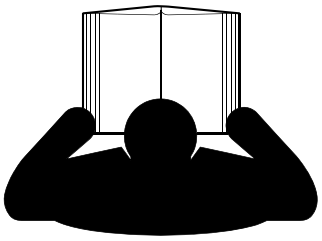
OPERATOR MANUAL

Supplement

Crane Warm-up Procedures



⚠DANGER

An untrained operator subjects himself and others to death or serious injury. Do not operate this crane unless:

- You are trained in the safe operation of this crane. Manitowoc is not responsible for qualifying personnel.
- You read, understand, and follow the safety and operating recommendations contained in the crane manufacturer's manuals and load charts, your employer's work rules, and applicable government regulations.
- You are sure that all safety signs, guards, and other safety features are in place and in proper condition.
- The Operator Manual and Load Chart are in the holder provided on crane.

Published 9-25-2014, Control # 516-02

SECTION CONTENTS

This Supplement provides information regarding the proper warm-up procedures for operating the crane in colder temperatures. The information provided here supplements the *Operator* and *Service Manual*s and must be used in conjunction with these manuals.

CRANE WARM-UP PROCEDURES

The following procedures detail the actions that must be taken to properly warm the different crane components before operating the crane.

NOTE: For temperatures below -9°C (15°F) refer to arctic lubricants and conditions in the Operator and Service Manuals.

Before starting the crane, ensure the appropriate lubricants are used in order to provide lubrication for the prevailing ambient temperatures in which the crane will operate in (a list of lubricants and their temperature ranges can be found in the Lubrication section of your crane's *Operator Manual*, by contacting your local Manitowoc distributor, or by contacting Manitowoc Crane Care directly).

CAUTION

Crane Damage Hazard!

Operating the crane with the incorrect lubricants and fluids for the prevailing ambient temperature and/or failing to adequately warm the crane prior to cold weather operation can lead to a failure of a crane component or system.

Always use Manitowoc recommended lubricants and fluids for the prevailing ambient temperature and properly start and warm the crane using the cold weather procedures found in this Operator Manual and supplement before operating the crane at full load.

Engine

NOTE: For National Crane engine warm-up procedures, refer to chassis manufacturer's manual.

Warm-up Procedures for All Temperature Ranges:

1. Upon startup, allow the engine to idle for 3 to 5 minutes before operating with a load.
2. Cold Engine Startup: After allowing the engine to warm by idling it for 3 to 5 minutes, slowly increase the engine speed to provide adequate lubrication to the bearings and to allow the oil pressure to stabilize.

Transmission

NOTE: For National Crane transmission warm-up procedures, refer to chassis manufacturer's manual.

Operating the transmission with a sump temperature below normal operating temperature is limited to:

- operating in the neutral gear or
- driving with an unloaded crane while not exceeding 1500 engine RPM and not exceeding half throttle.

Warm-up Procedures for Rough Terrain (RT) and Industrial Cranes:

1. Engage the parking brake and apply the service brake.
2. Shift the transmission into the highest gear and increase the engine RPM to 1500 for 15 seconds, then allow the engine RPM to return to idle.
3. Repeat Step 2 until the temperature of the transmission sump reaches normal operating temperature.

Alternate Warm-up Procedures for Rough Terrain (RT) and Industrial Cranes:

1. Setup the crane on outriggers.
2. Engage the transmission with 4-wheel drive selected (if equipped) and allow crane to run at idle until the temperature of the transmission sump reaches normal operating temperature.

NOTE: Warm-up operation of 4-wheel drive transmission engaged in 2-wheel drive only could cause transmission damage.

Alternate Warm-up Procedures for Truck Mount (TM/TMS) Cranes:

1. Setup the crane on outriggers.
2. Engage the transmission and allow crane to run at idle until the temperature of the transmission sump reaches normal operating temperature.

Hoist

Performing a warm-up procedure is recommended at every startup and is required at ambient temperatures below 4°C (40°F).

Warm-up Procedures:

1. Without operating the hoist function, warm the hydraulic oil (see *Hydraulic Oil System*, page 2-2).
2. Once the hydraulic system is warm, operate the unloaded hoist, in both directions, at low speeds several times to prime all hydraulic lines with warm hydraulic oil and to circulate gear lubricant through the planetary gear sets.

Swing Drive and Turntable Bearing

Warm-up Procedures for Temperatures Above -7°C (20°F):

1. Setup the crane on fully extended outriggers, with the boom fully retracted and near maximum lift angle with no load applied.
2. Rotate the superstructure at a speed of less than one RPM for at least one complete revolution in one direction, then rotate the superstructure at a speed of less than one RPM for at least one complete revolution in the opposite direction.

Warm-up Procedures for Temperatures Below -7°C (20°F):

1. Ensure the boom is fully retracted and near maximum lift angle with no load applied.
2. Rotate the superstructure at a speed of less than one-half RPM for at least two complete revolutions in one direction, then rotate the superstructure at a speed of less than one-half RPM for at least two complete revolutions in the opposite direction.

Axles

NOTE: For National Crane axle warm-up procedures, refer to chassis manufacturer's manual.

Warm-up Procedures for Temperatures Below -35°C (-30°F):

1. Setup the crane on outriggers.
2. Engage the transmission (see *Transmission*, page 2-1) with 4-wheel drive selected (if equipped) and allow crane to run at idle until the temperature of the transmission sump reaches normal operating temperature.

NOTE: Warm-up operation of 4-wheel drive transmission engaged in 2-wheel drive only could cause transmission damage.

Hydraulic Oil System

Operating Limits and Warm-up Procedures:

- **From 4°C to -10°C (40°F to 15°F):** Crane operation without a load is allowed with medium engine RPM and medium function speed (joystick position) until the fluid reaches at least 10°C (50°F). It is then recommended that all crane functions be cycled to remove cold fluid from all components and cylinders of the hydraulic system. If there is any unusual sound coming from the crane's hydraulic pumps or motors, stop the operation and engine immediately and contact a Manitowoc distributor.
- **From 10°C to 4°C (50°F to 40°F):** Crane operation with a load is allowed with medium engine RPM and medium function speed (joystick position) until the fluid reaches at least 10°C (50°F).
- **From 95°C to 10°C (200°F to 50°F):** Crane operation with a load is allowed with no restrictions.
- **Above 95°C (200°F):** No crane operation is allowed. Let the crane's hydraulic oil cool by running the engine at idle with no functions actuated.

GROVE

OPERATOR'S MANUAL

This manual has been prepared for and is considered part of -

7755/YB7722

Crane Model Number

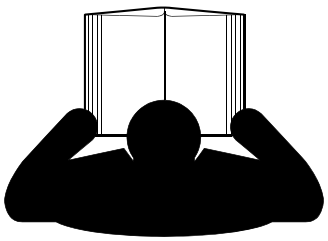
Crane Serial Number

This Manual is divided into the following sections:

NOTICE

The crane serial number is the only method your distributor or the factory has of providing you with correct parts and service information.

The crane serial number is identified on the builder's decal attached to the operator's cab. ***Always furnish crane serial number*** when ordering parts or communicating service problems with your distributor or the factory.



⚠ WARNING

To prevent death or serious injury:

- Avoid unsafe operation and maintenance.
- This crane must be operated and maintained by trained and experienced personnel. Manitowoc is not responsible for qualifying these personnel.
- Do not operate or work on this crane without first reading and understanding Operator's Manual and Rating Plate supplied with crane.
- Store Operator's Manual in holder provided on crane.
- If Operator's Manual or Capacity Charts are missing from cab, contact your Manitowoc distributor for new ones.

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TOC

1

SECTION 1
INTRODUCTION

SECTION CONTENTS

THE MANUAL

This operator's manual provides the information you need to correctly operate and maintain the Yardboss 7722 cranes.

NOTE: Before you operate the crane, carefully read this manual completely, so you will understand the safety instructions and the operation of the controls and safety equipment. You must comply with all **DANGER, WARNING**, and **CAUTION** notices. They are for your benefit.

DIRECTIONAL REFERENCE

All references to the right side, left side, front, and rear are given from the operator's seat looking in a forward direction.

SERIAL NUMBER PLATE

For easy reference, when contacting the dealer/manufacturer about this machine, record the machine's serial number in the space provided below. The serial number is stamped on the serial number plate, which is located behind the operator's seat. See Figure 1-1. Components, such as the pump, transmission, engine, axles, etc., have their own serial number plates that will be found on the housing of the component.

NOTE: The replacement of any part of this product with anything other than a manufacturer's authorized replacement part may adversely affect the performance, durability, or safety of this product and will void the warranty. The manufacturer assumes no liability for unauthorized replacement parts which adversely affect the performance, durability, or safety of this product.

p0294 **FIGURE 1-1**

REPORTS

NOTE: A Delivery Report form must be filled out by the manufacturer's distributor, signed by the purchaser, and returned to the manufacturer once the product is sold and/or put into service. This report activates the warranty period, assuring that your claims during the warranty period will be honored and processed expediently. To guarantee full warranty service, make sure your distributor has returned the report to the manufacturer. An engine warranty form must also be filled out, signed and returned to the engine manufacturer for full warranty coverage.

DISCLAIMER

The manufacturer reserves the right to make improvements in design or changes in specifications at any time without incurring any obligation to install them on units previously sold.

CUSTOMER SUPPORT

Manitowoc and our Dealer Network want to ensure your satisfaction with our products and customer support. Your local dealer is the best equipped and most knowledgeable to assist you for parts, service and warranty issues. They have the facilities, parts, factory trained personnel, and the information to assist you in a timely manner. We request that you first contact them for assistance. If you feel you need factory assistance, please ask the dealer's service management to coordinate the contact on your behalf.

New Owners

If you are the new owner of a Grove crane, please register it with Manitowoc Crane Care so we have the ability to contact you if the need arises.

Go to: http://www.manitowoccranes.com/MCG_CARE/Includes/EN/changeOfOwnership.cfm and complete the form.

SECTION 2
SAFETY INFORMATION

SECTION CONTENTS

2

SAFETY PRACTICES

Your safety and the safety of others in the work area depends upon your knowledge and understanding of all correct operating practices and procedures for this machine

Safety Alert Symbol

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

Signal Words

DANGER

Identifies **hazards** that will result in death or serious injury if the message is ignored.

WARNING

Identifies **hazards** that could result in death or serious injury if the message is ignored.

CAUTION

Identifies **hazards** that could result in minor or moderate injury if the message is ignored.

CAUTION

Without the safety alert symbol, identifies **hazards** that could result in property damage if the message is ignored.

NOTE: Highlights operation or maintenance procedures.

GENERAL

It is impossible to compile a list of safety precautions covering all situations. However, there are basic safety precautions that **MUST** be followed during your daily routine. Safety is **YOUR PRIME RESPONSIBILITY**, since any piece of equipment is only as safe **AS THE PERSON AT THE CONTROLS**.

With this thought in mind, this information has been provided to assist you, the operator, in promoting a safe working atmosphere for yourself and those around you. It is not meant to cover every conceivable circumstance which could arise. It is intended to present basic safety precautions that should be followed in daily operation.

NOTE: The information in this manual does not replace any safety rules and laws used in your area. Before operating this crane, learn the rules and laws in your area. Make sure the machine has the correct equipment according to those rules and laws.

TRAINED OPERATORS

NOTE: This crane should only be operated by personnel who have met the requirements of ASME B30.5 (Latest Revision).

Because you, the operator, are the only part of the crane that can think and reason, your responsibility is not lessened by

the addition of operational aids or warning devices. Indeed, you must guard against acquiring a false sense of security when using them. They are there to assist, **NOT** direct the operation. Operational aids or warning devices can be mechanical, electrical, electronic, or a combination thereof. They are subject to failure or misuse.

You are the only person who can be relied upon to ensure the safety of yourself and those around you. Be a **PROFESSIONAL** and follow the **RULES** of safety.

REMEMBER failure to follow just one safety precaution can cause an accident to people or equipment.

Ensure that you and those working with you are aware of any special dangers when you are operating the crane. Be especially careful of dangerous ground objects, including buildings, near the crane.

CAUTION

DO NOT attempt to operate the crane under the influence of alcohol or drugs. Persons involved in the operation of heavy equipment must possess sound judgement. Persons whose judgement is impaired due to mind altering substances may cause damage to the crane, it's load and yard facilities, as well as themselves. An accident could be fatal.

CAUTION

Operators of all hydraulic cranes must be guided solely by the capacity chart recommendations concerning load, boom length, load radius, and other factors listed on the capacity chart, such as outrigger position and level terrain. See Capacity Chart.

NEW OR ADDITIONAL OPERATORS

At the time of original purchase, the purchaser of this crane was instructed by the seller on its safe and correct use. If this crane is to be used by an employee, or is loaned or rented to someone other than the purchaser, make sure that the new operator reads and understands this Operator's Manual that is provided with the crane, ***before*** operating the crane.

Also, make sure that the operator has completed a walk-around inspection of the crane, is familiar with the decals and safety equipment on the crane, and has demonstrated the correct use of all controls.

PERSONAL CONSIDERATIONS

- Seat Belt

  Always adjust the seat and lock it in position, and fasten the seat belt securely before you start the engine.

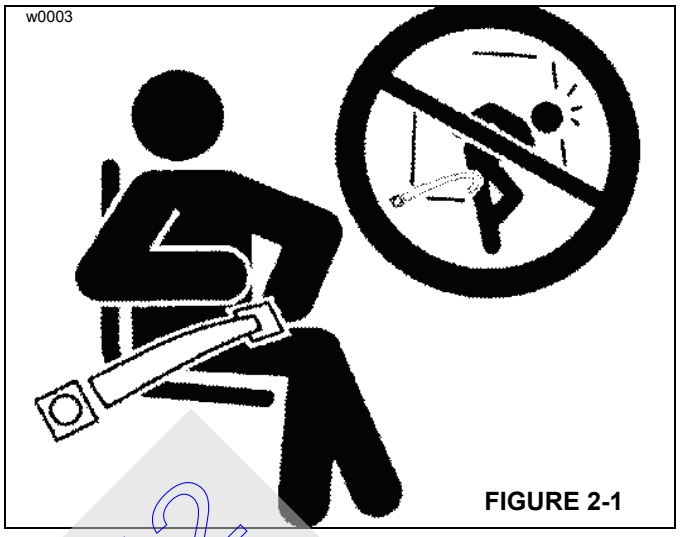

FIGURE 2-1

- Clothing and Gear

  DO NOT wear loose clothing or jewelry that can get caught on controls or moving parts. Wear the protective clothing and personal safety gear issued or called for by the job conditions. Hard hat, safety shoes, ear protectors, reflective clothing, safety goggles, and heavy gloves may be required.

- Mounting/Dismounting

  Use the recommended hand holds and steps with at least three points of support when getting on or off the crane.

  DO NOT get off the crane until you

  - place the travel selector lever in (N) Neutral,
  - engage the parking brake,
  - lower load to ground,
  - lower the boom,
  - turn engine off.

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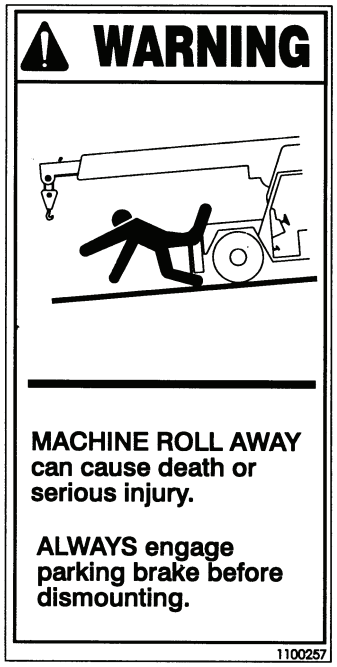

FIGURE 2-2

- **DO NOT** jump off the crane.
- **DO NOT** dismount while the crane is in motion.

• Chemical Hazards

- Exhaust Fumes

  Engine exhaust fumes can cause injury or death. When operating in an enclosed area, provide good ventilation to replace hazardous exhaust fumes with fresh air.

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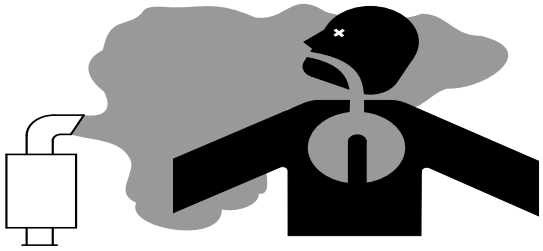

EXHAUST FUMES CAN BE FATAL.
When operating in enclosed areas with a gasoline or diesel engine, provide adequate ventilation.

FIGURE 2-3

CALIFORNIA PROPOSITION 65.

Diesel engine exhaust contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

- Explosive Fuel

  Engine fuel is **flammable** and can cause a fire and/or explosion. Avoid personal injury or death by keeping sparks, open flames, and smoking materials away from the crane and fuel during refueling or fuel system servicing. Know the location of the fire extinguishers on the job site and how to use them.

w0049

FIGURE 2-4

- Hydraulic Fluid
  - **DO NOT** use your hand or any part of your body to check for hydraulic fluid leaks when the engine is running or the hydraulic system is under pressure. Fluid in the hydraulic system is under enough pressure that it can penetrate the skin causing serious injury or death. Use a piece of cardboard, or piece of paper, to search for leaks. Wear gloves to protect your hands from spraying fluid.
  - If anyone is injured by, or if any hydraulic fluid is injected into the skin, obtain medical attention immediately or gangrene may result.
  - **DO NOT** attempt to repair or tighten any hydraulic hose or fitting while the engine is running, or when the hydraulic system is under pressure.
  - **NEVER** disconnect any hydraulic lines unless the boom is fully lowered, the engine is shut off, and the hydraulic pressure is relieved. To relieve hydraulic pressure, stop the engine and move the hydraulic controls in both directions several times.
  - **HOT HYDRAULIC FLUID WILL CAUSE SEVERE BURNS.** Wait for the fluid to cool before disconnecting any hydraulic lines.
  - Hydraulic fluid can cause permanent eye injury. Wear appropriate eye protection.

w0017

FIGURE 2-5

- Battery

The following **WARNING** is intended to supplement and does not replace the warnings and information provided on the battery by the battery manufacturer.

When jump starting the crane, carefully follow instructions found under “Jump Starting.”

Keep sparks, flames, and lit cigarettes away from the battery at all times. Lead acid batteries generate explosive gases. Severe chemical burns can result from improper handling of the battery electrolyte. Wear safety eye glasses and protective clothing to prevent electrolyte from coming in contact with eyes, skin, or clothing. See Section 6 for Battery Electrolyte First Aid.

w0019

FIGURE 2-6

- Radiator

  NEVER remove the radiator cap while the cooling system is hot. The system is under pressure and the coolant can cause severe burns or eye injury. Wear protective clothing and safety glasses. Always turn the cap slowly to the first stop, and allow the pressure to escape before removing the cap completely.

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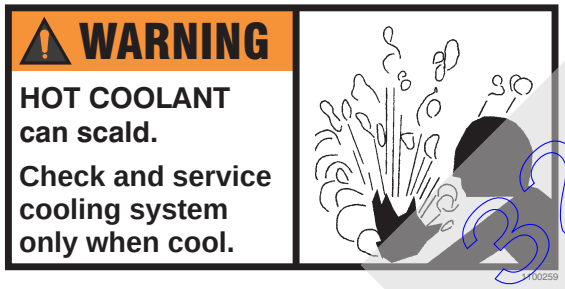

FIGURE 2-7

- Moving Parts

  DO NOT place limbs near moving parts. Amputation of a body part may result. Turn off the engine and wait until the fan and belts stop moving before servicing crane.

  Pinch points which result from relative motion between mechanical parts, are areas of the machine that can cause personal injury or death. **DO NOT** place limbs or your body in contact with pinch points either on or around the machine. Care must be taken to prevent motion between pinch points when performing maintenance and to avoid such areas when movement is possible.

DO NOT allow persons to stand near extending or lowering outriggers. Foot crushing could occur.

w0021

FIGURE 2-8

w0022

FIGURE 2-9

w0023

FIGURE 2-10

- Falling Load and Boom Hazard

  NEVER allow anyone to walk or stand under a raised load. A falling load can kill.

  Before lifting a load be sure it is within capacity of the crane. Overweight loads may fall, causing property damage, personal injury or death.

  DO NOT get under a raised boom unless the boom is blocked up safely. Always block up the boom before doing any servicing that requires the boom to be raised.

  Worn-out, damaged or abused wire rope and sheaves may cause a load to fall.

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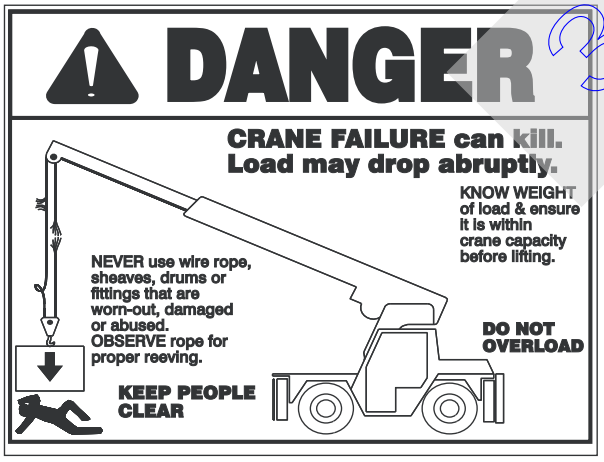

FIGURE 2-11

OPERATIONAL CONSIDERATIONS

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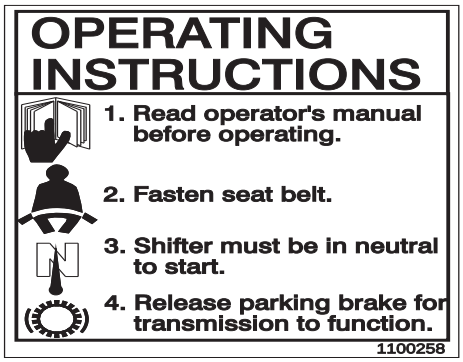

FIGURE 2-12

- Preparation and Prevention

  Know the location and function of all machine controls.

  Make sure all persons are away from the crane and the Travel Select Lever is in the “N” (Neutral) position with the parking brake engaged before starting the engine.

  DO NOT operate the crane unless:

  - all safety equipment is in proper working condition,
  - all covers and shields are in place, and
  - all safety and instructional decals are in place and readable.

  NOTE: Always install new decals whenever the old decals are destroyed, lost, painted over, or illegible. When individual parts are replaced that have decals attached, be sure to install new decals with a new part. Replacement decals are available from your dealer.

- Work Site

  Holes, obstruction, debris, and other work area hazards can cause injury or death. Always walk around and look for these and other hazards before operating the crane in a new work area.

  Prevent accidents when moving the machine around the job site. Know the rules for movement of people and machines on the job site. Follow the instructions of signals and signs. See section 2 for standard hand signals for controlling crane operations.

w0027

FIGURE 2-13

- Clearances

  Always check clearances carefully before driving under electrical lines, bridges, etc. See specifications at rear of manual for unit dimensions and weights.

- Limitations

  Understand the crane's limitations and keep the crane under control.

  This machine is manufactured with no axle suspension system. Traveling at high speeds, especially on rough ground, may create a bouncing affect that can result in loss of control. If bouncing occurs, reduce travel speed.

- Check Controls

  Check brakes, steering and all controls for proper operation. If a malfunction is found, shut down the crane and report the malfunction for resolution.

- Machine Failure

  If a failure that causes loss of control, such as steering, service brakes or engine occurs, stop the crane's motion as quickly as possible and shutdown the engine and crane. Keep the crane securely parked until the malfunction is corrected or the machine can be safely towed. See Towing in Section 3.

- Attachment Points

  Use the approved attachment point when using the crane for towing. If a cable or chain is used, keep people away from the tow line.

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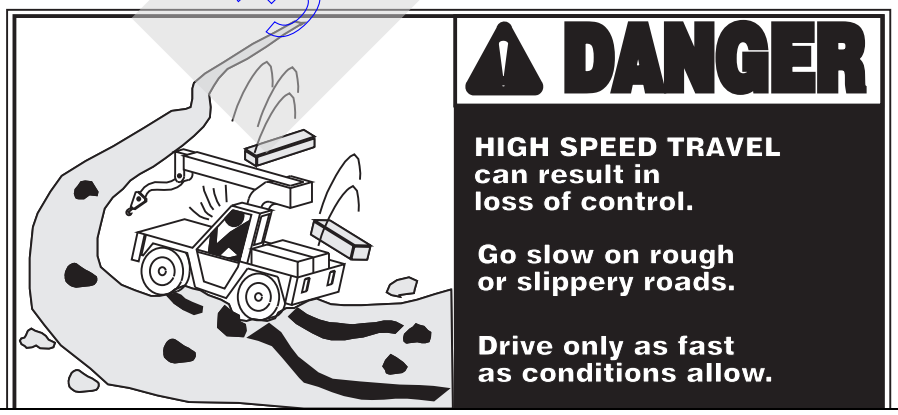

FIGURE 2-14

- Electrocution Hazard

  Never operate this or any equipment in an area in which overhead power lines, overhead or underground cables, or a power source exists without first notifying the appropriate power company or utility company to de-energize the lines.

  Never operate this machine, or any part of the load, closer to any electrical power line or power source than the distance specified or required by Federal, State/ Provincial, local or other applicable safety codes or regulations. In addition, United States OSHA regulations require a flagman when operating in close proximity to energized power lines.

  NEVER operate this machine without first consulting Federal, State/Provincial, local, or other applicable safety codes or regulations.

  It is the employer's responsibility to implement the above precautions and to provide the employees with all safety devices, or means that may be necessary or required for any particular use, operations, setup, or service.

CAUTION

ELECTROCUTION HAZARD. It is not necessary to come in contact with a power line for electrical energy to ground through the machine. If electricity does ground through the machine, remain in the cab. **DO NOT ALLOW ANYONE TO TOUCH THE MACHINE STRUCTURE**; injury or death could occur.

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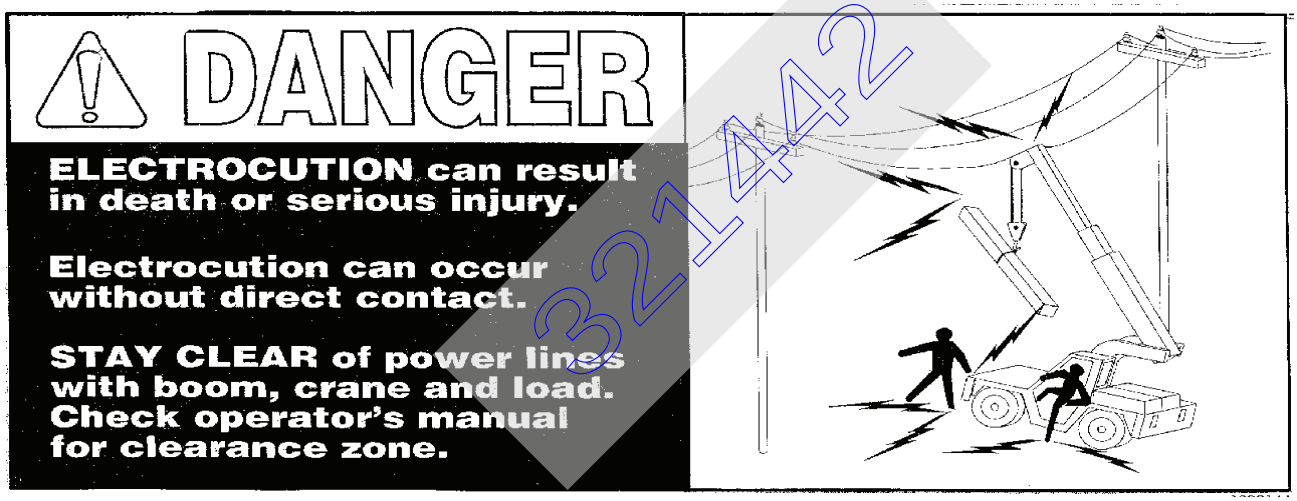

FIGURE 2-15

Table 2-1
Electrical Conductor Clearance Chart

Conductor Voltages	Minimum Vertical Clearance From Conductors	Minimum Lateral Clearance From Conductors	Clearance From Insulation Covered Conductors
50,000 V or less	10' (3.1 m)	10' (3.1 m)	4' (1.3 m)
Over 50,000 V up to and including 345,000 V	10' (3.1 m) plus 0.4" (10.22 mm) for each 1,000 V over 50,000 V	10' (3.1 m) plus 0.4" (10.22 mm) for each 1,000 V over 50,000 V	10' (3.1 m)
Over 345,000 V up to and including 750,000 V			16' (4.9 m)

- Carrying Personnel

  Never allow persons to ride on the crane. Serious injury or death can occur if this rule is not obeyed. Riders can fall and be crushed, or run over. Avoid accidents.

w0065

FIGURE 2-16

- Tip Over Hazard

  DO NOT exceed the rated lift capacity of the crane, as structural damage and unstable machine conditions will result.

  If proper operating procedures are not followed, this crane could tip over. If a machine ever becomes unstable and starts to tip over, **BRACE YOURSELF and STAY WITH THE MACHINE. KEEP SEAT BELT FASTENED. HOLD ON FIRMLY and LEAN AWAY FROM THE POINT OF IMPACT**. Indecision and trying to escape from a tipping machine can result in death or injury.

  Traveling with a suspended load and the boom raised is dangerous and can cause tip over. Keep the load as low as possible or place the load on the crane's deck. Travel with ***extreme caution*** and at the slowest possible speed.

  DO NOT side-pull with the boom, either by traveling with the crane in forward or reverse motion, or by means of the hydraulic swing control or cable control, while the unit is in a fixed position.

  Keep the machine under control at all times. Avoid jerky turns, starts, or stops. Reduce operating speed on rough ground and slopes.

  Use extreme caution when accelerating or decelerating on slippery or unstable surfaces. Vehicles equipped with traction differentials are inherently more sensitive to side slip.

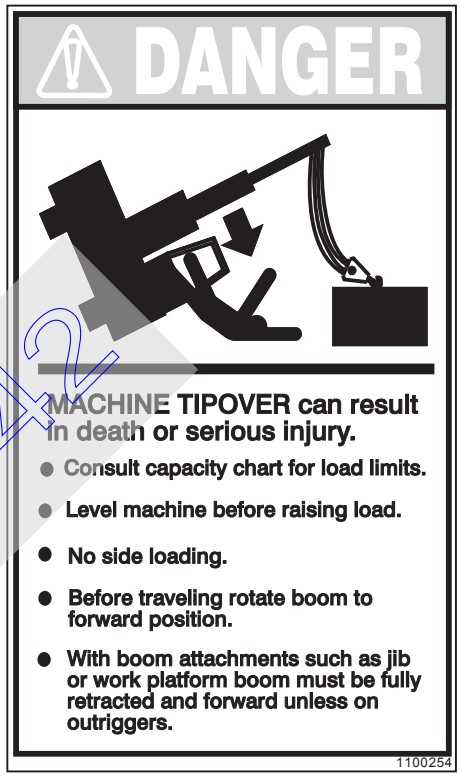

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FIGURE 2-17

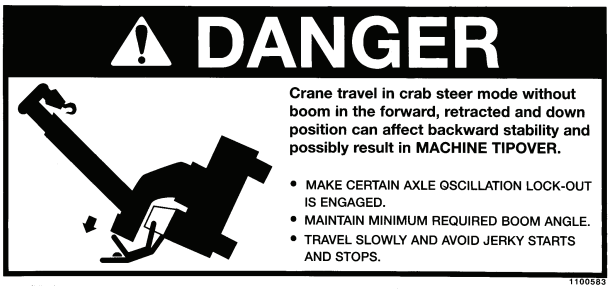

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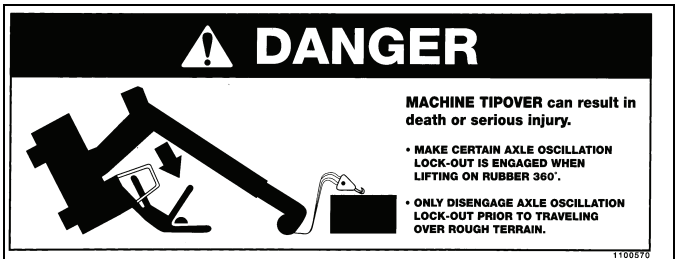
FIGURE 2-18



w0054 **FIGURE 2-19**

- Slopes

  DO NOT park the crane on an incline and leave it unattended.

  Driving across a slope is dangerous, as unexpected changes in slope can cause tip over. Ascend or descend slopes ***slowly*** and with ***caution***.

  Ascend or descend slopes with the boom and load pointing up the slope.

  When operating on a downhill slope, reduce travel speed and downshift to a low gear to permit compression braking by the engine and aid the application of the service brakes.

- Falling Load Hazard

  DO NOT downshift at a high ground speed. You may drop the load off the deck due to a sudden slowing.

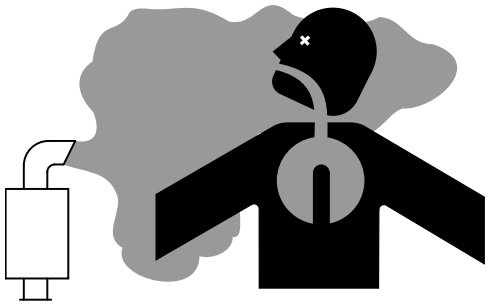
- Visual Obstructions

  Dust, smoke, fog, etc. can decrease vision and cause an accident. Always stop or slow the crane until the obstruction clears, and the work area is visible again.

- Ventilation

  Sparks from the electrical and engine exhaust can cause an explosion. DO NOT operate this crane in an area with flammable dust or vapors, unless good ventilation has removed the hazard.

  Carbon monoxide fumes from the engine exhaust can also cause suffocation in an enclosed area. Good ventilation is very important when operating the crane.



EXHAUST FUMES CAN BE FATAL.
When operating in enclosed areas with a gasoline or diesel engine, provide adequate ventilation.

w0002 **FIGURE 2-20**

EQUIPMENT CONSIDERATIONS

DO NOT modify, alter or permit anyone to modify or alter the crane or any of its components.

SAFETY DECALS

There are a number of specific safety decals installed on the machine. The location of each is reviewed here. Study and remember the locations of all safety messages.

All safety decals should be kept clean and readable. Clean decals with a mild detergent and water only. Never use a solvent to clean decals. Damage to the decal will result.

For your own safety and the safety of others, it is your responsibility to replace any missing, damaged or otherwise unreadable caution decals. If a component with a decal is replaced, be sure a new decal is installed.

Warning Decals on Mast (Both Sides)

P0513

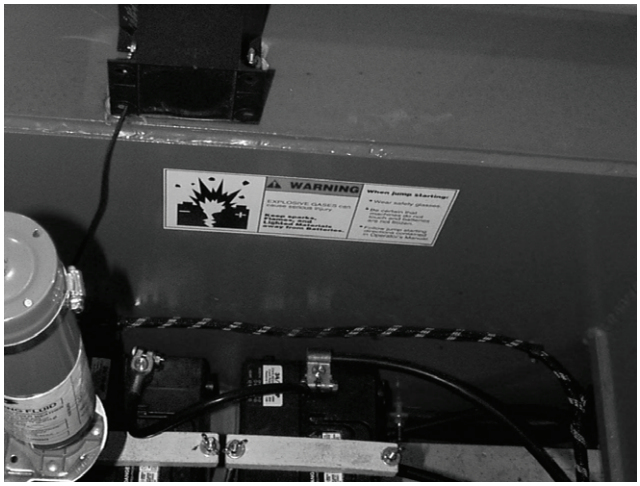
Warning Decals in the Cab

P0512

Warning Decals for Outriggers (Four Places)

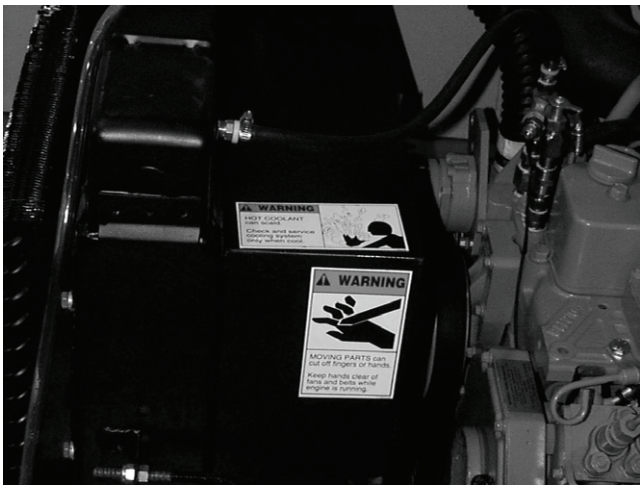
P0514

Warning Decal Near Battery



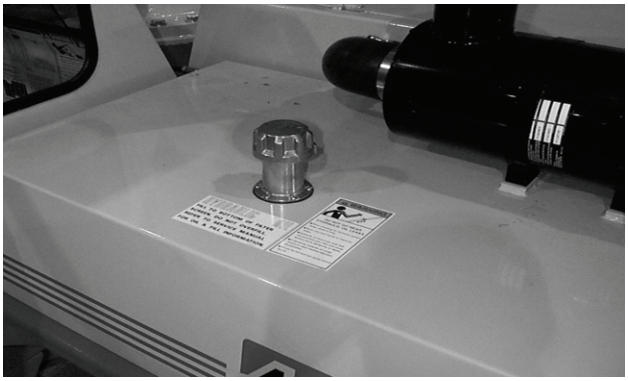
P0515

Warning Decals in Engine Compartment



P0516

Warning Decal on Hydraulic Oil Tank



P0530

Warning Decal Near Fuel Tank

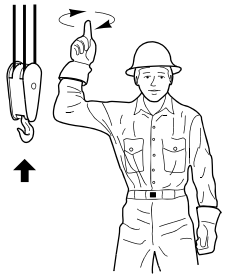
P0517

Warning Decal Near Seat

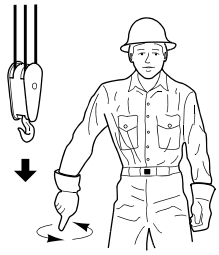
P0518

STANDARD HAND SIGNALS

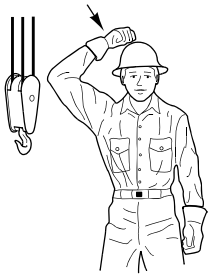
The following standard hand signals comply with ASME B30.5a-2002



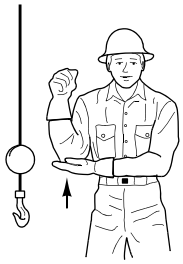
HOIST. With forearm vertical, forefinger pointing up, move hand in small horizontal circle.



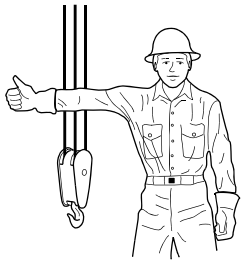
LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circles.



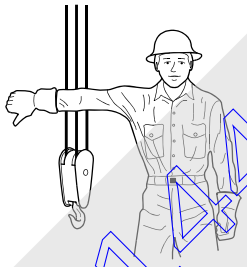
USE MAIN HOIST. Tap fist on head; then use regular signals.



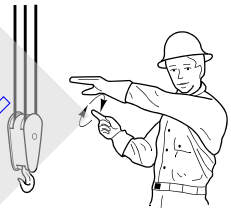
USE WHIPLINE. (Auxiliary Hoist.) Tap elbow with one hand; then use regular signals.



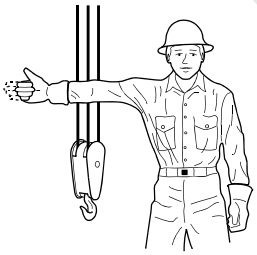
RAISE BOOM. Arm extended, finger closed, thumb pointing upward.



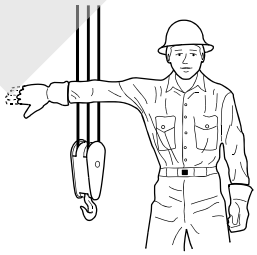
LOWER BOOM. Arm extended, fingers closed, thumb pointing downward.



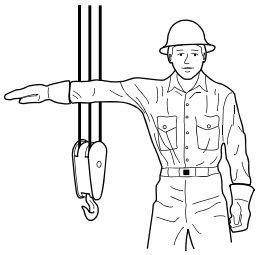
MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as an example.)



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

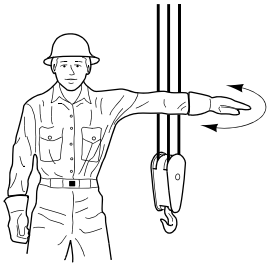


LOWER BOOM & RAISE LOAD. With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.

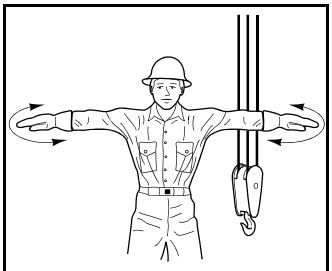


SWING. Arm extended, point with finger in direction of swing of boom.

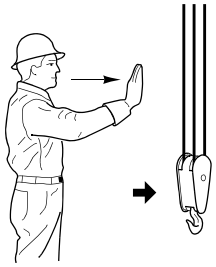
da0108



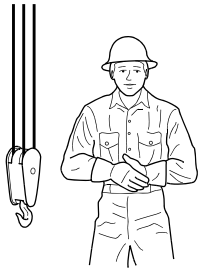
STOP. Arm extended, palm down, move arm back and forth horizontally.



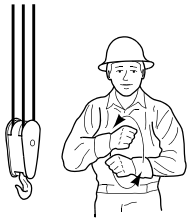
EMERGENCY STOP. Both arms extended, palms down, move arms back and forth horizontally.



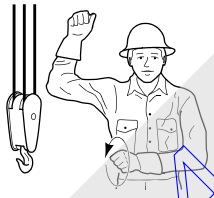
TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.



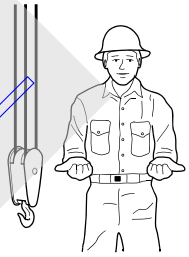
DOG EVERYTHING. Clasp hand in front of body.



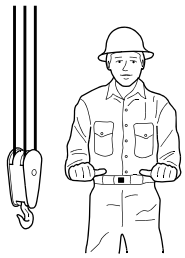
TRAVEL. (Both Tracks.) Use both fists in front of body, making a circular motion about each other, indicating direction of travel; forward or backward.



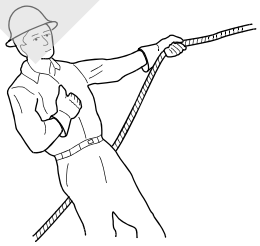
TRAVEL. (One Track.) Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body.



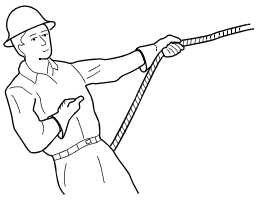
EXTEND BOOM. (Telescoping Booms.) Both fists in front of body with thumbs pointing outward.



