

# CARE, MAINTENANCE and OPERATION MANUAL



BUCYRUS-ERIE



®

## 380-W WALKING DRAGLINE

MACHINE SERIAL NUMBER \_\_\_\_\_

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### SWING RACK & LOWER RAILS

Bolted to the center base section and concentric with the center pintle is the swing rack (Figure 1.1-3). The swing rack is a large external tooth gear which meshes with the lower pinions of the swing machinery. Mounted in the machined groove on the top inner surface of the swing rack are the lower rails of the roller circle. The rails are held in place with chocks and clamps.

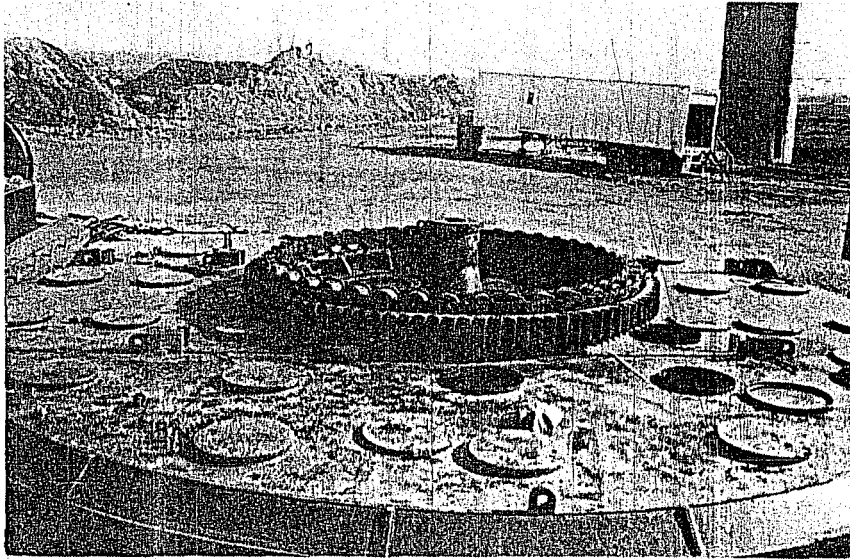


Figure 1.1-3

### ROLLER CIRCLE ASSEMBLY

The roller circle assembly consists of 42 tapered and flanged rollers which ride on the lower rails and are held spaced apart by inner and outer frames (Figure 1.1-3). The tapered rollers permit an even distribution of roller loads on both the base and the revolving frame. Furthermore, the action of the tapered rollers on the tapered rails enables a smooth swing of the machine with a minimum of roller skidding. The rollers are fitted with polyurethane bushings which are lubricated through fittings mounted in the roller pins. The roller circle upper rails form a complete circle and are secured to the bottom of the revolving frame with chocks and clamps.

### AIR SYSTEM

The air system on the 380W dragline is used to operate the brakes and clutches (Figure 1.1-24). The air is supplied from a compressor mounted on the right side of the propel module. The air is stored in an air receiver suspended from the right main truss. Air receiver and line air pressure is monitored by electrical pressure switches. Line pressure is regulated at various points to obtain proper pressure to operate the air controlled units of the machine. A safety valve is located to the air receiver to guard against excess pressure buildup. Air to all brakes and clutches, except the hoist and drag brake, is controlled by electro-mechanical valves. The hoist and drag brake are controlled by foot treadle air valves in the operator's cab. Lubricators, filters and shut-off valves are located throughout the air system. The air system also supplies air pressure to operate the automatic lubrication system and the diesel engine.

### LUBRICATION

The machine is equipped with an automatic lubrication system consisting of three separate systems (Figure 1.1-25). The "D" system supplies grease to the anti-friction bearings and bushings of the main machinery, swing machinery and propel machinery. The "H" system supplies a drip lubricant to all the gearing, except the transmission gears which run in oil, and the rail and roller surfaces. The "L" system supplies grease to the cam and cam roller during the walking mode. The lubrication pumping stations are located on the left side of the propel module.

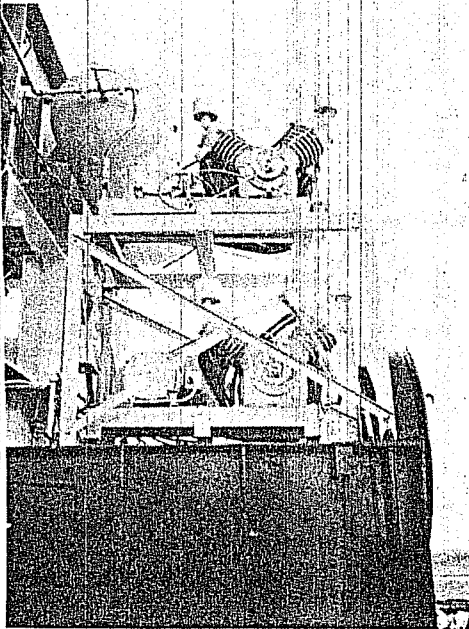


Figure 1.1-24

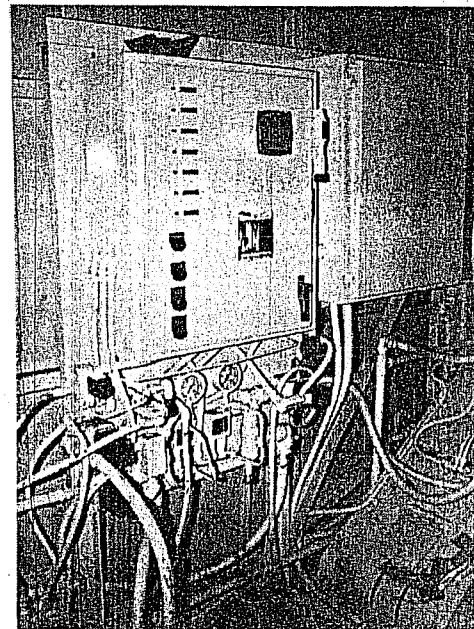


Figure 1.1-25

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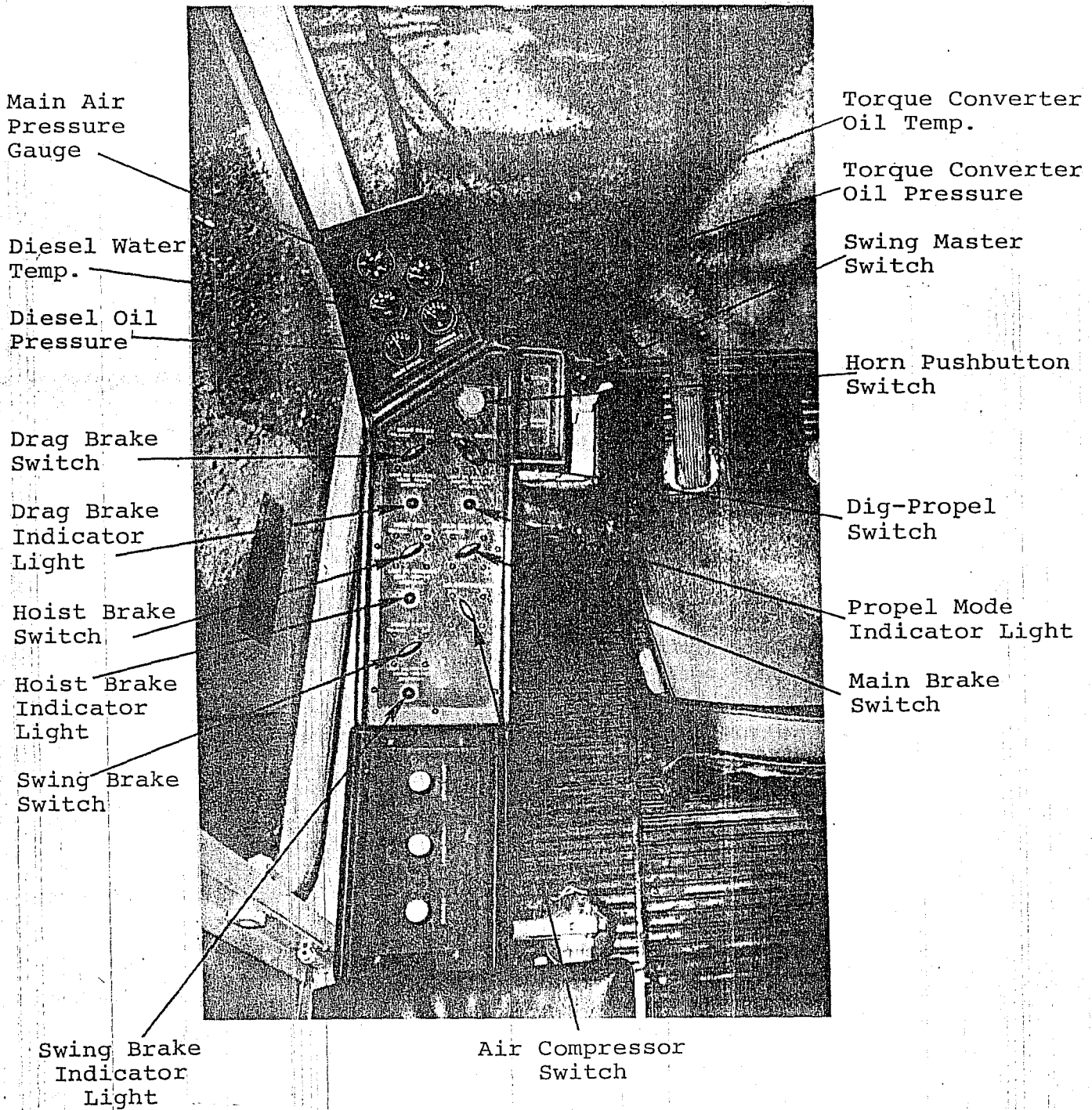


Figure 2.2-1

3. When the bucket has traveled three to four times its own length, bring the drag lever back to neutral and see how long it takes for the bucket to come to a halt and start to swing outward again. To control the outward movement or paying out of the bucket press down on the left foot lever.

#### NOTE

Because the hoist-drag lever is in the neutral position or drag motion during this procedure the bucket must be held in its hoisted position by holding the right foot pedal down or by turning the hoist brake switch to the set position.

4. Repeat this procedure several times, until you have learned to gauge the behavior of the drag ropes.

Before actual practice digging, note two important points about digging efficiency. First, the bucket should fill in a travel distance of two to two and one-half times its own length. Beyond that distance you are not getting good digging or filling action and the time would be better spent swinging to dump and coming back for another pass.

Second, the most effective digging point for the bucket is directly below the boom point. Therefore, in digging, efficiency is decreased the further you are away from that point. This means that you should always initially position the bucket beneath the boom point and dig towards the machine.

Presuming that you have, to this point, been practicing with the bucket in the air, lower it into the dirt to get some actual digging practice. Start with your bucket on the ground, with the hoist ropes taut, but not so taut that they lift the bucket off the ground at any point. The hoist rope is held taut by pressing down on the hoist brake foot pedal. Continue as follows:

1. Pull the drag lever to the rear slowly, releasing the pressure on the hoist brake foot pedal if more slack is needed to maintain a level position as the bucket moves through the dirt. If the bucket must be raised slightly while it is digging, let up on the hoist brake foot pedal and press in on the thumb lever on the hoist-drag lever. This lever will engage the hoist clutch and raise the bucket. When the bucket is at the desired height, release the thumb lever and press down on the foot pedal.

2. When the bucket has traveled twice its own length, push the lever to neutral to prepare for lifting of the load.

3. Push the lever forward momentarily to slightly raise the bucket. As the bucket is lifted it will have a tendency to swing out. Control of the payout by pressing down on the left foot pedal is required during the lifting motion to prevent premature dumping of the bucket.

## CHOP-DOWN OPERATION

The dragline is sometimes required to operate so that the bucket digs above the bench on which it is located or a "chop-down" operation. The amount of "chop-down" should be limited to soft material and should be restricted to a minimum necessary to insure a level bench or roadbed for the machine. "Chop-down" should not be used in rocky material.

## OPERATING HINTS

The following hints summarize practices which will aid in continued, efficient operation of the dragline.

- Engage the cut properly.
- Dig under the boom point.
- Make smooth safe swing cycles.
- Always use a signal man when propelling.
- Do not stall hoist or drag machinery.
- Do not return swing until the bucket is free of material.
- Make sure all structural strands and running ropes are in good condition.
- Remove material in singular horizontal layers.
- Avoid "roll-up" caused by pulling the bucket too close to the machine.
- Keep all bucket teeth sharp.
- Check all bucket rigging for broken lines and chains.
- Avoid "tight lining" so as to avoid damage to the drive systems and boom.
- Fill the bucket in a travel of two or two and one half bucket lengths.
- Do not strike the bucket against the ground during hoist and swing motions.
- Restrict chop-down operations to soft material.
- Avoid walking the machine on uneven terrain.

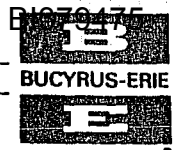


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OPERATION OF L SYSTEM

This system lubricates both walking cams and cam rollers every step. Electronic counters count the number of pump strokes to control the amount of lubricant to each point. The system uses a pumpable lubricant to lubricant performance requirements X-2640. The system requires drum heaters. Outside pipes and hoses must be heat traced and manifolds heated for temperatures below 60° F (Figure 3.2-3).

