



Technical Manual

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SECTION 1

INTRODUCTION

This manual is designed to be informative and helpful during the operation and preventive maintenance of this equipment. Great care has been taken to provide you, the owner, with the most comprehensive, up-to-date material available from our engineering, service and training departments. Following the easy to understand step-by-step procedures, the maintenance crew will be able to perform their duties without sacrificing safety or production. When a systematic and thorough maintenance/service procedure (a responsibility of the maintenance superintendent) is instituted for the Equipment, quality maintenance and operation will result.

THIS MANUAL IS NOT A PARTS BOOK, nor is it to be used to order parts. You have been supplied with a separate, detailed Parts Book. Please carefully read the instructions in the front of it. All parts are listed by group numbers with item/part numbers for THIS SPECIFIC MACHINE. Order parts in exact quantity. Parts ordered by mistake and returned, are subject to a rehandling charge. RIGHT and LEFT HAND PARTS on the upper frame correspond to the operator's hands at the controls; that is, facing forward and looking out the cab front window. Please state the correct machine SERIAL NUMBER (located on a plate in the operator's cab) when corresponding or conversing with us. Our records on each machine are filed by serial number and when given this number, your specific design and original equipment is both accurate and quick.

When required, ADDED INFORMATION not published in this Manual or the Parts Book, may be obtained from your local service representative or send correspondence to:

Services Department
Marion Power Shovel Division
Dresser Industries, Inc.
617 West Center Street
P.O. Box 505
Marion, Ohio 43302

or:

Telephone 614/383-5211
Telex 24-5307
TWX 810/487-2772
Telecopier 614/383-5211
Ext. 2275

Service and labor charges not accepted unless previously authorized, in writing, by Marion Power Shovel Division.

Start up the machine and dig enough to warm up machinery, open the inspection cover over gears and pinions. Look at gear teeth as machinery slowly goes thru its paces. Broken teeth are easy to spot, but splayed or unusual wear pattern takes a closer look.

For a quick check, run a piece of soft wire thru the gear mesh at each side of the pinion. Measure thickness of the two adjacent loops with micrometer. The sum of the two loops indicates backlash and gives an indication of misalignment.

Slowly rotate the upper frame several times in each direction. Look at condition of roller circle, rail, gear and swing pinion. Sound here may indicate a flat or chipped roller or even suggest burrs or damaged teeth on the swing pinion.



WARNING: Before doing ANY maintenance work in this area BE SURE electrical power is disconnected!

During dig cycles, check condition of sheave grooves and bearings. Check lock plate and shaft cap bolts at each end of boom point shaft and note condition of dust boots and cap-screws in sheave bearing retainers. Test all hold down bolts with proper torque wrench. Check rope guides and bails for wear. Inspect all rope for broken wires or a loss in diameter. When inspecting the boom point or gantry, check the auto-lube system for loose or damaged fittings. Note injector condition. Properly lube all points; IT'S IMPORTANT.

Lower bucket/dipper to the ground and shut off machine. Inspect bucket/dipper for cracks. Do not permit tooth base exposure. Teeth may be reversed with minimal effort. Remove bucket/dipper and rebuild.

Check main swing gear hold down bolts. Use proper torque wrench. Test all hold down bolts on upper frame, especially on swing gear case, motor mounting, machinery pedestal and base bolts. Also, check motor generator, air compressor mount and base bolts. Tighten rod bolts on bearing housing.

Examine and readjust, if needed, all brakes, Look at the condition of brake lining. Remove inspection plate from swing gear case. Look at condition of gears. Use pry bar to detect any side motion of shaft indicating worn bearings.

Inspect air compressor "V" belt tension, replace if needed. Fill the anti-freezer. Check auto-lube system for loose or broken fittings or injectors. This can be accomplished by manually cycling lube systems and visually inspecting components. Also inspect bearing areas for visual signs of lack of lubrication. Remember to replace ALL plugs, covers and inspection plates.

Check center journal thrust washer and bearing. Secure ALL guards and safety features in place. DISCONNECT POWER SOURCE with machine shut down so electrical crew may

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INTRODUCTION

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SAFETY PRECAUTIONS – continued

Be sure heavy items are properly supported from cranes or hoists before removing supporting members from machine.

Have sufficient service personnel available when removing or installing large heavy items to maintain control at all times.

Always use safety stands in conjunction with hydraulic jacks or hoists. Do not rely on the jack or hoist to carry the load, they could fail.

Use safety catch on all hoist hooks. Do not take a chance, the load could slip off of the hook.

If a heavy item begins to fall, let it fall, don't try to catch it.

When disassembling machines, be sure to use safety stands and adequate cribbing to prevent tipping or rollover of components.

Keep work area organized and clean. Wipe up oil or spills of any kind. Keep tools and parts off of the ground. Eliminate the possibility of a fall which could result in a serious injury.

Floors, walkways and stairways must be clean and dry. After draining operations be sure all spillage is cleaned up. Electrical cords and wet metal floors make a dangerous combination.

Check all wire ropes for telltale signs of early wear or failure. Look for and secure any loose bolts or locking devices.

Use extreme caution while working near any electrical lines or equipment whether it be high or low voltage. Never attempt electrical repairs unless qualified. Check limit switches for proper operation.

When using an acetylene torch, always wear welding goggles and gloves. Keep a "charged" fire extinguisher within reach. Be sure the acetylene and oxygen tanks are separated by a metal shield and are chained to the cart. Do not weld or heat areas near transformers or electrical cabinets and utilize proper shielding around lubrication lines.

Use pullers to remove bearings, bushings, gears, cylinder sleeves, etc. when applicable. Use hammers, punches and chisels only when absolutely necessary. Then, be sure to wear safety glasses.

Be careful when using compressed air to dry parts. Use approved air blow guns, do not exceed 207 kPa (30 psi), wear safety glasses or goggles and use proper shielding to protect everyone in the work area.

TRAINING

Qualified maintenance personnel using a scheduled maintenance program are the best way to minimize machine downtime and maximize productivity of equipment.

Marion offers factory and mine site maintenance seminars and special familiarization programs for mechanics, oilers, electricians and operators on a fee basis.

These programs are presented by qualified factory specialists and service technicians. Special customized training programs can also be developed to meet specific mine requirements.

Objectives of training and training materials are to provide the means for developing and maintaining on-site service repair capability. The Marion training programs use field proven concepts where your employees see, hear and participate in "hands on" practice of service repair operations.

For further information about Marion service training capabilities and programs contact:

Training Supervisor
Marion Power Shovel Division
P.O. Box 505
Marion, Ohio 43302

PLUGGING THE MOTION means reversing the generator field to act as a braking force and stop motion.

In normal operation, stop or retard the motion of D.C. drive motors by moving the control lever (or pedals) in the opposite direction. This reverses the current in the generator field. This reversing of field acts as a braking force retarding or stopping the motion. At the same time the rotation reaches zero, you must move the controller lever (or pedal) to the neutral position.

Plugging the motion rapidly dissipates the energy of heavy rotating parts by regenerating back into the power source, thus preventing heat created by mechanical friction brakes.

If hoist/propel 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.

The **CONTROL PANEL** mounted just to the right of your seat, consists of a number of switches and indicator lights; all clearly marked.

Starting on the top front of the panel are two green lights, that indicates if the machine is in the DIG MODE or the PROPEL MODE.

Next to these lights is a pistol grip, three position, transfer switch. This switch selects the DIG for dig mode, BRK SET for brake set and PROPEL for propel mode.

With switch in the DIG position, the dig mode light should be on, the hoist brake automatically released and the propel brake will automatically set.

When the switch is placed in the center or BRK SET position the hoist brake will automatically set and the propel brake remains set. Be sure to pause 5 seconds in this position before switching to propel or propel to dig so all mechanical/electrical transfer can be made. Failure to do so may result in uncontrollable travel.

NOTE: The drag brake is set manually.

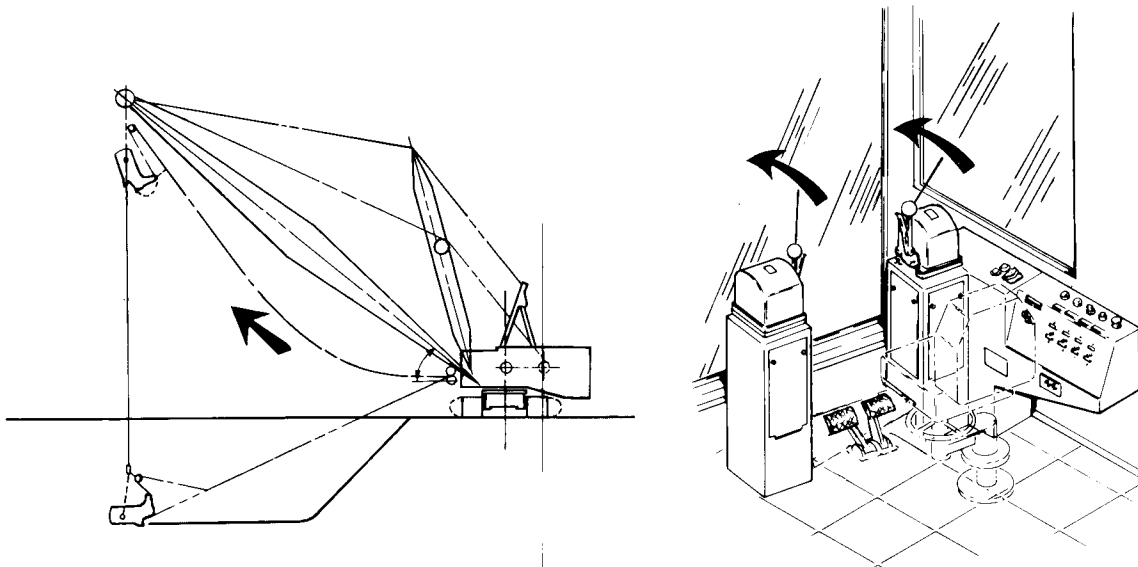
In the right position, PROPEL, the green propel mode light will come on and the dig mode light will go off. At the same time the hoist brake will be set and the propel brake will release.

This position (propel) also makes the electrical transfer from hoist to propel. See **PROPELLING THE MACHINE**.

- G. ANTI-CON. HTR'S. — A two position selector switch controls the anti-condensation strip heaters located in the motors, cabinets, MG set and exciter.
- H. FF 1 — Green push-lite start, red stop pushbutton controls the motor on the left hand filter fan located on the house roof.
- I. PH. SEQ. — Red light illuminates when the phase sequence is reversed in the trail cable. Electrical circuits will prevent start-up when this condition exists.
- J. FF 2 — Green push-lite start, red stop pushbutton controls the motor on the right hand filter fan located on the house roof.

NOTES:

Now, release tension on drag ropes allowing bucket to dump. As bucket dumps the hoist controller must be returned, moved forward to a point of less power. Do not allow excessive amount of drag to run out.



DO NOT hold load longer than necessary to complete the dumping cycle. After material clears bucket, slowly depress swing pedal (direction desired) to start return swing to pit and at same time lower bucket into pit.

While operating, the operator should observe components in his vision and be alert for pins coming out around bucket, support and running ropes for broken strands, fraying, etc. The wire ropes are expendable items. Kinks cause permanent damage. Replace these ropes promptly.

Also, note any uncommon feel or noise in the machine and notify maintenance of any problems while they are still minor.

GROUND PREPARATION is very important. The supporting ground must be as near level as possible but the machine will operate on a grade that does not exceed one percent (1%). Remove large rocks or cover area with fill dirt. Sharp rocks or boulders cause load points that damage the crawlers.

RAMPING the machine from one level to another requires exercising great care. The machine design allows travel up or down a grade of ten percent (10%) and a traverse of a three percent (3%) grade. However, avoid the latter if at all possible.

SAFETY PRECAUTIONS – continued

The operator must be alert, physically fit, and free from the influence of alcohol, drugs, or medications that might effect his eyesight, hearing or reactions.

Safety must always be the operator's most important concern. He must refuse to operate when he knows it is unsafe, and consult his supervisor when safety is in doubt.

The owner and/or operator must replace any and all safety and warning product graphics if they are defaced or removed from the machine.

Before doing any work on the machine, lock out or remove electric power supply from the machine and tag it so personnel are aware that someone is working on the machine.

Do not start an engine indoors unless adequate exhaust ventilators are provided. Once an engine is running, move the machine outdoors as soon as possible.

Keep hands, feet, clothing away from rotating parts.

As a machine is being moved, the operator must face the direction of travel.

Think before you act. Carelessness is one luxury the serviceman cannot afford.

Do not wear rings, wrist watches or loose fitting clothing when working on machinery. They could catch on moving parts causing serious injury. Never adjust and/or service a machine in bare feet, sandals or sneakers.

Always wear safety glasses when using a hammer, chisel or other tools that may cause chips to fly.

Excessive or repeated skin contact with sealants or solvents may cause skin irritation. In case of skin contact, remove sealant or solvent promptly by washing with soap and water.

Always use a safety bar to block air or hydraulic operated cylinders. Never rely on the machine air or hydraulic systems to hold when working on machines. An air or hydraulic line or cylinder could fail or someone could accidentally strike the control levers causing the equipment to fall.

Equipment must be level on ground at all times during machine servicing and periods of idleness.

Cranes and hoists must be of sufficient capacity to lift the heavier components (gear cases, dipper/bucket, boom, etc.) and have an ample safety margin.

* STANDARD WARRANTY

Marion Power Shovel Division, Dresser Industries, Inc. ("Marion") warrants that its products, when shipped, for a period of six (6) months from the date of delivery, F.O.B. point of shipment, will meet applicable, agreed specifications, if any with respect thereto, and will be free from defects in material and workmanship, provided that the Marion products sold are properly stored, assembled, used and maintained. Products not manufactured by Marion shall be subject only to such warranty as may be made by the manufacturer thereof. All claims under this warranty must be made in writing immediately upon discovery. **THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS.**

Should any failure of the Marion products to conform to this warranty appear within the limited time period set forth above, Marion shall, upon Buyer's submission of a claim as provided above, either 1) repair or replace, F.O.B. point of shipment, any nonconforming part or parts of Marion's products which have been returned to it for examination, transportation prepaid, or otherwise examined by Marion, and which examination discloses the nonconformity to Marion's satisfaction; or 2) refund an equitable portion of the purchase price.

THE FOREGOING IS MARION'S ONLY OBLIGATION AND BUYER'S EXCLUSIVE REMEDY FOR BREACH OF WARRANTY AND, EXCEPT FOR GROSS NEGLIGENCE OR WILLFUL MISCONDUCT, THE FOREGOING IS BUYER'S EXCLUSIVE REMEDY AGAINST MARION FOR ALL CLAIMS ARISING WITH RESPECT TO MARION PRODUCTS OR RELATING THERETO, WHETHER SUCH CLAIMS ARE BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES. BUYER'S FAILURE TO SUBMIT A CLAIM AS PROVIDED ABOVE SHALL SPECIFICALLY WAIVE ALL CLAIMS FOR DAMAGES OR OTHER RELIEF, INCLUDING, BUT NOT LIMITED TO, CLAIMS BASED ON LATENT DEFECTS.

