BUCYRUS®

Technical Manual

SAFETY PRECAUTIONS

This safety alert symbol is used here and throughout this manual to call your attention to instructions concerning your personal safety. Carefully read and follow these instructions and observe all safety and danger, and caution graphics mounted on various areas of the machine.

Be certain anyone servicing this machine is aware of these SAFETY PRECAUTIONS. In the event you question your ability to safely perform any of the enclosed maintenance and operational procedures contact your regional Dresser service representative or the factory.

The following defines distinctions between safety instructions. In all these definitions the safety alert signal is used.

DANGER: Denotes extreme intrinsic hazard which exists and could result in high probability of death or irreparable injury if proper precautions are ignored.

CAUTION: Denotes a reminder of safety practices or directs attention to unsafe practices which could result in personal injury if proper precautions are ignored.

An example of a safety alert symbol and special safety instructions is shown below.

DANGER: Inherent danger exists in the operation of any high voltage electrical equipment. A safe grounding system includes ground conductors in the power cable, a neutral grounding resistor and related relays and switchgear. A ground continuity check system is required by law in many parts of the world.

Operating, maintaining or servicing this machine can be dangerous unless performed properly. Each person must satisfy himself and his employer that he is alert and has the necessary skill and information, proper tools and equipment, and all methods are safe and correct. Factory service representatives and specialists are available to provide additional information or technical assistance.

Section 2 – Operation (cont.)

16. Swing Oil Flow Light indicates motor or pump failure, blocked filter, etc. in one or more rotating gear case lubricating systems.

17. Structure Pressure Loss Light indicates loss of air pressure due to a crack or break in the boom apex piping or tri-structure. This is a warning light only, with no shutdown.

18. Low Air Pressure Light indicates when system pressure falls below 95 psi.

19. Hyd IBS Pressure Loss Light indicates that the pressure switch, monitoring the hydraulic intermediate boom suspension system, has detected insufficient pressure.

20. Spare.

21. Left Shoe Push Button. Pressing this button will display left shoe position in degrees of rotation from top dead center (TDC).

22. Right Shoe Push Button. Pressing this button will display right shoe position in degrees of rotation from top dead center (TDC).

23. Shoe Error Push Button. Displays left/right shoe position error in degrees.

24. Hoist Rope Push Button. Displays distance of bucket from boom point in feet.

25. Drag Rope Push Button. Displays distance of bucket from fairlead in feet.

26. Hole Plug.

27. Lamp Test Push Button. Operate to check all warning lights on panel. Replace burned out lamps before operating machine.

28. Alarm Silence Push Button. Operate to shut off audible alarm. Warning light will remain on until malfunction has been corrected.

29., 30. Hoist and Drag Zero Set Push Buttons are used to calibrate the rope limit control system. See Dresser Protection system operating manual for details.

31. L.E.D. three digit display for items 21 thru 25.

OVERTEMPERATURE ALARM PANEL – Mounted in the rear wall of the operator's cab is a panel which contains a 51 point temperature monitoring system. The temperature monitoring panel consists of 26 dual input modules and a single master module used to read-out actual temperatures being monitored and to set the temperature alarm trip point of each of the 51 points.

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, boom 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 disconnects the drag motors from the drag generators and connects 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 selsyn system that

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.

USE ONLY CLEAN AND PROPER LUBRICANT – KEEP IT CLEAN

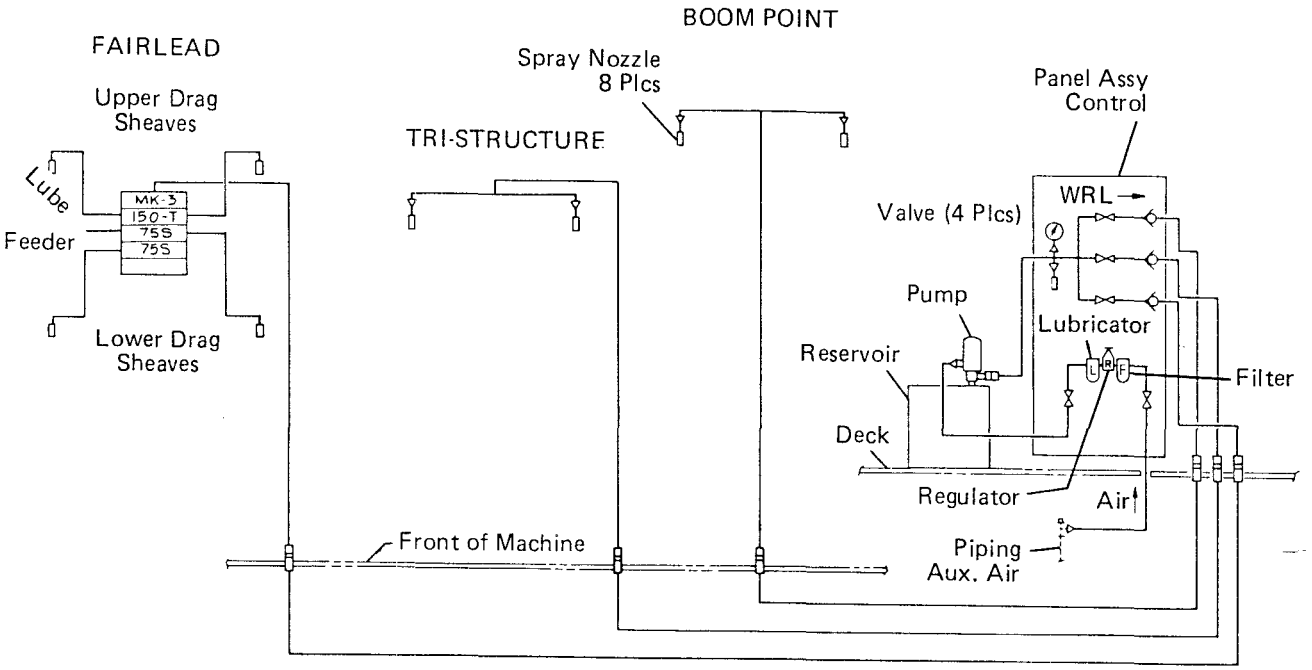
Selection of proper lubricant remains of the utmost importance. Improperly lubricated bearings, gears, couplings, and other precision parts quickly fail. For this reason, lubricants selected in accord with the ASTM Standards are recommended. These standards were compiled in cooperation with major petroleum suppliers to insure the consumer of exact supply to specific requirements regardless of source. DO NOT MIX GREASES OR BRANDS OF GREASE.

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

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

NAME OF PART	TYPE	NO. OF POINTS	LOCATION	LUB. SYM.	METHOD & FREQUENCY
Main Rotating Shaft Spline and Split Thrust Washer	—	1	Fitting at Top of Swing Case	MPG	Hand, 500 Hrs.
Rotating Motor	Anti-Friction	2	In Motor End Bell	EMG	Hand(see Electrical Section)
Main Rot. Shaft Bottom Bearing	Anti-Friction	1	In Top of Bearing sleeve	MPG	Automatic
LUBRICATION OF ROLLER RAIL AND CIRCLE					
Roller	Nylatron Bushing	143	In End of Roller	MPG	Hand, 30-60 days
Roller Rail	—	6	Drip on	OGL	Automatic
Third Rail	—	4	Drip on	OGL	Automatic
LUBRICATION OF HOIST MACHINERY					
Hoist Drum Support Bearing	Anti-Friction	2	In Bearing Housing	MPG	Automatic
Intermediate Hoist Shaft (In case)	Anti-Friction	3	From Gear Case, Fill at Air Filter	GL	95 U.S. gal. (359.6 liters) each case, Check Weekly At Dipstick Keep full
Intermediate Hoist Shaft (Inboard)	Anti-Friction	3	In Bearing Retainer	MPG	Automatic
Hoist Motor Extension Shaft	Anti-Friction	12	From Gear Case	GL	—
Hoist Motor Coupling	—	6	Plug in Coupling Flange	MPG	Hand, 3 mos. Keep Filled