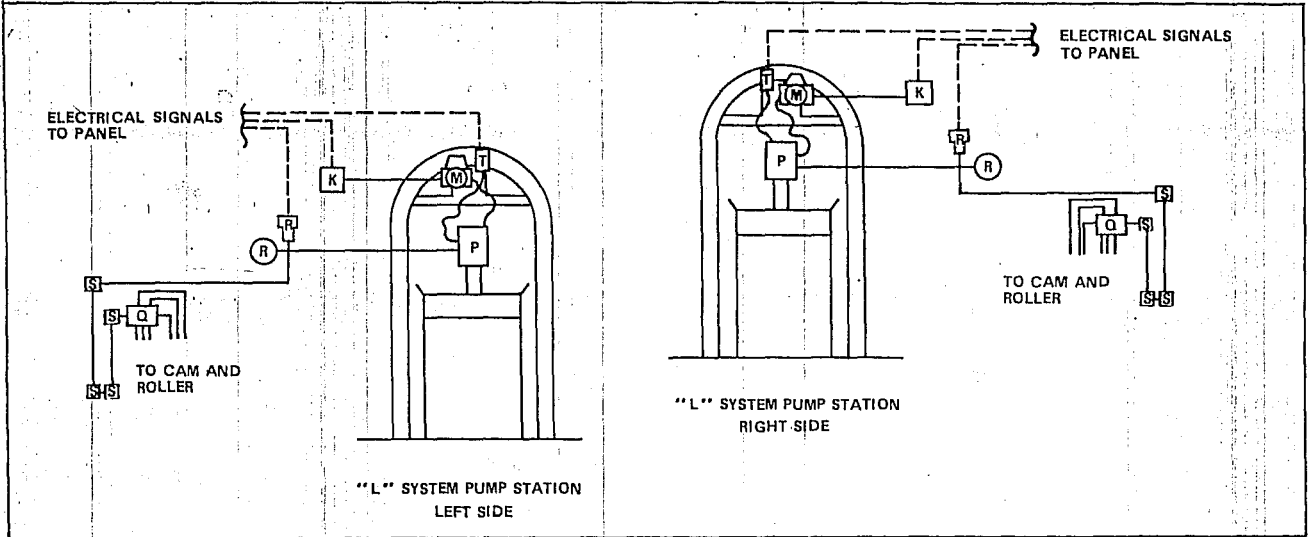


Figure 3.2-3

CONTROLS

The controls for all three systems consist of solid state modules which contain the necessary control and alarm circuitry, timers, relays and counters to operate the systems. The solid state module for all three systems are mounted in a single cabinet. A common horn will signal failure of a system to develop pressure to its extremity within a predetermined time. An L E D mounted on the cabinet door will indicate function or failure of each system. A push-button switch allows any system to be manually cycled at any time. The cabinet includes air solenoids, pressure switches and lube solenoid valves for systems D and H.

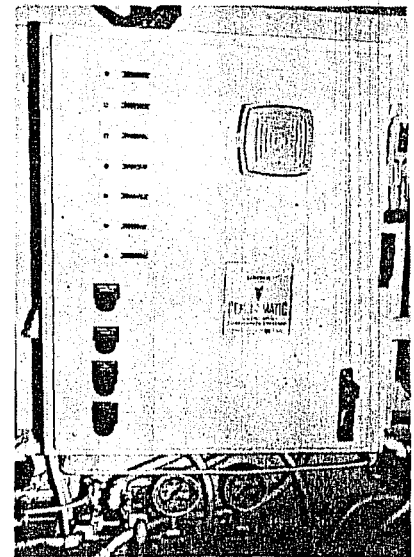


Figure 3.2-4



## INSTALLATION, OPERATING, AND MAINTENANCE INSTRUCTIONS

## NOTE

Maintenance and Troubleshooting begin with safety. Whenever you disconnect or replace any component in the compressed air system there are three important safety rules to follow: One, open the air compressor switch at the operator's console and attach a warning sign to the switch; two, open the auxiliary power circuit breaker and attach a warning sign to the breaker; and, three, drain the air receiver.

## AIR LINE LUBRICATORS

PIPING- Before installing lubricator blow out pipe line to remove any other foreign matter. Lubricator threads are DRYSEAL not normally requiring pipe compound, however, if desired, apply sparingly and to male threads only. Install lubricator with bowl vertical in pipe line so that air will flow in direction indicated on lubricator body. Install as near as possible to equipment to be lubricated. To promote trouble-free performance a filter should be installed upstream of the lubricator.

LUBRICATION - For average conditions, the use of a high quality SAE No. 10 (S.U.V. 800 SEC. @ 100<sup>o</sup>F.) is recommended. Caution is advised in the use of oils containing additives as many such agents are not compatible with plastic bowls.

## NOTE

The oil and its container must be clean, as dirt will clog the lubricator, necessitating shutdown and cleaning.

FILLING - All lubricators can be filled while under pressure and without shutting down equipment - slowly remove either fill plug and fill to within 1/4" of top of bowl using correct oil. For best results use a long spout oil can so that the tip can be inserted into top of bowl.

OPERATION - The "Dial-Set" knob is factory set so that when turned to zero (0) no oil is delivered to the venturi for atomization and equipment is not being lubricated. Turn on air to start flow and set knob to obtain the desired drops per minute as suggested, correct lubrication being a matter of experience and demand. Clockwise rotation of knob decreases oil feed rate. To check lubrication hold the thumb-nail or a mirror near the equipment exhaust, a heavy film indicates over-lubrication and the drops per minute should be reduced by turning knob to a lower setting.

## SECTION 3

## MECHANICAL MAINTENANCE

## BASE (Figure 3.3-1)

Inspect the base bolt connections every shift and if loosened bolts are noted, retighten the bolts to the torque values as shown in Table 4 of Chapter 5, Section 1. Inspect the base structure daily and if cracks are noticed contact the Bucyrus-Erie Service Department before attempting to repair by welding.

If the base must be removed from the machine to facilitate repair use the following procedure:

1. In a clear area with sufficient space to perform the required maintenance, lay planking. The planking will serve as a support for the base and it will also be used as skids when pulling the base from beneath the revolving frame.
2. Position the machine so that the base will be at one end of the planking. Also, position the bucket off to the side of the boom so that the bucket and drag rope will be out of the way during the maintenance. With the base setting firmly on the planking and the walking shoes in the high position, remove the center pintle clamp collar.
3. Remove the base front and rear hook rollers.
4. Install cribbing under the rear of the revolving frame and under the walking shoes. With jacks raise the revolving frame off the center pintle and high enough so that the pintle will clear the revolving frame during base removal. Add sufficient cribbing to maintain this height, then remove the jacks. Be sure the machine is securely blocked.
5. With bulldozers pull the base on the planking out from under the revolving frame.
6. Remove the roller circle assembly, the swing rack with rails, and separate the base sections.
7. Repair or replace the base as required and reassemble in reverse order. When reassembling, torque all bolts to the torque values as specified in Table 4 of Chapter 5, Section 1.
8. Lubricate the roller circle rollers and rails, the swing rack and the center pintle. For proper lubricants refer to Section 2 of this chapter.



1. Remove the gear case from the machine using the procedure of the preceding paragraphs. When the gear case is out of the machine, remove the shifter assembly and brake from the gear case. Be sure all safety measures are followed.
2. Set the gear case upside down and block it so that it cannot tip.
3. Block the idler gear. Then remove the idler gear shaft retainers and pull the shaft from the gear case. Lift the gear, bearing and spacer from the gear case. Remove the spacer, bearing retainers, and bearing from the gear.
4. Slide the jaw clutch from the input shaft. Unbolt and remove the brake drum retaining collar from the input shaft.
5. Slide the brake drum from the shaft and remove the key. Slide the bearing spacer from the shaft.
6. Unbolt and remove the bearing retainer. Then on the other side of the gear case remove the bearing and shaft retainers and slide the shaft from the gear case.
7. Lift the pinion and thrust washer from the gear case. Remove the right side bearing from the gear case. Remove the left side bearing and spacer from the input shaft.
8. Repair or replace all damaged or worn parts and reassemble in reverse order.

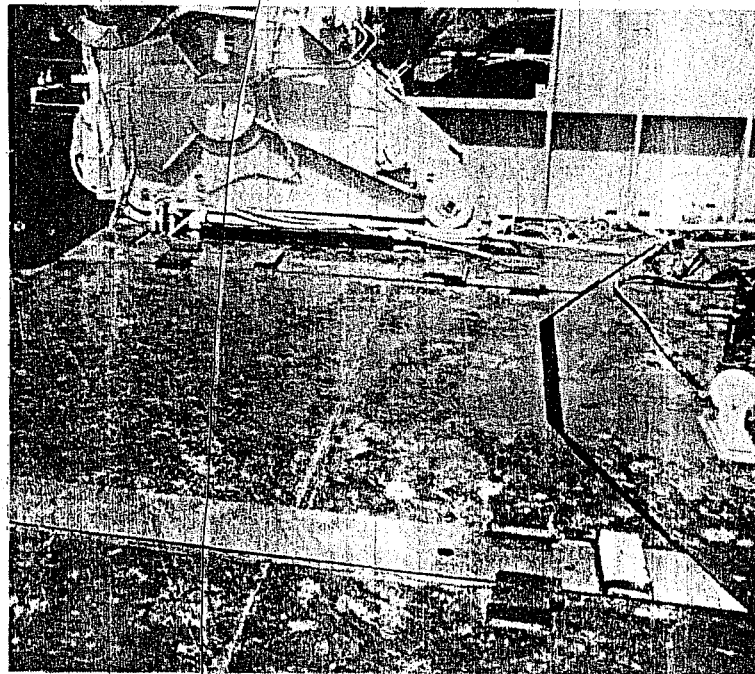


Figure 3.3-14

For servicing of the main brake use the same procedure as previously given for the swing brake.

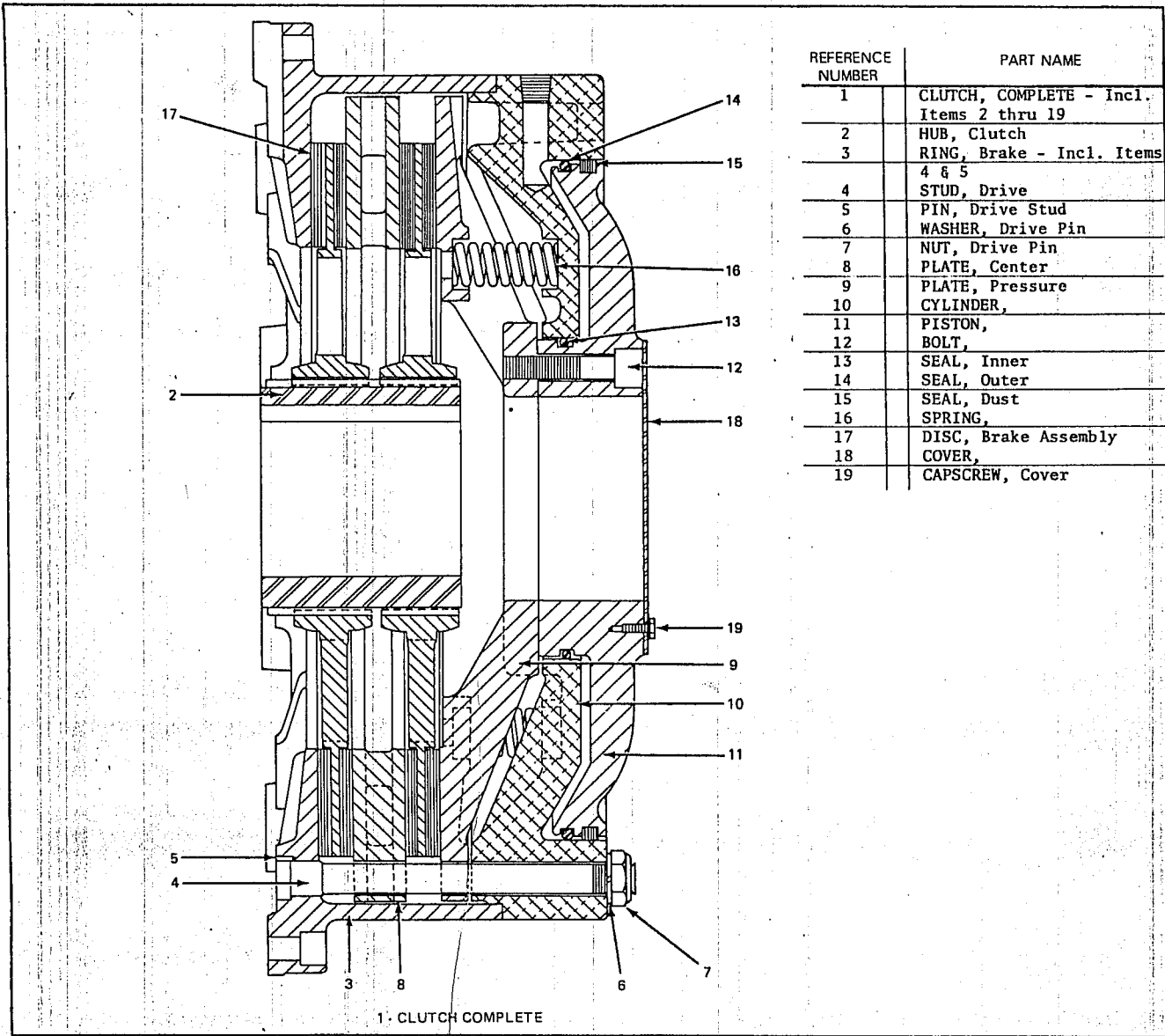


Figure 3.3-23

MAIN MACHINERY (Figure 3.3-24)

The main machinery can be removed from the machine as a complete unit for repair or disassembly, or partial units can be removed.

