Technical Manual

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

When disassembling machine, 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 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 30 psi (207 kPa), wear safety glasses or goggles and use proper shielding to protect everyone in the work area.

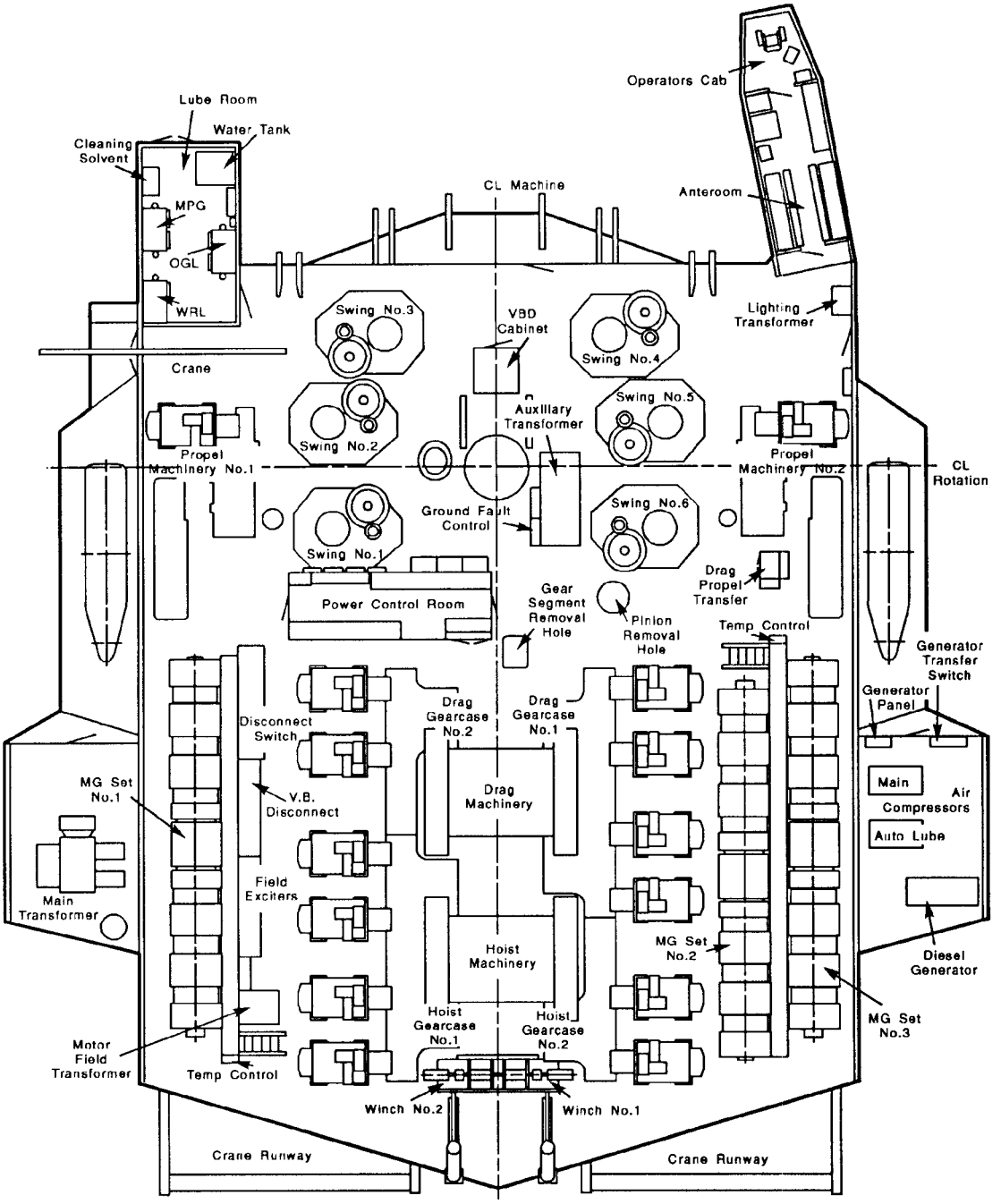
Be sure to promptly reinstall safety devices, guards or shields after adjusting and/or servicing the machine.

After servicing, be sure all tools, parts or servicing equipment are removed from the machine, or secured in an appropriate storage area.

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 constantly aware of swing clearance. Never hold a load longer than needed in the dump cycle. Use swing brakes only when machine is stopped.



8200 DECK PLAN

The following items are on the *RIGHT CONTROL PANEL*:

1. L. E. STOP - A pushbutton that DE_ENERGIZES the hoist, drag and swing controllers and also the solenoid circuits.

2. L. E. START - A pushbutton that ENERGIZES the hoist, drag and swing controllers and also the solenoid circuits.

3. HOIST BRAKE - This switch sets or releases the *HOIST* brakes. A red light will indicate when the hoist brakes are set.

4. SWING BRAKE - This switch sets or releases the *SWING* brakes. A red light will indicated when the swing brakes are set.

5. DRAG BRAKE - This switch sets or releases the *DRAG* brakes. A red light will indicated when the swing brakes are set.

6. PROPEL BRAKE - This switch sets or releases the *PROPEL* brakes. A red light will indicated when the swing brakes are set.

   NOTE: The motion brakes are *HOLDING BRAKES ONLY* and are not intended to retard or stop any drive motion *EXCEPT* in an emergency situation. See Plugging the Motion. Always bring any drive motion to a halt before applying these brakes.

7. DRAG TRANSFER - A pushbutton that transfers the machine to *DRAG* mode.

8. PROPEL TRANSFER - A pushbutton that transfer the machine to *PROPEL* mode.

9. SPECIAL MODES - An *ON/OFF* switch that enables the operator to: set motion limits, raise or lower the boom, or calibrate the masterswitches.

10. SHOE PARK - A green illuminated pushbutton used to initiate the automatic parking function. When lit it will indicate that the walking shoes are in their *PARKED* position. See *OPERATING WALKING MECHANISM* in this section.

11. ROPE ZERO - A 3-position selector switch used to calibrate the rope limit control system. See the DRESSER/MARION Protection System operating manual for details.

12. EMERGENCY STOP - A red mushroom type pushbutton that will set ALL brakes and de-energize ALL controllers when pressed.

13. M.G. SET STOP - A red pushbutton that, when depressed, removes drive power from the synchronous motors on all the M-G sets. The sets will coast to a stop and LE will be de-energized. The M-G sets must be restarted in the machinery house at the Power Control Room (PCR).

14. GROUND TRIP - A pushbutton used to dump the substation.

14. AIR COMPRESSOR NO.1 - A 2-position (OFF/AUTO) switch with a green indicator.

15. ELAPSED TIME METER, AIR COMPRESSOR NO.1 - Records total AIR COMPRESSOR NO.1 operating time.

16. M.G. SET START CYCLE - A pushbutton with a green light that indicates okay to start the M.G. sets. Push to sound the horn before starting the sets.

17. VACUUM CIRCUIT BREAKER NO.1 - A green indicator.

18. VACUUM CIRCUIT BREAKER NO.2 - A green indicator.

19. VACUUM CIRCUIT BREAKER NO.3 - A green indicator.

20. AIR COMPRESSOR NO.2 - A 2-position (OFF/AUTO) switch with a green indicator.

21. ELAPSED TIME METER, AIR COMPRESSOR NO.2 - Records total AIR COMPRESSOR NO.2 operating time.

22. BLOWER MOTORS START - A pushbutton with a green indicator.

23. BLOWER NO.1 START - Pushbutton STARTS drive motor.

24. BLOWER NO.2 START - Pushbutton STARTS drive motor.

25. BLOWER NO.3 START - Pushbutton STARTS drive motor.

26. BLOWER MOTORS STOP - A pushbutton.

27. BLOWER NO.1 STOP - Pushbutton STOPS drive motor.

28. BLOWER NO.2 STOP - Pushbutton STOPS drive motor.

29. BLOWER NO.3 STOP - Pushbutton STOPS drive motor.

30. ANTI-CONDENSATION HEATERS - A 2-position (OFF/AUTO) switch with a green indicator.

31. EXHAUST FANS - A 3-position (HAND/OFF/AUTO) switch with a yellow indicator.

32-37. FILTER FANS NO.1 THROUGH NO.6 - START/STOP selector switches start the bleed duct fans and after a 5 second delay start the main filter fans. A green light indicates that the main fans are operating.

A typical lube cycle operation for any of the circuits occurs in the following manner:

When a cycle is initiated by the PC, manually, or when LE is energized - the appropriate 3-way air solenoid valve is energized. Air to the pump causes the pump to pump lubricant to the distribution injectors and closes the vent valve. As the lubricant pressure builds in the circuit supply line, the injectors operate and push a metered amount of lubricant to the bearings, bushings, or open gearing. The lubricant pressure continues to build until it is sufficient to open the contacts in the pressure switch(es) in the circuit. When these contacts open, the controller de-energizes the air valve, shuts off the pump and vents the lube supply line to the reservoir. The lubricant pressure in the circuit decreases, allowing the injectors to recharge themselves for the next cycle.

A cycle time is the interval between the initiation of lube cycles. The cycles will continue as long as LE is energized and *NO* fault is detected in the lube supply circuit.

IMPORTANT NOTES ON SYSTEM OPERATION

- The lube system Programmable Controller (PC) is programmed to operate either MPG or OGL circuits. Both circuit types will not operate simultaneously.

- If any automatic lubrication supply circuit is operating at the time the machine's drive system control is changed from DRAG to PROPEL, DRAG to BRAKES SET, etc., the circuit(s) operating will complete its (their) cycle before being deactivated.

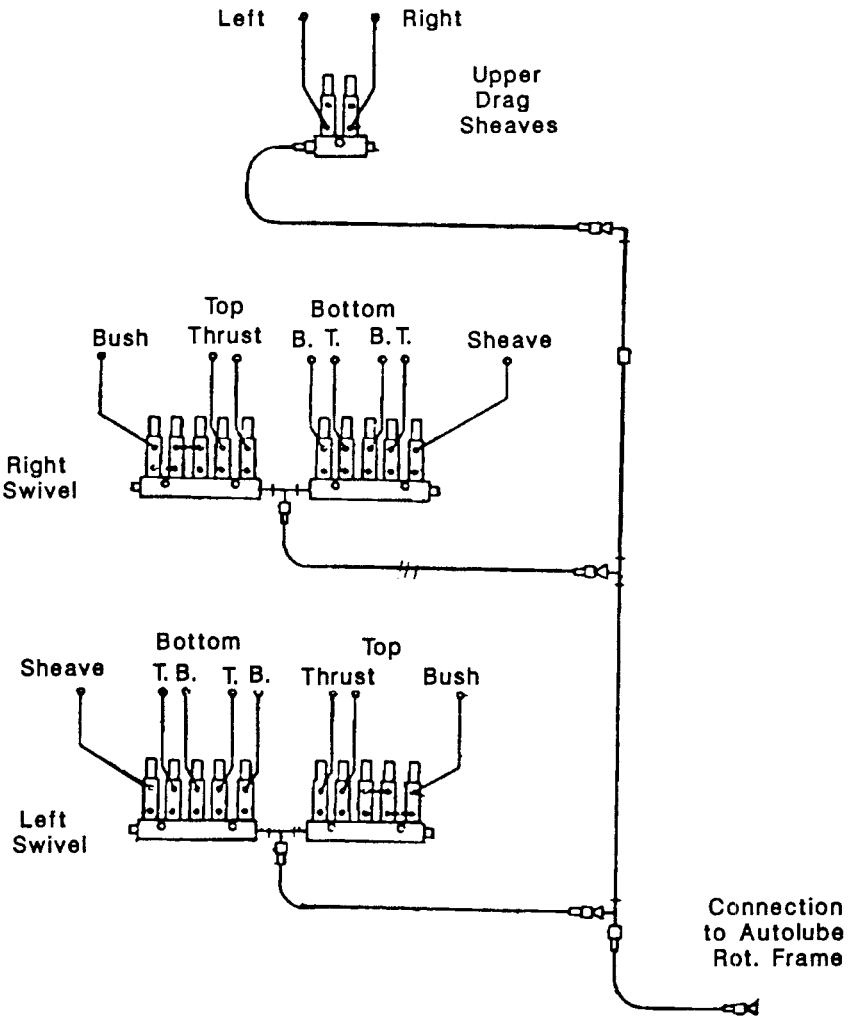
Any of the lubricant supply circuits can be cycled **manually** when power is ON the control panel, regardless of the machine control mode selection. The pushbuttons on the front of the control panel are used for manual operation. Manual operation of a lube supply circuit is useful for purging the lube lines, supplying additional lubricant to components or investigating a fault. It can also be used to verify or clear a fault. For manual operation, select the circuit desired by pressing one of the 6 pushbuttons provided on the auto lube control cabinet door. Push the Manual Cycle START button to start the lube cycle. More than one lube supply circuit can be operated at the same time.

