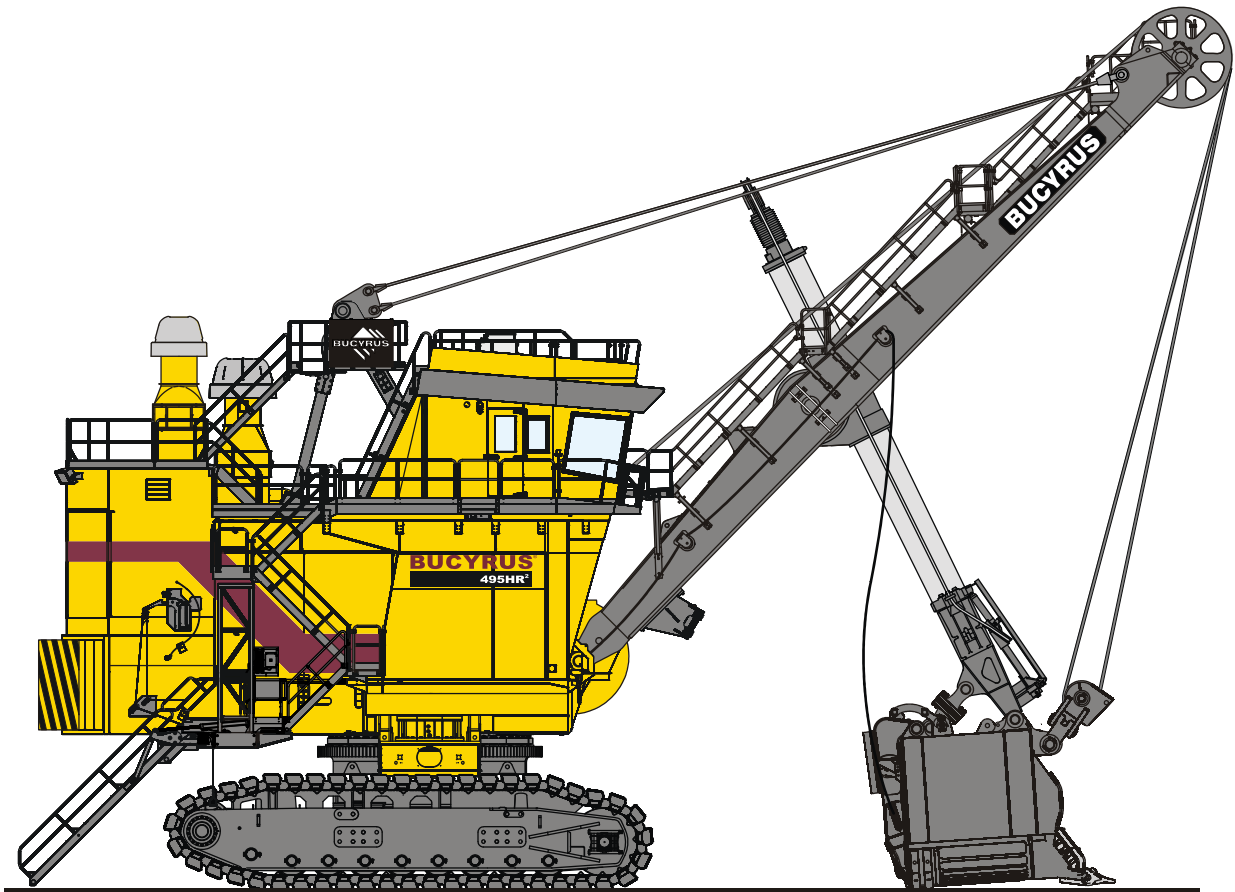




495HR² MINING SHOVEL MAINTENANCE MANUAL

SN: 141324
Manual No. 10968



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Bucyrus International, Inc.

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495HR² Electric Mining Shovel Maintenance Manual

Manual No. 10968

SN: 141324

Table of Contents

This manual is divided into major sections covering the various servicable components and systems of the 495HR² Mining Shovel. These sections and their contents are organized as shown below.

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IMPORTANT NOTE

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Revision History

August 2011 - Torque value change from 738 Ft-Lbs (1000.6 Nm) to
7,380 Ft-Lbs (10,006 Nm)..... 4-32, 4-43



CRAWLERS

This machine is provided with a crawler system composed of 2 independently-driven crawler frame assemblies, one on each side of the truck frame. Each crawler has its own belt driven by a sprocket-type drive tumbler. Individual crawler links are heavy alloy steel castings connected by heat treated pins.

Innovative drive tumblers made from large diameter steel castings have lugs extending beyond the tumbler rims. They are mounted on forged alloy steel shafts which turn on large anti-friction bearings mounted within the crawler frame. The sprocket type lugs provide a large area of contact against the crawler links, extending the life of both links and tumblers.

Lower rollers rotate on forged steel shafts mounted within the crawler side frames. Eight smaller rollers and 1 large roller per frame are specially suited to withstand the periodic single point ground reaction caused by uneven pit floors. Slide bars on top of each frame support the upper crawler belt, reducing propel friction and drag. These side frames are stress relieved weldments comprised of steel castings and cold weather steel plates.

The crawler assemblies are bolted to the truck frame with large diameter rods and torque nuts. Each crawler belt can be independently adjusted for tension.

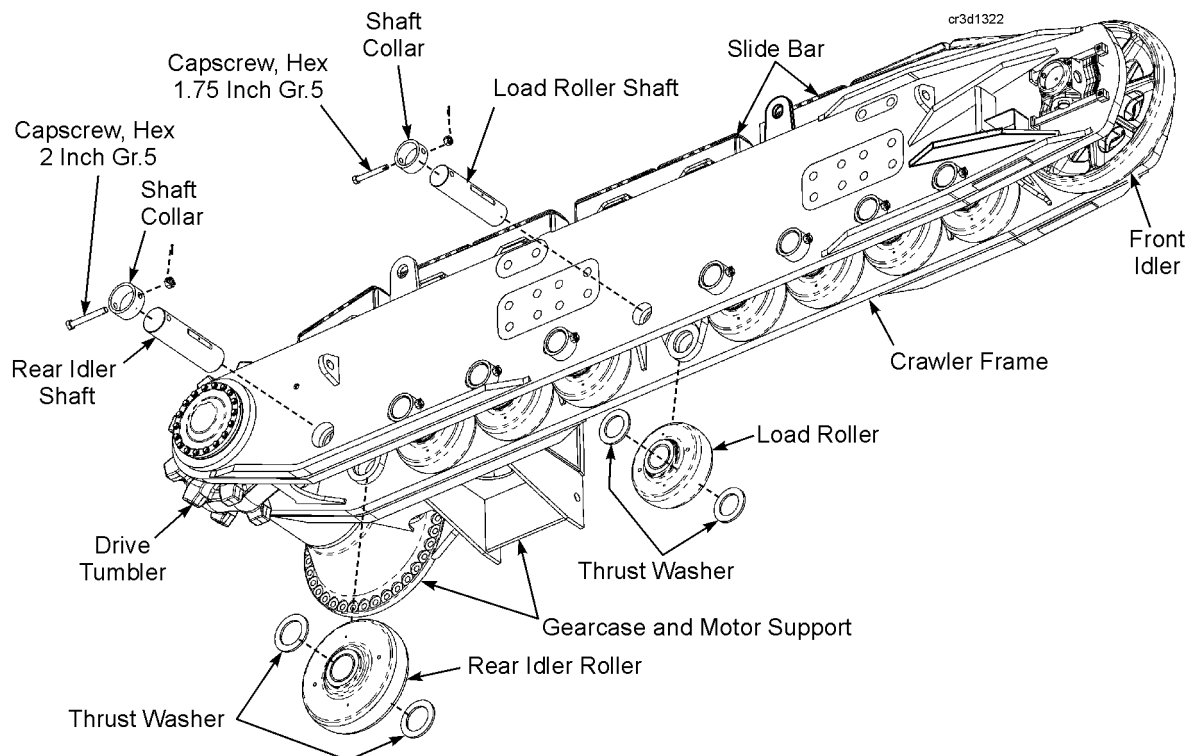


Figure 1-3: Right Crawler Assembly (Left Opposite)

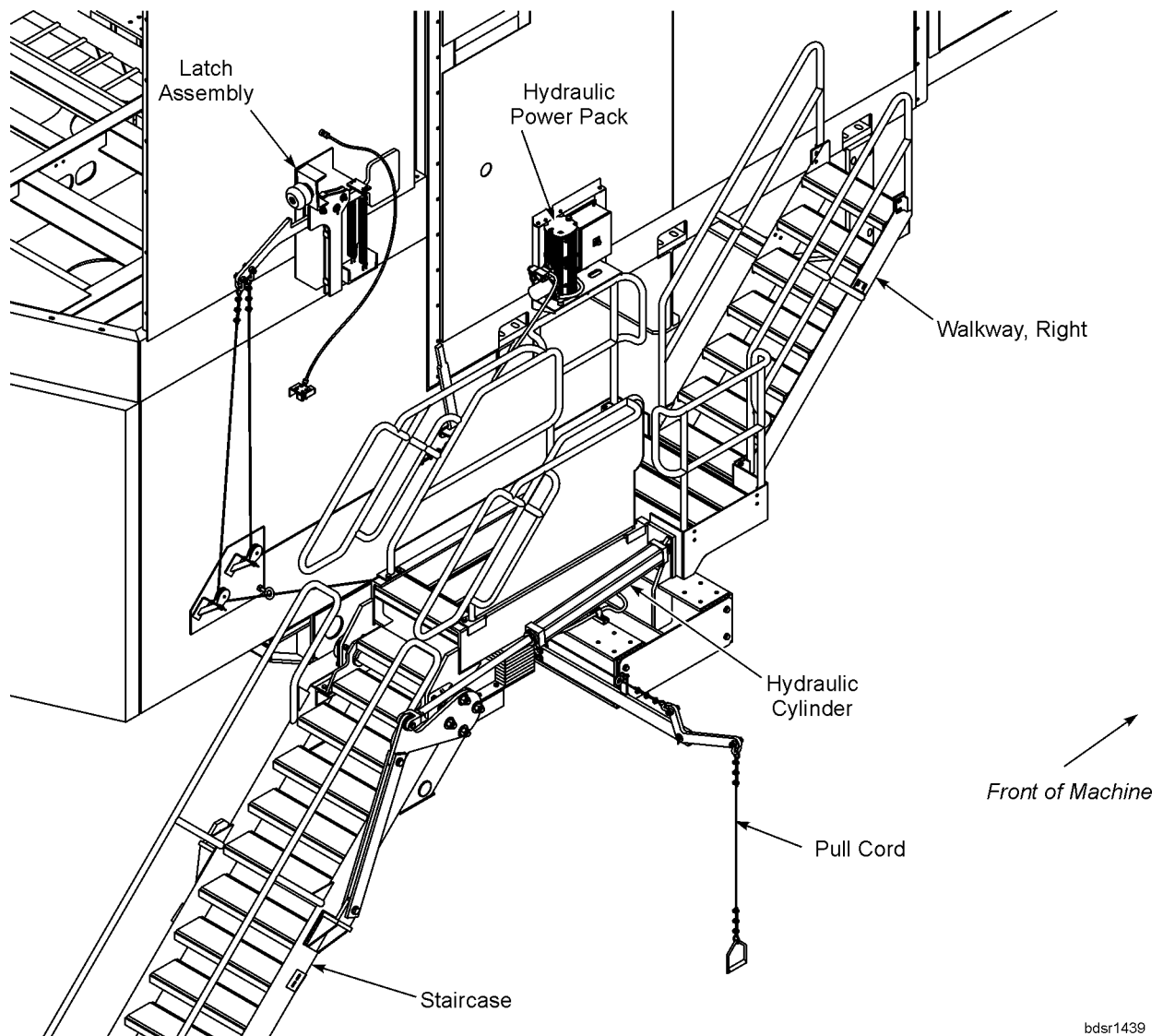


BOARDING STAIRS

A set of boarding stairs is attached to the machinery house platform - either on the left side of the machine, the right side or both. When lowered, the stairs allow entrance to the machinery house from ground level. To activate the stairs, a pull cord attached to a lever arm is reachable from the ground. An additional lever is available at the top of the stairs. These stairs must be in their raised and latched position to enable the operator's controls.



DANGER: STORED ENERGY! System may be under hydraulic pressure which can cause severe personal injury or death. Shut down pump and relieve system of all pressure before removing components.



bdsr1439

Figure 1-7: Right Side Boarding Stairs

495HR² Electric Mining Shovel**FRONT END EQUIPMENT**

The front end equipment consists of the boom, the boom point sheaves, padlock, saddle block, dipper handle, dipper, dipper trip mechanisms, running ropes and boom suspension strands.

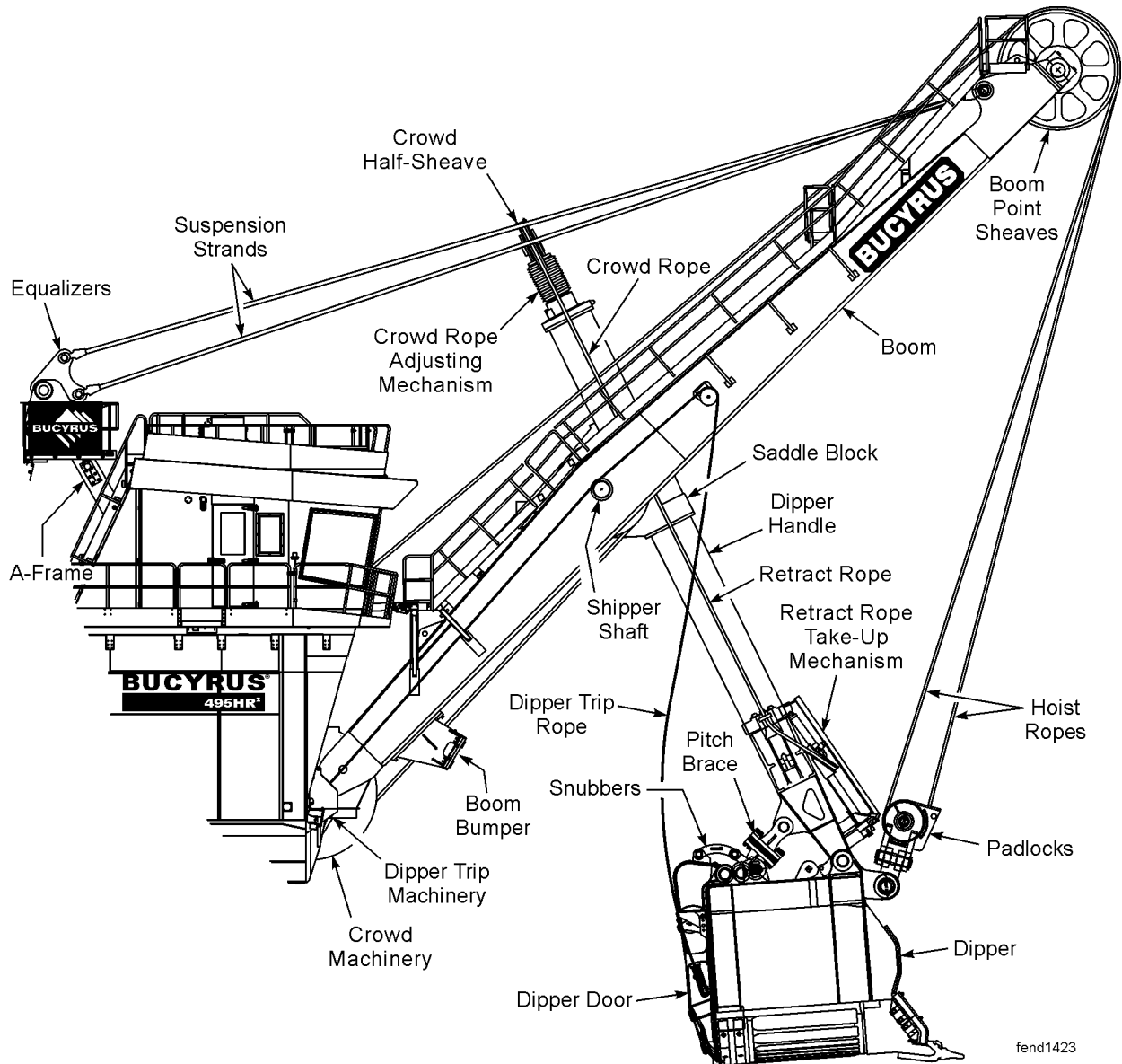


Figure 1-14: Front End Equipment

SUSPENSION STRANDS

The suspension strands are designed to maintain the proper boom angle. These are fixed-length strands that support the entire weight of the boom and the load.