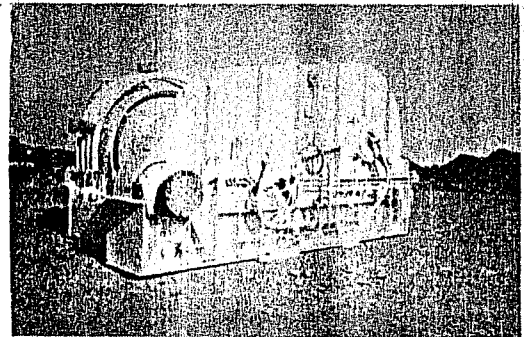


Figure 3.3-24

1. Remove old block by removing screws and locknuts.
2. Clean all foreign matter from backing plate.

## Step B

1. Place new friction block on backing plate.
  2. Use special wrench 304572 to hold locknuts in place in the hollow part of the backing plate. Insert flat head machine screw through hole in one corner of friction block and backing plate. Engage locknut with flat head machine screw and tighten securely.
  4. Repeat on remaining friction shoes until the entire set has been relined.
3. Installing friction shoes.
- a. Ready shoes for installation after springs and torque bars have been installed in the backing plate. Relined or re-used shoe assemblies should be returned (per match marks) to the same position as they were in the original assembly. If complete new friction shoe assemblies are installed, order is not important, because friction assemblies are shipped in matched sets.
  - b. Replace side plate per match mark. Be sure that the dowel portion of the torque bar is seated in the proper side plate hole.

## C. Replacing actuating tube.

Most Airflex VC elements are equipped with a continuous tube. This tube can be removed from either side of the element. The type of installation will determine how much of the element assembly must be dismantled to replace the tube. These instructions are for disassembling of the element only.

It is recommended that, during normal maintenance periods, the END RING be removed and the resilient BLOCKS be examined for evidence of cracking or splitting. Over a period of time, some of the rubber will wear from the surface of the BLOCKS and will form spongy deposits on the surfaces of the blades and END RING. The BLOCKS may also show some signs of permanent deformation, but unless there are signs of deterioration or destruction of the BLOCKS, this should not be considered cause for replacement. When replacement of the BLOCKS becomes necessary, the procedure for removal is the reverse of that described above for installation.

After removing the END RING, BLOCKS can be levered out individually or the SLEEVE can be jacked away from the RIGID HUB after flange bolts are removed, freeing all of the BLOCKS at once. Individual removal can be assisted by the application of torque to the coupling and, in either case, the application of castor oil reduces the effort required for disassembly.

Once the BLOCKS have been removed, clean inner surfaces, insert new BLOCKS and re-install END RING in accordance with installation instructions.

#### FAIRLEAD (Figure 3.3-44)

Frequently inspect the support link, the sheave brackets and all pin and cable connections to insure the proper mounting of the fairlead to the revolving frame. Also monitor the condition of the swivel frame and the upper swivel support. Thoroughly check the sheaves for structural damage.

The fairlead support pins should be manually lubricated weekly with multipurpose grease (MPG). The sheave bearings and swivel frame bushings and thrust washer are lubricated every 30 minutes by the automatic lubrication system:

6. Reel the hoist rope completely off the boom and onto the 100 ft drum. Then reeve the guide line up and over the mast head sheave. With the guide line pull the hoist rope up and over the mast head sheave and anchor it to the mast.

7. Secure a crane (100 foot boom) to the dragline boom. Then with the crane and the hoist machinery, simultaneously lift the boom and the mast until there is enough slack in the lower structural strands to unpin them at the anchor brackets at the rear of the machine house. (Figure 3.3-52)

#### WARNING

Secure the lower structural strands so that they do not swing free when they are unpinned, as they could damage the house.

8. When the lower structural strands have been released, simultaneously lower the boom and mast until the boom is resting securely on the cribbing. Then continue lowering the mast until it rests on the boom.

9. Disconnect the crane from the boom and use it to remove the strands from the mast and boom.

10. Lift the new lower boom structural strands in place with a crane or block and tackle and attach them to the mast head.

11. Use the crane to install the new upper boom structural strands between the mast head and the boom point.

12. Remove the intermediate boom structural strands from between the mast head and central section of the boom. (200 ft. boom only)

13. Use a crane or block tackle to install the new intermediate boom structural strands.

14. Use the crane to raise the mast until only a slight sag remains in the upper structural strands. Reel in the hoist rope until the mast is supported by the hoist rope then disconnect the crane.

15. Connect the crane to the boom and with the hoist machinery simultaneously lift the mast and boom until the mast is approximately 80 degrees from the horizontal. Pin the lower structural strands to the anchor brackets on the machinery house.

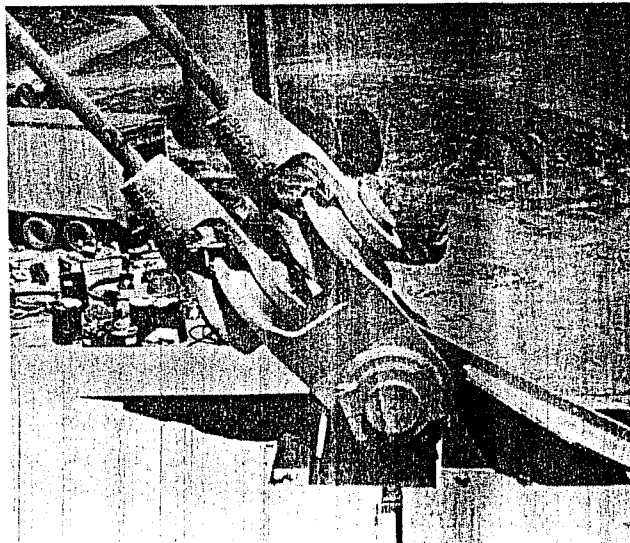


Figure 3.3-52

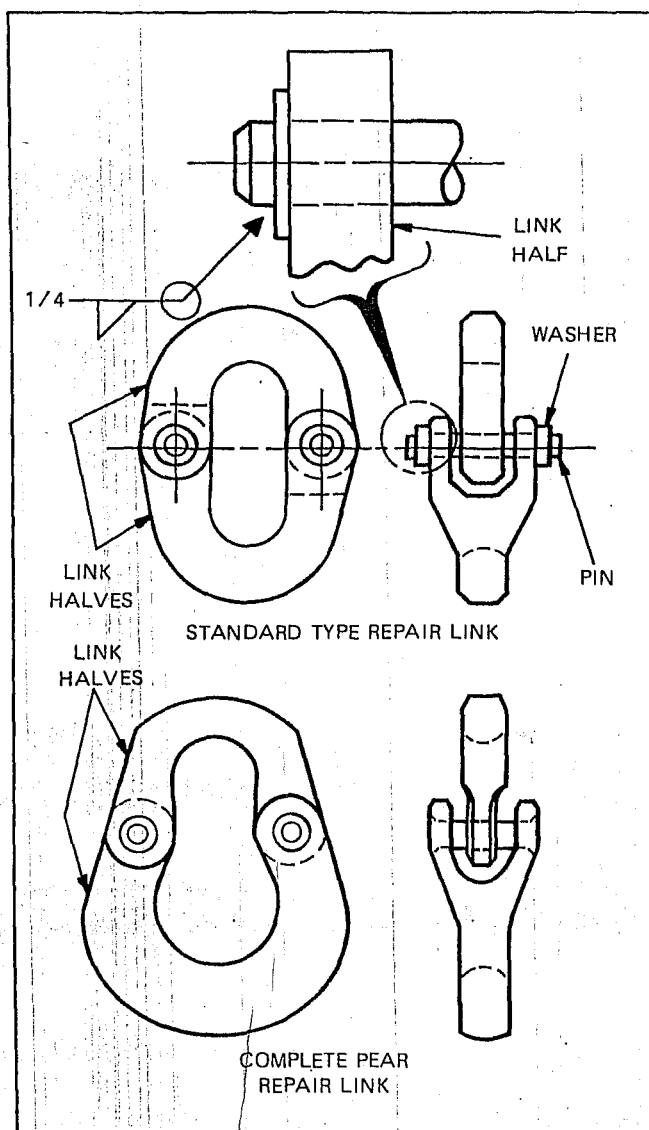


Figure 3.3-60

1. Align the link halves as shown in Figure 3.3-60 so the holes formed in the halves register with one another.
2. Insert a cylinder pin through each of the holes.
3. Place a washer flush against the outer link surface over each protruding pin end.
4. Weld the pins and washers together to secure the link halves in place.

c. Foreign matter such as carbon, metal chips, etc. on piston striking head at top of stroke (Remove head and clean).

d. Piston extending above cylinder at top of stroke and hitting head. (Remove cylinder and add base gasket, not upper cylinder gasket.)

e. End play in crankshaft - (Remove end cover, take out one end cover gasket and shim (5, Figure 3.4-6), and replace.) Do not remove too many shims or binding may result.

f. Loose valves - Hex head cap screws are not tight enough. (Tighten screws (1, Figure 3.4-4).

#### CAUTION

Screws should be tightened snugly but not too tight as hold-down cover corners could be broken. Screws should be tightened evenly keeping covers parallel with cylinder head. Screws have nylon insert in threads and are of self-locking construction. They will not loosen from vibration and can be removed and retightened several times without losing their holding ability.

OIL LEAK at base, end cover or side plate gasket - (Disassemble at point of leak, shellac or perma-gasket gasket on both sides and reassemble. Maintain correct oil level).

VIBRATION, characteristic of all reciprocating machines, can be held to a minimum by keeping the compressor securely fastened to a solid level foundation, maintaining proper belt alignment and keeping nuts and bolts tight.

OVERHEATING: Compression of air generates heat, much of which is dissipated as air passes through the intercooler and/or aftercooler. Overheating can be caused by:

a. Pump running backwards - (Reverse direction.) Proper rotation is counterclockwise facing flywheel. If pump has been run for any time at all with the wrong rotation it is possible that the intercooler fan and crankshaft extension (1 & 29, Figure 3.4-6) have backed off and fan is inoperative. The crankshaft extension has a left hand thread and can be reassembled to the crankshaft by inserting through the oil seal and end cover (4 & 28, Figure 3.4-6) and tightening by hand being careful not to damage the oil seal. As thread is left handed proper counterclockwise rotation will keep fan tight.

b. One or more head valves failing to seat properly - (Remove hold-down cover, valve cage, and valve. Clean, reseal or replace valves.)

c. Blown cylinder head gasket, especially between cylinders - (Replace after cleaning all traces of old gasket from head and cylinder.)

d. Restriction in head, radiator intercooler or check valve, if used. (Remove and clean.)

e. Lack of oil - (Check oil level and remove side plate to see that oil feeder ring (24, Figure 3.4-6) is free to turn.)

To adjust the drip rate of the lubricator turn the adjusting knob counterclockwise to increase the rate and clockwise to decrease the rate: Drip rate adjustment should only be made under a nominal steady flow condition. The lubricator can not be filled under pressure unless it is equipped with a quick-fill cap. The third lubricator (Figure 3.4-13) is located on the left rear side of the main machinery frame and is serviced in the following manner.

1. This lubricator should be disassembled in the same manner as the previous lubricator except for the omission of steps 6, 7 and 8.
2. Reassemble in reverse order of disassembly.

This lubricator is adjusted in the same way as the previously described lubricators. This lubricator has a special fill plug which allows filling the bowl while the lubricator is under pressure.

#### REGULATOR (Figure 3.4-14)

The regulators should be checked periodically to see that they are functioning properly and adjusted to their proper settings. Repair or replace all inoperative regulators. The pressure settings for the various regulator are as follows:

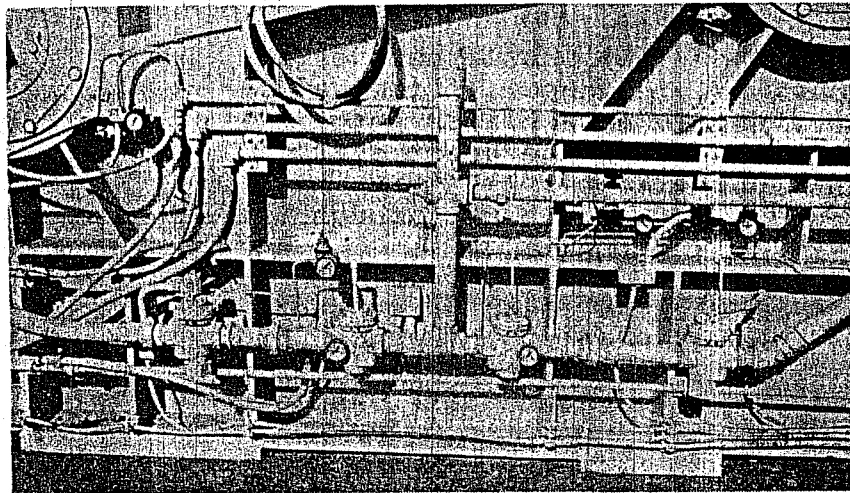


Figure 3.4-14

1. Regulators (Figure 3.4-14) which regulate the air to the hoist and drag clutches are set at 105-125 pounds-per-square inch. The pressure is read on the gauges mounted on the regulators. These regulators are adjusted by turning the adjusting screw on the pilot regulators (Figure 3.4-14).
2. The double check valve in the hoist clutch air line is controlled by regulator (Figure 3.4-14). The regulator is set at 7-10 pounds-per-square inch and the pressure is monitored on the gauge mounted between the regulator and check valve.

Carefully estimate the amount of oil which has escaped from the leak. If in doubt, drain all oil from the compressor and refill with Suniso 3-G, "Dual Inhibited" refrigeration oil or approved equivalent. Use oil from freshly-opened cans only. Refrigeration oil quickly absorbs moisture from the air. If stale oil is charged into the system it may cause contamination damage and burnout.

#### COMPRESSOR VALVE PLATE REPLACEMENT

If compressor discharge valve mechanism is faulty, replace the entire valve plate assembly, suction valve strip and valve plate gasket.

1. Pump down refrigeration system, if possible.
2. Turn off air conditioner circuit breaker or otherwise disconnect all power from compressor.
3. Front seat service valves.
4. Loosen gauge port plug in compressor discharge service valve and release head pressure from the compressor.
5. Remove cap screws from cylinder head.
6. Lift cylinder head off and replace valve plate assembly and gaskets.
7. Reassemble in reverse order and purge compressor.
8. Backseat service valves before operating compressor.

