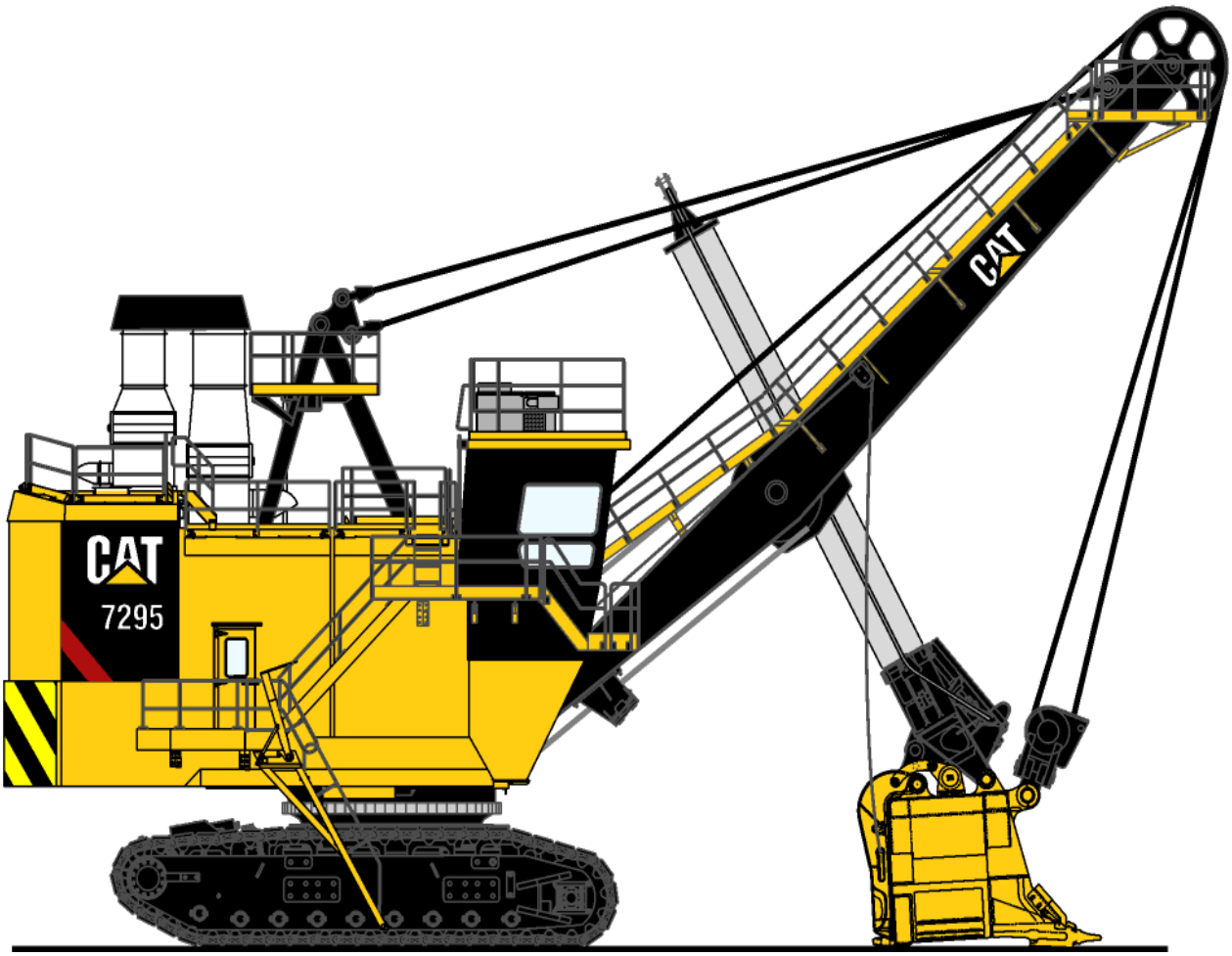
BUCYRUS®

295HR
MINING SHOVEL
MAINTENANCE and OPERATION MANUAL

SN:141401

Manual No. *11080*



SAFETY - SWINGING RESTRAINT & BALLAST BOX SUPPORT

BALLAST BOX SUPPORT

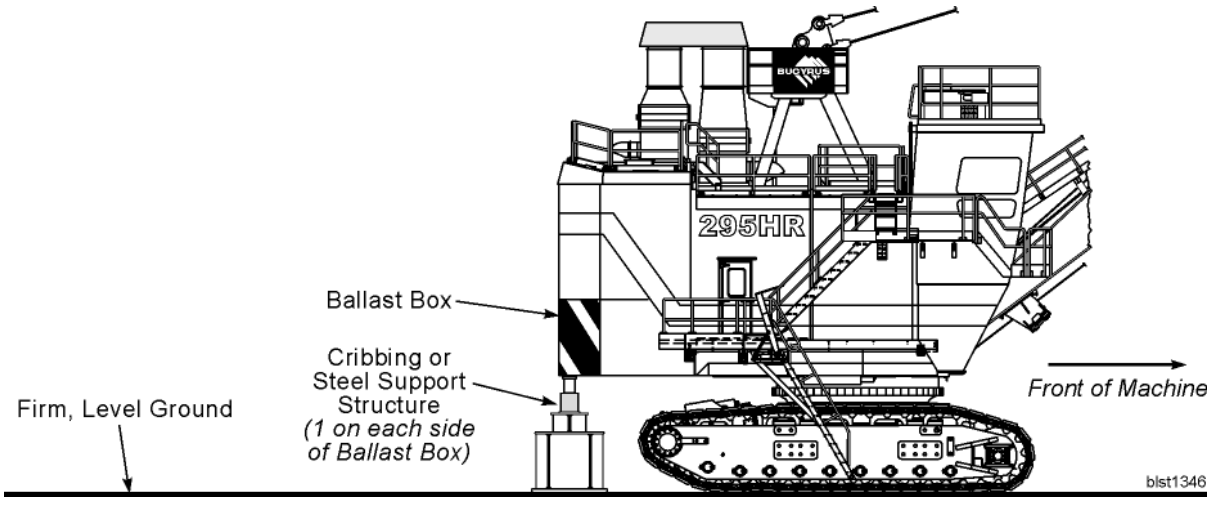
Before performing any maintenance on the mining shovel, it should be resting on a firm, level surface.

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”.

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.

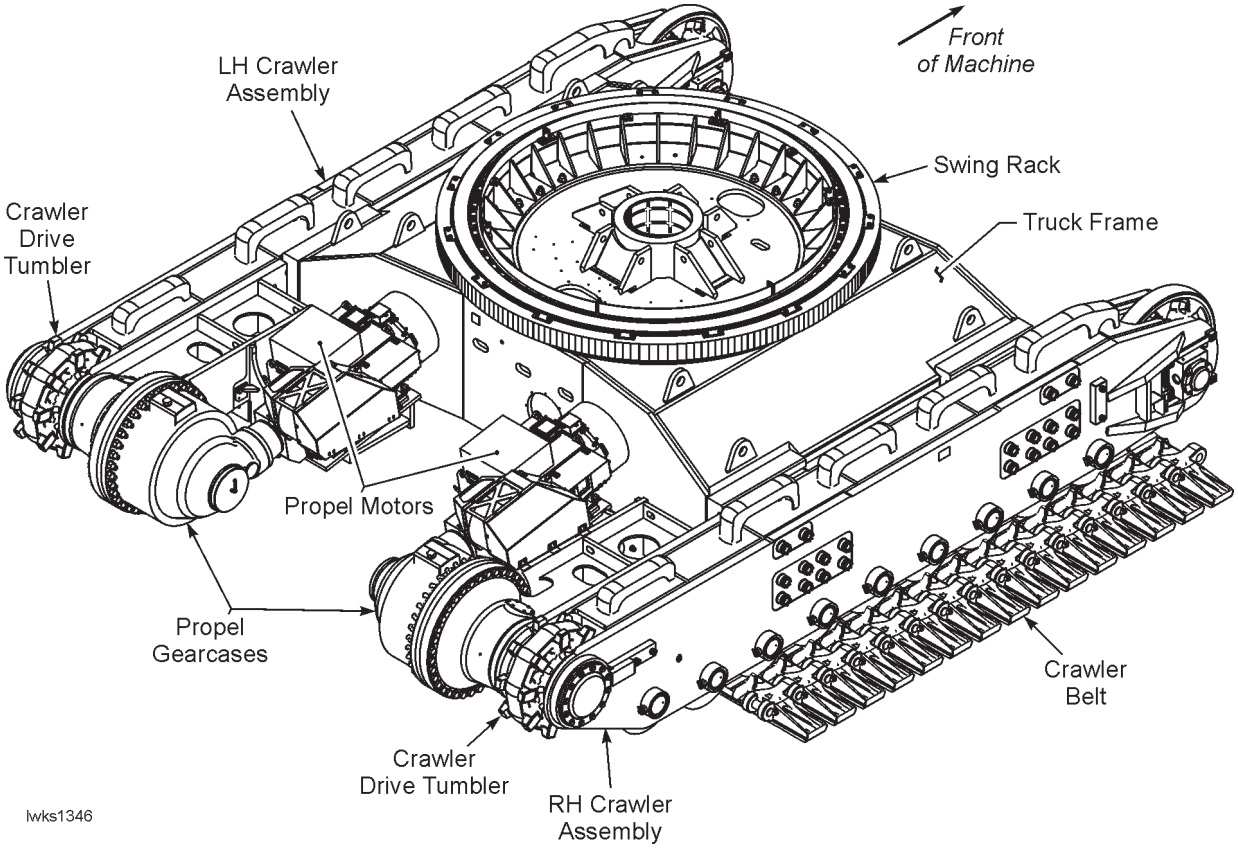
Boom removal or lowering will cause the center of gravity to shift toward the ballast box, decreasing machine stability. Stability is further dependent on the orientation of the upper works relative to the undercarriage. The machine may tip more easily over one of the four quadrants of the crawler mounting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



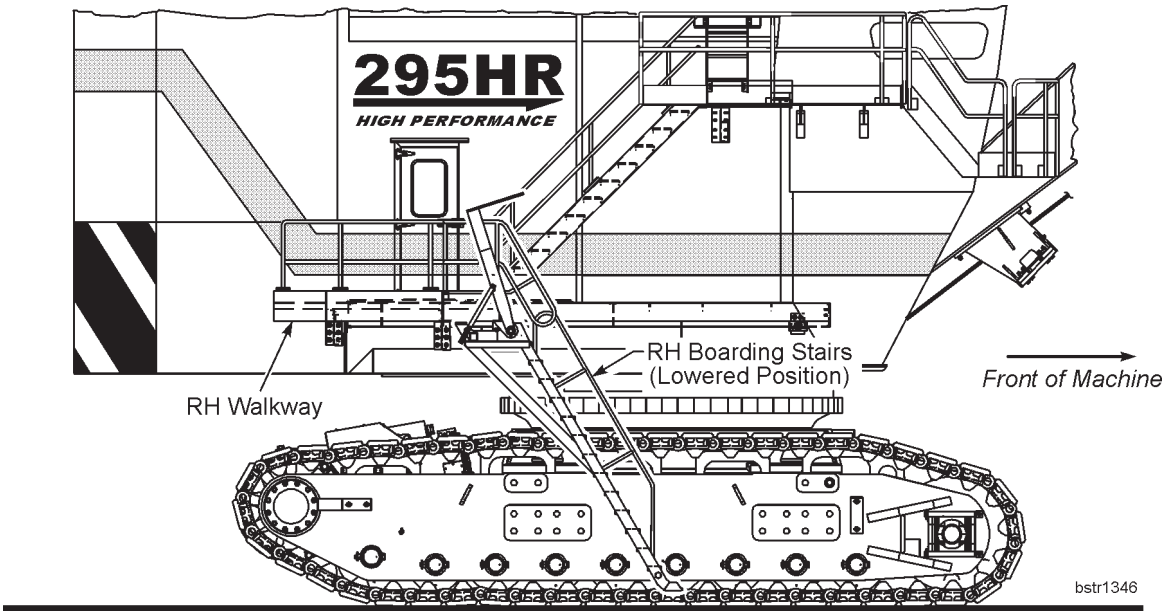
Truck Frame and Crawlers

MACHINERY HOUSE

The machinery house encloses the revolving frame, ballast box and deck extensions. It is constructed of self-supporting steel panels with built-in framing. Removable roof sections are provided over the swing machinery and to the side and rear of the A-frame. The house also provides mounting for the air ventilation and pressurization system. A separate electrical room is located over the ballast box. Platforms and stairs facilitate access to the sides and tops of the house for inspection and maintenance purposes. Boarding stairs permit easy access onto the machine.

BOARDING STAIRS

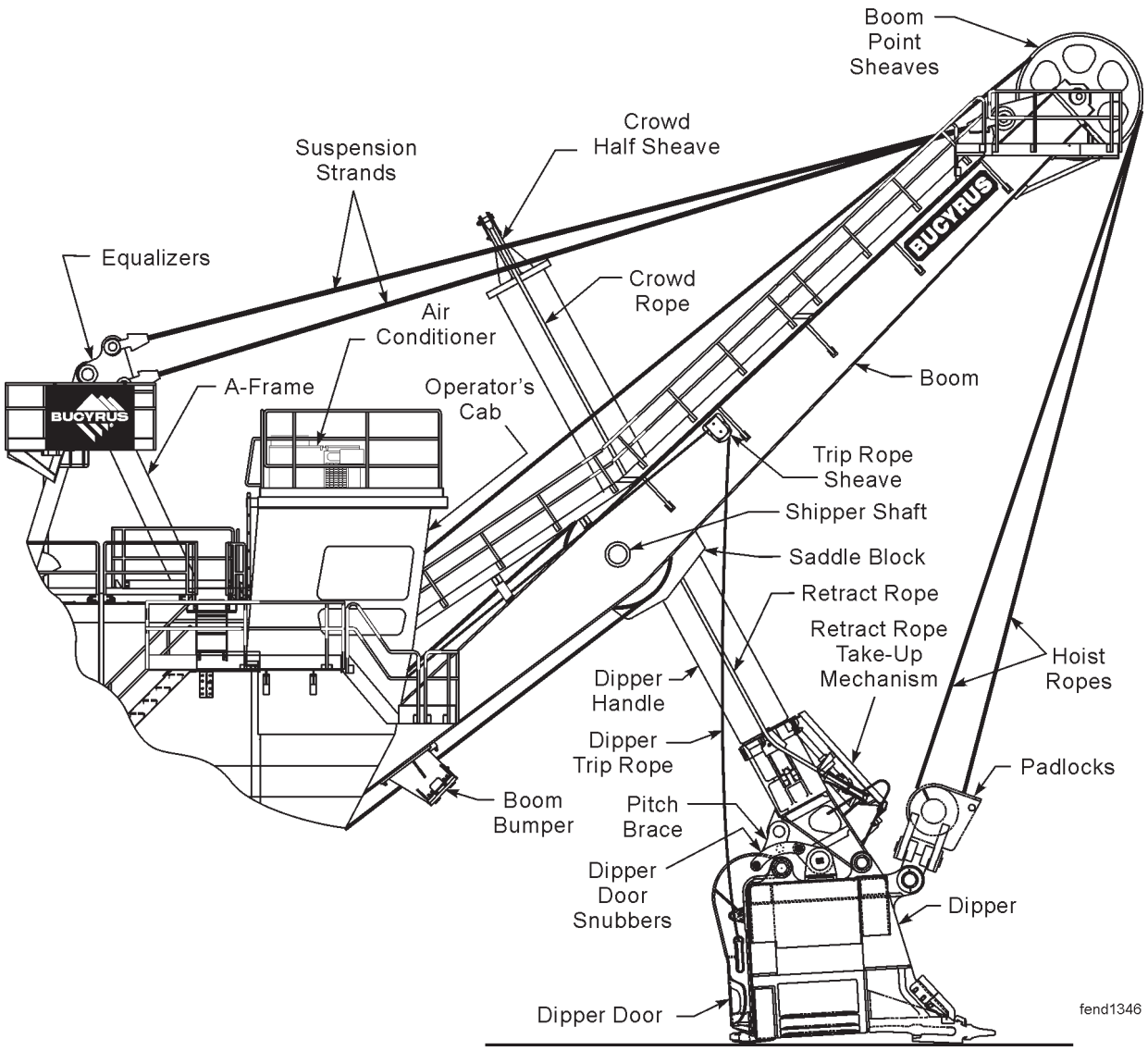
A set of boarding stairs is attached to the machinery house platform on the right side of the machine. When lowered, the stairs allow entrance to the machinery house from ground level. To lower the stairs, a chord attached to the stairway is reachable from the ground. The stairs must be in the raised position to enable the operator's controls.



