



# Technical Manual

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## SAFETY PRECAUTIONS — continued

Cranes and hoists must be of sufficient capacity to lift the heavier components (gear cases, dipper/bucket, boom, etc.) and have an ample safety margin.

Be sure heavy items are properly supported from cranes or hoists before removing supporting members from machine.

Have sufficient service personnel available when removing or installing large heavy items to maintain control at all times.

Always use safety stands in conjunction with hydraulic jacks or hoists. Do not rely on the jack or hoist to carry the load, they could fail.

Use safety catch on all hoist hooks. Do not take a chance, the load could slip off of the hook.

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

When disassembling machines, be sure to use safety stands and adequate cribbing to prevent tipping or rollover of components.

Keep work area organized and clean. Wipe up oil or spills of any kind. Keep tools and parts off of the ground. Eliminate the possibility of a fall which could result in serious injury.

Floors, walkways and stairways must be clean and dry. After draining operations be sure all spillage is cleaned up. Electrical cords and wet metal floors make a dangerous combination.

Check all wire ropes for telltale signs of early wear or failure. Look for and secure any loose bolts or locking devices.

Use extreme caution while working near any electrical lines or equipment whether it be high or low voltage. Never attempt electrical repairs unless qualified. Check limit switches for proper operation.

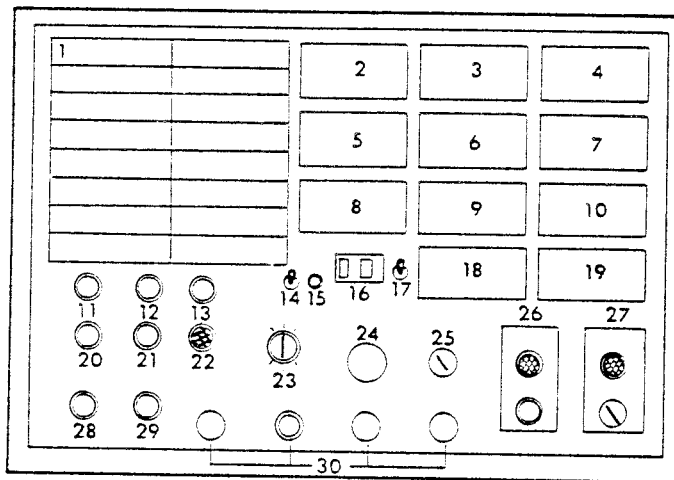
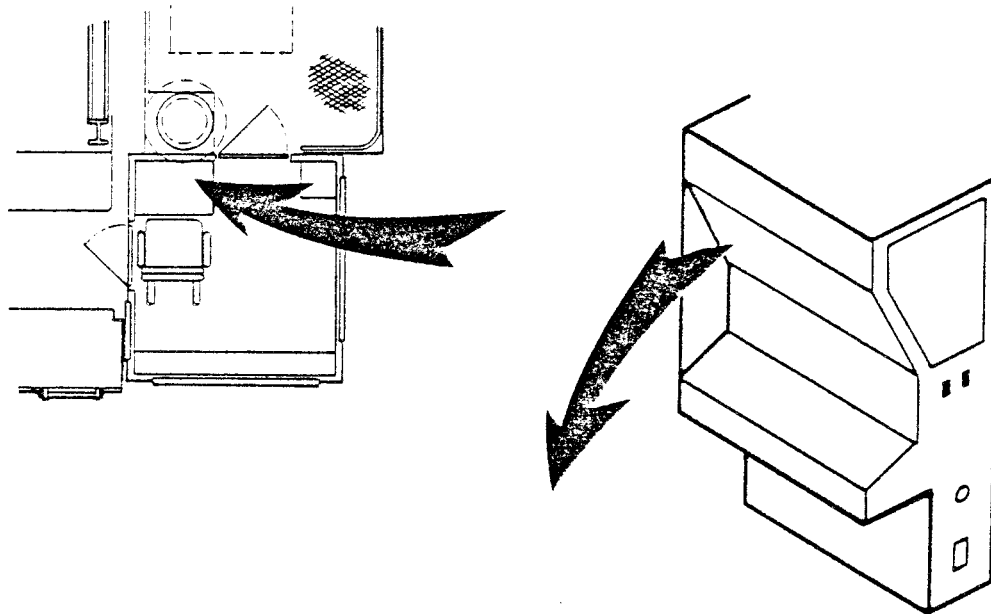
When using an acetylene torch, always wear welding goggles and gloves. Keep a "charged" fire extinguisher within reach. Be sure the acetylene and oxygen tanks are separated by a metal shield and are chained to the cart. Do not weld or heat areas near transformers or electrical cabinets and utilize proper shielding around lubrication lines.

Use pullers to remove bearings, bushings, gears, cylinder sleeves, etc. when

DRILLING CONTROL STATION, located at left front corner of operator's cab, contains controls for drill operation. Following number list identifies items on panel, for easy location on sketch provided.



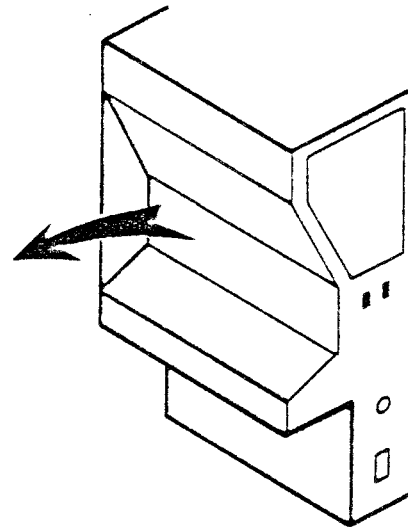
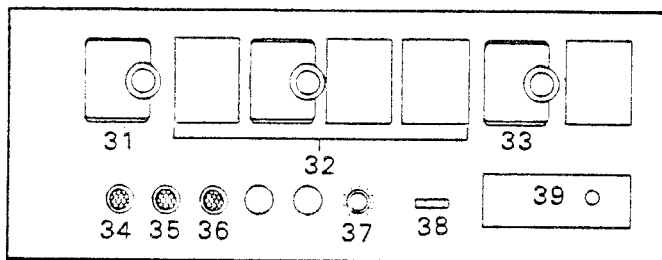
**CAUTION:** Understand operating procedures, sequences, and controls before operating this machine.



UPPER INCLINED PANEL ASS'Y.



**CAUTION:** DO NOT OPEN top or side doors of Drilling Control station unless qualified to work on automatic drill control (ADC).



### VERTICAL PANEL ASS'Y.

31. WINCH — This control lever operates winch located on front of drill table. Wire rope line from winch is reeved to top of mast and then back to drill table. Move lever up to raise hook or down to lower it.
32. STEM RK. — This control lever operates stem rack for handling drill stem. Move lever down to lower rack into position over deck bushing or up to raise rack into storage position. This control is used in conjunction with Stem Release push-button (item 30) to makeup or disassemble drill stem assembly. One center stem rack is standard equipment; right hand, left hand, and fourth stem racks are optional.
33. BRK. OUT TONGS — This control lever operates hydraulic cylinder mounted on left rear leveling jack housing (or on left rear mast structure, if machine has optional feature of angle drilling) and is used in conjunction with pipe tong to break thread engagement between drill string components. Move lever down to extend cylinder or up to retract it.



**CAUTION:** Keep this hydraulic cylinder secured in its stored position when not in use.

34. HYDRAULIC FILTERS - NO. 1 PUMP — A red light for indicating status of main hydraulic system in-line filter that is located below Pump No. 1 in hydraulic room. When this light is lit, filter is clogged. Replace filter element.

NOTE: for items 34, 35, and 36: These warning lights may come on at initial hydraulic system start-up because of cold fluid in system. If any light remains lit after operating period of 30 minutes, or one sufficient to let fluid warmup, then replace filter element in filter(s) indicated.

63. HOUSE FILTER FAN — Start and stop pushbuttons that control operation of machinery house air filter system.
64. HYDRAULIC PUMP — Start and stop pushbuttons that control A.C. motor which drives both main and auxiliary hydraulic systems pumps. Start pushbutton is illuminated type which contains green light. When starting pumps, depress and hold this pushbutton until green light lights.

NOTE: Hydraulic pumps can not be started unless Hoist/Pulldown control lever (item 50) is in its neutral position and Drill/Standby/Propel selector switch (item 23) is set at standby.

65. MAIN AIR COMP. — Start and stop pushbuttons that control A.C. motor which drives main air compressor. Start pushbutton is illuminated type which contains green light. When starting compressor, depress and hold this pushbutton until green light lights.
66. EMERGENCY STOP — This pushbutton shutdown hydraulic systems, main air compressor, and rotary drive in mast when depressed. All brakes set also. Diesel engines on drills so equipped will continue to run.



