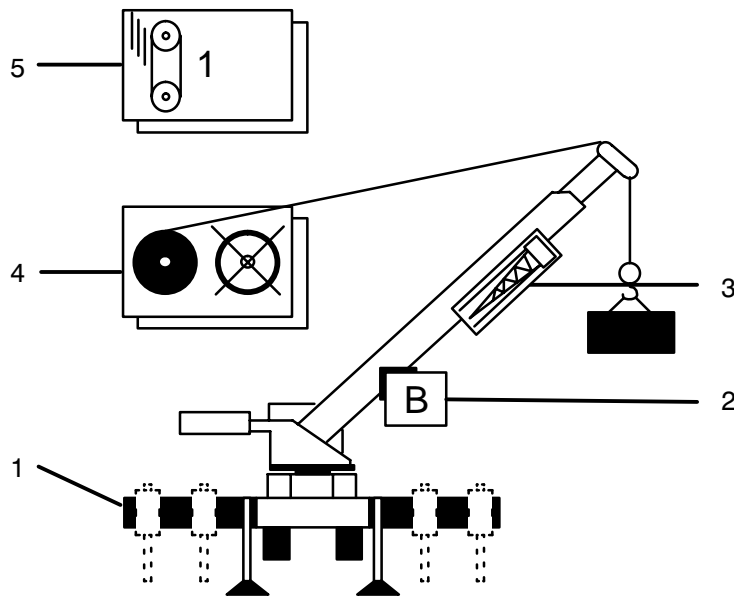
In this example the crane is setup on intermediate extended outriggers (1), boom mode B (2), 25' offset fly erected with 15° offset (3), the rear winch available with the main boom and the front winch selected (4), with the winch rope reeved over the 25' offset fly (5), with one part of line (6).

Figure 1–57
Normal Working Screen Examples

Operator's Manual



In this example the crane is setup for stationary tires (1), boom mode A (2), front winch not in use and the rear winch selected (3), winch rope reeved over the main boom (4), with three parts of line (5).




In this example the crane is setup on fully retracted outriggers (1), boom mode B (2), 25' fly stowed (3), front winch not in use and the rear winch selected (4), with one part of line (5).

Figure 1–58
Normal Working Screen Examples

To Select Rigging/Travel Mode

The CRANE SET UP push-button is also used to select RIGGING/TRAVEL MODE. This mode is used to facilitate rigging and travel of the crane by inhibiting function limiters and the audible alarm while selected. To resume crane operation, select proper outrigger or tire configuration per the proper procedure.

 **WARNING**

The Microguard 434 is not operational when in the RIGGING/TRAVEL Mode. Return the Microguard 434 to normal operation before operating the crane.

1. From the normal working screen press the CRANE SET UP button. The crane set-up screen will change and graphically display the carrier options.
2. Press the corresponding configuration selection button to select RIGGING/TRAVEL MODE. Refer to Figure 1-59.
3. The crane set-up screen will change and graphically display the RIGGING/TRAVEL MODE icon.

To 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 re-started.

The CANCEL ALARM is also used to reset the function limiters when it is necessary to by-pass 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 3 seconds, after which the function limiters will be reset to allow normal 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.

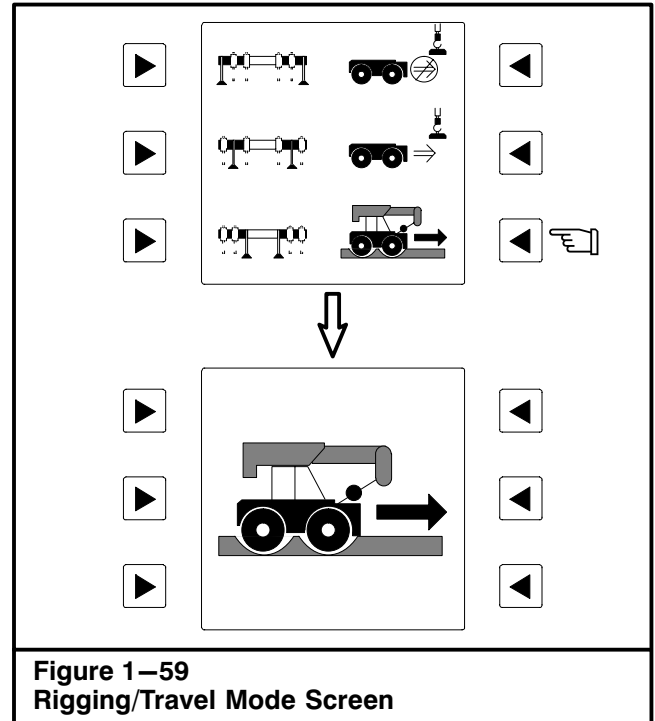



Figure 1-59
Rigging/Travel Mode Screen

 **WARNING**

Once the function limiters have been by-passed, 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.

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 settable alarms will be stored in the computer memory, even if the crane is shutdown, until they are cleared. Refer to Figure 1-60.

Six alarms are available for operator use.

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

Operator's Manual

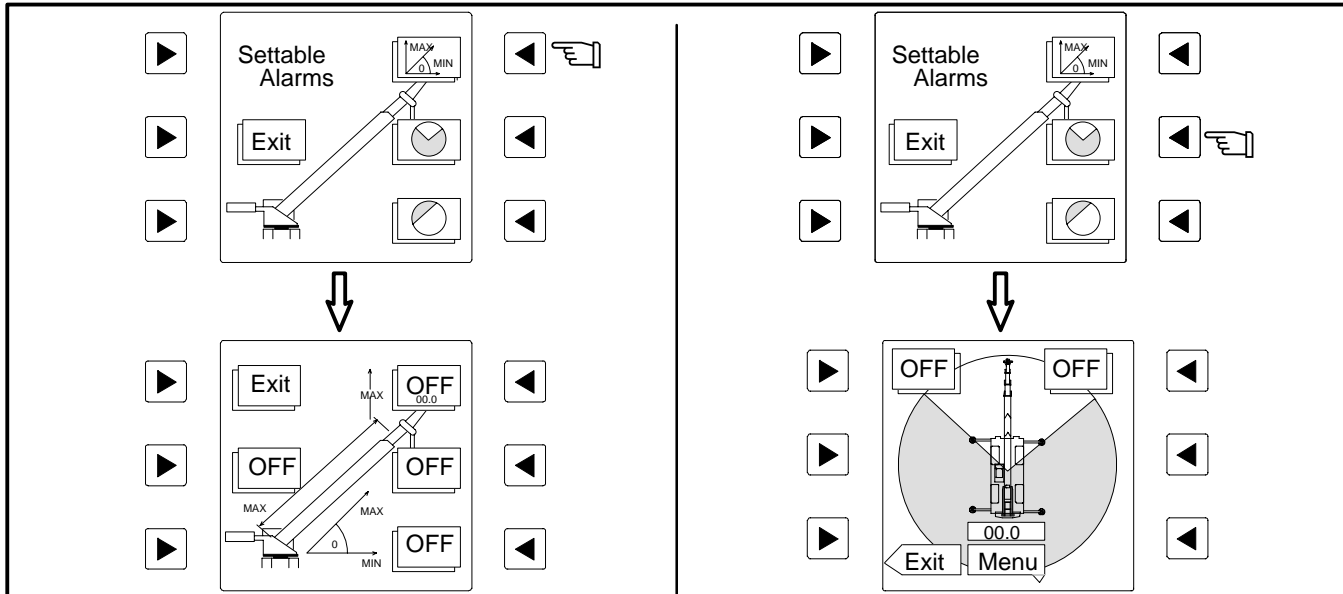


Figure 1-60
Operator Settable Alarms



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.

Setting Length/Angle/Height/Swing Operator Alarms

1. From the normal working screen press OPERATOR ALARM button to access the Operator Settable Alarm screen.
2. Press the corresponding selection button to select the desired alarm to be set.

Note: The bottom value displayed in the max height alarm box is the current head height.



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.

3. Place the crane in the desired position depending upon the alarm to be set. The numerical value displayed will be the current position of the crane.

Note: If an alarm had been previously set, the numerical value displayed will be the previously set alarm value. The previous alarm must first be cleared, then set the new alarm. Alarms which are not set are indicated by the word OFF.

4. Press the corresponding selection button to set the alarm value.
5. When all alarms are set press the EXIT button to return to the normal working screen or press the MENU (Operator Alarm) button to return to the previous menu screen.
6. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching the alarm set point the pre-alarm (amber) indicator lamp will illuminate, the audio will sound intermittently, and a warning message will appear in the Crane Set-up Screen. When exceeding the alarm set point the red lamp will illuminate, the audible alarm will sound continuously, and a warning message will appear in Crane Set-Up Screen.

Note: An alarm icon will appear on the normal working screen to alert the operator that an operator alarm has been set. The number of icons shown indicate how many operator alarms have been set.

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

Operator's Manual



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 and capacity chart and working area 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 OPERATOR ALARM button to access the alarm screen.
2. Press the corresponding button for minimum angle (top right).
3. Move the boom to a 30 degree angle.
4. Press the corresponding button (bottom right) to enter the alarm. The displayed value will be the alarm setting.
5. Press the EXIT button to return to the normal working screen or the MENU (Operator Alarm) button to return to the previous menu screen.
6. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching 30 degree boom angle the pre-alarm (amber) indicator lamp will illuminate, the audio will sound intermittently, and “!Minimum Angle” will appear in the Crane Set-up Screen. The red lamp will illuminate, the audible alarm will sound continuously, and “!Minimum Angle” will appear in Crane Set-Up Screen whenever the boom is lowered below 30 degrees.

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 OPERATOR ALARM button to access the alarm screen.
2. Press the corresponding button for maximum angle (top right).
3. Move the boom to a 60 degree angle.
4. Press the corresponding button (middle right) to enter the alarm. The displayed value will be the alarm setting.

5. Press the EXIT button to return to the normal working screen or press the MENU (Operator Alarm) button to return to the previous menu screen.
6. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching 60 degree boom angle the pre-alarm (amber) indicator lamp will illuminate, the audio will sound intermittently, and “!Maximum Angle” will appear in the Crane Set-up Screen. The red lamp will illuminate and the audible alarm will sound continuously whenever the boom is raised above 60 degrees and “!Maximum Angle” will appear in Crane Set-Up Screen.

To Set Maximum Length Alarm

Example: To have an alarm whenever the boom length exceeds 50 feet, use the following procedure:

1. From the normal working screen press the OPERATOR ALARM button to access the alarm screen.
2. Press the corresponding button for maximum length (top right).
3. Extend the boom to 50 feet.
4. Press the corresponding button (middle left) to enter the alarm. The displayed value will be the alarm setting.
5. Press the EXIT button to return to the normal working screen or press the MENU (Operator Alarm) button to return to the previous menu screen.
6. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching 50 foot boom length the pre-alarm (amber) indicator lamp will illuminate, the audio will sound intermittently, and “!Maximum Length” will appear in the Crane Set-up Screen. The red lamp will illuminate and the audible alarm will sound continuously whenever the boom is extended beyond 50 feet and “!Maximum Length” will appear in Crane Set-Up Screen.

To Set Maximum Height Alarm

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

1. Press the OPERATOR ALARM button to access the alarm screen.
2. Press the corresponding button for maximum height (top right).

Note: The bottom value displayed in the max height alarm box is the current head height.

3. Extend the boom and/or adjust the boom angle so that the tip height is 75 feet.

Operator's Manual

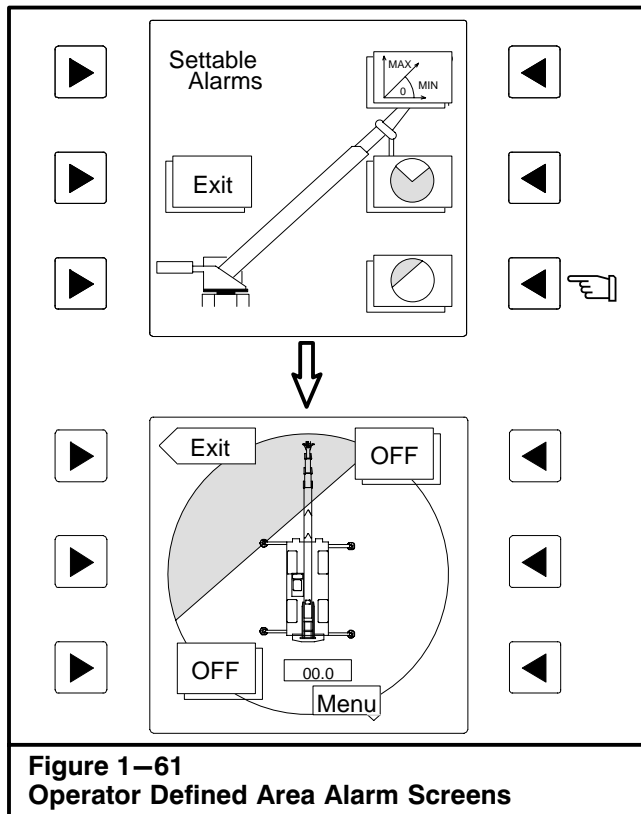


Figure 1-61
Operator Defined Area Alarm Screens

4. Press the corresponding button (top right) to enter the alarm. The displayed value will be the alarm setting.
5. Press the EXIT button to return to the normal working screen or press the MENU (Operator Alarm) button to return to the previous menu screen.
6. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching 75 foot boom tip height the pre-alarm (amber) indicator lamp will illuminate, the audio will sound intermittently, and “!Maximum Length” will appear in the Crane Set-up Screen. The red lamp will illuminate and the audible alarm will sound continuously whenever the boom tip height exceeds 75 feet and “!Maximum Height” will appear in Crane Set-Up Screen.

To Set Left & 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. Press the OPERATOR ALARM button to access the alarm screen.
2. Press the corresponding button for the swing alarm (middle right).
3. Swing the boom to the left alarm point.

4. Press the corresponding button (top left) to enter the left alarm point. The displayed value will be the left alarm setting.
5. Swing the boom to the right alarm point.
6. Press the corresponding button (top right) to enter the right alarm point. The displayed value will be the right alarm setting.
7. Press the EXIT button to return to the normal working screen or the MENU (Operator Alarm) button to return to the previous menu screen.
8. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching the set alarm point the pre-alarm (amber) indicator lamp will illuminate, the audio will sound intermittently, and “!Swing Alarm” will appear in the Crane Set-up Screen. The red lamp and the audible alarm will be activated whenever the swing exceeds the alarm points and “!Swing Alarm” will appear in Crane Set-Up Screen.

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

To Set 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 pre-alarm (amber) indicator lamp will illuminate, the audio will sound intermittently, and the message “Bad Area” will appear on the Crane Set-Up Screen. When passing the plane the overload (red) warning lamp will illuminate, the audio alarm will sound continuously, and the message “Bad Area” will appear on the Crane Set-Up Screen. Use the following procedure, Figure 1-61, and Figure 1-62 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.

Operator's Manual

Setting Operator Defined Area Alarm

1. From the normal working screen press the OPERATOR ALARM button to access the Operator Alarm screen.
2. Clear any previously set left and right swing alarms if required. Refer to "To Clear Operator Settable Alarms" found later in this section of the Operator's Manual.

Note: The left and right swing alarms must be cleared prior to setting the defined area alarm.

3. Press the corresponding button for Area Alarm (bottom right). Refer to Figure 1–61.



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.

4. Position the boom, attachment, load, rigging, etc. to the left alarm point and press the corresponding button (bottom left) to enter the left alarm point. The displayed value will be the left alarm setting.
5. Position the boom, attachment, load, rigging, etc. to the right alarm point and press the corresponding button (top right) to enter the right alarm point. The displayed value will be the right alarm setting.

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

6. When both alarm points are set, press the EXIT button to return to the normal working screen or the MENU button to return to the previous menu screen.
7. Test the alarm, with no load, to ensure the alarm points have been properly set. When approaching the plane the pre-alarm (amber) indicator lamp will illuminate, the audio will sound intermittently, and the message "Bad Area" will appear on the Crane Set-Up Screen. When passing the plane the overload (red) warning lamp will illuminate, the audio alarm will sound continuously, and the message "Bad Area" will appear on the Crane Set-Up Screen.



WARNING

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

To Clear Operator Settable Alarms

1. From the normal working screen press the OPERATOR ALARM button to access the Operator Alarm screen.
2. Press the corresponding selection button to select the desired alarm to be cleared.
3. Press the corresponding button for each alarm until the value is replaced with the word OFF.
4. When all alarms are cleared press the EXIT button to return to the alarm screen or press the MENU button to return to the previous menu screen.

Operator's Manual

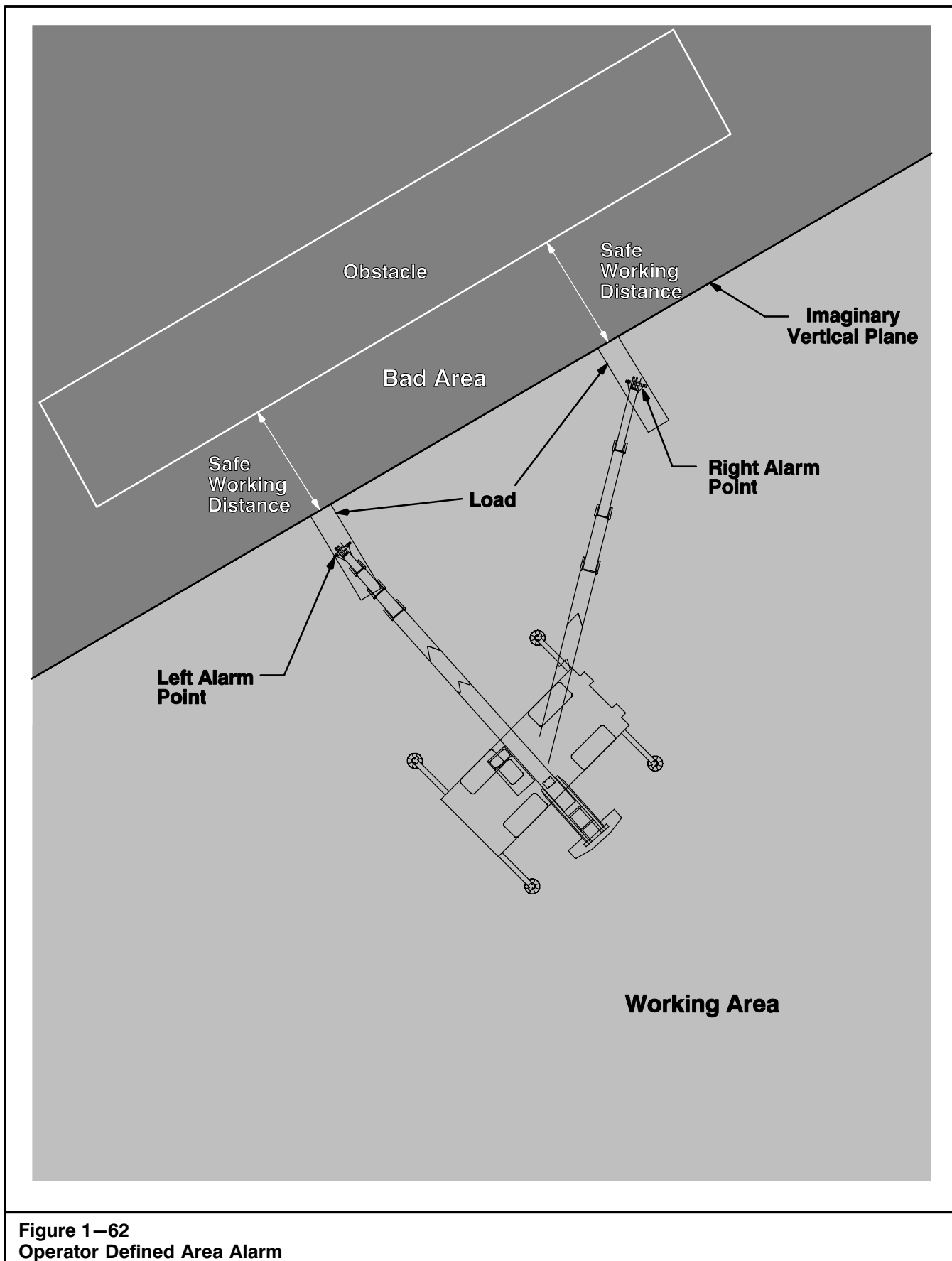
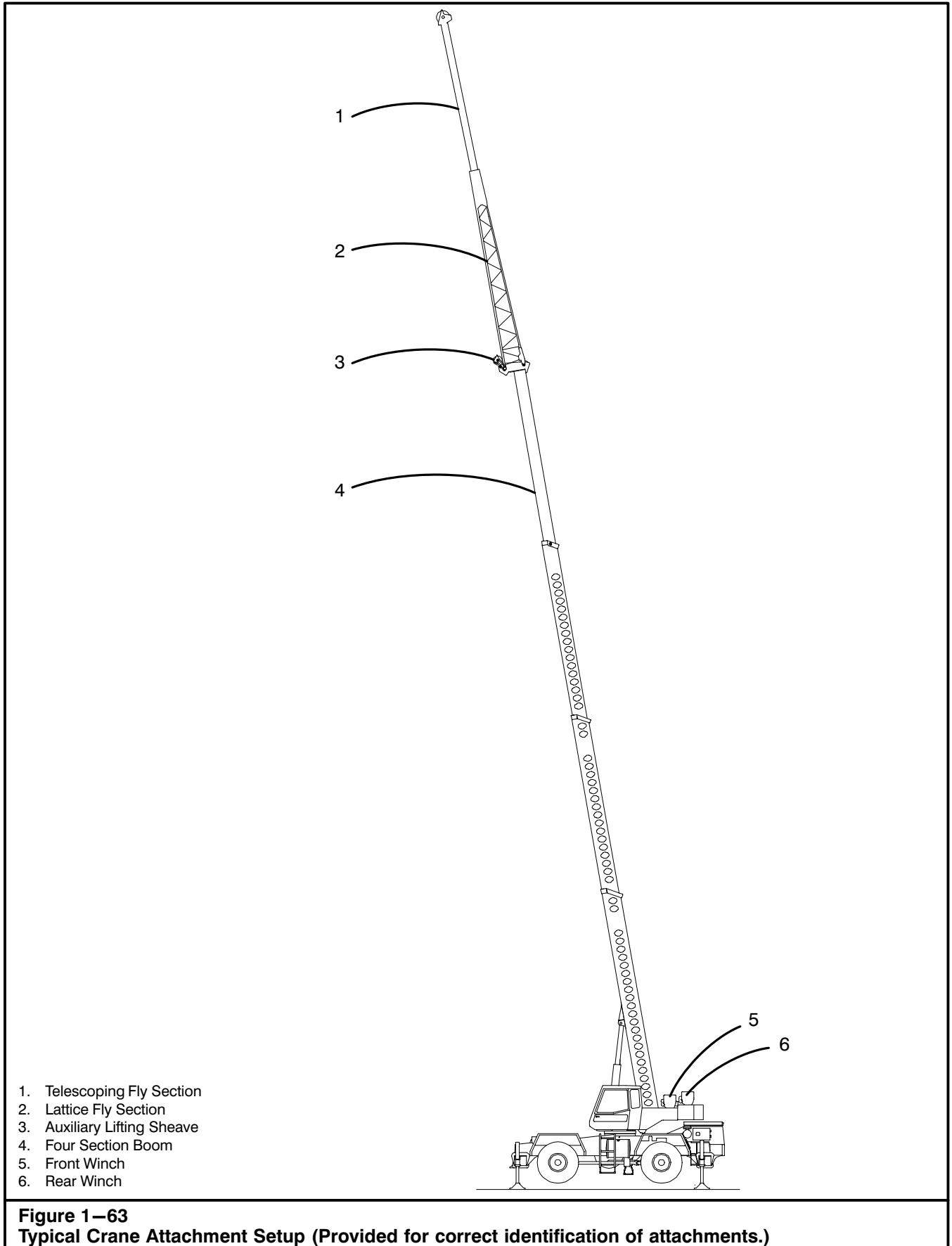


Figure 1-62
Operator Defined Area Alarm



Operator's Manual



Entering And Exiting The Operator's Cab

Entering or leaving 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 operator's cab. Numerous hand grips are also attached to the cab as well as non-skid safety strips on the surface of the carrier deck, to provide safe entry to the 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).

One more feature which is available to ease entry and exit of the operator's cab, is the adjustable operator's seat. Move the seat back as required to allow safe entry. The release lever on the forward left hand side of the seat allows movement of the seat forward and backward. This feature also provides operator comfort

during crane operation. Refer to "Operator's Seat" found earlier in this Section of the Operator's Manual for complete seat operating instructions.

Inside the cab two separate features are provided to prevent accidental operation of the hydraulic controls while entering or exiting the operator's seat.

1. 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 located on the cab control panel. Refer to Figure 1–33. Move the switch to the "DISABLE" position to prevent inadvertent operation of these controls. To allow normal operation of the control levers and the boom telescope pedal, move the function lockout switch to the "OPERATE" position. This switch must always be moved to the "DISABLE" position before entering or exiting the operator's seat.

2. Movable Left Side Console

The left side console is hinged at the rear to allow the operator to pivot the console up, out of the way while entering or exiting the upper cab. A spring assists movement of the console.

Lifting the left arm rest enables the console to pivot up, out of the way for ease of entry and exit. It also performs the same duty as the function lockout switch, described above, disabling all hydraulic functions related to the control levers and boom telescope foot pedal. Make sure the side console is rotated up, out of the way before attempting to enter or leave the upper cab.

Operator's Manual

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 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 crane as outlined in Section 2 of this 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 rear of the crane or on the "Tire Inflation Chart" in Crane Rating Manual. Check wheel lug nut torque, each day, for the first five (5) days of op-

eration and every 100 hours of operation thereafter. Refer to Section 3 of this 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 of this 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 air system pressure to reach its normal operating range. Check 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 located in the operator's cab underneath the left console. Refer to Figure 1—43. 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.

Operator's Manual

Engine Starting Procedure



WARNING

This manual must be thoroughly read and understood by the operator before starting the engine. Crane damage or 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, controls and having read and fully understood this entire 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, shut-down 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 indicator to insure 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 key is on, without the engine running.)
 - c. Low Air Pressure Indicator Light – When air pressure is sufficient for safe operation, the low air pressure indicator light and alarm will turn off. Do not attempt to operate crane until indicator light and alarm are off.
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.
3. Throttle the engine back to idle.
4. Turn the ignition switch to the "OFF" position.
5. Remove the ignition keys from the cab and lock the doors if the crane is to be left unattended.

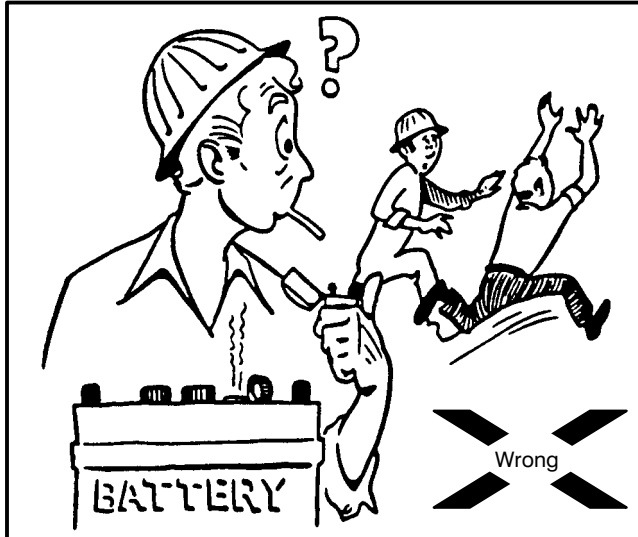


Figure 1-65
Do not use an open flame near the battery.

Jump Starting The Crane

The crane has two (2) 12V batteries. The crane may be configured with a 12V start system or the optional 24V start system. Refer to Figure 1-66 and Figure 1-67 to determine which system the crane is equipped with.

12V Start System

To jump start the crane equipped with 12V start system a 12V power source and two (2) jumper cables are required. Refer to Figure 1-66.

Jump Starting the Crane Equipped with 12V Start System



WARNING

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



WARNING

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

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

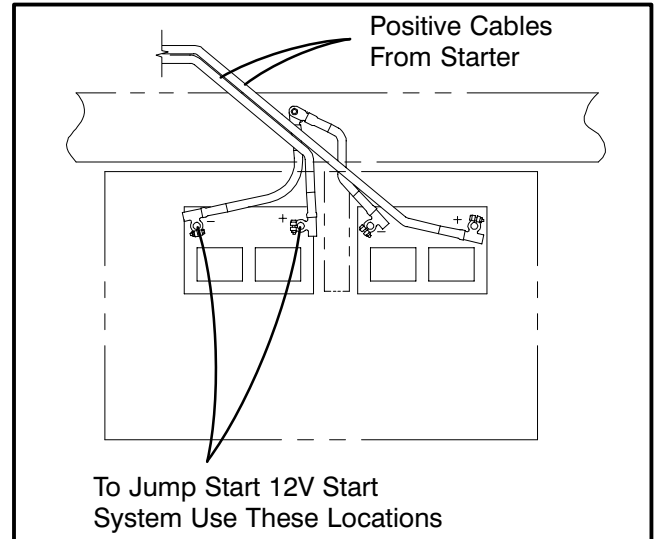


Figure 1-66
12V Start System Battery Cable Connections



WARNING

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

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 the negative (-) terminal of the discharged battery.
6. If another vehicle is used to jump start the crane, start the booster vehicle. Run the booster vehicle's engine at a moderate speed and allow discharged batteries to charge for a few minutes prior to attempting to start the disabled crane.
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 severely discharged, voltage may increase slowly. If voltage does not increase replace the batteries and/or check the electrical system.

Operator's Manual

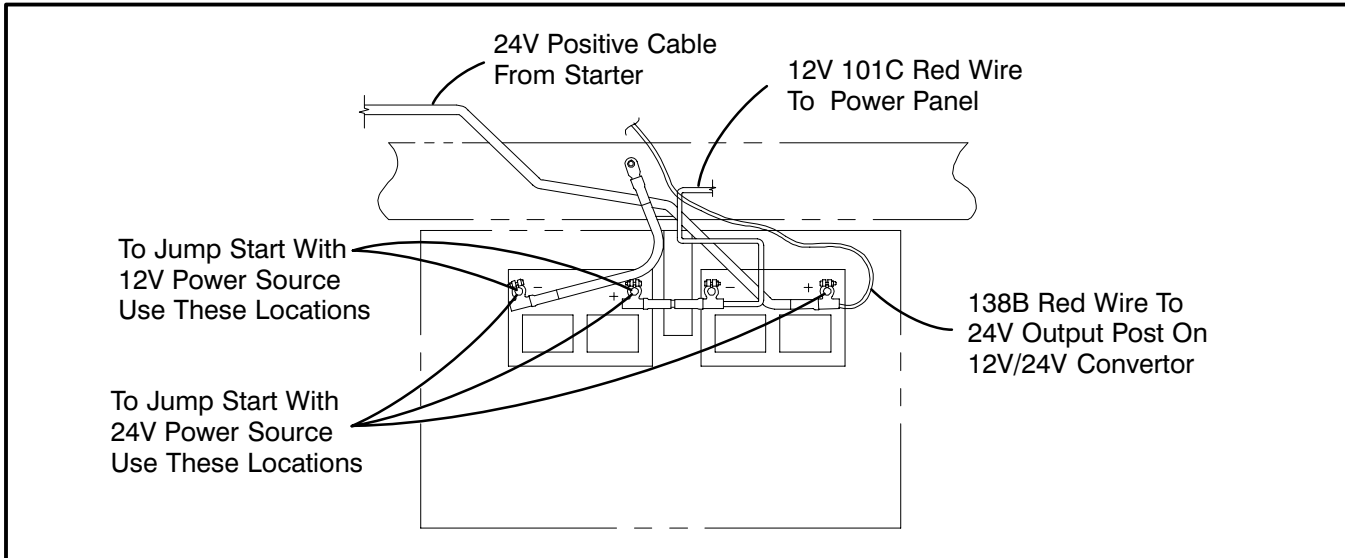


Figure 1-67
24V Start System Battery Cable Connections

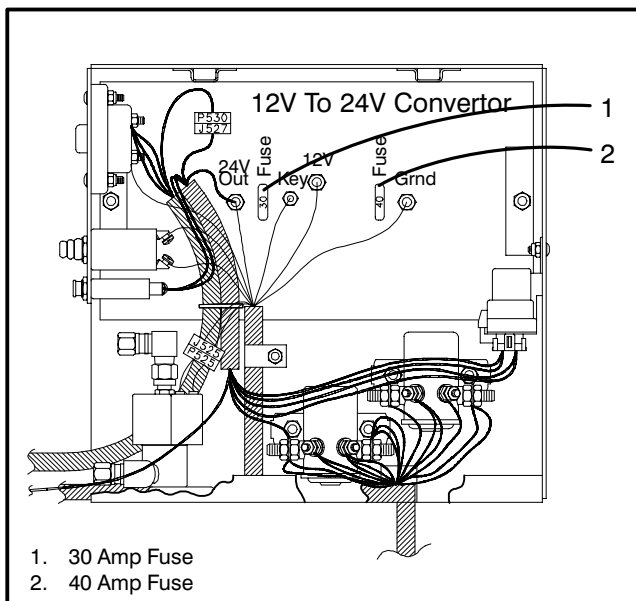


Figure 1-68
24V Start System Power Panel

24V Start System

If the crane is equipped with the 24V start system a 12V to 24V converter is used. The converter contains one (1) 30 amp fuse and one (1) 40 amp fuse to protect the converter. Failure of either the 30 amp or the 40 amp fuse will prevent charging the batteries. The converter is located in the power panel behind the left engine access door. If the crane is equipped with the 24V start system, it is recommended that the crane be jump started using the 24V power source starting method.

Jump Starting the Crane Equipped with 24V Start System Using 24V Source

To jump start the crane using a 24V power source, three (3) jumper cables are required. Refer to Figure 1-67.



WARNING

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



WARNING

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

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



WARNING

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

1. Inspect the converter for blown fuses and replace if necessary. Refer to Figure 1-68.

Operator's Manual

2. Check all battery terminals and remove any corrosion before attaching jumper cables.
3. Connect one end of the first jumper cable to the 24V positive (+) terminal of the discharged battery.
4. Connect the other end of the first cable to the positive (+) terminal of the 24V power source or booster battery.
5. Connect one end of the second jumper cable to the negative (–) terminal of the 24V power source or booster battery.
6. Connect the other end of the second cable to the negative (–) terminal of the discharged battery.
7. Connect one end of the third jumper cable to the 12V positive (+) terminal of the discharged battery.
8. Connect the other end of the third cable to the 12V positive (+) terminal of the 24V power source or booster battery.
9. If another vehicle is used to jump start the crane, start the booster vehicle. Run the booster vehicle's engine at a moderate speed.
10. Turn on the key switch to activate 12/24 volt convertor and allow discharged batteries to charge for a few minutes prior to attempting to start the disabled crane.

Note: If either fuse on the 12/24 volt convertor is blown, the batteries will not charge.

11. Start the disabled crane. After the crane is started, remove jumper cables in reverse order.
12. Let the crane's engine run for a few minutes to charge the discharged batteries.
13. Check the battery gauge in the operator's cab. The gauge reading should be increasing toward 14 volts.

Note: If the batteries are severely discharged, voltage may increase slowly. If voltage does not increase recheck the 30 and 40 amp fuses in the 12/24 volt convertor.

Jump Starting the Crane Equipped with 24V Start System Using 12V Source

To jump start using a 12V power source, two (2) jumper cables are required. Refer to Figure 1–67.



WARNING

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



WARNING

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

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



WARNING

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

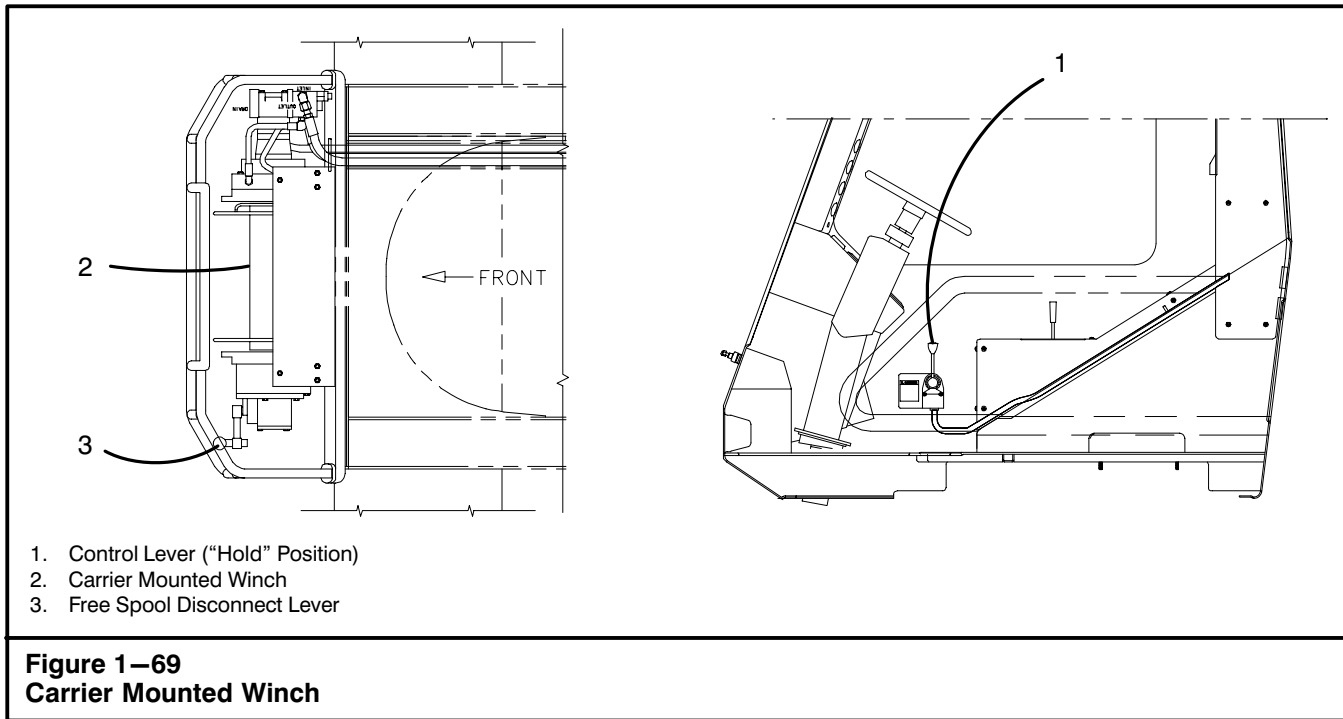
1. Inspect the convertor for blown fuses and replace if necessary. Refer to Figure 1–68.
2. Check all battery terminals and remove any corrosion before attaching jumper cables.
3. Connect one end of the first jumper cable to the 12V positive (+) terminal of the discharged battery.
4. Connect the other end of the first cable to the 12V positive (+) terminal of the 12V power source or booster battery.
5. Connect one end of the second jumper cable to the negative (–) terminal of the 12V power source or booster battery.
6. Connect the other end of the second cable to the negative (–) terminal of the discharged battery.
7. If another vehicle is used to jump start the crane, start the booster vehicle. Run the booster vehicle's engine at a moderate speed.
8. Turn on the key switch to activate 12/24 convertor and allow discharged batteries to charge for a few minutes prior to attempting to start the disabled crane.

Note: If either fuse on the 12/24 volt convertor is blown, the batteries will not charge.

9. Start the disabled crane. After the crane is started, remove jumper cables in reverse order.
10. Let the crane's engine run for a few minutes to charge the discharged batteries.
11. Check the battery gauge in the operator's cab. The gauge reading should be increasing toward 14 volts.

Note: If the batteries are severely discharged, voltage may increase slowly. If voltage does not increase recheck the 30 and 40 amp fuses in the 12/24 volt convertor.

Operator's Manual



Carrier Mounted Winch

The carrier mounted winch, if equipped, is located on the front of the carrier frame. The operating control is located inside the operator's cab, to the right of the operator's seat. Refer to Figure 1-69.

The carrier mounted winch may be used to pull loads within winch and wire rope capacities. The winch is controlled from the operator's cab and has two modes of operation, power in and power out. Pull control lever back to power in the wire rope. Push control lever forward to power out the wire rope.

A manual disconnect lever is provided on the right side of the winch that allows the winch drum to "free spool" in either direction. Pull up the spring loaded knob and rotate the lever 180° to disengage the drum and allow it to free spool. Rotate the lever 180° back to its original position, to engage the winch drum in the power in/power out mode. The lever should be pinned in this position, using the spring loaded knob on the end of the lever, to ensure that it does not slip out of position.

The following is a list of guidelines to be observed when operating the carrier mounted winch:

1. Do not use carrier drive train to pull loads which are attached to the carrier mounted winch. The crane must be stationary when pulling loads.
2. Do not use the carrier mounted winch while the crane is on outriggers. Crane must be on tires.

3. Do not reeve the carrier mounted winch with more than one part line.
4. When attaching wire rope to the load, it should be in line with the centerline of the crane.
5. Do not use the winch to lift any load. It is to be used to drag loads only.
6. Do not use winch to lift or move personnel.
7. Do not attempt pulls which exceed wire rope strength.
8. All personnel must stand clear of the immediate area when utilizing the winch.

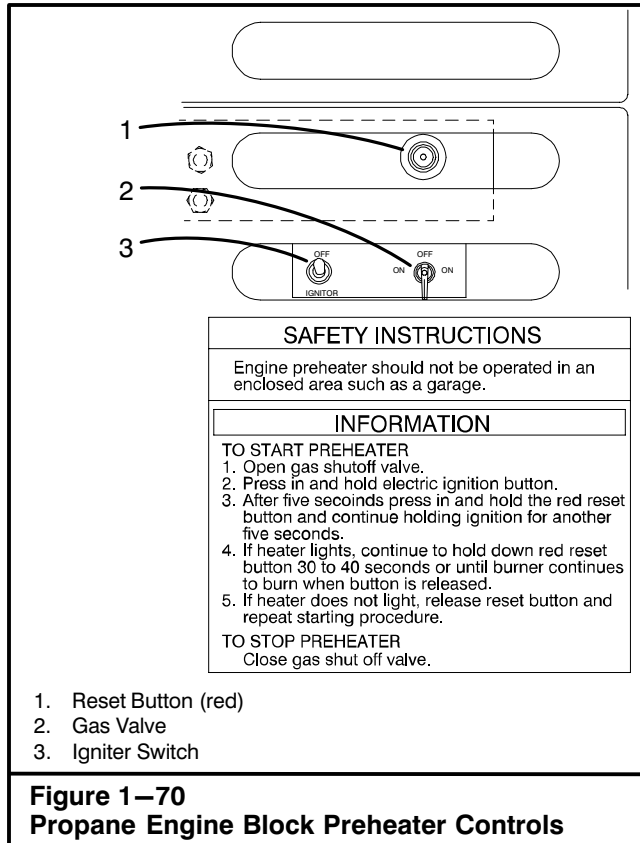


WARNING

Failure to follow the preceding guidelines may result in personal injury and/or crane damage. Breaking of wire rope or failure of other components could allow the wire rope to swing free, resulting in damage or injury. Stand clear of the immediate area when carrier mounted winch is in use.

CAUTION

The last five wraps of cable must be left on the drum to assist the cable clamp in holding the load.



Cold Weather Aids

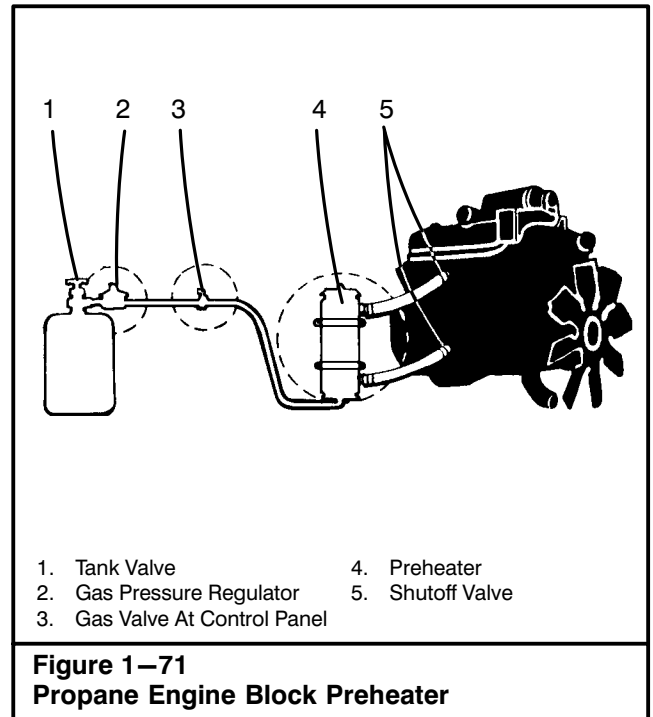
These options are offered to aid in engine start up and operator comfort in extremely cold weather conditions. Each system operates independently of the other which allows use of any one or all of them at the same time. The following is a brief description of each system and operating instructions.

Hydraulic Pump Disconnect

The pump disconnect disengages the main hydraulic pump when not in use. Disconnecting the main pump greatly reduces cranking resistance. The pump should be disconnected for cold weather starting. Refer to “Hydraulic Pump Disconnect” found earlier in this Section of the Operator’s Manual for proper operating procedure.

Engine Block Preheater


Two types of engine block preheaters are available for this crane: propane or electric. They are provided to make engine start-up easier in extremely cold weather by keeping the entire engine warm. The units are designed for all night operation but if weather conditions are not severe, they can be used for 30 minutes before engine start-up, with good results.



Propane Engine Block Preheater

The propane engine block preheater burns propane gas to heat the coolant and circulate it through the engine. The propane engine block preheater control panel is located at the back of the crane just behind the radiator grille. Refer to Figure 1–70.

The propane fuel tank for this system is located on the left side of the crane just ahead of the diesel fuel tank. Two shutoff valves for the purpose of blocking the coolant from circulating through the preheater are located on the engine at the preheater intake and output hoses. Each optional crane engine has a slightly different location for these valves but their purpose remains the same. Refer to Figure 1–71.



! WARNING

The propane engine block preheater should not be operated in an enclosed area such as a garage. Adequate ventilation is required. Fumes could be fatal.

To Start The Propane Engine Block Preheater

1. Park crane in suitable area for storage, engage the park brake, shift the transmission to neutral and shutdown the engine.

Operator's Manual

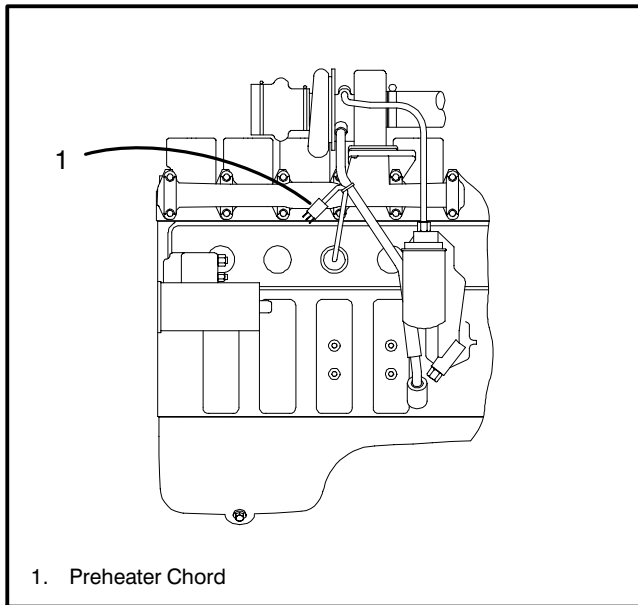


Figure 1–72
Electric Engine Block Preheater

2. Open both shutoff valves on the engine for the preheater intake and output hoses. Inspect the areas adjacent to the preheater to see that they are clean and free of oil and debris.