495HR² Electric Mining Shovel**GENERAL ESTIMATED COMPONENT WEIGHTS**

CAUTION: These are estimated weights only. Contact your Bucyrus International service representative for the exact weight of components on your specific machine before rigging and lifting.

LOWER WORKS

	<i>Quantity</i>	<i>Weight Each (U.S. Pounds)</i>
Truck Frame	1	191,330
Pintle Bushing	1	280
Lower Rail	9	570
Thrust Rail	9	170
Propel Brake Adapter	2	370
Propel Brake	2	650
Propel Brake Hub	2	60
Propel Motor	2	4,500
Propel Motor Blower	2	210
Propel Motor Duct Assembly	2	180
Propel Brake Guard	2	60
Coupling	2	90
Crawler Belt (2 per Machine)	2	245,490
Link, Crawler, 102 In. (47 per Belt)	47	2,480
Crawler Assembly~Shipping	2	128,500
Crawler Structure	2	83,880
Propel Gearcase	2	19,230
Front Idler	2	5,800
Shaft, Front Idler	2	1,150
Adjusting Block	4	370
Load Roller	8	2,020
Shaft, Load Roller	8	550
Rear Idler	2	3,800
Shaft, Rear Idler	1	700
Tumbler, Drive	1	7,120
Shaft, Drive Assy	1	4,330
Shaft, Drive	1	3,370
Sleeve, Center Pintle	1	9,100
Collar, Center Pintle, Upper	1	380
Washer, Thrust, Center Pintle	1	400
Nut, Lock, Assy, Center Pintle	1	1,470

495HR² Electric Mining Shovel

(If it is not practical to run the motor for one hour and then stop the motor, it is acceptable to reinstall the drain plug without damage to the bearings or seals.)

- i. Stop the motor and lock out the starter. Reinstall the drain plug.
- j. The motor is now ready to be put back in service.

4. REGREASING INTERVALS

The regreasing interval can be found in the following table. Follow either the recommended operating hours, or the time interval, which ever comes first.

<i>Motor</i>	<i>Regreasing Interval</i>	<i>Drive End Grease Amount Grams (oz.)</i>	<i>Non-Drive End Grease Amount Grams (oz.)</i>
Hoist motor	3000 operating hours or every 6 months	88 (3.1)	140 (5.0)
Propel motor	3000 operating hours or every 6 months	54 (1.9)	94 (3.3)
Crowd motor	3000 operating hours or every 6 months	54 (1.9)	94 (3.3)
Swing motor	1500 operating hours or every 3 months	54 (1.9)	80 (2.8)

NOTES:

- It is critical that the drainpipe not be allowed to become plugged with caked or contaminated grease. If it does, then the pipe must be cleared.
- A common mistake is over-lubrication of bearings. When grease is added without removing the drain plug, the excess grease can be forced into and through the grease seals leading to grease leakage along the shaft (out of the motor or into the motor and possibly onto the motor windings). Proper lubrication is desired, but some under-lubrication is less harmful than over-lubrication.
- Bucyrus part number 59100651 is a 14 ounce cartridge of Mobilith SHC100 grease.

LUBRICANT SELECTION

The selection of the proper lubricants for use on this machine is critical to its reliability. Improperly lubricated bearings, gears, couplings and other precision parts quickly fail. For this reason, lubricants selected in accordance with the "American Standards Testing Material" (ASTM) standards are recommended. These standards were compiled in cooperation with major petroleum suppliers to ensure the consumer of an exact supply to specific requirements, regardless of source.

We recommend you advise the petroleum supplier of the following information to assist in selecting the proper product for each application of this machine.

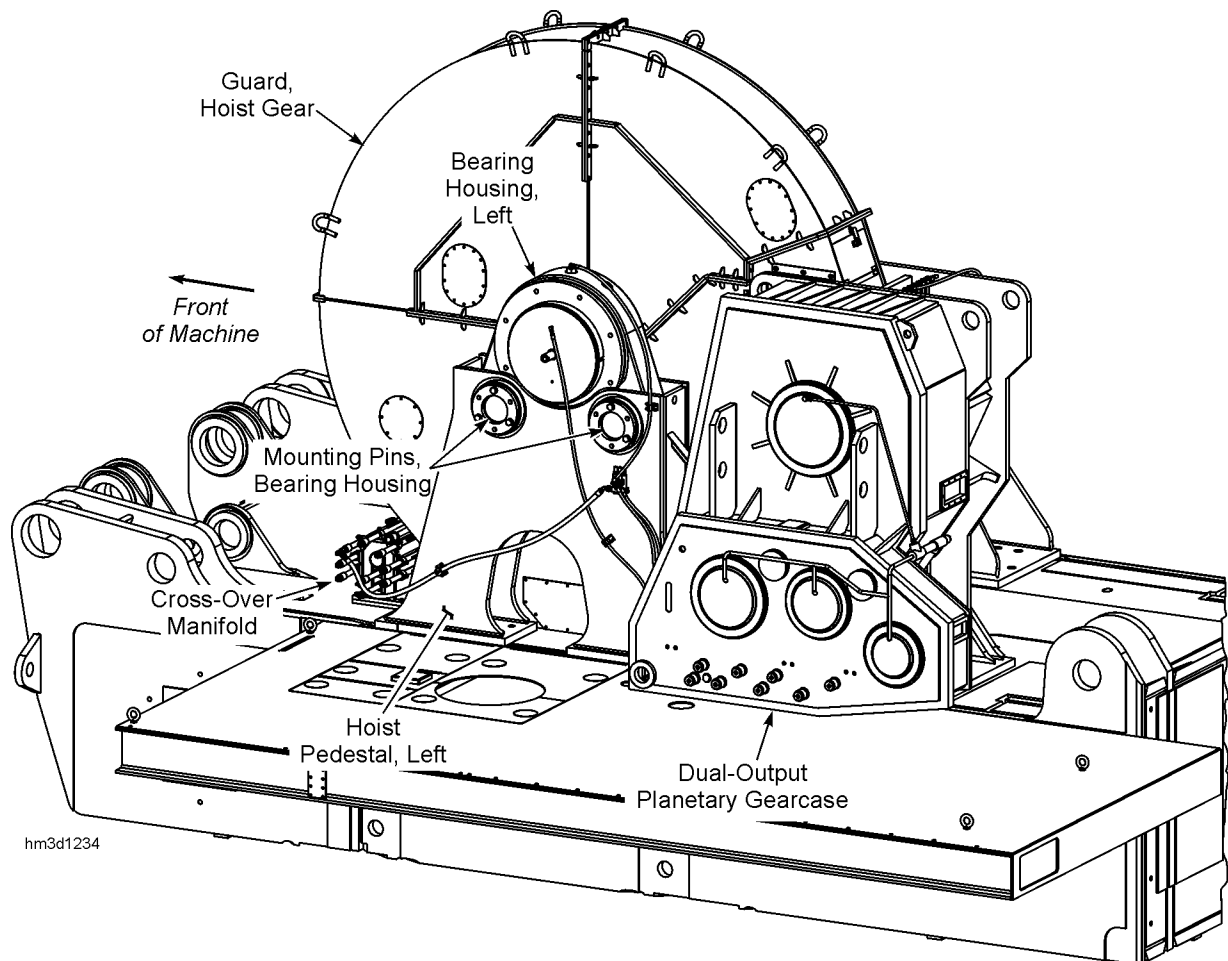
Final acceptance of all lubricants supplied to this standard will be based upon their satisfactory performance in the intended application and does not relieve the supplier of performance responsibility for brand name products.

Operation of this machine in extreme temperatures (below -20°F/-29°C or above 110°F/44°C) requires special lubrication. Note the temperature ranges on the following lubricant specification sheets. Contact your local supplier, your Bucyrus representative, or the Service Department of your local Bucyrus International office for recommendations if you require additional information or advice.

495HR² Electric Mining Shovel**HOIST MACHINERY LUBRICATION**

The hoist machinery drive is comprised of 2 stages of gear reduction. The first stage gear reduction is an enclosed system running submersed in lubricant. The gearcase housing is equipped with lubricant level check plugs on the right side of the case. A filter breather is provided to allow for air entry to equalize pressure differentials created by the warming and cooling of the gearcase, allows moisture to escape and prevents contaminants from entering.

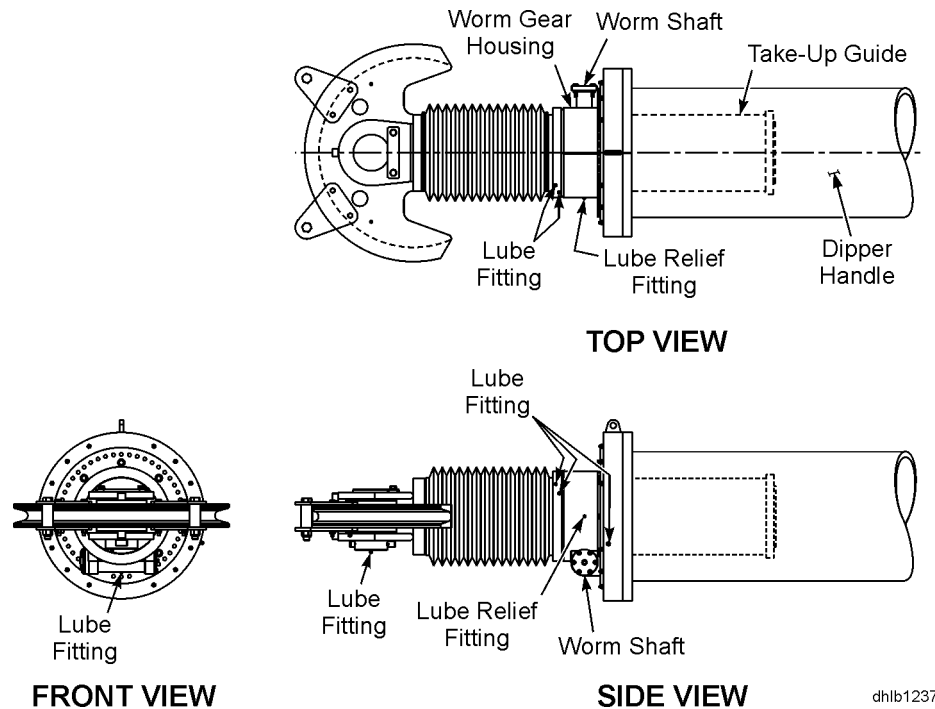
The second stage of gear reduction is operating as a semi-enclosed system lubricated by OGL. The drum shaft bearings are grease lubricated by System "C-1" along with the intermediate shaft of the hoist gearing. The motor pinion shaft bearings are splash lubricated from the 1st stage gearcase.



495HR² Electric Mining Shovel**CROWD ROPE TAKE-UP MECHANISM LUBRICATION**

Whenever the hydraulic motor adapter is installed in the crowd rope take-up mechanism to tension the crowd rope, fresh OGL lubricant should be applied to the assembly. Refer to Section 5 - *CROWD ROPE TIGHTENING* in this manual.

1. Hoist the dipper until the dipper handle is horizontal, parallel to the ground. Retract the handle until the crowd half-sheave is within reach of the hydraulic unit on the machinery house roof behind the operator's cab. (With the hoist ropes supporting the dipper and the handle just retracted, any slack that exists should be in the crowd rope.)



2. Refill the crowd rope worm gear housing with OGL, if required. (Total capacity is approximately 3.0 gallons.)
 - Add, at the least a small amount of OGL through all four of the lube fittings in the crowd rope worm gear housing, to lubricate friction surfaces adjacent to those fittings.
 - Look for OGL to bleed from the relief valve fitting in the side of the worm gear housing, when lubricant capacity of the housing is reached.
 - Pump a small amount of OGL through the fitting on the half-sheave clevis pin.

NOTE: During initial assembly, prior to shipping, grease lubricant is applied to all friction surfaces of the assembly. Traces of grease lubricant will be visible during initial maintenance, but for all lubrication procedures in the field, use Open Gear Lubricant (OGL) – *not* grease.



EGL - ENCLOSED GEARCASE LUBRICANT

Applicable to Models 495BII, 495HF, 495HR and 495HD Electric Mining Shovels.

(September 1, 2005)

SCOPE

This specification covers the requirements for “Enclosed Gearcase Lubricant” used on models 495BII, 495HF, 495HR and 495HD Electric Mining Shovels.

The materials furnished under this specification are intended to lubricate spur, helical and spiral bevel gears as well as anti-friction bearings at the interior of enclosed planetary and non-planetary type gearcases (Hoist, Swing, Crowd and Propel).

This specification covers “Enclosed Gearcase Lubricants” that may be applied in service at temperatures ranging from –50°C (-58°F) to the highest ambient temperature conditions.

Guidelines for Selecting an Approved Lubricant

1. Using *Table 1*, determine the recommended oil type (Mineral or Synthetic) based upon the anticipated ambient temperature range.

AMBIENT TEMPERATURE RANGE

Ambient Temperature: The ambient temperature is defined as the air temperature in the immediate vicinity of the gearcase.

- a. Use atmospheric temperature for gearcases located outside of the machinery house (Swing, Crowd and Propel Gearcases).
- b. Use machinery house temperature for gearcases located inside of the machinery house (Hoist Gearcase) for some machines are equipped with machinery house heaters.
- c. If the ambient starting temperature approaches the lubricant pour point, external heaters may be required to facilitate starting and insure proper lubrication. Use oil temperature for gearcases having oil immersion heaters.

