Technical Manual

Lower bucket/dipper to ground and shut down machine. Inspect bucket/dipper for cracks and breaks. Do not permit tooth base exposure. Teeth may be reversed. Remove bucket/dipper from service and rebuild in shop before breakdown. Check main rotating gear hold down bolts. Use impact wrench if needed. Test ALL hold down bolts on rotating frame. Especially swing gear case, motor mounting, machinery pedestal and base bolts. Check also motor generator and air compressor mount and base bolts. Tighten rod bolts on bearing housing.

Examine and readjust, if needed, hoist and drag brakes and drag clutch. Look at the condition of brake and clutch lining. Remove inspection plate from swing gear case. Look at condition of gears. Use pry bar to detect any side motion of shaft indicating worn bearings. Examine condition of rotating brakes and their adjustment. Adjust, if needed. Inspect air compressor "V" belt tension, replace if needed. Fill the anti-freezer but don't drink that stuff. Check auto-lube system for loose or broken fittings or injectors.

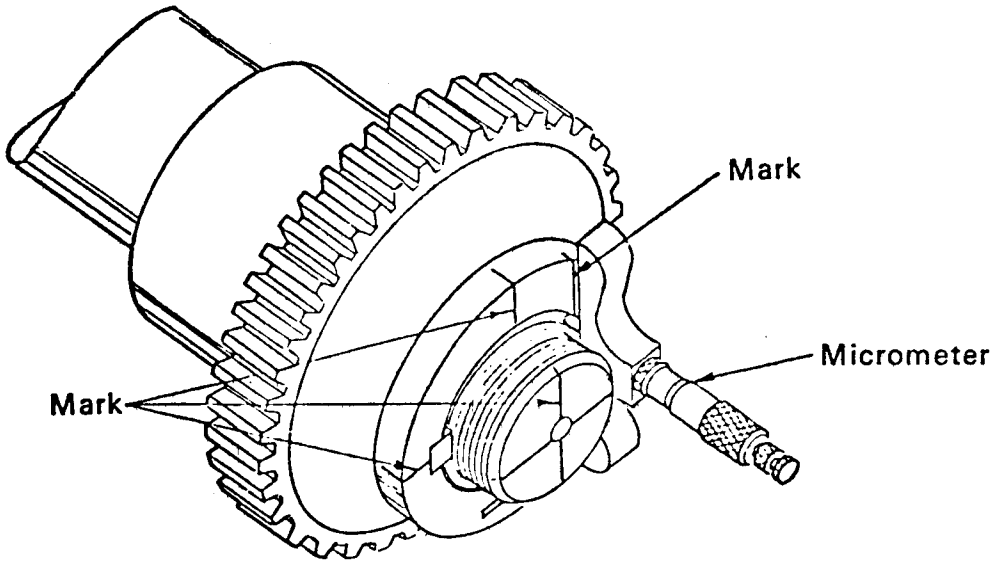
Check center journal thrust washer and bearing. Secure ALL guards and safety features in place. DISCONNECT POWER SOURCE with machine shut down so electrical crew may adequately clean and inspect motor generators and electrical cabinets. NOTE any discolored electrical parts, it's a sign of overheating. In humid areas, look for fungus and mildew. Dry compressed air at LOW pressure works well for dust removal. Clean corrosion from parts, joints and connections. Retighten, where needed, any loose connections and terminals. Use of proper tool here eliminates broken terminals and terminal blocks. Replace missing or damaged tags and labels. Bundle loose wiring. Fasten ALL components and wiring in cabinets. Check the cable armor tight in the fixture. Look closely where wires and cables pass thru openings and grommets. Insulation damage generally occurs here. Replace grommets if needed. Arcing of motors and generators causes discolored commutators. Look at brushes and brush holder condition. Correct brush spring tension where needed. Collector rings need cleaning and checking also. Use a hand grease gun at each injector. Fill ALL grease lines and purge EACH bearing with MPG. Remember to replace ALL plugs, covers and inspection plates.

This may seem like a lot of running around checking, looking, inspecting, cleaning and then greasing; but this is the machine that makes the payroll possible. Keeping it running is very important.

Passing equipment condition reports along the line is important also. Wear patterns show up at varying degrees in time. Recording and checking these reports at a future date allows comparison and planned shutdowns. Planned repairs, part orders and crews for a scheduled shutdown eliminates idle downtime.

Shaft Nom. Diam.	Shaft O.D.	Running Clear-ance	Shaft Nom. Diam.	Shaft O.D.	Running Clear-ance
9	9.000 8.997	.016 .026	13	13.000 12.997	.020 .033
9-1/4	9.250 9.247	.016 .026	13-1/4	13.250 13.247	.020 .033
9-1/2	9.500 9.497	.016 .027	13-1/2	13.500 13.497	.020 .033
9-3/4	9.750 9.747	.016 .027	13-3/4	13.750 13.747	.021 .034
10	10.000 9.997	.027 .027	14	14.000 13.997	.022 .035
10-1/4	10.250 10.247	.016 .027	14-1/4	14.250 14.247	.022 .035
10-1/2	10.500 10.497	.016 .027	14-1/2	14.500 14.497	.022 .035
10-3/4	10.750 10.747	.016 .027	14-3/4	14.750 14.747	.023 .036
11	11.000 10.997	.017 .028	15	15.000 14.997	.024 .036
11-1/4	11.250 11.247	.017 .028	15-1/4	15.250 15.247	.024 .036
11-1/2	11.500 11.497	.017 .028	15-1/2	15.500 15.497	.024 .036
11-3/4	11.750 11.747	.017 .028	15-3/4	15.750 15.747	.024 .036
12	12.000 11.997	.017 .028	16	16.000 15.997	.026 .039
12-1/4	12.250 12.247	.017 .028	16-1/4	16.250 16.246	.026 .040
12-1/2	12.500 12.497	.017 .028	16-1/2	16.500 16.496	.026 .040
12-3/4	12.750 12.747	.019 .030	16-3/4	16.750 16.746	.026 .040

