



# Technical Manual

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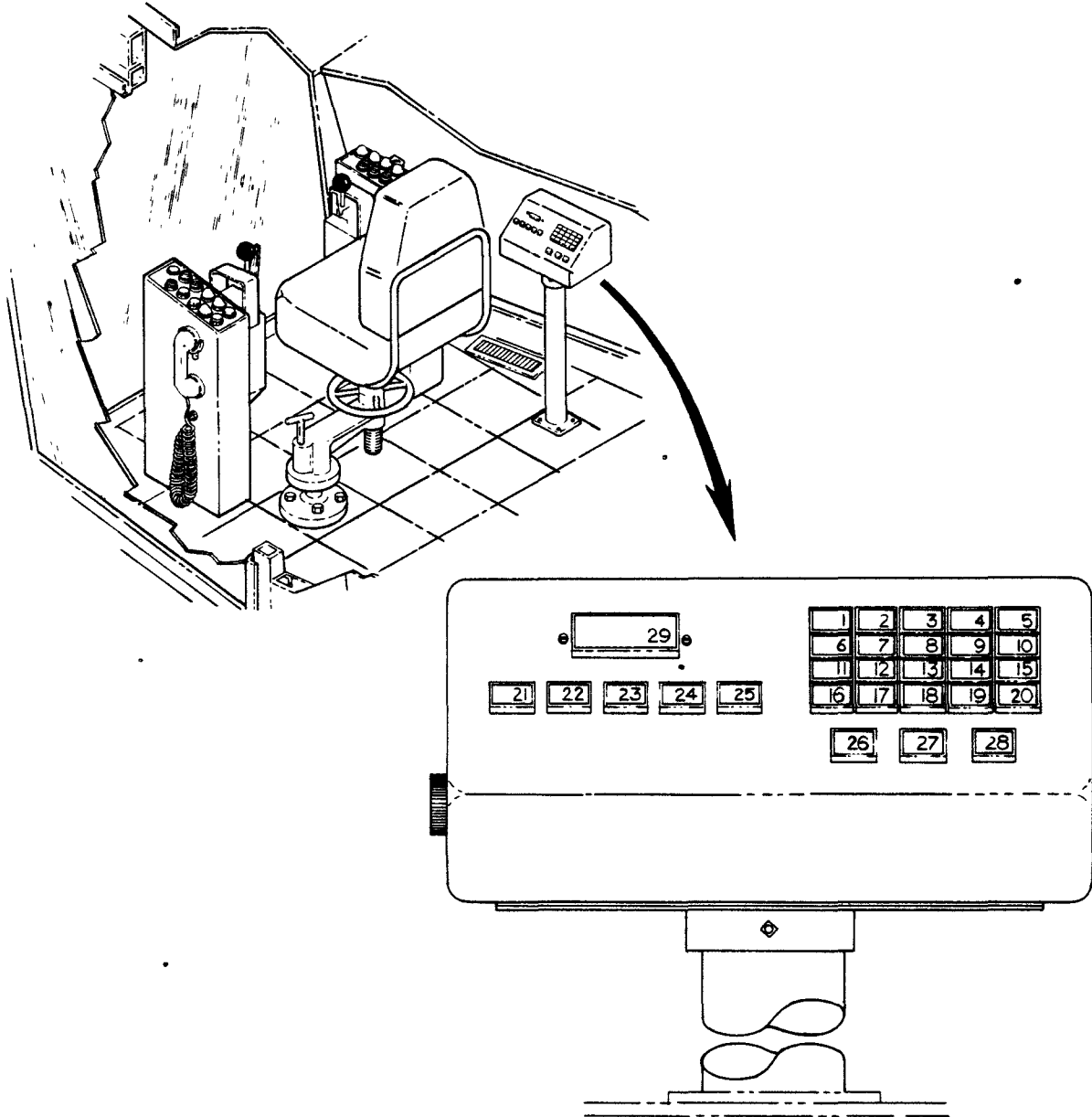
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The ANNUNCIATOR READOUT PANEL, located at right of the operator's seat, consists of warning lights, push buttons and L.E.D. display, all wired into various mechanical or electrical functions.

When a light comes on, an audible alarm will sound to alert the operator. The light identifies where the malfunction or maladjustment is located. The silence button (28) at right end of panel will stop the alarm but lamp will remain on until condition causing alarm has been corrected.



ANNUNCIATOR PANEL

As bucket clears the ground, the swing pedal, which corresponds to desired direction of swing is slowly depressed. (This avoids excessive bucket and rope swing). Swing and hoist bucket at same time so that dumping height is reached at same time bucket reaches spoil.



**CAUTION:** When swinging, make sure the bucket has been raised to clear all obstructions and rear of machine has clearance.

As dump point is reached, reverse swing pedals bringing swing to a smooth stop. When machine comes to rest, the pedal should be brought immediately to neutral position (no pressure on pedals) or else the machine will start to swing in the opposite direction.

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.

**PROPEL CONTROL** – Electrically, the propel equipment consists of:

1. D.C. drive motor on each machine side
2. A drag propel contactor and
3. A control and timing system

The motor, one each side, independently drives its propel machinery. The drag-propel contactors electrically disconnect the drag motors from the drag generators and connect the propel motors to these generators. Thus, the drag master switch controls the propel motors when walking. Since the two sets of propel machinery are not connected mechanically, the two shoes are electrically timed or synchronized. This is done using a system that detects when one shoe is getting ahead of the other. The error signal from this system slows down the fast shoe and speeds up the slow shoe. Limit switches, detecting shoe position, slow the shoes during the step when shoes approach the ground and when the tub approaches the

**NOTE:** Unusually dusty or dirty atmosphere, high humidity and extreme temperatures alter the effective life of a lubricant. Therefore, it shall be the responsibility of the owner/operator to determine the most effective lubricant interval according to existing environmental conditions for all components, bearings (plain and anti-friction), gears, gear cases, etc.

**WIRE ROPE PENDANT LUBRICATION** dislodges with the movement of strand against strand. This permits moisture to enter and causes deterioration of the rope. The area where greatest deflection occurs is at or adjacent to the socket connection. Experience shows this the most likely point of boom point support bridge strand rope failure. To avoid this condition and increase useful life expectancy of the bridge strand support rope apply wire rope lube to the socket area using the hand spray.

**CHECK LIST** for initial lubrication start up and any inspection following:

All grease piping connected and filled.

Proper lube supply to all bearing and lube points.

**NOTE:** All anti-friction bearings and bushings have correct initial lube fill per manufacturer's recommendations.

Proper oil level in all gear cases.

Open and semi-enclosed gear teeth coated with lube.

Automatic lubrication system with adequate lube supply.

<b>NAME OF PART</b>	<b>TYPE</b>	<b>NO. OF POINTS</b>	<b>LOCATION</b>	<b>LUB. SYM.</b>	<b>METHOD &amp; FREQUENCY</b>
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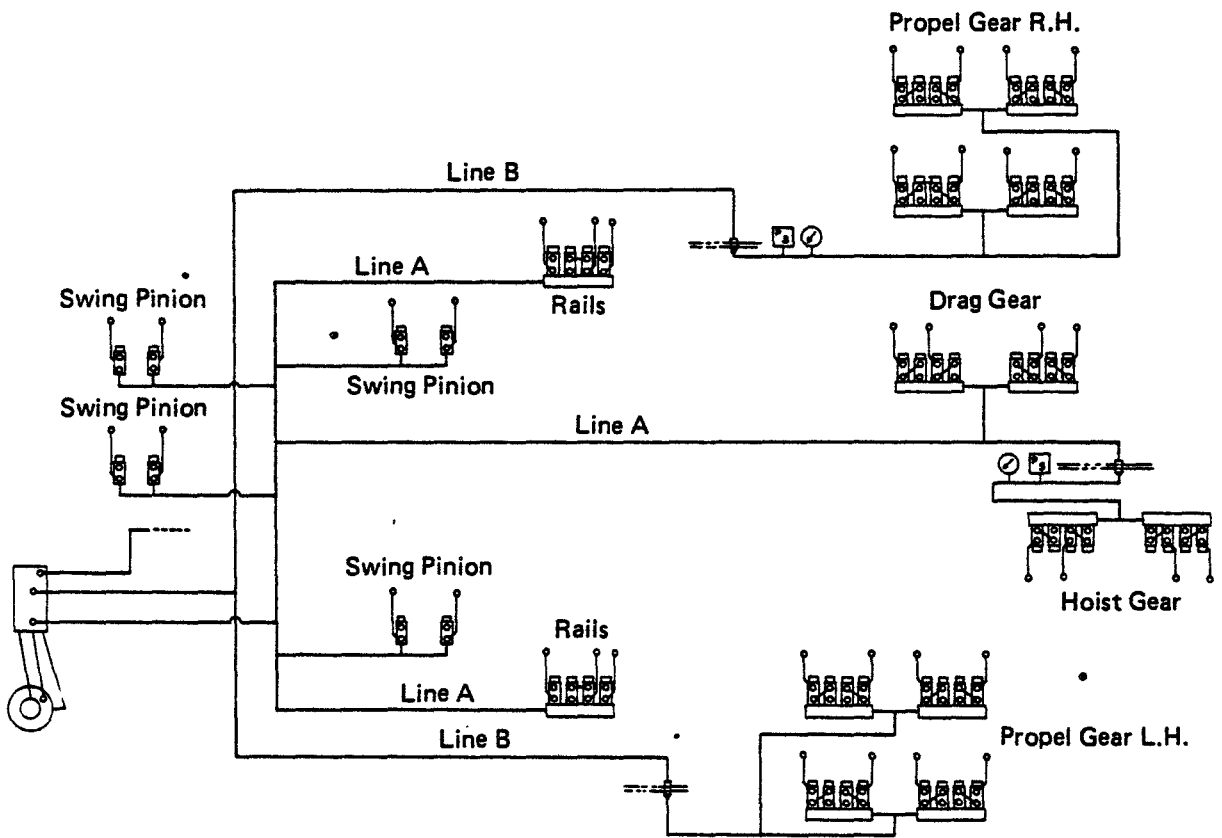
**LUBRICATION OF CENTER JOURNAL**

