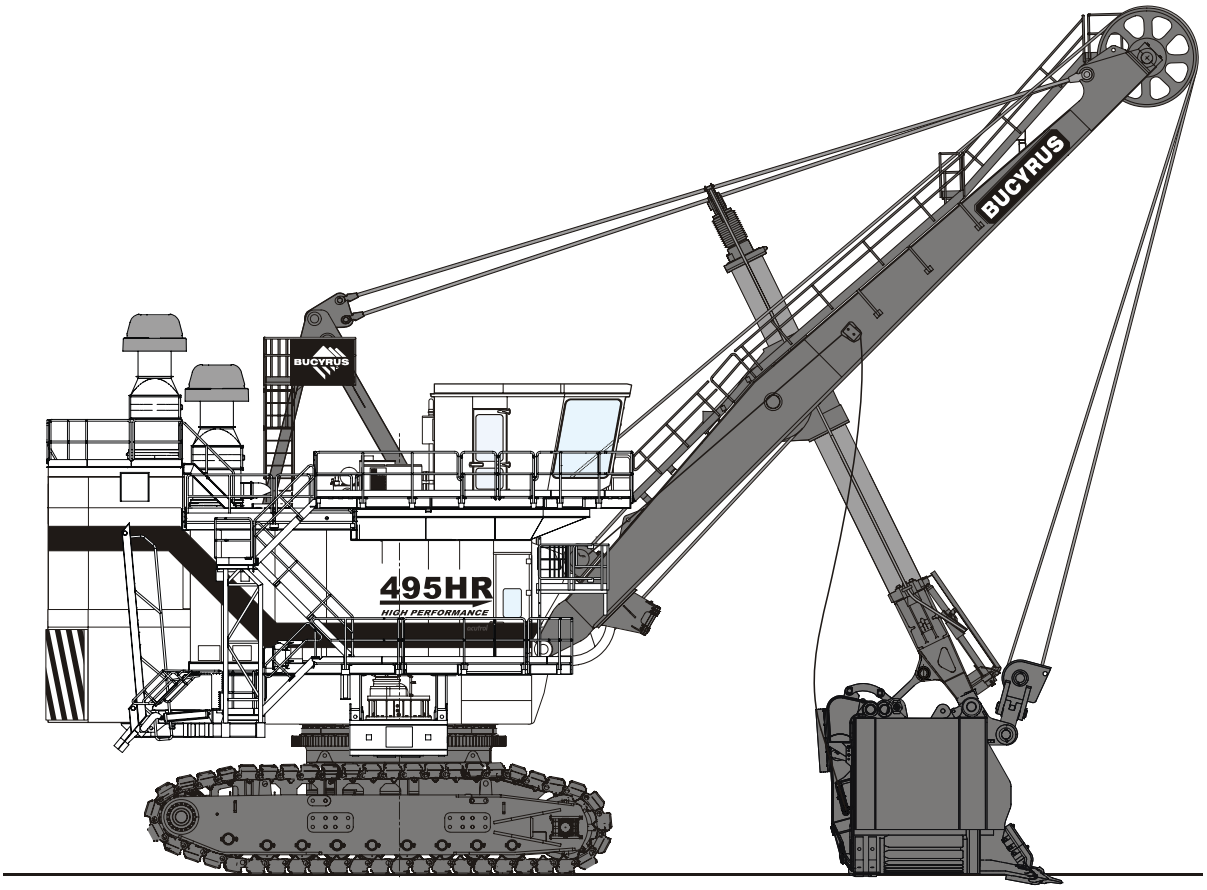
BUCYRUS®

495HR
MINING SHOVEL
MAINTENANCE and OPERATION MANUAL

SN: 141257

Manual No. *10674*



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Bucyrus International, Inc.

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495HR Electric Mining Shovel
Maintenance and Operation Manual

Manual No. 10674

SN: 141257 Lot 101

Table of Contents

This manual is divided into major sections covering the various servicable components and systems of the 495HR Mining Shovel. These sections and their contents are organized as shown below.

SAFETY

SECTION 1 - INTRODUCTION

MACHINE OVERVIEW

This mining shovel is designed and constructed to provide efficient service under the most severe conditions. The machine is built to the highest possible standards and will provide trouble free operation if properly maintained. This section of the manual introduces the machine and its functional capabilities and limitations.

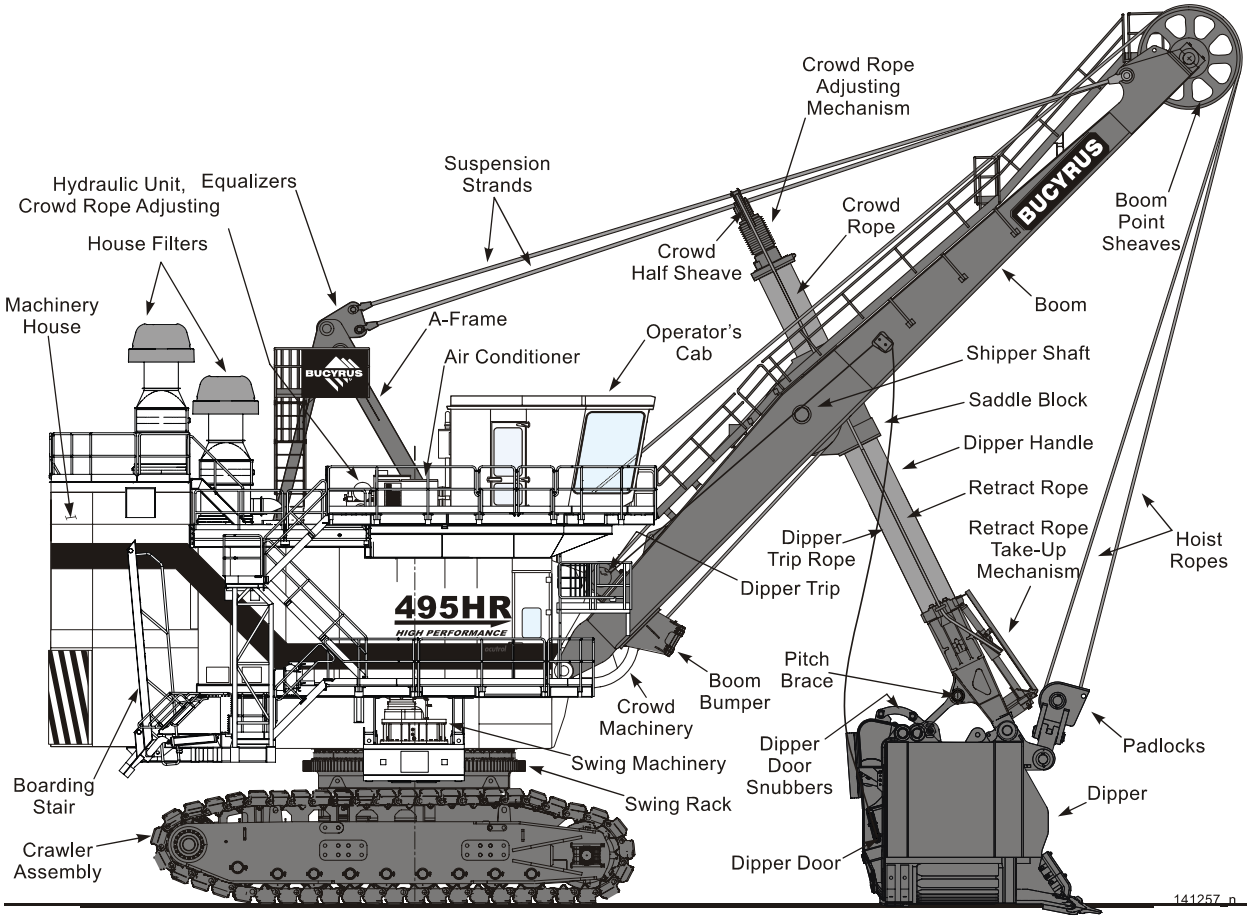
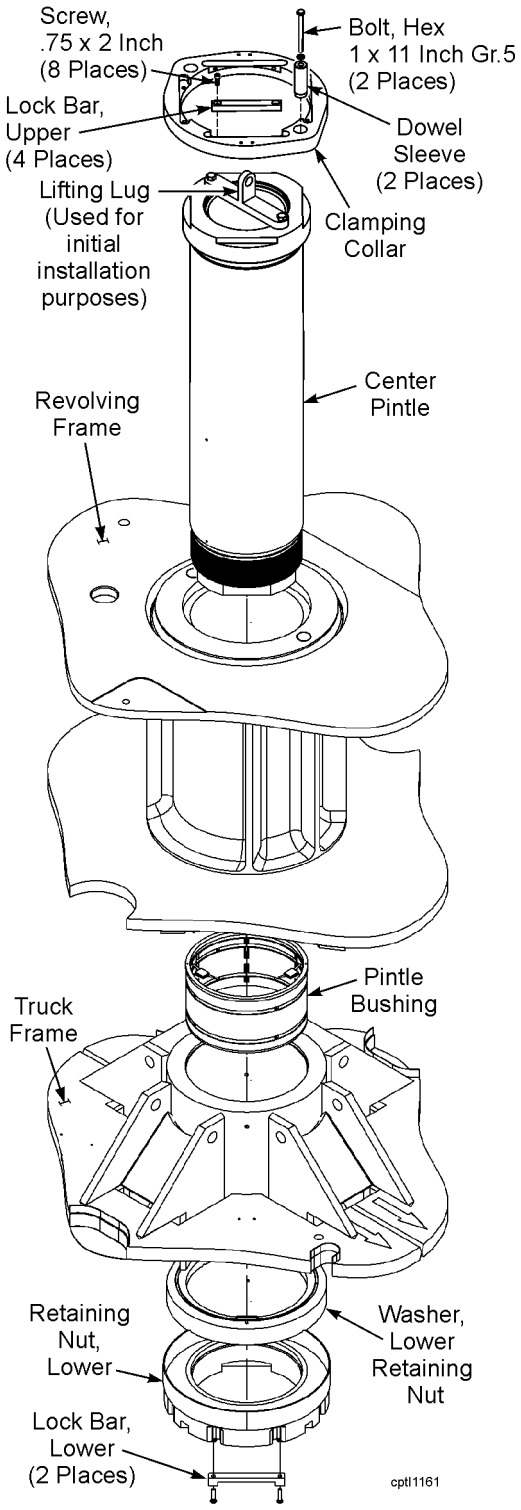


Figure 1-1: Nomenclature


Screw, .75 x 2 Inch (8 Places)
Bolt, Hex 1 x 11 Inch Gr.5 (2 Places)
Lock Bar, Upper (4 Places)
Dowel Sleeve (2 Places)
Lifting Lug (Used for initial installation purposes)
Clamping Collar
Center Pintle
Revolving Frame
Pintle Bushing
Truck Frame
Retaining Nut, Lower
Washer, Lower Retaining Nut
Lock Bar, Lower (2 Places)
cptl1161

AUTOMATIC LUBRICATION SYSTEM

The lube system is located in an insulated, double wall, lube room which can be heated for cold weather operation. A one ton (907 kg) monorail-mounted electric chain hoist is provided to be used to raise supplies from the ground onto the left house platform and into the lube room. Lube points on the electric motors, suspension rope pins and some dipper pins are manually accessed. All other lube points are fed from the automatic system or by oil bath.

A single-line automatic lubrication system applies open gear lubricant (OGL) and grease via a programmable logic controller (PLC). The system has six lube pumps (four for OGL and two for grease), each feeding individual PLC controlled circuits. Lincoln Powermaster Four 75:1 air powered pumps are mounted on two reservoirs. High pressure hoses with reusable fittings are utilized.

The six separately controlled lube circuits provide selective distribution frequency and quantity resulting in reduced lubricant usage and cost.

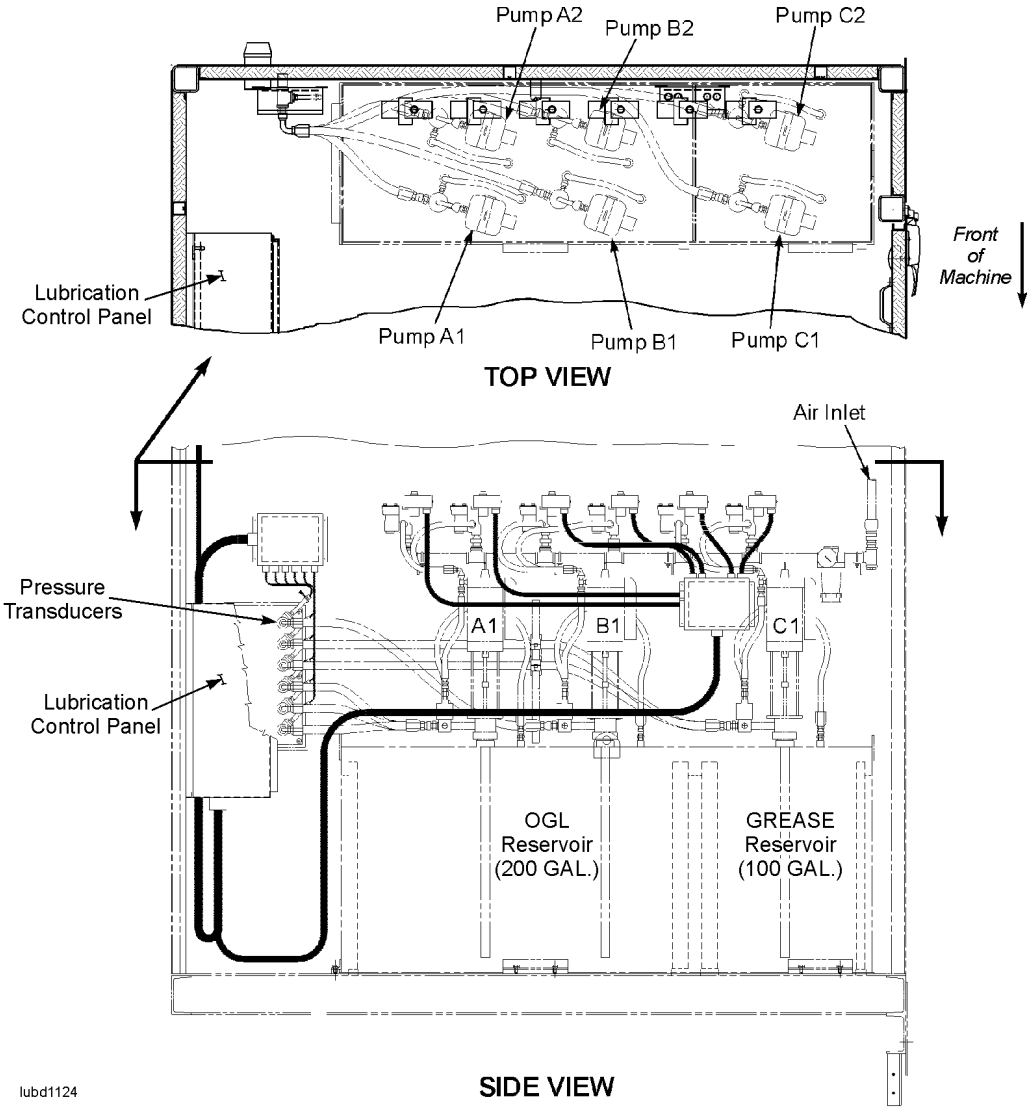
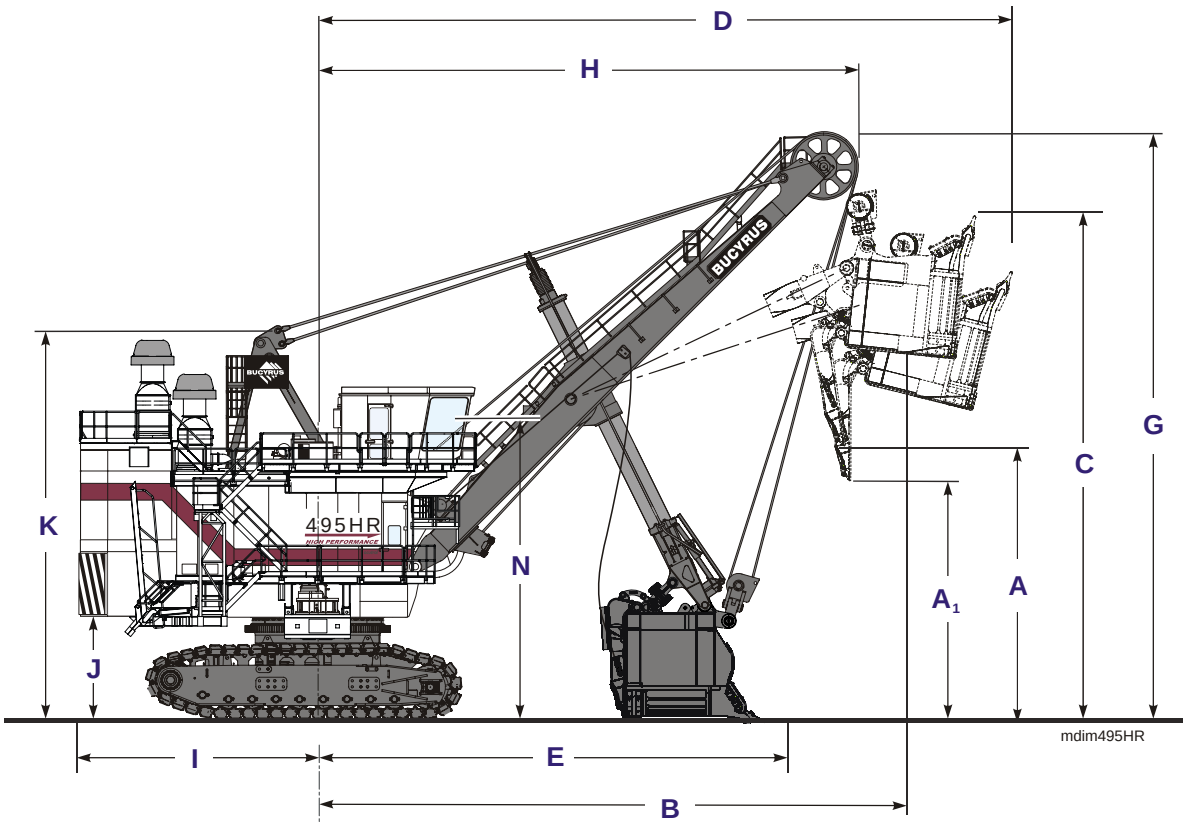