IN NO EVENT (INCLUDING, BUT NOT LIMITED TO, AVOIDANCE OF THE ABOVE LIMITED WARRANTIES AND REMEDIES) SHALL BUYER BE ENTITLED TO ANY INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER ARISING FROM LATE PERFORMANCE OR A FAILURE TO PERFORM, DEFICIENCIES OR NEGLIGENCE IN THE DESIGN, MANUFACTURE, SALE DELIVERY OR ASSEMBLY OF MARION PRODUCTS OR FAILURE OF MARION PRODUCTS OR FROM ANY CAUSE WHATSOEVER AND WHETHER BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES. ANY ACTION BY BUYER ARISING WITH RESPECT TO MARION PRODUCTS OR RELATING THERETO MUST BE COMMENCED WITH ONE (1) YEAR AFTER THE CAUSE OF ACTION ACCRUES OR IT SHALL BE BARRED.

Marion reserves the right to improve or change the design of its products and specifications thereof and Marion shall incur no liability thereby or any obligations to install such improvements on products previously sold.

*The above warranty relates to spare/repair parts for the Marion equipment referenced in this document. For specifics on the machine warranty, reference should be made to the purchase contract or Marion Power Shovel Division, Dresser Industries, Inc. may be contacted directly. Please identify machine serial number.



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SAFETY PRECAUTIONS – continued

Be sure to promptly reinstall safety devices, guards or shields after adjusting and/or servicing the machine.

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.

SECTION 3

LUBRICATION

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LUBRICATION SPECIFICATIONS

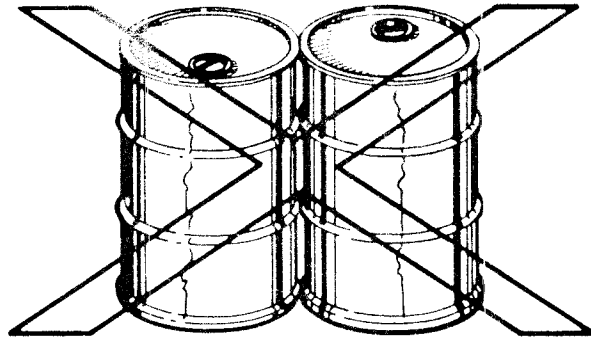
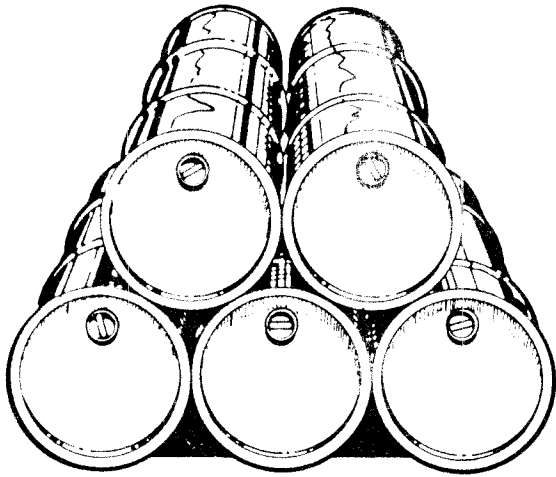
SPECIFICATION – GREASES

CODE OR SYMBOL NO.	ASTM or TEST	MPG	RGL	OGL	
				TYPE B	TYPE H
Penetration Worked 60X Summer, NLGI	D-217	2	semi-	1	—
Winter, NLGI		1	fluid	0	—
Penetration Worked 5000X, Max. Change	D-217	10%	—	—	—
Dropping Point, Min. °F.	D-566	350	—	325	—
Base Oil Viscosity @ 210°F., Min.	D-446	75 SUS	140 SUS	200 SUF	200 SUF
Oxidation Stability Max. psi Drop – 100 hrs.	D-942	10	—	—	—
Water Resistance Max. Loss @ 100°F.	D-1264	20%	—	10%	10%
Texture	Visual	Buttery	—	Adhesive	Tacky
EP Timken, Min. OK	—	35 lbs.	—	35 lbs.	35 lbs.

SPECIFICATION – OILS

CODE OR SYMBOL NO.		ASTM or TEST	MO	OILS PO
Pour Point °F. Max.	- Summer	D-97	5	15
	Winter		0	15
Flash Point °F. Min.	- Summer	D-92	450	410
	Winter		420	410
Viscosity @ 100°F. SUS		D-446	—	150 Min.

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



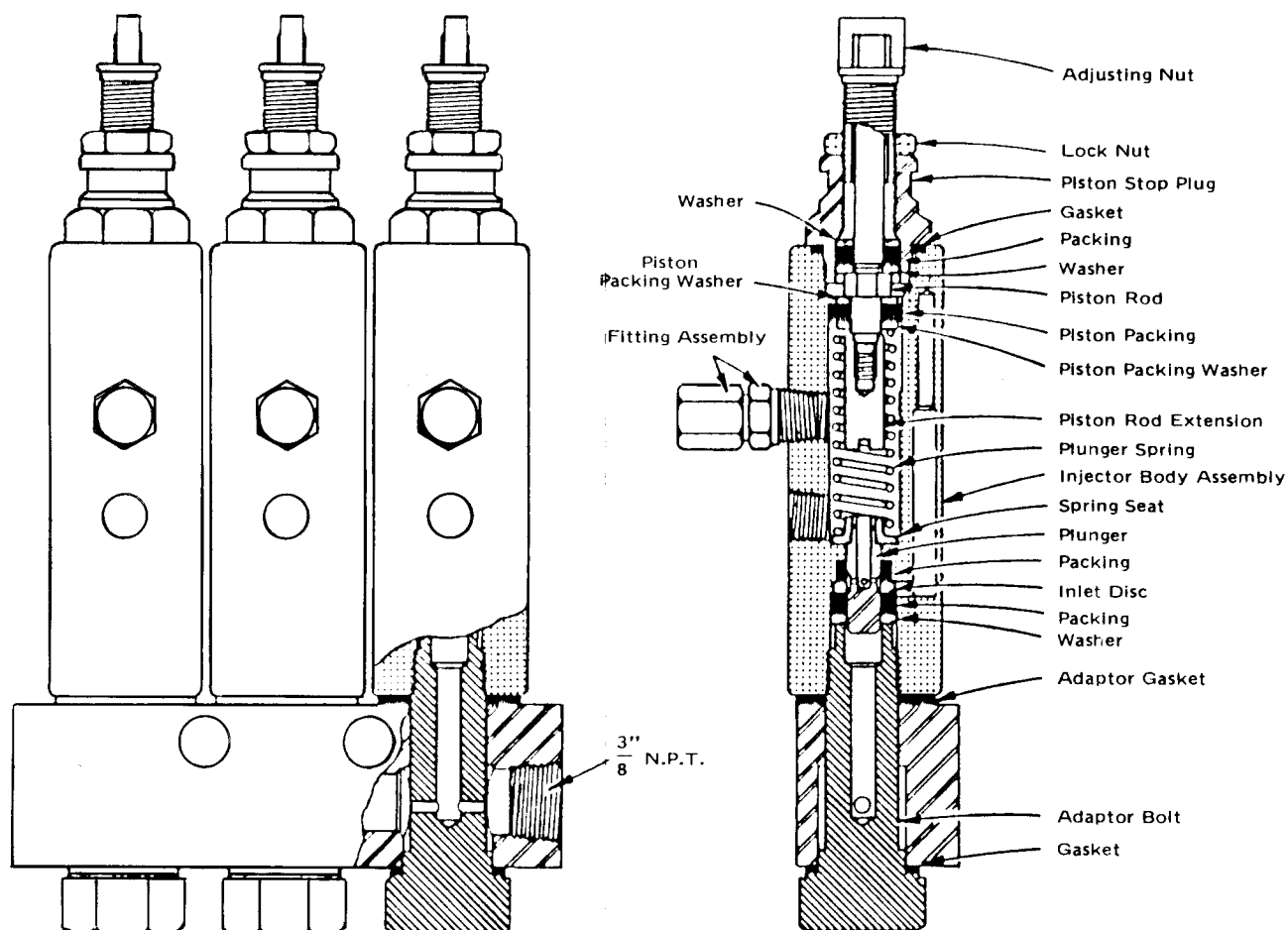
<u>NAME OF PART</u>	<u>TYPE</u>	<u>NO. OF POINTS</u>	<u>LOCATION</u>	<u>LUB. SYM.</u>	<u>METHOD & FREQUENCY</u>
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LUBRICATION OF FRONT END (cont.)

Boom Lowering Sheaves (Mast)	Bushing	2	End of Shaft	MPG	As required; 12 months
Mast Support Ropes at Gantry	Bushing	6	End of Pin	MPG	Auto, 10 min.
Boom Lowering Sheaves (Gantry)	Bushing	2	End of Shaft	MPG	As required; 12 months

NOTES:

LUBE INJECTOR ASSEMBLY



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.

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ADJUST CRAWLER TREAD BELTS by moving the front idler roller shaft assembly. The shaft mounts in two bearing blocks fitted into rectangular openings in each side of the crawler side frame. An adjusting pin, attached to each bearing block, is used to change the block position.

First, remove all dirt, mud, etc., from opening and shaft area. Place hydraulic jack and wood block in opening on each side of frame as shown in sketch on page 4.

Remove cover plate over bearing block and the shims from front of block. Apply slight pressure to jack to remove shims from rear of block. With all shims removed and jack released, roller should move freely.

The belt weight should move roller to rear (loosen) with both jacks retracted. If it doesn't, **CAUTIOUSLY** propel machine back and forth until block releases.

To tighten belt, operate jacks to move roller forward. **ALWAYS MOVE BOTH BLOCKS AT SAME TIME AND EQUAL DISTANCE. ROLLER SHAFT MUST BE KEPT AT NINETY DEGREE ANGLE TO CRAWLER SIDE FRAME.**

After belt is properly adjusted, three inch sag between slide bars, insert the **SAME NUMBER AND SIZE SHIMS** on both sides of side frame to rear of block.

Remove jacks and store remaining shims in front of adjusting blocks. Apply light oil or grease to all parts before replacing cover plate.

REPLACE TREAD BELT by retracting front roller. Separate belt at first joint above ground, under the front roller, by removing the lock bolts and pins. Weld an eyebolt to end of the outside pin, then pull. Drive out inside pin with maul and sledge. If pins are bent, burn them out.

Propel machine straight to the rear, allowing belt to lay out on ground. Connect new belt with the last shoe of old belt and continue to propel machine to rear to end of new belt.

Disconnect old belt and remove from area. Attach a wire rope from a truck or dozer and to the rear belt, running wire rope on top of crawler. Pull up on belt to engage shoe lugs with drive sprocket. Propel machine forward and at same time pull belt over top side of crawler side frame. Connect belt ends and adjust belt tension.

LOAD ROLLERS — Ten rollers on bottom of each side frame, distribute the machine weight evenly on the tread belt. Each roller turns independently on a bronze bushing and a shaft that is pinned at inside of side frame. Each roller is also equipped with two bronze

PROPEL SPROCKET SHAFT. Release belt tension, separate belt, remove steering cylinder, plug and remove lube lines, drain the gear case and remove cover, slide clutch onto main propel shaft. See propel pinion shaft on preceding page (page 7) for more detail.

NOTE: If the sprocket shaft propel gear is to be removed, the propel pinion shaft must be removed.

Block up or suspend sprocket shaft propel gear and drive sprocket to take weight off shaft.

Disconnect the steering levers and remove the retainer on each end of the sprocket shaft. Install an eyebolt in outer end of shaft and pull shaft out completely. Shaft weight is 2,550 pounds. Weight of drive sprocket is 4,234 pounds.

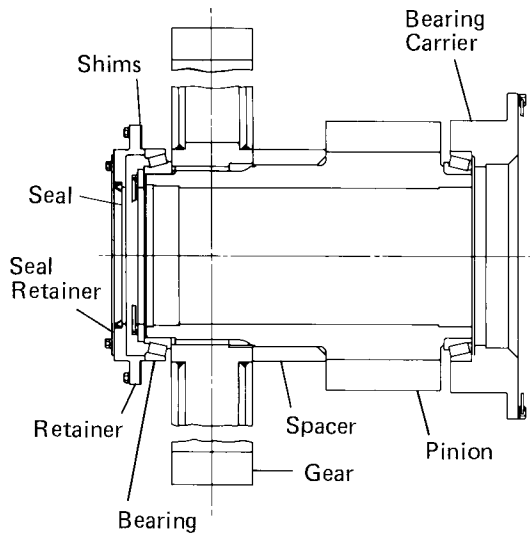
To install propel pinion shaft and propel sprocket shaft, use reverse of removal procedure.

Before installing sprocket shaft, check condition of oil seal and bushings, replace if worn.

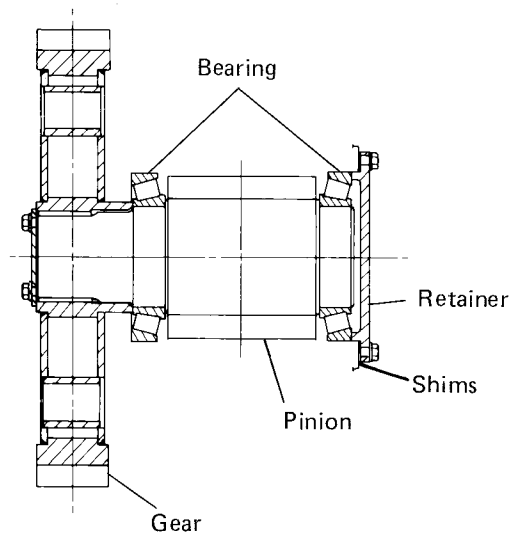
When assembling sprocket, propel gear and shaft align the splines. Also, gear case must be clear of dirt and other debris.

Replace cover and fill with ten gallons of gear lube (GL). Reconnect lube lines, steering air cylinders and crawler belt. Adjust belt tension and steering clutches. See Steering Clutch Assembly/Adjustment.