RH Boarding Stairs

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.



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.

	Quantity	*Weight Each (U.S. Pounds)*
Boom & Dipper Handle Components *(cont.)*		
Bearing, Boom Point	2	280
Shipper Shaft	1	4,500
Dipper Trip Components		
Base, Dipper Trip	1	750
Guard, Dipper Trip Drum	1	70
Drum, Dipper Trip	1	100
Gear, Dipper Trip	1	160
Support, Deflector	1	100
Support, Dipper Trip	1	200
Pad, Mounting, Dipper Trip, Rear	1	100
Pad, Mounting, Dipper Trip, Front	1	130
Motor, Dipper Trip	1	700
Rope, Dipper Trip	1	80
Swing Machinery		
Retainer, Bearing, Vertical Swing Shaft	2	90
Pinion, Vertical Swing, Induction	2	1,110
Gear, Swing	2	1,710
Bearing, Taper Roller	2	100
Bearing, Roller	2	180
Guard, Swing Pinion	2	110
Retainer, Bearing, Intermediate Shaft	2	100
Pinion, Shaft, 2nd Reduction	2	220
Bearing, Taper, Roller	2	100
Gearcase & Cover	2	6,580
Cover, Swing Gearcase	2	1,670
Gearcase, Swing	2	5,880
Hub, Swing Gearcase	2	1,790
Gear, Intermediate Swing Shaft	2	1,030
Motor, Swing	2	3,600
Blower, Swing Motor	2	230
Adapter, Swing Blower	1	1,760
Swing Brake	2	490
Adapter, Swing Brake	2	210

DIG/PROPEL TRANSFER SWITCH

The Dig/Propel Transfer Switch is used to switch between the two primary operating modes of the machine. The current mode of operation will be indicated on the Operator's screen on the Operator's Display.

IMPORTANT:

- WHILE IN *THE DIG MODE,* THE PROPEL CONTROLS ARE DISABLED.
- WHILE IN *THE PROPEL MODE,* THE DIG CONTROLS ARE DISABLED.

The recommended procedure to transfer from dig to propel is to bring all motions to a controlled stop by the operator. Turn the hoist brake switch to the SET position and then press the control stop pushbutton. Turn the transfer switch from DIG to PROPEL. When the indicator on the Operator Display screen indicates that the transfer has been completed, turn the propel brake switch to release.

EMERGENCY STOP PUSHBUTTON

The machine stop/emergency stop pushbutton is located on the right operator's console. It is used to remove power from the machine motions after the motions have been stopped in the normal manner. A second purpose of the pushbutton is to stop the machine under operational emergency conditions. Pushing this button will provide electrical and immediate mechanical braking simultaneously. Therefore, this button should only be used if the operator intends the harshest braking of all motions. If the machine is in motion, power will remain on the motions in order to provide electrical braking for a few seconds. If the machine is in motion or stopped, this button will power the DC bus to approximately zero voltage quickly after the time delay.

CAUTION: PRESSING THIS BUTTON WHEN ANY DRIVE IS IN MOTION MAY RESULT IN COMPONENT DAMAGE.

A second pushbutton that also provides the functions as described above is located in the remote start console and is labeled "machine stop."

MAIN POWER OFF PUSHBUTTON

The main power off pushbutton is located on the right operator's console. It is used only to immediately remove power from the drives in case of an electrical emergency involving component failure or fire.

CAUTION: PUSHING THE "POWER OFF" PUSHBUTTON WHILE IN MOTION WILL IMMEDIATELY SET THE MECHANICAL BRAKES AND REMOVE INCOMING HIGH VOLTAGE FROM THE DRIVES. THIS ACTION MAY RESULT IN COMPONENT DAMAGE. It will also result in the inability to power the DC bus voltage down to a low value. This voltage will decay slowly, taking several minutes.

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Limit Calibration Help

This screen will provide clarifying information on the calibration process.

4. At the AC control cabinet verify that the uninterruptable breaker is in the ON position. At the motor control cabinet, verify that all breakers are in the ON position.

5. At the remote starting console in the machinery house, use the following sequence to start the machine:

   a. Verify that the green AUXILIARY GROUND FAULT light is lit.

CAUTION: IF THE AUXILIARY GROUND FAULT LIGHT IS OFF, ALERT AN ELECTRICIAN AS SOON AS POSSIBLE. The machine may be operated with one fault but a second fault could cause damage to the machine and/or become a safety hazard. The fault should be cleared as soon as possible.

   b. Verify that the green PHASE SEQUENCE light is lit. This indicates that the incoming power sequence is correct. If not, the light will be out and the machine will not start. Electrical maintenance personnel must correct the problem.

NOTE: This PHASE SEQUENCE light also indicates auxiliary power phase unbalance, phase loss or under-voltage. Any of these faults occurring while the machine is running will produce an alarm. In the event of such an alarm an electrician should be notified, however the machine may be operated.

   c. Verify that the PLC and drive cabinets' green temperature lights are lit. If the cabinet temperature is too low or too high, the machine cannot be started.

   d. Press the UNINTERRUPTABLE POWER SUPPLY on pushbutton. A second start pushbutton is located on the UPS control cabinet.

   e. Verify that the green PLC POWER ON light is lit. This light should be on about 20 seconds after the UPS motor is started.

   f. Turn the AIR COMPRESSOR RUN switch to the run position or press the start pushbutton.

   g. Verify that the green SYSTEM READY light is lit.

   h. Press the SYSTEM RUN pushbutton. When this button is pressed, the system ready light will go out and the drive system will automatically power up.

   i. Verify that the red INCOMPLETE SEQUENCE light is out. If lit, call the electrician to troubleshoot the sequence.

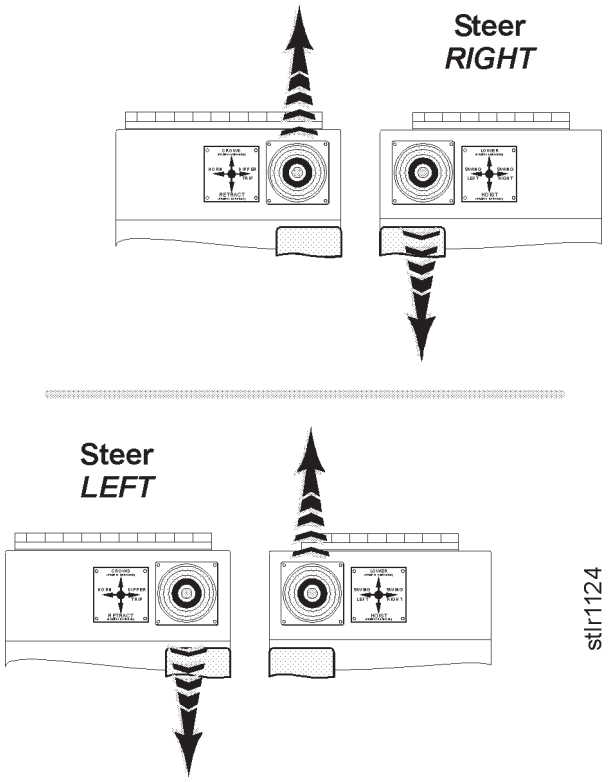
6. In the operator's cab, verify that the air pressure displayed on the operator's display is correct. The machine cannot be operated until the air pressure is at the specified rating.

COUNTER-ROTATION TURNS

Although possible, a single sharp turn should be avoided to minimize material build up on the crawler belt roller path. This results in high loading of the crawler belt and associated propel components.

To make a sharp right turn, move the LEFT joystick forward and pull the RIGHT joystick to the rear.

To make a sharp left turn, move the RIGHT joystick forward and pull the LEFT joystick to the rear.



CAUTION: When using the counter-rotation method for turning, have a helper ensure that the trail cable does not get fouled and/or torn from the machine.

NOTE: The ability of the machine to turn sharply is dependent on the surface on which the machine is setting. A soft surface will cause the crawlers to dig-in and machine to bog-down.

CAUTION: The propel brakes are released when either joystick is moved from neutral. The propel brakes are set when both joysticks are returned to neutral.

When moving the machine in a straight line, propel forward, which is in the direction of the take-up axle to reduce strain on the crawler belts and propel mechanism. When not possible and propelling to the rear, make sure the trail cable is clear of the machine and follow the signals given by the helper. The machine should be rotated in a position to allow the operator to face the direction of travel.

NOTE: Turning when propelling to the rear requires that the master control be positioned in a direction opposite the actual direction in which the turn takes place.

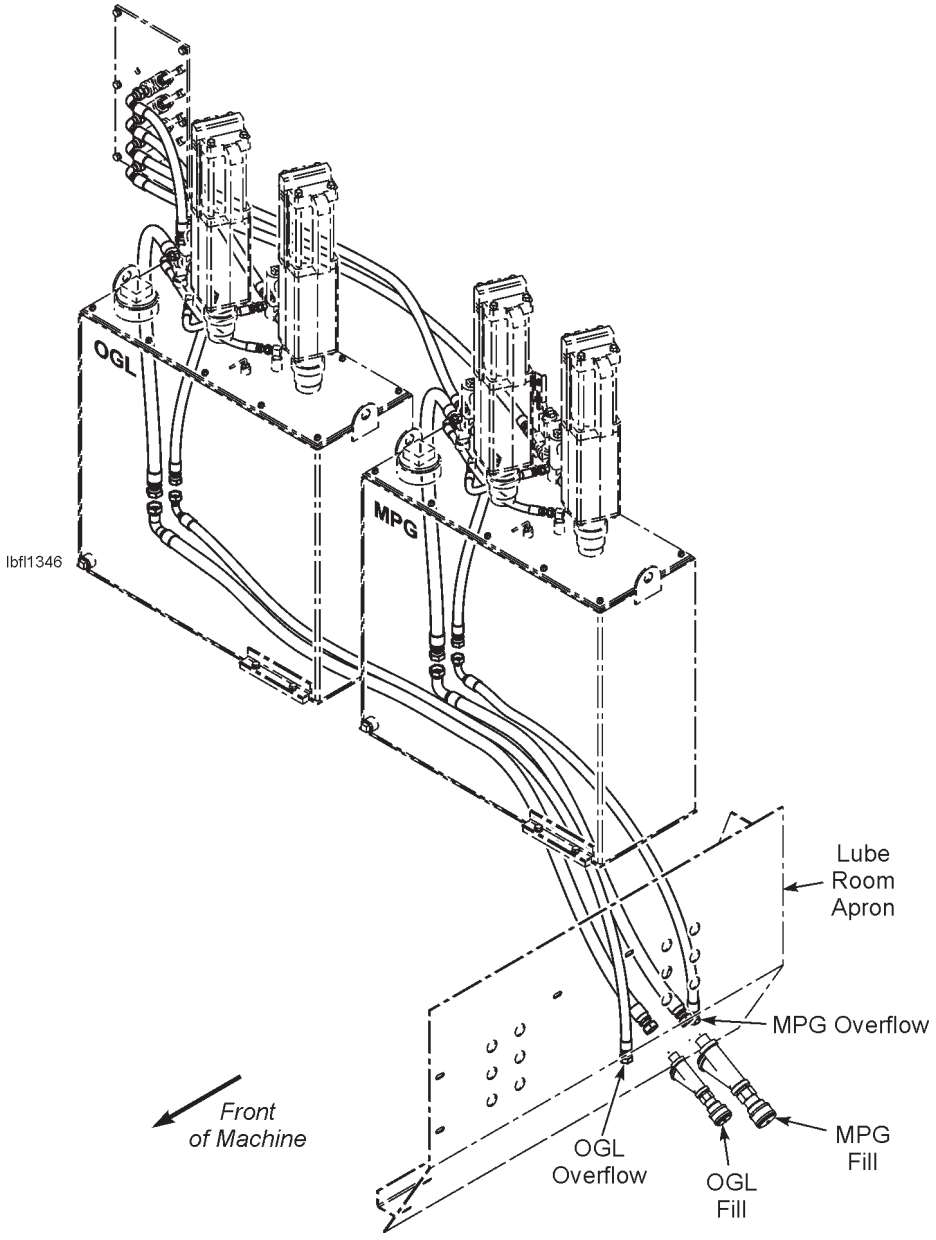
The machine should be moved close to the bank in short and frequent moves to maintain digging efficiency. Movement should occur between the loadings of haul units.