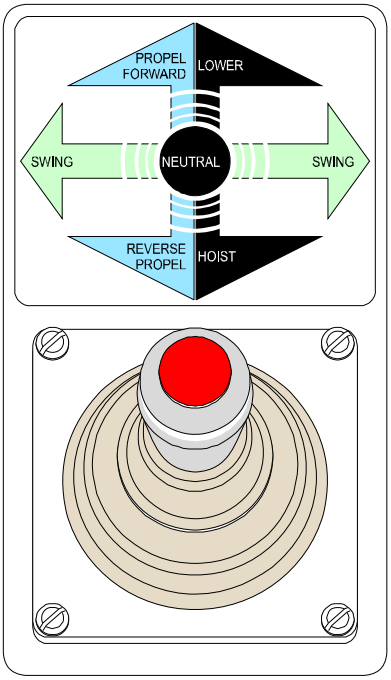
Figure 1-11: Lubrication Room

Table 1-4: Typical Dimensions and Working Ranges

	US	***Metric***
Dipper capacity (nominal)	82 yd^3	62.7 m^3
Dipper capacities (range)	40-82 yd^3	30.6-62.7 m^3
Length of boom	67'	20.4 m
Boom angle	43°	43°
Effective length of dipper handle	35'-10"	10.9 m
Overall length of dipper handle	47'	14.3 m
A: Dumping height	33'	10.0 m
$\mathbf{A_1}$: Dumping height at maximum radius	28'-3"	8.6 m
B: Dumping radius - maximum	71'	21.6 m
C: Cutting height - maximum	59'-2"	18.0 m
D: Cutting radius - maximum	82'	25.0 m
E: Radius of level floor	52'-11"	16.1 m
G: Clearance height @ boom point sheaves	68'	20.7 m
H: Clearance radius @ boom point sheaves	64'-9"	19.7 m
I: Clearance radius @ revolving frame	29'-11"	9.1 m
J: Clearance - revolving frame to ground	11'-11"	3.6 m
K: Height of A-frame	45'-7"	13.9 m
N: Operator's cab eye level	30'	9.1 m



RIGHT JOYSTICK



The right joystick controls the hoist/swing and propel. It is a joystick mounted on the right console of the operator's seat. The joystick is used to control the hoist, swing and right crawler motions of the machine. The position of the propel transfer switch will determine whether this switch controls the hoist motion or the crawler motion.

With the propel transfer switch in the dig position, pushing the joystick forward will lower the dipper. Pulling the joystick to the rear will hoist the dipper. The neutral position between the hoist and lower functions is defined by a detent that is easily felt. The speed of moving the dipper is controlled by varying the distance the joystick is moved from the neutral (center) position. The full forward, or full rearward position provides maximum speed to the dipper. Moving the joystick to neutral will cause a braking action slowing the hoisting or lowering motion. Reversing the joystick will cause the motion to stop and if the joystick is held in this position, it will change the direction of the motion.

NOTE: When the right joystick is used in the hoist/lower mode the switch is a spring returned switch. That is, it will return to the neutral position when it is released.

Moving the right joystick to the left from the neutral position will cause the machine to swing to the left. Moving the joystick to the right will cause the machine to rotate to the right. The swing motion is operational throughout the entire movement range of hoisting or lowering the dipper. The swing rate of acceleration is controlled by varying the distance the joystick is moved from the neutral position. Moving the joystick to the neutral position will not stop the swing motion but will allow the machine to coast. To stop or change direction the control joystick is moved past the neutral point in the opposite direction. The rate of deceleration is controlled by varying the distance the joystick is moved from the neutral position in the opposite direction.

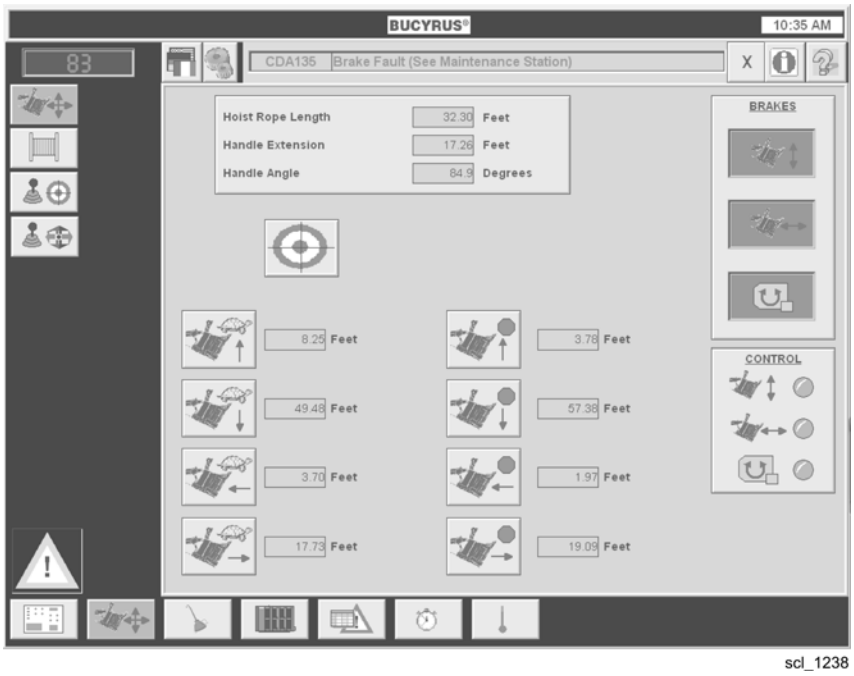


Figure 2-11: Calibration Limits

The Calibration screen is used to set the various limits required to control the movements of the machine.

On this screen can be found switches for the hoist, crowd and swing brakes along with status indicators for each.

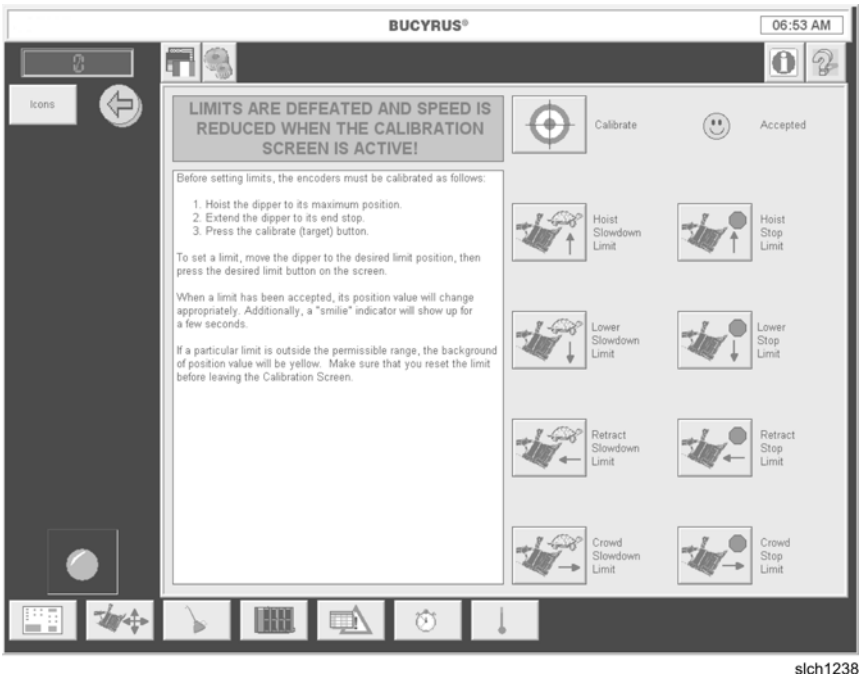


Figure 2-12: Limit Calibration Help

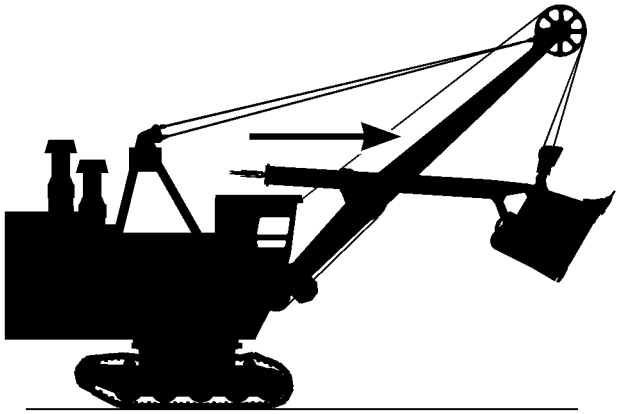
This screen will provide clarifying information on the calibration process.

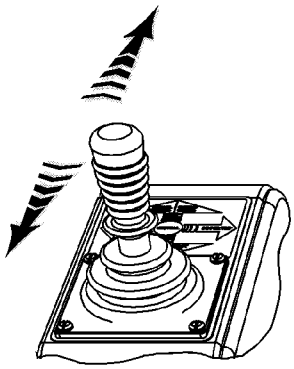
CROWD MOTION

Crowd motion is controlled by the operator's left joystick. Move the joystick to crowd and retract the dipper handle until a "feel" is developed for the limits and speed of the motion.

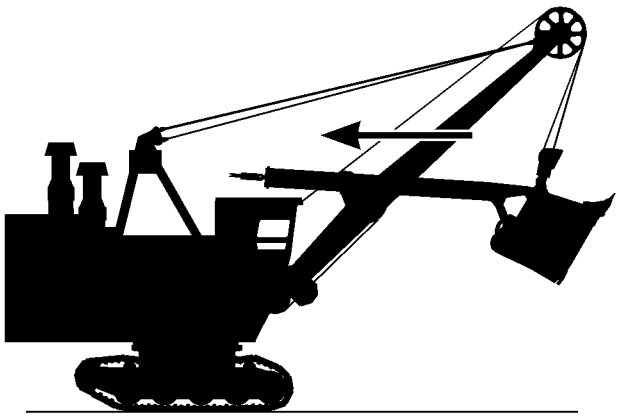
CAUTION: This joystick also controls the signal horn and dipper trip.

To ***CROWD***:
Push the *Left* Joystick Forward, away from the Operator.





To ***RETRACT***:
Pull the *Left* Joystick Back, toward the Operator.



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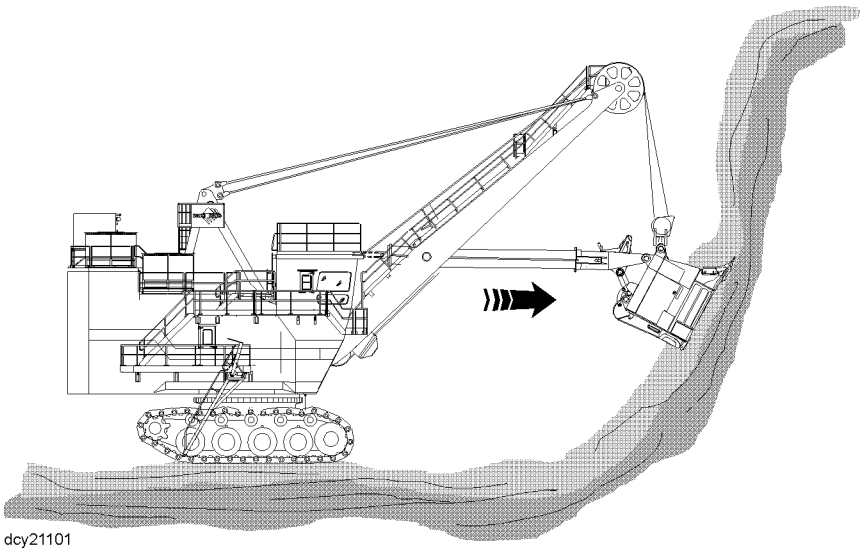
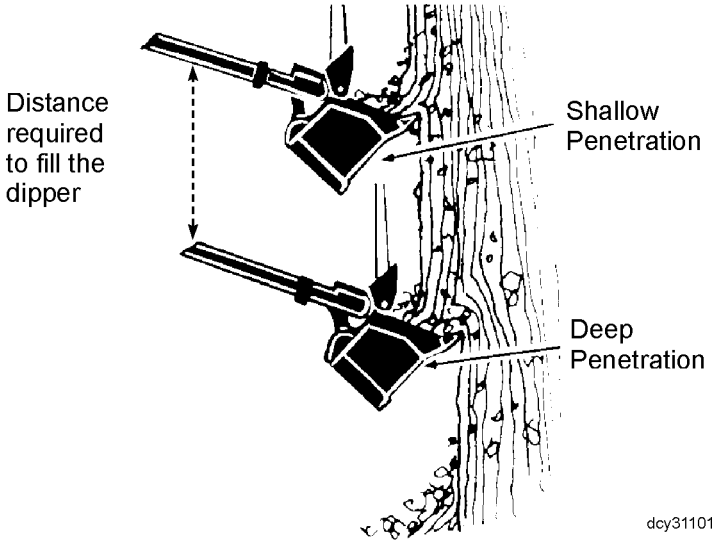
Practice the crowd and retract functions until the movement can be stopped smoothly. Combine the crowd and hoist functions and practice until smooth coordinated motions and subsequent machine effectiveness is achieved.



It is important that the full cutting surface of the dipper contact the bank on each pass. A full face cut combined with deep bank penetration will result in a full dipper for the least amount of hoist. A partial cut, even with deep bank penetration, requires a greater rise, and tends to leave voids in the dipper. This could necessitate additional passes to fill the haulage unit.



Shallow bank penetration of the arc of entry and rise is ineffective and inefficient. A shaving cut dribbles material into the dipper resulting in voids and making additional passes necessary while accelerating dipper lip wear.

NOTE: A deeper bite = quicker fill times

Section 3
Service Procedures

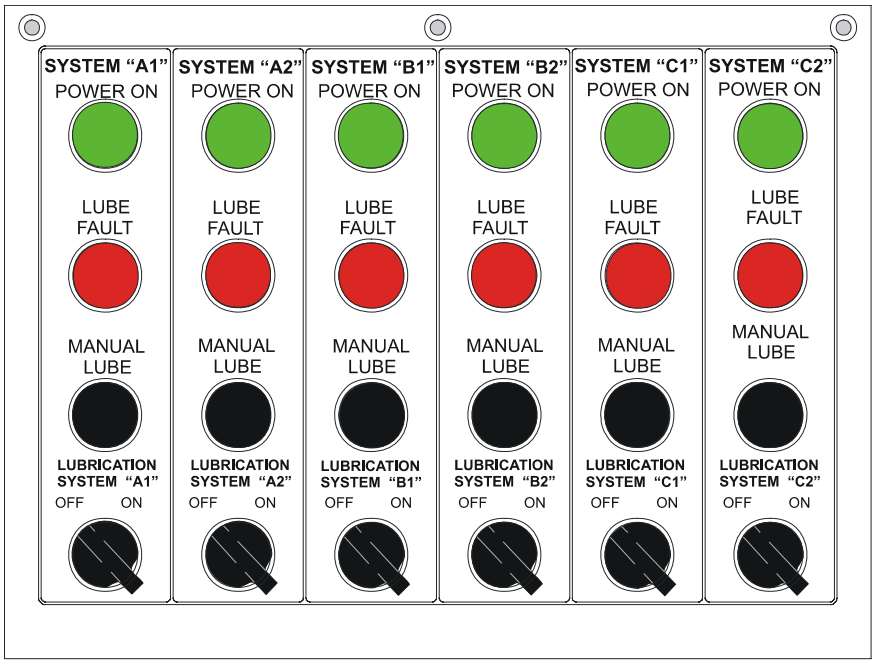
Always refer to the safety section of this manual before starting any maintenance procedure on this machine.