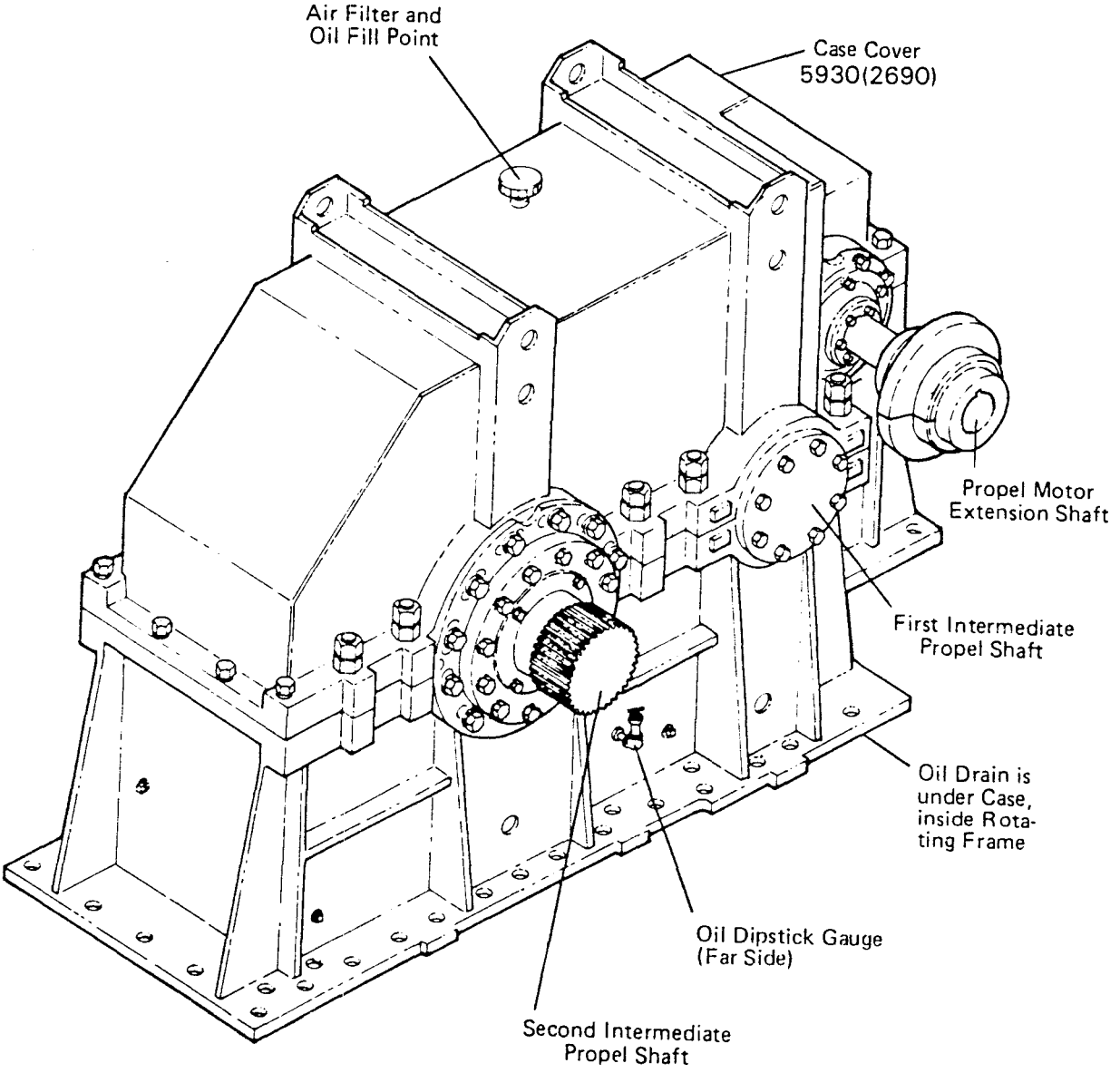
AUTO LUBE FOR WIRE ROPE, manually operated, supplies spray to the hoist rope at top of tri-structure and at boom point. The drag rope is sprayed at the fairlead sheaves. Set air pressure regulator at 80 psi (551.6 kPa). Open air valve first. Next open ONLY ONE of three line valves at a time as rope is moving. Lubricate moving rope every 8 hours or less, depending on site conditions. System uses a 200 gallon (757 liter) tank of wire rope lube (WRL). DO NOT USE GREASE. After ropes are lubed, close air valve.



SCHEMATIC
AUTO LUBE – ROPE SPRAY

Section 4 – Mechanical Adjustments (cont.) Page

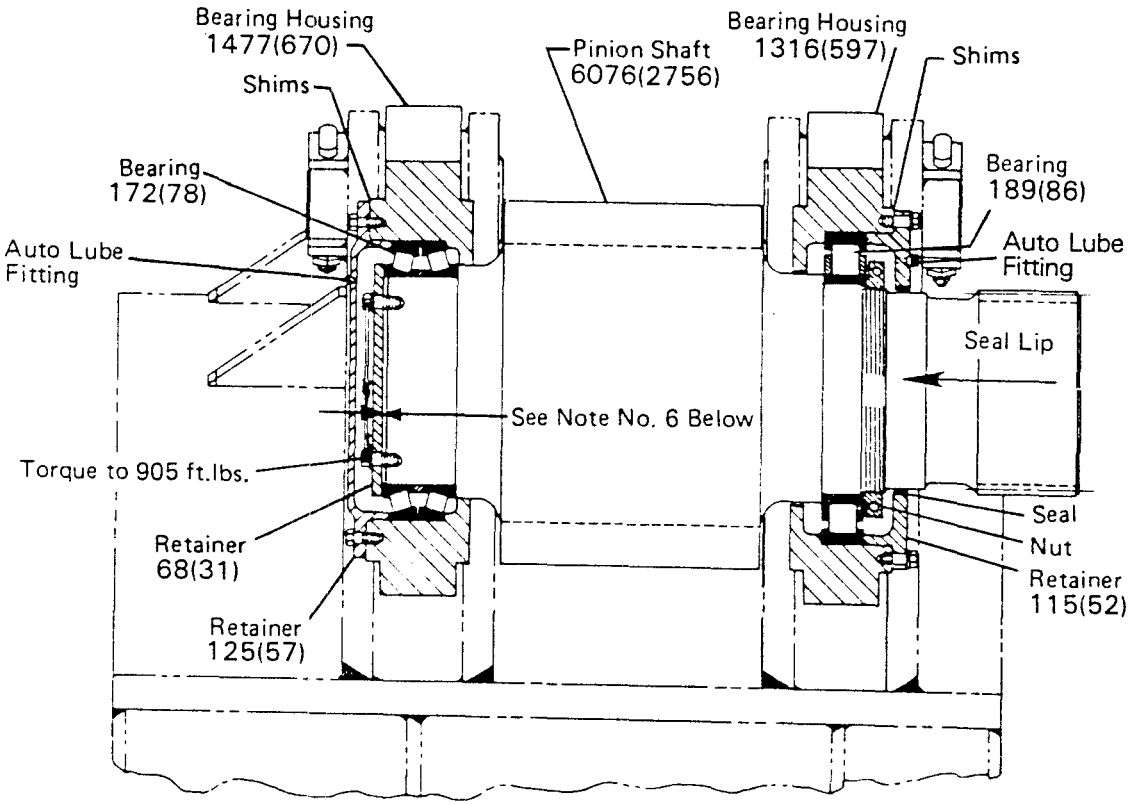
PROPEL GEAR CASES are oil tight and enclose first three shaft assemblies of propel gear train. These shaft assemblies are propel motor extension shaft, first intermediate propel shaft and second intermediate propel shaft.



NOTE: Gear Case capacity is 360 U.S. gallons (1363 liters).

PROPEL GEAR CASE

MAIN PROPEL DRIVE PINION SHAFT is coupled to second intermediate propel shaft and drives main propel shaft.



Assembly notes:

1. Coat coupling splines with type "B" OGL at assembly.

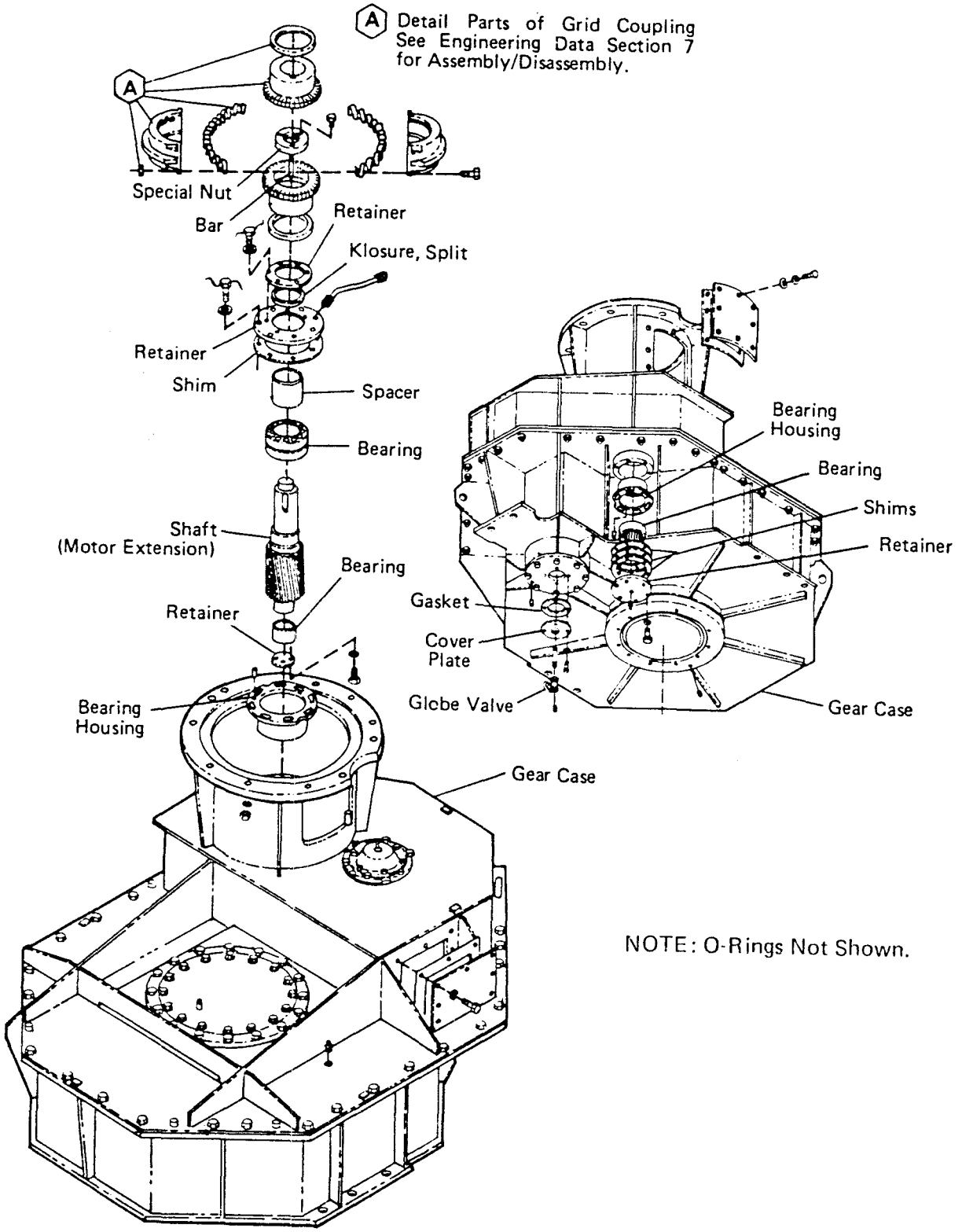
2. Bearing adjustment -- tighten caps (retainers) at each end of shaft and measure gap between cap and housing (three places minimum) and average the measurement. Shim caps to this measurement. Rotate bearing while clamping up tightly thru cones to assure proper seating of rollers.

