OPERATOR MANUAL
C-Series Crane
1000 thru 1700
# Table of Contents

## Chapter 1  Safety and Operation
- General ................................................................. 1-1
- Safe Operating Practices ........................................ 1-2
  - Operation Near High Voltage Power Lines .............. 1-2
  - Signals ................................................................. 1-3
- Preparing for Road Travel ........................................ 1-8
- Operating Controls ................................................. 1-10
  - Standard Outrigger Operation .............................. 1-16

## Chapter 2  Rigging
- Cutting Wire Rope .................................................. 2-1
- Anchoring Wire Rope to Drum .................................... 2-1
- Winding Wire Rope Onto Drum .................................... 2-2
- Anchoring Wire Rope to Wedge Socket ....................... 2-3
  - Correct Methods .................................................... 2-4
  - Incorrect Methods .................................................. 2-4
- Breaking In Wire Rope .............................................. 2-5
- Reieving ................................................................. 2-7
- Erecting and Storing Jib .......................................... 2-8
- Erecting Jib ............................................................. 2-9
- Jib Stowage ............................................................ 2-14
# Table of Contents

**Chapter 3  Lubrication**
- General .................................................................................. 3-2
- Intervals .................................................................................. 3-2
- Over-Lubrication ...................................................................... 3-2
- Service Tips ............................................................................. 3-3
- Oil Can Points .......................................................................... 3-3
- Wire Rope ............................................................................... 3-3
- Oil Capacities .......................................................................... 3-4
- Lubrication Specifications ..................................................... 3-4
  - Grease ................................................................................. 3-4
  - Open Gear Oil ....................................................................... 3-4
  - Gear Oil ............................................................................... 3-4
  - Anti-wear Hydraulic Oil .......................................................... 3-5
- Lubrication Points .................................................................... 3-7
- Lubrication Points Notes ....................................................... 3-8
- Rear Stabilizer ......................................................................... 3-11
- Outrigger ............................................................................... 3-11

**Chapter 4  Capacities**
- Load Rating .............................................................................. 4-1
- Total Load ............................................................................... 4-2
- Component Weights ................................................................. 4-3
- Totals ....................................................................................... 4-3
# Table of Contents

**Chapter 5  System Schematics**
- Hydraulic Schematic ................................................. 5-2
- Electrical Schematic ................................................. 5-4

**Chapter 6  General Maintenance and Repair**
- Safety ................................................................. 6-1
- Storing Components ................................................. 6-3
- Labeling Components at Disassembly ............................. 6-3
- Cleanliness ............................................................ 6-4
- Torque Values .......................................................... 6-5
- Maintenance Checks .................................................. 6-8
  - General ............................................................. 6-8
  - Inspection Intervals ............................................. 6-8
  - Records ............................................................. 6-8
  - Repairs ............................................................. 6-8
  - Daily Checks ..................................................... 6-9
  - Weekly Checks .................................................... 6-11
  - Monthly Checks .................................................. 6-11
  - Semiannual Checks ............................................... 6-13
  - Annual Checks ................................................... 6-13
- Wire Rope Maintenance ............................................ 6-14
- Lubrication ............................................................ 6-14
- Inspection ............................................................. 6-14
- Replacement ........................................................... 6-15
- Sheave and Drum Inspection ....................................... 6-17
Table of Contents

Replacing Hydraulic Filter Element ........................................ 6-18
Replacing Hydraulic Tank Breather ....................................... 6-18
Changing Oil ........................................................................ 6-19
Adjusting Levels ................................................................... 6-21
Boom Maintenance ............................................................... 6-22
  Slider Pad Adjustment/Replacement .................................... 6-22
    Rear Top Slider Pads ....................................................... 6-22
    Front Side Slider Pads .................................................... 6-23
    Front Bottom Slider Pads ............................................... 6-24
Crowd Rope Adjustment ....................................................... 6-26
Three-Section Boom ............................................................ 6-27
  Laying back the Winch ....................................................... 6-27
  Adjusting Crowd Ropes ..................................................... 6-28
Four-Section Boom ............................................................. 6-30
  Laying back the Winch ....................................................... 6-31
  Adjusting Crowd Ropes ..................................................... 6-33
Crowd Rope Inspection ......................................................... 6-34

Chapter 7  Hydraulic System Troubleshooting
General ............................................................................. 7-1
Troubleshooting Steps .......................................................... 7-1
Troubleshooting List ............................................................. 7-3
  Hydraulic Oil Condition ..................................................... 7-3
  System Operates Erratically ............................................. 7-5
  System Operates Slowly .................................................... 7-5
<table>
<thead>
<tr>
<th>Issue</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Overheating</td>
<td>7-7</td>
</tr>
<tr>
<td>Oil Foaming</td>
<td>7-8</td>
</tr>
<tr>
<td>Pump Makes Noise</td>
<td>7-8</td>
</tr>
<tr>
<td>Pump Leaks Oil</td>
<td>7-9</td>
</tr>
<tr>
<td>Motor Leaks Oil</td>
<td>7-10</td>
</tr>
<tr>
<td>Valve Sticks or Works Hard</td>
<td>7-10</td>
</tr>
<tr>
<td>Valve Leaks Oil (External)</td>
<td>7-10</td>
</tr>
<tr>
<td>Cylinder Leaks Oil (External)</td>
<td>7-11</td>
</tr>
<tr>
<td>Cylinder Drifts or Will Not Hold Load</td>
<td>7-11</td>
</tr>
<tr>
<td>Cylinder Will Not Extend or Not Retract</td>
<td>7-11</td>
</tr>
<tr>
<td>Boom Cannot Be Extended or Lowered</td>
<td>7-12</td>
</tr>
<tr>
<td>Swing Inoperative or Erratic</td>
<td>7-12</td>
</tr>
<tr>
<td>Swing Brake Does Not Hold</td>
<td>7-12</td>
</tr>
<tr>
<td>Winch Will Not Lower Load or Lowers Load Erratically</td>
<td>7-12</td>
</tr>
<tr>
<td>Winch Will Not Hold Load in Neutral</td>
<td>7-13</td>
</tr>
<tr>
<td>Winch Will Not Raise Load</td>
<td>7-13</td>
</tr>
<tr>
<td>Boom Chatters When Extending or Retracting Boom</td>
<td>7-14</td>
</tr>
<tr>
<td>Boom Does Not Sequence Properly</td>
<td>7-14</td>
</tr>
</tbody>
</table>
Operator Manual Notice

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

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

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

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

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

Safety messages are used throughout this manual to call attention to hazardous operating practices and maintenance procedures. The meaning of these safety messages is as follows:

**Danger** is used to identify an immediate hazard that can result in loss of life or personal injury if the warning is ignored.

**Caution** is used to identify a potential hazard that can result in loss of life or personal injury if the warning is ignored.

**Important** is used to identify an operating practice or maintenance procedure that can result in damage to or destruction of equipment if warning is ignored.

**Note** is used to highlight an operation or maintenance procedure.

Service/Parts Inquiries

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

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

Incidents

If a Manitowoc Boom Trucks crane is involved in an incident where there is personal injury or property damage, our Product Support Center should be notified as soon as possible. Provide details of the incident, including the model and serial number of the crane.
Questions

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

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

Manitowoc Boom Trucks, Inc.
Product Support Center
P.O. Box 1609
Georgetown, TX 78627-1609
Telephone: (512) 942-3000
Fax: (512) 942 3094
Chapter 1
Safety and Operation

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

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

Always refer to ANSI/ASME B30.5 standards for safe operation, inspection and maintenance. The subjects and material presented here are highlights of ANSI/ASME B30.5 and are intended as general information only. Existing federal, state and local laws, rules and regulations along with safety codes and insurance requirements take precedence over any information contained in this manual.

Failure to comply with safe operating practices and safety messages in this section may result in death or serious injury to operator and job site personnel and destruction of this crane. Read and understand instructions in this chapter and in Capacity Chart before attempting to operate this crane.
Safe Operating Practices

Operation Near High Voltage Power Lines
Operation of this crane near high voltage power lines shall be accordance with the following requirements.

<table>
<thead>
<tr>
<th>Normal Voltage, kV (Phase to Phase)</th>
<th>Minimum Required Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operation Near High Voltage Power Lines</strong></td>
<td></td>
</tr>
<tr>
<td>to 50</td>
<td>10 ft.</td>
</tr>
<tr>
<td>Over 50 to 200</td>
<td>15 ft.</td>
</tr>
<tr>
<td>Over 200 to 350</td>
<td>20 ft.</td>
</tr>
<tr>
<td>Over 350 to 600</td>
<td>25 ft.</td>
</tr>
<tr>
<td>Over 500 to 750</td>
<td>35 ft.</td>
</tr>
<tr>
<td>Over 750 to 1000</td>
<td>45 ft.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Operation in Transit with No Load and Boom Lowered</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>to 0.75</td>
<td>4 ft.</td>
</tr>
<tr>
<td>Over 0.75 to 50</td>
<td>6 ft.</td>
</tr>
<tr>
<td>Over 50 to 345</td>
<td>10 ft.</td>
</tr>
<tr>
<td>Over 345 to 750</td>
<td>16 ft.</td>
</tr>
<tr>
<td>Over 750 to 1000</td>
<td>20 ft.</td>
</tr>
</tbody>
</table>

Reference: ANSI B30.5
Any overhead line shall be considered to be an energized power line unless and until the person owning the line or the electrical utility authority indicates that the line is not an energized power line.

Before starting crane operations near electric power lines, the person responsible for the job shall notify the owner of the lines or his authorized representative providing them with all pertinent information and requesting their cooperation.

For all operations where it is difficult for the operator to maintain the required clearance by visual means, a qualified signal person shall be provided. The signal person shall observe the clearance and give the operator timely warnings so as to maintain the minimum clearance.

Avoid electrocution! If any part of the crane or the load contacts an energized electric power line, the operator shall not attempt to get off the crane. The operator shall remain at the controls until the contact has been cleared or the power line has been de-energized. Do not let anyone on the ground touch the crane.

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

Signals

Signals to the operator shall be in accordance with the standard signals shown on the following pages unless communications equipment (telephone, radio, etc.) is used.

For operations not covered in standard signals illustrations, or for special situations, additional signals may be required. In those cases, the signals used shall be agreed upon in advance by the operator and the signal person. The signals used should not conflict with or have the potential to be confused with the standard signals.

If it is necessary to give other than the standard signals to the operator, all crane motions shall be stopped.
The signal person shall:
- Be qualified by experience with the operations and knowledgeable of the standard signals.
- Position himself in clear view of the operator. The signal person’s position shall give him a clear view of the load, the crane, and the operating area.
- Direct the load so the load does not pass over personnel.
- Keep unnecessary personnel out of the crane’s operating area.
Chapter 1: Safety and Operation

Figure 1-1 Hand Signals 1 of 4

- **HOIST.** With forearm vertical, forefinger pointing up, move hand in small horizontal circles.
- **LOWER.** With arm extended downward, forefinger pointing down, move hand in small horizontal circles.
- **USE MAIN HOIST.** Tap fist on head, then use regular signals.
- **USE WHIP LINE.** (Auxiliary Hoist) Tap elbow with one hand then use regular signals.
- **RAISE BOOM.** Arm extended, fingers closed, thumb pointing upward.
- **LOWER BOOM.** Arm extended, fingers closed, thumb pointing downward.
Chapter 1: Safety and Operation

MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist Slowly shown as an example.)

