Technical Manual

SuperFront

SECTION 1

ENGINEERING DATA

INDEX

5. Place seal on the shaft with lip turned toward the pressure and install garter spring in the slot with the hook and eye, 90 degrees from split. Butt seal ends together. If desired, apply to the split a small amount of Loctite #404 or Eastman #910 adhesive; but be very careful to keep adhesive AWAY from shaft, bore and seal edge. START seal into bore with the split at top of shaft. Tap seal into bore with hammer and wood block. Alternate from side to side until seal firmly seats in the bore. (Read the solid seal installation).

INSTALL OIL AND GREASE SEALS with the following procedure:

1. Carefully inspect seal for cuts, nicks or breaks. Rub a finger over lip and edges to feel roughness or pits that might cause a leak. A damaged seal is not worth installing. A properly sized seal is.

2. Check shaft for scratches, burrs or roughness that may cut or score the lip of seal. Look closely at area over which seal installs. Keyway and splines need a thimble or protective tape to safeguard seal.

3. Inspect bore for roughness or burrs that might cut or scrape seal when pressed into place. The bore and shaft need 1/16" chamfer. If not, carefully break the corner of seal.

4. Determine proper position of lip. (Ask the question: Is seal used to retain fluid or grease IN or rather to keep other material OUT). Position seal with lip turned to INSIDE when retaining oil or grease. Place seal with lip to OUTSIDE when other material OUT of bearing or case.

5. Lube the seal with light coat of oil or grease on ALL surfaces, particularly the lip and O.D. Lube shaft and bore also.

6. CAUTIOUSLY install seal on shaft. Be sure garter spring is IN SLOT and lip is TURNED correctly. Move seal from the shaft end to bore with a spiral motion.

7. Align seal in bore and tap LIGHTLY with hammer on wood block. Change from side to side around the seal until firmly seated in bore. No retainer plate is needed.

TWO SEALS INSTALLED back to back retain grease or oil and keep out other material at the same time. Where this practice exists, fill the space between the two with MPG.

GEAR CASE SEAL used for ALL oil tight gear cases requires a coat on one surface of the gear case cover with aviation Form-a-Gasket #3 (Permatex Co.). Apply 1/100" thick. Is using a paper gasket at cover, ALWAYS replace with a NEW manila paper gasket .010" thick. Apply a gasket sealine compound, such as Form-a-Gasket #3, to BOTH sides of the gasket. Tighten the gear case cover bolts until the seal material extrudes from the joint.

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.

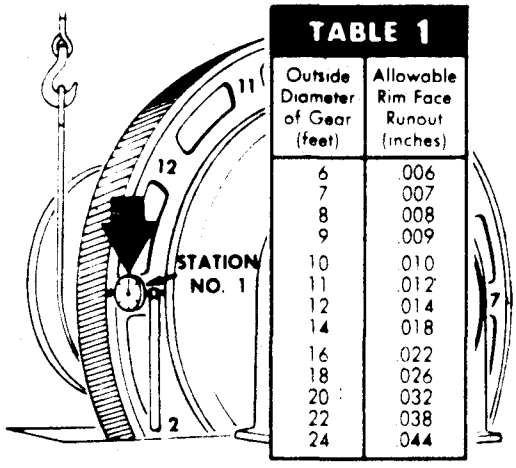


TABLE 1

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		
000	+ 004	+ 005	+ 004	000		

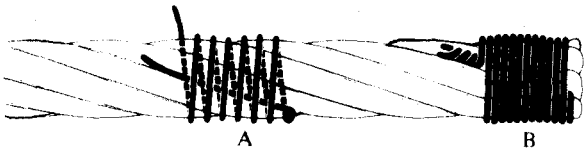
8	9	10			
- 014	- 015	- 014	- 010	- 005	000

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.

Proper Methods of Seizing



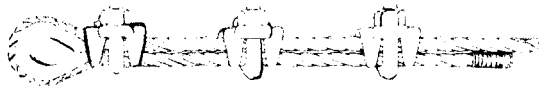
Sketch of Method No. 1 for applying seizings. At A the turns of the seizing wire are spread apart to illustrate method of applying them. Completed seizing is shown at B.

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.

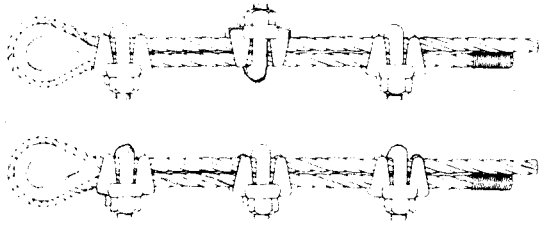
Properly seizing a wire rope end prevents the strands from slipping. Any strand movement causes uneven load distribution in the strands and reduces rope life.

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.

APPLYING WIRE ROPE CLIPS



The Right Way to Clip Wire Rope



The Wrong Way to Clip Wire Rope

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.

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.

MATERIAL INFORMATION

RAIL STEEL – MPS Symbol FB

To repair steel rail areas with spalled surfaces; first grind away ALL cracked edges. Preheat. Build up (pad) area, using E-9018M electrodes, to within 1/4 inch of finished surface approximately. Complete build up, using E-11018M electrodes, then grind weld to desired contour.

For crack repair, other than in rail wear surfaces; preheat, then use E-9018M or E-309 electrodes.

NOTE: The above is not an accepted practice for new rails. New rails should be ordered (from MPS) as repair may be short lived.

AUSTENITIC MANGANESE STEEL – MPS Symbol CH and FCHN

NEVER exceed 500 degrees F. (260 degrees C.) (1/2 inch back from joint) when welding OR flame cutting this steel; otherwise an embrittled (heat affected) zone results. Manganese, normally non-magnetic, may be slightly magnetic when work hardened. Because of this, remove the work hardened area by grinding BEFORE welding.

CAST IRON

FRICTION HOUSINGS

Welding for permanent repair is NOT recommended. Brazing or bronze welding gives temporary repair. Use general preheat. SLOWLY preheat entire part to a minimum of 400 degrees F. (204 degrees C.) MAINTAIN heat during welding. SLOWLY COOL after welding. When application does not permit brazing, use electric arc process, using ENiFe-CI electrodes (such as "Ni-Rod 55"). General preheat applies here.

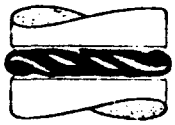
WELDING INSTRUCTIONS

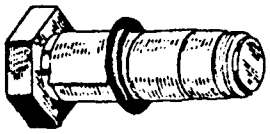
WELDING ELECTRODE TYPES, shown in Welding Specifications, are classified according to the American Welding Society standards. Use any reliable brand electrode conforming with A.W.S. We recommend LOW HYDROGEN ELECTRODES (AWS EXX-18) for all repair work. Please keep these electrodes dry. Use according to manufacturer's recommendations for the best results. Bake electrodes, when possible, in oven for one hour at 700 degrees F. (371 degrees C.). Then place in holding oven at 250 degrees F. (121 degrees C.) until used. If wire chemistry is compatible to specified stick electrodes; use CO2 semi-automatic, flux-core wire for flat position joints.

In hydraulic systems, flow wash bearing surfaces with hydraulic fluid and wipe parts, if needed ONLY with a dust free cloth.

In an oxygen system DO NOT PERMIT OIL AND GREASE around the O-ring. The mixture of oxygen; oil and grease causes an explosion.

INSTALLATION on a piston does require a bit of stretching, but try to keep it uniform. Once installed, remove any and ALL twists. When pushing piston into cylinder, push straight in; DO NOT TURN while pushing. Turning causes bunching and eventually a leak. Most installations are the removal procedure in reverse.

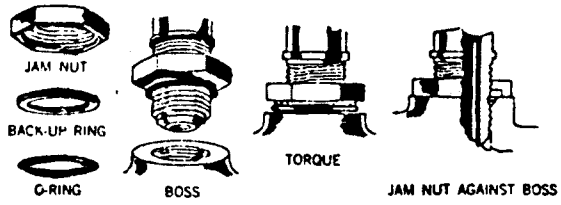


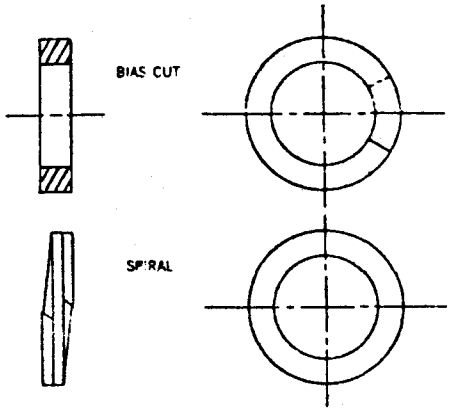


TAPE PROTECTS O-RING DURING INSTALLATION

Some installations require the O-ring to slip over sharp edges, such as screw threads. Cover these edges with thin plastic tape or aluminum foil, lube ring and work into place. Perhaps making a thimble of plastic to place over threads first is even easier.

Other installations, such as placing a ring in a positioning type, universal fitting are more involved. In this case, a backup ring is lightly coated with lube and then worked into the counterbore of the jamb nut. The O-ring is stretched and rolled over fitting threads and into smooth threadless surface designed for the backup and O-rings. Next, jamb nut is pushed firmly against lower threaded section of fitting. Fitting installs in boss until ring contacts boss and increases torque. Jamb nut is held stationary in this position while applying 1-1/2 turns to fitting. Then turn fitting into boss NOT MORE than ONE added turn to position it. Final step is to hold fitting and torque jamb nut properly.





A similiar procedure is used for non-positioning ifttings, but the jamb nut and backup ring may be omitted.

BACKUP RINGS provide a firm surface for O-rings to press against to avoid extrusion, under high pressures, into clearance between sealed surfaces. Any surface movement with O-ring so extruded results in high wear rate which finally leads to ring failure.

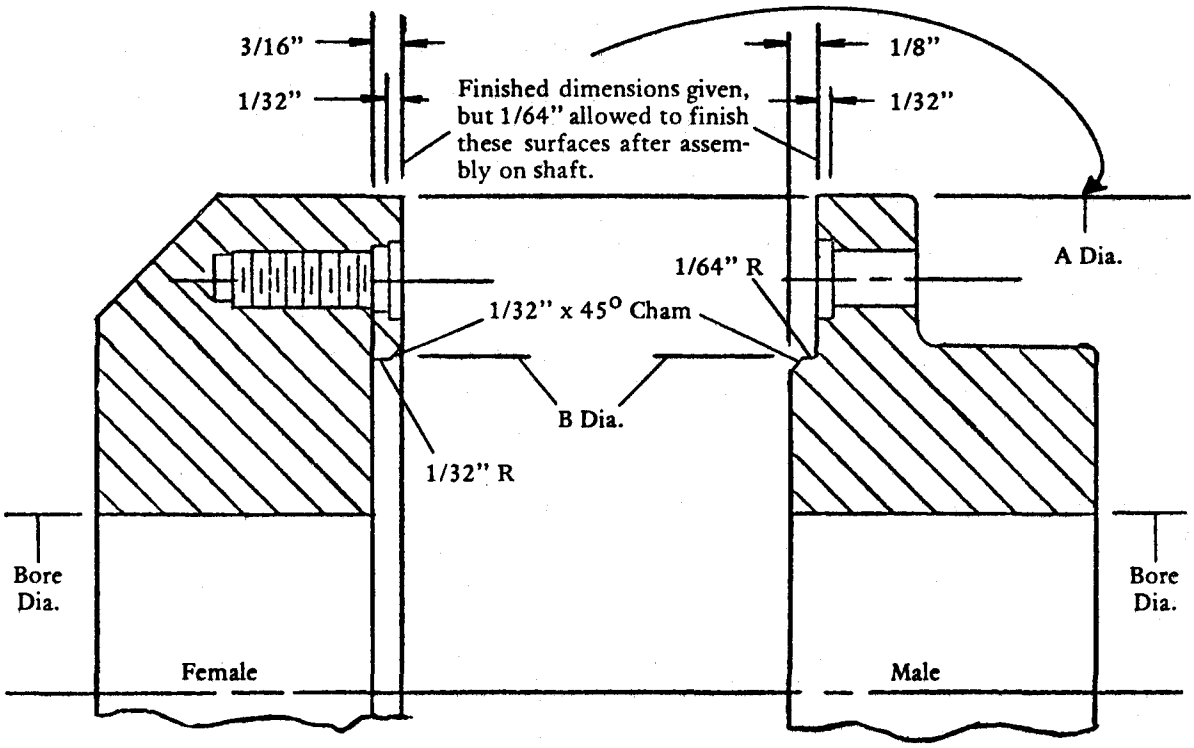
Backup rings are needed on each side of an O-ring when pressure is in alternate directions. Using a single ring, install on the downstream side of the O-ring.

FINISHING AND RECOMMENDED FITS – Unless otherwise called for, replacement coupling's have a finished bore and 1/64 inch of material on face, rabbet diameter and O.D. to be removed after assembly on shaft.

Keyed couplings usually have an interference fit between .5 to 1. mil per inch of diameter.

Keyless couplings need an interference fit of 1. mil per inch of diameter.

Measure the rabbet diameter and finish machined surfaces to match mating half coupling using fit from line to line to .001 inch interference. (See sketch.)



CHECKING COUPLING ALIGNMENT requires secure bolting of M-G set base to deck in operating position. Follow the step by step procedure and accurately record ALL readings. When checking more than one M-G coupling, always start at coupling nearest the two-bearing unit, (usually the motor).

THE SOLIDLY COUPLED SETS PROCEDURE IS:

1. Loosen ALL coupling bolts to point they do not hold valves together.

2. Start at coupling at two-bearing unit (usually the motor) or near middle of a long set. Two diametrically opposed bolts need careful adjustment to be loose and YET NOT

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SECTION 2

LUBRICATION

Application of CORRECT lubricant in the CORRECT amount thru a CORRECT program is required for the successful operation of any machine. Proper lubrication reduces maintenance and increases component life. Absence of proper lubrication wears moving parts quickly and failure results.

LUBRICATION FITTINGS on plain and anti-friction bearings not served by the automatic lubrication system are hydraulic type push on fittings, 1/8" or 1/4" as per MPS standard. When contamination creates a problem, as in slow speed bearings using labyrinth seals, new grease may be added until clean grease seeps out of the seal. When a bearing runs excessively warm due to overfilling, remove the pressure fitting and allow excess lube to excape. Allow bearing to operate and purge excess lube for 10-15 minutes, then replace fitting.

ANTI-FRICTION BEARINGS, grease lubed, require the full quantity of lube as specified in the Lubrication Charts. Ball and roller bearings require only a relatively small amount of lube and relube intervals are generally long with good seals. Accurate predetermination of when to add new grease is impossible. Grease in a bearing generally deteriorates gradually, not suddenly. Thus only a small amount need be added. A small amount of lube applied every 500 operating hours, unless otherwise specified, maintains adequate lubricating properties.

OPEN GEARS and pinions require a constant coat of a good grade of lubricant.

ENCLOSED GEAR CASES must maintain the recommended lubricant level. Check the dipstick or plug at regular intervals. When a seasonal change of lube occurs, pump used oil into a drum for final disposal. Drain all remaining oil from case thru drain plug opening. Flush gear case with fuel oil or light lube oil after draining. Refill with proper lube.

EXTREME TEMPERATURE OPERATION of this machine below -20 degrees F. (-29 degrees C.) or above 110 degrees F. (44 degrees C.) requires special lubrication recommendations, contact your local supplier. Give full particulars concerning specific conditions of your operation.

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

LUBRICATION OF FRONT END (Cont.)