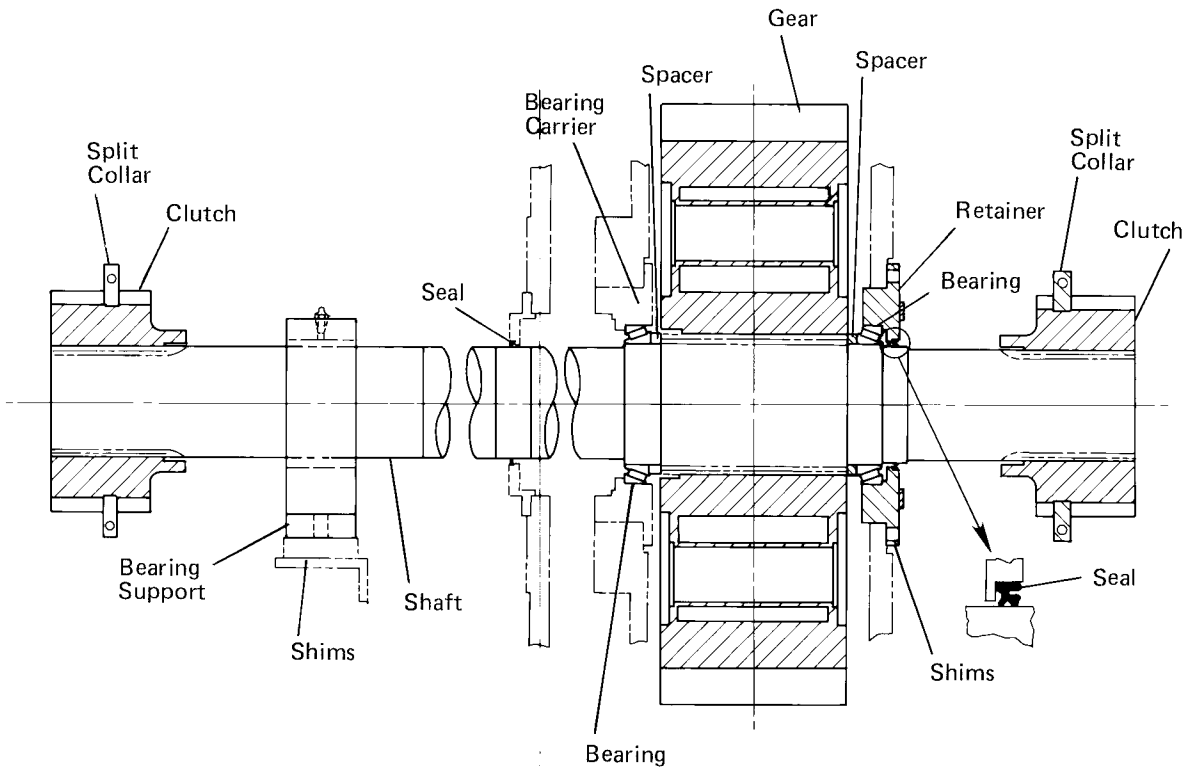
NOTES:



1ST INTERMEDIATE PROPEL SHAFT



2ND INTERMEDIATE PROPEL SHAFT



MAIN PROPEL SHAFT

Install the oil seals in each retainer. Spray shaft at each seal area with Moly-Lube A.R. (Bel-Ray). When the seal is completely bottomed in the counterbore, bolt each seal retainer in place.

SECOND INTERMEDIATE PROPEL SHAFT. Heat and mount the bearings on each end of the shaft

Move the second intermediate gear into position and engage teeth with the first intermediate shaft.

Insert the shaft from the right side of the gear case thru the gear. When the bearings are bottomed in the bearing boss, install the gear retainer plate.

Bolt the right bearing retainer in place without shims. To determine the correct bearing clearance, use the procedure described for the first intermediate shaft assembly.

PROPEL MOTOR EXTENSION SHAFT. Heat and mount the bearings on the extension shaft, then install the shaft in the case.

Install the bearing retainer, without the oil seal and shims. Again use the first intermediate shaft shimming procedure to determine bearing clearance, EXCEPT, add 0.003 to 0.005 inch to the average dimension.

Spray shaft with Molycote M3402 in seal area. Insert oil seal in retainer with lip toward inside of case. Install the shims and retainer.

PROPEL GEAR CASE. Apply Permatex Aviation Form-A-Gasket No. 3 onto the top of case. Replace the cover and bolt in place.

Lower the gear case onto the cribbing at rear of machine.

Install the keyed coupling half on the motor extension shaft, then the support on left end of main propel shaft and the splined clutch member on each end of the main propel shaft.

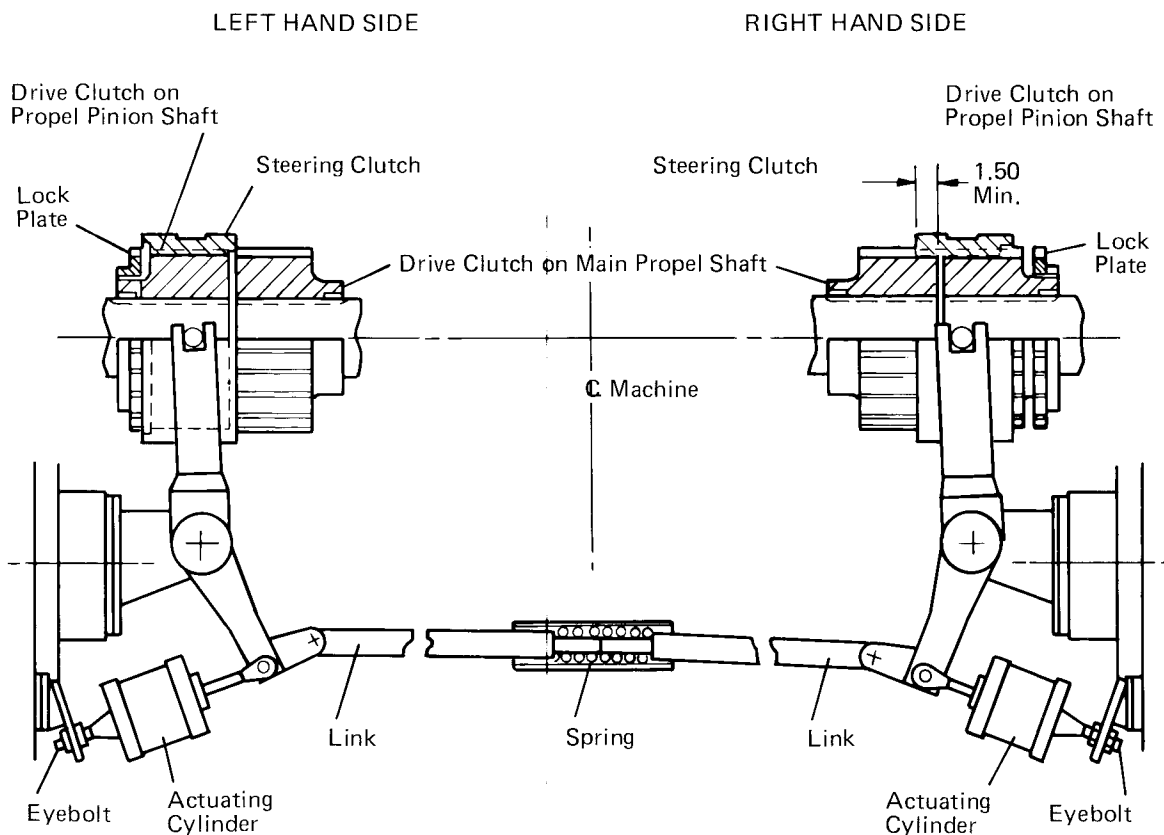
Raise the gear case into position and bolt it to the lower frame. Torque the bolts to 1950 foot-pounds.

Check the alignment of motor coupling. Move and/or shim motor to correct any misalignment. Connect the coupling.

Bolt the main propel shaft support bearing to the motor base. Shim under support for correct gear pattern.

- D. Check for proper performance to allow operation of only one steering clutch at a time. Place the steering clutches in a straight ahead travel position. Energize the left hand clutch in a steering mode.

Rotate the main propel shaft until the drive clutch on propel shaft is NOT aligned to the drive clutch on the propel pinion shaft. This prevents the steering clutch from engaging both drive clutches.



PROPEL STEERING MECHANISM
Diagram D

De-energize the left hand cylinder. This moves the left hand clutch to the right and disengages it from the lock plate and allows it to stop against the face of the drive clutch on the propel shaft.

Now, energize the right hand cylinder. The right hand steering clutch moves to the right until the right hand link comes in contact with the left hand link. The clutch must maintain engagement of 1.50 inch minimum.

3. Coat the unthreaded portion of the reaction pin with Molykote G-n paste grease.



WARNING: The unthreaded portion of the reaction pin and rods (4 and 15) must be free of burrs, metal chips or any abrasive particles. The presence of one or more of these conditions will affect the operation of the brake and can cause personal injury.

4. Slide the brake assembly over the brake drum and onto the reaction pin. The brake should pivot freely on the pin.

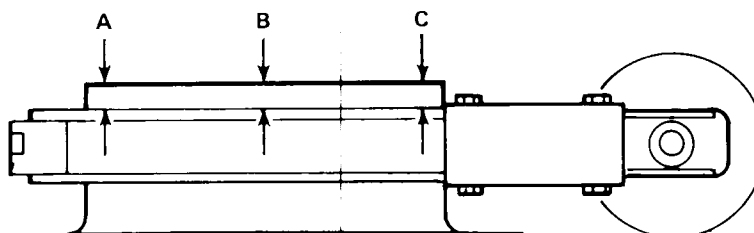


WARNING: The brake is unidirectional. To develop rated torque, the brake must be mounted with the arrow (12 and 13) on the brake shoe pointed in the direction of drum rotation.

5. Slide the flat washer onto the reaction pin and install and tighten the two locknuts to hold the brake in place.
6. Replace the stop nuts removed during brake disassembly (steps 4 and 5, paragraph A) and adjust the spring gaps and heights according to instructions give under Brake Adjustment in this section.
7. Align the brake according to instructions given in paragraph C.
8. Attach spring shields (39).

C. BRAKE ALIGNMENT

Apply and release the brake with air pressure to the brake cylinder. Observe dimensions A, B, and C. They should be identical all around the drum with the brake released as well as engaged. If the brake has a twisting or cocking movement when it releases and engages, this indicates misalignment and should be corrected by shimming or shifting of the brake support. The brake centering bracket, used when the brake is mounted horizontally, must be shimmed to prevent brake drag in the released position. After proper running clearances are assured, anchor the support to eliminate any possibility of movement.



- a. Remove jam screw (51) and set screw (43). Press cylinder out of brake shoe. Press new cylinder into shoe and lock in place with set screw (43) and jam screw (51).
8. Coat the inside cylinder diameter with a soft silicone type grease, primarily intended for dynamic lubrication between rubber and metal. A typical grease is Dow Corning 55M.
9. Slide the piston rod into the end cap, and insert the assembly into the cylinder. Lock the end cap in place with the snap ring or cap screws and lockwashers.
10. Install the brake on the machine by following installation instructions given in the Brake Removal and Installation Section.



WARNING: Safety and product identification decals are located on the brake releasing cylinder (34). Do not remove these decals. Replace any decal that is damaged.

ROLLER CIRCLE AND MAIN SWING GEAR — The lower frame rail forms a full circle that is bolted and welded to the main rotating gear. The weight of the rotating frame and front end equipment is supported by the roller circle. The rollers are tapered, with a flange on the inside edge. Each roller is mounted on a Nylatron spacer. There is a Nylatron thrust washer on the outer side of the roller.

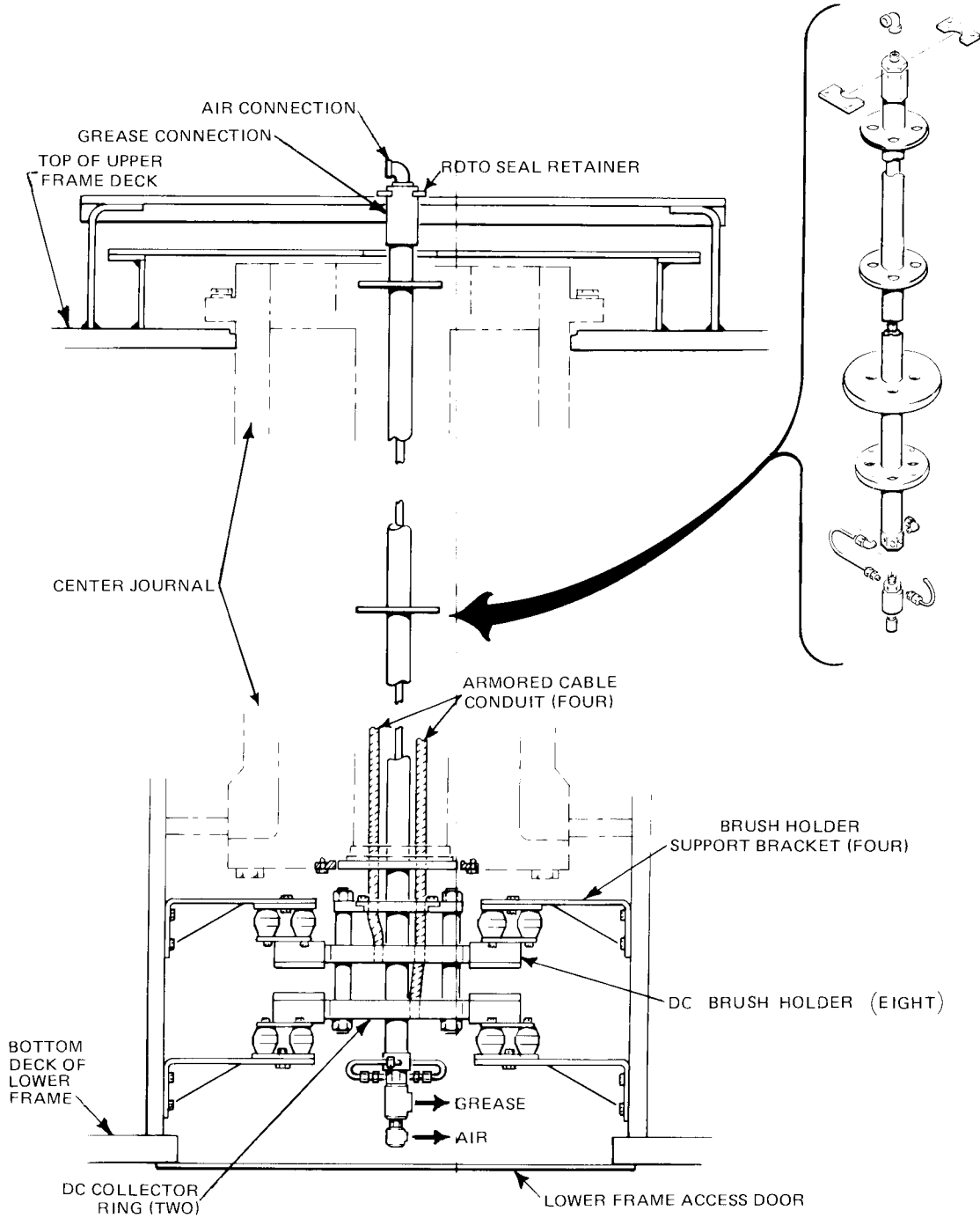
When starting a new machine, swing about 10 times in each direction with UNLOADED dipper, then repeat with LOADED dipper. For the first several operating days, swing machine one full revolution every four hours. After that, swing machine one full revolution at start of each shift.