OPERATING HINTS

The following hints are reminders of the do's and don'ts related to excavator operation:

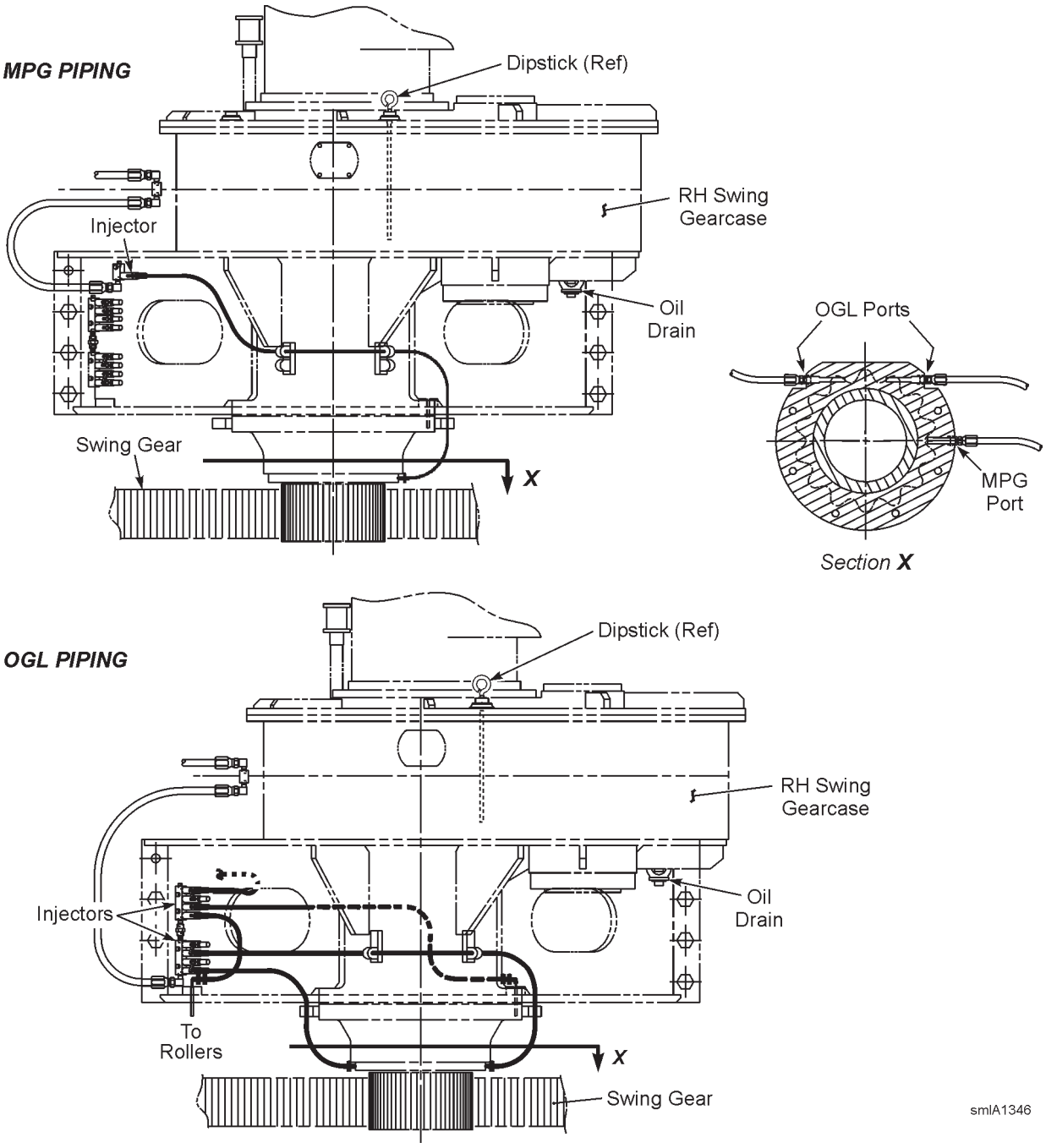
- Engage the bank properly.
- Load with the successive pass technique.
- Maintain a clean pit floor.
- Use proper hoist control.
- Make effective use of the hoist pull.
- Use proper crowd control.
- Force the dipper lip into the bank at the arc of entry.
- Crowd the dipper into the bank for deep penetration.
- Make full face cuts for faster loading cycles.
- Dig under the boom point.
- Make smooth, safe swing cycles.
- Keep swing arcs within 90°.
- "Spot" the haulage units properly.
- Keep the working faces free of projections.
- Propel forward whenever possible rather than backward.
- Move up to the bank frequently.
- Dig over the take-up axle end of the crawlers whenever possible.
- Make gradual turns when propelling.
- Do not suspend a loaded dipper for an extended time.
- Do not operate too close to material.
- Do not operate with missing dipper teeth.
- Do not stall hoist or crowd motions.
- Do not reach for material.
- Do not reach for haulage units.
- Do not overcrowd and jack the boom or machine.
- Do not make partial face cuts.
- Do not make shallow bank penetration.
- Do not make erratic swings.
- Do not swing until dipper is clear of the bank.
- Do not swing loaded or unloaded dippers over personnel or equipment.
- Do not "sweep" pit floor.
- Do not make sharp turns when propelling.
- Do not make long inefficient moves.
- Do not exceed swing arc of 90°.
- Do not spot haulage units inside or outside the boom point swing arc.
- Maintain adequate clearance between digging face and point sheaves.
- Do not allow the dipper to contact the crawler belts.

LUBE RESERVOIR FILL / OVERFLOW PLUMBING



Lube Reservoir Fill / Overflow Plumbing

The lube reservoir fill/overflow plumbing is located on the lube room apron at the front, left side of the machine. Lubricants can be added at this location. The overflow connections are also located here. DO NOT plug the overflow connections.



Swing Machinery MPG & OGL Lubrication Lines

A filter breather is provided on each planetary gearcase to allow air entry to equalize pressure differentials created by the warming and cooling of the gearcase. The filter breather allows moisture to escape and prevents contaminants from entering.

LUBRICANT SPECIFICATIONS

Planetary Propel and Swing Gearcases require ISO VG 220 Gear Oil.

Candidate products can be found in SPECIFICATION FOR ENCLOSED GEARCASE LUBRICANT for Rotary Blasthole Drills - SD4722.

Non-Planetary Hoist Gearcase requires ISO VG 1000 Gear Oil.

Candidate products can be found in SPECIFICATION FOR ENCLOSED GEARCASE LUBRICANT for Draglines - SD4721 Part A.

Non-Planetary Crowd Gearing uses “Open Gear Lubricant”.

Candidate products can be found in SPECIFICATION FOR OGL - OPEN GEAR LUBRICANT - SD4713.

Open Gear Lubricant

Candidate products can be found in CERTIFIED LUBRICANT LISTING FOR OGL, MPG AND EGL LUBRICANTS.

Multi-Purpose grease

Candidate products can be found in SPECIFICATION FOR MPG - MULTIPURPOSE GREASE - SD4711.

LUBRICANT CLEANLINESS

Even the best lubricant is a useless wear preventative if it has become contaminated by careless handling and storage. The lubricant manufacturer packs the lubricant in a tight container to keep it clean. It is the responsibility of the person performing the machine lubrication to make certain that no dirt gets into the lubricant.

Follow these points of good lubrication practice:

- Keep all oil and other lubricants in tightly covered containers.
- Wipe off covers before opening containers.
- Keep funnels, oil cans, grease guns, etc., in a clean place and wipe them off with a clean lint-free cloth before using.
- Wipe off each fitting before attaching the lubricant gun.
- Wipe off oil filler caps or covers and the surrounding area before removing them.

Refer to the topic “Lubricant Benchmarks” in Section 3 of this manual for an explanation of each type of lubricant required for servicing this machine. Make sure the lubricant was not dirty or of improper viscosity. When the machine is operated for more than one shift each day, all crews must cooperate on checking lubrication. This is to ensure that no lubrication point will be missed or over-lubricated. It is usually best to do this at the beginning of each shift. Reproducible service schedules are provided for recording service information.

NOTE: Lubrication instructions provided by any vendor for a vendor supplied item have priority over Bucyrus lubrication intervals and procedures.

CAUTION: When it is not possible to work on the machine with a safety harness, use a “cherry picker” or “man basket” when inspecting or servicing elevated areas. A slip or fall can result in severe personal injury or death.

500 HOURS OR MONTHLY *(cont.)*

19. Dipper Lip, Front - Completely check the front structure for wear, rebuild as required. Inspect for cracks and pay special attention to weld joint areas, repair immediately.

20. Dipper Back Structure - Inspect for cracks/damage, repair immediately.

21. Dipper Door - Check for bushing and pin wear. Rebuild as required. Check the door structure for cracks or damage, repair immediately.

22. Latch Bar/Mechanism - Inspect the latch bar for wear, rebuild as required. Adjust the mechanism for proper operation.

23. Latch Bar Dutchman - Rebuild as required, replace after 3 rebuilds.

24. Dipper Door Snubbers - Inspect the linkage, pins, bushings, replace as required. Adjust if door swings too freely or does not close completely.

25. Dipper Heel Band - Inspect and record wear to assure proper rebuild timing.

26. Dipper - Check wear internally to plans. Correct rebuild timing. Refer to Bucyrus International for reline recommendations.

27. Dipper Connecting Bushings and Pins - Inspect all connecting bushings and pins, replace as necessary.

28. Dipper Pitch Brace (Adjustable) - Check for missing or loose bolts. Tighten or replace as required.

Electric Mining Shovel

Preventive Maintenance

ITEM #	NOTED DISCREPANCY

pmc_1136

Date: _____

Shift: _____

Inspected By: _____

Supervisor: _____

5000 HOURS OR ANNUALLY *(cont.)*

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 re-tension 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.