Table of Contents

AUTO LUBE CONTROL PANEL

The automatic lubrication control panel is mounted on the inboard most wall of the lubrication room. The panel provides the switches and override functions required to activate, reset and override the automatic functions.

POWER ON	Allows electrical power to energize the system.
LUBE FAULT	A light that, when lit, indicates that a fault is present in that system. Reset the fault by turning the affected system OFF and then ON.
MANUAL LUBE	A pushbutton that will disperse (on command) 1 measured quantity of lubricant to the injectors on that system.
ON /OFF	Energizes the system for normal operation.



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LOWER WORKS LUBRICATION

Although this machine does not spend very much time being propelled between digging sites, there are considerable forces exerted on the lower works of the machine. The severe loads and oscillations created during the constant cycles of the digging process tend to squeeze the lubricant out of bushings, creating a circumstance for wear if proper lubrication habits are neglected.

With the high possibility of operation while submersed in water the applied lubricant should have properties which allow for protection under theses circumstances.

When propelling over any long distances the machine should be lubricated at least every 1500 feet of travel, or every 1/2 hour. Bearings and bushings should be carefully watched and force lubricated until they run cool if evidence of heat buildup is apparent.

Under extremely harsh conditions such as propelling up a hill, frequent turns, or through deep water and mud the lubrication frequency should be increased.

OIL PUMP

The heart of the power unit is the hydraulic pump. It is self-lubricating. Preventive maintenance is limited to keeping the system fluid clean. This is done by changing the filters frequently. The recommendations listed below are a minimum requirement.

All return line filters and pressure filters should be changed a minimum of two times per year or, upon the visual or electrical indicator signaling otherwise.

The suction strainer (immersed below the oil level in the reservoir) should be cleaned once a year or every 4000 operating hours. The suction strainer should be removed from the reservoir and can be cleaned with compressed air, blowing from the inside out. If there are holes in the mesh or if there is mechanical damage, the strainer should be replaced. It is especially important that the suction or inlet piping and fittings be tight and in good condition to prevent air from being drawn into the pump.

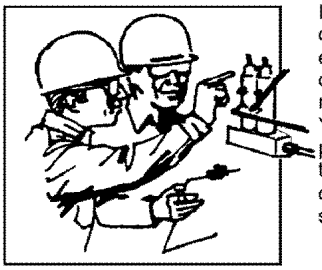
The reservoir air breather should be changed or cleaned once a year or every 4000 hours. The air breather filters all air drawn into the reservoir.

IMPORTANT! Failure to change or clean this filter can result in pump failure.

The electric motor requires very little attention when kept clean and dry.

INJECTOR ADVANTAGES

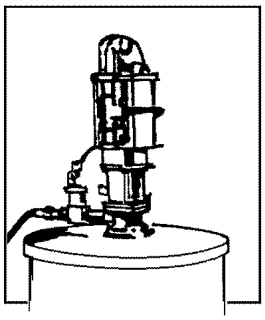
SIMPLICITY



Lincoln Centro-Matic is not only simpler and less expensive to install than other systems-it is also much easier to understand. Your maintenance personnel will appreciate the ease with which they can learn the operation and service of Centro-Matic.

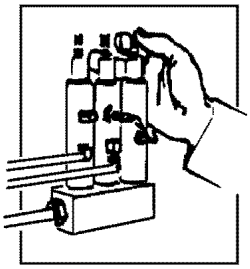
POWERFUL PUMPING UNIT

Lincoln's Power-Master pump widely recognized as a most powerful, trouble-free pump, so much so, that Lincoln Power-Master pumping units often are specified even where other centralized lubrication systems are used.

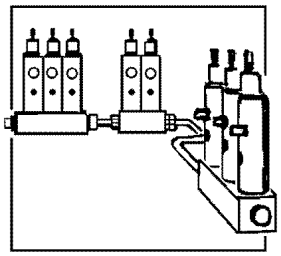


EXTERNAL ADJUSTMENT

A micrometer-type adjustment makes each injector (metering device) adjustable externally, without special tools. The Lincoln Centro-Matic System permits lubricant adjustments to meet actual bearing requirements - not just an approximation, as with all other systems.

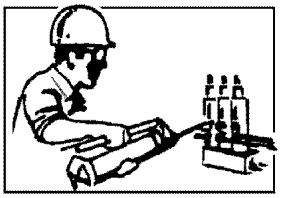


EXTREME PUMPING DISTANCE



Single-line design and powerful pumping unit permit installations at long distances from original refinery containers of bulk tanks to point of application. And if you plan to expand your operation, the Lincoln Centro-Matic System has the design and capacity that lets you do it - normally without adding booster pumps and controls.

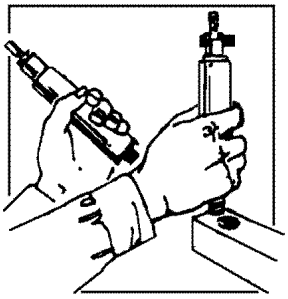
BUILT-IN GREASE FITTING



Lincoln Centro-Matic is the only system that has a capped grease fitting on the injector. This permits easy filling of lines when the system is installed. It also allows hand lubrication of the machine in the event of a pump or power failure, damage to the supply line, or even a malfunction in the air system. NO OTHER SYSTEM OFFERS THIS! The built-in grease fitting can also be used as an inspection system. When the cap is removed, the lubricant normally metered to a bearing will come out of the grease fitting head.

EASY INJECTOR REPLACEMENT

Should the Lincoln injector ever need replacing, it can be done quickly and easily without disturbing adjacent injectors or removing the supply line connections - does not require machine shutdown as do all other systems. As a matter of fact, injector replacement usually can be done between lubricating cycles, thus preventing lubricant loss or machine downtime.



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AIR COMPRESSOR LUBRICANT

Quin-Cip lubricant has proven under extensive testing to minimize friction and wear, limit lubricant carryover, and reduce carbon and varnish deposits. It will support the performance characteristics and life designed into all Quincy compressors and is highly recommended.

CERTIFIED LUBRICANTS

Lubricants certified by their manufacturers as complying with this specification will be listed on the “Certified Lubricants Listing for Multi-Purpose Grease” (see the Bucyrus International, Inc. web site www.bucyrus.com for the latest listing). The use of non-certified lubricants may invalidate the Bucyrus International, Inc. product warranty obligation.

Specific product selection is the responsibility of the equipment operator/owner and is dependent on climate, application, performance and regional/local regulatory requirements.

Lubricant manufacturers seeking to certify their products should contact the following for direction:

Bucyrus International, Inc.

Engineering Services & Technical Support

1100 Milwaukee Avenue

South Milwaukee, Wisconsin 53172

Phone (414) 768-4000

SPECIFICATION REVISIONS

This specification is subject to change without notice. Please contact the following for the latest specification:

Bucyrus International, Inc.

Engineering Services & Technical Support

1100 Milwaukee Avenue

South Milwaukee, Wisconsin 53172

Phone (414) 768-4000

Table 3-7: Certified Lubricant Listing for "Dragline Enclosed Gearcase Lubricant (SD4721 Part A)" - Synthetic (PAO) Oils

Manufacturer	***Product Description***
Bel-Ray	Synthetic Gear Oil 460 (ISO VG 460)
Bel-Ray	Synthetic Gear Oil 1000 (ISO VG 1000)
Lubrication Engineers	9846 Synolec Gear Lubricant (ISO VG 460)
Lubrication Engineers	9899 Synolec Gear Lubricant (ISO VG 1000)
Mobil	Mobil SHC 634 (ISO VG 460)
Mobil	Mobilgear SHC XMP 460 (ISO VG 460)
Mobil	Mobilgear SHC 460 (ISO VG 460)
Mobil	Mobil SHC 639 (ISO VG 1000)
Mobil	Mobilgear SHC 1000 (ISO VG 1000)
Mobil	Mobilgear SHC 1500 (ISO VG 1500)
Schaeffer Mfg.	#167 Pure Synthetic Gear Lube (ISO VG 460)
Schaeffer Mfg.	#167 Pure Synthetic Gear Lube (ISO VG 1000)
Shell	Omala HD 460 (ISO VG 460)
Shell	Omala HD 1000 (ISO VG 1000)
Whitmore Mfg. Co.	GF 365 Synthetic Gear Fluid (ISO VG 460)
Whitmore Mfg. Co.	GF 365 Synthetic Gear Fluid (ISO VG 1000)
Whitmore Mfg. Co.	Decathlon HD Series Synthetic Enclosed Gear Oil (ISO VG 460)
Whitmore Mfg. Co.	Decathlon HD Series Synthetic Enclosed Gear Oil (ISO VG 1000)

LUBRICANT CERTIFICATION RPOCESS

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SPECIFICATION REVISIONS

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MAINTENANCE PRECAUTIONS

The operator must be sure that the machine equipment is in a safe position before repairs or adjustments are made. The machine should not be endangered by falling rock or a possibly yielding support surface. Before beginning repair or adjustment, the operator shall:

1. Set the dipper on the ground.
2. Set all brakes.
3. De-energize control functions.
4. Do whatever else is necessary to prevent accidental movement of the machine.

DANGER: HIGH VOLTAGE! IF POWER IS ESSENTIAL TO THE REPAIR, SUCH AS FOR TESTING, IT SHOULD ONLY BE ENERGIZED WHEN ALL PERSONNEL ARE CLEAR OF ELECTRICAL AND MECHANICAL HAZARDS. The power should only be energized during the testing period and not when repair work is actually being done.

Prior to undertaking any work, maintenance personnel should notify the operator about the nature and location of the job. If work is to be done on or near moving parts, the starting controls should be locked in the OFF position and tagged. The lock and tag should only be removed by the maintenance people who installed them, or other authorized personnel. During all phases of maintenance, use extreme caution when working near electrical equipment. Never work near exposed, energized high voltage connections.

Approved protective equipment such as gloves and insulated hooks or tongs should always be used when high voltage electrical cables are handled.

DANGER: Only qualified electricians are permitted to directly maintain electrical equipment such as motors, transformers and switches.

While performing maintenance, the awkward positions assumed and the handling of heavy parts often increases the possibility of injuries. As a precautionary measure, use mechanical handling equipment whenever possible. The mining foreman can facilitate safer and easier maintenance work by providing blocking materials. Service crews should have a fundamental knowledge of lifting practices so their knees and legs are used rather than their backs.

DANGER: Many of the components comprising the machine are heavy, bulky items. EXTREME CAUTION SHOULD BE USED WHEN LIFTING THESE ITEMS. PERSONNEL SHOULD BE CERTAIN OF THE WEIGHTS OF COMPONENTS BEFORE ATTEMPTING TO LIFT THEM, EITHER MANUALLY OR WITH A LIFTING DEVICE. ALL APPLICABLE SAFETY RULES MUST BE FOLLOWED WHEN USING A CRANE OR OTHER LIFTING DEVICE. Be aware of the load rating, lifting height and swing radius of the lifting device before lifting a load. Failure to follow all applicable safety rules when performing maintenance could result in serious injury, or death.

✓	Check Points - Every 500 Hours or Monthly		
	Location	***Check***	***Noted Discrepancy***
	31. Dipper Trip Rope	Inspect the ropes, replace badly worn, frayed or damaged ropes.	
	32. Hoist Drum Lagging Grooves	Check for damage and excessive wear.	
	33. Upper Rail Clamps	Tighten the clamps and verify the integrity of the rail end chocks.	
	34. Propel Planetary Gearcases	Pull the bottom plug and collect a 1/2 gallon of lubricant. Inspect the sample for metal particles.	
	35. Boarding Stairs and/or Boarding Ladders	Check all components, including: safety chain and gate, mounting bolts, hydraulic line and fittings, cylinder pin, arm pins and pin retainers. Replace any worn or damaged components. Lubricate the arm pins and cylinder pins. Check the lock pin and lubricate as necessary.	
	36. Operator's Cab HVAC	Evaporator: check for leaks, fans for tightness on shafts, clean coils, flush drains and replace return air filter.	

Date:	
Shift:	
Inspected by:	
Supervisor:	