SHRINK FIT MOUNTING DATA



MOUNTING PINION

Motor Shaft Diam.	Motor Frame Size 600 Series	800 Series	Pinion Advance in Inches	Estimated Temperature Difference Degrees Cent.	Degrees Fahr.
1-3/4	600	802	0.011 to 0.014	70	126
2	603	803	0.013 to 0.018	70	126
2	604	804	0.013 to 0.018	70	126
2-1/2	606	806	0.017 to 0.022	70	126
3	608	808	0.020 to 0.025	70	126
3-1/4	610	810	0.027 to 0.032	80	144
3-5/8	612	812	0.037 to 0.045	95	171
4-1/4	614	814	0.045 to 0.055	100	180
4-5/8	616	816	0.055 to 0.065	115	207
5	618	818	0.065 to 0.075	125	225

MOTOR COUPLING

Motor Frame Size		Coupling Advance in Inches	Temp. Diff.
602	802	.008 to .012	200° F
603	803	.009 to .013	200° F
604	804	.009 to .013	200° F
606	806	.011 to .015	200° F
608	808	.013 to .017	200° F
610	810	.014 to .018	200° F
612	812	.015 to .019	175° F
614	814	.017 to .021	175° F
616	816	.019 to .023	175° F
618	818	.020 to .024	175° F

GEAR INSPECTION PROCEDURES

METHOD OF CHECKING RIM FACE RUNOUT OF GEAR. If gear can be rotated without end float, place dial indicator squarely against the rim face stamped (000), at station stamped (1) and set to zero.

Revolve gear slowly. Record reading at each station. After one complete revolution, indicator should read within (plus or minus) .002". If not, recheck. Allowable rim face runout is shown in table 1. Total rim face runout is the algebraic difference between maximum plus and maximum minus readings.

EXAMPLE: Readings for a 16 foot diameter gear are listed in a chart below.

Total rim runout is .020" is obtained between station 3 with a maximum plus reading of .005" and station 9 with a maximum minus reading of .015". This is within allowable .022" shown in table 1.

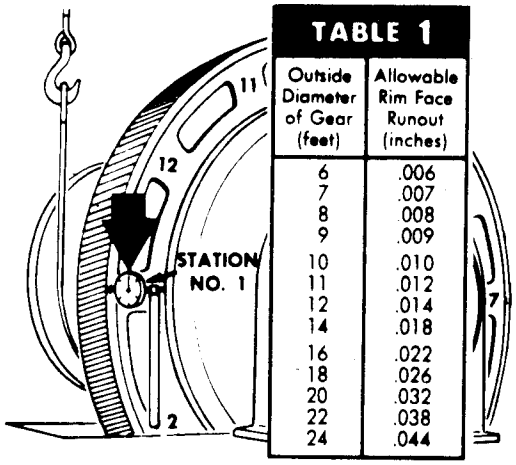


TABLE 1

Outside Diameter of Gear (feet)	Allowable Rim Face Runout (inches)
6	.006
7	.007
8	.008
9	.009
10	.010
11	.012
12	.014
14	.018
16	.022
18	.026
20	.032
22	.038
24	.044

Station No. / Indicator Reading

1	2	3	4	5	6	7
.000	+.004	+.005	+.004	.000	−.005	−.010

8	9	10	11	12	1
−.014	−.015	−.014	−.010	−.005	.000

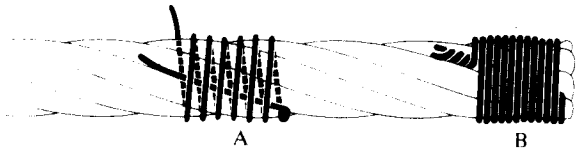
CHECKING RADIAL RUNOUT OF GEAR: Mount a dial indicator so it can be set against one of four machined surfaces. See sketch. Place indicator square with the machined surfaces at one of the stations stamped on the gear rim face. Revolve gear slowly and record readings at each station under the corresponding station number. After one complete revolution, indicator should read within (plus or minus) .002" of initial reading at starting station.

ALLOWABLE RADIAL RUNOUT is shown in table 2. The total radial runout is the algebraic difference between maximum plus and maximum minus readings. If radial runout ex-

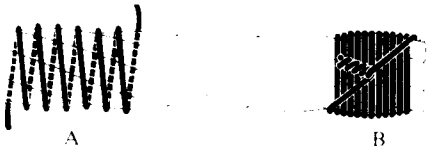
Another method requires hand pouring of lube onto rope after brush or air jet cleaning. In either method, the rope must remain coated at all times.

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

Proper Methods of Seizing



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



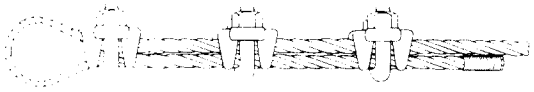
Sketch of Method No. 2 for applying seizings. At A the turns are spread apart to show method of applying them. Completed seizing is shown at B.

Properly seizing a wire rope end prevents the strands from slipping. Any strand movement causes uneven load distribution in the strands and reduces rope life.