Center Journal Bearing	Anti-Friction	4	In Top of Bearing Housing	MPG	Automatic
Center Journal Bushing	Bushing	8	In Top of Bearing Housing	MPG	Automatic
Retainer Aligning Pin	Bushing	4	In O.D. of Bearing Retainer	MPG	Automatic
Collector Ring Mount-Bottom	Anti-Friction	1	In Pipe Below Ring Housing	MPG	Hand, 500 Hrs.
Collector Ring Mount-Top	Oilite Bushing	1	In Top of Housing	—	None Required
Auxiliary Collector Ring	—	1	—	—	None Required

**LUBRICATION OF ROTATING MACHINERY (1 of 4)**

Main Rotating Gear Case	—	—	Fill at Air Filter to Oil Level Plug in Side of Case	GL	280 U.S. gal. (1060 liters) capacity, Check Weekly
Main Rotating Shaft Top Bearings	Anti-Friction	—	From Gear Case	—	—
Intermediate Shaft Bearings	Anti-Friction	—	From Gear Case	—	—
Motor Extension Shaft Bearings	Anti-Friction	—	From Gear Case	—	—
Rotating Shaft Bearing Bottom	Anti-Friction	1	Bottom of Upper Frame	MPG	Automatic

**AUTO LUBE FOR OPEN GEARS** supplies the roller circle rail, hoist and drag gear thru Line A which pumps ONLY when digging. The main propel gear and pinion obtain supply from Line B ONLY when propelling. The system time cycle is 10 minutes in dig and 2-1/2 minutes in propel. Alarm is set at 120 seconds. Air pressure is regulated at 80 psi (5.6 kg/cm<sup>2</sup>). End of line pressure switches set at 2500 psi (175.8 kg/cm<sup>2</sup>). This system uses a 400 pound (181 kg) drum of OGL.



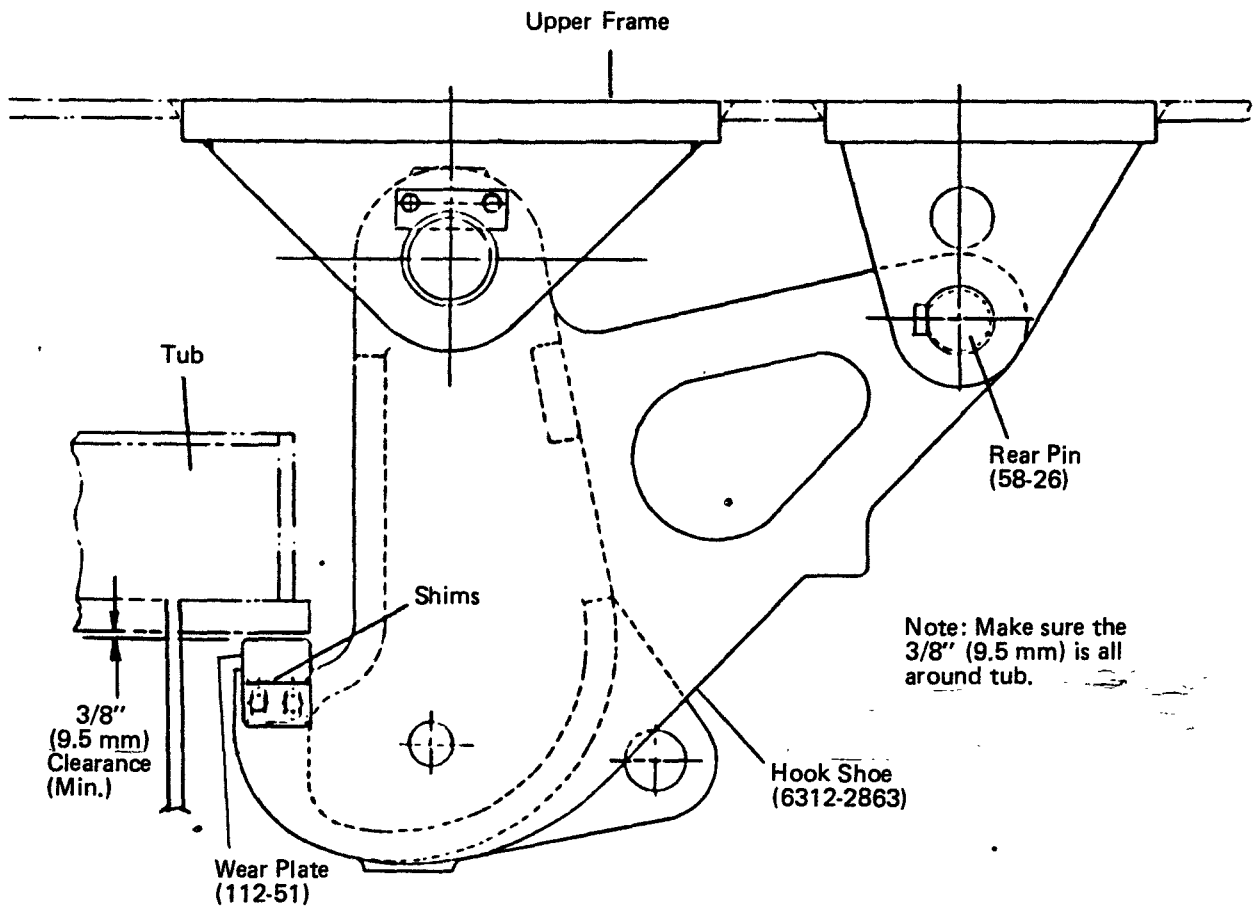
**SCHEMATIC**

Section 4 – Mechanical Adjustments (cont.)	Page
Rotating Machinery .....	4–16
Motor Extension Shaft Assembly .....	4–16
Intermediate Shaft Assembly .....	4–16
<b>Schematics:</b>	
Rotating Gear Case Assembly .....	4–17 thru 4–19
Motor Extension Shaft Assembly .....	4–20
Intermediate Shaft Assembly .....	4–21
Main Drive Gear Assembly .....	4–22
Main Gear Bearings .....	4–22
Main Gear Assembly Oil Seal .....	4–22
Main Rotating Shaft .....	4–24
Reinstalling Main Rotating Shaft .....	4–25
Lubrication of Rotating Gear Case .....	4–26
Tell-Tale Filter .....	4–26
Rotating Brake Assembly .....	4–27
Rotating Brake Limit Switch .....	4–28
Hoist and Drag Machinery .....	4–29
Hoist and Drag Drum Schematic .....	4–30
Hoist and/or Drag Drum .....	4–31
Hoist or Drag Machinery Gear Case .....	4–31
<b>Schematics:</b>	
Hoist/Drag Motor Extension Shaft .....	4–32
Hoist/Drag Intermediate Shaft Assembly .....	4–33

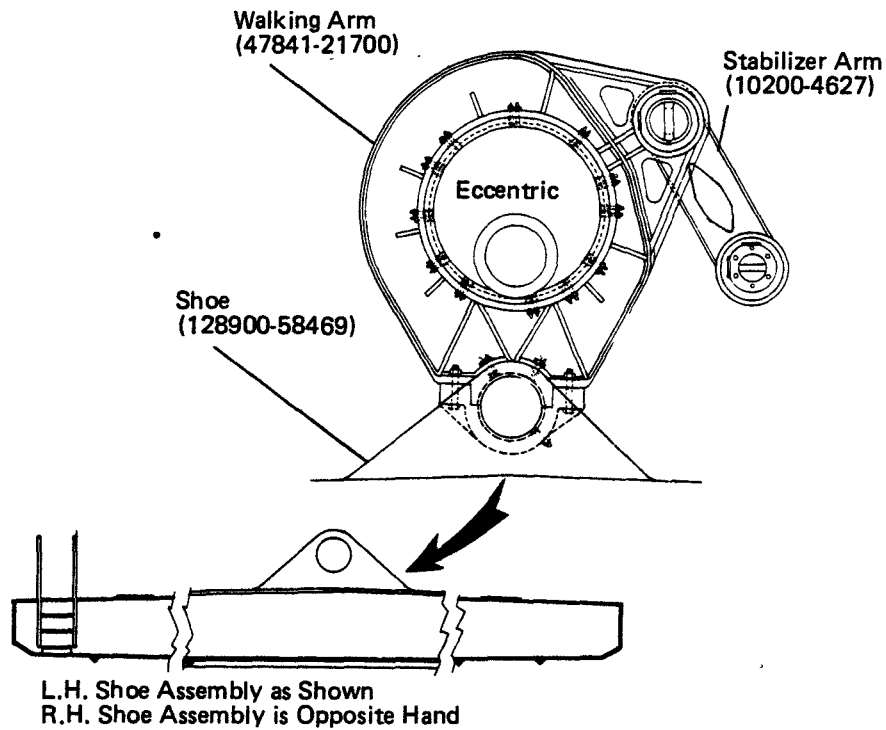
A matching rail is bolted to bottom of rotating frame and is the same as the tub rail except for the space provided to remove the rollers. There is a resilient pad assembled between the upper rail and the finished pad on the rotating frame.

Two **HOO SHOES** lift the leading edge of tub during the walking step. Each hook shoe is pinned to a support casting that is welded to the bottom of the rotating frame. Clearance of 3/8 inch (9.5 mm) exists between the hook rail on the tub and the wear plate on hook shoe when machine weight rests evenly on all rollers. Adjust clearance by placing or removing shims between the wear plate and hook shoe.

Disengage hook shoe by removing the rear pin and swing hook toward rear of machine and replace pin in top hole to hold hook shoe.

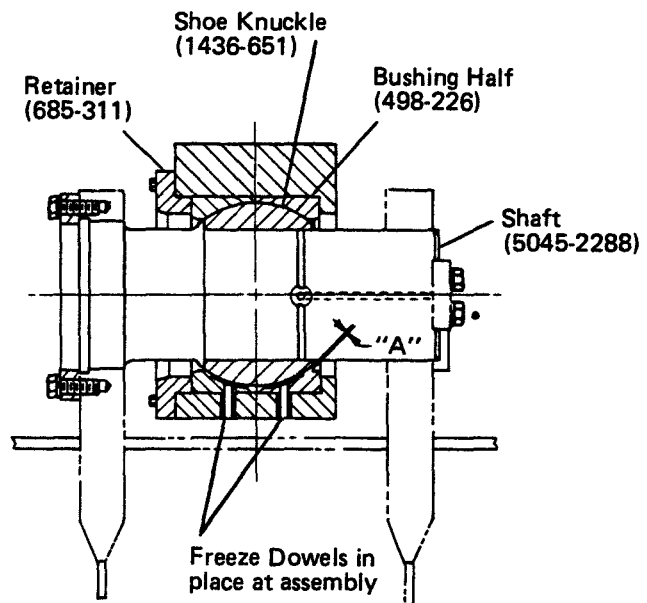


**HOO SHO ASSEMBLY**



### SHOE KNUCKLE ASSEMBLY NOTES

1. Assemble bushing halves on ball to assure that halves fit together at center.
2. Measure clearance at "A".
3. Assemble bushing halves and ball in walking arm with greaser tapped holes in bushing halves aligned with six holes in arm casting.
4. Check for same clearance at "A" as in step 2. If same, then bushings are together and assembly can continue.
5. Spherical bushing may be cooled to 0° F. to assist in assembly.



