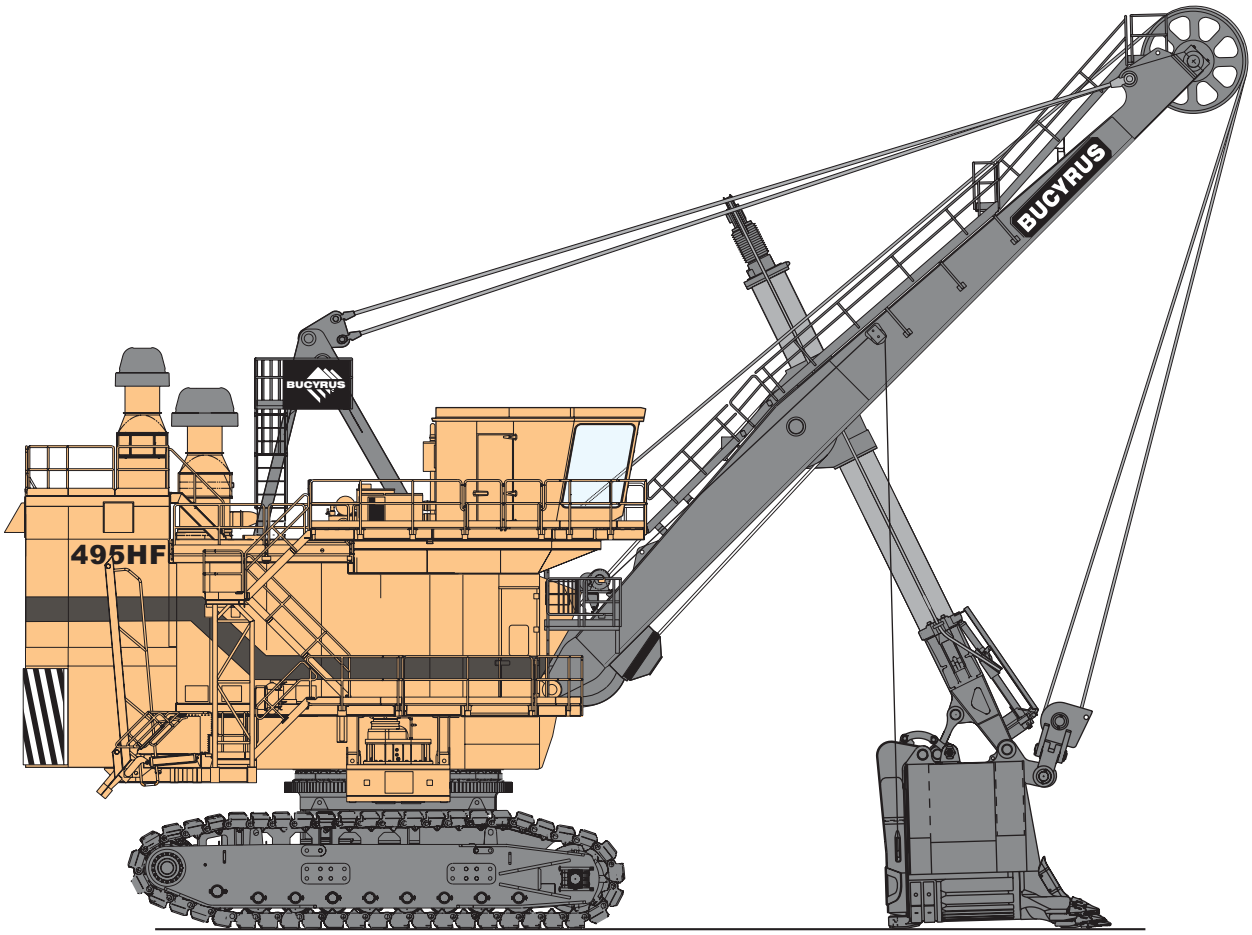
BUCYRUS®

495HF
MINING SHOVEL
MAINTENANCE and OPERATION MANUAL

SN: 141178
SN: 141179
SN: 141207

Manual No. *10373*



Bucyrus International, Inc.

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

SAFETY - SWINGING RESTRAINT & BALLAST BOX SUPPORT

BALLAST BOX SUPPORT

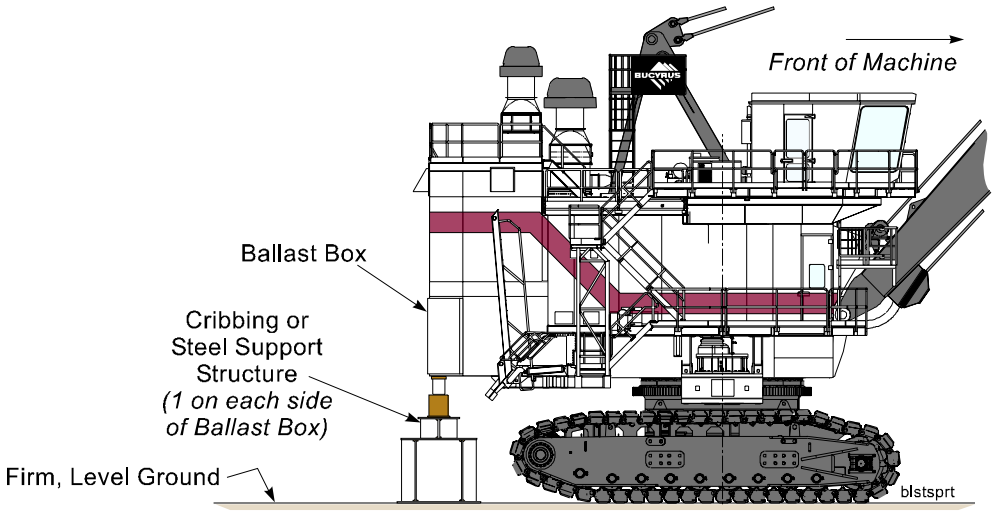
Before performing any maintenance on the mining shovel, it should be resting on a firm, level surface.

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

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

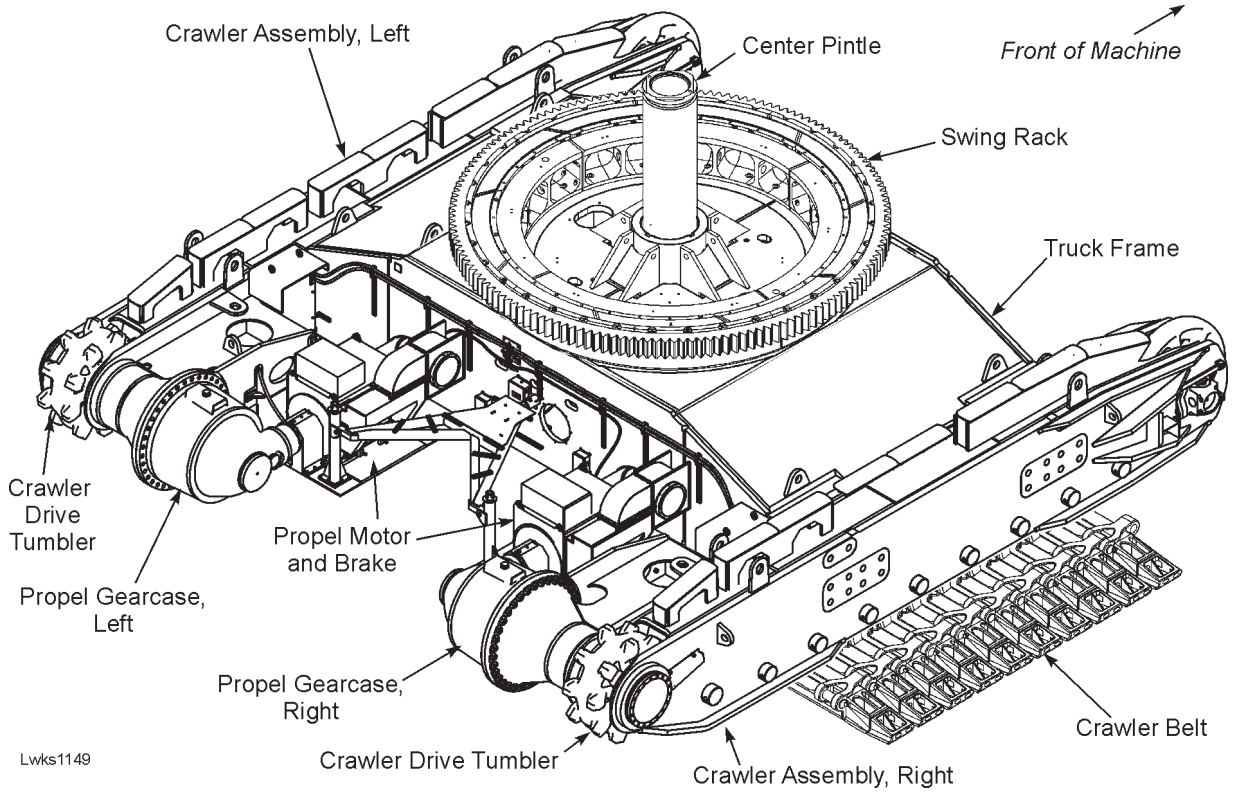
Boom removal or lowering will cause the center of gravity to shift toward the ballast box, decreasing machine stability. Stability is further dependent on the orientation of the upper works relative to the undercarriage. The machine may tip more easily over one of the four quadrants of the crawler mounting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

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



LOWER WORKS

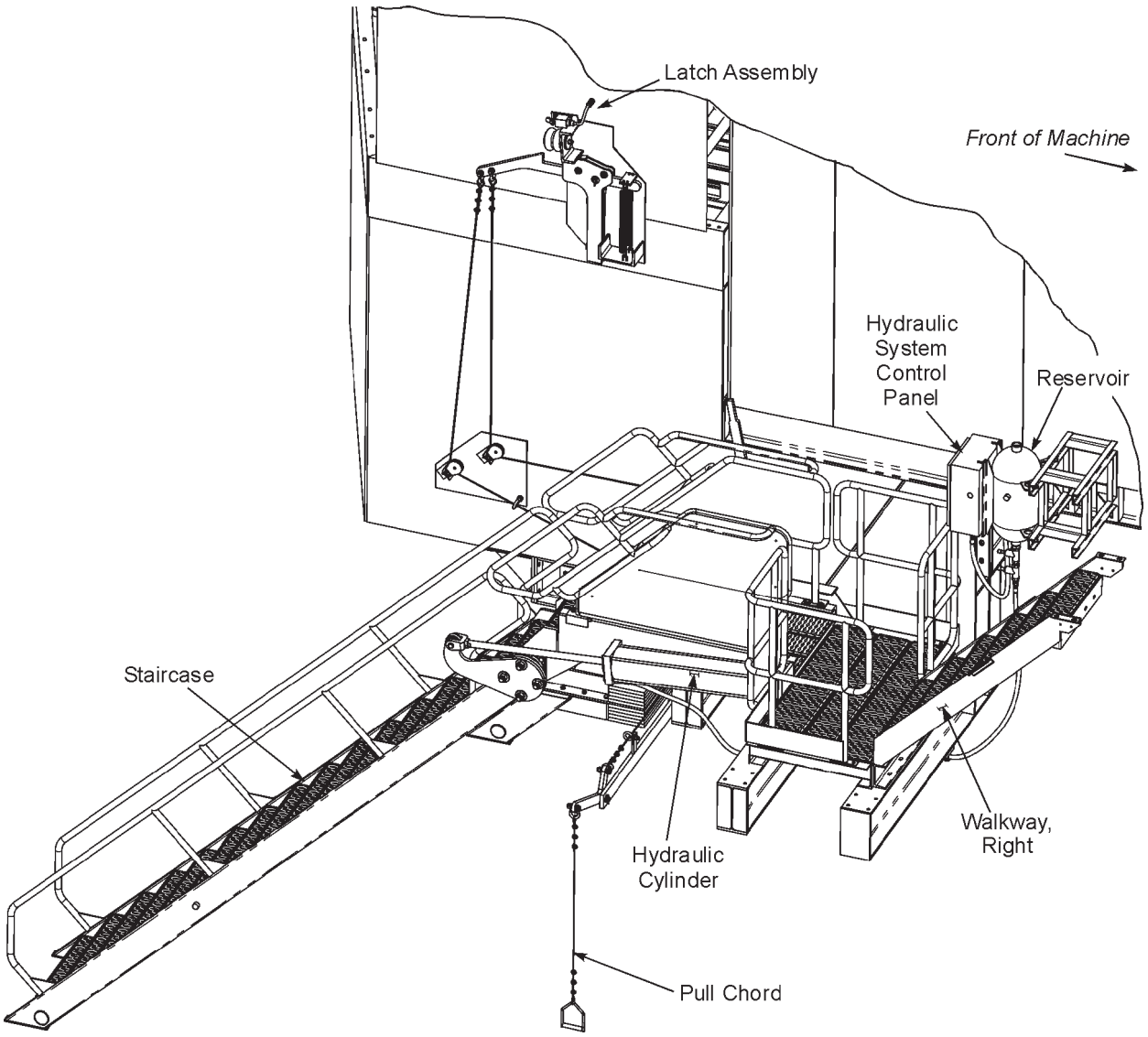
The lower works is comprised of the truck frame, right and left crawler frames, crawler belts, propel machinery, swing rack and roller circle.



Truck Frame and Crawlers

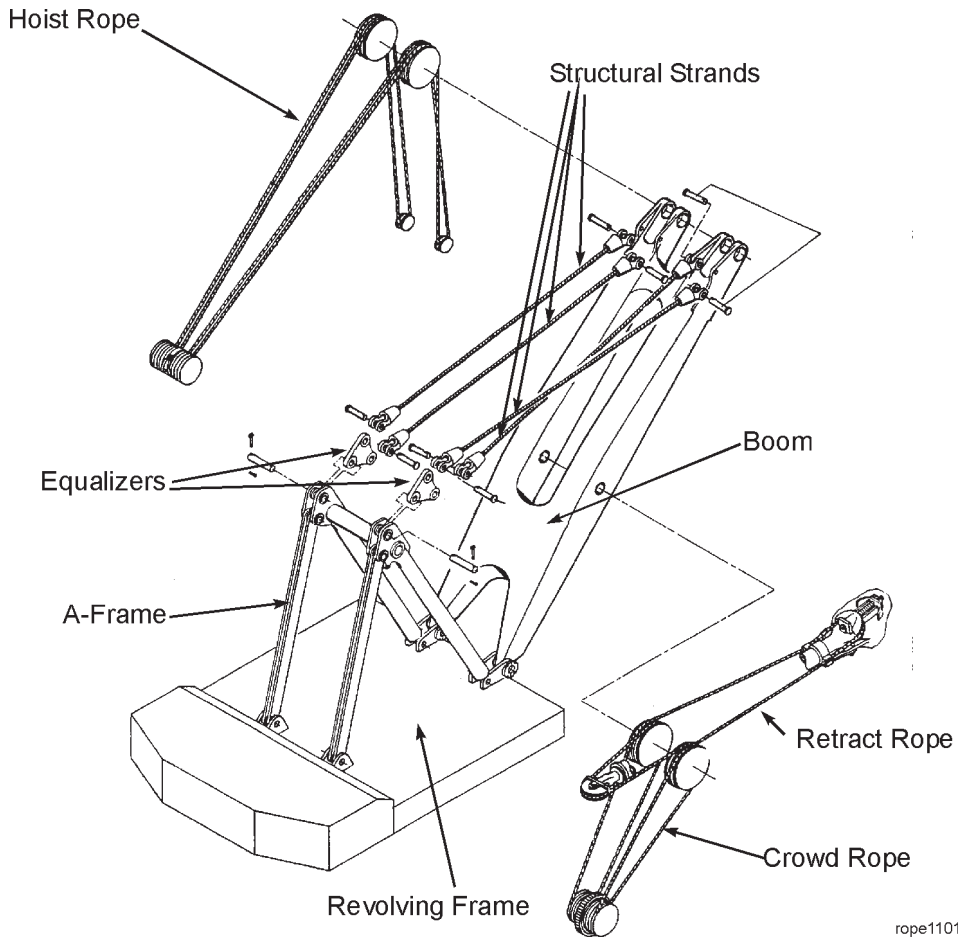
BOARDING STAIRS

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. These stairs must be in their raised and latched position to enable the operator's controls.



