Technical Manual

SAFETY PRECAUTIONS – continued

After servicing, be sure all tools, parts or servicing equipment are removed from the machine.

Protective eye goggles should be worn at all times when working on the air conditioning system. Work on the air conditioning system only in a well ventilated area.

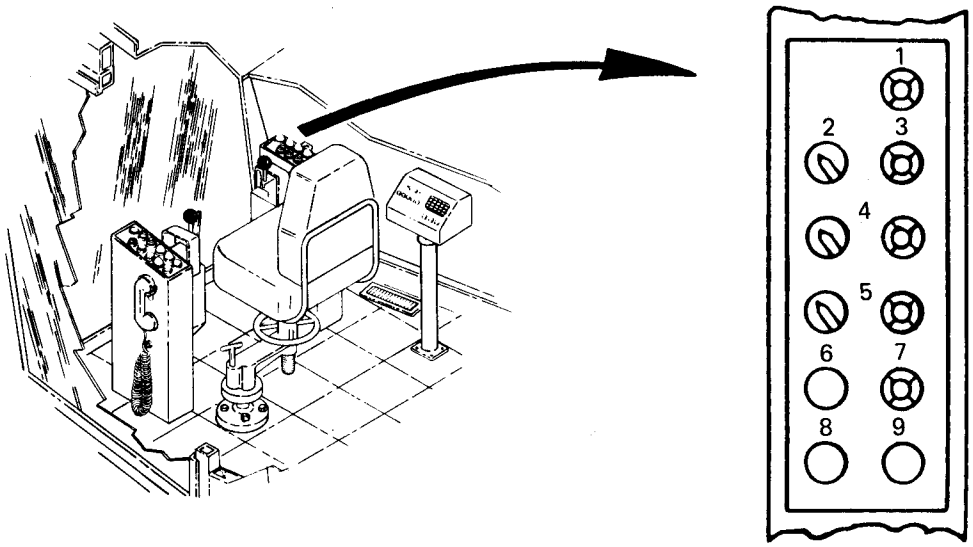
Wipe away excess lubricants around bearings and gears. Never lubricate parts in motion.

Operate machine on level ground and be continuously aware of swing clearance. Never hold a load longer than needed in dump cycle. Use swing brakes only when machine is stopped.

back into the power source, thus preventing heat created by mechanical friction brakes.

If hoist or drag controllers are returned to neutral with machine in motion, the control automatically plugs that motion to slow it down and finally come to rest.

CONTROL PANELS on top of each controller stand contains push buttons, selector switches and indicator lights; all clearly marked.



The panel located on top of hoist stand (right hand) contains five lights, three selector switches and three push buttons. They are:

1. Propel Brake. This red light will come on when the propel brakes are set.

2. Drag-Propel Brake. This switch will either set or release the drag or propel brakes depending on which mode the machine is in.

3. Drag Brake. This red light, when lit, indicates the drag brakes are set.

4. Swing Brake. Moving this switch to the left sets the swing brakes and right movement releases them. The red light will come on when the brakes are set.

5. Hoist Brakes. This switch either releases or sets the hoist brakes. The red light, when lit, indicates the hoist brakes are in the set position.

TUB CHECK LIST – Note the following items:

Cracks, broken welds.
Deformed bottom plates.
Bent or damaged bulkhead plates.
Hook shoe(s) adjustment with pin lock in place.
No obstructions in roller path or main rotating gear.
Trail cable in proper place.

HOUSE CHECK LIST – Note the following items:

Automatic lube system has adequate lube supply.
All gear cases have proper oil level and all filters installed.
Check air compressor crankcase oil level and drive belts tension.
Main house crane hoist is not parked on a crossover.
All limit switches work correctly.

FRONT END CHECK LIST – Check the following items:

Check bucket for wear, worn, broken or missing teeth, loose or missing pins, weld cracks.
Boom for cracks, bent pipes.
Condition of boom support ropes.
Intermediate boom support ropes have proper tension.
Condition of hoist and drag ropes.
Condition of fairlead components.

NOTE: If any problems are found after going thru the above check lists, notify maintenance AT ONCE, so corrections can be made.

TYPICAL START-UP from a completely shutdown machine. Use the controls on outside of power control room to start the Filter and Duct Fans, Motor Blowers, Exciter and M-G set. Start the Air Compressors at the starting panel located on each compressor unit.

All starters are protected by circuit breakers for overload protection and to open circuits for maintenance. **DO NOT** use breaker as an OFF-ON switch. Make sure ALL breakers are ON before start-up.

First, at the starting and metering panel, check to be sure that the "phase check" light is lighted. Then, at the air compressor unit, start the air compressors, using the selector switch.

Now start the filter fan system. Move the selector switch to "Start", hold momentarily, then release. The bleed duct fan will start first and then, after a five second delay the main fan will automatically start. Make sure that the indicator is lit but the sound of the fans will

SECTION 3

LUBRICATION

INDEX

SPECIAL PRODUCTS:

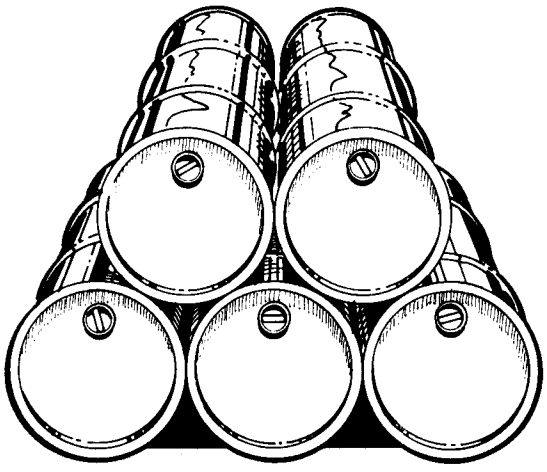
WRL – Wire Rope Lubricant. May be of either solvent cut-back asphaltic water resistant type or penetrating oil type containing corrosion and rust preventatives, anti-wear and other suitable polar additives. The former are preferred for wire rope operating in extremely wet environments while the latter are preferred for normal shovel and dragline operations where contamination of the wire with highly abrasive dust particles is the primary problem.

