



Technical Manual

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

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

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

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

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

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

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

Use pullers to remove bearings, bushings, gears, cylinder sleeves, etc. when applicable. Use hammers, punches and chisels only when absolutely necessary. Then, be sure to wear safety glasses.

Be careful when using compressed air to dry parts. Use approved air blow guns, do not exceed 30 psi (207 kPa), wear safety glasses or goggles and use proper shielding to protect everyone in the work area.

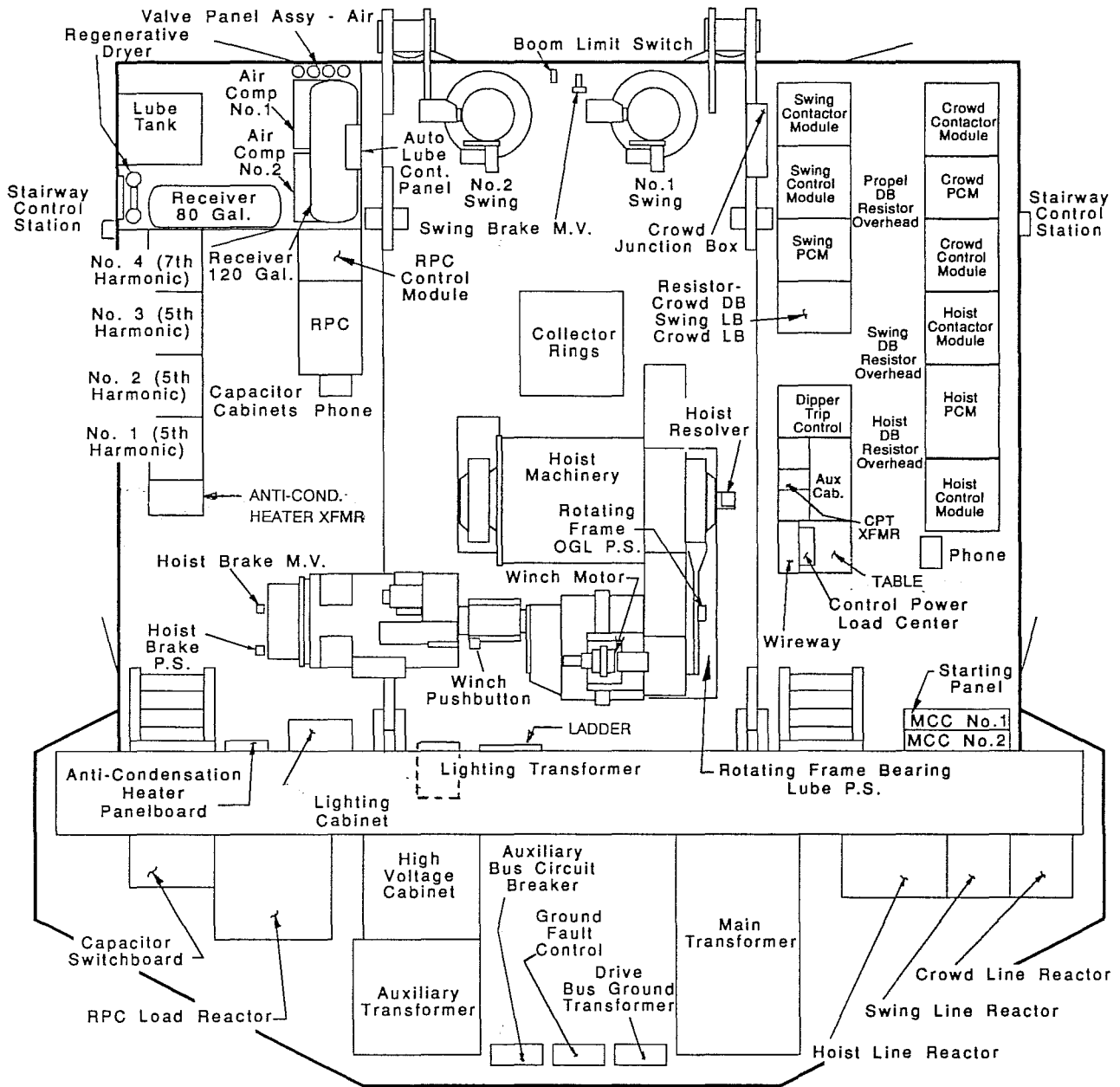
Be sure to promptly reinstall safety devices, guards or shields after adjusting and/or servicing the machine.

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

Protective eye goggles should be worn at all times when working on the air conditioning system. Work on the air conditioning system only in a well ventilated area.

Wipe away excess lubricants around bearings and gears. Never lubricate parts in motion.

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



301-M DECK PLAN



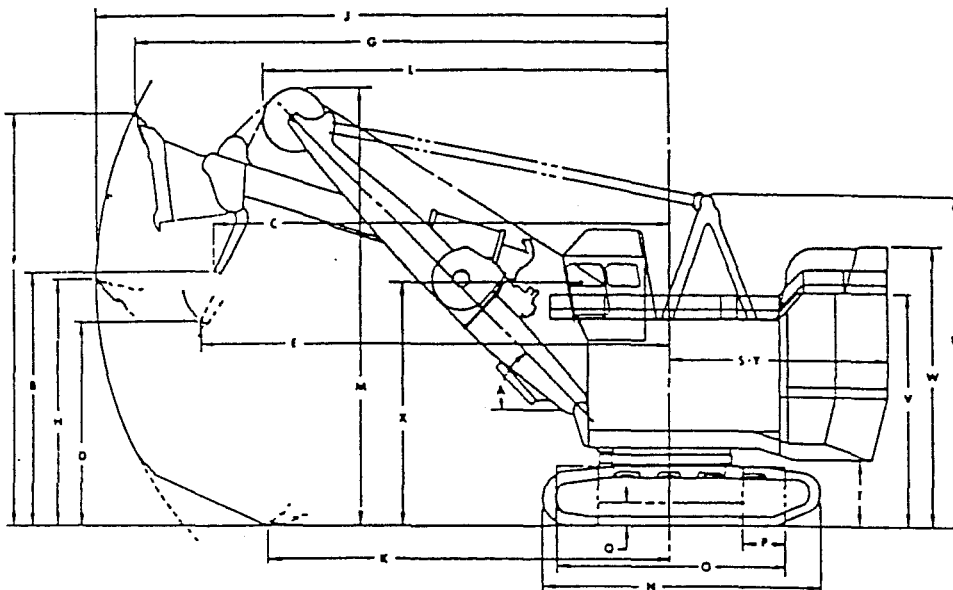
DRESSER INDUSTRIES, INC. MARION DIVISION
MACHINE SPECIFICATIONS

Model: 301M-HR MINING SHOVEL

Specification: 301M-HR-4B

Description: Standard Range - D.C. Static Power Conversion - Metric

No. 7050070189



BOOM - HANDLE - DIPPER

Meters

Boom Length	18.3
Boom Sheave Diameter - Pitch Diameter	2.4
Boom Foot Pin to Shipper Shaft	7.0
Dipper Handle Length	11.7
*Dipper Capacity, cu.m	24.5-61.2

*Based on Application.

+ WORKING RANGES (based on 41.3 cu. m Std. Dipper)

Without Limits	
A - Boom Angle	45°
B - Dumping Height - Maximum	10.1
C - Dumping Radius @ Maximum Height	19.5
D - Dumping Height @ Maximum Radius	7.1
E - Dumping Radius - Maximum	20.1
F - Cutting Height - Maximum	17.5
G - Cutting Radius @ Maximum Height	21.5
H - Cutting Height @ Maximum Radius	9.6
J - Cutting Radius - Maximum	23.6
K - Radius of Clean-up	15.4
L - Clearance Radius - Outside Boom Point Sheave	17.9
M - Clearance Height - Over Boom Point Sheave	18.8

+ Ranges Shown are at Maximum Mechanical Limit

CRAWLER AND LOWER FRAME

	Std.	Opt.
N - Crawler Length	11.4	11.4
O - Crawler Width	9.3	9.6
P - Belt Width	1.7	2.0
Bearing Pressure, kgs/Sq. cm	3.4	2.9
Q - Clearance Under Lower Frame	0.8	0.8

UPPER FRAME

Meters

S - Clearance Radius - Rear End	9.
T - Clearance Under Frame	2.6
U - Clearance Height - Gantry	13.0
V - Clearance Height - Machinery House	9.2
W - Clearance Height - Filter House	12.0
X - Eye Level - Operator's Cab, Std.	9.7
Y - Clearance Width - Machinery House	10.2
Hoist Drum - Pitch Diameter	1.5
Hoist Rope Diameter (Double Line), mm	64
Boom Support Rope Diameter (Quadruple), mm	80

ELECTRICAL EQUIPMENT

	Cont.	Peak
Hoist Motor, 969 kw. Total kw.	969	1409
Swing Motors, Two, 280 kw. Total kw	560	813
Propel Motors, Two, 239 kw. Total kw	478	694
Crowd Motors, Two, 190 kw. Total kw	380	552
Excavator D.C. Static Power Conversion		
Swing Speed, rpm.	2.83	
Travel Speed, kph.	1.2	

WEIGHTS

Shipping Weight, kgs	816,740
Export Shipping Weight, kgs.	839,150
Working Weight, kgs.	1,043,270
Ballast (Furnished by Purchaser), kgs.	226,800
Minimum Weight of Ballast, kgs./cu.m.	4005

Range and Weights Subject to Variation Due to Options Selected by Purchaser.

Patent Pending
Printed in U.S.A.

The Company reserves the right to improve or change the design of its products and specifications thereof and the Company shall incur no liability thereby or any obligations to install such improvements on products previously sold.

ANNUNCIATOR PANEL

The annunciator panel is located to the right of the operator. The function of this panel is to provide the operator with instant feedback data on a range of machine functions. When any annunciator panel light illuminates and the alarm sounds, it indicates a potential malfunction in the system or systems indicated. The first occurring fault will cause its light to flash, and it will remain flashing until the fault is cleared. Any succeeding fault(s), indicated while the first is still announced, will result in an audible alarm and a steady lit light that will also remain on until the fault is eliminated. Any audible alarm is silenced with the ANNUNCIATOR SILENCE pushbutton on the operator's right control console.

The ANNUNCIATOR TEST pushbutton on the operator's right control console will test the lights in the panel. When this is depressed and held, all the lights in the annunciator panel should come on. Report any that do not come on to the maintenance crew. These lights should be tested at the beginning of each shift.

Some of these alarms will simultaneously result in the loss of L.E. (line excitation), shutting the machine down. This fault may be cleared by depressing the EXCITATION START pushbutton on the operator's left control console and reactivating L.E. (indicated by its integral green light coming on). In the case where L.E. cannot be re-energized, notify the maintenance personnel so they investigate and correct the fault.

ANNUNCIATOR LIGHT FUNCTIONS

CONTROL STOP - A fault has been detected in one or more of the machine's drives. Control for the faulty drive(s) has been deactivated. Cease operating the machine and STOP excitation. Depress the START excitation button and see if control or faulty drive is restored. If not, call an electrician.

LIMIT OR LIMIT BYPASSED This indicator will light whenever the operator violates a limit setting. The following is a brief description of limits.

- **HOIST LIMIT** - Dipper has been raised to an unacceptable position. Carefully LOWER the hoist drive.
- **LOWER LIMIT** - Lowering has been stopped to prevent unspooling all of the rope from the drum. Carefully RAISE the hoist drive to take up the hoist rope slack.
- **CROWD LIMIT** - Crowding out has been stopped to prevent contact with the handle bumper. RETRACT the dipper handle to eliminate the fault.
- **RETRACT LIMIT** - Retracting has been stopped to prevent contact with the handle bumper. EXTEND the dipper handle to eliminate the fault.

If not satisfied with the operator seat positioning, adjust it to suit now before commencing operation.



CAUTION: Make sure all personnel and equipment are clear of the machine work area. Sound the signal horn as an audible warning that the machine is about to operate.

Press the EXCITATION START pushbutton to energize L.E., observing that its green indicator lights.

Move the CONTROL TRANSFER switch from *BRAKES SET* to *DIG*. Pause a few seconds to allow the circuitry to fully energize. Make sure the *DIG* and *SWING* lights on the left control console are illuminated.

Place the *SWING*, *HOIST*, and *CROWD* brake selector switches in the *RELEASE* positions. Make sure their red indicating lights **go out**.

The machine is now operational in the *DIG* mode.

To make the machine operational in the *PROPEL* mode, follow the same procedure down to moving the CONTROL TRANSFER switch off its *BRAKES SET* position, then do the following.

Move the CONTROL TRANSFER switch from its *BRAKES SET* to *PROPEL*. The propel warning buzzers are activated and commence beeping. Pause a few seconds to allow the circuitry to fully energize. Make sure the *SWING* and *PROPEL* lights on the left control console are illuminated.

Press the PROPEL BRAKE RELEASE pushbutton. Its green indicator will light when the brakes release and the red indicator in the *SET* button will go out. **DO NOT MOVE THE MACHINE UNTIL THE BRAKES ARE RELEASED** (green indicator on). Recommended standard procedure is to release the swing brakes while propelling/steering, so release them now.

The machine is now operational in the *PROPEL* mode.

NOTE: After L.E. has been energized, the transfer from one mode to the other can be made at any time by stopping the machine's operating drives (returning both joysticks to neutral), setting the brakes, and then moving the control transfer switch to the desired position. The propel warning buzzers are activated only while in *PROPEL* mode.



CAUTION: To avoid excessive brake wear, set the brakes only after all component motion has come to a complete stop. These are designed to be "parking" brakes, not dynamic brakes.

- AC power supply network to control panel.
- Programmable controller located in the auxiliary cabinet to control the cycle and alarm times.
- Lube reel with manually operated dispensing valve and a manual shutoff valve.