RAISE THE BOOM AND LOWER THE LOAD. With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.

LOWER THE BOOM AND RAISE THE LOAD. With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.

SWING. Arm extended, point with finger in direction of swing of boom.

STOP. Arm extended, palm down, move arm back and forth horizontally.

EMERGENCY STOP. Both arms extended, palms down, move arms back and forth horizontally.

Figure 1-2 Hand Signals 2 of 4
TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.

DOG EVERYTHING. Clasp hands in front of body.

TRAVEL. (Both Tracks) Use both fists in front of body, making a circular motion about each other, indicating direction of travel, forward or backward. (For land cranes only.)

TRAVEL. (One Track) Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of either raised fist, rotated vertically in front of body. (For land cranes only.)

EXTEND BOOM. (Telescoping Booms) Both fists in front of body with thumbs pointing outward.

RETRACT BOOM. (Telescoping Booms) Both fists in front of body with thumbs pointing toward each other.

Figure 1-3 Hand Signals 3 of 4
Preparation for Road Travel

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

- The jib shall be stored, if equipped.
- The boom shall be lowered onto the boom rest before the outriggers and stabilizers are retracted.
- The load block or the overhaul ball shall be secured to the rear of the subframe.
- The tires shall be inflated to the proper pressure.
- The outriggers and stabilizers shall be fully retracted.

**Important** Always retract front bumper stabilizer (optional equipment) before retracting outriggers or rear stabilizers.

- The PTO shall be disengaged.
- All loose items shall be secured to the flatbed.
- The total weight of the truck, the crane, and any load carried on the flatbed shall not exceed the allowable gross vehicle weight.
Figure 1-5
View in Truck Cab

Figure 1-6
View in Both Platforms

Figure 1-7
View Both Sides of Boom

Figure 1-8
View at Operator Station

Figure 1-9
View Inside Pedestal
**Operating Controls**

1. Power Take-Off (PTO) Control
2. Boom Hoist Control
3. Winch Control
3a. Speed-Lift Control
4. Telescope Control
5. Swing Control
6. This Side Outrigger Control
7. Other Side Outrigger Control
8. This Side Stabilizer Control
9. Other Side Stabilizer Control
10. Hydraulic Accessory Valve Control
11. Hydraulic Pressure Gauge
12. Bubble Level
13. Horn Switch
14. Engine Start/Stop
15. Foot Throttle
16. Boom Angle Indicator
17. Console - ATB w/Shutdown
18. Warning Horn
19. Overload Shutdown (Not Shown)
20. Boom Bypass Switch
21. Hydraulic Capacity Alert System (HYCAS) (Not Shown)

*Figure 1-10 Typical Operating Controls*
## Controls and Functions

<table>
<thead>
<tr>
<th>Control and Position (Figures 1-5 through 1-10)</th>
<th>Function</th>
</tr>
</thead>
</table>
| **1. Power Take-Off (PTO) Control**           | Operation of the PTO will vary; refer to the manufacturer’s manual in the truck cab for operating instructions.  
*Note*  PTO must be engaged to provide power to all crane functions and accessories.  
*Important*  Do not drive truck while PTO is engaged; hydraulic pump may be damaged. |
| **2. Boom Hoist Control**                      | DOWN (lower boom).  
UP (raise boom).  
OFF (counterbalance valve holds boom in position).  
*Important*  Return control lever to OFF as soon as boom is fully raised or fully lowered, otherwise, oil will flow over relief valve possibly causing damage to hydraulic system from overheating. |

*Note*  PTO must be engaged to provide power to all crane functions and accessories.

*Important*  Do not drive truck while PTO is engaged; hydraulic pump may be damaged.

*Important*  Return control lever to OFF as soon as boom is fully raised or fully lowered, otherwise, oil will flow over relief valve possibly causing damage to hydraulic system from overheating.
### 3. Winch Control

- Lever FORWARD from OFF
- Lever BACK from OFF
- Lever CENTERED (spring returned)

<table>
<thead>
<tr>
<th>Control and Position</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lever FORWARD from OFF</td>
<td>DOWN (lower load).</td>
</tr>
<tr>
<td>Lever BACK from OFF</td>
<td>UP (raise load).</td>
</tr>
<tr>
<td>Lever CENTERED (spring returned)</td>
<td>OFF (spring-applied brake holds load in position).</td>
</tr>
</tbody>
</table>

### 3a. Speed-Lift Control

- Button DOWN

<table>
<thead>
<tr>
<th>Control and Position</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Button DOWN</td>
<td>HIGH SPEED winch operation.</td>
</tr>
</tbody>
</table>

**Note** When Speed-Lift is activated, the excess oil from the main control valve is diverted to the winch valve, and winch speed increases. Speed-Lift will not operate if system pressure exceeds 2,500 psi or if another function is being operated at full speed.
### Controls and Functions

<table>
<thead>
<tr>
<th>Control and Position (Figures 1-5 through 1-10)</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4. Telescope Control</strong>&lt;br&gt; Lever FORWARD from OFF&lt;br&gt; Lever BACK from OFF&lt;br&gt; Lever CENTERED (spring returned)</td>
<td>OUT (extend boom sections).&lt;br&gt; IN (retract boom sections).&lt;br&gt; OFF (counterbalance valve holds boom sections in position). <strong>Important</strong> Return control lever to OFF as soon as boom is fully extended or fully retracted; otherwise, oil will flow over relief valve, possibly causing damage to hydraulic system from overheating. <strong>Note</strong> Due to variations in loading, boom angle and slider pad friction, the maximum load which can be telescoped cannot be specified. It is safe, however, to attempt to telescope the boom within the limits of the Capacity Chart.</td>
</tr>
</tbody>
</table>
5. Swing Control

Lever FORWARD from OFF
Lever BACK from OFF
Lever CENTERED (spring returned)

Swing LEFT (counterclockwise).
Swing RIGHT (clockwise).
OFF (spring-applied brake holds boom in position).

Note This crane has 372° uninterrupted swing in both directions. When the boom swings 372° a mechanical swing stop will automatically pull the swing control lever OFF and the swing brake will apply to stop the swing motion.

Important Do not disable swing stop. If boom swings more than 372° hydraulic lines will break.
Always move swing control lever gradually toward OFF to bring boom to a smooth stop. If swing control lever is suddenly released to OFF, swing brake will bring boom to an abrupt stop. This action will cause load to swing out from under boom point or jib point, possibly resulting in damage to boom or jib from side loading.
# Controls and Functions

<table>
<thead>
<tr>
<th>Control and Position (Figures 1-5 through 1-10)</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>6. This Side Outrigger Control</strong>&lt;br&gt;<strong>7. Other Side Outrigger Control</strong>&lt;br&gt;<strong>8. This Side Stabilizer Control</strong>&lt;br&gt;<strong>9. Other Side Stabilizer Control</strong>&lt;br&gt;<strong>10. Front Bumper Stabilizer</strong> <em>(If Equipped)</em></td>
<td>Note THIS SIDE refers to the side of the truck that is nearest the operator when standing at either control station. OTHER SIDE refers to the opposite side of the truck. DOWN (extend outrigger or stabilizer to raise truck). UP (retract outrigger or stabilizer to lower truck). OFF (valves hold outriggers and stabilizers in position).</td>
</tr>
<tr>
<td>Lever FORWARD from OFF</td>
<td></td>
</tr>
<tr>
<td>Lever BACK from OFF</td>
<td></td>
</tr>
<tr>
<td>Lever CENTERED (spring returned)</td>
<td></td>
</tr>
</tbody>
</table>

| **10. Hydraulic Accessory Control** *(If Equipped)* | |
| Lever FORWARD from OFF | HI Pressure to Port B of accessory valve. |
| Lever BACK from OFF | HI Pressure to Port A of accessory valve. |
| Lever CENTERED (spring returned) | Control valve blocks flow to work Ports A and B. |
Outrigger Operation and Warnings

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

- Warn all personnel to stand clear of outriggers and stabilizers before operating them.
- Operator — do not place hands and arms between outriggers and platform back guard.
- Set outrigger and stabilizer pads on flat, firm foundation that will support load placed on pads.
- Do not set pads in holes, on rocky ground, or on extremely soft ground. Use wood blocking or steel plates under pads, if necessary, to properly distribute loading on foundation.
- Fully retract outriggers and stabilizers before traveling in the truck.
- Return control levers to OFF as soon as outriggers or stabilizers are fully extended or fully retracted, otherwise, oil will flow over relief valve, possibly causing damage to hydraulic system from overheating.
- Crane operations with outriggers or stabilizers retracted is prohibited.

Step 1  Extend outriggers first so crane is level from side to side
Step 2  Then, extend stabilizers so crane is level from front to rear.
Step 3  Finally, extend the front bumper stabilizer, if equipped, until oil flows over the relief valve. At this point, the outrigger will stop extending, ensuring the stabilizer is properly loaded.
### Controls and Functions

<table>
<thead>
<tr>
<th>Control and Position (Figures 1-5 through 1-10)</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Hydraulic System Pressure Gauge</td>
<td>Indicates the pressure (0-2,800 psi) in the circuit operating under the most load.</td>
</tr>
<tr>
<td>12. Bubble Level</td>
<td>Indicates how level the crane is from side to side and from front to rear.</td>
</tr>
<tr>
<td>13. Horn Switch</td>
<td>Signal horn ON.</td>
</tr>
<tr>
<td>Button IN</td>
<td>START engine. STOP engine</td>
</tr>
<tr>
<td>14. Engine Start/Stop Switch</td>
<td>Always stop engine before leaving crane unattended and before servicing crane.</td>
</tr>
<tr>
<td>Toggle LEFT (Momentary)</td>
<td></td>
</tr>
<tr>
<td>Toggle RIGHT (Momentary)</td>
<td></td>
</tr>
</tbody>
</table>
## Controls and Functions

<table>
<thead>
<tr>
<th>Control and Position (Figures 1-5 through 1-10)</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>15. Engine Foot Throttle</strong></td>
<td><strong>Function</strong></td>
</tr>
<tr>
<td>Pedal DOWN</td>
<td>INCREASE engine speed in relation to how far the pedal is depressed.</td>
</tr>
<tr>
<td>Pedal UP (spring returned)</td>
<td>DECREASE engine speed.</td>
</tr>
<tr>
<td></td>
<td>Note  The speed of any crane function depends on engine speed and on how far the control lever is moved in either direction.</td>
</tr>
<tr>
<td><strong>16. Boom Angle Indicator</strong></td>
<td>Indicates the angle of the boom (in degrees) above or below horizontal.</td>
</tr>
<tr>
<td><strong>Main Boom Only</strong></td>
<td>Loaded boom angles at specified boom lengths give only an approximation of the operating radius. The boom angle before loading should be greater to account for deflections. Do not exceed the operating radius for rated loads.</td>
</tr>
<tr>
<td><strong>Main Boom with Jib Erected</strong></td>
<td>The operating radius shown in the jib rating chart is for fully extended boom only. When boom is not fully extended, use only loaded boom angle to determine load rating of jib.</td>
</tr>
</tbody>
</table>
## Controls and Functions

