

SHUTTLELIFT

INCORPORATED

49 EAST VEW STREET
STURGEON BAY, WISCONSIN 54285

MODEL NO.

3330C

SERIAL NO.

104205-89

CAPACITY

15000

LBS.



 **SHUTTLELIFT**

PCSA
RENTAL
EQUIPMENT
CORPORATION
10000
MILWAUKEE
WISCONSIN

JCB

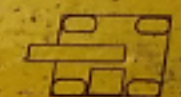
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Uni



SHUTTLELIFT

! WARNING

OPERATING RADIUS	3-SECTION BOOM OR 4-SECTION BOOM WITH 4TH RETRACTED			4-SECTION BOOM EXTENDED			PICK & CARRY - BOOM CENTERED		
	FEET (METERS)	ON RUBBER LESS JIB 360 ⁰	ON FULL EXTENDED OUTRIGGERS		ON RUBBER LESS JIB 360 ⁰	ON FULL EXTENDED OUTRIGGERS		OVER FRONT - 3-SECTION BOOM OR 4-SECTION BOOM 	
			LESS JIB 360 ⁰	WITH JIB 360 ⁰		LESS JIB 360 ⁰	WITH JIB 360 ⁰		4TH RETRACTED
5' (1.5 m)	9,500lbs (4300kg)	15,000lbs (6800kg)	2,900lbs (1310kg)	6,100lbs (2770kg)	6,100lbs (2770kg)	—	—	10,000lbs (4540kg)	4,500lbs (2040kg)
6' (1.8 m)	6,700lbs (3040kg)	13,200lbs (5990kg)	2,900lbs (1310kg)	6,100lbs (2770kg)	6,100lbs (2770kg)	—	—	7,600lbs (3450kg)	4,500lbs (2040kg)
8' (2.4 m)	4,100lbs (1860kg)	11,600lbs (5260kg)	2,500lbs (1130kg)	3,500lbs (1590kg)	5,300lbs (2400kg)	3,000lbs (1360kg)	—	4,700lbs (2130kg)	4,000lbs (1810kg)
10' (3.0 m)	2,600lbs (1180kg)	10,000lbs (4540kg)	2,300lbs (1040kg)	2,400lbs (1090kg)	4,700lbs (2130kg)	2,800lbs (1270kg)	—	3,000lbs (1360kg)	2,700lbs (1220kg)
12' (3.7 m)	2,000lbs (910kg)	8,800lbs (3990kg)	2,100lbs (950kg)	1,800lbs (820kg)	4,400lbs (2000kg)	2,600lbs (1180kg)	—	2,300lbs (1040kg)	2,000lbs (910kg)
14' (4.3 m)	1,600lbs (730kg)	6,600lbs (2990kg)	2,000lbs (910kg)	1,300lbs (590kg)	4,400lbs (2000kg)	2,300lbs (1040kg)	—	1,800lbs (820kg)	1,500lbs (680kg)
16' (4.9 m)	1,200lbs (540kg)	5,300lbs (2400kg)	2,000lbs (910kg)	1,100lbs (500kg)	4,400lbs (2000kg)	2,200lbs (1000kg)	—	1,400lbs (630kg)	1,200lbs (540kg)
17.2' (5.2 m)	1,100lbs (500kg)	4,700lbs (2130kg)	2,000lbs (910kg)	1,000lbs (450kg)	4,400lbs (2000kg)	2,100lbs (950kg)	—	1,300lbs (590kg)	1,100lbs (500kg)
18' (5.5 m)	—	—	2,000lbs (910kg)	1,000lbs (450kg)	4,400lbs (2000kg)	2,100lbs (950kg)	—	—	1,100lbs (500kg)
20' (6.1 m)	—	—	2,000lbs (910kg)	800lbs (360kg)	3,800lbs (1720kg)	2,000lbs (910kg)	—	—	900lbs (410kg)
22' (6.7 m)	—	—	2,000lbs (910kg)	600lbs (270kg)	3,200lbs (1450kg)	2,000lbs (910kg)	—	—	700lbs (320kg)
24' (7.3 m)	—	—	2,000lbs (910kg)	500lbs (230kg)	2,900lbs (1310kg)	2,000lbs (910kg)	—	—	600lbs (270kg)
26' (7.9 m)	—	—	2,000lbs (910kg)	—	—	2,000lbs (910kg)	—	—	—
28' (8.5 m)	—	—	—	—	—	2,000lbs (910kg)	—	—	—
30' (9.1 m)	—	—	—	—	—	2,000lbs (910kg)	—	—	—
32' (9.8 m)	—	—	—	—	—	1,800lbs (820kg)	—	—	—

3330C LOAD RATING CHART

- The rated loads are the maximum lifting capacities as determined by operating radius only. Any combination of boom lengths and angles may be used to obtain operating radius. 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.
- The rated loads shown on full extended 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 machine leveled, standing on a firm, uniform supporting surface. Practical working loads depend on supporting surface, operating radius, and other factors affecting stability. Hazardous surroundings, experience of personnel and proper handling must all be taken into account by the operator.
- Rated loads shown in the shaded areas, are based on structural strength and/or strength of material and not on the stability of the machine.
- 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.
- Ratings on outriggers are with all the outriggers fully extended and fully down. If any of the outriggers are down but not fully extended, then the ratings shown on rubber shall apply.

HOIST TACKLE CHART

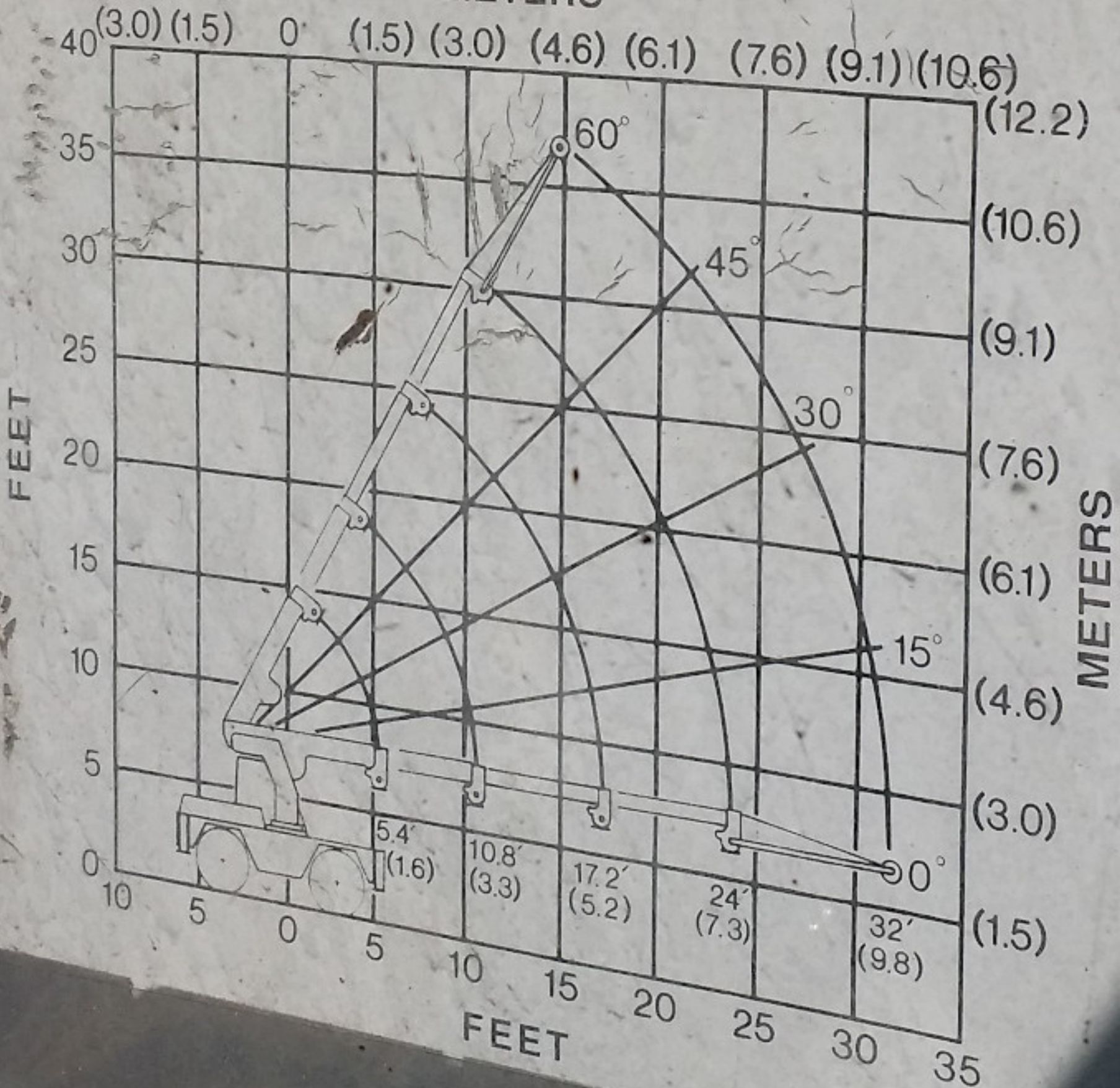
LOAD BLOCK REEVING FOR LOADS SHOWN IN POUNDS (Kg)		
 1 - PART 0 to 5000lbs (0 to 2270kg)	 2 - PART 0 to 10000lbs (0 to 4540 kg)	 3 - PART 0 to 15000lbs (0 to 6800kg)
WIRE ROPE : 7/16 inch, (11mm) dia. 6x19 EIPS IWRC GALVANIZED		

- Ratings on rubber depend on tire capacity, condition of tires, and proper inflation pressure. Loads on rubber may be transported at a maximum speed of 2.5 mph (4km/hr) on a smooth hard level surface with boom retracted to the shortest length possible and centered over front. Pick and carry is not allowed with a load on the jib.
- For operating radius not shown, use load ratings of the next larger radius.
- The maximum combined total boom and deck load is 12,000 pounds (5440kg). For deck loads only, the maximum is 14,000 pounds (6350kg) with 10-00 x 15 tires. Tire inflation at 100 psi (690kPa).
- NO EXTERNAL SIDE LOAD TO BE INDUCED ON BOOM.
- OPERATION OF THIS EQUIPMENT IN EXCESS OF RATING CHARTS AND DISREGARD OF INSTRUCTIONS IS DANGEROUS AND VOIDS WARRANTY.

3330C

3 AND 4 SECTION BOOM W/8' JIB

METERS





**3330 Series D
Carrydeck Crane**

Operator's Manual P/N 1000470

CABLE = $\frac{7}{16}$ " 6x19 - 120'/124'

hr



This Safety Alert Symbol Indicates Important Safety Messages In This Manual. When You See This Symbol, Carefully Read The Message That Follows and Be Alert To The Possibility Of Personal Injury Or Death.

IF THIS MACHINE IS USED BY AN EMPLOYEE OR IS LOANED OR RENTED, MAKE ABSOLUTELY CERTAIN THAT THE OPERATOR(S), PRIOR TO OPERATING:

1. IS INSTRUCTED IN SAFE AND PROPER USE.
2. REVIEWS AND UNDERSTANDS THE MANUAL(S) PERTAINING TO THE MACHINE.

WARNING

BEFORE STARTING ENGINE

STUDY OPERATOR'S MANUAL SAFETY MESSAGES
AND C.I.M.A. USERS SAFETY MANUAL
READ ALL SAFETY SIGNS ON MACHINE
CLEAR THE AREA OF OTHER PERSONS

LEARN & PRACTICE SAFE USE OF CONTROLS BEFORE OPERATING

IT IS YOUR RESPONSIBILITY TO UNDERSTAND AND FOLLOW MANUFACTURER'S INSTRUCTIONS ON MACHINE OPERATION, SERVICE, AND TO OBSERVE PERTINENT LAWS AND REGULATIONS. OPERATOR AND SERVICE MANUALS MAY BE OBTAINED FROM YOUR EQUIPMENT DEALER.

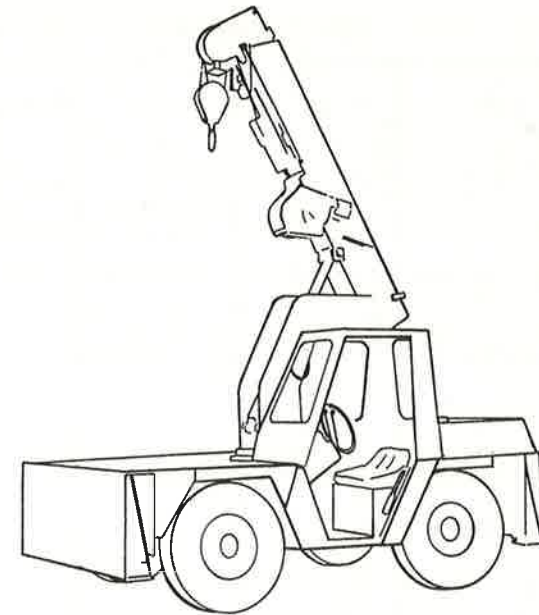


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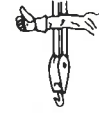



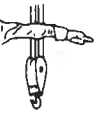
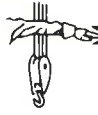


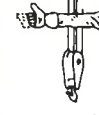
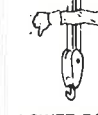


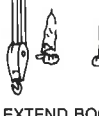



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HAND SIGNALS

 HOIST	 LOWER	 RAISE BOOM	 LOWER BOOM	 SWING	 TRAVEL
 STOP	 EMERGENCY STOP	 DOG EVERYTHING	 MOVE SLOWLY	 RAISE BOOM LOWER LOAD	 LOWER BOOM RAISE LOAD
 USE MAIN HOIST	 USE AUX. HOIST	 EXTEND BOOM	 RETRACT BOOM	 EXTEND BOOM (One Hand Signal)	 RETRACT BOOM (One Hand Signal)

ELECTRICAL CONDUCTOR CLEARANCE CHART

Conductor Voltage	Minimum Working Clearance from Conductor	Minimum Transit Clearance from Conductor
50,000 v. or less	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" (10.2 mm) for each 1,000 v. over 50,000	10' (3.1 m)
Over 345,000 up to and including 750,000 v.		16' (4.9 m)

NOTE: If above requirements are less stringent than state requirements, the state requirements shall apply.

SAFETY PRECAUTIONS

For your safety and the safety of other persons, be careful when you use this equipment. Know the location and functions of all controls before operating. **CHECK ALL CONTROLS IN A SAFE AREA BEFORE STARTING YOUR WORK.**

Read this manual and understand the contents. Make sure you understand all operating characteristics of this machine before starting to operate.

The safety information in this manual does not replace any safety codes, insurance requirements, federal, state and local laws, rules and regulations, which also apply. Know the regulations and laws for your area and make sure your machine is equipped for those laws and regulations.

Put a copy of the following safety rules where operators can easily see and read them.

WARNING: A hydraulic crane is NOT like a lattice boom friction crane in one very important way. In most cases, the rated lifting capacity of a lattice boom crane is based ON THE WEIGHT NEEDED TO TIP THE MACHINE. Therefore, operators of lattice boom friction machines depended on signs that the machine might tip to warn of impending danger.

This is a very dangerous procedure with a hydraulic crane. Most hydraulic crane ratings are based ON THE STRENGTH OF THE MATERIAL OF THE BOOM AND/OR OTHER COMPONENTS. Therefore, the hydraulic crane operator who waits for an indication of tipping to warn him of an overloaded condition WILL LIKELY BEND THE BOOM OR CAUSE SEVERE DAMAGE TO HIS MACHINE BEFORE ANY SIGNS OF TIPPING OCCUR.

OPERATORS OF ALL HYDRAULIC CRANES MUST BE GUIDED SOLELY BY THE RATING PLATE RECOMMENDATIONS CONCERNING LOAD, BOOM LENGTH, LOAD RADIUS, and other factors listed on the rating plate, such as outrigger position and level terrain.

CAUTION: Clearance is limited between cab and drop block when boom is fully lowered and retracted. Be careful to avoid hitting cab with drop block when rotating the boom.



WARNING: ELECTROCUTION HAZARD - To prevent serious bodily injury:

NEVER operate this or any equipment in an area in which overhead powerlines, overhead or underground cables or power sources exist without first notifying the appropriate power company or utility company to de-energize the lines or take other suitable precautions.

NEVER operate machine, any part thereof, or load closer to any electrical powerline 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 powerlines.

NEVER operate 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 employee(s) with all safety devices or means that may be necessary or required for any particular use, operations, set-up, or service.

NOTE: It is not necessary to come into contact with a utility line for the 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.**



WARNING: Keep the operator's area free of oil, loose objects or ice. Remove all maintenance or personal items. Failure to keep this area clean can cause an accident.



CAUTION: Wear the proper safety equipment -- avoid loose clothing. Obtain additional safety equipment when your safety may be in doubt. Hard hat, safety shoes, ear protectors, reflective clothing, safety goggles and heavy gloves may be required.



CAUTION: Before operation, visually check the machine for leaks, broken, missing or damaged parts. Make sure all caps, dipsticks, battery covers, etc. are in place. A part failure during operation can cause injury.



WARNING: Before you start the engine, make sure the parking brake is engaged and the transmission controls are in neutral position.



CAUTION: Before each operating period, check the machine for correct steering, braking, operation of the hydraulic controls and safety devices. A correctly operating machine can prevent accidents. If required, repair or adjust machine before operating.



WARNING: Operate the controls only from the operator's seat with seat belt fastened.



CAUTION: After adjusting seat, make sure the seat lock is fully engaged. Seat movement during operation can cause an accident.



WARNING: Become thoroughly familiar with the Load Chart before you lift any loads. Know the capacity of the CRANE.



WARNING: When moving a load, keep the load as close to the machine and as low to the ground as possible.



WARNING: Do not handle in winds over 20 mph (32 km/h). The winds can cause an unstable condition.



CAUTION: Never put side loads on the boom. Side loads can damage the swing gear. Move the boom into alignment with the load before lifting.



CAUTION: Keep your eye on the load at all times. If you must look away, stop the load first.



CAUTION: Always get a flagman to give assistance if you cannot see a moving load. Then make sure you can see the flagman at all times. Know the signals that will be used.



CAUTION: Before you rotate the mast, make sure you have enough clearance on all sides and all persons are away from the area. Keep clear of the pinch point area between the operator's cab and the mast.



WARNING: When you use the auxiliary winch, always engage the parking brake or lower the outriggers to prevent machine movement.



WARNING: When using the auxiliary winch, keep all persons away from the area. Injury can be caused if the wire rope breaks or the hook becomes disconnected.



CAUTION: Never use the crane to lift, lower or hold a person on the winch line, either on a platform or any other type of attachment.



Never use winch lines or discarded wire rope to make slings for a load.



CAUTION: When you use the main winch or extend the boom, be careful that the hook block is not pulled into the boom sheaves. Damage can be caused to the sheaves or the wire rope.



WARNING: Make a frequent inspection of the wire rope. Look for rust, broken strands, wear or other damage. Replace the wire rope immediately if damage is found.



CAUTION: To prevent injury to your hands, always wear gloves when working with the wire rope.



WARNING: Use a pry bar or piece of wood to move the wire rope over the sheaves or around the winch drum. Never use your hands.



WARNING: To prevent injury, keep clear of winches, sheaves and other moving parts during operation.



WARNING: Keep the machine in gear when going down hills or ramps. Use low gear to keep the machine under control.



CAUTION: Before operation, check the installation of the wire rope to make sure that the wedges are tight.



CAUTION: Before making a lift, make sure all persons are clear of the load.



CAUTION: Be careful not to hit any objects with the boom. If you do, make a careful inspection of the boom sections before you lift any other load.



CAUTION: Before you operate the outriggers or move the machine, make sure all persons are clear of the area.



CAUTION: To help prevent accidents, use the Slow Moving Vehicle Sign and the Flashing Strobe Light (if legal) for travel on the highway or public roads.



DANGER: Engine exhaust can cause death. If necessary to start the engine in a closed area, make sure there is enough ventilation.



CAUTION: Always lower or remove the load from the winch before you stop the machine. Never leave the machine with a load in the air.

SERVICE



POISON/DANGER: Batteries contain sulfuric acid which can cause severe burns. Avoid contact with skin, eyes or clothing. Antidote: EXTERNAL, flush with water; INTERNAL, drink large quantities of water or milk. Follow with milk of magnesia, beaten egg or vegetable oil. Call physician immediately; EYE, flush with water for 15 minutes and get prompt medical attention. Keep out of reach of children.



WARNING: To prevent eye injury, wear eye protection when doing maintenance on this machine.



WARNING: Stop the engine before doing any maintenance or adjustments. If necessary to make checks while the engine is running, have one person at the controls while the other person makes the check.



Keep a fire extinguisher available and **KNOW HOW TO USE IT**. Check the fire extinguisher at regular intervals for correct operation.



WARNING: Batteries produce explosive gases. Keep sparks, flame and cigarettes away. Ventilate when charging or using in enclosed space. Always shield eyes when working near batteries.



CAUTION: When removing a battery, always disconnect the (-) negative ground cable first.



CAUTION: Storage areas for batteries must be well ventilated to prevent accumulation of hydrogen gas from newly recharged batteries.



CAUTION: Never wear rings or metal watch bands as you may ground a live circuit.



WARNING: Never check battery charge by placing a metal object across the posts - the sparks could cause an explosion. Use a voltmeter or hydrometer.



Disconnect both cables from the battery before you work on the engine or electrical system. Always disconnect the (-) negative ground cable first.



CAUTION: To prevent personal injury, always use a protective cage when inflating or deflating tires.



