



Technical Manual

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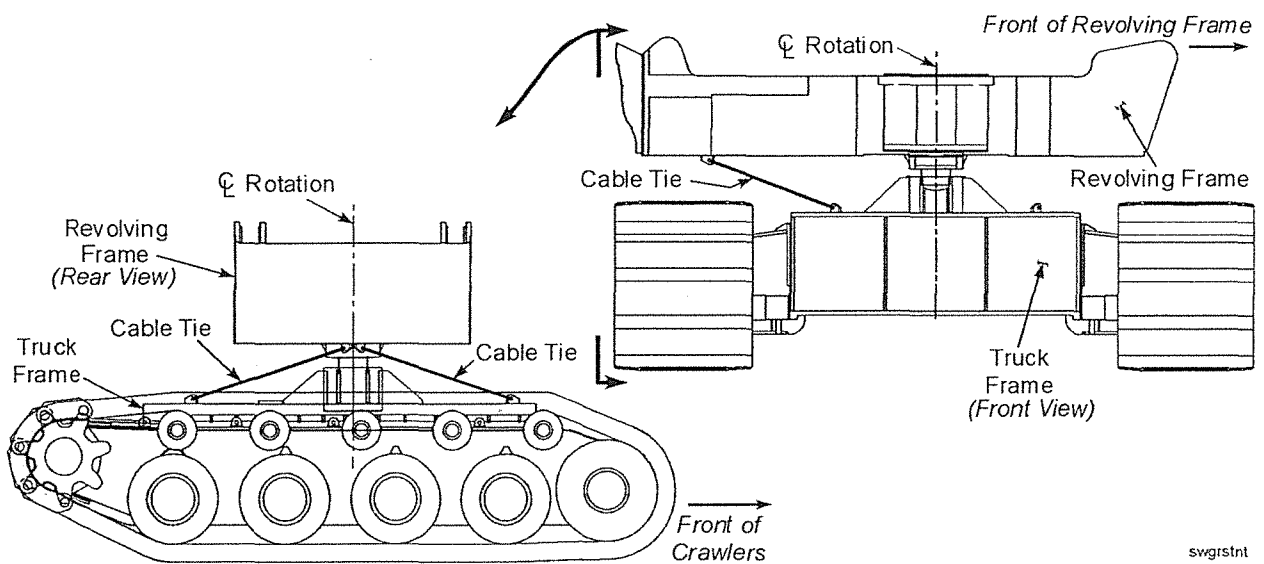
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An external means of preventing machine rotation must be used - if the dipper is not resting firmly on the ground *and* if any of the following are true:

- Two brakes are not effectively set and coupled to the motors, or
- The motors and geartrain are not fully coupled to the swing pinions, or
- The swing pinions are not engaged to the swing rack

The preferred method to prevent machine rotation is to use a pair of one inch diameter steel cables to tie the upper works to the lower works. Other alternatives such as welded plates etc. can also be used.



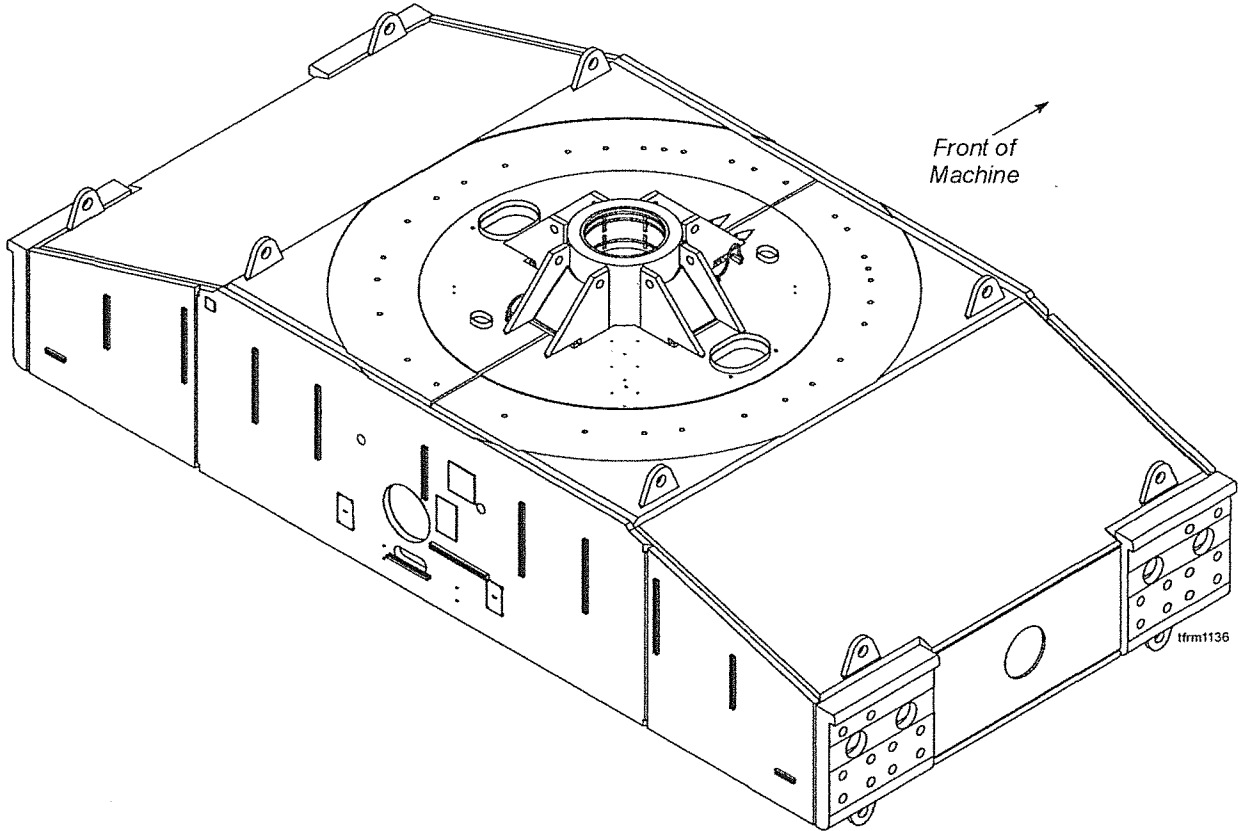
To use the steel cables, attach one end of each cable to the bottom surface of the revolving frame. Attach the other end of each cable to the top surface of the truck frame. This arrangement will prevent relative motion between the revolving frame and the truck frame. Installation of these cable restraints should become a part of the lockout procedure if conditions so warrant.

For typical part numbers and locating dimensions, refer to Bucyrus drawing E021447

TRUCK FRAME

The truck frame is a stress relieved welded cellular box structure which utilizes impact resistant steel in the major load carrying members. The low temperature toughness of the steel assures adequate strength and durability across a wide range of temperatures frequently encountered in machine applications. A fabricated support structure welded integrally into the truck frame supports the center pintle hub area.

The inner diameter of the hub is machined to accept the center pintle bushing. Truck frame surfaces which mate to crawler side frames and swing rack are shop machined to assure proper alignment and solid foundation.

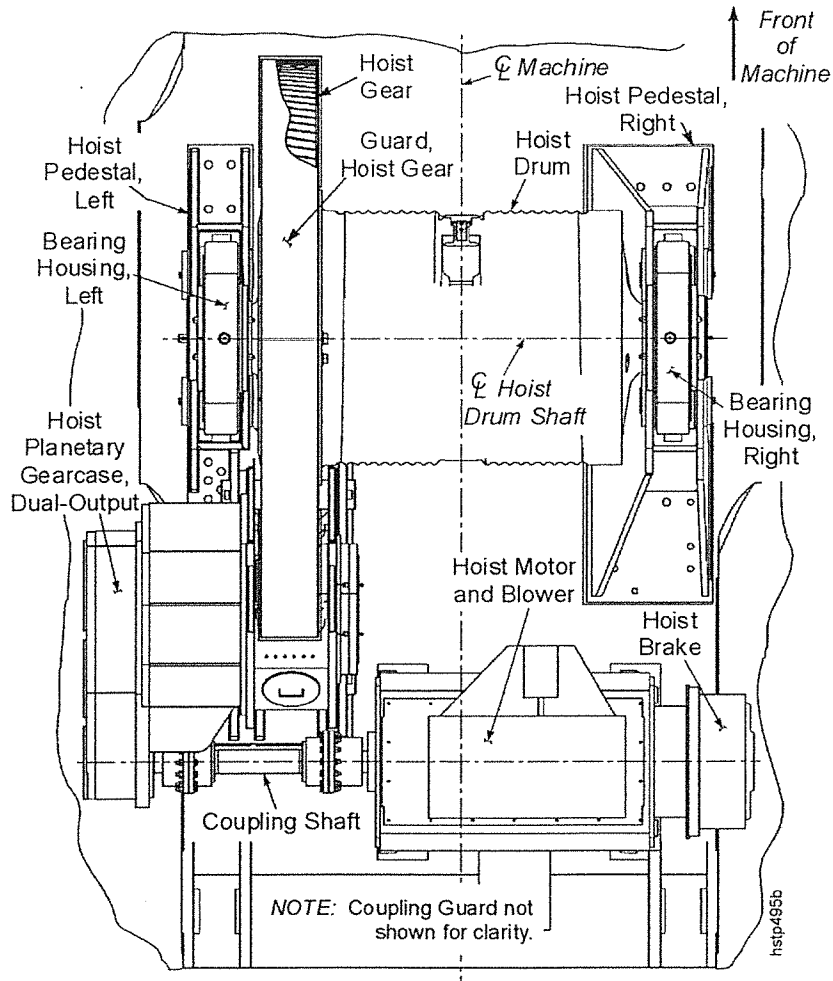


HOIST MACHINERY

The hoist machinery consists of a motor coupled to two gear reductions which drive the hoist drum. A spring-set, air-released disc brake is mounted to the motor. A hoist rotary encoder limits hoist travel. The hoist motor is connected to the motor pinion shaft by a multiple coupling shaft assembly.

The first reduction gear set is mounted in an oil lubricated, totally enclosed gearcase. The second reduction gears are drip lubricated with open gear lubricant from the automatic lubrication system. All shafts run on anti-friction bearings. The hoist bull gear is bolted to a spider on the left hand side of the drum.

The hoist drum is manufactured with machined, flame hardened rope grooves. Drum spider stub shafts turn on an anti-friction bearings supported by side frames which are bolted to the rotating deck.

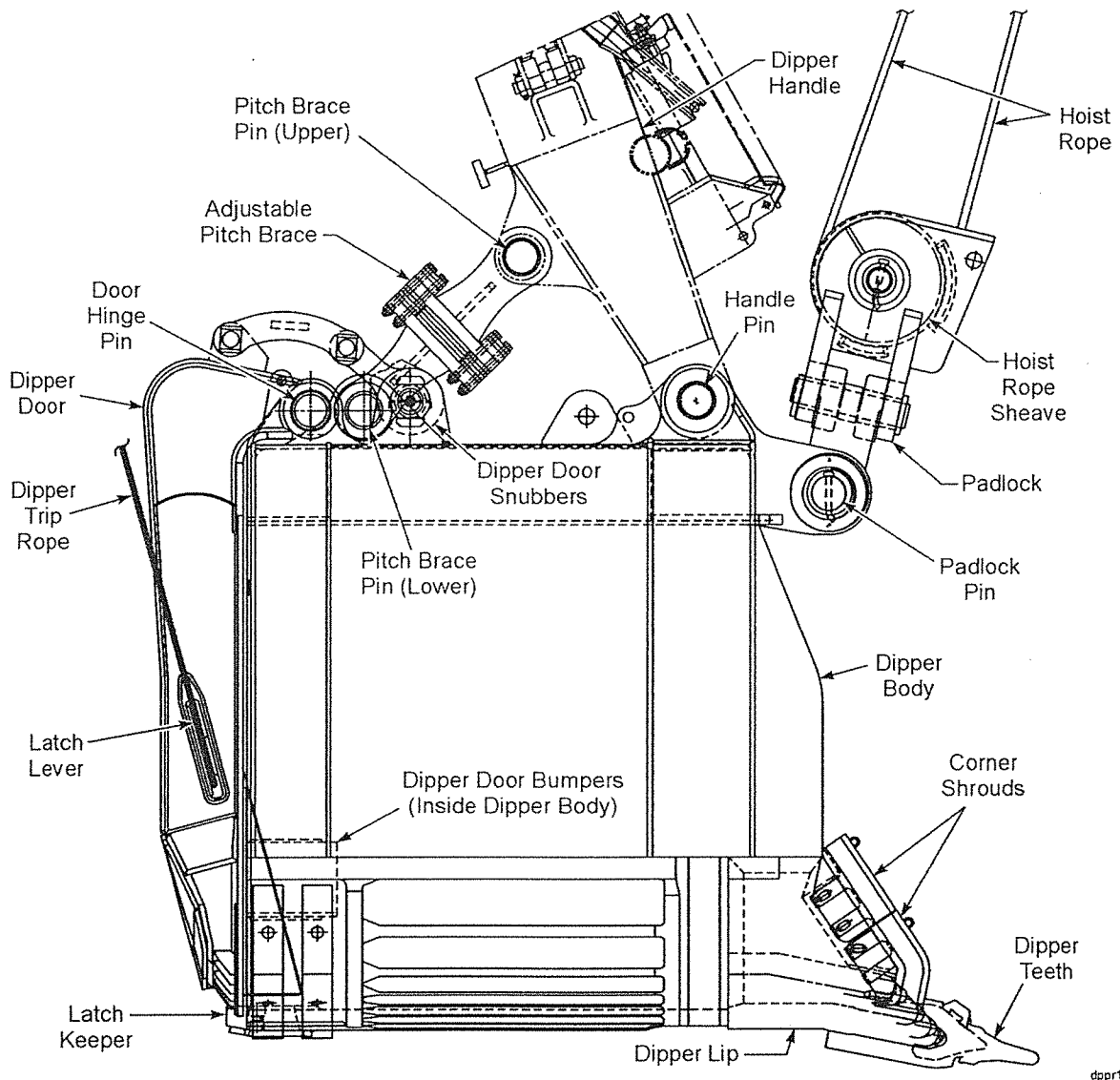


Hoist Machinery - Plan View

DIPPER

A general purpose dipper is usually constructed as a casting and plate weldment. The dipper lip and lower front are alloy heat treated castings. The dipper body, back, upper sides and door are made of steel plate. Removable tooth adapters and replaceable tooth points are attached to the lip casting to penetrate the bank material.

