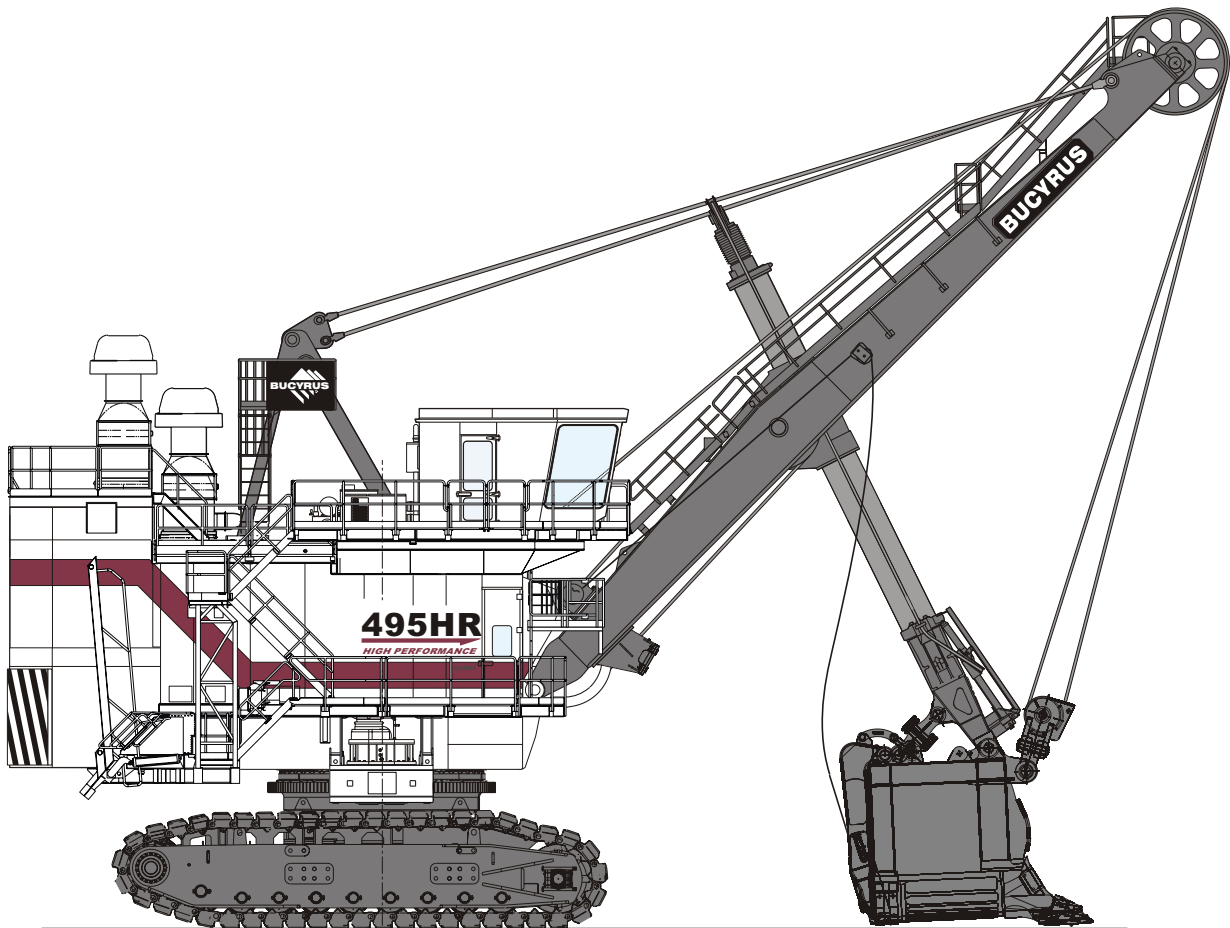




# 495HR MINING SHOVEL MAINTENANCE and OPERATION MANUAL

SN: 141234

Manual No. 10520



141234ms.cdr Pg.1

**Bucyrus International, Inc.**

1100 Milwaukee Ave. • P.O.Box 500 • South Milwaukee, Wisconsin 53172-0500 USA

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## SAFETY - SWINGING RESTRAINT & BALLAST BOX SUPPORT

### BALLAST BOX SUPPORT

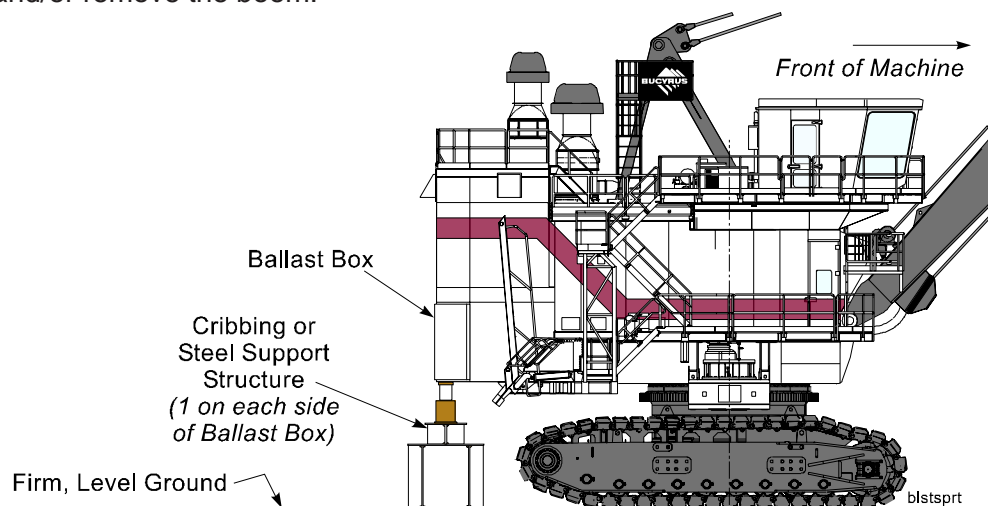
Before performing any maintenance on the mining shovel, it should be resting on a firm, level surface.

**Any mining shovel field work that requires the removal or lowering of the boom must incorporate additional support of the ballast box.** The supports may be wooden cribbing or steel structures. Two supports positioned side-by-side on level ground are recommended. These supports are intended to accept vertical loads only. To prevent machine rotation use the swing brakes, cable stays, welded ties, etc. Refer to "SWING RESTRAINT" below.

When electric-powered, cable-style mining shovels are properly ballasted and operational, the center of gravity for the machine's upper works lies within the roller circle area. This assumes that the boom is attached to the machine and in its elevated, working position. As such, the machine should not be prone to tipping.

Boom removal or lowering will cause the center of gravity to shift toward the ballast box, decreasing machine stability. Stability is further dependent on the orientation of the upper works relative to the undercarriage. The machine may tip more easily over one of the four quadrants of the crawler mounting than it may over others.

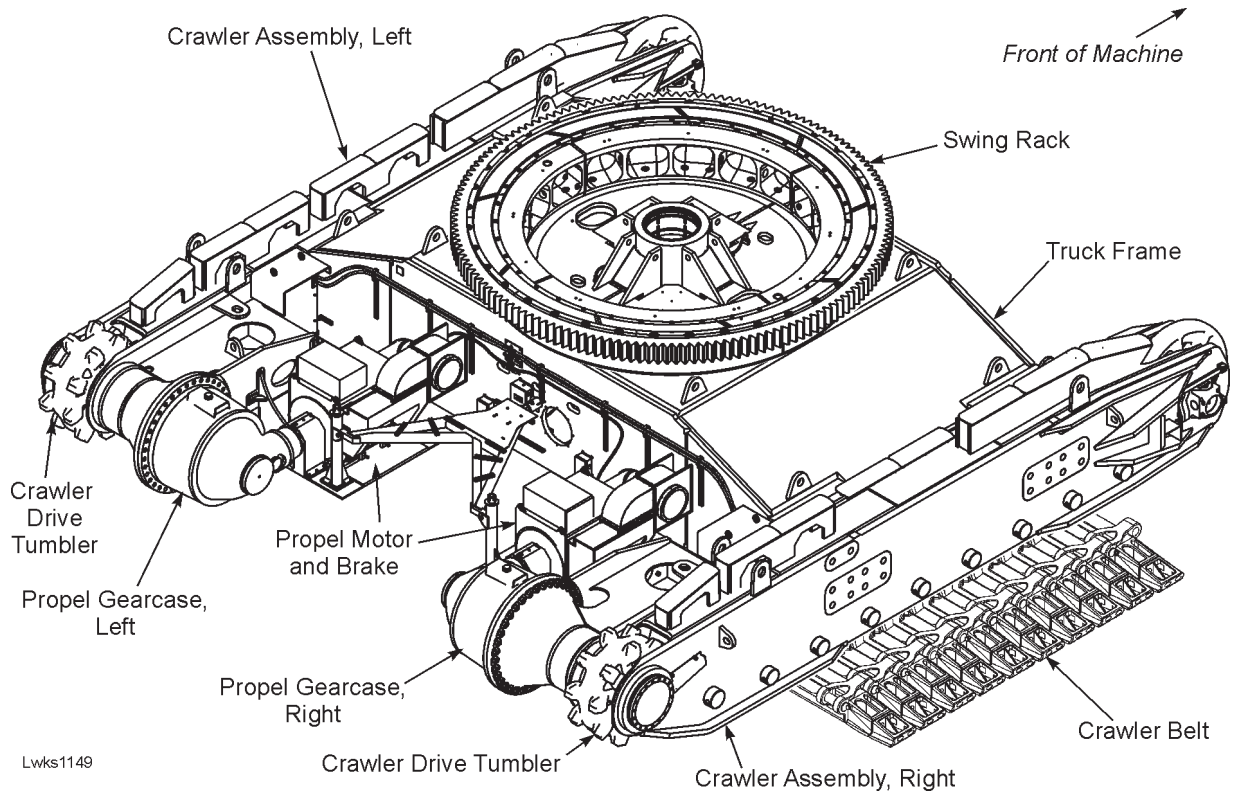
Normally the machine is more likely to tip over the rear-most lower-roller than over the side of a crawler. Therefore, with the boom removed and the ballast box sitting over the rear of the crawlers, the machine may be unstable. Because ballast quantities differ from machine to machine and model to model, it is recommended that the ballast box be supported *before* beginning any procedure to lower and/or remove the boom.





### LOWER WORKS

The lower works is comprised of the truck frame, right and left crawler frames, crawler belts, propel machinery, swing rack and roller circle.



Lwks1149

*Truck Frame and Crawlers*

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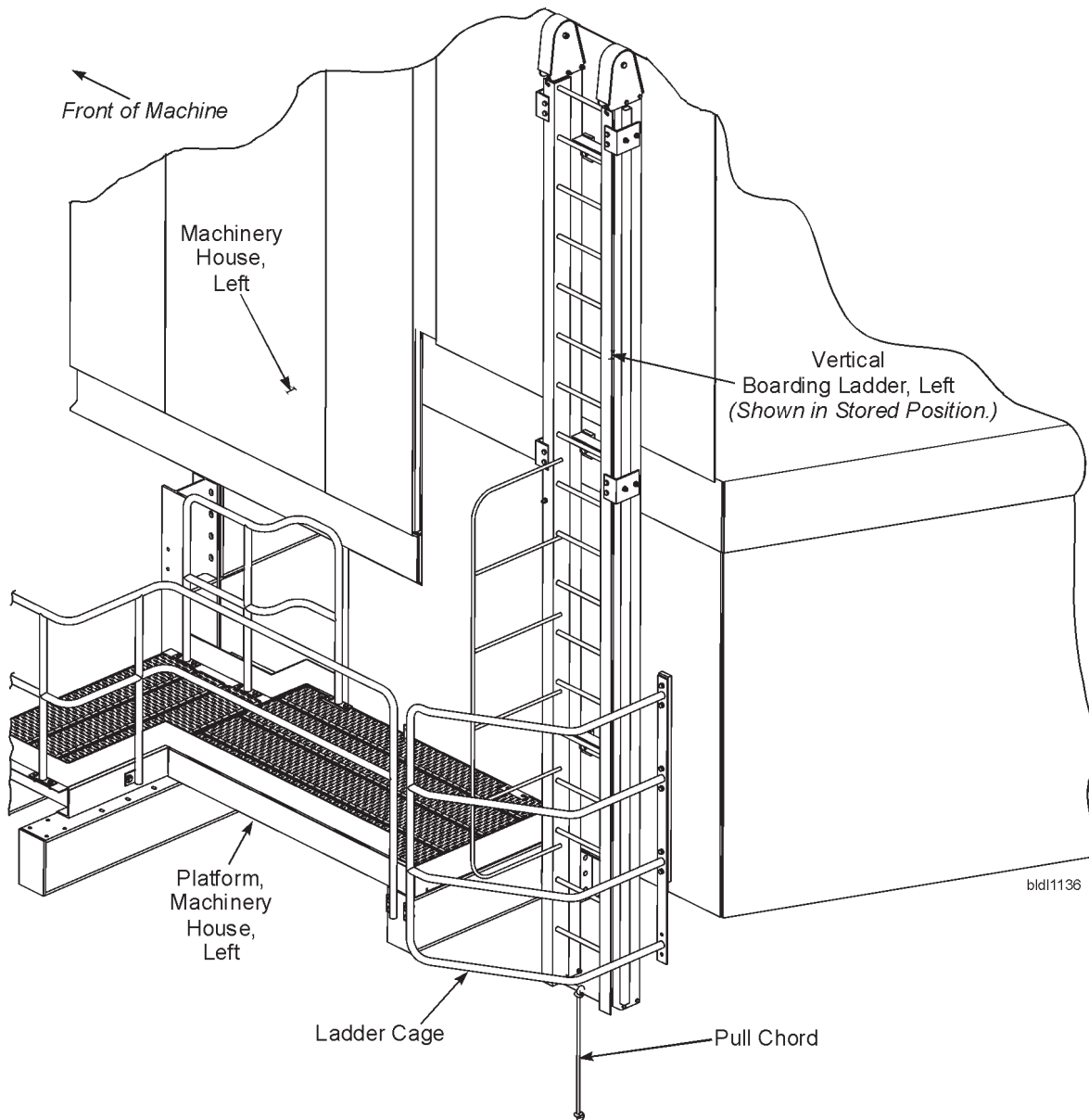
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## VERTICAL BOARDING LADDER

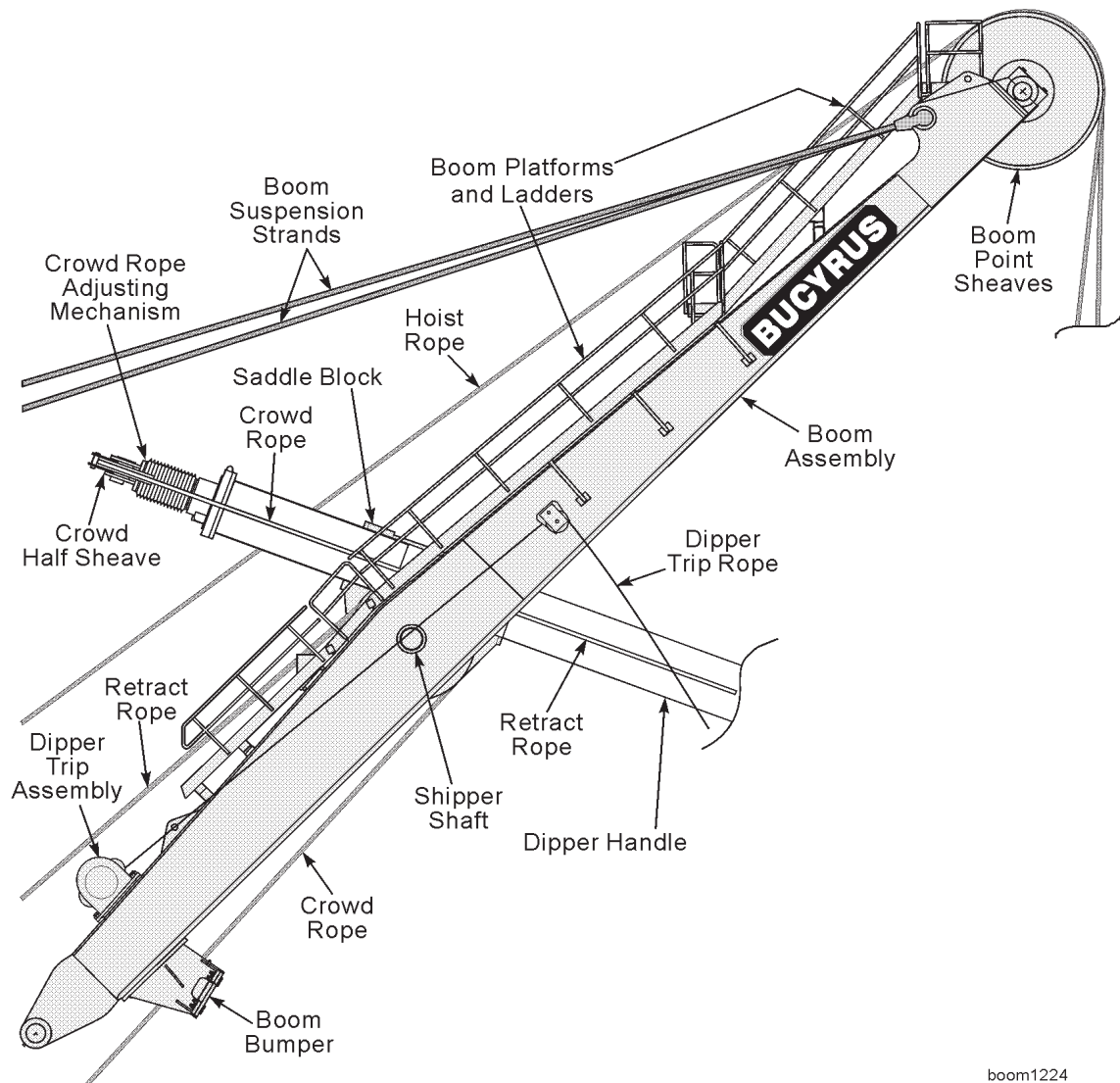


The vertical boarding ladder is one of the means for boarding the machine and is located on the left side of the machine, at the rear of the machinery house. Use the pull chord from ground level to lower the ladder. This ladder must be in their raised and latched position to enable the operator's controls.