**CAUTION:** To avoid damage to hydraulic system components, add only filtered hydraulic fluid to main and auxiliary system tanks.

Close doors to machinery house and operator's cab before leaving machine.

Leave electrical power supply to machine on for operating lights and heaters, especially in cold weather.

If machine is to be shutdown for period longer than one month, then special storage measures should be taken. Contact our Service Department for information about long term storage.

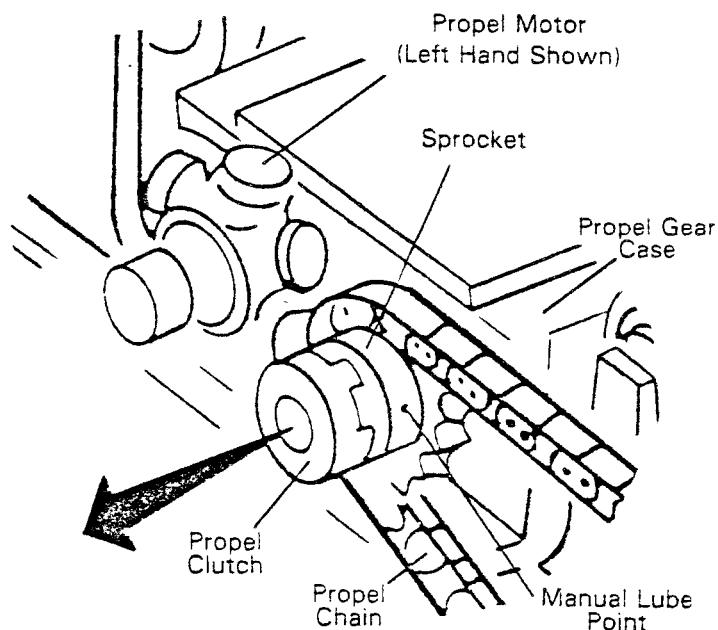
**PROPEL MACHINE** — For short move ups or moves on level ground, the independent propel system can be controlled from the propel control station or the handheld joystick (optional) at ground level. For this type of move the mast can remain in the raised and locked position.

For long travel over rough terrain, ramping slopes, or towing, the mast must be lowered.

Some checks to be made before any propelling (towing) operation are: 1) the drill bit is above ground; 2) leveling jacks are retracted; 3) winch line secure; and, 4) trail cable is NOT in line of travel.

**TOWING** - After lowering mast and retracting leveling jacks, shut down machine completely. Trail cable should be disconnected for long tows.

Pull the jaw clutch retaining pin on output shaft of each propel gear case. Pull clutch, turn 180 degrees and replace on shaft. Replace retaining pin and cotter. Crawler belts are now free to rotate on crawlers. Manually lube sprockets bushings.



To aid in towing, MARION offers an optional tow bar that is constructed of heavy structural steel members. It is recommended a tow bar of this type be used.

**ASSEMBLY OF DRILL STRING** — A normal drill string, starting at the drill bit and progressing to the rotary gear case assembly in the mast, consists of the following components:

1. drill bit
2. bit stabilizer
3. drill stem - one or more as desired; the number limited by the capacity of the machine
4. cross over sub - permanently attached to adapter.
5. adapter - part of output shaft in rotary gear case
6. drill bushing - a loose piece that seats in drill table opening.

The drill string should only be assembled after the mast is in its raised position and the machine is leveled for drilling. The drill bit and stabilizer are easiest to install when the mast is vertical. The drill stems required should already be stored in their stem racks. Refer to **LOADING AND REMOVING DRILL STEMS** in this section of manual for procedure. Making up or disassembling drill string should be done with drill control in **AUTOMATIC** mode and **OIL PRES. LIMIT** set at 30 because this provides for more precise control in the lower operating range of the hydraulic system which allows the rotary gear case to be moved in the mast a very minute amount.



**CAUTION:** Do not move the **MODE** toggle switch when the main hydraulic pumps are stroked. Always have the **Hoist/Pulldown** control lever in **NEUTRAL** (centered) position before making a drill control mode change.

Stem Rotation pistol grip switch should be set at **OFF**. **Hoist/Pulldown** control lever should be in **NEUTRAL**. Place the drill **MODE** toggle switch in the **AUTOMATIC** position. Now move the **Drill/Standby/Propel** selector switch to the **DRILL** position.



**WARNING:** Shut off the **STEM AIR** when working on the drill string assembly or disassembly. If left on, the air stream can create flying projectiles which might result in bodily injury to personnel.

Raise the rotary gear case into the mast high enough so it is clear of the stem rack operating area. Return the **Hoist/Pulldown** control lever to its neutral position and move the **Drill/Standby/Propel** selector switch to **STANDBY**.

The winch line should be reeved from the drum up over the front sheave on top of the mast, around the rear sheave on top of the mast, and then down to the drill table for handling drill string components from this point on.

mast. The rotary gear case remains seated against its lower stops at the drill table, where it was located for lowering the mast. Move the Drill/Standby/Propel selector switch to STANDBY.

Sling and lift the drill stem so it is horizontal. Maneuver the stem into the mast structure for placement into the center stem rack.



**CAUTION:** Do not swing stem over Operator's Cab. Work stem from the ground into the mast from the left side of the machine.

When the stem is in position in the mast for placing it into the center stem rack, then depress and hold the Stem Release button to open the upper stem latch. Place the stem into the upper stem holder and then push it into the stem pot. The stem pot will probably have to be rotated slightly on its suspension to align it with the stem. When the stem passes the proximity switch in the stem pot, the upper stem latch closes, locking the stem in place. This latch will also close if the Stem Release button is released.

Remove the lifting equipment from the drill stem.



**CAUTION:** Be careful when climbing and working about the mast structure and machine.

If more than one drill stem is to be loaded, then repeat this procedure, using the mobile lifting equipment to place each successive stem into one of the empty stem racks until all the stems desired are loaded. After the drill stems are loaded into the stem racks, reassemble the safety cable across the rear span of the upper middle portion of the mast.

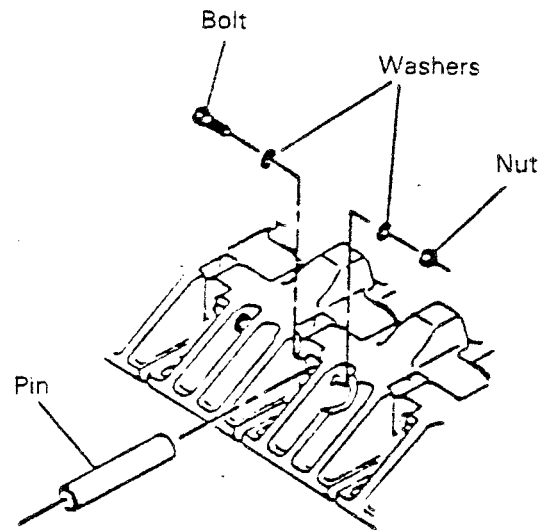
REMOVING a drill stem from the stem rack with the mast in its lowered position and placing it on the ground is the reverse procedure to that for loading it. Always work safely and use the proper tools.

**DRILLING OPERATION** can be controlled either "automatically" or manually. Automatic Drill Control (ADC) does not exclude the operator from participation. The ADC "automatically" limits the drill string downfeed rate within guidelines based on the perceived bit load induced by the rotary and pulldown drives. However controlled, the drilling performance is dependent upon operator skill and experience. The ADC is a valuable tool that allows the operator to more easily obtain maximum machine utilization with minimum machine abuse. The drill should normally be operated with its control in the AUTOMATIC mode.

**CRAWLER TRACKS** on each side frame consists of forty (40) separate shoes. The shoes interconnect with two, hardened steel pins, each locked in place by a bolt thru the shoe web. Every third shoe is a cleated type.

Periodically check shoe pin(s) lock bolts. Replace missing bolts at once. Propelling without lock bolts causes the shoe pins to work out and separates the track.

**ADJUST TRACK** tension by moving the front roller assembly forward to tighten or to rear to loosen.



**SHOE ASSEMBLY**

The crawler belt is in proper adjustment when the bottom of track is straight and tight, with six to eight inches of sag in top strand between front roller and center support roller. A crawler belt too tight causes loss of power. A loose crawler track results in serious damage as it may climb the drive sprocket.