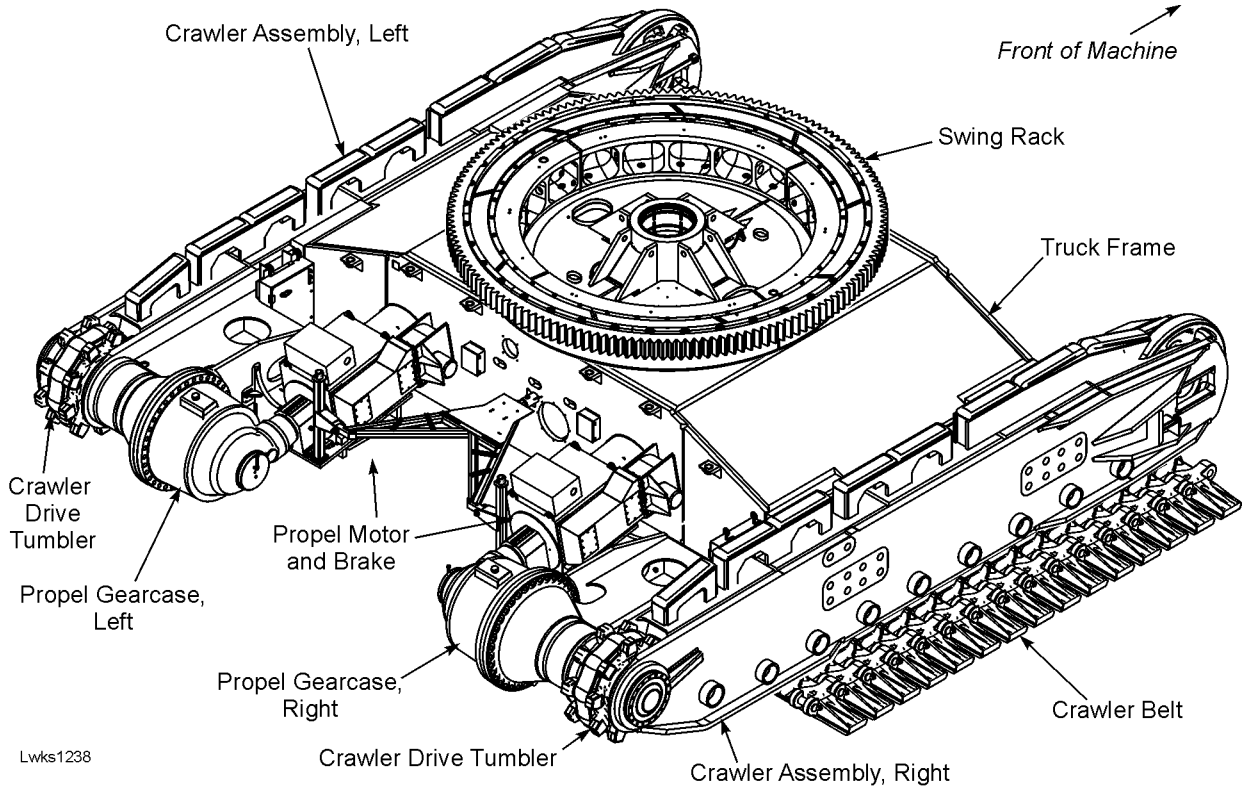


Figure 4-2: Lower Works and Crawlers

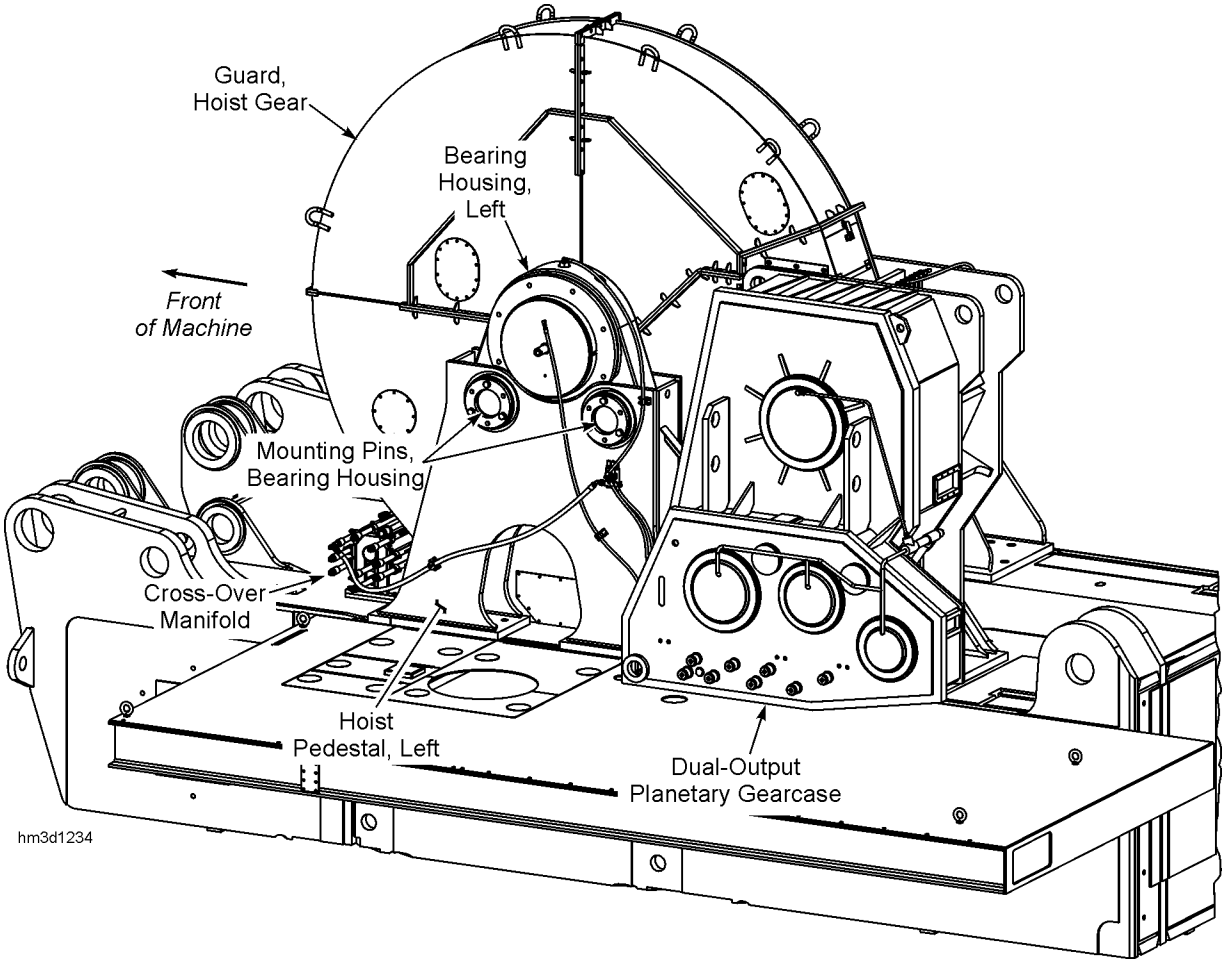


Figure 4-13: Hoist Machinery

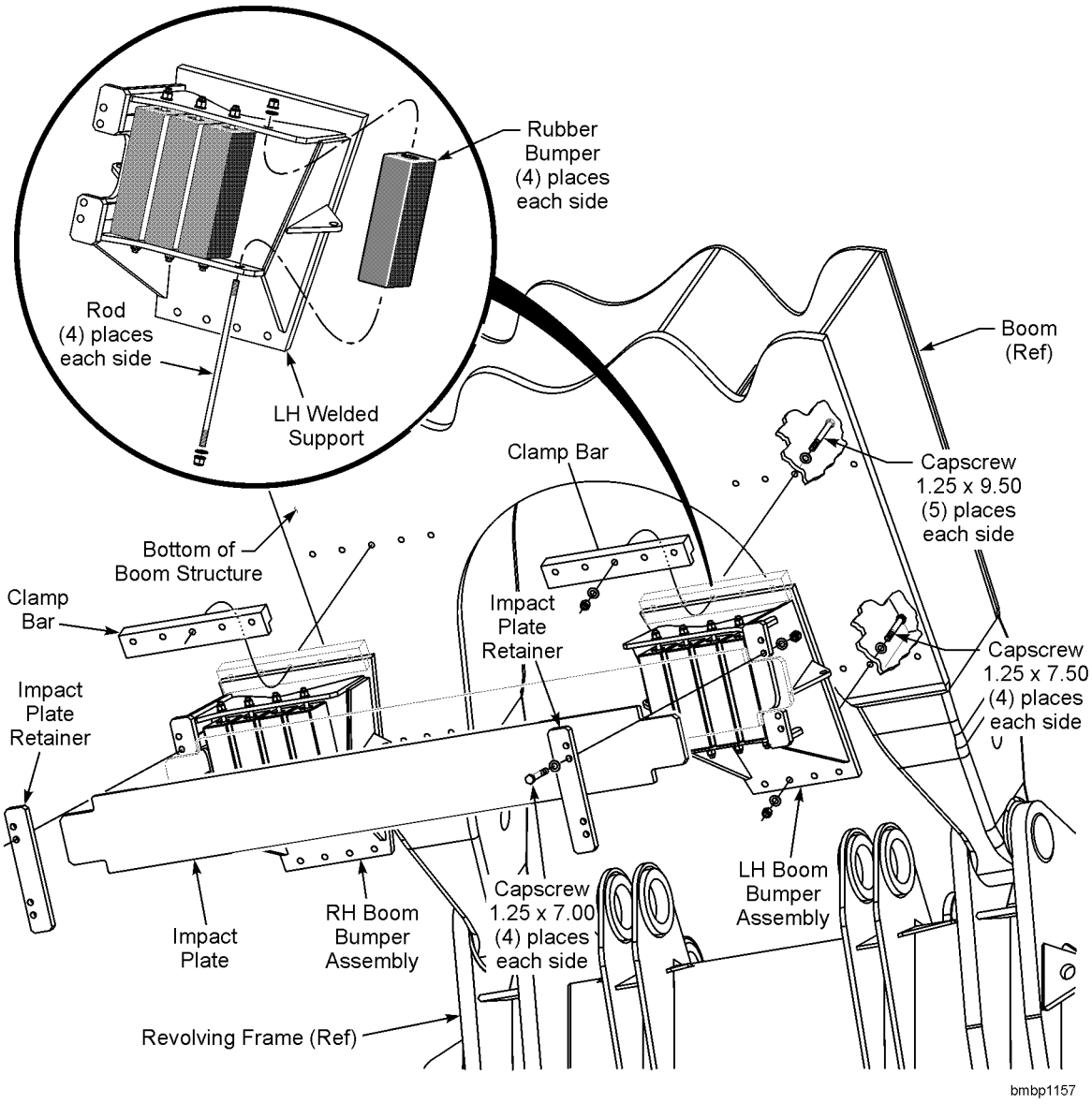


Figure 4-23: Boom Bumpers

ROLLER CIRCLE RAIL REPLACEMENT - UPPER

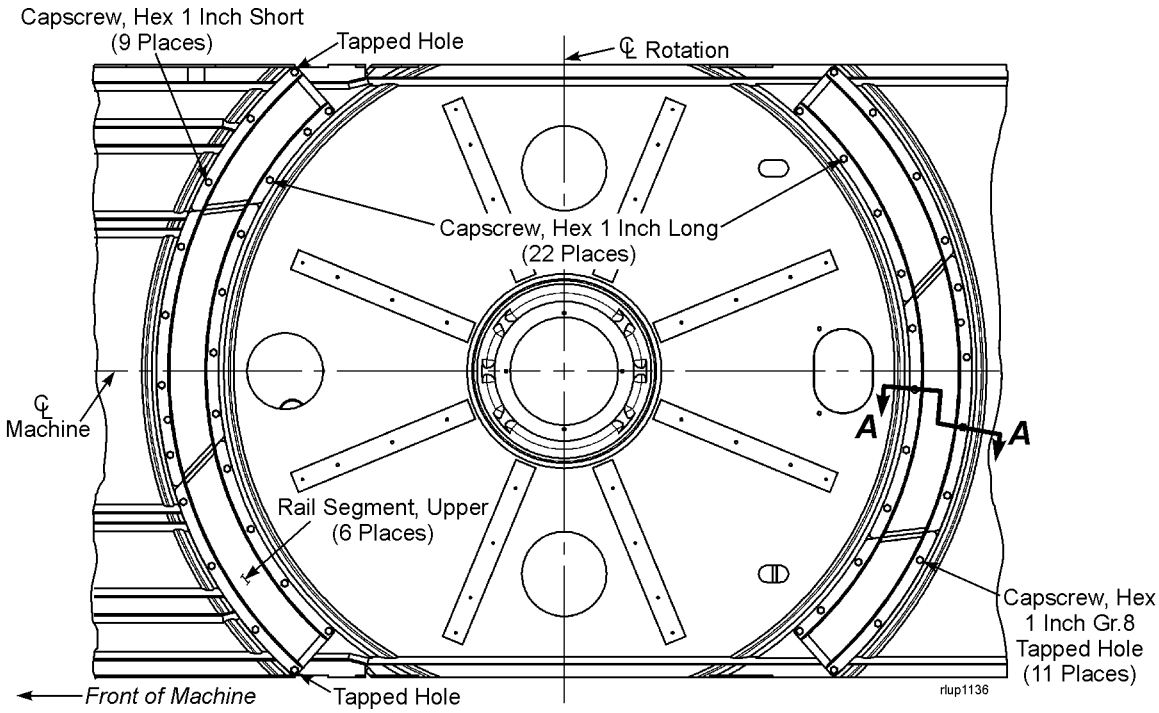


Figure 5-2: Revolving Frame Assembly (Viewed from the bottom)

The upper roller circle rails are composed of 6 rail segments bolted to the revolving frame. To replace the upper rail segments:

1. Park the machine in a level work area. Rotate the upper frame to position a roller circle retainer bar directly below the rail or rails to be removed.
2. If the rear rails are to be removed, raise the rear of the machine with jacks (or by hoisting the dipper into a bank). If the front rails are to be removed, jack the boom by crowding the dipper into the ground.

DANGER: BLOCK THE MACHINE IN PLACE AFTER RAISING THE FRONT OR REAR UPPER RAILS OFF THE ROLLER CIRCLE. DISCONNECT THE POWER SUPPLY. Failure to comply could result in serious injury.

3. Remove the roller circle outer retaining bar or bars as required.
4. Remove the bolts which secure the upper rail(s) to be removed from the revolving frame.

NOTES:

- BEFORE the drive lugs on the shoes touch the top of the crawler frame, replace or rebuild the slide bars to their original height.
- To check for the correct belt tension - while propelling the machine ensure that the crawler shoes effectively engage the drive tumbler. This is achieved when there is a minimum of radial shoe movement as it enters the load area of the drive tumbler.

CRAWLER SHOE REPLACEMENT

DANGER: STORED ENERGY! SECURE THE CRAWLER BELT BEFORE SEPARATING IT SO UNEXPECTED MOVEMENT UNDER ITS OWN WEIGHT IS PREVENTED. Failure to secure the belt could result in bodily injury or death.

1. Park the machine safely on a level work area with the shoe to be replaced at the front idler at the belt separation point.
2. Add blocking between the top of the crawler frame and the shoes to remove any slack in the belt.
3. Using hydraulic jacks, remove any belt tension by removing the shims behind the adjusting blocks on each side of the front idler shaft.

NOTE: Propel the machine slightly back and forth to unseat the adjusting blocks rearward in the frame slots if they do not move on their own.

4. Block or support the shoe below the one to be removed. To separate the belt, remove the pin locking hardware and the pin from 2 places on the bottom of the shoe to be removed.
5. Sling and support the shoe to be removed and then remove the pin locking hardware and the pin from 2 places on the top of the shoe to be removed. Remove the shoe from the belt.
6. Position the new shoe into the belt. To fasten one end of the new shoe to the belt, insert the pins and locking hardware in 2 places to secure one end of the shoe. Remove the sling.
7. Align the other end of the shoe to the existing shoe to close the belt. Install the pins and locking hardware in 2 places to secure the shoe. Tighten the capscrews that retain all 4 pins to 1045 Ft-Lbs.
8. Remove the blocking and adjust the belt tension.

Since the rollers are captured between the sides of the crawler frame, removal or replacement requires the separation of the crawler belt and the lowering of the roller below the crawler side frame. This is best accomplished by digging a pit to the dimensions shown in the following chart:

Pit Size	Height	Width
REAR IDLER	55 inches	79 inches
LOAD ROLLER	39 inches	63 inches

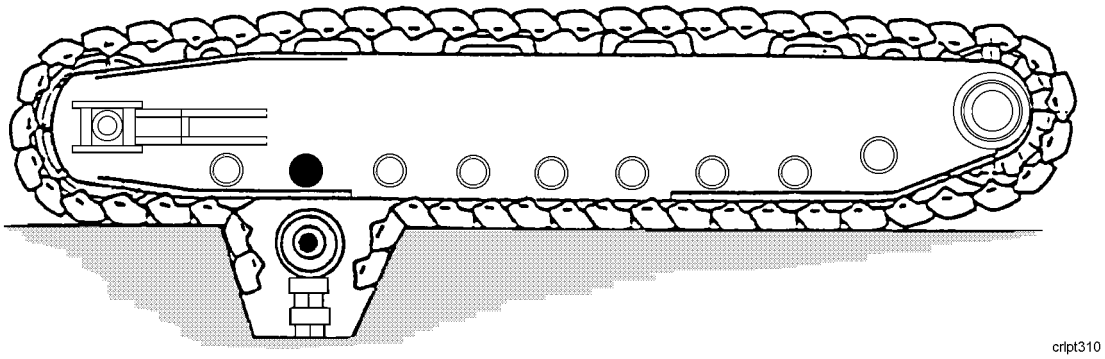


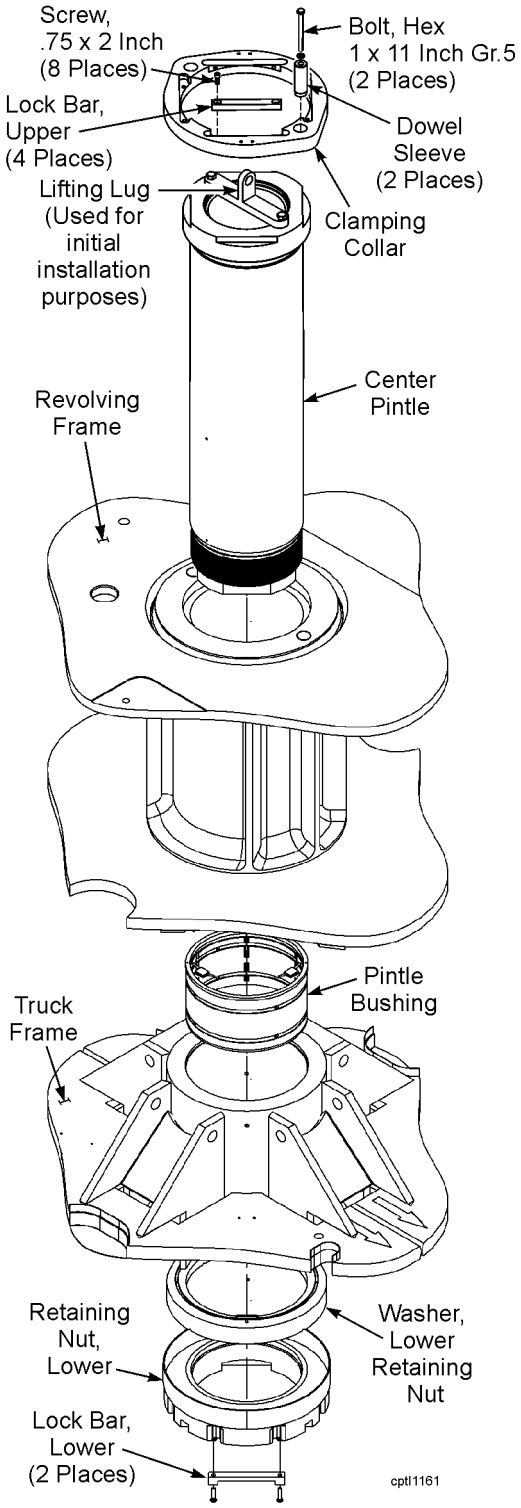
Figure 5-13: Load Roller Removal

PROPEL MACHINERY

The propel machinery is interchangeable between the left and right crawler assemblies. Both the planetary gearcases and motors mount inboard at the rear of the crawlers. Before installing a left gearcase onto a right crawler side frame, exchange the oil breather with oil drain and exchange eye bolt with screw plug. (As the same gearcase can be used on either the right or left side note that following the previous instructions, either hole can be used as an oil drain.) The drive motors are also interchangeable between the right and left crawler frames. A disc brake mounts on the rear of each motor frame.