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



EXTEND BOOM. (Telescoping Boom.) One Hand Signal. One fist in front of chest with thumb tapping chest.



RETRACT BOOM. (Telescoping Boom.) One hand signal. One fist in front of chest, thumb pointing outward and heel of fist tapping chest.

da0109

WIRE ROPE

Wire Rope Description

A wire rope is a machine, by definition: “An assemblage of parts that transmit forces, motion and energy one to another in some predetermined manner and to some desired end.”

A typical wire rope may contain dozens, even hundred, of individual wires which are formed and fabricated to operate at close bearing tolerances one to another. When a wire rope bends, each of its many wires slide and adjust in the bend to accommodate the differences in length between the inside and the outside of the bend. The sharper the bend, the greater the movement.

Every wire rope has three basic components (Figure 2-21): (1) The wires which form the strands and collectively provide rope strength; (2) the strands, which are laid helical around the core, and (3) the core, which forms a foundation for the strands. The core used in the crane’s wire rope is an Independent Wire Rope Core (IWRC), which is actually a smaller rope, or a strand similar to the outer strands of the rope. The IWRC core adds about 7.5% to the nominal strength of the wire rope.

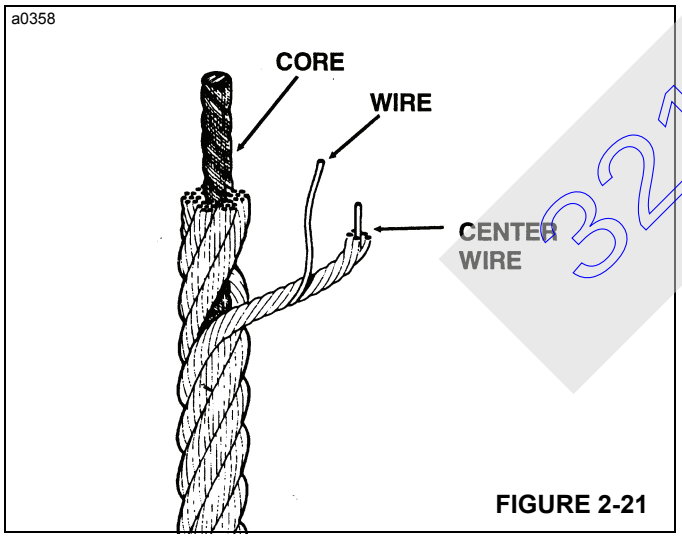


FIGURE 2-21

The greatest differences in wire ropes are found in the strands, which may vary widely in the pattern and number of wires which are laid together.

The wires of the rope may be made of various metals, including steel, iron, stainless steel, monel, and bronze. The materials of which wires are made is the primary determination of rope strength. High-carbon steel is used in the crane’s wire rope.

Carbon steel wire ropes come in various grades. The term “Grade” is used to designate the nominal strength of the wire rope. The most common grades are Traction Steel (TS), Plow Steel (PS), Improved Plow Steel (IPS), Extra Improved Plow Steel (EIPS) and Extra Extra Improved Plow Steel (EEIPS). The wire rope used on the crane is an EIPS Grade.

One cannot determine the grade of wire rope by its feel or appearance. To be sure you are using the proper rope, always obtain the wire rope from your dealer.

Wire Rope Safety

The following information is not a complete discussion of wire rope. What follows is a brief outline of the basic information required to safely use wire rope.

1. Wire rope **WILL FAIL IF WORN-OUT, OVERLOADED, MISUSED, DAMAGED** or **IMPROPERLY MAINTAINED**.
2. In service, wire rope loses strength and work capability. Abuse and misuse increases the rate of loss.
3. The **NOMINAL STRENGTH**, sometimes called **CATALOG** strength, of a wire rope applies **ONLY** to a **NEW, UNUSED** rope.
4. The Nominal Strength of a wire rope **SHOULD BE CONSIDERED** the straight line pull which will **ACTUALLY BREAK** a **NEW UNUSED** rope. The Nominal Strength of a wire rope **SHOULD NEVER BE USED AS ITS WORKING LOAD**.
5. **WIRE ROPES WEAR OUT**. The strength of a wire rope begins to decrease when the rope is put to use and continues to decrease with each use.
6. **NEVER OVERLOAD A WIRE ROPE**. This means **NEVER USE** the wire rope where the load applied to it is greater than the working load determined by the rope manufacturer.
7. **NEVER “SHOCK LOAD”** a wire rope. A sudden application of force or load can cause both visible external and internal damage. There is no practical way to estimate the force applied by shock loading a rope. The sudden release of a load can also damage a wire rope.
8. Lubricant is applied to the wires and strands of a wire rope when it is manufactured. The lubricant is depleted when the rope is in service and should be replaced periodically. See Section 7, Preventive Maintenance, for lubrication intervals.
9. In the **U.S.A.**, regular **INSPECTIONS** of the wire rope and keeping of **PERMANENT RECORDS SIGNED BY A QUALIFIED PERSON ARE REQUIRED BY OSHA FOR ALMOST EVERY WIRE ROPE APPLICATION**. The purpose of the inspection is to determine whether or not a wire rope may continue to be safely used on the application. Inspection criteria, including number and location of broken wires, wear and elongation, have

been established by OSHA, ANSI, ASME and similar organizations. See Section 7 for inspection procedures.

IF IN DOUBT, REPLACE THE ROPE. An inspection should include verification that none of the specified removal criteria for this usage are met by checking for such things as:

- Surface wear; nominal and unusual.
- Broken wires; number and location.
- Reduction in diameter.
- Rope stretch (elongation).
- Integrity of end attachments.
- Evidence of abuse or contact with another object.
- Heat damage.
- Corrosion.

In addition, an inspection should include condition of sheaves, drums and other apparatus with which the wire rope makes contact.

NOTE: A more detailed wire rope inspection procedure is given in Maintenance Section 7.

10. When a wire rope has been removed from service because it is no longer suitable for use, it must not be reused on another application.

11. Every wire rope user should be aware of the fact that each type of fitting attached to a wire rope has a specific efficiency rating which can reduce the working load of the wire rope assembly or rope system, and this must be given due consideration.

12. Some conditions that lead to problems in wire rope systems include:

- Sheaves that are too small, worn or corrugated causes damage to a wire rope.
- Broken wires mean a loss in strength.
- Kinks permanently damage a wire rope and must be avoided.
- Wire ropes are damaged by knots. Wire rope with knots must never be used.
- Environmental factors such as corrosive conditions and heat can damage a wire rope.
- Lack of lubrication can significantly shorten the useful life of a wire rope.
- Contact with electrical wires and resulting arcing will damage a wire rope.

Wind Forces

Wind forces can exert extreme dynamic loads. **Manitowoc Crane Group recommends that a lift not be made if the wind can cause a loss of control in handling the load.** Manitowoc Crane group recommends if the wind speed (velocity) is between 32 km/h (20 mph) to 48 km/h (30 mph), that the load capacities shall be reduced to account for the size and shape of the load and the wind direction in relation to the machine for all boom, boom extension, and jib lengths. Further, operation of the crane in wind velocities over 48 km/h (30 mph) is not recommended. To assist you in determining prevailing wind conditions, a chart has been provided below.

WIND VELOCITY CHART

Wind Force		Wind Velocity km/h (mph)	Visible Indicator Effects of wind as observed on land
Beauford Scale	Designation		
Zero (0)	Calm	<2 (<1)	No wind: smoke rises vertically
1	Light Air	2-5 (1-3)	Wind direction seen by smoke but not by wind vanes
2	Light Breeze	6-11 (4-7)	Wind felt on face: leaves rustle: wind vane moves slightly
3	Gentle Breeze	13-19 (8-12)	Leaves/small twigs in constant motion: wind extends flag
4	Moderate Breeze	21-29 (13-18)	Raises dust & loose paper: moves small branches
Reduce crane load ratings and operating parameters at 32 km/h (20 mph)			
5	Fresh Breeze	31-39 (19-24)	Small trees in leaf begin to sway: on ponds, crested wavelets form
6	Strong Breeze	40-50 (25-31)	Large branches in motion: telegraph wires whistle: umbrellas used with difficulty
Cease all craning operations at 48 km/h (30 mph); lower & retract boom			
7	Moderate Gale	52-61 (32-38)	Whole trees in motion: walking against wind is inconvenient

SECTION 3
OPERATING CONTROLS AND PROCEDURES

SECTION CONTENTS

CONTROLS, SWITCHES, GAUGES

Cab Controls

Swing Control

See Figure 3-1 for the following procedure.

The swing control operates the boom/mast rotation function. The boom and mast will rotate continuously through a full 360° circle.

Telescope Control

See Figure 3-1 for the following procedure.

The telescope control extends and retracts the boom sections.

Hoist Control

See Figure 3-1 for the following procedure.

The hoist control raises and lowers the drop block or hook and ball.

Boom Control

See Figure 3-1 for the following procedure.

The boom control raises or lowers the boom assembly.

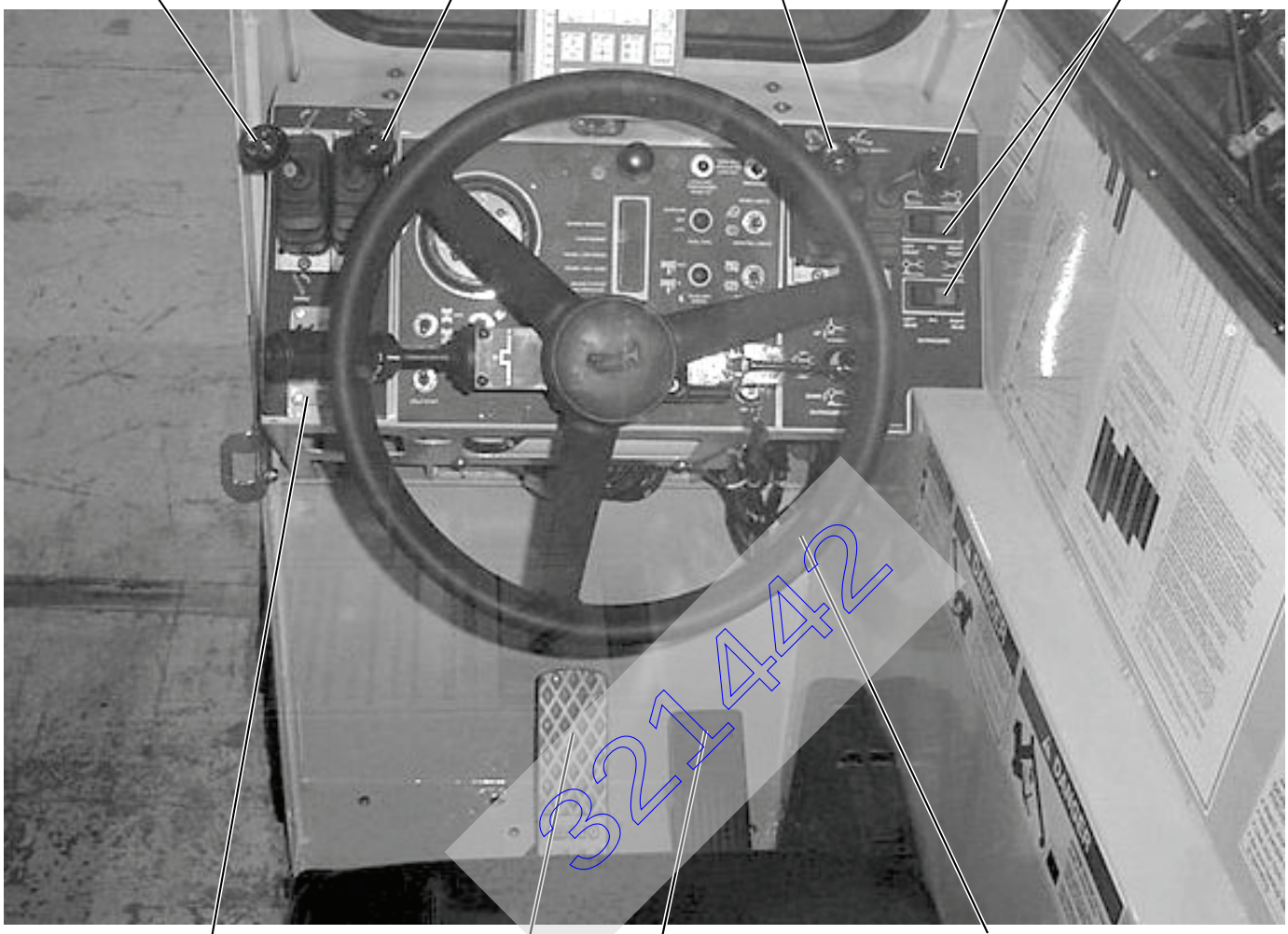


FIGURE 3-1

Outrigger Controls

See Figure 3-1 for the following procedure.

This set of controls extend/retract and lower/raise the outriggers.

Accelerator Pedal

See Figure 3-1 for the following procedure.

Controls the travel speed and hydraulic work function speeds of the crane. Pressing down on the accelerator pedal increases the engine speed. The pedal is spring-loaded to return to idle speed.

The accelerator pedal is also used to switch the engine electronic control module into diagnostic mode. When the diagnostic mode is activated, a sequence of flashing lights on the dash will occur (see engine stop and warning lights later in this section) indicating an engine fault. To activate the diagnostic mode, the accelerator must quickly cycled three times from 0 to 100% in order to define the accelerator pedal as a diagnostic switch. Once in diagnostic mode, cycling the accelerator pedal will sequence forward through the active faults.

Brake Pedal

See Figure 3-1 for the following procedure.

Pressing down on the brake pedal applies the service brakes located in the front and rear axles and slows and stops the crane.

Steering Select Control

See Figure 3-1 for the following procedure.

This control selects the two modes of steering (2-Wheel Steering and 4-Wheel Steering).

Travel Select Lever

See Figure 3-2 for the following procedure.

Selects the forward and reverse travel of the crane, as well as the speed ranges.

Turn Signal And Flasher

See Figure 3-2 for the following procedure.

Used to indicate turning direction. Activates hazard lights.

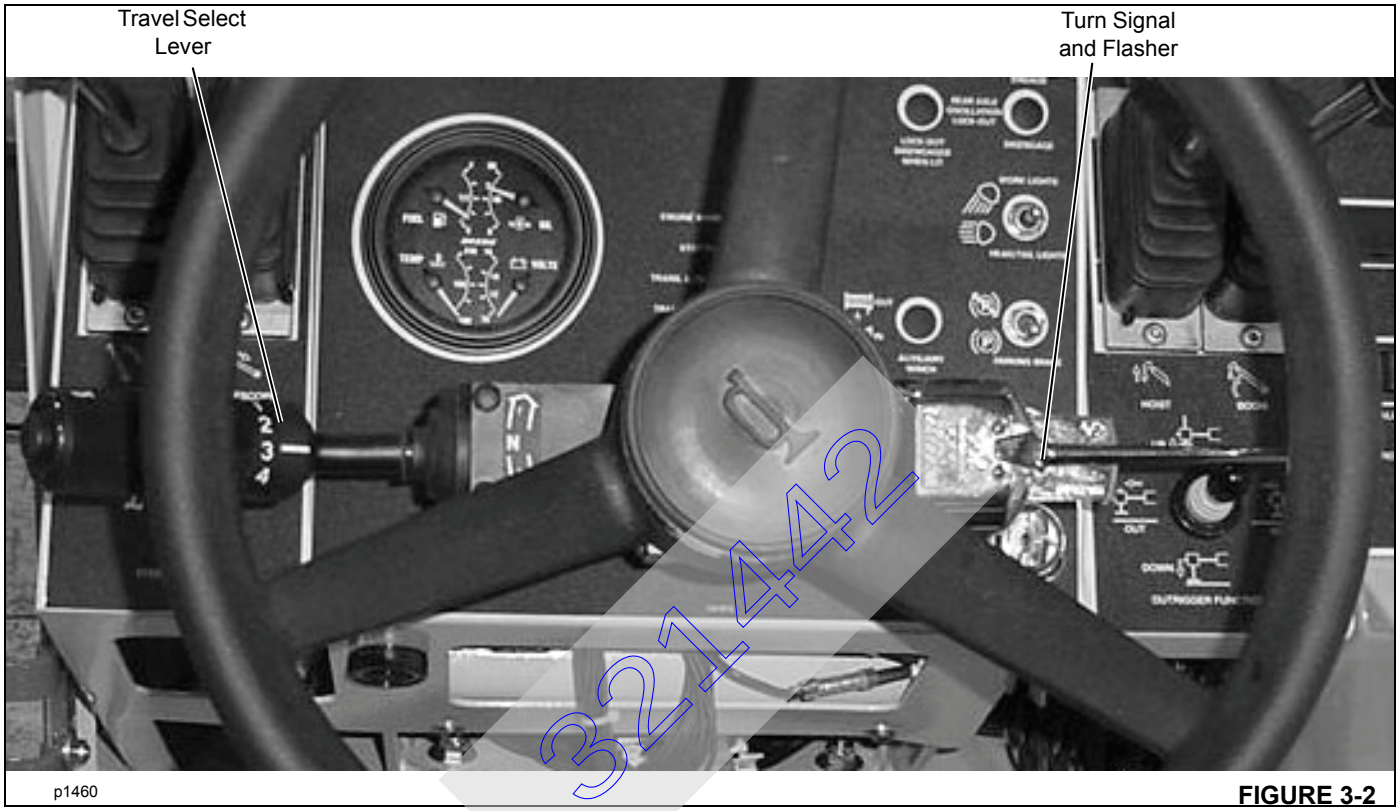


FIGURE 3-2

Gauges And Indicators

Instrument Panel Gauge

See Figure 3-3 for the following procedure.

The instrument panel gauge is four gauges in one. It registers the amount of fuel in the tank (Fuel Gauge), the engine oil pressure (Oil Pressure Gauge), the engine temperature (Temperature Gauge) and the amount of electrical system voltage (Voltmeter).

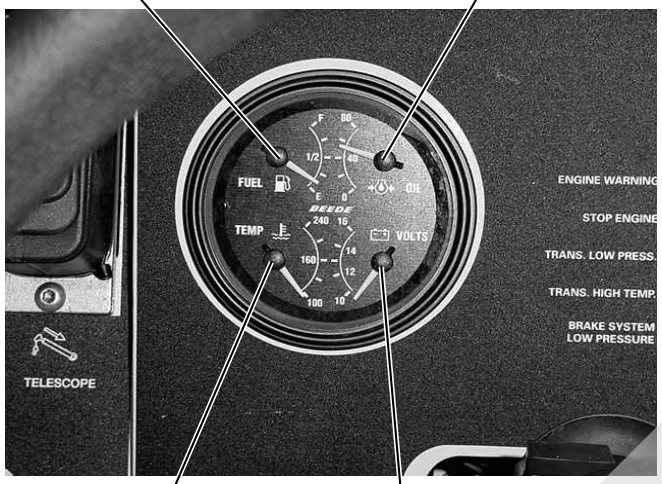


FIGURE 3-3

Normal Operating Pressures
Diesel Engine - 50 - 70 psi *(350 - 480 kPa)*
Gasoline/L.P.G. Engine - 45 psi *(311 kPa)*

Normal Operating Temperature
Diesel Engine - 160° - 190° F *(72° - 88° C)*
Gasoline/L.P.G. Engine - 160° - 190° F *(72° - 88° C)*

Normal Voltage Ranges
Engine above low idle - 14 to 16 volts
Engine stopped - 10 to 14 volts)

A reading of less than 10 volts with the engine stopped or at low idle, indicates a low battery charge.

A reading of less than 14 volts with the engine speed above low idle, indicates a problem in the charging system. The system should be checked by an authorized dealer.

Hourmeter

See Figure 3-4 for the following procedure.

The hourmeter registers the total hours the engine has been operated. Use this gauge to perform preventive maintenance scheduling.

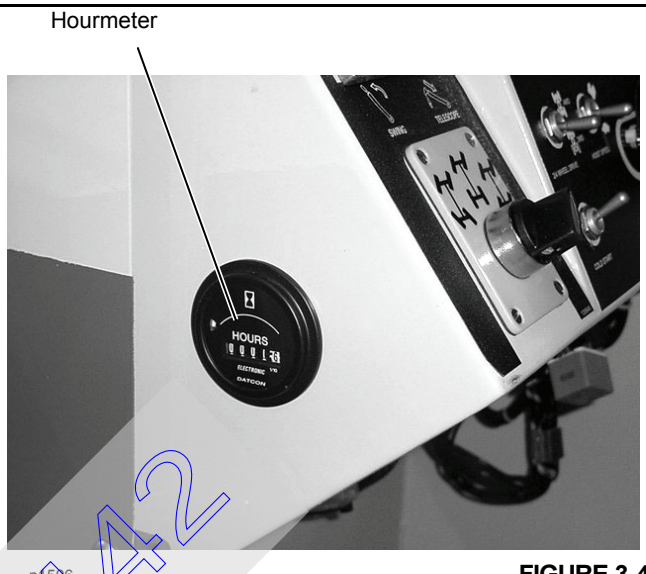


FIGURE 3-4

Crane Level Indicator

See Figure 3-5 for the following procedure.

This is bubble-type indicator, that allows the operator to level the crane when using the outrigger controls.

FIGURE 3-5

Engine Warning and Stop Lights (Diesel Engine Only)

See Figure 3-6 for the following procedure.

The engine warning light is part of a system that monitors engine operating conditions. When an operating condition is outside of calibration limits an engine derate results.

In operation, an engine electronic control module monitors engine operating conditions while the engine is running. If one of the critical operating conditions exceeds the engine protection limit, an engine derate will occur and the warning light will illuminate. The severity of the derate will vary according to which engine operating condition has exceeded its engine protection limit. Also, the severity of the derate may vary in relation to the severity of the event (Example: Coolant temperature is slightly above a threshold for a short period of time will result in a mild derate compared to a coolant temperature over a threshold for a longer time).

If the condition persists, the stop lamp (Figure 3-6) will flash to warn the driver that the engine should be shut down and the problem resolved before starting the engine again.

NOTE: If the engine stop light is illuminated, lower any load and shut off the engine. If the engine is not shut off, damage to the engine could occur. Before starting the engine again locate and resolve the problem.

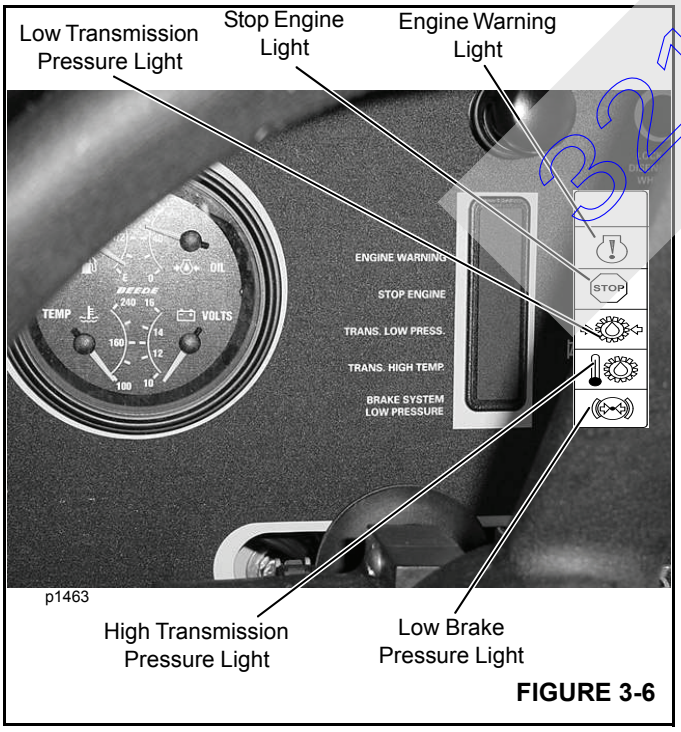


FIGURE 3-6

Flashing Fault Codes

NOTE: The engine stop light and engine warning lights are also used to flash out diagnostic fault codes. They are used in conjunction with the accelerator pedal activated diagnostic switch. See accelerator pedal.

There are three types of fault codes:

- Engine electrical control system fault codes.
- Engine protection system fault codes.
- Engine maintenance indicator fault codes.

To check for active fault codes, turn the ignitions switch to the ON position and then quickly press the accelerator pedal from 0 to 100% three times.

If no active fault codes are recorded, both the warning and stop lamps will stay on.

If active fault codes are recorded, both lamps will come on momentarily, then begin to flash one code of the recorded faults.

The fault code will flash in the following sequence:

First, the WARNING (amber) lamp will flash. There will a short 1- or 2-second pause after which the number of the fault code will flash on the STOP (red) lamp. There will be a 1- or 2-second pause between each number. When the number has finished flashing in red, the amber WARNING will appear again. The fault code will repeat in the same sequence.

The lamps will flash each fault code 3 times before advancing to the next code. To skip to the next code, press the accelerator pedal from 0 to 100% one time.

Fault codes can be found on the laminated QSB Wiring Diagram sheet furnished with this machine. Figure 3-7 depicts the pattern of the flash out scheme for two example fault codes. For example:

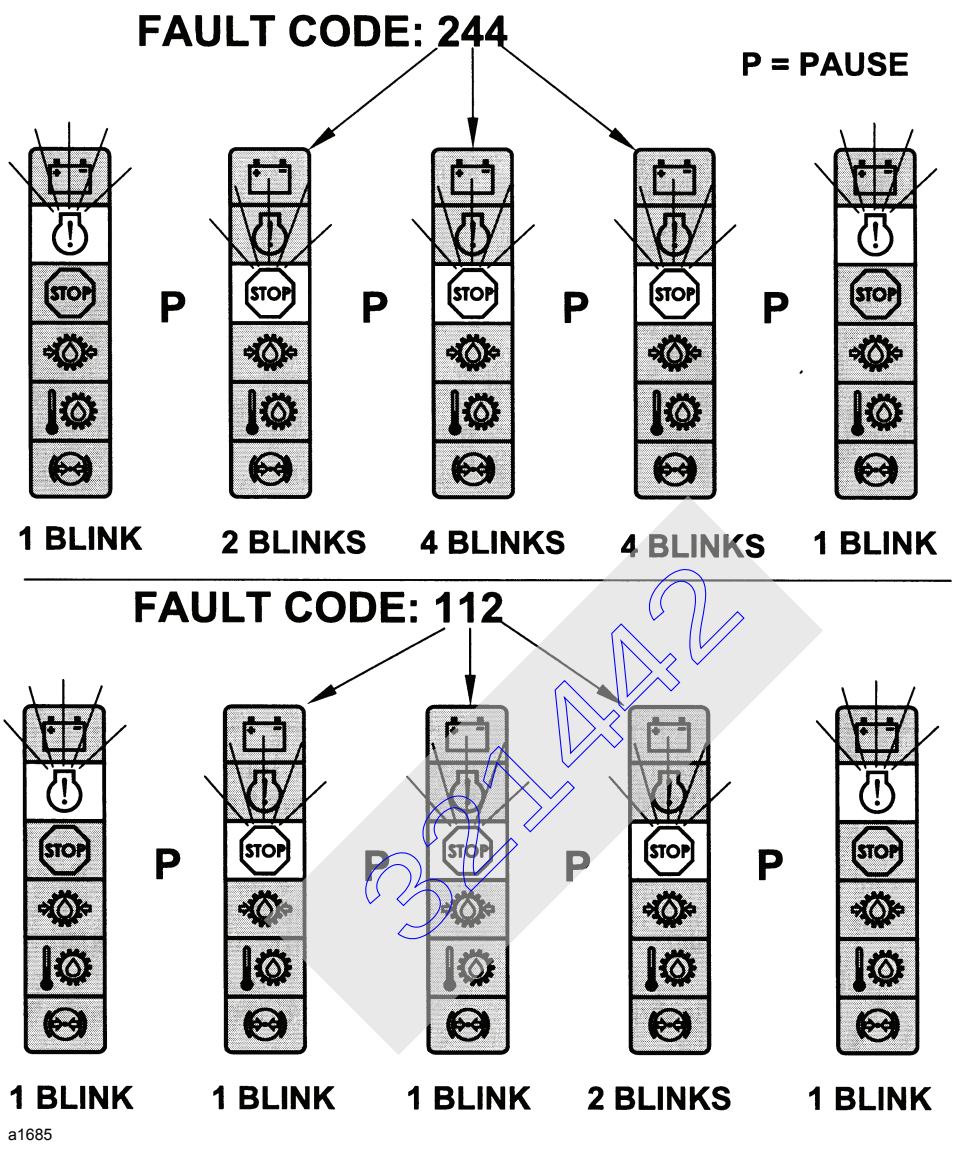


FIGURE 3-7

NOTE: If an engine or transmission warning light illuminates during operation, shut down the engine immediately to inhibit damage to either the engine or the transmission.

Transmission Low Oil Pressure Warning Light

See Figure 3-6 for the following procedure.

When illuminated (Red), this light indicates when the transmission oil pressure is below normal operating pressure. If the light illuminates, shut down the engine immediately and do not restart it until the problem has been repaired.

Transmission Oil High Temperature Warning Light

(See Figure 3-6)

When illuminated (Red), this light indicates when the transmission oil temperature has risen above normal operating temperature. If the light illuminates, shut down the engine immediately and wait until the transmission cools and the warning light goes out. Only then may the engine be started and work continued. If the light illuminates again, shut down the engine and have the transmission inspected and repaired.

IMPORTANT!

NOTE: If an engine or transmission warning light illuminates during operation, shut down the engine immediately to inhibit damage to either

TRANSMISSION LOW OIL PRESSURE WARNING LIGHT

(See Figure 3-6)

When illuminated (Red), this light indicates when the transmission oil pressure is below normal operating pressure. If the light illuminates, shut down the engine immediately and do not restart it until the problem has been corrected.

TRANSMISSION OIL HIGH TEMPERATURE WARNING LIGHT

(See Figure 3-6)

When illuminated (Red), this light indicates when the transmission oil temperature has risen above normal operating temperature. If the light illuminates, shut down the engine immediately and wait until the transmission cools and the warning light goes out. Only then may the engine be started and work continued.

Low Brake Pressure Warning Light

See Figure 3-8 for the following procedure.

WARNING

When the low brake pressure warning light is illuminated, immediately stop and shutdown the crane. DO NOT drive the crane with the warning light illuminated. Brake failure is possible and result could be serious personal injury and property damage.

When illuminated (red), the light indicates that there is a loss in brake pressure. At this point there is still enough pressure to stop the crane. Immediately stop the crane and shut off the engine. Do not drive the crane until the problem has been repaired. The light will illuminate briefly when the brake system charges during operation.

Axle Lockout Warning Light

See Figure 3-8 for the following procedure.

When illuminated (Red), this light indicates when the rear axle lockouts are disengaged. Axle lockout must be **disengaged** whenever the crane is traveling over rough terrain.

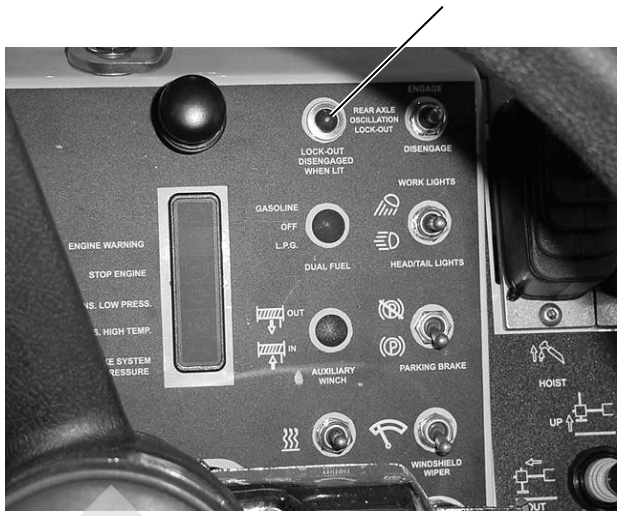


FIGURE 3-8

See Figure 3-9 for the following procedure.

Boom Angle Indicator

The boom angle indicator is a plumb arrow and a decal with angular graduations from 0° to 80°. It is located on both sides of the boom and is visible from the operator's cab. Use the indicator to determine the boom angle when reading the capacity chart. (See Using the Capacity Chart.

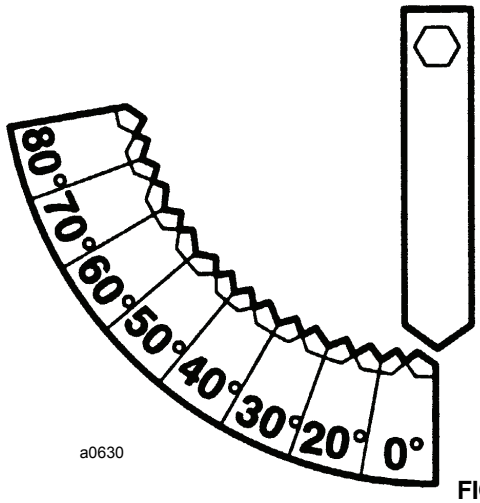


FIGURE 3-9

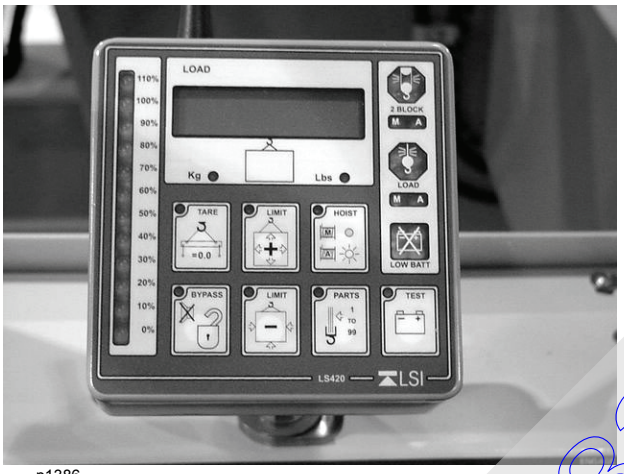
LSI Load Indicator Display Panel

The load indicator panel (Figure 3-10) displays load and capacity related information and warns the operator when a limit is exceeded. The operator is warned by a flashing light on the display panel.

In conjunction with the display panel (receiver), there is a transmitter and load pin attached to the boom head that sends the load information to the display panel.

For operating instructions and battery changing instructions, see the LSI Universal Users Manual supplied with the crane.

See transmitter changeover instructions in Section 5 for moving the transmitter to the down haul block when single part line in used.



p1386

FIGURE 3-10

LSI Rated Capacity Limiter (RCL) - Optional

The rated capacity limiter is similar to the standard Load Indicator, but instead of warning the operator when a load limit is exceeded it stops the telescope out function and the boom raise function when the load limit has been exceed. It uses a similar indicator panel as the Load Indicator (Figure 3-10) and the same transmitter and load pin, but the system also includes boom angle and boom length sensors and transmitters that sends boom angle and length information to the display panel. For operating instructions, see the LSI Universal User Manual furnished with the crane.

Optional Load Moment Indicator Display Panel (Wylie)

See Figure 3-11 for the following procedure.

Provides visual indications of angle, load, radius, capacity, etc. and allows the operator to set limits on these indications.

The display panel includes a digital display screen, LED illuminated bar graph, eight indicator warning lights, audible alarm and an operations key pad.

For operating instructions, see the LMI Operator's Manual furnished with the crane.

p0301

FIGURE 3-11

Panel Switches

Work Light/head Light Switch

See Figure 3-12 for the following procedure.

A three-position switch controls the crane's lights.

Up position illuminates the work lights, head and tail lights, and the instrument panel lights.

Center position turns off all lights.

Down position illuminates the head and tail lights. and the instrument panel lights.

Parking Brake Switch

See Figure 3-12 for the following procedure.

The parking brake switch is used to engage and disengage the parking brake.

To **ENGAGE** the parking brake, move the switch lever down.

To **DISENGAGE** the parking brake, move the switch lever up.

Ignition Switch

See Figure 3-12 for the following procedure.

The key included with this machine is necessary for operation of the ignition switch.

Turn the key clockwise to the first position **(Run)** to energize the electrical system.

Turn the key fully clockwise **(Start)** to engage the engine starting motor to crank the engine when the travel select lever is in the (N) Neutral position. The switch is spring loaded to return from the Start position to the Run position and must be held in place for normal starting.

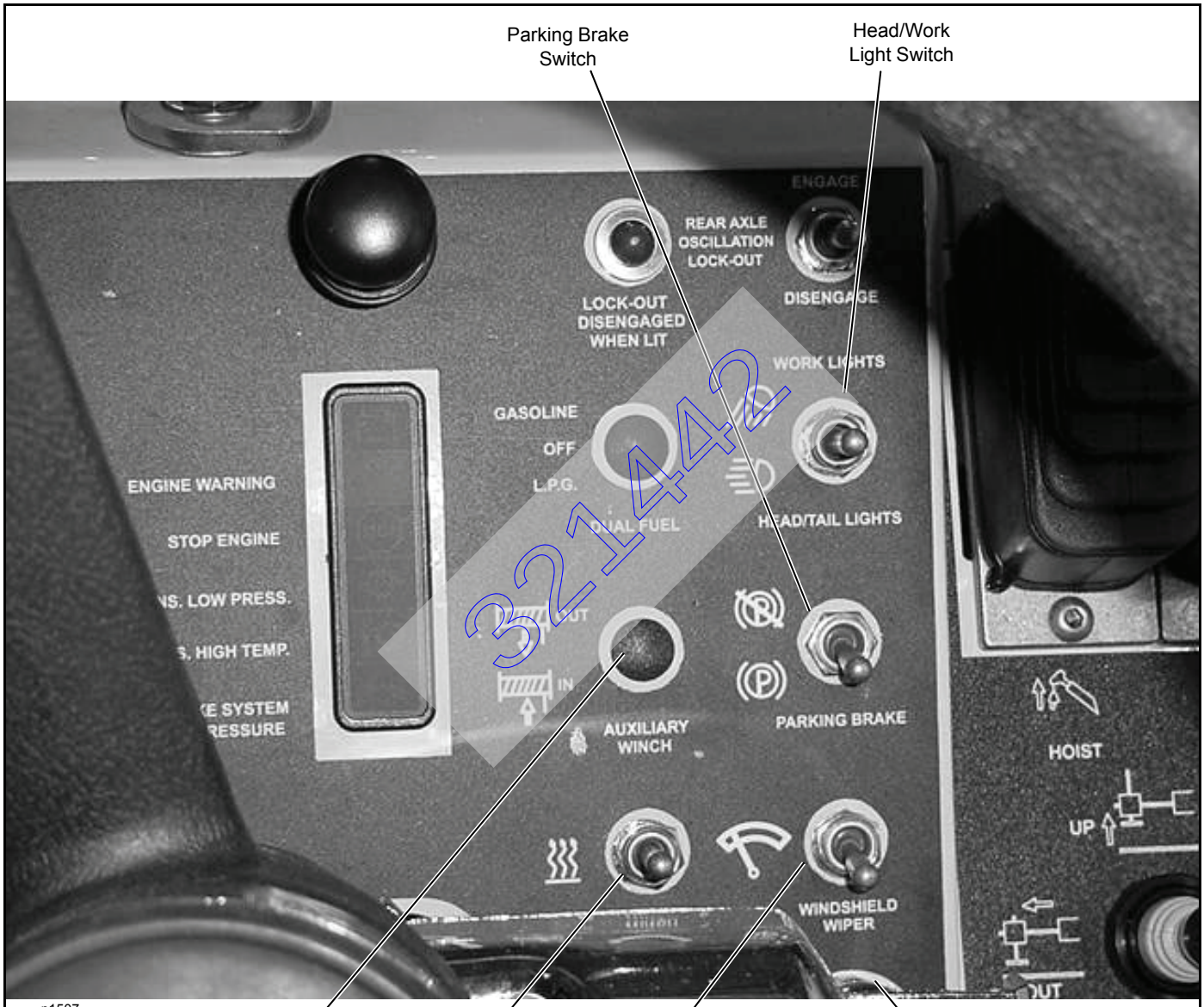


FIGURE 3-12

Hoist Speed Switch

See Figure 3-13 for the following procedure.

This switch is used to increase or decrease the hoist speed.

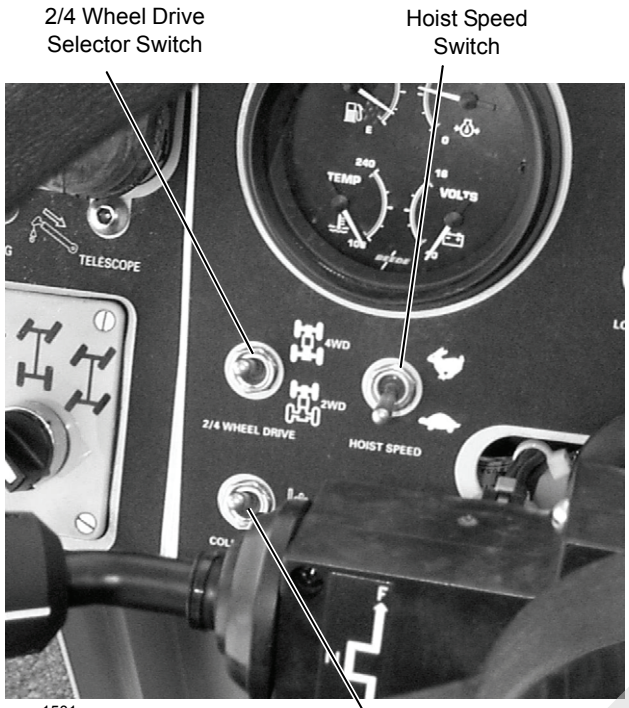


FIGURE 3-13

NOTE: Lift a load only at slower speeds. Faster speeds may result in loss of load control.

The slower speed is primarily used when more control of lifting or lowering a load is required.

The faster speed is used to raise the empty hoist block.

Two-Wheel/Four Wheel Drive Selector Switch

See Figure 3-11 for the following procedure.

This switch is used to select either two-wheel or four wheel drive.

Auxiliary Hoist Switch (Optional)

See Figure 3-12 for the following procedure.

This switch operates the optional hoist attached to the front end of the crane.

To **UNWIND** rope from the hoist, hold the switch lever up.

To **WIND** rope on the hoist, hold the switch lever down.

Windshield Wiper Switch (Optional)

See Figure 3-12 for the following procedure.

Pull the switch lever down to turn on the windshield wiper motor.

Heater/Defroster Switch (Optional)

See Figure 3-12 for the following procedure.

This switch is used simultaneously start both the heater and defroster fans. It is a three-position switch.

The up position is for **LOW** fan speed.

The center position is **OFF.**

The down position is for **HIGH** fan speed.

Cold Start Switch (Optional)

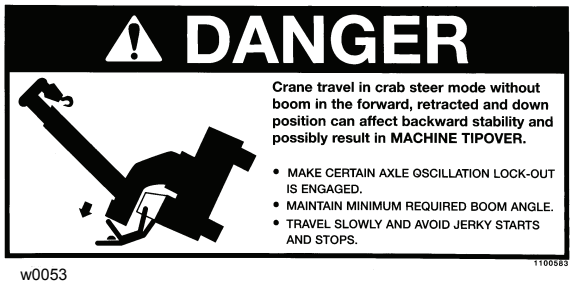
See Figure 3-12 for the following procedure.