## BOOM

The boom is a welded steel structure consisting of twin box girders integrally connected at the boom point and in the lower section between the shipper shaft and boom feet. Impact resistant steel is utilized, coupled with 100% penetration and UT quality welds on all main splice joints. Design optimization has resulted in heavier outside skin plates, minimizing the need for internal diaphragms. This reduction in weld related stress concentrations further enhances structural life. Open manholes have been incorporated in the boom as a standard feature permitting periodic structural inspection. Integral "ladders" within the upper boom sections permit internal access without lowering the boom.



*Boom Assembly*

boom1224

The boom is supported by four pre-stressed suspension (structural) strands attached to equalizer links on the A-frame. These inherent long life structural strands carry the working loads of the front end equipment. A boom limit switch with soft setdown prevents boom jacking shock loads.

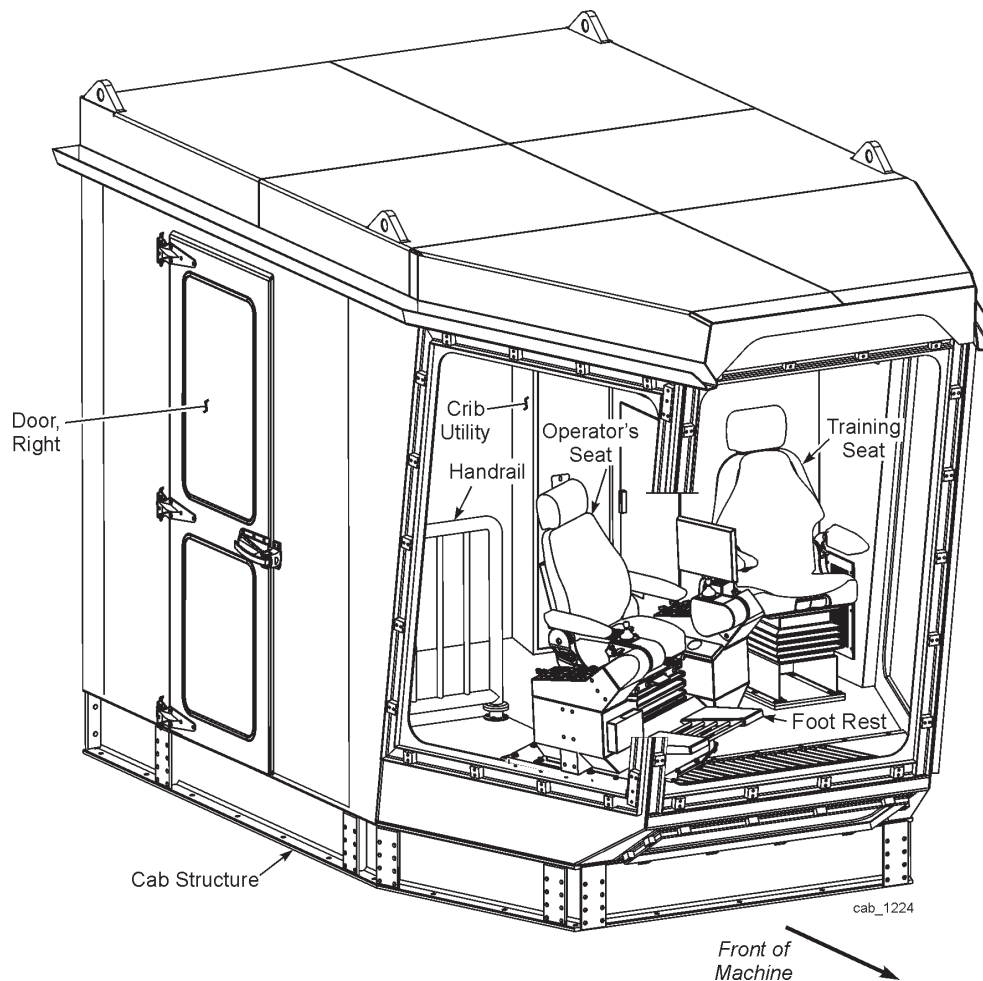


	<i>Quantity</i>	<i>Weight Each</i> <i>(U.S. Pounds)</i>
<b>Upper Works (Cont.)</b>		
Air Swivel .....	1	150
Front Swivel Housing .....	1	150
Rear Swivel Housing .....	1	150
Collector Ring Assembly .....	1	230
Hoist Planetary Gearcase .....	1	35,500
Hoist Pinion (Shaft Pinion) .....	2	1,650
Hoist Pinion Bearing Carrier .....	2	460
Hoist Machinery Guard - Bottom .....	1	2,000
Hoist Machinery Guard - Rear .....	1	940
Hoist Machinery Guard - Front .....	1	1,300
Hoist Machinery Guard w/Cover .....	1	200
Hoist Bearing Housing .....	2	3,200
Hoist Drum .....	1	27,000
Hoist Spider .....	1	16,000
Hoist Drum Gear .....	1	11,000
Hoist Pedestal - R. H. ....	1	8,400
Hoist Pedestal - L. H. ....	1	8,700
Hoist Oil Cooler .....	2	2,650
Hoist Motor .....	1	15,000
Hoist Brake .....	1	1,350
Hoist Brake Adapter .....	1	500
Hoist Brake Hub .....	1	210
Hoist Float Shaft Gear Coupling .....	1	1,440
Floating Shaft Assy Coupling .....	1	940
Hoist Elastometric Coupling .....	1	600
Hoist Motor Coupling Guards .....	2	240
Boarding Stairs - R. H. ....	1	5,300
Machinery House Filter Assembly .....	2	1,350
Elect Room Filter Assembly .....	1	1,350
Revolving Frame .....	1	162,500

- Consider all lines to be power lines and treat all power lines as energized even though it is known that the power is shut off and the line is visibly grounded.
- Slow down the operating cycle. Reaction time may be too slow and distances may be misjudged.
- Caution all ground personnel to stand clear of the machine at all times.
- Use a signal person to guide the machine into close quarters. The sole responsibility of the signal person is to observe the approach of the machine to the power line. The signal person must be in direct communication with the operator and the operator must pay close attention to the signals.



**DANGER: HIGH VOLTAGE!** Death or injury could result should any part of the machine approach the minimum distance of an energized power line specified by local, state and federal regulations.



This machine is equipped with three remote cameras mounted on the exterior of the machine. Three monitors are mounted inside the operator's cab.



### EARTH CONTINUITY LOCKOUT PUSHBUTTON

The earth continuity lockout pushbutton is used to trip the breaker that supplies power to the machine. When the machine is operating, this pushbutton should be used to shutdown the machine only when removal of power to the machine is required.

Actuation of this pushbutton when motions are running will cause all motions to automatically electrically brake to a stop and, when the motion speed has reached less than 5% speed, set all mechanical brakes. If the motions are already stopped, the brakes will be set and power is removed immediately. A similar switch is located on the front panel of the PLC control cabinet that can be used during testing of the machine.



**DANGER: THE OPERATOR SHOULD NEVER LEAVE THE OPERATOR'S SEAT BEFORE PRESSING THE CONTROL STOP PUSHBUTTON. Setting only the mechanical brakes with individual switches in not a sufficient safeguard to prevent machine damage and/or personnel hazards.**

### SEAT POSITION

A selector switch used to move the operator's seat and consoles forward or back. The seat will continue to move as long as the switch is held, or until the end of the seat's travel is reached.

### RADIO/CASSETTE/CD

A quality AM/FM Radio with cassette and CD player for the operator's use and connected to speakers in the operator's cab.

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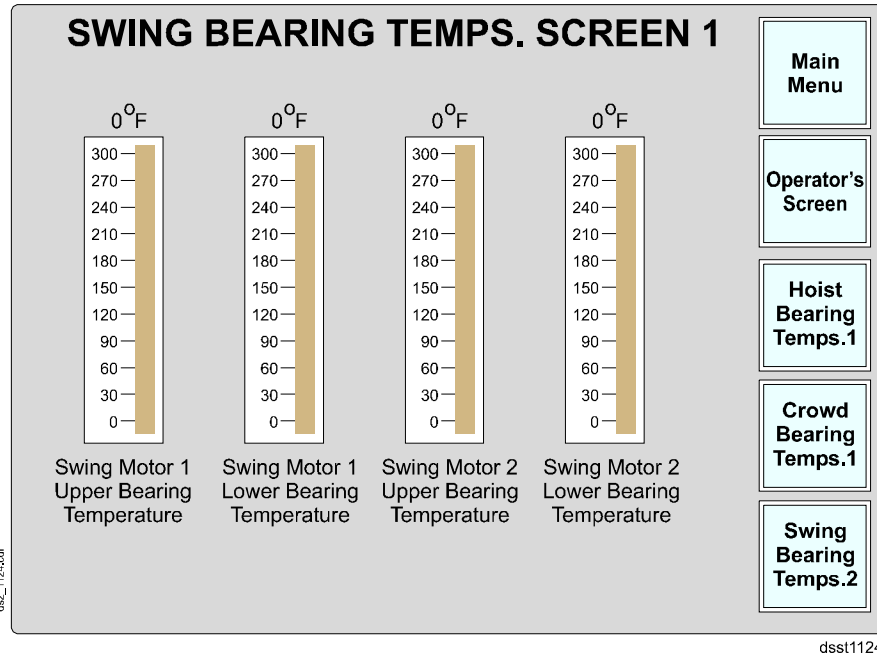
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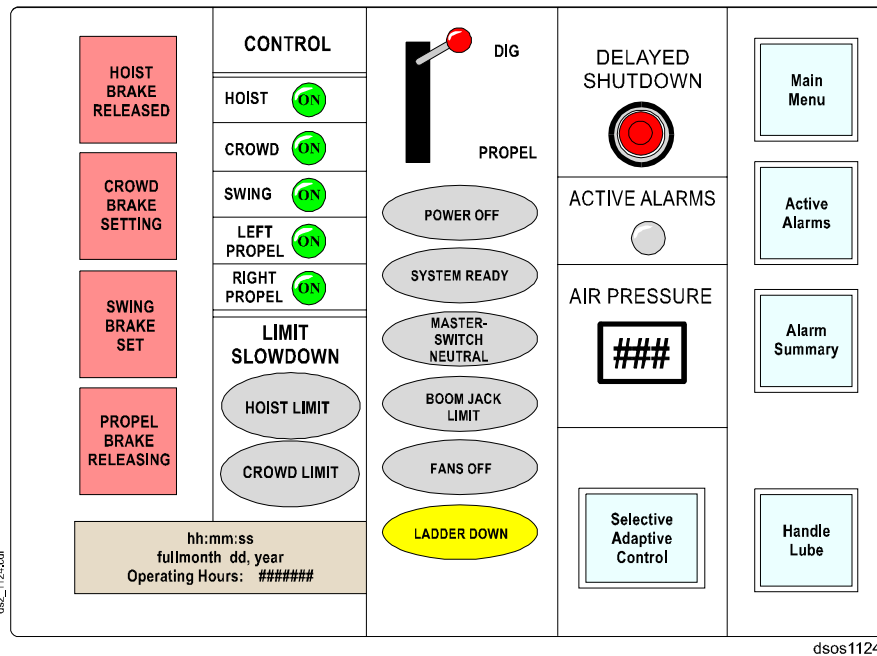
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Typical Bearing Temperature Screen



Operator's Screen

The Operator's Screen is the primary operational information tool to be visible to the machine operator during daily use of this machine. The controls available on this screen will provide the operator with the information needed to view "at a glance" the status of items required for digging and make changes in control settings.



2. For a boom jacking fault, ALL motions will stop but the controls will remain active. Reversing the crowd master switch will remove the fault and allow continued operation.
3. If the boarding ladder and/or stairs are pulled down while the machine is in operation, an alarm message will be sent to the operator, and swing and propel motions will be shut down. The hoist and crowd motions will remain active.

Once the ladder and/or stairs are back in position, the motions may be restarted by pressing the control reset pushbutton.

4. For most other faults, the machine will be shut down and brakes set. In these situations, the controls cannot be reset until the fault has been corrected by an electrician.

## **MACHINE OPERATION**

Efficient operation is essentially the result of understanding and applying the basic techniques related to each machine motion, to achieve fast, smooth and safe load cycles. The interrelated coordination of the hoist, swing and crowd motions results in efficient machine operation.

Each motion is described in the following paragraphs. The operator should thoroughly learn each motion, its purpose and how this knowledge can be applied in becoming a better operator.

When learning to handle the controls, be sure that all personnel are clear of the machine and that there is ample clearance with no danger spots around the machine such as culverts, ditches, embankments, and that the machine is not too close to the digging face or overhanging ledge and large rocks.

Use the operator's display in the operator's cab to assist in the operation of the machine. The monitor allows a large number of messages to be sent to the operator from all portions of the control system. These messages fit into four basic categories:

1. Normal routine operational messages.
2. Alarm only.
3. Delayed shutdown messages.
4. Immediate faults and shutdowns.

This display also allows the setting of certain operating parameters for the machine. Refer to separate manual for the operation of the display as the proper use of the monitor messages is essential for the operation of the machine.

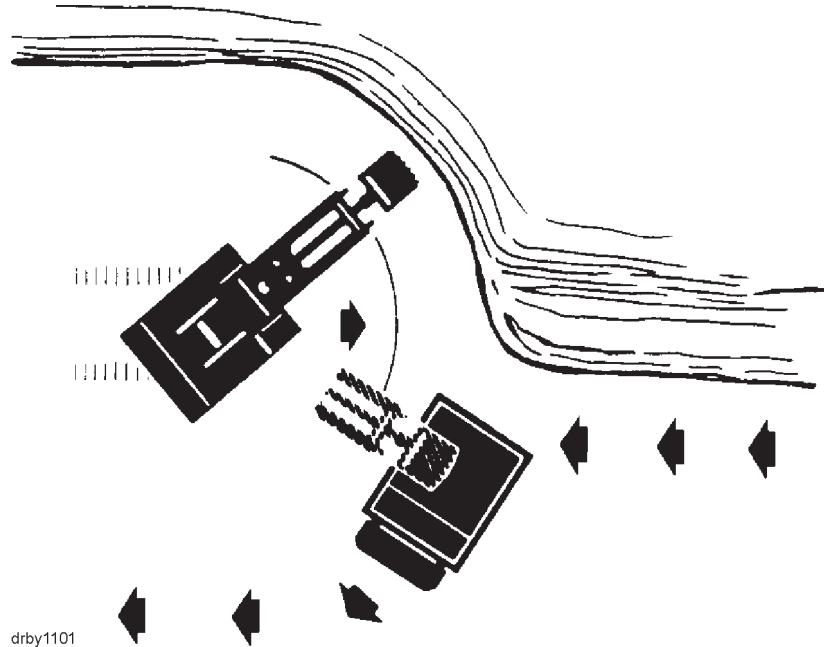


**DRIVE-BY METHOD**

*NOTE:* If the machine and haulage units cannot be set up as described below, the drive-by method should be avoided.

Position the machine crawlers parallel to the bank with the inside edge of the outer set of crawler tracks directly in line with the bank toe.

The trucks must approach the machine from the front making a turn away from the machine as the front wheel approaches the outside crawler. The truck should stop in a position to allow backing toward the point of the bank for loading.



During the load cycle, the swing arc should not exceed 90°. The time between finishing one truck to the first digging cycle of the next should not exceed that of any cycle during a load.