3. Grease bearings with multi-purpose grease at assembly.

4. Single-row bearing must be assembled on shaft with bearing housing in place at coupling end of shaft. Tighten special nut until inner race of bearing is secured in place. Lock nut onto shaft with cap screws.

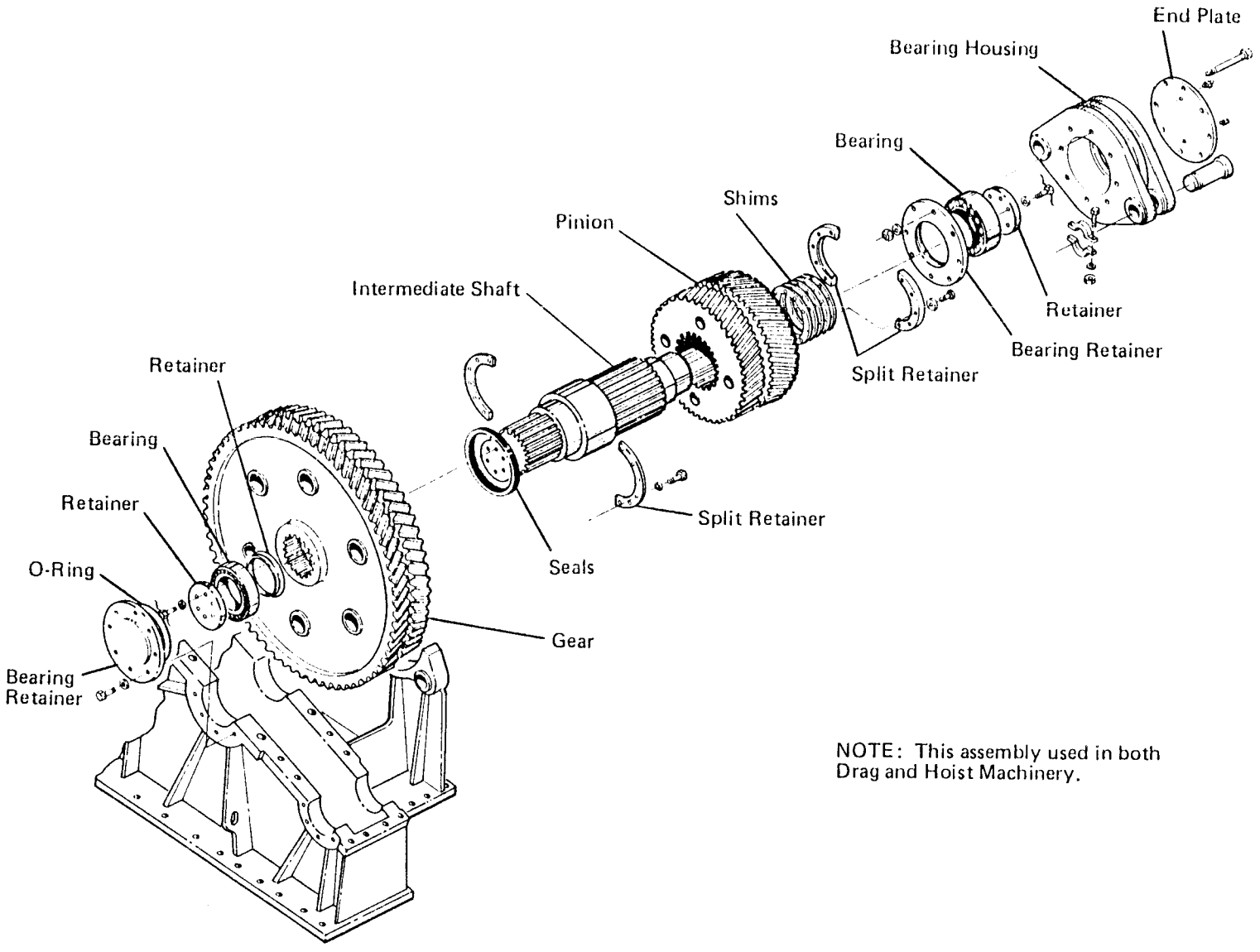
5. Spray coat shaft in lip seal area with Molycote M3402 (Dresser No. 170025-1).

6. After assembling bearings, measure gap under retainer and add shims, leaving .010 (.254mm) for clamping.



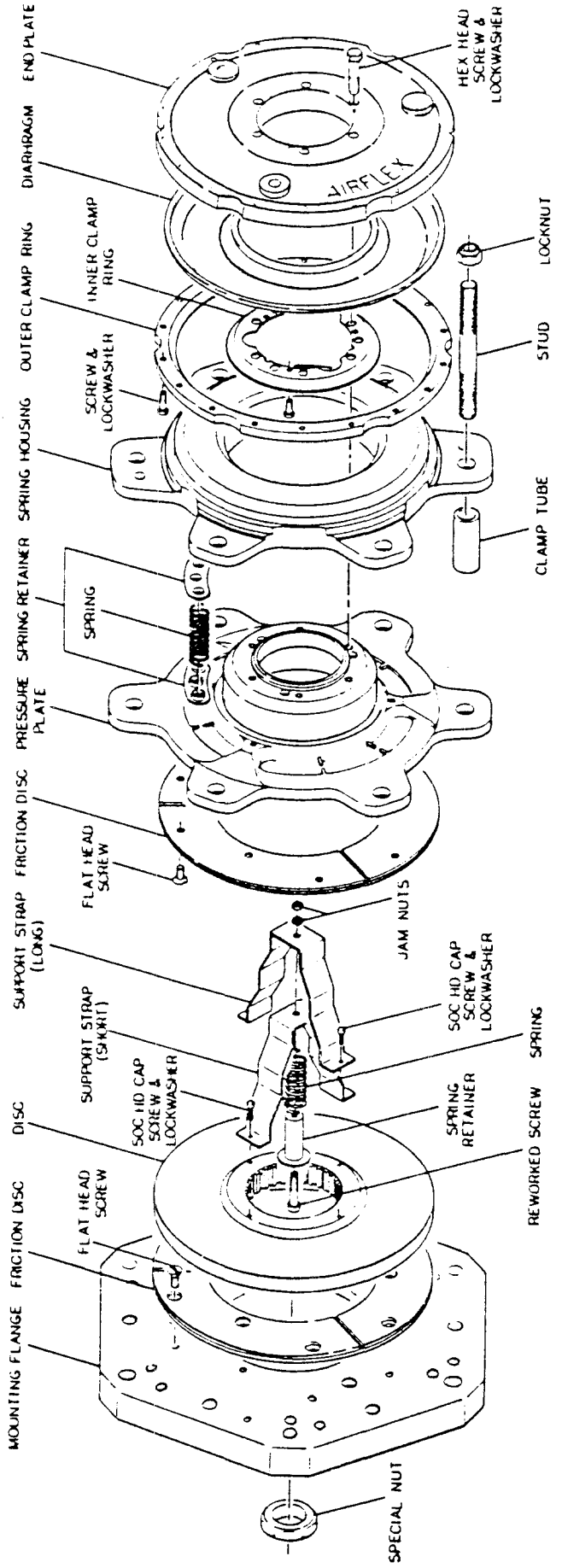
NOTE: O-Rings Not Shown.