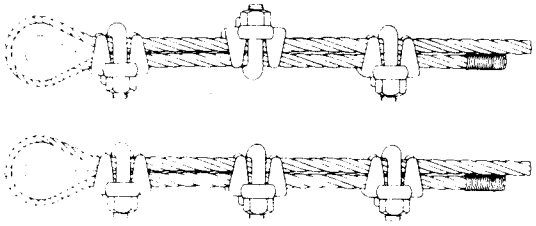
Seize rope BEFORE cutting. Tighten wrap, (a soft, annealed wire), about strand size wire; around rope. Pull wrap tight. Twist wire end secure. Use 1/4 inch wrap length on all rope up to 1/4 inch. On all other rope, measure wrap length at least one rope diameter in length. Place the first wrap about 1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

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

APPLYING WIRE ROPE CLIPS



The Right Way to Clip Wire Rope

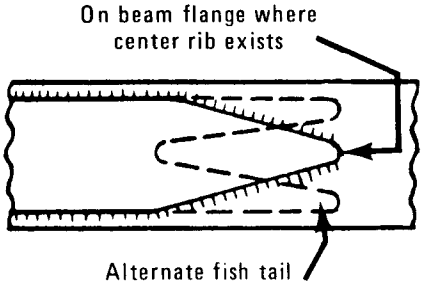


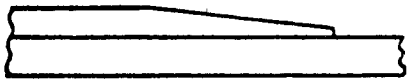
The Wrong Way to Clip Wire Rope

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

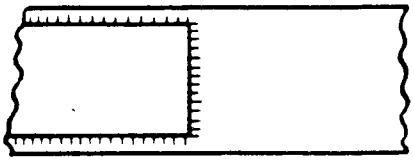
Only one correct method of attaching U-bolt clips on wire rope exists. The clip base must bear on the live end of rope. The U of the bolt bears on the rope dead end (see sketch). Otherwise, the U-bolt kinks or cuts the anchor live end and causes failure.

Wire rope adjacent to the dragline bucket is subject to the greatest abrasive wear. This is true of the shovel dipper ropes too. When this rope section shows excessive wear, remove the rope socket, seize the worn area and cut off.





Reinforcing Plate Taper End
recommended



Reinforcing Plate Square End,
not recommended

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

POSTHEAT TREATMENT: When employing this or in cold weather, SLOWLY COOL the welding area at a rate of 50 degrees F. (10 degrees C.) per hour to the normal temperature of 150 degrees F. (65.5 degrees C.). This is important. This usually means additional general heating AFTER completing the weld. Smooth up ALL rough edges and welds. Clean and repaint the repair areas.

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

MATERIAL IDENTIFICATION

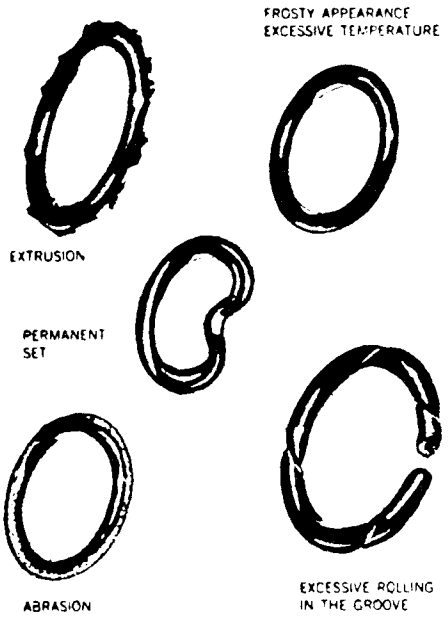
MARION MATERIAL SYMBOLS and

MAJOR COMPONENT PARTS

The following information contains the various materials used in major parts. Refer to the identification plate or material symbol on casting for specifics. Pre 1959 machines have no material identification on identification plate.

NOTE 1: Use E-6010 or E-6012 for nonstructural parts ONLY. For example; sheet metal, guard rails, catwalks, house coverings and stiffners.

O-rings in service udnergo slight swelling and softening which may be non-visible, when worn. Increased damage can occur on re-installation, so use ONLY NEW RINGS. Inspection of old, damaged rings can identify failure from extrusion, wear, torsion set, excessive permanent set or rolling in the groove.



Excessive extrusion may indicate the use of the wrong ring or backup rings were not installed. Irregular wear may indicate a rough spot or eccentricity in the cylinder. The ring may also fail from defect that careful pre-installation inspection may have seen. Some O-rings, lacking proper resilience, might have been subjected to overtemperatures. Since rings are not designed for high temperatures, they should be replaced, regardless of appearance, once known rings have been subjected to unusual heat. Overheated rings are hardened, crack with flexing, take a set and lack resilience. Once old ring has been inspected, cut it in two pieces and THROW AWAY.

Before installing, check surfaces and rings. Metal surfaces must be free of dust, dirt and gunk. Stoddard solvent (kerosene base with rust inhibitor) cleans parts and leaves a good surface for lube to adhere to. However, these cleaning fluids can cause some rings to swell. So check that cleaning fluid does not harm the O-ring if left on surface.

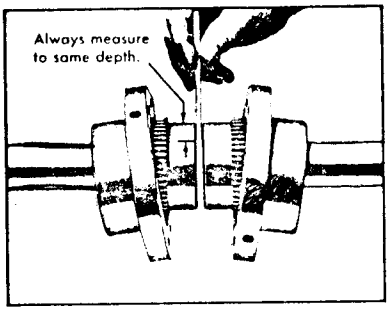
Once the proper O-ring is selected and part number is rechecked; examine the ring closely for defects, dirt or lint.

Throw out faulty rings after cutting so they do not get mixed with good ones. Discard new rings that are too tight once installed, do not return these to storage.