#### NOTE

The compressor in this unit is non-field-repairable except for the repair and maintenance procedures listed.

#### REPLACEMENT OF REFRIGERANT SYSTEM COMPONENTS

Expansion valves, solenoid valves, drier strainers, vibration eliminators, etc., can be readily replaced by any qualified refrigeration service technician utilizing normal refrigeration practices. Refer to the wiring diagram (Figure 3.5-2) and refrigeration schematic (Figure 2.5-3) for the location of these accessory components and their relationship to each other. Refer to the preceding section for adjustments and settings which may be required.

The direction of tightening the worm brake is shown in the <sup>B1379475</sup> instruction plate mounted at front of worm brake. The tightening procedure is by advancing the adjusting screw (B13). Secure adjusting screw with jam nut (B12).

#### ELECTRIC BRAKE FOR AUXILIARY WINCH (Figure 3.5-9)

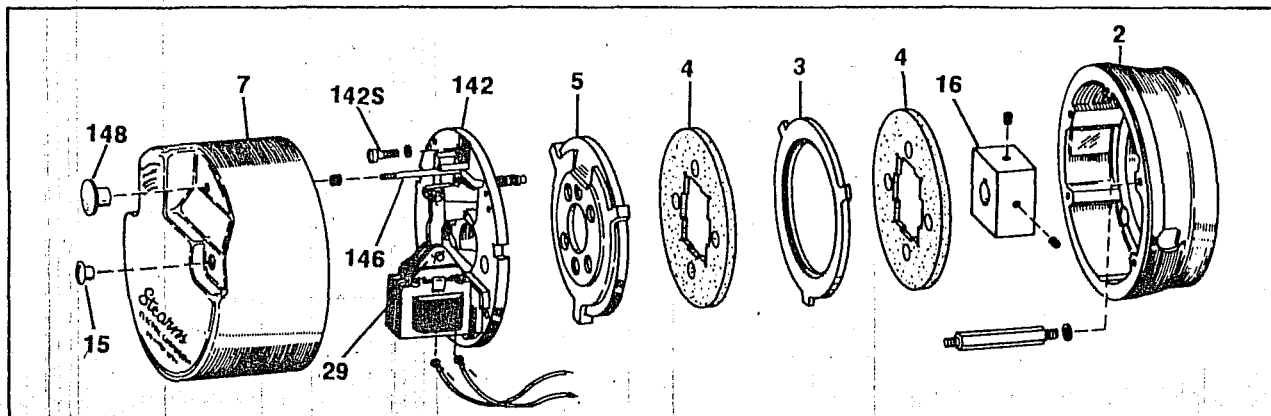


Figure 3.5-9

#### GENERAL DESCRIPTION

This is a spring set, electrically released brake, containing either one, two or three rotating friction discs driven by a hub which is mounted on the motor shaft. The brake is self-adjusted for friction disc wear. The solenoid air gap is factory set, and normally requires no resetting even when changing friction discs. A coil spring clutch permits the solenoid air gap to be automatically corrected to compensate for friction disc wear or normal expansion. Torque of self-adjusting brakes should not be varied from factory setting. Mounts directly on standard "C" face motor with 8-1/2" (AK) register and 7-1/4" (AJ) bolt circle.

#### INSTALLATION PROCEDURE

1. Remove Manual Release Knob (148), Housing Screws (15) and Housing (7).
2. Depress Solenoid Plunger (29) and pull Release Rod (146) back to lock brake mechanism in manual release position.
3. Remove entire Support Plate Assembly (142) by evenly unscrewing Screws (142S).
4. Remove Pressure Plate (5), Friction Discs (4), and Stationary Discs (3).

PROBLEM

Structural members fail.

Handrails, catwalks, platforms and stairways, inside or outside machinery house fail.

LUBRICATION SYSTEMS

Air locks in pump.

Air locks in supply lines.

Air locks in injectors.

Air locks in feed lines.

Injector or vent valve malfunctions.

Injectors will not move to discharge position.

Indicator stems on injectors do not return to normal position after venting.

Failure of pump to build pressure.

CAUSE AND ACTION

B1379475

Examine and repair all struts, columns, braces, purlins and panels. Search thoroughly for all missing fastening elements and replace where necessary.

Cracked welds or missing fasteners. Repair weld or replace nuts and bolt. Refer to Appendix 2 for repair welding information.

System is not primed properly. Open vent plug during pump operation and allow air to escape.

System is not primed properly. Loosen pipe plugs on each line; allow lubricant with entrapped air to escape.

System is not primed properly. Open lube fitting, allow lubricant and air to escape.

System is not primed properly. Loosen feed line at bearing inlet. Allow lubricant and air to escape as system cycles.

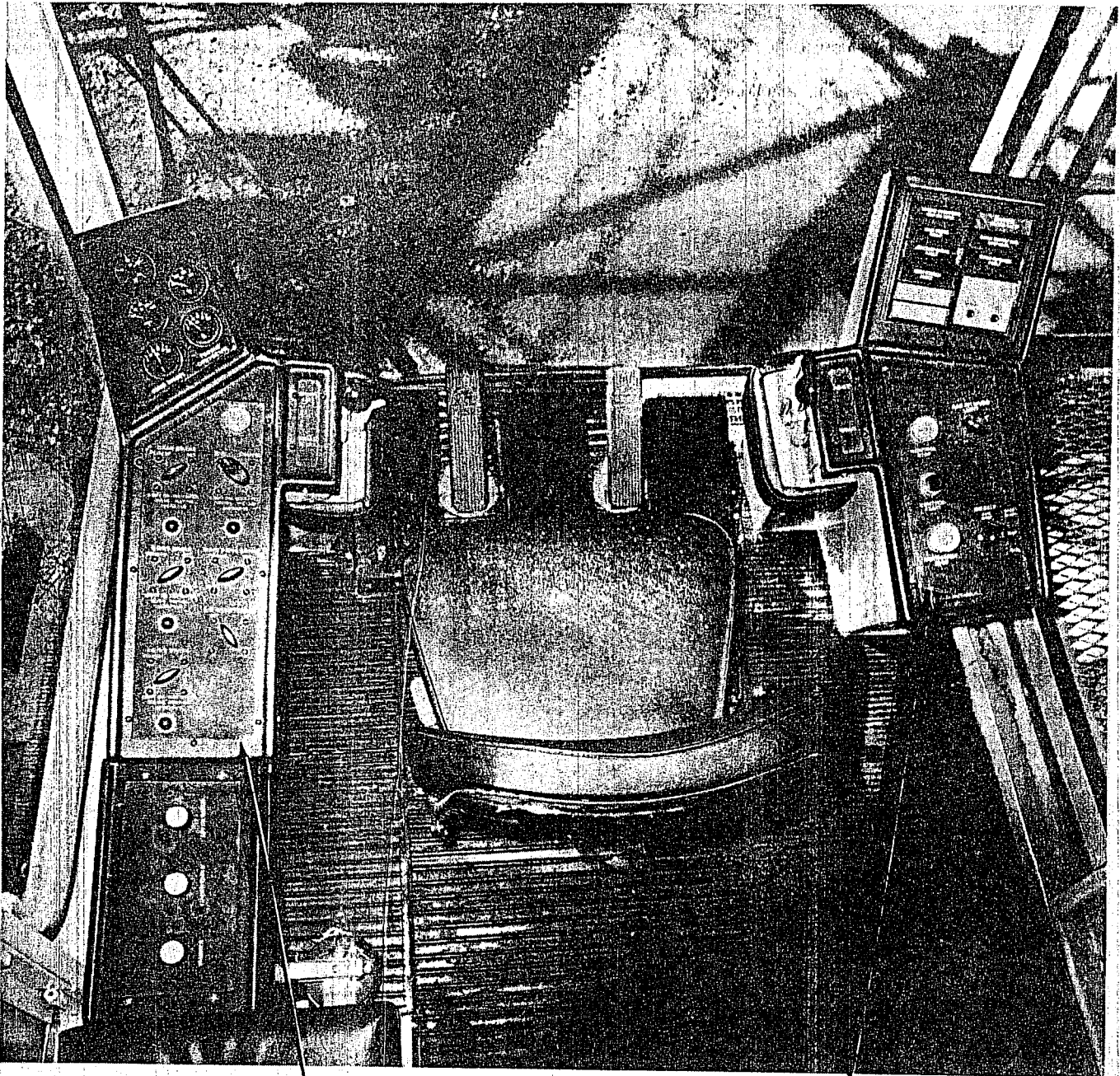
Dirty supply lines or worn injectors. Disassemble and clean or replace.

Bearings are not receiving lubricant or system not venting. Adjust pressure switch to higher developed pressure. (3500 psi maximum for high pressure systems, 1000 psi maximum for low pressure systems.)

Restriction in supply line. Check lubricant. Use low temperature additives. Use specified lubricant. See instructions.

Air locks in pump. Open vent plug during pump operation and allow air to escape. Pump outlet checks fail to hold pressure in supply line. Disassemble and clean check seat.

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OPERATOR'S CONTROL CONSOLE-LH

Figure 4.1-5

OPERATOR'S CONTROL CONSOLE-RH

Figure 4.1-4

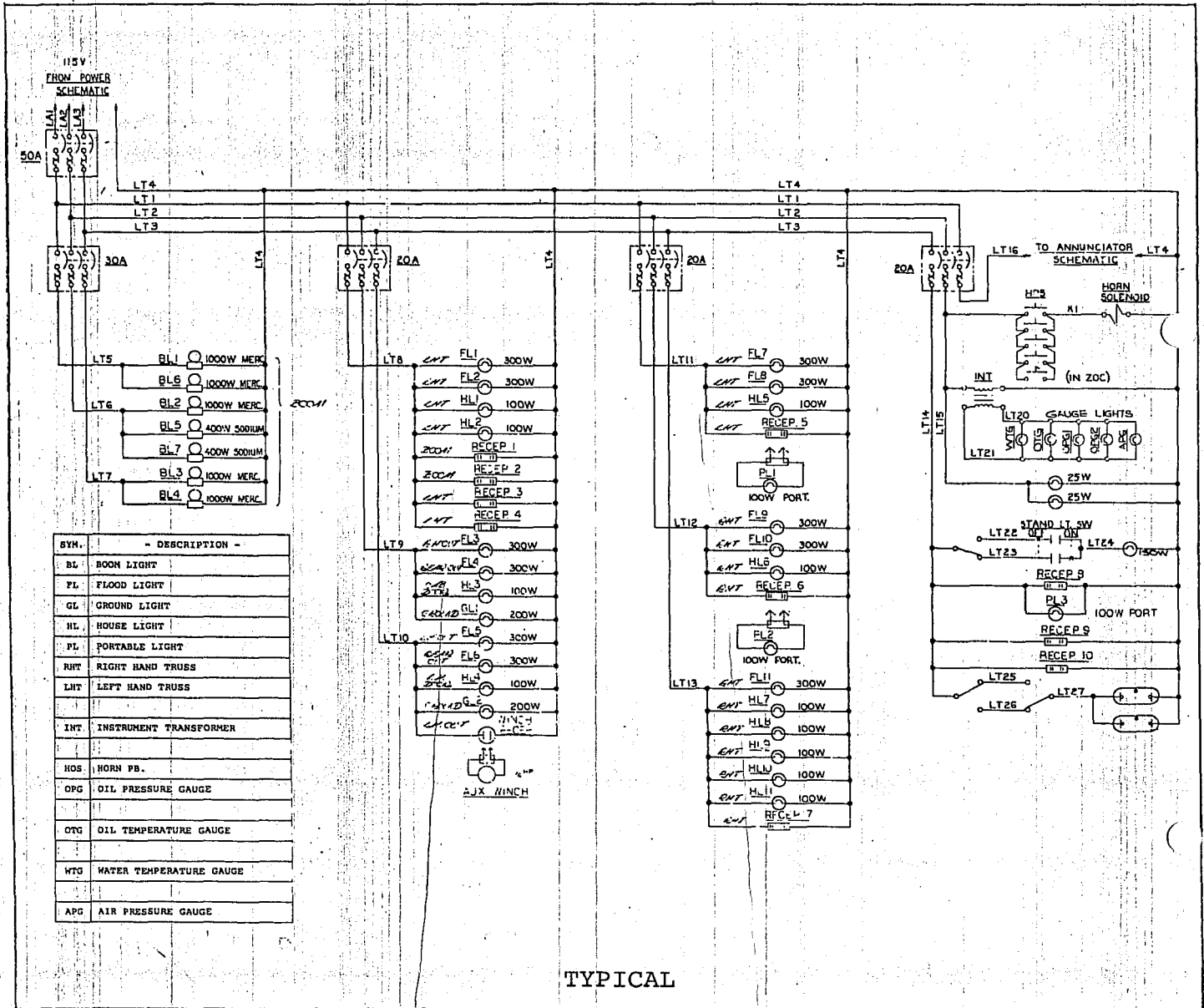


Figure 4.1-17

Schematic shown is for the standard machine.

(Always refer to the schematic furnished with the machine.)

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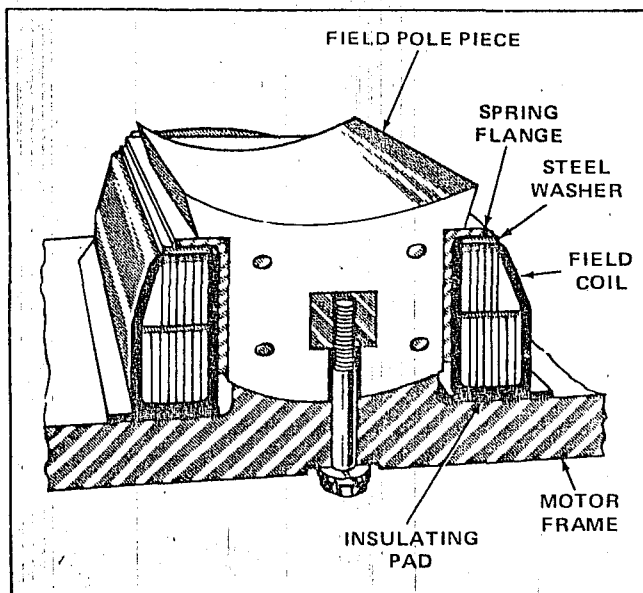


Figure 4.2-5

3. Assemble the pole piece ~~B1379475~~ coil assembly into the frame and secure it with bolts through the frame. It is recommended that new lockwashers be used on the pole piece bolts when reassembling the field coil in the frame. Draw the bolts up tight to seat the pole piece in position on the frame.