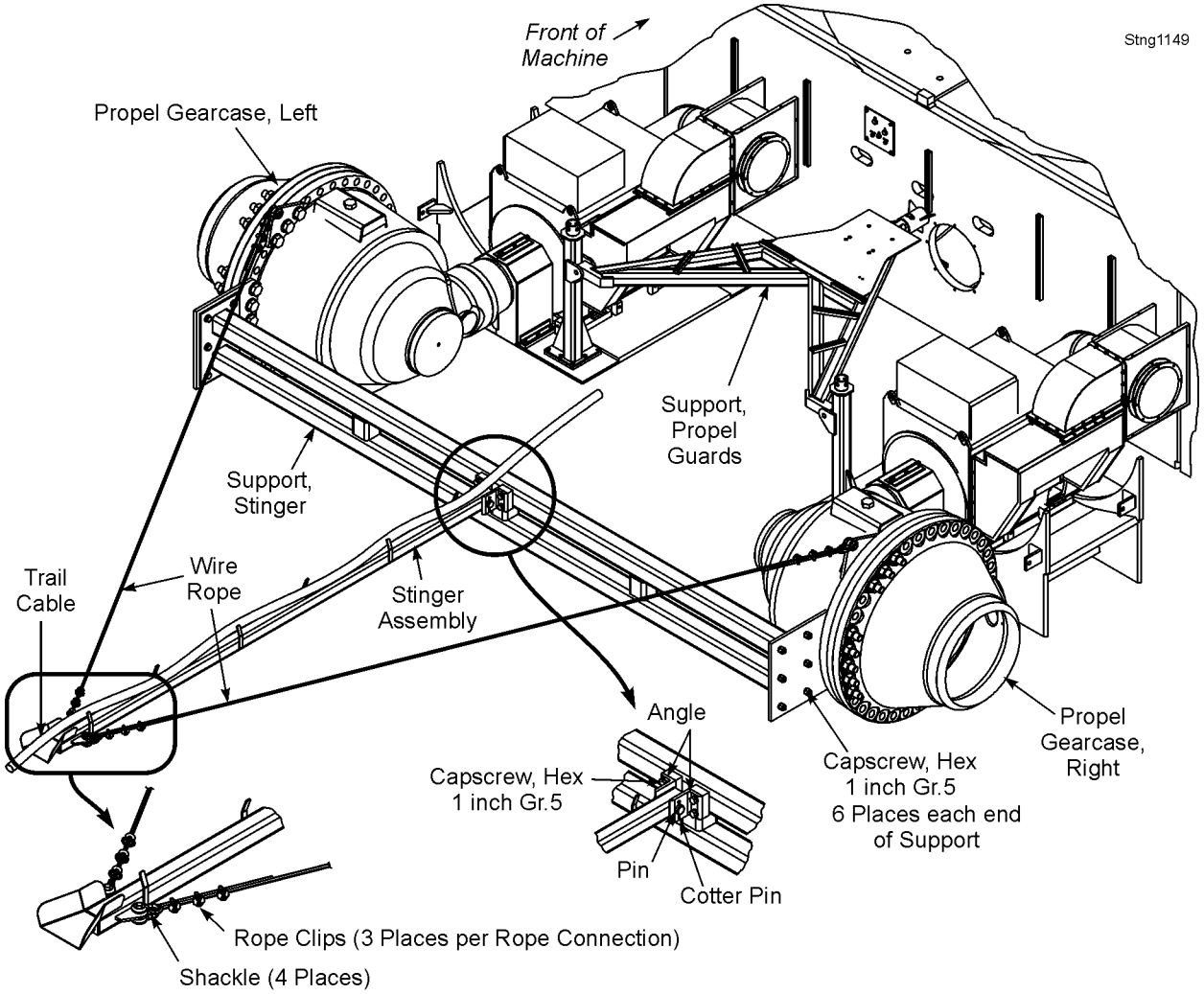
General maintenance and inspection of the propel machinery includes:

1. Inspection of the gearcase and electric motor mounting bolts.
2. Check the gearcase oil level daily by removing the oil level plug in the gearcase.
3. Change the oil in gearcase annually or as indicated by lab test analysis. Flush the gearcase before refilling with oil. (See Lubrication Section.)
4. Inspect the motor coupling quarterly for lube level and keep full.
5. Lubricate the motor bearings semi-annually with EMG (Electric Motor Grease). Application of grease should be performed by qualified personnel as an excess could cause motor failure.
6. Inspect the operation of the brakes daily. Monitor wear rate of friction disc. Replace when wear ring indicates lining is worn out. For more detailed information on the description and maintenance of the propel brakes, see Section 9 - ENGINEERING DATA, in this manual.


Screw, .75 x 2 Inch (8 Places)
Bolt, Hex 1 x 11 Inch Gr.5 (2 Places)
Lock Bar, Upper (4 Places)
Dowel Sleeve (2 Places)
Lifting Lug (Used for initial installation purposes)
Clamping Collar
Center Pintle
Revolving Frame
Pintle Bushing
Truck Frame
Retaining Nut, Lower
Washer, Lower Retaining Nut
Lock Bar, Lower (2 Places)
cptl1161

STINGER (TRAIL CABLE SUPPORT)

The trail cable support, or stinger, is a stationary square tube used to lift the trail cable off the ground for a distance of several feet to the rear of the machine. It is bolted to a bracket on the propel motor support. Two lengths of wire rope support the far end of the stinger to prevent left-to-right movement. The stinger should be horizontal. Insure that the wire ropes are firmly attached and that all wire rope clips are in place. Also be sure that the pin and cotter pins that attach the stinger to the bracket are in place. The trail cable should rest inside the permanent hangers on the stinger.

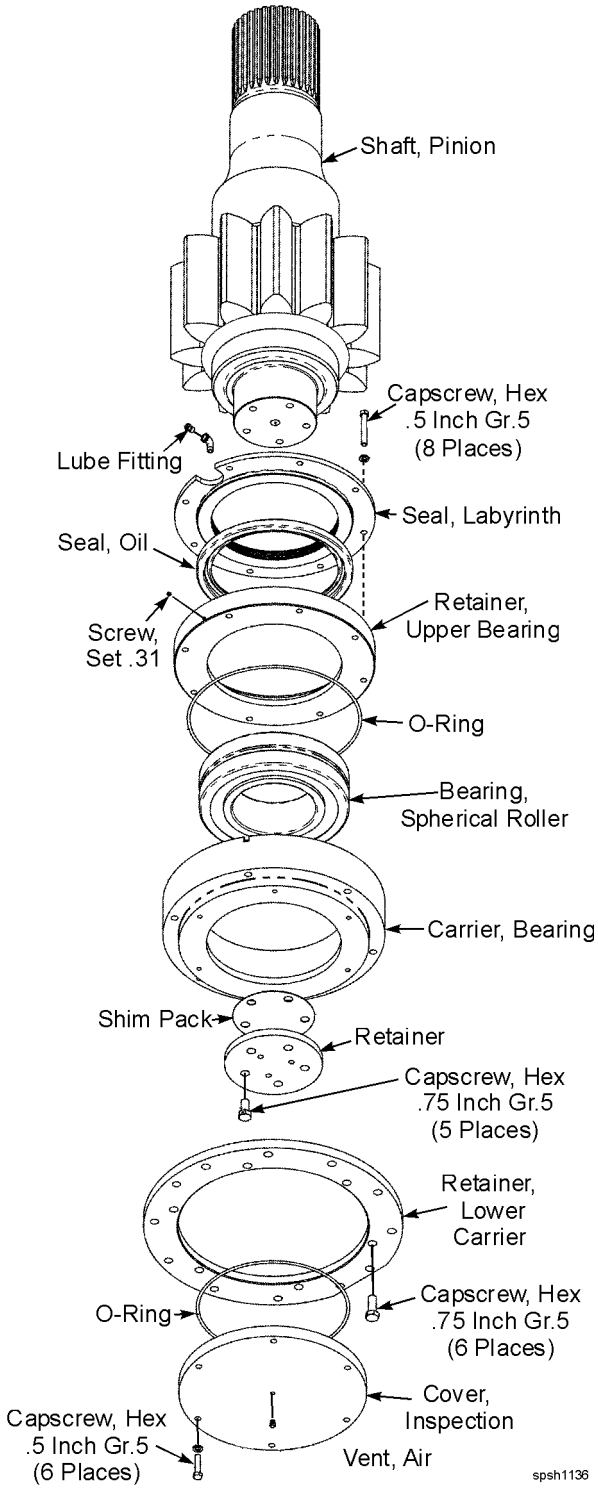


ROTATING DECK

The rotating deck consists of revolving frame, center pintle, right and left deck extensions, operator's cab and the machinery house. Also included are the electrical system components, operating controls, air system, A-frame, along with the hoist, swing and crowd machinery units.

SWING PINION SHAFT DISASSEMBLY

With the pinion shaft assembly resting in a near horizontal position, disassemble the shaft as follows:



8. Remove the coupling guard(s). Separate and remove the couplings from both ends of the motor coupling shaft and remove the shaft. (Shaft weight is approximately 940 Lbs.) Refer to Section 6 - BRAKES AND COUPLINGS.
9. Using a suitable crane, support the gearcase using the 4 lifting lugs at the top of the gearcase. Apply enough lift to just support the weight of the gearcase. (Gearcase weight is approximately 35,500 Lbs.)
10. Remove the cotter pins and the T-Head pins from the 3 mounting pins that attach the gearcase to the hoist pedestal.

NOTE: The gearcase is attached to the deck at the bottom of the gearcase with 1 long pin on the forward side and 2 unique short pins on the rear side. Mark the short pins to ensure correct re-installation.

- Forward Pin (long) 509 Lbs.
- Rear Pin Outer (short) 191 Lbs.
- Rear Pin Inner (short) 168 Lbs.

11. With the gearcase supported, it may be necessary to use a come-a-long or other suitable pulling device to pull the gearcase slightly toward the rear of the machine, in order to disengage it from the hoist gear.
12. Once the gearcase will clear all obstructions, lift it through the house roof and away from the machine.

The hoist gearcase can be reinstalled using the reverse procedure.

NOTES:

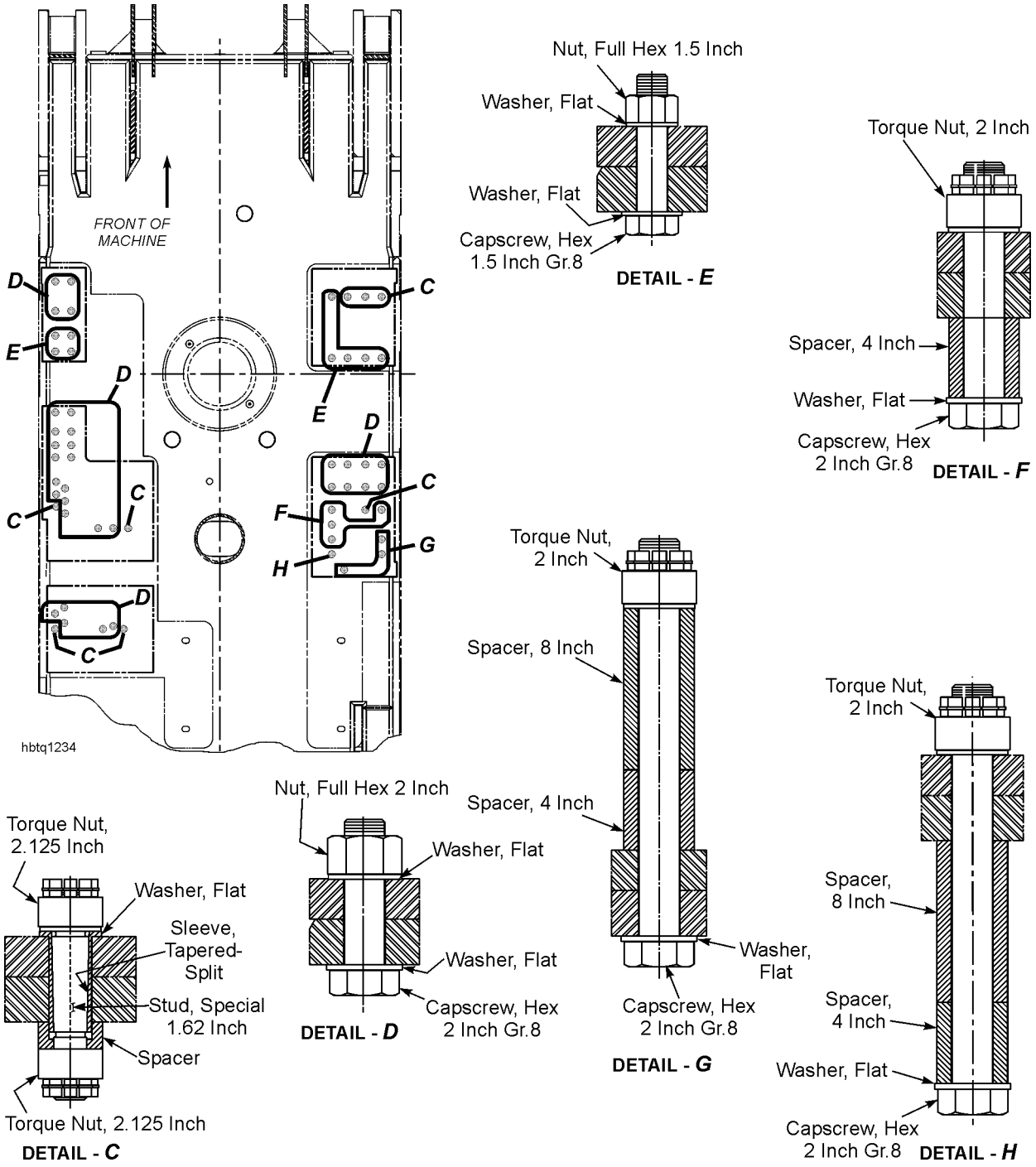
- Verify that the planetary output pinion-to-drum gear alignment has the proper backlash and contact patterns.
- Install the motor coupling shaft and check the alignment. Refer to Section 6 - BRAKES AND COUPLINGS, in this manual. Install the coupling guard(s).
- Re-install the gearcase drain lines into the openings in the deck.
- Re-install the oil cooling hoses. During re-installation, apply joint compound to all NPT threads.
- Ensure that the gearcase is filled with the proper type and amount of oil.

HOIST GEARCASE REPAIR

Repair of the hoist gearcase is best completed with the gearcase removed from the machine and in a shop environment. Basic “Level-1” repair involves replacement of seals and O-Rings in the pinion shaft area. Install oil seal with spring toward the bearing.

HOIST MOUNTING BOLTS

Use the following view to identify the correct installation of the mounting bolts for the hoist machinery.



For tightening the torque nuts, refer to TORQUE NUT INSTALLATION in Section 9 - ENGINEERING DATA in this manual.

CROWD GEAR AND DRUM

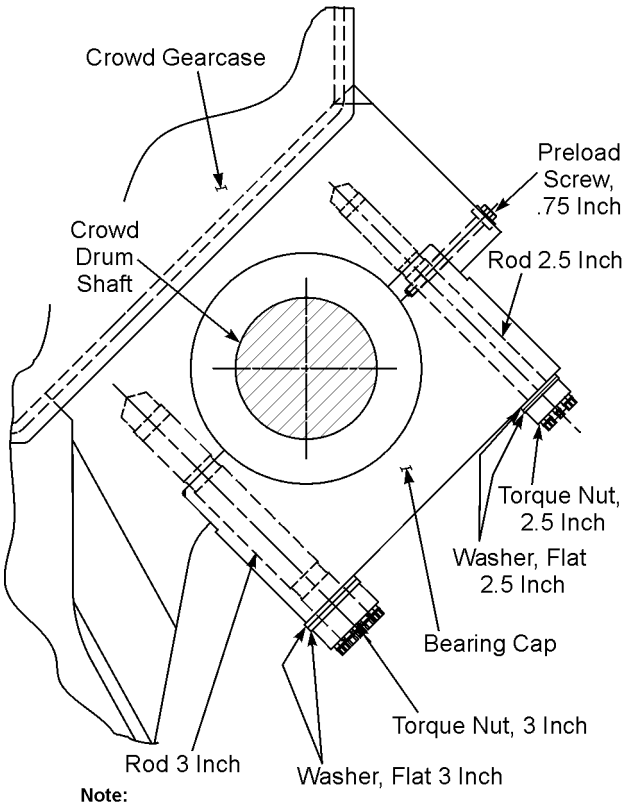
Inspect the drum gear-to-drum mounting hardware for loose or missing nuts and bolts. These bolts and nuts were tightened at the factory using Turn-of-the-Nut torque method. Loose bolts and nuts should not be retightened but replaced with new bolts and nuts. Tighten the new bolts and nuts using the Turn-of-the-Nut method per Section 9 - ENGINEERING DATA.

Check the drum for cracks. Check the drum grooves for rough edges and other defects which would damage the crowd and retract ropes. Check the retract rope for any damage. Inspect the drum gear teeth for pitting, abrasions, spalling, galling and other damage.