The door is hinged and latched to the dipper body. A dipper trip mechanism controls the release of the latch bar, allowing the door to swing open. The latch bar holds the door shut during digging. Spring loaded snubbers dampen the door's swinging action.



dppr1161

Dipper Assembly

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CONTROLS ON THE RIGHT CONSOLE

RIGHT MASTER SWITCH

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

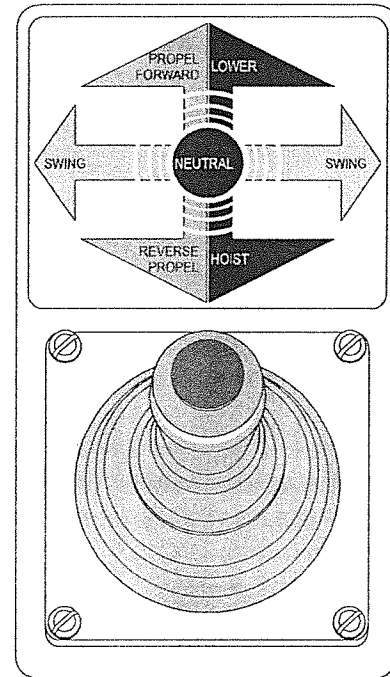
With the propel transfer switch in the dig position, pushing the joystick forward will lower the dipper. Pulling the joystick to the rear will hoist the dipper. The neutral position between the hoist and lower functions is defined by a detent that is easily felt. The speed of moving the dipper is controlled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

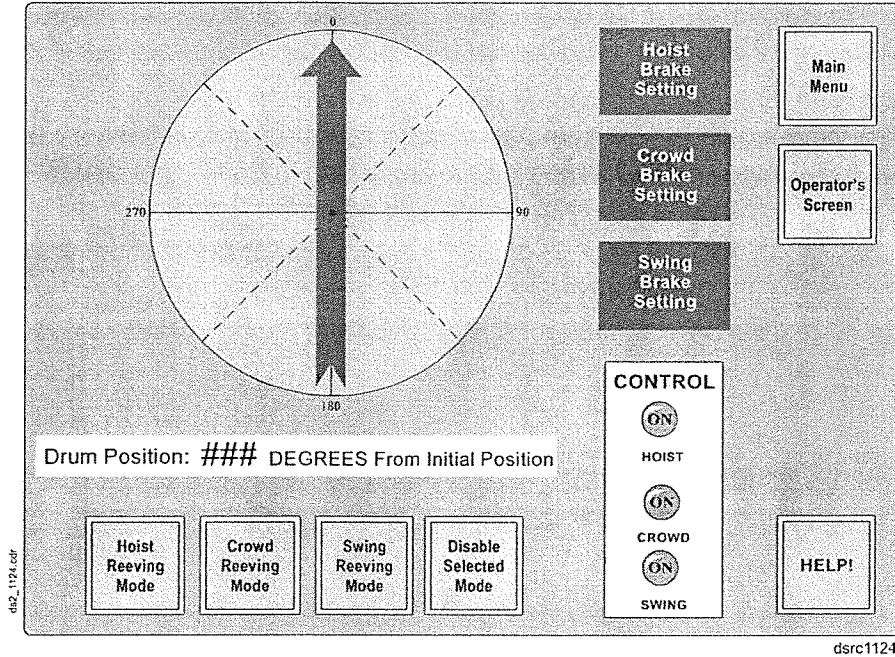
NOTE: When the hoist/swing master switch is used in the hoist/lower mode the switch is a spring returned switch. That is, it will return to the neutral position when it is released.

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

With the propel transfer switch in the propel position, pushing the lever forward will cause the right crawler to move forward. Pulling the lever to the rear will cause the right crawler to move in the reverse direction. The hoist motion is locked out electrically when the machine is in the propel mode.

NOTE: When the JOYSTICK is used in the swing mode the switch is a spring returned switch. That is, it will return to the neutral position when it is released.





Rope Reeving/Pintle Tightening

The Rope Reeving/Pintle tightening screen is selected in order to make adjustments to the center pintle or change any of the main machine wire ropes. This screen will become active in the pintle tightening mode. If rope reeving is the desired intent, a selection must be made at the buttons in the lower left of the display area.

NOTE: Before switching between different modes of operation the Disable Selected Mode button should be pressed.

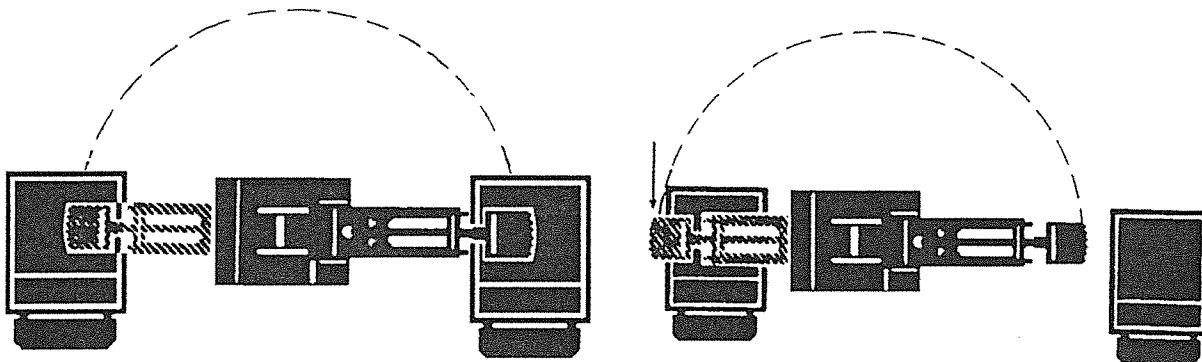
Switches for the activation/release of the hoist, crowd and swing brakes are provided, along with condition indicators displayed below the brake switches. This screen assists in the correct wrapping of the ropes on drums and allows full control of drum movements.

PROPER SWING MOTION

Proper swing motion means smooth control and an efficient swing cycle. The swing motion is begun toward the haulage unit when the dipper is filled and is clear of the bank.



DANGER: Extensive damage to the dipper handle and dipper can occur if the machine is swung before the dipper clears the bank. The swing motion begins with acceleration to an optimum point at which the excavator is brought to a stop over the haulage unit. Maximum efficiency and minimum swing machinery wear are direct results of mastering the swing motion.



Proper spotting of trucks will result in more efficient load cycles.

Poor spotting of trucks will result in inefficient load cycles and reduced machine production.

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NOTE: Improper swing motion results in erratic control, and an inefficient swing cycle.



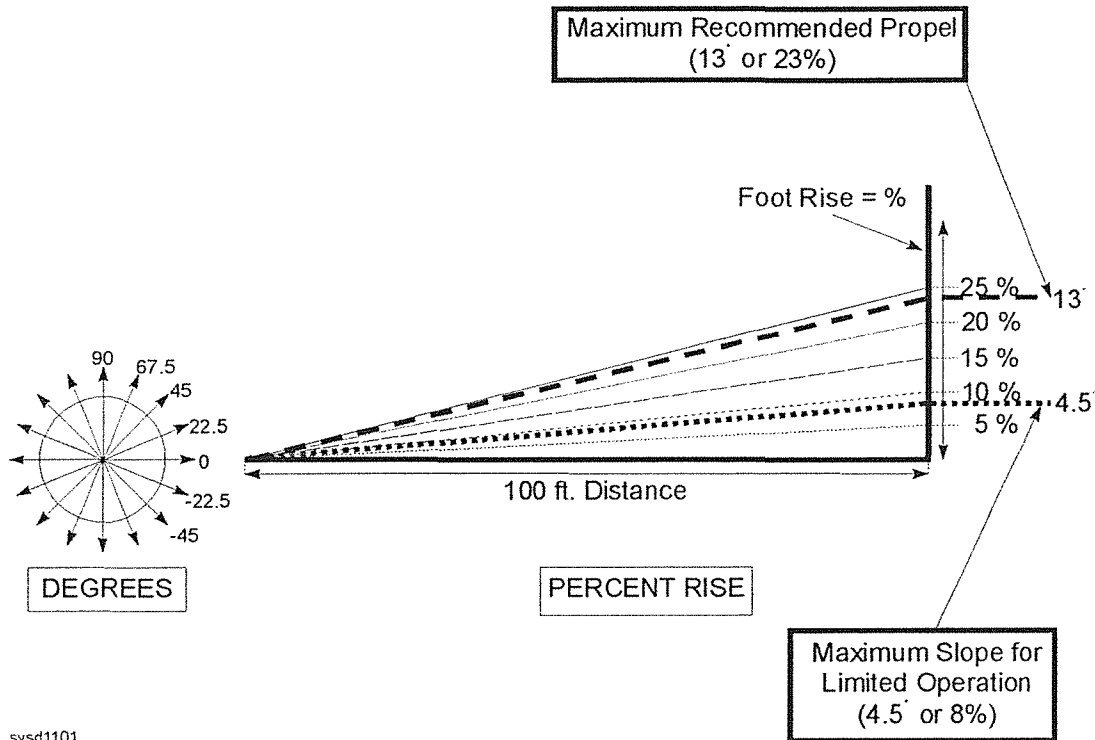
DANGER: The dipper should never be swung over personnel, trail cables, related electrical equipment or other equipment. When the dipper is loaded, accidental tripping of the dipper door could result in death or serious injury to personnel, and extensive damage to equipment. Empty dippers may contain small fragments of material that can be extremely dangerous when dropped from a considerable height. On long moves it's best to have the door open on an empty dipper and the dipper lowered to a point that permits moving without striking the ground.

Time is required to accelerate any motion from zero to working speed, and also to decelerate from working speed back to zero. The time expended for accelerating and decelerating the swing represents the major part of the entire dig cycle. Therefore, the swing arcs must be kept to a minimum to obtain maximum operating efficiency. As an example: assuming that a 90° swing results in 100 percent of the maximum output, increasing the swing arc to 180° reduces output to 70 percent, while decreasing the swing arc to 45° increased the output to 126 percent. Therefore, a swing arc of 90° or less should usually be used.

SLOPE LIMITATIONS

While it is strongly recommended that the machine dig on level ground for the greatest possible productivity and the longest component life, limited operation on slopes up to 8% is, however; acceptable with only minimal adverse effects.

NOTE: It is important to remember the difference between Slope Percent and Degrees!