<table>
<thead>
<tr>
<th>Control and Position (Figures 1-5 through 1-10)</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>17. Anti-Two Block with shutdown</strong> (operator console shown)</td>
<td>Automatically STOPS and prevents further operation of the WINCH UP and TELESCOPE OUT and BOOM DOWN functions when warning horn comes on. <strong>Important</strong> Always pay out load line while extending boom to prevent load block or overhaul ball from contacting two-block weight. Do not hoist load so high that load block or overhaul ball contacts two-block weight. For console function, controls and display information, refer to Radio ATB Operator Handbook provided with the crane.</td>
</tr>
</tbody>
</table>

---

**Important** Always pay out load line while extending boom to prevent load block or overhaul ball from contacting two-block weight. Do not hoist load so high that load block or overhaul ball contacts two-block weight. For console function, controls and display information, refer to Radio ATB Operator Handbook provided with the crane.
## Controls and Functions

### 18. Warning Horn — Anti-Two-Block, Overload Warning and Outrigger/Stabilizer

<table>
<thead>
<tr>
<th>Control and Position (Figures 1-5 through 1-10)</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>The horn BEEPS to warn the operator and surrounding personnel when any of the following conditions occur.</td>
<td></td>
</tr>
<tr>
<td>The load block or the overhaul ball is hoisted too high (against two-block weight on load line).</td>
<td></td>
</tr>
<tr>
<td><strong>Important</strong> Always pay out load line while extending boom to prevent load block or overhaul ball from contacting two-block weight. Do not hoist load so high that load block or overhaul ball contacts two-block weight.</td>
<td></td>
</tr>
<tr>
<td>The crane outriggers and/or stabilizers are being operated.</td>
<td></td>
</tr>
<tr>
<td><strong>Note</strong> Warning horn will stop sounding when the outrigger and stabilizer setup is completed.</td>
<td></td>
</tr>
<tr>
<td><strong>DANGER</strong> If warning horn comes on due to overload, immediately correct overload condition; failing to do so may result in structural damage or tipping.</td>
<td></td>
</tr>
</tbody>
</table>

Continued
## Controls and Functions

<table>
<thead>
<tr>
<th>Control and Position (Figures 1-5 through 1-10)</th>
<th>Function</th>
</tr>
</thead>
</table>
| **Continued**  
18. Warning Horn — Anti-Two-Block, Overload Warning and Outrigger/Stabilizer | **DANGER**  
Do not rely on warning horn to alert operator to an overload condition when jib is being used. Jib’s capacity can be exceeded before warning horn comes on.  
To correct a two-block condition — Lower the load or retract the boom.  
To correct an overload condition — Lower the load to the ground, retract the boom, or raise the boom. |
## Controls and Functions

<table>
<thead>
<tr>
<th>Control and Position (Figures 1-5 through 1-10)</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>19. Hydraulic Capacity Alert System with Overload Shutdown (Not Shown)</td>
<td>Hydraulic monitoring system provides an audible warning when the crane's rated capacity is exceeded. The system will disable Winch Up, Telescope Out and Boom Down crane functions until the overload condition has been corrected. <strong>DANGER</strong> The HYCAS system is designed to monitor Main Boom operation only. Do not rely on shutdown feature or warning horn to alert operator to an overload condition when the jib is being used. The jib's capacity can be exceeded before the shutdown feature or warning horn is activated. <em>Continued</em></td>
</tr>
</tbody>
</table>

1-22

Operator Manual C-Series 1000-1700
## Controls and Functions

<table>
<thead>
<tr>
<th>Control and Position (Figures 1-5 through 1-10)</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continued</td>
<td>The overload shutdown automatically stops and prevents further operation of the WINCH UP, TELESCOPE OUT, and BOOM DOWN functions when warning horn comes on.</td>
</tr>
<tr>
<td><strong>19. Hydraulic Capacity Alert System with Overload Shutdown</strong> (Not Shown)</td>
<td>If warning horn comes on due to overload, immediately correct overload condition; failing to do so may result in structural damage or tipping.</td>
</tr>
<tr>
<td></td>
<td>Do not rely on warning horn to alert operator to an overload condition when jib is being used. Jib's capacity can be exceeded before warning horn comes on.</td>
</tr>
</tbody>
</table>
20. Boom Down Bypass Switch (Not Shown)

<table>
<thead>
<tr>
<th>Control and Position (Figures 1-5 through 1-10)</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Button IN</td>
<td>This switch is used to bypass the overload shutdown system so the boom can be lowered from the maximum boom angle (80°). Button located on electrical enclosure inside the crane pedestal. Hold the button in and lower the boom. Once the boom has lowered a few degrees, the warning horn should shutoff. Release the button and continue to lower the boom to the desired angle.</td>
</tr>
</tbody>
</table>

**CAUTION**

Bypass switch to be used only for lowering boom from maximum angle. Do not use for any other reason.

Bypass switch must be in its normal position (OUT) during operation; otherwise, overload shutdown system will not work properly, and crane’s capacity may be exceeded.
Chapter 2
Rigging

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

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

Anchoring Wire Rope to Drum

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

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

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

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

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

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

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

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

**Winding Wire Rope Onto Drum**

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

Apply tension to the wire rope as it is slowly wound onto drum. It’s essential on smooth faced drums that the first layer is spooled with wraps tight and close together since the first layer forms the foundation for succeeding layers. Tap the adjacent wraps against each other with a rubber, lead or brass mallet (never steel).

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

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

**CAUTION** Prevent possibility of wire rope slipping out of socket and dropping the load!

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

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

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

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

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

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

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

Pull on the live side of the wire rope enough to tighten the wedge in the socket.
Chapter 2: Rigging

Correct Methods

- Live side in straight line with socket
- Dead end wrapped around live end
- 3 Times rope diameter (Maximum)
- Short piece of wire rope
- 7 Times rope diameter (Minimum)
- Rope Clip
- Seizing
- Wedge
- Socket

Incorrect Methods

- Both are dangerous!
- Dead end
- Rope Clip will transfer load to dead end of wire rope
- Live side kinked here because not in straight line with socket
- Live side

Figure 2-3 Wedge Socket Assembly

Operator Manual C-Series 1000-1700
Attach a wire rope clip to the dead end of the wire rope using one of the Correct methods shown in Figure 2-3. The rope clip will aid in preventing the wire rope from being pulled out of the socket.

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

After the socket is pinned in place, hoist the load slowly so the wedge and rope will seat firmly in the socket. Do not shock load the socket and wedge.

*Note* Some models use hole in rear of boom head plate, on ATB side, when socket needs to be attached to boom head.

**Breaking In Wire Rope**

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

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

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

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

Figure 2-4 Load Line Reeving — Three-Sheave Boom Point
Reeving

Reeving diagrams for the load line are shown in Figure 2-4. The number of parts of line used depends on the load to be lifted. Refer to the Capacity Chart for your specific crane to determine reeving requirements for the various loads that can be lifted.

Make sure the load line travels through each cable guide on the boom and on the jib, if erected.

Perform the following steps after the load line is reeved to make sure the Anti-Two-Block (ATB) device is operational.

- Install the ATB transmitter to the loop on the boom head if the load is to be handled with the main boom, or on the jib head if the load will be handled with the Jib.
- Check that the ATB counterweight is connected to the eye on the shaft at the bottom of the ATB transmitter switch and the counterweight is installed on the correct part of the line. Refer to Figure 2-4.

**Important** Do not shorten length of the chain on the ATB counterweight. If shortened, a two-block condition may occur.

- Ensure that the override flag is attached onto the same clip that attaches the transmitter to the loop on the boom or jib head.
- Test the ATB warning horn and function shutdown for proper operation. With engine running and PTO engaged and ATB hanging freely;
  - Switch 1 lamp should be on and the horn silent.
  - Raise the overhaul ball or load block until the chain on the ATB weight goes slack. Two
block light and Switch light come ON and BLINK, warning horn sounds, and functions Winch Up, Telescope Out and Boom Down are disabled.

**Important** Refer to Radio ATB operator manual supplied with the crane for comprehensive testing procedures. If this is the first use of the crane for the day, perform the Daily Checks in the ATB operator manual before placing the crane in service.

### Erecting and Storing Jib

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

Read all instructions on Capacity Chart before handling any load with jib. Do not attempt to erect jib until outriggers and stabilizers are properly set. Do not retract outriggers and stabilizers until jib is stored and boom is lowered onto boom rest.

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

\[
\text{Retracted boom length} + \text{Fixed jib length or retracted telescopic jib length} + 10 \text{ Feet}
\]

**Minimum side swing-around clearance**
Retracted boom length
+ Extended telescopic jib length (or fixed jib length)
+ 10 Feet

Minimum rear clearance

Erecting Jib

**CAUTION**

Outriggers must be properly set prior to attempting jib installation.

**DANGER**

Danger Do not operate the boom telescope function until you are instructed to do so. Operating the telescope function during jib deployment must be done only after certain steps in the procedure have taken place. Failure to do so may result in damage to crane or personal injury.

- Using all applicable safety precautions, operate the crane systems to raise the boom free of the boom support, swing the boom clear of support.
- Operating the telescope lever, extend the boom three fourths (3/4) its total extended length and lower the headache ball onto the ground.
- Operate the telescope lever, retract boom fully allowing headache ball and wire rope to stay in its extended position. At same time lowering boom to allow access to anti-two block counterweight and boom head.
- With boom lowered remove the two (2) hair pins on the anti-two block weight. Remove the weight from the wire rope and let it hang on the radio ATB switch/transmitter.

*Note* In the next step the open wedge cable socket will need to be removed from wire rope end and wire rope unreewed from lower boom head sheaves if your crane is reeved for 3 or 4 part line.
Chapter 2: Rigging

- Remove the two (2) winch wire rope retaining pins from the boom head and temporarily lay the wire rope to left side of boom head, out of the way of jib attach lugs. With wire rope off to the side, re-install only the lower wire rope retaining pin in boom head at this time.

**CAUTION** Although it may be necessary to operate the boom controls slightly to help align the jib attach point holes, do not attempt to telescope the boom at this time. Severe damage to the boom and/or jib may occur if a premature attempt is made to telescope the boom.

- Install right side upper and lower tapered jib attach pins through boom jib-boom lug attach points. Secure with hair pins, see Figure 2-5.
- Remove single aligning pin located on jib attach ear between jib foot and boom head and set aside for later use, see Figure 2-5.