RUNNING ROPES

Hoist, crowd, retract and dipper trip ropes are all plastic impregnated for increased life and for sheave and drum grooving life enhancement. The double twin hoist ropes are attached to the center of the hoist drum using ferrule-becket anchoring for faster rope change out. Each rope passes over a boom point sheave through the padlock and back over the boom point sheave to the hoist drum. The dual twin hoist rope configuration stabilizes the dipper while digging by attachment to the outer edges of the dipper body.



Ropes - General Arrangement

Crowd and retract ropes are attached to the crowd drum and work as an integral system. As the crowd rope is wound on to the drum, the retract rope is reeled off.

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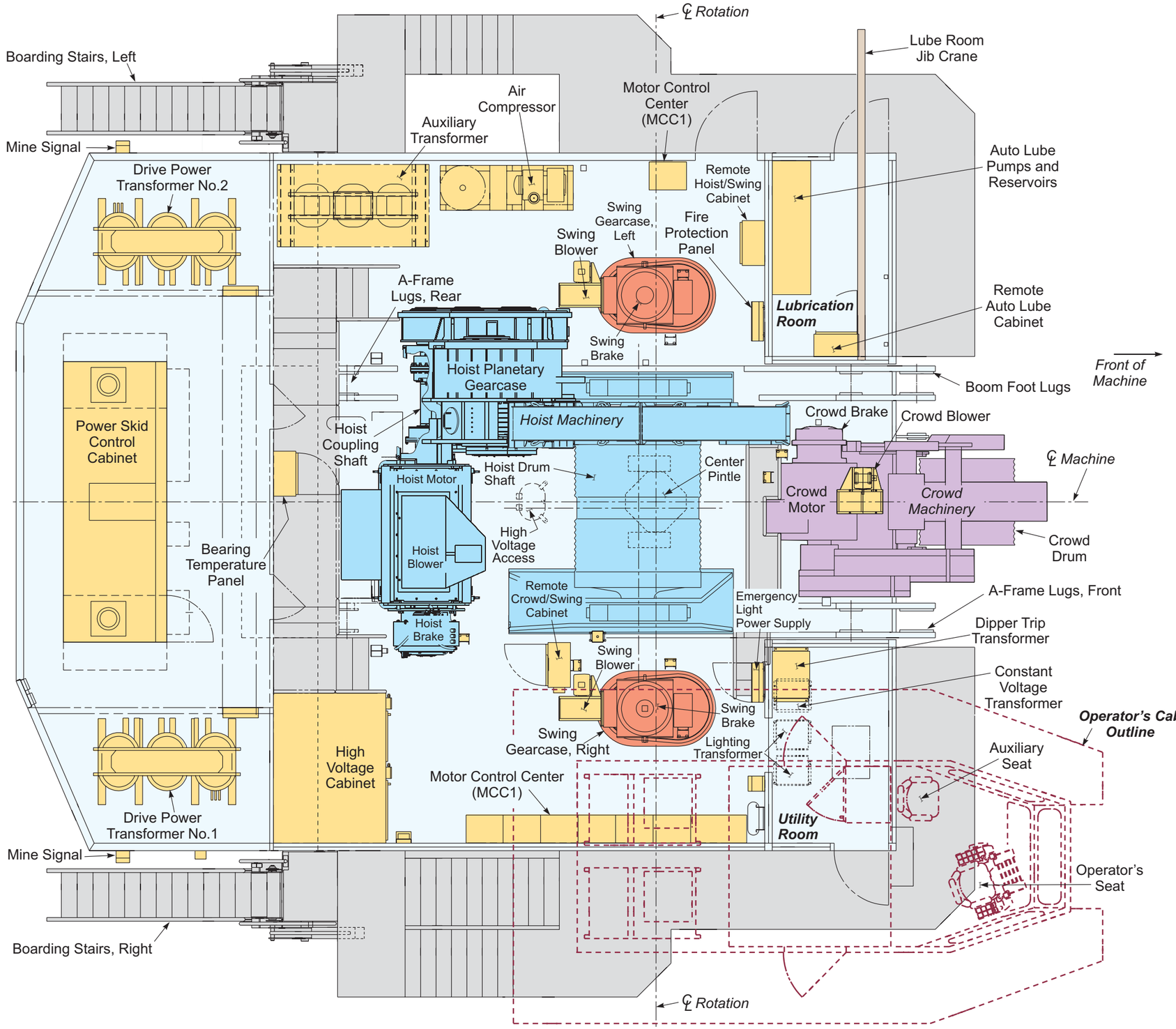


BUCYRUS®

495HF Deck Plan

LOT 63, SN: 141178
LOT 64, SN: 141179
LOT 69, SN: 141207

141178_d.cdr

START PUSHBUTTON

A pushbutton that, when pressed, will power up the drive system. The system ready light will go out.

PLC POWER ON

A green light that indicates the status of the PLC.

DRIVE CABINET TEMPERATURE

A green light that indicates temperature in the drive cabinet is neither too low nor too high.

INCOMPLETE SEQUENCE

A red light that indicates an incomplete sequence of startup events.

SYSTEM READY

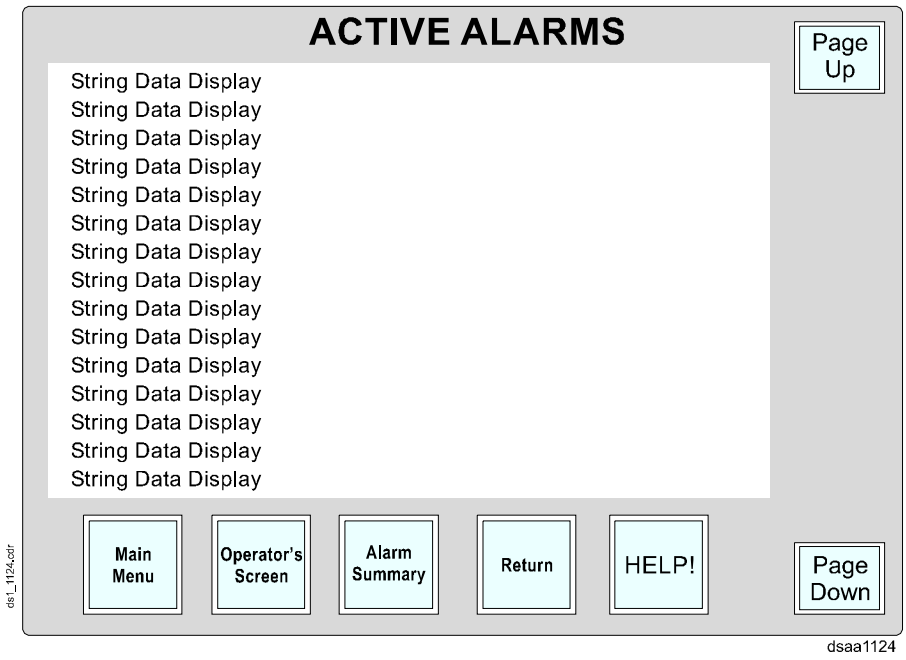
A green light that indicates that the drive system is ready to start, but not yet started.

PHASE SEQUENCE

A green light that indicates that the phase sequence is okay in the incoming power.

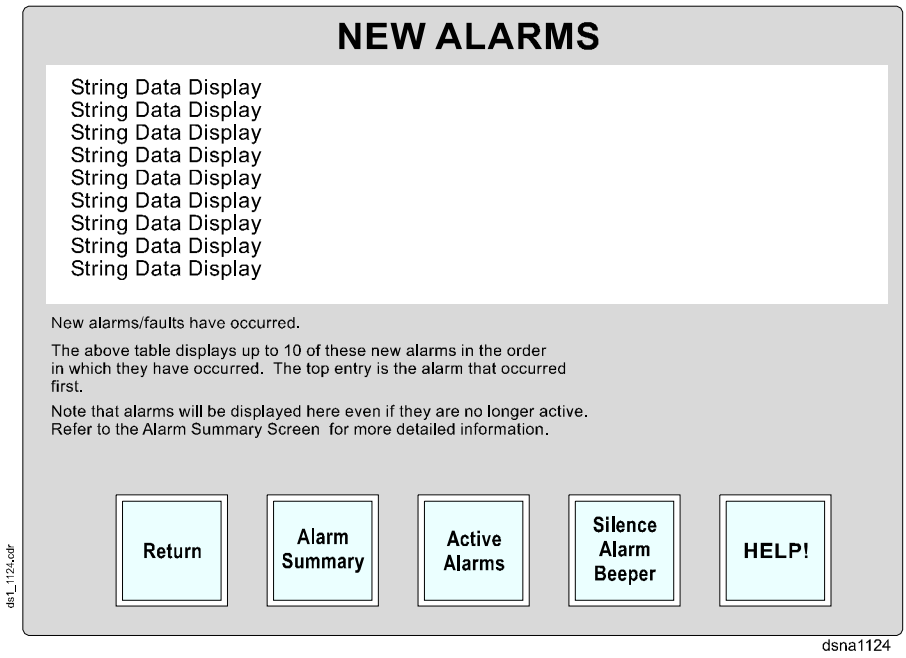
AUXILIARY GROUND FAULT

A green light that when lit, indicates that no auxiliary power ground fault exists. If the light is off, alert an electrician as soon as possible.



Active Alarm

The Active Alarm screen will provide a list of all active alarms and faults that have been initiated on the machine and have not been RESET. Once an alarm or fault has been sensed, these messages will remain visible and WILL NOT be removed from this screen until it is RESET.

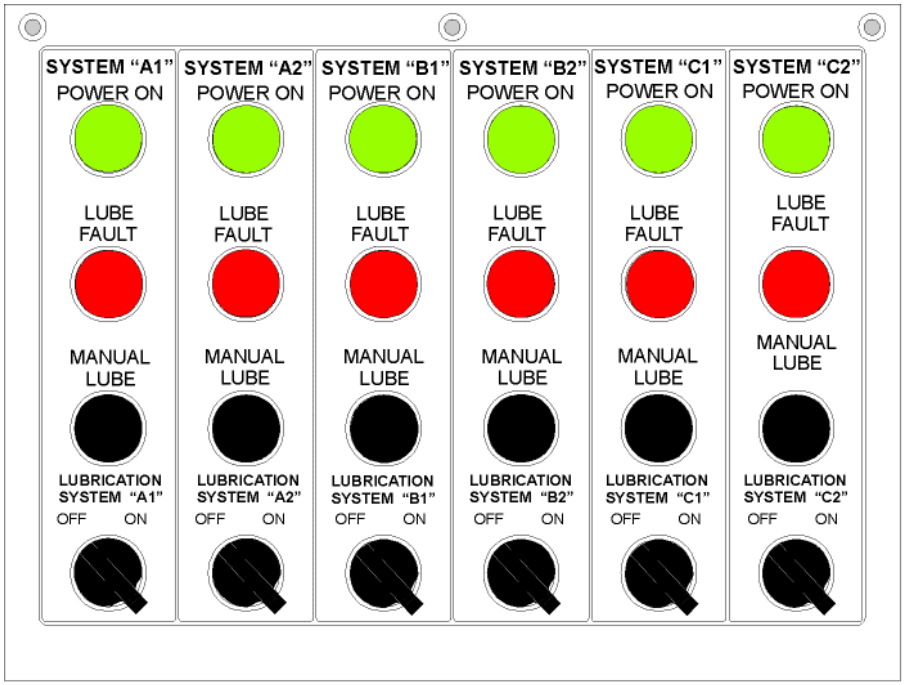


New Alarm

The New Alarm screen appears automatically any time a machine sensor detects a newly occurring fault or warning message. This screen has the ability to list up to 10 of the new fault messages that

LUBRICATION CONTROL PANEL

The top row on this panel consists of a group of indicating lights. A red light indicating that the system has a fault and a green light indicating that power for the system is provided for each independent lubricating system (A, B & C). Isolating switches are used to provide power to each system and a means of isolating each system from electrical power. They are also used to reset lubrication faults. These switches are normally on. Manual lube buttons are also provided.



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FIRE SUPPRESSION SYSTEM

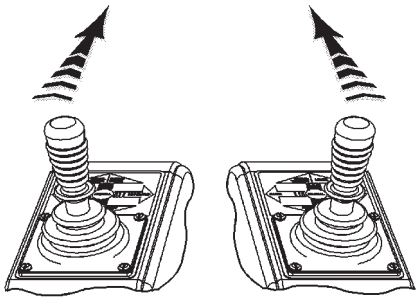
Fires on surface mining equipment typically involve faults in electrical equipment, or the combustion of flammable fluids. The time between the onset of the fire and its detection is critical. Early detection and suppression of a fire minimizes hazards to personnel, equipment damage, downtime and loss of production. The optional fire suppression system on this machine is supplied and installed by an outside source. Please refer to the system's manufacturer for maintenance and parts information.

PROPEL MOTION

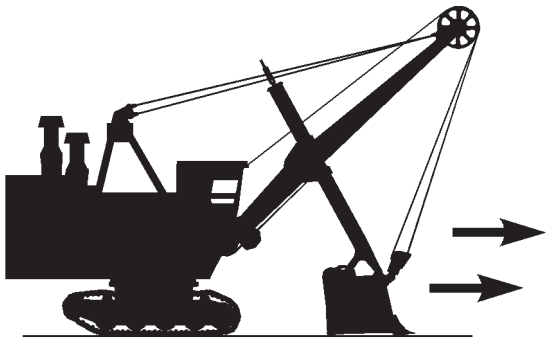
Propel motion is controlled by placing the propel transfer switch in the propel mode and actuating the hoist master switch control and/or crowd master switch control. To propel in a straight forward direction, push forward on both the hoist and crowd master switches at the same time. The speed is increased as the levers are displaced farther from neutral. To propel straight in reverse, pull equally both joysticks to the rear.

NOTE: The control stop pushbutton must be pressed before the propel transfer switch can be activated.

DANGER: THE HOIST BRAKE MUST BE SET WHENEVER IN THE PROPEL MODE.



To ***PROPEL*** the machine ***FORWARD***:
Push *Both* Joysticks equally Forward,
away from the Operator.



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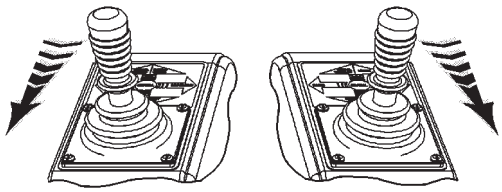
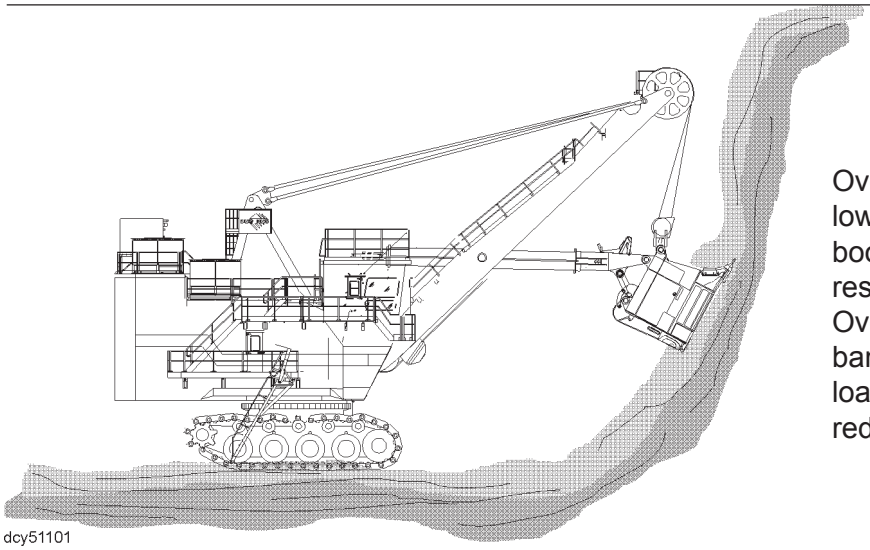
To ***PROPEL*** the machine ***BACK***:
Pull *Both* Joysticks equally Back,
toward the Operator.



Propel - Straight Forward/Reverse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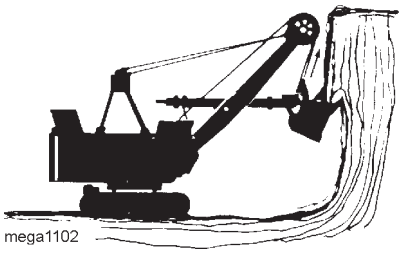
Overcrowding with the dipper lowered can result in lifting the boom. This jacking action can result in damaged components. Overcrowding the dipper in the bank slows up the dipper loading process, thereby reducing machine efficiency.