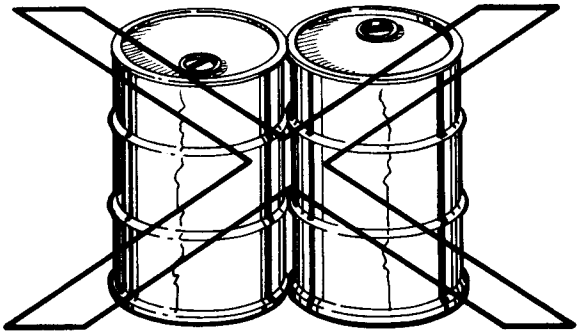
*WCL – Walking Cam Lubricant. A special product designed to lubricate bronze bushings. These bushings, up to 120" in diameter, are subjected to loads in excess of 2,000 psi in some areas.

APPROVED PRODUCTS:

*Jesco "Walking Cam Lubricant"
Mobil Oil "Mobiltac E"
Bel-Ray "ALO-Open Gear Lubricant"
Whitmore "Liquid Gear Composition"

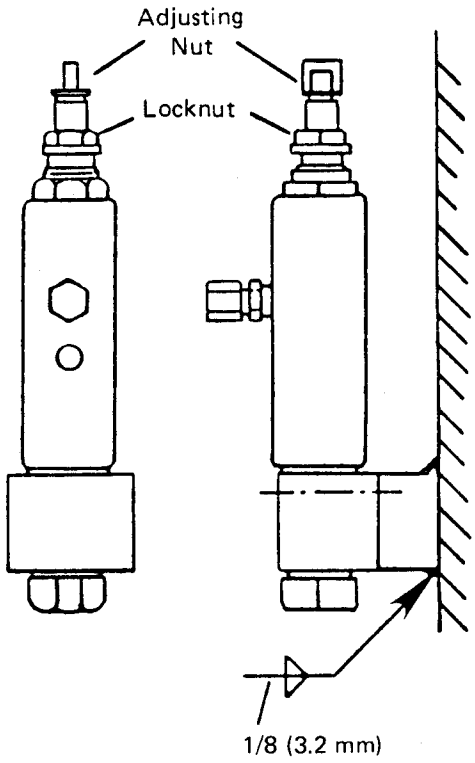
PLEASE STORE LUBRICATION DRUMS ON SIDE WITH OPENING UP. FILTER ALL OIL BEFORE ADDING TO SYSTEM.





NAME OF PART	TYPE	NO. OF POINTS	LOCATION	LUB. SYM.	METHOD & FREQUENCY
Intermediate Support Ropes Connection	Bushing	6	End of Pins	MPG	Automatic
Hoist Rope Float Sheaves	Bushing	2	End of Shaft	MPG	Automatic
Retaining Roller in Hoist Float Sheave Assembly	Bushing	2	In Bearing Block	MPG	Automatic
Rope Dampers	—	8	2 Each Damper	MPG	Hand, 6 Mo.
Boom Foot Pins	Plain	2	Bracket at Front of Rot. Frame	MPG	Hand, 500 Hrs.
LUBRICATION OF DRAGLINE BUCKET					
Dump Block Sheave	Anti-Friction	2	In End of Shafts	MPG	Hand, 8 Hrs.
Dump Block Anchor	Ball Joint	2	In End of Pins	MPG	Hand, 8 Hrs.
Trunnion Link	Steel Bushing	2	In End of Pins	MPG	Hand, 8 Hrs.
LUBRICATION OF MISCELLANEOUS POINTS					
Filter House	Anti-Friction	6	In Motor End Bell	EMG	Hand (see Electrical Section)
Filter Ducts	Anti-Friction	6	In Motor End Bell	EMG	Hand (see Electrical Section)
Filter House Blowers	Pillow Block Bearings	12	—	MPG	Hand, 500 Hrs.

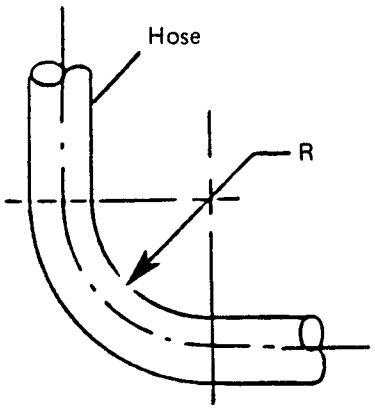
ADJUSTING AND MOUNTING OF LINCOLN INJECTOR



A new injector should be preset for maximum discharge. Maximum adjustment is set by loosening locknut and turning adjusting screw until daylight (space) appears between indicator pin and adjusting screw. Turn adjusting screw back down until it touches the indicator pin, then lock in place with the locknut.

To reduce discharge, start at maximum setting. With locknut loosened, turn adjusting nut clockwise until desired discharge is reached. Set locknut. DO NOT adjust more than six full turns (from maximum) of the adjusting screw. Check discharge for 3 to 4 lube cycles for operation of injector.