Once installed; an O-ring seats snugly, but freely in its groove.

PREPARATION requires checking the surface for scratches from fingernails, tools or fitting threads. DO NOT pinch ring between boss and fitting. Watch for sharp edges on groove shoulder or fitting. Thread burrs may be removed by running a nut onto the thread.

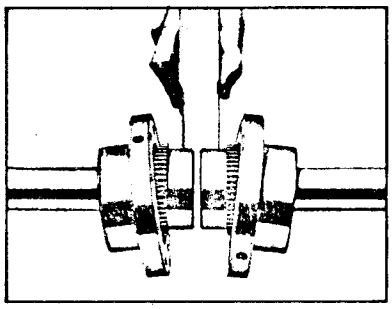
Before installing, lube ring and surface sparingly with a light coat of grease. Lubing helps eliminate a distorting stretch (causing a leak) and aids ring in seating naturally in groove without wrinkles or twists. Remember, the lube must be compatible with O-ring material and system fluid.



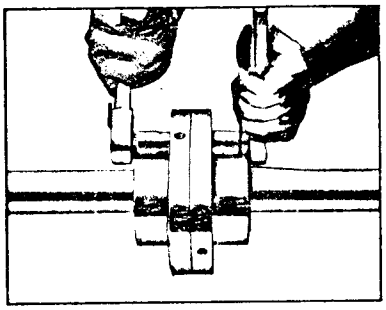
3 **GAP AND ANGULAR ALIGNMENT**

3. GAP AND ANGULAR ALIGNMENT—Use a spacer bar equal in thickness to gap specified in Table. Insert bar, as shown, to same depth at 90 degree intervals and measure clearance between bar and hub face with feelers. The difference in minimum and maximum measurements should NOT exceed the ANGULAR limit specified in Table.

4. OFFSET ALIGNMENT—Align so that a straight edge rest squarely on both hubs as shown and also at 90 degree intervals. Check with feelers. Clearance should NOT exceed OFFSET limit specified in Table. Tighten ALL foundation bolts and repeat steps 3 and 4. Realign coupling if necessary. Grease hub teeth.



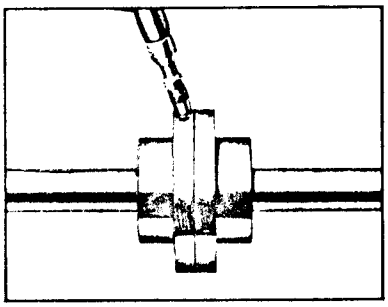
4 **OFFSET ALIGNMENT**



5 **INSERT GASKET AND JOIN FLANGED SLEEVES**

5. INSERT GASKET AND JOIN FLANGED SLEEVES—Insert gasket, DO NOT DAMAGE GASKET, between flanges. Position flanged covers with lube holes at 90 degrees and draw flanged cover into position. Use bolts, nuts and lockwashers furnished with coupling. IMPORTANT: Tighten flange bolts and nuts to torque specified in Table.

6. LUBRICATION—Fill with grease until excess appears at an open hole; then insert plub. Continue procedure until all plugs have been inserted. IN ADDITION, vent TOP flanged sleeve by inserting a 0.010 inch thick SMOOTH feeler gauge between seal and hub. Fill until excess appears at feeler. Repeat at 90 degree intervals. CAUTION: INSERT ALL plugs after lubricating.



6 **LUBRICATE**

SECTION 2

LUBRICATION

INDEX

SPECIAL PRODUCTS:

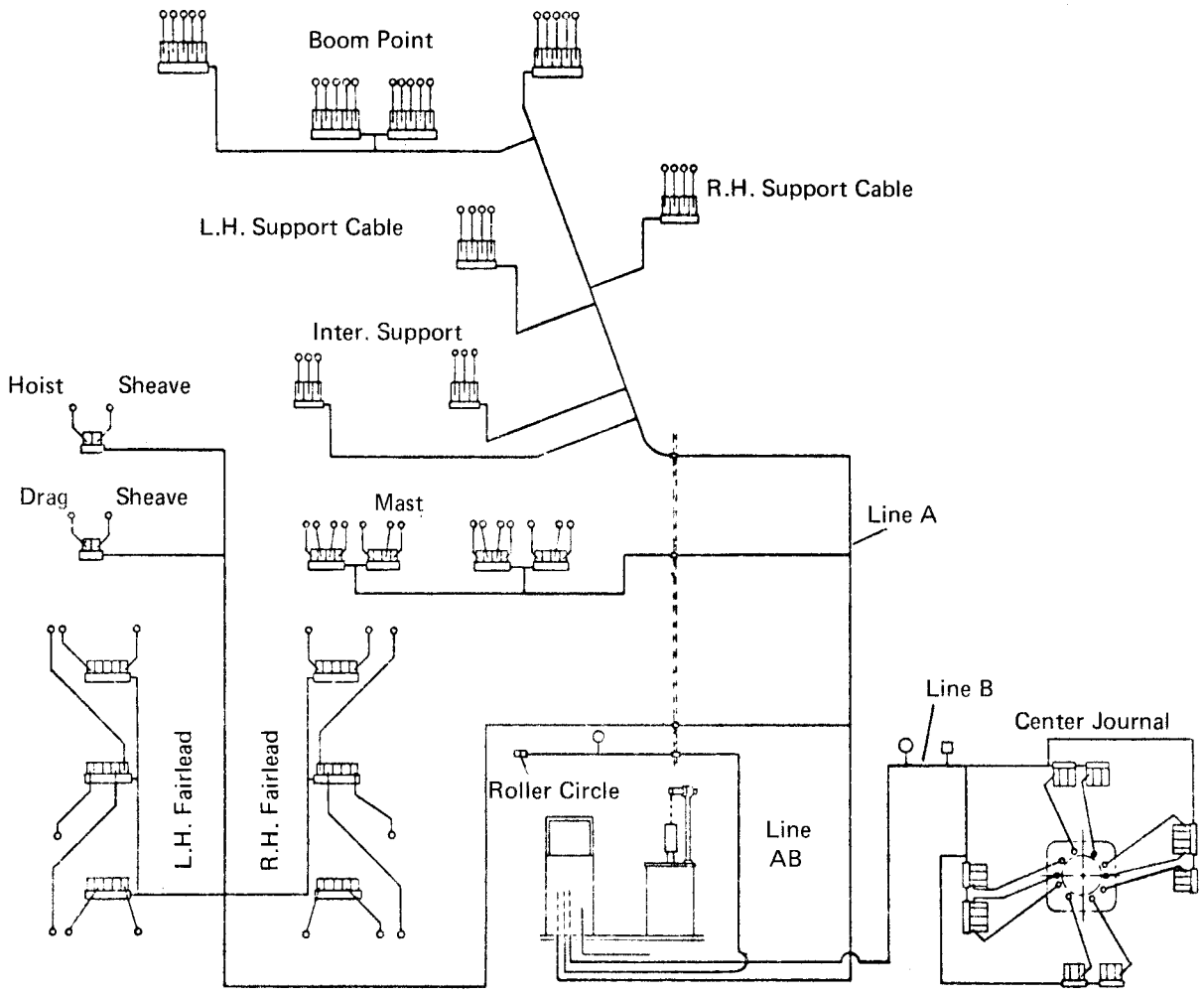
WRL – Wire Rope Lubricant. May be of either solvent cut-back asphaltic water resistant type or penetrating oil type containing corrosion and rust preventatives, anti-wear and other suitable polar additives. The former are preferred for wire rope operating in extremely wet environments while the latter are preferred for normal shovel and dragline operations where contamination of the wire rope with highly abrasive dust particles is the primary problem.

***WCL** – Walking Cam Lubricant. A special product designed to lubricate bronze bushings. These bushings, up to 120" in diameter, are subjected to loads in excess of 2,000 psi in projected areas.

APPROVED PRODUCTS:

*Jesco "Walking Cam Lubricant"
Mobil Oil "Mobiltac E"
Bel-Ray "ALO–Open Gear Lubricant"
Whitmore "Liquid Gear Composition"

The **AUTO LUBE FOR ROTATING FRAME** supplies the mast, gantry, the boom, the center journal, and provides grease gun with hose line to reach roller circle every 8 hours. The electric push button start is located about center on front of rotating frame. This system cycles once every 15 minutes in dig and 2-1/2 minutes in propel. Line A operates ONLY when digging. Line B operates ONLY during propel. Line AB operates for BOTH dig and propel. The alarm timer setting is 100 seconds. Air pressure is regulated at 80 psi and pressure switch is set at 2500 psi.



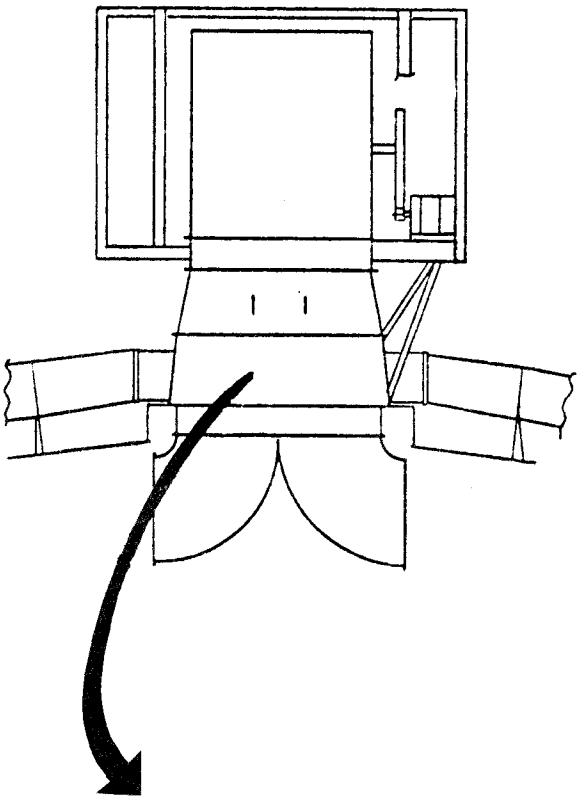
AIR FILTER SYSTEM

The entrance of dust and dirt into electrical equipment and other machinery causes extra wear to components. This is why ALL air entering the machinery house passes thru the filter house on top. Blowers create a slight pressure above the outside air. Leaving an access door open reduces this pressure. Dust and dirt generally enter. In operation, this slight pressurizing reverses any possible IN FLOW thru cable openings and personnel opening and CLOSING doors. This means ALL air drawn into the house is FILTERED. Thus protecting D.C. motors and generators, while providing longer life to commutators, carbon brushes and other machinery. Filtered air circulation reduces dust accumulation and results in lower operational temperatures of ALL equipment, including personnel.