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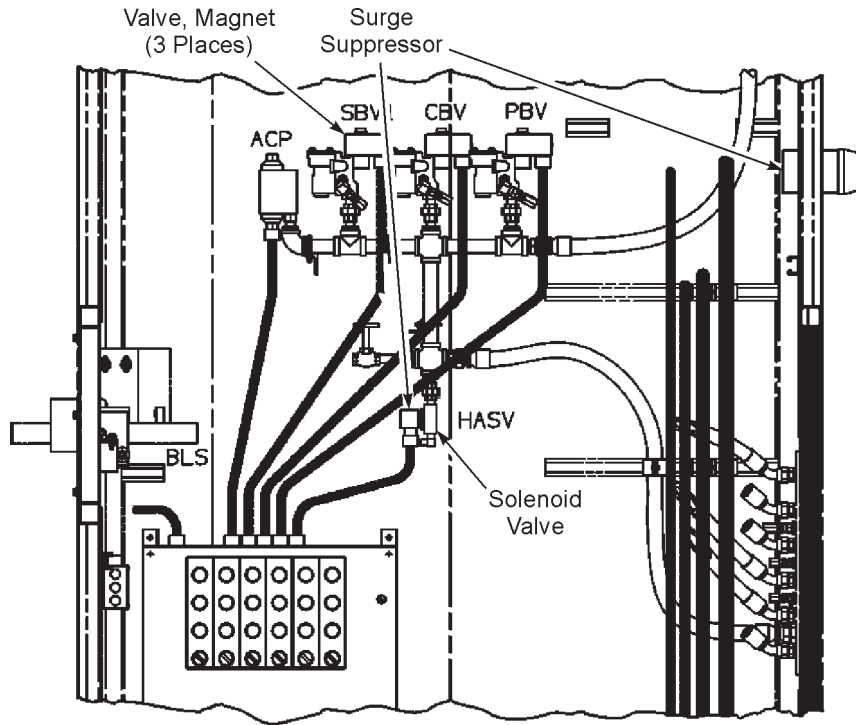
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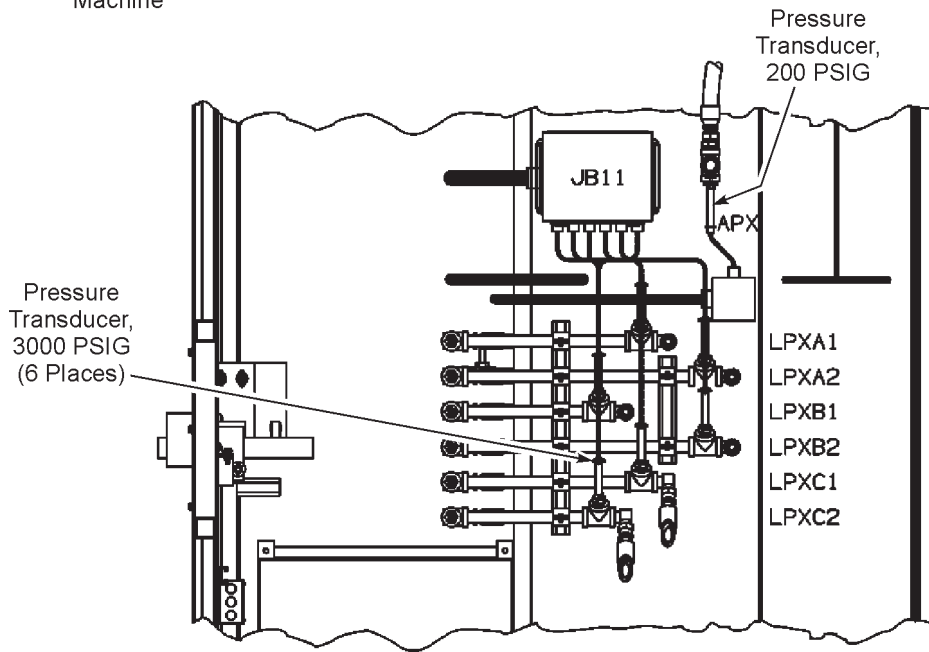
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VIEW A-A

←  
Front  
of  
Machine



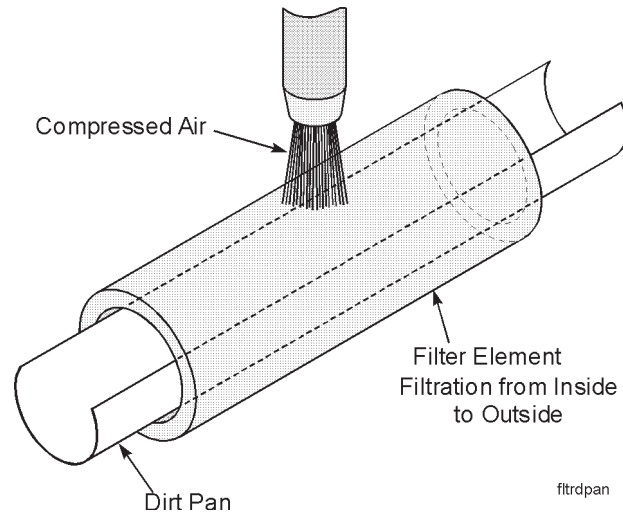
lubh1231

VIEW B-B

## FILTER ELEMENT CLEANING

The oil filter for the hoist planetary gearcase oil cooler has a removable, wire mesh filter element that can be cleaned and reused several times. *Use the following method:*

1. Clean any coarse dirt from the pressure side of the element with normal cleaning solvents and a smooth bristled brush (not a wire brush). This process can be done under a jet-stream, not a bath, to help prevent the removed particles from reaching the clean side of the element.
2. After cleaning, use compressed air to blow through the element from the clean side. **Filter elements which are filtered from inside to outside must use a dirt pan as shown in the figure.**
3. Next dip the cleaned element in cleaning fluid to pick up any remaining dirt particles. Use compressed air to blow out the element as in step 2 above.
4. Repeat the above steps until all dirt particles have been removed from the filter element.



### NOTES:

- Handle the mesh of the element carefully to avoid damage through improper handling.
- The filter element cannot be 100% cleaned. Therefore, the element should be cleaned a maximum of 3 times then discarded.
- Filter seals should be inspected and replaced as required during filter cleaning and maintenance.



**MPO - MULTIPURPOSE OIL**

*SCOPE:* Lubricant performance requirements for Multi-Purpose Oil.

*APPLICATION:* The addition of a lubricant to the compressed air system (not for screw-type air compressor systems - see ACSL), hand oil cans, etc.

*GENERAL REQUIREMENTS:*

- 1. Must be fluid at temperature applied.
- 2. Should contain rust inhibitor.
- 3. Motor oil - API service classification "MS".

*VISCOSITY RECOMMENDATIONS:*

- 1. Air Line Lubricant

AMBIENT TEMPERATURE	SAE NUMBER
Below 10°F	5W
Above 10°F	10W

- 2. Hand Oil Can - Viscosity suitable for application and temperature.

*NOTE:* These performance requirements are benchmarks and not a specification. Therefore, meeting these limits as described above does not relieve the supplier of the responsibility associated with brand name products.

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Bucyrus International, Inc.



**SPECIFICATION FOR  
MPG – MULTI-PURPOSE GREASE  
SD4711** (August 18, 2005)

PROPERTY	REFERENCE	REQUIREMENT
Pressure Oil Separation	The Lubrication Engineers Manual (United States Steel).	U.S. Steel test method - Cake penetration not less than 25% of grease penetration.
Grease Mobility	The Lubrication Engineers Manual (United States Steel).	U.S. Steel method - not less than 0.10 grams flow per second at the lowest anticipated ambient temperature. (Testing temperature not less than -34°C/-30°F).
Pumpability, Lincoln Ventmeter	The Lubrication Engineers Manual (United States Steel).	To vent from 1800 psi (127 kgf/cm <sup>2</sup> ) to less than or equal to 600 psi (42 kgf/cm <sup>2</sup> ) within 30 seconds at the lowest anticipated ambient temperature (Testing temperature not less than -25°C/-13°F).
Lubricating Solids (Molybdenum Disulfide, Graphite, Etc.) % by Weight		Less than or equal to 5%
Lubricating Solids (Molybdenum Disulfide, Graphite, Etc.) Particle Size, (Microns, max.)		10 Microns

## NOTES:

1. Ambient Temperature - The ambient temperature shall be the temperature at the point of lubricant application.
2. Low Temperature Grease - For extended use in low temperature (-12°C to -46°C / +10°F to -50°F) areas, this product should be capable of slumping in containers and should be pumpable through lube lines without the aid of heat tracing. This product should meet the Mobility and Pump-ability criteria for the lowest anticipated ambient temperature. In order to minimize compatibility problems, it is desirable that the thickener and additive system be compatible with the additional grades that are suitable for the other ambient temperatures.

Bucyrus International, Inc.

**CERTIFIED LUBRICANTS LISTING  
(January 22, 2007)**



**CERTIFIED LUBRICANT LISTING FOR "DRAGLINE ENCLOSED GEARCASE  
LUBRICANT (SD4721 Part A)"**

**Mineral Oils**

<b>Manufacturer</b>	<b>Product Description</b>
Bel Ray	100 Gear Oil 140 (ISO VG 460)
Bel Ray	100 Gear Oil 250 (ISO VG 1000)
Bel Ray	100 Gear Oil 350 (ISO VG 1500)
Bel Ray	100 Gear Oil 460 SBF (ISO VG 460)
Bel Ray	100 Gear Oil 1000 SBF (ISO VG 1000)
Bel Ray	100 Gear Oil 1500 SBF (ISO VG 1500)
Exxon / Esso	Spartan EP 460 (ISO VG 460)
Exxon / Esso	Spartan EP 1000 (ISO VG 1000)
Lubritene	Lubrene Syn 1500 (ISO VG 1500)
Lubritene	Lubrene Super Series Gear Oil 1500 (ISO VG 1500)
Lubritene	Lubrene Super Series Gear Oil 1000 (ISO VG 1000)
Mobil	Mobilgear 600XP 460 (ISO VG 460)
Mobil	Mobilgear 634 (ISO VG 460)
Mobil	Mobilgear XMP 460 (ISO VG 460)
Mobil	Mobilgear 639 (ISO VG 1000)
Petro-Canada	Ultima 460 (ISO VG 460)
Petro-Canada	Ultima 1000 (ISO VG 1000)
Schaeffer Mfg.	#209A Universal Gear Lube (ISO VG 460)
Schaeffer Mfg.	#209A Universal Gear Lube (ISO VG 1000)
Schaeffer Mfg.	#294 Supreme Gear Lube (ISO VG 460)
Schaeffer Mfg.	#294A Supreme Gear Lube No Tack (ISO VG 460)
Shell	Omala 460 (ISO VG 460)
Shell	Omala 1000 (ISO VG 1000)
Shell	Omala 1500 (ISO VG 1500)
Shell	SP Plus Gear Oil (ISO VG 1500)
Talcor	Gear Oil EP (ISO VG 1000)
Whitmore Mfg. Co.	Paragon Heavy Duty Enclosed Gear Oil (ISO VG 460)
Whitmore Mfg. Co.	Paragon Heavy Duty Enclosed Gear Oil (ISO VG 1000)
Whitmore Mfg. Co.	Paragon Heavy Duty Enclosed Gear Oil (ISO VG 1500)
Whitmore Mfg. Co.	Paragon Gold High Performance Gear Oil (ISO VG 1000)

**Synthetic (PAO) Oils**

<b>Manufacturer</b>	<b>Product Description</b>
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)



## 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 be removed only 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.**

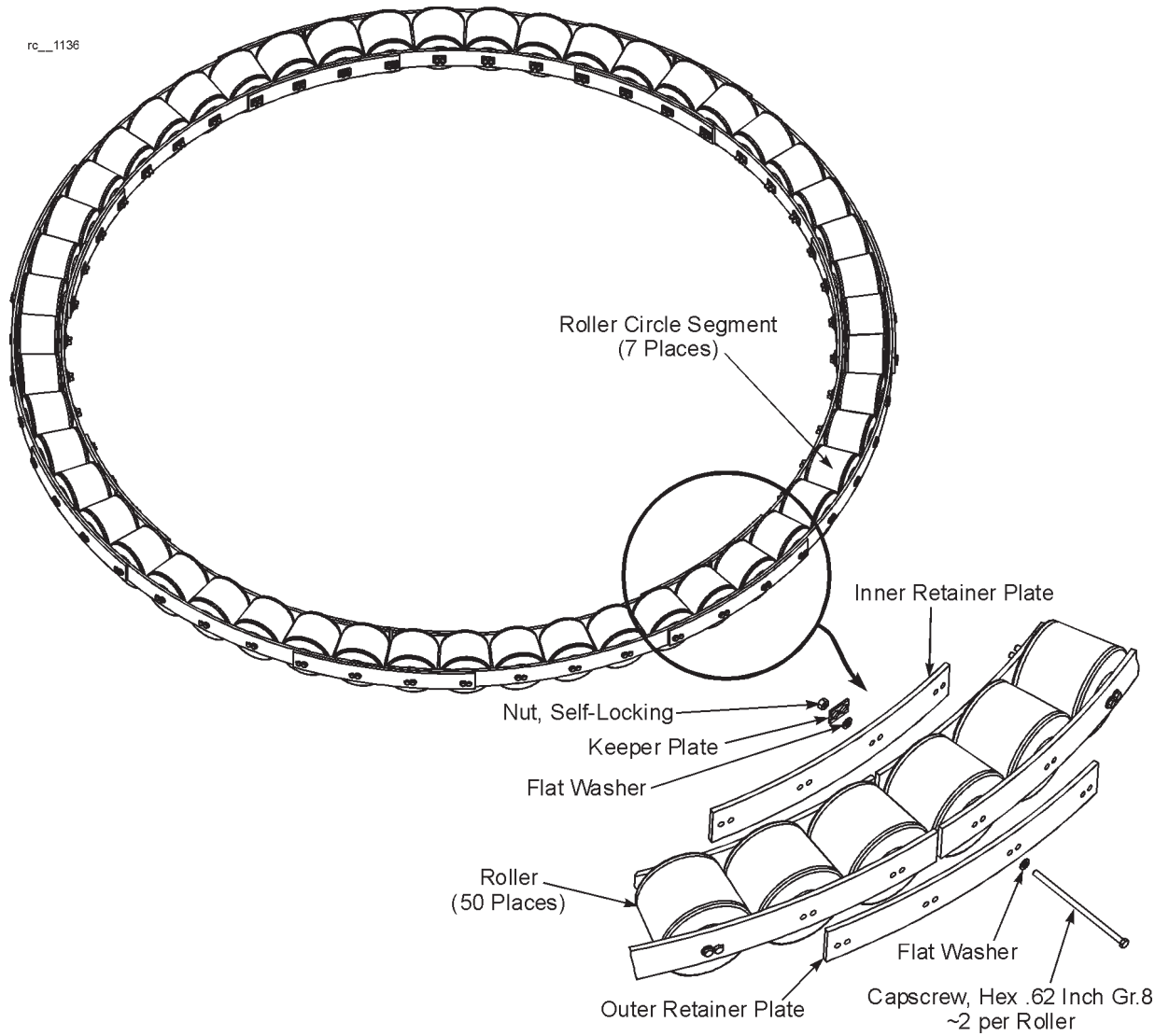
While performing maintenance, the awkward positions assumed and the handling of heavy parts often increases the possibility of injuries. As a precautionary measure, use mechanical handling equipment whenever possible. The mining foreman can facilitate safer and easier maintenance work by providing blocking 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.**