WARNING

Shutoff valves may be hot and could cause severe burns. Allow the valves to cool before opening them.

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

3. Open the valve on the propane fuel tank.
4. Open the gas valve on the control panel.
5. Push and hold the ignitor switch (momentary type toggle switch) for 5 seconds.
6. Continue holding ignitor switch and press the reset button (red button) and hold another 5 seconds.
7. Release ignitor switch. The preheater should be lit. Continue to hold reset button for 30 to 45 seconds.

8. Check the preheater to see if it is lit. If you are unable to hear fire, hold your hand over the exhaust. Heat can be felt if the preheater is burning. If it is not burning, wait 5 minutes and repeat Steps 5–8.

Note: Stop the propane engine block preheater before starting the engine.

To Stop Propane Engine Block Heater

1. Close the valve on the propane fuel tank.
2. Close the gas valve on the control panel. The preheater will stop when the fuel in the supply line has burned.
3. Close both of the shutoff valves on the engine for the preheater intake and output hoses.

Electric Engine Block Preheater

The electric engine block preheater uses electrical power to heat the coolant and circulate it through the engine. The electric engine block preheater power chord is located on the left side of the engine. Refer to Figure 1–72.

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 cord into 110V to 120V 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 cord from electrical source.

Ether Start

This system aids engine start-up by injecting ether into the combustion chamber while cranking the engine. The system is equipped with an electronic solenoid that prevents injecting ether except when engine is cranking. A thermostatic switch on the engine prevents ether from being injected into a hot engine. The ether fuel canister is located just inside the engine housing door. Refer to Figure 1-73.



WARNING

Use ether start system for starting cold engine only. Push injector button only while cranking engine. Use only ether in cold start system. Do not attempt to use any other type of fuel.

When maintaining or troubleshooting ether start system, always make sure the area is well ventilated and away from heat, open flames or sparks. Wear goggles to avoid eye injury. When opening ether fuel line or disconnecting atomizer, make sure it is pointed away from you. The ethyl ether fuel used in this system is extremely flammable, toxic, harmful and can be fatal.

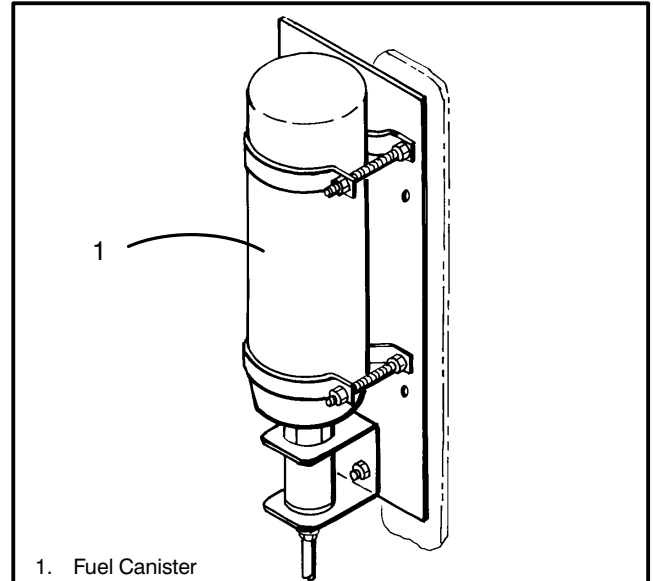
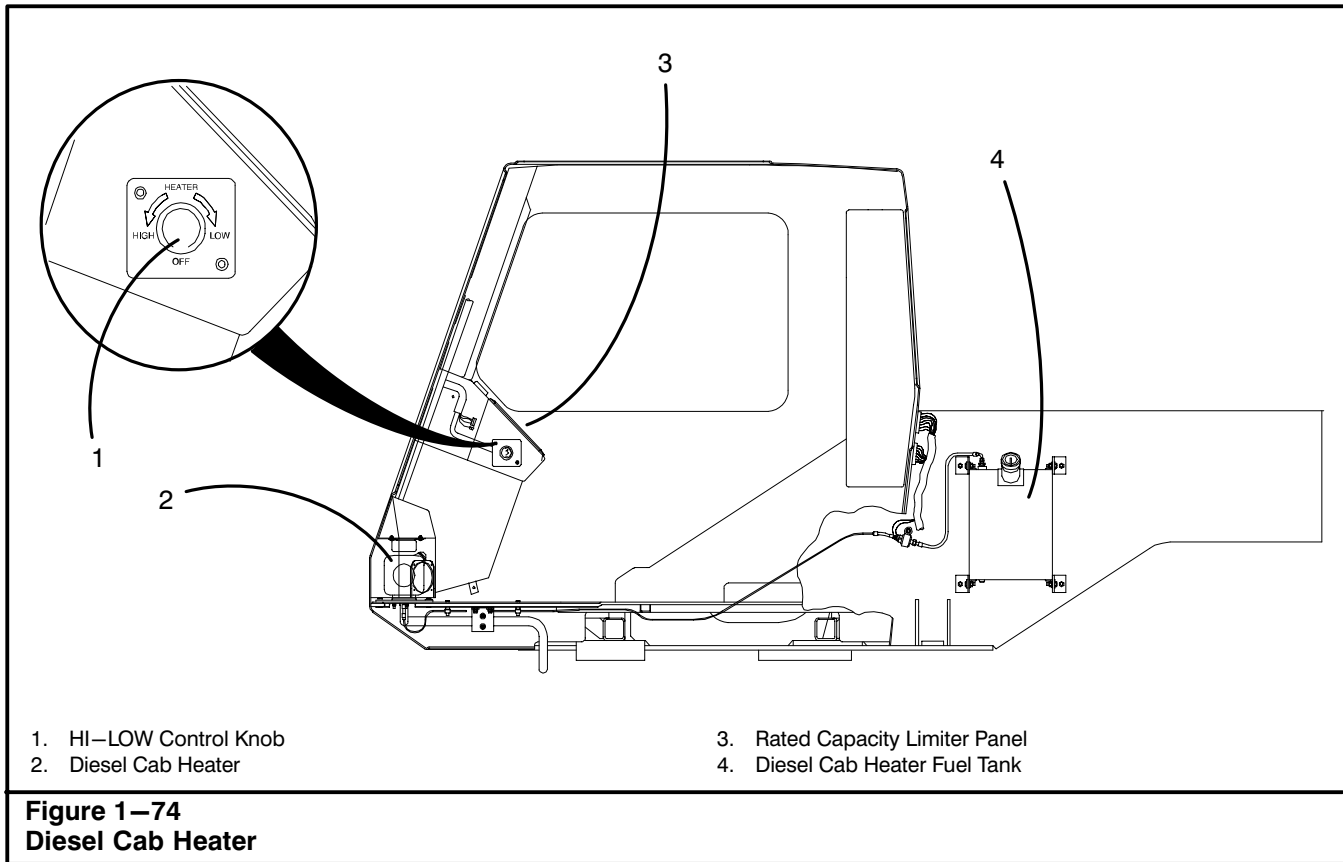


Figure 1-73
Ether Start System Fuel Canister

To Start The Engine Using Ether Start

1. With the transmission in neutral and the park brake engaged, start cranking the engine.
2. While the engine is cranking, press the ether start (yellow) button, located on the left side of the steering column. (Refer to Figure 1-37 for ether start button location.) Hold the button for 2 seconds. (Do not hold the button in over 2 seconds).
3. Release the ether start button to inject ether into the combustion chamber. Allow 3 seconds for the ether to discharge. If the engine fails to start, repeat Steps 2-3.

Operator's Manual



Diesel Cab Heater

A diesel cab heater may be used to heat the operator's cab. The heater control knob is located on the left side of the rated capacity limiter/indicator panel. Refer to Figure 1-74. The diesel fuel tank for the system is mounted to the left side of the upper revolving frame.

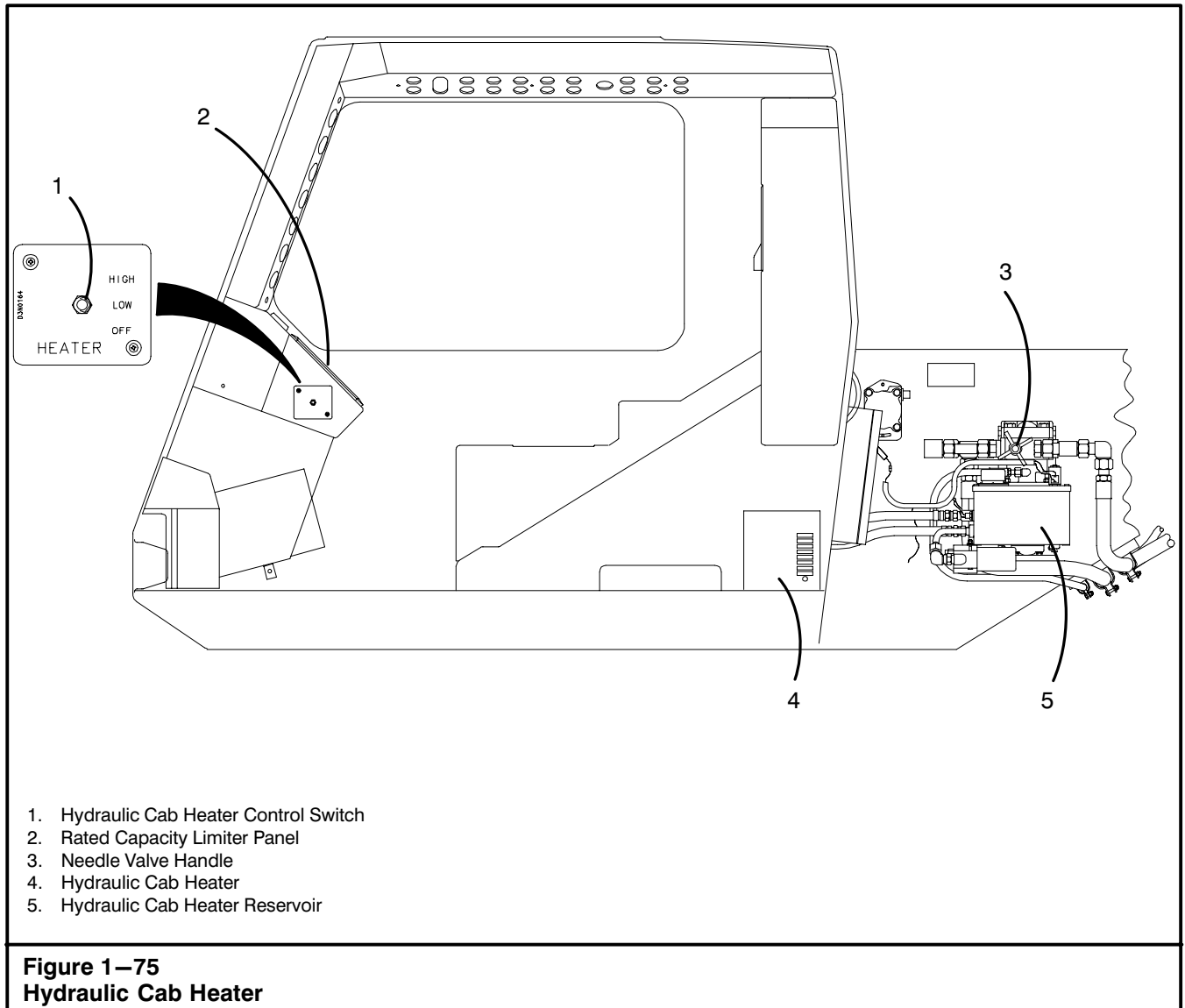
To Start The Diesel Cab Heater

Turn the "HI-LOW" control knob to the desired temperature setting.

To Stop Diesel Cab Heater

Move the "HI-LOW" control knob to the "OFF" position. The heater is equipped with a purge thermostat which permits the heater to continue to run for a short period of time in order to burn the fuel from the lines.

	<p>! WARNING</p> <p>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.</p>
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Hydraulic Cab Heater

A hydraulic cab heater may be used to heat the upper cab. The heater is located behind the operator's seat and the control switch is located on the left side of the rated capacity limiter panel. Refer to Figure 1–75. The hydraulic reservoir for the system is mounted on the left side of the upper revolving frame just behind the operator's cab.

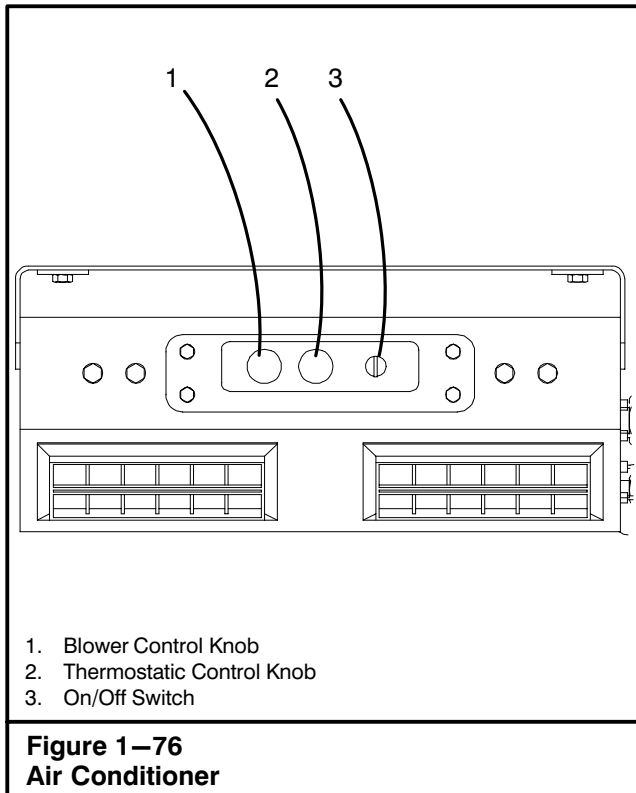
To Start The Hydraulic Cab Heater

1. Rotate the needle valve handle clockwise until it will not rotate anymore.
2. With the engine running, move the heater switch to the "LOW" or "HIGH" position.

To Stop The Hydraulic Cab Heater

1. Move 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 needle valve handle counterclockwise until it will not rotate anymore.

Operator's Manual



Air Conditioning

The operator's cab may be equipped with an air conditioning unit. Use the following instructions to operate the unit. Refer to Figure 1–76.

1. Start the engine and allow all operating temperatures and pressures to reach their normal range.
2. Move the on/off switch to the "ON" position, to activate the air conditioning unit.
3. Move the blower control knob to the desired speed.
4. Adjust the thermostatic control knob to the desired temperature range. Rotate it clockwise for cooler air; counterclockwise for warmer air.
5. To turn the unit off, move the on/off switch to the "OFF" position.

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. Be sure to add the weight of the hook block, slings, rigging, fly, jib, etc. Determine height to which the load must be lifted.
2. Consult the capacity chart, working areas and working range charts in the Crane Rating Manual located 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 over 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. Serious reductions in lifting capacity will result if beams are not in the same position and this could lead to serious crane damage or an 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 level. A bubble level is provided in the operator's cab to assist the operator in leveling the crane.

Operator's Manual

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 located on the rear of the crane or the Tire Inflation chart located 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, fly or telescoping fly.
 - c. Lifts while on tires must be from firm level surface. Use mats and/or grade the lifting surface as required to ensure safe lift.
7. Make sure 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. Make sure power boom sections are equally extended.
9. Lower the hook block 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. Consult wire rope strength chart in the Crane Rating Manual located 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 rope. Ease into the load. Lift the load a few inches off ground and hold to check brakes.
10. Lift the load to the desired height. Boom to the desired angle. Be careful when booming down or swinging the load, as these increase the load radius and result in a decrease in capacity. Make sure 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" found later in this Section of the Operator's Manual for further instructions.

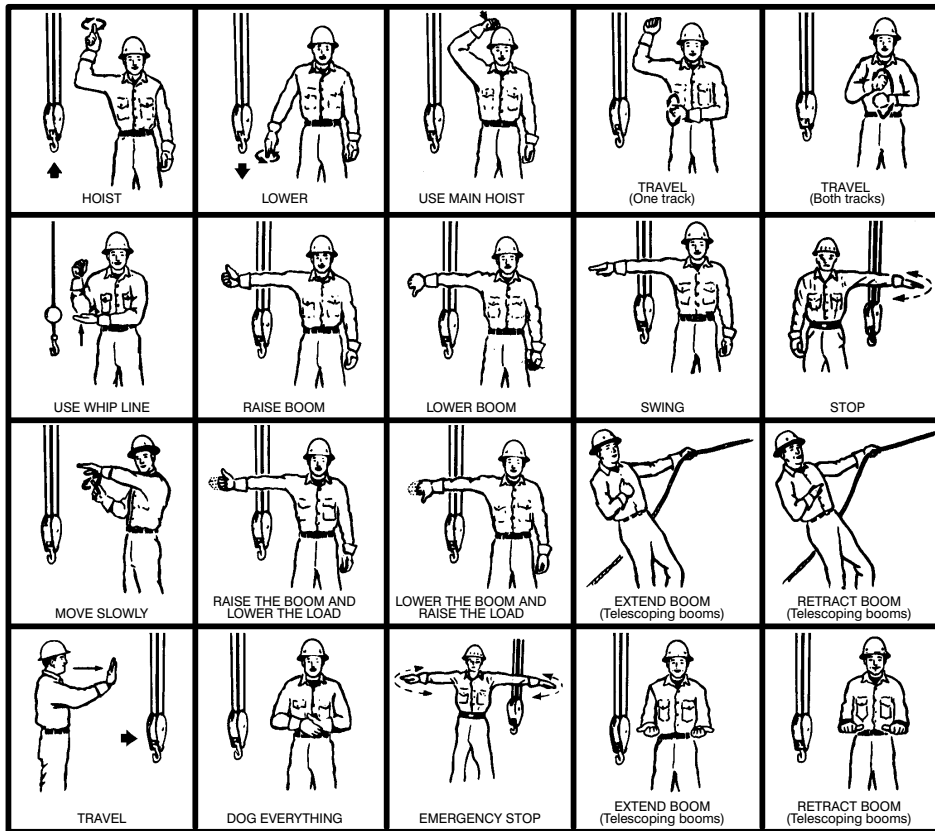
During Operation

The operator must remain alert to possible malfunctioning 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.
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 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 speed reducers. If any, correct problem.
4. Make sure 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 make sure the crane is level and stable. If working on tires, make sure the tires are inflated to the proper pressure. (Refer to the Tire Inflation label located on the rear of the crane or the Tire Inflation chart located in the Crane Rating Manual for proper tire pressure.)
7. Heed all warning and caution labels. Observe good safety practices at all times.

Operator's Manual

Standard Hand Signals For Controlling Crane Operations



Extracted from the American National Standard, Crawler, Locomotive and Truck Cranes, ANSI B30.5b-1985, with the permission of the Publisher the American Society of Mechanical Engineers, 345 E. 47th Street, New York, New York 10017.

Figure 1-77
Hand Signals

Hand Signals

Hand Signals are important for communications between the designated signalman and the operator. A hand signal chart, Figure 1-77, is included in this Section of the Operator's Manual. A copy is also located on the exterior of the engine housing.

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 signalman 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 1 mph (1.6km/h) or less on a firm, level surface. Lifts are to be made off the main boom only, with the crane prepared as follows:

1. Inflate the tires to the pressure listed on the Tire Inflation label or Crane Rating Manual for 1 mph (1.6km/h) maximum speed.
2. Level the crane on fully extended outriggers with the tires clear of the ground.

Operator's Manual

3. Position the upper over the front of the carrier and engage the travel swing lock. Release the swing park brake or the 360° swing lock if equipped.

CAUTION

Do not leave swing park brake applied or 360° swing lock knob in the engaged position during pick and carry operations. Failure to release these devices during this operation may result in damage to the swing speed reducer.

4. Boom must be extended in accordance with boom mode "A" or "B".
5. Properly store the fly, if equipped.
6. Make sure the Rated Capacity Limiter is properly set to match the crane configuration.
7. Retract all outrigger jacks just clear of the ground but leave the outrigger beams fully extended.
8. Attach as many hand lines as necessary to prevent the load from swinging during travel.
9. Carefully attach the load to the winch rope and lift it only as high as necessary.
10. Carefully travel at no more than 1 mph (1.6km/h). 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.
11. 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 crane.



WARNING

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

Do not travel with upper over the side. Crane may tip over causing personal injury and/or machine damage. Use travel swing lock.

Job Site Travel

Job site travel is limited to speeds less than 1.0 mph (1.6 km/h) on a firm, smooth and level surface. 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 Crane Rating Manual for 1 mph (1.6km/h) maximum speed.
2. Level the crane on fully extended outriggers.
3. 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 telescoping fly retracted and fly stored.
 - b. The upper over front of the carrier. The boom fully retracted. The fly erected and telescoping fly retracted.
 - c. The upper over front of the carrier. The boom fully retracted. The fly erected and telescoping fly extended and in the 2° offset position.
4. Boom down anywhere between 0° to 45°. Do not move the boom during travel.
5. Engage the travel swing lock. Release the swing park brake or the 360° swing lock if equipped.

CAUTION

Do not leave the swing park brake applied or the 360° swing lock knob in the engaged position when traveling the crane. Failure to release these devices while traveling may result in damage to swing speed reducer.

6. Fully retract all outrigger jacks and beams and properly store the pontoons.
7. Secure hook block to prevent excessive swinging.
8. Carefully travel at no more than 1.0 mph (1.6km/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.

Operator's Manual

Highway Travel

Highway travel is considered to be any travel of the crane over 1 mph (1.6km/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 boom.
2. The boom must be over the front of the crane with the travel swing lock engaged. Release the swing park brake or the 360° swing lock if equipped.

CAUTION

Do not leave the swing park brake applied or the 360° swing lock knob in the engaged position when traveling the crane. Failure to release these devices during this operation may result in damage to the swing speed reducer.

3. All boom sections must be fully retracted with the boom at 0° angle. Secure the hook block to prevent excessive swinging.
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 mode.
6. Disengage the main hydraulic pump.
7. Check all tires for correct pressure, adjust if required. Refer to the Tire Inflation label located on the rear of the carrier or in the Crane Rating Manual located in the operator's cab.
8. 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.
9. 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, be sure 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. Be sure to use towing equipment of ample size and strength. Refer to Figure 1—78.

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 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 speed reducer.

3. All boom sections must be fully retracted with the boom at a 0° angle. Secure the hook block to prevent excessive swinging.
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.
6. Unlock the axle differential if equipped.
7. Shift the transmission to neutral and engage the 2—Wheel Drive mode. Remove the drive tube between the transmission and axle including u—joints.

CAUTION

Failure to disconnect the drive tube including u—joints, or lift the driving wheels, before pushing or towing the crane can cause serious transmission damage.

8. Unlock the steering column by turning the ignition switch to the off position. Turn on the hazard flashers.
9. Release the park brake when the crane is attached to the towing vehicle and ready to be towed.

Operator's Manual

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. Severe personal injury or extensive 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 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 to prevent excessive swinging.

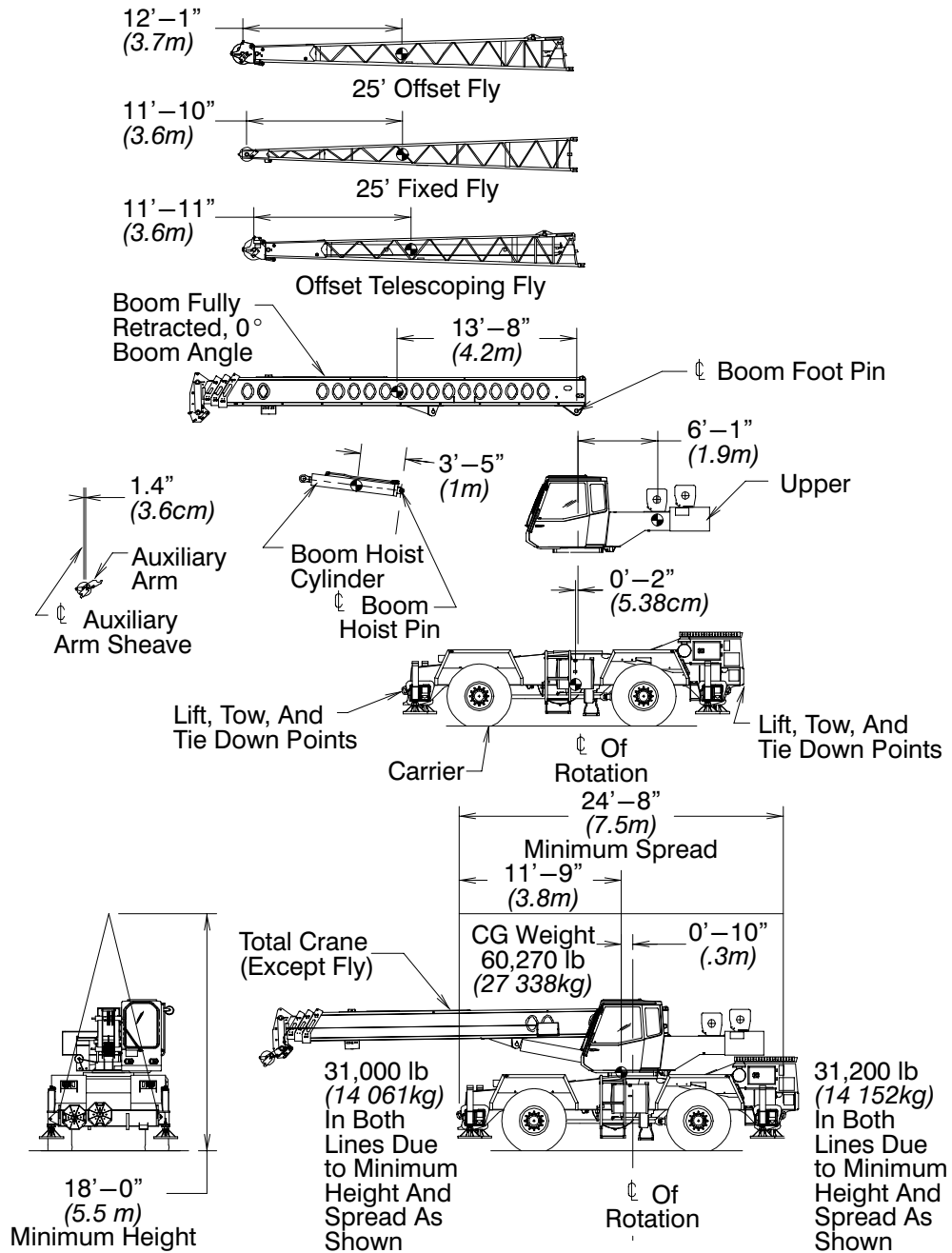
4. All outriggers must be fully retracted (jacks and beams) with all pontoons removed from jacks and stored properly.
5. Engage the park brake and shift the transmission to neutral.
6. All control levers in the operator's cab must be in the neutral position.
7. Lock all windows and doors. Remove the keys from the crane.
8. Depending on the specific situations, further preparations may be needed to protect the crane from the environment or vandalism. See "Crane Storage" for further suggestions.

Lifting The Crane

The entire crane (except the fly) can be lifted using the lifting lugs on the front and rear of the crane or the components may be removed from the crane and lifted individually. Refer to Figure 1–78 for the center of gravities (CG's) 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. 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 and adjust the hoist line to keep the crane/components level at all times.
4. Removal of any components from the crane will shift the CG of the entire crane. Adjust hoist line to account for the removal of any component.
5. The hook block and ball are assumed to be stored in the front carrier storage compartment.
6. 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.
7. 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.
8. Do not allow the hoist lines to contact boom while lifting crane. Damage to the boom may result.

Operator's Manual



Description	Weight
Carrier	29,460 lb (13 363kg)
Upper	17,100 lb (7 756kg)
Boom Hoist Cylinder	1,210 lb (549kg)
Boom W/ Foot Pin	11,300 lb (5 126kg)
Auxiliary Arm	60 lb (27kg)
25' Fixed Fly	540 lb (245kg)
25' Offset Fly	990 lb (449kg)
25-43' Offset Fly	1,480 lb (671kg)
Hook Ball & Block	1,140 lb (517kg)
Total Crane	61,750 lb (28 009kg)

Figure 1-78
Towing And Lifting The Crane

F1P0032D

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 swing lock must be engaged.
4. Fully retract the boom. Boom down to 0°. The fly or jib may be erected if the crane is on outriggers.
5. Tie off the hook block to the towing shackles. Winch lines should be snug.
6. All control levers must be in the neutral position.
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. Lock all windows and doors. Remove the keys from the crane.

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. Make sure all gear cases are filled to their proper oil level.
5. Inflate tires to proper pressure as shown on the Tire Inflation label located on the rear of the crane or the Tire Inflation chart located in the Crane Rating Manual. Check tire pressures periodically during storage to make sure they do not go flat. If possible

block the crane up so the tires are clear of the ground. Make sure 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, machined and unpainted surfaces with a coat of grease.
7. Leave all control levers in neutral.
8. Engage the park brake and shift the transmission to neutral and shutdown the engine.
9. After the engine has cooled, cover all open areas around the engine, cab, etc. to prevent entry of water. Cover the entire engine area with a tarp if possible.
10. Prepare the engine as per the engine manufacturer's manual. Make sure antifreeze protection is sufficient to prevent the engine from freezing. If antifreeze protection is not adequate, completely drain the engine block.
11. If in a location where vandalism may occur, lock the cab doors. Cover all 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, control cables and hydraulic functions several times to circulate lubricants and to keep all mechanisms and linkages operative.

Operator's Manual

Table Of Contents

General Lubrication Information	2-1
Lubrication Chart	2-3
Lubrication Specifications	2-4
Hi Performance Hydraulic Oil	2-10
Transmission And Torque Converter Lubrication	2-11
Transmission Oil Level Check	2-11
Transmission Filter Change	2-12
Transmission Oil Change	2-12
Axle Differentials Lubrication	2-14
Axle Differentials Oil Level Check	2-14
Axle Differentials Oil Change	2-14
Planetary Wheel End Lubrication	2-15
Planetary Wheel End Oil Level Check	2-15
Planetary Wheel End Oil Change	2-16
Wheel Bearing Lubrication	2-16
Hydraulic Reservoir	2-16
Water Drain	2-17
Hydraulic Reservoir Oil Level Check	2-17
Adding Oil To The Hydraulic Reservoir	2-18
Hydraulic Reservoir Oil Change	2-18
Hydraulic Reservoir Filter Change	2-19
Engine Air System Inspection	2-19
Engine Air Cleaner	2-20
Cleaning The Primary Air Cleaner Element	2-20
Inspecting The Air Cleaner Element	2-20
Changing The Air Cleaner Element (Style 1)	2-21
Changing The Air Cleaner Element (Style 2)	2-22
Drive Tube And U-Joint Lubrication	2-23
Swing Speed Reducer Lubrication	2-24
Swing Speed Reducer Oil Level Check	2-24
Swing Speed Reducer Oil Change	2-24

Operator's Manual

Winch Drum Lubrication	2-25
Winch Drum Oil Level Check	2-25
Winch Drum Oil Change	2-25
Air Dryer	2-26
Air Dryer – Horton	2-26
Filter/Coalescer Change	2-26
Desiccant Cartridge Change	2-26
Air Dryer – Chicago Rawhide	2-26
Desiccant Cartridge Change	2-26
Remote Fuel Filter	2-27
Fuel Filter Water Drain	2-27
Fuel Filter Change	2-27
Fuel Sediment Bowl	2-27
Boom Lubrication And Inspection	2-28
Wire Rope Lubrication	2-30
Lattice Fly Inspection & Lubrication	2-30
Crane Monitoring Systems	2-30
Display Cleaning	2-31
Hydraulic Cab Heater	2-32
Hydraulic Cab Heater Oil Level Check	2-32
Hydraulic Cab Heater Filter Replacement	2-33
Hydraulic Cab Heater System Oil Change	2-33
Carrier Mounted Winch	2-34
Carrier Winch Oil Level Check	2-34
Carrier Winch Oil Change	2-34
Hook Block, Ball & Swivel Inspection, & Maintenance	2-34
Turntable Bearing Capscrew Torque	2-36
Paint Maintenance	2-36
Regular Preventative Maintenance	2-36
Polishing And Waxing Procedure	2-36
Cab Dash Cleaning	2-36

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 located on the rear of the left front fender. 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

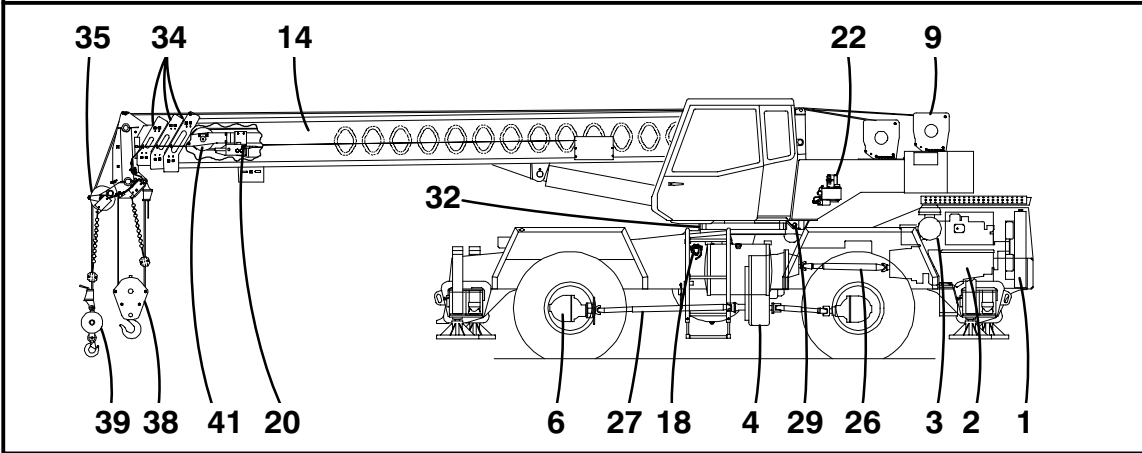
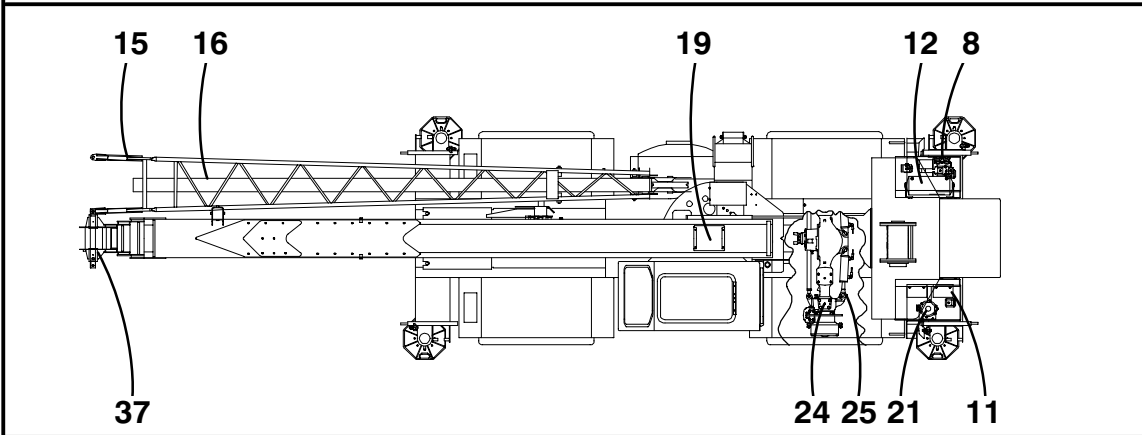
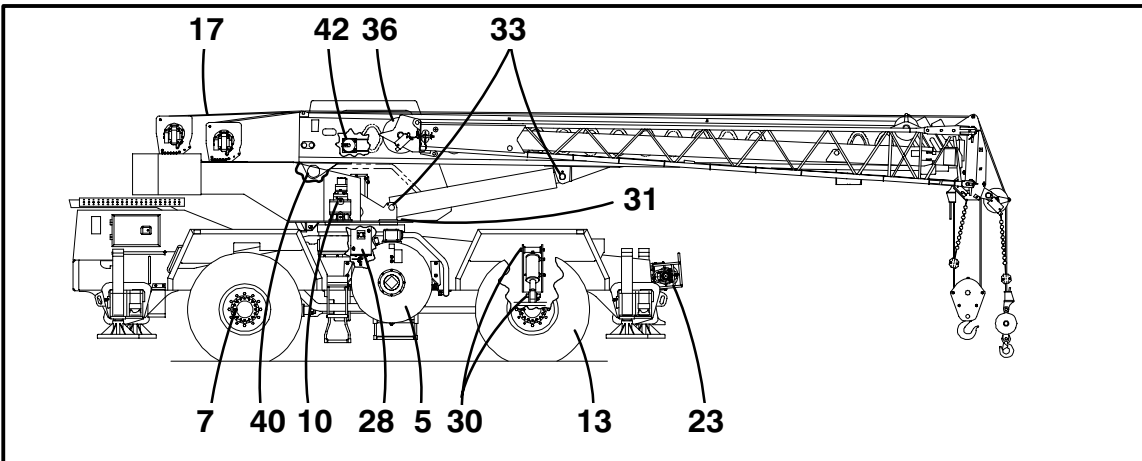
Shutdown engine before fueling or lubricating crane. To avoid a fire hazard, do not smoke or handle fuel around an open flame. To avoid crane damage and to prevent serious injury, do not lubricate gears or any assemblies while they are in motion.

The following procedures are important for proper lubrication of the crane:

1. Wipe the grease gun nozzle and grease fittings clean 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.

Note: See specific instructions later in this section 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 or panels before operating the crane.



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,D, etc. are 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 fitting on the inside of the bearing. 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 CODE IDENTIFICATION

Lube Code	Recommended Type
A	Bearing Grease NLGI Grade No. 2
C	SAE 10W/30 Detergent Engine Oil
E	80W/90 Extreme Pressure Gear Lubricant
H	Open Gear Grease (Summer Grade)
T	Super Heavy Duty Brake Fluid
U	SAE 80W/85W/140 Gear Lubricant
V	Molybdenum Disulfide Compound Lubricant
HH	Gear Lubricant
KK	Arctic Bearing Grease NLGI Grade No.1
LL	SAE 75W/140 Extreme Pressure Gear Oil
MM	5W/30 Multi-Purpose Synthetic Fluid
QQ	Synthetic Gear Oil
WW	Type C3 Transmission And Torque Convertor Fluid

MAINTENANCE						
Location	Ref. No.	Service Interval (Hours)	Operation	Key	Lube Code Above –10°F	Lube Code Below –10°F
Radiator	1	10	*,X	1,2	Key 2	Key 2
Engine	2	10	*	1,2	Key 2	Key 2
Air Cleaner	3	10	0	1,3	N/A	N/A
Transmission	4	10 500 1000	* # +	1,3 1,3 1,3	WW WW WW	MM MM MM
Hydraulic System Reservoir	5	10 250 1000	*,\$ # +	1,3 1,3 1,3	Key 3 Key 3 Key 3	Key 3 Key 3 Key 3
Axle Differentials	6	50 1000	* +	1,3 1,3	U U	LL LL
Wheel End Planetaries	7	50 1000	* +	1,3 1,3	U U	LL LL
Brake Fluid Reservoir	8	10	*	1	T	T
Winch	9	50 1000	* +	1,3 1,3	HH HH	QQ QQ
Swing Speed Reducer	10	50 1000	* +	1,3 1,3	E E	LL LL
Battery	11	50	*,0	1	N/A	N/A
Air Reservoir	12	10	\$	1	N/A	N/A
Tires	13	10	0	1,3	N/A	N/A
Boom	14	10	0	1,3	V,H	V,H
Fly	15	10	0	1,3	N/A	N/A
Telescoping Fly	16	10	0	1,3	N/A	N/A
Wire Rope	17	10	0	1,3	C	C
Fuel Sediment Bowl (If Equipped)	18	10	0	1,3	Key 3	Key 3
Remote Fuel Filter (If Equipped)	18	10 500	0 #	1,3 1,3	Key 3 Key 3	Key 3 Key 3
Boom Extend Wire Rope Anchors	19	250	0	1,3	N/A	N/A
Boom Retract Wire Rope Anchors	20	250	0	1,3	N/A	N/A
Air Dryer (If Equipped)	21	10 2000	0 #	1,3 1,3	N/A N/A	N/A N/A
Hydraulic Cab Heater (If Equipped)	22	10 500 1000	* # +	1,3 1,3	WW WW WW	MM MM MM
Carrier Mounted Winch (If Equipped)	23	10 50	* +	1,3 1,3	E E	LL LL

LUBRICATION					
Location	Ref. No.	Number Of Points	Lube Interval (Hours)	Lube Code Above –10°F	Lube Code Below –10°F
Steering Knuckles	24	8	50	A	KK
Steering Cylinder Ends	25	4	50	A	KK
Transmission Drive Tube/U–joints	26	3	50	A	KK
Axle Drive Tubes/U–joints	27	6	50	A	KK
Rotating Joint	28	1	250	A	KK
Travel Swing Lock	29	1	250	A	KK
Oscillation Cylinder Pins	30	4	250	A	KK
Turntable Bearing	31	1,Key 4	50	A	KK
Turntable Gear Teeth	32	All	50	H	H
Boom Hoist Cylinder Pins	33	2	10	A	KK
Boom Sliding Surfaces	34	All	Key 3	V,H	V,H
Auxiliary Lifting Sheave	35	1	50	A	KK
Fly Head Sheave	36	1	50	A	KK
Boom Head Machinery	37	All	50	A	KK
Hook Block & Sheaves	38	All	50	A	KK
Hook Ball	39	1	50	A	KK
Boom Foot Pin	40	2	10	A	KK
Boom Extend Sheave	41	2	50	A	KK
Boom Retract Sheave	42	2	50	A	KK

CAPACITY					
Location	Gallons	Liters	Lube Code Above –10°F	Lube Code Below –10°F	
Wheel End Planetary (Each)	0.75	2.84	U	LL	
Axle Differential (Each)	4.63	17.53	U	LL	
Transmission	7.00	26.50	WW	MM	
Brake Fluid Reservoir (Each)	0.12	0.47	T	T	
Hydraulic Reservoir	110.00	416.40	Key 3	Key 3	
Hydraulic System	180.00	681.40	Key 3	Key 3	
Swing Speed Reducer	0.56	2.12	E	LL	
Winch (Each)	2.00	7.57	HH	QQ	
Fuel Tank	75.00	283.90	Key 2	Key 2	
Engine Coolant	9.50	36.01	Key 2	Key 2	
Engine Oil	4.33	16.39	Key 2	Key 2	
Hydraulic Cab Heater Reservoir (If Equipped)	2.00	7.57	Key 3	Key 3	
Diesel Cab Heater Fuel Tank (If Equipped)	5.00	18.90	N/A	N/A	
Carrier Mounted Winch (If Equipped)	0.25	0.90	E	LL	

**Figure 2–1
Lubrication Chart**

Operator's Manual

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 (7.34 lbs/gal)
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 E

80W/90 Extreme Pressure Gear Lubricant

An extreme pressure gear lubricant containing anti-foam protection, oxidation stability, anti-rust, and anti-corrosion qualities. Contains sulfur and phosphorus additive materials but no zinc in compliance with Eaton, General Motors and International Harvester truck driving axle requirements.

Must meet or exceed military specifications MIL-L-2104C, and are suitable for API service designations GL3, GL4 and GL5, with a rating of 10 as determined in the shock load test CRC-L-42.

Physical Properties:

Gravity °API	25.1
Flash, COC (°F)	400
(°C)	204
Pour Point (°F)	-30
(°C)	-34
Viscosity at 100°F (38°C) SUS	829
Viscosity at 210°F (99°C) SUS	79.9
Viscosity Index	97
Sulfur	2.37
Ash (%)	None
CU Corr 3 Hours 250°F (121°C)	1 b
Channel Point (°F) Maximum	0
(°C) Maximum	-17.7
Timken Test Lever Load (Minimum)	50 lb
Phosphorus (%)	12

Texaco Code 2316 Multigear 80W/90 or Equivalent.

Type H

Open Gear Grease

For open gear applications. Satisfactory down to minus 40°F (minus 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	
(60 Strokes) Units	270
Penetration, Unworked at 77°F	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.

Operator's Manual

Type T

Super Heavy Duty Hydraulic Brake Fluid

A non-petroleum fluid for use in motor vehicle hydraulic brake or hydraulic clutch systems. Has high temperature stability and corrosion resistance.

This fluid meets or surpasses federal standard 116, DOT-3, and meets SAE J-1703 tests.

Physical Properties:

Specific Gravity @ 68°F (20°C)	1.0270
Boiling Point, SAE (Min)(°F)	450
(°C)	232
Viscosity at 68°F (20°C) SUS	89
Flash Point (°F) (Min)	250
(°C) (Min)	121
Water % By Volume (Max)	0.3

**Wagner Electric Corporation Part No. FC10341,
Super Heavy Duty Brake Fluid Or Equivalent.**

Type U

Multi-Grade Gear Lubricant (All Season)

SAE 80W, 85W, 140

Good quality gear lube, for both high and low temperature extremes. Good lubricant for most enclosed gear applications, axle and transmission requirements. With synthetic hydrocarbons, sulphur, phosphorus type of additives and with additives to prevent rusting and foaming. Exceeds API classifications GL4 and GL5. It is qualified under MIL-L-2105B, MIL-L-2105C and MIL-L-2105D; Rockwell Standard (Timken) 0-76B; Mack GO-D and GO-F; and International Harvester SP lubrication specifications.

Physical Properties:

Gravity, ° API	26.8 (7.443# Per Gal)
Brookfield Viscosity, @ 15°F Cps . .	130,000
Viscosity, cST	
100°F	268.0
210°F	26.85
Viscosity, SUS	
0°F (Extrapolated)	100,000
100°F	1,242.0
210°F	128.4
Viscosity Index	
(D-2270)	140
Pour Point	
°F	-20
°C	-29
Nonchanneling Temperature	
°F	-40
°C	-40
% Sulfur	2.0
% Phosphorus	0.11
Specific Gravity @ 60°F	0.8939
Lbs. Per US Gallon @ 60°F (15.6°C) . .	7.443
Flash Point, COC	
°F	310
°C	154
Timken OK Load, Pounds	40

The supplier assumes all responsibility of product and patent liability.

**Kendall Three Star SAE 80W-85W-140
(Product Code 7720) 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 pounds per square inch. 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. Molyube 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:

Gravity, °API	26.7
Viscosity cSt @ 40°C (104°F)	144.0
Viscosity cSt @ 100°C (212°F)	14.7
Viscosity SUS @ 100°F (38°C)	754.0
Viscosity SUS @ 210°F (99°C)	78.0
Viscosity Index	101
Flash COC	420°F
Pour Point	-20°F (-7°C)
Sulfur, %	0.66
Phosphorous, %	0.03
Timken Test Lever Load (Minimum)	60 lb
AGMA No. EP	4
Appearance	Dark Red

Texaco Code No. 2320, Meropa 150 Or Equivalent.