WARNING: To prevent injury from burns, always use a solvent that is not flammable for cleaning component parts. **DO NOT** use gasoline or other flammable substances.



WARNING: Never fill the fuel tank near an open flame or while the engine is running. Keep cigarettes away.



CAUTION: When checking coolant, remove radiator cap slowly to relieve pressure in the system. To prevent burns, remove radiator cap only when engine is cool.



CAUTION: Use care to avoid lowering the drop block when boom is over cab. Damage and personal injury can result if drop block contacts top of cab or canopy.



CAUTION: Hydraulic systems are highly pressurized. Escaping hydraulic oil, even an invisible pinhole leak, can penetrate body tissues causing serious injury. Use a piece of wood or cardboard when looking for leaks - never use the hands or other parts of the body.

Relieve hydraulic pressure before disconnecting circuits. When reassembling, make absolutely certain that all connections are tight.

If injured by hydraulic oil escaping under pressure, see a doctor immediately. Serious complications may arise if medical attention is not given at once.



WARNING: Never disconnect any hydraulic lines unless the boom is fully lowered and hydraulic pressure is relieved. To relieve hydraulic pressure, stop the engine and move the hydraulic controls forward and back several times.



CAUTION: ENGINE FAN AND BELTS - To prevent possible serious injury avoid contact with rotating fan and belts.



CAUTION: Be very careful when working with tires. Tires can come apart with explosive force. Never try to disassemble the wheel until all air is released from the tire.

WARNING: This crane was not designed to meet personnel lift or elevator requirements. Therefore, no lifting, lowering, swinging or traveling shall be done while a worker is on the hook, load, manlift platform, boom or other personnel lifting device attached to the crane load line or boom.

WARNING: Smoking or open flame should be avoided any time the fuel system is being repaired or serviced. The area should be properly ventilated. Improper handling of fuel could result in an explosion or fire causing bodily injury to yourself or others.

CAUTION: Improper adjustment of the main jet could lead to engine damage.

CAUTION: Do not change direction of foot pedal before first coming to a complete stop.

CAUTION: On machines with four wheel steer option, side shift may not be truly parallel. Machine position depends on wheel position when crab steer switch was activated.

CAUTION: Always keep hands and clothing clear of fair lead rollers and front opening while winch is operating. Keep all persons away from area when using auxiliary winch. Injury can be caused if the wire rope breaks or the hook becomes disconnected.

IMPORTANT: 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 a new decal with the new part. Replacement decals are available from your Crane dealer.

NOTE: 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.

INTRODUCTION

This manual gives instructions for operation and normal maintenance of the CRANE. The unit has a height of 7'10" and a capacity of 8½ tons.

It is important that you read this manual before you operate the machine. The manual has four sections. SECTION 1 includes important safety information and general information about the machine. SECTION 2 makes an identification of the controls and instruments and gives instructions for operation of the machine. SECTION 3 gives instructions for adjustments and installation of the attachments. SECTION 4 gives instructions for preventive maintenance.

SERVICE AND PARTS

When you write to the manufacturer about the machine, always give the model and serial number of the machine and the component.

The Serial Number plate for the machine is found in the cab (See Figure 1). The Engine Serial Number plate is shown in Figure 2. The serial plates of other components, for example: pump, transmission, axles, etc., can be found on the housing of that component.

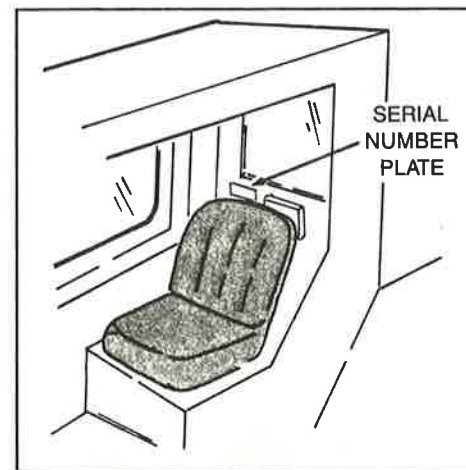


Figure 1. Machine Serial Number Plate

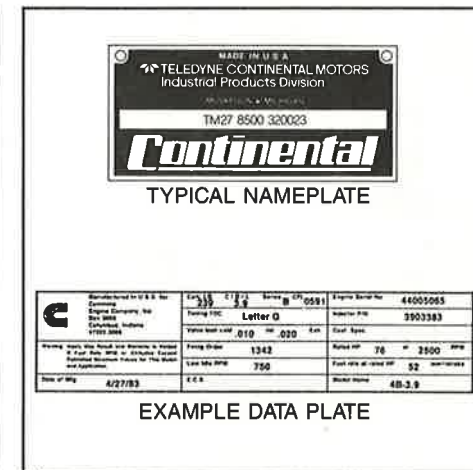


Figure 2. Engine Serial Number Plate

SYMBOLS

Symbols are used in this manual and on the machine for easy identification of the components.

A solid arrow (→) always shows direction. A broken arrow (---→) shows movement in that direction.

Learn the following symbols. To understand the difficult symbols, you must know the basic symbol. For example, the symbol for engine is (🔧). This symbol is found with the symbol for hourmeter (🕒), engine oil (🛢️), engine oil pressure (🛢️⚡), and engine rpm (🌀).














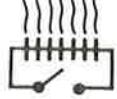






















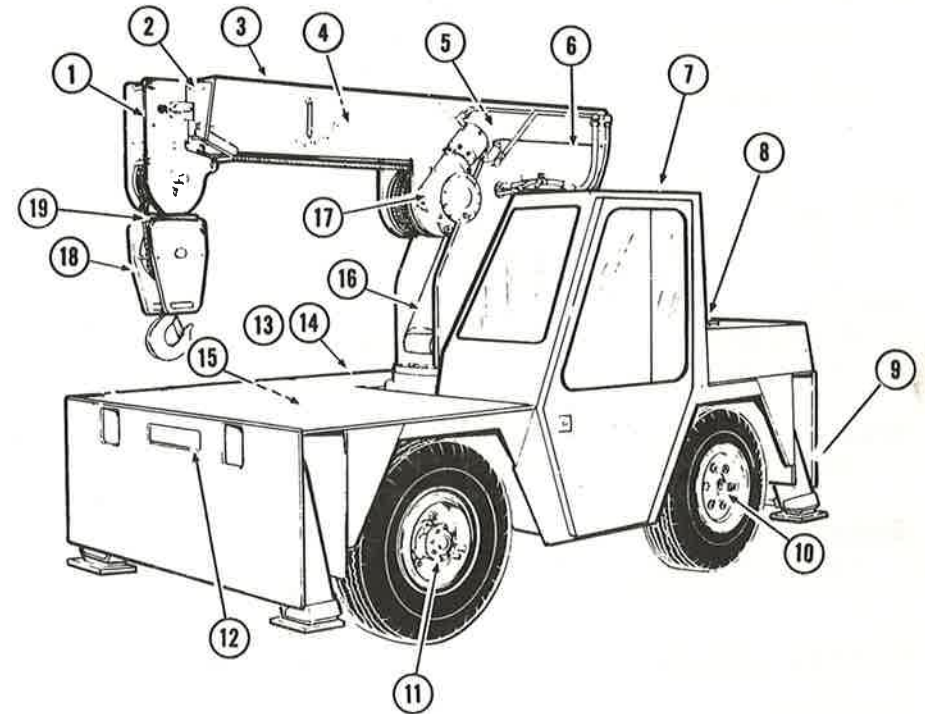
 DIRECTION of CONTROL LEVER	 FAST	 BOOM CROWD	 FORWARD	 REVERSE	 ROTATE CLOCKWISE
 ROTATE, COUNTER-CLOCKWISE	 MAIN LIGHT SWITCH	 WINDSHIELD WIPER	 FLASHING STROBE LIGHT	 INSTRUMENT PANEL LIGHT	 IGNITION SWITCH
 HORN	 HEATER (On/Off)	 BOOM HOIST	 CHOKE	 PARK	 BRAKE
 FUEL	 COOLANT	 TEMPERATURE WATER	 FILTER, AIR	 HYDRAULIC OIL FILTER	 HYDRAULIC RESERVOIR
 TORQUE CONVERTER	 TORQUE CONVERTER TEMPERATURE	 TRANSMISSION	 DIFFERENTIAL	 GEARBOX	 AMMETER GENERATOR
 ENGINE	 STARTER	 ENGINE HOURS (Running Time)	 ENGINE OIL PRESSURE	 LUBRICATE with Multi-Purpose Grease	 TRANSMISSION OIL PRESSURE

Figure 3. Symbols

DIRECTIONS

All directions in this manual are given in relation to the operator's seat. Left is the operator's left, right is the operator's right. Boom references are the same as for the machine when the boom is over the front of the machine.

NOMENCLATURE



LEFT FRONT SIDE VIEW

- | | |
|-----------------------------|--|
| 1. INNER BOOM | 11. DRIVE AXLE |
| 2. INTERMEDIATE BOOM | 12. RECESSED MOUNTED WINCH LOCATION (Optional) |
| 3. MAIN BOOM | 13. HYDRAULIC VALVE LOCATION |
| 4. SEQUENCING BOOM LOCATION | 14. RIGHT SIDE - FUEL TANK LOCATION |
| 5. CROWD CYLINDER LOCATION | 15. SWING GEARBOX and MOTOR LOCATION |
| 6. MAST | 16. HOIST CYLINDER |
| 7. OPERATOR'S COMPARTMENT | 17. WINCH GEARBOX, MOTOR and BRAKE |
| 8. ENGINE COMPARTMENT | 18. DROP BLOCK |
| 9. OUTRIGGER | 19. DOUBLE BLOCKING CUTOUT |
| 10. STEERING AXLE | |

SPECIFICATIONS

Engine

MODEL	CUMMINS 4B3.9 (Diesel)	CONTINENTAL TM 2.7L (Gas & Dual Fuel)
Type	4 cylinder, 4 cycle	4 cylinder, 4 cycle
Horsepower	71	57
Governed RPM	2200	2200
High Idle RPM	2500	2380-2420
Low Idle RPM	750	400-600

Drive Train

Forward-Reverse Unit and 4-speed transmission, hydraulic torque converter.

Axles

Front drive axle, rear steering axle. NoSPIN differential standard for front drive axle.

Tires

10.00 x 15, 12 ply rated, pneumatic 100 PSI (690 kPa)

Brakes

Foot (2 wheel steer) Fully hydraulic,
drum brakes on front wheels,
disc brakes on rear wheels

Foot (4 wheel steer) Fully hydraulic, oil immersed,
disc brakes on front wheel,
disc brakes on rear wheels

Hand Mechanical brake on transmission
output shaft for parking

Outriggers

Two stage, hydraulically operated, electrically controlled, front and rear.
Independent control of left and right set. Load check valves on jack cylinders.

Boom

Standard: 20'2" (6.14 m) boom, telescopic, three sections
Optional: 27'1" (8.2 m) boom, four sections
8' (2.4 m), jib, A-frame

Main Winch

Boom mount. Hydraulic drive with worm gear reduction and brake. 9.67" (246 mm) diameter drum.

Wire Rope: 7/16" (11mm) diameter 6 x 19 Galv. EIPS-IWRC x 124' (37.8 m).

*NOTE: Use 7 x 19 EIPS-IWRC No-SPIN wire rope for single part line only.

IWRC (Independent Wire Rope Core) EIPS (Extra Improved Plow Steel)

Auxiliary Winch (Optional)

Location: Under deck, front of machine. Electric, 2.50" (63.5 mm) dia. x 9.00" (228.6 mm) drum. 1/4" (6.35 mm) dia. wire rope x 100' (30.48 m) long. Maximum line pull 4,000 lbs. (1 814 kg). Line speed is 15 FPM (4.6 MPM), no load. Free spool disconnect lever.

Electrical System

Type 12 volt, direct current, negative ground
Alternator Diesel (63 amp), gas (37 amp)
Battery 370 CCA at 9°F (-18°C) for 30 sec.
(2 battery with optional aux. winch)
Location: Under front deck hatch cover

Hydraulic System

Main Pump Gear pump with two sections
Location: front of engine

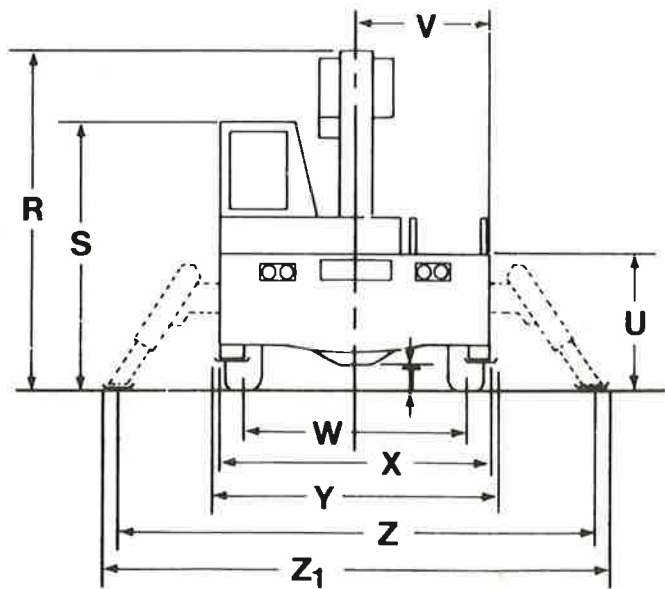
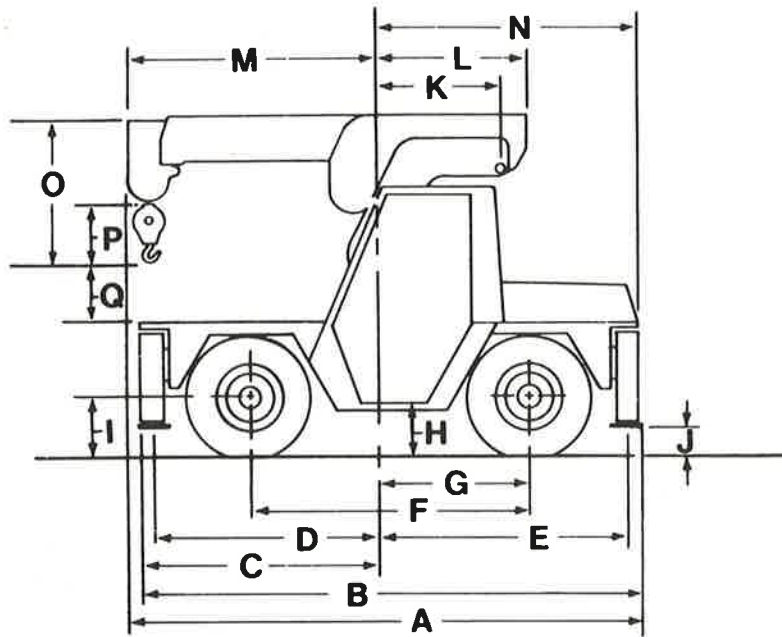
Steering Pump Integral w/main pump

Main Valves Location: Under deck, next to fuel tank
One single spool valve, one 3-spool valve

Main Relief Set at 2500 PSI (17 230 kPa)

Filter 10 micron element in line,
30 mesh diffuser inside tank

SPECIFICATIONS



GENERAL DIMENSIONS

	DIMENSIONAL DATA	
	U.S.	Metric
A. Overall Length - transport position	12'3"	3.73 m
B. Overall Length of Frame	12'0"	3.66 m
C. ϕ Rotation to Front of Frame	5'7"	1.71 m
D. ϕ Rotation to ϕ Front Outrigger	5'3"	1.60 m
E. ϕ Rotation to ϕ Rear Outrigger	5'11"	1.80 m
F. Wheelbase	6'7"	2.01 m
G. ϕ Rotation to ϕ Rear Axle	3'7½"	1.10 m
H. Ground Line to First Step (w/std. tires)	1'4"	406 mm
I. Ground Line to Center of Axle (w/std. tires)	1'6"	457 mm
J. Outrigger Clearance (w/std. tires)	1'0"	305 mm
K. ϕ Rotation to Boom Pivot Pin	2'11¾"	908 mm
L. Tail swing	3'7¾"	1.11 m
M. ϕ Rotation to Tip of Head Section	5'9½"	1.77 m
N. ϕ Rotation to Rear of Deck	6'4"	1.93 m
O. Height - Top of Boom to Bottom of Hook	4'1½"	1.26 m
P. Length of Hook Block	2' ½"	622 mm
Q. Height of Hook from Deck @ 0°	6½"	165 mm
R. Overall Height - Travel Position (w/std. tires) ...	7'10"	2.39 m
S. Height to Top of Cab (w/std. tires)	6'1"	1.85 m
T. Ground Clearance - Axle (w/std. tires)	9½"	241 mm
U. Deck Height: On Standard Tires	3'3½"	1003 mm
On Outriggers	3'7"	1092 mm
V. ϕ Rotation to Side of Deck	3'2"	965 mm
W. Wheel Tread	5'3"	1.60 m
X. Frame Width	6'4"	1.93 m
Y. Overall Width - Outriggers Retracted	6'7"	2.01 m
Z. Outrigger Spread ϕ to ϕ	11'2"	3.40 m
Z ₁ . Overall Width - Outriggers Extended	11'8"	3.56 m

OPERATING INSTRUCTIONS

CONTROLS IN OPERATOR'S COMPARTMENT

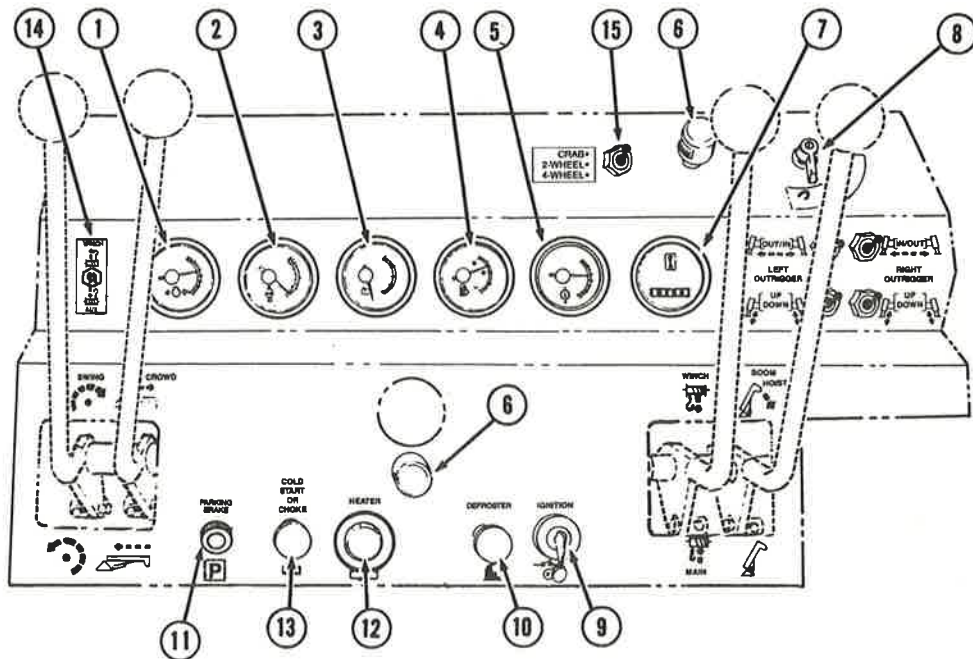


Figure 4. Instrument Panel

INSTRUMENT PANEL

1. **GAUGE FOR ENGINE OIL PRESSURE** - Gives indication of the pressure of the engine oil. Normal operating pressure is 24-32 psi (165-220 kPa) for the gasoline engine and 50-70 psi (340-480 kPa) for the diesel engine.
2. **GAUGE FOR TEMPERATURE OF THE ENGINE COOLANT** - Normal operating temperature is 160-190°F (72-88°C).
3. **VOLTMETER** - Indicates condition of charging system and battery. Normal operation range with engine above low idle is 14-16 volts. Normal indication with engine stopped or at low idle is 10-14 volts. A reading of less than 11 volts with engine stopped or at low idle indicates very low battery charge. Less than 14 volts above low idle indicates that there is a problem in the charging system, which should be checked by an Authorized dealer.



4. **FUEL GAUGE** - This gauge gives indication of the amount of fuel in the 18½ gallon (70 liter) fuel tank.



5. **TEMPERATURE GAUGE FOR TORQUE CONVERTER** - Indication on this gauge must not be above 190° F (88° C). If temperature increases above 190° F (88° C), put all controls in "NEUTRAL" position and run engine at half throttle until temperature decreases below 190° F (88° C). See "Overheating of Torque Converter" on page 30.



6. **PANEL LIGHTS** - Illuminated by main light switch, item 8.



7. **HOURMETER** - Gives indication of the total number of hours the engine has operated. This instrument can be used in a program of preventive maintenance for the machine.



8. **MAIN LIGHT SWITCH** - Turn counterclockwise to first position to illuminate the panel lights. Second position is for the head lights. Third position illuminates the work lights.



9. **KEY/START SWITCH** - Turn key clockwise to first position to energize the electrical system. The key included with the machine is necessary for operation of this switch. Turn key fully clockwise to engage the starting motor. Forward-Reverse Pedal (item 2, Figure 6) must be in neutral position before the engine will start.



10. **DEFROSTER SWITCH (Optional)** - Pull switch to operate the defroster fan. Push switch to stop.



11. **PARKING BRAKE LIGHT (Optional)**



12. **HEATER SWITCH (Optional)** - Turn the switch clockwise to first position to start the heater. Continue to turn the switch clockwise to increase the speed of the blower. Turn the switch fully counterclockwise to stop the heater.