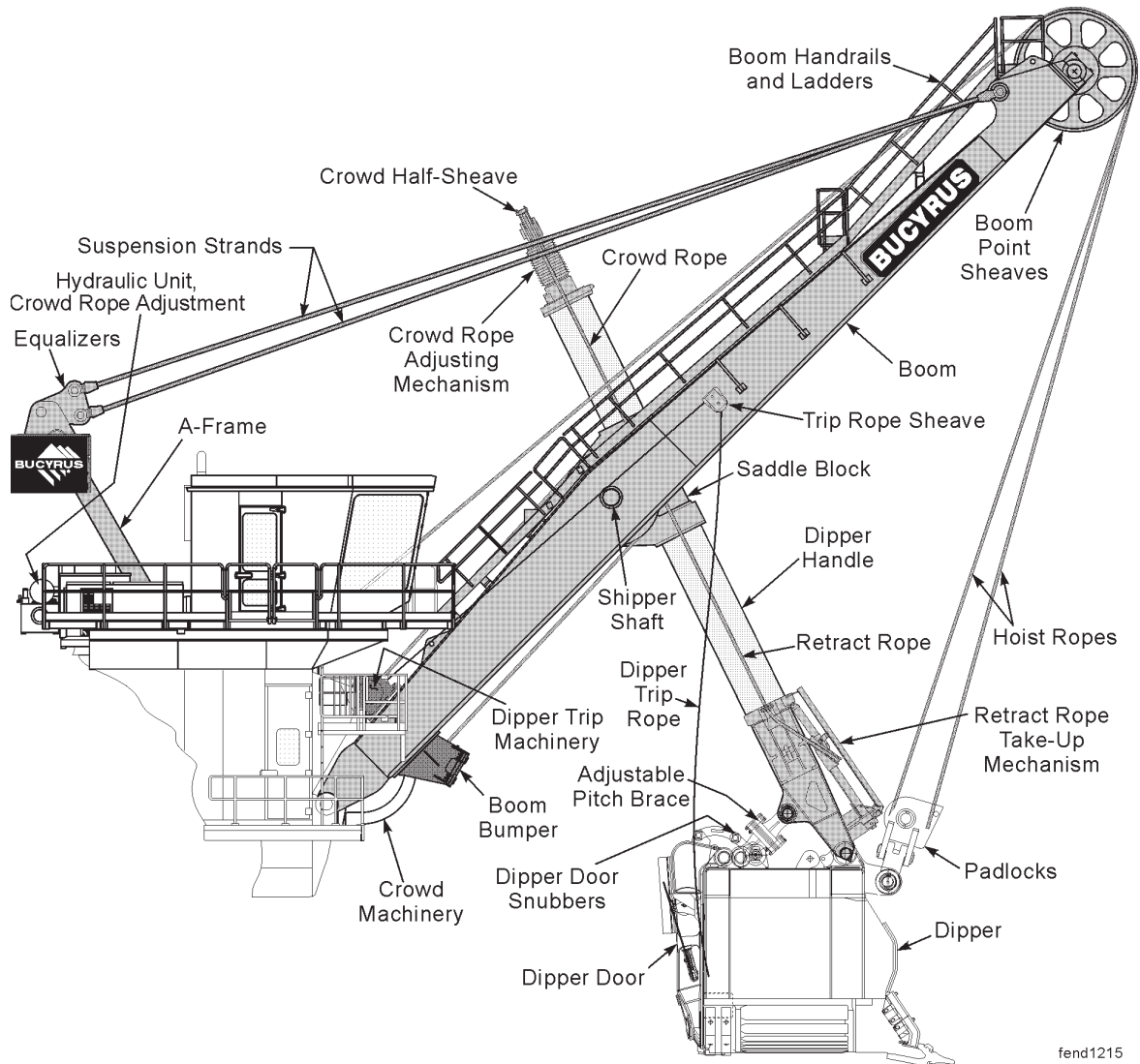




*Roller Circle Assembly*



495HR Electric Mining Shovel



fend1215

Front End Equipment



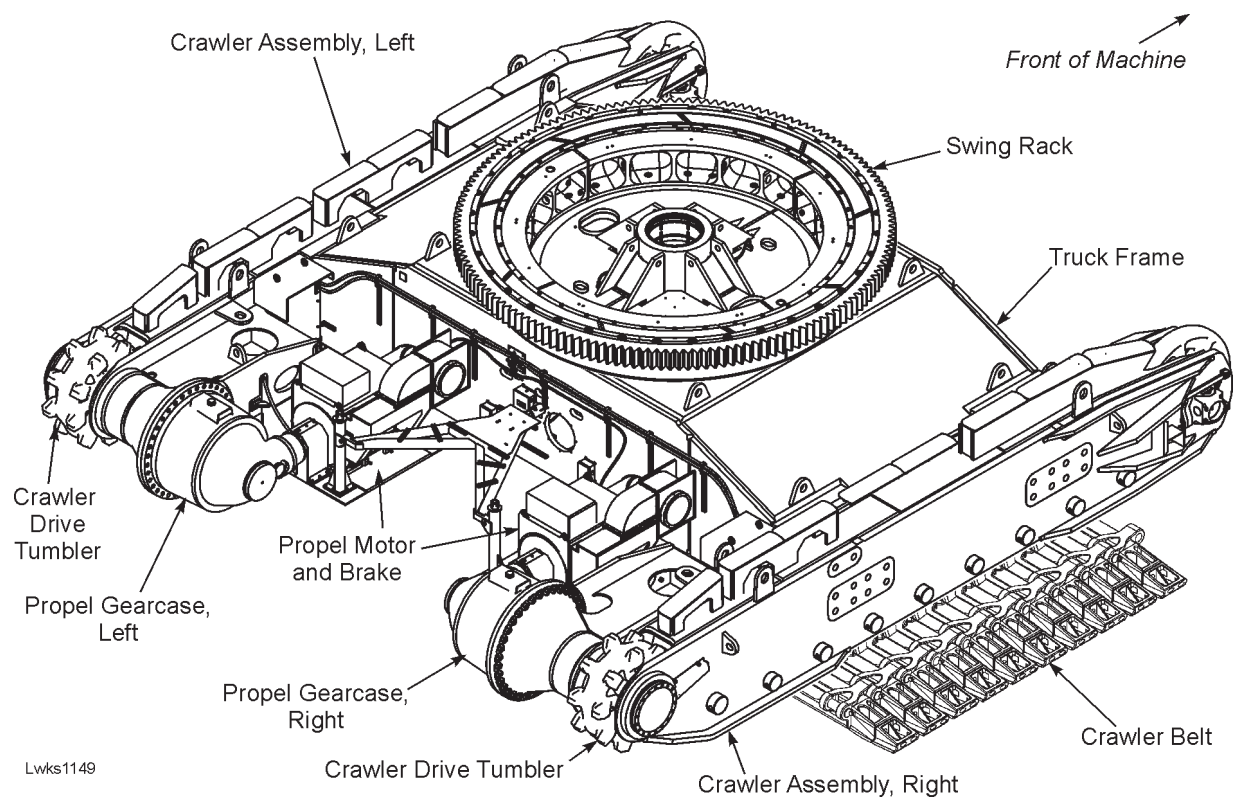
## Section **5**

### Service Procedures

#### LOWER WORKS

#### TRUCK FRAME ASSEMBLY

The *TRUCK FRAME* assembly consists of the bolt-on crawler assemblies with belts, truck frame structure, propel motors and planetary gearcases, center pintle, roller circle, swing rack and lower roller circle rails.



*Truck Frame and Crawlers Assembly*

The Truck Frame is the primary support structure for the machine. The two bolt-on crawler side frames each have a propel motor and planetary gearcase. This assembly provides the operator complete independent control of each crawler.

Both the Truck Frame and crawler structures should be inspected during each preventative maintenance period for areas of distress. If cracks are found in any of the structural welds or plates these should be repaired during the next scheduled maintenance period.



*Reassembly is the reverse of disassembly:*

- a. The diameter of the new roller must be within  $\pm.001$  inch of adjacent rollers. Measure the diameter of its adjacent rollers and grind the new roller(s) to match.
- b. Coat the nylatron bushing, thrust washer and bore of the roller with a winter grade of MPG
- c. With the roller seated against the thrust rail, the gap between the thrust washer and roller is to be .12 inch nominal. Refer to "Roller Circle Adjustment Procedure" above.
- d. Tighten the capscrews to 210 Ft.Lbs.

## **CRAWLER BELTS**

The Crawler Belts contact the ground and transfer the entire weight of the machine from the truck frame to the ground. Each belt is an endless shoe assembly that is moved by the propel machinery around the crawler side frame. One belt on each crawler consists of **47** cast alloy steel, non-cleated, double-pin connected shoes. The pins are retained in the shoes by lock bolts.

All the shoes assemble into the belt so that the male lugs on each shoe are toward the front of the machine when the shoe is on the bottom of the crawler frame.

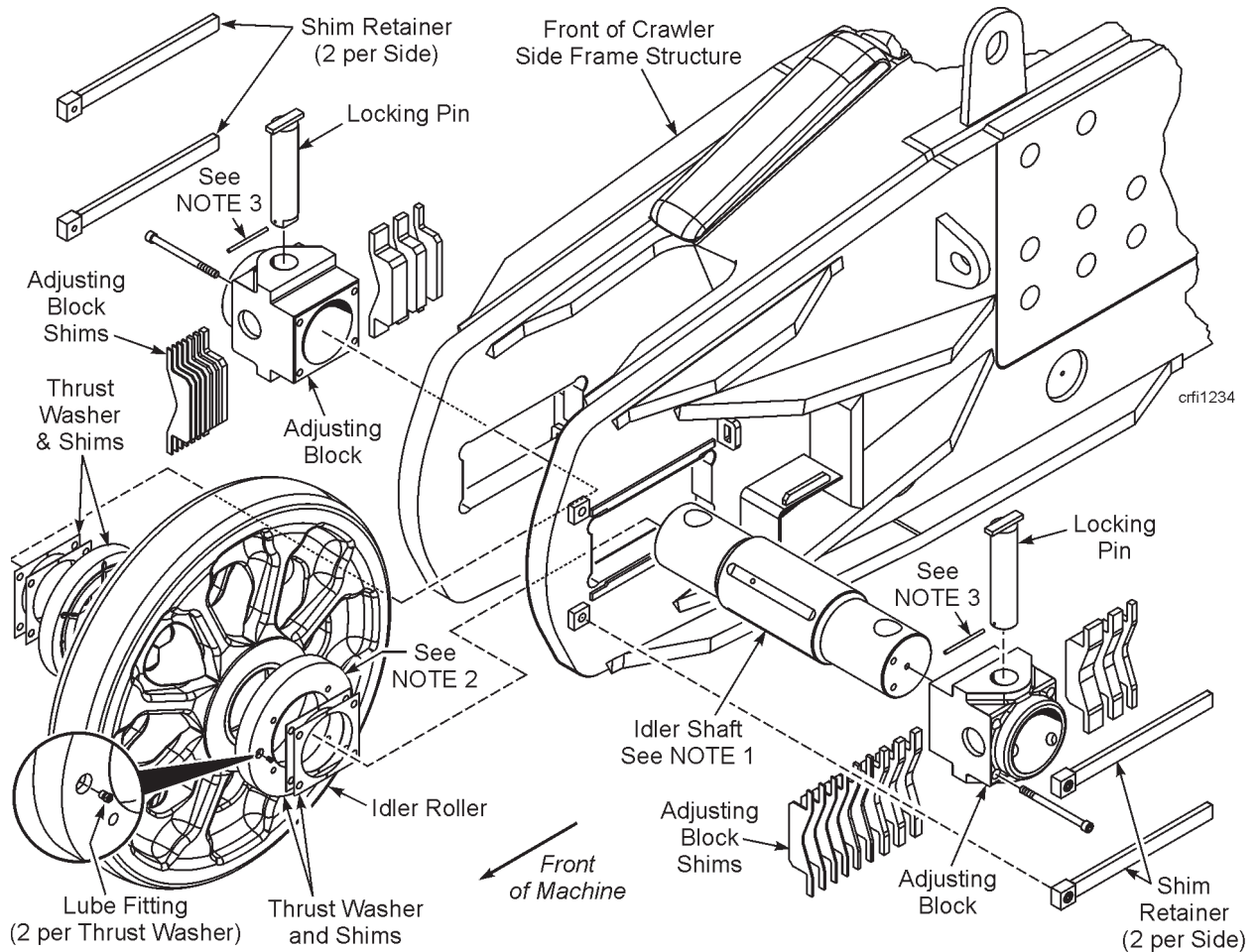
## **CRAWLER BELT MAINTENANCE**

1. Replace any missing or broken shoe pin lock bolts immediately.
2. To remove old shoe pins - drive them out if possible, burn them out if necessary.
3. Annually (5000 hrs.) remove any metal flow from the roller path on each shoe that interferes with belt motion. Use arc air to within .125 inch of final surface, then grind the remainder.
4. Monitor the fit of the shoes or belt to the drive tumbler monthly (420 hrs.)
  - Record wear rate.
  - Replace shoes or rebuild drive lugs as needed.
  - Replace the tumbler or rebuild wear areas as needed.
5. Replace or rebuild the slide bars on the crawler side frame *BEFORE* the drive lugs on the shoes touch the top of the crawler.

**IMPORTANT! PROPERLY ADJUSTED BELTS REDUCE THEIR WEAR RATE AND PROLONGS THEIR SERVICE LIFE!**



## 495HR Electric Mining Shovel



**NOTE 1:** Install the Idler Shaft with the Lube Grooves toward the Front of the Crawler and the Lube Supply Holes toward the  $\odot$  Machine (Inboard).

**NOTE 2:** Install the Thrust Washer with its Lube Grooves toward the Idler Roller.

**NOTE 3:** Heat and bend Pin at assembly.

*Crawler Front Idler Assembly  
(Left Shown, Right Opposite)*

## CRAWLER FRONT IDLER ROLLER ASSEMBLY

The front idler roller carries the machine weight in conjunction with the load rollers. The roller turns about the idler shaft on bronze bushings. The idler shaft mounting consists of a pair of adjusting blocks which can be moved to the front or rear to compensate for crawler belt wear. Shims located on either side of each adjusting block are used to maintain the roller position. *To remove the front idler:*

1. Park the machine in a level area leaving several inches of clearance under the front idler to be removed.
2. Rotate the revolving frame to provide crane access to crawler belt and idler.
3. Remove the shim retainer bars, lube lines and shims ahead of the adjusting blocks.

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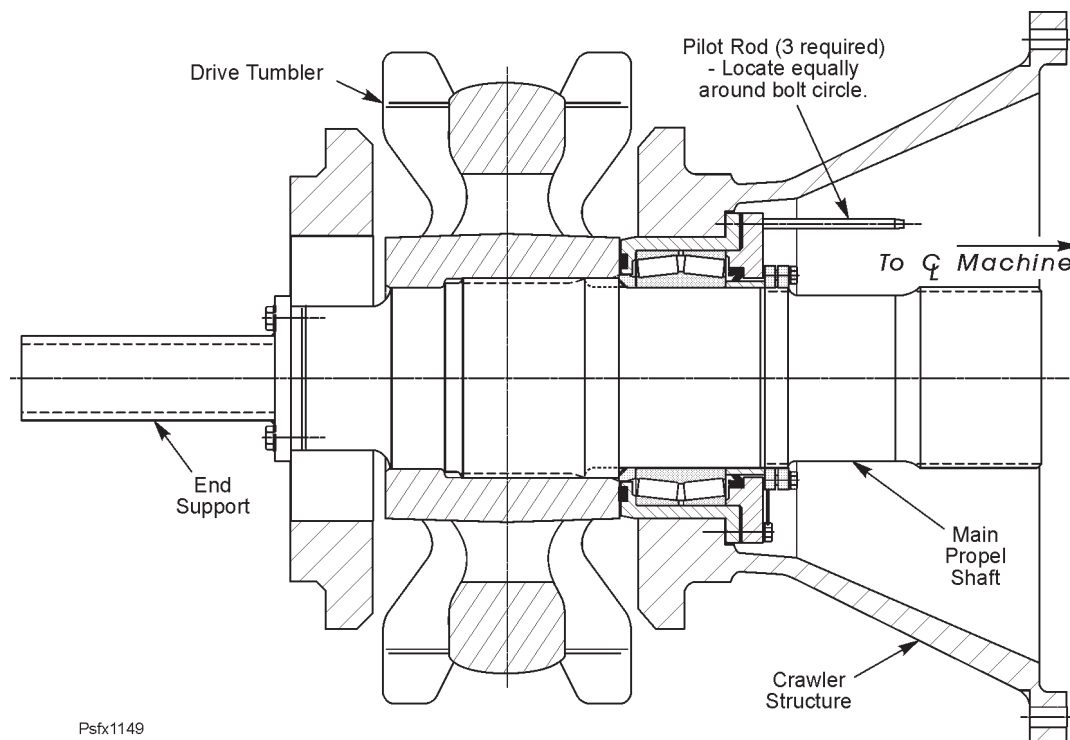


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16. Use the spacer between the bearing race and shaft shoulder as a puller. Six tapped holes (M20 x 25 ) are provided to attach the threaded rods and hardware required. Hydraulic expansion of the inner race is also provided to ease the pulling force. Attach the hydraulic pump provided with the machine to the .25 inch hole in the end of the drive shaft. Use hydraulic pressure and pulling force simultaneously to remove the bearing race.
17. Remove the 18 - 1 Inch capscrews which secure the cartridge and retainer to the crawler. *DO NOT* remove the 6 capscrews which secure the retainer to the cartridge.
18. Install a pulling eye in the ( M42 x 4.5 x 44 mm ) tapped hole provided and using the fixtures shown, remove the drive shaft assembly toward the CL machine.