The cold start switch (Figure 3-10) is used to actuate a cold start ether cylinder to aid the starting of the diesel engine in cold weather. See Applying Starting Fluid To The Diesel Engine.

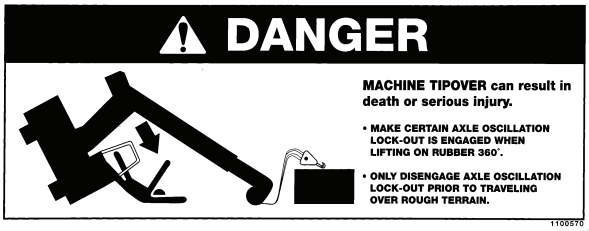
Axle Lockout Switch

See Figure 3-14 for the following procedure.

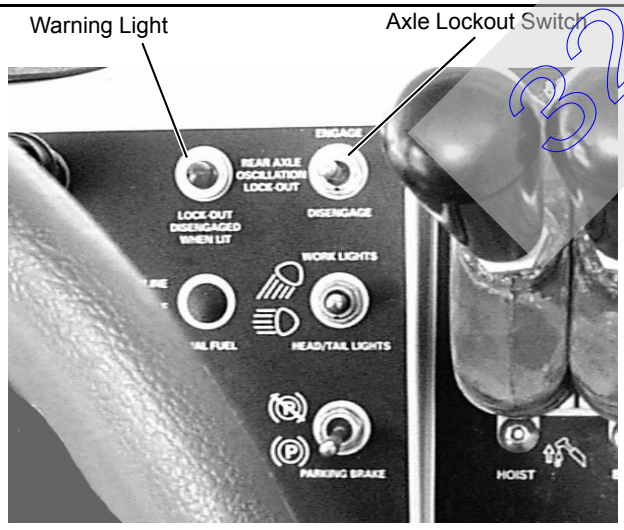
This switch engages and disengages the rear axle lockouts. For normal operation, the axle lockouts should be engaged. Disengage the axle lockouts when traveling over rough terrain.



w0053



w0054



p0473

FIGURE 3-14

This switch engages and disengages the rear axle lockouts. The axle lockout must be engaged when lifting on rubber and when traveling in crab steer. When traveling on rough terrain the axle lockouts must be disengaged.

The down position **DISENGAGES** the axle lockouts. When the axle lockouts are disengaged a red warning light will illuminate (See Figure 3-12).

The up position **ENGAGES** the axle lockouts and turns off the warning light.

Outrigger Controls

w0023

DO NOT allow any persons to stand near extending or lowering outriggers. Foot crushing could occur.

NOTE: For maximum lift and stability, fully extend and lower the outriggers. Be sure the crane is level before lifting a load. The bubble indicator Figure 3-15) located below the outrigger controls is to be used to determine when the crane is level. The bubble must be in the center of the indicator circle. Use the outriggers to level the crane. If this is not possible, reposition the crane until the bubble is centered.

p0262

Bubble Indicator

FIGURE 3-15

Outrigger Switches

Outrigger Select Switches

See Figure 3-16 for the following procedure.

These switches select which outriggers are to extended and lowered. The top switch operates the front outriggers and the bottom switch operates the rear outriggers.

The left position on both switches allows for the operation of only the left outrigger.

The center position on both switches allows for the operation of both the left and right outriggers.

The right position on both switches allows for the operation of only the right outrigger.

p0475

FIGURE 3-16

Outrigger Extend/retract And Lower/Raise Control

See Figure 3-17 for the following procedure.

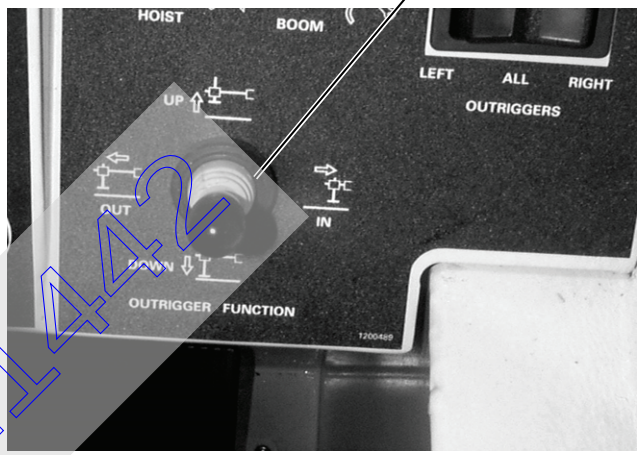
This control is used to extend/retract and lower/raise the outriggers. It is a four-way electrical switch, similar to a Four-way joy stick.

Moving the control handle DOWN, lowers the outriggers.

Moving the control handle UP, raises the outriggers.

Moving the control handle LEFT, extends the outriggers.

Moving the control handle RIGHT, retracts the outriggers.



p0268

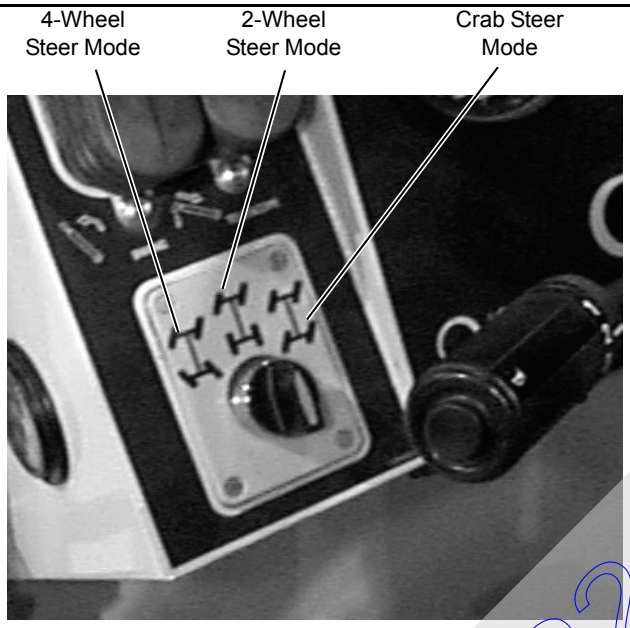
FIGURE 3-17

Steering Controls

The crane can be operated in three steering modes.

- Two-Wheel Steer
- Four-Wheel Steer
- Crab Steer

These modes are selected using the Steering Selector Switch shown in Figure 3-18.

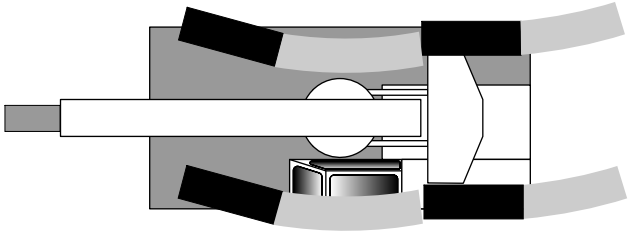


p0269 FIGURE 3-18

Two-Wheel Steer Mode

See Figure 3-19 for the following procedure.

The front wheels steer the crane. The rear wheels remain in the fixed forward position. This mode is used for highway travel and traveling at higher speeds.



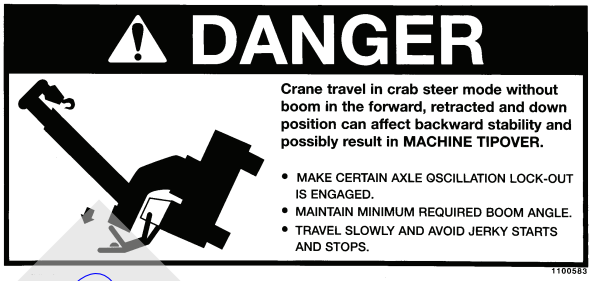
a0610 FIGURE 3-19

Four-Wheel Steer Mode

See Figure 3-20 for the following procedure.

NOTE: **DO NOT** travel at high speed with the crane in the four-wheel steer mode. Possible tipping may occur when turning.

The front wheels steer in the direction that the steering wheel is turned and rears wheels turn in the opposite direction. This mode allows for an extremely short turning radius. It enables the rear wheels to follow the track of the front wheels. This is an advantage in muddy or sandy conditions.



w0053 FIGURE 3-20

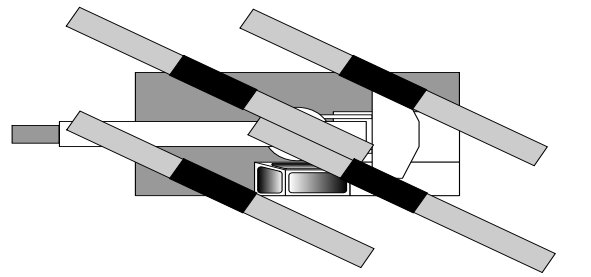
Crab Steer Mode

See Figure 3-21 for the following procedure.

NOTE: Before traveling in crab steer mode, engage the axle lockouts. Possible tipping could occur when turning.

NOTE: **DO NOT** travel at high speed with the crane in the crab steer mode. Possible tipping may occur when turning.

All of the wheels steer in the same direction. This mode permits the operator to move the machine sideways. This feature is especially helpful in tight areas on the job.



a0566 FIGURE 3-21

OPERATOR'S CAB

Heater and Defroster

The cab heater (furnished as an option with enclosed cabs) is located under the operator's seat (Figure 3-22). The windshield defroster vent is located on top of the instrument panel (Figure 3-23).

p0281 **FIGURE 3-22**

p0282 **FIGURE 3-23**

NOTE: Be sure the shut-off valve in the hot water supply line is open. The shut-off valve is located on the engine.

To operate the heater and defroster, use the heater and defroster switch located on the instrument panel. Select the desired fan speed.

Position the heater vent (Figure 3-20) for desired amount of air flow.

Seat Adjustment

Adjust the operator's seat correctly. Full foot pedal control must be obtained with your back firmly against the seat back.

Seat Fore & Aft Adjustment - To adjust the seat, move the control lever (Figure 3-24) to the right. Move the seat to proper position and then move the control lever back to the left to lock the seat position.

p0283 **FIGURE 3-24**

Seat Belt

The operator's seat is equipped with a seat belt. Use this belt at all times when operating the machine.

w0003

Cab Door (Enclosed Cab)

Opening the Cab Door from Outside

Pull the door latch out to release the cab door latch (Figure 3-25).

p0284

FIGURE 3-25

Opening the Door from Inside

Pull the door handle back to release the cab door latch (Figure 3-26).

p0285

FIGURE 3-26

Locking the Cab Door

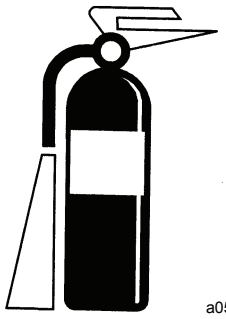
The cab door can be locked from the outside. Insert the key and turn it to the left to lock the door. Turn the key to the right to unlock the door. The door key number is stamped on the lock if additional keys are required.

Fire Extinguisher (Optional)

The fire extinguisher is located in the cab and is attached to the right and rear of the operator's seat (Figure 3-27). Study the manufacturer's instructions printed on the fire extinguisher for its proper use.

p0292

FIGURE 3-27



a0567

If the machine equipped with a fire extinguisher, maintain a charged fire extinguisher AND KNOW HOW TO USE IT.

MACHINE OPERATION

Starting the Engine

Normal Engine Starting

NOTE: Never leave the engine running while the crane is unattended. Shut off the engine to inhibit unauthorized persons from operating the controls.

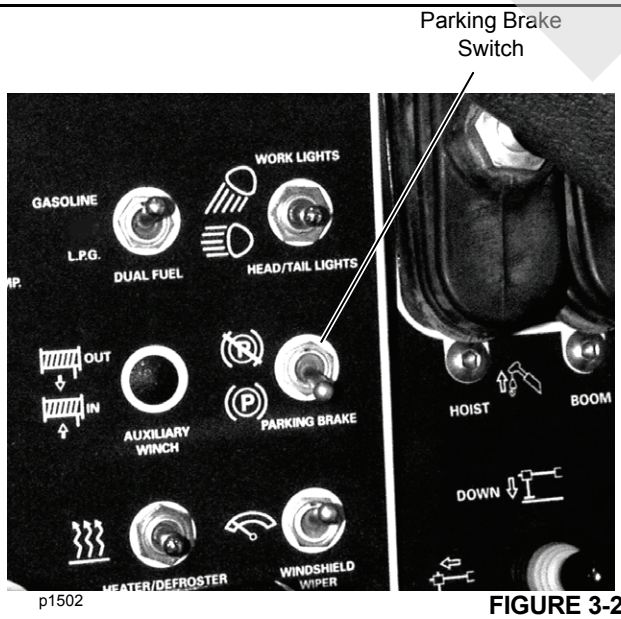
NOTE: Walk around the crane and warn all personnel who may be servicing the machine or are in the machine's path prior to starting. Do not start until all personnel are clearly away from the crane.

1. Enter the cab and adjust the operator's seat for comfortable operation.
2. Fasten the seat belt.

w0003

The operator's seat is equipped with a seat belt. Use this belt at all times when operating the machine.

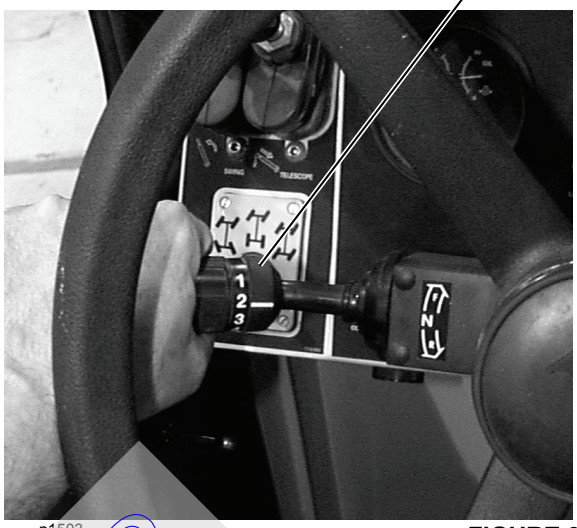
3. Check that the parking brake is engaged (Figure 3-28).



p1502

FIGURE 3-28

4. Place the travel select lever in the neutral position (Figure 3-29).



p1503

FIGURE 3-29

NOTE: Do not bypass the crane's neutral-start system. The neutral start system must be repaired if it malfunctions.

5. Start the engine. Follow the engine starting procedures in this section.

NOTE: If the crane is equipped with shutdown gauges and the engine starts but will not keep on running, check to see if the engine oil low pressure and engine high temperature light warning light is illuminated. If it is, either the engine oil pressure is low or the engine cooling system temperature is high. The engine will not start until the problem is repaired.

6. Check the engine oil pressure gauge for proper operating pressure. If the gauge is not registering the proper oil pressure, shut down the engine immediately. Locate what is causing the low oil pressure and repair it before starting the engine again.
7. Check the brakes, steering and all controls for proper operation. If a malfunction is found, shut down the engine immediately and park the crane until the malfunction is corrected or the crane can be safely towed.
8. Disengage the parking brake before you travel with the crane. See Travel Instructions later in this section

Engine Starting Procedures

NOTE: **DO NOT** crank the starter motor continuously for more than 30 seconds. Damage to the starter motor could occur.

NOTE: Check the engine oil pressure gauge immediately after the engine starts. If the oil pressure does not increase to approximately 10 psi (60 kPa), stop the engine and find the cause.

NOTE: **DO NOT** operate the engine at full RPM or apply a full load until the engine is warm. During cold weather, it may be necessary to run the engine at a higher speed to keep the correct operating temperature.

The diesel engine in this crane is not normally equipped with a metering cold starting aid. However, one is available as an option and is recommended when the crane is to be operated in temperatures below 10° F *(-29° C).*

NOTE: Temperature ranges will vary when using different oil weights.

1. If necessary, apply a starting aid to the engine. See Applying Starting Fluid to the Engine.
2. Depress the accelerator pedal halfway to the floor.
3. Turn the ignition switch to the START position to crank the engine. Release the switch when the engine starts. If the engine fails to start on the first try, wait until the starter motor comes to a complete stop; then again press the accelerator pedal halfway and crank the engine with the ignition key.

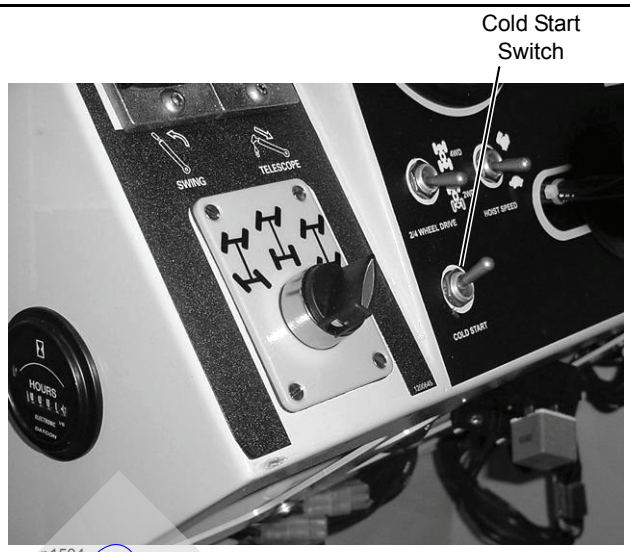
Applying Starting Fluid To The Diesel Engine

Applying Fluid Using A Metered Injection-type Starting Aid (Optional)

An ether injection kit is available as an option for injecting pre-measured amounts of ether into the engine's intake manifold, using a switch in the cab.

1. Push down and then release the cold start switch on the instrument panel (see Figure 3-30) to inject a metered amount of fluid into the engine. Turn the ignition switch to the START position to crank the engine.
2. If the engine does not start after the first injection of starting fluid, repeat step 1 until the engine starts.

NOTE: Avoid injecting too much starting fluid into the engine. Too much fluid will cause engine damage by washing lubricant from the cylinder bores.



p1504

FIGURE 3-30

WARNING

Hazard Table!

w0050

Ether is poisonous. Do not store ether cylinders in the operator's compartment. Breathing ether fumes or repeated contact with skin can cause serious personal injury. Use ether only in well ventilated areas.

WARNING

Hazard Table!

w0051

Do not smoke while changing ether cylinders or where ether cylinders are stored. Keep ether cylinders away from open flames.

WARNING

Hazard Table!

w0052

Discard spend ether cylinders per manufacturer's instructions. Do not puncture or burn. Ether cylinders can burst causing serious personal injury.

Applying Fluid from a Spray Canister

WARNING

Hazard Table!

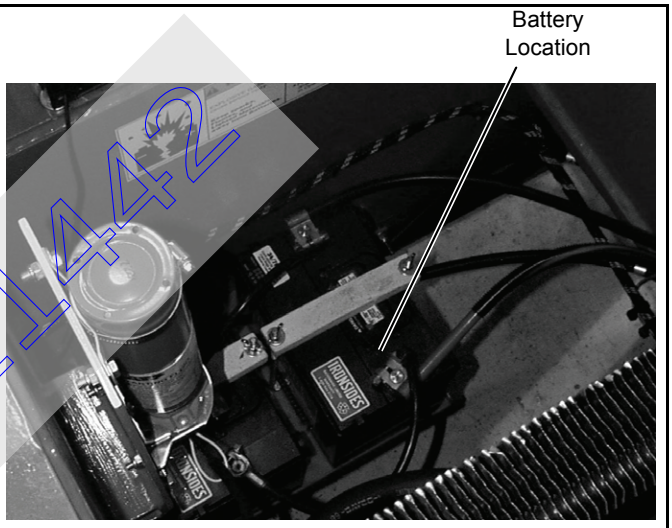
NEVER use starting fluid near an open flame, or with an electric pre-heater, or with flame heating equipment. Serious injury or death could occur from explosion.

DO NOT breathe starting fluid fumes. Serious injury or death could result from the toxic fumes.

DO NOT use excessive amounts of starting fluid. Serious injury or death could result from a backfire of flame, which could ignite the starting fluid canister and cause an explosion.

NOTE: Two people are recommended to be present when attempting to start the engine using a starting fluid without a metered starting fluid system. One is to operate the ignition switch, while the other sprays the starting fluid into the air cleaner intake. Avoid soaking the air cleaner element with fluid. This is extremely important, because a backfire of flame can completely destroy the air cleaner element, as well as cause other damage to the engine and possible personal injury.

1. Remove the intake cover from the air cleaner.
2. Spray a small amount of starting fluid into the intake opening.
3. Start the engine.
4. If the engine does not start, repeat the procedure until the engine starts or it is determined it will not start.



p0519

FIGURE 3-31

NOTE: Avoid injecting too much starting fluid into the engine. Too much fluid will cause engine damage by washing lubricant from the cylinder bores.

Towing or Pushing the Crane to Start the Engine

If the battery is discharged, DO NOT try to start the engine by towing or pushing the crane. Damage to the transmission will occur. Instead use a booster battery to jump start the engine.

Jump Starting the Engine

Follow the recommended jump starting procedure below when using booster batteries to start the engine.

1. Wear eye protection.
2. Engage the parking brake.
3. Place the travel select lever in the Neutral (N) position.
4. Stop all electrical loads (lights, heaters, etc.).

5. Lift the engine compartment cover and locate the battery (Figure 3-31). If the battery has removable fill caps, remove the fill caps being careful not to contaminate the battery fluid. Removing the battery caps reduces the danger of explosion of the battery gases.

NOTE: NEVER jump start the engine directly to the starter or starter solenoid. Serious injury could result from the crane moving forward or back and running over the person performing the jump starting procedure.

6. Disconnect the FIELD connection from the alternator (Figure 3-32). The connection is generally marked with an “F”.

NOTE: If a battery charger is used, disconnect the field connection from the alternator before connecting the battery charger to the battery. Do not install the field connection until the battery charger is removed.

7. If a booster battery is used, it must be a 12 Volt battery. If a vehicle is used, it must have a negative ground electrical system.

8. Connect one end of the positive (+) jumper cable (usually red) to the positive (+) post on the discharged battery. See Figure 3-32.

9. Connect the other end of the positive cable to the positive (+) post on the booster battery.

10. Connect one end of the negative (–) jumper cable (usually black) to the negative (–) post on the booster battery.

11. Connect the other end of the negative jumper cable to the engine block or a ground point furthest away from the discharged battery.

12. Follow the steps under “Normal Starting.”

13. When the engine starts, remove the jumper cables in reverse order (i.e., negative ground cable first, etc.). If removed, install the battery vent caps and the alternator field connection.

3

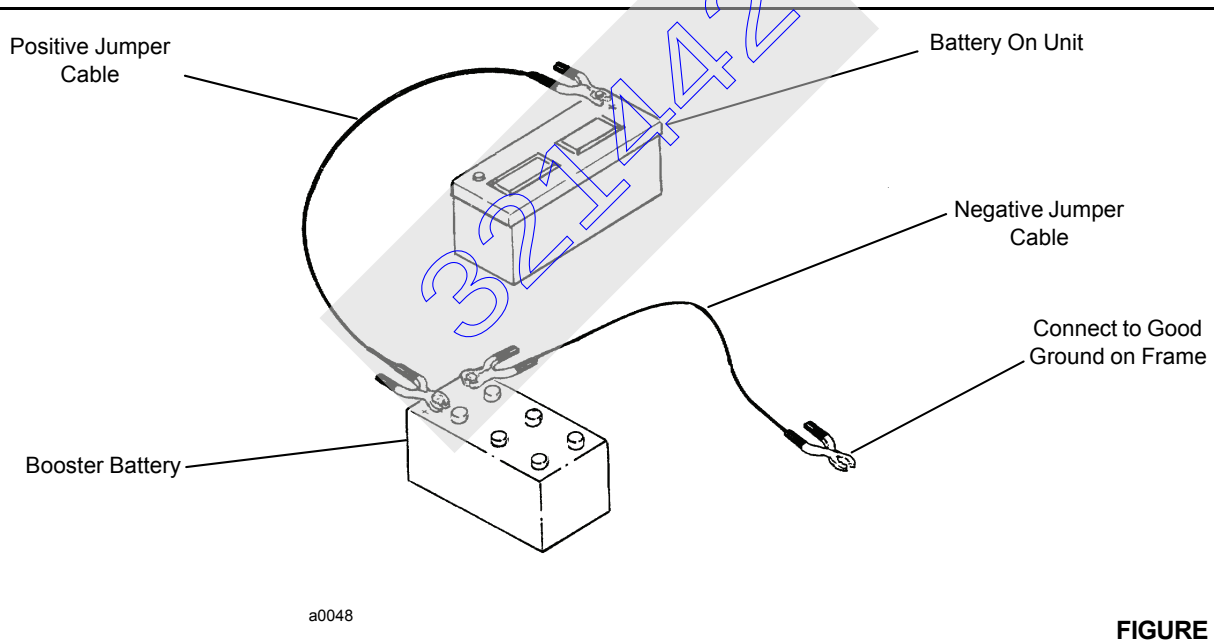


FIGURE 3-32

Traveling with the Crane

w0027

NOTE: If travel sight is restricted, do not attempt to travel with the crane until a signalman gives a signal that the crane is clear of obstacles in the wheel path. Remove any obstacles from the wheel path before moving.

NOTE: To help inhibit accidents, use a "Slow Moving Vehicle Sign and a flashing strobe light (where legal) for traveling on highways or public roads.

w0003

The operator's seat is equipped with a seat belt. Use this belt at all times when operating the machine.

1. Enter the operator's cab, close the door, if equipped, and fasten the seat belt.
2. Start the engine and disengage the parking brake.

NOTE: To avoid damage to the parking brake and crane, do not apply the parking brake while traveling.

3. Select either the Forward (F) or Reverse (R) travel position on the travel select lever. (See Figure 3-33).

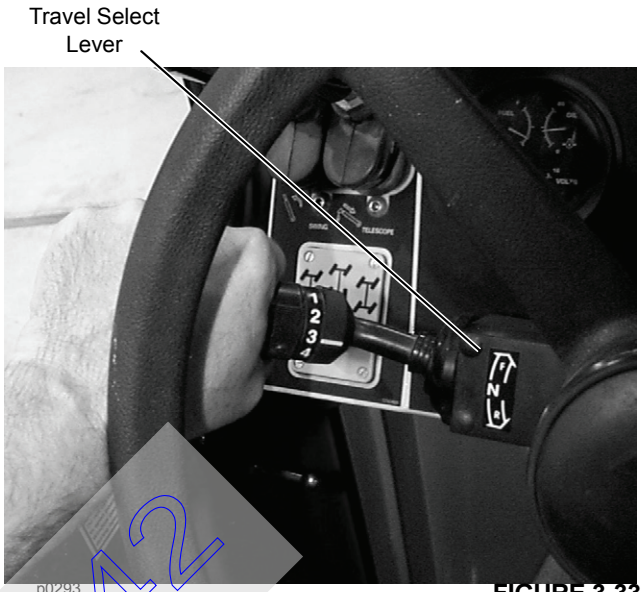


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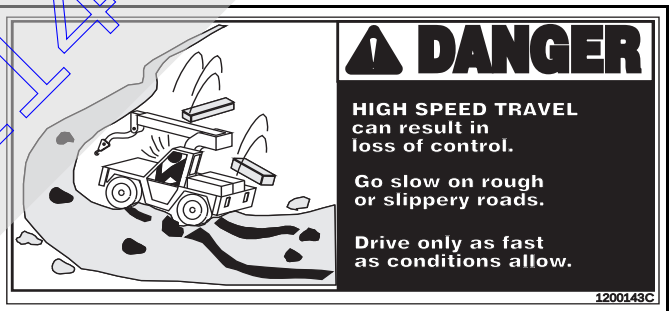
FIGURE 3-33



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- The crane has no axle suspension. Traveling at high speeds, especially on rough roads, can create a bouncing effect that can result in loss of control. Personal injury, death and property damage could result. Reduce speed if bouncing occurs.

4. Start out traveling from a stopped position in 1st speed. Travel speed may be shifted from 1st to 2nd, 2nd to 3rd, 3rd to 4th (Figure 3-34) when the crane is moving. See Shifting Gears, in the next column. Avoid operating at too high of speed when moving a heavy load, as this may cause "lugging" on the engine. Use a lower gear when moving a heavy load; higher gear when moving a lighter load. SELECTING THE CORRECT TRAVEL SPEED WILL PROLONG ENGINE LIFE.

FIGURE 3-34

NOTE: Check the instrument panel gauges frequently during operation. Any abnormal readings should be investigated and corrected as soon a possible.

Changing Travel Direction

1. Completely stop the crane travel.

NOTE: Shifting the crane from forward to reverse or reverse to forward when the crane in moving will cause damage to the transmission. Always stop the crane before changing travel directions.

2. Move the travel select lever to the opposite travel direction.

Shifting Gears (Travel Speeds)

NOTE: The transmission used on this crane is not an automatic transmission. It is “Powershift” transmission. The gears and clutches will not shift automatically. Each gear range must be shifted manually.

1. Shifting to the next gear (travel speed) may be done at any engine speed, while the crane is in motion, but first ease up on the accelerator pedal.
2. When downshifting, do not over-rev the engine. Allow the crane to slow down before shifting to the next lower gear.
3. The crane must come to a **complete stop** when shifting between forward and reverse.

NOTE: **DO NOT** attempt to start the engine by pushing or towing with another vehicle. The power train does not allow starting this way, and transmission damage may occur.

NOTE: The following practices could result in transmission failure:

- Shifting between forward and reverse while the engine is at high speed or heavy throttle, such as when the driving wheels are in mud or snow — commonly called rocking.
- Shifting to reverse or forward while operating the engine at high speed in neutral.
- Operating the transmission at or near “stall speed” for more than 10 seconds at a time. “Stall condition” is when the engine runs at high speed while the transmission is in forward or reverse and the drive wheels are not moving. For example, when the wheels are in deep sand or mud, or when the crane is against a fixed barrier.
- Down shifting at high speeds causing the engine to over rev.

Stopping Travel

1. Apply the service brakes and downshift as necessary to slow the crane until it comes to a complete stop.
2. Place the travel select lever in Neutral (N) and engage the parking brake.
3. Turn the ignition switch to the OFF position to stop the engine.
4. If the crane is parked and unattended, remove the ignition key.

Operating the Outrigger Controls

To Extend and Retract the Outriggers

- The most common way of extending and retracting the outriggers is to extend and retract the four outriggers at the same time. Place both selector switches in the center ALL position.

NOTE: Each outrigger may be adjusted independently if required for clearance and leveling problems. See Independent Outrigger Operation.

- **To Extend –** (Figure 3-35) Run the engine at idle speed (accelerator pedal released). Move the joystick control lever to the left and hold it in position. Press the accelerator pedal to increase the engine speed, which will accelerate the outward movement of the outriggers. Release the accelerator pedal and the switch control lever when the outriggers are fully extended.

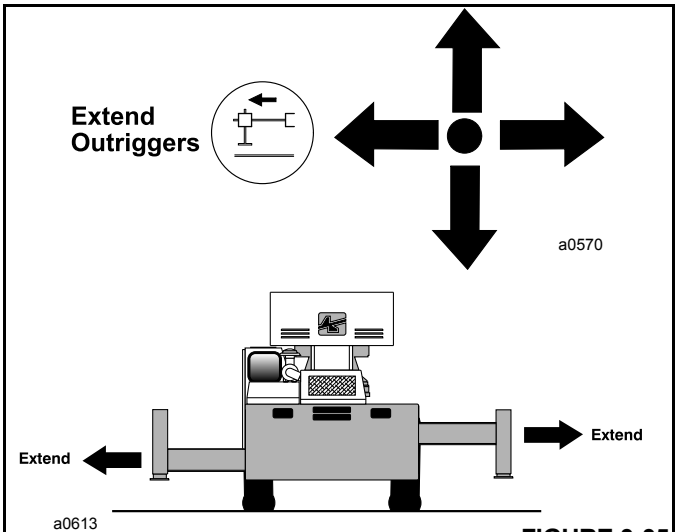
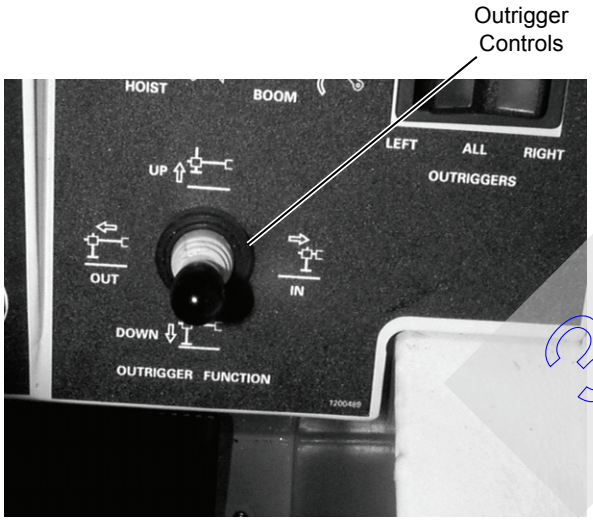


FIGURE 3-35



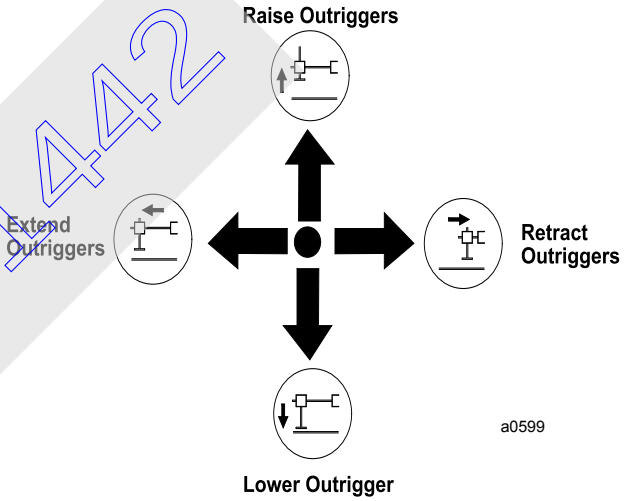


FIGURE 3-36

- **To Lower –** (Figure 3-37) Pull back on the joystick control lever and hold it in position. Press the accelerator pedal to increase the engine speed, which will accelerate the lowering speed of the outriggers. Release the accelerator pedal and the control lever when the outriggers are fully lowered.

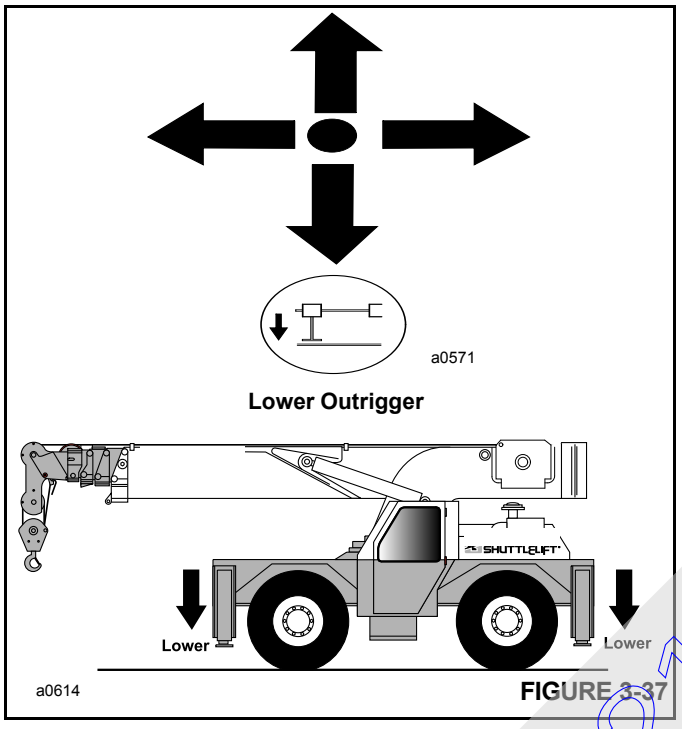


FIGURE 3-37

NOTE: The outriggers can not be extended or retracted when they are in the lowered position. Attempting to do this will cause damage to the outriggers.

To Raise and Retract the Outriggers

- **To Raise -** (Figure 3-38) Run the engine at idle speed. Push forward on the joystick control lever and hold it in position. Press the accelerator pedal to increase the engine speed, which will accelerate the raising of the outriggers. When the outriggers are fully raised, release the accelerator pedal and the control lever.

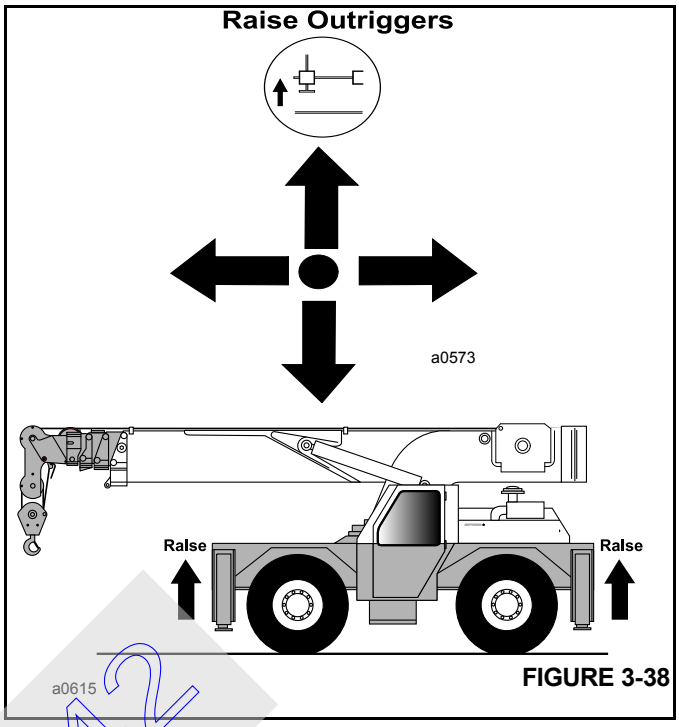


FIGURE 3-38

- **To Retract** - (Figure 3-39) Run the engine at idle speed. Move the joystick control lever to the right and hold it in position. Press the accelerator pedal to increase the engine speed, which will accelerate the retraction of the outriggers. When the outriggers are fully raised, release the accelerator pedal and the control lever.

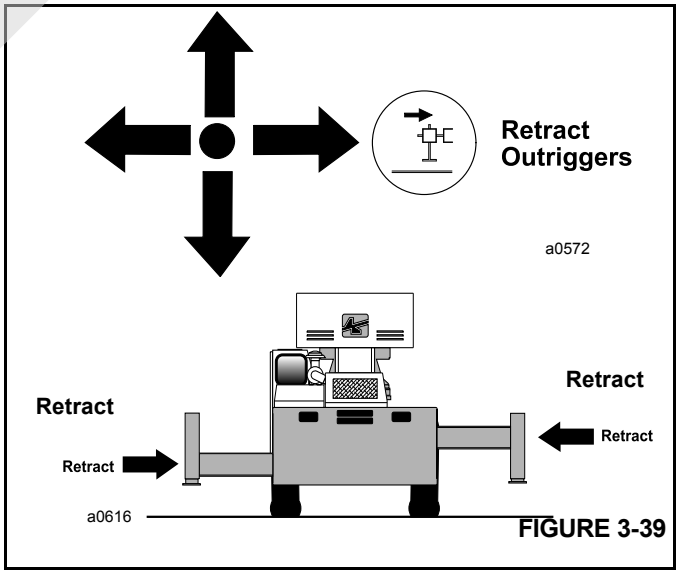


FIGURE 3-39

Independent Outrigger Operation

Each outrigger may be operated independent of the others. This is accomplished by placing the outrigger select switch (Figure 3-40) in position for the outrigger that is to be operated. For example; if the left front outrigger is to be operated independently from the others, place the top select switch in the LEFT FRONT position. When the switch is placed in this position the switch will illuminate, and all other outrigger functions will cease to operate.

To operate the outrigger, move the joystick control lever as indicated previously.

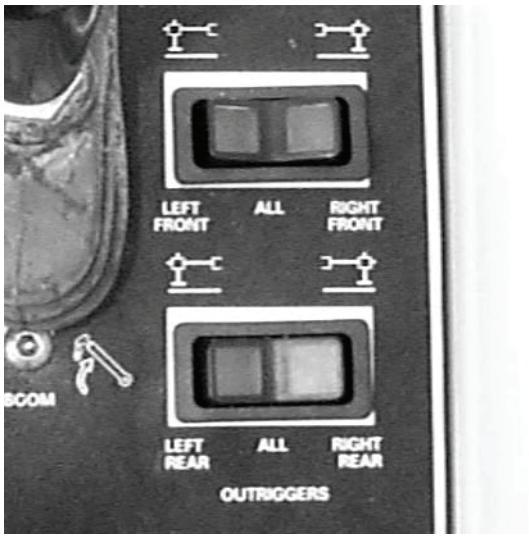


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FIGURE 3-40

Operating the Boom Controls

Four levers in the operator's cab control the crane function. See Figure 3-1. These levers are connected to the main control valves by hydraulic pilot lines. The function of each control is shown in Figure 3-41.

When operating each control, press the accelerator pedal to increase the engine speed to maximum rpm. Slowly move the control lever. The further the control lever is moved the faster the function will operate. To stop function movement, move control lever to the neutral position, then lower the engine speed to idle.

Boom Swing Operation

- Before rotating the mast, be sure there is enough clearance on all sides and that all persons are away from the area. A pinch point between the operator's cab and mast can cause injury or death.