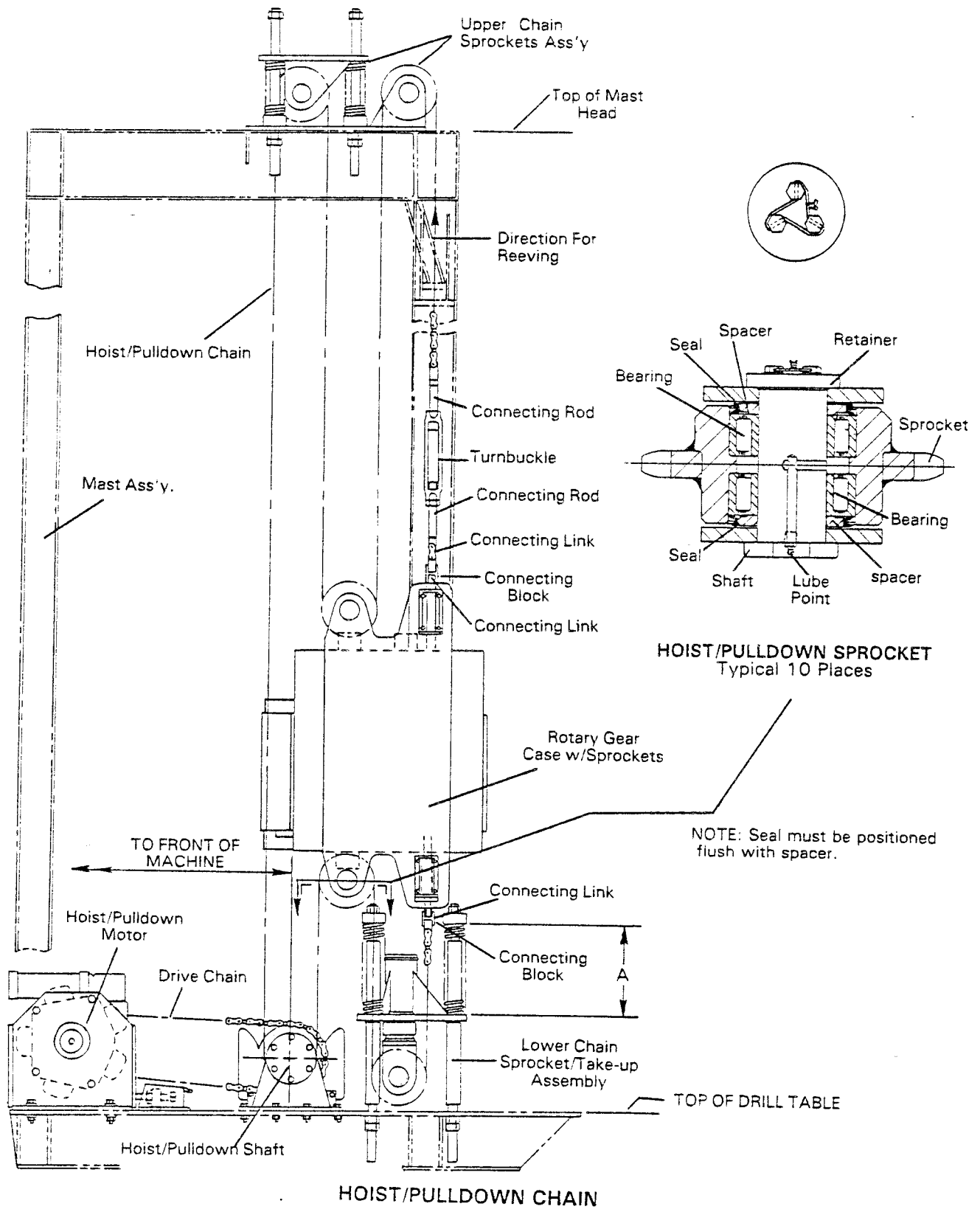
The front roller mounts in two adjusting bearing blocks fitted into rectangular openings at each side of the crawler side frame. Two shoulder pins install thru the adjusting blocks and roller shaft and extend thru rear wall of openings. These pins lock roller shaft in place and facilitate moving assembly for adjustment.

Two (2) hydraulic jacks are required to make the crawler track adjustment.

Remove the cover plate from each side of crawler side frame. Place hydraulic jacks, one at each side, in space behind front roller adjusting block and against shoulder pin. Operate jack enough to release shims and remove ALL shims. Now blocks freely move forward or rearward.

**IMPORTANT:** Move adjusting blocks on each end of roller shaft at SAME time and SAME amount to keep roller shaft at right angles to crawler side frame.

Move adjusting block (front roller assembly) forward by operating hydraulic jacks. If weight of tracks will not move roller assembly to rear when jacks are retracted; carefully propel machine back and forth until block releases.



The latch will AUTOMATICALLY close when the drill stem passes the proximity switch in the pot, when lowering it into the lower stem holder or pot. The latch also closes when the stem release button is released.

A spring locked pawl inside the lower pot prevents the stem from turning when separating threads at the top of the drill stem.

**BIT POT** is used to help remove or add a drill bit to the drill string. The tool is placed in the drill table opening, after removing the drill bushing, and the bit is lowered into it.

The shape of the top plate of the bit pot conforms to the shape of the bit to prevent the bit from rotating when it is added or removed from the stem. Be sure that the bit pot seats into the locking keys on the drill table.

**WINCH** and lifting tackle is used for lifting requirements such as loading and unloading the stems into the rack(s). Another use is to support the weight of the break out tong when used. The hydraulic winch, located on the drill table, is controlled from the operator's cab. A wire rope is reeved from the winch thru two sheaves mounted on the mast head. The working end of the winch rope swivel connects to a lifting hook. When not in use, the winch line should be hooked to the lug provided on the left side of the drill table.

**HOUSE VENTILATION SYSTEM** — The machinery compartment or house is pressurized to protect machinery from dust and dirt. The operating pressure is approximately .25 to .50 inches (62 to 125 Pa) of water.

Clean air for house pressurization and sufficient air for the air compressor(s) intake and hydraulic cooler exhaust is furnished by a DynaVane fan and filter system.

The multi-blade filter fan is axially mounted on an A.C. electric motor. The self-cleaning filter is a reverse flow, vane type filter. Dust is carried away by bleed air thru the discharge tube.

The only maintenance required is disassembly and cleaning at least once a year.

When operating the machine in an extremely humid atmosphere, moisture laden dust may collect at the air cleaner impingement plate. In such humid conditions, inspect air cleaner frequently. Break out any deposits with compressed air stream, or disassemble and clean the unit. Reverse the fan motor rotation for this cleaning operation to provide an exit path for the deposits removed.

**NOTE:** Unlatch and/or open machinery house door carefully when the house is pressurized (filter system operating).



**CAUTION:** NEVER DISASSEMBLE AN ACCUMULATOR WITHOUT FIRST RELEASING GAS PRECHARGE BUT FIRST, OIL PRESSURE MUST BE REDUCED TO ZERO.

**CHARGE PRESSURE SWITCHES** activate a timing relay to provide the operator with an audible and visual alarm when the charge pressure drops below 155 psi. If the pressure drop exceeds 10 seconds, the hydraulic pump motor shuts down automatically.

**MAIN HYDRAULIC SYSTEM MANIFOLD** mounted on the deck just below the two main pumps and transmission. This manifold provides the mounting base for three, four way mode selector valves, two crossover manifold valves, two inline filters and eight test ports.

This modular concept eliminates the requirement for numerous lines and fittings.

**MODE SELECTION CIRCUIT** — The three mode selector valve spools are shifted hydraulically by four way, two position solenoid operated pilot valve, mounted on each selector valve.

The charge pump on the right hand pump supplies fluid to pilot valves to shift the mode valves when the solenoid(s) is de-energized. Shifting occurs both on energization and de-energization of the solenoid.



**WARNING:** When shifting from each mode, propel to hoist/pulldown or pull down to propel, the main pumps must be in the unstroked neutral position.

All three valves work together, the pilot valves for number 1 and number 3 are energized during propel. While the pilot valve for number 2 is energized during hoist/pulldown.

**PROPEL MODE**, Valve 1 and 3 are open thru port A to T and Port B to P; so number 1 pump drives the right hand propel motor thru port 2 and number 2 pump drives the left hand propel motor thru port 1 in reverse propel mode. Valve 3 returns the charge pressure to the main pumps. See Color Chart A.

The rotation direction and motor speed is determined by main pump stroke. Steering is accomplished by stroking each pump individually. See Color Chart B.

**HOIST/PULLDOWN MODE**, valve 1 and 3 shift so ports P and T connect and ports A and B are blocked; valve 2 shifts so port B is open to P and port A open to T. The flow from both pumps combines and is directed to the hoist/pulldown motors. The flow (hoist mode) from both pumps combines and is directed to the motors and return to valve 2 thru ports T to A to the common return line.

**COST OF HYDRAULIC FLUID** — The overall cost picture reveals that the extra cost of a premium hydraulic oil is very small when compared to the cost of downtime that will result if proper hydraulic fluids are not used and these fluids are not maintained. The wrong hydraulic fluid can result in difficulties such as:

1. Premature wear in hydraulic components.
2. Filter clogging.
3. High contaminant level in hydraulic fluid.
4. Early breakdown of the hydraulic fluid.
5. Premature failures.
6. Sticking valves.