13. **CHOKE (Gasoline Engine Only)** - Used for starting a cold engine. See starting procedure for gasoline engine, page 26. On the diesel engine, a **Cold Start Button** can be installed in place of the choke.

14. **AUXILIARY BELOW DECK WINCH (Optional)** - Push and hold switch up to run hook out. Push and hold switch down to run hook in.

15. **STEERING MODE SWITCH (Optional)** - Switch up for crab steer. Switch center for two wheel steer. Switch down for four wheel steer.

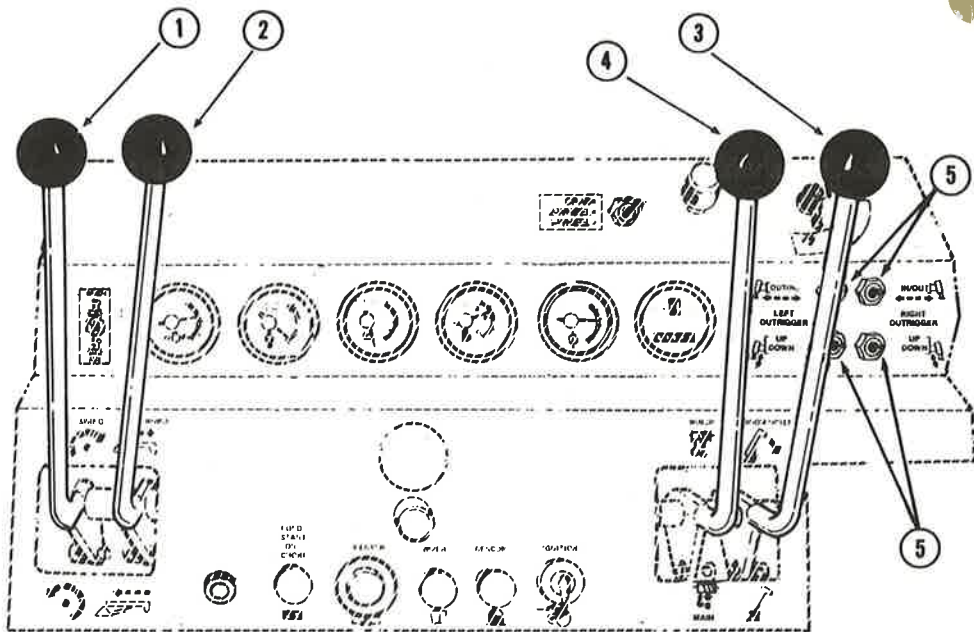







Figure 5. Hydraulic Controls

HYDRAULIC CONTROLS

- 
1. LEVER FOR BOOM SWING - Controls the rotation of the mast and boom. See page 35.
- 
2. LEVER FOR BOOM CROWD - Extends and retracts the telescopic boom. See page 36.
- 
3. LEVER FOR BOOM HOIST - Raises and lowers the boom. See page 37.
- 
4. LEVER FOR THE MAIN WINCH - Controls the winch on the boom. See page 38.
- 
5. OUTRIGGER SWITCHES - Used to select operation of the outriggers. See page 32.

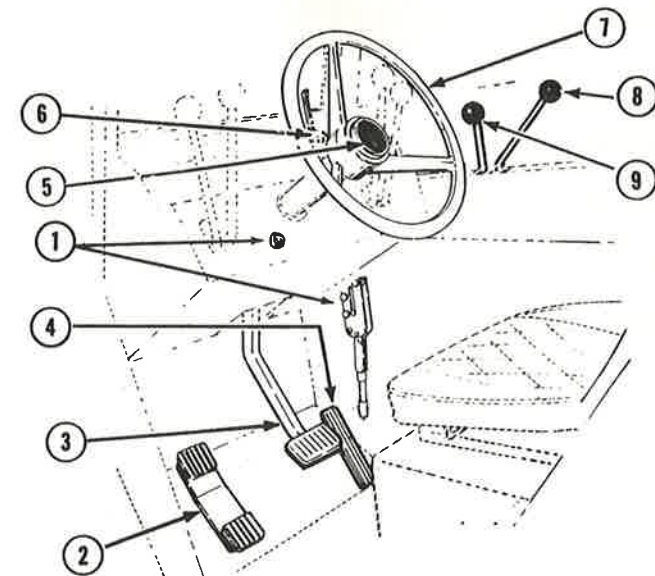







Figure 6. Machine Controls

MACHINE CONTROLS


- 
1. PARKING BRAKE - Pull lever to engage the parking brake (light will come on), push to disengage.
- 
2. FORWARD-REVERSE PEDAL - Push top of pedal for forward movement of the machine. Push bottom of pedal for reverse movement. When machine has the optional warning alarm, a bell will be activated when pedal is in reverse position. The center position of the pedal puts the transmission in neutral position. **IMPORTANT:** The shift lever (item 8) must also be put in the neutral position when machine is stopped.
- 
3. FOOT BRAKE - Applies the wheel brakes to stop or decrease the speed of the machine.
- 
4. ACCELERATOR PEDAL - Controls the speed of the engine.
- 
5. HORN - Push to actuate the warning horn.
- 6. TURN SIGNAL AND FLASHER** - For indication of turning direction. To operate the flasher, push the button under the signal lever. Lift the lever to stop the flasher.

7. STEERING WHEEL:

2 Wheel Steer - Controls the steering cylinders on the rear axle. Turn wheel clockwise for a right turn, counterclockwise for a left turn.

4 Wheel Steer - Controls the steering cylinders on the rear and front axles. Turn wheel clockwise for a tight right turn, counterclockwise for a tight left turn.

Crab Steer - Controls the steering cylinders on the rear and front axles. Turn wheel clockwise to side shift machine to the right, counterclockwise to side shift machine to the left.

 **CAUTION: Side shift may not be truly parallel. Machine position depends on wheel position when crab steer switch was activated.**

8. SHIFT LEVER - For selection of First, Second or Neutral. DO NOT move shift lever to First gear position when range lever is in low range and machine is in motion.

9. RANGE LEVER - Gives selection of High or Low range. Shift lever must be in Neutral position before you move the range lever. See page 29.

ELECTRICAL CIRCUIT PROTECTION

There are seven fuses on a fuse block on the back side of the instrument panel. These fuses give protection to the components and circuits indicated in Figure 7. Access to the fuses is through a cover at the front of the cab.




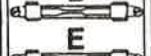
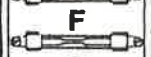

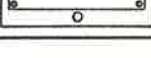
	FUSE	RATING	FUNCTION/CIRCUIT
	A	15 amp	Strobe light, heater fan, gauges
	B	15 amp	Windshield wiper, defroster fan, parking brake light
	C	15 amp	Horn
	D	15 amp	Back-Up alarm, winch control solenoid, steer control solenoid
	E	20 amp	Turn signal, brake lights, fuel shut-off valve (diesel only), spark ignition coil (gas only), hourmeter
	F	20 amp	Cold start, anti-double blocking, outrigger control, load indicator
	G	20 amp	Head lights, tail lights, dash lights, gauge lights, work lights

Figure 7. Fuse Block on Back Side of Instrument Panel

PROCEDURES FOR OPERATION

DELIVERY INSPECTION

See page 59. Complete all necessary forms and reports. See the Operator's Manual of the CUMMINS 4B3.9 DIESEL or CONTINENTAL TM 2.7L GASOLINE ENGINE for engine run-in procedure.

DAILY CHECKS

Before each period of operation, check all items for "DAILY OR EVERY 10 HOURS" in Maintenance Chart on page 61. Make necessary adjustments or repairs before starting.

 **WARNING: Operate the controls only from the operator's seat with seat belt fastened.**

The seat belt must be worn at all times when operating this machine. To fasten the seat belt:

1. Take the buckle end and connect it to the flat metal end. Keep the belt as low as possible on your hips.
2. Tighten the belt until tight, but not too tight. To tighten the belt, hold the buckle with your right hand and pull on the loose end of the belt.



FASTENING



TIGHTENING



UNFASTENING

To release the seat belt, lift the end of the buckle as shown.



CAUTION: Before each operating period, check the machine for correct steering, braking, operation of the hydraulic controls and safety devices. A correctly operating machine can prevent accidents. If required, repair or adjust machine before operating.

PROCEDURE TO START THE ENGINE

Before you start the engine, engage the parking brake. Make sure all controls are in neutral position. Turn off all lights and accessories. Put forward-reverse pedal and shift lever in neutral position.

GASOLINE ENGINE:

1. If the engine is cold, pull the choke control all the way out.
2. Push the accelerator pedal to the floorboard, then release the pedal.
3. Turn key switch to START position.

IMPORTANT: Do not operate the starter for more than 30 seconds or you can cause damage to the starter motor. Wait one minute or more between starts.

4. If the engine does not start, push the accelerator pedal again. After the engine starts, push the choke in until the engine runs smoothly. Push the choke all the way in when the engine is warm.

DIESEL ENGINE:

1. Push and hold the accelerator pedal down approximately 2 inches (50 mm).
2. Turn the key switch to START position and hold until the engine starts, or for a maximum of 30 seconds. See IMPORTANT above.

IMPORTANT: Check the gauge for engine oil pressure immediately after the engine starts. If the pressure does not increase to approximately 10 psi (69 kPa), stop the engine and find the fault.

USE OF BOOSTER BATTERY

This machine has a torque converter. Do not try to start the engine by towing or pushing the machine. If the battery is discharged, use the following procedure to start the engine.



WARNING: Batteries produce explosive gases. Keep sparks, flame and cigarettes away. Ventilate when charging or using in enclosed space. Always shield eyes when working near batteries.

1. Engage the parking brake. Put gear shift in Neutral position.
2. Stop all electrical loads (lights, heater, etc.).
3. Remove front deck hatch cover to access batteries. If batteries are equipped with vent caps, remove them. This procedure decreases the danger of explosion from battery gases.
4. Disconnect the FIELD connection from the alternator. See Figure 8.

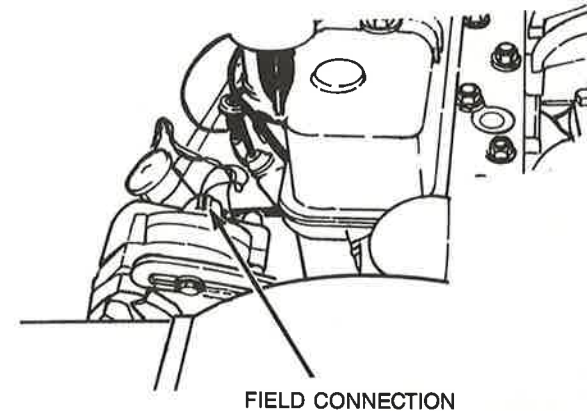


Figure 8. Field Connection on Alternator

NOTE: If you use a battery charger, disconnect the field connection from the alternator before you connect the battery charger to the battery. Do not install the field connection again until the battery charger has been removed.

5. Connect one jumper cable from the (+) positive terminal of the booster battery to the (+) positive terminal of the discharged battery. See Figure 9.
6. Connect a second jumper cable from the (-) negative terminal of the booster battery to a good ground on the machine frame. Make this ground connection far enough away from the battery to prevent the spark from causing an explosion.



CAUTION: When removing a battery, always disconnect the (-) ground cable first. When installing the battery, always connect the (-) ground cable last.

7. Start the engine from the operator's cab. After the engine is started, first remove the (-) ground cable from the frame. Then remove the other jumper cable. Install vent caps on battery. Install field connection on alternator.

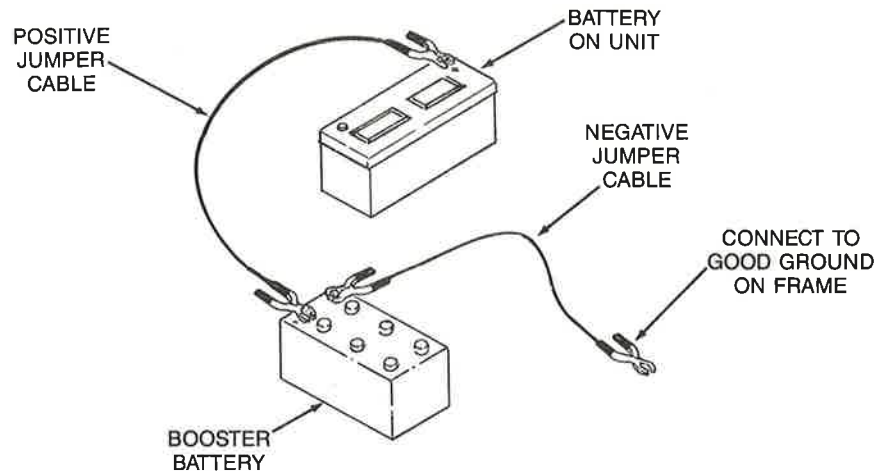


Figure 9. Connection for Booster Battery

TO STOP THE ENGINE

1. Put all controls in Neutral position. Engage the parking brake.
2. Turn key switch to "OFF" position to stop the engine (both gasoline and diesel engines).



CAUTION: Always lower or remove the load from the winch before you stop the machine. Never leave the machine with a load in the air.

ENGINE OPERATION

Correct operating temperature is important, especially for the diesel engine. Low engine temperatures do not give complete combustion. The result is deposit on the valves and cylinders which can cause damage to the engine.

DO NOT operate the engine at full rpm or apply a load until the engine is warm. After the engine is warm, do not let the engine run at idle rpm for long periods of time. During cold weather, it will be necessary to run the engine at high rpm to keep the correct operating temperature.

MACHINE OPERATION

The normal shift sequence is:

- 1st Gear - Put shift lever in Neutral.
Move range lever to LOW range position.
Put shift lever in 1st gear.
- 2nd Gear - Move shift lever to 2nd gear.
- 3rd Gear - Put shift lever in Neutral.
Move range lever to HI range position.
Push shift lever forward. (Shift lever will not move backward in HI range.)
- 4th Gear - Move shift lever to 4th gear.

To move the CRANE:

1. With forward-reverse pedal in neutral position, start the engine. Let engine run at low rpm.
2. Select LOW range, first or second gear. (If the gears do not engage, slowly increase engine speed while you apply force to the shift lever.)
3. Disengage the parking brake.
4. Select direction of travel on the forward-reverse pedal. Push top of pedal to move machine forward. Push bottom of pedal to move machine in reverse (See Figure 10).
5. Push the accelerator pedal. The CRANE will move in the direction selected (See Figure 10).

IMPORTANT: DO NOT move shift lever into FIRST gear, low range, while machine is in motion.



CAUTION: Do not change direction of foot pedal before first coming to a complete stop.



WARNING: Keep the machine in gear when going down hills or ramps. Use low gear to keep the machine under control.

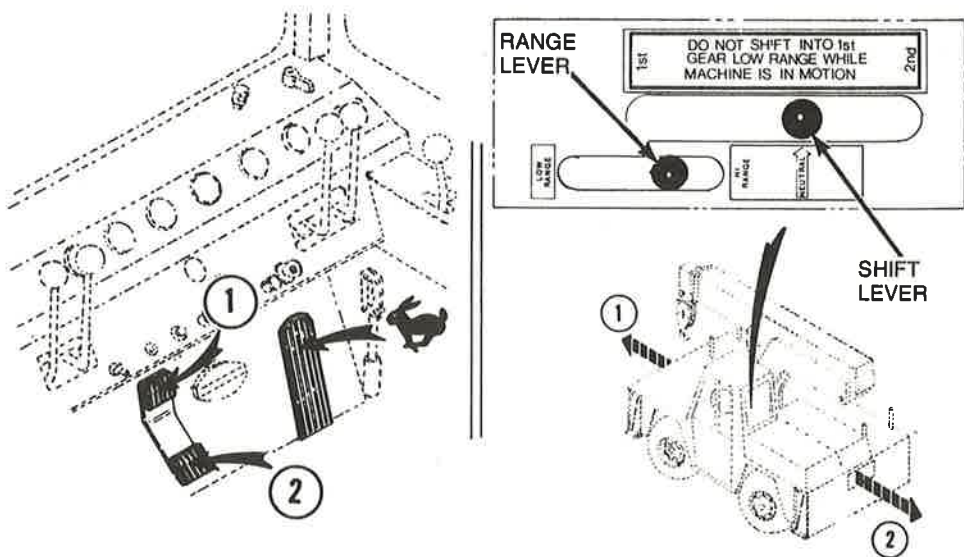


Figure 10. Machine Operation

6. To stop the CRANE, release the accelerator pedal and apply the foot brake. After machine is stopped, move the forward-reverse pedal and shift lever to neutral position. Engage the parking brake.

IMPORTANT: Do not continue to turn the steering wheel after the wheels are turned to the maximum angle. You will cause damage to the steering pump and actuator.

OVERHEATING OF TORQUE CONVERTER

To prevent overheating of the Torque Converter:

- a. Engage forward and reverse at IDLE SPEED ONLY.
- b. Use brakes to stop machine movement before changing direction of travel.
- c. Keep a check on the temperature gauge for the torque converter. When the temperature increases above 190° F (88° C), remove the load and run the engine at idle rpm until the temperature is normal.
- d. Move to a lower gear to prevent overheating.
- e. Use brakes on downhills to prevent overspeeding.

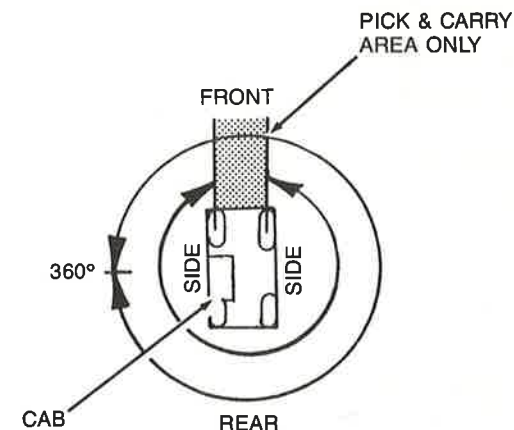
NOTE: If torque converter continues to overheat, see Service Manual.

CRANE OPERATION

The Load Chart for the CRANE is found in the Operator's Cab. The Load Chart shows the maximum loads that can be lifted, and gives conditions under which these maximum lifts can be made.

Capacities are given for both the boom and jib, for lifts made on rubber (outriggers not set), and on outriggers. All of the capacities are according to OPERATING RADIUS only. You can use any combination of boom lengths and angles to get the operating radius.

The diagram below shows the range of operation for Pick and Carry loads and for full 360°.



OPERATING RADIUS is the distance (horizontal measurement) from center of rotation of the mast to the load line.

To read the Load Chart, find the Operating Radius in the left column of the chart. Follow this line across to the Operating Range column. Read the maximum load for the given radius and operating range.

The Operator must remember that conditions such as soft ground, load restrictions, etc. decrease the lift capacity of the CRANE. All equipment such as hooks, hook blocks, slings, etc. must be included as part of the load.

NOTE: Rated loads shown in the black areas of the Load Chart are from calculations of the strength of the structures, not on crane tipping.

CRANE CONTROLS

Four levers in the instrument panel control the crane functions. These levers connect to hydraulic valves below the frame. The function of each control is shown on the decal of the instrument panel.

To operate the controls, slowly engage the control while the engine is running at low rpm. After the hydraulic valve is fully open, push the accelerator pedal to increase the speed of operation. Decrease engine speed to low rpm before you return the control to neutral position.

OUTRIGGERS

For maximum lift and stability, fully extend and lower the outriggers. See Load Chart for maximum loads on tires.

You can operate all four outriggers at the same time, but do not operate any other hydraulic functions when operating the outriggers.

The outriggers are controlled by four switches on the instrument panel. Each switch controls a function of two outriggers. See Figure 11.

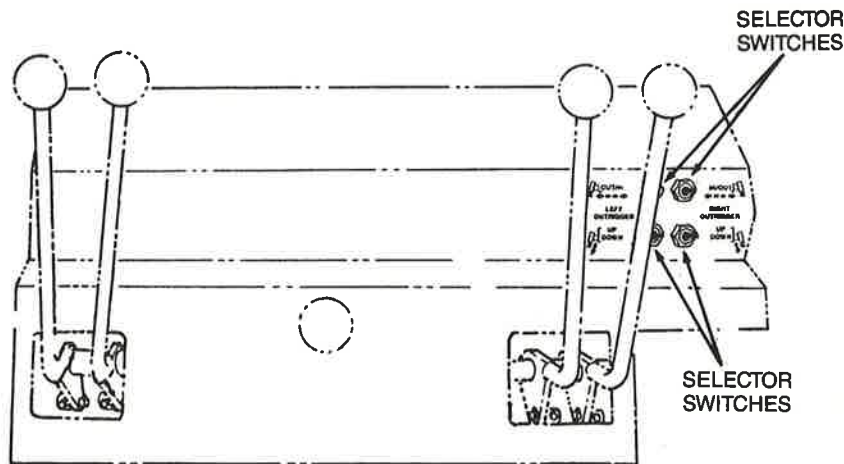


Figure 11. Outrigger Switches

To Extend and Lower the Outriggers:

NOTE: The left switches control the two outriggers on the left side of the machine. The switches on the right control the two outriggers on the right side of the machine.

1. To Extend: Run the engine at low rpm (accelerator pedal released). Push and hold the desired switch out as required (Figure 12, Item 1). Push the accelerator pedal to increase engine rpm and accelerate the outward movement of the outriggers. Release the accelerator pedal and the switch when the outriggers are fully extended.
2. To Lower: Hold the desired switch in the down position as required (Figure 12, Item 2). Push the accelerator pedal to increase engine rpm and accelerate the downward movement of the outriggers. Release the accelerator pedal and the switch when the outriggers are fully lowered.