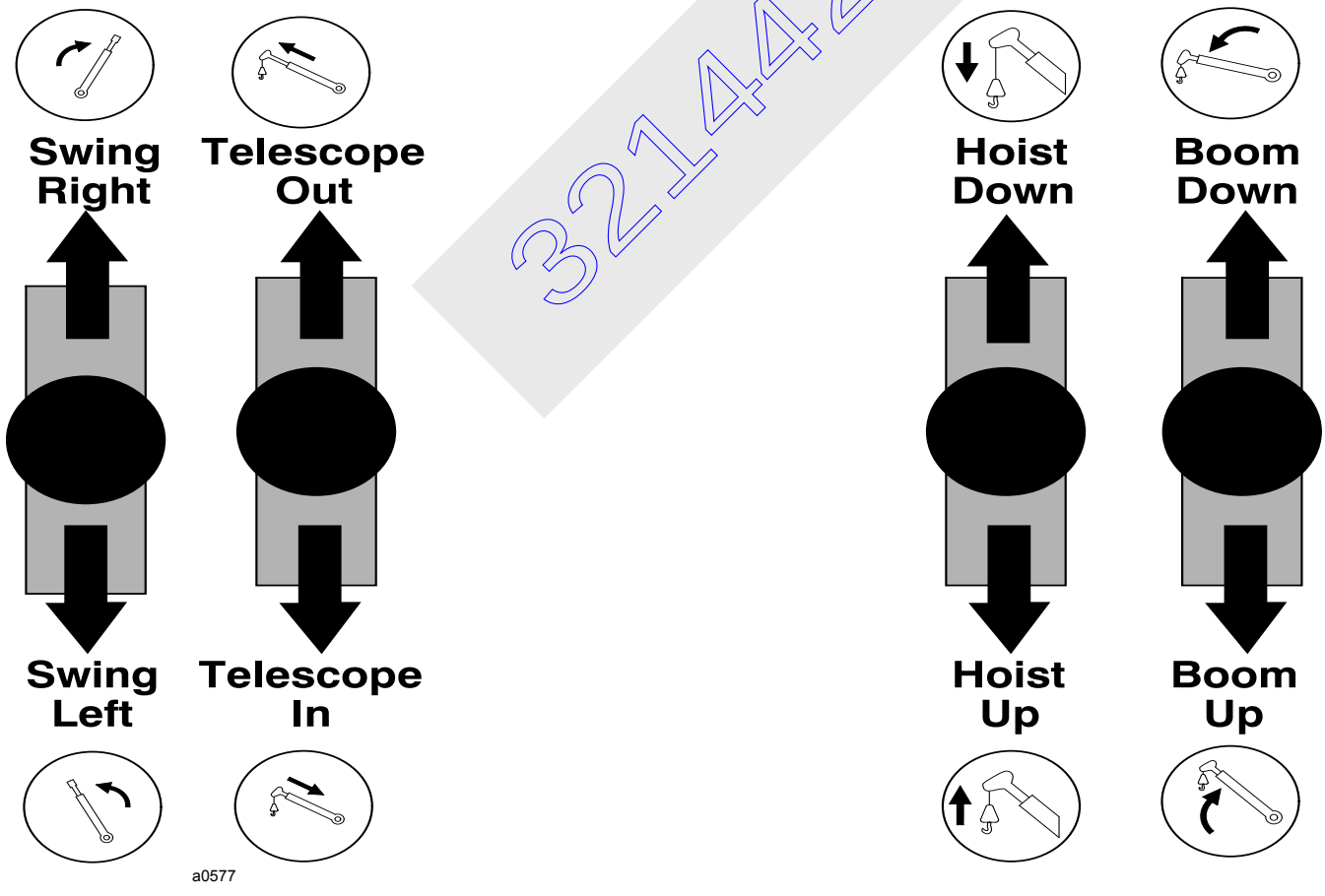


FIGURE 3-41

To Rotate the Mast to the Left (Counterclockwise):

Press the accelerator pedal to increase the engine speed to maximum rpm. Slowly pull back on the swing control lever (Figure 3-42) until the desired swing speed is obtained. The further the control is pulled back the faster the mast will rotate.

To Stop Rotation

Slowly move the control lever to the neutral position and decrease the engine speed to idle.

To Rotate the Mast Right (Clockwise)

Press the accelerator pedal to increase the engine speed to maximum rpm. Slowly push forward on the swing control lever (Figure 3-42) until the desired swing speed is obtained. The further the control is pushed forward the faster the mast will rotate.

NOTE: Never put side loads on the boom. Side loads can damage the swing gearbox. Move the boom so that it is directly above the load before lifting the load.

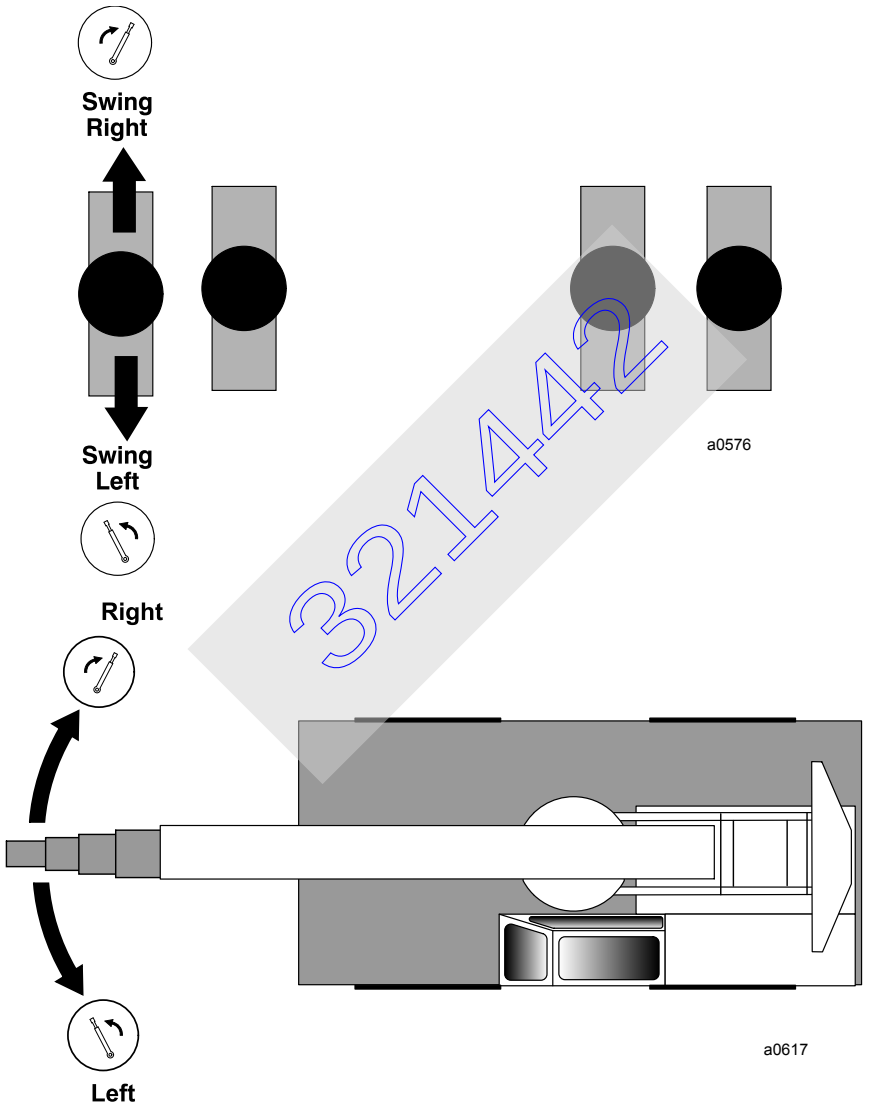


FIGURE 3-42

Boom Telescope Operation

NOTE: Always operate the hoist control to unwind the wire rope when extending the boom. Do not let the drop block touch the boom head. An automatic cutout device is equipped on this crane to inhibit the drop block from being pulled into the boom head. When the drop block touches the anti-double blocking bracket (Figure 3-43), hanging from the boom head, a switch is activated and the hydraulic flow to extend the crowd cylinder is stopped. An alarm will sound, warning the operator that the block has touched the bracket. The operator must then lower the drop block to stop the alarm and allow for the extension of the boom.

The above information also pertains when a boom extension is attached to the boom.

To Extend the Boom

Press the accelerator pedal to increase the engine speed to maximum rpm. Slowly push forward on the telescope control lever (Figure 3-44) until the desired extend speed is obtained. The further the control is pushed forward the faster the boom will extend.

p0496 **FIGURE 3-43**

To Stop Extension/Retraction

Slowly move the control lever to the neutral position and decrease the engine speed to idle.

To Retract the Boom

Press the accelerator pedal to increase the engine speed to maximum rpm. Slowly pull back on the telescope control lever (Figure 3-44) until the desired retract speed is obtained. The further the control is pulled back the faster the boom will retract.

WARNING

Hazard Table!

When lifting at high boom angles with an extended boom, it is crucial to maintain proper side slide pad adjustment. Visually check the lateral straightness of the boom before raising the load. Lifting with a boom which is not visually straight may cause boom failure and could result in injury or death.

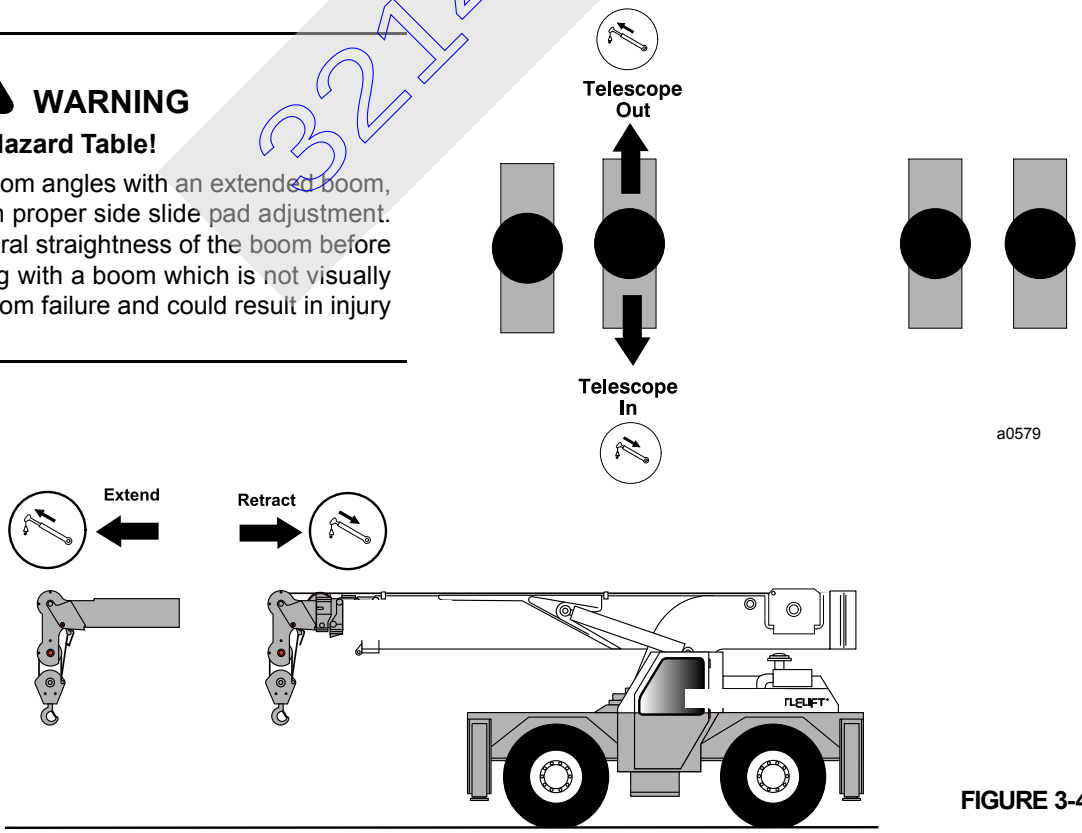
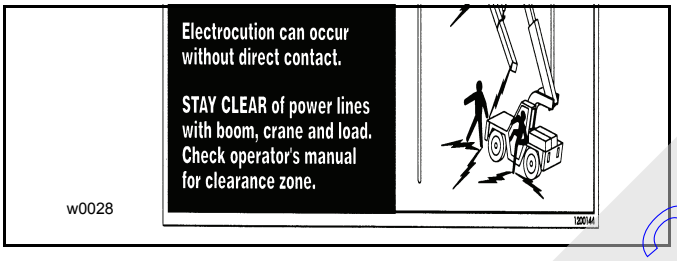


FIGURE 3-44

Boom Lift Operation

- Know the capacity of the crane. The operator must be familiar with the crane's capacity chart before lifting a load. See how to read the capacity chart in Section 4. A falling load or machine tip-over can cause injury or death.



NOTE: Look for overhead obstructions before raising the boom. Possible damage or electrocution could occur if the boom comes in contact with over head power lines.

To Raise the Boom

Press the accelerator pedal to increase the engine speed to maximum rpm. Slowly pull back on the boom control lever (Figure 3-45) until the desired raising speed is obtained. The further the control is pulled back the faster the boom will raise.

To Stop Boom Movement

Slowly move the control lever to the neutral position and decrease the engine speed to idle.

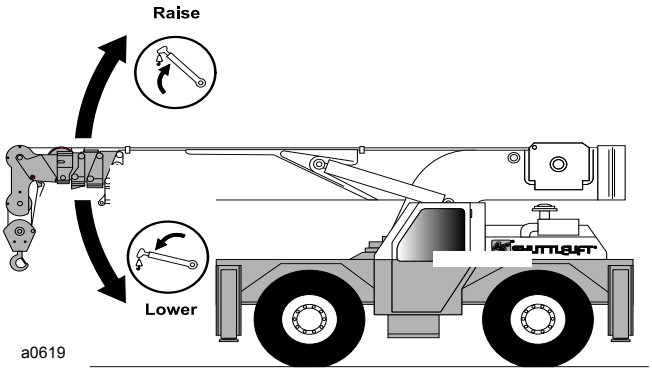
To Lower The Boom

Press the accelerator pedal to increase the engine speed to maximum rpm. Slowly push forward on the boom control lever (Figure 3-45) until the desired lowering speed is obtained. The further the control is pushed forward the faster the boom will lower.

WARNING

Hazard Table!

When lifting at high boom angles with an extended boom, it is crucial to maintain proper side slide pad adjustment. Visually check the lateral straightness of the boom before raising the load. Lifting with a boom which is not visually straight may cause boom failure and could result in injury or death.



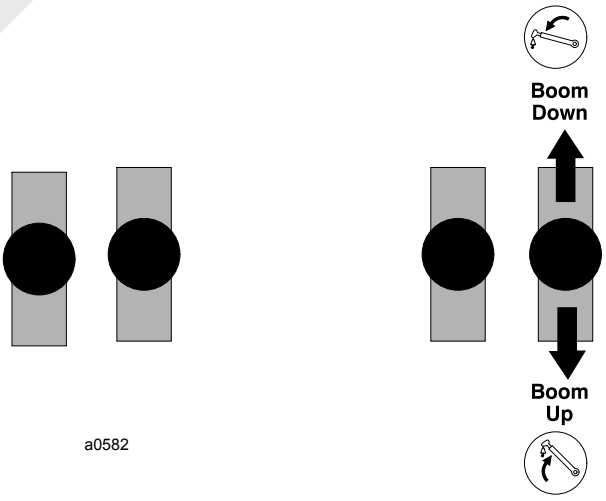


FIGURE 3-45

Hoist Hoist Operation

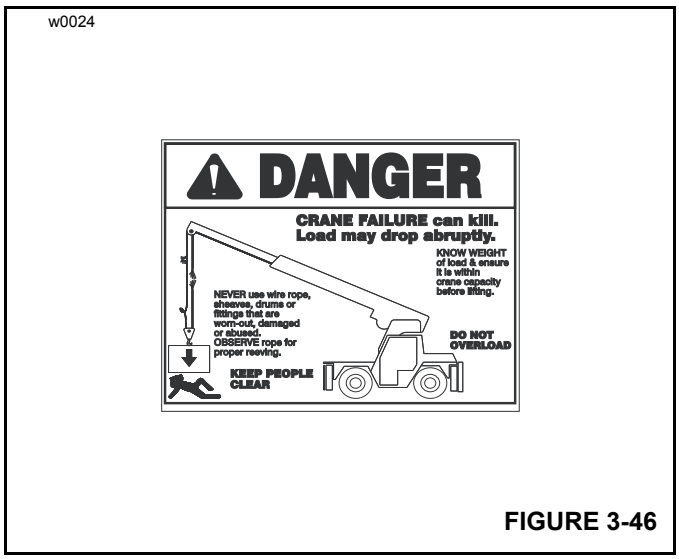
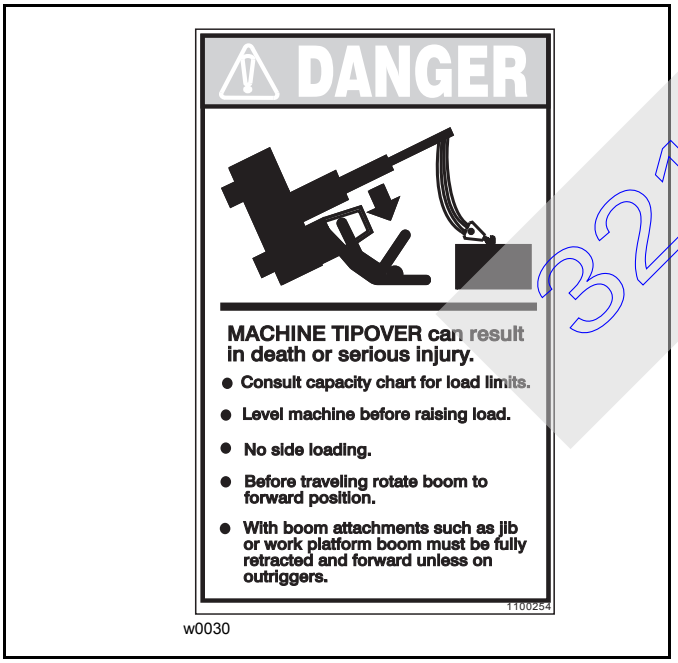


FIGURE 3-46

- Before making a lift, be sure all persons are clear of the load. A falling load can cause injury or death.



- Know the capacity of the crane. The operator must be familiar with the crane's capacity chart before lifting a load. See how to use the capacity chart in Section 4. A falling load or machine tip-over can cause injury or death.

NOTE: When lifting a load, keep your eyes on the load at all times. If you must look away, stop the movement of the load first. A moving load can cause injury or death.

NOTE: Always have a flagman give assistance if you can not see a moving load. Be sure you can see the flagman at all times. Agree in advance to hand signals to be used. A moving load can cause injury or death and/or property damage.

NOTE: Never put side loads on the boom. Side loads can damage the swing gearbox. Move the boom so that it is directly above the load before lifting the load.

NOTE: Do not let the drop block touch the boom head. An automatic cutout device is installed on this crane to inhibit the drop block from being pulled into the boom head. When the drop block touches the anti-double blocking bracket (Figure 3-42) hanging from the boom head, a switch is activated and the hydraulic flow to raise the drop block is stopped. An alarm will sound, warning the operator that the block has touched the bracket. The operator must then lower the drop block to stop the alarm and allow for other boom functions.

The above information also pertains when a boom extension is attached to the boom.

To Raise the Drop Block

Press the accelerator pedal to increase the engine speed to maximum rpm. Slowly pull back on the hoist control lever (Figure 3-48) until the desired raising speed is obtained. The further the control is pulled back the faster the drop block will raise.

To Stop Drop Block Movement

Slowly move the control lever to the neutral position and decrease the engine speed to idle.

To Lower the Drop Block

Press the accelerator pedal to increase the engine speed to maximum rpm. Slowly push forward on the hoist control lever (Figure 3-47) until the desired lowering speed is obtained. The further the control is pushed forward the faster the drop block will lower.

WARNING

Hazard Table!

When lifting at high boom angles with an extended boom, it is crucial to maintain proper side slide pad adjustment. Visually check the lateral straightness of the boom before raising the load. Lifting with a boom which is not visually straight may cause boom failure and could result in injury or death.

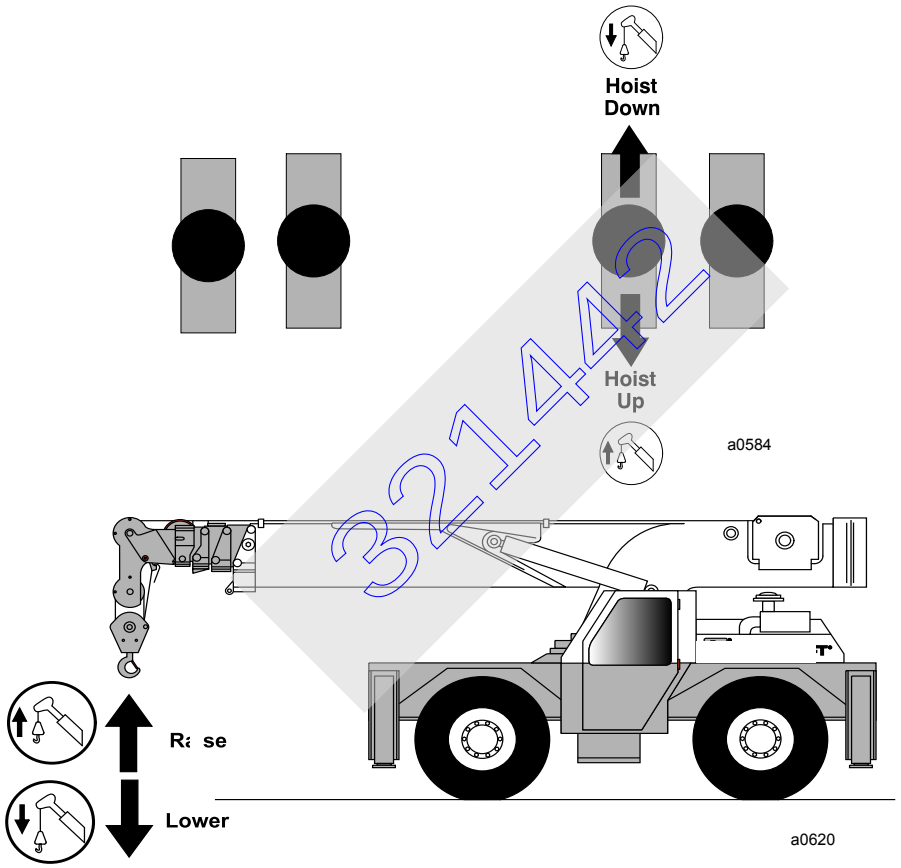


FIGURE 3-47

Optional Controls Operation

Auxiliary Hoist

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- Always keep hands and clothing clear of the fairlead rollers and front opening while the hoist is operating. Keep persons away from the area. Injury can be caused if the wire rope breaks or the hook becomes disconnected.

NOTE: The optional auxiliary hoist is only intended for intermittent use. Prolonged operation may cause excessive drain of the batteries.

To Extend the Wire Rope

Hold the toggle switch up (Figure 3-48). Keep tension on the wire rope to inhibit twisting of the wire rope on the hoist drum. For fast unwind, release the free spool lever on the right side of the hoist.

To Stop the Hoist

Release the toggle switch.

To Retract the Wire Rope

Hold the toggle switch down (Figure 3-48).

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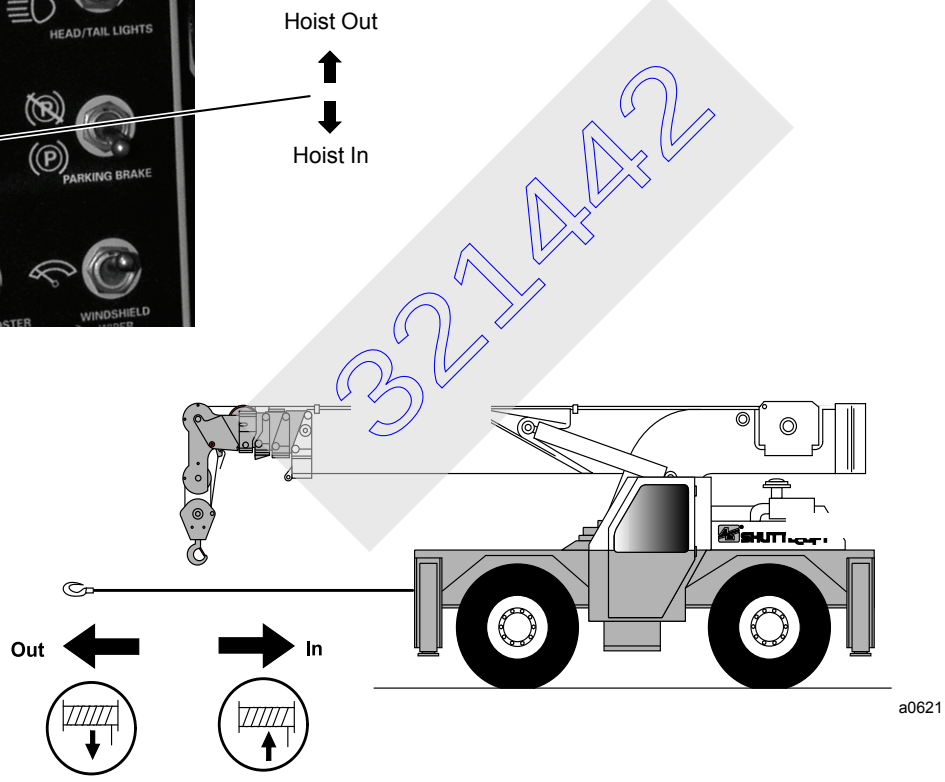

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FIGURE 3-48

OPERATING PRACTICES

Handling a Load

The crane must not be loaded beyond the specifications of the rated load chart. The load being lifted must be within the rated capacity of the crane.

When loads which are not accurately known are to be lifted, the operator of the crane shall ascertain that the weight of the load does not exceed the crane ratings at the radius at which the load is being lifted.

Attaching the Load

The hoist rope must not be wrapped around the load. The wire rope will be damaged

The load shall be attached to the hook by means of slings or other devices of sufficient capacity.

Holding the Load

The operator must not leave the controls while a load is suspended. An exception to this is under those circumstances where a load is to be held suspended for a period of time exceeding normal lifting operations, the operator may leave the controls provided that, prior to that time, the appointed individual and operator establish the requirements for restraining the boom hoist, telescope, load, swing and outrigger functions, and provide notices, barricades or whatever other precautions may be necessary.

No person should be permitted to stand or pass under a suspended load.

Moving the Load

1. The person directing the lift must see that:
   - **a.** The crane is level and where necessary, blocked.
   - **b.** The load is well secured and balanced in the sling or lifting device before it is lifted more than a few inches.
   - **c.** The lift and swing path is clear of obstructions.
2. Before starting to lift the load, the following conditions should be noted:

WARNING

Hazard Table!

When lifting at high boom angles with an extended boom, it is crucial to maintain proper side slide pad adjustment. Visually check the lateral straightness of the boom before raising the load. Lifting with a boom which is not visually straight may cause boom failure and could result in injury or death.

   - **a.** That the boom when extended, is laterally straight.
   - **b.** That the hoist rope is not kinked or damaged.
   - **c.** That multiple-part lines are not twisted around each other.
   - **d.** That the hook is brought over the load in such a manner as to minimize swinging.
   - **e.** If there is a slack condition in the wire rope, it must be determined that the rope is seated on the hoist drum and in the sheaves as the slack is removed.
   - **f.** The effect of ambient wind on the load and crane stability.
3. During lifting operations care must be taken that:
   - **a.** There is no sudden acceleration or deceleration of the moving load.
   - **b.** Load, boom and other parts of the crane do not contact any obstruction.
4. The load must not be lowered below a point where less than three full wraps of rope remain on the hoist drum.
5. When two or more cranes are used to lift one load, one designated person shall be responsible for the operation. That person must analyze the operation and instruct all personnel involved in the proper positioning, rigging the load and the movements to be made. Decisions such as the necessity to reduce crane ratings, load positions, boom location, ground support and speed of movement must be in accordance with this determination.
6. When rotating the boom with a load, sudden starts and stops must be avoided. Rotational speed must be such that the load does not swing out beyond the radius at which it can be controlled. A tag or restraint line must be used when rotation of the load is hazardous.

Traveling with a Load (Pick and Carry)

NOTE: Pick and carry is not allowed when the boom extension is attached and used to lift the load.

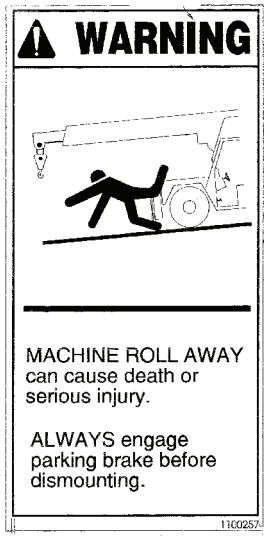
When traveling with a load, a designated person must be responsible for the operation. Decisions, such as the necessity to reduce crane ratings, load position, boom location, ground support, travel route and speed of movement must be in accordance with that person's determination. Specified tire pressure must be maintained. The boom should be carried in line with the direction of travel. Sudden starts and stops should be avoided. Tag and restraint lines should be used to control swinging of the load.

Turning Clearances

The front end of the boom extends beyond the end of the frame. The operator must be aware of the maximum sweep of the boom when turning and allow for adequate clearance between boom and other objects.

Machine Shutdown

1. Park the crane on level ground.
2. Place the travel select lever in Neutral (N) and engage the parking brake.
3. Lower any load to the ground and fully retract and lower the boom.
4. Turn the ignition switch to the OFF position and remove the key.



Unattended Crane

WARNING

Tipping Hazard!

Changing weather conditions including but not limited to: wind, ice accumulation, precipitation, flooding, lightning, etc. should be considered when determining the location and configuration of a crane when it is to be left unattended.

Failure to comply with these instructions may cause death or serious injury.

The configuration in which the crane should be left while unattended shall be determined by a qualified, designated individual familiar with the job site, configuration, conditions, and limitations

Towing a Disabled Machine

If the crane becomes disabled and can not be moved under engine power, the crane may be towed by another piece of equipment, which is designed for towing. Always disconnect the drive shafts from the transmission before towing. This will inhibit damage to the transmission. Always use a rigid tow bar. Restrict the travel to 15 mph (25 kmph).

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SECTION 4
CAPACITY CHART

SECTION CONTENTS

USING THE CAPACITY CHART

The capacity chart (Figure 4-3) for this crane is located on the inside of the operator's cab to the right of the seat. The chart provides maximum loads that can be safely lifted and gives conditions under which these maximum lifts can be made.

Operating Boom Radius

Located on both sides of the boom is an indicator that gives the angle at which the boom is positioned (Figure 4-1). The angle at which the boom is positioned and the length at which the boom is extended determines the lifting radius of the boom. For example, if the boom is at a 78° angle and is extended to 67 feet (20.42 meters), the lifting radius is 12 feet (3.66 meters). See capacity chart.

NOTE: To determine the exact lifting radius, use a tape measure and measure from the boom pivot to the load line.

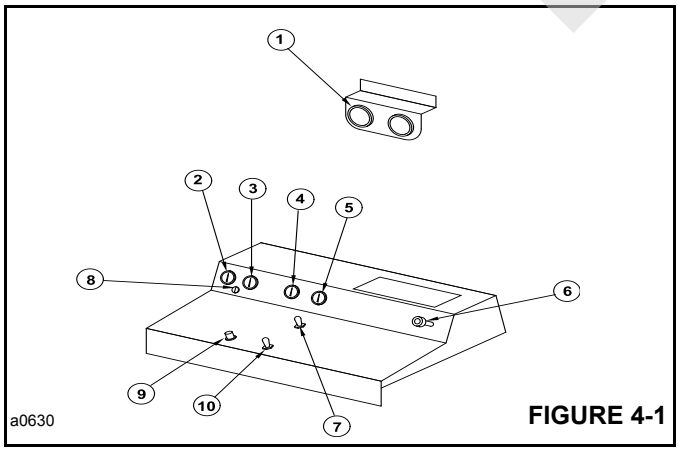

FIGURE 4-1

Locating the Lift Capacity

Locate on the capacity chart the Main Boom Load Ratings. Find the 12 foot radius in the chart. Always use the next highest radius if the radius measured is not on the chart. Read across the line to determine what can be lifted at that radius, either with the outriggers extended and down, retracted and down or on rubber.

DO NOT lift more than what the capacity chart states.

Things to Observe when Using the Capacity Chart

1. The rated loads are the maximum lift capacities as determined by operating radius, boom length and boom angle. The operating distance from a projection of the axis of rotation to the supporting surface, before loading, to the center of the vertical hoist line or tackle load applied.
2. The rated loads shown in the Capacity Chart **on Outriggers** do not exceed **85%** of actual tipping. The rated loads shown **on rubber** do not exceed **75%** of actual tipping. These ratings are based on freely suspended loads with the crane leveled, standing on a firm, uniform supporting surface. Practical working loads depend on supporting surface, operating radius and other factors affecting stability. Hazardous surroundings, climatic conditions, experience of personnel and proper training must be taken into account by the operator.
3. The weights of all load handling devices such as hooks, hook blocks, slings, etc., except the hoist rope, shall be considered as part of the load. See item 1. The weights for these items are stated on the capacity chart.
4. Ratings on outriggers are for either outriggers fully extended and down or fully retracted and down. Ratings for outriggers fully retracted and down will apply for any intermediate outrigger setting.
5. Ratings on rubber depend on tire capacity, condition of the tires and proper inflation pressure of 110 psi (758 kPa). Loads on rubber may be transported at a maximum speed of 2.5 mph (4 km/h) on a smooth level surface with the boom retracted to the shortest length possible and centered over the front. Do not use the jib crane on rubber.

6. For operating radius not shown on the Capacity Chart, use load rating of the next larger radius.
7. With a load both on the boom (pick and carry) and on the cranes's deck the maximum combined load is 20,000 lb. (9072 kg). The maximum load that can be placed only on the deck is 30,000 lb. (13 608 kg).
8. Do not induce any external side loads to the boom or the jib boom.

Lifting with the Jib Boom Installed

To find the lifting capacity when using the jib boom, observe the angle at which the main boom is positioned (use the angle indicator on the boom, see Figure 4-1). Find this angle on the capacity chart. Read across the line to the amount of offset on the jib boom. The capacity given is the capacity that can be lifted.

DO NOT lift more than what the capacity chart states.

Pick and Carry Ranges

Figure 4-2 illustrates the range of operation for pick and carry loads. Do not pick and carry outside of the specified ranges. The crane could become unstable and tip over.

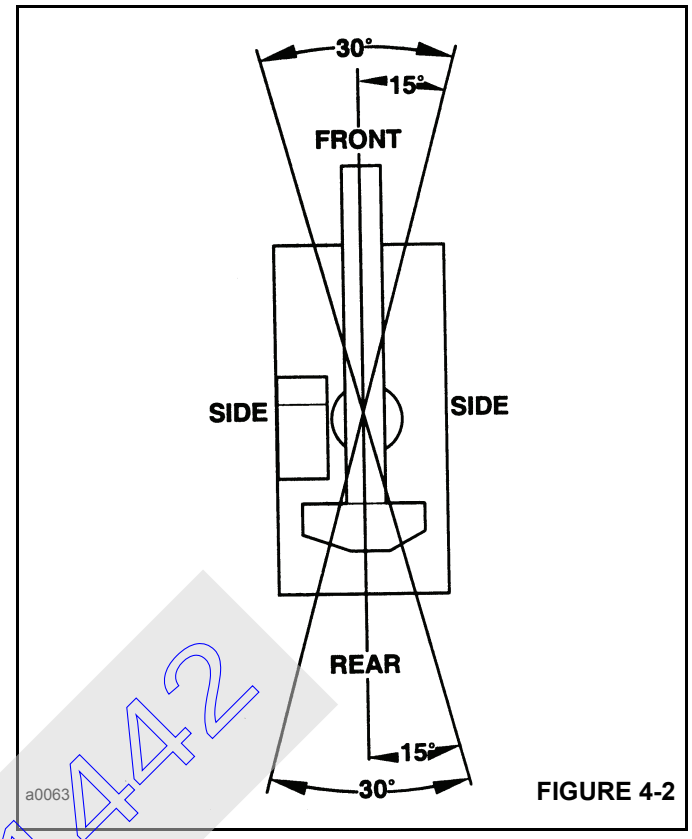

FIGURE 4-2

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LOAD RATING and RANGE DIAGRAM

MAIN BOOM LOAD RATINGS ON OUTRIGG[redacted]
Extended and Down 360° or Retracted and Down [redacted]

Radius (ft)	19.5 ft BOOM Boom Angle (deg)	19.5 ft BOOM Rated Load (lbs)	31.0 ft BOOM Boom Angle (deg)	31.0 ft BOOM Rated Load (lbs)	43.0 ft BOOM Boom Angle (deg)	43.0 ft BOOM Rated Load (lbs)	55.0 ft BOOM Boom Angle (deg)	55.0 ft BOOM Rated Load (lbs)	67.0 ft BOOM Boom Angle (deg)	67.0 ft BOOM Rated Load (lbs)
10	52	40000	68	26500	74	25400	78	22300	-	-
12	44	33800	64	25300	72	24200	76	20100	78	17500
14	33	28500	59	22900	69	22600	74	18000	77	15600
16	0	23700	55	20900	66	20000	71	16300	75	14000
18	-	-	50	19300	63	17900	69	14900	73	12700
20	-	-	45	17800	60	16100	67	13700	71	11700
22	-	-	39	16400	56	14600	64	12700	69	10800
24	-	-	31	14700	53	13300	62	11800	67	10000
26	-	-	22	13200	49	12300	60	11000	66	9300
27.5	-	-	0	11600	47	11600	58	10400	64	8800
30	-	-	-	-	42	10500	55	9400	62	8100
32	-	-	-	-	37	9800	52	8700	60	7600
34	-	-	-	-	32	8700	49	8100	58	7200
36	-	-	-	-	26	7800	46	7600	56	6800
38	-	-	-	-	18	7000	43	7100	53	6500
39.5	-	-	-	-	0	6400	41	6800	52	6300
42	-	-	-	-	-	-	36	6300	49	5900
44	-	-	-	-	-	-	32	5800	47	5600
46	-	-	-	-	-	-	28	5300	44	5300
48	-	-	-	-	-	-	23	4800	42	5000
50	-	-	-	-	-	-	16	4400	39	4700
51.5	-	-	-	-	-	-	0	4000	37	4600
54	-	-	-	-	-	-	-	-	33	4200
56	-	-	-	-	-	-	-	-	29	3900
58	-	-	-	-	-	-	-	-	25	3600
60	-	-	-	-	-	-	-	-	20	3300
62	-	-	-	-	-	-	-	-	14	3000
63.5	-	-	-	-	-	-	-	-	0	2800

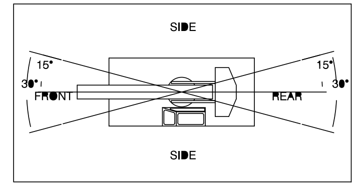
MAIN BOOM LOAD RATINGS ON OUTRIGGERS
Retracted and Down 360°

Radius (ft)	19.5 ft BOOM Boom Angle (deg)	19.5 ft BOOM Rated Load (lbs)	31.0 ft BOOM Boom Angle (deg)	31.0 ft BOOM Rated Load (lbs)	43.0 ft BOOM Boom Angle (deg)	43.0 ft BOOM Rated Load (lbs)	55.0 ft BOOM Boom Angle (deg)	55.0 ft BOOM Rated Load (lbs)	67.0 ft BOOM Boom Angle (deg)	67.0 ft BOOM Rated Load (lbs)
10	52	24000	68	22300	74	22000	78	22000	-	-
12	44	17200	64	16300	72	17000	76	17100	78	16300
14	33	13300	59	12500	69	13600	74	14000	77	13600
16	0	10200	55	9800	66	11100	71	11200	75	11500
18	-	-	50	7900	63	9100	69	9300	73	9400
20	-	-	45	6500	60	7500	67	7800	71	7700
22	-	-	39	5300	56	6200	64	6600	69	6500
24	-	-	31	4300	53	5200	62	5600	67	5600
26	-	-	22	3500	49	4400	60	4800	66	5000
27.5	-	-	0	2900	47	3900	58	4300	64	4600
30	-	-	-	-	42	3200	55	3600	62	3900
32	-	-	-	-	37	2700	52	3100	60	3400
34	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	2700	58	2900
36	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2300	56	2500
38	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2000	53	2100
39.5	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1750	52	1850
42	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1450	49	1500
44	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1200	47	1300
46	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1000	44	1100
48	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	850	42	950
50	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	700	39	800
51.5	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	600	37	700
54	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	33	500
56	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	29	350
58	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	25	250
60	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	20	150
62	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	14	50
63.5	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	0	-

MAIN BOOM ON RUBBER
Any Boom Length

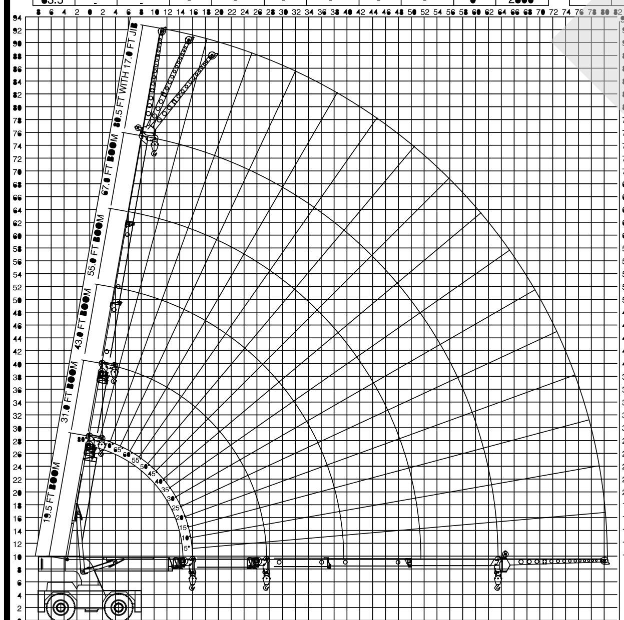
Radius (ft)	Front Rating (lbs)	360° Rating (lbs)
6	30000	21000
8	28000	17900
10	25000	15000
12	19600	12400
14	15600	9900
16	12700	7700
18	10300	6300
20	8300	4900
22	6800	3900
24	5800	3100
26	4900	2500
28	4200	2100
30	3700	1800
32	3300	1550
34	3000	1300
36	2700	1100
38	2500	950
40	2200	800
42	2000	675
44	1800	550
46	1650	450
48	1400	350
50	1300	250
52	1150	200
54	1050	150
56	950	75
58	875	25
60	800	-
62	700	-
63.5	600	-

Note: For 360° rating on rubber, rear axle locks must be in place.



RATING REDUCTIONS FOR LOAD HANDLING DEVICES INSTALLED (lbs)

	FROM MAIN BOOM	FROM JIB
MAIN BLOCK	400	NOT APPLICABLE
HOOK & BALL	100	100
JIB STOWED	NO REDUCTION	NOT APPLICABLE
JIB DEPLOYED	500	NO REDUCTION



...TRUCTURAL ...PPING.

...EXCESS OF ...ISTRUCTIONS ...RANTY.

...UTRIGGERS

Main Boom Angle (deg)	[illegible] To 67.0 ft Main Boom	30 deg Any Boom Length
80	5000	3500
75	4400	3100
70	3900	2800
65	3500	2550
60	3150	2350
55	2850	2200
50	2600	2100
45	2400	2000
40	2250	1950
35	2050	1900
30	1850	1830
25	1720	-
20	1590	-
15	1520	-
10	-	-
5	-	-
0	-	-

MAXIMUM PERMISSIBLE SINGLE LINE PULL = 10,000 lbs

WIRE ROPE: 9/16 inch dia. 6 x 19 EEIPS IWRC BRIGHT
Min. req'd breaking strength = 37,000 lbs

1) The rated loads are the maximum lift capacities as determined by operating radius, boom length and boom angle. The operating radius is the horizontal distance from a projection of the axis of rotation to the supporting surface, before loading, to the center of vertical hoist line or tackle with load applied.
2) The rated loads shown on outriggers do not exceed 85 %of actual tipping. The rated loads shown on rubber do not exceed 75% of actual tipping. These ratings are based on freely suspended loads with the crane leveled, standing on a firm, uniform supporting surface. Practical working loads depend on supporting surface, operating radius and other factors affecting stability. Hazardous surroundings, climatic conditions, experience of personnel and proper handling must all be taken into account by the operator.
3) The weights of all load handling devices, such as hooks, hook blocks, slings, etc., except the hoist rope, shall be considered as part of the load. See above.
4) Ratings on outriggers are for either outriggers fully extended and down or fully retracted and down. Ratings for outriggers fully retracted and down will apply for any intermediate outrigger setting.
5) Ratings on rubber depend on tire capacity, condition of tires and proper inflation pressure (110 psi). Loads on rubber may be transported at a maximum speed of 2.5 mph on a smooth hard level surface with boom retracted to the shortest length possible and centered over front. Do not use jib with crane on rubber.
6) For operating radius not shown, use load rating of next larger radius.
7) The maximum combined total boom and deck load is 20,000 lbs. The maximum deck load only is 30,000 lbs.
8) Do not induce any external side loads to boom or jib.