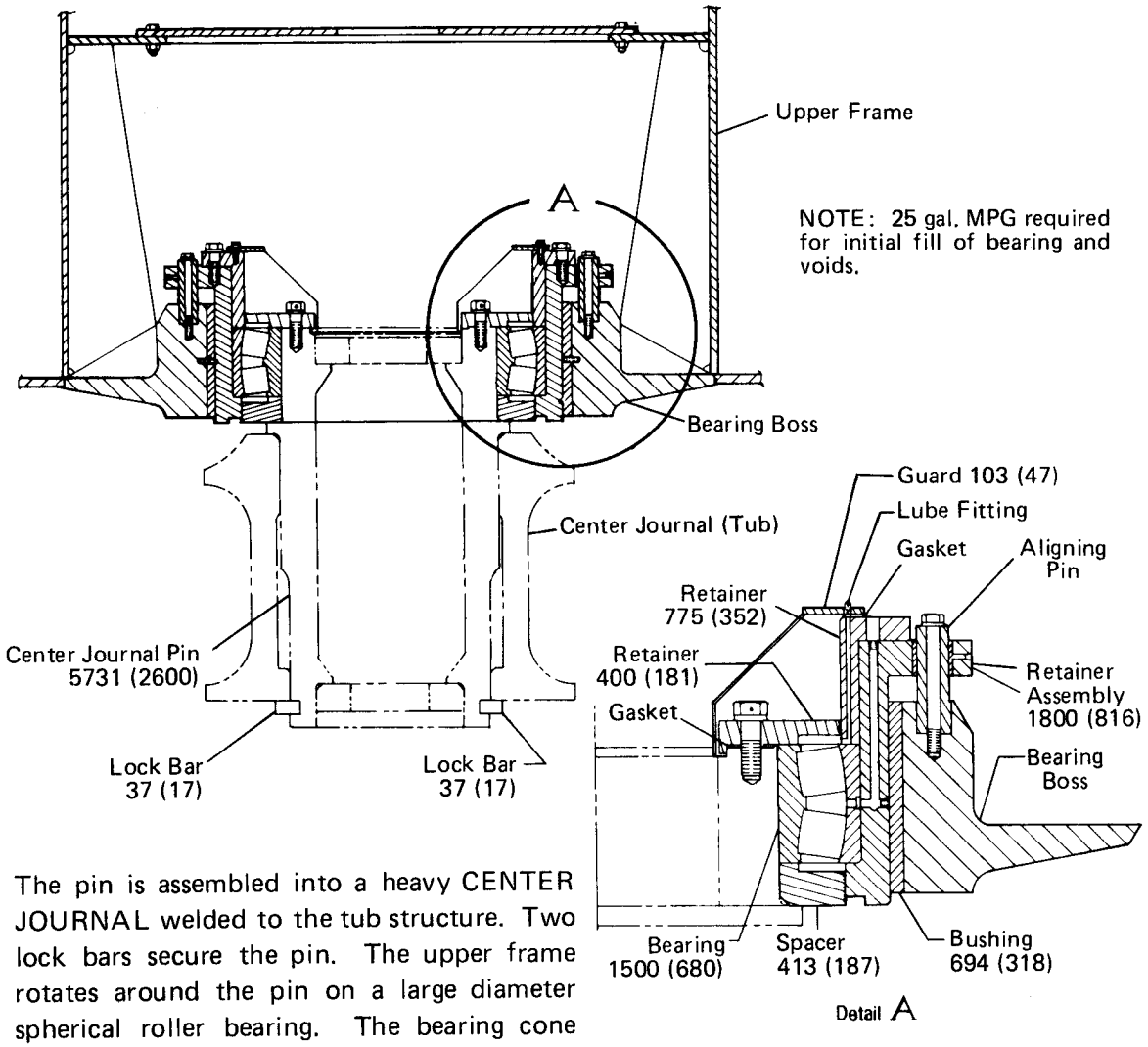
MINIMUM HOSE BEND RADIUS



MPSD NO.	Min. Radius (R) inches	mm
Hose R5-5	3-3/8	85.7
Hose R2-8	7	177.8
Hose R2-12	9-1/2	241.3
Hose R2-16	11	279.4

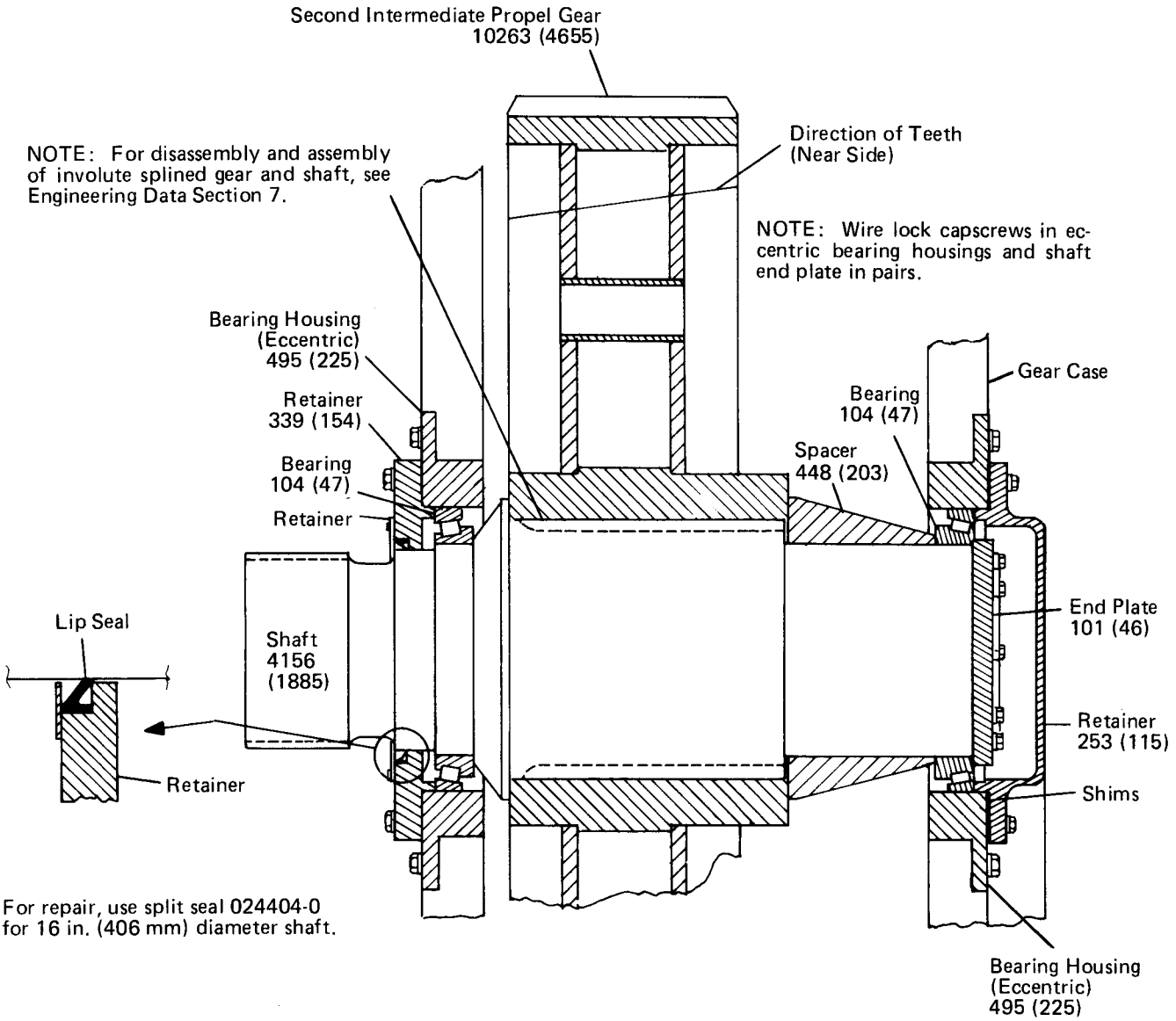
CENTER JOURNAL pin holds the rotating frame and the tub in concentric alignment at the center of rotation.

DANGER: Remove power from machine prior to removing housing from collector rings or gaining access to rings area.