Once activated manually, a lube supply circuit will run until one of the following occurs:

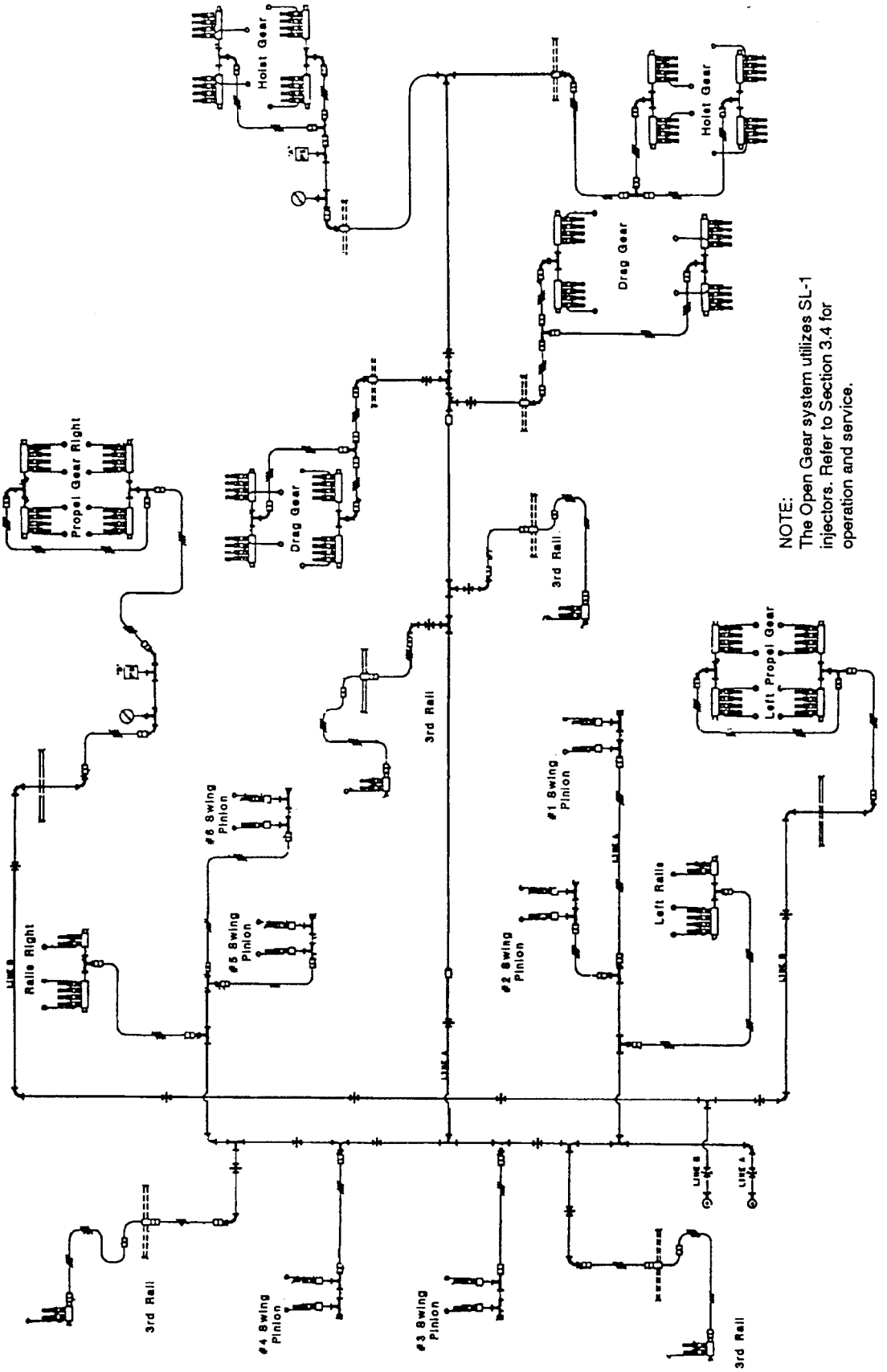
a. The contacts in the pressure switch(es) in the operating circuit *CLOSE*.

b. The alarm time for that system is exceeded and a fault is indicated.

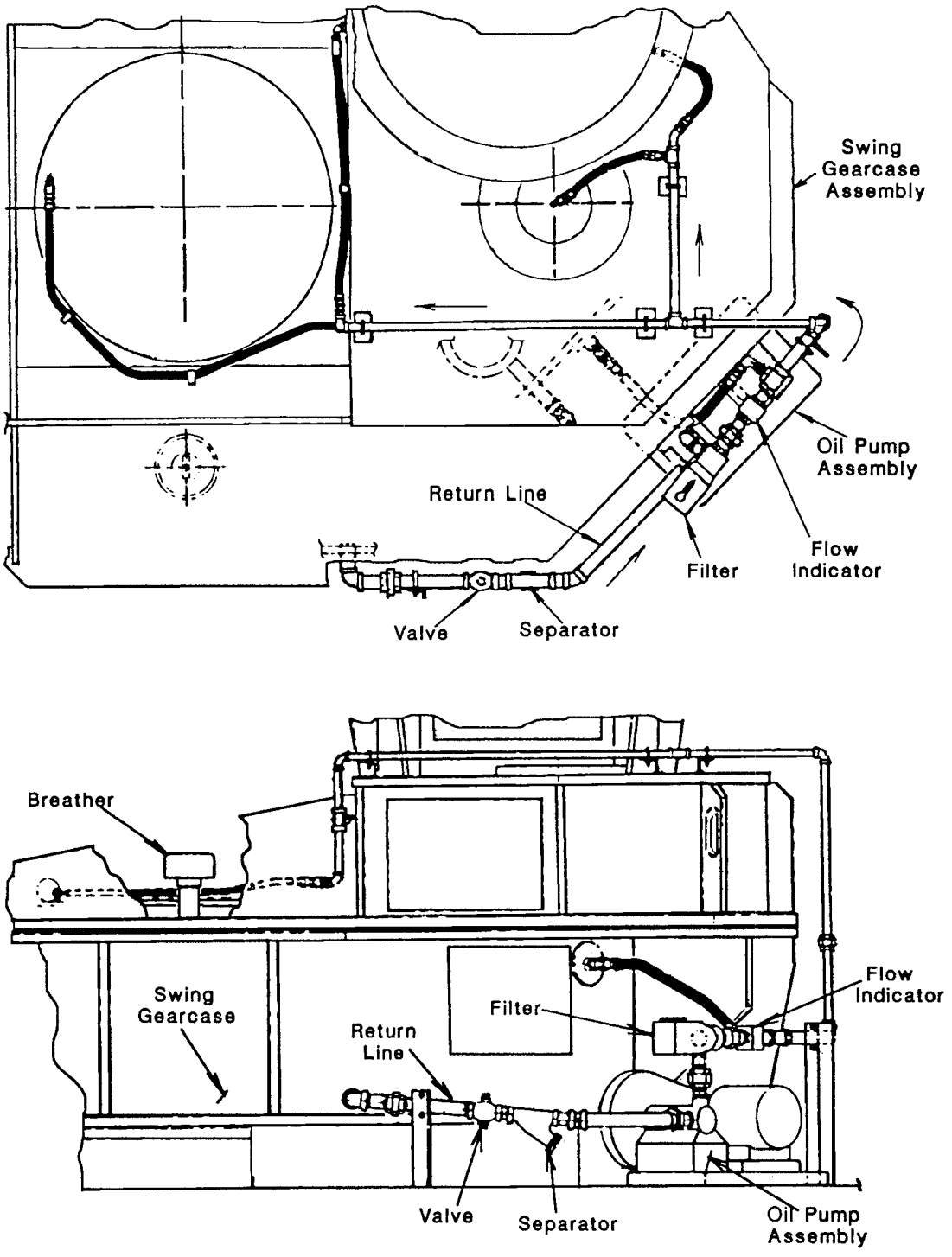
c. The pushbutton for the circuit in operation and the *ON / OFF* button are pushed.



AUTOLUBE SCHEMATIC - FAIRLEAD (MPG)



AUTOLUBE SCHEMATIC - OPEN GEARS



LUBE SYSTEM - ROTATING GEARCASE (Typical)

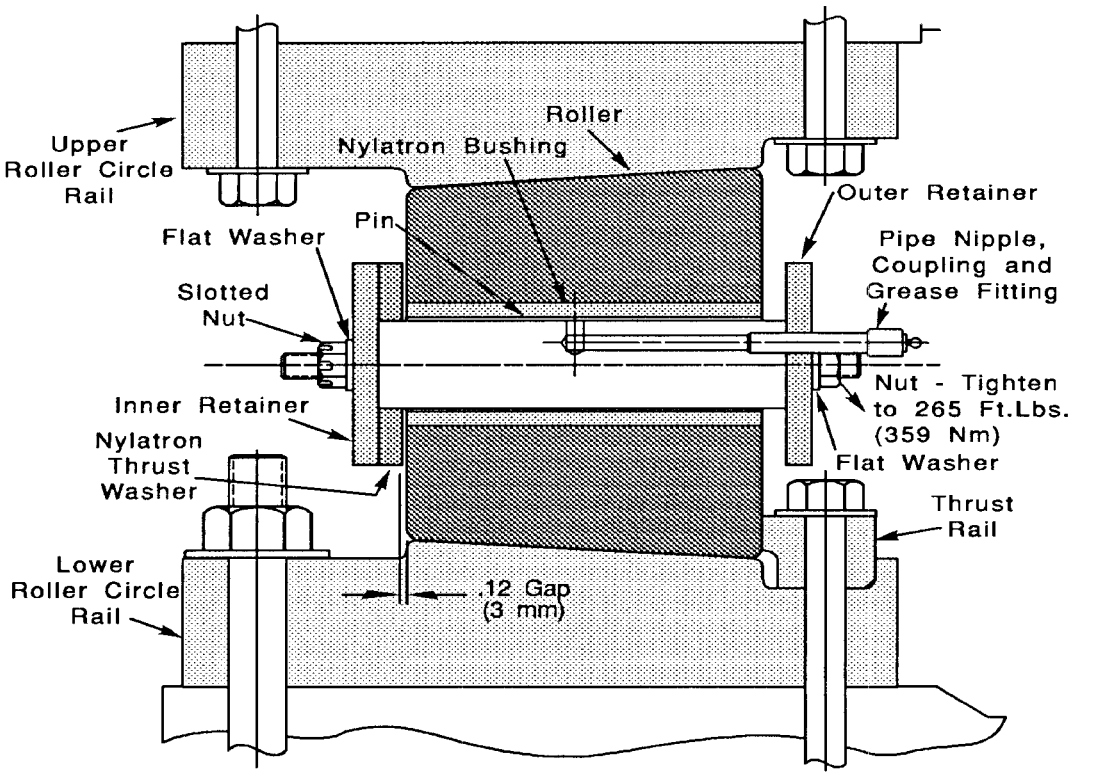
OILS

CODE OR SYMBOL NO.		ASTM or TEST	OIL MO	OIL PO
Pour point Max. °F(°C)	Summer	D-97	5(15)	15(-9)
	Winter		0(-18)	15(-9)
Flash point Min. °F(°C)	Summer	D-92	450(232)	410(210)
	Winter		450(232)	410(210)
Viscosity at 100°F(38°C) SUS		D-446	--	150 min.
Viscosity at 210°F(99°C) SUS	Summer	D-446	60 - 68	43
	Winter		51 - 55	43
Viscosity index,min.		D-567	90	101
Rust test - 48 hrs. Syn. sea water		D-665	none	--
Sae viscosity No.	Summer	--	30	10
	Winter	--	20W	10
Analine point min.		D-611	--	215

GEAR LUBRICANTS (OIL TYPE) -GL

CODE OR SYMBOL NO.	ASTM or TEST	GL-90	GL-140	GL-200	GL-250
Pour point, max.°F(°C)	D-97	0(-18)	10(-12)	20(-7)	30(-1)
Flash point, min.°F(°C)	D-92	410(210)	410(210)	410(210)	410(210)
Viscosity @ 100°F(38°C)SUS min.	D-446	1100	2000	3500	4500
Viscosity @ 210°F(99°C)SUS	D-446	80-120	120-180	180-210	210-260
Viscosity index, min.	D-567	80	80	80	80
Equiv.AGMA lubricant no.	--	6 EP	7-8 EP	8 ep	8a
SAE viscosity no.	--	90	140	140/250	250
EP Timken, min.OK	--	65	65	65	65
Copper corrosion, max.	D-130	2	2	2	2

NAME OF PART	TYPE	NO. OF POINTS	LOCATION	LUBE SYM.	METHOD & FREQUENCY
		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	OGL	Automatic
Retainer Assembly Aligning Pin	Bushing	4	In O.D. of Retainer	OGL	Automatic
Collector Ring Mount - Bottom	Anti-Friction	1	Piped out to O.D. of Housing	MPG	By hand, 500 hours
Collector Ring Mount - Top	Oilite Bushing	1	In top of Housing	---	Self lubricating
Auxiliary Collector Ring	---	1	---	---	None req'd
		ROTATING MACHINERY			
Main Rotating Gearcase	---	---	Fill at Air Filter to oil level in side of case.	GL	Check weekly 280 gal (1060 liters)
Main Rotating Shaft Top Brgs.	Anti-Friction	---	From Gearcase	---	---
Motor Extension Shaft Bearings	Anti-Friction	---	From Gearcase	---	---
Rotating Motor Coupling	---	---	Plug in Coupling Flange	MPG	3 months, by hand keep coated
Rotating Pinion and Gear	---	12	Drip On	OGL	Automatic, keep coated
Main Rotating Shaft Spline Split Thst. Wshr.	---	6	Fitting at top of swing case.	MPG	By hand, 500 hours



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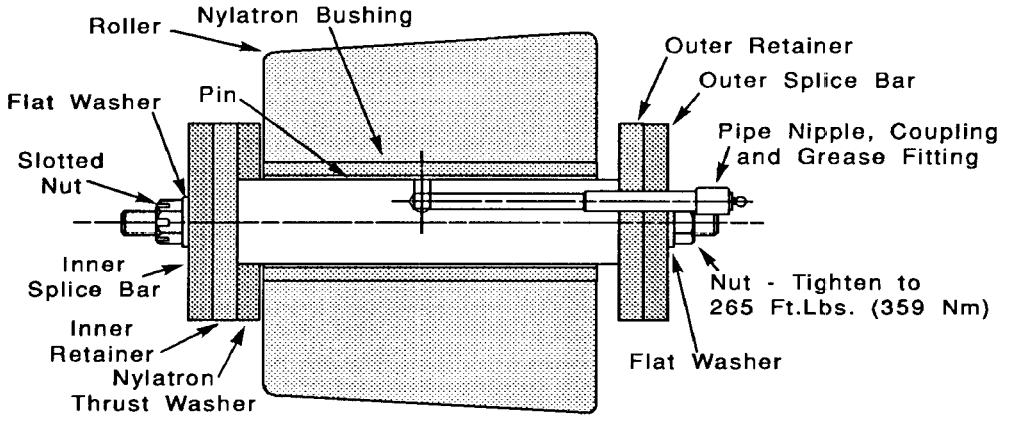
CROSS-SECTION THROUGH ROLLER ASSEMBLY

(107 Places)



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CROSS-SECTION THROUGH ROLLER ASSEMBLY