The 2 lube reservoirs with their pumps, the control panel, and the lube reel are located in the enclosed room on the front of the left wing, inside the machinery house. The 8 pressure switches used in the system are placed around the machine at locations that best insure that the lube supply is properly distributed in each injector.

OPERATION

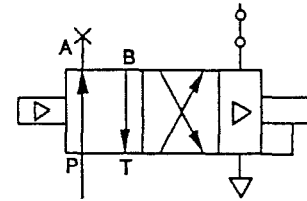
The automatic lubrication system operates when line excitation (LE) is energized. When LE is activated by the operator in the cab, the lubrication system will cycle the circuits as follows:

- A. If the machine control is in either DIG or BRAKES SET mode, then all five automatic supply circuits cycle.
- B. If the machine control is in the PROPEL mode, then only the crawler MPG circuit will cycle.

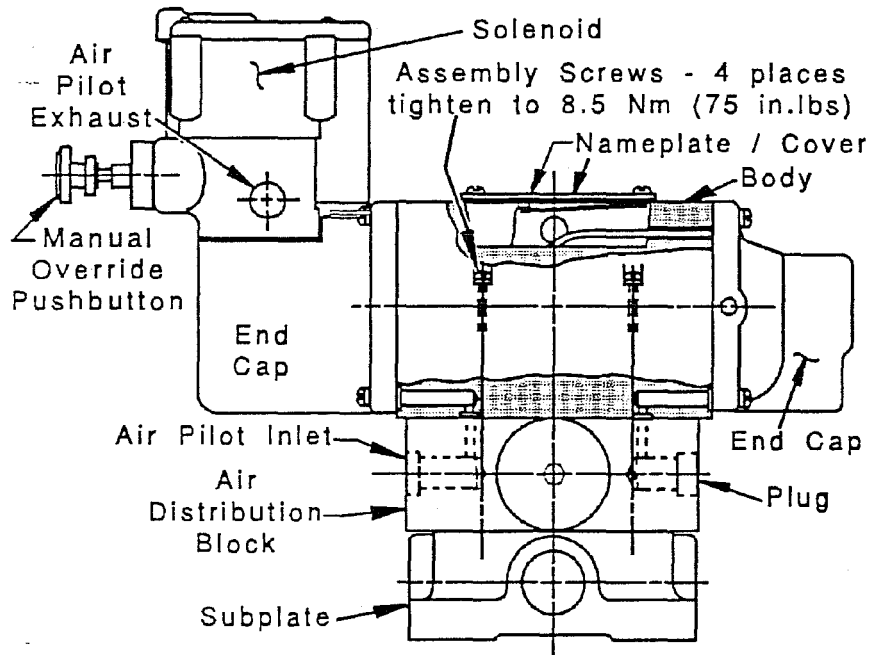
Once LE has been activated and the circuits complete their initial cycle, the preset timer in the controller (PC) takes over to initiate succeeding lube cycles.

A typical lube cycle operation for any of the circuits occurs in this manner. When a cycle is initiated by the controller by either LE activation or the timer, then the appropriate 3-way air solenoid valve and 4-way hydraulic solenoid valve are energized to direct air to the pump, which causes the pump to pump lubricant through the hydraulic valve to the selected circuit and its distribution injectors. When energized, the hydraulic valve closes off the vent return line to the reservoir. As the lubricant pressure builds in the circuit supply line, the injectors operate and push a metered amount of lubricant to the bearings, bushings, or open gearing. The lubricant pressure continues to build until it is sufficient to open the contacts in the pressure switch(es) in the circuit. When these contacts open, the controller de-energizes the air and hydraulic valves, shuts off the pump and vents the circuit supply line and distribution lines to the reservoir. The lubricant pressure in the circuit decreases, allowing the injectors to recharge themselves for the next cycle.

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



Graphic Symbol



LUBRICANT FLOW CONTROL / VENT VALVE

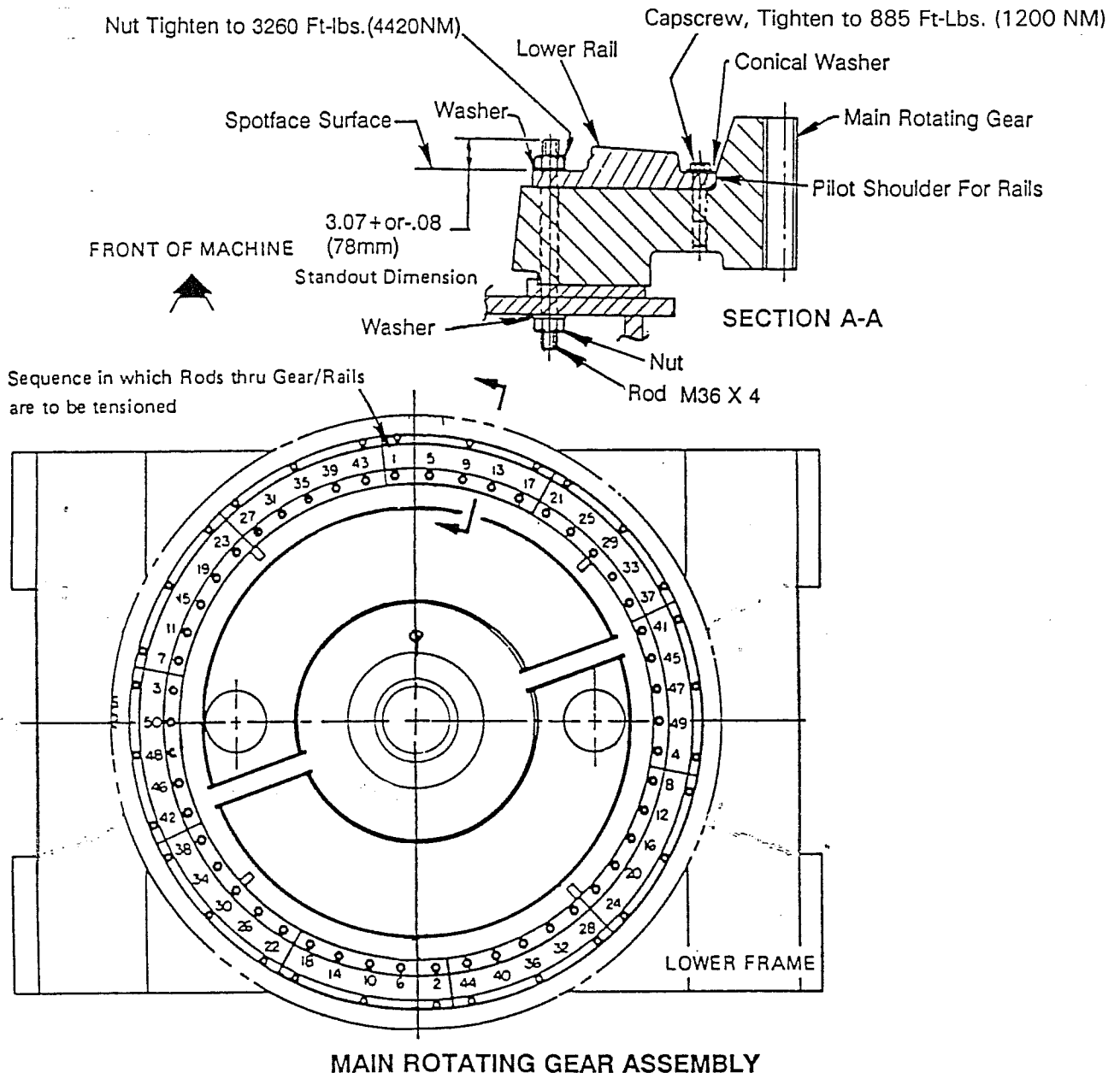
CODE	NAME	DESCRIPTION
GL	Gear Lubricant for Enclosed Gearcases with Through-hardened gears	<p>This gear oil must have good load carrying and extreme pressure (E.P.) properties. The gears will be highly loaded and subjected to large shock loads. Fast stops, starts, and reversing action will be "normal" operation for the gears and bearings lubricated by this oil.</p> <p>Use as viscous a product as possible for maximum gear life.</p> <p>On new machines, oil should be drained after the first 60 days of operation and replaced with new oil. Thereafter, change the oil once a year, or when determined necessary by the oil supplier. The oil should be checked for contamination every 30 days.</p>
MO	Motor Oil	A rust and oxidation motor oil suitable for use in DeVilbiss, Ingersoll Rand, and other makes of piston type, reciprocating air compressor crankcases.
HL	Hand Lubrication	Use oil MO above or a general machine oil such as S-SAE 30 or W-SAE 20W, etc.
PO	Pneumatic Oil	Petroleum oil especially compounded for use in air line oilers or built-in lubricators having the correct viscosity, low pour point, emulsifying ability, and film strength and that is free of deposit forming tendencies. It should not cause swelling or deterioration of rubber or leather seals and gaskets.

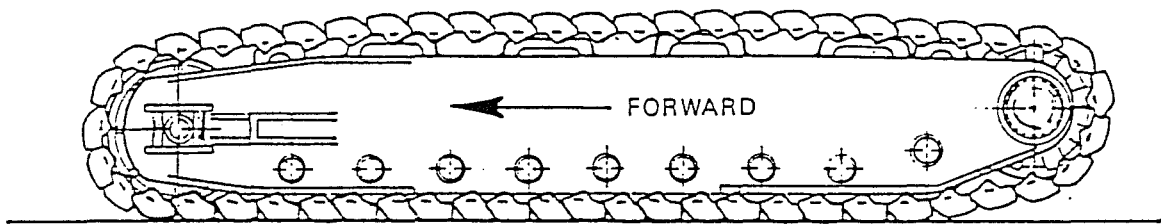
POINTS ON THE AUTO LUBE SYSTEM USING "MPG" - 56 Total Served

NAME OF PART	TYPE	NO. OF POINTS	LOCATION
Crawlers - Line 3: 24 points			
Front Idler Rollers	Bushing	2 (1 each side)	End of Shaft
Load Rollers	Bushing	16 (8 each side)	End of Shaft
Rear Idler Rollers	Bushing	2 (1 each side)	End of Shaft
Inboard Bearing - Main Propel Shafts	Anti-Friction	2 (1 each side)	Through Wall of Gearcase Bracket
Outboard Bearing - Main Propel Shafts	Anti-Friction	2 (1 each side)	O.D. of Retainer
ROTATING FRAME & BOOM Line 4: 24 points			
Boom Foot Pins	Plain	2	End of Pin
Center Journal Bushing	Bushing	2	Bottom Face of Rot. Fr. Housing
Thrust Surface for Center Journal Nut	Thrust Washer	2	Top of Rot. Fr. Housing at Deck
Boom Support Anchors on Gantry	Plain	4	End of Pin
Boom Support Equalizers on Gantry	Plain	2	End of Pin
Shipper Shaft Bearings - Outboard	Anti-Friction	2	Through Top Plate of Ctr. Boom Structure
Shipper Shaft Bushings - Inboard	Bushing	2	Through Top Plate of Ctr. Boom Structure
Dipper Trip Rope Guide Sheaves	Bushing	2	End of Shaft
Boom Support Anchors on Boom	Plain	4	End of Pin
Boom Point Sheaves	Anti-Friction	2	End of Shaft
BEARINGS - Line 5: 8 points			
Main Rotating Shafts - Upper	Anti-Friction	2	Through Wall of Gearcase Support

PROCEDURE FOR USE OF HYDRAULIC TENSIONER ON RODS:

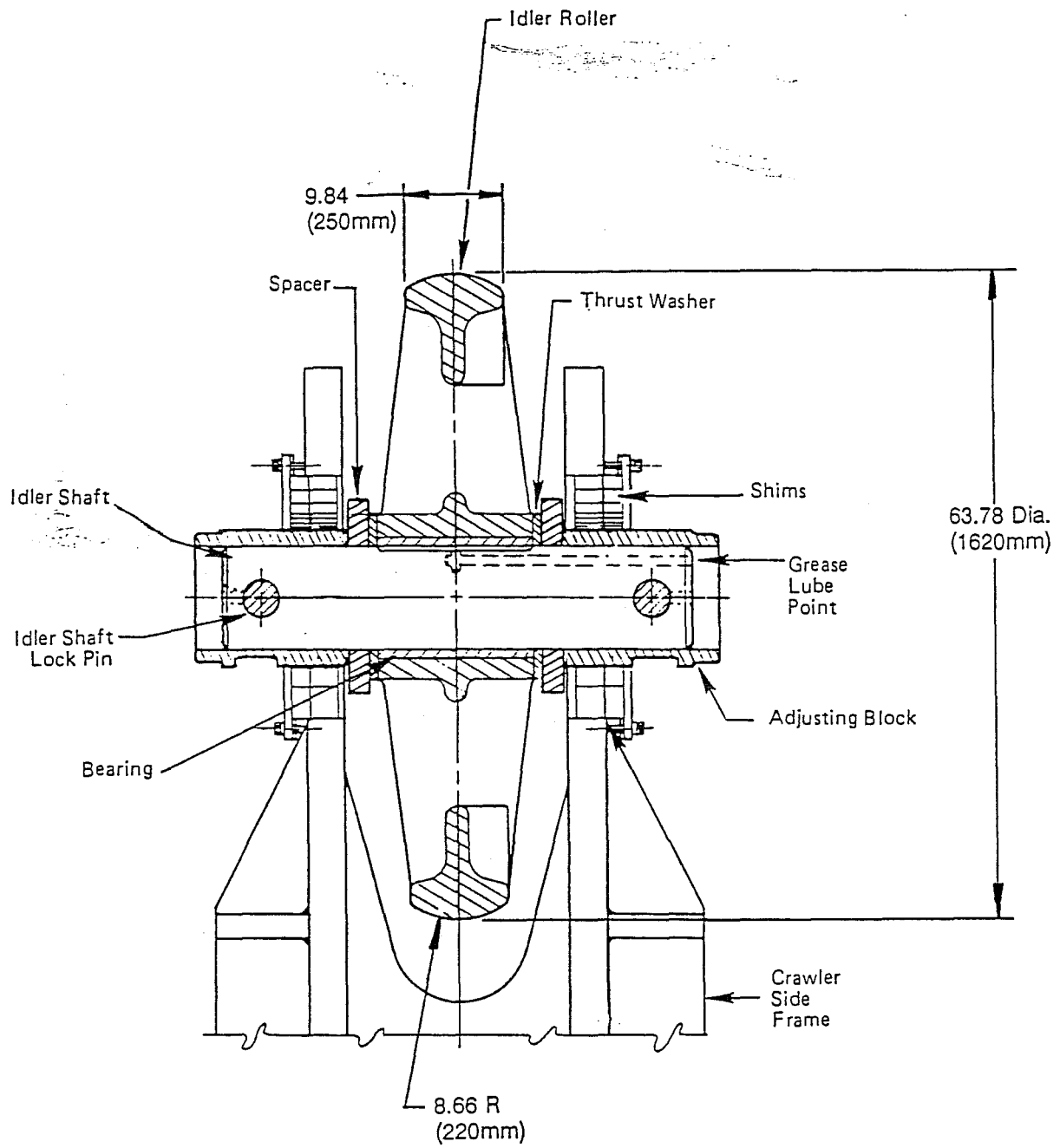
1. Seat rails against pilot shoulder in gear with equal gaps between rail ends.
2. Assemble screws through rails into gear. Tighten screws to 885 Ft-lbs. (1200 NM) before tensioning rods.
3. Assemble rods through gear rails to standout dimension. See the section view. Rod threads should be clean and the fit of the nuts on the rods should be very free. This is to allow for stretch of the rod during tensioning.
4. For hydraulic tensioner operation, refer to tensioner in Sect. NO.7. During all tensioning operations, observe the operation of the tensioner to be sure that maximum stroke is not exceeded.
5. Tension gear/rail rods in 4 steps:
 - 5.1 Tension the rods to 95,000 Lbs. (423 KN), ref. 2282 Ft-lbs. (3094 NM), in the sequence shown. Turn the nut down using the tensioner drive gear mechanism. When the nut bottoms, seat it with a firm twist of the drive gear.
 - 5.2 Tension the No. 1 rod to 136,000 Lbs. (605 KN), reference 3260 Ft-lbs. (4420 NM). Turn the nut down.
 - 5.3 Before moving on to the next rod, relax the tensioner, wait one minute, then bring the tensioner back to 136,000 Lbs. (605 KN). Turn the nut down. If possible, repeat the procedure in steps 5.2 and 5.3 for each rod in the sequence shown.
 - 5.4 After all the rods are tensioned per steps 5.2 and 5.3, repeat step 5.2 for all the bolts in the sequence shown.
6. Check tightness of the screws after tensioning rods. Re-tighten to 885 Ft-lbs. (1200 NM) if necessary.



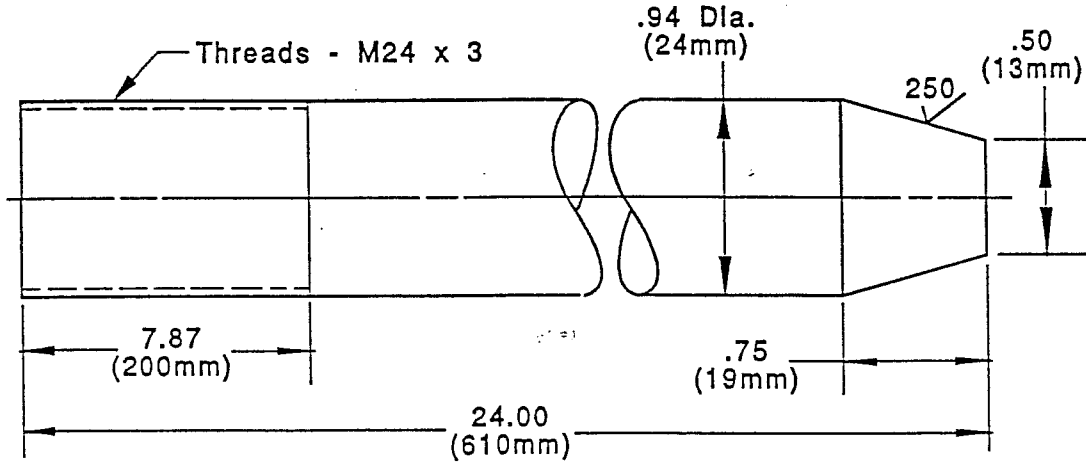


CORRECT BELT TENSION

- NOTES:*
- *BEFORE* the drive lugs on the shoes touch the top of the crawler frame, replace or rebuild the slide bars to their original height.
 - To check for the correct belt tension - while propelling the machine insure that the crawler shoes effectively engage the drive sprocket. This is achieved when there is a minimum of radial shoe movement as it enters the load area of the drive sprocket.

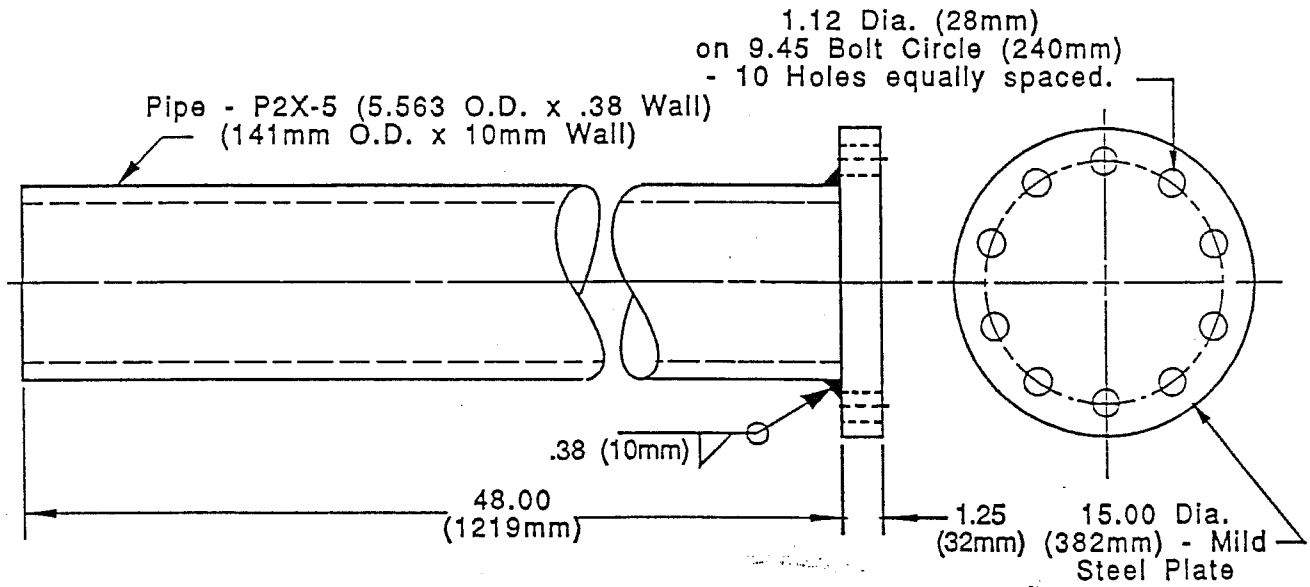


FRONT IDLER ASSEMBLY



Material: AISI 1020 steel - 3 Required.

PROPEL SHAFT PILOT ROD



PROPEL SHAFT END SUPPORT

PROPEL GEAR CASE

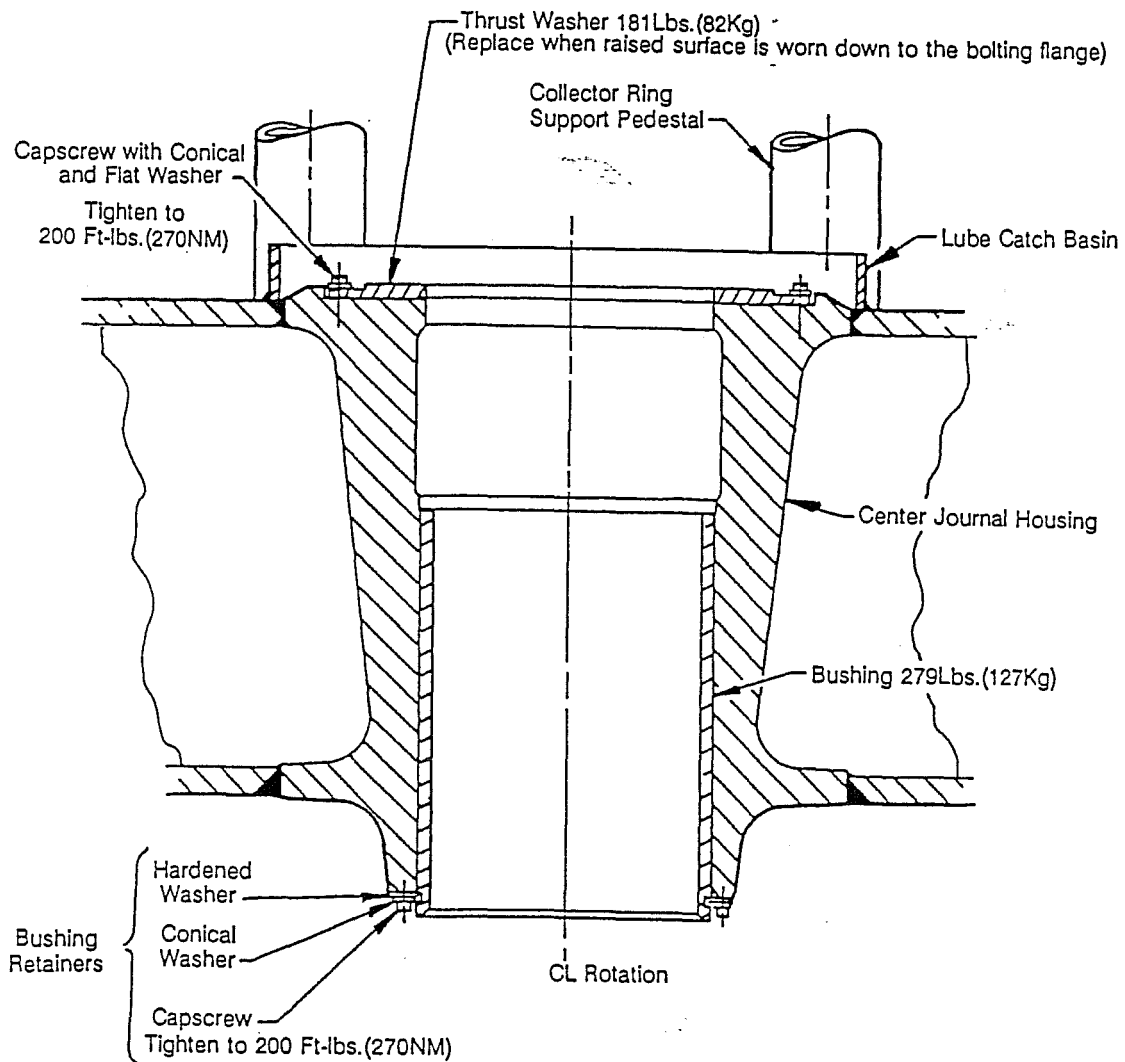
The propel gear case assembly includes three reductions - a right angle spiral bevel 1st reduction, a planetary 2nd reduction and a planetary 3rd reduction.

To minimize down time, it is recommended that the gearcase be replaced as a complete unit, if a problem should develop within the case.

If the case is to be disassembled, it should be taken to a maintenance shop for repairs.