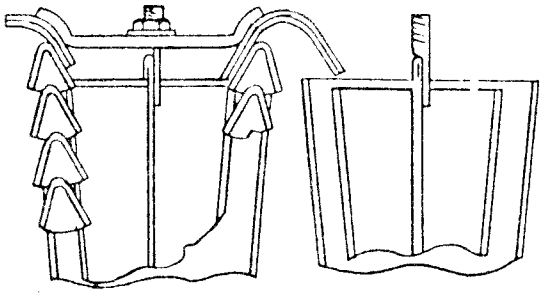
Dirty air passes into the inlets located at the wide end of wedge shaped cells. Most air (about 90%) changes direction quickly and passes thru the narrow side passages. The dirt particles due to their greater mass, tend to continue strait into the bleed air duct. The dirt ladden bleed air (about 10%) continuously cleans the bleed air duct. Thus dirt particles and bleed air return outside. These self-cleaning filters require no regular maintenance.

A few suggestions may be helpful. For instance, keep air passages free of paper, leaves, wiping cloths, etc. This allows constant air flow. An inspection helps here. Check also for build-up of deposits on filter blades. A light coat of dust is normal. Heavier build-up may require cleaning. Oil mist and similar vapors generally cause this problem. Remove the filters and scrub in soapy water. Please do not use solvents. The filter vanes do not need oil. Believe it or not, it's been done.

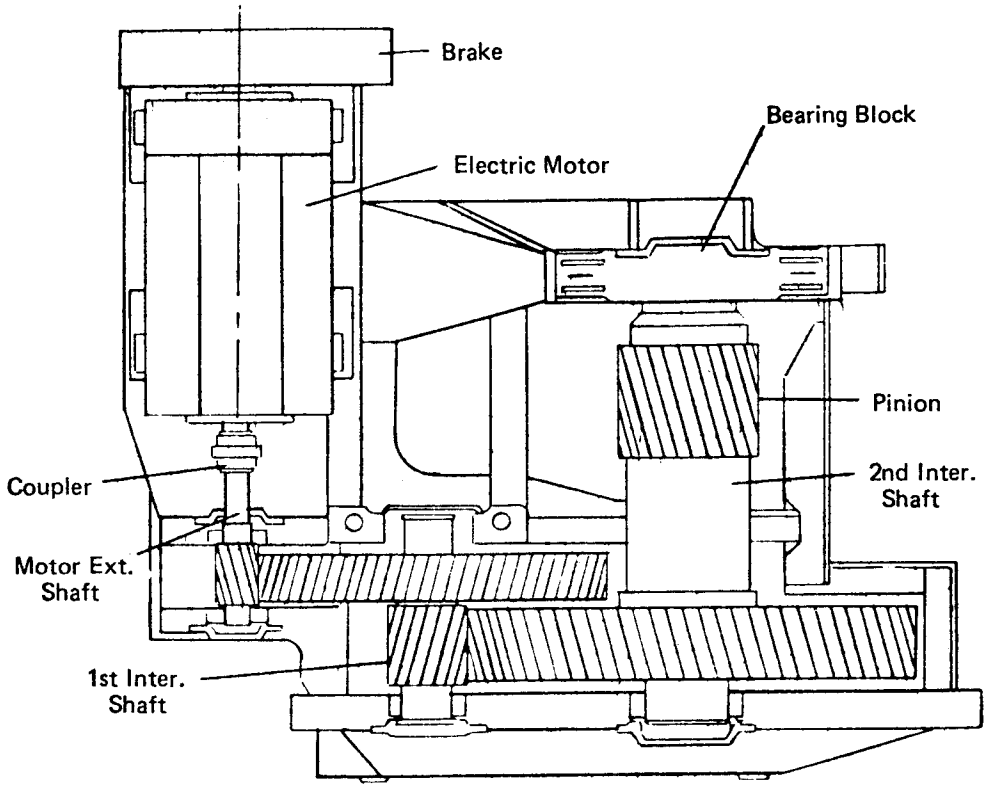
AIR FILTER HOUSE
ATOP MACHINE



CUTAWAY OF
FILTER SECTION



The 1st intermediate propel shaft includes a large diameter gear that meshes with the motor extension shaft pinion. The gear is attached to the integral pinion and shaft by involute splines. The assembly is supported by two tapered roller bearings. The 2nd intermediate shaft consists of a large gear that meshes with the 1st intermediate pinion. The gear is attached to the shaft by involute splines. The shaft extends outside the gear case when the integral pinion drives the main propel gear.



The 2nd intermediate shaft assembly is supported by one double row, tapered, roller bearing in the gear case and one cylindrical roller bearing in the outboard bearing.

The shaft assemblies can be removed from the gear case without draining the lubricant from the cases.

DISASSEMBLE GEAR CASE by separating the motor coupler and remove the oil seal from side of the case at the 2nd intermediate propel shaft. Remove the gear case cover hold down bolts and bearing housing rod bolts. Remove all cap screws from top half of all bearing retainer plates and loosen cap screws in bottom half of retainer about two turns.

It may be necessary to drive a small wedge between cover and case to break seal to separate cover from gear case. Lift off cover using lifting lugs provided. Remove bearing retainer