Dig with the Dipper Beneath the Boom Point

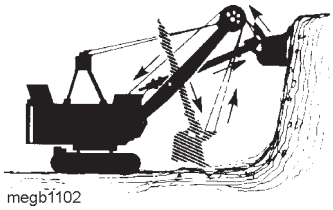
ENGAGING THE BANK

To make maximum use of the hoist rope pull, the dipper rise should be as close to vertical as possible. The dipper should enter the bank approximately under and behind the boom point. The actual cut should start a few degrees behind an imaginary vertical line from the front of the boom point sheaves. Proper bank engagement results in maximum hoisting force in line with the cut. When the dipper is too far forward, bank penetration will be minimal, and the hoist and crowd forces will oppose each other rather than working together.


mega1102

Make Effective Use of the Hoist Effort

An excavator dipper capacity rating is the struck measure cubic yard capacity. When digging, a load greater or less than the rated capacity may be obtained, depending on the type of material. An efficient operation can be measured by the number of dipper loads required to load a haulage unit. When the dipper capacity is efficiently sized to the truck capacity, not less than three or more than five dippers full should be required to load a unit. Other factors such as improper sizing of haulage units to dipper, improper material fragmentation, etc. also must be considered.


megb1102

Hoist Force Opposes Crowd Force

GREASING MAIN A.C. DRIVE MOTORS

Main drive motors are shipped from the factory with the bearings packed with grease. A lubrication information plate is mounted on each motor with greasing instructions and the correct quantity or grease to be added. Main drive motors for Bucyrus International machines have their inlet tube filled with greased and include nameplates attached to the motor indicating “grease inlet” and “grease drain”.

An improper greasing procedure will cause premature bearing failure. Mixing of non-compatible lubricants will result in lubricant breakdown and bearing failure. Proper lubrication is important for all aspects of bearing life.

NOTE: This information covers main drive motors manufactured by Siemens, Norwood, Ohio. It does not apply to NMA style motors manufactured by Siemens Germany.

1. TYPE OF GREASE

NOTE: Motors are shipped with Mobil SHC 100 NLGI #2 grease installed in the bearings. This grease has a lithium complex soap thickener and a synthetic base fluid having a base oil viscosity of 40 cSt @ 40°C.

Caution: Do not mix greases with different thickeners since the greases may not mix properly and bearing failure may result.

2. INITIAL COMMISSIONING

Prior to initial start-up, the bearings should be greased. The normal maintenance regreasing procedure, item 3, should be used except the quantities should be doubled.

3. MAINTENANCE

This procedure should be used for regular maintenance regreasing. Refer to the following table, item 4, and/or lubrication information plate on each motor for regreasing intervals and type and quantity of grease to be used.

a. Stop the motor and lockout the starter.

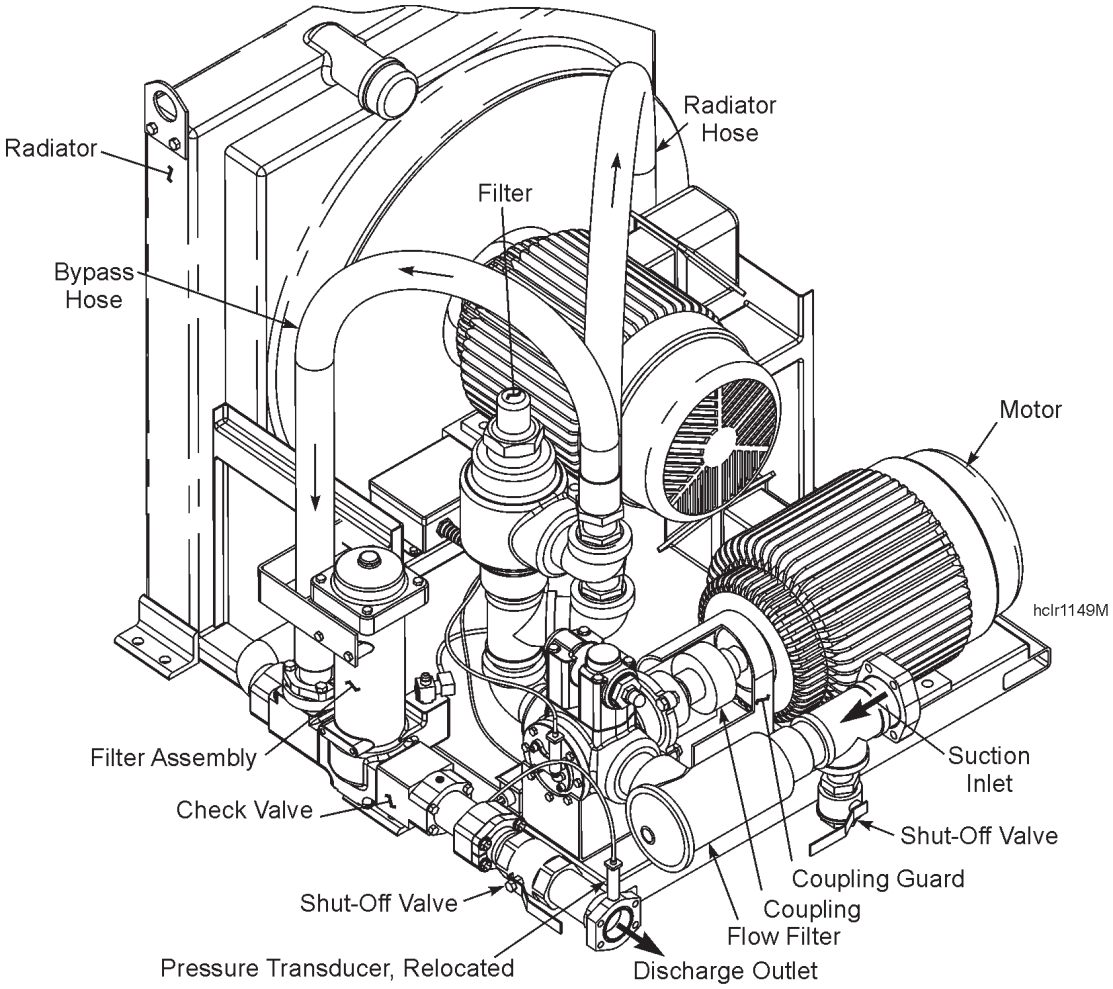
b. Remove and thoroughly clean the grease inlet fitting or plug.

c. Remove the drain plug and clean out any hardened grease.

d. Determine the correct amount of grease required for the bearings.

HOIST OIL COOLER

The Hoist Gearcase temperature is maintained by recirculating lubricating oil through a gearcase oil cooler.



The Gearcase Cooler is located beneath the revolving frame, on the left side of the machine, just behind the hoist machinery. It is supported by a set of beams bolted to the bottom of the revolving frame. *Should the cooler assembly require removal or replacement:*

1. Drain any fluid from the cooler, oil pump and lines between the cooler and the hoist gearcase.
2. Shut off the valves and disconnect the fluid lines at the oil pump and at the oil filter.
3. Support the cooler and support beam assembly with a jack(s) beneath the base of the cooler.

DANGER: DO NOT PROCEED UNTIL THE COOLER AND SUPPORT ASSEMBLY IS FULLY SUPPORTED. The weight of the cooler assembly and support beams is approx. 800 Lbs.

LINCOLN TYPE SL-V LUBRICANT INJECTORS

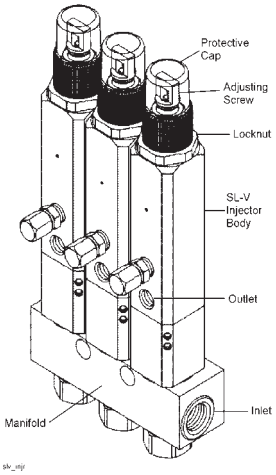
These pressure-operating, spring-reset, series-installed injectors are supplied in banks mounted on manifolds or individually. Each injector expels a maximum of .08 cu. inch of lubricant from its outlet port each cycle. Dual outlet ports on each injector permit the injectors to be piped in series for increased lube supply to a common point. The quantity of lube to each point on this machine has been carefully designed by our engineers for proper coverage. Each injector output can be adjusted; however Bucyrus recommends that injectors initially be set and used at their maximum setting.

NOTE:	MAXIMUM Operating Pressure:	*6,000*	PSI
	RECOMMENDED Operating Pressure:	*2,500*	PSI
	MINIMUM Operating Pressure:	*1,850*	PSI
	MAXIMUM Recharge Pressure:	*600*	PSI

CAUTION: **STORED ENERGY! Contact with or ingestion of petroleum products can be harmful. Automatic lubrication systems operate under pressure. Before opening any lube supply line, relieve the system and that line in particular, of any residual pressure.**

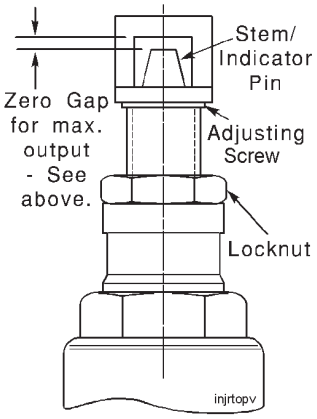
To set an injector for *maximum output:*

1. Loosen locknut.
2. Turn adjusting screw until there is a small gap at the top of the stem.
3. Orient the adjusting screw so that the opening is toward the front of the injector.
4. Tighten the locknut.



To reduce an injector's output:

1. Loosen locknut.
2. Turn adjusting screw clockwise (CW) until desired discharge rate is obtained. This forces the stem into the body, retarding the stem's movement.
3. Set the locknut.



CAUTION: **Do not turn adjusting screw down (clockwise) more than 5 full turns from the maximum discharge setting. Check output flow from injector at this time to ensure it is still operating. If not, back off adjusting screw until injector does consistently operate. Inspect the adjusted injector for operation over 3 or 4 cycles after returning machine to work to make sure it is functioning.**

SPECIFICATION FOR

ENCLOSED GEARCASE LUBRICANT

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

(September 1, 2005)

Table 1

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-α-olefin) Oil
Less than 14°F to 120°F (Less than -10°C to 50°C)	ISO VG 320 / Synthetic (poly-α-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.

Step #2

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

APPROVED LUBRICANTS:

Lubricants that have been approved for use by the Gearcase manufacturers are listed in the Approved Lubricant Tables 2 & 3. The use of non-approved 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/regulatory requirements.

Bucyrus International, Inc.

CERTIFIED LUBRICANTS LISTING

(May 15, 2006)

Haycock Petroleum	Calcuplex M5 NLGI #1
Haycock Petroleum	Calcuplex M5 NLGI #2
Lubrication Engineers	Almagard Vari-Purpose 3750
Lubrication Engineers	Almagard Vari-Purpose 3751
Lubrication Engineers	Almaplex Ultra-Synthetic 1299
Lubritene	Lubrene Li 500 EP 2
Lubritene	Lubrene LiM 500 EP 2
Lubritene	Lubrene AXM 1000 EP 1
Lubritene	Lubrene AXM 1000 EP 2
Lubritene	Lubrene AXM 500 EP 1
Lubritene	Lubrene AXM 500 EP 2
Lubritene	Lubrene LXCa 700 EP 2
Lubritene	Lubrene Li 900 WP EP 2
Lubritene	Lubrene EMV-2
Petro-Canada	Supreme Arctic
Petro-Canada	Supreme EP1
Petro-Canada	Supreme EP2
Petro-Canada	Precision XL 3 Moly EP1
Petro-Canada	Precision XL 3 Moly EP2
Petro-Canada	Precision XL 5 Moly EP0
Schaeffer Mfg.	Moly Ultra 800 EP #1 (#221)
Schaeffer Mfg.	Moly Ultra Red EP #1 (#229)
Schaeffer Mfg.	Moly Supreme #1 (#238)
Schaeffer Mfg.	Moly EP Synthetic Blend #1 (#274)
Shell	Albida Grease HDX2
Shell	Albida Grease MDX 1
Shell	Albida Grease MDX 2
Shell	Alvania Grease SDX2
Shell	Albida SLC 460
Shell	Limona LX1
Shell	Limona LX2
Shell	Albida HLS00
Shell	Albida HLS2
Whitmore Mfg. Co.	Omnilith 500 Extreme Pressure Grease EP 0
Whitmore Mfg. Co.	Omnilith 500 Extreme Pressure Grease EP 1
Whitmore Mfg. Co.	Omnilith 500 Extreme Pressure Grease EP 2
Whitmore Mfg. Co.	Omnilith 500 M Extreme Pressure Grease EP 0
Whitmore Mfg. Co.	Omnilith 500 M Extreme Pressure Grease EP 1
Whitmore Mfg. Co.	Omnilith 500 M Extreme Pressure Grease EP 2

DAILY Check Points *(cont.)*

6. Dipper Trip - Inspect the dipper trip mechanism, rope, latch bar and associated hardware for damage, adjustment and wear.

7. Dipper Door - Inspect the door structure, hardware and bumpers (if included) for damage and excessive wear.

8. Dipper Handle - Inspect the crowd and retract rope attachment points, take-up cylinders and spacers and dipper handle for damage, excessive wear and evidence of adequate lubrication.

9. Boom Bumpers - Inspect for security and damage.

10. Dipper - Inspect the dipper structure for cracks and deformations. Check the tooth adapters for security and excessive wear.

11. Padlocks - Inspect for damage, wear and evidence of adequate lubrication.

12. Ropes - Check both the running ropes and the boom structural strands for broken strands, loose sockets or any additional visual indications that would indicate a loss of structural integrity.

13. Gearcases - Visually inspect the swing, crowd and hoist gearcases for oil levels and leaks. Repair or service as required.

14. Gearcase Machinery - Visually inspect all machinery for loose bolts, nuts, clamps or unusual conditions. Repair as required.

Electric Mining Shovel

Preventive Maintenance

ITEM #	NOTED DISCREPANCY

pmc_1136

Date: _____

Shift: _____

Inspected By: _____

Supervisor: _____

QUARTERLY Check Points *(cont.)*

10. Warning/Safety Placards - Replace all missing safety and warning signs.

11. Left Hoist Drum Spider - Inspect the spider for cracks, the fit to the drum and bolt tension.

12. Hoist Drum Assembly Bearings - Inspect the bearings, retainers and seals for damage and correct as needed.

13. Hoist Motor Coupling - Inspect the coupling, replace as required.

14. Hoist Motor - Inspect the mounting bolts for security, the blower duct work for damage and security.

15. Hoist Brake Air System - Check the operation of the solenoid valve, release and set operations, hoses, fittings and quick release valve.

16. Crowd Machinery Frame - Inspect for loose bolts or chock blocks, worn mount pins and cracks. Repair as required.

17. Crowd Drum Bearing Journals - Inspect the retainer, bearing retainer bolts, seals and condition of bearings.

    Bearing Cap Mounting Bolts - Check for tightness.

18. Crowd 1st Gear Reduction - Inspect the gear and pinion teeth for the proper wear pattern, excessive wear and alignment. Correct as required.