4. Tie all cables into neat sturdy bundles. Tie cable bundles to cable anchors in the frame so the bundles are suspended securely in position. Locate the bundles away from sharp corners, moving parts, brush rigging, and hand hole openings.

5. Insulate all internal bolted coil connections as described below:

- a. Apply enough insulating putty to smooth sharp corners and fill all voids, thus rounding out the joint for easier taping.
- b. Apply several lengths of tape as necessary. Start each length so that one or more full turns of tape secure the previous tape end. Joint insulation taping must completely cover the bolt, nut, washers, terminals, etc. It should extend about one-quarter to one-half inch onto the cable and/or lead insulation. A minimum coverage of at least three tape thicknesses results.
- c. Paint the tape surfaces with fast-drying insulating varnish.

#### ASSEMBLY OF BRUSH HOLDER

1. Install the brush holder on the support as high off the commutators as possible. Tighten the bolt sufficiently to hold the brush holder in place until after the frame is closed on the armature. Remove brushes from the brush holders to prevent brush breakage when the armature is installed.

2. After the frame halves have been assembled in place with the armature, release the bolt and adjust the brush holder to provide 0.094 to 0.125 inch clearance between the face of the brush holder and the commutator surface. A 0.109 inch thick nonmetallic shim may be used. Tighten the bolt securely.

3. After tightening the bolt, again check the spacing to the commutator and the alignment of the brushes with the commutator segments.

4. Attach pigtails.

The armature coil insulation should be clean and free of cracks and damage. Armature glass bands are to be rigidly tight, as with the commutator, and should show no cuts or loose strands. Core laminations are to be undamaged and securely bonded together. Armature coil insulation and treating varnish must be uniform in color with no significantly dark or black areas, which indicate damage from over-temperature. B1379475

#### ARMATURE RECONDITIONING

After cleaning, inspection and test, the armature may require reconditioning as follows:

1. Armature glass replacement.
2. Commutator glass band replacement.
3. Commutator resurfacing and undercutting.
4. Commutator string band replacement.
5. Armature treatment.

Consult the Service Shop for specific reconditioning procedures.

#### EXCITING AND COMMUTATING FIELD COILS

During motor manufacture, the exciting and commutating field coils were permanently mounted onto the pole pieces by filling the coil-to-pole void with a specially formulated insulating compound which was subsequently cured by baking at high temperature. Prior to mounting, the coils were completely insulated by a series of impregnating and encapsulating treatments with accompanying cure by baking at high temperatures. These treatments prohibit internal repairs.

During initial assembly of the coils and frame, the coil-to-coil connections were completely insulated to prevent development of creepage grounds or shorts due to contamination.

#### CAUTION

Care should be taken to prevent damage to the terminals during handling.

1. As with the armature, carefully clean and inspect the coil and pole assemblies for signs of insulation weakness or damage.
2. If minor cracks have developed in the coil coating or bonding-to-pole compound, vacuum pressure impregnate (VPI) the coil and pole assemblies with the approved 100 percent solids varnish and bake as specified.
3. Examine the coil and cable terminals for signs of poor electrical contact, such as fretting or pitting, at the contact surfaces. Carefully repair these surfaces to provide a flat, smooth contact area.

Slot bar etching will normally be the first sign of a poorly adjusted machine. (See the Commutator Check Chart, Figure 4B1279475) Do not confuse this with slot bar marking, which is normally characteristic, especially during the early stages of commutator film development. Use a pencil eraser to erase a marked bar. If the copper is smooth under the erased area, there is no etching.

Once a D.C. machine is correctly adjusted, it will not require readjustment unless something loosens or fails within the machine. The loosening of the pole bolts or electrical connection screws is the most likely cause of poor adjustment. Check the tightness of these bolts periodically. (See TIGHTENING BOLTED JOINTS in the D.C. MOTOR MAINTENANCE Section.)

If a field coil fails and must be replaced, the shims must be replaced exactly as they were removed. Never intermix nonmagnetic and magnetic shims.

If an armature is replaced in a machine, set the brush yoke back on the factory mark. If commutation is poor after the brushes have been seated and run in for a few hours, it may be necessary to shift the yoke slightly. Shift the brush yoke no more than one-eighth inch (3.2 mm) and observe the commutation only after the machine has operated for at least five minutes under normal loading so the brushes will be reseated.

If commutation is better, shift slightly each way from this point, waiting until the machine has operated under load at least five minutes each time to find optimum commutation.

If commutation was worse after the original change, shift to the other side of the factory mark by no more than one-eighth inch (3.2 mm) and repeat the process.

Shading coils and pole face teeth affect these types of neutral settings.

The following check should be made if commutation problems develop, especially after any major repair or replacement of parts.

1. Inspect all electrical connections and make certain none are loose.
2. Check the connections and make sure that the commutating field or any part of it is not reversed, and that one or more of the main field coils is not reversed.
3. Inspect the brushes and see that they move freely in the holder, and that the pigtailed do not interfere with any part of the rigging.

The following procedure should be followed in assembling a ball or roller bearing:

1. Fill the grease cavity in the cartridge one-third to one-half full of the recommended grease and slide the cartridge onto the shaft as far as it will go.
2. Heat the bearing in oil or in an oven to  $116^{\circ}\text{C}$  -  $127^{\circ}\text{C}$  ( $240^{\circ}\text{F}$  -  $260^{\circ}\text{F}$ ) and slide the bearing onto the shaft. The inner race should be mounted tightly against the shoulder adjacent to the bearing fit.
3. After the bearing has cooled, slide the cartridge over the bearing. Assemble the snap ring if one is required.
4. Smear the bearing with grease, replace the grease metering plate, fill the bearing cap one-third to one-half full of the recommended grease and assemble.
5. Run the machine for several minutes to purge the excessive grease before replacing the plugs.

#### INSULATION RESISTANCE MEASUREMENTS

Take insulation resistance measurements with a 500 or 1000 volt megger and correct the measurements to  $40^{\circ}\text{C}$  ( $104^{\circ}\text{F}$ ). Be sure to disconnect all external wires before taking these measurements.

The following affect insulation resistance measurements:

1. Magnitude of the test voltage,
2. Time the test voltage is applied,
3. Temperature,
4. Surface condition (contaminants),
5. Moisture.

When a 100-volt megger is used, taking readings of one minute and converting the data to  $40^{\circ}\text{C}$  ( $104^{\circ}\text{F}$ ), the data will evaluate the other two factors, i.e., the contaminants and the moisture present.

The insulation resistance varies inversely with the winding temperature. That is, as the temperature decreases, the insulation resistance increases in accordance with Table 5-6.

Note that for a  $40^{\circ}\text{C}$  ( $104^{\circ}\text{F}$ ) temperature decrease, insulation resistance increases by a multiple of ten. The design of a machine affects its insulation resistance. For machines without pole face connections, the insulation resistance of the armature circuit corrected to  $40^{\circ}\text{C}$  ( $104^{\circ}\text{F}$ ) should measure at least 1.5 megohms or cleaning is required. Machine with pole face bars have multiple creepage in parallel and will have lower armature circuit insulation resistance. Such resistance corrected to  $40^{\circ}\text{C}$  ( $104^{\circ}\text{F}$ ) should measure at least 0.25 megohm or cleaning is required.

This configuration provides a pulsating d-c voltage across the load, and could be used to excite a generator field. However, no provisions are available for varying the voltage across the load. B1379475

When an SCR is placed in series with the resistive load, and the point in the cycle where the SCR starts conducting (fire) is controlled, then the average load voltage can be varied. With the circuit configuration to be used, the SCR is fired once each half cycle. The results can be seen in Figure 4.2-23.

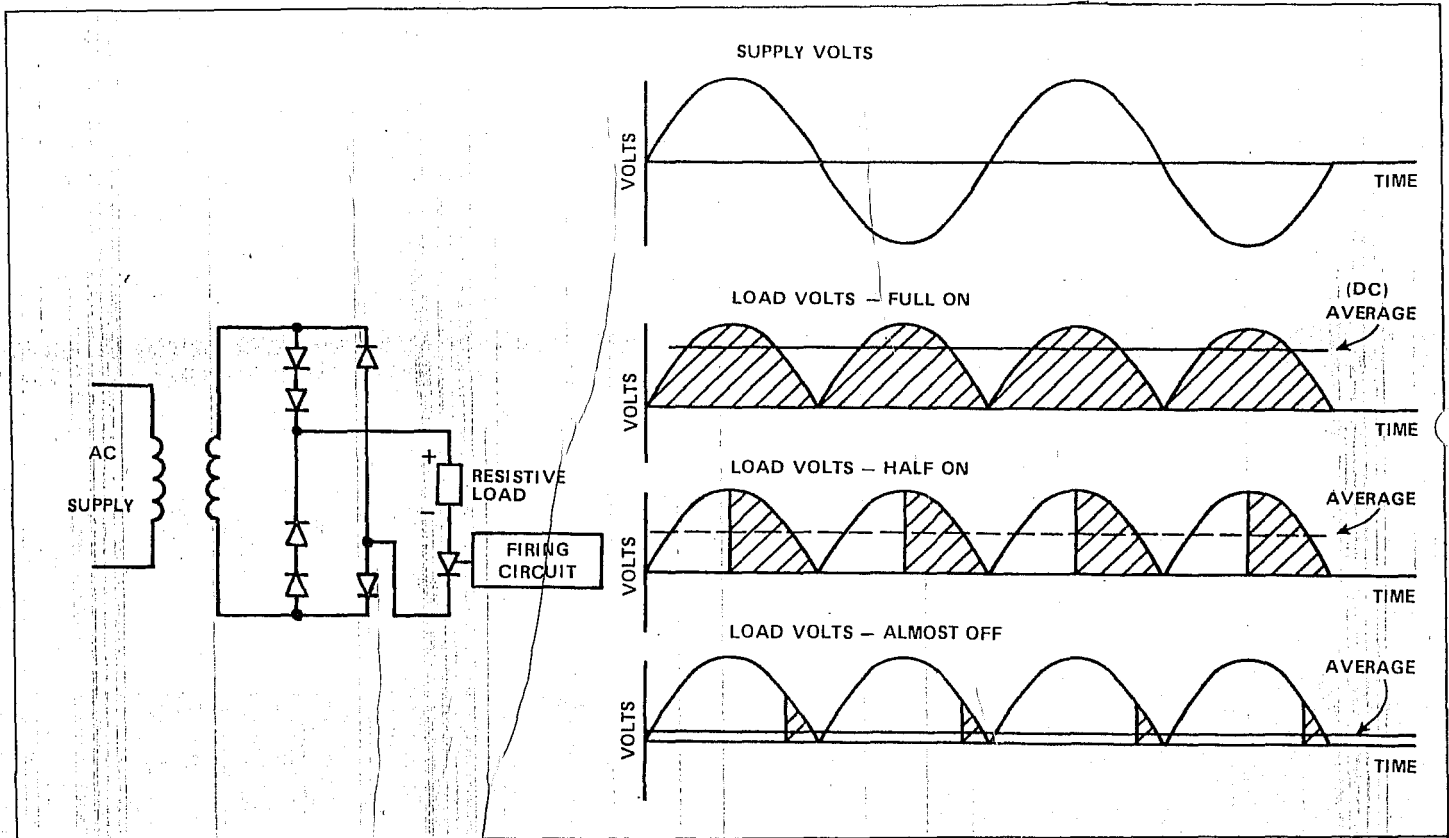


Figure 4.2-23

If the SCR is turned on at the beginning of each half cycle the voltage appearing across the load is the same as the output of a conventional full wave rectifier bridge. The average load voltage can be reduced by delaying the point at which the SCR starts conducting during each half cycle, as shown in the "half on" and "almost off" conditions. Since the SCR is operating well below its forward breakover voltage, it will effectively block forward current flow until it is fired by an external gate signal. In the "half on" case the gate signal is not applied until the mid-point ( $90^\circ$ ) of each half cycle. Since load current only flows for one-quarter of a cycle the average (d-c) load voltage is reduced to one-half its maximum value. The SCR and its associated firing circuit allow the average load voltage to be controlled continuously over a wide range.

Provisions have been incorporated into the Firing Circuit Module to allow for operation at supply frequencies of either 50 or 60 cycles per second.

A lower magnitude square wave must be applied to the gate winding of the amplistat at 50 cycles to obtain the minimum 3-5 volts across the generator field. This can be obtained by increasing the turns ratio between the primary and secondary of the transformer in the clipping circuit, since the primary voltage remains constant due to the zener diode.

This is practically accomplished by connecting terminal 14 to 24 of the Module for 60 cycle supply voltages, and 14 for 50 cycles. The connections are actually made at the customer terminal board by jumpering AC2 to 11 for 60 cycles, and AC2 to 12 for 50 cycles.

#### CONTROL FIELD POLARITIES

The control fields of amplistats 1A and 2A have been internally connected and then brought up to the Module terminal boards. Except for the bias windings, the polarity designations are as follows: If a positive control voltage is applied at an odd-numbered terminal, amplistat 1A is phased farther on, increasing the conduction angle of SCR-F. At the same time amplistat 2A is turned in the off direction, reducing the conduction angle of SCR-R. For example, if FCM-15 is positive with respect to FCM-16, then amplistat 1A and SCR-F are turned on. If the polarity of the control field voltage is reversed, amplistat 2A and SCR-R are turned on.