NAME OF PART	TYPE	NO. OF POINTS	LOCATION	LUB. SYM.	METHOD & FREQUENCY
Bell Crank	Bush	4	Side of Boss	MPG	Auto; 12 min.
Bell Crank Pitch Pend.	Bush	2	End of Pin	MPG	Auto; 12 min.
Handle Socket	Bush	2	Through Bush	MPG	Auto; 12 min.
Handle Pin	Bush	2	End of Pin	MPG	Auto; 12 min.
Hoist Link Ball Socket	Bush	2	Side of Ball	MPG	Auto; 12 min.
Hoist Link Ball Pin	Bush	1	End of Pin	MPG	Auto; 12 min.
Hoist Link Pin	Bush	2	End of Pin	MPG	Auto; 12 min.
Handle Pin	Bush	2	End of Pin	MPG	Auto; 12 min.
Handle Pitch Pend.	Bush	2	End of Pin	MPG	Auto; 12 min.
Dipper Door Hinge	Bush	2	End of Pin	MPG	Auto; 12 min.
Mast Foot Pin	Bush	2	End of Pin	MPG	Auto; 12 min.
Front Crowd Link Pin	Bush	2	Side of Boss	MPG	Auto; 12 min.
Rear Crowd Link Pin	Bush	2	Side of Boss	MPG	Auto; 12 min.
Gantry Crowd Cylinder Conn.	Bush	2	End of Pin	MPG	Auto; 12 min.
Front Crowd Handle Pin	Bush	2	End of Pin	MPG	Auto; 12 min.
Rear Crowd Handle Pin	Bush	2	End of Pin	MPG	Auto; 12 min.
Top Rear Support Pin	Bush	2	End of Pin	MPG	Auto; 12 min.
Bottom Rear Support Pin	Bush	2	End of Pin	MPG	Auto; 12 min.

SECTION 3

COMPRESSED AIR SYSTEM AND COMPONENTS

The Marion air control is quite simple in operation. Reasonable care and maintenance ensures a long and trouble free life. Compressed air is used to operate the propel, swing, hoist brakes, dipper trip and auto-lube system.

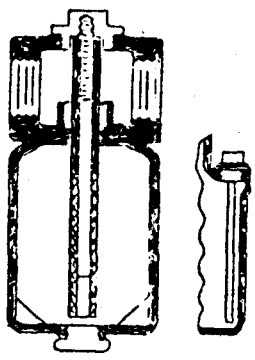
Air pressure provides a vital link in the safe operation of this machine. The operator MUST CONSTANTLY check the pressure gauge reading. If at any time this pressure DROPS below 80 psi, SHUT DOWN and investigate the cause.

NEVER OPERATE THIS MACHINE WITHOUT FULL TANK PRESSURE.

The **AIR COMPRESSOR,** located left front corner of the deck, is a complete unit. The direct connected 20.2 CFM (125 lbs.) compressor mounts on an 80 gallon horizontal tank with a 5 hp, 3 phase, 220/240 volt electric motor. Pressure gauge and pressure switch adjusted to 95-115 psi and manual are supplied.

INSPECT the belt drive often. Maintain PROPER belt tension. ADJUST by moving the electric motor on the base. CHECK crankcase oil level DAILY and keep at dipstick FULL mark. Every 500 operational hours, DRAIN and FLUSH the crankcase. Look in Lubrication Charts for the proper NON-DETERGENT oil use. Clean the air cleaner once a week or daily if conditions require.

ANTI-FREEZER, installed in air line, prevents icing and freeze-up of air system in severe weather. Introduced alcohol vapor mixes with water vapor in entering air. A bottom alcohol chamber and a top vapor chamber separate the unit. A central rod fits to a plug in the top. This rod, covered with a wick, carries alcohol up into the vapor chamber where it evaporates into the air stream. This in-line unit is non-adjustable.



MAINTENANCE requires cleaning bowl and wick assembly with non-flammable solvent before freezing weather. Drain plug is in bottom. TURN OFF air compressor BEFORE checking or refilling. Vent the line pressure thru cut-out. Pressure not vented off escapes thru a small hole drilled in cap and vents out between cap and bowl. Due to this filler cap safety factor and to avoid over-filling; NEVER REFILL THRU WICK CAP. Use methyl alcohol only. (Permanent anti-freeze types do not evaporate fast enough for good protection).

The **PROPEL BRAKE** attaches to the intermediate propel shaft. The brake hub with splines fits to the center and friction plates of brake lining. The brake is spring set and air released.

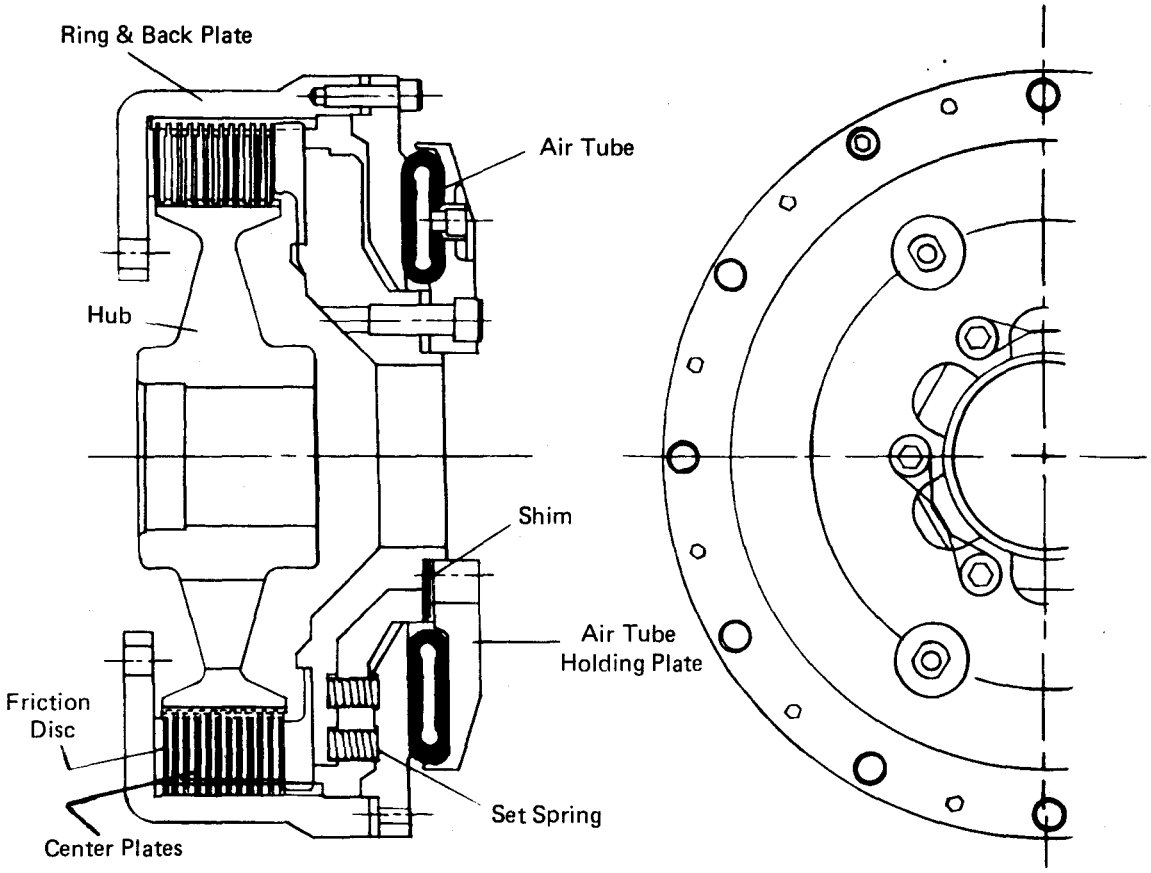
Brakes set automatically if power is cut off.

To apply brakes, air supply is stopped. The brake set springs expand and squeeze the cast iron pressure plates and friction discs together. The friction discs have molded teeth which engage with teeth on brake hub.

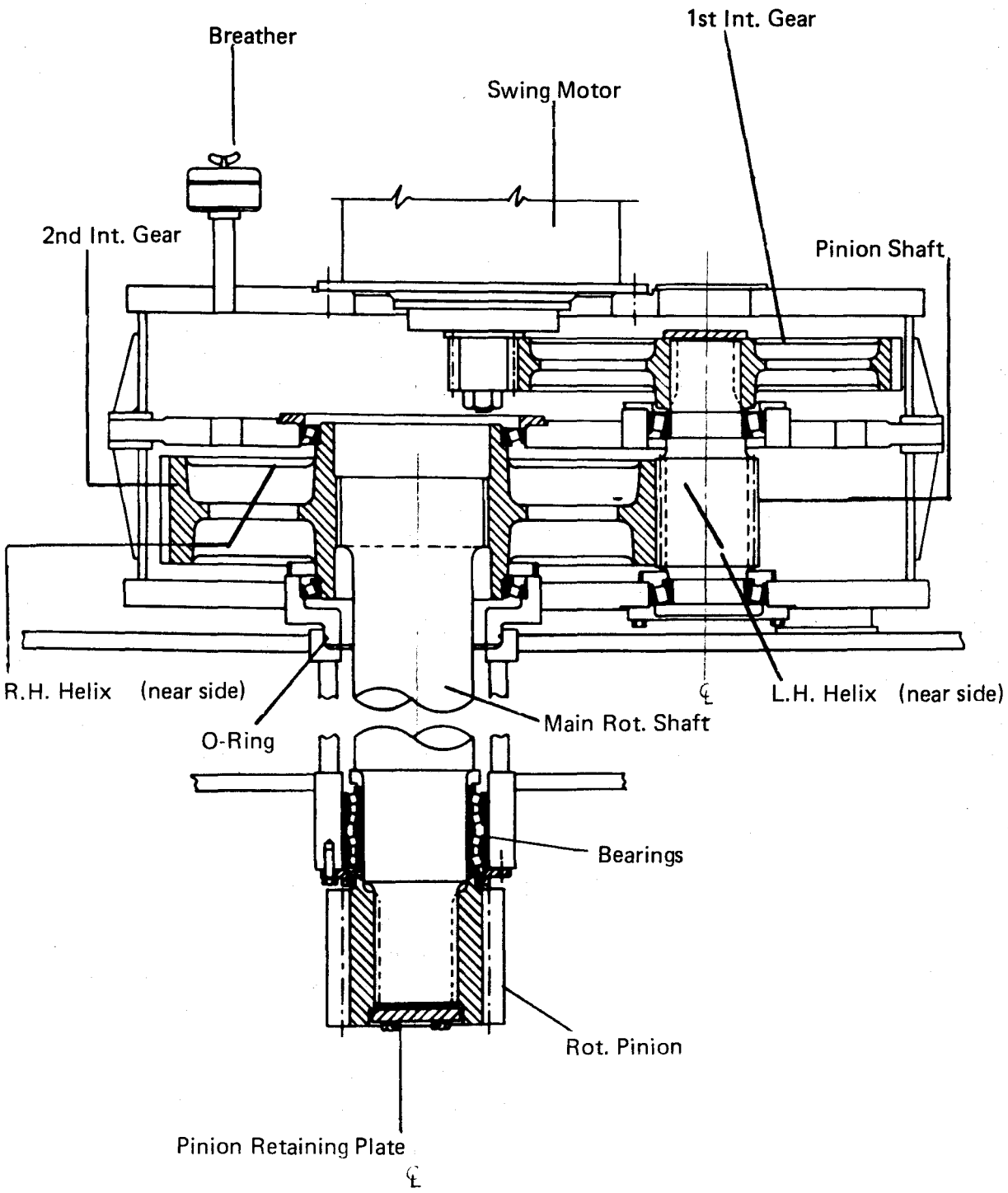
To release brakes, air pressure in the line expands the air tube which releases the pressure between the pressure plates and friction discs.

Regularly inspect the air system for leaks causing brake failure. A pressure of 70 psi is recommended for full brake release.

Brake clearance of 3/32 inch to 3/16 inch is factory set and maintained by placing shims between the spring plate and ring. Replace the friction disc when actuating assembly approaches the limit of travel.



PROPEL BRAKE

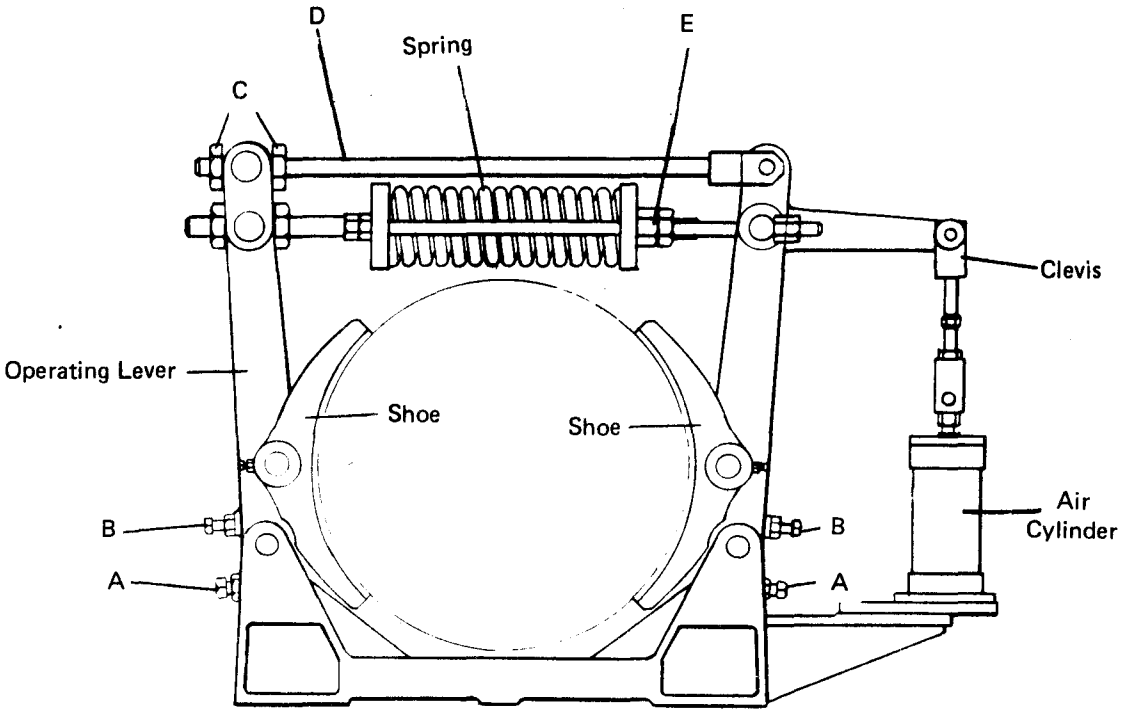


ROTATING GEAR CASE

The **HOIST BRAKE** is not intended to stop or retard hoist motion. It is a holding brake. Motion is slowed to a stop by plugging the motor (see Operation Section).

HOIST BRAKE ADJUSTMENT begins with brake in released position. Loosen set screws (A) and (B). Turn nut (C) on connecting rod (D) until clearance between shoes and housing is 1/8 inch. Balance clearance by adjusting set screw (A) at bottom of operating levers until clearance between shoes and housing equalizes on each side of housing. Position shoes by turning set screw (B) so heel of shoe does NOT drag on housing. Next, with brake SET; adjust set spring by turning nuts (E) on spring suspension until spring measures 17-1/2 inches with an initial deflection of 4-7/32 inches. Adjust cylinder piston rod connection so piston does NOT bottom in cylinder in EITHER set or released position. Adjust connection by loosening clevis locknut and turning piston rod in clevis. Be sure at least 3/4 inch of thread engagement exists between piston rod and clevis at final adjustment.