16. Hoist Drum Gear Cover - Clean out excessive OGL.

17. Hoist Brake Mounts - Inspect the mounting bracket bolts for damage and alignment.

18. Crowd Motor - Inspect the mounts, chocks, coupling and blower for damage or wear. Correct as required.

Electric Mining Shovel

Preventive Maintenance

ITEM #	NOTED DISCREPANCY

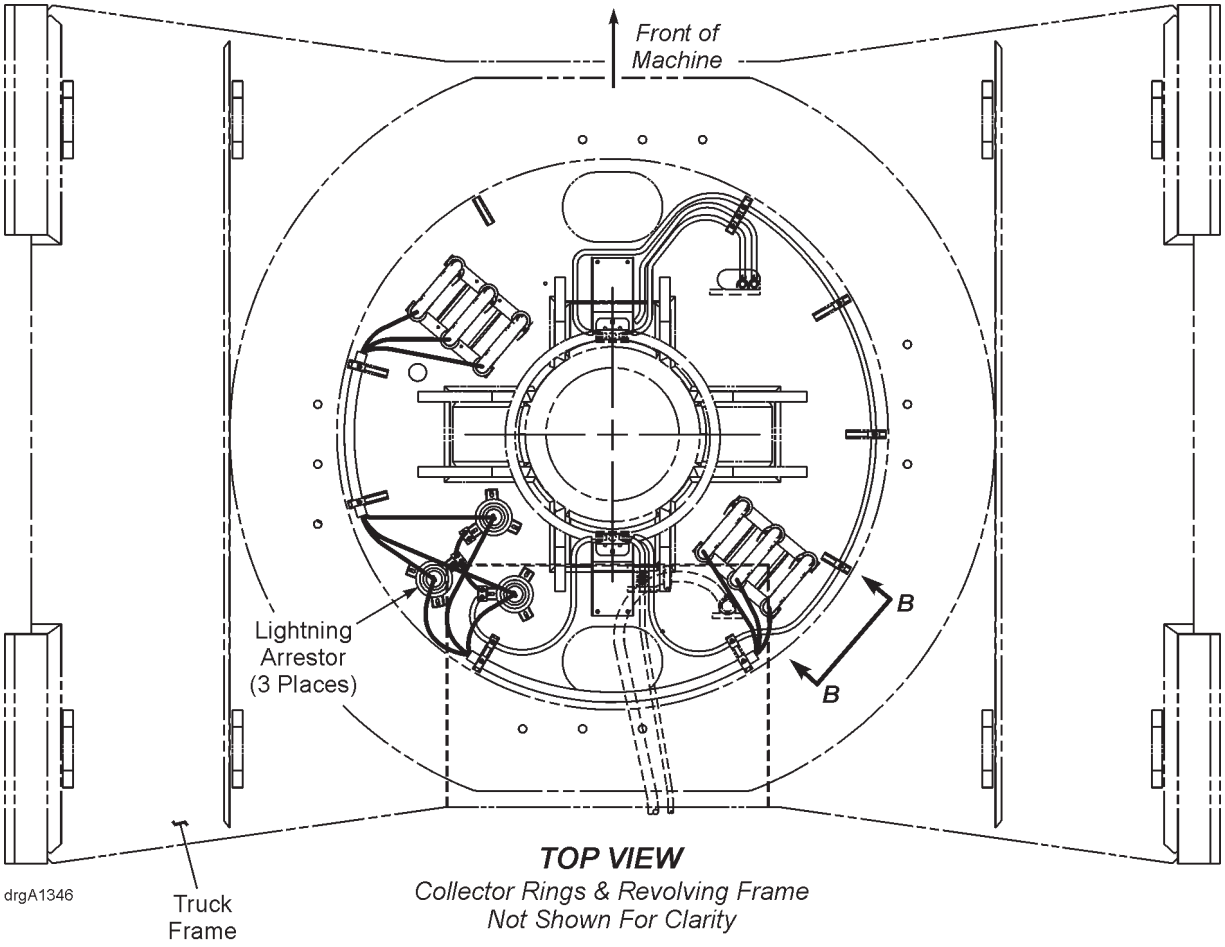
pmc_1136

Date: _____

Shift: _____

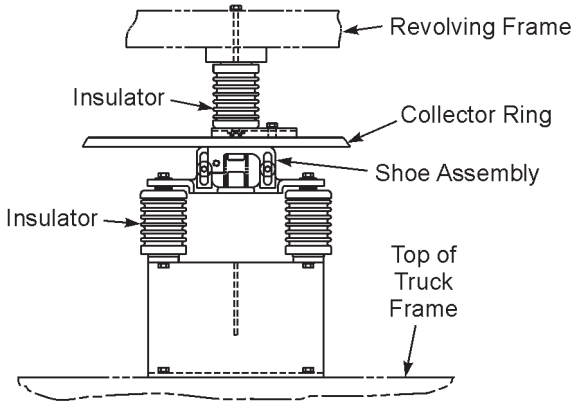
Inspected By: _____

Supervisor: _____



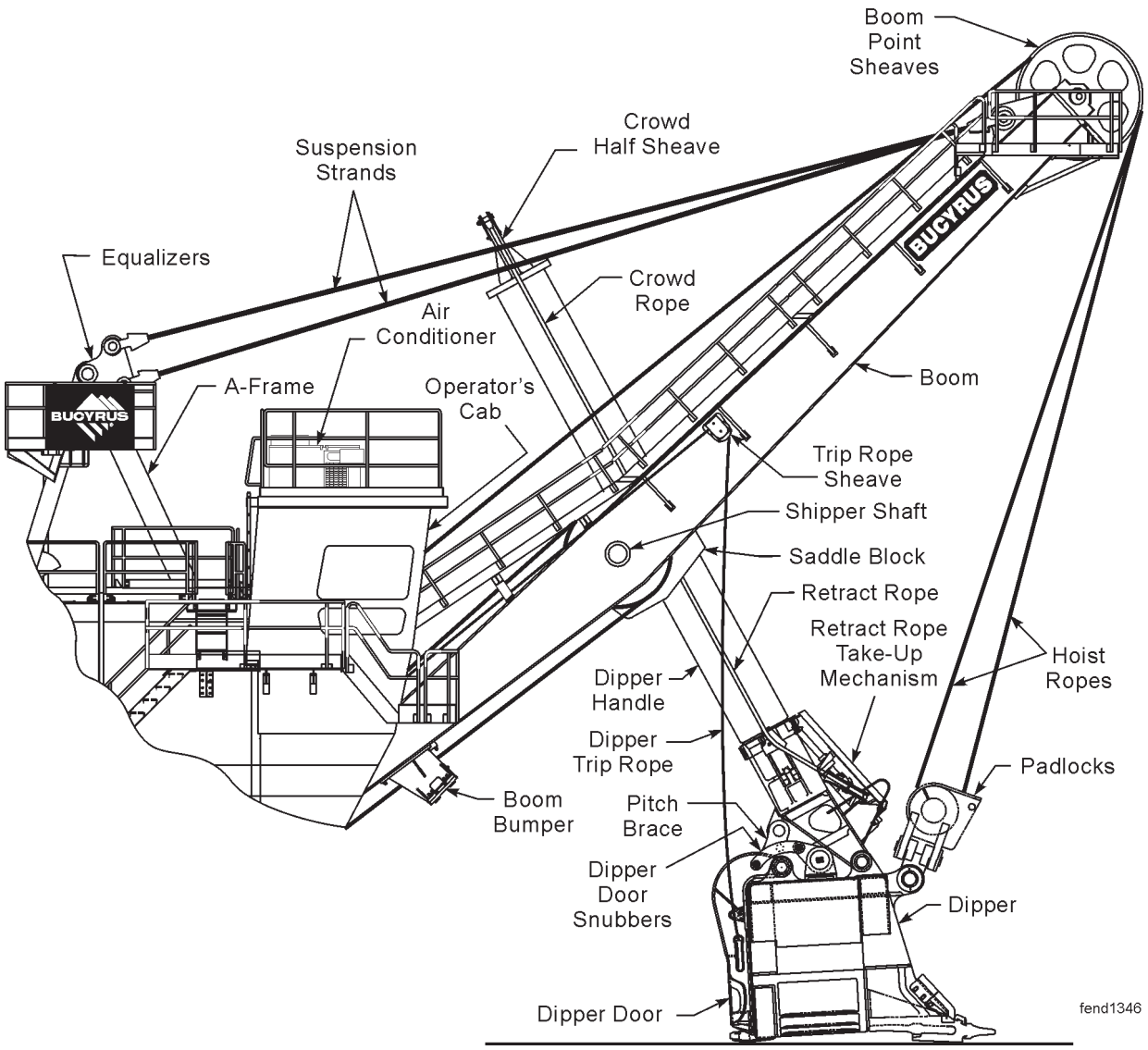
TOP VIEW

Collector Rings & Revolving Frame
Not Shown For Clarity



View B-B

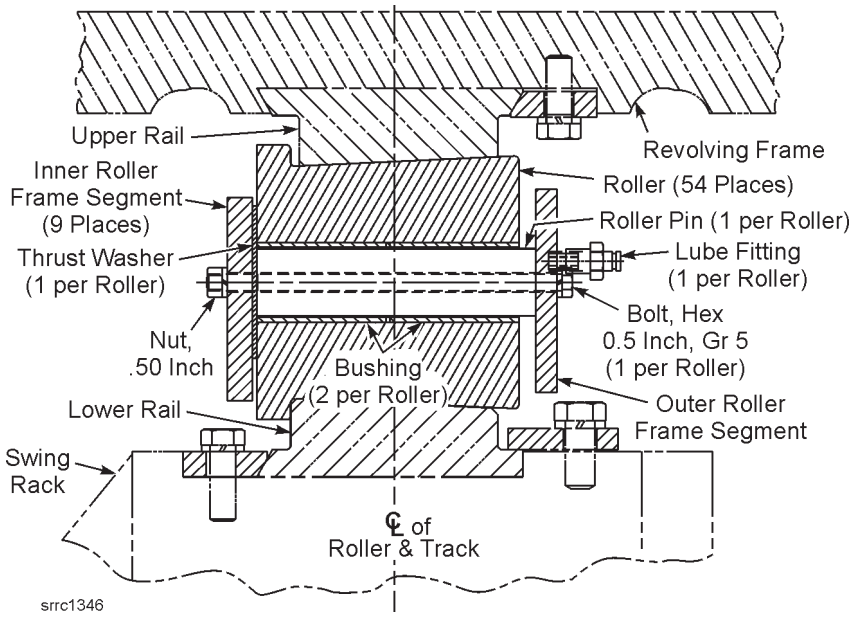
Main Phase Ring & Shoe Assembly



Front End Equipment

ROLLER CIRCLE

DANGER: **HIGH VOLTAGE! EXTREME CARE MUST BE EXERCISED AT ALL TIMES WHEN PERFORMING MAINTENANCE IN THE CENTER PINTLE AREA. High voltage can cause serious or fatal injury. Installation, operation and servicing of components should be performed only by qualified personnel. ALWAYS DISCONNECT THE ELECTRICAL POWER BEFORE ACCESSING THE CENTER PINTLE AREA.**

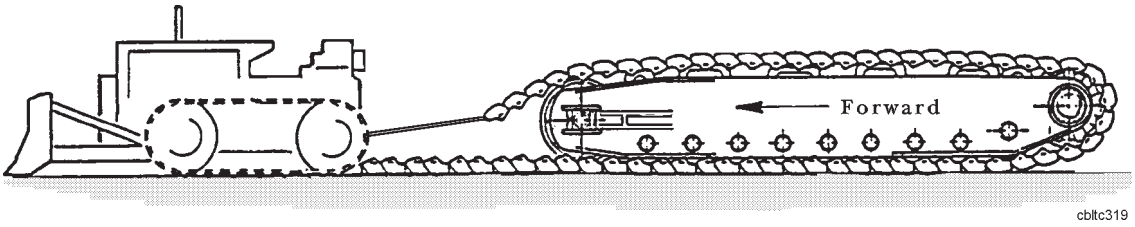


Inspect the rollers and rails of the roller circle monthly for severe pitting or spalling. This will usually be an indication of non-uniform loading. Small incipient pitting is not unusual and is not harmful. If rollers are damaged to the extent that they retard the swing function, they should be replaced as soon as possible. The diameter of the replacement roller must be matched to the worn good rollers. Consult the Bucyrus International Service Department for the correct procedure.

NOTE: The machine can operate in an emergency with a few rollers missing - however the missing rollers must not be adjacent to each other and must be equally-spaced around the roller circle. The remaining rollers will be subjected to increased loading, resulting in a shorter roller life.

Inspect the inner and outer roller frame sections and the rollers weekly for broken bolts. Normally the inside flange of the rollers contacts the inside edge of the lower rail. If they do not, a cracking or popping noise may be heard as the machine swings. This noise is caused by the rollers aligning themselves with the rails. Excessive popping requires a close inspection of the roller frame. Also, check the lubricant being used. Consult the Bucyrus International Service Department if noise is excessive.

Check both the upper and lower rails to see that they are properly chocked and secured to the swing rack and the revolving frame. Check the rail clamp bolts and retighten as required. Also check the rail surfaces for pitting and spalling.



Crawler Belt and Shoe Replacement

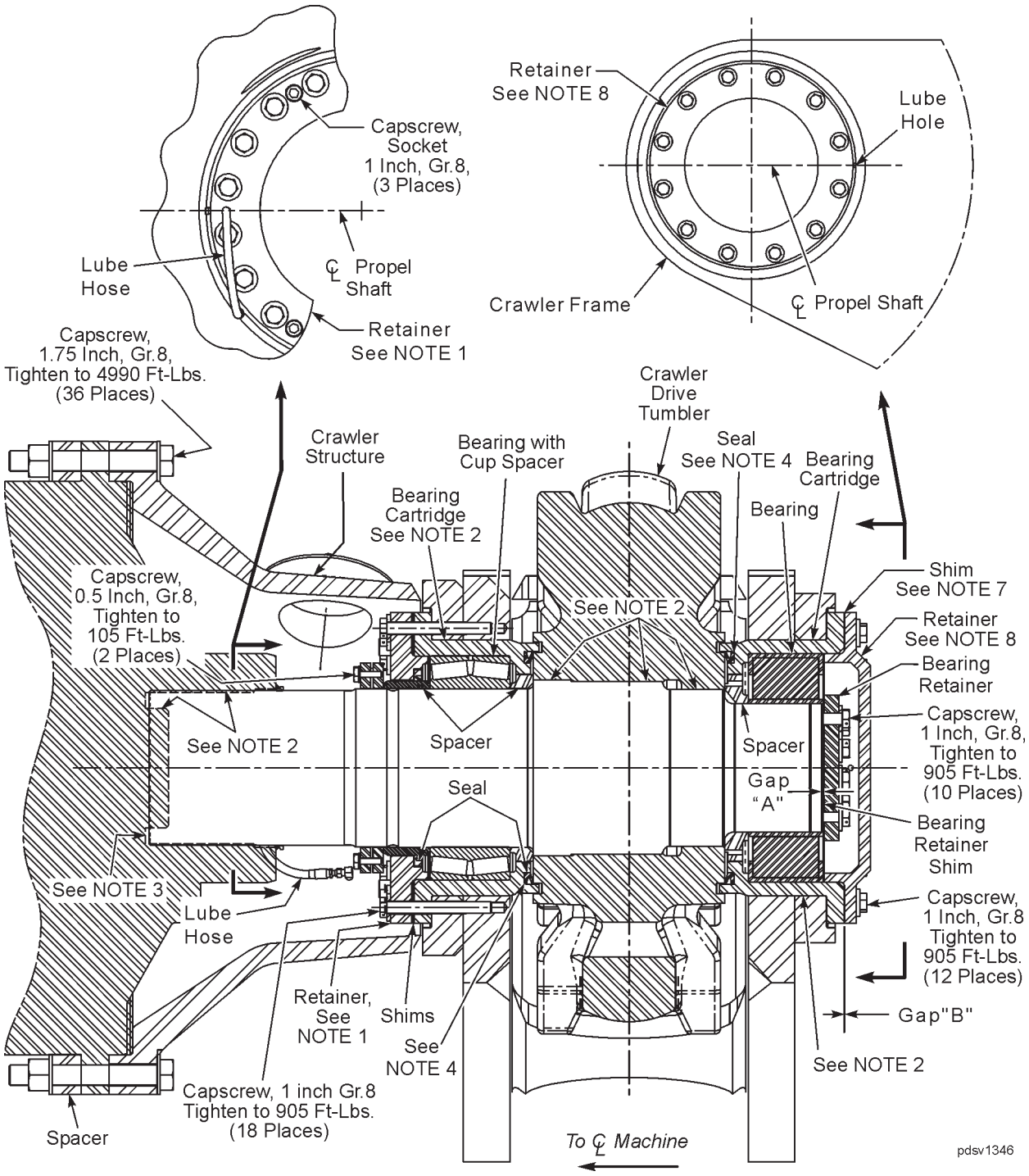
CRAWLER SIDE FRAME ASSEMBLY

The Crawler Side Frame assembly provides the motion path and support structure for each crawler belt. Each assembly bolts to the truck frame structure and contains the propel machinery to drive its respective belt.

Each side frame assembly consists of the following components:

- 8 Load rollers which transfer machine weight to the belt.
- 1 Front idler roller.
- 1 Rear idler roller.
- Drive tumbler shaft.
- Planetary propel gearcase, totally enclosed with right angle input.
- Propel motor with a single-disc, spring-set, air-released brake.
- Heavy duty fabricated frame structure with slide bars to guide the belt.

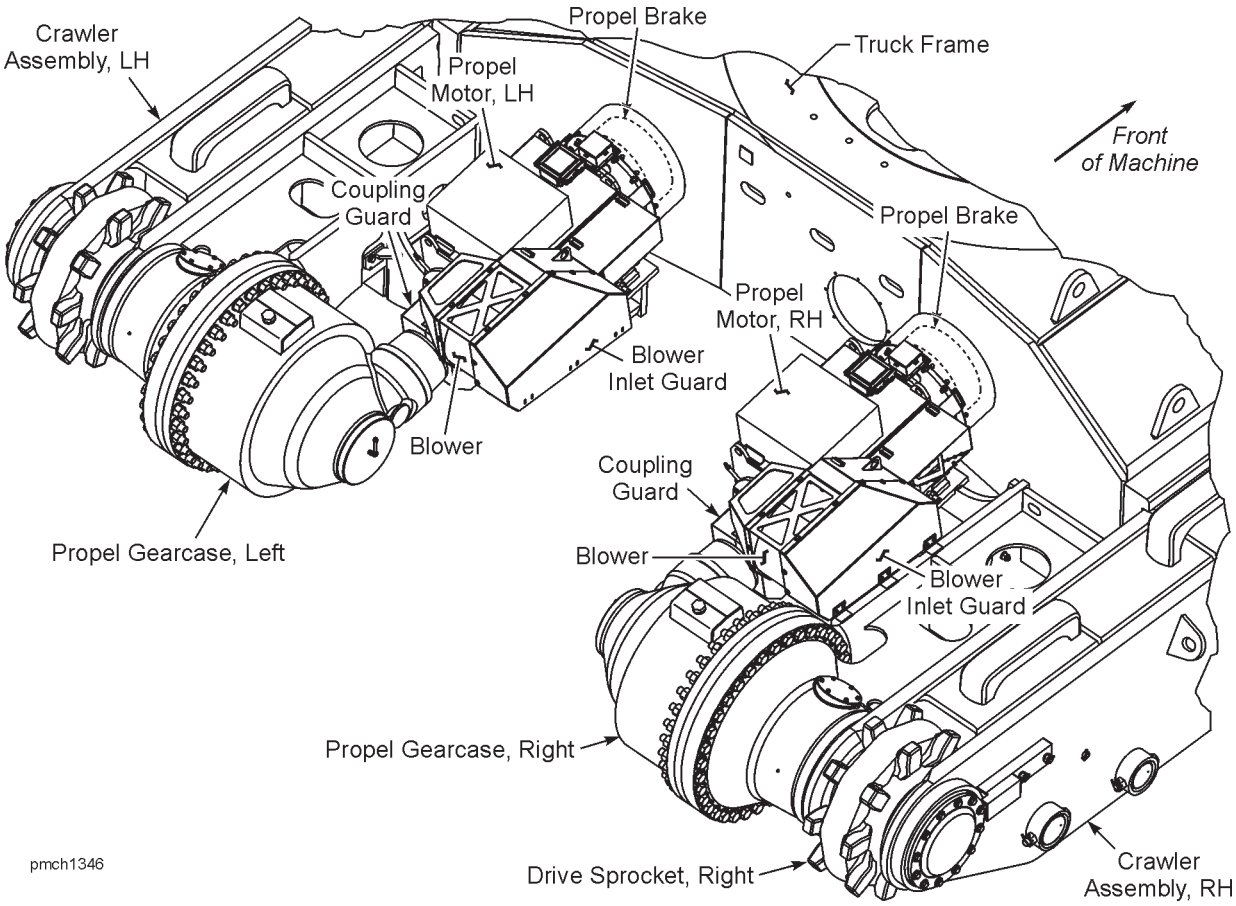
The drive shaft transmits propel effort from the planetary gearcase to the crawler belt. Anti-friction bearings support the assembly at each end.



Propel Drive Shaft Assembly - Section View

PROPEL MACHINERY

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



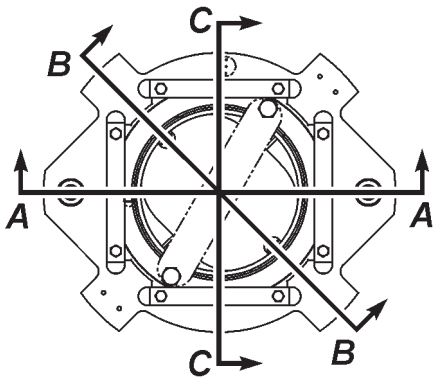
General maintenance and inspection of the propel machinery includes:

1. Inspection of the gearcase and electric motor mounting bolts.

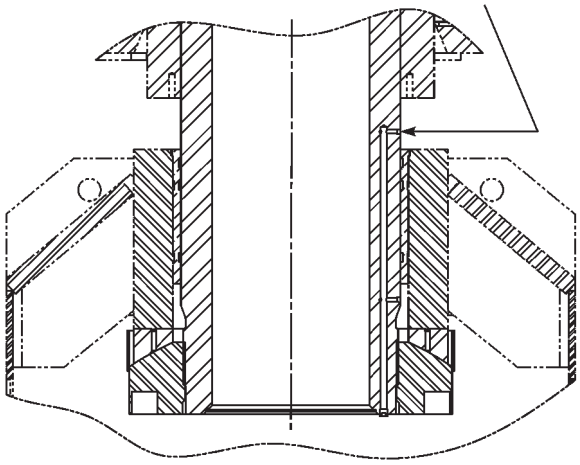
2. Check the gearcase oil level daily by removing the oil level plug in the gearcase.