*Figure 2-5  Stowed Jib on Typical Boom Point*
Attach a tag line to the jib head before releasing the jib stowage pin, see Figure 2-6. This will help the rigging personnel to swing the jib into position and prevent the jib from swinging uncontrolled in the following steps.

![Figure 2-6 Typical Jib Point](image1)

**DANGER** Do not remove stowage pin unless the jib has been pinned to the right side of the boom using the two tapered pins. Extreme care must be taken during removal of the jib stowage pin to avoid injury to personnel.

- Raise the boom to horizontal.
- Locate the ramp weldment on the side near the middle of the boom where the jib is secured. Remove the jib stowage pin, see Figure 2-7.
- Have rigging personnel restrict jib movement using the tag line attached to the jib head. Using applicable safety precautions, activate the crane controls and extend the boom until the jib brackets clear the ramp near the middle and the bracket at the forward end of the boom base.
- Using the tag line, have the rigging personnel pull the jib in a controlled swing motion until the jib attach holes are aligned to the boom head holes on the left side.
Note If necessary, carefully lower jib tip to the ground to assist in alignment of holes. Insert tapered end of the jib attach pins through the jib and boom head attach holes on the left side of the boom. Secure pins using the appropriate cotter pins.

- Re-install single jib alignment pin through jib attach ears, see Figure 2-8. Secure with hair pin.

![Diagram of jib pinned in erected position - Top View](image)

**Figure 2-8** Jib pinned in erected position - Top View

Note The following steps are applicable to telescoping jibs only.

- With boom slightly below horizontal and jib securely attached to boom, remove hair pin that retains the telescoping lock pin, see Figure 2-9.
- Remove the telescoping lock pin and carefully slide fly section from jib base section. Continue sliding the fly section out of the base until hole in fly section aligns with hole in jib base.
- Re-install telescoping lock pin and secure with hair pin.
- Lay wire rope over top sheave of boom head and re-install wire rope retaining pin, secure with hair pin.
- Lay wire rope along top plate of jib, at the jib base, insert wire rope through wire rope cable guide using the notch a the top of the guide, see Figure 2-9.
- Remove jib wire rope retainer at the jib head. Lay wire rope on jib head sheave groove and re-install retaining pin, secure pin with hair pin, see Figure 2-9.
- If open wedge socket was remove due to 3 or 4 part line reeving, re-install open wedge wire rope socket onto end of wire rope, see Figure 2-3.
- Remove radio ATB switch/transmitter and weight from the boom head, see Figure 2-10.
- Attach radio ATB switch/transmitter to loop on side of jib head, see Figure 2-9.
- Install anti-two block weight around wire rope and secure with pins.
- Test ATB warning horn and function shutdown for proper operation before placing crane back in service.

Figure 2-9 Typical Jib Point
Outriggers must be properly set prior to attempting jib installation.

- Using all applicable safety precautions, operate the crane systems to position the boom in area over the rear of the truck where easy access to the jib and boom components is possible.
- Retract the boom to within one (1) foot of its fully retracted position.
- Lower the headache ball to the ground.
- Remove the two (2) hair pin from the ATB weight and remove weight from wire rope.
- Remove the radio ATB switch/transmitter and weight from the jib head and attach to loop on the lower right side of the boom head.

![Diagram of典型Boom Point for Radio ATB](image-url)
- Remove the wire rope retaining pin from the jib head; lift wire rope off the sheave and out of the cable guide at the front of the jib base.
- Lay wire rope off to the side of the boom head out of the way.

*Note*  The following steps apply only to telescoping jibs, see Figure 2-9.

- Remove hair pin from the telescoping jib retaining pin. Remove pin from jib base.
- Slide the jib fly section into jib base section until the hole on the fly section is aligned with the hole on the jib base section.
- Re-install telescoping retaining pin in Jib base and secure with hair pin.
- Attach tag line to jib head to aid rigging personnel when swinging jib into stowing position.
- Remove the upper and lower jib attach pins on the left side of the boom head. Remove the single jib alignment pin from the jib foot and retain for later use, see Figure 2-11.

- Raise the boom to horizontal. Use the tag line to begin swinging the boom around the right side jib attach pivot pins until the jib is parallel to the boom.
Install the single jib alignment pin to jib attach ears. Secure with hair pin, see below.

- Slowly retract the boom. Ensure that the jib stowage hook and bracket dowels engage properly with the boom ramp weldment dowel and rest weldment bracket as the boom is retracted.
- Install the jib stowage pin at the ramp weldment on the side of the boom. Secure the stowage pin with cotter pin.

**CAUTION** Do not operate the telescope function until the two remaining jib attach pins have been removed. Failure to comply will result in damage to boom and jib.

- With jib properly stowed and stowage pins installed, proceed to remove the two remaining jib attach tapered pins on the right side of the boom.
Note To store the pins when the jib is stowed, insert two pins on the outboard side holes of the jib attach ears and the two other pins on the outboard side of the boom head jib attach holes, see Figure 2-14.

- Assemble the wire rope to the sheaves on the boom head and secure in place with wire rope retaining pins.
- Proceed to raise and extend the boom until all excess wire rope is taken off the ground and proceed to spool the wire rope onto the winch once all excess slack is taken up. This will prevent damage to wire rope due to birdcaging from lack of downhaul weight.
- Once wire rope is properly spooled onto winch, proceed to reeving instructions if the crane will be used in a multiple part line configuration.
- Test the radio ATB warning horn and shutdown functions before placing the crane back in service.
Chapter 3
Lubrication

CAUTION

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

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

Do not operate crane until all guards and covers have been securely replaced and all maintenance equipment has been removed.
**Chapter 3: Lubrication**

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

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

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

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

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

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

**Over-Lubrication**
Over-lubrication is not only wasteful but also harmful.

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

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

Oil Can Points

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

Wire Rope

The wire rope must be lubricated on a regular basis to maintain its strength and lengthen its useful life. Refer to the Maintenance Chapter for lubrication instructions.
Chapter 3: Lubrication

Oil Capacities

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
<th>Oil Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic System</td>
<td>70 gal</td>
<td>Hydraulic</td>
</tr>
<tr>
<td>Swing Reducer</td>
<td>1-1/2 qt</td>
<td>Gear</td>
</tr>
<tr>
<td>Winch</td>
<td>3-1/4 qt</td>
<td>Gear</td>
</tr>
</tbody>
</table>

Lubrication Specifications

Grease
Use lithium base, multi-purpose EP grease for all bearings except the swing reducer upper bearings.
Use EP heavy fiber type wheel bearing grease for the swing reducer upper bearings.

Open Gear Oil
The slewing ring gear teeth must be lubricated with a heavy oil with the following characteristics.
- Resists being thrown off by turning gears.
- Resists being washed off by water.
- Resists thinning out and dripping off at hottest operating temperature.
- Resists becoming so thick that it chips or peels off at coldest operating temperature.

Gear Oil
- Winch: Use AGMA No. 4EP or 5EP, e.g. Texaco Meropa 150 or 220
### Anti-wear Hydraulic Oil

<table>
<thead>
<tr>
<th>Temperature Range*</th>
<th>ISO Viscosity Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>-21°C to 60°C (-5°F to 140°F)</td>
<td>22</td>
</tr>
<tr>
<td>-15°C to 77°C (5°F to 170°F)</td>
<td>32</td>
</tr>
<tr>
<td>-9°C to 88°C (15°F to 190°F)</td>
<td>46</td>
</tr>
<tr>
<td>-1°C to 99°C (30°F to 210°F)</td>
<td>68</td>
</tr>
</tbody>
</table>

Temperatures shown are cold (ambient) start-up to maximum operating. During cold start-up, avoid high-speed operation of hydraulic components until the system is warmed up to provide adequate lubrication.
Figure 3-1 Lubrication Points

Left side of Winch

Jib Head
## Lubrication Points

<table>
<thead>
<tr>
<th>Identification (Figure 3-1)</th>
<th>Lubricant</th>
<th>Service</th>
<th>Interval</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Boom Slider Pads</td>
<td>Grease</td>
<td>Brush or Swab</td>
<td>Monthly 1</td>
<td></td>
</tr>
<tr>
<td>2. Boom Retract Sheaves</td>
<td>Grease</td>
<td>Grease Gun</td>
<td>Weekly 2</td>
<td></td>
</tr>
<tr>
<td>3. Boom Extend Sheaves</td>
<td>Grease</td>
<td>Grease Gun</td>
<td>Weekly 3</td>
<td></td>
</tr>
<tr>
<td>4. Boom and Hoist Cylinder Pivot Pins</td>
<td>Grease</td>
<td>Grease Gun</td>
<td>Weekly 4</td>
<td></td>
</tr>
<tr>
<td>5. Boom Point Sheaves (1 fitting each sheave)</td>
<td>Grease</td>
<td>Grease Gun</td>
<td>Weekly —</td>
<td></td>
</tr>
<tr>
<td>6. Jib Point Sheave</td>
<td>Grease</td>
<td>Grease Gun</td>
<td>Weekly —</td>
<td></td>
</tr>
<tr>
<td>7. Overhaul Ball Swivel</td>
<td>Grease</td>
<td>Grease Gun</td>
<td>Daily 5</td>
<td></td>
</tr>
<tr>
<td>8. Load Block Trunnion</td>
<td>Grease</td>
<td>Grease Gun</td>
<td>Daily 5</td>
<td></td>
</tr>
<tr>
<td>9. Load Block Sheave (1 or 2 fittings)</td>
<td>Grease</td>
<td>Grease Gun</td>
<td>Daily 5</td>
<td></td>
</tr>
<tr>
<td>10. Winch</td>
<td>Gear Oil</td>
<td>Check Level</td>
<td>Monthly 6</td>
<td></td>
</tr>
<tr>
<td>11. Winch</td>
<td>Gear Oil</td>
<td>Change</td>
<td>Every 1000 Hours or Semiannually 7</td>
<td></td>
</tr>
<tr>
<td>12. Winch Vent Plug</td>
<td>—</td>
<td>Clean</td>
<td>Monthly 8</td>
<td></td>
</tr>
<tr>
<td>13. Slewing Ring</td>
<td>Grease</td>
<td>Grease Gun</td>
<td>Monthly 9</td>
<td></td>
</tr>
<tr>
<td>14. Slewing Ring Gear Teeth</td>
<td>Open Gear Oil</td>
<td>Brush or Spray</td>
<td>Weekly 10</td>
<td></td>
</tr>
<tr>
<td>15. Swing Reducer</td>
<td>Gear Oil</td>
<td>Check Level</td>
<td>Semiannually 6</td>
<td></td>
</tr>
<tr>
<td>16. Swing Reducer</td>
<td>Gear Oil</td>
<td>Change</td>
<td>Annually 6</td>
<td></td>
</tr>
<tr>
<td>17. Swing Reducer Upper Bearings</td>
<td>Grease</td>
<td>Grease Gun</td>
<td>Monthly 11</td>
<td></td>
</tr>
<tr>
<td>18. Control Linkage</td>
<td>Engine Oil</td>
<td>Oil Can</td>
<td>Monthly 12</td>
<td></td>
</tr>
<tr>
<td>19. Outrigger Pins (3 fittings each outrigger)</td>
<td>Grease</td>
<td>Grease Gun</td>
<td>Monthly 13</td>
<td></td>
</tr>
<tr>
<td>20. Outrigger Pads (2 or 4 fittings each outrigger)</td>
<td>Grease</td>
<td>Grease Gun</td>
<td>Monthly 13</td>
<td></td>
</tr>
<tr>
<td>21. Rear Stabilizer &amp; Front Stab float pad</td>
<td>Grease</td>
<td>Brush or Swab</td>
<td>Monthly 13</td>
<td></td>
</tr>
<tr>
<td>22. Hydraulic Tank Fill Cap</td>
<td>Hydraulic Oil</td>
<td>Check Level</td>
<td>Daily 14</td>
<td></td>
</tr>
<tr>
<td>23. Hydraulic Filter</td>
<td>—</td>
<td>Check Pressure</td>
<td>Daily 15</td>
<td></td>
</tr>
<tr>
<td>24. Hydraulic Tank Breather</td>
<td>—</td>
<td>Replace</td>
<td>Every 3 Months 16</td>
<td></td>
</tr>
<tr>
<td>25. Hydraulic Tank</td>
<td>Hydraulic Oil</td>
<td>Change</td>
<td>Semiannually 17</td>
<td></td>
</tr>
<tr>
<td>26. Suction Strainer</td>
<td>—</td>
<td>Clean</td>
<td>At oil change —</td>
<td></td>
</tr>
</tbody>
</table>