The pin is assembled into a heavy CENTER JOURNAL welded to the tub structure. Two lock bars secure the pin. The upper frame rotates around the pin on a large diameter spherical roller bearing. The bearing cone (inner race) is clamped between a spacer and a bearing retainer which is bolted to the top of the center journal pin. The bearing cup (outer race) is mounted in a retainer assembly which moves vertically on four aligning pins. These pins also prevent rotation of the retainer assembly.

It is not necessary to disconnect incoming electrical power to service or inspect the center journal bearing because the collector rings are isolated. It will be necessary to disconnect and remove the collector rings if bearing replacement is required.

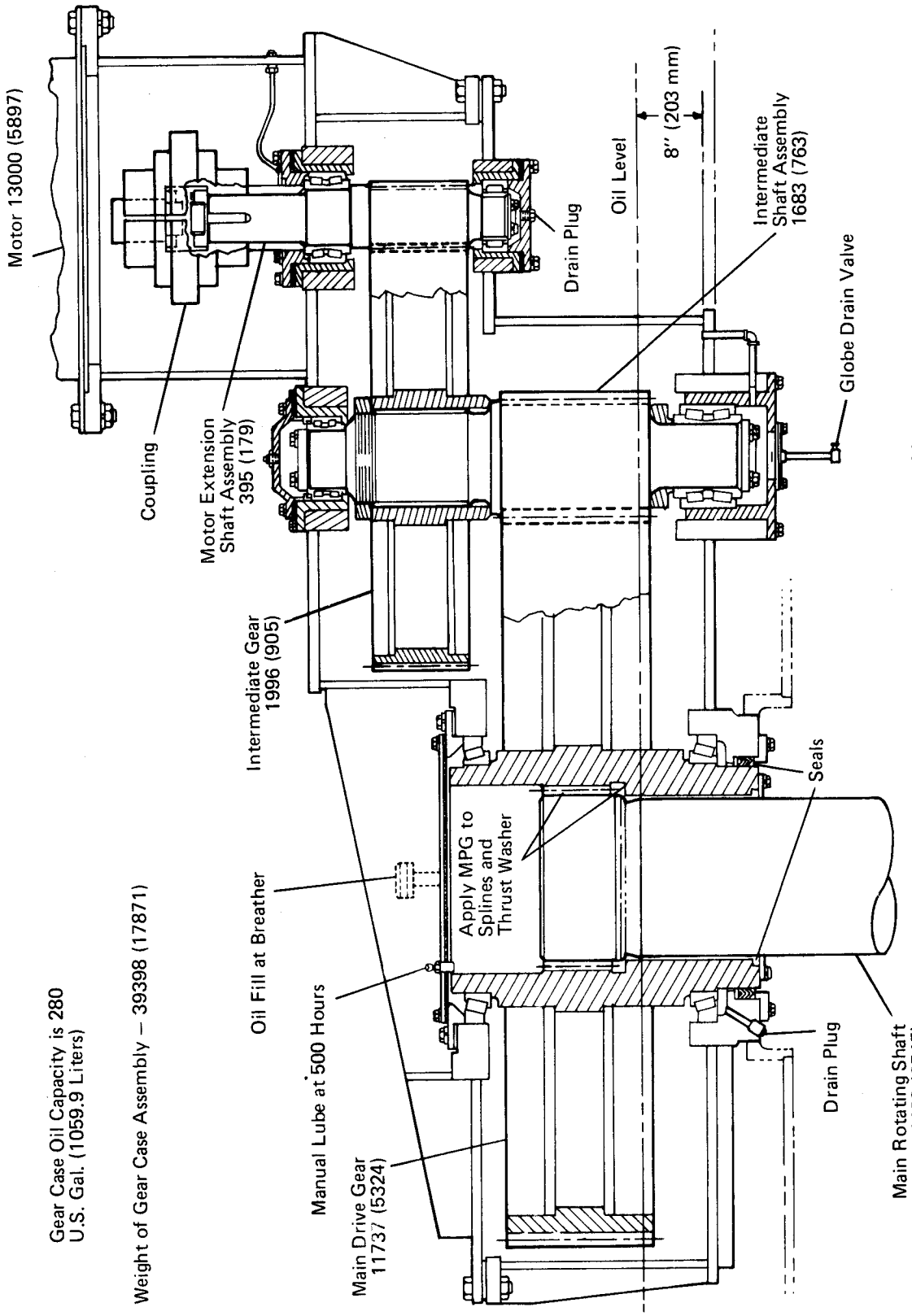


Spray shaft with Molycote M-3402 in lip seal area. Pack seal cavities with Belray silicone valve seal lubricant before installing seal.