Table 2-1: Guidelines for Selecting Approved Lubricant

Ambient Temperature Range	ISO Viscosity Grade / Oil Type
14°F to 100°F (-10°C to 37°C)	ISO VG 320 / Mineral or Synthetic (poly-a-olefin) Oil
Less than 14°F to 120°F (Less than -10°C to 50°C)	ISO VG 320 / Synthetic (poly-a-olefin) Oil

Under normal circumstances, an ISO VG 320 oil viscosity is required for all Gearcases (Hoist, Swing, Crowd and Propel). For cold weather applications, an ISO VG 220 oil viscosity may be used for the Propel Gearcases to help ensure that the lubricant pour point remains below that of the ambient starting temperature. The pour point and flash point of individual brand name gear oils must be observed. Refer to the oil manufacturers technical data sheets for these properties.

2. Select an approved lubricant for the Hoist, Swing, Crowd and Propel Gearcases from the Approved Lubricant *Table 2 & Table 3*.

APPROVED LUBRICANTS

Lubricants that have been approved for use by the gearcase manufacturers are listed in the Approved Lubricant *Table 2 & Table 3*. The use of non-approved lubricants may invalidate the Bucyrus International, Inc. product warranty obligation.



CERTIFIED LUBRICANTS

Lubricants certified by their manufacturers as complying with this specification will be listed on the “Certified Lubricants Listing for Open Gear Lubricant” (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



Section 3

Preventive Maintenance

INTRODUCTION

This section of the manual describes those aspects of preventive maintenance on the machine such as inspection, adjustment and routine repetitive tasks. Information related to lubrication techniques, frequency and service points is also partially included. Further detailed information can be found in *LUBRICATION* and *SERVICE PROCEDURES* sections of this manual.

PREVENTIVE MAINTENANCE PROGRAM

A Preventive Maintenance Program is a systematic series of operations performed periodically on equipment to prevent breakdowns.

Any breakdown *WILL* reduce productivity and increase overhead expense. Machinery is only new at one point in time. From that moment, the machinery begins to deteriorate through use and aging. A well organized maintenance program will avoid unexpected high-cost breakdowns and will increase component life.

A systematic approach to the program should be followed and detailed records of all findings kept, to detect potential problem areas. Valuable time and effort can be saved if defects are corrected before they lead to a major breakdown. The records should be reviewed often and kept on file for future reference.


Personnel involved in the program should go through an established training program, to know *WHAT* to check and *HOW* to rectify any potential problem area. When personnel are able to do routine maintenance and normal repairs efficiently, downtime is reduced and machine productivity increased. Also, to keep the machine in good running condition, the necessary parts, tools and current information should be kept on hand.

Equipment maintenance is a science and its practice an art. This art can be divided into 6 types of operations - *they are*:

- **Inspection** is probably the most important operation. Careful observation is required of all parts of the equipment. Slight abnormalities may not interfere with the equipment performance BUT those that are a deviation from the normal should be discovered early. When inspecting, notice placement, state of cleanliness, color, etc. of part(s). Example: discoloration indicates overheating; all guards, bolts in place and good housekeeping.
- **Cleaning** and keeping clean is essential for good operation. Periodic cleaning should be more frequent on exposed parts than those which are contained within cabinets. Parts, connections and joints should be free of dust, corrosion and other foreign matter.
- A **Feeling** operation is used more often to check guarded rotating machinery for vibration due to worn parts, lack of lubrication, overheating, etc. Feeling operation on electrical items should be performed as soon as possible *AFTER* power has been removed and the circuit grounded. Feeling of excessive heat may indicate an overloaded condition and should be corrected.
- A **Tightening** operation should be done on all connections that have worked loose due to vibration, etc. Loose parts are a definite hazard because they may fall out of place and



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Check Points - Daily			
✓	<i>Location</i>	<i>Check</i>	<i>Noted Discrepancy</i>
	23. Operator's Cab	Check for cleanliness and the visual condition of the controls. Check the location of special equipment that may be required by the mine site. Check all operating controls for freedom of movement. The controls should move freely without binding.	
	24. Operator's Cab	Clean all windows.	
	25. Walkways and Stairways	Inspect to ensure there are no obstructions, damage or fluids creating a safety hazard.	
	26. Boarding Stairs and/or Boarding Ladders	Ensure all are raised and properly stowed and latched.	
 DANGER: HIGH VOLTAGE! The machine trail cable carries a lethal voltage. Handle the cable in an approved manner with appropriate rubber gloves and insulated hooks or tongs.			
	27. Trail Cable	Visually inspect the trail cable for cuts, abrasions or other damage.	
	28. Cable Reel	At the Cable Reel, if equipped, check the Hydraulic Fluid Reservoir for proper fluid level. Add fluid if required.	
	29. Cable Reel Hydraulic System	Visually check the Cable Reel Hydraulic System for leaks. Tighten, repair or replace components as necessary.	
	30. Operator's Cab HVAC	Clean filter and pressurizer in dusty conditions. Observe charge.	

Date:	
Shift:	
Inspected by:	
Supervisor:	

495HR² Electric Mining Shovel**5000 HOURS OR ANNUALLY**

✓	Check Points - 5000 Hours or Annually		
	Location	Check	Noted Discrepancy
	1. Propel Gearcase	Check for leaks, cracks - repair as required.	
	2. Crawler Frame Underside	Check for wear, cracks, damage.	
	3. Crawler Frame	Tighten all crawler frame connecting rod jack bolts per Service Procedures section in this manual.	
	4. Propel Motors	Verify motor coupling clearance and alignment using a dial indicator. (Refer to manufacturer's information.)	
	5. Propel Gearcase	Pull the bottom plug and collect a 1/2 gallon of lubricant. Inspect the sample for metal particles.	
	6. Final Drive Shaft Bearing	Lube must be present! If fresh lube is not present, investigate the problem.	
	7. Swing Rack	Verify the tension of the rack-to-truck frame mounting bolts and the rack joint assembly bolts.	
	8. Roller Circle and Rails	Check for wear. Replace rails or rollers when wear exceeds 1/2".	
	9. Center Pintle Bushing	Check the truck frame bushing and replace if required.	
	10. Center Pintle Upper Nut	Verify that the lock bars and retaining dowels are in place. Check that the nut is flush with the top of the pintle - if not, investigate the problem.	
	11. Revolving Frame	Thoroughly inspect the revolving frame integrity. Repair damage from cracks and wear. (Includes the ballast box weld joint and swing gearcase support welds.)	
	12. Revolving Frame Extensions	Check the extension bolts for security and retension as required.	
	13. Machinery House	Repair all damaged sections, panels, doors and latches.	
	14. House Filtration	Clean the filter units, inspect the blowers and fan blades closely. Repair or replace damaged and worn parts.	
	15. Hoist Motor Pinion Shaft	Inspect the bearings, retainers and seals for damage. Correct as needed. Inspect oil passages for obstructions.	



495HR² Electric Mining Shovel

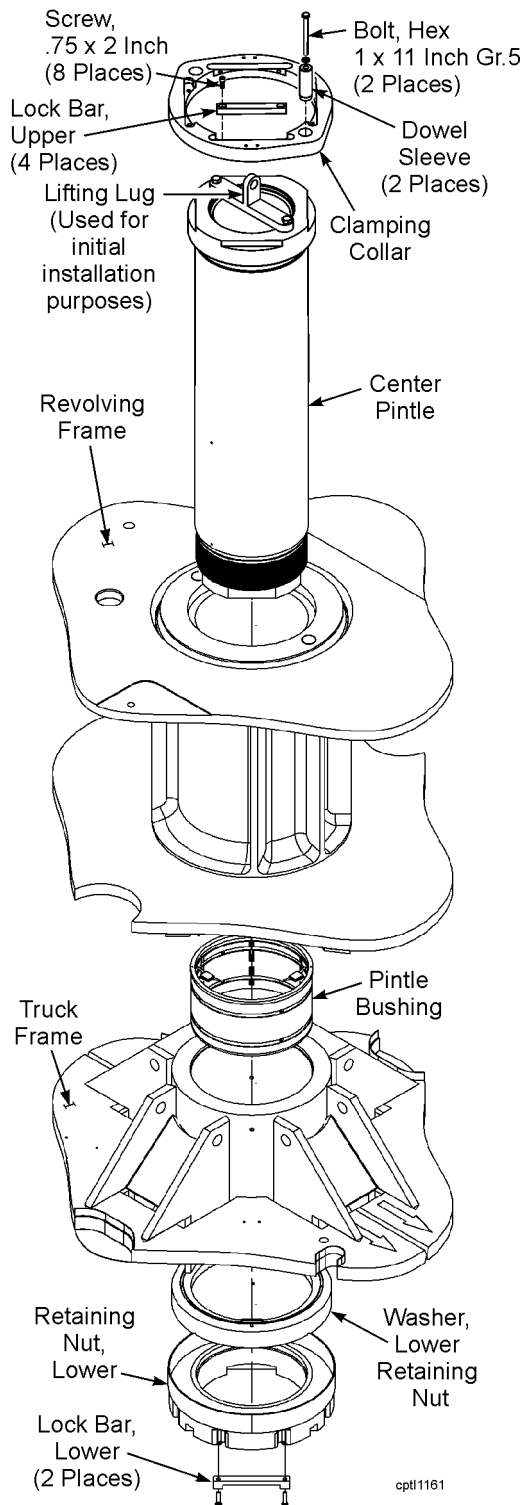


Figure 3-10: Center Pintle Assembly



495HR² Electric Mining Shovel

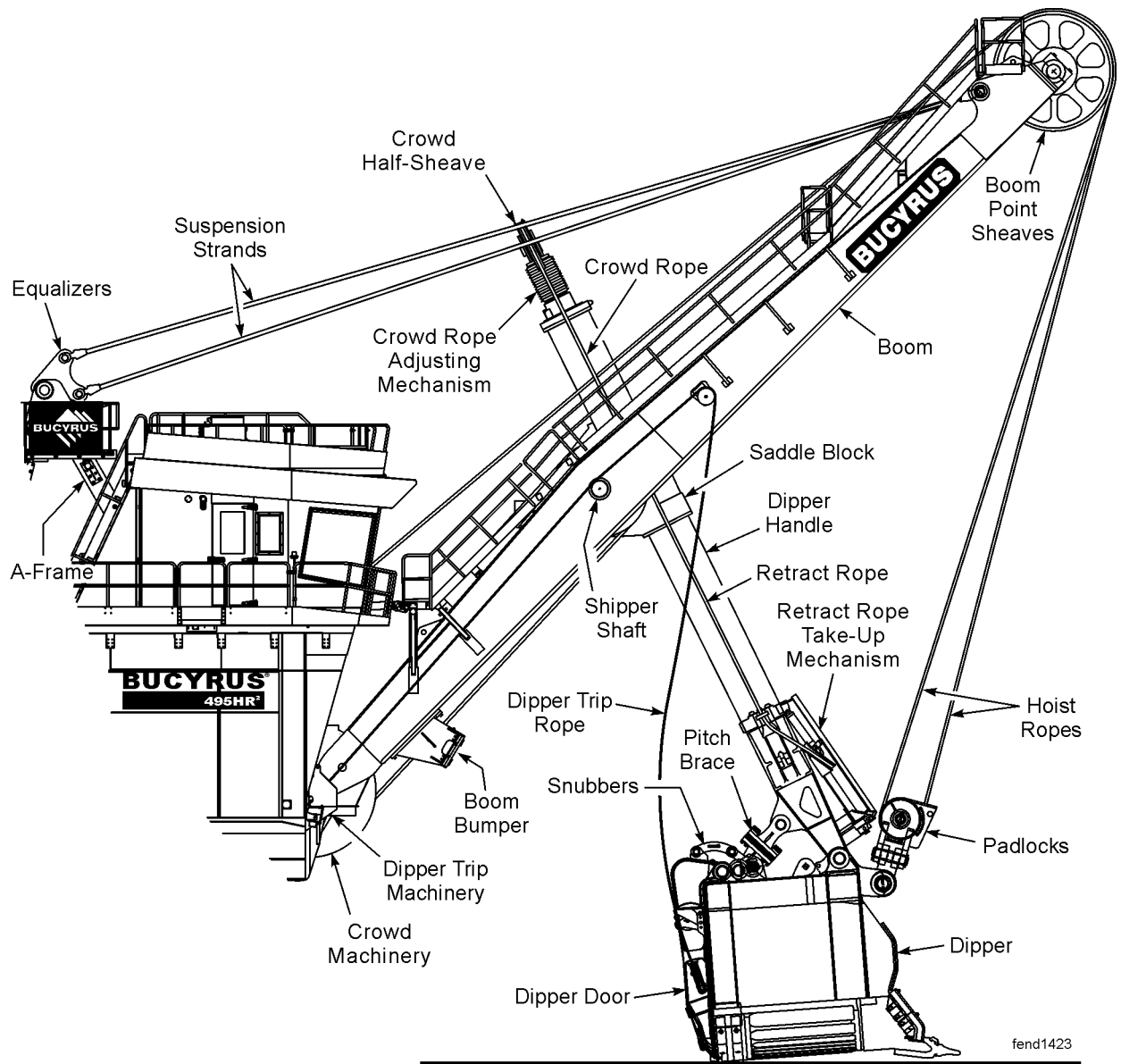


Figure 3-20: Front End Equipment



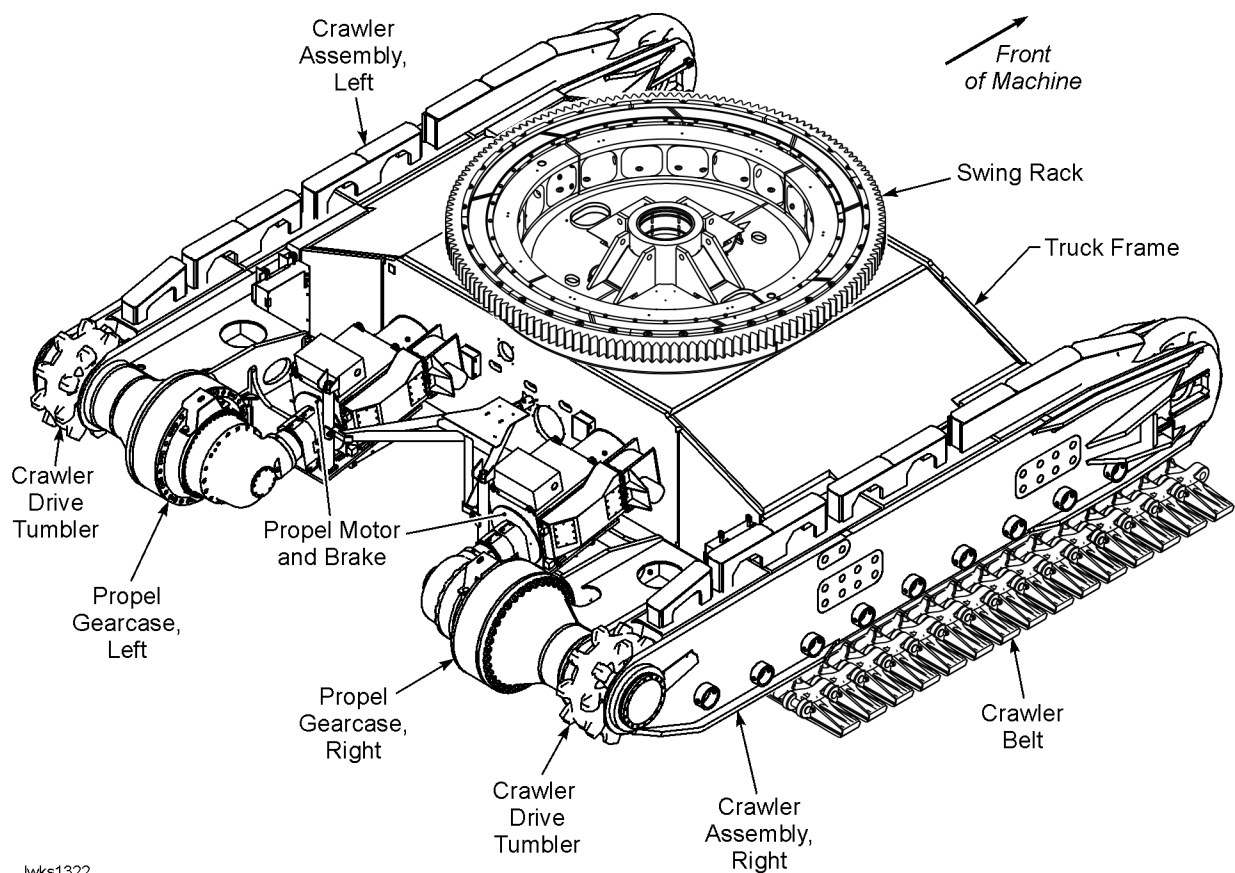
Section 4

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.