*Operator Manual C-Series 1000-1700*
Chapter 3: Lubrication

Lubrication Points Notes

1. Fully extend boom and apply a light coat of grease to both sides and bottom of each boom section in areas of slider pad contact.

   Fully retract boom. Remove cover from rear of boom base to expose top rear slider pads. Coat top rear slider pads with grease. Extend boom as necessary to expose each set of slider pads. Replace cover after greasing.

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

2. Retract sheave(s) on first section accessible through side plate at rear of boom. Fittings are located on each end of sheave pin.

3. Fitting is located on end of extend sheave pin. Extend boom to align lube hole located on the side of the boom mid and fly sections.

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

4. Grease fittings for cylinder pins are located on the middle of the cylinder pin tubes. Fittings for the boom pivot pin are located on the pivot tube on each side of the boom foot; they are accessible from the rear of the boom.

5. Daily interval is for continuous operation, for intermittent operation the interval may be extended to every 14 days.

6. Fill to bottom of plug opening.
7. Change after the first 100 hours of operation, then every 1,000 hours or six (6) months.

To drain winch oil, boom must be horizontal; align plug in drum with drain hole in bottom of side plate. Screw a short piece of 1-inch pipe into large drain hole in drum. Insert a 5/16-inch allen wrench through pipe and remove plug. Replace plug and remove pipe after oil has drained. To fill, remove plug at center of drum support, fill to bottom of hole, re-install plug.

**DANGER** Do not place fingers, pipe, or drive extension into hole in side plate until winch drum has stopped turning and engine is OFF.

8. Clean vent plug by soaking in solvent. Spring loaded pin must move in and out freely. Do not paint over vent plug. Never replace vent plug with a solid plug.

9. The slewing ring has a single, remote mounted grease fitting. Located at the front of the pedestal, it is accessible from the operator station on the drivers side of the crane.

Set-up crane for operation, with the boom in the boom rest apply five shots of grease, next swing the boom left 90° and apply another five shots of grease, then swing the boom right 180° and apply the last five shots of grease. Place boom back in boom rest.

10. Open gear oil must be brushed or sprayed on each gear tooth; do not rely on gear rotation to distribute oil. An access hole is provided in swing cover.

11. Use 3 pumps of grease every month or 15 hours of use. An access hole is provided in swing cover.

12. Remove cover to expose linkage. Replace cover after servicing.

13. Refer to Figure 3-2 lubrication of outrigger and stabilizer pins and slider pads.
   - Front center stabilizer, fill cavity in float with grease as required.
Chapter 3: Lubrication

14. Fill hydraulic tank so oil level is between high and low marks on tank sight gauge. To check the oil level, the crane must be in the normal roading position; i.e., the boom must be in the boom rest and all outriggers fully retracted.

15. Check the gauge after start-up each day and periodically throughout each work shift. Replace element if gauge reads 25 psi when engine is at high idle and oil is warm.

16. Do not attempt to clean breather; if needed, replace at earlier intervals.

17. See Chapter 6 for oil change procedure.
Chapter 3: Lubrication

Outrigger

Zerks on Cylinder base for upper pin.

Zerks on outer box for slider pad lube

Zerks on cylinder rod for float pad pin

After applying grease, cycle outrigger assembly to distribute grease along boxes.

Rear Stabilizer

Apply a light coat of grease on top of inner tube.

Zerks on outer box for slider pad lube

After applying grease, cycle stabilizer assembly to distribute grease along inner boxes.

Figure 3-2 Outrigger/Stabilizer Lubrication
Chapter 4
Capacities

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

Read all instructions on Capacity Chart before operating crane.
Do not lift any load without first determining total load to be lifted and maximum radius at which load can be lifted.

Radius shall govern load rating. Only use boom angle as a guide in positioning boom near corresponding radius for a given load.
EXCEPTION: Boom angle shall govern load rating of jib when boom is not fully extended.

Load Rating
The load ratings given on the Capacity Chart do not exceed a maximum stability tipping factor of 85 percent.
The main boom and jib load ratings above the heavy line on the Capacity Chart are based on the crane’s hydraulic or structural competence and not on stability.
The main boom and jib load ratings below the heavy line are stability limited capacities and do not exceed 85 percent of tipping.
Chapter 4: Capacities

Before lifting any load, the operator shall ensure that:

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

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

**Total Load**

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

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

See Deductions on Capacity Chart.

<table>
<thead>
<tr>
<th>Component</th>
<th>Pounds</th>
</tr>
</thead>
</table>
| 1. Stored Jib (if equipped)*     | _______
| 2. Overhaul Ball or Load Block (depending on which is used) | _______
| 3. Hose Reel (if equipped)       | _______
| 4. 2-Man Steel Basket (empty weight) | _______
| 5. 1-Man Steel Basket (empty weight) | _______
| 6. 1-Man Fiberglass Basket (empty weight) | _______
| 7. Slings and all other Load Handling Devices | _______

*Disregard when determining total load to be lifted with the jib.

**Totals**

A. Total Component Weights (ADD 1 through 7)  _______

B. Weight of Load to be Lifted  _______

C. Total Load to be Lifted (ADD A and B)  _______

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

Refer to the Capacity Chart to determine the parts of line required to handle the total load to be lifted.
Chapter 4: Capacities
Chapter 5
System Schematics
Important This section does not contain maintenance and repair instructions for the truck. Refer to the truck manufacturer’s manual for instructions pertaining to the truck.

Safety

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

- Apply truck parking brakes.
- Lower all loads to ground so wire rope is slack.
- Move all controls to OFF.
- Disengage Power Take-Off (PTO) and turn engine OFF.
- Attach CAUTION sign to start controls warning personnel that crane is being serviced and must not be started.
- Do not place hands or tools into any opening in boom sections while power is on or boom sections are moving.
- Do not perform maintenance, adjustment, or repair procedures unless authorized to do so. Make sure all applicable instructions have been read and are thoroughly understood.
Do not check for hydraulic leaks with hands. Oil under pressure can penetrate human skin causing serious injury. Oil under pressure can be nearly invisible; therefore, check for hydraulic leaks with a piece of cardboard or wood.

- Hydraulic oil is flammable; do not check inside hydraulic tank with open flame.
- Do not alter specified flow and pressure settings. Higher than specified flow and pressure can cause damage to crane and hydraulic components. Lower than specified flows and pressures can result in loss of control.
- Do not weld or burn close to hydraulic lines and components without first placing a protective cover over them.
- Do not remove cylinders until working parts are resting on ground or are securely blocked from movement.
- Components are heavy. Do not attempt to lift them by hand; use a chain hoist, jacks, or blocking.
- Do not place crane back into service until all guards and covers have been securely replaced and all service equipment has been removed.
- Personnel getting on or off the crane must do so only while the truck is parked. Do not attempt to get on or off the crane while it is moving.
- This crane has a step and two grab handles for climbing on and off the pedestal from either side of the crane. Crane owner/user shall provide sturdy ladders for personnel to gain access to components that cannot be reached from the ground, operator platform or top of flatbed. Do not allow personnel to climb onto turret, winch, or top of boom; use a sturdy ladder to gain access to these locations.


**Storing Components**

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

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

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

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

*Important* Do not use rags to plug openings. Use clean plastic shipping plugs and caps.

**Labeling Components at Disassembly**

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

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

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

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

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

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

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

Use tools that are clean and in proper working order.

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

The torque values for fasteners that must be torqued to a specific value are identified in Table 6-1 and shown in Figure 6-2.

**DANGER**

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

**Important** Observe following precautions when installing fasteners; failing to do so will seriously weaken attachment.

- Make sure each fastener is of correct size length and grade. If in doubt, refer to Parts Manual for specifications.
- Do not interchange Grade-5 fasteners with Grade-8 fasteners and vice versa refer to Figure 6-1 for identification.
- Use Grade-8 nuts with Grade-8 bolts.
- Use hardened flat washers under head of screws and under each nut of bolts and studs.
- Make sure threads are clean and free of burrs.
- Torque fasteners to proper torque values. Semiannual Check, items 1-9, Table 6-1.
- Use a torque wrench that is properly calibrated. Check calibration of torque wrench on a regular basis.