3. Change the oil in gearcase annually or as indicated by lab test analysis. Flush the gearcase before refilling with oil. (See Lubrication Section.)

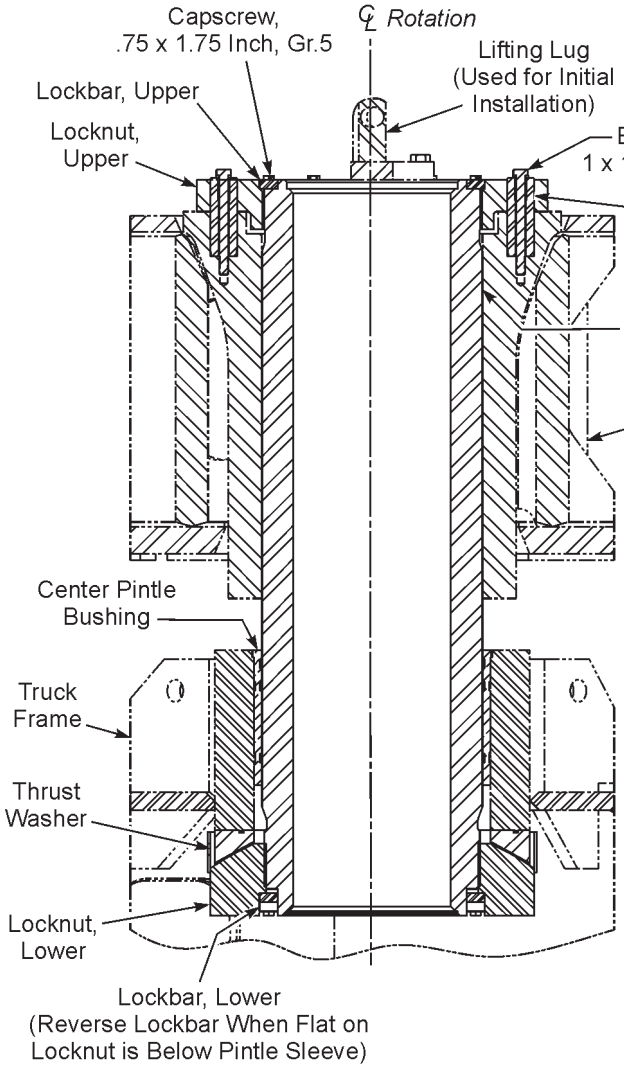
4. Inspect the motor coupling quarterly for lube level and keep full.



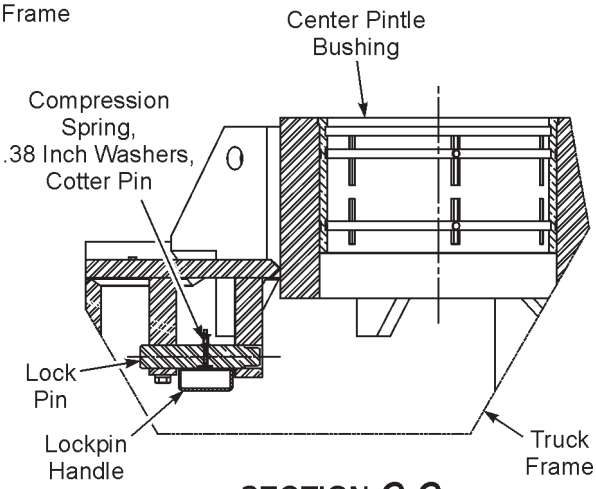
NOTE:
When installing Center Pintle, Be sure Lube Access is Toward the Right side of the Machine.



SECTION ***B-B***



SECTION ***A-A***



SECTION ***C-C***

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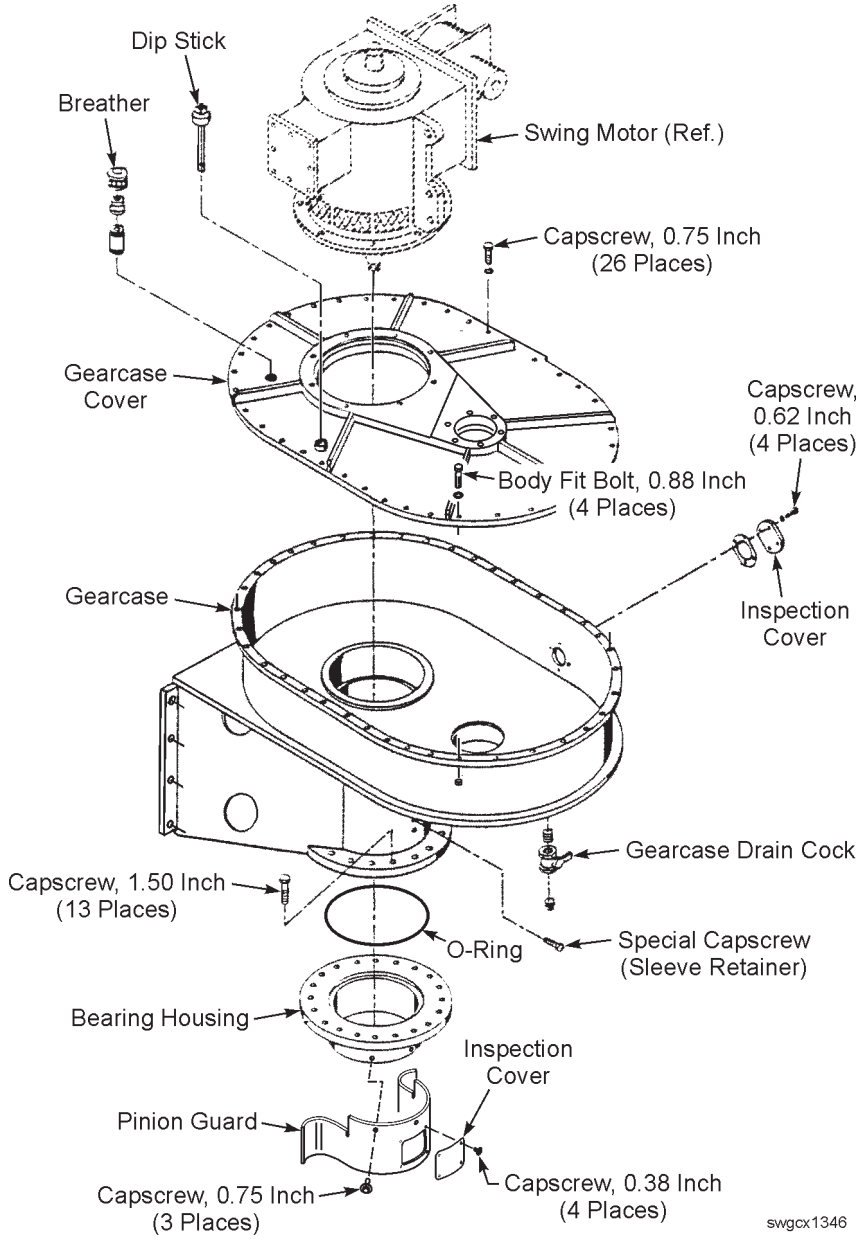
Center Pintle - Section Views

GEARCASE COVER REMOVAL



View G
Swing Gearcase and Cover

1. Remove the dip stick and the cover.

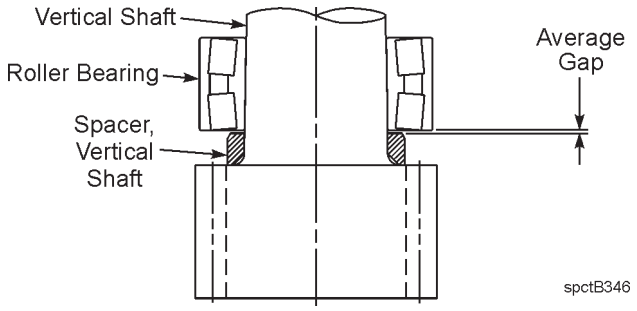
2. Drain the oil from the gearcase.

5. If new bearing spacers are required, determine their proper thickness as follows:

   a. Measure the bearing inner race width and the width of the vertical shaft spacer and record.

   b. Assemble the lower bearing lower spacer tight against the upper surface of the pinion. With the swing shaft and pinion in a vertical position, place the lower shaft bearing on the vertical shaft and pinion with only its own weight holding it in place.

   c. Measure the gap between the lower bearing lower spacer and the lower surface of the bearing, inner race at three equally spaced points; then calculate the average gap between the spacer and the bearing inner race. Refer to Detail B.

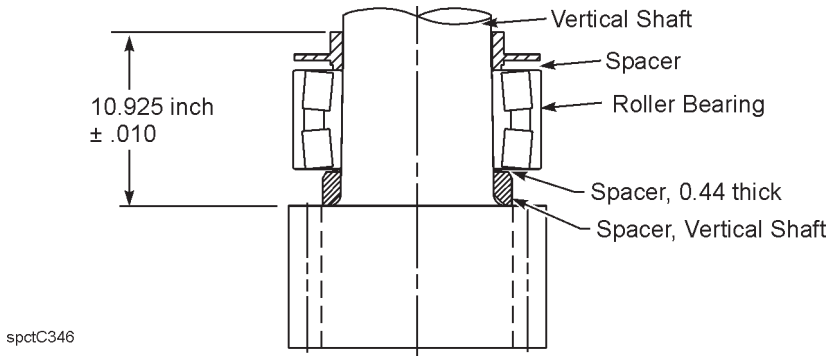


Detail B

   d. The required thickness of the lower bearing lower spacer is the average gap minus .162 inch. Machine the lower bearing upper spacer to this dimension plus or minus 0.005 inch.

   e. Subtract the width of the lower bearing inner race, and the widths of the lower bearing lower spacer and the lower bearing upper spacer from 10.925 inch.

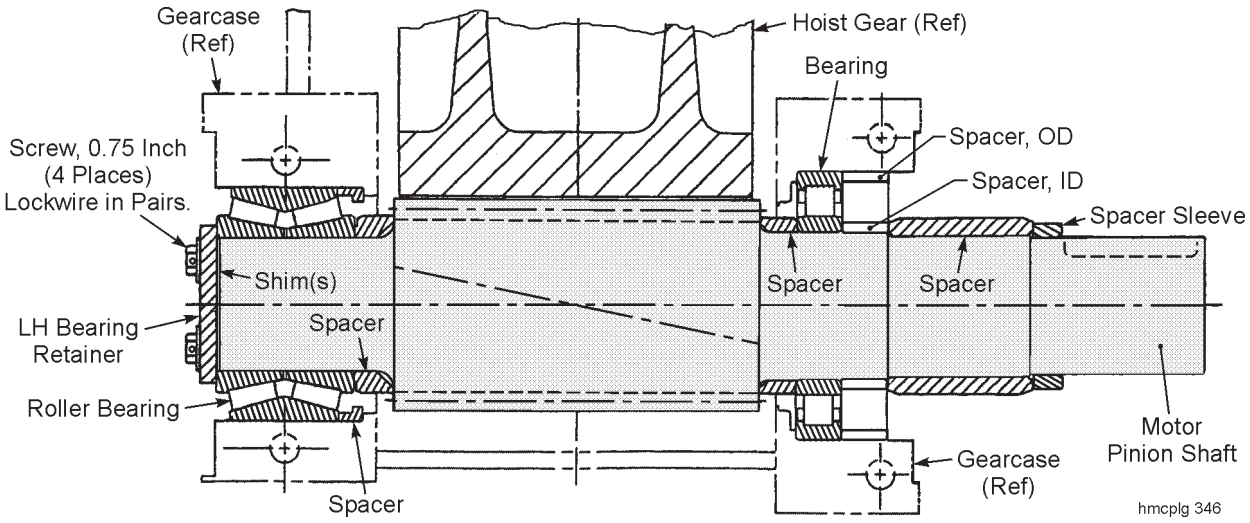
   f. Machine the bearing spacer to this required dimension ±0.005 inch. Refer to Detail C.



Detail C

NOTE: If lower bearing upper spacer is too short, build up of spacer may be required.

2. Remove the lockwire and 4 capscrews holding the LH bearing retainer in place. Remove the bearing retainer and any shims.



Hoist Motor Pinion Shaft Section View

3. Attach eyebolts to each end of the pinion shaft. Using a lifting sling and other additional rigging necessary, lift the pinion shaft (approximately 525 lbs.) just enough to support its weight.

4. With the pinion shaft fully supported, remove the sleeve and spacers from the input end of the shaft.

5. Remove the roller bearings and bearing spacers.

6. Lift the pinion out of the hoist gearcase. Lower the pinion to the ground and lay it down horizontally on cribbing.

NOTE: The bearings and spacers are interference fit so they must be preheated in an oil bath prior to installation on the shafts. Refer to *Bearing Installation* procedure on the following page.

7. Inspect all parts. Repair or replace as required.

Installation is the reverse of disassembly.

NOTE: Thoroughly clean or flush inside surfaces of gearcases and covers prior to assembly. Upon completion, fill gearcases to proper level before operation.

HOIST DRUM GEAR REPLACEMENT

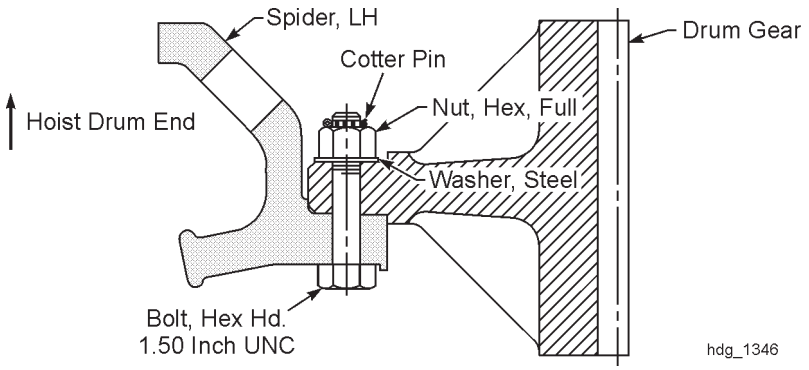
The hoist gear can be reversed on the hoist spider to provide more useful life. To reverse or replace the hoist gear, the hoist drum shaft must be removed from the machine. Remove the drum assembly using the HOIST DRUM REMOVAL procedure in this section of the manual.

1. Once removed, support the hoist drum assembly on cribbing in a vertical position, with the gear end down and the cribbing supporting the LH spider only. Ensure that the bearing housing on the gear end is not resting on the ground. This may require cribbing approximately 30 inches in height.

2. Ensure the drum assembly is stable and fully supported with adequate cribbing.

3. Using a suitable lifting device, attach a crane support to the drum gear so that it can be lifted in a horizontal position to the ground. The hoist gear weighs approximately 8,520 Lbs. DO NOT lift the gear until all the attaching hardware has been removed and the gear has been separated from the mounting flange of the spider.

4. Remove all the hardware securing the hoist gear to the spider.



NOTE: Six 1.50 inch bolts (3.50 inch or longer) can be threaded into the tapped holes in the gear to help separate the gear from the spider mounting flange. The holes are equally spaced around the diameter of the gear.