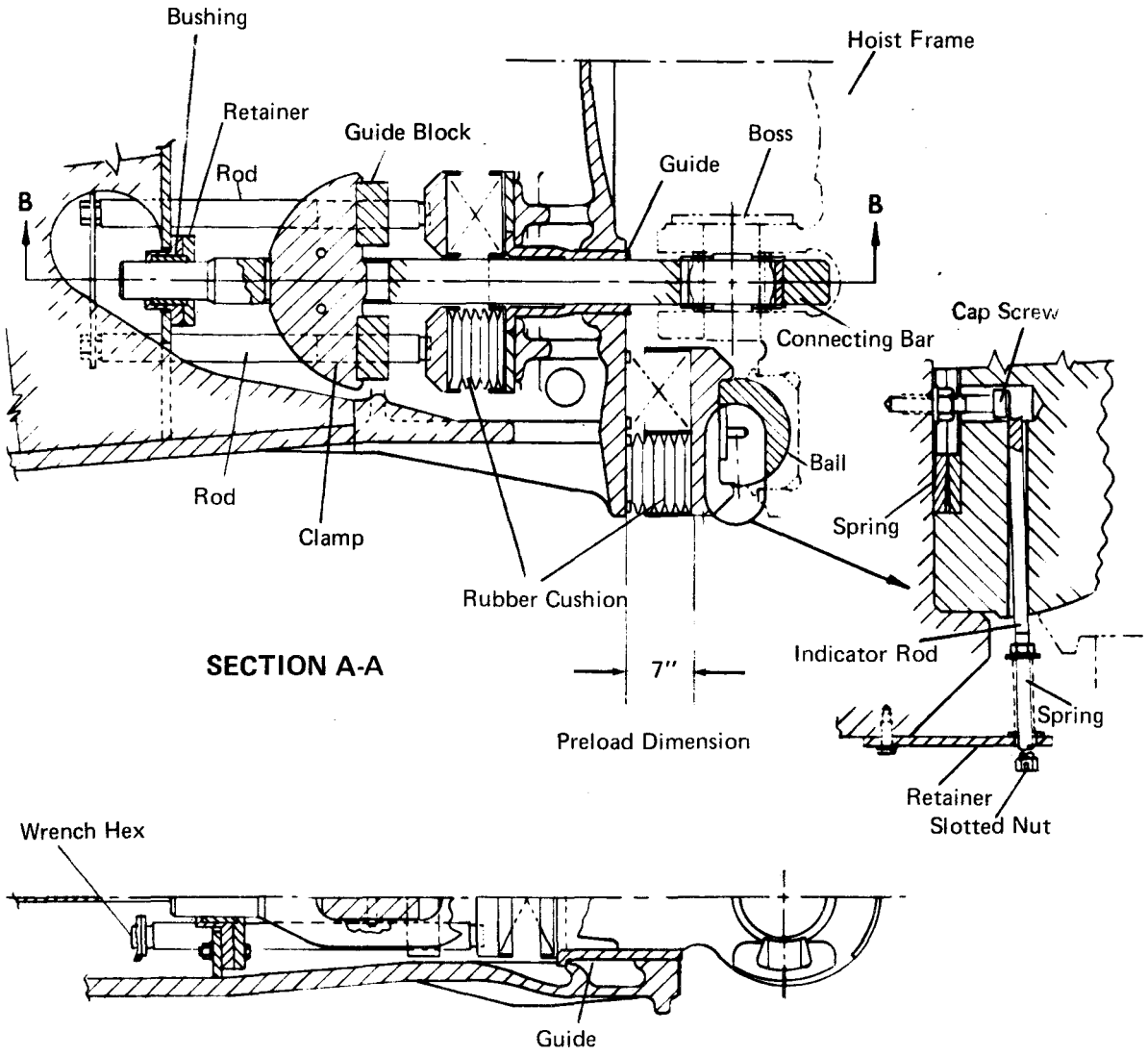
When brake lining wears to less than 3/8 inch; REPLACE THE LINING. Loosen set screw and remove pin at shoe and operating arm connection. Lift shoe up and around housing to remove. Attach new lining with 32 flathead brass machine screws only.



HOIST BRAKE

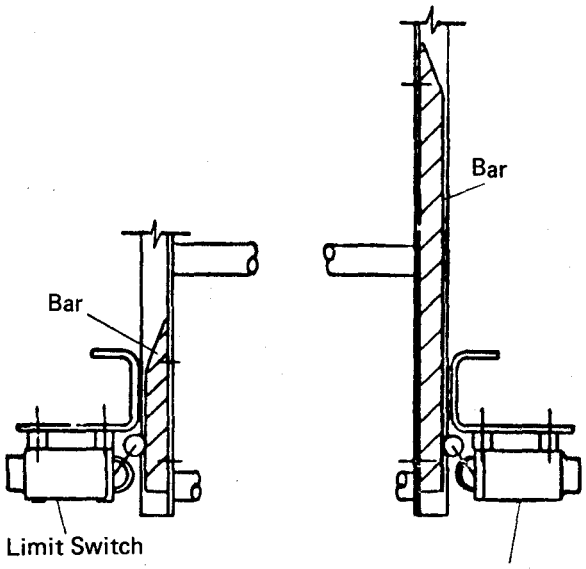
The **DIPPER HANDLE ASSEMBLY PRELOAD** on the rubber pads is obtained by turning the guide block until 7 inches can be measured between faces of blocks as shown. An indicator visually shows when this preload requires adjustment by moving into the ball with spring action, thus the slotted nut on the indicator rod rests against the retainer plate.

NOTE: Reposition this indicator rod before readjusting the preload to prevent rod damage.



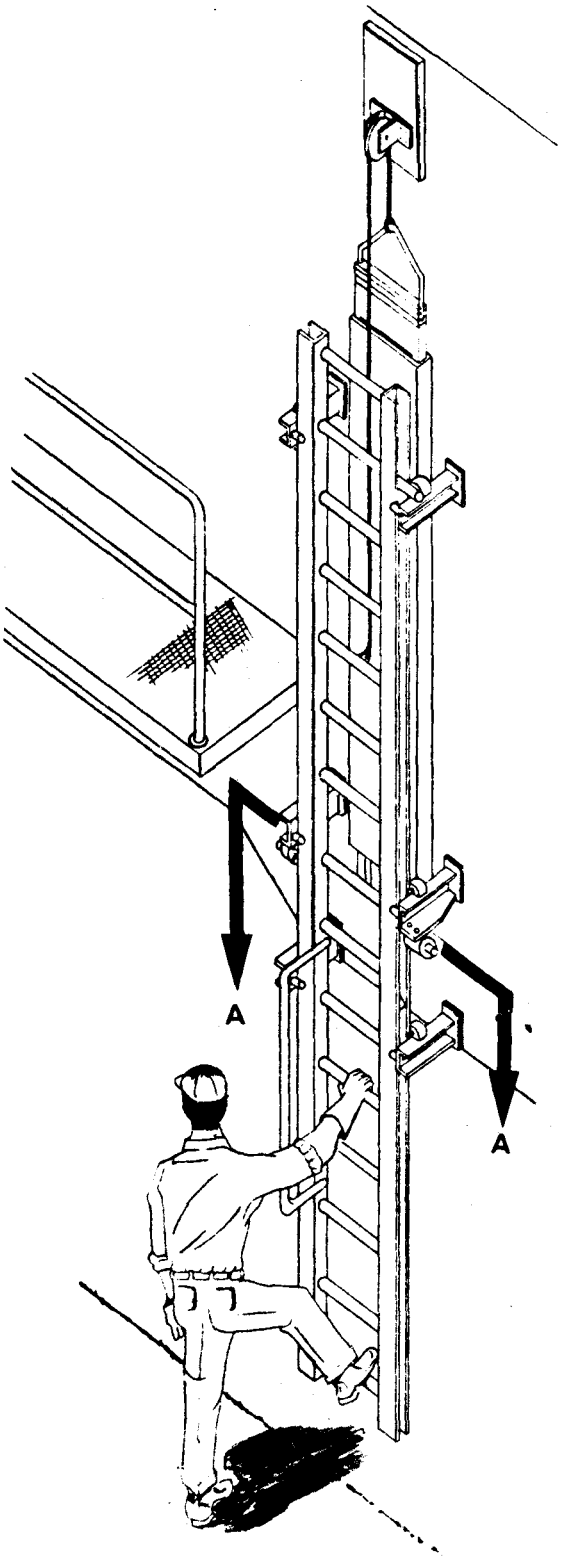
DIPPER HANDLE ASSEMBLY

NOTE: Turn rod each side until preload dimension measures 7 inches.



SECTION A-A

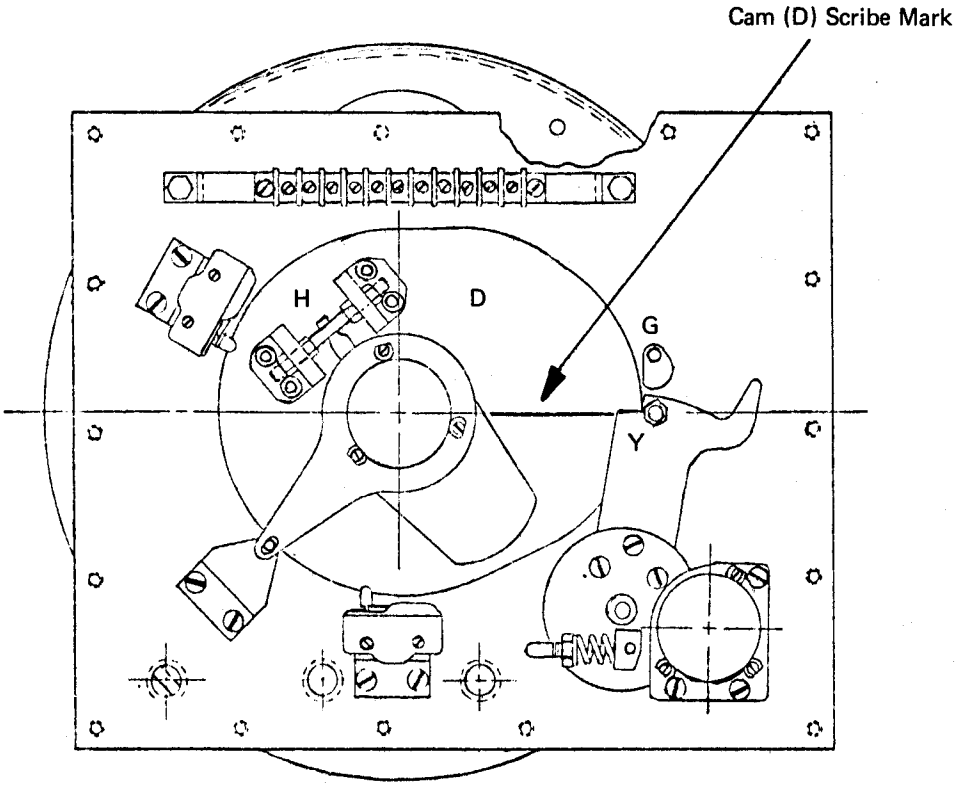
The first of two limit switches is activated when the ladder is pulled down approximately 6 inches. A buzzer signal is transmitted to the operator's cab alerting him that the power will be cut off within seconds. The second limit switch is activated when the ladder has travelled another 12 inches and cuts off all power to the machine allowing safe ascent or decent on the ladder. The ladder is counterweighted and will rise back slowly to its former position, at which time, the buzzer will stop and the operator can turn the power back on again.



RETRACTABLE LADDER

NOTE: DO NOT disturb the switches unless incorrect switch operation is observed. (Insufficient or excessive switch movement.)

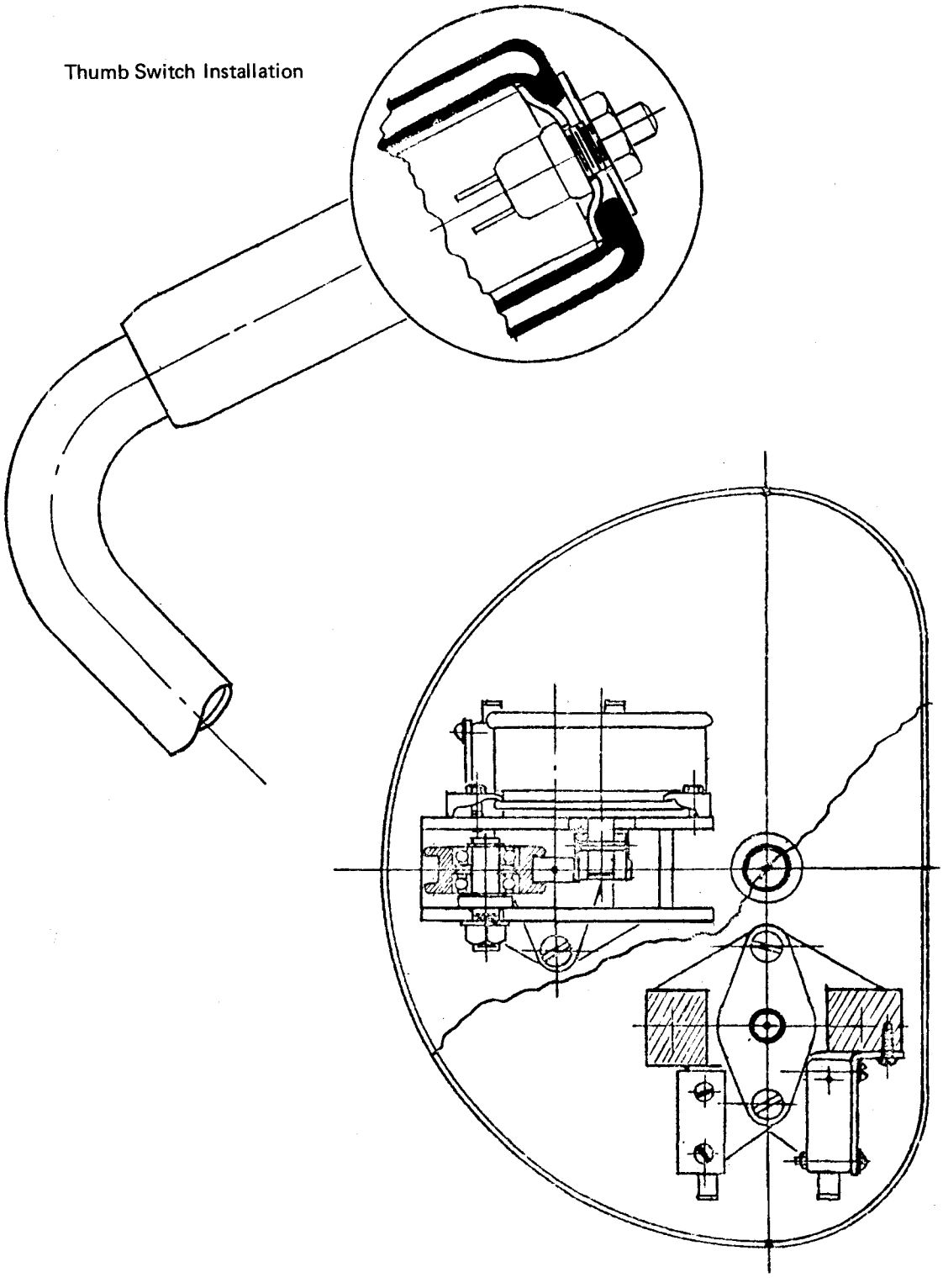
Using the Hoist Command Lever CAREFULLY RAISE the Dipper until the Upper and Lower Hoist Sheave Rims are approximately 2 meters apart. Adjust hoist position CAREFULLY until a measurement of 182.6 cm $\pm$ 1 cm exists between the Sheave Rims.



CROWD LIMIT CAM INDEX

ADJUSTMENT: Hoist Motion Limit Linkage – the large Cam (D) Alignment Mark should be aligned with the machined surface on the Follower (at Y). If out of alignment, COARSE ADJUST using U-clamp (X) on Hoist Frame Sheave and FINE ADJUST with Set Screws at (H). Back off Cam Follower Stop (G) so that the Follower will touch the low part of the Cam as it rotates. Potentiometer (F) should be placed on the mechanism with its brush at approximately mid-position. When installing potentiomenter on mechanism; mesh drive gears CAREFULLY so as NOT TO rotate shaft. With gears properly engaged, TIGHTEN Hold Down clamps. Back off the two Limit Switch Cams to inoperative positions by means of their opposing set screws (at H).

Thumb Switch Installation



CONTROL UNIT PLACEMENT IN STAND HOUSING

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SECTION 5

ELECTRICAL MAINTENANCE

CARE OF D.C. MOTORS AND GENERATORS holds one watchguard – cleanliness. Keeping this equipment free of dirt, oil and grease is of prime concern. The operator generally recognizes and may correct the few common problems. Failure of this equipment is rare. Serious problems require a competent electrician. In the case of poor commutation, where simple remedies can not solve the problem, consult the electrical equipment manufacturer.