**Note** Use Grade-2 nuts with Grade-5 bolts. Grade-2 nuts do not have any grade marking.
Table 6-1 Torque Values

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Fastener Size</th>
<th>Grade</th>
<th>Torque Ft-Lb (lubricated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pedestal Mounting Studs</td>
<td>1-8 UNC</td>
<td>5</td>
<td>440</td>
</tr>
<tr>
<td>2</td>
<td>Stabilizer Mounting Studs</td>
<td>3/4-10 UNC</td>
<td>5</td>
<td>200</td>
</tr>
<tr>
<td>3</td>
<td>Slewing Ring Mounting Bolts</td>
<td>5/8-11 UNC</td>
<td>8</td>
<td>170</td>
</tr>
<tr>
<td>4</td>
<td>Swing Reducer Mounting Bolts</td>
<td>3/4-10 UNC</td>
<td>5</td>
<td>200</td>
</tr>
<tr>
<td>5</td>
<td>Swing Motor Mounting Bolts</td>
<td>1/2-13 UNC</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>6</td>
<td>Winch Mounting Bolts</td>
<td>5/8-11 UNC</td>
<td>5</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>3-Section Booms</td>
<td>5/8-11 UNC</td>
<td>8</td>
<td>170</td>
</tr>
<tr>
<td></td>
<td>4-Section Booms</td>
<td>5/8-11 UNC</td>
<td>8</td>
<td>170</td>
</tr>
<tr>
<td>7</td>
<td>Winch Bracket Bolts</td>
<td>3/4-10 UNC</td>
<td>8</td>
<td>280</td>
</tr>
<tr>
<td></td>
<td>3-Section Booms</td>
<td>3/4-10 UNC</td>
<td>5</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>4-Section Booms</td>
<td>3/4-10 UNC</td>
<td>5</td>
<td>200</td>
</tr>
<tr>
<td>8</td>
<td>Winch Motor Mounting Bolts</td>
<td>1/2-13 UNC</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>9</td>
<td>Pump Mounting Bolts</td>
<td>1/2-13 UNC</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>10</td>
<td>Telescope Cylinder Mounting Bracket Bolts</td>
<td>1/2-13 UNC</td>
<td>5</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Booms 38', 47', 56' (1000-1200 Models)</td>
<td>1/2-13 UNC</td>
<td>8</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Booms 47', 59.5', 61', 70' (1400-1700 Models)</td>
<td>5/8-11 UNC</td>
<td>5</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>Boom 81' (1700 Model)</td>
<td>5/8-11 UNC</td>
<td>9</td>
<td>170</td>
</tr>
<tr>
<td>11</td>
<td>Telescope Cylinder Rod Mounting Bolts</td>
<td>1/2-13 UNC</td>
<td>8</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Booms 38', 47', 56' (1000-1200 Models)</td>
<td>1/2-13 UNC</td>
<td>8</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Booms 47', 59.5', 61' (1400-1700 Models)</td>
<td>1/2-13 UNC</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Boom 70' (1700 Model)</td>
<td>1/2-13 UNC</td>
<td>8</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Boom 81' (1700 Model)</td>
<td>Pin</td>
<td>Retaining Ring</td>
<td></td>
</tr>
</tbody>
</table>
Figure 6-2 Fastener Locations

Operator Manual C-Series 1000-1700
Maintenance Checks

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

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

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

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

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

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

CAUTION Take every precaution to prevent injury from moving parts when power is on.
**Daily Checks**

- Perform the daily lube services.
- Clean all debris and dirt from the crane.
- Check for fluid and air leaks.
- Verify all guards, covers, and platforms are securely in place.
- Inspect the crane for signs of damage.
- Inspect the wire rope for signs of wear and damage.
- Check the wire rope for proper spooling on the winch drum and reeving through all sheaves. Check that all sheaves turn freely.
- Make sure the load line is properly fastened to the load block or the overhaul ball.
- Check the load block or the overhaul ball whichever is being used, for loose or missing nuts, screws, and cotter pins.
- Check all slings and other loose gear to be used to make lifts are safe for operation.
- Inspect the hook latch for proper operation.
- Check that the Capacity Chart is present at each control station.
- Perform all daily inspections according to the prime mover and PTO manufacturers’ specifications.

✔ Test the radio anti-two-block warning horn and function shutdown.
  - Start the truck engine and engage the PTO.
    - With ATB hanging freely, the horn should be silent and functions Winch Up, Telescope out and Boom Down should be operable.
    - Lift the ATB weight by hand, the warning horn should sound and functions Winch Up, Telescope out and Boom Down should be disabled.
  - Next refer to the Radio ATB operator manual supplied with the crane for additional daily inspection procedures as outlined by the ATB system manufacturer.

✔ Test the overload warning horn and function shut-off system.
  - Identify a known load and a near overload radius for the load from the capacity chart.
Set-up the crane and load so that the load is 3 to 5 feet closer to the crane centerline of rotation than the selected test radius.
Lift and slowly luff the load to the determined radius. The overload warning horn should sound. The Boom Down, Winch Up and Telescope Out functions should be disabled.
To correct the overload condition, the crane should allow you to Lower the load, Telescope In, and Boom up.

**Note** The crane may simulate an overload condition when the boom is raised to 80° and hydraulic pressure is allowed to build on the extend side of the hydraulic cylinder. Use the override button on the electrical enclosure located inside the crane pedestal.

- Test the override button.
- With the hook empty, raise the boom to its maximum angle, approximately 80 degrees. The warning horn should sound and the Boom Down function should be disabled.
- Press the override button, the warning horn should go silent, attempt to lower the boom.
- Once the boom has lowered a few degrees, release the button, the warning horn should remain silent and the boom should continue to lower.

- Check for proper operation of the engine and PTO.
- Check for proper operation of all accessory devices such as horn, start/stop switch and so forth.
- Check for proper operation of each crane function in response to control lever movements.

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

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

**Note** The oil cooler fan comes on only when the temperature of the hydraulic oil rises to 120°F.
Weekly Checks
- Perform the daily and weekly lube services.
- Perform the daily inspection checks.
- Check all mechanical control linkage for excessive wear and binding; oil the linkage as required.
- Check for missing bolts, pins, keeper plates, retaining rings, and cotter pins.
- Check the winch drum and all sheaves for excessive wear, cracks or other damage.
- Check the boom angle indicators for accuracy over the full range of boom elevation.

Monthly Checks
- Perform the daily, weekly and monthly lube services.
- Perform the daily and weekly maintenance checks.
- Check the boom and all structural components of the crane for deformed, cracked or corroded members. Pay close attention to all welds.
- Clean, prime and paint any rusted surfaces.
- Thoroughly inspect the wire rope for damage.
- Check that the hook and hook housing on the load block and the swivel on the overhaul ball rotate freely without excessive play. Faulty operation indicates faulty bearings or inadequate lubrication.
- Check the load block or the overhaul ball for signs of overloading; spread side plates, elongated holes, bent or elongated tie bolts, and cracks.
- Check the gap between the shank and the barrel of the swivel on the overhaul ball. The gap must not exceed 1/16-inch.
Chapter 6: General Maintenance and Repair

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

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

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

Check that all nameplates and safety decals are readable and securely attached at the proper locations on the crane.

Check all control levers for proper adjustment.

Check the foot throttle settings for the proper engine speed.

**Semiannual Checks**

- Perform the daily, weekly, monthly and semiannual lube services.
- Perform the daily, weekly, and monthly maintenance checks.
- Tighten all fasteners on the crane. Tighten those fasteners that require torquing to the specified value, including slewing ring bolts.

- Check the adjustment of the crowd rope system in the boom.
- Check the boom slider pads for wear and proper adjustment.

- Check relief valve settings for all crane functions, refer to Hydraulic Schematic.

**Annual Checks**

- Perform all lube services.
- Perform the daily, weekly, monthly and semiannual maintenance checks.
- Check each hook for cracks using a nondestructive test.

- Check the Foot Air Throttle controller for correct settings, operating performance and leakage. Replace rubber and all worn parts as necessary.
Wire Rope Maintenance

Lubrication

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

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

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

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

Inspection

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

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

Each month, the entire length of wire rope must be thoroughly and carefully inspected by a qualified person. This interval also applies to any rope being placed into service that has been idle for one month or longer.
A dated and signed report of the wire rope's condition at each inspection interval must be kept on file at all times. The data from these reports can then be used to determine when the wire rope needs to be replaced.

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

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

### Replacement

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

Guidelines for replacement are listed in the following paragraphs.

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

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

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

- Severe corrosion.

**Sheave and Drum Inspection**

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

- Check the depth, width, and contour of each sheave using a groove gauge as shown in Figure 6-7. Replace sheaves that have over or undersized grooves.

![Figure 6-6 Wire Rope Core Inspection](image)

![Figure 6-7 Sheave Inspection Measurement](image)
Replace the winch drum or any sheave that has broken or cracked flanges.
- Check that the winch drum and all sheaves turn true on the shafts. If the drum or any sheave has a wobble to it, replace the bearings.

**Replacing Hydraulic Filter Element**

Refer to Figure 6-8.

Replace the filter element when the pressure gauge on the head reads 25 psi with the engine at high idle and the oil warm from operation.

*Note* The filter has a 25 psi bypass that opens when the element is plugged with dirt.

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

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

**Replacing Hydraulic Tank Breather**

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

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

Changing Oil

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

- Operate the crane until the oil is at its normal operating temperature. This step will help prevent impurities from settling in the system.
- Move all controls to OFF and stop engine.
Chapter 6: General Maintenance and Repair

- Remove the drain plug from the bottom of the tank to drain the oil, see Figure 6-8.

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

- Thoroughly clean all dirt from the access cover on the tank and remove the access cover.

- Clean out any sediment from inside the tank.

- Remove and clean the suction strainer. Soak in solvent and blow out with compressed air. Securely replace the strainer.

- Replace the cover on the hydraulic tank. Replace gasket if necessary.

- Replace the filter element.

- Replace the spin on breather, if equipped, otherwise, soak the fill cap breather in solvent and blow it clean with compressed air.

- Clean any metal particles from the drain plug. Replace and securely tighten the drain plug.

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

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

  **Important** Filter new oil through a 10-micron element when filling tank.

- Connect and securely tighten any hydraulic lines that are disconnected.

- Open suction line shut-off valve before starting engine or engaging PTO; otherwise, the pump will cavitate and be ruined. See Figure 6-8.

- Start the engine, engage the PTO, and operate the pump for at least two minutes with no load at lowest possible rpm. During this priming period, the pump should run smoothly and not develop excessive heat.

- Gradually increase speed and operate all functions (cylinders and motors) to purge all air from the system. Operation will be sluggish or erratic until all air is purged.

- Once the functions are operating smoothly, speed and loading can be increased to normal.
Stop the engine.
Fill the hydraulic tank to the proper level.

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

Adjusting Levels
Check the adjustment of the bubble levels on the control consoles every month using the following procedure.

- Extend all outriggers and stabilizers so the crane is level according to the bubble level at either control console.
- Raise the boom to the maximum angle of 80° and fully retract the boom.
- Place an accurate carpenter’s level on either side of the turret, see Figure 6-9. Do not lay the level across the top of the bolts.
- Adjust the outriggers and stabilizers so the crane is level from front to rear according to the carpenter’s level.
- Swing the boom 90° over either side of the truck and adjust the outriggers and stabilizers so the crane is level from side to side according to the carpenter’s level.
- Repeat Adjusting Levels procedure until the crane is level with all tires off the ground.

Figure 6-9  Carpenter Level
Check the bubble level at each control console. If necessary, adjust the levels as follows.

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

**Boom Maintenance**

**Slider Pad Adjustment/Replacement**

**Rear Top Slider Pads**

Refer to Figure 6-11.

*Note* The basic procedure for pad inspection and replacement is similar for the three and four section booms. Where there is a difference the steps will be noted.

- Retract boom completely.
- Remove the access cover from the top plate at the rear of the boom base.
- Stop engine.