To keep amplistats 1A and 2A from turning full on, FCM-22 and FCM-23 must be positive with respect to FCM-25.

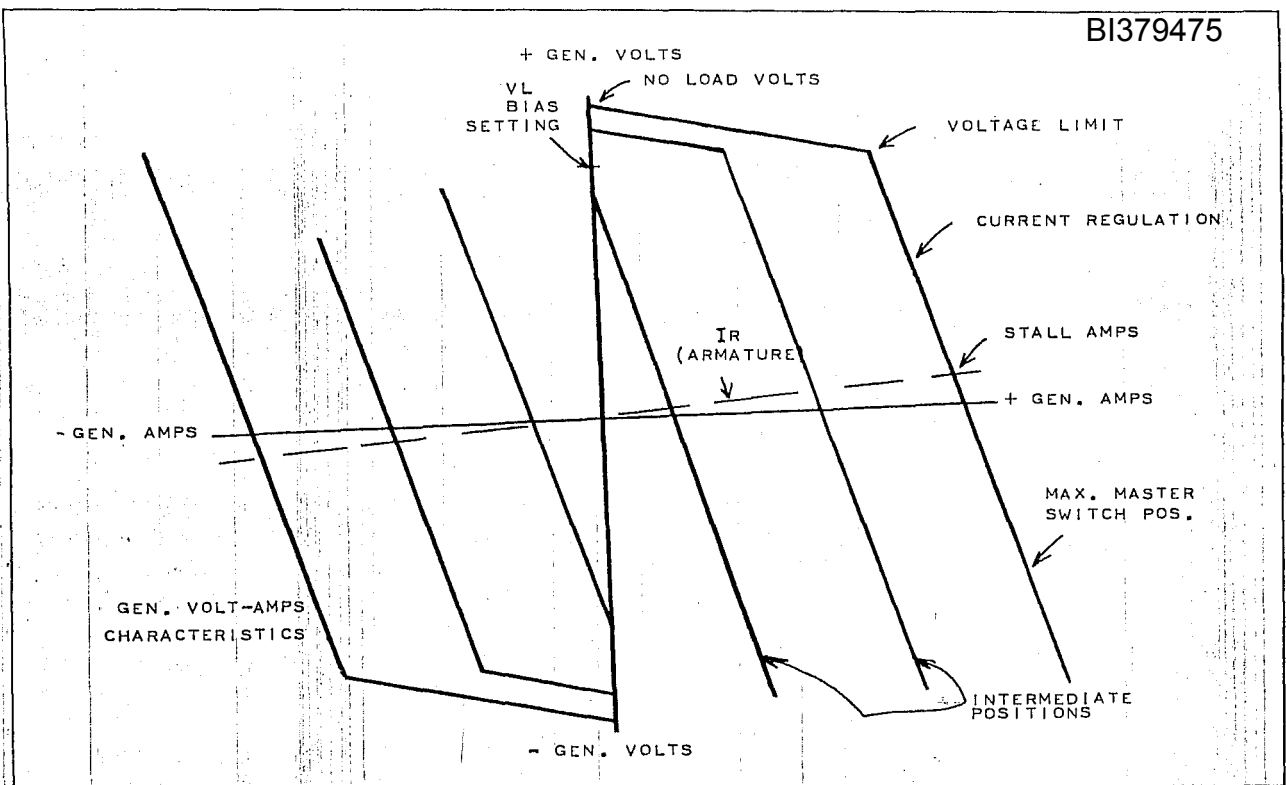


Figure 4.2-38

### BIAS

The bias windings are used to "set" the operating point of each exciter. With no current flowing in the reference and feedback windings the resistor in series with the bias windings determines the exciter output. Since the controlling amplistat turns full on with no current flowing in any of the control windings, the bias winding is connected to produce negative ampere turns. Increasing the resistance in series with bias windings causes a corresponding increase in exciter output. Once the bias resistor is set to produce the desired output voltage, normally referred to as "overlap volts", the exciter will operate about this point. That is, the exciter output will increase above "overlap volts" for a positive signal and decrease for a negative signal. The proper adjustment of "overlap" volts is important to machine operation. Insufficient overlap volts can cause a dead band around the master switch neutral position, resulting in no change in generator output when the master switch is moved slightly off the neutral position. Excessive overlap voltage increases field heating and can overtemperature the generator field coils.

Bias rheostats 8RH and 9RH are provided for adjustment of overlap voltage. These have been adjusted at the factory to produce equal volts across each generator field. This value of voltage is approximately 3-5 volts, and should be checked under field conditions.

Handwritten scribble or signature.

4. Have on hand adequate spare parts to replace failed components.

Most control difficulties stem from a loose connection, broken wire, or failed component. If a failure occurs, check overloads, breaker, fuses and power feeds. Use schematics and test instruments to isolate the source of trouble.

#### IV. Torque Converter

##### A. Theory of Operation

The twin disc modulated clutch drive employed on the 380-W is a power transmission system that combines an oil-actuated clutch and a hydraulic torque converter in one package. When using this drive with a constant speed engine or electric motor as a prime mover, output speed and torque can be varied over a wide range by controlling clutch pressure.

This particular converter is a stationary housing, single stage, three element type unit. The circuit elements consist of the stator, impeller, and turbine wheel with one set of blades from which the name "single stage" is derived.

An input gear box with a 1.763:1 set-up ratio and the modulated clutch are built integral with the converter to obtain a complete compact unit. An S.A.E. tandem pump drive is mounted integral with the modulated clutch housing for supplying oil from the sump to the converter for lubricating and operating purposes. A constant speed is available from this pump, regardless of impeller speed.

Twin disc hydraulic schematic 229053 shows the fluid flow from the sump through the filters, valves, heat exchangers and converter. The schematic indicates pressure check locations for purposes of set-up and troubleshooting.

11. After speed limits have been set, reconnect system per A.C. Control Schematic.

Then quickly but smoothly push master switch forward to full.

Hoist clutch should close and converter output speed should rise smoothly and controlled with minimal overshoot in speed limit with no noticeable instabilities. Repeat for drag motion. If instabilities occur, see section on governor fine adjustments. Step 12.

12. During tests governor fine adjustments will be made per Twin Disc Procedure #221091 2-22-77, except with starting adjustments as indicated previously. Sheet 4 of this spec is for any continuous instability that may occur. The remaining portion should be used for response and overshoot problems.
13. Adjust "HCTR" so that minimal converter output torque is present until drum clutches are fully engaged.
14. Replace response and then replace cover on "GCM".
15. Check "broken lead detection" feature on electronic speed switch "ESR" by disconnecting one of the wires H1 or H5 from the "ESR" unit. Contact ESR2 between wires CL37 and CC38 should open.

- e. Immediately check the voltage across each of the generator fields. If this voltage is 3<sup>B1379475</sup> volts or under, leave the breaker on. The voltage across each generator field should be balanced at approximately 3 volts at the factory and should only have to be checked in the field. Adjust 8RH (forward amplifier) and 9RH (reverse amplifier) for the C-143, specified field voltage. Increasing resistance increases generator field volts.

WARNING: Do not energize the regulators and leave them without immediately checking the generator field voltage because if the bias circuit is improperly wired or improperly set, the amplifiers will go to maximum output and burn out the generator fields.

- f. Open the auxiliary power breaker and remove the jumper, wires CC77 and CC78.

#### B. Motion Control Swing Test

1. Open circuit voltage adjustment.  
Swing motors must be uncoupled to run all tests.
  - a. Open all armature loops at the A1 motor terminals. Insert a millivoltmeter across the armature shunt and a voltmeter across the armature of the generator. Modify the reference circuit by moving the wire from terminal 20 to 18. Jumper terminal 2 to 3 and remove the wires on terminal 8 and 9 on the swing regulator panel. Check continuity between terminals 2 and 9 with the controller moved in the swing right direction and terminals 2 and 8 with the controller moved in the swing left direction.
  - b. Start the Main Diesel and close in the auxiliary power circuit breaker.
  - c. Close the Excitation Control Breaker (ECB). Press Start Push button "CRS" (control reset switch) to energize the amplifiers. Move the controller for about 200 armature volts in the swing left direction.



Speed Impeller	Torque Impeller	H.P. IMP.	Speed Motor	Torque Motor	H.P. Motor	H.P.Heat Clutch
0	0	0	100%	0	0	0
25%	6%	1.5%	100%	6%	6%	4.5%
50%	25%	12.5%	100%	25%	25%	12.5%
65%	42%	27%	100%	42%	42%	15%
75%	56%	42%	100%	56%	56%	14%
85%	72%	61%	100%	72%	72%	11%
100%	100%	100%	100%	100%	100%	0

$$\% \text{ Torque Impeller} = \frac{\text{RPM Impeller}^2}{\text{RPM } 100\%} \times 100\% \text{ Torque}$$

$$\text{Torque Motor} = \text{Torque Impeller}$$

$$\text{Horsepower Heat} = \text{Horsepower Motor} - \text{Horsepower Impeller}$$

V. Calibration and Adjustment Procedure For  
Electronic Governor

**Scope:** This procedure pertains to the adjustment of the Twin Disc electronic governor, 225466 - Series, which is part of X-228883 - Series control. This procedure is, in general, applicable to all Twin Disc converter/governor systems when independent of installation constraints. Installed systems must be individually adjusted per the Field Installation Test Procedure for the particular application and operated within the constraints thereof.

**Purpose:** To indicate a general sequence of adjustment which can be used successfully to achieve stable governor/converter performance.

**Procedure: A.** With electric power off and prime mover not operating, the adjustment potentiometers shown on Sheet 5 are made accessible by the following steps:

1. Remove cover assembly from X-228883 - Series by unscrewing 4 enclosure cover screws identified on Sheet 6.
2. Remove electronic governor 225466 - Series from the enclosure by unscrewing the 6 governor mounting screws.
3. To expose the governor adjustments, the access cover (on 225466 governor) may be removed by unscrewing 4 access cover screws. The adjustments under this cover appear as shown on Sheet 5.
4. More convenient adjusting may be possible by connecting an extension cable (X-225641) between the governor (225466) and the cover assembly. To use this cable, remove the cover assembly connector from the governor and attach the cable between the governor and cover connector. The governor may now be moved to a convenient location for making adjustments.

- b. Start the main diesel observing the millivolt-meter constantly for any sign of armature build up. If it should occur, shutdown the set immediately and check the connections of the series field. Repeat tests A and B closing each Ward-Leonard loop in turn.
- c. When the main diesel has been started satisfactorily, close APB and ECB breakers while carefully observing the generator current and the output of the regulators into the generator fields. Should any current build up occur, shut off the regulators immediately by tripping the excitation control breaker (ECB).
- d. Once the main diesel has been started satisfactorily and the regulator power has been turned on with no signs of current build up, using the modified reference circuit, move the controller in the swing right direction for about 50% of stall current. Momentarily close in the open wire to terminal 4 and immediately remove this wire. The current should reduce sharply, if not, go back to neutral and check the wiring. If the current does reduce sharply, reverse the controller and repeat the touch test. If again the current reduces, permanently connect in the wire to terminal 4. Cautiously, advance the controller until either the mechanical stops or the "C" sheet value of current is reached. Adjust rheostat 3RH to obtain maximum "C" sheet stall value with the controller in the maximum position.
- e. Check and record swing Ward-Leonard loop balance at stall.
- f. Reconnect swing motor fields, one at a time, and check rotation.
- g. Remove all test jumpers. Close all circuits left open.