NOTES:

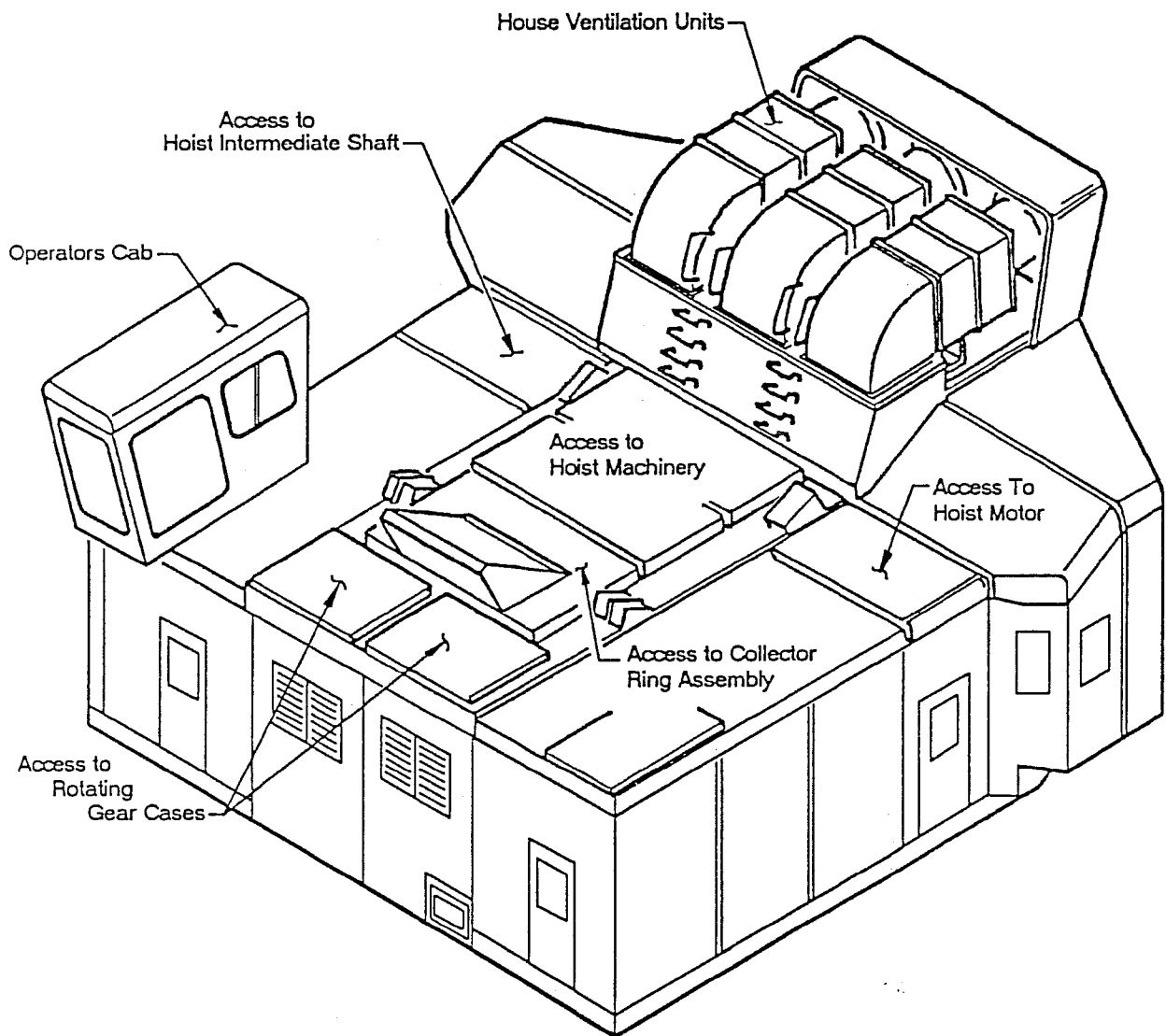
1. The reduction spiral bevel (pallid) gear & pinion are manufactured as a matched set. Do not interchange or order separately.
2. When replacing the single row tapered bearings on the spiral gear shaft & pinion cartridge, the end play must be adjusted & new spacers ground to fit.
3. Check the 1st reduction tooth contact when a new bearing & new gears are installed.
4. Change the planet gears in sets of 3 only.



CENTER JOURNAL BEARING BOSS ON THE ROTATING FRAME

CENTER JOURNAL THRUST WASHER REPLACEMENT

1. Park machine safely on level ground. Remove 3 center journal nut guards.
2. Rotate the machine as needed to align the jacking bracket on the deck with the jacking lug on the side of the center journal nut.
3. Assemble the hydraulic ram and special jacking equipment to the nut and jacking bracket.
4. Set the brakes.



MACHINERY HOUSE

2. A. Tension the No. 1 capscrew to 132,500 Lbs. (589 KN), ref. 5216 Ft-lbs. (7075 NM). Turn the nut down.
 - B. Relax the tensioner, wait one minute, then bring it back to load without shifting it. Turn the nut down if possible. Repeat this procedure for the remaining capscrews in the sequence shown.
3. After all the capscrews are tensioned per Step 2, repeat Step 2A for capscrew No. 1 and No. 2. If additional turning of the nut is possible when the tensioner is brought up to 132,500 Lbs. (589 KN), ref. 5216 Ft-lbs. (7075 NM), continue Step 2A on subsequent capscrews until there is no more take-up or rotation of the nut.

Pedestal Capscrews:

1. Tension the 5 - 1.75 inch capscrews (No's 7 through 11) to 100,000 Lbs. (446 KN), ref. 3560 Ft-lbs. (4950 NM), and the 6 - 2.25 inch capscrews (No's 1 through 6) to 172,000 Lbs. (767 KN), ref. 8824 Ft-lbs. (12,000 NM), in the sequence shown. Turn the nut down using the tensioner drive gear mechanism. Seat it firmly when it bottoms. During tensioning, observe the operation of the tensioner to be sure maximum stroke is not exceeded.
2. A. Tension the No. 1 capscrew to 246,300 Lbs. (1096 KN), ref. 12,500 Ft-lbs. (17,000 NM). Turn the nut down.
 - B. Relax the tensioner, wait one minute, then bring it back to load without shifting it. Turn the nut down if possible. repeat this procedure for the remaining capscrews (No's 2 through 6) in the sequence shown.
 - C. Tension the No. 7 capscrew to 143,300 Lbs. (637 KN), ref. 5216 Ft-lbs. (7075 NM). Turn the nut down.
 - D. Relax the tensioner, wait one minute, then bring it back to load without shifting it. Turn the nut down if possible. Repeat this procedure for the remaining capscrews (No's 8 through 11) in the sequence shown.
7. After all the capscrews are tensioned per step 2, repeat Step 2A for the No. 1 and No. 2 capscrews. If additional turning of the nut is possible when the tensioner is brought up to load, continue Step 2A and 2C on subsequent capscrews until there is no more take-up or rotation of the nut.

HOIST MOTOR REMOVAL

1. Park the machine in an open, level area, rest the dipper on the ground & slacken the hoist ropes.
2. Set all brakes & shutdown the machine. Have a qualified electrician isolate the hoist motor armature, blower motor, anti-condensation heaters, over temperature thermostat, brake magnet valve & pressure switch. Disconnect all wiring.

13. Using a padded sling, support the bearing housing end of the shaft. Attach a come-along to the end of the shaft & pull it out of the case toward the cab side of the machine.
14. Block under the bearing housing & reposition the padded sling to support the shaft assembly. Lift it clear of the machine.

To remove or replace the bearing:

1. Remove the retainer and shims from the bearing housing.
2. Remove the retainer and shims from the end of the pinion shaft.
3. Use a bearing puller over the bearing housing to remove the bearing from the pinion shaft.
4. Inspect all parts and repair or replace them as needed. Install a new seal, (with lip toward the bearing) & bearing in the bearing housing. Coat the lip seal with molyube 1200AR or equivalent & pack the bearing with MPG.
5. Install the bearing retainer & shims per the procedure for Gap "A" below.
6. Install the housing retainer & shims per the procedure for Gap "B" below.

To replace the inboard bearing:

1. Disconnect the hose from the retainer.
2. Support the inner retainer and seal and remove the retainer screws. Remove the inner retainer through the right hand bore.
3. Mark the position of the outer retainer and remove it.
4. Inspect all parts and replace as required.
5. Install a new bearing per the "Inboard Bearing Installation Procedure" below.
6. Install the intermediate hoist shaft and gear case in the reverse order of disassembly.

PROCEDURE FOR SHIMMING GAP "B": (2 Places)

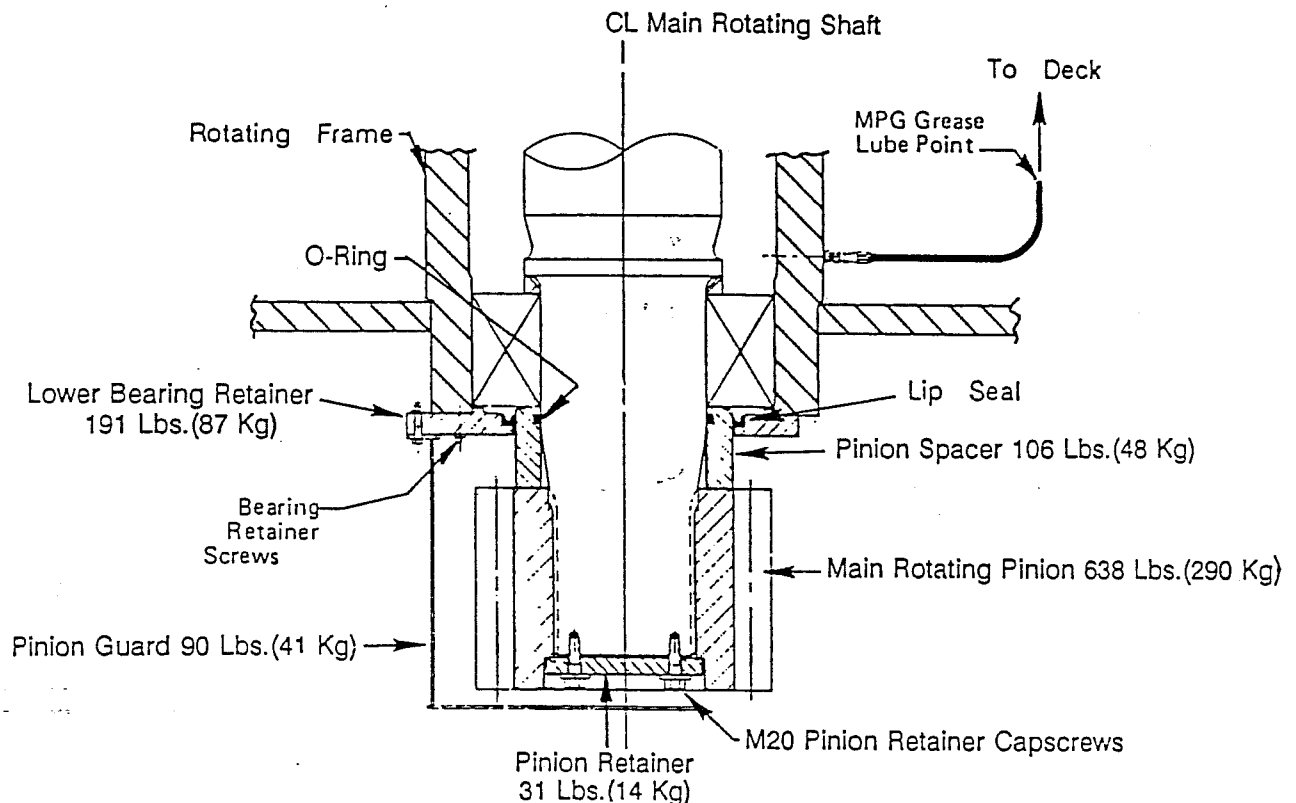
1. After the bearing has been installed on the shaft, assemble the internal bearing retainer to the end of the shaft, tightening the capscrews to 37 ft.lbs. (50 Nm) for the gap measurement.
2. Measure the distance from the outer face of the retainer to the end of the shaft with a depth micrometer through the three .25 inch (6 mm) holes in the retainer. Average these measurements.
3. Remove the retainer from the end of the shaft and measure its thickness at the three .25 inch (6 mm) holes with a micrometer. Average these measurements.
4. Subtract the average measurement of Step 3 from the average measurement of Step 2. This is the measured gap dimension.
5. Prepare a shim pack that is 0 -.003 inch (.08 mm) thinner than the measured gap dimension in Step 4.
6. Assemble the internal bearing retainer and shim pack to the end of the shaft. Tighten the 6 capscrews to 380 ft.lbs. (518 Nm).

HOIST DRUM GEAR REMOVAL or REPLACEMENT

1. Remove the drum assembly per the "Hoist Drum Removal Procedure".
2. Set the drum assembly on end with the gear on top. Position cribbing to support the assembly on the drum flange. Do not set the drum on the bearing or housing.
3. Remove the 20 bolts securing the drum gear. Replace or reverse the gear.

NOTE: The hoist gear is reversible by design.

4. Clean the mounting surfaces & set the new or reversed gear into position. Install all 20 mounting bolts and washers finger tight. Tighten all bolts to specification in the sequence shown on the following page.



SWING PINION - SECTION VIEW

SWING PINION SHIM PROCEDURE FOR GAP:

1. Assemble the spacer and the pinion to the shaft with the retainer. Tighten 4 capscrews to 37 Ft-lbs. (50 NM) for the gap measurement.
2. Using the 4.25 dia. (6 mm) holes in the retainer, measure the distance from the end of the shaft to the outer face of the retainer using a depth micrometer. Average these 4 measurements.
3. Remove the retainer and measure the retainer thickness at the 4 holes and average these 4 measurements.
4. Subtract the average measurement from Step 3 from the average measurement from Step 2. This is the gap dimension.
5. Prepare a shim pack that is .010 to .014 inch (0.25 to 0.35 mm) thicker than the gap dimension.
6. Install the shim pack between the pinion retainer and the bottom end of the main rotating shaft.
7. Tighten the 4 retaining screws to 380 Ft.lbs. (518 NM).

BOOM LOWERING/RAISING PROCEDURE

1. Park the machine in a level area with crane access on both sides of the boom.
2. Remove the dipper/handle assembly from the boom.
3. Position the rotating frame with the boom foot over the front and in line with the crawlers.
4. Set brakes and shut down the machine.
5. Build cribbing 10 ft. wide X 10 ft. high (3M x 3M) to support the boom point when lowered. Locate the center of the cribbing 45 ft. (14 M) from the foot pins.
6. Remove the crowd motor air ducts. Carefully store to prevent damage. Disconnect the dipper trip rope after isolating the trip motor.
7. Attach slings to the lifting eyes at the boom point and the crane to be used to lower the boom. The weight at the boom point when horizontal, is approximately 100,000 lbs (45352 kg).
8. Lift the boom to slacken the boom pendants and boom limit ropes. Disconnect the 4 pendants at the gantry and lay them on the boom. Disconnect the boom limit rope.
9. Lower the boom onto the cribbing. Check to insure the weight does not rest on the point sheaves or yoke block.
10. Raising the boom is the reverse of lowering.

NOTE: Reset the boom limit switch.