**SPECIFICATIONS** — We recommend that the following information be made available to your petroleum supplier to assist him in selecting the proper fluid for your Marion hydrostatic drive.

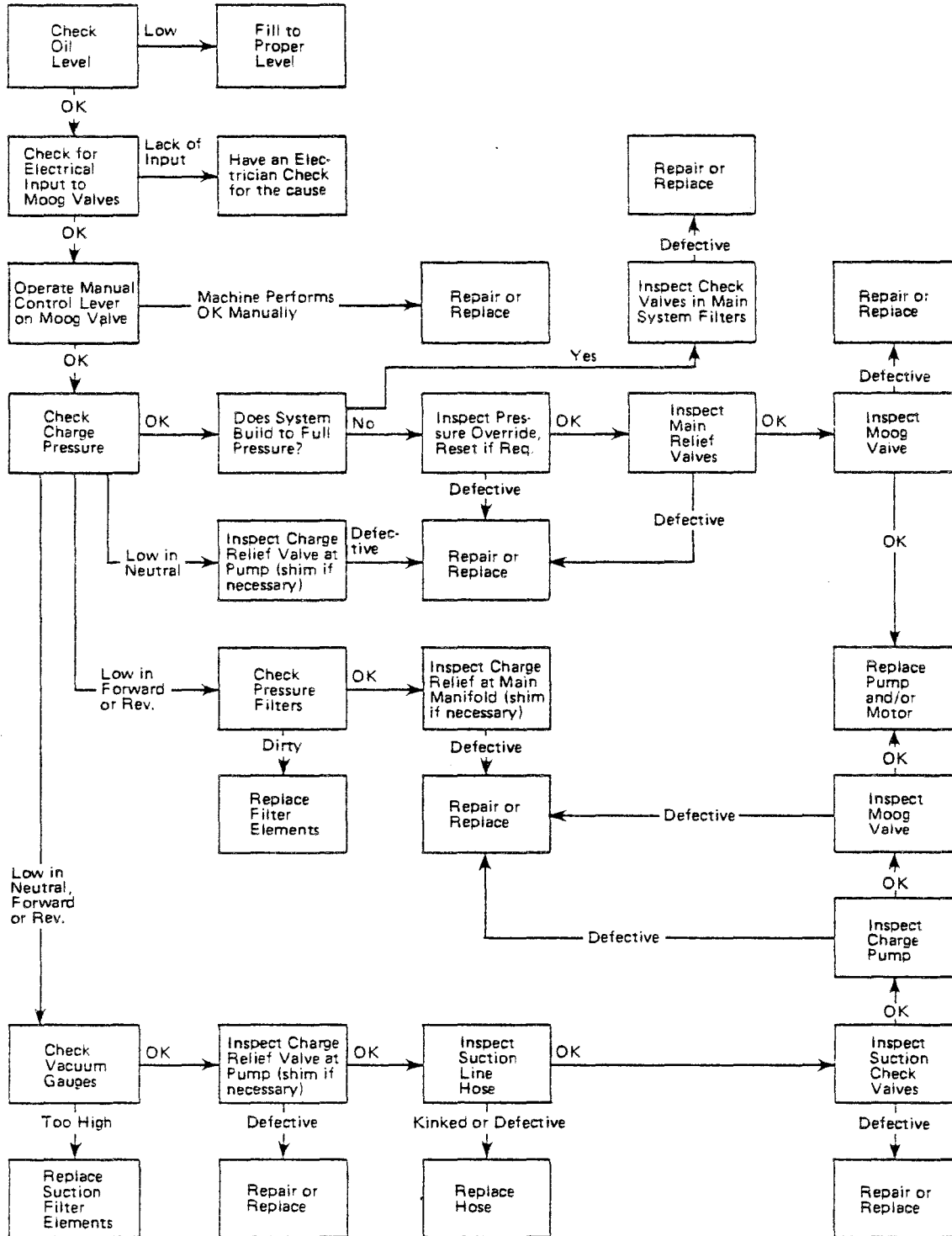
Final acceptance of all fluids supplied to this standard will be based upon satisfactory performance in the application for which it is intended, and does not relieve the hydraulic fluid supplier of responsibility for performance of brand name products.

NOTES:

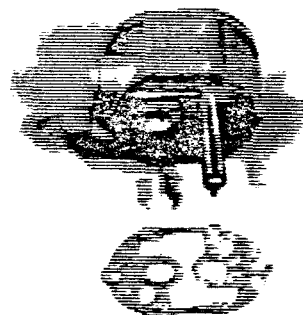
4. Mechanical damage or failure.
5. Internal or external leakage.
6. Dirt, water or sludge in the system.
7. Improper adjustment.
8. Overheating.

NOTES:

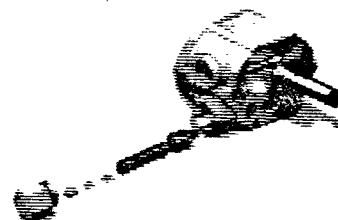
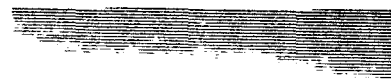
SYSTEM WILL NOT OPERATE IN EITHER DIRECTION



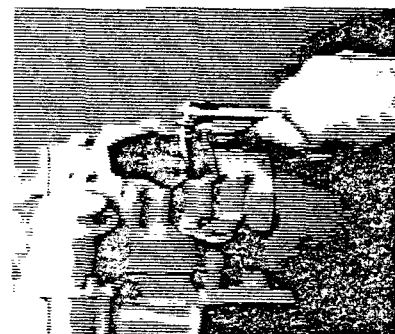
There is a gasket between the charge pump and end cap that should be replaced.



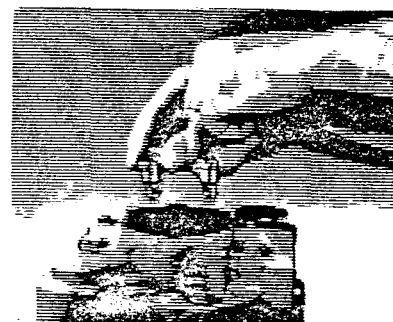
The charge relief valve can be inspected by removing the hex. plug, spring and poppet. Remove the shims from the counterbore of the hex. plug. Do not alter these shims unless new parts are used, in which case the valve must be re-shimmed to the proper setting.



The removal of the charge check valves requires the use of a drag link socket.



These check valves are cartridges and are interchangeable with each other. It is suggested that these check valves be replaced in pairs.



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All **O-RINGS** need replaced as matter of fact. If spares are not available, reuse old rings only when free of cuts or other damage and are of circular cross section. Overheating causes some section set and this is unacceptable.

**SHAFT SEAL** is generally replaced, but reuse original if seal lips are free of cuts or excessive wear and garter spring is intact. Front cover and motor case fit together with a light interference fit and running surfaces for retaining rings must be smooth. Motor face mounting case fret marks are caused by incorrect fitting on installation or loose mounting bolts. This causes front cover screw failure.

Check **RETAINING RINGS** smooth and free from metallic particles.

**SOCKET CAP SCREWS** holding front cover to motor case are fitted with locking nylon insert and show some resistance to turning during assembly, otherwise replace. If any one of a set of screws holding front cover, cylinder head or valve housing is broken, replace all screws in that component. Never assemble motor and run with screws missing or loose.

Check **OLDHAM COUPLING** for wear on tongues to allow no more than plus/minus one degree relative movement between valve and crankshaft.

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.

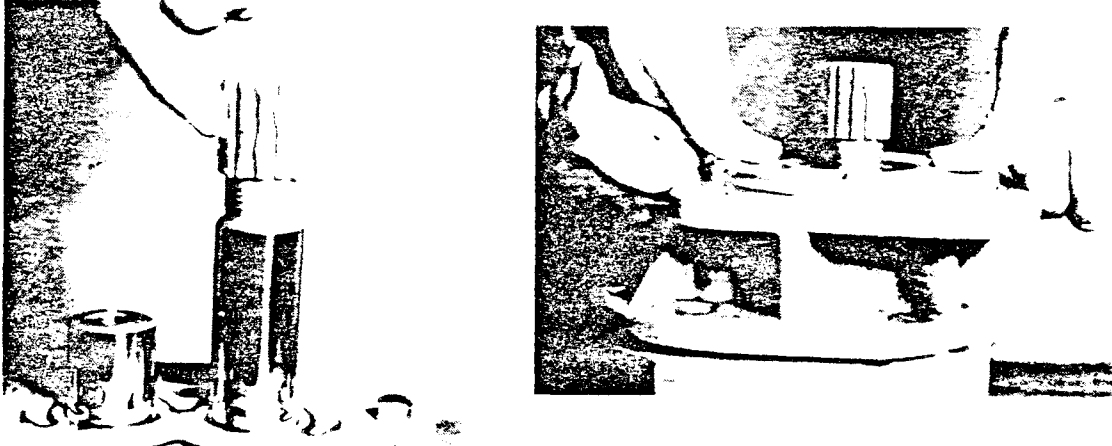
**MOTOR ASSEMBLY** begins with bearing refit on motor. Heat bearing cones in clean oil at 160 degrees C. for 10 minutes. Then drop squarely on appropriate journal of cold crankshaft. Ensure cone is fully home by immediately tapping it with tubular drift.