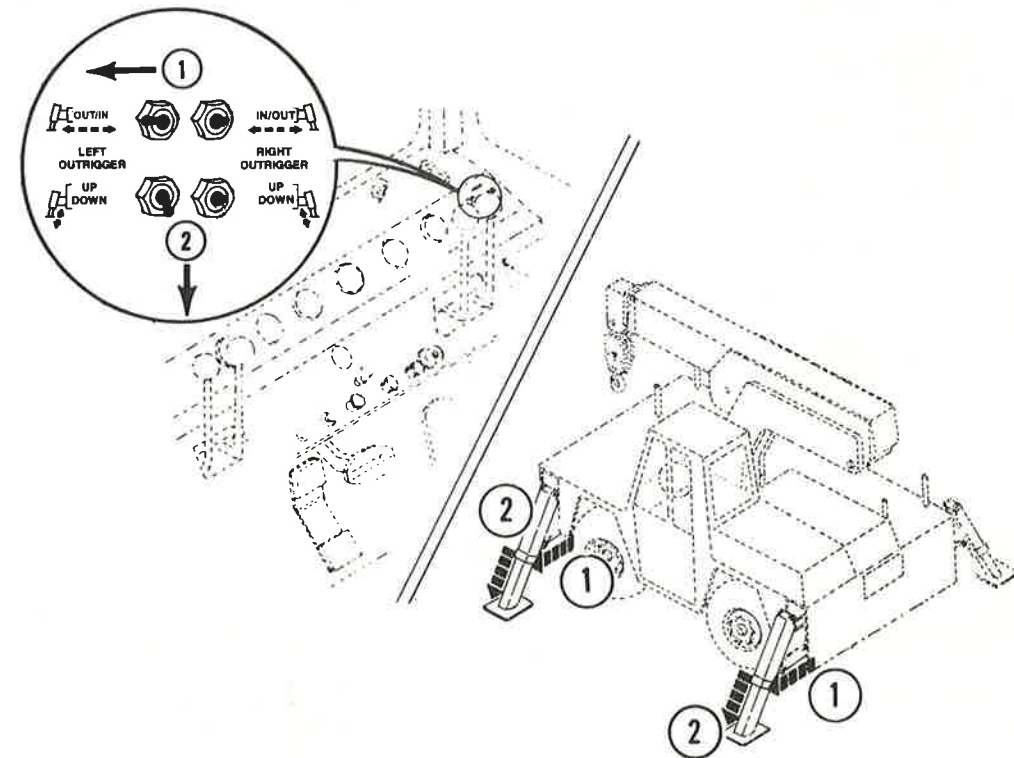


Figure 12. To Extend and Lower the Outriggers

To Raise and Retract the Outriggers:

1. To Raise: Run the engine at low rpm (accelerator pedal released). Engage and hold the desired switch up as required (Figure 13, Item 1). Push the accelerator pedal to increase the engine rpm and accelerate the upward movement of the outriggers. Release the accelerator pedal and the switch when the outriggers are fully raised.
2. To Retract: Engage and hold the desired switch as required (Figure 13, Item 2). Push the accelerator pedal to increase the engine rpm and accelerate the retraction of the outriggers. Release the accelerator pedal and the switch when the outriggers are fully retracted.

CAUTION: Before you operate the outriggers or move the machine, make sure all persons are clear of the area.

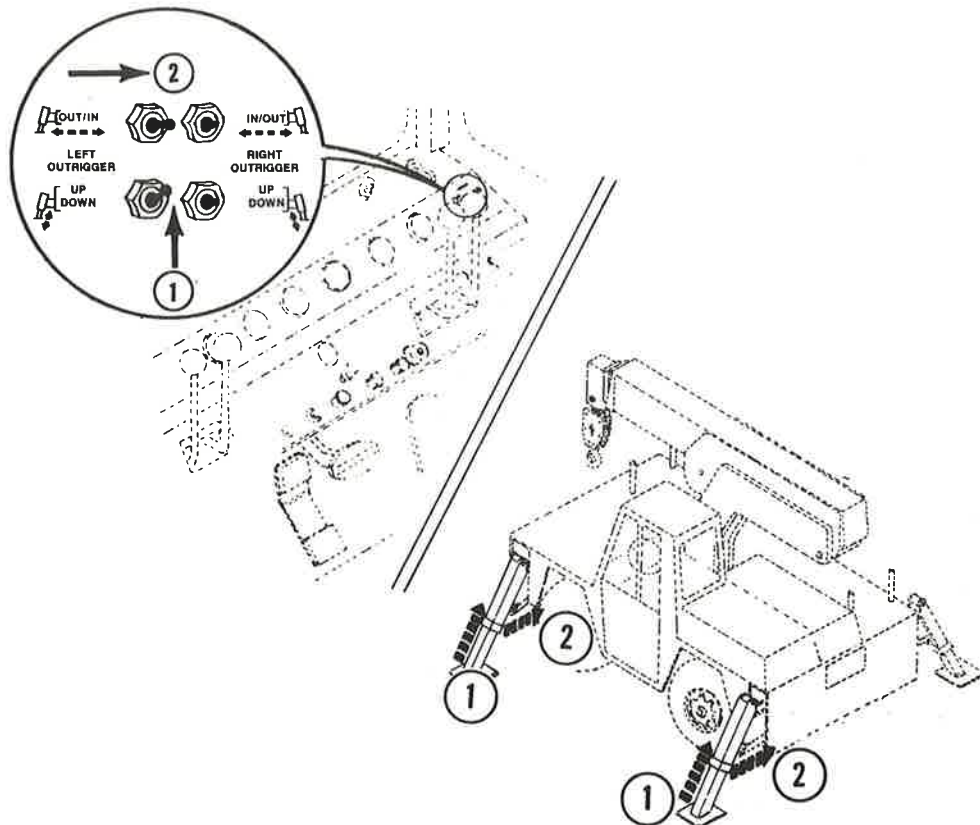


Figure 13. To Raise and Retract the Outriggers

BOOM SWING

To rotate the mast to the left (counterclockwise), pull the lever back (Figure 14, Item 1). Push the accelerator pedal to increase the engine rpm. Release the accelerator pedal and return the lever to neutral position to stop the rotation.

To rotate the mast to the right (clockwise), push lever forward (Figure 14, Item 2).

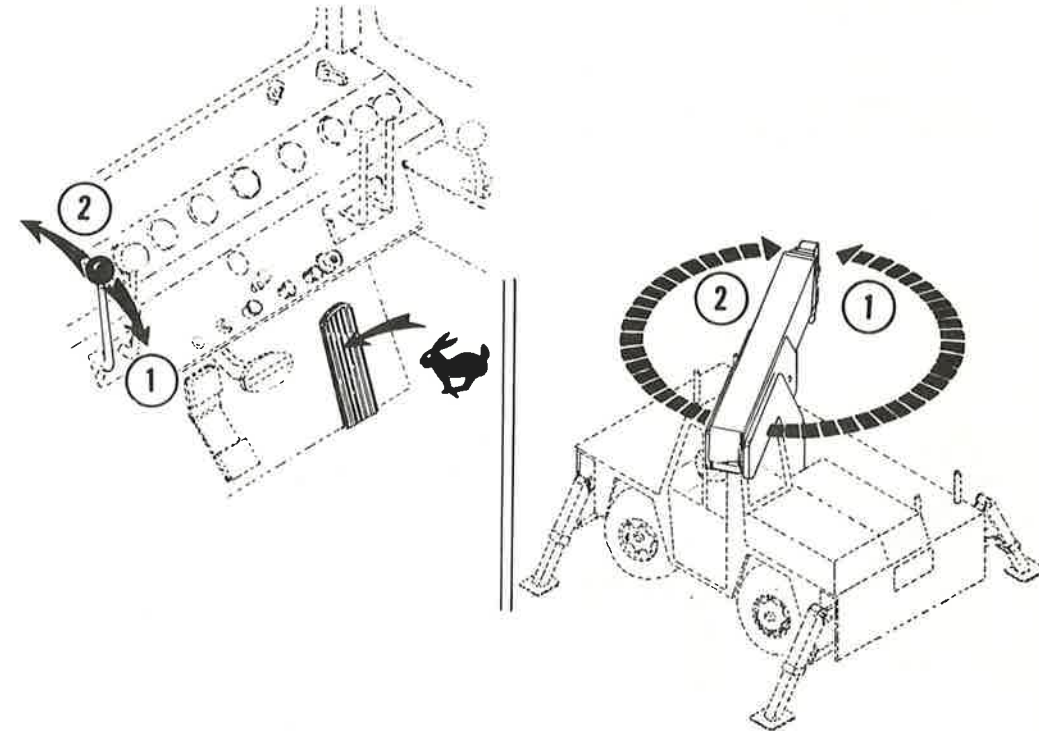


Figure 14. Operation of Boom Swing

CAUTION: Before you rotate the mast, make sure you have enough clearance on all sides and all persons are away from the area. Keep clear of the pinch point area between the operator's cab and the mast.

CAUTION: Never put side loads on the boom. Side loads can damage the swing gear. Move the boom into alignment with the load before lifting.

OPERATION OF BOOM CROWD

IMPORTANT: Always operate the winch to unwind the wire rope when you extend the boom. You must not let the hook block come in contact with the boom head. Damage can be caused to the wire rope system if the hook block is pulled into the boom head.

To extend the boom, push the lever forward (Figure 15, Item 1), then push the accelerator pedal to increase engine rpm. To stop the boom movement, release the accelerator pedal and move the lever to neutral position.

To retract the boom, pull the lever back (Figure 15, Item 2). There is a counterbalance valve in the hydraulic circuit. For smooth retracting of the boom, it is best to run the engine at higher than idle rpm.

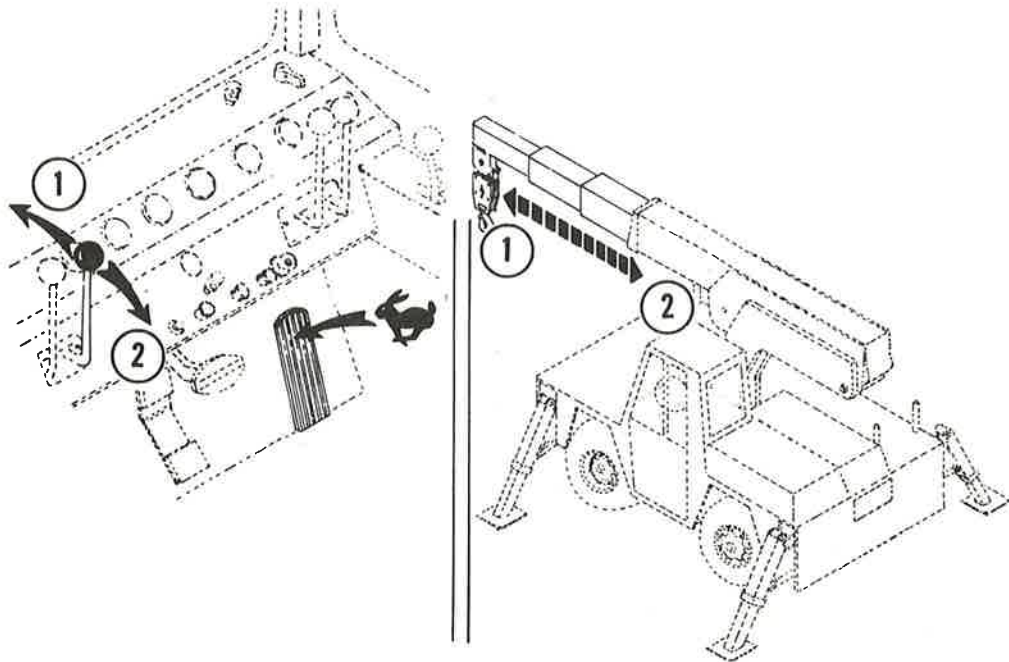


Figure 15. Operation of Boom Crowd

OPERATION OF BOOM HOIST

To raise the boom, pull the lever back (Figure 16, Item 1). Push the accelerator pedal to increase the hoist speed. Release the accelerator pedal and move the control to neutral position to stop the movement of the boom.

To lower the boom, push the lever forward (Figure 16, Item 2). There is a counterbalance valve in the hydraulic circuit of the hoist cylinder. Push the accelerator pedal to increase the hoist speed.

NOTE: The counterbalance valve will prevent the boom from being lowered unless the engine is running.

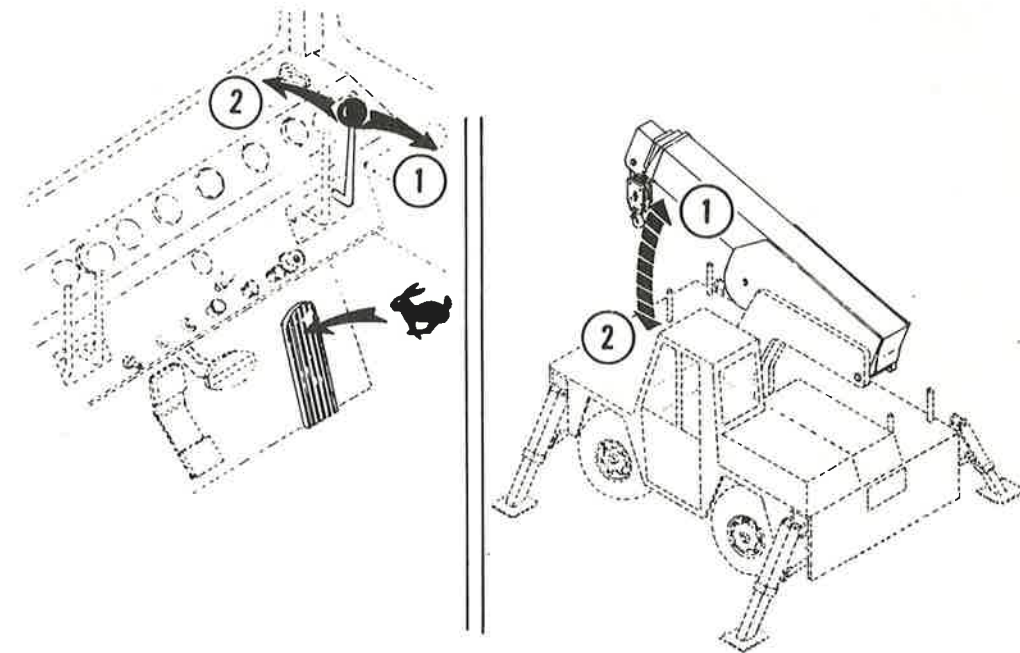


Figure 16. Operation of Boom Hoist



WARNING: Become thoroughly familiar with the Load Chart before you lift any loads. Know the capacity of the CRANE.

OPERATION OF MAIN WINCH

CAUTION: Before making a lift, make sure all persons are clear of the load.

To raise the hook, pull the lever back (Figure 17, Item 1), then push the accelerator pedal to increase engine rpm. Release the accelerator and move the lever to neutral position to stop the winch.

To lower the hook, push the lever forward (Figure 17, Item 2).

IMPORTANT: The boom must be in line and hook over center of load for a vertical lift. Side loads on the boom are not permitted.

CAUTION: Never use the crane to lift, lower or hold a person on the winch lines, either on a platform or any other type of attachment.

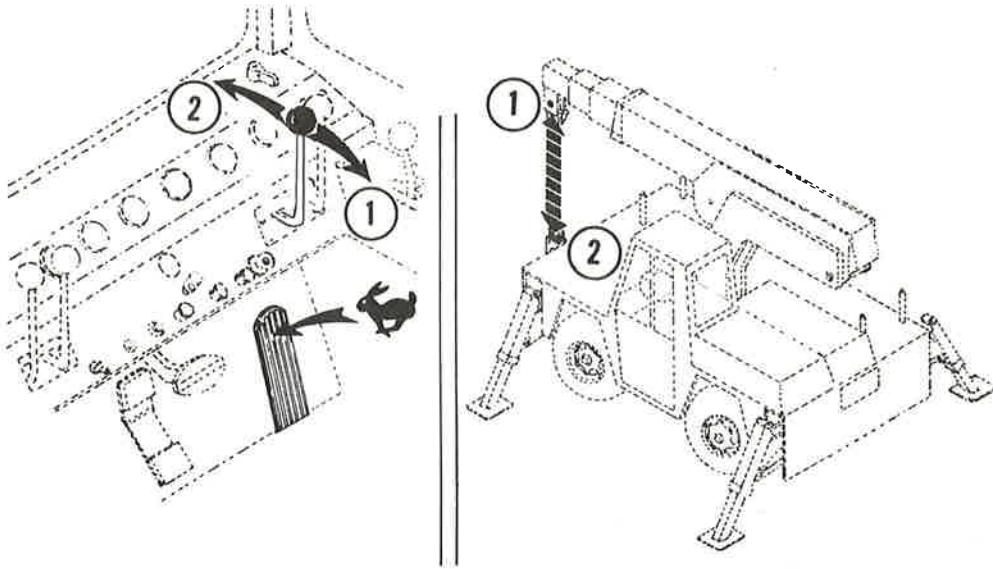


Figure 17. Operation of Main Winch

WARNING: Make a frequent inspection of the wire rope. Look for rust, broken strands, wear or other damage. Replace the wire rope immediately if damage is found.

OPERATION OF AUXILIARY WINCH (Optional)

WARNING: When you use the auxiliary winch, always engage the parking brake or lower the outriggers to prevent machine movement.

Auxiliary electric winch is intended for intermittent use. Prolonged operation may cause excessive discharge to batteries.

To unwind the wire rope, push and hold toggle switch up (Figure 18, Item 1). Keep tension on wire rope to prevent twisting of the wire rope on the winch drum. For fast unwind, release free spool lever on right side of winch inside front opening.

To retract the wire rope, push and hold toggle switch down (Figure 18, Item 2). To stop the winch, release the toggle switch.

CAUTION: Always keep hands and clothing clear of fair lead rollers and front opening while winch is operating. Keep all persons away from area when using auxiliary winch. Injury can be caused if the wire rope breaks or the hook becomes disconnected.

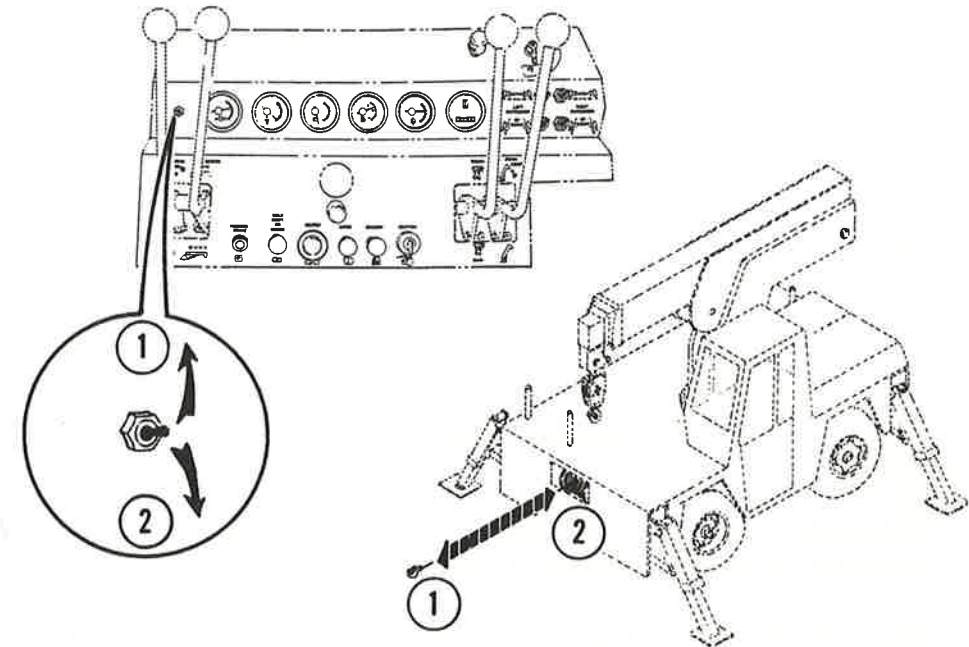


Figure 18. Operation of Auxiliary Winch

AUTOMATIC CUTOUT

This mechanism prevents the hook block from being pulled into the boom head during extension of the boom. When the hook block actuates the limit switch on the boom head, the oil flow to extend the crowd cylinder is stopped. A horn is actuated to give warning to the operator. The operator must operate the winch to lower the block before continuing to extend the boom. See Figure 19.

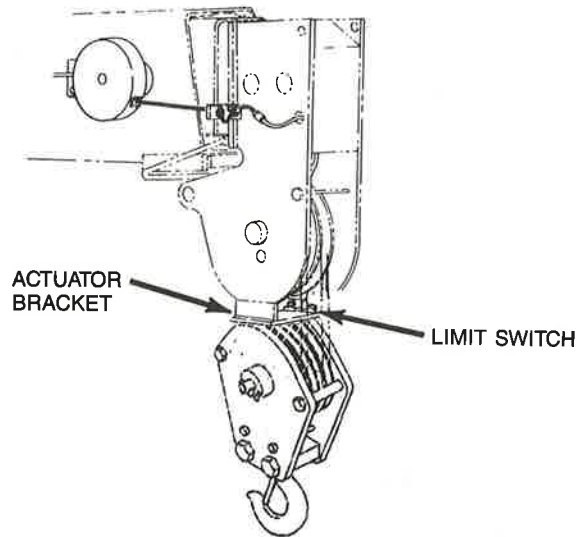


Figure 19. Automatic Cutout

IMPORTANT: This mechanism only stops the crowd cylinder. You must use care to prevent double blocking when operating the winch.