Operator's Manual

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 minus 65°F. 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, 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. Above this temperature, its compatibility is like any other bentone thickened grease.

Physical Properties:

Thickener	Bentone
Penetration worked @ 77°F (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°C (ASTM D446)	6750
Wheel Bearing Leakage Wt.% (D1263) . .	2.83
Water Washout Wt.% 77°F (D1264)	1.25
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/140 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-L-2105C.

Physical Properties:

Kinematic Viscosity @ 100°C (211°F), cST (ASTM D-443)	24.0 to <41.0
Apparent Viscosity @ -40°C (75°F), ml (Brookfield) (ASTM 2983)	150,000 max.
Flash Point, COC (ASTM D-92)	
(°F)	356 Min.
(°C)	180 Min.
Channel Point (FTMS 791B Method 3456)	
°F	-49 Max.
°C	-45 Max.
Copper Corrosion,	
3 hrs. @ 121°C (ASTM D-130)	3 Max.
Foaming Characteristics (ASTM D-892) (Foaming readings taken immediately after 5 minutes aeration)	
@ 24°C (75°F), ml	20 Max.
@ 94°C (200°F), 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.

Federal Test Method Standard

Mobil Oil Molilube SHC 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 converter 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 Spec MIL-L-46152C, MIL-L-46167, MIL-L46167A, Ford spec. M2C153-E and General Motors spec 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 (ASTM D-287)	35.1
Flash Point (ASTM D-92)	
°F	420
°C	402
Viscosity, cPs (ASTM D-2602)	
@ -25°C (-13°F)	3100
Viscosity, cSt (ASTM D-445)	
@ 40°C (104°F)	72.8
@ 100°C (212°F)	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	-72.9
High Temperature, High (Tapered Bearing Simulator {TBS})	
Shear Rate Viscosity, cP	3.3
Borderline Pumping Temperature (ASTM D-3829)	
°C	-65
°F	-85
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 machine 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 (229°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.

Operator's Manual

Type WW

Type C3 Transmission And Torque Fluid

High viscosity index characteristics permit use over a wide temperature range by providing low temperature fluidity and at the same time retaining their desired viscosity at high temperature conditions. High temperature oxidation resistance, dispersancy, detergency, anti-corrosion, 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 Allison hydraulic transmission fluid type C3 specifications.

Physical Properties:

Gravity, °API	27.5 (7.32 lbs/gal)
Viscosity @ 100°F (38°C), SUS	187.0
Viscosity @ 210°F (99°C), SUS	50.7
Viscosity O.F. (Brookfield)	1500
Viscosity Index	168
Flash COC	370°F (189°C)
Pour Point	-55°F (-49°C)
Ash % (Sulfated)	1.22
Appearance	Dark Pale
Color ASTM	4.5

Texaco Code No. 1821 – C3 Torque Fluid 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 damage to hydraulic components. Hi Performance Hydraulic Oil is available through your 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	18.9	830666001 830666002
			55	208.0	
Grade 46	10°F to 90°F -12°C to 32°C	195°F 91°C	5	18.9	830663001 830663002
			55	208.0	

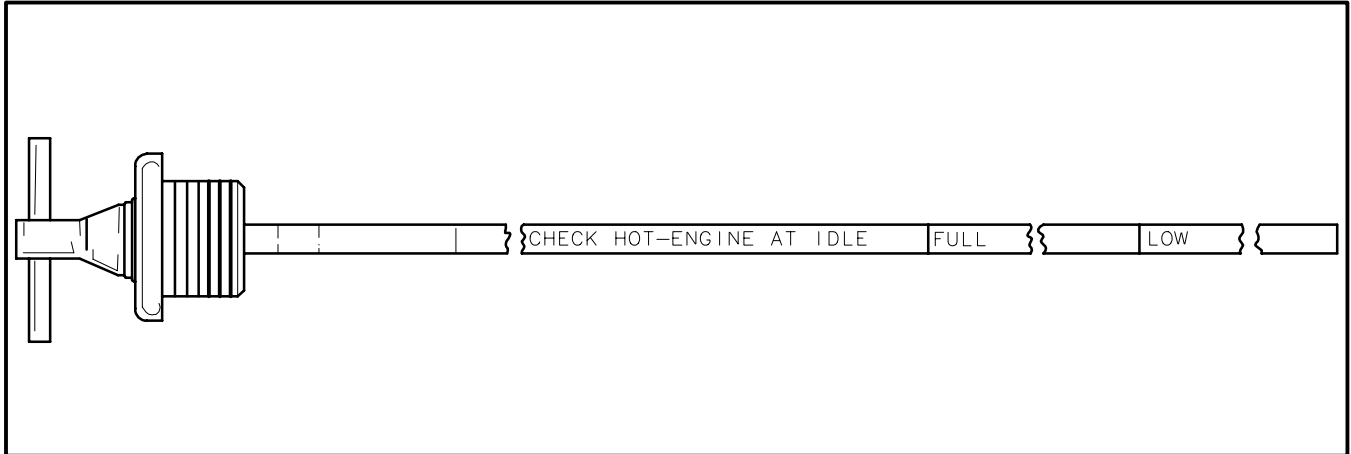


Figure 2-2
Transmission Oil Dipstick

YC1115-B

Transmission And Torque Converter Lubrication

The transmission and torque converter 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 converter parts may not receive adequate oil. 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. Use the following procedures to properly service the transmission and torque converter.

Transmission Oil Level Check

Check the transmission oil level daily. Before removing the transmission dipstick clean the area around the dipstick handle. 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).

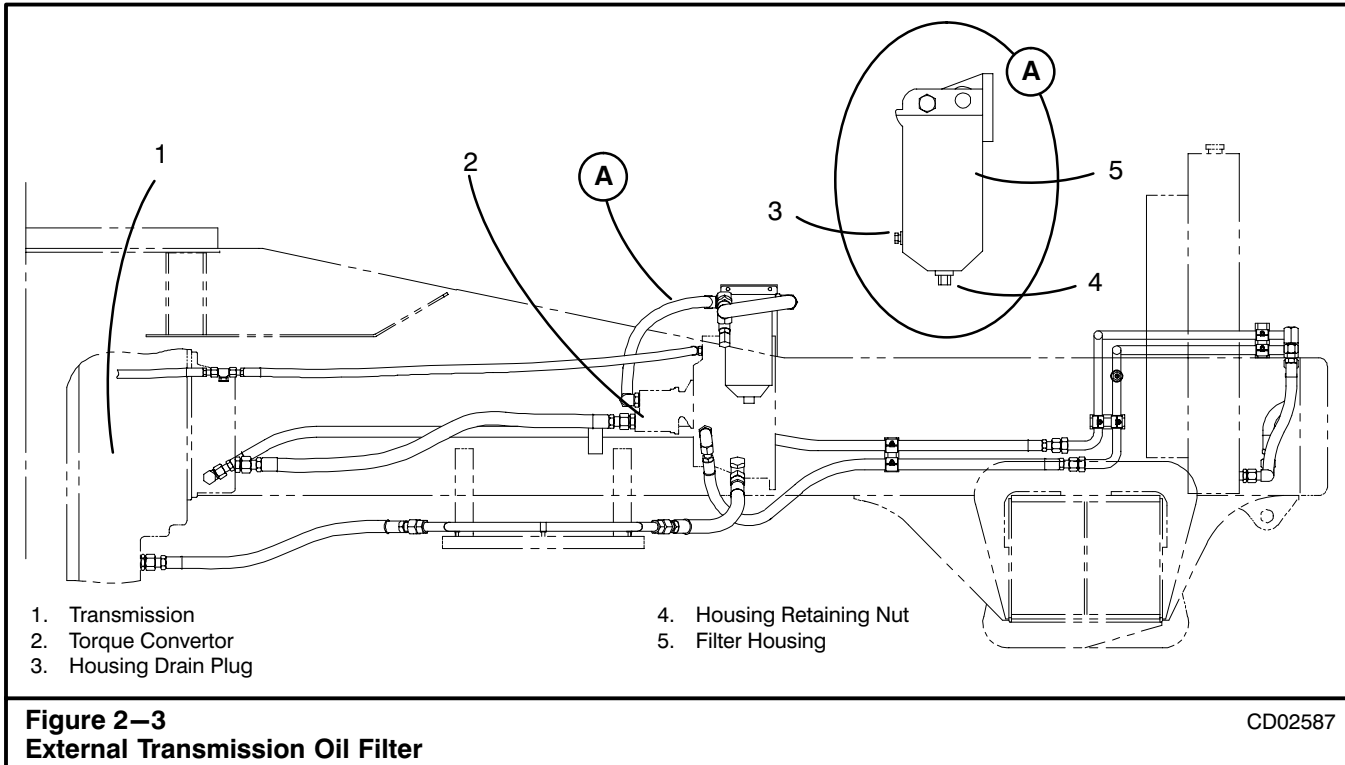
Note: Under certain conditions it may be necessary to stall out the converter to bring the transmission oil to operating temperature. To stall out the converter, shift the transmission to “3”, apply park brake, hold service brake down and accelerate engine to half throttle. Continue in this position until proper operating range is reached.

CAUTION

Using half throttle speed and stalling out the converter for an excessive length of time will overheat the converter.

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 dipstick located on the right hand side of the crane between the carrier ladder and hydraulic reservoir.
4. Wipe the dipstick handle area clean. Rotate the dipstick handle counterclockwise, until loose, and remove the dipstick from the filler tube.
5. Wipe all the oil from the dipstick and place it back into the filler tube.
6. Remove again and read the oil level on the dipstick. The oil level should be to the full mark on the dipstick. Refer to Figure 2-2.
7. Add oil as required through the filler tube. Use only the oil type specified on the Lubrication Chart. Do not overfill.
8. Once the proper oil level is obtained, install the dipstick in the filler tube and turn the dipstick handle clockwise until tight.

Operator's Manual



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 to the inside of the carrier frame just above the torque converter on the right side of the crane. Refer to Figure 2-3.

1. Park the crane on firm level ground, shift the transmission to neutral, apply the park brake and shut-down the engine.
2. Clean the filter housing to prevent contamination from entering the system.
3. Remove the filter housing drain plug and allow the oil to drain into a suitable container.
4. Remove the housing retaining nut and remove the filter housing and element within.
5. Properly discard the filter element and clean the filter housing.
6. Install a new filter element and housing gasket.
7. Install filter housing, retaining nut and filter housing drain plug.
8. Check transmission oil level. Refer to "Transmission Oil Level Check" found earlier in this Section of the Operator's Manual.
9. Start the engine and inspect the system for leaks.
10. Properly dispose of the used oil and element.

Transmission Oil Change

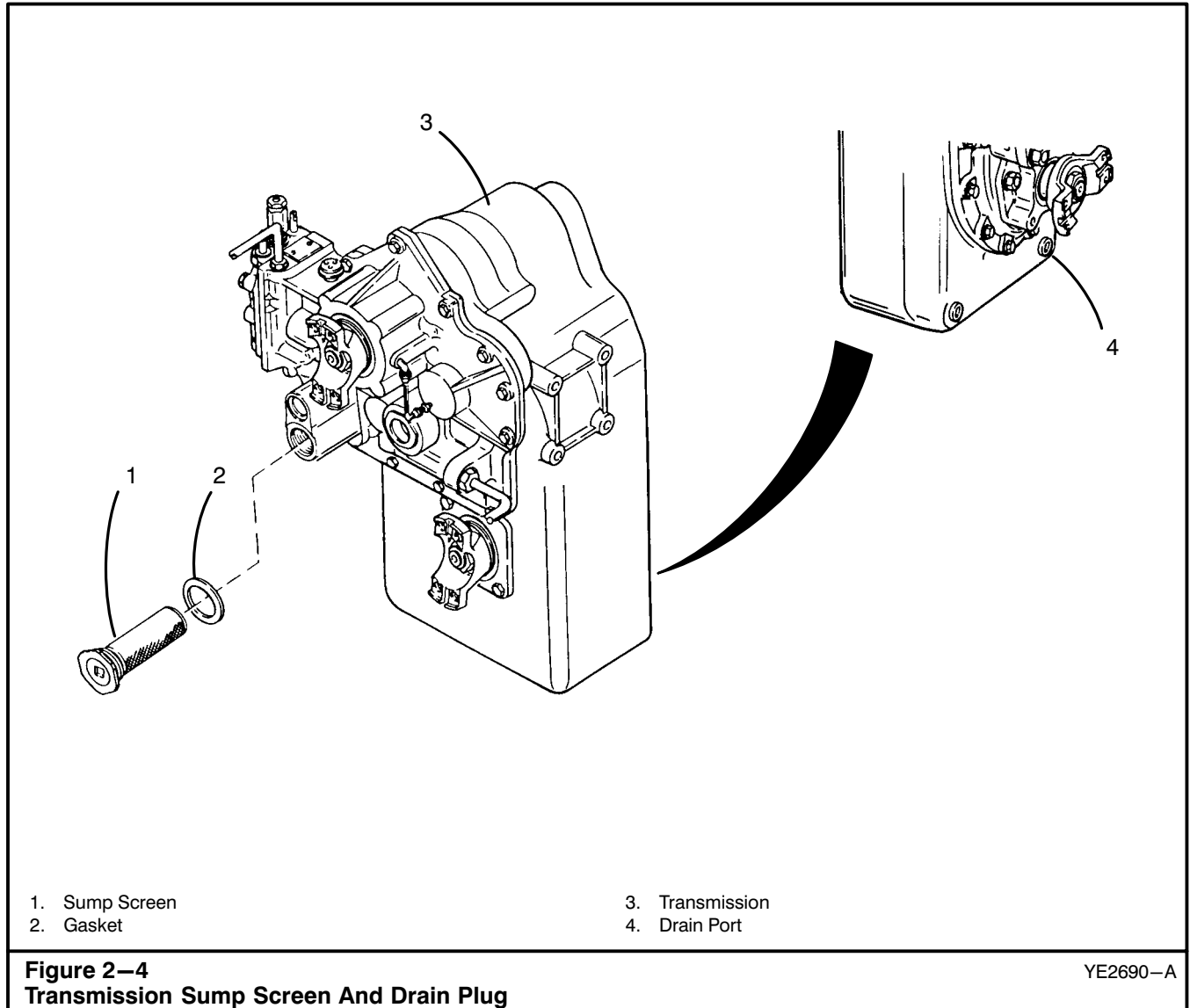
Change the transmission oil every 1,000 hours of operation or seasonally, whichever occurs first. Change it more often if job site conditions demand. If the oil has overheated, change it and the filter immediately.

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 "F3", apply park brake, hold service brake down and accelerate engine to half throttle. Continue in this position until proper operating range is reached.

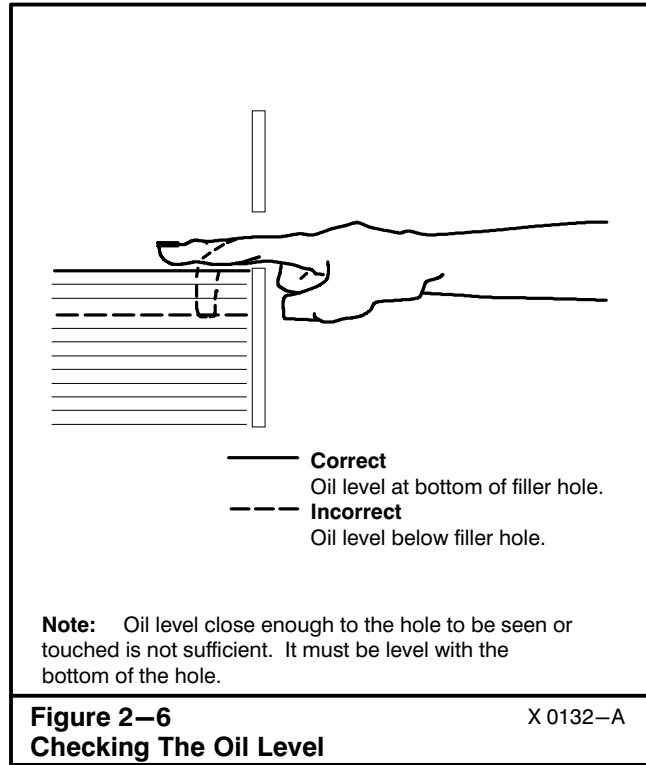
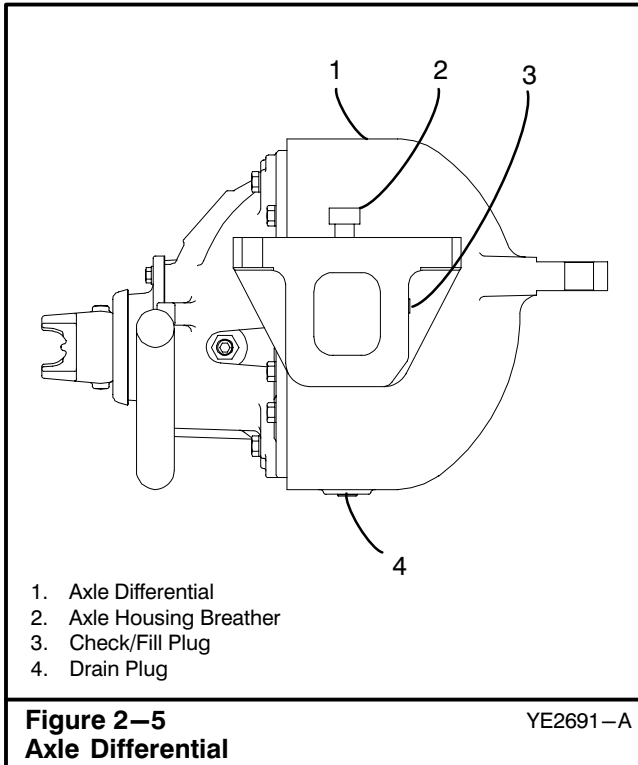
CAUTION

Using half 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 shut-down the engine.
3. Clean the area around the drain plug and sump screen. Refer to Figure 2-4.
4. Remove the hose and fitting from transmission drain port. Allow the oil to drain into a suitable container.
5. Remove sump screen, clean and reinstall it.
6. Replace transmission filter. Refer to "Transmission Filter Change" found earlier in this Section of the manual.
7. Install the hose and fitting to the transmission drain port.
8. Fill transmission with oil to "LOW" mark on the dipstick. Refer to "Transmission Oil Level Check" found earlier in this Section of the manual. Use only the 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 "LOW" mark on the dipstick.
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 "FULL" mark on the dipstick.
12. Check the system for leaks.
13. Properly dispose of the used oil and filter.

Operator's Manual



Axle Differentials Lubrication

For troublefree operation, over a period of years, the 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 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. The crane should be parked on a firm level surface with the park brake engaged, transmission shifted to neutral and the engine shutdown.
2. From the underside of the carrier, locate the check/fill plug of the differential. Refer to Figure 2-5.
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 2-6.

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: The axle manufacturer recommends 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, located on the top of the rear axle housings. Refer to Figure 2-5.

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. The crane should be parked on a firm level surface with the park brake engaged, transmission shifted to neutral and the engine shutdown.

2. Locate the drain plug in the bottom of the differential. Refer to Figure 2–5.
3. Clean the area around the drain plug, before removing it.
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. Clean the drain plug and install it after the oil has thoroughly drained.
6. From the underside if the carrier, locate the check/fill plug on the side of the differential. Refer to Figure 2–5.
7. Clean the area around the check/fill plug, and remove it.
8. Fill the differential with oil until it is level with the bottom of the check/fill hole. Refer to Figure 2–6. Refer to the Lubrication Chart for correct quantity and grade of oil.

Note: The axle manufacturer recommends brands of oil not be intermixed because of possible incompatibility.

9. Clean and install check/fill plug.
10. Check and clean the axle housing breathers, located on the top of the rear axle housings. Refer to Figure 2–5.
11. Properly dispose of the used oil.

Planetary Wheel End Lubrication

For troublefree operation, over a period of years, the wheel ends must be properly lubricated. Check the oil level in each wheel end every 50 hours of operation. The oil in a new 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. Use the following procedures to properly lubricate the planetary wheel ends:

Planetary Wheel End Oil Level Check

1. The crane should be parked on a firm level surface with the park brake engaged and transmission shifted to neutral.

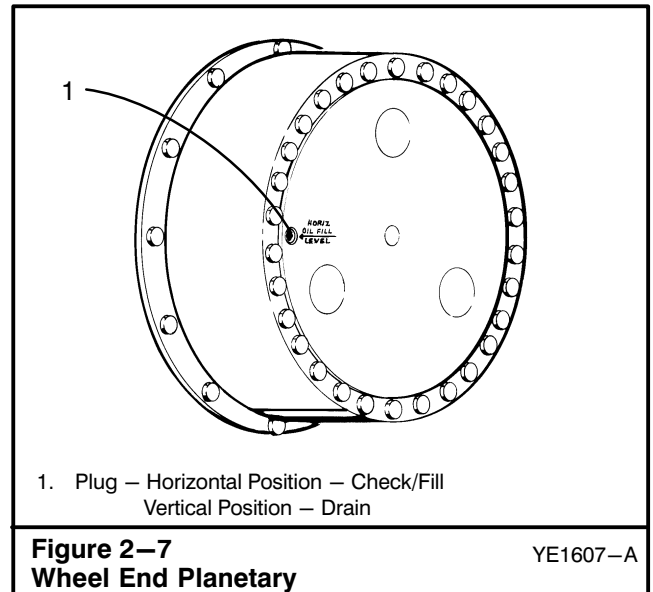


Figure 2–7
Wheel End Planetary

YE1607–A

2. Properly level the crane on outriggers, disengage the park brake and shutdown the engine but leave the key in the ON position.
3. Rotate the wheel end until the arrow next to the check/fill/drain plug is in the horizontal position. Refer to Figure 2–7.
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 of the hole. Refer to Figure 2–6.
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: The axle manufacturer recommends 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. Be sure to engage the park brake before lowering the crane from the outriggers.

Operator's Manual

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 crane for 5 minutes to agitate and warm oil.
2. The crane should be parked on a firm level surface with the park brake engaged and transmission shifted to neutral.
3. Properly level the crane on outriggers, disengage the park brake and shutdown the engine but leave the key in the ON position.
4. Rotate the wheel end until the arrow next to the check/fill/drain plug is in the vertical position with the arrow pointing down. Refer to Figure 2–7.
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 Planetary May Be Hot And Could Cause Severe Burns. Use Caution When Removing The Plug.

7. After thoroughly draining the oil, the wheel ends should be flushed.
 - a. Rotate the wheel end until the arrow next to the plug is in the horizontal position.
 - b. Fill the wheel end with a light flushing oil or kerosene and install the check/fill/drain plug.
 - c. Operate the wheel end for a short period of time at a very low speed.
 - d. Rotate the wheel end until the arrow next to the check/fill/drain plug is in the vertical position with the arrow pointing down.
 - e. Remove the check/fill/drain plug and allow all the flushing solution to drain into a suitable container.

8. Rotate the wheel end until the arrow next to the check/fill/drain plug is in the horizontal position.
9. Fill wheel end with oil until it begins to flow from check/fill/drain hole. Refer to Figure 2–6. See Lubrication Chart for correct grade and quantity of oil.

Note: The axle manufacturer recommends that types and brands of oil not be intermixed because of possible incompatibility.

10. Clean and install the check/fill/drain plug.
11. Properly dispose of the used oil and flushing oil or kerosene.

Wheel Bearing Lubrication

Under normal operating conditions, the axle wheel bearings are lubricated with oil from the planetary wheel ends. When the axle planetaries are operating with the proper oil levels, and using the correct grade of oil, the wheel bearings are automatically lubricated.

Hydraulic Reservoir

The hydraulic reservoir is used to supply and store hydraulic oil needed to operate all hydraulic functions of the crane. The hydraulic reservoir, as shown in Figure 2–8, is equipped with sight plugs for checking the oil level.

A filter housing is mounted on the top of the tank. It has a visual 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. Refer to the following procedures when servicing the hydraulic reservoir.

Water Drain

Drain the water from the hydraulic reservoir daily before start-up. Contaminated oil will damage the systems hydraulic components.

1. Park the crane on a firm level surface. Engage the park brake, shift the transmission to neutral and shutdown the engine.
2. Relieve the hydraulic system precharge pressure by pushing the button on the pressure relief valve. Refer to Figure 2-8.

! WARNING

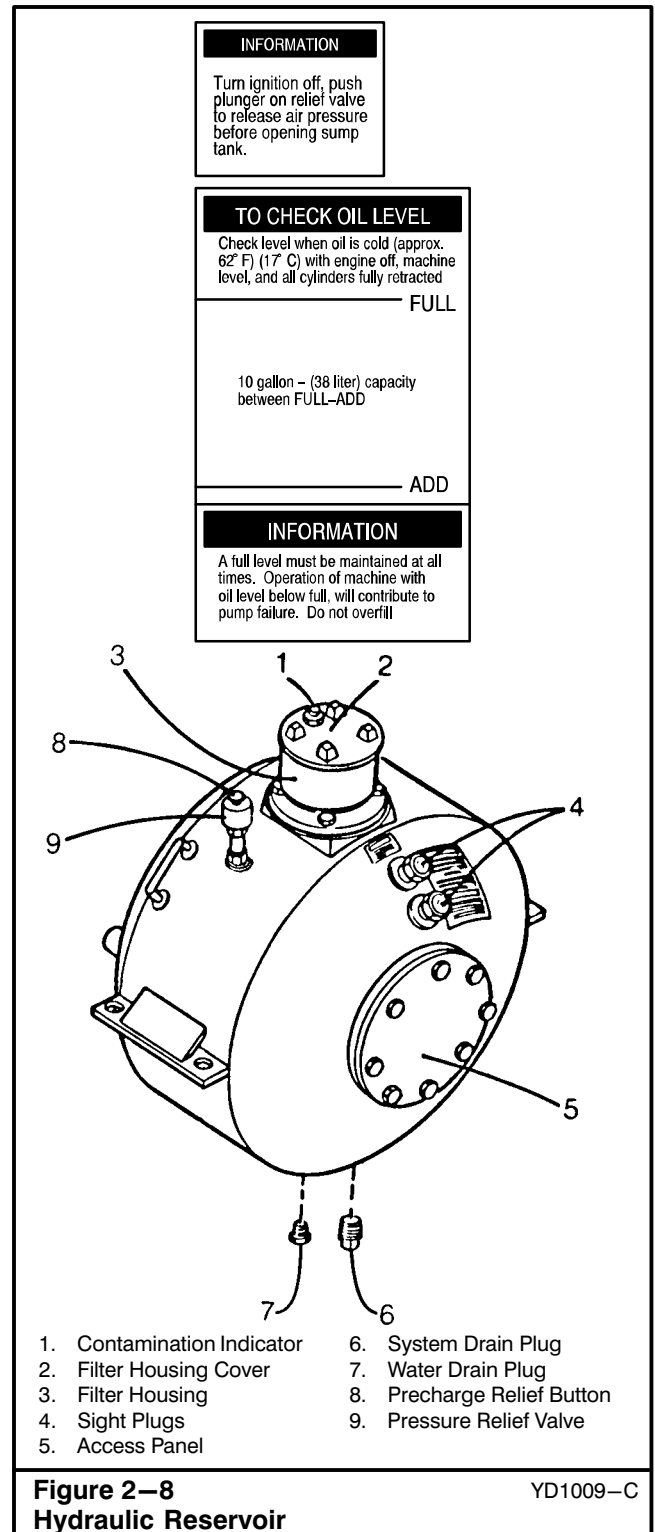
All trapped hydraulic pressure must be exhausted from the system before removing any plug or cover. A sudden release of hot oil could cause burns or other serious injury.

3. 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.
4. When a clean flow of hydraulic oil begins to drain from the water drain plug, tighten the plug.
5. Check the oil level in the hydraulic reservoir before beginning operation of the crane. Add oil if necessary. Properly dispose of the contaminated oil/water mixture.

Hydraulic Reservoir Oil Level Check

Check the oil in the hydraulic reservoir daily. Operating the crane with the oil level below the full mark can lead to hydraulic component failure.

1. With all hydraulic cylinders fully retracted, park the crane on a firm level surface. Engage the park brake, shift the transmission to neutral and shutdown the engine.
2. With the hydraulic oil cold (approximately 62°F 17°C), check its level through the sight gauge located on the front of the hydraulic reservoir. Refer to Figure 2-8. The proper level must be maintained at all times. Add hydraulic oil as necessary to bring the oil level to the "FULL" mark. Use only Hi Performance Hydraulic Oil or an approved substitute. Do Not Overfill.



Operator's Manual

Adding Oil To The Hydraulic Reservoir

1. Park the crane on a firm level surface. Engage the park brake, shift the transmission to neutral and shutdown the engine.
2. Relieve the hydraulic system precharge pressure by pushing the button the pressure relief valve. Refer to Figure 2–8.



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. Check the oil level.
6. Install filter housing cover.

Hydraulic Reservoir Oil Change

The hydraulic reservoir oil should be changed every 1,000 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. With all hydraulic cylinders fully retracted, park the crane on a firm level surface. Engage the park brake, shift the transmission to neutral and shutdown the engine.
2. Relieve the hydraulic system precharge pressure by pushing the button on the pressure relief valve. Refer to Figure 2–8.



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 when the access panels and filter housing are opened.
4. Remove the filter housing cover and filter. 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 water drain plug. Partially open the plug and drain one container full at a time, until the oil has thoroughly drained from the reservoir. Do not remove the plug completely until the reservoir is empty.



WARNING

Use caution when removing the system drain plug. A large volume of hot oil may suddenly be released resulting in personal injury and/or property damage.

5. Remove access panel and clean any old gasket material off access panel and hydraulic reservoir.
6. Clean the oil diffuser in the bottom of the filter housing and the interior of the hydraulic reservoir with clean diesel fuel or kerosene.
7. 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.
8. Clean and install water drain and system drain plug.
9. Clean the filter housing. Install the oil diffuser in the bottom of the filter housing. Install a new filter element.
10. Install the access panel, using a new gasket.
11. Using clean, uncontaminated oil, fill the reservoir through the filter element until it reaches the full mark by the sight plugs. Refer to the Lubrication Chart for the volume of oil required to fill the reservoir.
12. Install the filter housing cover.
13. 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.
14. Check the oil level in the hydraulic reservoir for proper level. Add oil if necessary. Properly dispose of the used oil and filter element.

Note: In case of hydraulic system component failure, a more thorough oil change procedure is required. Consult your distributor for this procedure.

Hydraulic Reservoir Filter Change

Change the hydraulic reservoir filter element after the initial 50 hours of operation and every 250 hours of operation thereafter. Change the filter element immediately if the contamination indicator signals a bypass condition after the oil has reached normal operating temperature at normal flow.

1. Park the crane on a firm level surface. Engage park brake, shift the transmission to neutral and shut-down the engine.



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. Relieve the hydraulic system precharge pressure by pushing the button on the pressure relief valve. Refer to Figure 2–8.
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 contami-

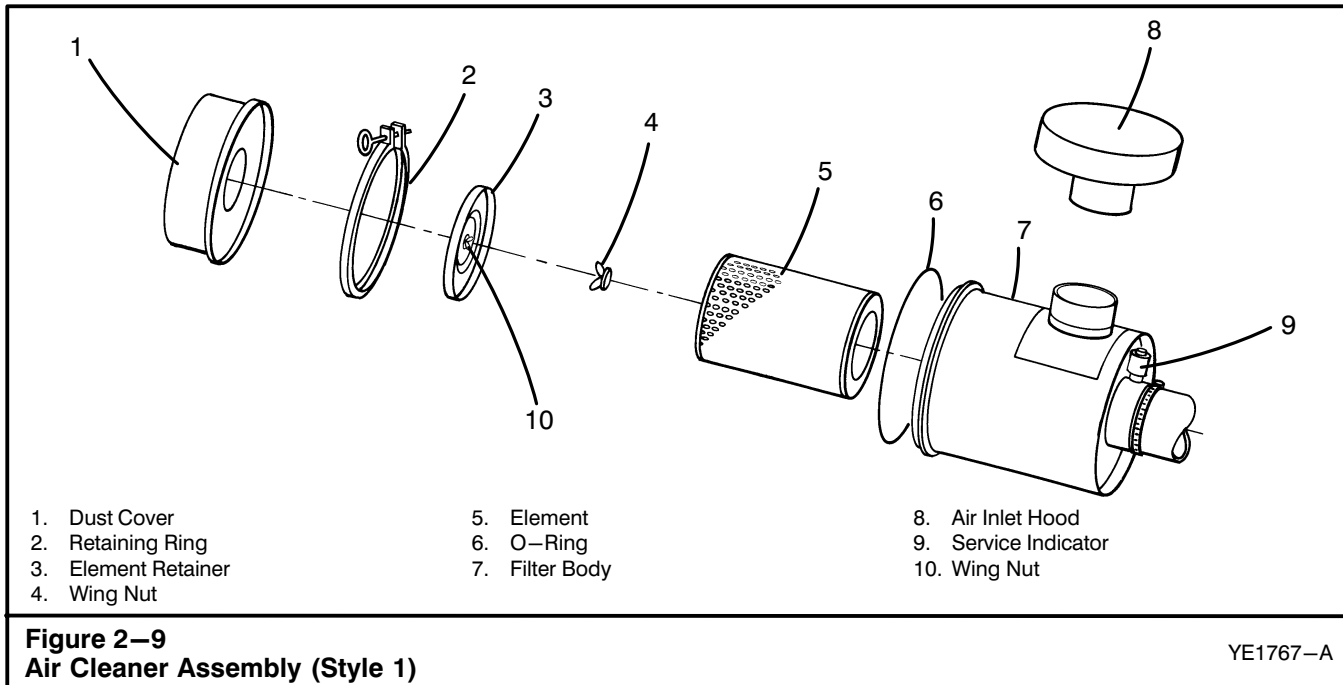
nation or imminent system component failure. Once the filter has been thoroughly inspected, dispose of it properly.

6. Install new filter element and filter housing cover.
7. 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.
8. Check the oil level in the hydraulic reservoir for proper level. Add oil if necessary. Properly dispose of the used oil and filter element.

Engine Air System Inspection

In addition to servicing the air cleaner, it is also recommended that the engine air system be inspected every 250 hours or 6 months. Inspect the air system pipes, hoses, air compressor and turbocharger systems, as equipped. (Be sure to inspect all the pipes and hoses associated with the air compressor, 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 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.

Operator's Manual



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 primary air cleaner element. Refer to Figure 2-13. Anytime the red band shows in the indicator, service the air cleaner immediately. Clean or replace the primary air cleaner element as often as required. Replace the primary air cleaner element after the sixth cleaning or annually, whichever occurs first. The safety element, if equipped is not intended to be cleaned. For maximum engine protection and air cleaner service life, install a new safety element with every third primary element change or cleaning. Two types of air cleaners have been used on this crane. Refer to Figure 2-9 and Figure 2-13. Service the engine air cleaner as follows:

Cleaning The Primary Air Cleaner Element

The primary 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 primary air cleaner element:

Washing

Soak the primary air cleaner element for 15 minutes or more, in a solution of water and Donaldson D-1400 detergent, or equivalent. Refer to Figure 2-10. 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 light bulbs. This may ruin the element. Thoroughly inspect the element after cleaning.

Compressed Air

Hold an air hose nozzle at least 1 inch (25mm) away from the primary 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. Thoroughly inspect the element after cleaning. Refer to Figure 2-11.

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. If any damage is discovered, replace the element. Refer to Figure 2-12.

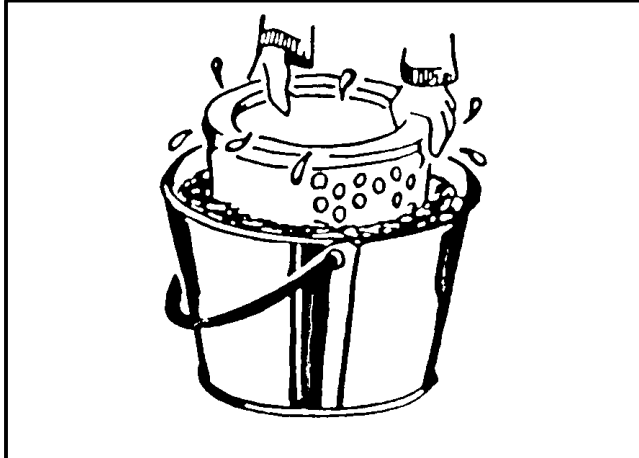


Figure 2-10
Clean the Primary Air Cleaner Element by Soaking

X 0133-A

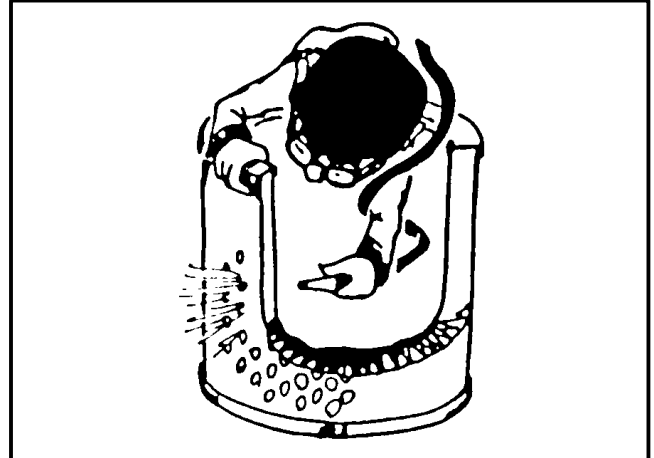


Figure 2-11
Clean the Primary Air Cleaner Element with Compressed Air

X 0133-A

Changing The Air Cleaner Element (Style 1)

1. Park the crane on a firm level surface. Apply the park brake, shift the transmission to neutral and shutdown the engine.
2. Inspect the service indicator (9) to see if the red band is showing. Refer to Figure 2-9. If the red band is visible, proceed with the following steps. If the red band is not visible, there is no reason to service the air cleaner element. Over servicing the air cleaner will shorten the life of the element and unnecessarily increase downtime.
3. Loosen retaining ring (2) and remove dust cover (1) from the end of the filter body (7).
4. Remove the o-ring (6). Inspect the o-ring and replace as required.
5. Remove the wing nut (4) which secures the element (5) within the filter body (7). Remove the element.
6. Wipe the inside of the filter body (7) clean, using a damp cloth.
7. Remove wing nut (10) which secures the element retainer (3) to the dust cover (1). Remove element retainer.
8. Thoroughly clean element retainer (3) and dust cover (1).

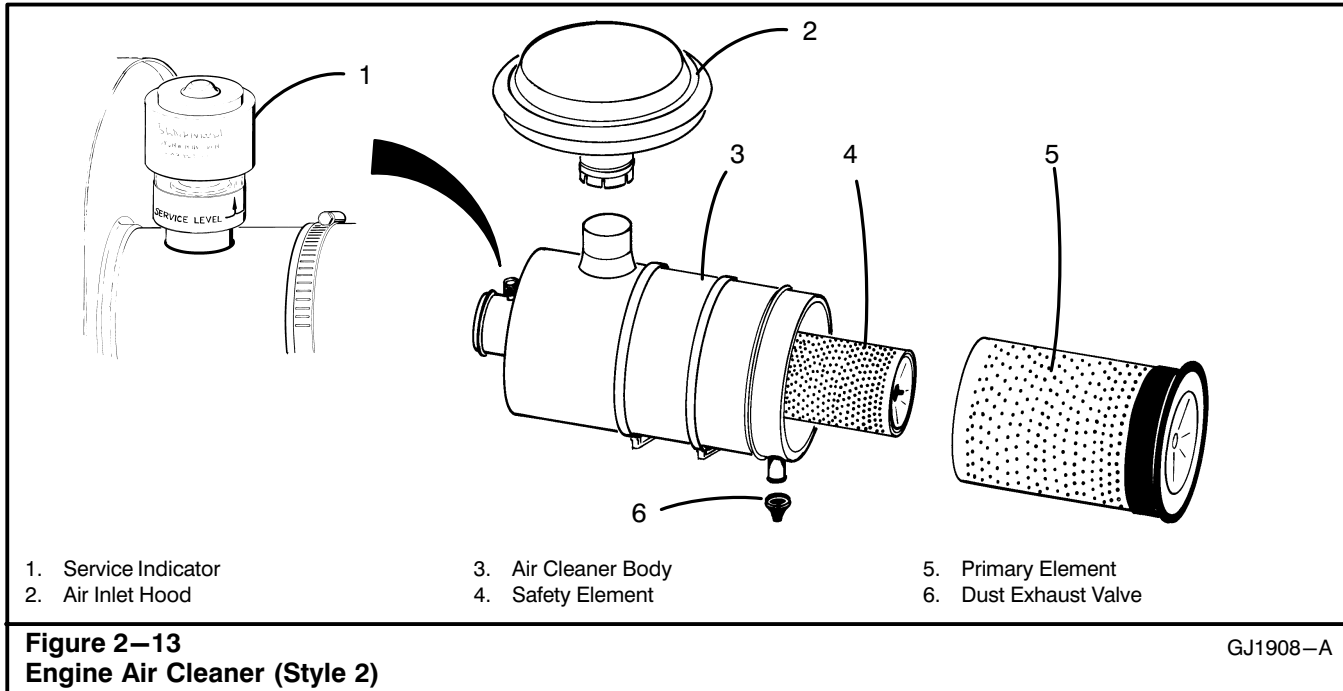


Figure 2-12
Inspecting the Air Cleaner Element

X 0133-A

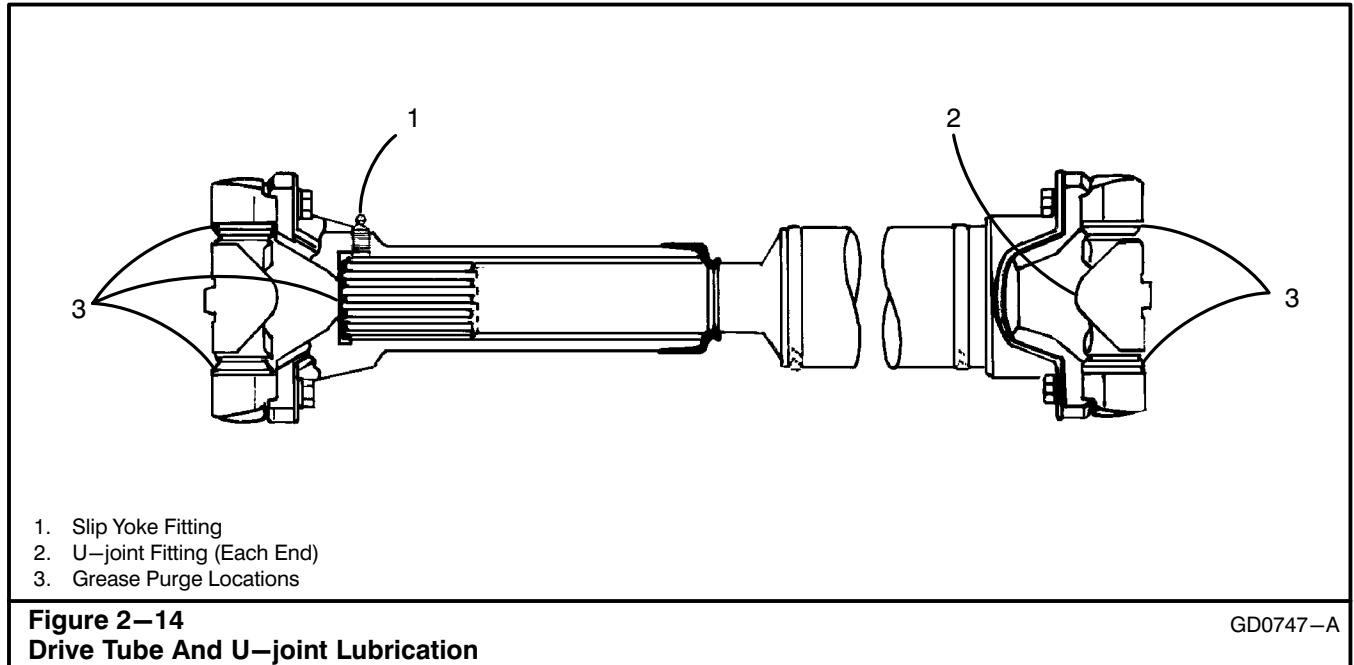
9. Install the element retainer (3) to the dust cover (1) and secure with the wing nut (10).
10. Clean or replace the element (5), as required.
11. Slide the element (5) inside the filter body (7) and install the wing nut (4).
12. Place the dust cover (1) on the filter body (7) and secure with the retaining ring (2).
13. Reset service indicator (9) by pressing button on top of it.

Operator's Manual



Changing The Air Cleaner Element (Style 2)

1. Park the crane on a firm level surface. Engage the park brake, shift the transmission to neutral and shutdown the engine.
2. Inspect the service indicator (1) to see if the red band is showing. Refer to Figure 2–13. If the red band is visible, proceed with the following steps. If the red band is not visible, 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.
3. Remove the cover from the air cleaner body (3).
4. Remove the primary element (5) from the air cleaner body (3).
5. If required, slide the safety element (4) out of the air cleaner body (3).
6. Remove the dust exhaust valve (6) and inspect it for damage or wear. Replace it if required.
7. Wipe the inside of the air cleaner body (3) clean using a damp cloth. Install the dust exhaust valve (6).
8. Install a new safety element (4) if required.
9. Clean or replace the primary element (5) as required.
10. Slide the primary element (5) into the air cleaner body (3).
11. Install the cover to the air cleaner body (3).
12. Reset the service indicator (1) by pressing the button on top of it.



Drive Tube And U-Joint Lubrication

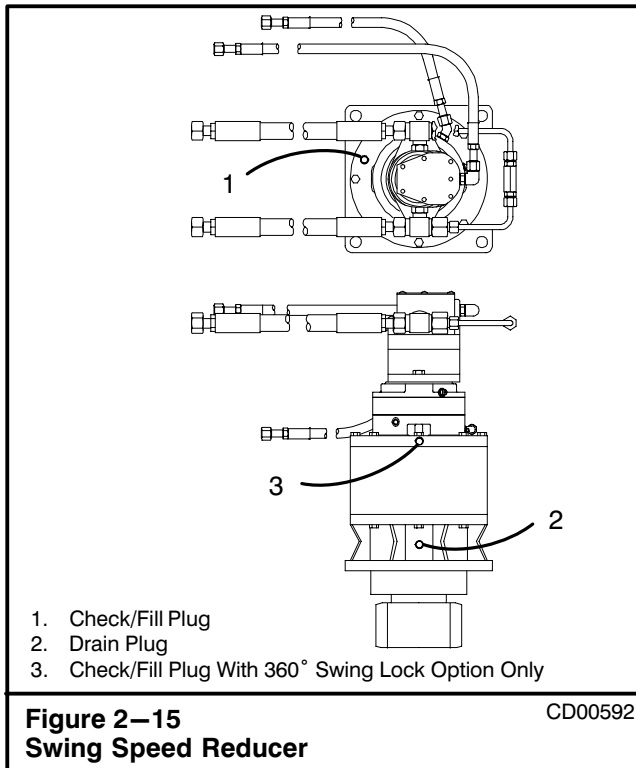
Drive tubes and u-joints are used to transmit torque from one drive line component to another. They also help absorb shock loadings. Because they are so critical to crane operation, thorough lubrication is necessary.