Electric Mining Shovel

Preventive Maintenance

ITEM #	NOTED DISCREPANCY

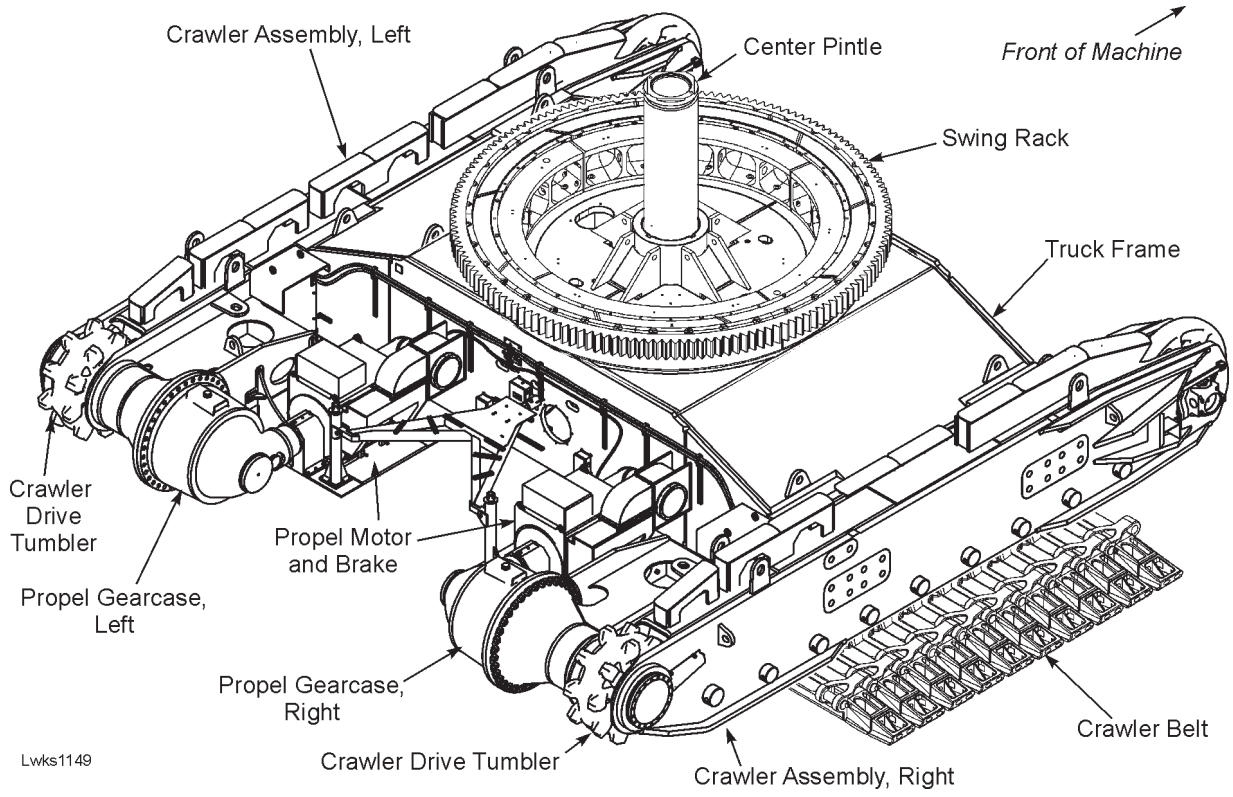
pmc_1136

Date: _____

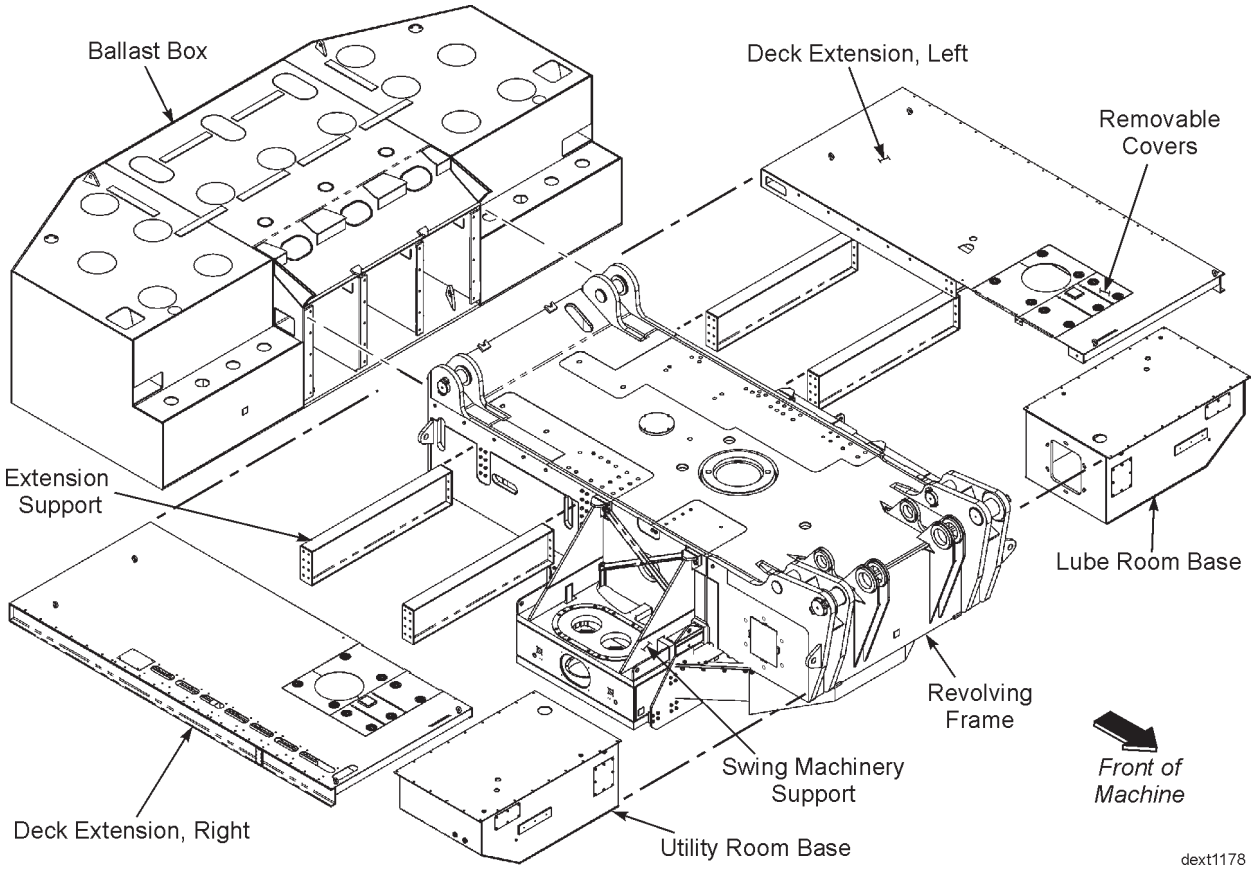
Shift: _____

Inspected By: _____

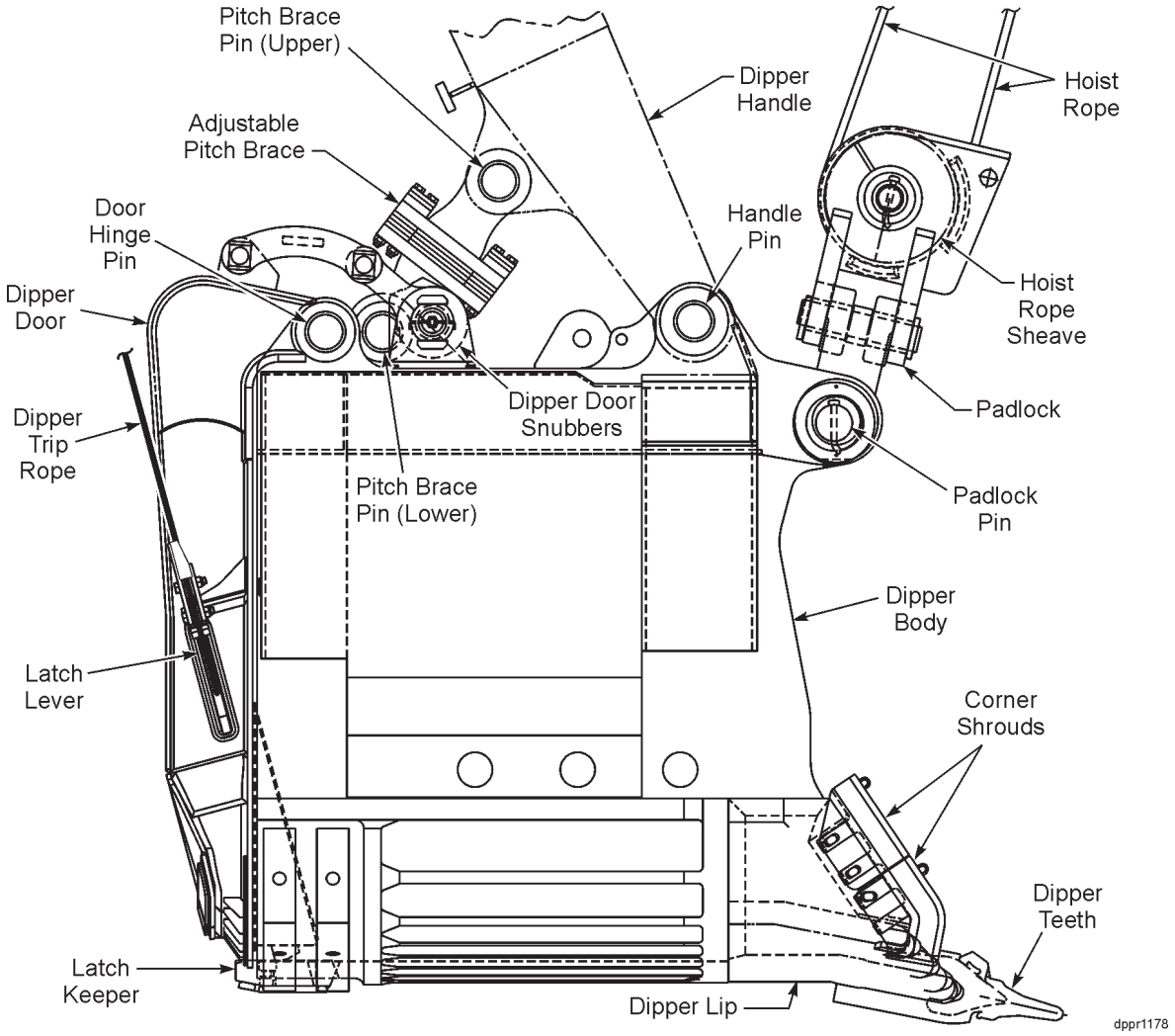
Supervisor: _____



Lower Works and Crawlers



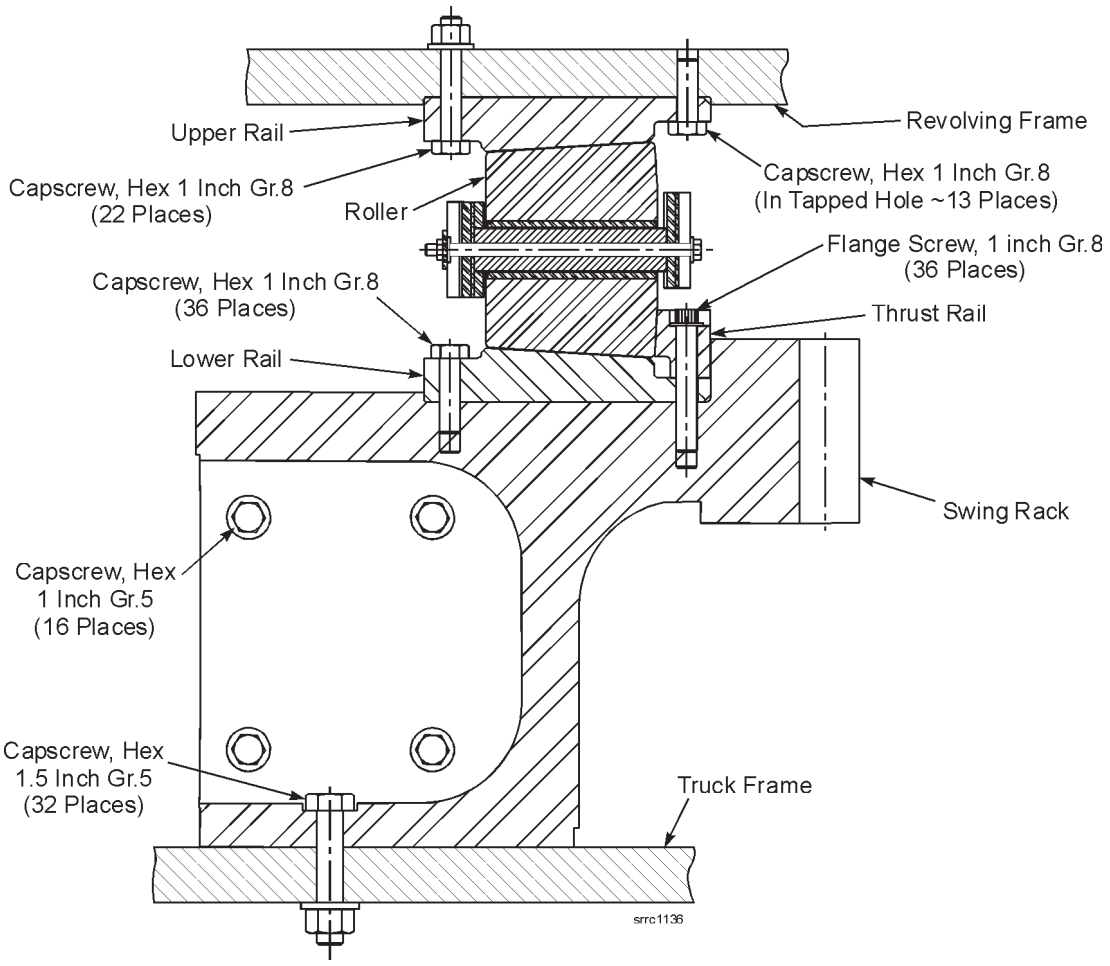
Revolving Frame Deck Extensions



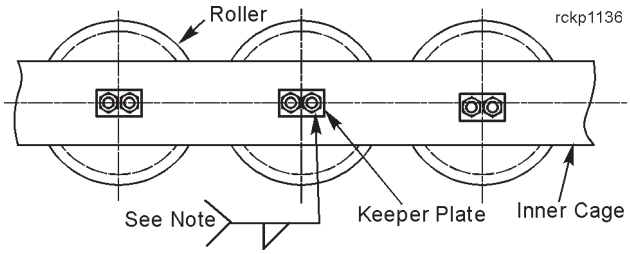
Dipper Assembly

ROLLER CIRCLE ASSEMBLY

The roller circle assembly is a tapered roller thrust bearing which supports the revolving frame assembly. It is composed of 50 tapered rollers which are held in position by a steel cage. The cage is divided into eight (8) subassemblies - 7 sections contain 6 rollers each and 1 section contains 8 rollers. The rollers are supported with a steel spacer and a self-lubricating nylatron bushing.



Swing Rack and Roller Circle Section View



Inspect the roller lube coverage daily. Only a light coat of OGL is required on the roller face and thrust rail. Check the roller and rail bolts monthly (420 hours), replace broken bolts and re-tighten all loose screws. Keep the lube drains open. Inspect the rollers and inside of the thrust rail for spalling. If this condition is found, check for proper ballast and roller alignment.

6. Align the other end of the shoe to the existing shoe to close the belt. Install the pins and locking hardware in 2 places to secure the shoe. Tighten the capscrews retaining all 4 pins removed to 1045 Ft.Lbs.

7. Remove the blocking and adjust the belt tension.

CRAWLER BELT REPLACEMENT

1. Park the machine in a level work area. Assemble the new belt forward of the machine, in line with the one to be replaced.

2. Add blocking between the top of the crawler frame and the shoes to remove any slack in the belt.

3. Remove any belt tension. To separate the belt, at the lowest point forward of the front idler, remove the locking hardware and pin from 2 places on the shoe.

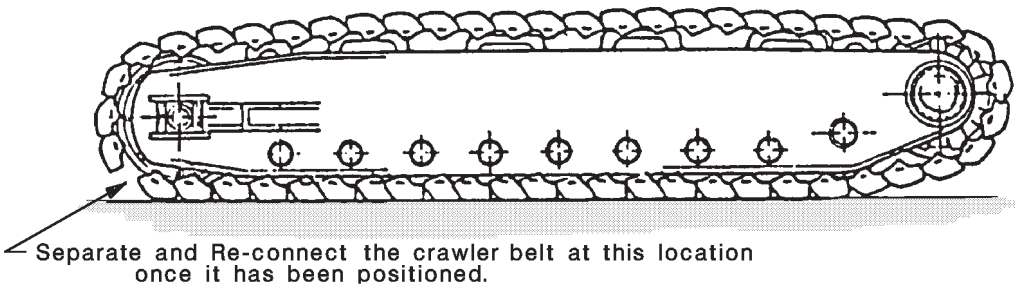
4. Connect the new belt to the front shoe under the front idler roller at the separation of the old belt. Install both pins and their locking hardware and tighten the capscrews to 1045 Ft.Lbs.

5. Attach a wire rope to the upper portion of the old belt at the separation point, then to a truck or dozer.

6. Pull on the top portion of the old belt to maintain engagement with the shoe lugs on the drive tumbler and *SLOWLY* propel the machine forward until the new belt has replaced the old on the crawler. Park the machine.