ROLLER CIRCLE consists of 45 rollers retained between three inner circle segments and three outer circle segments. Inner and outer splice bars joint circle segments. Roller circle transmits load of upper frame and front end thru single flanged steel rollers. Machine swings on rollers which ride between lower rail circle mounted on main ring gear and top rail mounted on upper frame assembly. Top rail is in four segments with gap at each side of upper frame to permit roller replacement.

Rail circle mounting cap screws may loosen during machine operation unless proper torque of 1,015 ft.-lbs. is maintained. Due to inaccessibility of screws with standard torque wrench, use adapter and adjustable click type torque wrench, range 100-600 ft.-lbs., with non-ratcheting head. Before installing screws, apply Loctite Grade 271.



DANGER: Disconnect Electrical Power Prior to Entering Lower Frame.



ROTO SEAL ASSEMBLY

INSTALLING HOIST DRUM ON MACHINE — Attach choker slings to the drum and lift into position on upper frame. Tighten the four rod bolts progressively.

Torque progressively the hoist gear bolts to 1,950 foot-pounds. Rotate the drum to bring the nut to be tightened to the top position.

IMPORTANT: Torque all drum gear bolts after 30 minutes of operation and check periodically.

Reinstall gear cover and reconnect the lubrication lines.

Reeve the hoist rope on the drum. See Hoist Reeving.

Replace the roof hatches.

HOIST INTERMEDIATE SHAFT REMOVAL — Lower bucket to the ground. Remove the roof hatches from above the hoist machinery.

Remove the cover from the intermediate hoist gear and hoist drum gear.

Remove the hoist drum from machine. (See Hoist Drum Removal).

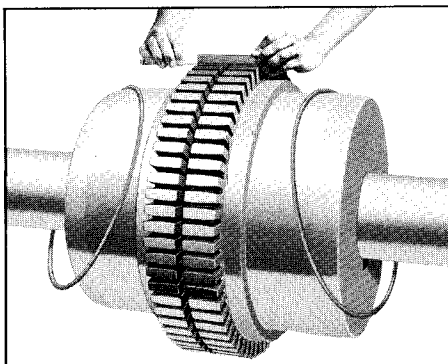
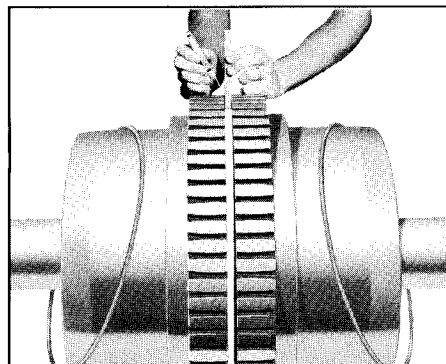
Remove the rod bolts from each end of the hoist intermediate shaft.

Attach a suitable lifting device (the lift will be approximately 6,000 pounds) to the intermediate hoist and lift it from the bearing supports and out thru the roof of the machine.

Support the shaft on cribbing and attach a lifting device to the double-herringbone gear. The weight is 2,220 pounds.

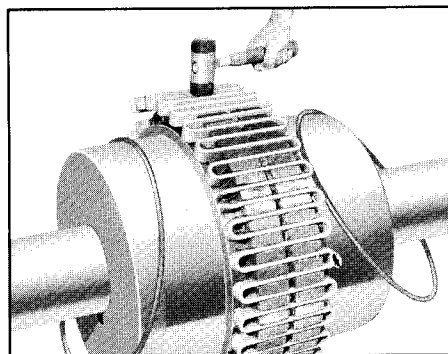
Remove the bearing cover and housing (377 pounds) from the left hand end of the shaft.

Use a short piece of 1/4 inch key stock (minimum .062, maximum .500) to measure for a snug fit at four locations, 90 degrees apart. Measure clearance between bar and hub face with feelers. The difference in minimum and maximum measurement must not exceed 0.015 limit.



Check offset alignment by resting a straight edge across both hubs as shown and also at 90 degree intervals. The clearance between the straight edge and hub must not exceed 0.015. Tighten motor hold down bolts. Repeat the gap and offset alignment measurements. Realign coupling if necessary.

Pack gap and grooves with MPG before inserting grid. Install grid segments so that all cut ends extend in the same direction. Spread grid segments slightly to pass over the coupling teeth and seat with a soft mallet.



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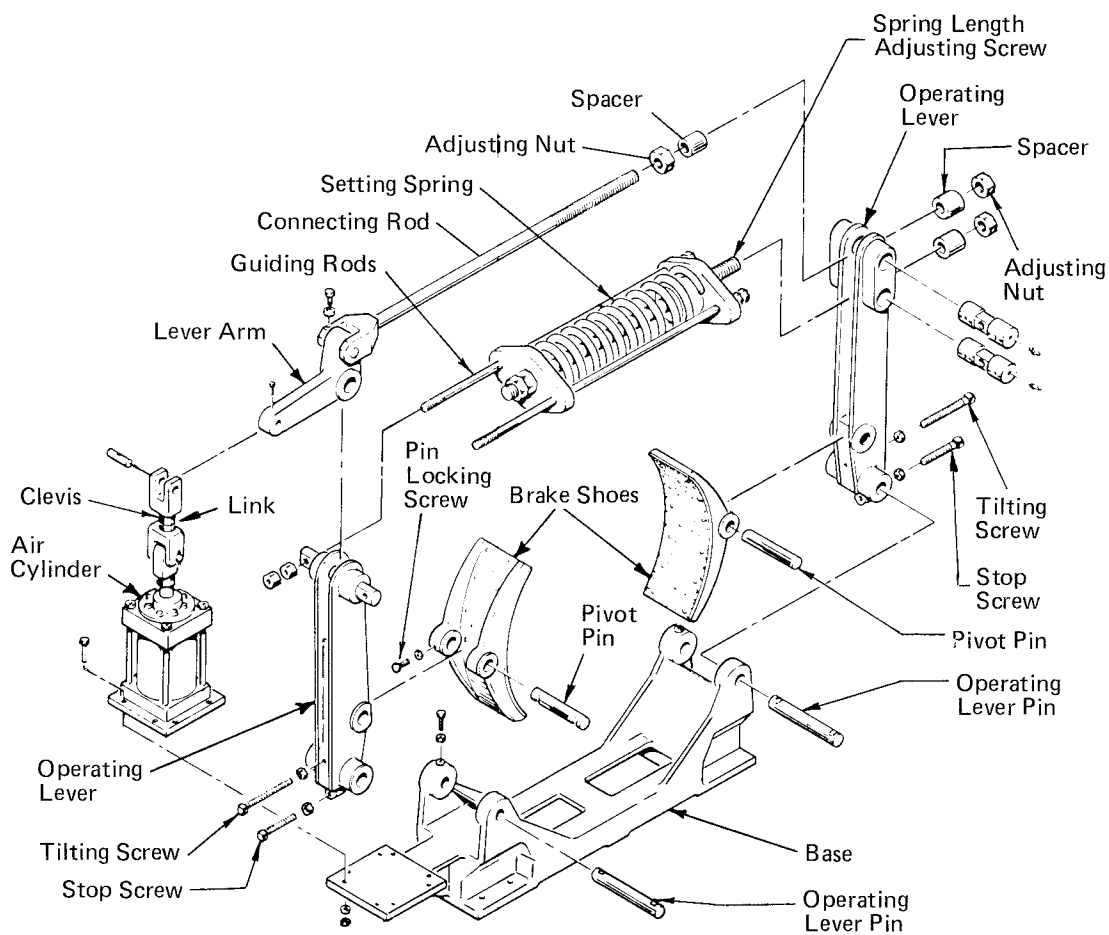


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Adjust brake shoe clearance by releasing the brake, then proceed as follows:

- A. Ensure piston in air cylinder does not bottom.
- B. Loosen locknuts and set screws on A and B on both sides.
- C. Turn nuts C on connecting rod D until approximate clearance of 1/8 inch between shoe and wheel is achieved.
- D. Turn set screw B in or out as required until a similar gap is obtained between drum and both shoes.
- E. Adjust set screws A until a uniform clearance is obtained along the whole length of the brake shoes. The heels of the shoes should not drag on the wheel when the brake is released.
- F. Tighten locknuts on set screws A and B on both ends. Replace guard.



The drag brake housing is splined to the other end of the drag intermediate shaft. Remove the cap screws and retainer (31 pounds). Support the brake housing (733 pounds) and slide it from the shaft.

Remove the retainer bolts; then, slide the retainer (74 pounds) and bearing housing (397 pounds) from the shaft. Remove the bearing (120 pounds), inside retainer (95 pounds) and spacer (25 pounds).

Slide the pinion (1010 pounds) from the shaft splines. The shaft weight is 2,680 pounds.

Inspect the shaft, brake housing, gear and pinion for cracks, signs of wear, etc. Replace any components that are questionable.

To reassemble and install the intermediate drag shaft assembly, the procedure is reverse of disassembly.

First, lightly lube the shaft and slide the pinion on until it seats.

Slide the bearing spacer and inner bearing retainer onto the shaft. Force them against the pinion. Make sure the ridge on each is pointing away from the pinion. Install new gasket on retainer.

Heat the bearing to 200 degrees F. and install on the shaft.

Install gasket and bearing retainer. Secure with cap screws.

Install the seal in retainer with the lip in the direction of the bearing.

Spray Molykote M3402 on the brake housing in the seal area. Slide the brake onto the shaft, making sure not to damage seal. Secure in place with the retainer and cap screws.

Support the intermediate gear and slide it onto the shaft. Install the bearing spacer against the gear.

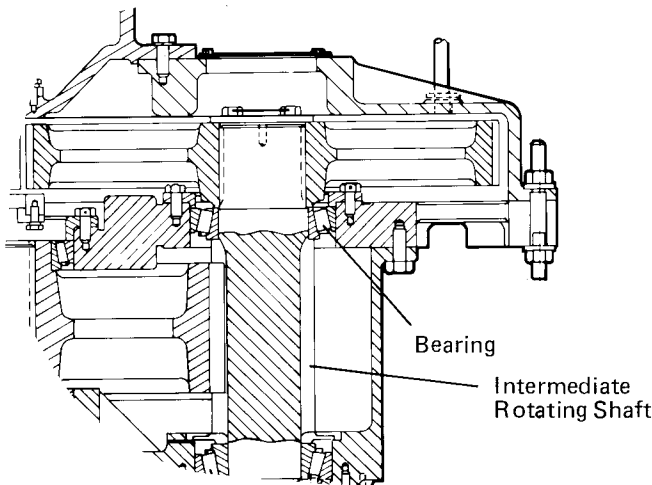
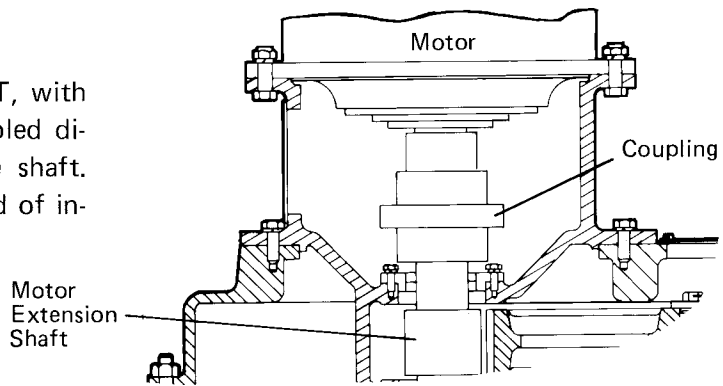
Heat the bearing to 200 degrees F, then install it on the shaft. Install the bearing housing and bearing retainer. Secure with cap screws. Bolt on the outside cover.

Attach a lifting device to the intermediate drag shaft assembly, pick it up and place it into position in the frame. Be sure all gears and pinions mesh properly.

Install the rod bolts at each end of the drag intermediate shaft.

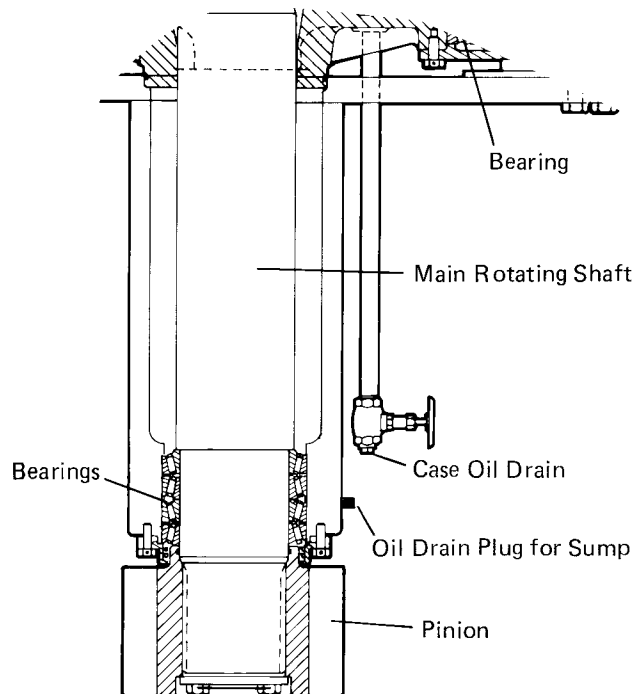
Reinstall drum shaft.

MOTOR EXTENSION SHAFT, with integral helical pinion is coupled directly to the motor armature shaft. Refer to Section 7 for Method of installing motor coupling.



INTERMEDIATE SHAFT, with integral pinion, has a large diameter helical gear splined on top of it. This gear meshes with the motor extension shaft. The integral pinion meshes with the gear on main rotating shaft.

MAIN ROTATING SHAFT has a large face helical gear splined on top of it. The shaft extends from bottom of gear case, thru rotating frame and has the swing pinion attached on bottom. This pinion meshes with the main rotating gear on the lower frame. The bottom of this shaft is supported by two double row tapered bearings that are lubricated from the gear case.



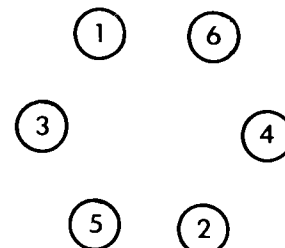
Replace the drain pipe that extends thru the upper frame to the gear case, and the sump plug above swing pinion. Make sure the valve is closed before filling the gear case with 101 gallons of GL oil. Check the oil level at the dipstick on side of case.