Lubrication Procedure For Drive Tubes/U-Joints

1. Park the crane on a firm level surface. Engage the park brake, shift the transmission to neutral and shutdown the engine. Follow steps 2 through 7 on each drive tube.
2. Check the slip yoke for looseness or side play.

3. Cover the air hole so that grease can flow easily to the seal. Apply grease through the fitting at the slip yoke until all the old grease is purged from the air hole at the end of the slip yoke. Refer to Figure 2-14 for illustration of 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 2-14 for grease fitting locations.
6. If grease does not purge from each seal, loosen the bearing cap bolts and 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.

Operator's Manual



Swing Speed Reducer Lubrication

Check the oil level in the swing speed reducer after every 50 hours of operation. The oil in a new swing speed reducer should be changed after the initial 100 hours of operation. Thereafter, change the 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 unit be disassembled and thoroughly inspected for damaged or worn parts. Replace damaged or worn parts as required.

Swing Speed Reducer Oil Level Check

1. Park the crane on a firm level surface. Shift the transmission to neutral, engage the park brake.
2. Engage travel swing lock and shutdown engine.
3. Clean the speed reducer around the check/fill plug to prevent contamination from entering the system. Remove the plug. Refer to Figure 2-15.
4. Oil should come to within .5 inch (12.7mm) of the bottom of the fill port. Add oil as required to bring the oil to the proper level. Refer to the Lubrication Chart for the correct grade of oil.

Note: On cranes equipped with the 360° swing lock option, oil should come to within .25 inch (6 mm) of the bottom of the fill port.



WARNING

On cranes equipped with the 360° swing lock option, make sure no oil is spilled on the swing brake or rotor when draining or adding oil to the swing speed reducer. This could cause erratic swing brake operation and result in an accident.

5. Clean and install the 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 check/fill and drain plugs to prevent contamination from entering the unit. Refer to Figure 2-15.
5. Remove 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. After the oil has thoroughly drained, clean and install the drain plug.



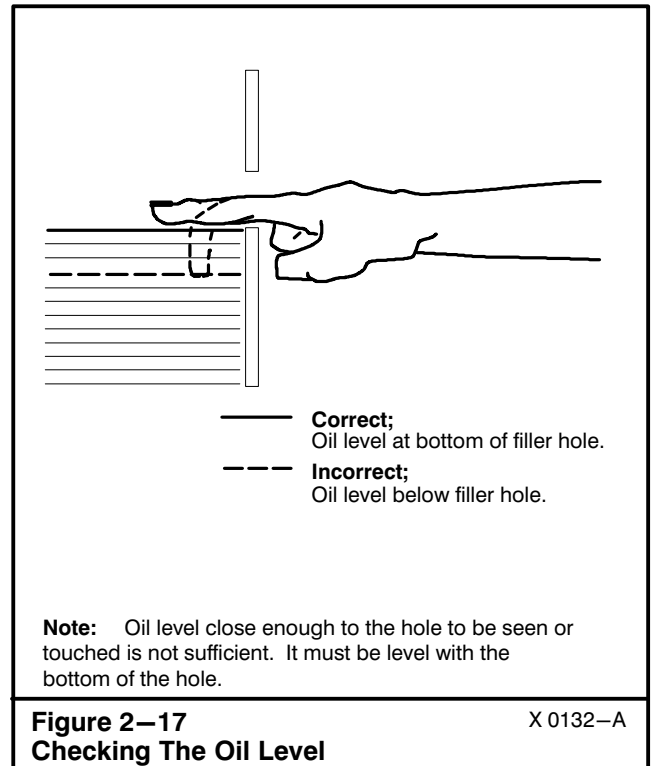
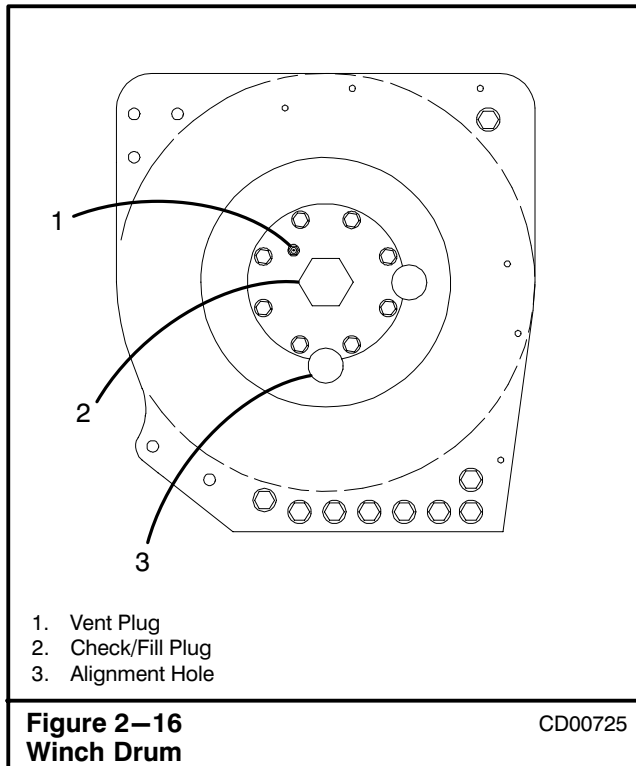
WARNING

On cranes equipped with the 360° swing lock option, make sure no oil is spilled on the swing brake or rotor when draining or adding oil to the swing speed reducer. This could cause erratic swing brake operation and result in an accident.

7. Fill the unit with oil through the check/fill hole. Oil should come to within .5 inch (12.7mm) of the bottom of the hole. For the correct grade and quantity of oil, refer to the Lubrication Chart.

Note: On cranes equipped with the 360° swing lock option, oil should come to within .25 inch (6mm) of the bottom of the fill port.

8. Clean and install the check and fill plugs. Properly dispose of the used oil.



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.

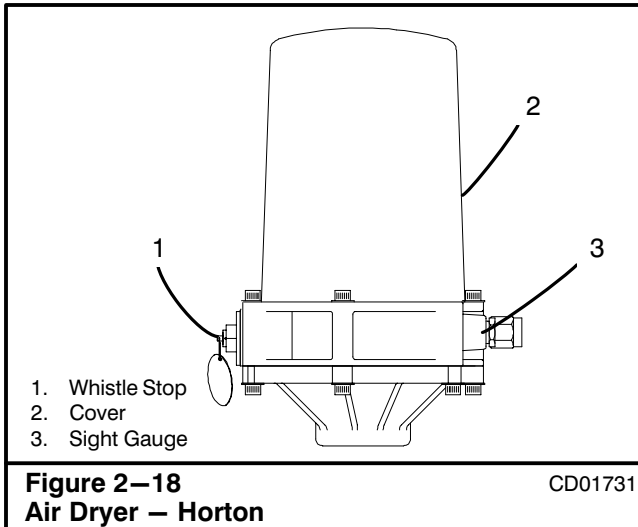
Winch Drum Oil Level Check

1. Park the crane on a firm level surface, shift the transmission to neutral, engage the park brake and shutdown the engine.
2. Thoroughly clean the exterior surface of the winch drum around the check/fill plug to prevent contamination from entering the unit. Refer to Figure 2-16.
3. Remove check/fill plug. Oil should be level with the bottom of the hole. Refer to Figure 2-17.
4. If necessary add oil as required, until it reaches the proper level. Refer to the Lubrication Chart for the correct grade of oil.
5. Clean and install the check/fill plug.

Winch Drum Oil Change

1. Park the crane on a firm level surface, shift the transmission to neutral and engage park brake.
2. Cycle winch for several minutes, without a load to agitate and warm the oil within winch drum.
3. Engage the travel swing lock and shutdown the engine. Thoroughly clean the exterior surface of the winch drum around the check/fill, vent and drain plugs to prevent contamination from entering the unit. Refer to Figure 2-16.
4. Rotate winch drum until the drain plug is aligned with the bottom alignment hole in the side support.
5. Remove the check/fill plug.
6. Install a short piece of pipe one inch in diameter in the larger threads of the drain hole.
7. Remove drain plug through the pipe and allow the oil to drain in a suitable container
8. After the oil has thoroughly drained, remove the vent plug.
9. Clean and install the drain and vent plugs.
10. Fill the unit with oil through the check/fill hole, until oil is level with the bottom of the hole. Refer to Figure 2-17. For the correct grade and quantity of oil, refer to the Lubrication Chart.
11. Clean and install the check/fill plug. Properly dispose of the used oil.

Operator's Manual



Air Dryer

The air dryer, if equipped, removes the three most harmful elements to the air system which are water, oil and dirt. The air dryer is located in the battery box at the left rear of the crane. Two types of air dryers have been used on this crane. Refer to Figure 2-18 and Figure 2-19.

Air Dryer - Horton

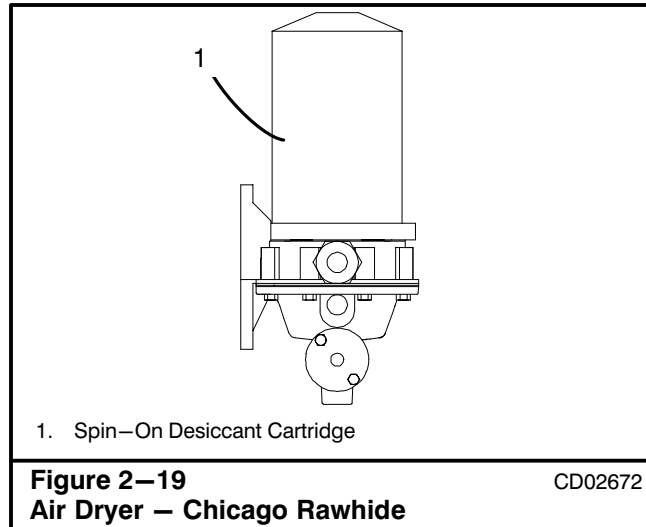
The Horton air dryer has two replaceable elements. The filter/coalescer element, located behind the whistle stop, must be changed annually or when whistle stop indicates a change is needed. The desiccant cartridge, located under the cover, should be checked daily using the sight gauge. When beads inside gauge change from dark blue to light blue, or white, the desiccant cartridge must be changed. See Figure 2-18.

Filter/Coalescer Change

1. Park crane on a firm level surface. Shift the transmission to neutral, and engage the park brake.
2. Engage travel swing lock and shutdown engine.
3. Relieve air system pressure by pushing the button on the relief valve located on hydraulic reservoir.
4. Open the drain valve on the air tank.
5. Remove whistle stop and slide out used element.
6. Slide in new element and install whistle stop.
7. Properly dispose of used cartridge.
8. Close the drain valve on the air tank.

Desiccant Cartridge Change

1. Remove whistle stop and slide out coalescer.
2. Remove allen head capscrews from base. Separate base from housing.
3. Turn desiccant cartridge counterclockwise to remove it from the base.



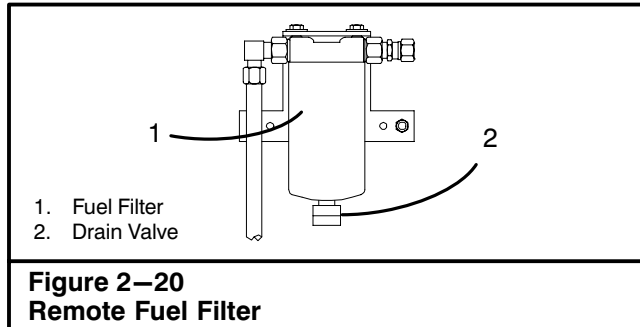
4. Install new cartridge by turning clockwise until hand tight.
5. Align base to mounting holes and install the allen head capscrews.
6. Install coalescer and whistle stop.
7. Properly dispose of used cartridge.

Air Dryer - Chicago Rawhide

The Chicago Rawhide air dryer has one replaceable element. The desiccant cartridge is a spin-on type and should be changed annually or when water is present. See Figure 2-19.

Desiccant Cartridge Change

1. Park crane on a firm level surface. Shift the transmission to neutral, and engage the park brake.
2. Engage travel swing lock and shutdown engine.
3. Relieve air system pressure by pushing the button on the relief valve located on hydraulic reservoir.
4. Open the drain valve on the air tank.
5. Turn the desiccant cartridge counterclockwise and remove it. Properly discard cartridge.
6. Remove and discard o-ring from adaptor plate stud.
- Note: If there is excessive oil in the check valve port, compressor may require servicing.**
7. Clean top surface of adaptor plate and threaded stud.
8. Using grease supplied, apply a light coating on o-ring. Install o-ring on adaptor stud.
9. Apply a generous coat of grease on the new desiccant cartridge gasket surface.
10. Thread new cartridge onto adaptor stud turning clockwise. When gasket contacts adaptor plate, tighten cartridge 1/2 turn. Do Not Overtighten.



Remote Fuel Filter

The function of the fuel filter is to remove water and contaminants from the fuel before they enter the fuel system. Removal of water and contaminants is important for troublefree operation and long life of the fuel system. Water should be drained daily before start-up. Change the filter every 500 hours of operation. Use the following procedures along with Figure 2–20.

Fuel Filter Water Drain

1. Park crane on a firm level surface and engage park brake, shift transmission to neutral and shutdown the engine.

CAUTION

The engine must be shutdown when draining water from the fuel filter to prevent water from being drawn into the fuel system.

2. Place a suitable container under the drain valve. Turn the valve counterclockwise approximately 1½ to 2 turns until draining occurs.
3. Continue draining until clear fuel is visible.

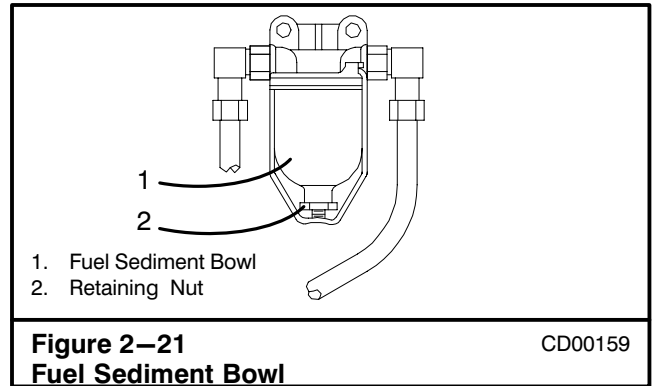
CAUTION

Do not over-tighten the valve. Over-tightening the drain valve can damage the threads.

4. Turn the valve clockwise to close the drain valve.
5. Properly dispose of fuel.

Fuel Filter Change

1. Park crane on a firm level surface and engage park brake, shift transmission to neutral and shutdown the engine.
2. Clean the area around the filter head.
3. Place a suitable container under the drain valve. Turn the valve counterclockwise approximately 3 turns until draining occurs. Drain all fuel from filter.
4. Remove the filter from head and discard.
5. Fill the new filter with clean fuel and lubricate the o-ring with clean engine oil.



CAUTION

To prevent fuel leaks, make sure the filter is installed tightly but do not over-tighten. Mechanical tightening will damage the filter.

6. Install new filter on filter head and tighten by hand.
7. Start the engine and check for leaks.

Note: If the crane is hard to start, it may be necessary to prime the fuel system. Refer to engine manufacturer's manual for the correct procedure.

8. Properly dispose of contaminated filter.

Fuel Sediment Bowl

The function of the fuel sediment bowl, if equipped, is to remove large contaminants from the fuel before they enter the fuel filter. Removal of contaminants is important for troublefree operation and long life of the fuel system. The fuel sediment bowl should be inspected daily and contaminants removed as required. Use the following procedures along with figure 2–21.

1. Park crane on a firm level surface and engage park brake, shift transmission to neutral and shutdown the engine.
2. Loosen retaining nut and remove sediment bowl.
3. Properly dispose of fuel and wipe bowl clean with a clean dry cloth.
4. Fill sediment bowl to the rim with clean fuel, install bowl and tighten the retaining nut.

Note: A small amount of air will be entrapped in the system which will be automatically vented. However, if the sediment bowl is not filled to the rim and a large amount of air enters the system it will make the engine hard to start, run rough, misfire, produce low power and can cause excessive smoke and a fuel knock. If this occurs manual bleeding of the fuel system is required. See engine manufacturer's manual for the correct procedure.

Operator's Manual

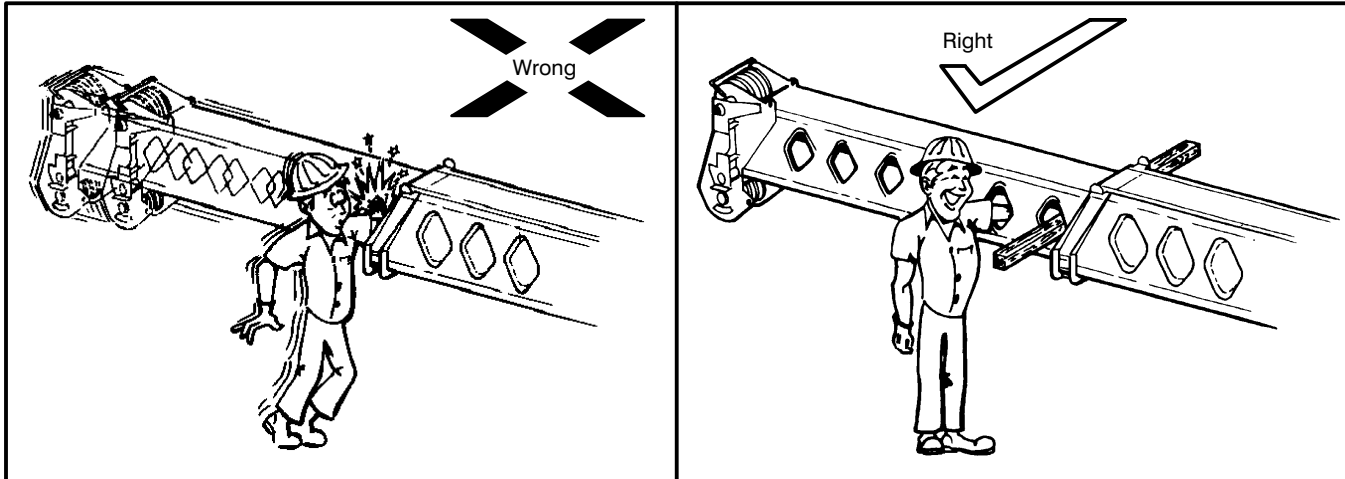


Figure 2-22
Place blocking through the diamond shaped hole, closest to the base section of the boom before putting hands or tools inside a boom section.

YC2333-A, YC2334-A



Figure 2-23
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 2-24 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 your 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 your nearest distributor for repair procedures. Also check for damaged or leaking hoses, fittings, valves, cylinders etc. Repair as necessary. At 250 hour intervals, check all boom wear shoes for proper adjustment. See "Boom Wear Shoe Adjustment" in Section 3 of this Operator's Manual for further details.

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" found later in this section and "Wire Rope Inspection And Replacement Recommendations" in Section 5 of this Operator's Manual.

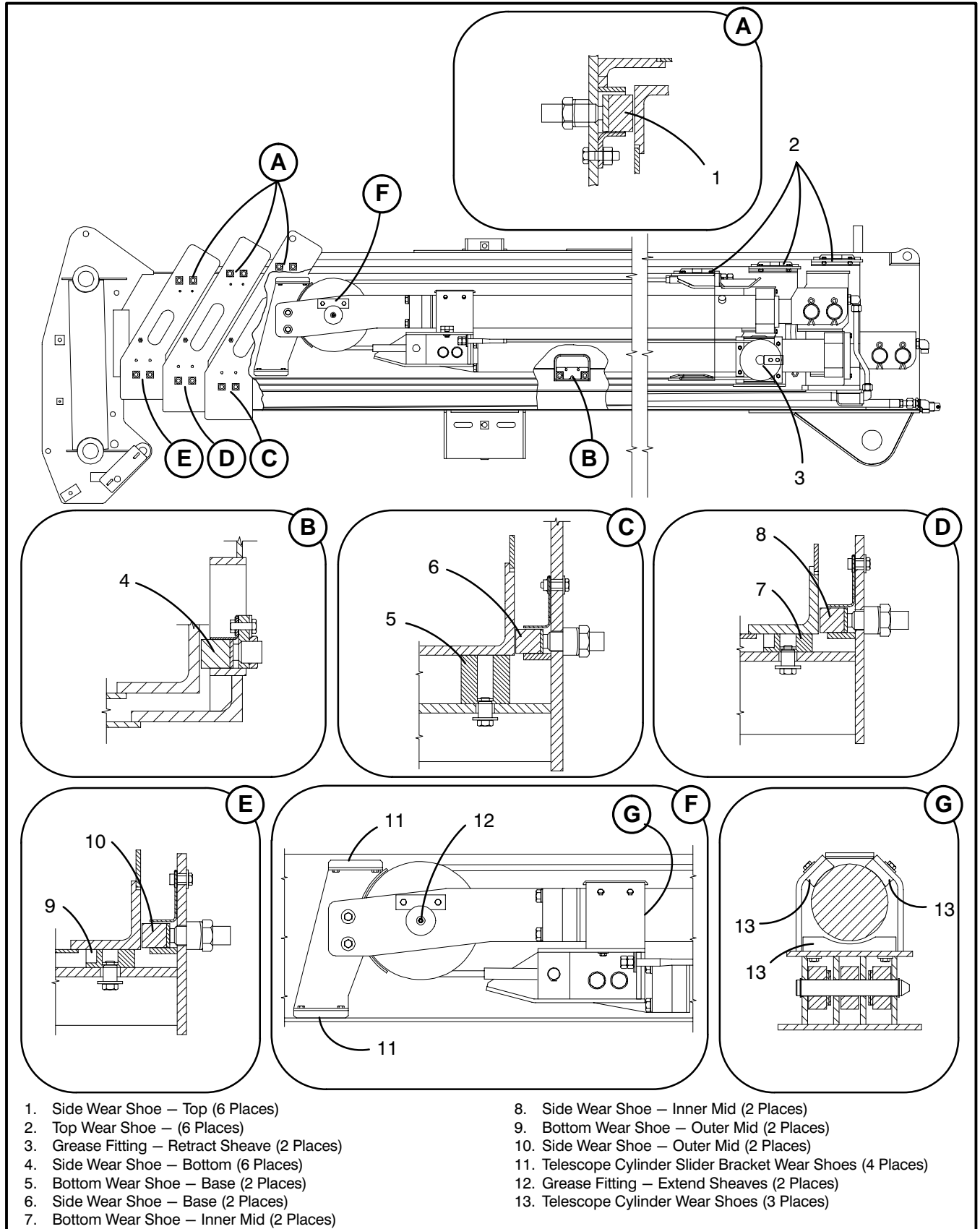


Figure 2-24
Boom Lubrication And Inspection

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Operator's Manual

Wire Rope Lubrication

Wire rope is like a crane 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 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 rope. The lubricant is squeezed out of the 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 rope.

No set rule can be given for lubrication frequency. This will depend on the type of conditions under which the rope is used.

A 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 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 rope. All possible foreign material and old lubricant should be removed from the rope before relubricating it. Use one of the following methods to apply the lubricant.

1. Continuous Bath

Run the rope through a container filled with lubricant. A sheave mounted in the center of the container will hold the rope submerged as it passes

through the container. Use swabbing to remove excess lubricant as the 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 & Lubrication

Inspect all parts of the lattice fly daily. Lubricate head machinery 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 your nearest 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 Systems

Maintenance of the Rated Capacity Limiter and anti-two block 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 the insulation on the boom reeling drum cable.
4. Check the boom reeling drum cable for proper tension.
5. Check the anti-two block boom 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 transducer at the boom hoist cylinder and the connecting hoses for oil leaks.
8. Test that the function limiters activate properly by two—blocking the crane. (Do this by manually lifting the ATB weight.)

Check the following every 30 days.

1. Check that the displayed boom angle agrees with the measured angle.
2. Check that the displayed radius agrees with the measured operating radius.
3. Check that the displayed boom length agrees with the actual boom length.
4. If a known test weight is available, check that the displayed weight agrees with the test load. The displayed load includes the hookblock and any lifting attachments such as slings, pins and shackles.
5. If the capacity chart is rated for specific areas e.g. side, front or rear, the system should be checked by swinging the boom into the permitted areas and checking that the Rated Capacity reading agrees with the crane Capacity Chart.



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/repared before continuing operation.

Display Cleaning

The Rated Capacity Limiter display is not field serviceable and should not be disassembled by anyone other than an authorized service repair facility. However, the screen can be sufficiently cleaned without unit disassembly.



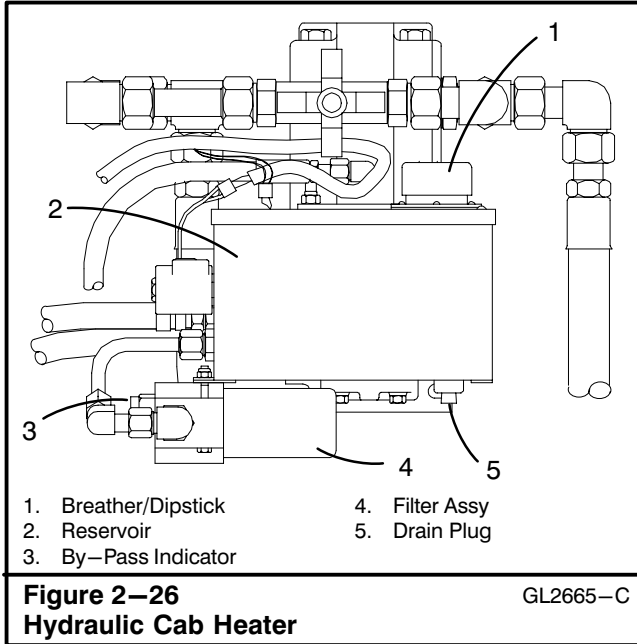
Figure 2—25
Display Cleaning

Compressed air used for cleaning electronic equipment can be obtained at any major electronic or office supply store. **DO NOT USE FACTORY COMPRESSED AIR.** Kensington Dust Blaster has been used with good results.

After removing the display from the crane console, locate the rectangular ventilation hole on the side of the display. This is the area of access for cleaning the display.

Insert the nozzle of the compressed air just to the edge of the LCD display at the air gap, and angled toward the display screen cover. Activate the air container and slide from end to end of the display. Only a few seconds of application should be required to sufficiently clean the display unit. If the unit cannot be adequately cleaned using this process, it must be returned to a factory authorized repair facility.

Operator's Manual



Hydraulic Cab Heater

The hydraulic oil within the hydraulic cab heater is self contained. Therefore, the system requires an oil level check and a filter and oil change on a periodic basis. Check the oil level after every 10 hours of operation. Change the filter after the initial 100 hours of operation and with every hydraulic cab heater system oil change thereafter. The system contains a by-pass indicator

which signals when the filter needs changing between oil changes. Change the oil in the reservoir with every 1,000 hours of operation or annually whichever occurs first.

Hydraulic Cab Heater Oil Level Check

1. Park the crane on a firm level surface, apply the park brake, shift the transmission to neutral and shutdown the engine.
2. Clean the top of the reservoir and the breather/ dipstick. Rotate the breather/dipstick counterclockwise, until loose, and remove the dipstick from the reservoir. Refer to Figure 2-26.
3. Wipe all the oil from the dipstick and place it back into the reservoir. Tighten the breather/dipstick.
4. Remove it again and read the oil level on the dipstick. The oil level should be to the "FULL" mark on the dipstick. Refer to Figure 2-27.
5. Add oil as required to bring the oil level to the "FULL" mark on the dipstick. Use only the oil type specified on the Lubrication Chart. Do not overfill.
6. Once the proper oil level is obtained, install the dipstick in the reservoir and turn the dipstick handle clockwise until tight.
7. Check the by-pass indicator on the filter assembly and service the filter if the red indicator is showing. Refer to "Hydraulic Cab Heater Filter Replacement" for specific instructions on filter maintenance.

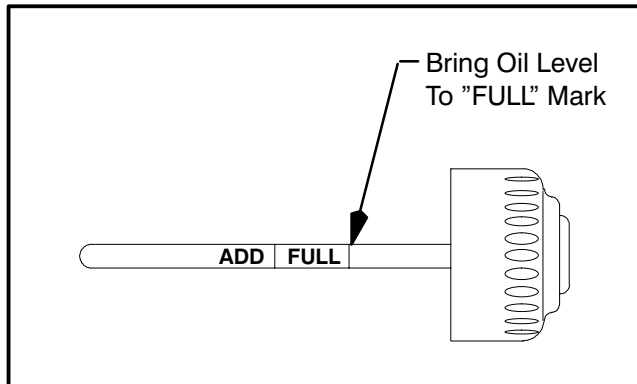


Figure 2-27
Hydraulic Heater Breather Dipstick

Hydraulic Cab Heater Filter Replacement

Change the filter element after the initial 100 hours of service. Change it every 500 hours, or when the hydraulic cab heater system oil is changed, or when the bypass indicator shows red thereafter. Allow the heater assembly to cool before making a filter change.

1. Park the crane on a firm level surface, apply the park brake, shift the transmission to neutral and shutdown the engine.



WARNING

Allow the heater assembly to cool before making a filter change. Oil may be hot and could cause burns.

2. Clean the entire filter assembly and adjacent areas. Refer to Figure 2-28.
3. Remove the filter housing from the head. Remove the element from the head. Clean the inside of the filter housing.
4. Install a new element in the head. Exercise care to prevent damaging the o-ring in the element during installation.
5. Install the filter housing into the head until it is fully seated.
6. Check the oil level in the reservoir and add oil as required.

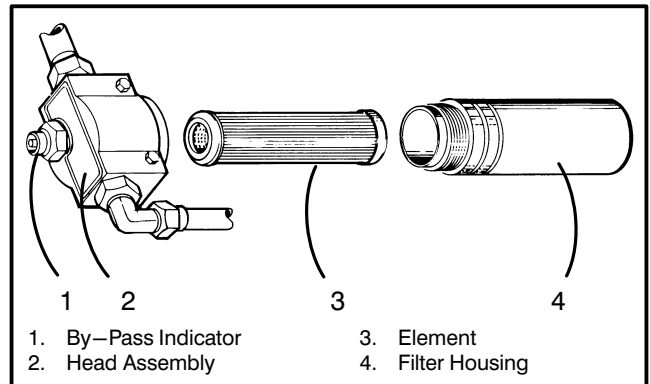


Figure 2-28
Hydraulic Heater Filter Assembly

GL2665-C

7. Start the engine and operate the heater for several minutes. Inspect for leaks. Check the oil level again and add oil as required.
8. Install the access panel.

Hydraulic Cab Heater System Oil Change

1. Park the crane on a firm level surface, apply the park brake, shift the transmission to neutral and shutdown the engine.
2. Clean the areas around the breather/dipstick and drain plug. Refer to Figure 2-26.
3. Place a suitable container capable of holding 2 gallons (7.6L) under the reservoir.
4. Remove the drain plug from the reservoir. Let the system drain thoroughly.

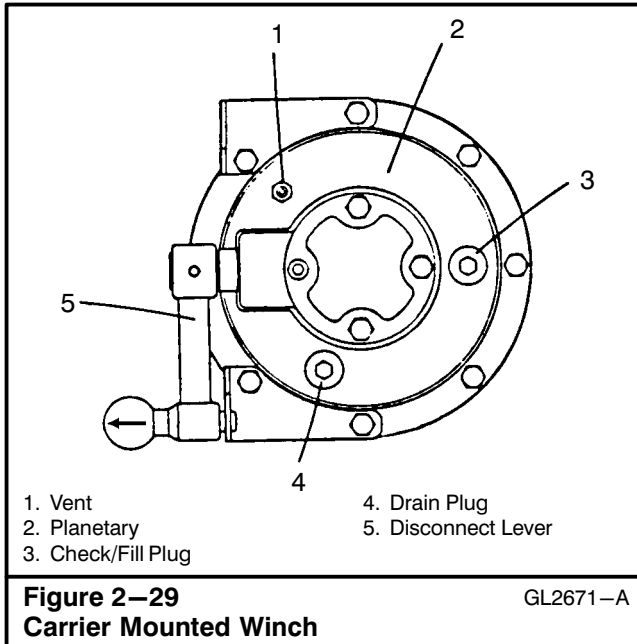


WARNING

Oil may be hot and could cause burns.

5. Replace the filter element using the procedures found earlier in this Section.
6. Clean and install the drain plug.
7. Remove the breather/dipstick from the reservoir. Pour 1½ gallons (5.7L) of clean, uncontaminated oil into the reservoir. Refer to the Lubrication Chart for the correct type of oil. Install the breather/dipstick.
8. Start the engine and operate the heater for several minutes. Inspect for leaks. Check the oil level again and add oil as required.

Operator's Manual



Carrier Mounted Winch

The planetary, of the carrier mounted winch, should have the oil checked daily, if it is in use. The oil should be changed after the initial 10 hours of operation, and every 50 hours of operation or annually thereafter.

Carrier Winch Oil Level Check

1. Park the crane on a firm level surface, apply the park brake, shift the transmission to neutral and shutdown the engine.
2. Thoroughly clean the area around the check/fill plug to prevent foreign material from entering the planetary. Refer to Figure 2-29.
3. Remove the check/fill plug. Oil should be level with the bottom of the check/fill hole. Add oil as required.
4. Clean and install the check fill plug.

Carrier Winch Oil Change

1. Operate the carrier winch, in both directions, for several minutes to warm and agitate the oil.
2. Park the crane on a firm level surface, apply the park brake, shift the transmission to neutral and shutdown the engine.
3. Thoroughly clean area around the check/fill and drain plugs to prevent foreign material from entering planetary. Refer to Figure 2-29.

4. Remove the check/fill and drain plugs. Allow planetary oil to drain thoroughly into an appropriate container. Properly dispose of used oil.
5. Clean and install the drain plug.
6. Fill the planetary with oil, until the oil is level with the bottom of the check/fill hole. Refer to Figure 2-17.
7. Clean and install the check/fill plug.

Hook Block, Ball & Swivel Inspection, & Maintenance

1. All nuts, set screws, 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 set screws 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, set screws that are tight and staked. Check that hook latch is operative.

Hook Balls: Check pin, nut and washer to insure 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 .020-.050 inches (0.5-1.2mm). If this distance increases more than .060 inch (1.5mm) over the above distance, it is a good indication of bearing fatigue and the unit should be removed from service.

Operator's Manual

Item	Under Intermittent Operating Conditions	Under Continuous Operating Conditions
Swivels, Swivel Overhaul Balls, Swivel Balls	14 days	24 hours
Blocks with Bronze Bushed Sheaves	14 days	8 hours
Blocks with Roller Bearing Sheaves	14 days	24 hours

Chart A – Hook Block, 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 .06 inch (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 severe bearing wear. Remove from service. Check for wear in bronze spacers where used.
		Striations or corrugations in sheave groove.	Result of rope wear. If serious, replace
Hook Latch	When Used	Missing, off center, bent, broken spring, missing or defective.	Replace immediately
Hooks	Daily or When Used	Permanent deformation or stretching.	An indication of overload. 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 magnifying, x-ray or other qualified method. Intermittent tests can be conducted by a less accurate oil stain method.

Chart B – Hook Block, Ball & Swivel Inspection Frequency

Operator's Manual

Turntable Bearing Capscrew Torque

Proper tightening of turntable bearing capscrews is very important. If the bearing has been replaced or the crane undocked for any reason, capscrews should be replaced. Reuse of capscrews is not recommended.

CAUTION

Loctite pipe sealant is used on the turntable bearing capscrews. The Loctite pipe sealant seals the threads to prevent rust and corrosion.

Capscrews should be inspected and/or torqued after the first 250 hours of operation. Inspect and/or torque capscrews every 500 hours of operation thereafter. Torque capscrews to 1,060–1,170 ft lb (1 437–1 587Nm).

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 machine'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 at a time. Make sure 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 1000 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 as 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

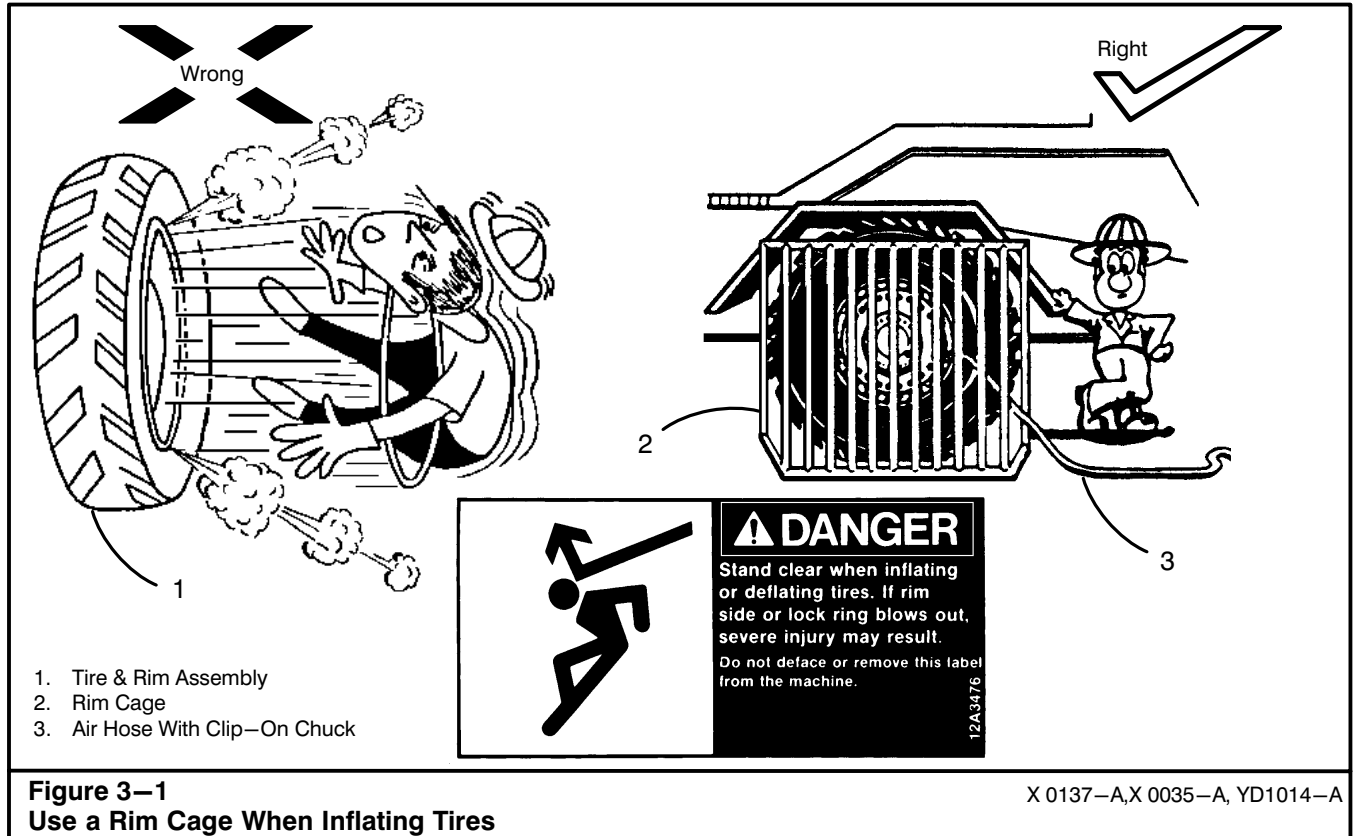
Care should be taken when cleaning the cab dash, especially the new polycarbonate dashes. If the incorrect cleaning agent is used, the finish of the material could be destroyed. It is recommended by the dash manufacturer that only the following materials be used for cleaning:

1. Soap and water
2. Denatured alcohol
3. Joy and Palmolive dishwashing liquids
4. Windex with Ammonia D
5. Formula 409, Fantastik, Mr. Clean

Table Of Contents

Tires And Tire Inflation	3-1
Tire & Rim Safety Instructions	3-2
Tire & Rim Removal And Installation	3-3
Removal	3-3
Installation	3-3
Brake Adjustments	3-4
Park Brake Adjustment	3-4
Swing Brake	3-6
Swing Brake Inspection And Adjustment	3-6
Travel Swing Lock	3-6
Travel Swing Lock Adjustment	3-7
360 Degree Swing Lock	3-7
360° Swing Lock Inspection & Adjustment	3-7
Bubble Level	3-8
Bubble Level Adjustment	3-8
Crane Monitoring System	3-8
Hydraulic System Relief Valve Adjustment	3-9
Preparing the Crane For Checking Relief Pressures	3-9
Relief Valve Pressure Checking Instructions	3-9
Emergency Steer Accumulator Pressure Check	3-13
Boom Wear Shoe Adjustment	3-14
Boom Extend And Retract Wire Rope Inspection And Adjustment	3-16
Extend/Retract Wire Rope Inspection	3-16
Extend/Retract Wire Rope Adjustment	3-16

Operator's Manual



Tires And Tire Inflation

Check the tire inflation pressures daily when the tires are cold. Use the Tire Inflation label, located on the rear of the carrier, 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 1 mph (1.6km/h). The crane should not be road driven with the tires inflated to “Maximum Lifts On Rubber” pressures.

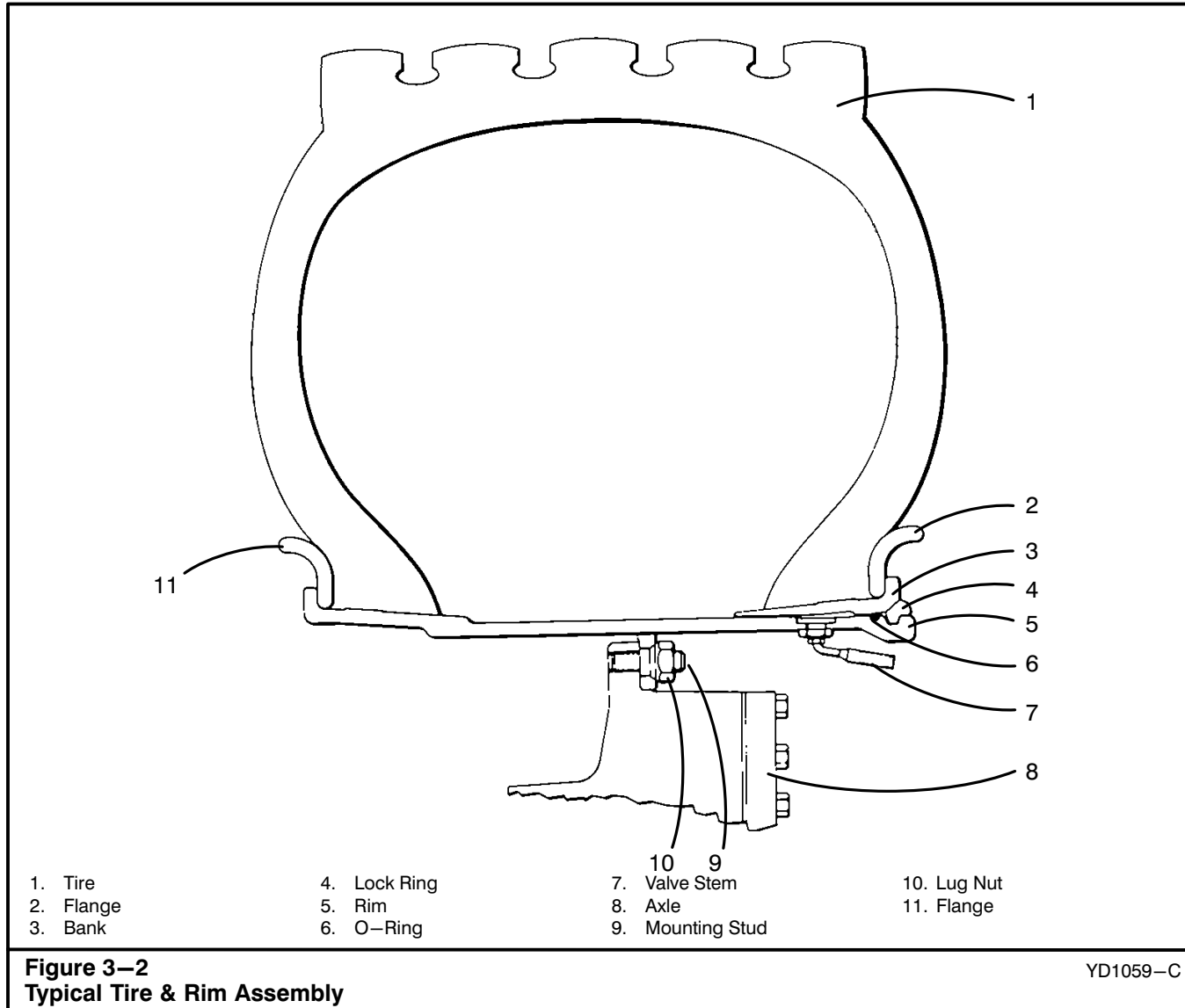
“Maximum Speed” pressures are for highway travel only. Even with the tires inflated to the “Maximum Speed” pressures, speed is limited to 20 mph (32km/h) with a 30 minute rest period after each 50 miles (80km) of driving or 2 hours of sustained operation, whichever comes first. One hour minimum stop 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.

! 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.

Operator's Manual



Tire & 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 be sure 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. Be sure the air hose is long enough, to permit the person inflating the tire, to stand clear of the rim cage.

Operator's Manual

- 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.
- Once it is determined that the tire and rim are properly assembled, inflate the tire to the pressure listed on the Tire Inflation Chart. Do not over inflate the tire.
- Always check rims and wheel ends for damage during normal tire inspection. Early detection of potential component failure may prevent serious injury.
- 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.
- Carefully remove the valve core from the valve stem (7). Allow the air pressure to exhaust from the tire (1). Install the valve core back in the valve stem. Remove the rim cage. Refer to Figure 3–2.
- Remove all but four of the lug nuts (10) from the mounting studs (9). The four remaining lug nuts should be equally spaced around the rim (5).
- Properly support the tire and rim assembly with an appropriate lifting device.
- Remove the remaining lug nuts (10) from the mounting studs (9).
- Carefully remove the tire and rim assembly from the axle (8).

Tire & Rim Removal And Installation

Carefully read and understand the safety instructions given earlier in this section of the 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

- Properly park the crane and engage the park brake. Level the crane on outriggers with all tires clear of the ground. shutdown the engine.
- 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.

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.