BRUSHES with an excessive amount of arcing between brush and commutator when operating under normal loads and speeds need checked for the following:

Are brushes sticking in holders?
Are brushes making full contact on commutator?
Are contact surfaces of the brushes clean?

NOTE: Determine this by removing the brush and looking at it's surface. The surface is smooth and polished where the brush rubs. Any portion not in contact has a rough, dark appearance. Loose brush holder studs throw brushes out of line and cause excessive arcing. Here the brush rides on heel or toe out of normal commutating plane. Tighten brush holder into correct position to solve the problem. Loose brush holder yoke set screws permit the yoke to rotate and shift all the brushes. So they arc. Reposition the holder yoke and tighten. Another problem solved. Keep even spring pressure on ALL brushes. This exact pressure varies with unit type. Call the factory for specific information on your unit. The brush springs are set originally at one point. One may assume this pressure setting as correct and keep it exact when installing a new brush. This initial brush pressure should be the same for all brushes on any one motor or generator. Inspect all brushes regularly. Brushes worn beyond a point of good contact need replaced. Put in new one(s). Avoid allowing rapid brush wear. This results in improper brush pressure and causes severe arcing. Excessive brush wear may even cause the pigtail to wear into the commutator proper. Check the brush springs. Are they in their slots? When using fairly long brushes, it's a good practice to increase spring tension after brushes wear to make up for brush pressure loss. Use the same brush type as originally furnished with the unit when replacing. Serious problems occur when using an incorrect brush. A change in brushes sometimes improves a condition of poor commutation and severe arcing. First, consult manufacturer before making this change.

BRUSH INSTALLATION – Brush should properly fit holder or guide, to work up and down freely. Grind brush with 2/0 or 3/0 sandpaper until contact surface matches the commutator contour. Use the following procedure: Place brush in holder, release spring and insert sandpaper (wider than brush, rough side to brush) between brush and commutator. Exert full spring pressure on brush. Hold sandpaper close to commutator and draw it in direction

speeds with light loads. Although this is uncommon, too strong a field creates low speed with light loads and probably high speed with heavy loads.

Many failures effect BOTH stall current and no-load voltage. A master switch failure generally effects BOTH.

Fortunate and rare is the case of an intermittent problem occurring with the electrician aboard, so finding these requires a combination of skill and luck.

The starting procedure is the same. Gather needed info regarding effect on speeds and pulls. Determine what the operator did just before the failure. Ask yourself, if any special weather or temperature conditions existed; how long did failure last in time and what was done to restart, etc. Study the system with this info and estimate the circuit(s) at fault. Look for the obvious first. Loose connections are commonplace.

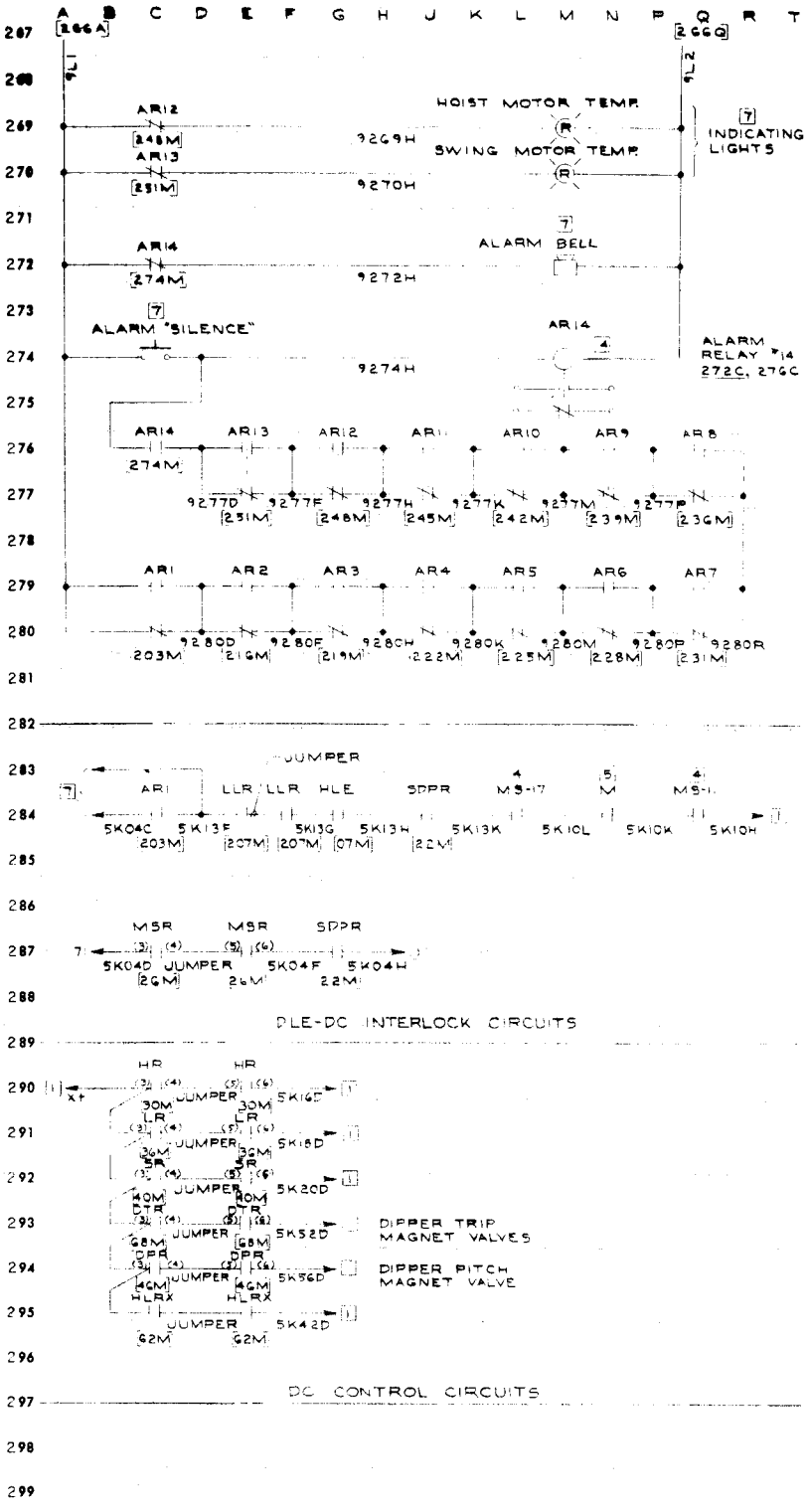
As a last resort; simulate the fault. In other words, open the circuit felt to cause the trouble and see if it occurs again. **CAUTION** is the byword here since opening the wrong circuit could cause more damage than the failure. **NEVER OPEN** a critical circuit such as; current-limit or voltage feedback unless positive the results will not prove damaging. Again, know your system.

As an example of simulated troubleshooting.

The complaint is of a sluggish swing motor. Although the troubleshooter rode the machine for several days, the trouble never re-occured. The operator remembered that the trouble occured only on hot days and he felt he'd know it if duplicated. The machine used three-field control. A weak motor field or weak generator self field could cause sluggishness.

Simulating the trouble required first opening the motor field contactor, but to no avail. Next, the self field contactor was opened and produced the same intermittent result. Investigation proved the contactor did not close in hot weather since coil resistance increased not allowing sufficient coil current to flow. Weakening spring tension solved the problem.

Unfortunately, some circuits do not check with the common instruments. These include anti-hunting or stabilizing circuits, plugging control circuits, rate circuits, etc. The use of these circuits is minimized, but often unavoidable on newer, sophisticated, fast response control systems. Failure of a plugging control circuit causes higher plugging currents and possibly bad commutation; but the operator generally notices a harder plug. Failure of stabilizing circuits causes motor oscillation, but not if critical frequency is too high. A high frequency oscillation causes a reduction in output (particularly stall current) if it is severe enough. When suspect of one of these circuits, the best one can do with the usual instruments is check circuit components. When these tests do not locate trouble, assistance may be required.


A B C D E F G H J K L M N P Q R T
266A
266Q
9L1
9L2
AR12
248M
AR13
231M
9269H
9270H
HOIST MOTOR TEMP.
SWING MOTOR TEMP.
INDICATING LIGHTS
AR14
274M
9272H
ALARM BELL
ALARM "SILENCE"
9274H
ALARM RELAY #14 272C, 274C
AR14 AR13 AR12 AR11 AR10 AR9 AR8
9277D 9277F 9277H 9277K 9277M 9277P
231M 248M 245M 242M 239M 236M
AR1 AR2 AR3 AR4 AR5 AR6 AR7
9280D 9280F 9280H 9280K 9280M 9280P 9280R
203M 216M 219M 222M 225M 228M 231M
JUMPER
AR1 LLR LLR HLE SDPR MS-17 M MS-11
5K04C 5K13F 5K13G 5K13H 5K13K 5K10L 5K10K 5K10H
203M 207M 207M 207M 22M
MSR MSR SDPR
5K04D JUMPER 5K04F 5K04H
26M 26M 22M
DLE-DC INTERLOCK CIRCUITS
HR HR
30M LR JUMPER 30M LR 5K16D
36M SR JUMPER 36M SR 5K18D
40M DTR JUMPER 40M DTR 5K20D
68M DPR JUMPER 68M DPR 5K52D
DIPPER TRIP MAGNET VALVES
46M HLRX JUMPER 46M HLRX 5K56D
DIPPER PITCH MAGNET VALVE
JUMPER 5K42D
62M 62M
DC CONTROL CIRCUITS

APPLYING LOAD – If practicable, allow set to warm up before connecting a heavy load. Continuous generator overloading may cause high operating temperatures that can damage the windings. The generator can safely handle an overload temporarily, but for normal operation, keep the load within nameplate rating. The exhaust system may form carbon deposits during operation at light loads; apply full load accasionally before shut-down to prevent excessive carbon accumulations.

Try to connect the load in steps instead of full load at one time. Most installations use a line switch that must be closed to connect a portion of the load.

SAFETY DEVICES – In case of dangerously high coolant (water) temperature or low oil pressure, the cutoff switch stops the unit. After an emergency stop, investigate and correct the cause. Press reset button before restarting.

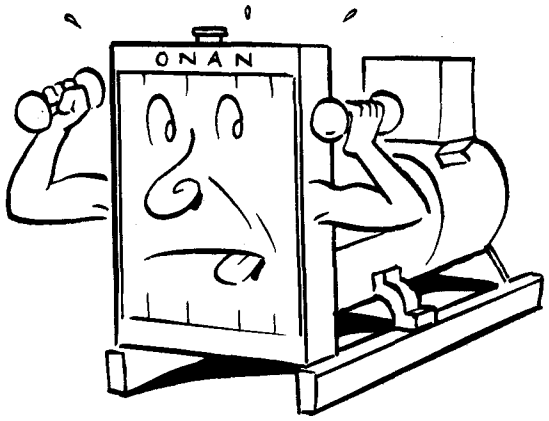
BREAK-IN PROCEDURE for the unit should be run in the following sequence:

1. One half hour at 1/2 load.
2. One half hour at 3/4 load.
3. Full load.

Continuous running under one half load during the first few hundred hours usually results in poor piston ring seating, causing higher than normal oil consumption and blowby.

Drain and replace the crankcase oil after 50 hours of operation; drain while the engine is still hot.

EXERCISE STANDBY PLANTS as infrequent use results in hard starting. Operate standby sets at least 30 minutes each week. Run longer if battery needs charging.

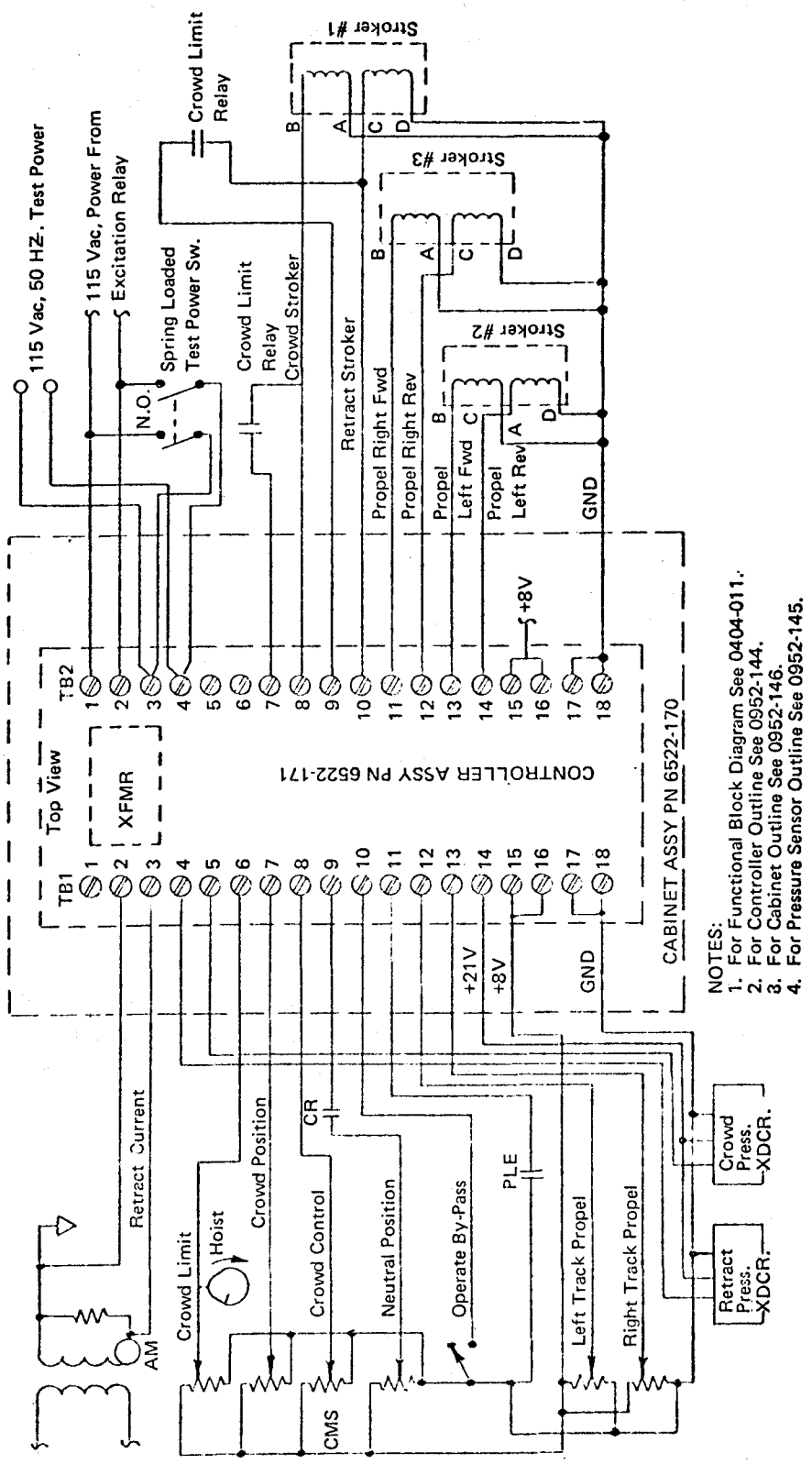


LOW TEMPERATURES –

1. Use correct SAE No. oil for temperature conditions. Change oil only when engine is warm. If an unexpected temperature drop causes an emergency, move the set to a warm location or apply heated air (never use open flame) externally until oil flows freely.