FIGURE 4-3

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SECTION 5
ATTACHMENTS

SECTION CONTENTS

PIVOTING BOOM HEAD

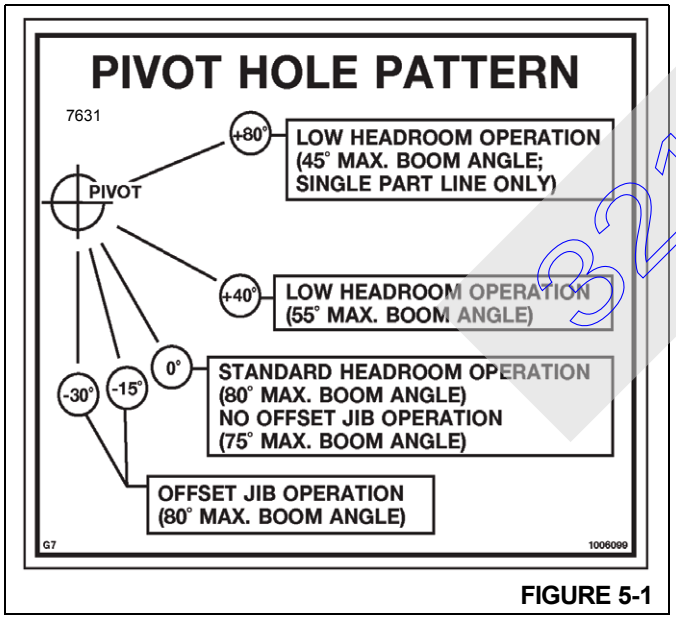

FIGURE 5-1

There are limitations to the boom elevation when the boom head is pivoted. Refer to Figure 5-1, Pivot Hole Pattern Decal (also attached to boom nose) for limitations.

Boom Head Positions

The pivoting boom head can be adjusted to five angle positions, three or four of which are used when there is no boom extension attached and two when a boom extension is attached.

Positions When No Boom Extension is Attached

The 0° boom head position is the standard position. The 30°, 60° and 80° (Figure 5-2) positions can be used when clearance requirements dictate a lower boom head profile. All positions can be used with either single or two part line setups.

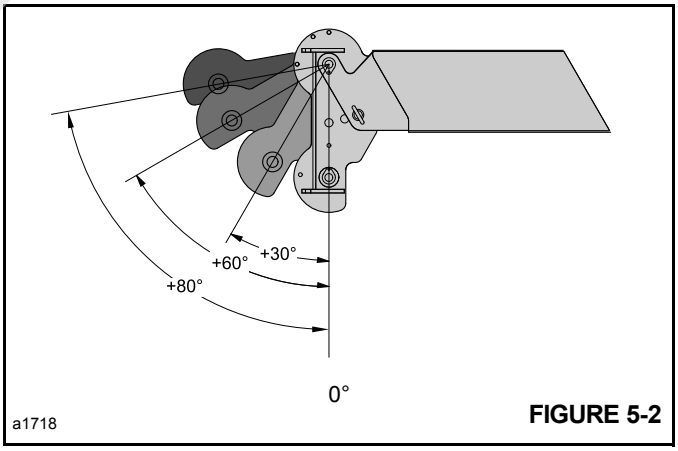

FIGURE 5-2

Positions When Jib Boom is Attached

The minus 15° and minus 30° boom angles are used to offset the boom extensions. See Figure 5-3.

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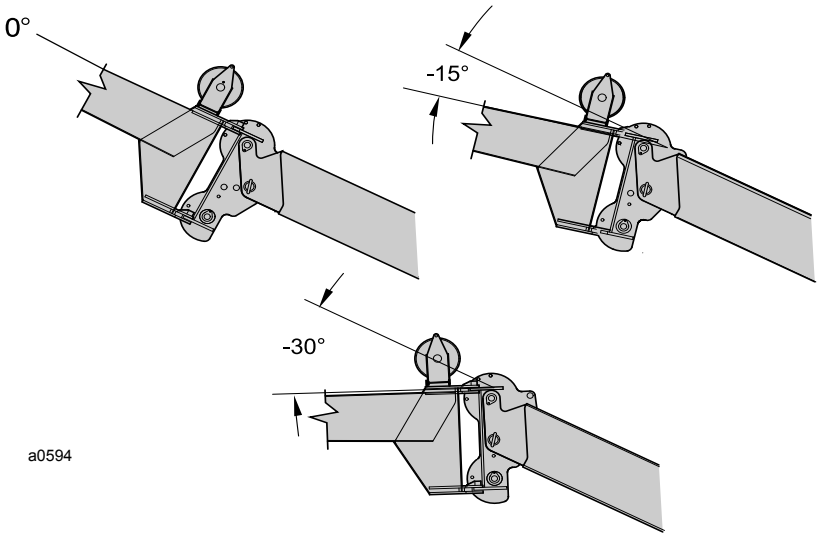


FIGURE 5-3

Changing the Boom Head Position (No Extension)

1. Lower and retract the boom.
2. Lower the block or ball to the ground to take weight off of the wire rope and boom head.
3. Remove the lynch pin and the pivot lock pin (Figure 5-4).
4. Remove the top hair pin and clevis pin from the top of the boom head (Figure 5-4).
5. Position the pin hole in the boom head to align up with the hole for the desired angle (see Figure 5-2). Insert the pivot lock pin through the holes and install the lynch pin.

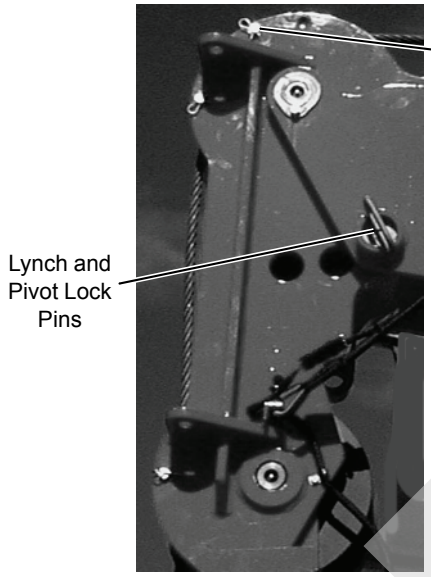


FIGURE 5-4

6. Using the hoist control, raise the block or hook ball off of the ground. Check that the wire rope is engaged in all the sheaves in the boom, hoist block and hoist drum.

Adjusting the Boom Extension Offset

WARNING

The jib boom is very heavy. Use adequate support to hold the jib from falling when the pivot anchor pin is removed. A falling boom can cause serious injury or death.

The jib boom offset is adjustable by moving the boom head to a minus 15° or 30°. With the boom attached it is necessary to both raise or lower the jib boom and the boom head simultaneously. The jib boom is very heavy and ***SHOULD NOT*** be lifted and supported by personnel.

1. Lower the hook and ball to the ground.
2. Provide adequate support at the end of the jib boom. If a mechanical hoist or equivalent is available, use it to support the jib boom.
3. Remove the lynch pin from the pivot lock pin (Figure 5-4).
4. Remove the top hair pin and clevis pin from the top of the boom head (Figure 5-4).
5. With the jib boom supported, remove the pivot lock pin. It will be necessary to remove the jib weight on the pin in order to remove it.
6. Raise or lower the main boom until the desired offset angle is achieved. (Figure 5-3).
7. Install the pivot lock pin and lynch pin.
8. Raise the hook and ball. Check that the wire rope is engaged in all the sheaves in the boom, hoist block and hoist drum.

5

HOIST BLOCK

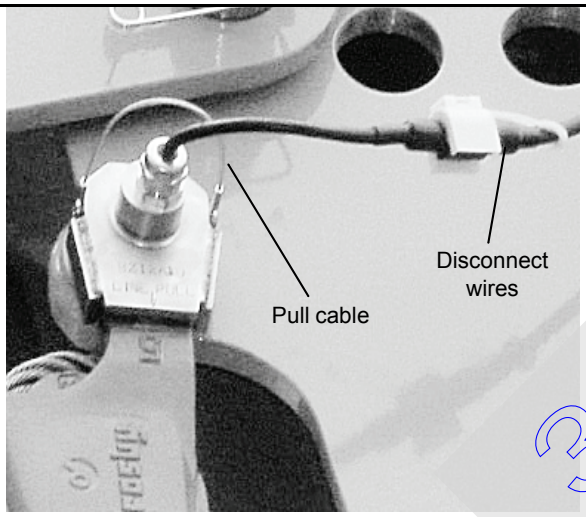
Removing the Hoist Block

1. Lower the hoist block to the ground to place slack in the wire rope.

CAUTION

Ensure that the hook assembly's safety latch (Figure 5-6) does not get damaged.

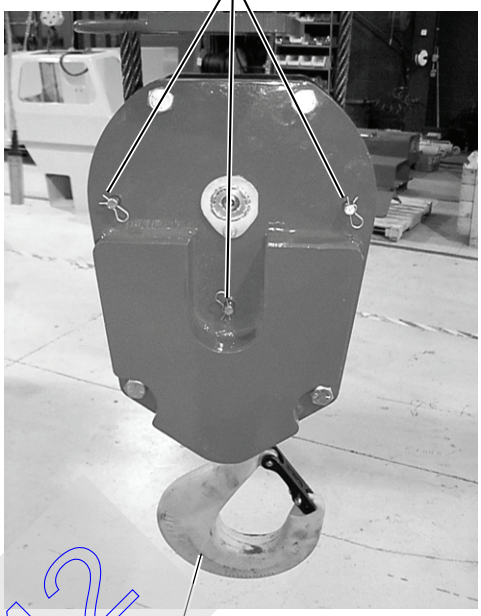
2. Unplug the wedge socket pin wire from the transmitter wire (Figure 5-5).
3. Remove the pin (Figure 5-5) securing the rope wedge socket to the boom head by using the pull cable, not the socket pin wire. Remove the wire rope dead end socket.



p3026a **FIGURE 5-5**

NOTE: When removing the hoist block to install the down haul weight, the wire rope dead end assembly does not have to be disassembled

4. Remove the three pins as indicated in Figure 5-6.
5. Pull the wire rope and dead end through the block.
6. Install the three pins.



p0529 **FIGURE 5-6**

Installing the Hoist Block

1. Remove the four pins and hook assembly from the hoist block assembly. See Figure 5-6.
2. Thread the wire rope through the hoist block so it is under the hoist block sheave.
3. Install the hook assembly and four pins to the hook block assembly.
4. Attach the wire rope wedge assembly to boom head.
5. Lift the hoist block off of the ground. Be sure the wire rope is engaged in the sheave grooves in both the boom head and hoist block and hoist drum.

BOOM EXTENSION

Installing the Boom Extension

To use the boom extension it must be attached to the boom head. The boom extension can be attached by performing the following procedure:

1. Completely retract the booms.
2. Remove the hoist block from the hoist wire rope.
3. Remove two pins form boom nose Figure 5-7.

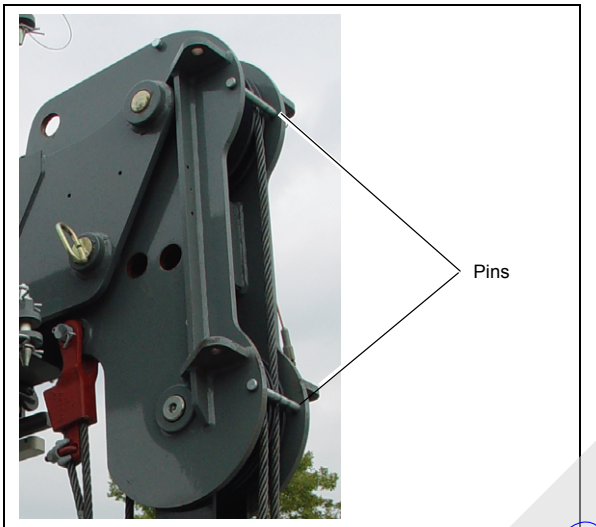


FIGURE 5-7

4. Remove the wire rope heaves. Operate the hoist control to release more wire rope.
5. Remove the pin from the boom extension anchor bracket (Location No. 1 in Figure 5-8).
   a. Remove the two pins from the extension link at location No. 2.
   b. Remove the outmost retaining pin at location No. 3 and flip up the deflector sheave bracket into its upright position.
   c. Install the pin at location No. 4 to secure the deflector sheave bracket in place.
6. Swing the boom extension at the swing arm pivot point (No. 5). Align and engage the extension link with the boom head at location No. 6. Install the two pins removed in the extension link.

NOTE: It may be necessary to extend the boom slightly to align the holes for installation of the pins.

7. Remove the pin at locations No. 7 and No. 8. Swing the boom extension forward (No. 9). Install the pin from No. 7 at location No. 11.
8. Engage the extension link with the boom head and install the pins from No. 8 at location No. 10. Swing the swing arm back towards the boom (No. 12) and install the pin from No. 1 at location No. 13.
9. Install the wire rope over the deflector sheave at the base of the jib boom.
10. Remove the two pins (1 and 2, Inset - Figure 5-8), and place the wire rope over sheave (3). Install pins (1 and 2).
11. Disconnect the wires from the anti-double blocking switch in the boom head. Connect the wire in the jib boom to the wires on the main boom.
12. Attach the down haul weight to the wire rope using wedge and socket per instructions later in this section.

Adjusting the Boom Extension Angle

The boom extension can be positioned to any one of three angles (Figure 5-3). For adjustment procedures, see the appropriate section of this manual.

Stowing the Boom Extension

To stow the jib boom, perform the following procedure:

1. Remove the hook and ball.
2. Remove the two pins (1 and 2, Inset - Figure 5-8).
3. Operate the hoist control to wind excess wire rope onto hoist drum. Install pins removed in step 2.
4. Disconnect the anti-double blocking switch wires.
5. Remove pins at location No. 10, Figure 5-8, and swing the boom extension backward. Install pins removed at location No. 10 in extension link to prevent them from becoming lost.
6. Remove the pin at location No. 4 and swing the deflector sheave to the left side of the boom. Install pin at location No. 3.
7. Swing the storage arm forward. Remove pin at location No. 11. Engage the boom extension with the storage arm and install pin at location No. 5.
8. Remove pins at No. 6 and disengage boom extension from boom head. Install pins from location 4 into jib link to prevent them from becoming lost.
9. Remove pin at location No. 13. Swing the boom extension to engage it with the bracket on boom. Install pin at location No. 1.

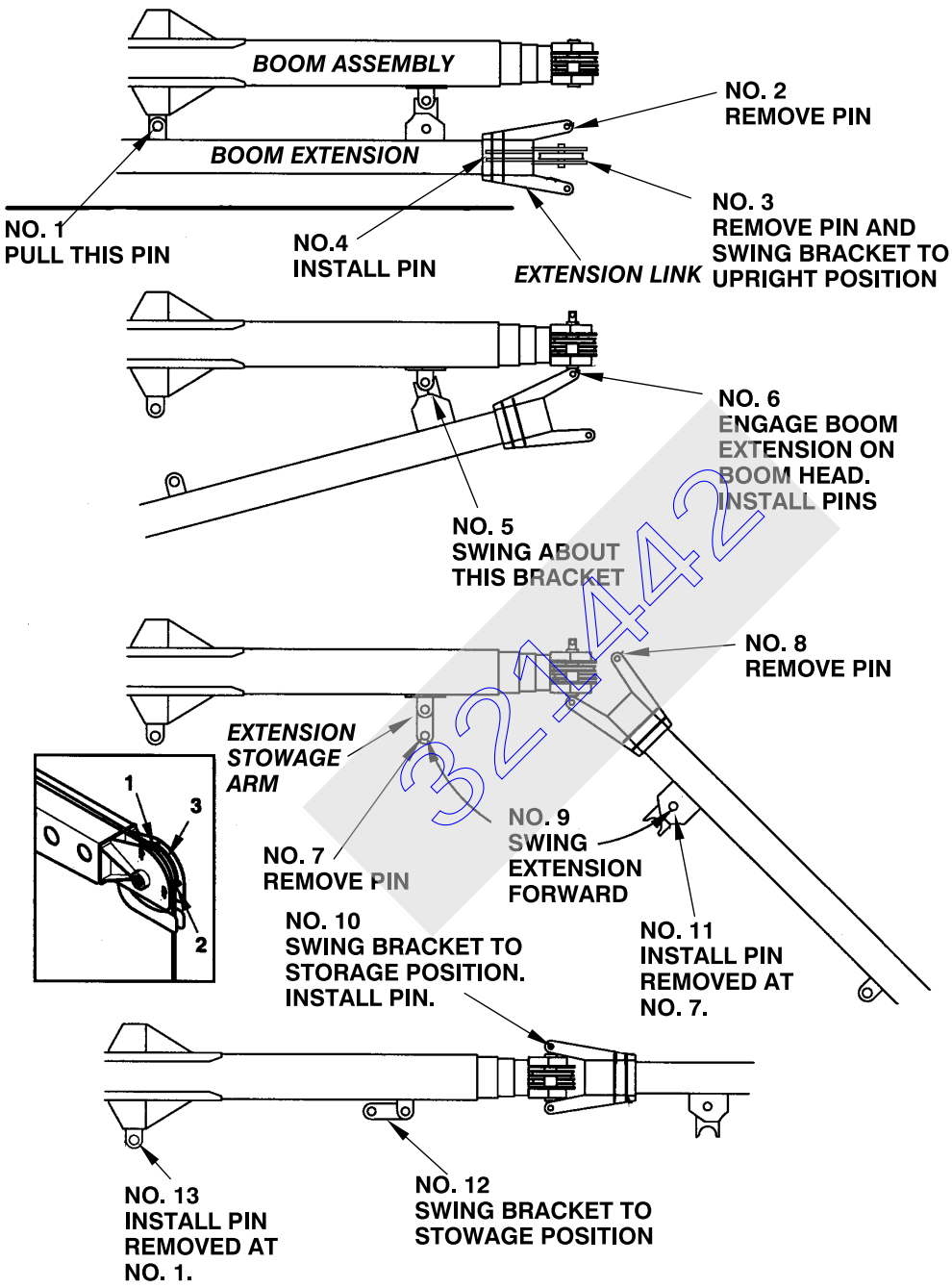


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FIGURE 5-8

DOWN HAUL WEIGHT

Installing the Down Haul Weight

Whenever a single part line is used on a crane to lift a load, the load indicator transmitter must be removed from the boom head and installed onto the down haul weight. Without the transmitter installed and attached to the load pin, the load indicator receiver in the cab will not register the weight being lifted by the single part line.

To install the load indicator transmitter in the down haul block perform the following steps:

1. Disconnect the transmitter wire and load pin wire (Figure 5-9) from the jumper wire.

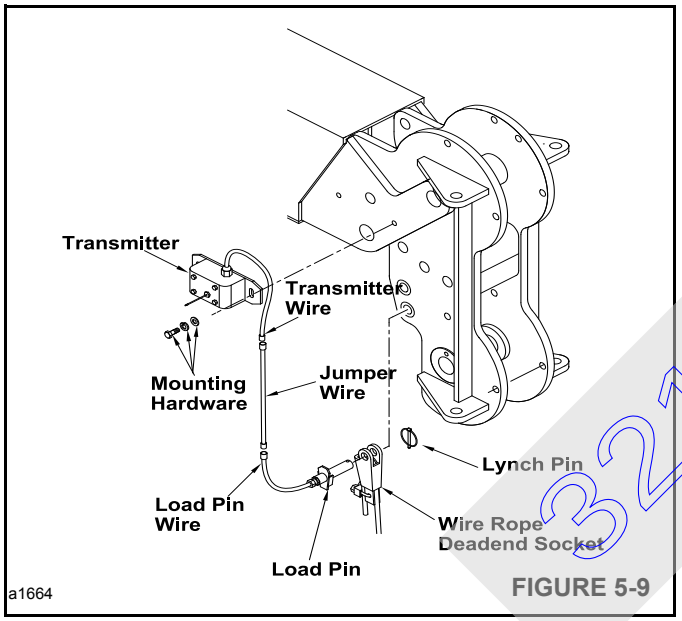

FIGURE 5-9

2. Remove the transmitter from the boom head by removing the transmitter mounting hardware (bolts, lockwashers and flat washers).
3. Remove the hoist block.
4. Using the hardware removed when removing the load indicator transmitter, install the transmitter onto the down haul weight (See Figure 5-10).

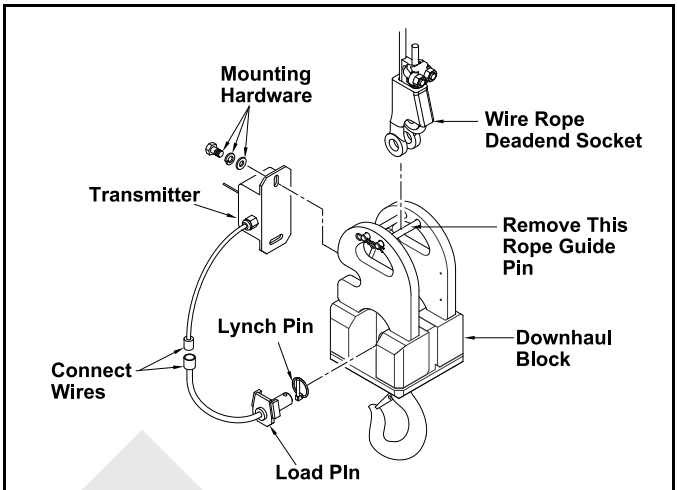

FIGURE 5-10

5. Remove the rope guide pin indicated in Figure 5-10 from the down haul weight.
6. Attach the wire rope dead end socket to the down haul weight using the load pin removed when removing the hoist block. Install the lynch pin.
7. Install the rope guide pin. Be sure the wire rope is placed between the two pins.
8. Connect the transmitter wire to the load pin wire.
9. Adjust the boom head angle in the position required for the lift operation.
10. Lift the hoist block off of the ground. Be sure the wire rope is engaged in the sheave grooves in both the boom head and hoist block.

5

Removing the Down Haul Weight

Whenever the down haul block is removed, the load indicator transmitter must be removed from the down haul block and installed onto the boom head. Without the transmitter installed and attached to the load pin, the load indicator receiver in the cab will not register the weight being lifted by the crane.

To install the load indicator transmitter to the boom head perform the following steps:

1. Lower the down haul block to the ground.
2. Disconnect the transmitter load pin wire (Figure 5-10) from the transmitter wire.
3. Remove the rope guide pin indicated in Figure 5-10.
4. Remove the lynch pin and the load pin from down haul weight. Remove the wire rope deadend socket. Install the rope guide pin in the down haul weight.
5. Remove the transmitter from the downhaul weight. Retain the hardware.
6. Install the transmitter to the boom head (Figure 5-9) using the existing hardware.
7. Install the hoist block. Install the load pin.
8. Connect the transmitter wire (Figure 5-9) and the load pin wire to the jumper wire.

INSTALLING CABLE ON THE HOIST

CAUTION

If cable is wound from the storage drum, the reel should be rotated in the same direction as the hoist.

NOTE: The cable should preferably be straightened before installation on the hoist drum.

Install cable on the hoist drum in accordance with the following procedure.

1. Position the cable over the boom nose sheave and route to the hoist drum.
2. Position the hoist drum with the cable anchor slot on top.
3. Insert the cable through the slot and position around the anchor wedge (1) Figure 5-11.

NOTE: The end of the cable should be even with the bottom of the slot for the anchor wedge.

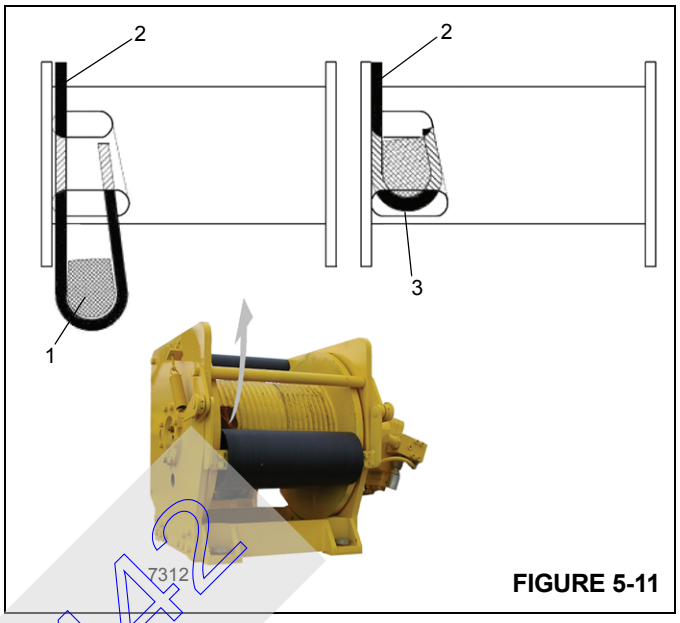

FIGURE 5-11

4. Position the anchor wedge in the drum slot; pull firmly on the free end (2) of the cable to secure the wedge.

NOTE: If the wedge does not seat securely in the slot, carefully tap (3) the top of the wedge with a mallet.

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5. Slowly rotate the drum, ensuring the first layer of cable is evenly wound onto the drum.
6. Install the remainder of the cable, as applicable.

WIRE ROPE WEDGE SOCKET

1. Inspect the wedge and socket. Remove any rough edges and burrs.
2. The end of the wire rope should be seized using soft, or annealed wire or strand. If the end of the rope is welded, the welded end should be cut off. Do not weld on size 6X37 rope. This will allow the distortion of the rope strands, caused by the bend around the wedge, to adjust themselves at the end of the line. Refer to SECTION 1 - INTRODUCTION in the Service Manual for wire rope procedures.
3. Make sure the live-end (Figure 5-12) of the rope is directly in line with the ears of the socket and the direction of pull to which the rope will be subjected. If the rope is loaded into the socket incorrectly, under a load the rope will bend as it leaves the socket, and the edge of the socket will wear into the rope causing damage to the rope and eventual failure.

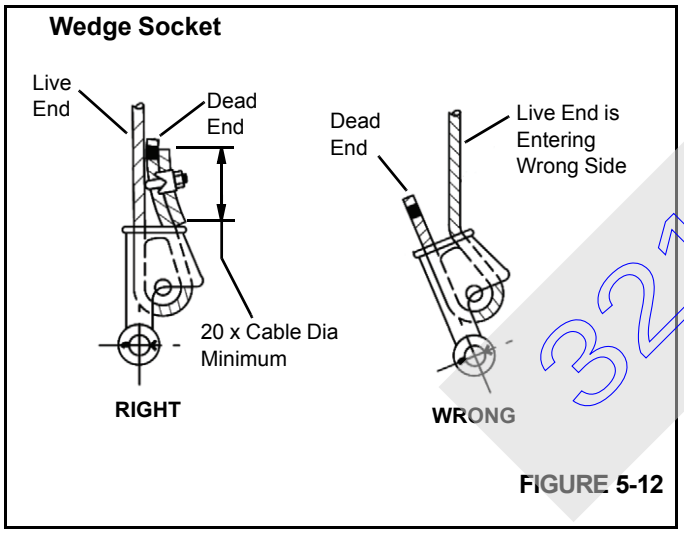

FIGURE 5-12

4. Insert the end of the wire rope into the socket, form a loop in the rope, and route the rope back through the socket allowing the dead-end (Figure 5-12) to protrude from the socket. Ensure the dead-end of the rope is of sufficient length to apply end treatment to the dead-end after the wedge has been seated.
5. Insert the wedge into the loop and pull the live-end of the rope until the wedge and rope are snug inside the socket. It is recommended that the wedge be seated inside the socket to properly secure the wire rope by using the crane's hoist to first apply a light load to the live-end.
6. After final pin connections are made, increase the loads gradually until the wedge is properly seated.
7. The wire rope and wedge must be properly secured inside the socket before placing the crane into lifting service. It is the wedge that secures the wire rope inside the socket. The dead-end treatment is used to restrain the wedge from becoming dislodged from the socket should the rope suddenly become unloaded due to the headache ball or hook block striking the ground, etc.

Sketches A through F (Figure 5-13) illustrate various ANSI approved methods for treating the dead-ends of wire ropes which exit a wedge socket assembly. While use of the loop-back method is acceptable, care must be exercised to avoid the loop becoming entangled with tree branches and other components during crane transport and with the anti-two block system and other components during use of the crane.

Of the methods shown below, Manitowoc prefers that method A or F be used, i.e., clipping a short piece of wire rope to the dead-end or using a commercially available specialty clip or wedge. Typically, it is recommended that the tail length of the dead-end should be a minimum of 6 rope diameters but not less that 6 in (15.2 cm) for standard 6 to 8 strand ropes and 20 rope diameters but not less than 6 in (15.2 cm) for rotation resistant wire ropes.

When using method A, place a wire rope clip around the dead end by clamping a short extra piece of rope to the rope dead end. DO NOT CLAMP THE LIVE END. The U-bolt should bear against the dead end. The saddle of the clip should bear against the short extra piece. Torque the U-bolts according to the table titled Wire Rope Clip Torque Values (Table 5-1).

Other sources for information with which crane users should be familiar and follow is provided by the American Society of Mechanical Engineers, American National Standard, ASME B30.5, latest revised. ASME (formerly ANSI) B30.5 applies to cableways, cranes, derricks, hoists, hooks, jacks, and slings. It states, in section 5-1.7.3, "(c) Swagged, compressed, or wedge socket fittings shall be applied as recommended by the rope, crane or fitting manufacture." Wire ropes are addressed in ASME B30.5, section 5-1.7.2, ROPES, it states, in pertinent part, "(a) The ropes shall be of a construction recommended by the rope or crane manufacturer, or person qualified for that service." Additional information is published by the Wire Rope Technical Board in the Wire Rope Users Manual, latest revised edition.

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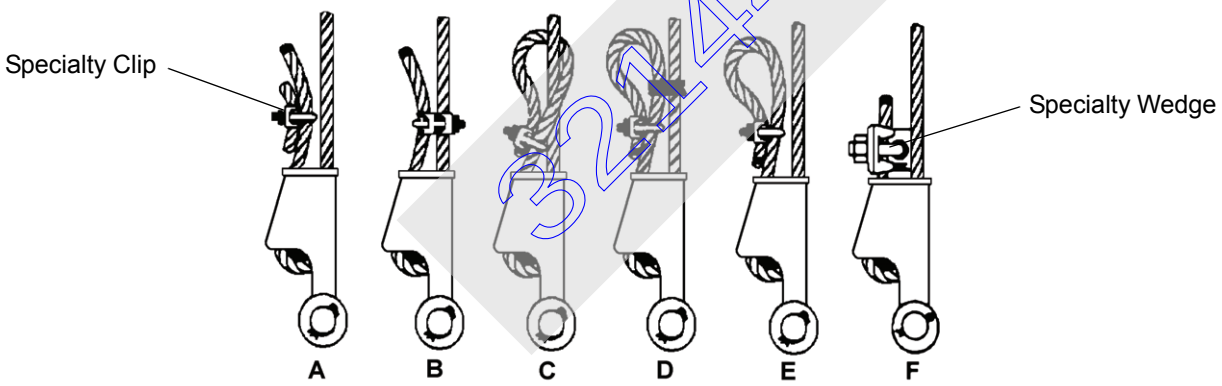
Table 5-1

Wire Rope Clip Torque Values			
Clip Sizes		Torque	
Inches	mm	lb-ft	Nm
1/8	3.18	4.5	6
3/16	4.76	7.5	10
1/4	6.35	15	20
5/16	7.94	30	40
3/8	13.28	45	60
7/16	11.11	65	90
1/2	12.70	65	90
9/16	14.29	95	130
5/8	15.88	95	130
3/4	19.05	130	175
7/8	22.23	225	300
1	25.40	225	300
1-1/8	28.58	225	300
1-1/4	31.75	360	490
1-3/8	38.68	360	490
1-1/2	38.10	360	490



Wedge Socket

FIGURE 5-13

SECTION 6
MAINTENANCE

SECTION CONTENTS

6

INTRODUCTION

CAUTION

Do not use gasoline or other flammable fluids to clean component parts. Fire or explosion may occur causing bodily burns.

CAUTION

Use eye protection when performing service or maintenance tasks. Propelled and/or dropped items can cause eye injury.

CAUTION

If maintenance or adjustments must be performed with the engine running, have a person at the controls while another person performs the work to inhibit accidental movement which could cause injury or death.

Preventive maintenance is necessary to keep the crane in good condition as long as possible. Adjust the maintenance schedule to your operation, according to the type of work, size of loads, temperature conditions and frequency of equipment use.

The intervals in the Maintenance Schedule are for average operating conditions, and must be understood as the ***MINIMUM*** maintenance necessary for the machine. Decrease these intervals if the machine is operated in conditions that are below average (for example, in dust, in high or low temperatures, with heavy loads or frequent starting and stopping.

Use the hourmeter and a calendar to make sure that all necessary maintenance is done according to the schedule.

NOTE: When performing service on the crane, put a tag on the key switch or remove the key to prevent operation of the crane.

Spark Arresting Mufflers

NOTE: Codes of some states or provinces may require that this crane be equipped with a ***SPARK ARRESTING MUFFLER***. The State of California as an example, is one state which has such regulations for agricultural and forestry applications, plus a regulation for construction applications in forest covered, brush covered, or grass covered lands.

Safety List

Inspect the following safety equipment daily:

SAFETY BELT - Check for frayed or cut webbing, damaged buckles or loose mounting hardware.

SAFETY DECALS - Check condition of decals. Replace if worn, damaged or missing.

COVERS - Keep all protective covers in place.

PARKING BRAKE - Check operation. Have unit repaired if brake is not functioning properly.

ENGINE - Check operation. Remove all dirt or debris, and all flammable materials before running engine.

LUBRICANTS

It is not the policy of Manitowoc Cranes, Inc. to publish lists of approved lubricants or guarantee lubricant performance. The responsibly for the quality rests completely with the distributor or manufacturer of the lubricant. It is not the policy of Manitowoc Cranes, Inc. to publish lists of approved lubricants or guarantee lubricant performance. The responsibly for the quality rests completely with the distributor or manufacturer of the lubricant.

In various paragraphs in this maintenance section, statements may be found, “use (lubricant brand name) or equivalent.” This statement does not constitute an unconditional guarantee of performance of the brand of lubricant mentioned. It is intended only as a guide to the type of lubricant recommended for a given application.

MAINTENANCE RECORDS

Dated records must be kept for inspection of critical components such as, brakes, crane hooks, wire ropes, hydraulic cylinders and relief valve pressure settings. These records must be kept where they can be easily obtained and reviewed.

SPECIAL MAINTENANCE

Delivery Inspection

Item	Action
Fuel Tank	Fill with correct fuel. Fill if level is low.
Engine	Check oil in crankcase. Remove water from fuel filters.
Cooling System	Check coolant level. Fill if level is low.
Hydraulic Tank	Check oil level. Fill if level is low.
Drive Axles	Check axle housing lubricant level and wheel hub lubricant level. Fill if levels are low.
Hoist Gearbox	Check lubricant level. Fill if level is low.
Tires	Check tires for correct air pressure.
Wire Rope Cable Clamps and Connections	Check for loose or missing parts.
Anti-Double Block System	Check that the system is working properly.
Controls	Check that all controls are working properly.

After First 50 Hours of Operation (New Cranes)

Item	Action
Engine	Change the engine oil and filter.
Transmission	Change the transmission oil filter.
Swing Gearbox	Check and tighten mounting bolts.
Hoist Gearbox	Check and tighten mounting bolts.
Swing Gear Pinion and Swing Gear	Lubricate.
Grease Fittings	Apply grease to all grease fittings.
Boom Chains	Inspect chains for looseness and tighten.
Boom Slides	Lubricate.
Wheel Mounting Nuts	Check Torque.

After First 100 Hours of Operation (New Cranes)

Item	Action
Hoist Gearbox	Change lubricant.

Cranes Not in Regular Use

A crane which has been idle for a period of one month or more, but less than six months, must be given an inspection by a qualified person. This person should use the daily through monthly inspections.

A crane which has been idle for a period of over 6 months must be given a complete inspection covering all inspections through one year, by a qualified person.

Standby cranes must be inspected using the daily through monthly inspection, by a qualified person.

PREVENTIVE MAINTENANCE

Maintenance Schedule and Checklist

CAUTION

Hour intervals in each maintenance chart show the correct time for service. The hourmeter located in the operator's cab indicates the total hours the crane has been running.

CAUTION

In addition to the following scheduled maintenance, perform the scheduled maintenance suggested in the engine manual furnished with the crane.

CAUTION

When performing maintenance, do the required maintenance interval as well as all previous interval maintenance. For example, when performing the 250 Hour (Monthly) maintenance interval, perform all the tasks required for Daily, 50 Hour and 100 Hour maintenance.

Service/Check	Interval						
	Daily Before Operation	50 Hours (Weekly)	100 Hours (Two Weeks)	250 Hours (Monthly)	500 Hours (Three Months)	1000 Hours (Six Months)	2000 Hours (Yearly)
Inspect the Anti-Double Blocking System	X						
Inspect the Wire Rope	X						
Inspect the Reeving, Clamps, and Connectors	X						
Inspect the Lifting Hook	X						
Inspect Safety Devices	X						
Check Controls Operation	X						
Check Engine Crankcase Oil Level	X						
Check Transmission Oil Level	X						
Check Engine Coolant Level	X						
Check Fuel Level	X						
Check Tire Pressure	X						
Drain Water from Engine Fuel Filter/ Water Separator	X						
Check Air Cleaner Restriction Indicator	X						
Check Hydraulic Oil Level	X						
Inspect Wire Rope and Sheaves		X					
Apply Grease to All Lubrication Fittings		X					
Lubricate the Boom Slides		X					
Check Hoist Gearbox Lubrication Level		X					
Lubricate the Boom Chains		X					

Service/Check	Interval						
	Daily Before Operation	50 Hours (Weekly)	100 Hours (Two Weeks)	250 Hours (Monthly)	500 Hours (Three Months)	1000 Hours (Six Months)	2000 Hours (Yearly)
Clean Air Cleaner Vacuator Valve		X					
Inspect the Engine Fan Belts			X				
Check Wheel Nut Torque			X				
Lubricate the Swing Gear and Pinion				X			
Lubricate the Wire Rope				X			
Inspect the Boom Chains				X			
Inspect All Hydraulic Hoses				X			
Replace the Engine Crankcase Oil[1]				X			
Replace the Engine Oil Filter[1]				X			
Clean Radiator Fins and Core				X			
Clean Battery and Connections				X			
Torque Critical Fasteners				X			
Check Axle Wheel Hub Lubricant Level (4)					X		
Check Axle Housing Lubricant Level (2)					X		
Check Swing Gearbox Lubricant Level					X		
Lubricate the Outrigger Slides					X		
Replace Fuel Filter/Water Separator Elements					X		
Replace the In-line Fuel Filter					X		
Replace Transmission Oil Filter					X		
Inspect the Parking Brake Pads					X		
Inspect Tires for Damage					X		
Add Rust Inhibitor to Engine Cooling System					X		
Replace the Air Cleaner Element[1]					X		
Check Swing Gear to Pinion Backlash						X	
Replace the Transmission Oil						X	
Replace the Axle Wheel Hub Lubricant (4)						X	
Replace the Axle Housing Lubricant (2)						X	
Replace the Hoist Gearbox Lubricant						X	
Replace the Swing Gearbox Lubricant						X	
Replace the Hydraulic Oil						X	

Service/Check	Interval						
	Daily Before Operation	50 Hours (Weekly)	100 Hours (Two Weeks)	250 Hours (Monthly)	500 Hours (Three Months)	1000 Hours (Six Months)	2000 Hours (Yearly)
Replace the Hydraulic Oil Filter						X	
Replace the Engine Coolant							X
Inspect the Crane Structure and Booms for Damage							X
Test the Load Moment Indicator (LMI) Option							X

1 Under extremely dusty conditions, the engine oil and filter, as well as the air cleaner element, may require replacement more frequently.

Lubrication Points

Apply grease to the following fittings after every 50 hours of operation. Use a Lithium Base, E.P. No.2 bearing grease or equivalent. Apply enough grease to remove the old grease.