Psf1149

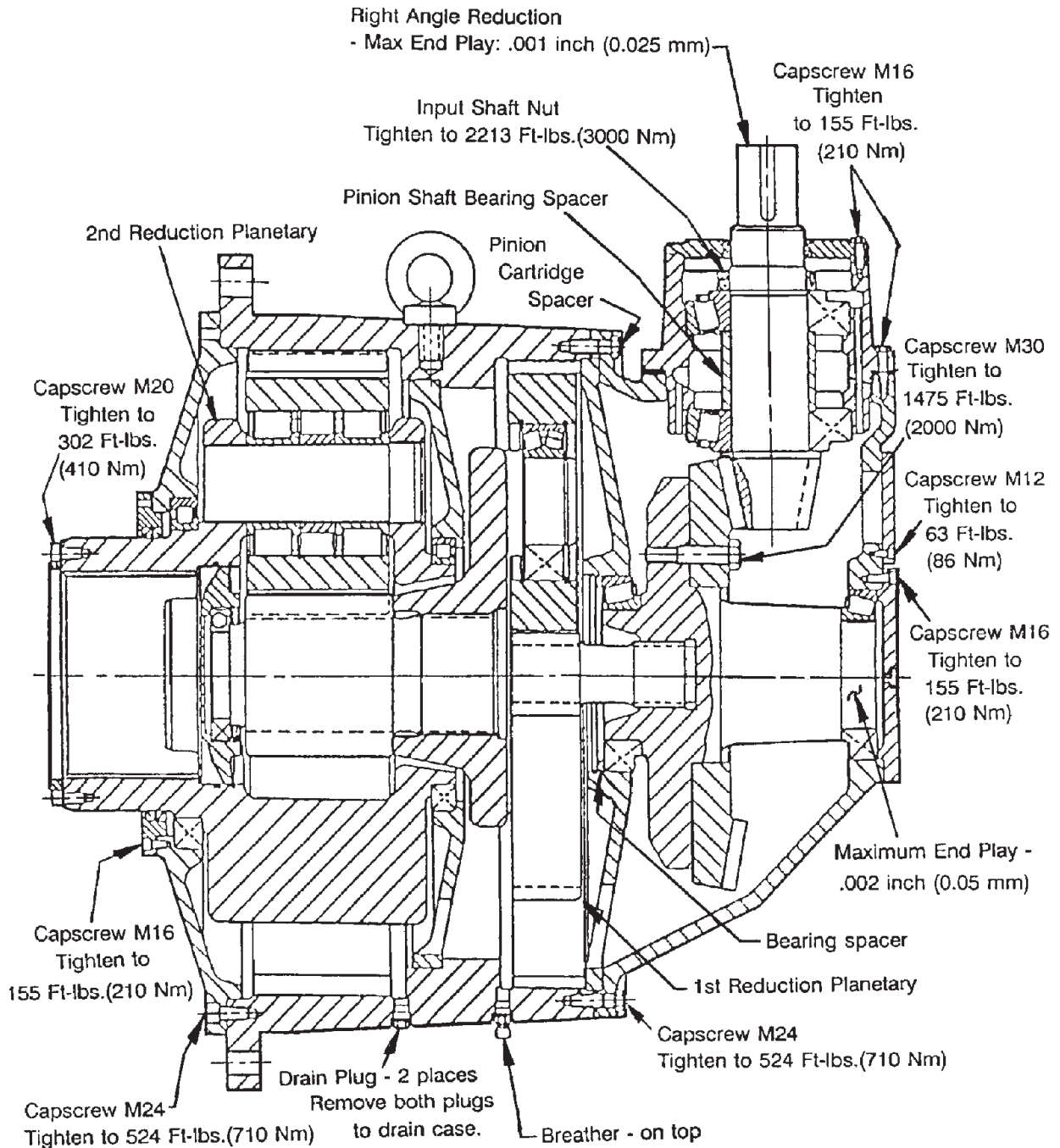
*Fixture for the Main Propel Shaft*

19. Lift the tumbler clear of the crawler after the shaft has been removed.
20. Inspect all parts for damage or wear. Replace or repair as required. Refer to the "Main Propel Shaft" for disassembly and rework.



NOTES:

1. Bearing spacer - grind to obtain a preload of .002 inch.
2. Bearing spacer - grind to obtain a preload of .001 inch.
3. Cartridge spacer - Grind to fill the gap after adjusting the tooth pattern.



Propel Gearcase ~ Section View



12. Install the lifting lug, supplied with the machine, to the top of the pintle and connect the auxiliary winch to the lifting lug.
13. Using the auxiliary winch, lift the sleeve out of the revolving frame. Replace a worn or damaged sleeve with a new one. Check the pintle sleeve bushing for wear or damage. Replace if required. Check the truck frame around the pintle structure for cracks. If the pintle structure area needs repair, contact the Bucyrus International Service Department for instructions.

*Center pintle sleeve installation is the reverse of disassembly.*



**DANGER: HIGH VOLTAGE!** Be sure the electrical lines are correctly connected and all connections are tight. Also make sure that the air and lube lines are connected to the correct outlets in the swivel assembly and that the connections do not leak.

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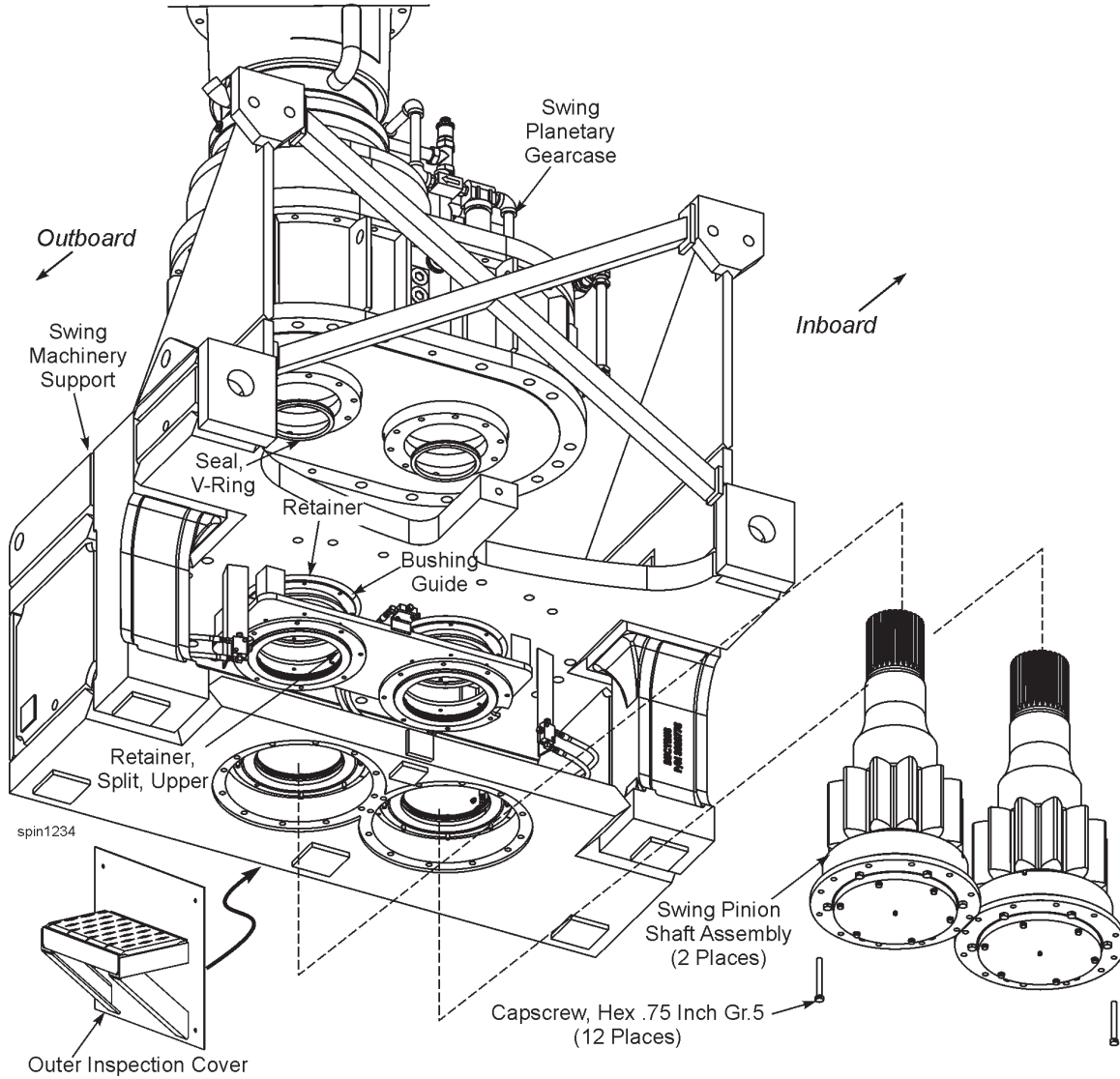


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### SWING PINION SHAFTS

Dual swing pinion shafts transfer torque from each planetary gearcase to the swing rack on the truck frame. Each pinion shaft is a 1-piece unit.



*Dual Vertical Swing Shaft Installation*

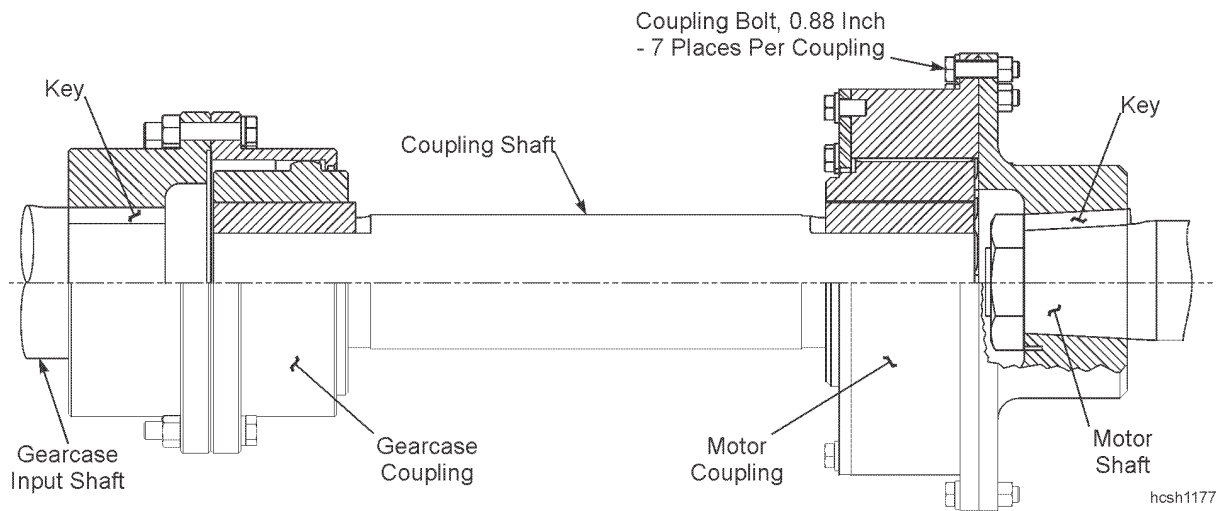


### MOTOR COUPLING SHAFT

Power is transferred from the hoist motor to the gearcase through a motor coupling shaft with 2 couplings. Using the inspection doors on the coupling guard, check the couplings for evidence of lubricant leakage. Under normal circumstances, a coupling will operate for 3 to 5 years before service is required. However, if leakage from a coupling is noticed, the coupling should be disassembled and repaired.

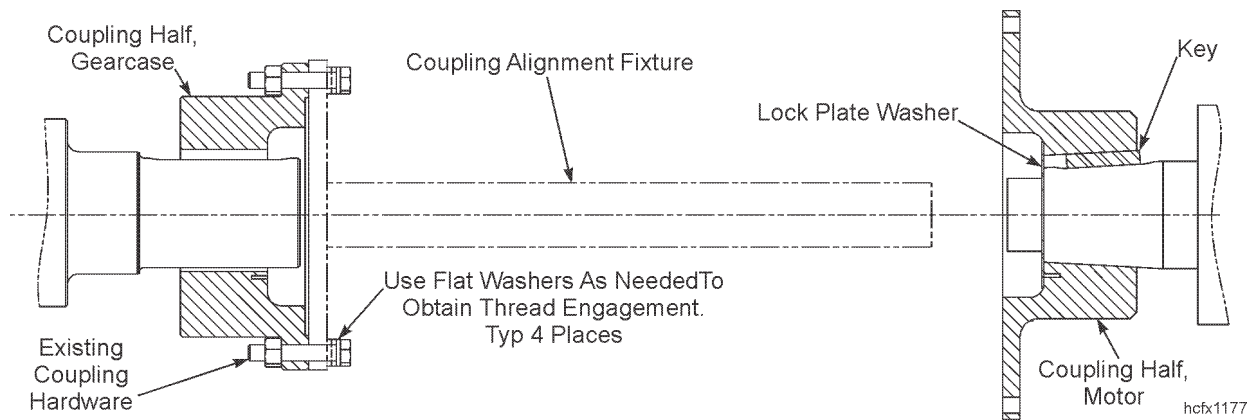


**DANGER: STORED ENERGY!** Gearing or drum must be blocked prior to performing maintenance in order to prevent unwanted movement. Failure to comply could result in death, severe personal injury, or damage to the machine.



*Motor Coupling Shaft*

When reinstalling the coupling shaft, it is recommended to use a coupling alignment fixture, part no. C117028-01, or similar.



*Coupling Alignment Fixture*

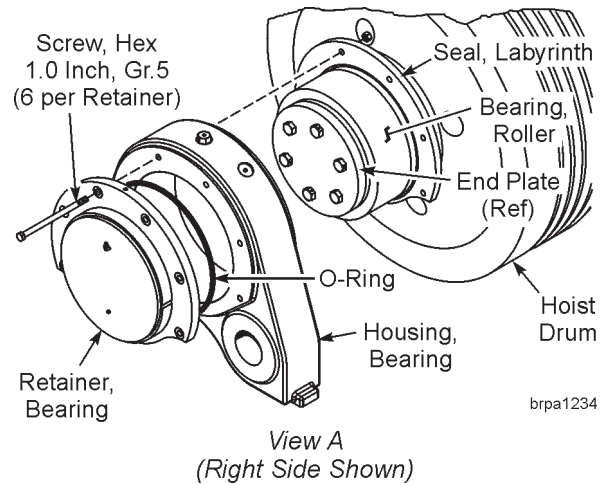


## BEARING REMOVAL

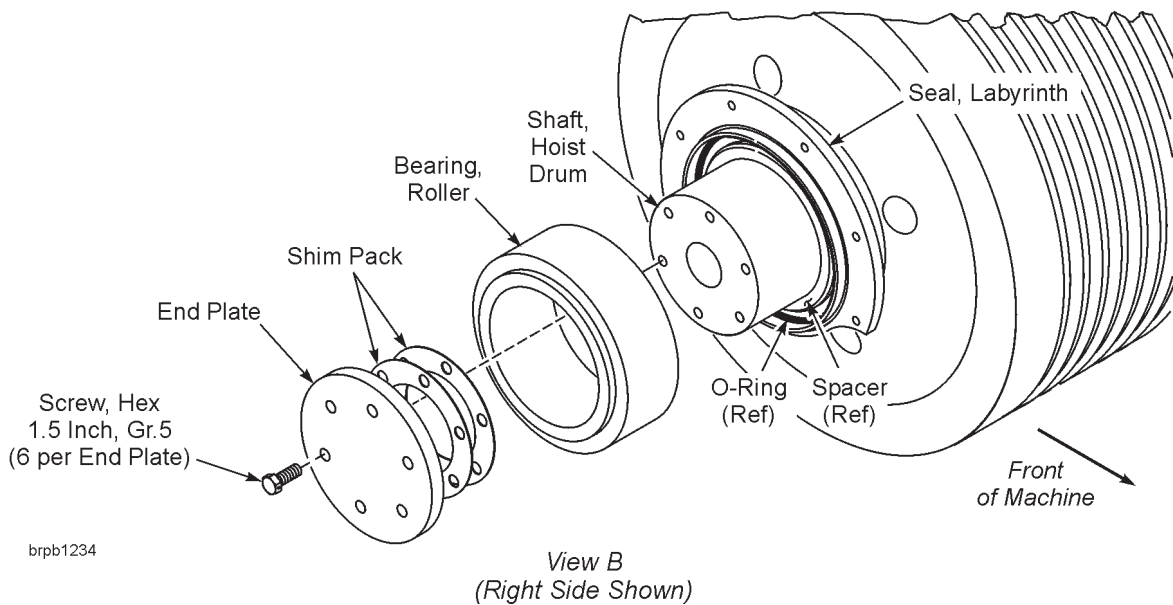
To remove or replace the hoist drum shaft bearings, it is best to remove the drum shaft assembly from the machine. Refer to *HOIST DRUM REMOVAL* in this section of the manual, then *proceed as follows*:

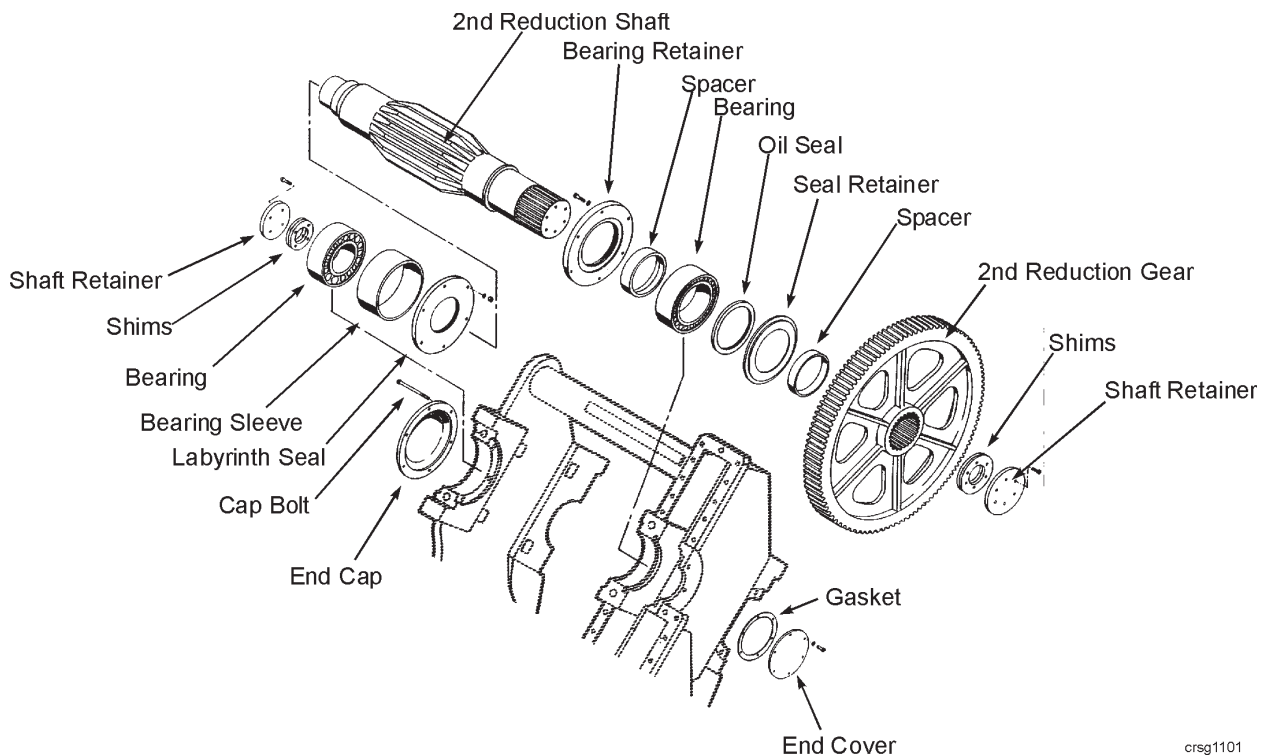
1. Ensure the drum shaft assembly is resting *horizontally* on cribbing (not shown).
2. Remove the 6 - 1 inch hex screws that fasten each of the outer retainers to the bearing housings. See View A.
3. Mark then remove each outer retainer. Each retainer weighs approx. 325-400 Lbs.