DIESEL ENGINE TROUBLESHOOTING GUIDE LIQUID OR AIR COOLED

TROUBLE / CAUSE	Compression Poor	Connecting Rod Bushings, Bearings Worn	Coolant Temperature Too High (Fresh Water System)	Coolant Temperature Too Low (Fresh Water System)	Coolant Loss (Fresh Water System)	Engine Misfire	Engine Power Low	Engine Overheat	Engine Speed Too Low	Engine Speed Too High	Fuel Consumption Excessive - Black Smokey Exhaust	Fuel Consumption Excessive	Fuel Knocks	Governor Control Loss	Hunting	Injection Pump Timing Incorrect	Mechanical Knocks	Oil Consumption Excessive - Light Blue Smokey Exhaust	Oil Consumption Excessive - No Smoke Increase	Oil Diluted	Oil Pressure High	Oil Pressure Low	Piston, Cylinder and Ring Wear	Starter Speed Slow	Starter Motor Does Not Turn	Starting Hard, or Failure to Start	Sensitivity Poor	Valve Breakage	Valve Burning	Valve Sticking
STARTING SYSTEM																													
Discharged or Defective Battery																								•	•				
Defective Glow Plug or Lead						•				•	•														•				
Load Connected When Starting																									•				
Defective Solenoid																						•	•		•				
Defective Starter																						•	•		•				
Defective Control Circuit																									•				
FUEL SYSTEM																													
Defective Fuel System						•	•			•	•			•											•				
Air in Fuel System						•	•			•	•		•												•				
Incorrect Timing						•	•			•	•					•									•				
Restricted Air Intake - Dirty Air Filter						•	•			•	•											•			•				•
Poor Quality Fuel						•	•			•	•	•													•				
Dirty Fuel Filters						•	•				•														•				
Out of Fuel or Shut Off Closed																									•				
Worn or Damaged Transfer Pump, Leaking Diaphragm										•							•								•				
Faulty Injection Pump, Nozzles or Gaskets						•	•			•	•	•					•								•				
Fuel Line Leaks						•	•			•				•											•				
Wrong Timing Button in Injection Pump							•									•													
Wrong Thickness Pump Mounting Gaskets							•									•													
Run For Long Periods of Time at NO LOAD	•						•										•												
LUBRICATION SYSTEM																													
Low Oil Supply		•	•													•				•	•								
Defective Oil Gauge																				•									
Excess Oil in Crankcase																	•			•									
Oil Leaks From Engine Base or Connections																		•											
Light or Diluted Crankcase Oil		•														•	•				•	•							
Leaky Oil Seals																		•											
Improper Lubrication		•	•														•				•	•							•
Faulty Oil By-Pass																				•	•								
Worn Oil Pump		•																		•									
Heavy Oil or Clogged Passages		•																		•									
Dirty Oil Filter		•																											•
GOVERNOR SYSTEM																													
Loose or Disconnected Linkage						•		•	•					•	•									•					
Binding Linkage						•		•	•					•	•									•					
Excessive Wear in Linkage								•	•						•									•					
Incorrect Governor Adjustment								•	•						•									•					
High Spring Sensitivity															•														
Incorrectly Installed Governor Yoke or Cup								•							•														
Overloaded Generator		•						•	•	•																			
COOLING SYSTEM																													
Insufficient Coolant			•				•																						
Faulty Thermostat			•	•		•		•																					
Worn Water Pump or Defective Seals			•		•			•																					
Water Passages Restricted			•					•																					
Blown Head Gasket	•		•		•	•											•												
Overheating																	•	•		•	•						•	•	
Restricted or Too Long Water Lines								•																					
Defective Expansion Tank Pressure Cap			•		•																								
Dirt on Cooling Fins (Air Cooled)								•																					
Inadequate Air Circulation (Air Cooled)								•																					
INTERNAL ENGINE																													
Poor Compression			•						•	•						•								•					
Loose Piston																•					•								
Loose Connecting Rod or Crankshaft Bearing																•					•								
Incorrect Valve Clearance	•		•	•					•							•								•		•	•	•	
Broken or Weak Valve Spring	•		•	•												•										•	•	•	
High Exhaust Back Pressure				•																						•	•		
Valves Not Seating Properly	•		•	•					•	•	•													•					
Worn Bearings																•				•		•							
Worn Cylinder Walls, Pistons, Rings	•		•	•					•								•			•									
Sticking Valves	•		•	•					•								•												
Worn or Dirty Valve Guides																											•		•


115 Vac, 50 HZ. Test Power
115 Vac, Power From Excitation Relay
Crowd Limit Relay
Stroker #1
Stroker #3
Stroker #2
Spring Loaded Test Power Sw.
N.O.
Crowd Limit Relay
Crowd Stroker
Retract Stroker
Propel Right Fwd
Propel Right Rev
Propel Left Fwd
Propel Left Rev
GND
+8V
TB2
TB1
Top View
XFMR
CONTROLLER ASSY PN 6522-171
CABINET ASSY PN 6522-170
+21V
+8V
GND
Retract Current
AM
Crowd Limit
Hoist
Crowd Position
Crowd Control
CR
CMS
Neutral Position
Operate By-Pass
PLE
Left Track Propel
Right Track Propel
Crowd Press. XDCR.
Retract Press. XDCR.
NOTES:
1. For Functional Block Diagram See 0404-011.
2. For Controller Outline See 0952-144.
3. For Cabinet Outline See 0952-146.
4. For Pressure Sensor Outline See 0952-145.

Sketch 7

TROUBLESHOOTING GUIDE (cont.)

SYMPTOM OR INDICATION	PROBABLE CAUSE	REMEDY
3.1 (cont.) Indicator lights turn on when switches are pressed, but no corresponding output on TB2-11, TB2-12 or TB2-13, TB2-14 Monitor voltage at TB1-11:		
If +12 VDC or greater	Defective Crowd/Propel	Refer to operation manual which covers manual controls
If zero VDC	Defective Propel Amplifier Module	Replace propel amplifier module
Indicator lights show correct function and output present at TB2-11, TB2-12 and TB2-13, TB2-14 (per Table 1) corresponding to lights Monitor TB1-12 and TB1-13:		
Voltages at TB1-12 and TB1-13 are not +4 VDC when controls in neutral position and voltages do not follow operation of manual controls	Defective Manual Control circuits	Refer to operation manual which covers check out of manual controls
Voltages at TB1-12 and TB1-13 are correct, no output drive on TB2-11, TB2-12 and/or TB2-13, TB2-14 when leads are reconnected to these terminals	Defective Stroker Circuitry	Refer to operation manual which covers set up and check out of stroker circuits

SECTION 6

HYDRAULICS

The **CROWD AND PROPEL HYDRAULIC SYSTEM** consists of three Main Pumps: One Auxiliary Pump, three Charge Pumps, three Transmission Valves, six Motors, six large Accumulators, three small Accumulators, two Heat Exchangers, two Crowd Cylinders, a Reservoir; plus various filters, valves, manifolds, solenoids, gauges, and controls as itemized on the pages following the reference schematic and shown by item number on the Colored Flow Schematics in the rear of this manual.

The **PITCH HYDRAULIC SYSTEM** consists of two Pitch Cylinders, one Reservoir; plus manifolds, valves, solenoids, gauges and controls as itemized on the pages following the reference schematic and shown by item number of the Colored Flow Schematics in the rear of this manual.

CHARGE PUMP CIRCUIT—Fluid flows from reservoir thru a gate valve (item 177); then filter (item 45) then check valves (item 254) to the inlet of each Charge Pump, mounted on the Main Pump (items 2). The Charge Pump provides fluid flow thru the transmission for cooling; pressured fluid supply to maintain a positive pressure on the low pressure side of the Main Pump circuit; provides adequate pressurized fluid for control usage and makes up internal leakage losses. A safety limit switch assures the gate valve (item 177) is open before system can be energized.

MAIN PUMP CIRCUIT—Charge Pump fluid is directed to low pressure side of Main Pump by means of one of two check valves. The second check valve is held closed by high pressure fluid on the high pressure side of the main circuit.

Main circuit fluid flows in a continuous closed loop. Fluid quantity is determined by displacement while flow direction is determined by swashplate angle either side of neutral.

A Hydrostatic Transmission Valve Assembly, (item 26) an itegral part of pump circuitry, includes essential elements to provide proper operation of main circuit. This valve contains two pilot operated high pressure relief valves (integral part of item 26) that serve to prevent sustained abnormal pressure surges in either of the two main hydraulic lines by dumping fluid from the high pressure line to the low pressure line during rapid acceleration, abrupt braking, sudden load application or dead heading.

SHUT-OFF VALVE (item 160-152) functions to allow flow or completely shut off flow. Purpose of this valve in system is to vent/open Relief Valve (item 40) allowing Accumulator System drain-off; BOTH Crowd Cylinders and Accumulators. This lowers dipper to the ground in event of breakdown.

PILOT OPERATED CHECK VALVE (item 101) functions to allow free flow from B to A after pilot operation. Purpose of this valve in system; with system in Retract Mode and retract pressure GREATER than Counterbalance pressure – the spool in valve (item 101) pushes the poppet valve open allowing flow from B to A at this time. Flow from the retract line flows thru the in line Check Valve (item 192); then thru the pressure compensated Fixed Flow Control (item 200) entering the Counterbalance system at the same time an equal amount of fluid leaves Chamber C of the Crowd Cylinders flowing thru item 200 and item 101 and back to the Reservoir.

Item 192, item 101, and two items 200 make up the Automatic Fill System; thus making sure the Counterbalance pressure always exists. Both items 200 are pressure compensated Flow Control Valves that maintain a controlled flow, unaffected by changes in system pressure. Flow rate is factory set at 4 gpm on each valve.

HYDRAULIC AUTO-BLEED (item 108) removes trapped air from system, when hydraulic fluid reaches the valve spool it will shift under hydraulic pressure thus closing the valve.

DIRECTIONAL, SOLENOID OPERATED VALVES (items 116) shuts off all flow (de-energized) except when "Whole" Recirculation System is selected, then valves are energized allowing flow thru Crowd Cylinder Chambers A and B and thru Main Pumps 2 and 3 back to the Reservoir.

POPPET RELIEF VALVE (item 40) (special) Function–Acts as relief valve when NOT vented; acts as two way directional valve when vented.

Purpose in System: When not in Retract or Extend–Valve is not vented (refer to item 152) the spool is in the closed position blocking flow from Chamber C Crowd Cylinder at this time Chamber C Pressure is on both sides of spool (refer to Propel Mode) if pressure exceeds 3000 psi small relief valve will open thus opening large spool and allow fluid to return to accumulators. Thus valve acts as relief valve protecting Chamber C from pressures in excess of 3000 psi. When in Retract or Extend, valve is vented allowing flow between Crowd Cylinders and Accumulator.

AMOT THERMOSTATIC CONTROL VALVE (item 67) up to 105 degrees F., this valve diverts flow around Heat Exchanger. Over 105 degrees F. the flow is thru Heat Exchanger.

If solenoid valve (item 345) checks operable, the next check requires disconnecting the Upper case drain on hydraulic motors (one at a time). Perform this check with a person stroking pump to slowly build pressure and insure ONLY 2 gpm discharge exists from the Upper case drain. Excess fluid flow OVER 2 gpm indicates hydraulic motor affected. Remedy is to replace motor.

If motor(s) check operable, then check the relief valves (3000 psi) and replace the faulty relief valves.

PROBLEM: COUNTER-BALANCE DOES NOT OPERATE.

Presume nitrogen accumulator properly charged (minimum 1350).

INDICATED BY: Inability to read pressure on gauge (item 279).

REMEDY PROCEDURE:

Check BOTH items 160 closed/shut-off.
Check item 108 in line from counter-balance port C closed/shut-off.
Check relief valve in items 40 closed/shut-off.
Check relief valve in item 168 closed shut-off.
Check item 101 to insure "no flow" from Port A. Disconnect line here to check flow.

Possibly the internal packing in the crowd cylinder is damaged. Check this by stroking main pump and reading pressure on gauge (item 279).

Also flow may be blocked from accumulators to crowd cylinders. Item 40 NOT opening. Normally BOTH pressure gauges (items 279) should read same pressure in Crowd Mode. If not, check item 152 functioning properly.

Spool in item 40 requires over 300 psi to function properly.

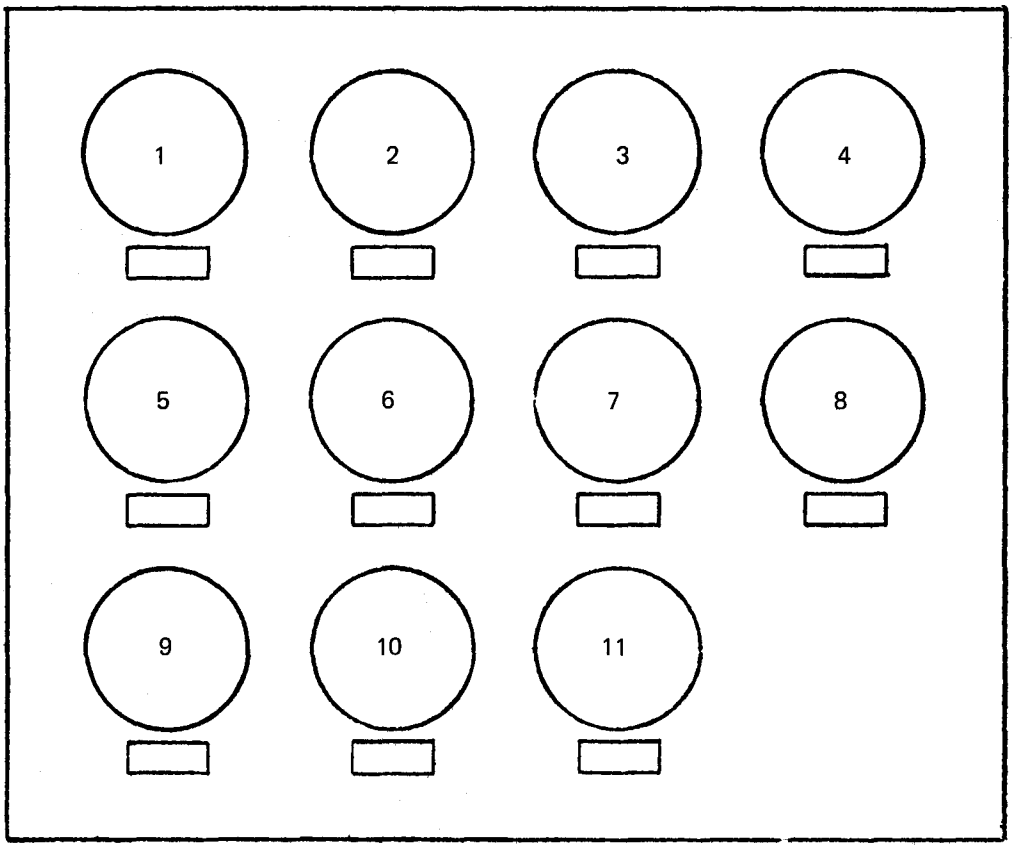
PROBLEM: RECIRCULATION SYSTEM PRESSURE GAUGES READS LOW.

INDICATED BY: Audible alarm and light indicator in cab warns that filter (item 237) is plugged in this system.

REMEDY PROCEDURE: Check to see if the solenoid operated valve (item 209) is stuck. Manually operate this valve to determine severity of this fault. Solenoid maybe weak; but if spool can't be moved manually, replace the valve.

The **10 MICRON FILTER** (item 28) cleans fluid flow from Reservoir to system and fluid added to system.

CHECK VALVE (item 12) creates a 20 psi back-pressure on flow returning from Operator Control Valve (item 62) and forces part of flow thru filter (item 28). This check valve also prevents fluid from leaving the Reservoir when Gate Valves (items 21 and 24) are closed.



1 – No. 1 Pump Pressure
2 – No. 2 Pump Pressure
3 – No. 3 Pump Pressure
4 – Counterbalance Pressure
5 – No. 1 Charge Pressure
6 – No. 2 Charge Pressure
7 – No. 3 Charge Pressure
8 – Accumulator Pressure
9 – Pitch Ram Pressure
10 – Pitch Tank Pressure
11 – Circulating Pump

HYDRAULIC GAUGE PANEL

Servo motors and valves, safety circuits and high reliability circuits have still higher needs. Usually oil in Class 4 is needed here and dirt of only 2.5 grams per barrel contaminates at Class 4.

Removing all contaminant certainly would maximize contaminant related reliability. Under normal operating conditions this is impractical, but under closely controlled conditions it proves very worthwhile.