### PROPEL LINKAGE AND SHOE ASSEMBLY

4. Install retainer (item 2) as shown. Measure dimension from bottom of boss to bottom of hub. If dimension is between .265 (6.731 mm) and .300 (7.620 mm), retainers can be assembled as shown by adding Permatex Aviation Form-A-Gasket No. 3 between bottom face of hub and mating face of retainer (item 2). Also add Permatex between bottom face of boss and mating face of retainer (item 1).

NOTE: Be sure that Permatex at both places has been crushed to the same thickness after assembly of retainers (items 1 and 2).

- 4a. If dimension is less than .265 (6.731 mm), add laminated shims (item 4) to bottom face of hub until this dimension reaches a nominal value of .278 (7.061 mm).
- 4b. If dimension is greater than .300 (7.620 mm), add laminated shims (item 5) to bottom face of boss until this dimension reaches a nominal value of .278 (7.061 mm).
- 4c. Apply Permatex to mating surfaces as described in Step 4 above. Paint both sides of shims with Permatex at installation. Tighten bolts in a uniform cross-hatch pattern.
5. Place one half of seal assembly (item 6) into shoulder area of retainer (item 1) with metal contact area of seal assembly facing outward. Install seal assembly as shown (repeat installation procedure of Step 4). Then add type GL oil to metal contact area of seal assembly.
6. Place one half of seal assembly into shoulder area of retainer (item 3) with metal contact area facing outward. Apply type GL oil to metal contact area of seal assembly only. Install with o-ring as shown and tighten bolts in a uniform cross-hatch pattern.

**MAIN ROTATING SHAFT** is removed and installed thru top of rotating gear case. Swing machine so that shaft to be removed is centered over an access hole in top of tub. Shaft can be removed without disassembling gear case cover or draining oil from case.

Remove cover plate and gasket from case. Insert lifting eye in threaded hole in end of shaft. Attach suitable lifting cable from overhead crane to lifting eye and snug up just enough to support shaft assembly weight (17,720 lbs.) (8038 kg) in installed position.

Support pinion on cribbing, with hydraulic jacks positioned so that they will not block removal of pinion retainer. Remove pinion retainer and pinion. Note that bottom bearing spacer is free to drop out of sleeve as pinion is removed. Remove split lip seal from bottom of main drive gear. Pull shaft up and out of gear case.

To remove bearing, remove lock plates, bearing shield and bearing spacer. Lift out bearing and bearing sleeve.

**DISASSEMBLE GEAR CASE** by removing case cover hold down bolts, the cap screws from top half of bearing retainers at intermediate shaft and the motor extension shaft assembly. Loosen cap screws in bottom half of bearing retainers about two turns. Remove split oil seal from intermediate shaft and remove rods from outboard bearing housing. Lift off case cover from over intermediate shafts. It may be necessary to drive a small wedge between case and cover to break seal.

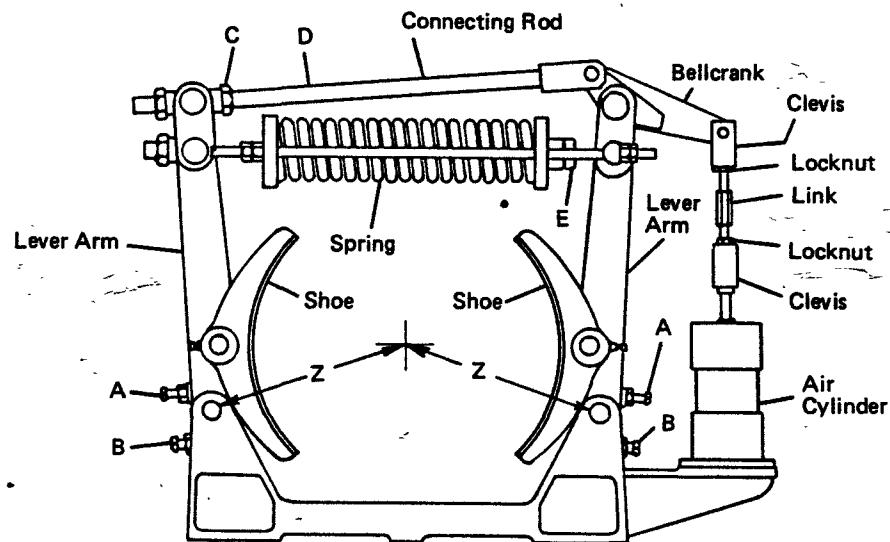
Remove cap screws from lower half of bearing retainers. Use a sling around shaft, lift intermediate shaft assembly out of case. Lift assembly along a line perpendicular to surface of gear case and allow gear to turn out of engagement with main drive gear. Separate motor couplings and remove motor extension shaft assemblies from case. Drain and clean gear case, flush out with light oil.

Reverse procedure to reassemble unit. Fill each gear case with "GL" oil. Hoist and drag motions have front and rear gear cases. Capacity of each gear case is 100 U.S. gallons (379 liters). See Section 5 for Hoist and Drag Limit Switches.

**HOIST, DRAG AND PROPEL BRAKES** are similar in design and construction. Four hoist, four drag and two propel brakes are used.

These brakes are not intended to stop or retard rotation of motor armature shaft, but are designed as holding brakes to hold armature when motors are de-energized. The motion is stopped by "plugging" the electric motors. (See Operation Section.)

Each brake consists of two shoes that act on a friction housing that is keyed to motor armature shaft. The brake is set by compression spring and released by an air cylinder.



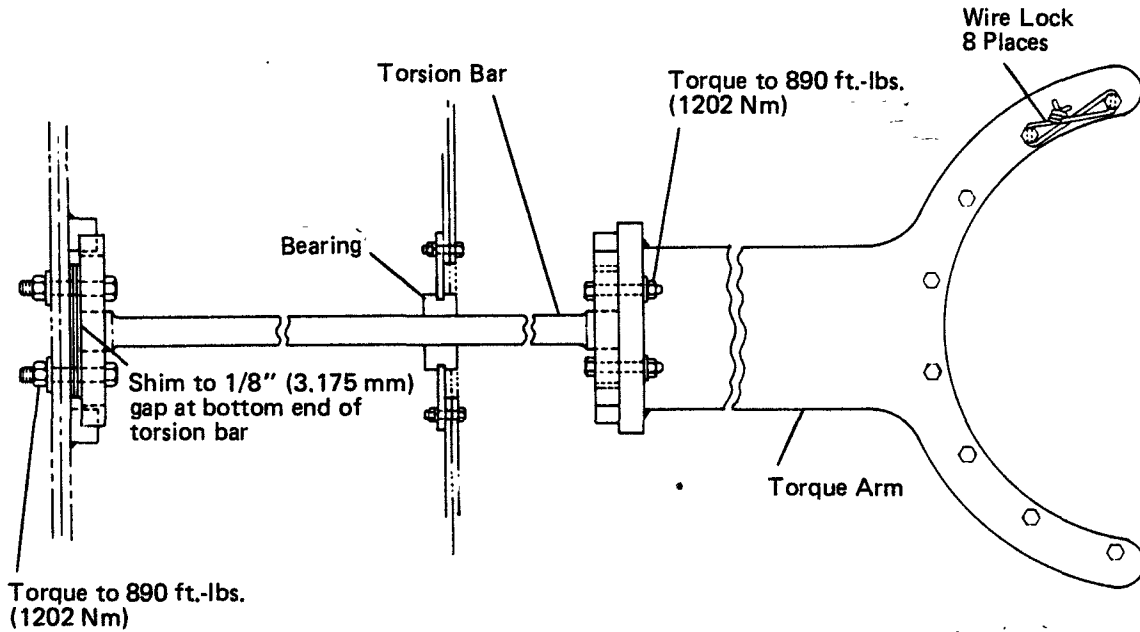
Weight of assembly is 1406 lbs. (638 kg)

**PROPEL BRAKE**

**CAUTION:** The torsion bar must be installed in a no stress condition, do not bend, twist or stretch.

Install torsion bar center support bearing in similar manner. The center support bearing must not place any bending stress on the torsion bar.

Assemble rope guard to boom point and attach all lube lines. Be sure to purge lines of air at hook up.