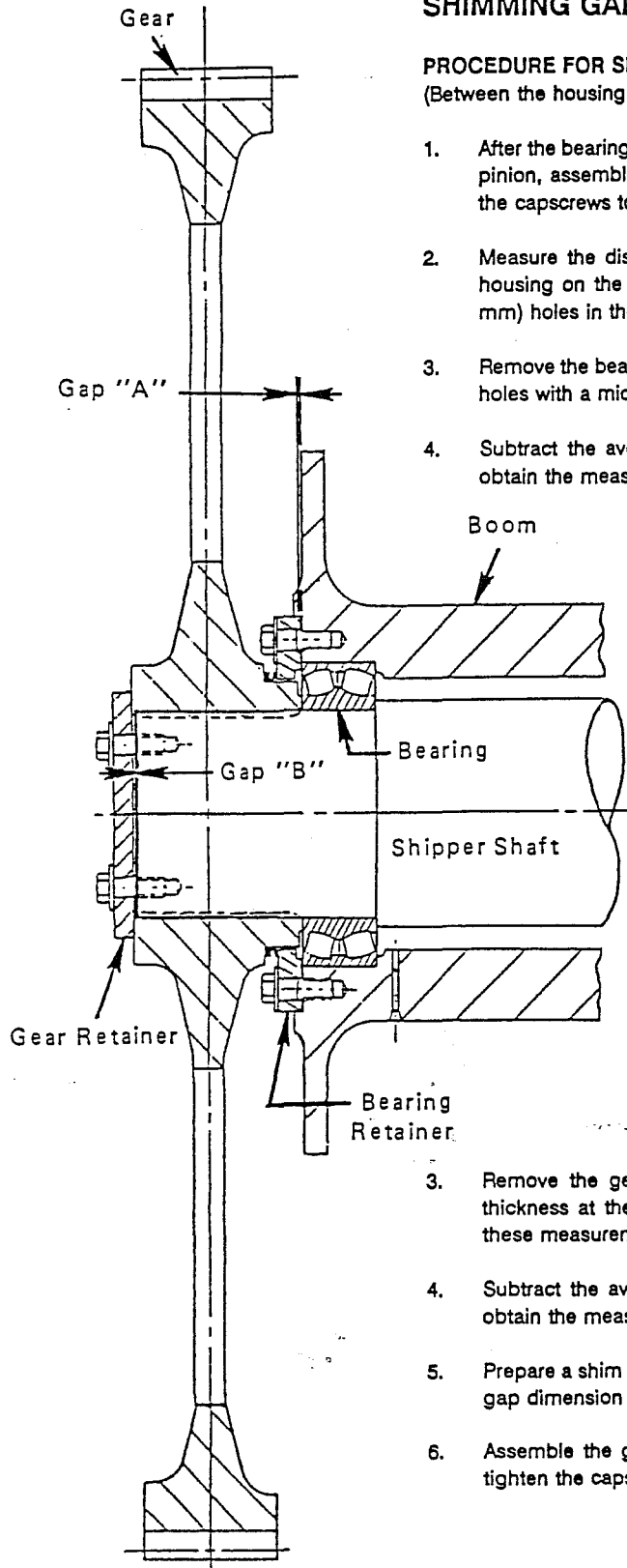
BOOM REMOVAL

1. Lower boom point to cribbing using the procedure above.

NOTE: It is safe practice to place support under the ballast box if the boom is to be removed from a mining shovel.

2. Disconnect all lube and air lines between the boom and rotating frame.
3. Have a qualified electrician disconnect all the wires from the boom at the crowd junction box on the right wing next to the swing motor/gearcase. Unclamp the cable leads to the boom inside the house. Pull the cable leads to the boom from the crowd junction box and bundle them for exit through the opening in the front wall of the house.

SHIPPER SHAFT GEAR INSTALLATION SHIMMING GAPS "A" & "B" (typical at each end)



PROCEDURE FOR SHIMMING GAP "A":

(Between the housing in boom and the bearing retainer)

1. After the bearing/shaft assembly has been installed into the boom & crowd pinion, assemble bearing retainer (over shaft) to the housing and tighten the capscrews to 110 Ft-lbs. (150 NM) for gap measurement.
2. Measure the distance from the outer face of the bearing retainer to the housing on the boom with a depth micrometer through the 3-.25 dia (6 mm) holes in the bearing retainer. Average these measurements.
3. Remove the bearing retainer and measure its thickness at 3-.25 dia (6 mm) holes with a micrometer and average these measurements.
4. Subtract the average measurement from Step 3 from that of Step 2 to obtain the measured gap dimension.
5. Prepare a shim pack that is 0-.003 (0-0.08mm) thinner than the measured gap dimension from Step 4.
6. Assemble the bearing retainer and shim pack to the housing in the boom and tighten the capscrews to 1310 Ft-lbs. (1780 NM), 6 places.

PROCEDURE FOR SHIMMING GAP "B":

(Between the end of the shipper shaft and the gear retainer)

1. After the gear has been installed to the outboard end of the shipper shaft/bearing assembly in the boom, assemble the gear retainer to the end of the shaft and tighten capscrews to 110 Ft-lbs. (150 NM) for gap measurement.
2. Measure the distance from the outer face of the gear retainer to the end of the shaft with a depth micrometer through the 4.25 dia (6 mm) holes in the gear retainer. Average these measurements.
3. Remove the gear retainer from the end of the shaft and measure its thickness at the 4.25 dia (6 mm) holes with a micrometer and average these measurements.
4. Subtract the average measurement from Step 3 from that of Step 2 to obtain the measured gap dimension.
5. Prepare a shim pack that is 0-.003 (0-0.08 mm) thinner than the measured gap dimension from Step 4.
6. Assemble the gear retainer and shim pack to the end of the shaft and tighten the capscrews to 1310 Ft-lbs. (1780 NM), 6 places.

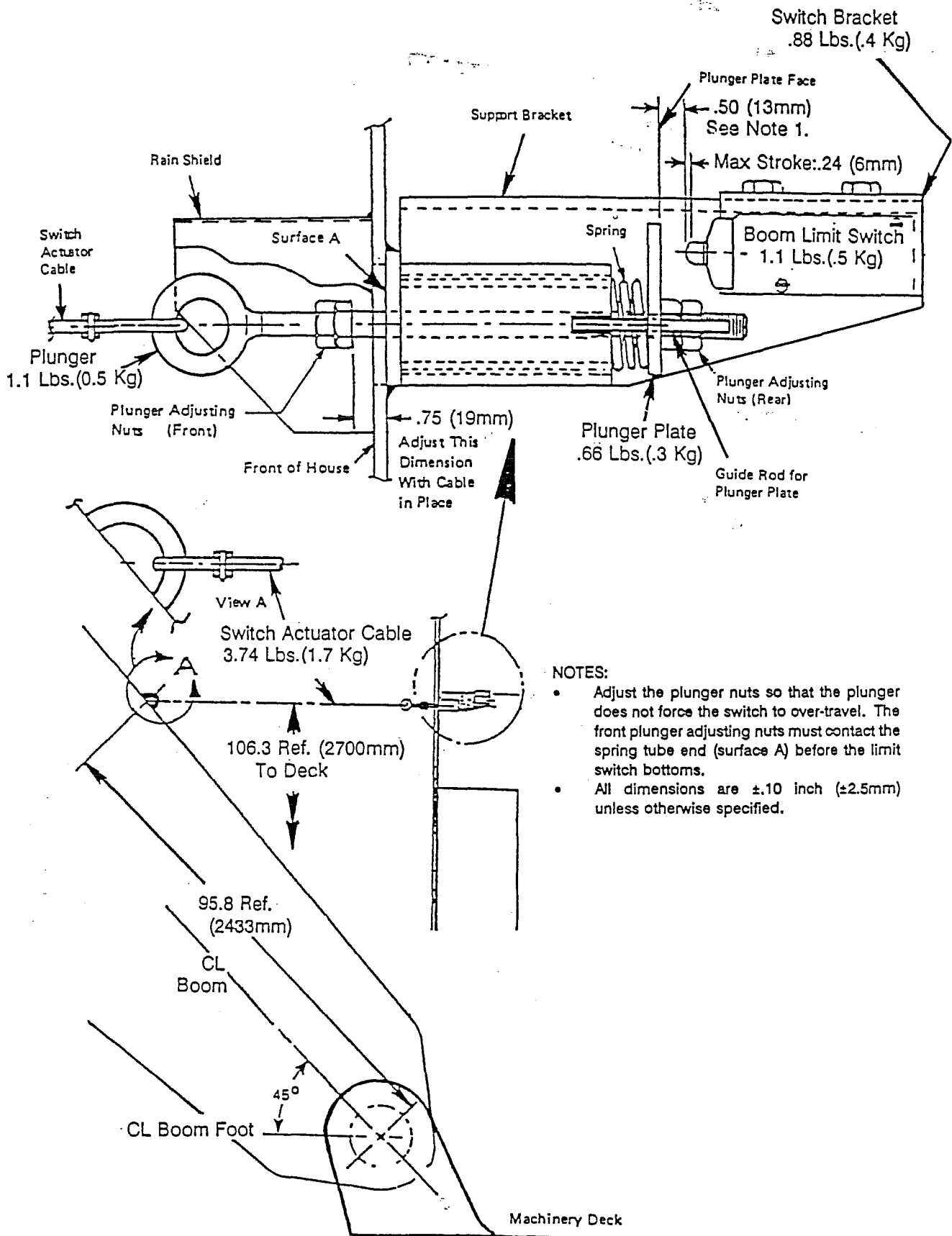
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- NOTES:
- Adjust the plunger nuts so that the plunger does not force the switch to over-travel. The front plunger adjusting nuts must contact the spring tube end (surface A) before the limit switch bottoms.
 - All dimensions are $\pm .10$ inch (± 2.5 mm) unless otherwise specified.

BOOM LIMIT SWITCH INSTALLATION



DANGER: Adjusting shims requires working around liver machinery. Use man baskets and safety belts while working in this area.

3. Top wear pad adjustment:
 - a. Hoist the dipper until the handle is horizontal. Crowd in or out to place the deepest section of the handle over the shipper shaft. Set all brakes and remove the pad retainers. Pull out the wear pad assemblies, thoroughly clean all parts and reinstall.
 - b. Check that the handle is resting squarely on the shipper shaft rollers.
 - c. Lift the front of the yoke block until the gap "A", between the handle and yoke block structures, is the same front and rear.
 - d. Wedge between the wear plate and handle at the front and rear of the yoke block; be careful not to change the position of the yoke block.
 - e. Measure the gap at the front and rear. Subtract .08 (2 mm) from the smaller dimension. The remainder is the maximum additional shim thickness required.
 - f. Remove the wedges and install an equal amount of shims at both wear pads. Install the shim retainers.
 4. Side wear pad adjustment:
 - a. Crowd or retract the handle to place the widest section over the shipper shaft, set all brakes and remove the shim retainers.
 - b. Check that the handle is resting squarely on the shipper shaft roller. The Gap "B" between the yoke block and handle structures must be the same at each end and at the front and rear of the yoke block.
 - c. Wedge between the wear pad and handle structure at each pad. Be careful that the handle is not moved. Measure the gaps on each side. Add opposite gaps, divide by 2 and subtract .04 (1 mm) at the 2 front and 1 rear pad positions. Add shims based on the smallest gap calculated. Note: this will be the maximum shim thickness required.
 - d. Remove the wedges and install the shims.
- NOTE:* Be sure the shims already in place are of equal thickness.
- e. Install the shim retainers. Tighten the capscrews to specification and lockwire in place.
 - f. Slowly crowd and retract the handle. Check for tight spots and correct as required.

DIPPER PITCH ADJUSTMENT

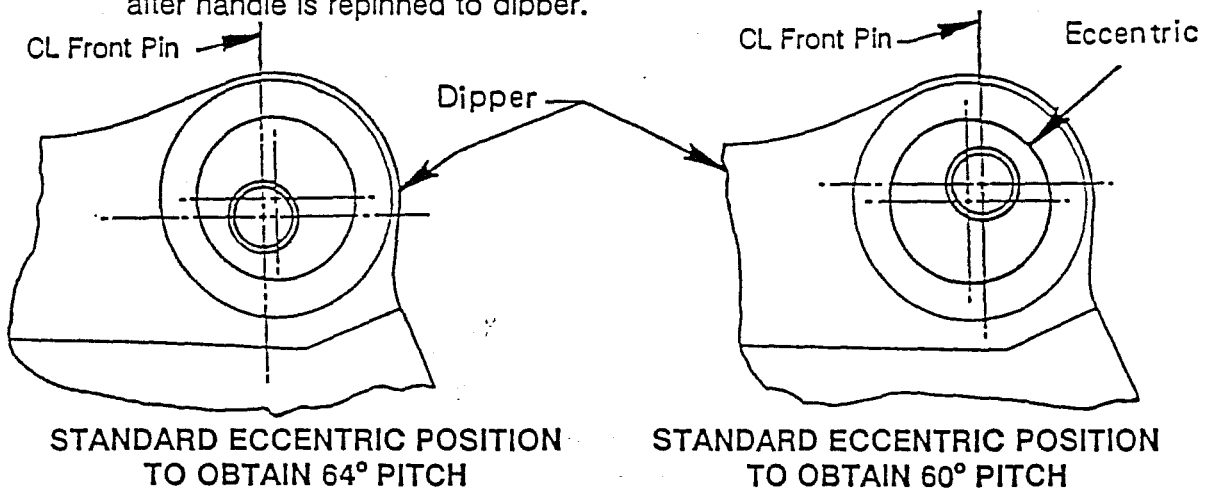
The dipper assembly is equipped with eccentric inserts at the front pin connection between the dipper and the handle. These allow the pitch of the dipper to be adjusted between 2 positions: a standard setting of 64° or an optional setting of 60°. To change from one to the other, proceed as follows:

1. Move the machine to a level, safe work area.
2. Place the dipper on the ground with its front flat on grade. Set all the brakes.
3. Remove the split retaining collars from the inboard end of the 2 front pins in the dipper/handle assembly. Use an air arc or torch to split the collars apart at their welded seam.
4. Push the 2 front dipper pins outward from their bores, and lift them clear.
 - a. The pins have handling holes in each end. The holes are threaded 1.6 inch (M24 X 3 X 40 mm) deep.
 - b. Use crowd and hoist motions to control handle to unload pins for removal.