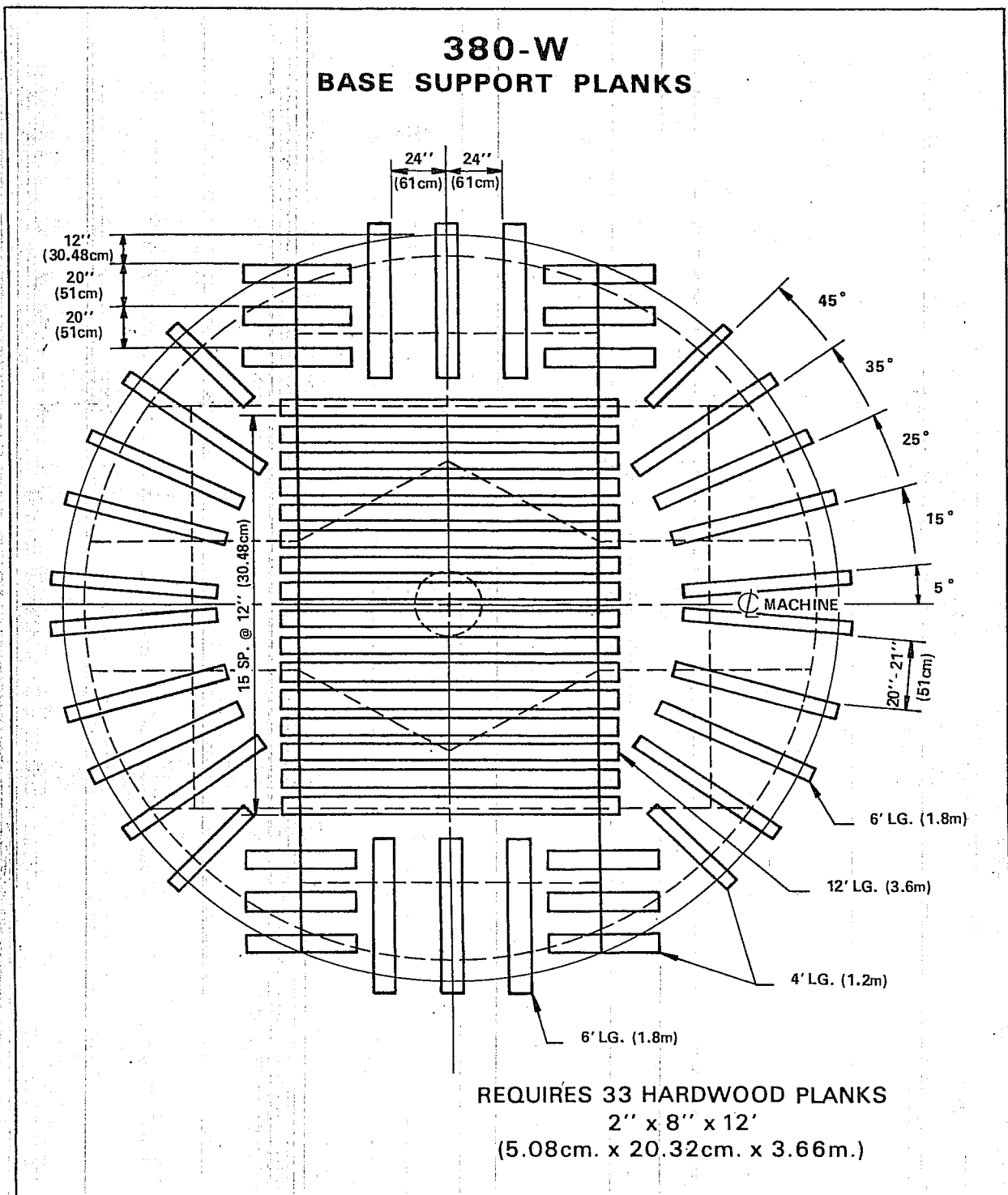


Figure 5.1-2

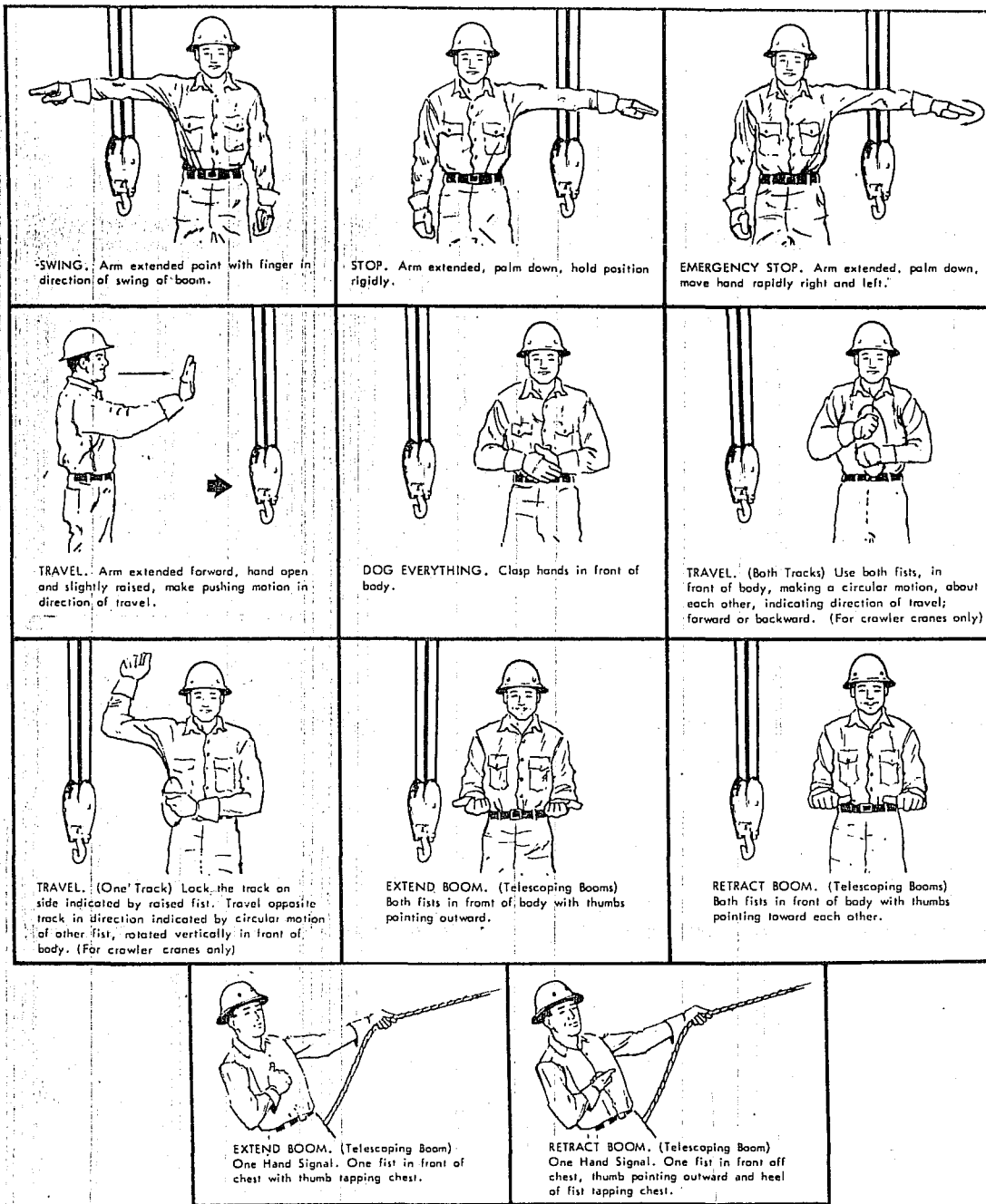


Figure 5.2-1 (cont.)

TRUSS FRONT BEAM AND BOX (Figure 5.2-18)

B1379475

Next, mount the truss front beam into the beam box. Clean the mating surfaces on the left hand truss and the truss front beam. Lift the beam and box as shown in Figure 5.2-19 and bolt into position on the truss and the mast support.

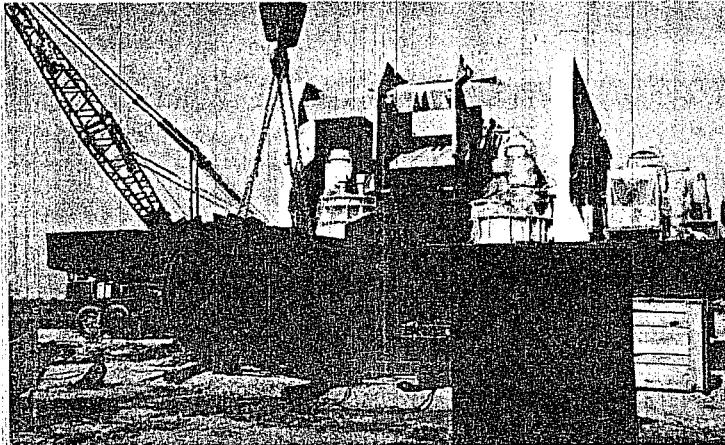


Figure 5.2-18

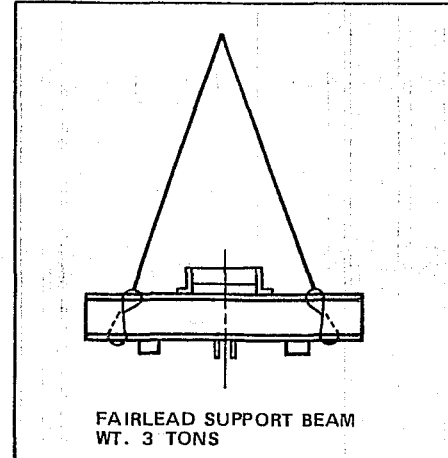


Figure 5.2-19

RIGHT HAND TRUSS (Figure 5.2-20)

Clean the bolting surfaces on the truss, then with slings and lifting lugs as shown in Figure 5.2-20, lift the truss into place on the machine. The truss must fit tight against the chocks on the modules. Insert the holddown bolts and tighten, using the turn of the nut method. The nuts must be tightened 1/2 turn past snug tight. Bolt the front beam to the truss.

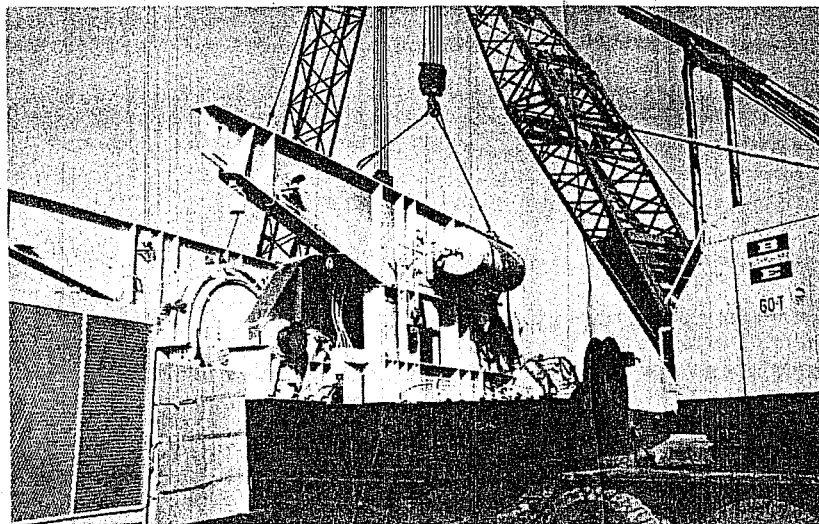


Figure 5.2-20

Lift the operator's cab with slings as shown in Figure 5.2-43, and set it on the cab support and swing module. Bolt it in place and torque all bolts. If the machine is equipped with an air conditioner, also connect the duct work at this time.

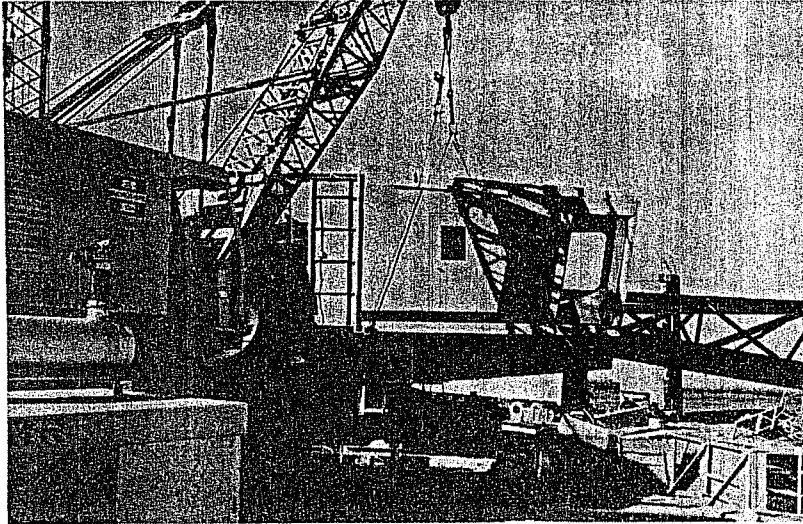


Figure 5.2-43

#### RESISTOR HOUSING (Figure 5.2-44)

Take the purlin which mounts to the resistor house and add the strips of insulation to it, and secure it to the resistor house. Then with slings as shown in Figure 5.2-44, lift the resistor house into position on the swing module. Bolt the housing and purlin into place.

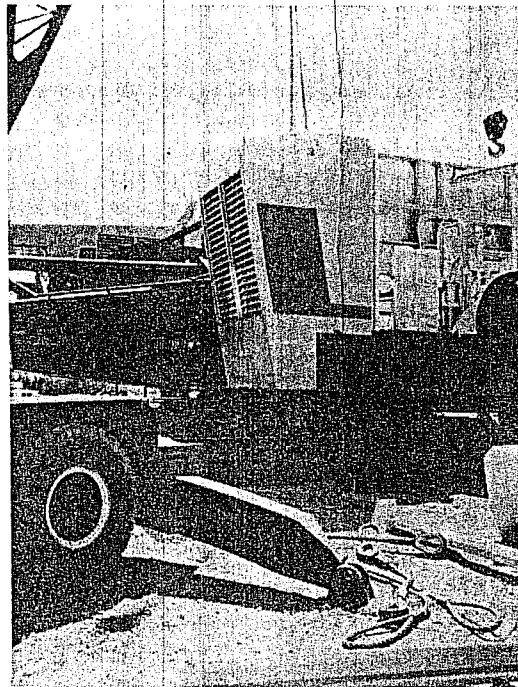


Figure 5.2-44



7. Dismantle the mast by removing the ladder and platform (Figure 6.2-3).

BI379475

- a. Leave the deflection sheave on the lower section (Figure 6.2-4) and the sheave and strand links on the mast head.
- b. Check the ladder and platform and make notes of any repairs required. Bag and tag all ladder and platform anchor bolts and if the bolts need replacing note the size and quantity required.
- c. Inspect the complete mast noting any repairs required.
- d. Separate the upper and lower half of the mast.