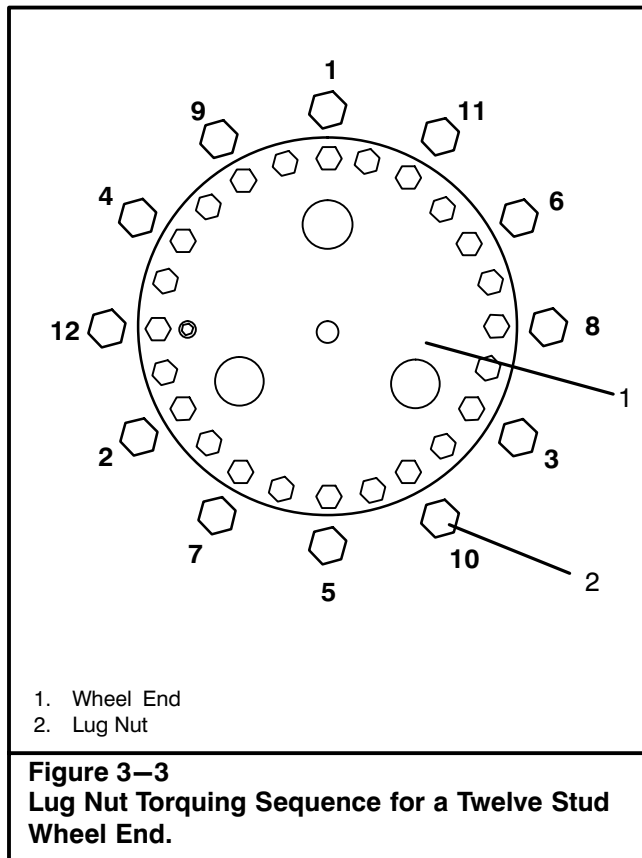
- Check the tire (1) to ensure it is completely deflated. Inspect the flanges (2,11), bank (3), o-ring (6), lock ring (4), and rim (5) for damage and proper assembly. Refer to Figure 3–2.
- Thoroughly clean the mounting surfaces of the rim (5) and axle (8). Remove any dirt, rust, excess paint, or other foreign materials. Also clean, but do not lubricate, the lug nuts (10) and mounting studs (9).
- 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 (8).
- Install the lug nuts (10) on the mounting studs (9). Tighten the lug nuts evenly to ensure the rim (5) is properly seated on the axle (8).



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.

Operator's Manual



5. Tighten the lug nuts (10) 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 (10) 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 Chart.

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.

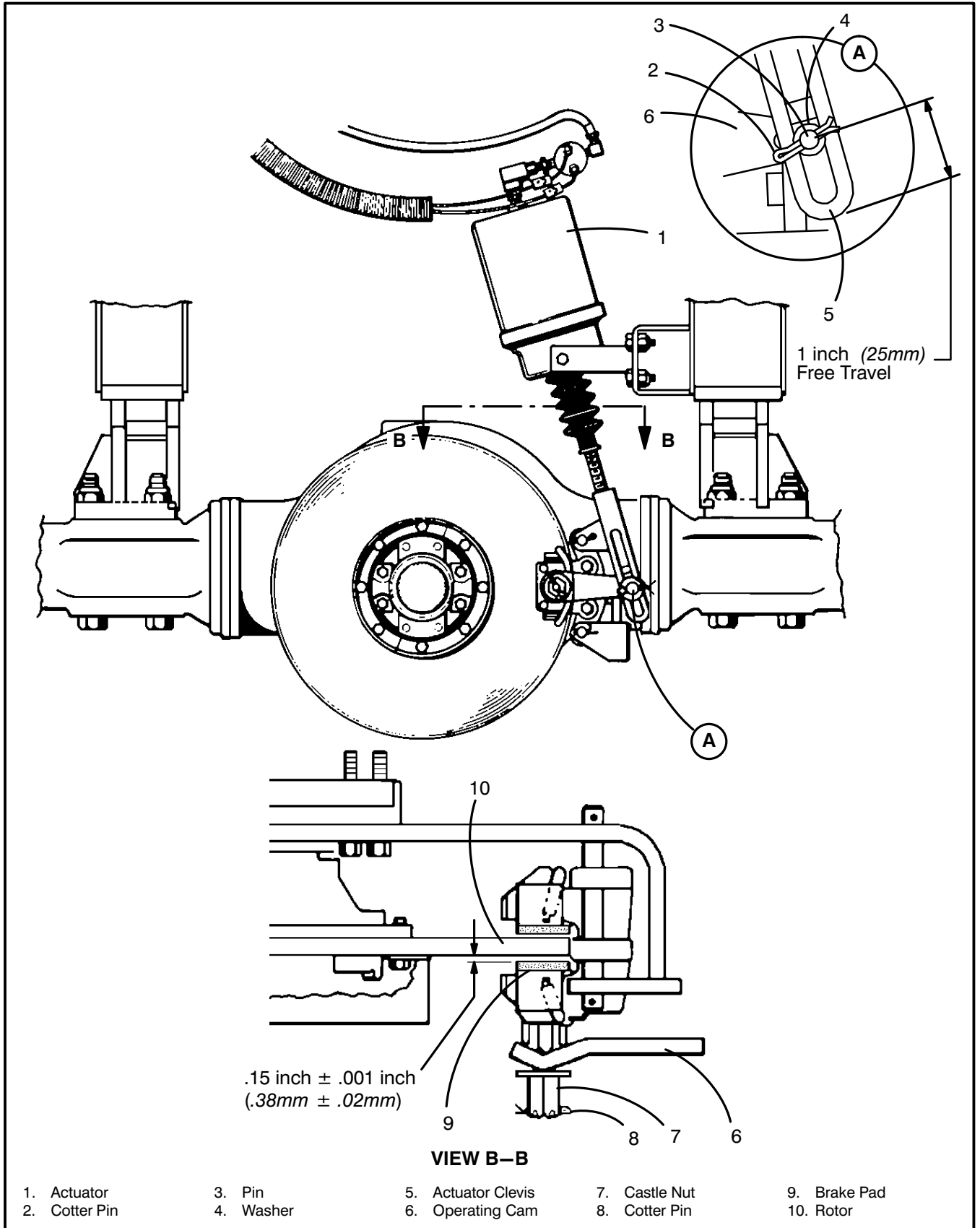
Brake Adjustments

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.

Park Brake Adjustment

1. Park the crane on a firm level surface. Engage the park brake and shift the transmission to neutral. Level the crane on outriggers.
2. Release the park brake.
3. Inspect the park brake actuator clevis (5) for proper adjustment. With the park brake fully released the clevis free travel should be 1 inch (25mm). Refer to Inset A, Figure 3-4.
4. If the actuator clevis needs adjustment, remove the cotter pin (2), pin (3) and washer (4) and disconnect the actuator clevis (5) from the operating cam (6) and adjust the free travel as required. Reconnect the actuator clevis once the proper adjustment is obtained.
5. Inspect the brake pads for proper clearance. There should be .015 inch \pm .001 inch (.38mm \pm .02mm) clearance between each brake pad (9) and the rotor (10). Refer to view B-B, Figure 3-4.
6. If the brake pad clearance requires adjustment, remove the cotter pin (8) and rotate the castle nut (7) until the proper clearance is obtained between each brake pad (9) and the rotor (10). Reinstall the cotter pin once the proper clearance is obtained.
7. Test the park brake adjustment by retracting the outrigger jacks and beams, shifting to 2 wheel drive, shifting the transmission to "1" and increasing the engine speed to full throttle. With the park brake engaged the crane should remain stationary.

Operator's Manual

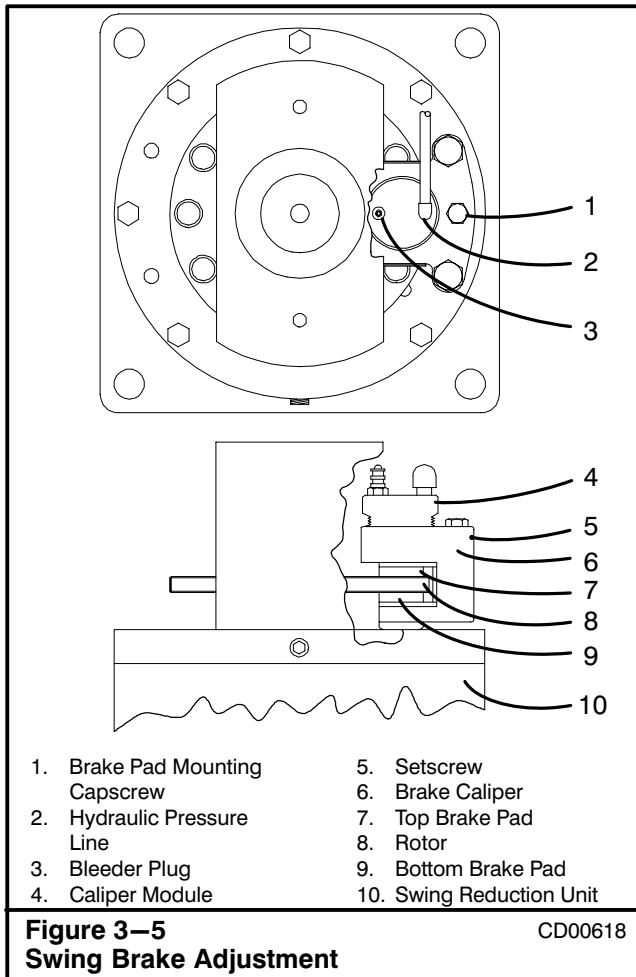


- | | | | | |
|---------------|-----------|--------------------|---------------|--------------|
| 1. Actuator | 3. Pin | 5. Actuator Clevis | 7. Castle Nut | 9. Brake Pad |
| 2. Cotter Pin | 4. Washer | 6. Operating Cam | 8. Cotter Pin | 10. Rotor |

Figure 3-4
Park Brake Adjustment

YE1606-B, YE1608-B

Operator's Manual



2. Engage travel swing lock and shutdown engine.
3. Check the clearance between the swing brake rotor and bottom caliper brake pad. This clearance should be .006–.030 inch (.15–.76mm). If the clearance is not within these specifications, proceed with Steps 4 thru 10. Refer to Figure 3-5.
4. Relieve the hydraulic system precharge pressure by pushing the button on the pressure relief valve located on the hydraulic reservoir.



WARNING

All trapped hydraulic pressure must be exhausted from the system before removing any line, plug or cover. A sudden release of hot oil could cause burns or other serious injury.

5. Disconnect the hydraulic line from the brake.
6. Loosen the setscrew in the side of the brake caliper to disengage the module.
7. Insert a .006–.030 inch (.15–.76mm) feeler gauge between the bottom disc brake pad and rotor. Rotate the caliper module until the feeler gauge is tight between bottom disc brake pad and rotor.
8. Back the module off until the feeler gauge is free and pressure line port, bleeder plug and capscrew, which secures brake pad to caliper, are in line as shown in Figure 3-5. Tighten the setscrew.
9. Install hydraulic pressure line and bleed all air from system using the bleeder plug. Apply hydraulic pressure and check for leaks.



WARNING

When bleeding air from the system, make sure no oil is spilled on swing brake or rotor. This could cause erratic swing brake operation and result in an accident.

10. Test all swing brake functions before operating the crane. Readjust if required.

Swing Brake

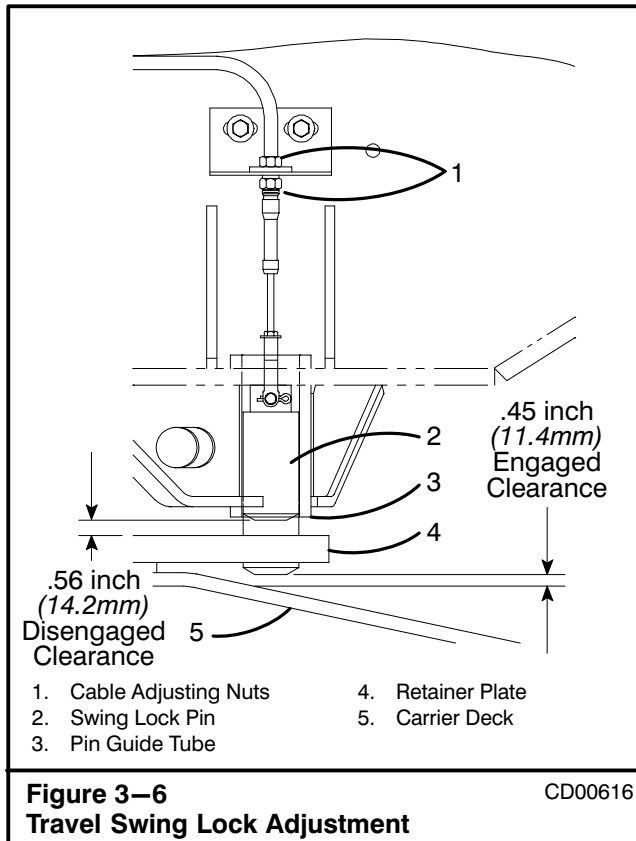
The standard swing brake is a self contained dry multiple disc type brake mounted on the swing speed reducer. The disc pads within the unit require no adjustment. The swing brake equipped with the 360 degree swing lock option is a hydraulic applied and released disc type brake mounted on the swing speed reducer. It requires periodic adjustment due to brake pad wear. The unit is engaged and released by the swing brake foot pedal.

Swing Brake Inspection And Adjustment

1. Park the crane on a firm level surface. Shift the transmission to neutral and engage the park brake.

Travel Swing Lock

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 adjusted properly.

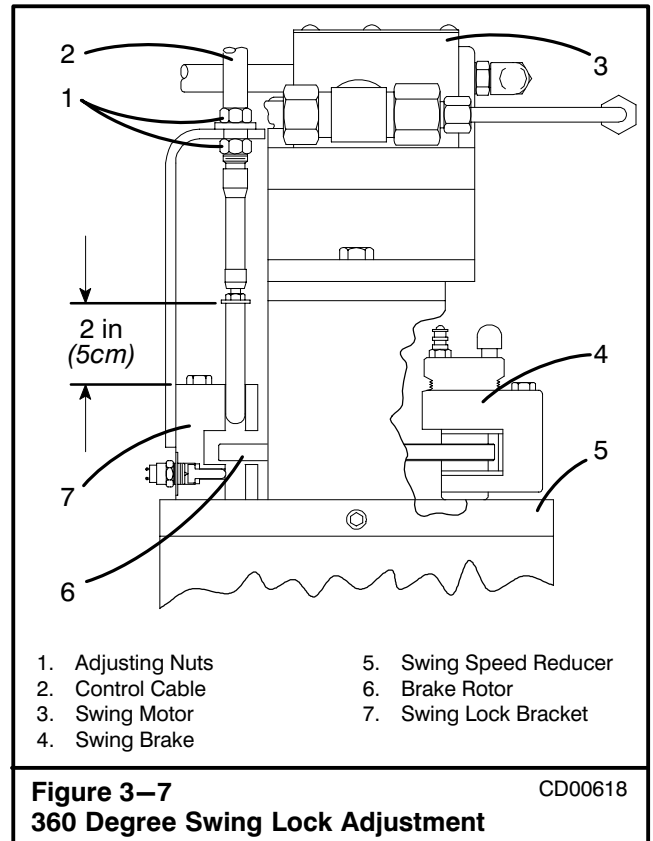


Travel Swing Lock Adjustment

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 3-6.
3. Check the engagement of the swing lock pin in the retainer plate on the carrier deck. The pin should extend in the retainer plate to within .45 of an inch (11.4mm) of the carrier deck.
4. Release the swing lock and check the clearance between the pin and retaining plate. The pin should be .56 of an inch (14.2mm) from the top of the retainer plate.
5. Adjust the stroke of the swing lock as required by using the cable adjusting nuts.
6. Test the swing lock in each working position before operating the crane.

360 Degree Swing Lock

The 360° swing lock, if equipped, functions to prevent rotation of the upper over the carrier by locking the swing speed reducer. For the swing lock to operate properly it must be adjusted correctly.



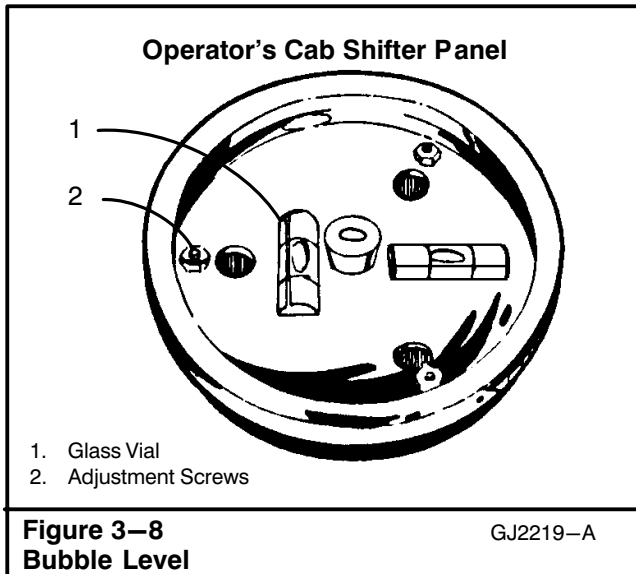
360° Swing Lock Inspection & Adjustment

1. Park the crane on a firm level surface. Engage the park brake and shift the transmission to neutral. Level the crane on outriggers.
2. Engage the travel swing lock and check that the 360° swing lock control knob is in the fully released position. Shutdown the engine.

Note: The travel and 360° swing lock control cables should only operate after the release button in the center of the control knob is depressed. Replace the control cable if the release button is defective.

3. Visually inspect the 360° swing lock pin. The top of the lock pin should be 2 inches (5cm) from the swing lock bracket surface. Refer to Figure 3-7.
4. If the lock pin is out of adjustment use the cable adjusting nuts to correctly position it.
5. Tighten the adjusting nuts and test the 360° swing lock before operating the crane.

Operator's Manual



Bubble Level

A bubble level, for leveling the crane on outriggers, is mounted on the operator's cab side console, to the right of the operator. It should be checked periodically to ensure proper adjustment.

Bubble Level Adjustment

1. Park the crane on a firm level surface. Engage the park brake and shift the transmission to neutral.
2. Level the crane on fully extended outriggers. Position the upper over the front of the carrier and en-

- gage the travel swing lock. Fully retract the power sections of the boom. Boom down to a 0° angle.
3. Verify the crane is level by placing a carpenter's level on the carrier deck. Check the levelness front to back and side to side. Adjust the outriggers as necessary.
4. Rotate the adjustment screws as required until the bubble inside the glass vial is centered within the vial. Refer to Figure 3-8.

Note: Do not flatten out the springs under the bubble level. Loosen rather than 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" found 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 local 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.

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—9 thru Figure 3—11 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 and work the control, for the circuit being checked, back and forth to relieve any trapped hydraulic pressure.

Note: For functions which are operated by a toggle switch, the ignition switch must be in the "ON" position but do not start the engine.



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.

3. Install the pressure gauge on the quick disconnect fitting.
4. 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.
5. Start the engine.
6. If applicable, fully engage the control for the circuit being checked and hold it in that position.
7. With the engine running at the speed specified in the "Hydraulic Pressure Settings" chart, check the gauge for the correct reading, adjust as required.

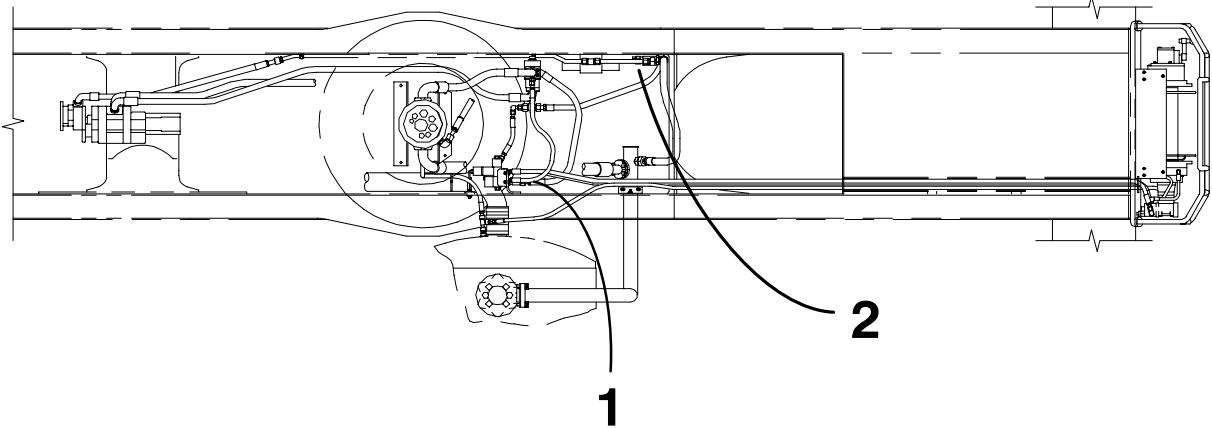
Note: Obtain each final pressure by bringing the pressure up to the proper setting, not by backing down to it.

8. Allow the engine to return to idle before shutting it down.
9. 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.

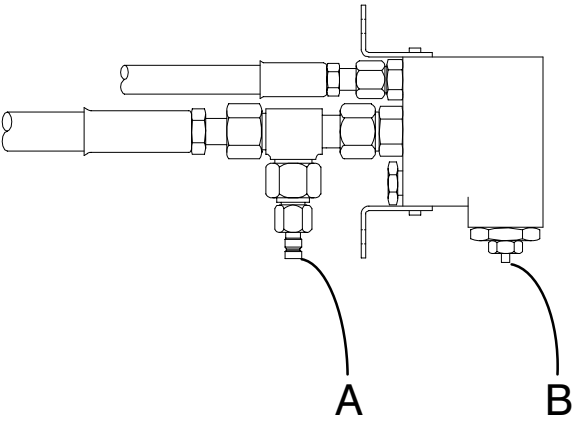
Operator's Manual

Hydraulic Pressure Settings				
Relief Valve	Hydraulic Circuit	Quick Disconnect & Adjustment Location	Relief Valve Setting*	Procedure For Setting The Relief Valve
1	Carrier Mounted Tow Winch (if equipped)	Figure 3–10 A & B	2,000 psi (13 790kPa)	Remove & Cap Brake Release Hydraulic Line. Winch In & Hold. Engine At Full Throttle.
2	Outrigger	Figure 3–10 C & D	2,500 psi (17 237kPa)	Fully Retract An Outrigger Jack or Beam & Hold. Engine At Full Throttle.
3	Steering	Figure 3–10 & Figure 3–11 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 & Hold, Check Pressure. Fully Steer Right & Hold, Check Pressure. Engine At Full Throttle.
4	Boom Telescope	Figure 3–11 F & G	2,500 psi (17 237kPa)	Crane on Fully Extended Outriggers, Travel Swing Lock Engaged with Boom Over Front. Fully Retract Telescope Cylinders & Hold. Engine At Full Throttle.
	Boom Hoist	Figure 3–11 F & H	3,100 psi (21 374kPa)	Crane on Fully Extended Outriggers, Travel Swing Lock Engaged, Boom Fully Retracted & Over Front. Fully Boom Up & Hold. Engine At Full Throttle.
5	Swing	Figure 3–11 I & J	1,900 psi (13 100kPa)	Swing Left & Hold, Check Pressure. Swing Right & Hold, Check Pressure. Engine At Full Throttle.
6	Front & Rear Winch	Figure 3–11 K & L	3,500 psi (24 132kPa)	Travel Swing Lock Engaged with Boom Over Front. Remove & Plug Line to the Rear Winch Brake. Engage Rear Winch Down & Hold. Engine At Full Throttle.
7	Pilot Control	Figure 3–11 M & N	500 psi (3 447kPa) +0 –50 psi (+0 –344kPa)	Fully Steer Right or Left & Hold. Engine At Full Throttle.
*Adjust All Pressures to Within ± 50 psi (344kPa) Except Where Noted				
Figure 3–9 Relief Valves Pressures & Adjusting Procedures				

Carrier Relief Valve Locations



1



2

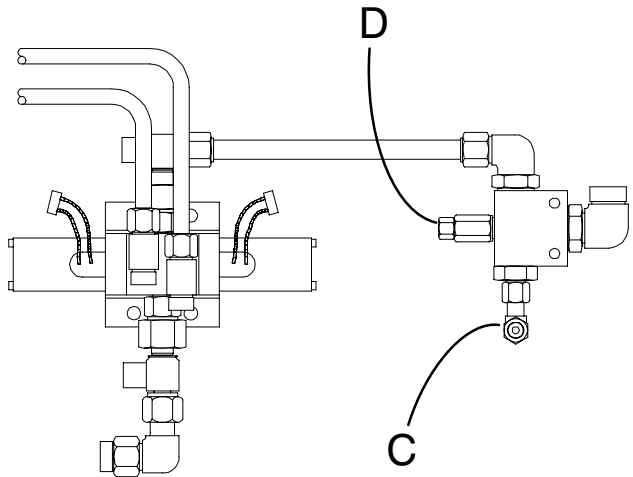
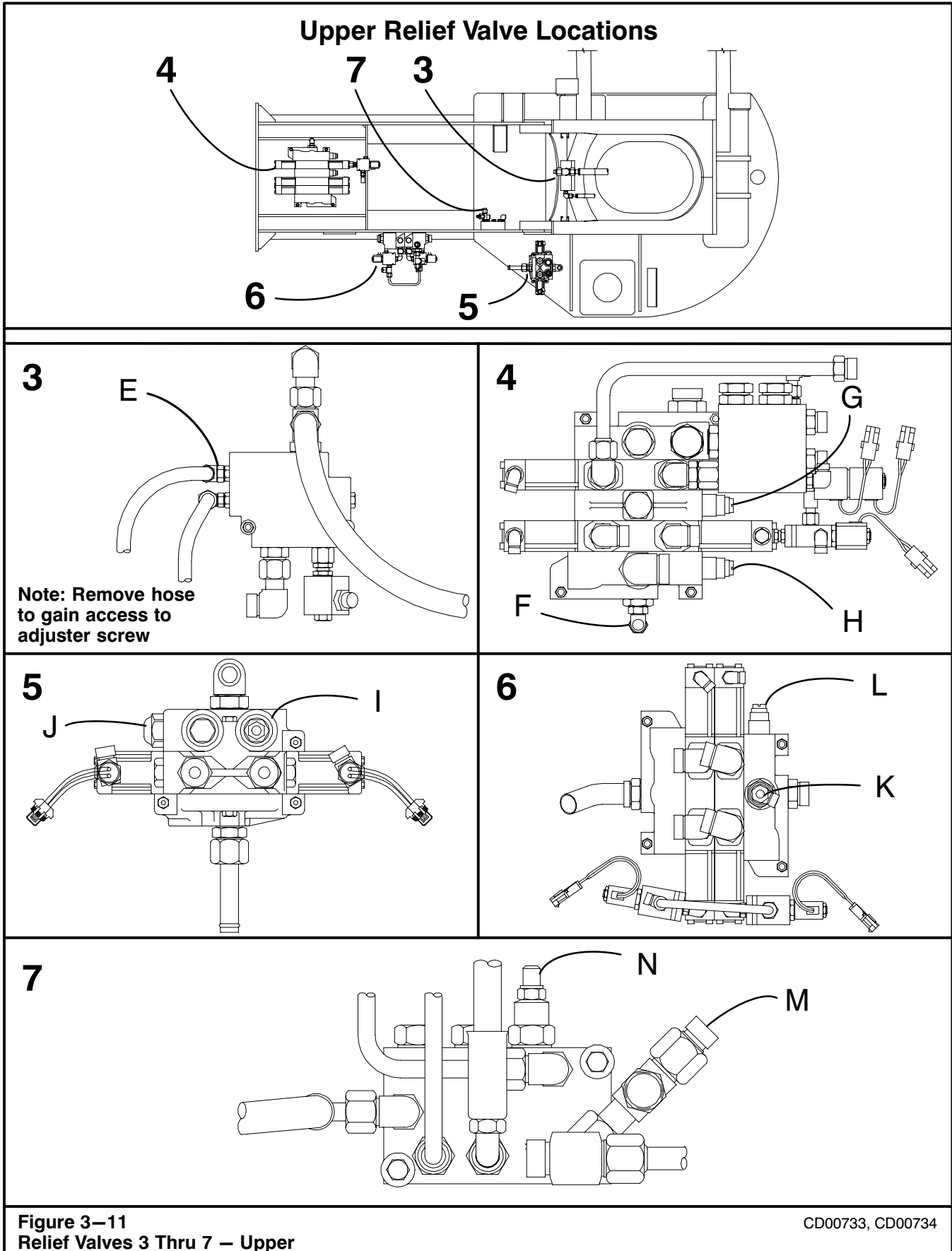


Figure 3-10
Relief Valves 1 & 2 – Carrier

CD00735

Operator's Manual



Emergency Steer Accumulator Pressure Check

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 3–12.

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" found earlier in this Section of the 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.

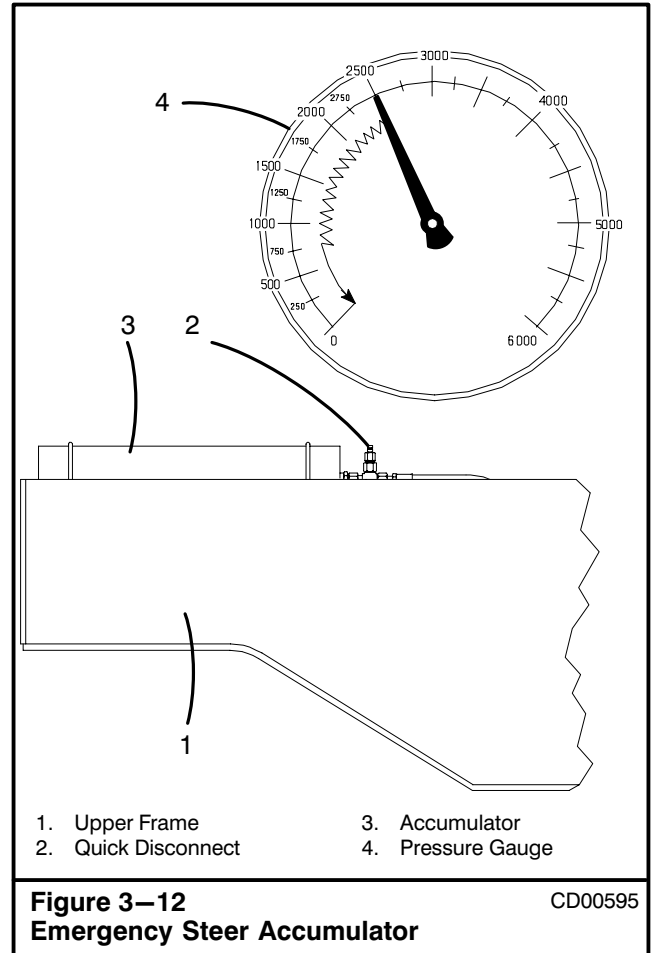


Figure 3–12
Emergency Steer Accumulator

CD00595

8. Shutdown engine and turn ignition switch to the "ON" position but do not start engine.
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.

Operator's Manual

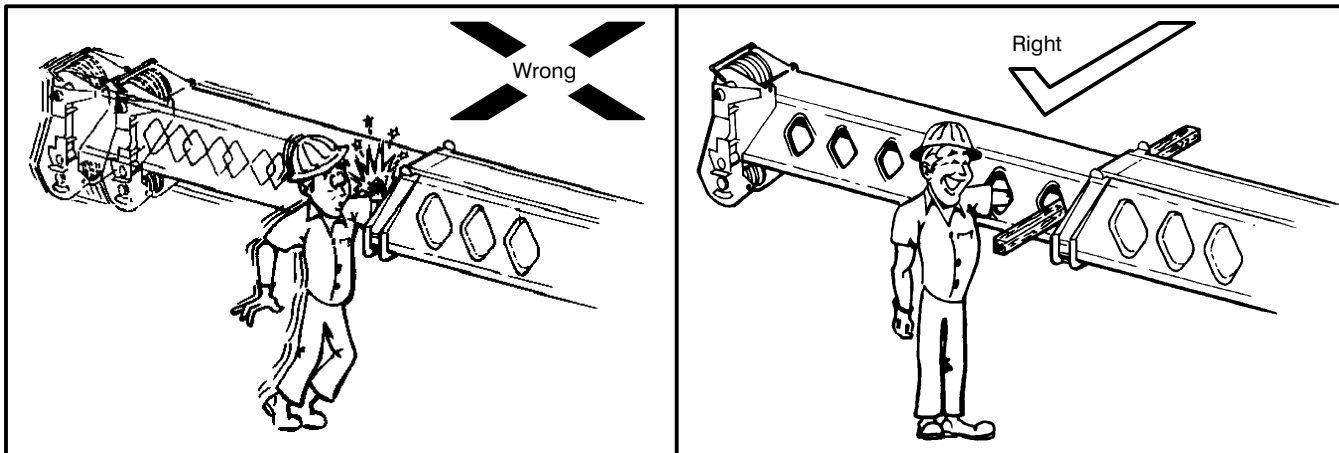


Figure 3-13 YC2333-A, YC2334-A
 Shutdown the engine, ensure that the operator has vacated the operators cab, and insert blocking through the diamond shaped hole, closest to the base section of the boom before putting hands or tools inside a boom section.



Figure 3-14 47P0144
 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 3-15.

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 (item 1) to maintain a .09 in. (2.3mm) maximum clearance. Adjust the bottom side wear shoes (items 4, 6, 8, & 10) to maintain a .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 all the wear shoes. Refer to the chart below for the minimum allowable thickness of each wear shoe. Replace the shoes in pairs as required.
4. After adjusting the boom wear shoe clearances, boom up to a 60° angle and fully extend the boom. Make sure 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.

Minimum Wear Shoe Thickness			
Item	Wear Shoe	Inches	mm
2	Top Wear Shoes	0.5	12.7
5	Bottom Wear Shoes	1.75	44.45
7 & 9	Bottom Wear Shoes	0.5	12.7
11	Slider Bracket Wear Shoes	0.5	12.7
13	Cylinder Wear Shoes	.38	9.7

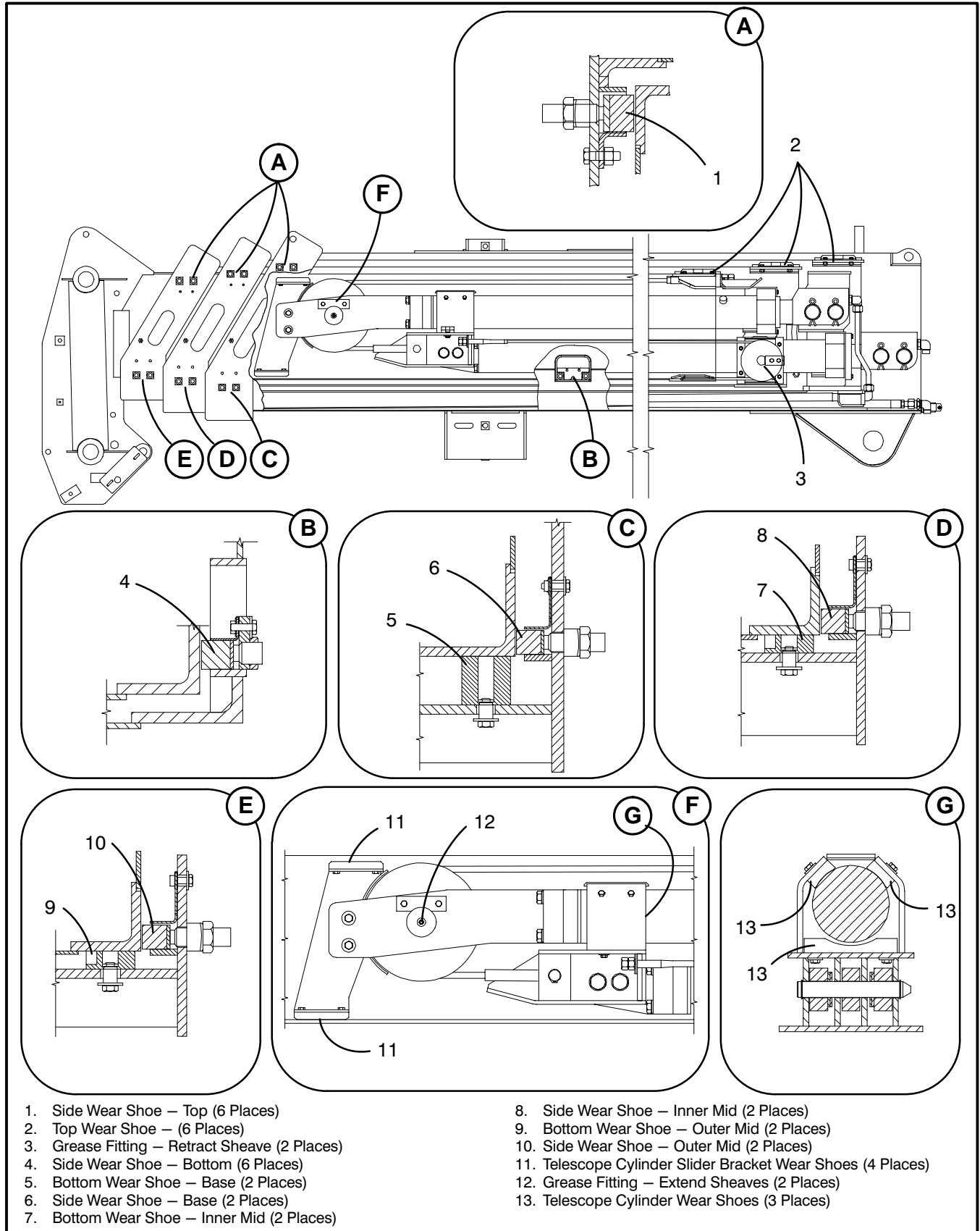
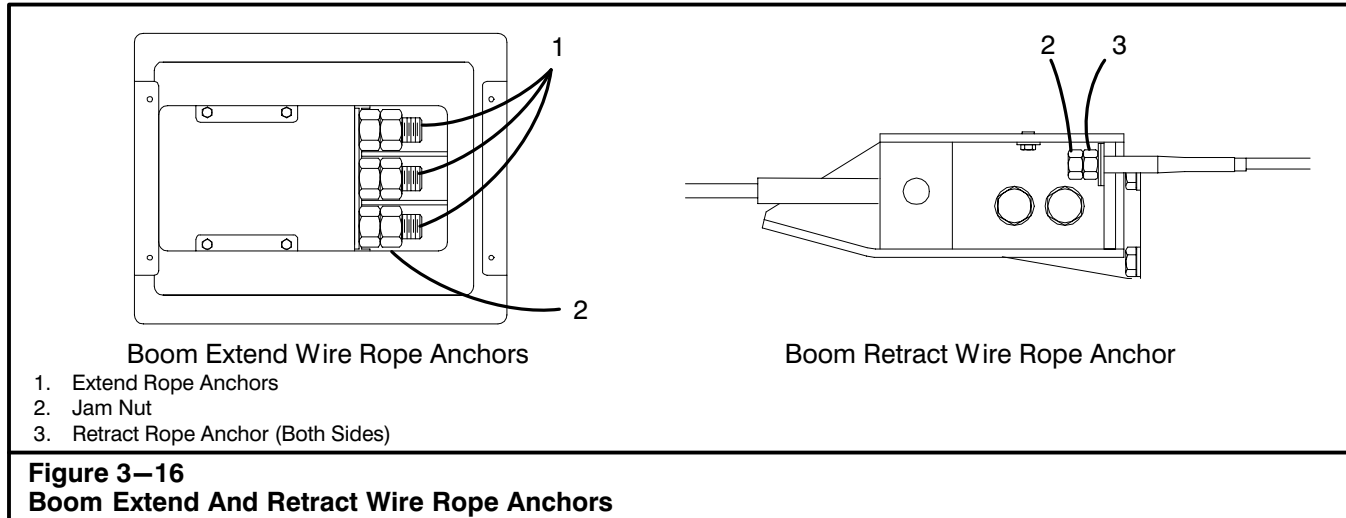


Figure 3-15
Boom Wear Shoe Adjustment And Inspection

CD02590

Operator's Manual



Boom Extend And Retract Wire Rope Inspection And Adjustment

The boom extend and retract wire ropes must be inspected and the rope anchors torqued periodically to compensate for stretching of the wire rope. Refer to Figure 3–16.



WARNING

To avoid personal injury, do not climb, stand or walk on the boom. Use a ladder or similar device to reach necessary areas.

Extend/Retract Wire Rope Inspection

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 travel swing lock.
2. Using the boom telescope override switch, fully extend the outer mid and tip sections at 0° angle. Retract the sections .5–1 ft (152–304mm) to remove the load from the extend wire ropes and allow them to sag.
3. Visually inspect the ropes through the diamond shaped cutouts of the outer mid boom section. If one or more of the extend wire ropes sag to less than 4 in (101mm) from the bottom of the outer mid section or if there is a difference of more than 1 in. (25.4mm) between any of them, wire ropes must be adjusted. Refer to “Extend And Retract Wire Rope Adjustment”.

4. Inspect extend/retract wire rope for wear. Refer to “Wire Rope Inspection And Replacement Recommendations” in Section 5 of this Operator’s Manual.
5. Lubricate the extend/retract wire ropes. Refer to “Wire Rope Lubrication” in Section 2 of this Operator’s Manual.

Extend/Retract Wire Rope Adjustment

1. Level the crane of fully extended outriggers with all tires clear of the ground. Swing the upper over the front of the carrier and engage travel swing lock.
2. Fully retract the boom sections. Boom down to 0° angle.

Note: If the tip section does not contact the outer mid section when fully retracted, loosen the extend wire ropes and tighten the retract wire rope until boom is fully retracted.

3. Access the retract wire rope through the cutout on each side of the boom.
4. Loosen the jam nut and torque retract wire rope anchor to 11 ft lb (15Nm). Refer to Figure 3–16. Tighten the jam nut.
5. Remove access cover on the top rear of the boom.
6. Torque each of the three extend wire rope anchors to 13 ft lb (18Nm). Repeat the torque until all anchors are torqued to 13 ft lb (18Nm).

Note: A 1 11/6 inch (43mm) “crows foot” is provided to aid in this adjustment.

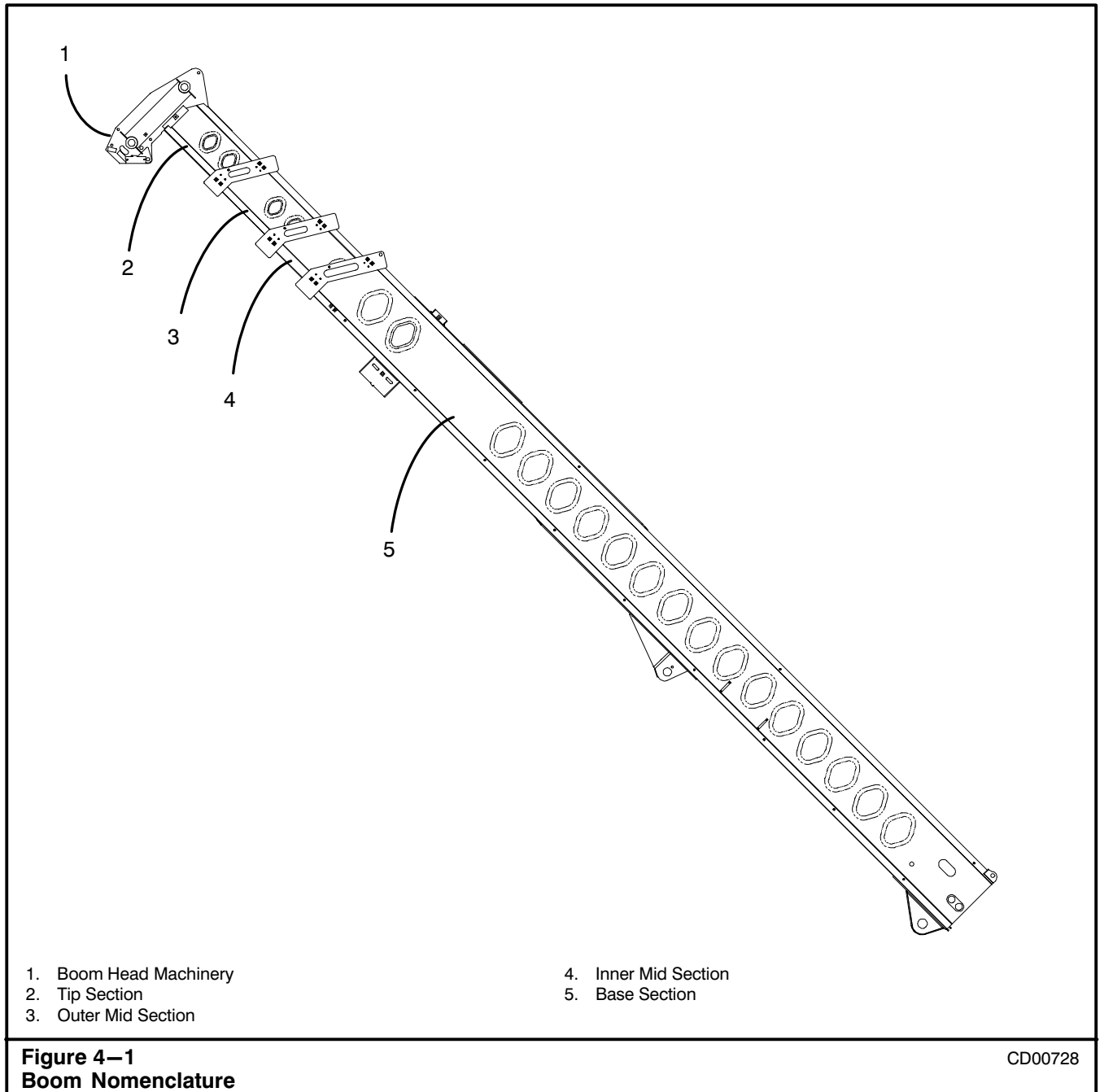
Extend wire rope should measure 4.5 in (114.6mm) from the bottom of the outer mid section when properly adjusted.

Operator's Manual

Table Of Contents

Boom	4-1
Auxiliary Lifting Sheave	4-2
Installation Of Auxiliary Lifting Sheave	4-2
Removal Of Auxiliary Lifting Sheave	4-2
Offset Lattice Fly	4-3
Installation Of Offset Lattice Fly	4-3
Removal Of The Offset Lattice Fly	4-5
Extending/Retracting The Telescoping Fly	4-7
Changing The Fly Offset Angle	4-8
Removing The Telescoping Fly	4-11
Installing The Telescoping Fly	4-12
Installing The Pin-On Fly Head Machinery	4-13
Removing The Pin-On Fly Head Machinery	4-14
Storage Of The Fly From The Erected Position	4-15
Erection Of The Fly From The Stored Position	4-17

Operator's Manual

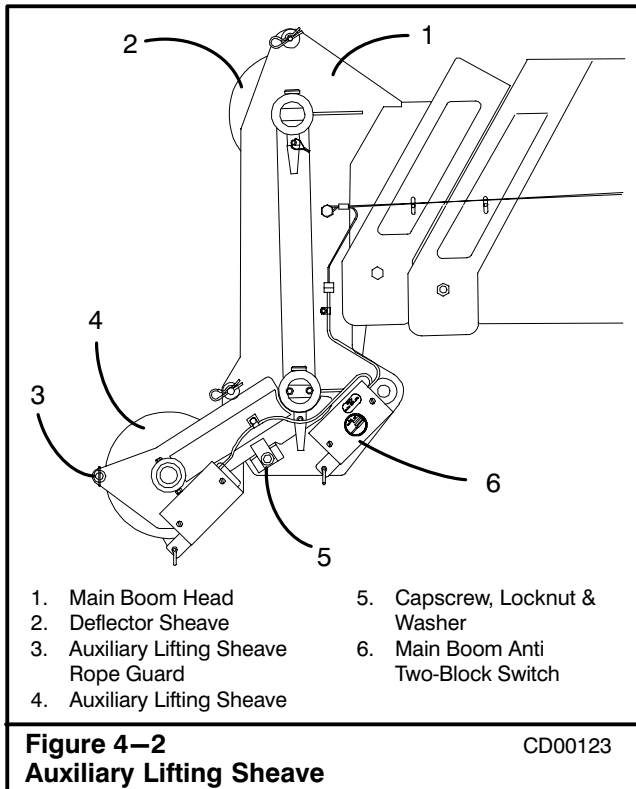


Boom

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 to any desired length using the boom telescope control in the operator’s cab. Refer to Section 1 of the Operator’s Manual for complete operating instructions.