7. Disconnect the old belt from the new and remove it from the work area. Pin the new belt together at the front idler.

8. Adjust the belt tension.



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2. Propel the machine forward to a position where the roller to be removed is directly over the hole. Separate the belt by removing the lock bolts. Lower each end of the belt into the pit exposing the roller for removal.

3. Disconnect the auto lube line from the end of the roller shaft. Plug the line to prevent dirt entry.

4. Remove the shaft retaining bolt.

5. Drive or pull the shaft out of the crawler frame, being careful to support the roller on a handling fixture, jack or cribbing. Remove the thrust washers as they come free.

The same procedure can also be used to remove the rear idler roller.

To install or replace a load or rear idler roller:

1. Position the replacement roller in the pit on some cribbing, a handling fixture or jack.

2. Start shaft through the outside crawler side frame member. When the shaft begins to exit the other side, install the thrust plate.

3. Raise the roller or idler into position and continue to drive the shaft through the roller or idler.

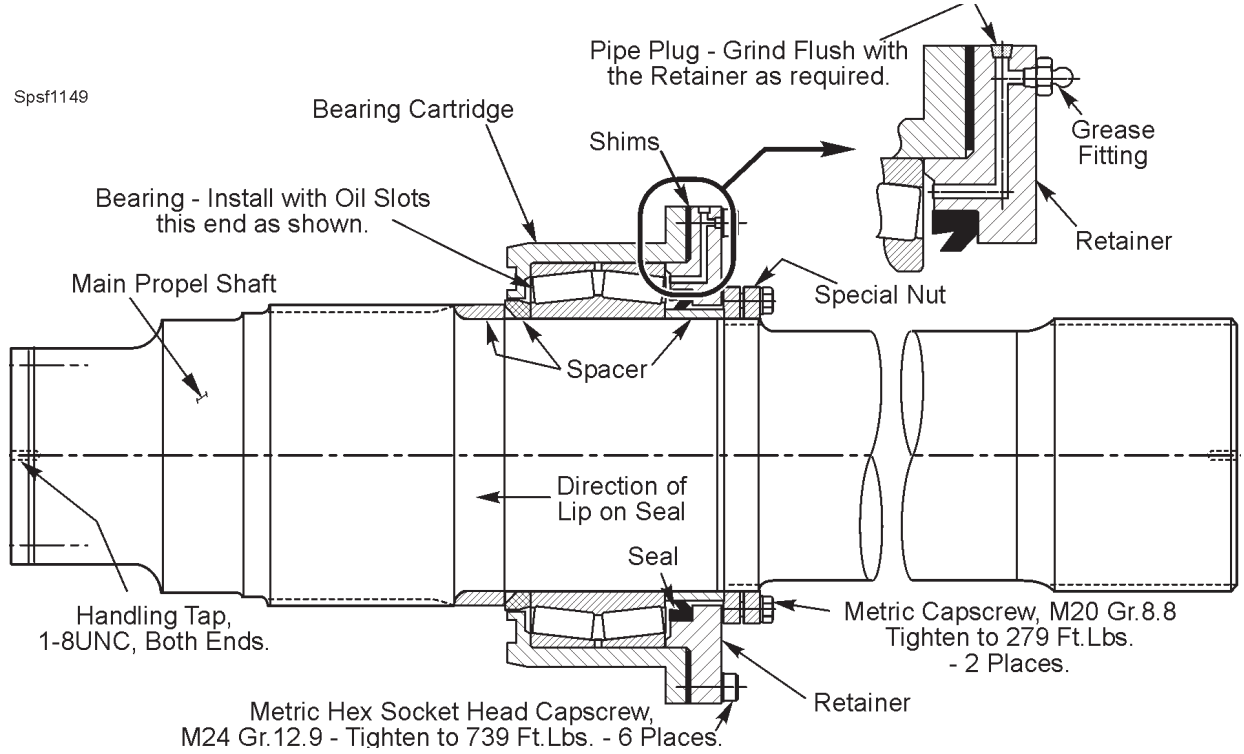
4. As the shaft exits the roller, install the other thrust plate.

5. Continue to drive the shaft through the crawler frame until the bolt retainer aligns with the hole in the collar.

NOTE: Install the load or idler roller shafts with their lubrication hole toward the front of the machine. The punch mark on the end of the shaft indicates the lube hole location.

6. Install the lock bolt.

7. Install and purge the automatic lube lines. Check the lube system operation and reinstall the guards.



Main Propel Shaft ~ Section View

NOTES:

1. If the bearing is heated for assembly purposes, do not exceed 300°F (149°C).

2. After installing the bearing and bearing cartridge, pack the bearing with MPG (P/N 380900-5).

3. Shim Procedure:

   a. Install the retainer and tighten the capscrews to 179 Ft.Lbs. for gap measurement.

   b. Measure the gap at 3 places equi-distant from each other around the O.D. of the retainer.

   c. Take the average of the 3 measurements and subtract .001-.004 inch to obtain the shim thickness.

   d. Install the shims and tighten the capscrews to 739 Ft.Lbs. If the shims are 2-piece, install them with the split as close as possible to the lube hole and seal the split with RTV.

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 Section 7 ~ *ENGINEERING DATA*, 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. Again, refer to Section 6 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 Section 6 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

6. Install the 4 motor mounting capscrews and related hardware.

7. Re-check the alignment. Reposition the shear blocks under the motor if required. Refer to shear block installation in Section 7 of this manual.

8. Install all guards, air lines & wiring.

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

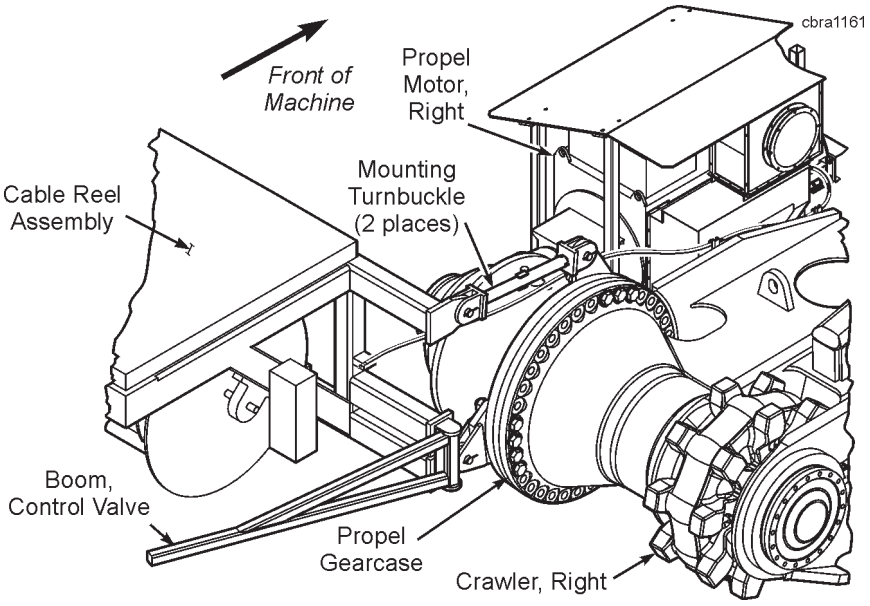
CABLE REEL

DANGER: HIGH VOLTAGE! WHEN ACCESSING THE CABLE REEL, THE TRAIL CABLE MUST BE DISCONNECTED FROM ITS POWER SOURCE. The trail cable carries high voltage which can cause serious or fatal injury.

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.

NOTE: The cable reel described here is an *INDUSTRIAL WELDER & MACHINISTS, INC.* cable reel. If the reel currently on the machine is from a different manufacturer, do not use the information given here, but refer to the manuals from that particular manufacturer.

The cable reel is used to store excessive lengths of trail cable, and also to retrieve and pay out cable as needed during machine propel. The cable reel should be checked daily to assure that it is working properly and that the trail cable is being spooled on and off the reel correctly.



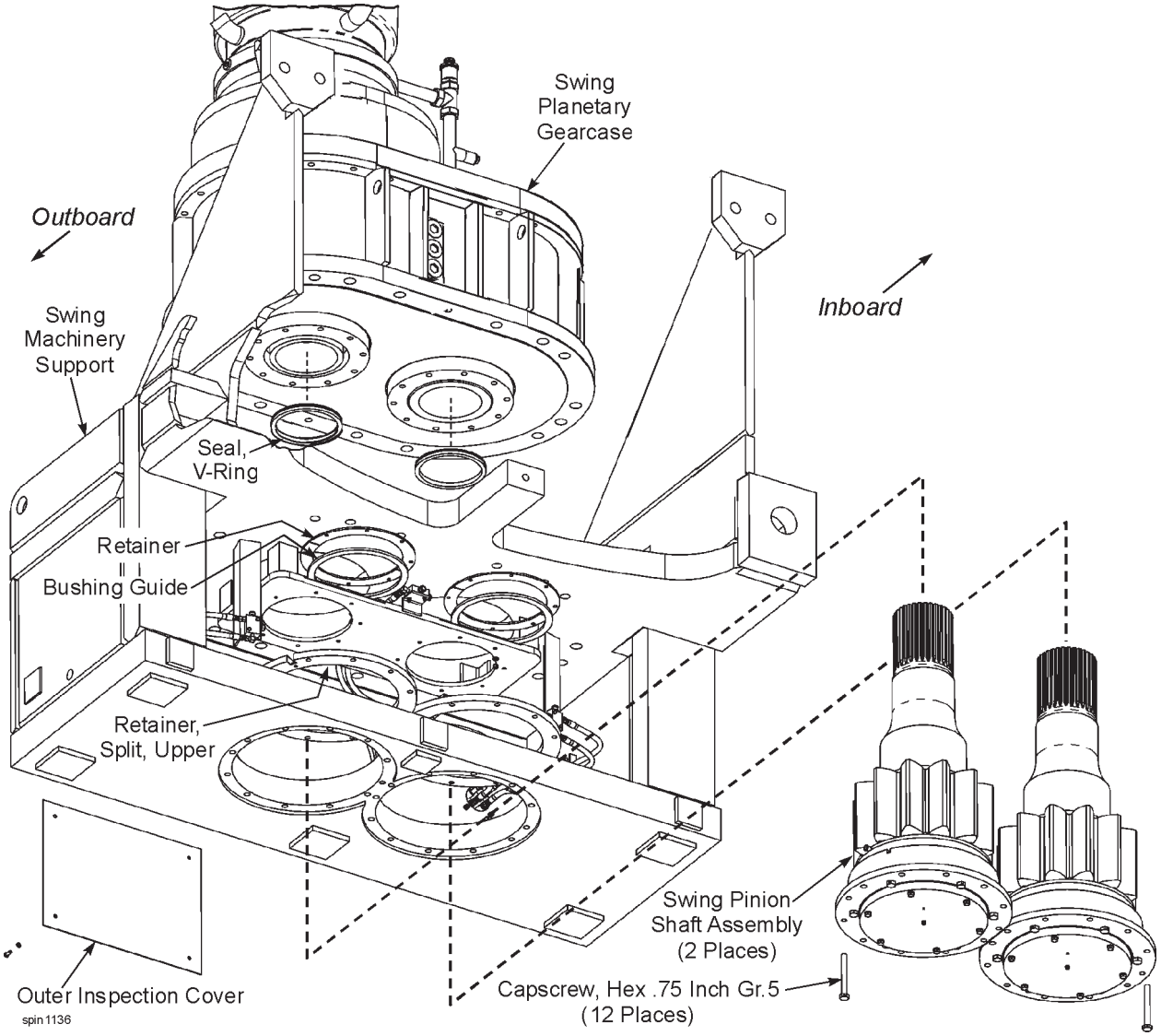
Check for the following:

- The level wind mechanism works freely.
- All drive chains are properly tensioned and well lubricated.
- The control valve lever works freely.
- The hydraulic reservoir for the proper level of fluid. Add fluid if required. Check the hydraulic lines for leaking.
- All structural components for cracking.

This cable reel is designed to operate under a variety of conditions to suit the individual requirements that are required in each application. During initial operation some adjustments will be necessary to determine what line pull and speed are best suited for the current conditions.

SWING PINION SHAFTS

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

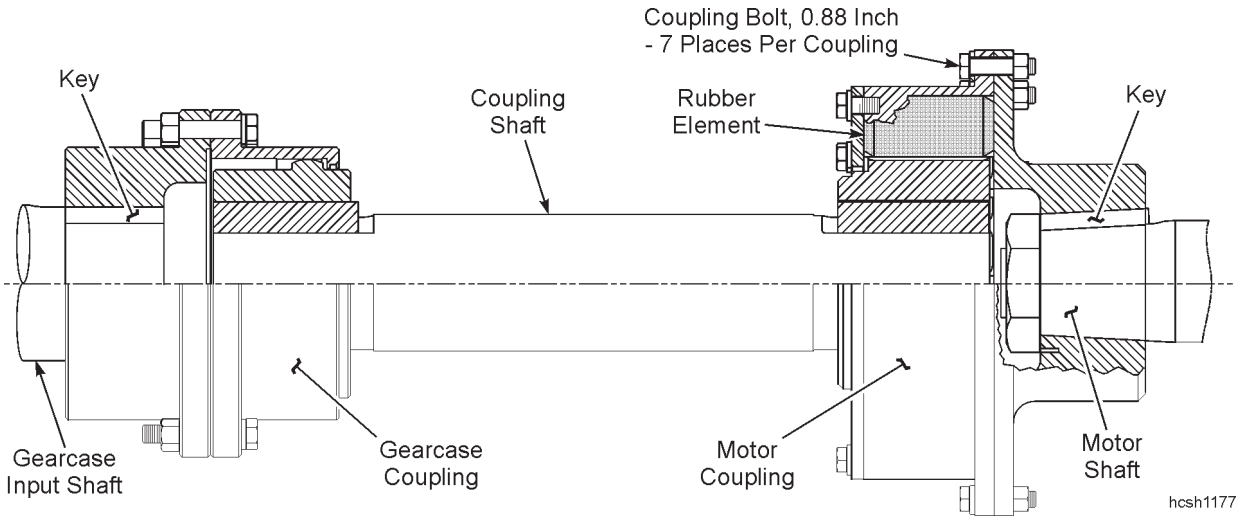


Dual Vertical Swing Shaft Installation

MOTOR COUPLING SHAFT

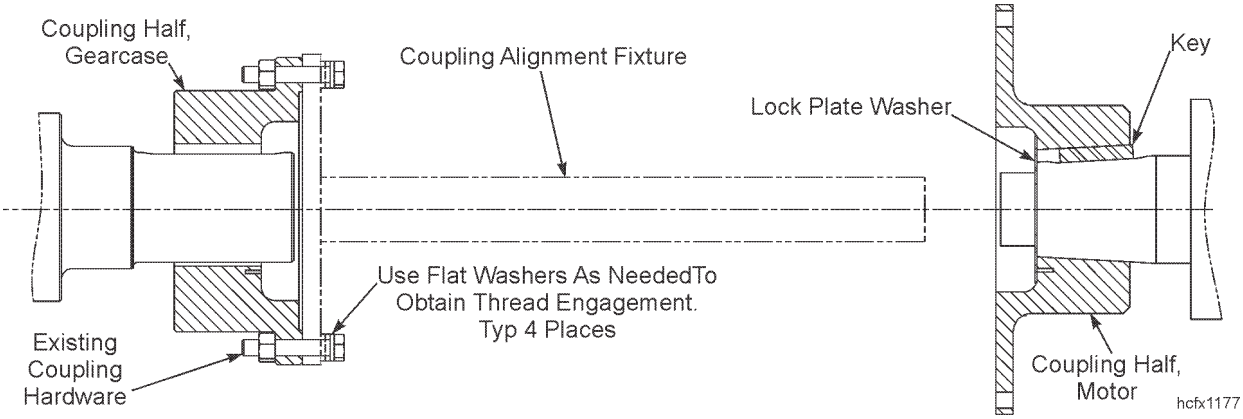
Power is transferred from the hoist motor to the gearcase through a motor coupling shaft with 2 couplings. Using the inspection doors on the coupling guard, check the couplings for evidence of lubricant leakage. Under normal circumstances, a coupling will operate for 3 to 5 years before service is required.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

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



Hoist Motor Coupling Shaft

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



Coupling Alignment Fixture

BEARING REPLACEMENT

To remove or replace the hoist drum shaft bearings, it is best to remove the drum shaft assembly from the machine. Use the above procedure, then *proceed as follows:*

1. Insure that the drum shaft assembly is resting *horizontally* on cribbing.

2. Remove the 8 - 1 inch rod assemblies that fasten each of the outer retainers to the bearing housings.

3. Mark then remove each outer retainer. Each retainer weighs approx. 230 Lbs.

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

4. Pull the bearing housings (3,000 Lbs. each) from the bearings.

5. Remove the 6 - 1.5 inch capscrews that fasten each drum shaft end plate to the shaft.

6. Mark then remove each end plate (approx. 170 Lbs. each). Tag and save the shim packs for later reuse.

7. Use a bearing puller to pull each bearing from the shaft. Each bearing weighs approx. 420 Lbs.

8. Inspect the bearings, the spacer and seal remaining on the shaft ends, and the O-Ring on each seal. Repair or replace any parts as needed.