5. Lift the hoist gear, removing it entirely from the drum assembly. Set hoist gear flat on the ground.

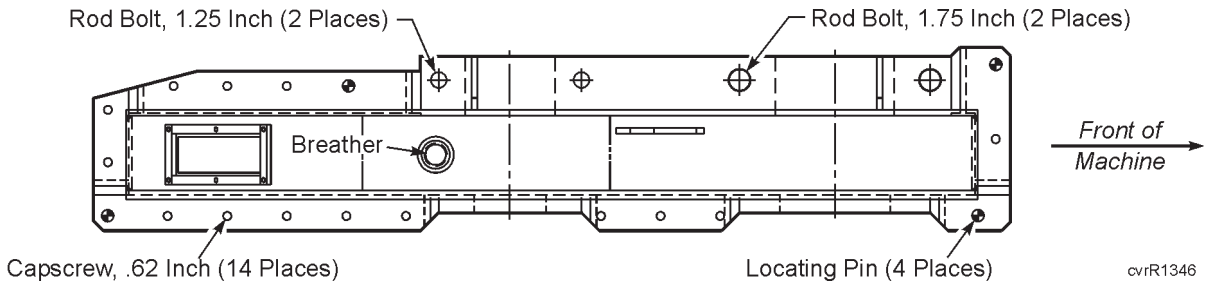
   a. If the old gear is to be re-used, it can be flipped over (reversed) at this time. Re-attach the crane support to the gear. Proceed to Step 6.

   b. If a new gear is to be used, attach a crane support to the drum gear.

To remove the RH Gearcase Cover:

1. Prior to removing the gearcase cover, disconnect the 2 drain lines from the labyrinth seals.

2. Attach a suitable lifting device to the gearcase cover's lifting lug. The gearcase cover weighs approximately 1,400 lbs.



R.H. Gearcase Cover Mounting Flanges
(Top View)

3. Remove 14 - .62 inch capscrews and lockwashers at the base flanges.

4. Remove the 2 - 1.75 inch rod-bolts.

5. Remove the 2 - 1.25 inch rod-bolts.

NOTE: The four locating pins can remain in place if necessary.

6. Remove the 2 round cover plates on the outboard side of the gearcase.

7. Hoist the cover 3-4 feet above the lower flange being careful not to contact the enclosed gears. Relocate cover to a clean work area.

8. Thoroughly clean flanges with solvent prior to assembly.

Installation is the reverse of disassembly.

NOTE: Apply RTV Sealant (PN:82833892) at assembly. Refer to GEARCASE SEALING procedure in Section 9 ~ ENGINEERING DATA.

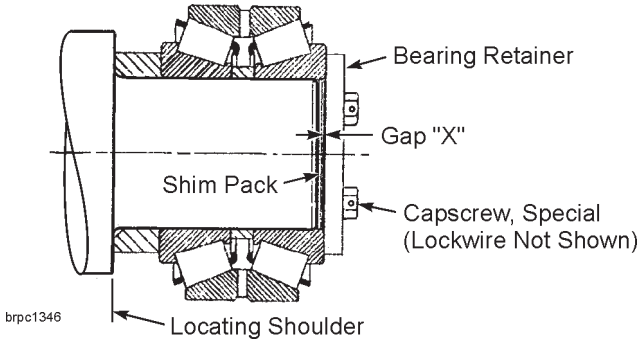
2ND INTERMEDIATE SHAFT BEARING INSTALLATION

NOTE: The bearings are assembled with an interference fit. Preheat the bearings in an oil bath to ease assembly.

1. Ensure the ends of the drum shaft are free of any burrs prior to assembly.

2. Assemble the preheated bearing on the shaft snug against the locating shoulder.

   Refer to View C.



View C

3. Assemble the bearing retainer to the drum shaft using 4 - .75 inch capscrews. Preload the bearing and allow the entire assembly to cool.

4. Remove the bearing retainer. Measure the gap “X” as shown in View C.

5. Assemble shim pack with thickness equal to the gap measurement (.002 - .005 inch).

6. Assemble the bearing retainer and secure with 4 - .75 inch capscrews. Snug all capscrews to 53 Ft-Lbs using a STAR pattern.

7. Continue to tighten capscrews using a STAR pattern until all capscrews reach a torque value 1/3 the torque value - approximately 67 Ft-Lbs.

8. Continue to tighten capscrews using a STAR pattern until all capscrews reach a torque value 75% of proof load torque - 200 Ft-Lbs.

9. Install lockwire to capscrews. Refer to *Wire Locking Capscrews* in Section 9 - *ENGINEERING DATA* of this manual.

CROWD DRUM REMOVAL

If repair of the crowd drum is needed:

1. Remove the crowd ropes and retract ropes from the drum. Refer to the *FRONT END EQUIPMENT* in this manual.

2. Remove the upper and lower gear guards from the drum gear.

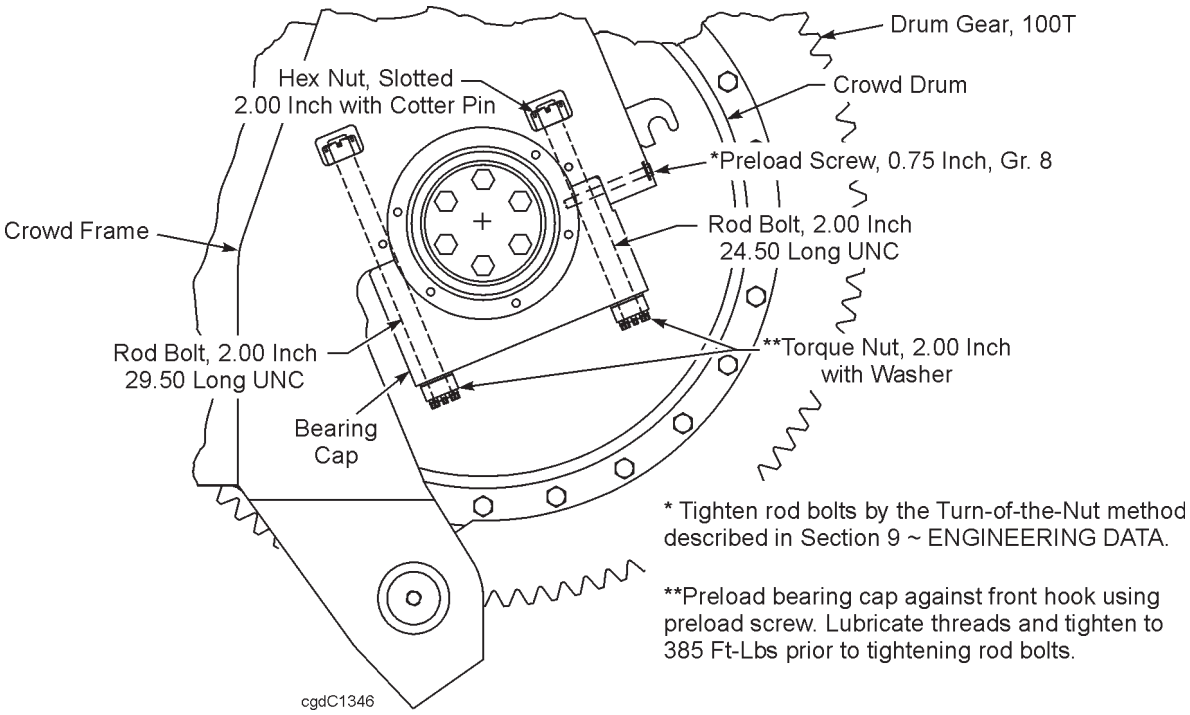
3. Disconnect the lubrication lines at the shaft end covers. Remove the end covers.

4. Remove the bolted-on crowd frame lower-front cross tie.

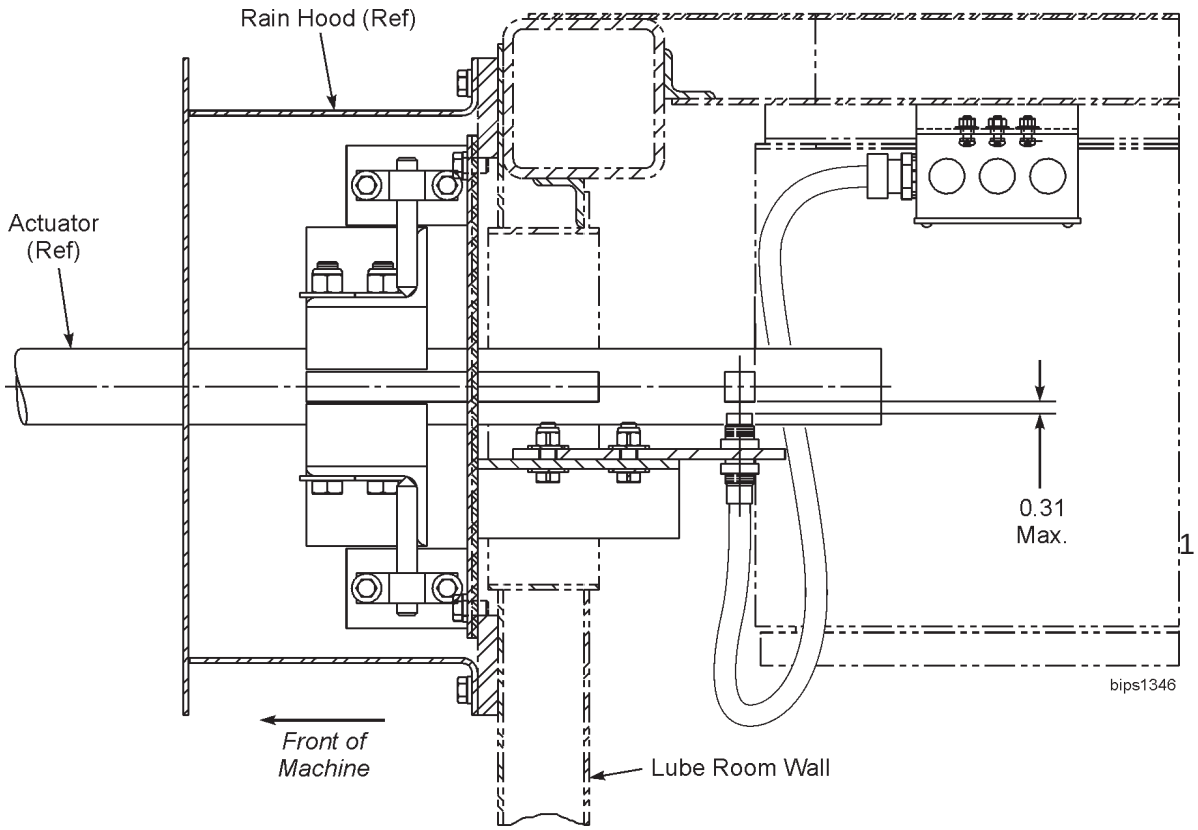
5. Attach a crane to the drum (approximately 12,665 lbs.) and apply enough force to support the weight of the drum. Support the bearing caps (approximately 500 lbs.) separately.

6. Loosen the torque nuts on the bearing caps. Refer to the procedures in Section 9 - *ENGINEERING DATA*. Remove the preload screws from each bearing cap.

7. Remove the torque nuts and washers securing the bearing caps then carefully remove the bearing caps. The drum can then be lowered to the ground.



NOTE: The bearing cap rods are nested in the crowd frame with slotted hex nuts with cotter pins. These can remain in place.



Section A - A
Boom Inductive Proximity Switch

Overall sensitivity can be further adjusted from this initial position to suit conditions.

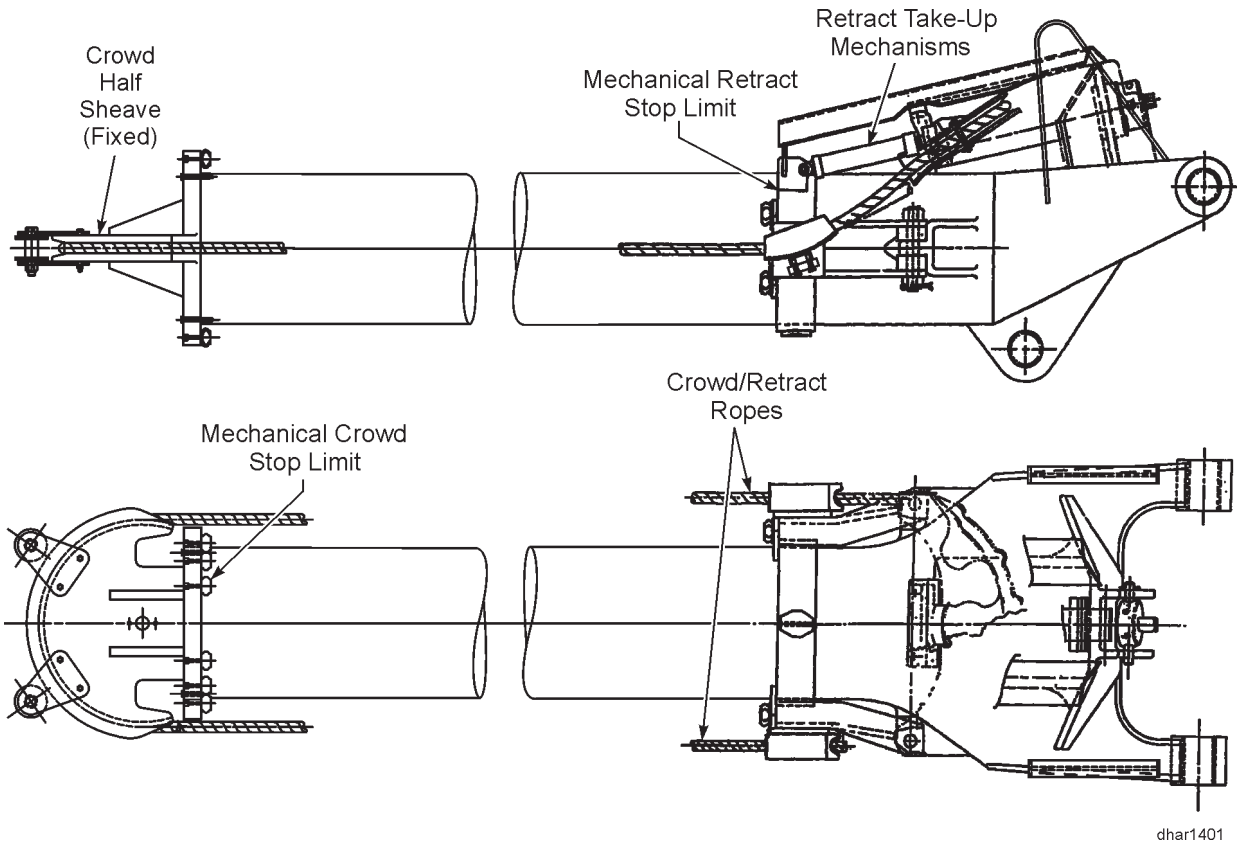
e. Re-install the bearing retainer and snug-tighten the cap screws. All cap screws require retaining compound 82 833 859. Tighten in a sequence 180° apart in 3 steps adding 1/3 torque value each time.

NOTE: All cap screws should be tightened to 146 Ft-Lbs.

8. Reinstall the saddle block in the boom. Reconnect the lube lines. Reinstall the dipper handle. Reeve the crowd and retract ropes on to the machine.

DIPPER HANDLE

The dipper handle should be checked regularly for cracking or bending. If cracking or bending is noticed, the handle should be removed and repaired as directed by Bucyrus International's Service Department. Check the handle for proper lubrication. Check condition of the crowd sheave and retract take-up mechanism.