LOAD INDICATOR (Optional)

This instrument gives indication of the total weight of the load, including the hook block (See Figure 20). To use the Load Indicator:

1. Adjust the indicator gauge to show the parts of line between the boom head and the hook block. See page 46. Turn the knob on top of the gauge until the correct number shows in the window on the face of the indicator.

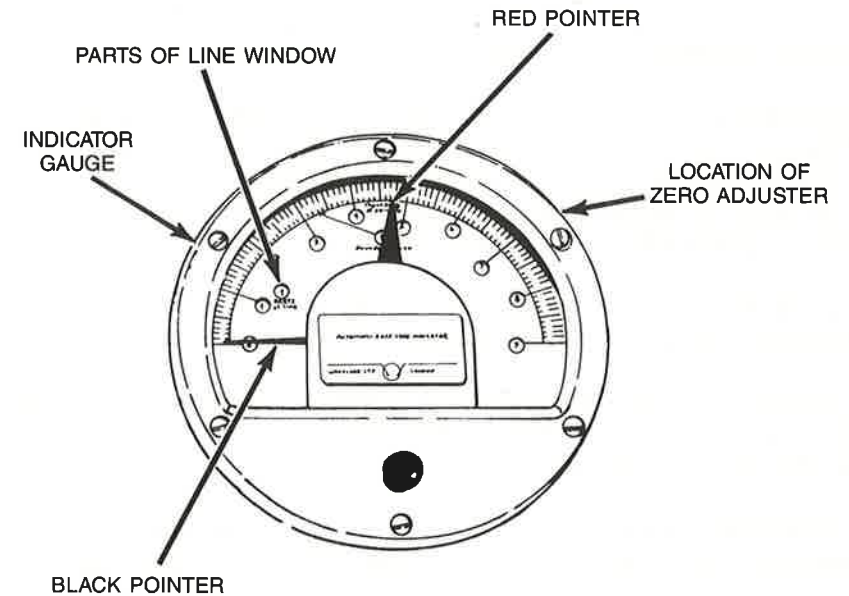


Figure 20. Load Indicator

NOTE: When the parts of line are correctly set, the black pointer on the indicator will show the weight of the hook block when the block is off the ground and ZERO when the block is on the ground.

2. Check the Load Chart to find the safe load limit for the arrangement of the reeving. Turn the black knob on the face of the indicator and move the RED pointer to this indication on the indicator gauge. When the BLACK pointer reaches this limit set by the red pointer, a warning bell will be activated.

3. The indicator gauge shows the load capacity for each part of line between the hook block and the boom head. The numbers in the circle cutouts represent thousands of pounds. Each intermediate division is shown in hundreds of pounds per division. For example, when you use a single part line, each division represents 100 pounds, or 200 pounds for 2 parts of line, etc.

IMPORTANT: When lifting a load, the black pointer must not go beyond the maximum amount shown on the gauge. This can cause damage to the gauge and is an indication that more parts of line are necessary.

ZERO ADJUSTMENT FOR BLACK POINTER

A slot for a screwdriver is found at the top right side of the indicator gauge. See Figure 20. This slotted adjuster is for zero adjustment of the black pointer.

Because the weight of the hook block is part of the load, the zero adjustment must be made with the hook block on the ground.

If the black pointer is not at the ZERO indication when the hook block is completely down, a zero adjustment is necessary.

Turning the adjuster screw counterclockwise moves the black pointer up the scale. **DO NOT TRY TO TURN THIS ADJUSTMENT BEYOND THE INNER STOPS,** that is, when you feel resistance on the adjuster screw.

When the black pointer is correctly set, turn the adjuster screw a very short distance in the opposite direction to release tension on the screw.

NOTE: To check the warning circuit, turn key switch to "ON" position and rotate the red pointer to the black pointer. The bell will ring if the circuit is working.

IMPORTANT: The Load Indicator must be checked at regular intervals for accuracy. See ADJUSTMENTS Section.

ADJUSTMENTS

OPERATOR'S SEAT

The operator's seat can be moved forward or back to fit the operator. To release the seat in the track, pull the lever on the left side of the seat.

PARKING BRAKE

Adjust tension on the linkage to the parking brake so approximately 50 pounds (23 kg) of force is necessary to engage the brake handle. To increase tension on the brake linkage, turn the knob on the brake handle clockwise. See Figure 21. If the knob is turned to the maximum and the parking brake still does not hold, see the Service Manual.

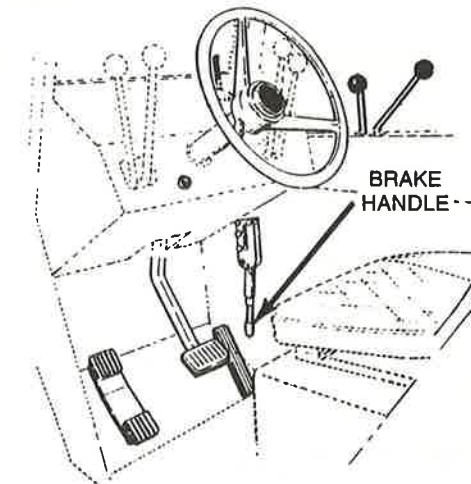


Figure 21. Parking Brake Handle

FOOT BRAKE

To prevent air from entering the brake hydraulic system, there must be a sufficient supply of fluid in the master cylinder. See Preventive Maintenance Section.

For brake adjustment and procedure to remove air from the system, see Service Manual.

SWING GEAR/PINION

- A. Remove swing pinion cover.
- B. Start machine and rotate mast until high point on gear is in alignment with pinion (See Figure 22). (**Note:** High point is punch-marked on edge of mast base plate after factory assembly). Lash at this position between gear and pinion should be between 0.005 and 0.015 (See Figure 22).

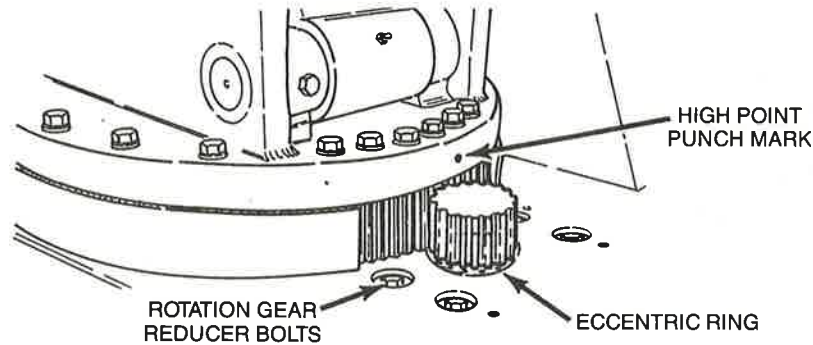


Figure 22. Adjustment of Gear/Pinion Lash

ADJUSTMENT OF GEAR/PINION LASH

- A. Loosen slightly the four bolts securing the rotation gear reducer.
- B. With spanner wrench, turn eccentric ring at pinion to set correct lash.
- C. Retighten bolts to appropriate torque.
- D. Replace swing pinion cover.

ADJUSTMENT OF DYNAMOMETER

1. Set the indicator gauge to show the parts of line between the hook block and the boom head.
2. Set the BLACK pointer on the gauge to ZERO. The zero adjuster is on the top right hand side of the gauge and has a slot for a screwdriver. Turning the adjuster counterclockwise moves the black pointer up the scale. DO NOT try to turn the zero adjuster beyond the inner stops (when resistance increases). After you have moved the black pointer to ZERO, loosen the adjuster screw a very small amount to release tension on the screw. Then carefully hit the gauge with your hand. If the black pointer moves, repeat the adjustment procedure.

3. Lift an exact weight. The accuracy of the weight must be known.
4. Adjust the dynamometer on the boom to give correct indication of the load.
 - a. On the shaft of the center roller, loosen the locknut that is on the side opposite the index plate. See Figure 23. Also loosen the two locknuts on the end of the shaft near the index plate.

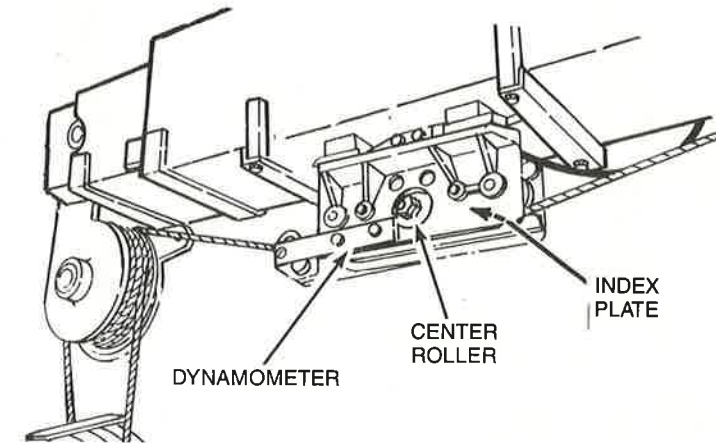


Figure 23. Dynamometer

- b. Turn the two locknuts near the index plate (and the shaft to which they are fastened) until the correct indication is given by the black pointer on the gauge.
- c. Hold the two locknuts near the index plate. Tighten the locknut on the side opposite the index plate. Make sure the setting does not change.
- d. Lower the weight and the hook block until there is no tension on the wire rope.
- e. Check the black pointer on the gauge. The pointer must be on the ZERO mark. If necessary, repeat the zero adjustment (see Step 2).
- f. Lift the weight again. If the indication of the black pointer is not correct, repeat the dynamometer adjustment.
- g. Repeat this complete procedure until you get correct indications with a load and without a load.

REEVING ARRANGEMENTS AND BLOCK

For 2-part line:

Assemble hook block for single sheave configuration. Put the wire rope over the center sheave in the boom head. Pull the wire rope through the hook block. Connect the loose end of the wire rope to the ear on the crane side of the boom head with a socket wedge. See Figure 24.

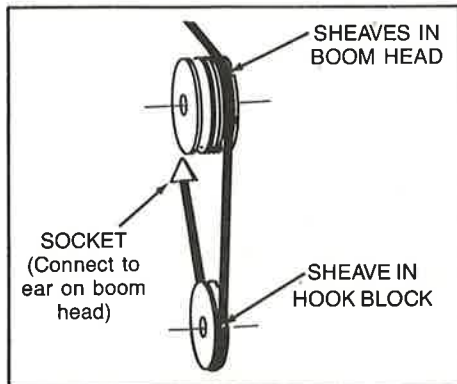


Figure 24. Reeving for 2-Part Line

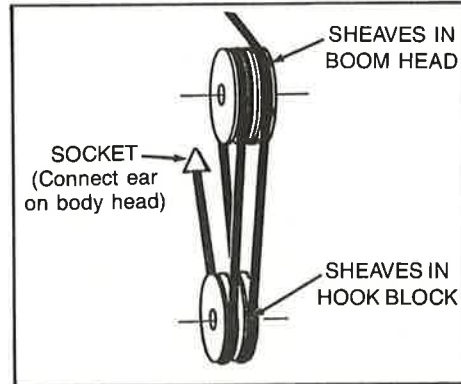


Figure 25. Reeving for 4-Part Line

For 4-part line:

Assemble hook block for double sheave configuration. Put the wire rope over the center sheave in the boom head, through the hook block, then over the second sheave in the boom head. Connect the loose end of the wire rope over second hook block sheave, to the ear on the crane side of boom head with a socket and wedge. See Figure 25.

CORRECT INSTALLATION OF THE SOCKET AND WEDGE

Always connect the socket so the load is pulled on the same line as the eye of the socket (See Figure 26).

When you install the wedge, hit the wedge several times with a hammer to make sure the wedge is fully engaged with the socket. Install a cable clamp on the loose end of the wire rope as shown in Figure 26.

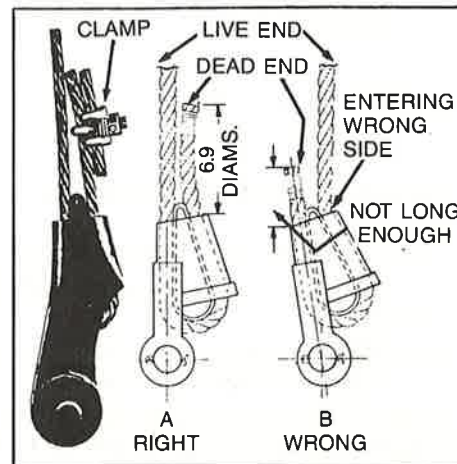


Figure 26. Installation of Socket

PROCEDURE TO EXTEND THE 4TH SECTION

A boom with four sections is optional for the CRANE. If the machine has this optional boom, use the following procedure to move the 4th section to the extended position. See Figure 27.

1. Extend and set the outriggers. The boom must be fully retracted.
2. On the left side of the boom, install Pin "B" to join the second and third sections. Remove Pin "A" from Hole "D" and install in Hole "C".
3. Fully extend the boom by actuating the lever for Boom Crowd. The 4th section is pushed to the extended position. Remove Pin "A" from Hole "C".
4. Retract the crowd cylinder. The 4th section will remain in the extended position. Align the rod of the crowd cylinder with the hole for Pin "A" at rear of 4th section. Install Pin "A". Remove Pin "B".

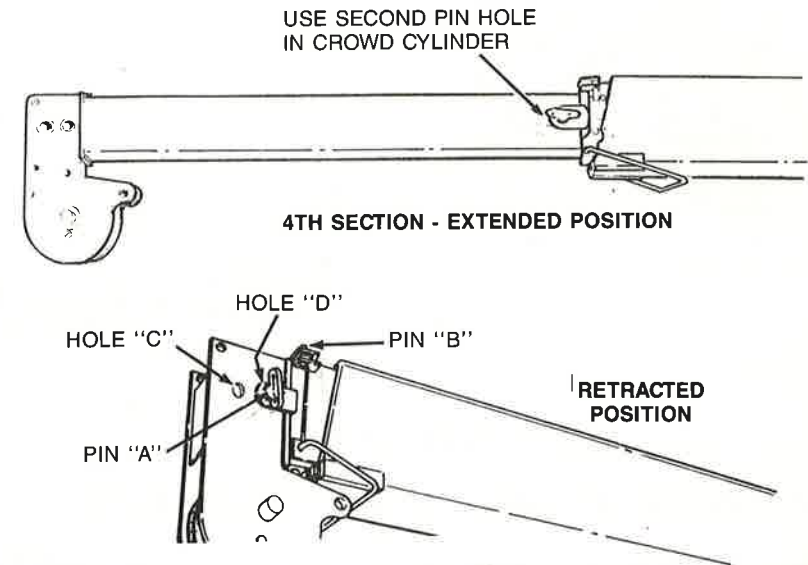


Figure 27. 4th Section Adjustment

To Retract the 4th Section:

1. Extend and set the outriggers. The boom must be fully retracted.
2. Install Pin "B" to join the second and third section. Remove Pin "A".

3. Actuate the lever for Boom Crowd to completely extend the cylinder. Install Pin "A" in Hole "C". Remove Pin "B" and put in storage.

4. Retract the boom. Remove Pin "A" from Hole "C" and install into Hole "D".

PROCEDURE TO INSTALL THE JIB

1. Connect the base of the jib to the sheave pin on the boom head with clevis pins and retainer pins.

2. Install the bracket for the suspension cable on the boom head as shown. See Figure 28.

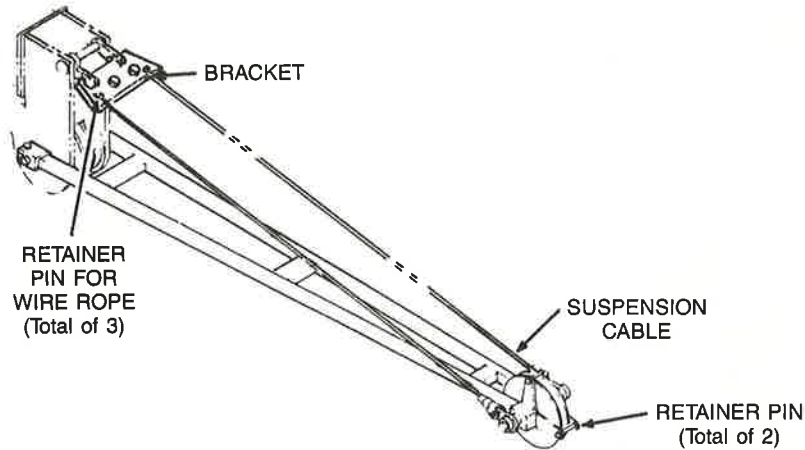


Figure 28. Jib Installation

3. Connect the suspension cable for the jib to the support bracket.

4. Remove the retainer pins for the wire rope from the jib head. Install the wire rope from the winch over the jib sheave. Install the retainer pins.

5. Install hook and ball.

JIB STORAGE

NOTE: The jib weight is 150 lbs. (68 kg). Use care when lifting.

Remove the jib from the boom head and connect the bracket and suspension cable to the base of the jib. Lift the base of the jib onto the rear boom bracket. Lift the front of the jib onto the front boom bracket. Install three retainer pins to hold the jib on the storage brackets. See Figure 29.

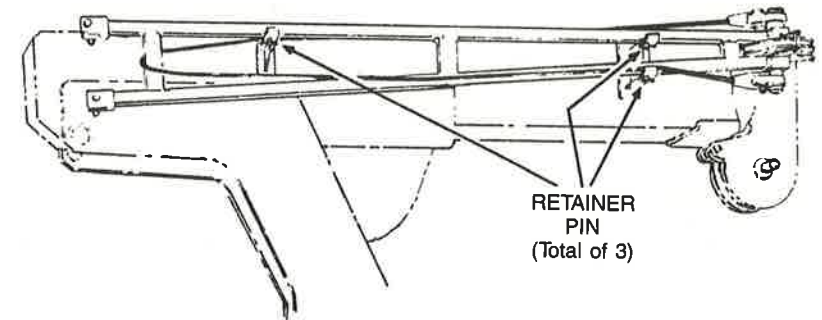


Figure 29. Storage Position

NOTES

SCHEDULED PREVENTIVE MAINTENANCE

INTRODUCTION

Preventive maintenance is necessary to keep the machine 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 Chart 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.

SPARK ARRESTING MUFFLERS

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

Typically, such laws and regulations require spark arresting devices to be maintained in good working order and typically to be attached to the exhaust system on naturally aspirated engines (engines without turbo charger).

LUBRICANTS

It is not our policy to publish lists of approved lubricants or to guarantee lubricant performance. The responsibility for the quality of any lubricant rests completely with the distributor or manufacturer of the lubricant.

In various paragraphs of this manual, you will find the statement "Use (lubricant brand name) or equal". This statement does not constitute an unconditional guarantee of the performance of the brand of oil mentioned; it is intended only as a guide to the type of lubricant recommended for a given application.

HYDRAULIC OIL RECOMMENDATIONS

*ISO #46 Hydraulic Oil (Mobil Fluid #423) is recommended for year-round use in the hydraulic system.

Viscosity: The viscosity of the oil must not be more than 4000 SUS (Saybolt Universal Seconds) when the engine is started, or go below 60 SUS for long periods of operation at high temperatures. Normal operating conditions are between 80 SUS and 180 SUS. The viscosity range must not be less than 90 (for this application).

Very Cold Temperature Conditions: SAE 5W or SAE 5W-20 oils can be used if the viscosity of the oil will not be less than 60 SUS at maximum operating temperature. It is necessary to use a preheater and a longer than normal warming period at low operation speed to heat the oil to operating temperature.

*International Standards Organization

FUEL SPECIFICATIONS

DIESEL FUEL

Cummins diesel engines operate most efficiently with No. 2 diesel fuel in temperatures above 32° F (0° C). See Note. When operating in temperatures below 32° F (0° C), use No. 1 diesel fuel.

NOTE: When No. 2 diesel fuel reaches its cloud point, wax crystals will fill the screen and filters. These crystals can cause loss of power or possible stopping of the engine. See your fuel distributor for more information.

The American Society for Testing Materials (ASTM) has assembled a specification, ASTM Designation D975, which is used in the United States, Canada, and many other areas of the world. Any fuel used in the Cummins engine must meet this ASTM specification.

Pour point, maximum	10° F (-12° C) below lowest atmospheric temperature at which engine must start and operate
Cetane number, minimum	40 (45-55 for winter or high altitudes)
Sulphur, by weight, maximum	.50 of 1%
Water and sediment, by volume maximum	.05 of 1%
Ash, by weight, maximum	.01 of 1%
Carbon residue on 10%, maximum	.20 of 1%
Distillation, 90%	540° - 625° F (282° - 329° C)
End point	675° F (357° C)
Flash point, minimum	125° F (51° C) or legal
Viscosity, centistokes at 100° F (38° C)	.32-40
Corrosion, copper strip, 3 hours at 212° C	No. 3 ASTM
API gravity, minimum	.30

GASOLINE

Continental Gasoline Engines operate on Regular Grade gasoline with a minimum research method rating of 90.7 Octane. This grade of gasoline gives power and economy, long engine life and low maintenance cost.

The typical Octane number ratings of regular grade gasoline are:

Motor Method	86.2 Octane Number
Research Method	94.2 Octane Number
Average	90.2 Octane Number

These two Octane ratings are used to show the anti-knock quality of gasoline. Normally, the Petroleum Industry uses only the RESEARCH METHOD RATING, except in the United States where the average of the two figures is given on gasoline pumps.

When only one Octane rating is given for gasoline and the rating method is not specified, it can be assumed to be the Average Rating in the United States or the Research Method Rating in other parts of the world.