### TORSION BAR ASSEMBLY

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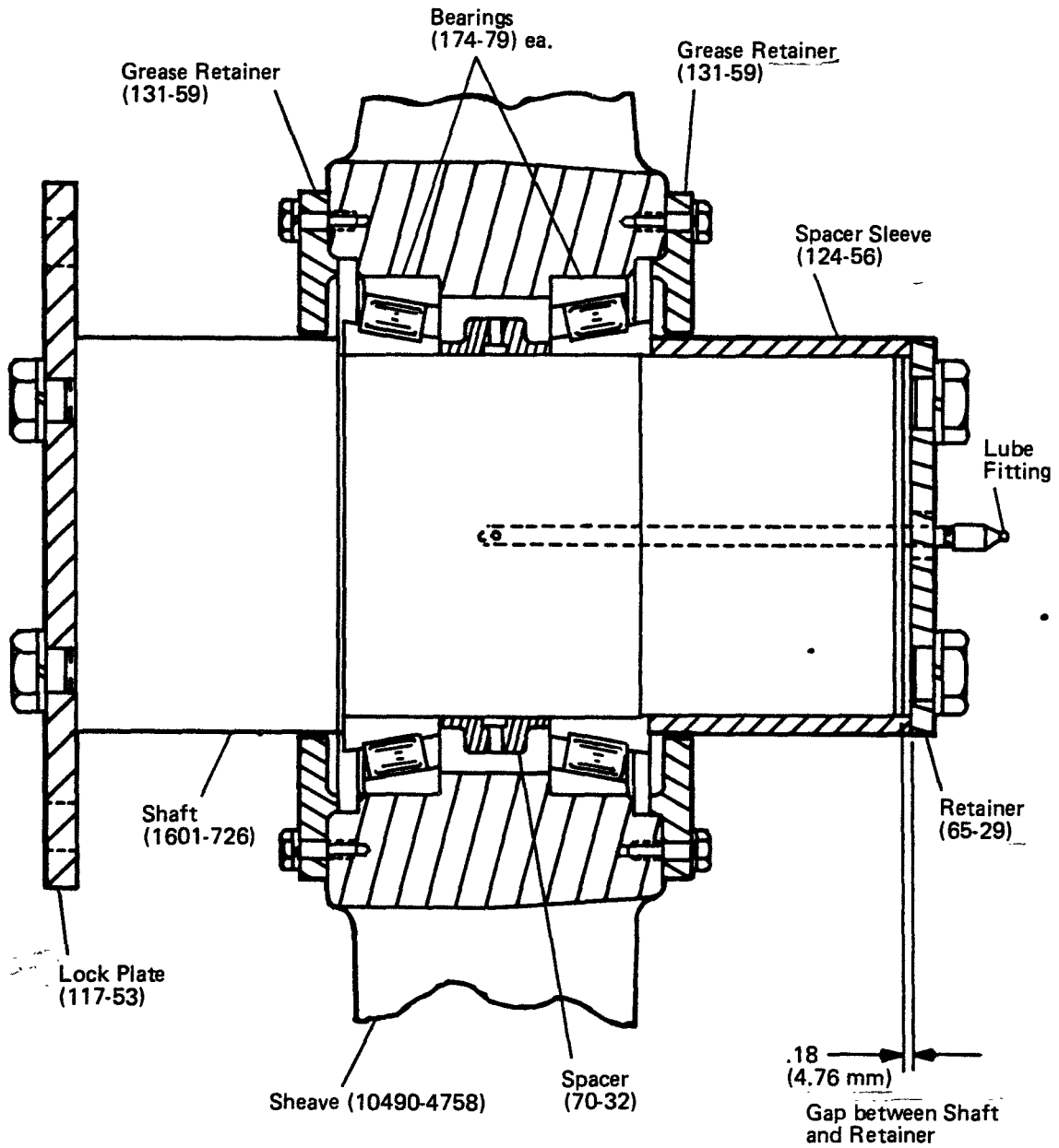


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If bearings must be replaced, remove the sheave assembly from the swivel frame by removing the lockplate, retainer and spacer sleeve. Press out shaft from outside and lower the sheave to the ground.

- **CAUTION:** Secure sheave before removing shaft.



**DRAG ROPE LOWER SHEAVE ASSEMBLY**

NOTE: Many small motors use sealed bearings requiring no lube for 2 or 3 years. Add lube with units stopped and drain plug removed. After adding lube, run generator or motor with bottom plug removed for a few minutes to allow ALL excess lube to flow out. PLEASE REPLACE DRAIN PLUG. In most cases, the main hoist, drag and swing motors have no plug to remove. Surplus grease flows out in the pocket beneath bearing housing.

On vertical and a few horizontal motors, remove the plug as done with generators. As mentioned in the 6 month lube procedure, these bottom plugs are removed before lubing to see that excess lube escapes. Probing with a clean wire assures the old grease has not hardened and blocked the passage. PLEASE REPLACE DRAIN PLUG.

About once a year, or after 7500 operating hours; purge bearings by pumping enough lube thru bearing while running so new grease appears at shaft or bottom plug hole. As lube seeps out along shaft, wipe away. This is important. Finally, after 15 or 20 minutes of operation, thoroughly clean off shaft. New grease usually appears first at bottom hole, but it may be seen first at the shaft. PLEASE DO NOT FORGET THE DRAIN PLUG.

Whenever possible, about once in 2 years, disassemble bearings and remove ALL old lube by thoroughly cleaning with light lube oil or petroleum solvent. Each time the bottom plug is removed, push a clean wire into the hole to check the lube is not hard and plugging the hole.

When repacking bearings with fresh grease, the housings or grease reservoirs should be filled from 1/2 to 2/3 full. An excessive amount of grease in the bearing will cause excessive bearing temperatures. See Table X.

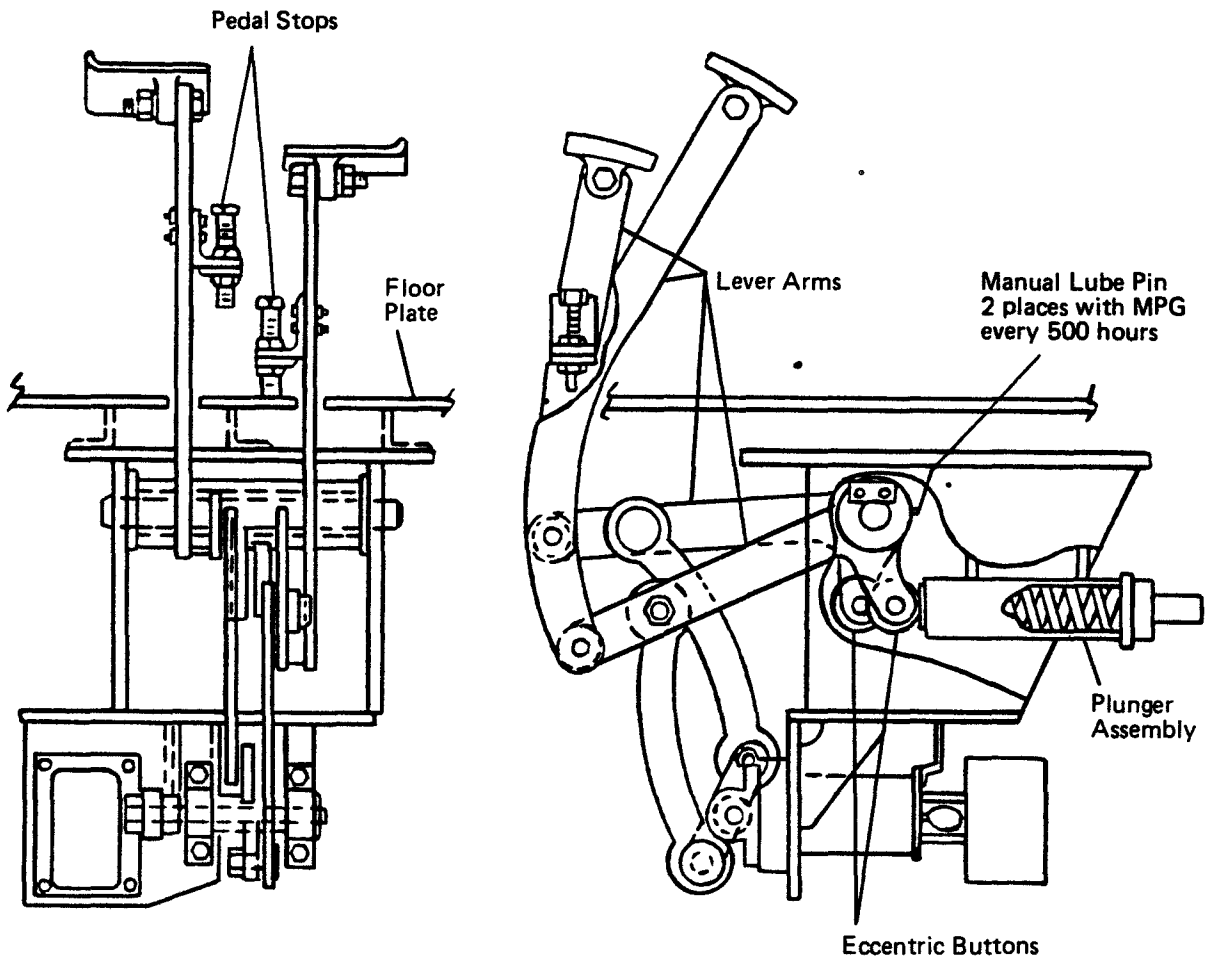
**TABLE X  
BEARING LUBRICATION DATA**

Frame Size	Min. (Grease Reservoir 1/2 Full) & Max (Grease Reservoir 2/3 Full) of Grease at Each Bearing			
	Cubic Inches of Grease	Cubic Centimeters of Grease	Ounces of Grease	Grams
802	3½- 4½	57- 74	1¾- 2¼	50- 64
803	4 - 5½	66- 90	2 - 2¾	57- 78
804	5 - 7	82- 115	2½- 3½	71- 99
806	6½- 9	107- 147	3¼- 4½	92- 128
808	8½-11½	139- 188	4¼- 5¾	120- 163
810	13 -17½	213- 287	6½- 8¾	184- 248
812	17 -23	279- 377	8½-11½	241- 326
814	20 -27	328- 442	10 -13½	284- 383
816	24 -32	393- 524	12 -16	340- 454
818	24 -33	393- 541	12 -16½	340- 468
820	29 -38	475- 623	14½-19	411- 539
822	34 -45	557- 737	17 -22½	482- 638
824	42 -51	688- 836	21 -25½	595- 723
828	67 -78	1098-1278	33½-39	950-1106

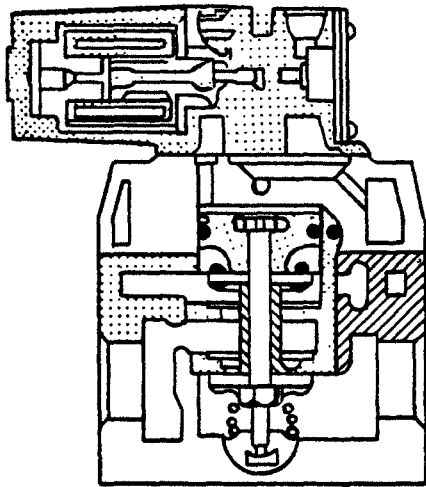
**SWING CONTROL PEDALS**, two located in front of operator, connect to the electric swing controller thru compound linkage. This linkage uses anti-friction bearings.

A spring loaded plunger, mounted under the deck plate, returns the pedals to the neutral position. When pedal reaction becomes sluggish or binds; check here. Remove the plunger from the case, clean and lube with a small amount of MPG. Spacers, placed between spring and end caps, increase the spring tension.

Adjust pedal stop to strike floor plate at FULL left and FULL right swing. Adjust the pedal return lever arm by rotating the eccentric button on the lever arm so BOTH eccentric buttons contact the spring plunger in the neutral position. Once adjusted, weld button to lever arm.