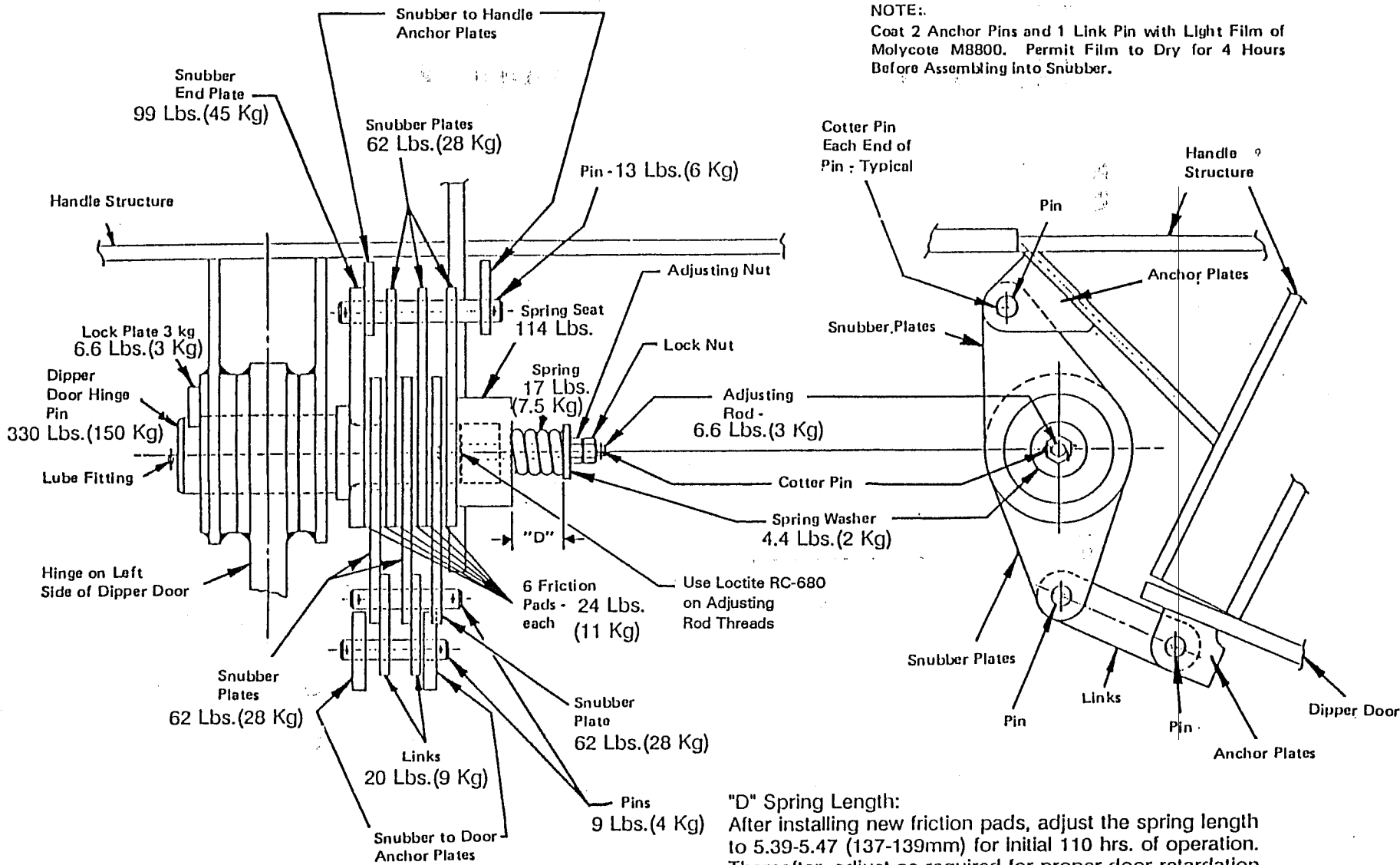
NOTE: More finite control of drives is obtained by putting it in "LIMIT BY-PASS". Be extremely careful. Be sure to return drive to "NORMAL".

5. Separate the handle from the dipper at the front by slowly hoisting and crowding out so the dipper rotates about the rear pins in the dipper/handle assembly. When the eccentrics in the dipper are exposed, stop the separation and set the brakes.
6. Rotate the eccentrics 180° in their bores.

NOTE: DO NOT weld eccentrics in place in the dipper. They will not rotate in bores after handle is repinned to dipper.



4.11.12



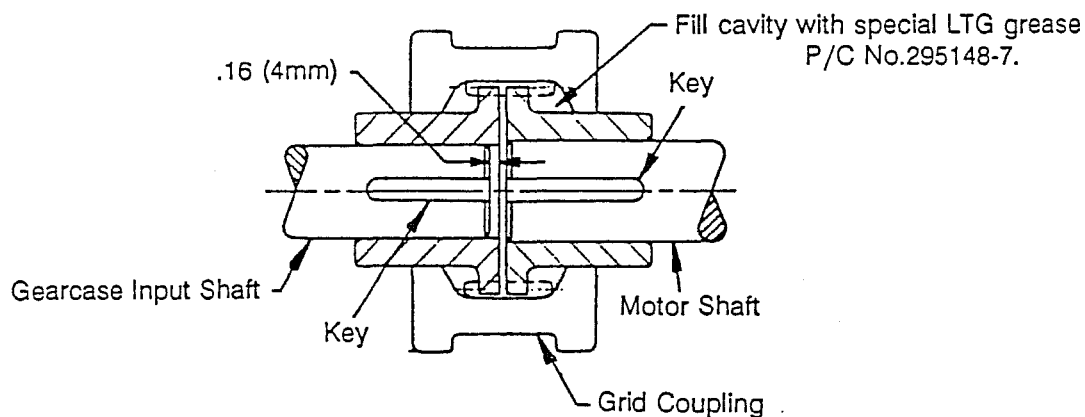
"D" Spring Length:
 After installing new friction pads, adjust the spring length to 5.39-5.47 (137-139mm) for initial 110 hrs. of operation. Thereafter, adjust as required for proper door retardation, using .08 (2mm) adjustment increments. Spring length should never be less than 5.08-5.00 (129-127mm).

Hinge Pin And Snubber Weight: 1080 Lbs. (490 Kg) each.

DIPPER DOOR SNUBBER ASSEMBLY
 Left Shown - Right Opposite

BI116336

4. Remove the guards from over the motor coupling and the trip drum/clutch assembly.
5. Open the coupling and remove the spring grids. Note any match marks.
6. Unbolt the gear case from the base and attach it to a crane for removal.
7. Use a puller to take the coupling hub from the gearcase if it is to be used on a replacement case.
8. Remove trip drum/air clutch assembly from gearcase if it is to be used on a replacement case.
9. Reassembly is the reverse of disassembly. See Section 7 - ENGINEERING DATA, in this manual, for assembly data on the motor coupling. Shim at the motor pads for alignment as required.



SECTION B-B
Dipper Trip Coupling

10. Gear case installation is the reverse order of removal:
 - a. Install the coupling hub on the input shaft. Note the hub extends .16 inch (4mm) beyond the end of the input shaft. The hub may be heated to assist in assembly. **Do not exceed 275° F (135° C).**
 - b. Refer to installation procedure for trip drum/air clutch assembly for its assembly to gearcase.
 - c. Fill gear case with GL - capacity 7 US gallons (26.5 liters).
 - d. Purge seals on input and output shafts of gearcase through fittings provided with MPG lube.
 - e. Check that all guards are in place.

REPLACEMENT OF DIAPHRAGM

After the torque assembly has been removed from the clutch assembly, proceed as follows:

1. Completely disassemble the torque assembly.
2. Install the inner and outer seals into the proper groove in the outer torque plate.

NOTES:

- Vaseline (petroleum jelly) may be applied to the seal to hold it in place.
 - Use the black circle on diaphragm for locating the guides.
 - The circle located near outer edge of diaphragm is to face away from the outer torque plate.
 - The air inlet holes in the outer torque plate are to line up with the black circles on the diaphragm.
 - All holes in the diaphragm should match those in the outer torque plate.
3. Assemble the inner clamp ring to the outer torque plate.
 4. Assemble the outer clamp ring. If required, push the diaphragm toward the center to align the holes. **DO NOT DISTURB THE INNER AND OUTER SEALS.**
 5. After tightening the screws that hold the inner and outer clamp rings, trim the edges of the diaphragm with a sharp blade.
 6. Install the torque plate assembly when required.



BOOM PENDANTS REPLACEMENT

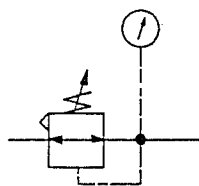
The boom pendants should give a service life of from 3 to 5 years. Therefore, they can be changed out as part of a scheduled boom lowering and detailed inspection of the front end. **ALWAYS REPLACE ALL 4 PENDANTS WITH A NEW SET AT ONE TIME.** Never replace just part of a set. Inspect the ropes monthly (every 420 hours). Check for rust and broken wires. Follow the procedure below:

1. Lower the boom to set the boom point onto cribbing. Refer to the procedure "Boom Lowering/Raising" previously in this section.
2. Disconnect the 4 boom support ropes from boom point.
3. Thoroughly examine the lugs in the boom structure and the equalizer links in the gantry for signs of fatigue. Report **any** problems to Dresser Marion for consultation.
4. Install a new set of boom support ropes to the boom point.
5. Raise the boom and attach the new boom support ropes to the equalizer links in the gantry.
6. Tighten the boom support pin retainer screws to 279 ft/lbs (380 Nm).

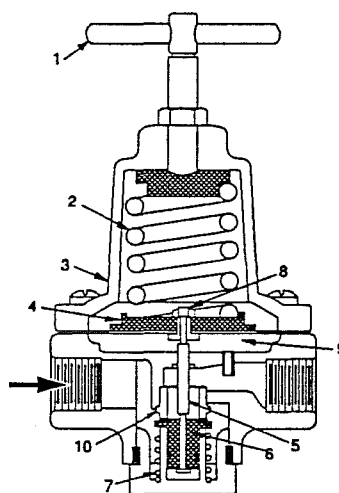
PRESSURE REGULATORS

These regulators are used in compressed air systems to maintain a nearly constant downstream (outlet) pressure despite changes in the upstream (inlet) pressure and in the downstream flow requirements. These units are of the relieving, diaphragm type and are each fitted with a gauge that indicates outlet air pressure.

Outlet pressure is controlled by an adjusting screw (1) on top of the regulator that is fitted with a T-handle. Clockwise (CW) rotation increases outlet pressure, and counterclockwise (CCW) decreases it.



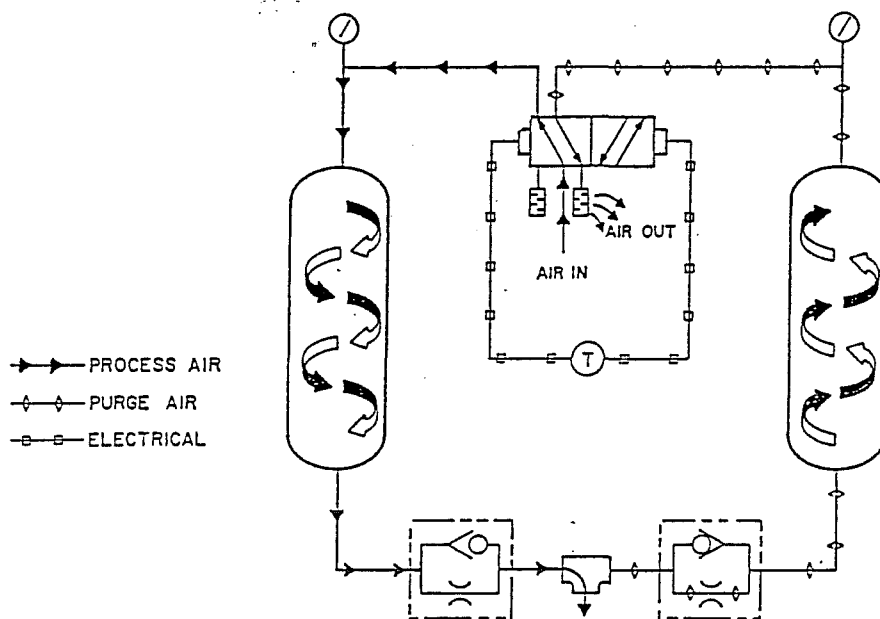
Graphic
Symbol



When the adjustment (1) is rotated fully counterclockwise, no force is applied to the regulating spring (2), and the valve (6) is held closed by the valve spring (7). Clockwise rotation of the adjustment (1) compresses the regulating spring (2) which applies a downward force on top of the diaphragm (4). The diaphragm and valve pin (5) move downward, forcing valve (6) off its seat (10) which allows air to flow through the regulator to the downstream system.

Outlet pressure increases in the downstream system and sensing chamber (9) and applies an upward force on bottom of diaphragm (4). The diaphragm, valve pin (5), and valve (6) move upward, compressing the regulator spring (2). Upward movement stops when the forces below the diaphragm balance the forces above the diaphragm. When there is no downstream flow demand, the balance of forces occurs with the valve (6) closed. When there is downstream flow demand, the balance of forces occurs when the valve opens sufficiently to compensate for demand, thus maintaining the desired outlet pressure.

These air pressure regulators require no maintenance. If a unit leaks air excessively or malfunctions, replace it.



FLOW DIAGRAM - AIR DRYER

Operation

Heatless models: The sequence of operation is completely automatic and has been programmed to allow one tower to be on stream, while the other one is regenerating. On larger models with a programmable timer, cam settings and functions can be found in the electrical schematic in the back of the manual.