Non-leaded gas can be used in the Continental gasoline engine if the Octane rating (Average Octane Rating in the United States or Research Method Rating in other parts of the world) is 90 or higher.

ENGINE OIL SPECIFICATION

CUMMINS DIESEL ENGINE

Oil Performance Recommendations

CC/SF for use in naturally aspirated engines and in engines that operate in light duty service including standby and emergency operation (equivalent to MIL-L-2104B).

NOTE: CC/CD or CD/SF oils can be used in areas where CE oil is not yet available.

Dual Category oils provide the performance required of each individual category. For example, a CC/CD oil is blended to meet both CC and CD performance levels.

A **sulfated ash limit** is specified for lubricating oil used in Cummins engines. Past experience has shown that oils with a high ash content may produce deposits on valves that can progress to guttering and valve burning. A maximum sulfated ash content of 1.85 mass % is recommended for all oil used in the engine.

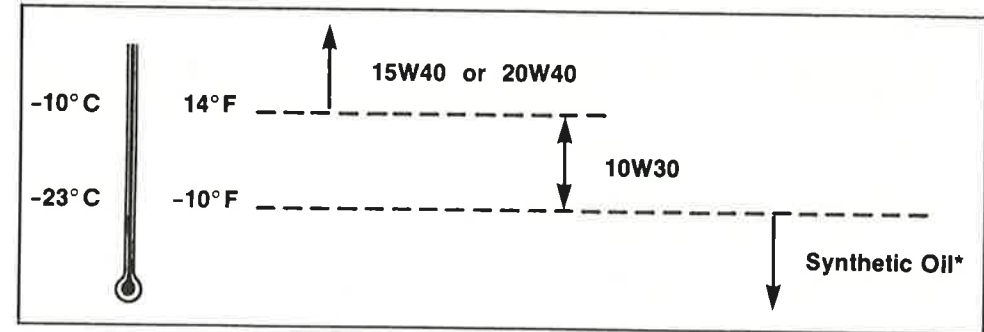
Break-In Oils

Do not use special "break-in" lubricating oils for new or rebuilt engines. Use the lubricating oils specified for normal engine operation.

OIL VISCOSITY RECOMMENDATIONS

The use of a multi-graded lubricating oil has been found to improve oil consumption control and improve engine cranking in cold temperatures while maintaining lubrication at high operating temperatures. A multi-graded* oil is, therefore, recommended with the viscosity grades shown in the chart on top of page 55. The use of single grade lubricating oil is not recommended except for synthetic oils used in Arctic conditions.

VISCOSITY GRADES



NOTE: *The same oil change interval is to be followed for synthetic oil as for petroleum based oil.

ARCTIC OPERATIONS

Where there is no provision to keep the engine warm when it is operating in ambient temperatures consistently below -23°C (-10°F), use a lubricating oil that meets the following requirements.

SAE 5W viscosity grade synthetic oils may be used provided they meet the minimum viscosity at 100°C (212°F).

Parameter (Test Method)	Specification
Performance	API Classification CC - Naturally Aspirated API Classification CC/CD - Turbocharged
Viscosity	10,000 mPa·s Maximum at -35°C (-31°F) 4.1 mm Squared Minimum at 100°C (212°F)
Pour Point (ASTM D-97)	Maximum of 5°C (41°F) Below the Lowest Expected Ambient Temperature
Sulfated Ash Content (ASTM D-874)	Maximum of 1.85% by Weight

CONTINENTAL GASOLINE ENGINE

The lubricating oil recommendation is based upon engine design, type of service, and the atmospheric temperature prevailing. High quality oils are required to assure maximum performance, long engine life, and minimum cost of operation.

Continental industrial engines operate in a wide range of service conditions and seasonal temperatures, so our recommendations are given for various types of service and ambient temperatures.

LUBRICANT DESIGNATIONS

We recommend using oil described below for all Continental gasoline engines.

<u>Fuel Type</u>	<u>API, SAE ASTM Classification</u>
Gasoline	SE, SF, SE/CD, SF/CD

Service typical of industrial gasoline engines operating under engine manufacturer's warranties. Oils designed for this service provide more protection against oil oxidation, high temperature engine deposits, rust and corrosion in gasoline engines than oils which are satisfactory for API Engine Service Classifications SD or SC.

S.A.E. OIL BODY GRADES

The oil grades available from the lightest (SAE 5W) to the heaviest (SAE 50) are:

5W	10W	15W	20W	20	30	40	50
5W-20							
	10W-30						
		15W-50					

Multi-Grade Oils such as SAE 5W-20 and SAE 15W-50 have the starting grade characteristics of the lighter oil and after warm up have the running characteristics of the heavier grade.

The following SAE grades are general recommendations for Continental gasoline engines during changing seasonal atmospheric temperatures:

AVERAGE AMBIENT TEMPERATURE AT WHICH ENGINE STARTING IS REQUIRED:

°C	-30	-18	-7	5	16	27	38+
°F	-22	0	20	40	60	80	100+

SAE 40					
SAE 30					
SAE 20W/20					
SAE 10W					
SAE 20W - 50					
SAE 20W - 40					
SAE 15W - 50					
SAE 15W - 40					
SAE 10W - 40					
SAE 10W - 30					
SAE 5W - 20					

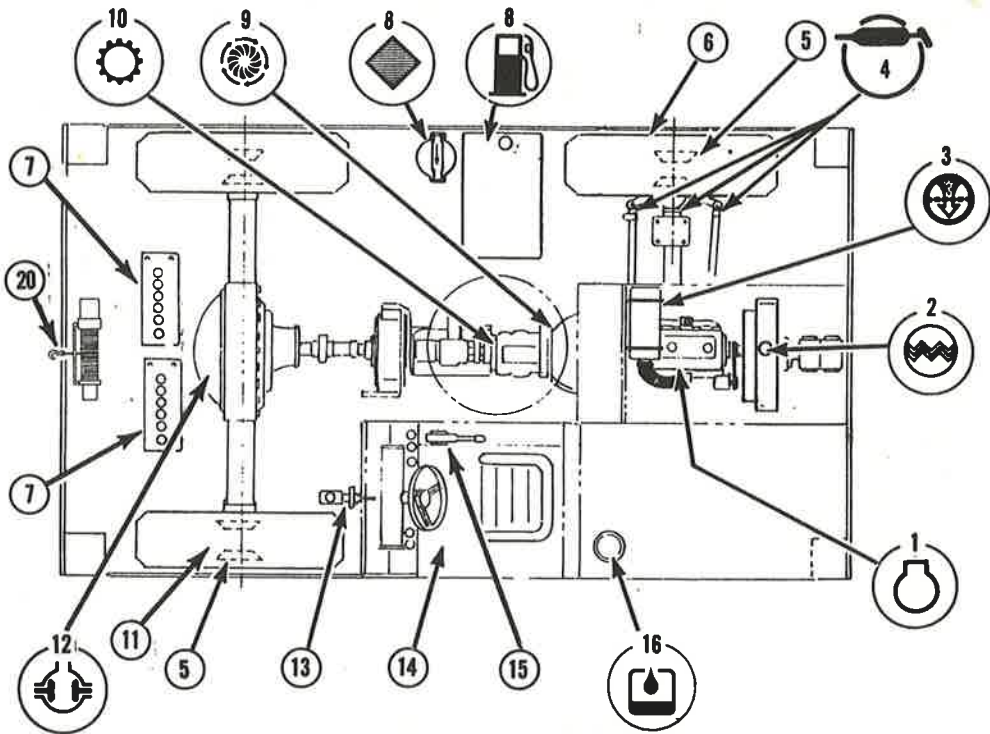


Figure 30. Maintenance Points on Lower Structure

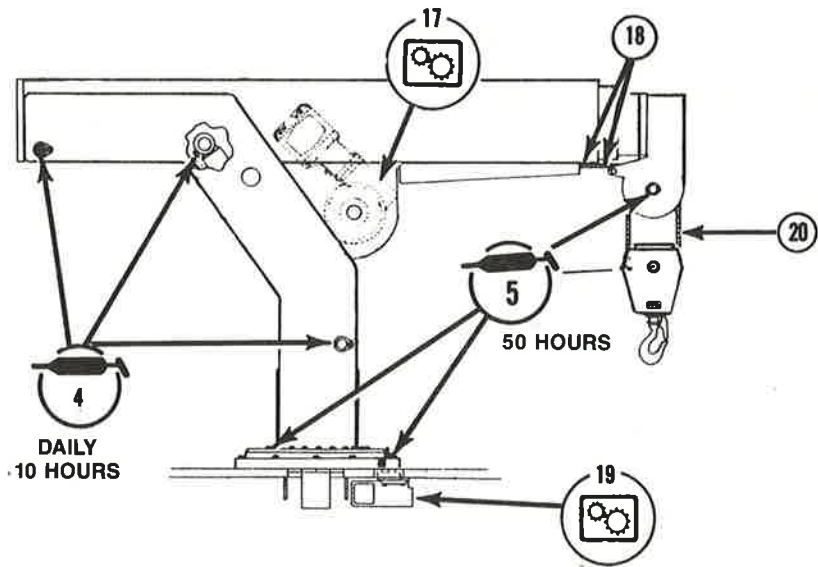


Figure 31. Maintenance Points on Upper Structure

MAINTENANCE CHART

- Daily - 10 Hours
 - Weekly - 50 Hours
 - 2 Weeks - 100 Hours
 - Monthly - 250 Hours
 - 2 Months - 500 Hours
 - 6 Months - 1500 Hours
 - 12 Months - 3000 Hours

Ref.	Component/System									Service/Check
1	Engine	X								Check oil in crankcase
				X						Change oil (See engine manual)
					X					Replace oil filter (See engine manual)
2	Cooling System	X								Check level of coolant in radiator
				X						Check fan belts
								X		Change coolant, flush system, clean radiator
3	Air Cleaner			X					Clean or replace element (See engine manual)	
4	Grease Fittings	X							Apply grease	
5	Wheel Bearings							X	Repack bearings	
6	Tires	X								Check pressures and general condition
7	Battery							X		Clean battery and connections
8	Fuel System	X								Fill Tank, remove water from fuel filters
								X		Change fuel filters
9	Torque Converter & Forward-Reverse Unit	X								Check level of fluid
								X		Change fluid
10	Transmission	X								Check level of oil
								X		Change oil
11	Planetary (Hurth Axle)	X								Check lubricant
								X		Change lubricant, clean breather
12	Differential	X								Check lubricant
								X		Change lubricant, clean breather
13	Brake Master Cylinder	X								Check level of fluid
14	Operator's Cab	X								Clean cab, check controls before operation
15	Parking Brake					X				Adjust as necessary
16	Hydraulic System	X								Check level of oil in tank
								X		Change filter in hydraulic line
								X		Change oil, clean tank and breather
17	Winch Gearbox	X								Check level of oil
								X		Change oil, clean breather
18	Boom	X								Apply "STP" type lubricant to slides
19	Swing Gearbox and Swing Gear	X								Check level of grease
							X			Clean and lubricate swing grease
20	Wire Rope System	X								Check reeving, clamps and connections
							X			Make careful inspection of wire rope, apply lubrication as necessary.

NOTE: The instructions in this Maintenance Chart are in addition to the instructions for special maintenance on page 59.

LIST OF GREASE FITTINGS

GREASE SPECIFICATION

Use a lithium base, E.P. No. 2 bearing grease, moly-disulfide grease or functional equivalent. Apply enough grease to remove the old grease.

Location	No. of Fittings	Fig. Ref.
1. Mast Bearing	1	32
2. Steering Cylinder & Steering Knuckles	6	33
3. Boom Pivot	2	34
4. Boom-Head Sheave	2	35
5. Universal Joint	3	36
6. Hoist Cylinder	2	37,38
7. Axle (Hurth)	4	39

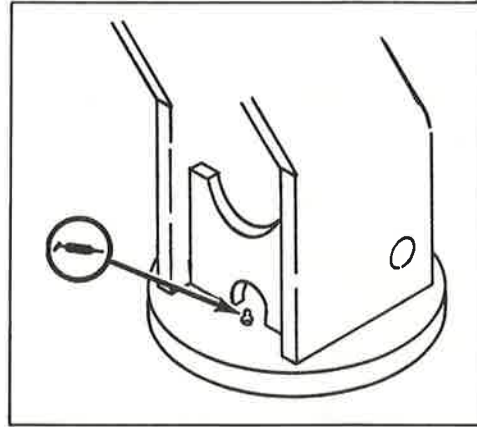


Figure 32.

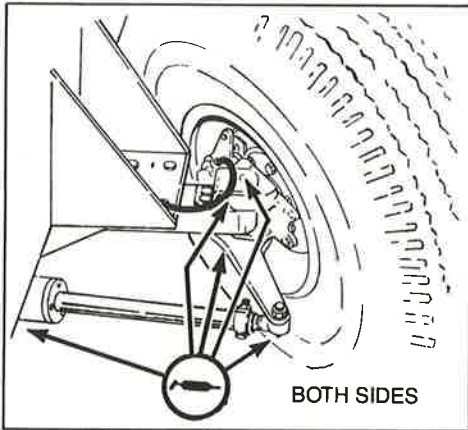


Figure 33.

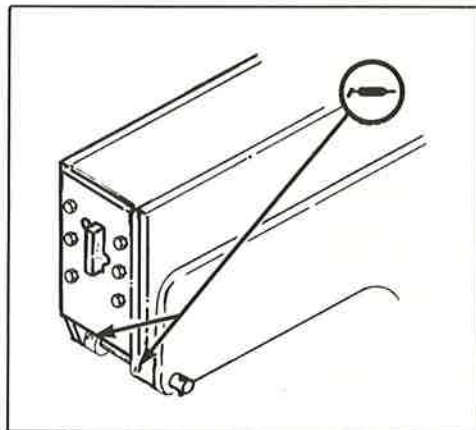


Figure 34.

BOOM LUBRICATION

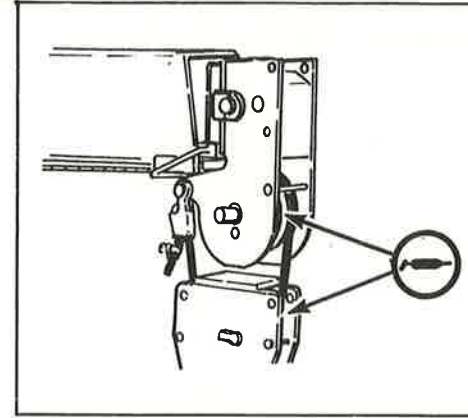
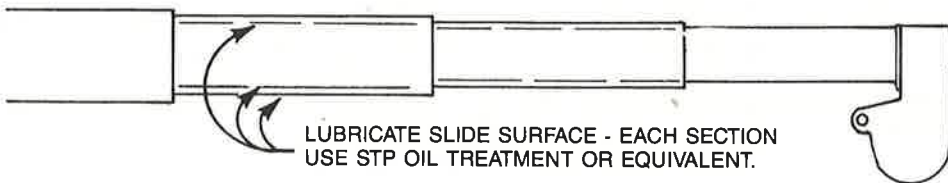


Figure 35.

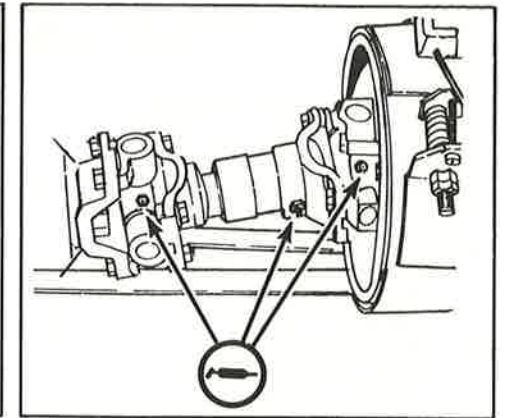


Figure 36.

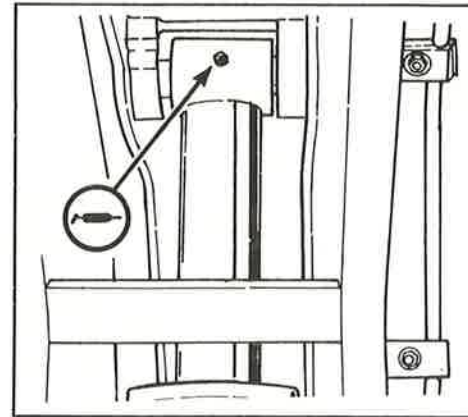


Figure 37.

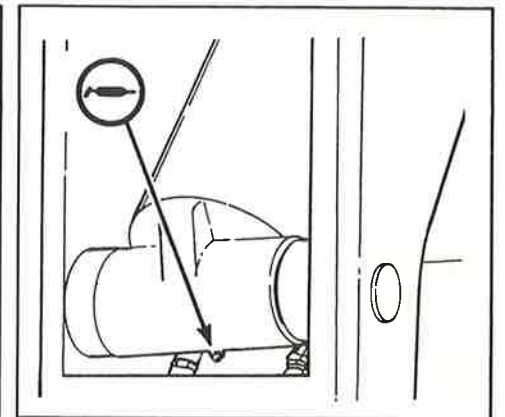


Figure 38.

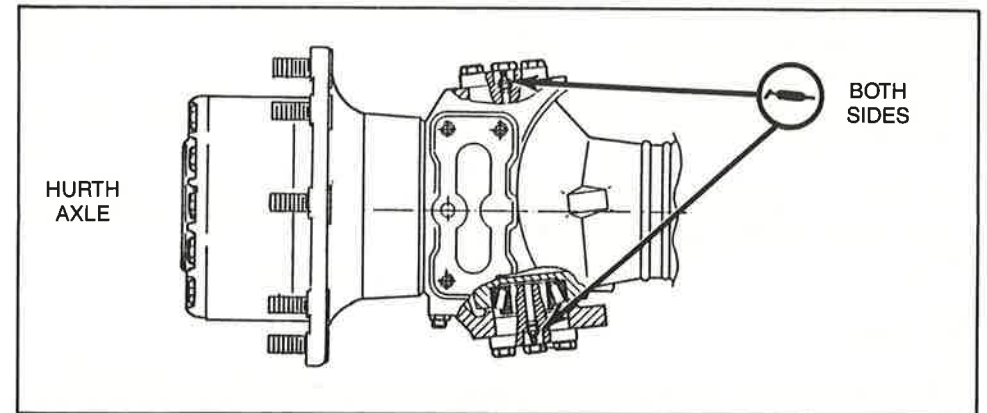
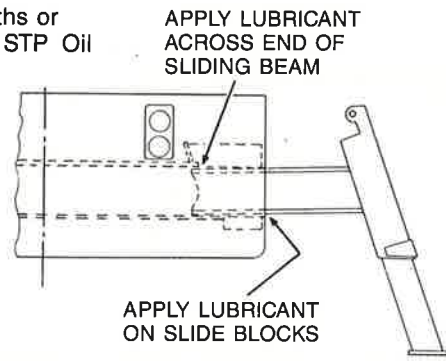


Figure 39.

OUTRIGGER LUBRICATION

Clean and lubricate outriggers every 3 months or when sliding surfaces become dry. Apply STP Oil Treatment, LUBAID NF, or equivalent.

1. Extend and set outriggers. Clean the sliding beams, top and bottom.
2. Apply lubricant in locations indicated. (Do not overlubricate by applying to complete outside of sliding beam. During extend and retract, the beam slides on only two surfaces.)
3. Raise outriggers and retract horizontal beams to make a distribution of the lubricant.



1. ENGINE

(Continental TM 2.7L Gasoline & Dual Fuel Engine)

Engine Specifications:

Type	4 cylinder, 4 cycle, Valves in Head
Firing Order	1-3-4-2
Valve Clearance	
Intake - in. (mm)014 (.36)
Exhaust - in. (mm)018 (.46)
Spark Plug Gap - in. (mm)032 (0.8)
Oil Capacity	
Crankcase - U.S. qt. (liters)	6 (5.7)
Filter - U.S. qt. (liters)	1 (.95)
Total - U.S. qt. (liters)	7 (6.65)
Coolant Capacity (Engine Only) - U.S. qt. (liters)	3.8 (3.6)
Engine Oil Pressure	
Max. Oil Pressure** - PSI (Bar)	40-60 (2.8-4.1)
Min. Oil Pressure (Idling) - PSI (Bar)	7 (0.5)

*If additional information is required, see "Continental's Operator, Maintenance and Overhaul Manual" furnished with your machine.

**Higher oil pressure may be experienced during cold starts.

Oil Change:

Run-In Oil. After the engine has operated for 50 hours, remove the run-in oil. Replace with oil of the correct type per Specifications on page 56.

Continuous Duty at Continuous Duty Rating		Light Duty Operation (25% Max. Continuous Rating) and Standby
CLEAN ENVIRONMENT	DIRTY ENVIRONMENT	
150 Hours Max.	50 Hours	100 Hours Max.

Suggested Oil and Oil Filter Change Intervals

- For oil change only, add 6 measured U.S. quarts (5.7 L) of oil. Do NOT fill using only the dipstick as a guide.
- For oil and filter change, use 7 U.S. quarts (6.65 L) of oil. Operate the engine for 2 or 3 minutes to fill the filter body. Stop the engine and check the level of oil with the dipstick. Check filter for leaks.

Filter Change:

Change the oil filter at the end of the run-in period (50 hours) and again per chart above.

- Turn filter counterclockwise to loosen. Remove and discard the old filter.
- Clean the mounting surface for the filter. See Figure 40.