Booms and Main Frame

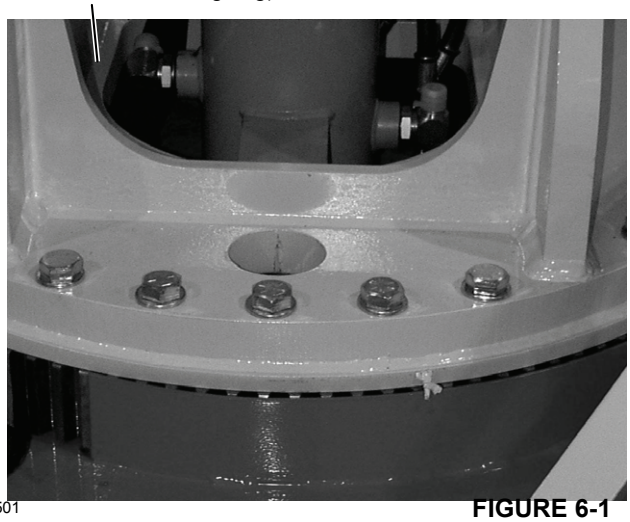
Location	Qty
Mast Bearing (See Figure 6-1)	2
Swing Gearbox Bearing (See Figure 6-2)	1
Boom Pivot (See Figure 6-3)	2
Retract Chain Rollers - 2nd Boom Section (See Figure 6-4)	2
Boom Head Sheaves and Pivot (See Figure 6-5)	2
5th Boom Extend Sheaves (SeeFigure 6-5)	2
Secondary Crowd Assembly (See Figure 6-6)	2
Lift Cylinder Pivots (See Figure 6-7)	2
Hoist Drum Bearing (See Figure 6-8)	1

Drive Train

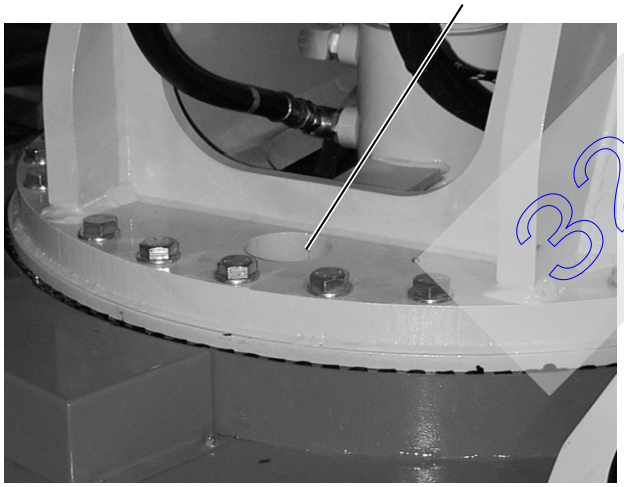
Location	Qty
Steering Knuckles - Front and Rear Axles (See Figure 6-9)	8
Steering Cylinder Pivot Ends - Front and Rear Axles (See Figure 6-10)	4
Drive Shaft - Front Axle (See Figure 6-11) No routine lubrication is required. Lubricate only after major axle overhaul.	2
Drive Shaft - Rear Axle (See Figure 6-12) No routine lubrication is required. Lubricate only after major axle overhaul.	2
Axle Pivot - Front and Rear Axles (See Figure 6-13)	4

Optional Equipment and Accessories

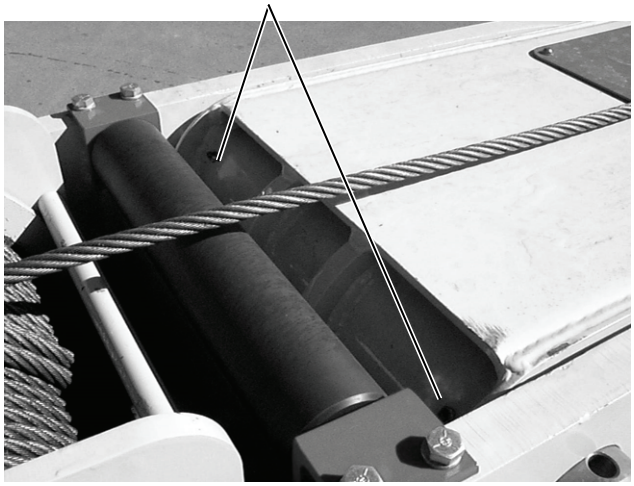
Location	Qty
Drop Block (See Figure 6-14)	1
Jib Boom Head Sheave (See Figure 6-15)	1
Jib Boom Deflector Sheave (See Figure 6-16)	1



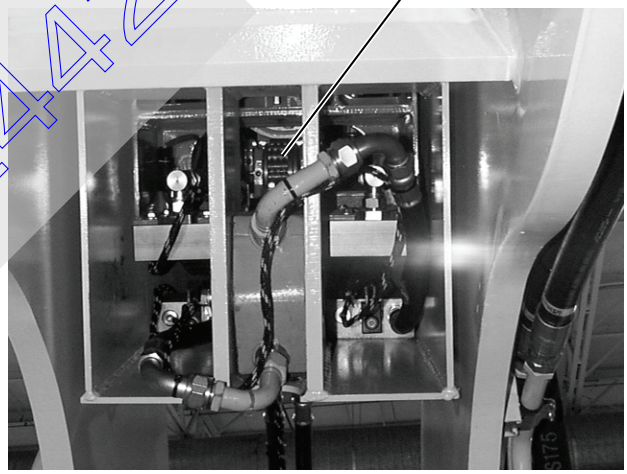
p0501 **FIGURE 6-1**



p0524 **FIGURE 6-2**



p0486 **FIGURE 6-3**



p0525 **FIGURE 6-4**

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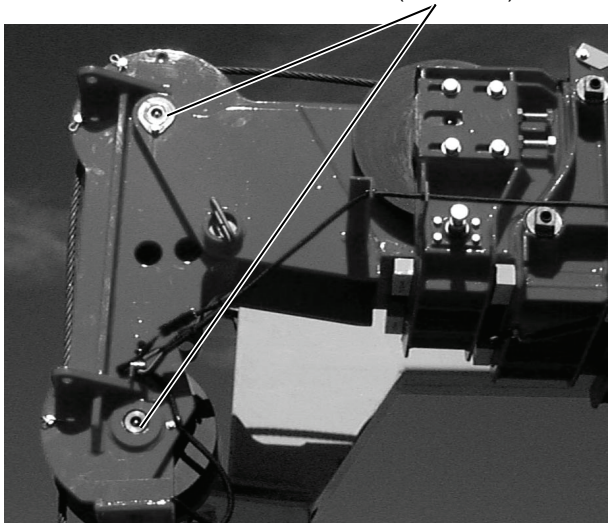
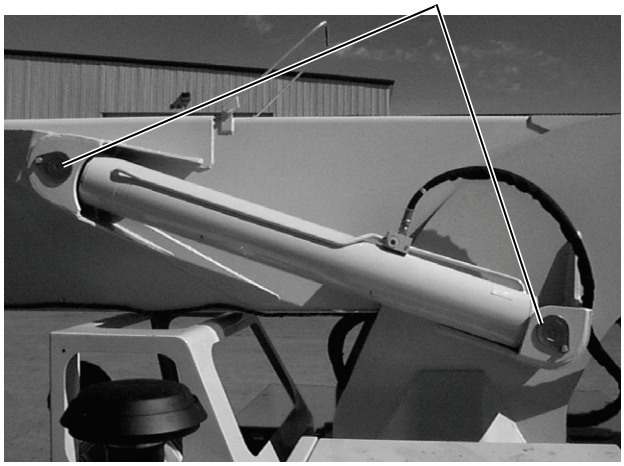
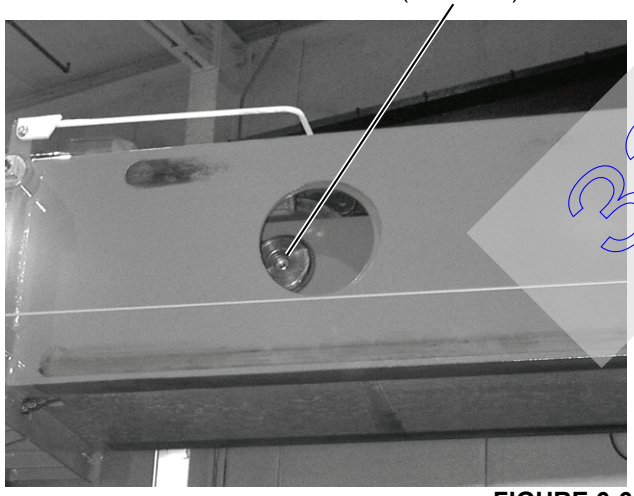


p0487 **FIGURE 6-5**



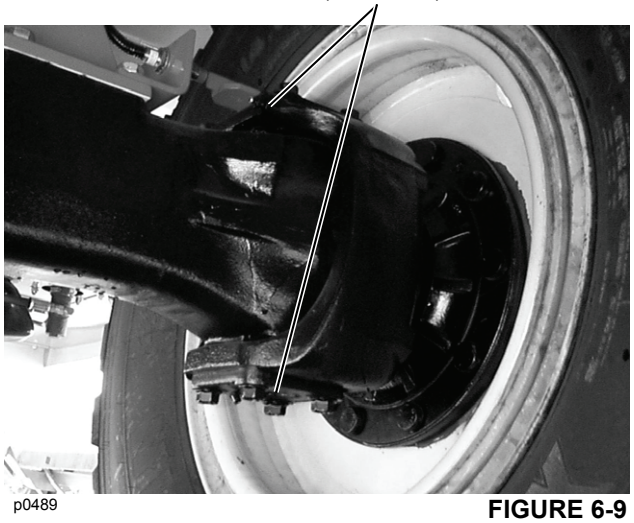
p0502 **FIGURE 6-7**



p0527 **FIGURE 6-6**

p0521 **FIGURE 6-8**

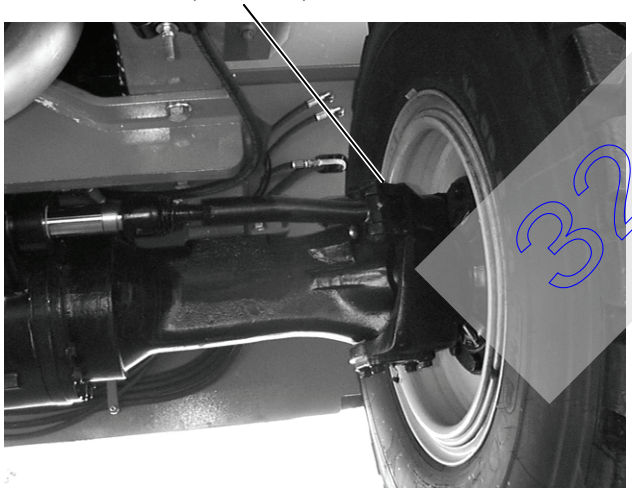
Steering Knuckle Grease Points - Front and Rear Axles (Both sides)



p0489

FIGURE 6-9

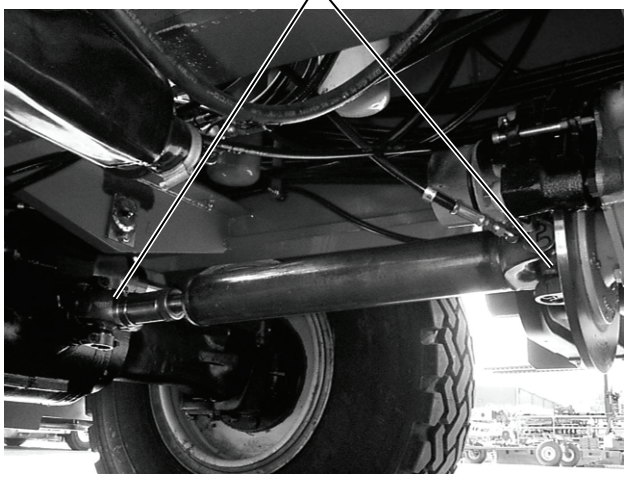
Steering Cylinder Pivot Grease Points - Front and Rear Axles (Both sides)



p0488

FIGURE 6-10

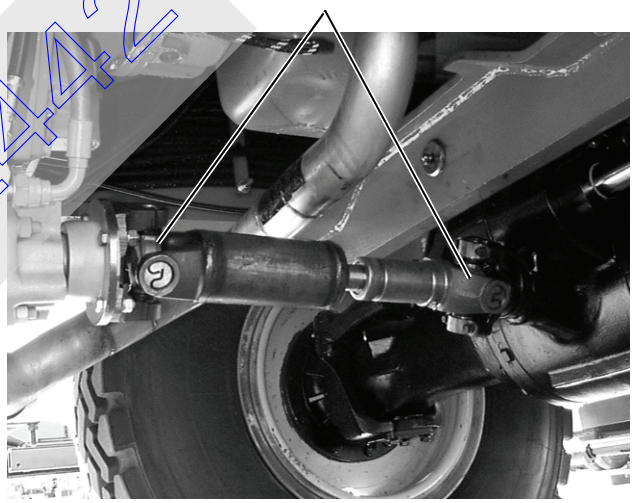
Front Axle Drive Shaft Grease Points - **NO LUBE REQUIRED**



p0490

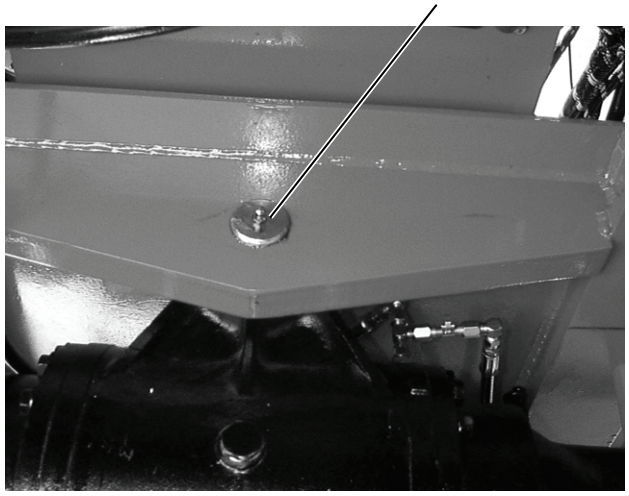
FIGURE 6-11

Rear Axle Drive Shaft Grease Points - **NO LUBE REQUIRED**

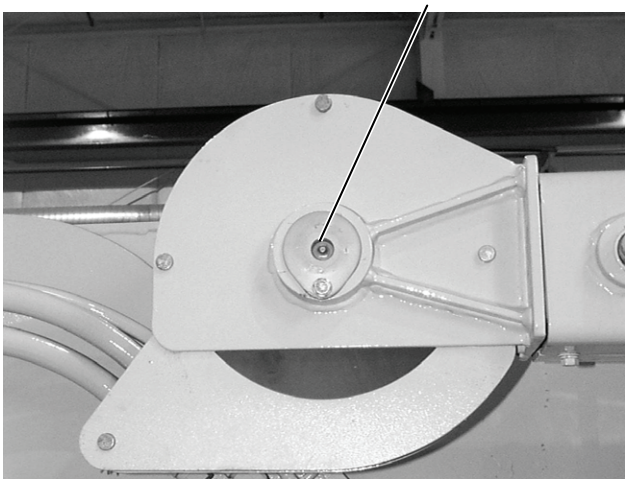


p0491

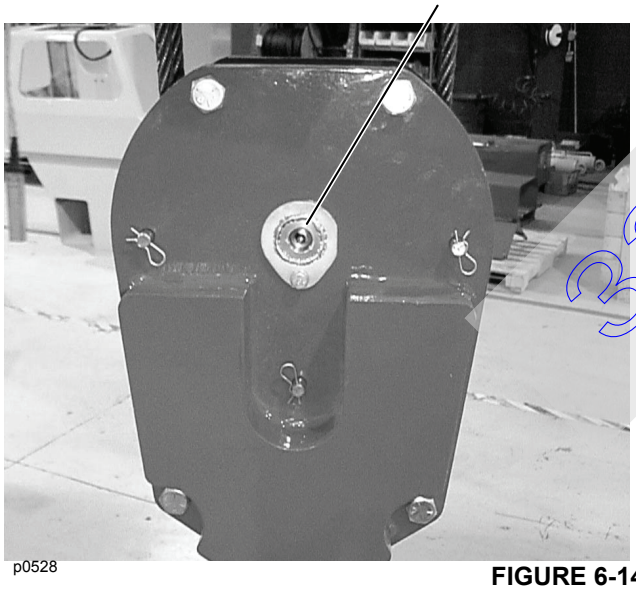
FIGURE 6-12



p0492 **FIGURE 6-13**



p0315 **FIGURE 6-15**



p0528 **FIGURE 6-14**

p0316 **FIGURE 6-16**

SCHEDULED MAINTENANCE DAILY (WALK-AROUND INSPECTION)

NOTE: You must read and understand the warnings and basic safety rules, found in Section 2 of this manual, before performing any operation or maintenance procedures.

For additional engine maintenance guidelines, see the engine manual furnished with this crane.

Inspections

Check The Anti-double Blocking System

Test the anti-double block system daily before beginning operation to make sure it is functioning properly.

Raise the drop block until it touches the anti-double blocking bracket under the boom head. An alarm should sound and the raising of the hoist block should stop.

Lower the hoist block and the alarm should stop.

If there is a malfunction in the system, **DO NOT** operate the crane. Have the malfunction corrected.

Inspect The Wire Rope

Each day before beginning operation, visually inspect the wire rope for damage. See 50 Hour Scheduled Maintenance for examples of damage that can be visually inspected for. If any damage is found, do not operate the crane. The wire rope must be changed out for a new rope before operation can resume.

Inspect Reeving, Clamps And Connections

Each day before beginning operation, inspect for correct reeving of the boom and drop block.

Inspect the terminal ends of the wire rope for damage parts, loose clamps or wrong installation.

DANGER

Loads may fall if the wedge and socket is not installed properly or has damage. A falling load can injure or kill.

Do not operate the crane if any of the above is found. Only after correcting the problem should the crane be put back in service.

Inspect The Lifting Hook

DANGER

Loads may fall if the lifting hook is damaged or loose. A falling load can inure or kill.

Daily before beginning operation, inspect the lifting hook for damage; cracks, deformation, loose retaining hardware, etc. If any damage is found, **DO NOT** operate the crane until the damage is repaired.

Inspect All Safety Devices

Daily before beginning operation, check all safety devices for proper operation. Examples of safety devices include, backup alarms, horn, and beacon lights.

If any is found to be malfunctioning, correct the problem before placing the crane in service.

Check Controls Operation

Each control should be checked for proper operation after the above inspections have been competed. Do not place the crane in service if any control is not functioning properly.

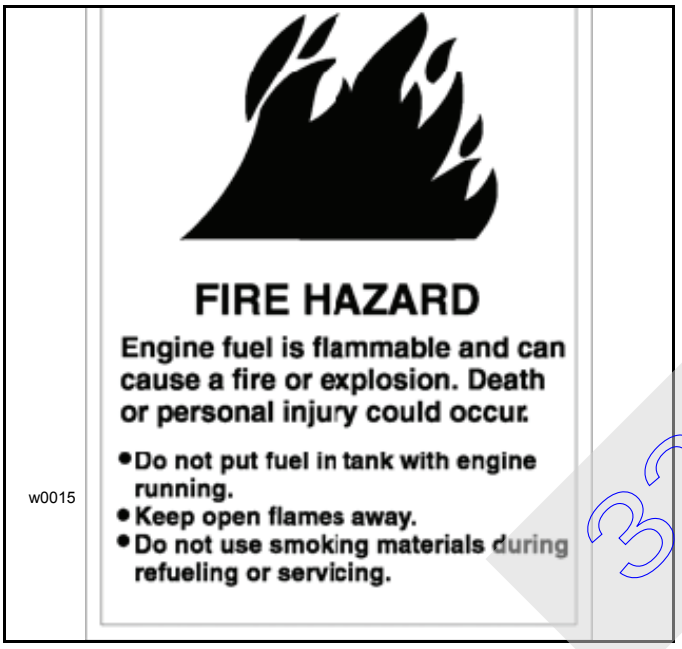
6

Component/System Checks

Check Fuel Level

Check the fuel supply daily before operation. Turn the ignition key to the ON position and view the fuel gauge on the instrument panel. If necessary, fill the tank with recommended fuel.

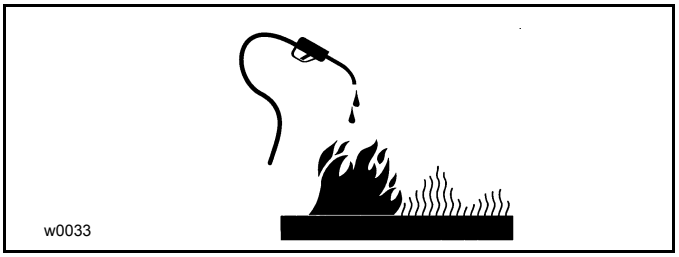
Engine fuel is **flammable** and can cause a fire and/or explosion. Avoid personal injury or death by keeping sparks, open flames, and smoking materials away from the crane and fuel during refueling or fuel system servicing. Know the location of the fire extinguishers on the job site and how to use them.



Maintain control of the hose nozzle when filling the fuel tank. Do not allow fuel to spill. Clean up spilled fuel immediately. Dispose of clean up materials properly.

Do not fill the fuel tank to capacity. Allow room for fuel expansion.

Tighten the fuel cap securely. If the cap is lost, replace only with original equipment.



Checking the Engine Crankcase Oil Level

1. Level the crane, engage the parking brake and shut off the engine.
2. Rotate the boom to the side. Lift the engine compartment cover.
3. Remove the engine oil dipstick and check the oil level. Oil should be present within the crosshatched mark area on the dipstick.
4. If the oil is low, add recommended oil to bring the level up to the crosshatch area of the dipstick. When full, install the dipstick and close the engine compartment cover.

Check the Transmission Oil Level

1. Check the oil level only when the oil is at normal operating temperature (180° to 200° F [82° to 93° C])
2. Level the crane, engage the parking brake and leave the engine run at idle speed.
3. Remove the transmission dipstick (Figure 6-17) and check the oil level. Oil should be at the FULL mark on the dipstick.
4. Install the dipstick.
5. If the oil is low, add recommended oil to bring the level up to the full mark on the dipstick.
6. Shut off the engine.

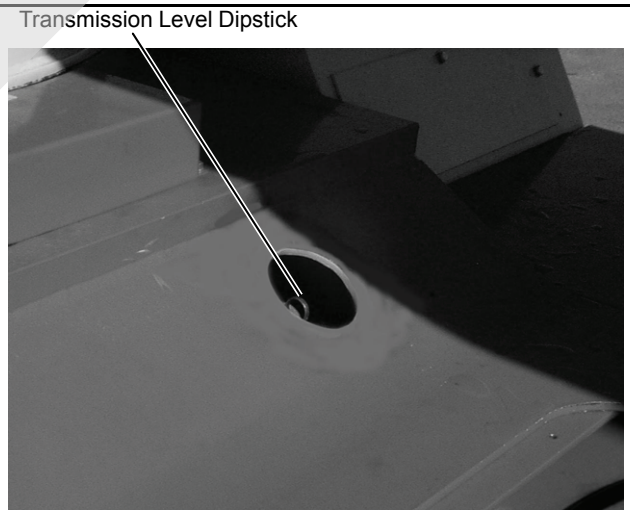
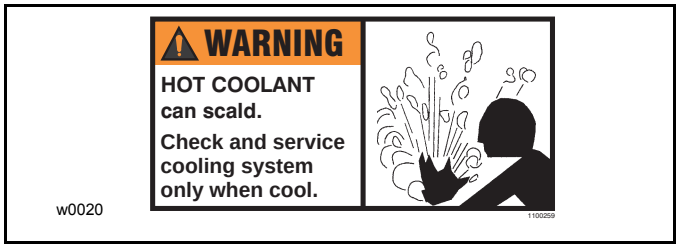


FIGURE 6-17

Check the Engine Coolant Level



Never remove the radiator cap while the cooling system is hot. Check coolant level only when the coolant temperature is cold. The system is under pressure and the coolant can cause severe burns or eye injury. Wear protective clothing and safety glassed. Always turn the cap slowly to the first stop and allow the pressure to escape before removing the cap completely.

1. Level the crane, engage the parking brake and shut off the engine.
2. Check that the coolant is to the bottom of fill tube collar. If coolant is low, add a 50/50 mixture of glycol antifreeze and water, do not add only water as this could cause rust to form in the radiator and engine.

NOTE: For more details on proper radiator checking and maintenance procedures, see the engine manual furnished with the crane.

Drain Water from Engine Fuel Filter/Water Separator

1. Shut off the engine and engage the parking brake.
2. See the engine manual furnished with the crane and follow the water draining instructions.

Check the Hydraulic Oil Level

If the hydraulic oil constantly low, check for leaks in the hydraulic system.

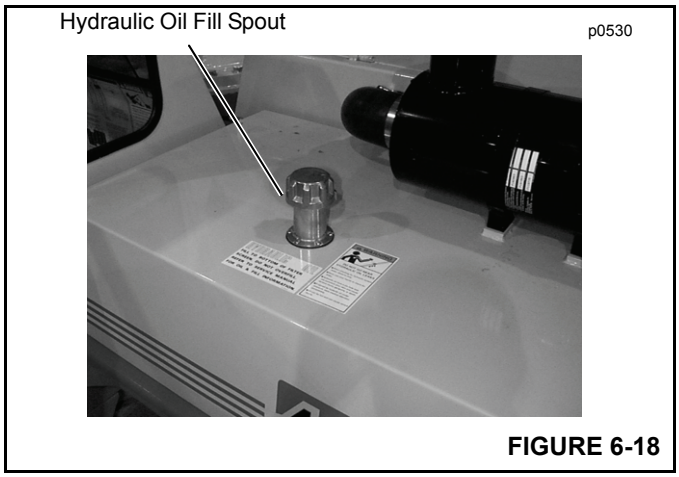


FIGURE 6-18

1. Be sure the boom is fully retracted and lowered and the outriggers are retracted and up.
2. Level the crane, engage the parking brake and shut off the engine.
3. Remove the hydraulic fill cap (Figure 6-18).
4. Visually check the oil level in the fill tube. The hydraulic oil should be visible in the sight gauge on the side of the tank. If low, fill the tank with pre-filtered recommended hydraulic oil.

NOTE: The pump used on this crane requires clean hydraulic oil for proper operation. **Contaminated oil can cause damage to the pump.** Before adding any hydraulic oil to the hydraulic system, be sure the oil has been filtered through a 10-micron (absolute), or less, filter.

Check the Tire Pressure

Check the air pressure in the crane's four tires. Correct pressure is 110 psi *(758 kPa)*.

Also, check for broken studs, rim damage, loose nuts, cracks and other tire damage.

Check the Air Cleaner Restriction Indicator

The air cleaner is equipped with a filter restriction indicator (Figure 6-19). The air cleaner element needs cleaning or replacing if the indicator's colored piston has popped out and is visible when the engine is running at high idle.

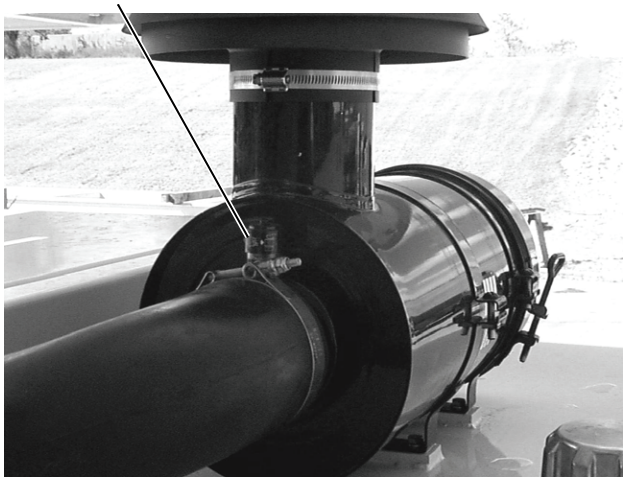
To check the visual indicator the engine must be running, but the transmission must be in neutral and the parking brake must be applied.

Don't remove the element for inspection. Such a check always does more harm to your engine than the good your

6

inspection can do. Ridges of dirt on the gasket sealing surface can drop on the clean filter side when the gasket is released.

Air Cleaner Restriction Indicator, Typical



p0494 **FIGURE 6-19**

Remove the Element

NOTE: Service the air cleaner only with the engine shut down. Dirt and debris can enter the engine and cause damage if the engine is operated with the air cleaner element removed.

1. Remove the cover clamp and housing cover.
2. Remove the element as gently as possible until it is outside of housing. Accidently bumping it while it is still inside the housing means dropped dirt and dust that may contaminate the clean side of the of the air cleaner housing, before the new or cleaned filter element has a chance to do its job.
3. Remove the safety element.
4. Clean the inside of the housing carefully. Any dirt left inside the housing could cause damage to the engine. Use a clean, water-dampened cloth to wipe every surface clean. Check it visually to make sure it is clean before installing a cleaned or new element.
5. Always clean the gasket sealing surfaces of the housing. An improper gasket seal is one of the most common causes of engine contamination. Make sure that all hardened ridges are completely removed, both on the bottom and top of the housing.

Inspecting the Element

1. Don't be fooled by the appearance of the element, it should look dirty.
2. Check the element for uneven dirt patterns. The dirty element is a valuable clue to dust leakage of gasket sealing problems. A dust trail or pattern on the element clean side is a sign that the element was not firmly sealed or that a dust leak exists. Make sure the cause of the leak is identified and rectified before replacing the element.

Cleaning the Element

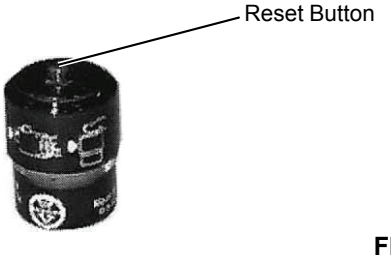
NOTE: To prevent personal injury, always wear safety glasses when using compressed air.

NOTE: Air cleaner elements must be replaced after six cleanings, every three months or after every 500 hours of operation, whichever occurs first.

1. Clean the filter element with compressed air. Use compressed air with 30 psi *(205 Nm)* maximum pressure at the nozzle.
2. With the air nozzle inside the element direct the air towards the outside and then move the nozzle up and down while rotating the element.

Installing The Element

1. Install the safety element over the stud in the housing and slide it all the way in.
2. Install the element over the stud in the housing and slide it all the way in.
3. Make sure the gasket is seating evenly. If the gasket is not seating evenly for a perfect seal, you won't have protection. Recheck to see if the sealing surface in the housing is clean, or if the element is not the right model number. If may be too short for the housing.
4. Install the air cleaner housing cover with the vacuator valve facing down. Install and tighten the cover clamp.
5. Reset the air cleaner restriction indicator by pushing in the reset button (Figure 6-20).
6. If a cleaned air cleaner element was installed, start the engine and run at high idle. If the air cleaner restriction indicator's colored piston pops out and is visible again, shut down and replace the air cleaner element with a new element.



p0450 **FIGURE 6-20**

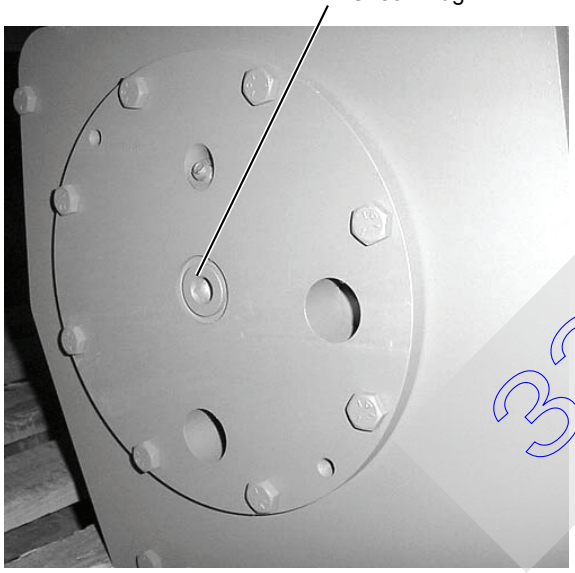
50 HOURS OF OPERATION (WEEKLY)

NOTE: You must read and understand the warnings and basic safety rules, found in Section 2 of this manual, before performing any operation or maintenance procedures.

For additional engine maintenance guidelines, see the engine manual furnished with this crane.

Check the Hoist Gearbox and Brake Lubricant Levels

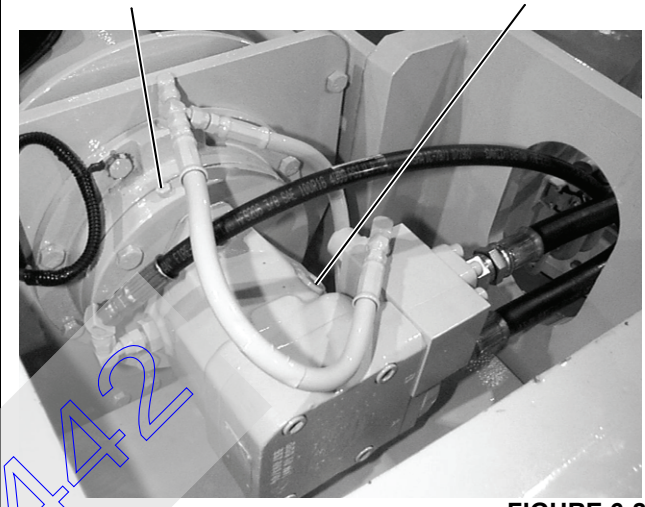
1. Lower the boom to its lowest position.
2. Engage the parking brake and shut off the engine.
3. Clean around the fill/check plug (Figure 6-21) and then remove the plug.



p1511

FIGURE 6-21

4. Check the lubricant level. Oil should be level with the bottom of the fill plug hole.
5. Add SAE 90 EP gear lube if necessary.
6. Clean around the area of the brake breather (Figure 6-22). Remove the breather.
7. Clean around the check plug and remove the check plug.
8. Check the lubricant level. Oil should level with the bottom of the check plug hole.



p1250

FIGURE 6-22

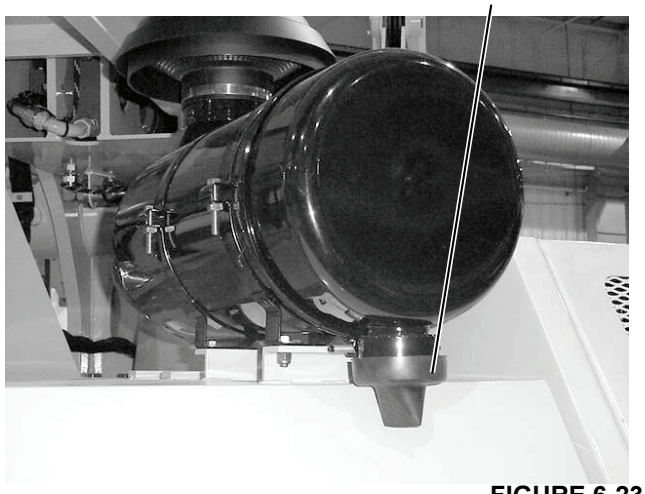
DANGER

Do not use EP type gear lube in the brake section of this hoist. EP gear lube may prevent the clutch from locking up, causing the load to fall which could result in property damage, personal injury or death.

9. If necessary, recommended fluid through the breather hole to fill the brake until oil is level with the bottom of the check plug hole.
10. Install both the breather and check plug.

Clean the Air Cleaner Vacuator Valve

Remove the dirt accumulated in the vacuator valve by squeezing the bottom of the valve until all dirt and debris is removed. If the vacuator valve is missing or damaged, replace it.



p1508

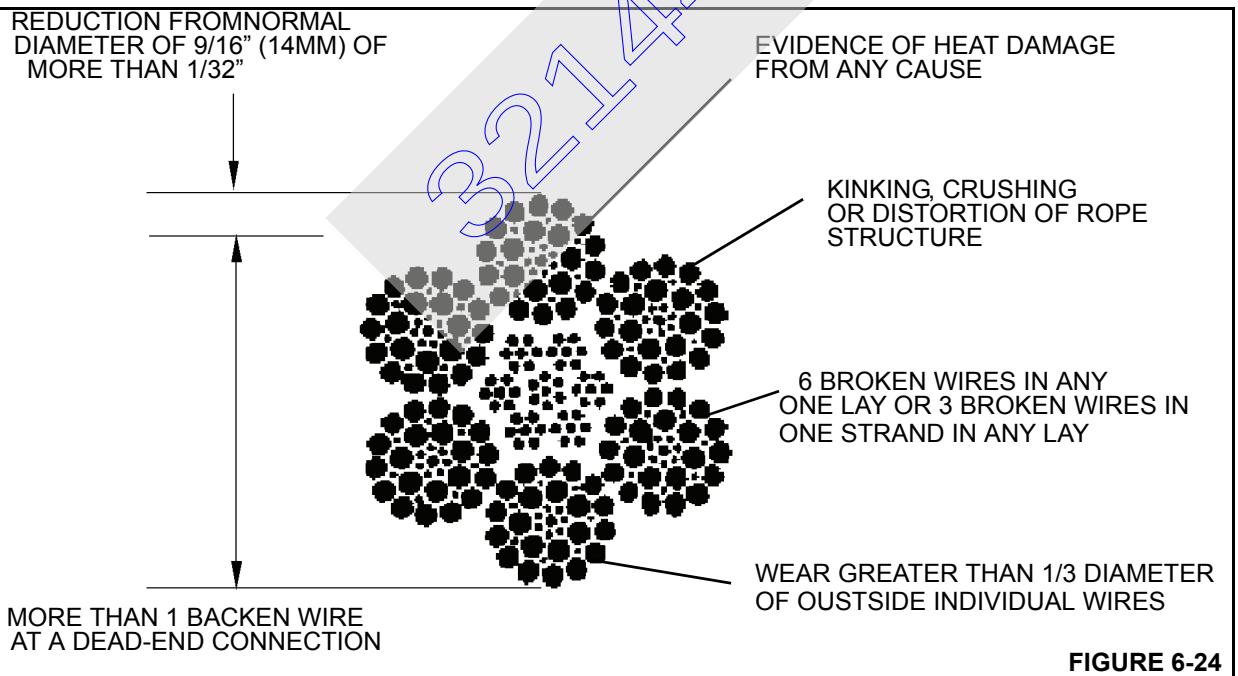
FIGURE 6-23

Inspect the Wire Rope

All wire rope wears out eventually and lose work capability throughout their service life. That's why periodic inspections are critical. SAE J959, Lifting Crane, Wire-Rope Strength Factors, requires that a thorough inspection be performed and recorded on the wire rope not less often then weekly when the crane is in continuous service.

Regular inspection of wire rope and equipment should be performed for three good reasons:

- It reveals the rope's condition and indicates the need for replacement.
- It indicates if you are using the most suitable type of rope.
- It makes possible the discovery and correction of faults in equipment or operation that can cause costly accelerated rope wear.



a0590b

FIGURE 6-24

Inspection

Inspections should be carried out by a person who has learned through special training or practical experience what to look for and who knows how to judge the importance of any abnormal conditions they may discover. It is the inspector's responsibility to obtain and follow proper inspection criteria for each application inspected.

If you are not familiar with wire rope inspection, information on how to inspect wire rope, sheaves and drums is available from your dealer.

General Inspection

NOTE: Always wear gloves when working with wire rope to inhibit hand injuries.

1. **Wire Rope** - Inspect for damage, rust or wear to the wire rope. Keep a record if each inspection. Replace the wire rope if any of the conditions in Figure 6-24 are present.
2. **Sheaves** - Inspect sheaves for damage and/or wear. The sheave grooves must be smooth and a little larger than the wire rope. Use a sheave gauge to check the size of the sheave groove. Rough edges, narrow or worn grooves will cause damage to the wire rope. Replace any worn or damaged grooves.

NOTE: As a sheave wears, the groove for the wire rope becomes smaller. The tracks on the sheave are caused by the wire rope. Yet, the wire rope will continue to engage these tracks, for example as a chain engaging a sprocket. As the wire rope turns and twists on the sheave, the wire rope will move out of the worn track. This will cause increased wear on the wire rope and the sheave.

Grease Fittings

Lubricate all points indicated under the heading Lubrication Points.

Lubricate the Boom Slides

1. Lower the boom and then extend it to its maximum out position.
2. Engage the parking brake and shut off the engine.
3. Clean the old lubricant from the booms.
4. Apply bronze anti-seize, or equivalent, to the boom sliding surfaces on the boom sections. Only use a small amount of lubricant for best results.
5. Align the boom access holes to gain access to the chain roller bracket and slide pad at the end of the boom telescope cylinder.
6. Apply bronze anti-seize, or equivalent, to the inner boom surface in front of and behind the slide block. Only use a small amount of lubricant for best results. Extend and retract the booms to distribute the lubricant along the slide path.

Lubricate the Boom Chains

NOTE: One of the most important, but overlooked factors causing premature wear or breakage of chains is inadequate lubrication. In addition to reducing internal friction, maintaining a film of lubricant on all chain surfaces will inhibit rust and corrosion.

The boom retract chain is lubricated through the access holes in the boom. Align the holes to expose sections of the boom chain. Each section must be lubricated.

NOTE: Use a good grade of spray chain lubricant. If none is available, use preheated oil (60° to 100° F [15° to 37° C]) to provide a better penetration of oil to the chain joints.

Apply ample lubricant to each pin, between the inner and outer side plates and between the inner side plates and roller. **DO NOT**, under any circumstances apply grease lubricant to the chain. Grease will not penetrate to the pin bearings. Lack of lubricant in the pin bearings is usually indicated by squealing or groaning sounds when the boom is extended or retracted.

NOTE: Under normal operating conditions, especially in dusty environments, lubricated chains will accumulate a paste-like buildup of grime. This buildup should never be permitted to accumulate sufficiently to seal off the clearances, thereby restricting the lubricant to the bearing surfaces. Whenever the buildup is excessive, the buildup must be removed by cleaning the chain immediately and then lubricating the chain. DO NOT steam clean or use degreasers; use a suitable solvent.

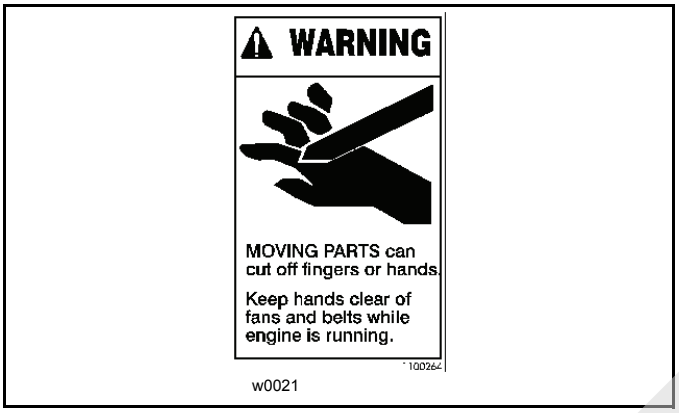
100 HOURS OF OPERATION (TWO WEEKS)

NOTE: You must read and understand the warnings and basic safety rules, found in Section 2 of this manual, before performing any operation or maintenance procedures.

For additional engine maintenance guidelines, see the engine manual furnished with this crane.

Inspect The Fan Belts

Keep the engine and accessory belts properly tensioned for maximum engine performance and fuel economy. Proper belt tension minimizes slippage and increases belt life.



Belts that are too loose see excessive vibration and increased wear. Belts that are too tight produce wear on the belt and the bearings of the pulleys it travels around.

Check ribbed belts for intersecting cracks. Cracks across the belt are acceptable. Cracks along the length of a ribbed belt are not acceptable. Ribbed belts with cracks along their length or intersecting cracks should be replaced. See Figure 6-25.

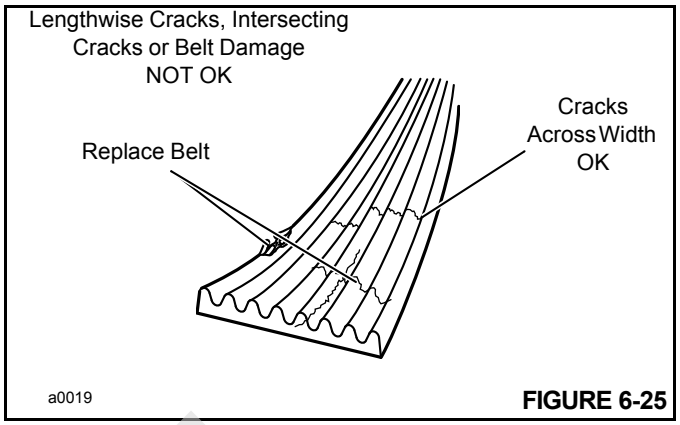


FIGURE 6-25

Any ribbed belt showing signs of wear or that has material missing should be replaced. When a belt is replaced, check its tension again after 30 minutes of operation. New belts will stretch with use.

Check the Wheel Nut Torque

Check the torque on each wheel nut in a crisscross pattern. Wheel nut torque is 368 lb-ft. (500 Nm).

250 HOURS OF OPERATION (MONTHLY)

NOTE: You must read and understand the warnings and basic safety rules, found in Section 2 of this manual, before performing any operation or maintenance procedures.