ROTATING GEAR CASE ASSEMBLY



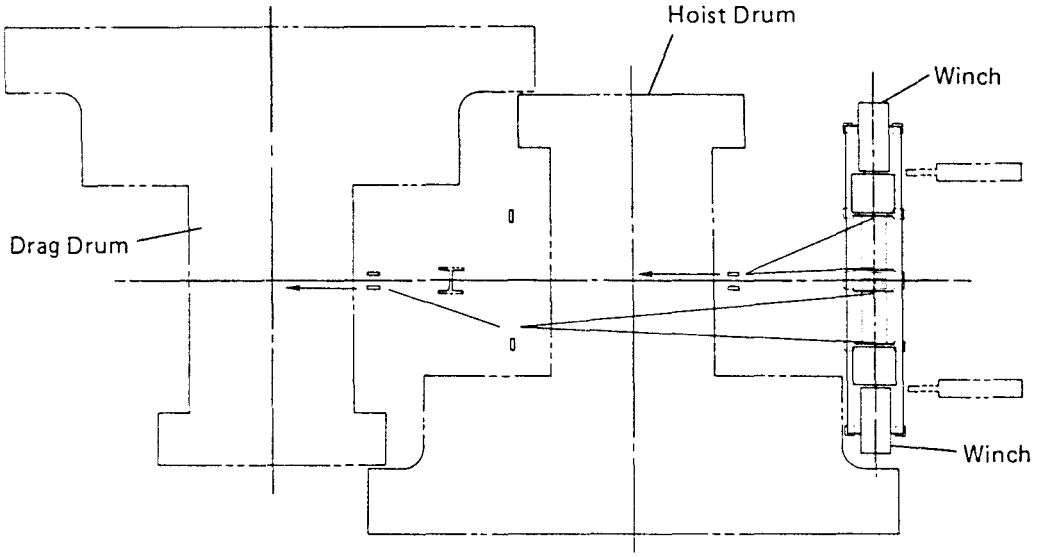
NOTE: This assembly used in both Drag and Hoist Machinery.

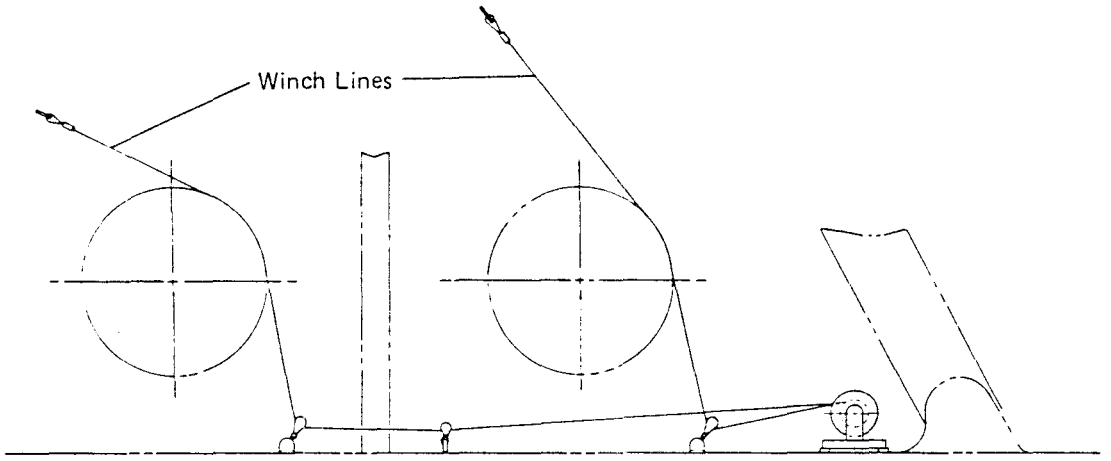
INTERMEDIATE HOIST/DRAG SHAFT ASSEMBLY



SWING DISC BRAKE

ROPE WINCHES located at rear of hoist drum, aid in reeving of hoist and drag ropes. Each winch drum has 1100 feet (335.2 m) of 5/8 inch (15.7mm) rope. Snatch blocks are provided and reeve winch line as shown in sketch.





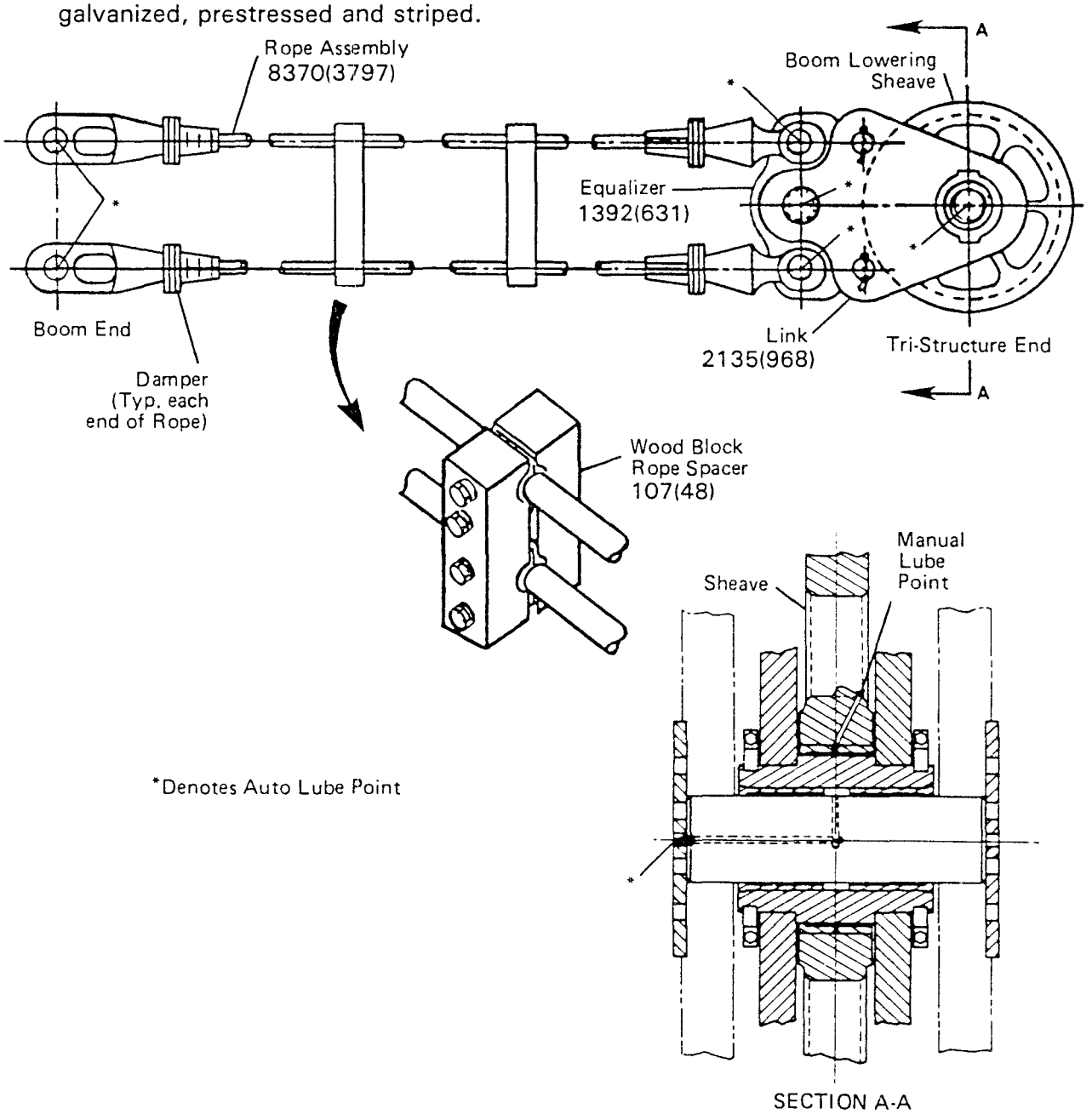
CHANGE HOIST ROPE(S) by disconnecting them from bucket rigging. Unwind hoist rope from drum.

CAUTIOUSLY pull rope away from machine with dozer or truck, BUT use care to keep rope from boom point sheave(s) to ground perpendicular as possible. See sketch.

Reeve winch rope and attach it to one hoist rope at drum. Remove hoist rope from drum clamps. Operate winch to remove hoist rope from machine. Reverse procedure to re-assemble hoist rope. Attach winch rope to other hoist rope and replace it in same manner.