CROWD DRUM REMOVAL

If repair of the crowd drum is needed:

1. Remove the crowd ropes and retract ropes from the drum. Refer to FRONT END EQUIPMENT.
2. Remove the gear guard from the drum gear.
3. Disconnect the lubrication lines at the shaft end covers. Remove the end covers.
4. Remove the bolted-on crowd frame lower-front cross tie.
5. Attach a crane to the drum and apply enough force to support the weight of the drum. Support the bearing caps separately.



BOOM ASSEMBLY

Maintenance of the front end equipment requires at minimum a weekly visual check for cracks or other damage to the boom structure. It will include checking the ladders and the boom point platform. Also, check for signs of wear and cracks on the sheaves. Replace, if necessary. There should always be a sign of fresh grease on both sheave bearing areas. Visually check sheave bearing retainer bolts. Inspect the boom foot lugs for any signs of cracking. Also check to see that the boom foot pins are being properly lubricated. Unusual problems should be referred to the Bucyrus International Service Department for solutions.

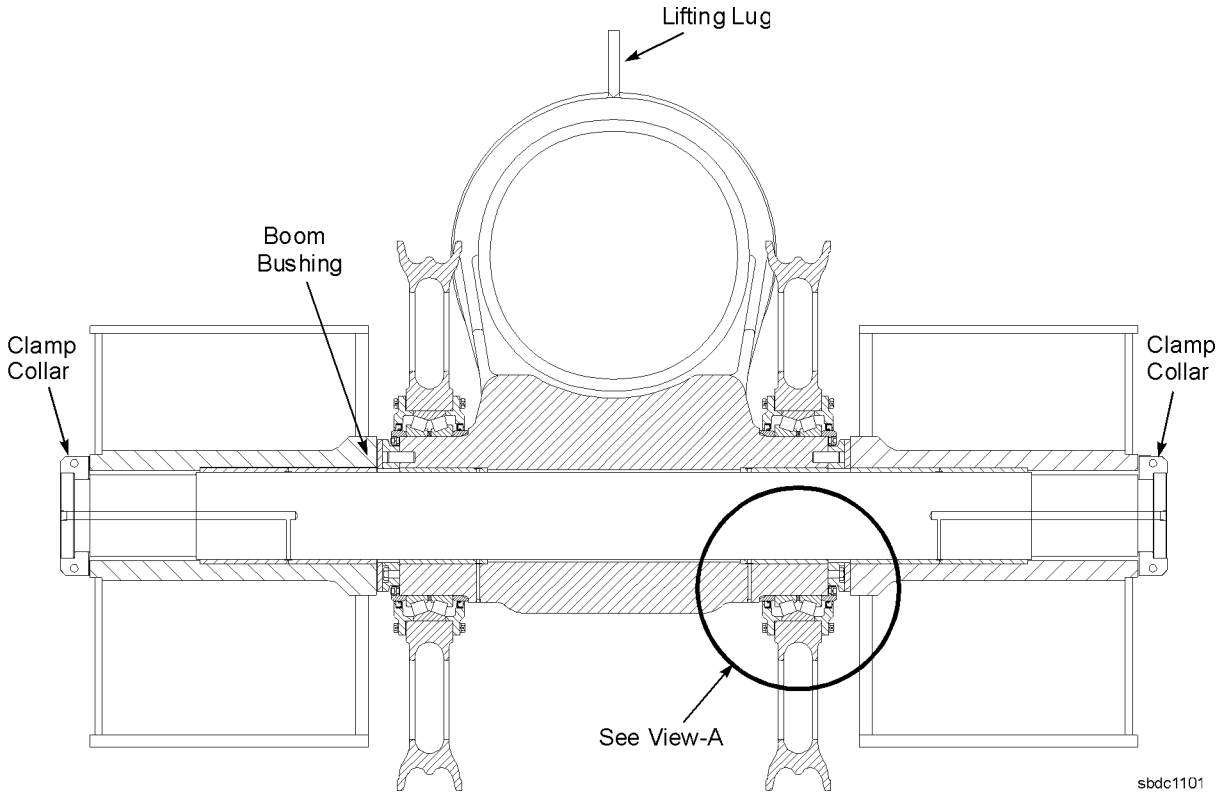
The welding of ANY attachments to the surface of the boom, other than those specified on an official Bucyrus engineering drawing, is to be prohibited during erection or maintenance of this machine. Any existing unauthorized attachments should be removed by grinding in order to prevent damage to the boom.

DANGER: STORED ENERGY! Removal of bolts and pins requires the attached items to have proper support to release the load. Failure to comply could result in death, severe personal injury, or damage to the machine.

SADDLE BLOCK REMOVAL

For any work to be done on the saddle block other than replacement of liners, the saddle block must be removed from the machine. Remove the saddle block as follows:

1. Remove the crowd and retract ropes as described under Crowd & Retract Rope Removal.
2. Remove the dipper handle as described under Dipper Handle Removal.



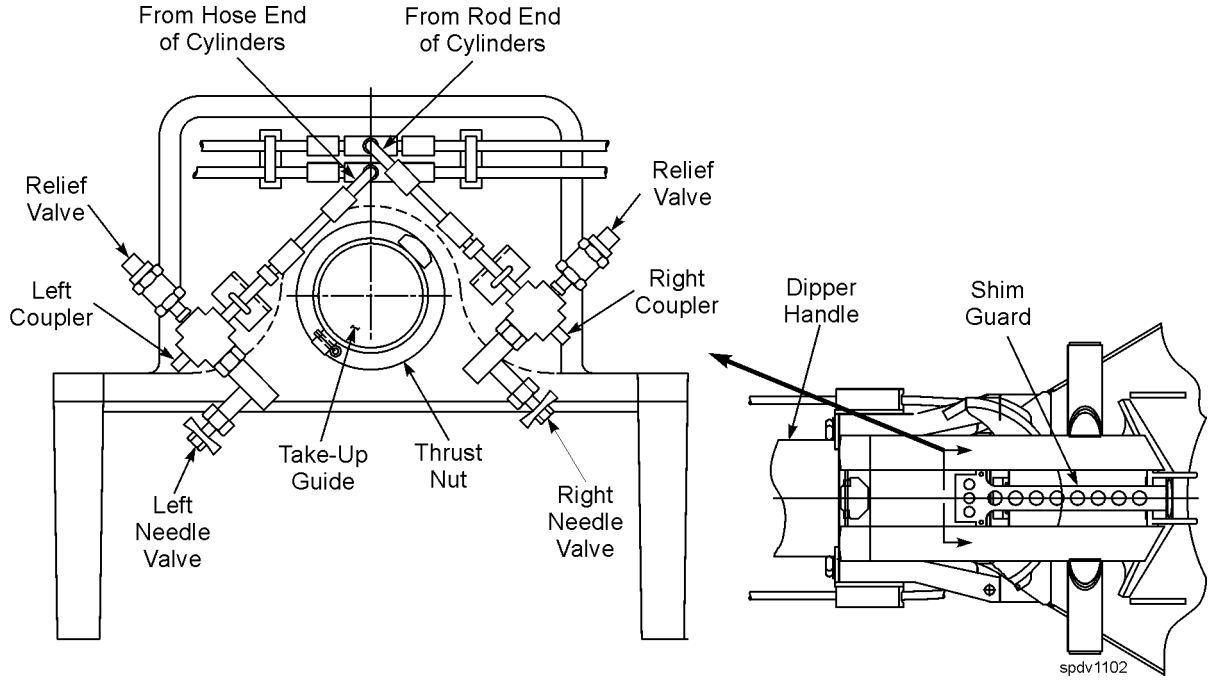
3. Two cranes are required to remove the saddle block. One crane is used to support and remove the saddle block. The other crane is used to remove the shipper shaft.
4. Separate and plug the lube lines to the saddle block.
5. With a crane supporting the saddle block, remove the shipper shaft clamp collars and slide the shipper shaft to either side to remove it from the saddle block and boom. Lower the saddle block to the ground.
6. Check the shipper shaft bushings in the boom and replace if required. Consult Bucyrus International Service Department prior to starting repair.

a. Clean and grease the sliding area on the take-up nut, support and screw.

b. Make sure the right needle valves are open and the left needle valves are closed.

c. Extend the cylinders by injecting hydraulic fluid into the coupler located on the left side of the dipper handle above the left needle valve.

CAUTION: Oil within the needle valves is under high pressure. STAY CLEAR OF TAKE-UP NUT, SHIMS AND CYLINDERS WHEN OPERATING NEEDLE VALVE, AS THESE ITEMS COULD MOVE UNEXPECTEDLY AND CAUSE SERIOUS INJURY.



d. Remove the desired amount of shims from the cylinder side of the take-up nut and store them on the opposite side of the nut.

CAUTION: The take-up nut must be shimmed tight, both fore and aft, using all shims originally provided with machine.

e. Slowly open the left needle valve.

CAUTION: Stay clear of the take-up nut. The weight of the rope may jerk the take-up nut when the needle valve is opened.

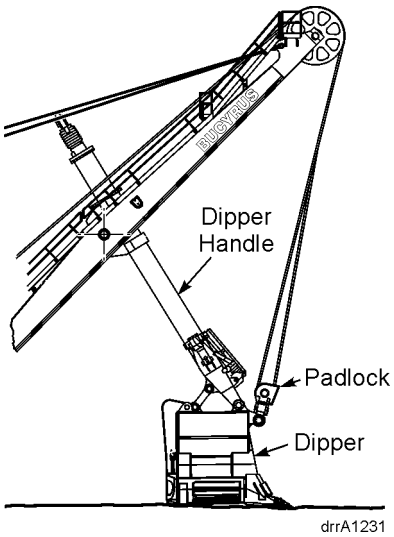
f. Close the right needle valve.

4. Release the pressure from the hydraulic jacks.

5. Repair or replace any damaged parts.

6. Retighten the retract rope per the procedure in RETRACT ROPE TIGHTENING later in this section of the manual.

DIPPER REMOVAL & INSTALLATION



IMPORTANT! Before performing this procedure, ensure that the proper lifting devices are available and that you have a complete understanding of the removal process. DO NOT continue this procedure until you have read and fully understand the removal process.

Follow the procedure closely. As each set of pins are removed, specific dangers as well as changes in the dipper handle's C.G. (center of gravity) can occur. Ensure that the components being removed are securely supported and the spotter (rigging crew) is in direct radio communication with the crane operator.

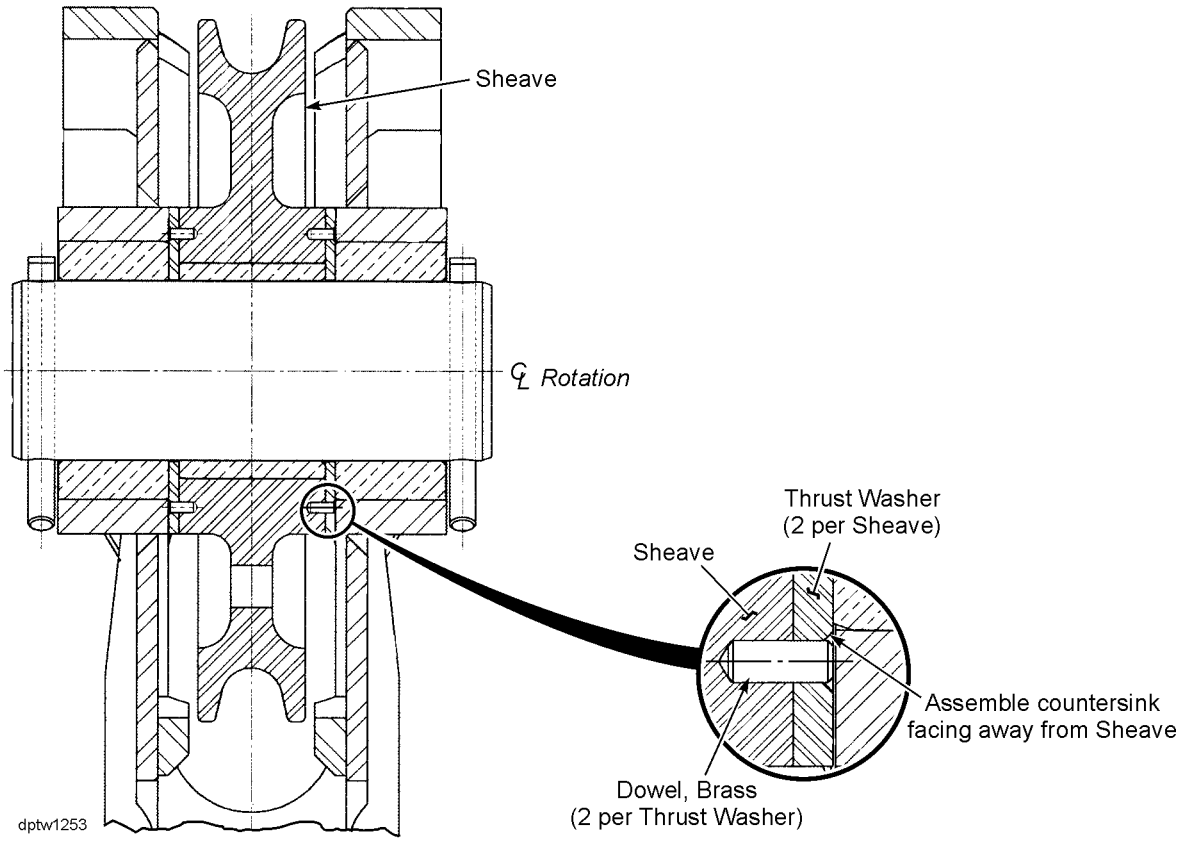
DANGER: STORED ENERGY! Removal of dipper pins requires the attached items to have proper support to release the load. Failure to comply could result in death, severe personal injury, or damage to the machine.

To remove the dipper:

1. Park the machine on a firm, level work surface. Position the revolving frame parallel with the crawlers, with the dipper over the front idlers. Allow approximately 75 feet of additional level work surface area behind the crawlers.
2. Position the dipper with the floor flat on level ground. Ensure the base of the dipper is fully supported and level.

DANGER: STORED ENERGY! If the dipper base is not fully supported and level, movement may result when the dipper is disconnected from the handle. Failure to comply could result in death, severe personal injury, or damage to the machine.

3. Clear the area of all personnel not directly involved in the process. Establish direct radio communication with the crane operator.
4. Disconnect the dipper trip rope from the dipper door.



NOTE: When installing new thrust washers, line up 0.484 inch diameter holes with 0.484 inch diameter holes in sheave. Using these holes as a pilot, ream to 0.50 inch diameter for proper fit with 0.50 inch diameter dowel pin.

NOTE: Assemble thrust washer with countersink facing away from sheave.

NOTE: To retain thrust washer, peen end of dowel pin into countersink.

The hydraulic unit is a self-contained unit, including a reservoir of hydraulic fluid, a stationary pump and electric drive motor, and a removable hydraulic motor (with handles) connected to the pump through a length of hydraulic hoses. To operate the unit, withdraw the hydraulic motor from its storage on the unit and install the motor on the dipper handle. Refer to the instructions in CROWD ROPE ADJUSTMENT in this section of the manual for the proper procedures. Press the start pump button on the control panel then use the hand held pendant station to control the pump.

Be sure the reservoir is filled with hydraulic fluid. Check for leaks in the piping. Replace the filter cartridge when indicated.