Exhaust Purge and Blower Purge Models: The sequence of operation is completely automatic and is programmed by a programmable cam timer as follows: When the tower is on stream drying for 4 hours (standard dryers operate on an 8 hour NEMA cycle - 4 hours on stream and 4 hours regenerating), the right tower is regenerating (heating for 3 hours, cooling for 1 hour). Approximately 10 minutes before tower shift, the purge-pressurization valve(s) operates to de-pressurize the left tower. The timer turns on a heater which heats the purge air to regenerate the tower. This cycle will be continuous unless the dryer is equipped with a Dewpoint Demand System.

The programmable cam timer settings and functions can be found on the electrical wiring schematic diagram later in this section.

IMPORTANT! At initial start-up, check the dryer operation for 1 or 2 cycles, especially at the time of the tower shift, to verify that all systems are operating in their proper order. Timer cams are preset at the factory and should not be re-adjusted in the field. If the dryer is not functioning properly, contact DRESSER/MARION.



immediately by an inspector from the carrier. Refer to Appendix "A" for complete details. **Shipping damage is not covered by Quincy Warranty.**

2. Insure that adequate lifting equipment is available for moving the machinery.
3. Read the compressor nameplate to be sure the compressor is the model and size ordered.
4. Check the receiver nameplate to be sure the tank is adequate for the pressure at which you intend to operate.
5. Read the safety valve nameplate to be sure it does not exceed the working pressure shown on the receiver or any other component in the system.
6. Read the motor nameplate to be sure the motor is compatible with your electrical conditions. (Volts - Phase - Hertz)

IMPORTANT: If voltage drops lower than 207 volts a 200 volt motor should be used, not a triple voltage (208/230-460) 3 phase motor.

Also note whether the motor is suitable for the expected environmental conditions.

NOTE: Standard motors are open drip proof with a maximum ambient temperature rating of 104° F. They are not suitable for salt laden, corrosive, dirty, wet or explosive environments.

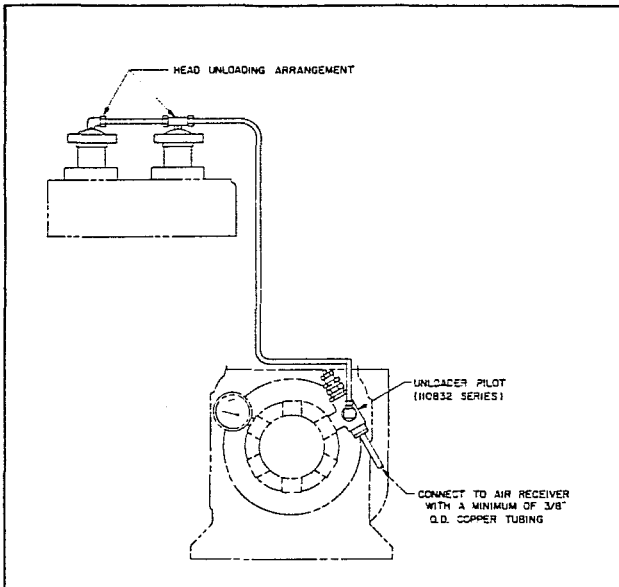
▲ CAUTION

Improper lifting can result in component or system damage or personal injury. Follow good shop practices and safety procedures when moving the unit.

SECTION III

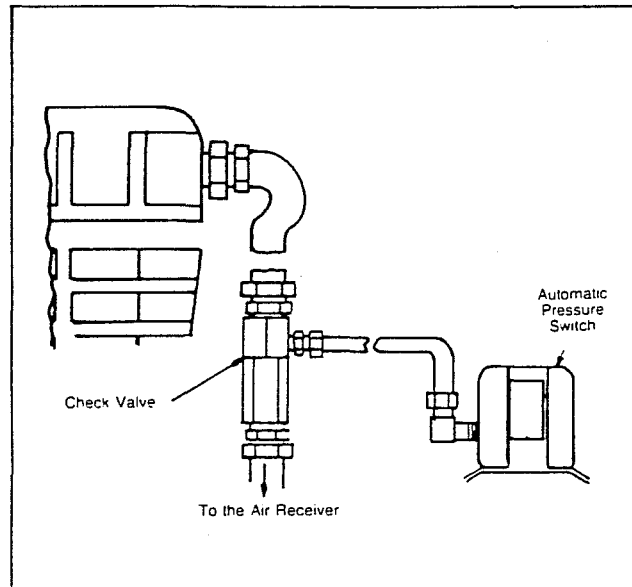
Installation

Location - Locate the compressor in an area that is clean, well lighted, and well ventilated, with sufficient space for safe and proper inspection and maintenance. Ambient temperatures should not exceed 104° F unless an electric motor rated for higher temperature is to be used. The compressor is capable of operating in an ambient temperature up to 120° F provided that the area is well ventilated. In cold climates, the compressor should be installed in a heated building. Inspection and maintenance checks are required daily, therefore, sufficient uncluttered space needs to be provided around the compressor.



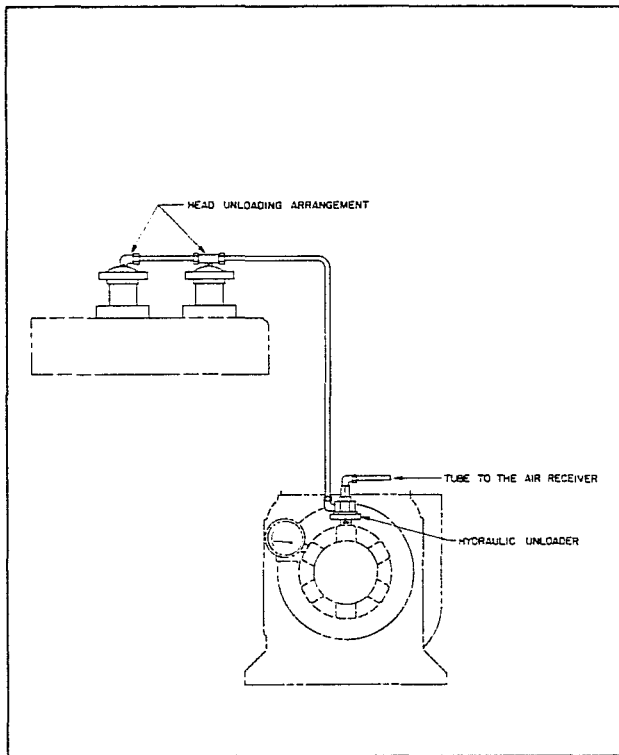
TUBING HOOKUP FOR UNLOADER PILOT

Figure 4-3



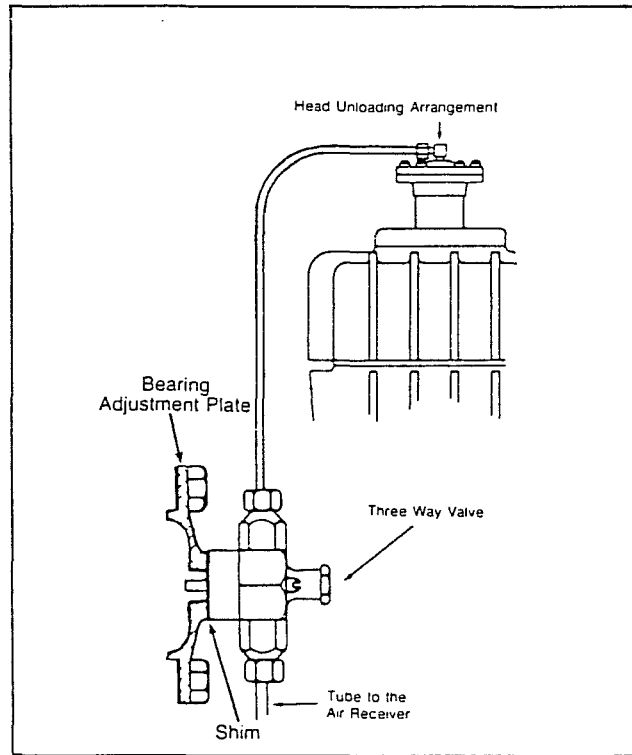
TUBING HOOKUP FOR COMPRESSORS USING DISCHARGE LINE CHECK VALVE AND PRESSURE SWITCH

Figure 4-4



TUBING HOOKUP FOR HYDRAULIC UNLOADER

Figure 4-5



TUBING HOOKUP FOR MECHANICALLY ACTUATED CENTRIFUGAL VALVE AS USED ON THE MODEL 106 AND 108

Figure 4-6

10. Manually blow safety relief valve(s).
11. Check operation of controls.
12. Observe general compressor operation closely for the first hour of operation and then frequently for the next seven hours. After the first eight hours, general compressor operation should be monitored at least once every eight hours. If any abnormal conditions are witnessed, stop the compressor and correct the problem.
13. After two days of operation check belt tension, air oil and water piping for leaks, and crankcase oil level.

⚠ CAUTION

Unusual noise or vibration indicates a problem. Do not operate the compressor until the source has been identified and corrected.

STOPPING FOR MAINTENANCE OR SERVICE

⚠ WARNING

Never assume the compressor is ready for maintenance or service because it is stopped. The automatic stop-start control may start the compressor at any time!

The following procedure should be followed to maximize safety when preparing for maintenance or service:

1. Disconnect and lock-out the main power switch and hang a sign at the switch informing of the unit being serviced.
2. Close shut-off valve (block valve) between receiver and compressor, or receiver and plant air system, to prevent any back-up of air flow into the area to be serviced.

TROUBLE	PROBABLE CAUSE
Rusty valves and/or cylinders.	<ul style="list-style-type: none"> •Compressor operated too infrequently. •Compressor does not run long enough to get hot and vaporize the moisture squeezed out of the air during compression. Compressor may be too large for application. •Water leaking in jacket or head. •Not properly processed for storage. •Cooling water circulating in compressor too cold. •Discharge line from compressor head is directed up allowing moisture drain back at shutdown.
Low oil pressure.	<ul style="list-style-type: none"> •Oil pump direction reversed. •Oil sump strainer plugged. •Excessive leakage at the crankshaft. •Oil level in the crankcase low. •Oil pump not properly assembled to the bearing carrier ("O" Ring not properly located between oil pump body and bearing carrier). •Oil pressure adjusting screw not set properly. •Defective oil pressure gauge. •Plugged oil filter.
Excessive vibration.	<ul style="list-style-type: none"> •Incorrect speed. •Compressor valves not functioning properly. •Pulley (sheave) loose. •Motor or engine out of balance. •Compressor, motor or engine not secured tightly, or tightened into a bind. •Foundation or frame inadequate. •Piping inadequately supported or tightened in a bind. •Excessive discharge pressure. •Receiver tank feet may need to be leveled with shims.
Compressor loads and unloads excessively.	<ul style="list-style-type: none"> •Air storage capacity too small. •Compressor valves or unloaders defective. •Excessive system leakage. •Incorrect speed. •Unloader pilot differential set too close. •Pressure switch defective

BRUSHES

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 the brush holder into the 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. 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. Avoid allowing rapid brush wear which 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. A change in brushes sometimes improves a condition of poor commutation and severe arcing. Consult manufacturer before making this change.

BRUSH INSTALLATION

The brush should properly fit the holder or guide, and work up and down freely. Grind the brush with 2/0 or 3/0 sandpaper until the 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 of rotation. Then lift brush, push sandpaper back and repeat this operation until brush shapes to an even contact with commutator. Be sure to raise the brush before moving sandpaper back for the next stroke. DO NOT raise sandpaper when removing from commutator. This act generally ruins the fit on the brush. DO NOT install brushes and allow to fit by wear. This method usually causes arcing and scoring before brush wears in. After sanding brushes in, thoroughly clean armature, commutator, risers and brush assembly with dry compressed air. Remove ALL carbon and copper cuttings. This prevents possible grounding or short circuiting. Failure to follow this procedure has resulted in costly shutdowns due to damaged armatures. After grinding brush, run in under light loads for a short period to allow the surface to set or wear in before applying heavier loads. Install a complete set of brushes rather than replacing them one by one.

A shorted capacitor creates various effects. With capacitor used in an anti-hunt or stabilizing circuit, shorting the capacitor usually causes very low output that may be confused with other failure. A shorted capacitor in a filter circuit generally causes loss of filtered voltage and failure in other devices. For example, if current-limit bias voltage is obtained from rectified A.C., shorting a filter capacitor causes bias voltage loss, low stall current and possible failure of rectifiers and transformers.

Generally, capacitors are tested with an ohmmeter. Connecting a discharged capacitor across the ohmmeter indicates low resistance at first instant and high resistance once capacitor charges from the ohmmeter batteries.

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.