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Slope vs. Degrees

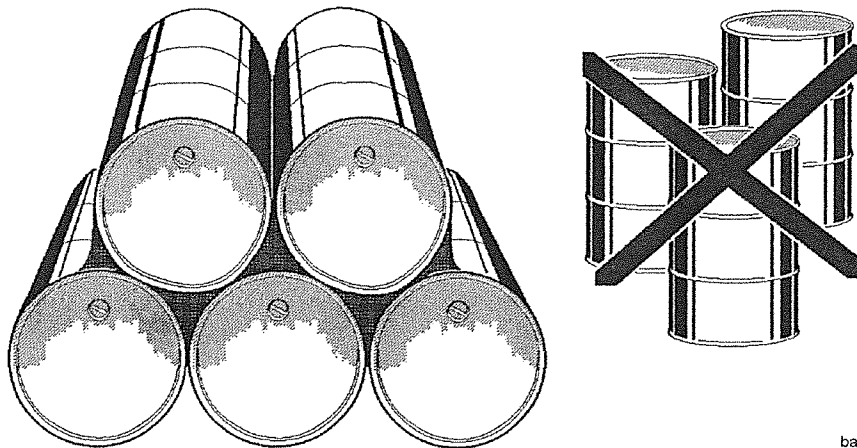
LUBRICANT SELECTION

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

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

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

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



barrels4

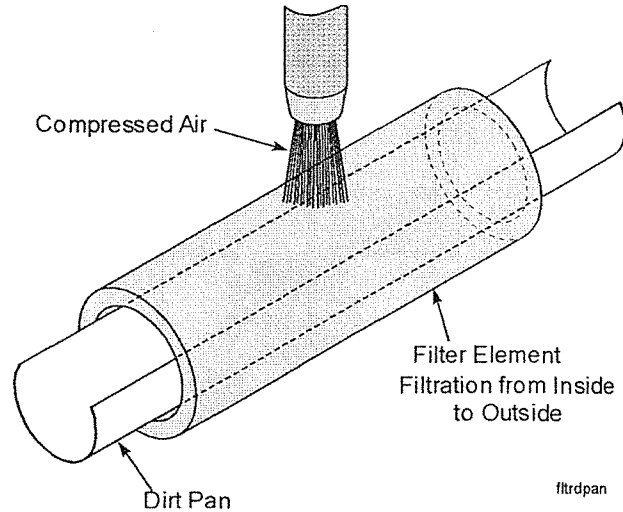
- STORE LUBRICATION DRUMS ON THEIR SIDE, WITH THE OPENING TOWARD THE TOP.
- STORE ALL LUBRICANTS IN TIGHTLY COVERED CONTAINERS!
- WIPE OFF COVERS AND SURROUNDING AREA BEFORE OPENING!
- FILTER ALL OIL BEFORE ADDING IT TO THE SYSTEM!
- USE ONLY CLEAN and PROPER LUBRICANTS!
- DO NOT MIX TYPES or BRANDS of LUBRICANTS!

Even the best lubricants are less useful in preventing wear if they become contaminated by dirt or water due to careless handling or storage.

FILTER ELEMENT CLEANING

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

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



NOTES:

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

MPO - MULTIPURPOSE OIL

SCOPE: Lubricant performance requirements for Multi-Purpose Oil.

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

GENERAL REQUIREMENTS:

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

VISCOSITY RECOMMENDATIONS:

1. Air Line Lubricant

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

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

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

Bucyrus International, Inc.



**SPECIFICATION FOR
ENCLOSED GEARCASE LUBRICANT**

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

(September 1, 2005)

SCOPE:

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

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

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

GUIDELINES FOR SELECTING AN APPROVED LUBRICANT:

Step #1

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

AMBIENT TEMPERATURE RANGE:

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

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

MAINTENANCE PRECAUTIONS

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

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



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

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

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

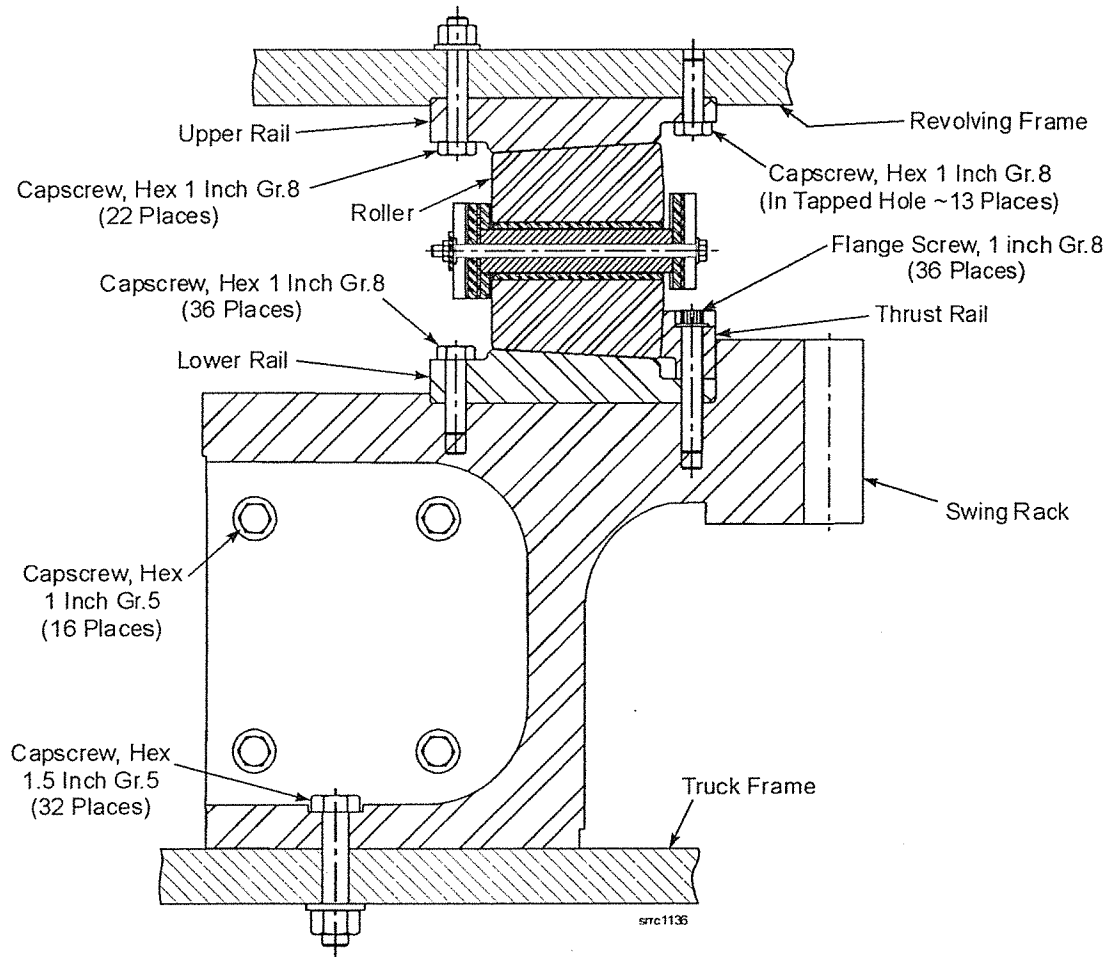


DANGER: Only qualified electricians are permitted to directly maintain electrical equipment such as motors, transformers and switches.

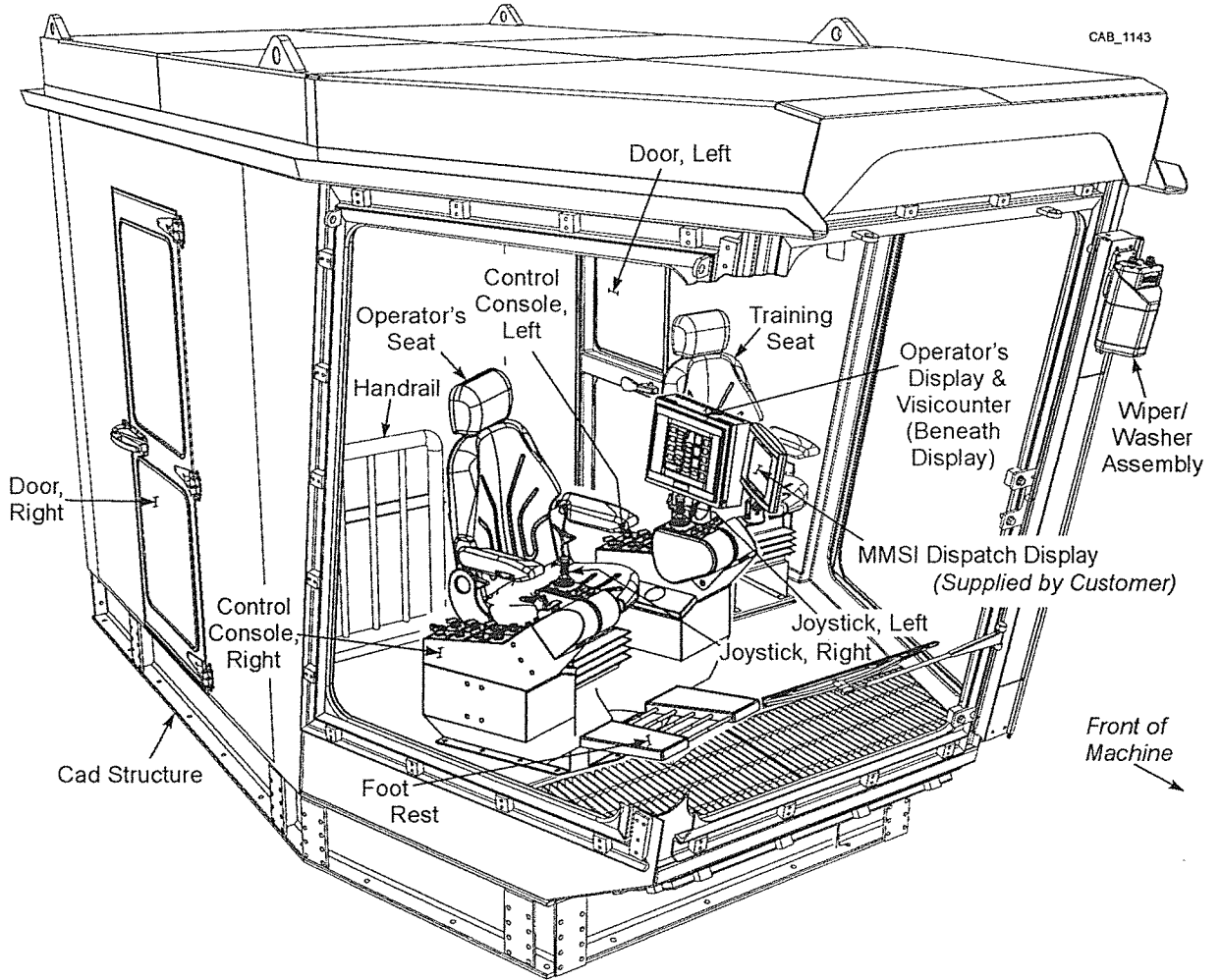
While performing maintenance, the awkward positions assumed and the handling of heavy parts often increases the possibility of injuries. As a precautionary measure, use mechanical handling equipment whenever possible. The mining foreman can facilitate safer and easier maintenance work by providing blocking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