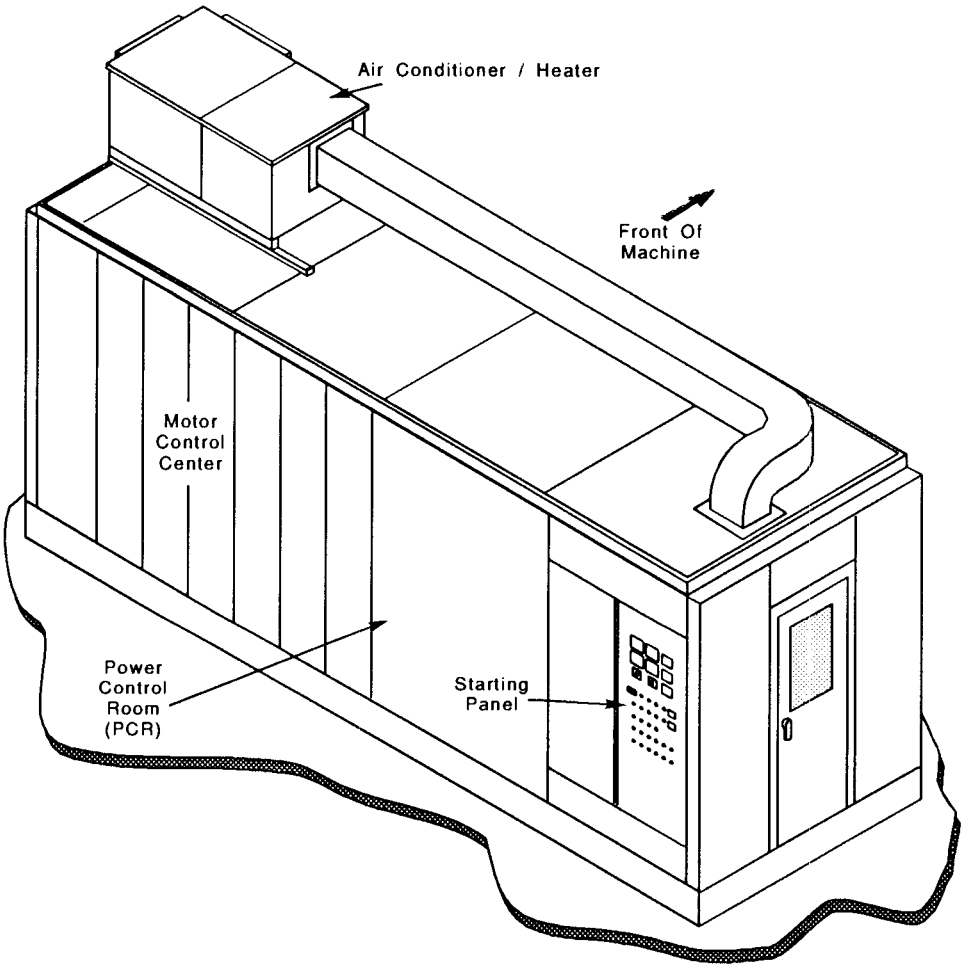
(36 Places)

POWER CONTROL ROOM

The Power Control Room (PCR) encloses the electrical control components away from dirt, grease and dust. The segregation of control components into a room type module centralizes the responsibility of the electrician, thus improving control maintenance.

The Power Control Room is supplied with a constant source of clean, filtered air which is under pressure to afford the ideal environment for the efficient operation of the electrical components.

The PCR is completely factory wired. Only the input and output connections must be made during field erection.



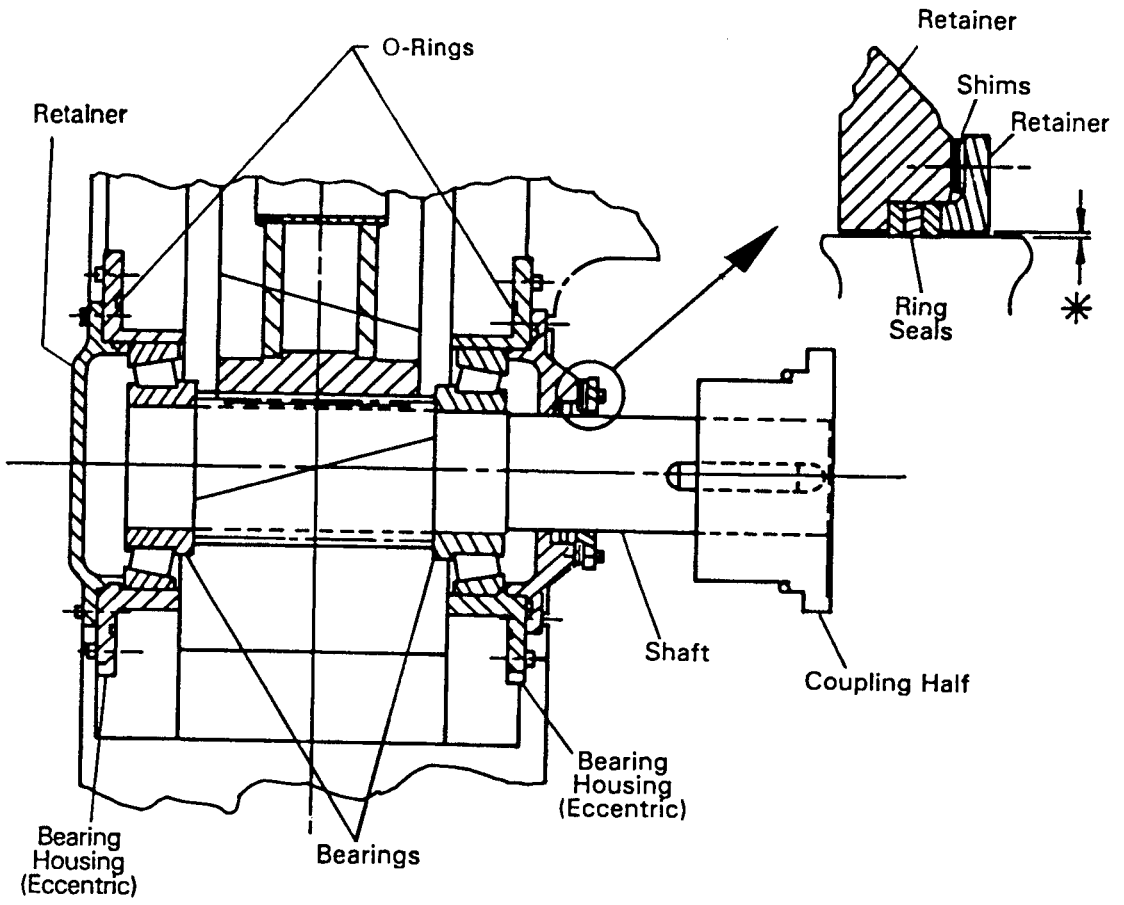
8200 POWER CONTROL ROOM (PCR)

BEARING SET-UP PROCEDURE:

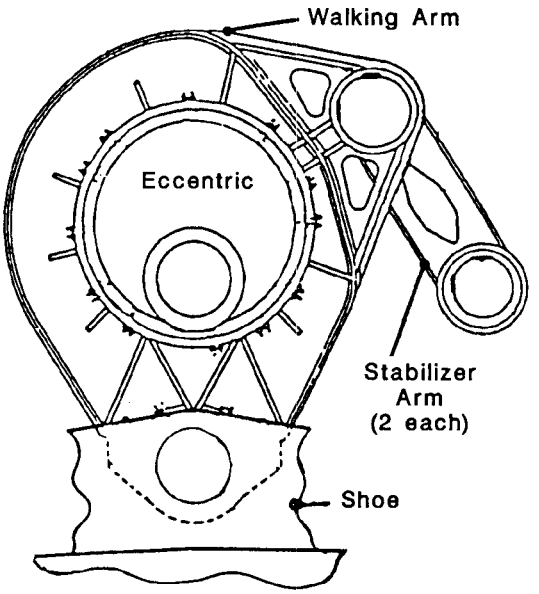
Take up on the cup follower until the bearings bind slightly in rotation. Install sufficient shims to give .003 - .005 inch (.076 - .127 mm) pre-load. Wire lock the retainer.

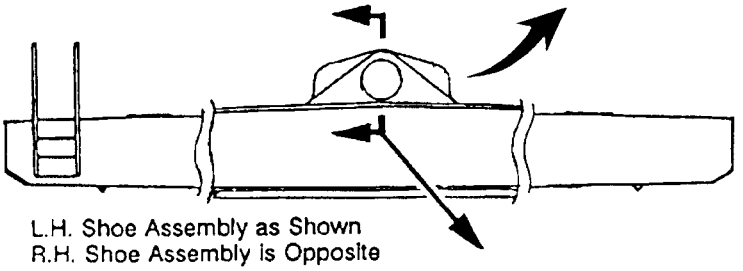
* Check for a minimum of .015 inch (.38 mm) clearance between the retainer and the shaft when tightening the capscrews. *THE RETAINER MUST NOT TOUCH THE ROTATING SHAFT.*

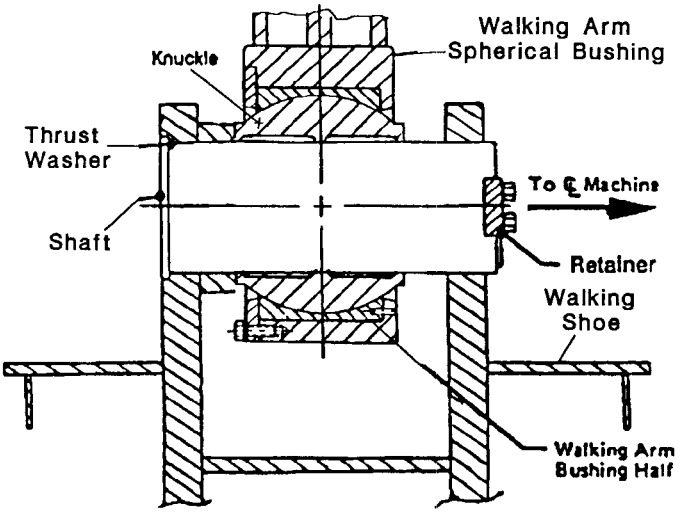
NOTE: Wire lock capscrews in the eccentric bearing housings in pairs.



PROPEL MOTOR EXTENSION SHAFT ASSEMBLY



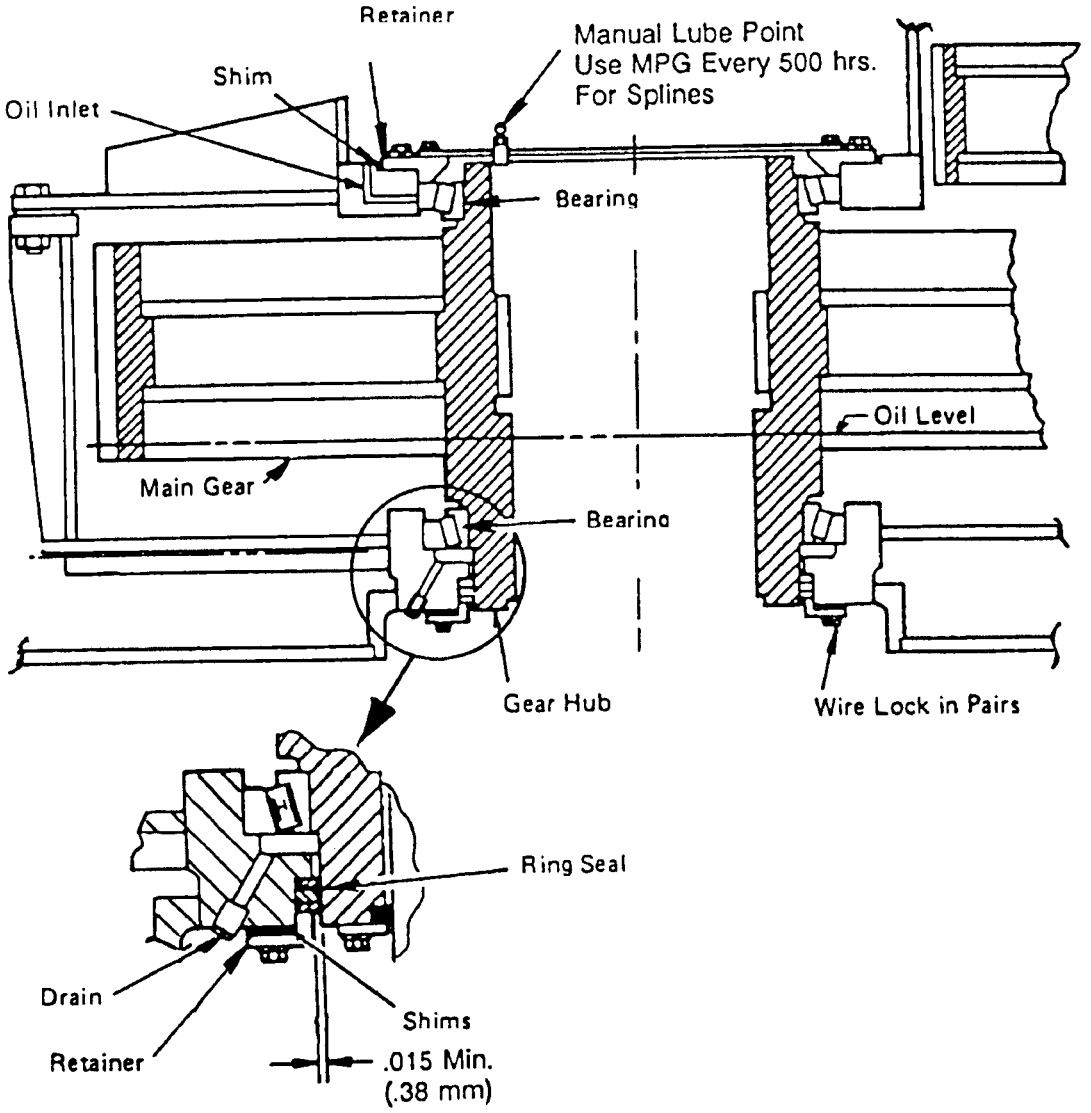




PROPEL LINKAGE AND SHOE ASSEMBLY

MAIN DRIVE GEAR ASSEMBLY

The Main Drive Gear Assembly consists of a gear which rotates on two single row bearings. The main rotating shaft is splined to the drive gear in the center of the gear hub.