Filters with a low micron rating have a short life and a small amount of dirt expires them. Replacement costs of these elements may rise into hundreds of dollars, hence no realistic solution to the typical problem.

The filter objective is to clear dirty fluids to a realistic level where components operate reliably. No sensible reason to "over-clean" a fluid exists, it merely costs more for nothing.

Contamination (dirt) is stopped in the filter by the filter media. With this continual process, an increased pressure drop across the filter occurs due to dirt build up in the media. A wide variety of filter medias exist in major use today. Two general categories to know are the depth media and surface media types. No exact "line of separation" exists as to where a depth filter and surface filter begins and ends.

Media refers to the actual material(s) (wire screen, paper, etc.) used to catch the dirt. This material, usually formed into a filter element, is placed into a filter housing.

Depth filter types force fluids to pass thru quite a media thickness in layers. This traps dirt in passages within the media and on the media surface.

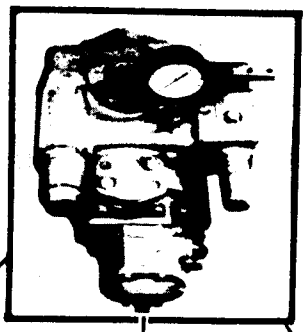
Paper is widely used; but synthetic fiber mats, sintered metal and cylinderical wrapped also exist.

Obviously, a multitude of various sized holes exist. A pore (hole) size called the "mean flow pore size" is the average pore size. Half the flow passes thru pores of equal or smaller size while the other flow half passes thru pores larger than mean flow pore size.

Since no one consistant pore size exists in a depth filter element it is usually given a nominal rating are proportunate. This only shows that in the nominally rated (or depth filter element) the nominal rating shows in some arbitrary way to types and sizes of pores in the media, but not to the size of contaminant (dirt) trapped.

Surface elements use a single layer of filter material in construction. Dirt stops in the media surface. Woven fiber (woven wire cloth) is most common here. Weaving this material is a precise operation, hence pore size may be closely controlled.

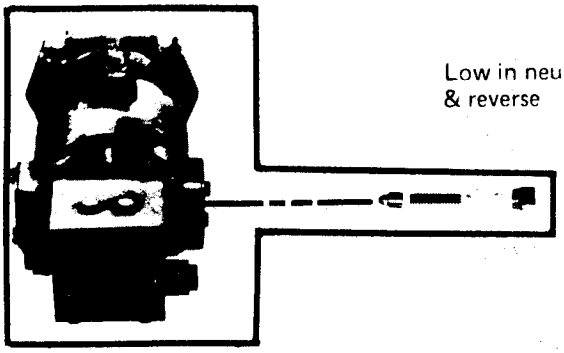
CHECK CHARGE PRESSURE



Neutral:
350
Forward & Reverse
330

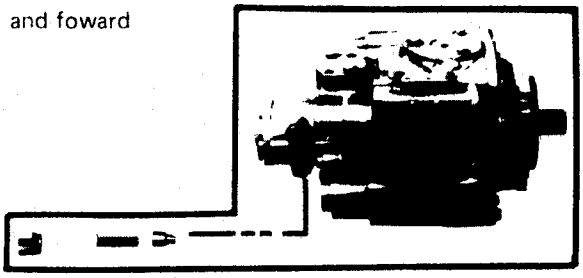
Low in foward & reverse
(OK in neutral)

Inspect charge relief
valve @ motor



Low in neutral
(Low or okay in foward
& reverse)

Inspect charge relief
valve @ pump

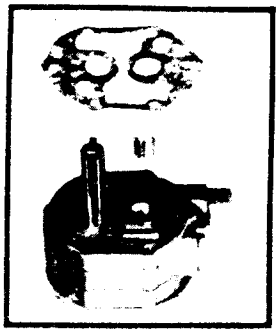


Low in neutral and foward
& reverse

Inspect charge pump

Inspect for foreign material
holding poppet open, galling
or wear on poppet & seat,
broken spring or improper
setting.

Inspect for foreign material
holding poppet open, galling
or wear on poppet & seat,
broken spring or improper
setting.



Shaft & internal gears
must turn smoothly.

Further disassembly of
charge pump is not
recommended.

REPLACEMENT OF CHARGE PUMP

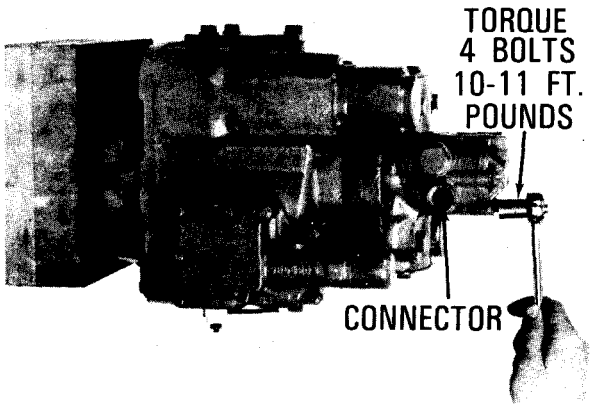


FIG. G

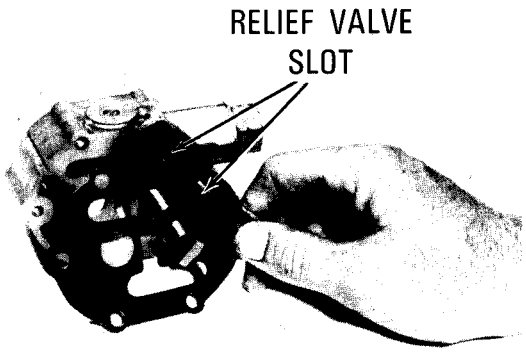


FIG. H

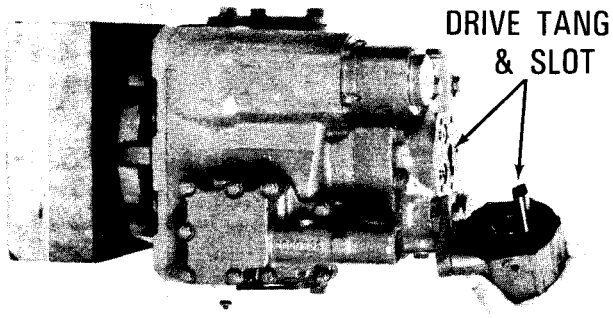


FIG. I

A. REMOVAL

1. Remove the line connecting charge pump to reservoir and plug with clean plastic plug to prevent draining of reservoir.

2. Remove the four (4) capscrews.

NOTE: *Do not remove the capscrew at the top and bottom of the charge pump, as these hold the charge pump together. See Figure G.*

3. Pull charge pump away from main pump.

NOTE: *Do not use sharp tools to pry charge pump from main pump. A scratch on the sealing surface may cause a leak. If charge pump does not pull loose, tap lightly on side of charge pump with plastic hammer to break paint or gasket seal.*

B. INSTALLATION

1. Install a new gasket. Make sure the new gasket is properly installed. See Figure H. If positioned wrong the relief valve port is covered by the gasket.

2. Line up the drive tang on charge pump shaft with slot in main pump shaft. See Figure I. The charge pump should assemble freely with main pump freely. Do not force charge pump into position.

3. Torque the four (4) mounting bolts to 10-11 ft. lbs.

Cleanliness is important. Keep all parts very clean before reassembly. Wash all metallic parts with kerosene (parafin) and oil. Avoid use of cleaning materials likely to leave lint or other impurities on motor.

MOTOR ASSEMBLY begins with bearing refit on motor. Heat bearing cones in clean oil at 160 degrees C. for 10 minutes. Then drop squarely on appropriate journal of cold crankshaft. Ensure cone is fully home by immediately tapping it with tubular drift.

Press rear bearing cup in squarely from valve end of motor case to a position .300 inch below surface.

If motor has no shim plate, press front bearing cup fully home into bearing plate. Fit neoprene plugs and just snug these up with screws. Smear screws with loctite. Fill recess between lips of shaft seal with grease and lightly coat the O.D. with loctite hydraulic seal. Press seal into bearing plate.

If motor has shim plate, press front bearing cup into front cover until it protrudes about 3 inches from front of front cover.

ASSEMBLING VALVE TO MOTOR–

If new plastic valve seal rings are supplied, scarf cutting as shown in sketch 2 is needed. Insert metal rings into bore to check gap before fitting to valve. Fit rings to valve, ensuring the small notches in seal grooves are clean.

Insert valve, using a ring compressor if metal rings are fitted, into housing with a smooth movement. Check the valve free to rotate with not over 60 inch pounds to turn.

Ensure the 2 sealing screws in place and tighten before fitting end cap with its O-ring to valve housing end. Tighten end cap screws.

Grease O-ring(s), then fit to valve housing in proper position, i.e. with correct drain-port arrangement. Tighten hold down screws with a torque wrench.

Recommended Tightening Torques:

Inch	Foot/Pounds
5/16 UNF	15- 20
3/8 UNF	35- 40
1/2 UNF	75- 80
5/8 UNF	150-180
3/4 UNF Mounting Bolts	250-260

into bushing locating pin (19). While holding cap screw with 3/16 inch Allen wrench, turn nut against pin extractor with 9/16 inch open end wrench to force screw upward and free bushing locating pin from body (19). Remove screw from bushing locating pin.

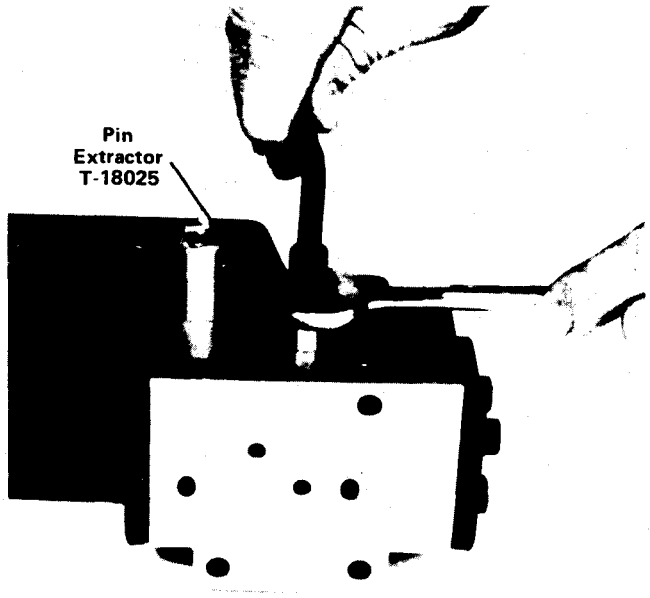


Photo 1

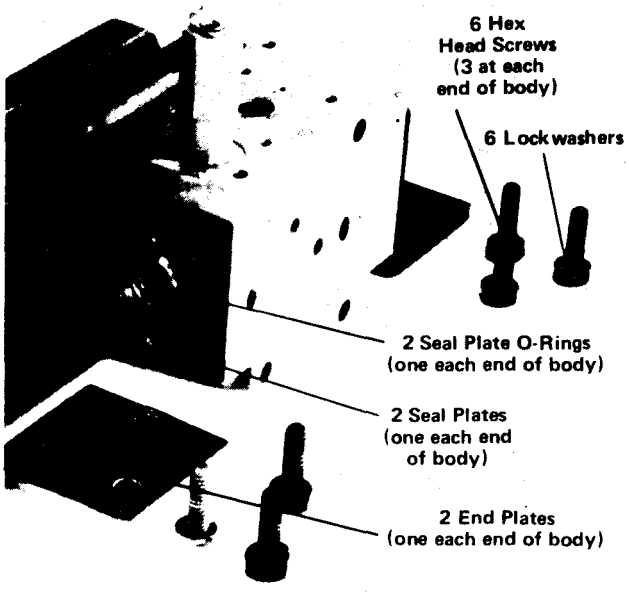
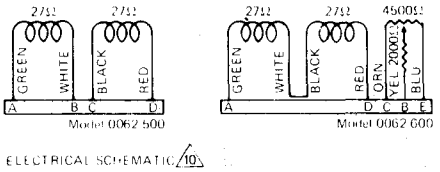


Photo 2

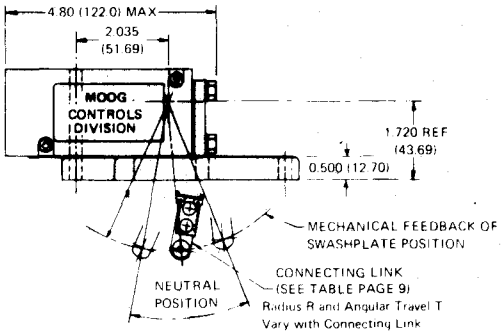
Using 3/16 inch Allen wrench, remove six hex head screws (20) and lockwashers (21). Remove end plates (22).

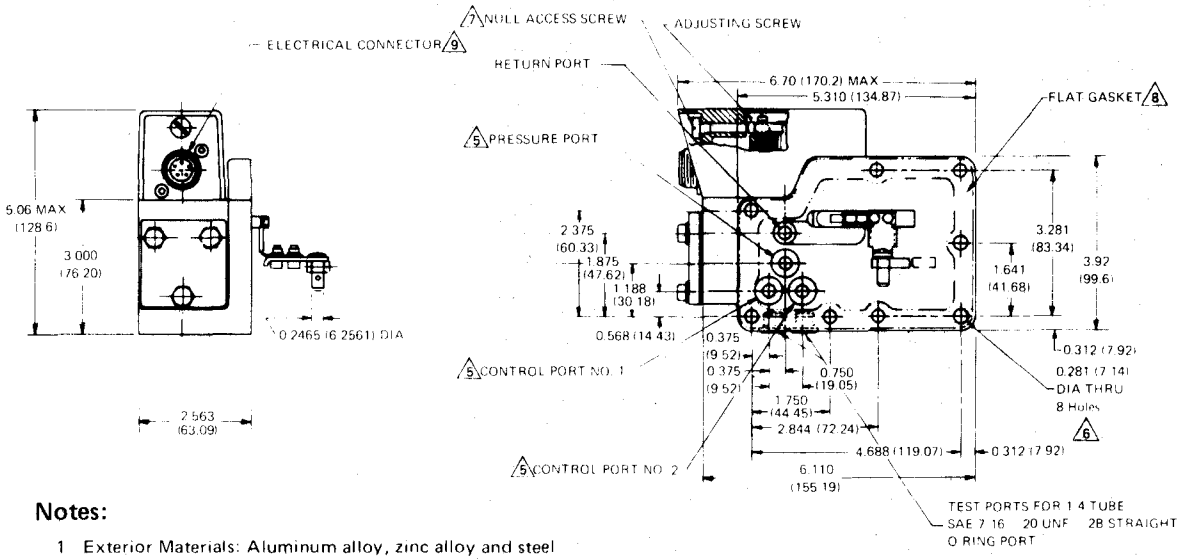
Remove seal plates (23) and o-rings (24).

Insert blade screw driver edge under lip of inlet orifice assemblies (26) and associate o-rings (27) from body (31). Unless new, discard inlet orifice assemblies and replace each time they are removed.