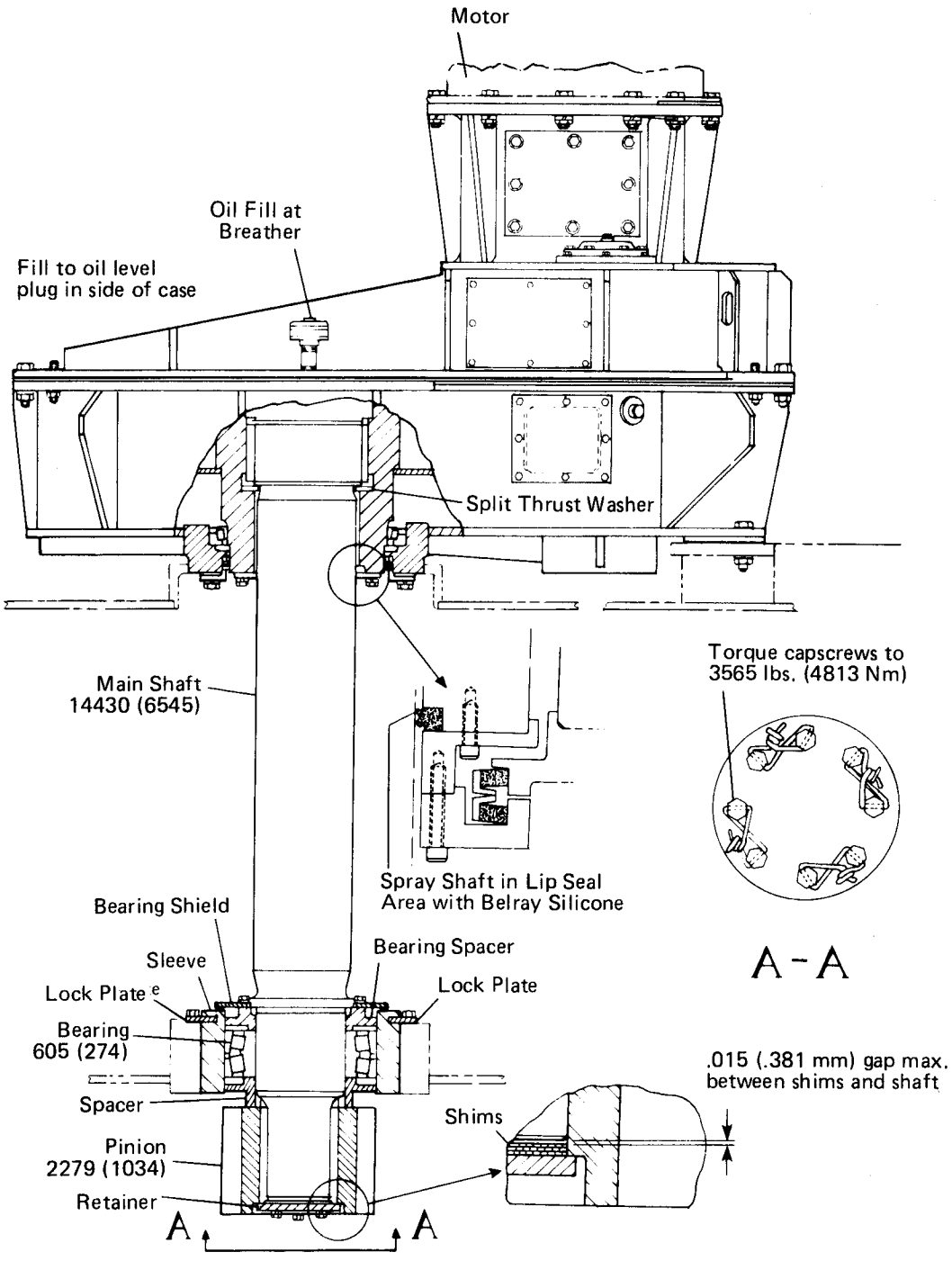
NOTE: Correct position of eccentric bearing housings is set at time of manufacture and fixed by installation of a dowel pin.

BEARING SET-UP PROCEDURE:
Take up on cup follower until bearings bind slightly in rotation. Install sufficient shims to give .004 to .008 (.10 mm to .20 mm) preload. Wire lock retainer (cup follower).

SECOND INTERMEDIATE PROPEL SHAFT ASSEMBLY



ROTATING GEAR CASE ASSEMBLY
(Sheet 1 of 3)



MAIN ROTATING SHAFT ASSEMBLY

The **HOIST/DRAG INTERMEDIATE SHAFT ASSEMBLIES** drive the drum gears. There are three of these assemblies in the hoist machinery and two in the drag machinery. The assembly consists of a large double helical gear, a double helical pinion, a shaft, bearings and a bearing housing.

The intermediate gear and pinion are splined to the intermediate shaft which is supported by two single row roller bearings. The bearings on the drive gear end of the shaft is mounted in the boss of the gear case while the other bearing is mounted in a housing which is pinned to the gear case structure. The intermediate shaft pinion is a guarded open gear which drives the drum gear.

NOTES:

B. INSPECTION OF FRICTION DISCS – To determine if friction discs need to be replaced, release air (engage brake) remove shield, and check if the wear indicating step on the friction disc is still visible. Also check if oil or grease has contaminated the surfaces. If the step is visible and the surfaces are not contaminated, no replacement is necessary. Reinstall shield. If the step is not visible, or if surfaces are contaminated, friction disc must be replaced. See Figure F.

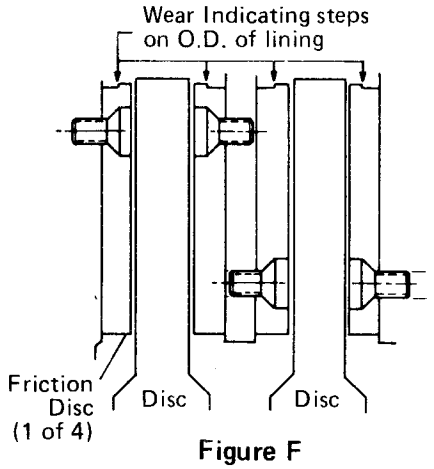


Figure F

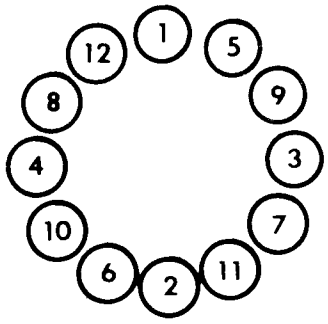


Figure G

C. REPLACEMENT OF FRICTION DISCS ON SINGLE DISC BRAKE (SWING) –

DANGER: Prior to disengagement of the brake, make sure machine will remain in a safe position. Failure to do so could result in personal injury or death.

1. Remove locknuts in alternating sequence in increments of 1/4 of the exposed stud thread length. See Figure G.

CAUTION: If a stud comes loose from the mounting flange, clean stud threads thoroughly. Apply Loctite 277 or equivalent. Stud must be threaded back in until it bottoms in mounting flange.

2. With locknuts removed, end plate, spring housing, and pressure plate can be removed as an assembly.

3. Remove disc from gear. Inspect disc for wear. If either surface of the disc is worn more than 1/32 inch (.7938 mm), replace the disc. Removal of the disc from the gear will expose the friction disc mounted on the brake mounting flange.

4. Remove old friction discs and replace with new friction discs and new flat head screws. Torque screws to 20 ft.-lbs. (27 Nm).