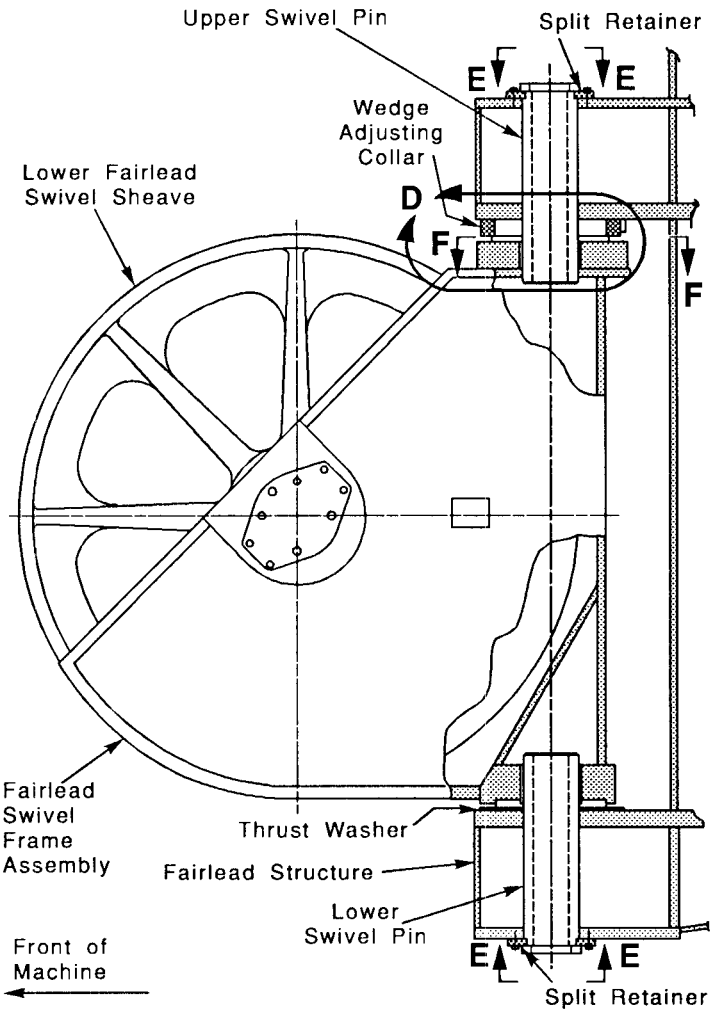
NOTE: Check for clearance between the retainer and the gear hub when tightening the capscrews. The retainer and the gear hub **MUST NOT TOUCH.**

The Hoist or Drag gearcases are oil tight and are provided with a dipstick to measure the lube level.

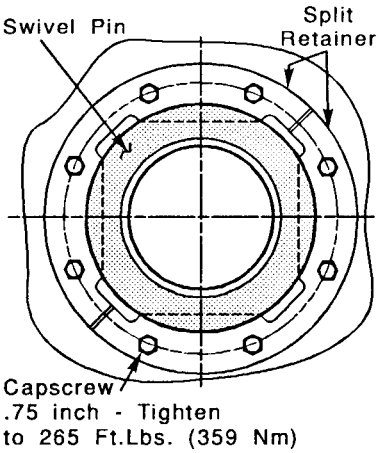
HOIST / DRAG DRUM ASSEMBLIES

The hoist / drag drum assemblies are supported by 2 large diameter spherical roller bearings. These mount in bearing housings that bolt to a gearcase at each end or the drum shaft assembly. A retainer holds the bearings in place (always place the spacer ring over the stub shaft, before assembling the bearing on the shaft). A retainer and a bearing cap, with through bolts, holds the bearing in the housing. The right hand end (operators cab side) bearing is held in place between the bearing cap and retainer. On the opposite end, the bearing "floats" within the housing. Hand pack the bearings at assembly with multi-purpose grease (MPG).

NOTE: Stub shafts have a provision for hydraulic-assist in bearing removal.



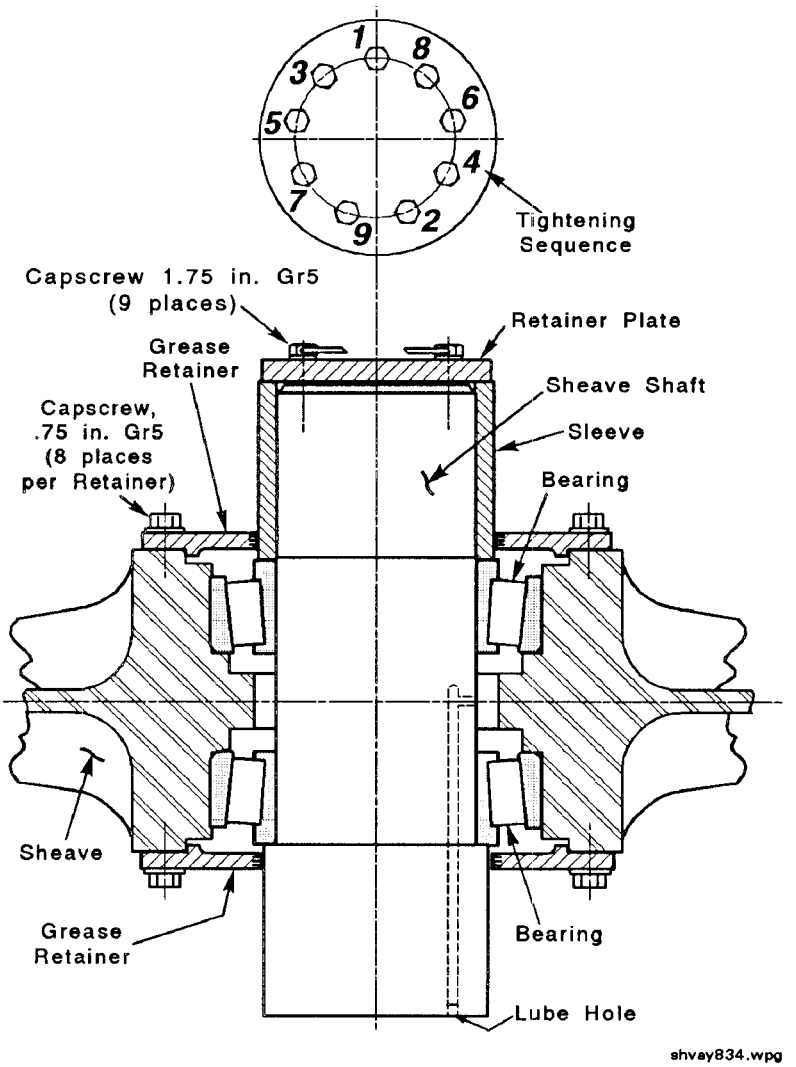
View - A
FAIRLEAD SWIVEL FRAME INSTALLATION



Section E-E
SWIVEL PIN RETAINER
(Top and Bottom)

UPPER FAIRLEAD SHEAVE BEARING REPLACEMENT

NOTE: Installation and setup of the bearing preload is done best in a shop environment.



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1. Set the shaft in a vertical position with the large diameter down, assemble the bearing retainer and bearing cone. Do not mix bearing parts. Coat the bearings with oil.

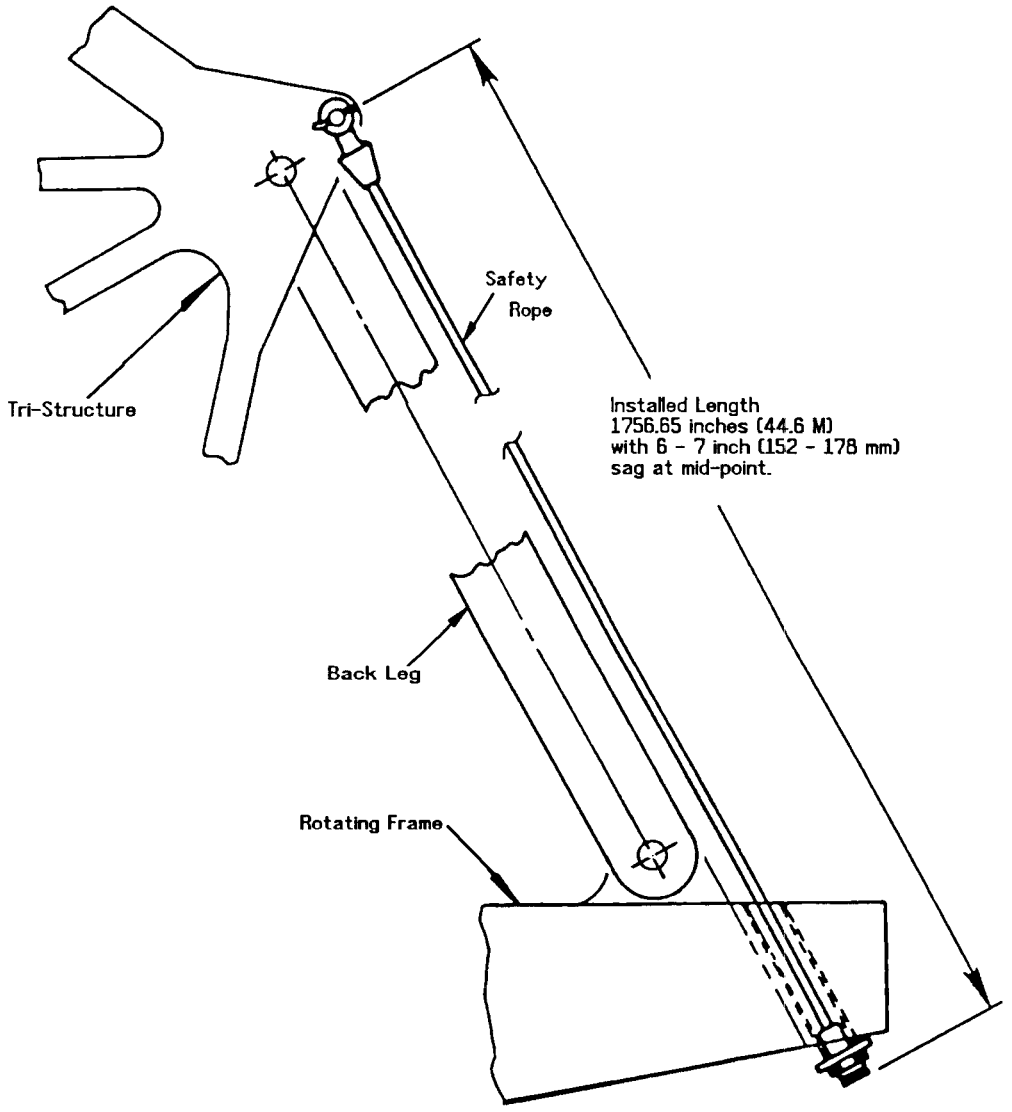
2. Set the sheave, with bearing cups in place, over the shaft and install the remaining bearing cone, retainer, sleeve and retainer plate.

3. Tighten the 9 retainer plate capscrews to 205 Ft.Lbs. while oscillating the sheave. Check the torque valve. Re-tighten as required. Back off the 9 capscrews and re-tighten to 135 Ft.Lbs.

4. Using a depth micrometer, measure the distance from the outer face of the retainer plate and the end of the shaft. Measure through the four .25 holes provided in the retainer plate. Subtract the thickness of the retainer plate from the dimension measured in at each hole and average. Adjust the shim thickness to the dimension calculated.

SAFETY ROPES

Two pendants, one on each side, are used in parallel with the tri-structure backlegs as safety ropes to support the front end equipment in the unlikely event that a backleg should fail. These pendants are bridge strand construction, 4.38 inch diameter, galvanized, stripped, and pre-stretched. Each has a zinced, open socket at one end and a zinced, double threaded anchor socket (tension type) at the other. The pendants are pin connected to the rear of the tri-structure head section, extend down through the machinery house roof, and are secured inside the rotating frame structure to its bottom plate. Since these are for *SAFETY* only, they are adjusted so they assume *NO* operating loads. They are properly tensioned when there is a 6 to 7 inch (150 to 175 mm) sag from their centerline at mid-span.



View - D
TRI-STRUCTURE SAFETY ROPES

CAUTION: Remove the filter bowl slowly. Although the pump pressure has been removed, there will be a small amount of pressure due to the check valve spring.

4. Carefully remove the bowl from the pressure line filter, take out the element, and thoroughly clean the bowl in an acceptable solvent. Discard the element in compliance with local codes.

5. Install a new filter and the clean bowl to the filter head. Pre-lube the O-rings with clean, filtered oil.

6. Open the air valves to start the pump

7. Purge the right hand cylinder piping of air and close the cylinder drain valve.

8. Open the left hand cylinder drain valve and purge any air from the hydraulic lines and close the valve.

9. Close both cylinder drain valves to retension the intermediate boom support pendants. *DO NOT* adjust the air regulator higher than the setting at the start of this procedure until after the pump has stalled. Adjust the air regulator upward in increments as needed to obtain a hydraulic system pressure of 975 PSI (6.7 MPa) at stall. After the pump stalls, reduce the regulator setting by 20 PSI (138 kPa) below this value. The machine is ready for operation.

The hydraulic line from each cylinder to the tank has a return line filter. This filter is mounted on top of the reservoir assembly and is a spin-on canister type with a paper element rated at 10 microns. The filter has a by-pass circuit that permits the oil to flow around the filter if it is plugged. The canister should be replaced after the first 50 hours of use following the replacement of an accumulator or cylinder assembly. Replace after every 1000 hours of operation.

To replace the 10 micron element in the return line filter, do the following.

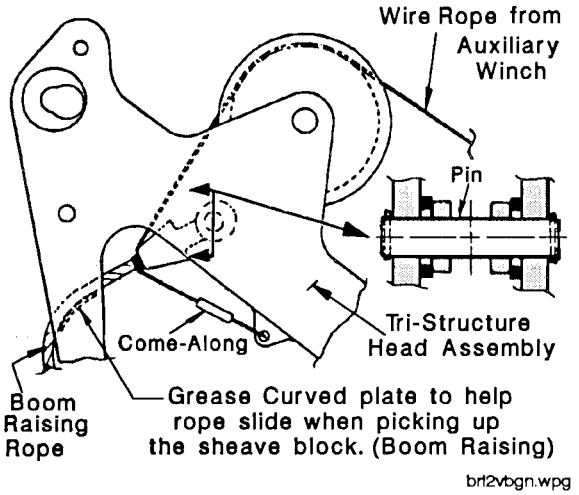
1. Set the bucket on the ground and shutdown the machine.

CAUTION: NEVER WORK ON THE BOOM WITHOUT USING A SAFETY HARNESS.