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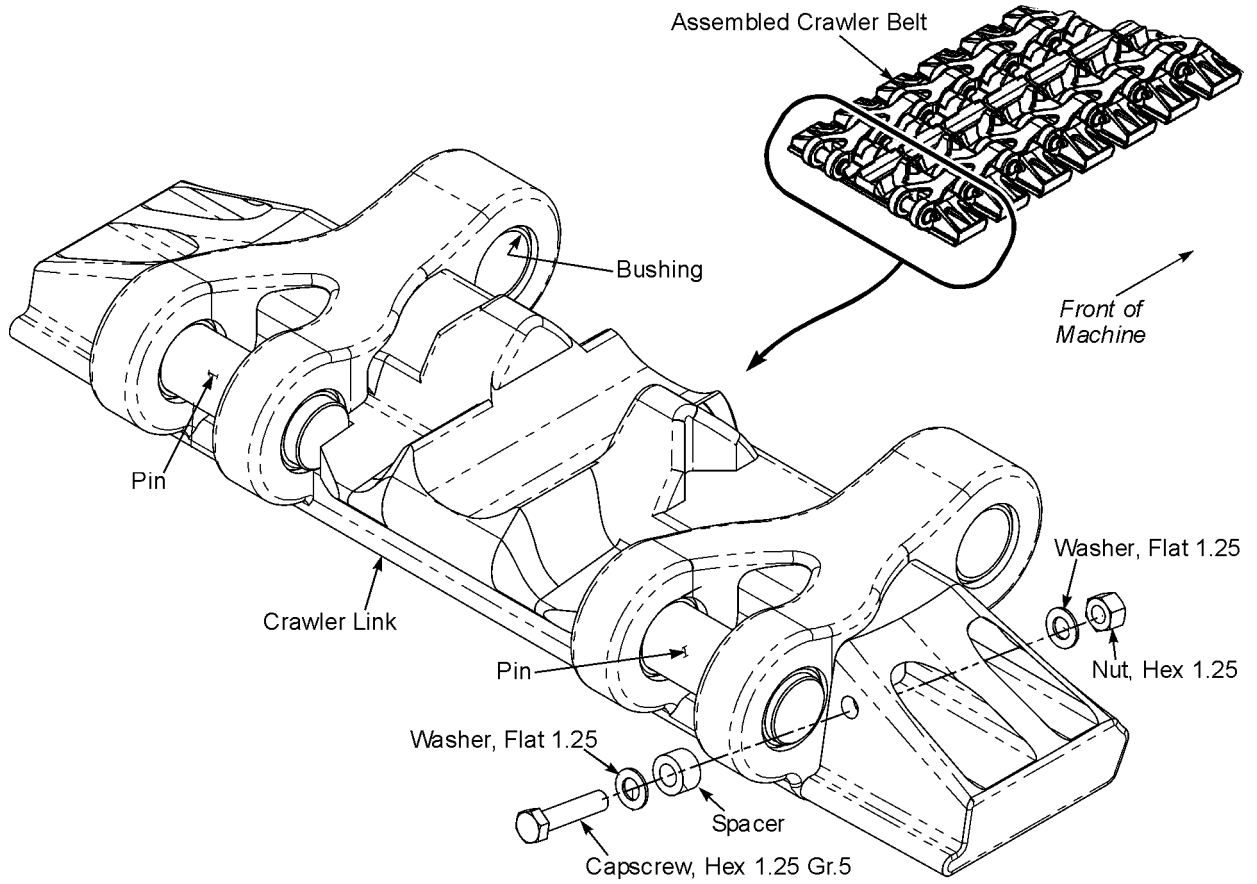
Figure 4-1: Truck Frame and Crawlers Assembly

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 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.



495HR² Electric Mining Shovel



belt1143



DANGER: 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.

7. Support the idler (approximately 5100 Lbs.) with a crane.
8. Remove the shaft locking pins, the adjusting block screws (4 places per block) and the adjusting blocks.
9. Use the tapped hole in the CENTER of either end of the idler shaft to remove the shaft.



CAUTION: STAND CLEAR OF THE AREA AS THE SHAFT IS REMOVED. The Thrust Washers and Shims are fastened to the adjusting blocks with long hex-socket-head screws. THESE PARTS MAY FALL OUT AS THE SHAFT IS REMOVED.

NOTE: Do not use the off-center lube supply holes at one end of the shaft for removal.

10. Lift the idler clear of the crawler frame.
11. Inspect all parts for wear or damage. Replace or repair as required.

Installation of the front idler is the reverse of removal.

NOTES:

1. Install the idler shaft with the 2 lube grooves toward the front of the crawler and the lube supply holes toward the CL machine (Inboard).
2. If removed, install the thrust washers with their lube grooves toward the idler roller. Verify that the proper running gap exists between the thrust washer and the idler on each side of the idler.
3. After installation, lubricate and check auto-lube. Adjust belt tension. Refer to proper procedures in this section of the manual.
4. Install the adjusting block with the jack depression toward the rear of the crawler.
5. Install the required shims to achieve the indicated gap between the idler and the thrust washer on each side of the idler.

495HR² Electric Mining Shovel**MAIN PROPEL SHAFT - DISASSEMBLY**

1. Remove 2 locking capscrews from the bearing nut, and unscrew the bearing nut from the shaft using the special wrench provided with the machine.
2. Lift the lip seal from the back face of the bearing cartridge, if it is still in place.
3. Remove 6 hex socket head capscrews holding the retainer to the cartridge.
4. Remove the retainer and seal spacer from the shaft.
5. Pull the cartridge from the bearing in the opposite direction.
6. Use a bearing puller to remove the bearing from the shaft.
7. Remove the bearing spacer from the shaft.
8. Inspect the final spacer that may remain next to the splines on the shaft. Remove if required for replacement.
9. Inspect all parts and replace as required.
10. Reassembly is the reverse of disassembly:
 - a. The double tapered bearing may be heated for assembly to the shaft. Use a dry heat source and do not permit the temperature of bearing to exceed 300°F (149°C). Allow the bearing to cool to ambient temperature before assembling any other parts to it.
 - b. Install the bearing retainer and new seal without shims. Shim the gap at the retainer/cartridge as indicated in the accompanying sketch.
 - c. Fill the bearing cavity with Multiplex EP2 grease (part number MP380900) at assembly.
 - d. Spray the lip seal area with lubricant (part number MP170025) at assembly.
11. Assemble the main propel shaft into the tumbler and crawler.

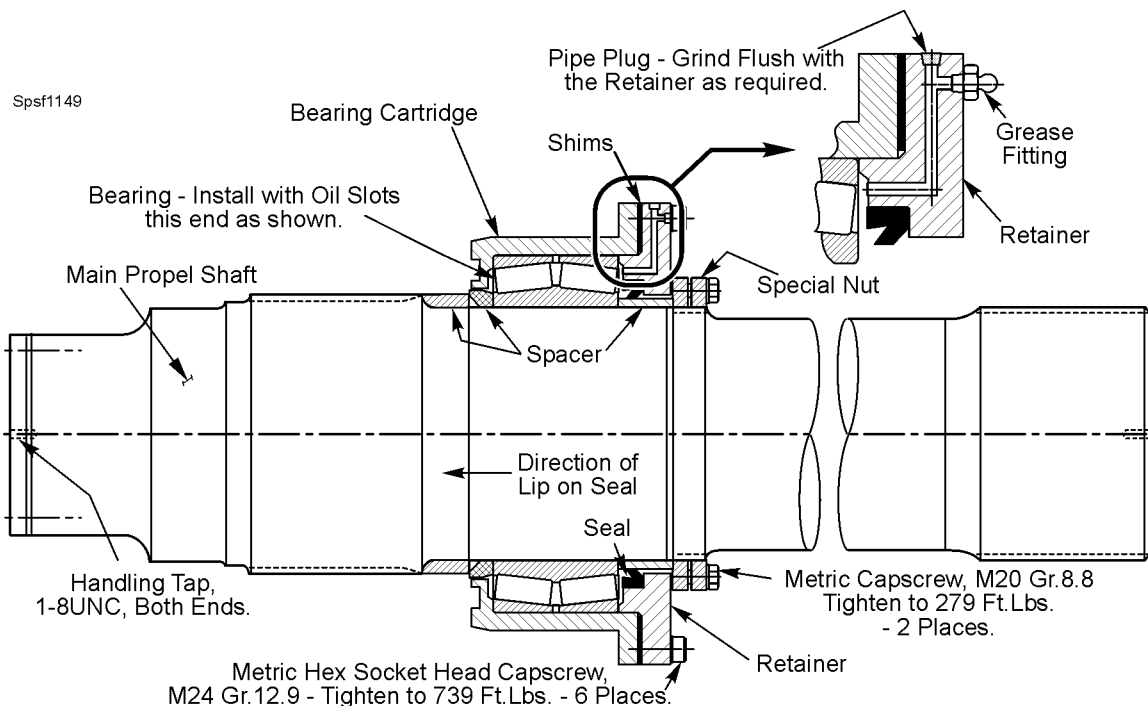


Figure 4-19: Main Propel Shaft - Section View



PROPEL MOTOR INSTALLATION

The following procedure assumes that the propel motor being installed is new & that it has none of the additional parts required for the application.

1. Install the drive coupling hub & brake rotor hub onto the motor shaft. The rotor hub installs on the commutator end of the motor. Follow the hub/gear installation procedure in *ENGINEERING DATA* section of this manual.
2. Install the brake assembly so that the air inlet is at the bottom after the motor assembly is installed onto the machine. Refer to *BRAKES AND COUPLINGS* section of this manual for installation & adjustment.
3. Install the motor and brake assembly onto the crawler frame. Check the coupling alignment. With the motor shaft at midpoint of its axial float, the gap, angular offset & radial offset must all be within specification. Refer to GRID COUPLINGS in *BRAKES AND COUPLINGS* section of this manual for specifications & mounting instructions.
4. If alignment is required, use the 4 jacking screws & mounting bolts to move the motor horizontally & the 2 jack screws under the motor to move it vertically. Once aligned, determine the shim thickness required and install the shims.
5. Install the 4 motor mounting capscrews and related hardware.
6. Re-check the alignment. Position chock and wedge blocks under the motor if required.
7. Install all guards, air lines & wiring.



CAUTION: ALL WIRING MUST BE DONE BY A QUALIFIED ELECTRICIAN.



COLLECTOR RING INSPECTION

Inspect the collector rings and shoes frequently for grease and contaminant accumulations on the rings, shoes, insulators and incoming wires.

Clean the collector rings and related parts with an approved solvent regularly to prevent high potential grounds. Make sure each shoe bears firmly against the collector ring. The shoes are spring-loaded to maintain constant contact.



CAUTION: Solvents may be toxic or flammable. Adequate ventilation must be provided to minimize fire and health hazards caused by using solvents for cleaning. Use away from sparks, heat or flame to prevent fire or explosion. Follow the manufacturer's instructions.

Check the insulators for cracks or chipping and replace promptly if damaged. Verify that the screws securing the rings to the insulators do not protrude beyond the countersunk holes of the rings.



CAUTION: A cracked or chipped insulator or an excessive amount of contaminants may cause an electrical fault. This could result in death or serious injury.

COLLECTOR RING REPAIR

Repair of the collector rings involves replacement of damaged insulators or defective shoes. The collector ring life expectancy exceeds the life expectancy of the machine. However, To replace the insulators or shoes:

1. Disconnect electrical power to the machine.



DANGER: HIGH VOLTAGE! Do not access the collector rings unless power to the machine has been disconnected and locked-out. Only authorized personnel should service the collector rings.

2. Remove the attaching hardware securing the insulator or shoe to the mounting. Access to the shoes mounted to the truck frame is obtained by entering the truck frame through the bottom access opening.
3. Install new insulators or shoes. Make sure all electrical leads are securely attached to the shoes and collector rings.



CAUTION: Do not attempt to inspect the underside of the revolving frame until power to the machine is disconnected.



SWING PINION SHAFT REMOVAL



DANGER: BE EXTREMELY CAUTIOUS WHEN REMOVING THE SWING PINION SHAFT ASSEMBLY THROUGH THE BOTTOM OF THE REVOLVING FRAME. AFTER LOOSENING THE BEARING CARRIER BOLTS THE SHAFT IS UNSUPPORTED AND MAY FALL.

1. Rotate the machine to place the swing shaft to be removed at the front of the truck frame.
2. Set the dipper lip and front flat on the ground. Set all brakes.
3. Disconnect the power leads to the swing motor that is connected to the shaft to be removed.



DANGER: BEFORE ATTEMPTING TO DISCONNECT ANY POWER LEADS, PRESS THE MAIN POWER OFF BUTTON AND TAG IT TO AVOID INADVERTENT ENERGIZING OF THE ELECTRICAL CIRCUIT. Electrocutation or serious injury may occur if appropriate safety measures are not followed. Electrical connections should only be handled by trained electrical personnel.

4. Support the swing pinion shaft to be removed (approximately 2200 Lbs.) by using a jack or other suitable device beneath the inspection cover.



DANGER: STORED ENERGY! Equipment 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. On machines using planetary dual-output swing drives, both swing pinions per drive must be engaged with the swing rack in order for the swing brake to be effective. The internal differential drive in the gearcase allows one pinion to rotate, even if the brake is set, when the other pinion has been removed. Refer to *INTRODUCTION - SWING RESTRAINT*.

5. Remove the capscrews that attach the lower carrier retainer to the swing machinery structure.
6. Lower the swing pinion shaft and set on cribbing.
7. Inspect all parts. Repair or replace any worn or broken components.