**DANGER** Do not place hands or tools into holes in boom sections until engine is OFF. Serious injury will result if boom is telescoped while hands or tools are in holes.
Measure the thickness of the slider pads, do not measure shims. Replace both slider pads if either has worn down to 7/16” or less.

- Measure the clearance between rear top slider pads and the adjacent section.
- Add shims under the slider pads as required to set the clearance to approximately 1/16”.

**Note** The shims come in two thicknesses: 1/16” and 1/8”.

- After the shims are installed, torque the slider pad screws to 15.5 ft-lbs (186 in-lbs).

**Note** Repeat procedure for each additional boom section. Extend boom each time to gain access to additional pads through the access holes at the top of the boom.

**Front Side Slider Pads**

Refer to Figure 6-12 or 6-13.

- Extend the boom approximately 12 inches.
- Stop engine.

**DANGER** Do not place hands or tools into openings in boom sections until engine is OFF. Serious injury will result if boom is telescoped while hands or tools are in openings.

- Measure the thickness of the front side slider pads, do not measure shims. Replace all of the slider pads for the respective section if any of the pads has worn down to 7/16” or less.

**Note** Replace thickness for the front side slider pads on the 81’ four-section boom is as follows, see Figure 6-13:
- Side pad on base and first section, 3/8” or less.
- Side pad on second section, 7/8” or less.

- Fully extend the boom and stop engine.

**Important** The most important function of the front slider pads is to maintain the boom assembly straight and prevent excessive side to side movement. Therefore, it is as important to maintain the...
slider pads within the recommended thickness as well as ensuring that they are properly shimmed.

- Determine the number of shims needed to ensure a clearance of approximately 1/32” per side between the side slider pad and the adjacent section. Attempt to use an equal amount of shims per side by selecting each size shim in even quantities.

Note: The shims come in two thicknesses: 1/16” and 1/8”. It is possible to have more shims on one side of the boom than on the other side, as long as the boom is straight.

- Divide the total number of shims selected by half and install behind each of the front side slider pads. Verify clearance is within 0 to 1/32” per side.

- Next, inspect boom assembly for straightness. If necessary, adjust the sections from side to side so the boom is as straight as possible by shifting shims from one side to the other.

- Once side clearances and boom straightness is verified, secure all slider pads, torque fasteners to 15.5 ft-lbs (186 in-lbs).

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

Front Bottom Slider Pads
See Figure 6-12 or 6-13.

- Extend the boom approximately 12 inches.
- Stop engine.

DANGER: Do not place hands or tools into openings in boom sections until engine is OFF. Serious injury will result if boom is telescoped while hands or tools are in openings.

- Measure the thickness of the front bottom slider pads, do not measure shims. Replace both slider pads for the respective section if either slider pad has worn to 7/16” or less.
Note Replace thickness for the front bottom slider pads on the 81’ four-section boom is as follows, see Figure 6-13;
- Bottom pad on base section, 5/8” or less.
- Bottom pad on first and second section, 1/2” or less.

Note It will be necessary to lift the ends of the sections with a hoist to remove and adjust the front bottom slider pad.

- If slider pad needs to be replaced, retain and identify any shims originally installed at each location. The shims under the front bottom slider pads are of a specific thickness for the given application. If necessary, refer to the boom assembly drawing in the crane parts book to determine correct shim usage and part number for a given location.
- After the pads and shims are installed, torque slider pad screws to 15.5 ft-lbs (186 in-lbs).

![Figure 6-12 Typical Slider Pad Placement 3-Section Boom](image)
![Figure 6-13 Typical Slider Pad Placement 4-Section Boom](image)
Chapter 6: General Maintenance and Repair

Figure 6-14  Typical 3-Section Boom Crowd Rope System

Attach point of Retract Ropes for models 1000-1200

Attach point of Retract Ropes for models 1400-1700

6 1/2"
Crowd Rope Adjustment

Three-Section Boom

Refer to Figure 6-14.

**CAUTION** Ensure machine is on a firm and level surface.

**Important** Before adjusting boom extend and retract cables, remove boom stop on top of second section, just behind boom nose. After cables have been adjusted, fully retract boom, install boom stop and shim as necessary until boom stop is snug against first section top pad stop plate.

**Laying back the Winch**

- Using all safety precautions operate crane and properly set outriggers and stabilizers.
- Lower boom to allow access to boom nose.
- Extend boom far enough to remove boom stops and shims from second section just behind boom nose.
- Ensure telescope cylinder is fully retracted (bottomed).

**Note** Open wedge socket may need to be removed to unreeve cable from around lower boom nose sheave wheels in next step if crane is configured for 3 or 4 part line. If socket is removed it will need to be re-installed to help complete the remaining steps in this procedure.

- With boom still in lowered position, remove headache ball/hook block assembly from load line and unreeve cable from boom nose sheaves. Also remove upper and lower load line retaining pins from boom head.
Using all applicable safety precautions, operate the winch and retract cable onto drum until cable socket on the end of cable is up over the boom nose and next to cable socket attach lug on top of base boom.

Using cable socket, pin load line to mounting block on top front of base boom, remove any excess slack in load line.

Using all applicable safety precautions, operate crane and move the boom to the horizontal position.

Remove the upper two (2) (3/4") bolts on the winch mount that go through the side plates of base boom.

Using all safety precautions start crane and operate winch down lever and gradually lower winch till it comes to rest against the back plate of the turret.

With winch in resting position, operate winch to allow slack in load line and move cable to the side out of the way.

Shut down crane.

Adjusting Crowd Ropes

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

*Note* Always replace cables in sets, i.e. All extend cables or all retract cables.

*Note* It is acceptable to cut one (1) inch off of cable adjustment stud with an abrasive cutting saw if extend cable stud interferes with winch mounting plate.

*Note* DO NOT TORQUE retract cable ends (on front (boom nose end) of base boom). TORQUE ONLY EXTEND CABLES (on aft end (winch end) of base boom). There are four (4) extend cables and two (2) retract cables.

Adjust retract cables to retract second section and remove all slack from cables.

Adjust extend cables to remove all slack from cables.
- Continue to adjust extend and retract cables to obtain a dimension of approximately 6 1/2” from the front edge of the first boom section to the center of the boom nose upper sheave.
- Using all applicable safety precautions, start crane and cycle boom (extend at least three (3) feet). Listen for cables hitting boom sections which indicates slack in cables.
- Recheck cables for slack and adjust as necessary to maintain dimension stated.
- Once proper tension on the ropes is achieved, torque extend cable adjusting nuts to 30 lb-ft. (dry).
- Install boom stop and shim as necessary, so stop is snug against first-section top plate when boom is fully retracted.
- Check for proper operation of boom.
- Operate winch and carefully remove slack in cable, be sure cable is in direct line with cable socket attached to lug on end of base boom.
- Carefully operate winch to pivot and raise winch until mounting plate holes line up with mounting holes in base boom side plates.
- Install the 3/4”-10 UNC grade 8 bolts, washers, spacers and nuts. Torque to 280 ft. lb. (lubed).
- Remove open wedge cable socket from base boom lug and reeve cable for the configuration required, i.e. one part line, two part line, etc. Refer to reeving instructions earlier in this manual.
Chapter 6: General Maintenance and Repair

Figure 6-15 Typical 4-Section Boom Crowd Rope System
Four-Section Boom
Refer to Figure 6-15.

**CAUTION** Ensure machine is on a firm and level surface.

**Important** Before adjusting boom extend and retract cables, remove boom stop on top of third section, just behind boom nose. After cables have been adjusted, fully retract boom, install boom stop and shim as necessary until boom stop is snug against first or second section top plate.

**Laying back the Winch**
- Using all safety precautions operate crane and properly set outriggers and stabilizers.
- Lower boom to allow access to boom nose.
- Extend boom far enough to remove boom stops and shims from third section just behind boom nose.
- Retract boom to ensure telescope cylinder is fully retracted (bottomed).

**Note** Open wedge socket may need to be removed to unreeve cable from around lower boom nose sheave wheels in next step if crane is configured for 3 or 4-part line. If socket is removed it will need to be reinstalled to help complete the remaining steps in this procedure.
- With boom still in lowered position, remove headache ball/hook block assembly from load line and unreeve cable from boom nose sheaves. Also remove upper and lower load line retaining pins from boom head.
- Using all applicable safety precautions, operate the winch and retract cable onto drum until cable socket on the end of cable is up over the boom nose and next to cable socket attach lug on top of base boom.
Chapter 6: General Maintenance and Repair

- Using cable socket, pin load line to cable socket attach lug on top of base boom and remove any excess slack in load line.
- Using all applicable safety precautions, operate crane and move the boom to the horizontal position.
- Remove upper four bolts on the winch mounting bracket that go through the side plates of base boom, see Figure 6-16.
- Using all safety precautions start crane and operate winch down lever and gradually lower winch till it comes to rest on the turret.
- With winch in resting position, operate winch down lever to allow slack in load line and move cable to the side out of the way.
- Shut down crane.

![Diagram of Typical 4-Section Boom Foot area](image)

*Figure 6-16 Typical 4-Section Boom Foot area*
Adjusting Crowd Ropes

**Important**  IMPORTANT: If locking nuts bottom out on threaded cable adjustment ends on both the extend and retract cables (no threads remain before adjustment dimension or torque can be obtained) cables are stretched and require replacement.

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

**Note**  It is acceptable to cut one inch off of cable adjustment stud with an abrasive cutting saw if extend cable stud interferes with hoist mounting plate.

**Note**  Do not torque retract cable ends on boom nose end of base boom. Torque only extend cables on hoist end of base boom.

The boom has six extend cables and four retract cables. Two extend cables extend the third section and four extend cables extend the second section. The second and third sections each use two retract cables.

- Adjust second section retract cables so lube port holes at turret end of the boom line up with grease fittings and all slack is removed from cables, see Figure 6-16.
- Adjust second section extend cables to remove all slack.
- Adjust third section retract cables to retract third section and remove all slack from cables.
- Adjust third extend cables to remove all slack.
- Continue to adjust extend and retract cables to obtain a dimension of approximately 6-1/2” from the front edge of the second section to the center of the boom nose upper sheave and to maintain the grease hole alignment.
- Using all applicable safety precautions, start crane and cycle boom (extend at least three feet). Listen for any cables hitting the inside of a boom section which indicates slack in cables.
- If the cables are hitting readjust as necessary to maintain conditions until cables do not hit, as established in step above.
Once proper tension on the ropes is achieved, torque extend cable adjusting nuts to 30 lb-ft. (dry).

Install boom stop and shim as necessary so stop is snug against second section top plate when boom is fully retracted.

Check for proper operation of boom.

Operate hoist and carefully remove slack in cable, be sure cable is in direct line with cable socket attached to lug on end of base boom.

Carefully operate hoist to pivot and raise hoist until mounting plate holes line up with holes in base boom side plates.

Install the 3/4"-10UNC grade 8 bolts, washers, spacers and nuts. Torque to 280 lb-ft (lubed).