Reassembly is the reverse of disassembly.

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

5. Tighten the torque nuts on the rods using the proper procedure.

6. Install the retainer hardware. Install and secure the shaft end covers. Be careful not to pinch the O-Rings.

7. Attach the lubrication lines and lubricate the bearings. Fill the gearcases with oil to level with the bottom of the oil filler opening. Attach the electrical leads to the motor and the blower motor.

8. Install the crowd and retract ropes on the drum. Refer to *FRONT END EQUIPMENT* in this manual.

CROWD MOTOR

Inspection, lubrication and maintenance instructions for the crowd motor are described in the motor manufacturer's manual. If removal of the crowd motor is necessary, follow the instructions below.

NOTE. Removal of the appropriate roof panel is necessary to facilitate this procedure.

Crowd the dipper outward and place the dipper on the ground.

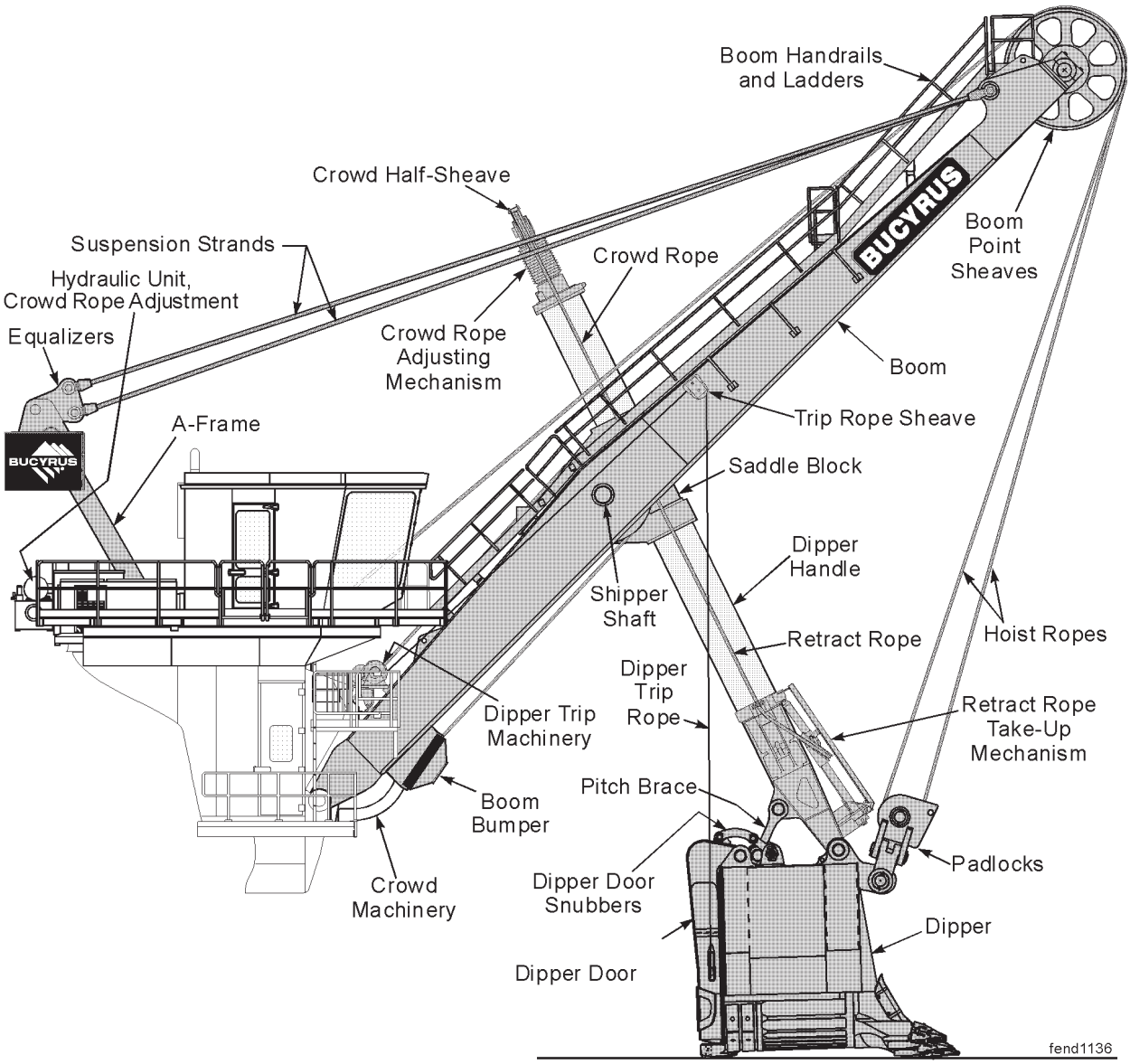
DANGER: BEFORE ATTEMPTING TO DISCONNECT ANY POWER LEADS, PRESS THE *MAIN POWER OFF* BUTTON AND TAG IT TO AVOID INADVERTENT ENERGIZING OF THE ELECTRICAL CIRCUIT. Electrocution may lead to serious injury or death if appropriate safety measures are not followed. Electrical connections should only be handled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

1. Disconnect and identify the electrical leads to the crowd blower motor and the crowd motor.

2. Remove the blower motor and duct as a unit from the crowd motor.

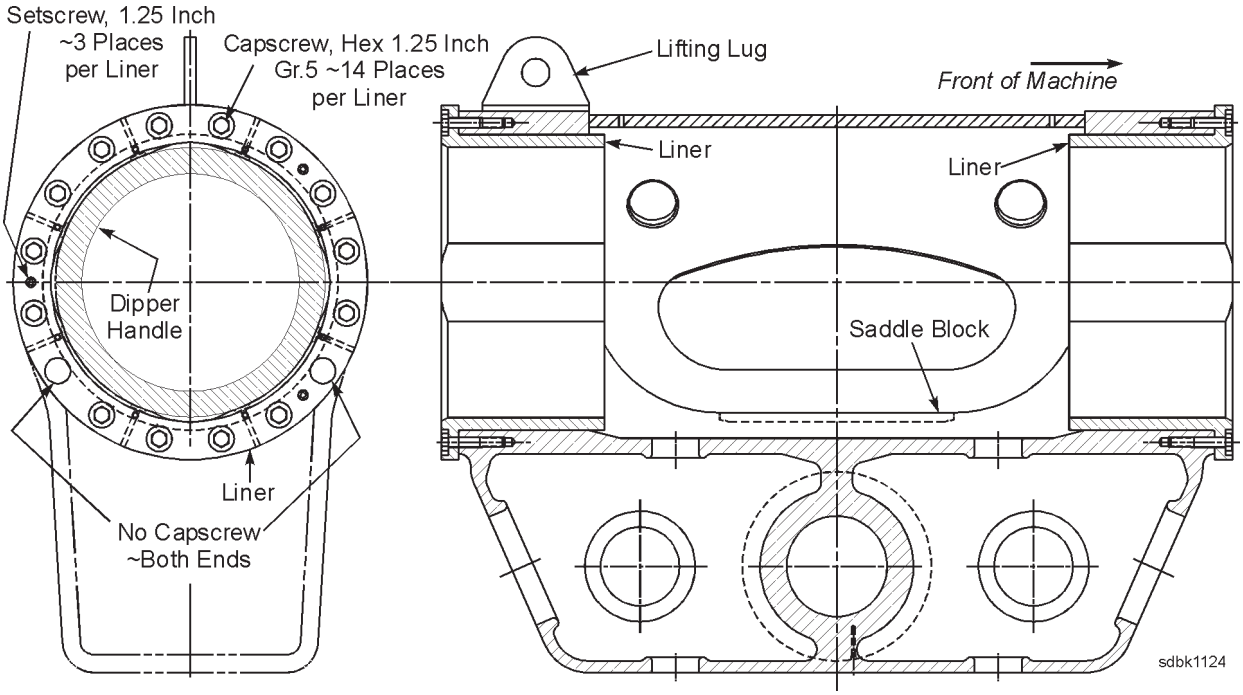
3. Remove the brake from the motor. Refer to Section 6 ~ BRAKES AND COUPLINGS.

FRONT END EQUIPMENT



SADDLE BLOCK

The saddle block should be inspected daily for signs of excessive wear. Make certain that it is being adequately lubricated and that the injectors are functioning properly. Also check the condition of the shipper shaft sheaves for signs of unusual wear. The lubrication lines which run up the boom should be checked for any signs of damage or crimping which could impede the flow of lubricant to the saddle block.



Saddle Block Bushing Arrangement

SADDLE BLOCK REPAIR

The saddle block liners should be replaced when the 0.50 inch chamfer has been worn off the inner bushings, or when the measured distance from one side of the handle to the lining is 0.12 inch or less - with the handle pushed to the same side of the liner. Measure the liners at 4 equally-spaced points about its circumference. It may be possible to remove the liner capscrews and rotate the liner for additional wear. *Replace the liners as follows:*

1. Remove the dipper handle per the procedures in Dipper Handle Removal.
2. Secure the rear liner with a crane and remove the liner mounting bolts. Remove the liner from the saddle block.

NOTE: The liner was installed with LocTite. It may be necessary to heat the saddle block or to cut the liner in order to remove it. Discard after removal.

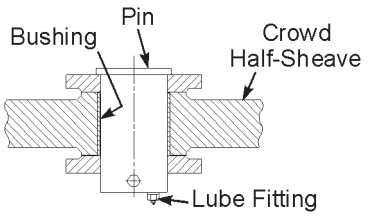
3. When installing new rear liners, uniformly coat the mating surfaces of liner O.D. and saddle block I.D. with LocTite (R) 680 immediately before installation. Use Loctite 227 on the liner bolts.
4. Replace the front liners using the same procedures as above.

6. Slide the worm gear wheel onto the screw rod and spin it onto the threaded portion of the screw rod.

7. Slide the worm gear bushing onto the screw rod.

8. Slide the crowd take-up guide onto the screw rod. Note the orientation of the lifting lug on the take-up guide.

9. Position the worm gear housing so that the worm shaft housing is opposite to the lifting lug on the take-up guide. Check that the bolt holes on the housing and crowd take-up guide are aligned for the capscrews.



SECTION *C-C*

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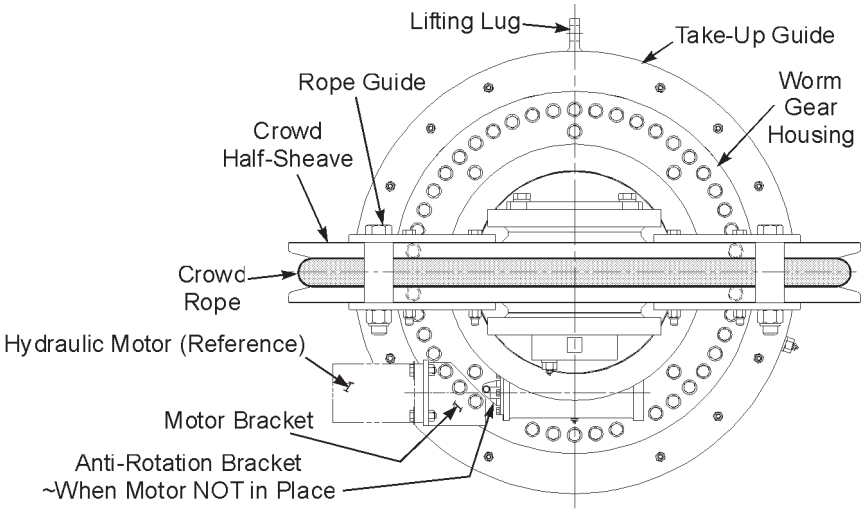


SECTION *B-B*

10. Bolt the screw rod stop plate to the end of the screw rod using the 4 - .75 inch capscrews. Tighten the clamps on the bellows.

11. Install an 8.00” long, 0.50” bolt or threaded rod into the end of the worm shaft, opposite the drive end, for assembly purposes.

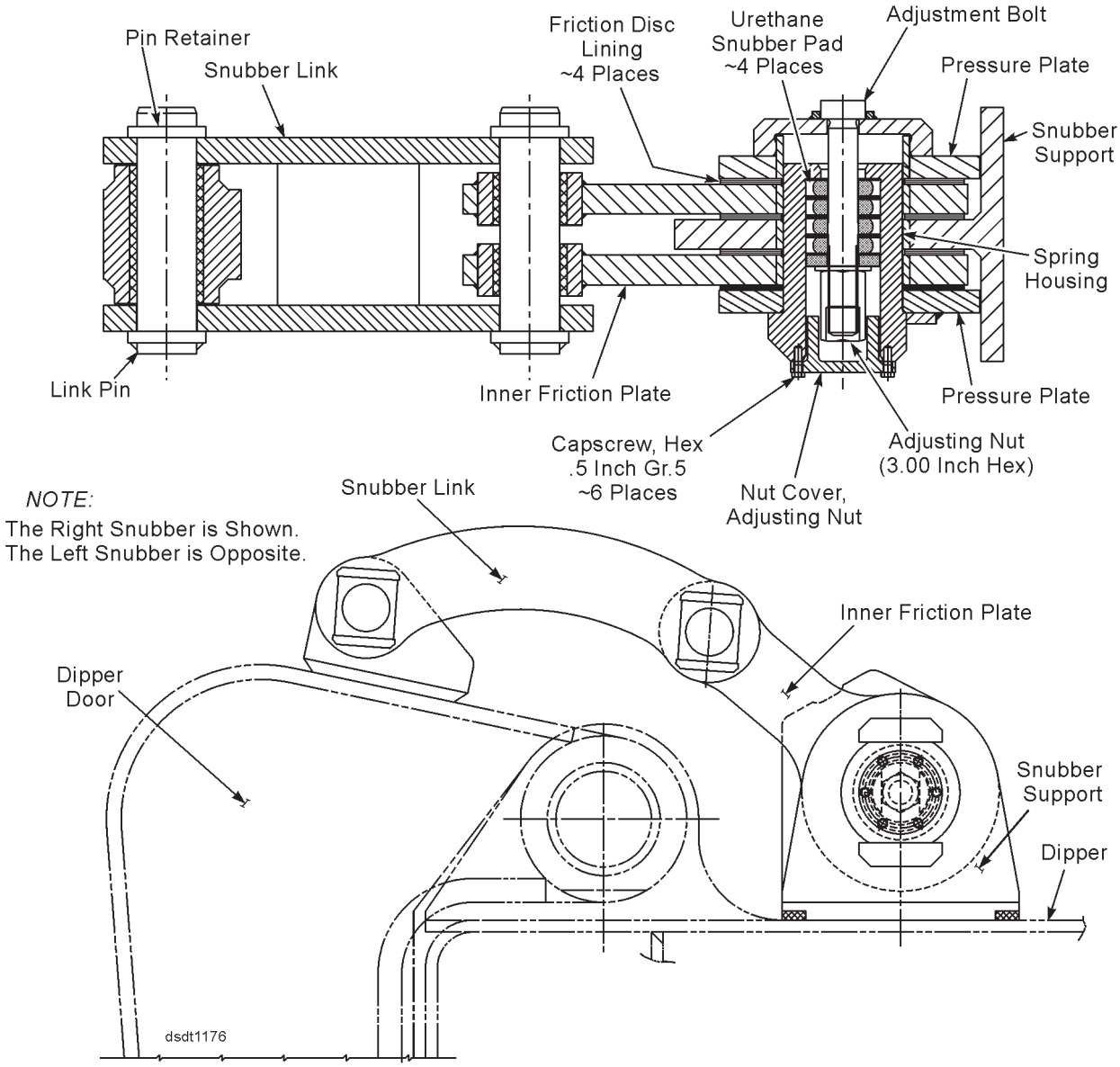
12. Slide one thrust washer bushing onto the end of the worm shaft, opposite the drive end.