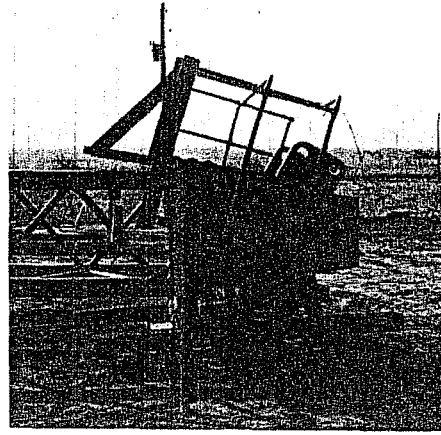


Figure 6.2-3

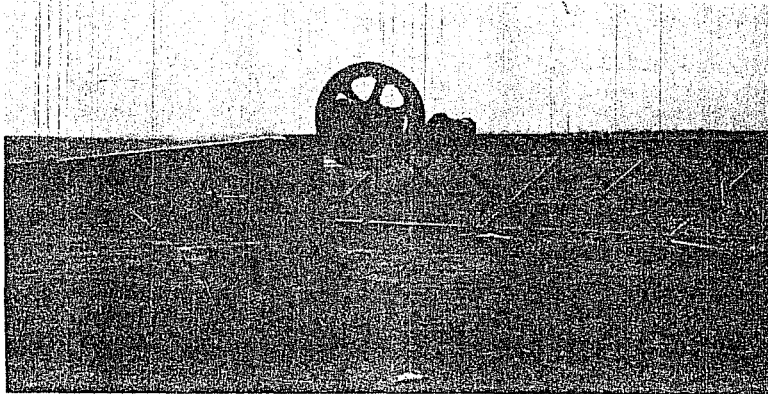


Figure 6.2-4

8. Now that no power is required on the machine, drain the fuel tanks, gear cases and radiators.

- a. The fuel should be pumped from the fuel tanks by removing the inlet cap and strainer and insetting a suction hose to draw the fuel from the tank. Any remaining fuel should be drained into drums by means of a hose connected to the drain cocks under the machine.
- b. The radiators shall be drained into drums by means of hose connected to the drain valves.
- c. The diesel engine crankcases, the torque converter tank and radiator, and the transmission can be drained from the under side of the machine into drums.
- d. The swing gear cases are equipped with drain cocks. Hoses may be connected to the piping and the oil drained into drums.

NOTE

Discard the mast splice bolts, as they must be replaced with new bolts when the machine is reassembled.

- c. Unbolt the power module from the trusses and with crane lift the two modules from the machine and place them on secure cribbing which was set up at the rear of the machine. B1379475
- d. Detach the cranes from the two modules and connect one of the cranes to counterweight module.
- e. Unbolt the counterweight module from the power module and set it to the side. The bolts that were removed may be discarded as new bolts will be required at reassembly.
- f. Inspect both modules and note any repairs which might be required.

31. Install the lifting brackets that were supplied with the machine, on the trusses. Attach the crane to the right hand truss (Figure 6.2-21) and unbolt the truss from propel and swing modules and the truss front beam.

- a. Lift the truss from the machine.
- b. The bolts for mounting the truss to the front beam should be bagged and tagged. The bolts which secured the truss to the modules may be discarded as these must be replaced with new bolts at reassembly.

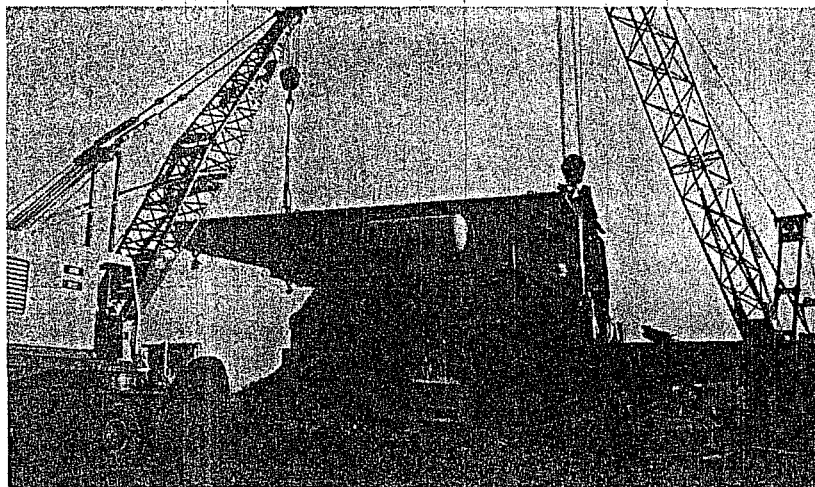


Figure 6.2-21

32. Attach the crane to the lugs on the main machinery module (Figure 6.2-22).

- a. Remove and discard the machinery module hold-down bolts. These bolts must be replaced with new bolts at reassembly.
- b. With the crane lift the module from the machine.
- c. Inspect the complete machinery and note any repairs which might be required.

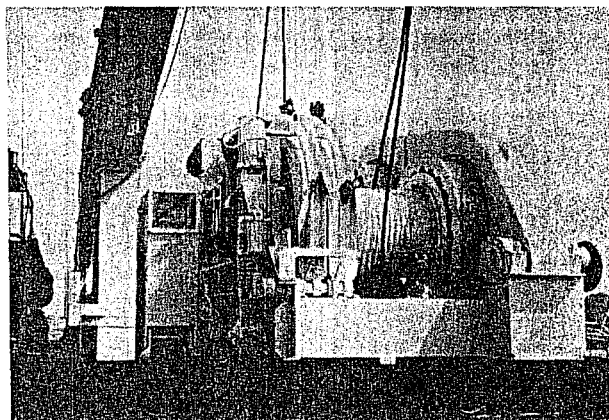


Figure 6.2-22

## MPG - MULTIPURPOSE TYPE GREASE (Continued)

NOTATIONS

1. AMBIENT TEMPERATURE - The ambient temperature shall be the temperature at the point of lubricant application.

2. LOW TEMPERATURE GREASE - For extended use in low temperature (+10° to -50° F) areas, this product should be capable of slumping in containers and should be pumpable through lube lines without the aid of heat tracing.

In order to minimize compatibility problems, it is desirable that the thickener and additive system be the same as NLGI #1 and #2 greases.

3. PUMPABILITY TESTS - Samples of the above grades of greases must be sent by the lubricant vendor to the major manufacturers of automatic lubrication systems for pumpability tests at the designated ambient temperatures. The results of these tests should be sent to the Engineering Department of Bucyrus-Erie for review.

4. SEALS AND PACKING - If a vendor should recommend a multi-purpose grease which would require a special type of material for seals and packing, he should contact the Bucyrus-Erie Engineering Department and discuss these requirements with them.

These performance requirements are benchmarks and not a specification. Therefore, meeting these limits as described above does not relieve the supplier of the responsibility associated with brand name products.

## RGL - REGULAR TYPE GEAR LUBRICANT (Continued)

## VISCOSITY AND VISCOSITY INDEX

For the maximum gear life the heaviest viscosity gear oil should be used, limited by the gear case ambient temperature and duty cycle. The gear oil used must have a viscosity index equal to or greater than the required minimum of this specification.

The AGMA grade in SUS (Saybolt Universal Seconds) is specified in this standard for gear oil viscosity. This tends to overcome the confusion (motor oil & gear oil, viscosity at what temperature, etc.) of selecting a grade of oil based on SAE numbers.

## NOTATIONS

1. Temperature

## 1.1 Ambient Temperature

The ambient temperature is defined as the air temperature in the immediate vicinity of the gear case. Refer to the following in determining the ambient temperature.

1.1.1 Use atmospheric temperature for gear cases in an extreme exposed location.

1.1.2 Use machinery house temperature for gear cases inside of the house. Some machines are equipped with house heaters.

1.1.3 Use oil temperature for gear cases having either strip heaters or immersion heaters.

1.1.4 Gear cases exposed to the direct rays of the sun will run hotter and must therefore be given special attention:

2. Requirements for Selecting Gear Lubricant

2.1 Lubrication of the gears and anti-friction bearings with the same gear case oil.

2.2 Lubrication for the gears only whenever the bearings are sealed and lubricated separately.

2.3 Duty Cycle

2.3.1 Semi-continuous operations such as: dragline hoist, drag and swing; shovel hoist, swing and crowd; drill rotary drive.

2.3.2 Intermittent operation such as propelling.

3. Guide Line for Selecting Temperature Range for any Gear Oil3.1 Minimum Ambient Temperature

3.1.1 Use oil pour point temperature when gears only are to be lubricated.

3.1.2 Use a temperature 10°F above pour point when gears and bearings are to be lubricated.



Use E8018-C1 electrodes as follows:

Position of Welding	Size	Amps D.C.+	Amps A.C.
Flat Only	3/16"	200-240	240-260
Flat, Horizontal or Vertical	1/8"	120-130	140-150
	5/32"	135-160	155-180

Use only oven dried electrodes. See section on WELDING ELECTRODES.

Hold a short arc and deposit stringer beads only. When depositing weld beads to the side walls of the groove, direct the arc to the side to obtain good fusion to the base metal. Thoroughly clean each pass to remove all slag before continuing. Grind to remove any undercut or other defects which occur during welding.

Maintain the preheat until arc gouging and welding has been completed. Arc-air gouge to half thickness. Prepare a V groove for welding. Weld this half completely. Turn bucket over. Arc-air gouge to completely remove the crack from the second side and prepare a V groove for welding as before.

**STRESS RELIEVING**

On major repairs, such as a broken lip or one which has cracked through the thickness, thermal stress relieving is recommended after welding. Stress relieving is beneficial in removing residual weld stresses, reducing hardness in the weld area, restoring ductility and aids in removal of hydrogen from the metal.

Electrical resistance heating with thermocouple temperature control is recommended. The area to be heated should include several inches on either side of the repair and should extend the full depth of the lip from leading edge to the basket. Heating elements, however, should not be placed over the plate of the basket. Thermocouples should be placed over the weld in the area of the thickest and thinnest portions of the lip.

Rate of heating and cooling must be controlled to avoid drastic temperature differences in the metal. Up to 600 degrees Fahrenheit, the lip can be heated at the maximum rate attainable with the equipment. Over 600 degrees Fahrenheit, the rate of heating should be restricted to 100 degrees Fahrenheit per hour up to a temperature at 1050 degrees Fahrenheit. The thermocouple readings should be within a range of 1025 to 1075 degrees

Fahrenheit for a period of time based on the thickness of the casting. To calculate the time in hours, multiply the average thickness of the lip in the repair area in inches by two. At the end of the holding time, the rate of cooling to 600 degrees Fahrenheit should be restricted to 100 degrees Fahrenheit per hour, after which air cooling is permissible.

**PROCEDURE FOR REPLACEMENT OF BUCKET LIP SHROUDS (Refer to Figures A2-6 and A2-7).**

Arc-air gouge to remove the shroud welds. Grind off the remainder of the weld and inspect the lip for soundness.

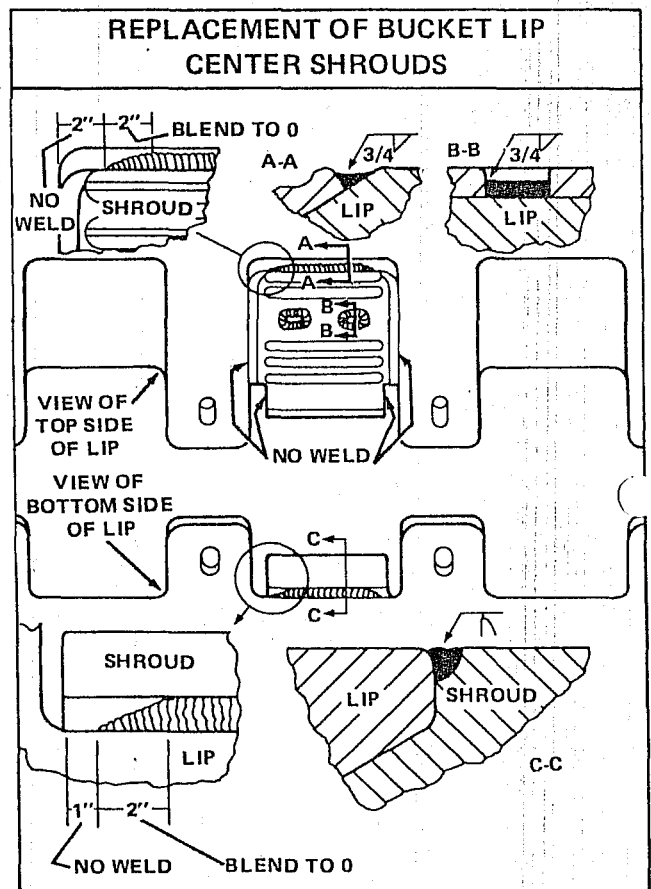


FIGURE A2-6

UNIT	✓	REMARKS
<ul style="list-style-type: none"> <li>• Clean all operator's cab windows</li> <li>• Check that windshield washers and wipers are working properly and the washer reservoir is full</li> <li>• Check controls that they work freely and all lights on consoles work</li> <li>• Check operator's cab lighting</li> <li>• Check control cabinets for cleanliness and that all breakers are closed</li> <li>• Check air compressor crankcases oil level</li> <li>• Check air compressor air filters</li> <li>• Drain moisture from air tank</li> <li>• Check that automatic drain is working</li> <li>• Check air line filters and lubricators</li> <li>• Check primary reducer oil level</li> <li>• Check torque converter oil level</li> <li>• Check torque converter lines for oil leaks</li> <li>• Check diesel engine water level</li> <li>• Check water lines, oil lines and radiators for leaking</li> <li>• Check oil level in generator drive housing</li> <li>• Check generator for foreign material</li> <li>• Check propel brake</li> <li>• Check propel clutch shifter</li> <li>• Check hoist and drag brake bands</li> <li>• Check hoist and drag clutches</li> <li>• Check hoist and drag drum ropes and rope anchors</li> <li>• Check brake cooling blowers</li> <li>• Check swing units oil level</li> <li>• Check swing motors for foreign material</li> <li>• Check all lube lines for leaking</li> <li>• Check all air lines for leaking</li> <li>• Check that lighting load center breakers are in closed position</li> <li>• Check that lube barrels are full</li> <li>• Check that lube station is functioning properly</li> <li>• Check auxiliary diesel oil level</li> <li>• Check auxiliary diesel water level</li> <li>• Check auxiliary diesel fuel</li> <li>• Check auxiliary diesel batteries</li> <li>• Check that all interior lighting is in working order</li> <li>• Check truss structure for cracking and loose bolts</li> <li>• Check diesel fuel level</li> <li>• Check auxiliary winch for oil level</li> <li>• Lubricate all manual lube points</li> <li>• Keep house and operator's cab clear of grease, oil rags, etc.</li> </ul>		

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