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DANGER: STORED ENERGY! Equipment must be blocked prior to gearcase removal to prevent unwanted rotational movement. Failure to comply could result in death, severe personal injury, or damage to the machine. On machines using planetary dual-output swing drives, both swing pinions per drive must be engaged with the swing rack in order for the swing brake to be effective. The internal differential drive in the gearcase allows one pinion to rotate, even if the brake is set, when the other pinion has been removed.

The hoist gearcase can be removed or replaced without removing the hoist motor or the hoist gear. To remove the gearcase:

1. Position the machine so that the dipper lip and front are flat on the ground.
2. Apply sufficient force on the crowd to “jack” the boom enough to unwind the suspension strands. Set the crowd brake. On machines equipped with hydraulic crowd, there is no crowd brake.
3. Remove the appropriate roof panels above the hoist gearcase.
4. Remove the left-upper-rear A-Frame leg pin. Swing the A-Frame leg to the rear of the machine.



DANGER: BEFORE PERFORMING ANY MAJOR MAINTENANCE ON THE HOIST MACHINERY, PRESS AND TAG THE MAIN POWER OFF BUTTON. Failure to comply may result in injury or death.



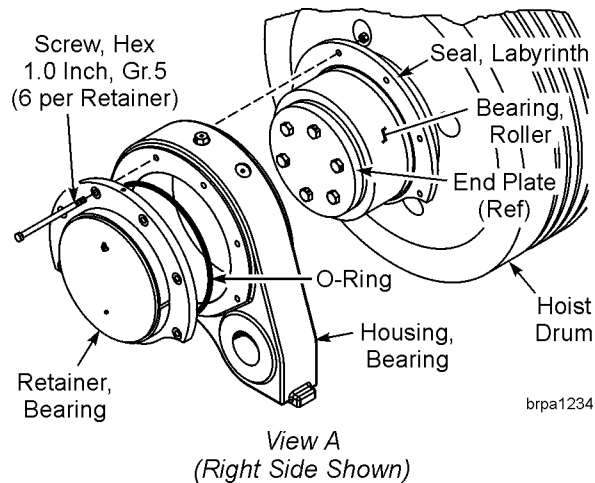
DANGER: STORED ENERGY! Gearing or drum must be blocked prior to performing maintenance in order to prevent unwanted movement. Failure to comply could result in death, severe personal injury, or damage to the machine.

5. Remove the upper-rear section of the hoist gear guard. Use blocking to prevent accidental movement of the hoist drum.
6. Pull the gearcase bearing drain hoses up from the deck and tie back out of the way.
7. Remove the guard covering the oil cooler piping. Drain the oil from the gearcase. Disconnect the oil pump-to-radiator line and the radiator-to-manifold line.
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 *BRAKES AND COUPLINGS* section.
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 locking assemblies from the 3 mounting pins that attach the gearcase to the hoist pedestal.

495HR² Electric Mining Shovel**BEARING REMOVAL**

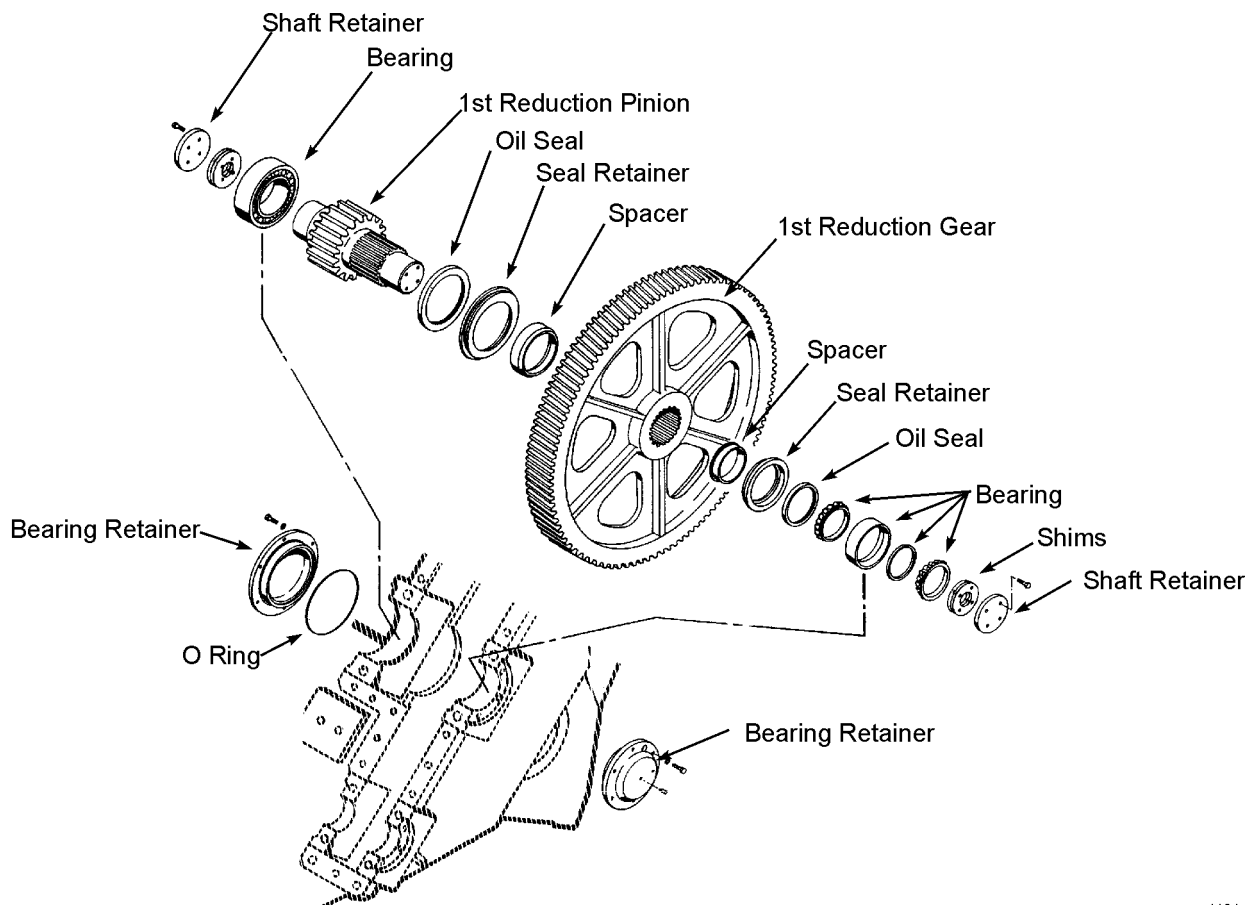
To remove or replace the hoist drum shaft bearings, it is best to remove the drum shaft assembly from the machine. Refer to HOIST DRUM ASSEMBLY, then proceed as follows:

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 approximately 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 (approximately 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.

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Figure 4-43: Crow 1st Reduction - Exploded View

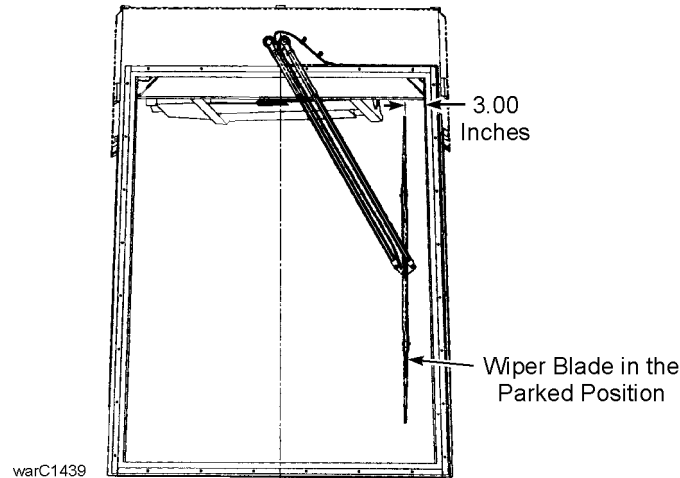
9. Dismantle the shafts as required.
 - a. For any shafts that are dismantled, inspect the bearings for pitting, scoring and other defects. Replace damaged bearings.
 - b. Check the oil seals for cuts, abrasions and other damage to the sealing surface. Replace as necessary.
 - c. Install new O-Rings and gaskets where required.
 - d. Some bearings and spacers are interference fit and must be preheated in an oil bath prior to installation on the shafts.



WIPER ARM REPLACEMENT

IMPORTANT! For safety, always use a man basket for this procedure. Do not attempt to perform this procedure without it!

1. With the wipers in the "parked" position, note the exact position of the wiper arms BEFORE you proceed. Match mark arms with wax pencil if necessary.



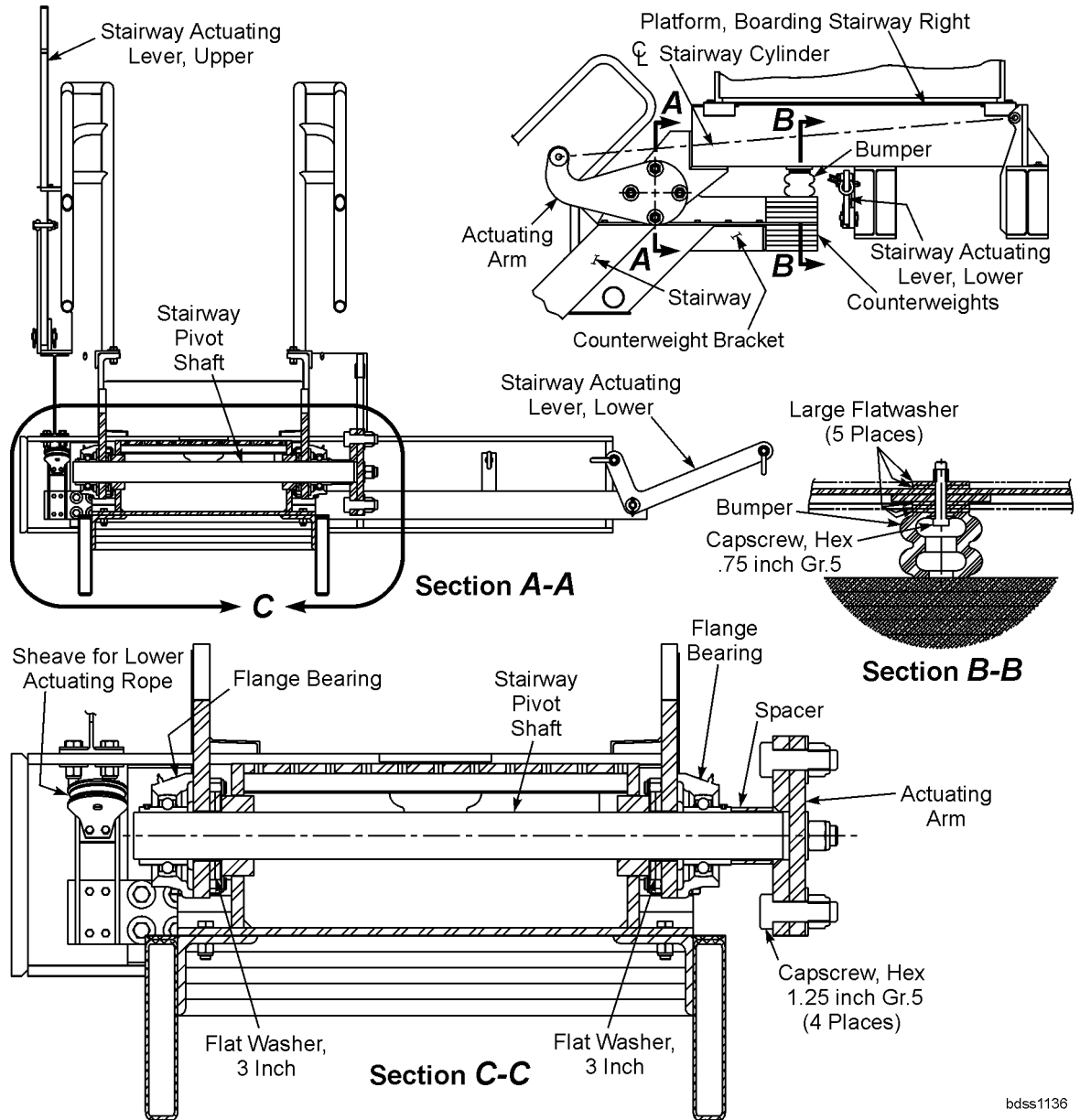
2. Remove the cap from one arm to expose the nut holding the arm in place. Repeat for the second arm.
3. Remove one of the two nuts.
4. Using a small block of wood, set it just under the wiper arm where it attaches to the threaded wiper arm stud.
5. Using a large bladed screw driver, position it just under the lip of the wiper arm head and pry upward towards you. The wiper arm should slide off the splined wiper arm stud.
6. Remove the remaining nut.
7. Tether the wiper arm if necessary to ensure it does not fall to the ground.
8. Repeat Step 5 for the remaining arm.
9. Before installing the new wiper arm assembly, examine the splines of each wiper arm stud for debris. Clean the splines with a small knife or wire brush if needed.
10. To install the new wiper arm assembly, realign as noted in Step 1 and carefully tap each arm onto the splines of each wiper arm stud.

NOTE: Some wiper motors have a flat spot on the threaded stud that will not allow you to misalign the wiper arm during re-assembly.

11. Install the two locknuts and tighten to 26-33 Ft-Lbs (35-45 N•m).



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BOOM POINT SHEAVE REASSEMBLY AND INSTALLATION

1. Apply a thin coat of Molycote G to the shaft. Install the sleeve onto the shaft. Install the bearing and sheave onto the sleeve.