**NOTE:** These parts are not interchangeable. Inspect the O-Ring on the inside of each retainer. Replace if required.



4. Using a suitable lifting device to support the weight of the bearing housing (approx. 3,200 Lbs. each), pull the bearing housings from the bearings.
5. Remove the lockwire from the end plate capscrews. Remove the 6 - 1.5 inch capscrews that fasten each drum shaft end plate to the shaft. Refer to View B.





crsg1101

Crow 2nd Reduction ~ Exploded View

## CROWD GEARCASE ASSEMBLY

To reassemble the crowd gearcase:

1. Install the shafts in the gearcase, using the crane to lift the shaft units.
2. Be sure the flanges of the gearcase and gearcase cover are clean. Install the seal in the groove in the gearcase. Apply a continuous bead of Loctite #515 to the gearcase flange halfway between the bolt pattern and the inside of the flange. Install the gearcase cover securing it with the necessary hardware.
3. Preload the second intermediate bearing cap against rear hook of frame with a 1-1/2" by 4" GR5 capscrew. Apply Loctite and tighten to 1,700 Ft.Lbs.
4. Install the rods and their associated hardware into the bearing caps and hand tighten.

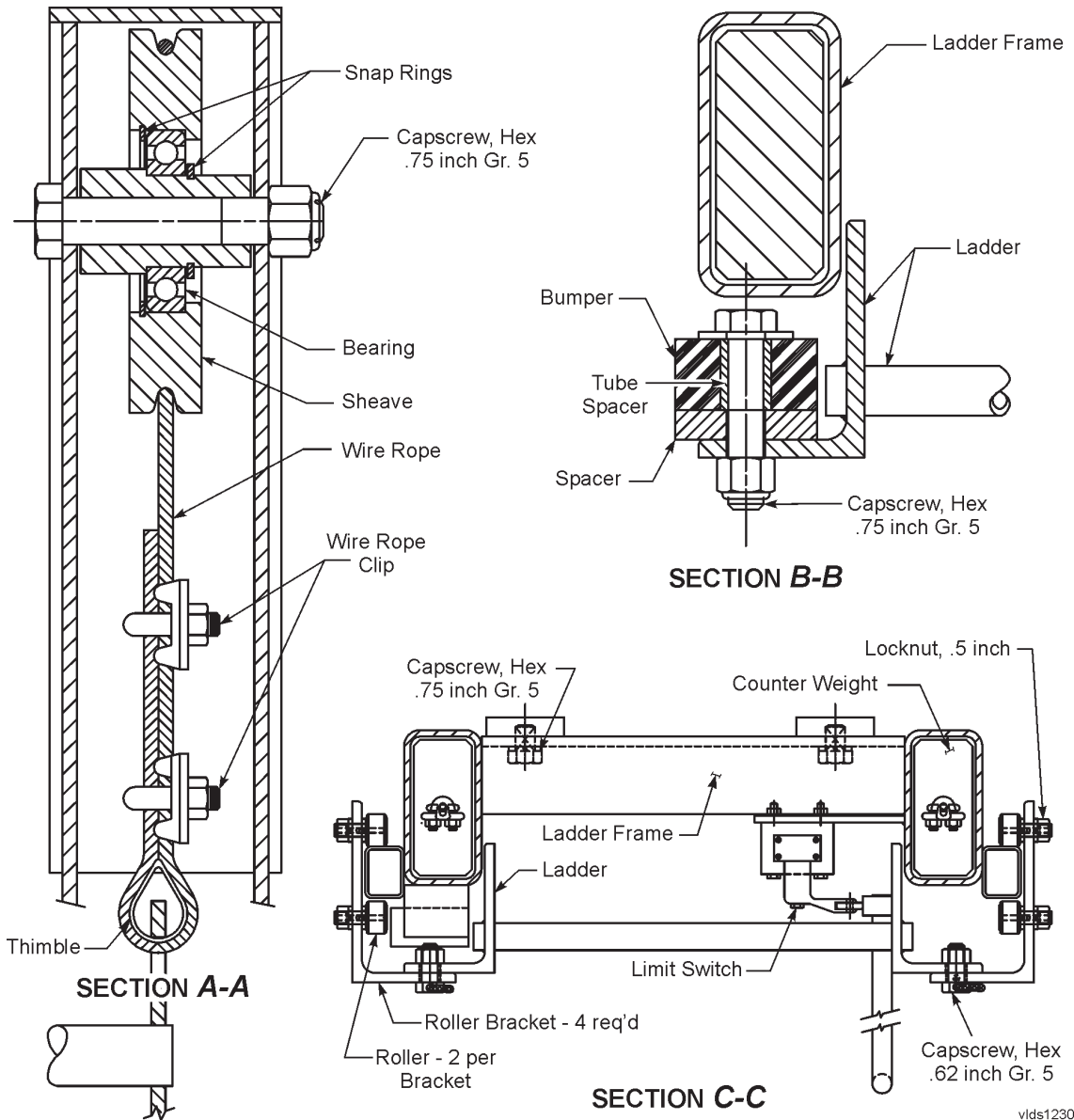
**NOTE:** The bearing caps and rods are assembled with torque nuts. Refer to Section 9 ~ ENGINEERING DATA for tightening instruction.



The ladder is a movable structure with a bracket and two rollers at four locations on the ladder. The rollers straddle a rail on each side of the ladder frame. Wire ropes (one on each side of the ladder) connect to the top of the ladder, pass up through sheaves and down to a counterweight inside each side of the ladder mounting frame.

The ladder should be in the UP position when at rest, with the weight of the counterweights holding it in place. If not, or if rough action is noted, check for binding in the rail structure, damaged or missing rollers, or binding with the counterweights.

Periodically check for lubricant in the sheaves at the top of the ladder.



Vertical Boarding Ladder, Miscellaneous Views

vlds1230

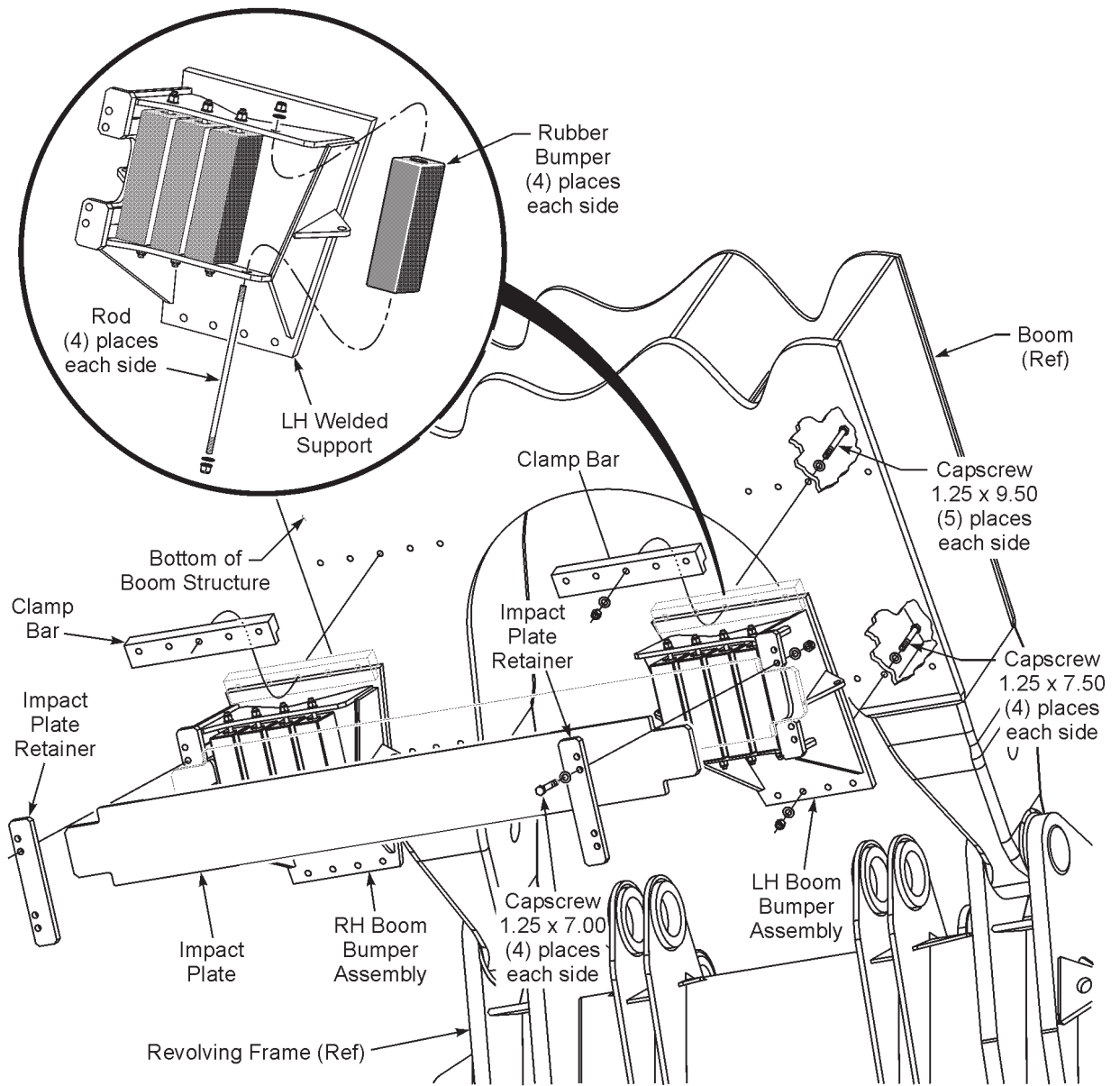


### BOOM BUMPER

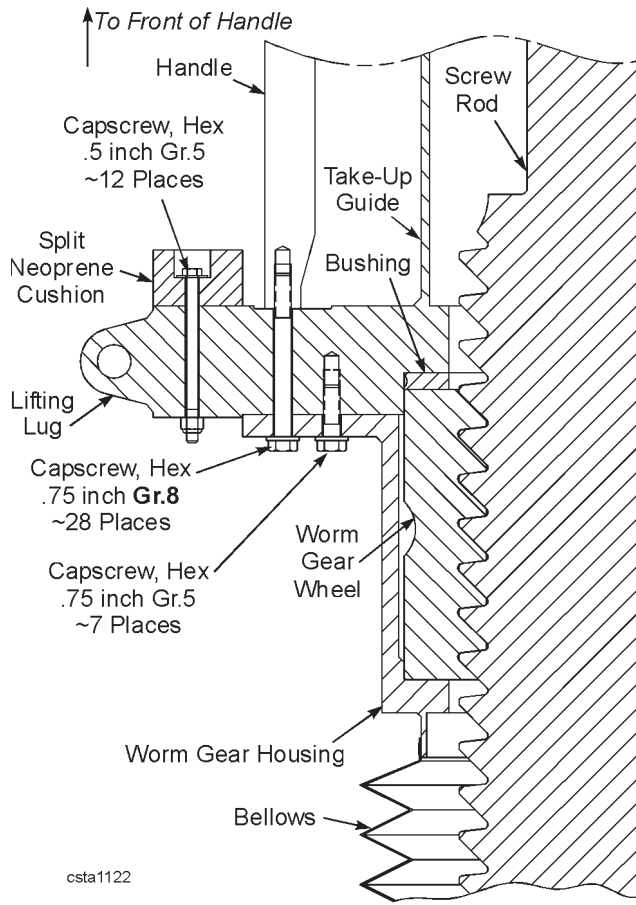
Regularly check the condition of the boom bumper and make repairs as required. Inspections should be conducted at minimum of once per operating shift. Additional inspections may be required. Operator's style will affect bumper life. Repair of the boom bumpers consists of replacing common hardware and cushion material.



**DANGER: STORED ENERGY!** Removal of bolts and pins requires that the attached items be properly supported to release their load. Failure to comply could result in death, severe personal injury, or damage to the machine.



bmbp1157



### SECTION A-A

## CROWD ROPE TAKE-UP MECHANISM ASSEMBLY

**NOTE:** Before beginning to assemble the take-up mechanism, fully cover all rubbing and contact surfaces with Molykote. DURING ASSEMBLY LIBERALLY COAT THE SAME SURFACES WITH TEFLON LUBE BUCYRUS PART NUMBER 62038320.

*Assemble the take-up mechanism in the following order:*

1. Position the screw rod so it is vertical and with its square end on top.
2. Slide the bellows onto the square end of the screw rod, down to the clevis end of the rod.
3. Shrink the worm shaft bushing and install it into the right-hand worm shaft bore at the bottom of the housing.
4. Shrink the opposite worm shaft bushing into the worm shaft cover.
5. Slide the worm gear housing onto the screw rod until it mates with the bellows.

10. Turn the worm gear wheel to remove it from the screw rod.
11. Loosen the clamps on the bellows. Remove the worm gear housing from the bellows and screw rod.
12. Carefully remove the bellows from the screw rod.
13. Remove the smaller bushings from inside the worm gear housing and the worm shaft cover.

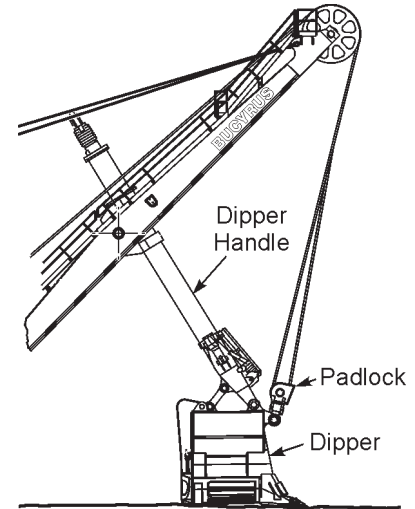
Inspect all parts for wear or cracking. Check for evidence of the proper amount of lubricant on all moving parts. Repair or replace any defective parts as required.



## 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.



drrA1231



**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.



Daily check excessive movement at the pin joints which indicate bushing wear. Replace worn bushings and pins. Check for cracking in the frames and links and make repairs when required.

*To Repair the Dipper Padlock:*

1. Place the dipper on the ground. Remove enough tension from the hoist ropes to remove the weight from the dipper lug pin, but not allowing enough slack to permit the weight of the padlock to rest on the pin.
2. Remove the clamp collars from the lug pin, as shown in Section C-C. Remove the lug pin (approximately 450 Lbs.) with a suitable pulling device.
3. Using the hoist ropes, lift the padlock from the dipper padlock lug and lower the padlock to the ground. Remove the thrust washers and the dowels from the lug.
4. Remove the clamp collar from the link pin, as shown in Section B-B. Strike the clamp collar end with enough force to expose enough of the link pin head to secure a suitable pulling device. Remove the link pin (approximately 267 Lbs.) from the padlock frame and the link.
5. Remove the bushings from the link and from the lower padlock frame. The bushings have an interference fit.
6. Support the padlock frame and the sheave. Remove the T-bolts retaining the padlock sheave pin, as shown in Section A-A. Remove the sheave pin (approximately 366 Lbs.) with a suitable pulling device.
7. Using a suitable lifting device, lift the padlock sheave from the padlock frame. Remove the thrust washers and the dowels from the sheave.
8. Remove the hoist rope from the sheave. Remove the sheave pin bushings from the sheave and the frame. The bushings have an interference fit.
9. Clean and inspect all parts. Repair or replace all damaged or worn parts.
10. Reassemble in reverse of disassembly. Be sure all the dowels are flush with, or below, the surface of the thrust washers.