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 three inches from front of front cover.

26. If drive shaft extension is splined, coat splines with clean, heavy grease. If drive shaft extension has a keyway, use tape or thin shim material to protect lips of the seals as flange plate slides down shaft. See Fig. 18.

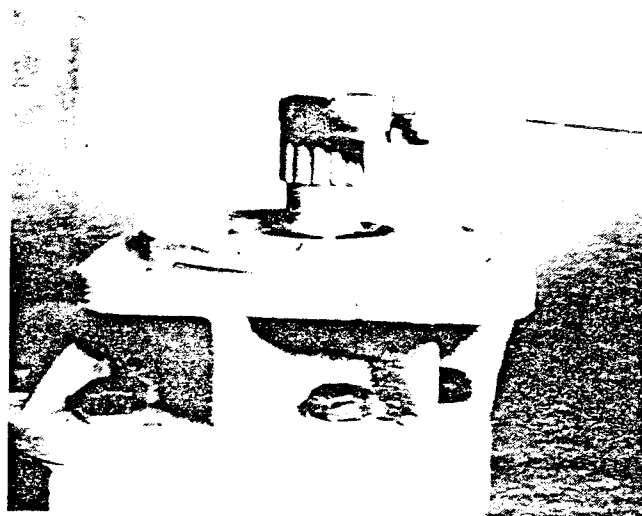


27. Slide flange plate down shaft until flange contacts dowels in pump body. Place hands, one on each side of the flange and press into position. The flange should slide into position with very little resistance. If it does not, lift flange slightly and check sealing strips to see if they have slipped out of position causing interference between sealing strip and the bearings. See Fig. 19.

28. Lubricate the threads on cap screws with SAE-10W oil. With washer, install cap screws and torque each one to 80-90 ft.-lbs. (109-123 Nm).

29. Using a wrench, check to see if the drive shaft will turn. Shaft will be tight but should turn freely with a maximum of 25 ft.-lbs. (34 Nm) torque.

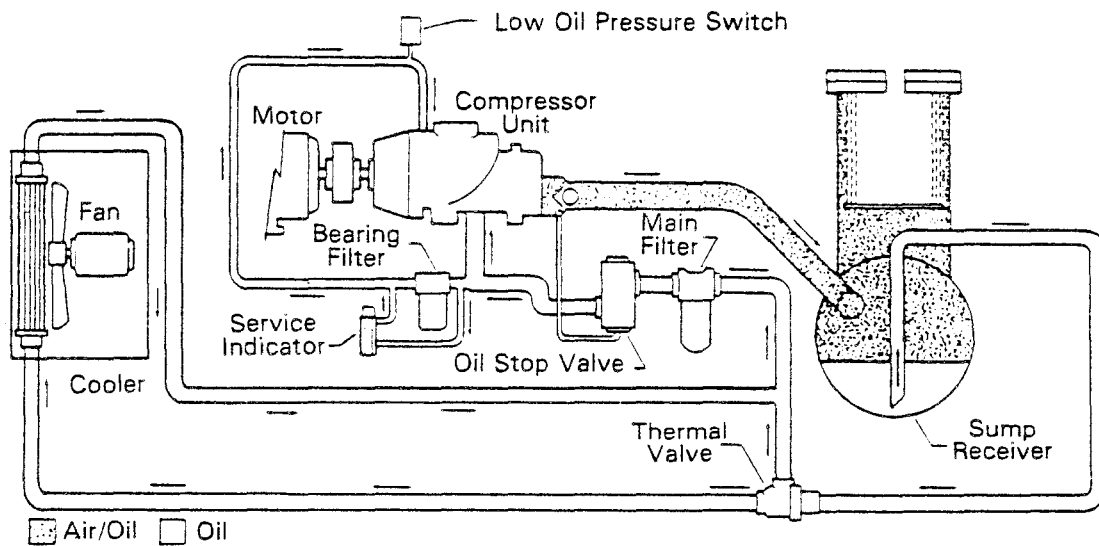
30. If shaft does not turn as stated, disassemble pump and examine parts for burrs or foreign material causing buildup or interference between parts. Check for top isolation plate (with all square corners) being installed in bottom of gear bore, instead of top.



3. Acts as a lubricating film between the rotors, allowing one rotor to directly drive the other, which is an idler.

After the air/oil mixture has been discharged from the compressor, the oil is separated from the air. At this time, the air flows to your service line and the oil is cooled in preparation for reinjection.

**OIL SYSTEM, FUNCTIONAL DESCRIPTION** — The oil cooling system (water-cooled version) consists of a shell and tube heat exchanger, water-flow regulating valve, main line filter, extra-fine bearing lube filter, thermal valve, oil stop valve and interconnecting piping. Air-cooled models are schematically the same as water-cooled models with the exceptions being a radiator-type cooler and a fan used in place of the shell and tube heat exchanger and the water flow regulating valve.



**COMPRESSOR OIL SYSTEM DIAGRAM (AIR-COOLED SHOWN)**

The pressure in the receiver/sump causes oil flow by forcing the oil from the high pressure area of the sump to an area of lower pressure in the compressor unit.

Oil flows from the bottom of the receiver/sump to the thermal valve. The thermal valve is fully open when the oil temperature is below 140 degrees F. (60 degrees C.). The oil passes thru the thermal valve, the main filter and directly to the compressor unit where it lubricates, cools and seals the rotors and the compression chamber.

## PURPOSE OF CONTROLS:

Control or Indicator	Purpose
HOURMETER	Records accumulative hours of compressor operation; useful for planning and logging service schedules.
LINE PRESSURE GAUGE	Continually monitors service line air pressure. Located on dry side of receiver downstream from check valve.
SUMP PRESSURE GAUGE	Continually monitors receiver/sump pressure at various load and/or unloaded conditions.
DISCHARGE TEMPERATURE GAUGE	Monitors temperature of air leaving the compressor unit. For both air and water cooled compressors, normal reading is approximately 170-195 degrees F. (76-90 degrees C.).
BEARING FILTER MAINTENANCE INDICATOR	Indicates when a bearing filter element change is required. A red signal is indicated when the pressure drop thru the filter is excessive.
SEPARATOR MAINTENANCE INDICATOR	Indicates when separator element change is required. A red signal is indicated when pressure drop thru the separator is excessive. Do not clean the separator elements.
OIL SIGHT GLASS	Monitors oil level in the sump. Proper oil level is apparent when you can visually notice oil thru the sight glass. Check the level when the machine is shut down. DO NOT OVER FILL.
SEPARATOR RETURN LINE SIGHT GLASS	Used to indicate oil flow in the return line. When the compressor is running at full load, oil flow should be visible in this sight glass. There may be little or no flow when the compressor is running unloaded, but a sluggish flow from the return line at full load indicates a need to clean the return line strainer.

#### TO INCREASE CAPACITY FROM A REDUCED LEVEL:

1. With compressor running at full load (Sullicon lever is against full load stop screw), loosen the full load stop screw jam nut. Turn the full load stop screw clockwise until inlet vacuum corresponds to desired capacity as shown in chart on page 5—37. The inlet vacuum is read on a gauge mounted on the instrument panel.
2. Tighten the jam nut.
3. Check to see that the Sullicon return spring is holding the lever against the full load stop screw. If not, tighten the spring adjusting screw accordingly.

If that pressure is not 110 PSI (759 kPa) an adjustment is required in the pressure switch. Follow instructions below for adjustments of both the pressure range and differential.

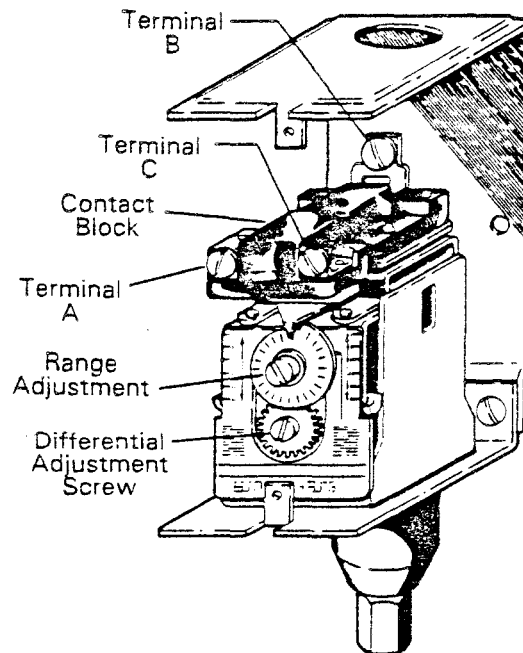
1. Remove cover to pressure switch.
2. Turn the range adjusting screw to the high pressure setting. Turning the screw counterclockwise lowers both the high and low pressure settings equally.