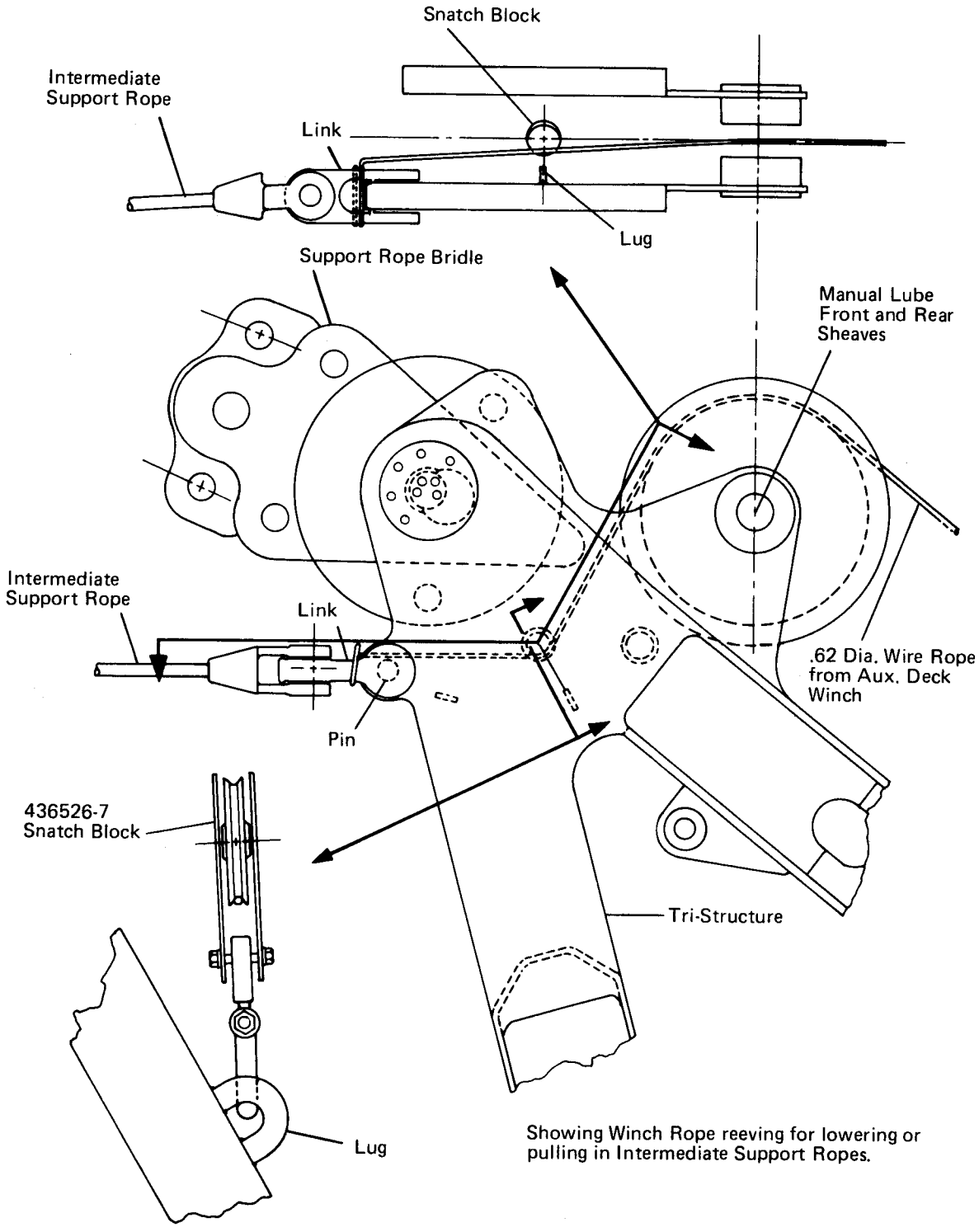


FIGURE 2
DISCONNECTING INTERMEDIATE SUPPORT ROPES

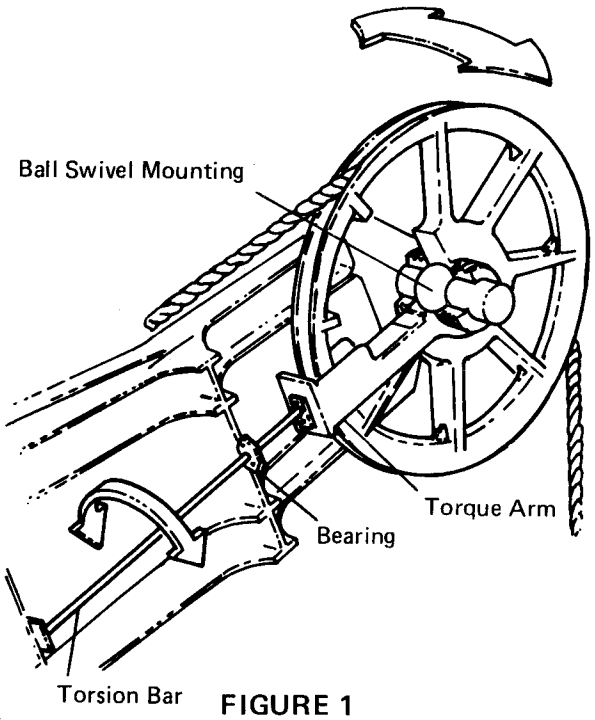


FIGURE 1

BOOM POINT SHEAVE ASSEMBLY contains two sheaves which rotate on a single shaft. Each sheave has two tapered roller bearings. Each sheave and bearing assembly is mounted on a spherical bushing which swivels on ball shaped part of shaft, allowing sheave to tilt or oscillate as hoist rope angle changes. Side movement of spherical bushing is limited by pins in sheave shaft.

A torsion bar assembly is attached to each sheave assembly. Torsion bar returns sheave to normal or vertical position when hoist rope aligns with centerline of boom. Live end of torsion bar is attached to sheave bearing retainers. Dead end of torsion bar is attached to bulkhead plate in boom structure.

REMOVAL OF BOOM POINT SHEAVE ASSEMBLY – Lower the bucket to the ground, then use auxiliary winch ropes to remove hoist ropes from machine. Auxiliary winch ropes will also be used to lower point sheave assembly and rope guard. Reeve winch ropes over hoist drum, then over hoist rope deflecting sheaves to boom point jib crane. Reeve ropes over jib crane sheaves and thru snatch blocks. See Figure 2. Use cable sling to attach snatch blocks to rope guard over point sheaves. Remove eight attaching bolts from rope guard and lower guard to ground. Weight of guard is 1600 pounds (726 kg).