13. Insert the worm shaft into its housing. Spin the worm shaft clockwise until it is fully inserted.

14. Install the remaining thrust washer bushing on the drive end of the worm shaft. Slide the cover onto the worm shaft and bolt it to the housing using 6 - .38 inch capscrews. Assemble the anti-rotation bracket. Remove the bolt or threaded rod from the end of the worm shaft that was used for assembly.

DIPPER DOOR SNUBBERS

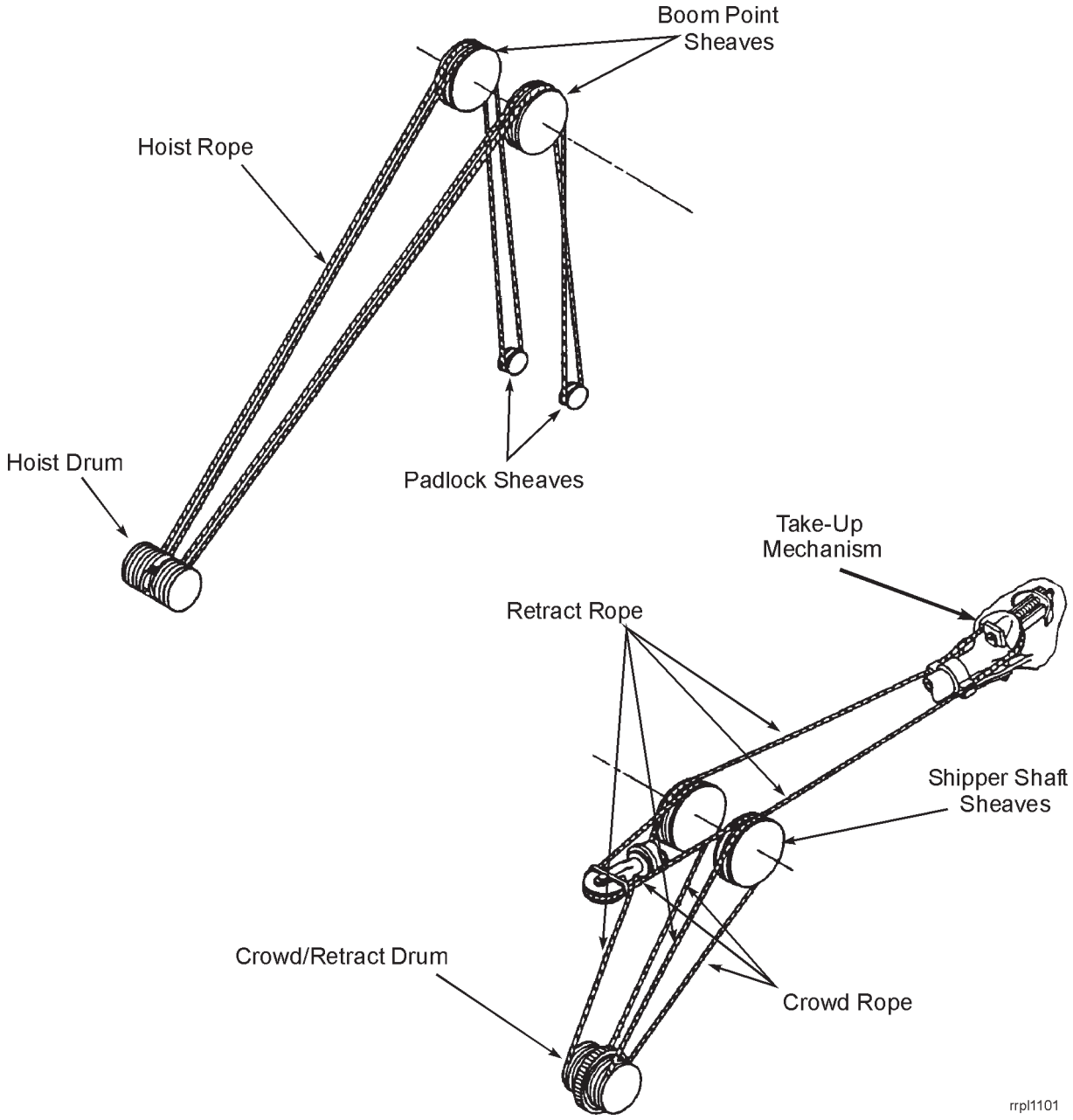
The dipper door snubbers provide tension on the dipper door to prevent excessive speed and movement of the dipper door during closing. Check the door snubber periodically for proper tension.



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

WIRE ROPES

In designing excavating machinery, careful study of the size and operating speed of all sheaves and drums is conducted to determine the proper wire rope for each application. Continual contact with many machines in the field and repeated consultation with leading rope manufacturers permits the selection of the most satisfactory rope for each machine. To maintain the machine at its highest level of efficiency, purchase new ropes which conform to Bucyrus International specifications, and thereby obtain the wire rope best suited for the particular application. Here are a few pointers relative to the proper inspection, lubrication and replacement of wire ropes on the machine.



If the old crowd rope IS NOT broken, attach the end of the new crowd rope to the end of the old crowd rope at the left side. Secure the end of the old crowd rope on the right side to a ground vehicle.

- OR -

If the old crowd rope IS broken and has to be removed in sections:

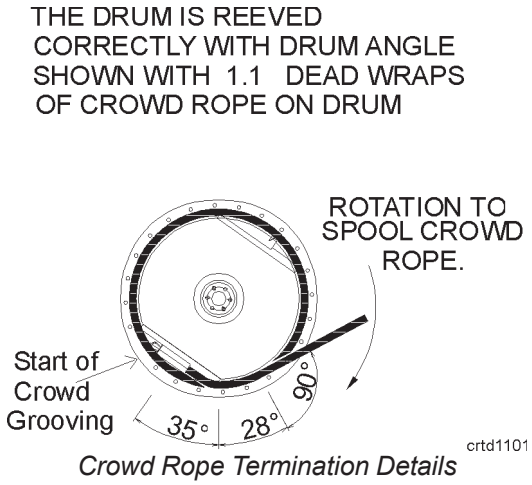
a. Inspect rope grooves and repair/weld as required.

b. Reeve an auxiliary line up to and over the inner groove of the right side saddle block sheave, around the crowd half-sheave, back over the inner groove of the left saddle block sheave, and down to the new reel of rope. Attach the auxiliary line to the becket loop of the new rope and the other end of the line to a ground vehicle as shown.

NOTE: The becketed ends of the crowd rope should pass through the rollers on the crowd half-sheave. If this becomes difficult, the rollers (2 places) can be removed during rope replacement. However, these rollers must be reinstalled before the machine is put into operation.

14. With the ground vehicle, pull the new crowd rope onto the machine until an equal amount of crowd rope hangs from each saddle block sheave. Secure the crowd rope and disconnect the auxiliary line.

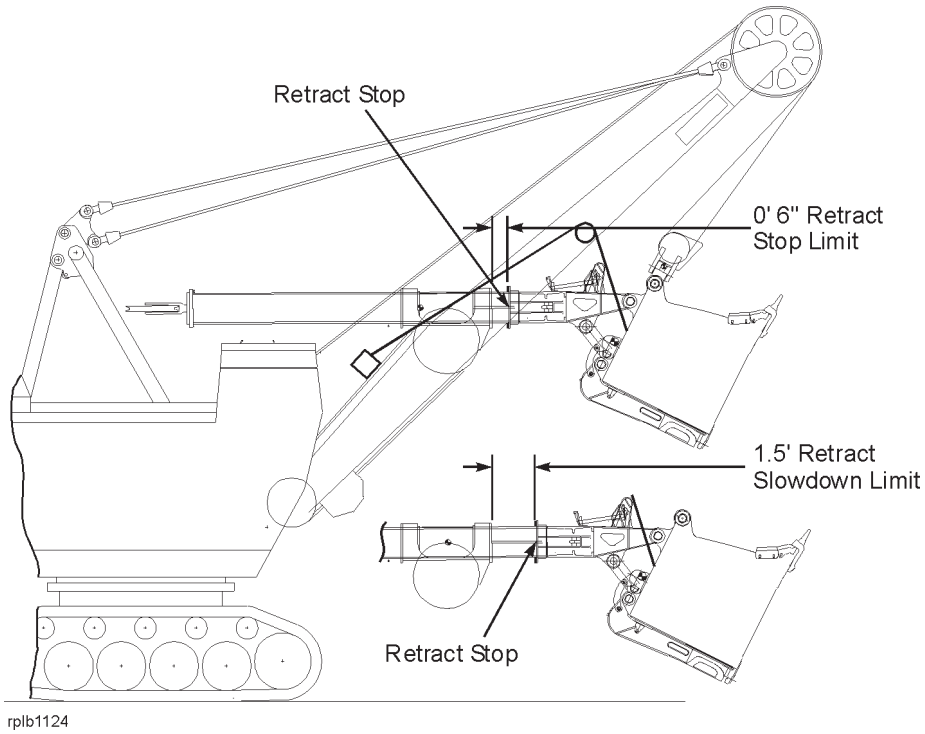
NOTE: Liberally lubricate the grooves of the crowd drum to help prevent damage to the new crowd rope as it is pulled into position on the crowd drum.



Crowd Rope Termination Details

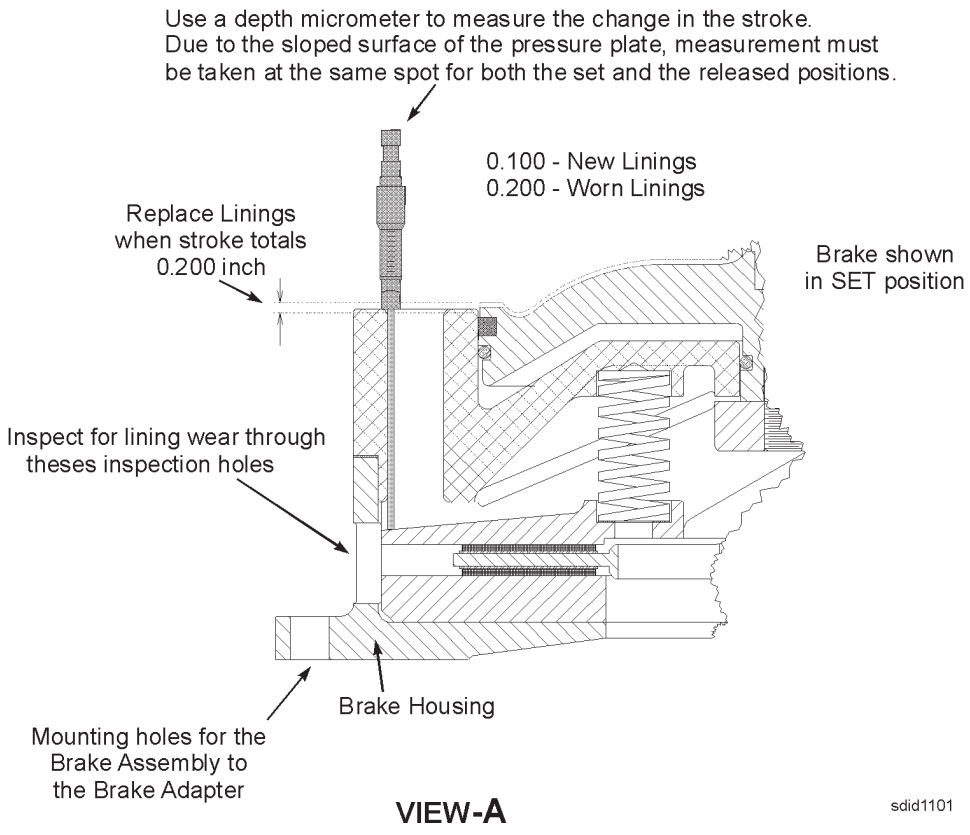
15. Bring the auxiliary line over the top of the crowd drum, through the crowd rope socket, around the rear of the drum and forward from the bottom of the drum to the corresponding end of the new crowd rope. Connect the auxiliary line to the corresponding end of the crowd rope. Release the corresponding end of the crowd rope from (step 12) securing means, and with the ground vehicle still attached to the other end of the auxiliary line, pull the crowd rope onto the rope ferrule socket on the drum. Secure the crowd ferrule button into the drum ferrule socket. Release the auxiliary line from the crowd rope.

RETRACT SLOWDOWN/STOP LIMITS



1. Retract the handle until the retract stops are approximately 1.5 feet from the front end of the saddle block. Press “ACCEPT”.

2. Next, position the handle with the retract stops approximately 6 inches from the saddle block. Press “ACCEPT” to accept limit.



Swing Brake Friction Disc Inspection

SWING BRAKE BURNISHING

The swing brake on this machine is a “single disc assembly” consisting of a ductile iron disc to which multiple metallic lining segments are riveted. The burnishing-in procedure for a new or relined disc brake initiates a controlled wear process to develop the maximum contact area between braking surfaces. The burnish-in process will also start the formation of an oxide layer on the surface of the linings to stabilize and to establish the coefficient of friction.

Prior to beginning the burnishing procedure check and record the brake pressure plate temperature with a hand held temperature measuring device. Between each stop, continue monitoring the pressure plate temperature. Do *not allow the pressure plate temperature to exceed 300° Fahrenheit (149°C).*

SPRING REPLACEMENT - ALL BRAKES

To replace the brake springs, disassemble the brake as follows:

1. Follow steps one through five of the Replacement of Friction Discs procedure.

2. Remove the cylinder stud nuts.

NOTE: It is recommended that the piston cylinder, pressure plate and drive ring be marked so that the same studs pass through the same bolt holes at reassembly.

Remove the piston with cylinder and pressure plate as a complete assembly from the studs and place on a clean level working area.

3. Slowly open the temporary shut-off valve and release pressure from the piston with cylinder and pressure plate assembly.

CAUTION: The brake springs are under compression. Care must be taken when removing piston bolts in order to avoid injury.

4. Remove all piston bolts except for four located at 90° from one another.

NOTE: Reinstall one piston bolt to the right of each of the four remaining piston bolts, turning each of the reinstalled piston bolts two turns. These bolts act as a safety stop during the removal of the four remaining piston bolts 90° from each other.

5. Carefully loosen each of the four remaining piston bolts two turns each in a pattern 180° opposite each other until all four piston bolts have been loosened two turns. Repeat loosening each of the four piston bolts in the above manner until the brake spring compression has been fully released at all four remaining piston bolts.

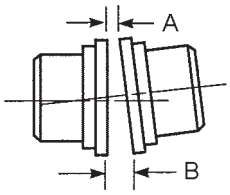
CAUTION: Tap the piston to make sure it has not bound against the cylinder. Care must be taken when loosening piston bolts so that the piston does not bind against the cylinder.

6. Remove the four remaining piston bolts and the safety stop bolts and lift the cylinder with piston off the pressure plate and brake springs.

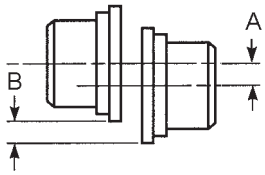
7. Remove all brake springs and insulating washers.

NOTE: The springs are equipped with insulated fiber washers. Be sure the washers are in place at reassembly.

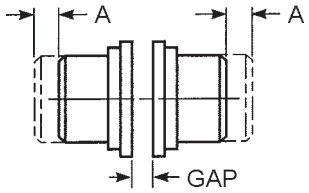
GRID COUPLING ALIGNMENT



ANGULAR ALIGNMENT is the difference between Gap "A" and Gap "B".



OFFSET ALIGNMENT is the amount distance (offset) between shafts.