Remove open wedge cable socket from base boom lug and reeve cable for the configuration required, i.e. one part line, two part line, etc. Refer to reeving instructions earlier in this manual.

**Crowd Rope Inspection**

Boom extend/retract cables must receive periodic inspections by a qualified person. Inspections should occur annually or every 2000 hours, which ever occurs first, and more often when deemed necessary based on experience.

**CAUTION**

*Wear gloves to protect hands when handling cable.*

The periodic inspection shall cover the entire length of the cable. The inspection frequency shall be based on such factors as expected cable life as determined by experience on the particular application or similar installations, severity of environment, percentage of capacity lifts, frequency
rates of operation, and exposure to shock loads. Inspection should be more frequent as cables approach the end of their useful lives.

Only the surface wires of the cable require inspection, do not attempt to open the cable. Any deterioration resulting in a appreciable loss of original strength, such as described below, shall be noted, and then a determination made if further use would constitute a hazard.

No precise rules can be given for determination of the exact time for replacement of the cables. This depends largely on the good judgment of the qualified person evaluating the cable.

Refer to “Wire Rope Maintenance” earlier in this section for guidelines regarding “inspection” and “replacement” criteria.
Chapter 7
Hydraulic System Troubleshooting

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

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

Troubleshooting Steps
A good troubleshooting program should include the following steps.

■ Know the System.
  ❑ Study the Hydraulic Schematic.
  ❑ Know what the relief valve settings and pump outputs should be.

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

■ Operate the Crane.
  ❑ How is the crane’s performance? Is any function slow, erratic, or not operating at all?
  ❑ Do the controls feel solid or spongy?
Chapter 7: Hydraulic System Troubleshooting

- Smell any unusual odors? Any signs of smoke?
- Hear any unusual noises? Where, at what speeds, and during what cycles?

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

**List the Problems.**
- Make a list of the problems found while inspecting the crane.

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

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

**Take Corrective Action.**
- Once the problem has been isolated and the possible cause has been determined, take the necessary corrective action.
- Fully test the crane before returning it to service.
Troubleshooting List

Hydraulic Oil Condition
- Oil milky or dirty.
  - Water in oil (milky).
  - Filter failure (dirty).
  - Metal particles (mechanical failure).
  - Oil discolored or has burned odor.
  - See Oil Overheating.
  - System Inoperative
- Power Take-Off (PTO) not engaged.
  - Engage PTO.
- No oil in system.
  - Fill tank to proper level. Check system for leaks.
- Oil viscosity too high.
  - Refer to Lubrication Chapter for proper viscosity.
- Suction line plugged.
  - Drain oil and clean suction line. Locate source of contamination.
- Ball valve closed.
  - Make sure this valve is fully open.
- Restriction in system.
  - Oil lines could be dirty or have inner walls that are collapsing and cutting off the oil supply. Clean or replace lines.
- Air leaks in pump suction line.
  - Repair or replace suction line.
Chapter 7: Hydraulic System Troubleshooting

- **Dirt in pump.**
  - Clean and repair pump. If necessary, drain and flush hydraulic system. Locate source of contamination.

- **Badly worn pump.**
  - Repair or replace pump.

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

- **Oil leak in pressure lines.**
  - Tighten fittings or replace defective lines.

- **Relief valves improperly adjusted or defective.**
  - Test relief valves to make sure they are opening at specified pressures. Refer to Hydraulic Schematic.
  - Examine seals for damage that could cause leaks. Clean relief valves and check for broken springs and other possible causes.

- **Pump rotating in wrong direction.** Applies to knockdown units only.
  - Replace with pump which rotates in the direction required.

*Important* To prevent pump damage, pump rotation must be matched with PTO and transmission.

- **Operating system under excessive load.**
  - Check Capacity Chart for load limits.

- **Hoses attached improperly.**
  - Attach correctly and tighten securely.

- **Broken PTO.**
  - Replace defective parts.

- **Pump not operating.**
  - Check for broken pump shaft.
System Operates Erratically

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

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

- **Components sticking or binding.**
  - Check for dirt or gummy deposits. If dirt is caused by contamination, locate the source.
  - Check for worn parts.

- **Pump damaged.**
  - Check for broken or worn parts. Determine cause of pump damage.

- **Dirt in relief valves.**
  - Clean relief valves.

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

- **Ball valve closed.**
  - Make sure this valve is fully open.

System Operates Slowly

- **Cold oil.**
  - Allow oil to warm before operating controls.

- **Oil viscosity too high.**
  - Refer to Lubrication Chapter for proper viscosity.

- **Insufficient drive speed.**
  - Make sure PTO is matched to transmission. Troubleshoot engine.
Chapter 7: Hydraulic System Troubleshooting

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

- **Air in system.**
  - Check suction line for leaks.

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

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

- **Ball valve closed.**
  - Make sure this valve is fully open.

- **Relief valves not properly set or leaking.**
  - Test relief valves to make sure they are opening at specified pressures. Examine valves for damaged seats that could leak.

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

- **Valves plugged.**
  - Clean dirt from components. Clean orifices. Find source of dirt and correct.

- **Oil leak in pressure lines.**
  - Tighten fittings or replace defective lines. Examine mating surfaces of fittings for irregularities.
Oil Overheating

- Operator holds control levers in power position too long, causing relief valve to open.
  - Return control levers to NEUTRAL position when not in use.
- Using incorrect oil.
  - Drain and refill system with proper oil. See Lubrication Chapter.
- Low oil level.
  - Fill tank to proper level. Look for leaks.
- Dirty oil.
  - Drain and refill with clean oil. Look for source of contamination.
- Engine running too fast.
  - Troubleshoot engine.
- Incorrect relief valve pressures.
  - Check and reset pressures; clean or replace relief valve.
- Internal oil leakage.
  - Examine and test valves, cylinders, and motors for internal leaks. If wear is abnormal, locate the cause.
- Restriction in pump suction line.
  - Clean or replace suction line.
  - Dented, obstructed or undersized oil lines.
  - Remove obstructions or replace defective oil lines.
- Ball valve closed.
  - Make sure this valve is fully open.
- Control valve stuck in partially open position.
  - Free spool so it returns to NEUTRAL position.
- Heat not radiating properly.
  - Clean dirt and debris from oil cooler, hydraulic tank, oil lines and all other components.
Make sure oil cooler fans are operating properly. The oil cooler fans should turn on when the oil temperature rises above 120°F. Make sure oil is circulating through oil cooler.

**Oil Foaming**
- **Low oil level.**
  - Fill tank to proper level. Look for leaks.
- **Water in oil.**
  - Drain and replace oil.
  - Wrong kind of oil being used. Drain and refill system with proper oil. See Lubrication Chapter.
- **Air leak in suction line.**
  - Tighten or replace suction line.
- **Kink or dent in oil lines (restricts oil flow).**
  - Replace oil lines.
- **Worn seal around pump shaft.**
  - Clean sealing area and replace seal. Check oil for contamination or pump for misalignment.

**Pump Makes Noise**
- **Low oil level.**
  - Fill tank to proper level. Check system for leaks.
- **Oil viscosity too high.**
  - Drain and refill system with proper oil. See Lubrication Chapter.
- **Pump speed too fast.**
  - Operate pump at recommended speed.
- **Suction line plugged or pinched.**
  - Clean or replace suction line.
- **Ball valve closed.**
  - Make sure this valve is fully open.
- **Sludge and dirt in pump.**
  - Disassemble and inspect pump and lines. Clean hydraulic system. Determine cause of dirt.
- **Tank breather plugged.**
  - Replace breather.
- **Air in oil.**
  - Tighten or replace suction line. Check system for leaks. Replace pump shaft seal.
- **Worn or scored pump bearings or shafts.**
  - Replace worn parts or complete pump if parts are badly worn or scored. Determine cause of scoring.
- **Broken or damaged pump parts.**
  - Repair pump. Look for cause of damage like contamination or too much pressure.
- **Sticking or binding parts.**
  - Repair binding parts. Clean parts and change oil if necessary.

**Pump Leaks Oil**
- **Damaged seal around drive shaft.**
  - Replace seal. Trouble may be caused by contaminated oil. Check oil for abrasives and clean entire hydraulic system. Locate source of contamination. Check the pump drive shaft; misalignment could cause the seal to wear. If shaft is not aligned, check the pump for other damage.
- **Loose or broken pump parts.**
  - Make sure all bolts and fittings are tight. Check gaskets and seals. Examine pump casting for cracks. If pump is cracked, look for a cause like too much pressure or hoses that are attached incorrectly.
Chapter 7: Hydraulic System Troubleshooting

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

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

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

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

Cylinder Drifts or Will Not Hold Load
*Important* See Cylinder Leaks Oil (External).
- Excessively worn or damaged piston seals.
  - Disassemble cylinder and replace faulty parts.
- Counterbalance valve or check valve stuck open.
  - Replace valve.

Cylinder Will Not Extend or Not Retract
*Important* See System Inoperative.
Counterbalance valve or check valve stuck closed.
   - Replace valve.

**Boom Cannot Be Extended or Lowered**

- **Capacity Alert System function lockout.**
  - See Hydraulic Capacity Alert System operating Instructions.
- **ATB Function lockout**
  - See ATB operating instructions.

**Swing Inoperative or Erratic**

*Important*  See System Inoperative or System Operates Erratically.

- **Swing parking brake switch.**
  - Brake not releasing.
  - Check for a collapsed, restricted, or leaking brake release hose. Clean or replace the hose.
*Note*  The brake should fully release at 250 psi.
- **Improper backlash between the swing pinion and the slewing ring gear.**
  - Adjust the backlash between the gears.
- **Damaged slewing ring bearing.**
  - Replace the slewing ring.

**Swing Brake Does Not Hold**

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

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

*Important*  See System Inoperative or System Operates Erratically.
Brake not releasing.
☐ Check for a collapsed, restricted, or leaking pilot line to the brake. Clean or replace the hose.

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

Counterbalance valve not opening.
☐ Check for a collapsed, restricted, or leaking pilot line to the counterbalance valve. Clean or replace the hose.

Winch Will Not Hold Load in Neutral

- Excessive back pressure acting on the brake causing brake to release partially.
  ☐ Back pressure must not exceed 150 psi. Inspect the return lines between the control valve and tank for restrictions.

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

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

Winch Will Not Raise Load

*Important* See System Inoperative.

- Load too heavy.
  ☐ Refer to the Capacity Chart for load limits and applicable reeving diagram.

- Capacity Alert System function lockout.
  ☐ See Hydraulic Capacity Alert System operating Instructions.

- ATB Function lockout
  ☐ See ATB operating instructions.
Chapter 7: Hydraulic System Troubleshooting

Boom Chatters When Extending or Retracting Boom

- Boom sections not lubricated.
  - Lubricate the boom sections as instructed in the Lubrication Chapter.
- Slider pads worn or improperly adjusted.
  - Check the slider pads for wear and proper adjustment.

Boom Does Not Sequence Properly

- Crowd rope system improperly adjusted.
  - Adjust the crowd ropes.