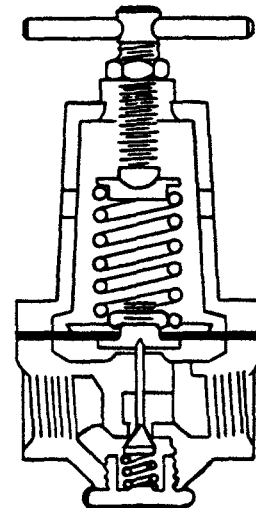
filling; NEVER REFILL THRU WICK CAP. Use methyl alcohol only. (Permanent anti-freeze types do not evaporate fast enough for good protection).



**MAGNET VALVES** need little or no maintenance. Dirt and scale cause a leaky valve sometimes. Try opening and closing it several times quickly by turning the small screw on top. Cleaning this way often avoids disassembly. If not, **DISMANTLE, CLEAN, and REPLACE** worn or damaged parts. Lube with a small amount of MPG.

These electrically operated (on and off) valves are normally closed when de-energized. A spring loaded plunger shuts OFF air from supply to cylinder while the exhaust port from the cylinder to atmosphere is OPEN. Energizing the coil moves the plunger down, CLOSING the exhaust port and OPENING the port from supply to the brake release cylinder.

**PRESSURE REGULATORS** consist of a spring loaded diaphragm that moves a cone shaped seat which opens and closes, allowing air to pass thru the valve. A spring under this seat keeps it against the diaphragm. A T-handle on top screws in and out to adjust diaphragm spring tension. Right (clockwise) increases and left (counterclockwise) decreases the tension; and the air pressure. When used in connection with clutches, the setting is at tank pressure low end to soften action and protect the clutch or parts. NEVER USE MORE pressure than needed to handle a fully loaded bucket. When used elsewhere, a pressure gauge reading shows needed operating setting.



**AIR CYLINDER VALVES** actuate the brakes and are spring set; air released. A sleeve retains the spring and threads into the open cylinder end. A set screw locks this sleeve. To re-pack cylinder, unlock set screw and turn out sleeve to release return spring tension. Discon-

**TABLE 1  
RUNNING CLEARANCES FOR BRONZE BUSHINGS  
Inches (Millimeters)**

SHAFT		Running Clearance	SHAFT		Running Clearance
Nominal Diameter	Outside Diameter		Nominal Diameter	Outside Diameter	
1 (25.4)	1.000-999 (25.4-25.375)	.006-.010 (.152-.254)	4.25 (107.95)	4.250-4.248 (107.950-107.899)	.010-.019 (.254-.483)
1.25 (31.75)	1.250-1.249 (31.750-31.725)	.005-.010 (.127-.254)	4.50 (114.3)	4.500-4.498 (114.300-114.249)	.010-.019 (.254-.483)
1.50 (38.10)	1.500-1.499 (38.100-38.075)	.008-.013 (.203-.330)	4.75 (120.65)	4.750-4.748 (120.650-120.599)	.014-.022 (.279-.559)
1.75 (44.45)	1.750-1.749 (44.450-44.425)	.008-.013 (.203-.330)	5.0 (127.0)	5.000-4.998 (127.000-126.949)	.011-.020 (.279-.508)
2.0 (50.8)	2.000-1.999 (50.800-50.775)	.007-.012 (.178-.305)	5.25 (133.35)	5.250-5.248 (133.350-133.299)	.011-.020 (.279-.508)
2.25 (57.15)	2.250-2.248 (57.150-57.099)	.006-.013 (.152-.330)	5.50 (139.7)	5.500-5.498 (139.700-139.649)	.012-.020 (.305-.508)
2.50 (63.5)	2.500-2.498 (63.500-63.449)	.006-.013 (.152-.330)	5.75 (146.05)	5.750-5.748 (146.650-145.999)	.012-.021 (.305-.533)
2.75 (69.85)	2.750-2.748 (69.850-69.799)	.008-.015 (.203-.381)	6.0 (152.40)	6.000-5.998 (152.400-152.349)	.012-.021 (.305-.533)
3.0 (76.2)	3.000-2.998 (76.200-76.149)	.008-.015 (.203-.381)	6.25 (158.75)	6.250-6.248 (158.750-158.699)	.012-.021 (.305-.533)
3.25 (82.55)	3.250-3.248 (82.550-82.499)	.008-.015 (.203-.381)	6.50 (165.10)	6.500-6.498 (165.100-165.049)	.012-.021 (.305-.533)
3.50 (88.90)	3.500-3.498 (88.900-82.499)	.008-.015 (.203-.381)	6.75 (171.45)	6.750-6.748 (171.450-171.399)	.013-.022 (.330-.559)
3.75 (95.25)	3.750-3.748 (95.250-95.199)	.011-.019 (.279-.483)	7.0 (177.8)	7.000-6.998 (177.800-177.749)	.013-.022 (.330-.559)
4 (101.6)	4.000-3.998 (101.600-101.549)	.010-.011 (.279-.483)	7.25 (184.15)	7.250-7.248 (184.150-184.099)	.013-.022 (.330-.559)

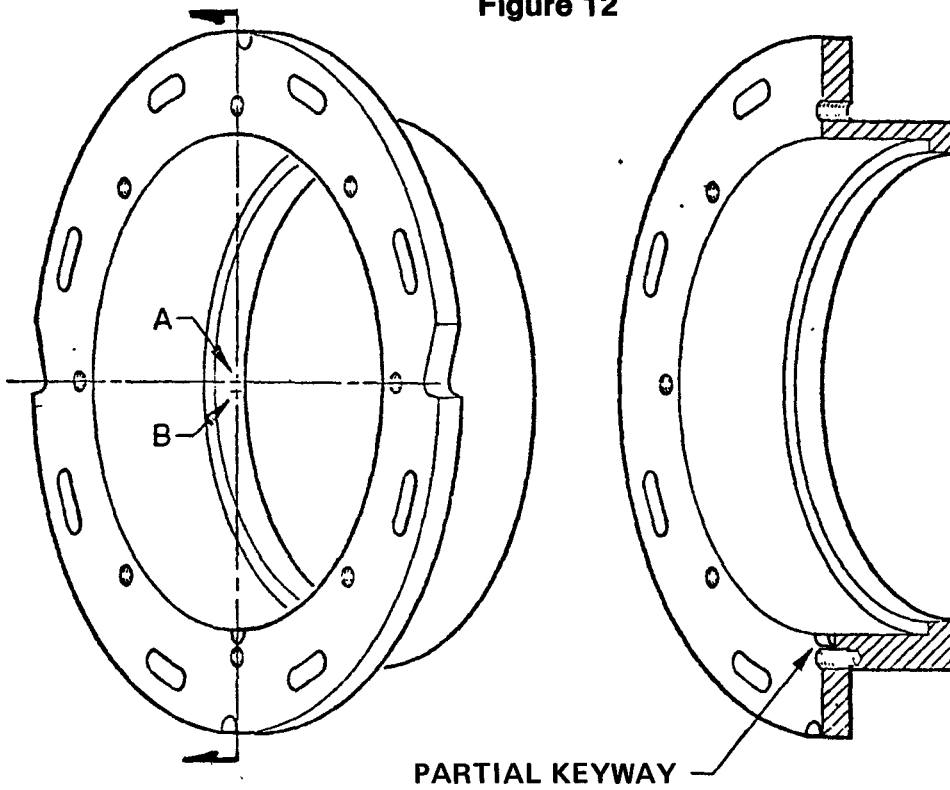
**TABLE 2  
ASSEMBLED GEAR BACKLASH  
TOLERANCES**

CENTER DISTANCE		DIAMETRIAL PITCH														
		.5 (14) — 625(16)			.75 (19)			1.25 (32)			2.0 (51)			3.0 (76)		
inches (millimeters)																
FROM	TO	MIN <sup>1</sup>	MAX <sup>2</sup>	MIN <sup>1</sup>	MAX <sup>2</sup>	MIN <sup>1</sup>	MAX <sup>2</sup>	MIN <sup>1</sup>	MAX <sup>2</sup>	MIN <sup>1</sup>	MAX <sup>2</sup>	MIN <sup>1</sup>	MAX <sup>2</sup>	MIN <sup>1</sup>	MAX <sup>2</sup>	
20 (508)	40 (1016)	.040 (1)	.104 (2.64)	.026 (.66)	.086 (2.18)	.020 (.51)	.070 (1.78)	.016 (.41)	.062 (1.57)	.010 (.25)	.050 (1.27)	.010 (.25)	.050 (1.27)	.010 (.25)	.050 (1.27)	
40 (1016)	60 (1524)	.040 (1)	.104 (2.64)	.026 (.66)	.086 (2.18)	.020 (.51)	.070 (1.78)	.016 (.41)	.062 (1.57)	.012 (.30)	.052 (1.32)	.012 (.30)	.052 (1.32)	.012 (.30)	.052 (1.32)	
60 (1524)	80 (2032)	.040 (1)	.104 (2.64)	.028 (.71)	.088 (2.24)	.024 (.61)	.074 (1.88)	.018 (.46)	.064 (1.63)	.024 (.61)	.070 (1.78)	.024 (.61)	.070 (1.78)	.024 (.61)	.070 (1.78)	
80 (2032)	100 (2540)	.044 (1.1)	.108 (2.74)	.030 (.76)	.090 (2.29)	.028 (.71)	.078 (1.98)									
100 (2540)	120 (3048)	.044 (1.1)	.108 (2.74)	.036 (.91)	.096 (2.44)	.036 (.91)	.086 (2.18)									