For additional engine maintenance guidelines, see the engine manual furnished with this crane.

Inspect the Boom Chains

Tightness Check

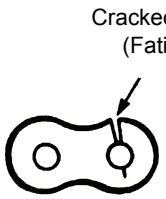
Extend the booms until access to the boom chains can be obtained through the access holes. Feel the chains for looseness. If they are loose, see Section 7 and adjust the chains.

Chain Inspection

1. Place the booms in the fully lowered position.
2. Extend the booms to expose all of the side access holes.
3. Visually inspect the chains through the access holes. A light may be needed to see most of the chain. Look for any damage to the chains.

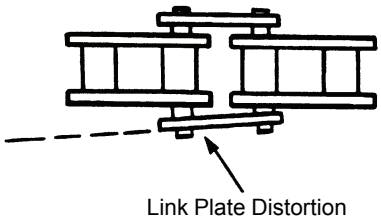
NOTE: If chain damage is found during the inspection, **DO NOT USE THE CRANE**. Cease operation and replace the damaged chain before placing the crane back in service. A damaged chain could break, causing boom to not function properly. Personal injury or property damage could result.

4. Damage could be any of the following:
   - **a.** A crack or complete break of a link plate, particularly an outer plate on either side of the chain (Figure 6-28).



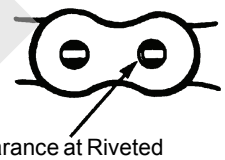
a0158 **FIGURE 6-26**

   - **b.** Distortion or spreading of an outside link plate, evidenced by increasing clearance between overlapping link plates, or between the inner link plates and the roller. This indicates a hidden break in a pin (Figure 6-29).



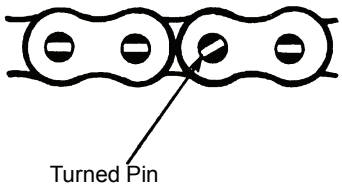
a0159 **FIGURE 6-27**

   - **c.** Looseness between the riveted ends of a chain pin and the outer link plates. If a pin is broken, the normal rigid riveting may loosen, leaving a visible clearance around the exposed ends of the pin (Figure 6-28).



a0160 **FIGURE 6-28**

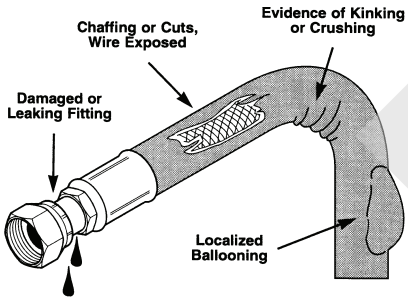
   - **d.** The pin head rivets should be examined to determine if the V-flats are still in the correct alignment. Chain with rotated or displaced heads or abnormal protrusion (Figure 6-29) should be replaced immediately.



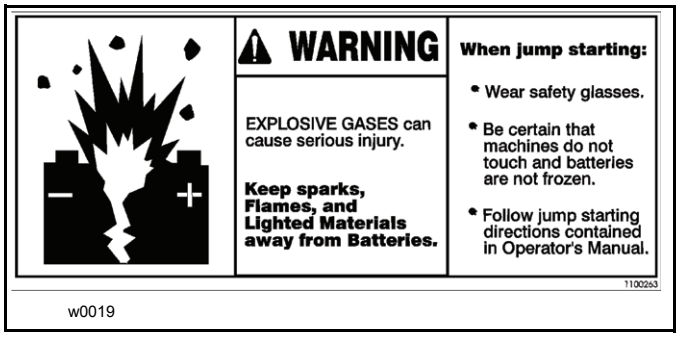
a0161 **FIGURE 6-29**

Inspect The Hydraulic Hoses

Inspect hydraulic hose assemblies for leaks, damaged fittings and worn exterior. Do not use your hands to check for hydraulic leaks. Hydraulic oil under pressure can cause serious injury or possible death. Use a piece of cardboard or other material as a deflector to detect leaks. Replace any problem hose before beginning work.



Clean The Battery And Cables



1. Open the engine compartment cover to gain access to the battery (Figure 6-30).
2. Tighten all battery hardware to keep the battery securely in place.
3. Disconnect the battery cables.
4. Sprinkle the top of the battery with baking soda. Apply water to wash the baking soda from the battery. Be careful not get any of the solution into the battery.
5. Clean the battery posts and cable ends with a battery brush.

FIGURE 6-30

6. Coat the battery posts with petroleum jelly and reinstall the battery cables.

Lubricate the Wire Rope

Apply lubricant to the hoist wire rope to inhibit rust, corrosion and wear.

1. Unwind the wire rope from the hoist drum.
2. Be sure the wire is clean and dry before applying the lubricant.
3. Apply a good grade spray wire rope lubricant to the entire length of the wire rope. If a wire rope lubricant is not available, a light weight engine oil may be used. Preheated oil (60° to 100° F) can be used to provide

better penetration of the oil into the wire rope. Use brush or cloth to apply the oil.

NOTE: Be sure the lubricant enters the strands of the wire rope for proper lubrication. Do not use grease to lubricate the wire rope.

Lubricate the Swing Gear and Pinion

1. Engage the parking brake and shut off the engine.
2. Remove the guard covering the swing pinion.
3. Using a brush, apply open gear lube to the pinion and swing gear teeth (Figure 6-31).

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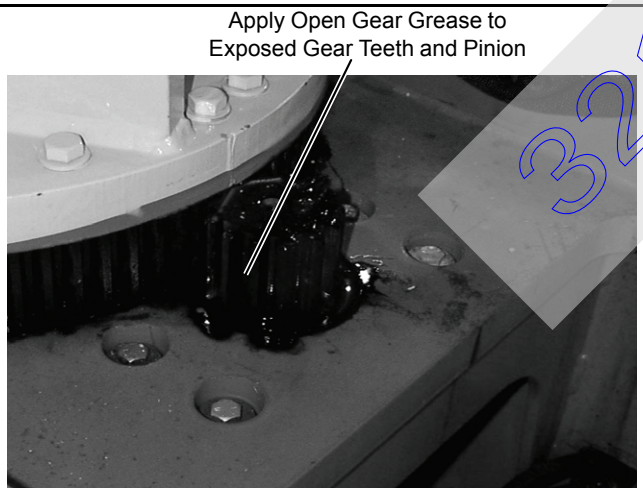
Rotating gears can cause injury. Keep hands clear of rotating pinion and gear while the mast is rotating.



p0324 **FIGURE 6-31**

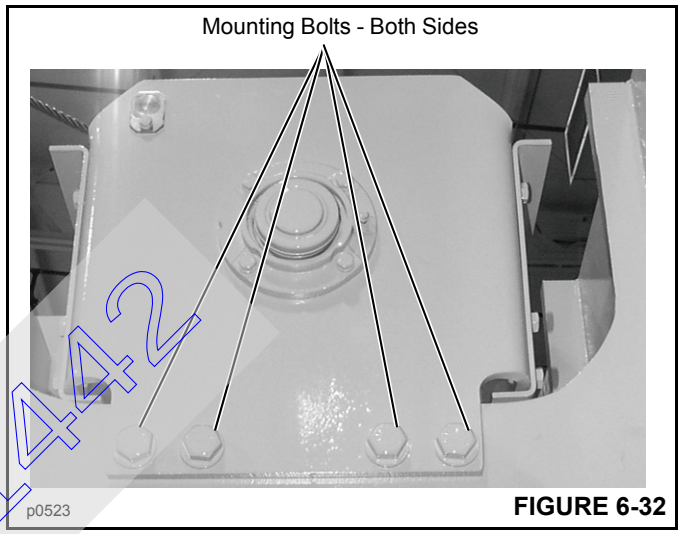
4. Start the engine and rotate the mast until a non-lubricated portion of the swing gear is exposed. Keep hand away from rotating pinion and gear.
5. Shut off the engine.
6. Using a brush, apply open gear lube to the swing gear teeth.
7. Repeat steps 4, 5 and 6 until the complete swing gear is lubricated.
8. Install the guard over the exposed pinion and swing gear.

Torque Critical Bolts

NOTE: Maintain correct torque on all bolts. Failure to do so may result in severe damage to the machine and/or personal injury.

Hoist Gearbox Mounting Bolts

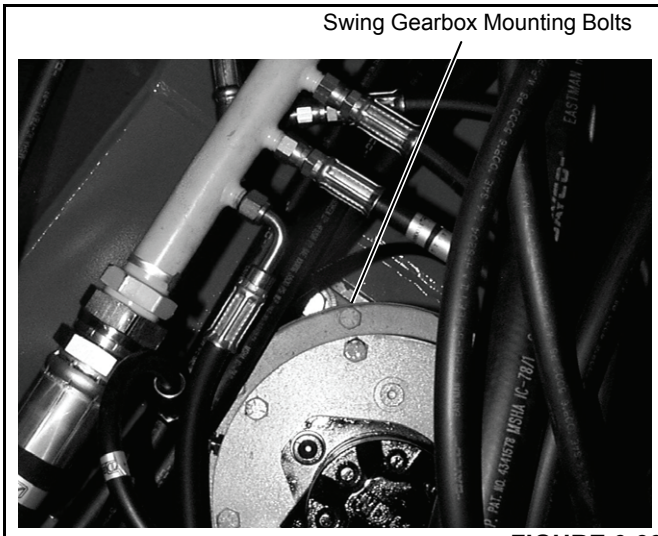
Torque the 3/4” mounting bolts (4) to 200 lb-ft. (272 Nm). See Figure 6-32.



p0523 **FIGURE 6-32**

Swing Gearbox Mounting Bolts

Torque the 5/8” gearbox mounting bolts (4) to 112 lb-ft. (152 Nm). See Figure 6-33. If bolts are loose check the gear backlash

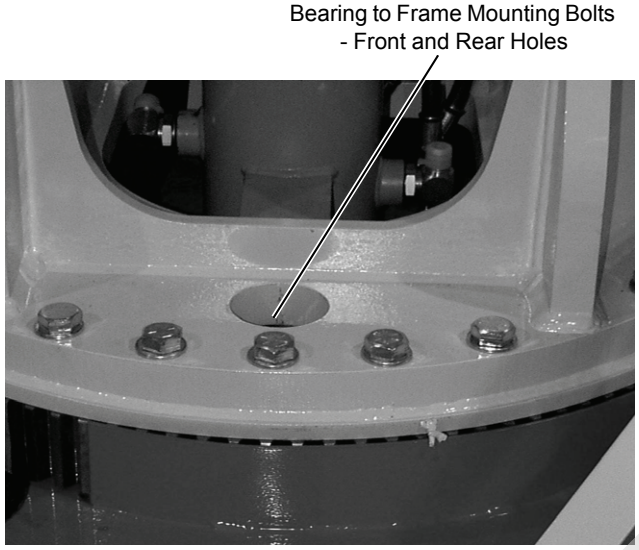


p0504 **FIGURE 6-33**

6

Swing Bearing to Frame Mounting Bolts

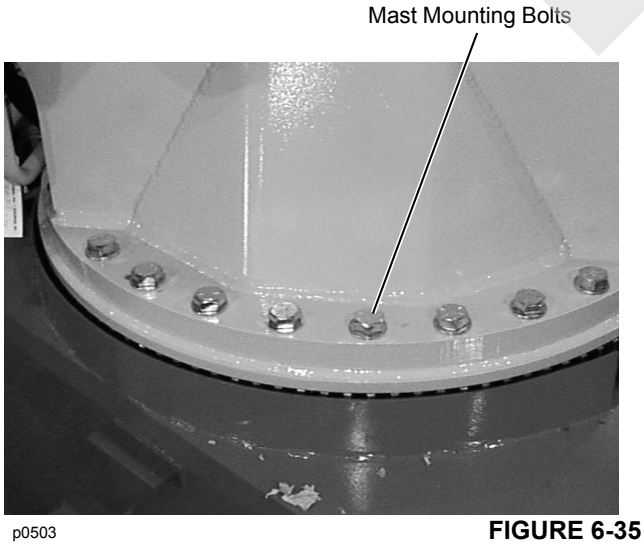
Torque the thirty (30) 7/8” bearing mounting bolts to 455 lb-ft. (619 Nm). To gain access to the bolts, rotate the mast until a bolt is visible in both access holes in the mast mounting plate (Figure 6-34). Tighten the bolts exposed in each hole, then Rotate the mast until different bolts are exposed and tighten them Rotate the mast through a complete cycle, tightening all bolts.



p0501 **FIGURE 6-34**

Mast To Swing Bearing Mounting Bolts

Tighten the twenty six (26) 7/8” mast mounting bolts (26) to 455 lb-ft. (619 Nm). See Figure 6-35. Tighten each bolt in a crisscross pattern.



p0503 **FIGURE 6-35**

Replace the Crankcase Oil

Change the engine oil more frequently if operating under difficult conditions, for example in high or low temperatures or frequent starting and stopping.

NOTE: It is necessary to climb under the crane to replace the engine crankcase oil. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

NOTE: Drain the engine oil only when it is hot and the contaminants are in suspension.

1. Review the engine manual furnished with the crane on how to change the engine crankcase oil and for oil specifications.
2. 15 quarts (14.2 liters) of oil is required for an oil change without changing the filter.

Replace the Engine Oil Filter

NOTE: It is necessary to climb under the crane to replace the engine oil filter. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

1. Drain the crankcase oil from the engine (See Changing The Crankcase Oil above).
2. Turn the filter counterclockwise to loosen. Remove and discard the old filter.
3. Clean the filter mounting surface on the engine.
4. Apply a small amount of clean engine oil to the gasket of the new oil filter. Turn the filter clockwise to tighten it until the gasket makes contact. Then, tighten the filter 1/2 to 3/4 turn to get correct seal.
5. Fill the engine with 17.2 quarts (16.3 liters) of recommended oil. See the engine manual furnished with the crane. Operate the engine for two to three minutes to fill the filter body. Stop the engine and check the oil level using the dipstick, add oil if necessary. Check the filter for leaks.

Clean the Radiator

NOTE: To inhibit personal injury, always wear safety glasses when using compressed air.

Clean the radiator fins using compressed air or a water hose to remove all foreign materials. If these materials are not removed, the engine may overheat due to blocked air through the radiator fins and core.

500 HOURS OF OPERATION (THREE MONTHS)

NOTE: You must read and understand the warnings and basic safety rules, found in Section 2 of this manual, before performing any operation or maintenance procedures.

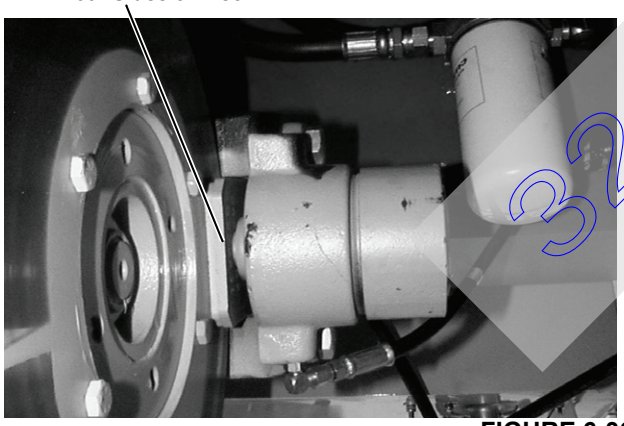
For additional engine maintenance guidelines, see the engine manual furnished with this crane.

Inspect the Tires

Inspect the tires for any signs of damage, such as cracks, large gouges, deterioration, etc. If damage is found, it must be carefully analyzed to determine if the tire is safe to use. Replace all tires that are unsafe.

Inspect the Parking Brake Pads

NOTE: It is necessary to climb under the crane to check the parking brake pads. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.



p0506 **FIGURE 6-36**

Inspect the thickness of the brake pads Figure 6-36. Replace the brake pads if they are 0.28 inches (7.1 mm) thick or less.

Replace Fuel Filter/Water Separator

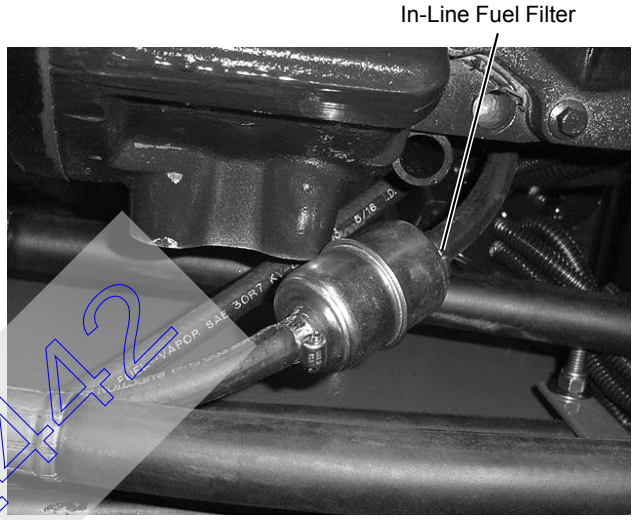
See the engine operator's manual furnished with the crane and follow the recommended replacement procedures.

NOTE: If the filter is not filled with fuel prior to installation, the engine will not start due to air in the fuel system. The fuel system will have to be bled as instructed in the engine manual furnished with the crane.

Replace the In-Line Fuel Filter

NOTE: It is necessary to climb under the crane to replace the in-line fuel filter. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

1. Loosen the two clamps (Figure 6-37) securing the in-line filter to hoses.
2. Replace the in-line filter with a new filter.
3. Position and tighten the clamps.



p1509 **FIGURE 6-37**

Replace Air Cleaner Element

NOTE: Service the air cleaner only with the engine shut down. Dirt and debris can enter the engine and cause damage if the engine is operated with the air cleaner element removed.

1. Remove the cover clamp and housing cover.
2. Remove the element as gently as possible until you get outside of the housing. Accidently bumping it while it is still inside the housing means dropped dirt and dust that may contaminate the clean side of the air cleaner housing before the new element has a chance to do its job.
3. Remove the safety filter.
4. Clean the inside of the housing carefully. Any dirt left inside the housing could cause damage to the engine. Use a clean, water-dampened cloth to wipe every surface clean. Check it visually to make sure it is clean before installing a cleaned or new element.
5. Always clean the gasket sealing surfaces of the housing. An improper gasket seal is one of the most common causes of engine contamination. Make sure that all

hardened ridges are completely removed, both on the bottom and top of the housing.

6. Install the safety element. Make sure it is seated all the way.

NOTE: The safety element must be replaced after two main element replacements.

7. Install the new element over the stud in the housing and slide it all the way in.

8. Make sure the gasket is seating evenly. If the gasket isn't seating evenly for a perfect seal, you won't have protection. Recheck to see if the sealing surface in the housing is clean, or if the element is not the right model number. If may be too short for the housing.

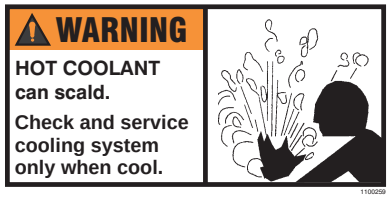
9. Install the air cleaner housing cover with the vacuator valve facing down. Install the cover clamp

10. Reset the air cleaner restriction indicator by pushing in the reset button (Figure 6-38).

p0450

FIGURE 6-38

Add Rust Inhibitor to Engine Cooling System



w0020

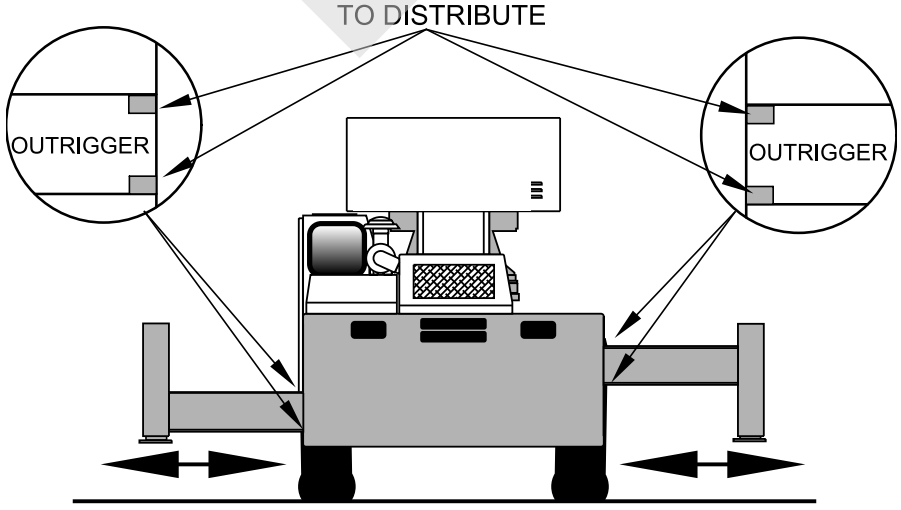
For maximum protection of the engine cooling system, add a corrosive inhibitor to the radiator. When the engine is cold, remove the radiator cap and pour the inhibitor in the radiator reservoir.

Lubricate the Outrigger Slides

1. Extend and lower the outriggers.

2. Clean the slide beams, top and bottom, with a suitable solvent.

3. Apply Mobil EP grease, or equivalent, to the areas shown in Figure 6-39. Do not over lubricate by applying to complete outside of sliding beam. Extend and retract the beams several times to spread the grease.



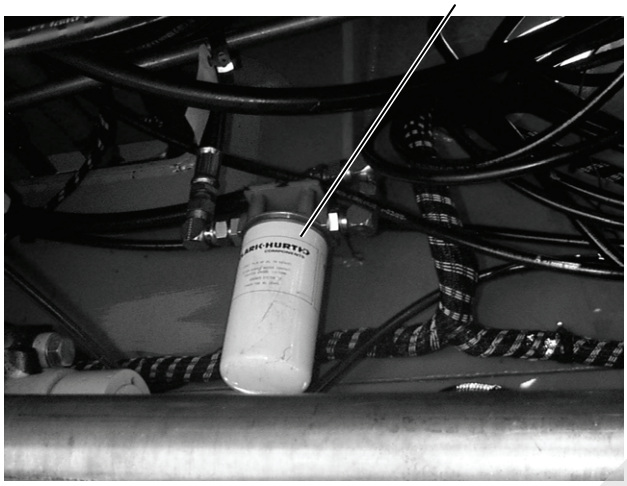
a0629

FIGURE 6-39

Replace the Transmission Oil Filter

NOTE: It is necessary to climb under the crane to a replace the transmission oil filter. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

1. Place a suitable container under the transmission oil filter and then remove the spin-on type oil filter (Figure 6-40). Properly discard the oil filter.



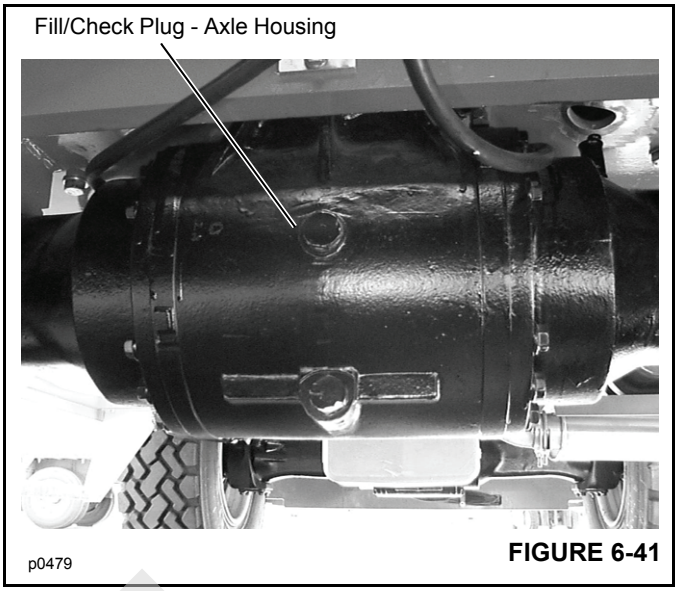
p0481 **FIGURE 6-40**

2. Coat the seal on the new transmission filter with new transmission oil, or equivalent, and stall the filter until the seal makes contact. Then, tighten the filter 1/2 to 3/4 turn to obtain a tight seal.
3. With the transmission in neutral and the parking brake set, start the engine and let the transmission obtain normal operating temperature (180° to 200° F [82° to 93° C]).
4. With the engine running, check the transmission oil level on the dipstick. If lower than the FULL mark, add recommended transmission oil.

Check the Axle Housing Lubricant Level

It is necessary to climb under the crane to add grease to check the axle housing lubricant. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

1. Clean around the axle housing fill/check plug (Figure 6-41) and remove the plug.
2. Check the lubricant level, which should be even with the bottom of the fill/check hole.

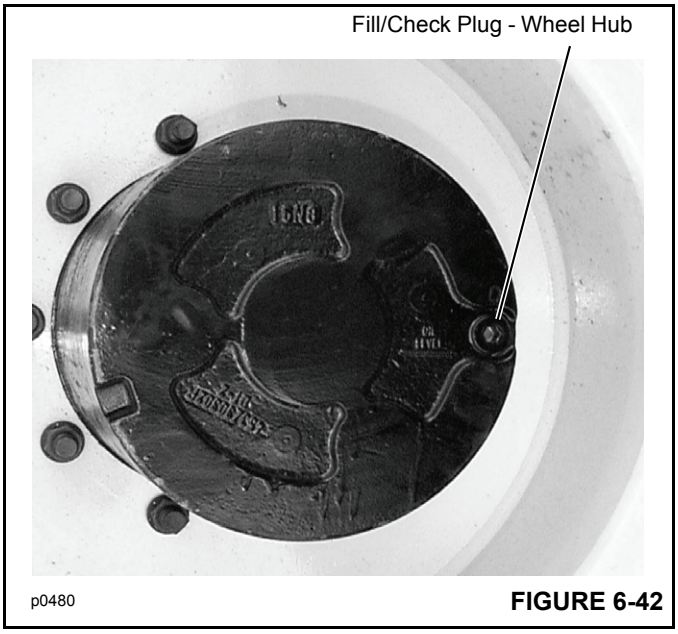


p0479 **FIGURE 6-41**

3. If necessary, add Mobil Fluid 424, or equivalent, to fill the housings until the oil is level with the bottom of the fill/check hole.

Check The Wheel Hub Lubricant Level

1. Position the fill/check plug so it horizontal with the ground (Figure 6-42).
2. Clean around the plug and then remove it.
3. Check the lubricant level, which should be even with the bottom the hole.
4. If necessary, add Mobil Fluid 424, or equivalent, to fill the hub to the bottom of the check plug hole.



p0480 **FIGURE 6-42**

5. Repeat Steps 1 through 4 for the other wheel hub.

6

Check Swing Gearbox Lubricant Level

It is necessary to climb under the crane to add grease to check the axle housing lubricant. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

1. Clean around the swing gear box check plug (Figure 6-43) and remove the plug.
2. Check the lubricant level, which should be even with the bottom of the check hole.
3. If necessary, add EP 90 weight oil, or equivalent, through the fill port to fill the housing until the oil is level with the bottom of the check hole. Install both plugs
4. Apply a Lithium Base E.P. No. 2 bearing grease to the grease fitting on the gear box.

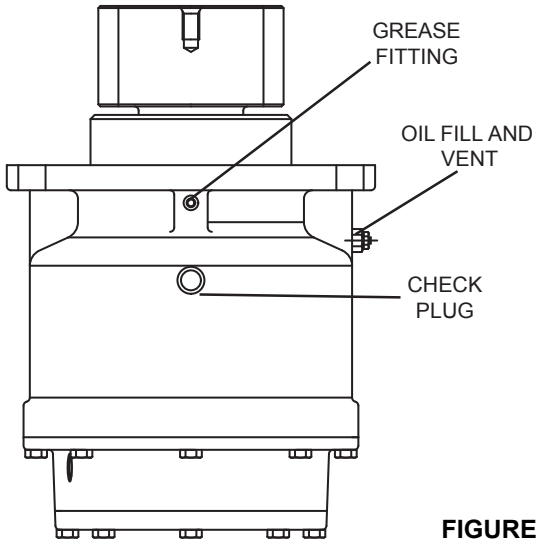


FIGURE 6-43

1000 HOURS OF OPERATION (SIX MONTHS)

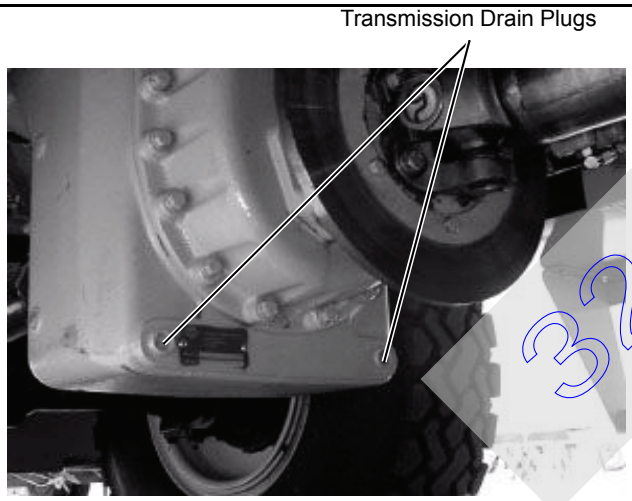
NOTE: You must read and understand the warnings and basic safety rules, found in Section 2 of this manual, before performing any operation or maintenance procedures.

For additional engine maintenance guidelines, see the engine manual furnished with this crane.

Replacing the Transmission Oil and Filter

1. Engage the parking brake and start the engine. Allow the transmission oil to obtain normal working temperature (180° to 200° F [82.2° to 93.3° C]).
2. Shut off the engine. Remove the ignition key.

NOTE: It is necessary to climb under the crane to drain the transmission oil. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.



p4154 **FIGURE 6-44**

3. Place suitable container under the transmission drain plug (Figure 6-44).
4. Remove the plug. Drain the transmission into the container. Install the drain plug.
5. Remove the transmission oil filter by unscrewing it from the filter housing (Figure 6-45). Properly discard the filter.

p0481 **FIGURE 6-45**

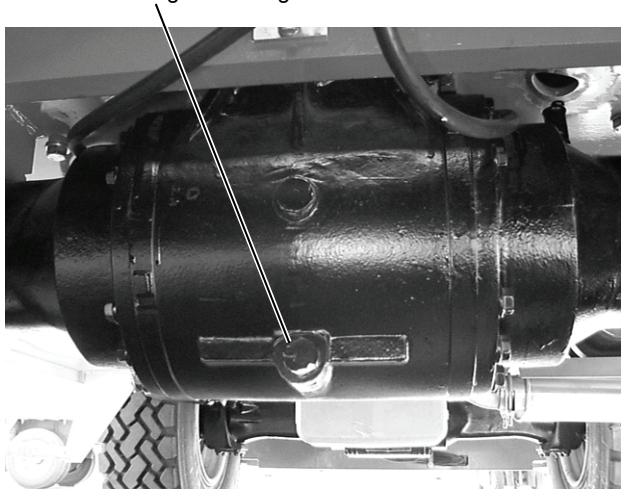
6. Coat the seal of the new filter with clean transmission oil.
7. Screw on the transmission filter until it touches the filter head. Then, turn the filter another 1/2 to 3/4 of a turn to seat the seal.
8. Refill the transmission with recommended fluid to LOW mark on the dipstick.
9. Start the engine and let it run at idle speed to prime the torque converter and fill all lines.
10. With the engine running at idle speed, check the transmission oil level and fill to the LOW mark on the dipstick.
11. When the transmission is at normal operating temperature (180° to 200° F [82° to 93° C]), make a final check of the oil level. Add oil to the FULL mark on the transmission.

6

Replace the Axle Housing Lubricant

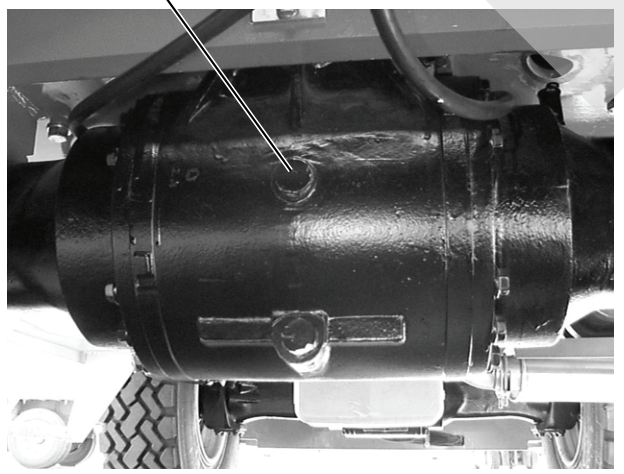
NOTE: It is necessary to climb under the crane to drain the axle housing oil. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

1. Place a container under the differential drain plug (Figure 6-46). Remove the drain plug and drain the fluid into the container. Install the drain plug.



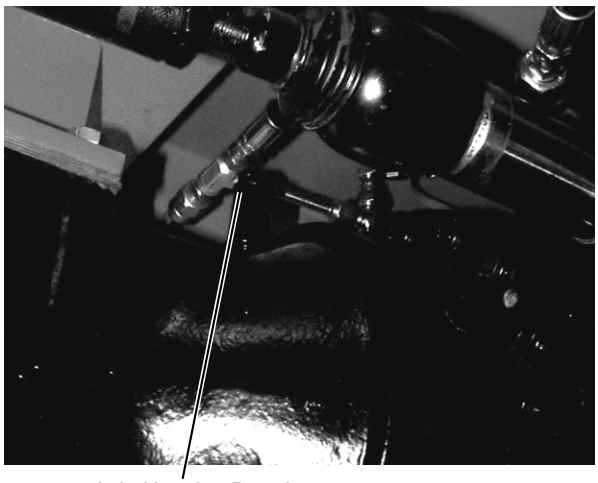
p0479 **FIGURE 6-46**

2. Clean around the check/fill plug in the axle housing (Figure 6-47). Remove the plug.



p0479 **FIGURE 6-47**

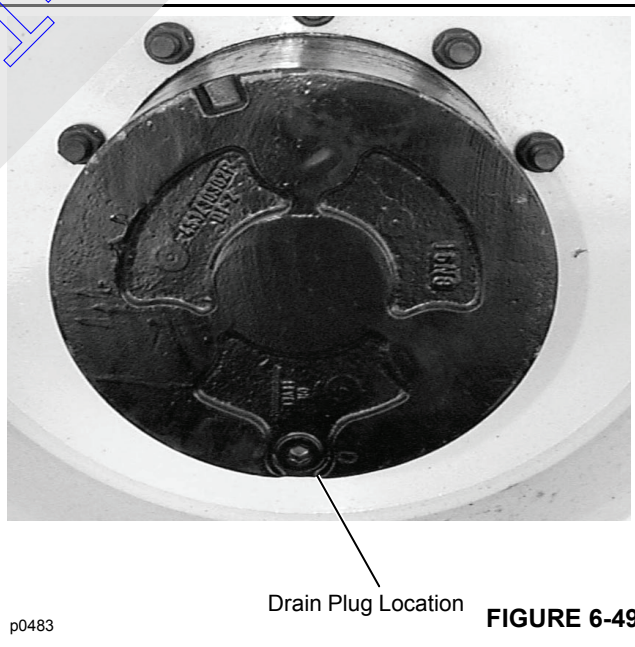
3. Remove and clean the axle breather (Figure 6-48) with a suitable solvent. Install the breather.



p0533 **FIGURE 6-48**

4. Fill the axle housing with approximately 6.9 gallons (26 liters) of Mobil Fluid 424 through the check/fill plug hole. Fill until the oil reaches the bottom of the fill hole.
5. Install the check/fill plug. Repeat procedure for the other axle

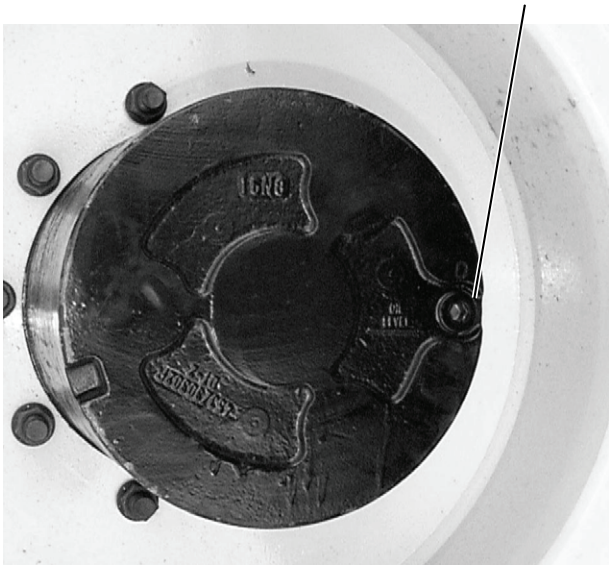
Replace the Axle Wheel Hub Lubricant



p0483 **FIGURE 6-49**

1. Drive the crane until one of the front axle wheel hub drain plugs is located at the bottom of the wheel hub (Figure 6-49).
2. Clean around the drain plug and then remove it. Drain the wheel hub oil into a suitable container.

3. Drive the crane until the drain hole is horizontal (Figure 6-50).



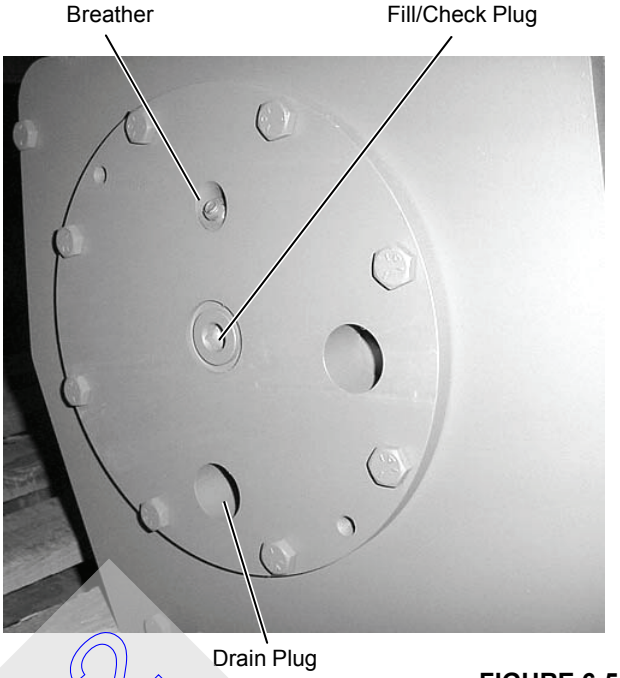
p0480 **FIGURE 6-50**

4. Fill the wheel hub with approximately 2.1 quarts (2.0 liters) of Mobil Fluid 424 through the exposed hole until the oil reached the bottom of the hole.
5. Install the plug.
6. Repeat the above procedure for the other three wheel hubs.

Replace the Hoist Gearbox and Brake Lubricants

Hoist Assembly

1. Fully lower the boom assembly, engage the parking brake, but leave the engine running.
2. Rotate hoist drum until the drain plug is visible through the hole in the side mounting bracket (Figure 6-51).



p1511 **FIGURE 6-51**

3. Clean around the gearbox breather (Figure 6-52) and the fill/check plug. Remove the gearbox breather and clean it in a suitable solvent, after which reinstall into the gear box.
4. Remove the fill/check plug.
5. Place a suitable container under the drain plug.
6. Remove the drain plug and allow the oil to drain into the container. Examine the oil for signs of metal particles. If found, the gear box must may require disassembly and repair.
7. Install the drain plug.
8. Fill the gearbox through the fill hole until the fluid is even with the bottom of the fill hole. Fill with SAE 90 EP gear lube.
9. Install the fill/check plug.

Hoist Brake

1. Clean around the brake breather (Figure 6-52). Remove the breather and clean it in a suitable solvent.

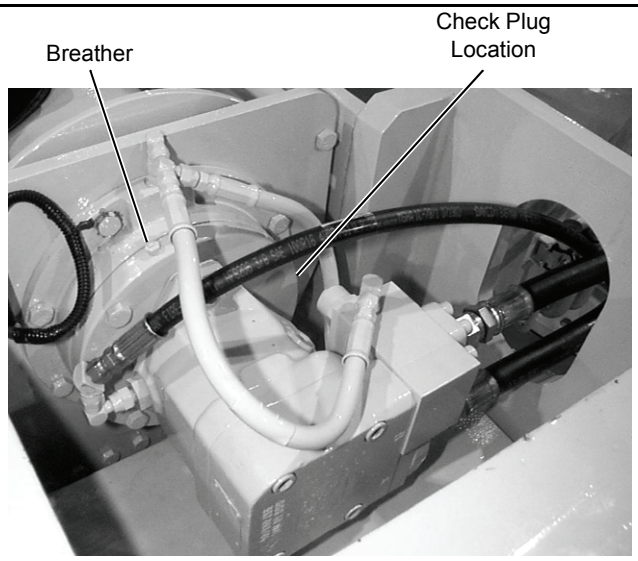


FIGURE 6-52

2. Place a suitable container under the brake drain plug. Clean around the drain plug and remove it. Allow the oil to drain into the container.
3. Install the drain plug.

DANGER

Do not use EP type gear lube in the brake section of this hoist. EP gear lube may prevent the clutch from locking up, causing the load to fall which could result in property damage, personal injury or death.

4. Fill the brake through the breather hole with recommended fluid until the oil is level with bottom of the check plug hole.
5. Install the breather and check plug.

Replace Swing Gearbox Lubricant

It is necessary to climb under the crane to add grease to check the axle housing lubricant. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

1. Clean around the swing gear box drain, check and fill plugs (Figure 6-53).
2. Remove the fill, check and drain plugs and catch draining lubricant in a suitable container. Properly dispose of the lubricant.
3. Install the drain plug.
4. Fill the swing gearbox with EP 90 weight oil until the oil reaches the bottom of the check plug hole.
5. Install the check plug.
6. Clean the fill plug/vent in a suitable solvent and then install the plug.
7. Apply a Lithium Base E.P. No. 2 bearing grease to the grease fitting on the gear box.

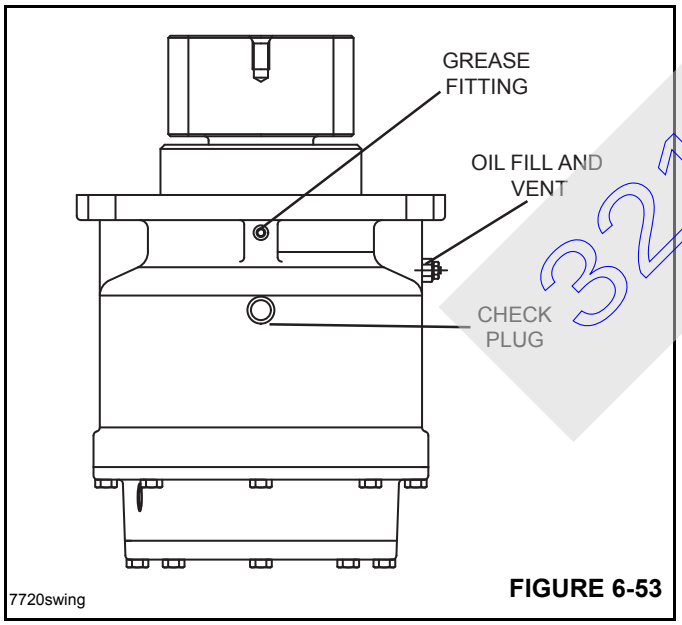


FIGURE 6-53

Replace the Hydraulic Oil

NOTE: SO (International Standards Organization) #46/68 Hydraulic Oil (Mobil Fluid #424) is recommend for year-round use in the hydraulic system.