#### FOR DIFFERENTIAL ADJUSTMENT:

Differential is the difference between high and low pressure settings.

1. Turn the differential adjusting screw to the lower (reset) setting. Turning the screw counterclockwise widens the differential by lowering the reset (lower) setting only.

#### ALLEN BRADLEY PRESSURE SWITCH



After the control pressures have been adjusted, the "unload" sump pressure must be adjusted. This is best done by closing the service line shutoff valve, allowing the pressure switch to open and causing the control system to go into the unload phase of operation. When the Sullicon Control lever is in the unload position, turn the stop-screw until the sump pressure gauge reads 70-80 PSI (482-551 kPa). The stop screw is turned clockwise to increase pressure and counterclockwise to decrease pressure. Cycle the control system several times and recheck air pressure settings.

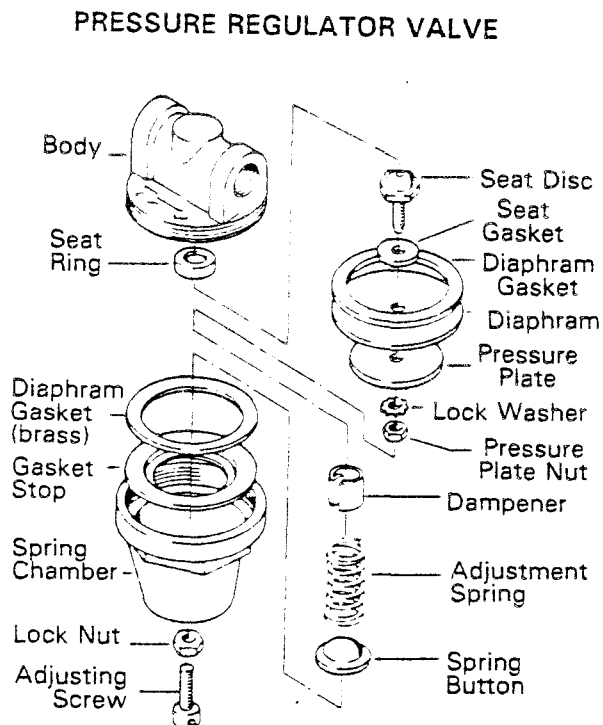
## SPECIAL NOTES

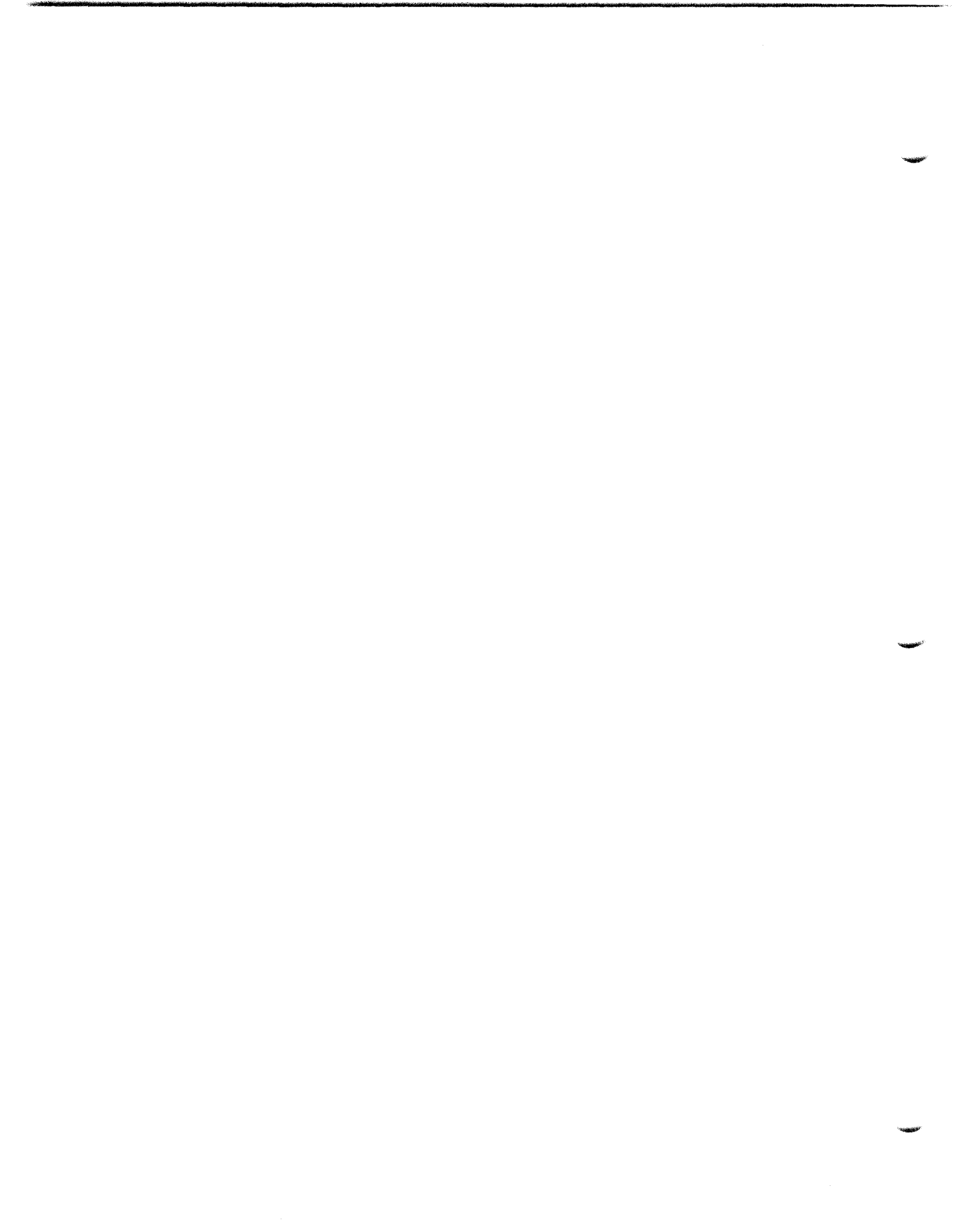
1. Assembly of the gaskets can be made easier by dipping the gaskets in water or the fluid to be sealed. Do not use other rubber lubricants.
2. Self-restrained gasket installation: To simplify installation of a self-restrained gasket, install the lower half of the gasket first, leaving the split area in the steel retaining ring free at the top. Stretch the gasket and split area of the retaining ring until they slip over the pipe into position. Refer to Step 4.
3. Flexmaster joints are not intended to support end loads caused by internal pressure or other forces causing pipe separation.

**PRESSURE REGULATOR VALVE MAINTENANCE** — Pressure regulator valve maintenance normally requires the replacement of the internal diaphragm, use repair kit No. 41742 and follow the procedure below for proper installation.

1. Loosen the locknut and turn the adjusting screw counterclockwise until the inner spring tension is relieved. The adjusting screw should turn freely when the spring tension is relieved.
2. Remove the spring chamber from the body to allow access to internal parts.
3. Next, remove the spring button and spring the dampener, located inside the spring. The damperer will stay inside the spring as it is removed. Leave the dampener inside the spring as there is no need to remove it.
4. After removing the spring, remove the gasket stop and brass gasket.

5. At this time, remove the pressure plate nut and disassemble the pressure plate, diaphragm, diaphragm gasket (rubberized asbestos), seat disc and seat ring.





**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.

**CHECK LIST** for initial lubrication start-up and any inspection following:

Clean up spilled petroleum products immediately.

Remove promptly any petroleum product that gets on your skin.

Don't use gasoline, naphtha, turpentine, or similar solvents to remove oil or grease from your skin.

Don't use dirty wipe cloths.

Avoid breathing oil mist or solvent vapors.

Don't wear oil-soaked garments.

Remove grease accumulation around bearing and gears.