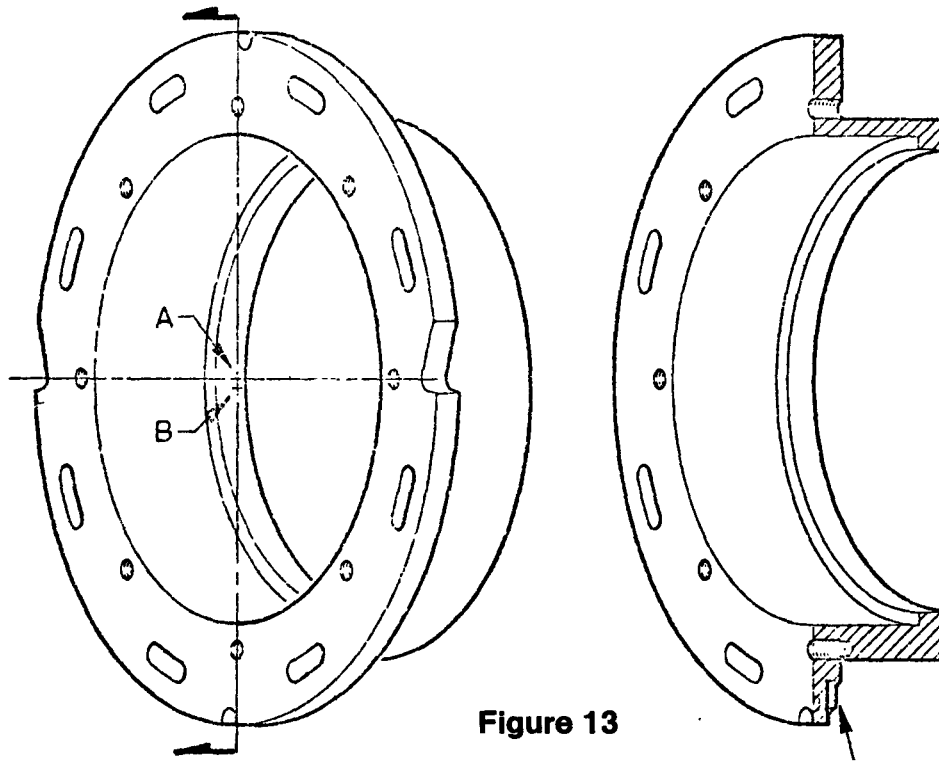
<sup>1</sup>When adjustment capabilities are designed into the open gear or pedestal mountings, backlash values should be selected between the minimum (MIN) and the average values as determined from the range indicated.

<sup>2</sup>Maximum (MAX) values may increase by an additional .010 (.254mm) when an eccentric adjustment for alignment has been made in the plane of centers of an enclosed gear case.

**Figure 12**

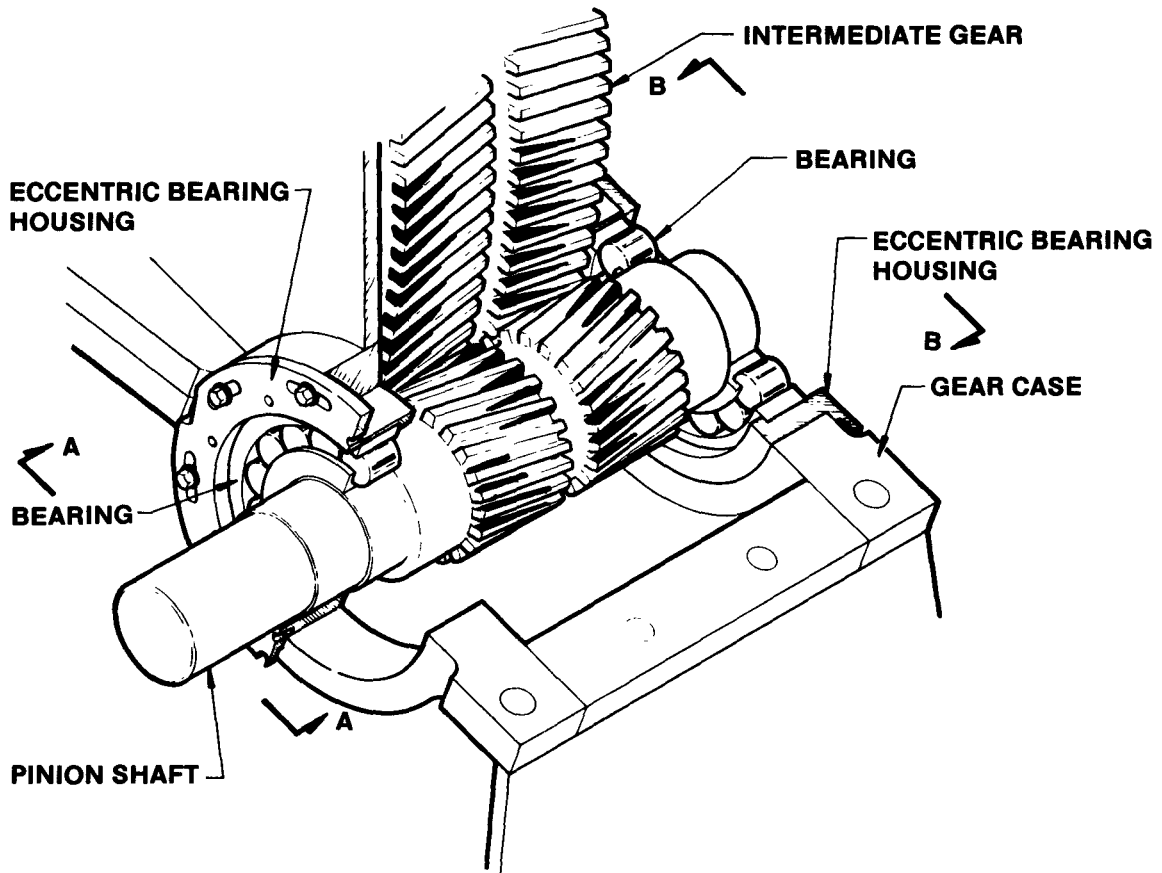


Figures 12 and 13 indicate other locations for the partial keyway rather than the location shown in Fig. 10. However, the partial keyway has the same meaning regardless of its location.



**Figure 13**

**PARTIAL KEYWAY**



## **SPLINES**

**Cured splines disassemble** by breaking the bond with puller, press or hydraulic jack and then removing. Temperatures at least 400 degrees F. (204 degrees C.) (NOT over 650 degrees F. or 343 degrees C.) weaken the bond also. Apply pressure and remove while hot.

## **INVOLUTE SPLINE ASSEMBLY**

**Involute spline assemblies permanent fit with adhesive** as indicated by Class #2 design. The approved adhesive is Loctite CVV 82 (key fit). Standard parts joined with involute splines assemble with a liquid adhesive that hardens when confined in the absence of air.

**Anti-friction bearings** installation on a shaft requires an interference fit, assemble BEST by shrinking the inner race onto the shaft. This means creating a difference in temperature between shaft and the inner race. Heating the bearing is easier than cooling the shaft. Heat the bearing in a suitable oven or other means of dry heat.

**NOTE: DO NOT APPLY HEAT DIRECTLY TO THE BEARING.**



**Warning: Do not use a water or oil bath to heat bearings.  
DO NOT HEAT ABOVE 250 degrees F.**

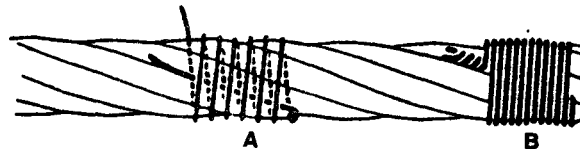
Another method requires hand pouring of lube onto rope after brush or air jet cleaning. In either method, the rope must remain coated at all times.

Inaccessible boom supports and bridge strands need lubricant applied at and around boom hoist sheaves, as well as, the dead end anchor area. Spray can lube helps here.

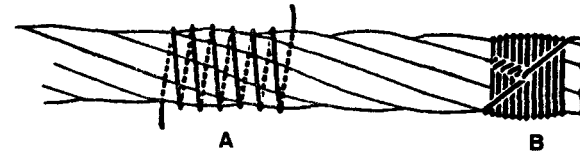
**PROPERLY SEIZING** wire rope ends prevent the strands from slipping. Any strand movement causes uneven load distribution in the strands and reduces rope life. (See Figure 12)

Seize rope **BEFORE** cutting. Tighten wrap, (a soft, annealed wire), about strand size wire; around rope. Pull wrap tight. Twist wire end secure. Use 1/4 inch wrap length on all rope up to 1/4 inch. On all other rope, measure wrap length at least one rope diameter in length. Place the first wrap about 1 to 1-1/2 inches from the intended cut. Then place a second wrap or seizing about 4 to 6 inches from the first.

**Figure 18**  
**Proper Methods of Seizing**



Sketch of Method No. 1 for applying seizings. At A the turns of the seizing wire are spread apart to illustrate method of applying them. Completed seizing is shown at B.



Sketch of Method No. 2 for applying seizings. At A the turns are spread apart to show method of applying them. Completed seizing is shown at B.

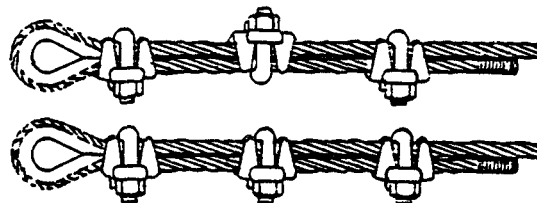
Use a portable cable cutter whenever possible. Often a flame cutting torch is used and generally fuses the strand and wire together. Do not use a melting tip here.

Space wire rope clips about 6 rope diameters apart. Tighten clip on rope **BEFORE** placing rope in tension. Then retighten after rope is in use. Any rope diameter loss caused by pulling on rope, loosens clips. Retighten clips.

**Figure 19**  
**Applying Wire Rope Clips**



**The Right Way to Clip Wire Rope**



**The Wrong Way to Clip Wire Rope**

Only one correct method of attaching U-bolt clips on wire rope exists. The clip base must bear on the live end of rope. The U of the bolt bears on the rope dead end (see sketch). Otherwise, the U-bolt kinks or cuts the anchor live end and causes failure.

## **STEP 5—Electrode Selection**

When selecting the right electrode, there are certain factors to consider. These are:

1. Welding process.
2. Welding position.
3. Welding current.
4. Service conditions or specifications.

1. **Welding process:** is the repair going to be made on the machine, somewhere in the field, or in a shop? What type of welding process is available? Shielded metal arc (stick), gas metal arc, flux cored welding (gas or gasless), submerged arc, or gas tungsten arc welding process? What is the extent of the repair?

The most common welding process is the shield metal arc welding process or stick. With the availability of new portable power sources and arc welding equipment, any of the processes mentioned could be used. For the rebuilding of rollers and shafts, the submerged arc process is very practical. The results are a smooth, neat overlay or build-up of high quality weld metal. In the past few years, a number of electrode manufacturers have developed small diameter flux cored electrodes for all position welding. If the repair is extensive, the flux cored process will reduce the repair time.