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



Roller Circle Section View



Operators Cab

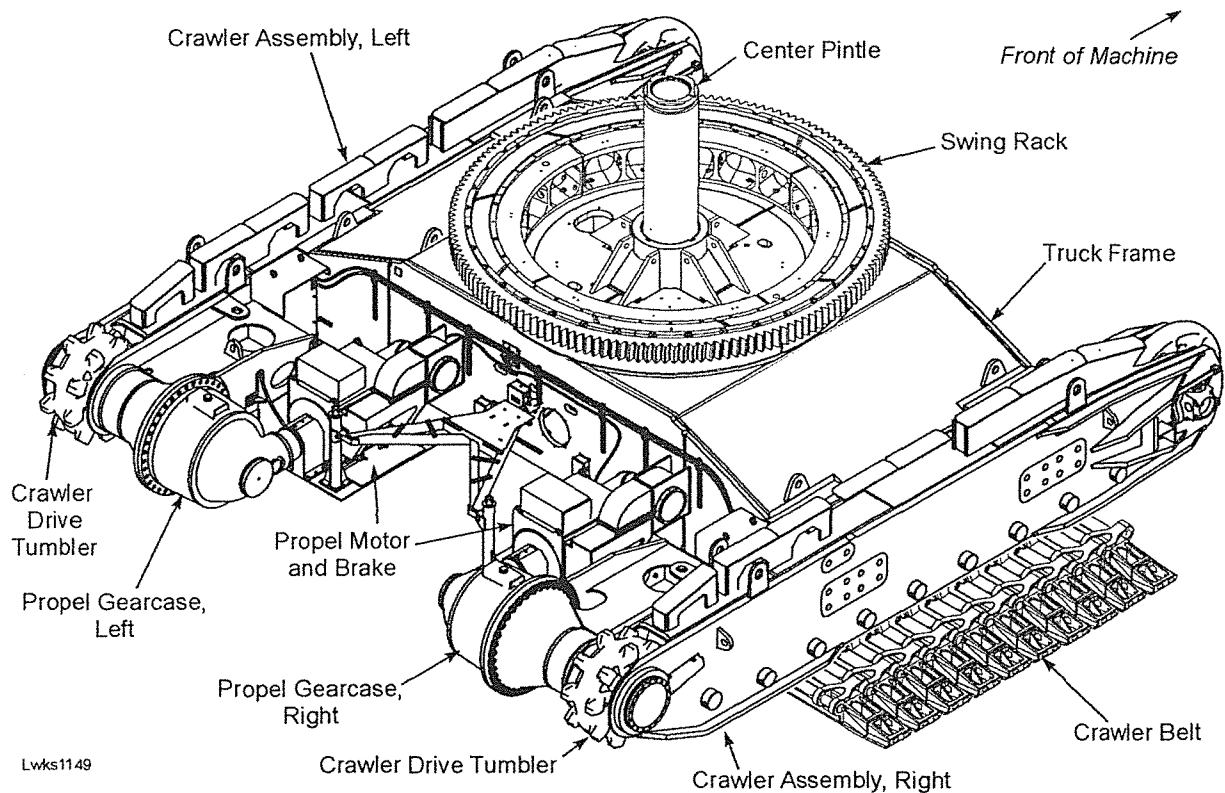
Section **5**

Service Procedures

LOWER WORKS

TRUCK FRAME ASSEMBLY

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



Truck Frame and Crawlers Assembly

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

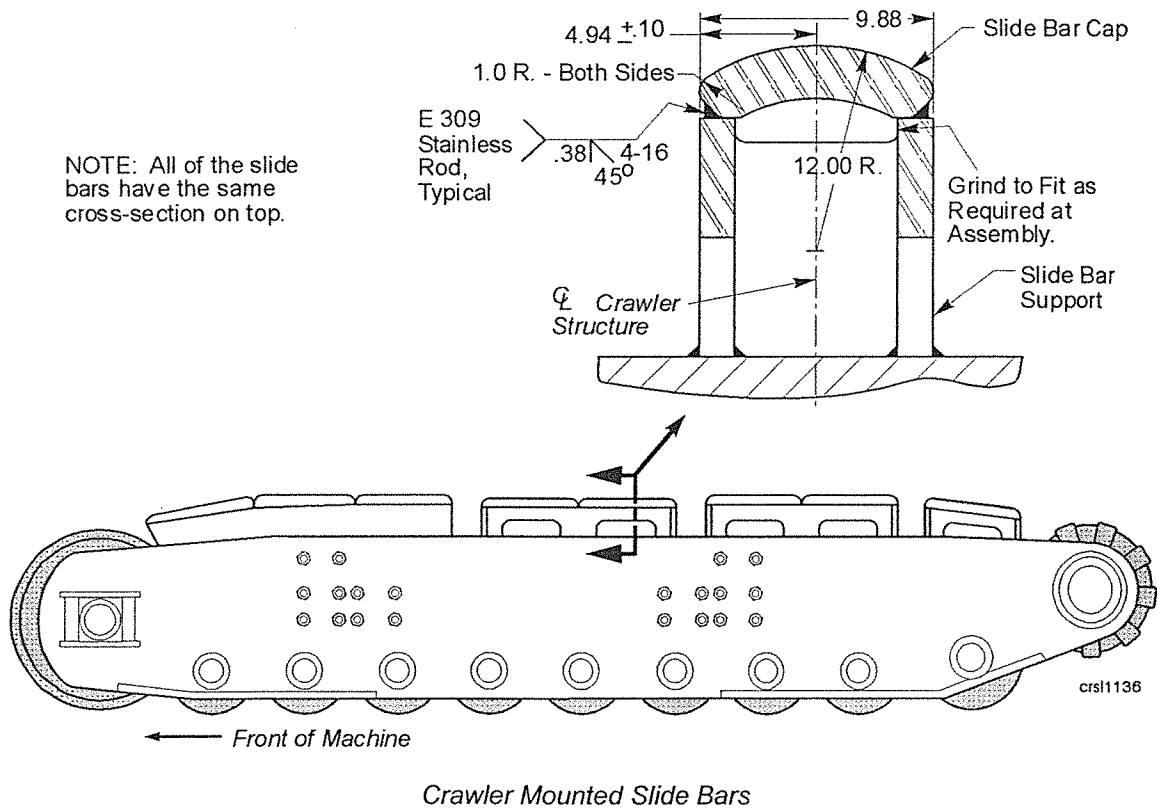
Both the Truck Frame and crawler structures should be inspected during each maintenance period for areas of distress. If cracks are found in any of the structural welds or plates these should be repaired during the next scheduled maintenance period.

SLIDE BAR REPLACEMENT

Eight Cast Manganese Slide Bar Caps guide the crawler belt over each crawler side frame. These slide bar caps are welded to 4 supports on each crawler and are intended to be replaced when worn.

The procedure for replacement is as follows:

1. Park the machine in a level work area.
2. Remove all tensioning shims in the front idler. This will provide as much slack as possible in the crawler belt. Raise the shoes over the slide bar(s) to be removed at least 6.5 inches.
3. Remove the 6 welds which attach the slide bar cap to be removed to its support and remove the slide bar cap.
4. Grind the new slide bar cap as required for a proper fit.
5. Install the new slide bar cap and weld in place. Refer to the figure below.



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MAIN PROPEL DRIVE SHAFT REMOVAL

1. Park the machine safely on a level work area.
2. Rotate the revolving frame to gain access to the propel machinery.
3. Release the tension in the crawler belt to unpin the belt.
4. Have a qualified electrician disconnect the trail cable from the machine and move it out of the way.



DANGER: HIGH VOLTAGE! Only qualified personnel are permitted to perform this operation. Failure to comply could result in bodily injury or death.

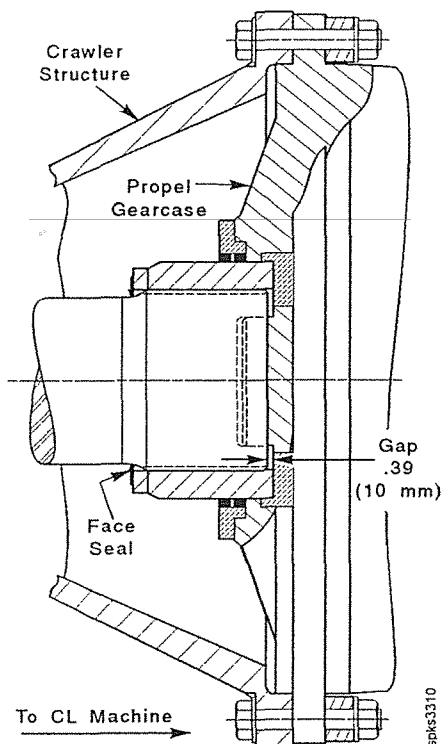
5. Remove the walkway from the front of the wing, above the propel machinery.
6. Separate the belt on top of the crawler, forward of the drive tumbler.



DANGER: Secure the belt before separating it so that it cannot move unexpectedly under its own weight. Failure to do this could result in personal bodily injury.

7. Lift the belt from the drive tumbler and lay it on the ground.
8. Mark the tumbler and the shoe under it with a visible mark (paint) so that the tumbler can be repositioned to the belt in same location.
9. Remove the guard from the propel motor coupling and disassemble the coupling.
10. Support the propel gearcase (approx. 15,800 Lbs.) with a crane.
11. Unbolt the propel gearcase and remove it. Store in a clean area.
12. Remove the lube line to the inboard propel bearing at the inside of the gearcase housing.
13. Disconnect and plug the lube line to the outboard bearing retainer. Remove the retainer with its shim pack from the end of the main propel shaft. Support the tumbler with the crane.
14. Pull the outboard bearing carriage from its bore using 3 - M24 x 3 x 200 jack screws in the tapped holes provided in the cartridge flange.
15. Remove the retainer plate from the outboard end of the tumbler shaft.

2. Install the a new face seal onto the propel shaft as shown in the sketch.



3. Pack the rear of the spline cavity in the propel gearcase for the main propel shaft with 1 pint of Molub-Alloy grease paste (P/C 480206-3) or equivalent.
4. Coat the internal and external spline surfaces and all shaft pilot surfaces with Molub-Alloy grease paste or equivalent.
5. Install the gearcase by engaging the splines of the gearcase with the main propel shaft and the pilot register of the gearcase with the crawler housing. Install the spacer and 36 fasteners and tighten to 7,380 Ft.Lbs.

NOTE: Align the match marks if the same gearcase is being reinstalled. This will minimize the time required to align the coupling. If a *NEW* gearcase is being installed, add new match marks after the gearcase has been installed and the coupling aligned.

6. Fill the gearcase with the proper lubricant to the specified capacity. Refer to Section 3 - LUBRICATION, in this manual. Be sure to install the breather and case plugs.
7. The reassembly of the propel motor coupling can be assisted by releasing the disc brake with the manual override on the air control valve. This will allow the rotation of the motor shaft.
8. Align the motor coupling per the specifications in Section 6 - BRAKES AND COUPLINGS, in this manual. Install the grids and cover.
9. Fill the propel motor coupling to the recommended level with special long term grease (P/C 295148-7).
10. Install the cable reel, if furnished, with the machine and reconnect the trail cable.



DANGER: HIGH VOLTAGE! - RE-CONNECTION OF THE TRAIL CABLE SHOULD ONLY BE PERFORMED BY A QUALIFIED ELECTRICIAN. Failure to comply could result in severe bodily injury or death.

CENTER PINTLE SLEEVE REMOVAL

Remove the center pintle sleeve and thrust washer through the top of the revolving frame as follows:

1. Propel the machine over a pit of sufficient depth to allow the center swivel housing to clear the truck frame.
2. Disconnect electrical power to the machine.



DANGER: HIGH VOLTAGE! EXTREME CARE MUST BE EXERCISED AT ALL TIMES WHEN PERFORMING MAINTENANCE IN THE CENTER PINTLE AREA OF ELECTRICAL ENERGY. 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.

3. Remove the coupling cover, the coupling, and shaft spacer. Disconnect, plug and tag all lube and air lines.
4. Remove hose guard and collector ring cover. Disconnect and tag electric leads.
5. Remove shoes, spacers and insulators from the collector ring housing.
6. Remove the control collector rings from the swivel shaft. Remove the swivel assembly retainer . Lift the swivel assembly and disconnect and tag the air and lube lines. Remove the retainer with swivel assembly attached. Remove the collector ring support and remove the support and collector rings as a unit.
7. Secure the swivel support at the top so that when it is removed it will not fall. Remove the access cover from the bottom of the truck frame and enter the truck frame. Disconnect and tag the electrical cables and tie them out of the way.
8. Remove the swivel support base from the truck frame and lower the swivel support with base out of the truck frame.
9. Remove the hoist drum shaft assembly. Refer to HOIST DRUM SHAFT in this section of the manual.

SWING MOTOR REMOVAL

NOTE: Removal of the appropriate roof panel is required for the removal/replacement of either the left or right swing motor. Complete instructions for the removal and replacement of the motor coupling hub and swing brake hub may be found in Section 6 ~BRAKES AND COUPLINGS, in this manual.

1. Position the machine with the dipper lip and front flat on the ground. Set all brakes.



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

2. Have a qualified electrician tag and disconnect the electrical leads to the motor.
3. Remove the swing motor blower and duct assembly.



CAUTION: **STORED ENERGY!** RELEASE THE AIR PRESSURE TO THE BRAKE BEFORE DISCONNECTING THE AIR LINE. Plug the line immediately after disconnecting. Failure to comply could result in personal injury.

4. Release the air pressure in the line to the swing brake, and disconnect the air line.

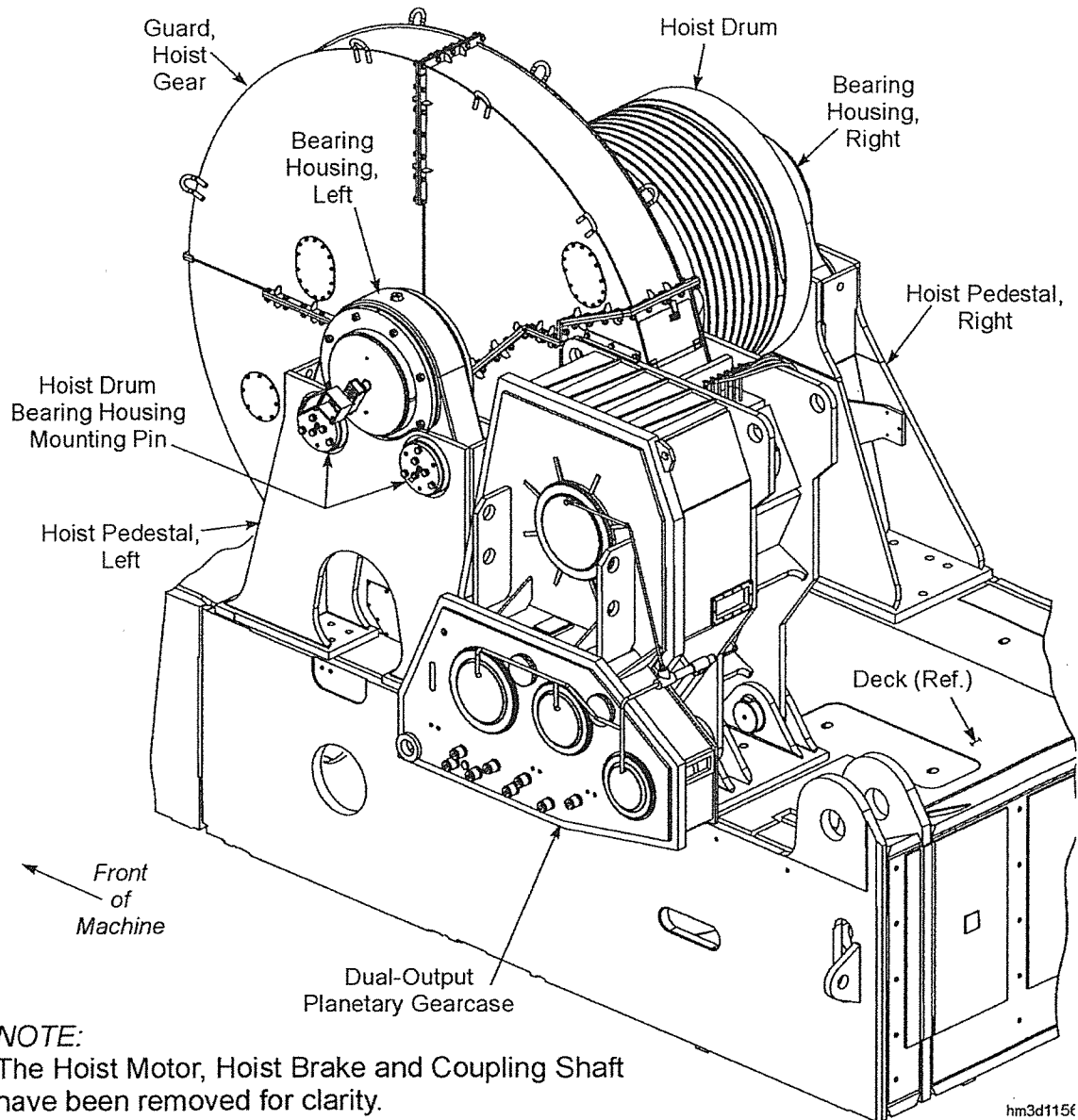
NOTE: The swing motor and brake can be removed as a unit if desired. If so skip the next step.