ELECTRICAL SCHEMATIC 10





Notes:

1 Exterior Materials: Aluminum alloy, zinc alloy and steel

2 Recommended fluids: Petroleum base. Supply filtration 10μ or better required.

3 Surface to which controller is mounted requires 125 finish and must be flat within 0.003 (0.08) t.i.r.

4 Ports are 0.365 (9.27) nominal diameter, counterbored 0.625 (15.88) OD x 0.040 (1.02) deep

5 Recommended seals: Buna N (90 durometer) O-rings 0.070 (0.18) section x 0.489 (12.42) ID

6 Mounting bolts: (3) ¼ x 20 x 3.00 and (5) ¼ x 20 x 1.00. Torque to 100-120 in. lbs. (11-13 Newton-meters)

7 Null adjustment: Remove access screw; use 9/64 hex socket wrench; 62-500: increase flow out port No. 2 with clockwise rotation; ±2-1/2 turns max. For 62-600 *counterclockwise* rotation will increase flow out port No. 2

8 Flat Gasket

9 Mating Electrical Connector (environmental capability)

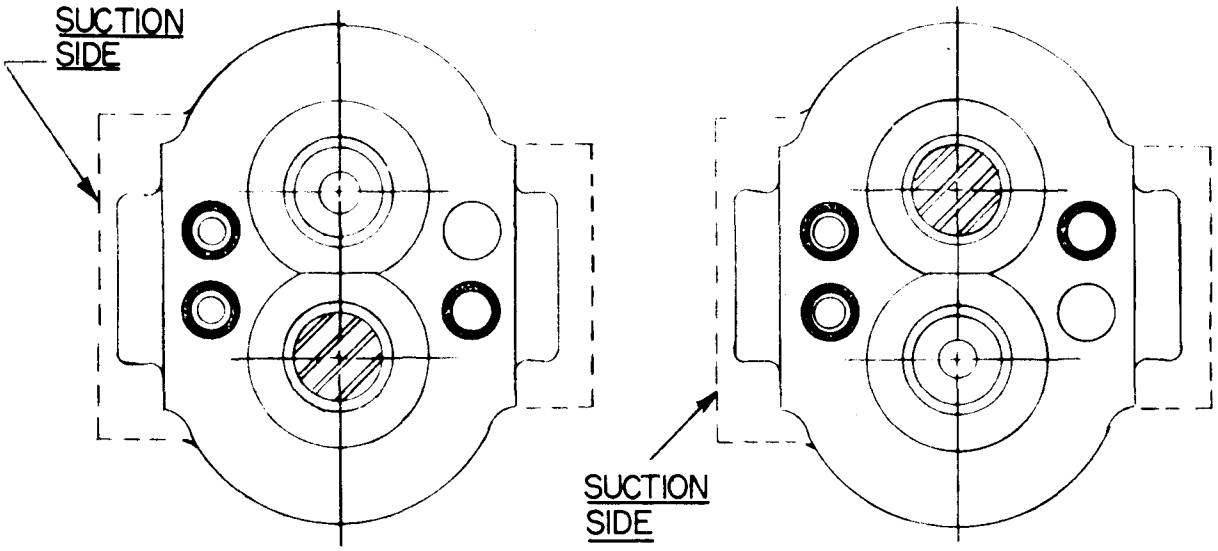
(a) Model 62-500, 62-501, 62-502, 62-504
(b) Model 62-600, 62-601

10 Electrical Polarity; increase flow out port No. 2 with:

Model 62-500, 62-501, 62-502, 62-504
(a) Series coils: B & C tied; A+, D-
(b) Parallel coils: A & C, B & D tied; A+, D -

Model 62-600, 62-601
Internally tied series coils; A+, D--

Dimensions in parentheses are in millimeters



"A" ROTATION "C" ROTATION

UNI-DIRECTIONAL ONLY

Sketch 2

11. Apply new, clean oil generously to gear and journal faces. Place flat of remaining two bushings together with pin in place and slide gently in place over shafts. (Photo 21)

12. Place small o-rings into recesses. (Photo 22)

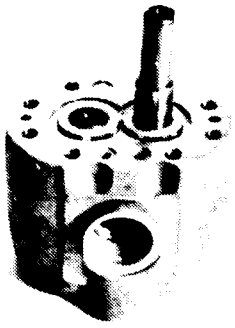


Photo 21

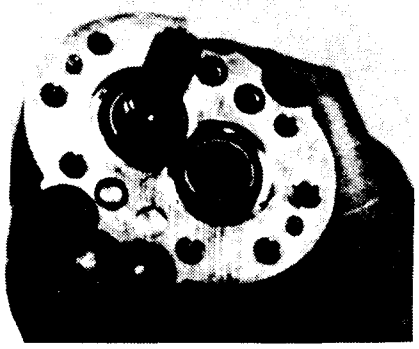


Photo 22

the fouled condition, operator must hold in the excitation on push button while moving hoist command lever forward to wind rope out to point where foul clears.

NOTE: Should warning persist with foul cleared, check limit switch operation/adjustment beneath hoist drum.

The **HYDRAULIC WARNING LIGHT PANEL** in right front corner of cab contains the following from top to bottom:

When hydraulic problem arises, the light indicates the problem area and an alarm sounds.

LOW OIL LIGHT (34) indicates the crowd/propel reservoir oil supply below the safe level and M-G set shuts down in 20 seconds.

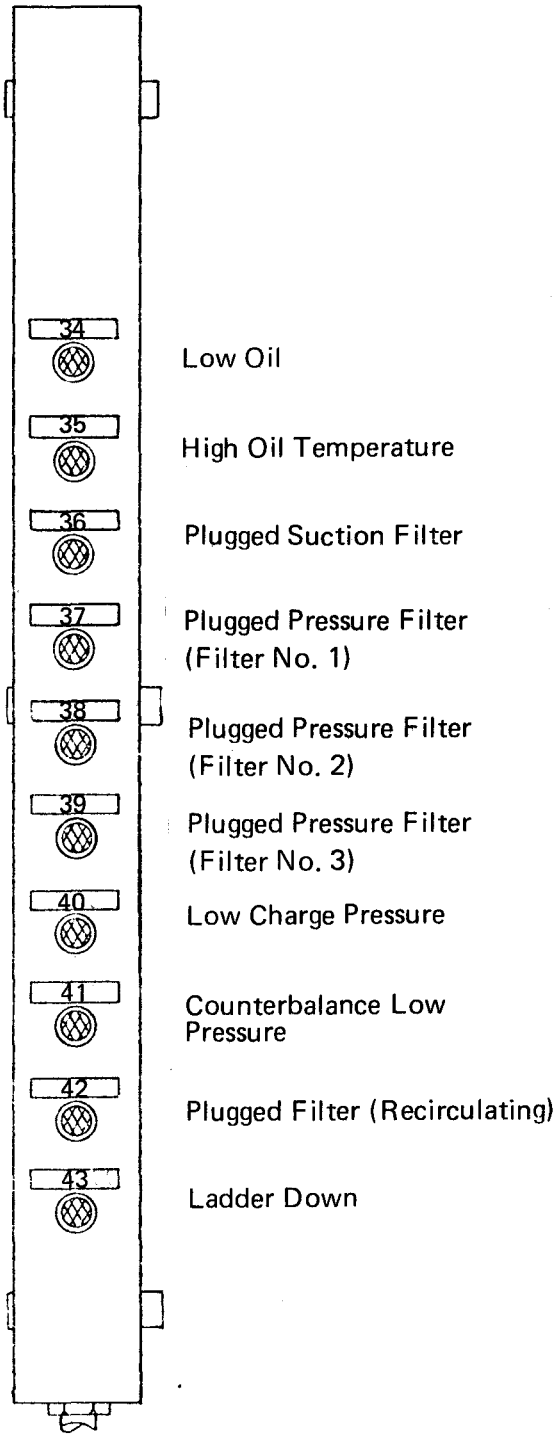
Quickly cease machine operation, place dipper on grade and refill Reservoir to point in operational level.

HIGH OIL TEMPERATURE LIGHT (35) indicates hydraulic fluid temperature above safe operational limits in the crowd/propel reservoir and M-G set shuts down in 20 seconds.

Quickly cease machine operation, place dipper on grade and check for heat exchanger or temperature circuit malfunction while waiting for fluid to cool.

PLUGGED FILTER (SUCTION) LIGHT (36) indicates flow thru main pumps suction filter below adequate gpm.

Quickly cease operation and change filter element.



HYDRAULIC WARNING LIGHTS

MOTOR-GENERATOR SET START-UP–

CROWD/PROPEL RESERVOIR 4 inch Gate Valve FULLY OPEN

CROWD/PROPEL RESERVOIR heaters ON 30 minutes

CIRCULATION SYSTEM running or ON 30 minutes

NOTE: OPERATE Heaters and Circulate for 1 hour total for Cold Weather Start-Up.

MOTOR-GENERATOR SET switch ON

NOTE: If SET will not run longer than 20 seconds, check Hydraulic Warning lights. Normally, M-G Set takes 3-5 seconds to reach operating speed.

CHECK HYDRAULIC COMPONENT GAUGE PANEL (near pump) for Pump Swashplate Centering.

NOTE: Follow Procedure in Hydraulic Section to fill Hydraulic System when starting SuperFront for the first time or when restarting after component replacement causing considerable fluid loss.

OPERATIONAL START-UP–

MACHINERY HOUSE–

RETRACTABLE BOARDING LADDER in UP position

D.C. MOTOR BLOWERS running

EXCITER SET running

FILTER FAN(s) running

NOTE: Fan No. 2 MUST RUN or Excitation interlocks OFF

OPERATOR'S CAB–

EXCITATION ON

CHECK GAUGES for operational pressure ranges

HOIST AND SWING brakes OFF

COMMENCE machine operation

If suitable heated warehousing is unavialable, electrical strip heaters may be used to protect some components from humidity. Use of these heaters is primarily up to your judgment. The use of moisture absorbing chemicals is generally not recommended for long term storage.

ELECTRICAL EQUIPMENT—Listed below are the storage requirements of vendor supplied electrical equipment. Dust, as well as humidity, is an enemy of all electrical switch gear. Any component should be left in its sealed container until used.

STORAGE OF ROTATING EQUIPMENT—

Rotating electrical equipment that is stored will require the following minimum protection and site preparations:

The area in which the rotating electrical equipment is to be stored should be selected and prepared as follows:

The area should have adequate natural drainage.

The surface of the earth should be covered with crushed rock or washed gravel. This is to prevent growth of weeds and prevent the collection of water or moisture under and around the equipment.

The equipment should be placed on supports so that the equipment is 12 inches (30 cm) to 18 inches (45 cm) above the ground. This will minimize the pickup of moisture from the ground.

Each of the units is furnished with 480-volt electric heaters. When a unit is in storage, the heaters should be energized to maintain the equipment a few degrees above ambient to prevent dew from condensing. Weekly inspection is required to be sure that the electric heaters are energized.

The shipping container should provide mechanical and weather protection.

The mechanical protection should be such as to prevent the entrance of rodents.

SuperFront

OLO312 CABLE REEL

8 KV AIR 1.9" Ø CABLE

ITEM	NO. USED	SIZE	PART NAME
7	2	4"	Reel Brgs.
9	1	80B18	Sprocket
10	1	#80	Chain
11	1	80A32	Plate Sprocket
12	1	80A40	Plate Sprocket
13	1	#80	Chain
14	1	Angle	MTD Chain Tensioner Assembly
15	1	80B39	Sprocket
16	1	2:1	Right Angle Reducer
17	1	80B11	Sprocket
18	1	#80	Chain
19	1	Flange	MTD Chain Tensioner Assembly
20	1	80B30	Sprocket
21	1	–	Drive ADJ Plate
22	1	100B12	Sprocket
23	1	#100	Chain
24	1	100B12	Sprocket
25	1	–	Idler Bolt
26	1	–	End ADJ Plate
27	1	–	Drive Link Assembly
29	4	3-1/4" Ø	Support Rollers
30	2	2-15/16" Ø	Alignment Rollers
41	1	8 KV	Collector Ring Assembly
45	1	MA3B	Air Motor
46	1	–	CPLG
47	1	203D24	Reducer
48	1	10" Ø	Disc Brake
49	1	P20-DA	Caliper
50	1	50 PSI	Relief Valve

PRESSURE SWITCH

A pneumatically operated electric switch for starting and stopping the electric motor at predetermined minimum and maximum air pressures. (See Figure 4).

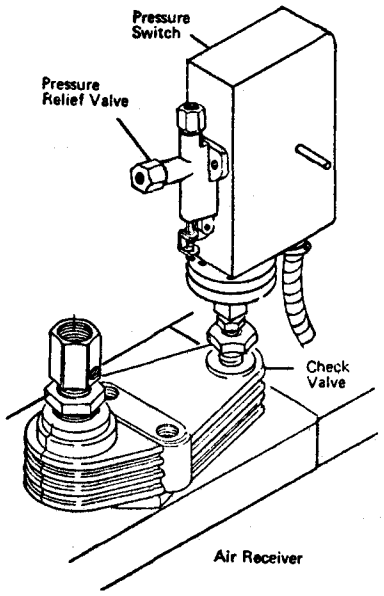


Figure 4

When maximum pressure in the air receiver is reached, air pressure on a diaphragm actuates a switch, breaking the circuit and stopping the motor. When pressure drops to a minimum setting, the circuit is closed again, the motor starts and operates the compressor until maximum pressure is reached.

PRESSURE RELEASE VALVE

The pressure release valve is attached to the side of the pressure switch. The valve's function is to release air from the compressor head, thus, preventing the motor from starting against a load.

When the motor stops, air can be heard to bleed from the valve. But, when the motor and compressor are operating no air should be leaking from the release valve.

A release valve serves the same function as a (CPR) but is equipped on outfits operating at lower air pressure.

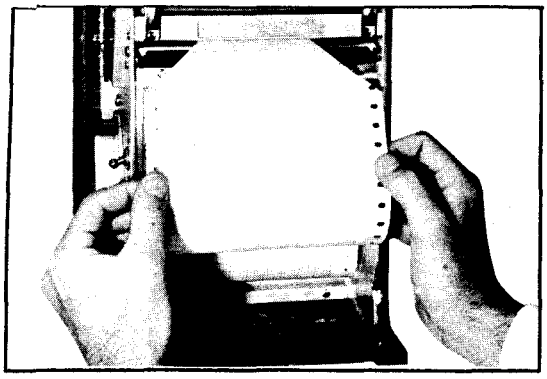


Photo 4

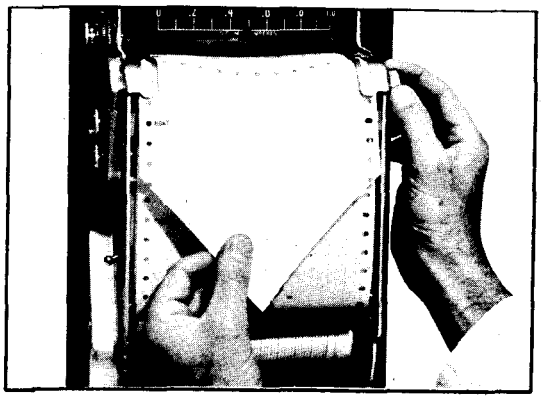


Photo 5

Snap reroll roller in place (gear end to left) and insert V end of chart into roller slot as shown in Photo 6. Turn reroll roller back 1/4 turn (window blind action). Advance set knob while permitting chart to reroll.

It may be necessary to momentarily energize an electric drive before reroll takes up the chart. Make sure chart is STRAIGHT and TAUT. You're ready for operation.

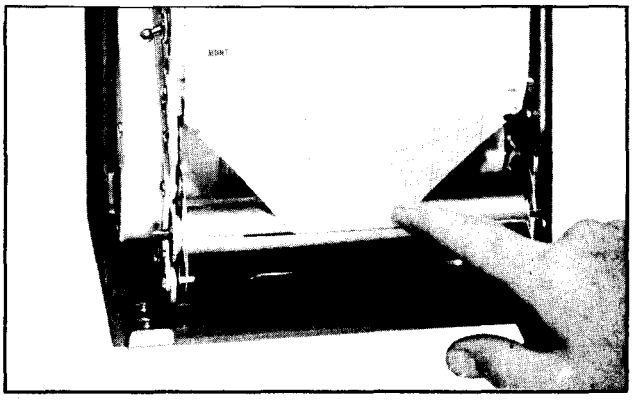


Photo 6

A chart portion may be unwound from reroll for inspection by pulling straight out on chart paper. To stop reroll action and examine chart at leisure, release chart suddenly after pulling a desired length from reroll. This locks reroll roller in position. Rewind chart by pulling it forward slightly and then letting it wind slowly back onto the reroll.

NOTE: To insure accurate recording, always check that chart paper is straight on reroll.

Instead of rerolling chart in a conventional manner, provisions may be made for feeding used chart out the bottom. To do this, remove rubber strip (or section of gasket) at case cover lower edge. Weight chart end hanging out of case; a two-ounce clamp-on device works. Do not pull or jerk on chart end as this throws it out of time or disengages chart from roller pins.