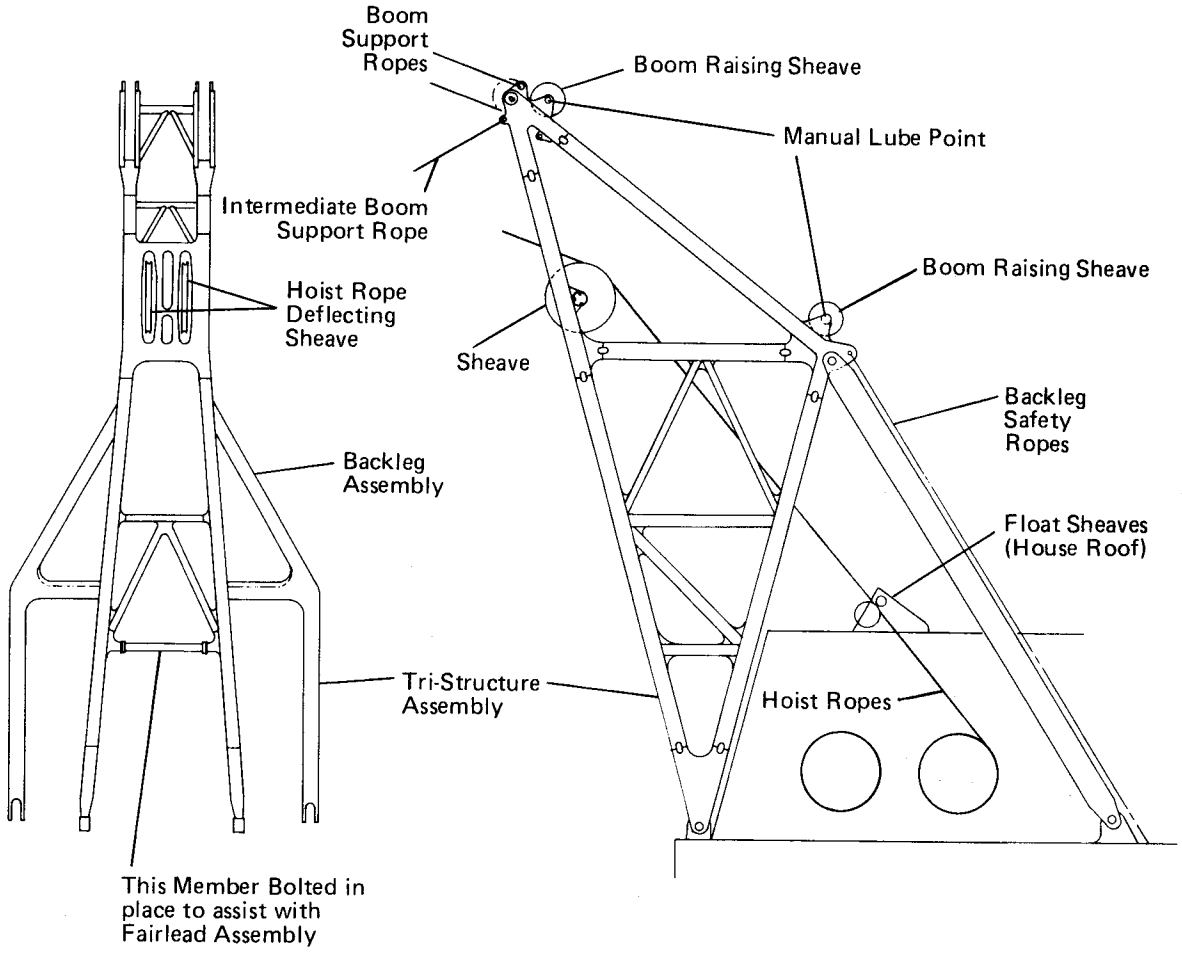
CAUTION: Good communication between personnel at point and those in house at winches is critical at this time.

Attach snatch blocks to two lifting lugs (eyebolts) at each end of sheave shaft. Pull winch ropes to tight condition. Remove special capscrews from torsion bar assemblies where torque arms attach to sheaves. Remove torque arms. Loosen outside dust boot clamps and slide boots toward sheaves. Wrap cable slings around sheave shaft and connect them to 6 ton (5.4 t) come-along on each side of shaft. Pull cable slings to tight condition. See Figure 2.

Disconnect lube lines, then cap lines and fittings to keep out dirt.

Remove six special capscrews and lock plate from each end of shaft. Then remove four capscrews from boom point caps which hold shaft in boom. Caps are match marked to boom point and must be reinstalled in same position.

TRI-STRUCTURE ASSEMBLY is a welded structure connected by pins to front girder of rotating frame and to back leg assembly. Back legs and four safety ropes anchor tri-structure assembly to rotating frame deck. Boom support rope bridles and intermediate support ropes are attached to top of tri-structure. Hoist ropes are routed thru tri-structure over deflecting sheaves.



TRI-STRUCTURE ASSEMBLY

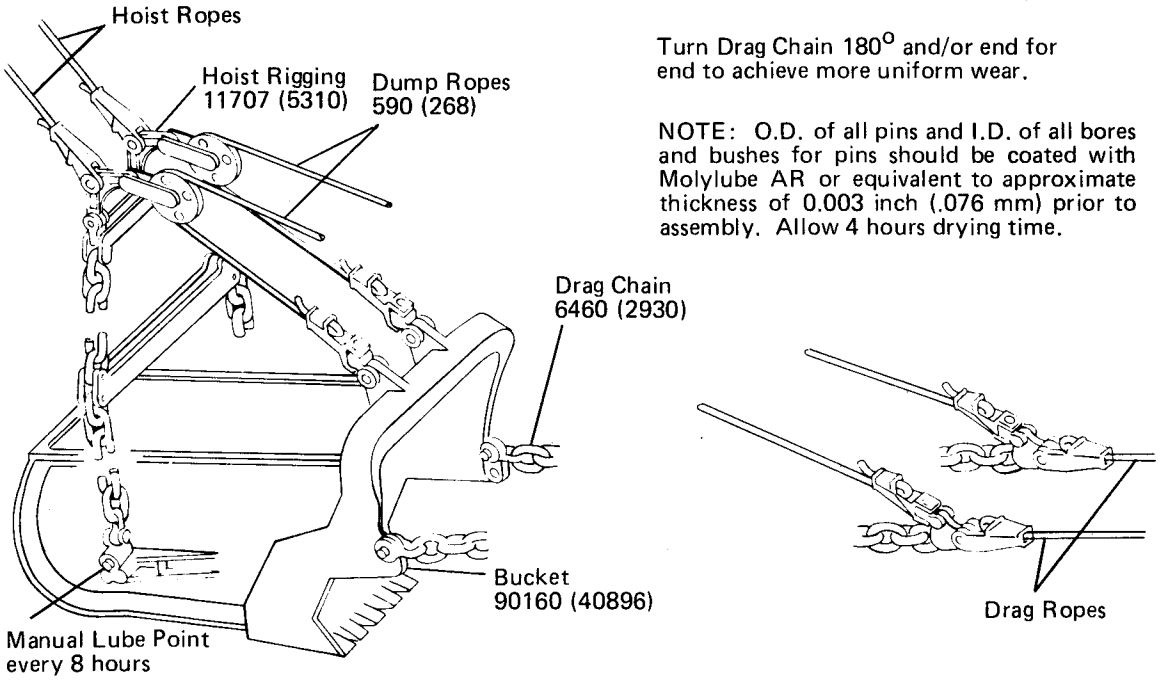
Two **HOIST ROPE DEFLECTING SHEAVES** are located in the upper front section of the tri-structure assembly. These sheaves lead the hoist ropes from the boom point to the hoist drum.