Use the following steps to install the shims:

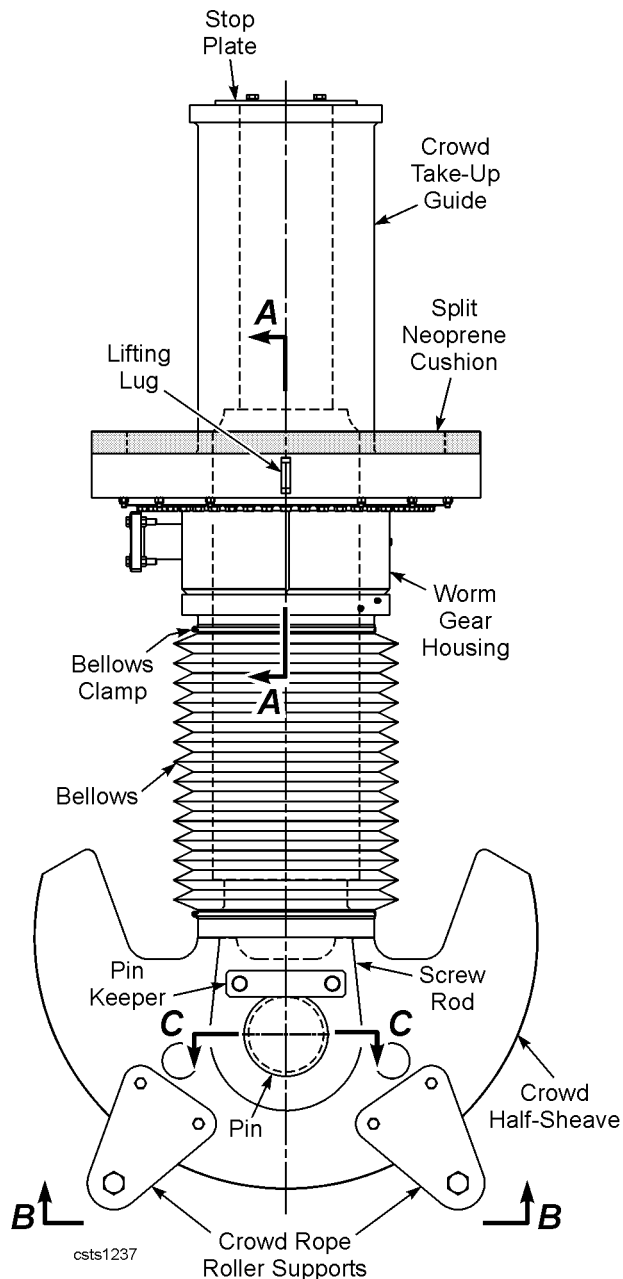
- a. Install the inside and outside bearing clamps. Ensure they are tight against the boom point sheave sleeve.
 - b. Use a depth mic through the 4 holes to measure the depth of the outside bearing clamp. Average this dimension.
 - c. Remove the outside bearing clamp and measure the thickness at the same 4 points. Average this dimension.
 - d. Subtract the averaged second outside dimension from the averaged first hole dimension.
 - e. Subtract 0.002 - 0.005" from this dimension and use this as the new shim thickness.
 - f. Install the shims. Assemble the O-Ring to each bearing clamp then install the bearing clamps.
 - g. Tighten the 0.75 inch socket head capscrews in a crisscross pattern to snug tight. (approximately 53 Ft-Lbs)
 - h. Continue to tighten the capscrews 1/3 of the required torque value at a time, until the proper torque is achieved. Refer to *ENGINEERING DATA* in this manual for the proper torque value.
2. Assemble the seal and O-Ring to each bearing retainer then install the bearing retainers. Tighten the 0.75 inch capscrews and lockwire in place.
 3. Slide the spacer onto the end of the shaft opposite the keyway.

To reinstall the boom point sheave assembly:

1. Insert the shaft key into the proper slot in the boom point structure.
2. Using a suitable crane, lift the sheave assembly into place at the boom point.

NOTE: The sheave assembly must be oriented with the spacer near the end of the shaft toward the center of the boom, and also the key slot on the shaft must be at the bottom and toward the outside of the boom. Ensure that the ends of the shaft in the bearing cap area are coated with Molycote G.

3. With the shaft in place, attach the bearing caps and capscrews.
4. Tighten the 1.5 inch capscrews to 1460 Ft-Lbs.
5. Slide the shaft toward the center of the boom as far as possible. Attach the clamp collar on that end and tighten its capscrews.
6. Slide the shaft as far as possible toward the outside of the boom. Attach the clamp collar on that end and tighten its capscrews.
7. Reconnect all lube lines.
8. Using a crane lift and set the hoist ropes back onto the sheaves. **DO NOT CROSS THE HOIST ROPES.** If required, refer to **HOIST ROPE REEVING & REPLACEMENT.**

495HR² Electric Mining Shovel**CROWD ROPE TAKE-UP MECHANISM DISASSEMBLY**

With the take-up mechanism off the machine proceed as follows to disassemble it:

1. Support the crowd rope take-up mechanism. (Weight is approximately 10,000 Lbs.)
2. Remove the 12 - 0.5 inch capscrews that fasten the crowd cushion to the forward side of the take-up guide. Then remove the crowd cushion.
3. Remove the crowd rope roller supports from the half-sheave.
4. Remove the 2 setscrews on the pin keeper for the sheave pin. Also remove the sheave pin t-bolt and cotter pin. Pull out the pin and slide the half-sheave away from the screw rod clevis.
5. Remove the worm shaft anti-rotation retainer, the bearing retainer and their hardware from the drive end of the worm gear housing. Remove the oil seal.



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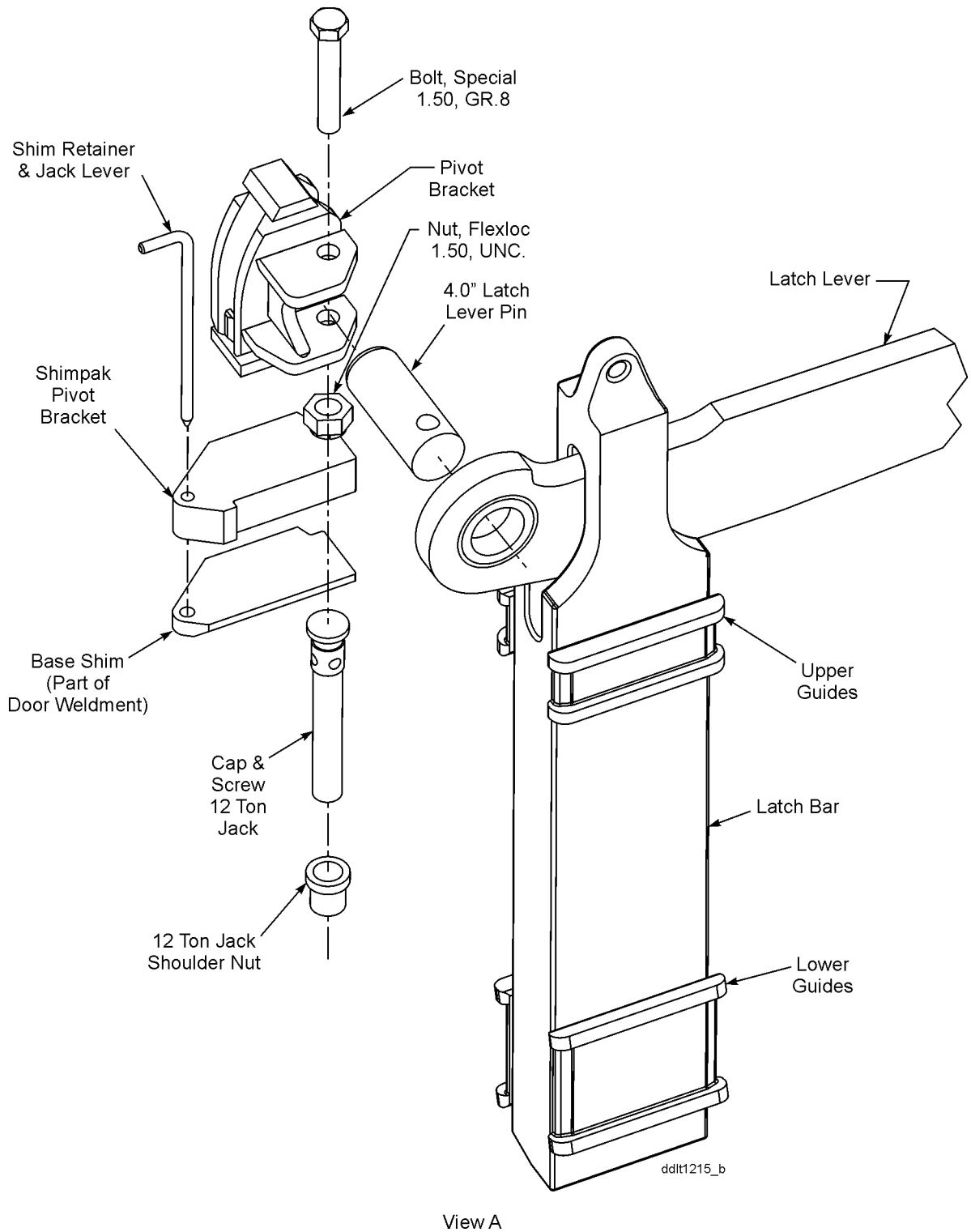


Figure 4-56: Latch Bar & Pivot Bracket Assembly



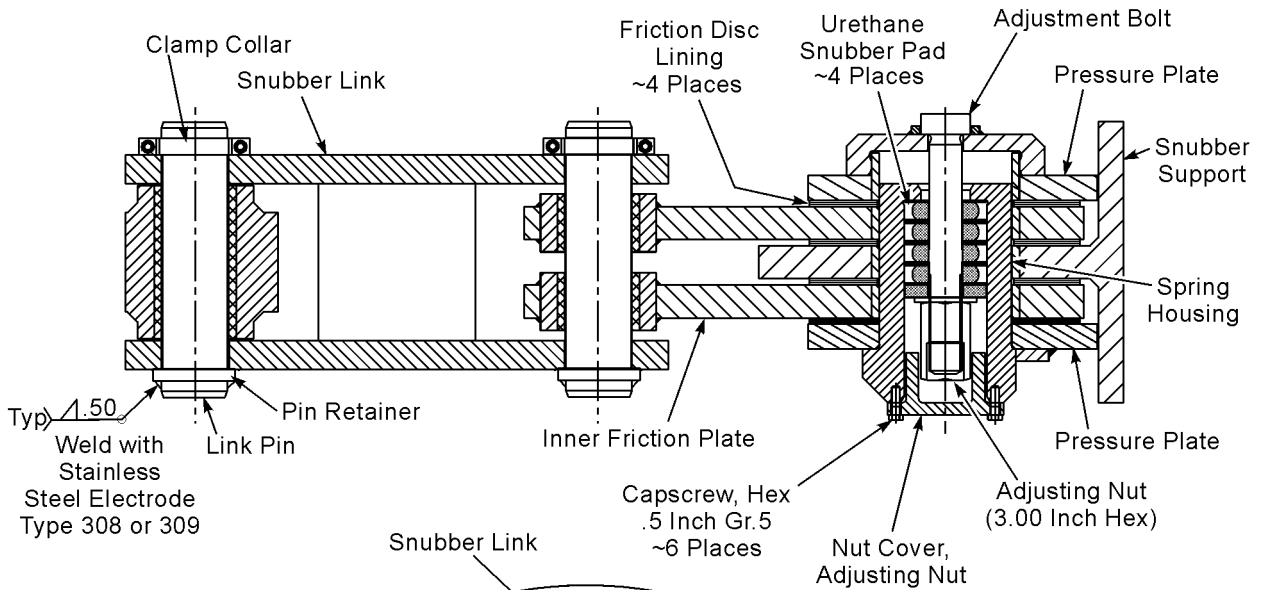
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DIPPER DOOR SNUBBERS

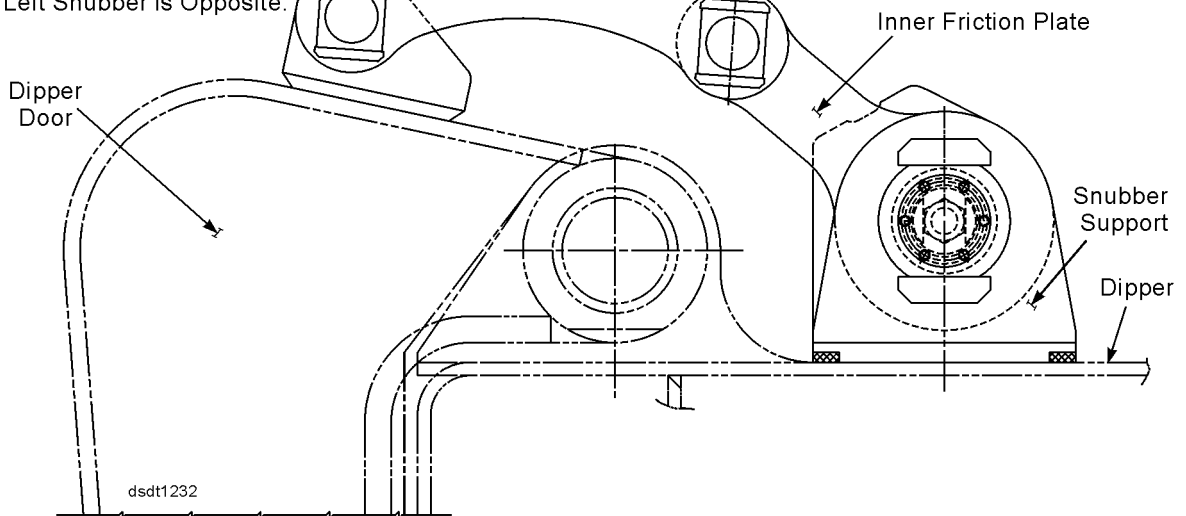
The dipper door snubbers provide tension on the dipper door to prevent excessive speed and movement of the dipper door during closing. Check the door snubber periodically for proper tension.



CAUTION: STORED ENERGY! The snubber pads are under compression. Care must be taken when removing the adjusting nut in order to avoid injury.



NOTE:
The Right Snubber is Shown.
The Left Snubber is Opposite.

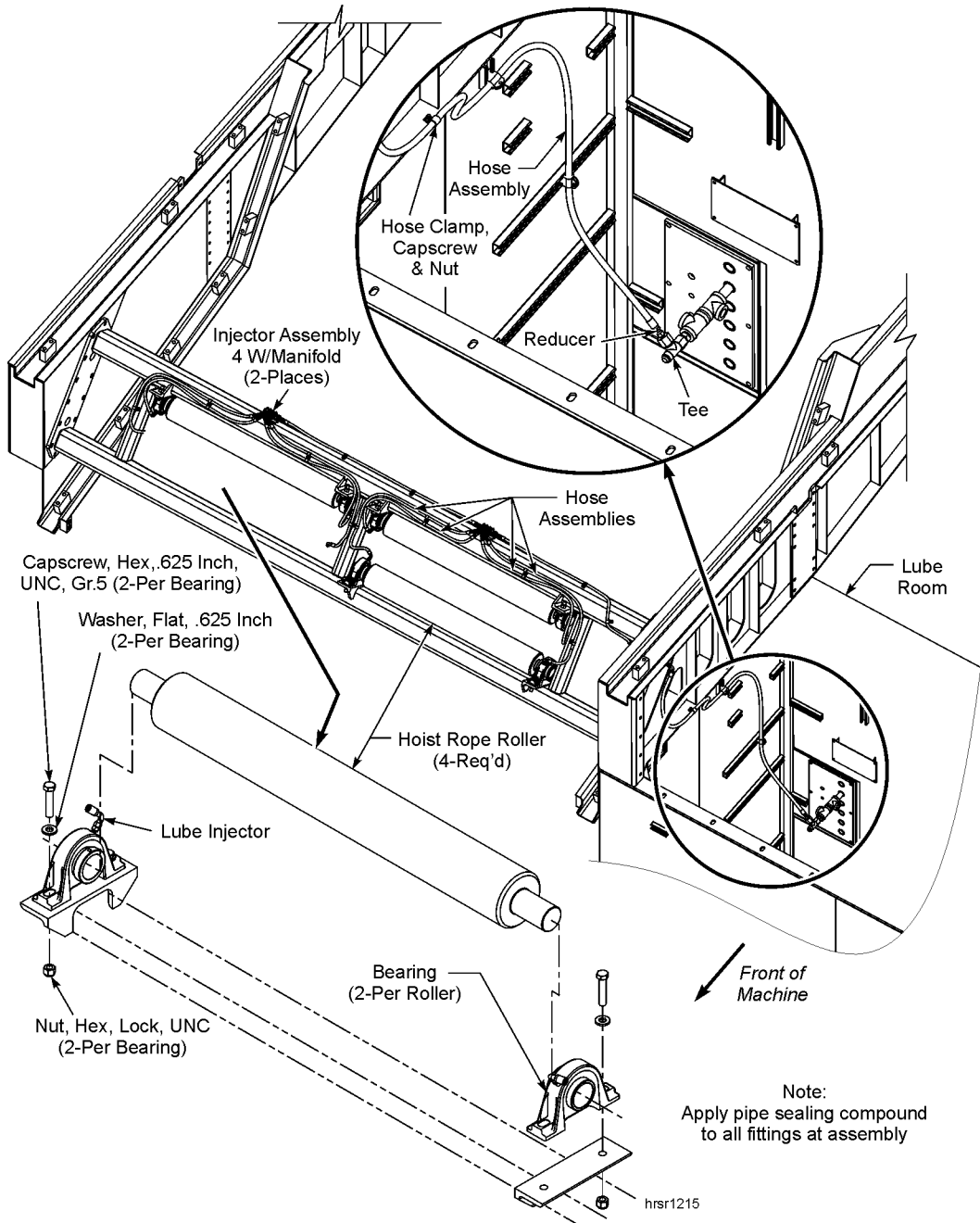




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HOIST ROPE SUPPORT ROLLER

The hoist rope support rollers are used to guide the hoist ropes as they leave the hoist drum and exit the machinery house.