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. Refer to Section 1 - Swing Restraint.

5. Remove the swing brake from the motor per the proper instructions. The weight of the swing brake is approx. 490 Lbs.
6. Remove the bolts securing the motor drive coupling halves together per the proper instructions in Section 6 of this manual.
7. Attach a lifting device to the motor and remove slack from sling.
8. Remove the bolts securing the motor to the planetary gearcase housing.
9. Remove the motor from the planetary gearcase and store in a dry location if to be reinstalled. The weight of the motor is approx. 4,600 Lbs.

HOIST MACHINERY

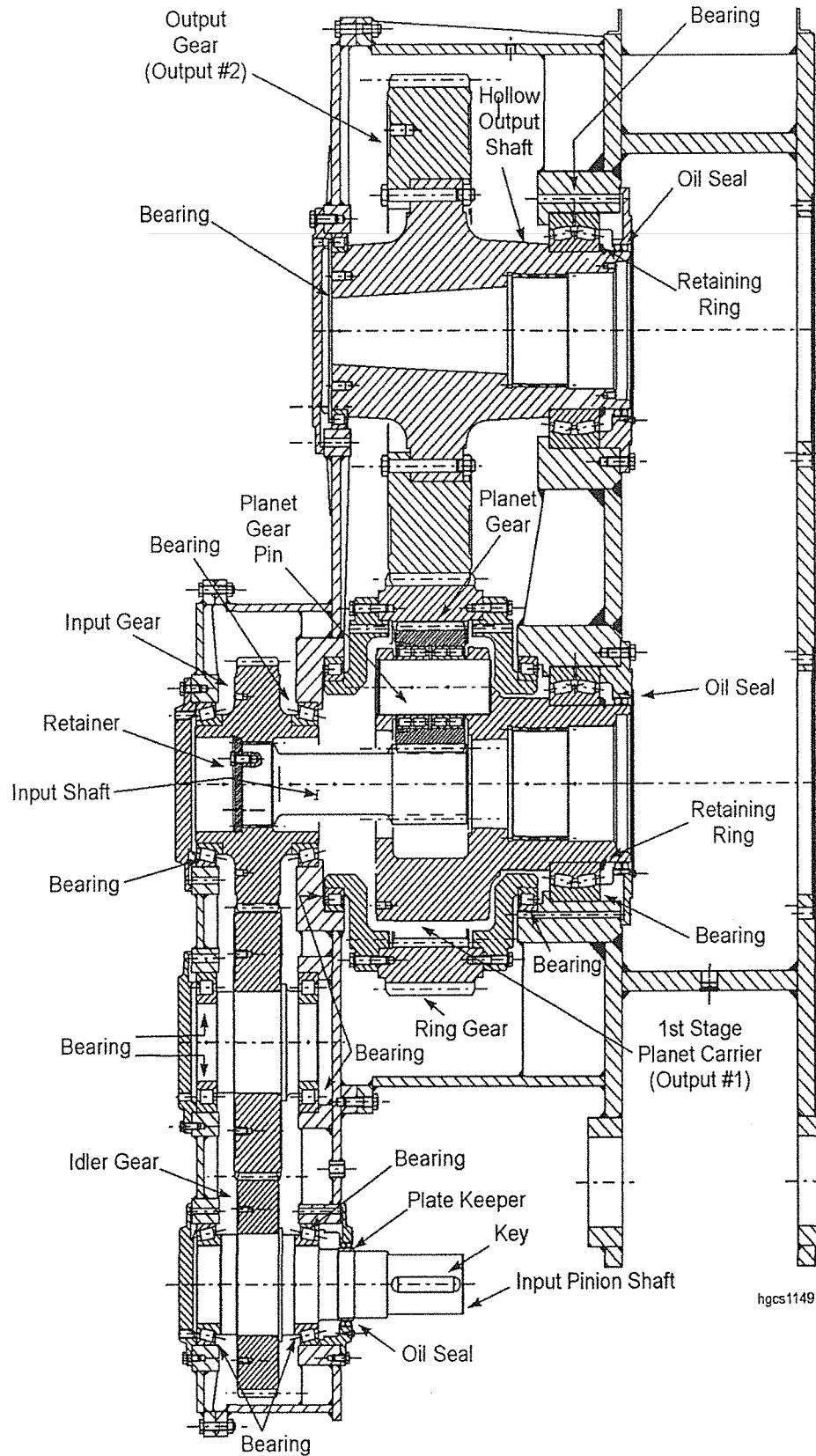


Hoist Machinery Assembly

The Hoist Machinery consists of:

- A Large Diameter Hoist Drum,
- Integral Single-Helical Hoist Gear,
- Dual-Output Planetary Gearcase,
- Hoist Motor and Brake Assembly.

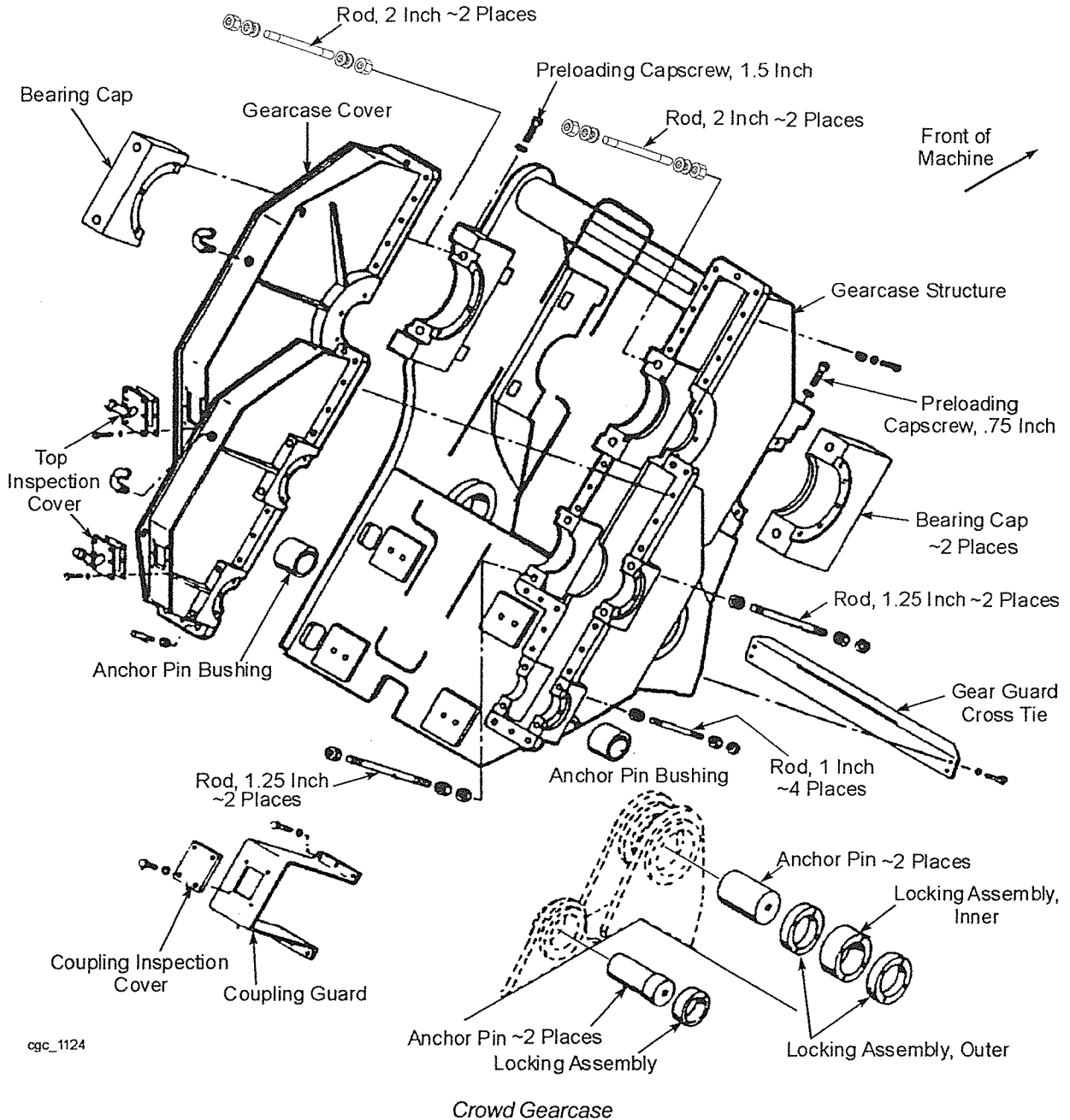
495HR Electric Mining Shovel



hgcs1149

Hoist Gearcase Section View

495HR Electric Mining Shovel



cgc_1124

Every six months remove the inspection covers of the gearcases and inspect the gears and pinions for pitting, abrasion, scratching, galling, spalling and other abnormal tooth wear.

Check the crowd machinery attachment pins for movement under load. Tight attachment pins minimizes wear on the pins and pin holes. Check every 100 hours.

Weekly, remove the pipe plugs in the first reduction gearcase and the second reduction gearcase and check the lubricant level. The first reduction gearcase lubricant level plug is located at the rear of the gearcase cover, to the rear of the first reduction pinion.



MACHINERY HOUSE

The machinery house has separate structural members consisting of front and rear main truss and interconnecting beams. These form the permanent house structure.

Roof panels are individually fastened to the interconnecting beams. Any panel can be removed separately to provide access to a machinery house unit. All roof panels are secured with hold down bolts on retainer bands. Vinyl tape weather stripping is installed between the retainer band and roof panel.

Shroud covers around the A-frame legs have vinyl tape between the leg and shroud. Shroud support joints are sealed with rubber cement or silicone caulking.

All mating surfaces of the machinery house wall panels are sealed with rubber cement or silicone caulking to ensure weather tight seal.

Frequently inspect all house panels and structural members for cracking. Include a close examination of all roof structures. Examine all struts, beams and braces used to reinforce the machinery house.

Always restore defective structural members to their original state by repair welding.

Periodically observe the hinges and closure mechanisms on all doors and windows to ensure they will remain closed during machine operation. Verify the sealing of the leg closures of the A-frame. Tighten all loose bolts and replace all missing hardware. The absence or looseness of these fasteners can result in excessive vibration and wear of house components. Individually, these faults can be considered minor, but taken collectively, they represent a major exposure of the electrical and mechanical elements of the house to dust and water.

Check the condition of the house paint. Paint is not impervious to deterioration. A well-painted machine is less susceptible to rust, corrosion and progressive failure.

Be sure the pressurization system is functioning properly to keep the house well-ventilated at a pressure higher than atmospheric pressure.

BOOM POINT SHEAVE REMOVAL AND DISASSEMBLY

Use the following procedures to remove ONE Boom Point Sheave assembly:

1. Position the machine in a clear and level area.
2. It is not necessary to lower the boom when removing the boom point sheaves. However, lift the hoist ropes, with a suitable crane, and set them at the center of the boom away from the sheave assemblies.



CAUTION: THE HOIST ROPES MUST BE SECURED TO THE BOOM FOR SAFETY UNTIL THE REPAIR IS COMPLETED. USE BLOCKING BETWEEN THE ROPES AND THE BOOM STRUCTURE TO PREVENT DAMAGE TO THE ROPES.