5. Lower the hoist ropes slightly to allow for pin removal.

6. Remove the padlocks one at a time using the following procedure:

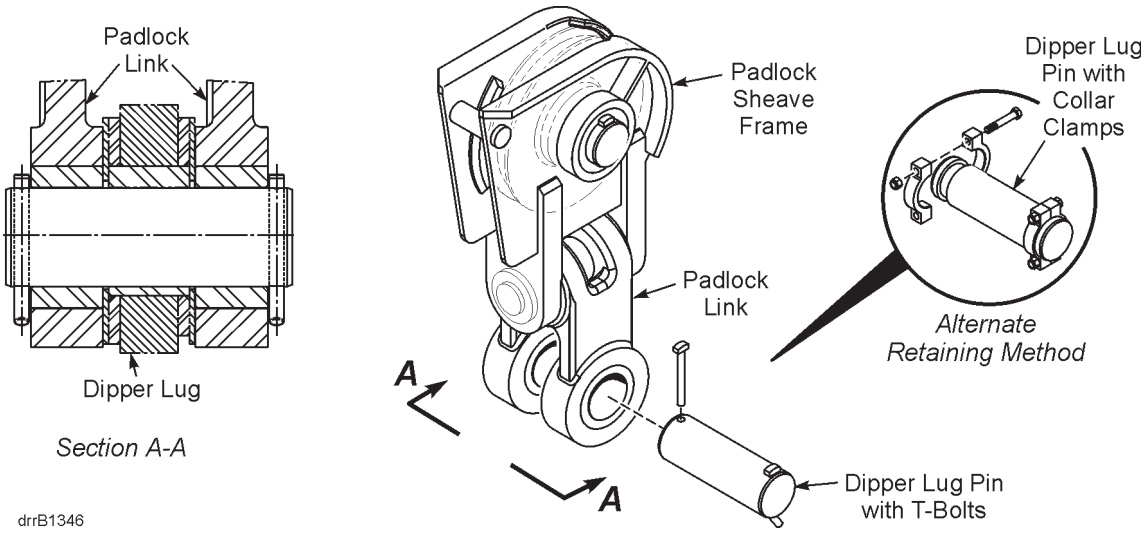
DANGER: STORED ENERGY! Removal of dipper pins requires the attached items to have proper support to release the load. Failure to comply could result in death, severe personal injury, or damage to the machine.

a. Using a suitable lifting device, raise the padlock (approx. 5,250 lbs) just enough to minimize the load placed on the dipper lug pin.

b. Remove the T-bolts securing the dipper lug pin in place. See View A.

NOTE: An alternate; pin & collar clamp assembly may replace the T-bolts as a retaining mechanism. If so, remove the collar clamps and attaching hardware.

c. With a second lifting device, position a strap type sling under the dipper lug pin (approx. 400 lbs) to support the pin during removal. Remove the pin. Do not lower the pin at this time, it will be reinstalled.



View A

3. Remove the drum retainer and drum.

4. Remove the bearing retainer and spacer on the drum side. Then remove the cover and bearing retainer at the other end of this shaft.

5. Support the gear and slide the shaft from the gear and base on the drum side of the base. Remove the gear, bearings, spacers and seals.

6. Repair or replace all worn or damaged parts and reassemble in reverse order of disassembly. Lubricate the bearings.

7. If the pinion was removed from the motor, when it is reinstalled, the motor shaft should be recessed inside of the pinion 1/16 inch.

A-FRAME

Periodically inspect the A-frame for signs of cracking or other damage. This check should include the mounting lugs and pins, the ladders and platforms, the equalizer links holding the boom structural strands and the leg shrouds on the machinery house roof. Make certain there are good seals around the leg shrouds.

If any repair welding is required, contact the Bucyrus International Service Department for a specialized repair process. For any other unusual problems consult the Bucyrus International Service Department.

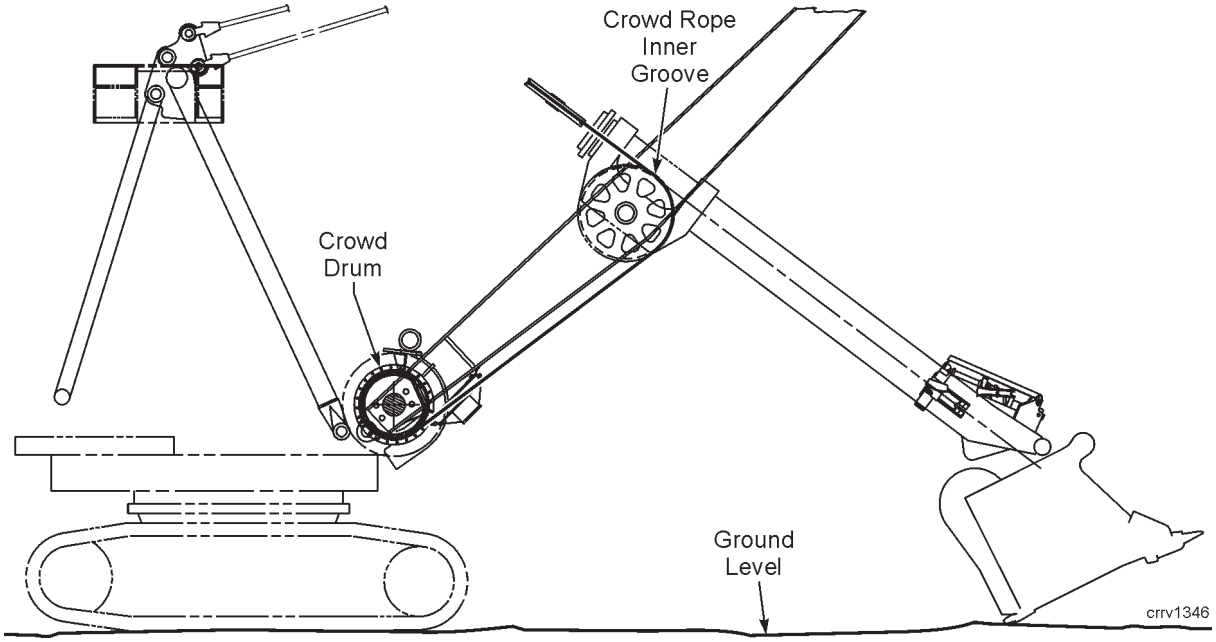
Carefully inspect the mounting lugs and pins for cracks or other signs of wear or deterioration. Lubricate these areas occasionally to prevent rusting. Check the leg shrouds both from the inside and on the top of the machinery house to see that a tight seal is maintained and there are no leaks. If there are any signs of leaking, reseal around the shrouds with a suitable caulking compound.

Make certain the ladders are securely mounted in good condition. Repair any cracks as soon as they are noticed.

Check the condition of the platforms to see that they are secure and safe. At the same time inspect the equalizer links and connections of the boom structural strands.

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 follow all safety precautions when burning. Always maintain complete control over the rope and over any burned sections of rope.

3. Crowd and lower the dipper simultaneously until the rear stop of the dipper handle contacts the saddle block and the dipper heel is resting on the ground as shown.



Crowd Rope Reeving

4. Set all brakes, shut the machine down and tag and lock all controls.

5. Back-off the retract take-up adjustment to its complete limit.

6. 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.

7. 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.

8. Secure both ends of the retract rope away from the crowd drum.

9. Remove locks and tags from the controls and, using the crowd motor, rotate crowd drum in the retract direction to unwind the crowd rope from the drum. When the crowd rope ferrule buttons are in position for easy removal from the sockets, stop rotating the crowd drum. Set the brakes and replace the tags and locks to the controls.

CROWD SLOWDOWN/STOP LIMIT

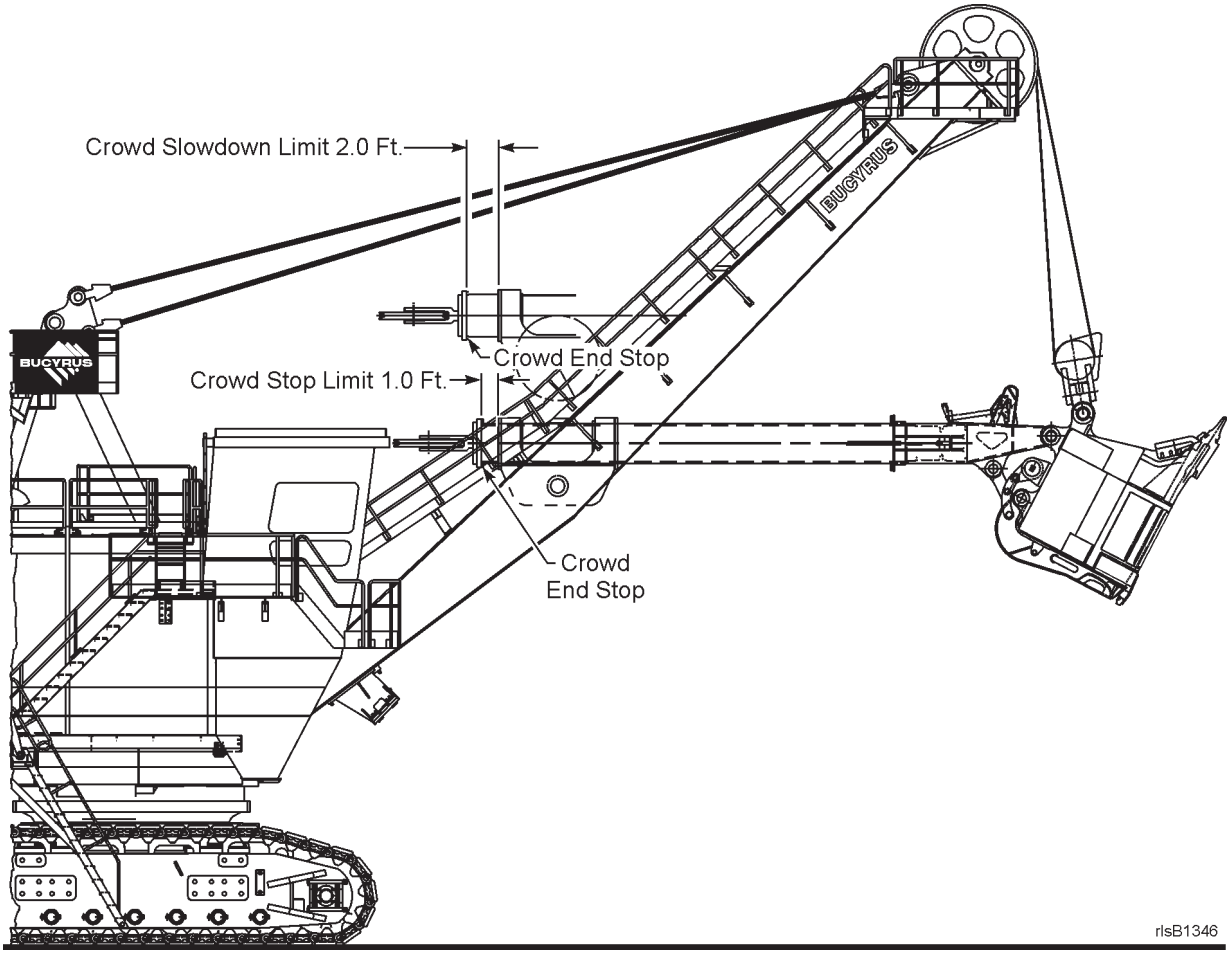
To set the crowd slowdown and stop limits:

1. With the handle horizontal, position the handle approximately one foot from the rear end of the saddle block.

2. Press the CROWD STOP LIMIT button on the operator display.

btnE1209

3. Retract the handle until the crowd stops are approximately 2 feet from the saddle block. Press the CROWD SLOWDOWN LIMIT button on the operator display.



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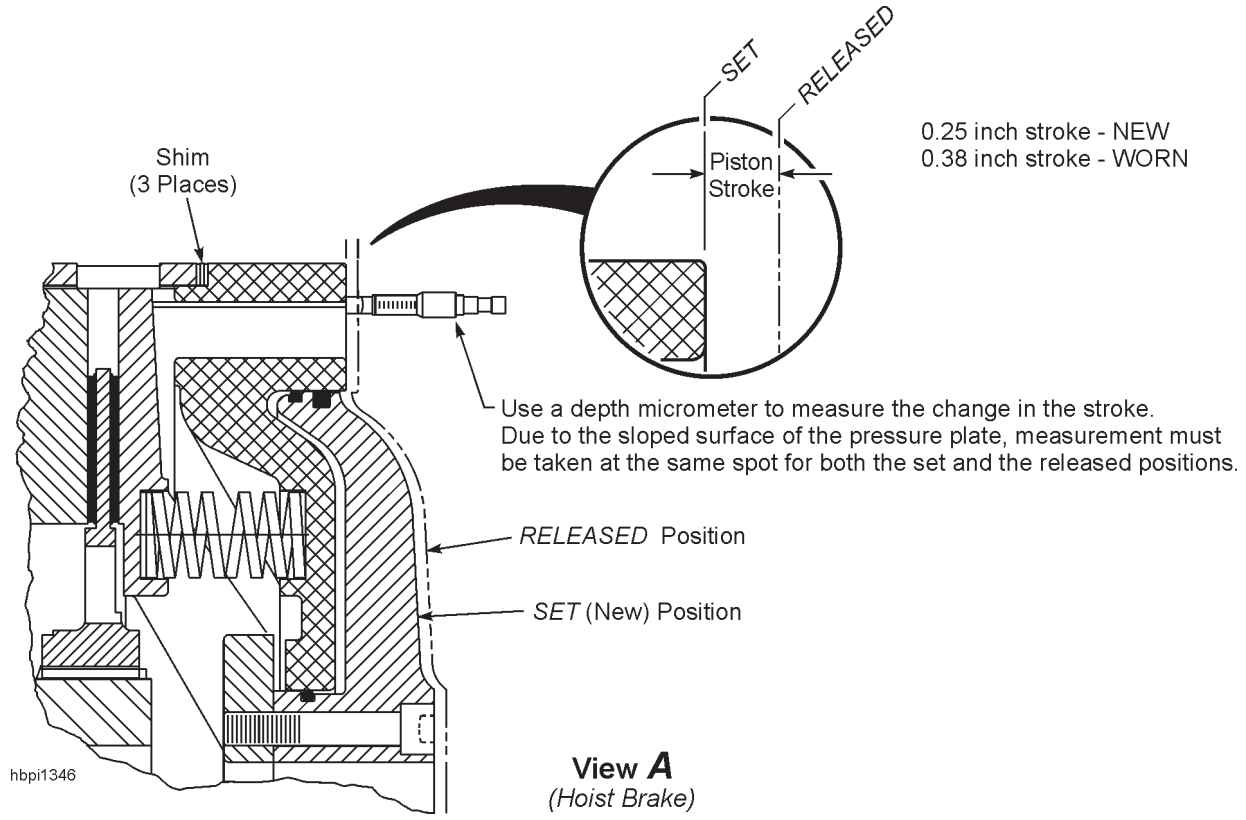
HOIST BRAKE ADJUSTMENT

The hoist brake is equipped with 3 adjustment shims to compensate for lining wear. This brake should be checked daily for lining wear and proper piston travel. If out of adjustment it will not be able to support a fully loaded dipper.