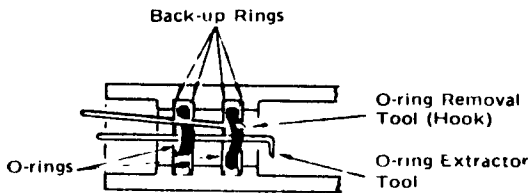
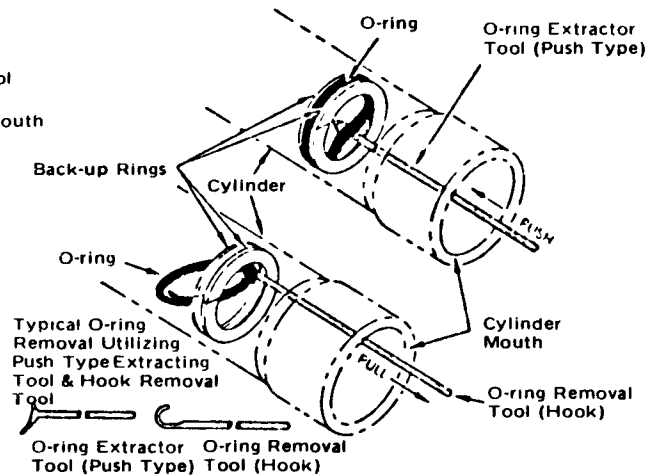
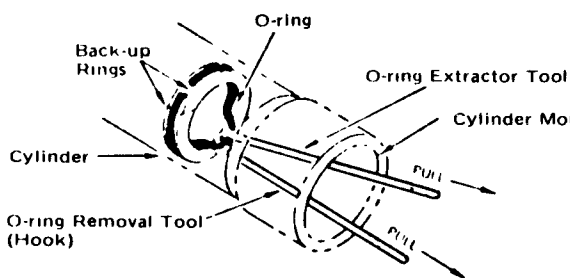
A process that is often overlooked for small repair jobs is the gas tungsten arc welding process, commonly known as T.I.G. With this process, almost any type of material can be welded. The T.I.G. process is not a high production process but the weld metal is of high quality. Any repair can be blended in with the surface of the part with very little grinding. The heat affected zone in high strength cast steel or forgings is not too much harder than the parent material. It can be used for the repair of gear teeth, small repair areas in almost any weldment, tubing and for the repair of hand tools.

2. The second factor to consider is the position the part will be repaired. If the repair can be welded in the flat position, larger electrodes can be purchased, and therefore, decrease the time to complete the repair. Depending on the type of repair and how critical the repair may be, the smaller electrode should be used. If the repair must be made in the vertical position, the electrode must be an all position type electrode.
3. A third factor to consider when purchasing electrode is the type of welding current. If the welding machine is a (stick) AC transformer, an electrode

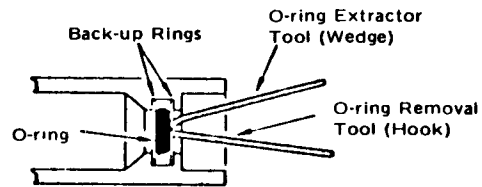
DO NOT USE pointed, sharp-edged or hardened steel tools (screwdrivers, church keys or knives) for removal or installation of backup rings or seals. Soft-metal tools of brass or aluminum, plastic, wood or phenolic rod when formed into desired shape save the critical surfaces.

Tool surfaces need to be well rounded, polished and no burrs on working end. This obviously prevents scratches. (Typical O-ring tools shown on page 71)

Removal from cylinders and pistons means every effort is needed to avoid contact with machined surfaces.

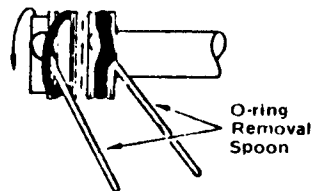


Typical Dual O-ring Internal Extraction & Simultaneous Removal

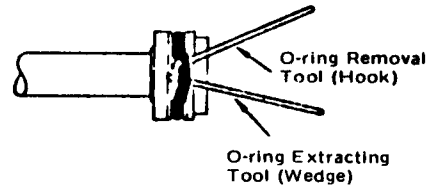


Typical Single O-ring Internal Extraction Utilizing Wedge Type Extracting Tool & Hook Removal Tool

O-ring Extractor Tool (Wedge)



Typical External O-ring Removal Utilizing O-ring Removal Spoon



Typical Single O-ring Removal Utilizing Wedge Type Extracting Tool and Hook Type Removal Tool

CAUTION: Do Not Permit Unnecessary Contact of Tools With Bearing and Cylinder Wall Surfaces. Avoid Dropping Tools Into Cylinders

NOTE After O-ring is Dislodged from Groove, Hold Spoon Tool Stationary Simultaneously Rotate and Withdraw Piston from Ring




**TABLE 9**

**PERMISSABLE COUPLING MISALIGNMENT AND END FLOAT**

**Gridmember Data**

INCHES (mm)  
POUNDS (Kg)

DO NOT APPLY LOAD UNLESS COMPLETE GRIDMEMBER IS  
INSTALLED AND ALL SECTIONS IN THEIR PROPER LAYER

Coupling Size	Gridmember Dimensions Inches (mm)	# Rungs	# Layers	# Segments Layer	Outside Diameter			Angular  NOTE 1	Parallel 	End Float 	GAP			WT lb (kg)	Lube Req. lb (kg)	Coupling Size
					Single Layer Aluminum Inch (mm)	Outer Layer Bronze Stamped "Out"	Inner Layer Aluminum Stamped "In"				MIN	NORM	MAX			
3	.048x3/16x1 1/2	20	1	1	2.375 (60.325)			.005 (.127)	.005 (.127)	5/32 (.006)	1/8 (3.2)	5/32 (4.0)	4 (1.8)	1/16 (.03)	3	
4	1/16x3/16x2 (1.6)x(4.8)x(50.8)	24	1	1	2.687 (68.25)			.005	.005	3/16 (4.763)	1/8 (3.2)	3/16 (4.8)	6 (2.7)	1/16 (.03)	4	
5	1/16x1/4x2 (1.6)x(6.4)x(50.8)	28	1	1	3.125 (79.38)			.005	.005	3/16 (4.763)	1/8 (3.2)	3/16 (4.8)	8 (3.6)	1/8 (.05)	5	
6	1/16x1/4x2	32	1	1	3.625 (92.08)			.005	.005	3/16 (4.763)	1/8 (3.2)	3/16 (4.8)	10 (4.5)	1/8 (.05)	6	
7	1/16x3/8x2 (1.6)x(9.5)x(50.8)	36	1	2	4.250 (107.95)			.005	.005	3/16 (4.763)	1/8 (3.2)	3/16 (4.8)	14 (6.3)	1/8 (.05)	7	
8	3/32x3/8x2 1/4 (2.4)x(9.5)x(57.2)	40	1	2	5.000 (127.0)			.010 (.2540)	.010 (.2540)	1/4 (6.35)	1/8 (3.2)	1/4 (6.4)	28 (12.6)	1/4 (.1)	8	
9	3/32x1/2x2 3/4 (2.4)x(12.7)x(69.9)	40	1	2	5.500 (139.7)			.010	.010	1/4 (6.35)	1/8 (3.2)	1/4 (6.4)	33 (14.9)	1/4 (.1)	9	
10	1/8x1/8x3 1/2 (3.2)x(3.2)x(88.9)	40	1	2	6.125 (155.58)			.010	.010	3/8 (9.525)	3/16 (4.8)	3/8 (9.5)	49 (22.1)	3/8 (.17)	10	
11	1/8x1/2x3 1/2 (3.2)x(12.7)x(88.9)	40	1	2	6.750 (171.45)			.010	.010	3/8 (9.525)	3/16 (4.8)	3/8 (9.5)	60 (27.0)	1/2 (.2)	11	
12	1/8x5/16x3 1/2 (3.2)x(7.9)x(88.9)	44	2	2	7.500 (190.50)	6.875 (174.63)		.012 (.3048)	.012 (.3048)	3/8 (9.525)	3/16 (4.8)	3/8 (9.5)	75 (33.8)	5/8 (.3)	12	
13	1/8x3/16x3 1/2 (3.2)x(4.8)x(88.9)	52	2	2	8.750 (222.25)	8.125 (206.38)		.012	.012	3/8 (9.525)	3/16 (4.8)	3/8 (9.5)	97 (43.7)	3/4 (.3)	13	
14	5/32x3/8x4 1/2 (4.0)x(9.5)x(114.3)	48	2	2	9.500 (241.30)	8.750 (222.25)		.012	.012	1/2 (12.7)	1/4 (6.4)	1/2 (12.0)	145 (65.3)	1 1/2 (.7)	14	
15	3/16x3/8x4 1/2 (4.8)x(9.5)x(114.3)	48	2	2	9.750 (247.65)	9.000 (228.6)		.012	.012	1/2 (12.7)	1/4 (6.4)	1/2 (12.7)	175 (78.8)	1 1/2 (.7)	15	
16	3/16x3/8x4 1/2	56	2	2	11.250 (285.75)	10.500 (266.70)		.012	.012	1/2 (12.7)	1/4 (6.4)	1/2 (12.7)	215 (96.8)	2 (.9)	16	
17	3/16x3/8x4 1/2	64	2	2	12.750 (323.85)	12.000 (304.08)		.012	.012	1/2 (12.7)	1/4 (6.4)	1/2 (12.7)	285 (128.3)	2 3/4 (1.2)	17	
18	3/16x3/8x4 1/2	72	2	3	14.250 (361.95)	13.500 (342.90)		.012	.012	1/2 (12.7)	1/4 (6.4)	1/2 (12.7)	365 (164.3)	3 1/4 (1.5)	18	
190	3/16x1/2x6 3/4 (4.8)x(12.7)x(171.45)	72	2	4	15.750 (400.05)	14.750 (374.65)		.015 (.381)	.015 (.381)	1/2 (12.7)	1/4 (6.4)	1/2 (12.7)	650 (292.5)	7 (3.2)	190	