CAUTION: ADEQUATE PRECAUTIONS MUST BE TAKEN TO ENSURE THE SAFETY OF PERSONNEL WHEN EQUIPMENT IS REMOVED AND REPLACED. USE EXTREME CAUTION AND PROPER SAFETY DEVICES WHEN WORKING AT THE BOOM POINT.

3. Disconnect and plug the lubrication lines to the sheave pins.
4. Use a suitable crane and provide just enough lift to the boom point sheave to be removed to carry its weight. The approximate weight is 7,000 Lbs. *DO NOT APPLY TOO MUCH FORCE WITH THE LIFTING DEVICE.*
5. Remove the sheave clamp collar from each end of the boom point shaft.
6. Ensure that the sheave assembly is supported with a sufficient sling or chain and loosen the four 1.5 inch capscrews that retain the bearing caps on the shaft to be removed.
7. With the shaft assembly secured, remove the capscrews and bearing caps.
8. Lift the sheave assembly away from the boom point and set on the ground.

NOTE: When lifting the sheave assembly, locate the key at the bottom of the outboard end of the shaft and retain for reinstallation.



CAUTION: THE SHAFT KEY MAY FALL WHEN THE SHAFT IS LIFTED!

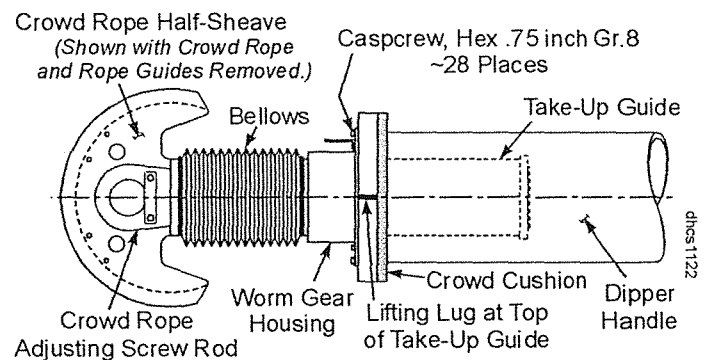
To disassemble the boom point sheave:

1. Remove the spacer from the shaft.
2. Remove the bearing retainer, bearing clamp and associated hardware from both sides of the sheave.

DIPPER HANDLE REMOVAL

1. Crowd the handle out until the saddle block is a slight distance from the crowd cushion. (This is to prevent undo tension on the worm gear housing capscrews.) Lower the dipper to the ground, resting it with the heel on the ground. Set all machine brakes, but do not lock out the power.
2. Remove the crowd and retract ropes. Refer to the proper instructions in the rope removal and replacement section of this manual.
3. Support the crowd screw half-sheave assembly with a crane, both at the half-sheave and at the take-up guide. (Weight is approx. 10,500 Lbs.) Be sure not to damage the bellows. Note the location of the lifting lug on the top of the take-up guide housing.

4. Remove the 28 - .75 inch capscrews, on the half-sheave end of the handle, that attach the worm gear housing and take-up guide to the handle. *Do not remove the 7 capscrews toward the inside of the worm gear housing, nor the 12 nuts and capscrews holding the cushion in place, at this time.*



NOTE: The 7 capscrews toward the inside of the worm gear housing attach the housing to the take-up guide. These screws must remain in place when removing the crowd rope take-up mechanism as a unit.

5. The crowd rope adjusting mechanism consists of the crowd half-sheave, screw rod, bellows, worm gear housing and crowd cushion. With the capscrews mentioned above removed, carefully slide the take-up mechanism out of the handle then lift it away from the handle and rest it on cribbing.
6. Secure a crane to the dipper handle, between the saddle block and the dipper. Insure that the crane will support the free end of the handle. Apply additional rigging to prevent the crane cable from sliding away from the dipper end of the handle. Support the saddle block to prevent it from rotating in either direction once the handle has been removed.



CAUTION: THE SADDLE BLOCK MAY ROTATE SUDDENLY ONCE THE HANDLE IS REMOVED. Be sure the saddle block is supported to prevent its rotation once the handle has been removed.



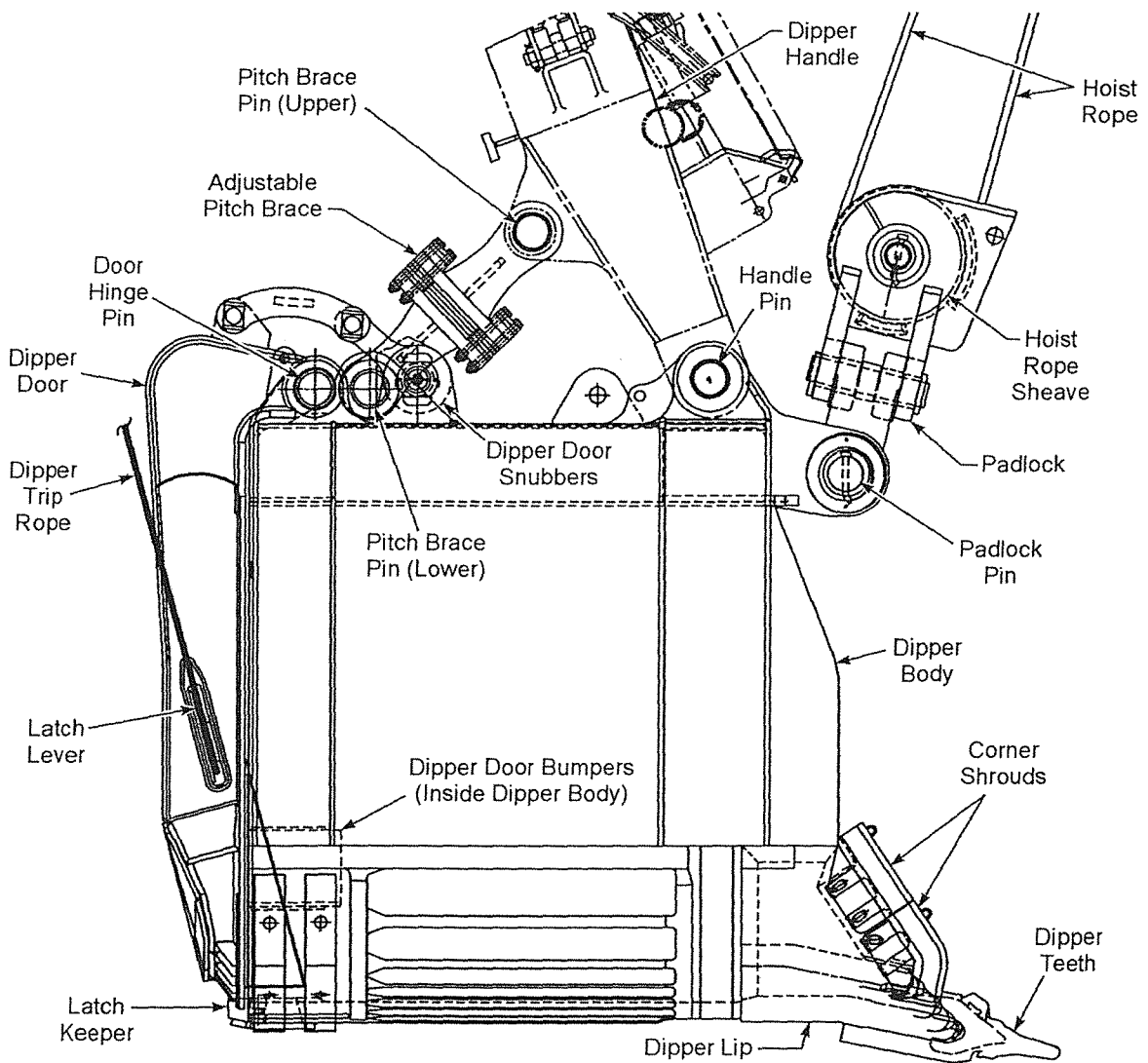
CAUTION: The rigging from the crane must be securely fastened with additional rigging to prevent the crane cable from sliding away from the dipper end of the handle, and also to support the free end of the handle once it is removed from the saddle block.

DIPPER ASSEMBLY

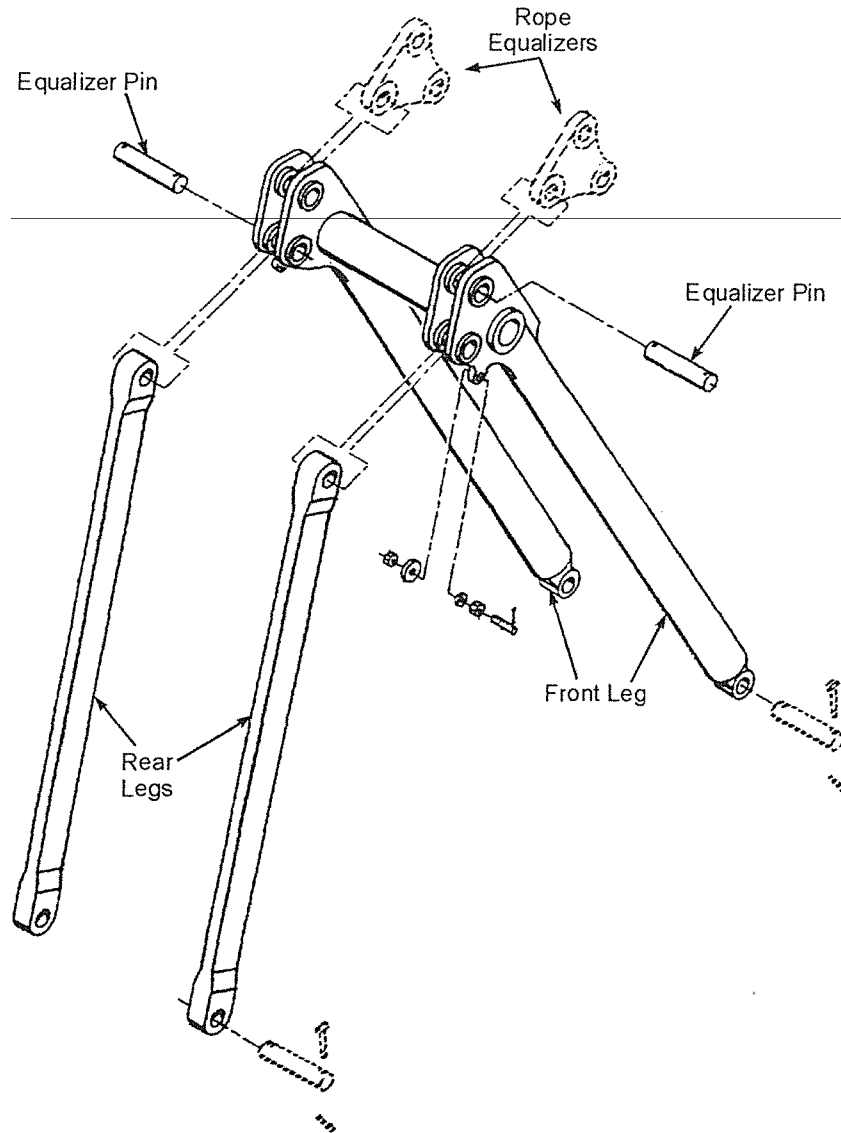
The dipper should be inspected before the start of each shift. The side and front surfaces provide critical reinforcement for the dipper. Consequently, they should be checked regularly for cracks and component wear. When wear spots develop in the side and front surfaces, the metal contour can be restored by building up the affected area. Contact the Bucyrus International Service Department for a specified welding repair solution.



DANGER: THE DIPPER HANDLE WILL FALL ONCE REMOVED FROM THE SADDLE BLOCK IF IT IS NOT FULLY SUPPORTED. Removal of bolts and pins requires the attached items to have proper support to release the load. Failure to comply could result in death, severe personal injury, or damage to the machine.



NOTE: Do not apply hard-surfacing to steel side and front surfaces. This could promote the development of cracks. Where wear is excessive, mild steel plates can be welded in place and hard-surfacing applied to these additional plates with excellent results.



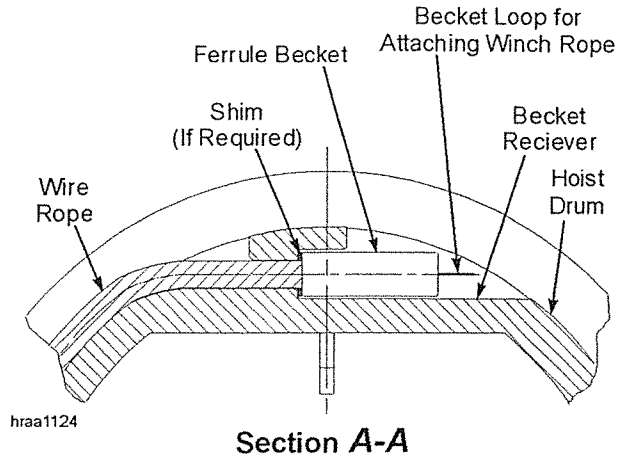
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DANGER: **STORED ENERGY!** Removal of equalizer pins requires the attached items to have proper support to release the load. Failure to comply could result in death, severe personal injury, or damage to the machine.