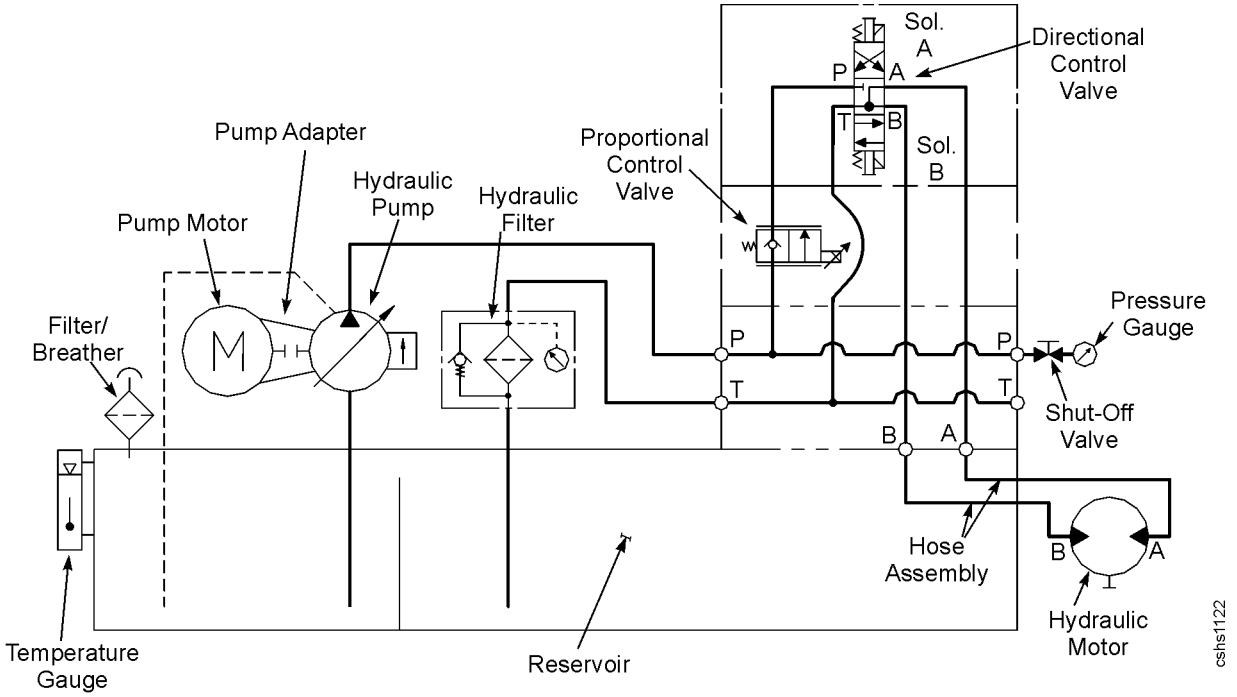


Figure 5-63: Hydraulic Schematic – Crowd Screw Hydraulic Unit

NOTE: Liberally lubricate the grooves of the crowd drum and the take-up nut to help prevent damage to the new retract rope as it is pulled onto the machine.

8. With the ground vehicle pull the new rope onto the machine until an equal amount of the retract rope is on each side of the machine. Disconnect the auxiliary line from the retract rope.
9. Reeve the auxiliary line, still attached to the ground vehicle, under the crowd drum up through the rope socket, down under then over the drum and secure it to the retract rope becket loop. With the ground vehicle, pull the retract rope onto the drum and into the rope socket. Seat the becket within the drum receptacle.
10. Install the other end of the retract rope in the crowd drum in the same way.
11. Be sure the retract rope is seated in the outer groove of the shipper shaft sheaves and the rope grooves of the front stops. Re-install the take-up nut rope retaining bolts and front stop rope retainers.
12. Take up any slack in the retract rope with the retract take-up mechanism. Refer to RETRACT ROPE TIGHTENING.
13. Re-index the crowd limit switch.

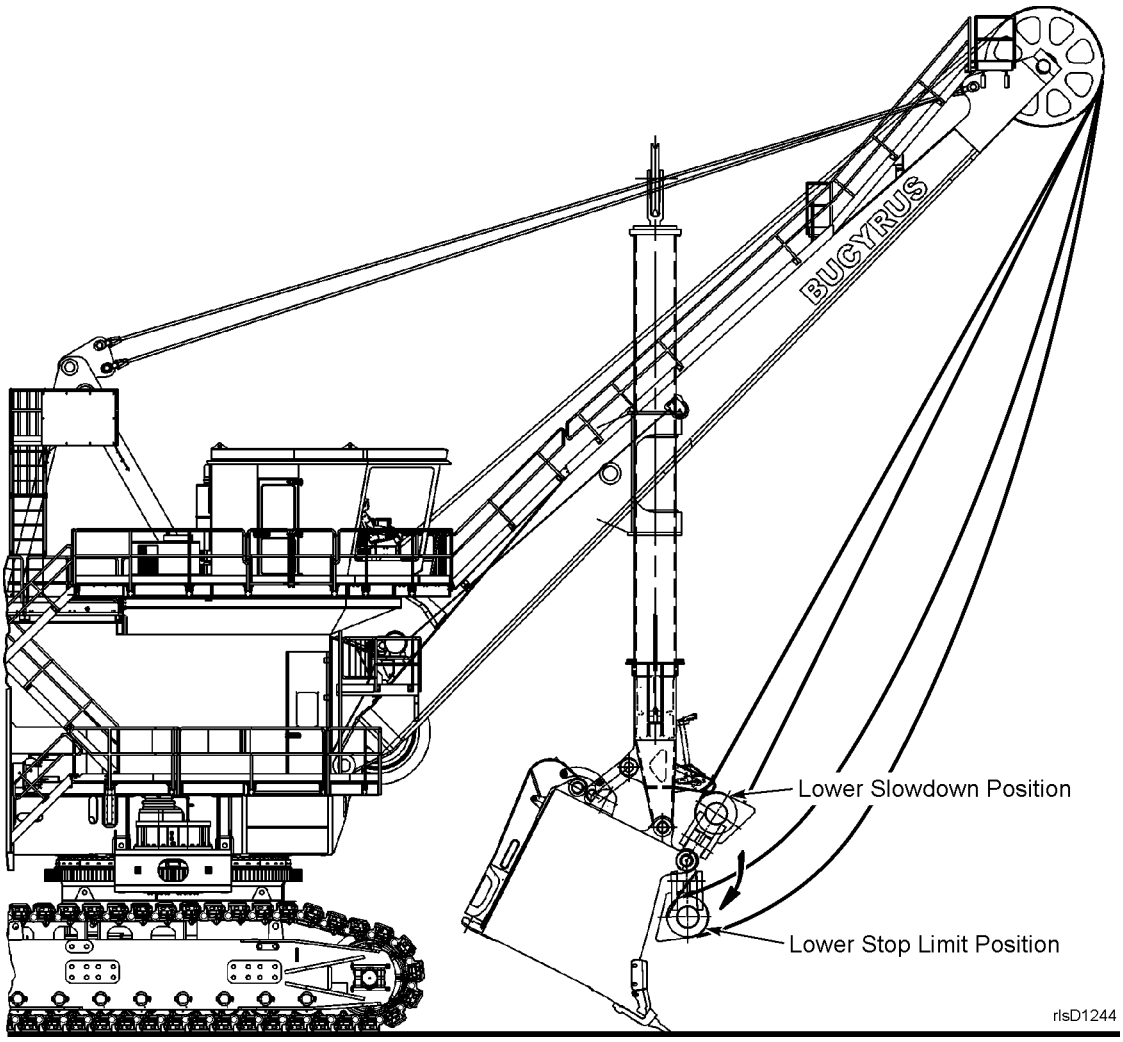
LOWER SLOWDOWN/STOP LIMITS

To set the lower slowdown and stop limits:

1. Position the handle vertically with the dipper teeth just touching pit floor and the hoist ropes tight. Press the LOWER SLOWDOWN LIMIT button on the operator display.

btnC1209

2. Keeping the handle vertical, let the padlocks fall forward until the padlocks contact the dipper.
3. Press the LOWER STOP LIMIT button on the operator display. The lower stop limit helps prevent rope from spooling off the hoist drum.



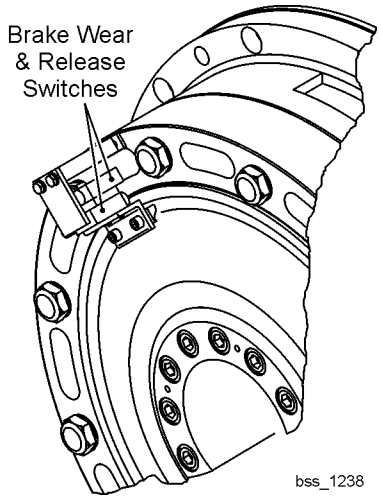
HOIST BRAKE INSTALLATION

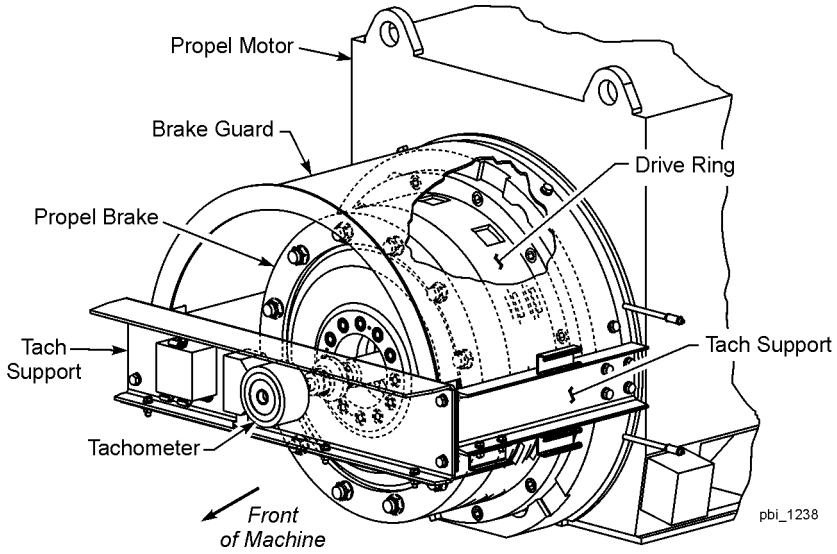
The tachometer, furnished with the electric motor, must be installed before installing the brake assembly.

1. Install the drive hub and keyway on the motor. Refer to *PINION & HUB INSTALLATION* in Section 9 - *ENGINEERING DATA*.
2. Install motor shaft nut and secure to shaft with Loctite.
3. Install brake adapter onto the motor and secure with hardware. Use care to align the access slots in the adapter for future tachometer inspections.
4. Lubricate the hub and friction disc splines with a light coat of Teflon grease or anti-seize compound.
5. Install the friction discs and center plates onto the shaft adapter in the required order before sliding on the brake assembly. Tighten the drive ring hardware and install the brake guard.

HOIST BRAKE WEAR & RELEASE SWITCHES

The hoist brake is equipped with two switches mounted to the outer edge of the brake housing. For more information, refer to *BRAKE WEAR & RELEASE SWITCHES - MULTIPLE DISC BRAKES* in this section of the manual.





TACHOMETER MOUNTING & ALIGNMENT

1. Assemble the tach drive shaft into propel motor shaft using retaining compound. Tighten to 300 Ft-Lbs.
2. Assemble tach shaft extension onto the tach drive shaft using the socket cap set screws, tach shaft extension should protrude beyond tach drive shaft by 1.31(+.13/-.00) as shown in View E.
3. Release the propel motor brake. The motor shaft can be rotated back and forth for tach alignment without breaking the motor coupling.

10. Reinstall the piston and pressure plate onto the top of the friction disc and align the pneumatic fitting, access holes and studs accordingly. Pressurize the piston once more to minimum pressure allowing complete disengagement of the components.
11. Replace the stud nuts and tighten to 90–100 Ft-Lbs.

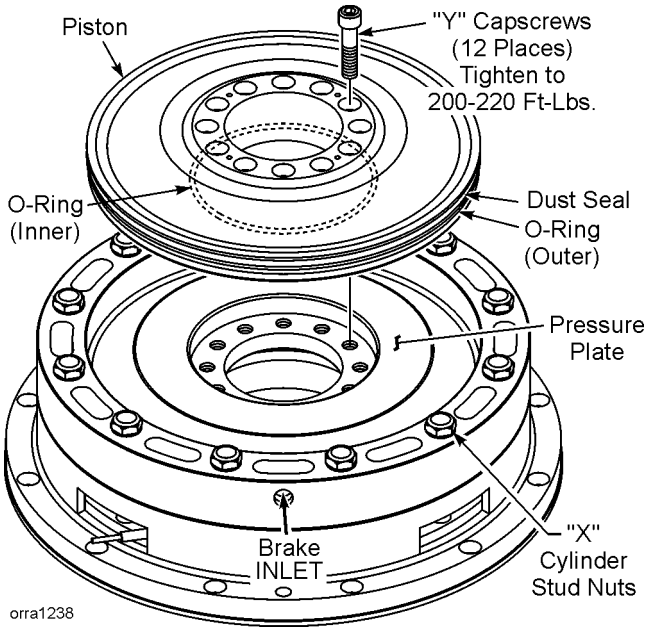
CAUTION: Tighten the stud nuts as per the instructions on the brake drive ring. Excessive, or improper, torque application can cause the drive ring to become deformed and seriously reduce the effectiveness and life of the brake assembly.

12. Ensure the air line and wear/release switches are properly reconnected. Refer to *BRAKE WEAR & RELEASE SWITCHES* in this section of the manual.

O-RING REPLACEMENT — ALL BRAKES

With machine parked on flat level surface, with dipper heel resting on the ground, the O-Rings may be replaced by disassembling the brake as follows:

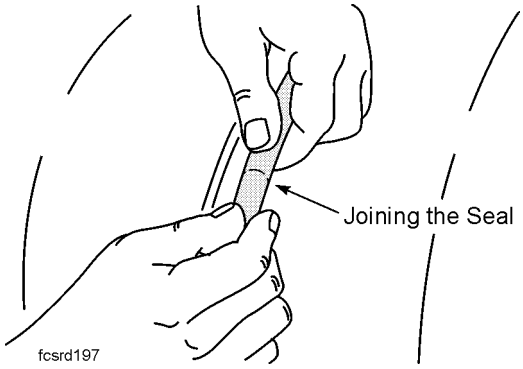
1. For the propel brake, remove the tachometer, tach supports and the brake guard as required.
2. For hoist, crowd or swing brakes, remove the wear and release switches along with the mounting bracket and hardware. Remove the brake guard.
3. Release air pressure to the brake. Disconnect the air line to the brake inlet. Install a temporary pressure regulator with gauge and a closed shutoff valve to the brake inlet.



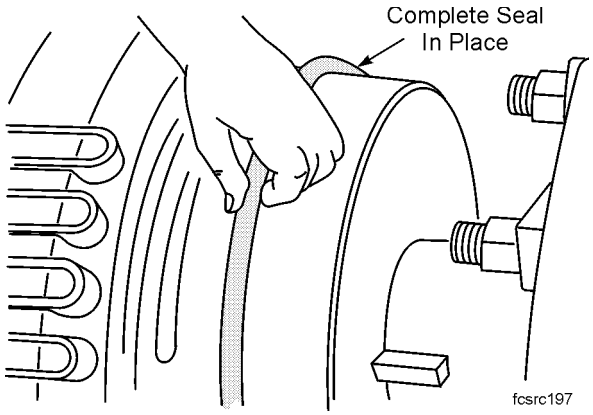
NOTE: The pressure regulator with gauge should be located between the brake and the shutoff valve.

4. Remove the capscrews attaching the piston to the pressure plate. Remove the piston.

4. Place the split seal around the shaft and carefully align the two seal ends.
5. Carefully press and hold the joint together. Do not attempt to stretch the joint seal over the hub for several additional minutes. Refer to the adhesive manufacturer's instructions for procedure and drying time.



6. Carefully position the fused seal in place on the coupling hub.



LOCKOUT VALVES

A series of lockout valves are provided to enable maintenance personnel to isolate and remove compressed air from the swing, crowd, hoist and propel brakes should they require maintenance. This permits airflow to continue to the other brakes and features of the machine.

CAUTION: Isolating only one feature of the machine will not eliminate the danger of machine motion while maintenance is being performed. The user is responsible to ensure that all proper precautions, including lock-out/tag-out, bracing and any other necessary precautions have been taken, so that no unanticipated machine motions will occur.