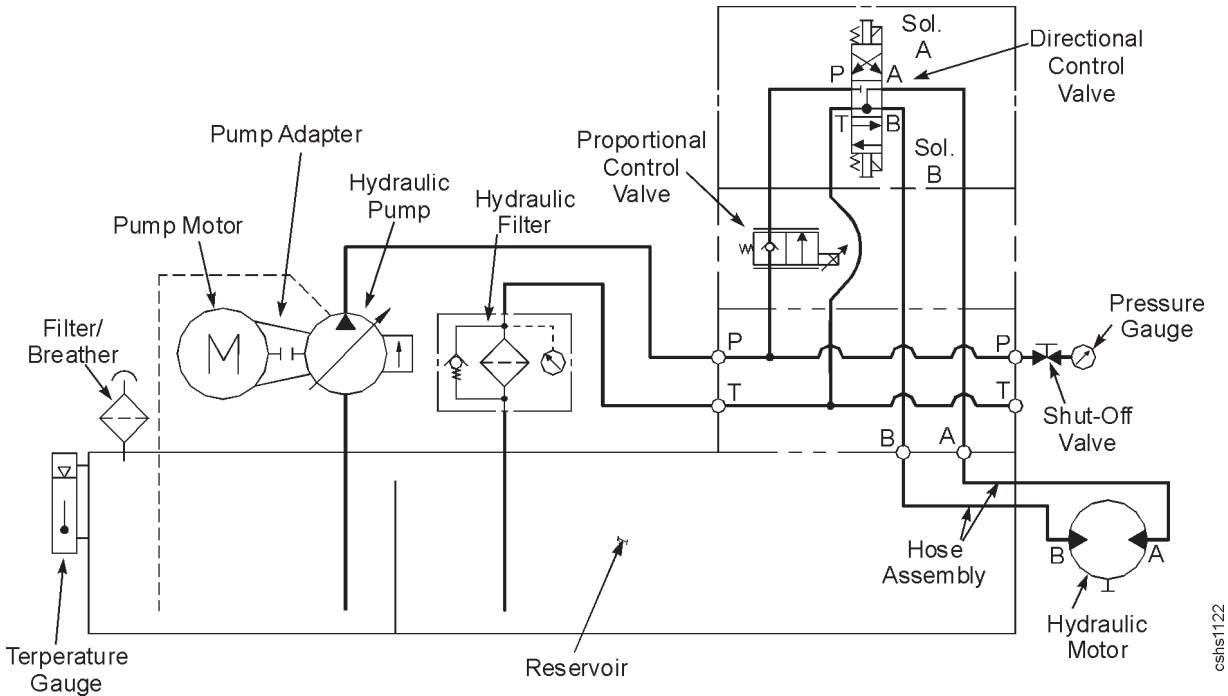
**NOTE:** The sheave pins and the lug pins are the same size but have different attaching hardware. Ensure they are replaced in the proper location during assembly.



This hydraulic unit is used to apply torque to the worm shaft at the end of the dipper handle when adjusting the tension in the crowd rope. It is located on the machinery house roof, near the center of the machine just behind the operator's cab.

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.

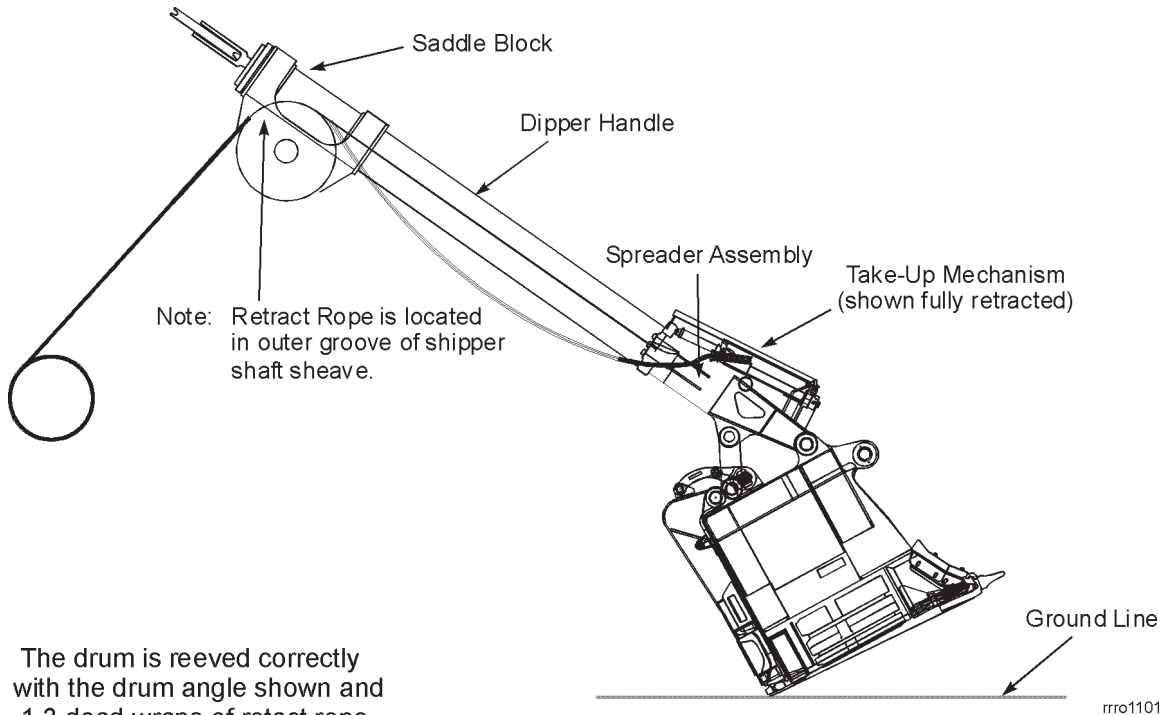
Be sure the reservoir is filled with hydraulic fluid. Check for leaks in the piping. Replace the filter cartridge when indicated.



Hydraulic Schematic ~ Crowd Screw Hydraulic Unit

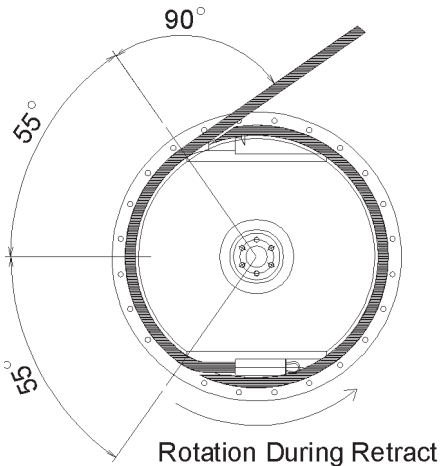


495HR Electric Mining Shovel



The drum is reeved correctly with the drum angle shown and 1.3 dead wraps of retract rope on the drum.

Retract Rope Reeving



rrrdw1101

7. Reeve an auxiliary line under then over the crowd drum, up and over the outer groove of the saddle block sheave, through the rope guide on the front stop and around the retract take-up nut. Reeve it through the rope guide on the front stop on the opposite side of the handle, over the outer groove of the other shipper shaft sheave, down and over then under the crowd drum and secure the other end of the auxiliary line to the ground vehicle.

**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.



Section **6**

**Brakes and Couplings**

*Always refer to the safety information in Section 1 of this manual before starting any maintenance procedure on this machine.*

**Table of Contents**

**BRAKES** ..... 3

*Machine Motion Brakes* ..... 3

**DISC BRAKE OPERATION** ..... 4

**MAINTENANCE** ..... 4

**SWING BRAKE** ..... 5

*Swing Brake Friction Disc Inspection* ..... 6

**SWING BRAKE INSTALLATION** ..... 7

*Swing Brake Assembly* ..... 7

    ..... 8

**SWING BRAKE BURNISHING** ..... 8

**CROWD BRAKE** ..... 10

*Crowd Brake Assembly* ..... 10

*Crowd Brake Tachometer* ..... 11

**HOIST BRAKE** ..... 13

**HOIST BRAKE ADJUSTMENT** ..... 14

*Hoist Brake Friction Plate Inspection* ..... 14

**HOIST BRAKE INSTALLATION** ..... 16

**PROPEL BRAKE** ..... 16

**PROPEL BRAKE ADJUSTMENT** ..... 17

*Propel Brake Assembly* ..... 18

**SPRING REPLACEMENT-ALL BRAKES** ..... 19

**FRICITION DISC INSPECTION AND REPLACEMENT - ALL BRAKES** ..... 21

*Friction Disc Inspection* ..... 21

**O-RING REPLACEMENT - ALL BRAKES** ..... 23

**COUPLINGS** ..... 24

**GRID COUPLINGS** ..... 24

**LUBRICATION** ..... 24

**COUPLING DISASSEMBLY AND GRID REMOVAL** ..... 25

**GRID COUPLING INSTALLATION** ..... 25

**SEAL REPLACEMENT WITHOUT HUB REMOVAL** ..... 28

**GRID COUPLING ALIGNMENT** ..... 30

*Grid Coupling Data* ..... 30

**GEAR COUPLINGS** ..... 31

**INSTALLATION** ..... 31

**GEAR COUPLING ALIGNMENT** ..... 33

*Gear Coupling Data* ..... 33

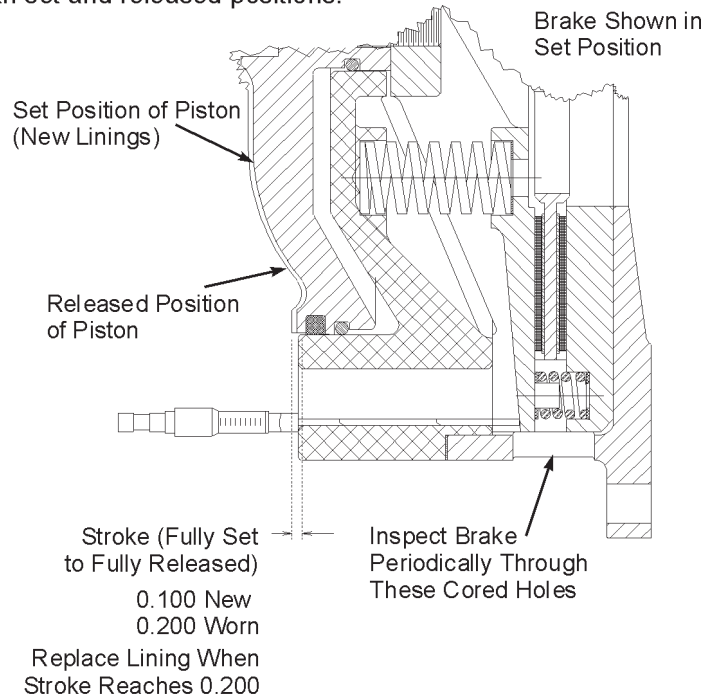
**HOIST COUPLING SHAFT ALIGNMENT** ..... 34

**ELASTOMERIC COUPLINGS** ..... 35

*Elastomeric Coupling Data* ..... 35



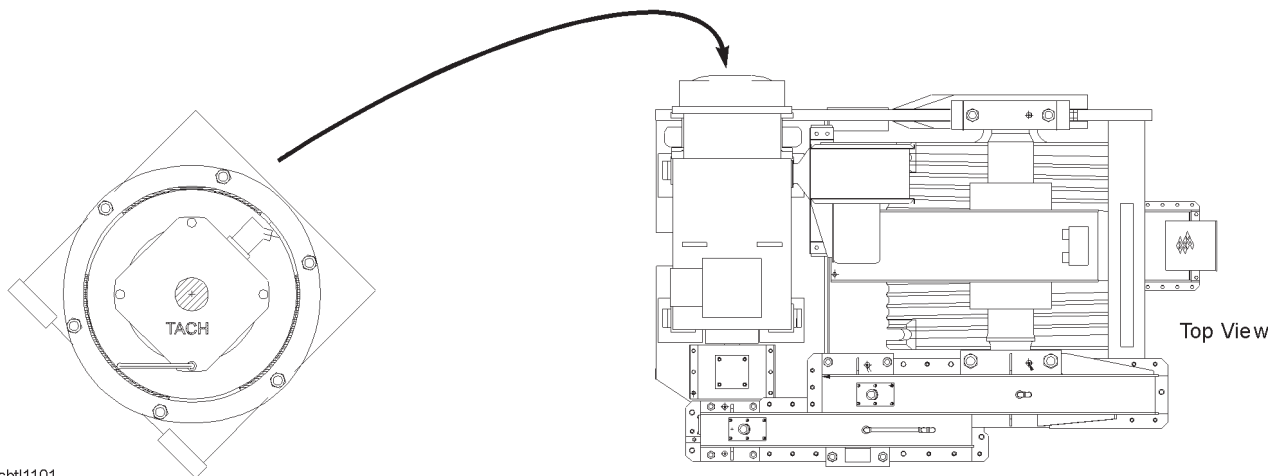
Use depth micrometer to measure change in stroke.  
 Due to the sloped surface of the pressure plate,  
 measurement must be taken from the same location  
 for both set and released positions.



cbid1101

**VIEW-B**

**NOTE:** The brake is furnished with (2) air inlets, located 180° apart. Mount the brake with one inlet positioned up and to the rear of the machine. Plug the lower, unused inlet.



cbtl1101

*Crowd Brake Tachometer*

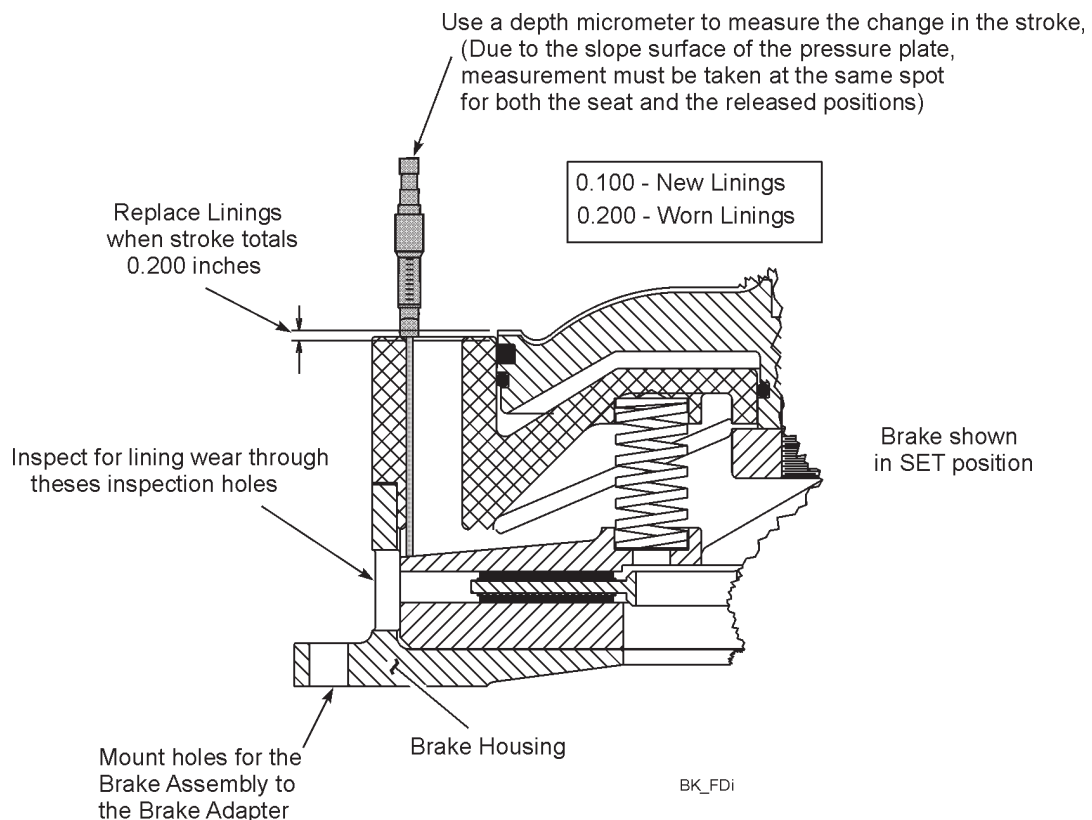
Installation of the tachometer, furnished with the electric motor, is required before beginning to install the crowd brake assembly. Install the tachometer and the torque arm in relation to the image provided.



## FRICITION DISC INSPECTION AND REPLACEMENT - ALL BRAKES

The friction disc will require replacement when excessively worn or when contaminated by grease, oil or other foreign materials.

Check for a worn disc by using a depth micrometer as depicted in the image below. The reading must be taken from the same location with the brake engaged and released. Due to the tapered surface of the pressure plate, care must be taken to duplicate the position and process as closely as possible.



*Friction Disc Inspection*

The disc will be considered excessively worn when the difference between the 2 readings approaches 0.200 inch.