Under normal circumstances the A-Frame of the machine will most likely not be removed until disassembly of the machine is required. Please contact the Bucyrus International Service Representative should any unusual circumstances arise.

8. Attach the auxiliary winch line to each lead rope becket. Remove the lead rope keeper. Payout the winch line until the lead rope can be tied off then tie it off.
9. Attach the follow ropes to the winch line.
10. Attach a sling to the follow rope near the front of the padlock. Attach this sling to a ground vehicle.
11. Slowly and carefully payout the auxiliary winch while pulling the hoist rope away from the front of the machine with the ground vehicle. Lower the hoist ropes until the winch line can be disconnected.



NOTE: The ground vehicle is required to pull the weight of the hoist ropes over the boom point sheaves, and also help bend the ropes through the padlock sheaves.

12. Rotate the hoist drum in the lower direction until the lead rope keeper in is the lower rear quadrant.
13. Attach a winch and lower the lead ropes in the same manner as that used for the follow ropes. When the ends of the lead ropes approach the padlocks, one rope must be removed from the winch line, the remaining lead rope lowered through the padlock, and then removed from the winch rope.

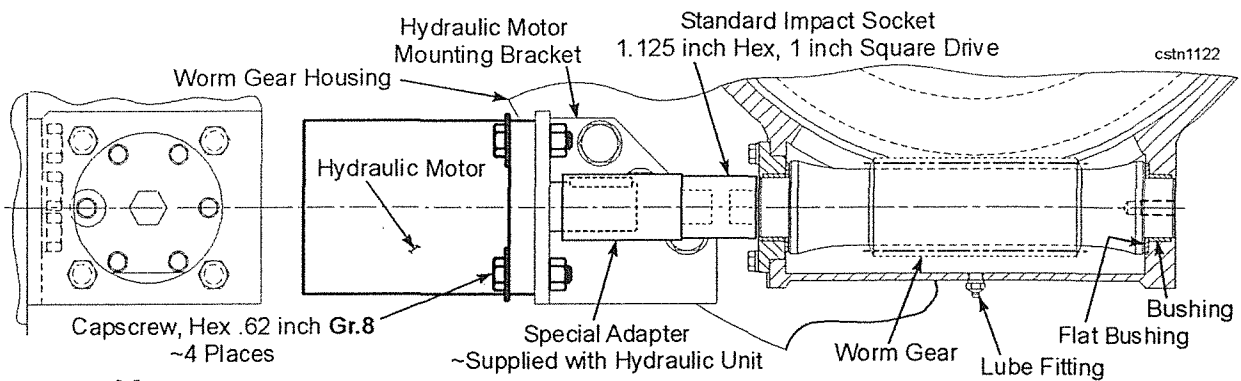
To install a new pair of hoist ropes:

1. Place the new hoist ropes approximately 10 feet in from of the dipper. If the ropes are on reels, they should be located so that the ropes unreel from the bottom of the reel.



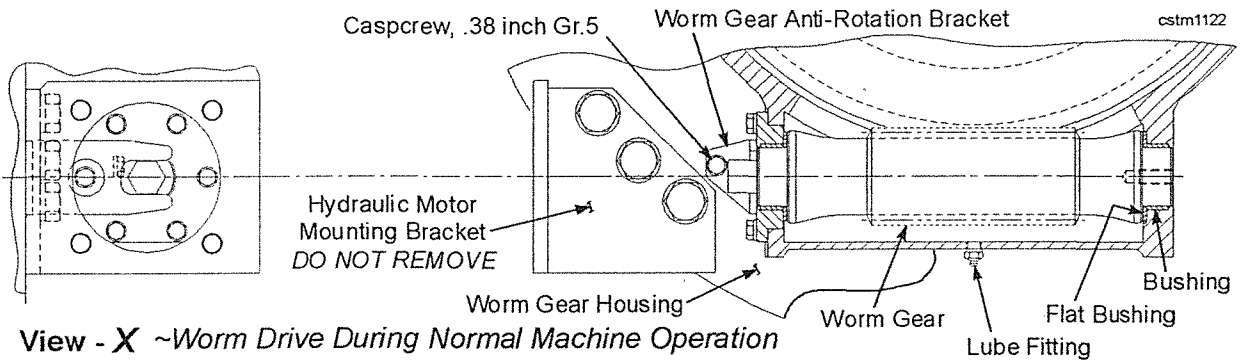
DANGER: ROPE END(S) WILL FORCEFULLY UNCOIL WHEN SHIPPING CONSTRAINTS ARE REMOVED.

2. Be sure a winch line runs through each padlock.
3. Attach a winch line to one end of each new rope, making them the new lead ropes.
4. Hoist the winch until the lead ropes have cleared the padlock. Attach the free end of each hoist rope to the winch line that its lead end is attached to.
5. Pull both ropes over the point sheave, being careful to keep the lead rope (rear rope in padlock) on the outside groove of the point sheave.



View - X ~Worm Drive During Crowd Rope Adjustment

5. Using the hand-held pendant on the hydraulic unit, extend the crowd screw rod until the crowd rope is tight. Back off the crowd screw rod 1/2 inch to allow for proper slack in the rope.
6. Remove the hydraulic motor from the bracket on the worm gear housing and place it in its holder on the hydraulic unit.



View - X ~Worm Drive During Normal Machine Operation

7. Replace the anti-rotation bracket on the worm shaft.

RETRACT ROPE TIGHTENING

NOTE: The constructional stretch may be out of the retract rope when it becomes necessary to adjust the rope for about the third time. Therefore, after the third rope adjustment or after replacement, back off the adjustment by one .5 inch shim after obtaining a tight rope by pressurizing the cylinders to prevent working with an overly tight rope.

NOTE: Do not overtighten the ropes. The ropes are properly adjusted when a very slight curvature is noticeable on the retract rope (a 3 to 5 inch sag) with a tight crowd rope.

Section **6**
Brakes and Couplings
BRAKES

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

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

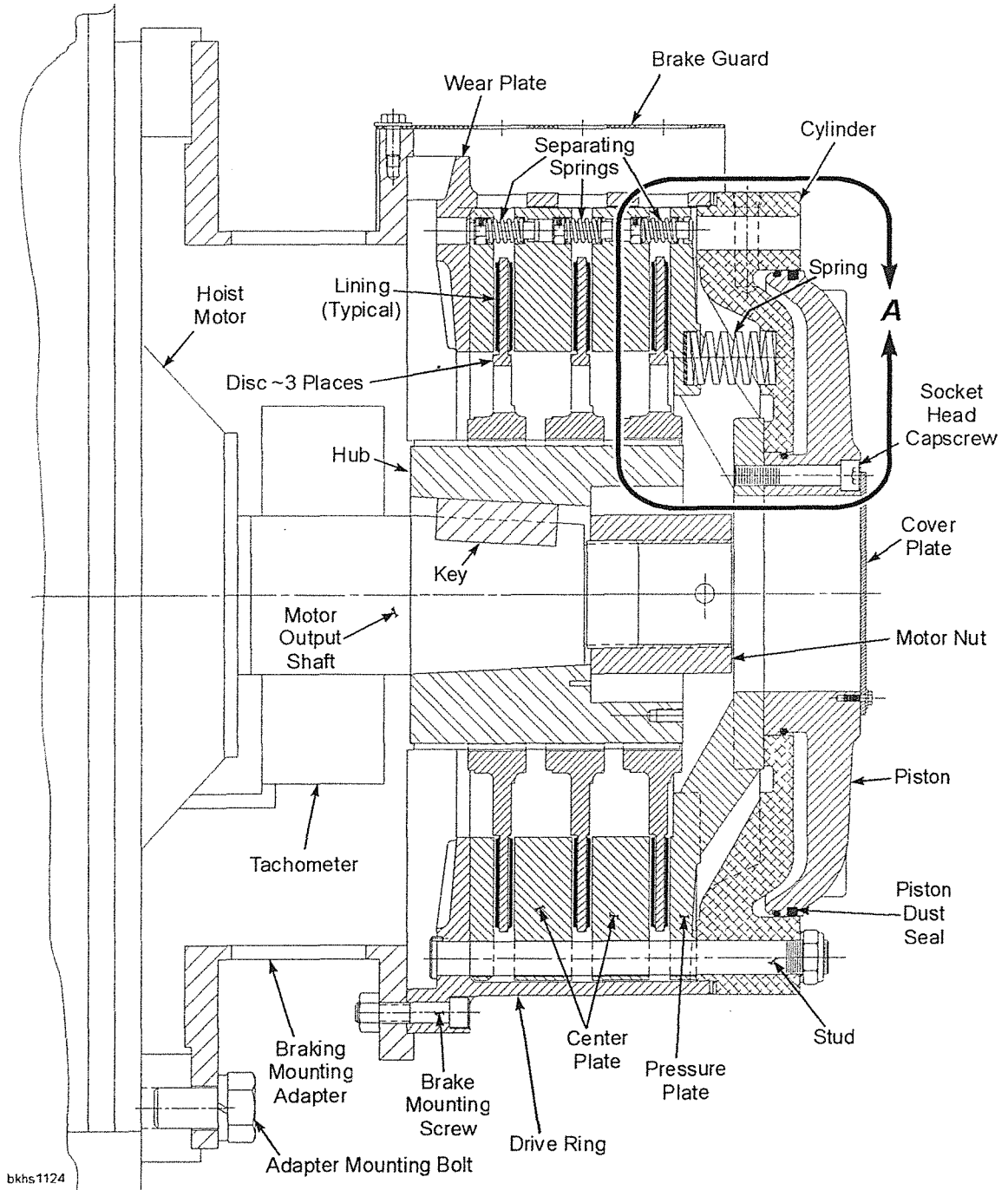
Each brake is fitted with a proximity sensor to monitor lining wear and a limit switch to monitor the brake set or released position. When the lining wear limit is reached, it is announced on the operator's display terminal. The brake position is announced in the operator's control screen.

		Hoist	Crowd	Swing	Propel
	Quantity	1	1	2	2
	Motor Frame Size	820	812	812	812
	Rotors per Brake	1	1	1	1
	Weight of Brake	1346 Lbs.	490 Lbs.	490 Lbs.	650 Lbs.
Mounting Screws	Quantity	12	12	12	12
	Size	.75 Inch	.75 Inch	.75 Inch	.75 Inch
	Torque	200-220 Ft.Lbs.	200-220 Ft.Lbs.	200-220 Ft.Lbs.	200-220 Ft.Lbs.
		(271-298 Nm.)	(271-298 Nm.)	(271-298 Nm.)	(271-298 Nm.)

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Machine Motion Brakes

HOIST BRAKE

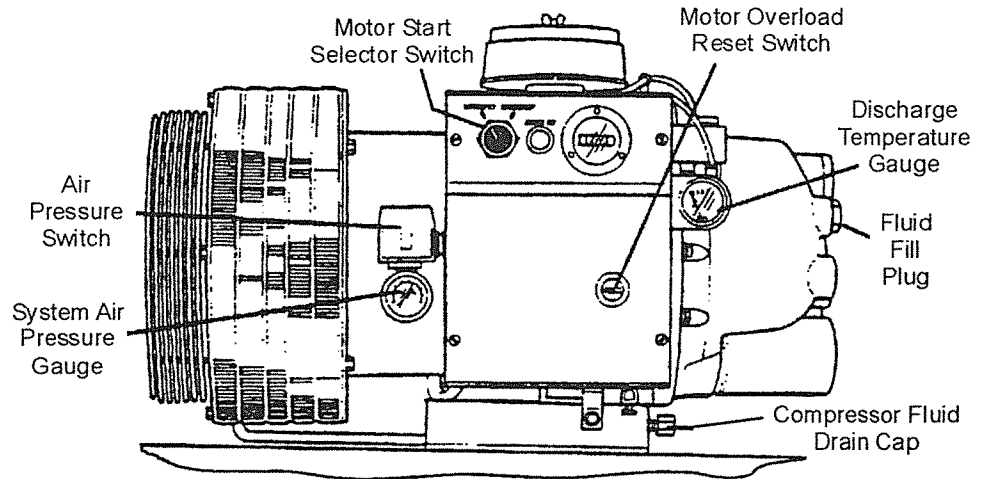
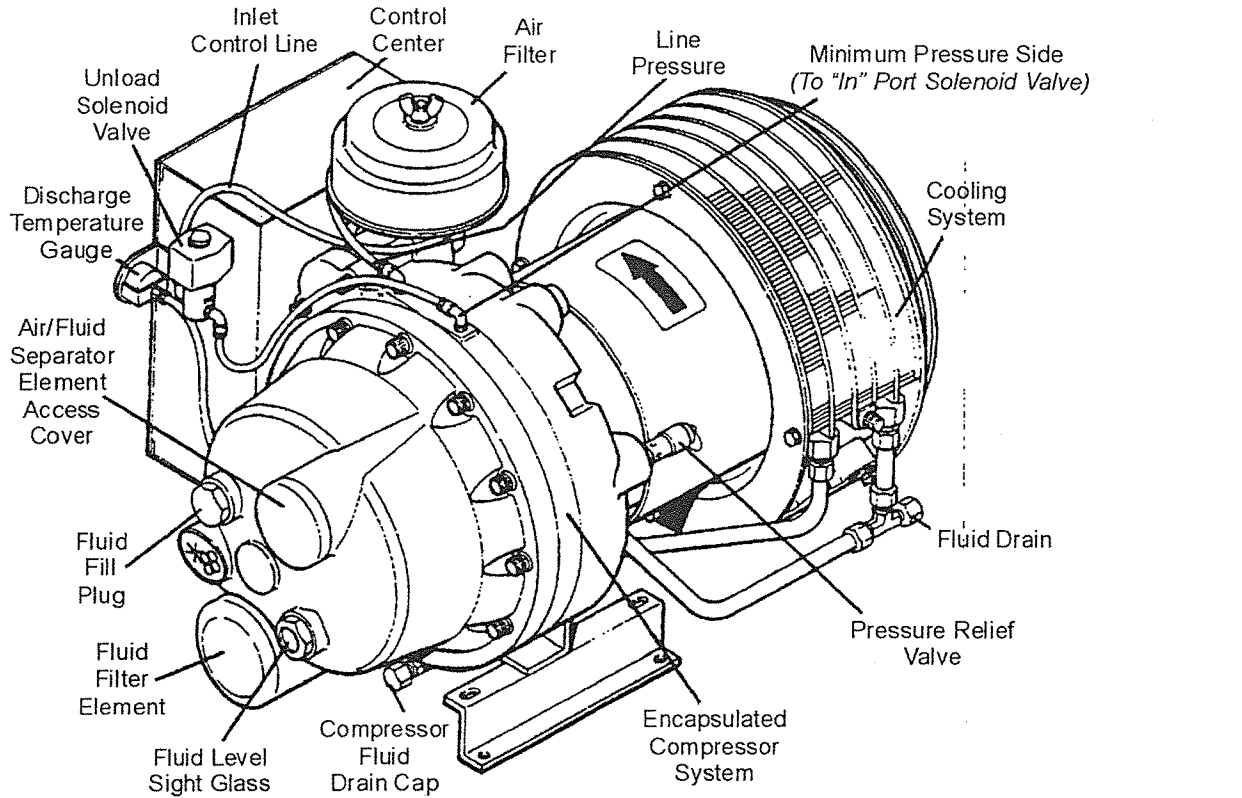