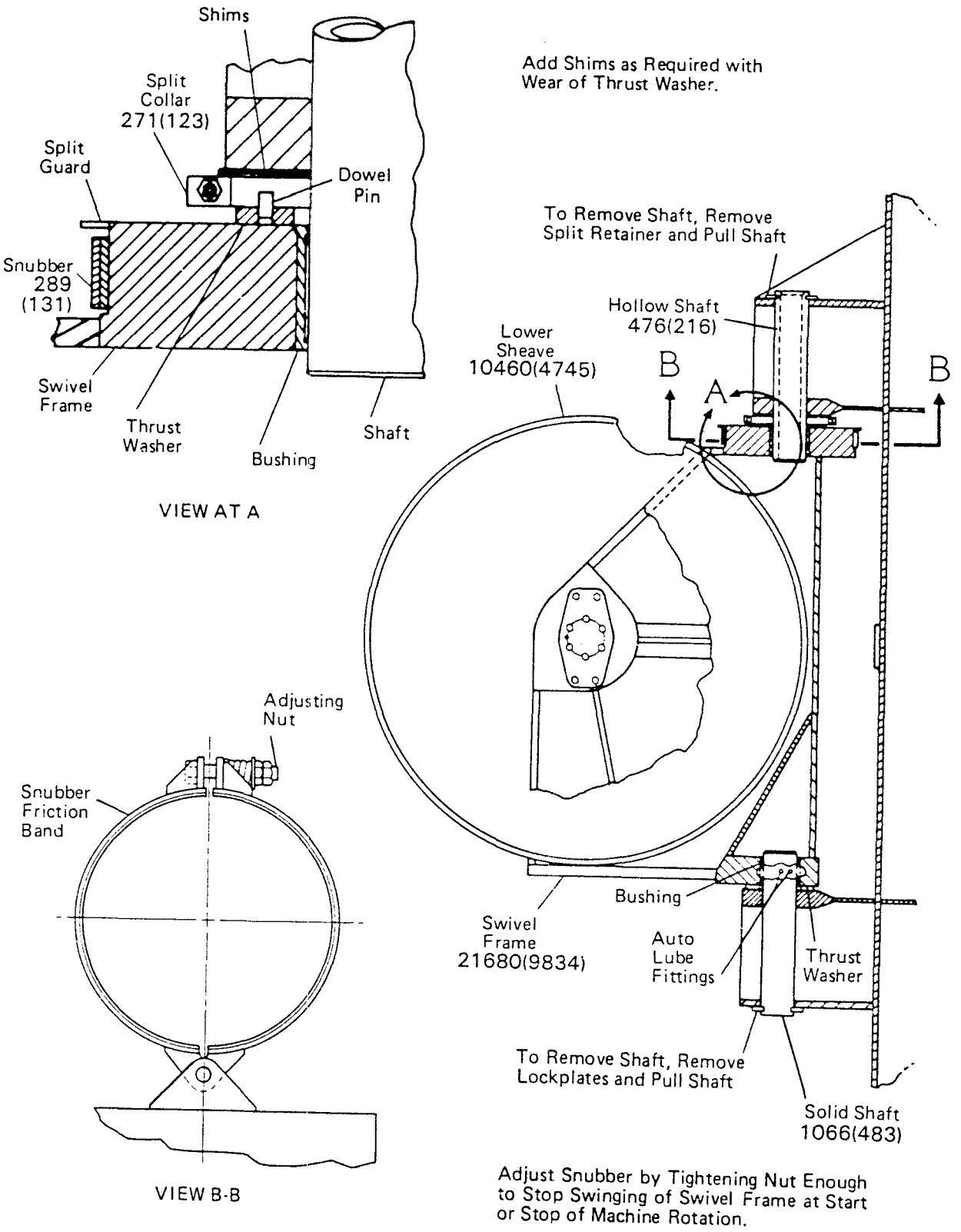
NOTE: Reset drum limit switch after changing rope(s). See Dresser Programmable System instruction manual.

Four **BOOM SUPPORT BRIDGE STRANDS,** two each side, support the boom. Each strand is 3-1/4 inches (82.5 mm) in diameter, 261 feet (79.5 m) long (pin to pin) galvanized, prestressed and striped.



The ropes are pinned at the boom point and to an equalizer link at the tri-structure connection. The stripe on the strand MUST NOT, at any time, have a twist, from boom point to equalizer link.

The ropes are interconnected with wood blocks to dampen rope oscillation. This reduces rope fatigue at end socket.



FAIRLEAD ASSEMBLY – SWIVEL FRAME

DANGER

DUE TO THE DANGERS INHERENT IN THE OPERATION OF ANY HIGH VOLTAGE ELECTRICAL EQUIPMENT, A SAFE GROUNDING SYSTEM SHOULD INCLUDE GROUND CONDUCTORS IN THE CABLE, A NEUTRAL GROUNDING RESISTOR AND RELATED RELAYS AND SWITCHGEAR. A GROUND CONTINUITY CHECK SYSTEM IS ALSO RECOMMENDED.

Dresser provides (under separate cover) a separate book/manual from the electrical manufacturer in addition to the information supplied in this section.

FEEDER CABLE must contain a provision for a ground connection. Especially where 2300 volts and above are used. The power line end must attach (see paragraph on ground circuits) to a suitable permanent ground. The machine end must securely attach thru a bolted connection to ground machine frame. This provides a constant ground for the machine and electrical equipment. Failure to provide this adequate ground endangers employees and equipment.

POWER LINE GROUNDING CIRCUIT ADEQUATE FOR THE MACHINE CANNOT BE OVER EMPHASIZED. Without a good grounding system, high voltage exists between the machine and ground. The portable cable and power lines supplying the machine must have a ground wire ample in capacity running parallel to the main wires over the entire distance from transformer to machine. A suitable grounding system must be used at the transformer. Consult your local electric supplier for details.

Open circuits can usually be found using an ohmmeter and care in analyzing the measurements. In many cases, sneak circuits present the need to completely disconnect a device from other circuits.

Open circuits generally cause complete or partial loss of output. In some cases, an open circuit can cause increased output. For example, if the current-limit field circuit opened; stall current exists higher than normal. Likewise, if voltage feedback opened; the no-load exists high.

Occasionally, open circuits cause effects very difficult to analyze. Consider an open armature circuit between the points where the current-limit signal taps off. This failure causes very low no-load voltage and very low stall current. Generally, these failures require a complete investigation. In this case mentioned, note th current-limit field current high at BOTH stall and no-load to point out the failure.

Measuring the current-limit signal voltage at stall gives a reading very close to normal, further indicating the need for proper understanding of measurements.

SHORT CIRCUITS, less common, are difficult to find; whether caused by external fault (foreign objects) or internal fault (turn insulation in coil failure). Capacitors and rectifiers generally fail due to shorting.

Characteristics are a lack of voltage across the part, and usually cause higher than normal currents that lead to failure in other devices.

Consider some typical cases. Shorted turns in a generator field coil give reduced output, the amount depending upon number of turns shorted. If coil resistance is quite low, determining that a few turns are shorted is difficult. Using a very accurate, low reading ohmmeter or voltmeter; take readings on ALL coils and compare accurately. Perhaps easier: apply A.C. voltage to all the coils connected in series and compare the voltage drop across each coil.

A shorted capacitor creates various effects. With capacitor used in an anti-hunt or stabilizing circuit, shorting the capacitor usually causes very low output that may be confused with other failure. A shorted capacitor in a filter circuit generally causes loss of filtered voltage and failure in other devices. For example, if current-limit bias voltage is obtained from rectified A.C., shorting a filter capacitor causes bias voltage loss, low stall current and possible failure of rectifiers and transformers.

Generally, capacitors are tested with an ohmmeter. Connecting a discharged capacitor across the ohmmeter indicates low resistance at first instant and high resistance once capacitor charges from the ohmmeter batteries.

C. Retainer cap sealing surface may or may not utilize shims depending on design. Eccentrics designed per detail shown would have shims installed at this location. Coat surfaces thoroughly on both sides of shim material.

D. When tapped holes are "thru holes" into interior of the gear case, apply Permatex thoroughly to both male and female thread prior to assembly.

For movable (o-ring equipped) eccentric gear cases contact surfaces A and B are designed with o-ring seals for maintaining positive sealing characteristics while still being movable for adjusting purposes.

When tapped threads are "thru holes into the interior of the gear case (C) apply Permatex thoroughly to both male and female threads prior to assembly.

Retainer cap flange surface (D) may utilize shims depending on design at this location.

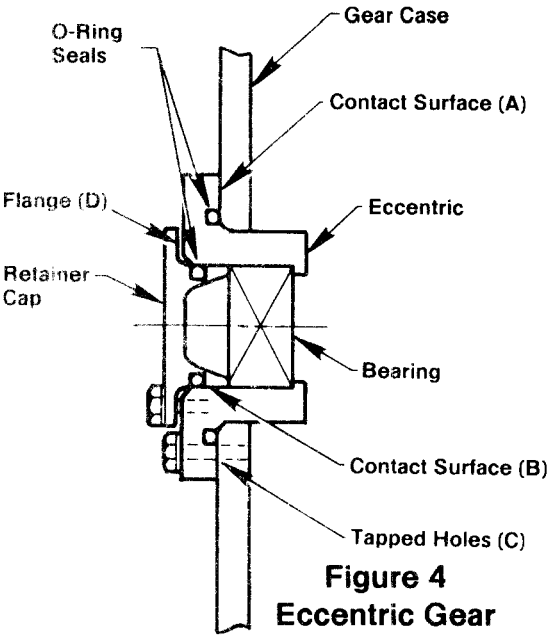


Figure 4
Eccentric Gear Case Sealing

GEAR BACKLASH

All backlash values are given in the normal plane. Therefore, backlash checked with a dial indicator requires this device be set perpendicular to the helix of the teeth.