END GAP is the min. gap between the shaft ends.

cplglmts

Grid Coupling Data

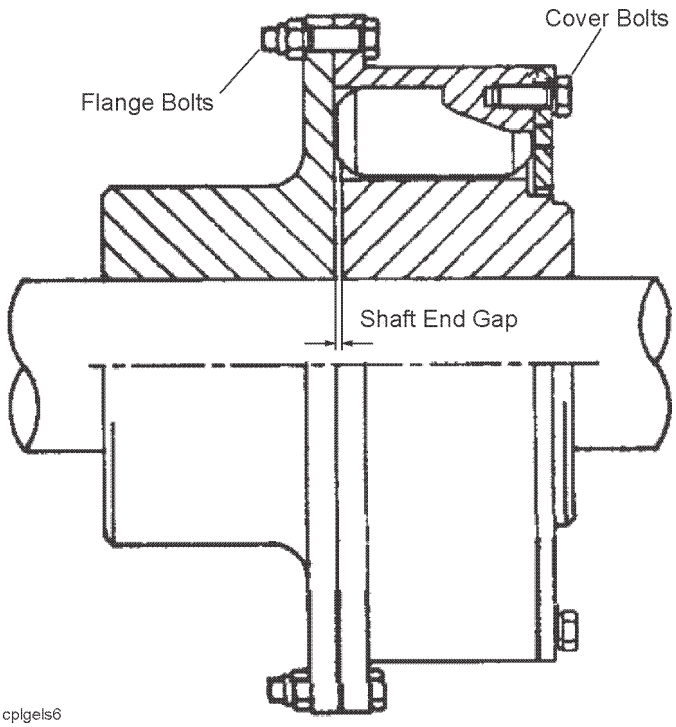
Coupling	Crowd	Propel
*Part No.	C113194-01	S021581
Type	Grid	Grid
Motor Frame	812	812
# Bolts	14	8
Dia. (inch)	0.5	0.75
Torque (in.lbs.)	650	650
Torque (Ft.Lbs.)	54	54
Max. Parallel Offset (in.)	0.022	0.022
Max. Angular Limit (in.)	0.04	0.04
Min. End Gap Limit (in.)	0.556	0.556
Grease Wt. (Lbs.)	1.6	1.6

NOTES:

- Bolts are NOT Standard Fasteners. Values indicated are for clean, dry threads.
- * Use Parts Book to Verify Part Number.

WARNING: DO NOT SUBSTITUTE STANDARD FASTENERS FOR COUPLING BOLTS.

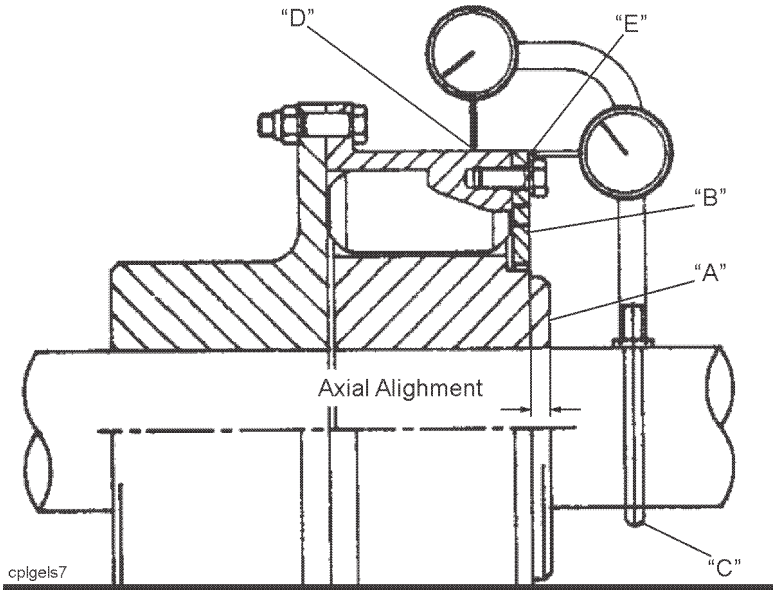
END GAP TABLE



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

COUPLING ALIGNMENT

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



RECOMMENDED LUBRICATION GUIDE

For longest uninterupted service, the compressor is factory filled with Sullube, a long life luricant.

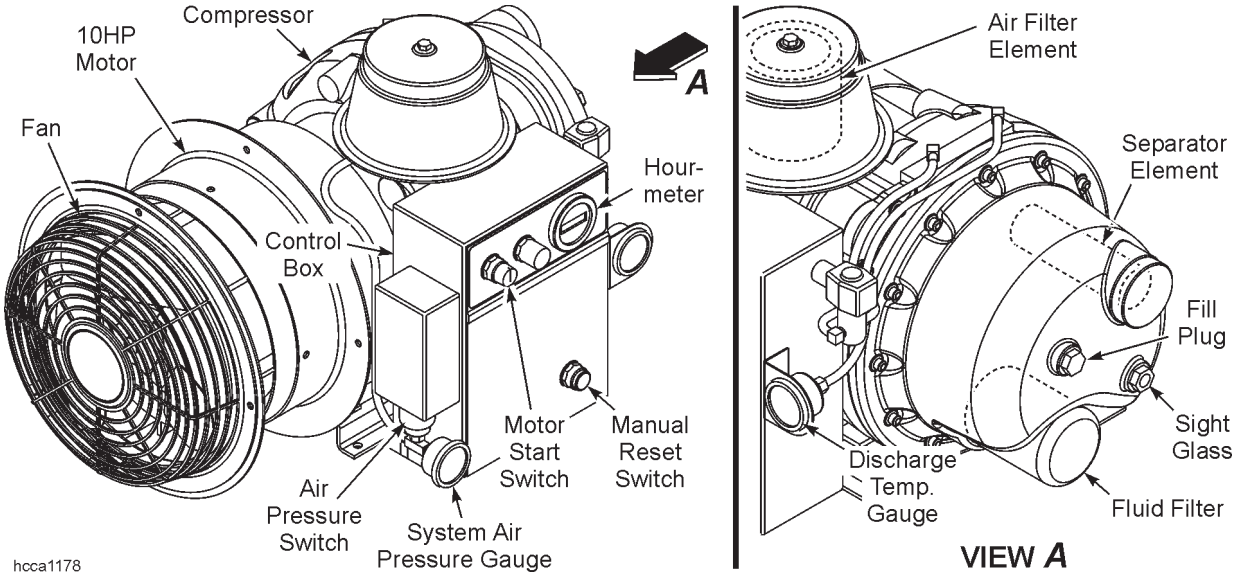
For light-duty high humidity service where condensed moisture and emulsification may occure, the fluid change interval must be reduced to 300 hours maximum. A non-detergent fluid with rust, oxidation and foam inhibitors and good water separation characteristics should be used.

DO NOT mix other fluids within the compressor. Contamination of non-detergent mineral fluids with traces of ATF or detergent motor fluids may lead to operational problems such as foaming, filter plugging, orifice or line plugging. Complete flushing is required if changing to a differnt lubricant.

LUBRICANT	FLUID CHANGE	FLUID FILTER CHANGE	SEPARATOR CHANGE
Sullube	**A, E**	**G, C**	**A, D**
SRF 1/4000	**B, E**	**G, C**	**B, D**
24KT	**F, E**	**G, C**	**A, D**

A - 8,000 Hours or once a year.
B - 4,000 Hours or once a year.
C - When measured pressure loss exceeds 20 psig (1.3 bar).
D - When measured pressure loss exceeds 10 psig (0.7 bar).
E - When required by fluid analysis or known contamination.
F - Does not require replacement during normal service conditions.
G - Every 1,000 hours.

aclbhycd



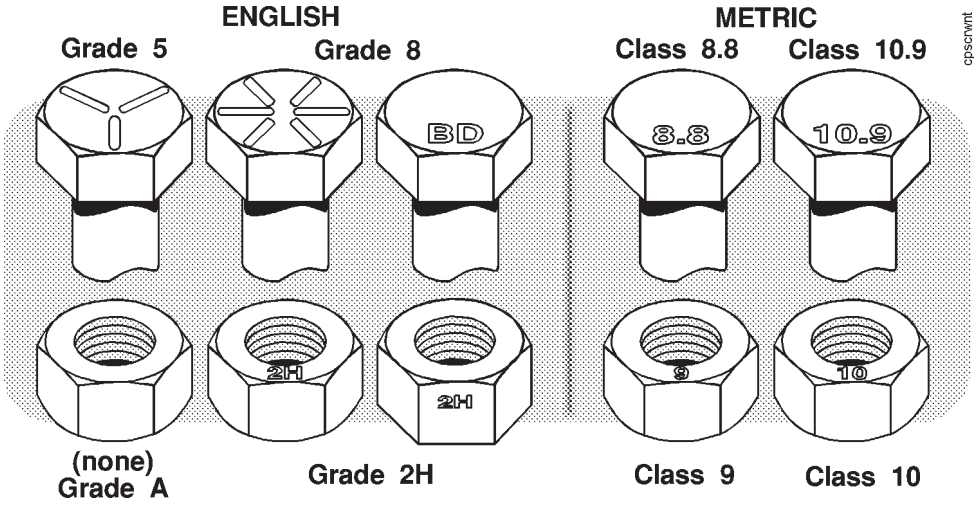
Compressor Assembly (Front and Rear Views)

Section **9**

Engineering Data

CAPSCREW (BOLT) GRADE

The grade classification of a capscrew (bolt) is identified by the marks on the head as shown below:



Use the SAME GRADE washer and nut as the capscrew. *NEVER SUBSTITUTE A LESSER GRADE CAPSCREW IN PLACE OF THAT WHICH IS SPECIFIED.*

8. Ensure that a special steel washer, supplied with the torque nut, is placed beneath the upper torque nut. DO NOT USE STANDARD COMMERCIAL WASHERS.

9. Spin the upper torque nut onto the stud by hand and spin tighten against the hardened washer.

10. Finalize the preload of the inner torque nut by tightening the inner torque nut jack bolts to **182** Ft.Lbs. as follows:

    a. Using the star pattern shown and a torque wrench, tighten the jack bolts (one round only) to approx. **90** Ft.Lbs.

    b. Set the torque wrench to **182** Ft.Lbs. Working in the circular pattern, continue tightening the jack bolts of the inner torque nut until they are stablized at full torque. This may take several rounds. (Stablized is when the torque wrench is moving less than 1/8 turn.)

11. Finalize the preload of the outer torque nut by tightening the outer torque nut jackbolts to **182** Ft.Lbs. as follows:

    Set the torque wrench to **182** Ft.Lbs. Working in the circular pattern, continue tightening the jack bolts of the outer torque nut until they are stablized at full torque. This may take several rounds.

NOTES:

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

Effective repair welding of cracked, broken or bent structural members of the machine involves knowledge of the types of steel used, proper welding electrodes and recognized good welding practice. The chemical composition, mechanical properties and thickness of the steel determine the welding electrode to be used and the preheat temperature required.

WELDING ELECTRODES

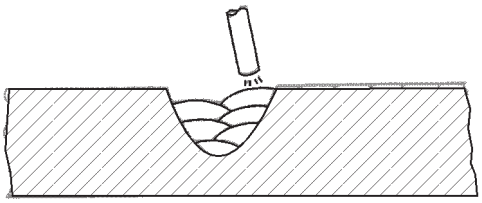
With the exception of the boom, weld repairs on the various structures of the machine can be made with two basic classifications of shielded metal arc electrodes: E7018 and E8018-C1. Both are low hydrogen electrodes which deposit weld metal having excellent properties at strength levels with 70,000 to 80,000 PSI, and impact properties from -20° to -75°F. These are all-position electrodes which produce high quality welds for repairing the structural components of heavy machinery.

NOTE: Although these electrodes are of superior quality, care must be exercised in their application. Low hydrogen electrodes are highly susceptible to moisture pickup after removal from sealed containers. To maintain low hydrogen, crack-resistant properties, they must be stored in electrode ovens at 250°F up to the time of use. Small portable rod ovens at the welder's side are ideal. Use of dry low hydrogen electrodes cannot be over-emphasized.

Cracks caused by hydrogen are extremely fine and occur invisibly below the surface in the base metal heat affected zone, as shown. Therefore, they are not detectable at the time of welding.

These cracks can propagate in service and lead to ultimate failure of the part. It is necessary to adhere strictly to recognized good welding practice regarding the handling, storage and use of low hydrogen electrodes. To avoid underbead cracks, remove all oil or grease or other contaminates from the surface and be sure the steel is dry.

Preheat to the required temperature. Use only dry electrodes taken from the electrode oven. After exposure to the air, the electrodes must be returned to the oven. Time limit outside the oven is four hours for E7018 and two hours for E8018-C1 electrodes.



1. Clean Steel - Remove all oil or grease.
2. Be sure steel is dry.
3. Pre-heat to required temperature.
4. Use dry low-hydrogen electrodes.
   Store in oven @ 250°F until time of use.
   Return to oven after:
   4 hours-E7018
   2 hours-E8018-C1
5. Discard any electrodes which have been wet.

wldrpr-a

WIRE ROPE CARE AND MAINTENANCE

STORAGE

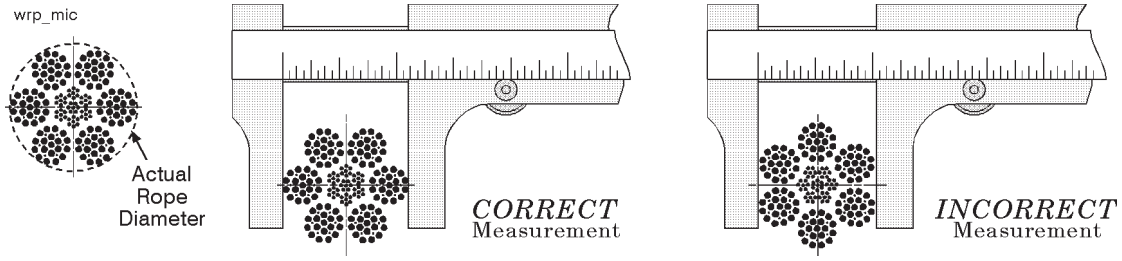
Reels of wire rope stock may be kept on hand for a considerable length of time. This is particularly true of slow-moving special ropes that may not be disposed of completely for several years. Consequently, wire rope should be stored in an are that is well-ventilated and stable with regard to temperature and humidity.

Do not store rope in contact with the bare ground or expose it to the elements. Excessive atmospheric vapors will condense moisture on the rope causing corrosion. If exposed to the direct sun, next to a boiler or in similarly warm conditions, the original lubrication will dry out and lose its preservation properties.

Similarly, storage in a dusty or chemical laden environment may coat the surface of the rope with corrosive materials or even deteriorate the fiber core. If it should be necessary to store rope outside, the reel should be set on blocks or raised off the ground, and covered with a waterproof covering.

CHECKING DIAMETER

It is critical to check the diameter of the delivered rope BEFORE installation on the machine. This is to ensure that the rope diameter meets the specified requirements for the given machine or equipment. An UNDERSIZE diameter rope will bring about a condition where stresses are exceeding design limitations. This will increase the possibility of injury or machine damage as the chances of breaking the rope will be increased. Use of an OVERSIZE diameter rope will bring about premature wear of that rope. The rope constantly being pinched and compressed in the grooves of the sheaves and drum causes this.



Correct Method for Checking Wire Rope Diameter

When checking it is imperative that the actual rope diameter is measured. This is defined as the diameter of the circumscribing circle, or its largest cross-sectional dimension. To ensure accuracy this measurement should be made with a wire rope caliper to obtain the outside dimension of 2 diametrically opposing strands of the rope. When measuring a rope with an odd number of outer strands, special techniques must be employed. Refer to the manufacturer of the product for accurate information.

GUIDELINE TO INSPECTIONS AND REPORTS

(Equipment, Wire Rope and Wire Rope Slings)

1. Maintain all inspection records and reports for the length of time deemed appropriate.

2. Prior to daily use, the following procedure should be followed.

    a. Check all equipment functions.

    b. Lower load blocks and check hooks for deformation or cracks.

    c. During lowering procedure and the following raising cycle, observe the rope and the reeving. Particular notice should be paid to kinking, twisting or other deformities. Drum winding conditions should also be noted.

    d. Check wire rope and slings for visual signs of any unsafe condition; to include, broken wires, excessive wear, kinking or twisting, and severe corrosion. Particular attention should be given to any new damage during operation.

3. Periodic inspections consistent with applicable standards are recommended with a signed report by an authorized and competent inspector. These Periodic Reports should include inspection of the following:

    a. All functional operating mechanisms for excessive wear of components, brake system parts and lubrication.

    b. Limit switches.

    c. Crane hooks for excessive throat opening or twisting, along with a visual for cracks.

    d. Wire rope and reeving for conditions causing possible removal.

    e. Wire rope slings for excessive wear, broken wires, kinking, twisting and mechanical abuse.

    f. All end connections such as hooks, shackles, turnbuckles, plate clamps, sockets, etc. for excessive wear, and distortion.

4. At least one annual inspection with signed report must be made for the following:

    a. Crane hook for cracks.

    b. Hoist drum for wear or cracks.

    c. Structural members for cracks, corrosion and distortion.

    d. For loose structural connections such as bolts, rivets, and weldments.