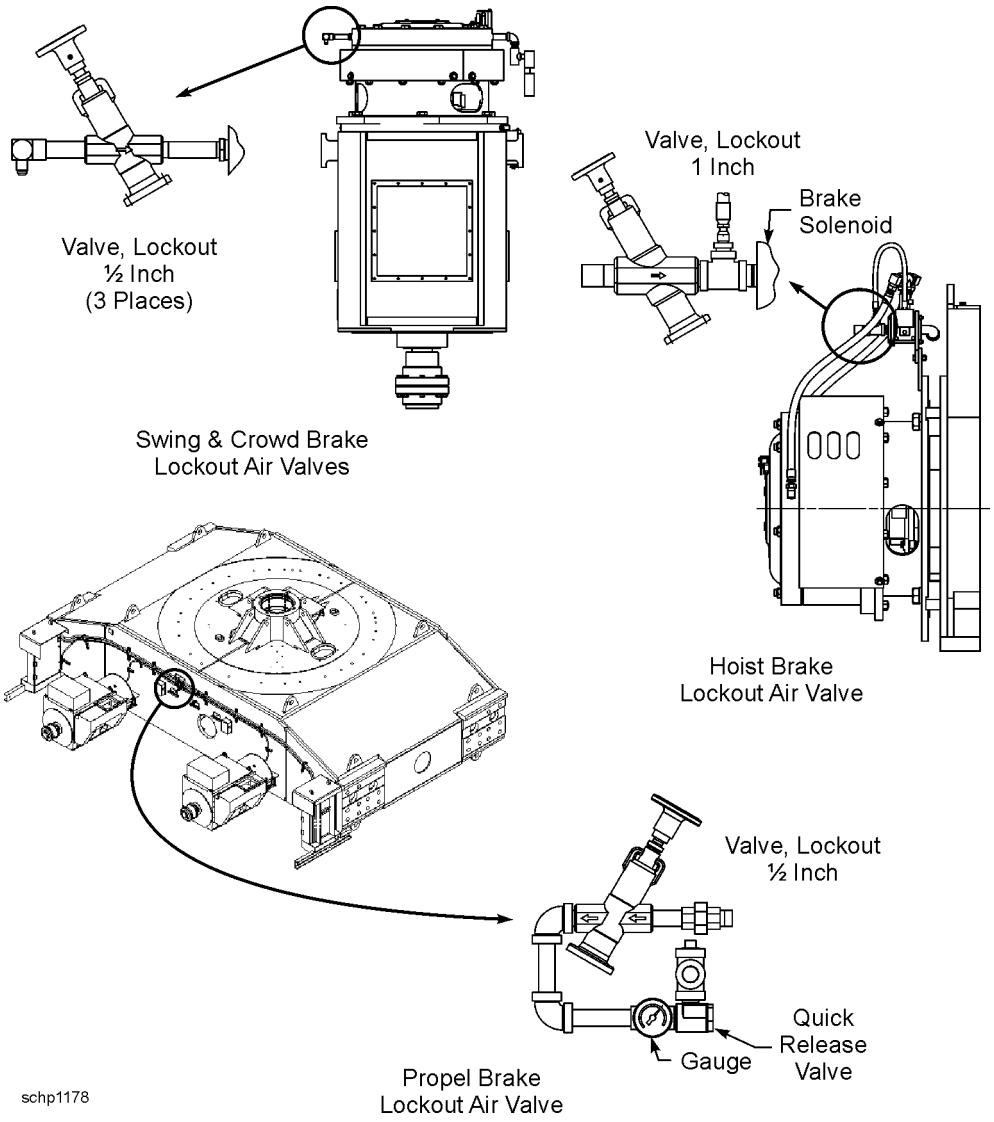


Figure 7-2: Lockout Valve Locations

DYNAVANE AIR CLEANER

Dynavane air cleaners are self-cleaning and do not require the routine service typical of air filters which collect and hold the dirt removed from the air. There are a few maintenance procedures which should be observed.

- The air entering the side of the cells should be kept free of rags, leaves and papers to assure free airflow. Applications exposed to this type of material should have intakes covered with a course mesh (5 mesh) screen to prevent entry of material larger than the bleed slot.

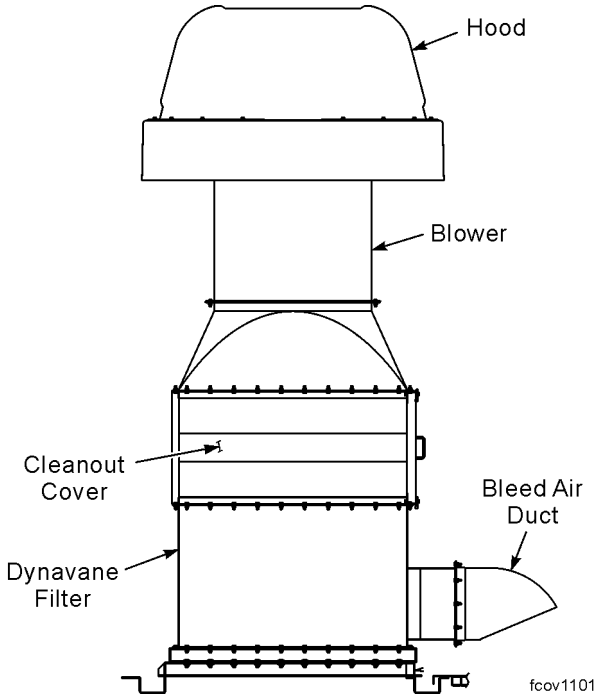


Figure 8-1: Filter Components Overview

- Check the bleed system to make sure nothing has impaired bleed airflow.
- The cells should be examined for buildup of deposits on the blades. A light coating of dust is normal and will not impair the operation or efficiency of the cell. Occasionally, due to the presence of oil mist or similar vapors in the air, heavier surface accumulations will occur and the cell will require cleaning. Cleaning the cells can be accomplished by brushing the surface of the blades or blowing down with compressed air.
- Another method of cleaning the Dynavane filters is to reverse the direction of fan rotation. This creates reverse air pressure which helps free up the dirt. The units can be removed for a more thorough cleaning.

Table 9-1 Lubricated or Plated Threads or with Hardened Washers

Diameter		Grade 5		Grade 8	
Inch	Cm	Ft-Lbs.	Nm	Ft-Lbs.	Nm
.250	.63	6.3	8	8	12
.375	.95	23	31	35	47
.500	1.27	55	74	80	108
.625	1.58	110	149	170	230
.750	1.90	200	270	280	379
.875	2.22	320	433	460	623
1.00	2.54	480	650	680	921
1.25	3.17	840	1,138	1,360	1,843
1.50	3.81	1,460	1,979	2,360	3,199
1.75	4.44	1,700	2,304	3,740	5,070
2.00	5.08	2,600	3,525	5,625	7,626
2.25	5.71	3,780	5,124	8,240	11,171
2.50	6.35	5,160	6,995	11,250	15,252
2.75	6.98	7,000	9,491	15,300	20,743
3.00	7.62	9,250	12,541	20,150	27,319

Table 9-2 Dry Threads

Diameter		Grade 5		Grade 8	
Inch	Cm	Ft-Lbs.	Nm	Ft-Lbs.	Nm
.250	.63	8.3	10	12	16
.375	.95	30	40	46	62
.500	1.27	73	98	106	143
.625	1.58	146	197	226	306
.750	1.90	266	360	373	505
.875	2.22	426	577	613	831
1.00	2.54	639	866	906	1,228
1.25	3.17	1,120	1,518	1,810	2,454
1.50	3.81	1,950	2,643	3,150	4,270
1.75	4.44	2,270	3,077	4,980	6,751
2.00	5.08	3,740	4,704	7,500	10,168
2.25	5.71	5,040	6,833	11,000	14,913
2.50	6.35	6,880	9,327	15,000	20,337
2.75	6.98	9,330	12,649	20,400	27,658
3.00	7.62	12,300	16,676	26,800	36,335

TORQUE NUT INSTALLATION

Table 9-20: Torque Nut Location Chart

Assembly	*Assembly Description*	*Bucyrus P/N*	*Supernut Size*	*Jackbolt Qty.*
K380509	Boom Point Sheaves	MP263241	1.25	8
S070569-VG01	Hoist Motor	82637920	2.00	8
E020743-01	2nd Intermediate Shaft	82637931	2.00	8
S006761	Hoist Pedestal Hardware	82637924	2.00	12
E022328-01	Crowd Drum Bearing/Cap	82637942	2.50	8
E022328-01	Crowd Drum Bearing/Cap	82637943	3.00	12
S051429	Crawler	82637955	3.50	16

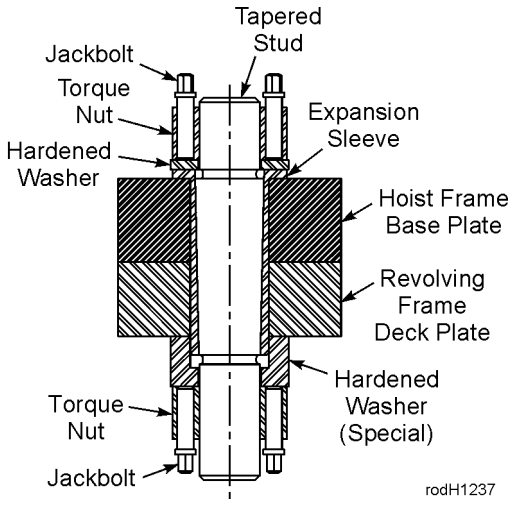
b. Set the torque wrench to **57** Ft-Lbs. Working in the CIRCULAR pattern, continue tightening the jack bolts of the upper torque nut until they are stabilized at full torque. This may take several rounds. (Stabilized is when the torque wrench is moving less than 1/8 turn.)

11. Finalize the preload of the lower torque nut by tightening the lower torque nut jackbolts to **57** Ft-Lbs as follows:

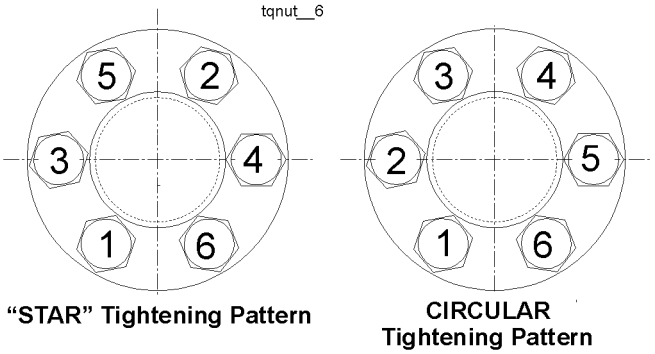
- Set the torque wrench to **57** Ft-Lbs. Working in the CIRCULAR pattern, continue tightening the jack bolts of the lower torque nut until they are stabilized at full torque. This may take several rounds.

NOTES:

- An impact wrench can be used for the initial tightening sequences, *however a torque wrench must be used to achieve the final torque values.*
- Repeat the above steps for all remaining torque nuts.

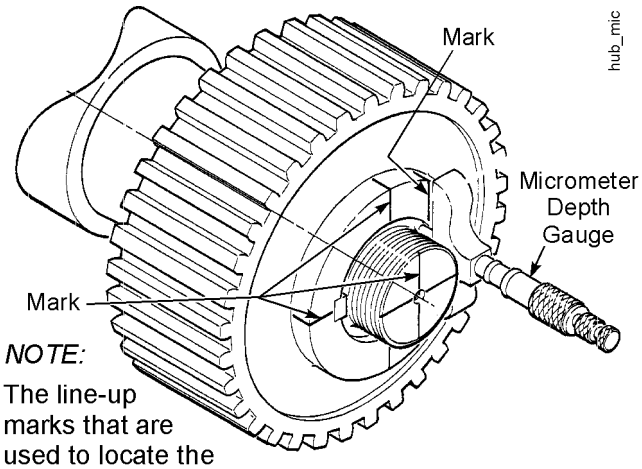


RACK & ROLLER TORQUE ROD, TAPERED SLEEVE & 1.5 INCH TORQUE NUT



Torque Nut with 6 Jackbolts

1. The jackbolt threads, tapered portion of the rod bolt and the expansion sleeve ID are prelubricated with graphite lube. Ensure that this lube is present. Apply additional lube



NOTE:
The line-up marks that are used to locate the gauge, component and shaft are in identical positions for "HOT" or "COLD" measurements.

3. Mount the pinion, brake drum or coupling cold by placing it on the shaft and snapping it into position by hand. Measure the "cold" position of the pinion, brake drum or coupling using a micrometer depth gauge. The following figure illustrates the method of using the depth gauge.

   Mark the places where the depth gauge was resting so measurements can be made from the same position after the pinion, brake drum or coupling has been mounted.

4. Remove the pinion, brake drum or coupling from the shaft and heat it in a suitable oven to the temperature specified. If the pinion, brake drum or coupling is heated in oil, the bore must be thoroughly cleaned before mounting. To avoid the cleaning, the use of an oven is recommended.

CAUTION:Use suitable protective equipment when handling hot items.

The pinion, brake drum or coupling temperature is indicated as a temperature difference between the shaft and pinion; this temperature difference is estimated only and can be adjusted to maintain the specified advance. Heat the pinion, brake drum or coupling in the oven until the temperature is uniform at the required number of degrees above the shaft temperature. For example, if the shaft temperature is 25°C (77°F) and the estimated difference is 125°C (225°F), heat the pinion, brake drum or coupling to 150°C (320°F) for mounting.

WARNING: Pinion, brake drum or coupling temperature must never exceed 190°C (374°F).

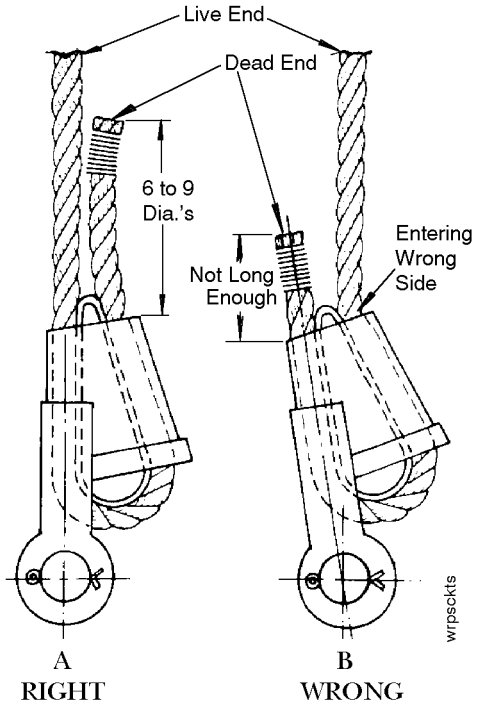
WELDING PROCEDURE

1. Refer to the previous butter-welding figures. The purpose of the butter weld layer is to provide a buffer between the weld required to fill the groove and the alloy cast steel. This technique is essential in preventing heat affected zone cracking in the cast steel which otherwise is likely to occur due to the shrinkage of the weld as the groove is filled. Butter welding permits the repair weld to be made at the preheat temperatures specified. Much higher temperature would otherwise be required for crack free welding.
2. Butter welding is done using 1/8 inch diameter E11018-M electrodes at a minimum preheat temperature of 250°F (121°C). (See section under *WELDING ELECTRODES* regarding use of the electrode drying oven.) Horizontal weld beads are applied to completely cover the cavity or surface to be welded. The edges of the butter weld must overlap the adjacent surface about 1/2 inch. This is to prevent subsequent welding from impinging upon the cast steel.
3. Before starting the butter weld, position a piece of thin mild steel plate under the bottom end of the tooth. This is to provide a shelf for starting the weld and to avoid irregular weld beads at the bottom which would become stress risers to cause cracking when the tooth is loaded in service.
4. Apply the butter weld, progressing with horizontal beads from bottom to top. Use care to keep the butter weld layer as smooth and regular as possible. When finished, remove all slag and grind any high spot which could trap slag when welding to fill the groove. In the case of repairing a broken tooth the prepared tooth segment is butter welded separately before positioning for final welding in place.
5. Filling the groove is done with 1/8 inch or 5/32 inch E11018-M electrodes at a minimum preheat temperature of 175°F (79°C). (See section under *WELDING ELECTRODES* regarding the use of the electrode drying oven.) Weld vertically up using a split layer technique as soon as the groove is wide enough to accommodate 2 or more beads. Refer to the butter-weld figures for the approximate weld bead sequence.
6. For replacing a tooth segment as shown, it will be necessary to prepare a tooth profile template. The template must be carefully made to fit the rack teeth as accurately as possible. Use the template to position the tooth segment prior to tack welding. When welding the tooth segment in place alternate welding from side to side to control distortion. Check frequently with the template.
7. When groove welding is finished check carefully for low spots and fill in as required. Grind the weld smooth and flush with the adjacent tooth surfaces. Use the tooth profile template to check grinding of a welded-on tooth segment. Grinding of the radius at the root of the tooth is very important. Avoid any nicks, gouges or grinding marks in a vertical direction. Grind a smooth radius using small diameter (peanut) grinders. Failure to achieve a smooth, notch-free radius may result in future cracking at the root of the tooth.
8. After the swing rack has cooled to ambient temperature, dye-penetrant test the repaired tooth for soundness.

WEDGE SOCKETS

One of the more popular field end attachments for wire rope is the wedge socket. Attachment and the dismantling of this device is both easy and simple.

1. Inspect the wedge and socket; remove all rough edges/ burrs that might damage the rope.



2. Welded ends of the rope should be cut off prior to assembly. This will allow the rope strands to distort slightly as they bend sharply around the wedge. If the welded end were not removed the minimal sliding of the strands would be restricted and evidenced further up the rope. This may result in the development of high strands, wavy rope and uneven loading.
3. Place the socket in an upright position and bring the rope around it in a large, easy to handle loop. Care must be taken to make certain that the live-loaded-side of the rope is in line with the ears.
4. The dead end of the rope should extend from the socket for a distance of six to nine times the rope diameter. The wedge is now placed in the socket.
5. Secure the socket and carefully apply a gradually increasing load to the live side of the rope in order to pull the wedge into position. Only tension sufficiently to hold the pieces in place.
6. After checking alignment increase the load GRADUALLY until the wedge is properly seated.

IMPORTANT! Avoid sudden shock loads.

This is the recommended procedure. If variations are made to suit special conditions, they should be carefully evaluated beforehand.