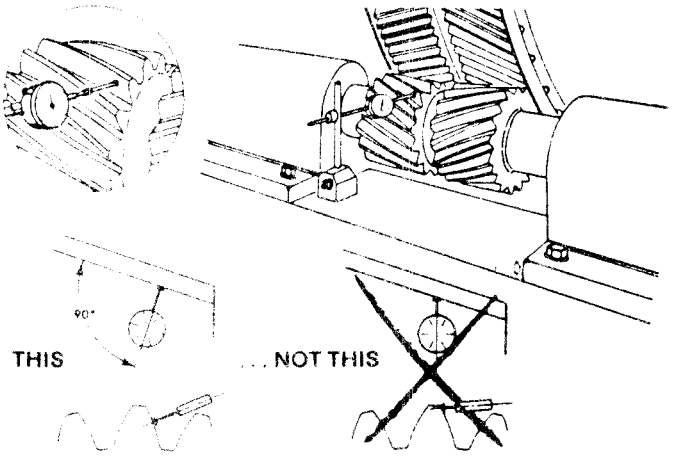
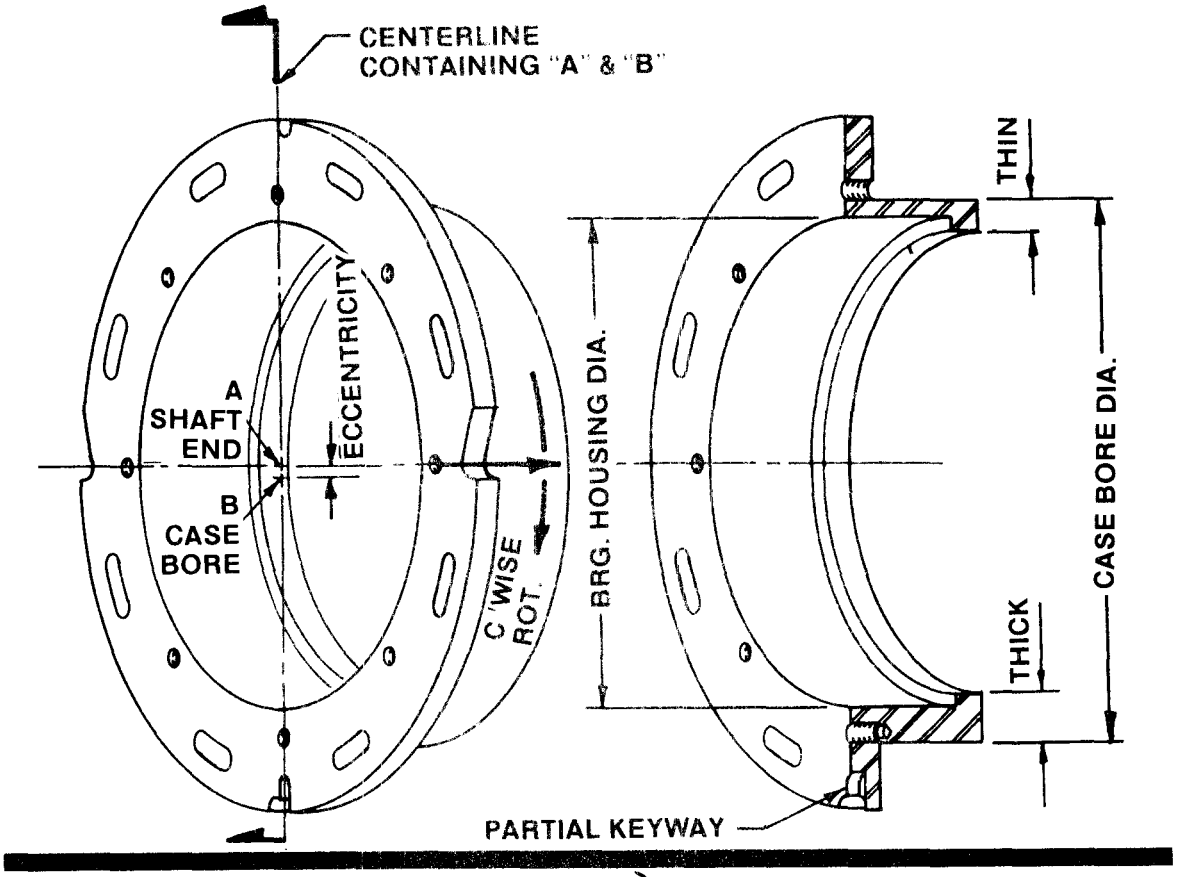


Figure 5

NOTE: Backlash is the amount by which a tooth space exceeds the thickness of an engaging tooth measured on pitch circles.