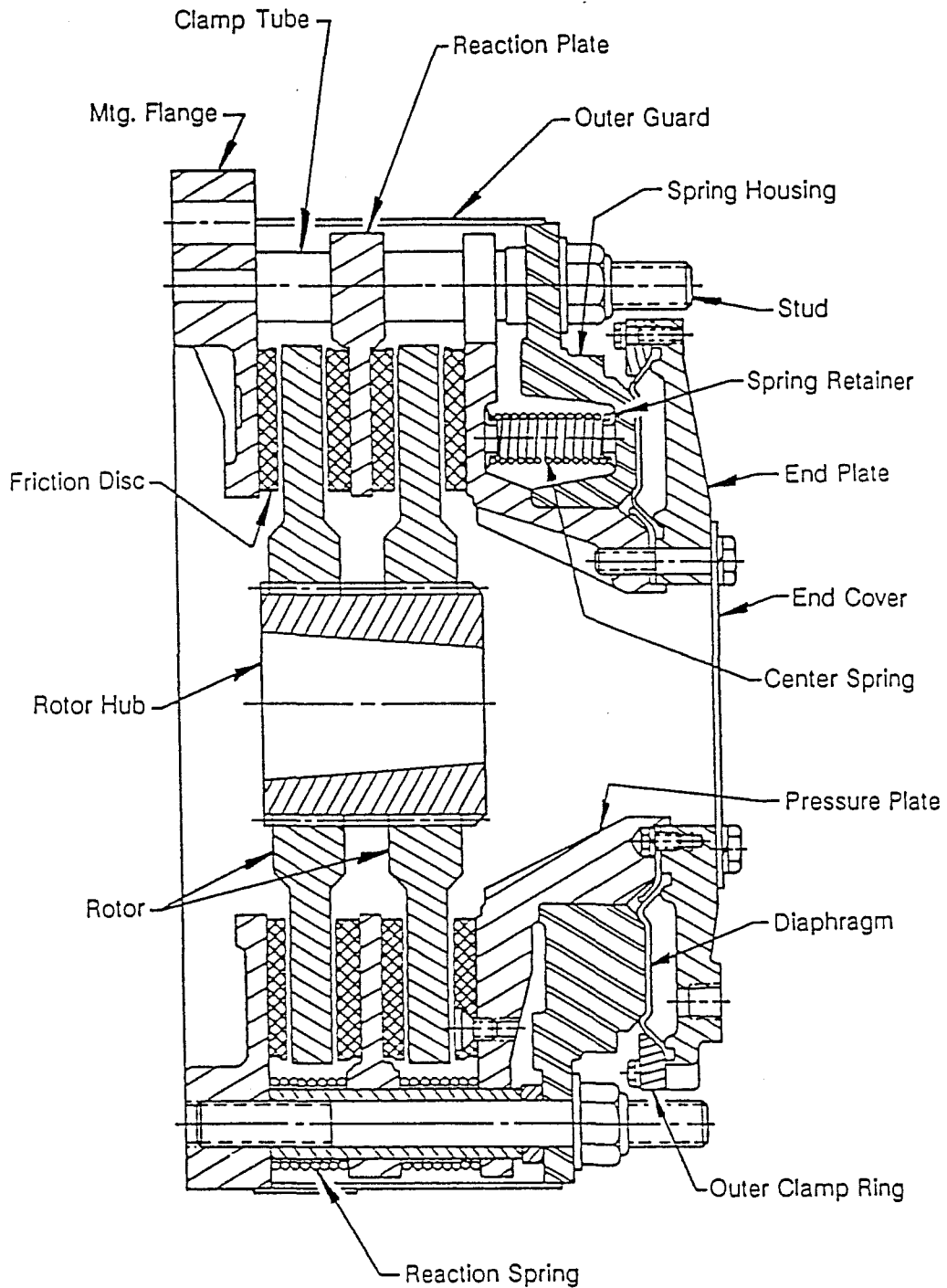
Start as before, interviewing operator, oiler and witnesses. Try in questioning to determine the exact nature of trouble. When complaint indicates partial power loss, find the effect under various load conditions and determine the cause of this effect.

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.

RUNNING CLEARANCES FOR BRONZE BUSHINGS
Inches (Millimeters)

Nominal Diameter	Shaft Outside Diameter	Running Clearance	Nominal Diameter	Shaft Outside Diameter	Running Clearance
18.00 (457.2)	18.000-17.996 (457.200-457.098)	.028-.042 (.071-1.066)	22.25 (565.15)	22.250-22.246 (565.150-565.048)	.033-.047 (.838-1.194)
18.25 (463.55)	18.250-18.246 (463.550-463.448)	.028-.042 (.071-1.066)	22.50 (571.5)	22.500-22.496 (571.500-571.398)	.033-.047 (.838-1.194)
18.50 (469.9)	18.500-18.496 (469.900-469.798)	.028-.042 (.071-1.066)	22.75 (577.85)	22.750-22.746 (577.850-577.748)	.033-.047 (.838-1.194)
18.75 (476.25)	18.750-18.746 (476.250-476.148)	.028-.042 (.071-1.066)	23.00 (584.2)	23.000-22.996 (584.200-584.318)	.034-.048 (.863-1.219)
19.00 (482.6)	19.000-18.996 (482.600-482.498)	.028-.042 (.071-1.066)	23.25 (590.55)	23.250-23.246 (590.550-590.448)	.034-.048 (.863-1.219)
19.25 (488.95)	19.250-19.246 (488.950-488.848)	.028-.042 (.071-1.066)	23.50 (596.9)	23.500-23.496 (596.900-596.798)	.034-.049 (.863-1.244)
19.50 (495.3)	19.500-19.496 (495.300-495.198)	.028-.042 (.071-1.066)	23.75 (603.25)	23.750-23.746 (603.250-603.148)	.034-.049 (.863-1.244)
19.75 (501.65)	19.750-19.746 (501.650-501.548)	.028-.042 (.071-1.066)	24.00 (609.6)	24.000-23.996 (609.600-609.498)	.034-.049 (.863-1.244)
20.00 (508.0)	20.000-19.996 (508.000-507.898)	.030-.044 (.762-1.117)	24.25 (615.95)	24.250-24.245 (615.950-615.823)	.034-.050 (.863-1.270)
20.25 (514.35)	20.250-20.246 (514.350-514.248)	.030-.044 (.762-1.117)	24.50 (622.3)	24.500-24.495 (622.300-622.173)	.034-.050 (.863-1.270)
20.50 (520.7)	20.500-20.496 (520.700-520.598)	.030-.044 (.762-1.117)	24.75 (628.65)	24.750-24.745 (628.650-628.665)	.035-.052 (.889-1.320)
20.75 (527.05)	20.750-20.746 (527.050-526.948)	.030-.044 (.762-1.117)	25.00 (635.0)	25.000-24.995 (635.000-634.873)	.034-.052 (.863-1.320)
21.00 (533.4)	21.000-20.996 (533.400-533.298)	.031-.045 (.787-1.143)	25.25 (641.35)	25.250-25.245 (641.350-641.223)	.034-.052 (.863-1.320)
21.25 (539.75)	21.250-21.246 (539.750-539.648)	.031-.045 (.787-1.143)	25.50 (647.7)	25.500-25.495 (647.700-647.573)	.034-.052 (.863-1.320)
21.50 (546.1)	21.500-21.496 (546.100-546.998)	.031-.045 (.787-1.143)	25.75 (654.05)	25.750-25.745 (654.050-653.923)	.037-.055 (.939-1.397)
21.75 (552.45)	21.750-21.746 (552.450-552.348)	.031-.045 (.787-1.143)	26.00 (660.4)	26.000-25.995 (660.400-660.273)	.037-.055 (.939-1.397)
22.00 (558.8)	22.000-21.996 (558.800-558.698)	.033-.047 (.838-1.194)	26.25 (666.75)	26.250-26.245 (666.750-666.623)	.037-.055 (.939-1.397)



HOIST BRAKE - DUAL ROTOR

The Hoist brake assembly is a dual-rotor brake mounted on the commutator end of the hoist motor frame. For installation and maintenance refer to the end of this section.

REPLACEMENT OF DIAPHRAGM

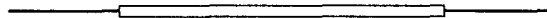
1. Disassemble the brake until you have an assembly consisting of end plate, diaphragm, outer clamp ring, and inner clamp ring, using procedure given under "Replacement of Springs".
2. Place this assembly on a clean working surface with the diaphragm up.
3. Disassemble the hex head screws from the outer and inner clamp rings.
4. Lift off the outer and inner clamp rings.
5. Replace the diaphragm.
6. Reassemble the brake, using the reverse of this procedure.
Tighten the hex head capscrews holding the inner clamp ring to:

Single Rotor Brakes	Dual Rotor Brakes
10 ft.lbs. (14 Nm)	20 ft.lbs. (27 Nm)

7. Tighten the hex head capscrews holding the outer clamp ring to 20 ft.lbs. (27 Nm). See "Replacement of Friction Discs" and "Replacement of Springs" procedures for more instructions.
8. Check for air leaks.



DANGER: Close the air valve manual override before operating the machine - or the brakes will not operate.



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

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

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

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

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

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

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

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

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

1. Determine when, where and how the failure occurred. Interview the operators.
2. What is the service history? Length of service? Was an accident involved? Have there been other similar failures?

EXAMPLES OF CORRECT WELD REPAIRS:

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

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

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

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

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

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

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

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

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

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

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

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

STEP 12: Flame harden the groove.

Correct high or displaced wires noticed during handling, particularly in large diameter strands, *BEFORE* installing strand assembly. This condition indicates that during un-reeling and handling, one or more outer wires suffered from squeezing or were forced out of normal position by the other wires in the strand. It does not mean defective manufacture. These displaced wires may be restored to proper position while the strand is stretched out by using a hardwood block and a hammer or rubber mallet. Please do not use anything that might nick the wires or damage the coating or outer strand wires.

Tap the wires back into position. Often this means moving other outer wires to replace the high wire into original position.

Intermittent bands applied to large diameter strands during manufacture minimize outer wire displacement while handling. These bands should remain on the strand until after installation.

After accurate measurement at the factory, a longitudinal stripe is placed on the strand. During installation, it is extremely important that this longitudinal stripe is kept in a straight line and *NOT* permitted to spiral around the strand.

If rotating the strand to align socket pin hole is absolutely necessary; then it's *BEST* to rotate in a direction opposite to the strand lay. For example, right lay strand (outer wires spiral to the right) may be turned in a counter-clockwise direction. Left lay (outer wires spiral to left) may be turned in a clockwise direction. It is *IMPORTANT* that the strand be turned so as to tighten, rather than loosen the lay of the outer wires. Exception: only if adjustment is very small.

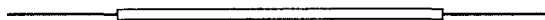
Following installation, and periodically thereafter, lube the strands at socket base for a minimum distance of three feet (one meter).



CAUTION: DO NOT attempt to uncoil the strand in the manner often used to uncoil a garden hose. (DO NOT lay coil on ground and carry one end away from it). This is wrong. This method easily results in destroying the strand.

When using a swift turntable for larger diameter strands shipped in coils, as recommended, use also a drag-type brake to prevent any rapid rotating speed from exceeding the pulling speed. This prevents kinking and looping. The pulling device attaches to the socket tagged, *FRONT END*.

Observe all the common precautions also. Remember the longitudinal stripe and keep it aligned.



SHOVEL NO:

DATE:

INSPECTION SCHEDULE	SERVICE HOURS			REMARKS
	250	500	1000	
LOWER FRAME				
2. PROPEL SYSTEM				
d) Propel Motor Couplings - disassemble and clean coupling. Reassemble with correct lube and torquing of bolts.		X		
e) Air and Lube lines - check for deterioration and leaks.		X		
3. ROTATING (SWING) GEAR				
a) Swing Pinions - remove guard and check teeth. Also, check retaining bolts for breakages and replace if required.	X			
b) Swing Rack - check for tooth condition and lubrication.	X			
c) Roller Circle - check rollers for accelerated flange wear and correct lubrication.		X		
d) Carbody - check for evidence of cracking. Indicate location/type of cracks on sheets.	X			
e) Carbody - check internal structures for cracks. Indicate location/type of cracks.		X		
f) Center Journal - check keeper plates and shear blocks.		X		
4. HOUSEKEEPING				
a) Check all tools, oil, parts, rags, paper, debris, and cleaning fluids are removed from machine when service is completed.	X			

**301-M MINING SHOVEL
PROJECTED MAINTENANCE SCHEDULE**

DESCRIPTION	QTY/ MACH.	OPERATING HOURS X 1000										
		10	20	30	40	50	60	70	80	90	100	
Propel Motor Assembly												
Propel Motor	2			R			X				X	
Motor Coupling	2			R			X				X	
Brake Gear Hub	2			R			R				R	
Brake Assembly	2			R			X				X	
Crawler Shoes												
Belt Section (6 Shoes)	14			R			X			X		R
Belt Section (6 Shoes)	2			R			X			X		R
Main Rotating Gear												
Roller Circle Track	8			R				R				R
Roller Circle												
Roller	48			R				R				R
Spacer	48			R				R				R
Bushing	48			R				R				R
Thrust Washer	48			R				R				R
Rotating Frame												
Bushing (Ctr Journal)	1							R				
Thrust Washer	1			R				R				R
Roller Circle Track	6			R				R				R
Boom Foot Pin	2			R				R				R
Bushing (Foot Pin)	4			R				R				R
Main Rotating Shaft												
Bearing (Upper)	2			R				R				R
Bearing (Lower)	2			R				R				R
Seal (Upper)	2			R				R				R
Seal (Lower)	2			R				R				R
Swing Pinion	2			R				R				R
Shaft	2			R				R				R

X = Exchange for Rebuild

R = Replace

W = Weld Repair

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- d) Open the charging valve slowly.
- e) Add refrigerant until a steady liquid flow in the sight glass indicates a fully charged condition. This can be accomplished by adding a small amount of refrigerant at a time.
- f) Back-seat the suction service valve, but do not disconnect the cylinder at this stage.
- g) Allow running conditions to stabilize and check the sight glass and discharge pressure. Add more refrigerant should "flashing" occur.
- h) On completion of the replenishment, tightly back-seat the suction service valve and remove the charging line. Fit a sealing cap to the line before storing.

ADDING OIL

Oil must be added only when the compressor has been stopped. For additional safety, the main power supply should be switched OFF.

The suction and discharge valves, on the compressor must be closed and then the crankcase plug should be slowly loosened and finally removed.

NOTE: The refrigerant vapor remaining in the compressor may cause foaming of the oil and major oil loss may occur if the crankcase plug is removed too quickly.

Once the pressure is released in the crankcase, oil from a freshly opened can of "Sunisco Grade 3GS" may be added using a clean funnel. When the oil level shows full sight glass the plug should be replaced loosely.

The compressor suction and discharge valves should now be cracked open to allow the refrigerant to purge the crankcase of air and then the sump plug fully tightened.

The compressor valves should now be fully opened and then turned half a turn off the back seat to allow the LP/HP controls to operate. The plug in the crankcase should now be tested for leaks using soap and water solution or a refrigerant leak detector when available.

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