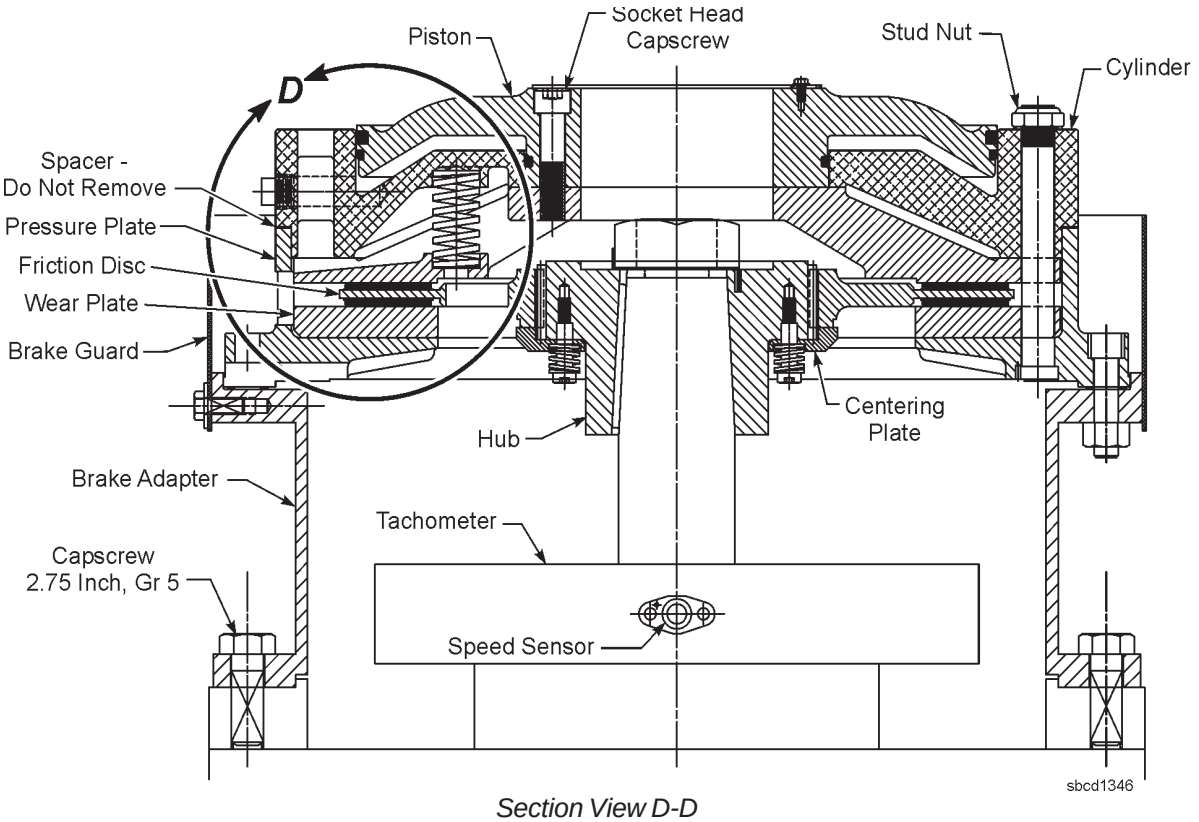
To inspect for excessive disc wear, use a depth micrometer as shown in View A. The reading must be taken from the same location with the brake engaged and released.

NOTE: The brake will be fully released once air pressure exceeds 65 PSI on a properly functioning brake. However, air pressure in excess of 125 PSI could damage the internal seals of the piston.

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 adjustment must be performed when the total wear reaches 0.38 inch.

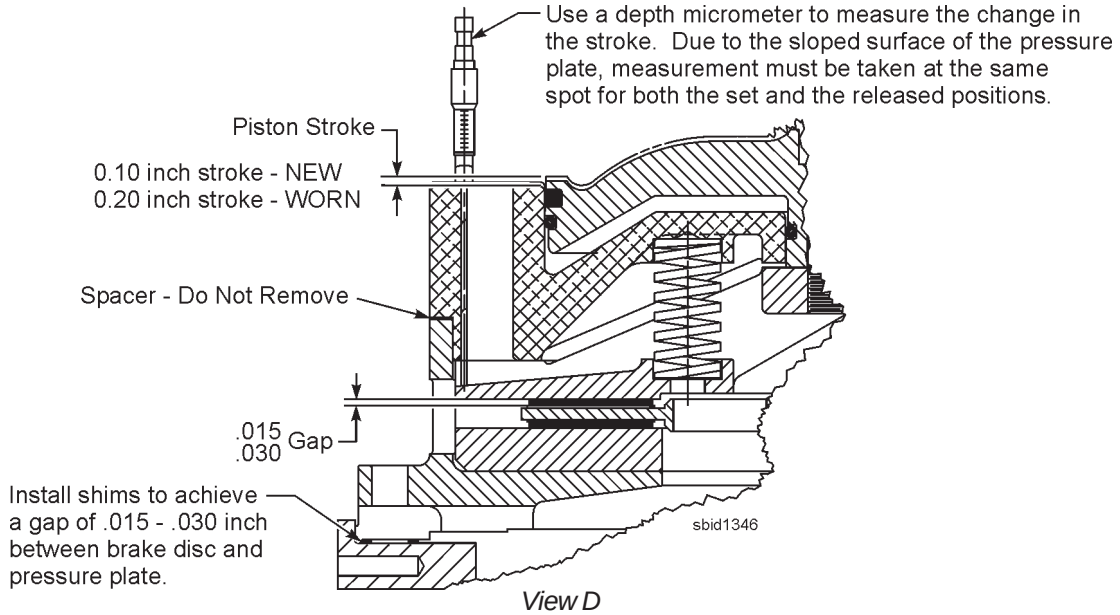


NOTE: Adjustment shims are split for ease of removal and installation. DO NOT DISCARD shims after removal during brake adjustment. These shims will be required when reassembling the brake following a friction disc replacement.



Section View D-D
(Swing Brake)

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.

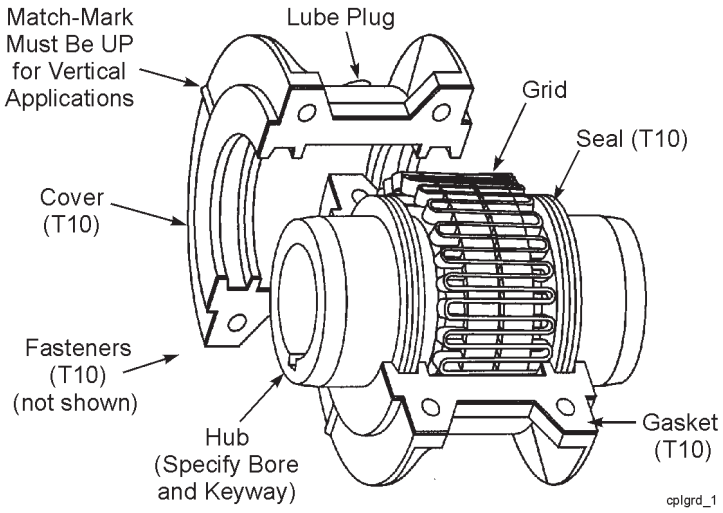


View D
(Swing Brake)

COUPLINGS

GRID COUPLINGS

These instructions apply to Tapered Grid Couplings. They are designed to operate in either the horizontal or vertical position without modification. However, for vertical applications, the match mark shown above, must be up. The performance and life of the couplings depend largely upon how they are installed and serviced. Carefully follow these instructions for optimum performance and trouble-free service.



All coupling parts have identifying part numbers. When ordering parts, always *SPECIFY SIZE and TYPE*. Cover halves have 1/8 NPT lube holes. Use a standard grease gun and lube fitting.

For Long Term Grease (LTG) use part no. MP295148.

LUBRICATION

Adequate lubrication is essential for proper operation of the coupling. Refer to the table *"Grid Coupling Data"* for the amount of lubricant required. It is recommended that the coupling be checked once a year and lubricant added if required. For extreme or unusual operating conditions, check more frequently. Grid couplings initially lubricated with LTG will not require re-lubrication until the connected equipment is stopped for servicing.

Section **7**

Compressed Air System

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

Table of Contents

AIR FILTER MAINTENANCE

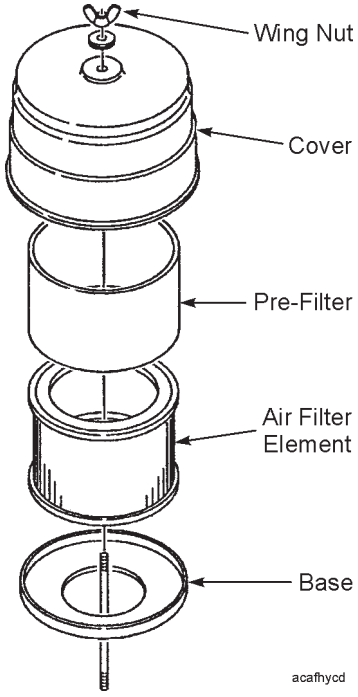
NOTE: Under normal service conditions air filter maintenance should be performed every six months, more frequently when operating in extreme conditions. Care should be taken so no dirt or debris is allowed to enter the intake housing during the procedure below.

1. Clean the exterior of the filter cover, removing any loose dirt or debris.

2. Remove the wing nut holding the air filter cover in place.

3. Remove the element and base. Clean the base and cover with a damp cloth.

4. Reposition the base to the compressor. Place a new air filter element onto the base. Replace the pre-filter and cover. Tighten wing nut securely in place.



AIR CONDITIONER

SIGMA MPV9 climate control units are heavy duty systems providing superior performance in a variety of climate and environmental conditions.

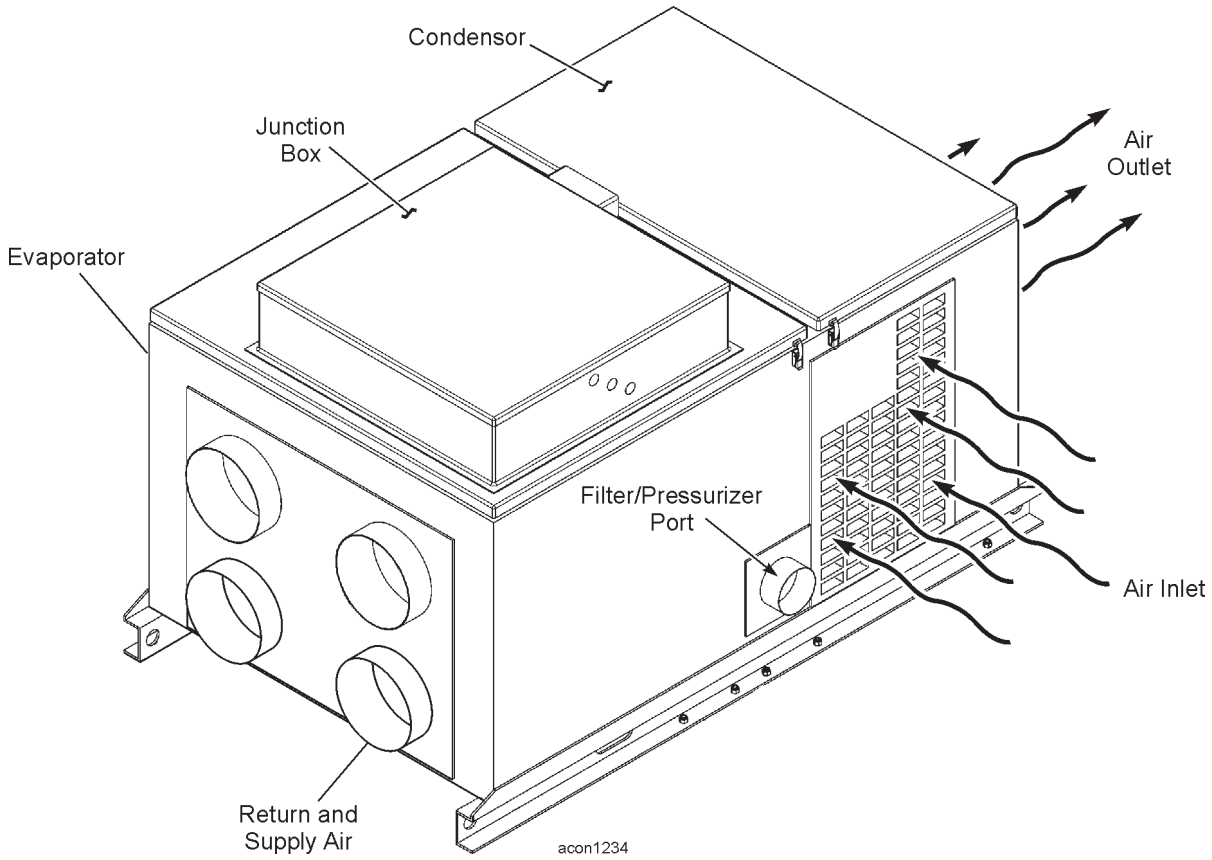
Air is drawn from beneath the unit, passes over the heat exchanger coil and the heating elements into a double-wheel fan where it is discharged through the base of the unit into the conditioned space below.

The refrigerant is metered by an externally mounted TX valve, and is cut off by a liquid line solenoid valve. The heat exchanger is large, constructed of heavy gauge tubing with a coarse fin pitch to reduce clogging. The fan motor is a large shaft, totally enclosed unit that is air cooled.

All pressure controls within the evaporator unit are fully sealed, preset and O-ring connected.

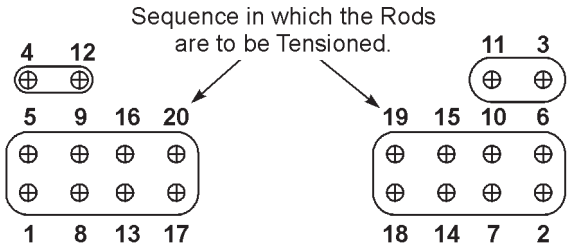
The compressor is a heavy duty, fully sealed scroll-type device. The unit is mounted in flexible mounts in an effort to reduce noise and vibration. All connections are either soldered, O-ring type or rotalok.

A large liquid drier is placed within the liquid line to filter moisture from the refrigerant. The condenser operates at a single speed only.



PROCEDURE FOR USE OF MECHANICAL TENSIONER ON CRAWLER RODS

NOTE: Steps 2 - 5 are to be done in the rod sequence pattern shown below.



crcr_346

NOTE:
LH Crawler shown
Rh Crawler opposire

1. Lubricate the threads and spin the tensioner onto the main thread until it seats against the washer (supplied with the torquenut).

2. Tighten 4 jackbolts at 90° apart as indicated in Sequence Fig. 1 on all studs with a partial torque (88 Ft-Lbs). This serves to seat the flange. If using an air impact, use a reduced setting or lightly pulse the trigger at the full setting.

3. At 100% target torque, (175 Ft-Lbs), tighten the same 4 jackbolts on all the studs.

4. At 100% target torque, (175 Ft-Lbs), tighten all the jackbolts in a circular pattern as shown in Sequence Fig. 2. Tighten jackbolts on all the studs.

5. Repeat Step 4 until all jackbolts are stabilized (less than 10° rotation). This usually requires 2-4 additional passes. If using air tools, switch to a torque wrench when socket rotation is small. Use the torque wrench to stabilize at the target torque (175 Ft-Lbs).

6. Repeat Step 5 for all studs after 20 hours of digging operation.

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.

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.

A complete penetration weld repair conditioned by grinding instead of adding reinforcement is favored to maintain the original pattern of stress flow designed into the structural members. Addition of reinforcement which is not part of the design can reduce fatigue strength because of the change in geometry from the original structure.

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 - .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.