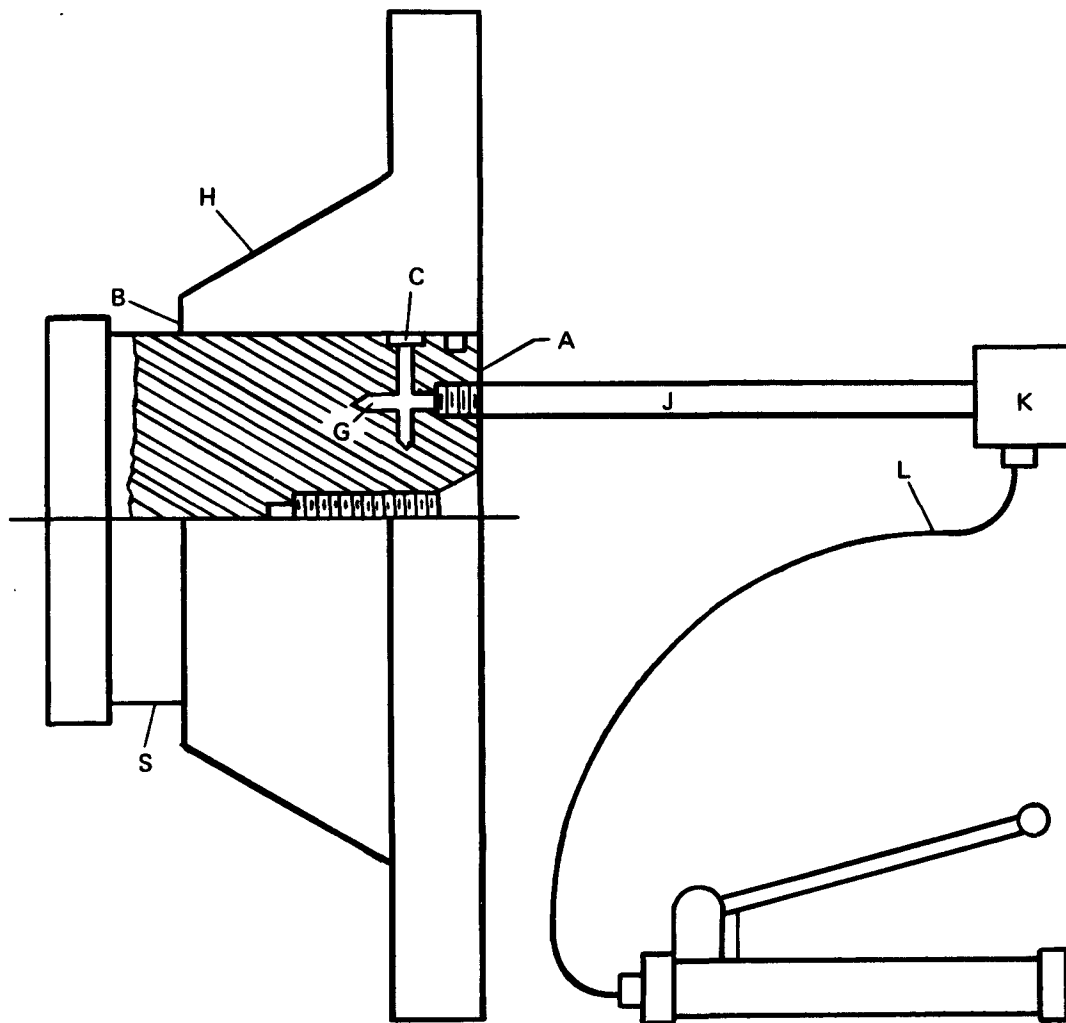
Note 1: e measured difference in gap of points 180° apart. Value indicated is total dist e measured at outer extremity of hub

If coupling removal is difficult using this procedure (bores or shaft surfaces abused) the following tips may help.

If oil does not appear on both hub ends due to insufficient pressure (excessive shaft end leaks), use heavier oil or grease. Slight, cautious peening around leak helps.

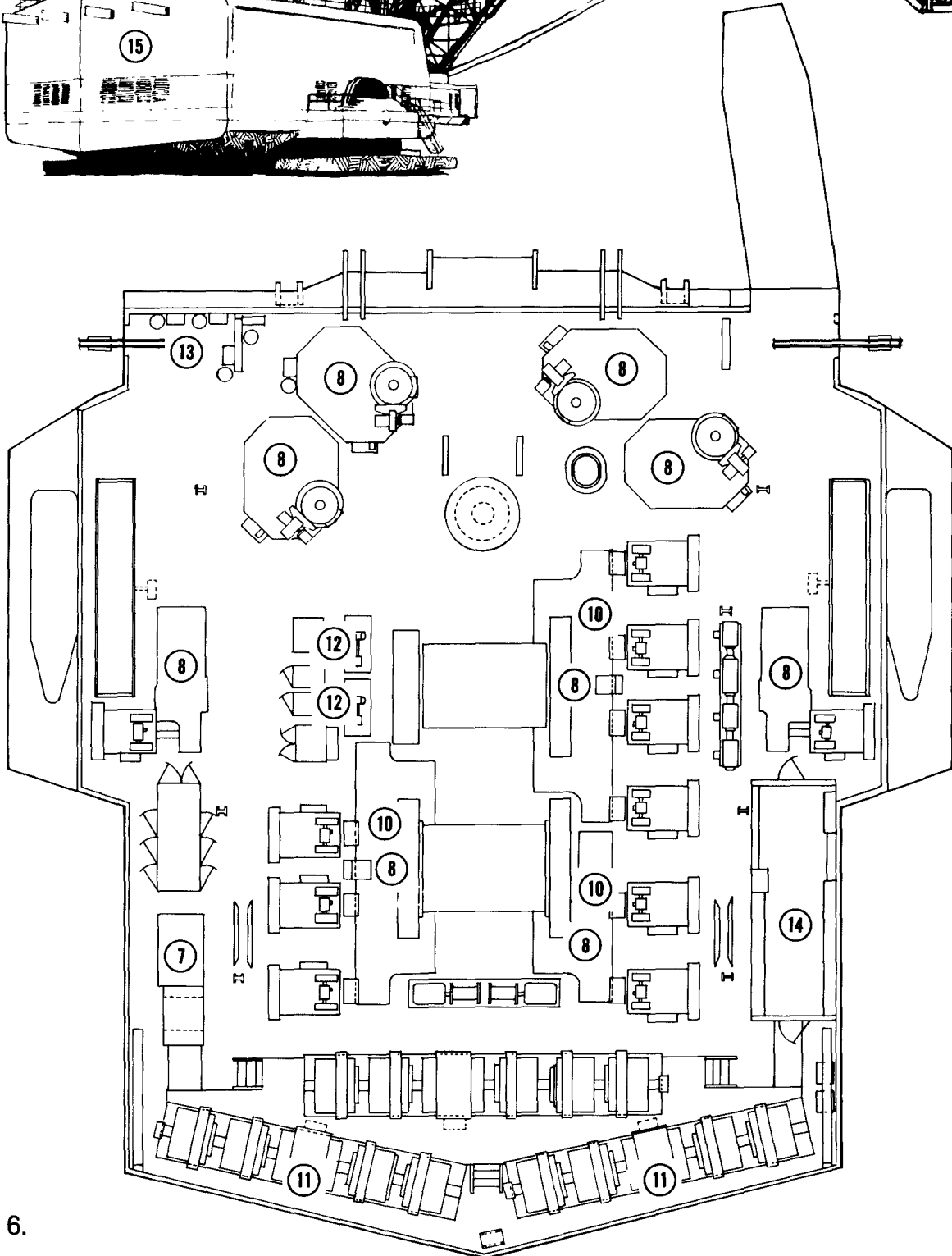
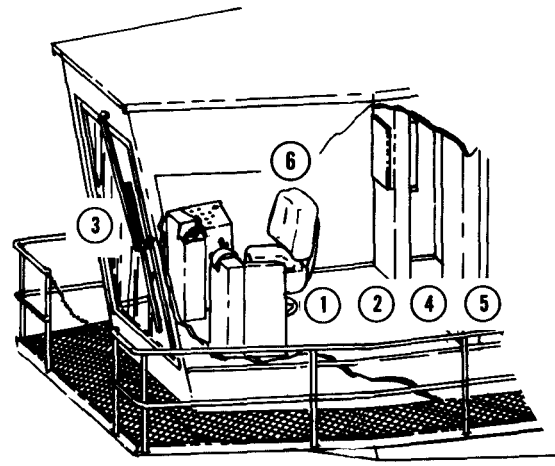
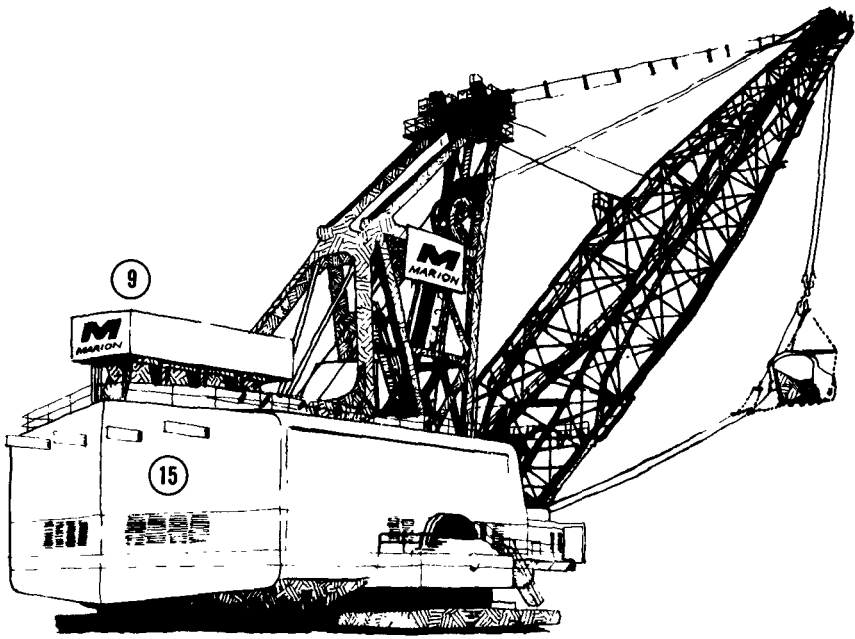
### SPECIAL TOOLS

Pressure Equipment, such as a Blackhawk pump, connects to groove C by high pressure flex hose L, high pressure elbow K and high pressure nipple J. This nipple J is long enough for hub to pull clear of shaft extension and not interfere with elbow or hose. The nipple J also supports coupling when it drops free. The nipple screws into a pipe tap in the shaft end which connects to groove C thru two drilled holes G.



**SPECIAL TOOL APPLICATION**

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