2. Loosen the hose fitting at the inlet port of the filter to vent any residual pressure and then, with a strap wrench, unscrew and remove the canister from the filter head. Dispose of the canister element and its contents in compliance with local codes.

3. Apply a thin film of clean, filtered oil to the new canister seal and install it onto the filter head. Tighten it in place by hand only, making sure it will not leak.

4. Re-tighten the hose end on the return line at the filter inlet. The machine can be returned to operation.



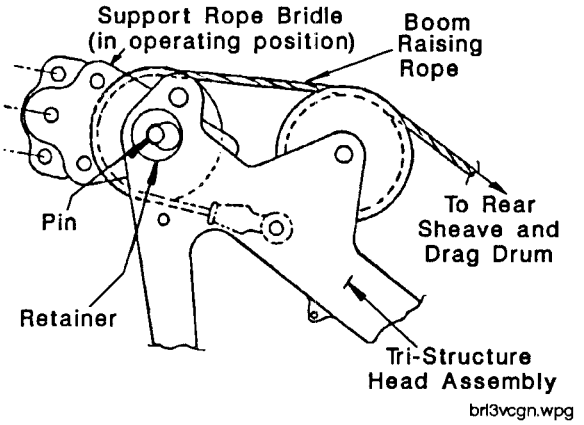
View - B

9. *Use a NEW set of ropes, P/N 205664-0, to lower the boom.* Attach the winch rope to the socketed end of the Boom Lowering/Raising Rope. Use the winch to lift the Boom Raising Rope to the Tri-Structure and pin the rope socket to the tri-structure as shown in *View - B.*

10. Use the winch rope to reeve the *FREE END* of the Boom Raising Rope up and around the sheaves on the Boom Support Rope bridle and back over the sheaves on the tri-structure.

11. Clamp the Boom Lowering/Raising Rope to the drag drum. Check to insure that the rope lengths on the drum are equal by allowing them to slip in the rope clamps. Lubricate the drum grooves to ease adjustment in case the ropes must be equalized. Tighten the rope clamps.

NOTE: Rope equalization is very important.



View - C

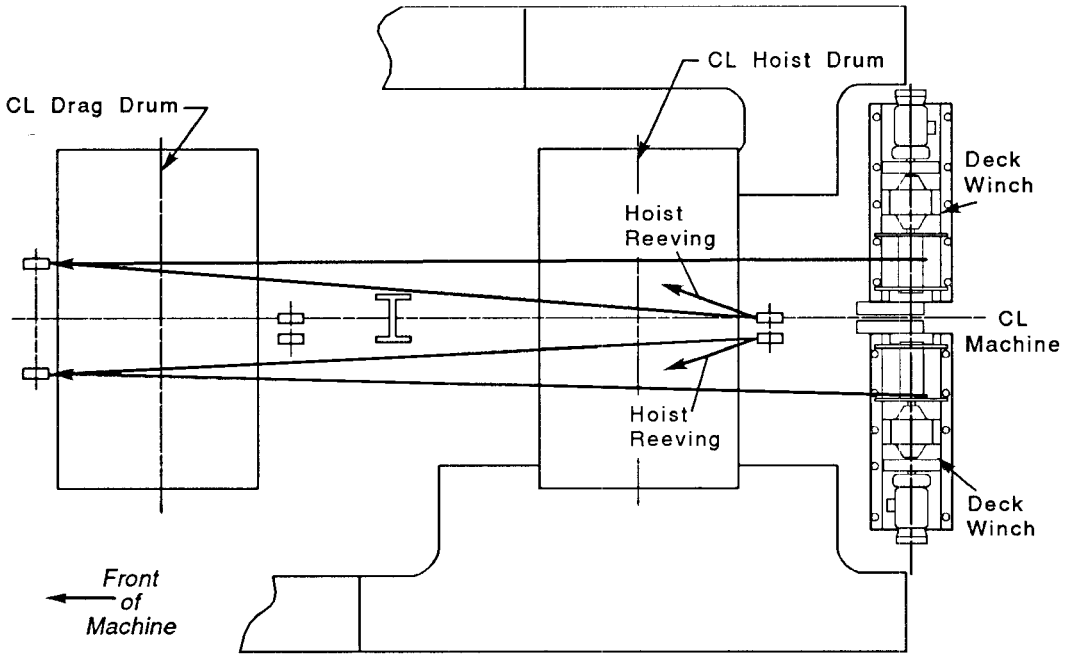
CAUTION: MAINTAIN CONTROL OF THE DRAG ROPES AT ALL TIMES WHILE REEVING.

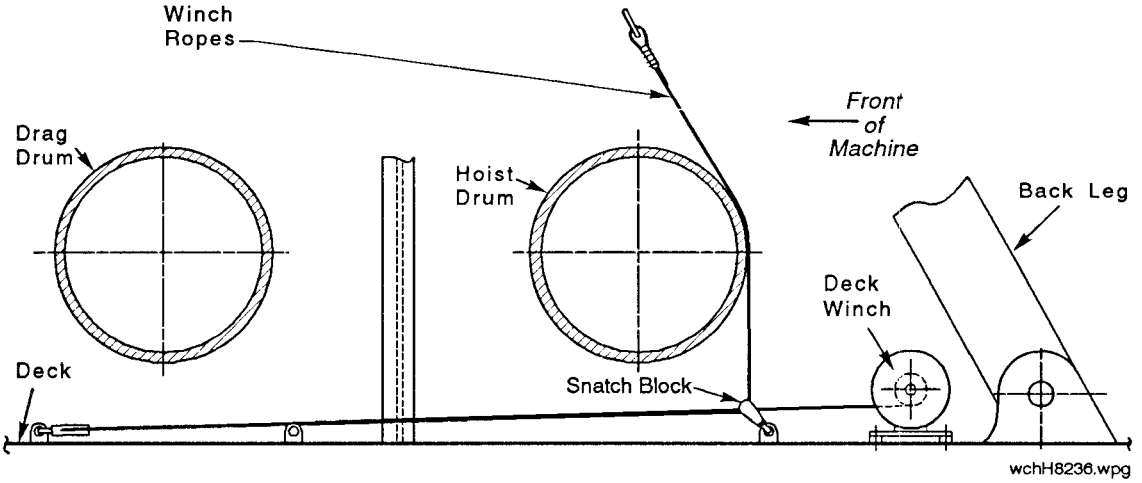
CAUTION: CHECK THE DRAG BRAKES FOR MAXIMUM BRAKING FORCE. CHECK ALL DRAG COUPLING GRIDS PRIOR TO RAISING OR LOWERING THE BOOM.

CAUTION: FAILURE TO INSURE THAT THE ROPES ARE PROPERLY SOCKETED COULD RESULT IN DEATH OR PERSONAL INJURY.

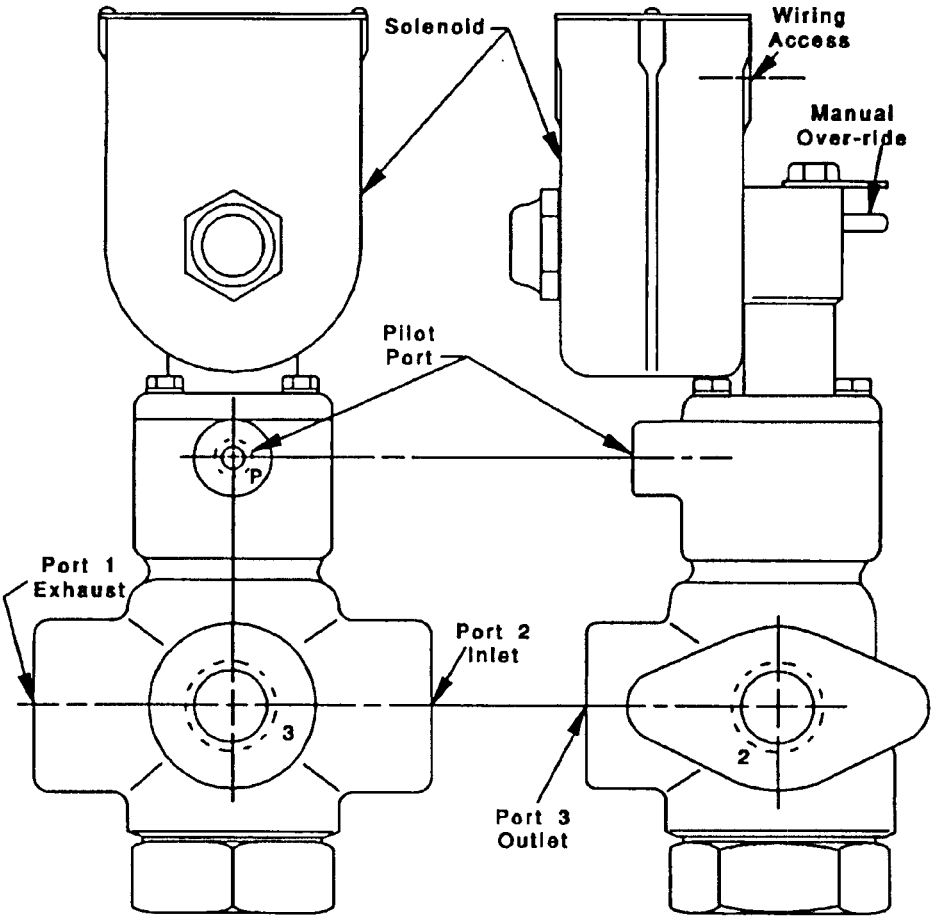
WINCHES, ROPE REEVING

The deck winches for reeving the hoist and drag ropes are located at rear of hoist drum. Snatch blocks are provided to assist in reeving the ropes. Refer to the figures below. For more information and maintenance on the deck winches, refer to the *APPENDIX* at the end of this manual.





REEVING The HOIST ROPES



SALEM 3-WAY SOLENOID VALVE
(Normally Closed)

The following, accurate and properly maintained test equipment is also needed.

✓ D.C. Voltmeter for 125 to 600 volts.

✓ D.C. Millivoltmeter for 600 millivolts.
(Zero center meters preferred.)

✓ Volt-ohm-milliamp meter or multi-meter.
(example: Simpson 260)

✓ A.C. Voltmeter, unless the multi-meter is accurate.

✓ Quality tachometer.

✓ 500 volt D.C. megger test.

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

INVESTIGATION

When trouble occurs, the operator is the EXPERT WITNESS, so he should be the first contact for any answers to the following important questions:

- How many motions are affected?
- Are the motions dead or just retarded?
- Are the motions intermittent or continuous?
- Did the trouble develop slowly or suddenly?
- What happened just before the failure?

POWER complaints require the following answers:

- Will the machine lift as heavy a load as before?
- Has speed increased or decreased for light loads?
- Has speed increased or decreased for heavy loads?

Page

This Section - 7 contains general information not specific to any individual machine. It is provided as a general reference for maintenance personel.

Should any additional specific data be required in these subject areas, contact your DRESSER/MARION service representative.

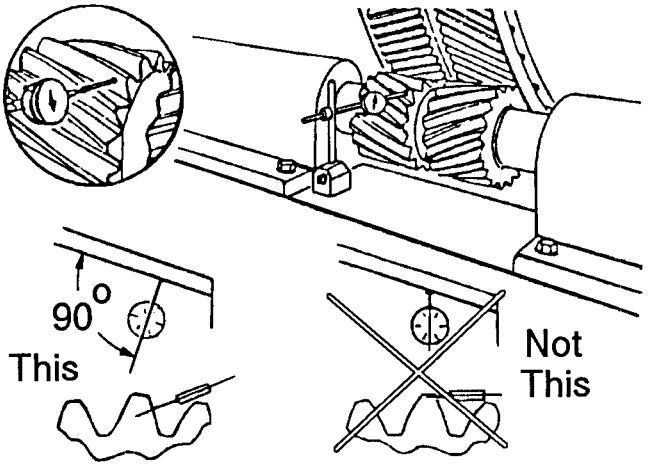
The chart below establishes approximate conversion from circular pitch (C.P.) to diametral pitch (D.P.).

CONVERSION

CIRCULAR PITCH FROM INCHES (MILLIMETERS)	DIAMETRAL PITCH TO INCHES (MILLIMETERS)
6.0 (152.4)	.5 (12.7)
5.5 (139.7)	.5 (12.7)
5.0 (127.0)	.625 (15.9)
4.5 (114.3)	.75 (19.0)
4.0 (101.6)	.75 (19.0)
3.5 (88.9)	.875 (22.2)
3.0 (76.2)	1.0 (25.4)
2.5 (63.5)	1.25 (31.8)
2.0 (50.8)	1.50 (38.1)
1.75 (44.5)	1.75 (44.5)
1.50 (38.1)	2.0 (50.8)
1.25 (31.8)	2.5 (63.5)
1.0 (25.4)	3.0 (76.2)
.875 (22.2)	3.5 (88.9)
.75 (19.0)	4.0 (101.6)

GEAR BACKLASH

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



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

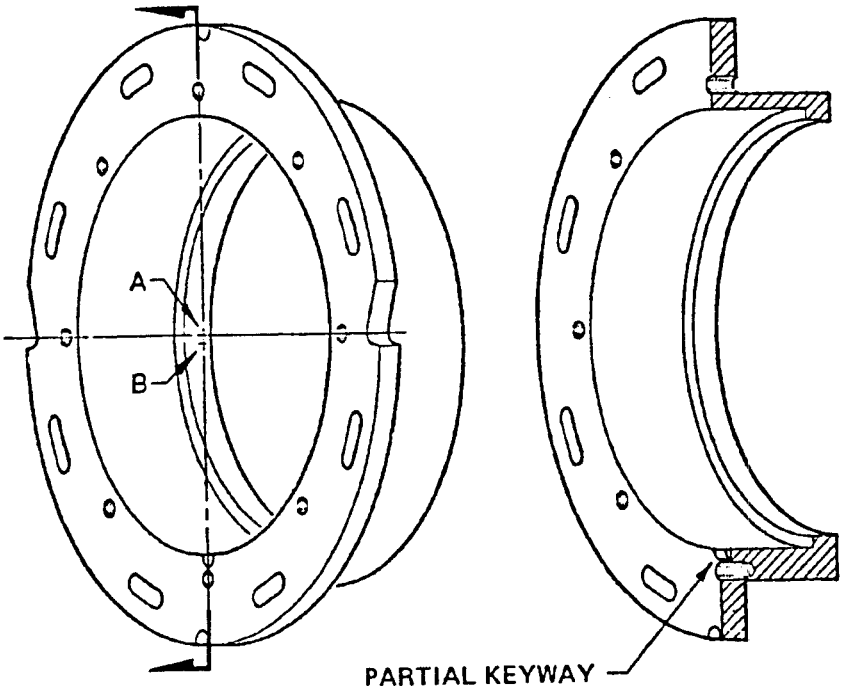


Figure 6

Figures 6 and *7* indicate other locations for the partial keyway rather than the location shown in *Figure 4*. However, the partial keyway has the same meaning regardless of its location.