Figure 10



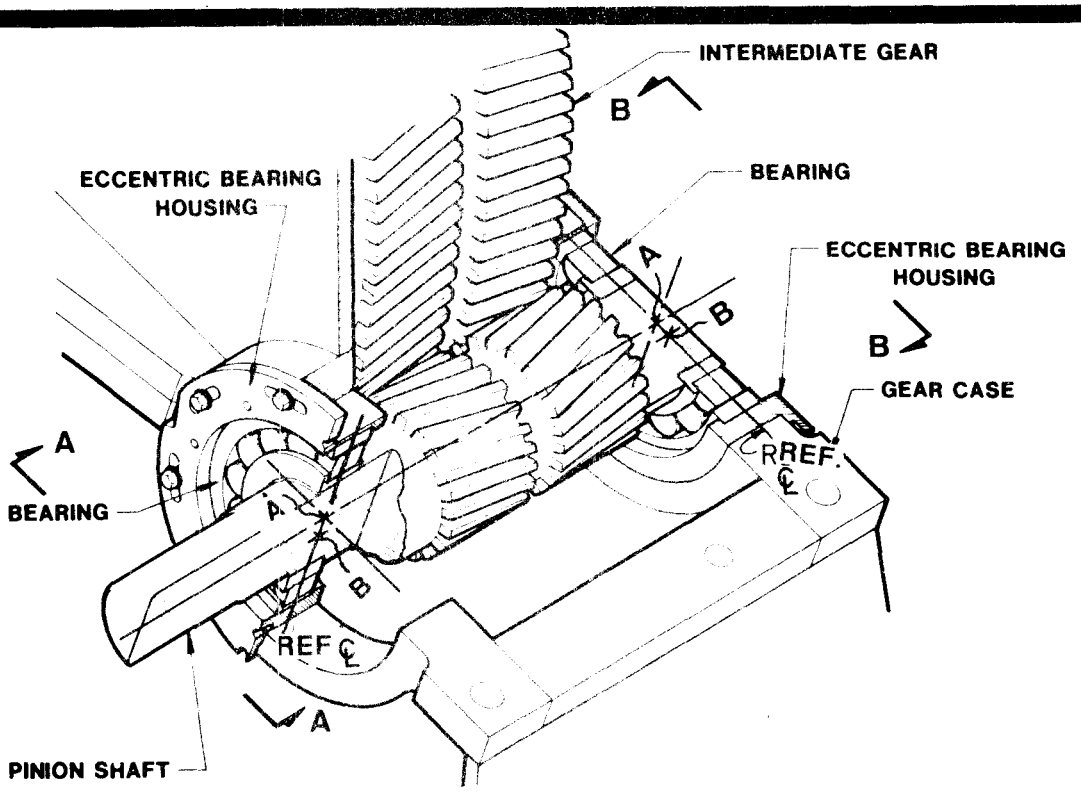
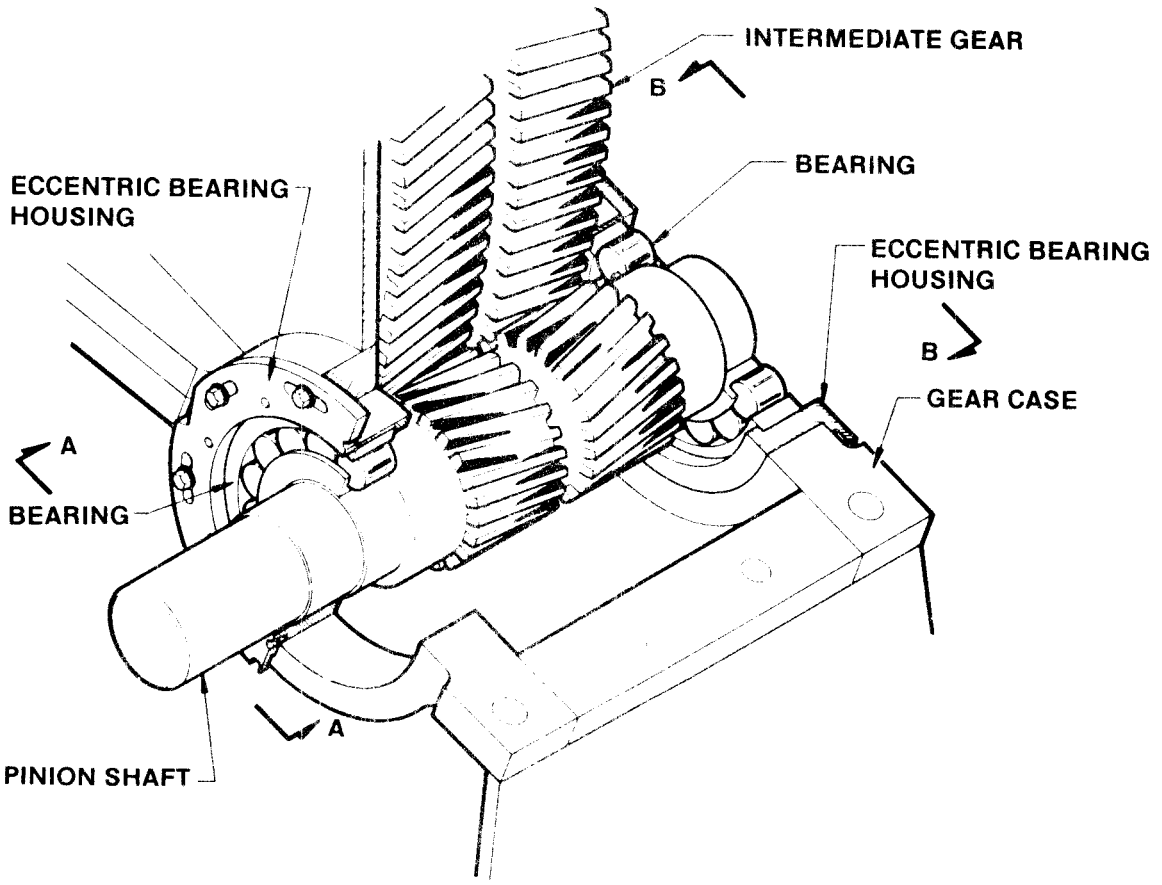
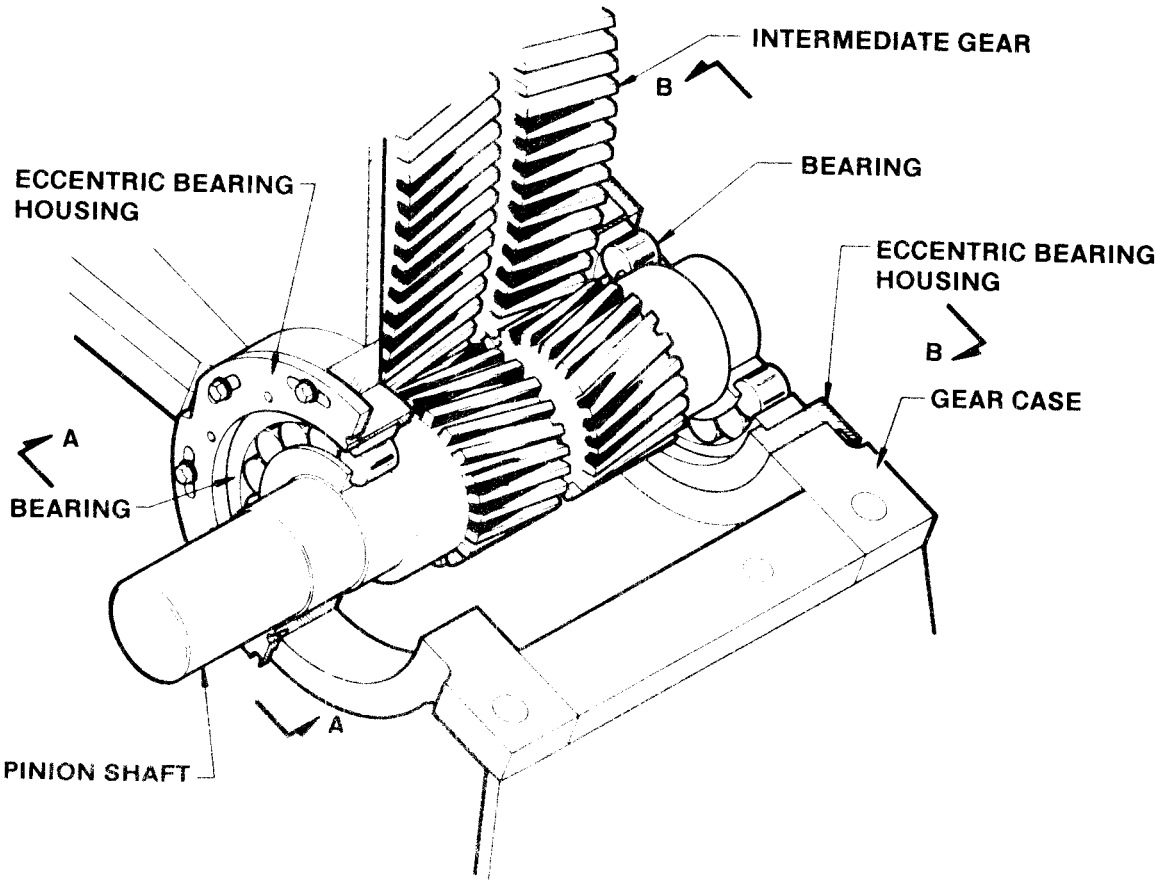


Figure 11


INTERMEDIATE GEAR
B
BEARING
ECCENTRIC BEARING HOUSING
ECCENTRIC BEARING HOUSING
B
GEAR CASE
A
BEARING
A
PINION SHAFT


INTERMEDIATE GEAR
B
BEARING
ECCENTRIC BEARING HOUSING
ECCENTRIC BEARING HOUSING
B
GEAR CASE
A
BEARING
A
PINION SHAFT

Determine the cause of outer wire breaks by examining the break.

Tension breaks show a cup and cone effect on the break. This is caused by overload, shock load, jerking a load or catching a falling load.

Careless operational load handling.

Fatigue break showing a square end break with granular metal appearance. Repeated bending over sheave causes fatigue or the sway and vibration at dead end anchor and static sheave.

A shear break indicated by a smooth, twisted break generally comes from external damage (nicks or kinks) in the rope.

Several outer wire breaks at isolated areas along rope length cause little concern. Concentrated breaks at a single location indicate severe rope damage. Retire this rope.

External corrosion indicated by rust, scales or pitting on rope surface remains out in the open. Internal corrosion may appear as pitting in strand valley or rust and scale working out from under strands. Outside wire or strands appear slack or seem to stand out from inner portion with severe corrosion. Under a load this rope shows a loss in diameter.

Internal wear or core fatigue indications emulate those of severe corrosion. Wire or strands appear slack and noticeable loss in diameter occurs under load. Internal wear often results from faulty equipment (tight sheave groove, etc.) in a local area.

Rope retirement from service requires a decision based upon a combination of factors.

Inspection determines the abrasive wear effect on outer wires. Percentage of rope area intact indicates rope strength percentage remaining.

The number of broken wires contained within one lay (one full strand wrap) evaluates remaining rope strength to some degree.

No reliable means of determining corrosive effect and internal wear exists. Good operating conditions and effective lubrication keeps these factors to a minimum.

Study the entire rope to determine the section suffering the most severe deterioration. One or more of the following indicates this deteriorating:

as lugs to a part as this may cause more d... rule of thumb is that the combined fillet welds should be of the s... the thickness of the lug or attachment.

STEP 4—Preparation of the Defect or Wo...

Proper preparation is half the job, therefo... portant to evaluate each part on its own merit. Some points to cons... follows:

1. How large is the crack or defect?
2. Is the crack completely through the thick...
3. Will distortion be a factor?
4. Can two welders weld opposite each o... to control distortion or must all the repair be done from one s...
5. Will the welder be able to withstand the ... required?
6. Can the welder get into a position to ...
7. Does the cost of repairing the part comp... to buying a new part?

These points are important factors when ... how the defect should be prepared for welding. A welder can repair ... defects, add modifications or repair worn parts as long as good equipm... available to him such as the correct clothing, head gear, exhaust syste... respirators and platforms for the job. If the welder is kept comfortable and ... required equipment and consideration, a quality job can be expected.

Methods of metal removal to be considered are:

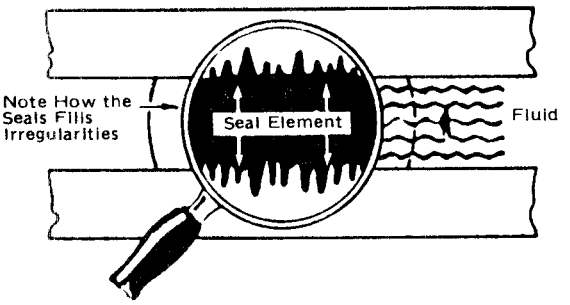
1. Air carbon arc gouging.
2. Grinding.
3. Machining.
4. Oxyfuel burning.

Before any weld repair is started, a survey ... made of the area and all safety considerations satisfied such as fuel ... lines, electrical cables and toxic materials.

A decision should be made whether the part ... repaired on the machine or disassembled and repaired in a shop or on ... floor.

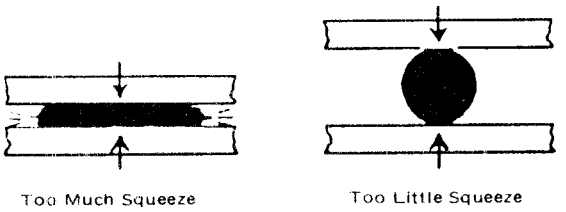
O-RING GUIDE

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.