BOLTING UP FLANGES

- All the rubber blocks should be in place and the driving and driven machinery should be brought together with the correct gap between the ends of the shafts. The shaft end gap is shown on the drawing and in the table below.
- Fit the cover and secure with bolts. Do not force the rubber elements into their cavities by tightening the cover bolts. Note that couplings size PM 180 and above use through bolts to secure the cover.
- Connect the two halves of the coupling using the bolts supplied with the coupling. It will be easier to fit these bolts if their shanks are coated with an anti-seize lubricant.
- Bolts normally have metric threads. Their sizes are shown in the table. Tighten the bolts to the torque values shown in the table.

BOLT TIGHTENING TABLE

Coupling Size	Flange Bolt		Cover Bolt	
	Size	Torque	Size	Torque
PM 0.4	M8	17 ft-lb	M8	17 ft-lb
PM 0.7	M8	17 ft-lb	M8	17 ft-lb
PM 1.3	M8	17 ft-lb	M8	17 ft-lb
PM 3	M8	17 ft-lb	M8	17 ft-lb
PM 6	M8	17 ft-lb	M8	17 ft-lb
PM 8	M12	63 ft-lb	M10	33 ft-lb
PM 12	M12	63 ft-lb	M12	63 ft-lb
PM 18	M16	162 ft-lb	M16	162 ft-lb
PM 27	M16	162 ft-lb	M16	162 ft-lb
PM 40	M16	162 ft-lb	M16	162 ft-lb
PM 60	M20	266 ft-lb	M20	266 ft-lb
PM 90	M20	266 ft-lb	M20	266 ft-lb
PM 130	M24	461 ft-lb	M24	461 ft-lb
PM 180	M24	461 ft-lb	M24	461 ft-lb
PM 270	M30	922 ft-lb	M30	922 ft-lb
PM 400	M36	1615 ft-lb	M36	1615 ft-lb
PM 600	M36	1615 ft-lb	M36	1615 ft-lb



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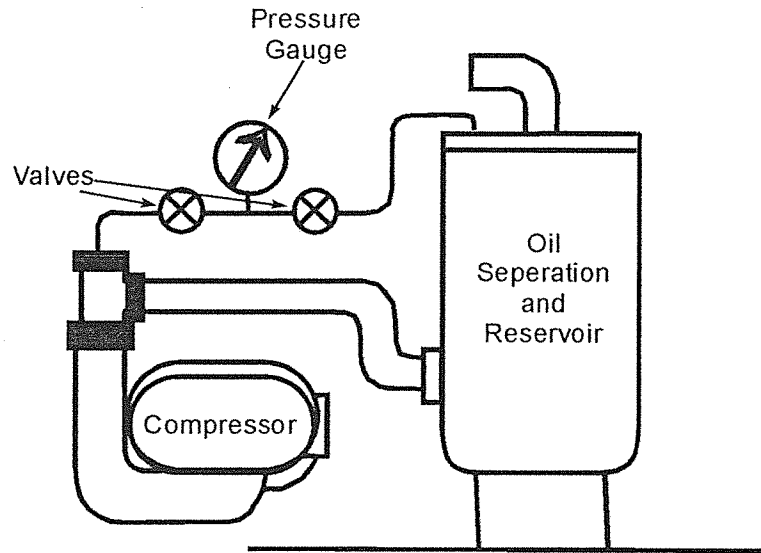
Air Compressor

For further specific information on the air compressor, refer to the compressor manufacturer's manual supplied with this machine.

PRESSURE DROP CHECK

A pressure drop check is performed to evaluate the condition of the separator element and lubricant oil within the compressor reservoir and system.

1. Connect a pressure gage within the system (as shown below) so that a reading may be taken on either side of the separator.
2. The pressure differential is measured by alternately opening and closing the valves.
3. If the pressure differential exceeds 8 PSI the separator should be changed.



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The savings from electrical usage alone will outweigh the cost of the new element and the system will operate at optimum efficiency.

NOTE: Do not attempt to clean the separator element - it must be replaced!

DRIVE BELT TENSION

Proper drive belt tension and alignment are provided initially at the factory. Check belt tension and alignment prior to initial start-up of the unit. The sheaves should be aligned with a straight edge. The tension should be just adequate to prevent a "squeal" on start.

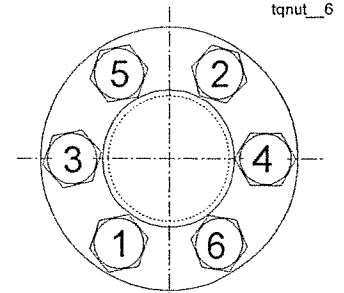
To remove the belts:

1. Remove the fan shroud from the cooler assembly.
2. Remove the belt guard from the motor.
3. Loosen the motor mount bolts which extend through the base of the motor housing.
4. Using the 2 adjustment bolts provided, release the pressure from the belts adequately to remove them from the sheaves of the pulleys.

Installation of the belts is the reverse operation of the removal.

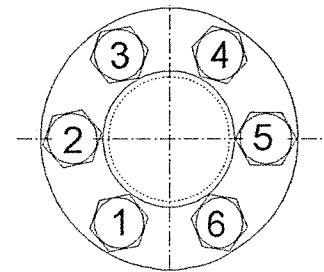
TIGHTENING PROCEDURE ~TORQUE ROD, TAPERED SLEEVE & 1.0 INCH NUT

1. Check the base of the torque nut to ensure that all jackbolts are flush with the bottom.
2. Insert the expansion sleeve from the top of the structure.
3. Insert the tapered stud into the sleeve. Note the direction of the taper on the rod.
4. Slip the special washer (spacer) over the lower threaded end of the stud.



"STAR" Tightening Pattern

5. Spin the lower torque nut onto the stud by hand.
6. Tighten the lower nut jackbolts to **27 Ft.Lbs.** as follows:
 - a. Snug all jackbolts to **5 Ft.Lbs.** each.
 - b. Using the STAR pattern shown, tighten all jackbolts to **15 Ft.Lbs.**
 - c. Switch to the circular pattern shown and tighten all jackbolts to **20 Ft.Lbs.**
 - d. Continue with the circular pattern and tighten all jackbolts to **30 Ft.Lbs.** Refer to the notes below.

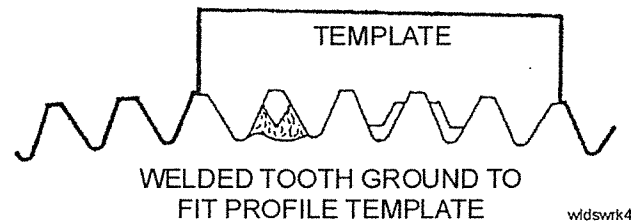
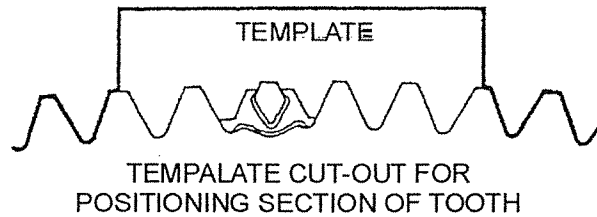
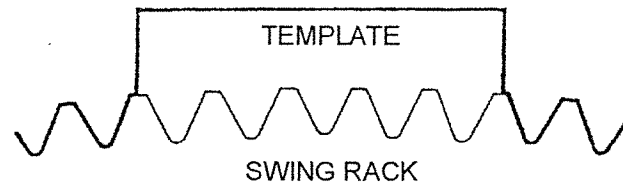

 CIRCULAR
Tightening Pattern

*Torque Nut with
6 Jackbolts*

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

NOTES:

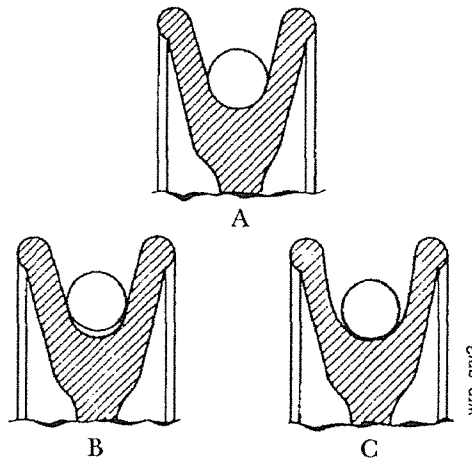
- With longer rods and bolts, stretch in the rod or bolt occurs during tightening of the jackbolts. Therefore, after tightening with the circular pattern in step 4-d above, the first jackbolt may have loosened. The higher torque value is used in this step only to speed the tightening process. After performing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



7. When groove welding is finished check carefully for low spots and fill in as required. Grind the weld smooth and flush with the adjacent tooth surfaces. Use the tooth profile template to check grinding of a welded-on tooth segment. Grinding of the radius at the root of the tooth is very important. Avoid any nicks, gouges or grinding marks in a vertical direction. Grind a smooth radius using small diameter (peanut) grinders. Failure to achieve a smooth, notch-free radius may result in future cracking at the root of the tooth.
8. After the swing rack has cooled to ambient temperature, dye-penetrant test the repaired tooth for soundness.

INSPECTION OF SHEAVES AND DRUMS

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

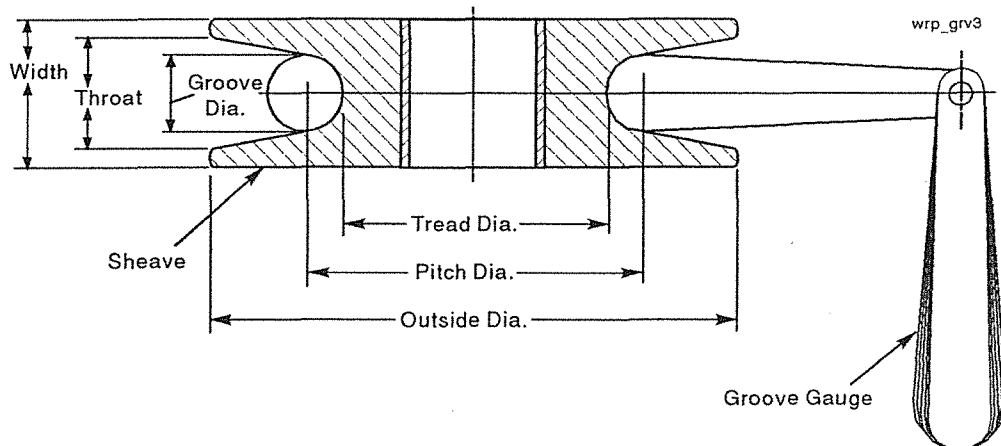


Examples of Sheave Groove Conditions

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

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

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



Groove Gauge for New or Re-Worked Sheaves

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