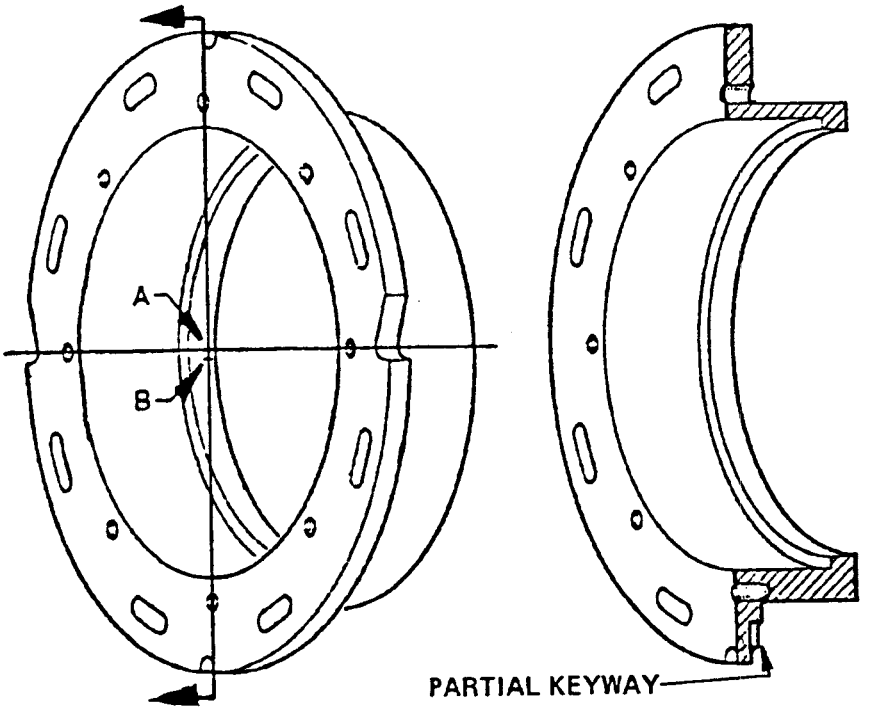


Figure 7

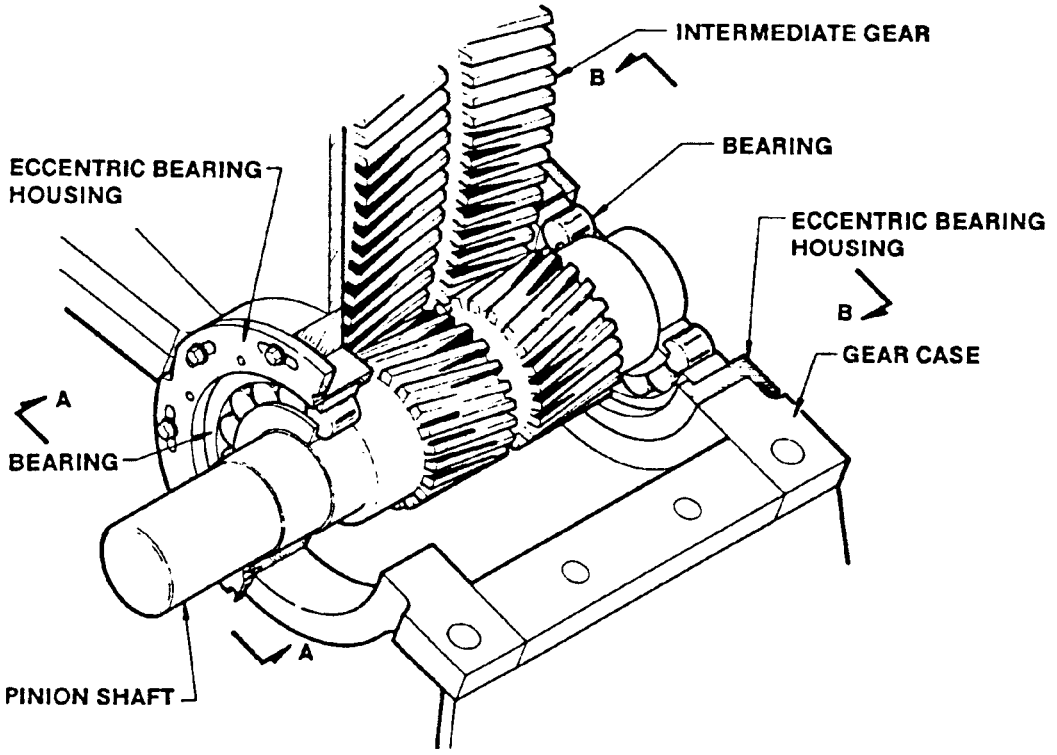


Figure 12

MISALIGNMENT OF PINION SHAFT
OUT OF PLANE

SPLINES

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

INVOLUTE SPLINE ASSEMBLY

Involute spline assemblies develop a 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 °F.**

5. Reinstall the rotor to the rotor hub.

6. Install the end plate assembly consisting of the end plate, spring housing, and pressure plate onto the mounting flange studs.

7. Lubricate the stud threads with 30 weight oil or "Never Seeze".

8. Assemble the locknut"s" in same alternation sequence as they were removed. Tighten the locknut to 200 ft/lbs. (271 Nm).

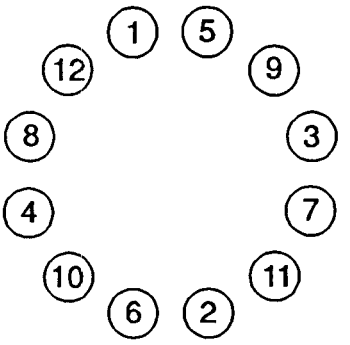
9. If applicable, center the rotor disc between the friction discs, using procedure given previously.

10. Reinstall the outer shield around the brake.

Dual Rotor Brakes

1. Remove the locknuts in an alternating sequence shown here and in increments of one quarter of the exposed stud thread length. If a stud comes loose from the mounting flange, clean the stud threads thoroughly. Apply Loctite 277 or equivalent. The stud must be threaded in until it bottoms in the mounting flange.

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



Locknut Removal Sequence

3. Remove the springs, clamp tube, rotor discs, and reaction plate. With these parts removed, all friction discs are accessible.

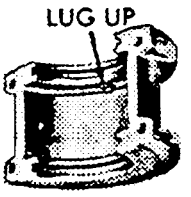
4. Inspect the rotor for wear. If either surface of the rotor is worn more than .03 inch (.76 mm), replace the rotor.

5. Remove the old friction discs and replace them with new discs and NEW screws. Tighten the screws to 20 ft.lbs. (27 Nm).

6. Reassemble the springs (on every other stud), clamp tubes, rotor discs, and reaction plate. Improper spring assembly will result in cocking of the reaction plate and uneven brake release.

7. Reassemble the wear spacers and then the end plate, spring housing, and pressure plate as an assembly. Take care to install the wear spacers behind the spring housing.

5. Pack with Grease and Assemble Covers



VERTICAL COUPLINGS

Pack the spaces between and around the grid with as much lubricant as possible and wipe off excess flush with top of grid. Position seals on hubs to line up with grooves in cover. Position gaskets on flange of lower cover half and assemble covers so that the match marks are on the same side as shown above. If shafts are not level (horizontal) or coupling is to be used vertically, assembly cover halves with the lug and match mark up, or on the high side. Secure covers halves with fasteners and tighten to torque specified in the coupling data table. *MAKE SURE LUBE PLUGS ARE INSTALLED BEFORE OPERATING!*

6. Periodic Lubrication

Remove both lube plugs and insert a lube fitting. Fill with recommended lubricant until an excess appears at hole opposite; then insert plug. Lubricate couplings at least once ever year. Lubricate more frequently when exposed to excessive-moisture, extreme temperatures, rapid reversing or shock loads or excessive misalignment. It is not necessary to re-lube couplings filled with Long Term Grease (LTG) until disassembled for service to attached components.

STEP 1 -- Clean the Worn or Fractured Part or Area to be Repaired or Rebuilt.

One of the most important considerations of a welding repair procedure is to clean the fractured area or worn part of all oil, grease, paint, moisture, dirt, rust spalled material, or any other material that may be detrimental to a weld.

Hydrogen has a bad effect on the properties of weld metal and can be found in most of the mentioned contaminates. As molten weld metal cools and solidifies, the hydrogen is rejected from the solution and becomes entrapped in the solidifying weld metal. It will collect at grain boundaries or at discontinuities of any type where it will create high pressures, which will in turn cause high stresses within the weld. Theoretically, these pressures and stresses could lead to minute cracks in the weld metal which could develop into larger cracks. Hydrogen will gradually escape from the solid steel over time.

Any spalled material should be air carbon arc gouged off or ground off because contaminates can be trapped under the spalled material. The spalled material may not allow the welding arc to penetrate to solid material.

Inspect the worn or fractured areas closely by visual inspection and/or nondestructive testing such as magnetic particle inspection or dye penetrant inspection. This will help determine the extent of the fracture. If one of the NDT techniques are used, make sure instructions on proper use are followed.

After testing decide whether to replace the part or risk the possibility of a potential future failure.

Some methods of cleaning a part are steam cleaning, blasting, or burning off the oils and greases with a torch. The cleaning process must be analyzed depending on how and where the part will be repaired and the type of material that requires cleaning. If heating torch should be used, make sure the operator of the torch is supervised closely. The flame should not be concentrated in one spot for long periods of time, but should be swept back and forth across the part. The burned ash can then be brushed off with a wire brush. Clean a large enough area around the fracture or worn part so that no contaminates reach the repair area.

STEP 2 -- Analyze and Inspect the Fractured or Worn Component for Proper Reporting.

The initial task is to seek out and compile as complete a history as possible of the failed or worn part. The following is a list of items that will be useful in analyzing the failure.

1. Determine when, where and how the failure occurred. Interview the operators.

2. What is the service history? Length of service? Was an accident involved? Have there been other similar failures?

EXAMPLES OF CORRECT WELD REPAIRS:

A sheave with a rope groove worn. Rebuild and keep as a spare.

STEP 1: Clean the sheave of all grease and oils for inspection of any fractures and clean it of contaminates that would be detrimental to welding.

STEP 2: Inspect the sheave visually and with magnetic particle inspection for signs of any other fractures. Compare the cost of rebuilding the groove with a new sheave. The decision is made to send the sheave to the manufacturer for rebuilding.

STEP 3: A review of the print shows the material is MN-MO cast material.

STEP 4: The sheave will be prepared for welding by sending it to the machine shop for a light clean-up cut to machine off any spalled material. The sheave will then be mounted on a welding positioner for rebuilding. Make a template to use as a guide to measure the depth of the weld metal.

STEP 5: Since the manufacturer has flame hardening equipment, a heat treatable type electrode will be used such as 4130 flux cored electrode and a constant voltage power source.

STEP 6: Use two preheating torches while rotating the welding positioner to preheat to 350°F (177°C). Use a temperature indicating device to continually check the preheat throughout the welding operation.

STEP 7: With automatic welding equipment, start welding at the center of the groove and as the groove builds up, start each layer at the groove walls and work to the center. Clean each pass of slag. Use the template to determine the correct amount of weld metal build up for machining. Once preheating has begun, do not stop until the job has been completed.

STEP 8: Since the part cannot be stress relieved in a furnace because of the machined hub, continue postheating the groove area for one hour. Keep the heat at 350°F (177°C) to 450°F (232°C).

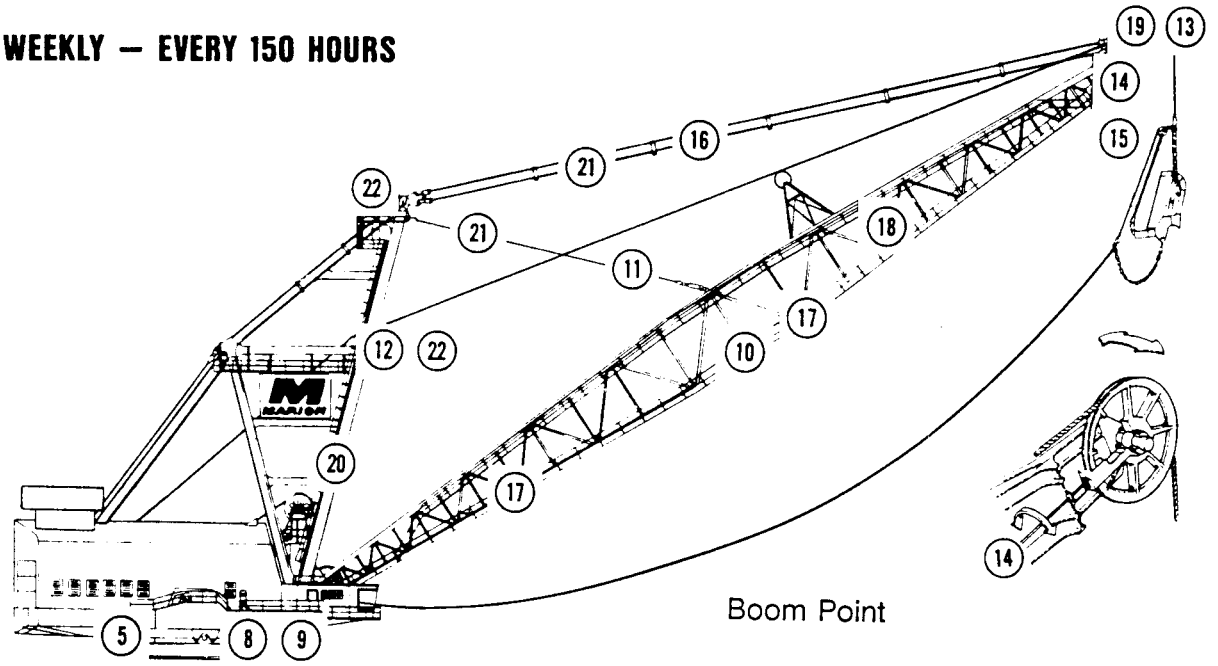
STEP 9: Slow cool by turning the torches down while the sheave is still rotating so it cools at a rate of 50°F (10°C) per hour until it reaches 150°F (66°C).