NOTES:

REPLACEMENT OF FRICTION DISCS

A. SWING (SINGLE DISC) BRAKE

1. Remove locknuts in alternating sequence (as shown in sketch) in increments of 1/4 of the exposed stud thread length. If a stud comes loose from the mounting flange, clean stud thread thoroughly. Apply Loctite 277 or equivalent. Stud must be threaded back in until it bottoms in mounting flange.
2. With locknuts removed, the 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 (0.7938 mm), replace the disc. Removal of the disc from the gear will expose the friction disc mounted on the mounting flange.
4. Remove the old friction discs and replace with new friction discs and NEW flat head screws. Torque the screws to 20 foot-pound (27 Nm).
5. Reinstall the disc.
6. Reassemble the assembly of the end plate, spring housing and pressure plate.
7. Lubricate stud threads with 30 weight oil or "Never Seez".
8. Assemble the locknuts in alternating sequence as they were removed. Torque locknuts to 200 foot-pound (271 Nm).
9. Reinstall shield.



REPLACEMENT OF SPRINGS is done by the following steps:



DANGER: Prior to removal of the brake, make sure that the machinery will remain in a safe position.

1. Remove the brake from the machine, place it on a clean working surface with the end plate facing up and remove the shield.

REMOVAL OF SHEAVE AND CRADLE – For safety and convenience, lower the boom to cribbing on the ground.

Support the sheave and cradle assembly (4,455 pounds) with a crane line.

Remove the eight bolts from the bracket on front of the boom point. Pull bracket (600 pounds) forward to remove from the cradle and boom.

Pull forward on the sheave to pull the rear cradle bearing from its boss. Support cradle on cribbing with the sheave in the vertical position.

REMOVAL OF SHEAVE FROM CRADLE – Support the sheave weight (2,000 pounds) with a crane.

Remove both lock wires and all of the cap screws from the retainer plate on the end of the sheave shaft.

Pull the shaft (550 pounds) out from the opposite side of the cradle.

REPLACEMENT OF POINT SHEAVE BEARINGS – Remove the eight cap screws from each bearing retainer, and remove retainers. The weight of each retainer is 37 pounds.

Pull the bearing from each side of the sheave hub. Clean the hub of the sheave thoroughly.

When installing the new bearing cups, it may be necessary first to shrink the cups in a dry ice and alcohol bath before they can be installed.

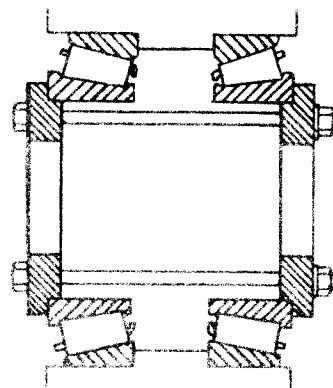
Assemble bearing cups in hub. Make sure they are well seated against their respective flanges.

Assemble the new roller assemblies and cones in the hub without the spacer. Clamp the bearing cones together until the bearings bind slightly when rotated.

With an inside micrometer, measure the space between the cones at four places, 90 degrees apart. Take an average of this reading and grind the new spacer to this measurement plus .002 to .003 of an inch.

Hand pack the bearings with MPG and assemble them with the new spacer in the hub of the sheave.

Install the retainers, torque bolts to 265 ft.-lbs.

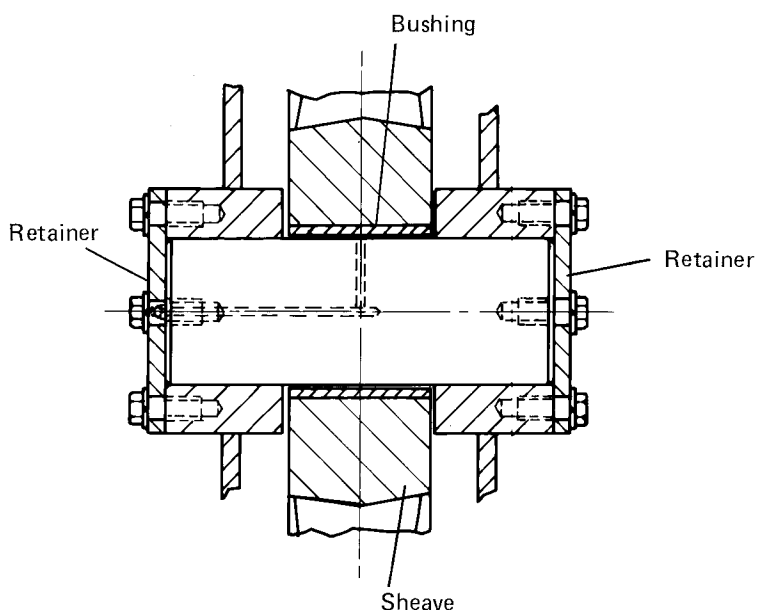


SWIVEL FRAME REMOVAL – Support the swivel (14,150 pounds) with a crane. Remove the keeper pin and the 797 pound swivel shaft (pin).

Remove the frame from the fairlead extension. Watch the shims and dowel pin that they do not fall to the ground.

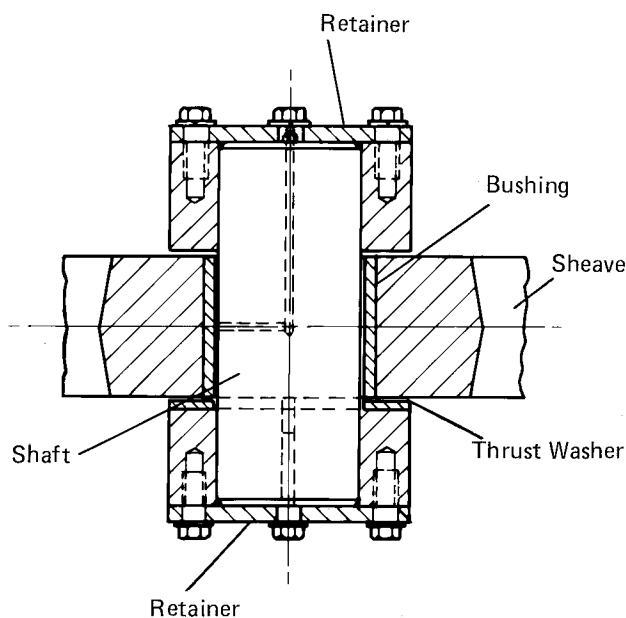
Assemble in reverse order.

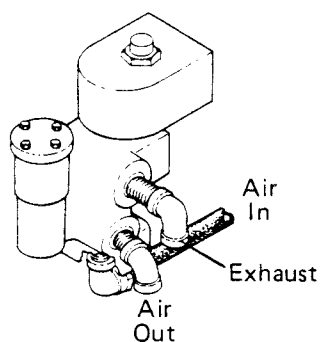
FAIRLEAD SHEAVES REMOVAL – The top three (fixed shaft) sheaves are removed by removing the retainer from each end of the shaft and pulling the shaft (118 pounds).



Slide the sheave (1,040 pounds) from between the bosses and lower to ground. There is a thrust washer under each horizontal sheave.

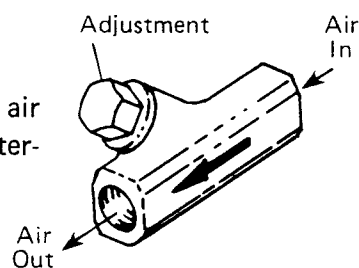
To remove the lower sheave, remove the retainer from each end of the shaft. Support the 1,620 pound sheave, then pull the shaft and the spacer from each boss.



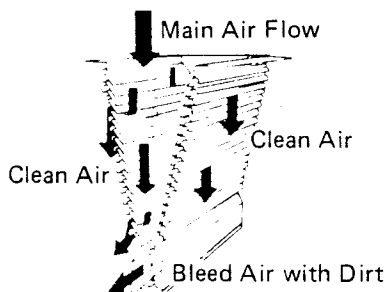


AIR VALVES are electrically controlled, pilot operated, non-compensating and normally closed. When valve fails to shut off or admit proper air volume, dismantle, clean out dirt and scale that caused it to leak. Replace worn or damaged parts. All parts for normal maintenance and repairs are available in a repair kit (see Parts Book).

REGULATOR VALVES are mounted downstream from the air valves with free flow to brake(s). Turn adjusting screw counter-clockwise (left) to restrict air flow.



AIR FILTRATION SYSTEM mounted on the machinery house roof introduces clean air into the house. The volume of air is greater than the capacity of the house, thus creating a positive pressure condition in the house.



This slight pressurizing reverses any possibility in flow thru rope openings and doors on the house.

All air drawn into the house is filtered, thus protecting and cooling the electrical equipment. Dirty air passes into the wide end of wedge shaped cells. About 90% of the air changes direction quickly and passes thru the narrow side passages. The dirt particles due to their greater mass, tend to continue straight into the bleed air duct where the air stream ejects it from the machine.

The filter system is essentially self-cleaning and requires only a periodic check. The inlet screens should be checked frequently and debris removed. Visually check the cell blades for dirt deposits. A light coat of dust is normal. Thick accumulations of dirt due to environmental conditions must be removed. Remove the cells and scrub in soapy water.

CAUSE: Wrong type or viscosity of oil.

REMEDY: See "Lubrication" or compressor in this section.

CAUSE: Restricted air intake filter.

REMEDY: Clean air filter.

CAUSE: Carboned exhaust valves.

REMEDY: Clean or replace.

CAUSE: Worn valves.

REMEDY: Replace valve assemblies.

CAUSE: Worn piston rings.

REMEDY: Replace and check cylinder walls for scratches.

CAUSE: Improperly installed rings.

REMEDY: See Service Bulletin on specific compressor or Service Bulletin 31:012 on ring kits.

CAUSE: High percent of run time. (80-100%).

REMEDY: Requires additional air compressor. Too much demand for air, locate leaks in your system.

CAUSE: High ambient temperature and humidity creates vapor mist of water and oil.

REMEDY: Control water and oil vapor condensing in the air line.

Install a moisture separator and/or oil filter at least eight (8) feet from the air receiver.

REMEDY: Align using a straight bar.

CAUSE: Mis-matched set of belts.

REMEDY: Check for equal tension, then purchase a complete set of matched belts.

CAUSE: A nick or tear on the edge of the belt.

REMEDY: Purchase new belts in matched sets.

CAUSE: Belts do not match the flywheel groove (such as "A" or "B" section belts).

REMEDY: Purchase new belts in matched sets.

J. CONDITION: Centrifugal Pressure Release (CPR) does not function and/or constantly leaks air.

CAUSE: Loose belts will cause CPR valve to alternately open and close continuously.

REMEDY: Check for worn motor pulley. Tighten belts but don't overtighten.

CAUSE: If air does not bleed out of (CPR) when compressor stops or bleeds out continuously while the compressor runs.

REMEDY: (CPR) is out of adjustment or clogged. See CPR Adjustment.

CAUSE: Compressor flywheel may also be rotating in wrong direction if air does not bleed out of (CPR) when compressor stops, or if the (CPR) acts erratic.

REMEDY: Correct the compressor flywheel rotation. If incorrect rotating, switch the motor leads.

CAUSE: A leaking check valve will cause the air to bleed from the (CPR) when the compressor stops.

REMEDY: Clean check valve and polish valve seat to remove nicks or scratches or replace the check valve or valve parts. Check valve in this section.

REMEDY: Replace points or switch.

T. CONDITION: Electric motor burns out.

CAUSE: Lack of overload protection, or incorrect fuse or heater size.

REMEDY: Determine cause and provide protection.

U. CONDITION: Motor overload and drawing amperage beyond nameplate rating plus service factor or temperature is beyond maximum rise shown on motor nameplate.

Normal operating temperature for electric motors is 170^o F.

CAUSE: Compressor starting against load.

REMEDY: Clean or adjust relief valve or CPR.

CAUSE: Low voltage.

REMEDY: Provide correct voltage. Call electrician.

CAUSE: Incorrect motor voltage.

REMEDY: Different motor or rewire if it's dual voltage.

CAUSE: Pressure switch set beyond factory recommended setting.

REMEDY: Do not set switch beyond maximum for which your DeVilbiss outfit was designed.

CAUSE: Belts too tight.

REMEDY: Adjust for proper tension.

CAUSE: Badly carboned exhaust valves, carbon filled aftercooler tube or check valve.

When maximum pressure in the air receiver is reached, air pressure on a diaphragm actuates a switch, breaking the circuit and stopping the motor. When pressure drops to a minimum setting, the circuit is closed again, the motor starts and operates the compressor until maximum pressure is reached.

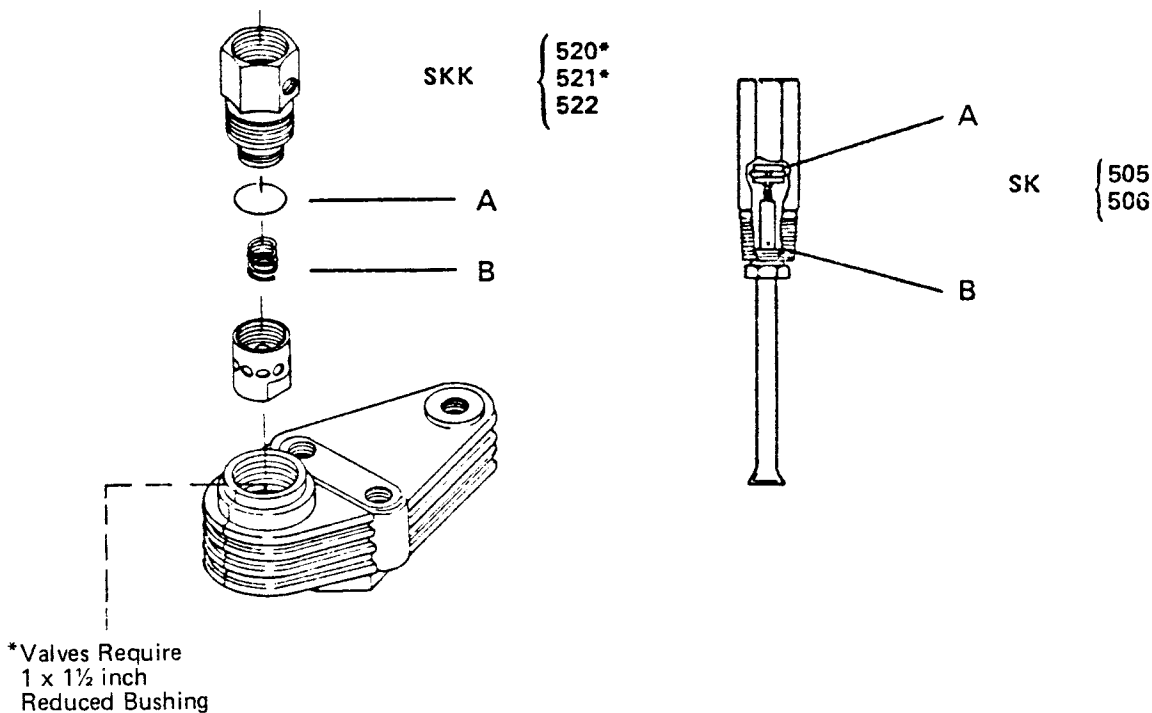
To adjust, change the cut-out and cut-in points.