Operator's Manual



Auxiliary Lifting Sheave

The auxiliary lifting sheave connects to the boom head machinery. Refer to Figure 4-2. It is used for reeving winch 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 to lifting capacities.

Installation Of Auxiliary Lifting Sheave

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 70 lb (32kg). Position the auxiliary lifting sheave frame under the boom head cross shaft. Align the holes in the auxiliary lifting sheave frame with the lugs in the main boom and install capscrews, locknuts and washers. Refer to Figure 4-2.



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 rope guard from the auxiliary lifting sheave. Reeve the winch rope on the boom deflector sheave, then over the sheave on the auxiliary lifting sheave. Install the rope guard.

CAUTION

All rope guards must be in proper position during operation.

6. Connect electrical cable for the two block system and install the two block weight. Set the main boom anti-two block switch to the "BOTH" position.
7. Check Crane Rating Manual in the operator's cab for necessary deductions with the auxiliary lifting sheave installed before continuing operations.

Removal Of Auxiliary Lifting Sheave

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. Disconnect the electrical cable for the two block system and remove the two block weight. Set the main boom anti-two block switch to the "MAIN" position.
5. Remove the rope guard from the auxiliary lifting sheave. Remove the winch rope and install the rope guard for storage.

6. Adequately support the auxiliary lifting sheave. It weighs 70 lb (32kg). Remove the capscrews, locknuts and washers. Remove the auxiliary lifting sheave. Refer to Figure 4–2.
7. Properly store the auxiliary lifting sheave, the capscrews, locknuts and washers and the winch rope which was used on the auxiliary lifting sheave.

Offset Lattice Fly

The offset lattice fly section, as seen in Figure 4–3, connects to the main boom head. It can be mounted in one of three offset positions: 2°, 15° or 30°. The fly section extends the boom length for greater heights. It is also available with a telescoping feature to extend its overall length from 25 ft (7.6m) to 43 ft (13.1m). Once installed, the offset lattice fly section can be stored on the right side of the boom base section.

Installation Of Offset Lattice Fly

1. Park the crane on a firm level surface, shift the transmission to neutral, 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 two position 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. Check that the fly adaptor lug and offset connecting pins are installed in the 2° offset position. Refer to Inset “B”, Figure 4–3.
5. Securely block up the fly, approximately 2 ft 9 inches (.83m) at the base and 53 ft (16m) from the boom foot pin of the crane. Refer to Figure 4–4. The 25 ft (7.6m) offset fly section weighs 990 lb (449kg); add 500 lb (227kg) if equipped with the telescoping fly feature.



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 the winch 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.
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 two fly connecting pins from storage rings at the rear of the fly and two from the boom head machinery cross shaft. Install the pins to connect the fly lugs to the head machinery cross shafts. (Install the pins with the head on top and keeper on the bottom.) Install the pin keepers. Refer to Figure 4–3.
9. Remove the rope guards from the fly head, fly deflector and boom head deflector sheaves. Reeve the winch rope over the boom deflector sheave, then on the fly deflector sheave and then on the fly head sheave. Install the rope guards.

CAUTION

All rope guards must be in proper position during operation.

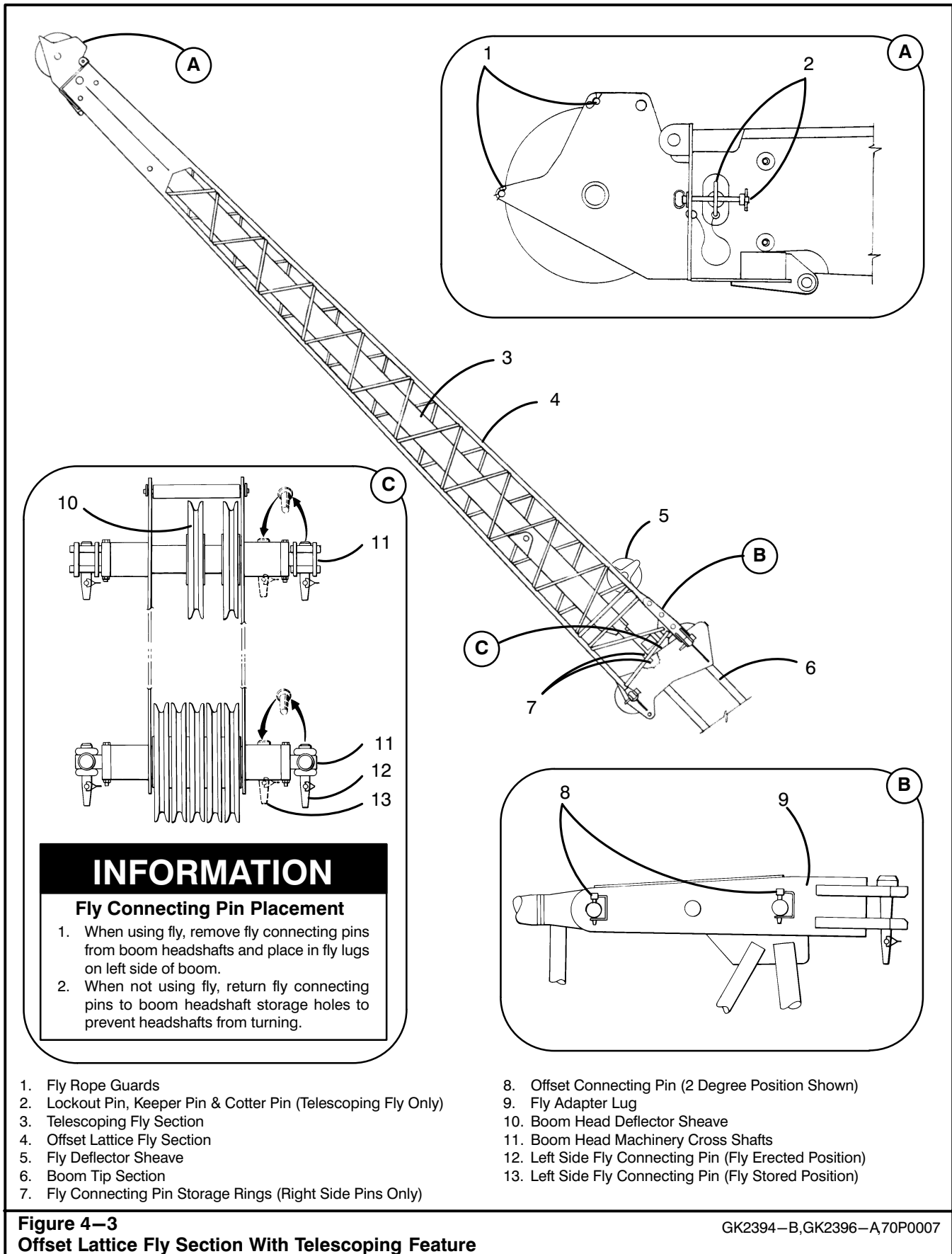
10. Connect the electrical cable for the two block system and install the two block weight. Set the main boom anti-two block switch to the “JIB” position.
11. If the offset lattice fly is equipped with the telescoping fly feature, check that the lockout pin and its keeper pin are properly installed before beginning operations. Refer to Inset “A”, Figure 4–3.
12. Check the Crane Rating Manual, in the operator's cab, for deductions to the lifting capacities with the fly installed before continuing operations.



WARNING

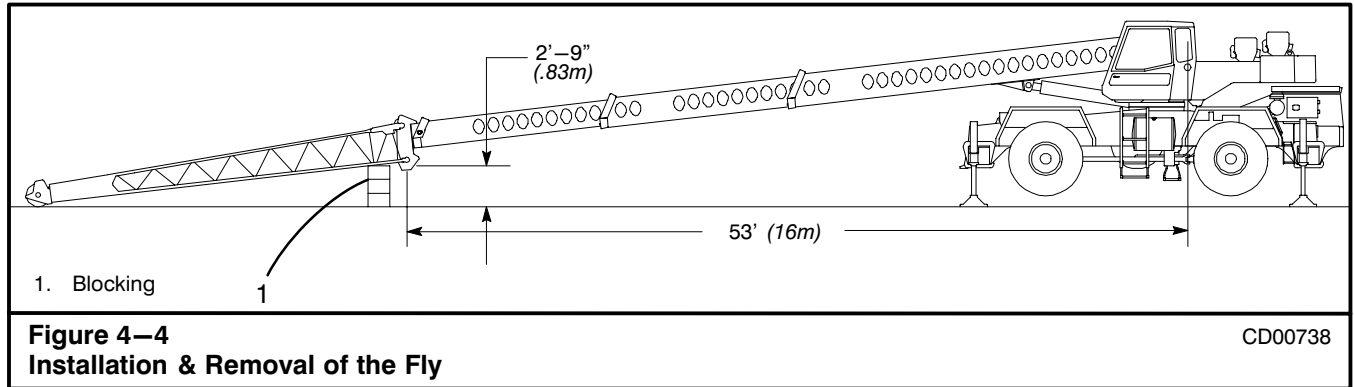
The fly adds weight to the boom which must be considered in lifting capacities, whether the fly is erected or stored on the boom. When making lifts from the main boom or auxiliary lifting sheave, refer to the Crane Rating Manual for the appropriate deductions to lifting capacities. Do not use the fly while on tires or fully retracted outriggers, level the crane on intermediate or fully extended outriggers when using the fly section.

Operator's Manual



1. Fly Rope Guards
2. Lockout Pin, Keeper Pin & Cotter Pin (Telescoping Fly Only)
3. Telescoping Fly Section
4. Offset Lattice Fly Section
5. Fly Deflector Sheave
6. Boom Tip Section
7. Fly Connecting Pin Storage Rings (Right Side Pins Only)

8. Offset Connecting Pin (2 Degree Position Shown)
9. Fly Adapter Lug
10. Boom Head Deflector Sheave
11. Boom Head Machinery Cross Shafts
12. Left Side Fly Connecting Pin (Fly Erected Position)
13. Left Side Fly Connecting Pin (Fly Stored Position)



Removal Of The Offset Lattice Fly

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 two position 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 fly is not in the erected position, erect it per "Erection Of The Fly From The Stored Position" found later in this Section.
5. If the telescoping fly is extended, fully retract it. Refer to "Extending/Retracting The Telescoping Fly" found later in this Section.
6. Check that the fly adaptor lug and offset connecting pins are installed in the 2° offset position. Refer to Inset "B", Figure 4-3. If necessary change the fly offset to the 2° position. Refer to "Changing The Fly Offset Angle" found later in this Section.
7. Boom down fully. Disconnect the electrical cable for the two block system and remove the two block weight.

8. Remove the fly head sheave, fly deflector sheave and boom head sheave rope guards and lay the winch rope aside.



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.

9. Install the fly and fly deflector sheave rope guards back in the fly head machinery.
10. Extend the boom approximately 53 ft (16m), until the fly sheave rests on the ground.
11. Securely block up the fly section to support it. Refer to Figure 4-4. The 25 ft (7.6m) offset fly section weighs 990 lb (449kg); add 500 lb (227kg) if equipped with the telescoping fly feature.
12. Remove the four fly connecting pins. Store two pins and keepers in the storage rings at the rear of the fly. Install the other two pins and keepers in the storage holes on the left side of the boom head machinery cross shafts to prevent the shafts from rotating.



WARNING

Use extreme care when removing the tapered fly connecting pins. They could pop out suddenly and cause personal injury.

13. Retract the boom away from the fly.
14. Properly reeve or secure the winch rope which was used on the fly. Install boom head sheave rope guard.
15. Properly store fly section to prevent damage to it.
16. Set the main boom anti-two block switch to the "MAIN" position.
17. Properly set the Rated Capacity Limiter to the current crane configuration. Refer to Section 1 of this Operator's Manual.

Operator's Manual

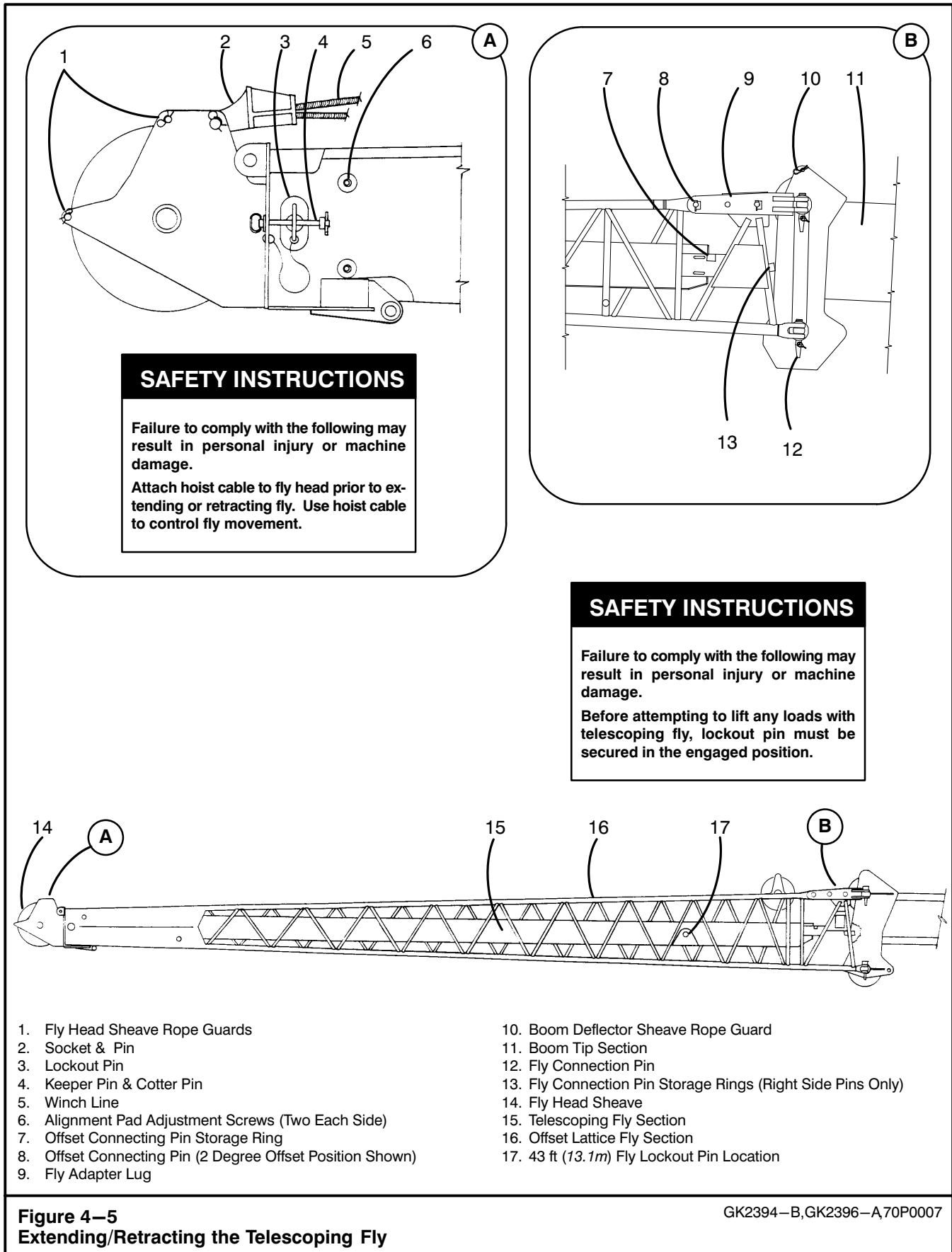


Figure 4-5
Extending/Retracting the Telescoping Fly

GK2394-B, GK2396-A, 70P0007

Operator's Manual

Extending/Retracting The Telescoping Fly

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

Extend the telescoping 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 two position swing lock engaged.

Refer to the Crane Rating Manual for the maximum boom length the telescoping 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 is not in the erected position, erect it per "Erection Of The Fly From The Stored Position" found later in this Section.
5. Check that the offset connecting pins are installed in the 2° offset position. Refer to Inset "B", Figure 4-3. If necessary change the fly offset to the 2° position. Refer to "Changing The Fly Offset Angle" found later in this Section.
6. Boom down fully and telescope the boom as required to ease access to the fly and boom head sheaves.



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. Disconnect the electrical cable for the two block system from the telescoping fly section.
8. Remove hook ball or block from the winch line.
9. Remove the fly head sheave rope guards and connect the winch line to the fly head using the winch line socket and pin. Refer to Figure 4-5.

10. Carefully winch up to eliminate any slack in the winch line.

CAUTION

Do not apply excess tension to the winch line as it may make removal of the lockout pin difficult or cause damage to the offset lattice fly.

11. On one side of the fly head, loosen the alignment pad adjustment screws one half turn each.



WARNING

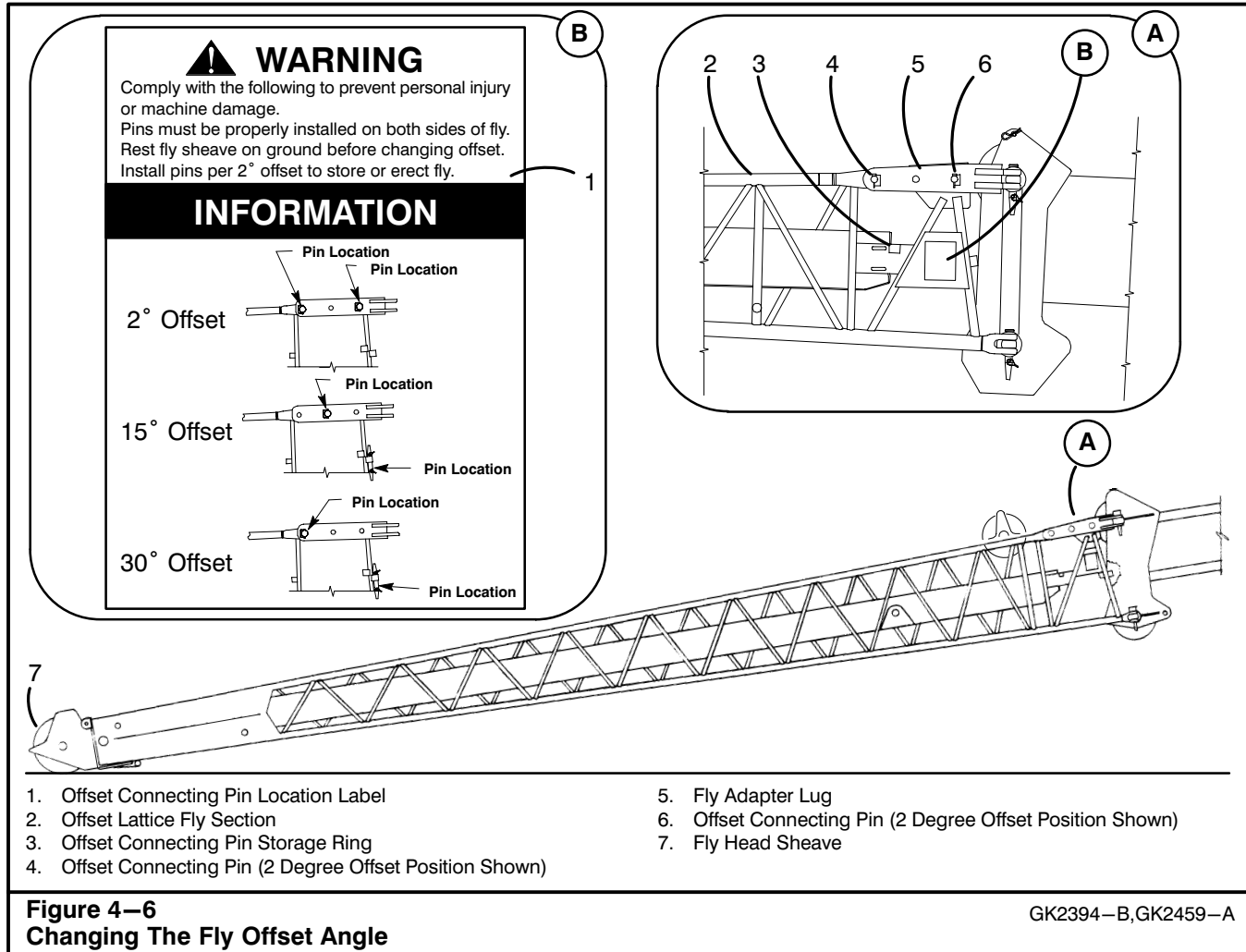
Do not remove the lockout pin from the fly head before making the winch line connection. Telescoping fly could extend rapidly, out of control causing damage or injury. Use the winch line to control movement of the telescoping fly section.

12. Remove the keeper pin from the lockout pin. Remove the lockout pin.
13. Slowly winch up/down allowing the telescoping fly section to extend/retract to the desired position.
14. Align the lockout pin mounting holes and install the lockout pin and keeper pin. Install the cotter pin in the keeper pin.
15. Fully tighten the alignment pad adjustment screws.

Note: The telescoping fly section should be centered within the offset lattice fly section. If necessary, use the alignment pad adjustment screws on both sides of the fly to center the telescoping fly section.

16. Disconnect the winch line from the fly head.
17. Reeve the winch line properly over the fly head sheave and install the fly head sheave rope guards. Be sure all cotter pins are properly installed.
18. Connect the electrical cable for the two block system. Set the main boom anti-two block switch to the "JIB" position.
19. Properly set the Rated Capacity Limiter to the current crane configuration. Refer to Section 1 of this Operator's Manual.
20. Check the Crane Rating Manual, in the operator's cab, for deductions to the lifting capacities with the fly installed before continuing operations.

Operator's Manual



Changing The Fly Offset Angle

1. Park the crane on a firm level surface. Shift transmission to neutral and engage 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.

4. If offset lattice fly section is not in the erected position, erect it per "Erection Of The Fly From The Stored Position" found later in this Section.
5. Carefully extend and/or lower the boom until the fly head sheave is resting on the ground. Use a signalman to alert the operator when the sheave is resting on the ground.

WARNING

Change fly offset angle with crane level on fully extended outriggers with all tires clear of the ground, upper directly over the front of the carrier and the two position 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.

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 signalman to aid the operator in lowering the fly head sheave to the ground.

Operator's Manual

6. Use one of the following procedures and the information label, located on the offset lattice fly section, to determine the correct offset connecting pin location for the desired offset angle of the fly. Refer to Figure 4–6.
7. Check the Crane Rating Manual, in the operator's cab, for deductions to the lifting capacities with the fly installed before continuing operations.

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. Make sure to properly locate the offset connecting pins on both sides of the fly and see 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 15° and a 2° offset is desired:

- a. Carefully extend and/or lower the boom until the fly reaches the 2° angle.
- 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 15° offset position to the 2° offset position.
- d. Make sure to properly locate the offset connecting pins on both sides of the fly and see that the keeper pins are securely installed.
- e. Slowly boom up to allow the fly section to adjust itself to the desired offset angle.

If the existing offset angle is 15° and a 30° offset is desired:

- a. Relocate the offset connecting pin from the 15° offset position to the 30° offset position.
- b. Make sure to properly locate the offset connecting pins on both sides of the fly and see that the keeper pins are securely installed.
- c. Slowly boom up to allow the fly section to adjust itself to the desired offset angle.

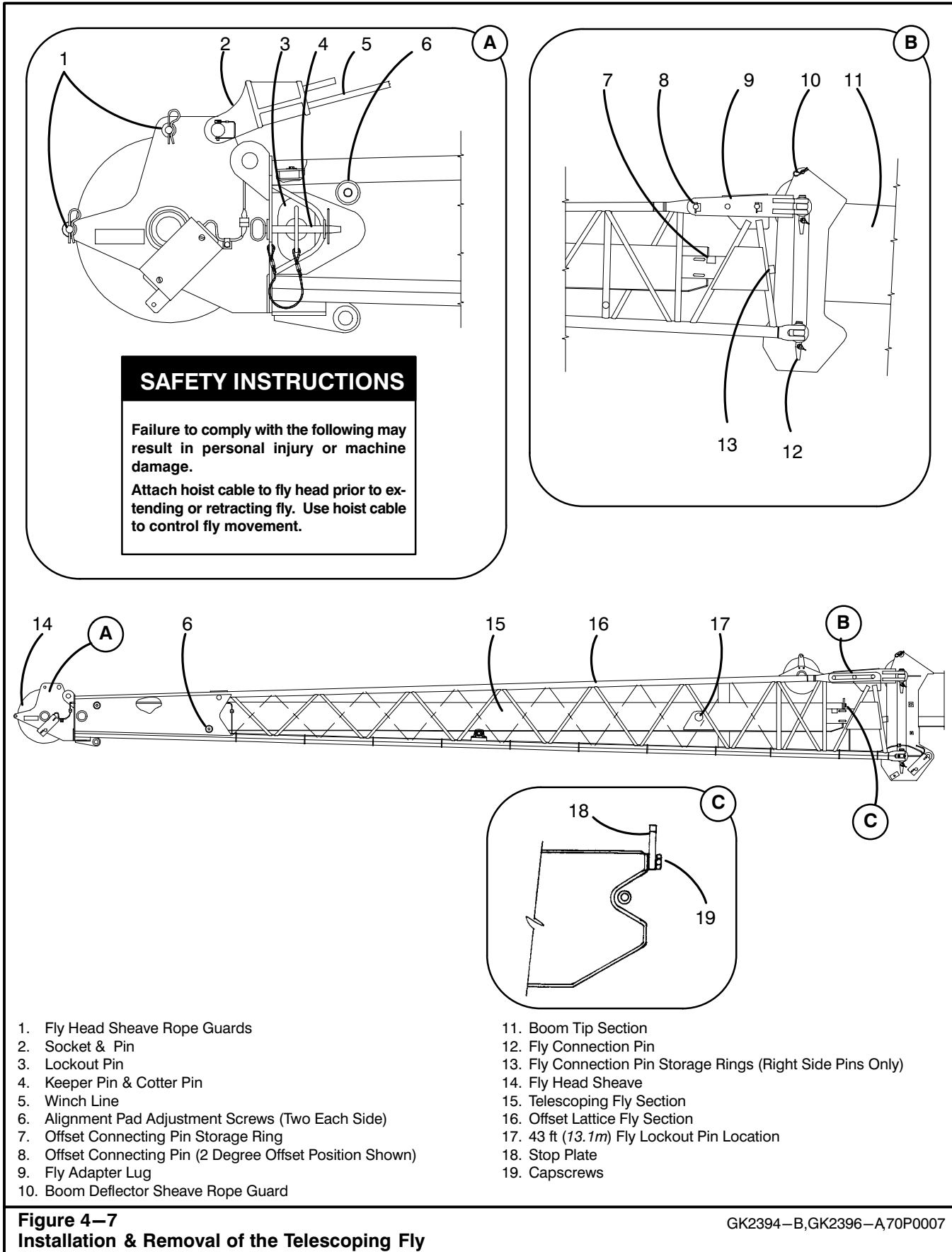
If the existing offset angle is 30° and a 2° offset is desired:

- a. Carefully extend and/or lower the boom until the fly reaches the 2° angle.
- b. Remove the offset connecting pin from the storage ring on the fly and install it through the fly adaptor lug, in the front 2° offset hole.
- c. Make sure to properly locate the offset connecting pins on both sides of the fly and see 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 30° and a 15° offset is desired:

- a. Carefully extend and/or lower the boom until the fly reaches the 15° angle.
- b. Relocate the offset connecting pin from the 30° offset position to the 15° offset position.
- c. Make sure to properly locate the offset connecting pins on both sides of the fly and see that the keeper pins are securely installed.
- d. Slowly boom up to allow the fly section to adjust itself to the desired offset angle.

Operator's Manual



1. Fly Head Sheave Rope Guards
2. Socket & Pin
3. Lockout Pin
4. Keeper Pin & Cotter Pin
5. Winch Line
6. Alignment Pad Adjustment Screws (Two Each Side)
7. Offset Connecting Pin Storage Ring
8. Offset Connecting Pin (2 Degree Offset Position Shown)
9. Fly Adapter Lug
10. Boom Deflector Sheave Rope Guard

11. Boom Tip Section
12. Fly Connection Pin
13. Fly Connection Pin Storage Rings (Right Side Pins Only)
14. Fly Head Sheave
15. Telescoping Fly Section
16. Offset Lattice Fly Section
17. 43 ft (13.1m) Fly Lockout Pin Location
18. Stop Plate
19. Capscrews

Figure 4-7
Installation & Removal of the Telescoping Fly

GK2394-B, GK2396-A, 70P0007

Operator's Manual

Removing The Telescoping Fly

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

Remove the telescoping 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 two position swing lock engaged.

Refer to the Crane Rating Manual for the maximum boom length the telescoping 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" found later in this Section.
5. Check that the offset connecting pins are installed in the 2° offset position. Refer to Inset "B", Figure 4-3. If necessary change the fly offset to the 2° position. Refer to "Changing The Fly Offset Angle" found earlier in this Section.
6. Boom down fully and telescope the boom as required to ease access to the fly and boom head sheaves.



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. Disconnect the electrical cable for the two block system and remove the two block weight from the telescoping fly section.
8. Remove the capscrews and stop plate from the end of the telescoping fly section.
9. Remove the hook ball or block from the winch line.
10. Remove the fly head sheave rope guards and connect the winch line to the fly head using the winch line socket and pin. Refer to Figure 4-7.
11. Carefully winch up to eliminate any slack in the winch line.

CAUTION

Do not apply excess tension to the winch line as it may make removal of the lockout pin difficult or cause damage to the fly.

12. On one side of the fly head, loosen the alignment pad adjustment screws one half turn each.



WARNING

Do not remove the lockout pin from the fly head before making the winch line connection. Telescoping fly section could extend rapidly, out of control causing damage or injury. Use the winch line to control movement of the fly.

13. Remove the keeper pin from the lockout pin. Remove the lockout pin.
14. Slowly winch down allowing the telescoping fly section to extend to the 43 ft (13.1m) lockout pin position.
15. Align the lockout pin holes in the offset lattice fly section and telescoping fly section and install the lockout pin.
16. Using a double sling arrangement and an appropriate lifting device, rig the telescoping fly for removal from the offset lattice fly section. The telescoping fly section weighs approximately 500 lb (227kg).
17. Once again remove the lockout pin and winch down to allow the telescoping fly section to slide the rest of the way out of the offset lattice fly section.
18. After the telescoping fly section is clear of the offset lattice fly section, remove the winch socket and pin from the fly head.
19. Install the lockout pin, lockout pin keeper pin, lock plate and all cotter pins for storage.
20. Install the pin-on head machinery. Refer to "Installing The Pin-On Fly Head Machinery" found later in this section of the Operator's Manual.
21. Connect the electrical cable for the two block system and install the two block weight. Set the main boom anti-two block switch to the appropriate position.
22. Properly set the Rated Capacity Limiter to the current crane configuration. Refer to Section 1 of this Operator's Manual.
23. Check the Crane Rating Manual, in the operator's cab for deductions to the lifting capacities with the telescoping fly removed before continuing operations.

Operator's Manual

Installing The Telescoping Fly

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 telescoping fly section 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 two position swing lock engaged.

Refer to the Crane Rating Manual for the maximum boom length the telescoping 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" found later in this Section.
5. Check that the offset connecting pins are installed in the 2° offset position. Refer to Inset "B", Figure 4–7. If necessary change the fly offset to the 2° position. Refer to "Changing The Fly Offset Angle" found earlier in this Section.
6. If the pin—on fly head machinery is installed, remove it. Refer to "Removing The Pin—On Fly Head Machinery" found later in this Section.
7. Boom down and telescope the boom as required to ease access to the fly and boom head.



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 hook ball or block from the winch line.
9. Remove the lockout pin from the end of the offset lattice fly section.

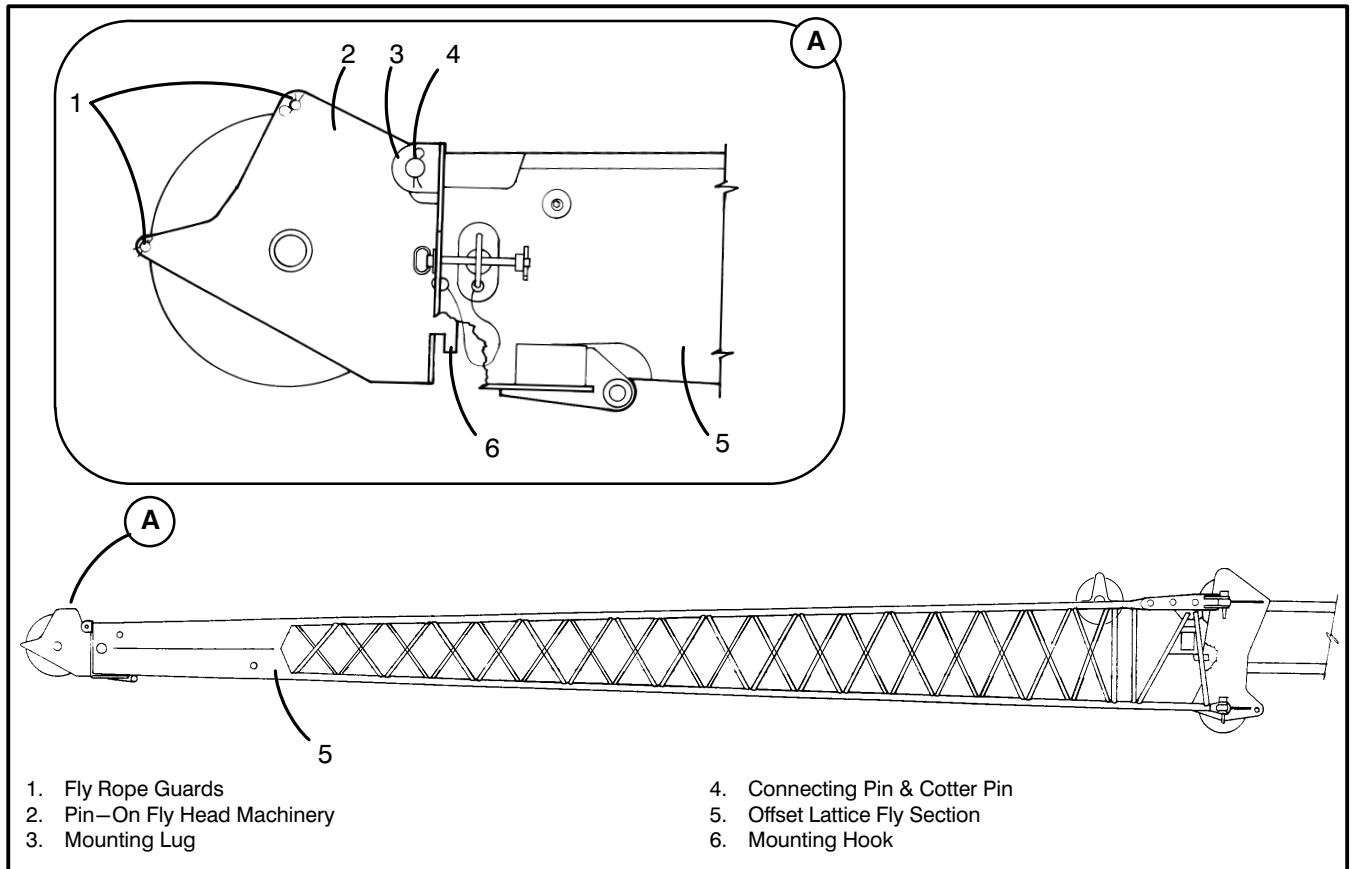
10. Using a double sling arrangement and an appropriate lifting device, rig the telescoping fly section for installation into the offset lattice fly section. The telescoping fly section weighs approximately 500 lb (227kg).
11. Carefully lift the telescoping fly section into position and guide it into the offset lattice fly section.

Note: If necessary, loosen the alignment pad adjustment screws on each side of the offset lattice fly section to ease installation of the telescoping fly section.

12. Align the lockout pin holes in the offset lattice fly section and telescoping fly section at the 43 ft (13.1m) lockout pin position. Install the lockout pin and lockout pin keeper. Refer to Figure 4–7.
13. Fully tighten the alignment pad adjustment screws.

Note: The telescoping fly section should be centered within the offset lattice fly section. If necessary, use the alignment pad adjustment screws on both sides of the fly to center the telescoping fly section.

14. Install the stop plate and capscrews on the end of the telescoping fly section.
15. If a different telescoping fly length is desired, refer to "Extending/Retracting The Telescoping Fly" found earlier in this Section for detailed instructions.
16. Reeve the winch line properly over the fly head sheave and install the fly head sheave rope guards. Be sure all cotter pins are properly installed.
17. Connect the electrical cable for the two block system and install the two-block weight. Set the main boom anti two-block switch to the appropriate position.
18. Properly set the Rated Capacity Limiter to the current crane configuration. Refer to Section 1 of this Operator's Manual.
19. Check the Crane Rating Manual, in the operator's cab, for deductions to the lifting capacities with the fly installed before continuing operations.



1. Fly Rope Guards
2. Pin-On Fly Head Machinery
3. Mounting Lug

4. Connecting Pin & Cotter Pin
5. Offset Lattice Fly Section
6. Mounting Hook

Figure 4-8
Installation/Removal of the Pin-On Fly Head Machinery

GK2396-A, GK2464-A

Installing The Pin-On Fly Head Machinery

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

Install the telescoping fly section 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 two position swing lock engaged.

Refer to the Crane Rating Manual for the maximum boom length the telescoping 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 is not in the erected position, erect it per "Erection Of The Fly From The Stored Position" found later in this Section.
5. Check that the offset connecting pins are installed in the 2° offset position. Refer to Inset "B", Figure 4-3. If necessary change the fly offset to the 2° position. Refer to "Changing The Fly Offset Angle" in this Section.
6. Remove telescoping fly section. Refer to "Removing The Telescoping Fly" found earlier in this Section.
7. Boom down and telescope the boom as required to ease access to the fly and boom head.



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 connecting pin from the pin-on fly head machinery. Refer to Figure 4-8.
9. Using an appropriate lifting device, rig the pin-on fly head machinery so it can be lifted onto the end of the offset lattice fly section. The pin-on fly head machinery weighs approximately 100 lb (45 kg).

Operator's Manual

10. Place the mounting hook, of the fly head, into the end of the offset lattice fly section. Rotate the fly head up to align the connecting pin mounting holes and install the connecting pin. Install the cotter pin to secure the connecting pin.
11. Remove the rope guards from the fly head and properly reeve the fly. Be sure to install the rope guards after reeving the fly head and secure them with the cotter pins provided.
12. Connect the electrical cable for the two block system and install the two block weight. Set the main boom anti-two block switch to the appropriate position.
13. Check the Crane Rating Manual, in the operator's cab, for deductions to the lifting capacities with the fly installed before continuing operations.
4. If the offset lattice fly section is not in the erected position, erect it per "Erection Of The Fly From The Stored Position" found later in this Section.
5. Check that the offset connecting pins are installed in the 2° offset position. Refer to Inset "B", Figure 4-3. If necessary change the fly offset to the 2° position. Refer to "Changing The Fly Offset Angle" found earlier in this Section.
6. Boom down and telescope the boom as required to ease access to the fly and boom head.



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.

Removing The Pin—On Fly Head Machinery

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.



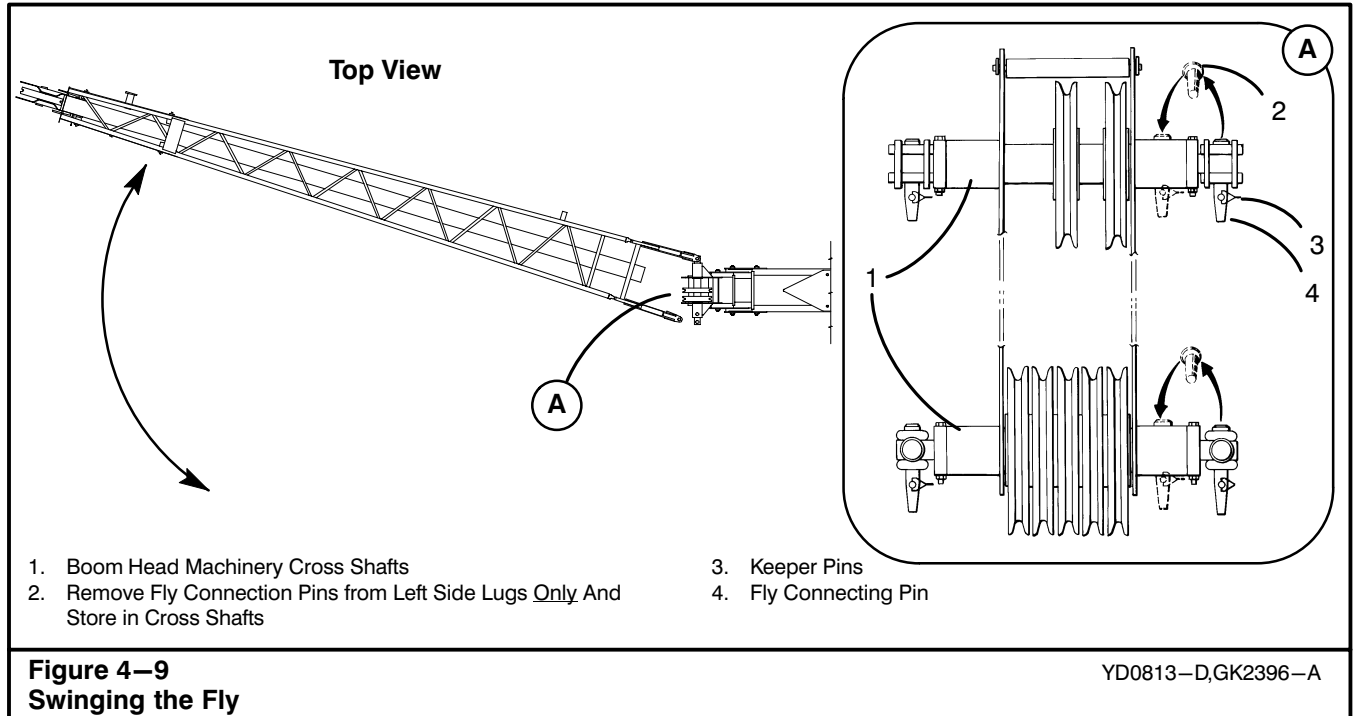
WARNING

Remove the fly head machinery 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 two position swing lock engaged.

Refer to the Crane Rating Manual for the maximum boom length the telescoping fly can be raised/lowered to/from the ground.

Failure to do the above could result in the crane tipping.

7. Disconnect the electrical cable for the two block system and remove the two block weight.
8. Remove the rope guards from the fly head sheave. Refer to Figure 4-8. Remove the winch rope and lay it aside. Install the rope guard back in the fly head for storage.
9. Using an appropriate lifting device, rig the fly head machinery so it can be lifted off the end of the offset lattice fly section. The fly head must be rigged so it will not fall once the connecting pin is removed. The pin on fly head machinery weighs approximately 100 lb (45kg).
10. Carefully remove the cotter pins from the connecting pin and drive the connecting pin out of the mounting lugs on the offset lattice fly section.
11. Rotate the fly head forward and carefully lift it allowing the mounting hook to disengage from the end of the offset lattice fly section.
12. Install the telescoping fly section. Refer to "Installing The Telescoping Fly" found earlier in this Section.



Storage Of The Fly From The Erected Position

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

Remove the fly head machinery 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 two position swing lock engaged.

Refer to the Crane Rating Manual for the maximum boom length the telescoping fly can be raised/lowered to/from the ground.

Failure to do the above could result in the crane tipping.

4. Check that the offset connecting pins are installed in the 2° offset position. Refer to Inset "A",

Figure 4-10. If necessary change the fly offset to the 2° position. Refer to "Changing The Fly Offset Angle" found earlier in this Section.

5. If the telescoping fly section is extended, fully retract it. Refer to "Extending/Retracting The Telescoping Fly" found earlier in this Section.
6. Extend the boom approximately 3 ft (.9m) and fully boom down.
7. Disconnect the electrical cable for the two block system and remove the two block weight.

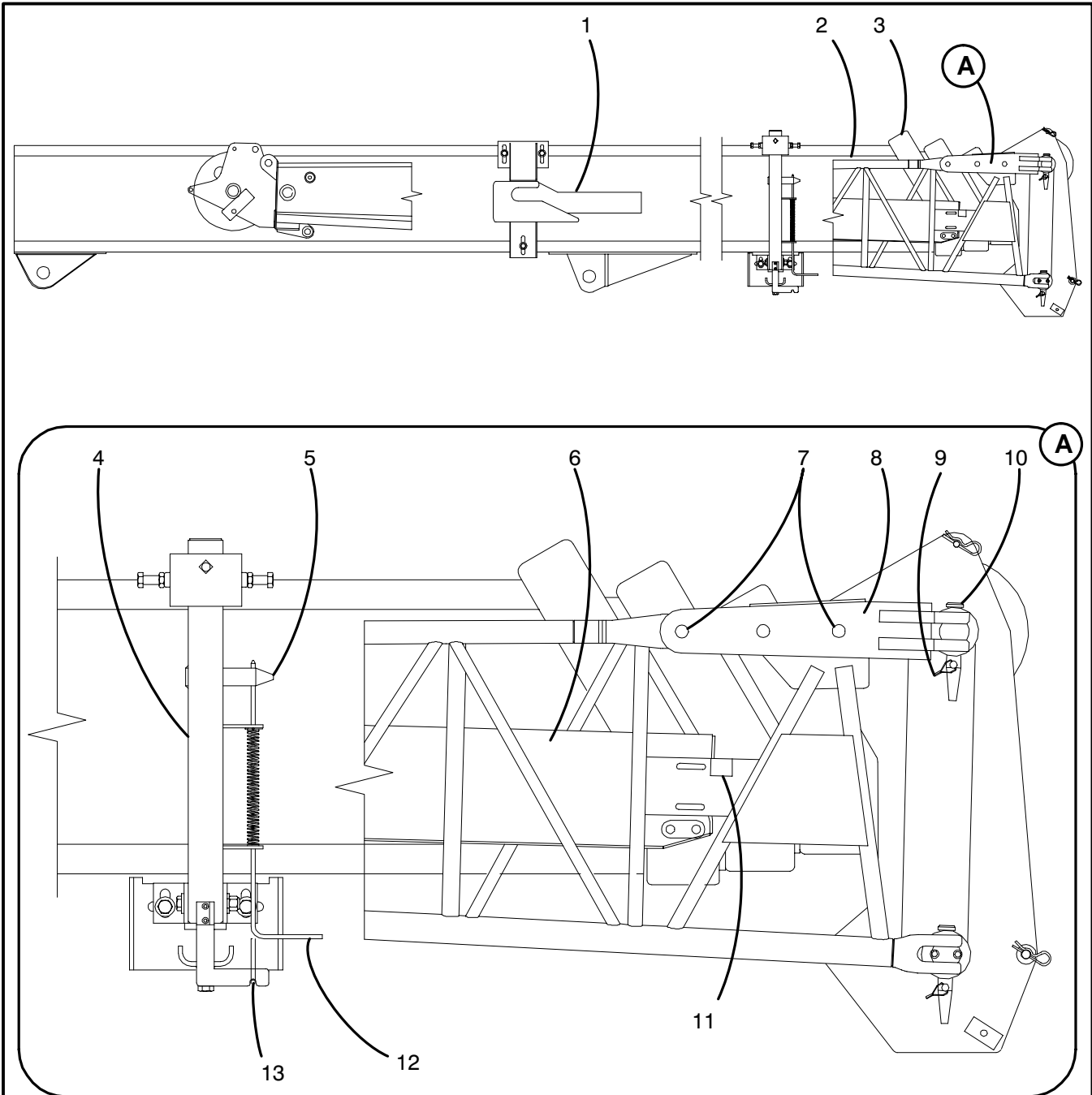


WARNING

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 rope guard from the fly head sheave and fly deflector sheave. Refer to Figure 4-3. Remove the winch rope and lay it aside. Install the rope guards back in the fly for storage.
9. Properly store the winch rope which was used on the fly.
10. Check that the retaining pin (item 13, Figure 4-10) is in the disengaged position
11. Attach a hand line to the tip of the fly.