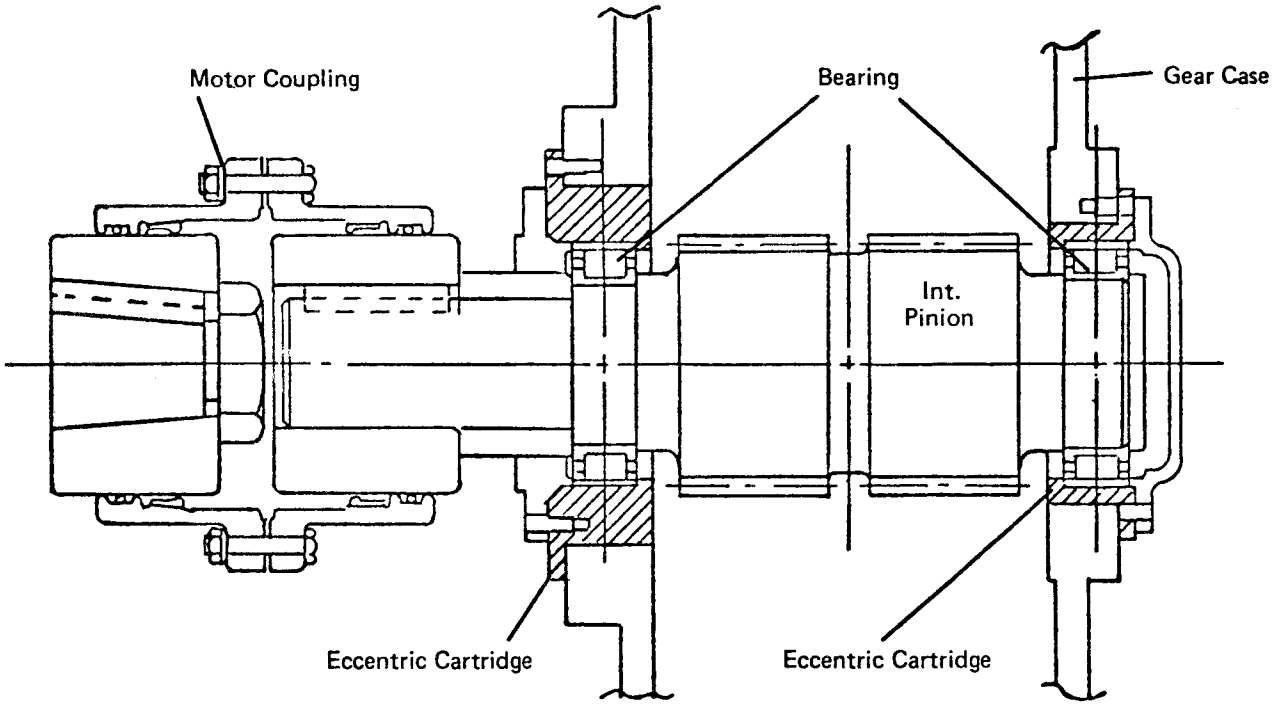
ECCENTRIC CARTRIDGE MOUNTING OF EXTENSION SHAFT GEARS – Each hoist, drag or propel motor extension shaft cylindrical roller bearing mounts in an eccentric cartridge housing. Accurate axial alignment of motor extension shaft and pinion is obtained in BOTH planes by using this cartridge.

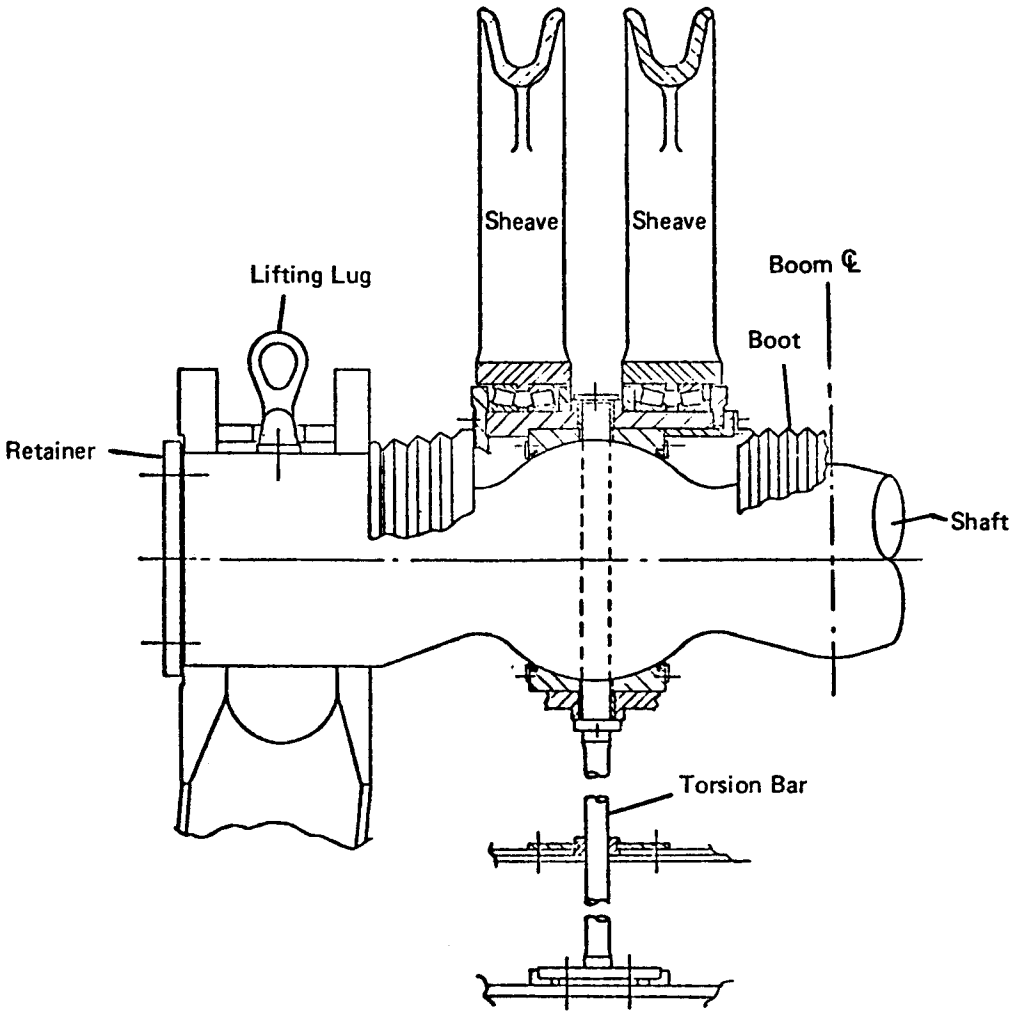
The cartridge is machined so the index boss fits the gear case bore. The cartridge has a flange concentric to the index bore with slotted mounting holes. The cylindrical roller bearing bore is machined eccentric to the index bore.