PRESSURE RELEASE VALVE – The pressure release valve is attached to the side of the pressure switch. The valve’s function is to release air from the compressor head, thus preventing the motor from starting against a load.

When the motor stops, air can be heard to bleed from the valve. But when the motor and compressor are operating no air should be leaking from the release valve.

A release valve serves the same function as a (CPR) but is equipped on outfits operating at lower air pressure.

CHECK VALVE – Allows air to flow from the compressor aftercooler thru the check valve toward the air receiver, but air cannot flow in the opposite direction. When the compressor is compressing air valve (A) is held down and off its seat. When compression is stopped spring (B) and tank air pressure force the valve disc (A) up and closed.

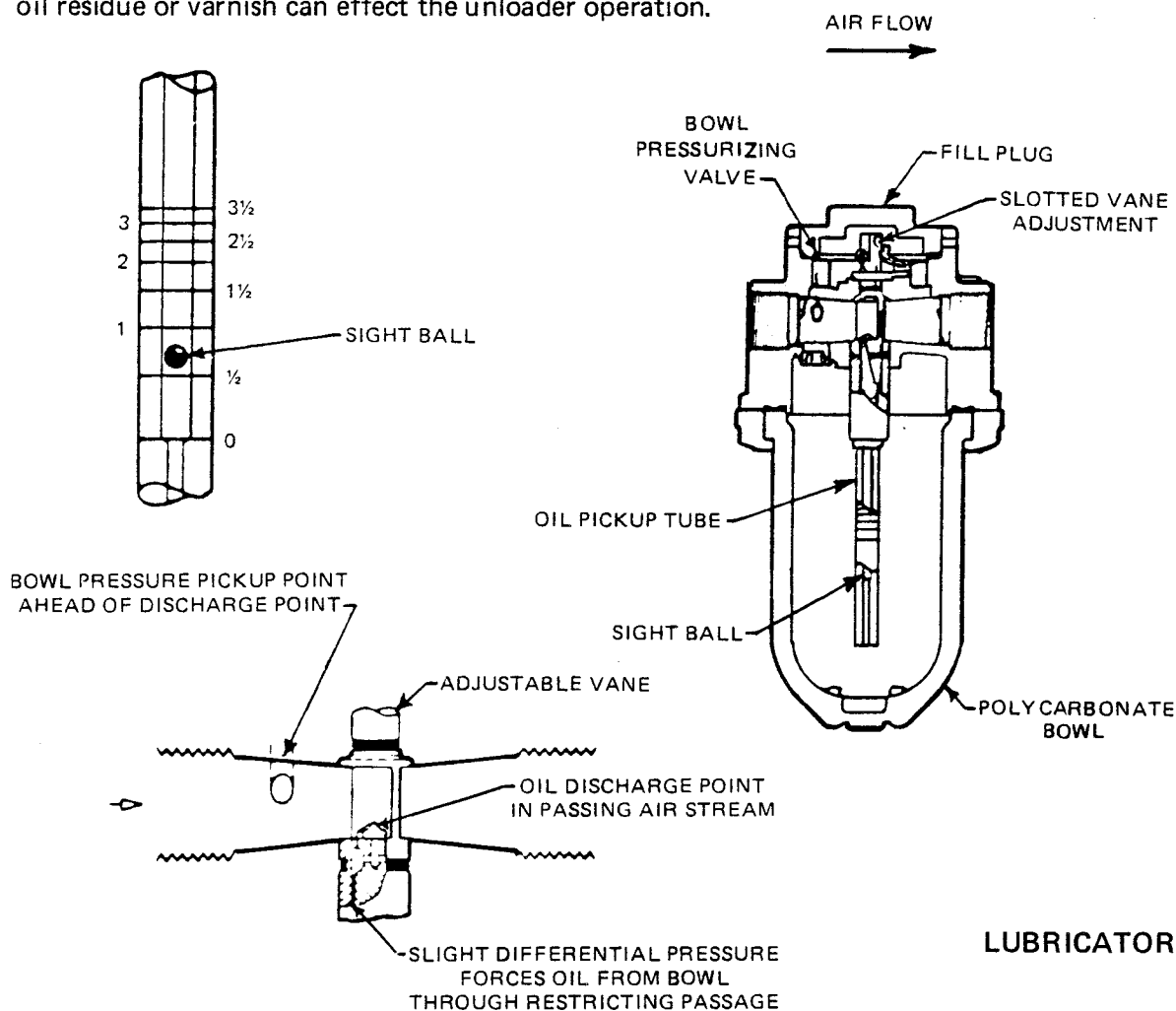


because the pilot valve screen is clogged with dirt and oil residue which prevents the passage of full air volume thru the pilot line.

Nicks, scratches or dirt on the valve disc or seat will cause leakage, polish these parts with (No. 400) sandpaper or replace the pilot valve.

UNLOADER VALVE MECHANISM REMOVAL AND MAINTENANCE – Disconnect the copper tubing on the compressor head and loosen the hex valve cap on the intake valve(s). Clean off the valve disc with solvent.

To remove the unloader mechanism assembly, loosen the entire assembly and remove the plunger and fork assembly, spring, and intake valve. Clean all parts with solvent. Any dirt, oil residue or varnish can effect the unloader operation.



LUBRICATOR – A micro-fog lubricator is located in the air line adjacent to the air receiver tank manifold. This device introduces a lubricant into the air stream in the form of airborne

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The proper **INSTALLATION OF OIL AND GREASE SEALS** insures the continued operation of this machine.

Wherever assembly design permits; solid molded, soft type seals are used. Each molded seal fits with a slight interference on the outside diameter creating an oil tight fit between seal and bore. This fit holds the seal and prevents it from turning in the bore. The split seals supplied for replacement avoid the major machine disassembly required to install solid seals.

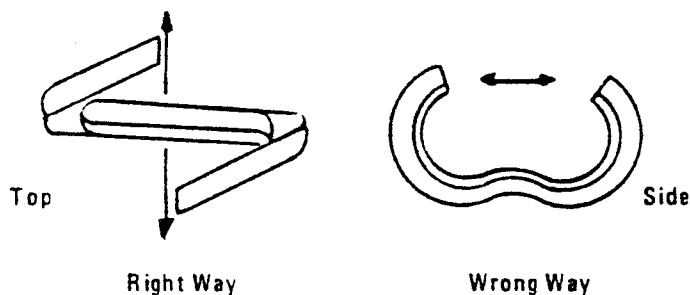
WARNING: DO NOT CUT A SOLID SEAL TO MAKE A SPLIT SEAL.

Split seals, especially made with interference fit at butt, install with compression at the joint. Consider split seals as temporary, until replaced with a solid seal at next major overhaul.

Store seals in a dark, cool, dry area. **DO NOT OPEN** shipping container before use. **KEEP** seal as clean as possible.

SPLIT SEALS install in a similar manner to solid seals.

1. Remove the garter spring and separate at the hook and eye.
2. Open the seal for shaft installation as shown in sketch.



3. Move the butt ends along the axis of the seal.

DO NOT PULL ENDS APART. THIS BENDS OR BREAKS THE BACK OF THE SEAL.

WARNING: AT FIRST A SPLIT SEAL MAY APPEAR TOO LONG. DO NOT TRIM OR CUT THE ENDS OF THE SEAL.

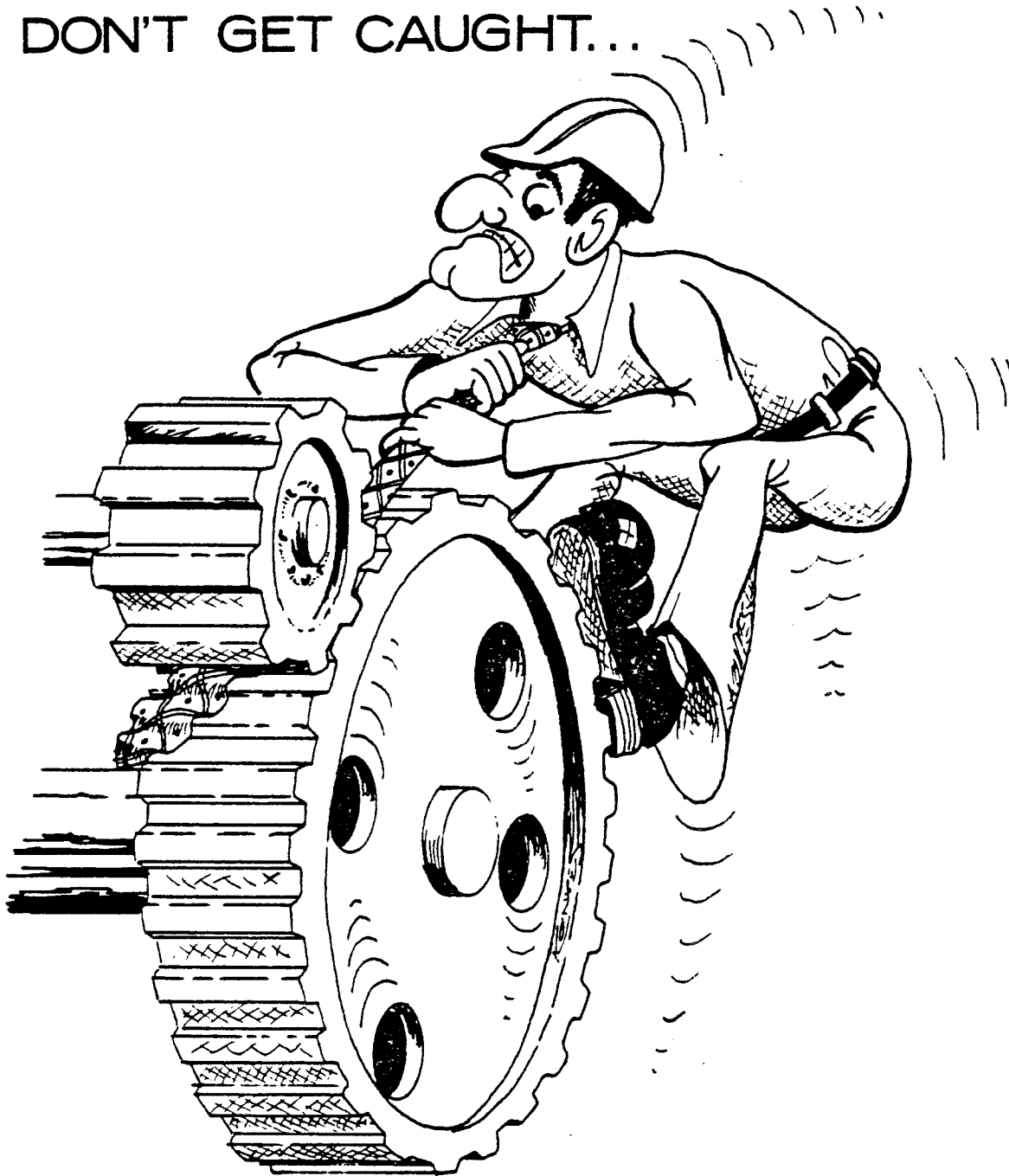
4. Lube ALL seal surfaces, particularly the O.D. and the lip. Apply lube to shaft and bore also.

- D. To check the temperature of the component, use a Fahrenheit or Celsius thermometer by placing putty over the bulb and holding it against the hub. Heat component a few degrees above the desired temperature before removing it from the oven.
9. After the component has been removed from the oven, wait a few minutes until the bore has cooled to the temperature required, remove the thermometer and quickly mount as described.
10. After making sure the bore is clean, quickly locate the component in the same angular position on the shaft as when cold. When nearly engaged with the taper fit, but not actually in contact, snap it forcibly into place with a quick push. **It is important that the hot component be instantly snapped into position before it has cooled appreciably. Otherwise, it will immediately freeze to the shaft and cannot be adjusted further.**
11. Check the hot shrunk-on position of the component on the shaft using the micrometer depth gauge as before.
- A. The actual advance is the difference between the depth gauge reading at the hot and cold positions. To control the stresses in the component the advance must be within the limits specified in the table.

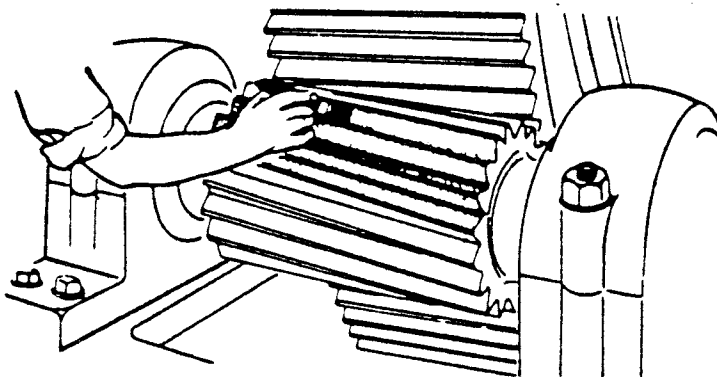
If the advance is not within the limits given, the component should be pulled and remounted.

12. After the component has been properly shrunk on the shaft, assemble the lock washer and nut or other means of locking.
13. When shoulder nuts are used, make certain the shoulder does not bottom before the main body of the nut tightens on the locking plate. In case the shoulder on the nut bottoms before tightening on the locking plate, the nut should be removed and the shoulder ground or machined off so clearance is available.
14. After it is certain that the nut is securely tight, turn up the locking plate on at least two faces of the nut.
- A. It should be kept in mind that **the component fit on the shaft and the fit on the key are the important points** in doing a good job of holding the component on the shaft. The locking plate simply serves to hold the nut on the shaft. With the correct fit between the tapered bore and shaft there is no load on the nut and locking plate.

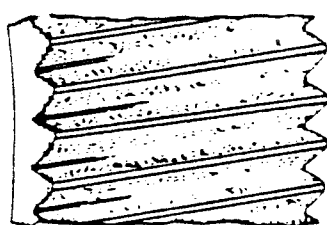
DON'T GET CAUGHT...