Operator's Manual



- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Rear Fly Storage Bracket 2. Offset Lattice Fly Section 3. Boom 4. Front Fly Storage Bracket 5. Tapered Storage Lug 6. Telescoping Fly Section 7. Offset Connecting Pins (2° Position Shown) | <ul style="list-style-type: none"> 8. Fly Adaptor Lug 9. Keeper Pin 10. Fly Connecting Pin 11. Fly Connecting Pin Storage Rings (Right Side Fly Connecting Pins Only) 12. Retaining Pin in Engaged Position 13. Retaining Pin in Disengaged Position |
|--|--|

Figure 4–10
Fly Erection & Storage

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Operator's Manual

12. Remove ONLY the TWO fly connecting pins, from the boom head cross shafts, on the LEFT SIDE of the boom. Refer to Figure 4–9. Immediately store the pins and keepers in the storage hole in boom head cross shaft to prevent the shafts from rotating.



WARNING

Use extreme care when removing the tapered fly connecting pins. They could pop out suddenly causing personal injury. 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.

13. Slowly swing the fly around to the right side of the boom while booming up to 10°.
14. Align the storage lug on the fly head with the slot on the rear storage bracket. Slowly retract the boom to slide the storage lug on the fly head into the slot on the rear storage bracket. Refer to Figure 4–10. (At the same time the tapered storage lug on the front storage bracket should slide through the storage plate on the fly).
15. Boom down to 0°. Pull down and rotate retaining pin. Release retaining pin to engage the pin through the tapered storage lug on the front storage bracket.



WARNING

Do not remove the fly connecting pins on the right side of the boom until the fly is pinned to the storage bracket. The fly could fall.

16. Remove the two fly connecting pins from the right side of the boom. Refer to Figure 4–10. Store the pins and keepers in the storage rings on the rear fly lattice.

CAUTION

Before operating or traveling the crane be sure 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 the fly connecting pins are not properly stored.

17. Set the main boom anti-two block switch to the appropriate position.
18. Properly set the Rated Capacity Limiter to the current crane configuration. Refer to Section 1 of this Operator's Manual.
19. Check the Crane Rating Manual for lifting capacities with the fly in the stored position before continuing operations.

Erection Of The Fly From The Stored Position

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

Erect the fly with the crane on fully or intermediate extended outriggers with all tires clear of the ground, the upper directly over the front of the carrier and the two position swing lock engaged.

Refer to the Crane Rating Manual for the maximum boom length the telescoping fly can be raised/lowered to/from the ground.

Failure to do the above could result in the crane tipping.

4. 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.
5. Remove the winch 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

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 the two fly connecting pins from the storage rings on the rear fly lattices. Install them through the fly lugs and the head machinery cross

Operator's Manual

shafts on the right side of the boom. Refer to Figure 4–10. (Install the pins with the head on top and the keeper on the bottom.) Install the pin keepers.



WARNING

Check that the fly connecting pins are installed on the right side of the boom before disconnecting the fly from the storage brackets. The fly could fall.

7. Pull down and rotate retaining pin. Release retaining pin to disengage the pin from the tapered storage lug on the front storage bracket. Refer to Figure 4–10.
8. Attach a hand line to the tip of the fly and boom up to 10°. Slowly extend the boom approximately 3 ft (.9m) to slide the fly off the storage brackets.
9. Slowly lower the boom to 0° angle to swing the fly around the boom head until the fly lugs engage with the cross shafts on the left side of the boom. Refer to Figure 4–9.



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.

10. Remove the two fly connecting pins from the storage holes in the boom head cross shafts. Install them through the fly lugs and the cross shafts on the left side of the boom. (Install the pins with the head on top and the keeper on the bottom.) Install the pin keepers.

Note: To ease installation of the left side fly connecting pins, it may be necessary to drive pins in alternately.

11. Remove the rope guard from the fly head and fly deflector sheaves. Refer to Figure 4–3. Reeve the winch rope on the boom deflector sheave, then over fly deflector sheave and then over the fly head sheave. Install all rope guards.

CAUTION

All rope guards must be in proper position during operation.

12. Connect the electrical cable for the two block system and install the two block weight. Set the main boom anti-two block switch to the appropriate position.
13. Properly set the Rated Capacity Limiter to the current crane configuration. Refer to Section 1 of this Operator's Manual.
14. 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, whether the fly is erected or stored on the boom. When making lifts from the main boom or auxiliary lifting sheave, refer to the Crane Rating Manual for the appropriate deductions to lifting capacities. Do not use the fly while on tires or fully retracted outriggers, level the crane on intermediate or fully extended outriggers when using the fly section.

Operator's Manual

Table Of Contents

Crane Rating Manual & Serial Number	5-1
Wire Rope Capacity Chart	5-1
Wire Rope Specifications	5-1
Wire Rope Diameter	5-1
Wire Rope Inspection And Replacement Recommendations	5-3
Wire Rope Inspection	5-4
Wire Rope Replacement	5-4
Wire Rope Installation	5-5
Winch Roller Adjustment	5-5
Uncoiling Wire Rope	5-6
Anchoring Wire Rope to Drum	5-6
Winding Rope on Drum	5-6
Wire Rope Reeving	5-7
Socket And Wedge Connections	5-8
Rope Break-In	5-8
Hook Ball Usage With Rotation Resistant Rope	5-9
Non-Swivel Usage	5-9
Swivel Usage	5-9
Rope Inspection	5-9
Rotation Resistant Wire Rope	5-9
Wire Rope Sockets With Clips	5-10
Wire Rope Clip Installation	5-11
Cutting Wire Rope	5-11
Hydraulic System Schematic Diagram	5-14
Electrical System Schematic Diagram	5-19
Air System Schematic Diagram	5-23
Crane Specifications	5-24
Upper	5-25
Carrier	5-26
Travel Speeds and Gradeability	5-27
Cummins 6BT 5.9 Engine Specifications	5-27
Axle Loads	5-28

Operator's Manual

Operator's Manual

Crane Rating Manual & Serial Number

The Crane Rating Manual is located in the lower right interior of the upper cab. This 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 factory concerning parts or warranty. This manual also lists the maximum allowable lifting capacities for the crane. The 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 manual can be ordered through your distributor.

CAUTION

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. Refer to Figure 5–1. It is located 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 rope breakage.

Before making a lift, compare the weight being lifted (remember to add the weight of the hook block, slings and riggings to the actual load weight) with the chart. 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 that is needed to make the lift, remember to add one (1) pound (.45kg) for each one (1) foot (.3m) of extra 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 crane damage may result.

Wire Rope Specifications

The specifications for the wire rope used on this crane are on the Wire Rope Capacity chart located in the Crane Rating Manual. Refer to Figure 5–1. Always refer to the Wire Rope Capacity chart in the Crane Rating 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 Rope Diameter	Allowable Limits	
Thru 1/8" (3.2mm)	–0	+8%
Over 1/8" (3.2mm)	–0	+7%
Over 3/16" (4.8mm) thru 5/16" (8.0mm)	–0	+6%
Over 5/16" (8.0mm) and larger	–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.

Operator's Manual

Wire Rope Capacity Chart		
Maximum Lifting Capacities Based On Wire Rope Strength		
Parts of Line	5/8"	Notes
	Type RB	
1	9,080*	Capacities shown are in pounds and working loads must not exceed the ratings on the capacity charts in the Crane Rating Manual. Study Operator's Manual for wire rope inspection procedures. * Use of swivel end with 1 part of line is not recommended.
2	18,160	
3	27,240	
4	36,320	
5	45,400	
6	54,480	
7	63,560	
8	72,640	
LBCE Type	Description	
TYPE RB	19 Strand, Compacted Strand, Rotation Resistant – Extra Improved Plow Steel – Preformed Right Lay – Regular Lay	
<p>Note: The Wire Rope Capacity chart depicted above is shown as an example only. Use the Wire Rope Capacity chart located in the Crane Rating Manual to determine the correct parts of line required for the given wire rope type and diameter.</p>		

Figure 5–1
Typical Wire Rope Capacity Chart (Example Only)

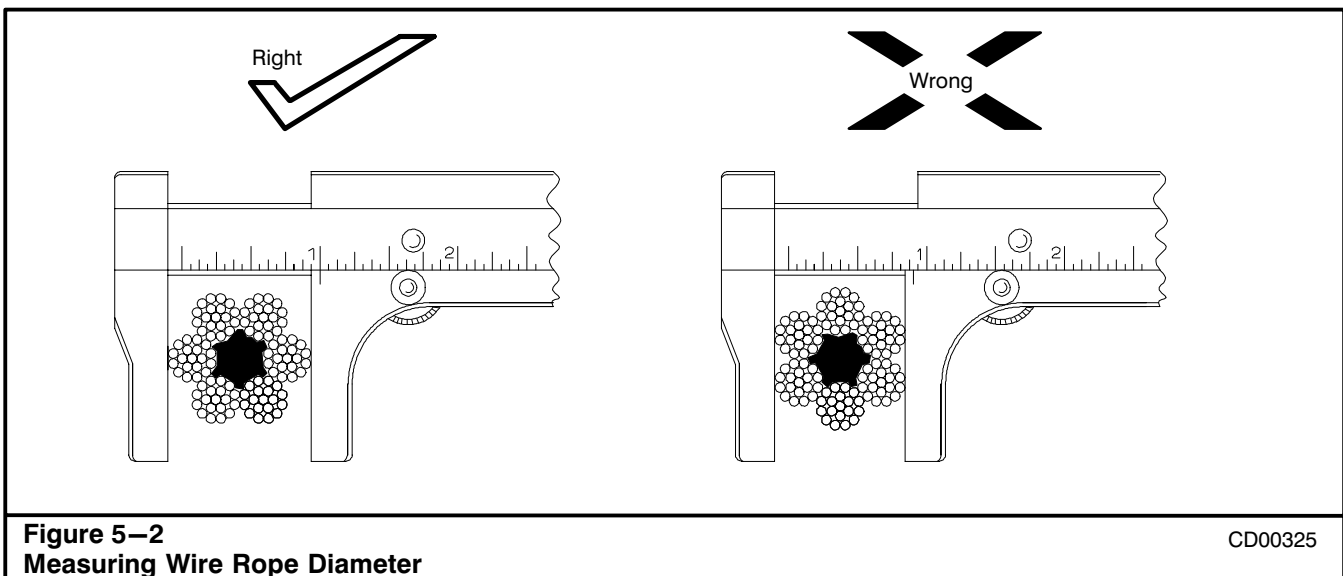


Figure 5–2
Measuring Wire Rope Diameter

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WIRE ROPE INSPECTION REPORT											
Machine _____			Owned By _____			Machine Location _____					
Date of Inspection _____			Rope Application _____			Rope Description _____					
Manufacturer's Ident. No. _____			Applicable Standards _____								
Criteria for Removal				1/3 of outside wire dia.	1						
Location on Rope	Measured Diameter	Broken Wires		Excessive Wear	End Attachments			Rope Damage	Sheave Condition	Drum Condition	Rope Lay Measurement
		In 1 Rope Lay	In 1 strand of 1 Lay		Broken Wires	Corrosion of Rope	Fitting Condition				
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 rope during normal usage.

When wire rope is replaced, use the type specified on the Wire Rope Capacity chart located in the Crane Rating Manual. Cranes are designed to use a specific type and size of rope. Using ropes other than those recommended, may result in short life or even failure of the 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 ropes are replaced.

These inspections should be done to determine the degree of deterioration of the rope at any given section (refer to the following on rope replacement). This will determine the suitability of the rope for continued service. A sample inspection report is shown in Figure 5-3. (It can be reproduced and used if desired.)

Operator's Manual

Wire Rope Inspection

Any of the following are reasons to question 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 rope or renewal of the attachment to eliminate the locally fatigued area. When running ropes over nylon sheaves, inspect the wire rope where it travels over the point sheaves. Inspect for a loss of diameter and then bend the 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 rope travel is limited, or in contact with saddles. Particular care should be taken to inspect rope at these points. If wire rope wear is detected at these locations, these wear points can be shifted by removing the 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. 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 rope diameter.
5. Time for rope replacement is indicated by the extent of abrasion, scrubbing and peening on the outside wires, broken wires, evidence of pitting or severe corrosion, kink damage or other mechanical abuse resulting in distortion of the 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 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 rope is installed.

Wire Rope Replacement

Any of the following are reasons for rope replacement:

1. In running ropes, six randomly distributed broken wires in one rope lay, or three broken wires in one strand in one rope lay.

For rotation resistant ropes, two randomly distributed broken wires in six rope diameters, or four randomly distributed broken wires in thirty rope diameters.

2. In pendants or standing ropes, evidence of more than two broken wires in one lay in sections beyond end connections or more than one broken wire in one rope lay at end connection.
3. One outer wire broken at the contact point with the core of the rope which has worked its way out of the rope structure and protrudes or loops out from the rope structure.
4. Abrasion, scrubbing or peening causing loss of more than 1/3 the original diameter of individual wires.
5. Evidence of rope deterioration from corrosion.
6. Kinking, crushing, "bird caging", or other damage resulting in distortion of the 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 rope stretch or elongation may also be an indication of internal deterioration. Reduction from nominal diameter or more than:

Reduction of	Nominal 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)	1/2" (13mm) 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.

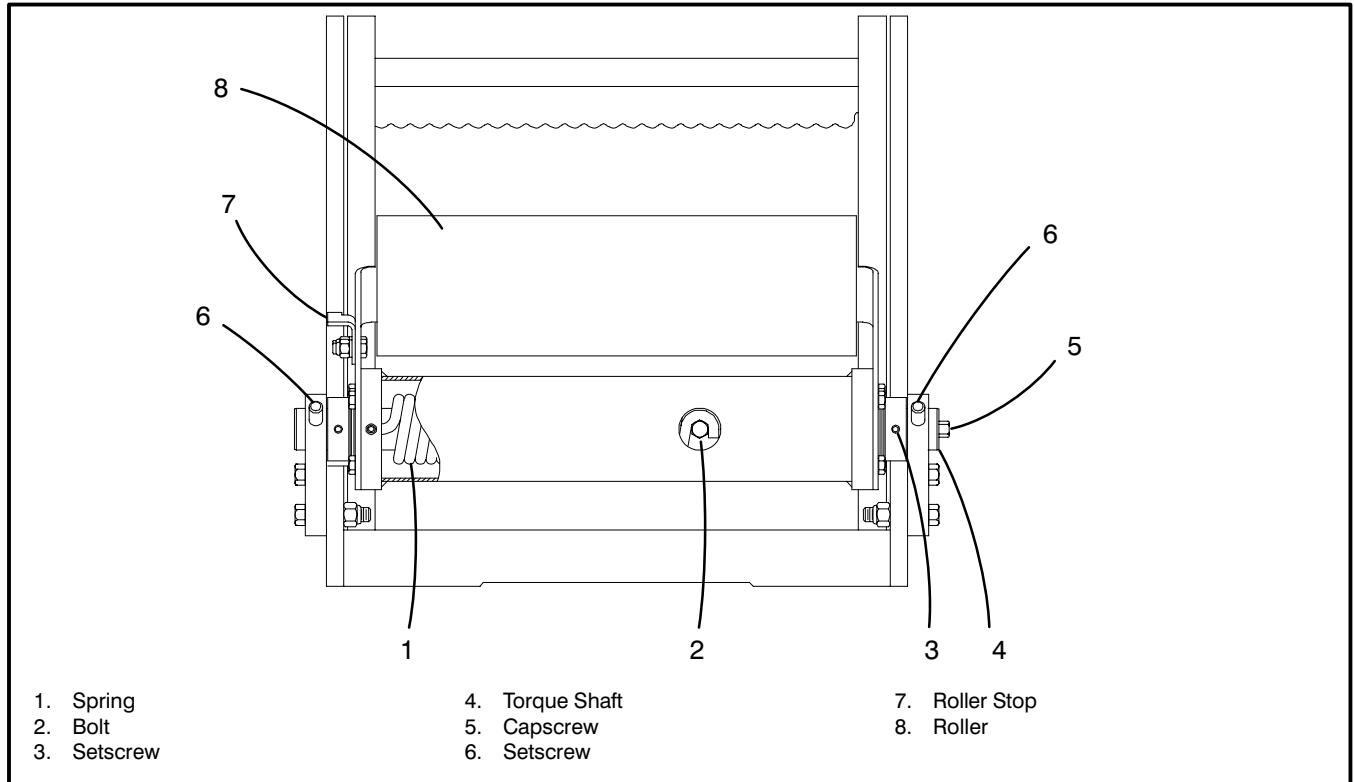


Figure 5-4
Winch Roller Adjustment

Wire Rope Installation

When installing wire rope, the primary concern is getting the rope onto the drum without trapping any twist that may have been induced during handling. Use the following procedure to install the rope on the crane.

Winch Roller Adjustment

Before installing wire rope on the drum, adjust the drum roller. Refer to Figure 5-4.

1. Check that the roller (8) is centered between the drum flanges. If not, loosen setscrew (3), center roller, and tighten setscrew.
2. Properly release torsion spring (1) 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 (5) is tightened securely in torque shaft (4).
 - b. Using a breaker bar or long handle wrench, hold tension on torsion spring (1) while loosening the setscrews (6) on both ends of torque shaft (4).
 - c. Allow torque shaft (4) to rotate counterclockwise, as far as possible while maintaining control of the torque shaft (4), then securely tighten setscrews (6).

- d. Reposition breaker bar or wrench on capscrew (5).
- e. Repeat steps b thru d until tension is fully relieved from torsion spring (1).

CAUTION

Do not overtighten the spring. Damage to the wire rope may occur.

3. With the roller stop (7) resting against the winch frame and the bolt (2) through the torque shaft (4) just contacting the spring (1), rotate the torque shaft 290° to preload the spring. The torque required to turn the shaft 290° is approximately 72 ft lb (97Nm).
4. Tighten setscrews (6). The roller should roll freely when the drum rotates. The force at the roller pushing on the first layer of rope will be approximately 169 lb (752N).

Operator's Manual

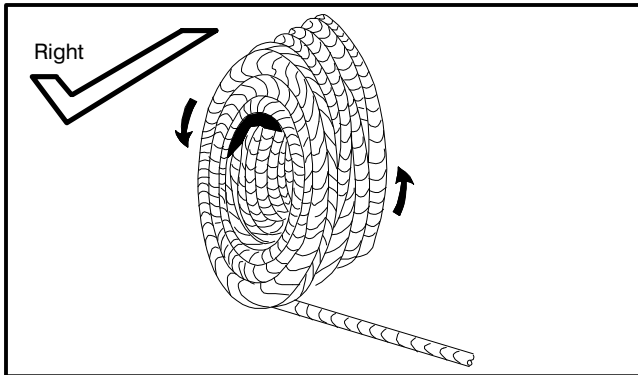


Figure 5-5
Uncoiling Wire Rope

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Uncoiling Wire Rope

1. To avoid twists, unreel the entire rope on the ground in line with the boom deflector sheave and drum. Set the reel up horizontally so it can rotate as the rope is reeled off. Refer to Figure 5-5. Reel the rope off slowly, so the reel won't tend to "throw" the rope off. If the new 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 unreel 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 rope on the reel or pass rope between blocks of wood or other material.
2. Reeve the 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 rope. On older equipment, remember that new rope is usually larger in diameter than the worn rope it replaces. The sheave grooves may be worn to the smaller diameter of the old rope.

A new rope should be broken in by running it slowly through its working cycle for a short period under a light load. Refer to "Rope Break-In" found later in this Section of the Operator's Manual.

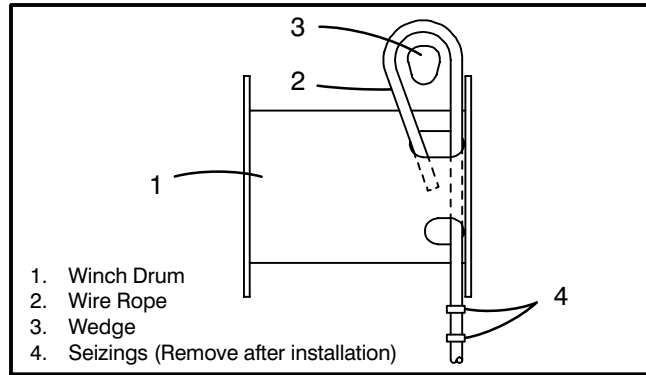


Figure 5-6
Anchoring Wire Rope to Drum

Anchoring Wire Rope to Drum

Attach two seizings (hose clamps are an effective and efficient alternative if traditional seizings are not available) about 24 inches (609.6mm) from the end with a 3 inch (76.2mm) space between them. Refer to Figure 5-6. The seizings will prevent any looseness of the outer strands from traveling up the rope during installation. Insert the free end of the rope into the small opening of the anchor pocket. Loop the rope and push the free end about three fourths of the way back through the pocket. Install the wedge, then pull the slack out of the rope. Remove the seizings after the rope is secured in the drum. Keep tension on the rope to prevent the rope from becoming slack and forming loops or kinks and also to allow uniform winding on the drum. It is important that original rope lay is maintained at all times.

Winding Rope on Drum

Proper winding of the first layer of 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 rope to prevent the rope from becoming slack and forming loops or kinks and also to allow uniform winding on the drum. It is important that original rope lay is maintained at all times.

It's important to apply a tensioning load while spooling the 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 seriously damage the rope.) The tensioning load should range from 1 to 2% of the 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 rope and sheaves. Refer to Figure 5–7.



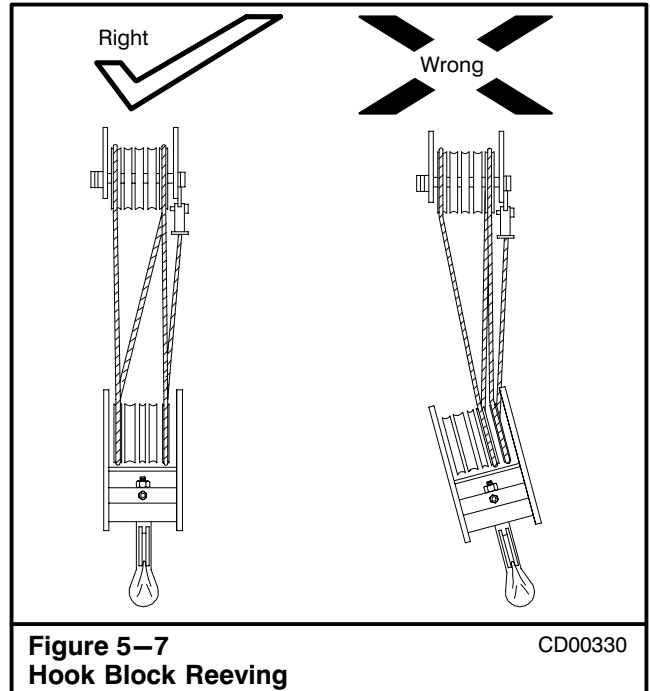
WARNING

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.

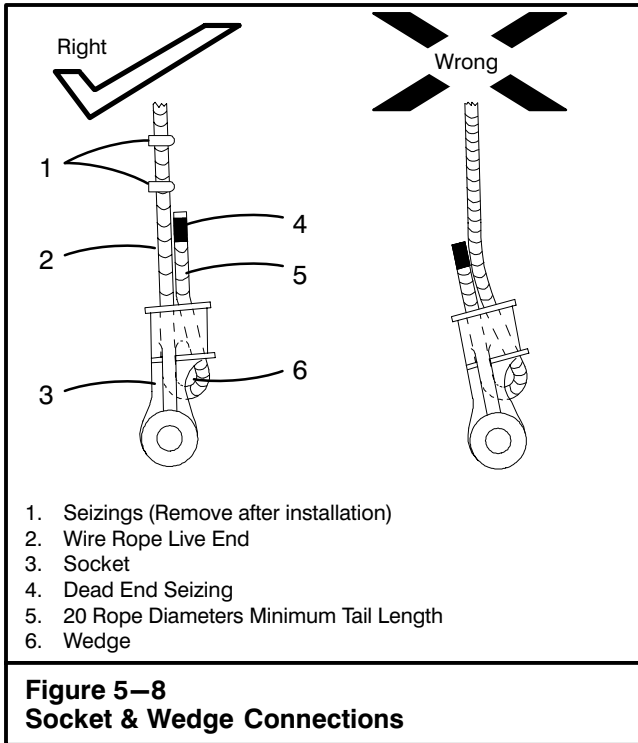
Only if certain criteria are met may a swivel hook ball be used with rotation resistant rope. Refer to "Hook Ball Usage With Rotation Resistant Rope" found in this Operator's Manual.

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 main winch, odd parts of line dead end at the hook block and even parts dead end at the boom peak. The auxiliary lifting sheave may be reeved with either one or two parts of line. The fly section may be reeved with two parts of line for better line control. Figure 5–13 and Figure 5–14 give 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 located in the Crane Rating Manual.

Note: Rope guards must always be used during operations. They must be pinned in place to prevent wire rope from jumping off the sheaves.



Operator's Manual

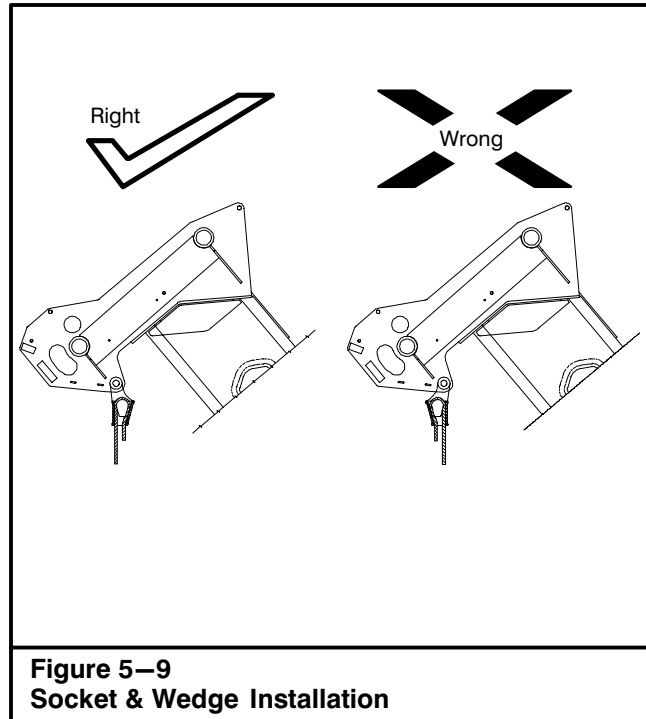


Socket And Wedge Connections

The correct and incorrect methods of attaching a socket and wedge to wire rope are shown in Figure 5-8. 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 rope is installed wrong as shown in Figure 5-8, a permanent will develop at the point where the rope enters the socket.

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 rope and a wedge for one or two. The size on the lagging, socket and wedge must correspond with the size of rope being used.



Before installing wire rope into the socket or wedge attach two seizings (hose clamps are an effective and efficient alternative if traditional seizings are not available) approximately 3-4 feet (.9-1.2m) from the end with a 3 inch (76.2mm) space between them. Refer to Figure 5-8. The dead end must also be seized and a minimum tail length of 20 rope diameters (12.5 inches for 5/8 inch rope) is required. The seizings will prevent core slippage and any looseness of the outer strands from traveling up the rope during installation while still allowing the rope strands to be free to adjust. Remove seizings from the live end after rope is securely installed into the socket.

When anchoring the socket to the boom head, make sure the flat face is facing out as shown in Figure 5-9. 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 re-established on an annual basis. This can be accomplished by cutting the rope 6" (.15m) above the socket and wedge connection. (See "Cutting Wire Rope" found in this section of this Operator's Manual). Install the socket and wedge connection as shown in Figure 5-8.

Operator's Manual

Rope Break—In

After the rope has been installed and the ends secured in the correct manner, the new rope must be run through a break—in period. This allows the component parts of the new rope to gradually adjust itself to actual operating conditions.

1. Level the crane on fully extended outriggers with all tires clear of the ground. Swing the upper over the rear 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 off the ground. Allow to stand for several minutes.
3. Run the 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 rope runs freely, and without any possible obstructions as it makes its way through the system.

Note: Run these loads with reeving that places the loads on the block with all 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 rope on the drum.

4. If no problems appear in running the rope, repeat procedure with an increased load.

Hook Ball Usage With Rotation Resistant Rope

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 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.

Rope Inspection

Marked reduction in diameter indicates deterioration of the core resulting in lack of proper support for the load carrying strands. Excessive rope stretch or elongation may also be an indication of internal deterioration. Major concerns and replacement recommendations include:

1. Loss of rope diameter (in excess of those listed in the table in the “Wire Rope Replacement” section found earlier in this Operator’s Manual), abnormal lengthening of rope lay, or protrusion of wires between the outer strands.
2. 2 randomly distributed broken wires in 6 rope diameters, or 4 randomly distributed broken wires in 30 rope diameters.

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 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 rope, the 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, affects the internal loading of the rope in this manner. This practice, or any other which allows the 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 rope utilized with a swivel hook ball has reduced the breaking strength by as much as 50% if excessive rotation occurs.

Operator's Manual

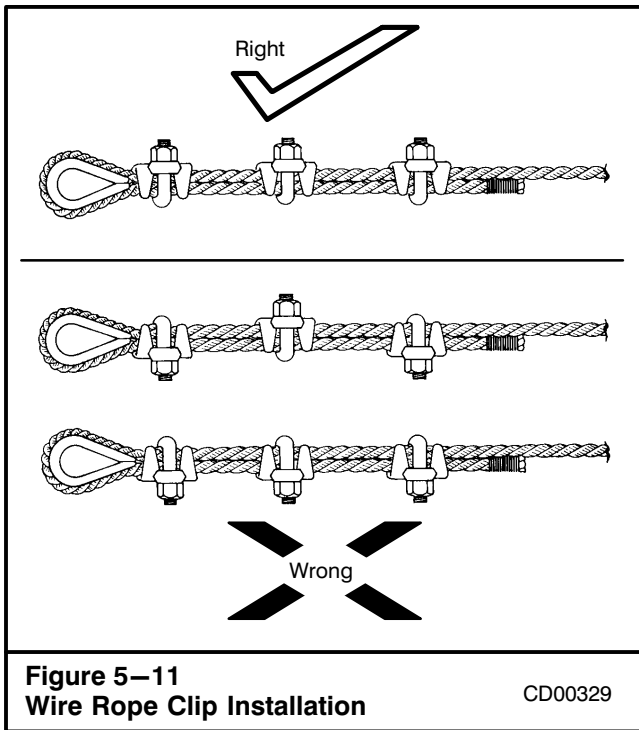
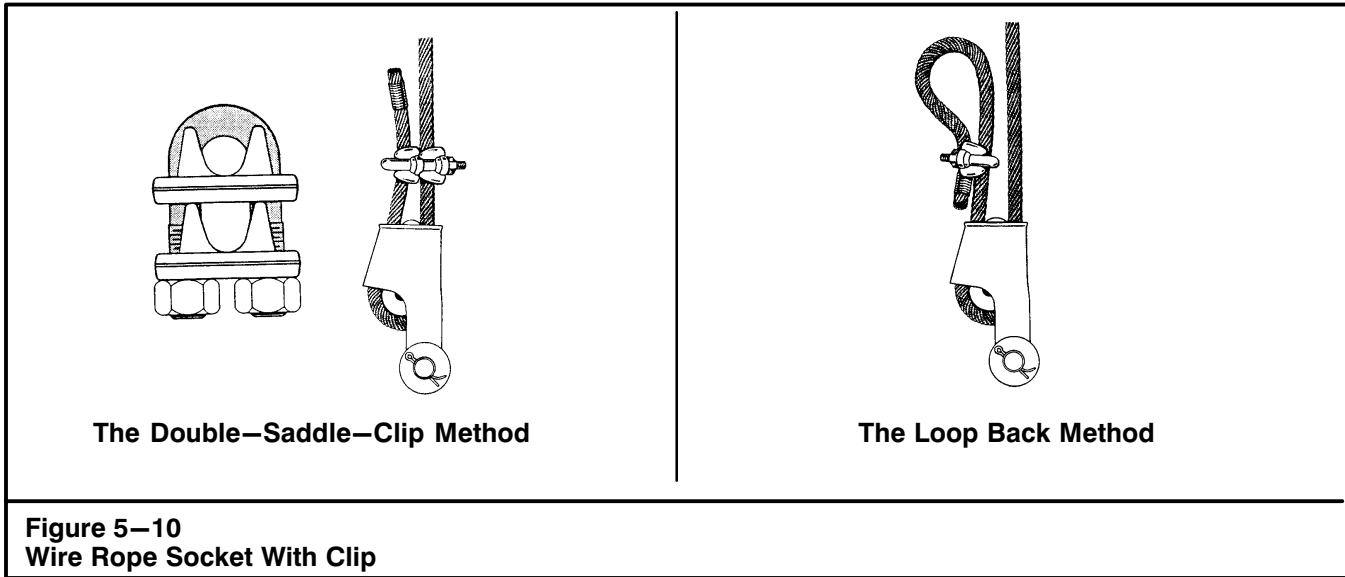


Figure 5-10 illustrates some typical methods of clip installation with sockets. In some cases, particularly in wrecking ball work, there is a chance that the wedge can loosen, releasing the socket from the rope. This could be caused by the banging action and alternate loading and unloading of the rope 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 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 rope to the live side with the clip as this will seriously weaken the connection. The clip may ultimately take the load and may deform or break the 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 rope diameters (12.5 inches for 5/8 inch rope).

Wire Rope Sockets With Clips

Some codes require the use of a wire rope clip in conjunction with a socket and wedge connection.

Clip Size		Minimum No. Of Clips	Amount Of Rope To Turn Back *		Torque	
Inches	mm		Inches	mm	ft-lb	Nm
1/8	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 rope turnback should be increased proportionally.

Figure 5–12
Wire Rope Clip Application Recommendation

Wire Rope Clip Installation

The correct method of installing wire rope clips is shown in Figure 5–11. 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 5–12.

CAUTION

Apply the initial load and retighten nuts to the recommended torque. Rope can stretch and shrink in diameter when loads are applied. Inspect periodically and retighten as required.

Cutting Wire Rope

When wire rope is to be cut, seizings should be placed on each side of the point where the rope is to be cut, to keep the strands in place. On preformed rope such as type RB, one seizing on each side of the cut is enough. On non–preformed rope less than 7/8 inch (23mm) diameter, two seizings are recommended. On non–preformed rope over 7/8 inch (23mm) diameter, three seizings are recommended. Original rope lay must be maintained at all times.

Two Basic methods of cutting wire rope are recommended:

1. Abrasive cutting tools.
2. Shearing tools. (Wire cutters on small rope, a wire rope cutter and hammer for larger ropes).
3. Oxy/acetylene fuel torch.

Operator's Manual

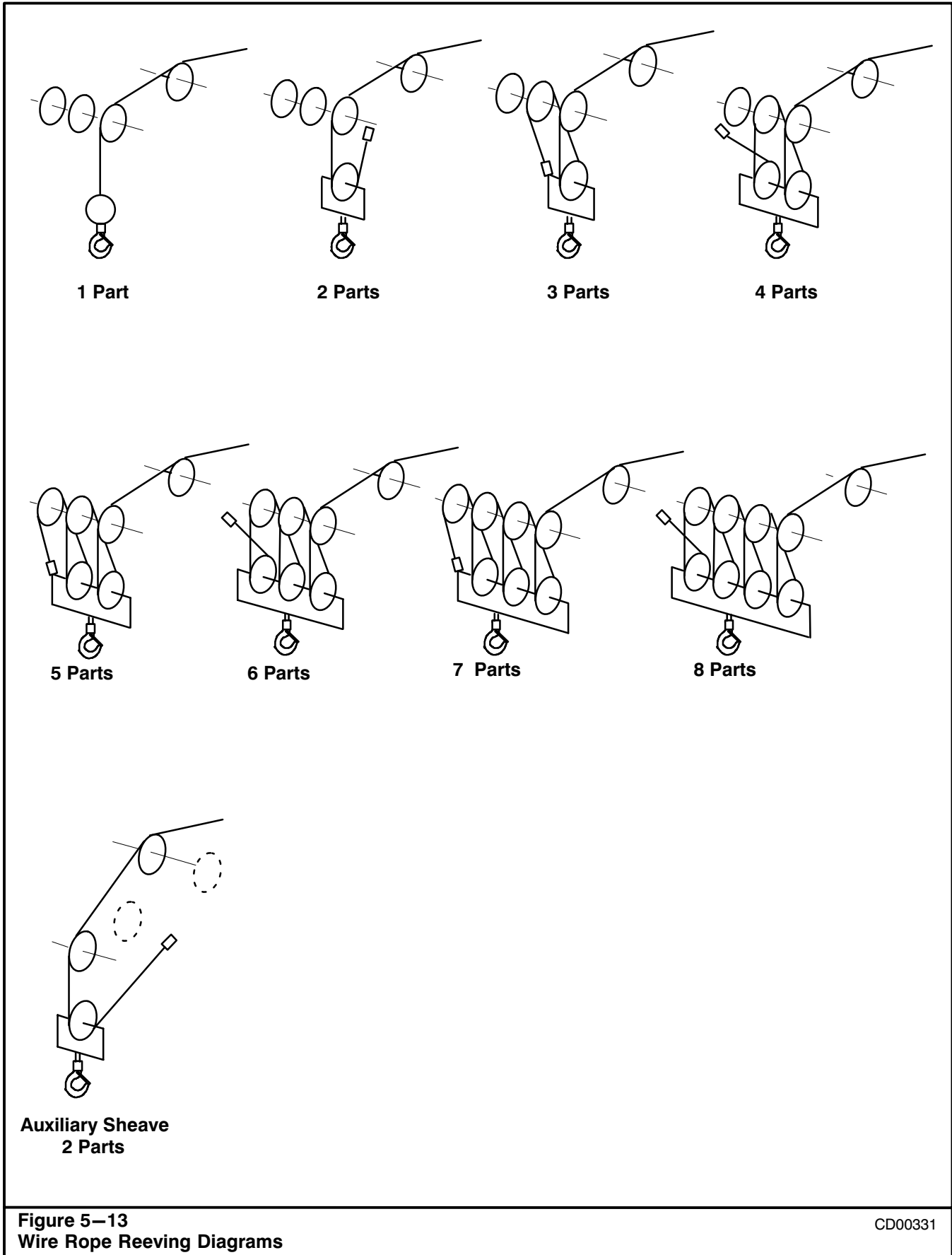
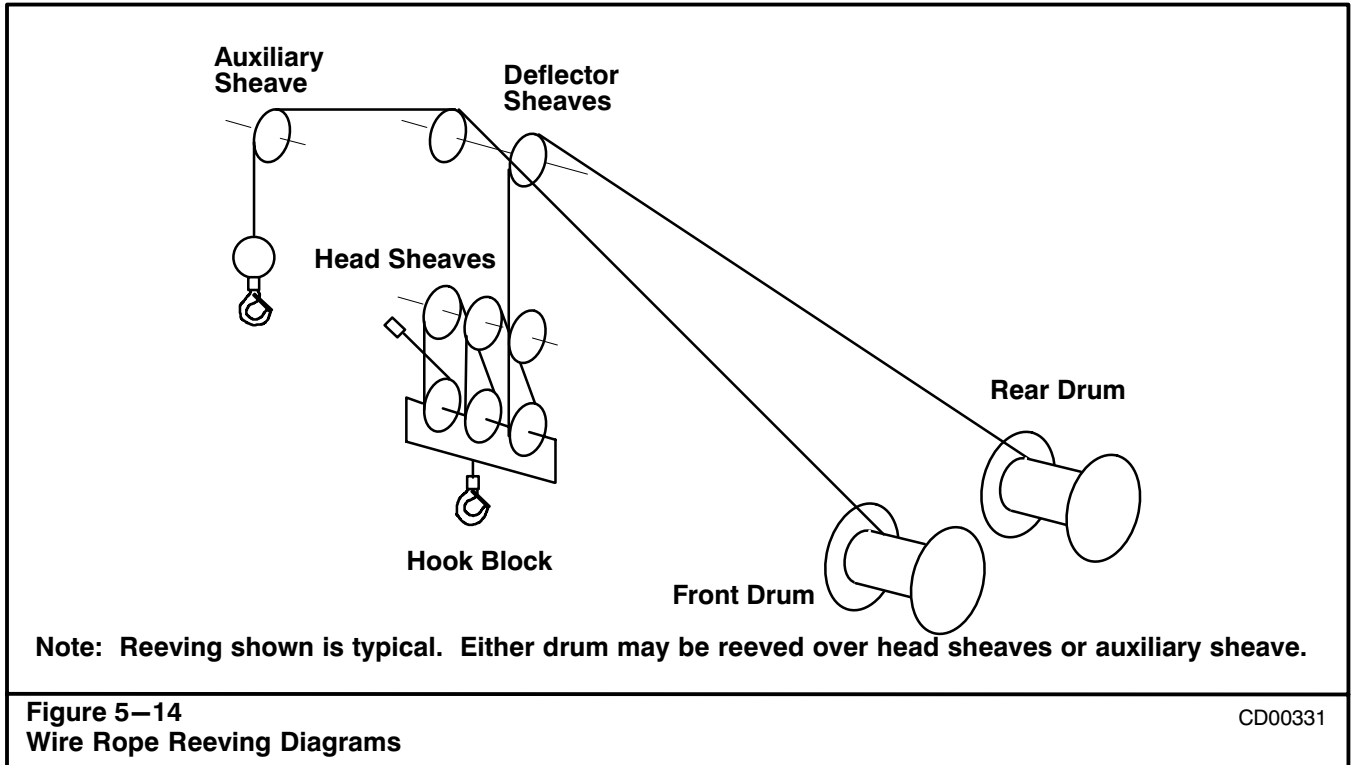


Figure 5-13
Wire Rope Reeving Diagrams

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Operator's Manual

Hydraulic System Schematic Diagram

Lines & Line Functions	
Line, Working	
Line, Pilot (L>20W)	
Line, Drain (L<5W)	
Connector	
Line, Flexible	
Line, Joining	
Line, Passing	
Direction of Flow	
Line to Reservoir Above Fluid Level Below Fluid Level	
Plug or Plugged Connection	
Restriction, Fixed	
Restriction, Variable	
Method of Operation	
Pressure Compensator	
Detent	
Manual	
Mechanical	
Lever	
Pilot Pressure	
Solenoid	
Solenoid Controlled, Pilot Pressure Operated	
Spring	
Miscellaneous Units	
Direction of Flow (Arrow in Front of Shaft)	
Component Enclosure	
Reservoir, Vented	
Reservoir, Pressurized	
Pressure Gauge	
Temperature Gauge	
Accumulator, Gas Charged	
Filter or Strainer	
Cooler	
Pressure Switch	
Basic Valve Symbols	
Check Valve	
Manual Shut off Valve	
Basic Valve Envelope	
Valve, Single Flow Path (NC)	
Valve, Single Flow Path (NO)	
Valve, Maximum Pressure (Relief)	
Basic Valve Symbol Multiple Flow Paths	
Flow Paths Blocked in Center Position	
Multiple Flow Paths (Arrow Shows Flow Direction)	
Valve Examples	
Unloading Valve, Internal Drain, Remotely Operated	
Sequence Valve, Directly Operated, Externally Drained	
Pressure Reducing Valve	
Counterbalance Valve With Integral Check	
Directional Valve, Two Position, Three Connection	
Directional Valve, Three Position, Four Connection	
Valve, Infinite Positioning (Indicated By Horizontal Bars)	
Pumps	
Pump, Single Fixed Displacement	
Pump, Single Variable Displacement	
Motors & Cylinders	
Motor, Rotary Fixed Displacement	
Motor, Rotary Variable Displacement	
Cylinder, Double Acting	

**Figure 5-15
Hydraulic Symbols Legend**

Operator's Manual

Hydraulic Components Chart – Refer to Figure 5–16 & Figure 5–17

Ref	Description
1	3–Way Solenoid Valve
2	Swing Control Valve
3	Swing Motor
4	Inline Orifice
5	Boom Hoist Counterbalance Valve
6	Joystick Controller Valve – Left
7	Joystick Controller Valve – Right
8	Boom Telescope Foot Controller Valve
9	Pilot Oil Supply Valve
10	Accumulator
11	Temperature Sender
12	Check Valve
13	4 Way – 2 Position Solenoid Valve
14	Load Sense Priority Valve
15	Check Valve – 85 psi (586kPa)
16	Power Steering Control Valve
17	Auxiliary Winch – 1 Speed Option
18	Main Winch – 2 Speed Option
19	Telescope Diverter Valve
20	Two Section Winch Control Valve
21	Boom Hoist/Telescope Control Valve
22	Boom Telescope Cylinder
23	Boom Telescope Counterbalance Valves
24	Boom Hoist Cylinder
25	4–Way Valve
26	Steering Cylinder
27	Double Pilot Operated Check Valve
28	Jack Cylinder
29	Beam Cylinder
30	2–Way Valve Stack
31	Relief Valve – 2,500 psi (17 237kPa) Relief
32	Gear Pump – Outrigger/Steer

Ref	Description
33	2 Section Main Pump – Winch/Boom Hoist
34	Relief Valve
35	Hydraulic Filter Assembly
36	Hydraulic Reservoir
37	Check Valve
38	Oil Cooler
39	Solenoid Lockout Valve
40	Lockout Cylinder
41	Priority Flow Valve – 11 gpm (41.6lpm)
42	Relief Valve – 3,300 psi (20 685kPa) Relief
43	Carrier Mounted Tow Winch
44	4–Way Directional Valve
45	Relief Valve – 1500 psi (10 342kPa)
46	Hydraulic Cab Heater
47	Check Valve – 15 psi (103kPa)
48	2–Way Solenoid Valve Cartridge
49	Thermostat
50	Hydraulic Heater Filter
51	Hydraulic Heater Gear Pump
52	Hydraulic Heater Motor
53	Needle Valve
54	Check Valve
55	Emergency Steering Accumulator
56	Priority Control Valve
57	Compressor
58	High Pressure Switch
59	Condensor
60	Dryer
61	Evaporator
62	Low Pressure Switch
63	Pressure Check Ports
64	One Section Winch Control Valve