STEP 10: After the sheave has cooled down to ambient temperature, inspect the weld visually and by magnetic particle inspection.

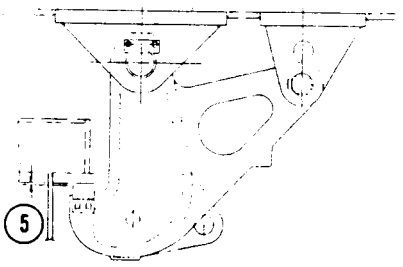
STEP 11: Send the sheave to a machine shop for re-machining to the contour of the drawings.

STEP 12: Flame harden the groove.

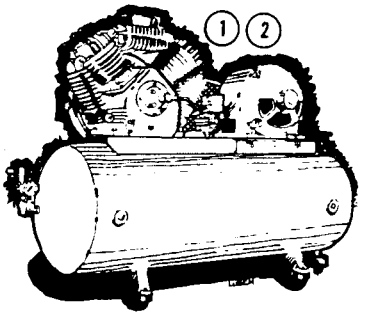
WEEKLY – EVERY 150 HOURS



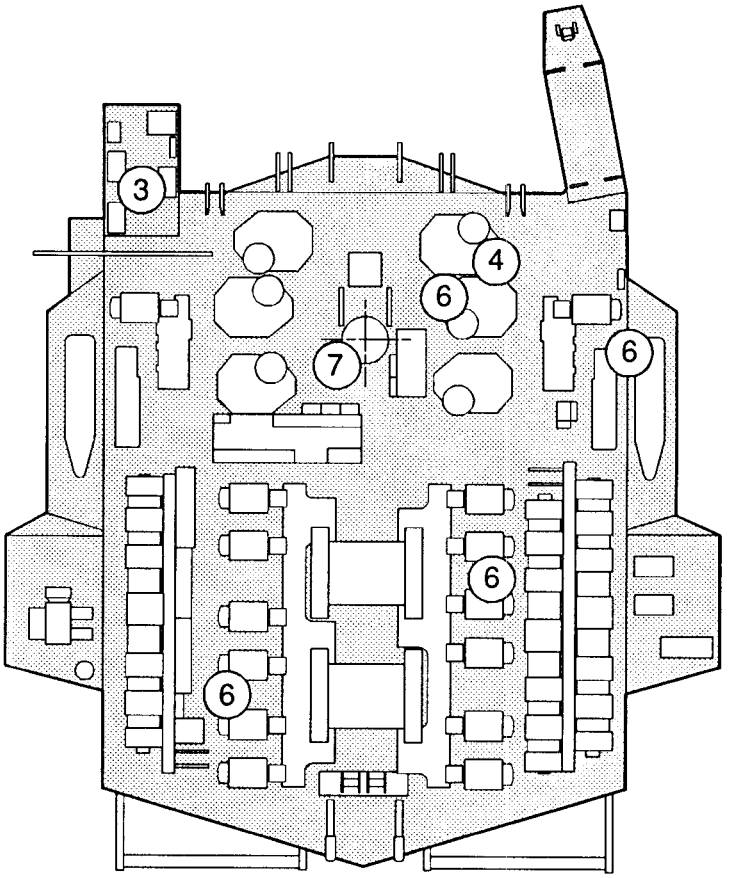
Boom Point



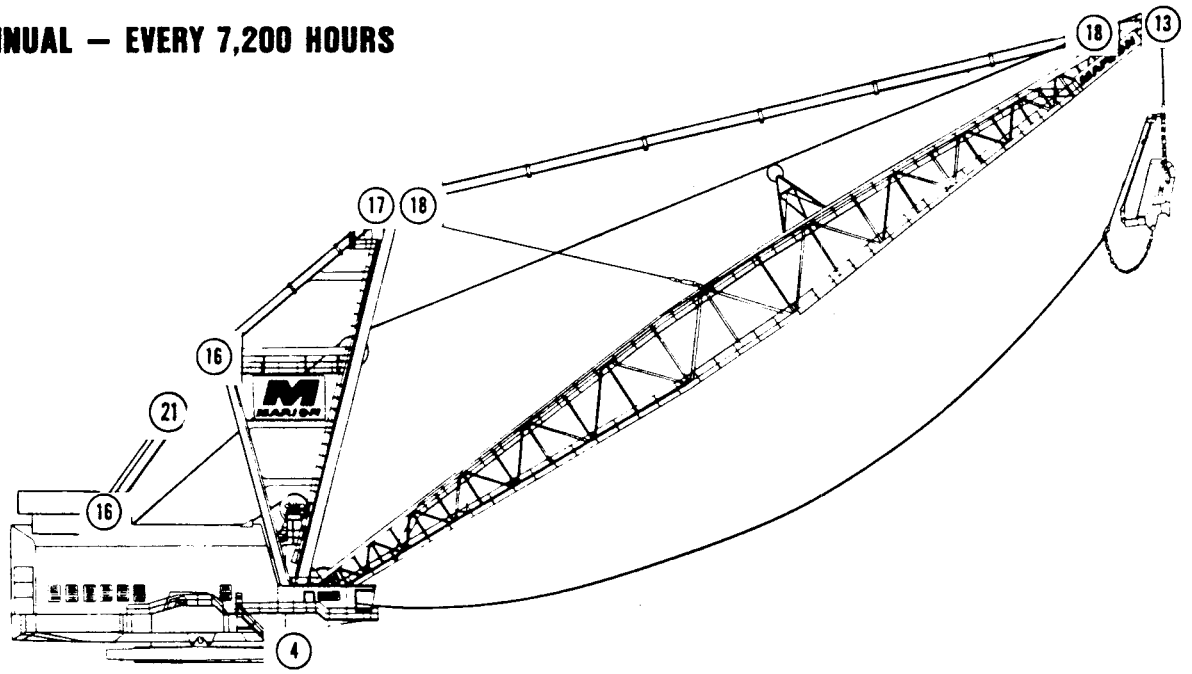
Hook Shoe

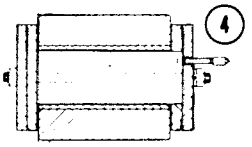


Air Compressor

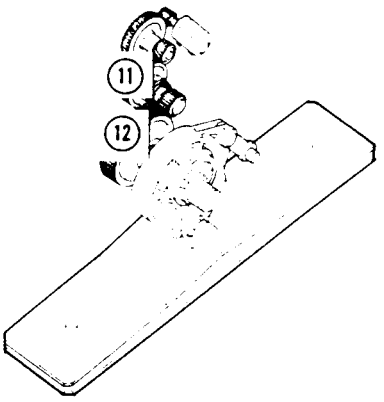


ANNUAL – EVERY 7,200 HOURS

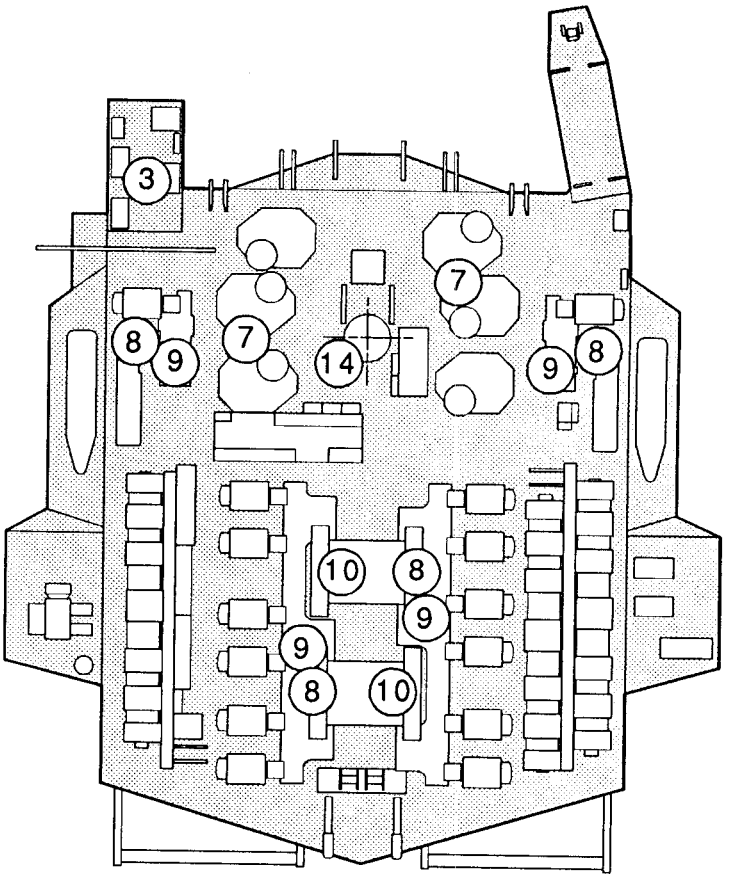


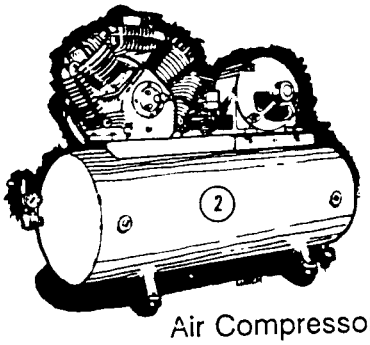


Rollers



Walking Mechanism





Air Compressor

COMPONENT MAINTENANCE

Specific instructions for the maintenance of components are listed below. Reference should be made to the Manufacturer's Handbook where necessary.

NOTE: **Before opening the refrigerant circuit to remove or replace any components, pump down the circuit as described below.**

Compressor - General

It is essential that the compressor is evacuated before any connection is broken for inspection. Proceed as follows:

a) By-pass compressor low pressure safety cut-out.

b) Close the liquid receiver outlet valve.

c) Start the compressor, observing the test gauge suction side, which must be fitted prior to test and reduce the pressure down to 2 psi (.2 Kg/cm^2) and then stop compressor.

NOTE: 1. **Stop the compressor several times during the operation to prevent excessive foaming of the oil as the refrigerant boils out. Violently foaming oil may be pumped from the crankcase.**

2. **If the pressure should accidentally be taken lower than 2 psi (.2 Kg/cm^2), refrigerant can be bled into the compressor to raise the pressure to the desired value.**

d) Close the discharge valve.

e) Permit all adjacent parts to warm up to room temperature before breaking the connections. This prevents moisture from condensing on the inside of the system if air is accidentally admitted.

f) Following assembly, it is necessary to purge the compressor of air with refrigerant vapor by "cracking" the liquid receiver outlet valve and venting the compressor through the discharge gauge connection on the compressor.

Heater Elements:	Finned tubular elements with sealed end connections.
Thermostat:	One stage for cooling. Two stage for heating (two stage optional). With adjustable set point.
Safety Controls:	Dual pressurestat with auto reset on high pressure and auto reset on low pressure. High temperature cut-out for electric heaters.
Compressor:	Multi-cylinder heavy duty accessible hermetic type with positive pressure lubrication, oil level sight glass, and crankcase heaters.
Refrigerant Line:	Copper pipe with flexible heavy duty refrigerant hoses. Liquid line has refrigerant strainer drier as well as sight glass/liquid indicator.
Capacity Control:	Hot gas bypass valve suction pressure controlled.
Return Air Filter: (Optional)	Sigma metal viscous filter with stainless steel frame and washable media for return air.
Fresh Air Filter and Pressurization Pack (Optional)	Three stage cyclonic type filter.
Fresh Air Fan Motor: (Optional)	Totally enclosed air over motor cooled.
Fresh Air Fan: (Optional)	One single inlet single width centrifugal wheel.

Note 7 - **Thermal Expansion Valve Too Small:**

If the replacement thermal expansion valve is too small, it cannot pass a sufficient amount of liquid to satisfy the evaporator. Under conditions of heavy load, the superheat will be excessive and the system will lose capacity. Under conditions of light load, the system may function properly. Too small expansion valves usually result in abnormally low suction pressure.

Note 8 - **Thermal Expansion Valve is Obstructed:**

Unless the expansion valve is properly protected by a strainer or filter, foreign matter may obstruct the valve port. If the obstruction is small, the resulting operation will be much the same as though the valve were undersized as described in Note 7. If the obstruction holds the valve open during shut-down, the operation will be as described in Notes 2 and 3. An obstructed expansion valve is usually indicated by a partly warm evaporator.

Note 9 - **Shortage of Refrigerant:**

There should always be sufficient liquid in the receiver to completely submerge the inlet to the liquid line pipe. If there is a shortage of refrigerant, the liquid level will fall below the inlet to the liquid line. Frequently there will be a hissing or whistle at the expansion valve. The coil and suction line will be relatively warm while the suction pressure will be low due to little or no liquid being supplied to the evaporator if the shortage is severe.

Note 10 - **Overcharge of Refrigerant:**

An overcharge of refrigerant will cause high head pressure. Liquid will back up in the condenser and decrease the amount of surface available for condensing and as a result the head pressure will rise. In extreme cases, it may rise to a point where the thermal overload elements in the compressor motor or the high pressure cut-out will stop the compressor. This may result in short cycling.

Note 11 - **Air System, Purge:**

If air or other non-condensable gases are present in the system, they will tend to move toward and collect at the condenser. The head pressure will rise to a point above the pressure corresponding to the temperature at which the vapor is condensing. In extreme cases, the pressure may rise to a point where either the high pressure cut-out or the thermal overload elements in the compressor motor may stop the compressor.

Note 12 - **Broken Valves in Compressor:**

Broken or leaky discharge valves in a compressor are generally indicated by the suction pressure rising rapidly as soon as the machine is stopped. If the suction pressure rises faster than 13 kPa per minute, it is an indication that the compressor discharge valves are not holding. Before the compressor is opened, however, it should be determined that the pressure rise is not due to other causes such as leaky expansion valve.