One cartridge mounts in the gear case (motor side) to allow the eccentric anti-friction bore movement perpendicular to the intermediate gear radius as the cartridge turns in the index bore.

Likewise, the cartridge mounted at the far side allows bore movement parallel to the intermediate gear radius. Each has a flange notch for use to bump the cartridge into position. The bearing bore eccentricity is slight and within the allowable misalignment range of the cylindrical roller bearing.

Tooth contact between gear and pinion indicates TRUE alignment or nature of misalignment.





To DISASSEMBLE POINT SHEAVES lower boom to ground on suitable cribbing or support. (See Lowering Boom.) Remove the rope guard and live end of torsion bars from the shaft assembly. Remove the dust boots and all automatic lubrication equipment.

Attach a lifting device to the lifting lugs provided at each shaft end. Pull up snug enough to support assembly weight and remove the bearing caps and rod bolts.

Remove the split retainer ring and pull away bearing retainer ring with labyrinth seal.

Slide sheave hub, anti-friction bearing and bearing carrier toward end of shaft, off spherical bushing. Remove the spherical bushing pin and bushing. When replacing spherical bushing, be sure mating parts are assembled together, check match marks carefully.

Pull out tapered roller bearing assemblies from sheave hub. Clean inside of hub and remove all burrs.

After listening to witnesses and making the first inspection, stop and consider ALL the facts before proceeding. Valuable time is lost by going off quickly in the wrong direction. So, carefully examine the problem logically, using what you know about the system. Consider all the data collected. Do not make hasty decisions on what to use or what info to discard. Give special value to obvious facts, easily confirmed (a stopped generator) and reserve opinion on contradictory facts.

Barring the obvious, you gain a direction from all this and knowledge of the system. For example, if no motion operates; look in circuits common to all motions, such as: D.C. exciter or A.C. circuits. Likewise, if one motion is normal in one direction; but not in the other, check the components for the separate directions. A few minutes spent analyzing here saves time spent in false, misled direction later.

Once a founded suspicion exists as to which set of components or circuits is faulty, select a starting point for tests that meets the following:

> You know approximate value expected here for test conditions; whether at stall, no-load, neutral, hoist, lower, etc.
>
> No false indications exist, you've avoided points where reading is effected by a sneak circuit.
>
> This point, logically, is in the suspected circuit.
>
> Also, it allows checking as many circuits as possible at one time.

With proper instrument, measure at a selected point and compare to expected value. If measurement is correct, apparently all system parts leading to this point are correct. Trouble exists further down the line. With an incorrect reading, trouble probably lies further back toward start of the system.

Based on first test, proceed toward system start or end and seek expected reading. The trouble, of course, lies between points where correct and incorrect readings occur. In other words, the faulty stage has correct input, but incorrect output. Be positive the correct stage is located, rather than a false lead. Where possible, make tests under two different conditions (i.e., stall and no-load) to confirm conclusions.

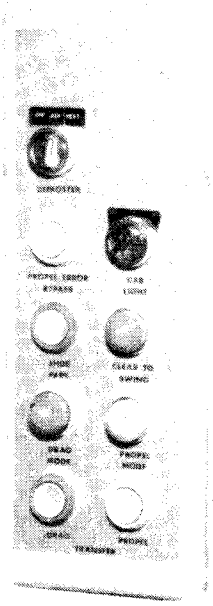
Once faulty stage is located, determine the actual part that failed. Often an ohmmeter helps here, but may offer erronious indications. If a semi-conductor, magnetic amplifier or other complex device is suspected, replace it rather than try to prove it bad by test. This saves time and tests just as well. This assumes that spares exist, as they should.

Excitation On—Indicating light when lit indicates hoist, drag and swing controller, are energized.

Emergency Stop—Push button when pressed de-energizes hoist, drag and swing controller, also, the operating solenoid circuits.

Excitation Start—Push button when pressed energizes the hoist, drag and swing controller, also, the solenoid circuits.

PANEL B, see sketch, includes two switches, three lights and four push buttons. Starting forward, left to right, they are:



Defroster—In cab, on and off switch.

Propel Error Bypass push button. If at any time walking mechanism is not synchronized, the selsyn syne relay drops out to deactivate the propel machinery. The push button overrides the relay so that shoes can be relined.

Cab Light—Switch turns cab's interior lights on or off.

Shoe Park push button is used to stop walking shoes in park position.

Clear to Swing green light—When lit indicates walking shoes in up or park position.

Drag Mode green light indicates machine is in the drag mode.

Propel mode amber light indicates machine is in the propel mode.

Drag push button when pressed puts machine in the drag mode.

Propel push button when pressed puts machine in the propel mode.

The **WARNING PANEL** mounts on a stand within easy reach of the operator's right hand. This panel consists of warning lights on the sloping panel at top. Below is two dial indicators calibrated in degrees of a circle which indicates position of walking shoe or position of drums. Between the dials is shoe-drum selector switch.

The light(s) calls operator's attention to certain machinery malfunctions or maladjustments.