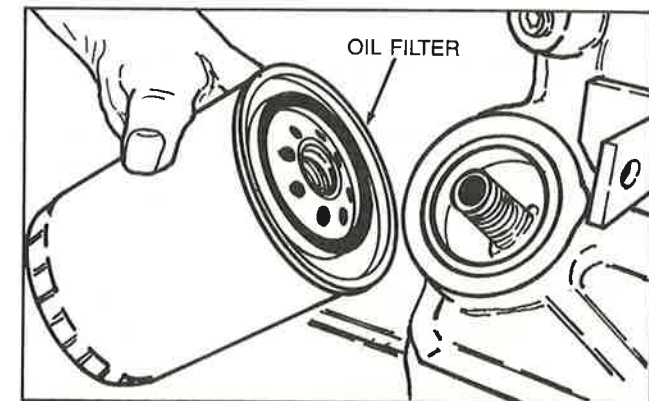


Figure 40. Removal of Oil Filter

- Apply a small amount of engine oil to the gasket of the new filter. Install filter. Turn filter clockwise to tighten until gasket contact is made. Tighten the filter only 3/8 of a turn. Loosen the filter and tighten again until gasket contact is made. Then tighten filter 1/2 to 3/4 turn more to get the correct seal.

Gasoline Fuel System:

The carburetor mixes fuel with air and meters the mixture into the engine as the power is demanded. For maximum power and minimum fuel consumption, correct adjustment is important. See Fuel specifications on page 53 and 54.



WARNING: Smoking or open flame should be avoided any time the fuel system is being repaired or serviced. The area should be properly ventilated. Improper handling of fuel could result in an explosion or fire causing bodily injury to yourself or others.

Continental CK Series Carburetor Adjustment:

The Continental CK Series carburetor has the following adjustments: See Figure 41.

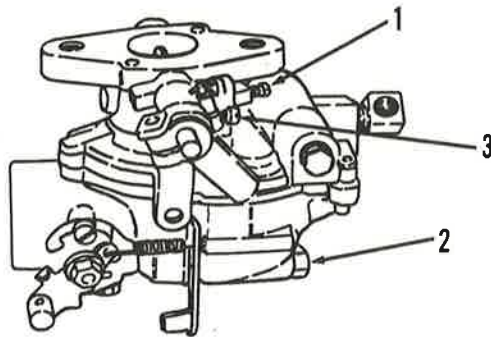


Figure 41. Continental CK Series Carburetor

1. Idle Fuel Adjusting Needle - should be seated lightly with small screwdriver, turning in (clockwise). It is then backed out (counterclockwise) 1/4 turns as a preliminary setting. Fuel flow is regulated like a water faucet, turn in to shut off, back out to open.

2. Main Jet Adjusting Needle - available for use with the fixed high speed jet for altitude compensation. Turn (in) for leaner mixture and (out) for richer mixture.



CAUTION: Improper adjustment of the main jet could lead to engine damage.

3. Idle Speed Adjustment Screw - turn in (clockwise) until throttle valve is slightly cracked open. Adjustment to recommended idle speed can be made after installation to engine. Turn screw clockwise to increase speed or counterclockwise to lower the R.P.M.

Spark Plugs:

Check, clean and adjust the spark plugs monthly or more often if necessary.

Gap Adjustment. Thoroughly clean the spark plugs, including the threads. Check the electrode gap with a .032 in. (0.8 mm) feeler gauge. Correctly adjusted, there will be a small amount of friction as you move the wire gauge between the electrodes. Bend only the side electrode to set the gap. See Figure 42.

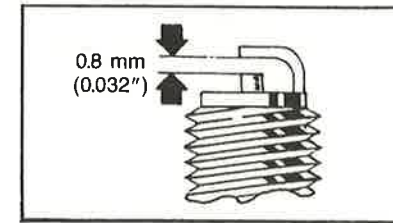


Figure 42. Gap Adjustment

Installation. Install the spark plugs, with gaskets, and tighten finger tight. Then tighten all 14 mm plugs to 30 lb.-ft. (40 Nm) torque with socket wrench of correct size.

Distributor and Ignition Timing

See Operator's Manual for Continental TM 2.7L Gasoline Engines furnished with your machine.

(Cummins 4B3.9 Diesel Engine)

Engine Specifications:*

Type	In-Line, Liquid Cooled, 4 Stroke Cycle
Firing Order	1-3-4-2
Valve Clearance:	
Intake in. (mm)	.010 (.25)
Exhaust in. (mm)	.020 (.51)
Oil Capacity	
Crankcase - U.S. qt. (liters)	10.0 (9.5)
Filter - U.S. qt. (liters)	1.5 (1.4)
Total - U.S. qt. (liters)	11.5 (10.9)
Coolant Capacity (Engine Only) - U.S. qt. (liters)	7.4 (7.0)
Engine Oil Pressure	
Max. Oil Pressure** - PSI (Bar)	40-60 (2.8-4.1)
Min. Oil Pressure (Idling) - PSI (Bar)	7 (0.5)

*If additional information is required, see "Cummins Operation and Maintenance Manual" furnished with your unit.

**Higher oil pressure may be experienced during cold starts.

Oil Change:

Run In Oil. Do not use special "break-in" lubricating oils for new or rebuilt engines. Use the lubricating oil specified for normal engine operation. Replace with oil of the correct type per Specifications on page 54.

Regular Oil Change. Change oil after every three (3) months, 250 hours or 5,000 miles whichever occurs first.

Under difficult conditions, for example, frequent starting and stopping, high or low operating temperatures, change the oil more frequently. Remove the oil while the engine is still warm from operation.

- For oil change only, add 10 measured U.S. quarts (9.5 L) of oil. Do NOT fill using only the dipstick as a guide.
- For oil and filter change, use 11.5 U.S. quarts (10.9 L) of oil. Operate the engine for 2 or 3 minutes to fill the filter body. Stop the engine and check the level of oil with the dipstick. Check filter for leaks.

Filter Change:

Same schedule as regular oil changes.

- Turn filter counterclockwise to loosen. See Figure 43. Remove and discard the old filter.

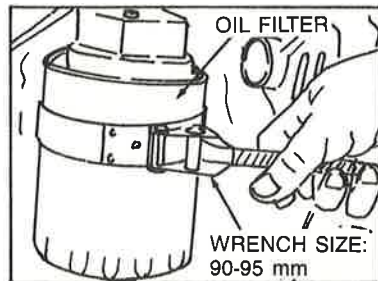


Figure 43. Removal of Oil Filter

- Clean the mounting surface for the filter.
- Apply a small amount of engine oil to the gasket of the new filter. Install filter. Turn filter clockwise to tighten until gasket contact is made. Tighten the filter only 3/8 of a turn. Loosen the filter and tighten again until gasket contact is made. Then tighten filter 1/2 to 3/4 turn more to get the correct seal.

Diesel Fuel System:

See Fuel Specifications on page 53.

Drain the water from the fuel/water separator everyday before starting engine.

- COOLING SYSTEM.** Check the level of the coolant daily or every 10 hours of operation. Coolant must be level with the bottom of the filler neck of the radiator.



CAUTION: When checking coolant, remove radiator cap slowly to relieve pressure in the system. To prevent burns, remove radiator cap only when engine is cool.

Coolant Recommendation. Use ethylene glycol antifreeze and water. Follow the recommendations on the container. Never use the antifreeze more than one winter because the rust inhibitors break down and are no longer efficient. For maximum protection, add corrosion inhibitor to the system every 2 months or 500 hours.

Thermostat Replacement. See Operator's Manual for Continental TM 2.7L Gasoline Engines or CUMMINS 4B3.9 Diesel Engines.

Radiator. Clean the radiator fins monthly or every 250 hours. Use compressed air or water hose to remove all foreign material.



CAUTION: ENGINE FAN AND BELTS - To prevent possible serious injury avoid contact with rotating fan and belts.

Fan Belts. Correct tension on the fan belts is important. Loose belts cause slippage and wear in the belts, engine overheating and battery failure. Tight belts cause rapid wear in the bearings of the water pump and alternator.

When adjusted correctly, the fan belt deflection on the long side should not exceed 3/8" - 1/2" (9.5 - 12.7 mm) (See Figure 44).

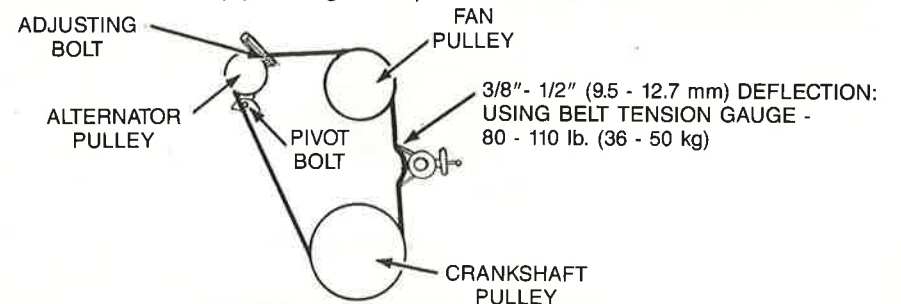


Figure 44. Adjustment of Fan Belt

Procedure to Clean the Cooling System: Change coolant and flush the system after every 12 months or 3000 hours.

- a. Open the drain valves on the engine block and radiator when the coolant is still warm from operation. Remove the radiator cap.
- b. Close the drain valves. Fill the system with radiator cleaner and water. Follow instructions on the container.
- c. Remove the cleaning solution and flush the system with water.
- d. Close the drain valves. Fill the system with coolant of the correct type. See coolant recommendations.
- e. Operate the engine for 5 minutes at idle rpm to remove air from the system. When the machine has a heater, start the heater to fill the heater lines.
- f. Stop the engine. Check and add coolant as necessary.

3. CHECK AIR CLEANER

All engines, when operating, consume several thousand cubic feet of air per hour. Since dusty air is full of abrasive matter, the engine will soon **wear excessively** if the air cleaner does not remove the dust before entering the cylinders.

On any air cleaner, operating environment dictates the air cleaner service periods. In extremely dusty conditions this may be once or twice daily. In dust protected areas the air cleaner should be serviced when changing oil.

To Clean the Element: The element can be cleaned with compressed air (See Figure 45). Use compressed air, 30 psi (13.6 kg) maximum at the nozzle, to remove dust from the element. Move the air up and down inside the element. Keep the nozzle far enough away to prevent damage to the element. Additional information may be found in engine service manual.



Figure 45. Cleaning the Element

NOTE: Elements must be replaced every 250 hours. Keep a spare element on hand at all times.

IMPORTANT: Never run the engine when the element or dust cup is removed.

4. GREASE FITTINGS - See List of Grease Fittings on page 62. Clean each fitting before applying grease. Use No. 2 Molydisulfide grease or lithium base, multi-purpose grease.

If any fitting will not take grease, remove and clean or replace the fitting.

5. WHEEL BEARINGS - Every 6 months or 1500 hours, put new grease in the wheel bearings. Use wheel bearing grease. See Service Manual for instructions.

6. TIRES - (Pneumatic Type) Check tire pressures daily before operation. For tire pressures, see page 14. Also look for broken studs, rim damage, loose nuts, cracks or other damage to the tires.

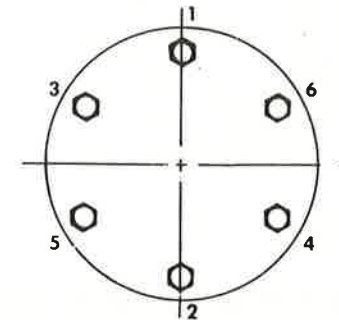


Figure 46. Tightening Order for Wheel Nuts



CAUTION: Be very careful when working with tires. Tires can come apart with explosive force. Never try to disassemble the wheel until all air is released from the tire.



CAUTION: To prevent personal injury, always use a protective cage when inflating or deflating tires.

7. BATTERY - Battery(s) are located under the front deck hatch cover. Keep battery and connections clean. Dirt and fluid on top of the battery can cause a battery discharge. Corrosion on the battery terminals or loose connections will cause poor battery performance. To clean the battery, apply soda or ammonia and flush with water.

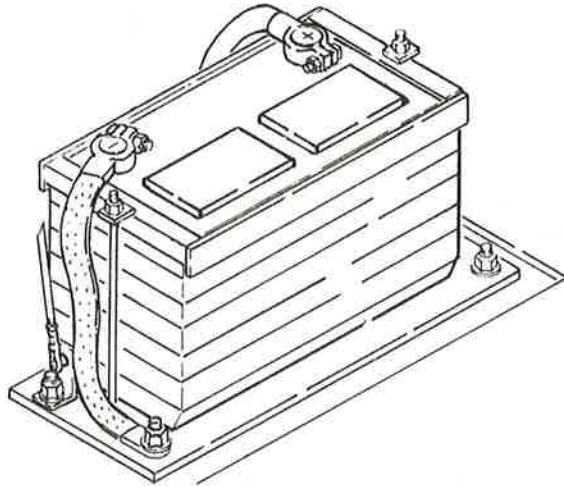


Figure 47. Battery Installation



POISON/DANGER: Batteries contain sulfuric acid which can cause severe burns. Avoid contact with skin, eyes or clothing. Antidote: **EXTERNAL**, flush with water; **INTERNAL**, drink large quantities of water or milk. Follow with milk of magnesia, beaten egg or vegetable oil. Call physician immediately; **EYE**, flush with water for 15 minutes and get prompt medical attention. Keep out of reach of children.



WARNING: Never check battery charge by placing a metal object across the posts - the sparks could cause an explosion. Use a voltmeter or hydrometer.

8. FUEL SYSTEM - The fuel tank is on the right side of the machine. For fuel recommendation, see page 53. Fill the tank at the end of operation to keep condensation to a minimum.



WARNING: Never fill the fuel tank near an open flame or while the engine is running. Keep cigarettes away.

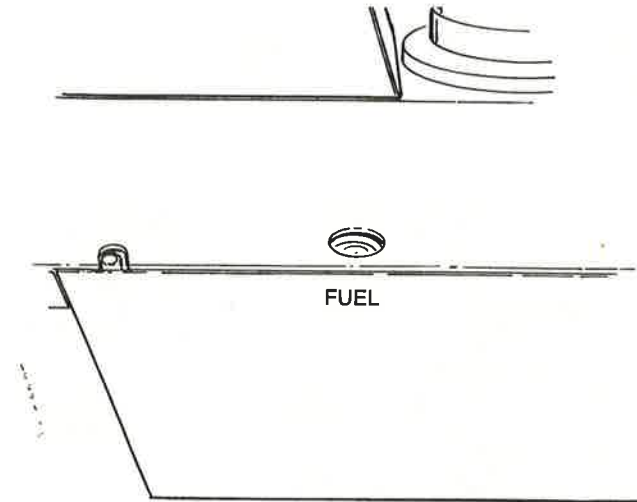


Figure 48. Fuel Tank

NOTE: See Cummins 4B3.9 Operator's Manual for description and maintenance of the diesel fuel system.

FUEL STORAGE

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

Keep the 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. If a barrel is used, keep the barrel in a horizontal position with the outlet end raised a few inches higher than the base. This causes a collection of sediment and water at the base.

9. TORQUE CONVERTER & FORWARD-REVERSE UNIT - Keep the oil level to the "F" mark on the dipstick. The dipstick is on the side of the Forward-Reverse Unit nearest the cab. For correct indication of the oil level:

- a. The oil must be at operating temperature (180°F, 82°C).
- b. The machine must be on a level surface.
- c. Forward-Reverse lever must be in neutral position.
- d. The engine must be running at 500-1000 rpm.

The dipstick is on the filler plug (See Figure 50). Clean the filler plug before removal to keep dirt out of the system. For oil recommendation, see Component Capacities Chart on page 58.

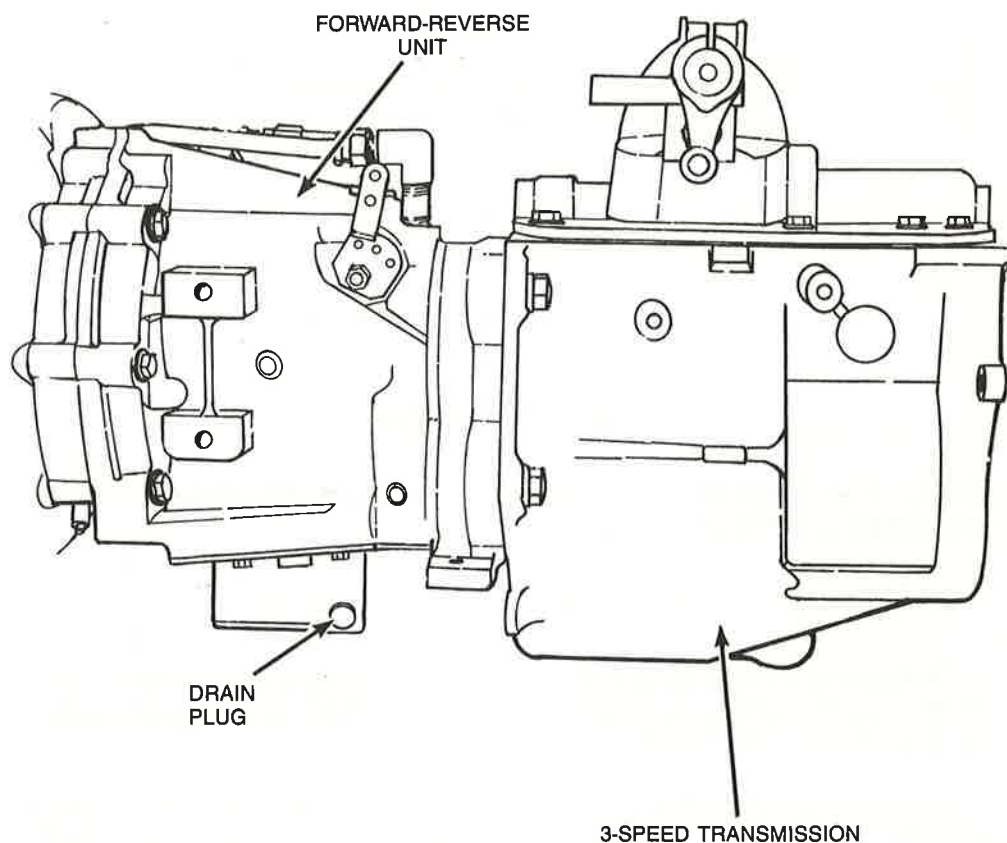


Figure 49. Right Side View of Transmission and Forward-Reverse Unit

Change the oil in the hydraulic system of the Torque Converter and Forward-Reverse Unit every 6 months or 1500 hours. Change the oil more frequently if the system is operated under high temperatures or heavy loads. For procedure, see the Service Manual.

IMPORTANT: Keep dirt out of the system. Use clean fluid and container when adding fluid.

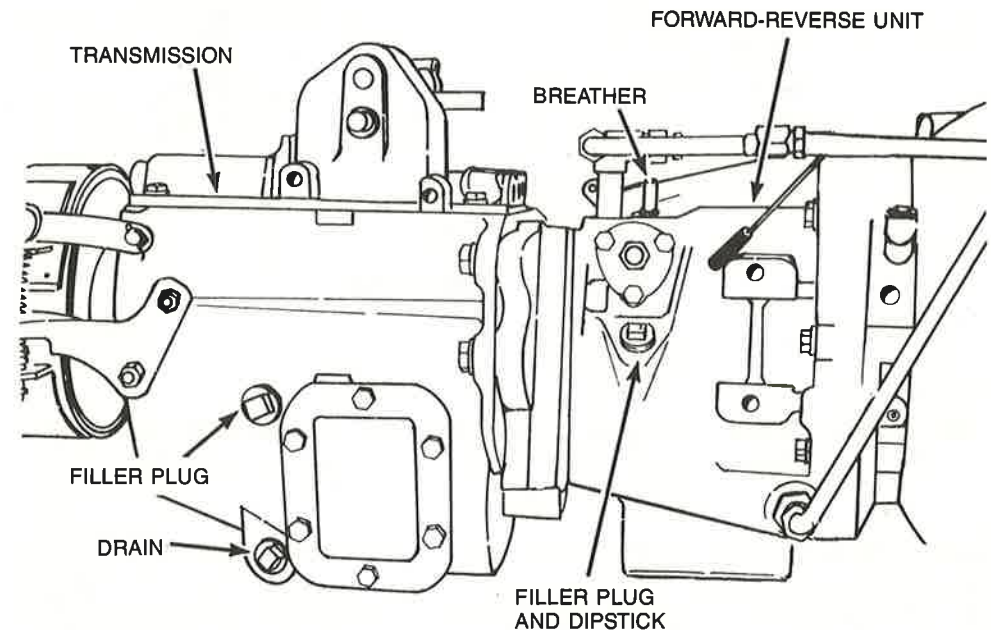


Figure 50. Left Side View of Transmission and Forward-Reverse Unit

10. TRANSMISSION - The transmission is connected to the forward-reverse unit, but is an independent unit with a separate supply of oil.

To check the oil, remove the filler plug, Figure 50. The oil must be level with this opening. For oil recommendation, see COMPONENT CAPACITIES on page 58.

Change oil after every 6 months or 1500 hours of operation.

- a. Remove drain plug while unit is still warm from operation.
- b. Install plug. Fill to level of filler plug with correct oil.

11. **PLANETARY (Hurth Axle)** - Keep oil at level of the plug on planetary (See Figure 51). If low, add per component capacities chart on page 58.