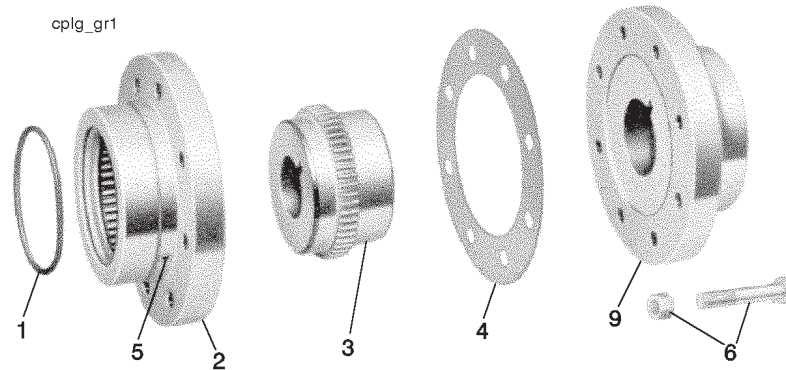


**CAUTION:** Major damage will occur to the components of the brake assembly if the friction disc is not replaced when wear approaches 0.200 inch. The result of “pushing” will result in metal-to-metal contact that will cause extremely expensive repairs and a seriously degraded braking system.



## GEAR COUPLINGS

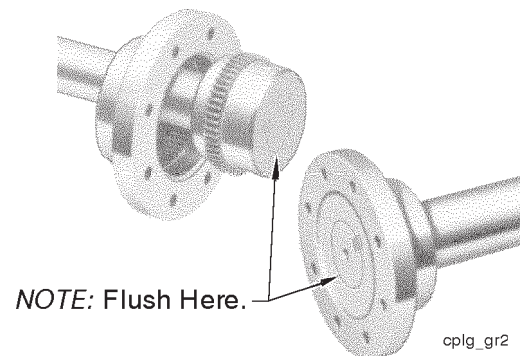
### INSTALLATION



1. Clean all parts. Heat hubs in an oven or use suitable dry heat. **DO NOT** rest gear teeth on container bottom or apply a flame directly to gear teeth. **DO NOT** heat hubs over 275°F (135°C) for mounting. Refer to motor shaft installation for hubs mounted on drive motors.

Pack sleeve teeth with grease and lightly coat seals with grease *BEFORE* assembly. **DO NOT DAMAGE THE SEALS.**

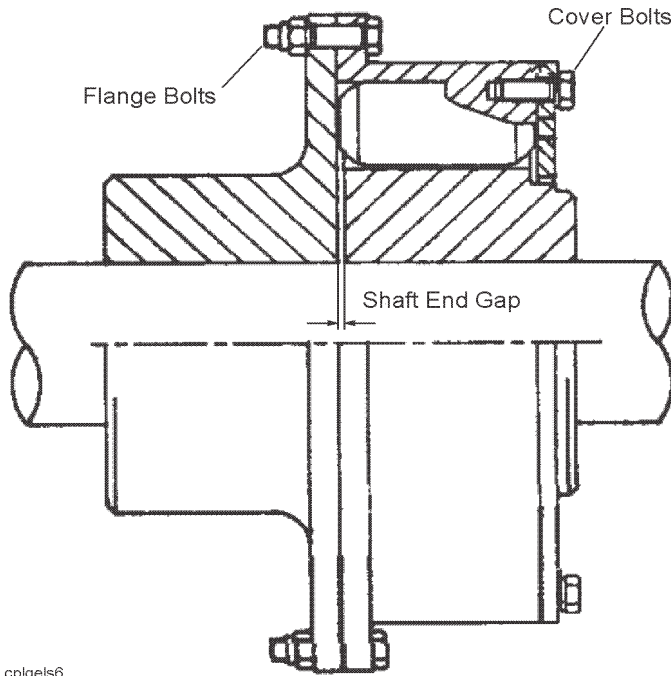
Use a dial indicator to align dynamically balanced couplings and assembly parts with mating match marks aligned. Mount the indicator on one hub and take readings for the *OFFSET* check on the O.D. of the other hub. The difference between the minimum and maximum readings *DIVIDED* by two should not exceed the values in the table. For *ANGULAR* check, take readings on either face of other hub. The difference between the minimum and maximum readings should not exceed the values in the gear coupling data table.



2. Mount the flanged sleeves, seal and hubs. Place the flanged sleeves *WITH* the seal rings on the shafts before mounting the hubs.



**CAUTION: DO NOT DAMAGE THE SEALS. Mount the hubs on their respective shafts, as shown, so that each hub is flush with its shaft end. Position the equipment in approximate alignment with the approximate gap specified in the table.**



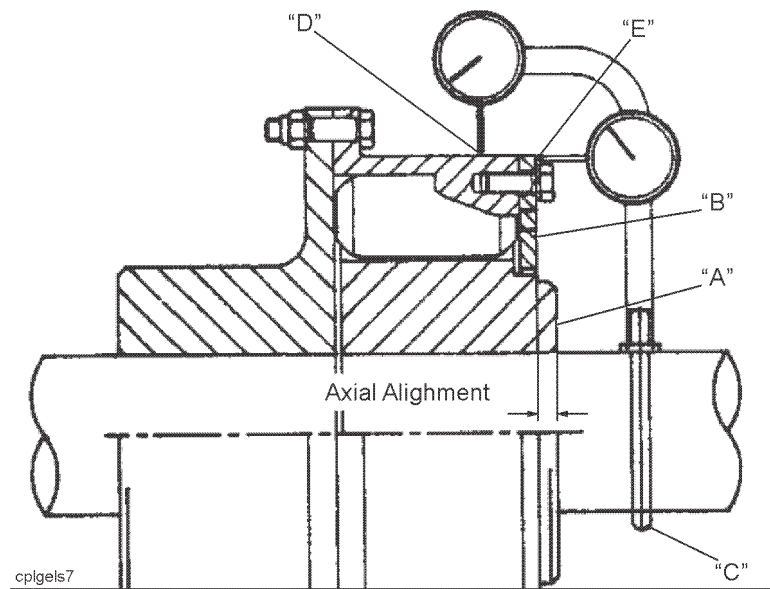
cplgels6

END GAP TABLE

Coupling Size	Shaft End Gap (in)
PM 0.4	0.04
PM 0.7	0.08
PM 1.3	0.08
PM 3	0.12
PM 6	0.12
PM 8	0.12
PM 12	0.14
PM 18	0.16
PM 27	0.18
PM 40	0.20
PM 60	0.22
PM 90	0.26
PM 130	0.28
PM 180	0.31
PM 270	0.35
PM 400	0.41
PM 600	0.47

**COUPLING ALIGNMENT**

The following describes how to verify that the alignment of the coupling is sufficient to prevent premature deterioration of the rubber elements. Note that the values given in the table are in inches.



cplgels7




### AIR PRESSURE SWITCHES

For air pressure switch settings, refer to the *AIR SCHEMATIC* included in this manual.

### SAFETY WARNINGS

Ensure all personnel are aware of, and adhere to the instructions of the following safety labels which are mounted on the compressor.

**⚠ DANGER**



DISCHARGE AIR USED FOR BREATHING WILL CAUSE SEVERE INJURY OR DEATH. CONSULT FILTRATION SPECIALIST FOR ADDITIONAL FILTRATION AND TREATMENT EQUIPMENT TO MEET HEALTH AND SAFETY REGULATIONS.

219EAG077


<p>HIGH VOLTAGE. ROTATING MACHINERY. AIR AND OIL UNDER PRESSURE. IMPROPER MODIFICATION OF EQUIPMENT WILL CAUSE SEVERE PERSONAL INJURY OR DEATH.</p> <p><small>219EAG077</small></p>	<p><b>⚠ DANGER</b></p>
	<p>DO NOT MODIFY UNIT WITHOUT WRITTEN PERMISSION FROM MANUFACTURER.</p>


**⚠ DANGER**



AIR AND OIL UNDER PRESSURE WILL CAUSE SEVERE PERSONAL INJURY OR DEATH. SHUTDOWN COMPRESSOR AND RELIEVE SYSTEM OF ALL PRESSURE BEFORE REMOVING VALVES, CAPS, PLUGS, FITTINGS, BOLTS AND FILTERS.

219EAG077

<p>ELECTRICAL SHOCK FROM IMPROPER GROUNDING CAN CAUSE INJURY OR DEATH.</p> <p>GROUND UNIT AND RELATED EQUIPMENT ACCORDING TO NATIONAL ELECTRIC CODE AND LOCAL REGULATIONS.</p> <p><small>219EAG077</small></p>	<p><b>⚠ WARNING</b></p>
	

<p>AIR AND OIL UNDER PRESSURE. CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. INSPECT OIL RESERVOIR FOR CRACKS AT LEAST ANNUALLY.</p> <p><small>219EAG077</small></p>	<p><b>⚠ WARNING</b></p>
	

wma1101

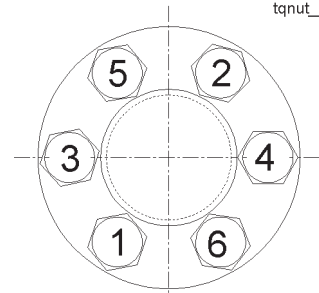


PREHEAT .....	27
WELDING TECHNIQUE .....	27
REPAIR WELDING OF BROKEN PARTS .....	28
REPAIR WELDING SWING RACK TEETH .....	29
PREPARATION .....	29
SWING RACK WELDING ELECTRODES .....	30
PREHEAT .....	30
WELDING PROCEDURE .....	31
WELDING AND CUTTING EQUIPMENT .....	33
STRESS RELIEVING & TEMPERATURE MEASURING EQUIPMENT .....	33
WIRE ROPE CARE AND MAINTENANCE .....	35
STORAGE .....	35
CHECKING DIAMETER .....	35
<i>Correct Method for Checking Wire Rope Diameter</i> .....	35
HANDLING WIRE ROPE .....	36
<i>Improper Methods for Uncoiling Wire Rope</i> .....	37
SEIZING WIRE ROPE .....	37
END PREPARATIONS/TERMINATIONS .....	38
WIRE ROPE CLIPS .....	39
WIRE ROPE CLIP APPLICATION .....	39
WEDGE SOCKETS .....	41
INSPECTION OF SHEAVES AND DRUMS .....	42
<i>Examples of Sheave Groove Conditions</i> .....	42
<i>Groove Gauge for New or Re-Worked Sheaves</i> .....	42
<i>Inspecting for Worn Sheave</i> .....	43
BREAKING IN A NEW WIRE ROPE .....	43
INSPECTION DATA .....	44
GUIDELINE TO INSPECTIONS AND REPORTS .....	45
<i>Wire Rope Stretch vs Rope Life</i> .....	47
<i>Examples of Broken Wires</i> .....	50
SEALS .....	51
SEAL INSTALLATION .....	51
GEARCASE SEALING .....	53

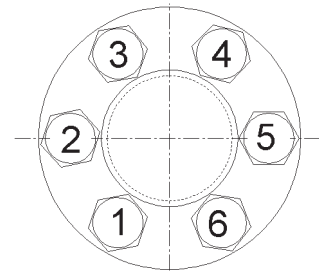
**TIGHTENING PROCEDURE ~TORQUE ROD, TAPERED SLEEVE & 1.0 INCH NUT**

tqnut\_6

1. Check the base of the torque nut to ensure that all jackbolts are flush with the bottom.
2. Insert the expansion sleeve from the top of the structure.
3. Insert the tapered stud into the sleeve. Note the direction of the taper on the rod.
4. Slip the special washer (spacer) over the lower threaded end of the stud.
5. Spin the lower torque nut onto the stud by hand.
6. Tighten the lower nut jackbolts to **27 Ft.Lb.** as follows:
  - a. Snug all jackbolts to **5 Ft.Lb.** each.
  - b. Using the STAR pattern shown, tighten all jackbolts to **15 Ft.Lb.**
  - c. Switch to the circular pattern shown and tighten all jackbolts to **20 Ft.Lb.**
  - d. Continue with the circular pattern and tighten all jackbolts to **30 Ft.Lb.** Refer to the notes below.



**“STAR” Tightening Pattern**



**CIRCULAR Tightening Pattern**

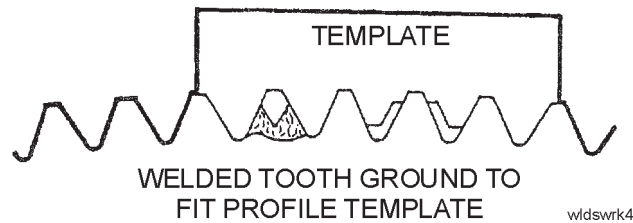
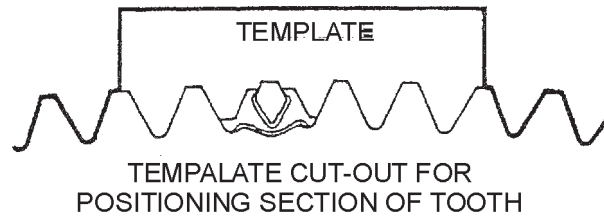
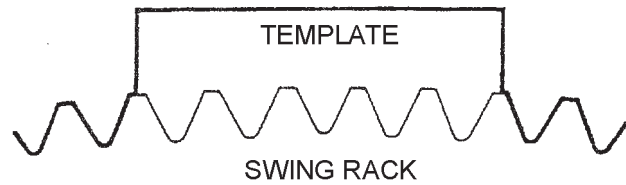
*Torque Nut with 6 Jackbolts*

7. Ensure that a special steel washer, supplied with the torque nut, is placed beneath the upper torque nut. **DO NOT USE STANDARD COMMERCIAL WASHERS.**
8. Spin the upper torque nut onto the stud by hand. Using the STAR pattern shown, tighten all jackbolts to **10 Ft.Lb.**

**NOTES:**

- With longer rods and bolts, stretch in the rod or bolt occurs during tightening of the jackbolts. Therefore, after tightening with the circular pattern in step 4-d above, the first jackbolt may have loosened. The higher torque value is used in this step only to speed the tightening process. After performing the above steps, use a torque wrench for the final torque values and continue tightening the jackbolts in a circular pattern until all jackbolts are tightened to a value of **27 Ft.Lb.**
- 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.

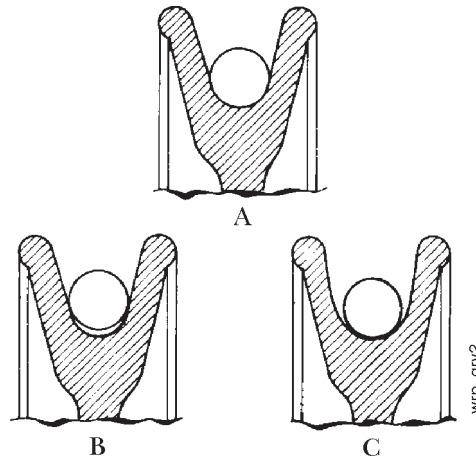




7. When groove welding is finished check carefully for low spots and fill in as required. Grind the weld smooth and flush with the adjacent tooth surfaces. Use the tooth profile template to check grinding of a welded-on tooth segment. Grinding of the radius at the root of the tooth is very important. 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.

### INSPECTION OF SHEAVES AND DRUMS

Machines should receive periodic inspections, and the results concerning their over-all condition recorded. Such inspections usually include the drum, sheaves, and any other parts that may come into contact with the wire rope. These are considered high wear items. As an additional precaution, any rope-related working parts, particularly those in the areas described below, should be re-inspected prior to the installation of a new wire rope.

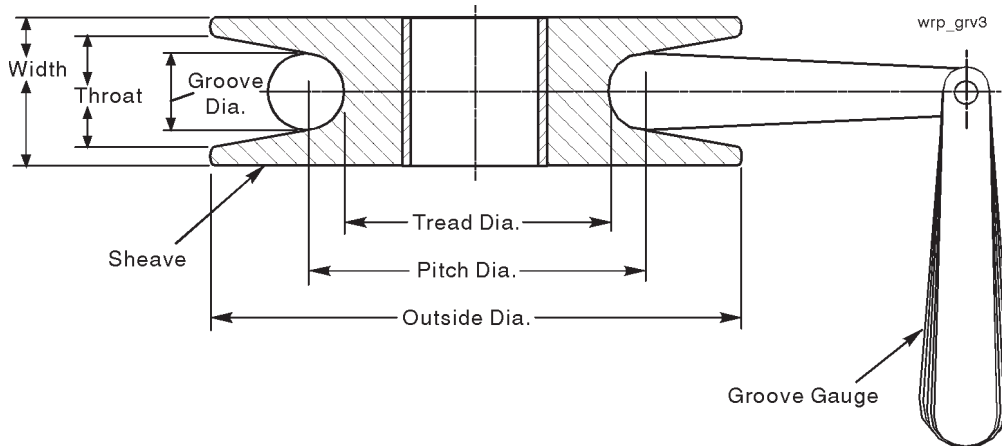


*Examples of Sheave Groove Conditions*

These cross-sections are illustrating three sheave-groove contact areas. "A" is correct, "B" is too tight, and "C" is too loose.

The very first item to be checked when examining sheaves and drums is the condition of the grooves. To accurately check the size, contour and amount of wear, a groove gauge is used. As shown in the figure, the gauge should contact the groove for about 150 degrees of arc when in optimal condition.

There are two types of groove gauges in general use. The two differ by their respective percentage over nominal.



*Groove Gauge for New or Re-Worked Sheaves*

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