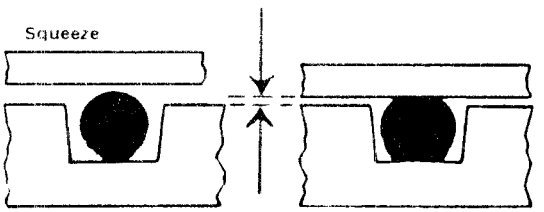


An O-ring's function is to confine and prevent passage of liquids and gasses under pressure from the part or joint. Perhaps simply stated; an O-ring closes off a passage to prevent loss or escape of fluid or gas.

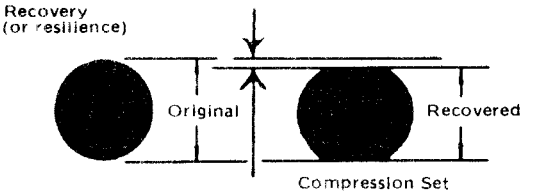
One basic principle of O-rings is compression under load to fill the machined surfaces in mating metal to block off fluid flow. Truly effective O-rings fill surface irregularities and maintain this ability. This is done in the following manners:



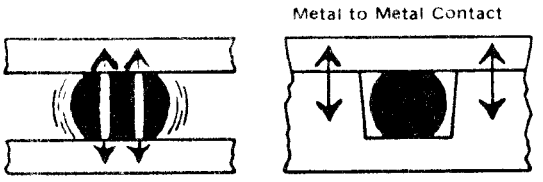
SQUEEZE is the ability of distortion while still blocking a passage. This does not mean CRUSH. Effective and usable squeeze is considered as from 12 to 35 percent. Insufficient squeeze causes leaks, almost always at low temperatures. Too much squeeze outright destroys the O-ring or causes it to cold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

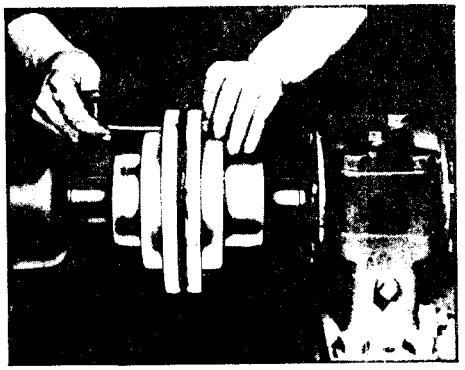


RECOVERY (or resilience) describes an O-ring acting as a surging spring over long periods. Failure to recover after deformation is called compression set.



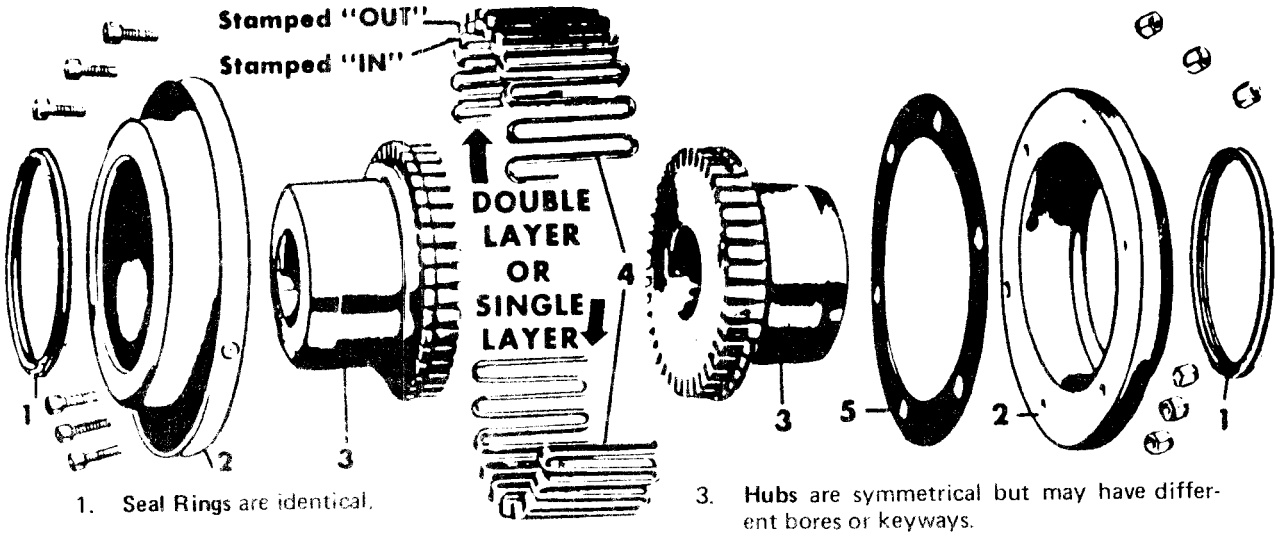
METAL to METAL contact is vital in creating correct squeeze while preventing destruction. A well designed seal transmits torquing loads thru the metal NOT the O-ring.





7 ASSEMBLE COVERS

7. Position covers so that lube fittings are 180 degrees apart. Align covers to prevent wobble. Tighten cover bolts. Check seals for proper seat. Insert thin, smooth screwdriver under seal for venting when lubing with permanent fittings.
Lube until grease flows thru coupling and out other hole. Then RE-INSTALL BOTH LUBE PLUGS.



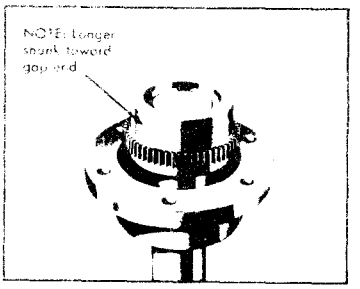
1. **Seal Rings** are identical.
2. **Cover Halves** are furnished with permanent lube fittings or, in some sizes, 1/8" or 3/8" NPT holes to receive your lube fittings. Cover halves are interchangeable and otherwise identical.
3. **Hubs** are symmetrical but may have different bores or keyways.
4. **Gridmember** for smaller sizes is in one piece. In larger sizes the gridmember is in several sections and layers.
5. **Gasket** fits between the covers and prevents grease leakage.

LUBRICATION OF COUPLING DURING ASSEMBLY

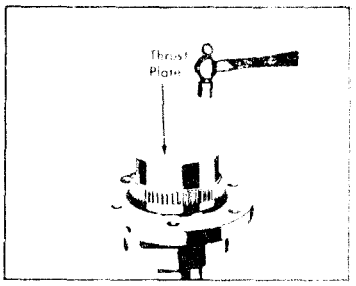
PROPERLY FILLED — Air pockets have been reduced to a minimum by careful packing and the gap between the hubs has been well filled.

GEAR TYPE COUPLING INSTALLATION (VERTICAL)

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.



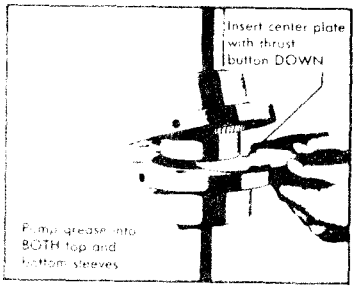
A MOUNT FLANGED SLEEVES, SEALS AND HUBS



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—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.



C INSERT CENTER PLATE WITH THRUST BUTTON DOWN

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 10
COUPLING INSTALLATION DATA

Coupling Size		10	15	20	25	30	35	40	45	50	55	60	70
GAP (Hub Separation)	G	1/8	1/8	1/8	3/16	3/16	1/4	1/4	5/16	5/16	5/16	5/16	3/8
in (mm)		(32)			(4.8)		(6.5)		(8)				(9.5)
	GV	7/16	7/16	7/16	9/16	9/16	1 1/16	7/8	1	1	1	1 1/8	1 3/8
		(11.5)			(14.5)		(27)	(22)	(26)	(26)	(26)	(29)	(35)
Operating	Offset	005	005	010	010	012	012	012	012	012	012	012	012
Alignment		127		.254		305							
	Angular	005	005	010	010	015	015	020	020	020	030	030	030
in (mm)		127		254		381		508			762		
Grease – lbs (kg)	G	1/16	1/8	3/8	1/2	3/4	1	1 3/4	2 3/8	3 1/2	4 1/4	7 5/8	14
		03	05	17	.2	3	5	8	1 1	1 6	2 0	3 4	6.3
	GV	1/8	1/4	1/2	3/4	1 3/8	2 3/8	3	5 1/4	6 3/4	8 1/2	11 1/4	23 1/8
		06	1	2	3	6	1 1	1 4	2 4	3 0	3 8	5.0	10.5
G&GV 10 Flange	Torque in/lb	95	170	170	420	420	845	845	845	1490	1490	— —	— —
	Nm	107	192	192	474	474	954	954	954	1682	1682		
G&GV 20 Flange	Torque in/lb	85	145	360	720	720	1290	1290	1290	1430	1430	1430	2160
	Nm	96	164	406	813	813	1456	1456	1456	1614	1614	1614	2438

DAILY – EVERY 24 HOURS