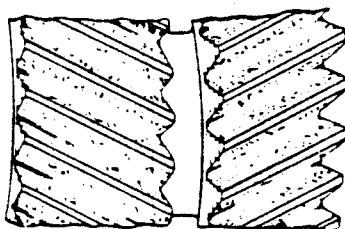
...WITH LOOSE CLOTHING



teeth across the face. Roll pinions back and forth thru the mesh several times to trace contact pattern on gear teeth. If motor power unavailable, use a torque arm and BUMP teeth on BOTH sides as pinion is rolled back and forth. This contact pattern may be scattered, but shows across at least 80 percent of the gear face. (See following sketch).



Single Helical

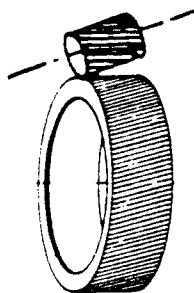


Double Helical

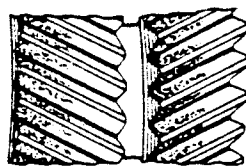
TYPICAL CONTACT PATTERNS:

After a satisfactory pattern is established for the initial position of the gear, make the SAME contact check at three more points on gear, spaced 90 degrees apart. A minor adjustment to pinion may be necessary to produce the best average contact on the gear,

INSPECTION: Dowel ALL bearing pedestals and RECHECK ALL bolts to secure gear setting. INSPECT gear teeth and REMOVE ALL metal upsets and burrs that occurred in handling or assembly. CLEAN gear teeth and enclosures thoroughly BEFORE enclosing gears.

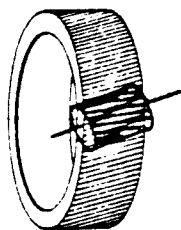


Single Helical

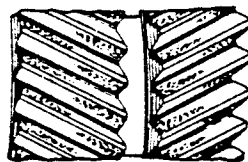


Double Helical

AVOID MISALIGNMENT IN PLANE OF CENTERS: If gears are misaligned in plane of centers, pattern develops as shown in sketches at left. MOVE pedestals to correct this condition and obtain FULL contact across ENTIRE face width of gear.



Single Helical



Double Helical

AVOID MISALIGNMENT AT RIGHT ANGLE TO PLANE OF CENTERS: If gears are misaligned at right angles to plane of centers, pattern develops as shown in sketches at left. To correct, MOVE pedestals until obtaining a FULL contact across ENTIRE face width of gear.

Broken wires.

Corroded wires.

Marks indicating mechanical abuse, distortion or crushing.

Inspect rope sheaves often. Check sheaves and drums for proper alignment. Use no reeving that requires reverse bends unless provided with sufficient space between the bends for adequate rope recovery.

Do not allow wear at rope sheave groove. An old rope wears a groove to a reduced radius. This groove crushes or deforms a newly installed rope.

Avoid sheave groove or drum lagging from assuming rope lay shape. Alternate right and left hand lays, if needed. Keep sheaves and drum free of rough spots, nicks and burrs. Never use cracked or chipped sheave.

Maximum rope life and the best service evolves from extreme care in handling and installation. This is important. Working a new rope at reduced loads gives the rope lay time to acquire a permanent set. Slow acceleration and deceleration of load and eliminating sudden actions are good habits to develop. Never overstress a rope by jerking or catching a heavy, falling load.

Lubrication remains the most important item in rope care. All rope is lubed when manufactured. Generally thin and filmy, this lube eases the manufacture rather than preserve the rope. This film dries rapidly or dissipates thru surrounding conditions.

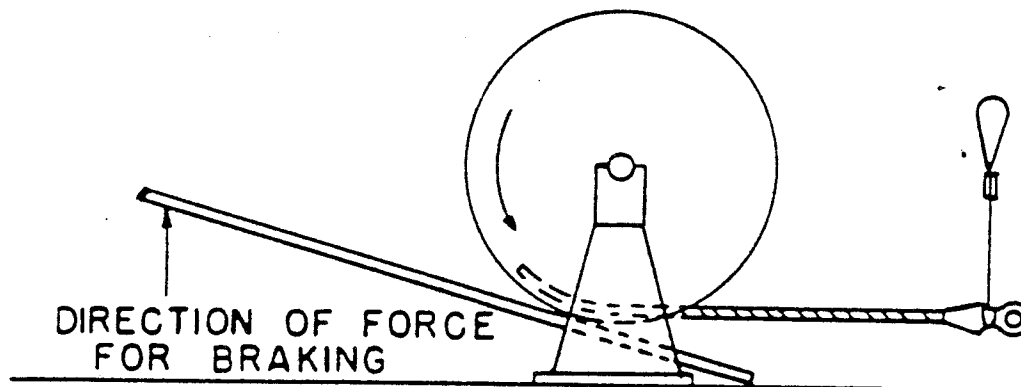
Lubricate every rope at installation and keep coated thru continued service. Lubricant serves to reduce internal friction wear and the outer wire wear against sheave or drum. Lube protects rope from weather and corrosive air, too.

Marion recommends a light, penetrating type lubricant (WRL) containing anti-rust and corrosion agents and anti-wear additives. This lube saturates rope interior thus reducing internal friction while providing a protective outer coating.

The rope lubricant selected may be an asphaltic type containing volatile solvent or diluent which allows strand and core penetration. This lube type works well for operations in highly abrasive material or water submersion.

One method of rope lubrication utilizes an automatic system that provides a drip fixture above sheaves on boom point, gantry, and fairlead. This system is generally timer controlled with manual override for severe conditions.

Position socket tagged, FRONT END (remove first) AS CLOSE to bottom of reel as practical and pull this free end away from reel. Pulling hitch or sling is recommended to attach to socket. Where sling must attach on strand; use great care to avoid kink or dogleg in the strand at socket base. DO NOT nick or damage wires here. Keep the longitudinal stripe aligned also.



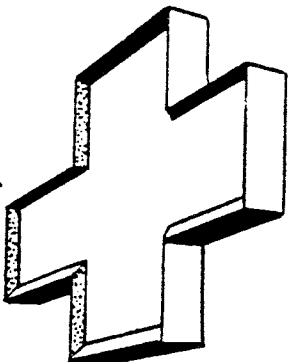
Usually an area of the reel is **BLOCKED OUT**, thru necessity, for positioning and securing the socket during shipment. Use normal care when removing sockets from this **BLOCKED OUT** area.

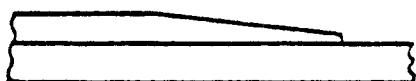
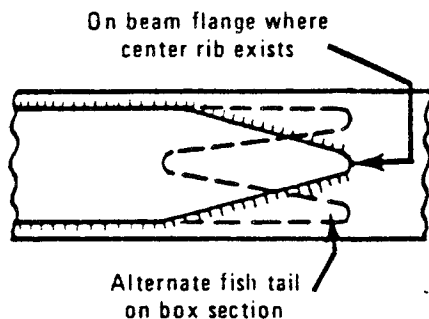
During unwinding from reel, pull the strand in a straight line and please **DO NOT** pull over sharp edges or object(s) on ground.

After strand is unwound from reel, remove socket tagged, **REAR END**.

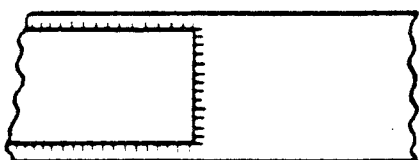
If more than one strand is packed on the reel, remove lengths in order in which they are tagged, using the procedure as outlined.

Please use Common Precautions here also.

THINK  **SAFETY**



Reinforcing Plate Taper End
recommended



Reinforcing Plate Square End,
not recommended

REINFORCING REQUIRES EXTREME CAUTION in weld repairs. Faulty reinforcing has caused many repeat failures. The weld alone, if **PROPERLY** made, is sufficient to make the part as strong as it was originally. However, in cases where reinforcing seems needed, apply the following. Patch plates of **NOT** greater than three fourths the thickness of the part being reinforced to **EXTEND** beyond the critical areas. **TAPER** and **ROUND** the ends of these plates. **EXTEND** the weld completely around the ends and **SMOOTH OUT** gradually to the original structure. **TAKE** every care to eliminate stress concentration, such as: square ends; sharp break offs; exposed and rough, flame-cut edges; etc. (See sketches).

POSTHEAT TREATMENT: When employing this or in cold weather, **SLOWLY COOL** the welding area at a rate of 50 degrees F. or 27 degrees C. per hour to the normal temperature of 150 degrees F. (65.5 degrees C.) This is important. This usually means additional general heating **AFTER** completing the weld. Smooth up **ALL** rough edges and welds. Clean and repaint the repair areas.

ADDITIONAL INFORMATION or material on welding for a particular repair job may be obtained by sending **ALL** details to the Service Department of Marion Power Shovel Division, at Marion, Ohio 43302.

NOTE: Use E-6010 or E-6012 for nonstructural parts **ONLY**. For example; sheet metal, guard rails, catwalks, house coverings and stiffeners.

MATERIAL INFORMATION

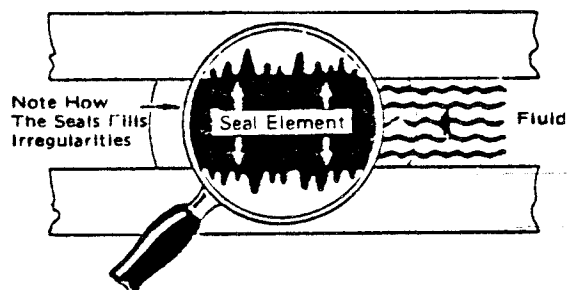
RAIL STEEL – MPSD Symbol FB

To repair steel rail areas with spalled surfaces; first grind away **ALL** cracked edges. Preheat. Build up (pad) area, using E-9018M electrodes, to within 1/4 inch of finished surface approximately. Complete build up, using E-11018M electrodes, then grind weld to desired contour.

For crack repair, other than in rail wear surfaces; preheat, then use E-9018M or E-309 electrodes.

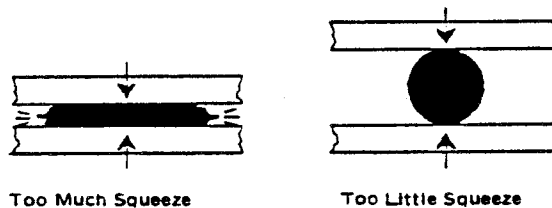
O-RING GUIDE

The dilemma of how to identify an O-ring generally derives from the question; "Is it a gasket, seal or packing?" Hence the confusion. One solution is to rely on the part number. Much like a Social Security number, it identifies even though the name may be confusing. If the part number (Social Security number) is correct, the name doesn't complicate the issue. Chasing down a part number takes a bit longer, but in the end; it is well worth it.

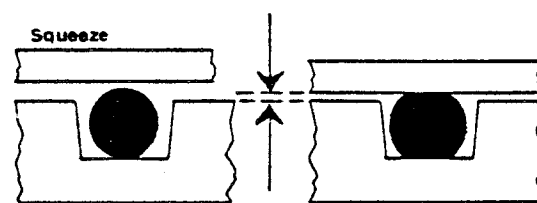


An O-ring's function is to confine and prevent passage of liquids and gasses under pressure from the part or joint. Perhaps simply stated; an O-ring closes off a passage to prevent loss or escape of fluid or gas.

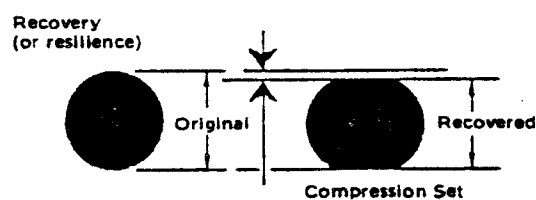
One basic principle of O-rings is compression under load to fill the machined surfaces in mating metal to block off fluid flow. Truly effective O-rings fill surface irregularities and maintain this ability. This is done in the following manners:



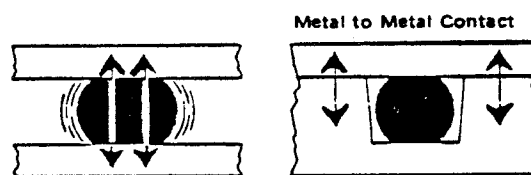
SQUEEZE is the ability of distortion while still blocking a passage. This does not mean **CRUSH**. Effective and usable squeeze is considered as from 12 to 35 percent. Insufficient squeeze causes leaks, almost always at low temperatures. Too much squeeze outright destroys the O-ring or causes it to cold flow to a premature set.



RECOVERY (or resilience) describes an O-ring acting as a surging spring over long periods. Failure to recover after deformation is called compression set.



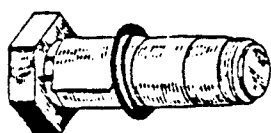
METAL to METAL contact is vital in creating correct squeeze while preventing destruction. A well designed seal transmits torquing loads thru the metal **NOT** the O-ring.



In hydraulic systems, flow wash bearing surfaces with hydraulic fluid and wipe parts, if needed **ONLY** with a dust free cloth.

In an oxygen system, **DO NOT PERMIT OIL AND GREASE** around the O-ring. The mixture of oxygen; oil and grease causes an explosion.

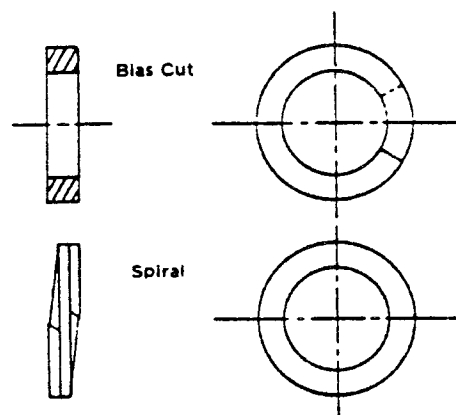
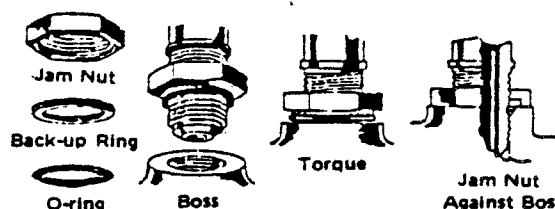
INSTALLATION on a piston does require a bit of stretching, but try to keep it uniform. Once installed, remove any and **ALL** twists. When pushing piston into cylinder, push straight in; **DO NOT TURN** while pushing. Turning causes bunching and eventually a leak. Most installations are the removal procedure in reverse.



Tape Protects O-ring During Installation

Some installations require the O-ring to slip over sharp edges, such as screw threads. Cover these edges with thin plastic tape or aluminum foil, lube ring and work into place. Perhaps making a thimble of plastic to place over threads first is even easier.