Each sheave is supported by a fixed shaft and rotates on two single row roller bearings. Bearings are assembled into the sheave with a machined spacer between the cones for accurate alignment and adjustment.

DRAGLINE BUCKET digging characteristics are primarily determined by the calculated geometry incorporated into the design. The behavior of each dragline bucket can be established within close limits.

However, digging conditions cause every bucket to develop certain operating characteristics that affect bucket action. For this reason, each bucket has been provided with three points of adjustment: (1) drag chain attachment, (2) hoist chain attachment and (3) length of dump rope.

Two bosses, at each side of bucket, are provided for connecting the drag chain. The position of drag chain connection affects the bucket teeth angle of entry and cutting edge.



When drag chain is connected in the top boss, angle of entry is the greatest and the cutting edge is suitable for digging loose material that offers little resistance.

With drag chain connected in bottom boss, bucket teeth angle of entry is decreased with a more direct line of pull, suitable for hard digging, breaking rock, etc.

The hoist chain is attached to trunnions on each side of the bucket. The attach point is to rear of and below the center of gravity of a loaded bucket. When the distance from center of gravity is increased, dumping response is faster, but load on dump rope is greater and amount of tension required on drag rope to carry load is increased. When hoist chain is attached near center of gravity the dump action is sluggish but rope pull is less.

The length of dump rope determines the angle of bucket when carrying the load.

Accurate, properly maintained test equipment, suitable for the quantities for measurement is needed also.

a D.C. voltmeter for 125 - 600 volts,

a D.C. millivoltmeter for 600 millivolts,

zero center meters preferred,

a volt-ohm-milliamp meter or

a multi-meter (example, Simpson 260),

an A.C. voltmeter, unless multi-meter is accurate,

a quality tachometer is often handy, and

a 500 volt D.C. megger test insulation quickly.

Knowing the capabilities and limitations of each instrument helps keep repair and replacement costs reduced, since most test equipment suffers from the wrong connection rather than damage from dropping.

Now – get set to find the trouble.

INVESTIGATION: When trouble occurs, the operator is the "Expert Witness", so contact him first for answers to the following important questions:

How many motions are affected?

Is motion dead or just retarded?

Is it intermittent or continuous?

Did trouble develop slowly or suddenly?

What happened just before the failure?

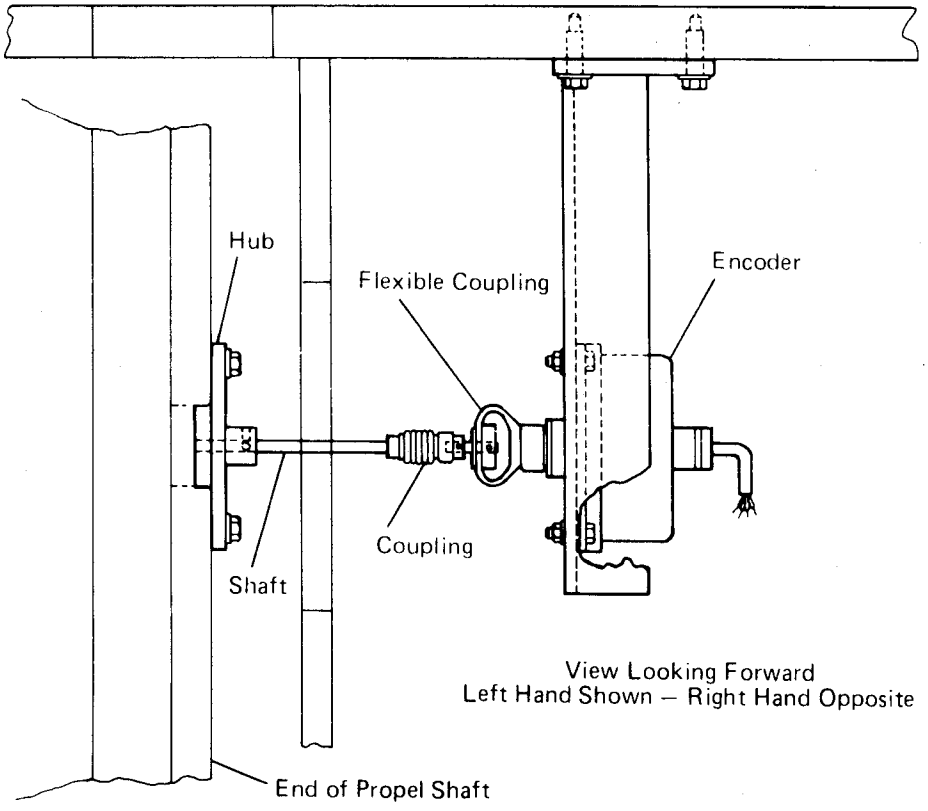
A complaint concerning POWER means different things to different people, so try to get specific answers to the following:

Will machine lift as heavy a load as before?

Each hoist or drag limit switch (encoder) is mounted on a bracket which is attached to the drum shaft bearing retainer. Installation is accomplished as follows:

1. Mount encoder on bearing retainer with only solid shims in place.
2. With capscrews tight, check for +/-5 degree angular and +/-.010 parallel misalignment of encoder shaft with drum stub shaft. Add or subtract laminated shims to achieve proper alignment.
3. Hand grind a flat surface on encoder drive shaft for coupling set screw.
4. Install flexible coupling.
5. Apply Loctite 242 to set screws.
6. After adjusting coupling, lock with set screws.

The **PROPEL LIMIT SWITCHES,** left hand and right hand are connected to a hub in the end of each main propel shaft. These switches are components of the Marion Protection System. Complete description, operation and calibration information is contained in the Marion Protection System Instruction Manual.



PROPEL LIMIT SWITCH (ENCODER)