For operating in cold climates, Mobilfluid 424 may be substituted with Mobil DTE 10M Series, or equivalent. Specific series selection should be based on an operating viscosity range (at operating temperature) to 80 to 170 SUS (Saybolt Universal Seconds) when referring to tank temperature. It may be necessary to use a pre-heater and longer warming period at low operating speed to heat the oil to operating temperature.

NOTE: The pump used on this crane requires clean hydraulic oil for proper operation. Contaminated oil can cause damage to the pump. Before adding any hydraulic oil to the hydraulic system, be sure the oil has been filtered through a 10-micron (absolute), or less, filter.

To change the hydraulic oil:

1. Fully retract and lower the booms.
2. Retract all outriggers.
3. Operate the hydraulic system until the hydraulic oil is warm.

NOTE: It is necessary to climb under the crane to drain the hydraulic oil. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

4. Level the crane, engage the parking brake, shut off the engine and remove the ignition key.
5. Place a suitable container under the hydraulic tank drain port (Figure 6-54).
6. Remove the drain plug and drain the oil into the container.

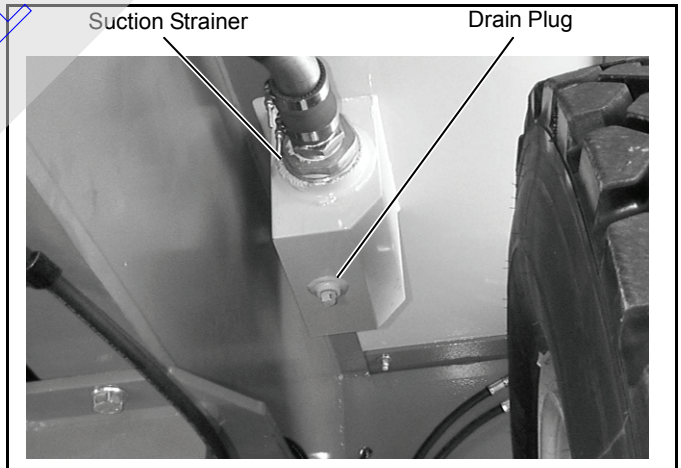


FIGURE 6-54

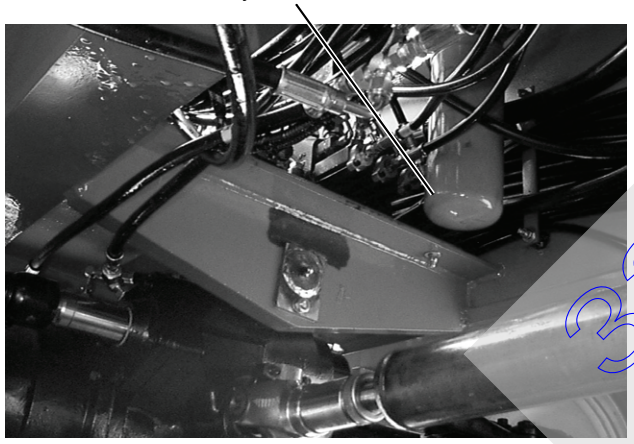
7. Disconnect all hoses from the hydraulic tank Figure 6-52. Drain the hydraulic oil into the container. Remove the suction strainer from the hydraulic tank and clean it in a suitable solvent.
8. Remove the fill strainer from the fill tube and clean it in a suitable solvent.
9. Clean the inside of the hydraulic tank and remove any sediment.
10. Install the fill strainer, suction strainer, suction hose and return hose to the hydraulic tank.

11. Replace the hydraulic oil filter. See Replacing The Hydraulic Oil Filter.
12. Fill the hydraulic tank with Mobil Fluid 424 hydraulic oil to the bottom of fill stainer.
13. After the tank is filled, start the engine and operate each function until all the cylinders and lines are filled.
14. Fully retract and lower the boom and retract the outriggers. Check the hydraulic oil level. Oil must be visible in the sight gauge on the side of the tank. Add hydraulic oil if necessary.

Replace the Hydraulic Oil Filter

It may be necessary to climb under the crane to replace the hydraulic oil filter. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

1. Engage the parking brake and shut off the engine.



p0485 **FIGURE 6-55**

2. Remove the filter:
   a. Using a filter wrench, turn the filter counterclockwise to loosen and remove the filter. Properly discard the removed filter.
   b. Clean the mounting surface on the filter head of the filter.
3. Install the filter:
   a. Apply a small amount of clean hydraulic oil to the gasket of the new hydraulic filter. Install the filter. Install the filter to the filter head by turning it clockwise until the filter gasket makes contact. Then, tighten the filter 1/2 to 3/4 turn to achieve a tight seal.
   b. Start the engine and check for leaks around the filter.

Check The Swing Gear/Pinion Backlash

1. Remove the cover to expose the swing pinion and ring gear.
2. Start the engine and rotate the mast until the high point on the swing gear is in alignment with the pinion. The high point is punch-marked on the edge of the mast base plate (Figure 6-56).

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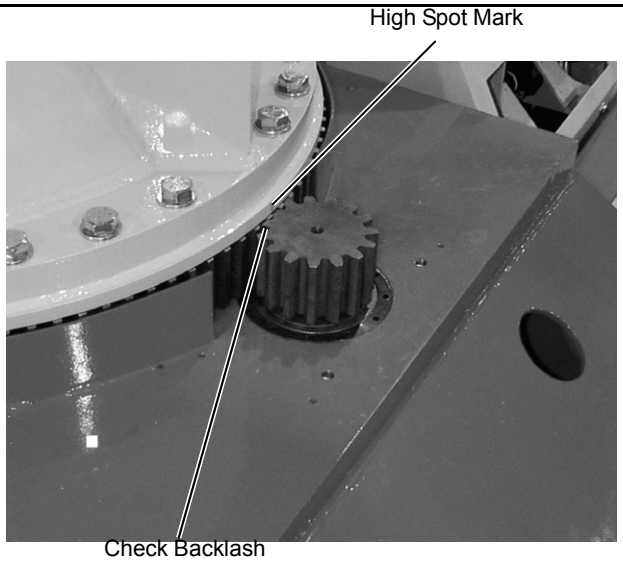
Rotating gears can cause injury. Keep hand clear of rotating pinion and gear while the mast is rotating.

3. Using a feeler gauge, check the backlash between the gear and pinion. There should be no clearance between the swing gear tooth and the pinion tooth. If there is any clearance, adjust the backlash. See Section 7, Adjustments.



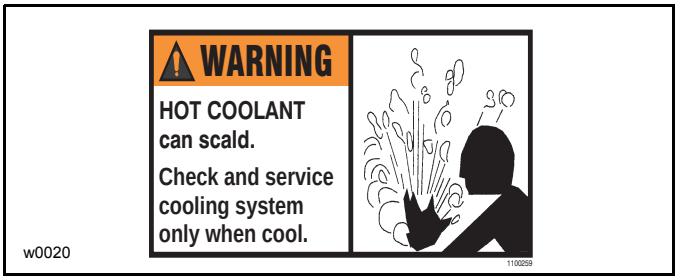
p0500 **FIGURE 6-56**

2000 HOURS OF OPERATION (YEARLY)

NOTE: You must read and understand the warnings and basic safety rules, found in Section 2 of this manual, before performing any operation or maintenance procedures.

For additional engine maintenance guidelines, see the engine manual furnished with this crane.

Replace The Engine Coolant



1. Rotate the boom to the side. Open the engine compartment cover.
2. **BE SURE THE ENGINE IS COOL** and follow the cooling system draining and filling procedures in the Engine Operation and Maintenance Manual furnished with the crane.
3. After the coolant is replaced, close the engine compartment cover.

Inspect the Crane Structure and Booms for Damage

Thoroughly inspect the crane structure and booms for the following:

1. Inspect for loose mounting hardware. Tighten any loose hardware.
2. Inspect for cracked or broken welds. Do not operate the crane if a critical weld is cracked or broken, until the weld is repaired.
3. Inspect for missing or unreadable warning decals. Replace if necessary.
4. Inspect for excessive rust or corrosion on crane structure and booms. Paint any areas with excessive rust or corrosion.
5. Inspect for missing items. Replace if necessary.
6. Inspect the crane for any damage that might inhibit safe operation of the crane. Repair any damage.

Test the Load Moment Indicator (Optional)

See the Load Moment Indicator manual furnished with this crane and test the indicator according to instructions in the manual.

MISCELLANEOUS MAINTENANCE

Batteries/Charging System

NOTE: Lead-acid batteries produce flammable and explosive gases. To avoid personal injury, when checking, testing or charging batteries:

- **DO NOT** use smoking materials near batteries.
- Keep arcs, sparks and flames away from batteries.
- Provide ventilation and wear safety glasses.
- Never check battery charge by placing a metal object across the posts. The sparks could explode battery gases and cause injury or death. Use a voltmeter or hydrometer.

Checking the Charging System

Check the voltmeter reading on the instrument panel. Normal voltmeter readers are as follows:

Normal Operating Ranges

Engine above idle - 14 to 16 volts

Engine stopped - 10 to 14 volts

A reading of less than 10 volts with the engine at low idle indicates a low battery charge.

A reading of less than 14 volts with the engine speed above low idle indicates a problem in the charging system. The system should be checked out by an qualified service technician.

When the voltmeter on the instrument panel indicates a low battery charge, attach a battery charger and increase the battery charge.

Charging the Battery

Under normal conditions, the engine's alternator will have no problem keeping a charge on the battery. The only condition in which the battery may cause a problem is when it has been completely discharged for a long period of time. Under this condition the alternator may not be able to recharge the battery and a battery charger will be required for charging the battery.

Before using a battery charger, an attempt can be made to recharge the battery using the engine alternator by first jump starting the crane (See Jump Starting, in Section 3) and letting the engine run.

DO NOT charge a frozen battery; it may explode and cause injury. Let the battery warm up before attaching a charger.

Charging rates between 3 to 50 amperes are satisfactory if no excessive gassing or spewing of electrolyte occurs or the battery does not feel excessively warm (over 125° F [52° C]). If spewing or gassing occurs or temperatures exceed 125° F (52° C), the charging rate must be reduced or temporarily stopped to permit cooling.

Replacing the Battery

NOTE: The fluid in electric storage batteries contains sulfuric acid, which is a **POISON** and can cause **SEVERE CHEMICAL BURNS**. Avoid all contact of fluid with eyes, skin or clothing. Use proper protective gear when handling batteries. **DO NOT** tip any battery beyond a 45° angle in any direction. If fluid contact does occur, follow the First Aid suggestions below.

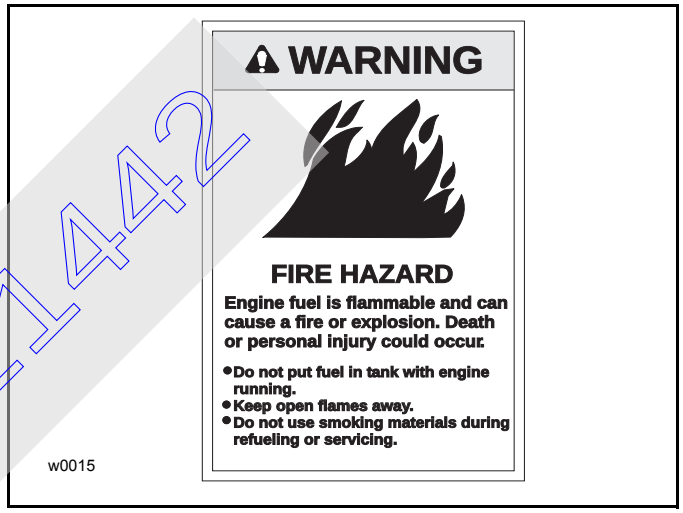
Battery Electrolyte First Aid

- **External Contact** - Flush with water.
- **Eyes** - Flush with water for at least 15 minutes and get immediate medical attention.
- **Internal** - Drink large quantities of water. Follow with Milk of Magnesia, beaten egg or vegetable oil. Get immediate medical attention.

NOTE: In case of internal contact, **DO NOT** give fluids that would induce vomiting.

Remove the battery very carefully to avoid spillage of battery fluid. Properly dispose of the battery.

Fuel System



Fuel Storage

Storage of fuel for an extended period causes accumulation of sediment, dirt, water and other foreign materials in the fuel. Many engine problems are caused by dirty fuel and long storage periods.

Keep fuel in an outside location. Use a shelter to keep the fuel as cool as possible. The water from condensation must be removed at regular intervals from the storage tank.

Fuse Replacement

There are two fuse locations on the crane.

Ten fuses are located on a fuse block behind the instrument panel. Theses fuses protect the crane's electrical system. To access the fuses, remove the outside cover (Figure 6-57) from the front of the cab. Table 6-1 gives the fuse location, rating and circuit function.

Six fuses are located at the rear of the crane in front of the radiator (Figure 6-58). These fuses protect the engine wiring system.

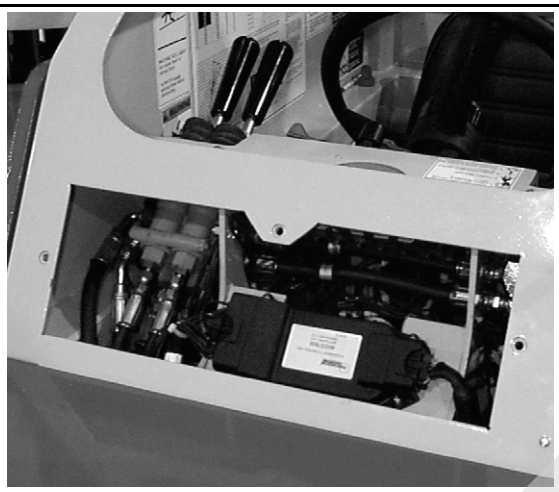


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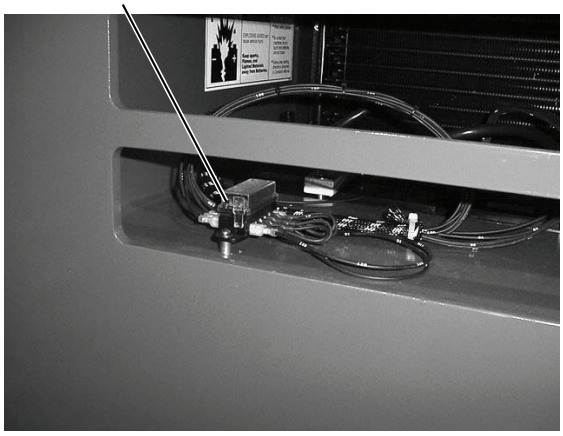
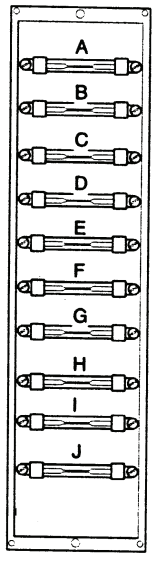
FIGURE 6-57



p1510

FIGURE 6-58

Table 6-1



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Fuse Chart

Fuse	Rating	Function
A	15 amp	Heater/Defroster, Strobe Light, Gauges
B	15 amp	Windshield Wiper
C	15 amp	Cold Start, Horn
D.	15 amp	Hoist Control, Outriggers Control
E	15 amp	Brake Lights, Fuel Shut-off (Diesel Engine) or Spark Ignition Coil (Gasoline Engine), Oil Pressure Switch
F	20 amp	Anti-double Blocking
G	20 amp	Transmission Warning Light, Engine Warning Light, Axle Lockout, Flasher, Turn Signals
H	15 amp	2WD/4WD Switch, Parking Brake
I	20 amp	4-Wheel and Crab Steering
J	20 amp	Head and Tail Lights, Work Lights, Dash/Gauge Lights

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SECTION 7
ADJUSTMENTS

SECTION CONTENTS

HYDRAULIC SYSTEM ADJUSTMENTS

See the service manual to perform the hydraulic pressure test and adjustments for this crane.

BOOM ADJUSTMENTS

Boom Slide Pad Adjustment

The boom side slide pads on the main, 1st, and 2nd boom sections are adjustable to allow for wear on the pads.

1. There are side slide pads located on the main, 1st, and 2nd boom sections. Each slide pad is adjustable by turning the adjustment screw for each slide pad.
   a. The main boom section has four slide pads; two on each side.
   b. The 1st boom section has four slide pads; two on each side of the boom.
   c. The 2nd boom section has four slide pads; two on each side of the boom.
2. Starting with the main boom section, position the boom at the tightest spot on the boom. Wear marks will identify the tight spot on the boom.
3. Tighten the adjustment screws until the adjustment pads make contact with the boom and the boom is centered. **DO NOT OVERTIGHTEN.** Back out each adjustment screw 1 full turn.
4. Repeat steps 2 and 3 for the 1st, and 2nd boom sections.
5. After the slide pads are adjusted, retract the boom sections and visually check that the booms are centered within each boom section and that there is no binding of the boom sections. If a boom section is not centered, adjust the slide pads until the boom is centered. If a boom binds while retracting, loosen each slide slightly until the boom slides freely.

SWING GEAR AND PINION ADJUSTMENT

NOTE: It is necessary to climb under the crane to loosen the swing gearbox mounting bolts. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

1. Remove the cover over the swing gear pinion.
2. Start the engine and rotate the mast until the high point on the swing gear is in alignment with the pinion (Figure 7-1). The high point is punch-marked on the metal base plate.

NOTE: Be sure the swing gear and pinion are aligned at the high spot of the swing gear.

3. From under the crane, slightly loosen the four bolts securing the rotation gearbox (see Figure 7-1).

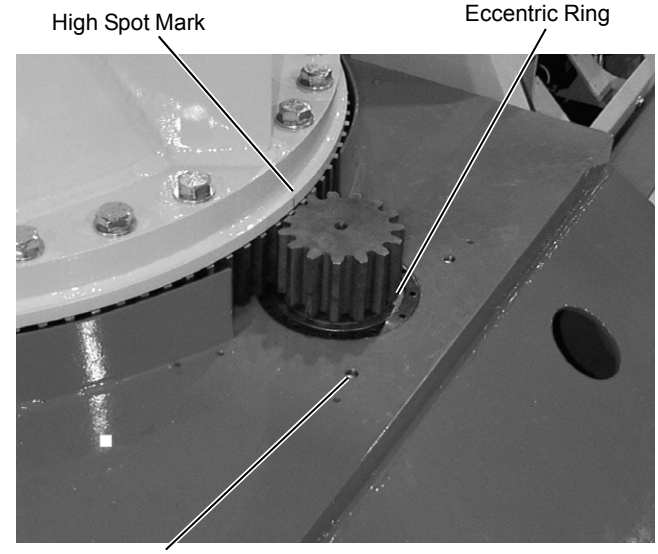


FIGURE 7-1

4. With a spanner wrench, turn the eccentric ring to move the pinion until it contacts the swing gear tooth (zero backlash).
5. Tighten the four bolts to the appropriate torque.
6. Install the swing pinion cover.

BOOM CHAIN ADJUSTMENTS

4th Boom Section Lower Retract Chain

1. Completely extend the boom sections until the chains are accessible throughthe side access holes.
2. Manually check the 4th section retract bottom chain for looseness by pressing on top of the chain. There should no slack in the chain. In most cases the chain will be loose due to chain stretching during use.
3. To adjust the chain, loosen the jam nut on the lower chain adjusting rod (Figure 7-2). Tighten the chain by turning the adjusting nut clockwise. Tighten the chain until there is no slack in the chain.

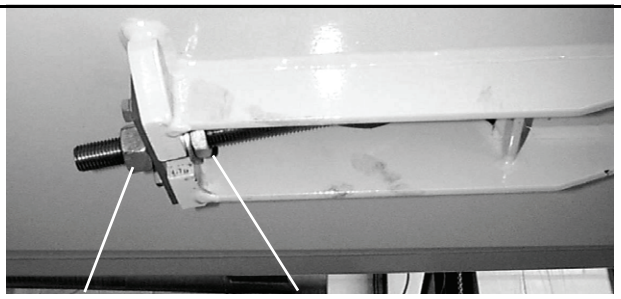


FIGURE 7-2

4. Fully retract the boom sections. Check that the 3rd boom section comes within approximately 1/16 inch (2 mm) of touching the stop block (Figure 7-2) on the 2nd boom section. If the 3rd boom section is spaced as stated it is properly adjusted. Tighten the jam nut loosened in step 3. If the 3rd boom section is more than stated, the chain is too tight and must be loosened slightly.

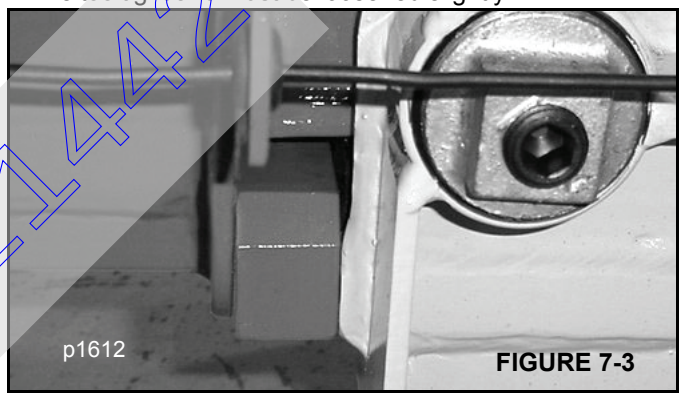


FIGURE 7-3

5. If the chain is too tight, loosen the jam nut (Figure 7-3) and turn the adjusting nut counterclockwise until the 2nd boom section moves to with approximately 1/16 inch (2 mm) of touching the stop block. Then, tighten the jam nut.

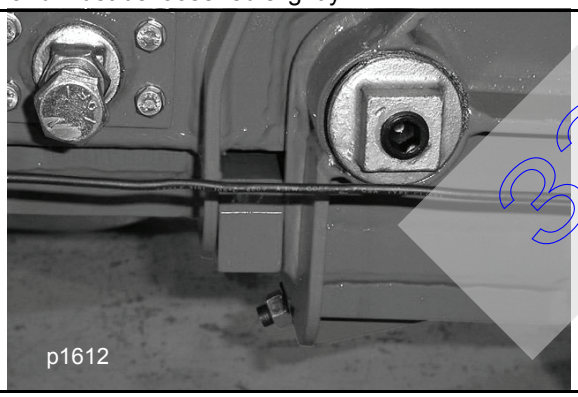
4th Section Upper Extend Chain

1. Completely extend the boom sections until the chains are accessible through the side access holes.
2. Manually check the 4th section extend top chain for looseness by pressing on top of the chain. There should no slack in the chain. In most cases the chain will be loose due to chain stretching during use.
3. To adjust the chain, remove the top access cover on the 2nd boom section (Figure 7-2). Using a pipe wrench attached to the 4th section extend chain rod, turn the

adjusting rod clockwise to tighten the chain. DO NOT use the castle nut on the end of the rod for adjustment.

p0289 **FIGURE 7-4**

4. Fully retract the boom sections. Check that the 4th boom section comes within approximately 1/16 inch (2 mm) of touching the stop block (Figure 6-15) on the 2nd boom section. If the 4th boom section is spaced as stated it is properly adjusted. Install the top access cover. If the 4th boom section is more than stated, the chain is too tight and must be loosened slightly.

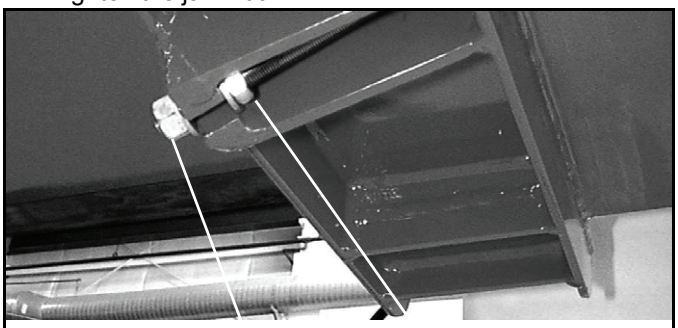


p1612 **FIGURE 7-5**

5. If the chain is too tight, extend the booms until the chain adjustment rod is exposed in the top access hole. Using the pipe wrench turn the adjusting rod counterclockwise until the 4th boom section moved out slightly. Remove the pipe wrench and fully retract the booms again. If the boom sections are not within approximately 1/16 inch (2 mm) of touching the stop block, repeat this step until spacing is correct. Install the top access cover

5TH Section Retract Chain

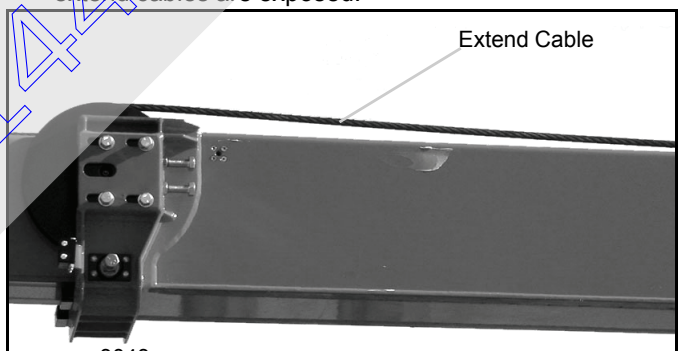
1. Completely extend the boom sections until the chains are accessible through the side access holes.
2. Manually check the 5th section retract chain for looseness by pressing on top of the chain. There should be no slack in the chain. In most cases the chain will be loose due to chain stretching during use.
3. To adjust the chain, loosen the jam nut on the lower chain adjusting rod (Figure 6-16). Tighten the chain by turning the adjusting nut clockwise. Tighten the chain until there is no slack in the chain.
4. Tighten the jam nut.



p0186 **FIGURE 7-6**

5TH Section Extend Cable

1. Completely extend the boom sections until most of the extend cables are exposed.



p3043 **FIGURE 7-7**

2. Manually check both 5th section extend cables for looseness by pressing on top of each cable. The cable should deflect approximately 1/2” (12.2 mm). If the deflection is more then this the cable is too loose. In most cases the cable will be loose due to the cable stretching during use.
3. To tighten the cable, loosen the jam nuts on the two adjusting screws shown in Figure 7-8. Turn the two screws in until the cable will deflect approximately 1/2” *(12.2 mm)*, by pressing on top of the cable. Do

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completely remove the slack from the cable, as the cable will be too tight.

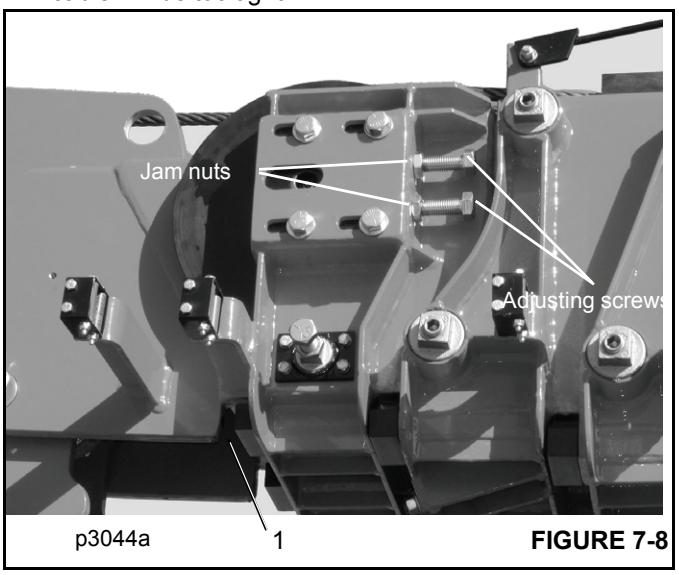


FIGURE 7-8

4. Figure 7-8. 5th Section Extend Cable Tension Adjusting Bolts
5. Tighten the jam nuts against the sheave bracket to lock the tension setting.
6. Repeat steps 3 and 4 for the cable on the other side of the boom. Both cables must have the same tension.
7. After the tension adjustments are made. retract the booms.
8. When all boom adjustments are correct, the gap (1, Figure 7-8) between the 4th section stop blocks and the 5th section must be between.75" to 1.5".

Swing Gear and Pinion Adjustment

NOTE: It is necessary to climb under the crane to loosen the swing gearbox mounting bolts. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

1. Remove the cover over the swing gear pinion.
2. Start the engine and rotate the mast until the high point on the swing gear is in alignment with the pinion (Figure 7-9). The high point is punch-marked on the metal base plate.

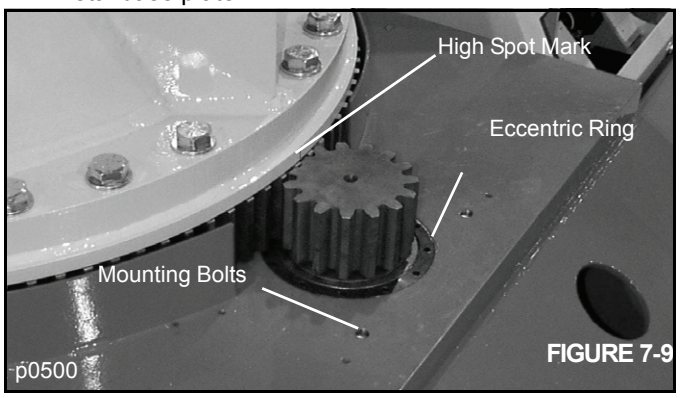


FIGURE 7-9

NOTE: Be sure the swing gear and pinion are aligned at the high spot of the swing gear.

3. From under neath the crane, loosen the jam nuts on the two jacking bolt (Figure 7-10). Back out the jacking bolts about 1/4" *(6.35 mm)*.
4. Slightly loosen the four bolts securing the rotation gearbox (see Figure 7-9).

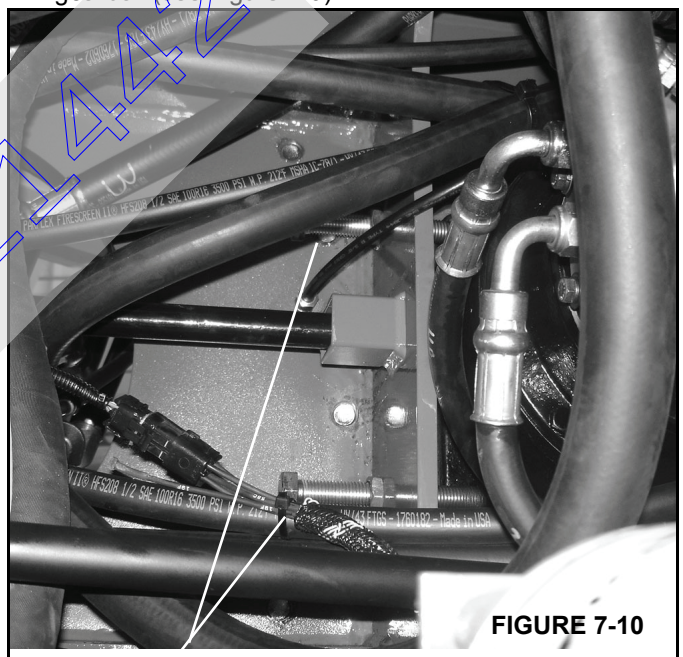


FIGURE 7-10

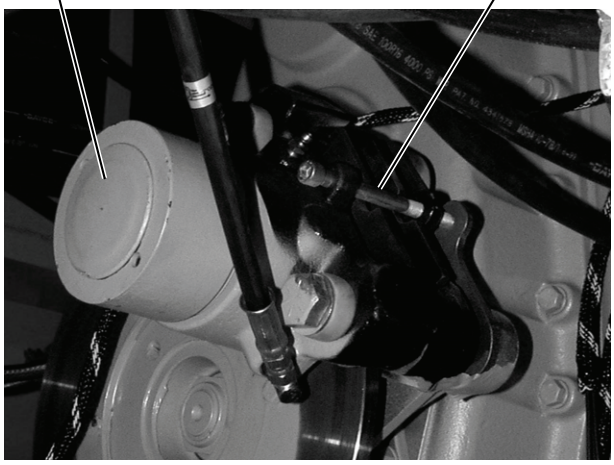
Jack Bolts

5. With a spanner wrench, turn the eccentric ring to move the pinion until it contacts the swing gear tooth (zero backlash).
6. Tighten the four bolts to the appropriate torque.
7. Tighten the jacking bolts and then tighten the jam nuts.
8. Install the swing pinion cover.

PARKING BRAKE ADJUSTMENT

NOTE: It is necessary to climb under the crane to adjust the parking brake. Be sure engine is shut off, the ignition key is removed and chock blocks are in place before climbing under the crane.

1. With the engine running and the parking brake released, remove the plug from the end of the brake housing (Figure 7-11).
2. Using the screw in the opened hole, adjust the set running clearance of the brake pads to 0.020” - 0.030” (0.5 mm - 0.76 mm).
3. Install the plug.
4. Even up the running clearance on each side of the disc by adjusting the carrier retaining bolt (Figure 7-11).



p0495 **FIGURE 7-11**

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SECTION 8
SPECIFICATIONS

SECTION CONTENTS

LUBRICANTS AND CAPACITIES

NOTE: The following list of lubricants does not constitute an unconditional guarantee of the performance of the lubricant mentioned. It is intended solely as a guide to the type of lubricant recommended for a given application.

COMPONENT	CAPACITY	LUBRICANT/FLUID
Engine Crankcase	See engine manual	See engine manual
Fuel Tank	50 gal. (189 L)	See engine manual
Cooling System	23 qt. (21.9 L)	See engine manual
Hydraulic Tank	60 gal. (227 L)	Mobil Fluid #424, (ISO 46/68) ***Very Cold Temperatures***: Mobil DTE 10M Series if the viscosity is between 80 to **170SUS at maximum operating temperature.**
Transmission, Cooler and Lines	6 gal. (22.7 L)	Mobil Fluid #424 (ISO 46/68)
Front Axle Housing	6.9 gal. (26.0 L)	Mobil Fluid #424 (ISO 46/68)
Front Axle Wheel Hubs (2)	2.1 qt. - each (2.0 L)	Mobil Fluid #424 (ISO 46/68)
Rear Axle Housing	6.9 gal. (26.0 L)	Mobil Fluid #424 (ISO 46/68)
Rear Axle Wheel Hubs (2)	2.1 qt. - each (2.0 L)	Mobil Fluid #424 (ISO 46/68)
Swing Gearbox	2 qt. (1.89 L)	SAE EP90 gear lubricant, or equivalent
Hoist Gearbox	1-1/2 - 2 qt. (1.4 - 1.9 L)	SAE 90 EP gear lubricant or equivalent
Hoist Brake	1/2 - 1 pt. (.2 -.5 L)	Mobil Fluid #424 (ISO 46/86) or SAE 20-20W oil
Swing Gear Pinion	As required	Open gear lube

ENGINE OIL SPECIFICATIONS — DIESEL ENGINE

Oil Performance Recommendations

The use of quality engine lubricating oils combined with appropriate oil drain and filter change intervals are critical factors in maintaining engine performance and durability.

It is recommended that a high quality SAE 15W40 heavy duty engine oil which meets the American Petroleum Institute (API) performance classification CE/SG.

NOTE: CC/CD or CD/SF engine oils can be used in areas where CE oil in not available, but the oil change interval must be reduced to one half the interval given in the maintenance schedule.

A sulfated ash limit of 1.0 mass percent is suggested for optimum valve and piston deposit

and oil consumption control. The sulfated ash ***must not*** exceed 1.85 mass percent.

Oil Viscosity Recommendations

The use of multi-viscosity lubricating oil has been found to improve oil consumption control and improve engine cranking in cold temperatures while maintaining lubrication at high operating temperatures.

While 15W-40 oil is recommended for most climates, see the viscosity recommendations for extreme climates (Figure 8-1).

NOTE: Limited use of low viscosity oils, such as 10W-30 may be used for easier starting and providing sufficient oil flow at ambient temperatures below 23° F (-5° C). However, continuous use of low viscosity oils can decrease engine life due to wear.

New Engine Break-In Oils

Do not use special “break-in” lubricating oils for new or rebuilt engines. Use the same type of oil during the “break-in” as that which is used in normal operation.

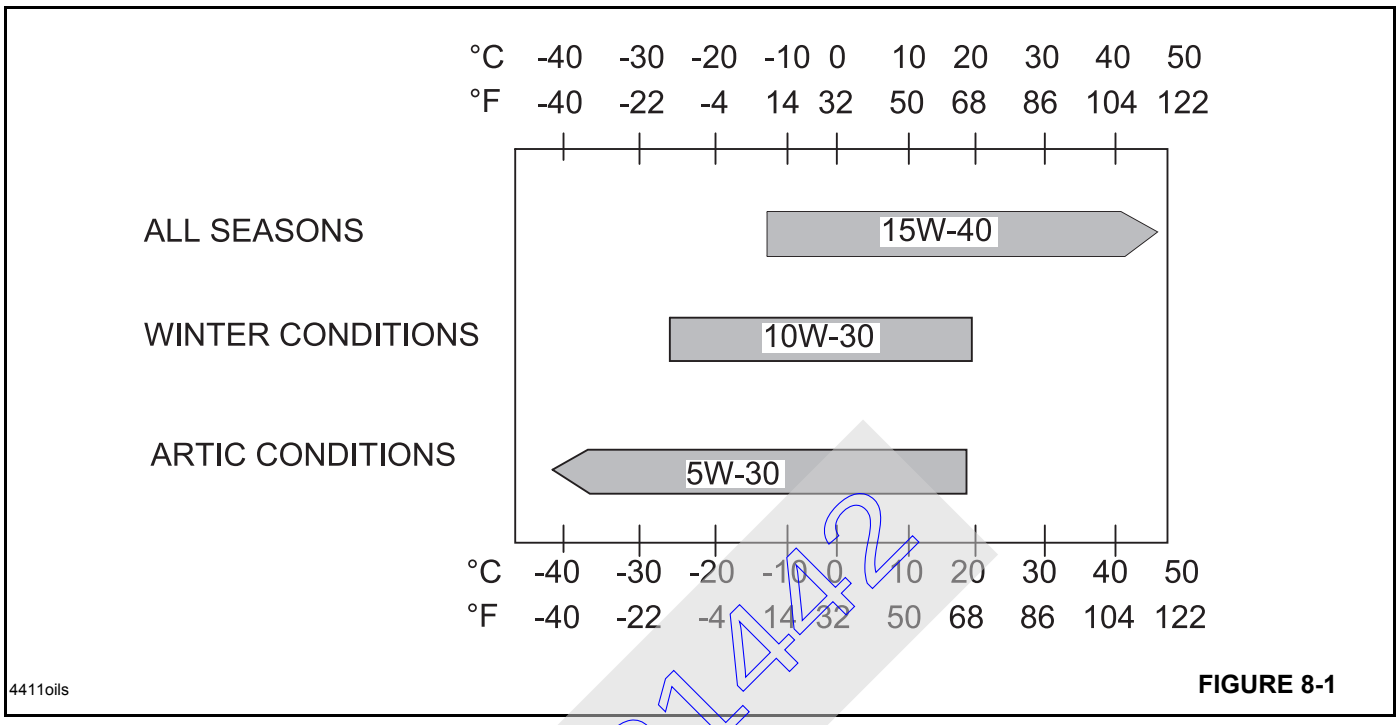

FIGURE 8-1

FUEL TYPES — DIESEL

The Cummins Diesel Engine operates most efficiently with No. 2 diesel fuel in temperatures above 32° F (0° C). When operating in temperatures below 32° F (0° C), use No. 1 diesel fuel, or a blend of No. 1 and No. 2 diesel fuels, most commonly known as “Winterized” No. 2 diesel. Use ASTM No. 2 diesel fuel with a minimum Cetane number of 40. No. 2 diesel fuel gives the best economy and performance under most operating conditions. Fuels with Cetane numbers higher than 40 may be needed in high altitudes or extremely low ambient temperatures to prevent misfires and excessive smoke.

RELIEF VALVE SETTINGS

Relief Valve	Pressure Setting
Pump Pressure Compensator	3500 +0/-50 psi (24 115 +0/-345 kPa) — Set at pump
Pump Margin Pressure	275 ± 5 psi (1895 ± 35 kPa) — Set at pump
Swing Circuit Relief Valve Pressure	2000 ± 50 psi (13 780 ± 345 kPa)
Outrigger Circuit Relief Valve Pressure	2500 ± 50 psi (17 225 ± 345 kPa)
Steering Relief Valve Pressure	3500 ± 50 psi (24 115 ± 345 kPa)
Swing Pump Relief Valve	2800 - 3500 psi (13 815 - 24 115 kPa)

GENERAL SPECIFICATIONS

Engine	
Make and model	Cummins QSB5.9-130diesel
Type of aspiration	Turbocharger
Horsepower	130 hp @ 2500 rpm
Torque	386 lb-ft (525 Nm) @ 1400 rpm
Low idle speed	800 rpm
Maximum engine speed (full load)	2500 rpm
Transmission	
Make and model	Spicer T20000
Type	4 Speed Powershift
Tires	
Size	Standard: Bias 14.00 X 24 Optional: Bias 17.5 X 25 Optional: Radial 14 R24 Optional: Radial 17.5 R25
Air Pressure	14” Tires 110 psi (758 kPa) 17.5 “Tires 100psi (689kPa)
Wheel nut torque	368 lb-ft. (500 Nm)
Electrical System	
Rating	12 VDC negative ground
Number and type of batteries:	
Standard	One - maintenance free
With optional cold weather start	Two
Battery rating	90 amp/hr
Alternator	63 amps
Boom	
Reach (from center line of rotation)	64’ 0” (19.5 m)
Type of boom	Telescopic
Wire Rope	
Size	5/8” (15.9 mm) 6 x19 Bright, XIPS, IWRC
Length	375’ 0” (114.3 m)
Hydraulic System	
Main pump	Variable displacement piston
Steering pump	Fixed gear
Outrigger/swing pump	Fixed gear
Hydraulic pressure settings	See Section 6.
Maximum flow	74 gpm (280 Lpm) @ 2500 rpm

Hydraulic Filters	10 micron return line filter 30 mesh suction filter in tank
Weight	
Crane	43,000 lb. (19 504kg)
Travel Speeds	
Two-wheel steer:	
1st gear	2.9 mph (4.66 km/hr)
2nd gear	6.5 mph (10.45 km/hr)
3rd gear	14.3 mph (22.99 km/hr)
4th gear	19.5 mph (31.35 km/hr)
Operating Dimensions	
Two-wheel steer:	
Outside turning radius (center line of outside tires)	24’ 0” (7.32 m)
Four-wheel steer:	
Outside turning radius (center line of outside tires)	13’ 3” (4.04 m)
Boom angle:	
Maximum	80°
Minimum	0°

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ALPHABETICAL INDEX