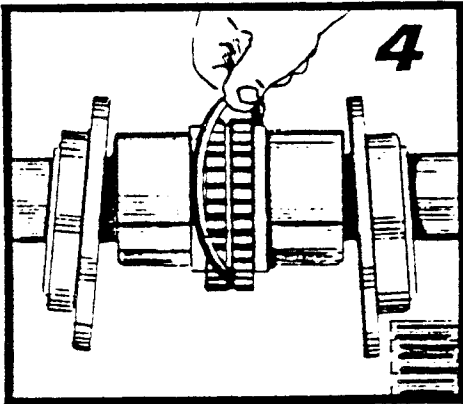
Other installations, such as placing a ring in a positioning type universal fitting, are more involved. In this case, a backup ring is lightly coated with lube and then worked into the counterbore of the jamb nut. The O-ring is stretched and rolled over fitting threads and into smooth threadless surface designed for the backup and O-rings. Next, jamb nut is pushed firmly against lower threaded section of fitting. Fitting installs in boss until ring contacts boss and increases torque. Jamb nut is held stationary in this position while applying 1-1/2 turns to fitting. Then turn fitting into boss **NOT MORE** than **ONE** added turn to position it. Final step is to hold fitting and torque jamb nut properly.



A similar procedure is used for non-positioning fittings, but the jamb nut and backup ring may be omitted.

BACKUP RINGS provide a firm surface for O-rings to press against to avoid extrusion, under high pressures, into clearance between sealed surfaces. Any surface movement with O-ring, so extruded, results in high wear rate which finally leads to ring failure.

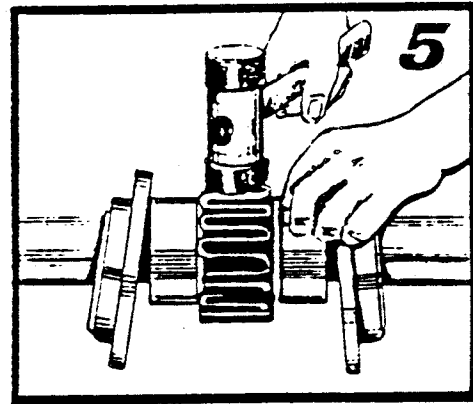
Backup rings are needed on each side of an O-ring when pressure is in alternate directions. Using a single ring, install on the downstream side of the O-ring.



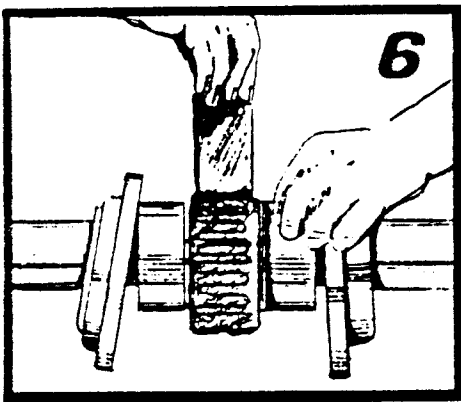
4. Once aligned, carefully insert gasket between hubs and hang it on either hub. **DO NOT DAMAGE** gasket. Force as much lube as possible into gap and gridmember grooves.

5. Insert gridmember. Coupling sizes 3 thru 11 use a single layer grid, painted aluminum. Size 12 thru 190 use a two layer grid with the inner layer painted aluminum and stamped IN while the outer layer is painted bronze and stamped OUT.

Installation — Gridmember rungs, truly radial, need spreading slightly to pass over coupling tooth at its O.D. To do this with minimum spreading, start grid at either end and tap rungs only part way into grooves. Once all rungs are partially into respective grooves, tap grid all the way in. When installing a two layer grid, center the outer layer sections over free ends of inner layer.



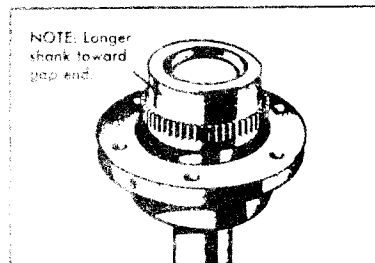
Removal — A round rod or screwdriver of a size to easily fit into open loop ends of grid is all that's needed. Begin at open end of grid section and insert rod into loop ends. Use next tooth as a pry point and pry grid out radially, in **EVEN** and gradual stages. Proceed alternately from side to side, lifting grid about halfway out until end of grid is reached. By repeating same steps again, grid clears teeth.



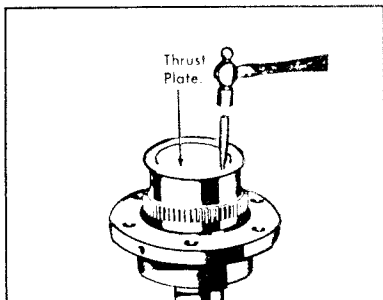
6. Pack spaces between and around grid with as much lube as possible. Scrape or wipe excess lube off flush with grid. Lightly oil hubs to ease sliding covers onto hubs.

GV TYPE COUPLING INSTALLATION

- A. MOUNT FLANGED SLEEVES, SEALS AND HUBS** — Refer to step 1. Place flanged sleeves WITH seal rings on shafts BEFORE mounting hubs. DO NOT DAMAGE SEALS. Mount hubs on respective shafts, as shown, so counterbore face is flush with shaft end.

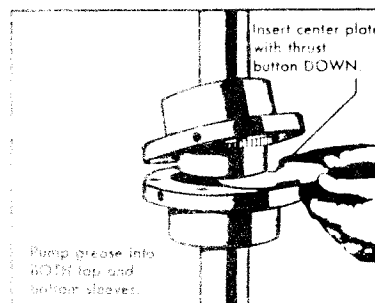


A MOUNT FLANGED SLEEVES, SEALS AND HUBS



B INSTALL THRUST PLATE IN LOWER HUB

- B. INSTALL THRUST PLATE IN LOWER HUB** — Tap thrust plate into counterbore until fully seated and stake in place. Position equipment. Refer to steps 3 and 4. **IMPORTANT:** With coupling aligned, pack lower flanged sleeve with grease and correctly position sleeve and gasket. DO NOT DAMAGE GASKET.



C INSERT CENTER PLATE WITH THRUST BUTTON DOWN

- C. INSERT CENTER PLATE WITH THRUST BUTTON DOWN** — Center plate in counterbore of lower flanged sleeve. **IMPORTANT:** Pack upper hub teeth with grease and then complete assembly per steps 5 and 6.

MAINTENANCE — Lubricate couplings at least once every six months. Lubricate more frequently when exposed to excessive moisture, extreme temperatures, rapid reversing or shock loads or excessive misalignment.

Table		INSTALLATION DATA											
COUPLING SIZE		10	15	20	25	30	35	40	45	50	55	60	70
Gap (Hub Separation) — inches	G	1/8	1/4	1/2	3/4	1 1/4	1 1/2	1 3/4	2	2 1/2	3	3 1/2	4
	GV	7/16	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3	3 1/2	4
Operating Alignment Limits — inches*	Offset Max	.005	.005	.010	.010	.015	.015	.020	.020	.020	.030	.030	.030
	Angular Max	.005	.005	.010	.010	.015	.015	.020	.020	.020	.030	.030	.030
Coupling Speed Range with NLGI #1 Grease — rpm*		1030/★ 10000	700/★ 8000	550/★ 5500	460/★ 5300	380/★ 4800	330/ 4200	290/ 3850	250/ 3500	230/ 3300	210/ 3000	190/ 2850	160/ 2500
Max Bore with Sq. Key — inches		1 3/8	2 1/8	2 3/8	3 1/4	3 3/4	4 1/2	5 1/8	5 3/8	6 1/8	7	7 3/4	8 1/2
Grease — pounds	G	3/8	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3	3 1/2	4
	GV	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3	3 1/2	4	4 1/2
G & GV10	Flange Bolt Torque—lb-in.	95	170	170	420	420	845	845	845	1490	1490	1490	
G & GV20	Flange Bolt Torque—lb-in.	85	145	360	720	720	1290	1290	1290	1430	1430	1430	2160

★ Align couplings within the operating alignment limits specified above. Exceeding these limits reduces coupling life and the maximum speed stated.
 ★ Coupling speed range with NLGI #0 grease is from zero rpm to the maximum shown in Table 1 for NLGI #1 greases except for the following: Size 10, 7000; Size 15, 6000; Size 20, 5000; Size 25, 4750 and Size 30, 4500.

COUPLING ALIGNMENT (REPRESENTATIVE READINGS)
(ALL READINGS IN MILS OR THOUSANDTHS OF AN INCH)

Feeler Position	Coupling Position			
	0 Right	0 Top	0 Left	0 Bottom
Right	12	14	13	14
Top	12	13	14	14
Left	13	14	13	15
Bottom	13	13	14	15

Coupling in line. Gradually changing readings indicate coupling is opening slightly with rotation.

Feeler Position	Coupling Position			
	0 Right	0 Top	0 Left	0 Bottom
Right	12*	14*	14*	16*
Top	15	17	17	19
Left	18*	21*	20	23*
Bottom	15	18	17	20

Coupling out of line sideways. Note that right and left readings* show constant difference of 6 to 7 thousandths; top and bottom readings all right.

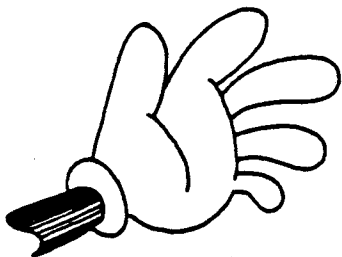
Feeler Position	Coupling Position			
	0 Right	0 Top	0 Left	0 Bottom
Right	14	14	16	17
Top	10*	10*	11*	12*
Left	15	14	17	17
Bottom	19*	19*	22*	22*

Coupling out of line vertically. Note that top and bottom readings* show constant difference of 9 to 10 thousandths; left and right readings all right.

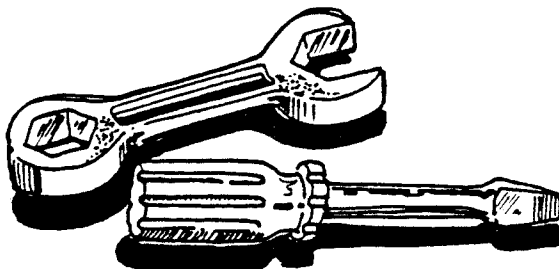
Feeler Position	Coupling Position			
	0 Right	0 Top	0 Left	0 Bottom
Right	14	11*	16	20*
Top	18*	15	11*	16
Left	14	19*	15	12*
Bottom	10*	16	20*	15

Bad coupling face indicated. Note how tight and loose spots* travel with rotation of coupling. Necessary to remove both rotors and true-up coupling faces.

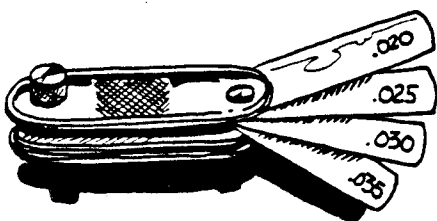
FEELING



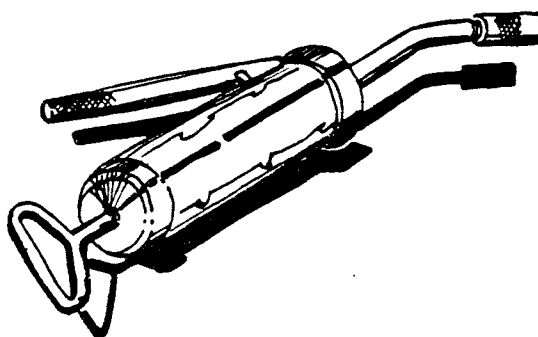
TIGHTENING



ADJUSTING

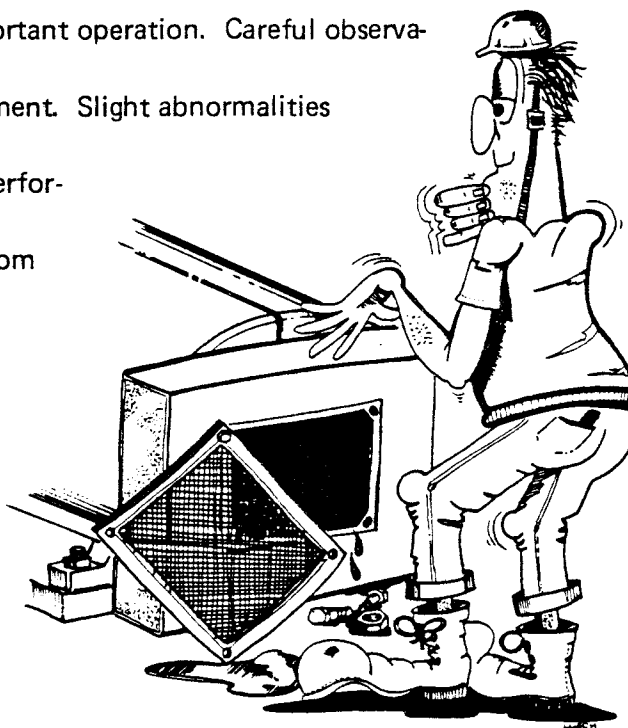


LUBRICATING



INSPECTION is probably the most important operation. Careful observation is required of all parts of the equipment. Slight abnormalities may not interfere with the equipment performance BUT those that are a deviation from the normal should be discovered early.

When inspecting, notice placement, state of cleanliness, color, etc. of parts(s). Example: discoloration indicates overheating; all guards, bolts in place and good housekeeping.



OPERATOR PRE-OPERATION CHECKS

1. Crawler Frame
 - a. Are crawler belts adjusted properly?
 - b. Do belts, sprockets or idlers show excessive wear?
 - c. Does lubrication look good?

2. Lower Frame
 - a. Are there any cracks, loose bolts, stress marks?
 - b. Is lubrication good on circle gear and pinions?
 - c. Do pinions or circle gear teeth show abnormal wear?

3. Bucket
 - a. Does bucket show excessive wear?
 - b. Are all pins and keepers in good condition?
 - c. Are any teeth lost or worn out?

4. Boom Components
 - a. Are there any visible cracks in any components?
 - b. Are there any broken or missing lube lines?
 - c. Is there structural damage to any components?
 - d. Does lubrication look good?

5. Machinery House
 - a. Are lube systems on and operating properly?
 - b. Are the hoist and drag positioned properly on the drum?
 - c. Are there any cracks in components?
Stress marks? Lubrication good?
 - d. Are all bolts tight in hoist and/or drag machinery?
 - e. Are there cracks in upper frame structure?
 - f. Are any house bolts loose or missing?

DAILY MECHANICAL INSPECTION

LUBRICATION SYSTEMS

1. Are all grease tanks filled with correct grease?
2. Are all the grease pumps operating properly?
3. Are all injectors pumping grease correctly?
4. Are all grease lines intact and undamaged?
5. Do all systems cycle properly?
6. Any broken lines or bent lines?

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