The rollers should be inspected daily for wear. The roller bushings should be lubricated once every shift. Repair of the rope rollers will consist mainly of replacement of worn bushing and/or rollers.



CROWD ROPE REEVING & REPLACEMENT

NOTE: To use the procedure below the old crowd rope must not be broken or severely frayed, the new crowd rope should be wound on a shipping reel with one ferrule button-end in and one ferrule button-end out, and all tools and equipment specified must be on hand.



DANGER: AVOID ANY METHODS WHICH ALLOW THE ROPE TO UNWIND OR FALL UNCONTROLLED. An uncontrolled rope could cause death or serious injury.

NOTE: Should it be necessary to replace both the crowd and retract ropes, the crowd rope should be replaced first. The crowd rope has ferrules swagged onto the ends of the rope to the drum. These ferrules limit the amount of rope on the crowd drum in relationship to the handle position. Failure to install the crowd rope first may cause the ropes to be “out of time” and cause operating difficulties. Replacing both ropes simultaneously should not be attempted.

To replace the crowd rope:

1. Check the new rope for the correct length. Measure to the inner ends of the ferrule buttons.
2. The machine should be in a clear flat area with sufficient room to allow all of the steps in the procedure to be carried out. All applicable safety regulations should be followed. Only personnel directly connected with replacing the rope should be allowed on or near the machine.



CAUTION: The condition of the rope may make it necessary to modify the procedure described here, especially if the rope is broken or severely damaged. Be sure to always follow all safety precautions when burning. Always maintain complete control over the rope and over any burned sections of rope.

3. Position the dipper handle horizontal and retract the handle until the crowd screw retract mechanism is within reach of the hydraulic unit on the machinery house roof.
4. Use the hydraulic unit to retract the crowd rope retract mechanism. Refer to CROWD ROPE TIGHTENING in this section of the manual.

NOTE: The dipper handle must be extended next. Use caution when crowding to carefully take up any slack just developed in the crowd rope.

5. Carefully crowd and lower the dipper simultaneously until the rear stop (cushion) of the dipper handle contacts the saddle block and the dipper heel is resting on the ground as shown in the figure.
6. Set all brakes, shut the machine down and tag and lock all controls.
7. Back-off the retract take-up adjustment for the retract rope to its complete limit.
8. While using an auxiliary line to control the becketed end of the retract rope, remove the clamp and disconnect retract rope from left side of the crowd drum.
9. Use an auxiliary line to pull the ferrule button-end of the retract rope sufficiently to permit the removal of the ferrule button from the ferrule socket on the right side of the crowd drum.
10. Secure both ends of the retract rope away from the crowd drum to allow rotation of the crowd drum.
11. Remove locks and tags from the controls. Using the crowd motor, rotate the crowd drum in the retract direction to unwind the crowd rope from the drum. When the crowd rope ferrule buttons



HOIST AND CROWD LIMIT SYSTEMS

All Bucyrus International, Inc. mining shovels incorporate a PLC-based limit position system that permits the setting of the Hoist/Lower and Crowd/Retract operational limits. Hoist and crowd encoders send digital signals to the PLC relative to the hoist crowd motor positions. The setup of the hoist and crowd limits is accomplished through the operator's display terminal by following the instructions provided here in this manual along with those on the operator's display. When encoder calibration and hoist/crowd positional limits have been properly set the system will prevent the dipper handle from hitting its end stops and will prevent the padlocks from being pulled into the boom point sheaves.

Hoist/Crowd encoder calibration provides the limit system a reference point for tracking both the hoist and crowd positions. Performing the encoder calibration sets all the hoist and crowd limits to their previously set values in order that the actual limits do not require reset after initial commissioning.



Section 5

Brakes and Couplings

BRAKES

This machine uses spring-set, air-released disc brakes on the *HOIST*, *CROWD*, *PROPEL* and *SWING* motions.

In the event of a power failure or loss of air pressure, the brakes will automatically set to stop the machinery motion. Pressure switches located near each brake control valve monitor air pressure at the brake. The brakes cannot be released for operation until the air pressure reaches the operating pressure.

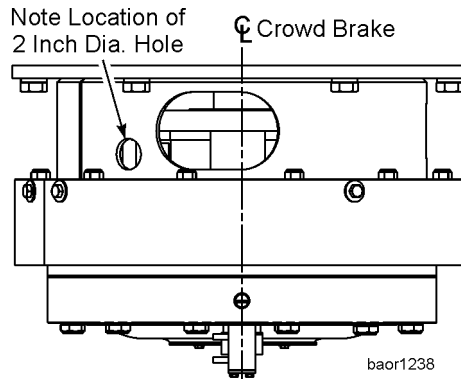
Each brake is fitted with a proximity sensor to monitor lining wear and a limit switch to monitor the brake set or released position. When the lining wear limit is reached, it is announced on the operator's display terminal. The brake position is announced in the operator's control screen.

Table 5-1: Machine Motion Brakes

		<i>Hoist</i>	<i>Crowd</i>	<i>Propel</i>	<i>Swing</i>
Friction Disc per Brake	Quantity	1	1	2	2
	Friction Disc per Brake	3	1	2	1
	Weight of Brake	1,346 lbs.	490 lbs.	650 lbs.	490 lbs.
Mounting Screws	Quantity	12	12	12	12
	Size	0.75 inch	0.75 inch	0.75 inch	0.75 inch
	Torque	200-220 Ft-Lbs (271-298 Nm)	200-220 Ft-Lbs (271-298 Nm)	200-220 Ft-Lbs (271-298 Nm)	200-220 Ft-Lbs (271-298 Nm)

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1. Install the drive hub and keyway on the motor. Refer to *PINION & HUB INSTALLATION* in Section 9 - *ENGINEERING DATA*.
2. Install the motor shaft nut and secure to the shaft with the lockwasher by bending the tabs over the flats.
3. Install the brake adapter onto the motor and secure with hardware. Use care to align the access slots in the adapter for future tachometer inspections. Refer to View BE.
4. Lightly coat the splines of the drive hub with a Teflon grease allowing only a thin film of lubricant to remain on the splines. Excess grease will be thrown outward by centrifugal force and have a degrading effect on the brake.

View **BE**

5. Using a lifting device and the holes provided in the outer portion of the drive ring, place the brake assembly onto the drive hub and lower while aligning the splines in the drive hub with those in the brake disc.
6. Apply at least 46 PSI compressed air to release the brake. Verify piston stroke.

NOTE: The brake will be fully released once air pressure exceeds 46 PSI on a properly functioning brake. However, air pressure in excess of 125 PSI could damage the internal seals of the piston.
7. Release the air pressure from the brake piston to relax the internal springs.
8. Tighten the drive ring for final installation.
9. Apply at least 46 PSI compressed air to release the brake. Verify that the proper gap remains between the pressure plate and friction surface of the disc.
10. Install safety guard around the brake assembly.



SWING BRAKE

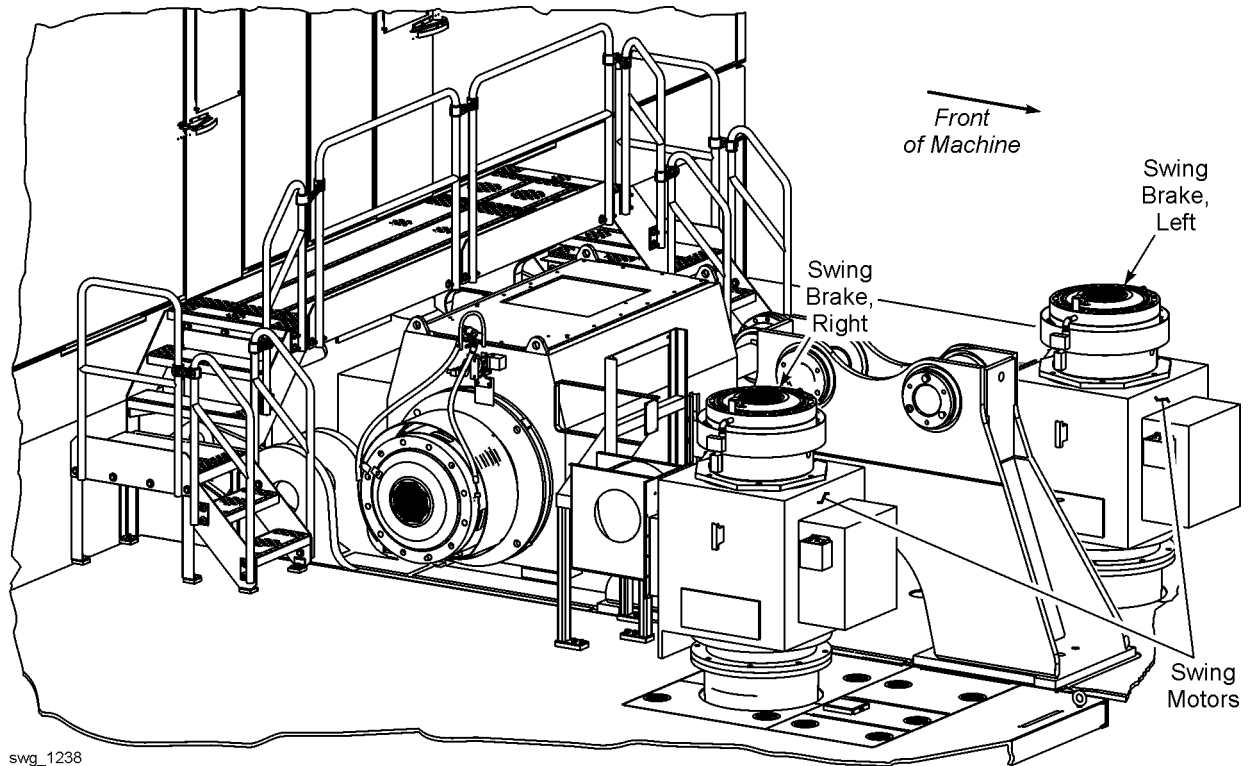


Figure 5-8: Location of Swing Brakes and Motors

A swing brake is located on top of each of the two swing motors. An internal tachometer is installed on one of the two swing motors (inside the brake adapter). Due to the mechanical coupling of the motors and the gearcases, both motors will operate at the same speed. Each swing brake contains a single friction disc and is non adjustable, refer to Section View D-D. Once the stroke reaches 0.20 inch, the friction disc must be replaced. Visual inspection of the brake's internal components can be made after removing the brake guard. Periodically inspect the brake friction disc, wear plate, pressure plate and center plates for signs of uneven or excessive wear. If found, disassemble brake to determine the extent of damage.



DANGER: PRIOR TO INSPECTION OR MAINTENANCE ON A BRAKE, MAKE SURE THAT MACHINE OR MACHINERY IS BLOCKED TO PREVENT MOVEMENT. Failure to do so could result in serious personal injury or machine damage.

Swing brakes are unique because of its horizontal operation which requires an additional burnishing procedure when new or relined brake discs are installed. For additional information, refer to the *SWING BRAKE BURNISHING* procedure in this section of the manual.

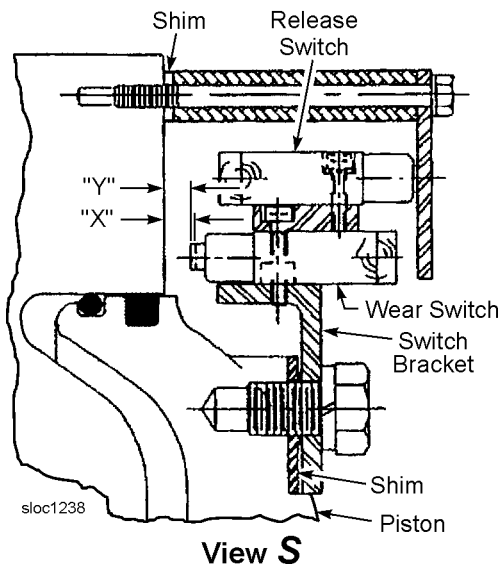
The swing brakes are non-adjustable. Once the piston stroke has reached a specified point, the friction disc must be replaced. Refer to the Brake Adjustment Chart in *BRAKE ADJUSTMENT SPECIFICATIONS*. A friction disc must be replaced if it has become contaminated with grease, oil or foreign material. Refer to the *FRICTION DISC REPLACEMENT* procedure in this section of the manual.

495HR² Electric Mining Shovel**BRAKE WEAR & RELEASE SWITCHES — MULTIPLE DISC BRAKES**

The brake is equipped with two switches mounted to the outer edge of the brake housing as shown in View S.

For identification purposes, the loose end of the release switch is tagged yellow and the loose end of the wear switch is tagged red. Both switches are preset by the manufacturer and do not require adjustment unless they are being removed or replaced.

Note the location of the two shims for proper assembly. When replacing switches, set switch trip point dimension "Y" to brake shim thickness when brake is engaged. Reference "X" to brake stroke new + brake shim thickness when brake is released.