Operator's Manual

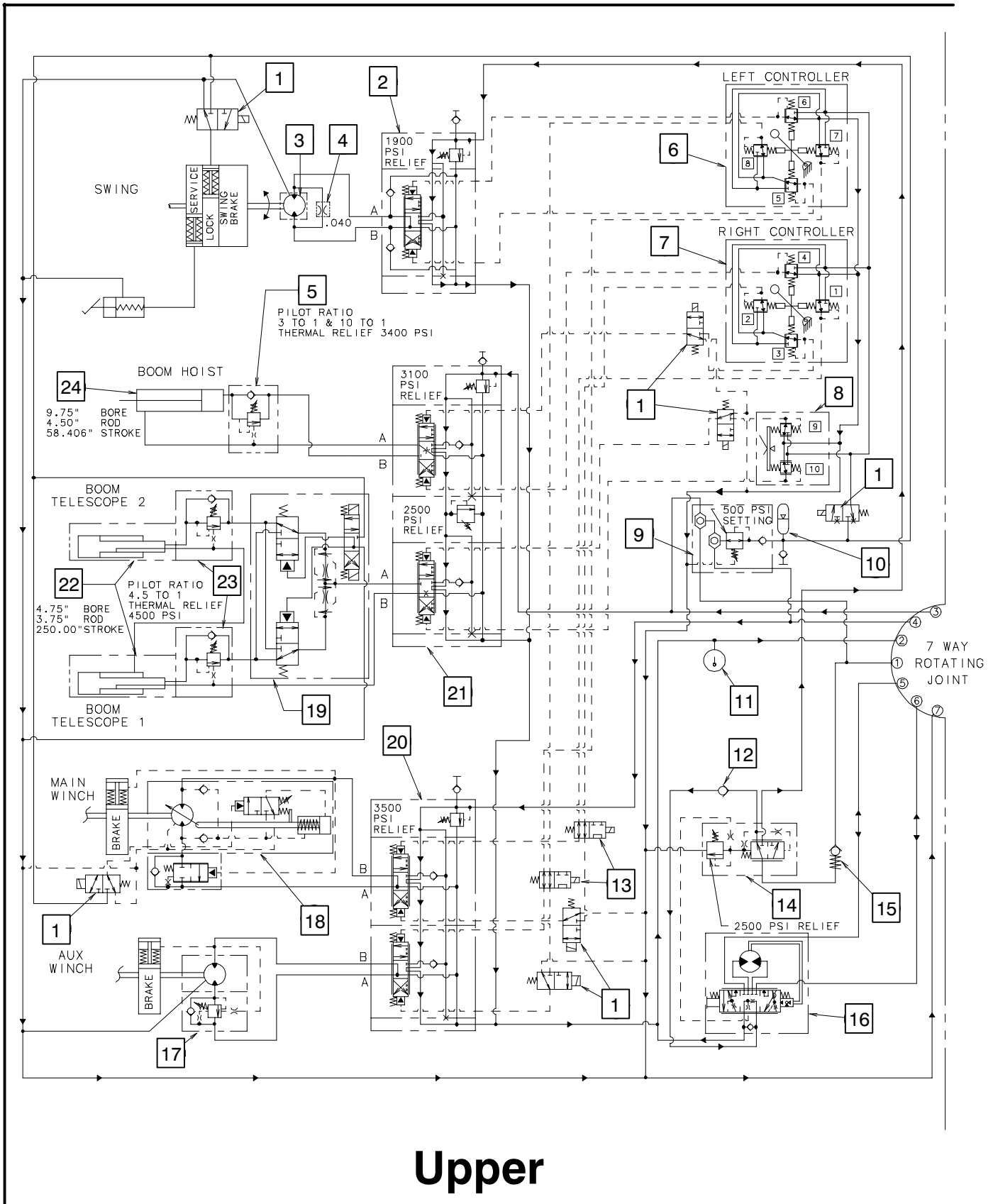
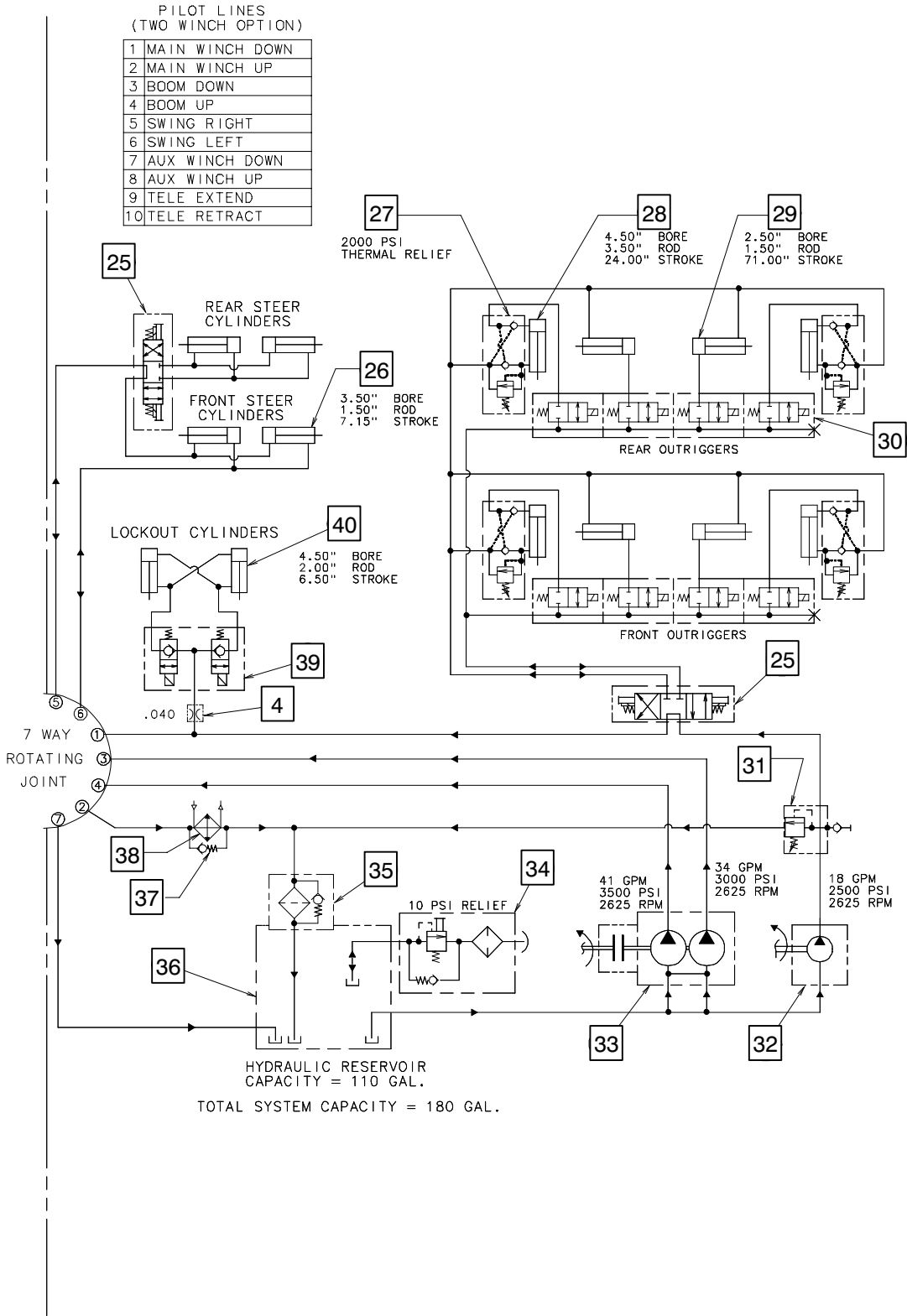


Figure 5-16
Hydraulic System Schematic Diagram

Operator's Manual



Lower

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Operator's Manual

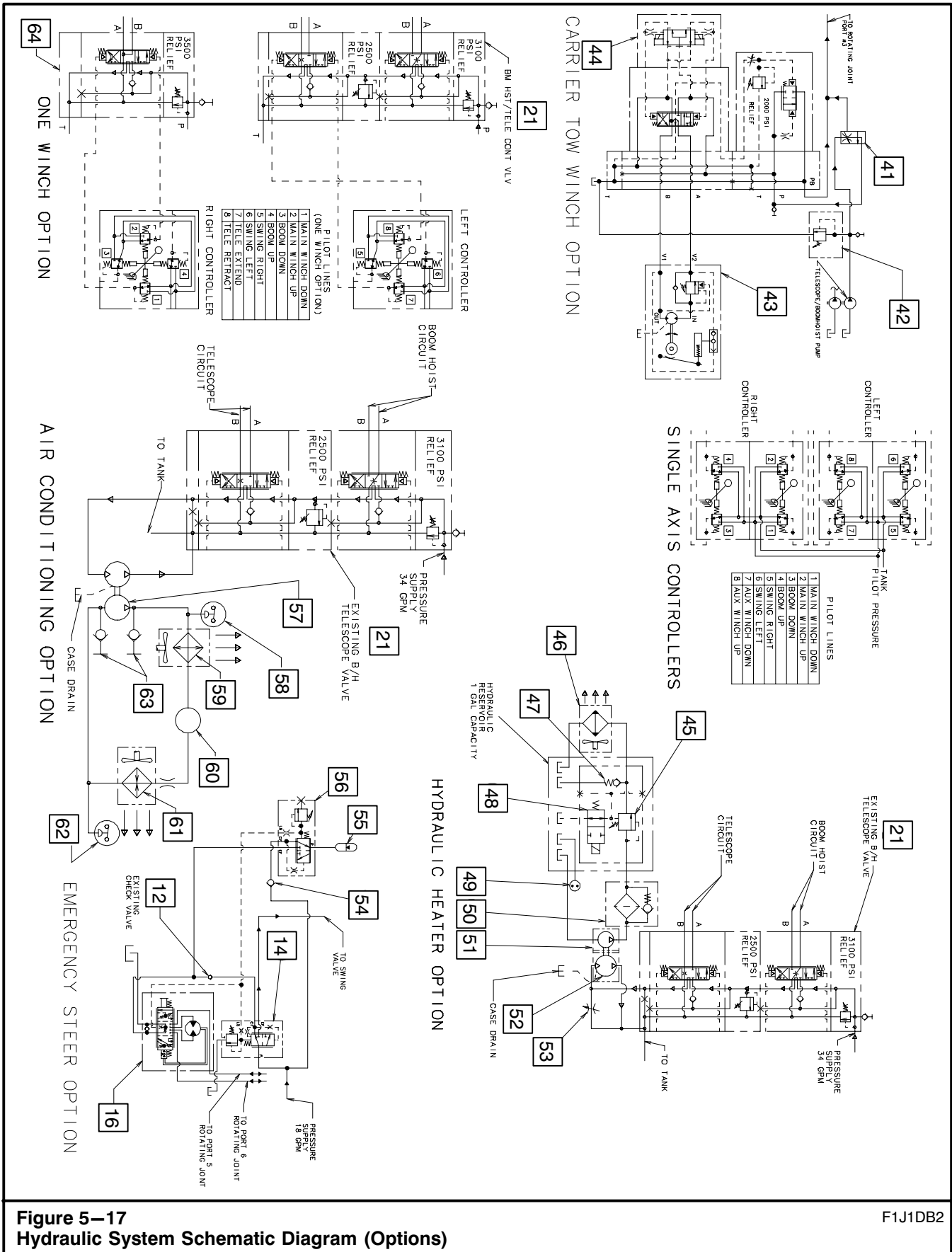


Figure 5-17
Hydraulic System Schematic Diagram (Options)

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Electrical System Schematic Diagram




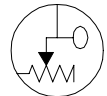
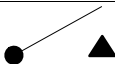
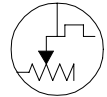




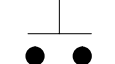

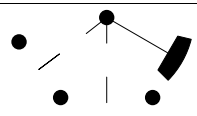
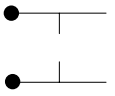

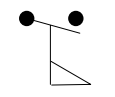
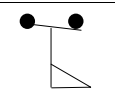

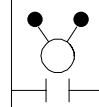


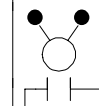


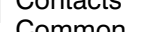
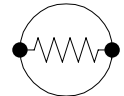

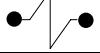



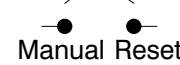

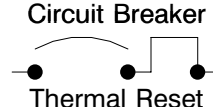

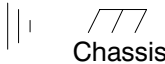

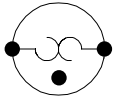

Switches		Senders	
	Maintained Contact Normally Open		Pressure Sensitive
	Maintained Contact Normally Closed		Liquid Level
	Momentary Contact		Thermal Sensitive
	Mechanically Actuated		Speedometer
	Pressure Sensitive Opens As Pressure Rises		
	Pressure Sensitive Closes As Pressure Rises		
	Momentary Contact Normally Open		
	Momentary Contact Normally Closed		
	Make Before Break		
	Mechanically Linked		
	Variable Resistance With Off Position		
	Closes With Increase In Flow		
	Opens With Increase In Flow		
Audible Signals		Heating Element	
	Buzzer		Coil
	Horn, Backup Alarm		Contacts NO
			Coil
			Contacts NO
			Contacts NC
			Contacts Common
			Heating Element
			Diode
			Valve Solenoid
Lights		Circuit Protectors	
	Gauge		Fuse
	Head, Tail, Dome, Brake, Etc.		Circuit Breaker Manual Reset
	Head, Tail, Dome, Brake, Etc.		Circuit Breaker Thermal Reset
			Battery
			Ground Chassis
			Gauge
			Flasher
			Motor

Figure 5-18
Electrical Symbols Legend

Operator's Manual

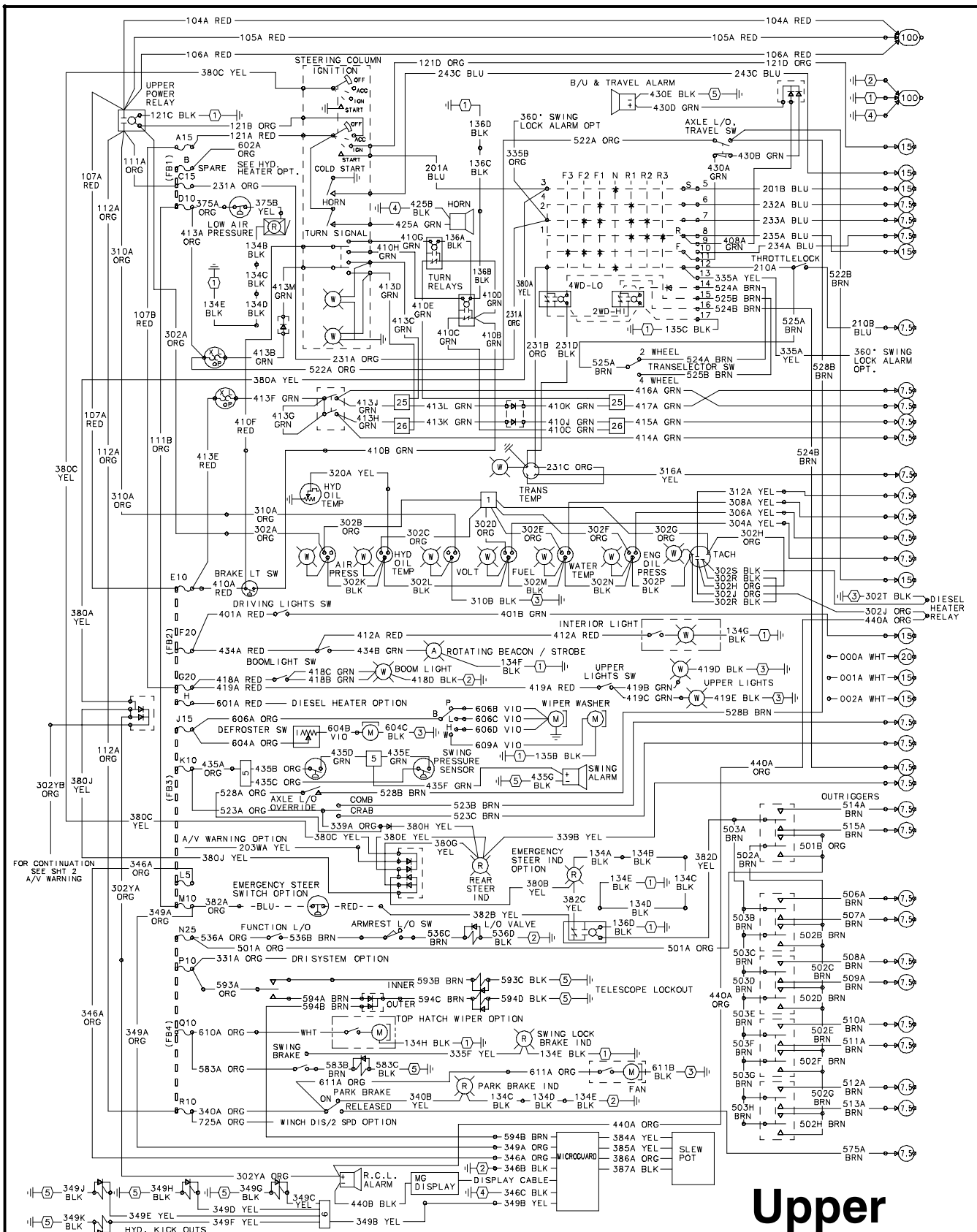
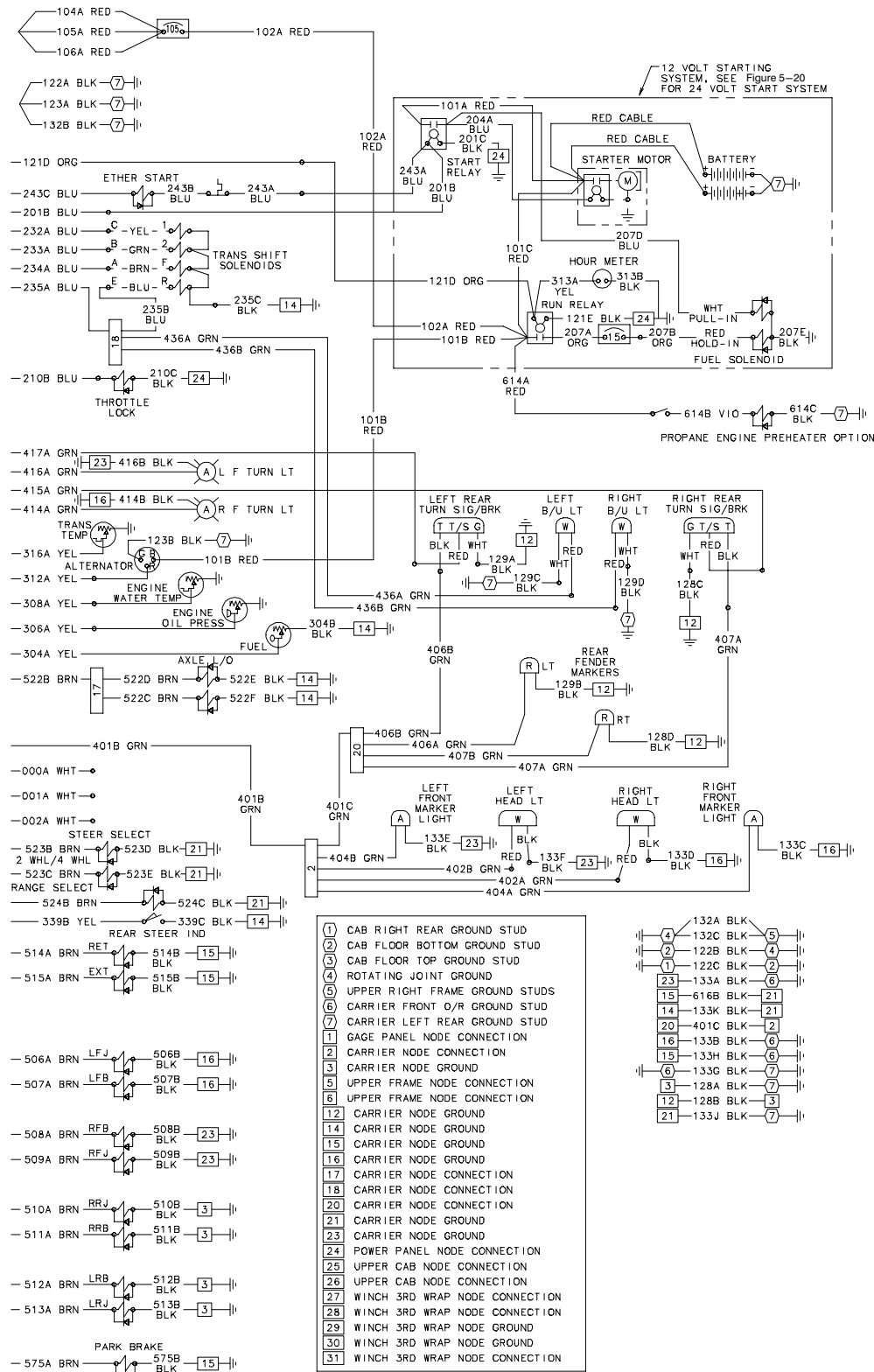


Figure 5-19
Electrical System Schematic Diagram

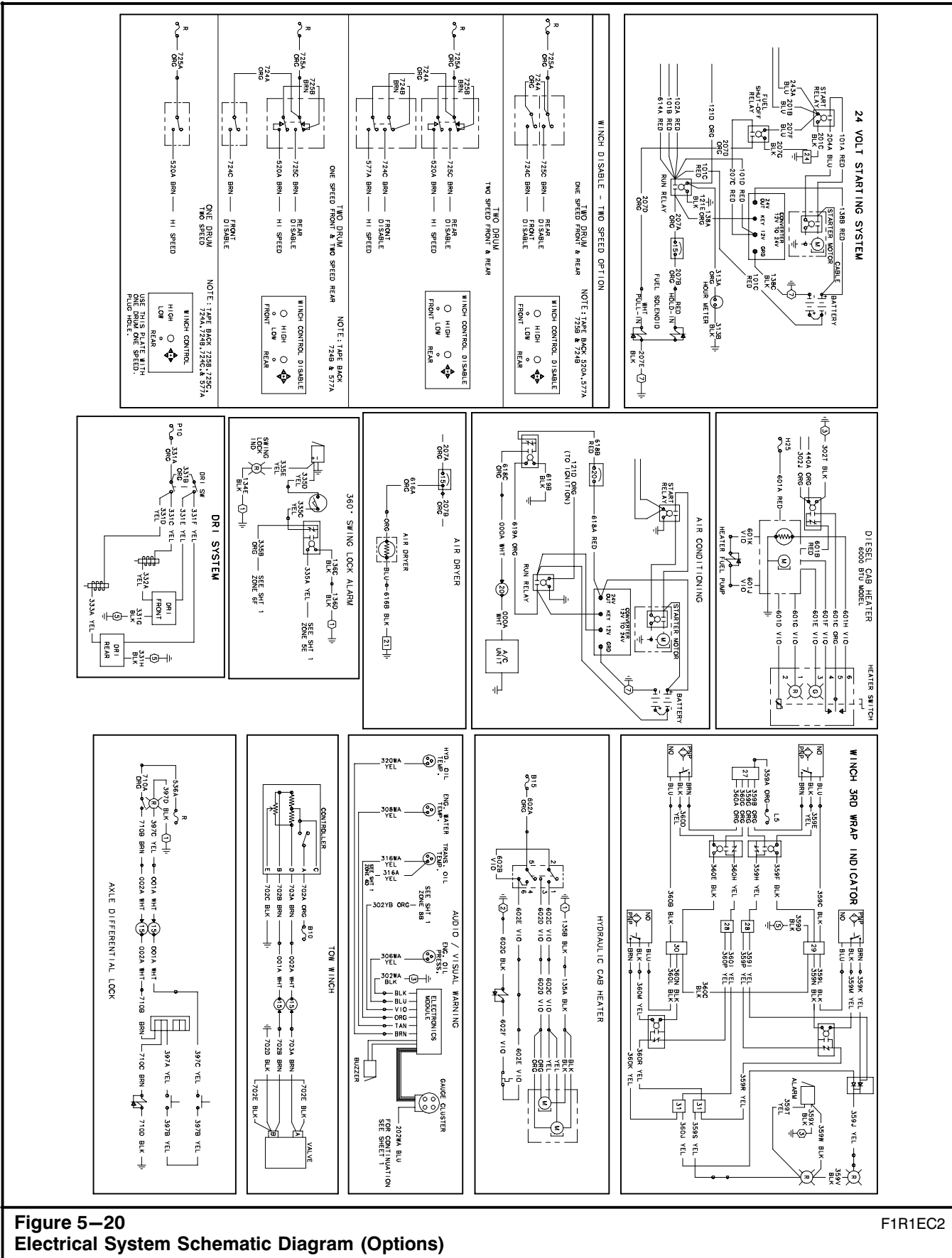
Operator's Manual



Lower

F1R35EB1

Operator's Manual



**Figure 5-20
Electrical System Schematic Diagram (Options)**

F1R1EC2

Air System Schematic Diagram

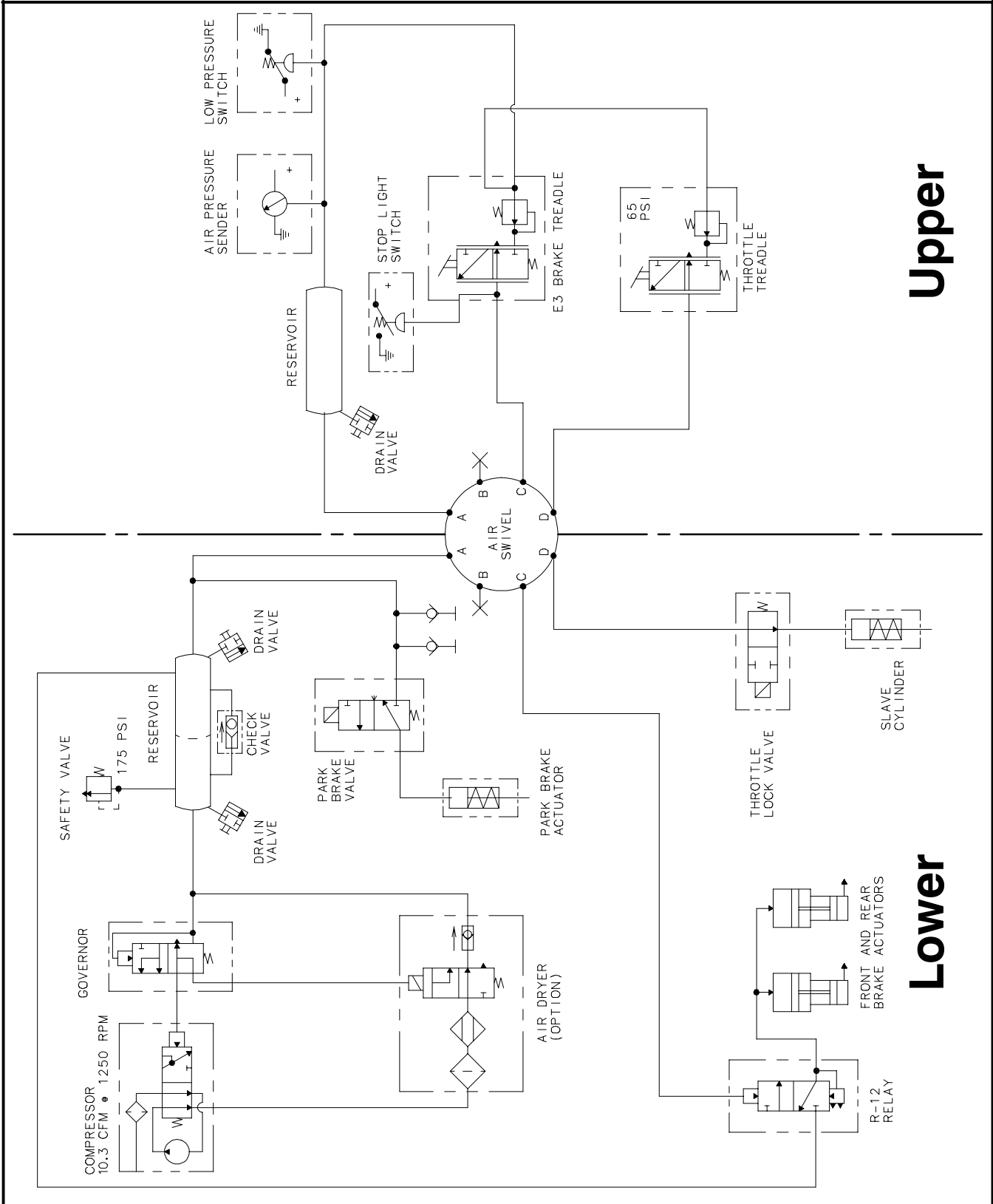


Figure 5-21
Air System Schematic Diagram

F1A140CB

Operator's Manual

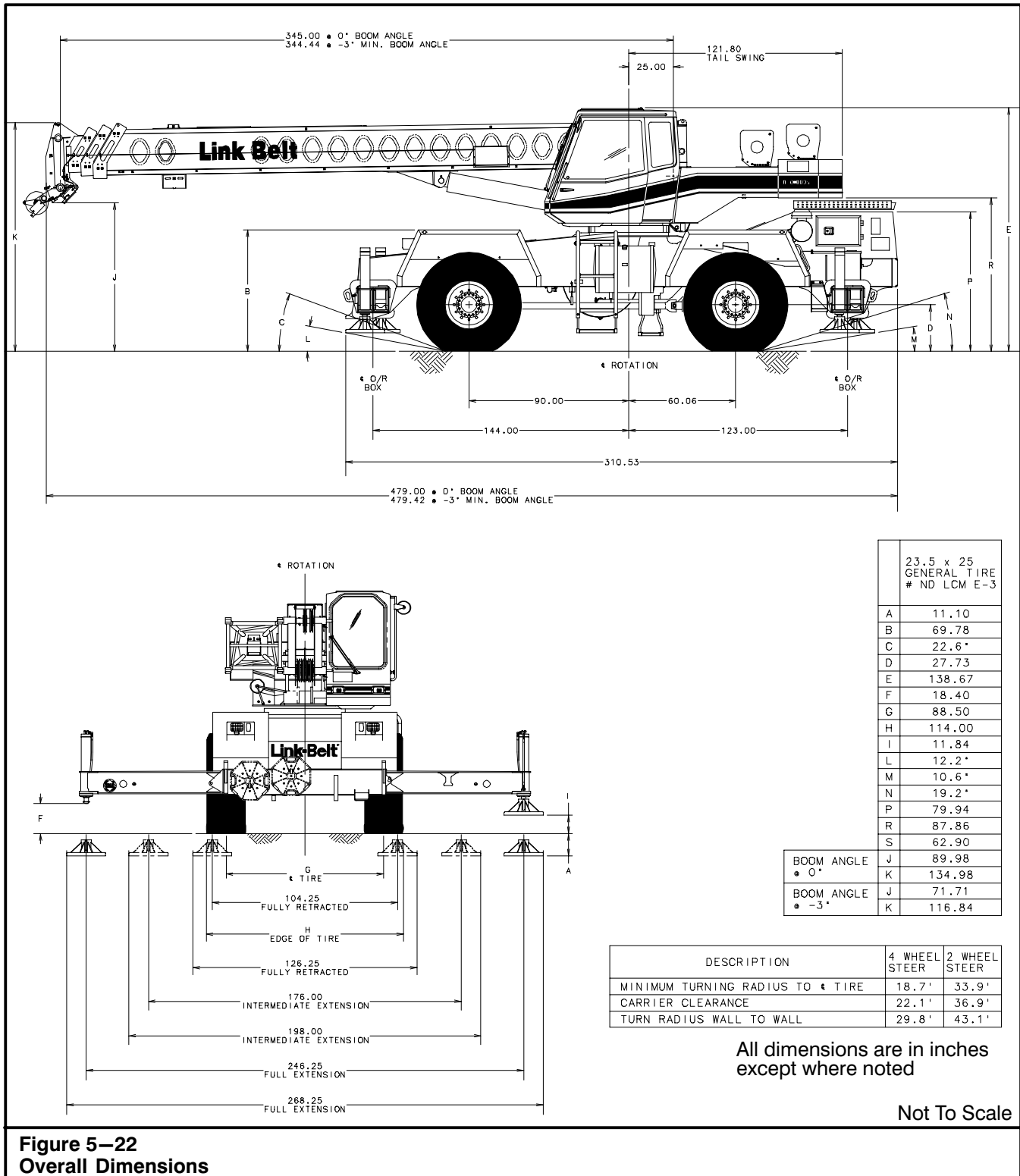


Figure 5-22
Overall Dimensions

Crane Specifications

The information in Figure 5-22 and the following instructions 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. Consult the factory to verify the specific information if required.

Operator's Manual

Upper

Boom

Patented Design. All boom section side plates have diamond shaped impressions for superior strength to weight ratio and 100,000 p.s.i. (689.5MPa) steel angle chords for lateral stiffness. Boom telescope sections are supported by wear shoes both vertically and horizontally to prevent metal to metal contact.

Rated Capacity Limiter — Standard; Graphic, audio—visual warning system built into corner post with anti—two block and function limiters. Operating data available includes boom length, boom angle, head height, radius of load, machine configuration, allowed load, actual load and percent of allowed load. Presettable alarms for maximum and minimum boom angles, max. tip height, max. boom length, swing left/right positions. Operator defined area alarm is also provided.

Optional; Load rating bar graph for quick operator reference.

Standard Boom — 28 ft 9 in — 91 ft 0 in (8.76 — 27.74m) four—section full power boom. Two mode boom extension — Basic mode (or mode 'B') is the full power, synchronized mode of telescoping all sections proportionally. The exclusive *A—max* mode (or mode "A" extends only the inner mid—section to 49 ft 6 in (15.09m) offering increased capacities for in—close, maximum capacity picks.

Boom head — Four 10—5/8 in (0.27m) root diameter nylon sheaves handle up to 8 parts of wire rope. Rope dead end lugs provided on each side of boom head. Easily removable wire rope guards are standard; one on top sheaves and one on bottom sheaves. Boom head designed for quick reeve of hookblock.

Auxiliary lifting sheave — *Optional;* Single 10—5/8 in (0.27m) root diameter nylon sheave with removable wire rope guard. For use with one or two parts of line off the optional auxiliary winch. Does not affect erection of fly or use of main head sheaves for multiple reeving.

Boom elevation — One Link—Belt designed hydraulic cylinder with holding valve and bushings in each end. Hand control for controlling boom elevation from -3° to $+79.9^{\circ}$.

Fly

Optional — 25 ft (7.62m) fixed stowable one piece lattice type.

Optional — 25 ft (7.62m) offsettable (2° , 15° , or 30°) stowable one—piece lattice type.

Optional — 25 — 43 ft (7.62 — 13.10m) offsettable (2° , 15° , or 30°) stowable type lattice with telescoping box section.

Cab and Controls

Environmental ULTRA—CAB™ of LFC•2000 construction process featuring laminated fibrous composite material; isolated from sound with acoustical fabric insulation providing 82 dBA sound level, all tinted and tempered safety glass windows. Sliding rear and right side windows and swing up roof window for maximum visibility and ventilation. Slide—by—door opens to 36" (0.91 m) width. 6—way adjustable operator's seat for maximum operator comfort. Hydraulic control levers (joystick type) for swing, winches and boomhoist. Out-rigger controls conveniently located in overhead control console; sight level bubble also provided in upper cab. Foot controls for boom telescope, swing brake, travel brake and engine throttle.

Cab instrumentation — Corner post mounted gauges for hydraulic oil temperature, air pressure, fuel, tachometer, water temperature, voltmeter and oil pressure. Converter oil temperature gauge mounted in side console.

Swing

Bi—directional hydraulic swing motor mounted to a planetary reducer for 360° continuous smooth swing at 3.6 r.p.m.

Swing parking brake — 360° , electric over hydraulic (spring applied, hydraulic released) multi—disc brake mounted on the speed reducer. Operated by toggle switch in overhead control console.

Swing brake — 360° , foot operated, hydraulic applied disc brake mounted on the speed reducer.

Travel swing lock — Standard; two position travel swing lock (pin device) operated from the operator's cab.

Counterweight — Bolted to upperstructure frame. 9,750 lb (4 422kg) cwt. on machines with two hoist drums; 10,615 lb (4 814kg) cwt. on one drum machines.

Operator's Manual

Hydraulic System

Main pump — 2—section gear type pump. Combined pump capacity 75 gpm (283.8 *lpm*). Torque converter mounted pump powered by engine through a pump disconnect. Pump disconnect is engaged/disengaged from carrier. Section one operates winch circuit @ max. pressure of 3,500 psi (246 kg/cm^2). Section two operates boomhoist and telescope circuits @ max. pressure of 3,100 psi (218 kg/cm^2).

Swing/outrigger/steering pump — Single gear—type pump, 18 gpm (68.13 *lpm*) maximum. Torque converter mounted pump powered by engine. Pump operates at 2,500 psi (175 kg/cm^2).

The three pump hydraulic circuit allows simultaneous operation of the three main crane functions (winch, boom hoist, swing) without any function interference.

Reservoir — 110 gallon (416.39L) capacity. One dif-fuser for deaeration.

Filtration — One 10—micron filter located inside hydraulic reservoir. Accessible for easy replacement.

Control valves — Five separate pilot operated control valves allow simultaneous operation of all crane func-tions.

Load Hoist System

Standard — 2M main winch with two—speed motor, automatic brake and electronic drum rotation indica-tor; power up/down mode of operation. Bi—directional piston—type hydraulic motor, driven through a plane-tary reduction unit for positive control under all load conditions.

Optional — Model 1M main winch with one—speed motor and automatic brake, power up/down mode of operation.

Optional — Model 1M auxiliary winch with one—speed motor and automatic brake, power up/down mode of operation.

Optional — Model 2M auxiliary winch with two—speed motor and automatic brake, power up/down mode of operation.

Line pulls and speeds — Maximum line pull 10,360 lbs. (4 699 kg) and maximum line speed of 473 fpm. (144 m/min) on standard 10—5/8 in (0.27 m) root diame-ter grooved drum.

Additional Equipment — Standard

Fire extinguisher, seat belt, horn, dome light, mirrors, tilt/telescoping steering wheel, electric windshield wiper/washer, rooftop window electric wiper, defroster fan, backup alarm, audible swing alarm, cab—mounted work lights, and rotation resistant wire rope.

Additional Upper Equipment — Optional

360° swing lock (meets New York City requirements), single axis controls, diesel or hydraulic heater, air con-ditioning, 35—ton (31.77 *metric ton*), 15—ton (13.6 *met-ric ton*), or 25—ton (22.7 *metric ton*) hook blocks, 8—1/2—ton (7.71 *metric ton*) hook ball and swivel, en-gine monitoring system, amber rotating beacon, boom floodlight, drum cable follower, and 3rd wrap drum indi-cator.

Carrier

Type

9 ft 6 in (2.89 m) wide, 150 in (3.81 m) wheelbase.

4 x 4 x 4 — (4—wheel steer, 4—wheel drive)

Standard — For rough terrain with limited turning area.

Frame — 100,000 psi (689.5 MPa) steel, double walled construction with integral 100,000 psi (689.5 MPa) steel outrigger boxes.

Axles

Front— Standard; heavy duty planetary drive/steer type.

Rear— Standard; heavy duty planetary drive/steer type.

Front/Rear — *Optional*; driver controlled differential lock for high traction.

Suspension

Front axle — Rigid mounted to frame.

Rear axle — Pin—mounted on welded steel box cradle. Automatic hydraulic rear axle os-cillation lock—out engages when upper-structure rotates past 2—1/2° of center-line.

Operator's Manual

Tires

Front and Rear

Standard — 23.5 x 25 (20—PR) Earthmover type.

Brakes

Service — Air over hydraulic, disc type brakes at each wheel end.

Parking/emergency — Disc caliper type spring applied, air released, fade resistant; cab controlled, mounted on front axle.

Steering

Hydraulic two wheel, four wheel and “crab” steering: controlled from steering wheel.

Transmission

Clark three—speed two range power shift transmission. Six speeds available forward and reverse. Front axle disconnect for two or four—wheel drive.

Outriggers

Three position (fully extended, intermediate and fully retracted) operation capability. Four hydraulic, telescoping beam and jack outriggers. Vertical jack cylinders equipped with integral holding valve. Beams extend to 20 ft 6 in (6.25m) centerline—to—centerline and

retract to within 9 ft 6 in (2.90m) overall width. Equipped with stowable, lightweight 22 in (0.56m) octagonal aluminum floats. Controls and sight level bubble located in upperstructure cab.

Confined Area Lift Capacities (CALC) System — Outrigger may be extended to an intermediate position for working in confined areas. Extend position levers located on outrigger boxes allow the outrigger beams to be fully extended or limits them to intermediate position based on the selected position.

Additional Equipment — Standard

Cab steps, front, side, and rear carrier steps, electronic controlled front axle disconnect, skid resistant finish on carrier deck, front storage, fenders, pontoon storage, full travel lighting package, throttle lock, hour meter, air chucks, and lifting/tie down lugs.

Additional Equipment — Optional

Differential lock on both axles, front and rear towing shackles, propane fired engine block heater, ether injection package, air dryer, spare tires and rims, front and rear mounted pintle hooks, outrigger cover package, emergency steering system, rear steer indicator, and carrier mounted winch, 24 volt start, and tire inflation kit.

Travel Speeds and Gradeability									
Engine	Tires	Maximum Speed		*Grade-ability at stall	Maximum tractive effort at stall		*Grade-ability at 1.0 mph (1.61km/h)	Maximum tractive effort at 1.0 mph (1.61km/h)	
		mph	km/h		pounds	kg		pounds	kg
Cummins 6BT 5.9	23.5 X 25	22.8	36.69	72.3%	38,240	17 346	47.0%	28,069	12 732

*Transmission lubrication must not exceed 25°.

Cummins 6BT 5.9 Engine Specifications	
Cylinders — cycle	6 — 4
Bore	4.02 in (102.1mm)
Stroke	4.72 in (119.9mm)
Displacement	359 cu in (5 884cm ³)
Maximum brake hp	152 @ 2500 rpm
Peak torque	400 ft. lbs. (542J) at 1500 rpm
Electric system	12 volt
Fuel capacity	75 gallons (284L)
Alternator	130 amps
Crankcase capacity	17.3 qts. (16.4L)

Operator's Manual

Axle Loads										
Base crane with standard 28 ft 9 in–91 ft 0 in (8.76–27.74m) four–section full power boom, 2M main (rear) winch with 2–speed hoisting and power up/down, 450 ft (137.16m) 5/8 in (16mm) wire rope, 4x4x4 carrier with Cummins 6BT 5.9 engine, 23.5 X 25.0 tires, full fuel and counterweight.	G.V.W.*		Upper Facing Front				Upper Facing Rear			
			Front Axle		Rear Axle		Front Axle		Rear Axle	
	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg
	57,785	26 210	25,323	11 486	32,462	14 724	20,321	9 217	37,464	16 993
Cold weather starting aids – propane heater and ether injector	48	22	6	3	42	19	6	3	42	19
Tow shackles	39	17	18	8	21	9	18	8	21	9
Pintle hook, front	20	9	28	13	–8	–4	28	13	–8	–4
Outrigger cover package	110	50	52	24	58	26	52	24	58	26
Carrier mounted winch	686	311	923	419	–237	–108	923	419	–237	–108
Winch roller – front	76	34	–14	–7	90	41	75	33.5	1	.5
Winch roller – rear	76	34	–1	–.5	77	34.5	62	28	14	6
1M main (rear) winch	–24	–11	6	3	–30	–14	–25	–11.5	1	.5
1M auxiliary (front) winch	–232	–105	17	8	–249	–113	–202	–91	–30	–14
2M auxiliary (front) winch	–210	–95	15	7	–225	–102	–183	–83	–27	–12
350' (106.7m) wire rope on auxiliary (front) winch	286	130	–24	–11	310	141	253	115	33	15
Hydraulic heater	110	50	22	10	88	40	66	30	44	20
Diesel heater	70	32	16	7	54	25	40	18	30	14
Fly brackets to boom base section for fly options	113	51	156	71	–43	–20	–66	–30	179	81
25 ft (11.34m) fixed fly (stowed)	544	247	794	360	–250	–113	–359	–163	903	410
25 ft (11.34m) offsettable fly (stowed)	1,002	455	1,492	677	–490	–222	–690	–313	1,692	768
25–43 ft (11.34–13.11m) offsettable fly (stowed)	1,492	677	2,206	1 001	–714	–324	–1,013	–460	2,505	1 137
Floodlight on boom base section	4	2	7	3	–3	–1	–4	–2	7	3
35–ton hookblock to front bumper	780	354	1,108	503	–328	–149	–	–	–	–
Hookball to front bumper	360	163	511	232	–151	–69	–	–	–	–
Auxiliary arm	60	27	157	71	–97	–44	–109	–50	169	77

* Adjust gross vehicle weight & axle loading according to component weight

Note: All weights are \pm 3%

Tire	Max. Axle Load @ 20 mph (32.7km/hr)
23.5 x 25 (20–PR)	33,000 lbs. (14 969kg)

Table Of Contents

Fundamental Terms 6-1

Operator's Manual

Operator's Manual

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.

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.

Auxiliary Lifting Sheave: A unit which connects to the boom head machinery and is used for reeving winch 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, center, outer, 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, center, outer, and tip segments which are used as the telescoping extension.

By—Pass: 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.

Center Section: The segment of the boom that is in the middle, that attaches to the inner and outer sections.

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 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 area diagram, 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.

Operator's Manual

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 Section: Boom tip extension supported only at its base.

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: $F = P \times A$)

Frame: Structure on which either upper or carrier machinery is attached.

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 machine can climb expressed as a percentage.

Ground Pressure: Weight of machine divided by the area of the surface directly supporting the crane.

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 Rope: The wire rope used to reeve the winch and the attachments for lifting loads.

Holding Valve: See Counterbalance Valve

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: The storage tank for hydraulic fluid.

Inner Section: The segment of the boom which is attached to the base and center sections.

Lifting Capacity: The rated load for any given load radius and boom angle under specified operating conditions.

Line Pull: The rope pull generated off a rope drum or lagging at a specified pitch diameter.

Line Speed: The rope velocity at a rope drum or lagging at a specified pitch diameter.

Load Radius: The horizontal distance from the center-line of rotation of the upper to the center of gravity of a suspended load.

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.

Offset Fly: A hydraulic crane fly section that is capable of being pinned at differing 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 Section: The segment of a the boom which is attached to the center and tip sections.

Outrigger: An extendable supporting device used to level the crane and increase stability.

Operator's Manual

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 it 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 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.

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 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 delivered to the brake chamber, which determines the braking force.

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.

Swing Brake: A foot operated brake which is used to stop the rotation of the upper over the carrier.

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.

Operator's Manual

Tailswing: The swing radius from the centerline of rotation of the upper frame to the extreme rear of the counterweight.

Tip Section: The outer most segment of a 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 or transporting 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 or ball contacts the attachment's head machinery.

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 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.

Winch: Function of lifting and lowering loads.

Winch Drum: A rotating cylindrical spool with side flanges used to wrap the winch rope during the raising and lowering with the winch.

Winch 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 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.