CHART REMOVAL of an entire rerolled chart, PUSH DOWN one reroll latch and PULL chart roll FORWARD and OUT of instrument. Remove the chart paper from reroll roller by holding disk at gear end of roller, pulling out plug from opposite end, and sliding chart from tube. If chart is wound tightly, twist roller counterclockwise while withdrawn from chart.

ESCAPEMENT REMOVES without major chart drive disassembly. First, FOLLOW INSTRUCTIONS under Unwinding Springs. Next, REMOVE CONTROL LEVER and three screws holding escapement to left sideplate of drive. The escapement is accurately positioned by two dowell projections on plate. This insures correct gear mesh which drives escapement with pinion in escapement. Grasp right escapement plate with a pair of flat-nosed pliers and CAREFULLY pull off the dowels.

CAUTION: ALWAYS unwind reroll spring BEFORE attempting to remove escapement.

To regulate CHART TIMING for hour-feed timing, MOVE regulator lever EITHER UP to make drive run faster, OR DOWN to run slower. Regulator lever is visible through front instruction plate slot. A movement of one division on regulator scale affects timing approximately four minutes a day. The regulation of chart speed on minute feeds is accomplished by turning a small screw location above control lever on escapement. Direction to turn for a faster or slower adjustment is shown by the arrows. THIS ADJUSTMENT IS VERY SENSITIVE. Turn screw slightly, permit mechanism to reach full speed, and note effect on chart speed by using a timepiece and measuring how much chart is fed during a given peiod.

MOTOR-WOUND SPRING—Power to wind mainspring of this drive is supplied by an internal induction motor. Another identical motor rerolls used record chart as required. BOTH motors are energized periodically by means of a cam-operated switch. At any standard hour feed, the motor-wound spring drive operates for five hours without electrical power.

NOTE: Should actuation of cam-operated switch result in undersirable electrical interference; correct a .25 mfd @ 600 V capacitor in parallel with a 2000 ohm, 10-watt resistor across the switch terminals.

Before undertaking ANY repair work on this chart drive, completely unwind springs. Failure to unwind springs releases power suddenly and damages chart drive. To unwind mainspring, FIRST TURN OFF power supply switch, THEN REMOVE instruction plate from drive front. Next, find the copper colored detend located below power switch on the inside of right sideplate. Push in on tail of this detent and allow spring to unwind until gearing stops turning. This spring unwinds rather slowly, so ALLOW enough time to COMPLETELY unwind.

UNWIND reroll storage spring before removing the reroll train. Let reroll roller turn slowly in hand until spring runs down completely.

Escapements used in motor-wound chart drives are similar to those used in hand-wound chart drives.

CAUTION: DO NOT rest assembly on zero adjustment rod, and NEVER REMOVE armature from magnet structure unless means are available to recharge the magnet-armature assembly and recalibrate instrument.

PEN TIP REPLACEMENT for the pen element is a push fit into pen tube end. Extra pen points have a sizing wire furnished for use when the new point fits loosely into pen element tube. To use this wire, insert into pen element tube and squeeze tube about 1/16 inch from end with narrow flat-nosed pliers. Remove sizing wire and insert tip of pen point's long end into tube.

Place a drop of lacquer on pen point body and then push/twist into tube until distance from knife-edge pivot to writing point is 4-3/8". The lacquer seals point into tube. Position point so it rests perpendicular to chart when pen element installs in recorder.

Use the simplified TROUBLESHOOTING GUIDE to correct minor measuring-system troubles that occur in the field. The guide describes the most common troubles, lists the most frequent causes, and suggests the most likely remedy procedures.

If trouble is indicated in the electrical measuring system, isolate the fault to one electrical module or component—such as a transformer, rectifier network, internal amplifier, or movement armature. Voltage and current measurements, continuity checks, and DC resistance measurements may be necessary to pin-point the trouble.

CAUTION: ALWAYS REMOVE POWER FROM INSTRUMENT BEFORE MAKING DC CONTINUITY CHECKS OR RESISTANCE MEASUREMENTS.

Check the power supply and signal circuits of the amplifier using conventional troubleshooting techniques.

If trouble traces to a defective movement, measure circuit resistance; also examine leads and springs while carefully turning armature. If internal armature leads are burned off or control springs are physically damaged, return instrument for factory service.

CAUTION: DO NOT REMOVE armature from magnet structure UNLESS means are available to recharge and recalibrate instrument.

If adequate repair facilities are not available, contact the nearest field representative for instructions.

REPLACEMENT PARTS—When ordering parts, always give descriptions, part numbers and instrument serial number.

ITEM	NO. USED	PART NAME
177	1	Gate Valve, cast steel, Fig. 1503N size 4 inch flanged end, 150 pound rising stem—POWELL.
184	1	Hydraulic Constant Volume Priority Divider with 3/4 NPTF ports, Model No. B-50 Brand—SCOTT EQUIPMENT CO.
192	9	Check Valve In Line, 3/8 NPTF, Model No. C-600-S-10—P&H MANATROL.
200	7	Pressure Compensated, fixed flow control, Model No. PCK-600-S-40—P&H MANATROL.
209	1	Directional Valve, solenoid controlled, pilot operated No. 66556-06-115V-50 Hz-50—RIVETT.
217	1	Subplate, PS016-3/4—RIVETT.
223	1	Pilot Relief Valve, Model No. R.P.-1200-S-2—P&H MANATROL.
230	1	Check Valve, in line, 3/4 NPTF, Model No. C-1200-S-10—P&H MANATROL.
237	1	Filter; 3 micron with st. thd. ports and electric dirt alarm (K3 element), Model No. LF-20-1K3-M-S-MS—SCHROEDER.
246	3	Hydraulic Accumulator, 5 U.S. gallon capacity with adaptor No. 1631-572087, Model No. A7J1155A1—PARKER.
254	3	Check Valve, No. 583-1-1/2 D-2—REPUBLIC.
260	3	Pressure Switch (close at 130 psi falling), ACW-2—SQUARE D.
272	3	Shuttle Valve, Model No. 449B-2PPP—CIRCLE SEAL.
279	5	Noshok guage, type 223-4 inch with Narrow Bezel and V-clamps, O-5000 psi—O.W. HEYMANN CO.
288	4	Noshok Guage, type 223-4 inch with Narrow Bezel and V-clamps, O-1000 psi—O.W. HEYMANN CO.
297	2	Heat Exchanger with 5 hp-440 Volt-3 phase 50 cycle, totally enclosed fan motor, Model No. OCS-1000 D—YOUNG RADIATOR.
309	1	Four Way Pressure Compensated Flow Control Valve, Model No. DCF16-TM30-4-L-S—BRAND HYDRAULICS INC.
320	3	Quick Disconnect Coupler, nose only, 1 inch NPSF, No. S-902—BRUNING CO.
332	1	High Pressure Hydraulic Switch, type ACW-10 (close at 1200 psi falling)—SQUARE D.
339	1	Solenoid Valve, normally open, Model No. 3-022-6-115V Hz—FLUID POWER SYSTEM.
345	2	Solenoid Valve, normally closed, Model No. 3-C5-6-115V-50 Hz—FLUID POWER SYSTEM.
352	1	Filter, Model TF-1-1A3-M-S-D—SCHROEDER.

ITEM	NO. USED	PART NAME
177	1	Gate Valve, cast steel, Fig. 1503N size 4 inch flanged end, 150 pound rising stem—POWELL.
184	1	Hydraulic Constant Volume Priority Divider with 3/4 NPTF ports, Model No. B-50 Brand—SCOTT EQUIPMENT CO.
192	9	Check Valve In Line, 3/8 NPTF, Model No. C-600-S-10—P&H MANATROL.
200	7	Pressure Compensated, fixed flow control, Model No. PCK-600-S-40—P&H MANATROL.
209	1	Directional Valve, solenoid controlled, pilot operated No. 66556-06-115V-50 Hz-50—RIVETT.
217	1	Subplate, PS016-3/4—RIVETT.
223	1	Pilot Relief Valve, Model No. R.P.-1200-S-2—P&H MANATROL.
230	1	Check Valve, in line, 3/4 NPTF, Model No. C-1200-S-10—P&H MANATROL.
237	1	Filter; 3 micron with st. thd. ports and electric dirt alarm (K3 element), Model No. LF-20-1K3-M-S-MS—SCHROEDER.
246	3	Hydraulic Accumulator, 5 U.S. gallon capacity with adaptor No. 1631-572087, Model No. A7J1155A1—PARKER.
254	3	Check Valve, No. 583-1-1/2 D-2—REPUBLIC.
260	3	Pressure Switch (close at 130 psi falling), ACW-2—SQUARE D.
272	3	Shuttle Valve, Model No. 449B-2PPP—CIRCLE SEAL.
279	5	Noshok guage, type 223-4 inch with Narrow Bezel and V-clamps, O-5000 psi—O.W. HEYMANN CO.
288	4	Noshok Guage, type 223-4 inch with Narrow Bezel and V-clamps, O-1000 psi—O.W. HEYMANN CO.
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ITEM	NO. USED	PART NAME
177	1	Gate Valve, cast steel, Fig. 1503N size 4 inch flanged end, 150 pound rising stem—POWELL.
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192	9	Check Valve In Line, 3/8 NPTF, Model No. C-600-S-10—P&H MANATROL.
200	7	Pressure Compensated, fixed flow control, Model No. PCK-600-S-40—P&H MANATROL.
209	1	Directional Valve, solenoid controlled, pilot operated No. 66556-06-115V-50 Hz-50—RIVETT.
217	1	Subplate, PS016-3/4—RIVETT.
223	1	Pilot Relief Valve, Model No. R.P.-1200-S-2—P&H MANATROL.
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237	1	Filter; 3 micron with st. thd. ports and electric dirt alarm (K3 element), Model No. LF-20-1K3-M-S-MS—SCHROEDER.
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254	3	Check Valve, No. 583-1-1/2 D-2—REPUBLIC.
260	3	Pressure Switch (close at 130 psi falling), ACW-2—SQUARE D.
272	3	Shuttle Valve, Model No. 449B-2PPP—CIRCLE SEAL.
279	5	Noshok guage, type 223-4 inch with Narrow Bezel and V-clamps, O-5000 psi—O.W. HEYMANN CO.
288	4	Noshok Guage, type 223-4 inch with Narrow Bezel and V-clamps, O-1000 psi—O.W. HEYMANN CO.
297	2	Heat Exchanger with 5 hp-440 Volt-3 phase 50 cycle, totally enclosed fan motor, Model No. OCS-1000 D—YOUNG RADIATOR.
309	1	Four Way Pressure Compensated Flow Control Valve, Model No. DCF16-TM30-4-L-S—BRAND HYDRAULICS INC.
320	3	Quick Disconnect Coupler, nose only, 1 inch NPSF, No. S-902—BRUNING CO.
332	1	High Pressure Hydraulic Switch, type ACW-10 (close at 1200 psi falling)—SQUARE D.
339	1	Solenoid Valve, normally open, Model No. 3-022-6-115V Hz—FLUID POWER SYSTEM.
345	2	Solenoid Valve, normally closed, Model No. 3-C5-6-115V-50 Hz—FLUID POWER SYSTEM.
352	1	Filter, Model TF-1-1A3-M-S-D—SCHROEDER.

SuperFront

NOTES:

SuperFront

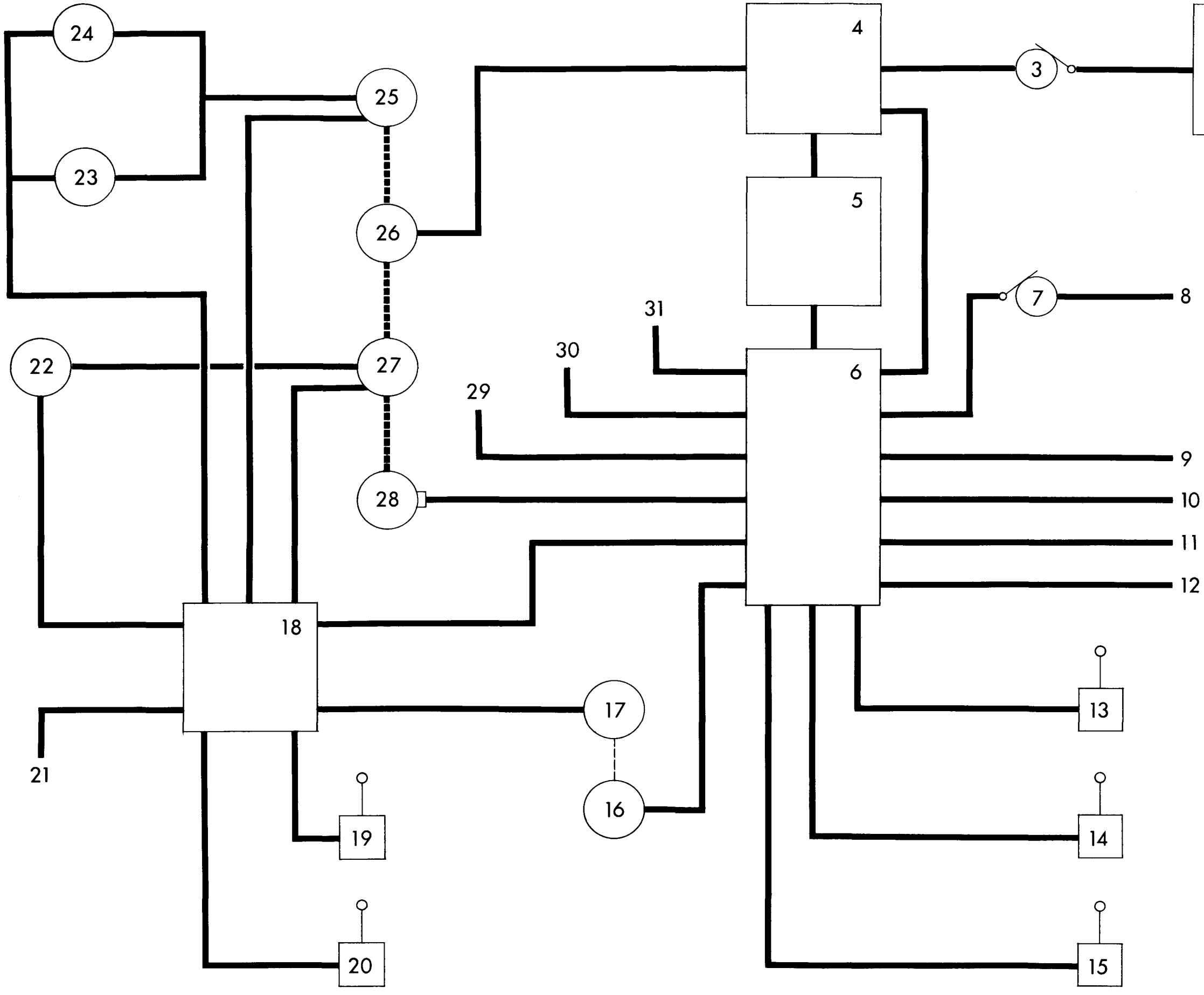
COMPRESSED AIR SYSTEM

UPPER FRAME

1 – Horn
2 – Solenoid Valve
3 – Pressure Gauge
4 – Dipper Trip
5 – Solenoid Valve
6 – Cylinder Return Regulator
7 – Pitch Control
8 – Solenoid Valve
9 – Left Swing Brake
10 – Right Swing Brake
11 – Solenoid Valve
12 – Hoist Brake
13 – Solenoid Valve
14 – Compressor Receiver
15 – De-Icer Unit
16 – Shut Off Valve
17 – Check Valve
18 – Left Crowd Support Cylinder
19 – Right Crowd Support Cylinder
20 – Roto Seal

LOWER FRAME

21 – Auxiliary Receiver
22 – Cable Reel Motor
23 – Solenoid Valve
24 – Left Dig Lock Cylinder
25 – Right Dig Lock Cylinder
26 – Quick Release Valve
27 – Left Propel Brake
28 – Right Propel Brake
29 – Pressure Switch



ELECTRICAL SYSTEM SCHEMATIC

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