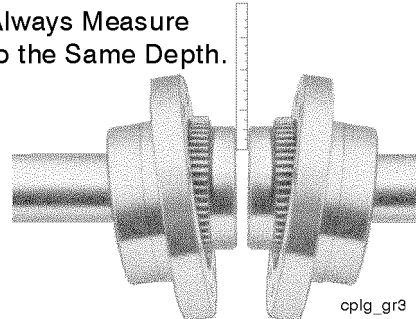


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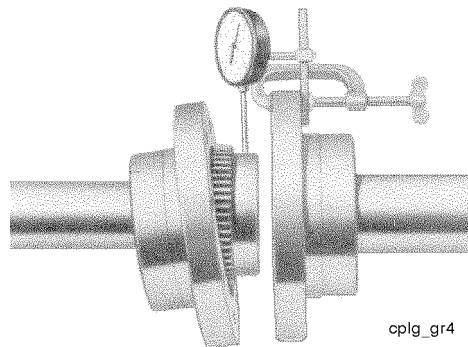
3. Gap and angular alignment - Use a spacer bar equal in thickness to gap specified in Table. Insert bar, as shown, to same depth at 90° intervals and measure clearance between bar and hub face with feelers. The difference in minimum and maximum measurements should *NOT* exceed the *ANGULAR* limit specified in the table.

NOTE:

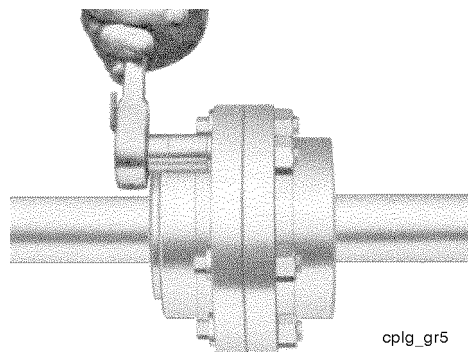
Always Measure
to the Same Depth.



4. Clamp a dial indicator to the rigid hub as shown and rotate the rigid hub one complete turn. The total indicator reading *DIVIDED* by two must not exceed the *OFFSET* limit specified. Tighten all foundation bolts and repeat Steps 3 and 4. Realign coupling if necessary. Grease the hub teeth.



5. Insert gasket, *DO NOT DAMAGE the GASKET*, between flanges. Position flanged covers with lube holes at 90° and draw flanged cover into position. Use bolts, nuts and lockwashers furnished with couplings.



IMPORTANT! Tighten the flange bolts and nuts to the torque specified in the table.

6. For *TYPE G* couplings, fill with recommended grease until excess appears at the open hole; then insert plug. For *TYPE GV* couplings, proceed as outlined above. *IN ADDITION*, when flex




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SAFETY WARNINGS

Ensure that all personnel are aware of, and adhere to the instructions below, which may or may not appear as warnings on the compressor. In addition, refer to all instructions and warnings contained in the manufacturer's catalog for 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.

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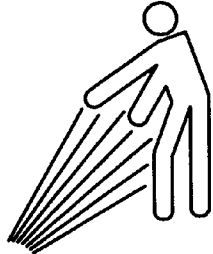
▲ DANGER

HIGH VOLTAGE. ROTATING MACHINERY. AIR AND OIL UNDER PRESSURE. IMPROPER MODIFICATION OF EQUIPMENT WILL CAUSE SEVERE PERSONAL INJURY OR DEATH.

DO NOT MODIFY UNIT WITHOUT WRITTEN PERMISSION FROM MANUFACTURER.

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▲ DANGER



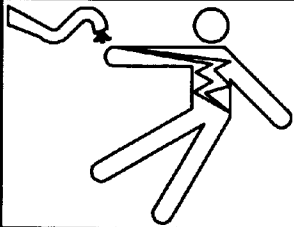
AIR AND OIL UNDER PRESSURE WILL CAUSE SEVERE PERSONAL INJURY OR DEATH. SHUTDOWN COMPRESSOR AND RELIEVE SYSTEM OF ALL PRESSURE BEFORE REMOVING VALVES, CAPS, PLUGS, FITTINGS, BOLTS AND FILTERS.

237EAB077

▲ WARNING

ELECTRICAL SHOCK FROM IMPROPER GROUNDING CAN CAUSE INJURY OR DEATH.


GROUND UNIT AND RELATED EQUIPMENT ACCORDING TO NATIONAL ELECTRIC CODE AND LOCAL REGULATIONS.



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▲ WARNING

AIR AND OIL UNDER PRESSURE. CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. INSPECT OIL RESERVOIR FOR CRACKS AT LEAST ANNUALLY.



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Section 8

Engineering Data

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

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TIGHTENING PROCEDURE FOR 2-INCH TORQUE NUT	8-20

495HR² Electric Mining Shovel*Table 8-11: Apothecaries' Measure***Apothecaries' Measure**

1 UK Gallon = 4 UK Quarts

1 UK Quart = 2 UK Pints

1 UK Pint = 4 UK Gills

Table 8-12: Volume Conversions - English to Metric

English	Metric
1 US Gallon = 3.785 Liters	1 Liter = 0.2642 Gallon
1 Quart = 0.9464 Liter	1 Liter = 1.057 Quarts
1 Pint = 0.4732 Liter	1 Liter = 2.113 Pints

Table 8-13: Volume Conversions - Apothecaries' Measure to English

English	Apothecaries' Measure
1 US Gallon = 0.8327 UK Gallon	1 UK Gallon = 1.201 US Gallons
1 US Pint = 0.8327 UK Pint	1 UK Pint = 1.201 US Pints
1 US Fld Oz = 1.041 UK Fld Oz	1 UK Fld Oz = 0.9608 US Fld Oz

Table 8-14: Volume Conversions - Apothecaries' Measure to Metric

Apothecaries' Measure	Metric
1 UK Gallon = 4.546 Liters	1 Liter = 0.2200 UK Gallon
1 UK Quart = 1.137 Liters	1 Liter = 0.8799 UK Quart
1 UK Pint = 0.5683 Liters	1 Liter = 1.760 UK Pints

The Apothecaries Measure was established in England in 1824. Originally set up to be similar to the Apothecaries Weight System, parts of it were abandoned in 1963 and banned from use in 1971. The only remnants still in limited use are the UK (Imperial) Gallon, Pint and Fluid Ounce measurements.

TORQUE MEASUREMENTS*Table 8-15: Torque Standards*

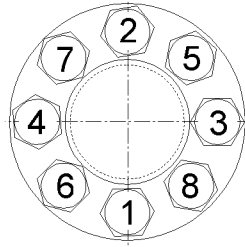
Metric	English
1 N·m = 1000 mN·m	1 ft-lb = 12 in-lb
	1 ft-lb = 192 oz-in

Table 8-16: Torque Conversions

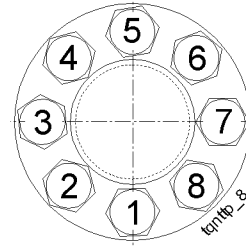
Metric to English	English to Metric
1 N·m = 0.7376 ft-lb	1 ft-lb = 1.356 N·m
1 N·m = 8.851 in-lb	1 in-lb = 0.1130 N·m
1 mN·m = 0.1416 oz-in	1 oz-in = 7.062 mN·m



TIGHTENING PROCEDURE FOR 2.5-INCH TORQUE NUT



“STAR” Tightening Pattern



CIRCULAR Tightening Pattern

Torque Nut with 8 Jackbolts

1. Ensure that a special steel washer, supplied with the torque nut, is placed beneath the torque nut. DO NOT USE STANDARD COMMERCIAL WASHERS.
2. The jackbolt threads and faces are prelubricated with graphite lube. Ensure that this lube is present. Apply additional lube (part number MP390331) as needed.
3. Check the base of the torque nut to ensure that all jackbolts are flush with the bottom.
4. Spin the torque nut onto the rod or bolt by hand.
5. Tighten the jackbolts to **233 Ft-Lbs** as follows:
 - a. Snug all jackbolts to **10 Ft-Lbs** each.
 - b. Using the STAR pattern shown, tighten all jackbolts to **100 Ft-Lbs**.
 - c. Switch to the CIRCULAR pattern shown and tighten all jackbolts to **150 Ft-Lbs**.
 - d. Continue with the CIRCULAR pattern and tighten all jackbolts to **256 Ft-Lbs**.

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 5-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 **233 Ft-Lbs**.
- 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.



TORQUE NUT REMOVAL PROCEDURE



CAUTION: THE PROPER REMOVAL OF TORQUE NUTS REQUIRES FOLLOWING STRICT PROCEDURES. LONGER ANCHOR BOLTS AND RODS REQUIRE GREATER CARE. If some jackbolts are completely unloaded prematurely, the remaining jackbolts will carry the entire load of the fastener. This may cause the jackbolts to become extremely hard to turn or even deformed.

NOTE: It is a good practice to spray the entire fastener and jackbolts with a penetrating type lubricant prior to attempting removal. This step will be critical if rust exists on the components.

1. Turn the first jackbolt counter-clockwise until it feels loose, but no more than 1/2 turn.
2. Repeat the loosening with the rest of the jackbolts. Use the reverse of the star pattern used to tighten the jackbolts. This will minimize loading on the last few jackbolts.
3. Repeat the entire loosening pattern, turning each jackbolt no more than 1/2 turn at a time, until the torque nut can be spun off the rod or bolt by hand.

After removal of the torque nut:

- Remove all jackbolts from the torque nut. Clean, inspect and lubricate the torque nut, hardened washer and the jackbolts for later reassembly.

NOTE: On smaller torque nut fasteners it may be possible to utilize impact tools to speed removal after performing step 2 above. However, **DO NOT USE IMPACT TOOLS FOR THE INITIAL LOOSENING PROCEDURE.** Longer anchor bolts may require several repetitions of the initial loosening process prior to switching to impact tools for assistance.

THREAD LUBRICATION

For the main studs of torque nut fasteners any standard anti-seize compound may be used. A thin, brush-on type application, or aerosol spray lubricant is acceptable.

Jackbolts are pre-lubricated from the factory with either moly or graphite lubricants depending on the intended use. Ensure lube is present on these surfaces and apply additional lube (part number MP390331) as needed. Similar lubricants may be used on the jackbolt tips and hardened washer during installation.



MAINTENANCE WELDING

These recommendations for repair welding apply to the major structural members of the machine. The high cyclic loading characteristics of the machine are considered in the design and material selected for the construction of the machine. However, due to unusual operational conditions that may be encountered and to the great number of cyclic loadings that may be applied to the machine, fatigue cracks or other abnormalities may occur. Early detection of these conditions through regular machine inspection helps to avoid problems or emergency breakdowns.

Maintenance welding is applied to the repair of cracked or broken structural components. Reconditioning of broken parts by the application of heating, cutting and welding processes requires attention to a number of details, careful adherence to the repair procedure and observance of federal, state and local safety regulations.



CAUTION: WELDING AND THERMAL-CUTTING OF METALS INVOLVE THE GENERATION OF TEMPERATURES UP TO THOUSANDS OF DEGREES AT WHICH METALS MELT AND VAPORIZE. When proper precautions are taken to protect personnel and property against the heat, evolved gases and fumes, electric shock and radiation, no harm will result either to personnel or property. In gas heating and cutting, the handling and storage of compressed gases present other hazards that also must be protected against to provide a safe working environment.



CAUTION: Safety precautions should conform to the latest edition of ANSI standard Z49.1, Safety in Welding and Cutting, published by the American Welding Society.

Reconditioning of failed members requires attention to a number of details and careful application of the repair procedure. Only in certain cases is it necessary to strengthen members by added reinforcement.



WARNING: REINFORCING STRUCTURAL MEMBERS SHOULD BE MADE ONLY UPON RECOMMENDATION BY BUCYRUS INTERNATIONAL, INC. IMPROPERLY APPLIED REINFORCEMENTS CAN HAVE AN ADVERSE EFFECT ON THE PERFORMANCE AND LIFE OF THE STRUCTURE.

A broken member is best repaired by making a complete penetration weld, preferably by welding from both sides, using the correct welding electrode and observing all precautions such as preheat, back-gouging, etc. The complete penetration groove weld should be ground flush with the base metal on both sides to remove all surface irregularities. An alternate procedure incorporates backup bars to ensure sound, complete penetration welds in the repair area. Be sure to follow all applicable safety measures and federal, state and local regulations.



STRESS RELIEVING & TEMPERATURE MEASURING EQUIPMENT

The equipment recommended for stress relieving, after repair welding, is listed below.

TEMPERATURE MEASURING EQUIPMENT

SPEEDOMAX, "W" Multipoint, Potentiometer Recorder

POWER REQUIREMENT - 120 Volts, 60 or 50 Hz.

RANGE - 0 to 1500°F (-18 to 816°C)

CALIBRATION - Chromel-Alumel Thermocouple Wire

ACCURACY RATING - 0.3% of Electrical Span

CHART SPEED - 2" per Hour

THERMOCOUPLE SELECTION - Six (6) Points

FLUORESCENT LIGHTING

MANUFACTURER - Leeds & Northrup Company

THERMOCOUPLE EXTENSION WIRE

DUPLEX WIRES - Chromel-Alumel - Type K - 16 AWG Stranded

LENGTH - Total External Resistance for both Wires including Thermocouple not to exceed 2500 Ohms or 410 Feet.

WIRE RESISTANCE - Nominal Resistance, Ohm per Foot at 20°C (66°F) - Chromel - Ohms - Alumel - 0.0683 Ohms.

WIRE INSULATION - each Conductor Enamel, Asbestos (Twisted Pair) Overall Asbestos Braid

WIRE CODE -Alumel, Negative Wire (Red); Chromel, Positive Wire (Yellow)

OVERALL COLOR - Yellow

CATALOG No. 16-59-17

POLARITY DISCONNECT

CHROMEL-ALUMEL COMPENSATED CONNECTION

JACK Color Code (Yellow) - Catalog No. 040419

PLUG Color Code (Yellow) - Catalog No. 040434

CABLE CLAMP - Catalog No. 072513

ADAPTER - Catalog No. 076794

THERMOCOUPLE ELEMENT

CHROMEL-ALUMEL - Type K - Swaged One (1) Inch Stripped

CHROMEL POSITIVE WIRE Color Code (None)

ALUMEL NEGATIVE WIRE Color Code (Red)

CATALOG No. 8784-K-1-3-12"-D

1. 588003 Kaopak Flex Heaters

2. 588004 Kaopak Collector Streamer Type

3. Kaopak Blankets 3, 5, or 6 Pocket Size as needed for Size Pipe being Stressed Relieved

Thermocouple Assembly, Complete

Catalog No. 8784-K-1-3-12"-Q

Temperature Indicating Pellets (Tempil[®] Pellets)

Indicating Temperature: 1050°F, 1100°F, 1200°F, and 1250°F. (Several of each temperature)



INSPECTION DATA

It is essential to maintain a well-planned program of periodic inspection. Frequently, there are statutory and/or regulatory agencies that incur additional requirements that must be adhered to. Refer to the suggested procedures that follow.

Abrasion - Bending and crushing represent the ABC's of wire rope abuse. It is the primary goal of a good inspection practice to uncover such conditions early enough that corrections may be made, or ropes replaced safely with minimum effort. When any sudden degradation indicates a loss of original rope strength, a timely decision is required as to allowing the rope to remain in service. Such a decision can only be made by an experienced inspector. His/her determination should be based on:

1. Details of the equipment's operation.
2. Frequency of inspection.
3. Maintenance history.
4. Consequences of failure.
5. Historical records of similar equipment.

To ensure sufficient information can be obtained, the following pages contain guidelines that should be adhered to.

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