Preparation for Start-Up:

Rotate shafts until the bearings move freely. This is to assure that the bearings have not become lacquered. Lacquered bearings may fail at start up. Reducer may be operated without draining the lubricant described in "Preparation for storage" above.

LONG TERM STORAGE

Reducer can be ordered from the Factory for long term storage. Field preparation for long-term storage is the same as for "Preparation for storage" above.

NOTE: [1]Or equivalent to Mobil product.

TABLE OF CONTENTS
(CONTINUED)

Section 5
OPERATION

Section 6
MAINTENANCE

it matches the amount of air being used. The control system functions continually in this manner, between the limits of 100 to 110 PSIG (689 to 758kPa), in response to varying demands from the service line.

The pressure regulator has an orifice which vents a small amount of air to the atmosphere when the pressure regulator controls the inlet valve. The orifice also bleeds any accumulated moisture from the control lines.

UNLOAD - IN EXCESS OF 110 PSIG (758kPa) LINE PRESSURE
When no air is being used,the service line pressure rises to the setting (cut-out pressure) of the pressure switch. the pressure switch opens, interrupting the electrical power to the solenoid-type pilot valve. At this time, the pilot valve allows dry sump tank air pressure to be applied directly to the inlet valve piston and keeping it closed. Simultaneously, the pilot valve sends a pneumatic signal to the blowdown valve. The blowdown valve opens to the sump to the atmosphere reducing the sump pressure to approximately 20 to 30 PSIG (138 to 207kPa). The check valve in the air service line pressure prevents line from returning to the sump.

When the line pressure drops to the low setting (cut-in pressure) of the pressure switch (usually 100 PSIG [689kPa]), the pressure switch closes, re-energizing the 3-way pilot valve and allowing the blowdown valve to close. The re-energized pilot valve again prevents line pressure from reaching the inlet valve. Should the pressure begin to rise, the pressure regulator will resume its normal function as previously described.

For a compressor with varied periods of time when there are not air requirements, a "Dual-Control" option is available. This option allows you to set the compressor in an automatic position whereby the compressor will shut down when no compressed air requirement is present and restart as compressed air is needed.

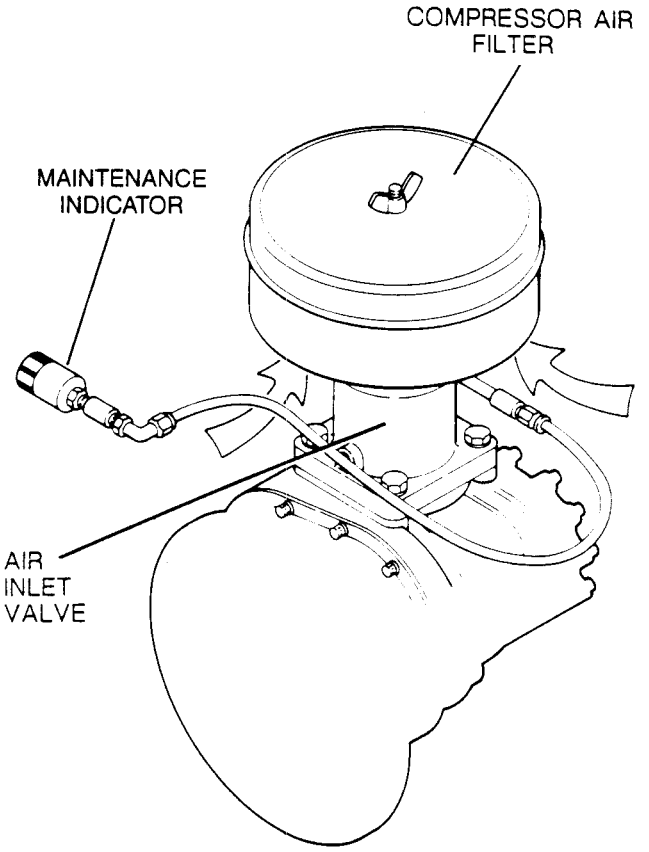
2.7 AIR INLET SYSTEM, FUNCTIONAL DESCRIPTION

Refer to Figure 2-6. The compressor inlet systems consists of a dry-type air filter, a restriction gauge and an air inlet valve.

The restriction gauge, (located on the compressor inlet pipe), indicates the condition of the air filter by showing red when filter maintenance is required. This indicator must be manually reset after the air filter has been serviced.

The poppet-type modulating air inlet valve directly controls the amount of air intake to the compressor in response to the operation of the pressure regulator (par. 1.6).

Figure 2-6 Air Inlet System

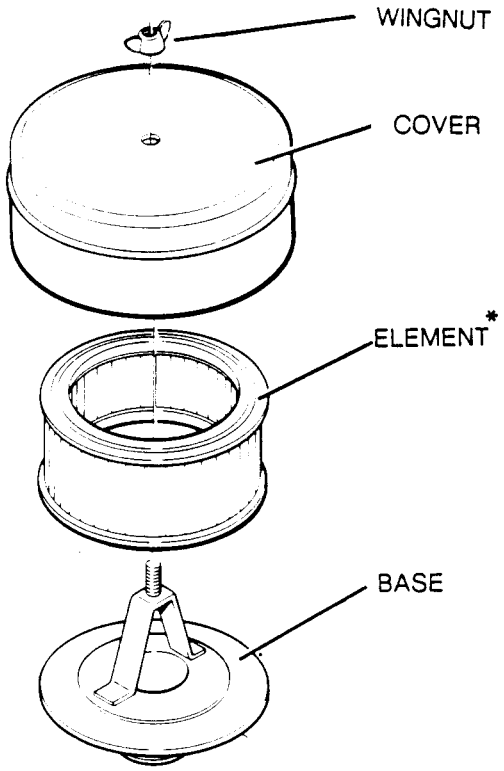


2.8 INSTRUMENT PANEL GROUP, FUNCTIONAL DESCRIPTION

Refer to Figure 2-7. The instrumentation for the 25, 30 and 40HP air compressors consists of a panel group which continually monitors the operating condition of the compressor. The panel group has the following gauges: a **sump pressure gauge, line pressure gauge, compressor fluid temperature gauge, hourmeter, air filter restriction indicator, separator maintenance gauge** and a **fluid filter maintenance gauge.**

- The **sump pressure gauge** continually monitors the sump pressure at the various load and/or unload conditions.
- The **line (terminal) pressure gauge** is connected to the dry side of the receiver downstream from the check valve. It continually monitors the air pressure.
- The **fluid temperature gauge** monitors the temperature of the fluid in the sump. The normal reading should be approximately 170°F (77°C) with 70°F (21°C) ambient.

Figure 6-2 Air Filter Element Replacement (P/N 410036)



* Replacement Element P/N 042445

1. As indicated by the filter maintenance indicator.
2. Every 6 months.

Below you will find procedures on how to replace and how to clean the air filter element.

AIR FILTER ELEMENT REPLACEMENT

1. Clean exterior of air filter housing.
2. Remove the air filter cover by loosening the wingnut securing the cover.
3. Remove element and clean interior of housing using a damp cloth. **DO NOT** blow dirt out with compressed air.
4. At this time clean or replace the element.
5. Replace cover.
6. Reset the filter maintenance indicator.

AIR FILTER ELEMENT CLEANING

The air filter element is cleanable by using compressed air. When cleaning the element with compressed air, never let the air pressure exceed 30 PSI (207kPa). Reverse flush the element by directing the compressed air up and down the pleats in the filter media from the "clean side" of the element. Continue reverse flushing until all dust is removed. Should any fluid or greasy dirt remain on the filter surface, the element should then be replaced. When the element is satisfactorily cleaned, inspect thoroughly prior to installation (see Element Inspection).

ELEMENT INSPECTION

1. Place a bright light inside the element to inspect for damage or leak holes. Concentrated light will shine through the element and disclose any holes.
2. Inspect all gaskets and gasket contact surfaces of the housing. Should faulty gaskets be evident, correct the condition immediately.
3. If the clean element is to be stored for later use, it must be stored in a clean container.
4. After the element has been installed, inspect and tighten all air inlet connections prior to resuming operation.

SEPARATOR REPLACEMENT

Refer to Figure 6-3. The separator must be changed when indicated by the maintenance gauge, or once a year whichever occurs first. Order separator element repair kit, No. 408167-009 for 25 and 30HP compressors and repair kit No. 408167-010 for 40HP compressors. Follow the procedure explained below for separator element replacement.

1. Relieve all pressure from the sump tank and all compressor lines.
2. Disconnect all piping connected to the sump cover to allow removal (return lines, service lines, etc.).
3. Loosen and remove the hex head capscrews from the cover plate.
4. Lift the cover plate from the sump.
5. Remove the separator element.
6. Scrape the old gasket material from the cover and flange on the sump. Be careful not to let the scraps fall in the sump.
7. Install the new gaskets; one on the sump tank the other on top of the element.
8. Reinsert the separator element into the sump taking care not to dent it against the tank opening.
9. Clean the cover plate, washers and capscrews. Torque to 55 ft./lbs. (75 Nm).
10. Reconnect all piping making sure return line tube extends to the bottom or ½" above the bottom of the separator element. This will assure proper fluid return flow to the compressor.
11. Clean the return line strainer before restarting the compressor.

INLET VALVE MAINTENANCE

Refer to Figure 6-4. The inlet valve (P/N 250025-654) maintenance usually requires the replacement of the piston spring, piston o-ring, seal ring, and check valve spring. Use repair kit No.

6.8 MAINTENANCE RECORD

MODEL NO. _____ SERIAL NO. _____

DATE	HOURMETER	MAINTENANCE PERFORMED	WORK PERFORMED BY	AUTHORIZED BY

FIRE PREVENTION

Always have a "charged" fire extinguisher on hand and know how to use it. Inspect and service the extinguisher as indicated on its instruction plate.

DO NOT smoke while handling flammables or when near batteries.

Inspect all lines, tubes, and hoses carefully. Tighten all connections to the recommended torque. See the Visual Inspection Schedule for the walk around inspection procedure.

Loose or damaged lines, tubes, and hoses, which leak, can cause a fire.

Make certain that all clamps, guards, and shields are replaced correctly so as to prevent vibration and the rubbing of one part against another which might result in heat build-up during operation.

DO NOT carry flammable fluids such as gasoline or solvents on board the machine.

DO NOT over-bend or strike pressurized hose lines. DO NOT install bent or damaged lines, tubes, or hoses. Replace them with new immediately.

DO NOT start the machine or move any of the controls if a warning tag is attached to the controls or the start panel.

Keep all cleaning rags properly stored. DO NOT discard them into a pile on board.

Keep all structural frame compartments, walkways, and work areas clean and free of lubricant residue.

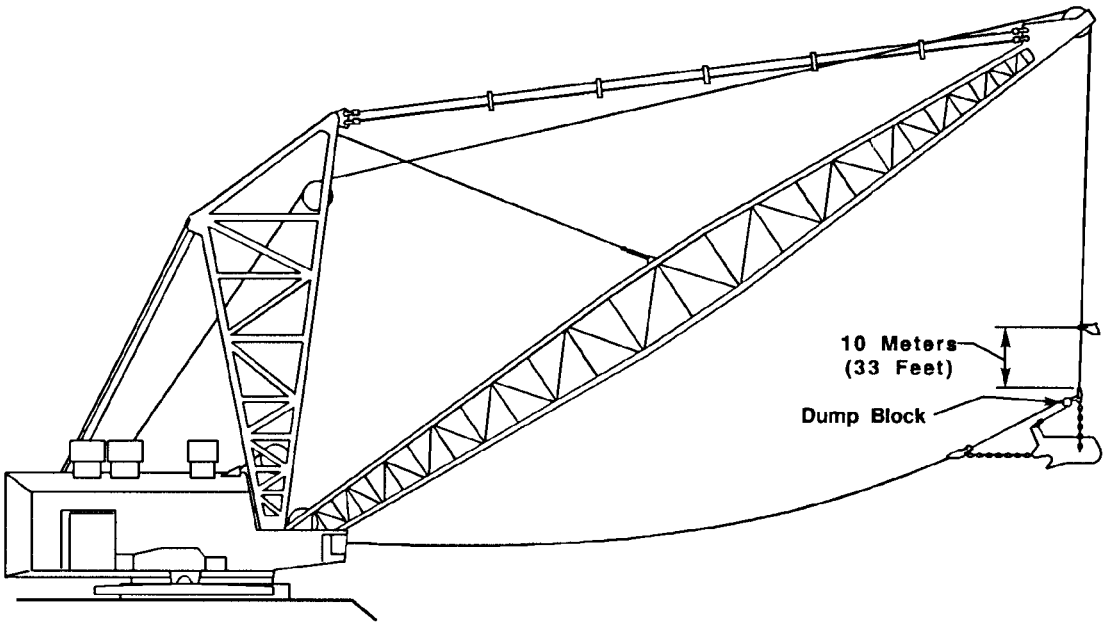
NEVER weld, burn, or perform service on the machine alone.

If a motor or other component is running hot, shutdown the machine until it has cooled and/or the cause eliminated.

HOIST/DRAG LIMIT CALIBRATION

An encoder attached to the end of the hoist and drag drum shafts continually monitors the drum position during operation. As the bucket nears the preset limits, reference is gradually removed until the drum rotation is stopped. To prevent tight-lining or pulling the bucket into the boom, the sum of the hoist and drag ropes payed out in monitored. If this sum reaches a preset length, the hoist or drag functions will be stopped.

The limits must be recalibrated after changing the ropes or anytime maintenance is performed which alters the encoder versus drum rotation. Recalibration is required on the function, hoist or drag, being serviced.



HOIST LIMIT

To set the hoist limit:

1. Tie a flag on the hoist rope 10 meters from the socket at the dump blocks and hoist the bucket until the flag touches the boom point sheave.

2. Set the hoist and drag brakes, turn excitation (L.E.) *OFF*.

3. Set the L.E.D. selector switch on the annunciator panel to *HOIST*.

4. Place the hoist controller in the *HOIST* position and turn the rope zero switch on the right console to *HOIST*. Hold for 5 seconds. The L.E.D. will blink, then indicate "10".

5. To set the hoist lowering limit, lower the bucket until 2 turns of rope remain on the drum. Repeat steps 2 and 3 above.