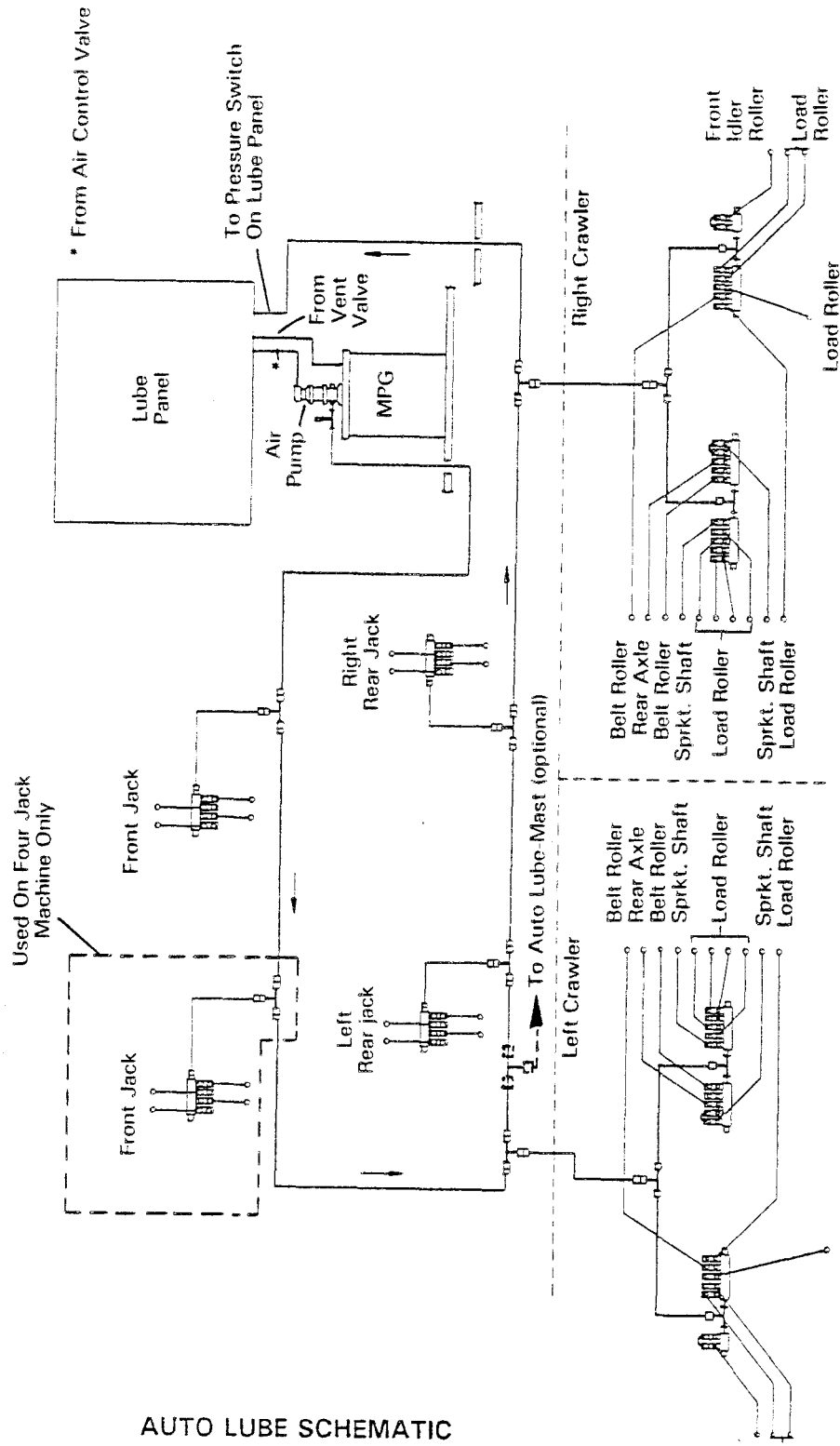
All grease piping connected and filled.

Proper lube supply to all bearing and lube points.

Proper oil level in all gear cases.

Open and semi-enclosed gear teeth coated with lube.

Automatic lubrication system with adequate lube supply.



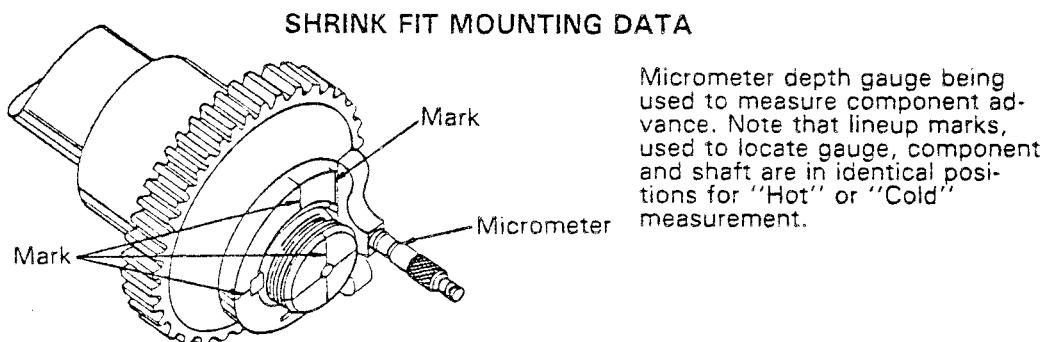
AUTO LUBE SCHEMATIC

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- A. It should be kept in mind that the component fit on the shaft and the fit on the key are the important points in doing a good job of holding the component on the shaft. The locking plate simply serves to hold the nut on the shaft. With the correct fit between the tapered bore and shaft there is no load on the nut and locking plate.

## REMOVAL

1. When removing the component from a motor armature, always use a suitable puller to avoid causing damage to either the component, motor frame, bearings or armature shaft. Do not heat the component before pulling and do not use wedges between the component and the bearing cap. In order to prevent damage to anti-friction bearings, avoid the use of sledge hammer on the puller.



**ADVANCE AND TEMPERATURE CHART**

Motor Frame Size		Motor Shaft Dia.	Hub Advance (Inches)	Temperature Difference	
W	GE			Deg. (F)	Deg. (C)
802	802	1.75	.019 to .029	230	128
803	803	2.00	.023 to .033	230	128
804	804	2.00	.023 to .033	230	128
806	806	2.50	.028 to .038	215	119
808	808	3.00	.028 to .038	190	106
810	810	3.25	.033 to .043	190	106
812	812	3.62	.033 to .043	170	94
814	814	4.25	.038 to .048	165	92
816	816	4.62	.038 to .048	155	86
818	818	5.00	.043 to .053	155	86
720	820	5.88	.043 to .053	135	75
722	822	6.25	.047 to .057	135	75
724	824	7.00	.047 to .057	120	67
—	828	8.50	.052 to .062	110	61

**PREHEAT AND POSTHEAT** — When practical preheat the entire part, when not practical a soaking preheat is required for a minimum of 3 inches from the weld joint in all directions.

Preheat temperatures indicated are minimum; maximum preheat and interpass temperatures should not exceed those listed for over 2.5 inches by more than 100 degrees F. Avoid excessive concentrated temperature which could cause distortion, embrittlement or other detrimental effects.

Weldments containing conditions of high restraint may require the use of high preheat or the use of lower strength electrodes, or both, as specified by Marion Welding engineer.

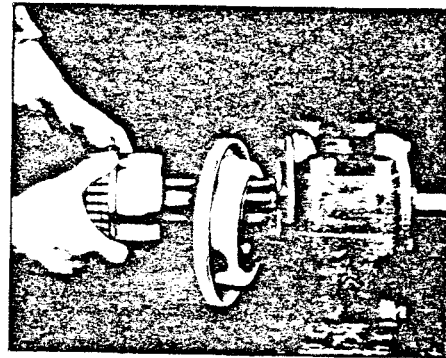
#### **CROSS REFERENCE OF MATERIAL SPECIFICATIONS**

<u>NEW</u>	<u>OBSOLETE</u>
CB	CA, CB
CL5	CL5
CN	CN, CJ
CC2A	CC2A, CC2B, CC6, CD, CD1
CK	CC9, CK, CK1, CK8, CFC2
CL4B	CL4B, CL3, CL4, CL4A
CFE	CFE, CFC, CFC1, CKF, CKF1, CFD, CFD1, CL2, CO, CO1
CC2A-Q	CC7, CC10, CC11, CC12
CK-Q	CK2B, CK3, CK4, CK5
CKQS	CK2, CK6, CK7

NOTES:

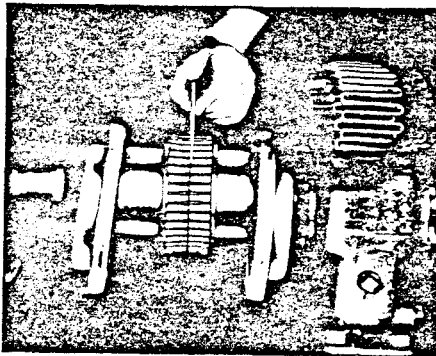
## F TYPE COUPLING INSTALLATION

1. Mount cover with seal ring and hub on shaft. Press or shrink hubs on respective shafts so hub face is flush with shaft end. Tighten set screws on BOTH hubs on sizes 3 thru 11.