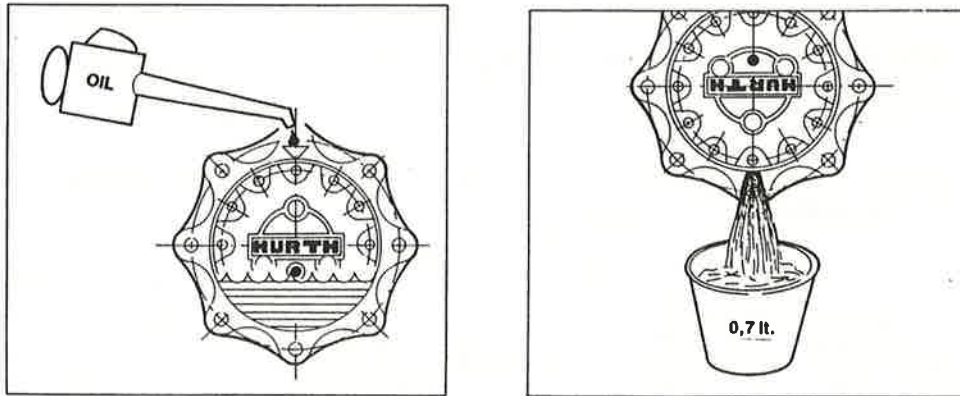


Figure 51. PLANETARY

12. **DIFFERENTIAL** — Keep oil at level of the plug on rear of differential (See Figure 52). If low, add per component capacities chart on page 58.

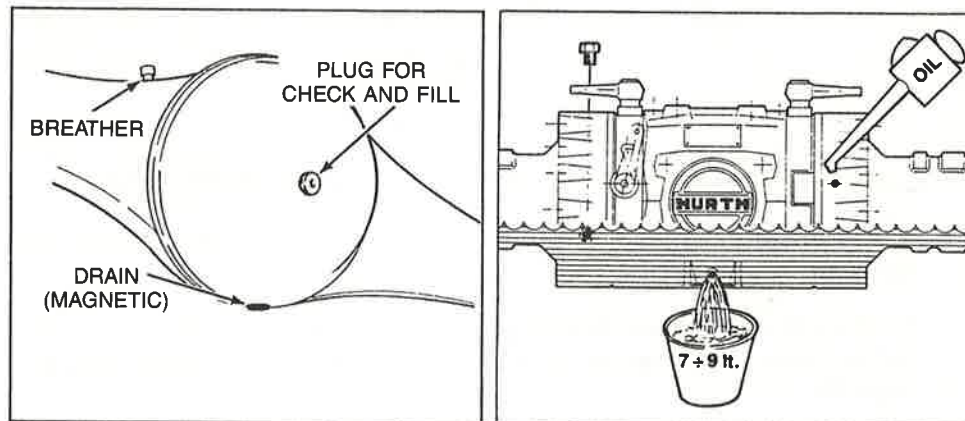


Figure 52. Differential

Cold Weather Lubricants for Differential

	Outside Temperature	
	Minimum	Maximum
Hatcol 2601	-70° F (-21° C)	+30° F (-2° C)
Conoco Polar Start DN-600 Gear Lube	-60° F (-16° C)	+40° F (+5° C)

NOTE: The above lubricants must not be used when outside temperatures are above the maximum range.

13. **BRAKE SYSTEM** - The master cylinder is under the left front fender (See Figure 53). Access to the filler cap is through a hole in the front deck. Keep reservoir full with appropriate brake fluid per component capacities chart on page 58.

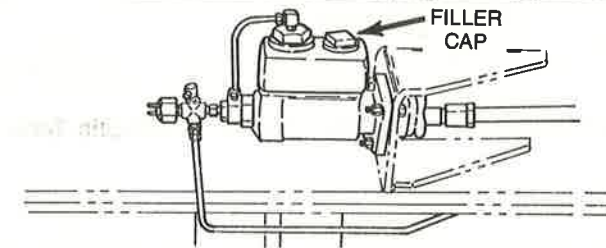


Figure 53. Brake Master Cylinder

IMPORTANT: Clean all dirt away from filler cap before removing the cap. Keep fluid, funnel and container clean. Use only specified brake fluid. (See component capacity chart on page 58 for type of brake fluid required).

Brake Adjustment. See Service Manual.

14. **OPERATOR'S CAB** - Keep clean. Remove all loose items, tools, etc. before operating machine. Make sure all controls are in good condition, and free of grease or ice.
15. **PARKING BRAKE** - See ADJUSTMENTS.
16. **HYDRAULIC SYSTEM** - The hydraulic system is completely closed, except for the breather on the hydraulic tank (See Figure 54). It is very important that dirt is kept out of the system. Use care when checking or adding oil. Make sure the oil, funnel and container is clean.

Check the oil supply daily or after every 10 hours of operation. If the oil level is constantly low, look for leaks in the system. For hydraulic oil recommendation, see page 52.

For correct indication of oil level, the boom must be fully retracted and lowered, and the outriggers retracted. The machine must be level. When machine is in this position, the oil level must be at the bottom of the filler screen (approximately 3 inches [76 mm] from top of tank).

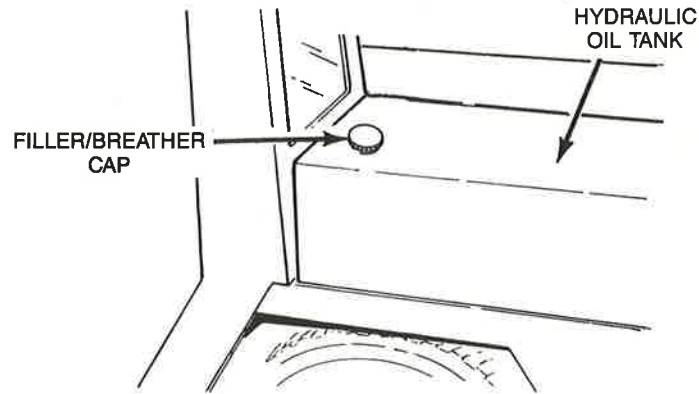


Figure 54. Breather and Filler Cap on Hydraulic Tank

Hydraulic Filter

Replace the filter after the first 20 hours of operation and then after every 2 months or 500 hours of operation.

For access to the filter, remove the side cover in the fuel tank area (See Figure 55).

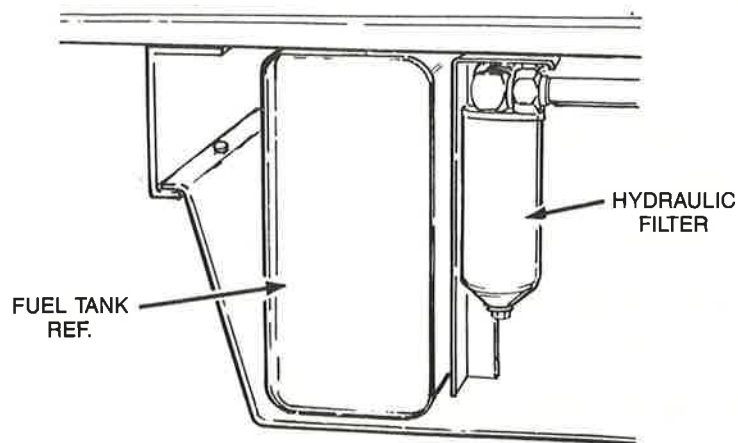


Figure 55. Hydraulic Filter

To replace the filter:

- a. Loosen the center bolt. Remove the filter housing and filter.
- b. Install new filter.
- c. Check the o-ring in the filter head and the seal washer on the center bolt. Replace if damage is found.
- d. Assemble filter and housing to head. Tighten the center bolt to a torque of 20 lb-ft (30 Nm).

Oil Change

Change oil in the hydraulic system every 6 months or 1500 hours of operation.

17. WINCH GEARBOX - Check oil in gearbox weekly or every 10 hours. For correct indication, the boom must be in the horizontal position. The correct oil level is indicated in Figure 56.

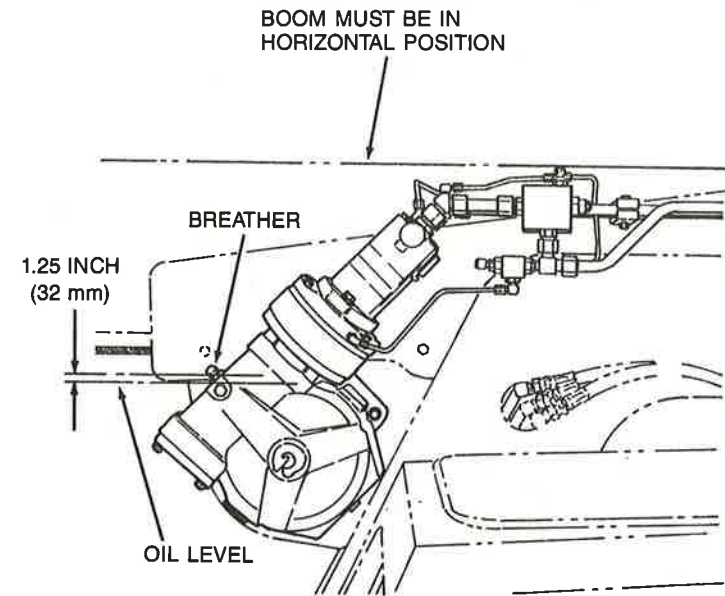


Figure 56. Winch Gearbox

Use a solvent that is not flammable to clean the breather. It is important that the breather is kept clean.

18. BOOM SLIDES - Weekly or every 50 hours, clean and lubricate boom sliding contact areas indicated in Figure 57. Use STP Oil Treatment or equivalent. Use small amount only for best results.

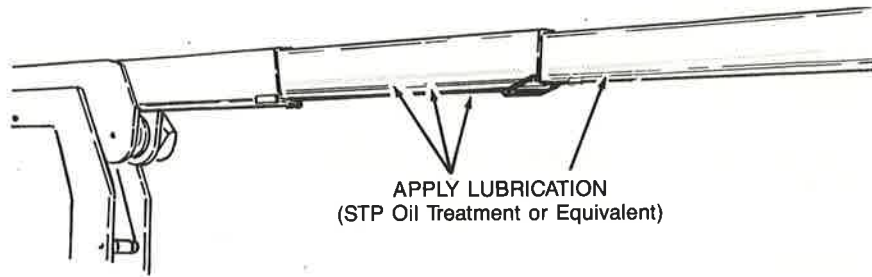


Figure 57. Boom Lubrication

19. SWING GEARCASE - Keep gearcase filled with grease. If low, add multipurpose EP Lithium base grease.

SWING GEAR - Clean, adjust, then lubricate swing pinion/gear monthly or every 250 hours. Using brush, apply open gear lube to pinion/gear. Keep hands clear of rotating pinion and gear (See Figure 58).

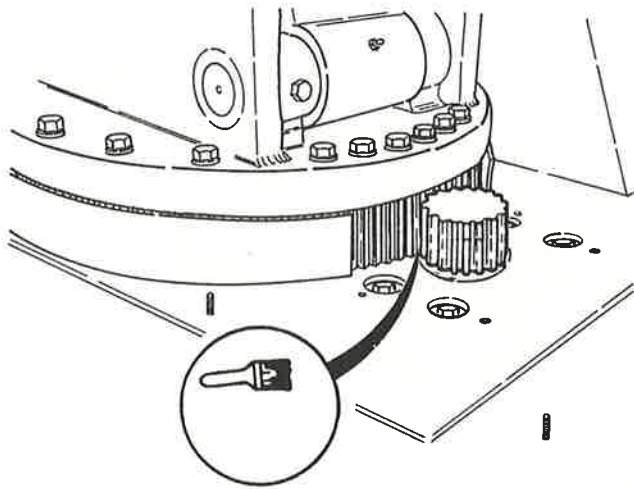
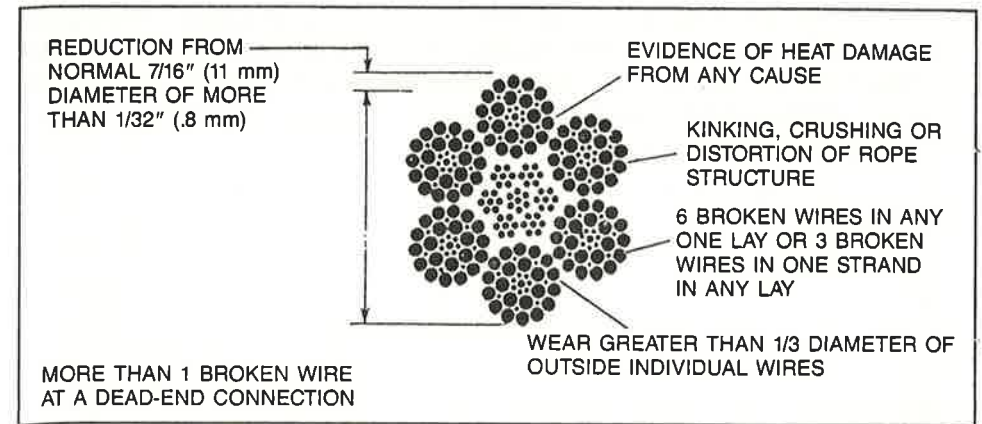


Figure 58. Swing Pinion/Gear

20. WIRE ROPE and SHEAVES - Monthly or every 250 hours, make an inspection of the wire rope. Look for damage, rust or wear. Keep a record of these inspections. Replace the wire rope if any of the following conditions are found.



CAUTION: To prevent injury to your hands, always wear gloves when working with the wire rope.

Lubrication of Wire Rope

Regular application of a good lubricant is necessary to prevent rust and corrosion of the wire rope.

Make sure the wire rope is clean and dry before applying the lubricant. To apply the lubricant use a cloth or brush.

Installation of New Wire Rope

The many moving parts of a wire rope must work together. Before you install a new wire rope, make sure the sheaves are in good condition. Unwind the wire rope from the coil and onto the winch drum in the same direction as the wire rope was in the coil. Do not put reverse bend in the wire rope.

After installation, operate the winch with a minimum load until you see that the wire rope is moving freely over the sheaves and winding correctly on the drum. Then gradually increase the speed and load until the wire rope is moving at the normal work speed.

Sheaves

The sheave grooves must be smooth and a little larger than the wire rope. Rough edges, narrow or worn grooves will cause wear and damage to the wire rope.

As the 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 not continue to engage these tracks as, for example, a chain engages 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.

TORQUE CHART

MAXIMUM RECOMMENDED TORQUE VALUES FOR JIC SWIVEL NUTS (37° SEAT)

THD. SIZE	SIZE	OD TUBE	TORQUE	
			Lb-Ft	Nm
7/16 - 20	-4	1/4	9	12
1/2 - 20	-5	5/16	17	23
9/16 - 18	-6	3/8	20	27
3/4 - 16	-8	1/2	30	40
7/8 - 14	-10	5/8	40	54
1-1/16 - 12	-12	3/4	85	115
1-3/16 - 12	-14	7/8	100	135
1-5/16 - 12	-16	1	110	150
1-5/8 - 12	-20	1-1/4	150	200
1-7/8 - 12	-24	1-1/2	170	230
2-1/2 - 12	-32	2	300	400
	-40	2-1/2	400	540
	-48	3	500	680

These values are recommended torque values for JIC (37° Seat) swivel nuts either swaged or brazed type. The swivel nuts will normally withstand this torque for a minimum of 15 repeated assemblies.

The torque required to seal swivel female fittings or hose couplings to a male connector depends on many variables such as fluid medium, surface finish, etc. The above values are intended only as a guide for the maximum values the fittings may be subjected to.

TORQUE CHARTS

SAE GRADE 5 or A325 Fine Thread				SAE GRADE 5 or A325 Coarse Thread			
SIZE	CLAMP LOAD	PLAIN/ LT. OIL	PLATED	SIZE	CLAMP LOAD	PLAIN/ LT. OIL	PLATED
1/4-28 (.250)	2,325	10 ft.lbs.	87 in. lbs.	1/4-20 (.250)	2,025	8 ft.lbs.	76 in. lbs.
5/16-24 (.3125)	3,675	19 ft.lbs.	14 ft.lbs.	5/16-18 (.3125)	3,338	17 ft.lbs.	13 ft.lbs.
3/8-24 (.375)	5,588	35 ft.lbs.	26 ft.lbs.	3/8-16 (.375)	4,950	31 ft.lbs.	23 ft.lbs.
7/16-20 (.4375)	7,575	55 ft.lbs.	41 ft.lbs.	7/16-14 (.4375)	6,788	50 ft.lbs.	37 ft.lbs.
1/2-20 (.500)	10,200	85 ft.lbs.	64 ft.lbs.	1/2-13 (.500)	9,075	76 ft.lbs.	57 ft.lbs.
9/16-18 (.5625)	12,975	122 ft.lbs.	91 ft.lbs.	9/16-12 (.5625)	11,625	109 ft.lbs.	82 ft.lbs.
5/8-18 (.625)	16,350	170 ft.lbs.	128 ft.lbs.	5/8-11 (.625)	14,400	150 ft.lbs.	112 ft.lbs.
3/4-16 (.750)	23,775	297 ft.lbs.	223 ft.lbs.	3/4-10 (.750)	21,300	266 ft.lbs.	200 ft.lbs.
7/8-14 (.875)	32,475	474 ft.lbs.	355 ft.lbs.	7/8-9 (.875)	29,475	430 ft.lbs.	322 ft.lbs.
1-12 (1.000)	42,300	705 ft.lbs.	529 ft.lbs.	1-8 (1.000)	38,625	644 ft.lbs.	483 ft.lbs.
1-14 (1.000)	32,275	721 ft.lbs.	541 ft.lbs.	1-1/8-7 (1.125)	42,375	794 ft.lbs.	596 ft.lbs.
1-1/8-12 (1.125)	47,475	890 ft.lbs.	668 ft.lbs.	1-1/4-7 (1.250)	53,775	1120 ft.lbs.	840 ft.lbs.
1-1/4-12 (1.250)	59,550	1241 ft.lbs.	930 ft.lbs.	1-3/8-6 (1.375)	64,125	1470 ft.lbs.	1102 ft.lbs.
1-3/8-12 (1.375)	72,975	1672 ft.lbs.	1254 ft.lbs.	1-1/2-6 (1.500)	78,000	1950 ft.lbs.	1462 ft.lbs.
1-1/2-12 (1.500)	87,750	2194 ft.lbs.	1645 ft.lbs.				

Torque values for bolts listed above are with Engine Oil and/or Loctite applied to threads and under head. Applies to plated and non-plated capscrews.



NOTE: Torque values specified are with residual oil remaining on bolts. If special lubricants of high stress ability such as never-seez compound, graphite and oil, molybdenum di-sulfide, colloidal copper or white lead are used, multiply the torque figures in the chart by the factor .90.

TORQUE CHARTS

SAE GRADE 8 or A490 Fine Thread				SAE GRADE 8 or A490 Coarse Thread			
SIZE	CLAMP LOAD	PLAIN/ LT. OIL	PLATED	SIZE	CLAMP LOAD	PLAIN/ LT. OIL	PLATED
1/4-28 (.250)	3,263	14 ft.lbs.	10 ft. lbs.	1/4-20 (.250)	2,850	12 ft.lbs.	9 ft. lbs.
5/16-24 (.3125)	5,113	27 ft.lbs.	20 ft.lbs.	5/16-18 (.3125)	4,725	25 ft.lbs.	18 ft.lbs.
3/8-24 (.375)	7,875	49 ft.lbs.	37 ft.lbs.	3/8-16 (.375)	6,975	44 ft.lbs.	33 ft.lbs.
7/16-20 (.4375)	10,650	78 ft.lbs.	58 ft.lbs.	7/16-14 (.4375)	9,600	70 ft.lbs.	52 ft.lbs.
1/2-20 (.500)	14,400	120 ft.lbs.	90 ft.lbs.	1/2-13 (.500)	12,750	106 ft.lbs.	80 ft.lbs.
9/16-18 (.5625)	18,300	172 ft.lbs.	129 ft.lbs.	9/16-12 (.5625)	16,350	153 ft.lbs.	115 ft.lbs.
5/8-18 (.625)	23,025	240 ft.lbs.	180 ft.lbs.	5/8-11 (.625)	20,325	212 ft.lbs.	159 ft.lbs.
3/4-16 (.750)	33,600	420 ft.lbs.	315 ft.lbs.	3/4-10 (.750)	30,075	376 ft.lbs.	282 ft.lbs.
7/8-9 (.875)	45,825	668 ft.lbs.	501 ft.lbs.	7/8-9 (.875)	41,550	606 ft.lbs.	454 ft.lbs.
1-12 (1.000)	59,700	995 ft.lbs.	746 ft.lbs.	1-8 (1.000)	54,525	909 ft.lbs.	682 ft.lbs.
1-14 (1.000)	61,125	1019 ft.lbs.	764 ft.lbs.	1-1/8-7 (1.125)	68,700	1288 ft.lbs.	966 ft.lbs.
1-1/8-12 (1.125)	77,025	1444 ft.lbs.	1083 ft.lbs.	1-1/4-7 (1.250)	87,225	1817 ft.lbs.	1363 ft.lbs.
1-1/4-12 (1.250)	96,600	2012 ft.lbs.	1509 ft.lbs.	1-3/8-6 (1.375)	103,950	2382 ft.lbs.	1787 ft.lbs.
1-3/8-12 (1.375)	118,350	2712 ft.lbs.	2034 ft.lbs.	1-1/2-6 (1.500)	126,450	3161 ft.lbs.	2371 ft.lbs.
1-1/2-12 (1.500)	142,275	3557 ft.lbs.	2668 ft.lbs.				

Torque values for bolts listed above are with Engine Oil and/or Loctite applied to threads and under head. Applies to plated and non-plated capscrews.



NOTE: Torque values specified are with residual oil remaining on bolts. If special lubricants of high stress ability such as never-seez compound, graphite and oil, molybdenum di-sulfide, colloidal copper or white lead are used, multiply the torque figures in the chart by the factor .90.

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