**1 MOUNT COVER, SEAL RING AND HUB ON SHAFT**

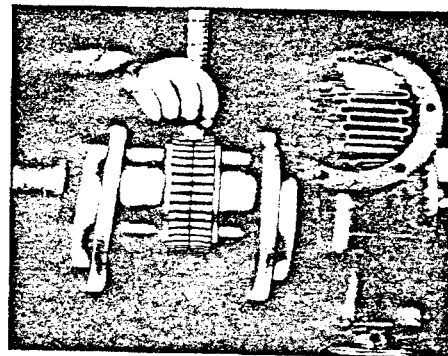
2. Check gap and angular alignment. Set coupling for normal gap. Align shafts by placing spacer block equaling gap between hub faces, and at right angles to it. Check using feelers.



**2 GAP AND ANGULAR ALIGNMENT**

Maintain normal coupling gap where possible. To insure best performance, **DO NOT EXCEED** minimum and maximum gaps. Consult company if limited axial float is needed. Provide for shaft end play in coupling gap when using sleeve bearing units. Once mounted, position free unit so coupling gap is between minimum and maximum limits with **BOTH** shafts in extended or retracted position. With gap set and shafts aligned, tighten unit foundation bolts and **RECHECK** alignment.

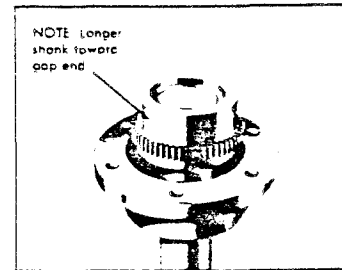
3. Check parallel alignment so a straight edge rests squarely on **BOTH** hubs at right angles. Fasten foundation bolts and **RECHECK** alignment and gap.



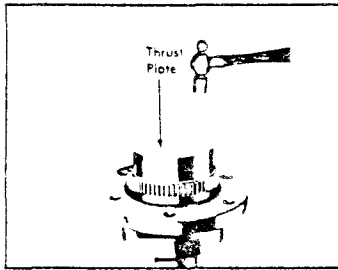
**3 OFFSET ALIGNMENT**

## GV TYPE COUPLING INSTALLATION

- A. MOUNT FLANGED SLEEVES, SEALS AND HUBS — Refer to step 1. Place flanged sleeves WITH seal rings on shafts BEFORE mounting hubs. DO NOT DAMAGE SEALS. Mount hubs on respective shafts, as shown, so counterbore face is flush with shaft end.



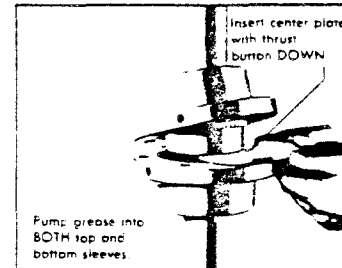
**A MOUNT FLANGED SLEEVES, SEALS AND HUBS**



**B INSTALL THRUST PLATE IN LOWER HUB**

- B. INSTALL THRUST PLATE IN LOWER HUB — Tap thrust plate into counterbore until fully seated and stake in place. Position equipment. Refer to steps 3 and 4. IMPORTANT: With coupling aligned, pack lower flanged sleeve with grease and correctly position sleeve and gasket. DO NOT DAMAGE GASKET.

- C. INSERT CENTER PLATE WITH THRUST BUTTON DOWN — Center plate in counterbore of lower flanged sleeve. IMPORTANT: Pack upper hub teeth with grease and then complete assembly per steps 5 and 6.



**C INSERT CENTER PLATE WITH THRUST BUTTON DOWN**

MAINTENANCE — Lubricate couplings at least once every six months. Lubricate more frequently when exposed to excessive moisture, extreme temperatures, rapid reversing or shock loads or excessive misalignment.

### COUPLING INSTALLATION DATA

Coupling Size		10	15	20	25	30	35	40	45	50	55	60	70
GAP (Hub Separation)	G	1/8	1/8	1/8	3/16	3/16	1/4	1/4	5/16	5/16	5/16	5/16	3/8
	in (mm)	(.32)			(.48)		(.63)		(.8)				(.95)
	GV	7/16	7/16	7/16	9/16	9/16	1 1/16	7/8	1	1	1	1 1/8	1 3/8
		(.4375)			(.5625)		(.71875)		(.875)			(.125)	(.1875)
Operating Alignment	Offset	.005	.005	.010	.010	.012	.012	.012	.012	.012	.012	.012	.012
	Angular	.005	.005	.010	.010	.015	.015	.020	.020	.020	.030	.030	.030
in (mm)		.127		.254		.381		.508			.762		
Grease—lbs (kg)	G	1 1/8	1/8	3/8	1/2	3/4	1	1 3/4	2 3/8	3 1/2	4 1/4	7 5/8	14
	GV	1/8	1/4	1/2	3/4	1 3/8	2 3/8	3	5 1/4	6 3/4	8 1/2	11 1/4	25 1/8
G&GV 10 Flange	Torque in/lb	95	170	170	420	420	845	845	845	1490	1490	---	---
	Nm	107	192	192	474	474	954	954	954	1682	1682	---	---
G&GV 20 Flange	Torque in/lb	65	145	360	720	720	1290	1290	1290	1430	1430	1430	2160
	Nm	96	164	406	813	813	1456	1456	1456	1614	1614	1614	2436



Rectifiers normally fail by shorting, but the effect depends upon the circuit. With rectifiers used to convert A.C. to D.C., shorting provides A.C. in output; detected by a multimeter on the output circuit. Shorted, blocked rectifiers allow current flow when the wrong polarity of voltage is detected.

Rectifier failure detection using the ohmmeter works, but the low voltage batteries in the meter do not always give a good test. Best results show up using the high resistance scale, but even this may not be conclusive.

The best test for rectifiers uses D.C. voltage at least 1/4th its rating. Connect a resistor in series with rectifier to limit current to a safe value. Connect resistor and rectifier across D.C. voltage, then read voltage across resistor. Reverse rectifier and measure resistor voltage. A good rectifier gives voltage across resistor with only one polarity.

Many other failures occur and often good intuition and ingenuity is needed to find them.

The trouble discussed thus far usually results in complete and permanent malfunction.

Perhaps more common and more difficult to find are intermittent failures resulting in only partial power loss. These trouble types distinguish a good troubleshooter from an average one.

Start as before, interviewing operator, oiler and witnesses. Try in questioning to determine the exact nature of trouble. When complaint indicates partial power loss, find the effect under various load conditions and determine the cause of this effect.

Often a cause for weakening may be determined in a similar manner as locating complete failure. Select a starting point and compare measurements taken against recorded data. Compare honestly. A slight difference shows due to aging, temperature or an inaccurate instrument along with failure. Tests under one condition might not give a true problem indication. For example, tests at stall do not indicate no-load voltage is incorrect. Likewise, test for proper motor field voltage ONLY with controller (master switch) in proper position. In addition, check that stall current or no-load voltage varies properly with master switch position, since trouble could be failure of master switch.

In locating trouble of the weakening kind, one needs to know the various devices functions used to augment or increase power under certain conditions. Master switch contacts fall in this device class. Motor field contactors increase field strength under certain conditions. Conversely, current or voltage feedback circuits limit certain quantities to acceptable values. Failures resulting in decreased or increased outputs generally come from failure in these supplementary circuits.

Help here comes from knowing the effects certain changes have on performance.

power has been removed and the circuit grounded. Feeling of excessive heat may indicate an overloaded condition and should be corrected.

TIGHTENING operation should be done on all connections that has worked loose due to vibration, etc. Loose parts are a definite hazard because they may fall out of place and damage nearby components. The importance of firm mounting and tight connections cannot be overemphasized. Always replace missing or broken bolts of proper size and use the correct tools.

ADJUSTING should be done when inspection indicates that it is required to maintain normal operating conditions. Specific adjustment is contained in the "Mechanical Adjustment Section" of this manual, the electrical manual or the component manufacturer's manual.

LUBRICATION refers primarily to the application of CORRECT LUBRICANT in the CORRECT AMOUNT to bearings and other rotating parts. It also means the application of a light oil to door hinges or other sliding surfaces. Use only clean and proper lubricant.

Planned maintenance, common sense and good judgment is less costly and more effective than panic maintenance. Action taken on recommendations made on the following suggested inspection Check List, or Lists by your maintenance department, should reduce repair, maintenance cost, and increase production.

Whenever a problem is indicated, the inspector should briefly explain it on the maintenance report (end of this section) along with his signature. Then, an authorized person should explain briefly a solution to the problem. Now, set a date and time to, and above all, CORRECT THE PROBLEM.

NOTES:

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